DISCOVERY

VOLUME 47 * 2019 * NATURE VANCOUVER

continued on next page...

Table of Contents continued...

President's Message

After a somewhat soggy September, the month is ending with cooler temperatures and glorious fall weather. On the environmental front, the last week of September has seen a wonderful expression of concern and caring about the environment, with Greta Thunberg's challenge to world leaders at the United Nations, and unprecedented events and marches in support of the environment all around the world.

Seeing such support gives one some hope for the environment's *and* mankind's future. For me, it also reinforces the value of Nature Vancouver. Caring about issues is important, but that concern is substantially increased by having knowledge and a personal connection to those issues. This is where Nature Vancouver shines.

For more than a century, Nature Vancouver has championed the study and appreciation of nature through numerous activities, including weekly speakers, walks, hikes and summer camps. Our present-day challenge as a society is to involve younger people, who are at the forefront of stepping forward to protect the environment.

Welcoming new members will strengthen Nature Vancouver for the future. For members, our society offers a solid base to appreciate and learn about the environment. This, in turn, complements and strengthens the commitment to the larger worldwide challenges we face. Please take the opportunity, whenever you can, to inform friends, family and colleagues about Nature Vancouver, particularly the younger folks—it is to the benefit of everyone.

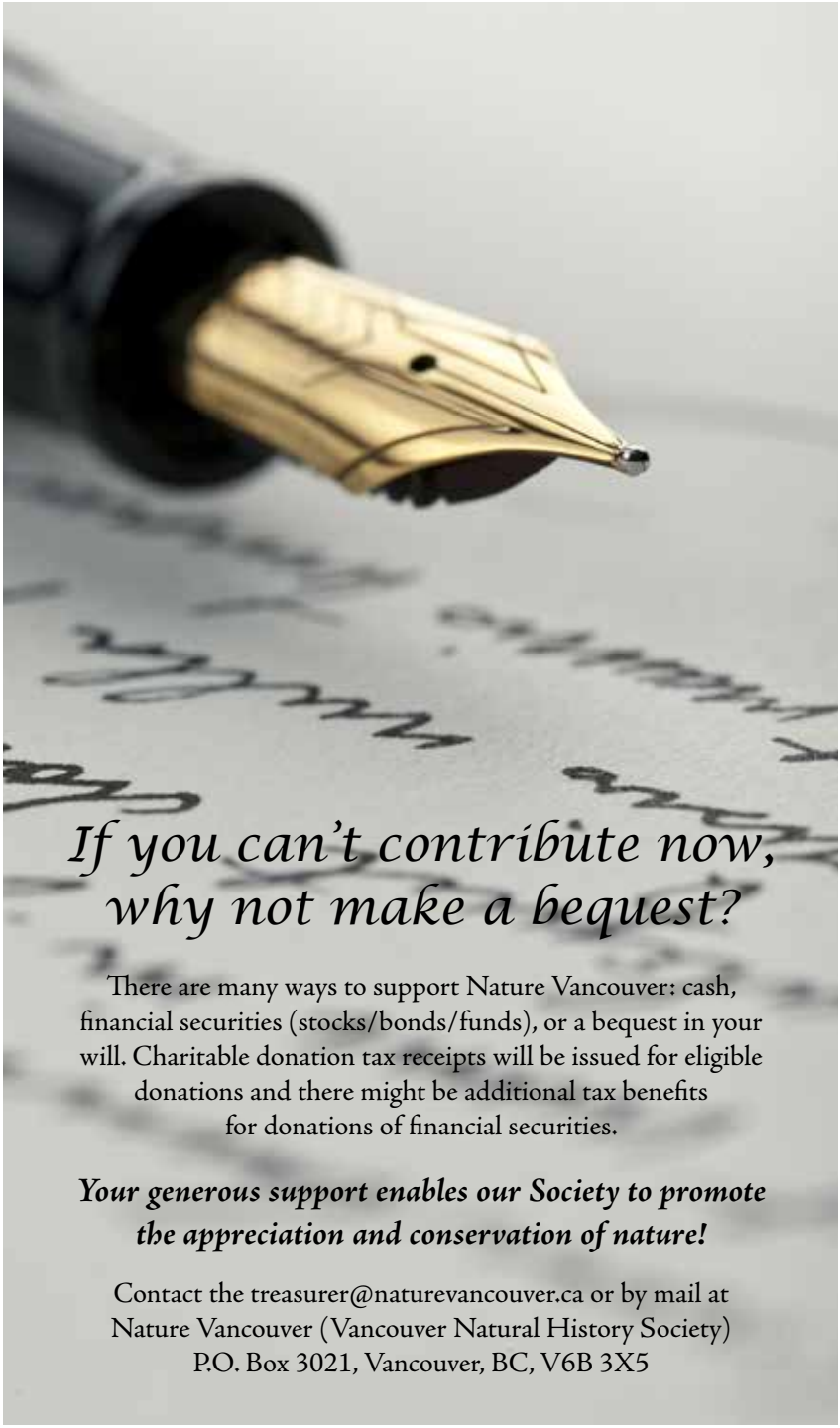
—Nigel Peck

NATURE VANCOUVER

The Vancouver Natural History Society, now known by its members and the public as Nature Vancouver, was founded in 1918 by Professor John Davidson, with the following objectives:

- To promote the enjoyment of nature
- To foster public interest and education in the appreciation and study of nature
- To encourage the wise use and conservation of natural resources
- To work for the complete protection of endangered species and ecosystems
- To promote access to and maintenance of natural areas in the vicinity of Vancouver

Discovery: *Discovery* is a journal of natural history and conservation for British Columbia. It is published annually by the Vancouver Natural History Society (Nature Vancouver), PO Box 3021, Stn. Terminal, Vancouver, BC, V6B 3X5, as a service to its members and subscribers. ISSN 0319-8480. Publication Sales Agreement #40038882.



If you can't contribute now, why not make a bequest?

There are many ways to support Nature Vancouver: cash, financial securities (stocks/bonds/funds), or a bequest in your will. Charitable donation tax receipts will be issued for eligible donations and there might be additional tax benefits for donations of financial securities.

Your generous support enables our Society to promote the appreciation and conservation of nature!

Contact the treasurer@naturevancouver.ca or by mail at
Nature Vancouver (Vancouver Natural History Society)
P.O. Box 3021, Vancouver, BC, V6B 3X5

Editor's Notes

Dan Overmyer. *Photo: Jordanna Hertz*

Our universe is approximately 13.7 billion years old, while our sun and the Earth appeared about 4.54 billion years ago. Since that time, the Earth has been through many transformations: continents have split apart, oceans have formed and reformed, huge volcanoes have erupted to cover vast areas with lava, and asteroids have smashed their way in. About 66 million years ago, an asteroid 11–81 kilometres wide crashed into the area we know as the Yucatan Peninsula and threw up so much dust and rock that sunlight was blotted out; 75% of the plants and animals alive then were destroyed, including the dinosaurs and primitive birds. Yet, despite this terrible destruction, life slowly recovered and now we have this beautiful green Earth, with its blue atmosphere, oceans and continents full of life—as well as about 10,000 species of birds! In this same context, our animal predecessors and human ancestors also developed, and here we are! All so utterly improbable and amazing! Other groups such as Greenpeace, the Wilderness Committee, and BC Nature are concerned with wider areas, but Nature Vancouver is our response to all this wonder in Vancouver and its environs. We are doing our best in our part of the Earth to understand, enjoy and care for it. Our members and leaders have learned so much about the geology, plants, sea life, animals and birds in our area, and share their knowledge in field trips, camps, talks and more. Except for our modest membership dues, all this is free to those who are interested. Nature Vancouver is a wonderful organization for which we should all be proud and support. This 2019 edition of *Discovery* demonstrates what we are doing and learning now. My gratitude to all who have contributed to it. I hope you enjoy the result!

—Dan Overmyer, Past President and Editorial Committee member

James Adrian Neill Grant Duff

September 20, 1939–July 5, 2019

Adrian was volunteering with Nature Vancouver right up to the end of his life.

He orchestrated the Christmas Bird Count from 1997 to 2018—21 years of organizing team leaders and collating the results on the Sunday in December when the count was held.

Adrian was far from well this past Christmas, but there he was, out at the crack of dawn with his son, Brian, and others to cover his usual areas—Vancouver Port, New Brighton Park and Hastings Conservancy. Although he was moving slowly, he coordinated and directed the count right through to the required end.

But the day didn't stop there. With his usual grace and good cheer, Adrian emceed the post-count communal dinner and wrap-up at St. Mary's Church hall later that day, with Brian beside him at the sign-in table.

Adrian joined Nature Vancouver in 1980. He chaired the Birding Section from 1998 to 2001. This section has always been the reason many people join Nature Vancouver.

James Adrian Neill Grant Duff

As Chair, he ensured that there were weekly birding walks throughout Greater Vancouver which enabled members and people simply interested in discovering birding to get out and observe. He was particularly helpful to new members. Adrian's kindness, patience and empathy were unwavering, and he always welcomed questions.

Adrian was President of Nature Vancouver 2003–2007. One of his tasks was guiding us through the name change from Vancouver Natural History Society to Nature Vancouver for everyday use and branding. It was amazing to find out how many bridges would have to be crossed before the powers that be in Revenue Canada would approve this. But Adrian stuck with it, and here we are.

When the City of Vancouver formed the Vancouver Bird Advisory Committee in 2015, with the purpose of helping protect and enhance bird habitat, Adrian became Nature Vancouver's representative. This important committee did much to raise the profile of bird habitats in Vancouver, thanks to Adrian and his fellow committee members.

He also participated in many of the society's wilderness camps, working on the set up and striking of camp, and leading groups on birding field trips. On the last Saturday during the 2007 Blowdown Lake camp, just after the cook and dining tents were taken down, a torrential rainstorm hit. People were soaked in the half hour it took to erect tarps, first over the cooking area, then where the dining tent had stood just a couple of hours previously. All were huddled under a 20- x 25-foot tarp when Adrian showed his social acumen by whipping out a 26'er of his favourite single malt scotch. This he shared with the soggy campers, all the while with a wonderful, cheerful smile on his face.

Adrian's celebration of life at St. Mary's on August 12 was almost standing room only, with people attending from his church, Scottish country dancing group, curling and other areas of interest. Clearly, Nature Vancouver is not the only organization that will be forever grateful to have benefitted from his knowledge and friendship.

We send our condolences to his sons, Brian and Kevan, and their families. And to Grace Shaw, who, as his family noted, "inspired his second act."

—Cynthia Crampton

Remembering Roy Edgell

June 28, 1917—November 16, 2018

Almost everyone in Nature Vancouver knew or knew of Roy Edgell. Quiet, confident, energetic, resourceful and ever cheerful, he was a prominent active member of our society for two thirds of its existence, from 1951 to 2018.

Born in London, England, in 1917, Roy developed an interest in photography at an early age. Unable to join the Royal Air Force as a photographer, he was conscripted into the army in 1940. After basic training, his primary duty was installing and servicing electrical and radar equipment to defend England. He met his wife, Helen, during the war and they emigrated to Canada, settling in Vancouver in 1949. In 1951 the Edgells joined Nature Vancouver, then called the Vancouver Natural History Society. Here they found a like-minded cohort of outdoor nature enthusiasts.

By profession, Roy was a printer, culminating his career as a manager with Pacific Press, publishers of the *Vancouver Sun* and *Province* newspapers. He retired in 1982.

At Nature Vancouver, Roy preferred to work behind the scenes, leading or assisting in a wide variety of activities rather than taking on executive responsibilities. Between 1965 and 1971, he was Nature Vancouver's representative (along with Jack Husted) on the province's Mountain Access Committee. Always interested in photography, between 1969 and 1971 his skill was of great assistance to our Botany Section where Kay Beamish and Nancy Anderson were engaged in a plant family identification project. Roy eventually became Photographic Section leader and coordinator for our annual photography competition. The annual presentation of members' photographs, in both print and 35 mm slide format, was a highly anticipated event each year. In the early 1980s, he also prepared a series of articles to help members understand photography and sharpen their photographic skills.

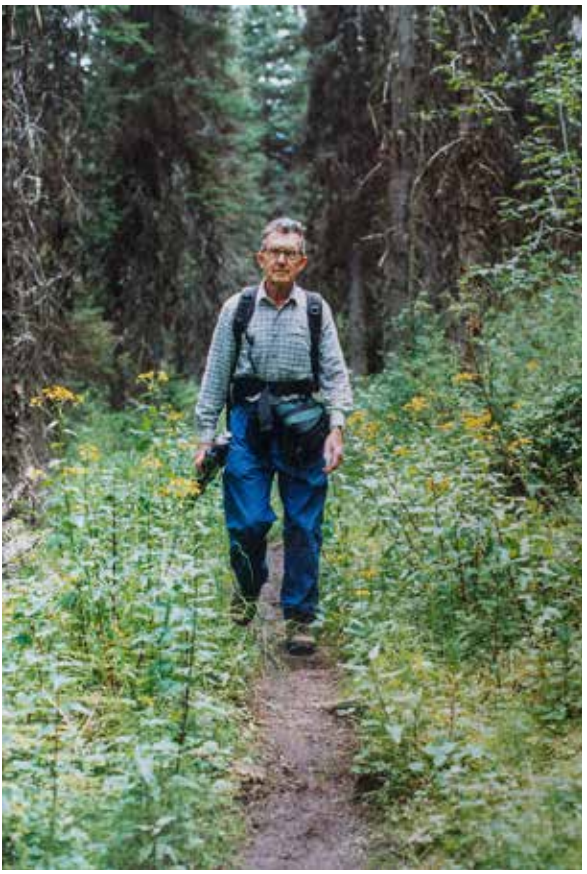
The annual summer camp, a Nature Vancouver tradition initiated in 1918 by John Davidson, our first president, continues to the present day, come rain, hail or snow! Roy and Helen along with other members of the Edgell family were regular participants. During the camps of 1966, to Kokanee Park, and 1976, to Meadow Mountain, Roy took on the considerable responsibility of being camp leader. He was co-leader with Bob Wheeler to Tulameen (1967); with Bill Smith to the Black Tusk Meadows (1968); and with John Philip to the Cinnabar Basin (1980).

The establishment of Campbell Valley Regional Park in Langley became one of the many challenges Nature Vancouver undertook during the late 1960s and early 1970s. Roy was among those who promoted its acquisition.

Roy was also one of the society's earliest recipients of the Kaye and

Charles Ney Award—our society's premier award! It is presented annually to a non-executive member who had shown exemplary service and dedication.

In 1995, during Nature Vancouver's bus trip to the Grand Canyon, Roy will forever be remembered for rising at 3:00 a.m. and, with Halvor Lunden, hiking to the bottom of the canyon and back up in time to catch the bus before our afternoon departure (that's 3,000+ ft down and back up). The Hiking Guide states: "*Completing this hike in one day is only for the fittest of all hikers.*" Roy was 78 at the time of this feat!



Roy Edgell. *Photo: courtesy of Phil and Lauralee Edgell*

Five years later, with his son and two grandsons, he hiked the west coast of Nootka Island from north to south! Roy and Helen greatly enjoyed Scottish country dancing and travelling in the British Isles, and they were always looking for new hiking destinations to satisfy their curiosity and love of nature.

Just before Nature Vancouver's Centennial Celebration (October 25, 2018) I phoned Roy at his son's home in Port Alberni. Phil answered, saying to Roy, "Do you know a Bill Merilees?" Roy responded in a voice loud enough for me to hear clearly, "Who doesn't know Bill Merilees!" Well, I would like to return the compliment: Who at Nature Vancouver did not know, benefit from, and enjoy the good company of Roy Edgell?

Roy passed away in his 101st year November 22, 2018. He had been a cherished member of our society for 67 years.

I would like to thank the Edgell family and May Loudon for their assistance in preparing Roy's story from a Nature Vancouver perspective.

—Bill Merilees

A Natural Destination in BC's Chilcotin Region

Welcome to Puntzi Lake, home of Woodlands Fishin Resort!

250-481-0011

Choose our campground or cabins as your home base when visiting this awe-inspiring area! Puntzi Lake and surrounds feature natural pelican habitat, wild horses, bears, eagles and more… And yes we even have a bakery….yum!

The Blackbelly Eelpout and its Role in the Outer Burrard Inlet Ecosystem

by Colin Levings

Introduction

The eel-like zoarcid fish (*Lycodes pacificus* Collett 1879), more commonly known as the Blackbelly eelpout, is one of the most abundant but least known members of the bottom fish community in Burrard Inlet. This species lives on mud or sand bottom substrates that are not favoured by divers and as Vancouver Harbour is now mainly closed for commercial fishing and sports fishing for bottom fish, it is one of the more secretive fishes inhabiting our waters. I provided some of the original data on the ecology of this species in outer Burrard Inlet, officially called the western portion of Vancouver Harbour, when I was an MSc student at UBC in the late 1960s. I used the nomenclature of the day, *Lycodopsis pacifica* (Collett 1879). However, while the common name has stayed the same, the correct scientific name is now *Lycodes pacificus* (Collett 1879) (www.fishbase.de/summary). The basic findings of my thesis were published in 1977. This is an update reflecting current knowledge of the ecological role of the species, including how it contributes to the biodiversity of the harbour.

When I met my supervisor, Norman J. Wilimovsky, at the University of British Columbia's Institute of Fisheries in 1965 to discuss my MSc thesis project, I really did not know what to study. After discussions, he suggested that I research the life history of the Blackbelly eelpout, a representative of the little-known family Zoarcidae, in which he was interested. After deciding to tackle the project, a first practical issue was how to obtain specimens to conduct a study. I believe it was shrimp specialist Terry Butler at the Pacific Biological Station in Nanaimo who told me it was abundant in outer Burrard Inlet and frequently caught there by shrimp fishers. Fortunately, I had a background of working with commercial fishers, so I turned to the shrimpers working local waters to see what help was available.

Obtaining Samples of Blackbelly Eelpout

In the 1960s, there was an active otter trawl and beam trawl fishery for shrimp in outer Burrard Inlet (Figure 1). Records for this specific area are not available but Ketchen *et al.* (1983) stated that in the Vancouver area catches mainly of Pink shrimp (*Pandalus borealis*) peaked at 442 tonnes in 1957. In 1966, many boats were still making regular trips. The fishery was an interesting reflection of the environment at the time. The owners of the small gillnetter-type boats supplied Vancouver residents with the freshest shrimp possible as they were cooked right after they were caught, using onboard stoves and water pumped directly from the inlet.

After making some contacts with the fishers, Mr. K. Tanaka and

Mr. J. Kondo very kindly agreed to collect specimens of Blackbelly eelpouts from their fishing trips in the inlet (Figure 1). It was not a big problem for them as many of this type of eelpout were just the right size to clog their nets, so they had to pull them out between beam trawl sets (Figure 2). One day each month between December 1965 and November 1966, I would take a bucket down to the main fish dock in Vancouver and then pick up the eelpout specimens a day or so later. It all worked out very well, providing me with an excellent series of samples to study growth, reproduction, feeding and other aspects. The shrimp boat samples were supplemented with 25 otter trawl samples along a straight-line transect off Spanish Banks (Figure 1) that I obtained in May and June 1966 using the Institute of Fisheries' seven-metre launch.

Thirty-three years later, I was able to provide an update on the abundance of the species. The 1999 study was part of an international workshop conducted under the auspices of PICES (the North Pacific Marine Science Organization) with the goal of conducting a detailed environmental assessment of Vancouver Harbour (Figure 1). The PICES project (Levings *et al.* 2003) was focused on samples of English sole (*Parophrys vetulus)* but all fish were enumerated, providing data on Blackbelly eelpout and other species. One of the sites we sampled for fish was in outer Burrard Inlet off West Vancouver, very close to where most of my 1966 samples were obtained from shrimp fishers. Site T-49 was sampled six times in May and June 1999.

Abundance and Place in the Fish Community

Results from the two sampling time periods are not directly comparable because the 1999 study used a larger mesh net, but clearly the eelpout was still abundant in the region 33 years after I did my thesis work. In the 1966 studies off Spanish Banks, the species was found in 92% of 25 trawls, accounting for 29.3% of the fish caught with average abundance of about 11 fish per 100 m^2, which was calculated very approximately from the area of the bottom swept by the net. Results from the 1999 study at sites from Thornborough Channel (Figure 1; outer Howe Sound near Gibsons) to Port Moody showed the species was most abundant at Site T-49, accounting for about 38% of all specimens in the six otter trawls at this site. Abundance was estimated at approximately one per 100 m^2, the highest of all the 20 species caught at this site (Levings and Ong, 2004).

The Blackbelly eelpout is a dominant species in quite a diverse, and apparently relatively stable, fish community. In the 1966 trawl survey at Spanish Banks, 26 species of fish representing 15 families were found and 20 species representing the same 15 families were found in the 1999 PICES survey at Site T-49. Fourteen species were found in both surveys. Considering the combined data set from both surveys (thesis and PICES data), the bottom fish community of outer Burrard Inlet was composed of 32 species of fish (Table 1).

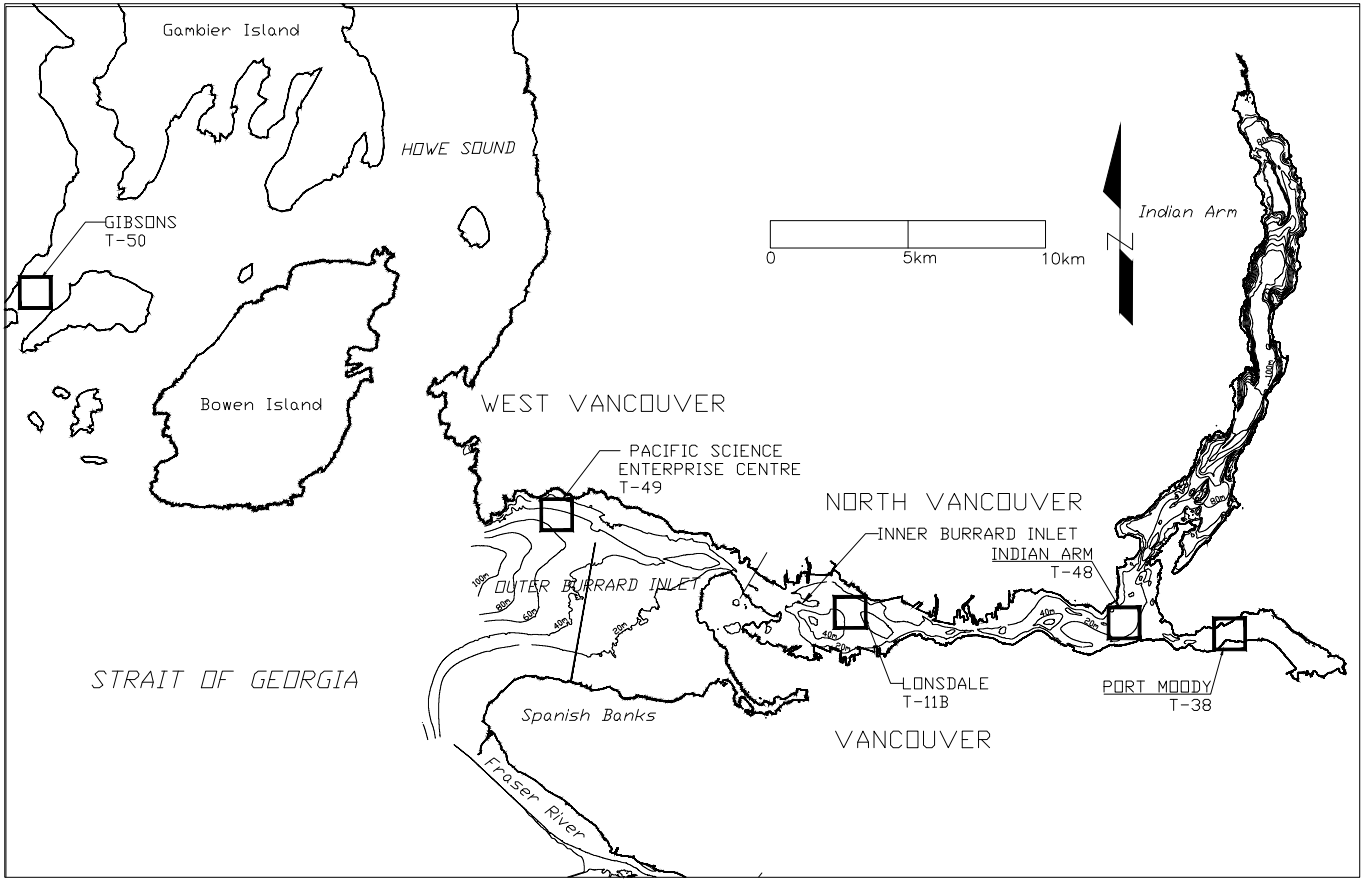


Figure 1. Map of the study area and locations trawl sampled in 1966 (Spanish Banks transect, Site T-49 area) and 1999 (T-50, T-49, T-48, T-38, T-11B). Adapted from Levings et al., 2003.

Size, Growth and Reproduction

The Blackbelly eelpout from my 1966 study showed a maximum size of about 20 cm and weight of 30 g. The smallest fish caught was 7 cm in length but because of the relatively large mesh size in the shrimp trawls (3.2 cm in the codend or narrow, closed end of the trawl net) smaller individuals may have been present but not caught. Males grow faster and are larger than females by about 3 cm at maximum length. There is sexual dimorphism, with the males having larger "alligator" heads (Figure 3). Using otoliths (earbones) to estimate age, I determined the species lived approximately five years.

Reproduction of the Blackbelly eelpout has some interesting aspects. The females have very large eggs, about 5 mm in diameter, and mature fish were found to hold only about 30 eggs. This is somewhat unusual for marine fishes as many species produce thousands of eggs which are released into the water and fertilized with sperm in a process known as broadcast fertilization. Many of these species produce free floating larvae but zoarcid larvae have never been found and juvenile bottom-dwelling fish are likely released directly from the egg after hatching. As well, with such a small number of eggs, the species may have evolved some type of egg or parental care. I was unable to

Figure 2. Neil McDaniel sorting samples of the Blackbelly eelpout from a trawl survey in Howe Sound, 1976. *Photo: Graham Christie*

explore this aspect of the life history for my thesis, but this would make a good project. In a photo taken from a submersible by a researcher working in California, it seemed the Blackbelly eelpout made a type of nest in the mud bottom (Levings 1967). If this was so, the Blackbelly eelpout would fit into the type of reproduction called Os by Elliott and Dewailey (1995) wherein eggs are shed/protected in a nest or case or pouch. Some recent behavioural data on parental care in genus *Lycodes* and the related genus *Lycodapus* using laboratory observations reinforced the idea that a parental care life history strategy is important among zoarcids in general (Ferry-Graham et al., 2007).

Role in the Food Web

The Blackbelly eelpout is clearly an opportunistic benthic feeder, as I found bivalve molluscs, polychaetes and crustaceans such as benthic amphipods in stomach samples. Dr. Ian McTaggart-Cowan, the renowned ecologist and Head of the Faculty of Graduate Studies at UBC at the time, very kindly identified the bivalves for me. He found the most common species were the Charlotte macoma (*Macoma carlottensis*), the Lenticular axinopsid (*Axinopsida serricata*), the Oblique-lined yoldia (*Yoldia seminuda*), and the Almond yoldia (*Yoldia amygdalea*). Polychaetes in the diet included the distinctive Dumbbell worm (*Sternaspis* spp.) and the Three-section tubeworm (*Phyllochaetopterus* spp.). There were also a few examples of planktonic organisms such as crab larvae.

Little was known about how the Blackbelly eelpout supported higher trophic levels when I studied it, but more recent information shows the

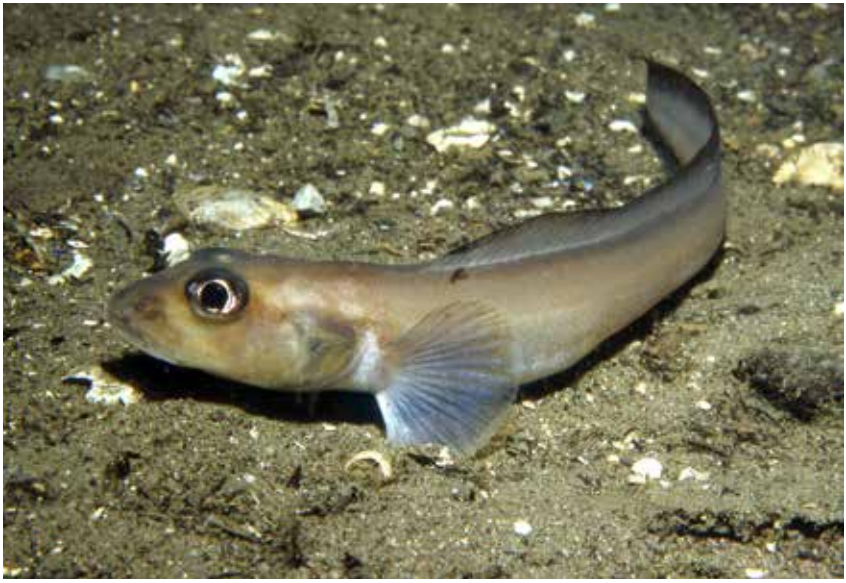


Figure 3. Blackbelly eelpout on the ocean floor. *Photo: Neil McDaniel*

Table 1. Species list of fishes caught in trawl surveys off Spanish Banks in 1966 and outer Burrard Inlet (Site T-49) in 1999. Note that some name changes have occurred in the past 53 years. Sources: https://www.fishbase.se/search.php (accessed June 17, 2019); WoRMS; ITIS

Scientific Name	Common Name	Family	Spanish Banks (1966)	Outer Burrard Inlet, Site T-49 (1999)	Caught in Both Surveys
Podothecus accipenserinus	Sturgeon poacher	Agonidae	+	+	Yes
Ronquilus jordani	Northern ronquil	Bathymasteridae	+	-	No
Porichthys notatus	Plainfin midshipman	Batrachoididae	+	+	Yes
Clupea pallasii pallasii	Pacific herring	Clupeidae	-	+	No
Chitonotus pugetensis	Roughback sculpin	Cottidae	-	+	No
Icelinus tenuis	Spotfin sculpin	Cottidae	+	-	No
Leptocottus armatus	Pacific staghorn sculpin	Cottidae	+	+	Yes
Psychrolutes paradoxus	Tadpole sculpin	Psychrolutidae	-	+	No
Radulinus asprellus	Slim sculpin	Cottidae	+	-	No
Cymatogaster aggregata	Shiner perch	Embiotocidae	+	+	Yes
Racochilus vacca	Pile perch	Embiotocidae	+	-	No
Microgadus proximus	Pacific tomcod	Gadidae	+	+	Yes
Gadus chalcogrammus	Walleye pollock	Gadidae	+	-	No
Lepidogobius lepidus	Bay goby	Gobiidae	+	-	No
Spirinchus thaleichthys	Longfin smelt	Osmeridae	+	-	No

Thaleichthys pacificus	Eulachon	Osmeridae	-	+	No
Citharichthys sordidus	Pacific sanddab	Paralichthyidae	+	+	Yes
Citharichthys stigmaeus	Speckled sanddab	Paralichthyidae	+	+	Yes
Atherestes stomias	Arrowtooth flounder	Pleuronectidae	+	-	No
Glyptocephalus zachirus	Rex sole	Pleuronectidae	-	+	No
Hippoglossoides elassodon	Flathead sole	Pleuronectidae	+	+	Yes
Lepidopsetta bilineata	Rock sole	Pleuronectidae	+	+	Yes
Lyopsetta exilis	Slender sole	Pleuronectidae	+	+	Yes
Microstomus pacificus	Dover sole	Pleuronectidae	+	+	Yes
Parophrys vetulus	English sole	Pleuronectidae	+	+	Yes
Platichthys stellatus	Starry flounder	Pleuronectidae	+	+	Yes
Psettichthys melanostictus	Pacific sand sole	Pleuronectidae	-	+	No
Beringraja rhina	Longnose skate	Rajidae	+	-	No
Sebastes maliger	Quillback rockfish	Sebastidae	+	-	No
Squalus suckleyi	Pacific spiny dogfish	Squalidae	+	-	No
Lumpenus sagitta	Snake prickleback	Stichaeidae	+	-	No
Lycodes pacificus	Blackbelly eelpout	Zoarcidae	+	+	Yes

species may be important in the diets of marine mammals, other fishes and seabirds in our region. It was found in stomachs of Harbour porpoise (*Phocoena phocoena*) (49.0% of stomach content by number) and Dall's porpoise (*Phocoenoides dalli*) (92.2% of stomach content by number) in Puget Sound (Walker et al. 1998) and in Harbour seals (*Phoca vitulina*) stomachs (0.2–1.1% relative mass of stomach content) at four locations in the Strait of Georgia (Canadian part of the Salish Sea) (Thomas 2015). The species may be a prey item for some of the larger bottom-feeding fish species in the area but there are few specific data. Blackbelly eelpouts were not found in stomachs of the Pacific spiny dogfish (*Squalus suckleyi*), one of the suspected predators in the region. In a food web model of the Strait of Georgia, eelpouts were included in the group of fish called small demersals—those living on or near the bottom of the ocean. They were linked to lingcod (*Ophiodon elongatus*) and rockfishes (*Sebastes* spp.) but no specific feeding data were given (Preikshot et al., 2012). Diving seabirds are likely predators on Blackbelly eelpouts in shallower waters. Johnsgard (1987) noted that the fish prey of the Red-throated Loon (*Gavia stellata*), Arctic Loon (*Gavia arctica), Common Loon (Gavia immer)* and Thick-billed Murre (*Uria lomvia)* included eelpouts such as *Lycodes* spp.

Habitat Considerations

Little is known about the habitat requirements of the species, but the Blackbelly eelpout may be adapted to a muddy substrate. It was more abundant on mud bottoms (approximately 13 per 100 m^2) than on sand bottoms (approximately 9 per 100 m^2) (Levings, 1973). The differences in abundance may have been because benthic (bottom-dwelling) invertebrate food was more abundant in muddy sediments. It is possible the Blackbelly eelpout is indicative of a relatively pollution-free habitat. In the 1999 PICES study, the species was caught at all Vancouver Harbour sites except for Port Moody (Site T-38), a site characterized by higher levels of contaminants. Further information is needed to investigate this hypothesis.

Conclusions and Contemporary Role of the Blackbelly Eelpout in the Burrard Inlet Ecosystem

There is an ever-growing interest in biodiversity in the world's oceans and this concept takes into consideration species such as the Blackbelly eelpout—of no significant commercial or recreational value to humans but important for a natural ecosystem function. As an example, Horn (1980) pointed out that only 3% of the 550 marine fish species in California contributed significantly to the commercial catch. The other 97% contributed "as predators or prey, as competitors, or otherwise by their ecological position, affect community structure and indirectly influence commercially important populations". In outer Burrard Inlet, which no longer supports a commercial trawl fishery, it appears the Blackbelly eelpout could be an important food source for culturally significant

species such as porpoises, seals and seabirds. Although baseline data are lacking, it is possible the Blackbelly eelpout is more abundant now that potential competitors for food, such as the English sole, have been reduced due to overfishing.

Further studies are needed to understand fully the Blackbelly eelpout's role in the coastal ecosystem, especially details on the ecological niche it occupies and its relationship to other species. In outer Burrard Inlet, the species lives with at least 31 species of bottom fish, and possibly even more smaller species that were not captured with the nets I used. Elsewhere in the Strait of Georgia the species is also abundant—for example, it was one of the most common fishes caught in Howe Sound trawl surveys (Figure 2) and recent data show the species is common in the main Strait of Georgia, ranking 15th by biomass in an extensive trawl survey where 66 species were caught (King *et al.* 2013).

In retrospect, it was fortunate that I had the chance to study the Blackbelly eelpout and contribute baseline data for a component of Burrard Inlet's ecosystem. At present, natural history and basic ecological studies of non-commercial species seem to be unpopular or not funded, even in today's era of environmental consciousness and concern about biodiversity. In order to understand how the Blackbelly eelpout interacts with other species, information is also needed on the species with which it lives. Data on the non-commercial species are sorely lacking. For example, a Google Scholar search (2009–2019) for English sole found 1,490 citations, whereas over the same period Blackbelly eelpout earned only 224. Going forward, I hope more details of the species' complex and ecological interactions in Vancouver Harbour are investigated to ensure a solid database to assess biodiversity changes that may be related to our commercial and recreational use of this important body of water.

Colin Levings is a retired Fisheries and Oceans Canada research scientist who works out of his home office in Lions Bay, BC. He began his career in 1962 working on trawl surveys in the Gulf of Alaska. He obtained his BSc and MSc at UBC and his PhD at Dalhousie University, and then conducted estuarine and coastal habitat research all along the BC coast, retiring in 2006. See ***colinlevings.ca*** *for more information.*

Acknowledgments

Thanks to all who contributed to this report: Herb Herunter for his helpful review of the manuscript and assistance with its preparation; Sheila Byers for her many useful comments and edits; and Trevor Andrews, Aquatics Specialist with Vancouver Fraser Port Authority, who facilitated the development of the study area map by Port Authority technical staff.

Blackbelly Eelpout References

Note: Only key references are given. For a complete listing, please contact the author at colinlevings.ca or **discovery@naturevancouver.ca**.

Elliott, M. and F. Dewailly. 1995. Structure and components of European estuarine fish assemblages.
Netherlands J. Aquat. Ecol. 29: 397–417.

Ferry-Graham, L.A., J.C. Drazen and V. Franklin. 2007. Laboratory observations of reproduction in the deep-water zoarcids *Lycodes cortezianus* and *Lycodapus mandibularis* (Teleostei: Zoarcidae). Pac. Sci. 61 (1): 129-139.

Horn, M. 1980. Diversity and ecological roles of noncommercial fishes in California Marine Habitats. CalCOFI Reports 21: 37–47.

Johnsgard, Paul A. 1987. Diving Birds of North America: 4 Comparative Diets and Foraging Ecologies. University of Nebraska, Lincoln. Chapter 4: 1-18.

Ketchen, K.S., N. Bourne, and T.H. Butler**.** 1983. History and present status of fisheries for marine fishes and invertebrates in the Strait of Georgia, British Columbia. Can. J. Fish. and Aquat. Sci. 40: 1095–1119.

King, J.R., A.M. Surry, M.R. Wyeth, N. Olsen and G. Workman, 2013. Strait of Georgia Groundfish Bottom Trawl Survey, March 14–24, 2012. Can. Tech. Rep. of Fish. and Aquat. Sci. 3056. 68 pp.

Levings, C.D. 1967. Aspects of the life history of *Lycodopsis pacifica* (Collett) 1979. M.Sc. Thesis, Department of Zoology, University of British Columbia, Vancouver BC. Canada. 81pp.

Levings, C.D. 1973. Sediments and abundance of *Lycodopsis pacifica* (Pisces, Zoarcidae) near Point Grey, B.C., with catch data for associated demersal fish. Fish. Res. Bd. Canada Tech. Rep. No. 393. 32pp.

Levings, C.D. and S.M. Ong. 2004. Fish communities and life history attributes of English sole (*Pleuronectes vetulus*) in Vancouver Harbour. Mar. Environ. Res. 57: 103–120.

Levings, C.D., J. E. Stein, C.M. Stehr, and S.C. Samis, 2003. Introduction to the PICES practical workshop: objectives, overview of the study area, and projects conducted by the participants. Mar. Environ. Res. 57:3-18.

Thomas, A.C. 2015. Diet analysis of Pacific harbour seals (*Phoca vitulina* Richardsi) using high-throughput DNA sequencing. PhD Thesis, University of BC, Vancouver BC. 166pp.

Walker, W.A., M.B. Hanson, R.W. Baird and T.J. Guenther. 1998. Food habits of the harbor porpoise, *Phocoena phocoena*, and Dall's porpoise, *Phocoenoides dalli*, in the inland waters of British Columbia and Washington. In Marine Mammal Protection Act and Endangered Species Act Implementation Program 1997. AFSC Processed Report 98-10: 63-75.

Applying Statistics to "Bird Listening"

by Sunny Tseng

It was an early morning in spring; the party in Pacific Spirit Regional Park had just begun. At four o'clock, the first Swainson's Thrush started his fluting song. The cold air carried the upward-spiraling melody through the dense hemlocks, breaking the silence of the forest. Then a Pacific Wren joined in with his tumbling, trilling, complex song. Oh, a Purple Finch also flew in with his slurred warbling characteristic of finch songs. All these birds revealed their existence, even when hidden by dense foliage and the dim light, with their song.

Many people agree that most birds in the field are heard rather than seen. Previous studies have shown that the majority of the birds in a breeding survey were detected aurally (~70% in suburban landscapes and ~90% in closed-canopy deciduous forests). Given this high reliability of aural detection and the development of technology, in recent decades ornithologists started putting audio recorders in the field to remotely monitor bird sound activity. Simply by listing to sound recordings, ornithologists can determine the bird biodiversity in an area.

Despite increasing interests and the wide use of audio recorders for bird surveys, analyzing the sound recordings is a current challenge. Manual inspection of sound recordings is extremely time- and labour-consuming, especially when the data amount to terabytes in large monitoring projects. This made me think it would be a huge help if we can teach the computers to "listen" to the sound recordings and analyze the data for us. But, is it possible?

Pacific Wren by Sunny Tseng.

As an MSc student in the University of British Columbia's Faculty of Forestry, I am currently developing a statistical model which can distinguish bird sounds from other noises such as sounds from weather, traffic or human speech. Bird sound has its distinct sound frequency and timbre; these are called "features" in computer science terminology. Those features enable the statistical model to search for a similar pattern and capture bird sounds in a sound recording. When analyzing a long recording, the statistical model I developed can label each recording period with 1/0 to indicate the presence/absence of bird sounds. After that, ornithologists only need to check the periods with bird sounds and save the processing time. To build the model, I used 15,000 audio recordings provided by an IEEE Bird Audio Detection challenge. It turns out that the model has 90% accuracy in detecting bird sound when a bird is actually calling in a recording. More importantly, the model took less than one hour to analyze 44 hours of recordings, which means the model can "listen" to the audio 50 times faster than a human being.

So, can statistics be applied to "listen" to birds? The answer is yes, and I am excited about developing more statistical tools to assist avian acoustic studies in the future.

Sunny was born and raised in a beautiful country called Taiwan. During her graduate studies at UBC, she pursues her passion in developing mathematical methods for conservation ecology. For further information, please contact Sunny at ***sunnyyctseng@gmail.com****.*

Sunny recording bird sounds in Williams Lake, BC with her Telinga parabolic microphone.

A Bighorn Quest

Text and photos by J. Gerry Polman

The High Bar

A few years ago I decided to photograph one of B.C.'s iconic animals, the Bighorn Sheep. My research disclosed that the best place to find them was in Junction Sheep Provincial Park at the confluence of the Fraser and Chilcotin rivers west of Williams Lake. By all accounts, I was guaranteed to see them there. However, over three full days of driving all the roads in the park, and hiking miles of trails where the roads ended, I saw neither hide nor hair nor horn of my targets. Disappointed, I gave up, crossed over to the east side of the Fraser River and made my way south toward the Big Bar car ferry, where I hoped to cross back over to the river's west side. More disappointment awaited me there. The Fraser's spring freshet had flooded the ferry landing and it was not running. On a whim, I turned onto a side road, a dirt track named High Bar that runs south along the east side of the river through a remote part of the Fraser Canyon that has been avoided by the highways and railroads and power lines. The only human footprints here are some widely scattered ramshackle abodes surrounded by not very prosperous looking acreages on which sagebrush appears to be the main crop. A few miles along this desolate road, a small covey of Chukars suddenly flew in front of my vehicle and disappeared down the steep embankment on my right. (The Chukar, an introduced Old-World partridge, is, as far as I know, one of those rare instances where a non-native species has not caused major impacts on the native flora or fauna.) Always looking for a wildlife photo opportunity, I stopped my truck, got out, went around the front and peered over the bank for the Chukars.

To my utter surprise and delight, I found myself looking down onto the upturned faces of a herd of about 15 magnificent Bighorn rams, perhaps 50 feet (15 m) below me. They were very nervous about my sudden looming appearance on the rim, had apprehensively bunched together in the gully below, and seemed ready at any second to dash off in one direction or another. After a few moments, however, and seeing no further advance from me, the herd relaxed a bit and some even returned to grazing the rare patch of green they had found in this arid landscape. Others, though, remained tense and watchful. Rather than stressing them further, I snapped a few photos, went back to my truck and drove on. "Serendipity" is a pretty big word, but it hardly seemed large enough to encompass what had just happened. After three unsuccessful days of looking for Bighorns in a provincial park where they were supposed to be, I had instead found them in this forlorn place where I wasn't looking for them, along a road I hadn't planned to be on, then stopped at

Bighorn rams at High Bar, Fraser River.

the exact spot where they were—only because of the Chukars—and where, due to the steep downslope, I would never have seen them from my vehicle if I had just kept driving by. What's more, because the encounter was as great a surprise to them as it was to me, I had a much closer view than if I had been in purposeful pursuit. I have seen Bighorns in B.C. many times before and since, but this incredibly fortuitous rendezvous on the High Bar still stands out as the most memorable of all.

Bighorn Biology 101

Those High Bar rams are part of a Bighorn Sheep population in B.C. which, in an average year, totals 6,000–7,000 animals. Formerly classified into two separate subspecies—California Bighorns and Rocky Mountain Bighorns—recent research has shown their DNA to be so similar that these are now generally considered to be ecotypes of the same subspecies, *Ovus canadensis canadensis*. As their ecotype label suggests, Rocky Mountain Bighorns in B.C. are found on the western slopes of the Rockies while others occupy ranges on the eastern slopes in Alberta and in the U.S. Rocky Mountain states. California Bighorns in B.C. inhabit dry grassland terrain in the Okanagan, Fraser-Thompson and Chilcotin regions, along with other populations south of the 49th parallel.

Biologists identify about 60 distinct Bighorn herds in B.C.—a herd being defined as a group that shares a common range, which is sometimes only a single mountain, with seasonal migration to different elevations. Herds may further subdivide into smaller bands. Rams over the age of two or three form bands that live separately from bands of ewes and

their young, except leading up to and during the mating season (the rut), from late October to mid-December. The rams' horns grow substantially throughout their lives, producing a line or annulus each winter when growth slows, which are useful in determining age. Rams may engage in their famous head-butting contests at any time of the year but these are most frequent and intense during September and October, leading up to the rut. Generally, only rams that dominate in these contests get to mate with the ewes, although less dominant rams are sometimes successful in mating by using sneakier tactics. Lambs are born from late April to early June; twins do occur but are rare. Average life expectancy for Bighorns is about 10–14 years, slightly less for rams, but some individuals have been known to live for 20 years. Bighorn Sheep in B.C. are blue-listed, meaning they are vulnerable but not endangered.

The Trophy Hunt

The hunting season for Bighorn Sheep in B.C. is in September and October. Generally, only rams may be killed and they must have either three-quarter or full curl horns, depending on the type of permit. The BC Fish and Wildlife Branch, which oversees the hunt, annually issues a limited number of Bighorn permits but only for those areas where, in its estimation, the herds can sustain the losses. Only some of the males in any herd will be of an age (usually six years or older) to have grown the bigger horns. By some estimates, 30-80% of those "legal" males might be killed during the hunting season. If they are not killed, it would be those big curl rams that mate and pass on their prime genes to the next generation.

All that spectacular head-butting is natural selection in action. It is so imperative that evolution has even endowed rams' skulls with certain features to protect their brains from injury during those thundering collisions. However, on the very eve of their triumph, many of these dominant males are mounted on trophy walls instead of on ewes, while lesser males sire the next generation. Thus natural selection, perfected over the millennia, is being supplanted by a form of artificial selection designed and regulated by humans. There is as yet little conclusive data on what might be the long-term effects of the hunts' disruption of the herds' natural social structures, mating behaviours or genetics.

BC Fish and Wildlife does not appear to fully or consistently appreciate that its "killing of the fittest" hunting regulations may work against natural selection. For example, when criticized for permitting the resumption of the trophy hunt of the Taseko Bighorn herd in the western Chilcotin in 2018, after severe fluctuations in population numbers in previous years, the agency responded that even if all rams with full curl horns were killed in that herd, there would still be enough mature males remaining for breeding purposes. Apparently, any ram will do, a concept that surely would send Charles Darwin spinning in his grave. A more perceptive view is found in the BC Conservation

Status Report on Bighorns: "There is additional concern about the artificial selection by trophy hunting for rams with smaller horns but the implications of this are not known."

Interestingly, several studies from Alberta have found that over decades of the big-curl hunt, succeeding generations of rams show decreases in horn size and overall body size, traits which equate to fitness. Similar results have been obtained in studies of some African antelopes heavily hunted for their trophy horns. Any conclusions drawn from this research are hotly disputed by pro-hunting groups, yet along with nutrition and other factors, genetic inheritance is a substantial factor in both body size and horn size in Bighorns. Intense hunting pressure on the bigger horns could therefore be accelerating evolution in favour of less fit and smaller rams with smaller horns. However, more time and research is needed before definite conclusions are possible. In B.C., no measurement studies on Bighorns have been conducted, but there is anecdotal evidence on the website of the main BC sheep hunting group, which is replete with complaints from hunters who report seeing Bighorn rams but none with horns of legal size. In desperation, some hunters have resorted to a form of poaching called "strapping" or "cranking" in which a ram with smaller than legal horns is shot. The horns are soaked in liquid to soften them, then bent into a tighter curl to make the legally required full circle, and held in that position by straps

Distracted Bighorn rams are easy prey for trophy hunters. Photo taken along Fraser River near Lillooet in mid-October with still two weeks left in hunting season.

until dry. With straps removed, the sheep is presented for the compulsory inspection by a wildlife officer, who unwittingly certifies it as legal by inserting an inscribed metal disk, without which no reputable taxidermist would work on the trophy. There is, of course, no official data on the prevalence of this or other forms of poaching.

Polls have shown that 80% or more of B.C. residents oppose trophy hunting. Conservation groups, animal welfare organizations, the Green Party and most First Nations have called for a ban on trophy hunting of all animals in B.C., including Bighorns. (BC Nature has opposed the grizzly bear hunt but has not taken a position on other forms of trophy hunting.) On the other hand, pro-hunting groups consider opposition to the trophy hunt as "wildlife management by emotion", thus implying that the current hunting regulations are entirely rational. Yet is it rational to schedule the hunting season at the beginning of the rut when rams are so distracted by their head-butting contests and attention to females that they can be quite closely approached? That doesn't even seem sporting. And is it rational at all to hunt and kill rams in the prime of life? This appears to be entirely driven by the hunters' preference for impressively horned trophies. It would be highly ironic if the demise of the trophy hunt comes about, not from a ban imposed by its "emotional" opponents, but rather as the result of a critical diminution of trophy horn traits in Bighorn herds and their gene pool caused by the hunt's proponents.

Disease and Other Existential Threats

Despite the controversy, hunting is likely the least consequential of all the threats to the survival of Bighorns as a species. The chief peril comes from a lethal array of introduced pathogens, some of which have the capacity to wipe out an entire herd of Bighorns in a matter of days or weeks. In particular, diseases carried by domestic sheep—to which they are largely resistant—are all too often fatal when transmitted to their wild cousins. Those die-offs are also frequently followed by many years of poor lamb survival in the affected herds. The BC government tries to obtain sheep farmers' cooperation for a buffer zone between sheep pastures and the nearest Bighorn range, but the wild herds are still periodically devastated by various sheep diseases. The well-known Vaseux Lake herd in the South Okanagan for example, has only lately recovered from a 65% die-off in 1999-2000, believed to have been caused by a pneumonia virus transmitted by domestic sheep. The Chasm herd in the Cariboo has more recently undergone a similar disaster, its numbers plunging from 110 to just 28 in 2013.

Another introduced disease that plagues wild sheep populations is mange, a skin condition not fatal in itself, but which can lead to malnutrition which, in turn, may cause weakened immune systems and greater mortality from diseases such as pneumonia and lungworm. The Similkameen herd in southern B.C. has declined by two thirds as a result of mange. An even more dramatic

example comes from New Mexico where, over a period of years, mange reduced a herd of 200 Desert Bighorns to a single surviving ewe. In B.C., Bighorn herds are geographically separated enough that no single disease outbreak is likely to extirpate the entire Bighorn population, but clearly, herd by herd, introduced diseases have the potential to do exactly that.

Another primary threat to Bighorn existence is habitat loss and fragmentation. It is estimated that considerably less than 50% of what used to be Bighorn habitat is still viable for them and is shrinking steadily. For a graphic illustration, one has only to go to the Okanagan and see the subdivisions and vineyards creeping up the hillsides. Livestock grazing has also severely reduced Bighorn habitat. A further threat is posed by human harassment, particularly by that scourge of the back country–irresponsible ATVers. The challenge of protecting Bighorn habitat is exemplified by the ongoing stubborn local resistance to the establishment of a national park in the South Okanagan.

Cougars, coyotes and wolves are the main non-human predators of Bighorns. Their population in the Churn Creek area of the Chilcotin numbered in the hundreds only a couple of decades ago, but as of 2018 has been reduced to two small herds, one numbering 29 individuals, the other only eight. The cause(s) of that drastic decline are unclear but predators threaten to eliminate the few survivors. As a result, the province contracted for a predator cull,

Bighorn ram of the Vaseux Lake herd, a herd only lately recovered from a major die-off in 1999–2000 due to disease.

resulting in the killing of 13 wolves and five coyotes between 2016 and 2018. As with a similar wolf cull program to save endangered Mountain Caribou, the Churn Creek cull is highly controversial and its prospects for success very uncertain.

A further looming threat to Bighorn survival comes from climate change, although the exact effect of a warming climate on the spread of pathogens or predators is not yet known, nor is the effect of changing patterns of rain/snowfall on the grasslands favoured by Bighorns. However, increased forest fires will likely help slow the encroachment of forests onto those grasslands.

Wild Mountain Sheep

In addition to the two ecotypes of the *canadensis* Bighorn subspecies here in B.C. and in the American states immediately to the south of us, there are also two other Bighorn Sheep subspecies in western North America—the Sierra Nevada Bighorns in California and the endangered Desert Bighorn Sheep of the American Southwest and northern Mexico. B.C. is also home to two Thinhorn Sheep subspecies, the light-coated Dall's Sheep and the darker Stone's Sheep, both inhabiting the far northwest of our province and southern areas of the Yukon and Alaska. There are no other wild mountain sheep anywhere in the Americas, and only a few scattered and remote populations elsewhere on the planet. Here, along the western spine of North America, we are therefore uniquely fortunate to encounter these rare wild sheep, such as that memorable occurrence at High Bar. However, this proximity confers on us the responsibility to protect these docile and vulnerable creatures from all the various threats that our kind poses for the survival of their kind.

Information in this article was obtained from various academic journals and studies, from websites and news sources, and from a number of experts in the field. In particular, the author would like to thank Dr. Marco Festa-Bianchet (University of Sherbrooke), Dr. David Shackleton (UBC Department of Agriculture [retired]), and Dr. Helen Schwantje (Provincial Wildlife Veterinarian) for generously providing their time and expertise. Any reader who would like specific references for any information in the article can contact the author at ***polman.jg@gmail.com****.*

Gerry Polman is a retiree who hibernates in Vancouver in winter and spends as much time as possible during the warmer months of the year hiking, kayaking, and camping in B.C.'s amazing backcountry. His previous contributions to Discovery *include "A Mass Stranding of Velella at Pachena Bay" (2015); "An Avian Q-Tip" (2016); and "Breakfast with a Beaver" (2018).*

Quality Food Expert Advice

Wild Birds Unlimited®

Nature Shop

BIRD FOOD • FEEDERS • GARDEN ACCENTS • UNIQUE GIFTS

1302 West Broadway , Vancouver, B.C. V6H 1H2

604-736-2676 www.wbu.com/vancouver

The Decline of Sea Stars from Wasting Disease

by Sheila Byers

The temperate waters of the Northeast Pacific Ocean, from Alaska to Baja California in Mexico, boast the highest diversity, greatest numbers and greatest total mass of sea stars in the world. Sea stars (Echinodermata: class Asteroidea) are ecologically significant constituents of benthic communities worldwide. Most sea stars are carnivorous predators that control or strongly influence their ecosystem composition, structure and function.

Of some 20 species commonly found in our Northeast Pacific waters, the Ochre Sea Star (*Pisaster ochraceus*) and the Sunflower Star (*Pycnopodia helianthoides*) are two species with pivotal predatory roles that help to stabilize and maintain diverse communities by controlling the abundance of their prey.

Over the past decade, however, massive mortalities of sea stars have occurred in the Northeast Pacific Ocean. The impacts on the ocean ecosystems have been so massive and so dramatic that the event has been identified as an epidemic—currently the largest documented marine wildlife die-off. Determining the exact cause of the massive sea star population die-offs has been a major challenge for researchers who, since the 1980s, have been tracking species of sea stars and other echinoderms that have succumbed to wasting diseases.

Ochre Star (ochre and purple variants) at Figurehead Point intertidal zone, Stanley Park, July 2008. *Photo: Sheila Byers*

Before delving into the depths of this wasting disease, let's review some background and ecology of these two sea star species to help clarify their roles in the functioning of ocean ecosystems.

The Role of Keystone Species

The Ochre Sea Star gained unique stardom as being the first species named as a keystone species. The keystone concept was introduced in 1969 by Dr. Robert T. Paine, an ecologist and zoology professor at the University of Washington who revolutionized the dominant view of ecology at the time by re-defining the key players in an ecosystem. Through years of field experiments in the intertidal zones off British Columbia and Washington, Paine observed hundreds of species jostling for space and dominance. He concluded that it was individual species that controlled the abundance of their prey, allowing a diversity of other species to thrive. Such prima donna species (as he called them), if manually removed from an ecosystem or disappeared due to a disease or other event, would result in dramatic changes to the rest of the community. The "new", changed community usually had half the total number of species and a monoculture of one dominant species. Paine's prima donna keystone species was the Ochre Sea Star (hereafter called Ochre Star).

I learned about Dr. Robert Paine through my association with Dr. Chris Harley at the Biodiversity Research Centre at the University of British Columbia. He, along with his many students, researches the implications of climate change on coastal marine ecosystems. Harley was one of Paine's PhD students, and, since 2005, has been Associate Professor of Zoology at UBC. As with his predecessor, Harley continues to focus on the Ochre Star. With the benefit of comparing today's intertidal community ecosystems with those studied by Paine 52 years ago, Harley has observed significant changes as a result of climatic warming (a 3.4^{0}C increase in summer average daily air temperatures)—a suspected driver of the wasting disease.

To better understand the value of these two sea stars, we need to know their interactions with other species within the ocean ecosystems. Their predatory appetite provides the clue.

Ochre Star and Sunflower Star—Stars in their Own Right

The keystone Ochre Stars that Paine removed from his experimental plots reached a size of 50 cm across their five sucker-lined arms. They live from the mid-intertidal zone to about 97 m deep. The orangey-yellow colour, after which the sea star was named (*P. ochraceus*), is a different form of the local commonly seen purple variant called Purple Star. Both colour variants belong to the same species.

By eating and controlling the abundance of mussels (California mussel [*Mytilus californianus*] and Pacific blue mussel [*Mytilus trossulus*]) within an ecosystem, the top predator Ochre Star creates space within the community for other species such as chitons, limpets, barnacles, etc., thereby increasing the diversity within the community.

Healthy-looking Sunflower Star moving across sea colander kelp. *Photo: Donna Gibbs, Ocean Wise*

From a nutritional (caloric) basis, mussels are far more nutritious as a food item compared to barnacles by about 2:1. The Ochre Star is, however, a generalist that will eat lampshells, limpets, snails, chitons, hermit crabs and marine worms.

The Sunflower Star, on the other hand, rates its own stardom as the largest, heaviest, softest and swiftest sea star, and one of the world's largest predatory sea stars. The Sunflower Star is called a mesopredator—a medium-sized, middle trophic (feeding) level predator that is also preyed upon. It is gaining wide acceptance as a keystone species.

The Sunflower Star size has been recorded as reaching 1 m across and weighing 5 kg. Its distribution in the Northeast Pacific ranges from the low intertidal zone to 435 m deep. The Sunflower Star is highly mobile and surprisingly agile. By activating its estimated 15,000 tube feet on up to 26 arms, this species moves at an estimated 1.6 to 3 m per minute! It is a voracious, generalist predator that consumes virtually any living organism that crosses its path including bivalves, limpets, snails (including abalone), chitons, octopus, sea urchins, at least eight other sea star species, sea cucumbers, sand dollars, hermit and other crabs, barnacles, and squid. It will also scavenge dead or dying fish and eggs of Pacific herring.

In Alaska, juvenile intertidal Sunflower Stars were found to chow down on the Pacific blue mussel, with one individual's stomach stuffed with 275 of them. In the subtidal zone, large Sunflower Stars consume sea urchins (67% of their diet). By eating medium and small-sized urchins, Sunflower Stars play an important

role in controlling the abundance of these herbivores that would otherwise consume kelp forests. As a result, the mesopredator enhances the resilience of kelp forest ecosystems.

Local sea stars appear to have relatively few predators, perhaps accounting for their abundance in some benthic communities. Predators of Ochre Stars include Glaucous-winged Gulls and sea otters. For the Sunflower Star, only the red king crab, graceful rock crab and Glaucous-winged Gull have been observed as predators. Sea stars also eat other sea stars! The relatively few sea star predators may be due to a defense mechanism and feeding deterrent—a suit of saponins (e.g., triterpenoids) are found in asteroid tissue that are not palatable to many predators.

Chronological Summary of Wasting Disease Events

Echinoderms—spiny-skinned marine invertebrates like sea stars and their sea urchin relatives—have been a focus of research for decades because of disease outbreaks resulting in mass mortalities of species in both the Atlantic and Pacific oceans. Diseases in sea urchins have been reported more widely than in sea stars. For example, in the 1980s a major widespread mass mortality in the Caribbean reduced populations of an herbivorous urchin *Diadema antillarum* by up to 99% at some locations, resulting in macroalgae overgrowing and replacing corals. A water-borne pathogen was suggested as the most likely cause.

A severe, disease-induced die-off occurred in the Gulf of California where the once-abundant, predatory intertidal Gulf Sun Star (*Heliaster kubiniji*) was virtually eliminated in 1978. Intertidal communities changed: without the sea star, barnacles abounded at the expense of less algae and limpets. Climate change as prolonged elevated temperatures (1-2^{0}C above the 15-year-long mean) was hypothesized as triggering an unidentified pathogen. As of 2008, the Gulf Sun Star populations had not recovered.

Over the next 20 years, the wasting disease caused population declines in the Channel Islands off the coast of southern California. Again, a long-term warming trend in California from 1976 to 1998 was suggested as the cause of a *Vibrio* bacteria outbreak. This event, however, affected 10 species of sea stars, including the Ochre Star and Sunflower Star, as well as sea urchins. Keystone sea star species in these locations recovered from near depletion within about seven years.

The most northerly documented case of wasting disease in Ochre Stars in the Northeast Pacific occurred in Barkley Sound, B.C., in 2008. Other global reports of sea star wasting disease declines were widespread: in waters off New England, U.S.A. (1898), Tasmania (1998), Sardinia (2008), Australia (2015), and the Yellow Sea, China (2015). Most of these population-decline events were relatively isolated geographically.

In 2013, however, the picture changed dramatically. The Northeast Pacific experienced a massive die-off of millions of sea stars affecting more than 20 species and spanning

a geographically extensive area from Alaska to Baja California.

Citizen science divers played an important role in the discovery of local sea star die-offs. Symptoms of the wasting disease in the Ochre Star were first observed by divers at Sokal Point, Olympic Peninsula, Washington (June 2013). At Whytecliff Park in Howe Sound, B.C., alarmed recreational divers observed hundreds of wasting Sunflower Stars in September 2013. By October the Sunflower Star populations had virtually dissolved into a bacterial mess in both Howe Sound and Indian Arm. Soon, divers also reported affected stars around the coast of the Salish Sea including in Puget Sound, offshore of the Seattle Aquarium (November 2013).

Ocean Wise, UBC researchers and Fisheries and Oceans Canada reacted quickly to determine the cause of the wasting disease and sea star demise. Soon, sea star specimens, tissues, sediments, etc. from aquaria and researchers from California to Alaska were being sent to various labs throughout North America for investigation, including the microbiology research lab at Cornell University in New York.

What is Sea Star Wasting, and What Does It Look Like?

Unlike sea stars themselves, the wasting disease is not a pretty sight. It leads to physical and behavioural changes that rapidly progress in a relatively predictable fashion. Clinical signs include twisting arms and

Sea star wasting disease: afflicted Sunflower Star exhibits loss of turgor pressure and body wall ruptures. *Photo: Donna Gibbs, Ocean Wise*

rapid growth of white dermal lesions on the aboral (upper) surface, followed by loss of turgor (rigidity); tissue swelling; loss of arms from the central disc and loss of grip on substrate; gonads spilling out from fully reproductive stars; and death characterized by rapid degradation ("melting") and decay. Death has generally been observed to occur within a few days to two weeks, whether in the field or in the lab. Observations of death at some field locations were estimated at weeks to several months.

Although it's called a wasting disease, the actual microorganism, or etiologic agent, causing the disease condition has been elusive. In 2014, the sea star-associated densovirus (SSaDV), a member of the family Parvoviridae, was identified at Cornell University as the best candidate microorganism causing the disease. The colloquial term "wasting disease" was formalized as the sea star wasting disease (SSWD). Densovirus is a transmissible, water-borne, infectious disease agent—not an environmental pollutant. Research of ethanol-preserved museum sea star specimens suggests that the densovirus was already present (naturally occurring) decades before the current SSWD event. As such, it has a high potential for persistence over time in echinoderm reservoirs, raising questions as to the recovery and long-term survival of sea stars.

Evidence of Continental-Wide Ecosystem Changes: The Harsh Reality

With the knowledge that SSWD was rampant in geographically isolated events, the race was on to determine

Sea star wasting disease: Sunflower Star autotomization, disintegration and death. *Photo: Donna Gibbs, Ocean Wise*

impacts of SSWD elsewhere in the Northeast Pacific. Concern mounted regarding the potential for continental-scale changes in coastal habitats. Fortunately, long-term monitoring programs provided valuable data about the densovirus spread.

In April 2014, the Ochre Star in rocky intertidal habitats of Oregon was hard hit with the SSWD, rapidly depleting up to 90% of individuals over a five-month period. Nothing like it had been observed in more than 30 years of studies. An important anomaly of the Oregon population declines was that the onset and impact of SSWD increased with cool seawater temperatures, contrary to warm water temperatures associated as the trigger of population declines north and south of Oregon.

A collaboration of universities, government agencies and private organizations from Alaska to California who conducted annual monitoring programs at 90 rocky intertidal sites provided reams of data on the Ochre Star from 2000 to 2016, both before and after the 2013 onset of SSWD. Analyses revealed unprecedented, synchronous declines of populations in 2014 and 2015 across multiple biogeographic regions.

Although the keystone Ochre Star has been a focus species in the realm of SSWD events, the Sunflower Star has not been ignored. Like the Ochre Star, the Sunflower Star is very susceptible to the SSWD. Sunflower Star populations have collapsed (80-100%) across its ~3000-km range from Alaska to California. Monitoring programs included shallow nearshore diver surveys (2006–2017) and deep offshore trawl surveys (55 to 1280 m) with results indicating no refuge for the Sunflower Star from the SSWD at subtidal depths. The persistence of this critical predator is considered threatened with expressed concern of the as yet unknown consequences to ecosystems.

Up to this point, the role that seawater temperature played in the initiation or intensification of SSWD outbreaks remained unclear. The Sunflower Star peak declines, however, coincided with the presence of "The Blob"—a persistent body of anomalously warm seawater that was resident in the Northeast Pacific Ocean in the fall of 2015. This prolonged heat wave registered 2.5–4^{0}C sea surface temperature anomalies (depending on latitude) between 2013 and 2015.

Closer to Home: Howe Sound Kelp Forest Ecosystem

When a disease outbreak affects a keystone species like the Ochre Star or a pivotal mesopredator like the Sunflower Star, disease-induced changes in abundance, size structure, and individual behavior and performance can ripple throughout the entire ecosystem, causing substantial and long-term changes in system structure and function. The kelp forest ecosystems in Howe Sound have clearly demonstrated such changes with the 2013 SSWD mass mortality of the once-dominant Sunflower Star populations.

The Coastal Ocean Research Institute, also known as Ocean Wise® Research, has monitored the community composition and abundance

of species on rocky reefs in Howe Sound for more than 35 years. Evidence from SCUBA-based data surveys indicated that the SSWD die-off was quickly followed by a shift in the overall community composition in the form of a trophic (feeding) cascade. Previously dense aggregations of the Sunflower Star declined by ~90% while the abundance of the Green Sea Urchin (*Strongylocentrotus droebachiensis*) quadrupled. The result was an ~80% reduction in kelp cover by the Sea Colander Kelp (*Agarum fimbriatum*). This shift, with alternating species trends, is called a trophic cascade. The near-demise of the Sunflower Star in Howe Sound rivals the largest magnitudes reported for disease-induced echinoderm mass mortalities.

How does a trophic cascade like this Sunflower Star/urchin/kelp forest affect us? The tri-trophic cascade has the potential of a fourth step that involves the decline in abundance of the Spot Prawn (*Pandalus platyceros*). The Sea Colander Kelp is specifically used by Spot Prawn as a nursery habitat. Reduction of the kelp cover by the herbivorous Green Sea Urchin translates to less protection for, and greater predation of, prawn larvae and fewer adults. Howe Sound Spot Prawn are a well-known delicacy in both local cuisine and international consumer markets. With such demand, prices will rise, placing more pressure on the existing, yet declining, Spot Prawn populations. This will result in a greater potential of overharvesting—further threatening the sustainability of Spot Prawns in Howe Sound.

The Plot Thickens; The Future Remains Uncertain

The densovirus pathogen and etiologic agent of SSWD identified in 2014, was associated with only one sea star species: the Sunflower Star. No candidate pathogen(s) have been identified for the remaining 19 sea star species affected by SSWD. The consistent symptoms of SSWD across these species make the identification of individual pathogens more difficult. Although warming ocean temperature anomalies or intense marine heat waves like The Blob have, for the most part, been associated as the driver of this disease epidemic, there may be yet unknown combinations of environmental and biological factors affecting the pathogenic agent(s). Researchers speculate that the SSWD is a syndrome of diverse etiologies between geographic locations, between species, or even within a species between locations. As such, SSWD is now referred to as a syndrome or Asteroid Idiopathic Wasting Syndrome.

The wasting syndrome has had an undeniable impact on the population declines of the keystone Ochre Star and the mesopredator Sunflower Star. The important role of these keystone and mesopredator sea stars in stabilizing and enhancing the diversity and resilience of benthic communities (nearshore intertidal and subtidal kelp forests, respectively) is also clear. The long-term recovery of sea stars and the functioning of these ecosystems in their absence may take decades, but that has yet to be determined. In the meantime, the U.S. National Oceanic and Atmospheric

Administration is currently tracking the potential return of The Blob to the Northeast Pacific.

Many of the studies mentioned herein reported a surge of juvenile sea star recruitment post-wasting-syndrome occurrence, but their survivorship was short-lived. As larval recruitment levels vary widely over the geographic range of sea stars, nearby or neighbouring sites with unaffected populations could provide potential sources of larvae to help replace decimated populations. With reports of pockets of healthy-looking sea stars being observed from locations around B.C., I remain hopeful for the recovery of our sea stars in all their prima donna glory and stardom.

Thank you to Jessica Schultz and Andy Lamb for reviewing this article and to others on the Editorial Committee who helped me stay focused on this complex theme.

Sheila Byers is a marine biologist and Registered Professional Biologist. She has been a member of Nature Vancouver and the Marine Biology Section Planning Committee since 2002. She is also Vice-President of the Marine Life Sanctuaries Society as well as a Museum Interpreter at UBC's Beaty Biodiversity Museum.

References

Note: Only key references are given. For a complete list, please contact **discovery@naturevancouver.ca**.

Burt, J. et al. 2018. Sudden collapse of a mesopredator reveals its complementary role in mediating rocky reef regime shifts. Proc. R. Soc. B: 285: 20180553.

Harley, C.D.G. 2011. Climate Change, Keystone Predation, and Biodiversity Loss. Science Vol 334: 1124-1127.

Harvell, C.D. et al. 2019. Disease epidemic and a marine heat wave are associated with the continental-scale collapse of a pivotal predator (*Pycnopodia helianthoides*). Science Advances 5:eaau7042.

Hewson, I. et al. 2019. Perspective: Something Old, Something New? Review of Wasting and other mortality in Asteroidea (Echinodermata). Front. Mar. Sci. 6(406): 1-8.

Menge, B.A. et al. 2016. Sea star wasting disease in the keystone predator *Pisaster ochraceus* in Oregon: insights into differential population impacts, recovery, predation rate, and temperature effects from long-term research. PLOS One 11(5): e0153994.

Miner C.M. et al. 2018. Large-scale impacts of sea star wasting disease (SSWD) on intertidal sea stars and implications for recovery. PLOS One 13(3): 21 pp.

O'Clair, R.M. and C.E. O'Clair. 1998. Southeast Alaska's Rocky Shores. Animals. Plant Press, Auke Bay, Alaska. 562 pp.

Paine, R.T. 1966. Food Web Complexity and Species Diversity. The American Naturalist 100 (910): 65-75.

Schultz, J.C., R.N. Cloutier and I.M. Côté. 2016. Evidence for a trophic cascade on rocky reefs following sea star mass mortality in British Columbia. PeerJ 4: e1980 https://peerj.com/articles/1980.pdf.

The Magic of a Manna Ash on Stanley Park's Promenade Revealed Over Time

Text and photos by Nina Shoroplova

If you were walking to the Rose Garden in Stanley Park the first week of April to meet up with the crowd for the Cherry Blossom Walk, you might not notice this sombre little tree.

If you were walking home from the Shakespeare Garden in June after admiring the Weeping beech (*Fagus sylvatica* 'Pendula') in front of Rose Cottage, the quintessential Ginkgo (*Ginkgo biloba*) surrounded by a bed of colourful annuals, the very tall Tree of heaven (*Ailanthus altissima*), and the crinkly-leafed Harry Lauder walking stick (*Corylus avellana* 'Contorta'), you also might not notice this little tree.

Fall splendour.

If you were, perhaps, walking through Stanley Park toward the statue of Lord Stanley some July to buy tickets for one of the Theatre Under the Stars' summer musicals, you probably wouldn't see it either. July and August are not this particular tree's most showy months. You're more likely to notice the cheery Norway maples (*Acer platanoides*), the Copper beech (*Fagus sylvatica* Atropurpurea Group), the elegant Deodar cedars (*Cedrus deodara*), and the gnarly, bare tree trunk—all that's left of a Northern catalpa (*Catalpa speciosa*) that fell in the 2006 windstorm.

So again, you might not notice the unpretentious young tree with its bunches of green samaras that I'm writing about.

I first really noticed it in the late fall of 2018 when I was creating a map of the 19 trees growing along the Stanley Park promenade, the 100-year-old walkway that's now a throughway for walkers, bikers and rollerbladers. That fall, the tree had turned into a palette of subtle yellows and rusts with flashes of purple. Its fallen leaves created a cream-coloured carpet. While cars rushed beside me between Vancouver and the North Shore via the Stanley Park Causeway and Lions Gate Bridge, I examined the tree's compound leaves of nine glossy elongated leaflets—at least

those that hadn't fallen yet. As I photographed the lichen and moss mottling its grey-barked trunk, I noticed its flimsy-yet-persistent bunches of then-brown samaras and I appreciated how up close and personal I could get with this tree as its branches are growing low enough to the ground that I can take photos without having to point my smartphone up to the sky.

Using the apps Vancouver Trees and PlantSnap, I eventually identified this little princess—it's a female *Fraxinus ornus*, known as Flowering ash or Manna ash. Primarily a wind-pollinated genus of deciduous trees, *Fraxinus* belongs to the olive family, Oleaceae. *Fraxinus ornus*, however, is insect-pollinated, as foretold by its showy, white, fragrant flowers. It is also a strictly dioecious species—female trees bear flowers and fruit; male trees bear staminate flowers and pollen.

I've since learned that the more popular common name for *Fraxinus ornus* is Manna ash. "Manna" is a rather generic term, referring to sweet sap from several different tree species. Manna ash trees are grown especially for their sap in herbariums in Sicily and Italy. An incision in the bark (don't do this in Stanley Park!) causes a sweet sap to run. The sap is harvested; allowed to dry into white flakes, fragments and droplets; then sold to herbal medicine and cosmetic industries as mannose and mannitol.

The biblical story of the people of Israel surviving on manna for 40 years in the desert is told twice: in Exodus 16:1–36 and in Numbers 11:1–9. It's a romantic story of survival.

Bud soon to burst open.

Here we go.

Stanley Park doesn't have one official entrance. It has multiple entrances—from Beach Avenue, from Lagoon Drive, from a bunch of streets and lanes in the West End, and from Georgia Street. Even so, the promenade and Lord Stanley statue are the most likely contenders for demarcating a special park entrance.

And this little Manna ash is tucked into the northwest corner of this entrance area at latitude 49.29611° N | longitude 123.13601° W.

In spring 2019, during one of my frequent walks to the Shakespeare Garden, I noticed some large hairy terminal buds on the tree, along with some axillary ones. It was April 7. The rest of the tree looked quite dull in comparison with the nearby floriferous cherry blossom trees, but I could tell that exciting things were going to happen. I returned to this ash intermittently over the coming weeks.

On April 19, the promising flower buds were starting to crack open. Immature leaves, already clearly compound, were pushing apart the leaf bud scales with their green potential. A week later, on April 24, the tree still resembled a black-green skeleton from a distance but up close, much more had happened. Leaves were stretching themselves into the warming sun.

On May 4, the flowers were starting to show their future beauty. On May 13, the tree reached its peak. A close-up photo shows a riot of white petals and future seeds. By June 1, the excitement was over—the petals had darkened and dried to a coffee colour. They had done their work of attracting insects and the Manna ash could now produce its annual crop of fruit—chains of single samaras—once more.

I don't know when this little ash tree was planted, but I do know it's not very old. When I researched the history of the trees of Stanley Park, I discovered that many of its neighbours are approaching their hundredth birthday. In 1916, work began on the causeway that first stopped Lost Lagoon from flowing back into Coal Harbour twice a day. Work on the entire causeway was finally completed in 1926, and this ash's compatriots were planted in the early 1920s to adorn the soon-fashionable promenade.

South European flowering ash *Fraxinus ornus*.

If you, too, want to get up close and personal with this Manna ash, remember that the merry month of May is its showtime.

Nina Shoroplova is the author of numerous books, including Cattle Ranch: The Story of the Douglas Lake Cattle Company and Spiraling Self-Awareness. *Her latest book,* Legacy of Trees: Purposeful Wandering through Vancouver's Stanley Park, *will be published spring 2020.*

Glaciers Give Us So Much More than Fresh Water

by Bettina Matzkuhn

It's like walking on the back of a giant beast. The creature's skin is gritty, cracked and wrinkled, sometimes streaked with pink algae.

I've only walked on glaciers a few times, but each experience was distinct and otherworldly. My sense of scale goes awry, my usual perception of being an already small figure in a large landscape shrinks yet again. I crawl like an ant on the glacial body. And it *is* a body: The terminus is referred to as a snout or a toe, it lies in a bed, its length is a tongue, it calves when spawning icebergs. Each glacier is an individual in setting, surface and configuration. Some dangle on impossibly steep slopes, others lounge in wide valleys, while a few curl around spires.

I'm a visual artist who relies heavily on my sense of sight, but it is sound that has given me an intense perception of a glacier as a living being. I will hear my companions' footsteps in their toothy crampons and the hissing of wind. The shadows of clouds seem to sigh as they pass over the higher snowfields. On one glacier, I could hear the water making bathtub-drain noises as it gargled into crevasses. Even the hatchings they etch into mountain walls in passing are called chatter marks, visual traces of sound.

I once heard a glacier's voice, too. We had crossed Atlin Lake in northern British Columbia, steering the boat down channels between mountains covered with grey and white V-shaped patterns of snow like Icelandic sweaters, their reflections distorted in our wake.

We pulled the boat up on a shallow beach and hiked through the woods for 30 minutes, until a valley several kilometres across opened up with its glacier draped across a distant ridge. At its foot lay a café au lait-coloured lake, opaque with silt. Reaching the glacier required several hours trudging across glittering stones and ankle-high beds of willowherb, a small type of fireweed that streaks magenta across grey stone.

Standing on a bluff close to the glacier's snout, I could see jagged ridges of ice glowing turquoise at the edges. My field of vision was filled by neon-blue cracks that burrowed into surfaces marbled with grey streaks of grit. If I turned, the lake, sky and surrounding mountains were monochromatic; only the glacier's blue highlights contained colour.

All at once, a great slab of ice the size of an apartment building sheared off and landed in the lake. A milky tsunami emanated from its splash. I stared. I viscerally felt the approaching roar, a sound I can only describe visually as vast, nimbus grey, muscular. It soared over my head and, banked by the mountainside, circled the bowl of the valley. I could hear it echo off the stone cliffs. The growl turned and came back at least twice before it diminished and subsided.

But the demise of glaciers is here. I picture them now tender as snails, without a shell into which they might retreat, their bodies exposed to the oblivious sun. On a visit to the Columbia Icefields in Alberta, I walked past markers showing where the ice had reached in different years. The glacier's toe has pulled back two kilometres from its position in the late 1800s.

A young woman who grew up at a backcountry lodge in B.C. told me how, within a decade, the nearby glacier shrank back into its valley. Next to a glacier in France, a hiker said to me, "Ça recule"—it's backing up. These creatures' lairs are remote.

Photograph and textile art: B. Matzkuhn

Aside from a few hikers having to climb farther for glacial selfie backdrops, the loss of glaciers isn't always in our faces. Out of sight, out of mind.

In B.C., recent summers' forest fires have sent soot eastward to cover the ice like a black babushka. It gets hot under that scarf, so the glaciers melt faster. The planet's water savings accounts are being drained to service a significant debt that we humans have incurred.

I find a particular resonance in two artworks about glaciers. I am moved by Paul Walde's video installation, *Requiem for a Glacier*—an orchestral piece performed in 2013 by musicians in dark garb on a glacier's surface. Urgency and sorrow are expressed collectively and accompanied by gushes of constant melting. The performance—the only audience being the glacier and the video-production crew—stands as a sincere and direct apology.

I also identify with a character in Thomas Wharton's novel, *Icefields*, who became obsessed with a glacier. Accidentally wedged into a crevasse, he saw something. Once rescued, he spent the rest of his life calculating when it would appear at the glacier's toe. And what materialized, ultimately, was not what he expected. As glaciers disappear, it's hard to know what to expect.

On that trip when I heard the glacier's voice, I don't recall my companions or the date. But I still carry that sound with me. It circles in my cranium, reverberating in my bones.

Glaciers give us more than just fresh water. They give us what endangered rhinos and blue whales do: otherness. Their snouts and toes literally shape our landscapes and remind us about the mosquito-short span of our lives. That glacier also gave me the sound of otherness: a great cracked tongue bellowing its loss.

Bettina Matzkuhn is a member of Nature Vancouver who explores history, geography and personal stories through embroidery and fabric collage. She exhibits internationally and writes on the arts. This article was originally published as a First Person essay in The Globe and Mail. For more information, go to ***www.bettinamatzkuhn.ca****.*

Nature Vancouver's Photo Contest

Photos on these two pages are entries in the 2019 photo contest. The photo on the back cover, Humpback Whale fluke by Joan Lopez, was judged best in show. All the photo entries are shown on Nature Vancouver's website under Sections—Photography Section, together with contest details. To enter, submit your photos to Ron Long in February 2020.

Northern Shoveler takeoff over marsh grasses. *Photo: Virginia Hayes*

Awn light. *Photo: Bill Ramey*

Testing the Water—loon parent and chick. *Photo: Donna Topham*

Frozen Fraser Fraternity—winter photo taken on the South Dyke trail in Richmond, at the foot of Gilbert Road, looking across the south arm of the Fraser. *Photo: Carlie Holland*

Spectacular 2019 Niut Lakes Camp a Smashing Success

by Stephen Partington

What an amazing setting for a Nature Vancouver camp!

Twelve minutes or so in the helicopter was all it took to hop overtop of the imposing mountains towering above Bluff Lake south of Tatla Lake and to be deposited near the treeline about 1000 m higher than the chopper launch pad.

Instant wilderness!

And there we were—on a small plateau forested with patches of low pines at about 2000 m elevation and tucked among a series of small lakes and ponds. The rugged Niut Range peaks of the Coast Mountains loomed large to the west and south while the vast Chilcotin Plateau stretched invisibly to the east.

From here, the Nature Vancouver 2019 campsite offered a stunningly gorgeous 360-degree view free from any signs of humans. Nature was at our doorstep. The quiet was delicious. No-one needed to hike anywhere—we were already there!

Helicopter delivery of all goods and personnel was key to the comfortable establishment of our near-alpine occupation. Not many who attended this camp would have been happy to make the hike to such a place. Our flight was fleetingly short

View of lakes, Goat Ridge, glacier and Niut Peak from Snow Patch Peak. *Photo: Caroline Penn*

at a little more than 10 km, but the terrain that we flew over was rugged, rocky, steep and trackless.

Geology of the Niut Range

The Niut Range is a place where immense geological events have unfolded. Tectonic peregrinations of crustal fragments in ancient times brought the location of the 2019 Nature Vancouver camp close to the contact edge between the ancient Peri-Laurentian terrane of North America and some curiously far-roving Arctic terranes that crashed into the continent from the west. This Arctic terrane complex was what built up most of the Coast Mountains of present-day B.C.

The eastern side of this Arctic terrane complex underwent a transformation during subduction of plates colliding with North America from the Pacific during an interval 175 to 45 million years ago. The melting rock and volcanism caused by these tectonic events resulted in a huge coalescent igneous batholith of granite that formed a great belt of metamorphic rock stretching through the Coast Mountains north from Vancouver to Prince Rupert and beyond. The granitic mountains thus formed towered high enough to create a rain shadow and dry conditions eastward.

After the mountain-building subduction ceased 45 million years ago, these mountains were subjected to weathering that reduced their height to mere hills. After 40 million years of erosion, the greater mass of the granitic Coastal Mountain batholith resided largely beneath ground level as a root embedded within the mantle of the earth.

The geologic conditions changed radically, however, about 5 million years ago when a shift in the offshore plate subduction zones resulted in the appearance of the Cascade Volcanic Arc. From these changes came fresh subduction-induced volcanic activity accompanying a heating and expansion of the batholith. These events triggered a 2000 m uplifting of the batholithic mass of granite and the rebuilding of the Coast Mountains that continues today. The Niut Range took part in this re-elevation and, like the rest of the Coast Mountains, was still on the rise beneath the Nature Vancouver camp this past summer.

Overlaid upon these incomprehensively long geo-tectonic sculptings of the Earth's crust beneath our campsite was an even more recent surface etching of the landscape by glacial advances and retreats. The whole Niut Range terrain is currently a jumble of ice age features: moraines, cirques, tarns, kettle lakes, glacier lakes, hanging valleys, remnant glaciers and broken rock-covered slopes. The relative flatness of the area hosting the Nature Vancouver camp may well have been due to the location being a glacial kame terrace—a glacial landform usually shaped like an irregular hill, which is formed when sediment accumulates in ponds or lakes trapped between glacier ice.

Geographic Setting

An unnamed pond that's the Homathko River headwaters is located fairly near the camp setting. Despite all of the camp participants

having traveled up the Fraser River watershed to get to the staging area at Bluff Lake, the Niut Range drainage flows westward through the Coast Mountains to enter the Pacific Ocean at the head of Bute Inlet fjord.

The Niut Range nestles in the angle between the two arms of a "Y" configuration delineated by the Homathko River and Mosley Creek, its major tributary. These two valleys are the primary lowland corridors between the Pacific Ocean and Chilcotin Plateau. These routes have facilitated the passage of wildlife and people between the coast and the interior since the last ice age waned. Although, by map, the Homathko can be traced up through Tatlayoko Lake and the Mosley up through Bluff Lake to origins apparently very close to Tatla Lake, which drains into the Fraser River, there is, in fact, a clear watershed and no shared source between the Homathko and Fraser watersheds.

Industrial Development

Great industrial schemes to utilize the Homathko-Mosley corridors for transportation or hydroelectric generation have been floated or actually launched since the Cariboo Gold Rush.

The first venture began in 1861 when Alfred Waddington set about building a road to access the gold fields. A townsite was surveyed at the head of Bute Inlet and 50 km of crude road was built nearly to the confluence of Homathko River with Mosley Creek. At this point, in 1864, the construction came to an abrupt halt when people were killed during a series of events often referred to as the Chilcotin War. No town was subsequently built on the surveyed plot and very little of the road lasted long afterward because of the erosive power stemming from heavy coastal precipitation.

Next came the prospect, in the 1890s, of running the first Canadian transcontinental railway by way of the Homathko River drainage to link the Pacific seaboard of B.C. with the rest of the country that the crown colony had been induced to join. The Canadian Pacific Railway did some preliminary surveys, but these were abandoned when Burrard Inlet was selected as the logical destination for the rail link.

The most comprehensive and compromising plan for industrial use of the Homathko and Mosley corridors came as grandiose hydroelectric ventures first proposed in the mid-20th Century that would have seen a series of dams built on the Homathko and its tributaries. Diversion via Tatlayoko Lake of the waters of the Taseko Lakes and Chilco Lake from the Fraser River drainage was suggested in order to enhance the turbine spinning potential of the waterhead above these dams.

Protection of the Niut Range Area

The hydroelectric development scheme described above was stopped in the 1990s for a variety of reasons after much review and considerable controversy. The Cariboo Land Use Plan process as well as the successful implementation of several long-standing park proposals starting in the 1990s established a basis for

My favourite Niut view. *Photo: Phil Edgell*

protection against regional industrial development. In 1994, Ts'il?os Provincial Park that encompassed Chilco Lake at the head of Nemiah Valley was established. Bishop Creek Provincial Park was added to the south side of Ts'il?os in 1995. The same year, Big Creek Provincial Park was created east of Taseko Lakes. This holding was expanded by the southern addition of South Chilcotin Mountains Provincial Park in 2001.

The Homathko River-Tatlayoko Protected Area was proclaimed on February 14, 1996.

Nature Vancouver Campsite and Nearby Hiking

Our actual camp setting contained scattered scrubby pine trees but was relatively flat with lakeside views and very easy access to an endless water supply. This water was clear of the glacial flour that makes some other nearby lakes appear blue due to the refraction of light. Our local watershed was without a glacier in its cirque and therefore had been flushed clean of this fine silt. Despite the rocky substrate, the biffies proved diggable, and everyone managed to secure their tents sufficiently to weather the fierce winds and pelting rain that, at times, challenged our security and comfort.

Exciting first impressions included finding an abundance of inky gentian and roseroot around the campsite and the discovery of a family of Spotted Sandpipers nearby, which entertained campers for several days.

There were no trails visibly radiating from camp despite there being an active fire pit and deposits of horse dung nearly adjacent to the cook tent. Therefore, one task of Week One campers was to

bushwhack and flag hiking routes through the patchy low forest of lodgepole and whitebark pines.

Easy trails were soon established near the camp. These led to a number of small lakes and bogs scattered among the moraines and glacial churnings on the level terrace. Intermediate trails were also established in short order to provide upstream access into the cirque area with its complex of little lakes.

For hikers who wanted more elevation gain, there were two challenging but readily accessible peaks north of camp. These provided rigorous scrambles across tricky slopes covered with broken rock. The rewards for enduring the somewhat treacherous passage were the stellar views from

Hiking in the clouds. *Photo: Kris Andrews*

The crossing. *Photo: Caroline Penn*

the heights of what became known as Ridge Peak and Snow Patch Peak. From these vantages, hikers could spot Tatla Lake and the hills of Itcha Ilgachuz Provincial Park to the north and gaze east across the seemingly endless Chilcotin Plateau. Westward, the 180-degree Coast Mountain panorama featured the readily identifiable peaks of Niut Mountain (2,153 m) and Razorback Mountain (3,183 m). Hikers who made it to Snow Patch Peak (2,600 m) had a chance to view the absolutely monstrous Mount Waddington (4,019 m), B.C.'s tallest peak, 40 km to the southwest.

Looking south and east from Snow Patch Peak, the mountains beyond Tatlayoko Lake marked an arc over Chilco Lake in the Nemiah Valley, the Taseko Lakes to the South Chilcotin Range peaks of Ts'il?os, and the South Chilcotin Mountains Provincial Parks.

Slightly Further Afield

Another challenge for the adventurous hiker was the ridge of high cliffs south of camp. This feature was dubbed Goat Ridge when a moving white dot was spotted on it from a great distance. The cliffs were obviously unassailable no matter how hard we stared at them, so it was decided to skirt around the eastern toe of the ridge and take a run up from there.

The first attempt to do this led to a rather large group of hikers turning back after encountering steep screes of unstable broken rock.

A second try by a smaller group led to successfully flagging a route across the broken rock up to what turned out to be a sloping plateau or terrace. Lovely views of the camp from the top of the cliffs were enjoyed triumphantly that day. The vegetation on the terrace was a mix of sod and patches of scrubby willow and birch that appeared to have been uniformly browsed to about waist height. Ungulate droppings were in abundance. One strange human feature that day was the discovery of what we thought was a hunting blind. This was constructed by excavating stones on the hillside to form a pit with a rock-wall screen. It was later learned that this blind was actually constructed by an expedition member during the *Atlas of the Breeding Birds of British Columbia* project some years ago.

On the far western side of the plateau, a view of a small glacier along with its subtending blue lake was awesome. The problem of the scree, however, remained outstanding and the descent was uncomfortable down the horrible broken rock.

The next ascent of Goat Ridge masochistically traversed the broken rocks once again. After a good ramble about on the plateau, during which three small inukshuks were found and all the fine views were reviewed, it was decided to try and follow the wildlife access trail for the descent. This way the entire scree was avoided and the hikers found themselves below the rocks on a fairly clear trail with tiny rock cairns. This

Reference

Sydney Cannings, et al. 2011. Geology of British Columbia. Greystone Books. Vancouver. 144 pp.

Elly Brok shows her painting. *Photo: Sabina Harpe*

series of cairns led along the contour towards camp and merged with our own flagged route exactly at the point at which we had turned to ascend the scree slope three times. Bingo! Our new, safer route to the top of Goat Ridge had been found.

Camp Entertainment

Aside from the usual after-supper hike reports, during Week One we enjoyed a couple of social nights, a talent show and an evening of games.

Janet Rozanski played ukulele for sing-alongs and organized the Niut NightinGals, who sang an admirable rendition of Joni Mitchell's "Circle Game". We all sang the chorus of the following, which was written by the Dohan sisters to the tune of the Everly Brothers' "Bye Bye Love":

Bye bye Camp Niut
Bye bye Nature V
Hello Highway 3
We think we're gonna cry
Bye bye dear camp goodbye

We've cleaned the biffies,
we've cleaned the pots
We've walked in meadows,
we've walked on rocks
We've made great friendships
and lived our dreams
As we jumped over
the babbling streams

We love our Nigel and Elly too
Paul, Janet, Sally, the wonderful crew
We stretched our muscles and
trimmed our thighs
Challenged the mountains
with many sighs

We also enjoyed a lovely series of readings by Jane Srivastava of excerpts from Chris Czajkowski's book, *A Mountain Year—Nature Diary of a*

Nightingals sing Circle Game. *Photo: Denis Laplante*

Wilderness Dweller. It describes the area surrounding her ecotourism site, Nuk Tesli, northwest of the Nature Vancouver camp near Tweedsmuir Provincial Park. Selections coincided with the dates in 2019 when we were at camp. Jane also recited "I Go Down to the Shore", a poem by Mary Oliver.

Denis Laplante sang "There's a Wild Boar in These Woods"; Teresa Gagné recited "The Cremation of Sam McGee"; and Stephen Partington read "Portrait From Memory" from *Beyond the Fringe*.

Margaret Dohan finished us off with her "Limerick for Nigel":

There was a camp manager Peck
Whose job it was to recheck
A stepladder on table
"Don't do this, I'm able
I know it's unsafe, what the heck?"

Now Nigel is one who is trusted
His camping skills have not rusted
He works and he works
Despite having no perks
And he fixes all things
that are busted

So to Nigel we show our gratitude
For his always positive attitude
Our camp is such fun
It's not yet all done
Our Nigel is one really great dude

Stephen has been a member of VHNS/ Nature Vancouver since 1987 and has attended a smattering of Nature Vancouver camps.

Species Lists—Niut Lakes Camp

July 21 to August 4, 2019

Plant and Insect Lists compiled by Teresa Gagné, Judith Holm and Denis Laplante

TREES

Family PINACEAE, (pine family)
Abies lasiocarpa, subalpine fir
Picea englemannii, Englemann spruce
Pinus contorta var. latifolia, lodgepole pine
Pinus albicaulis, whitebark pine

SHRUBS

Family BETULACEAE, (birch family)
Betula glandulosa, scrub birch

Family CUPRESSACEAE, (cedar family)
Juniperus communis, common juniper

Family ELAEAGNACEAE, (oleaster family)
Shepherdia canadensis, soopolallie/soapberry

Family ERICACEAE, (heath family)
Arctostaphylos uva-ursi, bearberry/kinnikinnik
Cassiope mertensiana, white mountain-heather
Chimophyla umbellata, pipsissewa
Empetrum nigrum, crowberry
Kalmia microphylla (syn. polifolia), small bog-laurel
Phyllodoce empetriformis, pink mountain-heather
Phyllodoce glanduliflora, yellow mountain-heather
Phyllodoce x media, hybrid pink/yellow mountain heather
Rhododendron albiflorum, white rhododendron
Rhododendron groenlandicum, Labrador tea
Vaccinium caespitosum, dwarf huckleberry
Vaccinium membranaceum, black huckleberry
Vaccinium scoparium, grouseberry
Vaccinium uliginosum, bog blueberry

Family SALICACEAE, (willow family)
Salix arctica, arctic willow
Salix barclayi, Barclay's willow
Salix brachycarpa, short-fruited willow
Salix commutata, under-green willow
Salix nivalis, dwarf snow willow
Salix stolonifera, creeping willow

Family SANTALACEAE, (sandalwood family)
Arceuthobium americanum, American dwarf mistletoe

HERBACEOUS

Family ASTERACEAE, (aster family)
Achillea millefolium, yarrow
Agoseris aurantiaca (var. aurantiaca?), orange false-dandelion
Agoseris glauca var. dasycephala, short-beaked agoseris
Antennaria alpina, alpine pussytoes
Antennaria microphylla (rosea), rosy pussytoes
Antennaria pulcherrima, showy pussytoes
Antennaria racemosa, racemose pussytoes
Antennaria umbrinella, umber pussytoes
Arnica angustifolia ssp. tomentosa,

Whitebark pine and lodgepole pine scrub. *Photo: Caroline Penn*

alpine arnica
Arnica cordifolia, heart-leaved arnica
Arnica lanceolata ssp prima, clasping arnica
Arnica mollis, hairy arnica
Arnica rydbergii, Rydberg's arnica
Artemisia norvegica, mountain sagewort
Crepis nana, alpine hawksbeard
Erigeron aureus, golden fleabane
Erigeron compositus var. glabrus, cut-leaved fleabane
Erigeron glacialis var. glacialis, subalpine fleabane
Erigeron humilis, arctic daisy
Erigeron peregrinus, subalpine fleabane
Hieracium albiflorum, white hawkweed
Hieracium gracile, slender hawkweed
Hieracium triste, wooly hawkweed
Packera cana, wooly packera
Packera pauciflora, alpine rayless butterweed
Petasites frigidus var nivalis, arctic sweet coltsfoot
Senecio triangularis, arrow-leaved groundsel
Solidago multiradiata, mountain goldenrod
Tonestus lyallii, Lyall's serpentweed

Family BORAGINACEAE, (borage family)
Myosotis alpestris ssp. asiatica, mountain forget-me-not

Family BRASSICACEAE, (mustard family)
Boechera stricta, uptight suncress
Draba aurea, golden draba
Draba novolympica, leeward draba

Family CAMPANULACEAE, (harebell family)
Campanula lasiocarpa, mountain harebell

Raindrops on lodgepole pine (*Pinus Contorta*). *Photo: Gail Newell*

Family CAPRIFOLIACEAE, (valerian family)
Linnaea borealis, twinflower
Valeriana sitchensis, Sitka valerian

Family CARYOPHYLLACEAE, (pink family)
Eremogone capillaris, thread-leaved sandwort
Silene douglasii, Douglas' campion
Silene noctiflora, night-flowering catchfly
Silene parryii, Parry's campion
Silene acaulis, moss campion
Stellaria longipes, long-stalked starwort

Family CELASTRACEAE, (bittersweet family)
Parnassia fimbriata, fringed grass-of-Parnassus

Family CORNACEAE, (dogwood family)
Cornus unalaschkensis, dwarf dogwood

Family CRASSULACEAE, (stonecrop family)
Rhodiola integrifolia ssp. integrifolia, western roseroot
Sedum divergens, spreading stonecrop
Sedum lanceolatum var. lanceolatum, lance-leaved stonecrop
Sedum lanceolatum var. nesioticum, lance-leaved stonecrop

Family CYPERACEAE, (sedge family)
Carex aquatilis, water sedge
Carex lenticularis var. dolia, tarn sedge
Carex nigricans, black alpine sedge
Carex phaeocephala, dunhead sedge
Eriophorum angustifolium, narrow-leaved cotton-grass

Family ERICACEAE, (heath family)
Orthilia secunda, one-sided wintergreen
Pyrola asarifolia, pink-flowered wintergreen

Family FABACEAE, (pea family)
Lupinus arcticus, arctic lupine

Family GENTIANACEAE, (gentian family)
Gentiana glauca, inky gentian
Gentianella amarella, northern gentian
Gentianella propinqua, four-part gentian

Family HYDROPHYLLACEAE, (waterleaf family)
Phacelia sericea, silky phacelia

Family JUNCACEAE, (rush family)
Juncus drummondi, Drummond's rush
Juncus mertensianus, Merten's rush
Luzula parviflora, small-flowered woodrush

Family MELIANTHIACEAE, (false hellebore family) ex Liliaceae
Veratrum viride, false hellebore

Family ONOGRACEAE, (evening primrose family)
Chamerion (Epilobium) angustifolium, common fireweed
Chamerion latifolium, river beauty

Family ORCHIDACEAE, (orchid family)
Platanthera dilatata, fragrant white bog orchid

Family OROBANCHACEAE, (broomrape family)
Castilleja miniata, common red paintbrush
Castilleja rhexifolia, alpine/rosy paintbrush
Castilleja parviflora var. albida, white small-flowered paintbrush
Pedicularis bracteosa, bracted lousewort
Pedicularis langsdorffii ssp. arctica, Langsdorff's lousewort

Bird's beak lousewort (*Pedicularis ornithorhyncha*). *Photo: Gail Newell*

Pedicularis ornithorhyncha, bird's beak lousewort

Family PLANTAGINACEAE, (plantain family) ex Scrophulariaceae
Penstemon procerus, small-flowered penstemon
Veronica beccabunga (syn. americana), American brooklime
Veronica wormskjoldii (syn. alpina), alpine speedwell

Family POACEAE, (grass family)
Elymus trachycaulus, slender wheatgrass
Festuca brachyphylla, alpine fescue
Festuca saximontana, Rocky Mountain fescue
Phleum alpinum, alpine timothy

Poa arctica, Arctic bluegrass
Tricetum spicatum, spike tricetum

Family POLEMONIACEAE, (phlox family)
Phlox diffusa, spreading phlox
Polemonium pulcherrimum, showy Jacob's-ladder

Family POLYGONACEAE, (buckwheat family)
Bistorta vivipara, alpine bistort
Oxyria digyna, mountain sorrel
Rumex acetosella, sheep sorrel
Rumex lapponicus, Lapland mountain sorrel
Rumex paucifolius, alpine sorrel

Family PORTULACACEAE, (purslane family)
Claytonia lanceolata, western spring-beauty

Family RANUNCULACEAE, (buttercup family)
Anemone drummondii, Drummond's anemone
Anemone multifida, cut-leaved anemone
Anemone occidentalis, western anemone
Aquilegia formosa, red columbine
Caltha leptosepala, white marsh-marigold
Ranunculus escholtzii, mountain buttercup
Ranunculus flammula, lesser spearwort
Ranunculus pygmaeus, pygmy buttercup
Thalictrum occidentale, western meadow-rue
Trollius albiflorus, globeflower

Family ROSACEAE, (rose family)
Dryas octopetala, white mountain-avens
Luetkea pectinata, partridge-foot
Potentilla glaucophylla, vari-leaved cinquefoil
Potentilla flabellifolia, fan-leaved cinquefoil
Potentilla gracilis, graceful cinquefoil
Potentilla nivea, snow cinquefoil
Potentilla palustris, marsh cinquefoil
Potentilla uniflora group, one-flowered cinquefoil
Rosa acicularis, prickly rose
Rubus arcticus ssp. acaulis, dwarf nagoonberry
Sanguisorba stipulata, Sitka burnet
Sibbaldia procumbens, creeping Sibbaldia

Family SAXIFRAGACEAE, (saxifrage family)
Leptarrhena pyrolifolia, leatherleaf saxifrage
Saxifraga bronchialis ssp austromontane, spotted saxifrage
Saxifraga tricuspidata, three toothed saxifrage
Micranthes lyallii, Lyall's saxifrage

Family TOFIELDIACEAE, (false-asphodel family) ex Liliaceae
Tofieldia pusilla, common false asphodel
Triantha (Tofieldia) glutinosa, sticky false-asphodel

Family VIOLACEAE, (violet family)
Viola adunca, early blue violet

FERNS

Family WOODSIACEAE, (cliff ferns)
Cystopteris fragilis, fragile fern

HORSETAILS

Family EQUISETACEA (horsetails)
Equisetum arvense, common horsetail

CLUBMOSSES

Family LYCOPODIACEAE
Diaphasiastrum sitchense,
Sitka clubmoss
Selaginella wallacei,
Wallace's spikemoss

BRYOPHYTES

Family Polytrichaceae, (haircap mosses)
Polytrichum juniperinum,
juniper haircap moss

Family Sphagnaceae, (peatmoss)
Sphagnum magellanicum,
Magellan's peatmoss

LICHENS

Family CLADONIACEAE
Cladina sp., reindeer lichen sp.
Cladonia spp., club lichen species

Family LECANORALES
Lepraria neglecta, grey dust lichen

Family PARMELIACEAE
Letharia vulpina, common wolf lichen

Family PELTIGERACEAE
Peltigera sp., pelt lichen

Family RHIZOCARPACEAE
Rhizocarpon geographicum,
map lichen

Family ICMADOPHILACEAE
Thamnolia sp., whiteworm lichen

Family UMBILICAIACEAE
Umbilicaria hyperborea,
blistered rocktripe
Umbilicaria torrefacta,
punctured rocktripe

Family TELOSCHISTACEAE
Xanthoria sp., orange leaf lichen

FUNGI

Family BOLETACEAE
Leccinum scabrum
(brown birch-bolete)

Family CORTINARIACEAE
Cortinarius sp.

Family SUILLACEAE
Leccinium sp., slippery jacks

BUTTERFLIES

Family LYCAENIDAE (gossamer-winged butterflies)
Plebejus idas, northern blue
Callophrys polios ssp. obscura,
hoary elfin

Family NYMPHALIDAE (brush-footed butterflies)
Chlosyne whitneyi, rockslide
checkerspot
Erebia vidleri, Vidler's alpine

Family PAPILONIDAE (swallowtails and parnassians)
Parnassius smintheus,
Rocky Mtn parnassian

OTHER INSECTS

Order Orthoptera
Caelifera sp., grasshopper

Family CHRYSOMELIDAE (leaf beetles)
Chrysomela sp., leaf beetle

Family PROPHALANGOSIDAE (grigs)
Cyphoderris monstrosa, great grig

Family TENTHREDINIDAE (common sawflies)
Pontania sp., willow gall sawfly

BIRDS

Compiled by Gail Kenner

Taxonomic order and nomenclature follow the American Ornithologists' Union Checklist of North American Birds, 7th edition.

Family Anatidae
Bucephala islandica, Barrow's Goldeneye

Family Phasianidae
Falcipennis canadensis, Spruce Grouse
Lagopus leucura,
White-tailed Ptarmigan
Dendragapus obscurus, Dusky Grouse

Family Trochilidae
Selasphorus rufus, Rufous Hummingbird
Selasphorus calliope,
Calliope Hummingbird

Family Scolopacidae
Actitis macularius, Spotted Sandpiper
Tringa melanoleuca, Greater Yellowlegs

Family Laridae
Larus sp., Gull sp.

Family Gaviidae
Gavia immer, Common Loon

Family Accipitridae
Aquila chrysaetos, Golden Eagle
Circus hudsonicus, Northern Harrier
Haliaeetus leucocephalus, Bald Eagle
Buteo swainsoni, Swainson's Hawk

Family Tyrannidae
Contopus cooperi,
Olive-sided Flycatcher

Family Corvidae
Perisoreus canadensis, Canada Jay

Spruce Grouse, female. *Photo: Kris Andrews*

Nucifraga Columbiana,
Clark's Nutcracker
Corvus corax, Common Raven

Family Alaudidae
Eremophila alpestris, Horned Lark

Family Hirundinidae
Tachycineta thalassina,
Violet-green Swallow

Family Paridae
Poecile gambeli, Mountain Chickadee

Family Sittidae
Sitta canadensis,
Red-breasted Nuthatch

Family Regulidae
Regulus calendula,
Ruby-crowned Kinglet

Family Turdidae
Myadestes townsendi,
Townsend's Solitaire
Catharus guttatus, Hermit Thrush
Turdus migratorius, American Robin

Family Motacillidae
Anthus rubescens, American Pipit

Family Fringillidae
Leucosticte tephrocotis,
Gray-crowned Rosy-Finch

Family Passerellidae
Spizella passerine, Chipping Sparrow
Junco hyemalis, Dark-eyed Junco
Zonotrichia leucophrys,
White-crowned Sparrow
Zonotrichia atricapilla,
Golden-crowned Sparrow
Zonotrichia albicollis, White-throated Sparrow (rare for this area)
Passerculus sandwichensis,
Savannah Sparrow
Melospiza lincolnii, Lincoln's Sparrow

Family Parulidae
Parkesia noveboracensis,
Northern Waterthrush
Geothlypis tolmiei,
MacGillivray's Warbler
Setophaga petechia, Yellow Warbler
Setophaga coronata,
Yellow-rumped Warbler
Cardellina pusilla, Wilson's Warbler

MAMMALS

Compiled by Gail Kenner

Taxonomic order and nomenclature follow E-Fauna BC.

Family Bovidae
Oreamnos americanus, Mountain Goat

Family Cervidae
Odocoileus hemionus, Mule Deer
Oreamnos americanus,
mountain goat

Family Mustelidae
Mustela frenata, Long-tailed Weasel
Neovison vison, American Mink

Family Ochotonidae
Ochotona princeps, American Pika

Family Sciuridae
Marmota caligata, Hoary Marmot heard
Neotamias amoenus,
Yellow-pine Chipmunk
Tamiasciurus hudsonicus, Red squirrel

Family ZAPODIDAE
Zapus princeps,
western jumping-mouse

Birdwatcher as Landscape

Don't mind me I'm just part of the furniture

by Gail Kenner

There is much to be said for sitting quietly beside a stretch of stream and becoming "landscape".

At Niut Lakes camp this summer, the short riffle connecting the Swim and Water lakes was ideal—I could sit on the edge with sun and wind at my back and a panoply of life spread before me.

Once I settled in, it took, at most, a half-hour for me to be accepted by the birds as and generally ignored. Mammals also lost any concern for me as a yellow-pine chipmunk scampered just in front of me and across the stream, bouncing from rock to rock.

Spotted Sandpipers, American Pipits, Mountain Chickadees, Yellow-rumped Warblers (predominantly Audubon's), Savannah Sparrows and Dark-eyed Juncos were all breeding in the camp area, with the last two species especially abundant. Just-fledged chickadees, warblers and juncos bumbled around me, trying out their wings and following adults in a largely futile attempt to get fed.

Rufous Hummingbirds buzzed through occasionally. Yellow-rumped Warblers of all ages and plumages were constantly fly-catching.

The highlight of the streamside site was the family of Spotted Sandpipers — one vigilant adult and three fluffy/scruffy chicks sporting spiky dark crown feathers like punk hairdos. At times, they fed quite close by. During Week One Camp sandpiper chicks morphed into two sleek fledglings; the third chick fledged, and all four birds were gone before the end of Week Two Camp.

Other notable streamside encounters: a Northern Waterthrush, a Hermit Thrush, a Greater Yellowlegs, a White-throated Sparrow (unusual), a few Lincoln's Sparrows and a flock of Chipping Sparrows.

Niut lakes Spotted Sandpiper. *Photo: Melanie Marchand*

After Supper at Camp: Meet the Kafers

by Cathy Walker

Week Two summer campers in the Niut Range were privileged to hear Esther Kafer describe her mountaineering expeditions with her husband, Martin.

Martin and Esther helped to organize three climbing trips in the area of our summer camp, the Niut Range, in August 1967, July 1972 and July–August, 1980. Each time their goal was to find the best routes and get to the top of mountains, most of which were first ascents.

Martin organized the logistics and approaches and Esther organized the food for the groups. She described going around the wonderful food floor at Woodward's with the manager to choose the food which was then put into special boxes to be sent north. The boxes had to fit through the drop hole in the Beaver airplane to be dropped onto glaciers for pickup by the mountaineers.

The first trip in 1967 was with nine people, two of whom were a local couple from the Chilcotin, whose canoe was used to cross Mosley Creek. After a two-day bush-whack they finally got up to the Rusty Glacier where they found the food boxes had landed safely. Esther would later use a rock-walled cooking area to prepare their meals. They climbed the 10,000-foot peaks of Mt. Rusty and Trident and the east peak of Pagoda, which at that time was the highest unclimbed peak in the Coast Range and was later named "Plummer Peak". Another part of the trip was the exploration of the Camel Mountains. They climbed the main peak and the very difficult "Camel Tower".

Another goal was Royal Peak but it proved to be too difficult to reach on this trip. On the way, wading over Five Finger Creek the team took their pants off to keep them dry as it was hip deep, fast and cold. One climber was from New Zealand and this was evidently their normal technique. On the return there was a big rain storm overnight which made the planned route over a steep glacier too dangerous because of the falling rocks loosened by the downpour. The New Zealander put in a piton and they rappelled down using a (thankfully former) rappelling technique with a rope over the shoulder and between the legs, called "Duelfer Sitz" (no harnesses back then). Esther, already soaking wet, wound up upside down, swinging back and forth over swirling water. Fortunately, she lived to tell us this account.

In 1972, this time a group of only three, they made another attempt to climb Royal Peak. The daring Wilderness Airlines pilot flew them from Horn Lake and, after the airdrop, managed to land them on Mosley Creek, while the plane was tied to a tree, and then successfully took off again. Using a compass and a lot of hard effort, the group found the air drop of the food boxes on the glacier. Unfortunately, there was a big snow storm that lasted three days so the group holed up. Esther managed to read a 700-page book. They then

Esther and Martin Kafer at Niut Camp. *Photo: Kris Andrews*

walked in extremely deep snow and finally managed the first ascent of Royal Peak (9,500 ft). Moving camp down, they found beautiful meadows full of wild flowers and then climbed Success Mountain. That wasn't enough, of course, so their next challenge was Hanging Peak, a long way from their air drop camp. Walking across deep snow on glaciers full of crevasses they reached the summit over some rocks, the last first ascent of this trip. At three am after a 21-hour hike they were finally back at their tents.

On the long walk-out they had to lower the heavy packs by rope over a crevasse and the pack of their fellow climber came loose and fell deep down into the slot. Using his flashlight he roped up, climbed down and retrieved it.

Getting back from climbing these peaks was extremely taxing as the hike out took three long days (no plane to pick them up of course).

For both trips, the people of the Chilcotin were very helpful and friendly, letting the climbers park their cars on their properties, unlocking gates for them, repairing bridges, putting them up in their houses, letting them shower and feeding them dinner.

The third trip in 1980 was organized by the camp committee of the BC Mountaineering Club. This was a similar set-up to the Nature

Niut Camp Week One participants. *Photo: Phil Edgell*

Vancouver summer camp, flying in from Tatlayoko Lake using White Saddle, 37 climbers, 2 cooks, a cook tent and a dining tent. Going in on the first flight, Martin found a beautiful spot to be used as base camp. Martin and Esther did three more first ascents.

A grizzly bear was spotted on a glacier, having a grand old time, sliding down the glacier on his behind and jumping over small crevasses. When confronted with a crevasse too wide to jump across, the grizzly did what any sensible mountaineer would do, he thought about it, turned aside and found a way around.

In addition to seeing much snow, ice and rock and beautiful meadows with flowers on their trips, the Kafers saw many mountain goats on these three trips. Sadly, during our Week Two summer camp with Nature Vancouver we saw none, though evidence was found in the form of hoof prints and hair.

Over the three expeditions, the Kafers did thirteen first ascents.

Full reports of the first two expeditions are available in the Canadian Alpine Club Journal and the third trip is reported in the BC Mountaineering Club Report. The Kafers brought with them these reports and a number of fascinating photographs from these expeditions, including one of the climbers crossing a raging Mosley Creek with their backpacks on and in their underpants.

Oh, did Martin and Esther ever climb Niut Mountain which we saw from near our summer camp? "No," they said, "it was too far from our base and had already been climbed".

In December Esther and Martin gave their son, Tom, and their daughter, Kathy, a nice Christmas present of the trip with them to this summer's Nature Vancouver summer camp. It was a pleasure meeting them as well.

(More information on the achievements of Esther and Martin Kafer is available through website search by their names.)

Ode to Parnassus

by Sabina Harpe

Ode to Parnassus
Queen of the high,
unobtrusive and radiant
lining rivulets and filling mossy dips.

Named after sacred mountain in Greece
So distant from this new world mountain path.

Fringed grass of Parnassus
Proudly offering gifts
From a bowl of heart shaped leaves
Each stem straight and strong,
Shooting five petals
Laced, and delicate
Around an oval mound.

Ode to you, Queen of the heights
I tower above with giant foot
Pausing,
I am
touched
by your wild and beauty-filled being.

Fringed grass of Parnassus (*Parnassia fimbriata*). *Photo: Gail Newell*

The Remarkable Life Cycle of Fairyslippers in Nanaimo

by Bill Merilees

During a binge of flowering phenology observations, we kept a small patch of Fairyslippers under observation near our home in Nanaimo. Professional wildlife artist Kathleen Van der Sande was commissioned in 1985 to produce a painting of the annual cycle of this species from pictures supplied by the author. You can see the results in the photos.

In Nanaimo, this species pokes its basal leaf above ground in September; the flowering stalk appears in February; it blooms in early April; disperses seed in July; and by August the plant has wilted and fallen to the ground. Kathleen's lovely painting stands the test of time as a tribute to this remarkable life cycle.

Photos show paintings by Kathleen Van der Sande of *Calypso bulbosa*.

Gentians of Blue Gentian Lake

by Lyn Grants

Some, but not all the lakes in Cypress Provincial Park have evocative names: Cougar Lakes (a sighting?), Lost Lake (found after having been—lost?), and Blue Gentian Lake (why blue? why gentian?).

Of course, we know the lake takes its name not from the colour of the lake but from the gentian, the King Gentian plant that flowers blue and beautiful around Blue Gentian Lake and along some of its margins and boggy trails.

But what about the name "gentian" itself? It comes from an ancient king—King Gentius, the ruler of the kingdom of Illyria in the western Balkan Peninsula from 181–168 BCE. King Gentius was credited by Dioscorides, that great physician, pharmacologist, botanist and writer of the 1st Century CE, with having discovered medicinal properties of the root of the yellow gentian, *Gentiana lutea*. The root of the yellow gentian is used now, as it has been for centuries, as an ingredient in bitters.

The Gentianaceae is a large family of flowering plants, with 87 genera and 1,600 species. Within Cypress Provincial Park we have one species only, our stunning King Gentian, watched for and welcomed in the late spring and into the fall as we make our journeys to the lake. As befits a king or monarch, the King Gentian (*Gentiana sceptrum)* carries a sceptre or staff. Look closely at the lance-shaped flowers that stand upright on the stem—the sceptre, the monarch's sign of office.

The tight flowerhead of the King Gentian rarely seems to open, yet pollination from moths, bees, hummingbirds and butterflies must occur. Dry fruits and seeds are spread by the wind. With luck, if the habitat is not too disturbed, the plant will spread.

Take notice of where you see *Gentiana sceptrum*. Is it more widespread than formerly thought?

Blue Gentians (*Gentiana sceptrum*). *Photo: Heather Filyk*

NatureKids Vancouver News

by Leslie Bol, President, NatureKids BC and co-leader, NatureKids Vancouver Club

NatureKids BC has an annual citizen science program which, in recent years, has focused on amphibians and pollinators; this year the focus is on BC's bats (**https://www.naturekidsbc.ca/be-a-naturekid/stewardship-citizen-science/bat-citizen-science/**).

Our annual citizen science program is an important aspect of what we do to make sure that we are encouraging children and their families to take action for nature. Many activities, resources and a webinar were developed this year in a collaboration between NatureKids BC Program Coordinator, Christina Chowaniec, and Paula Rodriquez de la Vega, an ecologist, member of the Okanagan Community Bat Team, and co-leader of the South Okanagan NatureKids Club**.**

To connect kids and their families to the interesting natural history of bats and their current plight, the Vancouver NatureKids Club had a bat-focused Explorer Day in July at Trout Lake Park with Danielle Dagenais, Regional Bat Coordinator with the Metro Vancouver and Squamish Community Bat Program.

Danielle began the Explorer Day with a personally written and illustrated story about a bat family.

Bat focus during an Explorer Day. *Photo: Deborah Simpson, co-leader, NatureKids Vancouver Club*

She continued to engage everyone through the use of museum specimens, interesting facts, a demonstration of her ultrasonic bat-detecting cellphone accessory, imitating the slow heart rate of a bat in winter, and even dressing up in a bat costume!

Kids and parents alike were intrigued and couldn't stop tapping into Danielle's knowledge with unending questions. She raised awareness and our level of understanding of bats' biology, shared resources for building roost boxes, and encouraged families to participate in local roost counts.

NatureKids BC Explorer Days are made possible by nature mentors such as Danielle who enthusiastically share their expertise and generously volunteer their time. The children and families who attended the bat Explorer Day with Danielle will now be advocates for protecting bats and their habitat in B.C.

Father Sandhill crane feeding its colt, June 2018, Reifel Bird Sanctuary. The adult had caught a four-spotted skimmer dragonfly and given it to the colt, but the dragonfly's wings made it too large for the colt to eat. The adult then retrieved the dragonfly, chewed it to reduce its size, and fed it again to the colt. *Photo: Angela Burnett*

This Program is brought to You by You—Knowledge Network Television in British Columbia

by Dan Overmyer

The Altiplano and Atacama deserts of Chile and Peru, 12,000 feet high, hold vast sources of salt and lithium, which is vital for smartphones, along with the hardy animals that live there, such as chinchilla, guanaco, and Darwin's rhea. Had you ever heard of the Yamnaya people of central Asia, predecessors of Indo-Europeans and among the first tamers of horses? Speaking of horses, did you know that they first appeared in Africa, migrated from there to what we call North America, and then returned to Asia, to be reintroduced to the Americas by Spaniards in the 16th century?

What about the fact that from its beginning 13.7 billion years ago, the universe will expand forever, ultimately disappearing from view? Who knows all this stuff? BC's Knowledge Network, that's who! And it belongs to all of us. What a treat we have created for ourselves!

Knowledge Network was launched in 1981, with Walter Hardwick as its first president. It started as an educational newsletter. The accomplished Dr. Pat McGeer—neuroscientist, UBC Professor Emeritus and former provincial cabinet minister—was also instrumental in establishing Knowledge in its early days. My friend, Dr. Mark Bullen, writes, "(This network) started out as more of an instructional TV service supporting colleges and universities and, in the 1980s, became part of the Open Learning Agency." Charitable status was soon granted. Knowledge Partners was created in 1988 to generate donor support from British Columbians with a wide variety of interests. The network is now supported primarily by donations from individuals interested in public education for all.

Knowledge Network now has 40,000 contributing members, with many thousands more viewers. It is one of only four such publicly-supported stations in Canada, along with two in Ontario and one in Quebec. Knowledge programs are enjoyed by viewers on television, but they can also be streamed at Knowledge.ca.

I watch it every night, primarily the nature programs like *Eden*; *Wildest Islands of Indonesia* and *Dragons' Domain*. I also enjoy University of Sussex physicist Jim Al-Khalili, who guides us through the history of science, quantum physics, cosmic entropy, and topics such as "Nothing—What is Nothing?". *Magic Numbers* features the mathematician Hannah Fry, who tries to answer the fundamental question, Is mathematics just a human construct, or is it part of the universe itself? To this, UBC Professor Emeritus of Mathematics Peter Bullen (father of Mark, mentioned above) responds that there can be no such question, because we humans *are* part of the

universe! Knowledge also features great programs about Canadian and American national parks, including those in Montana, Utah, and Canada's east coast and far north.

But Knowledge programs are not just about nature; they also include excellent detective dramas such as *Vera*, *Wallander* and the *Murdoch Mysteries* series, which is set in Toronto of the 1890s and early 1900s and is full of references to the Victorian technology of the era, such as handprints—the forerunners of fingerprints—and the first lie detectors. It also features the careful forensic work by detective Murdoch's wife, Dr. Julia Ogden, a skilled pathologist and medical examiner. (Not incidentally, he is handsome and she beautiful!)

And then there are the travel programs, like Sophie Fouron's explorations of islands and coastal cities, and Joanna Lumley's travels across Central Asia, India and Japan. For nostalgic ex-Brits there is *Heartbeat*, a light-hearted police drama set in 1960s Yorkshire; for lovers of New Zealand, the *Brokenwood Mysteries*; and for people hooked on politics with a European twist, the fine Danish series, *Borgen*. For a change, you can watch *Heavy Lifting*, about mobile crane operators who specialize in lifting and transporting massive objects like industrial furnaces and grand pianos.

All of this is presented commercial-free but, of course, with appeals for donations from viewers, which I hope keep pouring in. Knowledge Network is a blessing for us all.

Besides drawing upon years of watching Knowledge for this information, I am indebted to K: (Knowledge program guides) and to Knowledge Network staff, especially its President and CEO, Rudy Buttignol, who kindly met me in person for an interview.

Bryological Research in the Yukon's Richardson Mountains

by Terry McIntosh

Inuvik, a young arctic town, slow-paced and friendly, is a place that many would like to visit, although longer than we stayed. Getting there required flying from Vancouver to Whitehorse, then to Dawson City and Old Crow, finally landing just outside of town. The next day, for an hour or so, we were flown in by chopper to Stewart Lake in the Richardson Mountains, where we waited a few more hours before being transported to our wilderness campsite a short heli-ride away. We set up tents on one of the few available flats, near a stream for water and with abundant habitats for exploration nearby. That left me five days to collect bryophytes, more commonly known as mosses and liverworts, in an arctic wilderness where the skies get dim around 2 a.m. in late July, but never dark.

This research trip was planned by my good friend, Bruce Bennett, coordinator for the Yukon Conservation Data Center. Many areas of the Yukon require detailed inventory, from insects to bryophytes, and the Richardson Mountains are no exception. We had two crews of five, separated by a number of kilometers. Our group included Bruce, who is interested in vascular plants; Joel Kits, an entomologist; and Julie Thomas and Justine Benjamin, two mammal biologists. The mammal focus was

Richardson Mountains camp from a distance. *Photo: Bruce Bennett*

mainly on the collared pika, a lagomorph closely related to rabbits and an important "canary in the coal mine" with regard to climate change (it's considered of special concern federally and is on the IUCN Red List of Threatened Species). The location of our camp was approximately 780 metres high at latitude 67.7777° N and longitude 136.6904° W.

The campsite was spectacular with large, lichen-covered, boulder talus slopes (ideal for pika). Nearby were numerous willow- and dwarf-birch-covered streams, scattered Dahl sheep along the slopes, and evidence of Porcupine cariboo in the form of their dung, although we didn't see any during our stay. Berries were everywhere, mainly crowberries and alpine bearberries with a few scattered blueberries as well. The numerous species of mature but nicely drying mushrooms (in particular boletes) scattered everywhere were also remarkable. Grizzly bear feces were also fairly common, especially along long-used wildlife trails near the main stream below us. Particularly large clumps drew the attention of Bruce the first day. (More on that later.)

After camp was set up, all food and supplies tightly packed away in various plastic containers (this is grizzly country, after all), and our bear sprays attached to our belts, we set out in different directions. The mammal folks left to set live traps along transects to see what small mammals inhabited the area around camp and Joel, Bruce and I left to look for insects and other small critters and plants. My first observation was that the bryophytes were mostly absent from dry and exposed open outcrops and boulder fields but were fairly rich in adjacent habitats.

As the week wore on, as voles were caught and pikas observed, and centipedes and too many insects to count were trapped, I explored as much of the area as possible (bryologists are very slow in the field). Two habitats in particular stood out in and around two small waterfalls and in wet, often boggy habitats that popped up everywhere. The humidity near the falls was more favourable for many mosses and liverworts, including a few rare Grimmiaceous species of moss, *Coscinodon hartzii* and *C. cribrosus* most notably, but also species of *Schistidium*, one probably a new species to science. The wetter habitats were open and dominated by Ericaceous shrubs, dwarf birches and species of *Eriophorum* (cottongrass). These sites abounded in numerous species of *Sphagnum* (peat mosses) many of which have proved difficult to identify. I have not observed this variety of *Sphagnum* species in such a small area anywhere else in the Arctic. Altogether, it was a very successful bryological foray.

A couple of other adventures were of note. A grizzly bear was spotted the third day heading towards Joel when he went to retrieve his binoculars. Bruce spotted it and Joel moved back, but once the bear saw Bruce it high-tailed it out of there faster than any human can run through dense shrubs. On the last evening, Bruce spotted a black shape about 200 m away, which proved to be a very large and very black grizzly—the biggest Bruce had ever seen. It was

grazing berries along a slope and slowly moved out of sight. The next morning, after the helicopter landed, the pilot exclaimed that the grizzly down the slope from our camp was the biggest he had ever seen! So the "king of the mountains" had probably wandered near our camp and found us uninteresting, which is probably a good thing—although I would have liked some photos!

Terry has been consulting and teaching in various botanical fields for over 40 years. His work ranges from various parts of BC (but mainly open, dry areas) into Washington State and up to, most recently, Yukon where he has been conducting biodiversity surveys and attending Bioblitzes over the past few years. He is a board member and a principal editor for the Flora of North America project based in St. Louis.

Nature Vancouver Scholarship

How to Apply and a Donation

Nature Vancouver wishes to thank John Coope for directing his Lifetime Achievement Award prize from the Canadian Museum of Nature to Nature Vancouver's Scholarship. The Nature Inspiration Awards recognise individuals and organizations whose specific projects encourage Canadians to create links with nature and contribute to its preservation. John is being recognized for his long-term restoration work in Jericho Beach Park. He chose to direct his associated financial award to Nature Vancouver's Scholarship Fund and to the Jericho Stewardship Group.

Reminder: Nature Vancouver's $1000 scholarship is presented annually to a post-secondary student who is a member of Nature Vancouver or belongs to the immediate family of a member. Application deadline is March 31st. The scholarship is presented at the Nature Vancouver AGM in April. Details and application form **https://naturevancouver.ca/scholarships/**.

Bryophytes on the Edge of the World

by Caitlin Laidlaw

A TWO-DAY DRIVE and seven-hour ferry ride can transport you from Vancouver and leave you on the edge of the world. As the road snakes north the landscape changes from a lush temperate rainforest to the dry interior of the Cariboo. Take a left at Prince George, and the road meanders beside streams where bears saunter in search of food. A bit further, and lush rainforest appears once again covering mountains in a race to touch the sun. As the ferry from Prince Rupert enters the Hecate Strait, you sway under the strength of the swells while flukes of humpbacks descend into the depths. When the dark islands appear in the distance, a small part of you wonders if you really had found the edge of the world.

When I asked graduate student Ernest Wu why he travels all this way to study mosses his answer was simple: "Why wouldn't you?" As his only field assistant, I had no objections to spending a month traveling Haida Gwaii in search of mosses, but the eager scientist in me wanted more. After more prodding, I learned that Haida Gwaii had been a refuge from glaciers during the last ice age nearly 12,000 years ago. As a result, the flora present across the archipelago have more resemblance to ancient flora than anywhere else in British Columbia. Additionally, certain species of mosses, such as *Seligeria careyana,* are endemic to the island and found nowhere else in the world. The variety of endemic species explains why Haida Gwaii is often referred to as the Galapagos of the North. This is why we were here. We would be collecting as many moss species as we could find to bring back to the University of British Columbia for both Ernest's masters research and to expand the collection of UBC's herbarium.

It didn't take long for me to begin to appreciate mosses in a way I never had before. Mosses exist at the interface of above-ground and below-ground ecosystems. To the yellow spotted millipede or forest arthropods, mosses are as dominating as Douglas firs are to us. If you were to lower your eye to the level of the mosses, an entire moss forest appears in front of your eyes. Not only are these mosses an integral habitat for forest decomposers—they also play an important part in the nitrogen cycle. They are hosts to *Nostoc* bacteria, which have the ability to fix atmospheric nitrogen. Mosses also play a role in the carbon cycle. Sphagnum moss, historically used for dressing wounds, can use methane as a carbon source; methane is a greenhouse gas 13 times more potent than carbon dioxide. This is made possible by methanotropic bacteria that live within the sphagnum leaves.

When collecting mosses, habitat is far more important than distance. You could walk hours through a forest and collect less diversity than walking an hour along a stream, or spending an hour collecting on a limestone cliff. The adventures in our

Ernest Ting Yu Wu and Caitlin Laidlaw collecting moss specimens on beach shoreline of Haida Gwaii.

field season started with daily trips to Spirit Lake, a short hike that begins in Skidegate. As our confidence and collection routines solidified, we searched farther across the island. Three hours of driving down bumpy logging roads and camping on log sorts; kayaking into inlets; wandering along streams we came across; and boat trips to old village sites were just some of our daily activities.

Of all the adventures our field season entailed, perhaps the most challenging one was visiting the west coast of Haida Gwaii. The rugged coastline drops steeply into swells that have not seen land since Japan—nearly 7,000 km away. We were dropped off on a remote bay and set loose to search the cliffs and inlets. A few lucky breaks from the clouds allowed us to enjoy a pleasant lunch on a pebble beach and then continue to search the boulders along the beach for more species of moss. Upon returning to the Village of Queen Charlotte, we were fortunate enough to stumble upon a pod of

orcas. In a wilderness as remote as the west coast of Haida Gwaii, the only sounds mixed in with the waves were the breaths of the orcas as they breached the surface.

As my understanding of mosses transformed so, too, did my appreciation for the diversity of life here on Earth. Haida Gwaii is home to more than 400 moss species alone. They play a significant role in the ecosystem that I believe should continue to be researched. There are entire species and ecosystem linkages that we have yet to understand, and need to continue to research to fully appreciate their complexity. After a month of collecting mosses, and more than 300 specimen paper bags later, we boarded the ferry home. As we pulled away from the island and the dark shapes faded into the distance, I thought, if the world had an edge, surely this was it.

Born and raised in Mississauga, Ontario, stories of the natural wonders of the West Coast drew Caitlin Laidlaw to the University of British Columbia to complete a BSc with the Faculty of Forestry. Throughout her degree program, she took as many opportunities as possible to explore the province. This adventure to Haida Gwaii was a perfect ending to her five-year journey. Caitlin is currently continuing her education via a Master of Environmental Studies at the University of Waterloo.

Sentinel by the Trail, Hoary Marmot. *Photo: Daphne Nagorsen*

Coatings on the Rocks

by Terry Taylor

Rock surfaces contain some fascinating micro-ecosystems. In fact, if you look at an old rock surface you may not see any rock at all! You may need to look at it with a hand lens or magnify an image with your camera, but if you look closely at rock exposures you hike past, you will certainly see things you have never seen before.

The most obvious organisms on dry rocky sites are the lichens. Most of those on a bare surface are crustose ones—the simplest lichen growth form, which looks like a thin coating like paint across the rock surface, but is much more complex because it's alive. Most lichen species are these crust-like forms, and many people think they are just mineral coatings on the rocks, if they think about them at all.

Crustose lichens are not usually included in most books about lichens because they are very difficult to distinguish from each other, even by professional lichenologists. But you don't need to know their names to appreciate their beauty. They contain acids that gradually dissolve the minerals on which they grow, and the pitted surfaces produced eventually allow larger lichens, mosses and seedlings to grow there. However, that takes a long time. Crustose lichens are not known for being in a hurry, and many of them increase their diameters by less than a millimetre per year.

What do you see when you get down on your hands and knees? Quite a bit, especially if you have a lens or camera with you since you can't really see and appreciate nature by looking at it from a distance. Up close, you'll see that lichen crusts do not all look the same. The most obvious distinction is all their different colours: some of them are white or gray; others are green or orange. Probably one of the most obvious and intriguing crustose lichens is the green one with black lines across it—commonly called the map lichen (*Rhizocarpon geographicum*) because it looks like a map. Several orange ones, which also stand out against their rocky backgrounds, are especially common on seashore rocks as they thrive on the fertilizer from bird droppings. You may also see little round discs on some of these lichens. These are called apothecia, which are reproductive structures that produce spores.

If the rock surface is damp and shady, the whole ecosystem is different. Most crustose lichens are like people, they go for the sun. On shady rocks they are replaced by algae. Most of us consider it to be slime, and to be avoided. If you have a microscope, however, these green coatings are something to be taken home and studied. Some of them consist of aggregations of single round or oval cells, but others have their cells attached to each other, forming long filaments. There are quite a few different types, and you never know what you have until you take them home and have the excitement of discovery.

Then there are the rocks that are permanently wet or underwater. They

have a slippery surface called biofilm, which hikers should be especially aware because it's very slippery and as hazardous as an icy sidewalk. These biofilm coatings are made by single-celled microorganisms. Although simple organisms, there are many different groups—bacteria, algae, protozoa, etc.—which together form complex micro-ecosystems. They protect themselves by forming a gelatinous covering.

As you can see, not everything meets the eye when it comes to coatings on rock surfaces, so take your time—and a little magnification—and see what you can see.

Terry Taylor has studied British Columbia botany and mycology for 50 years. He joined the Vancouver Natural History Society in 1967, and his main interest is mosses and fungi. He is a member of the American Bryological and Lichenological Society. Terry lives in Qualicum Beach and is a member of the Arrowsmith Naturalists. He can be reached at ***trtaylor@shaw.ca****.*

Map lichen (*Rhizocarpon geographicum*) in Kakwa Provincial Park. *Photo: Bev Ramey*

Some Red Huckleberry Plants have Two Types of Leaves

by David Cook

If you look closely at red huckleberry bushes in our area you will often notice that some plants have two leaf forms; small-toothed (serrated) leaves at the base of the bush and larger smooth-edged (entire) leaves higher on the same bush. The larger leaves are deciduous and the smaller leaves are evergreen. You may need a hand lens (loupe) to see this. The immature leaf form persists for the first three to four years of the plant's life with the mature form following in succession (Vander Kloet 1988) as the plant ages. The accompanying figure shows the two types of leaf.

It has been shown that on global and geological scales plant species with serrated leaves tend to be more common in colder, wetter climates. This observation has been used extensively as a proxy for the understanding of past climates by observing leaf forms in plant fossils.

Also, it was found that leaves with teeth enhance plant growth at the beginning of the growing season when temperatures are limiting (Royer & Wilf, 2006).

The two-leaf form is only presented by the huckleberry plant for the first three or four years of their

Evergreen (left) and deciduous leaves from the same red huckleberry (*Vaccinium parvifolium*). *Photo: David Cook*

Red huckleberry (*Vaccinium parvifolium*) with unripe fruit. *Photo: Rosemary Taylor*

life. You may ask why is this? Keeping in mind the above studies it is reasonable to assume that the young plant gains a competitive advantage over other understory plants in the dark forest by being able to perform year-round photosynthesis.

Also, the evergreen leaves are smaller and somewhat tougher, having a thickened margin, which are defenses against possible freezing temperatures in the winter. They are also low to the ground where it is warmer. As the plant gains some elevation and additional canopy with its deciduous foliage, the evergreen part of the plant is required less and less and is discontinued.

References

Royer D.L. and P. Wilf 2006. Why do toothed leaves correlate with cold climates? Gas-exchange at leaf margins provides new insights into a classic paleotemperature proxy. *International Journal of Plant Sciences*, 167: 11–18.

Vander Kloet, S. P. 1988. The genus *Vaccinium* in North America. Publication 1828. Ottawa: Research Branch, Agriculture Canada.

The West Coast's Little Slit Shell and Its Prized Cousins

by Bill Merilees

Every shell collection is a grab bag of material—a collection of specimens as unique at its curator. Peter Henson's collection (See, *Discovery*, 2008, Vol. 37 (2): p. 18-21.) was no exception. From his earliest years as a young boy in England he developed an interest in molluscs, but it was not until his appointment as government agent to Masset on Haida Gwaii that the expression of this interest blossomed.

Between March 15, 1957 and June 15, 1962, Peter meticulously recorded 2,297 entries in his Haida Gwaii shell catalogue. His penultimate dredge sample, recorded as, "In 100 fathoms, west and slightly north of Rose Spit, [Graham Island] June 15, 1962. Bottom of silty mud, with thousands of brittle stars," contained a number of little slit shells (*Scissurella kelseyi*). This species is now recognized as *Anatoma kelseyi* (Dan Geiger, pers. com.) At 5 mm, *Anatoma kelseyi* is miniscule when compared to its gigantic, highly prized relatives.

We are not certain if Peter was on board Bill Wylie's fishing boat *Dungeness* when the sample was taken. Peter is believed to have often lent his dredge (given him by Dr. Ian McTaggart-Cowan of the University of British Columbia) to friends in the commercial fishing community. His expectation was a bottom sample or two from their fishing grounds when they returned to port.

Slit shells, (as opposed to little slit shells) are very large, warm water species that attract considerable

Little slit shells (*Scissurella kelseyi*). *Photo: Rick Harbo*

attention from shell collectors. They have been prized by emperors, and have developed an intriguing, almost mythological, cult following. Specimens of these large species occasionally appear at shell club auctions or are available for sale from shell dealers. At a recent Pacific Northwest Shell Club auction, a small specimen fetched US$40. A perfect specimen of spectacular size (230 mm or 9 inches) of *Pleurotomaria rumphii* recently sold for US$3,500!

Along with the abalones, slit shells are among the most ancient lineages of gastropods. The slit in their shells is an evolutionary feature important for respiration and possibly excretion of waste.

References

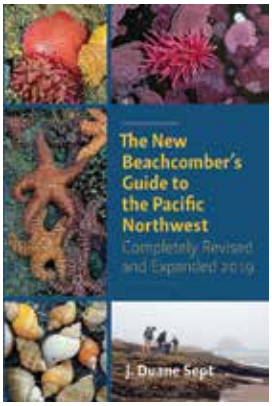
Geiger, D., 2019: Personal Communication.

Merilees, B., 2008: A Love of Molluscs: Peter Henson's Story. Discovery, Journal of Nature Vancouver, Vol. 37(2): 18-21.

Wikipedia: Slit shells (Selenizone) https://en.wikipedia.org/wiki/Selenizone

Glaucous-winged gull eating sea star. *Photo: Terry Carr*

Dive into the Salish Sea—and Beyond—with Harbour Publishing



The New Beachcomber's Guide to the Pacific Northwest

Completely Revised and Expanded 2019

J. Duane Sept

Explore one of the most diverse displays of intertidal marine life in the world with this expanded guide to the Pacific Northwest. Featuring sections on sponges, sea stars, seaweeds, molluscs, fishes and more! $32.95 PB

A Field Guide to Marine Life of the Outer Coasts of the Salish Sea and Beyond

A Field Guide to Marine Life of the Protected Waters of the Salish Sea

Rick M. Harbo

The marine life of the Salish Sea is abundant and diverse. Learn about giant green anemones, amazing sea stars and thick kelp forests, as you discover new worlds in oceanic depths. These compact guides are a must-have resource for both visitors and residents alike.
$7.95 WATER-RESISTANT, 8-FOLD FIELD GUIDE

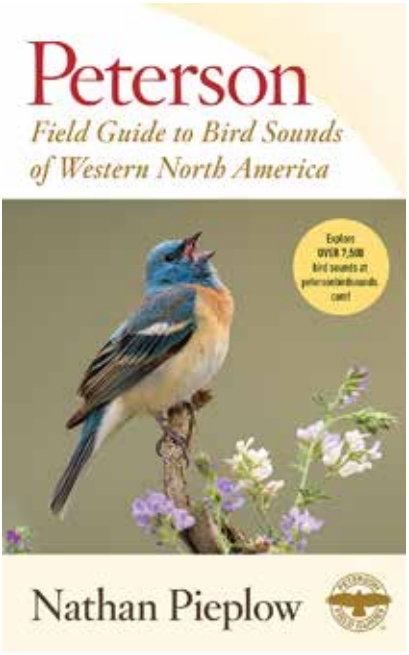
Available at bookstores near you!

harbourpublishing.com

Peterson Field Guide to Bird Sounds of Western North America

Author: Nathan Pieplow, April 2019
Houghton Mifflin Harcourt, New York
648 pages; paperback; $40

This is the second book on bird sounds by Nathan Pieplow and follows the format of the well-received *Peterson Field Guide to Bird Sounds of Eastern North America* (Houghton Mifflin Harcourt, March 2017, 608 pages, ISBN: 9780547905587). The book is 13x3x21 cm, and weighs 911g—about the size and weight of the *National Geographic Field Guide to Birds of North America*. A website with 7,500 audio files of bird sounds accompanies the book (www.petersonbirdsounds.com). The book covers 537 species of birds regularly found in the western United States west of the 100th meridian and adjacent Canada, south of the 50th parallel. Together, the two books provide a quite comprehensive reference to North American bird sounds. The breeding-season sounds of some arctic nesters are omitted unless they are known to be made during migration or winter.



Nathan Pieplow is well qualified to produce these books. He teaches writing and rhetoric at the University of Colorado, Boulder, and has extensively studied bird sounds since 2003. He is also well known for his blog Earbirding—recording, identifying and interpreting bird sounds (http://earbirding.com/blog/), which has a good deal of interesting, helpful information on bird sounds.

Pieplow notes, "I became dedicated to finding new and better ways to learn, describe and catalog bird sounds." He was motivated, in part, because his high-frequency hearing is getting worse every year and he doesn't have a great auditory memory, conditions which might be shared by many birders, who would therefore appreciate this book even more.

Pieplow's approach is based on sonograms—computer-generated graphs that show the basic shape of an audio wave and how its frequencies change over time. Many of you will remember the sonograms in the Golden Field Guide *Birds of North America* from the 1960s. Those

sonograms did not catch on, likely partly due to their small size and poor legibility. Pieplow refines the sonogram approach and produces them for a great variety of sounds, beyond song, for each species. This new approach is based on visualizing and indexing bird sounds. The sonograms show us the speed, repetition, pauses, pitch pattern and tone quality of the sounds, but visualizing them can still be challenging.

The book is divided into three sections: Introduction (33 pp.), Species Accounts (490 pp.), and Visual Index (87 pp.). The Introduction discusses how to visualize the sounds in the spectrograms, and the names used for the sounds. It is *essential* to read and understand this section before using the book. Visualizing sounds is not familiar to most of us, but it is the basis for using this book. Information on how to visualize sounds is also available at http://earbirding.com/blog/specs. The Species Accounts present a small illustration, a range map and brief information on each species, which help connect the bird we know with the spectrograms for songs, calls and other sounds. The Visual Index lists every sound in a group with similar sounds, a symbol of roughly how the sounds appear in the spectrograms, and a list of species that exhibit the sound. The inside covers also provide quick references to the bird sounds.

Although Pieplow describes his book as a field guide, I found it to be most useful as a reference guide. I took the book to the field to use as I heard the songs and sounds of various birds with which I was familiar. I sometimes had difficulty in translating what I was hearing into the specific pip, pik, chirp, cheep, seet, dzit, etc. used in the book. I also found myself looking up the sound as I heard it only to find that it was in the book under a slightly different label. I think that my problem was one of language, and that making the book effective as a field guide would require me to learn a new one.

Perhaps because I learned bird songs using other tools, including sound memorization and mnemonics, I had more difficulty than someone who starts with this visual approach. Using the book as an effective field guide requires time, study and patience. Pieplow notes that there are several spectrogram apps available that can allow you to make a picture of a sound right when you hear it, which can show you the *shape* of the sound, and then you can compare that shape to the ones in the book. "It turns bird sound identification into a visual challenge, which can be really advantageous since many of us have an easier time remembering visuals than sounds," says Pieplow on his blog. (earbirding.com/blog/archives/5394). [I would be remiss, however, if I did not point out that a simpler, but extremely useful approach to bird calls is found in *A Guide to Bird Calls of Southern Vancouver Island* (6 CDs and a 68-page guide) by Ian Cruickshank, Rocky Point Bird Observatory (rpbo.org/bird_call_resource_kit.php).]

On the other hand, I found the book quite useful as a reference guide in separating some similar sounding notes of different species. The careful

documentation of the sounds helped me in hearing the subtle differences in the notes and calls. Using the book in conjunction with the accompanying website is useful, if not essential, in hearing and learning the differences in the sounds and the names used in the book.

A very useful feature of the book is that for several species, accounts are presented separately for distinctive subspecies/types: Northern Pygmy-Owl (Southern Rockies, California, Mountain), Warbling Vireo (Western, Eastern), White-breasted Nuthatch (Pacific, Montane, Eastern), Marsh Wren (Western, Eastern), Swainson's Thrush (Russet-backed, Olive-backed), Evening Grosbeak (Type 1, 2, and 4), Red Crossbill (Type 1, 2, 3, 4, 5, 6, 7, and 10), Brewer's Sparrow (including Timberline), Bell's Sparrow (including Mojave), Fox Sparrow (Sooty, Thick-billed, Slate-colored), Dark-eyed Junco (Slate-colored, Red-backed), Savannah Sparrow (including Belding's and Large-billed), Yellow-rumped Warbler (Myrtle, Audubon's). This assists in separating these subspecies and types, and I am sure will be used by many birders.

Overall, I found the *Peterson Field Guide to Bird Sounds of Western North America* to be a useful addition to any birder's library. It is valuable as a comprehensive reference book to bird sounds and, for some, it provides a new approach to learning bird sounds and a useful field guide.

This review is by Art Martell of Courtenay, B.C., who is a keen birder, board member of the British Columbia Field Ornithologists, Editor of British Columbia Birds, and Volunteer Caretaker for the K'omoks Important Bird Area. He was a Regional Coordinator for the British Columbia Breeding Bird Atlas and continues to be an active contributor to the North Vancouver Island birding community.

Cover Stories

Front Cover Photo by Caroline Penn

The Inky Gentian (*Gentiana glauca*) is often found in the alpine and subalpine areas of Northern B.C. The photo was taken during a walk around the upper lakes during the 2019 Nature Vancouver Niut Camp, Week Two, on July 31st. 2019. The elevation was just above 2000 metres.

Back Cover Photo by Joan Lopez

The photo was taken on Oct 22, 2018. We had planned on going for a boat ride to observe some wildlife, but it was mid-afternoon by the time the fog lifted. Once the visibility cleared, the waters of Georgia Strait were remarkably calm and reflective. A late start on our excursion meant sunset arrived too soon, cutting the trip short, but providing the warmest colours for photographing some amazing creatures. This photo is the fluke of a humpback known as "Raptor", officially BCY0660.

Alpine Meadow Hiking

Durrand Glacier Chalet in the Selkirks

A mecca for naturalists and photographers

Over 80 km of hiking trails, blooming meadows, waterfalls and mountain lakes... Marmots, mountain goats and birds. 100 wildflower varieties.

Three paces of guided hikes, or hike on your own.
Helicopter access only from Revelstoke, BC.

Swiss style alpine chalet, first class meals and lodging.
One or two person rooms. No single supplement.

Always smiling and helpful staff!

SELKIRK MOUNTAIN EXPERIENCE

WWW.SELKIRKEXPERIENCE.COM | 250.837.2381

DISCOVERY

Published by Nature Vancouver as a service to members.
P.O. Box 3021, Stn. Terminal, Vancouver, BC V6B 3X5

Canadian Publication Mail Sales Agreement 40038882