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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: Monster *iqaluk* (*Salvelinus namaycush*). Ferguson Lake, Kitikmeot Region, Nunavut, November 2020. Photo Credit: M. Buchan.

Back Cover Top: Strathcona biologists with Dan Strickland and students banding Canada Jay (*Perisoreus canadensis*) nestlings. Top Right Insert: Egg from Canada's official national bird "Canada jay". Photos Credit: Loys Maingon, Strathcona Wilderness Institute.

Bottom Left: RC BioSolutions Ltd. biologists setting up a fyke net in a shallow central Alberta lake in November, 2020. The net captured over 10,000 fish in under three hours. Photo Credit: Richard Carson, BC BioSolutions Ltd. Bottom Right: Ice fishing hole and camp at Ferguson Lake, Nunavut. Photo Credit: M. Buchan.

CSEB BULLETIN 2020

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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.

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.
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LE BULLETIN de la SCBE 2020

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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 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 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

The COVID-19 pandemic in Canada and globally cannot be ignored. As of this writing, the end of November 2020, we are entering a second surge of the virus, with governments all across Canada tightening public and private activities to safeguard public health and ultimately the economy. There is already early speculation that when vaccines become widely distributed and the pandemic subsides, our society will not be returning to the status quo. To quote Dr. Theresa Tam, Canada's Chief Public Health Officer, gaps have been exposed in our society that will need to be addressed as we return to a new normal. With the connection between health and economy now exposed, the socio-economic impacts are going to be far-reaching.

We'll certainly have a renewed sense of emergency preparedness, health security, and inclusivity, but also employer/employee relationships, digital literacy, education modalities, and business practices, including the study and practice of environmental biology. The connection between environmental biology and health is an obvious one. As Antonio Guterres, UN Secretary-General remarked, "Everything we do during and after this crisis must be with a strong focus on building more equal, inclusive, and sustainable economies and societies that are more resilient in the face of pandemics, climate change, and the many other global challenges we face." The intersecting challenges of health and healthy environments are increasingly clear, and an opportunity to examine these challenges should not be missed.

Perhaps it's timely that the CSEB examine its role as an organization in response to new emerging priorities and major re-alignments of policies and practices that affect Canadian society and environments:

- What new tensions and trends will develop, affecting environmental practitioners in industry, academia, and government?
- Can we provide a platform for dialogue among members that can support their professional development?
- Should our Bulletin offer a platform to advance dialogue and understanding of the impact of the corona-virus pandemic?
- Are there positive consequences to membership in this change?
- Can we develop new partnerships nationally and internationally that promote a vision of the new global realities?

Plenty of room for conversation!

Do you have an opinion on the subject? If so, please contact me at schroederc@saskpolytech.ca.

SCIENCE TIDBITS

Submitted by John Retallack, CSEB Alberta Member

Mostly Terrestrial!

Flavour, Taste and Smell of Cheese May be Influenced by Music

This one might be at the extreme edge of environmental biology (maybe even over the edge a bit) but, as a result, I may need to change my opinion of hip-hop music.

Wheels of Emmental cheese were exposed to various types of music for 24 hours a day. The music selected for individual cheese wheels included the following:

- A Tribe Called Quest's hip hop track "We Got it From Here",
- Mozart's 'Magic Flute' opera,
- Vril's techno "UV",
- Yellow's ambient "Monolith", or
- Led Zeppelin's rock classic "Stairway to Heaven".

Simple sound waves at low, medium and high frequencies were played to an additional three wheels, while a "control" wheel was not subjected to any sound. The experiment used mini transmitters to conduct the energy of the music into the cheese.

After exposure, a jury of cheese experts then judged the cheeses on the basis of texture, taste, appearance, flavour, and smell. The jury indicated the differences were very clear and the cheese exposed to hip-hop music was judged to be superior. The team will now focus on different types of hip hop music to see if they can refine the results.

Robots Control Bee and Fish Cross-Communication

Hmmmmmm! Call me skeptical but this buzz seems a bit fishy!

The Ecole Polytechnique Federale de Lausanne Biorobotic Laboratory (Frank Bonnet) reported in *Science Robotics* (Volume 4, Issue 28) that they had successfully created "…an unprecedented bridge between two animal communities, enabling them to exchange some of their dynamics." This example of cross-species communication involved equipping groups of honeybees and zebrafish with co-habbing robots (fixed location robots for the bees and swimming robots with the fish) that exhibited representative animal traits (e.g., bee robots vibrated, changed temperature, and were able to create mild air movements whereas the fish robots changed their colours, shapes, and type/direction of movement). The robots with each group of animals in Switzerland and Austria recorded information from its source group (e.g., honeybees) and transmitted that information to the robots working with the other groups of animals (e.g., fish), and vice versa. The robots receiving the information translated it into a form that their species could understand, and recorded and reported behavioural responses.

The authors reported that after about 25 minutes, the two different groups of animals had synchronized their movements, with the fish steadily swimming in a counterclockwise movement while the bees schooled around their robot. As noted by the authors, "The robots acted as if they were negotiators and interpreters in an international conference. Through the various information exchanges, the two groups of animals gradually came to a shared decision."

From the abstract the authors note:

> "Here we show that robots socially integrated into animal groups of honeybees and zebrafish, each one located in a different city, allowing these two species to interact. This interspecific information transfer is demonstrated by collective decisions that emerge between the two autonomous robotic systems and the two animal groups. The robots enable this biohybrid system to function at any distance and operate in water and air with multiple sensorimotor properties across species barriers and ecosystems. These results demonstrate the feasibility of generating and controlling behavioural patterns in biohybrid groups of multiple species. Such interspecies connections between diverse robotic systems and animal species may open the door for new forms of artificial collective intelligence, where the unrivalled perceptual capabilities of the animals and their brains can be used to enhance autonomous decision making, which could find applications in selective "rewiring" of ecosystems."

This is either really scary or reflects some degree of confirmation bias. I even checked the dates on the article to make sure it wasn't early April.

The Buzz On Why Zebras Have Stripes

The study, from the University of Bristol, was published in the journal *PLOS One* last year. The study, carried out in Somerset, England, involved horses, zebras, and horses dressed as zebras.

Dr. Martin How, co-author of the research, noted flies seemed to behave naturally around zebras and horses, until it came to landing and they were close to the test subjects! While horseflies circled or touched all of the animals at similar rates, landing was a different matter, with a lower rate seen for zebras than horses.

When horses were dressed as zebras (black, white, and zebra-striped coats over top the horse's bodies), flies landed on the horses' exposed head at the same rate as without the coat but they touched and landed on the 'zebra' coat far less often than other natural or all-black or all-white garments. The researchers noted, further, that stripes did not act as a long-range deterrent but had an effect only when the flies got up close – possibly because of the flies' low-resolution vision.

FYI, after years in the field in various environments, usually wet, I have developed a purely hate relationship with horseflies…I wonder if there is an opportunity here to help the aquatic and wet-terrestrial enviro-folk by testing whether zebra-like clothing and face paint can have the same effect on humans!

***Update - from Aichi Agricultural Research Center and Kyoto University Graduate School of Agriculture (*PLOS One* October 3, 2019) - Cows painted with zebra-like striping can avoid biting fly attack as well. The zebra-painted cows were found to have over 50 percent fewer biting flies on their bodies than those in control groups.

California Condor Births Mark Soaring Comeback

Last breeding season, California condor chicks numbers 1,000 and 1,001 made their entrance into the world in Zion and Grand Canyon National Parks. Both chicks were born to parents bred in captivity and released into the wild.

The total population of condors in the wild and in captivity is around 500. More than half of those are in the wild.

In 1987, the number of these condors in the wild numbered just 22. The few remaining wild birds were placed into a captive breeding program in 1987 and slowly released back into the wild starting in the early 1990s.

California condors remain classified as critically endangered (IUCN).

Komodo Dragons Have Chain Mail Bones Hidden Under Their Skin

Researchers have discovered that komodo dragons (*Varanus komodoensis*) have a hidden layer of armour that covers their body. Tiny chain mail-like bones, osteoderms, have been observed underneath the scaly skin of these reptiles.

Osteoderms in komodo dragons have been known about for decades but researchers never looked at the morphology of them. Using computerized tomography (CT) scans, the researchers looked at two dead specimens…one an adult and one a two-day old baby.

In the adult, the osteoderms were abundant and appeared in many different shapes. Osteoderms were not present in the baby. Young komodo dragons tend to be arboreal and have limited interaction with other dragons. Once they are large enough, they head to the ground and it is speculated that osteoderms have developed to provide a degree of protection from other dragons.

Ancient 'Mold Pigs' Found Trapped In Amber Don't Fit Into Any Known Animal Group

In September, 2019, paleobiologist and entomologist George Poinar Jr. (Oregon State University) and research colleague Diane Nelson (East Tennessee State University) published an article in *Invertebrate Biology* (September 28, 2019) describing a new animal, *Sialomorpha dominicana* (mold pigs), in fossilized amber from the Dominican Republic.

The animals are microscopic and date to the Tertiary period, about 30 million years ago —100 micrometres long, four pairs of legs, a flexible head, and an exoskeleton that molts as they grow.

All fine and good, discovering a new species is a big deal. But the bigger deal here is that the mold pigs don't seem to fit any known taxonomic groupings. While they resemble tardigrades, they appear to be an entirely new Phylum!

Just FYI, Poinar Jr. and his spouse Roberta Hess may be better known as the paleobiologist and electron microscopist, respectively, who inspired the major plot line from Jurassic Park —that animals can be immaculately preserved in amber.

REGIONAL News

BRITISH COLUMBIA News

Submitted by Loys Maingon, CSEB BC Director

Beyond Reason: *"The World is Not That Simple Anymore"*

"But we do not live in a rational world…"

- Jorgen Randers[1]

The world's oceans have now warmed an average one degree centigrade as the world has warmed between 1.1 and 1.3 degrees centigrade since the end of the 19th century.[2] On average a mere degree may seem like nothing. However, it has huge impacts on the processes that control the global thermostat and regulate the basic biotic processes we depend on. What matters is not what one degree means at a specific site or region, but what one degree means within isotherms. As von Humboldt noted 200 years ago, isotherms determine ecosystem composition and distribution. As scientists at the NOAA and the Australian Bureau of Meteorology report, even customary cooling processes like this year's La Niña can no longer be expected to save the Great Barrier Reef. Changes we have wrought to this planet's ecological processes are altering the ecosystems they create and control. As the Great Barrier Reef Marine Park Authority's Dr. David Wachenfeld succinctly puts it: "The world is not that simple anymore."[3]

As the data roll in, there is an inevitable growing concern that after at least 50 years of climate inaction, the impetus of climate change may have pushed earth systems to a series of tipping points that seem inevitable if the Paris target of a maximum of 1.5°C rise cannot be reached.[4] As we witness increased permafrost melting and rising temperatures in the Arctic[5], concerns are growing that feedbacks may create an irreversible situation. Indeed, a modelling experiment by Randers and Goluke released this month suggests that permafrost melting may be self-sustaining, "even if man-made emissions stop in 2020."[6] While one should bear in mind that, as the authors point out, the model used is simple, the scenarios should give us pause for thought of points-of-no-return given the accumulating evidence, as documented and catalogued by Lenton et al. in 2019.[7] Models are probabilistic scenarios; the question now has to be how to beat the odds, which, as analysts have pointed out, have been severely handicapped by the damage done by the Trump administration's four-year disregard of science and facts. This makes "climate damage" his most lasting legacy,[8] greater yet than the deaths caused by the COVID debacle.

The collapse of predictive simplicity is not just an Australian problem. It is part of a global biotic emergency, which we generate at a very local level and witness daily throughout BC. Reports show that just as we have consistently failed to meet climate change targets for the last 30 years, we have also consistently failed to meet any one of the 20 AICHI targets, and now endanger life on this planet.[9] The logic, which seems to be becoming disturbingly and increasingly acceptable, has been aptly summed up as "today's environmental problems become tomorrow's catastrophes."[10] Never has the human footprint on this planet been bigger.[11] We are well on track to eliminating 40% of the plant species we share this planet with and that contribute to moderating climate change.[12]

We talk about the importance of planting trees to capture carbon, just as we continue to eliminate irreplaceable ancient forests in British Columbia. We live in two distinct realities. Just as our government talks about having passed legislation on the recognition of the United Nations Declaration of the Rights of Aboriginal Peoples (UNDRIP), contradictorily, in order to facilitate logging of old-growth forests by Western Forest Products, the same government also argues in court that, in spite of known continuous aboriginal presence for at least 5,000 years, Nuchatlaht Nation were just nomads with no right to their traditional lands.[13] The truth has become opportunistic in practice for governments primarily committed to the demands of an unsustainable economy.

Of course, maybe that is all just "doomster" pessimism. After all, we have all those great, high-visibility, feel-good, multi-million community conservation projects funded by the province to distract us from the constant destruction by development and industry. But then, sometimes an uncomfortable reality called "science" "disturbs the shit" as they say, like a recent study in *Conservation Science and Practice*, which showed that the province's most important ecosystem is "on the verge of collapse," with about 70 of its species facing imminent extinction. To summarize this for a reality check:

> *"The study focused on a swath of the lower Fraser River running through major municipalities south of Vancouver and adjacent marine waters that spans more than 1,000 square kilometres. Within that area, Dr. Kehoe and her co-authors analyzed threats faced by 102 species, most of which are considered at risk.*
>
> *The list includes all five species of commercially harvested salmon in British Columbia, along with numerous other marine and freshwater fish, migrating birds, dozens of smaller animals and plants that live in the estuary's grasslands, salt marshes, and forest ecosystems. Also on the list is the region's most well-known species at risk: the beleaguered southern resident killer whale, with a population that numbers just 74 at latest count.*
>
> *Drawing on detailed data and the expertise of 65 specialist contributors, the team found that two thirds of those species had a less than 50-per-cent chance of surviving on the estuary over the next 25 years."*[14]

And perhaps it bears repeating. The Fraser River delta ecosystem is "on the brink of collapse". It took an Irish post-doc, now at Oxford, to point this out to us, while overlooking the lesser

publicized fact that taxpayers, enriched consultants, and government officials seem blissfully unaware that the Fraser delta lies in the Salish Sea, which as prior research has already established, is itself "a collapsed ecosystem."[15] The novelty here is that the immediacy of yet more collapse is becoming particularly evident to outsiders who are not in the purse of our local, provincial, or federal governments. After three decades of re-assuring "wise use" conservation messaging promoting "feel good" notions that we can "develop with care" through environmental engineering programmes of "integrated water management," being "communities connected by water" etc., this "news" simply homes the point that "sustainable growth" is simply not sustainable and endangers us all. Of course, a succession of governments has touted BC's achievements as "world class," so British Columbians may take comfort in the thought that with the Fraser delta ecological collapse, BC is well on its way to join one-fifth of countries world-wide that face ecological collapse due to biodiversity declines, according to a new Swiss Re Institute's Biodiversity and Ecosystem Services Index.[16]

It seems that there are still things that British Columbians do not wish to know, and even less want to talk about seriously unless our colonial masters send someone from the mother country to tell us the obvious. The colonial mindset dies hard. We are in an existential moment in history. British Columbians want to give the benefit of doubt where it can be given, but for the sake of future generations, we also need to acknowledge the facts before us in order to address the real problems that we face.

Over the past three months, BC has mainly been preoccupied by COVID-19 (as has the rest of Canada), a provincial election, and the elections of our neighbours to the south, which will impact the course of both science and history. With fisheries generally collapsed, controversy over the federal government's re-interpretation of its promise to phase out open-net salmon aquaculture continues to simmer.[17] Fisheries reports this year indicate that 2020 salmon returns are "the worst ever."[18] Clear-cutting and destruction of BC's last old-growth forests continues as it has for the last eight decades unabated, in spite of the release of the Old-Growth Strategy review at the start of the election, and misleading promises of change.[19]

We do not change. We perpetuate all the cornucopian assumptions of an unsustainable economy without acknowledging its finite impacts about us. Adaptation to these changes has become merely cosmetic as we set the ground for a growing list of "tipping points" and species collapses, as witnessed in the Fraser delta. We amass contradictions between reality and political representations to keep up the illusion of normality. As Dr. Kehoe's study confirms, nowhere is this clearer than when it comes to protecting endangered species in a province that takes great pride in touting the fact that BC has the highest species diversity in Canada. Species diversity protection in BC constantly hits the wall of economic opportunity and pillage. The Fraser delta collapse is just a microcosm of the province's ecologically metastasized economic cancer.

With the results of the provincial election just in, BC has given license to trap endangered populations of fishers (*Pekania pennanti*).[20] This decision comes in spite of a 2018 Forest Practices Board ruling that found that the BC government had failed in its obligations to "protect a local species at risk when it allowed for extensive logging in the central Interior."[21] Endangered species protection is shelved to allow for economic opportunity. This telling act does not just stand in sharp contrast with the NDP's 2017 election promises to enact a BC "Species-at-Risk Act," in keeping with similar legislation in other provinces. The approach taken by the current government that likes to be seen as "progressive" is, in fact, regressive. Even when we talk about protecting endangered species, we only do so in the illusory framework of the US (1972) "Endangered Species Act," as though the terms-of-reference were still the same.

Since coming into office in 2017, the only thing that the NDP government has done towards initiating the process of developing a species-at-risk act has been to revise and downgrade the listing of many species previously at risk, thereby lowering any anticipated protection. For reasons that will be discussed below, after four critical years of participation in a sustained campaign of global environmental vandalism, should a BC government finally enact a piece of species-at-risk legislation similar to that of other provinces, that legislation is unlikely to meet challenges identified by the scientific community, because even the best endangered species act no longer meets the needs of our times.[22]

This point, which was the subject of the CSEB's Spring 2020 Bulletin BC report,[23] was the recent topic of a noteworthy "Policy Forum" article in Science appropriately entitled; "Species protection will take more than rule reversal."[24] Noting that the 1972 Endangered Species Act (ESA) was undermined by the Trump administration to facilitate business interests and constrain the ESA's ability to restrict economic activities, the authors point out that even this act, which is considered to be "the strongest model for endangered species protection worldwide," is in their words "inconsistent" even in its original form and in its amended versions, and needs to be re-written to meet modern challenges. The authors of this paper argue that the original ESA "invites political intervention that undercuts species protection and public confidence." Indeed, while the ESA proved to be an important conservation tool between 1972 and 2017, it could not entirely prevent species and ecosystem extinction, even in a now by-gone relatively stable and predictable world.

As a 2016 report on the ESA for the Ecological Society of America notes, the ESA could only evolve through litigation, as opposed to evolving through the evolution of scientific knowledge, which is how a robust ESA should adapt to our changing times.[25] Changes in the balance of the USA Supreme Court now foreclose further hope of evolution through litigation. The limitations of the USA's ESA are particularly important to note because it is still considered to be the gold standard. It serves as a conservation standard that guides the relationships between economic aspirations and conservation aspirations in economies within the American sphere of influence.

The ESA is the framework that will guide any effort that BC makes at drafting a species-at-risk act, particularly so because of the nature of our economic planning. In that context, it is important to note that the 2018 "Clean BC Plan", leading to the 2020 "Climate Change Accountability Act," is modelled on the Obama administration's and California's climate change plans.[26]

The architect of the energy policy behind those plans is Dr. Ernest Moniz, Obama's Secretary of Energy (2013-2017), whose MIT career has long associations with the oil and gas industries, and is largely funded by Southern California Gas, "one of the most polluting companies in America."[27] Moniz has long supported research that advocates for gas power plants with technologies to capture their emissions that would reduce climate pollution as the favoured energy alternative. Hence the commitment of the BC governments, Liberal and NDP alike, to the development of LNG, and LNG infrastructure such as the Site C hydroelectric development. It does not matter which government comes into power, that transition model, however flawed, is the template for the global economy that BC expects to participate in and reap the economic benefits.

These are climate plans built around an energy transition model, which posit natural gas as the main transition fuel into 2050, as extensively forecast by Jorgen Randers in his 2012 report for the Club of Rome, *2052: A Global Forecast for the Next 40 Years*. The report draws on the assessment of international experts. As Randers explains, these plans are a failure to break with the economic growth model in order to sustain GDP growth, which is essential to our concept of prosperity and political stability. The central outcome of these plans is that business as usual will be sustained into 2050, with oil and gas continuing to be economic drivers. The transition proposed by these models actually comes at tremendous ecological cost, because the economic footprint continues to grow in a world of depleted resources and deteriorating ecological circumstances. An objective ESA, one based on reason, would pose an immediate challenge to the priority of the GDP. It would, therefore, require a re-formulation of the Clean BC Plan away from its current reliance on a transition-fuel economy. Whether that shift is politically feasible is an open question.

It is worth observing here that Randers, and the international team of experts he draws on in his report, cast doubt on the rationality of the choices made by politicians of all stripes. Randers and his associates see the Moniz template as an inevitable outcome of the political inability to shift economic expectations rapidly enough. Of particular note for biologists is the extensive comment by Dag O. Hessen, a professor of biology, specializing in arctic ecology who points out that by 2052, Arctic waters will experience a drop in pH from 8.2 to 7.9. This apparently small change is not trivial. It is enough to limit planktonic crustacean life, with a cascading decline in arctic productivity affecting everything from cod, mackerel, and herring to puffins and auks. A growth in GDP would be pyrrhic: "…we vocalized these worries long before 2000. I am a biologist, and the trajectories humanity has followed over the past twenty-five years, despite very clear warnings, make me wonder about human rationality. I wonder about the apparent victory of our selfish, evolutionarily short-sighted reasoning that maximizes personal goods at present over the intellectual or moral rationality that would have been able to avoid the crisis."[28] Writing in 2012, Hessen only dimly foresaw the level of irrationality that society would reach after 2016. The million-dollar question now is whether the much-touted Biden climate plan will in fact be able to move away from the dependency on oil and gas, which, as analysts have noted, is also at the heart of Canada's economic and climate plans.[29]

Both in the original and in the revised versions of the ESA, much of the legal contention depends on the immediacy of threats to species in an undefined "foreseeable future."[30] As paragraph 1 of this report should make amply clear, with climate change, regardless of whether we wish to accept that it is anthropogenic or not, our ability to foresee the future is no longer simple, and if it ever was, it has now become a whole lot more uncertain.

In designing a species-at-risk legislation, political or ministerial discretion should no longer guide the meaning of "foreseeable future." The "foreseeable future" has been made amply clear in the fires that swept Australia in 2019, with heat waves now returning and setting the stage for another heatwave in 2020,[31] unprecedented Pacific West Coast fires, and the fires of the Pantanal.[32] The future is one of extreme climate events.

We need a species-at-risk act free from political interference. We need science. As the authors of the Science paper stress, the time-frame for the "foreseeable future" has to be based on the species status by 2100. "2100" becomes the benchmark for assessing if a species is at risk. In that framework, the immediacy of the risk level of individual species may be less important than the fact that an ecological community may be at risk. The emphasis shifts towards the preservation of the whole to save the individual species or range of species. Furthermore, based on that longer timeframe, there have to be very clear policies to give equal urgency to what we now consider to be "vulnerable" and "threatened" species as "at-risk". Determination of "risk" by 2100 must be based on standardized objective norms determined by science, not politics or economics, to avoid arbitrary political interference. Given the magnitude of the problems associated with a rapidly changing environment, there is an ethical, if not legal, obligation to ensure that all species at risk can recover. To achieve that goal, private land owners cannot be expected to carry the burden. Incentives by way of tax benefits for easements and donations need to be implemented. We can neither exclude nor penalize private land ownership from conservation and preservation initiatives necessary for biodiversity recovery, nor can we pretend that preservation or restoration of highly visible small parcels of land, like suburban public parks politically created as trade-offs for development in sensitive ecological areas in an ocean of destruction, will actually offset the biodiversity emergency that we face. Objectively, that means that we have to mobilize preservationist interests on both public and private lands. We need to take a very comprehensive and long-term approach free from political intervention. As these authors note: "To keep pace with our biodiversity crisis, the ESA will need to go well beyond the status quo." Forty years of status quo just got us to the Fraser River delta collapse.

BC needs to move beyond that. The case for this was recently eloquently illustrated by biologist Helen Davis and Chief Jake Smith, Mamalilikulla First Nation hereditary chief and manager of the Nation's Environmental Guardian program. They have brought to public attention that one of the most common animals in North Vancouver Island's forests is disappearing at an alarming rate, largely because the large hollow cedar trees that have provided bear dens for millennia, are disappearing together with the old-growth forests.[33]There is a concern that black bears may disappear within our generation. Again, it is

not just the extremely rare or red-listed species that are at risk. Entire ecological communities are at risk from climate change and industrialization by 2100.

Remarkably, as the global climate and biodiversity emergencies continue to grow, there has been very little front-page environmental reporting over the past couple of months that is directly pertinent to BC. Reality is something we seem to want to forget. In the midst of consternation over the growing toll of COVID-19 and unprecedented forest fires from California to Washington, which sent smoke and ash from coast to coast in Canada, election news in BC and the United States has dominated our attention and served as a general distraction from the deteriorating state of our environment. It isn't that nothing has been happening; in fact, all the standard environmental problems in BC have remained and those in the United States and the world have been exacerbated. Through August and September, the poor air quality merely served to remind us that when the elephant sneezes in Washington, Canada is affected by "every twitch and grunt."[34]

Minimal discussion about the state of the environment is a silence akin to the cold heavy calm that precedes the violence of a storm. It isn't that nothing has been happening outside of everybody's COVID bubble. Largely, we don't want to talk about it because we want to prioritize a return to a booming economy. The situation is symptomatic of a growing crisis in the relationship of our society with science, which started in earnest four years ago when the acceptance of "alternate facts" and post-truth became a political norm.[35] Many commentators feel that it will be very difficult to recover the sense of, and the obligation to, truth and facts.[36] As the past four years have shown, this is a major concern, not just for politics, but for the practice of science itself. Indeed, the seriousness of this concern has led national scientific organizations, such as the American Association for the Advancement of Science, to feel obliged to state their concerns publicly.[37] Truthfulness is essential to science and the exercise of its public role. Without a commonly shared trust in facts, there can be no public trust in science.

Nothing quite speaks to the level of disconnection of the public to facts as the report from members of the medical community of dying patients who spent their last moments refusing to accept the diagnosis of COVID-19, because their faith in politicians has led them to believe that COVID-19 is not real. Unfortunately, there is a tight correlation between COVID-19 and climate change deniers—neither care for science. These deaths do not just reveal "a disturbing level of COVID-19 denial."[38] It is an irrational denial of facts and science, and a sordid consequence of a cavalier faith in "alternate facts" and "post-truth." This example is not an exception. Based on voting patterns, it is part of a norm, which at least half of the population has come to accept as a normal part of daily discourse. This illustrates the consequences of a pattern of decades of lies of convenience that we have tacitly accepted in order to promote the interests of an unsustainable economy, which we now hope to re-start.

In BC, the biggest topic of alternative reality is Site C, the energy dam being built to power LNG development in Northern BC, at great environmental and cultural costs to northern BC. It is public knowledge that this project was started by the previous Liberal government at a cost of $8.3 billion. The 2017 Utilities Commission Report recommended that it be terminated; however, for then unclear reasons, it was continued by the incoming NDP government with the knowledge that the project was likely to exceed $10.7 billion.[39] As was discovered through Freedom of Information revelations, serious geotechnical problems were known to top civil servants as of May 2019. The problems were reported this summer in all national and provincial papers. Site C has now run into major geotechnical problems due to the well-known instability of the sediments on which it is being built.[40] The project has now run over $13 billion with no end in sight. The government has largely been secretive about the extent and potential costs of this boondoggle, which was foreseen well before the project was started. Of particular concern, but in keeping with practices surrounding this project, the government has encouraged and sanctioned BC Hydro to flaunt its legal obligations to accept the oversight of the BC Utilities Commission, which is the mandated regulator protecting public interest: "BC Hydro has, in a Trumpian gesture, brushed off the last independent oversight of the out-of-control Site C project, with the apparent support of the newly-elected NDP government."[41] As is often the case, the alternate reality of politicians is at odds with both the law and science. The Liberal and NDP deep commitment to Site C is really understandable only if BC irrationally has no Plan B beyond the Moniz energy transition template. It is as irrational as the gold fever that created this province.

If the shifting foundations of Site C as a keystone in the LNG/Clean BC climate plan left any doubt in the minds of the public about the viability of LNG plans in BC, there is now growing doubt in the viability of an international market for LNG.[42] Energy companies in the USA alone—following the guidance of the Moniz template— are planning to build 235 gas-fired power stations across the country. The impact of these plans, which follow the Moniz transition template, would negate any climate gains. More importantly, an economic report from the Goldman School of Public Policy at Berkeley University confirms that the USA, as do other major industrial countries, already has enough gas plants to support a transition. The same report also confirms that both the efficiency and costs of alternative (solar and wind) energy are increasingly more attractive to investors than oil or gas. The fact that any additional gas plant built now may need to be shut down within 10 to 15 years to meet national, state, or utility goals for emissions reductions make these projects in the words of the report's authors: "a foolhardy investment." We are already seeing some of the shift happening in Australia where finance for similar gas-fired national projects is being questioned because it is clearly at odds with growing climate plans and obligations.[43] In BC, it is increasingly difficult to understand how an investment in the vast LNG development network, based on Site C (which will never pay for itself), is built to support fracking in the north (whose methane output negates any climate targets), and extend pipelines across the province to terminals in Kitimat, Squamish, and Campbell River, all of which pose risks to an already precarious environment, might increasingly look attractive to our potential markets. It is increasingly uncertain that either Site C or the LNG infrastructure will ever pay for themselves, but it is definitely certain that any profits will be privatized and any costs will be socialized.

If the economic benefits are dubious, the ecological costs of LNG development are also already increasingly apparent to many British Columbians. Fracking is not just a problem for its impact on climate change. The processes involved have been found to release radioactive airborne particles downwind, posing a serious health hazard to local populations.[44] Fracking also produces a tremendous amount of contaminated waste water, as would be expected of any hydraulic mining operations, such as gold mining operations, which were banned at the turn of the century in many jurisdictions. Waste water from fracking comes into contact with any elements overlying the gas deposits. It, therefore, comes as no surprise that fracking wastewater can be expected to be radioactive if the geology has radioactive materials. This problem is now becoming commonplace in Northern BC, where radioactivity levels in water exceed normal background levels.[45] As with all radioactive material, it is rarely easy to figure out how to dispose of, or treat, radioactive water. Dealing with the disposal of radioactive waste is always costly. Currently, waste radioactive waters threaten to contaminate local water tables in northern BC. Again, there seems to be no urgency from the BC government to address this problem. As is the normal practice with nuclear energy waste, this is a corporate environmental cost that will be socialized.

That British Columbians do care about their natural heritage became evident in three positive stories from the last couple of months that stand in stark contrast with our generally poor environmental management.

First, the BC Parks Foundation was able to buy West Ballenas Island off Parksville after a very short, about one week, effort in crowd funding to raise the $1.7 million to keep the island from falling into a private developer's hands.[46] Islands like West Ballenas are important ecologically. Botanically, they are northern extensions of the Californian Mediterranean ecosystem and form important marine areas and bird sanctuaries in the otherwise much impacted Salish Sea. Interestingly, funding was not offered by the provincial government.

The second uplifting story is the successful conservation effort by Ocean Wise's conservation and research team of 10 out of the 17 glass sponge reefs in Howe Sound BC—a sensitive ecological area soon to be threatened by LNG development and LNG tankers.[47] As noted by Jessica Schulz, sadly, this effort was not driven by government: *"It wasn't a group of politicians and scientists that really did the heavy lifting on the conservation — it was community members and individuals dedicating their own time."*

A spectacular movie entitled "Moonless Oasis" of this rare ecosystem can be found at the URL attached to endnote 47, or https://www.imdb.com/title/tt12262136/.

Finally, after many years of a conservation effort that began in 1983, the BC Environment ministry did quietly sign off on a new wildlife habitat area of 511 hectares in the Campbell River forest district to save an endangered species of cave-dwelling amphipods.[48] With the preservation of *Stygobromus quatsinensis,* BC also sets aside important karst habitat, which makes up less than 4% of Vancouver Island's geology. Yet again, the discovery and the push to protect were not led by government but by an individual caver and a community of cavers and residents who were concerned to protect the old growth forests on which this amphipod and other yet unknown organisms depend. Although government officials did support this effort, it is regrettable to consider that this positive outcome only came about as a reaction, rather than from proactive steps guided by established science that has been pushing for similar environmental preservation for decades.

People protect the environment in BC. Sadly, government environmental leadership is lacking at a time when it is needed most, given the urgencies of our "foreseeable future."

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ALBERTA News

Submitted by Gary Ash, CSEB Alberta Member

Solar Farm for Fort Chipewyan, AB

Fort Chipewyan has officially opened a solar farm, which has been designed to reduce the dependence of the community in northern Alberta on diesel fuel to produce power for the community. The solar farm is designed to provide up to 25% of the annual power requirement of the community, thereby saving 800,000 L of diesel fuel that has to be trucked into the community over a winter road, as the community is not connected to the provincial power grid.

The project consists of 6000 solar panels, and is expected to reduce greenhouse gas emissions by 2170 tonnes per year.

The project was founded by Three Nations Energy (3NE), which is a partnership between the Athabasca Chipewyan First Nation, the Mikisew Cree First Nation, and the Fort Chipewyan Métis Association. The project came in on time and under budget, with funding backed by the federal and provincial governments' grants totalling $7.8 million. The project is expected to be fully up and running by the end of the year, and 3NE using the cost savings to add an additional 400 solar panels to the farm. About 15% of the revenue from the solar farm will go back into the community education programs, including green energy programs for youth.

Source: Adapted from Edmonton Journal, 26 Nov. 2020

Woodland Caribou Habitat Recovery Program

The woodland caribou (*Rangifer tarandus caribou*) is listed as Threatened under Canada's *Species at Risk Act* and Alberta's *Wildlife Act*. Woodland caribou populations in the province have been declining. The Government of Alberta's Draft Provincial Woodland Caribou Range Plan includes caribou recovery actions and strategies that will demonstrate commitment to caribou recovery, and advancement of range planning.

It will include the use of conservation areas, restoration of human disturbance, mandatory Integrated Land Management, and other actions.

The objective of the Caribou Habitat Recovery Program (CHRP) is to support Alberta Environment and Parks' efforts to sustain and improve caribou habitat in a manner that supports healthy and self-sustaining caribou populations.

The specific purpose of the Program is to support the Recovery Strategy for the Woodland Caribou Boreal Population and the Recovery Strategy for the Woodland Caribou, Southern Mountain Population, by providing funds for Eligible Activities.

The Program is structured around projects that are made up of Eligible Activities aimed at the Program's purpose. Eligible Activities that may be funded through projects include:

- Planning—This includes operational planning for caribou landscape restoration activities.
- Caribou habitat restoration—This includes operational activities that serve to restore disturbed habitat such as reclamation and planting on seismic lines.
- Monitoring, evaluation and reporting—This includes activities that measure, track and report on project activities and caribou habitat conditions for project management and outcomes measurement purposes.
- Other activities—This may include activities such as access management planning, Traditional Knowledge collection and others.

For more information, go to the Alberta Environment and Parks website at https://www.alberta.ca/mammal-species-at-risk.aspx#toc-10. The Alberta Woodland Caribou Recovery Plan 2004/05 – 2013/14 prepared by the Alberta Woodland Caribou Recovery Team is available at the following URL:

https://open.alberta.ca/dataset/1f7203ef-711a-4909-95cc-f689dc7f3468/resource/0feb7a3f-60c5-481b-9db7-c227450e78da/download/sar-woodlandcaribourecoveryplan-jul2005.pdf

SASKATCHEWAN News

Submitted by Robert Stedwill, CSEB 2nd Vice President and Saskatchewan Regional Director

When one looks at the proposed four billion dollar irrigation project here in Saskatchewan, one has to give one's head a shake.

Doing the environmental assessments and First Nation consultations after the project has started? There are so many environmental unknowns that the Saskatchewan Environmental Society (SES) is concerned to the point that it suggests that any consultation is meaningless if the province has made up its mind to begin work.

The SES suggested that there are risks associated with Saskatchewan River Delta or water quality in Saskatoon. Further, loss of water to irrigation could negatively impact hydro generation at SaskPower's generating facility at Coteau Creek, thus resulting in more fossil fuels being burned.

The SES also suggests that the majority of the province's 40,000 plus farmers will get no direct benefit from the project. Additionally, it would appear that no real cost benefit analysis has been done. In other words, let's see the pros and cons of the project before committing four billion dollars to a questionable project.

For more information, go to https://www.saskatchewan.ca/government/news-and-media/2020/july/02/irrigation-project

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MANITOBA News

Submitted by Robert Stedwill, CSEB 2nd Vice President

It appears that the environment will suffer in different ways due to the pandemic. Although we have seen significant improvement in air quality, for example, due to cutbacks in emissions from industry and fewer vehicles on the roads world wide, other cutbacks are occurring that may negatively impact our environment.

In April of this year, Manitoba Hydro asked the province to relax some of its environmental requirements during the COVID-19 pandemic. The request asked for approval to "some changes in requirements due to COVID-19 under environmental licensing for certain low-risk elements of projects."

Manitoba Conservation and Climate did not disclose what those projects entail or provide detail on the proposed changes to the environmental work.

Environmental work is considered an essential service by the province, which Manitoba Hydro recognizes; however, due to constraints in northern Manitoba, changes to some monitoring needs were required.

For example, bird habitat monitoring on the Bipole III transmission line was being reviewed as possibly being delayed until the pandemic is over and monitoring can proceed normally.

One rare species of longspur (*Calcarius ornata*) is known to frequent the area and is of concern.

It is not known at this time whether the requested changes by Manitoba Hydro were approved or not, but in light of the deteriorating pandemic conditions in Manitoba, it might be assumed that the requested changes were approved.

Youth Advisory Council

In late October, the province announced the selection process for the youth advisory council on climate. As the minister of Conservation and Climate said, "young people want to be heard". They have great ideas and solutions and will report to the Expert Advisory Panel, which advises the province on all aspects of the province's Made-in-Manitoba Climate and Green Plan.

Selection criteria include the following:

- be Manitoba residents.
- ideally be between 15 and 25 years of age as of 1 Dec. 2020.
- represent the diversity of Manitoba and Manitobans.
- be knowledgeable of issues related to the Climate and Green Plan.
- demonstrate a proven engagement and interest in environmental issues and/or civil society issues.
- engage in respectful, open discussion, and be accepting of differing viewpoints.
- not be employed by the Manitoba government.
- be willing to serve for a one-year term.

For more information on the Youth Advisory Council and the Made-in-Manitoba Climate and Green Plan, or to apply, visit: https://www.gov.mb.ca/climateandgreenplan/yac.html

ATLANTIC News

By Peter Wells, CSEB Atlantic Member

A summary of some environmental issues of interest to environmental biologists follows, with a focus on Nova Scotia. Local citizens such as Bob Bancroft, a highly respected wildlife biologist and the current president of Nature Nova Scotia, have been vocal constantly about the plight of the province's forests and wildlands. Sadly, few biologists speak out on the many issues, despite the many threats to the region's habitats and biological diversity. On the positive side, there continue to be expert contributions from COSEWIC (The Committee on the Status of Endangered Wildlife in Canada), a group that CSEB should herald for its decades of dedicated work.

1. Boat Harbour Restoration

Boat Harbour, a tidal estuary off the Northumberland Strait, is being assessed for its remediation, after being used for more than five decades as part of a treatment system for the pulp mill wastes of Northern Pulp and the former Canso Chemicals. The challenge is what to do about the layer of sludge, up to 26 cm deep, in the harbour that contains dioxins, furans and heavy metals (Beswick 2020). A study at St. Francis Xavier University, Antigonish, is proposing remediation using salt marsh grasses such as eel grass. The whole cleanup is estimated to cost $217 M, given that there are over 200,000 cu m of sludge in the ecosystem. This bodes to be another expensive industrial cleanup in Nova Scotia, not unlike the tar ponds of Cape Breton Island. Industry comes, industry goes, leaving huge messes behind to be cleaned up at public expense.

2. Provincial Forests

Glyphosate – a never ending saga

Glyphosate is a broad spectrum, organophosphate herbicide, sold as Roundup and Visionmax. It has been used for many decades in agriculture and forestry to control unwanted weeds, shrubs and trees. Its wide use and wide detection in water and food remain highly controversial due to the possibility that it is a carcinogen, according to the World Health Organization. Controversy continues over its use in Nova Scotia as a result (Campbell 2020).

Continued clear cutting

Massive clear cutting on crown land continues unabated year round, despite the Lahey report (now 2 years old) and the needs of migratory and resident wildlife. The provincial government's Department of Lands and Forestry (not Forests!) appears complicit in this activity. The clear cuts are obvious to anyone who drives the province's highways and side roads, especially in the SW of the province. The wood is largely being used for chips for energy production and export to foreign markets, given that Northern Pulp's mill is closed. As well, "NS DLF and Forestry and the forestry industry are planning to replace more than 800,000 acres of fertile public forest land with softwood plantations that are simplified, even-aged crop rotation systems largely devoid of nature. Clearcutting followed by even-aged softwood plantings on former hardwood and mixed hardwood-softwood sites severely degrades these sites over a short period of time. The resulting ecological imbalance promotes pest infestations, disease, vulnerability to strong winds and stresses caused by hot, dry weather" (Bancroft 2020). The mismanagement of our forests continues with abandon.

Owls Head Park Reserve crisis

This provincial park on the Eastern Shore of Nova Scotia was secretly delisted as a park last year by the NS government, with the intention to sell it to a US land developer intent on making it a golf course. This issue is now in the courts, as several groups such as CPAWS, the Eastern Shore Forest Watch, and the NS Nature Trust, amongst other NGOs, oppose the sale and the whole notion of provincial parks not having long term legal protection. It is a complicated issue; look at www.saveowlshead.org for a reliable authoritative summary of the issue and "the timeline of promised protections", as of June 16, 2020. Importantly, the message here for citizens involved in conservation and protection is that constant vigilance is required to ensure that our protected places and species are truly protected. Think about what has happened recently in the USA with the loss of protections of many federal lands, such as national monuments; this can happen in Canada too, at either the federal or provincial levels, when anti-nature tyrannical politicians are in power!

3. Species at Risk

Mainland moose are endangered

A great number of NS citizens care about the natural environment, including our forests and wildlife. A group called the Forest Protectors are camped out in an area of the Digby County to demonstrate the need to protect the mainland moose population, threatened with displacement due to continued logging, both the roads required for access and the harvests themselves, and poaching (Wigney 2020). This is a long-standing issue in Nova Scotia and seemingly one that the Province ignores. In the meantime, the moose population on the mainland dwindles, the numbers, estimated at 1,000 animals or less (Nova Scotia Lands and Forestry Fact Sheet).

The North Atlantic Right whale – bordering on extinction

According to recent field data, there are only approximately 350 individuals left in the population. Monitoring of the whales continues in Canadian waters in an effort to reduce contacts with and injuries from fishing gear and ships. Due to recent losses and low calving rates, they are in threat of extinction over the next 20 years (Canadian Wildlife Federation 2020).

Disrepecting bears

An incident involving a bear cub, accidentally hit by a vehicle in the summer and then immediately shot by conservation officers (Lambie 2020, Wells 2020), has raised the issue about the need to have an official program for rehabilitating orphan bear cubs in Nova Scotia. Many are orphaned as their mothers are killed by hunting and road accidents. There is a need for an enlightened policy and funding to care for such animals, rather than simply destroy them, according to Hope Swinimer of the Hope for Wildlife animal sanctuary (Lambie 2020). The incident raised some ethical questions about our care, or lack of it, for nature and wildlife in the Province (my personal view).

4. Marine conservation

Lobster fisheries and disputes – Bay of Fundy

This has been a season (Summer and Fall) of high tension in St. Mary's Bay, the lower Bay of Fundy, with an ongoing dispute over the rights of indigenous fishermen to fish lobsters out of the official DFO regulated lobster season. Female lobsters in this area are molting (hence are soft shelled), mating and extruding their fertilized eggs to their pleopods during this time, hence the closed fishing season to protect them and the population. Indigenous fishers want year-round access to the waters for a moderate livelihood fishery; commercial fishers object strenuously. The situation is not yet resolved but knowledgeable observers state that conservation concerns should be listened to and followed (e.g., Hipson 2020; Miller 2020).

Fish passage at Windsor

Highway 101 construction across the Avon River continues unabated, while the issue of suitable fish ways for migratory fish in the estuarine ecosystem seems unresolved. Little has been said about the loss of the saltmarsh on the tidal flats being covered by road works, and the loss of wildlife habitat. Acadia University's Estuarine Centre seems unusually silent on the issue, despite formerly being involved in ecological research on the tidal flats.

5. Pollution

Plastics on the coast and in the ocean - implications for wildlife

Coastal litter cleanups continue annually in all of the Atlantic Provinces, spurred on by the recent scientific and public interest in plastics and their fate and effects in aquatic environments. Of interest recently is the news of one woman's effort to clean up her local NS beach – Black Rock, Kings County; she collected 6350 kg of garbage over 2.5 years (Fairclough 2020). Most common items were rope and rubber lobster claw bands. However, based on extensive recent, shoreline litter collections over ten years, the dominant items for three provinces are cigarette butts (N.Blais, Dalh. Univ., pers. comm.). All can pose a risk to marine wildlife, as shown by many recent scientific studies. See the recent article by Lau et al. (2020) for an overview of this pervasive pollution problem and how to reduce it.

6. Cliffs of Fundy UNESCO Global Geopark Established

The Cliffs of Fundy UNESCO Geopark was formally opened in August and promises to be an economic, tourism and scientific boost for the communities along the Parrsboro shore of the upper Minas Basin (www.fundygeopark.ca). The whole shoreline is biologically rich and is known for its geology and paleontology, as well as for its natural beauty. Various committees are being set up, including one for education and interpretation. It is part of the Canadian Geoparks Network.

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Addressing the Crisis In Biodiversity – Its Status and Our Role as Canadian Environmental Biologists[1]

Across the globe, academic publications and the news increasingly carry stories about the growing crisis in biodiversity, both in terrestrial and aquatic environments. Biodiversity, or biological diversity, is "the variety of life found in a place on Earth or, often, the total variety of life on Earth" (www.Britanica.com). Globally, since the Rio World Summit of 1992 and the signing of the Convention on Biological Diversity, the United Nations Environmental Programme (UNEP) has led on this issue and has worked with the Global Environment Facility (GEF) "to arrest the decline in biodiversity and conserve ecosystem services for the benefit of current and future generations" (www.unenvironment.org/resources/factsheet/biodiversity-factsheet). Lately, various UN committees in New York have addressed the impacts of overfishing in international waters (areas beyond national jurisdiction) and the impending effects of industrial deep sea mining on species and habitats little studied or as yet unknown. Importantly, UNEP's latest report, concerned about the rate of biodiversity loss, "emphasizes that countries need to bring biodiversity into the mainstream of decision making and factored into policies across all economic sectors" (www.unenvironment.org/resources/report/global-biodiversity-outlook-5-gbo-5). A good source of the latest information on global biodiversity is also found at the UN's Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (www.ipbes.net).

Other groups have been actively involved in addressing the status and decline of global biodiversity; the work of these NGOs (non-government organizations) is vitally important. The World Wildlife Fund has just released its latest Living Planet report (WWF 2020), describing the rapid decline in a number of species populations since 1970 and the global implications for the natural world, human health, and our economies. The IUCN (International Union for the Conservation of Nature) has documented the biodiversity decline over decades and in recent years; of late, almost one quarter of the assessed species are threatened with severe loss or extinction. This is attributed to

[1]This article is adapted from an Editorial by P.G. Wells and D.H. Richardson, currently in press with the PNSIS (Nov. 2020).

human population pressure and the resulting demand for space and resources, pollution, and climate change. Most recently, the American Association for the Advancement of Science (AAAS) has highlighted the problem in an editorial, stating that "we are in danger of losing 80% or more of the world's species……..and have clearly entered the world's sixth major extinction event" (Raven and Miller 2020). Clearly, the problem is dire!

The IUCN recognized that "nature will recover if given half a chance", illustrated by some species being brought back from the edge of extinction (www.iucn.org/news/species/201912/species-recoveries-bring-hope-amidst-biodiversity-crisis-iucn-red-list). "When governments, conservation organisations, and local communities work together, we can reverse the trend of biodiversity loss" (J. Smart, IUCN Biodiversity Conservation Group). In this spirit is the recent funding by Norway of mapping the worlds tropical forests, critical for assessing the Earth's species diversity and the role of forests in climate control (BBC News, 23-10-20); new insights about the recovery of marine ecosystems after conservation interventions (Duarte et al. 2020), bringing renewed attention to the amazing recovery potential of nature; and the role of social sciences and local communities in many aspects of coastal and ocean management (Manuel and MacDonald, 2020, McKinley et al. 2020), because if people care, policies can change and biodiversity conservation can prosper.

Bringing the biodiversity issue to public attention across the globe has been the role of many film makers, producing such television series as Nature and Nova seen on the US PBS channel. As with climate change, a large informed and concerned public will help convince politicians and policy makers to heed the importance of biodiversity and turn the situation around. Science has a key role here to provide reliable information and advice. In recent years, making this point has been the objective of the noted UK's Richard Attenborough, in his interviews, films and books.

Especially noteworthy and an engrossing read is Attenborough's latest book, "A Life on Our Planet" (Attenborough and Hughes 2020).[2] It is highly recommended for all CSEB members. He provides a chronology of one person's observations of the dramatic changes to global ecosystems and species, and a template for how to arrest them over the next few decades. After a polemic on the many problems facing our biological world, he describes a few actions that could be taken – switching to greener energy to arrest climate change and its broad effects on ecosystems, rewilding the oceans through establishing more protected areas and practising sustainable aquaculture, using land space within urban areas more efficiently, reducing deforestation, protecting more terrestrial wilderness, having so-called wildland farms (a mixture of agriculture and wild areas), introducing top predators into rural areas, and planning for the impact of 2-3 billion more people within the next few decades. These suggestions are general and may need to be modified for specific regions. The main message is that humans across the planet have to rethink their interactions with nature, reverse the course of habitat and species loss, and slow the increase in our population. This must be done within the next few decades.

In Canada, the many status reports that are on the Species at Risk Public Registry for 2020, prepared for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2019), attest to the fact that Canada is not doing well to protect its biodiversity, in spite of considerable effort. Action is needed on all fronts. This should include greater protection and conservation efforts for both terrestrial and aquatic ecosystems.

So what should the role of the Canadian Society of Environmental Biologists (CSEB) be in this global and Canadian issue? To initiate some hard thinking on the issue and writing this as a Canadian living in Nova Scotia, it is clear that this province has had a litany of biodiversity challenges for many decades. For example, the small population of mainland moose are of great concern due to continued habitat alteration and loss, amongst other factors; they are considered endangered (Snaith and Beazley 2004, NSDNR n.d.). Freshwater turtles are often in the news too, due to concerns about the endangered Blanding's turtles of SW NS; considerable conservation efforts continue for them, such as at Kejimkujik National Park. Other turtles (wood, snapping) may be at risk too (Harding G., pers. comm.). Sadly, our many roads continue to kill or injure countless small amphibians, reptiles, and mammals; every road trip is a visual experience of so-called road kills, innocent animals living in a fragmented habitat.

However, alongside these animals, it can be argued that the poster children of Nova Scotia biodiversity loss and needs are birds and whales. Many of our songbirds and migratory shorebirds spend the winter thousands of kilometres to the south where their populations are susceptible as a result of loss of their wintering habitat and often having to migrate through storms made more severe due to climate change (www.birdscanada.org; COSEWIC 2013a,b). Logging in late winter and early spring during the nesting season for newly arrived songbirds is a continued threat. For whales, the much diminished and endangered population of North Atlantic Right whales is in crisis with fewer than 400 individuals left (366 was the last estimate) and too few breeding females (Cooke 2020); in our waters, they mainly inhabited the outer Bay of Fundy in the summer months but many individuals now spend that period in the southern Gulf of St. Lawrence (Gunn 2020; Mitchell and Hawkins 2020), exposed to the pressures of ship strikes and entanglement with fishing gear. This whale may go extinct in our lifetime, despite considerable efforts to reverse the trend. Mitchell's recent article is essential reading for all of us!

The plight of the forest dwelling birds is connected to how we as citizens are looking after the land and the land-sea interface. The birds suffering the highest declines are the aerial feeders, such as swallows and swifts, and insect feeders such as flycatchers (Harding, G., pers. comm.; Nebel et al. 2020). Large scale deforestation continues relentlessly around the clock in Nova Scotia, despite the 2-year old Lahey report on forest practices (Lahey 2018) and provincial government promises to redress the problem. This has been often mentioned in the pages of the CSEB Bulletin. The proportion of mature and old growth forest, where the greatest biological diversity occurs, continues to decline. To repeat, clear cutting occurs even during the spring nesting season for many songbirds, a huge concern due to its obvious impact. The apparent disregard for wildlife and the natural world shown by

[2] Also highly recommended is the book by E. O. Wilson, "Half-Earth. Our Planet's Fight for Life" (2016, Liveright Publ. Corp., W.W. Norton and Co., New York, London. PB. 259p.). It is a plea to preserve the planet's biodiversity by putting more lands and waters aside for conservation on a global scale. Easy to read, hard to put down, stimulating, heart-breaking and maddening - another great Xmas stocking stuffer for the environmentalist in the family.

the forest industry and provincial politicians is hard to understand and even harder to forgive.

In contrast, on the positive side in Nova Scotia is the increasing effort and success of groups such as the NS Nature Trust and the Nature Conservancy of Canada, amongst others, to conserve lands near Halifax, Cape Breton Island, south-west Nova Scotia and along the eastern shore, all of which offer habitat protection for wildlife and nature experiences for citizens. Our provincial biologists and ecologists also work hard to document our fauna and flora and their population health[3]. Many scientists across the country, professional and amateur, contribute to the work of COSEWIC, documenting the status of species from lichens to mammals.[4]

The upcoming Issue of PNSIS (51-1, 2021), from which this article is adapted, features a research article by Dadswell and Rulifson (2021) on the fishes of Minas Basin in the upper Bay of Fundy, a highly diverse coastal ecosystem. The cover picture is of Atlantic sturgeon caught in a coastal weir; these magnificent ancient fish still thrive, even under the pressures of fishing, river obstructions and general habitat deterioration (Bradford et al. 2016). In recent Issues, there have been articles on species such as lichens (Cameron and Bayne 2020), endangered plants (Fancy et al. 2020), and biodiversity survey methods (Cameron 2019), to mention some of the scientific effort contributing to biodiversity conservation in Nova Scotia. That said, more such recognition of the status and requirements of provincial wildlife is needed.

The CSEB could discuss and initiate a number of actions to bring sustained attention to the need for biodiversity protection in Canada. These could include more webinars on specific species and habitats that require protection and conservation; focussed field trips to places where endangered species reside (e.g., in Nova Scotia - Brier Island, Kejimkujik National Park, the Tobeatic Wilderness Area; in Alberta, to the badlands or to distant locations such as Wood Buffalo National Park); and with the support of our academic members, the encouragement of student research projects and papers on wildlife and their needs. The Society could also encourage and support more citizen science, by individuals and NGOs, to help monitor and document the status of critical habitats and species. CSEB could interact with these scientifically based groups on the biodiversity issue and make concerns known to policy makers and legislators in the federal and provincial governments. We could especially be supporting in any way possible the exemplary efforts of COSEWIC. Finally, the CSEB Bulletin could solicit and welcome papers and status reports on any aspect of the biodiversity of Canadian lands and waters, as shown by the above examples. Great conservation science led by Canada's environmental biologists will support great protection policies. It is hoped that CSEB members and other readers of this Bulletin will pursue some of these activities to help protect and conserve the rich biodiversity of Canada and be an example for the world.

Acknowledgements – I thank Dr. David H. Richardson (Saint Mary's University, Halifax, and COSEWIC member) for his review of and contributions to the PNSIS Editorial (Vol. 51, Part 1, in press, Winter 2021), and Dr. Gareth Harding (DFO-BIO, Halifax, retired) for his review of the same Editorial. This article is dedicated to the memory of Dr. and Professor Ronald (Ron) Keith O'Dor, Biology Department, Dalhousie University, former Chair of the highly successful international Census of Marine Life Program, and squid biologist extraordinaire.

[3] Why aren't more of these individuals members of the CSEB?
[4] DITTO

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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. Awareness of environmental biology issues would be an asset.

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

Regional Directors

CSEB Requires Regional Directors for the following Regions:

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

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.

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

TERRITORIES News

Submitted by Anne Wilson CSEB Territories Director

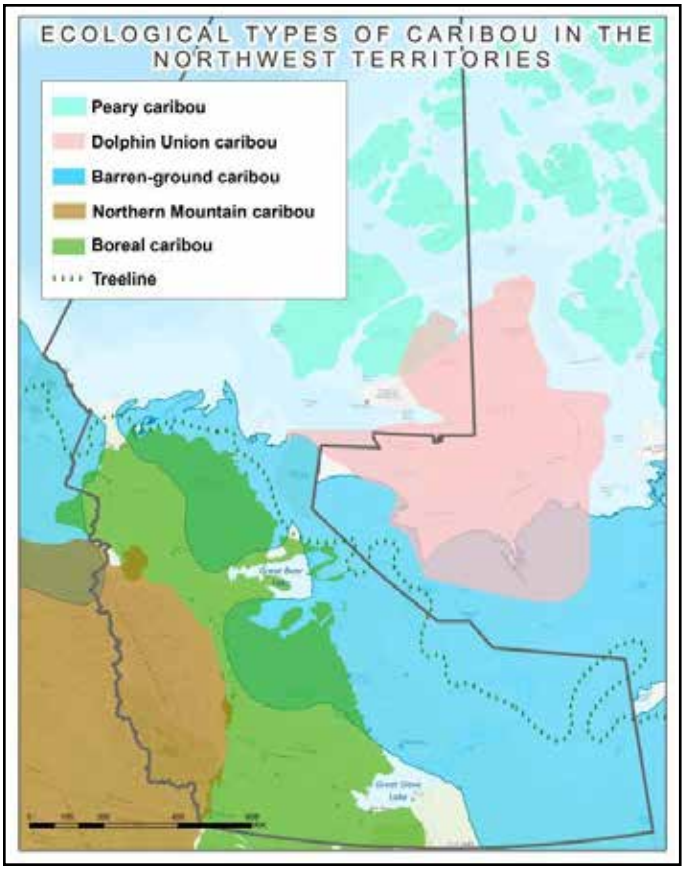
Winter is settling in, and the shorter daylight becoming an Arctic twilight in many northern communities. As of the start of the last week in November, daylight length ranges from a few hours to no sunrise in the Arctic Islands. Travel restrictions remain in place, and have increased in Nunavut at this time. Access by researchers has been limited, resulting in a year of missing data for many programs, and interruptions in data collection for many university students. It is recognized that it is important to work with those who already live in the regions, and that partnerships with northern communities are essential.

Caribou populations in the North are still highly vulnerable, and with few exceptions population numbers continue to decline. A study was recently published (S.C. Davidson, G. Bohrer, et al. 2020. Ecological insights from three decades of animal movement tracking across a changing Arctic. Science: Vol. 370, Issue 6517, pp. 712-715) which uses a 30 year period of record for combined datasets from a variety of sources to identify changes in different species. Observations on caribou calving dates among the far north populations identified changes, with calving occurring earlier in response to climate changes, which may put caribou out of synch with food sources and contribute to mortality.

There are five distinct caribou sub-species:

- The Boreal caribou (listed as Threatened) inhabit a range roughly occupying the western NWT into northern Alberta and Saskatchewan and are showing declines in the southern populations where the majority occur.
- Peary caribou, which live on the high Arctic islands of the NWT and NU, are at low numbers following a steep decline by the 1990s and are listed as Threatened.
- Dolphin and Union caribou are listed as Endangered by COSEWIC, having declined to about 4000 as of 2018.
- Northern Mountain caribou are thought to be stable, but are listed as "Special Concern" under the federal SARA.
- Barren-ground caribou are the most widespread, and do the long migrations between summer and winter ranges. There are nine distinct herds spanning ranges from the Yukon to Northern Ontario, and all but the Porcupine herd are listed in the NWT as Threatened, having declined dramatically in their numbers.

A contentious program to reduce wolf predation has been proposed for the North Slave Region, which has seen significant declines in the Bathurst and Bluenose-East caribou herds (see CBC article below). Wolves are the primary predator of the barren-ground caribou, and it is thought that reducing predation could increase herd survival. However, a recent paper reviewing results of a BC wolf cull program raised questions as to whether this was the case. The reanalysis of data found that ecotype identity and the disparate responses to industrial disturbances needed to be considered. (Harding, L.E., Bourbonnais, M., Cook, A.T. et al. 2020. No statistical support for wolf control



and maternal penning as conservation measures for endangered mountain caribou. Biodivers Conserv 29: 3051–3060. https://doi.org/10.1007/s10531-020-02008-3).

A Recovery Strategy was released in July for the Barren-ground caribou. (Conference of Management Authorities. 2020. Recovery Strategy for Barren-ground Caribou (*Rangifer tarandus groenlandicus*) in the Northwest Territories. Conference of Management Authorities, Yellowknife, NT). It defines overall goals:

1. Maintain or restore self-sustaining, resilient populations of each barren-ground caribou herd, such that no herd is lost.
2. Support and maintain the caribou-people relationship.
3. Promote conditions that allow caribou to move and migrate across their historic ranges without barriers.
4. Promote the conditions necessary for recovery.

The objectives and approaches to meeting these goals are set out, and include collaboration, monitoring, filling knowledge gaps, protecting populations and their habitat, and education on caribou. The document discusses many factors affecting caribou populations, and outlines conservation and recovery aspects (https://www.nwtspeciesatrisk.ca/file/recovery-strategy-barren-ground-caribou-nwt-2020).

Environmental assessments and regulatory processes in the North continue and have substantially moved to virtual platforms for technical meetings and hearings. Participants from outside of the territories can't attend in person due to border restrictions and quarantine requirements, but Boards and participants are adapting to the current "norm" with virtual meetings or written processes instead of the community hall versions. This comes at the cost of all the side conversations which are so invaluable, and the personal interactions that bring understanding and appreciation of each other's concerns.

Some of the current reviews include:

- The Environmental Assessment process for Baffinland Iron Mine's proposed Phase 2 expansion involved technical meetings in the fall; public hearings will be scheduled at a later time. The Phase 2 Water Licence amendment process is on hold.
- Agnico Eagle's Meliadine Gold Mine is dealing with higher volumes of saline water than predicted, and following an emergency basis discharge, has applied to permanently increase the Water Licence discharge limits for total dissolved solids into a freshwater lake. They are also undergoing an environmental assessment for the construction of a water line for marine discharge of saline effluent, with concerns around wildlife dominating. Technical meetings have been delayed by the recent Covid outbreak in Nunavut.
- In the diamond mining sector, De Beers' Gahcho Kue mine application for an expansion for extraction of additional resource has gone through public hearings, and closing arguments will be due in September, then the Board will make its decision on the application.
- The Diavik Diamond mine is proceeding with the Water Licence amendment to dispose of processed kimberlite into mined-out pits and mine workings. These will ultimately be connected at closure to Lac de Gras, a pristine and highly valued large lake, so this is receiving considerable scrutiny. Public hearings are scheduled for Dec. 16-18, 2020.
- Custodians of the historic Rayrock Mine are applying for a new Type A water licence to carry out remedial activities. The tailings were capped and the site abandoned in the 1990s, but further work is needed to stabilize and encapsulate.
- Municipal wastewater management continues to be a challenge in the North, and work continues on the development of effluent quality standards, similar to the Wastewater System Effluent Regulations that apply south of 60. Further consultations will be carried out in the NWT and Nunavut, but have been held up by travel restrictions. A draft regulatory framework of the Northern version of the regulations will follow consultations.

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 newsletter, 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.

Submitted by Sharleen Hamm, CSEB Regional Director

As Anne mentions in her Director's Report, Canada's north has been closed to southern researchers for much of the year due to travel restrictions brought about by the COVID-19 pandemic. For those of you looking get your Arctic science and research fix, there are some ongoing and upcoming options:

Arctic Speaker Series, presented by the **Arctic Institute of North America** (AINA) is currently ongoing. Access the talks here: https://arctic.ucalgary.ca/arctic-speaker-series-2020-21

- AINA is a research institute associated with the University of Calgary and has a mandate to advance the study of the North American and circumpolar Arctic through the natural and social sciences, the arts and humanities, and to acquire, preserve, and disseminate information on physical, environmental and social conditions in the North.
- AINA is home to the Kluane Lake Research Station (KLRS), 220 km northwest of Whitehorse, Yukon, on the south shore of Kluane Lake, on the traditional lands of the Kluane, Champagne-Ashihik and White River First Nations, next to the world's largest sub-polar icefield and in an area of tremendous biodiversity. In non-pandemic times, the station can house up to 35 guests and provides office and lab space, meeting rooms and communications for researchers from across Canada and around the world. The station is currently closed to researchers, but you can still take a virtual tour here: https://arctic.ucalgary.ca/KLRS_VirtualTour/KLRSvirtualtour.html

- **Arctic Change 2020,** Arctic Net's international arctic science conference will be held virtually from Dec 7-10. As the conference is now over and was held virtually, registered delegates can access presentations here: https://arcticnetmeetings.ca/ac2020/

Researchers may want to check out the following calls for proposals and applications:

- The **Inuit Nunangat Research Program** (INRP) has launched its first call for proposals for Inuit-led research. INRP has a budget of roughly $900,000 per year over the next four years. Find information on how to apply: https://www.itk.ca/inuit-nunangat-research-program. All Inuit are invited to submit proposals as project leaders, with no need to partner with an academic researcher.
  - INRP is supported by both Inuit Tapirisat Kanatami through it's implementation of the National Inuit Strategy on Research (NISR), and ArcticNet through it's North by North program.
  - INRP is a program intended to fund Inuit-led research and knowledge holders to engage in studies that are relevant and prioritized for Inuit Nunangat, advance Inuit self-determination in research, develop partnerships to build

capacity and strengthen the impact and effectiveness of Inuit Nunangat research for Inuit (ArcticNet 2020; ITK 2019).

- **2021 Weston Family Awards in Northern Research** is now accepting applications. Scholarships are awarded to early career researchers in the natural sciences, including studies of northern ecosystems, biodiversity, flora and fauna, meteorology, oceanography, glaciology, geography and environmental studies.
  - Interested applicants can apply here until January 27, 2021 https://portal.scholarshippartners.ca/welcome/WestonFamilyAwards/
  - Scholarships are awarded to the following:
    - ◊ Masters researchers for $15,000 over 1 year;
    - ◊ Doctoral researchers for $50,000 over 2 years;
    - ◊ Postdoctoral researchers for $100,000 over 2 years.

Good luck to all applicants, and I look forward to 'seeing' you at the Arctic Change 2020 conference!

N.W.T. Wolf Cull 'Inhumane and Unnecessary,' says Łutsel K'e Dene First Nation

First Nation one of many voices skeptical of proposed plan

John Van Dusen · CBC News · Posted: Nov 13, 2020

A proposed plan calls for killing 60 to 80 per cent of wolves that prey on the Bathurst and Bluenose East caribou herds every year for the next four years. (Dean Cluff/GNWT)

The Łutsel K'e Dene First Nation (LKDFN) says a proposed wolf cull put forward by the Northwest Territories and Tłı̨chǫ governments to protect two declining caribou herds is "both inhumane and unnecessary."

The First Nation is one of several voices in the territory to question a four-year plan that builds on a pilot-project this spring involving satellite collars and shooting from aircraft to drastically cut wolf populations that prey on the Bluenose East and Bathurst caribou herds by up to 80 per cent.

A letter dated Nov. 5 submitted to the Wek'èezhìi Renewable Resources Board (WRRB), which is currently reviewing the updated plan, spells out the First Nation's concerns.

"Based on our Dene values, traditional knowledge, and our review of the science, we believe it to be both inhumane and unnecessary. We believe that the proposal distracts and draws resources from actions that could benefit caribou," read the letter signed by Beth Keats on behalf of Glen Guthrie, the manager of the LKDFN's Wildlife, Lands, and Environment Department.

"We object to the practice by which the cull would be executed. Wolves hold a sacred place for many people of our community. They are respected co-dependents of caribou, and while some of our people harvest wolves, no one attacks them."

The letter also takes issue with a proposed $1.1 billion all-season road project the territory is moving ahead on that would likely travel through the Bathurst caribou herd range.

"It is unacceptable to the LKDFN that this proposed wolf cull program would proceed with such a high degree of uncertainty regarding its effectiveness to increase caribou survival rates, while at the same time the [government of the Northwest Territories] is contemplating development activities that will likely produce significant negative impacts on the Bathurst herd," the letter reads.

In a final submission dated Oct. 30 to the WRRB, the N.W.T. and Tłı̨chǫ governments say they will use an adaptive management approach and continue to rely on the best available scientific, local and traditional knowledge in their decisions about wolf management.

But a group that represents Métis in the territory questioned whether the relatively short project timeline will allow for "proper adaptive management."

"We request more information on how wolf populations are being estimated and how wolf removal targets are being set each year," read an Oct. 28 letter submitted to the board by the North Slave Métis Alliance.

The purple and green in this graphic show the winter ranges of the Bathurst and Bluenose-East caribou herds from December 2019 to March 2020. (Department of Environment and Natural Resources)

The letter said that current wolf population estimates in the Bathurst and Bluenose-East region are not available and predation rates on the caribou are likely overestimated.

"While wolf control programs in other northern jurisdictions such as Alaska and Nunavut have shown that predator control can have short-term benefits in the recovery of caribou populations, their

long-term effects on both caribou populations and the overall ecosystem is unclear," the letter read.

It said the removal of wolves must be done as fairly and humanely as possible, and communication must be maintained to ensure wolves are not over-harvested.

According to 2018 population estimates by the territory's environment department, the Bluenose-East herd has declined from about 120,000 animals in 2010 to about 19,000, and the Bathurst herd dropped from an estimated 186,000 caribou in 2013 to 8,200.

The WRRB is expected to make a decision on the wolf management plan in January.

Source: CBC News, Posted: Nov 13, 2020

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@cseb-scbe.org.

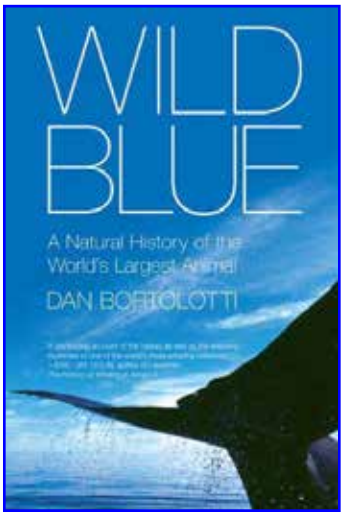
For more information, contact President Curt Schroeder at schroederc@saskpolytech.ca.

BOOK Review

Submitted by Bob Gainer, CSEB Member

Wild Blue

by Dan Bortolotti. 2009. Thomas Allen Publishers, Toronto



This is a biologist's biology book. A topic about what you have little or no involvement with but one that is of great interest to you. This is the first book that gives a review of the whole picture about blue whales and how relatively little is still known about them.

Bortolotti is actually a journalist who was assigned this topic. It took three years to complete and several deadlines were missed. He had to research the topic and then personally interview most of the active researchers and commentators on the topic. Normally, journalism aims for a grade 7 level of readability. This book is probably about a grade 12, and he is a gifted writer (as opposed to, ahem, a Grade 12 english student we know whose teacher told him never to write). Bortolotti is a Canadian with two books that have already been nominated for awards. It was easy and a pleasure to read this masterpiece.

Ideas Wanted!

The CSEB is planning on hosting two web-based forums (conference or workshop) in the upcoming year, dealing with emerging themes. The first may be a workshop on concerns about how professional biologists may be affected by federal and provincial climate plans as Canada moves beyond the COVID pandemic.

Join us for an ideas exchange and planning kick-off session on Jan 11, 2021 at 1:01 PM PST (4:01 PM EST) by registering here:

Register Now!

This session is presented alongside the CSEB AGM; registration facilitates participation in both the planning discussion and the AGM.

Blues are the largest animal to have ever existed in this world, if not by length, by weight (average adult weight of 80 tons, but some reaching 200 tons. Bortolotti prefers whaling measures to metric measures). Before the days of commercial whaling for the large whales (circa 1860), it is estimated that there were 300,000 blues. One hundred years later it was estimated there were 600, and in 2008, the time of this book, 10,000 was the estimate.

There are six of the seven rorqual family members in the same genus as the blue whale. Usually they are distinguished roughly by length: the blue 21.3 m (70 feet), the fin 18.3 m (60 feet), the sei 15.2 m (50 feet), the Bryde 13.7 m (45 feet). The much smaller two Minke species are 7.6 m (25 feet). They all hybridize, and the blue has even hybridized with the other non-genus member of the rorquals—the humpback. Most of them have pygmy subspecies as well. Females, of course, are larger than males. Distinguishing the four largest rorquals in the field must be a challenge—at least to me, a non expert. For instance, a blue fin hybrid male pygmy could be the size of a Bryde female.

Some populations of the rorquals are listed as "threatened``, but today none of them are considered in danger of extinction despite the fact that some, including the blue, are classified "endangered". All whale species have made comebacks since the whaling moratorium in 1986. The blues have too but notably less than the others. Rorquals, in general, have a long slow reproductive rate. Sexual maturity is about 10 years of age, at least 3 years between pregnancies, a life span of up to an estimated 100 years (however, an amino acid age determination of 48 bowhead eyeballs found several they thought were over the age of 200 years). In the case of the blue whale, it took several years to build up a population of breeding age animals but now their reproductive rate is thought to be about a healthy 7% a year.

Because of their size, they have few natural enemies. The worst by far is the Orca's predation of their young, but large ships split adults open (like us standing on a highway being hit by a semi). They sink to the bottom and no one knows it happened. Ships and whales don't hear or detect each other enough to avoid collisions. Also pollution—most notably in the Gulf of Saint Lawrence. The raw sewage upstream from several large urban areas, pulp and paper mills, and aluminum refineries along the banks is thought to reduce their fertility. Other factors, such as whale watching and global warming (of the oceans, not the atmosphere), may have positive or negative effects. We actually don't know how many are harvested by man but it is not 0%.

There are five basic blue whale populations, all about 2,000 animals:

- Antarctic (they circle the continent more or less continuously and never go north)
- North Atlantic (Gulf of Saint Lawrence, Baffin Strait, Greenland and what may be a separate population in Iceland, Azores and Northwest Africa)
- Eastern North Pacific (Aleutians, Queen Charlottes, California, Baja, Costa Rica dome)
- Indian Ocean (Madagascar, Maldives, Australia, Indonesia with a little bit of southwest Pacific; this population is pygmy blue)
- Southeastern Pacific (off the coast of Chile; another pygmy blue, probably a separate subspecies).

Each of these populations is considered to have more than a viable enough population size separately, but so little is known about blue movements, just that they travel long distances and are hard to keep track of, so there may be mixing between some populations. The Indian Ocean pygmy population, and especially the Chilean pygmy population, are the most genetically isolated according to their DNA. In theory, they are no longer being harvested so all five populations are slowly recovering. By 2068, they will have recovered their pre-whaling population size of 300,000 individuals.

And then there is one little minor existential threat to discuss; Politics of course! After World War I, Britain organized what became the International Whaling Commission to regulate whaling like most fisheries were being regulated, "for the proper conservation of whale stocks for the orderly development of the industry." Needless to say it failed horribly. In 1960 they formed a Committee of Three to critically examine their progress and in 1963, it reported that they had to drastically reduce all their quotas and completely eliminate any hunting of blues, which they estimated to be fewer than 600 left. The total ineptitude of the IWC was its denial of the report's findings by the most influential and respected whale biologists of the time who said "We can be proud of the fact that, of the over 20 species of whale we managed, only one or two had been driven to extinction."

IWC considered that blue whale conservation didn't matter about the same time as the environmental movement was becoming a force in the USA, and groups like Greenpeace came to the rescue of the blues to say that they did matter (even though they never did actually stand in the way or prevent the harpooning of a blue). The Americans, with the assistance of environmental groups and promises of "aid" money, convinced many small countries to join IWC and vote with them to slow down the harvest of all whales, and by 1986, the anti whaling voting bloc had put a stop to whaling almost completely with its moratorium on hunting.

Reporting had been voluntary, the honour system, up until then. Aristotle and Jackie Onassis and their "Olympic Challenger" factory ship, the largest at the time, had been the worst offenders, but the Russian, Japanese, and virtually all fleets were guilty to lesser degrees. Then there were mandated on-board official observers that slowed things down, and then the moratorium stopped whaling, but only with those countries that complied.

The moratorium in 1986 should have been an end to it but there was just one tiny little loophole that the Japanese started to exploit. Commercial harvesting of whales was stopped but the IWC needed money for its funding so it sold permits for scientific studies. The Japanese bought up all the permits they could and easily became the world's experts on all things whale.

After a few years, the Japanese were asserting two unassailable facts:

1. Several whale species eat fish; in fact, whales eat 3-6 times as much fish as humans do. They were competing for a diminishing resource. The fish eaters (whales) needed harvesting for this reason.

2. There were perhaps 100 times as many Minke whales in the Antarctic as there were pre-whaling. They were competing for the same krill as the blues, which would explain the slow recovery of blues to only about 2,000 today, from formally 240,000 in the Antarctic Ocean. Minkes needed to be harvested (and by the way they taste delicious). The Japanese have many facts and data to back up their allegations that no other country has to match them. At the time of the printing of this book, the momentum was on the side of the Japanese. According to environmental groups, they are out bribing the countries they had previously been able to bribe, and a whole lot more, with "aid" money to vote to cancel the moratorium.

The meat from the Scientific permits was allowed to be sold in Asian markets. An environmental group also managed to buy from some of these markets and did DNA analysis of what was advertised as Minke whale meat. They found that there were two- dozen fin whale samples, a humpback whale, a blue whale, and a fin/blue whale hybrid from Icelandic whalers. Obviously whalers still could not be trusted, no more than fishing boats could be in other fisheries or the commercial harvest of any natural, "common property" species. It is easy for me to be judgemental when I have already admitted I could not distinguish the overlap between the largest four rorquals, their sexes and hybrids, and pygmy subspecies, some of which have large healthy populations.

The Japanese, of course, are correct in asserting that there are many Minke, humpback, sperm, and orca whale stocks that could (should?) be safely harvested, but look at the history of this industry. What's to stop them from throwing in the meat from blues? Perhaps Hardin's "Tragedy of the Commons" explains it, or more likely it is less sophisticated than that, but Bortolotti is right in saying we need a better regulatory mechanism. We don't even know the basics like how blues can find their periodically abundant food supply and their movement patterns over great distances at the right moment to take advantage of the abundance, as well as many other important features of their biology, to be comfortable letting them be legally harvested yet. What population information we do have is mostly indirect "allusions" to increasing population sizes; reported sightings, sonar recordings, some catch recapture, photo ID, etc. No actual direct observational estimates can be made because of the vast, enormous range of these animals.

Above all, Bortolotti thinks we need to leave them in peace, at least until we understand them better (not in the form of recipes).

I know of no other biologist who has read this book. It should be mandatory reading for Canadians biologists. Bortolotti (Canadian) and Thomas Allen Publisher (Canadian) did a magnificent, world-class job of describing blue whale biology and has set the bar for more books like this from folks like us.

Upcoming CSEB Research Webinars

Restoration Effectiveness of Living Shorelines in the Salish Sea

By Dr. Jason Toft, University of Washington School of Aquatic and Fishery Sciences

When: Jan 17, 2021 at 7:00 PM PST/8:00 PM MST/9:00 PM EST

Shoreline armouring has altered many intertidal beaches. Living Shoreline techniques aim to improve shoreline conditions by re-creating some of the functions of natural shorelines. Recent design implementations include complete removal of armouring, as well as eco-engineering approaches. Learn about how ecological monitoring of these sites can inform shoreline planning now and into the future.

Register now!

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

Salmon Hatcheries and Unintended Consequences for Wild Pacific Salmon

By Dr. Carrie Holt, University of Toronto

When: Feb 21, 2021 at 7:00 PM PST/8:00 PM MST/9:00 PM EST

Register now!

For more information, check the CSEB Website at www.cseb-scbe.org.

COSEWIC
Committee on the Status of Endangered Wildlife in Canada

COSEPAC
Comité sur la situation des espèces en péril au Canada

Tough Times for Animal Travellers

Travelling can be tough, and not just for people in a pandemic. At their most recent virtual meeting, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) found that while some assessed migratory species are doing well, many others are facing challenges wherever they go.

After maturing at sea, Chinook Salmon on Canada's West Coast swim back to their natal streams to spawn. Twenty-eight populations of Chinook Salmon live in Southern British Columbia, each with different habitats and survival strategies. Chinook Salmon face many threats in both fresh and saltwater, including climate change and detrimental effects from hatchery fish. At the current meeting, COSEWIC considered the 12 populations of Chinook Salmon most impacted by hatcheries: four were designated Endangered, three Threatened, and one Special Concern, while one was deemed Not at Risk. Three remote populations were determined to be Data Deficient, and will require additional research before being re-assessed.

Steelhead Trout is a form of Rainbow Trout that migrates out to sea before returning to spawn in streams. These salmon-sized trout have been an important late winter food source for thousands of years. Gloria Goulet, Co-chair of the Aboriginal Traditional Knowledge Subcommittee quoted late Secwépemc Elder Laura Harry: "Salmon are our first children", underscoring the significant relationship between Ts'egwllníw't (Steelhead) and Aboriginal people in the Thompson River watershed. The two populations in Southern British Columbia that migrate furthest recently declined to alarmingly low numbers and were subject to an emergency assessment in early 2018. At the present meeting, they were confirmed as Endangered.

As John Reynolds, Chair of COSEWIC and a salmon researcher, highlighted, "These new assessments reinforce our understanding of the urgent challenges wild salmon face in Canada and the need for continued co-operation."

The Red Knot's remarkable migration spans the continents, with some of these shorebirds flying more than 30,000 kilometers a year. Climate change, anthropogenic disturbances, and scarce stopover food resources are making this odyssey more difficult for some populations. The Knots that travel to the very tip of South America and those that winter in the Gulf of Mexico were designated Endangered, both with severely declining numbers on the wintering grounds. A third population of Red Knot was assessed as Threatened, a fourth as Special Concern while the fifth was considered Not at Risk. Lesser Yellowlegs, which migrates significant distances, and the Atlantic population of Leach's Storm-Petrel, which can fly up to 800 km a night to feed on bioluminescent lantern-fish, were also deemed Threatened. However, Canada Warbler, another migratory bird that winters in the Northern Andes, has slowed its long-term decline, and its status improved from Threatened to Special Concern.

Beluga and Inuit have been vital parts of each others' lives, ecologies and cultures for over a thousand years. Canada is home to eight distinct Beluga populations, each with its own migration route between summer and wintering grounds. Six of these Beluga populations were assessed at this meeting by COSEWIC. Though industrial hunting decimated populations a century ago, current traditional harvests are mostly sustainable. There are also some encouraging signs, as many Beluga populations have been stable or have improved. Two large populations in Hudson and James Bays were determined to be Not at Risk, while two were designated Endangered, one Threatened, and one Special Concern. There are ongoing concerns from underwater noise and boat disturbance, which can displace the whales from important habitats and impair their ability to communicate and feed. Climate change may also be a problem, as sea ice retreats and industrial activity and beluga-eating Orcas move in.

Further details on all wildlife species assessed at this meeting can be found on the COSEWIC website (https://www.cosewic.ca/). For more information on how COSEWIC assesses species, and a complete list of Canadian wildlife species assessed by COSEWIC up to 2020, please see https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/species/CanadianWildlifeSpeciesAtRisk-2020.pdf.

Next meeting

COSEWIC's next scheduled wildlife species assessment meeting will be held in May 2021.

About COSEWIC

COSEWIC assesses the status of wild species, subspecies, varieties, or other important units of biological diversity, considered to be at risk in Canada. To do so, COSEWIC uses scientific, Aboriginal traditional and community knowledge provided by experts from governments, academia and other organizations. Summaries of assessments are currently available to the public on the COSEWIC website (https://www.cosewic.ca/) and will be submitted to the Federal Minister of the Environment and Climate Change in fall 2021 for listing consideration under the Species at Risk Act (SARA). At that time, the status reports and status appraisal summaries will be publicly available on the Species at Risk Public Registry (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

For further information, go to https://www.cosewic.ca/.

Source: Excerpted from press release dated 8 December 2020, Ottawa ON.

CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS
LA SOCIETE CANADIENNE DES BIOLOGISTES DE L'ENVIRONNEMENT

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