LICHENS OF LUMMI ISLAND

INVENTORY AND REPORT TO

LUMMI ISLAND HERITAGE TRUST

Lecanora xylophila and Lecanora orae-frigidae

SUBMITTED BY

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I – INTRODUCTION

The botanical diversity of Lummi Island is rich and important. The mission of the Lummi Island Heritage Trust is to protect this resource for future generations, including the lands within the 435 acre Baker Ranch. Consequently, inventories of the flora of these protected areas constitute an important record of the Island's natural resource.

In 2009 the Koma Kulshan Chapter of the Washington Native Plant Society compiled a list of vascular plants found on the Baker Preserve property of Lummi Island. This survey, which includes ferns, records 157 species of plants found along the Baker Preserve Trail and at two west facing balds at the top of the trail.

With this in mind, we deemed it appropriate to undertake a survey of the area's "cryptogams". Greek for hidden "marriage", cryptogams embrace non-flowering organisms including ferns and fern allies, sea weeds, mushrooms, mosses, liverworts, and lichens. Reproduction occurs by way of spores, rather than the seeds of flowering plants and conifers.

In January 2010 a handful of native plant enthusiasts (*) began this process by compiling an initial inventory of lichens found along the Baker Preserve Trail. This was followed by several visits from 2010 to 2013 to this same trail, and to a short stretch of Baker Ranch shoreline on the west side of the Island. (**) This report on lichens (and the attached lists and photographs) is respectfully submitted to the Lummi Island Heritage Trust.

The Northwest Mushroom Association, led by Dr. Fred Rhoades, is compiling an inventory of the Island's mushrooms.

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II – METHODS

Vehicle at Baker Ranch colonized by lichens and moss (RD)

The two sites of this survey differ substantially as to habitat; consequently, the lichens collected at each are remarkably distinct (indeed with very little overlap). Thus, we attach a separate list for each location.

The Baker Preserve Trail (1.6 miles, 1,050 elevation gain) rises through a mature and moist forest on the eastern flank of Lummi Mountain. The primary vegetation is Douglas Fir, Western Red Cedar, Western Hemlock, Grand Fir, Big-leaf Maple, and Red and Sitka Alder. The understory is varied (Sword Fern, Oregon Grape, and various shrubs such as Oceanspray, Snowberry, Salmonberry, and Red Flowering Currant). This habitat includes lichen species that would typically be found in a moist Pacific Northwest forest. The other feature is west facing balds and rock outcrops at the top of the trail (approx. 1,100 feet elevation). These open patches, while not large, play host to several lichens not found in the forest, especially those that occur on rocks.

"Bird Rock" Beach. We had the unique opportunity to explore approximately ½ mile of shoreline on the west side of the Island, naming it for the rock, immediately off shore, pictured below. It is loaded with lichens.

"Bird Rock" with distinct bands common to rocky Salish Sea shorelines. The black band consists of *Verrucaria/Hydropunctaria*, a smear lichen, and the yellow-orange is mainly *Caloplacas* and *Xanthoria*. (RD)

Since the slope along the west side of Lummi Mountain is prohibitively steep, the only (easy) access is via the Baker Ranch by way of a one mile trail/abandoned road to the shore. Most of the beach is rocky, stretching from the low tide mark to steep rock outcrops at the upper shoreline. Intertidal zones, spray zones, supratidal rocks, transitional woods, and driftwood combine to support a significant lichen population. Indeed, one reason for the Lummi collection is to integrate it with surveys conducted in the nearby San Juans such as Fidalgo, Cypress, Vendovi, and Lopez Islands. (See Lichens of South Lopez Island by Fred Rhoades, Washington Native Plant Society Occasional Paper 2009.) It is of interest to compare lichens found in the larger Salish Sea zone with those on Lummi. We found it noteworthy that a handful of species occur on Lummi that were not observed at the other sites. The shoreline we explored is just north of the Lummi Rocks, clearly visible off shore as seen in the following image.

Lummi Rocks (off shore background) (WL)

Specimens were collected of virtually all lichens observed. Voucher specimens will be archived at the Western Washington University Herbarium.

The attached DVD disc contains photos of a representative sampling of common and uncommon Lummi lichens. Unless otherwise indicated in the labels, pictures were taken on Lummi. Photos by Fred Rhoades (FR), Richard Droker (RD), and Walt Lockwood (WL).

III – LICHENS, BRIEFLY SPEAKING

The beauty, indeed wonder, of lichens knows no bounds – the diversity and abundance of species in the Pacific Northwest alone is impressive (some 1,100 taxa and counting). On Lummi, though often overlooked, we pass by, under and over them every day – on rocky shorelines, ferry landings, picnic tables, trees and shrubs from base to canopy, soil, rocks, wind blown debris, gravestones, old cars (pictured above), etc.

So, what is a lichen? First, it is not a higher plant, nor is it a moss. It is, in fact, a unique biological association consisting of two organisms: a fungus and at least one photosynthetic partner. The latter, known as the photobiont, contains chlorophyll in the form of green algae and/or

cyanobacteria. We are not likely to see the photobiont with the naked eye, since it is almost always buried in the body of the fungus. The two join in a symbiotic relationship: the fungus provides the body (thallus) of the lichen while the embedded algae provide nutrition by way of photosynthesis. Either of the two would have a tough time surviving on its own. Thus, the fungus serves as housing or shelter to the algae which would otherwise not make it in harsh environments. Correspondingly, the fungus draws upon carbohydrates generated by the algae for its survival. This combination results in a distinct thallus bearing little resemblance to the individual partners.

Lichens come at us in many sizes, shapes, and colors. Growth forms are arbitrarily broken down into three categories.

(a) **Foliose.** Lichens with a more-or-less flat leafy structure of varying sizes with different upper and lower surfaces. Common genera found on Lummi include *Hypogymnia, Parmelia, Peltigera, Physcia, Platismatia, Sticta, Tuckermannopsis* and *Xanthoparmelia.*

Platismatia glauca **and** ***Parmelia sulcata*** **(foliose) (WL)**

***Peltigera britannica* (foliose) (RD)**

(b) **Fruticose.** Shrub-like, tufted, or pendulous lichens. Their branches are usually round in cross section; if flat, then both sides are the same. On Lummi, be on the lookout for *Bryoria, Cladonia* (squamulose primary thallus with erect stems or podetia), *Evernia, Ramalina*, and *Usnea*.

***Cladonia chlorophaea* (fruticose) with cupped podetia (RD)**

***Usnea filipendula* (fruticose) and *Hypogymnia imshaugii* (foliose) (WL)**

(c) **<u>Crustose</u>** - Simple powder-like crusts, smears, or more elaborate structures firmly attached to the substrate (mainly rocks and trees). A few of the more common genera on Lummi include *Amandinea, Buellia, Caloplaca, Graphis, Hydropunctaria, Lecanora,* and *Pertusaria*.

***Caloplaca roseii* and *Caloplaca luteominia* (Crustose) (WL)**

Lecanora straminea **(Crustose with brown apothecia)**
Caloplaca rosei **(Crustose),** ***Xanthoria candelaria*** **(Foliose) (RD)**

Buellia stelluata **(Crustose) (RD)**

Lichen reproduction is at once simple and complex. Lichens can reproduce sexually or vegetatively. Sexual reproduction is by the fungal partner which produces spores in varying forms of fruiting bodies (apothecia and other structures). Released spores must seek out the appropriate photosynthetic partner to form a new lichen. The more frequently employed vegetative/asexual method is achieved by growth forms (propagules) of the lichen which contain both partners (powder-like soredia and wart-like isidia). These in turn release or break off and under the right conditions grow into a new lichen. Reproductive structures are often key to identification.

Lichens are important for many reasons. Soil enrichment is a leading example. Those species that contain cyanobacterial photobionts also fix nitrogen, an important biological process that converts nitrogen gas in the air into amino acids and proteins. Other examples include the use of lichens as bioindicators of air pollution, a food source for wildlife ("reindeer moss", actually a lichen, is a major part of the caribou diet), medicinal usage, color for dyes, ornamentation and more.

Lichens are named for the fungus. Lichenologists usually use the scientific names (which are derived from Greek and Latin) of lichens, although some species have common names.

The literature on lichens has grown exponentially over the past 20 years and is too extensive to cite here. Still, for anyone who cares to pursue this fascinating universe, any or all of the following are recommended:

Macrolichens of the Pacific Northwest by Bruce McCune and Linda Geiser, Second Edition, Oregon State Unuversity Press 2009.

Lichens of North America by I. M. Brodo, photos by the Sharnoffs, Yale University Press 2001.

Lichens of South Lopez Island by Fred Rhoades, Washington Native Plant Society Occasional Paper 2009.

IV – GEOLOGY

Geologically the San Juan Island Group consists of a series of terranes that have been accreted onto the continental margin. Much of Lummi Island consists of segments of ocean floor of the Cretaceous to Jurassic Periods. This tectonic overlay is known as the "nappes" of the San Juan Islands. Approximately 80 to 100 million years ago thick sheets of oceanic rock, the nappes, were thrust from the east many kilometers over one another and the continental shelf to form the San Juan Islands – Northwest Cascades thrust system.

Bedrock for the southern mountainous half of the Island is mainly comprised of the "Lummi Formation". This is a zone of oceanic deposits of the late Jurassic (approx. 161 to 145 million years ago) which have been subjected to low temperature/high pressure metamorphism. The rocks are mainly shale, graywacke, and granule conglomerates. In places beautiful turbidites are exposed, consisting of alternating bands of fine-grained dark and pale coarser sediments.

***Turbidite* along Bird Rock Beach (RD)**

***Turbidite* along Bird Rock Beach (RD)**

Small rocks below *Turbidite* are coated with *Catillaria chalybeia*, a dark crust lichen that is frequently overlooked (RD)

Most bedrock of the northern low and flat half of Lummi Island is of the "Chuckanut Formation", deposited as river sediments during the Eocene Epoch (approx. 50 million years ago). It is relatively unmetamorphosed and is noted for fossils, particularly plants including palms. Drift and outwash from the Fraser Glaciation (10,000 to 25,000 years ago) covers much of Lummi's northern half. Lichen substrates there include soil and erratics.

Geology is important because many lichen species are found on rock. There are two basic categories of rock which influence the substrate of lichens.

Calcareous rocks such as limestone and marble contain calcium carbonate (derived from marine organisms). This cateogory also includes some sandstone rocks and even concrete. They are distinguished by their lichen communities, which often include yellow/orange species of *Caloplaca*, grey species of *Physcia*, certain *Lecanoras*, and endoloithic species of *Hydropunctaria/Verrucaria* which can pit the rock surface.

***Caloplaca litoricola, Physcia caesia and Hydropunctaria maura* (RD)**

Siliceous rocks are low in calcium carbonate but rich in silicates. Examples are granites and schists. Lichens restricted to siliceous rocks include *Porpidia, Umbilicaria, Xanthoparmelia, and Pseudephele*. Besides hardness and texture, the makeup of lichen communities on siliceous rock is influenced by relative proportions of felsic and mafic materials. Most if not all lichens listed in this survey were found on siliceous rocks.

V – RESULTS

We found 78 species at Baker Preserve Trail and 88 species at Bird Rock Beach. An (*) indicates a species found at Lummi that we have not to date observed at other locations in the north Salish Sea zone. Lichen names and author citations are in accord with the North America Lichen Checklist (online version 18) by Esslinger.

TABLE A – BAKER PRESERVE TRAIL

Lichenomphalia umbellifera. **The fruiting bodies are mushrooms. The thallus is the dark green coating on the wood. It occurs on rotten logs.** ***Cladonia ochrochlora*** **at upper left. (WL)**

Amandinea punctata (Hoffm.) Coppins & Scheid. = Buellia punctata
Bryoria capillaris (Ach.) Brodo & D. Hawksw. = Alectoria capillaris
Bryoria fremontii (Tuck.) Brodo & D. Hawksw. = Alectoria fremontii
Candelariella aurella (Hoffm.) Zahlbr.
Cetrelia cetrarioides (Duby) W. L. Culb. & C. F. Culb.
Chrysothrix candelaris (L.) J. R. Laundon = Lepraria candelaris
Chrysothrix chlorina (Ach.) J. R. Laundon = Lepraria chlorina

Cladonia chlorophaea (Florke ex Sommerf.) Sprengel
Cladonia cornuta (L.) Hoffm.
Cladonia furcata (Hudson) Schrader
Cladonia ochrochlora Florke
Cladonia pyxidata (L.) Hoffm.
Cladonia squamosa Hoffm.
Cladonia transcendens (Vainio) Vainio
Diploschistes scruposus (Schreber) Norman = Urceolaria scruposa
Evernia prunastri (L.) Ach.
Graphis scripta (L.) Ach.
Hypogymnia apinnata Goward & McCune
Hypogymnia enteromorpha (Ach.) Nyl.
Hypogymnia imshaugii Krog
Hypogymnia inactiva (Krog) Ohlsson
Hypogymnia occidentalis L. Pike
Hypogymnia physodes (L.) Nyl. = Parmelia duplicata var. douglasicola
Hypogymnia tubulosa (Schaerer) Hav. = Parmelia tubulosa
Hypotrachyna sinuosa (Sm.) Hale = Parmelia sinuosa
Icmadophila ericetorum (l.) Zahlbr.
Lecanora hybocarpa (Tuck.) Brodo
Lecanora pacifica Tuck. = Lecanora tetraspora
Lecidea atrobrunnea (Lam. & DC.) Schaerer
Lecidea lapicida (Ach.) Ach.
Lepraria incana (L.) Ach.
Lepraria membranacea (Dickson) Vainio = Leproloma membranaceum
Leptogium lichenoides (L.) Zahlbr.
Leptogium palmatum (Hudson) Mont.
Lichenomphalia umbellifera (L.:Fr.) Redhead, Lutzoni, Moncalvo & Vilgalys = Omphalina umbellifera
Massalongia carnosa (Dickson) Korber
Melanelixia fuliginosa (Fr. Ex Duby) O. Blanco et al. = Melanelia fuliginosa, Parmelia fuliginosa
Melanelixia subaurifera (Nyl.) O. Blanco et al. = Melanelia subaurifera, Parmelia subaurifera
Melanohalea subelegantula (Essl.) O. Blanco et al. = Melanelia subelegantula, Parmelia subelegantula
Ochrolechia laevigata (Rasanen) Verseghy ex Kukwa (Kukwa 2011)
Ochrolechia subpallescens Verseghy
Parmelia hygrophila Goward & Ahti
Parmelia saxatilis (L.) Ach.

Parmelia sulcata Taylor
Parmeliopsis hyperopta (Ach.) Arnold = Foraminella hyperopta
Parmotrema arnoldii (Du Rietz) Hale = Parmelia arnoldii
Peltigera britannica chloromorph (Gyelnik) Holt.-Hartw. & Tonsberg
Peltigera britannica cyanomorph (Gyelnik) Holt.-Hartw. & Tonsberg
Peltigera canina (L.) Willd.
Peltigera collina (Ach.) Schrader
Peltigera membranacea (Ach.) Nyl.
Peltigera neopolydactyla (Gyelnik) Gyelnik
Peltigera praetextata (Florke ex Sommerf.) Zopf
Pertusaria amara (Ach.) Nyl.
Pertusaria ophthalmiza (Nyl.) Nyl.
Pertusaria subambigens Dibben
Physcia adscendens (Fr.) H. Oliver
Physcia aipolia (Ehrh. Ex Humb.) Furnr.
Physcia caesia (Hoffm.) Furnr.
Physcia tenella (Scop.) DC
Platismatia glauca (L.) W. L. Culb. & C. F. Culb. = Cetraria glauca
Platismatia herrei (Imahaug) W. L. Culb. & C. F. Culb. = Cetraria herrei
Ramalina dilacerata (Hoffm.) Hoffm. = Fistulariella minuscula
Ramalina farinacea (L.) Ach.
Sphaerophorus tuckermanii Rasanen (Wedin et al. 2009)
Sticta fuliginosa (Hoffm.) Ach.
Thelotrema lepadinum (Ach.) Ach.
Trapeliopsis flexuosa (Fr.) Coppins & P. James = Lecidea flexuosa
Tuckermannopsis chlorophylla (Willd.) Hale = Cetraria chlorophylla
Tuckermannopsis orbata (Nyl.) M. J. Lai = Cetraria orbata
Usnea filipendula Stirton
Usnea flavocardia Rasanen (Clerc 2004)
Usnea lapponica Vainio
Usnea pacificana P. Halonen (Halonen 2000)
Usnea quasirigida Lendemer & Tavares (Lendemer & Tavares 2003)
Usnea subfloridiana Stirton
Xanthoparmelia mougeotii (Schaerer) Hale = Parmelia mougeotii
Xanthoria polycarpa (Hoffm.) Th. Fr. ex Rieber = Teloschistes polycarpus

TABLE B – BIRD ROCK BEACH

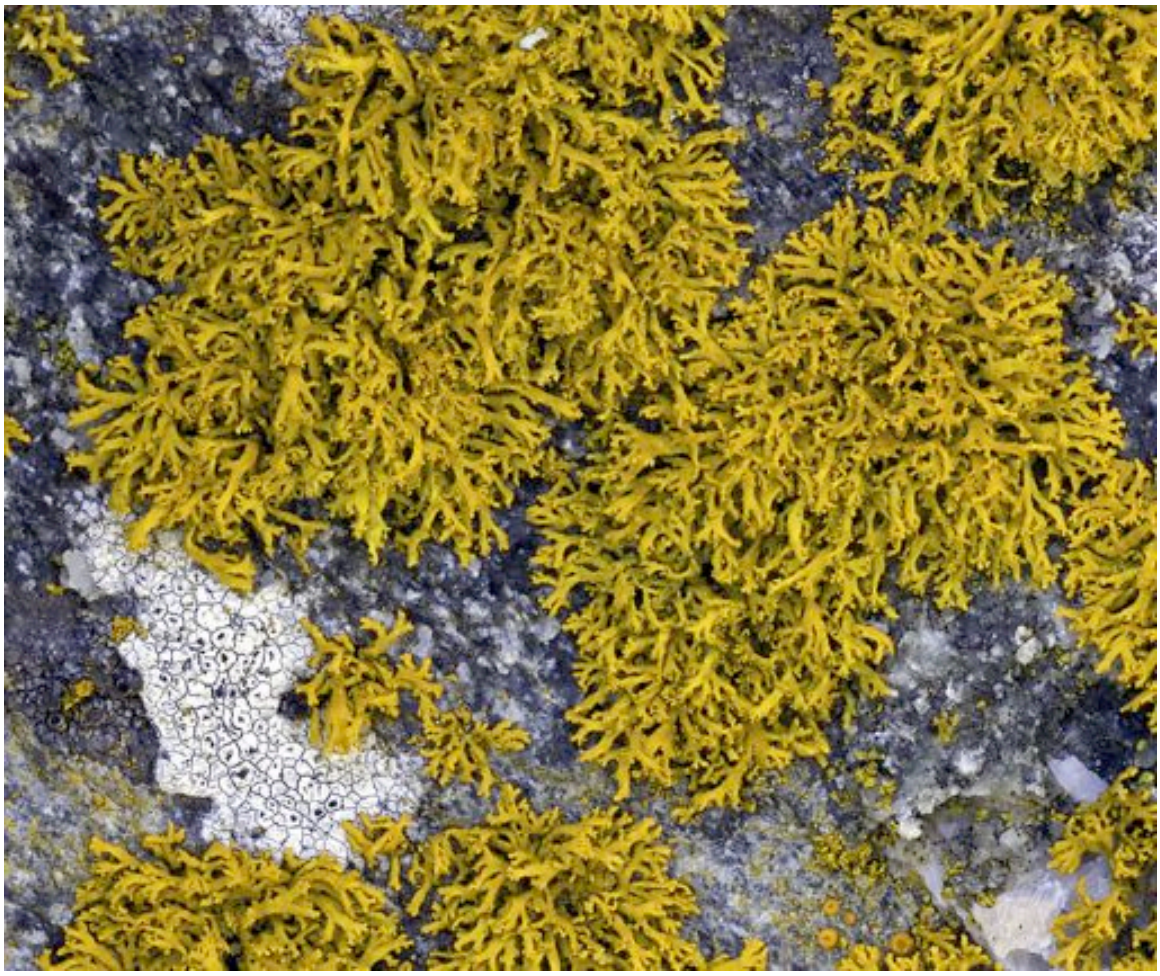
Herteliana alaskensis **and** ***Caloplaca flavogranulosa*** **(FR)**

***Agonimia tristicula** (Nyl.) Zahlbr. = Polyblastia tristicula
Amandinea lecideina
Amandinea punctata (Hoffm.) Coppins & Scheid. = Buellia punctata
Arthonia phaeobaea (Norman) Norman
Buellia badia (Fr.) A. Massal = Amandinea turgescens
Buellia stellulata (Taylor) Mudd
Caloplaca californica Zahlbr.
Caloplaca citrina (Hoffm.) Th. Fr.
Caloplaca flavogranulosa Arup
Caloplaca litoricola Brodo
Caloplaca luteominia var. luteominia (Tuck.) Zahlbr. =
Blastenia luteominia
Caloplaca marina (Wedd.) Zahlbr.
Caloplaca rosei Hasse

Caloplaca verruculifera (Vainio) Zahlbr.
Catillaria chalybeia (Borrer) A. Massal.
Circinaria caesiocinerea (Nyl. ex Malbr.) A. Nordin, S. Savic & Tibell = Aspicilia caesiocinerea
***Circinaria contorta** (Hoffm.) A. Nordin, S. Savic & Tibell = Aspicilia contorta
Cladonia fimbriata (L.) Fr.
Cladonia furcata (Hudson) Schrader
Cladonia ochrochlora Florke
Collema fecundum Degel.
***Collema subflaccidum** Degel.
Collemopsidium foveolatum (A. L. Sm.) F. Mohr (Dillman et al. 2012)
Cyphelium inquinans (Sm.) Trevisan
***Dermatocarpon meiophyllizum** Vainio (Glavich & Geiser 2004)
***Dermatocarpon reticulatum** H. Magn.
Diploschistes muscorum (Scop.) R. Sant.
***Diplotomma alboatrum** (Hofffm.) Flotow = Buellia alboatra
***Diplotomma chlorophaeum** (Hepp ex Leighton) Szatala = Buellia chlorophaea
Evernia prunastri (L.) Ach.
Fuscopannaria maritima (P. M. Jorg.) P. M. Jorg. = Pannaria maritima
Graphis scripta (L.) Ach.
Herteliana alaskensis (Nyl.) S. Ekman = Bacidia alaskensis
Hydropunctaria maura (Wahleb.) Keller, Gueidan & Thus = Verrucaria maura
***Lecania erysibe** (Ach.) Mudd
Lecanora confusa (Almb.)
Lecanora hybocarpa (Tuck.) Brodo
Lecanora muralis (Schreber) Rabenh. = Protoparmeliopsis muralis
Lecanora orae-frigidae R. Sant.
***Lecanora straminea** Ach.
Lecanora strobilina (Sprengel) Kieffer
Lecanora xylophila Hue
Lecidea tessellata Florke
Lecidella asema (Nyl.) Knoph & Hertel = Lecidea catalinaria
Lecidella stigmatea (Ach.) Hertel & Leuckert = Bacidia arthoniza
Lepraria membranacea (Dickson) Vainio = Leproloma membranaceum
Leptogium lichenoides (L.) Zahlbr.
Leptogium palmatum (Hudson) Mont. (Hoffman & Hafellner 2000; Santesson et al. 2004)

***Leptorhaphis atomaria** (Ach.) Szatala
Massalongia carnosa (Dickson) Korber
***Melanelia hepatizon** (Ach.) Thell = Cetraria hepatizon
Melanelixia fuliginosa (Fr. ex Duby) O. Blanco et al. =
Melanelia fuliginosa
Melanelixia subargentifera (Nyl.) O. Blanco et al. =
Melanelia subargentifera
Melanelixia subaurifera (Nyl.) O. Blanco et al. = Melanelia subaurifera
Mycoblastus caesius? (Coppins & P. James) Tonsberg =
Haematomma caesium
Ochrolechia arborea (Kreyer) Almb.
Ochrolechia szatalaensis Verseghy
Parmelia hygrophila Goward & Ahti
Parmelia saxatilis (L.) Ach.
Parmelia sulcata Taylor
Parmotrema arnoldii (Du Rietz) Hale = Parmelia arnoldii
Peltigera collina (Ach.) Schrader
Pertusaria amara (Ach.) Nyl.
Pertusaria opthalmiza (Nyl.) Nyl.
Pertusaria pseudocorallina (Lilj.) Arnold
Physcia adscendens (Fr.) H. Olivier
Physcia aipolia (Ehrh. ex Humb.) Furnr.
Physcia caesia (Hoffm.) Furnr.
Physcia tenella (Scop.) DC.
Prasiola meridionalis (nonlichen fungal-algal association)
Punctelia stictica (Duby) Krog = Parmelia stictica
***Pyrenula occidentalis** (R. C. Harris) R. C. Harris
Pyrrhospora quernea (Dickson) Korber = Protoblastenia quernea
Ramalina farinacea (L.) Ach.
Ramalina subleptocarpha Rundel & Bowler
Rhizocarpon disporum (Nageli ex Hepp) Mull. Arg.
Rhizocarpon geminatum Korber
Rhizoplaca chrysoleuca (Sm.) Zopf = Lecanora chrysoleuca
Rinodina gennarii Bagl.
Sticta limbata (Sm.) Ach.
Tephromela atra (Hudson) Hafellner = Lecanora atra
Thelomma mammosum (Hepp) A. Massal. = Cypheliopsis bolanderi
***Verrucaria prominula** Nyl.
Xanthoparmelia cumberlandia (Gyelnik) Hale = Parmelia cumberlandia

Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch (Blanco et al. 2004b) = Neofuscelia verruculifera
Xanthoria candelaria (L.) Th. Fr. = Teloschistes candelarius
Xanthoria parietina (L.) Th. Fr. = Teloschistes parietinus
Xylographa opegraphella Nyl. ex Rothr.



***Xanthoria candelaria* (RD)**

VI – CONCLUSION

The primary purpose of this report and inventory is to reveal the richness and diversity of Lummi Island's natural resource, in this instance by way of an impressive population of lichens. It is one reason why conservation and good stewardship of the Island's properties are of tremendous value, most especially for future generations. The Lummi Island Heritage Trust embraces these goals and practices.

We would like to thank Lummi Island Heritage Trust for its permission to conduct this survey and its enthusiastic support. Executive Director Rebecca Rettmer was always there to lend a helping hand and point us in the right direction. Charlie Baker's vision for the preservation of the Baker Ranch properties, and his permission to allow us access to the western shore via the ranch, are very much appreciated.

This report, inventory and photographs compiled by:

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Well worth protection for future generations (RD)