

# Intertidal Surveys on Valdes Island

With additional background regarding intertidal and subtidal species diversity

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## INTRODUCTION

The temperate coastal waters of the British Columbia coast contain a rich marine flora and fauna. This array of aquatic organisms has and continues to provide sustenance as well as cultural values for numerous First Nations living in the region. For countless generations, coastal aboriginal peoples assembled knowledge about a large number of organisms that were vital to their survival. First Nation peoples passed on this significant data base via the spoken word—their traditional method of communication. A written language was not utilized.

Upon a much later arrival to the northeast coast of the Pacific Ocean, European explorers began gathering biological information based upon a scientific method. A primary focus involved cataloguing species using the Linnean binomial classification system. While this process began more recently, its resulting data base is extensive and continues to expand. The scientific approach emphasises the written word.

In recent times, environmental concerns have escalated as real and perceived threats continue to mount. It is now of critical importance for current generations, from both points of view, to come together and share information required for addressing environmental threats. Benefits of such a partnership are many, both globally and locally.

As to the latter, the Lyackson First Nation contracted Salish Sea Marine Surveys Inc, to assess the marine environment surrounding Valdes Island, B.C., and report its findings. The primary focus was species diversity and abundance in the intertidal zone. A three-day period of July 21-23, 2013, with very low tides, provided an opportunity for a snap shot of the current situation.

In addition to recording these data, the report also includes some historical, long-term information from the surrounding subtidal waters of Valdes Island. Intertidal observations from nearby Clam Bay, Thetis Island were included as a reasonable comparable and provide additional, longer term information.

A projected and significant expansion of oil exports from the Port of Vancouver provided the impetus for this report. If this initiative proceeds, increased tanker traffic through the Strait of Georgia could pose a greater oil spill risk. As a significant shoreline component along the transport route, Valdes Island would be subject to resulting affects from any oil spill that should occur. The Lyackson First Nation has very significant current and historical legal rights concerning Valdes Island and its surrounding waters. This report provides relevant information to the Lyackson First Nation for representation concerning their considerable interests.

## METHODS

### Intertidal Surveys

Six intertidal survey sites were chosen at Valdes Island based on several criteria: geographic location, degree of exposure to waves and tidal currents, angle of shore slope, physical/geological nature of the shore and accessibility for survey work. The field work was carried out July 21-23 to take advantage of three of the lowest daylight tides of the year. The sites were accessed by boat with a three-person crew; two marine biologists and a boat tender. Each day's pair of survey sites was situated fairly close together so that after surveying the first site as the tide ebbed the crew could move quickly in order to survey the second site as the tide began to flood.

At each survey site a measuring tape was deployed between the approximate highest high tide level and the lowest point of the tide to determine the overall length of the intertidal zone and to provide a reference when recording biological data.

Geographic positioning was recorded using a hand-held Garmin GPS76 to establish start and end points for each transect. This GPS has a maximum precision of +/- 5 metres.

At each site we recorded species present and made notations regarding position along the transect line and relative abundance. Abundance was estimated using "A" for Abundant, "C" for Common, "F" for Few and for rare species, the actual number observed. All species of conspicuous (easily visible with the naked eye) marine life were identified in the field to the best of our expertise. Common and scientific names were recorded according to **Marine Life of the Pacific Northwest** (2005). Organisms were listed according to their presence in the High, Mid or Low intertidal zone. These sub-zones were determined based on estimates of elevation within the intertidal zone. Where feasible boulders or slab-rocks were turned over temporarily so that marine life inhabiting the surfaces and spaces beneath could be observed. At sites with sand or mud substrates, a shovel or rake was used to expose buried or burrowing organisms.

A Nikon D300 SLR digital camera was used to record views of each site and close-ups of representative marine life and substrates.

### Shoreline Survey

To provide a general overview of the shoreline types around Valdes Island, a series of photographs was taken from offshore locations around the perimeter of the island. GSP waypoints were recorded for each photographic location at the same time that a digital photograph was taken of the shore.

## RESULTS

The Transect Summaries provide a general description of the physical and biological nature of each of the six beaches surveyed. Marine life of special aboriginal interest and notable sightings are also specified. Photographs are included to show the general nature of each site.

Appendix 1 provides detailed lists of marine life observed at each of the six intertidal transects, organized according to recognized phyla. Both common and scientific names are presented. For each species observed, estimates of relative abundance are presented in the High, Mid and Low intertidal zones. Photographs of representative species are presented in Appendix 8.

Appendix 2 lists the various species of salmonids that have been recorded from the waters surrounding Valdes Island, along with Hulquminum names.

Appendix 3 presents a list of fishes, invertebrates, mammals and algae of aboriginal interest observed while scuba diving around Valdes Island from 1968 through 2013. These data are based on logs compiled by Andy Lamb and include Hulquminum names.

Appendix 4 presents a list of marine birds and mammals directly observed during the July 21-23, 2013 survey of the shoreline of Valdes Island. Hulquminum names are included where available.

Appendix 5 provides a list of marine birds and mammals observed at Clam Bay, Thetis Island from January, 2007 to July, 2013. This list is based on data compiled by Andy Lamb and provides year-round sightings. Hulquminum names are included where available.

Appendix 6 provides geographical location data as determined by a GPS device for various photographic and sampling locations around Valdes Island.

Appendix 7 presents a series of shoreline photographs taken around the perimeter of Valdes Island. The WP (Way Point) number on each image refers to the data in Appendix 6.

Appendix 8 presents a sampling of close-up images of representative marine life found in the intertidal zone around Valdes Island. Each photograph is labelled with common and scientific name.

## INTERTIDAL SURVEYS: TRANSECT SUMMARIES

### Transect # 1

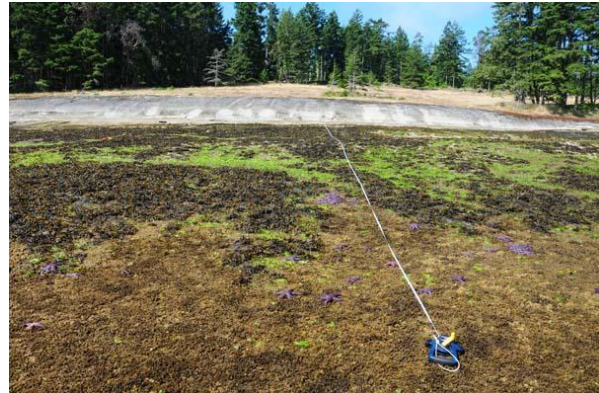
Date: July 21, 2013  
Latitude: 49° 05.796N  
Transect Length: 70 m

Site Name: "North Cove"  
Longitude: 123° 40.214W

**Physical Description:** From high water mark, a sloping sandstone outcrop at first, moderately steep but becoming more gentle with long gullies; with evident scouring; line of algal debris; in upper intertidal zone; transitioning to continuing gentle sloping sandstone outcrop with band of cobble/boulder; band of mussel shell debris in deep, wide gully into mid intertidal zone; one large tide pool and several small elongate tide pools in gullies; fine sand/mud beneath cobble boulders; sand/mud anoxic beneath thin top layer; transitioning into low intertidal zone of continuing gentle sloping sandstone outcrop; at far west side of bay, outcrop abuts to higher outcrop/boulder point .



**Biological Description:** A barnacle/mussel band with rockweed/Turkish washcloth dominates upper intertidal; previous band continues in mid intertidal with the addition of sea lettuce and more associated molluscs and arthropods under boulder/cobble; low intertidal rocky areas over grown with rockweed/wireweed/various red algae providing cover for more molluscs/arthropods and clusters of purple sea stars; a small subtidal bull kelp bed just below the lowest tide mark associated with a reef outcrop.



**Notable Sightings:** mud nemertean *Paranemertes peregrina* , rock prickleback *Xiphister mucosa*



\***Aboriginal Interests:** **iuqus** sea lettuce, **qw'aqwuqw** rockweed, **lew'qum'** Pacific blue mussel, **skwley** Pacific littleneck clam, **tthuqwiye'** snails & periwinkles, **skwitthi'** green sea urchin

## Transect #2

Date: July 21, 2013  
Latitude: 49° 07.544N  
Transect Length: 80 m

Site Name: "Gabriola Bay", Gabriola Pass  
Longitude: 123° 42.591W

**Physical Description:** From high water mark, a moderate sloping rolling sandstone outcrop with some narrow gullies; no tide pools; some wire/metal debris (evidence of log booming?); transitions into mid intertidal zone; a wide diagonal band of gravel over sandstone outcrop; few small patches of shell hash; transitioning into same substrate in low intertidal zone; few, mostly flat rocks/boulders throughout entire intertidal expanse.



**Biological Description:** Overall low organism abundance and interrupted barnacle bands with little associated algae suggests scouring; transitioning into similar situation with more rockweed/Turkish washcloth moving into mid intertidal zone; few flat cobble/boulders provide cover for some molluscs; similarly transitioning into low intertidal zone; slightly more numerous boulders/cobble providing shelter for more molluscs and arthropods; greater algal diversity, including several large kelps at lower levels of low intertidal zone.



**Notable Sightings:** frilled dogwinkle *Nucella lamellosa* with numerous patches of egg cases, abundance of Sitka periwinkle *Littorina sitkana*

**\*Aboriginal Interests:** iuqus sea lettuce, **qw'aqwuqw** rockweed, **gam** bull kelp, **lew'gum** Pacific blue mussel,

**tluhwtluhw** Pacific oyster, **skwley** Pacific littleneck clam, **tthuqwiye'** snails & periwinkles, **kwukwatlshun** red rock crab, **skwitthi'** green sea urchin, **thikwt** red sea cucumber



### Transect # 3

Date: July 22, 2013  
Latitude: 49° 03.654N  
Transect Length: 80 m

Site Name: Detwiller Bay, northwest  
Longitude: 123° 37.482W

**Physical Description:** From high water mark, above which was some log debris, a moderate slope of sand/gravel and into embedded cobble/some boulders transitioning with slightly gentler slope into mid intertidal zone; down to cobble/boulder sitting on fine sand/mud that is anoxic just below surface; transitions into low intertidal; this substrate then reaches a gentle fine sandy/mud substrate to subtidal zone; along northwest edge of bay is a sandstone outcrop formation with large boulders that eventually forms a point/reef that defines the bay and into the subtidal zone.



**Biological Description:** Barnacle band with small, sparse sea lettuce defines the upper intertidal zone and slightly lower it transitions to a barnacle/rockweed/Turkish washcloth sheltering shore crabs band; transitions into mid intertidal as thicker, large sea lettuce/barnacle/rockweed upon cobble/boulders; cobble boulders providing cover for worms, molluscs and arthropods; this transitions into low intertidal, where wireweed/sugar kelp provides even more cover until reaching the sand/mud level where eelgrass becomes a major component; boulders/outcrop at the point provides significant cover for many invertebrate groups.



**Notable Sightings:** dire whelk *Lirabuccinum dirum*, sickle jackknife-clam *Solen sicarius*



**\*Aboriginal Interests:** **iuqus** sea lettuce, **qw'aqwuqw** rockweed, **s'ahwa'** Washington butter clam, **stlula'um** basket cockle, **lew'gum'** Pacific blue mussel, **skweley** Pacific littleneck clam, **sweem** gaper or horse clam, **tthuqwiye'** snails & periwinkles, **kwukwatshun** red rock crab, **'ey'h** Dungeness crab, **skwitthi'** green sea urchin, **sqwe'** plainfin midshipman (singing bullhead)



## Transect # 4

Date: July 22, 2013  
Latitude: 49° 03.495N  
Transect Length: 90 m

Site Name: Detwiller Bay, southeast  
Longitude: 123° 37.428W

**Physical Description:** From high water mark a short, moderate gravel slope transitioning into a gentle slope fine sand/mud slope with much embedded small cobble; also coarse sand bank fronting a low very shallow tidepool in high intertidal zone; becoming the mid intertidal with very similar physical features; transitioning into low intertidal of fine sand/mud with only some bivalve shell debris; and into subtidal; on southeast side and defining the bay, a sandstone outcrop with large boulders reaching into subtidal zone; this edge in the low intertidal fans out with a large area of embedded large cobble/boulders into gentle sloping area providing much cover for marine life.



**Biological Description:** High intertidal features a band of barnacles/short and stringy sea lettuce sheltering shore crabs that also transitions into mid intertidal where large sand/mud area provides habitat primarily for bivalve molluscs and worms; into low intertidal and large patches of eelgrass and associated arthropods; outcrop and cobble/bolder strewn area forming the southeast side of bay features lush kelp/wireweed/red algae that provides cover for wide variety of invertebrates.



**Notable Sightings:** burrowing anemone  
*Anthopleura artemisia*, American bloodworm  
*Glycera americana*



**\*Aboriginal Interests:** **iuqus** sea lettuce, **qw'aqwuqw** rockweed, **gam** bull kelp, **lew'qum'** Pacific blue mussel, **stlula'um** basket cockle, **skwley** Pacific littleneck clam, **tthuqwiye'** snails & periwinkles, **kwukwatshun** red rock crab, **'ey'h** Dungeness crab, **skwitthi** green sea urchin

## Transect # 5

Date: July 23, 2013  
Latitude: 49° 03.328N  
Transect Length: 80 m

Site Name: Blackberry Point  
Longitude: 123° 39.409W

**Physical Description:** From the high water mark, a steep gravel slope gives way to sandy/shell hash with few flat boulders and small cobble/gravel on top; a more moderate slope for the high intertidal zone; transitioning into a gently sloping rolling shelving ridges of sandstone (and softer “mudstone”) with numerous boulders/cobble and thin layer of mud for mid intertidal zone; transitioning into an even gentler slope with same substrate for the low intertidal zone and into subtidal; some sand/mud patches in low intertidal zone.



**Biological Description:** High intertidal featured a broad, deep band of algal litter; further down, bands of barnacle/sea lettuce overlaying shore crab abundance; into mid intertidal where extensive bands of pink-tipped anemones attached to ridges poke through mud; from mid intertidal and through the low intertidal zone and into the subtidal, an increasingly dense, lush cover of diverse algal cover providing shelter for rich assortment of invertebrates and fishes; small eelgrass patches growing from few scattered sand/mud areas.



**Notable Sightings:** pink tipped anemone *Anthopleura elegantissima*, flat-tip piddock *Penitella penita*, rough piddock *Zirfaea pilsbryi*



**\*Aboriginal Interests:** **iuqus** sea lettuce, **qw'aqwuqw** rockweed, **s'ahwa'** Washington butter clam, **stlula'um** basket cockle, **lew'gum** Pacific blue mussel, **tluhwtluhw** Pacific oyster, **skwley** pacific littleneck clam, **sweem** gaper or horse clam, **tthuqwiye'** snails & periwinkles, **kwukwatishun** red rock crab, ? ghost shrimp, **skwitthi'** green sea urchin, **thikwt** red sea cucumber, **sqwe'** plainfin midshipman (singing bullhead), ? shiner sea perch (yellow shiner)

## Transect # 6

Date: July 23, 2012  
Latitude: 49° 02.460N  
Transect Length: 80 m

Site Name: Shingle Point  
Longitude: 123° 38.561W

**Physical Description:** From high water mark, a steep gravel slope into a more gradual sand/shell hash slope in the high intertidal zone; transitioning into a more gently sloping fine sand/mud substrate with copious bivalve shell debris; some large areas of small cobble on sand/mud in mid intertidal zone; transitioning into exclusive fine sand/mud with similar slope; and copious bivalve debris into the low intertidal zone and beyond.



**Biological Description:** A band of short sea lettuce and barnacles and sheltering shore crabs; high quantities of bivalve shell debris in high intertidal zone; transitioning into mid intertidal where dense eelgrass beds dominate throughout and transition through low intertidal zone to subtidal; some scattered bivalve shell debris.



**Notable Sightings:** white bubble shell *Haminoea vesicula*, excentric sand dollar *Dendraster excentricus*

**\*Aboriginal Interests:** **iuqus** sea lettuce, **s'ahwa'** Washington butter clam, **stlua'um** basket cockle, **tluhwtluhw** Pacific oyster, **skwley** Pacific littleneck clam, **sweem** gaper or horse clam, **tthuqwiye'** snails & periwinkles, **kwukwatishun** red rock crab, **'ey'h** Dungeness crab, ? shiner seaperch (yellow shiner)



Note: Historical First Nation clam garden activity at Shingle Point was recently confirmed by Dr. John Harper and associates.

\*This category includes marine life (documented in this report) that is listed, with traditional names, in the Hulquminum Treaty documents referenced in this report. “?” represents species listed but with no aboriginal name in Hulquminum Treaty documents. A more detailed discussion of aboriginal interests appears elsewhere in this report.

## DISCUSSION

The actual short- and long-term impacts of an oil spill on the marine environment and associated shoreline habitats is beyond the scope of this report. It is a complex topic that involves many disciplines. One only needs to consider Alaska's Exxon Valdes case study and all its ramifications to comprehend this fact. Certainly that event has a relevance to the temperate marine waters of B.C. in general and Valdes Island's surrounding sea in particular respect to this report.

However, several basic assumptions could be made about what likely would transpire should a significant oil spill occur in the Strait of Georgia. These could be categorized as short-term and long-term.

Initially, under the influence of the existing wind and tide regime, some quantity of oil would wash ashore along the Valdes Island coast that faces into the Strait of Georgia. Tidal currents, generated on the twice daily ebb tide, would most likely draw oil through Gabriola and Porlier Passages. Under that scenario, oil would be deposited on adjacent Valdes Island shores and most likely along the Trincomali/Pylades Channel foreshore as well. Consequently, the entire coastline of Valdes Island potentially lies in the path of an oil spill event.

The wide ranging, detailed affects of oil washing ashore in the intertidal zone of Valdes Island are again beyond the scope of this discussion. However, one result would certainly occur. Intertidal organisms inhabiting habitats in the path of the oncoming oil would be subjected to some degree of coverage.

The primary goal of this report is to supply information concerning the intertidal zone of Valdes Island and to document the organisms present and potentially subject to coverage via an oil spill event.

Long-term affects of an oil spill are very difficult to assess and such a process is still continuing many years after the Exxon Valdes event. However, implications for marine food webs and subtidal organisms logically follow.

Another component of this report is a list of subtidal organisms that inhabit the regions from the lowest tide mark to approximately 35 m (115 ft). Generated via SCUBA diving over the last 44 years, it provides a baseline for reference.

This report provides a detailed list of species and relative abundance for a three-day period in July, 2013. Unfortunately, this is only a "snap shot" in time and does not address seasonality of species presence. This is significant issue as organisms may be present at a certain time of year while absent at others. The example of over-wintering ducks that are not present during the summer period is notable but only one of many. This report includes additional material based on long-term data gathering as an attempt to address seasonality. The subtidal list, the result 44

years of observations from the waters around Valdes Island, is one such presentation. Another component is the list of intertidal flora and fauna observed over a seven-year period at nearby Thetis Island (Clam Bay) and was generated via year round observations. Given more time to survey the Valdes Island sites selected for the field portion of this study, it is probable that many more species would be added to the presented list.

As mentioned in the INTRODUCTION, a large amount of relevant information results from generations of Lyackson First Nation oral tradition. This background material actually speaks to several issues covered above and is illustrated by the few following examples.

Kathleen Johnnie, who is the Lyackson Lands & Resources Coordinator and facilitates Elders meetings provided the following story passed along via the oral tradition. “My grandfather used to sing up the dolphins as he rowed his children to Nanaimo from Shingle Point grocery shopping. He would instruct them never to harm the dolphins. They were friends. According to witnesses, when my grandfather passed on, 16 to 18 dolphins escorted the boat carrying his body to Penelekut – he was buried on Penelekut, not Valdes, although he was Lyackson.”

Kathleen also mentioned “recently seeing a whale” an observation reinforced by a “hermitish” gent who has lived on Valdes Island for decades. He identified it as a gray whale *Eschrichtius robustus*. Further verification is available via whale watching operators.

At an Elders meeting, several attendees mentioned a sea lion haul out site (just north of a transect site at Detwiller Bay) that they were familiar with. This oral information is no doubt accurate but due to seasonality, verification was not possible in July, 2013.

In summary, this report provides current and historic information about the marine life and habitats surrounding Valdes Island. It documents what is at stake for everyone associated with Valdes Island should a significant oil spill occur in the adjacent waters of the Strait of Georgia.

## ACKNOWLEDGEMENTS

Dr. Michael Hawkes provided assistance with identification of marine algae. Rick Harbo confirmed the identification of piddocks and other bivalves. Linda Schroeder verified the identification of a chiton.

Tenny McDaniel and Heather Harbo assisted in the field operations. Peter Luckham provided information regarding First Nations names for marine life and other assistance in the preparation of this report. The Lyacksan First Nation Elders provided background on the historical use of marine resources around Valdes Island.

Dr. John Harper, Coastal & Ocean Resources, provided information and images of the clam gardens at Shingle Point.

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# Appendix 1: Intertidal Transects—Marine Life Inventory

Intertidal Transects--Marine Life Inventory																				
COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
<b>SEA GRASSES</b>	<b>ANTHOPHYTA</b>																			
Eelgrass	<i>Zostera marina</i>				C			C			C		F	C		A	C		A	A
Dwarf eelgrass	<i>Zostera japonica</i>															C		F	A	
<b>GREEN ALGAE</b>	<b>CHLOROPHYTA</b>																			
Short sea lettuce	<i>Ulva</i> sp. 1			C					C				F		C	A		C		
Large sea lettuce	<i>Ulva</i> sp. 2			F	A		A	A	C	A	A	C	A	C	A	C	A		A	
Flat-tube sea lettuce	<i>Ulva linza</i>								C	A	A	C	A					C	A	A
Green hair	<i>Urospora penicilliformis</i>											F	F							
<b>BROWN ALGAE</b>	<b>OCHROPHYTA</b>																			
Rockweed	<i>Fucus gardneri</i>	√	C	A	A	A	A		A	A	A	C		A	C	C	C			
Sea cauliflower	<i>Leathesia difformis</i>	√		C	C			C		C	C			C		C	C			
Sugar wrack kelp	<i>Saccharina latissima</i>	√						C			C			C			A		C	
Wireweed	<i>Sargassum muticum</i>				C			A			A			A		A	A			
Bull kelp	<i>Nereocystis luetkeana</i>							F						F						
Dark brown wrack kelp	<i>Saccharina simplex</i>													F						
Skinny rockweed	<i>Fucus</i> sp.															C				
Whip tube	<i>Scytosiphon lomentaria</i>														F					
Yellowish on Zostera	species not determined																			C
Wiry acid kelp	<i>Desmarestia aculeata</i>															A				
Round brown bag	<i>Colpomenia perigrina</i>																F			
<b>RED ALGAE</b>	<b>RHODOPHYTA</b>																			
Bushy Turkish washcloth	<i>Mastocarpus jardinii</i>	√	C	A			C		A			C		A	C	F				
Sea sacs	<i>Halosaccion glandiforme</i>	√						F									A			
Beauty bush	<i>Callithamnion pikeanum</i>			C	A					C	A		C	A		C	C			

Intertidal Transects--Marine Life Inventory																				
COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
Iodine seaweed	<i>Prionitis</i> sp.				C									F						
Crustose coralline	<i>Clathromorpha</i> sp.				C												C			
Articulated coralline	species not determined				A															
Blade red alga 1 short, red	species not determined				C									F						
<b>RED ALGAE</b>	<b>RHODOPHYTA</b>																			
Turkish towel	<i>Chondracanthus exasperatus</i>										C			C			A			
Sea lace	<i>Microcladia</i> sp.				F									C			C			
Ruffled red seaweed	<i>Cryptopleura</i> sp.				C									F						
Nori	<i>Porphyra</i> sp.								C			C	C		A	C		C	A	
Short red algal turf	species not determined									C	A		C		C	C	C			
Red fringe	<i>Porphyra naiadum</i>										F									
Iridescent seaweed	<i>Mazzaella splendens</i>										F			F						
Blade red alga 2 ruffled	species not determined										F			F			C			
Dark branching-tube seaweed	<i>Cryptosiphonia woodi</i>													F						
Succulent seaweed	<i>Sarcodiotheca gaudichaudii</i>													F			A			
Red rock crust	<i>Hildenbrandia</i> sp.													F						
Sarcodiotheca-like	species not determined																C			
Red spaghetti	<i>Gracilaria/Gracilariopsis</i>																A			
Sea belly	<i>Gastroclonium subarcticulatum</i>																C			
<b>SPONGES</b>	<b>PORIFERA</b>																			
Yellow encrusting sponge	species not determined							F			C					C	C			
Orange thin encrusting sponge	species not determined										F					F				
<b>ANEMONES/JELLIES</b>	<b>CNIDARIA</b>																			
Plumose anemone	<i>Metridium farcimen</i>				F											F	F			
Burrowing anemone	<i>Anthopleura artemisia</i>			2	1					C	A			A						
Pink-tipped anemone	<i>Anthopleura elegantissima</i>	✓								F					C	A	C		C	



Intertidal Transects--Marine Life Inventory																				
COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
Stubby rose anemone	<i>Urticina coriacea</i>										1									1
Water jelly	<i>Aequorea</i> sp.													2						
<b>FLATWORMS</b>	<b>PLATYHELMINTHES</b>																			
Brown flatworm	<i>Notoplana</i> sp.						C								C					
<b>RIBBON WORMS</b>	<b>NEMERTEA</b>																			
Green ribbon worm	<i>Emplectonema gracile</i>						F													
<b>RIBBON WORMS</b>	<b>NEMERTEA</b>																			
White ribbon worm	<i>Amphiporus</i> sp.			C			C	C			C			F						
Mud nemertean	<i>Paranemertes peregrina</i>																			
Orange ribbon worm	<i>Tubulanus polymorphus</i>															1				
<b>POLYCHAETE WORMS</b>	<b>POLYCHAETA</b>																			
Sea nymph	<i>Nereis</i> sp.							C	C	C	C	C	C	C		C	C			
Red trumpet tubeworm	<i>Serpula columbiana</i>	√						C			C					C	C			
Pink spaghetti-worm	<i>Thelepus</i> sp. 1							F								C	F			
Commensal worm	<i>Ophiodromus pugettensis</i>							F												
American bloodworm	<i>Glycera americana</i>										A			A						C
Sandmason worm tubes	species not determined										2					1				
Thread sludge worm	<i>Notomastus</i> sp.													C			C			C
Brown intertidal spaghetti-worm	<i>Eupolymnia heterobranchia</i>	√															1			
<b>MOSS ANIMALS</b>	<b>BRYOZOA</b>																			
Orange encrusting bryozoan	<i>Schizoporella japonica</i>				F			C			A			A		C	C			
Kelp encrusting bryozoan	<i>Membranipora serrilamella</i>																A			C
<b>CHITONS</b>	<b>MOLLUSCA</b>																			
Woody chiton	<i>Mapalia lignosa</i>							2			F			F		C	C			
Northern hairy chiton	<i>Mapalia kennerlyi</i>	√						1			1					C	C			
Swan's mopalia	<i>Mapalia swani</i>	√														1				
Lined chiton	<i>Tonicella lineata</i>															1				

**Intertidal Transects--Marine Life Inventory**

COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
<b>BIVALVES: CLAMS, MUSSELS</b>	<b>MOLLUSCA</b>																			
Washington butter clam	<i>Saxidomus gigantea</i>										F					A	C			
Purple mahogany-clam	<i>Nuttallia obscurata</i>											C	C	C	C	C		C	C	
Nuttall's cockle	<i>Clinocardium nuttallii</i>	√								C				C		A	C		C	A
Pacific blue mussel	<i>Mytilus trossulus</i>		C	A			A		C	C		C	C		F	F				
Pacific oyster	<i>Crassostrea gigas</i>						C									F			C	
Green false-jingle	<i>Pododesmus macrochisma</i>	√			F			F			F			F		F				
Arctic nestler	<i>Hiatella arctica</i>	√						1									F			
Bentnose clam	<i>Macoma nasuta</i>										C			C					C	C
Pacific littleneck clam	<i>Protothaca staminea</i>	√		F			F			C				F		C	C		C	C
Gaper clams	<i>Tresus</i> spp.	√														A	C		A	A
Sickle jackknife clam	<i>Solen sicarius</i>													2						
Soft-shell clam	<i>Mya arenaria</i>																		F	
Baltic macoma	<i>Macoma balthica</i>																		F	
<b>BIVALVES: CLAMS, MUSSELS</b>	<b>MOLLUSCA</b>																			
Olympia oyster	<i>Ostrea lurida</i>																1			
Rough piddock	<i>Zirfaea pilsbryi</i>	√														A	A			
Flat-tip piddock	<i>Penitella penita</i>	√														A	A			
Monterey piddock	<i>Penitella richardsoni</i>																F			
White-sand macoma	<i>Macoma secta</i>	√																	C	C
<b>UNIVALVES: SNAILS, LIMPETS</b>	<b>MOLLUSCA</b>																			
Mask limpet	<i>Lottia persona</i>			F			F	C	C	C		C	F		C	C				
Shield limpet	<i>Lottia pelta</i>			C			C			C	C	C	F			C				
Wrinkled dogwinkle	<i>Nucella lamellosa</i>	√		F			A			C	C			C	A	A	A		F	
Dire whelk	<i>Lirabuccinum dirum</i>					1				C	C			C						
Checkered periwinkle	<i>Littorina scutulata</i>		A			C			A						A					
Sitka periwinkle	<i>Littorina sitkana</i>	√		C		C	A								F					
Nassa snail	<i>Nassarius</i> sp.						1													
Threaded bittium	<i>Bittium eschrichtii</i>			F											C					
Helicina margarite	<i>Margarites helicinus</i>				1															
Plate limpet	<i>Lottia scutum</i>										F									
Lewis's moon snail	<i>Euspira lewisii</i>																F			C

Intertidal Transects--Marine Life Inventory																				
COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
Carinate dovesnail	<i>Alia carinata</i>				C				C						C					
<b>NUDIBRANCHS/BUBBLE SHELLS</b>	<b>MOLLUSCA</b>																			
White bubble shell	<i>Haminoea vesicula</i>							A											C	C
Barnacle-eating nudibranch	<i>Onchidoris bilamellata</i>							1												
Monterey sea lemon	<i>Doris montereyensis</i>										F									
Hooded nudibranch	<i>Melibe leonina</i>																1			
<b>CRABS, SHRIMPS, BARNACLES</b>	<b>ARTHROPODA</b>																			
Amphipods	species not determined					C			A			A			C					
Stubby isopod	<i>Gnorimosphaeroma oregonensis</i>			C				A		C		A	C	F						
Rockweed isopod	<i>Idotea vosnesenskii</i>			F			F				F			F		F				
Shrimp	species not determined										1					F	F			
Gray shrimp	<i>Crangon</i> sp.													F						F
Green shore crab	<i>Hemigrapsus oregonensis</i>			A			A	C	C	A	C	C	C	C	A	A		C		
Purple shore crab	<i>Hemigrapsus nudus</i>						F		C	A	C	F			C					
Black-clawed crab	<i>Lophopanopeus belli</i>							F								C	C			
Red rock crab	<i>Cancer productus</i>							F			F			F		C	C			F
Graceful decorator crab	<i>Pugettia gracilis</i>				1									1		C	C			F
Flat porcelain crab	<i>Petrolisthes cinctipes</i>							1								F				
<b>CRABS, SHRIMPS, BARNACLES</b>	<b>ARTHROPODA</b>																			
Common acorn barnacle	<i>Balanus glandula</i>	√	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	C	C
Dungeness crab	<i>Cancer magister</i>										F			C						F
Northern kelp crab	<i>Pugettia producta</i>																F			F
Bay ghost shrimp	<i>Neotrypaea californiensis</i>	√															1			
Graceful crab	<i>Cancer gracilis</i>																			1
Hairy hermit crab	<i>Pagurus hirsuticulus</i>			F			F	C	A	C	C	C	C	F	A	C				
Grainyhand hermit crab	<i>Pagurus granosimanus</i>			A			C	A		C	C	C	C	F	A	C				
<b>SEASTARS, URCHINS, CUCUMBERS</b>	<b>ECHINODERMATA</b>																			
Purple/ochre star	<i>Pisaster ochraceus</i>	√			A			C		C	C	F	F	C		C	C		1	
Giant pink star	<i>Pisaster brevispinus</i>	√						1						1		1				

Intertidal Transects--Marine Life Inventory																				
COMMON NAME	SCIENTIFIC NAME	Photo	T1 H	T1 M	T1 L	T2 H	T2 M	T2 L	T3 H	T3 M	T3 L	T4 H	T4 M	T4 L	T5 H	T5 M	T5 L	T6 H	T6 M	T6 L
Mottled star	<i>Evasterias troschelii</i>							C		C	C		F	C	F	C	F			
Sunflower star	<i>Pycnopodia helianthoides</i>										F			F			F			1
Leather star	<i>Dermasterias imbricata</i>																F			
Green sea urchin	<i>Strongylocentrotus droebachiensis</i>				F			F		F	F			F			F	F	C	
Excentric sand dollar	<i>Dendraster excentricus</i>	√																		
Red sea cucumber	<i>Cucumaria miniata</i>	√						2								C	C			
Stiff-footed sea cucumber	<i>Eupentacta quinquesemita</i>															F	F			
<b>FISHES</b>																				
Rock prickleback	<i>Xiphister mucosus</i>			1																
High cockscomb	<i>Anoplarchus purpureus</i>				F					C	C		C	C		A	A			
Tidepool sculpin	<i>Oligocottus maculosus</i>			C				C		C	A		A	A			C			C
Plainfin midshipman	<i>Porichthys notatus</i>	√									1					F	F			
Pacific staghorn sculpin	<i>Leptocottus armatus</i>																F			C
Rock sole	<i>Lepidopsetta bilineata</i>																			1
Shiner perch	<i>Cymatogaster aggregata</i>																F			C

## Appendix 2: Salmonids and Valdes Island

Species of Pacific salmon were not observed during the July 21-23, 2013 inventory undertaken by Salish Sea Marine Surveys Inc. Neither were any recorded during the SCUBA diving activities which generated the list of subtidal species for the waters surrounding Valdes Island. However, aboriginal, commercial and recreational fishing activities occurring over many years have established a salmonid presence, particularly during spawning migrations.

The following species list acknowledges this faunal component and its Lyacksan First Nation special interest:

**stthaqwi'** chinook (spring) salmon *Oncorhynchus tshawytscha*  
**thuqi'** sockeye salmon *Oncorhynchus nerka*  
**kwa'luhw'** chum salmon *Oncorhynchus keta*  
**the'wun** coho salmon *Oncorhynchus kisutch*  
**haan'** pink salmon *Oncorhynchus gorbuscha*  
**s'huw'gum'** steelhead *Oncorhynchus mykiss*

### Appendix 3: List of fishes, invertebrates, mammals and algae of aboriginal interest observed while scuba diving around Valdes Island from 1968 through 2013

This list is meant to be inclusive providing the largest potential relevant species that would be suitable for aboriginal harvest, consumption and cultural activity. A primary consideration in this regard is species maximum size. Hulquminum names provided when available. Some discussion points concerning certain species are included.

#### ALGAE

**luqus** sea lettuce *Ulva* spp.

**qw'aqwuqu** rockweed *Fucus gardneri*

**gam** bull kelp *Nereocystis luetkeana*

\*sugar wrack kelp *Saccharina latissima*

\*dark-brown wrack kelp *Saccharina subsimplex*

\*seersucker kelp *Costaria costata*

\*broad-wing kelp *Alaria marginata*

(species listed above with \* could most likely be included as **gam**)

#### MOLLUSCS

**'ukws** giant gumboot chiton *Cryptochiton stelleri*

**hulum'** black leather chiton (black katy chiton) *Katharina tunicata*

\*woody chiton *Mopalia lignosa*

\*mossy chiton *Mopalia muscosa*

\*northern hairy chiton *Mopalia kennerlyi*

\*Swan's chiton *Mopalia swani*

\*Hind's chiton *Mopalia hindsii*

\*red-flecked chiton *Mopalia spectabilis*

(species listed above with \* most likely be included as **hulum'**)

**lew'qum** Pacific blue mussel

(spiny pink scallop *Chlamys hastata* – possibly included as **kwun'eem'mun'** the word for weathervane scallop *Patinopecten caurinus*)

giant rock scallop *Crassadoma gigantea*

**tluhwtluhw** Pacific oyster *Crassostrea gigas*

**stlula'um** basket cockle *Clinocardium nuttallii*

**sweem** horse clams – fat gaper *Tresus capax* and Pacific gaper *Tresus nuttallii*

**pun'eq** Pacific geoduck *Panopea generosa*

sunset clam *Gari californica*

**s'ahwa'** Washington butter clam *Saxidomus gigantea*

**skwley** Pacific littleneck clam *Protothaca staminea*

**geyus tetsul skwley** Japanese littleneck clam *Venerupis philippinarum*

Kennerley's venus clam *Humilaria kennerleyi*

rock entodesma *Entodesmus navicula*

rough keyhole limpet *Diadora aspera*

### Appendix 3 (continued)

**qumine'** northern abalone *Haliotis kamtschatkana*

\*wrinkled dogwinkle *Nucella lamellosa*

\*leafy hornmouth *Ceratostoma foliatum*

\*dire whelk *Lirabuccinum dirum*

\*Lewis's moonsnail *Euspira lewisii*

\*Oregon triton *Fusitriton oregonensis*

(species listed above with \* would be included in **tthuqwiyi** snails and periwinkles)

**sqimukw** giant Pacific octopus *Enteroctopus dofleini*

Pacific red octopus *Octopus rubescens* – most likely included as **sqimukw**

opalescent squid *Doryteuthis opalescens*

### ARTHROPODS

Pacific prawn *Pandalus platyceros*

\*coonstripe shrimp *Pandalus danae*

\*rough patch shrimp *Pandalus stenolepis*

(species listed above with \* could most likely be included with Pacific prawn)

**kwukwatshun** red rock crab *Cancer productus*

**'ey'h** Dungeness crab *Cancer magister*

graceful crab *Cancer gracilis* – most likely included as **'ey'h**

tanner crab *Chionoecetes bairdi*

Puget Sound king crab *Lopholithodes mandtii*

giant acorn barnacle *Balanus nubilus*

### ECHINODERMS

**hihwu** red sea urchin *Strongylocentrotus franciscanus*

**skwitthi** green sea urchin *Strongylocentrotus droebachiensis*

**thikwt** red sea cucumber *Cucumaria miniata*

giant sea cucumber *Parastichopus californicus* – most likely included as **thikwt**

### FISHES

Pacific spiny dogfish *Squalus suckleyi*

**qequw'** big skate *Raja binoculata*

longnose skate *Raja rhina* – most likely included as **qequw'**

**slewut** Pacific herring *Clupea pallasii*

Pacific cod *Gadus macrocephalus*

walleye pollock *Theragra chalcogramma*

**wiitsi** pile perch *Rhacochilus vacca*

striped seaperch *Embiotoca lateralis* – perhaps included as **wiitsi**

shiner perch *Cymatogaster aggregata*

penpoint gunnel *Apodichthys flavidus*

**luluthun** wolf-eel *Anarrhichthys ocellatus*

### Appendix 3 (continued)

**tqas** rockfish (cod) including copper rockfish *Sebastes caurinus*, quillback rockfish *Sebastes maliger* and brown rockfish *Sebastes auriculatus*

**syenyenhw** black rockfish (black bass) *Sebastes melanops*

yellowtail rockfish *Sebastes flavidus* – most likely included as **syenyenhw**

**tuqwtuqw** yelloweye rockfish (red snapper) *Sebastes ruberrimus*

tiger rockfish *Sebastes nigrocinctus* –perhaps included as **tuqwtuqw**

**lthumukwa'** kelp greenling *Hexagrammos decagrammus*

whitespotted greenling *Hexagrammos stelleri* – most likely included as **lthumukwa'**

**'eeyt** lingcod *Ophiodon elongatus* (**huy'huy'tl** lingcod eggs)

cabezon *Scorpaenichthys marmoratus*

great sculpin *Myoxocephalus polyacanthocephalus*

buffalo sculpin *Enophrys bison*

red Irish lord *Hemilepidotus hemilepidotus*

Pacific staghorn sculpin *Leptocottus armatus*

**sqwe'** plainfin midshipman (singing bullhead) *Porichthys notatus*

**pi'hwus/pul'iphwus** English sole *Parophrys vetulus*

rock sole *Lepidopsetta bilineata* – most likely included as **pi'hwus/pul'iphwus**

**puwi'** starry flounder *Platichthys stellatus*

### MAMMALS

Harbour seal *Phoca vitulina*

Steller sea lion *Eumetopias jubatus*

Killer whale *Orcinus orca* (above water)



**Appendix 4: List of marine birds and mammals observed during the July 21-23, 2013 survey of the shoreline of Valdes Island**

(Hulqumimum names appear where available)

**BIRDS**

'ehu (s'hul'ulwul) Canada goose *Branta canadensis*

double-crested cormorant *Phalacrocorax auritus*

**smuqwa'** great blue heron *Ardea erodias*

glaucous –winged gull *Larus glaucescens*

pigeon guillemot *Cephus columba*

belted kingfisher *Ceryle alcyon*

turkey vulture *Cathartes aura*

**yuhwule'**bald eagle *Haliaeetus leucocephalus*

**swakwun (swqkwun)** common loon *Gavia immer*

**MAMMALS**

harbour seal *Phoca vitulina*

## Appendix 5: List of marine birds and mammals observed at Clam Bay, Thetis Island from January, 2007 to July, 2013 by Andy Lamb

(Hulqumimum names provided where available)

### BIRDS

**'ehu (s'hul'ulwul)** Canada goose *Branta canadensis*  
**tunuqsun** mallard *Anas platyrhynchos*  
harlequin duck *Histrionicus histrionicus*  
bufflehead *Bucephala albeola*  
common goldeneye *Bucephala clangula*  
Barrow's goldeneye *Bucephala islandica*  
lesser scaup *Aythya affinis*  
greater scaup *Aythya marila*  
**hwaaqw** (female) **qumut** (male) common merganser *Mergus merganser*  
**kwalhw** surf scoter *Melanitta perspicillata*  
**swakwun (swqkwun)** common loon *Gavia immer*  
**skwulkwulth** western grebe *Aechmophorus occidentalis*  
pelagic cormorant *Phalacrocorax pelagicus*  
double-crested cormorant *Phalacrocorax auritus*  
**smuqwa'** great blue heron *Ardea herodias*  
turkey vulture *Cathartes aura*  
osprey *Pandion haliaetus*  
**yuhwule'** bald eagle *Haliaeetus leucocephalus*  
black oystercatcher *Haematopus bachmani*  
whimbrel *Numenius phaeopus*  
sandpiper *Calidris* sp.  
Bonaparte's gull *Larus philadelphia*  
Heermann's gull *Larus heermanni*  
mew Gull *Larus canus*  
glaucous-winged gull *Larus glaucescens*  
**s'hetth** common murre *Uria aalge*  
pigeon guillemot *Cephus columba*  
rhinoceros auklet *Cerorhinca monocerata*  
belted kingfisher *Ceryle alcyon*  
northwestern crow *Corvus caurinus*  
common raven *Corvus corax*  
American robin *Turdus migratorius*

### MAMMALS

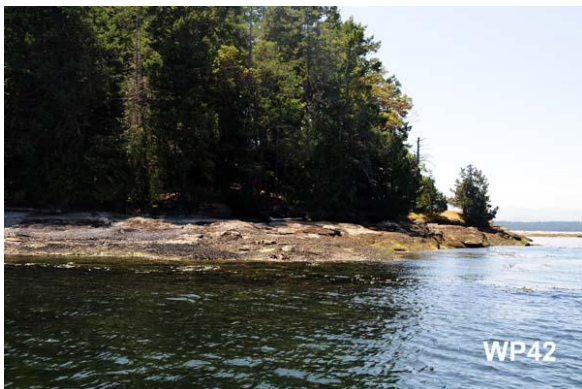
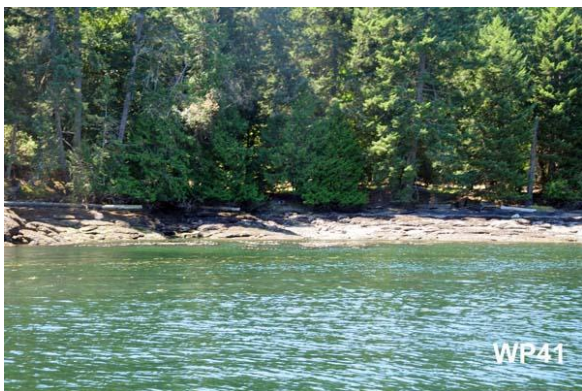
harbour seal *Phoca vitulina*  
Steller sea lion *Eumetopias jubatus*  
river otter *Lutra canadensis*  
mink *Neovison vison*

## Appendix 6: Shoreline Survey Photograph Data

Shoreline Survey Photograph Data					
WP#	Latitude North	Longitude West	Date	Time	Location
25	49 05.796	123 40.214	July 21 2013	10:05	T1 top of beach
26	49 05.805	123 40.194	July 21 2013	10:09	T1 30 m downslope
27	49 05.813	123 40.172	July 21 2013	10:53	T1 60 m downslope
28	49 05.803	123 40.138	July 21 2013	11:10	T1 water's edge
29	49 07.546	123 42.571	July 21 2013	11:42	
30	49 07.533	123 42.546	July 21 2013	11:44	
31	49 07.538	123 42.562	July 21 2013	11:45	
32	49 07.545	123 42.538	July 21 2013	11:46	
33	49 07.544	123 42.534	July 21 2013	11:46	
34	49.07.545	123 42.564	July 21 2013	11:50	
35	49 05.546	123 42.562	July 21 2013	11:51	
36	49 07.543	123 42.562	July 21 2013	11:51	T2 water's edge
37	49 07.542	123 42.577	July 21 2013	11:58	T2 30 m upslope
38	49 07.544	123 42.578	July 21 2013	12:07	T2 60 m upslope
39	49 07.554	123 42.591	July 21 2013	12:14	T2 top of beach
40	49 07.537	123 42.589	July 21 2013	12:22	
41	49 07.623	123 42.643	July 21 2013	13:25	
42	49 07.672	123 42.848	July 21 2013	13:30	
43	49 07.531	123 42.046	July 21 2013	13:33	
44	49 07.343	123 42.939	July 21 2013	13:36	
45	49 07.100	123 42.707	July 21 2013	13:39	
46	49 06.652	123 42.545	July 21 2013	13:43	
47	49 06.355	123 42.285	July 21 2013	13:45	
48	49 05.905	123 41.881	July 21 2013	13:47	
49	49 05.356	123 41.237	July 21 2013	13:50	
50	49 04.700	123 40.355	July 21 2013	13:54	
51	49 04.231	123 39.543	July 21 2013	13:56	
52	49 03.471	123 39.492	July 21 2013	13:59	
53	49.03.198	123 39.403	July 21 2013	14:05	
54	49.02.660	123 38.722	July 21 2013	14:09	
55	49 02.412	123 38.654	July 21 2013	14:12	Shingle Pt.
56	49 02.232	123 37.942	July 21 2013	14:16	
57	49 01.691	123 37.325	July 21 2013	14:19	
58	49 01.018	123 36.662	July 21 2013	14:22	Cardale Pt.
59	49 00.723	123 36.089	July 21 2013	14:27	Cayatano Pt.
60	49 00.824	123 35.790	July 21 2013	14:30	Porlier Pass
61	49 00.956	123 35.597	July 21 2013	14:33	Porlier Pass
62	49 01.033	123 35.596	July 21 2013	14:39	Vernaci Pt.

Shoreline Survey Photograph Data					
WP#	Latitude North	Longitude West	Date	Time	Location
63	49 03.654	123 37.482	July 22 2013	9:58	T3 at top of beach
64	49 03.635	123 37.461	July 22 2013	10:04	T3 30 m downslope
65	49 03.628	123 37.439	July 22 2013	10:36	T3 60 m downslope
66	49 03.625	123 37.423	July 22 2013	11:09	T3 at water's edge
67	49 03.529	123 37.365	July 22 2013	11:49	T4 at water's edge
68	49 03.520	123 37.388	July 22 2013	12:24	T4 30 m upslope
69	49 03.499	123 37.423	July 22 2013	12:48	T4 60 m upslope
70	49 03.495	123 37.428	July 22 2013	12:56	T4 top of beach
71	49 03.597	123 37.292	July 22 2013	14:08	
72	49 05.783	123 40.150	July 22 2013	14:22	
73	49 05.687	123 40.078	July 22 2013	14:30	
74	49 05.604	123 39.830	July 22 2013	14:35	
75	49 05.376	123 39.530	July 22 2013	14:37	
76	49 05.023	123 39.156	July 22 2013	14:40	
77	49 04.705	123 38.694	July 22 2013	14:43	
78	49 05.455	123 38.373	July 22 2013	14:46	
79	49 04.000	123 37.577	July 22 2013	14:50	
80	49 03.563	123 37.068	July 22 2013	14:53	Detwiller Pt.
81	49 02. 839	123 36.403	July 22 2013	14:57	
82	49 02.239	123 35.918	July 22 2013	15:01	
83	49 01.651	123 35.541	July 22 2013	15:04	
84	49 01.681	123 35.358	July 22 2013	15:07	Canoe Islet
85	49 01.226	123 35.344	July 22 2013	15:16	Vernaci Pt.
86	49 59.306	123 39.161	July 23 2013	17:29	
87	49 59.306	123 39.161	July 23 2013	17:29	
88	49 03.328	123 39.409	July 23 2013	10:16	T5 at top of beach
89	49 03.323	123 39.436	July 23 2013	10:51	T5 30 m downslope
90	49 03.312	123 39.455	July 23 2013	11:42	T5 60 m downslope
91	49 03.311	123.39.475	July 23 2013	12:11	T5 77 m at water's edge
92	49 02.411	123 38.561	July 23 2013	13:04	T6 at water's edge
93	49 02.427	123 38.565	July 23 2013	13:26	T6 30 m upslope
94	49 02.445	123 38.558	July 23 2013	13:56	T6 60 m upslope
95	49 02.460	123 38.561	July 23 2013	13:58	T6 81 m upslope

**Appendix 7: Shoreline Survey Photographs** (refer to Appendix 6 for GPS coordinates)



**Appendix 7: Shoreline Survey Photographs (continued)**



**Appendix 7: Shoreline Survey Photographs (continued)**



Appendix 7: Shoreline Survey Photographs (continued)





Appendix 7: Shoreline Survey Photographs (continued)



Appendix 8: Selected Marine Life Photos



Appendix 8: Selected Marine Life Photos (continued)



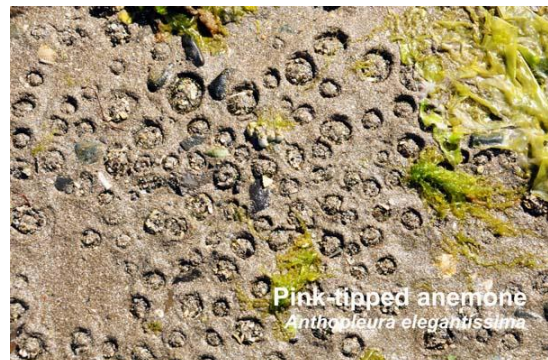
Northern hairy chiton  
*Mopalia kennerleyi*



Arctic nestler  
*Hiattella arctica*



Wrinkled dogwinkle  
*Nucella lamellosa*



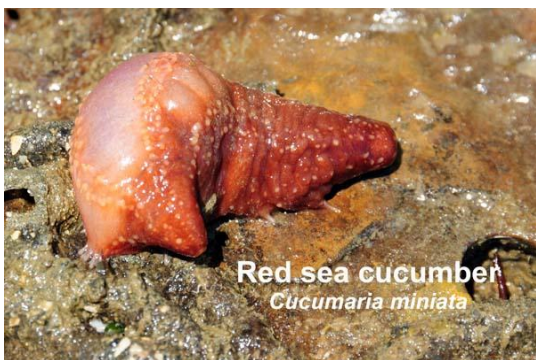
Pink-tipped anemone  
*Anthopleura elegantissima*



Sea cauliflower  
*Leathesia difformis*



Brown intertidal spaghetti-worm  
*Eupolyornia heterobranchia*



Red sea cucumber  
*Cucumaria miniata*



Flat-tip piddock  
*Penitella penita*

Appendix 8: Selected Marine Life Photos (continued)



Appendix 8: Selected Marine Life Photos (continued)

