Lakelse Lake: A Collation of Research Studies and Government Documents

This reference guide has been put together for the Lakelse Watershed Stewards Society and while some aspects will seem quite familiar, other portions may be new material and have relevance to some of the concerns raised by the Lakelse Watershed Stewards Society in regards to Lakelse Lake. This list is an amalgamation of the pertinent information from various works available on Lakelse Lake and provides an overview and a list of the sources where these works have been found.

HISTORY AND PHYSICAL GEOGRAPHY OF LAKELSE LAKE AND RELATED STUDIES

BC Geological Survey. Geotour Guide for Terrace B.C. Bob Turner, Natural Resources Canada, JoAnne Nelson, BC Geological Survey, Richard Franklin, Saanich, BC Gordon Weary, Tony Walker, Bonnie Hayward and Cathy McRae, Terrace, BC. Internet Source

Mount Layton Hot Springs, also known as Lakelse Hot Springs, include at least half a dozen warm seeps that straddle Highway 37 and flow into wetlands which surround the resort area. Warm springs may also occur on the floor of Lakelse Lake, as local residents have noticed soft spots in the lake ice during the winters.

BC Lake Stewardship and Monitoring Program Lakelse Lake 2004-2005. A partnership between the BC Lake Stewardship Society and the Ministry of Environment. Internet Source

Lakelse Lake is located approximately 10 kilometers south of Terrace on Highway #37 and lies at an elevation of 72 meters. The lake has a maximum depth of 31.7 meters and a mean depth of 8.5 meters. Its surface area is 1460 hectares and the shoreline perimeter is 26.8 kilometer. The flushing rate of Lakelse Lake is estimated to be five to six times per year. The flushing rate is a measure of time that inflow replaces the lake water volume. It is important because the longer the retention time, the less the lake has the ability to assimilate additional nutrients, and therefore avoid unnatural eutrophication. The high flushing rate of Lakelse Lake is caused by its large watershed and the high annual precipitation for the area. A large percentage of the precipitation occurs during the winter as snow, causing maximum water input during the spring and summer months. (This report contains additional information on Lakelse Lake in other topic areas).

Chemical, Biological and Physical Characteristics of Lakelse Lake, B.C. T.R. Cleugh, C.C. Graham and R.A. McIndoe. Fisheries and Marine Service Manuscript Report No 1472. 1978. NWCC Archives.

Drainage History: The Lakelse Lake area has undergone a complex glacial history. In pre glacial times, it was most probable that the ancestral Nass and Skeena Rivers flowed through the Kalum Valley to Kitimat Arm. Since that time, indications are that at least two major glacial advances and two major prolonged halts occurred in the final recession of ice (p 2).

Geology: The bedrock of this region is made up mainly by rocks of the Coast Range Batholith. They consist of diorite, granodiorite, granite and porphrytic granite and intrude and include highly metamorphasized limestones, marbles, cherty quartzites and argillities of probable Triassic age (p 5). (This report contains additional information on Lakelse Lake in other topic areas).

Taxonomy of Lakes. A. R. Zafar. n.d. Internet Source.

It is evident that A and B type lake-basins will have a larger continental shelf and lesser mean depth. Their profundal regions will be confined to smaller areas, thereby containing lesser bulks of hypolimnion water. Damming Lake (Hooper, 1951) and Lakelse Lake (Brett, 1950) may be quoted as examples of such basin types. (A good source for lake classification types).

RIPARIAN VEGETATION AND AQUATIC PLANTS OF LAKELSE LAKE

Chemical, Biological and Physical Characteristics of Lakelse Lake, B.C. T.R. Cleugh, C.C. Graham and R.A. McIndoe. Fisheries and Marine Service Manuscript Report No 1472. 1978. NWCC Archives.

A sample of each predominant aquatic macrophyte observed in Lakelse Lake was returned to Vancouver laboratory and keyed to a genus. From diver estimates the dominant species throughout the lake were Elodea and Potamogeton. The Williams Creek Bay contained a substantial number of aquatic macrophytes. The predominant plant of this area was Elodea. The southern shoreline is sheltered from most winds and is relatively shallow. This area has the greatest coverage and the greatest diversity of macrophytes in the lake. The most dominant plants in number and coverage were identified Potamogeton sp. and Elodea sp. (p 27). (This report contains additional information on Lakelse Lake in other topic areas).

Lakelse Lake Draft Management Plan Prepared for: The Lakelse Watershed Society. Julia Kokelj. British Columbia: Ministry of Water, Land and Air Protection Skeena Region. 2003. Internet Source.

In recent years, residents in the Lakelse watershed have noticed growth of the invasive species Elodea canadensis in their lake. Based on patterns of infestation in other lakes in the region, it is likely that the growth of Elodea in Lakelse will continue, until it occupies most of the shoreline. The beginning of significant human activity in the Lakelse watershed coincides with increases in sediment delivery rates to the lake. This suggests that land use activities in parts of the watershed may be contributing to the water quality concerns in Lakelse Lake, and may be a contributing factor to the Elodea infestation. Elodea canadensis is endemic to North America. Commonly found in south-western B.C., it is rare northward, with the exception of occurring in lakes along Highway 16. It can be found in lakes, ponds, streams and ditches in lowland, steppe, and montane zones. Elodea canadensis is often referred to by various names including Canadian waterweed, American elodea, Canadian pondweed, Common elodea, and Water thyme (Warrington, 2001). Elodea species are widespread in a variety of habitats and may become weeds in eutrophic conditions. The leaves occur in whorls of 3, rarely being over 1.5 cm long and approximately 2 mm wide, and taper abruptly to a blunt point. It is commonly found at depths of 1 to 8 meters. Since these are favored aquarium plants, they may be introduced to a number of lakes. Flowers are very small, white, and on the end of a very long thin stalk, that reaches the surface (Warrington, 2001). The literature suggests that once introduced into a region, E. canadensis tends to disperse rapidly.

The growth of Elodea canadensis in the lake over the last 4 years has reached a level that seasonally occludes beaches and shorelines. It currently occupies most of the volume of several shallow bays of the lake, as well as patches of shoreline where fine sediments allow rooting. This same infestation also exists in over 25 lakes in the Highway 16 corridor between Prince George and Terrace B.C. Based on growth in

the other Highway 16 corridor infested lakes, it is likely that the pattern of invasion of Elodea in Lakelse will continue, until it occupies most of the littoral zone.

(This report contains additional information on Lakelse Lake in other topic areas).

The Distribution of Aquatic Vegetation in Lakelse Lake and the Partitioning of Nutrients among Sediments, Water and Plant Tissue. P. Warrington. Resource Quality Section, Water Management Branch, Ministry of Environment and Parks. 1986

This report was requested by regional staff as part of a complete study on Lakelse lake. There was a need to know the value of aquatic plants, for fish habitat, and their relative value in the nutrient cycle of Lakelse Lake.

SOCKEYE SALMON AND FISH RELATED STUDIES

A Creel Survey of the Lakelse Lake Cutthroat Sport Fishery, June- August 1979 S.P. Hatlevik, K. Diemert & M.R. Whate. 1979. Internet Source

The sport fishery for cutthroat trout (Salmo clarki) in the Lakelse watershed has long been of major importance to recreationists in North western British Columbia and particularly to residents of Terrace and Kitimat. The sport fishery is traditionally divided (as influenced primarily by fish movements) into two zones. During April and May, large numbers of cutthroat move into Lakelse River to spawn and feed on emerging salmon fry (Bilton, 1954; and Bilton and Shepard, 1955). Aspects of this spring cutthroat fishery were first discussed by the above authors and more recently by Imbleau (M.S. 1978). The fishery shifts to Lakelse Lake during the summer months and it is upon this fishery that this report focuses.

An Upstream Battle: Declines in 10 Pacific Salmon Stocks and Solutions for their Survival. David Suzuki Foundation. Internet Source.

From 1962 to 1967, hatcheries, fish fences, and spawning facilities were operated on Williams and Scully creeks, and a weir across the Lakelse River was used to monitor adult escapement and downstream smolt migration. Detail studies of Lakelse Lake were conducted in 1994 and 2003 to assess sockeye production capacity and factors limiting their production (Shortreed 1998, 2003).

BC Lake Stewardship and Monitoring Program, Lakelse Lake, 2004-2005. A partnership between the BC Lake Stewardship Society and the Ministry of Environment. Internet Source

Lakelse Lake contains fish species such as aleutian sculpin, brook trout, Dolly Varden, longnose sucker, largescale sucker, northern pikeminnow, mountain whitefish, prickly sculpin, rainbow trout, redside shiner, river lamprey, threespine stickleback, western brook lamprey, steelhead and chinook, chum, coho, pink, and sockeye salmon.

Conserving Lakelse Fish and their Habitat. Lakelse Watershed Backgrounder Skeena Fisheries Commission. 2003. Internet Source.

This backgrounder has been updated for the use of the Lakelse Lake Sockeye Recovery Plan (LLSRP) planning table. It briefly presents at a watershed scale a biophysical profile, a description of the fisheries resource, and anthropogenic effects; both tangible and intangible. Social, political, and economic factors influence the status of fish and habitat in the Lakelse Watershed.

Conserving Skeena Fish Populations and their Habitat. Allen S. Gottesfeld, Ken A. Rabnett, and Peter E. Hall. 2002. Skeena Fisheries Commission. Internet Source.

The very high fishery values stem from the superb spawning and rearing habitat. Though the Lakelse Watershed was impacted by large scale industrial logging, particularly in the mid 1960's to mid 1980's, some of the post-logging impacts to fish and fish habitat have been mitigated by time. Lasting impacts of timber harvesting are primarily disturbance of tributary riparian zones, alteration of stream structures, and an increased bed load mobilization leading to channel destabilization and aggradation on steep gradient stream fans. Many tributary riparian zones have seen an expansion of beaver habitat that may provide rearing habitat, but access to this habitat is problematic.

Factors Limiting Juvenile Sockeye Production and Enhancement Potential for Selected BC Nursery Lakes. K.S. Shortreed, K.F. Morton, K. Malange & J.M.B. Hume. Fisheries and Oceans Canada Marine Environment and Habitat Science Division. Canadian Science Advisory Secretariat. 2001. Internet Source.

Lakelse Lake appears to be an effective rearing area for sockeye fry with an abundant food supply. In 1994 sockeye fry biomass was only one-half of the maximum biomass predicted by the PR model and average escapements of 4,900 are substantially less than the predicted optimum escapement of 33,000. Potential competitors (stickleback and mysids) were present in the lake but the degree of competition (and consequent reduction in productive capacity) is unknown. Increasing fry recruitment would be the most effective way of enhancing this stock, but given the currently low Daphnia biomass, careful monitoring of sockeye growth rates and zooplankton community structure would be required.

Northern Fund Projects 2005/06. Lakelse Lake Sockeye Rehabilitation Program: Hatchery Creek Spawning Habitat Improvement Project. 2005/06 Internet Source.

The project proposes to improve sockeye spawning habitat in the upper reaches of Hatchery Creek through the removal of small woody debris and resulting sediment accumulations, placement of large woody debris (LWD) complexes and gravel, as well as excavation of the upstream groundwater table to increase flows to the improved areas. This project proposes to design and implement the project in one field season. Upon completion of the project, spawning habitat for more than one thousand spawners will have been rehabilitated.

Observations on Cutthroat Trout of the Lakelse River systems, 1986, and implications for Management. A.D. de Leeuw. B.C. Environment Fish & Wildlife Branch, Smithers, B.C. Skeena Fisheries Report #SK—79. 1991. Internet Source.

A consistent evaluation of the Lakelse lake and/or river cutthroat trout population should be developed. Such an evaluation, repeated every 4 to 5 years, would sample cutthroat trout to determine changes in age, growth and relative population abundance.

What's Happening to Wild Salmon in Your Community? Dawn Steele & Mark Johannnes. Pacific Fisheries Resource Conservation Council. 2008. Internet Source.

Several Skeena sockeye stocks are down, including Kitwanga and Lakelse sockeye, which was identified as the third most endangered. Declining populations in Lakelse Lake and surrounding creeks was blamed on logging and habitat disturbance. Some problems were also noted for pink and chum, along with a sharp decline in steelhead in Kitimat.

Report on Limnological and Limnetic Fish Surveys of North Coast Area lakes in 2002 and 2003. Ken Shortreed & Jeremy Hume. Fisheries and Oceans Canada Cultus Lake Salmon Research Laboratory. Internet Source.

Lakelse Lake contained substantial numbers of the mysid Neomysis mercedis, which can be an effective competitor with juvenile sockeye. Daphnia (a zooplankton that juvenile sockeye eat) comprised a substantial proportion of total zooplankton biomass Lakelse lake at the time of study. However, in Lakelse Lake Daphnia numbers were high only on the July sampling date. Mysids are known to be effective predators on Daphnia and seasonal variation in biomass of both suggests this is the case in Lakelse Lake. Daphnia numbers were high in July but declined rapidly to negligible numbers in August, when mysids reached their seasonal peak. The only other available food source in Lakelse Lake which would result in an elevated 815? is mysids. 813C in both mysids and sockeye remained stable and similar to that of a Daphnia-dominated zooplankton community. Further analysis is needed, but at this time we suggest that mysids are both a direct competitor (both sockeye and mysids preferentially forage on Daphnia) and a food resource. During daylight hours in Lakelse Lake mysids and sockeye occupy the same narrow depth strata on or near the lake bottom.

Sockeye Salmon Status Review: Life History of Oncorhynchus Nerka. NOAA-NMFS-NWFSC TM-33. Internet Source.

Sockeye salmon fry mortality, due to predation by other fish species and birds, can be extensive during downstream and upstream migration to nursery lake habitat and is only partially reduced by the nocturnal migratory movement of some fry populations (Burgner 1991). Predation losses during fry migration to Lakelse Lake, British Columbia down Scully Creek were estimated at 63-84% over 4 years (Foerster 1968).

LAKELSE LAKE PHOSPHORUS, NUTRIENT LOADING, AND SEDIMENT STUDIES

Assessment of Changes in Total Phosphorus in Lakelse Lake, BC: A Paleolimnological Assessment. 2002. Internet Source.

Sediment cores were retrieved from the north and south basins from Lakelse Lake with a modified K-B corer (internal diameter -6.35) on February 25, 2002. Results from the CRS model suggest that sedimentation rates increased after 1950 in both basins. In the south basin estimated sedimentation rates were highest between approximately 1967 to 1972 and from 1981 to 1984. In the north basin sedimentation rates have steadily increased since 1950, peaking in 1991, with much reduced rates after this time.

BC Lake Stewardship and Monitoring Program Lakelse Lake 2004-2005. A partnership between the BC Lake Stewardship Society and the Ministry of Environment. Internet Source.

Non-Point Source Pollution and Lakelse Lake: When Onsite septic systems fail, they become significant sources of nutrients and pathogens. Poorly maintained pit privies, used for the disposal of human waste and grey water, can also be significant contributors. Runoff: Lawn and garden fertilizer, sediment eroded from modified shorelines or infill projects, oil and fuel leaks from vehicles, snowmobiles and boats, road salt, and litter can all be washed by rain and snowmelt from properties and streets into watercourses. Phosphorus and sediment are of greatest concern, providing nutrients and/or a rooting medium for aquatic plants and algae.

The Socio-Economic Importance of Maintaining the Quality of Recreational Resources in Northern British Columbia: The Case of Lakelse Lake By William F. Sinclair 1974 jointly published by Fisheries and Marine services Northern operations branch Pacific Region Kitimat-Stikine Regional District Terrace, BC archives NWCC.

Nutrient loading into Lakelse Lake could only be measured at two sources, the inflowing streams and the hot springs canal. Nutrient loading from the streams is computed at 0.019 grams of phosphorus per square meter of lake. The hot springs canal loading is computed at 0.02 grams of phosphorus per square meter of lake, which is as much as all the streams combined…The nutrient input of the streams…indicates low enrichment from the watershed as a result of deforestation and natural soil leaching …In conclusion, although absolute evidence is not present, the recreational activities on the lake or lake shore must be considered as having the major influence on the lake trophic level. If the water exchange rate were less it is very likely that the lake would have a luxuriant growth of plants with its repercussions on the lake metabolism. Therefore, unless some measures are taken to regulate present development trophic levels will increase and eventually cause severe eutrophication within the lake (p 162). (This report contains additional information on Lakelse Lake in other topic areas).

WASTE MANAGEMENT, BACTERIA, AND DRINKING WATER QUALITY

Attainment of Water Quality Objectives for Lakelse Lake in 2001-2003. Executive summary. 2001-2003.

Designated water uses for Lakelse Lake include protection of raw drinking water supplies, primary-contact recreation, and aquatic and wildlife use. Water quality objectives set to protect the lake for these designated uses include: fecal coliform concentrations at beaches and water intakes, turbidity, dissolved oxygen, total phosphorus and chlorophyll a. This report summarizes levels of attainment in 2001, 2002 and 2003, and provides recommendations for updating the objectives.

British Columbia Ministry of Environment. Summary of Drinking Water Quality Monitoring at Lakelse Lake in 2002-03. Internet Source.

Lakelse Lake Drinking Water Intakes: All three bacteriological indicators were detected at Lakelse Lake drinking water intakes in 2002-03 indicating that the water is not safe for consumption without treatment. Fecal coliform and E. coil concentrations were below these guideline levels, but Enterococci concentrations did not meet the guidelines. Fecal coliforms, E. coli, and Enterococci were all detected in every Lakelse Lake tributary that was tested in 2003. Generally, downstream sampling sites had higher concentrations than upstream sites on the same date, suggesting that contamination is originating in the developed area of the watershed. In Lakelse Lake tributary creeks, turbidity, iron, manganese, and phosphorus also exceeded MoWLAP guideline levels in some samples.

Drinking Water Source Quality Monitoring 2002-03 Lakelse Lake and Mountain Creek Surface Water, and Jackpine Flats Groundwater. A.J. Downie Environmental Protection Division Skeena Region July 2005. Internet Source.

Lakelse Lake septic tanks and disposal fields discharge to ground and surface water sources which supply water for residences. Should the RDKS be instituting any particular regulations or controls on the existing systems? For health reasons the opportunity to construct a community water supply system should also be investigated.

Preliminary Survey of Potential Sites for cluster Liquid Waste Disposal in the Beam Station Road Area of Lakelse Lake, B.C. Brianna Benzer, Anna Rei Jones, Amarita Gill & Tracey Sam. Additional Report on Septic Systems: Janis Webb. Supervisor/Editor: Norma Kerby. NWCC Stacks.

There is concern that water quality of the lake is being compromised by the increase of nutrient release into the lake and its tributaries. This is thought to be being caused by the increase in numbers of houses on each lot and the ability of their septic tanks and fields to properly handle the amount of sewage. Currently depending on the lot size, zoning may allow for a house and up to two guest cabins on each lot. In some cases, three dwellings have been built.

Water Management Branch, Environment and Resource Division, Ministry of Environment, Lands and Parks, Ambient Water Quality Objectives for Lakelse Lake Overview Report. Original signed by Ben Marr Assistant Deputy Minister, Environment and Lands HQ Division, February 3, 1986.

Water quality objectives are set to protect the most sensitive designated water use at a specific location. A designated water use is one that is protected in a given location and is one of the following: raw drinking water, public water supply, and food processing; aquatic life and wildlife; agriculture (livestock watering and irrigation); recreation and aesthetics and industrial water supplies. This study assesses the water quality of Lakelse Lake which drains into the Skeena River in the vicinity of Terrace, British Columbia (Figure 1). The Lakelse watershed is one of the more important salmon rearing and migration areas in the province. It is also a popular recreational area, and development for recreation and logging is predicted to increase. There is therefore a need to develop water quality objectives where designated water uses are threatened either now or in the future, and to present lake management strategies which can be adopted to protect the existing water quality.

FORESTRY AND LOGGING AROUND LAKELSE LAKE

BC Lake Stewardship and Monitoring Program Lakelse Lake 2004-2005. A partnership between the BC Lake Stewardship Society and the Ministry of Environment. Internet Source.

Timber harvesting can include clear cutting, road building, and land disturbances, which alter water flow and potentially increase sediment and phosphorus inputs to water bodies.

Lakelse Lake Watershed Society. Forestry. Internet Source.

The Lakelse watershed with its aquatic and terrestrial components has a unique mixture of habitats, from the Lakelse River, as part of the Skeena system, to numerous creeks that drain into the lake. The southern wetlands and remaining old growth forests all require careful balancing of resource values related to human development. Everything we do within the watershed has cumulative impacts. The practice of Forestry includes road building, harvesting, and replanting. The Lakelse Lake Watershed has experienced over 40 years of industrial logging. As these complex forests have been cut, options for the biodiversity of plants, fish and wildlife are now reduced. Reforestation has often been met with problems of soil erosion on steep sites, with thin and nutrient poor soils, and the loss of topsoil, leaving bare ground and sand, making forest regeneration in some areas difficult or unlikely. (This website contains additional information on Lakelse Lake in other topic areas).

BC Lake Stewardship and Monitoring Program. Lakelse Lake 2004-2005. A partnership between the BC Lake Stewardship Society and the Ministry of Environment. Internet Source.

Human activities that impact water bodies range from small but widespread and numerous non-point sources throughout the watershed to large point sources of concentrated pollution (e.g. waste discharge outfalls, spills, etc). Undisturbed watersheds have the ability to purify water and repair small amounts of damage from pollution and alterations. However, modifications to the landscape and increased levels of pollution impair this ability.

Boating: Oil and fuel leaks are the main concerns of boat operation on small lakes. With larger boats, sewage and grey water discharges are issues. Other problems include the spread of aquatic plants and the dumping of litter. In shallow water operations, the churning up of bottom sediments and nutrients is a serious concern.

Agriculture: Agriculture including grains, livestock, and mixed farming, can alter water flow and increase sediment and chemical/ bacterial/parasitic input into water bodies.

Lakelse Lake Plan. 1975. Unknown author. NWCC Archives.

An important determinant of the amount and direction of the region's growth and subsequent pressure on the region's lake resources is the rate of population growth. For the purpose of this plan it is assumed that the regions natural population growth will continue to exert a substantial demand on the regional lake resources, and that further population increases could well put this demand at a critical level.

LAKELSE LAKE PROVINCIAL PARK

Lakelse Lake Wetlands Provincial Park. Ministry of Environment: BC parks. Internet source.

Lakelse Lake Wetlands Park protects a biologically exceptional and Provincially significant warm-water wetland complex. Warm water springs in the Lakelse Lake Wetlands drain into Lakelse Lake, the largest warm water lake in northwestern BC. Clearwater and Andalas Creeks have open water throughout the winter. The streams are fed by warm water springs along an escarpment above the creeks. The bog ecosystem in the Lakelse Lake Wetlands is the largest in the region. It contains scattered and stunted Lodgepole Pine, Western Red Cedar, and Western Hemlock. In addition to water loving shrubs and herbs, the bogs contain specialized plants such as sundews, tall white bog orchids and bog club-moss.

Accumulations of moss and organic material are often greater than 100-cm and water tables are within 20-cm of the surface.

Skeena District Management Direction Statement. July, 2000 for Lakelse Lake Provincial Park.

http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/lakelse/lakelse.pdf

Lakelse Lake Park covers 362 ha, in two parcels, on the northeast shore of Lakelse Lake, 25 km south of Terrace on Highway 37 (area population is 32,000; Terrace and Kitimat). The park, surrounded by the mountains of the Kitimat Range, lies within the asserted traditional territory of the Allied Tsimshian Tribes. The park, established in 1956, protects lakeshore old growth forest, salmonid spawning habitat and wildlife habitat, and provides recreation and camping opportunities for local residents and travelers along the Highway 16 corridor. Large day-use areas, within the southern parcel (Furlong Bay, with camping facilities) and the northern parcel (the picnic area and Gruchy's Beach; without camping facilities), are the major swimming, boating and picnic spots for area residents. Gruchy's Beach is accessible only by foot or water, providing a quieter day-use beach. The many camping facilities attract both en-route tourists and regional residents.

OTHER RELATED MATERIAL

British Columbia Archives (no date). Boating on Lakelse Lake & Lakelse Lake Skeena River Survey Photograph. British Columbia Archives. Search B.C. Archives Visual Records for Lakelse Lake.

31 photographs – personal photos and survey photos of Lakelse Lake. Circa 1948-1968

Freshwater Mussels of the Pacific Northwest. Ethan Nedeau, Allan K. Smith, and Jen Stone. Internet Resource.

Since individuals live from ten to over one hundred years, their populations reflect the cumulative effects of environmental conditions and extreme events over time. The age and growth of mussels provides insight into population health and reproductive success. Adult mussels may only move a few yards during their lives. Mussels cannot respond quickly to escape adverse conditions (as a fish can), and if they disappear from an area, they are slow to recolonize. If conditions become unsuitable for mussels, they either stop reproducing, stop growing, or die. Careful studies can detect these responses. Mussels are sensitive to changing water quality, habitat, and fish communities. Low dissolved oxygen, chemical contamination, and sedimentation are just three of myriad stressors that affect mussels. Loss of host fish will eventually eliminate mussel communities even if other physical and chemical conditions are ideal. Because mussels are long-lived, filter-feeding animals, they accumulate chemical contaminants in their bodies and shells. Tissue concentrations of contaminants—such as mercury, lead, dioxin, poly-chlorinated biphenyls, and polycyclic aromatic hydrocarbons—will indicate exposure risk of the entire aquatic community and provide insight into ecosystem health.

Microsatellites Reveal Regional Population Differentiation and Isolation in Lobaria Pulmonaria, an Epiphytic Lichen. Jean-Claude Walser, Rolf Holderegger, Felix Gugerli, Susan Eva Hoebee and Christoph Scheidegger. 2005 Molecular Ecology, Volume 14, Issue 2, Page 457-467. Internet Source.

[The] premise was that populations of L. pulmonaria in the continuous old-growth forests of British Columbia should be genetically diverse and show low differentiation because of abundant gene flow among them. The Canadian populations indeed exhibited high genetic variation but the results of the analyses indicated a distinct genetic geographical structure of L. pulmonaria populations. This geographical structure is possibly not caused by anthropogenic factors or geoclimatic zonation, but may be due to postglacial population history (Fig. 1a). In this context, molecular data suggest that the ice ages profoundly influenced the genetic architecture of the flora and fauna of the Pacific Northwest (Soltis et al. 1997).

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