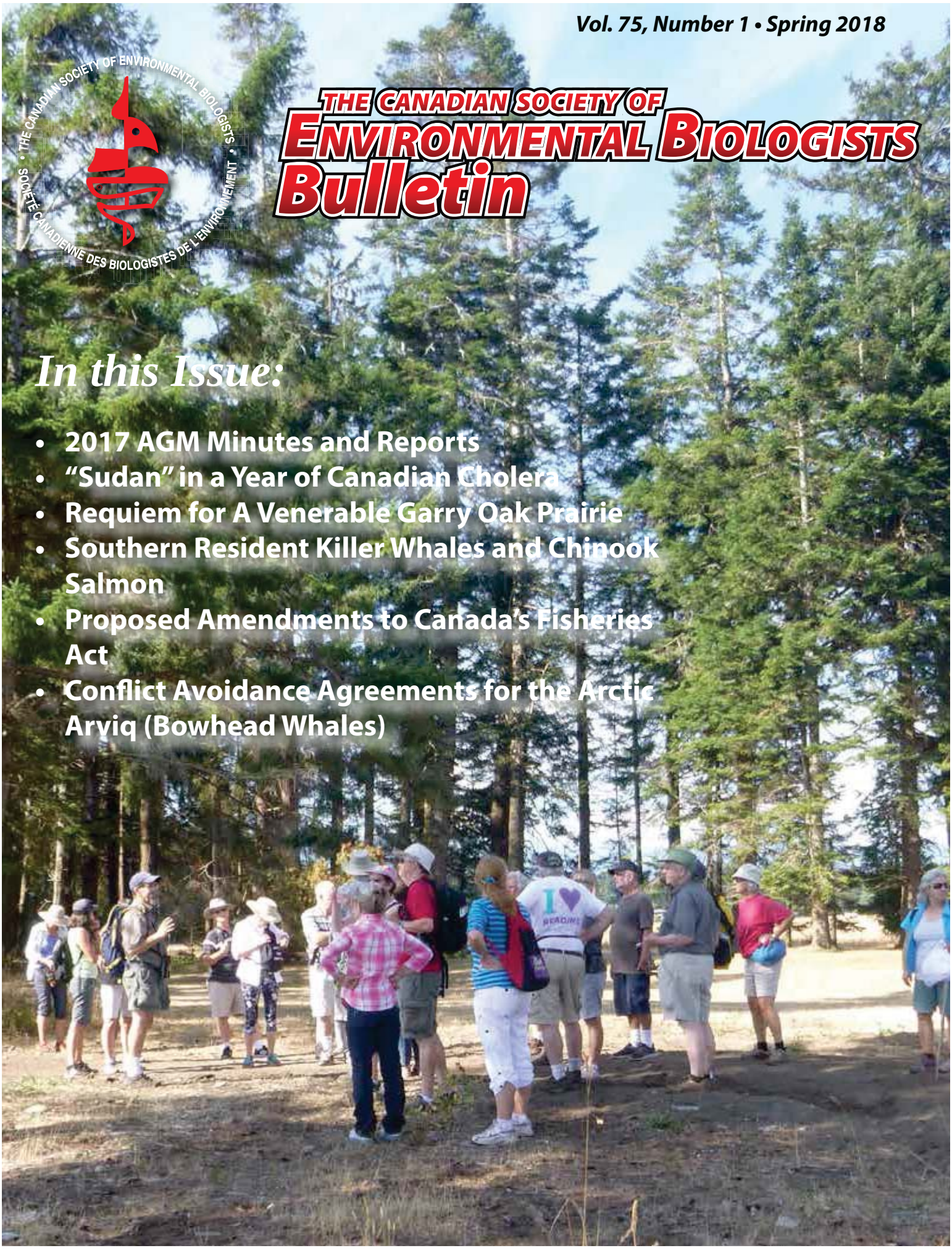
Vol. 75, Number 1 • Spring 2018

THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Bulletin

In this Issue:



CSEB Bulletin SCBE

VOLUME 75, ISSUE 1, Spring, 2018

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

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In this issue

Date of Issue - April 2018

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Front Cover: Loys Maingon teaching Coastal Ecology, lecturing on the impacts of the 9.2 Great Cascadia earthquake and tsunami of January 26, 1700 for Elder College

Back Cover, Top: Mt Tzouhalem Native Garry oak meadows in bloom. Insert: Western Toad navigating an ephemeral stream near Pearse Lake Strathcona Park.

Back Cover, Bottom: Native Ginger (*Asarum caudatum*) flower, Old Homestead on the Puntledge River, Bevan, BC.

Photo Credits: Loys Maingon, CSEB BC Regional Director.

CSEB BULLETIN 2018

Vol. 75, Number 1, Spring 2018

The Canadian Society of Environmental Biologists Bulletin is a quarterly publication. The Bulletin 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 Bulletin 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:** garyash@shaw.ca.
Editor: Gary Ash
Layout: Gary Ash
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LE BULLETIN de la SCBE 2017

Vol. 75, Numéro 1, Printemps 2018

Le Bulletin de la SCBE est une publication trimestriel de la Société Canadienne des Biologistes de l'Environnement. Le Bulletin informe les membres des activité 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 diverssifié d'environnementalistes Canadien. Les membres sont invités a contribuer des articles, photos (noir et blanc) ou des messages qui sont d'intérêt nationale en sciences biologiques et environnementales. Les lettres à l'editeur sont bienvenues.
Tout la correspondence 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'editeur: Gary Ash, Editor, courriel:** garyash@shaw.ca
Rédacteur en chef: Gary Ash
Impression: LaserText Digital Print & Copy Centre, Edmonton, AB.

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.

NATIONAL News

PRESIDENT'S Report

By Curt Schroeder, CSEB President

Now that the AGM is behind us, it's time to move forward with business. As the new President, I am humbled to take on this position and work with a new executive and Board and I hope to meet your expectations. Thanks to those who stepped forward to volunteer their time and energy – it is the life blood of any organization. Thanks to Anne Wilson and your leadership as President, you deserve more time to yourself, but immediately taking on the role as Secretary-Treasurer seems out of place, but not out of character – glad to have you on board.

One or two things that I hope to accomplish during my tenure is to ensure that our governing documents are serving the interests of our organization in a way that allows for efficient and effective leadership. This includes ensuring that we have a board structure and member volunteers contributing as needed to maintain a viable organization. Secondly, I want to pitch the idea of creating a national award program where we recognize those who demonstrate outstanding contributions to the field of Canadian environmental biology. As an organization with a long history of serving its members and advancing the prudent management of Canada's natural resources, we periodically should make the time to celebrate achievement in our field.

PAST-PRESIDENT'S Report

By Anne Wilson, CSEB Past-President

I would like to start by welcoming Curt to his new role as President of the CSEB, and thank the Board for all your tremendous support during my term as President!

As the immediate Past-President, my role as outlined in our bylaws will be "to provide assistance and advice to the President in order to maintain continuity in the Society." In addition, I look forward to continuing to participate in our meetings and initiatives! The other change in my CSEB role is taking on the Secretary-Treasurer position, which is one I feel I can contribute to on a practical level.

I would like to encourage people to think of the CSEB as a resource when it comes to making a difference on environmental issues. As a well-respected national environmental organization, we have a voice that can be brought to bear on issues of concern – contact any of the Officers or Regional Directors to bring up issues that need to be raised with decision-makers. We also have our webinars, which are a great platform to present scientific information on research and emerging issues! The CSEB Bulletin is a useful forum for information and discussion as well.

With best wishes to all for renewal and rejuvenation this Spring!

CSEB 2017 AGM

Annual General Meeting Minutes (Draft)

28th February, 2018 2:00 pm MST

Attendees: Anne Wilson, Gary Ash, Sharleen Hamm, Loys Maingon, Patrick Stewart, Robert Stedwill, Curt Schroeder Heidi Klein, Pam Zebot, Elizabeth Kingston

Regrets: Brian Free, Karen March, Sean Mitchell

Plenary Speaker John Donihee: ***Navigating Environmental Risk: When and How to Apply the Precautionary Principle***

1. Welcome – President Anne Wilson

Move to accept agenda: Loys M., Second: Curt S., carried.

2. Approval of Minutes from 2016 AGM

Move to accept: Curt S., Second: Loys M., carried.

3. President's Report – Anne Wilson

Over the past year, Anne chaired the monthly CSEB Directors' meetings and contributed items to the newsletter, and would like to extend many thanks to Curt, who stepped in to chair meetings for several months while she was unable to. Anne is resigning as President effective immediately. Many thanks to all the Officers and Directors (Patrick, Curt, Karen, Brian, Gary, Robert, Loys, Sharleen).

4. 1st Vice President's Report – Patrick Stewart

Patrick worked on a number of initiatives and provided newsletter articles; he developed the email list to circulate webinar notices, and continues to work on recruitment.

5. 2nd Vice President's Report – Curt Schroeder

This was Curt's first term on the Board, although he served as the SK Chapter president long ago, and he has been glad to contribute and work on projects. Curt stepped in as President during Anne's absence. It would be good to get more SK newsletter contributions; this is challenging. Curt is pursuing the idea of a CSEB award on a national level to garner interest in the organization.

CSEB Research Webinars

Check the CSEB Website at www.cseb-scbe.org for upcoming webinars and registration information.

6. Secretary-Treasurer's Report – Presented by Gary Ash for Karen March

Gary presented the Treasurer's report with the 2017 Financial Report presented first. Income was approximately $4794.63, and expenses posted at the end of Dec. were $5964.17. The difference was an estimated -$1169.54, but this will be higher as the Dec. 2017 bank balance does not include Dec. payments for $2,555.53 in 2017 expenses – Vol 74.3,4 $442.84 for mail-out; Ninja and Wanderoak -$570.38, web hosting, flow $323.56, web form $78.75,Webgoto $1140. Actual expenses will be approximately $8519.70 for a negative cash flow of $3725.07. This leaves a bank balance of approximately $9021.78, plus a GIC worth $1602.95.

The 2018 Draft Budget was presented next. It was noted that we are covering the proposed deficit from the current reserve. The cost for a Public Relations contractor was included under Miscellaneous expenses for $1000. The bank account is currently in Toronto, with the TD Bank.

Move to accept Financial Report: Gary A., Second: Robert S., carried.

7. Past President's Report – Robert Stedwill

With the untimely death of Bill Paton who was in his second term as president in 2016, Anne Wilson was encouraged to take the leadership of the CSEB. As Past President during Bill's tenure, Robert continued in that role. With Anne's formal election as president, Robert continues to be Past President and prepared to assist where possible and able. To date, Robert has been filling in by contributing material from Manitoba for the CSEB newsletter/bulletin. Robert outlined the role of the Past President, which is to take on any functions the President requires. Robert also canvassed for candidates for the 2018 elections.

8. Membership Report – Gary Ash

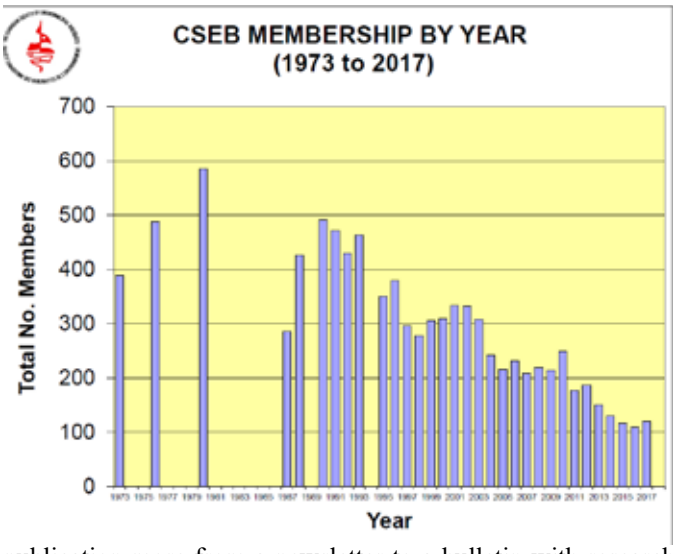
Gary presented a breakdown of membership, and noted we need to increase student memberships by spreading the word about free student memberships. Local universities should be contacted.

2017 CSEB Membership
by Region and Membership Category
as of 31 December 2017

Region	Complimentry	Honourary	Associate	Library	Regular	Student	Total
1 Atlantic	1	1	3	1	5		11
2 Quebec					3	2	5
3 Ontario	1		1	1	23	2	28
4 Manitoba					2		2
5 Sask.			1		14		15
6 Alberta		1		2	22	2	27
7 BC		1			27		28
8 Territories					2		2
9 USA				1	1		2
0 Foreign							0
Totals	2	3	5	5	99	6	120

The suggestion was made to give a complimentary membership (1 year) to webinar presenters. This was put to a motion: Gary moved that the CSEB offer non-member webinar presenters and people who contribute research newsletter articles a one year free membership in whatever category they qualify for.

There was some question on what would qualify as a newsletter contribution for the free membership, and the intent is for this to be offered in return for scientific research articles, to move the publication more from a newsletter to a bulletin with research results.



Seconded: Loys M. Carried (3 opposed).

9. Newsletter Editor's Report – Gary Ash

Gary highlighted the due dates for submissions for the Spring 2018 Bulletin.

Canadian Society of Environmental Biologist

2017 NEWSLETTER/BULLETIN EDITOR'S REPORT

Prepared by Gary Ash

21 February 2018

- In 2017, four Newsletter/Bulletins were published (Vol 74 issues 1, 2, 3, 4).
- Newsletter/Bulletin distribution format in 2017 was as follows:
  - Electronic Distribution – 79
  - Hard Copy Distribution – 42 (incl. two copies to National Library of Canada)
- In December 2017, the executive voted to rename the CSEB Newsletter/Bulletin to the CSEB Bulletin, to encourage more scientific articles to be submitted for publication
- Deadlines for Submissions for 2018 CSEB Bulletin (Volume 75) are as follows:
  - Spring 2018 – 15 March 2018
  - Summer 2018 – 1 May 2018
  - Fall 2018 – 15 Sep 2018
  - Winter 2018 – 1 Nov 2018
- Currently looking for Guest Editors and submission for 2018 Bulletin – Contact Gary Ash (garyash@shaw.ca)
  The CSEB Bulletin can only be as good as the input of content received. Consider submitting a scientific article for publication.
- Currently looking for photos of Biologists in Action for upcoming newsletter covers
- I would like to especially thank Loys Maingon, Peter Wells, Sharleen Hamm and Anne Wilson for their newsletter contributions, as well as the rest of the executive for their continued help in content submission and proofing the draft Newsletter/Bulletin in 2017.

10. Webinar Chair Report – Loys Maingon

The CSEB offered 12 webinars in 2017, with two from affinity groups. Attendance varied from 12 – 100, with an average of 42. Partnerships and commitments from presenters are difficult. It is suggested that we all reach out to post-docs for recent research to be presented.

11. CSEB Website Report- Brian Free

The CSEB website is now well established and functioning well.

The relatively static information, such as contact list, scholarship recipients, membership fees, etc. are being updated as they change.

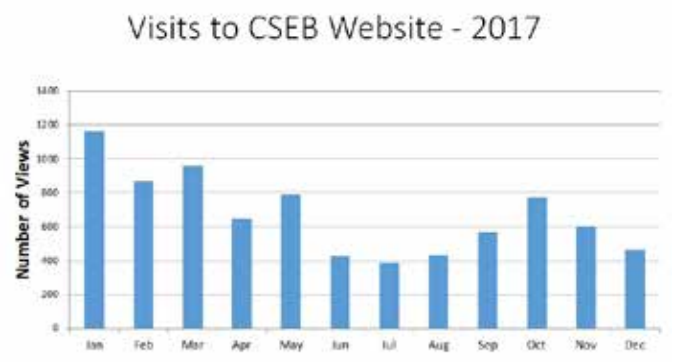
Most of my activity is adding new Webinar announcements to the News and Events page and later adding the recorded webinar to the Webinar Archives page. Thanks, Loys!!

Have also added over a dozen job ads to the Biology Careers and Employment page. Most were from the Government of B.C. A few came from other western provinces or the territories.

Other directors have occasionally forwarded newsworthy announcements regarding conferences, federal government recruitments to expert committees and so on. These have been added to the website.

Top 10 Pages
(Number of Views in 2017)

Home	2460
Resources	1003
Biology Careers & Employment	779
About	579
Membership	547
Contact	399
CSEB Webinar Archives	189
Join	158
Newsletter	151
Renew	149



Gary has been posting the 2017 newsletters, up to the issue prior-to-current. Thanks, Gary!

Other administrative tasks include backing up the website, renewing our CSEB domain name and website host subscription, and maintaining our capability for on-line membership renewal (Thanks, Gary).

Gary and I have exchanged occasional emails with our website designer, WanderOak. They offer ongoing maintenance services of various types, but we have not yet felt the need to secure these services.

What's missing? Some of my suggestions include;

- Link to the CSEB Facebook page.
- Job ads from all parts of the country.
- More content regarding environmental issues of interest to members.
- Interaction with members/viewers, e.g. blogs? surveys?
- Documentation about our website management so that others can step in. Gary Ash is already well versed.

12. Directors' Reports

Atlantic – Pat Stewart – low membership in the four Atlantic provinces. Karen March is stepping away from the Board after 15-16 years and about 10 as Secretary-Treasurer – many thanks to Karen for all her work! There has been some traffic with Pat Ryan in NL. The focus in the Atlantic is on tidal energy, fisheries, and LNG.

BC – Loys Maingon – We are happy to welcome Sean Mitchell to the Board as a BC Director. Sean has been active on fisheries issues. Membership numbers in BC are dwindling.

Manitoba Report – Robert Stedwill *(retired) Saskatchewan Chair* – I have endeavoured to capture newsworthy reports focused in Manitoba for the newsletter/bulletin, however, not being physically present in Manitoba, this has been done by scanning Manitoba websites devoted to environmental issues and monitoring newspaper reports of continuing stories, such as the Zebra Mussel infestation of Lake Winnipeg and the Red River. This is not an ideal situation, and members in Manitoba must be recruited to submit Manitoba material of interest to the whole CSEB membership. As reported previously in my Saskatchewan Report for the AGM, active participation by working biologists in the province are needed to report on issues germane to the CSEB, and to reactivate the Manitoba Chapter. The untimely passing of Bill Paton of Brandon University impacted that Chapter's ability to recruit new members and keep interest alive in the province's CSEB membership. I will continue to work with a professor at the university who is collaring much of Bill's work, and has indicated a willingness to share this with the CSEB.

Saskatchewan – Robert Stedwill – There has been very little activity in the Saskatchewan Chapter this past year. Requests for submissions to the Newsletter/Bulletin have been unsuccessful, and there have been no meetings of the membership. What is required is an active member who is working as a biologist and has the contacts with the environmental/biological community to gather like-minded individuals and establish an active CSEB group in Saskatchewan. I can continue to monitor news clippings and reports from public websites and news generating services for material germane to the interests of the broader CSEB membership, however, an active biologist would be more desirable.

Robert likes the idea of free student memberships and will contact the U of S and Regina, and will also contact the current list of SK members.

Territories – Sharleen Hamm – It's been nearly a year since I joined the Board of Directors for the CSEB, and so with this is being my first AGM, it is a good time to revisit my reasons for joining the CSEB Board, identify accomplishments and look to the year ahead.

My intent in joining the CSEB Board was to support a pan-Northern venue for science communication, foster a greater understanding of Northern matters both across the North and in other jurisdictions, and to generally increase Northern content and participation in the webinar series and our newsletters/bulletins. Accomplishments supporting achievement of these goals in 2017 included the following:

- Participating in seven Board meetings;

- Providing input into the CSEB obtaining public relations support;
- Contributing to three newsletters (content and edits);
- Arranging for two guest articles featuring Northern content, along with contributing photographers for each newsletter;
- Arranging for the AGM keynote speaker;
- Conducting informal in-person engagements with students, practicing environmental biologists and other interested parties in all three territories at venues such as the Nunavut Mining Symposium (Iqaluit), Geoscience Forum (Yellowknife), Geoscience Forum (Whitehorse), Kitikmeot Trade Show (Cambridge Bay), to increase awareness of the CSEB and to identify opportunities for partnerships and participation;
- Providing regular dissemination of Northern-related CSEB content through the Northwest Territories and Nunavut Chamber of Mines to their membership, as well as through my own professional network across the North.

I see the year ahead bringing a continuation of these efforts, along with the following:

- Ongoing engagement with Polar Knowledge Canada, ArcticNet and other interested parties to establish partnerships and/or ongoing content contributions to the webinar series and newsletters/bulletins;
- Hosting at least one North-focussed guest article per newsletter;
- Hosting at least one North-focussed webinar per quarter;
- Focusing efforts on bringing in more Yukon content;
- Participating in a CSEB editorial sub-committee to examine and enhance the structure and function of the bulletin.
- Increasing understanding of Board operations.

Motion: Anne W. moved that all reports be accepted. Seconded: Loys M. Carried.

13. Elections – all Positions

Nominations – The following slate was nominated: Curt Schroeder for President, Robert Stedwill for 2nd VP, Anne Wilson for Secretary/Treasurer.

Motion: Anne W. moved to accept the slate of candidates as noted, by acclamation. Seconded: Robert S., Carried.

14. New Business

Elizabeth Kingston was introduced as our new Public Relations consultant, and is looking forward to working with us. A working meeting will be set up with Curt and others to get started on several ideas.

Next Directors' meeting: March 29th at 8 am PST – Loys will set up a web call.

CSEB FINANCIAL REPORT FOR 2017 (Feb. 20 2018 Draft)

Cash in bank as Dec. 28 2016 (from bank statement)		$ 10,378.39
Receipts		
Membership Fees (no paypal inputs)		$ 2,669.57
NRC Journals		$ 2,125.06
Publication Sales (advertising)		*$ 0.00*
Bank Interest		$ 0.00
Contributions		$ 0.00
Total	***ESTIMATE***	***~$4,794.63***
Expenses		
Newsletter Production		$ 768.45
V74.1 – 144.43		
V74.2 – 181.18		
V74.3 – 272.42		
V74.4 – 170.42		
Newsletter Mail-out		$ 281.63
V74.1 – 44		
V74.2 – 78.02		
V74.3- 100.70		
V74.4 – 59.12		
Membership Renewal (and cards) (ink 70.86)		$ 70.86
Administration (Board)		$ 0.00
Phone Conferencing Recite – Aug. 86.27		$ 86.27
Mail Redirect and Mail Box Renewal (Apr 354.76+ 259.90)		$ 614.66
NRC Journals 1625.46+52.50+52.60+352.5		$ 2,083.06
Chapter Rebates		$ 0.00
Other (Flowers 105)		$ 105.00
Web Charges		$ 1934.03
(CSEB domain renewal 5 yrs 87.37, web host 151.19+65.67, Web design 78.75, Ninja form 32.44+32.32, Goto Webinar 1140 chq outstanding, cloud sub 346.29)		
Bank Charges		$ 0.00
Society registration (federal)(KM paid, owed)		$ 20.00
Total	***preliminary ~ $5,964.17***	
Difference	*preliminary -$1169.54*	
Cash in bank as of end of December 2017	$11,577.31*	
GIC investment (maturity value as *of Jan. 11 2017*)		*$ 1,602.95*

Bank balances are provided for information purposes.
*Dec. 2017 bank balance does not include Dec. payments for 2017 expenses – Vol74.3,.4-442.84,mailout, ninja and wanderoak -570.38, webhost, flow 323.56,web form 78.75,webgoto 1140 =2,555.53 2017 expenses not included

15. Adjournment: 4:20 MST

CSEB BUDGET FOR 2018 (Feb. 20 2018 draft)

	2011	2012	2013	2014	2015	2016	2017*	2018
Receipts								Proposed
Membership fees	$5,700.00	$6,500.00	$6,400.00	$5,000.00	$4,500.00	$5,650.00	$2,700.00	$2,500.00
NRC Journals	$1,200.00	$1,400.00	$800.00	$900.00	$1,300.00	$1,000.00	$2,100.00	$1,500.00
Publication Sales	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$30.00
Bank Interest	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Conference Proceeds (incd. Sponsors)	$0.00	$1,500.00	$0.00	$1,800.00	$0.00	$0.00	$0.00	$0.00
Revenue Generation	$175.00	$0.00	$0.00	$0.00	$400.00	$0.00	$0.00	$900.00
Total receipts	*$7,075.00*	*$9,400.00*	*$7,200.00*	*$7,700.00*	*$6,200.00*	*$6,650.00*	*$4,800.00*	*$4,930.00*
Expenses								
Corporate registration	$30.00	$30.00	$30.00	$30.00	$30.00	$20.00	$20.00	$20.00
Newsletter Production	$3,600.00	$2,500.00	$2,400.00	$2,700.00	$1,300.00	$700.00	$750.00	$1,650.00
Board Meeting (travel subsidy)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$100.00
Administration (conference call, misc.)	$150.00	$750.00	$300.00	$700.00	$600.00	$700.00	$200.00	$700.00
Web hosting, Update	$150.00	$0.00	$200.00	$650.00	$300.00	$1,260.00	$800.00	$1,300.00
Webinar	$0.00	$0.00	$0.00	$0.00	$0.00	$1,140.00	$1,140.00	$1,140.00
NRC Journals	$1,200.00	$1,400.00	$800.00	$900.00	$1,300.00	$1,000.00	$2,100.00	$1,500.00
Postage and Email Newsletters	$1,000.00	$1,000.00	$700.00	$800.00	$450.00	$400.00	$300.00	$450.00
Mail Box Rental	$250.00	$250.00	$240.00	$250.00	$250.00	$250.00	$250.00	$250.00
Redirect Mail	$350.00	$350.00	$350.00	$350.00	$350.00	$350.00	$350.00	$350.00
Chapter Rebates	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Membership renewal, cards, postage	$600.00	$750.00	$500.00	$100.00	$400.00	$500.00	$100.00	$100.00
Bank and Web Registration Charges	$20.00	$20.00	$20.00	$0.00	$0.00	$150.00	$200.00	$200.00
Miscellaneous, Conference	$1,000.00	$4,000.00	$30.00	$1,500.00	$0.00	$200.00	$0.00	$1,000.00
Total expenses	*$8,350.00*	*$11,050.00*	*$5,570.00*	*$7,980.00*	*$4,980.00*	*$6,670.00*	*$6,210.00*	*$8,760.00*
Net	-$1,275.00	-$1,650.00	$1,630.00	-$280.00	$1,220.00	-$20.00	-$1,410.00	-$3,830.00

**** Estimated - as outstanding items at time of print***

2018 Web charges include

REGIONAL News

BRITISH COLUMBIA News

Submitted by Loys Maingon, CSEB BC Director

"Sudan" in a Year of Canadian Cholera

Now we are borrowing from nature at a rate that is many times higher than the world can sustain. The day of reckoning will come,"
Christian Steel (Norway)

These days the French existential philosopher and 1957 Nobel prize-winner, Albert Camus (1917—1960) would find British Columbia to be fertile grounds for his brand of realism. Camus was made famous for his work on the myth of Sisyphus, and his 1947 novel *The Plague*, which describes an ethical and physical outbreak of the plague in a North African city. BC's not quite made it to the "black plague" (*Yersinia pestis*), but we have made it to the "blue plague" (*Vibrio cholerae*). The symptoms are similar.

Nothing really quite speaks to the state of BC's mythical "pristine" environment, as a recent outbreak of cholera in the retirement haven of Parksville and Qualicum Beach.[1] As noted by the provincial health officer: it is the kind of disease one normally associates with the worst of the third world, or that one currently reads about in the context of Yemen, where local infrastructure has collapsed in the wake of a protracted civil war.[2] (Incidentally, Yemen's misery is in part made possible by the sale of Canadian armaments to Saudi Arabia,[3] perhaps demonstrating once again hubris: we never quite escape the consequences of living in a global village.) Of course, we can always pretend that the usual laws of nature do not apply to Canada. However, if it quacks like a duck, chances are it is a duck.

BC's unique cholera outbreak has its own special significant cultural and environmental dimensions in the global village that are well-worth noting for what they tell us about the real state of BC's environment. In particular, it should raise red flags about the state of our coastal waters. As the BC Centre for Disease Control notes: "The main sources of contamination are humans and coastal waters."[4] A cholera outbreak is, therefore, not without known antecedents. Even if we cannot determine the point-source, we can ascertain the general processes leading up to it.

First, as befits a third-world disease outbreak, the victims are from the most vulnerable and exploited cultural group in Canada, which an endless succession of provincial and federal governments claim to respect, First Nations. And the sanctimonious talk of respect has to be notwithstanding Premier John Horgan's recent very quotable justification for dismissing First Nations' cultural concerns in the Site C decision, in a memorable betrayal of public expectations:

> *"When it comes to reconciliation and working with Indigenous leadership there has been over 150 years of disappointment in British Columbia," said Horgan. "I'm not the first person to stand before you and disappoint Indigenous people."*[5]

Premier Horgan's defense is the most mendacious argument in law. It is known as: "*everybody was at it.*" There is a legal test for this defense. It is known as the "*Ghosh test* for honesty." It depends on demonstrating that the perceived common practice is socially acceptable, and that if it is not, that the defendant did not know that it is unacceptable. Given that failure to respect cultural rights and treaties is not deemed socially acceptable in Canada, even if it has a long history, and by his own admission he knows it is not, Horgan fails both limbs of the test.[6] It is therefore not surprising that with less than a year in government, the Horgan administration has already reached an all-time low in its relations with First Nations.[7]

In BC much of the land mass is "unceded First Nations territory." No treaties were ever agreed upon. The government must, therefore, consult meaningfully with the original residents, as determined by *Tsilqot'in vs British Columbia*. It is, therefore, impossible to embark on long-term management of the environment without first establishing a working relationship with First Nations' governments. As was the case with the previous government, like Sisyphus, this new government now faces a host of uphill legal challenges, as a result of the Site C decision, its reversal of its previous position on LNG development, and its tacit refusal to accept First Nations' requests to terminate Atlantic salmon fish farm licenses, as the State of Washington has done. These apparent reversals from the pre-electoral positions that the NDP took, are likely to have critical ramifications for the long-term environmental management of this province.

This outbreak of cholera is without any precedent. Over the thousands of years of cultural celebration of the herring spawn, there has never been any record of poisoning. This is not "red tide." This event is a contamination of a traditional food source, herring eggs, that corresponds to the early March herring run. The annual herring spawn is a cyclical culturally and environmentally important event rooted in the cultural fabric of local First Nations. It heralds the abundance that comes with the return of early salmon and spring freshets. The outbreak of cholera is therefore not just a simple incident. It is a cultural affront resulting from decades of provincial environmental mismanagement, and disregard for First Nations traditional management of the environment.

As in Yemen, the usual source of cholera likely is a contamination of surface waters. The winter/spring surface waters of the "Salish Sea" (Strait of Georgia) receive rain and snow run-off and have a relatively low salinity. As Richard and Sydney Cannings eloquently put it:

> *"The fresh water pouring out of these mountains is an important part of the coastal marine environment. The flow of large rivers is especially important: at maximal flow in early June, the Fraser can turn the surface layer of the entire Strait of Georgia into one large, brackish lake."* [8]

In BC, and particularly on the east coast of Vancouver Island, development has been proceeding at an unbridled pace. We are "world-class". We treat our rivers as drainage ditches. So, the findings of the just released 2018 *United Nations World Water*

Development Report: Nature-based Solutions for Water[9] on the global state of water and the limits of "grey infrastucture" are appropriate:

> *For too long, the world has turned first to human-built, or "grey", infrastructure to improve water management. In so doing, it has often brushed aside traditional and Indigenous knowledge that embraces greener approaches. Three years into the 2030 Agenda for Sustainable Development, it is time for us to re-examine nature-based solutions (NBS) to help achieve water management objectives.*[10]

Grey infrastructure is akin to our blue-box approach to recycling, which is currently running into trouble all across Canada.[11] By building multi-million water treatment plants, we defer having to deal with the problem of a generalized degradation of our surface water resources. Just as the blue box programmes merely enable consumers to consume more and dispose of waste "out of sight and out of mind", without having to deal with the source problems, multi-million dollar water treatment plants create the illusion of an endless supply of potable water that will never challenge our economic assumptions.

In this context, it is somewhat bewildering that British Columbians, and nominally so the current government, oppose and face daily arrest in their opposition to the Kinder-Morgan pipeline out of genuine concern for the potential oil contamination, while seemingly remaining silent about the less visible contamination of the Salish Sea.[12] The levels of contamination are well-documented through the study of contaminant levels in resident orcas.[13] Sources of contamination of the strait, which include the state of our freshwaters are known, and well-established as indicated by recent work by Patrick Shaw et al.[14]

On Vancouver Island and in the Lower Mainland, the demand for housing is such that it often exceeds sustainable potable water supplies. Over the past two decades, all municipalities along Vancouver Island's east coast have faced increasing problems with water quality, which they are now moving to address in order to conform with the requirements of Vancouver Island's Health Authority, by building multi-million dollar water treatment plants. However, addressing the problem of drinking water quality is not the same thing as addressing the quantity and quality of the environmental surface water supply that flows into the Salish Sea.

The two questions—the quality of the drinking water supply and the quality and potential contamination of surface waters—are often confused in the public mind. It is noteworthy to consider that until very recently, rural surface waters were considered potable. Untreated surface water was the only source of potable water in much of rural Canada. Public expectation with regards to surface water quality over the last 50 years has shifted from concerns over eutrophication of public waters in the late 1950s and 1960s to a broad acceptance after 2000 that all surface waters were deemed unpotable. Concern for eutrophication in the 1950s led to research on the impacts of environmental non-point source disturbances on the water supply, and the ecological processes that maintained water quality. This guided much of the now classic Hubbard Brook experiments largely led by Gene Likens and Herbert Borman who studied the relationships between soil and vegetation and water fluxes and quality, which is what we now refer to as "green infrastructure. Failure to heed the findings and applications of this work has resulted in a number of "accidents" and, in Canada, to a broad acceptance after the successive Walkerton and North Battleford *E. coli* outbreaks in 2000 and 2001 that surface waters are no longer expected to be potable. In keeping with the 2018 United Nations report referred to above, the main reason why surface waters that were previously potable are now no longer potable is because we have by and large effectively destroyed the green infrastructure that previously filtered and treated water microbially. We have directly contaminated water tables and exceeded carrying capacity of the land.

This is a result of increased population density and increased direct and indirect contamination of the water supply through poor land use and management. In other words, the effective general mismanagement of the environment, of which surface water quality is perhaps our best and most direct indicator, has not been addressed at source, but has been circumvented by an increasingly costly and fragile "grey infrastructure", which is highly vulnerable in a region subject to cycles of 9.5 earthquakes. The increased contamination is a result of managing the problem ad hoc, while claiming that the continued practices that generate contamination are "sustainable", rather than address them at source and acknowledging unsustainability of an over-built infrastructure.

The thin zone of rich agricultural land on the east coast of Vancouver Island, which forms an essential part of BC's ALR (agricultural land reserve, **Figure 1**) is also home to a relatively densely populated and highly developed retirement real estate market. BC's ALR makes up only 1.1% of the total provincial landmass. This means that BC only has 1.1% of arable land that can be used for agriculture. Vancouver Island's agricultural reserve is a mere fraction of the that 1.1%, but it is increasingly intensely managed. The current government proposes to intensify

Figure 1: Map of BC's Agricultural Land Reserve, showing the narrow coastal strip along east Coast Vancouver Island. Vancouver Island ALR shown as a red line underlining the green patches.

the agricultural footprint. This poses a number of important conservation challenges.

Agricultural land is "valley bottom" land rich in organic soils. As such, in its natural state, it is made up of some of the most microbially active and complex soils that support some of the province's highest biodiversity, with milder microclimates and more complex environments. On Vancouver Island, the ALR area is, therefore, contiguous and synonymous with some of Canada's most endangered ecosystems: the Coastal Douglas Fir and Garry Oak ecosystems. These thin strips of dry Mediterranean climate ecosystems are also in high demand for housing development.

On Vancouver Island, the twin problems of water quality and quantity are compounded by climate change, which is already observable in the climate data. Climate data based on ClimateBC data indicate that mean annual temperature warmed across Vancouver Island from 1962 to 2005 from 4.86 to 5.11 ºC and annual precipitation decreased from 3768 to 3359 mm.[15] These trends have only increased over the past 13 years, over which Vancouver Island has experienced a succession of summer droughts, and water deficits have ceased to be met by diminishing glaciers and snowpacks, which are vanishing and receding early.

These adverse surface water quality and quantity conditions are further exacerbated by a drive towards agricultural intensification in a largely unregulated environment, created by abuses in *The Right to Farm Act*. It is, therefore, to be noted that within the east Vancouver Island ALR, both the previous Liberal and current NDP government, as would the Green Party were it in power, promote an intensification of agricultural activities[16]. Ironically, the Horgan government, which has elected to continue the Site C project and, therefore, to destroy some 5,550 hectares of prime agricultural land within the traditional territory of Treaty 8 First Nations, has embarked on a ministerial review "to protect the ALR." The main concern of the review stems from the previous government's re-classification of the ALR into two different regulatory zones to enable landowners to sell and subdivide agricultural land for other purposes in Zone 2 (See **Figure 1**). Beyond this main concern, the current government is interested in augmenting agricultural production on agricultural land by penalizing through increased taxation what they interpret to be the non-productive or non-agricultural uses of ALR properties, and rewarding agricultural intensification, presumably through subsidies.

This has huge conservation implications for BC's biodiversity. Of particular concern is the fact that this involves the conversion of forest and wetlands to agriculture. To date the east coast of Vancouver Island has already lost about 75% of its wetlands and intermittent streams. Unlike, most other Canadian provinces, such as Alberta, Saskatchewan, and Ontario, BC has no clear regulation or enforcement controlling the landfilling and drainage of agricultural and development land. In BC, farmers and developers regularly deforest land, fill wetlands and intermittent streams, and connect drainage directly into the Ministry of Transport ditching system, with impunity and minimal, if any, oversight. Even the Minister of Agriculture's Advisory Committee's "Discussion Paper for Stakeholder Consultation and Public Engagement"[17], only tacitly acknowledges this problem, if insufficiently so:

> *"Government ministries and agencies can have considerable impact on agricultural land through such things as transportation planning, wildlife habitat management and conservation, forest and water management and energy planning. Accordingly, the ALC is both proactive and collaborative in working with ministries…"*

The ALC cannot be proactive if it does not address the question of on-site water management, deforestation, and drainage. The disturbing anomaly is that in BC, there is no drainage regulation comparable to other provinces. The fact is that highway ditches are not common property for landowners to drain into, but property of Ministry of Transportation and Highways, and therefore, should not be connected to without explicit permission. Failure to exercise its responsibilities to downstream landowners carries liabilities for the MoT. It is a common law offense to flood a "downstream" neighbour[18], an inconvenient fact ignored by developers, would-be farmers, and Ministry of Transportation staff alike.

Given Coastal BC's high winter precipitation, winter water saturation is a growing major concern, as climate change proceeds. Here, as elsewhere on the planet, flooding is increasingly becoming a major recurrent event. Addressing flooding problems by restoring estuarial wetlands as Campbell River has done, and now as Courtenay is proposing to do with Kus-kus-sum project on multi-million dollar grants, is doubtless meritorious and deserves to be supported.[19] However, while such projects principally address the management of water quantity, they do not address the source problems, and they only secondarily address the problems of water quality, which can be addressed cheaply at source.

The continued destruction of upland ephemeral and permanent wetlands, and the unrestricted drainage of agricultural lands results in poor water retention throughout the region during the summer water deficit period (July to October), with consequent over-pumping of the water table and aquifers. Moreover, as our rain events are increasingly stochastic and come as large storms, this results in river surges and flood events. Such events are forecast to increase globally as climate change develops[20]. The outcome is that BC, and most of east Vancouver Island, experiences flash floods during these events. That means that all contaminants from road waste, industrial, and agricultural activity effectively flush into Georgia Strait, without any or little processing from a green infrastructure that has been extirpated. The expectation is that these contaminants will be diluted in the water.

That BC continues to rely on "the dilution model", warrants recalling Newman's comment in his 1998 ecotoxicology primer: *"As World War II ended, the **dilution paradigm** (the solution to pollution is pollution), was replaced by the **boomerang paradigm** (what you throw away can come back and hurt you)."*[21] Since the writing of this primer, BC's approach to pollution has not evolved. BC has not really progressed beyond 1945 practices. Our recycling and waste problems show that we continue to be a throw-away society, and we continue to rely on dilution to absorb our waste. Victoria's lengthy debate over sewage treatment, and the continued acceptance of fish farm practices speak volumes about the collective mindset determining what is environmentally

acceptable in BC. The dilution model is known to be limited by carrying capacity, but we seem to ignore those limits, until we hit a major crisis, such as the looming one that this small anomalous cholera outbreak signals.

Even a cursory review of our precipitation pattern over the past years can show that rain has not been constant, but rather comes in large rain events. This means that contaminants are accumulated on land over protracted periods and flushed in large pulses. This is exactly what Environment Canada's data for precipitation at Parksville BC shows for the period around the herring spawn (**Figure 2**).

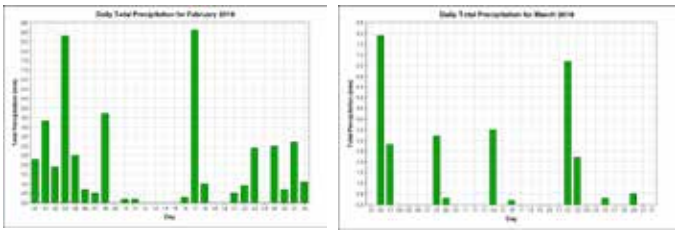


Figure 2: Environment Canada Data for precipitation at Parksville BC, during the herring spawn (February 20–March 15).[22]

Monitoring broad environmental contamination pulses at a regional scale is challenging, and contaminants can easily escape detection.

While agriculture is certainly to be promoted to minimize the carbon footprint and ensure our food security, it should be noted that this cannot be done at the expense of a healthy and sustainable environment. As other provinces, BC needs to pass laws mandating that landowners protect and restore green infrastructure. We have access to aerial photographs of the ALR dating back to about 1920, which can enable us to evaluate the losses that we have incurred, and to develop restoration strategies.

Agricultural intensification has serious environmental costs, which politicians, by and large, do not understand. The loss of species is not the loss of landscape ornaments. It is the loss of ecosystem functioning. Argentina provides a textbook example of the consequences of deforestation and agricultural intensification in the Morro basin. The recent conversion of forests and savannah that absorbed rainfall and maintained a stable landscape, to soy bean field agriculture has resulted in the massive erosion of the landscape and the appearance of previously unknown rivers.[23] This is a repetition of all the lessons that were learnt in 1935 when Paul B. Sears published *Deserts on the March*, which was mandatory high school reading in 1965 (as I recall from personal experience).

More recently, the European Union's policy of intensifying agricultural production, with minimal conservation incentives has resulted in the collapse of insects throughout Europe[24], and the resulting documented collapse of bird populations in France[25] and in Britain[26]. In all cases, biodiversity collapse is driven in part by pesticide use, and perhaps to a larger extent by habitat destruction. It is, therefore, surprising to note that Brexit may have at least one positive result for conservation. In its rejection of European rules and subsidies promoting intensive agriculture, Britain proposes to reward landowners and farmers who enhance conservation values on their land. In other words, having lost 56% of its farmland birds, and experienced an unprecedented biodiversity collapse between 1970 and 2015, the current conservative government is moving to reward farmers, not for the amount of food they produce, nor for the amount of arable farmland they own, but for the amount of conservation measures that they implement:

> *"They will be paid according to the amount of environmentally friendly measures they can put in place on their land. The new philosophy is "public money for public goods", and the environment is explicitly recognised as the principal public good."*[27]

This reversal of policy comes at a most critical time in which the entire planet is experiencing a collapse in biodiversity without any precedent since the Cretaceous-Paleogene extinction event that ended the Mezozoic era 65 million years ago. Just as President Trump has revoked the United States' first International Convention on Migratory Birds, signed exactly 100 years ago, for its inconvenience to agriculture and oil field development, the National Wildlife Federation has released a major report detailing the collapse of fully 1/3rd of America's wildlife:

> *"Habitat loss and degradation, invasive species, disease, and pollution all pose threats to our wildlife—threats that are being amplified by a rapidly changing climate."* [28]

As Canada did when we signed the International Migratory Birds Convention in 1917, we should understand that while politicians may reckon by borders, wildlife knows no borders. The American problem is fully our problem. And this problem is also that which has been widely documented in Europe, and concerns the entire planet.

The conservation incentives to farmland owners proposed by the British government need to be also implemented and enhanced in BC, and particularly so on east-coast Vancouver Island. They are in keeping with the eloquent proposal made by E.O. Wilson in his latest book, *Half –Earth: Our Planet's Fight for Life*[29], the contents of which are summarized in a New York Times editorial "*The Eight Million Species We Don't Know*."[30] Wilson's proposal is quite simple. We have to take steps to curtail our consumption, shift our economy, and set aside 50% of the planet for the preservation of the other species who make our well-being possible. After decades of mumbling about "sustainability," nothing that we have proposed or done so far has delivered actual sustainability. The very real and measurable biodiversity crisis and the collapse of the ecosystem services that it sustains are the very palpable measure of the unsustainability of our economic system and demands.

And Wilson was proven right in what is probably the best and most significant research article produced in January 2018 by O'Neil et al. "*A good life for all in planetary boundaries*" in the journal *Nature Sustainability*. The article is a resounding condemnation the sustainability mantra that has dominated political thinking since the mid1980s. The authors' conclusions roundly reject the sustainability of our current practices and the economic system that sustains them:

> *"We find that no country meets basic needs for its citizens at a globally sustainable level of resource use. Physical needs such as nutrition, sanitation, access to electricity and the elimination of extreme poverty could likely be met*

for all people without transgressing planetary boundaries. However, the universal achievement of more qualitative goals (for example, high life satisfaction) would require a level of resource use that is 2–6 times the sustainable level, based on current relationships."[31]

The data for this research are available on a website managed at Leeds University, which compares the performance of 150 countries. Canada is among the worst delinquents, and performs only mildly better than the USA. What is notable is that for all the talk of sustainability and good intentions to meet climate change objectives, after three years of talk, no country is anywhere near meeting the objectives set in the Paris Agreement of 2015.[32]

Any proposal "to save the ALR" should be based on a workable proposal to save the biodiversity of the ALR and the ecosystem services it provides to the citizens of BC. Farmers and landowners should be rewarded for preserving at least 50% of their ALR land, and conversely landowners who destroy 50% of natural ecosystems should be penalized for poor stewardship. And within that framework, drainage must adhere to basic common law principles that make landowners responsible for the conservation of water resources and water treatment on their land.

In March, BC experienced floods in the Okanagan[33], and its first major forest fire[34], on the same day. One might think that an outbreak of cholera might raise red flags in public consciousness… it would have in the Middle Ages. In spite of any public talk to the contrary, in BC, as elsewhere in Canada, the environment remains a subsidiary concern, and at best a subject of much talk. For politicians, it is something to be addressed once we attain a nirvana of "economic prosperity." Regrettably, life is fragile, and becoming more fragile as the consumer economy and the energy sources that drive it continue to reach out towards a nirvana that daily recedes infinitely.

On March 20, 2018, the world lost one more iconic species, among many. "Sudan," the 45-year old last surviving male Northern White rhinoceros (*Ceratotherium simum cottoni*) had to be euthanized. Although much is made in the popular press about in vitro fertilization efforts that will be made to continue the species with his two surviving daughters, given the success rate of many efforts over the past decade, the probability of success is extremely low. The promises of technology are much overrated. As E.O. Wilson so eloquently put it, as he touched one of the last equally endangered Sumatran rhinoceros (*Dicerorhinus sumatrensis*): "*…I did so, once each, quickly and softly, with the tips of my fingers. My feeling at that moment was spiritual and lasting, one I can't explain to you or even to myself.*"[35] That feeling is known at the very least to most biologists versed in evolution as the moral obligation that comes with our evolutionary connection to the rest of the species that are quickly disappearing.

Unfortunately, most politicians do not seem to understand the connection. Although reports of the clearly deteriorating state of the planet continue to mount in spite of continuous promises of change, the only change that seems to matter is the weight of economic change that skews the future of this planet.

It, therefore, comes as no wonder that as we slide to the end of the NDP's first year in power, both David Suzuki and Andrew Weaver have recently assessed the achievements of the Horgan government as "very little change." And in so doing, they confirm the findings of the latest depressing UN report on the continued land degradation that is undermining biodiversity and human well-being.[37]

In BC as in the rest of the planet, only climate changes and even cholera becomes almost acceptable.

It is Easter, maybe there will be a resurrection? I doubt it. The deathly economy must prevail, no matter what government.

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Requiem for A Venerable Garry Oak Prairie

By Loys Maingon, Conservation Chair, Comox Valley Nature

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(Photos courtesy of Sharon Niscak)

Comox has just lost the last remains of the 6,000+ year-old Cape Lazo Garry oak prairie. Until last year when the Department of National Defense took an active interest in this site, it was a poorly- stewarded one to two–acre corner of land at the bottom of the Comox Valley airfield fronting Knight and Kye Bay Roads. This original part of what must have been Dr. Walter Gage's father's farmland, was converted on the eve of WWII into the airfield that we know today as CFB Comox.

Before 1860, most of that was a rich traditional Pentlatch Garry oak meadow. It was together with the lower Tsolum Valley "Comox Prairie" the original wealth of the valley in which British pioneers settled. These last two acres was all that remained of 65 square kilometres (25 square miles) of a northern Californian flora and fauna, that we know today as "Garry oak ecosystem," and it even had some stunted wind-blown Garry oaks.

From a floristic point of view, this site was a charm. It was a site I regularly took visiting botanists to. They came from the USA and Victoria, to view the native flowers and grasses amidst the Comox garbage and vandalism. New plants, often not found anymore in and around the rest of Comox and Courtenay, such as red maids (*Calandrinia ciliate*), which are otherwise only found locally on Hornby Island, would be spotted about every second year and added to the local species lists. So we are still uncertain as to what lay hidden in the site's soil seed bank. A one–day count in April 2017 identified 28 species of native flowers (camas, harvest brodeia, Hooker's onion, Chocolate lily, Scouler's popcorn flower, and the list goes on), a carpet of purple and gold. Nobody had time to study the pollinator populations, and the Western bluebirds have been long-gone (about 1960), probably with insects unknown. Again, we will possibly never know the full extent of our children's losses.

For years, everybody, including DND who put signs up to limit trespassing, thought that this was DND land. For conservationists, this was a boon, although it limited access, DND has an excellent record of responsible stewardship. Indeed, last year when it was pointed out that the site was being vandalized by ATVs and was becoming an unmanageable and illegal dumping site overgrown by broom, DND mobilized soldiers to remove broom and garbage, and erected a gate to limit illegal access. We had every reason to hope that with responsible stewardship, this site would one day be an important regional conservation legacy.

As it turns out, the land is private. It is within the administrative boundary of the Town of Comox, whose uncontrolled development policies have laid waste the Lazo Sand Dunes

ecosystem area over the past two years. Garry oaks on private land have been extirpated and native flora replaced by Kentucky turf. That is largely because Comox mayor, Town Council, and staff either don't care, or are ignorant of Comox's natural heritage, or are hell-bent on development vandalism, which they seem to have a well-honed reputation for. Sadly, they are the town's "representatives."

In either case, DND learnt indirectly that it was not the owner of this piece of land, and was unable to buy it from the new owner, who it seems had no problems obtaining building and development permits from the Town of Comox on what any other town would have classed "ecologically sensitive habitat with significant heritage values." Comox, after all, has no real tree by-laws or special environmental permitting requirements that would encourage landowners to manage land responsibly, for the benefit of other Canadians. If the political leadership is lacking and only exhibits a tendency to systemic ignorance, reckless vandalism, and disregard of the public interest, one should not dare expect private landowners to meet a higher standard.

So the new landowner did what almost every other landowner in the Comox Valley before him has done—he hired an excavator to strip the topsoil and "improve" the building site, undoubtedly assuming it was a valueless field, and never having been told otherwise. He is not to blame. We all do it, and he sought permits and guidance from the Town of Comox.

We have lost the last remnant of our native grass prairie. We have erased a cultural presence. At a time when this planet is experiencing a species collapse unmatched since the Cretaceous (65 million years ago), this is more significant than it seems. This prairie survived all the insults we threw at it since white settlers arrived, and stole it. It is proof that we have been the worst stewards imaginable. Even those of us who claimed to care, myself included, did not care enough to check the title, we took for granted DND's claims, and what local environmental organizations told us. So we failed all those other species whose DNA we share, and handed our trust and future over to Comox Council and staff.

It is exactly that ill-placed trust that drives mass extinction, and climate change, every day.

Southern Resident Killer Whales and Chinook Salmon

Submitted by John Retallack[1], CSEB Member

The efforts to assess population numbers and determine the best ways to intervene to address the plight of the Southern Resident Killer Whales (SRKW) have been ongoing for many years and the process was probably predestined to result in "winners" and "losers", from both the ecological and human perspectives. Most recently, after several years of research and discussion Fisheries and Oceans Canada (DFO) has proposed changes primarily to recreational fishing regulations on the Southern West Coast of Canada to better manage the population of SRKW, at least over the short term. The situation is quite complicated and this article summarizes some of the issues.

1) What are Southern Resident Killer Whales (SRKW)?

Three ecotypes of killer whales exist on the west coast of Canada; Resident Killer Whales, Transient Killer Whales and Offshore Killer Whales. Resident Killer Whales feed on fish and cephalopods. Transient Killer Whales feed almost exclusively on marine mammals – mostly harbour seals, sea lions and porpoises. Offshore Killer Whales are thought to feed primarily on fish and, as the name suggests, they are not commonly found closer to shore.

Resident Killer Whales are differentiated into Southern and Northern populations.

While sightings of SRKW have been confirmed as far north as Haida Gwaii, and as far south as central California, they tend to range only as far north as mid-Vancouver Island. During the spring, summer and fall, they tend to concentrate around Puget Sound, Strait of Juan de Fuca and southern Georgia Strait. Northern Resident Killer Whales (NRKW) tend to range as far south as mid-Vancouver Island and the two populations overlap for about 200 km between Kyuquot Sound and Barkley Sound on the west coast of Vancouver Island but with a clearer delineation around Campbell River on the east side of the Island.

At present, the population of SRKW is pegged at 76 animals, down from 83 animals a couple of years ago. COSEWIC considers the status of the SRKW as endangered and that of the NRKW as threatened.

Critical Habitat of SRKW is considered to be the southern Salish Sea (generally west and south of Vancouver, BC and west around the southern tip of Vancouver Island). That area is also ground-zero for Chinook salmon migrating back to their natal waters in the Fraser River system. The survival of SRKW appears to be linked to the abundance of Chinook salmon.

Chinook salmon (*Oncorhynchus tshawytscha*) is the favoured prey of SRKW. More specifically, SRKW feed primarily (90%) on mature Chinook salmon from Fraser River runs between May and September and most of those are mature Chinook salmon in the 4 and 5 year-classes. In the fall and winter periods of each year, when most of the Chinook salmon have returned, primary prey species appear to be mostly Coho and Chum salmon.

Chinook salmon populations are also facing some issues and the interrelationship between SRKW and Chinook salmon is critical! Chinook salmon abundances have generally been decreasing for the past several years and the Chinook salmon returning to the Fraser/Thompson River system tend to be among the most affected populations.

After years of research and debate, there now seems to be general agreement that the protection of SRKW needs some focused energy and specific action to try to turn around the population decline. Unfortunately, the current dialogue seems to indicate that there is anything but consensus from stakeholders with regard to the form(s) of assistance that should be implemented!

[1] *John Retallack is a former owner of Blackstone Fishing, Quatsino, B.C.*

2) Who are the stakeholders that may be affected by any actions to protect SRKW?

The ocean and ocean resources users groups (stakeholders) affected by this issue include:

- recreational/sport fishing
- commercial fishing
- other commercial interests that "use" the resource (e.g., whale watching enterprises, dive boats)
- other commercial and recreational interests that transit the area where SRKW tend to congregate (e.g., local and international marine shipping, ferries, recreational boaters)
- Aboriginal groups
- Environmental non-governmental organizations
- Federal, provincial/state and local governments in Canada and USA.

3) What are the issues identified as posing an historical and/or ongoing threat to SRKW?

Generally, the issues seen by DFO and others as posing the greatest risk to SRKW are as follows:

- decreased availability of prey
- water quality/contaminants
- vessel traffic (physical disruption)
- noise (disruption of ability to communicate and find prey).

Within each of those issues is a complex set of frequently interconnected factors. For instance, the reasons for 'decreased availability of prey' are myriad throughout a salmon's life cycle… e.g., poor spawning success, unsuitable overwintering conditions for eggs/alevins, marine bird and seal predation of smolts in river mouths, open ocean conditions, high seas commercial fishing, commercial fishing of salmon prey (e.g., herring), commercial fishing for lower trophic level species that salmon depend upon at various life stages (e.g.. krill), near shore commercial and recreational fishing during the return run, predation of mature salmon by killer whales, seals and sea lions, in-river fishing by First Nations, unsuitable water levels or temperatures in spawning stream.

DFO, in their Discussion Paper: February 15, 2018 - Proposed 2018 Salmon Fishery Management Measures to Support Chinook Salmon Prey Availability for Southern Resident Killer Whales noted; "The purpose of this discussion paper is to identify potential salmon management measures aimed at mitigating the threat of reduced Chinook prey availability to SRKW in 2018." and "…while it seems likely that there are large-scale processes influencing Chinook Salmon productivity, no single predominant factor can be readily identified at this time to fully account for the recent patterns and trends observed for southern Chinook Salmon."

A joint DFO/NOAA Prey Availability technical workshop was held (November, 2017) to identify short-term management actions to increase immediate abundance and accessibility of Chinook salmon for SRKW, based on current health of Chinook salmon stocks. That workshop identified "…targeted, area-based fishery management measures designed to improved Chinook salmon availability for SRKW in key foraging areas should be a high priority." Those measures were considered as useful for assisting SRKW by decreasing direct competition for Chinook salmon from recreational fishing along with collateral benefits from the absence of recreational boats through the minimizing of physical and acoustic disturbances while SRKW were foraging.

4) What are the main recommendations to assist with stabilization and recovery of SRKW?

Despite previous recognition of a variety of very complex issues posing the greatest risk to SRKW (Section 3 above), the primary direct action by DFO to support increased Chinook salmon prey availability in 2018 appears to be to restrict recreational fishing in several Pacific Fishery Management Areas and Sub-Areas in the Salish Sea. By doing so, the intention is to also minimize physical and acoustic disturbance to SRKW caused in those areas by recreational fishing.

The discussion paper also identified ongoing research and observational activities as well as supplemental research and observational programs to assess the effectiveness of the 2018 trial plans.

5) Where From Here?

Based on the historical analysis of SRKW and issues affecting their success, the future appears unclear. Remember, if availability of Chinook salmon is the critical link, as suggested by DFO in their proposed restrictions on recreational fishing, a Chinook salmon spawned this fall will not be available to SRKW as the preferred class 4 or 5, until 2022 or 2023.

In the DFO 2018 Discussion Paper, it appears, at least in the short term (2018), recreational fishing has taken the biggest hit. Historically, the recreational fishing community has tended to be the least coordinated and vocal of the groups potentially affected by this issue, but that may be changing. Recent local press in northern coastal BC suggests potential for added Chinook salmon closures along the north coast – not necessarily for the protection of NRKW but more to help struggling salmon runs. More extensive DFO management measures focused on recreational fishing will likely awaken that recreational fishing 'beast'.

The recreational fishing folks appear prepared to do their part to assist with ensuring successful returns of Chinook salmon but, to ensure recreational buy-in and success, there needs to be visible inclusion of all other ocean and ocean resource users implicated in the list of issues posing the greatest threats to SRKW!

Desperate times call for desperate measures! But it appears at least on the surface of it that the immediate solution of selectively restricting the recreational fishery may be seen as only partially-sighted! If the goal is to make more Chinook salmon immediately available, a broader basket of effective and immediate actions is warranted, including some that may be a tough sell!

That arsenal of effective and immediate actions/solutions to consider and implement include:

- habitat restoration in the natal streams to ensure better spawning success
- greatly enhanced hatchery efforts to select for and promote more and larger fish

- ocean net pens to help hatchery fish avoid bird and pinniped predation in estuaries in the spring
- raising Chinook salmon in ocean net pens for release to provide immediate food for SRKW - net pens would function as a temporary strategy until other longer-term Chinook recovery strategies deliver results
- pinniped management (seals and sea lion populations have grown substantially after they were protected in 1970 and that increased number of pinnipeds consume a large volume of salmon, as much as 40 – 50% of Chinook and Coho salmon juveniles, twice as much as consumed by RKW, and as much as six times that caught by commercial and recreational fisheries, combined)
- stop or restrict mining of the food chain – more precautionary management of commercial fishing for salmon prey species at all their life stages (e.g., krill, crab [crab larvae are a significant food source for salmonids], herring, cephalopods)
- strict regulation and enforcement of the numbers and behaviour of whale watching boats, including noise "bubble zones" (nominally 400 m)
- creation of meaningful and strictly enforced noise and sonar "bubble zones" for recreational fishing (engines and sonar/fish finders off when within a defined distance from SRKW – nominally 400 m)
- restrictions on large commercial vessel traffic to significantly reduce speed, which will in turn, diminish acoustic disturbance
- strict regulation and enforcement of any in-river fishing
- immediate control of raw and partially treated sewage released to the Salish Sea.

There is no question that these programs will require substantial effort and dollars and some will probably be hard sells! But, if we are at the crossroads that DFO, RKW scientists, ENGOs and others are suggesting, and SRKW are in danger of disappearing in the foreseeable future, should we not be pulling out all the stops to prevent that?

Proposed Amendments to Canada's Fisheries Act – A Step Back

by
Sean Mitchill, CSEB BC Director

On February 6, 2018, the Minister of Fisheries and Oceans, the Honourable Dominic LeBlanc, announced several proposed amendments to the current *Fisheries Act*. This Act has a long history, being first enacted in 1868, and undergoing several revisions, amendments, and modernizations over its 150 year lifespan. The most recent changes were those of the Harper government enacted in early 2013. The *Fisheries Act* has from its origins had provisions for the protection of fish (all species) though habitat protections were not introduced until the 1970s. This Act has long been considered one of the strongest pieces of environmental legislation in Canadian law. In particular, through the first decade of the 21st century, the Act framed the protection of fish and fish habitat under two fundamental concepts. First was that the intent of, and obligations flowing from, the legislation was to protect all fish species in the waters of Canada. Society's values were not reflected in the original legislation, rather all species were considered worthy of protection for Canadians. The second provision was a prohibition on activities that resulted in Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat. The focus was on protection of habitat, rather than the fish themselves. Protection of habitat was inferred to result in protection of the fish.

The Harper revisions replaced these two key tenets and, if truth be told, made the day-to-day protection of fish habitat more difficult. In the days before the revision, the critically important decision point: whether a waterway was fish-bearing or not – this characterization is fundamental in determining whether the Act applies to the specific site of interest – was relatively easily determined by capture or sighting of any fish species. The 2013 revision replaced this with only those species of Commercial, Recreational, or Aboriginal (CRA in the working parlance) values requiring protection. That small subset of fish species in Canada is more challenging to unequivocally show as being present than simply accepting only fish presence as defining fish-bearing waters.

Abandonment of the second tenant was even more problematic. Under the HADD paradigm, impact to habitat can be relatively easily measured and quantified on an area basis affected, and then required compensation to account for lost fish habitat determined. The 2013 revisions did away with the habitat area approach, and instead focused on fish productivity. The question to fish biologists became "how is the productivity of fish in the stream or lake affected?", not how the habitat was impacted. It became quickly clear that this approach was designed by lawyers, not biologists "Productivity" and "production" are loose terms (in the realm of philosophy these would be known as concept clusters – terms lacking single rigorous definition and instead being used to mean different things under different conditions). Such definitionally loose words can be exploited by lawyers willing to haggle over meaning. The larger issue, however, is simply the question of how to measure what the legislation calls productivity. During the decades of the 1970s-90s there was great deal of work done on this very question – measuring production of fish individuals, species, and populations in streams. The concept is to measure a change in biomass over time (production or productivity) as a useful assessment of the condition of fish in a stream to infer something of the habitat and factors affecting the fish. These attempts faded away before the 21st century for the simple reasons that to achieve relatively precise estimates of production requires a huge amount of labour and does not provide more information on the system than do the more standard "instantaneous" presence, abundance, and biomass estimates. The measures are also less intuitive or meaningful than the single snapshots typically used as a sampling method. Using production the measurement of an effect on a fish species or community was made considerably more nebulous and difficult to interpret. Requiring this approach under the legislation has resulted in alternating hand-waving and wringing-of-hands to determine how to sample a population to meet the legislation or how even to infer likely impacts. Four years after the Act was passed, an approach to rigorously assess productivity remains enigmatic.

Given this background, the February 6th announcement of amendments is heartening. There are several amendments proposed but, to my mind as a working biologist dealing with impact assessment, the two key areas are: (1) a return to a fish is a fish, irrespective of society's values of it, and (2) a return to HADD as a framework for estimating the effect of an activity of both fish and fish habitat. The HADD approach is not without its challenges, dissenters, and uncertainties. For example, it remains unclear how to factor in habitat quality and estimates of population sizes or fish species it could support. However, HADD has the advantages that it is relatively easy to quantify effects, it is intuitive, communication is straightforward among all parties with little ambiguity, and it has a long history of use. This last point is important as practitioners with decades of experience can bring that knowledge and experience back into play on how to effectively employ this approach. Transferring this information to younger, upcoming practitioners is important to ensure continuity and build on lessons learned. Fundamentally changing the approach as the Harper government did made everyone beginners again and reduced the value of decades of practical experience and knowledge of how to effectively protect, mitigate, and compensate fish habitat.

I called the amendments heartening. It is encouraging to see the direction that DFO is choosing to go on what constitutes a fish and what end point (habitat or fish) to measure for impact assessment. However, the coming days and months between announcing the intent and scope of the amendments and the final wording will be one of negotiating and compromise. It thus remains to be seen what these changes will look like when brought into the fore. As a fish biologist, however, the direction of reversion from CRA to fish and from productivity to habitat is indeed a welcome step back.

I titled this brief essay 'a step back'. I do not mean a step backward, as in retrograde direction. Rather, I see this as a step back in the sense of a pause to consider, an intermission to observe deeply and see the larger picture. I would not argue that HADD is the best of all methods; it certainly has its limitations. It is, however, by focussing on habitat rather than biology, an improvement over productivity. It is a useful and valuable approach as we then consider other methods to improve our ability to measure and compensate impacts to fish, including all species, and fish habitat.

ATLANTIC News

Submitted by Patrick Stewart, CSEB Atlantic Director and National 1st VP

CSEB has been active in the Atlantic Region, with local executive members participating in semi-monthly conference calls, in relaying announcements of CSEB Webinars, and organizing the Society Annual General Meeting. The Society presence in the region includes the Atlantic Director, who also serves as national 1st VP, and the previous CSEB Secretary-Treasurer, Karen March. Karen, a biologist with Dillon Consulting, a local engineering-consulting firm, stepped down this year as CSEB national Secretary-Treasurer after more than 10 years in the position. Karen will be continuing to pursue her other outside interests, in particular obedience training of her German Shepherds. She did a great job in the position and was a big asset, both as Treasurer, and providing advice and support to the national and regional executive.

Local CSEB member Peter Wells has been active in organizing the 12th biennial Bay of Fundy Science Workshop, "A Changing Fundy Environment: Emerging Issues, Challenges and Priorities" which will be held 9-12 May 2018 at the Dalhousie University Agricultural Campus in Truro, Nova Scotia. This event is supported by the Bay of Fundy Ecosystem Partnership (BoFEP), a non-profit group of researchers and organizations interested in the ecology and issues in the Bay of Fundy.

As has been the case over the past decade, CSEB needs the membership in the Atlantic Region to take an active role in promoting the Society and organizing events which will bring biologists together. As biologists, we all share a legacy—not only of the educational background and interest in the processes of life and its intriguing details—but also the commitment that comes from advanced education in biology to share that knowledge and experience with others. An important thing about being a biologist is that it can a very 'people-oriented' calling—you have the opportunity to get much more out of it in person. Make a belated New Year's Resolution to get out of your armchair or from behind your computer screen, to volunteer to set up a local workshop or meeting. It will be rewarding, guaranteed, and is the kind of initiative we need to keep the mission of CSEB alive.

TERRITORIES News

Submitted by Sharleen Hamm, RPBio, CSEB Territories Director.

I was lucky enough to travel to Cambridge Bay, Nunavut in early February to participate in the Kitikmeot Trade Show, which is an annual gathering of businesses, governments, regulatory agencies, Inuit organizations and other interested folks. While in town, I took a walk out to the Canadian High Arctic Research Stations (CHARS) and also caught up with some colleagues from Polar Knowledge Canada (POLAR). POLAR's mission is to further Canada's understanding of polar regions, and support Canada's leadership in polar science and technology. POLAR will be headquartered out of the CHARS campus, which is still under construction and scheduled for completion later this year. Further information on POLAR and CHARS can be found here: https://www.canada.ca/en/polar-knowledge.html

POLAR is currently funding a number of projects including the following (a complete list of projects can be found here: https://www.canada.ca/en/polar-knowledge/polar-funded-projects/2017-2019.html):

- The state of Northwest Territories country food systems: Planning for long-term sustainability, Arctic College;
- Improving Canada's climate change projections by incorporating Arctic shrub feedbacks, Carleton University;
- Kitikmeot wolverine monitoring - non-invasive and community-based initiative, Government of Nunavut;
- What mechanisms drive habitat choice by caribou? – A resource selection function approach using Traditional Knowledge, remote sensing and field surveys, Environmental Resource Management;
- Inuit Qaujimajatuqangit study into impacts of snow goose overpopulation on land, animals and people near Coral Harbour and Arviat, Nunavut, Kivalliq Wildlife Board;
- Ecological monitoring in the North Baffin region: open-access data diffusion, technological innovations, and development of new community partnerships, Université Laval;
- Migrations of sea run Arctic char in a changing Arctic: Integrating acoustic telemetry, physiology, and genomics, Université Laval;
- The Arctic Zoonoses Network: a community-centred monitoring network for vector-borne diseases and wildlife zoonosis in a changing Arctic, Université de Montréal;
- Enabling the co-production of Inuit and scientific knowledge through integrated information management, Inuit Tapiriit Kanatami.

Further Arctic research was presented at ArcticNet's 2017 program in December, which took place in Québec City. Conference program and proceedings can be found here: http://www.arcticnetmeetings.ca/index.php?url=13213 . ArcticNet, based out of the Université Laval, is funded by the Government of Canada, and partners with Inuit organizations, northern

communities, federal and provincial agencies, academia, industry and other members of the private sector to translate a growing understanding of the Arctic into action through policies, assessments and strategies. Current research projects underway through ArcticNet include the following (a full list of project can be found here: http://www.arcticnet.ulaval.ca/research/current.php):

- Innovative Research on Monitoring Marine Mammals to Mitigate Impacts of a Changing Arctic, Steven H. Ferguson (Fisheries and Oceans Canada, University of Manitoba);
- The Arctic Cod (*Boreogadus saida*) Ecosystem of the Beaufort Sea: Synthesis of Decadal Records, Louis Fortier (Université Laval);
- The Potential for Natural Oil Spill Biodegradation by Microorganisms in Canada's Arctic Marine Environment, Casey Hubert (University of Calgary);
- Freshwater-Marine Coupling in Hudson Bay: a Study of Winter Estuarine Processes in the Coastal Corridor in Southeast Hudson Bay and Effects of Environmental Change, Zou Zou Kuzyk (University of Manitoba);
- Population Dynamics and Predator-Prey Relationships in Migratory Caribou of the Québec-Labrador Peninsula in the Context of Climate and Anthropogenic Changes, Steeve D. Côté (Université Laval);
- Biology of the Three Morphotypes of Arctic Char in the Nettilling Lake System: Developing Sustainable Commercial and Subsistence Fisheries in Nunavut's Two Largest Lakes, Aaron Fisk (University of Windsor);
- Monitoring and Managing Muskox Health for Food Security and Ecosystem and Socio-Economic Resilience: Integrating Traditional, Local, and Scientific Knowledge, Susan Kutz (University of Calgary).

A final note on the subject of Arctic research: in late March 2018, Inuit Tapiriit Kanatami (ITK), the national organization representing Inuit in Inuit Nunangat (53 communities across the Inuvialuit Settlement Region, Nunavut, Nunavik and Nunatsiavut), released their National Inuit Strategy on Research (NISR). The purpose of the NISR is to address research challenges such as the domination of Inuit Nunangat research by non-Inuit researchers based outside of Inuit Nunangat, and the reflection of a biological-physical science research bias observed in current research that diminishes consideration of other Inuit research priorities, such as health and social science. To achieve this, five objectives and actions are identified:

1. Advance Inuit governance in research;
2. Enhance the ethical conduct of research;
3. Align funding with Inuit research priorities;
4. Ensure Inuit access, ownership, and control over data and information; and
5. Build capacity in Inuit Nunangat research.

Read more on the NISR here: https://itk.ca/national-strategy-on-research/

Conflict Avoidance Agreements for the Arctic Arviq (Bowhead Whales)

By

James Goacher, Student-at-Law, Gowling WLG

Adam Chamberlain, Gowling WLG Partner and member of the firm's Canada North, Environmental and Indigenous Practice Groups

A relatively new form of agreement, called a Conflict Avoidance Agreement, is being used to avoid or reduce the likelihood of conflict between oil and gas companies and subsistence Bowhead Whale hunters in Alaska. The success of their use in this remote region suggests that they could also be useful in reducing impacts on wildlife elsewhere. Recent numerous collisions with fatal results between marine vessels and Right Whales on the eastern seaboard provides evidence that new tools are needed. Perhaps the experience in Alaska (described below) could be put to use in regions like the St. Lawrence estuary or elsewhere.

Recent reports examining Conflict Avoidance Agreements have remarked on their success on the north shore of Alaska.[1] They combine Traditional Knowledge with western science to create thresholds that address potential effects on Bowhead Whales and traditional hunters. These agreements seem to have great potential to be implemented in Canada. They appear best suited for areas where the regulatory scheme in place does not fully address local needs.

Bowhead Whales

The Bowhead Whale (*Balaena mysticetus*, or Arviq in Inuktitut) is a large Arctic marine mammal that can break sea ice over 20 centimetres in thickness. During the summer months of June to September, Bowhead Whales can be found in many of the fjords and bays of the Canadian Arctic. They gather around crustaceous zooplankton, their main source of food. After September, the

[1] JP Clement, JL Bengtson, & BP Kelly, "Managing for the Future in a Rapidly Changing Arctic, A Report to the President" (Washington: 2013), online: <http://www.afsc.noaa.gov/Publications/misc_pdf/IAMreport.pdf>; J Lefevre, "A Pioneering Effort in the Design of Process and Law Supporting Integrated Arctic Ocean Management" (2013) 43 Environ Law Rep 10903.

Bering-Chukchi-Beaufort Sea population migrates southwest to the Bering Sea. The Eastern Canada-West Greenland population migrates toward unconsolidated pack ice in northern Hudson Bay, Hudson Strait, central Davis Strait, southern Baffin Bay, and West Greenland. Inuit subsistence practices have been fundamentally tied to Bowhead Whales since 1200 AD as they provide a rich and nutritious source of food in a barren landscape.

Intersection with Oil and Gas Exploration

The Arctic reservoir of oil and gas could account for four percent of the remaining conventionally recoverable oil in the world. As ice cover decreases, oil and gas deposits become more accessible and more profitable. In 1977, the International Whaling Commission expressed concern over the low Bowhead Whale population, especially given the predicted expansion of offshore oil and gas extraction. Thus, since 1986, offshore stakeholders such as representatives from whaling villages, the Alaska Eskimo Whaling Commission ("AEWC"), and oil and gas companies, have all met to identify sources of potential conflict.

The most recent Open Water Season Programmatic Conflict Avoidance Agreement was reached in 2016. Highlights include (a) a communications protocol; (b) spatiotemporal separations; and (c) undertakings of good faith.

The communication protocol involves hiring an Inupiat-speaking Protected Species Observer ("PSO") from local Alaskan communities to correspond with a land-based communication centre. The PSO reports all travel, interactions with whales, and accidents. This type of communication allows for greater coordination of competing uses of the Arctic. For example, industry participants agree to coordinate the location and timing of geophysical exploration. No development occurs during the traditional Bowhead Whale hunting season. Additionally, ships must remain at least two miles from the shore and aircrafts must remain at least 1,500 feet from the surface of the water.

Industry participants undertake to promote transparency and good faith. They provide maps of all expected exploration and drilling, locations of their vessels, and sound signature data. If additional parties become involved in the area, industry participants agree to make good faith efforts to encourage these parties to join the Conflict Avoidance Agreement. Each of these provisions sets up a strong relationship between industry and the local community. Overall, the design of these provisions was tailored to meet local needs without imposing a blanket ban on commercial activity in the spring and fall.

Benefits and Potential Uses for Conflict Avoidance Agreements in Canada

Issues in the Arctic are often unsuitable for broad, costly regulatory schemes (please see original article for a regulatory overview). These schemes can fail to meet the needs of local communities. For example, local First Nations often want to include Traditional Knowledge. Although some Canadian territorial regulatory regimes require developers to consider and incorporate Traditional Knowledge, Conflict Avoidance Agreements take Traditional Knowledge a step further by using it actively in the protection of a particular resource. Traditional Knowledge is well-suited to aid in reducing conflict quickly because it does not require a lengthy study, write-up, peer review, and publication before it can be accepted and implemented

A Conflict Avoidance Agreement is also flexible due to its annual renegotiation. This allows for timely changes in response to new stressors. In the context of a species that may change behaviours in response to pressure from climate change or increased boat traffic, flexibility is crucial. A Conflict Avoidance Agreement is also flexible enough to be adapted to other species such as caribou, whales, and other threatened species in ecologically sensitive ecosystems frequented by Indigenous hunters/gatherers. Right Whale numbers are more threatened than their distant Bowhead cousins. While Right and Bowhead Whales live in very different environments and are subject to significantly different human threats, lessons learned in protecting Bowheads by those who rely on them for subsistence may well be useful in protecting Right Whales from accidental or negligent collisions in the very busy shipping lanes of the eastern seaboard of North America.

John Lilley Undergraduate Scholarship in Environmental Science

In 2008, the John Lilley Environmental Scholarship was established in memory of our past President and long-time supporter and friend, John Lilley. The $500 scholarship is at the University of Alberta and is awarded to a student with superior academic achievement entering the second year of study for a Bachelor of Science in Environmental and Conservation Sciences in the Faculty of Agricultural, Life and Environmental Sciences. Selection is based on demonstrated involvement with a not-for-profit environmental organization and academic standing.

The recipients since 2008 have been as follows:

Year of Award	Name of Student
2008	Chen, Qiting
2009	Veillard, Marie Frances
2010	Zhang, Daiwei
2011	Jacklin, Meghan Lynn
2012	Cherlet, Erin Alexandra
2013	O'Neill, Megan Nicole
2014	Wheatley, Melissa
2015	Suhertan, Ellis
2016	Huang, Rebecca
2017 (2)	Moir, Anthony and Thomasson, Charlotte

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Student Members: persons who are enrolled in an accredited college or university in a discipline of the biological sciences, and who are preparing themselves for professional work in teaching, management, or research related to natural resources and to the application of sound ecological principles to management of the environment.

Associate Members: persons who support the purposes and activities of the Society but who do not qualify for Regular or Student membership.

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Year Grad./Ann. Gradué _____ Field of Biology/Spécialité de Biologie: _____

Occupation/Emploi: _____ Employer/ Employé par: _____

Responsibilities/Interests/Responsabilités/Intérêts d'emploi: _____

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