



THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Newsletter / Bulletin

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- SANDY POND COMPENSATION PROPOSAL



CSEB Newsletter Bulletin SCBE

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CSEB NEWSLETTER 2010

Vol. 67, Number 1 Spring 2010

The Canadian Society of Environmental Biologists Newsletter is a quarterly publication. The Newsletter keeps members informed of the Society's activities and updates members on the current affairs and advances in the field of environmental biology. This publication draws together the widely diverse group of Canadian environmental biologists through a national exchange of ideas. Members are invited to contribute papers, photos or announcements that are of a national biological and environmental interest. Letters to the editor are welcome. This is a volunteer non-profit organization and we rely on your participation to make the newsletter a productive forum for ideas and discussion.

All business correspondence, changes of address, undeliverable copies and membership applications should be sent to: CSEB National Office, P.O. Box 962, Station F, Toronto, ON., M4Y 2N9. **Editorial correspondence:** Gary Ash, Editor, e-mail: gash@golder.com

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LE BULLETIN de la SCBE 2010

Vol. 67, Numéro 1 Printemps 2010

Le Bulletin de la SCBE est une publication trimestrielle de la Société Canadienne des Biologistes de l'Environnement. Le Bulletin informe les membres des activités de la Société sur événements courants ainsi que les progrès qui font en sciences de l'environnement. Par un échange d'idées au niveau national, cette publication intéresse un groupe très diversifié d'environnementalistes Canadien. Les membres sont invités à contribuer des articles, photos (noir et blanc) ou des messages qui sont d'intérêt nationale en sciences biologiques et environnementales. Les lettres à l'éditeur sont bienvenues.

Tout la correspondance d'affaires, y compris les abonnements, les changements d'adresse, les exemplaires retournés et les formulaires: CSEB National Office, P.O.Box 962, Station F, Toronto, ON, M4Y 2N9. **Les lettres à l'éditeur:** Gary Ash, Editor, courriel: gash@golder.com

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The Canadian Society of Environmental Biologists



CSEB OBJECTIVES

The Canadian Society of Environmental Biologists (CSEB) is a national non-profit organization. Its primary objectives are:

- to further the conservation of Canadian natural resources.
- to ensure the prudent management of these resources so as to minimize environmental effects.
- to maintain high professional standards in education, research and management related to natural resources and the environment.

OBJECTIFS de la SOCIÉTÉ

La Société Canadienne des Biologistes de l'Environnement (SCBE) est une organisation nationale sans but lucratif. Ses objectifs premiers sont:

- de conserver les ressources naturelles canadiennes.
- d'assurer l'aménagement rationnel de ces ressources tout en minimisant les effets sur l'environnement.
- de maintenir des normes professionnelles élevées en enseignement, recherche, et aménagement en relation avec la notion de durabilité des ressources naturelles et de l'environnement, et cela pour le bénéfice de la communauté.

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NATIONAL News

PRESIDENT'S Report

Spring Greetings!

Submitted by Brian Free, CSEB President

I look forward to this year as we continue to focus our CSEB work on Canada's environmental issues. Every day, one can read about the latest environmental issue: the integrity of climate change science, hunting of seals or caribou, ducks dying in tailings ponds, and so on. Some issues are strongly tied to economic factors. For example, early in 2010, Canada's economic recovery is still more a promise than a fact. Budgets are still tight and for some environmental programs, funding has been reduced or eliminated. This poses a challenge for many environmental monitoring and research programs. Reading my Queen's University alumni newsletter, I've learned that the Queen's field station at Lake Opinicon has been suffering from significant budget cuts over the past several years. A quick survey of some other universities suggests that this is a broader problem facing many teaching/research stations. Biological field stations, where many of us gained our first real experience in environmental research and sampling techniques, are very important for undergraduate learning and graduate studies. I've brought this issue to the attention of our CSEB Board for further action.

This is but one example of the kinds of issues CSEB can profile. There are many environmental issues that deserve our attention. What issues are important to you? This newsletter provides an excellent means to inform other biologists about what is happening in your part of the country or in your area of study. Why not make a personal resolution to write a letter to our editor with your thoughts about a particular issue? Or prepare an article with more complete information. A simple e-mail or telephone call to your Regional Director or anyone on the Executive is most welcome.

Brian Free
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REGIONAL News

BRITISH COLUMBIA News

B.C. Grizzly Hunt

Reprinted from the Edmonton Journal, 2 April 2010

As hunters converge on British Columbia for the spring trophy bear hunt, a new report shows grizzly bears are being killed by humans at a rate that far exceeds limits set by the province.

The study by the David Suzuki Foundation and Natural Resources Defense Council used the province's own statistics to examine the number of grizzly bears that were killed by humans between 2004 and 2008. It then compared that data with provincial limits for what it considered the allowable human-caused mortality rate for grizzlies.

The report found that, largely because of trophy hunting, the government's limits were exceeded in 63 per cent of grizzly populations at least once over the past five years and, in some cases, there were more than double the number of allowed kills.

ALBERTA News

Submitted by Brian Free, CSEB President

As winter turns to spring, many Albertans are thinking about lawns and gardens. And farmers are thinking of cattle and crops. Everyone is thinking we need a long, heavy spring rain. The below-normal snow pack in the mountains and across the province doesn't bode well for our rivers and lakes. Trees and other vegetation are showing evidence of stress and I'm sure this drought is affecting wildlife and natural ecosystems in general. This could easily change with an extended period of wet weather.

Two years ago, over 1600 migrating ducks made the fatal mistake of landing in Syncrude's oily tailings ponds. Now Syncrude is facing charges under federal and provincial legislation for failing to prevent this. Syncrude admits it did not have its noisy cannons operating to scare away migrating waterfowl, but it is fighting the charges from all sorts of legal and other perspectives.

It's a legal fight that has garnered international attention. Several biologists have taken the stand and graphic photographic evidence has hit the front pages of newspapers around the world. Fish and wildlife officers on the scene struggled to clean oil-soaked birds and save them, as well as humanely killing them to end their suffering. It must have been a difficult situation to face.

Now that this is before the courts, it is anyone's guess as to the eventual result; conviction based on what actually happened or charges dismissed because of some legal technicality. It will be interesting to see how this plays out.

In February, the Alberta Government released an updated report on the status of grizzly bears in Alberta. The report was prepared by Dr. Marco Festa-Bianchet of the Université de Sherbrooke in Québec. Based on DNA-based capture-mark-recapture studies and other research, Dr. Festa-Bianchet estimates that there are 691 grizzly bears in the province. In some areas, populations appear stable. However, human activity is leading to unsustainable bear populations in other parts of the province. This is especially evident where the network of roadways is expanding.

Grizzly bears are an important indicator of intact wilderness and a real test of our ability to maintain healthy ecosystems. We are now awaiting the Endangered Species Conservation Committee to review this report and decide on the designation of grizzly bears in Alberta; Not at Risk, Data Deficient, Species of Special Concern, Threatened or Endangered.

To see Dr. Festa-Bianchet's report and other information about Alberta's grizzly bears, go to; <http://www.srd.alberta.ca/BioDiversityStewardship/SpeciesAtRisk/DetailedStatus/GrizzlyBear.aspx>

SASKATCHEWAN News

Education on Earth Hour

*Submitted by Robert Stedwill
Saskatchewan Chapter Chair*

I could sit down and write an article on what is happening in Saskatchewan with respect to uranium mining, the deeply buried oil sands in west central Saskatchewan, or even the carbon dioxide capture from the coal burning Boundary Dam Power Station in the Province's southeast. Undoubtedly, the environmental implications of those three, plus many others here would make for some interesting reading for biologists.

However, I'm not going to do that. I am going to embark on something more fundamental. Something which will have far more impact on the environment than data from biological monitoring, research findings, or even evolutionary theories. This is not to dismiss this kind of work, because it is necessary, particularly if problems are already occurring, or are imminent.

What if we could eliminate the problem in the first place?

The many environmental issues we face today are human-kind inflicted. We want our cars, our air conditioned homes, our computer games, our mega plasma TVs, our ATVs, snow machines, snow blowers, and we want to use them when and where we want. The list is endless as industries generate more and more goods because of the demand by consumers. Even basic commodities such as much of the food we eat is transported thousands of kilometres to our dinner tables so that we can eat that tropical want, when we want, usually in the middle of a Canadian winter.

The term "social license" has often been used by industrialists when seeking environmental approval for their particular projects, which may have undergone an EIA, that not only have they undertaken that required by law, but has also received the "license" that society may bequeath a project. Although not required by law, it nevertheless supports the industry's contention that what they are proposing is fundamentally "good," if the public will go along with it. The public of course is not necessarily basing their approval on the environmental merits or impacts of the project, but on whether the project will benefit them personally. Will it provide me with a possible job; will it bring prosperity to my community; will it lower my taxes, or ultimately, will my life be better as a result?

Many, I feel, do not understand the connection between one's better life, and impacts on the environment. We need to go back to the fundamentals of educating our society. Earth Hour is one such endeavor scheduled for March 27 between 8:30 and 9:30 in the evening, when families are together, and parents can take advantage of instilling in their children, or vice versa in some cases, the need to understand what it means to do without for an hour. Only an hour.

In 2009 I was disheartened the following morning after Earth Hour to hear from the local power utility that Earth Hour hardly registered, and could not be discerned from the normal variability of the electrical load at that time of day and month, having taken into account other load factors such as weather. The utility's report confirmed my earlier findings from my walk around my neighbourhood during Earth Hour that few, if any, had paid any heed to advertising

and promotion of “the hour.” More disappointing was the fact that, in many of the “young family” homes, lights were still on and plasma screens still glowed through drawn curtains and blinds. What was needed that night was me being “Mrs. Kravitz,” inserting myself into their lives for that one hour. Taking away their social license for one hour; alerting them of their impact on the environment, our shared environment, and our global environment. As a Society, are we prepared to be the Mrs. Kravitz’s of the world? Inserting ourselves into people’s lives?

What purpose does the CSEB have, other than to inform other biologists of our work, lobbying governments perhaps of the perils of their impending decisions, or decisions already made? We need to reach a more fundamental audience.

MANITOBA News

Submitted by Dr. Bill Paton, CSEB Director

A current ongoing debate in the province of Manitoba is whether it is important to reduce all nutrient inputs into surface waters. In particular, political debate has focused on a recent Manitoba Clean Environment Commission recommendation that the City of Winnipeg be required to remove nitrogen from its sewage effluents. Some, including Dave Schindler and an (unidentified) significant and respected collection of scientists, do not believe it necessary to do so and have supported the Winnipeg mayor in this regard, commenting that it is sufficient to address the phosphate discharge (Kives 2010; Mitchell 2010, Carr, 2010.) The cost of nitrogen removal has been estimated at \$350 million in capital expenditures and \$9 million annually in operating costs. Again the expense incurred for infrastructure that should have been in place since the 1970s rears its head in this province. Indeed, Dr. Eva Pip, a well known aquatic toxicologist at the University of Winnipeg, has publicly said “They (the City) want to cheap out and do phosphorous only” (Brodbeck 2010). I talked to Dr. Schindler at our meeting in Edmonton and suggested to him that perhaps he was being used in this situation.

Here is my rationale for nitrogen removal from effluents being discharged to surface waters in Canada. It is of note that the only Manitoban wastewater treatment plant that does remove nitrogen from its waste stream is the Brandon Industrial Wastewater treatment plant. I served, as a community service, on the design team for this plant and indeed the team received an award from the Manitoba Association of Engineers and Geoscientists for the success of this plant. I personally was recognized by the Manitoba

Network for Science and Technology with a Certificate of Achievement in 2004.

In the 1991 State of the Canada’s Environment Report (‘The Charest Report’), the popular British science magazine, *The New Scientist*, carried the headline “Canada Land of Dying Lakes and Rivers.” The section on the Prairies reported on serious eutrophication in all of the major rivers feeding Lake Winnipeg and the Hudson Bay system. The warnings were ignored by Manitobans and no measures to deal with eutrophication were adopted until the appearance of massive blue-green algal blooms in Lake Winnipeg. It should also be noted that other warnings on water quality in the province had been ignored by a series of governments since the 1970s.

The immediate response to the Lake Winnipeg problem was measures to reduce phosphate inputs into the Lake since the problem was linked only to cyanobacterial blooms and not to the eutrophication problem impacting the entire Hudsons Bay drainage system (McGinn and Paton 2008; Paton 2001, 2003).

Aquatic plants, like land plants, require a large number of inorganic elements derived from minerals or mineralized by the decomposition of organic matter in order to grow and reproduce. The minerals are taken up in the form of ions and incorporated into the plant biomass. As has been known since the time of Liebig, a nutrient element available in inadequate concentration can be a growth limiting factor. The supply of mineral nutrients to submerged and floating aquatic plants is, next to the available radiation, the most important production-limiting factor in aquatic communities. Primary production by autotrophic planktonic organisms (prokaryotes and eukaryotes) is possible only in the euphotic (adequately illuminated) layer, which becomes noticeably depleted of minerals (particularly nitrogen, phosphorus, and silicon) when the phytoplankton multiplies rapidly. Even before such depletion, nitrogen and phosphorus are present in only trace amounts in unpolluted fresh and sea water (0.0003 g/L and 0.00003 g/L, respectively)(Larcher 1975). Thanks to their special ability to concentrate minerals, the planktonic algae manage initially with this limited supply. Algae (prokaryote and eukaryote) can also accumulate stores of phosphate so large that they have enough for synthesis and metabolism for several successive generations.

If mixing occurs in a water body, nutrients are restored to the euphotic zone. The cyanobacteria have the additional property of nitrogen gas fixation, that is, they can take nitrogen gas from the atmosphere and use this a nitrogen source for growth and multiplication. The rates of nitrogen fixation by these organisms can be very significant. Hendzel

reported 11,000 tons of nitrogen fixed by cyanobacteria in Lake Winnipeg in the 2004 season (Casey 2006). Decomposition of their cells adds to the nitrogen levels in the sediment and therefore, by recirculation, to the euphotic zone. If anoxic conditions are prevalent in the sediments, then ammonium/un-ionized ammonia will be the major product of cyanobacterial cell decomposition. Un-ionized ammonia is a top priority pollutant in aquatic ecosystems, since it is very toxic to aquatic life.

Wherever fertilizer salts appear in surface waters, eutrophic regions of water with greatly enhanced plant productivity result. In rivers and lakes, a great influx of drainage water rich in nitrogen and phosphate can cause excessive fertilization, which endangers the overall balance of the ecosystem. Increased growth of aquatic plants, green algae, and periphyton have been noted as nitrate nitrogen is increased in the Little Saskatchewan and Assiniboine rivers. These other contributors to eutrophication are currently limited by nitrogen. Senescence of these plants in the fall leads to increased demands for oxygen in the sediments. The spring melt and high river flows carry large levels of nutrients and organic matter downstream to Lake Manitoba and Lake Winnipeg. Changes in species composition result in these river systems as a result of oxygen depletion zones, turbidity, and un-ionized ammonia (Henriksen et al. 1997; Noton 1998; Camargo and Alonso 2006). The latter study concludes that levels of total nitrogen lower than 0.5- 1.0 mg/L could prevent aquatic ecosystems from developing eutrophication and acidification. This decaying plant matter also results in high levels of the carcinogenic trihalomethanes in potable water when it is chlorinated for disinfection.

Many jurisdictions around the world have been striving to reduce inputs of nitrogen into surface waters to reduce ecosystem changes in rivers and streams. Particular concerns have been raised about estuaries and coastal ocean regions where nitrogen is the limiting nutrient for eutrophication (Paerl et al. 2002; Howarth and Marino 2006; Alvarez-Cobelas et al. 2008; Paerl 2009). In the last publication after some 30 years of study and review, Paerl concludes that both nitrogen and phosphorus reductions are essential to estuarine and coastal ecosystems. Domestic wastewater discharges are considered one of the most significant threats to coastal environments worldwide (GPA 2001; Matthiessen and Law 2002). It should be noted, in the Lake Winnipeg context, that the lake drains into the coastal regions of Hudson Bay.

In the United States, as early as the 1970s, limitations on nitrogen additions to surface waters were implemented (USEPA 1980). The overriding rationale for establishing water quality criteria were as follows:

- (a) ammonia toxicity to aquatic life;
- (b) growing plants assimilate nitrate and ammonium ions into plant material; and
- (c) both nitrate and nitrite nitrogen are toxic to aquatic life where specific concentrations are reached in a water body.

Some specific state requirements are as follows:

- Arkansas - The naturally occurring N:P ratio shall not be significantly altered due to municipal, industrial, agricultural, or other waste discharges.
- Florida - In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.
- Maryland - The state recognizes that certain waters of the State are eutrophic or are approaching eutrophic conditions.

All discharges to waters, which are eutrophic or potentially eutrophic, shall be treated as necessary to reduce eutrophic effects. Wastewaters containing nutrients that cause or may cause eutrophication must be given advanced treatment prior to discharge or irrigated.

Terrestrial eutrophication is also a worldwide phenomenon with nitrogen deposition from the atmosphere impacting negatively on forests, global plant biodiversity, and land and water ecosystems (Sutton et al. 2008). Indeed, calculations derived from our data in the Brandon region suggested that approximately 10% of the current deposition of nitrogen to Lake Winnipeg could be from the atmosphere.

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ONTARIO News

Canadian Wildlife Scientists Needed

Submitted by Wendy Tompson, Ontario Region

Stornoway Productions are developing a documentary concept for a major public German broadcaster on the topic of Canadian wildlife. The angle of the documentary is to explore the last "untamed" frontiers of North America with a focus on interesting biology and science stories. They would like to show dramatic landscapes and magnificent animals like grizzly bears, polar bears and mountain lions. CSEB has members who work in this region of Canada, they are hoping we might be able to share some story angles with them. For now, they are primarily interested in putting together a short demo and pitch document, but if the documentary is financed then they will hire several scientists to appear as characters or even hosts in the show. If anyone has an interest in being part of this documentary please contact Jude Hornborg, Researcher and Associate Producer, Stornoway Productions, (416) 923-1104. jhornborg@stornoway.com

CSEB Annual Meeting and Conference

The CSEB is looking for volunteers to help arrange our AGM and conference in the Toronto area in fall 2010, likely using the facilities at the Toronto Zoo. If interested, please contact Brian Free at bfree@cseb-scbe.org.

ATLANTIC News

Atlantic Director's Report

Submitted: Patrick Stewart, Atlantic Region Director

CSEB Atlantic is just climbing out of the winter doldrums, created in part by the long dark days and winter workloads, but also the release from pressure that comes after the annual conference, this year held in mid-October in Edmonton. This is usually a slow time for CSEB (although some members are working their butts off managing annual registration), but there's no reason it should be. We'd like to break the mold, and hold a CSEB event in the Halifax area (a sponsored talk, a field trip, whatever) and are looking for members who'd like to organize it. We're also looking for suggestions for the second CSEB Atlantic Director—someone who's been a member and who would be willing to be instrumental in expanding membership in the area. Some first tasks could be to start chapters in some of the

major Atlantic Canadian cities—Fredericton, Moncton, Charlottetown, Halifax, Saint John and St. John's. CSEB is a wonderful and useful organization, one it would be very rewarding to help organize and be a part of. But we need someone with the interest and most importantly, a knack for doing it. Novices can apply, and we'll bend over backwards to train you.

One of the positive things we do is serve as point persons for media inquiries. Last Fall, for example, I was interviewed by a freelancer from MacLean's magazine, as they were writing their annual university issue. They needed some insight into biological careers, and specifically I filled them on the career of Marine Biology. Check out the November 16th issue (page 122) to see how we were able to provide useful input on behalf of biologists at the national level.

TERRITORIES News

Submitted by Anne Wilson, 1st Vice-President, CSEB

Spring greetings to all from Yellowknife! The lengthening days and above-normal temperatures in March are bringing thoughts of open water and greenery to mind. This "between-seasons" field hiatus will pass quickly with report-writing for winter work, as well as preparation for the upcoming field programs. For those of us in the North who are substantially "desk biologists" there will be plenty of reading to occupy our days! There has been progress on several projects which are undergoing environmental assessment, and some new activity is on the horizon.

Project Updates: Mining:

In the NWT, proponents of the three proposed new mines have been preparing the Developer's Assessment Reports (DAR) for submission to the Mackenzie Valley Environmental Impact Review Board. First out of the gate is the DAR for Canadian Zinc Corp.'s Prairie Creek Mine, which is expected to generate a lot of public interest, given its proximity to the Nahanni National Park. Fortune Minerals Ltd. will be submitting the DAR for the proposed NICO mine (bismuth-gold-cobalt-copper), which is located 160 km northwest of Yellowknife. Fortune has decided to ship concentrate south for smelting, which simplifies the project for the northern jurisdiction. Although the proponents of the Yellowknife Gold Project, Tyhee NWT Corp., have been issued final terms of reference for their DAR, submission is not expected in the near term.

In case we don't have enough technical reading to absorb, the Giant Mine Remediation Project DAR is expected in April. The project includes the containment of 237,000 tonnes of arsenic

trioxide dust currently stored underground. Minewater will need to be managed and discharged in perpetuity, and a new aspect of the project is a diffuser to discharge treated effluent into Yellowknife Bay.

The latest update from De Beers on the Gahcho Kué Diamond Project is that we can expect the release of the Developer's Assessment Report in Fall of 2010, at which time the Environmental Impact Review process will resume.

Avalon Rare Metals Inc. is continuing work on the rare earth and metals property in the Thor Lake area of the NWT, which lies just north of the Hearne Channel of Great Slave Lake. Monitoring programs have been ongoing, to prepare for development of an impact assessment once the project description has been developed and applications submitted.

Information on current projects undergoing assessment is available from the Mackenzie Valley Environmental Impact Review Board site at <http://www.mveirb.nt.ca/>.

As far as producing mines in the NWT, there are the three diamond mines (Ekati, Diavik, and Snap Lake). These files generate a fair amount of traffic due to an ongoing flow of management plans, reports, and monitoring results. The Snap Lake water licence will be up for renewal next, and that process will involve a comprehensive review of the performance of the environmental protection measures and the monitoring programs as part of the water licence renewal process.

In October, the North American Tungsten Ltd. Cantung Mine, located near the Yukon border in the western NWT, ceased production and moved to a care and maintenance state. Obligations under the Water Licence and MMER-EEM for aquatic monitoring are still required to be met, but this presents challenges.

Tamerlane Ventures Inc. has updated feasibility and reserve report work for the million-ton Pine Point Project test mine, and is working on securing financing for construction of the project.

In Nunavut, the newest mining development application to be submitted is from Comaplex Minerals to develop a mine at Meliadine Lake, located 25 km north of Rankin Inlet. This would involve the extraction of ore by open pit and underground mining, milling on-site, and construction of a 27 km all season road connecting the mine to the municipality. The Nunavut Environmental Impact Review Board will be conducting the environmental assessment of this project.

AREVA Resources Canada Inc. has applied for permits for mine development at the Kiggavik uranium property 80 km west of Baker Lake. The preliminary screening done by the Nunavut Environmental Impact Review Board was confirmed in February by the federal Minister as a Board process, which will proceed to scoping in the near future.

Newmont Mining Corp. is proceeding to develop the Doris North gold project and working concurrently on a project description for a regional development of the adjacent Hope Bay area deposits. Aquatic effects monitoring will be re-instigated in the upcoming open water season to meet the requirements of both the Water Licence as well as those of the Metal Mining Effluent Regulations Environmental Effects Monitoring program.

Other mining projects have been quiet, including the base metal properties held by MMD Minerals at High Lake, Ulu, Lupin, and Izok Lake. Sabina Silver Corp. is revisiting the Preliminary Economic Assessment of their resource at the proposed Hackett River Mine (lead, silver, copper, lead, and gold), and will re-evaluate the Pre-Feasibility Study that was started in 2007.

Baffinland Iron Mines Corp. was issued Final EIS guidelines from the Nunavut Impact Review Board last November. In 2010, the company will be doing further exploration work to add to inferred resources for two other deposits in the area, and working to secure financing for development.

And, to wind up the mining news on an exciting note, Nunavut's first producing gold mine poured its first gold bar in February, with the Meadowbank Gold Mine moving from construction to operations. On the monitoring front, Agnico-Eagle Mines (AEM), which owns the Meadowbank Project, are breaking some new ground in their work to integrate the various monitoring programs and link them directly to adaptive management in a comprehensive "Aquatic Effects Monitoring Plan." AEM is also applying to increase their bulk fuel storage by almost 50%, and to extend the airstrip into the adjacent lake.

Hydroelectric:

Taltson Hydro Expansion: Public hearings have been conducted for this project, and the NWT Energy Corporation is currently assessing alternate transmission line routes. When this stage of the process wraps up, the Mackenzie Valley Environmental Impact Review Board will prepare a Report of Environmental Review with their decision.

There has not been any progress on the Qulliq Energy Corp, Nunavut hydro proposal to build a dam at Jaynes Inlet, near Iqaluit, to generate power on a seasonal basis to meet the City's power demands. The proposed system would generate an estimated 5-9 MW of power.

Oil & Gas:

Following the release of the Joint Review Panel's report on the Mackenzie Gas Project, regulators are formulating their response to the recommendations made by the Panel. That said, the pipeline proponents, lead by Imperial Oil Ltd., have advised that they will make the decision to proceed by the end of 2013,

which would delay startup to 2018. In retrospect, the pipeline's cooperation agreement for the review process was initiated in mid-2002, and if the pipeline is constructed and commissioned, it will be a generation later – something not envisioned at the start of this process. The Panel's report is available on the Mackenzie Valley Environmental Impact Review Board's site at http://www.reviewboard.ca/registry/feed.php?project_id=36.

Municipal:

Following on the signing of the Canada-wide Strategy for the Management of Municipal Wastewater Effluent by the Canadian Council of Ministers for the Environment in February, wastewater regulations under the *Fisheries Act* have been drafted and released for public review. The draft regs can be found at <http://www.gazette.gc.ca/rp-pr/p1/2010/2010-03-20/html/reg1-eng.html> and the public comment period runs until May 19th, 2010.

To recap the implementation of the Strategy, in southern Canada there will need to be administrative agreements between jurisdictions. Operators of southern systems will have to meet performance standards, conduct monitoring, and look at environmental discharge objectives (among other things) with time frames based on risk and size. The Strategy specifies that the North is being given a five year period to determine reasonable and protective performance standards for systems that face challenges of extreme climatic conditions, infrastructure limitations, capacity, and logistics. This has been implemented in the draft regulations by specifically excluding the NWT and Nunavut, and areas north of 54 degrees latitude in Quebec, Labrador, and Newfoundland.

Municipal field work is being planned for several communities across the North in order to identify reasonable performance standards for wastewater systems. This will involve comprehensive characterization of representative Northern systems in order to evaluate performance, as well as collection of sampling data from a number of other systems to round out the community data inventory.

Input Requested:

Are you doing work in the North that you'd like to let others know about? Please feel free to contact me, or to draft an article for the newsletter. The CSEB provides a valuable networking and communication forum! There is also the option of instigating CSEB activities – both of the fun and/or of the educational variety - with colleagues in the north. Please email your thoughts to me at anne.wilson@ec.gc.ca.

Meanwhile, enjoy the spring sunshine, and best wishes to you all!

A HISTORICAL PERSPECTIVE ON THE EVOLUTION OF BIOLOGICAL SOCIETIES IN ALBERTA

Submitted by Lu Carbyn, CSEB Member

Editor's Note: This article was prepared for the 20th anniversary of the Alberta Chapter of the Wildlife Society, and is reprinted here for the information of CSEB Members.

On the occasion of the 20th anniversary of The Alberta Chapter of The Wildlife Society it is worthwhile to reflect on its origins. It is important of course to recognize that the parent society – The Wildlife Society - had a much older history with its formation in the United States in 1937. North American biologists, from both Canada and the United States, had formed a professional bond quite early on its history. Much of the leadership coming from the Americans, although numerous Canadians also served in various executive positions from time to time. The Alberta Chapter of The Wildlife Society was an offshoot of those early beginnings but had quite a circuitous evolution. To better understand that path it is necessary to look at the bigger picture.

Currently there are 4 organizations that serve biologists in Alberta. These are the Canadian Society of Environmental Biologists (CSEB), The Alberta Society of Professional Biologists (ASPB), The Alberta Chapter of The Wildlife Society (ACTWS), and the Alberta Natives Plants Council (ANPC). Three of these have their origins in a progenitor -- the Canadian Society of Wildlife and Fisheries Society (CSWFB).

The Canadian Society of Wildlife and Fisheries Biologists was established in 1958. Membership dues in 1967 were \$7.00 for regular members and \$1.00 for students. It was a pan-Canadian Society with 6 regional chapters (Maritimes, Quebec, Ontario, Prairie Provinces, British Columbia, and the Territories). Membership was small but relatively active and there was considerable cohesion country wide; that despite the absence of computers, fax machines, and xerox machines. It had a strong traditional base in the classical disciplines of wildlife and fisheries biology and represented professionals from government and agencies and universities. There were no environmental consultants active at the time. Consultants burst unto the scene in the late 1960s and early 1970s. It was also a time that governments began to establish Departments of the Environments. With the emergence of laws protecting the environment the growth of private initiatives and environmental consultants was inevitable and a very worthwhile development. This

brought new, evolutionary initiatives, to the forefront. The once, close-knit Canadian Society began to fall apart. In the immediate terms, the name of CSWFB changed to the Canadian Society of Environmental Biologists (CSEB) and that was only the beginning of a process that led to the formation of other societies.

I served as the Chairman of CSEB, Alberta Chapter, when much debate and considerable turmoil existed in the different orientations within the professional community. Chief architects at the time, who prompted change and demanded a more structured professional group, were government administrators and some newly established consulting firms and individuals. Others were not happy with a change from classical wildlife and fisheries orientation to a “watered down” environmental label. These were the more conservative elements among the professionals. Nevertheless, the CSEB survived, but only as a much smaller national organization. Two societies, the ASPB and ACTWS staked out their claims for action in the provincial scene. In that regard, the province of Alberta became a leader on the national scene. So how was that possible? In reality it was not at the expense of CSEB, an organization that proved to have a remarkable level of survival.

Today the Canadian Society of Environmental Biologists has a membership over 200 biologists from coast to coast in Canada. Provincial chapters within CSEB are quite variable and, generally, not as strong as the national organization. CSEB membership ranges broadly within a range of environmental biologists including fisheries and wildlife biologists, forestry, environmental toxicology, limnology, plant science and zoology. For more details visit the website <http://www.cseb-scbe.org>. With these changing trends there was also competing visions of what professional organizations should be about.

In the early 1970s, the struggle for influence and membership between the different organizations serving professional biologist was very pronounced and resulted in heated debates. On the one hand, we had those that believed in environmentally oriented actions. These proponents urged biologists to speak up on environmental issues. Principal proponents of that view were University of Alberta professors, most notably Dr. David Boag, Dr. Bill Fuller, Dr. Tim Myres, and Dr. Joe Nelson. Another group felt that professional biologists should form a “union”

to protect professionalism and establish an organization whose prime focus was to evolve as a self regulating body in Alberta. Such a society would be committed to the promoting excellence in the practice of biology. The society that evolved out of that initiative was The Alberta Society of Professional Biologists (ASPB) with a 2010 membership of over 900 biologists. The principal leader in the movement towards establishing a provincially incorporated society, much like that of the engineers, was the then Alberta Director of Wildlife and Fisheries, Dr. Stu Smith. On the provincial scene the ASPB has grown at a remarkable rate and established a very effective society with a well funded infrastructure (www.aspb.ab.ca). One major difference between the ASPB and CSEB is the membership fee, which is considerably higher for ASPB. Another difference is the services to the membership and more restrictive nature of ASPB. Both organizations put on workshops and hold symposia, but lacking the financial stability and depending on volunteer services, the CSEB had a much more difficult time in serving its members. Outstanding in the service of that organization was, and continues to be, Gary Ash, an environmental consultant with a very stellar record of service.

I was the chairman (Alberta Chapter) of CSEB (1974 and 1975) when all these interactions and developments took place. Simply put, loyal and traditional Wildlife Biologists from the old Canadian Society of Wildlife and Fisheries Biologists were not happy with CSEB or ASPB at the time, and began to develop a Canadian Branch of a very well established and functioning North American Society whose international power base was in the United States. Bill Glasgow, Dr. Michael Dorrance, and Dr. Bill Samuel provided much of the leadership in organizing the first meeting of ACTWS.

The Alberta chapter of the Wildlife Society has less rigid entrance requirements than the ASPB and is very much oriented towards research and management of wildlife resources and wild lands. It retained the old CSWFB perspectives, but added many new dimension towards its sphere of involvement. Most notably holding effective annual meetings in the province, and more than any other professional group, fostered the development of student participation. The chapter in 2010 has a membership of about 250 individuals. Members are associated with a broad spectrum of disciplines associated with universities, government agencies, consultants, various private organizations and industry. Much of the core membership comes from leadership provided by universities and colleges in the province, as well as Alberta Fish and Wildlife Division. A very encouraging aspect of ACTWS is its strong and active University of Alberta branch, in which students provide leadership and professional development.

For the website of ACTWS youth chapter – the University of Alberta entity – visit: <http://www.ualberta.ca/~uactws/>

Independent from the evolution of CSWFB, CSEB, and ACTWS was another professional organization, the Alberta Native Plant Council (ANPC) whose membership consists of botanists and those interested in plant conservation in Alberta. The Alberta Native Plant Council was organized as a result of the 1986 Federation of Alberta Naturalists Workshop on “Endangered Plant Species” in the Prairie Provinces. In 1986 the society was formally established as a registered society. The society meets on a regular annual basis and in 2010 had a membership of about 200 individuals.

Few could have predicted the outcomes of the struggles that existed in the early 1970s. What is remarkable is the growth and proliferation of both the number of societies and the total population of biologists in the province. From what started as one society with about 12 to 20 members (meeting regularly in private homes in the mid 1960s) to as many as 1,500 biologists all over the province who are largely unknown to each other, and likely often not even aware of each other societies’ existence.

Climate Change

Sprinkling Iron in the Ocean - An Update

Editor's Note: We included an article in the CSEB Newsletter /Bulletin (Vol. 64 (4): Winter 2007) that described a technique that was thought to be a possible solution to global warming by removing CO₂ from the atmosphere by increasing phytoplankton productivity in the ocean. Recent scientific experiments, however, indicate that this type of geo-engineering could result in disastrous consequences.

Recent tests conducted by a Canadian-U.S. scientific team in the North Pacific show that enriching water with iron favours the growth of an algae, *Pseudo-nitzschia*, that produces a potent neurotoxin. The toxin, domoic acid, can be lethal to marine mammals and aquatic life. It is also linked to amnesic shellfish poisoning in humans, which can be deadly.

A research team lead by Charles Trick published the findings of experiments conducted in tanks on the deck of a research vessel near Station Papa in the Gulf of Alaska in the Proceeding of the National Academy of Sciences. The findings raise serious concerns about large-scale iron fertilization as an effective tool to sequester CO₂ from the atmosphere by stimulating algal growth in the ocean.

Trick and his colleagues found that the toxin-producing *Pseudo-nitzschia* thrived in sea water enriched with iron. The algae accounted for just a small fraction of algae and plankton in the water at the beginning of the experiments, but eventually dominated the populations in the tanks. The enriched environment also appeared to increase the amount of domoic acid produced by individual algae

Pseudo-nitzschia blooms occur naturally off the coasts of British Columbia and Washington, and can poison marine mammals and sea birds; it also periodically causes major shellfish harvest closures along the coast. Trick and his colleagues are concerned that large-scale iron fertilization, which has been proposed by commercial companies as solution for global warming, could make the problem even worse. They indicated that the findings suggest that more independent research is needed before any largescale iron enrichment programs are undertaken.

At the very least, he and his colleagues say, the findings point to the need for more independent research. Trick notes the United Nations has declared a moratorium on oceanic iron fertilization, although some companies are pushing for the restrictions to be lifted, with some even defying the UN ban to conduct small-scale experiments.



Regional Directors Positions

CSEB is currently looking for Regional Directors in most of our regions across Canada. The position is a four year term. The official duties of the Regional Directors according to the by-laws is to “bringing to the attention of the Chapters in their respective Regions matters related to the conservation of resources and quality of the environment, and which are of National or Regional significance.” The directors should promote the affairs of the society in their region, and submit quarterly a short report for the newsletter. The duties also include participating in Board of Directors meetings either in person or via teleconference.

If you are interested in the position, please contact bfree@cseb-scbe.org

CSEB FINANCIAL Report

CSEB FINANCIAL REPORT FOR 2009

Submitted by *KAREN MARCH, Secretary/Treasurer, CSEB*

Cash in bank as of Dec 31/08 \$10,206.48
(from bank statement) *

Receipts

Membership Fees \$9,335.05
(include web registration closeout)
NRC Journals \$2881.50
Publication Sales \$0.00
Bank Interest \$0.00
Contribution (Conference Sponsors) \$2800.00
2009 Workshop Receipts \$13,602.02

Total

\$28,618.57

Expenses

Newsletter Production \$4529.18
Newsletter Mailout \$1240.84
Postage (Canada Post) \$303.25
(to Date and estimated)

Membership Renewal (&cards) \$665.13
AGM \$0.00
Administration (Board) \$0.00
2009 Conference Expenses \$12,583.64
Phone Conferencing \$1968.96
(to date and estimated)

Mail Redirect and Mail Box \$1220.40
Journals \$2881.50
Administrative (shipping) \$342.00

Chapter Rebates \$0.00
Web charges \$120.58
Bank Charges \$15.57
Society registration (federal) \$30.00

Total

\$25901.05

Difference

\$2717.52

Cash in bank as of Dec. 31/09 \$11,193.45
(from bank statement)**

GIC investment \$1,502.65
(value as of Jan. 09 /10)

Bank Balances are provided for information purposes only

*December 2008 bank statement does not reflect 2008 expenses for fall 08 v65 newsletter \$1541.27, mailsort \$86.63 and phone conferencing \$561.4

** December 2009 bank statement does not reflect 2009 expenses for fall 09 v66 newsletter and mailsort \$1428.79

The Sandy Pond Compensation Proposal

Submitted by R. John Gibson, Sandy Pond Alliance to Protect Canadian Waters

The Sandy Pond Alliance to protect Canadian Waters Inc. is a new organization formed in Newfoundland and Labrador to protect and conserve Canadian waters and their ecosystems. We presently are attempting to save Sandy Pond, which is presently proposed as a dump site for toxic effluents from a hydrometallurgical nickel processing plant, operated by Vale Inco. The company proposes to deposit toxic slurry wastes, of 375,000 tonnes per year, in Sandy Pond. All life would be extinguished in the lake. Two adjacent small lakes would also be affected. This would be cheaper for the company (\$62 million) than building a tailings impoundment (\$490 million). Sandy Pond is a lake on the south side of Long Harbour, Placentia Bay, on the west side of the Avalon Peninsula in Newfoundland. The federal Departments of Fisheries and Oceans and of Environment have given permission for Sandy Pond to be destroyed under the auspices of Schedule 2 of the Metal Mining Effluent Regulations, a retrograde amendment made in 2002, allowing mining companies to destroy pristine lakes, under the condition that there be adequate compensation.

Sandy Pond has a surface area of 37.83 ha, and a mean depth of 7.5 m, with a maximum depth of 16.5 m. Fish species in the lake are brook trout, smelt, and eel. Sandy Brook, the outlet stream, would be dewatered, resulting in the additional loss of 14460 m² of fluvial habitat. Two small adjacent lakes, Pond 26 (Moore's Pond), of 4.10 ha, and Pond 27, of 1.62 ha, would also be drained.

Compensation for the destruction and alteration of fish habitat was calculated as 18.11 ha of lacustrine habitat to be created. This would be done by: (1) creating a reservoir 2–8 m² deep, by impounding a nearby valley; creating 15.0 ha of lake habitat; (2) expanding existing ponds which have filled in with vegetation, creating 5.0 ha of aquatic habitat. "Vale Inco NL would relocate/transfer all appropriate species to the newly created habitats."

The calculation requiring only 18.11 ha of lacustrine habitat as compensation for the destruction of Sandy Pond is based on a DFO document describing how to assign ratings to habitat features for each fish species. We believe the compensation proposal is naïve and inadequate for many reasons. Although the habitat ratings generally are based on reasonable but somewhat coarse observed data, they may not be applicable in all situations. For example, brook trout are given high ratings for the littoral parts

of the lake (13.91 ha), but a low rating for the profundal zone of 23.92 ha. However, the brook trout of Sandy Pond apparently have evolved an ecotype to use the pelagic region. Local residents and sport fishers tell us that Sandy Pond is known for its large trout of 3 – 5 lbs, which feed on the dwarf smelt. The trout are lighter coloured than the usual colouration of trout, similar to the silvery colouration of sea trout, although resident. This indicates that these trout use the pelagic region of the lake. Smelt are essentially schooling pelagic fishes inhabiting mid-waters of lakes. Therefore, since the pelagic zone is the major habitat of the smelt, and the source of food for the piscivorous trout, the pelagic zone of Sandy Pond should be given a much higher rating for the trout than was given in the mining company's Environmental Impact Statement.

Pond 27 contains brook trout. Pond 26 had no fish, a situation commonly found in recently glaciated areas. Because Pond 26 had no fish it is "not considered as fish habitat." This is despite the fact that conditions are suitable for fish and are good for stocking of a salmonid for angling, or for lake rearing of salmon smolts for supplementing a salmon run, the success of which has been demonstrated by G. Power and students at Matamek, Quebec, and by Vern Pepper of DFO. The potentials of Pond 26 should not be ignored. There were no robust estimates of fish biomass or production of Sandy Pond (and we believe the estimated 'Habitat Equivalent Units' are inappropriate).

Therefore we conclude the full 37.83 ha of Sandy Pond (plus 1.62 ha of Pond 27) needs to be replicated. Definition of fish habitat under the *Fisheries Act* means spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes. The overall objective of DFO's Policy for the Management of Fish Habitat is a net gain of the productive capacity of fish habitats for Canada's fisheries resources. The policy is intended to "increase the natural productive capacity of habitats for the nation's fisheries resources to benefit present and future generations of Canadians." Pond 26 has a "productive capacity," and the pelagic region of Sandy Pond is used for migration and feeding by brook trout and the smelt.

The intention is to "relocate/transfer all appropriate species." Presumably this means the brook trout, smelt and eels. There are no indications as to how these species would interact in the newly created habitat. It is likely the brook trout and the smelt have been selected for genotypes to most efficiently use Sandy Pond, and it is unlikely the community composition and large size of trout would

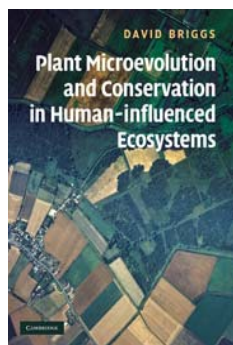
persist in the new habitats. American eel has been listed as 'a species of concern' by COSEWIC, so present habitats should be conserved. The eel populations of the Sandy Pond watershed would be eliminated, and would not persist in the new reservoir created for the proposed 'compensation,' since access, by an intermittent stream, is limited. In the newly created acidic waters mercury would be leached for several years, and with microbial interactions methyl mercury would move up the food chain, making the fish unhealthy to eat for a number of years.

The loss of Sandy Pond would cause major losses of fish habitats and biological diversity, as well as removing recreational opportunities.

The proposed compensation is clearly inadequate to justify the destruction of Sandy Pond, and would not compensate for the loss of a unique ecosystem. In fact, we believe the exercise is a public relations strategy, similar to the inappropriate "compensations" for the recent destructions of Star Lake and Trout Pond in central Newfoundland.

The case study above illustrates the problem with the adequate compensation for a whole ecosystem, and may be impossible. Traditionally mining companies built their own tailings ponds, and this should be the norm, rather than allowing destruction of pristine waters under Schedule 2 of the Metal Mining Effluent Regulations.

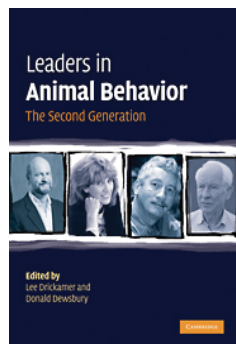
BOOKS OF Interest



Plant Microevolution and Conservation in Human-influenced Ecosystems.

David Briggs. Cambridge University Press, 2010.

As human activities are increasingly domesticating the Earth's ecosystems, new selection pressures are acting to produce evolutionary winners and losers among our wildlife. With particular emphasis on plants, Briggs examines the implications of human influences on micro-evolutionary processes in different groups of organisms, including wild, weedy, invasive, feral, and endangered species. Using case studies from around the world, he argues that Darwinian evolution is ongoing. He considers how far it is possible to conserve endangered species and threatened ecosystems through management, and questions the extent to which damaged landscapes and their plant and animal communities can be precisely re-created or restored. Many of Darwin's ideas are highlighted, including his insights into natural selection, speciation, the vulnerability of rare organisms, the impact of invasive species, and the effects of climate change on organisms. This book will be an important acquisition for students and researchers of evolution, conservation, climate change and sustainable use of resources.

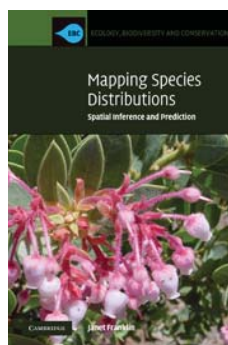


Leaders in Animal Behaviour: The Second Generation.

Lee Drickamer and Donald Dewsbury. Cambridge University Press. 2010.

Animal behaviour, as a discipline, has undergone several key transitions over its recent history. Key advances

over the past 25 years have been made in behavioral ecology and sociobiology, in the development of studies integrating proximate and ultimate causation, in the integration of laboratory and field work, and in advances in theoretical work in areas such as sexual selection, foraging and life-history traits. The lives of those on the forefront of this developing science can be both interesting and instructive. *Leaders in Animal Behavior: The Second Generation* profiles 21 of these modern pioneers and outlines their important contributions.

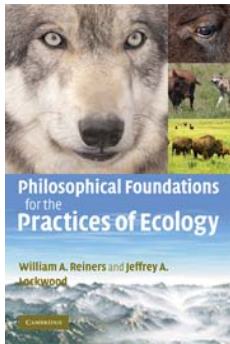


Mapping Species Distributions. Spatial Inference and Prediction.

Janet Franklin. Cambridge University Press. 2010.

Maps of species' distributions or habitat suitability are required for many aspects of environmental research, resource management and conservation planning. These include biodiversity assessment, reserve design, habitat management and restoration, species and habitat conservation plans, and predicting the effects of environmental change on species and ecosystems. The proliferation of methods and uncertainty regarding their effectiveness can be daunting to researchers, resource managers and conservation planners alike. Franklin summarises the methods used in species distribution modeling (also called niche modeling) and presents a framework for spatial prediction of species distributions based on the attributes (space, time, scale) of the data and questions being asked. The framework links theoretical ecological models of species distributions to spatial data on species and environment, and to statistical models used for spatial prediction. This book will be useful for students, researchers and practitioners in a broad range of environmental sciences including ecology, geography, conservation biology, and natural resources management.

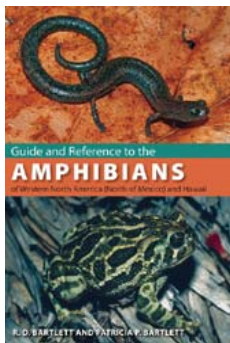
BOOKS OF Interest



Philosophical Foundations for the Practice of Ecology.

William A. Reiners and J.A. Lockwood. Cambridge University Press. 2009.

Ecologists use a remarkable range of methods and techniques to understand complex, inherently variable, and functionally diverse entities and processes across a staggering range of spatial, temporal and interactive scales. These multiple perspectives make ecology very different to the view of science presented by philosophers. *Philosophical Foundations for the Practices of Ecology* puts ecology into a new philosophical framework that engages with this inherent complexity while still constraining the ways that we can investigate and understand nature. Designed for graduate students and researchers, the book explores the sources of variety in the practice of ecology and how these have led to the current conceptual confusion. The authors argue that the solution is to adopt the approach of constrained perspectivism and go on to explore the ontological, metaphysical, and epistemological aspects of this position and how it can be used in ecological research and teaching.



Guide and Reference to the Amphibians of Western North America (North of Mexico) and Hawaii.

R.D. Bartlett and P.P. Bartlett. University of Florida Press. 2009.

More than 500 species and subspecies of amphibians and reptiles can be found in western North America. This set of three field guides focusing on the western United States, offers a complete survey of the frogs, toads, salamanders, snakes, turtles, and lizards that reside west of the Rocky Mountains (north of Mexico) and in Hawaii. It has been described as a little less technical than other field guides, with a writing style that will appeal to non-scientists. As an in-depth guide covering just western amphibians, it includes more material about each species than other reptile and amphibian guides can cover.

These familiar animals are found in habitats that range from seaside sand dunes to rocky montane outcroppings, and from mossy grottos to deciduous forests. Uniquely adapted to their

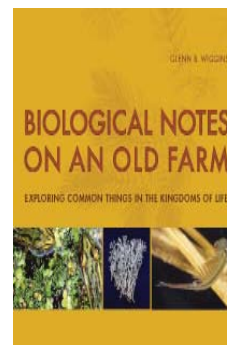
environments, all are interesting, a few could be considered beautiful, and a small number are deadly. The Bartletts' Guide seeks to expose them in an orderly (species are grouped alphabetically by scientific name within each order), colourful (color photographs) and detailed presentation. For each species the authors provide descriptions that detail the appearance, naturally occurring color morphs, behavior, range/habitat, and prey--as well as species with which they may be confused. Geared toward a popular audience of people interested in reptiles and amphibians, the simple writing style is accessible and informative without being overly technical.



The ROM Field Guide to Freshwater Fishes of Ontario.

Erling Holm, Nick Mandrak, Mary Burridge. Royal Ontario Museum Publications. 2009.

A beautiful and authoritative full-colour field guide to all species of freshwater fishes found in Ontario. This new field guide is an excellent addition to the natural history and distribution of northeastern fishes. Particularly helpful is the numerous comparative photos of fish species, including lookalike cyprinids (minnows, shiners, dace). Also helpful is the distinctive color-paged arrangement of species accounts within the various families. This soft-covered 4 x 8 inch sized book promises to be very useful as a true field guide and a valuable fish reference.



Biological Notes on an Old Farm: Exploring Common Things in the Kingdoms of Life

Glenn B. Wiggins. Royal Ontario Museum Publications, 2009.

On his retirement, ROM Curator Emeritus Dr. Glenn Wiggins, and his wife, bought an old farm near the Eastern Ontario town of Harrowsmith. An international authority on aquatic caddisfly larvae, Dr. Wiggins was quick to record his observations on the biodiversity of the farm, its ponds, and its springtime temporary pools. With authority and humour, Dr. Wiggins leads readers through the seasons on the farm and the record of nature through the year. A handbook of the seasons for anyone who owns a cottage, farm, or country property.

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