



Vol. 66, Number 1 • Spring 2009

# **THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Newsletter / Bulletin**

## *In this Issue:*

- LAKE WHITEFISH BIOLOGY  
IN OKANAGAN BASIN LAKES
- CSEB CONFERENCE - ENVIRONMENTAL  
MONITORING - FIRST CALL FOR PAPERS
- EAT YOUR DIRT
- JOHN LILLEY SCHOLARSHIP AWARDED
- BLACK WOLVES
- ANNUAL GENERAL MEETING



# CSEB Newsletter Bulletin SCBE

VOLUME 66, NUMBER 1, 2009

CSEB Website <http://www.cseb-scbe.org>

Webmaster: Shawn Martin • Email: [shmartin@eba.ca](mailto:shmartin@eba.ca)

## In this issue

National Executive & Regional Chapter Listings .....	1	Territories News.....	9
CSEB Objectives/Objectifs de la SCBE .....	2	Eat Your Dirt .....	10
<i>National News</i>		CSEB Scholarship Awarded .....	11
President's Report .....	3	Black Wolves .....	12
2008 CSEB Annual General Meeting .....	3	Lake Whitefish Biology .....	13
<i>Regional News</i>		Books of Interest .....	19
British Columbia News .....	5	Membership/Subscription Application .....	20
Alberta News .....	6		
Saskatchewan News .....	7		
Ontario News .....	8		
Atlantic News .....	8		

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**Cover Photo:** Students from Keyano College, Ft McMurray, Alberta, processing fish and taking down a fyke net on a local stream near Conklin, Alberta, during a hands on training session.

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### NATIONAL EXECUTIVE 2009

President: Brian Free (2008-2009)  
(Work) 780-427-7765; (Fax) 780-422-5120  
(E-mail) [bfree@cseb-scbe.org](mailto:bfree@cseb-scbe.org)

1st Vice-President: Anne Wilson  
(Work) 867-669-4735; (Fax) 867-873-8185  
(E-mail) [anne.wilson@ec.gc.ca](mailto:anne.wilson@ec.gc.ca)

2nd Vice-President: Vacant

Secretary/Treasurer: Karen March  
(Work) 902-453-3115; (Fax) 902-454-6886  
(E-mail) [kmarch@dillon.ca](mailto:kmarch@dillon.ca)

Newsletter Editor: Gary Ash  
(Work) 780-930-8666; (Fax) 780-483-1574  
(E-mail) [gash@golder.com](mailto:gash@golder.com)

Immediate Past-President: Shawn Martin  
(Work) 403-203-3305 Ext. 843  
(E-mail) [shmartin@eba.ca](mailto:shmartin@eba.ca)

Membership: Gary Ash  
(Work) 780-930-8666; (Fax) 780-483-1574  
(E-mail) [gash@golder.com](mailto:gash@golder.com)

•Term of Directorship

### REGIONAL DIRECTORS

Atlantic:  
Patrick Stewart (2009)  
(Work/Fax) 902-798-4022  
(E-mail) [enviroco@ns.sympatico.ca](mailto:enviroco@ns.sympatico.ca)

Québec: Vacant

Ontario:  
Denisa Necula (2010)  
(Work) 416-750-2478  
(E-mail) [denisaneacula@yahoo.ca](mailto:denisaneacula@yahoo.ca)

Wendy Thomson (2012)  
(Home) 905-723-9217  
(E-mail) [wendy@exworld.org](mailto:wendy@exworld.org)

Manitoba: William Paton (2010)  
(Work) 204-727-9783; (Fax) 204-728-7346  
(E-mail) [patonw@brandonu.ca](mailto:patonw@brandonu.ca)

Doug Ramsey (2008)  
(Work) 204-477-1848; (Fax) 204-475-1649  
(E-mail) [dramsey@seacorcanada.com](mailto:dramsey@seacorcanada.com)

Saskatchewan:  
Joseph Hnatiuk (2009)  
(Work) 403-524-1147; (Fax) 403-524-1148  
(E-mail) [hnaj@shaw.ca](mailto:hnaj@shaw.ca)

Jeff Hovdebo (2011)  
(Work) 306-780-8107; (Fax) 306-780-8722  
(E-mail) [Jeffery.Hovdebo@dfo-mpo.gc.ca](mailto:Jeffery.Hovdebo@dfo-mpo.gc.ca)

Alberta: Vacant

British Columbia: Vacant

Territories:  
Anne Wilson (2010)  
(Work) 867-669-4735; (Fax) 867-873-8185  
(E-mail) [anne.wilson@ec.gc.ca](mailto:anne.wilson@ec.gc.ca)

### REGIONAL CHAPTERS

Newfoundland & Labrador  
Contact: Pat Ryan  
(Home) 709-334-2962  
(E-mail) [patrickr@mun.ca](mailto:patrickr@mun.ca)

Atlantic Chapter  
Contact: Pat Stewart  
(Work/Fax) 902-798-4022  
(E-mail) [enviroco@ns.sympatico.ca](mailto:enviroco@ns.sympatico.ca)

Québec  
Contact: Claude Delisle  
(Work) 514-340-4962; (Fax) 514-340-5918  
(E-mail) [cedelisle@courriel.polymtl.ca](mailto:cedelisle@courriel.polymtl.ca)

Ontario  
Greater Toronto Area  
Chairperson: Wendy Thomson  
(Home) 905-723-9217  
(E-mail) [wendy@exworld.org](mailto:wendy@exworld.org)

Manitoba  
Contact: Douglas J. Ramsey  
(Work) 204-988-0512; (Fax) 204-988-0546  
(Cell) 204-792-3492  
(E-mail) [dramsey@seacorcanada.com](mailto:dramsey@seacorcanada.com)

Saskatchewan

Chairperson: Robert Stedwill  
(Home) 306- 585-1854  
(E-mail) [rjstedwill@live.ca](mailto:rjstedwill@live.ca)

Vice-chair: Jeff Hovdebo  
(E-mail) [Jeffery.Hovdebo@dfo-mpo.gc.ca](mailto:Jeffery.Hovdebo@dfo-mpo.gc.ca)  
(Work) 306-780-8107; (Fax) 306-780-8722

Alberta

Contact: Sheri Dalton  
(Work) 780-479-9262; (Fax) 780-474-1933  
(E-mail) [sdalton@concordia.ab.ca](mailto:sdalton@concordia.ab.ca)

British Columbia - Pacific Chapter

Chair: Vacant

Secretary: Diane Urban  
(E-mail) [durban27@shaw.ca](mailto:durban27@shaw.ca)

Treasurer: Jeff Matheson  
(Work) 604-685-0275; (Fax) 604-684-6241  
(E-mail) [jmatheson@eba.ca](mailto:jmatheson@eba.ca)

Membership: Vacant

Chapter Webmaster: Ajay Pradhan

Territories

Contact: Anne Wilson  
(Work) 867-669-4735; (Fax) 867-873-8185  
(E-mail) [anne.wilson@ec.gc.ca](mailto:anne.wilson@ec.gc.ca)



**CSEB NEWSLETTER 2009**

Vol. 66, Number 1 Spring 2009

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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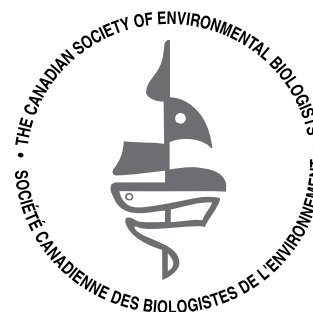
Vol. 66, Numbre 1 Printemps 2009

Le Bulletin de la SCBE est une publication trimestriel de la Société Canadienne des Biologistes de l'Environnement. Le Bulletin informe les membres des activités de la Société sur événements courant 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 professionnels élevés 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.

**Advertising Rates:****CSEB National Newsletter/Bulletin**

<b>DISPLAY ADS• ( 4 issues)</b>	<b>Rate Per Issue</b>	<b>Annual Rate</b>
Business Card Size (3.5" x 2")	\$ 25.00	\$ 85.00
1/4 Page (4"x 5")	\$ 55.00	\$ 190.00
1/2 Page (7"x 5")	\$ 100.00	\$ 375.00
Full Page	\$ 175.00	\$ 650.00

- prices are for camera-ready ads
- ads are subject to our approval for acceptance

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# NATIONAL News

## PRESIDENT'S Report

*Submitted by: Brian Free, CSEB President*

### Greetings!

So, President Obama came to Canada and we were swept up by the optimism that follows him everywhere. But the sun continues to rise in the east. Oil sands continue to be mined and natural landscapes continue to be cleared for our expanding cities and industries. Pollution hot spots are still with us and many species are still under siege.

There is still work to be done. And CSEB offers you an opportunity to contribute to solutions for these and other environmental challenges.

Why not volunteer to help out with one of our priorities for 2009? You will not be asked to abandon your lucrative career or give up your first-born child. As the saying goes, "Many hands make lighter work" and simply volunteering to do one small thing is greatly appreciated.

Here are some ideas:

- Addressing environmental issues. I'm sure that many of you belong to the CSEB because of a personal interest in environmental issues and a belief that biologists can provide a well-informed perspective, contributing to **real** solutions. We're forming an Issues Committee – Get involved!
- Planning the 2009 conference. A committee has formed to plan a conference on the topic of environmental monitoring. Would you like to contribute ideas for the program? Do you have experience in planning conferences and would like to help? Are you in a good position to advertise and promote the conference?
- Meeting other biologists. Get in touch with your Regional Director or Chapter Chair. If there is no active chapter in your area, you can still organize a seminar or informal get-together for area members.
- Are you more interested in Society operations? Have you ideas for increasing membership, improving communications through our website or newsletter? Would you like to get involved in your region? In the National Board?

Don't be shy! We are very interested in hearing from you. Contact your Regional Director or me. We're only an e-mail away.

Brian Free  
President  
bfree@cseb-scbe.org ☎

## 2008 CSEB AGM

### December 17, 2008 teleconference

Members in Attendance:

B. Free, G. Ash, S. Martin, K. March, J. Hnatiuk, P. Ryan

#### Opening President's Report by B. Free (full text on web site)

- 2008 was the 50th Anniversary year for CSEB.
- Membership is steady at approx. 200.
- Highlighted need to recruit new members, reflect and take positions on current environmental issues and pursue association's objectives.
- Recognize the importance of the annual conference and the efforts of BC Director, Jim Armstrong, to organize it this past year. Unfortunately, the 2008 conference could not be held. Renewed commitment to holding a conference in 2009.
- Noted CSEB's 2008 accomplishments: role in environmental policy issues; public education; John Lilley Scholarship established; popular and well-read newsletter; important web site public face; and role as credible authority on environmental biological issues.
- Challenges: to promote more active participation in the association; to ensure natural turnover in Board occurs smoothly; and to increase recruitment of general membership.
- Thanks to all for participation and support!

Report accepted by Board (motion J. Hnatiuk, 2nd K. March).

#### 1st Vice President's Report Tabled

- VP report is posted on the web site; highlighted areas of interest, including a newsletter issue focused on monitoring.

Report accepted by Board (motion B. Free, 2nd J. Hnatiuk).

#### No 2nd Vice President's Report due to earlier resignation.

#### Financial Report by K. March (interim reports on web, final report will include December data)

- Reviewed 2008 financial summary to mid December 2008 and proposed 2009 budget.
- Financial report to be updated to December 31 when data available.
- Note to be added to explain correspondence of 2008's beginning amount to the 2007 Financial Statement year-end amount.
- Budget for 2009 to increase revenues to reflect 2009 conference proceeds and to balance expenses and receipts.

**Action:** K. March to request a local CSEB member review financial statements.

Report accepted by Board (motion G. Ash, 2nd J. Hnatiuk).

#### Membership Secretary Report by G. Ash (full text on web site)

- Breakdown of membership by category (regular, associate, library, student) and area (Atlantic, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, BC).
- Discussion points on need for plan to increase membership:
  - 1) Needs to be proactive, beyond renewals of existing members.
  - 2) Strategy for membership drive required.

- 3) Slogan to be included in membership drive – e.g. “Biologists who care!”
- 4) Suggestion to email all members and libraries regarding membership drive.
- 5) Target students and professional biologists.
- 6) Increase CSEB's profile by addressing environmental issues, attending workshops and through the 2009 conference.
- 7) Need for promotional material – posters, power-point presentation.

**Action:** B. Free to recruit someone to work with membership secretary on a membership drive.

Report accepted by Board (motion K. March, 2nd J. Hnatiuk).

#### Newsletter Editor Report by G. Ash (full text on web site)

- Three issues published to date, with winter newsletter pending.
- Deadlines for submissions for 2009 newsletter issues is to be listed on web.
- Request for regional content and submission on schedule.
- Request for cover photos showing biologists at work.
- Guest editor working on dedicated issue on Environmental Monitoring.
- Request for proofing assistance on a timely basis.
- President noted that the newsletter is a highly visible and valued CSEB document.

Report accepted by Board (motion J. Hnatiuk, 2nd S. Martin).

#### Web Master Report by S. Martin (full text on web site)

- Figures show increases in web site hits year over year. Noted that the site was transferred to a new host in October and has had an increase in hits since.
- Figure showing November hits/visits to web site and other details. The lunch hour and after work are the most frequent time for hits. Most popular pages – Jobs, members, AGM, new items and meetings. Number of external sites referring to CSEB is up. Most common search word on our site is “litter”.
- Discussed ways to increase job listings. Agreed not to be a simple copy of federal & provincial information, but will investigate adding links to relevant sites.
- President noted that web site an important CSEB tool.

Report accepted by Board (motion K. March, 2nd J. Hnatiuk).

#### Regional Report Summaries (full text on web site)

- Ontario – Noted that it has been an active chapter; ideas identified related to partnering, advertising, membership survey and emailing newsletter.
- Saskatchewan (presented by J. Hnatiuk) – also active, have had four meetings, but membership is down. Addressed a variety of issues particularly related to new government, uranium mining, CO2 and Saskatchewan Power. Have had a workshop on nuclear waste management. Organizing a workshop on the Canadian Environmental Assessment Act review for the public and NGO's in collaboration with Aboriginals in Fort McMurray. Will post schedule/details on web site when organized.
- No Alberta or British Columbia reports available.
- Newfoundland (summarized by P. Ryan) – Noted that there are many environmental issues and other interest groups in the province. Addressed affiliation with Canadian Environmental Network. Noted that the CSEB annual meeting should be a key focus to address issues and membership.

Reports accepted by Board (motion J. Hnatiuk, 2nd K. March).

#### General Discussion

- Suggestion that solicitation of contributions for annual meeting should be underway in January prior to government year end. If possible target large donors. Investigation of other revenue generation required.
- Discussed options for advertising on web site.
- Discussed partnering with other organizations for conference may work; depending on situation.

**Action:** B. Free to enlist assistance to investigate fundraising options for CSEB.

#### Priorities for 2009

- Membership drive – How to will be determined.
- Recruitment of Directors to fill current vacancies on Board.
- Increasing Chapter activity – Suggest at least one meeting per region in 2009.
- Annual meetings should be scheduled 2 years in advance for planning purposes, tentatively proposed:
  - ▶ 2009 West (Alberta) – potential topic Environmental Monitoring
  - ▶ 2010 Central Canada (Ontario)
  - ▶ 2011 Eastern Canada.

**Action:** B. Free to convene committee for Conference program and venue.

**Action:** B. Free to draft Strategic Plan for 2009.

**Action:** G. Ash to document how newsletter is published for future reference.

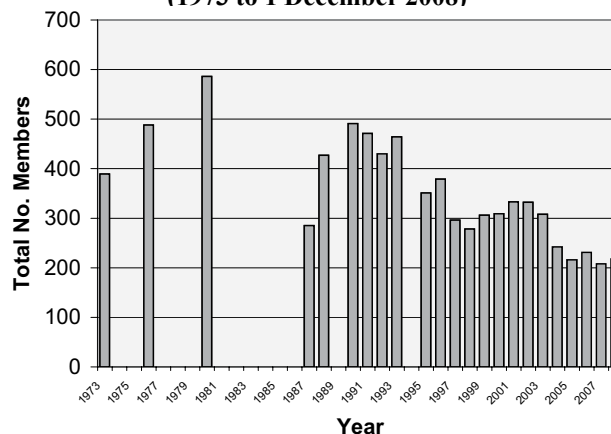
#### NEXT BOARD OF DIRECTORS MEETING – January 6, 2009 – 3 pm EST.

Web Site: <http://www.cseb-scbe.org/english.html> ☎

#### 2008 CSEB Membership by Region and Membership Category to 1 December 2008

Region	Compl. / Hon.	Associate	Library	Regular	Student	Total
1 Atlantic	2	8	2	18	2	32
2 Quebec			1	8	1	10
3 Ontario	2	2	2	51	4	61
4 Manitoba				6		6
5 Sask.	1			19		20
6 Alberta	1		4	40	4	49
7 BC	2			32	3	37
8 Territories				3		3
9 USA			1			1
O Foreign						0
<b>Totals</b>	<b>8</b>	<b>10</b>	<b>10</b>	<b>177</b>	<b>14</b>	<b>219</b>

#### CSEB Membership By Year (1973 to 1 December 2008)



## REGIONAL News

### BRITISH COLUMBIA News

*Submitted by: Jim Armstrong, M.Sc., R. P. Bio.*

#### Boundary Bay Ambient Monitoring Program

##### Scope of Work:

##### 1.0 Introduction

Metro Vancouver (formerly the Greater Vancouver Regional District) has illustrated through the GVRD Liquid Waste Management Plan (LWMP) its commitments to monitor and evaluate receiving environments. As a component of commitment C4 of the LWMP, one of the monitoring activities specified is "Ambient receiving environment monitoring in areas where water quality (as indicated by water quality objective criteria) is potentially affected by wastewater and/or stormwater." As a result, an ambient monitoring program is proposed for Boundary Bay, north of the 49th parallel. It should be noted that ambient environmental monitoring is separate and distinct from receiving environment monitoring associated with individual discharges.



##### 1.1 Goals and Intent of Boundary Bay Ambient Monitoring Program

Metro Vancouver (MV) in partnership with other local government agencies and in collaboration with the Puget Sound Partnership, state and federal agencies is preparing an ambient monitoring program with the purpose to evaluate overall environmental conditions over time in the Boundary Bay area. Data from this type of program will provide a baseline measure of conditions within the area being studied, and demonstrate if there is a temporal trend in any of the proposed variables that are being measured that might affect environmental quality. In addition, these data provide a basis to compare results from the various local receiving environmental monitoring programs, including upland monitoring programs that may have a potential to affect the overall environmental health of Boundary Bay and nearby areas.

The proposed ambient monitoring program for Boundary Bay should be conducted in areas where water quality is potentially affected by wastewater and/or stormwater originating from point-source and non-point source discharges, but outside the direct influence (i.e., mixing zone) of any single discharge point. Ambient monitoring may also include reference stations which are normally outside the known influence of any discharge. The program should be able to demonstrate whether or not efforts made by the member municipalities of Metro Vancouver to improve overall environmental quality are having the desired effects.

Additionally, the British Columbia Ministry of Environment (BCMOE) has mandated resources to produce a State of the Environment Report –Phase 1 "To provide a recommended list of indicators and associated parameters that can be used to report on the quality of Boundary Bay for water uses." The report would be used "to provide an environmental quality status report to decision makers in various levels of government, as well as to other stakeholders such as NGOs and the public." The development of an ambient monitoring program for Boundary Bay through this partnership approach should assist in the coordination of monitoring programs through the various government organizations on both sides of the USA-Canada border.

The ambient monitoring program should also incorporate data inputs from a variety of sources including receiving environment monitoring undertaken by other agencies to assist with the assessment of the ambient conditions within Boundary Bay.

##### 1.2 Coordination of Boundary Bay Ambient Monitoring Program

The intent for the Boundary Bay Ambient Monitoring Program (BBAMP) is to develop a monitoring program that is consistent with other MV ambient monitoring programs, including the Fraser River and Burrard Inlet ambient monitoring programs. In addition, the recommended sampling parameters and respective detection limits should be consistent with the appropriate water quality objectives and guidelines for Boundary Bay.



##### 1.3 Recommended Components for Boundary Bay Ambient Monitoring Program

Similar to the Fraser River (Enkon Environmental, 2002) and Burrard Inlet (Nautilus Environmental, 2006), the recommended components should include:

- Water sampling at a number of relevant stations (7 stations were identified in each of Fraser River and Burrard Inlet Ambient Monitoring Programs) once per week for a five week period each year. This sampling period may vary from



the other programs due to the shallow depth of Boundary Bay and the locations of navigation channels. Sampling under low-flow slack tide conditions may not be feasible due to these same conditions and recommended sampling methodologies must account for this variation from the conditions encountered in the other MV ambient monitoring programs. Similar parameters to other MV ambient monitoring programs including conventional variables; total and dissolved metals, fecal coliforms, *E.coli* and enterococci. Additional parameters should include nonylphenol and its ethoxylates on a reduced frequency (e.g. three out of five weeks).

- Sediment sampling at a similar number of stations as the water column and preferably in the same general area on a bi-annual frequency beginning in 2009 for various conventional parameters; total metals, polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyl (PCB) congeners; nonylphenol; organochlorine pesticides (OCPs), polybrominated diphenyl ethers (PBDEs) and dioxins and furans.
- Fish sampling at a number of stations that are representative of the overall health of the Boundary Bay ecosystem using a representative sentinel species (e.g. Peamouth chub) and analyzing for various health conditions (e.g. length, weight, liver weight, gonad weight) and tissue characteristics (e.g. lipids and concentration of metals, PCB congeners, organochlorine pesticides, total chlorophenols, benzo (a) pyrene, polybrominated diphenyl ethers, and dioxins and furans).

## 2.0 Partnership Considerations

As partnership members have or are conducting various ambient programs in conjunction with receiving environment, and initial dilution zone monitoring programs, the Boundary Bay ambient monitoring program design should be reflective of historical monitoring locations and parameters that have been used for these various programs.

Justification for variation from the other MV ambient monitoring program criteria is a requirement.

## 3.0 Current Program Initiatives



The BBAMP planning process has now reached the stage of building a data management system that will allow each of the partners to input their separate monitoring data. Each of the partners will have control over their program data with access

granted to selected individual that will undertake the hydraulic modelling of flow patterns, sediment transport analysis and community mapping of the identified contaminants.

As the Program is providing an exchange of information with the Puget Sound Assessment and Monitoring Program in Washington State, collaboration on the monitoring criteria for both programs has been assessed to promote the transboundary model that is being developed for the overall assessment of Boundary Bay. ☺

# ALBERTA News

## Alberta Report

*Submitted by: Brian Free, CSEB President*

On the air side of things, the Clean Air Strategic Alliance has wound up its consultations for a review of the Emission Management Framework for the Alberta Electricity Sector. This framework has governed how emissions from the electricity sector are managed since 2003. We'll have to await the results of this review to see if any major changes are needed.

These days, an Alberta report is not complete without reference to the Athabasca oil sands. If it's not dead ducks in a tailings pond, it's greenhouse gas emissions or downstream health concerns from pollution in the Athabasca River. And now add low flows in the Athabasca River. In January, the flow of the Athabasca River had fallen below a critical level into the "yellow zone", triggering a requirement that the oilsands facilities limit their water withdrawals from the river.

This requirement is part of a 2007 water management framework for the lower Athabasca River, prepared by Alberta Environment and the federal Dept. of Fisheries and Oceans. While industrial withdrawals are not the cause of the low flows, it highlights another sensitive issue related to the scale of these oil sands developments – the huge demand for water to extract and process the oil set against a backdrop of naturally low water levels throughout the province.

Indeed, over the past few years, there has been a general drought across the prairies and a decline in river flows and water levels. Mountain runoff forecasts for central and southern Alberta river basins are generally "below average". In fact, a recent report by Alberta Environment indicates that new historical minimum levels were reached for about one-third of the lakes monitored in 2008 (36 out of the 114 lakes). It is times like this, when aquatic ecosystems are being stressed, that organizations like the CSEB need to be vigilante about the impacts of water management decisions on the environment.

And finally, a note about Alberta's wildlife. As of last December, there were 13 endangered species and 11 threatened species listed in Alberta. There were also 11 species classed as being of "Special Concern". Action to help restore these species' populations will be guided by a new government policy. Alberta's Strategy for the Management of Species at Risk (2009-2014) has been published by the Dept of Sustainable Resource Development. Check out this document at <http://www.srd.gov.ab.ca/fishwildlife/speciesatrisk/strategy2009/default.aspx>. Does it meet your expectations as a Canadian biologist? Check it out! ☺

## 19 Grizzly Deaths Last Year Raise Alarm with Bear Advocates

**Fatal encounters with humans must be reduced, they say.**

*Reprinted from the Edmonton Journal, February, 2009*

More grizzly bears than ever were killed last year in Alberta -- by motorcycle, train, illegal hunters and euthanasia.

It was the worst year for human-related fatalities for the at-risk species in the province since the government banned the grizzly hunt three years ago.

With only 500 or fewer believed to exist in Alberta, conservationists aren't sure how many more years of 19 grizzly fatalities per year their population can withstand, and they're demanding the province do more to protect the bears.

People caused nine deaths the year before.

The newly released statistic puzzled provincial officials, after years of their Bearsmart education program. No environmental conditions seemed to make the bears more eager to come in contact with humans, said Darcy Whiteside, spokesman for Alberta Sustainable Resource Development.

"There's no specific reason as to why this year was any different from last year or the year before -- besides that it's just a natural fluctuation in the data," he said.

"It's not natural, of course," Whiteside quickly added.

Carl Morrison of the group Action Grizzly Bear suggested the deaths may total more than five per cent of all grizzlies in Alberta, since it's normal for many human-caused deaths to go uncounted.

"Obviously, that's fundamental in recovering the species: that we gain more bears than we lose each year," Morrison said Monday. "And with the numbers of bears we saw disappear last year, that's not the case."

He accused the province of not doing enough and taking too long with its bear recovery program, which has been in the works since 2002. The official count that could mean the grizzly is threatened or endangered won't be complete this year, and the province is still consulting with various groups on how -- or whether -- to limit access on certain roads within key bear habitats.

Last year's human-related grizzly mortalities were the most since 2005, when 10 of the 23 deaths were by licensed hunters in the last year of the legal grizzly hunt.

In 2008, six grizzlies were put down because they had attacked or otherwise posed risks; another six in self-defence, and four died by road or rail accident. Others were killed by aboriginal subsistence hunters -- including one tranquilized and therefore inedible bear -- in an illegal kill, or for unknown reasons.

University of Calgary biologist Robert Barclay, who helped craft the province's recovery program and now sits on its scientific advisory committee for grizzlies, said 19 deaths last year is "a worrying number," but said it was hard to measure whether that would have lasting effects on the species.

## Mercury Health Hazard Found in Area Fish

**Province warns against eating walleye and pike from several local lakes.**

*Reprinted from the Edmonton Journal, February, 2009*

A health advisory has been issued warning women and children about the hazards of eating mercury-contaminated walleye and

northern pike caught in Lac la Nonne and Lac Ste. Anne. Both lakes are northwest of Edmonton.

The fish were tested at the request of the community, said John Tuckwell, an Alberta Health and Wellness spokesman.

The results were viewed by Alberta's Acting Chief Medical Officer of Health Dr. Richard Musto, who decided a public health notice was needed. The type of mercury found in fish is called methylmercury.

Small amounts can be safely eliminated, but large amounts of mercury in the body may damage the nervous system, Alberta Health says.

An unborn baby is more sensitive to mercury poisoning due to rapid brain development during this period

Musto's Advice to Albertans is:

- Women of child-bearing age and children aged one to 11 years old should avoid eating walleye or northern pike from Lac la Nonne.
- Healthy adults may eat up to 400 grams (2.5 cups) of walleye and northern pike per week.
- Women of child-bearing age may eat up to 700 g (4.5 cups) per week of walleye and northern pike from Lac Ste. Anne. Children aged one to four may eat up to 150 g (one cup) of walleye and northern pike per week. Children aged five to 11 may eat up to 300 g (2 cup) of walleye and northern pike per week. Healthy adults may eat unlimited quantities of walleye or northern pike from Lac Ste. Anne.
- Musto said the levels of methylmercury do not pose an immediate threat, but limiting consumption is a prudent measure.

For more information on the health advisory, call Surveillance and Environmental Health, Alberta Health and Wellness at 780-427-4518 between 8:15 a.m. and 4:30 p.m., Monday to Friday.

### OTHER EXISTING MERCURY ADVISORIES ON FISH INCLUDE:

- Eastern brook trout in Chrystina Lake and Edith Lake
- Northern pike in Edwards Lake
- Walleye and northern pike in Helena, Hilda and Ironwood Lakes
- Walleye and northern pike in Moose and Muskwa Lakes

## SASKATCHEWAN News

*Submitted by: Robert Stedwill, CSEB Saskatchewan Chapter Chair*

With a million people here in the Province -- I guess that is a million PLUS as the provincial economy powers along contrary to the rest of the country, we look for new opportunities to participate as a chapter, and they are limitless! The difficulty arises with so few members of the CSEB in Saskatchewan, and even fewer who actively participate! I am as guilty as anyone.



As a recent retiree, within the last two years, one would think that I would have more time available than most. Unfortunately, I spend a good deal of my time in the United States on other business matters, unrelated to the environment, and any news that does make it to the States on TV, in newspapers, or on radio, normally deals with war efforts or the economy; and mostly with the major industrial provinces' issues; not Saskatchewan's. That is not to say that there is nothing going on in Saskatchewan, it is just because Saskatchewan has not been traditionally seen as mainstream in terms of Canadian news.

Fundamentally what I am saying is this needs to be a team effort of all our provincial members, and more so by those who are actively engaged in those issues germane to the environment which is being impacted by the unfamiliar Saskatchewan booming economy, and which can be seen as issues that each one of us in the Province can embrace in some fashion or another. Even those not remotely connected to the Province, currently know Saskatchewan as having concerns in uranium mining, possible nuclear generation, carbon dioxide sequestration, potash, agriculture, electrical generation, manufacturing, and the list goes on. In other words, let's not rely on the same four or five individuals to go to meetings, provide input to our chapter, or even attend an AGM! We all live here – we all belong to the Saskatchewan Chapter of the CSEB, and we all have something to share!

Chapter members – submit your ideas, your work projects and reports, even your philosophical thoughts on Saskatchewan's environmental future to your Chapter organization! ☺

## ONTARIO News

*Submitted by: Wendy Thomson and David McRobert, CSEB Ontario Region*

Ontario's environmental commissioner Gord Miller says Ministry of Natural Resources must strengthen its new *Endangered Species Act*.

Ontario's 183 at-risk species could be further threatened if the government doesn't strengthen its new *Endangered Species Act* (ESA), environmental commissioner Gord Miller said in a *special* report he released on Monday, March 2. The report reviews the ESA which took effect last June 30. He also said the province could lose some of its more iconic creatures -- like the monarch butterfly and woodland caribou -- if more care isn't taken in protecting them.

"There's something permanent about extinction that insults the morality of humankind," Miller said at a press conference at Queen's Park where the report was released. "This is serious business. The conservation of biodiversity should be a priority for all governments, yet in Ontario, there is no law which obligates the government to even monitor biodiversity, let alone conserve it."

Miller didn't provide examples of species that have been affected in the seven months since the new act was brought in, but said he's concerned about the flexibility written into the law, which could create problems down the road. The government has the power to write regulations that override protections in

the ESA, and issue permits and agreements allowing species and their habitats to be destroyed, Miller said. As an example, he cited the first permit to be issued under the new ESA, which allowed a company to run a quarry on Pelee Island even though it affected two endangered species: The blue racer snake and the Lake Erie water snake. Miller went on to say that "the broad discretion involved in these decisions, if not exercised with great care, could have the troubling potential to significantly undermine the law's basic purpose of species protection." For further information, see [www.eco.on.ca](http://www.eco.on.ca). ☺

## ATLANTIC News

*Submitted by: Patrick Stewart, Atlantic Director*

Life has been busy on the East Coast but CSEB has been keeping a low profile, largely to my heavy work load. Secretary-Treasurer Karen March of Dillon Consulting in Halifax, however, has been minding the affairs of the Society and participating in regular conference calls. I've been more delinquent in attending meetings, but one of the recent suggestions was to place a CSEB booth at the Bay of Fundy Science Workshop on May 26-29, 2009 at Acadia University. As always we're looking for initiatives from Nova Scotia members to create a chapter here, which would be a boost to CSEB nationwide.

### There's Beauty in the Sea

The continental slope is the portion of the East Coast offshore where ocean depths increase rapidly off the margin of the 200-mile continental shelf, to reach depths of several kilometers. In 2007 scientists at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, led an expedition to photograph sea bottom life in these poorly-explored areas. Some of the results are striking photographs of deep-sea life, with a Canadian connection. A powerpoint with some of the incredible images, and explanation of the deep sea program, is presented at the following website, <http://www.bio.gc.ca/wn/fauna/rptfauna-e.html> as well as <http://www.bio.gc.ca/info/whatsnew-e.html>.

### Inner Bay of Fundy Species at Risk

The Inner Bay of Fundy at one time supported strong runs of Atlantic salmon and other species, but as a result of land use changes, commercial overfishing, and other factors, salmon and striped bass are currently listed under the *Species at Risk Act*. Fisheries and Oceans Canada are actively pursuing efforts to improve conditions and restore the species, and have active programs. In the case of the Salmon, DFO a gene banking program, which involves individuals in some of the other Nova Scotia populations which are not at risk. This year salmon and striped bass caught in the Minas Basin of the Inner Bay of Fundy were tagged with acoustic transponders designed to give information on migratory movements as the species moved out of the Bay and passed listening devices near Cape Split. Movements of bass are also being monitored by an MSc. student at Acadia University conducting rod and line censuses along the Minas Basin shore. ☺

## TERRITORIES News

*Submitted by: Anne Wilson*

### Greetings all!

It is that wonderful time of year when the day length is increasing by leaps and bounds, and when you know the end of winter is in sight, no matter what the weather may throw at us now! March is also my favorite time to do field work, so I am feeling particularly desk-bound this month as being tied to public hearings, workshops, and an office move. Many of us are finding that it is a different situation this year, with many projects on hold or cancelled, so workload may be changing. Existing projects are still conducting the required monitoring and environmental work, but it is evident that the companies are looking for economies in the environmental programs. This is understandable in times when workers are being laid off, and commodity prices and stock values are diminished. Our role as biologists can be to focus on the necessary and distinguish the “nice to have” from the “need to have” in our monitoring programs.

To this end (among others), the theme of this year’s CSEB Conference will be monitoring, and I would encourage anyone who works with environmental monitoring programs to think about joining the conference committee. You can contact Gary Ash or me by email if you are interested.

In spite of slowing exploration and development activity in the North, some interesting environmental assessments and projects have helped the winter fly by.

### Project Updates:

#### Mining

On the NWT side of things, there are now three proposed new mines in the environmental assessment stage. In addition to Tyhee NWT Corp.’s Yellowknife Gold Project, and Canadian Zinc Corp.’s Prairie Creek Mine, Fortune Minerals Ltd. has applied for permits to develop a bismuth-gold-cobalt-copper property 160 km northwest of Yellowknife. Information on current projects is available from the Mackenzie Valley Environmental Impact Review Board’s site at <http://www.mveirb.nt.ca/>.

The Gahcho Kue Diamond project environmental assessment has moved further onto the back burner, with the Developer’s Assessment Report delayed to late 2009.

Tamerlane Ventures Inc. has received land use permits for their zinc/base metal project near Pine Point, NWT, and should have received their water licence by the time this goes to press. Given the low price of zinc, the company has opted to delay construction.

In Nunavut, the Meadowbank Gold Mine has been under accelerated construction, and will be proceeding with further dyke construction and lake dewatering. This project involves open pit mining, and with large portions of the deposits below lakes, dikes will be required to access the ore bodies (similar to the Diavik Diamond Mine). Closure planning is one particularly interesting aspect of this project, as there will be “pit lake” basins following flooding of the open pits and reconnection to

the main lakes. I am very curious as to what the water quality and potential for density layering will be!

Planning work continues on the Doris North gold project, as the new owner Newmont Mining Corp. works out a regional mining approach.

The environmental assessment scoping continues for Sabina Silver Corp.’s proposed Hackett River Mine (lead, silver, copper, lead, and gold) in Nunavut, although commodity prices may delay this going forward. OZ Mineral’s High Lake and Izok Lake base metal properties are quiet, but still on the radar. Similarly, Baffinland Iron Mines Corp. has scaled back work at their iron ore property at Mary River (north Baffin Island), but continue to define the resource.

AREVA Resources Canada Inc. has applied for permits for mine development at the Kiggavik uranium property, and this has gone to the Nunavut Impact Review Board for environmental assessment. Exploration and feasibility work continues for other uranium targets near Baker Lake.

#### Taltson Hydro Expansion

The NWT Energy Corporation proposes to increase electricity production on the Taltson River system, with expansion of the existing facility plus construction of a 435 km long transmission line to the diamond mines. The Developer’s Assessment Report was to be submitted at the end of February, moving the environmental assessment forward.

#### Oil & Gas

Hearings for the Mackenzie Gas Project wound up in late 2007, and the Joint Review Panel’s report is long overdue. Industry and stakeholder pressure on the Panel may accelerate the report release from the Dec. 2009 timeline previously announced.

#### Municipal

The Canadian Council of Ministers for the Environment signed the Canada-wide Strategy for the Management of Municipal Wastewater Effluent in February, so now work will go forward to implement the Strategy. For the South, this will mean 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 North is being given a five year period to determine reasonable and protective performance standards for systems which face challenges of extreme climatic conditions, infrastructure limitations, capacity, and logistics. Environment Canada is collaborating with other Northern stakeholders to identify and plan for further work to determine Northern performance standards. Wastewater regulations are expected to be drafted by the fall. Further information on the Strategy is available on the CCME website at: [http://www.ccme.ca/ourwork/water.html?category\\_id=81](http://www.ccme.ca/ourwork/water.html?category_id=81).

Is there work going on north of 60 that our members would be interested in? Please take the time to drop me a line, or consider drafting an article for inclusion in the newsletter. I know there is a fair bit of research going on in the North, and let’s optimize our membership in the CSEB by using it as a networking and communication forum! Also, I would also appreciate hearing from northern members with ideas about what we can initiate by way of CSEB activities – both of the fun as well as the educational variety! Please email your thoughts to me at [anne.wilson@ec.gc.ca](mailto:anne.wilson@ec.gc.ca). ☺

# Eat Your Dirt Dear

**BABIES KNOW BEST** / Infants can teach us a thing or two about building healthy immune systems, it seems, as researchers dig up more evidence that putting a fistful of filth in your mouth can be good for you.

Ask mothers why babies are constantly picking things up from the floor or ground and putting them in their mouths, and chances are they'll say that it's instinctive — that that's how babies explore the world.

**Researchers are concluding that organisms like the millions of bacteria, viruses and especially worms that enter the body along with "dirt," foster development of a healthy immune system.**

But why the mouth, when sight, hearing, touch and even scent are far better at identifying things?

When my young sons were exploring the streets of Brooklyn, I couldn't help but wonder how good crushed rock or dried dog droppings could taste when delicious mashed potatoes were routinely rejected.

Since all instinctive behaviours have an evolutionary advantage or they would not have been retained for millions of years, chances are that this one too has helped us survive as a species. And, indeed, accumulating evidence strongly suggests that eating dirt is good for you.

In studies of what is called the hygiene hypothesis, researchers are concluding that organisms like the millions of bacteria, viruses and especially worms that enter the body along with "dirt" spur the development of a healthy immune system. Several continuing studies suggest that worms may help to redirect an immune system that has gone awry and resulted in autoimmune disorders, allergies and asthma.

These studies, along with epidemiological observations, seem to explain why immune system disorders like multiple sclerosis, Type 1 diabetes, inflammatory bowel disease, asthma and allergies have risen significantly in the United States and other developed countries.

"What a child is doing when he puts things in his mouth is allowing his immune response to explore his environment," Mary Ruebush, a microbiology and immunology instructor, wrote in her new book, *Why Dirt Is Good* (Kaplan). "Not only does this allow for 'practice' of immune responses, which will be necessary for protection, but it also plays a critical role in teaching the immature immune response what is best ignored."

One leading researcher, Dr. Joel V. Weinstock, the director of gastroenterology and hepatology at Tufts Medical Center in Boston, said in an interview that the immune system at birth "is like an unprogrammed computer. It needs instruction."

He said that public health measures like cleaning up contaminated water and food have saved the lives of countless children, but they "also eliminated exposure to many organisms that are probably good for us."

"Children raised in an ultra-clean environment," he added, "are not being exposed to organisms that help them develop appropriate immune regulatory circuits."

Studies he has conducted with Dr. David Elliott, a gastroenterologist and immunologist at the University of Iowa, indicate that intestinal worms, which have been all but eliminated in developed countries, are "likely to be the biggest player" in regulating the immune system to respond appropriately, Elliott said in an interview. He added that bacterial and viral infections seem to influence the immune system in the same way, but not as forcefully.

Most worms are harmless, especially in well nourished people, Weinstock said.

"There are very few diseases that people get from worms," he said. "Humans have adapted to the presence of most of them."

In studies in mice, Weinstock and Elliott have used worms to both prevent and reverse autoimmune disease. Elliott said that in Argentina, researchers found that patients with multiple sclerosis who were infected with the human whipworm had milder cases and fewer flare-ups of their disease over a period of four and one-half years. At the University of Wisconsin, Madison, Dr. John Fleming, a neurologist, is testing whether the pig whipworm can temper the effects of multiple sclerosis. In Gambia, the eradication of worms in some villages led to children's having increased skin reactions to allergens, Elliott said. And pig whipworms, which reside only briefly in the human intestinal tract, have had "good effects" in treating the inflammatory bowel diseases, Crohn's disease and ulcerative colitis, he said. How might worms affect the immune system? Elliott explained that immune regulation is now known to be more complex than scientists thought when the hygiene hypothesis was first introduced by a British epidemiologist, Dr. David P. Strachan, in 1989.

Strachan noted an association between large family size and reduced rates of asthma and allergies. Immunologists now recognize a four point response system of helper T cells: Th 1, Th 2, Th 17 and regulatory T cells. Th 1 inhibits Th 2 and Th 17; Th 2 inhibits Th 1 and Th 17; and regulatory T cells inhibit all three, Elliott said.

"A lot of inflammatory diseases — multiple sclerosis, Crohn's disease, ulcerative colitis and asthma — are due to the activity of Th 17," he explained. "If you infect mice with worms, Th 17 drops dramatically, and the activity of regulatory T cells is augmented."

In answer to the question, "Are we too clean?" Elliott said: "Dirtiness comes with a price. But cleanliness comes with a price, too. We're not proposing a return to the germ-filled environment of the 1850s. But if we properly understand how organisms in the environment protect us, maybe we can give a vaccine or mimic their effects with some innocuous stimulus."

Ruebush, the *Why Dirt Is Good* author, does not suggest a return to filth, either. But she correctly points out that bacteria are everywhere: on us, in us and all around us. Most of these microorganisms cause no problem, and many, like the ones that normally live in the digestive tract and produce life-sustaining nutrients, are essential to good health.

"The typical human probably harbours some 90 trillion microbes," she wrote. "The very fact that you have so many microbes of so many different kinds is what keeps you healthy most of the time." Ruebush deplores the current fetish for the hundreds of antibacterial products that convey a false sense of security and may actually foster the development of antibiotic resistant, disease-causing bacteria. Plain soap and water are all that are needed to become clean, she noted.

"I certainly recommend washing your hands after using the bathroom, before eating, after changing a diaper, before and after handling food," and whenever they're visibly soiled, she wrote. When no running water is available and cleaning hands is essential, she suggests an alcohol-based hand sanitizer.

Weinstock goes even further. "Children should be allowed to go barefoot in the dirt, play in the dirt, and not have to wash their hands when they come in to eat," he said. He and Elliott pointed out that children who grow up on farms and are frequently exposed to worms and other organisms from farm animals are much less likely to develop allergies and autoimmune diseases.

Also helpful, he said, is to "let kids have two dogs and a cat," which will expose them to intestinal worms that can promote a healthy immune system. ☺



## LETTER to the EDITOR

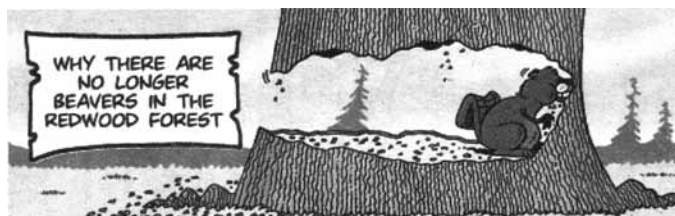
Two issues ago in the CSEB (*"Another Bright Idea,"* 2008, Vol 65(3): 17) it was suggested that compact florescent lightbulbs be banned. I agree, at least until we put more methods in place for containing the mercury inside them.

I've been involved in the development of regulations for the removal of mercury from coal fired power plants in Alberta for the past 10 years. This took a lot of community volunteers, government and corporate work and money but the province is now a world leader in this field.

In Europe it is becoming mandatory that only florescent light bulbs be used, yet there is nothing in place for the secure storage, use and disposal of them. Virtually all of the mercury in these light sources is released to the environment.

The power companies are now required to remove the mercury from their emissions at a great expense only to find out that mercury is going to be discarded into the environment because of some misguided environmental gesture.

Yours truly  
Bob Gainer



## CSEB Scholarship Awarded

In 2007, CSEB lost a good friend and colleague with the passing of John Lilley, a past President and long-time active member in the CSEB. In memory of John, CSEB established the John Lilley Undergraduate Scholarship in Environmental Sciences. This \$500. scholarship is given to a qualifying student entering second year of the B.Sc. program in Environmental & Conservation Sciences at the University of Alberta. The first recipient is Qiting Chen, who sent this letter of thanks to CSEB President Brian Free:

Dear Mr. Free,

How are you? I'm one of the recipients of the John Lilley Undergraduate Scholarship in Environmental Sciences. Thank you for your generosity very much!

I'm an international student from China, and now major in Conservation Biology. It's always hard for students to study abroad because of the loneliness and the cultural difference. Meanwhile, we have to pay double tuitions compared to those local students. This scholarship helps me a lot and removes some of the financial pressures on my shoulder. I think that I can never thank you enough!

I'm entering the second year of my undergraduate, and I really enjoy my major. I'm most interested in the conservation of wetlands because they are amazingly beautiful and full of biological diversity. By now the courses are easy to me. I'll continue to study hard and try my best to keep good marks. I decide to work in Canada after graduation for several years and then go back to my home country, which has more and more serious environmental problems. I wish that I could use what I learnt to make some differences. However, no matter where I am, I'll never forget your generosity and your help!

Big smile! Big thanks ☺

Yours sincerely,

Qiting Chen  
陈锦婷  
8.22.2008

## BLACK WOLVES May Have an Evolutionary Advantage Over their Grey Cousins

Black wolves and coyotes apparently inherited their color from dogs, a new Canada-U.S. study says.

This looks like an extremely rare case in which genes from a domestic animal — the dog — can actually help a wild animal survive in the wild.

Grey wolves are the main wolf species in North America. Any wolf found in Canada is a grey — even if it's black, or a white Arctic wolf. (The Arctic wolf and its southern relatives are simply close relatives adapted to different ecosystems.)

But while there are wolves scattered across Europe and northern Asia, none is black.

Now Marco Musiani from the University of Calgary has traced the black gene back to its source, in dogs.

His team's study analyzed DNA from dozens of Canadian Arctic wolves, and more than 200 wolves in Yellowstone Park in the Northern U.S. that are descended from an Alberta group sent there for repopulation. The study is published in the journal *Science*.

The gene responsible for the color, beta-defensin, was discovered in 2007 by geneticist Greg Barsh, of Stanford University Medical Center. It belongs to a family of genes thought to be involved in fighting infections.

When the gene appears in its normal form, the animal has a light or yellow coat. But when one copy of the gene is missing three nucleotides, the animal develops a black coat.

The trait shows up in the wild primarily in North America, and it was probably brought to the continent about 15,000 years ago, when the first immigrants crossed over the Bering land bridge, bringing their dogs along.

This "black-coat gene" is the same gene found in black poodles and Labradors.

Is there an evolutionary advantage to the wolf? That the mutation has stayed in the wild population for so long suggests it is beneficial in some way. Black wolves don't seem to have any special hunting ability, says Barsh.

Yet black wolves live mainly in forested areas. Wolf packs in open country have fewer black members.

Black coats occur in about 62 percent of wolves in the forested areas of the Canadian Arctic, compared with about 7 percent of them in the icy tundra. Researchers agreed the coat does not serve as camouflage for the animals to escape predators, but it may help them sneak up on prey.

The mutated gene might also provide a better immune defense against infectious agents that occur primarily in the warmer forests, Barsh said.

The dark fur developed by human dog-breeding may actually help wolves adapt to climate change, which is also caused by humans, said Musiani, a professor in the Faculty of Environmental Design.

Normally, the environment changes slowly, and animals adapt at the same pace, he said. But the climate is now changing too fast for animals that adapt slowly.

"The wolves have found a shortcut," he said. Dark wolves, even in the Arctic, can help a pack hunt as winters become shorter. There are now more months with bare, dark ground when prey can see a white wolf from far off.



Photo credit: DANIEL STAHLER, THE ASSOCIATED PRESS

"People are influencing the environment so much," Musiani said. "Sometimes, if we want to give (an) organism a chance to survive and to evolve, we shouldn't underestimate the role of exchanging DNA and getting back mutations (i.e., genetic traits) from domesticated animals."

While this seems unnatural, he said, "we have already reached a point where the environment is human-determined." ☞

Gray wolves, some with grey coats and some with black coats, are seen at Yellowstone National Park. At least some of today's wolves inherited traits from ancient dogs, researchers say.

# Lake Whitefish Biology in Okanagan Basin Lakes

T.G. Northcote, *Professor Emeritus, Zoology and Forest Sciences Departments, The University of British Columbia*

G.B. Northcote, *Biology Teacher, Summerland Secondary School, Summerland, British Columbia*

## Introduction

Native populations of Lake Whitefish (*Coregonus clupeaformis*) are widely distributed in watersheds of the northern half of mainland B.C. (McPhail 2007, Map 56), and by introduction to several southern lakes in the upper Thompson, Okanagan, Arrow, and Kootenay systems in the late 1800s and early 1900s. According to J.L. McHugh in Clemens, Rawson, and McHugh (1939), Lake Whitefish were first introduced to Kalamalka and Okanagan lakes in 1894 as 1.2 million fry coming from Lake Winnipeg eggs reared in the New Westminster hatchery. No further stockings of Lake Whitefish occurred until 1928 and 1929 when eggs from Waterhen River, Manitoba, were hatched at Summerland Hatchery and planted as fry to Okanagan Lake – 4.8 million in 1928 and 4.7 million in 1929. Those introduced to lakes in the lower Fraser River system and southern Vancouver Island failed, as well as apparently to the southern Okanagan Basin (McPhail 2007, Map 56).

Lake Whitefish were not caught in Wood or Kalamalka lakes in 1929 but in Okanagan Lake, 330 were taken by netting in 1928 and 1564 in 1929, as well as 339 in Skaha, 102 in Vaseux, and 14 in Osoyoos lakes (McHugh 1936). Lake Whitefish were prevalent in Skaha Lake in the mid 1930s and also in Okanagan, Skaha, Vaseux, and Osoyoos lakes in the early 1970s (Northcote et al. 1972), either from the early introductions noted above or from dispersion thereafter.

Very little seems to be known about the life history of native Lake Whitefish in B.C. (McPhail 2007). Nevertheless reasonably broad life history coverage (abundance, size, age, growth, maturity, food habits and so on) has been in the “grey literature” for decades on the populations in Okanagan, Skaha, and Osoyoos lakes, so it would seem useful to assemble coverage of that as well as more recent information here.

As a final introductory note, the Okanagan Basin Lake Whitefish populations, especially those of Okanagan and Skaha lakes, were used from 1995 to 1997 by G.B. Northcote (also a member of the 1971 gillnetting and seining crew in the Canada-British Columbia Okanagan Basin lakes study) to acquaint senior school students with the biology of this fish species. He showed them in the field the lake distribution and abundance of Lake Whitefish, and also gave them hands-on laboratory experience in examining their size range, sex, age, feeding habits and other biological features.

## Distribution and Abundance

Lake Whitefish do not occur in three lakes of the upper chain of Okanagan Basin mainstem lakes (see Fig. 1) – Ellison (Duck), Wood, or Kalamalka – the first very small and shallow, the second larger and deeper (9 sq. km, maximum depth 34 m), and the third much larger and deeper (26 sq. km, maximum depth 142 m). McHugh (1939) in Clemens et al. (1939) notes that in 1894, over one million Lake Whitefish fry were planted in

Kalamalka Lake as well as in Okanagan Lake. None were later caught in Kalamalka test-net fishing in 1929, whereas 12 to 15 per day were taken from Okanagan Lake, as well as 12 per day from Skaha, 51 from Vaseux, and 14 from Osoyoos lakes. In 1935, July and August gillnetting captured 45 Lake Whitefish in Okanagan Lake (Clemens et al. 1939). These various studies suggested that attempts to develop a commercial fishery for Lake Whitefish in the larger Okanagan Basin lakes would be unsuccessful, because of their low abundance and small size according to Carl and Clemens (1948).

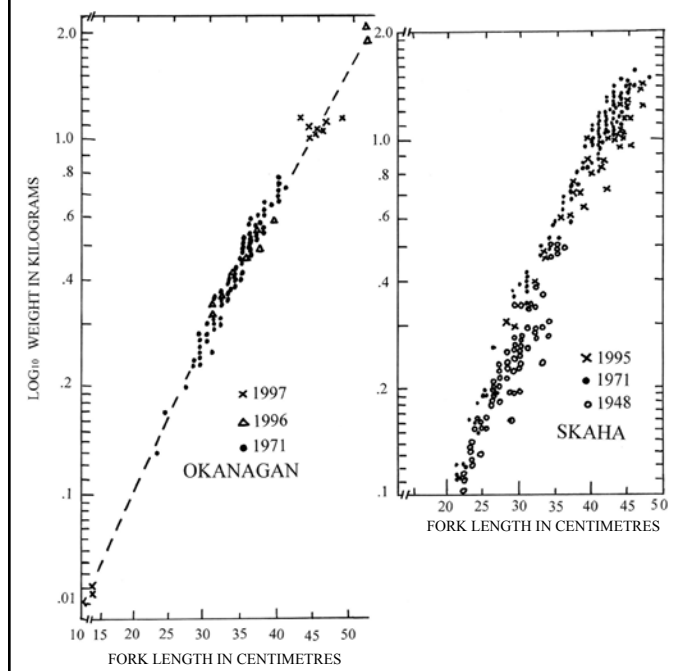
**Figure 1.** Okanagan Basin main lakes, drainage basin, and Okanagan River system in British Columbia to Washington State, U.S.A. where the Similkameen River joins it (about 83 km of the upper Similkameen R. not shown, nor is its whole drainage basin).



The relative abundance of Lake Whitefish (mean number caught per gillnet station in the 1971 spring, summer, and autumn gillnetting periods) of Northcote et al. (1972) were low at north and central Okanagan Lake stations (70.6 and 68.2) as well as at the Osoyoos Lake station (72.9), higher in the south Okanagan Lake stations (105.9), and highest at Skaha (211.8) and Vaseux (409.4) lakes stations (see Fig. 11 in the March 1972 Annual Report of the Canada – British Columbia Okanagan Basin Agreement and also Fig. 4 in its June Bulletin No. 6, 1972, used in part here for Figure 2).



**Figure 2.** Length – weight relationships for lake whitefish captured in standard gillnet sets overnight offshore in Okanagan and Skaha lakes. See Ferguson (1949), Northcote et al. (1972) for methods and location details.



An attempt was made (Northcote et al. 1972, Table 5) to determine if there had been major changes in summer abundance of Lake Whitefish in Okanagan Lake between the 1935 and 1971 gillnetting, but, except for those at the central station K, differences between the two years were not large. Lake Whitefish taken by gillnet sets in Skaha Lake were low in abundance in 1948 (Ferguson 1949) and higher in 1971 (Northcote et al. 1972). Summer early evening echo sounder tracings in the six main Basin lakes (Wood to Osoyoos) do not show characteristic inverted V recordings of fish in the deep waters of Wood or Kalamalka lakes, but clearly do so in deep waters of Okanagan, Skaha, Vaseux, and Osoyoos lakes (Northcote et al. 1972, Fig. 3).

Day and night echo sounder tracings in the summer of 1980 made by Regional Fishery biologist Alan Martin in Skaha Lake show the presence of large fish (many probably Lake Whitefish based on his netting experience there) near the bottom in deep waters during the day and their rise towards the surface waters during evening hours.

An overnight gillnet set at 30 m depth in Skaha Lake on 5-6 October 1980 caught 18 Lake Whitefish and were used for school student analysis, but no information on size or age is available.

On 9 and 11 October 1995, multi-meshed gillnets were set on the bottom overnight (17:00 to 07:00 h) near the stations used in 1971 at the 15 and 30 m depth zones in Skaha Lake, using

two 76 m gangs of five gillnets (2.4 m deep, 15.2 m long) with mesh sizes ranging from 25 to 102 mm. On 9 October, six Lake Whitefish were caught in the 15 m set and 12 in the 30 m set. On 11 October, eight Lake Whitefish were caught in the 15 m depth set and 13 in the 30 m set.

In Okanagan Lake on 2 and 3 October 1996, similar nets were set overnight as in 1995 off the Summerland Yacht Club dock, one set at 6.1 m depth and one at 9.1 m depth. On 3-4 October 1996, these nets were set at 9.1 m depth in Okanagan Lake off Crescent Beach near Summerland.

The overnight net sets of 2-3 October caught six Lake Whitefish at 6.1 m and three at 9.1 m depths. Those on 3-4 October caught four Lake Whitefish at the 9.1 m depth Crescent Beach set. Gordon Northcote, with Summerland Secondary School Biology students, again set overnight gillnets at the above location in Okanagan Lake, on 2 and 3 June 1997 capturing seven and four Lake Whitefish, respectively, on the two nights.

### Length – Weight Relationships

The presently available data (1971, 1996, 1997) for the Okanagan Lake Lake Whitefish length-weight relationship suggests a nearly linear slope up to a fork length of about 30 cm, followed thereafter by a slightly reduced slope up to a maximum length slightly over 50 cm (Fig. 2). A similar pattern is also evident for those from Skaha Lake in 1948, 1971, and 1995, although the variability of length – weight data there was greater than that for Okanagan Lake.

### Length – Age Relationships

Available data on average length at age for our study area covers the period from 1929 to 1997 in publications from 1939 to 1972, as well as from samples taken by collection permits obtained from the B.C. Ministry of Water Land & Air protection, Okanagan Regional Office in 1995, 1996 and 1997 by G.B. Northcote and members of his school classes in biology. These data are summarized in Table 1, giving sample size under each sampling year and making appropriate length adjustment to report all data in mean fork length at the end of each year class.

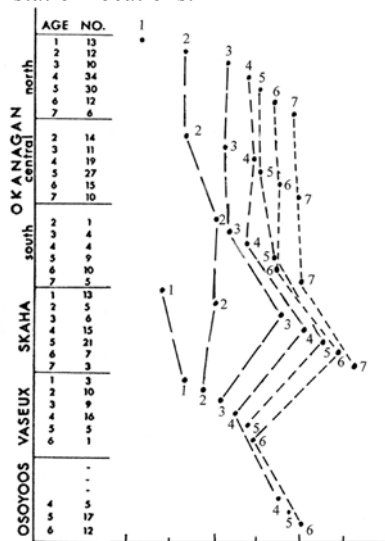
Although sample sizes were small in most of the early years for Okanagan Lake (1929 – 1934) age I Lake Whitefish, even then their mean length at the end of year one was appreciably higher for the 1933 and 1934 set compared with that for 1929 to 1932.

By 1971, Lake Whitefish of ages I to IV also were higher in mean fork length than those in earlier sampling years, but not so for the older age groups from V to VII. In 1971, Lake Whitefish of ages I and II in Skaha Lake had higher mean lengths than those in Okanagan Lake, as probably did those for age I in Vaseux Lake and certainly for ages V and VI in Osoyoos Lake (Fig. 3).

**Table 1.** Mean fork length (cm) for year-classes of Lake Whitefish in Okanagan Basin lakes from 1929 to 1934, 1971, 1995, 1996, and 1997. Data from J.L. McHugh (in Clemens, Rawson, and McHugh 1939), T.G. Northcote, T.G. Halsey, and S.J. MacDonald (1972), and G.B. Northcote (unpublished data Summerland Secondary School 1995, 1996, 1997). Sample sizes are given in parentheses under each sampling year.

Lake	Sampling Year	Year classes									
		I	II	III	IV	V	VI	VII	VIII	IX	X X+
Okanagan	1929	12.7	21.9	28.7	33.4	37.1	39.9	41.0			
	(1)										
	1930	12.4	18.4	25.5	31.1	34.8					
	(1)										
	1932	12.2	20.5	27.2							
	(2)										
Okanagan	1933	14.1	24.4								
	(28)										
	1934	15.1									
	(7)										
	1971	22.0	27.0	32.0	35.0	36.5	37.0	39.5			
	(34)										
Okanagan	(Central)		27.5	31.5	35.5	36.5	37.5	40.5			
	(27)										
	(South)		27.5	31.0	34.0	37.0	38.0	41.0			
Skaha	1971	25.0	30.0	37.5	41.0	42.5	45.0	46.2			
	(21)										
Vaseux	1971	26.5	28.0	31.0	32.5	34.1	35.0				
	(16)										
Osoyoos	1971				37.0	38.5	40.0				
	(17)										
Skaha	1995			29.4	31.2	40.8	43.0	44.3			
	(38)										
Okanagan	1996				32.5	36.6	40.0		52.8		54.2
	(13)										
Okanagan	1997						44.2	44.8	46.1		
	(9)										

**Figure 3.** Mean length at age for lake whitefish in Okanagan Lake (north, central, south stations), Skaha, Vaseux, and Osoyoos lakes in 1971. See Northcote et al. (1971), Fig. 11 and text for station locations.



## Food of Lake Whitefish

Stomach contents of Okanagan Lake Whitefish were reported on by J.L. McHugh in Clemens et al. (1939) for 18 specimens taken during September – October 1929 and 37 from July – August 1935, summarized here in Table 2. McHugh reported larvae (70 to 80%), also taking bryozoan statoblasts, ostracods, and filamentous algae. Three two year olds had used mainly gastropod snails (up to 75%) and filamentous algae, as well as cladocerans, copepods, ostracods, hydracarinans, midge larvae, and algae including branched filaments of *Chara*. Twenty-six three year olds fed mainly on zooplanktonic cladocerans and copepods, and on aquatic insect larvae, some small fish, filamentous algae and *Chara*. Five Lake Whitefish in their fourth year chiefly used aquatic insect larvae, small fish such as sculpins, and algae. The various editions of Carl and Clemens on B.C. freshwater fishes, starting in 1948 and extending up to 1977 with C.C. Lindsey as coauthor, all note that Lake Whitefish in B.C. are bottom feeders using aquatic snails, small clams, insect larvae, and oligochaete worms, though in Morrison Lake of the Skeena River system they feed largely on copepods. Unfortunately the coverage of fish in the Okanagan Basin lakes by Northcote et al. (1972) did not report on feeding habits of Lake Whitefish. Furthermore the B.A. thesis of Ferguson (1949) covering biology of Skaha Lake fish populations in 1948 no longer seems available so Lake Whitefish data on summer feeding there could not be checked now.

On 5 October 1980 there was information on food habits of 18 Lake Whitefish from Skaha Lake taken at 30 m bottom gillnet sets. Stomachs of 10 of these fish were empty. Data for the eight with prey are summarized in Table 3 but no length, weight, or age data seem to be available.

**Table 2.** Food organisms used by Lake Whitefish in Okanagan Lake during 1929 and 1935 modified from tables XI & X, respectively, given by J.L. McHugh in his section, pages 39-50, in Clemens, Rawson and McHugh (1939).

(1) Sept. –Oct. 1929; 18 L. Whitefish; (see McHugh 1939, Table 11, page 43)

Taxa	In number of stomachs	Average %	Highest % (any one stomach)
Cladocerans			
<i>Eurycerus</i>	13	21	90
<i>Leptodora</i>	4	-	5
Ostracods	5	-	-
Water mites	13	2	20
Midge fly larvae	13	41	95
Midge fly pupae	3	-	-
Mayfly nymphs	2	4	75
Other insects	2	-	-
Sphaerid clams	14	5	50
Bryozoan statoblasts	2	-	-
Algal filaments	2	-	10
Blue-green alga ( <i>Nostoc</i> )	2	-	-
Plant seeds	4	-	-

Table 2 (continued)

(2) July –Aug. 1935; 37 L. Whitefish; (see McHugh 1939, Table 10, page 43)

Taxa	In number of stomachs	Average %	Highest % (any one stomach)
Cladocerans			
<i>Daphnia</i>	8	8	100
<i>Eurycerus</i>	4	-	-
<i>Leptodora</i>	4	4	100
<i>Bosmina</i>	1	-	-
Copepods			
<i>Cyclops</i>	7	-	-
<i>Epischura</i>	1	-	-
Ostracods	18	-	-
Water mites	25	-	5
Midge fly larvae	18	6	100
Midge fly pupae	14	5	70
Crane fly pupae	10	4	15
Caddis fly larvae	4	-	-
Caddis fly pupae	4	-	-
Mayfly nymphs	12	7	90
Ants	2	-	-
Sphaerid clams	1	-	-
Gastropod snails	18	6	75
Sculpins (cottid fish)	12	18	95
Bryozoan statoblasts	6	-	-
Algal filaments	16	16	95
<i>Chara</i>	14	10	5
<i>Nostoc</i>	5	3	70
Pond weed ( <i>Potamogeton</i> )	2	-	-

**Table 3.** Food organisms used by eight Lake Whitefish captured in 30 m depth gillnet sets overnight 4-5 October 1980 in Skaha Lake (10 others had empty stomachs). Length, weight, sex, and age data were unavailable for this sampling series.

Taxa	In number of stomachs	Approximate % volume
Oligochaete worm	1	5
Midge fly larvae	5	5, 10, 10, 15, 50
Sphaerid clams	1	50
Mysids ( <i>Mysis relicta</i> ) *	6	30, 90, 90, 90, 100, 100
Unidentified plant matter	2	40, 50
Unidentified animal matter	1	20

\* (number of mysids taken per fish where present: 1, 2, 7, 20, 26, 62)

As in the previous sampling years (1929 – 1935), oligochaetes, midgefly larvae, sphaerid clams, and aquatic vegetation contributed 5 to 50% of stomach volume, but most from *Mysis relicta*, which was introduced to Okanagan Basin lakes in 1966. Mysids contributed some 90 to 100% of the total stomach volume for most of the Lake Whitefish sampled (Table 3).

Sampling for Lake Whitefish again was carried out at Skaha Lake on 9 and 11 October 1995 (17:00 to 07:00 h) via bottom sets at 15 and 30 m depths with two gangs of five nets (2.4 x 15.2 m dimensions) with mesh sizes ranging from 25 – 102 mm at each depth contour. Thirty-eight lake whitefish were captured in these sets with fork lengths ranging from 28.5 to 47.5 cm, weights from 310 to 1375 g, and ages from 3 to 7

years. Nine of the stomachs were empty leaving 29 with prey items for one 3 year old, two 4 year old, ten 5 year old, twelve 6 year old, and three 7 year old fish for food analysis (Table 4). Lake Whitefish taken in 15 m depth sets fed largely on chironomid larvae and pupae, although five had mysids in their stomachs. Of the 38 Lake Whitefish taken in 30 m depth sets, nine had taken chironomid larvae or pupae and 21 had taken mysids, sometimes in large numbers.

**Table 4.** Food organisms (numbers) taken by Lake Whitefish (arranged by age where data present) from Skaha Lake 9 to 11 October 1995 in overnight gillnet sets at 15 and 30 m depths. Age where determined by scale reading. Also included are data for fish where only stomach content data were available.

Net set depth (m)	Age (years)	Fork length (cm)	Weight (g)	Sex (m or f)	Stomach contents (numbers)			
					chironomid	larvae	pupae	mysids
15	3	29.4	300	m	-	4	-	-
"	4	32.0	390	m	-	15	-	-
"	4	33.0	475	m	-	-	-	-
"	5	38.5	700	m	-	10	-	-
"	5	37.7	750	m	9	-	-	-
"	5	45.0	1225	m	1	11	-	-
"	5	43.7	1050	m	-	15	-	-
"	5	33.0	475	m	10	-	-	-
"	5	47.3	1250	m	-	-	5	-
"	-	-	-	-	1	8	-	-
"	-	-	-	m	10	-	-	-
"	-	-	-	-	5	9	51	-
"	-	-	-	-	1	16	-	-
"	-	-	-	-	8	-	18	-
"	-	-	-	-	2	-	5	-
"	-	-	-	-	2	-	-	-
"	-	-	-	-	10	-	-	-
"	-	-	-	-	11	3	-	-
"	-	-	-	-	-	-	1	-
30	4	31.5	525	m	4	8	12	-
"	5	37.6	600	f	-	-	-	-
"	5	38.5	700	m	-	10	-	-
"	5	40.7	950	f	-	-	40	-
"	5	41.5	875	f	-	-	-	-
"	5	39.0	650	f	1	-	-	-
"	5	42.0	725	m	-	2	-	-
"	5	43.5	1075	f	-	-	-	-
"	5	36.1	600	m	-	-	-	-
"	5	37.0	700	-	-	1	-	-
"	5	39.5	875	f	13	-	1	-
"	5	40.1	800	f	7	6	34	-
"	6	41.2	825	f	7	8	50	-
"	6	42.0	1000	-	-	-	-	-
"	6	42.8	1000	-	-	-	-	-
"	6	43.5	1025	f	9	6	34	-
"	6	44.0	1025	m	5	-	-	-
"	6	44.0	950	f	7	2	-	-
"	6	44.3	1225	f	-	-	-	-
"	6	44.8	1150	f	-	-	-	-
"	6	46.4	1250	f	-	5	-	-
"	6	48.0	800	f	2	1	7	-

**Table 4 (continued)**



Net set depth (m)	Age (years)	Fork length (cm)	Weight (g)	Sex (m or f)	Stomach contents (numbers)			
					chironomid	larvae	pupae	mysids
"	7	42.3	1000	-	-	-	1	6
"	7	43.4	1000	f	-	1	-	-
"	7	44.5	1150	m	-	-	1	6
"	-	-	-	-	-	8	-	2
"	-	-	-	-	-	-	-	9
"	-	-	-	m	-	1	10	-
"	-	-	-	-	-	5	3	4
"	-	-	-	-	-	-	-	23
"	-	-	-	-	-	-	10	1
"	-	-	-	-	-	1	-	12
"	-	-	-	f	-	1	-	112
"	-	-	-	-	-	-	1	6
"	-	-	-	-	-	-	-	67
"	-	-	-	-	-	3	4	17
"	-	-	-	-	-	1	8	35
"	-	-	-	-	-	-	-	11

Food organisms taken by Lake Whitefish captured in gill nets set overnight in Okanagan Lake on 2 and 3 October 1996 included primarily snails and chironomid larvae, with smaller numbers of clams and chironomid pupae (Table 5). Only one caddisfly larvae and one mysid were observed in the stomachs of the 13 fish analysed.

**Table 5.** Food organisms (numbers) taken by Lake Whitefish arranged by increasing age within the three depth zones sampled by gillnets set overnight in Okanagan Lake, 2 and 3 October 1996, at 15, 20, and 30 m depths off Summerland Yacht Club dock.

Net depth (m)	Fish age (years)	Fork length (cm)	Weight (g)	Sex	Stomach contents (numbers)				
					caddis larvae	chironomid larvae	snails	clams	mysids
15	5	24.0	258	m	-	-	-	81	-
"	5	30.5	344	f	-	-	-	-	-
"	5	32.0	359	f	-	-	1	1	-
"	5	37.0	496	f	-	-	-	182	2
"	6	30.5	344	f	-	-	-	-	-
"	11	54.2	2032	f	1	1	1	-	-
20	4	31.0	303	f	-	-	-	10	1
"	4	34.0	375	m	-	-	-	-	-
"	5	33.5	405	f	-	-	-	-	-
"	5	34.1	416	f	-	4	3	8	-
30	5	35.5	454	m	-	-	-	-	-
"	5	39.0	604	m	-	79	2	-	15
"	8	-	1902	f	-	-	-	-	-

On 2 and 3 June 1997, G.B. Northcote and members of his biology class carried out overnight gillnet sampling in Okanagan Lake at bottom depths of 20 and 40 m offshore from the Summerland Yacht Club dock. Eleven Lake Whitefish were caught and 10 of these were aged by scale analysis following sex, fork length, and weight determination (Table 6). Although data are limited, younger age fish (2, 3 year olds) in the sample rarely fed on mysids but instead heavily on chironomid larvae, snails, and small sphaerid clams. Older age groups also fed on these, but most heavily on mysids.

**Table 6.** Food organisms (numbers) taken by Lake Whitefish arranged by age within depth zones sampled by gillnets set overnight in Okanagan Lake, 2 and 3 June 1997 off Summerland Yacht Club dock.

Net depth (m)	Fish age (years)	Fork length (cm)	Weight (g)	Sex	Stomach contents				
					chironomid larvae	chironomid pupae	snails	clams	mysids
20	7	46.1	1138	m	-	-	-	-	-
"	8	44.7	1055	m	11	2	164	2	21
"	9	42.9	874	f	18	-	6	-	193
"	9	43.0	1101	m	3	-	11	10	4
"	9	48.6	1302	m	-	-	-	-	-
40	2	10.0	11	-	3	-	-	13	-
"	2	13.1	20	m	-	-	-	-	2
"	3	13.5	24	f	7	-	-	21	-
"	8	43.7	1026	f	1	-	6	-	-
"	-	44.5	1145	f	-	-	1	-	10
"	10	45.6	1088	m	4	-	1	-	5

**Note:** 11 additional preserved lake whitefish stomachs from 2-3 June 1997 gill-netting were not sampled by the students in G.B. Northcote's biology class laboratory session but were given to T.G. Northcote for later analysis of stomach contents. These are arranged below by increasing total stomach length.

Stomach length (mm)	Stomach contents							
	oligochaetes	leaches	aq. mites	chiron. L.&p.*	caddis l.*	gammarids	snails	clams mysids
110	1		4	3	4	1	25	
113	14			181			10	124
116	11	48		123			17	66
119		8		48	3		3	101
153				4	2		3	3
165				76		1	3	2
166	1			357	2		268	
166	1						2	
167				7			1	
206		1						324

\* chiron.l.&p. = chironomid larvae & pupae; caddis l. = caddis larvae

In Albertan lakes, the Lake Whitefish populations feed primarily on bottom organisms, especially chironomid larvae, small clams and snails and secondarily on amphipods, other insect larvae and zooplankton though some take small fishes (Nelson and Paetz 1992). Ash (1974) noted Lake Whitefish in Lake Wabamun, Alberta, also fed extensively on aquatic vegetation (shoots of *Elodea canadensis*) in winter in the shallow east end of the lake, and on small fish (primarily stunted yellow perch) during the fall. Machniak (1975) gives an extensive coverage of Lake Whitefish biology with special reference to hydroelectric development.

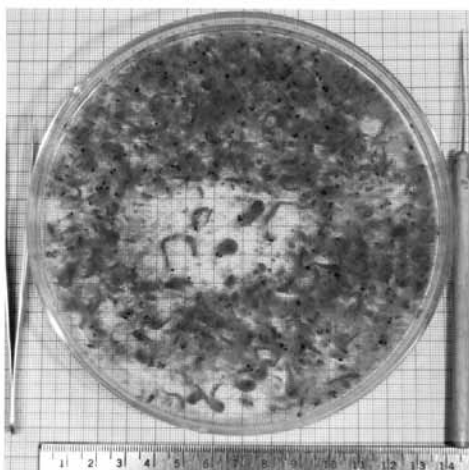
## Discussion

Lake Whitefish from non-native stocks (Lake Winnipeg and Waterhen River, Manitoba) have become reasonably abundant in Okanagan, Skaha, Vaseux, and Osoyoos lakes in the southern British Columbia Okanagan Basin since their introductions in the late 1800s and early 1900s. Nevertheless no attempts have been made to develop commercial fisheries for them although in recent years, recreational fisheries have expanded somewhat, especially in Vaseux and Osoyoos lakes. Personal experience fishing for them has convinced me that they provide excellent sport on light spinning gear as well as fine pan fish when cooked.

With regard to their length-weight and length-age relationships, no major changes were evident between these characteristics after the long period since that of their initial introductory decade. A more interesting change is that of prey use occurring during the recent four decades after the introduction of *Mysis relicta* aimed not at Lake Whitefish but instead as one means for improving abundance and growth of lake dwelling Kokanee salmon, which had seriously declined. To some extent, this introduction has had some positive effects on the Kokanee populations in the Okanagan Basin lakes, but probably much more so on their Lake Whitefish populations, especially for their older age groups.

In recent years, those of age 5 and older make mysids a major prey item and it is becoming common to find their stomachs extended with mysids, sometimes up to a hundred or more in a stomach (see Fig. 4). It will be of considerable interest to follow further changes that may occur in the feeding ecology and other interactions between Lake Whitefish and Kokanee in the Okanagan Basin lakes.

**Figure 4.** Stomach contents of a lake whitefish *ca* 50 cm fork length and 10+ years old from an overnight gillnet catch in Okanagan Lake off Summerland, 2-3 June 1997. Total contents shown in a 14 cm diameter Petri dish composed of 1 leach and 324 *Mysis relicta* adults.



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## NOTICE of CSEB CONFERENCE & AGM

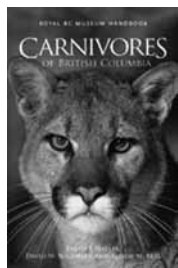
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# BOOKS of Interest



## Carnivores of British Columbia.

*D.F. Hatler, D.W. Nagorsen and A.M. Beal. 2008. UBC Press. Paperback (\$27.95 CAD).*

Carnivores are animals that hunt and eat other animals, mostly herbivorous mammals. Humans share a long history with carnivores. We fear carnivores as predators, revile them as competitors, exploit them for their fur, or admire them for their grace and beauty. This book, the fifth of six volumes on the mammals of BC, provides comprehensive, up-to-date information on the 21 species of wild terrestrial carnivores in the province.

Included are discussions of the canids, Coyote, Grey Wolf, Red Fox; the American Black Bear & Grizzly Bear; Northern Raccoon; Mustelids (weasels and relatives) including Sea Otter, Wolverine, Northern River Otter, American Marten, Fisher, Ermine, Long-tailed Weasel, Least Weasel, American Mink, American Badger; the Striped Skunk and Western Spotted Skunk; as well as the Cougar, Canada Lynx, and Bobcat.

*Carnivores of British Columbia* describes each species, with illustrations of whole animals and skulls. For each species it discusses distribution and habitat, feeding ecology, social behavior, reproduction, issues around health and mortality, abundance, human uses, conservation and management. This book will be an important educational reference for the general public, schools, naturalists and wildlife biologists. ☺



## Animal Experimentation – A Guide to the Issues.

*2nd Edition. V. Monamy. 2009. Cambridge University Press.*

Animal Experimentation is an important book for all those involved in the conduct, teaching, learning, regulation, and support of animal-based research. While maintaining the clarity of style that made the first edition so popular, this second edition has been updated to include discussion of genetically modified organisms and associated

welfare and ethical issues that surround the breeding programs in such research. It also discusses the origins of vivisection, advances in human and non-human welfare made possible by animal experimentation, principle moral objections to the use of research animals, alternatives to the use of animals in research, and the regulatory umbrella under which experiments are conducted in Europe, USA and Australasia. The book highlights the future responsibilities of students who will be working with animals, and offers practical advice on experimental design, literature search, consultation with colleagues, and the importance of the on-going search for alternatives. ☺



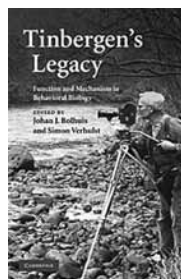
## Setting Conservation Targets for Managed Forest Landscapes.

*Marc-André Villard and B.G. Jonsson, eds. 2009. Cambridge University Press.*

Forests host a disproportionate share of the world's biodiversity. They are increasingly being seen as a refuge for genetic diversity, native species, natural structures, and ecological processes. Yet, intensive forestry threatens their value for biodiversity. The authors (Villard from the U. de Moncton and Jonsson from Mid-

Sweden University) present concepts, approaches and case studies

illustrating how biodiversity conservation can be integrated into forest management planning. They address ecological patterns and processes taking place at the scale of landscapes, or forest mosaics. This book is intended for students and researchers in conservation biology and natural resource management, as well as forest land managers and policy makers. It presents examples from many forest regions and a variety of organisms. With contributions from researchers that are familiar with forest management and forest managers working in partnership with researchers, this book provides insight and concrete tools to help shape the future of forest landscapes worldwide. ☺



## Tinbergen's Legacy.

*Function and Mechanism in Behavioral Biology. J. Bolhuis & S. Verhulst, eds. 2009. Cambridge University Press.*

Nobel laureate Niko Tinbergen laid the foundations for the scientific study of animal behavior with his work on causation, development, function and evolution. In this book, an international cast of leading animal biologists reflect on the enduring significance of Tinbergen's groundbreaking proposals for modern behavioral biology. It includes a reprint of Tinbergen's original article on the famous "four whys" and a contemporary introduction, after which each of the four questions are discussed in the light of contemporary evidence. Also discussed is the wider significance of recent trends in evolutionary psychology and neuroecology to integrate the "four whys". With a foreword by one of Tinbergen's most prominent pupils, Aubrey Manning, this wide-ranging book demonstrates that Tinbergen's views on animal behavior are crucial for modern behavioral biology. It will appeal to graduate students and researchers in animal behavior, behavioral ecology and evolutionary biology. ☺



## A Nature Guide to Ontario.

*Now available in paperback. Winifred (Cairns) Wake, ed., 2007. University of Toronto Press.*

From Hudson Bay to Pelee Island, from Rainy River to the Quebec border, Ontario offers a rich variety of experiences for nature-lovers of all ages and interests. *A Nature Guide to Ontario* showcases more than six hundred of the best sites for viewing the many forms of plant and animal life found across the province. All sites are open to the general public, most are easily accessible, and a surprising number are located in or near the province's biggest cities.

The book is divided into seven regions, and sites are listed under county, district, or municipality. Entries contain instructions on how to reach sites, descriptions of the major landscape and habitat features, information about typical as well as important or unusual animals and plants to be found at the site, and an address to contact for more information. Introductory chapters give an overview of Ontario's natural history and its rich and diverse plant and animal life. The book also discusses environmental concerns, offers tips on how to get the most out of an outing, and lists the 'top ten' nature sites in Ontario. There are lists of useful addresses and references, a site index, and an extensive glossary. Production of this volume was a project of the Federation of Ontario Naturalists, whose affiliates and individual members contributed to the book. *A Nature Guide to Ontario* is an invaluable reference for all who want to experience and enjoy the best of Ontario's natural areas. ☺



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