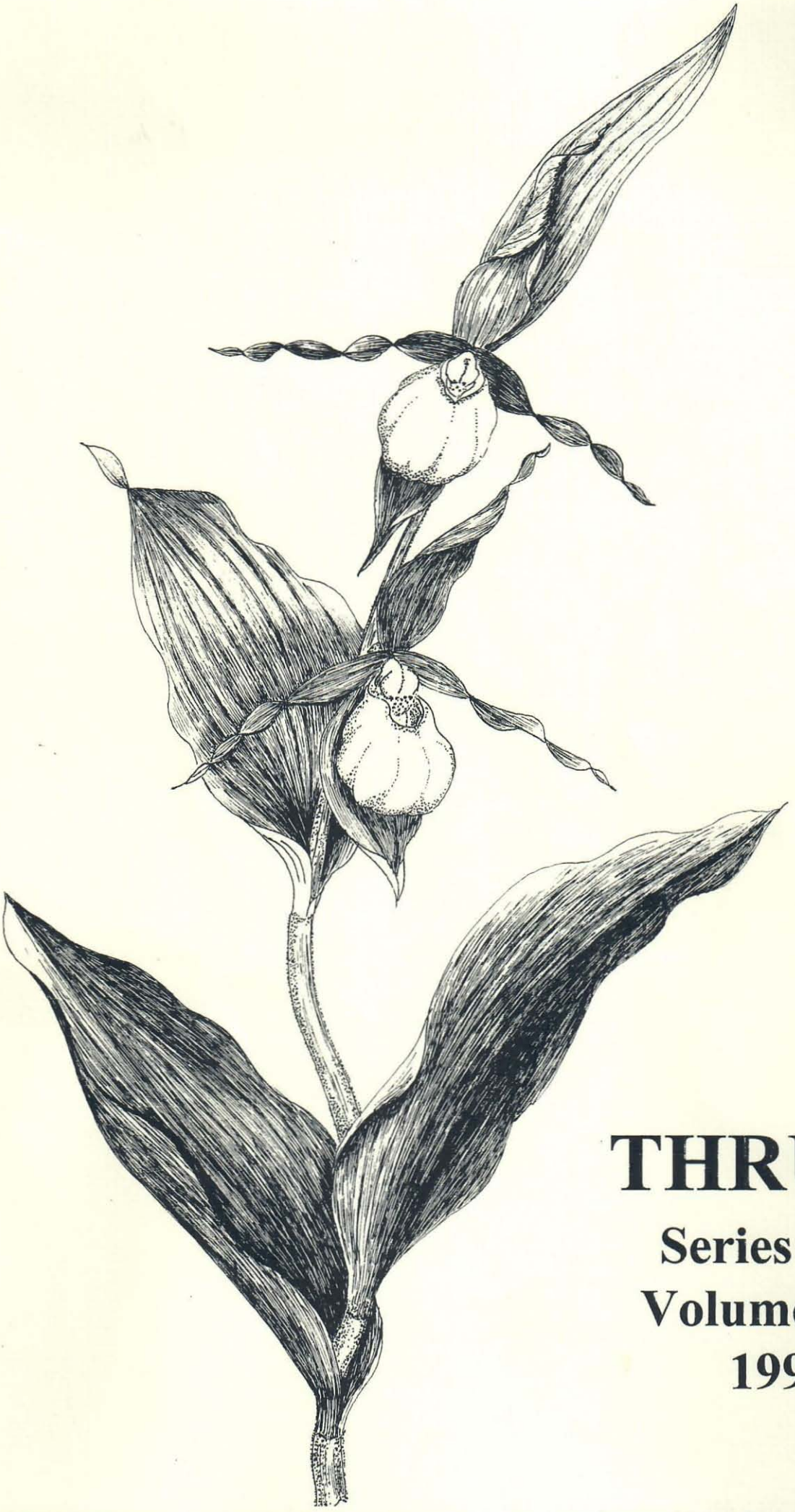

THRUSH

Series Two
Volume Five
1998

THRUSH

Series 2, Volume 5 - 1998

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Editor's Message

STEVE BAILLIE

It's been 6 years since the last issue of Thrush, the journal of the Nanaimo Field Naturalist Club, and many things have and are happening. This issue (Series 2, Volume 5) has several articles of great interest to club members and the public.

The articles by Bill Merilees and Keith Ketchen about the clam fauna of Nanaimo 10,000 years ago is very interesting and should spur the enthusiasm of any local fossil hunter.

The article by Jane James and Phyllis Fafard documenting the flora of Gabriola Island is of great value for it presents the status of the plant life at this time and will be important to future research as a historical document. Bill Merilees has also written an article noted the rare plants that are known to occur in Nanaimo. Bruce Cousens and Charlene Lee have written an article on Purple Loosestrife in Nanaimo and the control measures the club has undertaken to limit the spread of this weed.

The article by Bill Merilees and Graham Gillespie on varnish clams was originally published in *Discovery*, the journal of the Vancouver Natural History Society. It is reprinted here with permission from the authors because it is of local interest.

For the invertebrate naturalist, Bill Merilees describes a species of sea slug living in Swy-a-lana Lagoon.

There are four bird articles included. Aran Gough and Andrew Wozney conducted a study of the bird communities at Buttertubs Marsh as part of their academic work at Malaspina University/College and have allowed it to be published here. Bruce Cousens has compiled observations of the Bald Eagle nests from Nanoose to Yellow Point for a major contribution to the knowledge of eagle breeding success, and compiled the existing knowledge of the breeding status of the American Bittern at Buttertubs Marsh. Finally, I have included an article on the additions to the Nanaimo Bird Checklist.

Many thanks to all of the authors who have taken the time to write down their observations and allowed the rest of us to enjoy nature from their point of view. A flower is a flower, but different people will look at it in different ways. Diversity is more than a 'buzz' word, it is a fact of our society in addition to a requirement of nature.

Thrush was originally the newsletter of the club, and was augmented by a mailing of events and outings. This mailout was expanded over the years to include small articles by club members and the Thrush publication was changed to the current format around 1980. The aim of Thrush is to publish articles that are relevant or of interest to the central Vancouver Island area. The Nanaimo Field Naturalists hope you enjoy them all. Thanks to the Federation of British Columbia Naturalists, whose financial support enabled us to publish.

The Scallops and Clams of Dufferin Crescent

KEITH S. KETCHEN

Introduction

In the summer of 1995, ground was cleared in Nanaimo for the extension of Dufferin Crescent to its junction with Bowen Road. To do this it was necessary to cut into the base of what I have called "Arbutus Hill", a rise in the land between Townsite Road and Dufferin Crescent that is adorned with a fine grove of arbutus trees (Figure 1). The road-cut exposed a seam of blue-gray mud (Figure 2) which contained many scallop shells along with shells of six other clam species, plus sea snails and tubeworm cases.

One would never guess from looking at the scallops (Figure 3) that they are more than 12,000 years old. Some still had the pink hue which gives them their common name of "pink scallop". How did they come to be there, 93 meters (300 ft) above present day mean sea level and nearly 2 kilometers from the nearest seashore? The answer to this question provides us with a glimpse of Nanaimo's prehistoric past.

The last ice age

It was around 35,000 years ago that the most recent ice age began. The climate turned much colder and wetter than it is today and glaciers started to accumulate in the alpine area of Vancouver Island and adjacent mainland. They grew enormously in size. They flowed down into the valleys; reaching and filling that part of the Coastal Trench occupied by the Strait of Georgia. This massive sea of ice streamed southward over Vancouver Island and ground its inexorable way out to the open coast.

The advance of the ice reached its maximum around 17,000 to 18,000 years ago. In the Nanaimo area, geologists surmise that it achieved a staggering thickness of about 1600 meters (over 5,000 ft). Even nearby Mount. Benson was completely buried.

Under this enormous burden, the land along the east coast of Vancouver Island from Campbell River to Victoria (known to geologists as the Nanaimo Lowlands), subsided as much as 300 meters (1,000 ft). And there it remained for several thousand years.

Return to a warmer climate

About 15,000 years ago the climate started to turn warm again. The glaciers began to melt and retreat back to their distant points of origin. Two things happened more or less simultaneously with retreat of the ice: the sea invaded the depressed landscape and the land, relieved of its icy burden, began to rebound.

By 13,000 years ago the east coast of Vancouver Island was again ice free. A few hundred years later, the northern part of Nanaimo may have looked much like the map in Figure 4, as compared with the present topography shown in Figure 5. The southern half of town, roughly that part south of Townsite Road, was all under water. Probably most of the area north of Townsite was an island separated from the rest of Vancouver Island by a long

passageway. This comprised the present day valley of the Millstone River, Brannen Lake, and Green Lake.

Fanciful names have been ascribed to some of the physical features in Figure 4, if only to give the reader some idea of their relationship to today's geography. Off what has been called "Meredith Point" (because today's Meredith Road cuts through it) was a small island named "Arbutus Island", a piece of real estate that would some day become the "Arbutus Hill" referred to at the beginning of this account.

The appearance of Nanaimo, as we have postulated above, did not remain that way for long - maybe 500 to 600 years at the most. The land was rising very rapidly out of the sea, despite the fact that the sea itself was rising because of all the melting ice throughout the northern hemisphere. Geologists estimate that by about 11,000 years ago, the land had rebounded to its present-day elevation and was continuing to rise. By 9,000 years ago, mean sea level was actually lower than it is today. It did not finally settle out at its present level until about 5,000 years ago.

Discoveries on "Arbutus Hill"

"Arbutus Hill" is a little over 300 m (1000 ft) long (Figure 6). Towards its eastern end is the well-known Chinese cemetery. Beyond its western end is a flatish area, bounded by Townsite Road, Bowen Road and the new extension if Dufferin Crescent. This is the site of a proposed urban development called "Westhill". Forty-three years ago, when it was known simply as McGarrigle's gravel pit, reports were received of large numbers of clam shells being exposed in sand and gravel excavations. The late Dr. Ferris Neave and the writer visited the site and identified them as the common butter clam (Figure 7). Many were found less than a meter below the land surface near the top of the hill or about 103 m (338 ft) above present mean sea level. They were lying in their natural positions in the sand, seemingly still waiting for a tide that never came in. The July 1995 discoveries, made along the new Dufferin Crescent roadside, were at an elevation of 93 m (305 ft) or about 10 m lower than the butter clam site. These included seven species that today are to be found several to many metres below the intertidal zone. So there was a substantial community of clam-family members that once inhabited waters around "Arbutus Island". They became established there as the result of a drift of larvae from spawning areas in regions which had been ice-free longer or had largely escaped the glaciation process.

The age of the "Arbutus Hill" shells is estimated from that of shells discovered during 1962 excavations on Department of National Defense property along the Nanaimo Lakes Road. This site, popularly referred to as the Diefenbunker, is at about the same elevation (108 m or 354 ft) and about 4 km south of "Arbutus Hill". At least two of the clam species found at the Diefenbunker, were the same as those found in the summer of 1995 on "Arbutus Hill". Radiocarbon dating done by the Geological Survey of Canada places the age of the Diefenbunker specimens at 12,450 ± 150 years. The same age very likely applies to the "Arbutus Hill" specimens.

All but two of the species that inhabited waters around "Arbutus Island" were accustomed to much colder seawater than we have around us today - probably more like the conditions to be found today in the Gulf of Alaska around 60 degrees North Latitude. Today, Nanaimo is near the southern limit of the range of most of these species, living examples being more numerous to the northward as far as the Bering Sea and Arctic Ocean.

The common names of some of them certainly imply a cold environment. For example, one known as the Iceland cockle (Figure 8), and another the Greenland cockle (Figure 9), were common in the Dufferin collection, as was one with the strange name of Arctic saxicave (Figure 10). The latter was the most abundant of all species found.

Other species included a clam known as a chalky macoma (Figure 11), a member of a genus loosely referred to as "sand clams", and an oddly shaped species with a common name of fossa nut (Figure 12). Occasionally a small snail, the boreal hairy shell (Figure 13) was encountered on the "Arbutus Hill" site.

No photograph was obtained of a clam known to belong to the soft-shelled clam genus *Mya*, because it occurred only rarely and then only in bits and pieces. Clams of the Mya group were encountered also at the Diefenbunker site in 1962. Recently, local naturalist, Bill Merilees, found specimens of *Mya* beneath a peat bog near the end of Barrington Road (above Departure Bay). These were at an elevation of 124 m (over 400 ft) above mean sea level.

Although boaters and swimmers may at times think that barnacles were created as retribution for their sins, there is ample evidence that these animals too were present around "Arbutus Island" long before man put in an appearance on our coast (Figure 14).

The shell-lined tunnels of burrowing seaworms were also in great abundance (Figure 15), another indicators of nature's vigorous effort to re-establish life forms in areas subjected to the ravages of glaciation.

None of the species discovered on "Arbutus Hill" is new to science. In fact, all have been found at numerous sites along the east coast of Vancouver Island from Courtenay to Parksville, near Alberni and on Saanich Peninsula. They have also been encountered over a wide area of the lower Fraser Valley, as far east as Aldergrove. The "Arbutus Hill" site, however, is a new one for the record.

Concluding comments

The 1995 discoveries on "Arbutus Hill" might easily have escaped notice entirely, had it not been for the fact that a 43 year old memory had been kept alive. Ever since the reporting of butter clam shells in McGarrigle's gravel pit, the writer entertained the notion that "Arbutus Hill" might hold still more secrets about Nanaimo's prehistoric past. Indeed it did. Who knows what other secrets remain to be exposed there and elsewhere in the Nanaimo area?

Acknowledgments

I could not have completed the identification of the various shellfish species without the generous help of Phil Lambert at the Royal British Columbia Museum in Victoria, B.C. and the advice of Neil Bourne, retired shellfish specialist from the Pacific Biological Station in Nanaimo.

Geologist John Clague of the Geological Survey of Canada, Vancouver, and Prof. Ian Hutchinson of the Geography Department, Simon Fraser University, were most helpful in providing me with copes of publications and in checking my interpretation of the geological record. I am also indebted to Gordon Miller, Librarian at the Pacific Biological Station, who started me on the right track in search of scientific references.

Some additional reading

Abbott, R.T. 1974. American seashells. Van Nostrand Reinhold Co., 2nd Ed.: 663 p.

Clague, J., J.R. Harper, R.J. Hebda and D.E. Howers. 1982. Late Quaternary sea levels and crustal movements, coastal British Columbia. Can. J. Earth Sci. 19:597-618.

Dyck, W. And J.G. Fyles. 1963. Geological Survey of Canada, Radiocarbon dates I and II. Geol. Surv. Can., Paper 63-21: 31 p.

Griffith, L.M. 1975. The intertidal univalves of British Columbia. B.C. Prov. Mus., Handbook 26: 101 p.

Keen, M.A. and E. Coan. 1974. Marine molluscan genera of western North America. Stanford U. Press, 2nd Ed., 208 p.

Quayle, D.B. 1970. The intertidal bivalves of British Columbia. B.C. Prov. Mus., Handbook 17: 104 p.

Wager, F.J.E. 1959. Palaeoecology of the marine Pleistocene faunas of southwestern British Columbia. Geol. Surv. Can., Bull. 52: 67 p.

Yorath, C.J. and H.W. Nasmith. 1995. The geology of southern Vancouver Island: A field guide. Orca Book Pub., 172 pp.

Figure 1. A view of "Arbutus Hill" from the junction of Townsite and Bowen Roads.

Figure 2. Views of part of the new extension of Dufferin Crescent. Arrows indicate the approximate location of the shell discoveries.

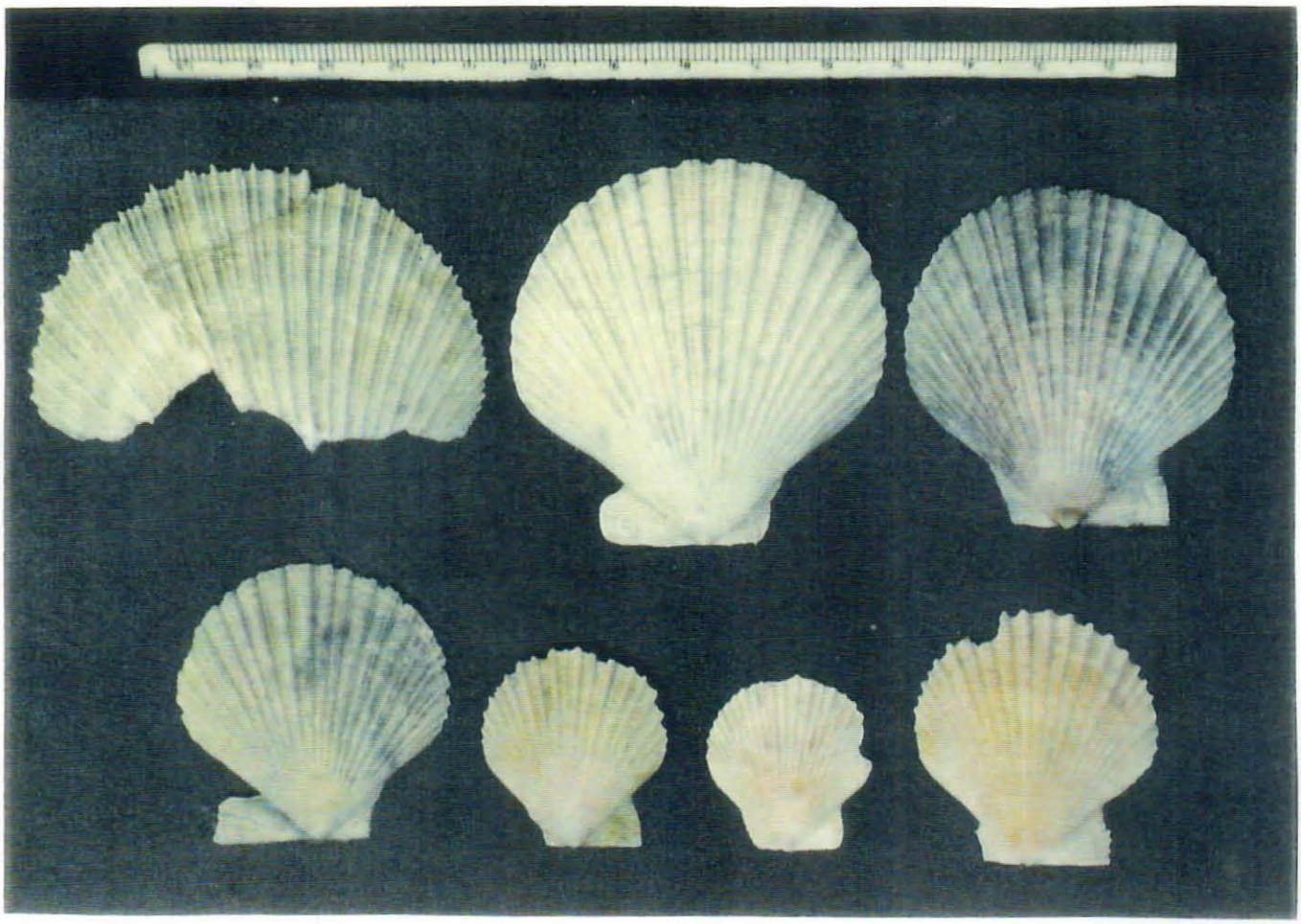

Figure 3. Some of the pink scallops (*Chlamys rubida*) that were found in the Dufferin Crescent excavation. The one at the bottom right is a spiny scallop (*C. hastata*).

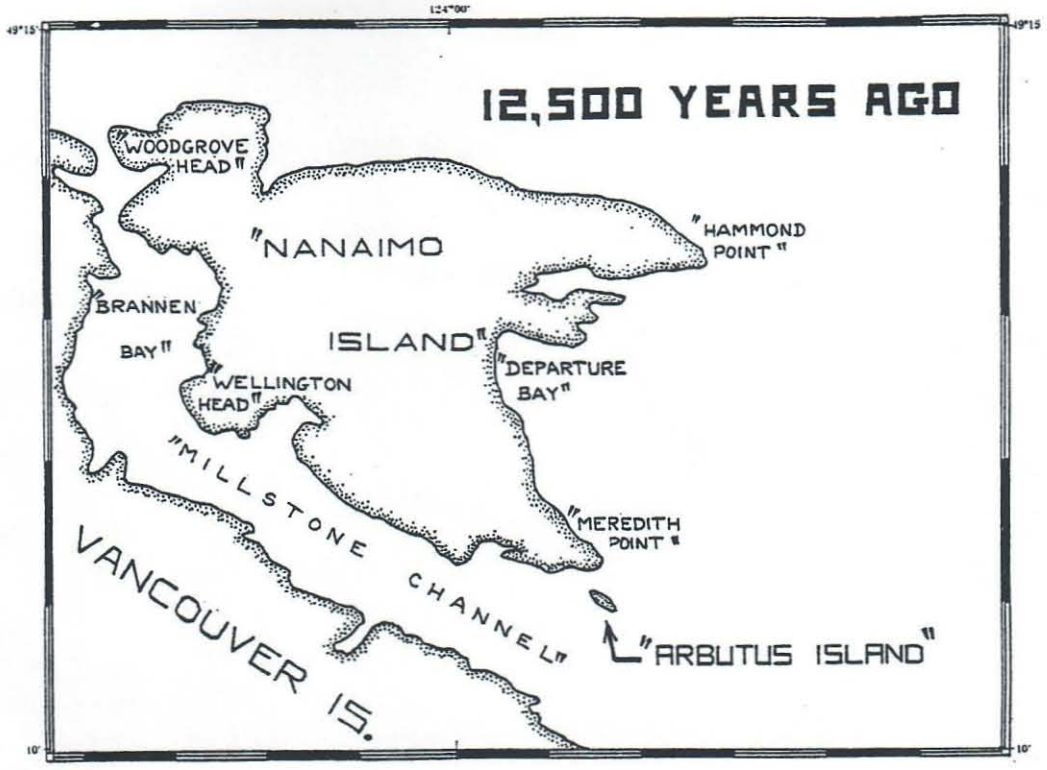

Figure 4. The northern part of Nanaimo as it may have appeared 12,500 years ago. The outline is based on the present-day 100 m contour of elevation above mean sea level.

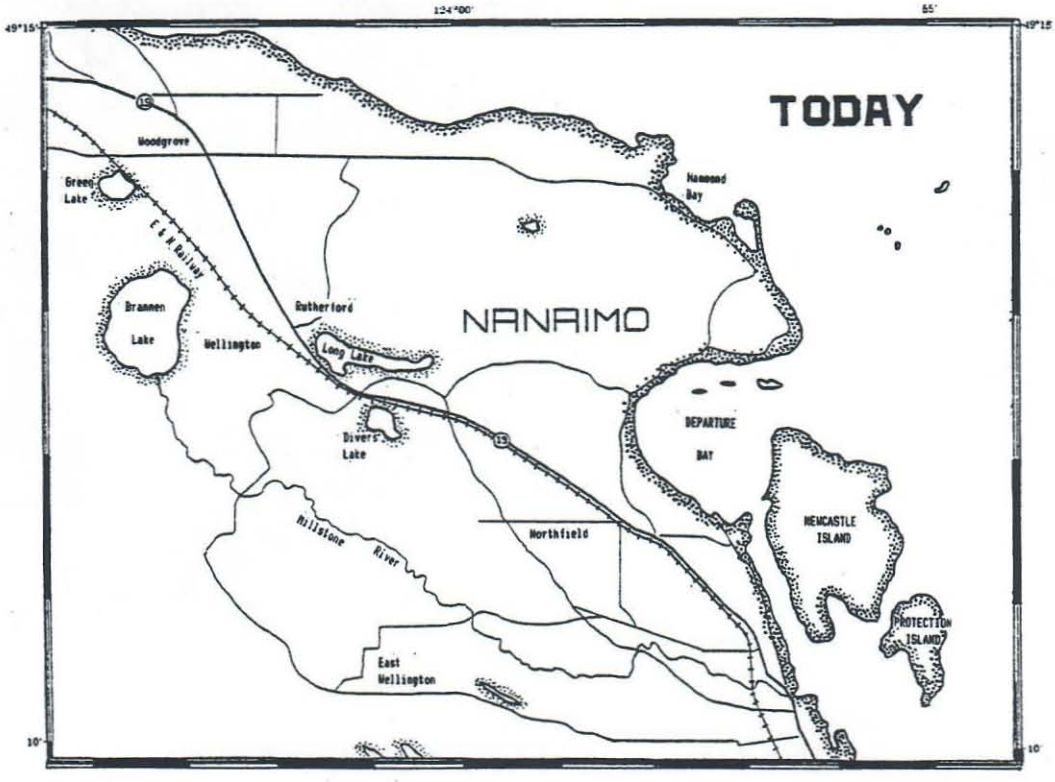

Figure 5. The northern part of Nanaimo as it looks today.

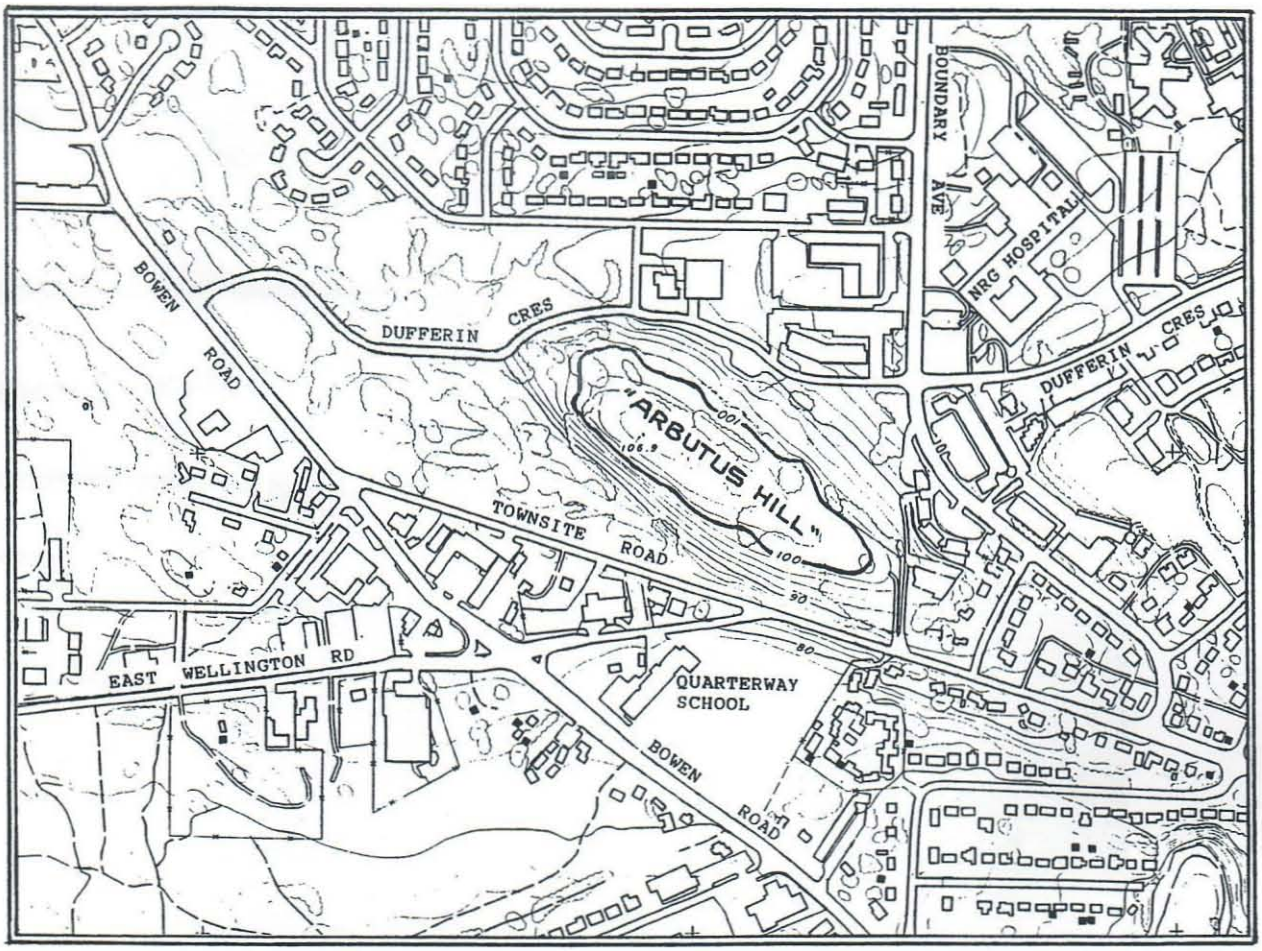

Figure 6. The position of "Arbutus Hill" in relation to Bowen Road, Townsite Road and the new extension to Dufferin Crescent.

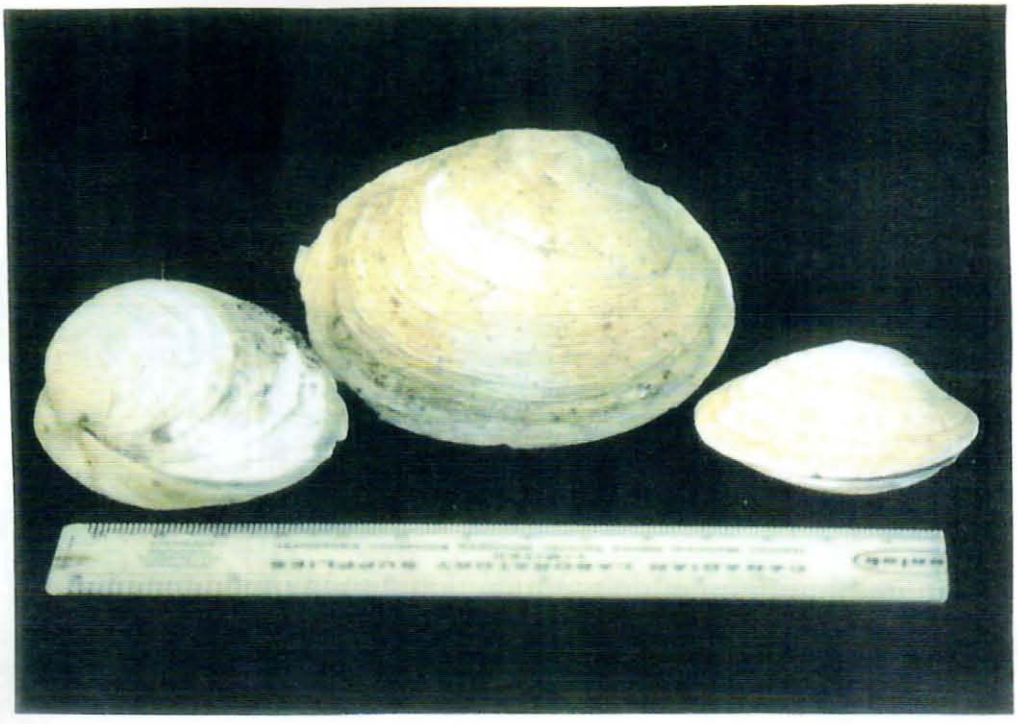

Figure 7. Specimens of the butter clam (*Saxidomus giganteus*) found in 1953 at the 103 m level on "Arbutus Hill".

Figure 8. A cluster of Iceland cockles (*Clinocardium ciliatum*) found in July 1995 at the 93 m level on "Arbutus Hill". This species occurs today from Alaska to Puget Sound.

Figure 9. The Greenland cockle (*Serripes groendlandicus*), another cold water clam that occurs in the Atlantic and Arctic Oceans, as well as in the Pacific from Alaska to Puget Sound.

Figure 10. The most common of the clams found on "Arbutus Hill", the Arctic saxicave (*Hiatella arctica*). It occurs from the Arctic Ocean southward to the deep cold water off Panama. (The larger shell at the top is a *Macoma* - see Figure 11)

Figure 11. The chalky macoma (*Macoma calcarea*) which occurs today from Bering Sea to Puget Sound.

Figure 12. Specimens of a little clam known as the fossa nut (*Nuculana fossa*), another cold water species that is found today from Alaska to Puget Sound.

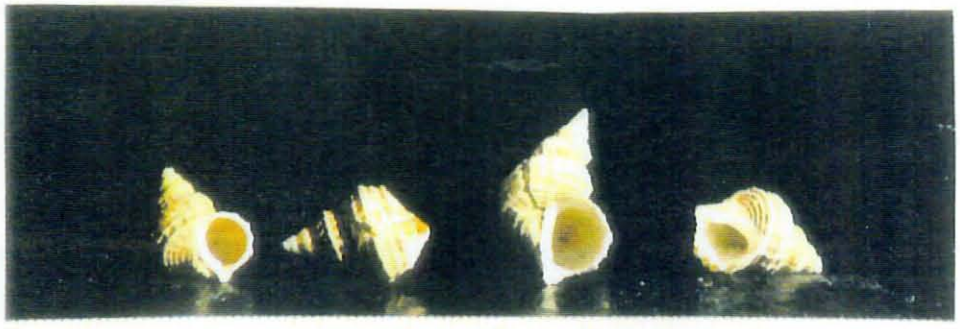

Figure 13. A gastropod or snail known as the boreal hairy shell (*Trichotropis borealis*) was also encountered on "Arbutus Hill". Today it is found from Arctic seas to British Columbia.

Figure 14. Signs of the long-ago presence of barnacles (*Balanus* spp.).

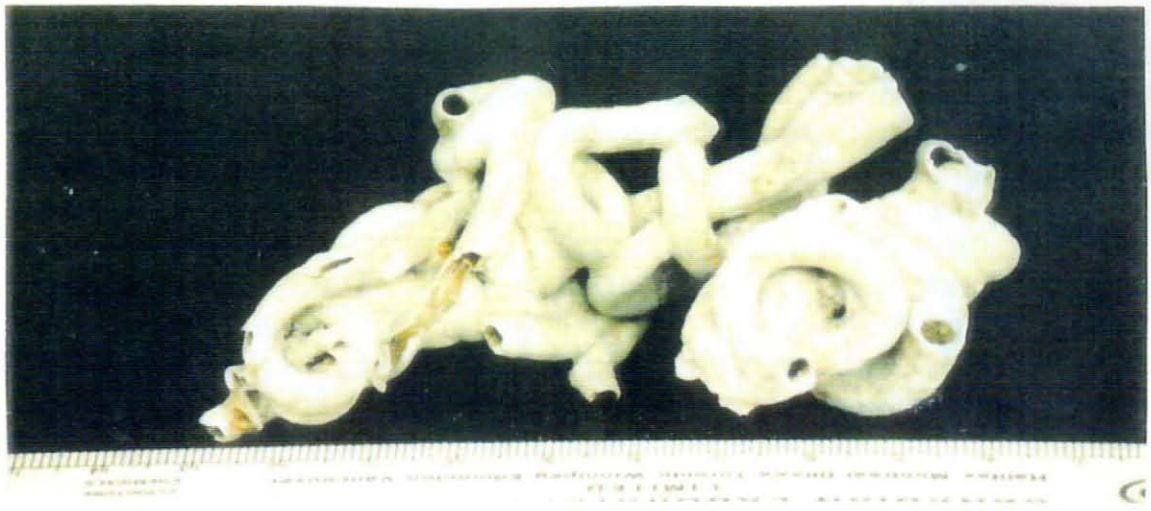

Figure 15. Of common occurrence were remains of calcified tunnels belonging to tubeworms of unknown species.

Observations of Bald Eagle Nest Status and Nesting Success in the Nanaimo Area, 1995-1997.

BRUCE COUSENS

Introduction

Biology and status of the Bald Eagle (*Haliaeetus leucocephalus*) in British Columbia were reviewed in detail by Blood and Anweiler (1994). Nest sites in the Nanaimo area (Fig. 1) were initially documented in a survey completed for the Min. of Environment, Lands and Parks (MELP) by *Don Blood and Associates Ltd.*, (Blood, 1989), with recommendations for conservation and protection of these sites. This survey was updated by members of the *Nanaimo Field Naturalists* under Don Blood's direction in 1994, with survey results being added to a nest tree inventory being developed for the Strait of Georgia (Georgia Basin) area and eventually all of Vancouver Island by the late Rick Davies, Senior Wildlife Biologist, MELP, as a priority under the Regional Wildlife Plan. Under his initial direction portions of the database for the Georgia Strait Bald Eagle Nest Tree Inventory have recently been updated and published with additional recommendations for conservation and protection by Terri Martin for Vancouver Island components of the Regional District of Comox-Strathcona (Martin, 1995) and the Regional District of Nanaimo (Martin, 1996).

This report summarizes the results of three years of monitoring bald eagle nesting activity and brood rearing success in the Nanaimo area, with the much appreciated assistance of Charlene Lee and Harriet Rueggeberg. This is not a new idea; Rick Davies had been accumulating breeding history data for a number of years from his own observations and those of others (MELP personnel, naturalists, nest tree owners and neighbours) who observe bald eagle nesting activities. My own nest monitoring effort started in 1994, when I began watching an active eagle nest with three eventually fledged young on Bayshore Dr. (North Nanaimo, site #22 26H) which had recently become visible from my house after adjacent land clearing for a large subdivision development. With encouragement from Don Blood this effort was expanded in 1995, 1996 and 1997 - the study area now extends from the southern Regional District of Nanaimo (RDN) boundary just north of Yellow Point to Schooner Cove and Mistaken Island in the Nanoose area (Fig. 1) - with the objectives of providing an annual nest status checklist, increasing the sample size of local nests with reliable breeding history data on record, and documenting breeding success for these nests consistently over time, in hopes of evaluating reproductive capability and learning more about health and nesting success of the local population of this majestic, interesting and potentially threatened raptor.

This ongoing project is dedicated to the memory of Rick Davies, a committed professional biologist who's life and work were interrupted far too soon.

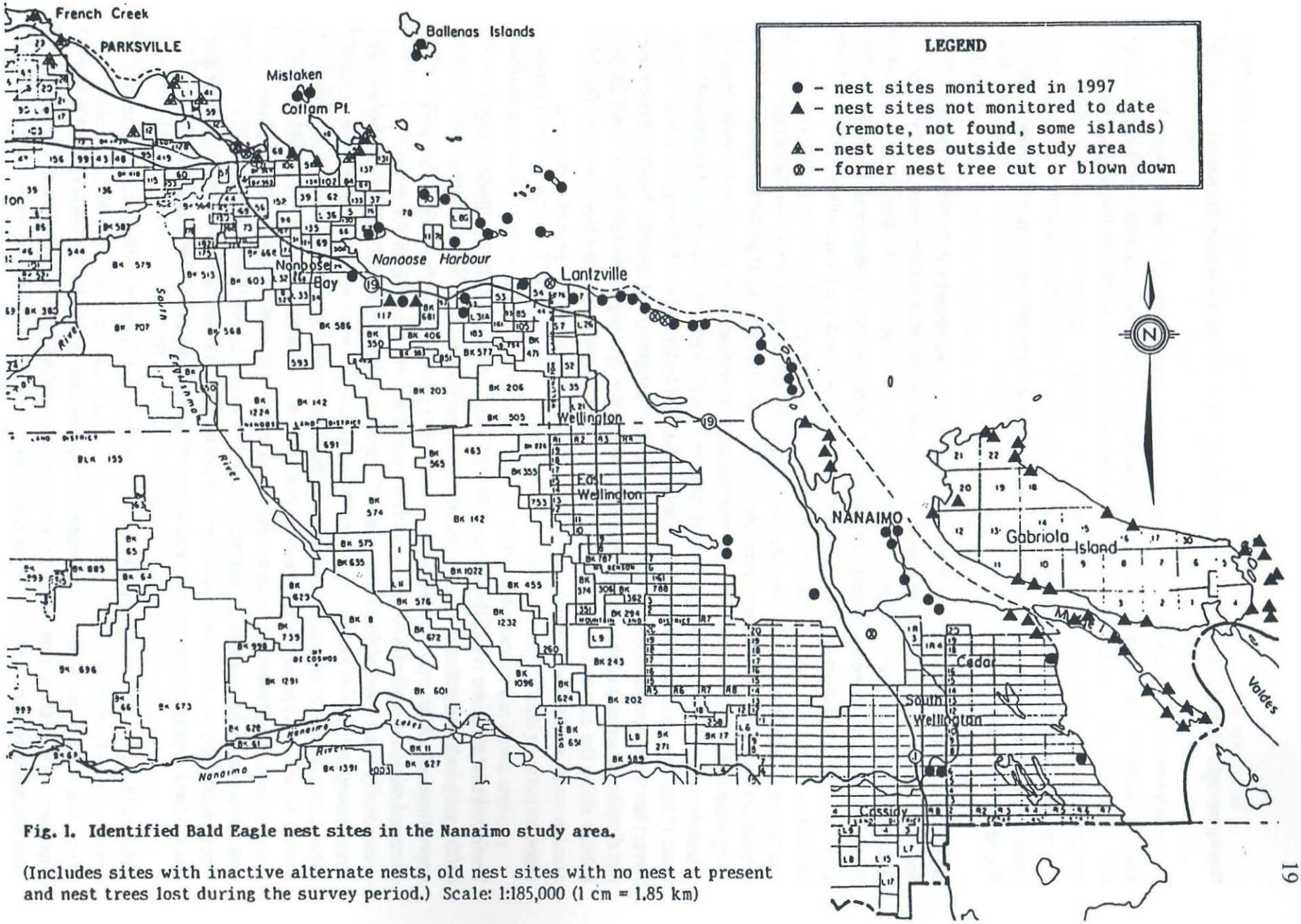

Fig. 1. Identified Bald Eagle nest sites in the Nanaimo study area.

(Includes sites with inactive alternate nests, old nest sites with no nest at present and nest trees lost during the survey period.) Scale: 1:185,000 (1 cm = 1.85 km)

Background - Bald Eagle Nesting Habitat Requirements and Human Impacts

Bald eagles nesting in the Georgia Depression Ecoprovince occupy the same geographic areas preferred by the rapidly expanding human population, specifically the marine shoreline and occasional sites beside rivers, lakes and wetlands, with the result that these areas of critical bald eagle habitat are subject to heavy development pressure due to growth of the human population (forecast to double in the Regional District of Nanaimo [RDN] within 15 years at the present growth rate) and increasing levels of human disturbance (Martin, 1996; Blood & Anweiler, 1994).

Bald eagles typically nest in very large old trees, in this area primarily (80-90%) Douglas firs, which often dominate the surrounding preferably forested landscape and usually stand within a few metres to several hundred metres of the shoreline (Fig. 1). These trees, termed "veterans" because those remaining are old growth survivors of past fires and logging activities, are much older than surrounding second growth and are frequently visually prominent. They occur as isolated single trees, in small groups and in small pockets of remnant old growth forest. Within the Georgia Basin only about 0.5% (1100 ha) of the original mature Douglas fir forest remains (and is Red-listed) in the Coastal Douglas Fir Biogeoclimatic Zone that characterizes the Nanaimo Lowlands Ecosection of the east coast of southern Vancouver Island and a small amount of adjacent Gulf Islands and mainland coast (MacKinnon *et al*, 1995). Of this, only about 100 ha (0.06% of the original forest cover) has been protected from future logging and/or development, and the large old trees are not distributed evenly along the shoreline. Thus surviving Douglas fir veterans in bald eagle habitat along the east coast of south Vancouver Island, many on private land, are now few in number compared to their original abundance and constitute a finite limited and at-risk resource.

Preferred nest trees are typically at least 150-200 years old and often considerably older (300+ yrs), indicating that it takes a long time to create a new bald eagle nest tree, *if* appropriate conditions prevail for the necessary time period. Most logging in this area occurred within the past 50-60 years, so few second growth Douglas fir (or other occasionally used species, including grand fir, spruce, cottonwood and bigleaf maple) are yet large enough to provide stable nest sites. When no useable trees remain in otherwise suitable habitat, that habitat is no longer available for bald eagle nesting (e.g. the urban Nanaimo foreshore between Departure Bay and the Nanaimo River estuary, Fig. 1). This habitat loss is permanent and irreversible in any meaningful human (or eagle) time frame, since habitat restoration and enhancement are not realistic options once all remaining nest sites in a territory are lost. A displaced pair must find another unoccupied territory with a nest tree and nearby food supply (primarily fish, gulls, waterfowl and carrion) to breed successfully.

Adult bald eagles *breeding* in the Georgia Basin are non-migratory, often occupy a nesting territory for 9-10 months of the year (i.e. except during late summer dispersal), and show strong site fidelity, returning to the same nesting territory in successive years (Blood & Anweiler, 1994). (It is important to distinguish this *resident breeding population* from the variable annual influx of additional overwintering migrant adults and juveniles from less

temperate climates, which breed elsewhere.) As with many other territorial species in healthy populations with sufficient food resources, most suitable habitat within a given area is already occupied. Loss of nesting habitat may thus result in a permanent reduction in the reproductive capacity of the population. Inevitably then, if the number of available nesting territories in the area declines, the number of resident breeding pairs will also decline, eventually resulting in decline of the regional resident population.

With ongoing loss of nesting habitat, the breeding success of the remaining population may also be reduced due to increased stresses of raising young in sub-optimal habitat, particularly with increased levels of human disturbance. This susceptibility to long term critical nesting habitat loss and resulting regional population decline with continued human population growth and development is the primary reason why the bald eagle, until recently included on the Blue List of vulnerable species for which survival is considered at risk province-wide, is now classified as Regionally Important (in need of special management consideration for conservation) in the Georgia Basin Ecoprovince, where its breeding habitat and numbers are most threatened.

Protecting identified existing nest trees, while an essential first step, is not alone sufficient to meet long term breeding habitat requirements, since even old growth trees that have escaped the saw do not last forever, eventually becoming weakened by disease, dying and decaying, blowing down (especially when the buffer of surrounding trees is removed), or being topped or removed as hazard trees in and adjacent to developed areas. It is thus necessary to maintain a source of replacement nest trees of adequate size, age and distribution by preserving some other old growth and larger second growth trees in suitable nesting locations, as well as any recorded nest trees.

Martin (1996) describes 77 known nest trees (+4 added herein), some currently without nests (including recently unused alternate and old nest sites, two trees recently cut down and one blown down), within the coastal Vancouver Island portion of the RDN, which extends roughly from Mapleguard Point (Deep Bay) to Yellow Point. These comprise about 60 known nesting territories, with at least 37 and possibly up to 51 active in 1995. (A similar number of nest sites is reported for the Vancouver Island portion of the Comox-Strathcona Regional District, excluding Quadra, Denman and Hornby Islands [Martin, 1995].) Including identified nest sites on islands in the portion of the Strait of Georgia lying within the RDN (Ballenas and Winchelsea Islands groups, Mistaken, Newcastle, Gabriola, Mudge, Link and DeCourcey Islands), there appear to be about 90 active and potential nesting territories and 110-120 known nest trees still standing in the RDN. About 18 of these territories with 30 known nest trees lie within the city limits of Nanaimo, about half of these in protected park areas. These numbers are approximate because the island site inventory has not been updated recently (in progress) and because territories may have an active nest and at least one old unused or alternate nest, making boundaries of closely spaced territories uncertain.

Though these numbers may at first seem comfortably large, they are fairly small finite numbers for a resident breeding population within an area of this size, such that it is possible with only modest effort to document loss of a single known nesting site (at least eight nest

trees [10%] were lost within the RDN on Vancouver Island due to both human and non-human-related causes in the past 5-6 years). Theoretically at least, it should also be possible to determine and implement the practical measures needed to minimize nesting habitat loss for the foreseeable future.

This goal is particularly challenging when two thirds of the known nest trees in the RDN (and likely a similar proportion of other large trees suitable for future nest sites) are on private land either already developed for residential and commercial use or subject to future logging and development uses (Martin, 1996). It is already an offence under Section 35 of the Wildlife Act to destroy or damage an eagle nest or nest tree. Permission is required from MELP to remove or top a nest tree deemed a hazard (whether or not a nest is present), and where possible MELP applies various restrictions to the extent (and timing, when the nest is active) of development adjacent to nest trees. Martin recommends the development of stronger and more comprehensive legislation at the municipal level, indicating that most tree protection bylaws are inadequate in this regard (though the Municipal Act which regulates municipal powers is limited with regard to environmental concerns, particularly after initial development occurs) and encourages increased use of conservation covenants to protect blocks of bald eagle habitat containing nest trees.

Monitoring bald eagle nest/tree status and reproductive success within this area is a necessary first step in:

i) determining normal annual variation in reproductive success locally,
ii) determining if and to what level breeding success may be effected, and
iii) devising and implementing appropriate additional measures for ongoing nest site and habitat protection.

Methods

Bald eagle nests in the study area are inspected during the nesting season using binoculars and/or a 15-45x spotting scope from readily accessible vantage points which provide good (or best available) views of the nest. Vantage points are often from public roads, as well as other easily reached public areas (trails, beaches, etc.) if necessary. Private land owners/observers are contacted in person or by phone to confirm uncertain data or obtain otherwise unavailable information, though we try to minimize disturbance of land owners whenever possible. A few resident observers contact us if we don't call them first, or if something unusual occurs.

Apart from the Bayshore Dr. nest, which is visible from my home and is monitored closely when active during the nesting season (mid/late-January to mid-July) and viewed daily at other times of the year, all monitored nests are inspected at least once in early July, when young are large, close to fledging and usually readily visible. Accessible nests in the Nanaimo area are inspected more frequently, typically at least once in March-April when a nesting female would be present almost continually, in an attempt to determine nest condition and early season usage, and again at least once in June to determine hatching and rearing progress. Nests on offshore islands in the Winchelsea Group and on Ballenas and

Mistaken Islands are monitored by Harriet Rueggeberg one or more times during the nesting season, accessing these sites by kayak.

Initially active nests that later appear unoccupied and may have been abandoned after brood failure, or where re-nesting is indicated, as well as nests where the juvenile count appears to have decreased, are re-checked several times for confirmation. (Most nestling mortality seems to occur early during the grey down phase, before the chicks are big enough to be readily visible from the ground in most nests, so is rarely observed directly.) Territory occupation and/or nest building or rebuilding with no apparent incubation attempt is scored as brood failure.

Nearly fledged and apparently healthy juveniles observed in late June or early July are considered to have fledged successfully. In most situations the July juvenile count for each nest is almost certainly complete, but at a few nest sites with a single juvenile there may be a possibility that a second juvenile was present and not visible. **The nesting success data presented herein should thus be interpreted as *minimum fledging success (0-3 young) per active nest with known production***, prior to post-fledging juvenile mortality and subject to revision where other reliable reports of additional late nesting season juvenile presence are available. (However, such reports should be interpreted carefully, since we have in the past received occasional incidental reports from nearby residents of juvenile bald eagle rearing success from nests which were known to have failed in the incubation or nestling phase, as well as reports of other bird species, possibly ravens, hawks, owls or osprey, seen on inactive nests and mis-identified as juvenile bald eagles.)

Nest site ID numbers of the form 21 22C conform to the current site numbering system used by Martin (1996) to index nest sites to the Regional District map numbering system; site ID numbers of the form R-2273 conform to the earlier sequential nest site indexing system devised by Rick Davies (MELP) and refer to island sites not included (and renumbered) in Martin's report; nest sites with no ID number (n/a) are not yet included in either indexing system and may be new site records. Three additional nest site records not included in Martin (1996) (21 24C, Nanoose Indian Reserve #2; 23 28C, Bonnie Dr., north of Planta Park; and 26 27B, Westwood Lake #2) are included and have been numbered in accordance with the current indexing system (T. Martin, pers. comm.). A fourth active territory with two nests has also been located recently in the Nanaimo R. - Cassidy area.

Results

The results of the bald eagle nesting success surveys for Nanaimo and the surrounding area in 1995, 1996 and 1997 are listed in Appendix 1 and summarized in Table 1. Summary values therein **do not include** nests at Hamilton Marsh and the mouth of French Creek in the Parksville-Qualicum area, which were monitored incidentally in 1996-97 and are listed in Appendix 1 for reference, but lie outside the Nanaimo study area. Also, the original 1995 survey report, circulated previously, has been updated to include additional new information and revised to the present format (Appendix 1a) for consistency with the list format and new site numbering system used by Martin (1996).

Table 1. Summary of Nanaimo area Bald Eagle nest status and nesting success, 1995-1997.

	1995	**1996**	**1997**
# of nest sites monitored	35	40	47
# of territories monitored	22	27	31
# of known active nests/occupied territories	18	21	27
- with known brood production (= n_1)	18	21	24
# of successful occupied sites/territories (= n_2)	12	13	11
% of known active nests successful	**66.7%**	**61.9%**	**45.8%**
# of young fledged (= n_3)	19	17	15
Average young per *active* nest (= n_3/n_1)	**1.06**	**0.81**	**0.63**
Average young per *successful* nest (= n_3/n_2)	1.58	1.31	1.36
Active nests down [-] / rebuilt [+] in season	-2 / +1	-	-5 / +3
Active nest trees lost [-] / replaced [+]	-1 / +1	-	-1 / +2
Nest down / rebuilding; no breeding effort (active; no nesting attempt / nest building only)	1 / 1	1 / 1	1 / 3

A total of 35 nest sites (some with nest or tree down) in 22 presumed nesting territories were included in 1995, with brood production data obtained for 18 confirmed active nests/territories. The survey was expanded in 1996 to include 40 nest sites in 27 presumed territories, with brood production data obtained for 21 confirmed active nests/territories. Further expansion in 1997 included 47 nest sites in 31 presumed territories, with brood production data obtained for 24 active nests in 27 confirmed active territories. Some further expansion may occur when monitoring of nest sites on Gabriola Island and other offshore islands within the Nanaimo study area can be coordinated.

Conclusions and Discussion

The most obvious conclusion from the results of the 1995-1997 Nanaimo area bald eagle nesting success surveys is that average brood production from active territories/nests ***with known nesting success*** (i.e. excluding active nests with unknown brood production) varied considerably over the three years, with an apparent downward trend from 1.06 young fledged per nest in 1995 to 0.63 young per nest in 1997, despite an increasing number of active nests in the sample. These averages are reflected to varying degree in sub-area data in Appendix 1, since most sub-area samples are likely too small to permit drawing meaningful conclusions for sub-areas individually.

As well, the proportion of active nests that successfully fledged young decreased during this period, particularly in 1997, from 66.7% in 1995 and 61.9% in 1996 to only 45.8% in 1997. As a result, 13 of the 24 occupied territories/nest sites with known brood production (54.2%) failed to fledge any young in 1997.

Interestingly, the average brood production per ***successful*** nest also declined over this period, from 1.58 young per nest in 1995 to 1.31 young per nest in 1997. These values are of limited meaning, since active nests that failed to produce any young are excluded by definition (hence the need for an initial nest survey in early spring to determine actual site use), but they do indicate that successful nests also showed a drop in productivity during the study period.

Both the number of nests blown down just before or during the nesting season and the number of previously fallen nests under re-construction with no brood production, as well as the number of active intact nests with brood failure, increased each year over the three year observation period, all of which contributed to the decline in brood production success over this period. This decline is only partially explained by a nest loss "carry-over" effect, where in several instances a fallen nest with no alternate site either was not replaced the following spring or was observed under re-construction for 1-2 years with no evident egg incubation or brood production. The number of "non-breeding" active nests/territories increased from 2 in 1995 and 1996 to 4 during the 1997 nesting season, partly as a result of increased nest loss in storms during the winter of 1996-97. Bald eagle nest replacement rate is quite variable, for as yet unexplained reasons - some pairs begin rebuilding in the same season and nest normally the following year, e.g. #21 25, #22 26F, others may take 1-2 years to rebuild and resume breeding, e.g. #22 26B. This may partially explain the advantage of building alternate nests. Failure of a few pairs in a population to attempt breeding in a given year has been shown in other studies, and there is some evidence from marking studies to suggest that pairs usually mated for life may occasionally re-mate after a failed nesting attempt (Blood & Anweiler, 1994), though which partner retains the "family home" was not discussed.

Martin (1996) reports a minimum documented production within the Vancouver Island portion of the RDN (i.e. excluding offshore islands) of 41 fledglings from 26 ***successful*** nests/territories in 1995 (out of a total of about 60 presumed nesting territories in this area), or 1.6 young per nest. Again, this ratio does not accurately represent nest productivity because any initially active nests that failed are excluded. However, the same fledging rate was found for the sub-sample of 12 successful nests in the Nanaimo study area in 1995, indicating no difference in this value between the Nanaimo study area and the RDN as a whole that year.

When the 7 additional known active nests/territories which produced ***no young*** in 1995 (6 nests in the Nanaimo study area) are included, brood production for the 33 active nests/territories in the RDN for which brood production is known averages 1.2 juveniles/nest. This is somewhat higher than the Nanaimo study area average of 1.06 juveniles/nest for 1995, and is likely still biased high by under-reporting of failed active nests with no young outside the Nanaimo study area, due to lack of a comprehensive early spring survey to determine initial nest activity.

Comparing the number of nests with unknown use in the Nanaimo study area and the remainder of the RDN in 1995 (Martin, 1996) supports this conclusion: the Nanaimo area sub-sample includes 6 nests (15%, n = 40) with usage unknown, while the sample from the remainder of the RDN includes 13 such nests (36%, n = 36). Some of these nests in each area were likely active nests that failed and were abandoned prior to inspection. Given the higher proportion in the latter sample, it seems probable that the actual nesting success rate within both sub-areas (and the RDN as a whole) was close to 1.0 juvenile per active nest in 1995.

Considerable caution is needed in interpreting and comparing these initial sets of results because the sample sizes are quite small and thus subject to both random variation and sampling bias effects (particularly since the two sets of data were collected differently, with active nests that failed likely under-reported in the RDN sample) and because a single year of comparative nesting success data is almost meaningless without additional information, such as similar comparisons for a number of years and/or firm supporting evidence for the mechanisms responsible for any significant differences in survival rate. It would thus be a mistake to attribute much significance to these single year comparisons at this stage. Comparisons for later years are not yet available.

To put these results in a broader perspective, the 1995 and 1996 Nanaimo survey results for nest productivity (1.06 and 0.81 young per active nest) are similar to the value of 0.9 young per active nest reported by Blood (1989) for the Nanaimo area during the 1988 nesting season and cited from an earlier study in Washington State, and slightly lower than productivity values of 1.1 young per active nest reported for populations studied in southwest Yukon and Idaho (Blood & Anweiler, 1994). However, these values are at or near the lower end of the range observed (0.9 - 1.5 young per active nest) and the 1997 productivity value of 0.63 young per active nest is well below this range. Similarly, the 1995 and 1996 Nanaimo survey nest success rates of 66.7% and 61.9% are similar to the value of 62% reported for this area by Blood (1989) for the 1988 nesting season, and within the range of values reported for other locations in and adjacent to B.C. (62-91%). Again, the 1997 Nanaimo area nest success rate of 45.8% was well below this range.

However, in comparison with other bald eagle populations in North America for which nesting success and productivity have been determined and correlated with the population growth trend (increasing, stable or declining), Nanaimo area nesting success rates of 45.8% - 66.7% and productivity levels of 0.63 - 1.06 young fledged per active nest are all within ranges considered characteristic of stable or increasing populations (Blood and Anweiler, 1994).

Thus the recent apparent downward trends in nesting success and productivity in the Nanaimo area, while not cause for immediate alarm based on only three years of data, are certainly reason for continued monitoring and further investigation, in an effort to determine:

i) whether the recent decline is sustained over time and indicative of a long-term trend, or simply an aberration due to, for example, unfavourable weather conditions before

and during the nesting season (which seems more likely so far, given the recent relatively severe winters and cool wet springs), and

ii) what are the most probable causes of the observed variability in nesting success in this area (which may include adult age, health and breeding condition, nestling mortality factors such as weather conditions during the nesting season, disease, availability of adequate food resources and interference from other species such as crows, hawks and owls, as well as nest loss due to high winds and human-related disturbance factors.)

From these data there is no conclusive evidence that bald eagle ***reproductive rates*** in the Nanaimo area are being consistently negatively effected by human disturbance during nesting, despite past isolated individual examples to the contrary, though the threat of resident population decline due to permanent loss of critical veteran nest trees and nest habitat with ongoing growth and development impacts remains quite real. However, meaningful long-term evaluation will require a greater number of years of brood production data to provide reliable conclusions.

A far more probable explanation for the observed decline in productivity is simply variation in nesting success due to other likely weather-related effects. For example, the brood at the Bayshore Drive nest (#22 26H) that I monitor daily from my home was abandoned within hours of an unusual heavy hail storm on March 28-29/95, shortly after the eggs were due to hatch, though the nest continued to be used for perching and feeding, and eventually for a brief but unsuccessful re-nesting attempt in April. It is thus tempting to suspect that the cold weather and/or hail may have been the cause of this nest failure and perhaps others in the area. Disturbance from excavation of a house foundation on the adjacent lot may(?) have contributed to lack of re-nesting success in April, but the tree and nest were used as a perch and feeding platform until August.

Reproductive success would also be expected to vary somewhat between years as a result of variations in weather (temperature, rain/snow, wind storms causing nest damage or loss), food availability and possibly other environmental conditions during the nesting season, so comparisons between years must be interpreted with caution as well. Typically bald eagles raise one or two young, occasionally three under presumably optimal conditions (Campbell *et al*, 1990; Blood and Anweiler, 1994), and a nestling may die or a nest may fail entirely for a variety of reasons that are not readily apparent. For example, at least three nests within the RDN on Vancouver Island produced three young in 1994 (including two in the NFN Nanaimo survey area, at Bayshore Drive and Brickyard Cove), but no nests with three young were reported in the RDN in 1995 and none were observed in the Nanaimo area survey in 1996 or 1997 (in fact, both nests that produced three young in 1994 produced none in 1996 and one failed in 1997, though the nests remained intact and active). It is tempting to suggest from these anecdotal observations that for some reason 1994 might have been a "better year" for raising eaglets than any of the three following years, but such a conclusion is speculative without other supporting evidence.

In addition, bald eagle nests fall periodically, often during winter and spring storms, with loss of any nestlings that may be present if collapse occurs during the breeding season, since the

adults abandon fallen nestlings. Depending on timing relative to the breeding season, availability of a suitable alternate nest and possibly other factors, nest loss alone may cause a pair to fail to produce young for at least 1-2 and occasionally 3 years, which is a significant loss of reproductive capacity for a bird that requires four years to reach maturity, may not breed for several more years until a vacant nesting territory is available, and is thought to survive for up to 20-25 years in the wild. A few such events would be sufficient to substantially reduce average nesting success and productivity in a small sample of nest territories.

Hence several years of sample observations will not reliably reveal subtle differences in reproductive success between areas or years, given expected variation in nest and nestling survival. It is necessary to continue the survey annually over a period of years and expand the coverage where appropriate before meaningful conclusions can be drawn about the reproductive health of the local population and any changes in reproductive success that might indicate increased stress.

The Bald Eagle Nest Tree Inventory program is the repository for this information, to await further analysis. Even with both the RDN nest tree inventory review and the NFN Nanaimo area survey in progress in 1995, breeding success was determined for just over half of the 60 presumed nesting territories identified in the RDN study area on Vancouver Island, and the Nanaimo area survey in 1997 determined brood production for about half of the roughly 50 presumed nesting territories within the Nanaimo study area (including offshore islands), so there is plenty of room to improve the extent of the database. Hopefully repetition and further expansion of the NFN nesting success survey in future years will make a useful contribution in this regard.

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Literature Cited

Blood, D.A. 1989. Conservation plan for bald eagle nesting trees in the Nanaimo area. Prepared for: B.C. Ministry of Environment, Vancouver Island Region, Nanaimo, B.C. Habitat Conservation Fund. 35pp.

Blood, D.A., and G.G. Anweiler. 1994. Status of the Bald Eagle in British Columbia. Prepared for: Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, B.C. Wildlife Working Report #WR-62. 77pp.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser and M.C.E. McNall. 1990. The Birds of British Columbia. Vol. 2. Nonpasserines: Diurnal birds of prey through woodpeckers. Royal B.C. Museum, Victoria, B.C. 636pp.

MacKinnon, A., and M. Eng. 1995. Old Forests: Inventory for Coastal British Columbia. Cordillera Vol. 2, No. 1.

Martin, T.D. 1995. Georgia Strait Bald Eagle Nest Tree Inventory. Regional District of Comox-Strathcona. Prepared for: B.C. Ministry of Environment, Vancouver Island Region, Nanaimo, B.C. 45pp + append..

Martin, T.D. 1996. Georgia Strait Bald Eagle Nest Tree Inventory. Regional District of Nanaimo. Prepared for: B.C. Ministry of Environment, Vancouver Island Region, Nanaimo, B.C. 45pp + append.

Appendix 1A. Nanaimo area bald eagle nest site status and nesting success, 1995.

Probable nesting territories are separated by single horizontal lines, grouping active and presumed alternate/old nest sites where these are known or suspected. A broken line indicates uncertain territory' separation. A few of these groupings may be subject to change with further information. Indications of a nest or tree being active, inactive and/or intact, etc., refer to the duration of the relevant nesting season and do not necessarily indicate present usage status or condition of the nest/tree after the subsequent winter storm season. Notes in ***bold italics*** indicate changes in nest status for each year, including several updates to Martin's (1996) report for the 1995 breeding season.

Site No. 1995	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
A: Nanoose Bay & Peninsula:					
20 23A	Parker Rd.	**Act.**; intact; used initially, failed	Active	0	Alt: 20 23B adult present early in nesting season
20 23B	Russel Rd.	**Act.?**; intact, (Martin, 1996)		0	may have switched sites to re-nest; failed '95
20 24A	Schooner Cove Dr. (Dolphin Lk.)	**Act.**; intact	Active	2	Martin, 1996
20 24B	Fairwinds Golf Course	**Act.**; intact	Active	2	
20 24C	Brickyard Cove, Andover Rd.	**Act.**; intact	Active	2	3 juv. in '94 - neighbour
20 24D	Wallis Pt.; CFMETR Base #2	Inact.; nest down		-	Old nest site; Alt: 20 24C
21 23A	Island Highway, Nanoose Bay	Inact.; remnant	Unknown	-	Old nest site
21 23B	Hillview Rd. A	Inact.; intact	Unknown	-	Alt: 21 23C
21 23C	Hillview Rd. B	Not found		?	Alt: 21 23B; nest down?
21 24A	DND Tower, CFMETR Base #1	Inact.; nest down <'95	Unknown; no info.	-	Old site; no active nest in territory known
21 24B	Nanoose Indian Reserve #1	**Act.?**; intact	Active 3/95	0	Alt: 21 24C; failed '95
21 24C	Nanoose Indian Reserve #2	Inact.?; intact	(adults obs)	-	Alt: 21 24B
Totals (known active nest sites & brood production):			**5**	**6**	**Avg: 1.2 juv./active nest**

Site No. 1995	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville:					
R-2260	'Blue Roofs', Lantzville Rd.	**Act.;** ***nest down, tree removed***	Active	-	***Hazard tree removed after nest fell/abandoned***
21 25	Mostad's, Lantzville Rd.	**Act.**; intact		0	***new nest built to replace above; no brood***
22 25	Jenna Dr. & Nestor Way	**Act.**; intact	Active	2	
22 26A	Seabold Rd.	**Act.**; intact	Active	0	Failed '95

Appendix 1A. Nanaimo area Bald Eagle nest site status and nesting success, 1995.

Site No. 1995	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville (cont 'd):					
22 26B	Blueback Rd., Icarus Pt.	**Act.; *nest down in June '95***	Active	0	***No new nest built in '95; 1 chick fell, both died***
22 26C	6258 Icarus Rd.	Inact.; nest down ('87)		-	Alt./perch tree for 22 26B
22 26D	Desmond Rd. & Icarus Rd.	**Act.**; intact	Active	2	
22 26E	Sealand Park	inact.; nest down < '94; tree topped	Active	-	Alt: 22 26F (D. Blood)
22 26F	Driftwood Pl.	**Act.**; intact		2	Alt: 22 26E
22 26G	Bayshore Dr. (alternate)	Inact.; **remnant**	Active	-	Alt: 22 26H
22 26H	Bayshore Dr. (original)	**Act.**; intact		1	Alt: 22 26G; **3 juv. in '94**
22 27A	Gulf View Dr.	**Act.**; intact	Active	0	Alt: 22 27B; failed '95
22 27B	Morningside Dr.	Inact.; intact		-	Alt: 22 27A
23 28A	Planta Park North	Inact.; nest down < '94	Active	-	Alt: 23 28B; old nest site, perch tree
23 28B	Planta Park South	**Act.**; intact		1	Martin, 1996
Totals (known active nest sites & brood production):			**9**	**8**	**Avg. O.88 juv/active nest**

Site No. 1995	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
C: Duke Point, Jack Point & Cedar-Yellow Point:					
26 29A	North Jack Point (central)	**Act.**; intact	Active	2	Alt: 26 29B; ***juv banded***
26 29B	North Jack Point (west shoreline)	Inact.: nest down <'95		-	Alt: 26 29A; old nest
26 29C	South Jack Point	Inact.; intact	Inact./alt.	-	Alt: 26 29A?; old nest site
26 29D	Biggs Park, Jack Point	Inact.; ragged	Inact./unk.	-	Old nest; no known alt.
27 29A	Hooker Rd., Harmac/CanOxy	**Act.**; intact	Active	1	Alt: 27 29B; road closed
27 29B	Jackson Rd., Harmac/Duke Pt.	Inact.; remnant		-	Alt: 27 29A; old nest site
28 30	Barnes Rd., Cedar	**Act.**; intact	Active	1	Martin, 1996
30 31A	Ingram Rd., Cedar	**Act.**; intact	Active	1	Reported by owner
Total (known active nest sites & brood production):			**4**	**5**	**Avg: 1.25 juv/active nest**

Overall Bald Eagle Brood Production Success in the Nanaimo Area, 1995			
Total known active nest sites & brood production:	**18 nests**	**19 young**	**Avg: 1.06 juv/active nest**

Appendix 1B. Nanaimo area Bald Eagle nest site status and nesting success, 1996.

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
A: Nanoose Bay and Peninsula:					
20 23A	Parker Rd.	Unknown; intact	Unknown	-	Alt: 20 23B
20 23B	Russel Rd.	Unknown; intact	no use obs.	-	Alt. 20 23A
20 24A	Schooner Cove Dr. (Dolphin Lk.)	Unknown; intact	Unknown	-	
20 24B	Fairwinds Golf Course	**Act.**; intact	Active	2	
20 24C	Brickyard Cove, Andover Rd.	**Act.**; intact	Active	0	Failed '96
20 24D	Wallis Pt.; CFMETR Base #2	Inact.; nest down		-	Old nest site; Alt. 20 24C
21 23A	Island Highway, Nanoose Bay	Inact.; remnant	Unknown	-	Old nest site
21 23B	Hillview Rd. A	Inact.; intact	Unknown	-	Alt: 21 23C
21 23C	Hillview Rd. B	Not found		?	Alt: 21 23B; nest down?
21 24A	DND Tower, CFMETR Base #1	Inact.; nest down < '95	Unknown; no info.	-	Old site; no active nest in territory known
21 24B	Nanoose Indian Reserve #1	**Act.**; intact	Active 3/96	0	Alt: 21 24C; failed '96
21 24C	Nanoose Indian Reserve #2	Inact.; intact		-	Alt: 21 24B
Totals (known active nest sites & brood production):			**3 +**	**2**	**Avg: 0.67 juv/active nest**

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville:					
21 25	Mostad's, Lantzville Rd.	**Act.**; intact	Active	2	***New nest '95-'96; pair from lost Blue Roofs site***
22 25	Jenna Dr. & Nestor Way	**Act.**; intact	Active	2	
22 26A	Seabold Rd.	**Act.**; intact	Active	1	
22 26B	Blueback Rd., Icarus Pt.	**Act.**; nest down ('95)	Active	0	***Adults obs.; no new nest built in '96; no brood***
22 26C	6258 Icarus Rd.	Inact.; nest down ('87)		-	Alt./perch tree for 22 26B
22 26D	Desmond Rd. & Icarus Rd.	**Act.**; intact	Active	0	Failed '96
22 26E	Sealand Park	Inact.; nest down < '94; tree topped	Active	-	Alt: 22 26F (D. Blood)
22 26F	Driftwood Pl.	**Act.**; intact		0	Failed '96
22 26G	Bayshore Dr. (alternate)	Inact.; remnant	Active	-	Alt: 22 26H
22 26H	Bayshore Dr. (original)	**Act.**; intact		0	Failed '96; nest/tree in use Oct.-July (nest log)

Appendix lB. Nanaimo area Bald Eagle nest site status and nesting success, 1996.

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville (cont 'd):					
22 27A	Gulf View Dr.	Inact.; intact	Active	-	Alt: 22 27B
22 27B	Morningside Dr.	**Act.**; intact		1	Alt. 22 27A
23 28A	Planta Park North	Inact.; nest down < '94	Active	-	Alt: 23 28B; old nest site, perch tree
23 28B	Planta Park South	**Act.**; intact		1	Alt: 23 28A
Totals (known active nest sites & brood production):			**9**	**7**	**Avg. 0.78 juv/active nest**

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
C. Duke Point, Jack Point & Cedar- Yellow Point:					
26 29A	North Jack Point (central)	**Act.**; intact	Active	1	Alt: 26 29B
26 29B	North Jack Point (west shoreline)	Inact.; nest down < '95		-	Alt: 26 29A; old nest site
26 29C	South Jack Point	Inact.; intact	Inact./alt.	-	Alt 26 29A?; old nest site
26 29D	Biggs Park, Jack Point	**Act.**; intact	Active	1	Adult obs. feeding chick
27 29A	Hooker Rd., Harmac/CanOxy	**Act.**; intact	Active	1	Alt: 27 29B; road closed
27 29B	Jackson Rd., Harmac/Duke Pt.	Inact.; remnant		-	Alt: 27 29A; old nest site
303 IA	Ingram Rd., Cedar	**Act.**; intact	Active	0	Failed; reported by owner
Totals (known active nest sites & brood production):			**4**	**3**	**Avg: 0.75 juv/active nest**

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
D. Winchelsea & Ballenas Is.: (Monitored by Harriet Rueggeberg, by kayak)					
R-2272	Southey Is. - southwest	**Act.**; intact	Active	1	nest difficult to observe
R-2273	Maude Is. - northwest	**Act.**; nest down '95	Active	0	***Rebuilding '96; no brood***
R-2274	S. Winchelsea Is. A - centre	**Act.**; intact	Active	2	
n/a	S. Winchelsea Is. B - 50 m E of A	Inact.; intact		-	Alt: R-2274; old nest site
R-2275	E. Ballenas Is. A, N. shore SE Is.	Unknown; intact	Unknown	?	Alt: R-2276?; old nest site
R-2276	E. Ballenas Is. B, W. side SE Is.	Unknown: intact		?	Checked late in season
n/a	Mistaken Is. A, on east shore	**Act.**; intact	Active	1	
n/a	Mistaken Is. B, on west shore	**Act.**; intact	Active	1	
Totals (known active nest sites & brood production):			**5**	**5**	**Avg: 1.0 juv./active nest**

Appendix lB. Nanaimo area Bald Eagle nest site status and nesting success, 1996.

Site No. 1996	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
E. French Creek Area:					
17 19C	French Creek Estuary	**Act.**; intact	Active	?	2 adults obs. May-June; no brood obs. (poor view)
18 17	Hamilton Marsh, Hilliers	**Act.**; intact	Active	2	
Totals (known active nest sites & brood production):			**1+**	**2**	**Avg: 2.0 juv/active nest**

Overall Bald Eagle Brood Production Success in the Nanaimo Area, 1996			
Total known active nest sites & brood production:	**21 nests**	**17 young**	**Avg: 0.81 juv./active nest**

Appendix 1C. Nanaimo area Bald Eagle nest site status and nesting success, 1997.

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
A: Nanoose Bay & Peninsula:					
20 23A	Parker Rd.	Inact.; intact	Active	-	Alt: 20 23B
20 23B	Russel Rd	**Act.**; intact		0	Alt: 20 23A
20 24A	Schooner Cove Dr. (Dolphin Lk.)	Inact. or failed; intact	Unknown	-	Adult nearby; (from 20 24B?)
20 24B	Fairwinds Golf Course	**Act.**; intact	Active	1	
20 24C	Brickyard Cove, Andover Rd	**Act.**; intact	Active	0	Failed '97
20 24D	Wallis Pt.; CFMETR Base #2	Inact.; nest down		-	Old nest site; Alt 20 24C
21 23A	Island Highway, Nanoose Bay	Inact.; remnant	Unknown	-	Old nest site, no nest
21 23B	Hillview Rd. A	Inact.; intact	Active (?)	-	Alt: 21 23C; adults obs.
21 23C	Hillview Rd. B	Not found		?	Alt: 21 23B; nest down?
21 24A	DND Tower; CFMETR Base #1	Inact.; nest down < '95	Reported active	?	Old site, no nest; may be new/alt. nest nearby
21 24B	Nanoose Indian Reserve #1	Inact.; intact	Active	-	Alt: 21 24C
21 24C	Nanoose Indian Reserve #2	**Act.**; intact		1	Alt: 21 24B
Totals (known active nest sites & brood production):			**4 +**	**2**	**Avg: 0.5 juv./active nest**

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville:					
21 25	Mostad's, Lantzville Rd.	**Act.**; intact	Active	0	Failed '97
22 25	Jenna Dr. & Nestor Way	**Act.**; intact	Active	1	
22 26A	Seabold Rd.	**Act.**; intact	Active	0	Failed '97
22 26B	Blueback Rd., Icarus Pt.	Inact.; nest down ('95)	Active	0	***New nest built in '97; no brood***
22 26C	6258 Icarus Rd.	Inact.; nest down ('87)		-	Alt./perch tree for 22 26B
22 26D	Desmond Rd. & Icarus Rd.	**Act.**; ***nest down '97***	Active	2	***Nest destroyed by brood in July '97***
22 26E	Scaland Park	Inact.; nest down < '94; tree topped	Active	-	Alt: 22 26F (D. Blood)
22 26F	Driftwood Pl.	**Act.**; ***tree down in March '97***		0	***Building new nest in nearby D. Fir tree***
22 26G	Bayshore Dr. (alternate)	Inact.; ***down '97***	Active	-	Alt: 22 26H; remnant '96
22 26H	Bayshore Dr. (original)	**Act.**; intact		1	Used Oct.-July (nest log)

Appendix 1C. Nanaimo area Bald Eagle nest site status and nesting success, 1997.

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
B: North Nanaimo & Lantzville (cont 'd):					
22 27A	Gulf View Dr.	Inact.; intact	Active	-	Alt: 22 27B
22 27B	Morningside Dr.	**Act.**; intact		0	Alt. 22 27A; failed '97
23 28A	Planta Park North	Inact.; nest down < '94	Active	-	Alt: 23 28B; old nest site, perch tree
23 28B	Planta Park South	**Act.**; ***nest down < April '97***		0	Alt: 23 28A; ***not rebuilt***
23 28C	**Hammond Bay Rd. @ Bonnie Dr.**	**Act.**; ***new nest***		**n/a**	***new nest built '97-'98***
Totals (known active nest sites & brood production):			**9**	**4**	**Avg. 0.44 juv/active nest**

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
C: South Nanaimo & Harewood:					
26 27A	Westwood Lk. A (Reservoir #4)	Inact.; intact	Active	-	Alt: 26 27B
26 27B	Westwood Lk. B (Reservoir #4)	**Act.**; intact		0	Alt: 26 27A; failed '97: ***new nest site record '97***
27 28	Chase R. (NE of Laurence Pkwy)	**Act.**; intact	Active	2	
Totals (known active nest sites & brood production):			**2**	**2**	**Avg. 1.0 juv/active nest**

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
D. Duke Point, Jack Point & Cedar-Yellow Point:					
26 29A	North Jack Point (central)	**Act.**; intact	Active	0	Alt: 26 29B; failed '97
26 29B	North Jack Point (west shoreline)	Inact.; down		-	old nest site, down < '95
26 29C	South Jack Point	Inact.; intact	Inact./alt.	-	Alt: 26 29A?; old nest site
26 29D	Biggs Park, Jack Point	**Act.**; intact	Active	2	
27 29A	Hooker Rd., Harmac/CanOxy	**Act.**; intact	Active	1	Alt: 27 29B; road closed
27 29B	Jackson Rd., Harmac/Duke Pt.	Inact.; ***remnant nest down '97***		-	Alt: 27 29A; old nest site
28 30	Barnes Rd., Cedar	**Act.**; intact	Active	2	Reported by owner
30 29A	Nanaimo R. A, South Wellington	Nest down <'97	Unknown	-	No sign of recent activity at either site
30 29B	Nanaimo R. B. South Wellington	Nest down <'97		-	Alt: 30 29A
30 31A	Ingram Rd., Cedar	**Act.**; ***nest down late May '97***	Active	0	Failed '97, 1 chick died, 1 in foster nest also died
Totals (known active nest sites & brood production):			**5**	**5**	**Avg: 1.0 juv./active nest**

Appendix lC. Nanaimo area Bald Eagle nest site status and nesting success, 1997.

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
E. Winchelsea & Ballenas Is.: (Monitored by Harriet Rueggeberg, by kayak)					
R-2272	Southey Is. - southwest	**Act.**; intact	Active	1	nest difficult to observe
R-2273	Maude Is. - northwest	**Act.**; nest down '95	Active	0	***rebuilding '97; no brood***
R-2274	S. Winchelsea Is. A - centre	**Act.**; intact	Active	1	
n/a	S. Winchelsea Is. B - 50 m E of A	Inact.; ***nest down '97***		-	Alt: R-2274; old nest site
R-2275	E. Ballenas Is. A, N shore SE Is.	Inact.; intact	Active	-	Alt: R-2276; old nest site
R-2276	E. Ballenas Is. B, W side SE Is.	**Act.**; intact		?	2 adults only obs.
n/a	Mistaken Is. A, on east shore	**Act.**; ***down '97***	Active	0	2 adults obs.; ***no brood***
n/a	Mistaken Is. B, on west shore	**Act.**; intact	Active	?	both nests used in '96
Totals (known active nest sites & brood production):			**4+**	**2**	**Avg: 0.5 juv./active nest**

Site No. 1997	Site Name (location)	Tree / Nest Status	Territory Status	Brood Prod'n	Comments
F. French Creek Area:					
17 19C	French Creek Estuary	**Act.**; intact	Active	?	2 adults obs. May-June; no brood obs. (poor view)
18 17	Hamilton Marsh, Hilliers	**Act.**; intact	Active	1	
Totals (known active nest sites & brood production):			**1+**	**1**	**Avg: 1.0 juv/active nest**

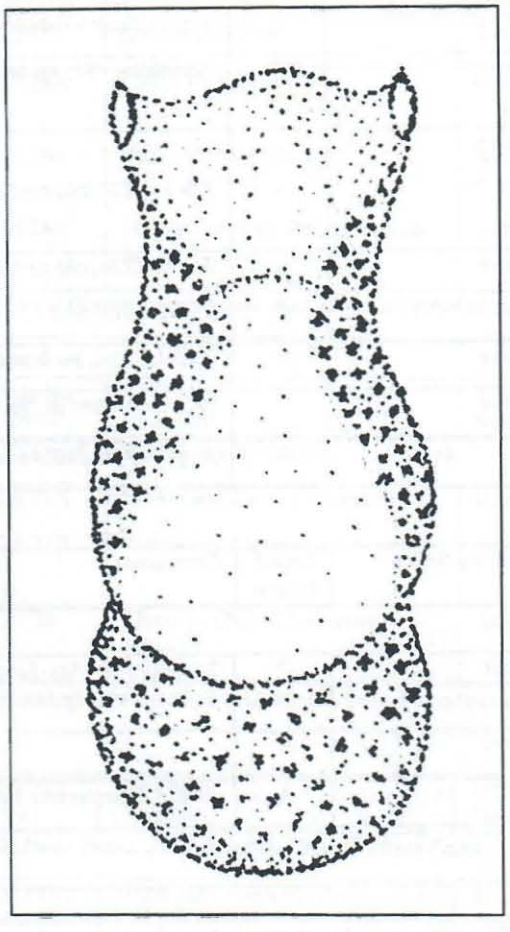
Overall Bald Eagle Brood Production Success in the Nanaimo Area, 1997			
Total known active nest sites & brood production:	**24 nests**	**15 young**	**Avg: 0.63 juv./active nest**

Bald Eagle Nest Size Changes and Additions in Nanaimo Study Area, 1997

Site No.	Site Name (location)	Status	Change	Comment
22 26F	Driftwood Pl. (former site)	Active	Nest/tree down Mar./97	Moved to nearby D. fir tree
22 26F	Driftwood Pl. (new site)	Active	New nest built spring '97	No breeding attempt
23 28B	Planta Park South	Active	Nest/tree top down > Apr./97	Moved to new site 23 28C
23 28C	Hammond Bay Rd. @ Bonnie Dr.	Active	New nest built late '97-'98	No breeding attempt
26 27B	Westwood Lk. @ Reservoir #4	Active	New nest record, Alt. 26 27A	40m NE 26 27A; failed '97
30 28 A/B	Nanaimo R. - Cassidy	Active	New report of 2 old nest sites	Reported 1 juv. '97 (NFN)

The Sea Slugs of Swy-A-Lana Lagoon

BILL MERILEES



Nanaimo's seaside walkway - the Queen Elizabeth II promenade passes a prominent man-made lagoon known as Swy-a-lana. As a decorative feature incorporated into this design are a number of trailside 'reflecting pools', gravel bottomed and flowing salt water.

I wonder how many people have ever looked closely into these pools to notice the sea slug *Haminoea vesicula*. This cryptic olive brown nudibranch with a thin transparent, parchment like, bubble shaped, shell has the common name Gould's Paper Bubble or Gould's Bubble Snail. In the pools alongside Swy-a-lana it is present in considerable numbers. A large specimen when gliding along the pebbles may be 2.5 cm long.

The more usual habitat for this snail is among eel grass or beds of green algae near or below the low tide line.

When the Nanaimo Harbour Commission contracted the design of this lagoon I'm certain the architect had not the least intention of creating a sea slug habitat. Without even trying they did a marvelous job.

"Enjoy the road the best is lost to those who travel quickly to journey's end" was a quotation noted many years ago. At Swy-a-lana, where a leisurely and slow walking pace is the norm and sea slugs are one of the more common creatures - how many passers by (other than a curious naturalist ??) would know they were near hundreds of Gould's Bubble Snails - let alone know that this interesting animal even exists?

Biological Control of Purple Loosestrife in Nanaimo

BRUCE COUSENS AND CHARLENE LEE

Introduction

The introduced Eurasian plant commonly known as Purple Loosestrife (*Lythrum salicaria*) is a herbaceous perennial that was imported to eastern North America in the early 1800's (Figure 1). It has spread westward from its original range and can now be found across Canada (DeClerck-Floate, 1992; Laing and Corrigan, 1996). Purple Loosestrife was discovered in the Nanaimo area around 1992.

This highly invasive weed is considered to present a serious ecological threat throughout North America because of its ability to spread rapidly and eventually dominate wetland areas, crowding out many other native plants, clogging shallow open water areas and thus reducing species and habitat biodiversity of invaded wetlands. This situation occurs because of the plant's vigour and prodigious capacity to reproduce by seed, runners and rooting of fragments (Canadian Wildlife Service, no date; Ducks Unlimited Canada, no date).

Purple Loosestrife has now become well established locally at the mouth of Chase River and around Diver Lake in the Millstone River system, is fairly well established in Buttertubs West Marsh (about 30 flowering clumps) and is beginning to appear in Buttertubs Marsh Conservation Area (two flowering clumps 4-5 years old).

Manual Control Methods

The Nanaimo Field Naturalists Club (NFNC) has been involved with combating this invasion since its discovery in 1992. Control options have been limited to seed head removal, uprooting of small plants and cutting back of large, well-established plants.

While young plants can be uprooted, eradication of an established stand is NOT a realistic option, since manual methods are ineffective and no herbicide is yet approved in Canada for use within or near wetlands. A formulation of Roundup called "Rodeo", a non-specific herbicide, is approved for wetland use against Purple Loosestrife in the USA (Blossey et al, 1994). However, Canada is taking a more cautious approach to the application of non-specific systemic herbicides in wetlands. The active ingredient in Roundup, glyphosate, is considered to break down in soil very rapidly and safely into compounds not directly toxic to plants or animals (people, pets, birds, bees, etc.). Consequences of its use in aquatic ecosystems and possible longer term effects on other biological processes (e.g. larval insect maturation) are still being determined (Ducks Unlimited Canada, no date).

Even if a demonstrably safe herbicide becomes approved and available for spot application to target plants in wetlands, it is not a long term solution for mature stands, since Purple Loosestrife seeds may lie dormant for a number of years before germination (Ducks Unlimited Canada, no date), leading to the establishment of a "seedbank". Seedbanks have

already been established at Chase River, Diver Lake, Buttertubs West Marsh and within the Buttertubs Marsh Conservation Area as well. Also, new seeds may be imported repeatedly from more distant Purple Loosestrife infested areas on the feathers and/or in the digestive tracts of migrating waterfowl. Therefore, this weed will be in Nanaimo for the foreseeable future and an ongoing control effort will be required.

Biological Control Methods

Inquiries about control methods led us to Mr. Roy Cranston, Provincial Weed Specialist in the B.C. Ministry of Agriculture, Fisheries and Food, who was responsible, at the time, for the B.C. Purple Loosestrife Control effort. The main features of this program involve registration and annual updating of the location and extent of purple loosestrife infested sites in their weed database and implementation of a (so far experimental) biological control program, using insects that feed exclusively on/in Purple Loosestrife and limit its development in its native Eurasian habitats.

After rigorous host specificity testing, Canadian federal government approval was obtained in 1991 for release of three species of beetles that attack only Purple Loosestrife (two Chrysomelid leaf beetles and one Curculionid or root weevil). Since the initial releases of leaf-eating beetles (*Galerucella calamariensis*) in 1993 in British Columbia (in Vancouver, Burnaby, Chilliwack and Penticton), additional introductions of this beetle were made in the Lower Mainland, Boundary Bay and the Okanagan. A second leaf-eating beetle (*G. pusilla*) was introduced to the Campbell River and Kelowna areas, as well as a release of the root weevil (*Hylobius transversovittatus*) at Iona Island (Cranston, 1994).

It is important to note that this beetle introduction program requires the ongoing presence of Purple Loosestrife in the experimental release areas, both to provide the beetles a food source for their survival and to provide undisturbed local study sites for monitoring success of the program and collection of beetles for transfer to other infested areas. Within the primary release study sites, removal of flower/seed heads to prevent spreading by seed is desirable and (presumably) does not interfere with the bio-control program, but uprooting established plants or cutting them to the ground will disrupt the program and must be avoided, since the beetle larvae feed and overwinter in the lower stems and root crowns of the plant.

Biological Control Project in Nanaimo

In the winter of 1994, application was made to Mr. Cranston for the NFNC to participate in the Purple Loosestrife biological control program. We were put on the list for receiving a shipment of bio-control beetles when the next batch became available from Agriculture Canada, likely in the spring of 1995 when the reproductive cycle resumed.

Prior to receipt of the bio-control beetles, we needed to identify an appropriate study site and receive approval from the landowner(s) to conduct the study on their property. In May 1995, we explored the shore and marshes at Diver Lake to determine the abundance and distribution of Purple Loosestrife around the lake, identify the major concentrations and select suitable locations for the control and release study plots. The most suitable location seemed to be in the marsh at the southeast end of the lake, just within the City park

boundary. After discussing the project and inspecting the proposed study area with City Parks and Maintenance staff, the City of Nanaimo issued the NFNC a letter of approval authorizing us to conduct the bio-control study in the City park area at Diver Lake.

Initial beetle release

A shipment of cultured bio-control beetles (*G. calamariensis*) for a Nanaimo experimental study arrived by courier from Agriculture Canada on June 6, 1995. Of the 246 beetles shipped, 216 were released in a 5 m square study plot at Diver Lake that evening, 20 were retained for an attempt at backup cage culture on potted Purple Loosestrife, and 10 were dead on arrival due to normal mortality in transit.

The study plot is located in the northeast corner of Diver Lake Park, in an open stand of Purple Loosestrife and well away from areas of public use (hip waders are required for access) to minimize the chance of interference. When we inspected the area earlier, we noted that much of the Purple Loosestrife had been heavily browsed by the local deer population, so we fenced off the release plot with 6-foot high plastic mesh normally used to keep birds out of fruit trees, in hopes of discouraging the deer from eating the release plot plants and maybe the valuable beetles as well. This was a light, cheap, easily erected and (from any distance) nearly invisible solution, though hardly impenetrable, but it worked - at the end of August, the fence was still standing, the plants within were intact and the plot was undisturbed.

As one might expect, 216 small brown beetles (each about 3 mm long, a bit smaller than a lady bug; Fig. 2) quickly disappeared in a 5 m square plot of lush marsh vegetation. Evidence of their continued presence in the form of shot-hole feeding damage in Purple Loosestrife leaves (Fig. 3) was apparent in and within a few meters of the release plot nearly three weeks later.

Inspections after mid-August indicated some recent feeding damage on new foliage at the release plot, as well as in other nearby areas of the marsh, so at least some beetles were still present in the study area. However, no beetles or larvae were seen.

Cage culture on potted purple loosestrife

A total of 20 beetles were retained for an attempt at culture on potted and caged Purple Loosestrife, both to monitor progress in our climate and, with luck, to build up a second population for eventual release. The beetles were divided between two apparently healthy plants, and were retained on the plants by fine mesh cages to keep them from escaping. Initially, all appeared to go well, and the beetles proceeded to feed on the leaves, mate and lay eggs.

These plants developed aphid infestations and began to wilt. Aphid infestations were also observed at all field sites, along with healthy populations of aphid predators, including assorted species of lady bugs, lacewing larvae (a.k.a. "aphid lions") and syrphid (hover) fly larvae and adults. We collected a dozen or so lady bug adults and several syrphid and lacewing larvae from wild loosestrife, and turned them loose in the cages. They made fairly

short work of the aphids and proceeded to the next stage of their life cycle - the adult lady bugs laying eggs and the larval forms pupating and emerging as adults.

Meanwhile, the Purple Loosestrife plants gradually recovered and the bio-control beetles lived out their short lives, laid more eggs, then died in the normal manner. Unfortunately, no larvae were produced to continue the population. Many of the eggs failed to hatch and instead appeared to dry up and collapse, which may indicate the need for higher humidity than available in the average garden. Predation on beetle larvae by the aphid predators was not observed (since few beetle larvae were observed) but may have occurred.

Year One - beetle survival

Approximately one year after the initial beetle release, we inspected the study area (Aug. 25, 1996) to monitor beetle survival and found that the beetle introduction was successful. The beetles that resulted from reproduction on the site last summer had survived the winter and dispersed beyond the release area.

We did not find live larval or adult beetles during our inspection, but there was ample evidence of their feeding activity on loosestrife leaves and stems in and adjacent to the release plot, as well as in several pockets of infestation at least 50-75 m away, both within and outside the park boundary. Feeding damage was variable even within the release plot and ranged from light to quite heavy on specific plants. Deer browsing on young top growth of loosestrife plants was again evident, producing some low bushy plants outside the fenced release plot.

Year Two - beetle population increase

1997 had one of the wettest winter-spring seasons on record, resulting in high lake levels well into June and flooding of the study area for most of this time. In addition to restricting access, prolonged winter-spring flooding is considered to be detrimental to beetle overwinter survival and spring emergence (Peggy Liu, pers. comm.), so we were quite concerned.

However, when the study plots at Diver Lake were inspected on August 10, 1997, newly emerged (tan coloured) beetles were evident on loosestrife plants in and near the study plot. In fact, the impact of the beetles on the Purple Loosestrife was higher than we expected for the second season. The loosestrife plants in and adjacent to the release plot suffered extensive defoliation, some stunting of growth, significant reduction or inhibition of flowering and some top-kill.

Dispersal of the leaf beetle had increased slightly since the previous year. There was some increase in leaf damage in the Purple Loosestrife clumps in the duck pond (over 100 m from the release plot), some limited patchy leaf damage west to Kenworth Rd., and some new damage this year in the SW area of the lake shore.

On August 11 we visited the beetle study area with Peggy Lue and Janis Newhouse, two students from the UBC Women in Science Program, so they could assess the success of the

beetle release and the bio-control of Purple Loosestrife for comparison with other release sites on Vancouver Island and the Lower Mainland. They were impressed with the extent of the damage near the release plot ("the greatest impact they had seen"), especially given the relatively short time since release (2 yrs) and the extent of the winter-spring flooding.

They also provided a quantitative data collection protocol and sample data forms developed at Cornell University (New York) for monitoring the progress and impact of biological controls on Purple Loosestrife infestations in North America. Since much of Purple Loosestrife around portions of the lake shore had already had flower spikes removed, permanent sample quadrats in areas away from the release site will be set up in the spring of 1998.

Additional beetle releases

Diver Lake

On August 10, 1997 we collected 80 beetles at the original study site and released them on Purple Loosestrife plants at the shoreline on the south side of Diver Lake, just west of the duck feeding area at the main park access.

Chase River estuary

On August 11, 1997 about 100 mature leaf beetles (*G. calamariensis*) from UBC, provided by Peggy Liu, and an additional 40 mostly newly emerged beetles from Diver Lake study area (total 140) were released at Chase R. estuary in the early evening. The release plots are on either side of small muddy slough that was the original channel of Wexford Creek before its diversion into the Nanaimo River estuary.

The release plots were inspected again on August 13. A few beetles were found and localized leaf damage was observed on shoot tips of some Purple Loosestrife plants.

Sample data was collected for a $1m^2$ quadrat at the release plot on the south side of the slough channel. The quadrat was marked with pink survey tape temporarily until stakes could be put in place. Flower head removal was completed in Purple Loosestrife stands along the main channel, but was not done along the slough channel near the release plots. If the flowers are a visual key for locating host plants during beetle dispersal, the presence of the flowers might help to keep early dispersal localized.

Acknowledgments

We would like to thank those people who have participated in the Purple Loosestrife seed head removal and uprooting of young plants and encourage them and others to participate again in future years. These include: Steve and Kanya Baillie and family, Margie Bryant, Elthea Dale, Arline Haddaway, Harriet Rueggeberg, Meike Smits Van Ham, Jill Sims, Tony Guppy, Joe Materi, Chad Henderson, Mia Parker, Scott Pilcher, members of the PRIMUS II Environmental Team and the Provincial Environmental Youth Team and any others who came out to help that we may have missed.

We would also like to thank Roy Cranston, Provincial Weed Specialist at the B.C. Ministry of Agriculture, Fisheries and Food, City of Nanaimo Parks and Maintenance staff and Peggy Liu and Janis Newhouse, students of the UBC Women in Science Program for their support and co-operation.

Literature Cited

Blossey, B., D. Schroeder, S.D. Hight, and R.A. Malecki. 1994. Host specificity and environmental impact of the weevil *Hylobius transversovittatus*, a biological control agent of Purple Loosestrife (*Lythrum salicaria*). Weed Science 24: 128-133.

Canadian Wildlife Service. no date. Beautiful killer (brochure and purple loosestrife report form). Canadian Wildlife Service.

Cranston, R. 1994. Biological control of Purple Loosestrife. Update, June 1994. Ministry of Agriculture, Fisheries and Food. Surrey, B.C.

DeClerck-Floate, R. 1992. The desirability of using bio-control against Purple Loosestrife in Canada. Agriculture Canada. Lethbridge, Alberta.

Ducks Unlimited Canada. no date. Purple Loosestrife (brochure and report form). Ducks Unlimited Canada.

Laing, J.E. and J.E. Corrigan. 1996. Field identification of *Galerucella* beetles: biological control agents of Purple Loosestrife. Department of Environmental Biology, University of Guelph, Guelph, Ontario.

Liu, Peggy, pers. comm., student, UBC Women in Science Program.

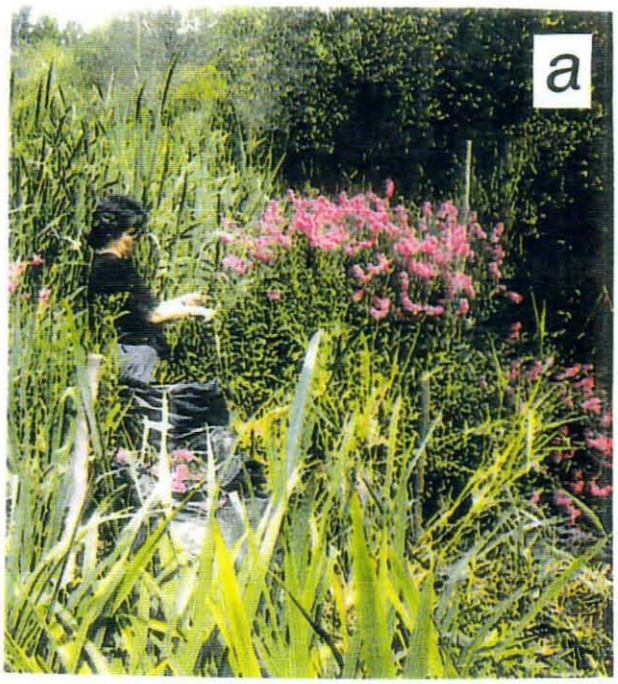


Figure 1. Purple Loosestrife (*Lythrum salicaria*)
a) at Buttertubs West Marsh, and
b) flower spike.

Figure 3. Feeding (shot-hole) damage inflicted by adult *Galerucella* beetles.
(from Laing & Corrigan, 1996)

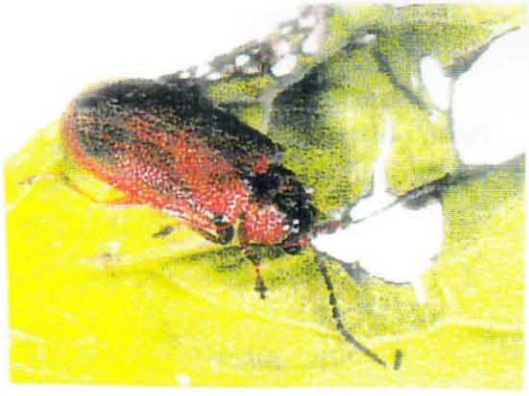


Figure 2. Adult *Galerucella*.
About 7X natural size.
(from Laing & Corrigan, 1996).

Recent Additions to the Bird Checklist of Nanaimo

STEVE BAILLIE

Members of the Nanaimo Field Naturalists have prepared several checklists of the birds that have been seen in the area over the years and have published several. The first one that was published was put together by Rick Ikona, Don Blood and Peter Van Kerkoerle in 1986 and listed 225 species. I prepared a new list in 1992 for the purposes of distributing to birding classes that included 21 additional species for a total of 246. The new species for this list came from historical records as well as diligence of the local birders. In 1996 the club published a new checklist which listed 258 species. This article describes 9 species of birds that represent additions to the 1996 list which brings the total to 267.

Acceptance of sight records.

To establish a rare sighting, the bird in question must be confirmed by a second, independent observer. Unfortunately the birds don't always hang around waiting for someone else to see it. Photographs are acceptable if the bird can be identified from it and a specimen is irrefutable though please keep in mind that specimen collecting with a gun is illegal. Some of the following records have been seen by only one observer. I have requested a written description from the observer to support their sighting and have accepted them for our checklist on the basis of that description.

Red-shouldered Hawk

Peter and Anneke Van Kerkoerle have seen this species occasionally through the years during spring migration. On 4 May 1998 Peter observed a red-shouldered hawk he describes as:

> "We observed a slenderer bird than red-tailed hawk. A clear spot in the wing that showed bars. When the light was a little better we could see that the bird was light brown but did not have any special markings. Wings were narrower at base than wings of red-tailed hawk, and the hawk flew much more buoyantly."

Peter's observations have been sent to the provincial authorities. Peter has also reported one flying over the ridge next to his Cassidy farm in September 1995, in the company of a common raven.

Piping Plover

Mr. Peter Scott provided this record, which has been submitted to the provincial authorities. Several other sightings of this species has occurred in BC, but none have been accepted yet. Peter saw the bird in question at the Dumont Marsh, off Normorel and Sywash Ridge Roads in early July 1997. He describes the bird as having a white breast and belly, a tawny back, very evident orange bill and legs, with an obvious lack of any neck markings, and about 7-8 inches in length. Incidentally, Peter also saw an eastern kingbird here at about the same time which is very rarely seen in our area.

Semipalmated Sandpiper

On 7 August 1996 Guy Monty, Donna McKean, and Bruce Colvin were birding in the Nanaimo River Estuary. At around 12:30 pm they came upon an incredible group of shorebirds on a gravel bar. Using a spotting scope, they identified:

2 semipalmated plovers,
15 killdeer,
9 greater yellowlegs,
4 lesser yellowlegs,
1 solitary sandpiper,
1 semipalmated sandpiper,
50+ western sandpipers,
20 least sandpipers, and
3 pectoral sandpipers.

The solitary sandpiper and semipalmated plover are listed as vagrants on the 1996 Nanaimo Checklist, and the semipalmated sandpiper has not been recorded here before. Bruce spotted and identified the bird. The field notes are: 'peep' type sandpiper, slightly smaller than western sandpipers, bill noticeably shorter than westerns, a little thicker at the base. Overall, grayer with no rusty tinge at all on back as westerns, back is gray edged with a dull gray-brown.

Stilt Sandpiper

Guy, Donna and Bruce were back at Nanaimo River Estuary on 26 September 1996 trying to add another species to the local checklist. While searching over the fields beyond the model airplane landing area, they located a stilt sandpiper. The bird is described as about the size of a lesser yellowlegs, with extremely long gray-yellow legs, long bill with a slight droop at the tip. There was faint barring on the upper breast, and belly was a clear gray. The crown was rusty brown, with a distinct white eyebrow and a red-brown stripe below the eye from lore to ear. The back feathers showed well defined rusty edges, the rump was white, and the tail was grayish. When it flushed it gave a very raspy 'hue hue hue'.

Little Gull

Little gulls are seen periodically on the BC coast and it was only a matter of time before one was reported from this area. Mr. Dave Martens, a visitor from Ontario, watched a winter plumage little gull from Sealand Park on 10 August 1997. It was also seen by Linda Wladarski, Carol and Chris Jenkins. In Dave's words:

> We were sitting on the beach at Sealand Park from ~3:30 to 4:30 pm watching birds fishing and flying by. There were about 20 Bonaparte's gulls within sight, some close to shore, some further out, some flying along the shoreline, some sitting on emergent rocks. At 4:00 pm a small gull flew past us to the south towards Neck Point about 100 m from shore. I could see with my eyes that it wasn't a Bonaparte's, so grabbed a pair of binoculars and immediately identified it as a little gull because of the solid black underwing and pale grey upperwing (no black tips or white mirrors). About 10 minutes later the little gull returned, this time flying north along the shoreline but only about 50

metres out. The bird was fishing because at one point it "wheeled" around (showing its full under and upper wing pattern) and dove to pick up a small fish from the surface. The bird eventually headed out from shore to join a group of fishing Bonapartes's gulls. We did not trace the bird after this point.

Dave added that he sees about 5-20 little gulls a year from Ontario, especially in winter plumage.

A little gull, possibly the same one, was reported at the Morningside Golf Course with 50 Bonaparte's gulls on 15 September 1997

Western Gull

The most abundant gull here is the glaucous-winged gull and it interbreeds with the western gull which is found along the coast of Washington, Oregon and California. There are numerous individual gulls here that are obviously intergrades with darker primaries and mantle but not dark enough to be called a full western gull. I found a western gull during the 1990 Christmas Bird Count and on 23 February 1991 at the Nanaimo River Estuary. This species should have been included on the 1996 checklist but was overlooked.

Sabine's Gull

An adult summer plumage bird was seen by Guy Monty at Neck Point on 14 Sept 1996. These birds are uncommon off the west coast of Vancouver Island in late summer, and are rarely seen in inside waters.

Yellow-throated Warbler

A yellow-throated warbler was seen on Gabriola Island, near Nanaimo, BC. The bird was first sighted on or about 3 January 1998 by Diana and Ron Mumford at the tray feeder on the sundeck of their home. They phoned our local bird hotline on Wednesday, 7 January 98. Photographs were taken of the bird on 8 Jan 98 by Ron Mumford, the owner of the birdfeeder (BC Photo 1613). The bird was seen by numerous birders over the ensuing three weeks at this location. It was last reported by the Mumfords on 25 January 98 when they suspect a hawk of unknown species preyed on the warbler. This was the first record of this species for BC.

The bird had bright plumage, with a completely white supercilium. The ear-coverts and forehead were black, not grey, indicating the bird was an adult male (Curson et al., 1994). The colour of the supercilium indicates that the bird was the *albilora* subspecies.

The breeding distribution of the species is southeastern United States and the Bahamas. The winter distribution of the species is normally Mexico south to Costa Rica, the coastal Caribbean states and many of the Caribbean islands. Vagrants have appeared in Canada from Saskatchewan east, but mainly in Ontario in spring. Vagrants have also appeared in the New England states and Columbia (Curson et al., 1994). In California it has occurred in all seasons and 1-2 times per year both in spring and fall. There was also a recorded unsuccessful breeding attempt (Small, 1994). In Oregon the species has been reported twice, in spring (Gilligan et al., 1994) and has not been reported in Washington.

The observed subspecies breeds from the Appalachian Mountains in the eastern United States, along the Mississippi River and into central Texas. It winters in Central America from Mexico to Costa Rica (Curson et al., 1994). Most of the California records are of this subspecies (Roberson, 1980).

The Gabriola bird was usually seen at a feeder. It appeared to be eating white millet or cracked corn, and suet. It was also observed gleaning for insects in and around the house, and on the household compost pile. There are many bird feeders present in the neighbourhood, and the bird was also seen at some of them. Toward the end of the observation period, the bird was spending a majority of the day in the yard of the Mumford residence.

References cited:

Curson, Jon, David Quinn, and David Beadle. 1994. Warblers of the Americas: an identification guide. Houghton Mifflin Company. ix + 252 pp.

Gulligan, Jeff, Mark Smith, Dennis Rogers, and Alan Contreras, editors. 1994. Birds of Oregon: Status and Distribution. Cinclus Publications. 330 pp.

Small, Arnold. 1994. California Birds: Their Status and Distribution. Ibis Publishing Company. 416 pp.

Roberson, Don. 1980. Rare Birds of the West Coast. Woodcock Publications. xxxii + 496 pp.

Grasshopper Sparrow

Peter Van Kerkoerle was birding at his favourite site, the Nanaimo River Estuary on 11 September 1995 when he found in the parking area at the end of Raines Road a sparrow that had never been seen in Nanaimo before. His description:

> Large beak, low front head. Gray stripe above eye, with an off white band over head from beak to neck. Spotted (streaked) on flank under wing, and possibly on chest. The wing had a brown patch on the mid-section, and legs were red in colour.

In BC this grassland species is a local breeder in the Vernon area of the Okanagan. It migrates south during the September/early October period which coincides with Peter's sighting. The streaking along the flank indicates this is a juvenile bird which are more likely to wander off the usual migration paths.

The Botanical Community of Gabriola Island

JANE JAMES AND PHYLLIS FAFARD

Retired from our careers as Botanist (Jane) and Landscape Architect (Phyllis), we have been meeting regularly since the fall of 1992 to explore and document Gabriola Island's rich and varied plant environment. We thought that our list might be of use to others interested in the local flora and want to share it. It is by no means complete and the occasional discovery of a "new" species keeps us searching. (If you note a species we have missed, please record it and let us know.)

We have relied for identification upon *Flora of the Pacific Northwest*, Hitchcock and Cronquist (1973); *Trees, Shrubs and Flowers to Know in British Columbia and Washington*, Lyons and Merilees (1995); and *Plants of Coastal British Columbia*, Pojar and Mackinnon (1994). As well, Jennifer Penny, visiting botanist from the Conservation Data Centre, added a number of plant species, notably in the sedge family, to the list.

We have indicated introduced and naturalized species with an asterisk. Rather than attempt to arrange species by common names, floral colour or habitat, we have organized plants by family. This has enabled us to observe the similarities of plants in a given family and to note interesting relationships.

Native plants are integral parts of their biological communities. Many wild plants take years to flower and casual picking can quickly destroy a population. We request anyone using this list to leave the flora for others to enjoy, and please to respect parks and private property.

Family	Latin Name	Common Name
Beech	*Quercus garryana*	Garry oak
Cypress	*Thuja plicata*	Western red cedar
Holly	*Ilex aquifolia* *	Holly
Maple	*Acer glabrum*	Douglas' maple
Maple	*Acer macrophyllum*	Big-leaf maple
Pine	*Abies grandis*	Grand fir
Pine	*Pinus contorta*	Lodgepole pine
Pine	*Pinus monticola*	Western white pine
Pine	*Pseudotsuga menziesii*	Douglas fir
Pine	*Tsuga heterophylla*	Pacific hemlock
Yew	*Taxus brevifolia*	Western yew
Arum	*Lysichitum americanum*	Skunk cabbage
Duckweed	*Lemna minor*	Water lentil - Duckweed

Lily	*Allium acuminatum*	Hooker's onion
Lily	*Allium cernuum*	Nodding onion
Lily	*Brodiaea coronaria*	Harvest brodiaea
Lily	*Brodiaea hyacinthina*	Fool's onion
Lily	*Camassia leichtlinii*	Leichtlin's camas
Lily	*Camassia quamash*	Common camas
Lily	*Erythronium oregonum*	Easter lily
Lily	*Fritillaria lanceolata*	Chocolate lily
Lily	*Lilium columbianum*	Tiger lily
Lily	*Maianthemum dilatatum*	False lily-of-the-valley
Lily	*Trillium ovatum*	White trillium
Lily	*Zygadenus venenosus*	Death-camas
Iris	*Iris pseudacorus* *	Yellow flag
Iris	*Sisyrinchium angustifolium*	Blue-eyed grass
Orchid	*Calypso bulbosa*	Fairy-slipper
Orchid	*Corallorhiza maculata*	Spotted coral-root
Orchid	*Goodyera oblongifolia*	Rattlesnake-plantain
Orchid	*Listera cordata*	Heart-leaf twayblade
Orchid	*Platanthera eleglans*	Elegant rein-orchid
Orchid	*Platanthera unalascensis*	Alaska rein-orchid
Orchid	*Spiranthes romanzoffiana*	Hooded ladies-tresses
Willow	*Populus balsamifera*	Balsam poplar
Willow	*Populus tremuloides*	Trembling aspen
Willow	*Salix lasiandra* var. *lasiandra*	Pacific willow
Willow	*Salix scouleriana*	Scouler's willow
Willow	*Salix sitchensis*	Sitka willow
Birch	*Alnus rubra*	Red alder
Birch	*Corylus avellana* *	European filbert
Nettle	*Urtica dioica* *	Stinging nettle
Buckwheat	*Polygonum aviculare* *	Doorweed
Buckwheat	*Polygonum convolvulus* *	Dullseed
Buckwheat	*Polygonum persicaria*	Spotted lady's thumb
Buckwheat	*Polygonum spergulariaeforme*	Fall knotweed
Buckwheat	*Rumex acetosella* *	Sheep sorrel
Buckwheat	*Rumex conglomeratus* *	Clustered dock
Buckwheat	*Rumex crispus* *	Curly dock
Goosefoot	*Atriplex patula* var. *litorali*	Atriplex
Goosefoot	*Chenopodium album*	Lamb's quarters
Goosefoot	*Salicornia virginica*	Samphire
Goosefoot	*Suaeda maritima*	Seablite
Purslane	*Montia cordifolia*	Heart-leafed montia
Purslane	*Montia linearis*	Indian lettuce

Purslane	*Montia parvifolia*	Little leaf montia
Purslane	*Montia perfoliata*	Miner's lettuce
Purslane	*Montia sibirica*	Siberian lettuce
Pink	*Arenaria macrophylla*	Big leaf sandwort
Pink	*Cerastium arvense*	Field chickweed
Pink	*Cerastium vulgatum*	Mouse-eared chickweed
Pink	*Lychnis alba* *	White campion
Pink	*Lychnis coronaria* *	Rose campion
Pink	*Silene armeria* *	Sweet William catchfly
Pink	*Spergula arvensis* *	Stickwort
Pink	*Spergularia canadensis* var *occ.*	Canadian sand spurry
Pink	*Spergularia rubra* *	Red sand spurry
Pink	*Stellaria media* *	Chickweed
Water-lily	*Nuphar polysepalum*	Yellow water-lily
Buttercup	*Anemone lyalli*	Lyall's anemone
Buttercup	*Aquilegia formosa*	Red columbine
Buttercup	*Clematis vitalba* *	Travelers-joy
Buttercup	*Ranunculus aquatilis*	White water buttercup
Buttercup	*Ranunculus flammula*	Creeping buttercup
Buttercup	*Ranunculus occidentalis*	Western buttercup
Buttercup	*Ranunculus repens* *	Creeping buttercup
Buttercup	*Ranunculus uncinatus*	Little buttercup
Barberry	*Achlys triphylla*	Vanilla leaf
Barberry	*Mahonia aquifolium*	Shining oregongrape
Barberry	*Mahonia nervosa*	Dull oregongrape
Poppy	*Eschscholzia californica* *	California poppy
Fumitory	*Dicentra formosa*	Pacific bleedingheart
Mustard	*Cakile edentula*	American searocket
Mustard	*Capsella bursa-pastoris* *	Shepherd's purse
Mustard	*Cardamine oligosperma*	Little western bittercress
Mustard	*Cardamine pulcherrima*	Slender toothwort
Mustard	*Draba verna*	Common whitlow grass
Mustard	*Erysimum cheiranthoides* *	Treacle mustard
Mustard	*Lepidium campestre*	Field peppergrass
Mustard	*Rorippa calycina*	Yellowcress
Mustard	*Rorippa palustris*	Marsh yellowcress
Mustard	*Sisymbrium officinale* *	Hedge mustard
Stonecrop	*Sedum acre* *	Golfmoss sedum
Stonecrop	*Sedum spathulifolium*	Spatula leaf sedum
Saxifrage	*Heuchera micrantha*	Small flower alumroot
Saxifrage	*Lithophragma bulbifera*	Bubiferous fringecup
Saxifrage	*Lithophragma parviflora*	Small fringecup

Saxifrage	*Mitella nuda*	Mitrewort
Saxifrage	*Saxifraga ferruginea*	Rusty saxifrage
Saxifrage	*Saxifraga integrifolia*	Early saxifrage
Saxifrage	*Tellima grandiflora*	Tall fringecup
Saxifrage	*Tiarella laciniata*	False mitrewort, Foamflower
Saxifrage	*Tiarella trifoliata*	Trefoil foamflower
Currant	*Ribes lobbii*	Gummy gooseberry
Currant	*Ribes sanguineum*	Red currant
Hydrangea	*Philadelphus lewisii*	Mockorange
Rose	*Amelanchier alnifolia*	Saskatoon berry
Rose	*Crataegus douglasii*	Black hawthorn
Rose	*Crataegus monogyna* *	Hawthorn
Rose	*Fragaria vesca*	Woods strawberry
Rose	*Fragaria virginiana*	Strawberry
Rose	*Geum macrophyllum*	Largeleafed avens
Rose	*Holodiscus discolor*	Ocean-spray
Rose	*Malus fusca*	Western crabapple
Rose	*Oemlaria cerasiformis*	Indian plum
Rose	*Physocarpus capitatus*	Pacific ninebark
Rose	*Potentilla pacifica*	Pacific silverweed
Rose	*Prunus emarginata*	Bitter cherry
Rose	*Prunus spinosa*	Blackthorn
Rose	*Prunus virginiana* var. *demissa*	Chokecherry
Rose	*Rosa gymnocarpa*	Little wild rose
Rose	*Rosa nutkana*	Nootka rose
Rose	*Rubus discolor* *	Himalayan blackberry
Rose	*Rubus laciniatus* *	Evergreen blackberry
Rose	*Rubus leucodermis*	Blackcap
Rose	*Rubus parviflorus*	Thimbleberry
Rose	*Rubus spectablis*	Salmonberry
Rose	*Rubus ursinus*	Trailing blackberry
Rose	*Sorbus aucuparia* *	Mountain ash
Rose	*Spirea douglasii*	Hardhack
Pea	*Cytisus scoparius* *	Scotch broom
Pea	*Lathryus japonicus*	Japanese beach pea
Pea	*Lathryus latifolius* *	Perennial pea
Pea	*Lathryus nevadensis*	Nevada peavine
Pea	*Lotus micranthus*	Small-flowered lotus
Pea	*Lotus pinnatus*	Bog bird's foot trefoil
Pea	*Lupinus arboreus* *	Tree lupine
Pea	*Lupinus micranthus*	Bicoloured lupine
Pea	*Lupinus polyphyllus*	Bigleaf lupine
Pea	*Medicago lupulina* *	Black medic
Pea	*Medicago sativa* *	Alfalfa

Pea	*Melilotus alba* *	White sweet clover
Pea	*Melilotus officinalis* *	Yellow sweet clover
Pea	*Trifolium pratense* *	Red clover
Pea	*Trifolium procumbens*	Hop clover
Pea	*Trifolium repens* *	White clover
Pea	*Trifolium tridentatum*	Lance clover
Pea	*Vicia americana*	American vetch
Pea	*Vicia cracca*	Tufted vetch
Pea	*Vicia disperma*	Two seeded vetch
Pea	*Vicia gigantea*	Giant vetch
Pea	*Vicia hirsuta* *	Hairy vetch
Pea	*Vicia sativa* *	Common vetch
Geranium	*Erodium cicutarium* *	Filaree
Geranium	*Geranium dissectum* *	Cut-leaf geranium
Geranium	*Geranium molle* *	Dovefoot geranium
Geranium	*Geranium robertianum* *	Herb Robert
Oxalis	*Oxalis corniculata* *	Creeping yellow wood-sorrel
Oxalis	*Oxalis stricta*	Upright yellow wood-sorrel
Spurge	*Euphorbia peplus* *	Petty spurge
Sumac	*Rhus diversiloba*	Poison oak
Staff-tree	*Paxistima myrsinites*	False box
Buckthorn	*Rhamnus purshiana*	Cascara
Mallow	*Sidalcea hendersonii*	Henderson's checker-mallow
St. John's-wort	*Hypericum anagalloides*	Bog St. John's Wort
St. John's-wort	*Hypericum perforatum* *	St. John's Wort
Violet	*Viola adunca*	W. Long-spurred violet
Violet	*Viola glabella*	Yellow wood violet
Violet	*Viola palustris*	Marsh violet
Violet	*Viola sempervirens*	Evergreen violet
Oleaster	*Shepherdia canadensis*	Buffaloberry
Evening Primrose	*Circaea alpina*	Enchanter's nightshade
Evening Primrose	*Epilobium angustifolium*	Fireweed
Evening Primrose	*Epilobium ciliatum*	Purple-leafed willowherb
Evening Primrose	*Epilobium minutum*	Small flowered willowherb
Evening Primrose	*Epilobium paniculatum*	Tall annual willowherb
Evening Primrose	*Epilobium watsonii*	Watson's willowherb
Ginseng	*Hedera helix* *	Ivy
Parsley	*Anthriscus scandicina* *	Chervil
Parsley	*Daucus carota* *	Queen Anne's lace
Parsley	*Foeniculum vulgare* *	Sweet fennel

Parsley	*Heracleum lanatum*	Cow parsnip
Parsley	*Lomatium utriculatum*	Spring gold
Parsley	*Oenanthe sarmentosa*	Water- parsley
Parsley	*Osmorhiza chilensis*	Sweet cicely
Parsley	*Sanicula crassicaulis*	Pacific sanicle
Dogwood	*Cornus nuttallii*	Pacific dogwood
Indian Pipe	*Monotropa uniflora*	Indian-pipe
Heath	*Arbutus menziesii*	Arbutus
Heath	*Arctostaphylos columbiana*	Bristly manzanita
Heath	*Arctostaphylos uva-ursi*	Kinnikinnick
Heath	*Arctostaphylos x media*	Media manzanita
Heath	*Chimaphila umbellata*	Prince's-pine
Heath	*Gaultheria shallon*	Salal
Heath	*Ledum groenlandicum*	Labrador tea
Heath	*Vaccinium ovatum*	Evergreen huckleberry
Heath	*Vaccinium parvifolium*	Red huckleberry
Primrose	*Dodecatheon pulchellum*	Shootingstar
Primrose	*Trientalis latifolia*	Starflower
Plumbago	*Armeria maritima*	Thrift, Sea pink
Gentian	*Centaurium umbellatum* *	Centaury
Dogbane	*Vinca major* *	Periwinkle
Dogbane	*Vinca minor* *	Dwarf periwinkle
Morning-glory	*Convolvulus arvensis* *	Field morning-glory
Dodder	*Cuscuta salina*	Salt-marsh dodder
Phlox	*Collomia heterophylla*	Varied leaf collomia
Phlox	*Linanthus bicolor*	Bicolored linanthus
Phlox	*Microsteris gracilis*	Pink microsteris
Waterleaf	*Nemophila parviflora*	Small-flowered nemophila
Borage	*Myosotis discolor* *	Forget-me-not
Borage	*Myosotis laxa*	Forget-me-not
Borage	*Plagiobothrys scouleri*	Popcorn flower
Mint	*Galeopsis tetrahit*	Common hemp nettle
Mint	*Lamium purpureum* *	Red dead-nettle
Mint	*Lycopus uniflorus*	Northern bugleweed
Mint	*Melissa officinalis* *	Lemon balm
Mint	*Mentha arvensis*	Canada mint
Mint	*Mentha citrata*	Bergamot mint
Mint	*Prunella vulgaris* *	Self-heal
Mint	*Satureja douglasii*	Yerba buena
Mint	*Scutellaria lateriflora*	Blue skullcap

Mint	*Stachys cooleyae*	Hedge nettle
Nightshade	*Solanum nigrum*	Black nightshade
Figwort	*Castilleja hispida*	Indian paintbrush
Figwort	*Collinsia grandiflora*	Blue-eyed Mary
Figwort	*Cymbalaria muralis* *	Ivy-leafed toadflax
Figwort	*Digitalis purpurea* *	Foxglove
Figwort	*Euphrasia officinalis* *	Hairy eyebright
Figwort	*Linaria vulgaris* *	Butter and eggs
Figwort	*Mimulus alsinoides*	Little monkey flower
Figwort	*Mimulus guttatus*	Common monkey flower
Figwort	*Mimulus moschatus*	Musk-flower
Figwort	*Orthocarpus pusillus*	Dwarf owl-clover
Figwort	*Parentucellia viscosa* *	Yellow bartsia
Figwort	*Verbascum thapsus* *	Mullein
Figwort	*Veronica americana*	American brooklime
Figwort	*Veronica filiformis* *	Thread-stalk speedwell
Figwort	*Veronica scutellata*	Marsh speedwell
Figwort	*Veronica serpyllifolia*	Thyme-leafed speedwell
Broomrape	*Boschniaka hookerii*	Ground-cone
Plantain	*Plantago elongata*	Slender plantain
Plantain	*Plantago lanceolata* *	English plantain
Plantain	*Plantago major* *	Common plantain
Madder	*Galium aparine*	Cleavers
Madder	*Galium trifidum*	Three petalled bedstraw
Madder	*Galium triflorum*	Fragrant bedstraw
Madder	*Sherardia arvensis*	Blue field madder
Honeysuckle	*Linnaea borealis*	Twinflower
Honeysuckle	*Lonicera ciliosa*	Orange honeysuckle
Honeysuckle	*Lonicera hispidula*	Purple honeysuckle
Honeysuckle	*Sambucus caerulea*	Blue elderberry
Honeysuckle	*Sambucus racemosa*	Red elderberry
Honeysuckle	*Symphoricarpos albus*	Snowberry
Valerian	*Plectritus congesta*	Sea blush
Valerian	*Valeriana sitchensis*	Mountain heliotrope
Harebell	*Campanula medium* *	Canterbury bells
Harebell	*Campanula scouleri*	Scouler's harebell
Sunflower	*Achillea millefolium*	Common yarrow
Sunflower	*Adenocaulon bicolor*	Path-finder
Sunflower	*Anaphalis margaritacea*	Pearly-everlasting
Sunflower	*Anthemis arvensis* *	Corn chamomile
Sunflower	*Arctium minus* *	Common burdock
Sunflower	*Artemisia suksdorfii*	Coastal Mugwort

Sunflower	*Aster eatonii*	Eaton's aster
Sunflower	*Aster subspicatus*	Douglas' aster
Sunflower	*Bellis perennis* *	English daisy
Sunflower	*Centaurea diffusa* *	Diffuse knapweed
Sunflower	*Chrysanthemum parthenium* *	Feverfew
Sunflower	*Cichorium intybus* *	Chicory
Sunflower	*Cirsium arvense* *	Canada thistle
Sunflower	*Cirsium vulgare* *	Bull thistle
Sunflower	*Conyza canadensis*	Horseweed
Sunflower	*Crepis capillaris* *	Smooth hawksbeard
Sunflower	*Eriophyllum lanatum*	Wooly sunflower
Sunflower	*Galinsoga ciliata* *	Quickweed
Sunflower	*Gnaphalium microcephalum*	Slender cudweed
Sunflower	*Gnaphalium uliginosum* *	Marsh cudweed
Sunflower	*Grindelia integrifolia*	Gumweed
Sunflower	*Hieracium albiflorum*	White-flowered hawkweed
Sunflower	*Hypochaeris radicata* *	Spotted cats-ear
Sunflower	*Lactuca muralis* *	Wall lettuce
Sunflower	*Lactuca seriola* *	Compass plant
Sunflower	*Lapsana communis* *	Nipplewort
Sunflower	*Leontodon nudicaulis* *	Hairy hawkbit
Sunflower	*Leucanthemum vulgare* *	Marguerite daisy
Sunflower	*Madia glomerata*	Cluster tarweed
Sunflower	*Madia madioides*	Woodland tarweed
Sunflower	*Madia sativa*	Chilean tarweed
Sunflower	*Matricaria discoidea*	Pineapple weed
Sunflower	*Petasites palmatus*	Coltsfoot
Sunflower	*Senecio jacobea* *	Tansy ragwort
Sunflower	*Senecio sylvaticus* *	Wood groundsel
Sunflower	*Senecio vulgaris* *	Common groundsel
Sunflower	*Solidago canadensis*	Goldenrod
Sunflower	*Sonchus arvensis* *	Perennial sow-thistle
Sunflower	*Sonchus asper* *	Prickly sow-thistle
Sunflower	*Sonchus oleraceus* *	Common sow-thistle
Sunflower	*Tanacetum vulgare* *	Common tansy
Sunflower	*Taraxacum officinale* *	Common dandelion
Sunflower	*Tragopogon dubius* *	Yellow salsify
Sunflower	*Tragopogon porrifolius* *	Salsify
Arrow-grass	*Triglochin maritimum*	Seaside arrow-grass
Buddleja	*Buddleja davidii* *	Butterfly-bush
Bur-reed	*Sparganium emersum*	Simplestem bur-reed
Cat-tail	*Typha latifolia*	Common cat-tail
Clubmoss	*Selaginella wallacei*	Wallace' selaginella

Common Fern	*Adiantum pedatum*	Northern maidenhair fern
Common Fern	*Athyrium filix-femina*	Lady fern
Common Fern	*Blechnum spicant*	Deer fern
Common Fern	*Cryptogramma crispa*	Parsley-fern
Common Fern	*Dryopteris expansa*	Spiny wood-fern
Common Fern	*Polypodium glycyrrhiza*	Licorice fern
Common Fern	*Polystichum munitum*	Sword fern
Common Fern	*Pteridium aquilinum*	Brachen fern
Eel-grass	*Zostera marina*	Eel-grass
Grass	*Agrostis alba*	Redtop
Grass	*Aira caryophyllea* *	Silver hairgrass
Grass	*Aira praecox* *	Little hairgrass
Grass	*Anthoxanthum odoratum* *	Sweet vernal grass
Grass	*Arrhenatherum elatius* *	Tall Oat Grass
Grass	*Brachypodium sylvaticum*	False brome
Grass	*Bromus erectus* *	Meadow brome
Grass	*Bromus hordeaceus*	Soft brome
Grass	*Bromus sterilis* *	Barren brome
Grass	*Cynosurus echinatus* *	Hedgehog dogtail
Grass	*Dactylis glomerata* *	Cock's-foot grass
Grass	*Danthonia californica*	California oatgrass
Grass	*Distichlis spicata*	Seashore saltgrass
Grass	*Echinochloa crusgalli* *	Barnyard grass
Grass	*Elymus mollis*	Dune wildrye
Grass	*Holcus lanatus* *	Common velvet-grass
Grass	*Holcus mollis* *	Creeping softgrass
Grass	*Hordeum jubatum*	Foxtail barley
Grass	*Hordeum murinum* *	Mouse barley
Grass	*Lolium multiflorum* *	Italian ryegrass
Grass	*Lolium perenne* *	Perennial ryegrass
Grass	*Panicum miliacium* *	Millet
Grass	*Panicum occidentale*	Witch grass
Grass	*Phalaris arundinacea*	Reed canary grass
Grass	*Phleum pratense* *	Timothy
Grass	*Poa annua*	Annual bluegrass
Grass	*Vulpia bromoides*	Barren fescue
Horsetail	*Equisetum arvense*	Common horsetail
Horsetail	*Equisetum telmateia*	Giant horsetail
Mare's-tail	*Hippuris vulgaris*	Common mare's tail
Mezereon	*Daphne laureola* *	Spurge laurel
Mulberry	*Humulus lupulus* *	Hop
Pondweed	*Potomogeton foliosus*	Close-leaved pondweed

Rush	*Juncus bolanderi*	Bolander's rush
Rush	*Juncus bufonius* *	Toad rush
Rush	*Juncus effusus* var. *pacificus*	Soft rush
Rush	*Juncus ensifolius* var. *ens.*	Dagger leaf- rush
Rush	*Juncus tenuis*	Slender rush
Rush	*Luzula campestris*	Field woodrush
Sedge	*Carex deweyana*	Dewey's sedge
Sedge	*Carex exsiccata*	Inflated sedge
Sedge	*Carex macloviana*	Thick-headed sedge
Sedge	*Carex obnupta*	Slough sedge
Sedge	*Carex pachystachya*	Thick-headed sedge
Sedge	*Carex rostrata*	Beaked sedge
Sedge	*Carex unilateralis*	One-sided sedge
Selaginella	*Selaginella wallacei*	Wallace's clubmoss
Water-fern	*Azolla mexicana*	Water-fern

Update on Occurrence and Breeding of the American Bittern at Buttertubs Marsh, Nanaimo

BRUCE COUSENS

The American Bittern (*Botaurus lentiginosus*), a secretive member of the heron family that frequents densely vegetated marshes, appears on the B.C. Blue List (considered threatened and potentially at-risk of extirpation in the province) and is thought to be in continent-wide decline, primarily due to loss of suitable wetland breeding habitat (Ehrlich *et al*, 1988; Gibbs *et al*, 1992). (Some recent estimates indicate less than 10% of the original wetland area remains intact in temperate North America.) Though the species is known to breed in some areas of the B.C. interior and lower mainland, there has in the past been no known documented record of the American Bittern breeding on Vancouver Island (Campbell *et al*, 1990), though breeding here has long been suspected.

This species has been known to occur at Buttertubs Marsh in Nanaimo for many years, in both the Conservation Area, owned by The Nature Trust of B.C., and the adjacent independently-owned "West Marsh", and has been recorded by the Nanaimo Field Naturalists Club in 12 of the past 26 annual Christmas Bird Counts, begun in 1972. All these records occurred since 1979 (last 19 years), with three individuals being recorded on one occasion in 1986 (S. Baillie, pers. comm.). This record of occurrence dates back almost to the creation of the Conservation Area in 1975-76 by diking and flooding of part of the marsh and surrounding farmland within the Millstone River floodplain. It is thus quite possible that the American Bittern may have been present here but was not recorded in the early Christmas counts prior to 1979. Creation of the Conservation Area undoubtedly increased the area of useable habitat, as well as ease of human access into the centre of the marsh for observation.

In addition to overwintering here, this species is known to be present at Buttertubs Marshes during the spring and summer breeding season (although until recently there has been little or no formal documentation of this fact) and some individuals may reside here year-round; some turn-over between winter and summer residents may also occur. As frequent visitors to the Buttertubs Marsh Conservation Area are aware, one or more males can be regularly heard and occasionally observed calling in morning and evening between April and June, and in recent years as many as 3-4 males have been heard calling at one time from different areas of the wetland, in the Conservation Area and particularly in the West Marsh. In light of this regular occurrence and behaviour during the breeding season, it seems highly likely that the species is breeding or attempting to breed here, and in 1996 I set out with the help of several other members of the NFNC to more formally document this calling activity, with the possibility of finding a nest and establishing a breeding record for the site.

The breeding behaviour of this species is poorly known, but it appears that males defend seasonal breeding territories around regularly-used calling stations in preferred habitat, where they call repeatedly from dense marsh vegetation to repel other males and attract receptive breeding females (Gibbs *et al*, 1992). One to several females may visit calling males for

courtship and mating (polygyny) and either nest nearby in his territory or may use separate nesting territories. Males take little or no part in nest-building, incubation and rearing of young. In fact, one rarely finds two Bitterns close together, except during courtship/mating and occasional territorial disputes between males. The nest tending behaviour is extremely secretive, with the female closely approaching the nest only under cover on foot and taking separate routes to and from the nest to further reduce the chance of betraying its location to nearby predators (Ehrlich *et al*, 1988) or nosy naturalists, so confirming breeding by locating and photographing a nest with eggs or young is a difficult and time consuming undertaking.

Since the male American Bittern calls repeatedly during the breeding season and also responds to tape-recorded territorial calls (a well-known census technique for this and several other marsh species), our method of documenting the abundance and location of breeding and possible nesting territories consisted of periodically listening for calling males, usually during a 1-2 hour period after dawn or before dark, and recording their number and approximate location in the marshes, if necessary initiating call responses by playing taped calls. In general, use of taped calls was only necessary near the end of the breeding season when spontaneous calling became erratic, or on occasion to draw a nearby calling male from deep cover into a better viewing location, since males will sometimes approach a persistently repeated call from a nearby "intruder". Monitoring was intermittent in 1995, occurred 1-2 times/week with several calling males during April-June 1996, when an enthusiastic volunteer, Aran Gough, was available, and has been less frequent in subsequent years.

The data collected to date (Table 1) suggest that male bitterns have 3-4 consistently preferred calling areas in the Buttertubs Marshes: one on the east side of the Conservation Area near the viewing platform and three in the West Marsh, in the southeast corner, on the northwest side on or near the soil piles and on the far west side. When several males are present these calling areas may all be in use at once, as in 1996, and likely constitute part of their individual breeding territories, and other sites may be used as well. The southeast and northwest portions of the West Marsh seem preferred when only one or two calling males are present, and a single male may move between and call from the other locations periodically, perhaps in an effort to attract the attention of females that may frequent (or nest in) other portions of the marsh, since most of the marsh area appears to be used for feeding.

The questions of how many American Bitterns these marshes may support and how many might breed here remain unanswered, although the population is undoubtedly small, likely consisting of fewer than ten birds and perhaps as few as 2-5 adults in most years. The available food supply includes abundant three-spined stickleback and pumpkinseed sunfish year-round, with Pacific treefrogs and red-legged frogs and their tadpoles in spring and summer (other amphibians and larvae appear uncommon), as well as many aquatic insects and their larvae, all preferred prey (Gibbs *et al*, 1992).

At least 3 males attempted to breed here in 1996 (Guy Monty reported clearly hearing four males calling on one occasion very early in the season; Aran Gough also suspected there were four different birds calling initially, with calling from the Conservation Area ceasing after early May, perhaps due to predation or abandonment of the territory). More commonly 1-2 males are heard. Breeding success has not been confirmed and may be compromised by

predation from raccoons and river otters, so it is unclear whether the population is sustained locally or by seasonal dispersal or migration from other areas. Calling of males at dawn and dusk and sometimes at night may attract nocturnal migrants passing overhead in spring, though with few overwintering sites and no other breeding sites known on Vancouver Island, such migrants may be few in number. Late summer dispersal for overwintering is another possible recruitment mechanism, since both migration and dispersal may occur over long distances (Gibbs *et al*, 1992).

This project is ongoing, as we have yet to find and document a nest site or conclusively confirm the presence of young (and much of the heavily frequented and most likely nesting area is on private property to which access is denied). One possible juvenile was seen briefly in late June of 1995, and one possible sub-adult (no black neck stripe) was observed and photographed eating a red-legged frog in May, 1996 (too early to be a young of the year, so possibly an immigrant from elsewhere). However, the record of observations of numbers and locations of calling males over the 1995, 1996 and 1997 nesting seasons and much of the 1998 season indicates that breeding behaviour was regularly being initiated by one or more males throughout each nesting season; one or more non-calling adults, presumably females, were also observed occasionally, sometimes near calling males. Taken together, these observations strongly suggest that breeding is indeed being attempted in this area.

In the meantime, Wayne Campbell was able to unearth from his voluminous files and nest records a direct historic confirmation of American Bittern breeding in this area in 1976 by a young egg collector who found a nest with five eggs "in a cattail marsh west of Nanaimo" and brought an egg to the then Fish and Wildlife Branch office in Nanaimo for identification by Ian D. Smith; Mr. Smith confirmed the bittern egg identification and filed a nest record card (W. Campbell, pers. comm., to S. Baillie). Buttertubs Marsh is the only large cattail marsh capable of supporting bitterns within the indicated N.T.S map grid sector (92G/4) west of Nanaimo, and the only site where the bittern has been recorded repeatedly in the Nanaimo area. (There is one more recent sighting by Rick Ikona from the smaller Jingle Pot Marshes adjacent to the Buttertubs area, but these originated from later beaver damming circa 1980 and did not provide suitable bittern habitat in 1976.)

This nest record establishes Buttertubs Marsh in Nanaimo as the first (and only, so far) documented breeding site of the Blue-listed American Bittern on Vancouver Island. Since the date of the nest record is concurrent with origin of the Buttertubs Marsh Conservation Area and most of the recent male calling activity has occurred in the adjacent shallow and less altered West Marsh, it seems likely that bitterns were breeding here before the Conservation Area was created. Our recent documentation of regular spring territorial reproductive behaviour in these marshes over four years (with anecdotal reports of male calling over a much longer period) strongly suggests the area is still used by this species for breeding, although nesting success is unknown.

(Note: An American Bittern sighting was reported in spring, 1998, at Richardson Marsh, another large cattail marsh south of Nanaimo, but has yet to be confirmed; no male calling has yet been reported.)

Acknowledgments

Many thanks to all who have helped with this project and/or contributed their field observations, including NFN members Aran Gough, Charlene Lee, Steve Baillie, Guy Monty and Rick Ikona, with special thanks to Wayne Campbell for his interest and encouragement and for taking the time to track down the American Bittern egg/nest record for this area.

Literature Cited

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser and M.C.E. McNall. 1990. The Birds of British Columbia. Vol. 2. Nonpasserines: Diurnal birds of prey through woodpeckers. Royal B.C. Museum, Victoria, B.C. 636pp.

Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1988. The Birders Handbook: A Field Guide to the Natural History of North American Birds. Simon & Schuster Inc., New York, NY. 785 p.

Gibbs, J.P., S. Melvin and F.A. Reid. 1992. American Bittern. *In* The Birds of North America, No. 18 (A. Poole, P. Stettenheim and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union

Table 1. Recent observation records for the American Bittern at Buttertubs Marshes, Nanaimo.

Date	Number	Observation Notes (time, location, etc.)
1995		
May 31	2 males	2030 hrs: Both heard calling, one in Conservation Area, one in West Marsh (BC)
June 1	1 male	0530 hrs: Calling in West Marsh (BC)
June 26	2 males	0530 hrs: Both heard calling, one in Conservation Area, one in West Marsh (BC)
June 30	1 adult 1 juvenile?	One adult and one possible juvenile (no black neck stripe) observed briefly close together in West Marsh (BC)
December 19	1	1600 hrs: One AMBI seen in SE corner of West Marsh (BC).
1996		
April 30	2 males	1305-1415 hrs: Both heard calling in centre of Cons Area near E and W sides (AG)
	3 males	2000-2115 hrs: Heard calling repeatedly from E side of Cons. Area near viewing deck, SE corner of West Marsh & W side of West Marsh, near Millstone R. (BC)
May 1	1 sub-adult?	0920-1030 hrs: Obs. possible sub-adult with red-legged frog (photo); N side of Cons. Area beside dike/trail along river (AG)
	2 males	2030-2100 hrs: Both heard calling repeatedly from West Marsh, from SE corner and W side, near centre (BC)
May 4	1 male	2045-2145 hrs: Heard calling from E side of Cons. Area near E platform (AG)
May 7	1 male	2100-2200 hrs: Heard calling in SW corner of West Marsh (BC)
May 9	3 males	2020-2130 hrs: Heard/obs. one male calling from E side of Cons. Area and heard 2 males calling alternately close together on N side of West Marsh (AG)
May 10	1 male	1800-1900 hrs: Heard calling from E side of Cons. Area (BC)
May 15	3 males	2025-2115 hrs: All heard calling in West Marsh, one in SE corner, one on W side near the centre and one in NW corner on soil pile (also observed) (AG)
May 16	1 male	2015-2115 hrs: Heard calling on W side of West marsh, near centre (AG)
May 21	2 males	1920-2030 hrs: Heard calling from West Marsh, one on W side near the centre and one on soil pile in NW corner (AG)
May 24	-	1200-1320 hrs: No AMBI activity heard or observed (AG)
May 27	3 males	2000-2115 hrs: All heard calling in West Marsh, one in SE corner (also obs.), one on soil piles in NW corner and one on N side near Millstone R. (AG)
May 30	2 males	0600-0800 hrs: Both heard calling in West Marsh, one in SE corner and one in NW corner near soil piles (AG)
June 7	2 males	2050-2130 hrs: Both heard calling in West Marsh, one in SE corner (also obs.) and one in NW corner near soil piles (AG)
June 12	2 males	2010-2115 hrs: Both heard calling in West Marsh, one in SE corner and one in NW corner near soil piles (AG)
June 17	1+ male	1945-2200 hrs: Heard calling from SE corner of West Marsh (AG, BC) (*Obs. from E side of Cons. Area only; second male may be present, too far away to hear)
June 18	1+ male	2000-2100 hrs: Heard calling from SE corner of West Marsh (AG, BC) (* above)
June 19	1+ male	1945-2200 hrs: Heard calling from SE corner of West Marsh (AG, BC) (* above)

Date	Number	Observation Notes (time, location, etc.)
June 21	2 males	0730-0830 hrs: Heard/obs. one male calling/displaying from SE corner of West Marsh; heard second male calling from NW near soil piles & Millstone R. (BC)
June 25	1+ male	1945-2200 hrs: Heard calling from SE corner of West Marsh (AG, BC) (* above)
1997		
February 10	1	0530-0600 hrs: Obs. adult flying into SE West Marsh; no response to taped calls.
February 13	1	1400 hrs: Obs. adult fly from West Marsh over Cons. Area and back to N side of West Marsh near Millstone R.
April 11	1 male	1900 hrs: Heard/obs. adult male calling/displaying in Cons. Area; after 15-20 min. bird flew N and W into Millstone R. channel beside West Marsh.
May 17	2 males	2000-2100 hrs: Heard male calling repeatedly from NW side of West Marsh near soil piles; second male calling from centre of West Marsh near main dike.
May 21	1 male	2045-2115 hrs: Heard/obs. male calling repeatedly in SE corner of West Marsh.
May 25	1 male 1 female?	0630-0930 hrs: Heard/obs. male calling/displaying in SW corner of West Marsh; responded to and approached taped calls, displayed shoulder plumes; second bird (silent, possibly a female) flew from N side of West Marsh into Cons. Area.
May 30	1 male 1 female?	0645-0700 hrs: On arrival flushed possible female from West Marsh beside dike, which flew into Cons. Area; departing croak initiated calling from nearby male, which continued to respond to taped calls: other bird in Cons. Area did not respond.
June 4	1 female?	0630-0730 hrs: Obs. AMBI flying from Cons. Area into N side of West Marsh near Millstone R.; did not respond to taped calls. (Also 1 green heron in W. Marsh).
June 19	1 male	2115-2145 hrs: Heard one male calling from SE corner of West Marsh near dike; responded repeatedly to taped calls.
June 20	1 male 1 female?	0630-0800 hrs: Heard/obs. male calling repeatedly from SE corner of West Marsh; responded to and approached taped calls; second AMBI (silent, possibly female or sub-adult) flushed from West Marsh near dike & flew NW into West Marsh.
June 26	1 male	2000-2115 hrs: Heard male calling from centre of West Marsh; responded to taped calls; flew to SE corner of West Marsh, continued calling/answering taped calls.
June 30	1 male	2100-2145 hrs: Heard male calling from far (W) side of West Marsh; called intermittently, did not answer taped calls (may not have heard them).
1998		
~March 15	1	One AMBI reported flying over marsh (very few sightings reported over winter).
April 8	1 male	1800-1900 hrs: Heard one male calling intermittently from W side of West Marsh.
April 20	1 male	1730-1830 hrs: Heard one male calling intermittently from W side of West Marsh.
May 3	1 male	1830-1900 hrs: Heard one male calling intermittently from W side of West Marsh
May 10	1 male	2015-2045 hrs: Heard one male calling intermittently from W side of West Marsh
May 21	1 male	1930-2000 hrs: Heard one male calling regularly from SE corner of West Marsh.
June 5	1 male	2030-2100 hrs: Heard one male calling regularly from SE corner of West Marsh.
June 14	1	~1100 hrs: One AMBI seen (G.M.) flying W over West Marsh to Millstone R.
June 16	1 male	2000 hrs: One male calling from SE corner of West marsh.

Mya profundior - 116 m A.S.L. - Nanaimo

BILL MERILEES

Today's speech regularly reduces names, titles and units of measurements to acronyms, T.V. for television, P.M. for Prime Minister, SCUBA for self contained underwater breathing apparatus and QANTAS for Queensland and Northern Territories Airline Services. These are 'oldies' but new ones crop up almost hourly and frankly, unless you are in the 'know', many conversations can be totally 'greek' simply for their use of acronyms. For example just talk to any public servant about environmental initiatives these days and PAS, CORE, RPAT and what seem like a thousand other acronyms are continuously brought into play. However that is not what this article is about. In geographical terminology A.S.L. simply means "above sea level". Should you know who or what *Mya profundior* is then you have the gist of what will be reported here.

A few years ago, a small sphagnum bog with a rich assemblage of bog plants came to the notice of Nanaimo's naturalist community. Due to its proximity to Barrington Road it became known as the Barrington Bog. In addition to its flora, this area was unique due to its geological configuration, As a small natural depression near the summit of one of Nanaimo's higher hills it was a micro catchment area for whatever happen to live, die or fall into this space. However all the land that comprised this tiny basin was privately owned.

When negotiations to preserve this bog reached an impasse between the City and the owner, the site was razed destroying 13,000 years of natural records. Sediment and peat accumulations were trucked away and the hole filled with rock rubble. With winter rains, this depression has become a lake. This type of desecration, though not unprecedented, was a travesty to common sense, public dignity and 1990's environmental logic. During the bog's destruction some very interesting information came to light which demonstrated even more strongly, this area's uniqueness and importance.

One of the first excavations revealed a marine sandy clay deposit with a number of clam fragments. The species of clam found resembled none of the species currently known for the Nanaimo area. Its identification has been confirmed as *Mya profundior* Grant & Gale, 1931 (Bernard, 1983) (Figure 1). This species currently lives in waters 10 to 100 metres deep between 58 and 60 degrees north latitude. In other words it is a cold water or arctic species that now lives along the Alaskan coast from approximately Juneau north into the southern Bering Sea.

When this area was surveyed it was determined its elevation to be 116m (about 382 feet!) above current sea level (A.S.L.).

Discussion with John Clague of the Geological Survey of Canada indicate that this area and the specimens found probably date back to about 12,500 B.P. (Before Present).

When all this information is brought together the evidence indicates that this hill in Nanaimo was at least 10m or 33 feet under the sea about 12,500 nears ago. To put this in perspective 'Nanaimo's' shoreline map would have looked like Figure 2. Can you imagine the possibility of walrus herds and bowhead whales being hunted by natives from skin boats (?); flocks of eider ducks and who knows what else?

Who knows what additional information might have been learned if narrow-minded developers were not so hell bent to moonscape local environments for personal profit and greed. What is equally sad is that local governments neither have the power nor the desire to put public interests first.

Barrington bog was a microcosm of many environmental challenges mankind is facing - and again - it amply demonstrates that what may be 'right' has little bearing or influence on what in fact should happen.

Acknowledgments:

The author would like to thank John Clague of the Geological Survey of Canada for his interest and assistance.

References:

Bernard, F.R. 1983. Catalogue of the Living Bivalvia of the Eastern Pacific Ocean: Bering Strait to Cape Horn. Canadian Special Publication of Fisheries and Aquatic Sciences 61. Department of Fisheries and Oceans, Ottawa.

Figure 1. *Mya profundior.* (Photo Bill Merilees)

Mya profundior 116 m A.S.L. - Nanaimo. Bill Merilees.

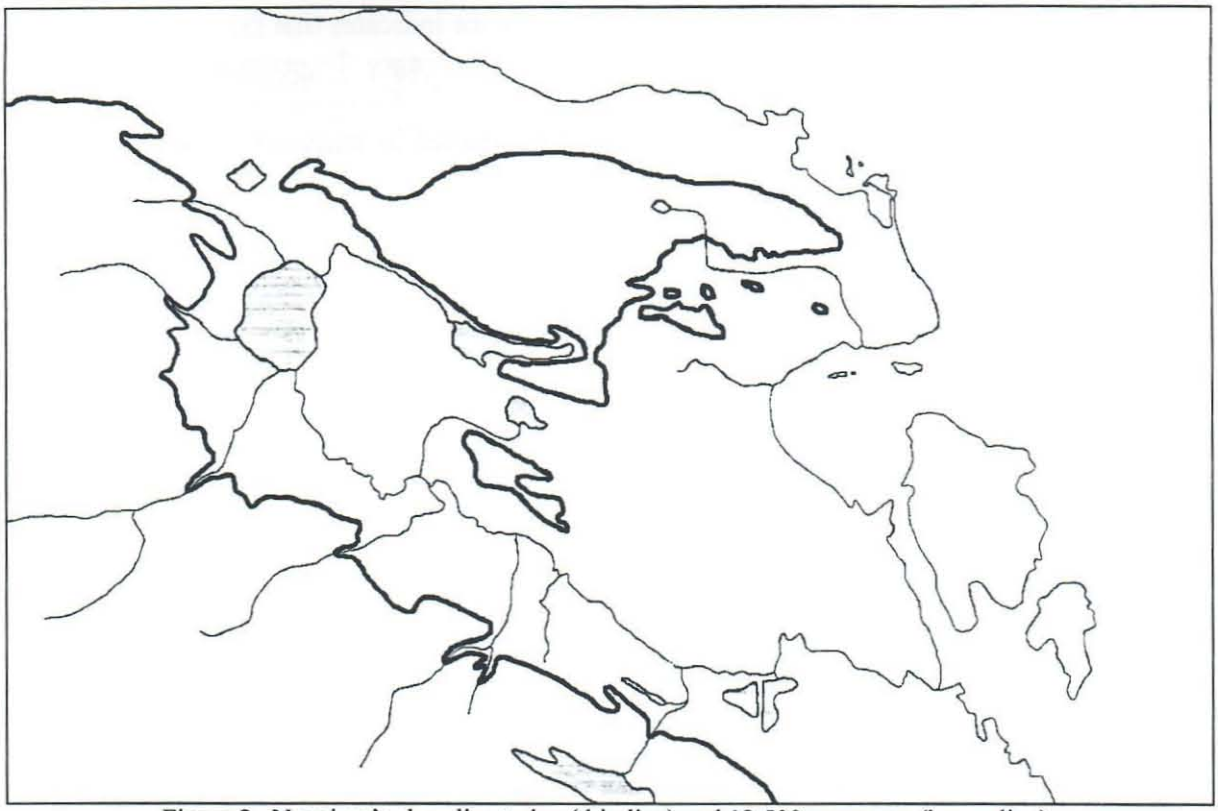


Figure 2. Nanaimo's shoreline today (thin line) and 12,500 years ago (heavy line).

A Study of the Bird Species Diversity of Buttertubs Marsh

ARAN C. GOUGH AND ANDREW W. WOZNEY

Abstract

This is a study of the diversity of bird species in Buttertubs Marsh, Nanaimo, BC in spring 1994 with analyses of habitat preference, migration patterns, and similarities between the observation sites. The vegetation types were determined and we used this to classify the birds into guilds where each guild represented a certain habitat preference. It was found that the habitats preferred by the birds were related to their guild feeding habits. Some migration patterns were observed with the birds either flying in to breed, passing through to another breeding site or living at the marsh year round. We also found that there were similarities in the bird species at the sites that looked out upon the same geographic region of the marsh.

Introduction

Buttertubs Marsh in Nanaimo, BC is a protected wildlife reserve situated about 5 km northwest of the downtown core. It is surrounded on all sides by developed land; a retirement community to the north, residential properties to the east, a major through-road to the south and a golf course to the west. Our study covers the most populated region of the marsh - from about 50 m south of the public staging area east and west to the edges of the marsh and north to the retirement community. With this study we are trying to determine the diversity of the bird species, which birds are migrant to the marsh, which birds are migrating to a location other than the marsh, and which birds are of a resident community. With this in mind we also try to determine the habitat preference of groups of ecologically related bird species.

Materials and Methods

For the collection of the data we spent roughly 2 - 2.5 hours on Mondays and Wednesdays, in the afternoon, from February 2 to March 30, 1994. The time was spent observing and identifying bird species and counting individuals. Data was compiled from six primary observation sites around the marsh, each with its own constituent plant life, as well as along a transect that encompassed and connected those six sites. Identification was done visually with reference to a bird guide (Farrand, 1988). Statistical analysis of the sites, using the Jaccard index, will show how related each site is to the other sites.

Results

The observation sites are identified as site 1, the trail head; site 2, the rocky clearing; site 3, the cut line; site 4, the retirement community; site 5, the stump; and site 6, the staging area. Site one vegetation is mainly english hawthorn, *Crataega oxyacantha*, and broom, *Cytisus scoparius*, with various sedges, family *Juncacea*, grasses, family *Poacea*, meadow goldenrod, *Solidago canadensis*, and some cattails, *Typha latifolia*. Site two is a rocky clearing with broom to the east, hawthorn to the south and water with cattails on all other boundaries. Site three vegetation consists of cattails to the east and west with some standing deadwood and beech trees, *Fagus sylvatica*, also on the east side. Site three is situated along a cut line on the east side of the marsh. Site four is at the retirement community on the north

side of the marsh and its vegetation includes blackberry, *Rubus fruticosus*, and some small grasses with cattails and a solitary red alder, *Alnus rubra*, in the shallows of the marsh. Site five is also on the north side of the marsh and its vegetation consists of few hawthorns to the north, sparse broom, some grasses and a line of oak trees, *Quercus* sp., also to the north. Cattails are found in the marsh to the south. Finally, site six is a public staging area erected for bird watchers and is situated on the west side of the marsh. The vegetation surrounding it is composed of red alder to the west and oak trees along side with some small grasses underneath.

Table 1 shows the bird species diversity of the entire study region and the presence of each species at each site, respectively. Species diversity throughout the study region is quite large but there are definite trends as to the location of each species within the region which can be correlated to its feeding habits. As there are so many species found here we have, with reference to the Audubon Handbook, grouped like species (species that share the same habitat and fill similar ecological niches) into guilds. The first of the guilds is that of the dabbling birds and includes the mallards, American coots, and Canada geese. These birds tend to hug the shores of the marsh, rarely venturing out to the more open areas. The second of the guilds is the diving waterbirds and includes the common goldeneye, the mergansers, the pied-billed grebe, bufflehead, ring-necked duck, green-winged teal, American wigeon, and lesser scaup. These birds can be found throughout the marsh but tend to stay out in the open areas more. The third guild is the spear-billed birds and includes the American bittern, great blue heron and the belted kingfisher. These are patient birds who wait for their prey then catch them with their beaks. We have left the glaucous-winged gulls out of a specific guild as they are opportunistic scavengers that can spend feeding time both on the water and on the land. The fourth guild is composed of the ground dwelling songbirds, the largest of the guilds, containing the American robin, brewers' blackbird, spotted towhee, European starling, varied thrush, the species of sparrows, the Bewick's wren and the marsh wren. These birds are generally seed eaters or are opportunistic feeders and tend to inhabit the undergrowth and trails connecting the observation sites, The fifth guild is for the tree dwelling songbirds and includes the red-winged blackbird, purple finch, golden-crowned kinglet, bushtit, chestnut-backed chickadee, dark-eyed junco, yellow-rumped warbler, tree swallow, northwestern crow and common raven. Again these birds are either seed eaters, insectivores, or opportunistic feeders. The sixth guild contains the woodpecker-like birds: the northern flicker, the downy woodpecker and the brown creeper. The last guild, the raptors, contains the bald eagle, sharp-shinned hawk, red-tailed hawk and merlin. Figure 1 shows the relative locations of each guild in relation to the vegetation present.

We determined that the birds that migrated to the marsh to breed were the marsh wren which appeared on March 2, common merganser which did not appear until March 7, the tree swallows which appeared March 9, the yellow-rumped warbler which didn't arrive until March 16, the dark-eyed junco which appeared on March 21, and the pied-billed grebe which did not appear until March 21. All of these birds winter in the southern U.S.A. with the exception of the yellow-rumped warbler (very southern B.C.) and the marsh wren (southern Washington state) (Farrand, 1988).

The birds that migrated through the marsh to breeding sites elsewhere included the green-winged teal, the American wigeon, the common goldeneye, the lesser scaup, the American bittern, the varied thrush and the merlin, With the exceptions of the scaup, the thrush and the bittern, all of these birds were migrating to breeding grounds further north (Udvardy, 1977). The scaup may have been migrating inland after wintering on the coast, the thrush is a notorious wanderer, and the bittern may, as yet, still be at the marsh (its colouration makes it very hard to observe).

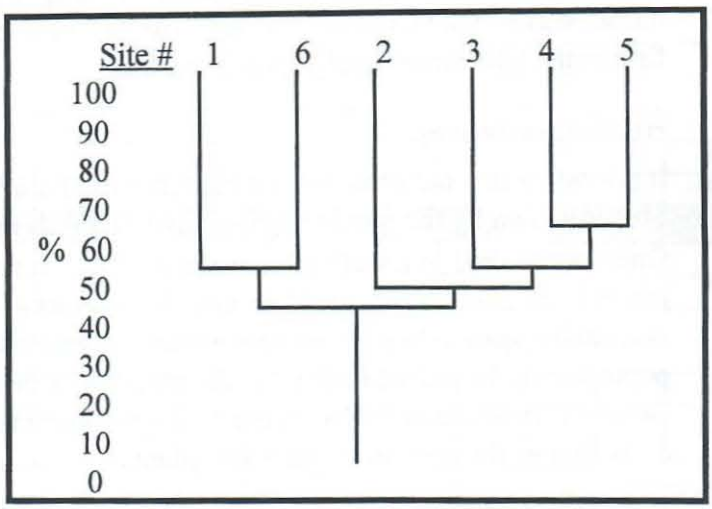


Figure 1. Cleidogram derived from Jaccard coefficients relating each observation site to the others in terms of the similarity of bird species found there.

All the rest of the birds are assumed to compose the resident population that is at the marsh year round. This may not be the usual behavior of some species of this resident community but is made possible by visitors to the park and the residents of the retirement community feeding the birds year round.

Statistical analyses of the site data, using the Jaccard index shows us that the northern sites, 4 and 5, which are both typified by shortgrass and cattails, are the most closely related at 64%, site 3, the eastern site typified by cattails and beech trees, is related to this at 52%, the rocky site 2 is related to this at 46% and sites 1, the trail head, and 6, the staging, which are related at 52% are related to sites 2,3,4 and 5 at 43%. This is diagrammed in Figure 1.

Discussion:

The dabbler ducks were expected around the edges of the marsh as they feed on plant materials on the marsh bottom. The area where they were found was shown to be in the shallows much of the way around the study area. We also expected that the diving ducks would be more in the open area of the marsh as they are piscivorous and must follow where the schools of fish are. The mergansers were seen to dive repeatedly, and quite successfully, for fish in the open areas. The other birds of this guild also showed the same behaviors in the same regions of the marsh as the mergansers but it was not as evident as to their success. All of our other expectations about where each bird guild would be found were born out as well.

We have shown with the cleidogram (Figure 1) that the bird species at each site are related more within sites of the same geography than between sites of less related geography (sites 1 and 6 look out upon the same region of the marsh ands sites 2, 3, 4 and 5 also look out on the same region of the marsh but a different region from sites 1 and 6).

It is difficult to predict the overall picture of migration to and from the marsh in only a two month survey but this study should provide an indication as to what birds we would expect to find in the late winter /early spring season.

Recommendations:

It is evident that the processes of plant natural succession are ongoing in Buttertubs Marsh. This is shown by the increasing density of cattails and other water dwelling plants each year. Once established in a wetland these plants, which provide excellent feeding and breeding grounds for many birds, build up into dense mats of growth that clog the waterways and, eventually, lead to bog conditions which are less favourable to sustaining bird, fish and other populations. In order to maintain the marsh as a place of refuge for the many species that currently, or could potentially, use it, we recommend some small scale dredging and curtailing of the growth of the water plants.

We also recommend the planting of small, controlled patches of wild rice in the southern portion of the marsh. This would increase the number of bird species which would use the marsh. It is important, though, to plant these patches only in the southern region of the marsh as it is currently not widely used by the resident birds and so any potentially harmful competition for space can be minimized.

Acknowledgments:

We would like to thank Bill McMillan for his help in identifying the vegetation, and Dr. Dave Kerridge for his assistance in bird identification.

Literature Cited:

Farrand, Jr., J. 1988. An Audubon Handbook *WESTERN BIRDS*. McGraw-Hill Book Co. New York.

Udvardy, M.D.F. 1977. The Audubon Society Field Guide to North American Birds *Western Region*. Alfred A. Knopf, Inc. New York.

Species	DATE																
	FEBRUARY								MARCH								
	2	7	9	14	16	21	23	28	2	7	9	14	16	21	23	28	30
Mall	190	238	108	264	16	166	279	261	42	223	163	189	175	162	95	128	113
AmCo	23	11	15	8	8	16	17	16	15	10	40	25	32	37	13	27	22
CaGo	156	139	9	144	30	65	34	71	126	103	134	114	126	61	20	79	104
CoGo												1	1	1			
HoMe	4	12	18	6	22	8	13	30	5	5	20	7	5	7	5	8	5
CoMe										2	11	15	2	9	5	3	4
PBGr														3	1	2	5
Buff	2	1	14	6	12	10	14	4	5	4	9	4	1	1			3
RNDu	1		22	6	3	2	3	5	11	16	16	36	33	35	11	20	10
GWTe			2						2								
AmWi										3	1						
LeSc									1		1	1					
AmBi									1								
GBHe	1	2	3	13	2		19	12	5		5		3				2
BeKi					1											1	1
GWGu	10	42	10	24		14	92	7	51	12	10		3	3			10
AmRo	5	2	1	2			3	2		5	2		5	5	2		1
BrBl		6	7			25	1	16		6	27	10	10	1		9	1
SpTo	1	5	7	1	3		9	2		18	8		1	2		3	2
EuSt				3				4		2	3		8	3			2
VaTh											1						
BeWr		2	1							1				1			
MaWr									1	1	2		2				1
SoSp		3	2		5		2		2	6	8		13	11	37	15	18
RWBl	261	30	82	30	12	42	75	40	13	48	97	41	37	51	14	23	24
PuFi			1	1	2			5									1
GCKi				2	6						2						
Bush							3										3
CBCh			4	8	1												2
DEJu														2			
YRWa													1	1	2		3
TrSw											8	6	27	10			many
NoCr	5	1	1		1	1		1		1			2	1	2		1
CoRa										1				2			
NoFl	2	1	2	1			1	1					1				1
DoWo		1	2		1						1	1		1			
BrCr			1	1													
BaEa	1			1					1	2			1				
SSHa								2									
RTHa										1							
Merl											1						

Table 1. Bird species diversity and numbers of individuals at Buttertubs Marsh, Nanaimo, BC in spring 1994.

Two New Exotic Clams in Georgia Strait

BILL MERILEES AND GRAHAM GILLESPIE

The purpose of this note is to record the arrival of two more exotic bivalve species in British Columbia waters.

Japanese Varnish Clam

On May 8, 1994 at Newcastle Island's Saltery Beach, a right valve of the Japanese varnish clam (*Nuttallia obscurata*) was found. On June 10, we revisited the site and dug 33 live specimens from sandy gravel, approximately 2 metres below the high tide line. Based on the concentric rings on the shells, and the several sizes found, four age classes were apparent in this sample.

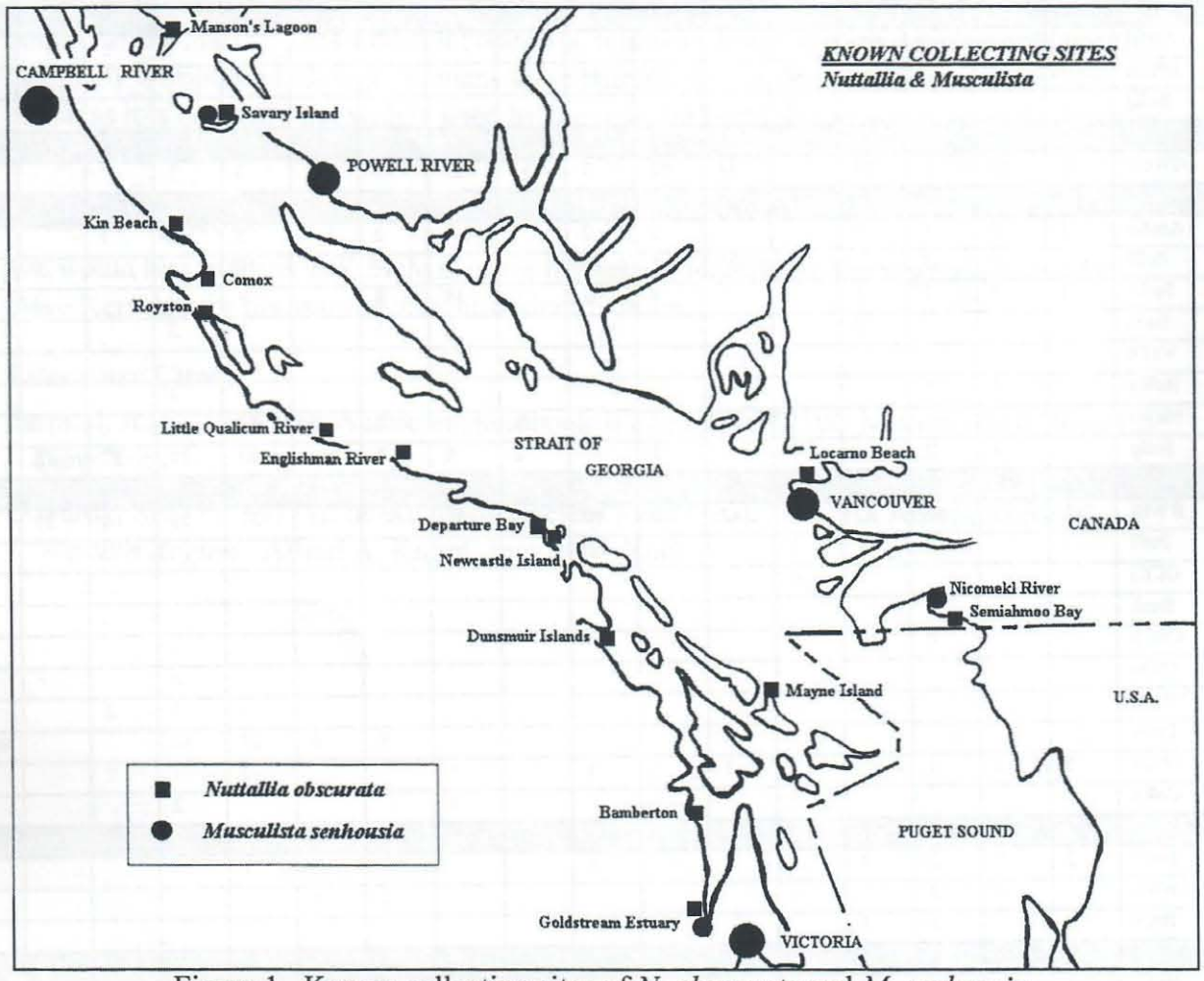


Figure 1. Known collecting sites of *N. obscurata* and *M. senhousia*.

Enquiries to Phil Lambert of the Royal BC Museum, and Bill Austin of Khoyatan Marine Laboratories in Duncan, provided other locations where this species has been found. We discovered further records of *Nuttallia obscurata* throughout the Strait of Georgia from Manson's Lagoon on Cortes Island in the north to Bamberton and Boundary and Semiahmoo

Bays in the south (Figure 1). The first record came from Semiahmoo Bay where Robert Forsyth collected specimens in 1991 (Forsyth, 1993). Beachcombers should keep their eyes open for this relatively large, distinctive clam. No other BC clam has the combination of shiny brown periostracum (skin) on the outside and royal purple on the inside. Shells can achieve a length of 6 cm. Live specimens prefer will-drained, sandy gravel (often associated with freshwater streams or ground water seepage), at or about midtide level. They sit in a vertical position, at 5 to 8 cm below the surface of the sand. Figure 2 shows the Japanese varnish clam.

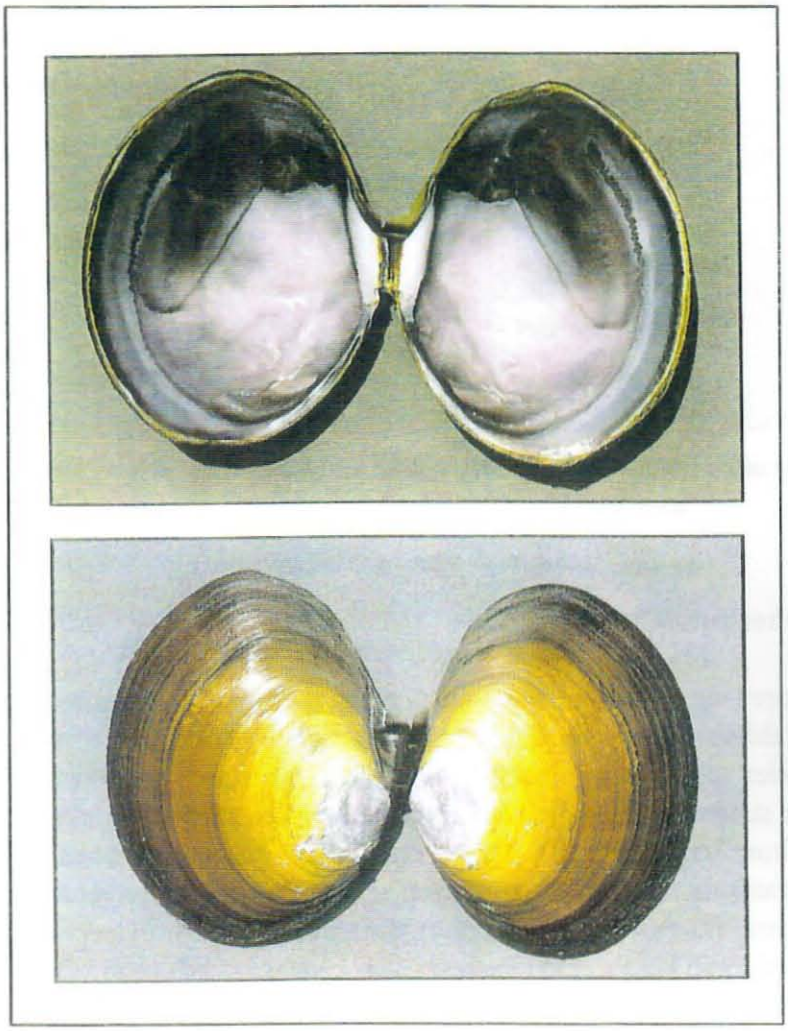


Figure 2. *Nuttallia obscurata.* (Bill Merilees photo)

Japanese Mussel

We have also found the Japanese mussel (*Musculista senhousia*). We collected two in the estuary of the Goldstream River near Victoria in August 1994, and two from Savary Island in April, 1995 (Figure 1). Robert Forsyth (1993) also reports this species from the Nicomekl River. Together these are the first records for this species from British Columbia. The Japanese mussel has previously been reported from the Pacific coast of North America from San Francisco to Puget Sound (Ricketts and Calvin, 1968).

Japanese mussels are small (2 cm) bivalves, their maximum length recorded at 2.3 cm (Abbott, 1974). The dark chevron markings, sub-apical umbo and crenulations near the hinge (Figure 3) distinguish this mussel from the native species *Mytilus trossulus*, *M. californianus*, and *Modiolus rectus*. *Musculista* forms a byssal nest, collecting small pieces of gravel or broken shells into a loose cocoon. Our specimens were detected because they were attached to the shells of Manila clams being gathered as part of a survey. Had they not been attached to the larger clams, they likely would have been overlooked.

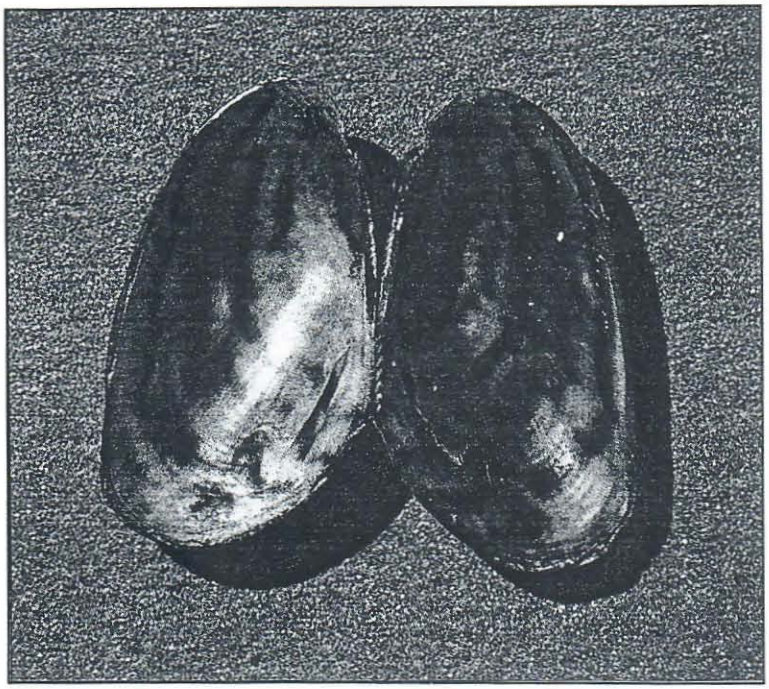


Figure 3. *Musculista senhousia*, from Goldstream Estuary near Victoria. (Bill Merilees photo)

Many introduced clam and snail species have arrived in British Columbia waters, most via the oyster culture industry. Few naturalists are aware that at one time it was a native oyster species (*Ostraea lurida*) around which a small industry grew (Quayle, 1964). As the base for this industry was depleted, Atlantic and Pacific oysters (*Crassostraea virginica* and *C. gigas*) were introduced and cultured. Carl and Guiguet (1958) and Quayle (1964) list three clam species, five snail species, and one slipper shell that are believed to have arrived in British Columbia via oyster culture.

Other Introduced Species

More than oysters arrived in BC when the early oyster transplants were undertaken to establish our oyster culture industry. Quality control or inspections were not part of the oyster seed import process. As a result, other species were able to hitchhike, which prompted the statement, "the greatest agency of all that spreads animals must be the business of oyster culture" (Elton, 1958). Oyster culture is not the sole means for the introduction of aquatic organisms. Ballast water discharge is suspected as the vector of introduction of the zebra mussel (*Dressena polymorpha*), the river ruffe (*Gymnocephalus cernua*), and a predatory planktonic cladoceran (*Bythotrephes cederstroemi*) to the Great Lakes of eastern Canada (Anon., 1990).

N. obscurata may have been recently transported to the Strait of Georgia as pelagic larvae in ship ballast water. Its wide distribution and the recent detection of *N. obscurata* throughout the Strait of Georgia suggest that it was pre-adapted to local conditions.

The discovery of the Japanese mussel in BC waters, well after its establishment in Washington State, may indicate that relatively rare conditions are required for this species to become established in new areas, or that its small size and cryptic habit have allowed it to avoid detection for many years.

Specimens of both species are housed in the authors' personal collections, and in the collection of the Royal British Columbia Museum in Victoria.

Acknowledgments

The authors wish to thank Dr. Phil Lambert of the Royal BC Museum, Bill Austin of Khoyatan Marine Laboratories, Dr. Eugene Coan of Santa Barbara Museum of Natural History, Dr. Neil Bourne, Dr. Glen Jamieson, Rick Harbo and Dwight Heritage of the Pacific Biological Station, Sandra Millen of the University of British Columbia, Nicole Sims, Carol Berryman, J. Carolfeld, Greg Klimek, Carley Somerset, Sabina Leader-Mense, and Terri Martin for sharing their expertise and information or providing specimens. We wish to extend a special thank you to Robert Forsyth for kindly sharing his information on these species.

References

Abbott, T. T. 1974. American seashells. Van Nostrand Reinhold Co., New York, 663 pp.

Anon. 1990. Exotic species and the shipping industry: the Great Lakes-St. Lawrence ecosystem at risk. International Joint Commission and the Great Lakes Fishery Commission Special Report. September, 1990. 74 pp.

Carl, G. C. And C. J. Guiguet. 1958. Alien animals in British Columbia. B.C. Provincial Museum Handbook 14. 94 pp.

Elton, C. S. 1958. The ecology of invasion by animals and plants. Methuen. 181 pp.

Forsyth, R. 1993. *Nuttallia obscurata*, an introduced bivalve (Psammobiidae) in British Columbia waters. Journal of the Fisheries Research Board of Canada 21:1155-1181.

Ricketts, E. R., and J. Calvin. 1968. Between Pacific tides. Stanford University Press, Stanford.

Rare Plants of Nanaimo

BILL MERILEES

The following list of plants has been extracted from *The Rare Vascular Plants of British Columbia*, Syllogeus No. 59 of the National Museum of Canada, 1985 prepared by G. B. Straley, R. L. Taylor and G. W. Douglas. The species listed here have been collected in the Nanaimo area and/or on the basis of the habitat listed are likely to occur. Many likely occur within the "inner route" or Parkway Corridor and other areas open to disturbance.

Definition of 'Rareness':

R1 = Plant taxa that are represented by a single or few known populations, usually with only a few individuals plants in the population

R2 = Plant taxa that have few to several populations, but usually with a relatively large number of individuals in each population

R3 = Plant taxa that have no distinct geographical range or distribution, usually scattered in the province, in isolated populations consisting of a small number of plants.

R4 = Plant taxa that are restricted in their general distribution in the province and often represent the northern or southern limits of more commonly distributed plants. The populations often consist of numerous individuals, but with a narrow geographical range in the province.

Agrostis microphylla	Small-leaved Bent Grass	R4
Allium acuminatum	Hooker's Onion	R4
Allium amplectens	Slimleaf Onion	R2
Allium geyeri	Geyer's Onion	R2
Allotropa virgata	Candystick	R4
Amsinckia lycopsoides	Bugless Fiddleneck	R3
Amsinckia spectabilis	Seaside Amsinckia	R3
Anagallis minima	Chaffweed	R2
Aphanes occidentalis	Western Parsley-piert	R4
Apocynum sibiricum	Clasping-leaved Dogbane	R1
Arctostaphylos columbiana	Bristly Manzanita	R4
Armeria maritima	Thrift	R4
Athysanus pusillus	Common Sandweed	R3
Balsamorhiza deltoidea	Deltoid Balsamroot	R1
Boisduvalia densiflora	Dense Spike-primrose	R2
Boisduvalia stricta	Brook Spike-primose	R1
Boschniakia hookeri	Vancouver Groundcone	R1
Botrychium simplex	Little Grape Fern	R2
Brodiaea coronaria	Harvest Brodiaea	R4
Calandrinia ciliata	Desert Rock Purslane	R3
Callatriche marginata	Winged Water Starwort	R1
Calystegia soldanella	Beach Bindweed	R4
Camassia leichtlinii	Great Camas	R4
Camassia quamash	Common Camas	R4
Carex brevicaulis	Short-stemmed Sedge	R4
Carex hendersonii	Henderson's Sedge	R4

Carex macrocephala	Big-headed Sedge	R4
Castilleja levisecta	Golden Indian Paintbrush	R1
Caucalis microcarpa	California Hedge Parsley	R2
Ceratophyllum echinatum	Spring Hornwort	R3
Clarkia amoena	Farewell-to-spring	R4
Claytonia spathulata	Pale Spring Beauty	R2
Collomia heterophylla	Diverse-leaved Collomia	R4
Crocidium muticaule	Goldstars	R4
Cryptantha intermedia	Large-flowered Cryptantha	R1
Daucus pusillus	American Wild Carrot	R4
Deschampsia danthonooides	Annual Hair Grass	R3
Dryopteris arguta	Coastal Shield Fern	R1
Epilobium halleanum	Glandular Willowherb	R3
Erythronium oreganum	White Fawn Lily	R4
Erythronium revolutum	Pink Fawn Lily	R4
Galium cymosum	Pacific Bedstraw	R3
Gilia capitata	Globe Gilia	R3
Githopsis specullariodes	Common Bluecup	R1
Gratiola ebracteata	Bractless Hedge-hyssop	R4
Gratiola neglecta	Common American Hedge-hyssop	R2
Hemitomes congestum	Gnome-plant	R4
Hydrocotyle ranuncloides	Floating Water Pennywort	R1
Hepericum anagalloides	Bog St. John's-wort	R4
Hypericum formosum	Western St. John's-wort	R3
Isoetes nuttallii	Nuttall's Quillwort	R4
Juncus covillei	Covilles' Rush	R3
Lilaeopsis occidentalis	Western Lilaeopsis	R3
Limnanthes macounii	Macoun's Meadow-foam	R1
Linanthus bicolor	Bicolored Flaxflower	R2
Linaria canadensis	Blue Toadflax	R4
Lobelia dortmanna	Water Lobelia	R3
Lonicera hispidula	Hairy Honeysuckle	R4
Lotus micranthus	Small-flowered Bird's-foot Trefoil	R4
Lotus pinnatus	Bog Bird's-foot Trefoil	R1
Lotus purshinanus	Spanish Clover	R1
Ludwigia palustris	Water-purslane	R4
Lupinus bicolor	Bicolored Lupine	R4
Lupinus polycarpus	Small-flowered Lupine	R2
Madia madiodes	Woodland Tarweed	R4
Marah oreganus	Oregon Manroot	R1
Meconella oregana	White Meconella	R2
Melica harfordii	Harford's Melic Grass	R2
Microseris biglovii	Coast Microseris	R1
Mimulus alsinoides	Chickweed Monkeyflower	R4
Montia dichotoma	Dwarf Montia	R2
Montia fontana	Blinks	R4
Montia howellii	Howell's Montia	R2
Nemophila pedunculata	Meadow Nemophila	R2
Oenothera villosa	Yellow Evening Primrose	R4
Orobanche californica	California Broomrape	R3
Orobanche pinorum	Pine Broomrape	R1
Orthocarpus pusillus	Dwarf Owl-clover	R4
Panicum capillare	Witch Grass	R4

Penstemon nemorosus	Woodland Penstemon	R4
Penstemon ovatus	Broad-leaved Penstemon	R4
Perideridia gairdneri	Gairdner's Yampah	R4
Pityogramma triangularis	Goldenback Fern	R3
Plagiobothrys figuratus	Fragrant Popcornflower	R1
Platanthera unalscensis ssp. maritima	Maritime Alaska Rein Orchid	R1
Polygonum erectum	Erect Knotweed	R1
Polygonum paronychia	Beach Knotweed	R2
Polystichum imbricans	Imbricate Wood Fern	R1
Pyrola dentata	Nootka Pyrola	R3
Ribes lobbii	Gummy Gooseberry	R3
Salix geyeriana	Geyer's Willow	R2
Sanicula bipinnatifida	Purple Sanicle	R1
Satureja douglasii	Yerba Buena	R4
Sidalcea hendersonii	Henderson's Checker-mallow	R2
Stipa lemmonnii	Lemmon's Needle Grass	R2
Toxicodendron deversilobium	Poison-oak	R1
Trifolium bifidum	Pinole Clover	R1
Trifolium cyathiferum	Cup Clover	R2
Trifolium macraei	Macrae's Clover	R1
Trifolium microdon	Thimble Clover	R3
Trifolium microcephalum	Small-headed Clover	R3
Trifolium oliganthum	Few-flowered Clover	R4
Trifolium tridentatum	Tomcat Clover	R4
Trifolium variegatum	White-tipped Clover	R4
Triteleia hyacinthina	Fool's Onion	R4
Valeriana scouleri	Scouler's Sitka Valerian	R4
Vulpia microstachys	Small Vulpia	R2

Members who have found and/or identified species on this list in the greater Nanaimo area are asked to report these to the author or the club President for our records.