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THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Bulletin

In this Issue:

CSEB Bulletin SCBE

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In this issue

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Front Cover: RC BioSolutions Ltd. ecologist performing a morning breeding bird survey within the Little Bow River floodplain in Southern Alberta. Photo Credit: Richard Carson, RC BioSolutions Ltd.

Back Cover: Top: Drying skins, Iqlauit, NU. Bottom Left: *Clematis occidentalis*, Banff National Park, AB. Bottom Right: *Polygonatum biflorum*, White Rock, BC. Photo Credit: Sharleen Hamm, CSEB Territories Director.

CSEB BULLETIN 2019

Vol. 76, Number 1, Spring 2019

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
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LE BULLETIN de la SCBE 2019

Vol. 76, Numéro 1, Printemps 2019

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

Hello CSEB members. A committee has been struck to examine how the Bulletin can be changed to better serve our members and offer more ways to engage our community. You will shortly receive an email with a link to an online survey asking a few questions about the Bulletin and what you find most interesting about it and what we could do differently. Please take the time to give us some feedback.

The **Annual General Meeting** will take place on **April 12th** via web-meeting. Please check our website at www.cseb-scbe.org for more details. Also, please watch our website for details about upcoming webinars, including one by Dr. Peter Leavitt, a paleolimnologist at the University of Regina, who has recently been have been elected to the prestigious Royal Society of Canada.

All the best,
Curt Schroeder
President

MONARCH NUMBERS UP 144% AT WINTERING GROUNDS

Edmonton Journal, 31 Jan 2019— The population of monarch butterflies wintering in central Mexico is up 144 per cent over last year, experts said Wednesday. The data presented by Andrew Rhodes, Mexico's national commissioner for protected natural areas, was cheered, but scientists quickly warned that it does not mean the butterflies that migrate from Canada and the United States are out of danger. This winter, researchers found the butterflies occupying 6.05 hectares of pine and fir forests in the mountains of Michoacan and Mexico states.

That's an increase from 2.48 hectares a year ago. They arrive in such numbers that their population is measured by how much surface area they cover. This year's is the biggest measurement since the 2006-2007 period, Rhodes said.

Editor's Note: The above is for the eastern population that over-winters in Mexico. Unfortunately, the western population, which over-winters on the California coast, is in much greater peril. At a meeting in February at the University of California at Davis, entomologists heard that the western population of monarch butterflies had dropped 86% over the past year, to 0.6% of their historical average. There is compelling evidence that pesticides, deforestation, and habitat loss are to blame for the monarch decline. Climate change may also be a contributing factor (info from Edmonton Journal, 18 March 2019)

Everyone should plant some milkweed to help the monarchs!!!

SCIENCE TIDBITS

Submitted by John Retallack, CSEB Alberta Member

And Now the GOOD News!

The following comes by way of FUTURE CRUNCH, a group centered in Australia that is trying to highlight the good news out there. These 18 environment/conservation success vignettes are part of an extensive list of successes (all from their newsletter) related to environment/conservation, global health, living standards, clean energy, and sustainable economies that tended not to get much, or any, media coverage. From their website:

> *"If we want to change the story of the human race in the 21st century, we need to change the stories we tell ourselves.*
>
> *We help people understand what's on the frontiers of science, technology and human progress, and what it means for humanity.*
>
> *For the last 12 months, the global media has been focused on a lot of bad news. But there were other things happening out there too: conservation successes, huge wins for global health, more peace and tolerance, less war and violence, rising living standards, some big clean energy milestones, and a quiet turning of the tide in the fight against plastic. Stories of human progress, that didn't make it into the evening broadcasts, or onto your social media feeds.*
>
> *We spent the year collecting them, in our ongoing mission to stop the fear virus in its tracks."*

The FUTURE CRUNCH website provides live links to the sources of the 18 environment/conservation success commentaries as well as 82 other global successes.

1. The Kofan people of Sinangoe, in the Ecuadorian Amazon, won a landmark legal battle to protect the headwaters of the Aguarico River, nullifying 52 mining concessions and freeing up more than 32,000 hectares of primary rainforest.
2. Following China's ban on ivory last year, 90% of Chinese support it, ivory demand has dropped by almost half, and poaching rates are falling in places like Kenya.
3. The population of wild tigers in Nepal was found to have nearly doubled in the last nine years, thanks to efforts by conservationists and increased funding for protected areas.
4. Deforestation in Indonesia fell by 60%, as a result of a ban on clearing peat lands, new educational campaigns and better law enforcement.
5. The United Nations said that the ozone hole would be fully healed over the Arctic and the northern hemisphere by the 2030s, and in the rest of the world by 2060.
6. $10 billion (the largest amount ever for ocean conservation) was committed in Bali this year for the protection of 14 million square kilometres of the world's oceans.

7. In California, the world's smallest fox*** was removed from the Endangered Species List, the fastest recovery of any mammal under the *Endangered Species Act*. *(***JR editorial note: this apparently refers to the Santa Cruz Island Fox that is about the same size as the Fennec Fox).*
8. In 2018, after more than 10 years of debate, 140 nations agreed to begin negotiations on a historic "*Paris Agreement for the Ocean*," the first-ever international treaty to stop overfishing and protect life in the high seas.
9. Niger revealed that thousands of local farmers have planted more than 200 million trees in the last three decades, the largest positive transformation of the environment in African history.
10. Spain said it would create a new marine wildlife reserve for the migrations of whales and dolphins in the Mediterranean and will prohibit all future fossil fuels exploration in the area.
11. Following 'visionary' steps by Belize, UNESCO removed the Belize Barrier Reef, the second largest in the world, from its list of endangered World Heritage Sites.
12. Colombia officially expanded the *Serranía de Chiribiquete* (also known as *The Cosmic Village of the Jaguars*) to 4.3 million hectares, making it the largest protected tropical rainforest national park in the world.
13. Mexico said its population of wild jaguars, the largest feline in the Americas, grew by 20% in the past eight years, and 14 Latin American countries signed an agreement to implement a regional conservation program for the big cats through 2030.
14. In the forests of central Africa, the population of mountain gorillas, one of the world's most endangered species, was reported to have increased by 25% since 2010, to over 1,000 individuals.
15. Canada signed another conservation deal with its First Nations people, creating the largest protected boreal forest (an area twice the size of Belgium) on the planet.
16. Chile passed a new law protecting the waters along its coastline, creating nine marine reserves and increasing the area of ocean under state protection from 4.3% to 42.4%.
17. The Seychelles created a new 130,000 square kilometre marine reserve in the Indian Ocean, protecting their waters from illegal fishing for generations to come.
18. New Caledonia agreed to place 28,000 square kilometres of its ocean waters under protection, including some of the world's most pristine coral reefs.

Check out the CSEB Video at
http://youtu.be/J7cOuDbBf9c **or**
https://www.youtube.com/watch?v=J7cOuDbBf9c

CSEB Comment Regarding a Proposed Hunting Season for Double–Crested Cormorants

Posted Jan, 3, 2019. At https://ero.ontario.ca

The Canadian Society of Environmental Biologists wishes to provide comments to Proposal 013-4124 to establish a hunting season for double-crested cormorants in Ontario.

We suggest that the Ontario Ministry of Natural Resources and Forestry conduct population surveys before developing any hunting regulations. Should a hunting season be implemented based on the results of the surveys, it is recommended that it should be temporary until numbers are reduced and that it is accompanied by continued annual population monitoring by the Ministry. The use of nuisance wildlife permits may also be an option to deal with specific human conflict instances.

[Note, President Curt Schroeder received an appeal from Ontario member Cindy Lee to submit a comment regarding a proposed cull of double-crested cormorants. Barbara Hard drafted a comment and input was received from Patrick Stewart, with Curt Schroeder making the final post].

CSEB Annual General Meeting

Join us for the CSEB AGM

April 12th, 2019 at 2 pm Pacific/4 pm Central/6 pm Atlantic time.

Please register for CSEB AGM at

https://attendee.gotowebinar.com/register/3740812733816195331

Annual General Meeting 2018-2019

After registering, you will receive a confirmation email containing information about joining the webinar.

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More details to follow on our website at www.cseb-scbe.org.

Have You Seen Me?

Reporting banded Lesser Yellowlegs

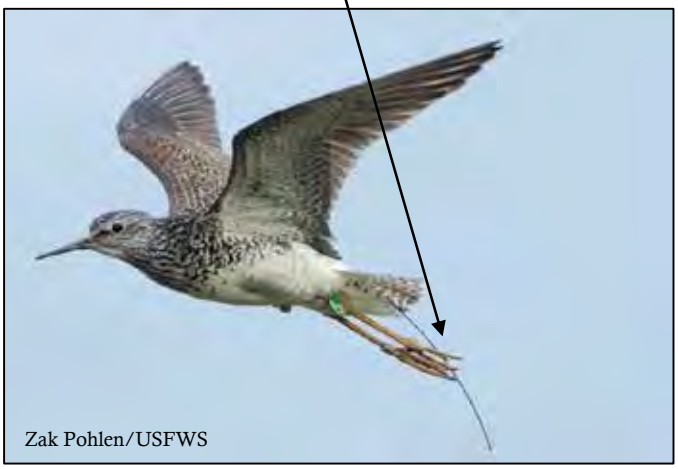
As part of a collaborative study to understand the migratory movements, survival, and breeding site fidelity of adults, biologists have marked Lesser Yellowlegs with color bands and unique alpha character or numeric leg flags. In addition, tracking devices were deployed on a proportion of banded adults.


Zak Pohlen/USFWS

Color bands you may see:
Db= Dark Blue
R= Red
Y=Yellow
W= White
Dg=Dark Green
Lb= Light Blue
Bk= Black
M= Metal (aluminum)

Leg flags you may see:
Dark Green (United States)
White (Canada)

Tracking devices you may see:
Light-level geolocator
OR
PinPoint Argos-GPS satellite tag


Zak Pohlen/USFWS

If you see a banded bird please REPORT:

Via email: yellowtringa@gmail.com

Please include a description of leg flag code, color of band, date of sighting, and location of sighting.

If possible, please send a photo(s) of the bird.

CSEB Letter Regarding Creation of Departmental Science Advisors

The Honourable Catherine McKenna
Minister, Environment and Climate Change Canada
200 Sacre-Coeur; 2nd Floor
Gatineau, Quebec K1A 0H3
Email: catherine.mckenna@canada.ca

January 31, 2019

The Honourable Jonathon Wilkinson
Minister, Fisheries, Oceans and the Canadian Coast Guard
200 Kent St.
Station 15N100
Ottawa ON K1A 0E6
Email: min@dfo-mpo.gc.ca

Dear Ministers McKenna and Wilkinson,

Re.: Creation of Department Science Advisors

On behalf of the Board of Directors of the Canadian Society of Environmental Biologists (CSEB), I congratulate your government on the creation of positions for Departmental Science Advisors, as announced on September 27, 2018. We applaud your government's action towards further integration of science into departmental operations across Canada, increasing support for high quality scientific research within the federal government and increasing the availability of government science to the Canadian scientific community and the public.

The CSEB is a national, non-profit registered society celebrating it's 61st year in 2019, whose primary focus is to further the conservation and prudent management of Canada's natural resources based on sound ecological principles. Our membership is comprised of professionally-trained biologists and biology students; interested individuals with other backgrounds comprise our associate membership. We feel that the creation of Departmental Science Advisors aligns with many of our objectives and the interests of our membership.

The CSEB welcomes an opportunity to collaborate with the National Science Advisor's office on matters pertaining to environmental biology. Further, the CSEB invites the National and Departmental Science Advisors to consider membership with the CSEB, to support a continued conversation on the important role of science in the prudent management of Canada's natural resources.

Sincerely,

Curt Schroeder, B.Sc., M.E.Des.
President
Canadian Society of Environmental Biologists

c.c.: Hon. K. Duncan, Minister of Science and Sport
Dr. M. Nemer, Chief Science Advisor of Canada
CSEB Board of Directors

PO Box 962, Station F, Toronto, ON Canada M4Y 2N9 cseb-scbe.org

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REGIONAL News

BRITISH COLUMBIA News

Submitted by Loys Maingon, CSEB BC Director

A New "Domain of Risk" for Environmental Policy-Making From Coast to Coast

Can one write a BC report that would not be equally applicable to what is happening in Quebec? To consider this is almost an object lesson of why the profession truly needs the "Canadian Society of Environmental Biologists" around to develop a national conversation on the common professional and environmental challenges that we will face over the next 12 years, as urged by the latest IPCC report. [1]

Events in BC and in Quebec both point to the urgency of phasing out fossil fuels by 2050 and reducing carbon emissions by 50% by 2030.[2] That this is technically and economically feasible is confirmed by a recent report by the Stanford environmental engineering team headed by Mark Z. Jacobsen: *"100% clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States."* [3] The assessment is essentially that "the barriers to getting to 100% clean energy are social and political, not technical or economic." [4] Beyond the matter of the feasibility of shifting the energy foundation for the economy, which is now a necessity, lie the problems that the environmental legacy of a fossil fuel economy will continue to pose for environmental biologists well into the 22nd century.

Whether it be in BC or in Quebec, Canadians are experiencing anthropogenic climate change first hand, as it is expressed in ocean rise and extreme weather events in patterns that have changed within a generation.[5] The material costs associated with these events bring home the realization that business-as-usual can not be assumed to be sustainable for much longer. It also increasingly casts into doubt the credibility of both provincial and federal Ministries of Environment and Climate Change's policy advocating for oil and LNG pipelines as part of a "transition," which is causing social unrest in both BC and Quebec.

British Columbians went into shock December 20, 2018 when high winds and accompanying wave surge did unprecedented damage to the 100 year-old pier at White Rock.[6] Shortly before that, after a storm on November 29, Quebecers also became acutely aware that their shorelines and sensitive ecosystems, such as the unique Iles de La Madeleine archipelago, are washing away at an unprecedented rate through a combination of rising seas and extreme storms.[7] As reported by the mayor of the Îles-de-la-Madeleine: "Overnight, entire dunes, roadside stops, and all kinds of infrastructure were engulfed by the sea." ("En une seule nuit, des portions entières de dunes, de haltes routières et d'infrastructures de toutes sortes ont disparu à la mer.")

In both cases, reaction started with a measure of incredulity followed by political reassurances that infrastructure can and will be rebuilt, only to be updated by a realization of the unbelievable magnitude of the costs. In the aftermath, White Rock residents were incredulous at the loss of the landmark historical pier, which has always been an integral part of their "normal" routine life. Political reassurances on the costs of restoring the White Rock Pier began at $4.2 million only to spiral to $16 million in four weeks. All prior re-assurances were based on the dubious assumption that the December storm was somehow just an anomaly. The additional $12 million costs integrated, and brought a tangible measure to, the reality of the new abnormal, largely based on the unreal assumption that climate conditions might not get worse and that business-as-usual can somehow continue without lifestyle disruptions.

In Quebec, with full recognition that coastal erosion rates between 2004 and 2016, were 50 cm per year, and that between 2016 and 2017, the rate had grown to 60 cm per year, immediate infrastructure costs to manage the St. Lawrence coastline alone were estimated by Ouranos (a consortium on regional climatology) to exceed $1.5 billion. This winter, king tides gave a similar glimpse into the future rise of sea levels over existing sea walls in Vancouver.[8]

What both of these cases, in BC and in Quebec, highlight is that, as observed in Quebec by the director of Ouranos, Alain Bourque—although full scientific analyses always remain to be done, we now have enough data to immediately develop a comprehensive "national" (provincial) strategy to re-design and re-locate shoreline infrastructure: "within the context of climate change. Currently we manage everything in crisis mode. One has to move beyond this, to avoid a problem that will cost billions of dollars within the next 30 years." ("Présentement, on continue de gérer le problème en mode "crise". Mais il faut dépasser cette approche, il faut penser à tout cela à l'échelle provinciale, pour éviter que le problème nous coûte quelques milliards de dollars d'ici 30 ans."). As with Mark Jacobsen's Stanford University report, the data and the technology needed to address the problem are currently available. The socio-political will is lacking.

After decades of warnings from over 95% of the scientific community, it is increasingly becoming obvious, even to many non-scientists, that climate change is no longer something that we may experience or plan for in the future, but a phenomenon that we are experiencing every day. Most importantly, that comes with a growing realization that it cannot be reversed, but only mitigated. And any mitigation will have to begin with socio-economic changes, because "climate change" is best referred to as "anthropogenic climate change." It is not a planetary cyclical phenomenon beyond our control that is driving "climate change." It is, to quote one of a growing number of studies detailing irreversible impacts on ecosystems and biodiversity, our anthropogenic footprint on the planet that is "driving the redistribution of species and reorganization of natural systems, and represents a major threat to global biodiversity." [9]

The past months of extreme global weather, from Australia's record heat to the extreme cold of eastern Canada, appear to consolidate the sense that we have crossed new thresholds and

need to develop new priorities to address an uncertain future.[10] The evidence that we have crossed a new threshold and what is now to be expected comes from a report of the Met Office in Britain. The extremes we are experiencing are consistent with the decadal modelling of the Met Office, which has a good track record for accuracy. The Met Office suggests that there is now a 10% chance that we are increasingly likely to experience spikes reaching or exceeding the targeted limit of 1.5°C for 2100 within the next five years: [11]

> *"…..for the first time, we are seeing a chance of a temporary rise of 1.5°C due to a combination of global warming and natural climate variation."*
>
> *Since 2014, the world has experienced the four hottest years since records began in 1850, but these highs are likely to be exceeded soon. From now until 2023, the Met has 90% confidence that mean annual temperatures will range between 1.03°C and 1.57°C above pre-industrial levels."*

Because global temperatures are based on a 30-year average, this does not mean that the average target limit is breached; however, the concern from now on should be that the frequency of these excursions above 1.5°C will increase every decade from now on. The problem that this poses for environmental scientists is two-fold. On the one hand, through restoration and conservation policies, problems posed by the impacts of these extremes can be transiently managed, as long as the frequency of extreme years allows for recovery. This means that on the other hand, one has to manage the source problem driving the increased frequency of 1.5°C and above extreme years. Conservation and restoration efforts will come to nought if the frequency of extreme events overwhelms recovery potentials between years of extreme heat.

Conservation in the new climate framework becomes a game of averages beyond our control. There will now be good years and bad years until years of extreme warming become the norm. If socio-economic factors can be addressed as suggested by Jacobsen et al. (2018), it should be possible to maintain an average of good years within which we can work to restore the damage of the bad years, and possibly stabilize our climate.

The fate of the Great Barrier reef should serve as a model for what may be expected from a conservation point of view. At first, over the last two decades, we faced occasional limited coral die-backs. Those were occasional "bad years" for coral ecosystems. Conservation biologists developed techniques to repair the damage, to "re-seed" dead zones and monitor them. Now that opportunity is slipping away as the ocean continues to warm exponentially. The IPCC forecast is that the corals of the Great Barrier reef will be essentially gone by 2040.[12] Given that it takes 10 years for corals to recover from bleaching[13] and that the expected minimal interval between years in excess of 1.5°C is five years, environmental recovery will be challenging. The expectation that we may lose coral ecosystems, which support 25% of all marine life, within the next 20 years, is further supported by recent research that shows that just as terrestrial ecosystems are being re-shaped by wildfires, so too heat-waves are sweeping away marine ecosystems.[14]

While BC does not have the same concerns with coral ecosystems as Australia, marine heat-waves have also been implicated as drivers in the "80–100% declines of sunflower sea stars (*Pycnopodia helianthoides*) from California to Alaska.[15] Here too, the implications of the removal of this keystone predator has large ecosystemic implications for the economy and biodiversity. The sunflower sea star is a major predator on sea-urchins, which graze on kelp forests that are essential for the maintenance of ecosystemic biodiversity. Economically, kelp forests are essential for the maintenance of herring populations, which are themselves the fulcrum of coastal salmon fisheries. The Salish Sea kelp forests have been in trouble for some time. The collapse of *Pycnopodia helianthoides* comes as a major blow to ongoing recovery efforts.

That we are crossing a new climate threshold now needs to be a part of a Global Village conversation. By all accounts, we have indeed entered into what some consider to be "a new domain of risk." [16] The developing situation suggests that we may be headed towards a systemic ecological and economic collapse. This inevitably requires that biologists engage in considerations that would normally be considered to be outside of their area of professional expertise. We have, at the very least, to integrate socio-economic considerations in conservation planning.

It has been clear for a long time to insurance companies that climate change-related risks are increasingly no longer insurable.[17] By its own title, the 2018 IPCC entitled "*Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*" [18] makes clear that the scope of the threshold exceeds the usual limitations of professional disciplines. As human population approaches 8.5 billion, the footprint of our human consumption and socio-economic condition encroaches on, and shapes, wild spaces and ecosystems that are home to a shrinking biodiversity.

The civic conversation with the public and politicians that we have until now had as scientists is radically changing, though habits die hard and politicians may remain largely insensitive to the implications of the mounting environmental data. Until now, scientists have been able to sit out largely as observers, providing data interpretation for the consideration of clients or politicians to implement policies that were to promote sustainable practices and protect resources theoretically within the framework of an economy of endless growth. Evaluation of the impact of the economic framework was not really required to be part of our expertise. As interest in the "Green New Deal" grows south of the border, that is now becoming part of professional obligations, as a recent call by 500 women scientists in *Scientific American* indicates.[19]

That complements both legislative work and research in BC that is re-evaluating how scientific information is delivered to government and industry. In BC, since 2006, science is no longer exclusively delivered by government, it is subcontracted within the "professional reliance model," to private or industry contractors. The Professional Reliance Review, which culminated in the tabling of the Haddock Report in May 2018,[20] has resulted on October 22, 2018 in the *Professional Governance Act.*[21] The act significantly grants "right to practice." All members of the profession, both in government and in the private sector, must be registered. An oversight body will regulate all levels of the profession, from individuals to firms.

This comes together with two important studies, notably from UBC researchers, both concerned with the impact of a lack of oversight. These articles review the lack of rigorous scientific standards in environmental assessments carried out for large projects in BC. Work by Cathryn Clarke Murray et al. (2019) in this month's journal *Environmental Management* shows that "*Governments and agencies can better protect resources by requiring clear and defensible significance determinations, by making government-defined thresholds legally enforceable and accountable, and by requiring or encouraging significance determination through inclusive and collaborative approaches.*"[22] Lest one assume that this problem is unique to BC, two other papers of interest evaluating international environmental assessment literature indicate serious problems in even what might be considered "world class" environmental management promoting development.[23]

These findings and the need to redefine "professional reliance"are the product of a political bias for extreme "laissez-faire" economics that has prevailed for the past 70 years, and which is largely responsible for the environmental predicament in which we now find ourselves. This was correctly identified in 1972 by the authors of *Limits to Growth*, which pointedly stressed that the economy was tightly coupled to the environment. The 1987 Brundtland Report, created to respond to *Limits to Growth*, created a mirage that the economy could somehow be decoupled from the environment and grow 5 to 10 fold—with no real impact on the environment. As Vitousek et al. showed in 1986,[24] and Haberl et al. re-confirmed in 2007,[25] human economies already appropriate approximately 25-40% of the planet's primary productivity. The maximum is one planet (100%), which places economic growth limits at the lower range of 2.5 to 4 times. Notwithstanding current over-consumption, species and resource declines, contrary to the 1987 expectations, a 2.5 to 4 fold increase in the economy assumes a linear relationship between appropriation and cumulative ecological impacts, which is not the case since feedbacks make the relationship geometric.

In point of fact, the economy cannot be decoupled from the environment. Thirty-three years after the Brundtland report evidence of the unsustainability of the economy is all around us. The practical implications of this are evident in recent research which shows that phytoplankton productivity, which is a good measure of global primary productivity, has declined by 40% since 1950.[26] This should be taken a measure of anthropogenic impacts on the base of the food-web of an ocean-planet, not just of the ocean. This is not a simple measure of impacts on ocean food webs, it also a measure that is consistent with the massive insect, avian, fish and mammalian collapses which are becoming increasingly evident.[27]

It is no surprise that this decline has been ongoing since about the 1950s, which concurs with the adoption of the principles of Kuznet's curve in 1954 by mainstream North-American economists.

Based on select data of wealth distribution between 1913 and 1948, Kuznet's curve posits that while inequalities of wealth increase in early industrialization, as prosperity increases wealth becomes more equally distributed. The curve is theoretically an inverted "U". As Thomas Piketty, and others, have demonstrated this interpretation was enthusiastically embraced during the Cold War, largely because it served political interests. In point of fact, "reduction in income inequality between 1914 and 1948 was due above all to world wars…"[28] What economists now observe is that the inverted "U" is only substantiated by using selective short-term data. As larger data sets are analysed, the curve becomes an "N" leading to overshoot, income inequality grows, and wealth becomes concentrated in fewer hands.[29]

Because Kuznet's curve is an ideological model, its simplicism continues to pervade political thinking that one needs wealth to pay for environmental programs. It shaped the central assumption of the Brundtland report as the "Environmental Kuznets' curve" (EKC), which is based on the parallel notion that after initial industrialization, prosperity enables countries to implement and pay for environmental programs. In point of fact, data show that the EKC also results in an "N" curve, as environmental damage increases since wealth increases a nation's environmental footprint.[30]

BC is an extremely wealthy province. It should, therefore, come as no surprise that in spite of earnest efforts to be environmentally responsible, we have an enormous environmental footprint. Our economic impacts override all environmental objectives. We either prefer not to acknowledge this reality, or we prefer to hide it with environmental programs that claim to address the problem, even if mounting environmental problems indicate that these programs have not been successful. Both positions are a tacit acknowledgement that problems continue to grow because they are rooted in the failed economic mindset of endless growth. BC is not meeting its climate change targets anymore than the federal government is.[31]

The most obvious of our problems are our freshwater problems, which are often under-reported and go unnoticed by the majority of the population. We have known for decades that the waters of the Salish Sea were heavily contaminated, ever since toxicology reports indicated that resident Orcas were bioaccumulating toxins at concentrations that met and exceeded those of the Swan Hills contaminated waste disposal site in Alberta. While we have targeted the obvious contamination of septic outfalls, we have been less sensitive to the impacts of agricultural, garden, and urban household run-off, which is carried into coastal streams via a largely uncontrolled network of Ministry of Transport ditches. Indeed work shows that in BC, as in all around the world, "… humans are dumping more chemical waste into the environment than can be tested for its impacts……Agricultural run-off is a major pollution, as are landfills leaking chemicals into water sources." [32]

This is a major problem in BC. It is as unaddressable here as it is around the world. In the last three months in the wake of "unprecedented rain" events, reports of surface contamination have made the news, such as at Wagg Creek[33] where industrial effluent that found its way into the creek system resulted in yet another fish kill and provided yet another clear example of the actual state of surface waters. Similarly in January, in a very strangely-worded news release, "high rains discharged unexpected amounts of raw sewage to the shorelines of Greater Victoria." The wording is really symptomatic of the mental whitewashing needed to exonerate anthropogenic responsibility! The wording suggests that this is magical and entails no responsible agent. In

fact, the high rains only discharged relatively clean water with some airborne pollutants; however, sewage overflows from Saanich to Sooke discharged a toxic e-coli solution mixed with unidentified chemical waste.[34]

The reported extent of the contamination only reflects the extent of municipal monitoring. It likely extended much farther along the shores of the Salish Sea where there was no monitoring. One can build the most sophisticated sewage plant in the world —however, if basic problems posed by surface contamination are not addressed, pulse events of environmental contamination negate all stewardship efforts.

This is particularly important given the way in which anthropogenic climate change is affecting precipitation patterns. This year, the Cowichan River, which is a historic fisheries reference river, is making the news early. Cowichan Lake, which supplies the Cowichan River, and the local pulp mill, is already down by 40%. A collapse of salmon runs, therefore, is to be expected for this summer, unless we have an unexpected wet summer. This situation is also expected in streams around the Salish Sea, such as Chapman Creek on the Sunshine coast.[35] As noted by Cowichan streamkeepers, the low levels of the Cowichan River correlates with a 35% decrease in summer precipitation since 1980, and a smaller snowpack.[36] This means that not only will salmon returns and spawning be negatively affected, but flows resulting from extreme surges will have two impacts. Physically the river will be subjected to higher scouring and erosion rates. Chemically surges resulting with extreme rain events will carry pulses of more concentrated pollutants, whose effects would have been minimized in the past by the application of the dilution principle.

Agricultural practices are not just the major contributor to the contamination of surface waters. Agricultural development has played a key role in the demise of salmon populations throughout British Columbia simply because of the province's geography. Agricultural lands are valley bottom lands. Prior to contact and agricultural and residential development, these bottom lands were home to extensive wet meadows and wetland systems, which were an essential component of the river systems that produced the large salmon populations. The migratory cycle of these large salmon populations have previously provided the annual nitrogen inputs essential to BC's terrestrial ecosystems. Agricultural development, therefore, is a major concern for its impact on the remnants of critical fish habitat.

Few incidents better illustrate this than the recent "scandal" at Herrling, Carey, and Strawberry Islands, which form a large sandbar in the lower Fraser River. Until recently these islands were part of a tree farm owned by Kruger Paper Products. They were bought in the fall of 2018 by a large agricultural concern, Klaasen Farms. When deforestation began as part of a conversion to blueberry farming, local streamkeepers alerted DFO out of concern for the destruction of fish habitat. These islands are part of a "stretch of river (that) is a spawning site for threatened white sturgeon, a rearing area for Chinook Salmon and provides habitat for more than two dozen other finfish species."[37] DFO is currently investigating.

While there is concern for the impact of private forestry practices on rivers, which are at a lower standard than industrial forestry on Crown Lands, the standards that agricultural development have to meet are even lower. As pointed out by Mark de Angelo, this stretch of the river is critical Chinook Salmon rearing habitat:

> *"This isn't just the most urgent rivers issue in B.C., but the whole country. Chinook Salmon from the Fraser River are a vital part of the diet of endangered southern resident killer whales.*
>
> *"The federal government just this past week has announced enhanced protections for these killer whales," he said. "But we cannot protect killer whales without also protecting areas like Herrling and Carey Island. They are all interlinked. You can't have one without the other."*

This concern for the cumulative effects of rampant development comes at a critical moment in the environmental history of Canada. In December, COSEWIC listed most of the Lower Mainland populations of Chinook Salmon as "threatened" or "endangered":

> *"Mainly a migratory species, these large-bodied fish were historically abundant. Chinook Salmon are important culturally and as a food source for diverse groups of West Coast people, and also provide food for a diversity of wildlife species. The committee found 13 populations to be declining, with 8 assessed as Endangered, 4 as Threatened and 1 as Special Concern. Only the large population that lives in the Thompson River is stable."*[38]

Both the COSEWIC listing and the regional ecological consequences of seemingly disconnected continued agricultural development constitute a real clarion call for ecological and environmental sanity. It is part of a choice that needs to be weighed. Is the priority a short term economic one, in which we continue to pretend that the economy can be decoupled from the environment, or is it an ecological choice in which we acknowledge that an economy of endless growth endangers the viability of the environment, and even our long-term economic survival?

One cannot pretend to protect the environment for future generations while remaining oblivious to the ongoing crisis posed by anthropogenic climate change and continue to develop business-as-usual. To continue to do so not only compounds the challenges posed by climate change, but destroys sources of possible environmental recovery.

This is a challenge we face from coast to coast. Fortunately, it seems that after a brutal backlash south of the border, a new generation of voters and politicians are calling for a change of priorities. The Green New Deal that is galvanizing interest around the world is, as one commentator put it "What Realistic Environmental Policy Looks like".[39] The Green New Deal is a generational change. It is important because it points to the reality that old truths endanger future generations and no longer hold. It is not clear that we have much choice if we want to preserve the ecosystems that have enriched our lives. Either one believes that the current order of things is no longer sustainable and that things are changing, or one believes that there is no crisis and that there is no other order of things possible. Either way, we are all on the same planet, and the signs of crisis are evident from coast to coast in every changing ecosystem.

The question for environmental biologists has to be **how shall we change?**

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ALBERTA News

Submitted by Brian Free, CSEB Alberta Director

As we approach a provincial election—scheduled for April 16—political statements are coming out on a variety of environmental issues.

For example, on climate change, the NDP remain committed to Alberta's Climate Leadership Plan. The Alberta government recently released a progress report on this plan; greenhouse gas emissions are tracking towards 263 megatonnes per year by 2030 instead of 314 megatonnes as was projected in 2015. That's good progress…. Is it enough? The United Conservative Party has committed to scrapping the province's Climate Leadership Plan. And they also plan to divert money from a planned solar energy farm to create a new provincial park in Edmonton's river valley. That can be either good or bad, depending on your values—and whether or not you live in Edmonton.

The Alberta Green Party is calling for an Environmental Bill of Rights. They are also calling for a provincial sales tax…. Yikes!

I encourage our Alberta members to do your research into the issues and party positions, and get out and vote on April 16.

Three Trips to Siberia and Surprisingly Good Native—Non-native Relations

Submitted by Bob Gainer, CSEB Alberta Member.

In the footsteps of Farley Mowat, I have just returned from two weeks in Yakutia, the province-like district in Northeastern Siberia, following two trips to Yamal province in January and November 2018. My original interest in visiting these places was anthrax in reindeer, horse, and cattle herding. Virtually all of the herding is done by indigenous people in quite a remote, traditional and unsophisticated manner. During the course of my tours, I lived and ate with the herders and developed a superficial appreciation of their culture considering I didn't speak their language except through the tour guide. They seemed to be very happy with their relatively modest living conditions, living in chums, large teepees covered with reindeer hides and heated with a wood fired stove in the middle. Actually chums are very pleasant dwellings and attractive places to be. The native life on the land was balanced with work opportunities in a nearby (100 km) town, plus there were markets for their meat, fish, furs, hides, honey, and berry jams and now western retirees adventure tourism (like me, actually a very growing industry). Every chance they would get, they and all their family and friends would dress up in traditional garb and sing and dance late into the night. They were happy and proud being native.

Probably the most successful of approximately 100 significant native groups in Russia are the Yakuts of the Oblast of Yakutia. Yakutia is much the same size and shape of India, approximately 2,000 km straight south, but instead of a billion or more residents, Yakutia has little more than 1 million. Considering the fact its capital city of approximately half the total population, Yakutsk, is known as the coldest city on earth, that is quite a few people. It actually reminded me of living in Yellowknife, which I found comfortable.

Almost all of the people you meet are Yakuts. The only time you really notice any non-Yakuts are at the airport where the shift workers fly in and out of their jobs at the diamond, gold, other minerals, and oil and gas camps. Yakuts basically have all the positions from top to bottom in Yakutia in politics, government, academia, small and large non-multinational businesses, and as complex qualification required for jobs, they learn as easily as any ethnic group.

"Why?" is what I asked of everyone. Well approximately 1,000 years ago when Ghengis Khan and his Golden Horde had conquered most of Asia, some of his followers moved north. Normally preferring the treeless steppes for their horse-based culture, some of the mongols noticed that there were breaks in the taiga called "alaases" that were covered with sedge grasses that was excellent horse fodder. Over time, the area was populated with a significant and distinctive group of people that integrated with the few local non-horse herding tribes. Following the Golden Horde were Russians exploring Sibir for its sable and other furs. Their forts or bases of operation depended on the surrounding natives for food, furs, and other necessities of life in the region they were not familiar with, so they generally cultivated good relations. The Tsarists then found these distant communities were perfect "prisons without walls" for their political exiles, many of whom were quite educated and taught the locals many of the arts and sciences of the day. The Yakuts were found to be excellent students. Towards the end of their time, they even had constructed the Trans-Siberian Railway for military purposes (their wars with Japan). After the Soviets came to power, their "equality of people" meant that education and opportunity for all was mandatory, regardless of native or non-native origins. Stalin's gulag system meant the opposite—if you were a prisoner, you were worked to death helping develop the natural resources of the region. With the end of the Soviets, Yakutia had tremendous developments of its natural resources and its Governor at the time quite alertly managed to pass a law requiring that 25% in some form (shares or dividends, etc.) stayed in Yakutia. The money was designated for the benefit of the people of Yakutia and has resulted in a very stimulated economy and population.

This is the briefest description that I can give of why Yakuts seemed so happy, remembering that they are a special case. The three different native groups I met in Yamal also seemed happy, if less so financially and population wise. Contrast that with part of my lifetime of working as an agrologist, biologist, and veterinarian in northern Alberta and the southern Northwest Territories communities. Many natives are doing well, but the more isolated and subject to the *Indian Act* the community or Reservation was, the higher the proportion of natives that were definitely not doing well. North America's relations with its western native population is hardly 150 years old and seems to be based on Manifest Destiny and the confinement of natives so that non-natives could develop the resources for the country's good. Where Russia did not enact such harsh measures, natives, non-natives, and the government seem to be getting along much better. Manifest Destiny for the "good of the country" principal needs to be reversed as Farley so vocally expressed back in the 1950s. Canada should exist for the benefit of every ethnic group.

CSEB Regional Directors Needed

CSEB has Regional Director vacancies as follows:

- Territories
- Ontario
- Saskatchewan
- Quebec
- Manitoba
- Alberta
- Atlantic

If you are interested in taking on one of these positions, please contact Curt Schroeder at President@cseb-scbe.org. It is not an onerous task, and will greatly help strengthen the organization. Your help would be greatly appreciated.

SASKATCHEWAN News

Submitted by Robert Stedwill, CSEB Saskatchewan Director

Saskatchewan recently developed a report entitled *Prairie Resilience* in response to the federal government's announced carbon tax on greenhouse gas emissions. It has not been well received by the federal government nor the Saskatchewan Environmental Society (SES).

The task for Saskatchewan is significant in that, if the province is to reduce its current 76 million tonnes of man-made greenhouse gas emissions to the Canadian commitment agreed to in the Paris Agreement, it will need to do more than that envisaged in the aforementioned report.

Those 76 million tonnes will need to be reduced by 28 million tonnes if Saskatchewan is to comply to Canada's commitment of a 30% reduction of 2005 levels by 2030.

"In a newly released publication, "*Prairie Resilience*" *Is Not Enough*, SES analyzes the Saskatchewan government's plans for greenhouse gas emission reduction in every sector of the Saskatchewan economy. SES finds that in all but two sectors, those plans fall well short of what Saskatchewan needs to do."

According to the SES assessment, the government's plan would only get the province halfway to its targeted goal of a 30% reduction.

The "SES outlines more than 30 additional measures that could be taken. They include the following:

- phasing out conventional coal-fired power stations
- expanding co-generation of electricity in Saskatchewan
- installing 500 megawatts of solar power onto the grid
- introducing strict regulations to monitor for and repair methane leaks in the oil and gas sector
- incentivizing the purchase of ultra-fuel-efficient vehicles
- lowering the speed limit on divided highways
- restoring a provincial inter-city bus service
- supporting extensive tree planting programs for carbon sequestration
- establishing a comprehensive building retrofit program and more ambitious energy efficiency standards in the provincial building code
- instituting more ambitious performance standards for large industrial emitters
- introducing a price on carbon in line with the Government of Canada's plans."

One component of the Saskatchewan plan, and not fully identified in the SES response, is the need for citizens of the province to change their habits as well. I say this because, many of our own habits contribute to the industrial issues identified by the government, but which the government is focusing on to be the sole solution.

We as a society need to look at ourselves and see where we can improve; do we really need to drive a block to pick up a litre of milk for supper; do we always need to buy something new when a simple repair will do; do we really need to add accent lighting for the outside of our houses? And the list goes on.

The carbon tax identified by the government of Canada is not designed to restrict our freedom, but a way in which to get us to change our ways. At times, you need to take the bull by the horns and get things done, rather than try and ensure that they will retain your vote!

By way of example, one country has done just that. As of April 1, 2019, the government of Barbados is banning "the importation, retail, sale, and use of petro[leum] based single-use plastic."

That will certainly come with some controversy, but will definitely change citizen habits!

MANITOBA News

Submitted by Robert Stedwill, CSEB Member

From the website of the Manitoba's Sustainable Development Ministry, the Manitoba government has officially designated the Skylake Wildlife Management Area (WMA) near Arborg, Manitoba, an area of approximately 614 hectares.

This is a unique forest and wetland area approximately 120 kilometres north of Winnipeg. According to the minister responsible for the ministry, "the designation of the Skylake WMA adds another natural area in our province where activities that significantly affect wildlife and habitat will not be permitted." This includes logging, mining, hydroelectric development, oil and gas exploration or development, exploring for and harvesting peat, and other activities. Existing Indigenous rights will be respected and traditional uses, including hunting and trapping, will continue in the area.

The Skylake WMA is a large fen–forest in the south central Interlake. This low-lying land has islands of tamarack–black spruce forest, trembling aspen, white spruce, wetlands bounded by cattails, sedges and willows, as well as pools fed by artesian springs.

The area supports a variety of wildlife species including white-tailed deer, sandhill crane, and songbirds. It contains orchids, including rarer species such as Dragon's mouth, Northern green bog, and White bog orchids, as well as the more common Showy lady's slippers and Yellow lady's slippers.

With this designation, Manitoba will have 85 wildlife management areas encompassing approximately 2.3 million hectares, about 3.6% of the total area of the province.

Manitoba CSEB Members

Manitoba CSEB members, we need you to step forward with your voice as to what's going on in your province, and the environmental work that you're doing. I can only do so much from where I sit in Saskatchewan.

ONTARIO News

Submitted by Derek Moggy. CSEB Ontario Member

Ontario Considering Changes to the *Far North Act*

The Ontario government is currently reviewing the *Far North Act* with the goal of improving economic development opportunities in the Far North.

The *Far North Act* came into effect January 31, 2011 and provided the legislative basis for land use planning in the Far North. The Act provided for joint community-based land use planning between the Indigenous communities and Ontario that supports the environmental, social, and economic objectives for Ontario.

The Far North covers 42% of Ontario's land mass and stretches from Manitoba in the west to James Bay and Quebec in the east. It is home to 24,000 people (90% of them First Nations) and 31 Indigenous communities. It includes distinct ecological regions that play a key role in helping reduce global warming, including the bogs and fens of the Hudson Bay Lowlands, as well as the boreal forest of the Canadian Shield. It also provides habitat for over 200 sensitive species, including species at risk like woodland caribou and wolverine, as well as Ontario's only populations of polar bears, beluga whales, and snow geese.

The natural resource potential in the Far North is great and the demand is growing. The Ring of Fire is located in the Far North and may be the economic equivalent of the Athabasca oil sands, with a potential of generating $120 billion. However, challenges facing its development include lack of access to the remote region, infrastructure deficits, Indigenous rights, and environmental issues. To help ensure sustainable development, the Ontario government and Indigenous communities have been working together on community-based land use planning, through the *Far North Act*.

Ontario is currently seeking input on a proposal to repeal the *Far North Act.*

Federal Approval of Mine Projects

On January 24, 2019, the federal Minister of Environment and Climate Change announced that the Magino Gold Project is not likely to cause significant adverse environmental effects when mitigation measures are taken into account.

The Magino Gold Project, proposed by Prodigy Gold Incorporated, consists of the construction, operation, decommissioning, and abandonment of an open pit gold mine and on-site metal mill located near Dubreuilville, Ontario. The project, valued at $427 million, could create up to 550 jobs during construction and 350 during operations over the life of the project, according to figures provided by the proponent.

The Minister established 120 conditions to protect fish and fish habitat, migratory birds, human health, the current use of lands and resources for traditional purposes, and species at risk, and includes mitigation measures and requirements for a follow-up program that the proponent must fulfill.

This is the second mineral development project approved by the federal Minister of Environment and Climate Change in three months, with the approval of the Hardrock Gold Mine on December 13, 2018.

QUEBEC News

Submitted by Loys Maingon, CSEB Director

359 Scientifiques Appuient Les Manifestations Étudiantes Pour Le Climat

Le consensus scientifique est sans équivoque : sans changements rapides et radicaux, nous serons confrontés à des bouleversements qui entraîneront des impacts catastrophiques pour l'humanité et la vie sur Terre. Contrairement à certaines croyances, la science est claire quant au fait que le Québec et le Canada ne sont pas à l'abri d'impacts climatiques aux conséquences graves. Les récents événements extrêmes que nous avons connus donnent un avant-goût de ce que l'avenir nous réserve si l'inaction persiste. Chaque région a été touchée à sa façon : canicule meurtrière ici, sécheresses là-bas, variation extrême de pluies et de grands froids, inondations, rivages ravagés, etc. Ces phénomènes ont un impact sur notre santé et notre sécurité, sur nos terres agricoles, nos pêches, nos forêts, nos milieux de vie.

Malgré le fait que tous ces exemples devraient suffire à réveiller nos gouvernements et l'ensemble des décideurs économiques, force est de constater que ce n'est pas encore le cas. La pression citoyenne doit augmenter. Nous comprenons les jeunes qui ont du mal à continuer à étudier comme si rien n'avait changé. Il est de notre responsabilité de les accompagner dans la dénonciation du grave manque de leadership politique et économique auquel nous assistons. Nous devons travailler ensemble à la recherche et à la mise en oeuvre de solutions garantes d'une économie soutenable dans un monde viable.

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CSEB Research Webinars

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

ATLANTIC News

Submitted by Patrick Stewart, CSEB Atlantic Director and Vice President

Gaspereau Begin Comeback After $4 Million Fish Ladder Installed

Source: Cassie Williams · CBC News With files from Anjuli Patil

Logging and dams had driven Gaspereau, a species which is closely related to herring, from a St. Margarets Bay, Nova Scotia, watershed. But more than a hundred years later, the species has made a comeback, thanks to a fish ladder.

Last year, Nova Scotia Power invested $4 million into building the largest fish ladder in the province at Sandy Lake Dam (Craig Hominick of Fisheries and Oceans Canada).

Gaspereau—also known as the alewife—is a herring-like species that forms an important commercial and recreational fishery in Nova Scotia, where it is often used as bait in the lobster fishing industry. The project, completed two years ago, is an example of a situation involving removal or modification of dams that at one time blocked fish passage into the headwaters of some of Nova Scotia's major rivers.

As they are in many parts of Nova Scotia, Gaspereau had once been common in Indian River, which flows into St. Margaret's Bay, before dams and the logging industry began using the river in the mid–to–late 1800s. The current fishway skirts a hydroelectric dam that has operated in the area for many years.

Gaspereau, also known as the alewife, is a species of herring that is often used as bait in the lobster fishing industry. (CBC)

A federal Department of Marine and Fisheries official (the precursor of the current Fisheries and Oceans Canada) first noted the significant lack of fish when he toured the watershed on May 16, 1881, a while after the first dams were placed on the river.

Nova Scotia Power, the local electricity utility, which generates 30 gigawatt hours of hydroelectricity per year from the water system, invested $4 million into building the fish ladder, which is the largest in the province, at their Sandy Lake Dam. The project was carried out through a memorandum of understanding between the utility and the Department of Fisheries and Oceans to help re-establish the fish.

"We hope that it eventually it might even work for the return of some Atlantic Salmon, but Gaspereau are more prevalent still in Nova Scotia," said Terry Toner, director of environmental and Aboriginal affairs at Nova Scotia Power. "The fish ladder is about 500 feet [150 m] long. It's the longest one we've built in Nova Scotia." As it turns out, it's also turned out to be the longest fish ladder in Nova Scotia.

During the spring upstream migration, shortly after the fishway was installed a field biologist with Nova Scotia Power checked the ladder and spotted three gaspereau in the resting pools.

The ladder—a pool and weir design—allows Gaspereau and other species to work their way up through a series of chambers, including resting pools, finally exiting into Sandy Lake where they spawn. They return to the sea in autumn. Gaspereau are anadromous—they spend much of their lives in marine and estuarine waters—and move upstream to spawn in freshwater. Juveniles exit Sandy Lake and are carried down the fish ladder in autumn.

On May 17, 135 years and one day after the federal inspector had been there, a field biologist with Nova Scotia Power checked the ladder and spotted three gaspereau in the resting pools. Speckled trout and smallmouth bass and white sucker have also been seen in the ladder.

"Gaspereau tend to go back to spawn in the same river that they're used to. They imprint on the stream on their way out, and when they come back to spawn, most go up the river they were born in," Jay Walmsley, a senior environmental scientist, said in the Nova Scotia Power news release.

The change is good for the local ecosystem. "The more different types of fish we have in the system, the greater the diversity and productivity and the healthier the system," Walmsley said. Migrating fish such as Gaspereau also bring nutrients from the ocean.

Gaspereau using the ladder offers a promise that the fish will redistribute into the rest of the watershed.

Rare Bird Adopts Nova Scotia Seniors' Home

This Chukar first appeared at the Parkland Clayton Park last summer. Staff and residents have no idea how he got there, but he has remained. (CBC)

A bird that's a long way from home has been welcomed by residents at a Halifax retirement complex. This Chukar, the national bird of Iraq and Pakistan, took up residence in Halifax last summer and is still holding on. The bird appeared outside the Parkland Clayton Park seniors residence and has remained there ever since. The red-billed partridge has since been named Clayton, a nod to the Clayton Park neighbourhood where the retirement facility is located.

Chukars are native to the Middle East and southern Asia. According to the National Audubon Society, they were brought as a game bird to North America and have thrived in some arid regions in the western U.S. [Editor's note: also located in BC].[1]

"We have no idea how he got here, but he seems to be faring well so far and he's certainly being well fed and well looked after," said Jennifer Shannon, the general manager at Parkland Clayton Park.

At night, Clayton roosts on a ledge on a second-floor window at the corner of one of the buildings. Concerned about his winter survival, officials called a wildlife rehabilitation centre to take him. But he couldn't be caught. A dog house acquired for him and installed at the home has worked instead as a shelter.

Keeping an eye on Clayton has become a part of resident Joan Maddison's daily routine. Assuming she can find Clayton, she feeds the bird three times a day. When she wears her red coat, Clayton recognizes her.

"If I wear my black coat because it's snowing and raining, he's reluctant to come to me. I have to talk to him and then I whistle and he recognizes me," she said.

Shannon said Clayton is welcome to stay at the complex for as long as he wants."He makes the residents happy," she said.

Source: CBC Atlantic

[1] There are also populations of Chukar in BC (https://www.birdatlas.bc.ca/accounts/speciesaccount.jsp?lang=en&sp=CHUK)

Nova Scotia's Environmental Issues, Circa 2019 – Facilitating Scientific Understanding and Action On Multiple Fronts – a Viewpoint [1]

Submitted by Peter Wells, CSEB Atlantic Member [2]

Currently (circa March 2019), Nova Scotia faces a broad spectrum of environmental challenges. As stated in these pages before, many important issues demand attention, scientific understanding, thoughtful broad discussion, and timely decisions and action. Amongst the most prominent ones are as follows:

- The various effects of **climate change**, certainly the predominant global and regional issue (IPCC 2018; Wells and Richardson 2018). Climate change in the NW Atlantic and Gulf of Maine/ Bay of Fundy will be discussed in detail at the upcoming Gulf of Maine 2050 Symposium in November, in Portland, ME (Fig 1)
- The potential impacts of treated **kraft pulp mill** effluent, proposed for discharge directly into the Northumberland Strait, near Pictou (Fig. 2)
- The potential effects of **brine discharges** into the Shubenacadie River and its estuary, originating from the development of underground gas storage caverns
- The impacts to wildlife and forest ecosystems from continuous and accelerating **clear cutting** of huge swaths of crown and private woodlands
- The potential human health effects of continued **glyphosate spraying** on forests, as well as from the **burning of used vehicle tires** as fuel for cement plants
- The health and ecological impacts of **raw sewage** still being discharged from homes (without septic systems) into local rivers, such as the LeHave River, near Bridgewater
- The potential damage to a major, ecologically productive salt marsh, albeit man-made, from impending **highway construction** - twinning the main highway at the causeway at Windsor, in the upper Bay of Fundy (Fig. 3)
- The continued **pollution from mink farms** of lakes and rivers in south-western Nova Scotia
- The continued **impact of the tidal power station** at Annapolis Royal on shad, bass and sturgeon (M. Dadswell, Acadia Univ., pers. comm.)
- The lingering effects of **acid rain and trace mercury** on freshwater quality, fish and birds in SW parts of the province
- Continuing concerns about the coastal impacts (chemical contaminants, nutrients, disease, accidental releases) of **open water salmon aquaculture** (Fig. 4)

The reader familiar with the province and maritime region can likely identify other issues. One that is in the news a lot is the urgent need to protect the endangered North Atlantic Right whale from boat traffic (strikes, noise) and entanglement in fishing gear. Importantly, as mentioned below, some of these problems should be looked at alone and together, as there is the potential for cumulative effects of the stressors in some localities.

The current provincial government and the responsible departments have been quite slow to address these issues in a meaningful and comprehensive way. In some cases, e.g., the Northern Pulp mill at Pictou, the government is in a direct conflict of interest, as part owner and part regulator. Overall, the situation points to significant barriers operating at the interface of relevant information, political will, and decision-making in the responsible provincial and federal ministries. Clearly, there needs to be timely decision-making and action on these issues, based on the scientific and other evidence at hand.

In the case of the new report on forestry (Lahey 2018), there should be an immediate comprehensive response to its extensive recommendations (Armstrong 2018; Guderley 2018; Pross 2018). Happily, as of late 2018, this has started. But unfortunately, too often the responsible departments and their ministers are very slow at finding or suggesting workable solutions. Clear cutting across the province continues unabated. Delay rather than resolution seems to be the mantra on such problems demanding action.

Given this situation, organizations such as the Canadian Society of Environmental Biologists (CSEB) should be more engaged in helping to find resolutions to these issues. CSEB biologists are needed as researchers, writers, and advocates for solutions. Actions could include fostering the exchange of reliable, i.e., scientifically credible, information; encouraging debate on the more contentious issues (most of them are!); and asking the various governments and the interested public to further engage with one another, and to do so frequently, and in a timely fashion.

For example, on the questions of how to protect and manage our provincial forests on both private and crown lands, and whether or not to use forest debris and wood chips for generating electricity, CSEB and others (e.g., NSIS, EAC, WWF, CPAWS) should encourage further discussion and support for ecological forestry, as recommended in Lahey's report (Lahey 2018). That would entail the broad interested public being well briefed on the contents and recommendations of the report, as well as informed about the concept of ecological forestry (what is it, can be done in a practical way, and why is it so important that it be attempted)? In this particular case, CSEB could help facilitate this understanding and foster the linkage between the science and the required policy and decision making; the webinar series may have a role here, as well as topic specific workshops.

Further, there are connections between some, if not all, of these environmental issues as they impact the quality of the province's lands, forests, and waterways—how we manage the forests influences on stream, river, and estuarine water quality; where we discharge industrial effluents may impact our fisheries and in some cases, migratory wildlife species; and how well our sewage is treated determines whether our health and that of aquatic ecosystems are protected. If terrestrial and aquatic environments are not protected comprehensively and so continue to decline in quality, their capacity to support us and other species will be imperilled.

On this point, it is extremely sobering to know that over 1000 species are listed as being at some level of risk in the Public Registry associated with the Canadian Species at Risk Act (D.H. Richardson, Saint Mary's University, pers. comm.).

1 This article is adapted from an editorial, by Wells, published in the PNSIS 50(1), p.1-5, Feb. 2019.

2 International Ocean Institute – Canada, Dalhousie University, Halifax, NS. (email: oceans2@ns.sympatico.ca)

For example, on mainland Nova Scotia, iconic animals such as the moose are at risk due to habitat loss, black bears have a very limited distribution and small numbers, the little brown bat is almost gone due to white nose syndrome, and piping plovers are at risk at their beach nesting sites. Clearly, our terrestrial and aquatic environments in the province need more comprehensive management and protection.

It is especially worth reading the recent reports of the IPCC (IPCC 2018) and the WWF [3] —The Living Planet 2018 (WWF 2018). These reports and their observations about what is happening to the planet do not stand alone; both reports point to the many changes and stresses faced on land and sea.

Important to note is that there is a commonality in the breadth and overlap of some of the problems. Considerable attention is given to the potential of cumulative change/impacts from multiple stressors acting together in time and space (Breitburg et al. 1998, among many others). The quality of our land and our waters often declines slowly, piece by piece, one stress building upon another, and all unnoticed until the change is massive, reflecting a new state of the environment that is far from the natural state, a so-called "new normal" (MacKinnon 2013) or shifting baseline (Pauly 1995; Papworth et al. 2009). Indeed, this is exactly what has occurred with the loss over four centuries of the mixed Acadian forest in Nova Scotia; the landscape is now largely covered by the impoverished "sticks" of a few species of trees rather than healthy, old growth, highly diverse forests. Sadly, we now take this new, highly changed (disturbed) landscape as being natural and normal, much like the situation in our southern prairie provinces (largely converted to agriculture) and in long inhabited countries such as the United Kingdom (their mountainous areas now bare of natural forests, and low lying areas being farmland).

Despite the obstacles, optimism and commitment must fuel our way forwards as we collectively tackle these environmental issues, engaging the public and supporting the government to foster better policies and effective solutions.

One approach is for CSEB to be supportive of the considerable citizen science practised across the country and region on many of these issues (Cigliano et al. 2015; Wells and Richardson 2015; Hannibal 2016). Our activities should recognize this immense effort, as well as the value of natural history studies (Anderson 2017). Citizen science is carried out by volunteers devoted to the environment and the public good. Work done to conserve and protect species and habitats abound across the Maritimes. This work provides information directly relevant to the various current wildlife issues faced by each province. For example, in Nova Scotia, amazing field work is conducted on turtles, snakes, fish, loons, terns, and water quality conducted by the Friends of Keji Cooperating Association and the Mersey Tobeatic Research Institute (www.merseytobeatic.ca). With an increased membership, CSEB members could work with one or more such citizen science groups—volunteers are always needed and the new information, if properly recorded and archived, such as with "ebird" or "inaturalist.ca", is of interest to the wider public and invaluable to the responsible provincial and federal agencies.

Nova Scotia is part of a region with a plentiful and diverse natural environment but one continuing to suffer a range of environmental threats and challenges. Tackling them demands timely decision making and effective policies based on science. Hence, a greater engagement of CSEB and other similar groups can be a positive contribution to understanding the issues and using our science-based information for their resolution. Protecting our natural world deserves nothing less than a full joint effort from regional biologists and other concerned citizens.

[3] Nova Scotian Institute of Science; Ecology Action Centre; World Wildlife Fund; Canadian Parks and Wilderness Society

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Fig 1. The upcoming Gulf of Maine 2050 Symposium, with the emphasis on climate change impacts and community adaptation and mitigation.

Fig. 2. The Northern Pulp mill at Pictou, NS.

Fig. 3. The highway causeway and downstream salt marsh at Windsor, NS.

Fig 4. Salmon pens in Annapolis Basin, Bay of Fundy.

Science Atlantic Environment Conference - Thank you to our sponsors!

Editors Note: below is a thank you note received 13 March 2019 from the Science Atlantic Environment Conference for the sponsorship donation from the Canadian Society of Environmental Biologists.

On behalf of the organizers of the Environmental Conference and Science Atlantic, we would like to thank you for your generous donation of $100.

The conference was a great success, with 23 oral presenting students and 15 poster presentations, and 80 total student and faculty attendees. Academic conferences provide excellent opportunities for students to present their work in a formal setting – great preparation for future graduate studies or professional presentations.

These opportunities would not be available without the help of generous sponsors like you. Please feel free to check out the Science Atlantic website at https://scienceatlantic.ca/committees/environment/ or https://saec2019.weebly.com/ for conference pictures and list of award winners. Your support is greatly appreciated.

Thank you,
Clare Henderson & Carley Ross
Co-Chairs
Science Atlantic Environmental Conference
St. Francis Xavier University

TERRITORIES News

Submitted by Anne Wilson, CSEB Territories Director .

Last bulletin I mentioned the 2018 Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5°C, which was released in October 2018, and talked about the fact that we are already seeing the consequences of 1°C global warming (http://www.ipcc.ch/report/sr15/). This statement is very true for the Arctic, on many fronts. In addition to damage to infrastructure caused by thawing permafrost, there are significant environmental changes occurring. For example, a recent journal article (https://www.ncbi.nlm.nih.gov/pubmed/30474969 Environ Sci Technol. 2018 Dec 18; 52(24):14099-14109) notes that there are already record levels of mercury being released by thawing permafrost—not to mention the effects of sediments entering watercourses, and the changes to surface water drainage patterns resulting from the thaw slumps.

Methyl mercury is being released into environments such as this one on the Peel Plateau in the Yukon, according to a new study by U of A researchers. (Photo courtesy Scott Zolkos)

Thawing permafrost is also associated with the release of carbon dioxide, as exposed minerals from slumps are weathered by sulfuric acid formed by sulfide oxidation.

(https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2018GL078748)

A permafrost thaw slump on the Peel Plateau in the Northwest Territories exposes permafrost rich in ice and sediment. As the permafrost thaws and collapses, sulfuric acid in water breaks down the exposed minerals, releasing substantial amounts of carbon dioxide. (Photo: Scott Zolkos)

Recently published work done by the Centre for Hydrology, University of Saskatchewan predicts a 6.1° C warming by the end of this century in the Arctic, and examined what that would mean for impacts to a small headwaters basin near Inuvik, NWT (https://journals.ametsoc.org/doi/full/10.1175/JHM-D-18-0187.1). Imagine increasing snow cover by 70%, deepening the active layer by 0.25 cm, and experiencing doubled discharge volumes and a 130% increase in spring runoff. Commentary from the Global Water Futures web site summed it up:

> *"There will be a tipping point reached over the next few decades, putting at risk communities whose infrastructure was designed for 20th century climate and hydrology," said Dr. John Pomeroy (PhD), senior author of a recent paper in the American Meteorological Society's prestigious Journal of Hydrometeorology.*

CBC picked up on the implications of the study, reporting in January on the need to fortify infrastructure in the face of climate change (https://www.cbc.ca/news/canada/north/climate-change-infrastructure-study-1.4982063).

Heavy rains in 2016 caused a washout on the Dempster Highway. Research suggests climate change could cause significant damage to crucial roads and infrastructure in Canada's North. (Joe Bishop)

On a more cheerful note, the Wood Buffalo Action Plan has been released by Parks Canada. Once the French translation version is available, the Action Plan will be posted at https://www.pc.gc.ca/en/pn-np/nt/woodbuffalo/info/action. This has been developed in response to concerns taken by Indigenous groups to the World Heritage Committee, which requested that Canada undertake a Strategic Environmental Assessment of the cumulative impacts of all developments on the world heritage values of WBNP. This was completed in May 2018. The Action Plan identifies work to be done on seven theme areas:

1. Strengthening Indigenous Partnerships with Wood Buffalo National Park
2. Environmental Assessment
3. Conservation Area Connectivity
4. Tailings Ponds Risk Assessment
5. Environmental Flows / Hydrology
6. Monitoring and Science
7. Wildlife and Habitat Conservation.

The federal government has committed $27.5 million dollars to begin implementing the actions identified. Ottawa submitted the action plan to the United Nations Education, Scientific, and Cultural Organization to prevent having the park designated as "in danger" due to poor management practices; UNESCO will meet in July to decide if the park should be on the 'List of World Heritage in Danger'. For some photos and an overview, see https://www.cbc.ca/news/canada/edmonton/more-staff-artificial-flooding-among-plans-to-save-wood-buffalo-national-park-1.5002375.

Development Activities

There are several developments in the NWT and NU that are proceeding through the environmental assessment and regulatory processes.

- In the Environmental Assessment forum, Baffinland Iron Mines has applied to increase production to 12 Mtpa (double), which involves construction of a north railway to transport ore to the marine port for shipping to markets. If the already permitted south railway is constructed, production would eventually increase to 30 Mtpa. The expansion has EA hearings scheduled for next September in Pond Inlet.
- Two of the northern mines have proposed disposing of tailings in mined-out pits, and this is undergoing review. Current closure plans involve reconnecting the pits to the large, pristine, lakes that they are adjacent to, once water quality is acceptable, and the addition of tailings raises questions for closure. It will be important to understand the groundwater flow direction and quality, and the likelihood of stratification of the pits. Meadowbank is awaiting approval of their proposed tailings disposal from the Nunavut Water Board; the Diavik Diamond mine will go to public hearings in mid-2019 for their application.
- The Tlicho All-Season Road construction contract has been awarded, and this will open up the development of the Fortune NICO mine (gold/copper/cobalt) in the western NWT.
- Canadian Zinc Corp. (now re-named NorZinc Ltd.) received a positive decision on the 184 km all-season Road EA, and

will now be able to proceed to permitting of the access route to the Prairie Creek lead-zinc-silver mine.

- The Giant Mine Remediation Team will be submitting the Type A Water Licence application in April 1, 2019, which will kick off intensive review and stakeholder meetings.

Municipal wastewater management continues to be a challenge in the North, and work is once again underway on the development of effluent quality standards, similar to the *Wastewater System Effluent Regulations* that apply south of 60. It will be several years before we can expect these to be promulgated into law.

Other Territories News

Submitted by Sharleen Hamm, RPBio, CSEB Territories Director.

March already…the days are getting longer, the sun is back across the north and I'm packing my bags for another trip to Nunavut next week where I will be visiting both Kugluktuk and Cambridge Bay in the Kitikmeot Region.

Also in the Kitikmeot region and subject of past articles I've written is the Canadian High Arctic Research Station (CHARS) and home of Polar Knowledge Canada (POLAR). POLAR is currently accepting applications for research funding (2020-2023) under the following programs:

- Northern Science and Technology (NST) Program: aim is anchor a strong research presence in Canada's Arctic. This program will create an environment in which both Indigenous and local knowledge and science contribute to addressing challenges in the Arctic.
- Polar Knowledge Application (PKA) Program: aim is to promote and further strengthen science and technology nationally and internationally and build science capacity through training, outreach, increased knowledge sharing and learning opportunities. The program aims to enhance and build awareness of the polar regions across Canada through fostering collaborations with other organizations to promote Canadian northern science and technology and advance the next generation of researchers and highly qualified personnel.

Funding is available for up to $150,000 per project per year for up to three years. The total request for funding for each project cannot exceed $450,000. You better hurry….**the deadline for submitting applications is April 30, 2019 23:59 (Pacific Time)**.

For more information and to apply, please visit POLAR's website at Funding for Researchers. For any questions, please contact grants-contributions@polar.gc.ca and include "Polar Knowledge Canada – Call for Funding Applications 2020-2023" in the email subject line.

For those of you who may be in Iqaluit in early April, hopefully we will cross paths at the Nunavut Mining Symposium on April 1-4, 2019 (https://www.nunavutminingsymposium.ca/). I will be chairing a dialogue on Diversity and Inclusion in Nunavut Mining, and also look forward to talks on caribou and land use planning, recent Supreme Court decisions in environmental law, and fish habitat compensation in marine Arctic environments, among others. See you there!

Book Review

By Loys Maingon, CSEB BC Director

Reconsidering Wolves and Wilderness

Paula Wild (2018). Return of the Wolf: Conflict and Coexistence. Douglas and McIntyre. 262 pages.

As mankind changes the planet's ecosystems, imperceptibly it also changes the distribution of animals and their genetics. Evolution never stops. So it is with members of the "dog family", the Canidae, who have always shared the planet with mankind. After its virtual extirpation over the last century and a half in America and Europe, the Grey wolf (*Canis lupus lupus*) and its smaller cousin, the coyote (*Canis latrans*) are re-distributing throughout their previous domains, and even colonizing new environments. There is a growing concern about human interaction with these wild carnivores, in ecosystems increasingly shaped by, and managed by, man. Hence the need to understand that while these are all members of the dog family, behaviourally they are not domestic dogs (*Canis lupus familiaris*).[1]

Wolf behaviour towards humans changes with the environment and with increased frequencies of human and wolf encounters. Wolves have been as successful as humans in populating every continent except Antarctica, because like *Homo sapiens*, they are extremely intelligent and adaptable. Wolves have an intelligence of this world unlike ours. They study their prey, and sometimes humans are prey, as we study them. Throughout the wolf's range, the history and mythology of all cultures records our competition and coexistence with wolves. Wolves have been an integral part of humanity's evolution. As we enter the age of biodiversity collapse, or as E.O. Wilson names it the "Eremocene"—the age of loneliness—understanding how and why we need to further that co-existence, is more important than ever. The wolf is, after all, our evolutionary link to the wilderness that houses the memory of biodiversity.

Paula Wild. Photo by Rick James.

Paula Wild's *Return of the Wolf: Conflict and Coexistence*, therefore, is a very timely guide to understanding wolves, and how to adapt our human behaviour to co-exist with wolves. The book tries to encompass the Grey wolf's distribution in America and Eurasia. However the focus is predominantly North-American. It does not include extensive work done in Russia. The book breaks down into the following:

a general cultural introduction to human attitudes to wolves, a chapter on nineteenth and early twentieth-century extermination, followed by an outline of wolf behaviour, which brings back some considerations on the individuality and personality of "the wolf." By visiting domesticated wolf hybrids, Wild provides personal insights into wolf elusiveness. Lest the reader get too sentimental, the fifth chapter describes how these carnivores make their living with their extraordinary sense of smell and ability to work with ravens to find and kill prey that feeds wolves and ravens and other attending carnivores. Chapter six gives a good overview of the complex relationship of wolves with domestic dogs and coyotes, on whom wolves preferably prey, though they will occasionally mate with either, as numerous genetic studies have shown.

Chapter 7 "Wolf Wars" is the pivotal point in Wild's narrative. She sets the tone for a thesis that she will develop in subsequent chapters: "*Writing about wolves is writing about death,*" namely the death of wolves whose interests clash with those of ranchers and hunters, and even hikers. Chapter 7 is pivotal because that is where she introduces the key work of Troy Bennett, a shepherd, who is largely responsible for the re-introduction of the wolf in France and much of the legislation that has made the controversial return of the wolf in Europe possible. Bennett has spearheaded wolf conservation by studying and re-introducing traditional sheep herding practices still common in Romania, which is home to the highest population density of wolves in Europe, and possibly one of the largest remaining intact wilderness areas in Europe. Bennett re-discovered and advocates sheep management practices that were common practices in the Middle Ages and Renaissance when wolves, and relatively intact wilderness, were also common throughout Europe. The practices involve labour intensive, night penning and the use of a variety of guard dogs reared to dissuade wolves.

Red Riding Hood, from Les Contes de Perrault, dessins par Gustave Doré. Paris, 1867

This raises an extremely important point that seems to be overlooked by Wild. Although she alludes to a general shift in demographics in America (p.124) in terms of percentage, percentages don't really give the reader a good understanding of the impact of population densities on natural ecosystems. To tell the reader that "*In 1800, city dwellers were a scant 3 percent of the population, a century later it was 14 percent and, as of 2017, more than 80% of people residing in Canada and the US live in cities,*" is almost meaningless if the exponential growth of the total population is not taken into account. Percentages give the false impression that total population and its impact per area remains constant. According to Statistics Canada, Canada's population in 1800 was 427,464, in 1900 it was 5,301,000 and is now 37,500,000.[2] Therefore, using Wild's percentages, the number of people residing in rural conditions in 1800 was 414,640, in 1900 was 4,558,860 and today 7,500,000. This means that although North American cities have grown exponentially, and growth in rural environments has been slower since 1945, there has none the less been a constant population increase and development of "wilderness." While growth in agricultural areas has stagnated globally, in North America resource development has continued to shrink the area of intact wilderness.

In 1600, world population was 500 million. The population of France was 20 million. It was rural and agricultural. As in most of Europe, there was little wilderness that was not agriculturally used. Today, world population is 7.63 billion and France's population is 68 million, mostly urban. The return of the wolf in Europe has been made possible to a large extent by the emptying of rural villages and mechanized agriculture, which consolidates the cultivation of 100 farms into a single operation. Areas, such as the Massif de Monge where Bennett lives, are now largely empty and have reverted to "wilderness".

Whether this 're-wilding" is really "wilderness" is open to debate.[3] Wilderness is not just "emptied nature,"or "restored nature." It is intact ecosystems The current return of wolves, while it is desired by a majority of Europeans, is not without controversy, because it requires a cultural shift in farming attitudes and labour intensity. Whereas for the past one hundred years in the absence of wolves, a shepherd could be carefree and leave sheep overnight in mountain meadows, he or she now needs to pen them overnight and acquire and maintain guard dogs. Wild points to the introduction of similar practices in Alberta by Louise Leibenberg and Eric Verstappen, who have advocated adapting these practices out of "respectful use of the land, which involves protecting it and coexisting with the wildlife that lives there."[4]

What Wild does not include in her discussion of Bennett's work is the extremely crucial question that drove Bennett to become an advocate for wolf conservation. Bennett describes his first encounter with a wolf that had been killing his lambs as a life-changing discovery of "the other' in wilderness, and it is worth quoting:

> *"Our eyes met and were locked, I was drawn into them. People talk about the wolves' stare and how it holds you, how it holds its prey. When a wild wolf looks into your eyes, it looks deep and you cannot look away. Something holds you there. Whether it is hypnotism or fear or something else is unsure. I didn't feel fear, but I was held. In that look I felt something change in me, I felt an exchange of information, I don't know what the wolf took from it, but I was left with something, a gift, as it were. I have deliberated over it many times, something primeval that was dormant in me was awakened that day; it's not something I can write about, I cannot even put it into words.* ***It was a feeling of the wild that I'd never imagined existed and it has stayed with me ever since****."*[5]

Wolf swimming after buck in Lakeland Provincial Park, Alberta. Photo by David Smith

This is an excellent description of an experience that is not unique in the annals of wolf conservation. It repeats an experience known to many naturalists. The experience became a classic in Aldo Leopold's 1948 description in *Sand County Almanac* of the dying green fire in a wolf's eyes and the realization of a reality "*of something new to me in those eyes - something known only to her and the mountain*." [6]

The thesis in Paula Wild's account of the wolf is articulated from the outset: "*A huge fallacy is that healthy North American wolves do not pose any danger to humans.*" [7] The subject of the wolf as a potential predator on humans becomes the explicit topic of the last four chapters (9-12). The general question from Wild's perspective, therefore, is that if the wolf does pose a threat to humans, how can we best understand the wolf and share our space with it. Absent from the discussion is why this so-called "huge fallacy" may not have been a fallacy for the previous 200-300 years in America. There are no healthy wolves outside of their healthy habitat. The proper habitat of the wolf is wilderness. In order to adequately discuss the status of the wolf, one has to weigh the less considered question of the current health of our wilderness.

To talk about "the wolf", be it ethnographically or biologically, is to tackle the question of our relationship with "wilderness." As one economist recently put it, we live in a world in which "most people assume that "life is beautiful and local ecosystems are in good health." [8] Just as we take wilderness for granted, so too do we take the wolf for granted.

Wolf mask at Courtenay Museum. Photo by Courtenay Museum.

Wilderness is as misunderstood as the wolf itself, in our increasingly sub-urbanized and digitalized global, largely disconnected, society. In some cultures, such as First Nations, there is traditionally no "wilderness," because wilderness is co-extensive with cultural meaning. For "hunter-gatherers" the wolf is a totemic animal, and to be human is to be a potential wolf and a possible member of a wolf clan as deeply socially knit to kin and place as is the wolf family in a space shared with the human family. In other cultures with a pastoral history, like the Greco-Roman culture, wilderness is everything alien and threatening outside the city-state, as is wilderness' emblem, the wolf, to the pastoral economy. Even so, the Romans, whose founders were raised by a wolf, knew that man was always a potential wolf, albeit a paragon of human cruelty as Plautus mused "*Homo homini lupus*". The wolf is cruel or noble depending on wilderness' potential for being either John Muir's "Holy Temple" or Nathaniel Hawthorne's "hopeless snare," the devil being a particular rabid

familiar of America's puritan founders, often confused, as were witches, with local wolves.

Scribner's 1937 edition.

Paula Wild provides a good general introduction, covering some of the cultural and anthropological background in the first three chapters. Unfortunately the introduction over-generalizes. She homogenizes First Nations interpretation of the wolves as though all First Nations cultures interpreted "the wolf" in the same way. She also unfortunately resurrects as fact Ernest Thompson Seton's fictitious tale of Lobo, without taking into account the famous controversy over "nature faking" that it sparked among the giants of "nature writing" from Burroughs to Theodore Roosevelt before the First World War.[9] The presentation of Seton's fiction as fact one hundred years later leaves Wild's own account open to question, as Wild herself oscillates between factual account, personal anecdote and subjective anthropomorphic description.

The conversational approach taken by Wild to a complex problem is itself sometimes problematic, though always worth reading. She alternates between personal anecdote and scientific references without footnotes or endnotes to guide the reader. While she notes in her introduction that since 1980 wolf populations have been rising and re-occupying regions where they were once extirpated, she gives few references to research or data to substantiate this. The anecdotes can take her indiscriminately from Norway to Athens and Tofino in less than two sentences and immediately back to a camera in Tofino and to an unnamed city in Minnesota in the next: "*Trail cameras in Tofino on the West Coast of Vancouver Island show wolves taking nocturnal strolls and a healthy wolf was discovered living in a small city in Minnesota*." (page 7).

Animals are primarily individuals. Animal population behaviours normally vary subtly between individuals and between regional populations. Although Wild herself refers to the individuality of wolf calls (p.45), she does not follow up on this important aspect of behavioural studies. Biologists increasingly stress the importance of the cultural knowledge of individual populations, which are passed on matriarchally, such as migration patterns, which differ between populations.[10] Logical clumping does not do justice to the study subject. The value of ethological work such as Jane Goodall's on "chimpanzees" or Paul Spong on "killer whales", rather than on "the chimpanzee" or "the killer whale" depends on the importance of recognizing each organism's individuality, and each population's differences. The same applies to wolves, who cannot all be subsumed to "the wolf."

The danger in logical clumping and what it entails is born out by the fate of Dr. R. Wielgus' research, and the attack on science, on academic independence and the political controversy it provoked when rancher and senior Washington state representative: "*Representative Joel Kretz, Representative of the 7th Legislative District and Deputy Minority Leader, (has) engaged in a prolonged pattern and practice of unethical behaviour that includes threats to public researchers, attempted bribery of university administrators, and attempts to force university administrators to fire tenured professors as a means of suppressing peer-reviewed research that undercuts his personal interests*." [11] Wielgus demonstrated that contrary to what one might expect, wolf culls destroy social structure of wolf populations by indiscriminately removing older males who control killing rates by younger males. Counter-intuitively, culling results in higher livestock mortalities.[12]


Wolf with Sockeye Salmon, Brooks Falls, Katmai National Park, Alaska, 2007. Photo by Paul Stinsa.

Much like the use of percentages in human demographics, culling reduces numbers but it does not account for long term social or ecological systemic effects on ecosystems. By implication, Wielgus' excellent scientific research challenged the simplistic assumptions of most wildlife managers, ranchers, hunters, and fishermen who advocate for culls of wolves, badgers, seals, with little understanding of species ethology and its relationship with local ecology. It is strange that this "cause celebre," which is in the world of wolf research on a par with *L'Affaire Dreyfus*, is absent from Wild's work, since it dominated mainstream media, during the period when *The Return of the Wolf* was in preparation.[13]

Wild's account is a useful journalistic introduction to an extremely complex problem. Unfortunately, the account comes without a good questioning of the current state of the wilderness, which is the context not just of "the wolf," but of the many varying wolf populations, distributed throughout the ecosystems of North America. There is a misleading assumption that wilderness is a given that humans and wolves can share, even as humans modify and destroy wilderness both passively through anthropogenic climate change and actively through natural resources exploration and development. Wild's otherwise thorough account of popular concepts of "the wolf", therefore, poses a larger problem of definition and place, that can lure the reader into intellectual complacency.

The potential for complacency becomes obvious if we consider the fate of the two longest-running ecological wolf studies in North America: Isle Royale and Yellowstone. Wolves and Moose at Isle Royale colonized the island thanks to the formation of periodic ice bridges from the northern shore of Lake Superior. Wolves colonized the island in 1948. Studies showing how

wolves and moose dynamics mutually control their populations and local ecology have been carried out since 1958. However, due to warming trends associated with climate change, there has been little or no new gene flow to either moose or wolves. Wolf inbreeding has resulted in a collapse of the original 1948 wolf population, which is now being replaced artificially.

What this is likely to mean for the future of Isle Royale's ecosystems can be answered by what is currently happening at Yellowstone. The Yellowstone experiment, which began with the re-introduction of 36 Canadian wolves in 1995, has proven to be a remarkable success. It has demonstrated two key things. First, that the population control that wolves bring has a direct impact on vegetation, which in turn improves water quality and fish habitat.[14] Second, that the level and quality of ecosystem recovery provided by apex predators such as wolves, far exceeds, and cannot be replaced by, human manipulations and restoration.[15] Apex predators, such as wolves, are essential constituents of native ecosystems, as we have known them until now.

In a relatively steady state environment, wolves, therefore, are key to the restoration and health of intact wilderness. That assumption holds only as long as these ecosystems are not pushed beyond their tipping point. As scientists are now observing, human-driven climate change is shifting entire ecosystems. Polar bear populations are collapsing simply because ice, which is disappearing, is to polar ecosystems what soil is to forests.[16] Without ice, polar ecosystems are re-organizing into novel ecosystems in which the polar bear has no place. We are moving into unknowns.

Climate change also changes soils, and forests are changing. While the Yellowstone experiment has not been without the usual politics of hunting and ranching, it is misleading to believe that the wolf problem can be simply limited to ranching and hunting. As all our ecosystems, Yellowstone is now under the twin pressures of excessive tourism demand and traffic, and climate change, which are unravelling its ecosystems. This should be common knowledge, and a common concern. It is not without reason that the normally conservative *New York Times* can run an editorial: "*Your Children's Yellowstone will be radically different*."[17] Though we may talk of a re-assuring resilience, our ecosystems are far more fragile than previously thought.[18] National parks, which were established as reference ecosystems, are already seeing the first signs of irreversible changes:

> *"the country's first national park will quite likely see increased fire, less forest, expanding grasslands, more invasive plants, and shallower, warmer waterways — all of which may alter how, and how many, animals move through the landscape. Ecosystems are always in flux, but climate change is transforming habitats so quickly that many plants and animals may not be able to adapt well or at all."*[19]

At a time of global biodiversity collapse, as recently pointed out in a study fittingly entitled *Protect the last of the wild*,[20] Canada is nevertheless the second most important of only five nations still blessed with "relatively intact" ecosystems. By 1880, when North America's population was only one tenth of what it is now, we had already collapsed "game" populations in many areas.[21] When Theodore Roosevelt, John Muir, and John Burroughs spearheaded the great conservation movement of 1900

Wolf and grizzly fighting over a deer carcass, Montana. Tom Littlejohns photo.

that established the first national parks, monuments and forests, and Canada's Gordon Hewitt rescued the last prairies buffalo from extinction: "*only 15% of the Earth's surface was used to grow crops and raise livestock. Today, more than 77% of land (excluding Antarctica) and 87% of the ocean has been modified by the direct effects of human activities*." That means that after over 10,000(+) years of relatively intact "wilderness" since the birth of agriculture[22], in the last 100 years, a staggering 62% of global wilderness has been systematically exterminated by human development, together with a similar proportion of wildlife. As reported by the World Wildlife Foundation, Canada has lost a staggering 60% of its wildlife since 1970.[23] Wilderness continues to be eliminated to this day at a rate unprecedented since the great Cretaceous extinction. This is proceeding even as scientists call for the urgent need to set aside 50% of the planet if we want to preserve functioning biodiversity, for our own well-being.[24]

Russia, Canada, Australia, the USA, and Brazil house 70% of the 23% global wilderness that remains today. While Canada's position as a wilderness champion may sound re-assuring to Canadian readers, the practical reality is far more chilling. While most of our urban and agricultural development is clustered around the 49th parallel, our natural resource exploration and infrastructure, which supports our cities, extends all over our would-be "wilderness." What wilderness is, is a function of population density and resource development impact. While Canadian population density remains relatively low, our impact on what remains is enormous and unsustainable. We rate among this planet's highest per capita energy consumers, and we have a disproportionately high impact on wilderness. The state of Canadian ecosystems can be measured not only by the impacts of the Athabasca Tar Sands Project, or the Site C hydroelectric development, but by the disappearance of iconic flora and fauna, which is accompanied by an increase in after-the-fact "management by crisis."

BC's mutilated landscapes scarred by decades of industrial forestry that continues to this day as the NDP/Green government permits clearcut logging of the last of Vancouver Island's old-growth forests,[25] as well as within provincial park boundaries, such as "The Donut" between Manning and Skagit Provincial Parks,[26] bear witness to the actual state of the ecosystems and wild fauna and flora, essential to the preservation of the True North's wilderness and identity. Wilderness conservation emblems, such as Spotted owls have collapsed to less than a dozen in BC. Caribou populations across Canada are collapsing, largely due to decades of forestry, oil and gas extraction. The general attitude is that they are "too expensive to save."[27] Half of BC's Chinook Salmon populations have been found to be "endangered" by COSEWIC,[28] at a time when the future of iconic resident killer whales of the Salish Sea hangs in doubt through Chinook Salmon collapse, intensified recreational and commercial boat traffic and the threat of future oil tanker traffic. The declines of polar bears and caribou are just the most widely publicized concerns.

If there is a fit for "the wolf" today, it is in that precarious man-made context. It is not a simple question of a fallacy "*that healthy North American wolves do not pose any danger to humans*."[29] It is a question that we cannot expect to have healthy wolves, or healthy humans, in an increasingly endangered and ecologically "unhealthy" wilderness.

In Canada, it has been customary to blame First Nations and wolves for wilderness declines. After years of blaming the decline of the Bathurst caribou herd from a high of 500,000 in 1989 to 20,000 in 2018 on over-hunting by First Nations and by wolves in the North West Territories, remarkably it took the research of independent university researchers to confirm that increased mortality rates were a product of mineral exploration disturbance.[30] The intensity of mineral exploration with its seismic lines, dust, and roads has created a disturbance regime that has collapsed the once vast caribou populations. As these researchers suggest: "*….if land management officials are serious about protecting the caribou, they need to take a closer look at the habitat changes that have occurred.*"

Wilderness is a mirage in the Canadian psyche, not unlike "the imaginary Indian." We assume that "The True North" still exists, that the all too numerous mega– resource projects like Site C or the Athabasca Tar Sands can continue infinitely without having a cumulative vanishing impact on the very wilderness, which national pride claims defines "the Canadian experience." Wilderness is always that place of the mind beyond all the "natural resource exploitation". It is the place where Stan Roger's Franklin points. It is the infinite indomitable pioneer space. It is a general definition we live by of a general nature beyond us that informs our recreational spaces that we expect will always remain, even as we destroy them. As such, we treat the place of wilderness as a platonic definition or idea, much as we do the definition of "the wolf." In so doing we forget the fragility of nature, the elusiveness of wilderness and the individuality of wolves, wolf populations, and wolf families.

Wild devotes much of the book to convincing the reader that communities can come to live with "the wolf". She provides good examples and case studies, such as the community programme on Cortes Island to educate the public on how to dissuade wolves from preying on pets and humans. The techniques she proposes are known as "hazing" which are growing in popularity in North America as wolf and coyote encounters increase. These have been used with general success with coyote populations that have been increasingly settling in urban centres. These techniques work in the early stages, but research also indicates that they may lose their effectiveness as wolves and coyotes become increasingly habituated to urbanized environments, to the point that their genetics change.[31] As pointed out in a recent article: "*Montreal turns to coyote hazing after 19 people are bitten:*"

> *"Finding ways to make coyotes fear humans again is "tricky," said Roland Kays, an ecologist at North Carolina State University and the North Carolina Museum of Natural Sciences. "Because out in the wild in rural areas if a coyote gets bold and hangs around people, it's going to get shot," he said. "And in urban areas that just doesn't happen." In Denver, officials encouraged residents and city staff members to use exclusion techniques on coyotes, but most important was the advice for humans to change their own behaviour."*[32]

The undiscussed problem is that with our own population growth, we are turning rural landscapes into a vast economically and ecologically unsustainable suburbia. Negative wolf–encounters should be taken as symptoms of an "unhealthy" environmental condition driven by mankind. Wolf-hazing is not a panacea. It should really be considered a stop-gap measure until humans learn to manage their own behaviour and the associated destruction of

Wolves in Kibbutz Ein Gedi, Israel. Photo by Avishag Ayalon.

wilderness. *Return of the Wolf* should be read as an invitation to rediscover that green fire known only to the wolf and the mountain that Tony Bennett and Aldo Leopold have written about. It is an essential invitation if we are to meet our obligation to save "Half-Earth" for future generations.

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