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In this Issue:

CSEB Bulletin SCBE

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Front Cover: Freshwater pond at Annapolis Royal, NS, that acts as the sewage tertiary treatment pond just before discharge into the Annapolis River. Photo Credit: Peter Wells, CSEB Atlantic member.

Back Cover, Top: Photo of a crew sampling for fish presence using backpack electrofishing for a proposed watercourse road crossing in Nunavut. Photo Credit: Richard Carson, RC BioSolutions Ltd.

Back Cover, Bottom: Fall colours in Kejimkujik National Park, Nova Scotia. Insert: bracket fungus on tree in Kejimkujik NP. Photo Credits: Peter Wells.

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CSEB BULLETIN 2018

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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.

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LE BULLETIN de la SCBE 2018

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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
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The views expressed herein are the writer's of the articles and are not necessarily endorsed by CSEB, which welcomes a broad range of viewpoints. To submit a piece for consideration, email newslettereditor@cseb-scbe.org.

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.

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NATIONAL News

PRESIDENT'S Report

By Curt Schroeder, CSEB President

This summer I made a road trip to Tuktoyaktuk. Yes, a road trip. The Dempster Highway has been extended from Inuvik to Tuktoyaktuk (about 130 km). The Governor General Julie Payette officially opened the highway in November of 2017. Having worked around Tuk many years ago for Imperial Oil during the winter months, I thought a summer visit would give me an opportunity see this part of Canada in a different light.

The road trip from Regina takes you through prairie, parkland, boreal forest, and finally tundra landscapes and through several mountain passes. The Alaska and Klondike Highways are paved, and the Dempster Highway looks like any grid road in Saskatchewan. No wonder I shared the road with motorcycles and bicycles. I even had to share the road at times with Bison, Stone Sheep, Black Bear, and Caribou. As a biologist, I had to wonder what impacts roads have on certain wildlife and potential for conflict. I did get some good photos, though. Interestingly, when I traveled this route, all fire hazard signs indicated little or no fire hazard. This was early July. That certainly changed quickly as July progressed into August, but by then, I was nowhere near the forest fires that engulfed northern B.C. Strangely, I found Tuk to be the warmest part of my trip, high's of 24 °C with little cooling at "night". The hamlet's website indicated the average temperature in July was 10 °C. I did get to see Beluga whales feeding a short distance off the Tuk coast.

I recommend the trip to anyone who wants to experience our northern landscapes and learn how they shape our economy and human settlement. Here is a "dead-end" sign to greet you at the end of the road in Tuk (Figure 1). You can now drive to three oceans in Canada on public roads.

Figure 1. End of the road sign in Tuktoyaktuk.

SCIENCE TIDBITS

Submitted by John Retallack, CSEB Alberta Member

This issue of Science or "Science" is a bit more eclectic than the last one. But like the last issue and future ones, there is a least a kernel of environmental science in each story.

Megapropodiphora arnoldi

Arnold Schwarzenegger has had a species of fly named after him – *Megapropodiphora arnoldi*. While the fly, from the Brazilian Amazon, does have over-sized legs and body proportions (hence the reference to the Terminator), it is the smallest known fly, with a total body length of only 0.395 mm (about the size of the period at the end of this sentence).

Canada Has a Claim on Part of Australia

According to recent work out of Curtin University (in Perth, WA), an area around Georgetown, Queensland (southern part of that sharp spike of northern Australia that pokes up to Papua/New Guinea) was originally part of what became North America, notably Canada. In simple terms, two components, the Georgetown Inlier and Laurentia, were previously attached until about 1.6 billion years ago when the pieces separated. Laurentia headed north but the Georgetown block held on to some pieces of Laurentia and eventually collided with northern Australia, leaving part of what is now Canada firmly attached in northern Australia.

I think you will all agree that we want our land back, or at least free annual trips to visit! If it's good enough for Trudeau, it should be the same for us! Please write your local MPs in Canada and Australia to support this initiative.

Science Nomenclature Appropriation (SNA)

SNAs tend to be co-opted by sloppy professionals in other disciplines (science or otherwise) who are too lazy to think up their own terms or find the terms so juicy that can't help but misuse them. A couple of examples:

> **Organic**: (e.g., as used in chemistry) — the structure, properties, composition, reactions, and preparation of carbon-containing compounds – the key words here are carbon-containing…i.e., if the substance does not contain carbon it is NOT organic! Organic chicken – yes of course it is! Organic vegetables – again carbon tends to be the building block of most life forms!
>
> But did you know you can now buy bottled water labeled "organic and gluten/GMO free". Obviously, producers and advertisers want to make their products as sexy and desirable as possible. But to call water "organic" is the ultimate SNA insult! Water, the universal solvent, is, after all, H_2O. Do you see any "C" in that simplest of formulas. No, then it is not organic (unless it is carbonated)! To be fair though, there certainly are parts of the world where water-in-the-raw may well contain substantial quantities of organic material but that is definitely NOT a good thing, and I would not recommend you drink it.
>
> And BTW, water is unlikely to ever see gluten or GMOs unless it is used to produce whiskey or beer.

Ecosystem – the term was first proposed in the early 20th Century by Arthur Tansley and refined by his contemporary G.E. Hutchinson (a Limnologist by the way) and others. It was developed to describe "a community of living organisms in conjunction with the non-living components of their environment (things like air, water and mineral soil), interacting as a system"

Move forward about 80 years and the new "general use" definition of the term ecosystem (i.e., fakey non-scientific use) is for "a complex network or interconnected system" – or in simple terms a bunch of people and their computers doing what they are supposed to do – WORK!

Sorry Fish, But We are Higher on the Food Chain!

Eating fish and other seafood has been shown by researchers to slow down cognitive decline. Diets containing plenty of seafood are linked with a lower risk of dementia and reduced chances of chronic heart disease. Recent studies have shown adults with the highest intakes of fish were 20% less likely to develop Alzheimer's disease when compared with those who consumed the lowest levels or no fish.

Recent French research of adults 65 or older, who weren't genetically predisposed to Alzheimer's disease and who ate fish once a week, were 35 per cent less likely to get Alzheimer's disease and 40 per cent less likely to get any form of dementia during the duration of the study.

Docosahexanoic acid or DHA (one of the omega-3 fats in fish) is known to have an important role in keeping our brain healthy and is considered to be a crucial nutrient for reducing the risk of dementia. Many other nutrients that are found in fish are also important for a healthy brain. For example, pantothenic acid (a B vitamin that supports normal mental performance) is found in fish such as anchovies, crab, lobster, salmon, and rainbow trout.

With regards to heart health, omega-3 fats such as those found in fish also help with maintaining lower levels of triglycerides and reduce blood pressure.

So my selective assessment of these results says pizza would be considered as a health food as long as I include anchovies as a topping.

Mac and Cheese – Les Suisses, nous l'avons invente

Those darned Swiss…yes, those people that recently banned boiling lobsters in favour of electrocution or "stunning"…may be able to lay claim to inventing the Mac & Cheese! While this is gastronomic anthropology, it still involved considerable research to track the evolution of the dish the Americans thought was theirs.

Popular in the Alps region of Switzerland, Älplermagronen (Alpine herder's macaroni) involves elbow macaroni usually finished with Gruyère from western Switzerland. Local variations abound throughout the area.

The International Pasta Organization attributes the word 'macaroni' to the Greeks who set up shop in the area of modern day Naples about a few thousand years ago, and appropriated a local barley flour pasta.

Considerable debate has ensued over the past centuries regarding evolution of macaroni, but the first published record of tubular pasta was in the 15th century, in what is today Ticino (the part of Switzerland just above Italy). While later Italian versions included cheese, they tended to include odd flavour combos like rosewater, cinnamon, and sugar. Swiss chefs refined macaroni further, and the world's first commercial production of macaroni, as we know it today (short elbows), was in Switzerland in 1872. Since the Swiss were (are) pretty good in the cheese department, the marriage of macaroni and Swiss cheese (Emmental, Gruyère, or others) was inevitable.

If you were like me, while attending graduate school at U of A, I survived on KD. But I would challenge you to give real Mac & Cheese (Swiss-style) a try, and you might wonder what Mr. Kraft was thinking.

Rediscovering Mayan Ruins Using High Tech

As we all know, Dr. Evil always wanted to have his own school of sharks mounted with "frickin laser beams" but they are more useful if you mount them on planes or satellites and shine them at the earth's surface.

LIDAR ('light detection and ranging') evolved as an extension of the development of lasers. It became better known to the public during the moon exploration days of the early 1970s when astronauts used an earlier version of the "laser altimeter" to map the surface of the moon.

Using this technology, researchers have recently found tens of thousands of previously unknown Mayan ruins in Guatemala. LIDAR enables researchers to essentially cut through the jungles and display a clear and detailed 3D version of the land and features beneath the canopy that has been hidden by the dense vegetation.

The use of LIDAR in archaeology seems to be a relatively recent application, but deployment in heavily forested areas like those found in Central American jungles has indicated occupancy and population levels much greater than previously thought.

***If you want a great trilogy of books to get a better appreciation of colonization of North America after the Bering Land Bridge formed (lots of focus on Central America), I would strongly suggest reading: Felipe Fernandez Armesto "*1492 – The Year Our World Began*"; Charles C. Mann "*1491 – New Revelations of the Americas*"; and Charles C. Mann again with "*1493 - Uncovering the New World Columbus Created*". They are a bit heavy but, along with some great insight about the development of the Americas, you get to see how archaeologists fight with each other…nasty lot those archaeologists.

Earth is Still a Big Place!

This is just a reminder that Earth is a big place, and there are parts of the planet that, despite technological advances, we still know very little about.

Using images from the American Landsat spacecraft, scientists detected signs of penguins (i.e., penguin guano) on the Danger Islands area in the northerly Antarctic Peninsula. Those initial photos turned out to be one of the largest colonies of Adelie Penguins ever found. Ground surveys were begun in late 2015 and have confirmed a population of more than 1.5 million birds.

This colony is especially important since their ongoing presence seems to be contrary to declines in Adelie penguin colonies elsewhere. Luckily, these new nesting colonies are encompassed in an area being proposed as a marine protected area.

REGIONAL News

BRITISH COLUMBIA News

Submitted by Loys Maingon, CSEB BC Director

"Triage" by Rule of Law and Common Sense Scientific Obligations

Why should we accept an under-performing environment, when governments tremble at under-performing economies that ultimately depend on the state of the environment?

BC experienced a summer marked by the worst fire season on record.[1] Smoke and ash blanketed parts of the country, just as scientific reports continued to mount that climate change is changing ecosystems irreversibly.[2] While there is much talk about the new extremes being "the new normal," there is also an increasing realization that "normal" is a misleading term, because there is nothing normal about a deregulated environment characterized by extreme events of expanding magnitude.[3] When the environmental framework goes, so do the ideological and economic assumptions that have until now sustained our interpretation of "normality."

We are now in a world in which the reality of a global mass extinction event, without precedent for the last 65 million years, currently threatens more than 26,000 species. Economic considerations now obscenely determine the "triage" between what species may be selected for conservation and what is willingly driven to extinction.[4] While some will say that conservation triage is a "painful question," they do so without questioning the economic assumptions that drive the current extinction. The economy is a choice consumers and electors make. It is not a given. Thus, while in a recent article in *Science*,Warren Cornwall correctly attributes the demise of smaller mountain caribou herds such as the Kootenay herd and the Selkirk herd[5] to logging and oil and gas development, he tacitly makes the false logical assumption that this is inevitable, because as he innocently and disconcertingly implies, extinction comes when "*humans move in*":

> *Canada's Woodland caribou are a symbol of Canadian culture and a keystone for many First Nation peoples. But when humans move in, things don't go well for the animals. Forests cleared for logging, drilling, mining, or roads draw deer and moose that feed on the brush that grows back. The prey, in turn, attracts wolves and mountain lions. Caribou become collateral damage.*[6]

Contrary to this logical cultural semantic blunder, in the Kootenays humans did move "back-in" at least 6,000 years ago after the last Ice Age. Things went relatively well for both humans and most of their genetic relatives until about1850 when North America experienced the first big game crisis that gave rise to the first conservation movement, and things definitely worsened after 1945, when the area was subjected to industrial-scale resource extraction for the well-being of the global market and endless needs. Since then, things have not gone so well for plants, animals, or the original First Nations neighbours, who incidentally also happen to be very human. In other words, before we introduced a consumer economy of endless needs, for thousands of years circular economies maintained relatively high biodiversity values in a sustainable environment.

The rarely-asked question is whether the unsustainable economic system that currently drives the ongoing mass extinction should also continue to be the unquestioned framework within which its implacable logic acts as plaintiff, judge and executioner of this planet's species. Sometimes, a spectacular logical legal luddite monkey wrench is thrown into the works to help us all question what politicians tell us is the unquestionable "norm", or "national interest." If nothing else, at a time of a growing loss of cultural sophistication, recent events serve to remind us of the value of Reason, and of the sophistication of our Western cultural heritage rooted in the principles of rule of law and science. Our long Western legal and scientific traditions serve us well when they are respected and applied as they are intended to be, as demonstrated in the recent Trans Mountain decision of the Federal Court of Appeal.[7]

Of note in this regard is the resignation of Nicolas Hulot, the French minister of Ecological Transition and Sustainability. He handed in his resignation at about the same time as the *Trans Mountain* decision and it reflects the same much-needed logical integrity.[8] Hulot's resignation expressed his frustration at a similar global betrayal of trust by the liberal-minded governments he belonged to. In his view the Macron government claims to uphold environmental priorities, but in fact continues to promote an economic agenda that perpetuates a status quo adverse to the planet's environmental interests. His resignation simply expressed that at a time when scientists point out that we are moving into a hothouse climatic tipping point, and that we are experiencing the early beginnings of an unprecedented global biodiversity collapse, his role was simply that of a patsy to make a government bent on maintaining the status quo of a failed economic model seem respectable. It comes as no surprise that in Toronto, *The Globe and Mail* immediately carried a special editorial condemning Hulot's resignation, as "climate defeatism",[9] on very false grounds. Contrary to fact, *The Globe and Mail* claims that he quit because France failed to meet climate targets —see the interview in *Le Monde*—speciously, it also claims that bee populations are recovering, contrary to research and insect collapse data, and it goes on to paint a very rosy picture of tree planting in Pakistan, and the claimed 15% global conservation areas as great successes, when the need is 50%. And the list goes on.

Hulot was not expressing "climate defeatism," but an actual need to stop posturing and renew a public engagement against the unsustainable status quo which is structurally part of current government constraints. The public question is not how we transition within the current failed status quo at some nebulous future point, but how we shift into a new economy and adapt to an evolving deteriorating situation, now. Hulot stands as one of the few politicians actually honest enough to publicly admit to

the unsustainability of the illusion of "the new normal" in a way consistent with climate science, rather than market economics.

The summer of 2018 will undoubtedly be remembered as an important turning point in the province's, and Canada's, environmental history. BC drew world attention in several ways, which the casual observer may think are independent of one another, but which, in fact, are closely related to one another. The salient points were, in chronological order, the release of Mark Haddock's report on professional reliance,[10] the crisis in the health and viability of J-pod orcas,[11] and the Trans Mountain decision.[12] All three events are products of the general mismanagement of the environment by a succession of governments who espoused the mantra of "deregulation" and prioritized short-term economic growth at the expense of the environment. All three reflect the way in which, despite all the lip-service, the environment continues to be taken for granted as a playground and held as an after-thought by a majority of the electorate.

The Trans-Mountain, or Kinder-Morgan, decision (*Tsleil-Waututh Nation v. Canada [Attorney General])* is possibly a high-water mark for an all-too-often passively accepted practice of corporate and government bullying. It brings back the quaint notions of consequences and accountability. It re-asserts the principle that being in power does not exonerate one from the rule of law and the force of facts inherent in scientific rigour. Merely going through procedural moves does not grant validity. Just as one is obliged not just to consult, but to consult meaningfully, with First Nations, one is also obliged to assess impacts comprehensively, and not set arbitrary limits and exclusions.

One may rig a process in the hope of by-passing legal obligations, but ultimately on closer scrutiny the subterfuge is likely to be outed. Justices Dawson, De Montigny and Woods found that in approving the Trans Mountain pipeline the federal government had violated its own laws and knowingly endorsed the National Energy Board's report which contained serious flaws and illegalities. Much of the judgement goes back to paragraph 125 of *Gitxaala Nation v. Canada*, 2016 FCA 187, [2016] 4 F.C.R. 418. *Gitxaala Nation* overturned the Northern Gateway project on the basis of lack of meaningful consultation. In doing so, it also made determinations concerning approval standards for the NEB process.

Justice Dawson notes that because of the arbitrary restrictions placed by the NEB in the Kinder Morgan consultative process, the report is seriously flawed and does not meet legal (or scientific) standards. It is important to note that Dawson does not impugn the science itself, but the limits that were placed on scientific inquiry by NEB scientific staff acting with political motives that restricted the findings that could be drawn from the process:

> *[201] I respectfully disagree. As this Court noted in Gitxaala at paragraph 125, the Governor in Council is required to consider any deficiency in the report submitted to it. The decision of the Governor in Council is then subject to review by this Court under section 55 of the National Energy Board Act. The Court must be satisfied that the decision of the Governor in Council is lawful, reasonable and constitutionally valid. If the decision of the Governor in Council is based upon a materially flawed report the decision may be set aside on that basis. Put another way, under the legislation the Governor in Council can act only if it has a ""report"" before it; a materially deficient report, such as one that falls short of legislative standards, is not such a report.*

This judgement therefore rejected the decision on the same grounds as *Gitxaala Nation*, for failing to meet its constitutional obligations to consult meaningfully with First Nations. Additionally, it re-affirms the obligation not to unduly restrict the public and scientific understanding of the scope of the project.

By excluding and prohibiting presentations on the potentially adverse impacts of increased tanker traffic, as a logical outcome of the pipeline construction on the marine environment, and thereby overlooking law related to *The Species at Risk Act*, the NEB illegally biased the findings of the report. As Andrew Weaver has pointed out:

> *The Board unjustifiably defined the scope of the project under review not to include project-related tanker traffic. This exclusion permitted the Board to conclude that, notwithstanding its conclusion that the operation of project-related marine vessels is likely to result in significant adverse effects to the Southern resident killer whale, the project was not likely to cause significant adverse environmental effects. The unjustified exclusion of project-related marine shipping from the definition of the project rendered the Board's report impermissibly flawed: the report did not give the Governor in Council the information and assessments it needed in order to properly assess the public interest, including the project's environmental effects—matters it was legally obligated to assess.*[14]

The implications of this judgement set a precedent. The judgement effectively rules that political and economic interests cannot automatically be put ahead of scientific environmental evidence. The key here is "automatically." As history shows, one can always legislate unjust laws. However, this opens the door for free and open discussion of facts not necessarily restricted to narrow definitions, which are essential to the proper functioning of an open society. It opens the door to social and broad environmental implications of a project in time and space. Open discussion goes hand in hand with the free flow of information and inquiry which is the cornerstone of science.

The broad implication of *Tsleil-Waututh Nation v. Canada (Attorney General)*, lies in the logical implication for the future consideration of the climate change impact of fossil fuel projects on the health of the planet and biodiversity. There are already serious legal challenges being mounted against fossil fuel companies for their contribution to climate change.[15] BC is currently drafting legislation related to fossil fuel climate-related harm to the environment in preparation for legal action against Big Oil, much as it did against Big Tobacco. In the case of the Energy East NEB process, the NEB barred presentations and consideration of the impacts of the carbon footprint of the pipeline. In the light of this decision, the question arises: were the draconian limits placed by the NEB on the Energy East process an undue exclusion of all the scientific evidence necessary to make a scientifically-informed objective report?

Again, the answer to this question will lie in the intellectual and economic framework within which decision-makers operate. If politicians can show leadership, and political and economic interests are not given precedence over the environment, then objective science encompassing holistic implications may change how we relate to the planet's health.

Much depends on the role that environmental scientists play. The uncritical acceptance of the flawed NEB report by the government of Canada, unfortunately reflects poorly on the role that at least one

segment of the scientific community played in the NEB process. The biases identified in court reinforce the public perception of environmental scientists in the pocket of corporate interests. In point of fact, the report's failure to cover marine impacts which were a logical part of the environmental assessment goes against the obligations of environmental professionals working in BC. These are listed in the "Stewardship Principles" which are an inherent practical application of the "Code of Conduct," of BC's College of Applied Biology.

The Stewardship Principles clearly lay out a professional biologist's obligations to take a holistic approach, maintain resilience and minimize ecosystem harm:

> *"1. **Take a comprehensive, holistic view.** Ecosystems are considered as a whole, and terrestrial or aquatic ecosystem management is based on a comprehensive view of the ecological systems and their components 2. **Maintain resilient ecosystems**. Ecosystem structure, composition and function are maintained within a range of biological diversity and complexity that enables resilience in the face of the combined incremental effects of environmental change or disturbance. 3. **Minimize harm, improve and enhance**. Harm to the ecosystem is minimized while opportunities are sought to maintain, improve or enhance ecosystem function"* [17]

The NEB report did not uphold any of these three professional obligations. Professionals working for industry or government have an overriding obligation to the public and to objective science. The legal adage "*Silence is approbation*" applies. While discretion is the hallmark of professionalism, silence is not because it can have criminal implications contrary to professional probity. Professionals who remain silent in the preparation of flawed reports promoting illegalities, or who actively participate in the destruction of ecosystems, violate the fundamentals of the Code of Conduct. Professionals have an obligation to raise questions that may not be in the interests of their clients, and to provide as comprehensive and unbiased scientific information as possible.

Tsleil-Waututh Nation v. Canada (Attorney General) is yet another challenge to the practice of "professional reliance" which is effectively a form of de-regulation that has been favoured by resource industries. De-regulation has led to abuses which have resulted in public dissatisfaction.[18] The validity of "professional reliance" still depends on obtaining social licence. Excessive fealty to corporate or government interests loses intellectual independence and, as a result, social licence. *Tsleil-Waututh Nation* poses overriding questions on the integrity of the whole approach, which seems to be primarily focused on the well-being of the market economy rather than on the environment, in spite of the best intentions of professional societies, as noted above in the "Stewardship Principles." *Tsleil-Waututh Nation* re-enforces the need for mechanisms that regulate actual professional obligations to the public. In that respect, this ruling substantiates and re-enforces the findings of the Haddock Report which recommends mechanisms for the re-organization and oversight over self-regulating professions.[19]

It needs to be noted that there is a possible political weakness in the Haddock report. It is not clear that the review was entirely independent since the author was a civil servant prior to his current employment at the University of Victoria, and therefore a member of the British Columbia Government and Service Employees' Union (BCGEU). The BCGEU which lost members to the 2010 cutbacks in the Ministry of Environment with the introduction of the professional reliance model, has been a driving force behind this report.[20] While the Haddock report was tabled in March, it is as yet unclear what future directions these recommendations will take, but what emerges is a realization that the top-down model that governed the profession before 2010 had its own inefficiencies, and one cannot turn the clock back. Given the environmental history of the province's resource management and the current state of the environment, BC's environment and the public interest have not been well served by either model. There is very little difference in outcomes when either government or corporate interests are subsumed to market interests that relegate the interests of the environment to an afterthought.

Ironically, the outcome of decades of mismanagement provides its own form of "triage", at all levels. The law points to the necessity to make serious changes. It is a form of natural selection.

Nothing speaks quite as loudly of the actual quality of BC's marine environment, as the current problems that beset "The Salish Sea", better known to most Canadians as "Georgia Strait," and the fate of its 75 iconic orcas that make up J-pod. It has been common knowledge for decades (since this author took his first university biology class in 1970) that the bio-accumulation of toxicants concentrated in the flesh of members of this pod is akin to the contaminant concentrations found in some of this planet's worst "toxic dumps". The waters that they ply are not just known to be contaminated but are increasingly contaminated and polluted. Despite common knowledge that came in the commonsense messages in those courses I took five decades ago, on the impacts of hard shoring, agricultural drainage, hydro development, septic treatment and industrial waste disposal, these problems have continued to mount. Increased development has gone on unabated, and the magnitude of the problem has grown, as though the risks and problems never existed, with the increased population density and unbridled economic demands.

In BC, we admire the recreational landscape and normally avoid considering the health of its inhabitants. This summer it took the unusual grotesque spectacles of the death of a newborn orca kept afloat by mother and pod for 17 consecutive days,[21] as well as the attempts to rescue an emaciated juvenile known as J50, by shooting antibiotics and feeding it fish farm salmon—to bring some public attention to the actual state of the Salish Sea.[22] Ironically the feeding of J50 took place at a time when fish farms are being closed in Washington state, the 'Namgis First Nation is preparing a lawsuit to remove fish farms from Kingcome Inlet, and Alexandra Morton is in court to force the federal government to uphold its own laws.[23]

Minister Wilkinson's reaction to *Tsleil-Waututh Nation* was indeed quite correct when he pointed out that the problem is not just the potential additional tanker traffic, but the thousands of boats that turn the Salish Sea into an acoustic pollution nightmare:

> *"If we are going to recover the southern resident killer whale, we need to take action that will mitigate noise from all of those sources, not simply six or seven tankers coming out of the terminal every week."* [24]

The defense that Wilkinson is using to justify the government support for Kinder Morgan boils down to "*everybody's at it,*" the most mendacious legal defense, which as I pointed out in the

spring 2018 report, depends on the *Ghosh test*.[25] It is in effect a "bankrupt" argument that tacitly admits the unsustainability of the entire project and the underlying economic model. We perpetuate it because everybody is participating in it— and apparently even the leadership does not know any better. The entire way of life that depends on a fossil fuel energy model continues to endanger the province's biodiversity, as it does that of the planet.

In a sense, these events home the point made by Nicolas Hulot—we can't continue with window-dressing, and talk of "transitions" that merely compound our problems. We need real change and action. It is time for a major shift in the economy and the energy that powers it that would at last prioritize the planet's well-being. *Tsleil-Waututh Nation* may be part of our "triage". We need to demand full accounting of the environmental costs of this economy. We can't bear the full costs of an unsustainable economy. This ruling may just provide the catalyst that forces us to re-assess the situation at a time when the United Nations is launching a final last gasp effort to force nations to take the challenge of climate change seriously.[26]

The good news is that some politicians are beginning to acknowledge the bad news. The question is whether enough political leaders will rise to Hulot's standards of political leadership. To quote Secretary-General Guterres:

> *"If we do not change course by 2020, we risk missing the point where we can avoid runaway climate change. Climate change is the defining issue of our time, and we are at a defining moment. Scientists have been telling us for decades. Over and over again, far too many leaders have refused to listen."*

It is time to keep oil in the ground and start a political and economic triage to limit the species triage.

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A Notable Book

While in Jasper, I found a recently published book very well worth mentioning to our readers.

Van Tighem, K. 2017. Our Place. Changing the Nature of Alberta. Rocky Mountain Books Ltd. 402 p.

The author, a previous superintendent of Banff National Park, is a well-known nature writer. This book is a collection of beautifully written essays, some previously published, many new ones. They describe the landscapes and natural history of Alberta, and the various threats to the province's wilderness areas and wildlife, after the many destructive practices of the 20th century brought about by agriculture and energy developments (i.e., oil and gas) and a complicit government. It is a plea for more action to protect and conserve what is left in the province. One wonderful essay describes the many contributions of Andy Russell, an icon in the Canadian conservation movement. This book is surely of interest to CSEB members and their range of contacts in the environmental and conservation movements. One only has to fly over the province to see the massive landscape changes and wish to have seen it in an earlier pre-settlement time. We can never return to that time but collectively, inspired by the writings of authors such as Van Tighem, we (especially members of CSEB) can help protect what is left and educate the next generation as to the immeasurable value of undisturbed wilderness and wildlife in the west.

Peter Wells, CSEB Atlantic Member

ALBERTA News

Submitted by Gary Ash, CSEB Bulletin Editor

Big Fish in St. Albert

If you are looking to catch a really big fish in St. Albert, a city on the NW outskirts of Edmonton, you are probably too late.

An 11-year-old boy, fishing in Lacombe Lake Park in St. Alberta in late August managed to reel in a 7.3 kg (16 pound) Koi (carp) that measured about 76 cm in length.

That opportunity is about to end, though, as Koi are an invasive species, believed to have entered the pond though illegal dumping of someone's aquarium pets into the pond. In hopes of eradicating the invasive species, Alberta Environment and Parks and the City of St. Albert are completing a chemical treatment of the pond using a product called rotenone to kill the fish in the pond.

"Rotenone is not harmful to humans, pets, wildlife, or vegetation, and breaks down naturally after the application," the city said in a media release. Rotenone is a piscicide derived from the roots of a tropical plant in the Fabaceae family of legumes, and it interferes with cellular respiration.

If successful, the plan is to later re-stock Rainbow Trout in the pond next spring.

Supporting Critical Land and Water Conservation

The province of Alberta is helping conserve 13,000 acres of private land containing vital watersheds, grasslands, and wildlife habitats across the province. The Alberta Land Trust Grant Program approved more than $7 million to support 24 different projects for the 2017-18 grant cycle. The grants protect watersheds and wildlife habitats on private land and help keep ranchlands intact.

Grants will support projects by the Alberta Conservation Association, Ducks Unlimited Canada (DUC), the Legacy Land Trust Society, the Nature Conservancy of Canada, the Southern Alberta Land Trust Society (SALTS), and Western Sky Land Trust.

Quick Facts:

- The Alberta Land Trust Grant Program supports projects that conserve ecologically important areas to prevent habitat fragmentation, maintain biodiversity and preserve native landscapes.
- This is accomplished through legally binding conservation easements that ensure good stewardship of private land and safeguard against most types of development.
- The program was established in 2011, and, to date, more than $55.7 million worth of grants have helped support the conservation of almost 111,000 acres of land in Alberta — the equivalent of approximately 55,500 football fields.
- For 2017-18, nearly 13,000 acres of land across the province will be conserved.

SASKATCHEWAN News

Submitted by Robert Stedwill, CSEB Saskatchewan Director

The Saskatchewan Prairies Acting as a Refuge for Little Brown Bats?

Joe Poissant, an employee with the Nature Conservancy of Canada, discovered in 2017 a number of Little Brown Bats (*Myotis lucifugus*) living in the Old Man on His Back Conservation Area (OMB) in southwestern Saskatchewan — definitely prairie grasslands.

Normally these bats utilize old buildings, tree cavities, and crevices as roosts, very few of which are found in The Old Man on His Back Conservation Area. Poissant believes that the bats had probably migrated from river valleys where trees are plentiful. He was able to locate the bats utilizing recordings of bat calls, with the data downloaded to geographically display their location.

White-nose Syndrome (WNS) has not yet arrived in Saskatchewan, but "understanding where these bats exist before white-nose comes to the area is important for conservation efforts, and to understand how they're moving around on the landscape" Poissant said.

White-nose syndrome is a fungus that attacks the bare skin of bats, causing their body temperature to rise during hibernation. In the process, they use up fat reserves and end up starving before spring arrives.

The OMB could in fact be labeled a refuge for bats, and potentially provide for a stable population in the future, if and when WNS arrives.

Unfortunately, a recent finding in Manitoba may be an omen of things to come.

Saskatchewan CSEB Member Elected to Royal Society of Canada

One of our members here in Saskatchewan has been elected to the Royal Society of Canada for his contributions to science as well as Canadian public life. "**Dr. Peter Leavitt** has advanced our understanding of how climate change and human activities interact to degrade Canada's surface waters. A global pioneer in the field of paleolimnology, Leavitt has investigated how lakes are impacted by global warming, hydrological variability and societal development associated with food production, resource extraction, and urbanization."

A professor in the faculty of Science at the University of Regina, he is the current Canada Research Chair in Environmental Change and Society, Director of the University's Institute of Environmental Change and Society, and recently completed six years as Director of the Canadian Institute of Ecology and Evolution.

He is currently working on a long-term ecological research program in Qu'Appelle Valley, and some of the data is being used to look at how prairie lakes act like carbon sinks.

We look forward to future results of his work! Congratulations Peter on your election to the Royal Society!

MANITOBA News

Submitted by Robert Stedwill, CSEB Member

White Nose Syndrome

For the first time, a fatal infection known as white-nose syndrome (WNS) has been detected in Manitoba bats in March of 2018. The disease was found in Little Brown Bats (*Myotis lucifugus*) in the Lake St. George area, about 200 km north of Winnipeg.

The manager of the University of Winnipeg lab studying bats, Kaleigh Norquay, found the infected bats at an interlake cave at Lake St. George. The cave is typically home to about 10 000 Little Brown Bats.

There are two hibernating bats species in Manitoba, the other being the northern long-eared bat (*Myotis septentrionalis*). It is difficult to determine how many of the bats perished; however, Norquay estimates the number is in the hundreds.

There is a belief that there may be other sites, which to date have gone undetected. White-nose syndrome first emerged in New York state in 2006 and has since caused the deaths of millions of bats across the United States and in six Canadian provinces: New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, and Quebec.

If WNS becomes widespread, there is a feeling that its impact on bats could also have a significant impact on agriculture, as crop devastating insects populations become more prevalent as bat populations decline.

Humans have the potential to spread WNS (not unlike the spread of zebra mussels) if care is not taken to ensure that WNS spores are not inadvertently transported to others sites in the province, or to other provinces in Canada, particularly farther west where WNS is still not evident.

CSEB VOLUNTEERS NEEDED

Website Assistant:

CSEB requires a volunteer to assist our Webmaster Brian Free with managing the CSEB Website. You should be familiar with using WordPress for website management, and able to gather relevant material for posting on the site. It would also be useful to have experience with MailChimp for sending out webinar and other notices, but training can be provided. For more information, please contact Brian Free at bfree.x@shaw.ca

For more information, contact President Curt Schroeder at schroederc@saskpolytech.ca.

ONTARIO News

Submitted by Barbara Hard. CSEB Ontario Director

100 Years of Point Pelee National Park

This year Point Pelee is celebrating 100 years as a National Park. The park is located in the Carolinian region in southwestern Ontario on a peninsula that extends into Lake Erie, and it is the southern most point of mainland Canada. Point Pelee is the smallest national park, covering an area of 15.5 km^2, and it was established in 1918 (Parks Canada 2017).

The park consists of 72% wetland habitat (cattail marsh), 21 % forest habitat, and 4% coastal savannah (Lake Erie Sand Spit Savannah) (SARA 2016). The wetland was designated as wetland of international significance (RAMSAR site) in 1987.

Forest habitat includes species like Southern hackberry (C*eltis laevigata*), American sycamore (*Platanus occidentalis*), red mulberry (*Morus rubra*), black walnut (*Juglans nigra*), Eastern red cedar (*Juniperus virginiana*), common hoptree (*Ptelea trifoliata*), and blue ash (*Fraxinus quadrangulata)*. The mixed wood in the northern portion includes sugar maple (*Acer saccharum*), Eastern white pine (*Pinus strobus*), and American basswood (*Tilia americana*).

The park is internationally recognized as an important bird area for spring and fall migrations, and 390 bird species, including 43 warblers, have been recorded. It also is an important site for monarch migration stop-over between August and October.

Point Pelee has the highest biodiversity of any Canadian national park, with more than 60 Species at Risk known to occur in the park, including 30 bird species, 4 mammals, 10 reptiles, and 14 vascular plants.

Southern flying squirrel (*Glaucomys volans*) was successfully re-introduced to the park in 1993 and 1994 from a population at Long Point, starting with 99 individuals, with a target of 600 individuals (Parks Canada 2010). The individual count for 2018 is underway at the present time (Parks Canada, personal communication).

Of the 700 flowering and non-flowering plants at the park, species of interest include Eastern prickly pear cactus (*Opuntia humifusa*), tulip tree (*Liriodendron tulipifera*), Kentucky coffee-tree (*Gymnocladus dioicus*), and swamp rose-mallow (*Hibiscus moscheutos*).

Current plant community conservation efforts are focusing on the re-introduction and expansion of savannah habitat, including tall grass savannah and red cedar savannah using mechanical means, herbicide application, prescribed fires, and seed collection (Parks Canada 2018).

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ATLANTIC News

Submitted by Peter Wells, CSEB Atlantic Member

The big news here in Atlantic Canada is the Northern Pulp pulp mill near Pictou and the public opposition to a pipeline for its treated effluent, planning to go straight into the Northumberland Strait (no pun intended). There is about to be a public review of a report prepared by the mill, perhaps leading to a formal Environmental Assessment.

Links from Northern Pulp - the Northern Pulp Effluent Treatment Facility website https://sites.google.com/dillon.ca/northernpulpetf/home (all information kindly sent from a colleague in Ecojustice, Halifax office):

1. Preliminary Receiving Water Study for Northern Pulp Effluent Treatment Plant Replacement, Pictou Harbour, Nova Scotia, Final Report: https://drive.google.com/file/d/1H1HltUnh9Oem_KpPHwxmye7z5mfJP5_W/view
2. Recommended Approach – Replacement Effluent Treatment Facility Design, with interactive map: https://sites.google.com/dillon.ca/northernpulpetf/effluent-treatment-facility
3. Technical Description of the Recommended Effluent Treatment Facility: https://sites.google.com/dillon.ca/northernpulpetf/effluent-treatment-facility/technical-description
4. Frequently Asked Questions – including information on Northern Pulp's position as to why a closed-loop effluent treatment system is not possible in connection with the Pictou Mill: https://sites.google.com/dillon.ca/northernpulpetf/frequently-asked-questions

Links from Friends of the Northumberland Strait:

Friends of the Northumberland Strait website: https://www.friendsofthenorthumberlandstrait.ca/. It contains many expressions of community members' concerns, some of which are summarized in a three-page piece entitled *What you should know about Northern Pulp's proposed new treatment facility* (docs.wixstatic.com/ugd/b61814_40a0f43682ee45d99af01fb432d910fd.pdf) and two-page document entitled *50 Years of Pulp Effluent (*https://docs.wixstatic.com/ugd/b61814_ab61cca668f1432f890d2d0a7715a554.pdf*)*.

TERRITORIES News

Submitted by Sharleen Hamm, RPBio, CSEB Territories Director.

Having spent most of the last 15 years working in the Territories, I found myself lucky enough to be out on the land largely facilitated by air travel; if it flies in the North, I've probably been on it. Having said that, my terrestrial travels in NWT have been limited, for the most part, to Yellowknife city limits. This year, I decided to change that and joined a group of approximately 35 other cyclists, a bunch of support volunteers, and my mom to partake in the YK2HR[1], a three-day supported road ride from Yellowknife to Hay River in late July. It was a spectacular journey through the Taiga Plains, from the Great Slave Plain high boreal ecoregion, across the Mackenzie River, and through the Great Slave Lowland mid boreal ecoregion. The weather was hot, the sky clear, and surprising smoke-free, and of course, it was buggy; a steady pace of 25 km/h kept the horseflies, or 'bulldogs', from landing long enough to bite, while it was rumoured that they could be outrun altogether at 30 km/h (a pace I failed to reach!).

North of the Mackenzie River, the highway traverses the Mackenzie Bison Sanctuary, where I encountered my first wood bison, *Bison bison athabascae*. Wood bison are the largest land mammal in North America, with males reaching up to 3.8 m in length and more than 1.8 m in height; good thing they are not too bothered by cyclists!

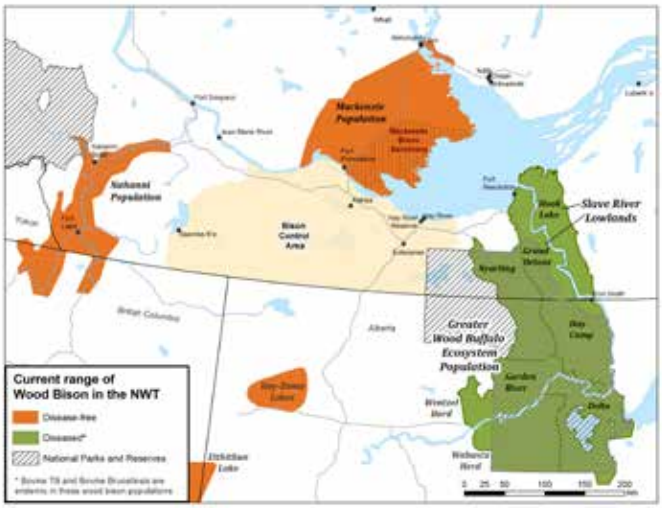
Wood Bison *in Wood Bison Sanctuary, NWT. — Photographed one-handed, on a bike, riding uphill, into a head wind. Photo Credit: S. Hamm, 2018.*

NWT is home to three populations of wood bison: the Mackenzie population in the North Slave region; the Nahanni population in the Dehcho region; and the greater Wood Buffalo National Park population in the South Slave/Tlicho Region. With a range originally extending throughout much of the boreal forest of BC, Alberta, Saskatchewan, NWT, Yukon, and Alaska, wood bison were hunted to near extinction in the 19th century. With the population in decline, Wood Bison National Park (WBNP) was established to save the bison from extinction and protect habitat. In the 1920s, plains bison were transferred to WBNP. Unfortunately, along with the plains bison came bovine brucellosis and tuberculosis, exotic diseases that affect productivity and survival; disease and interbreeding with plains bison resulted in what was feared to be the end of wood bison altogether. However, in the 1950s, a herd of disease-free pure wood bison were found in WBNP; 18 of these wood bison were released north of the Mackenzie River in the Mackenzie Bison Sanctuary, founding the Mackenzie population of wood bison. This population, along with the Nahanni population, remains free of exotic diseases. To mitigate risk posed by these exotic diseases to the Nahanni and Mackenzie populations, a Bison Control Area program is in place on the south side of the Mackenzie River: all bison encountered in the control area are considered to be disease carriers and so are removed from the population.

The Mackenzie population of wood bison stabilized at about 1,500 animals in early 2012, yet was devastated by an outbreak of anthrax, a naturally occurring endemic disease, later that year resulting in a 50% population decline[3]. While the population is recovering from the outbreak, harvesting is currently not permitted within the Mackenzie range.

In NWT and federally under SARA, wood bison are listed as Threatened, while COSEWIC has assessed them as a species of Special Concern. A national recovery strategy under SARA was released in August 2018 and can be accessed on the SARA Registry.[4] Federal short-term conservation objectives for wood bison on Crown land are to maintain the exotic disease-free status, population size, and range within the original wood bison range in Canada, while the long-term objective is to ensure the existence of at least five populations of 1,000 animals that are disease-free, genetically diverse, connected, self-sustaining, and free ranging within the original wood bison range in Canada. Action plans are forthcoming by 2022[5].

Territorially, a Draft Proposed Recovery Strategy for Wood Bison in the NWT[6] has been developed under the *Species at Risk (NWT) Act*, and will guide overall conservation in NWT outside Crown lands. Specific recovery actions will be captured in population specific management plans: a population specific management plan has been developed for the Mackenzie population[7], recently released in August 2018, while management plans are under development for the other NWT populations. The Proposed Draft Recovery Strategy is currently out for public comment until **October 31, 2018**. Access the document and provide your input here: https://www.nwtspeciesatrisk.ca/news/draft-proposed-recovery-strategy-wood-bison-nwt.



Wood Bison Range. Source: Environment and Natural Resources, Government of the Northwest Territories.

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Territories Update

Submitted by Anne Wilson, CSEB Member

2018 will be remembered in the NWT as the summer that didn't happen. The Territory received high amounts of rainfall, with several records broken, and experienced cooler temperatures than usual. This meant the fire season was the quietest in a long time – only 13,220 ha affected this year, with a total number of 55 fires, compared to the 25 year average of 402,976 ha burned and 172 fires, thanks to more rain and less lightening.

It may be some consolation to the NWT that the southern NWT and much of Nunavut are forecast to have above normal temperatures this fall, with near-normal precipitation for most of both territories. Unfortunately for the NWT, the Historical Percent Correct for their prediction is zero, and the NU percent is only 40-50! This is borne out by the fact that Yellowknife has already broken cold records for three days in the first half of September.

Activity on the development front continues to be busy in both territories. Waste management is the leading issue for the mines – many are located in remote and pristine environments, and have to dispose of tailings and waste rock, manage camp wastes and hazardous materials, and ensure the receiving environments are not impacted to unacceptable degrees.

In the NWT:

- Miramar Northern Mining Ltd.'s Con mine has just gone through hearings for its water licence. The mining started over 80 years ago, and the closure and remediation activities have dealt with a lot of legacy wastes. However, the effluent flow path through contaminated ponds means that treated wastewater from the mine leaves their lease and becomes significantly altered for the worse by the time it reaches Great Slave Lake. Not an easy situation to regulate!
- The Giant mine is proceeding with its application for a water licence, and work is ongoing to review the options for remediation. There is a lot of public interest in this site, and the Giant Mine Oversight Board website provides some information on the clean-up project at https://www.gmob.ca/remediation/#giantmine
- This summer there were public hearings for the Gahcho Kue Diamond Mine's water licence amendment, to increase the waste rock mined, and to modify water management and discharge criteria.
- The Diavik Diamond Mine has put a proposal in front of the Wek'eezhii Land and Water Board to dispose of tailings in mined-out pits, which will eventually be reconnected to Lac de Gras. Diavik has started mining the A21 pipe, which is fully surrounded by the lake, and is expected to have a four-year mine life.

Diavik Diamond Mine A21 Pipe Mine. Photo Credit: Photo from a Facebook video posted by Diavik Diamond Mines Inc.

In Nunavut, there are a number of active projects:

- In October, there will be Nunavut Water Board public hearings for the TMAC Hope Bay Gold project, which is located south of their operating Doris Project.
- The Sabina Gold Project has been through water licence hearings this summer, and is waiting on the licence approval by the federal Minister.
- Baffinland's Mary River project has submitted a Phase 2 FEIS submission, which covers development of a rail line and increased ore production; this is with the Nunavut Impact Review Board for conformity review.
- Agnico Eagle Mines' Meadowbank Gold Mine has applied to dispose of tailings into mined-out pits. These pits will be flooded eventually, and reconnected to lakes, so this proposal is being closely examined by the Nunavut Water Board. They are gearing up for mid-2019 production at both the Amaruq expansion (near the Meadowbank mine) and at their Meliadine Mine.
- The Meliadine Gold Project underwent public hearings in mid-September for their application to discharge saline groundwater to Itivia Bay near Rankin Inlet.

Closing:

If you are connected to activities in the Yukon, Northwest Territories, or Nunavut, doing work north of 60 that you would like to highlight in the CSEB Bulletin, or running some seminars or other training opportunities, please let us know. The CSEB provides a valuable networking and communication forum, and a voice for biologists if there are any issues to be raised. There is also the option of instigating other CSEB activities – both of the fun and/or of the educational variety – with colleagues in the North. Please email your thoughts to Anne Wilson at anne.wilson2@canada.ca or Sharleen Hamm at sharleen@sharleenhamm.com.

CLIMATE CHANGE IN THE MARITIMES – CONCERNS AND CHALLENGES

Editorial by Peter Wells, Dalhousie University, Editor, PNSIS and D.H. Richardson, Saint Mary's University, Assoc. Editor, PNSIS.
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Global climate change is accepted now as a fact by the scientific community, as well as by other enlightened groups in society. The evidence is overwhelming. Five assessments from the IPCC (the Intergovernmental Panel on Climate Change) indicate a rapidly warming planet, outside of historic limits, that is driven by the increased concentration of CO_2 in the atmosphere now over 400 ppm. This issue of the PNSIS has two articles on the topic, one by Charles Schafer, formerly at the Bedford Institute of Oceanography, and a second by David Garbary of St. Francis Xavier University. The first paper discusses historical warmer climatic periods that the earth has endured; the second describes a practical way of teaching about climate change. The reader is implored to read these articles carefully as they present different perspectives and draw attention to this pivotal environmental and social challenge of our time and one with great consequences for the Maritimes.

Society faces many climate-change related events which are becoming well documented. They include: sea-level rise and the increased height of storm surges; more fierce storms (such as the one just experienced in January 2018, with wind gusts of over 200 km/h); increased coastal erosion, aggravated by the storms and higher sea levels; increased water temperatures in the North Atlantic, both at surface and in places, such as the Gulf of Maine, at depth; acidification of the ocean, with pH dropping by 0.1 units (30%); changing distribution of various species (invertebrates, fish, birds, marine mammals), linked to changing water temperatures and food availability; and the prospect of hotter and drier summers on land, with implications (positive and negative) for agriculture and forestry.

The causes and the impact of climate change are highly complex. Indeed, understanding it is the number one problem of ecology, environmental science, atmospheric science, and oceanography. It also involves a consideration of both complexity theory and Gaia theory. The latter considers the earth to be a self-regulating system in a state of homeostasis, a global example of symbiosis (see book review of *One Plus One Equals One* in this issue of the Proceeding, and articles and books by Lynn Margulis, James Lovelock, and Stephen Lewis).

For Atlantic science, the challenges posed by global climate change are many and surviving them requires science, adaptation, mitigation, and public education. Continued research is needed on the possible impacts of changing temperature regimes and ocean acidification on species of economic importance, e.g., fish species such a cod, haddock and lobsters. Research is also required to understand the physical and chemical processes that drive climate change and affect the seas of the NW Atlantic, and the adjacent land. This should involve obtaining long-term data sets by monitoring and measuring key variables associated with the weather, climate, and the water column. Research should also continue on approaches for mitigation and adaptation. What can be done or should be done? Can we reduce CO_2 emissions and eliminate the use of coal? And what should not be done? It can be argued that armouring shorelines or constructing houses and roads close to cliff tops and on top of barrier beaches should no longer be allowed. There is an urgent need for more public and political education on this issue, but it should be solution-based, not apocalyptic. Education should focus on what we, as individuals and collectively as a society, can do to reduce our carbon footprint (for example, for related marine conservation initiatives, see www.bridge.ocean.org).

Rapid climate change is upon us; the time for effective action is now to ensure a liveable planet for future generations.

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CSEB VOLUNTEERS NEEDED

Social Media Coordinator:

CSEB requires a volunteer to manage our social media (e.g., Facebook, Twitter, etc.). The volunteer should be familiar with social media, have a good command of the English language, and willing to spend the time to post new items, keep the social media current, and communicate with our members.

If interested, please contact President Curt Schroeder at schroederc@saskpolytech.ca.

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CSEB Requires Regional Directors for the following Regions:

Alberta (2), Saskatchewan (1), Manitoba (2), Ontario (1), Quebec (2), Atlantic (1), and Territories (1).

Duties involve promoting CSEB in the Region, participating in monthly Board conference calls (1 hour/mo), and providing regional news for the CSEB Bulletin four times per year.

For more information, contact President Curt Schroeder at schroederc@saskpolytech.ca.

Book Review

By Bob Gainer, CSEB Alberta Member

The Death and Life of the Great Lakes

By Dan Egan, 2017 Norton and Co., New York.

This is a story of serial well-meaning environmental mismanagement, how bad the decisions were, and all with the arm-chair quarterbacking of several hundred years of hindsight and billions of dollars of management experience. Aldo Leopold and Rachel Carson are quoted frequently. This book was a finalist for the 2017 Pulitzer Prize and is very readable, probably because the author is a journalist, a fisherman, and father of a son who is learning to fish. It is written at what would be labelled a Grade 10 level of journalism, very gripping but 300 pages of smaller type and full pages made it a book I was forced to put down several times.

The Great Lakes is the world's largest freshwater system, roughly 20% of what is usable for humans, five giant inland rivers flowing from each Lake, like buckets pouring into the next, with Niagara Falls a one-way valve on the flow of aquatic life. As a fur-trading transportation network, it saved slogging through the bush for thousands of miles into the interior of the continent. The French started construction on the Lachine canal, which was finished by the English about the same time as the Americans' construction of the Erie canal in 1825, followed by the Welland canal, several more add ons, the Chicago Sanitary and Ship canal, and finally in 1959, the grand daddy of them all—the Great Lakes Seaway.

Before the Seaway removed the Niagara Falls one-way valve, the Lakes were an incredible fishery, then the lamprey and the river herring got upstream plus a relatively modest amount of pollution and by 1965 it was a disaster. A poison was found for the lamprey, fishery biologists knew that pacific salmon loved herring, they were introduced, and the Lakes were the greatest sport fishing hole in the world for 30 years. Then zebra and quagga mussels, plus over 180 other invasive species, and agricultural pollution killed the salmon fishery.

In 1972, the US *Clean Water Act* was introduced to take away industry's right to pollute. Its goal was swimmable and fishable water by 1983 and zero pollution by 1985; approximately half of that has been achieved today. It allowed citizens to sue the US Environmental Protection Agency to enforce the Act, which is mostly catch up, plus there were loopholes, like allowing the Seaway's traffic to sail from anywhere in the world and dump their ballast of invasive species, and allowing agriculture pollution. Today's management problems are interesting to say the least. Here are a few examples.

Canada would like the Chicago Sanitary and Ship Canal closed because of Asian Carp getting in and mussels getting out via the Mississippi River system. Chicago would have to replace it with sewage treatment and a transportation network. The Americans would like the Seaway closed. For all the tanker traffic, which never did amount to very much and is of little value, there is an enormous cost of operation and maintenance, plus there are all these invasive species, water level fluctuations, etc. The Canadians will not consider closing it.

Canadians in Georgian Bay and Lake Superior point to 90% open water in the winter now, as opposed to being 25-30% 50 years ago because of lower water levels. This dark water will absorb heat and increase evaporation that white ice- and snow-covered water would not, an enormous contribution to climate change. They point out that dredging and locks on the interlocking rivers and canals can raise and lower water levels, prompting one cynic to say they want it 15 cm (6") below the end of their docks.

Americans, especially in the reclaimed black swamp near Toledo, are criticized for their fertilizer contamination and are told they need to reduce it by 40%. The farmers say 40% is the amount of corn production in their area that goes to ethanol. Quit putting food in your gas tank and we'll quit using fertilizer.

The 10,000 pound gorilla in our living room about to have a bowel movement, though, is surface and ground freshwater. America is running out of it fast, and all these anti-pipeliners are wasting their political capital on oil. The Aral Sea used to be the 4th largest freshwater lake in the world, now it is 95% gone because of cotton production. In China they have diverted two rivers the size of the Colorado from the south to the north, mostly for Beijing. There are too many examples like this to elaborate.

I found this book to have a profound effect on me. I am an old man now, and in 55 adult years I have been a politician, professional biologist, large animal veterinarian, and agrologist. I was never at the high levels described in this book, but in a way, I identify with all these misguided, well meaning do-gooders and the stupidity of intelligence. That is, the finest and most accomplished members of our society thought they were doing exactly what Aldo and Rachel and I would have expected of them, and what a mess they made of it.

It is very depressing to read how much harm the brightest of us can cause. It all starts with a politician either responding to their constituent needs, or one who is actually visionary; ... the worst. And all politicians want to be visionary. Next, the vision or need goes to the chief administrative officers (everybody hates these invisible, behind-the-scenes, out-of-sight, but by far the most important elements) who finds experts in the field to consult with, PhD's with all the right publications, biologists, engineering firms, construction contractors, operators, etc., .. the best. Mostly it is free enterprise in action but sometimes a government will do it. This doesn't seem to matter in the long term; it will be bad either way. Jack Schultz, a fur trader 150 years ago in southern Alberta, who became rich trading whiskey to the Blackfeet, freely admitted having feelings like this: “It was wrong, all wrong and none realized it better than we when we were dispensing the stuff.”

The reality is that humans always find some way to deal with these issues and survive, from politicians to bird watchers, and even to journalists. Today the pollution is largely under control, there is a potential that GMO introduced species can control the mussels and carp, the native fishery is recovering, and the author is taking his 8-year-old son fishing in Lake Michigan. He didn't say whether they ate the fish or not, but still Aldo and Rachel (and I) feel a little bit better.

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