

Field Verification of Historic Records of Olympia Oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia - 2009

L.M. Stanton, T.C. Norgard, S.E.M. MacConnachie and G.E. Gillespie

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7

2011

Canadian Technical Report of Fisheries and Aquatic Sciences 2940



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada 

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences. Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in Aquatic Sciences and Fisheries Abstracts and indexed in the Department's annual index to scientific and technical publications. Numbers 1 - 456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457 - 714 were issued as Department of the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925. Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais que ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques. Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue Résumés des sciences aquatiques et halieutiques, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère. Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925. Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of Fisheries
and Aquatic Sciences 2940

2011

FIELD VERIFICATION OF HISTORIC RECORDS OF OLYMPIA OYSTERS
(*Ostrea lurida* Carpenter, 1864) IN BRITISH COLUMBIA - 2009

by

L.M. Stanton, T.C. Norgard, S.E.M. MacConnachie and G.E. Gillespie

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, British Columbia V9T 6N7

© Her Majesty the Queen in Right of Canada, 2011
Cat. No. Fs 97-6/2940E ISSN 0706-6457

Correct citation for this publication:

Stanton, L.M., Norgard, T.C., MacConnachie, S.E.M., and Gillespie, G.E. 2011. Field verification of historic records of Olympia oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia - 2009. Can. Tech. Rep. Fish. Aquat. Sci. 2940: vi + 115 p.

Table of Contents

LIST OF TABLES..... IV

LIST OF FIGURES..... IV

LIST OF APPENDICES..... IV

ABSTRACT V

RÉSUMÉ..... VI

INTRODUCTION 1

METHODS..... 2

RESULTS..... 3

 WEST COAST VANCOUVER ISLAND 3

 STRAIT OF GEORGIA 4

 STRAIT OF JUAN DE FUCA..... 6

DISCUSSION..... 6

ACKNOWLEDGEMENTS 8

REFERENCES 9

APPENDICES 39

List of Tables

TABLE 1. KNOWN LOCATIONS OF OLYMPIA OYSTER, <i>OSTREA LURIDA</i> , IN BRITISH COLUMBIA, CANADA (GILLESPIE 2009).....	12
TABLE 2. LOCATION AND COLLECTION DATE OF ALL VOUCHER SPECIMENS INCLUDING THE BEACH CODES FOR EACH LOCATION , VOUCHER NUMBER AND RBCM NUMBER.	16
TABLE 3. LOCATION, DATE SAMPLED, NUMBER OF BEACHES SAMPLED AND NUMBER WITH <i>O. LURIDA</i> FROM EXPLORATORY OLYMPIA OYSTER SURVEYS IN BRITISH COLUMBIA, 2009.....	20
TABLE 4. PRESENCE OR ABSENCE OF <i>O. LURIDA</i> BY LOCATION FROM EXPLORATORY OLYMPIA OYSTER SURVEYS IN BRITISH COLUMBIA, 2009.....	21
TABLE 5. POTENTIAL OLYMPIA OYSTER LOCATIONS FROM PERSONAL COMMUNICATIONS AND PREVIOUSLY UNKNOWN LITERATURE RECORDS WHICH REQUIRE VERIFICATION.....	25

List of Figures

FIGURE 1. OLYMPIA OYSTER SURVEY LOCATIONS FROM APRIL TO AUGUST 2009.....	26
FIGURE 2. OLYMPIA OYSTER SURVEY LOCATIONS IN BARKLEY SOUND.	27
FIGURE 3. OLYMPIA OYSTER SURVEY LOCATIONS IN NORTHEAST CLAYOQUOT SOUND.	28
FIGURE 4. OLYMPIA OYSTER SURVEY LOCATIONS IN NORTHWEST CLAYOQUOT SOUND.....	29
FIGURE 5. OLYMPIA OYSTER SURVEY LOCATIONS IN NOOTKA SOUND.....	30
FIGURE 6. OLYMPIA OYSTER SURVEY LOCATIONS IN THE SHOAL AND SALTSRING ISLANDS.....	31
FIGURE 7. OLYMPIA OYSTER SURVEY LOCATIONS IN GOLDSTREAM AND ESQUIMALT.....	32
FIGURE 8. OLYMPIA OYSTER SURVEY LOCATIONS FROM NANOOSE TO LADYSMITH.....	33
FIGURE 9. OLYMPIA OYSTER SURVEY LOCATIONS IN BAYNES SOUND.....	34
FIGURE 10. OLYMPIA OYSTER SURVEY LOCATIONS IN THE SUNSHINE COAST AND MAINLAND INLETS.....	35
FIGURE 11. OLYMPIA OYSTER SURVEY LOCATIONS IN BOUNDARY BAY.....	36
FIGURE 12. OLYMPIA OYSTER SURVEY LOCATIONS IN THE GORGE WATERWAY.....	37
FIGURE 13. OLYMPIA OYSTER SURVEY LOCATIONS IN SOOKE.....	38

List of Appendices

APPENDIX FIGURE 1. FIELD DATA SHEET (FRONT) USED DURING EXPLORATORY OLYMPIA OYSTER SURVEYS IN BRITISH COLUMBIA IN 2009.....	40
APPENDIX FIGURE 2. FIELD DATA SHEET (BACK) USED DURING EXPLORATORY OLYMPIA OYSTER SURVEYS IN BRITISH COLUMBIA IN 2009.....	41
APPENDIX TABLE 1. DOCUMENTATION OF BEACH AND VOUCHER INFORMATION FROM EXPLORATORY OLYMPIA OYSTER SURVEYS IN BRITISH COLUMBIA IN 2009.....	42

Abstract

Stanton, L.M., Norgard, T.C., MacConnachie, S.E.M., and Gillespie, G.E. 2011. Field verification of historic records of Olympia oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia - 2009. Can. Tech. Rep. Fish. Aquat. Sci. 2940: vi + 115 p.

The Olympia oyster, *Ostrea lurida* Carpenter, 1864, was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2000 and listed under the Canadian Species At Risk Act in 2003. An updated status report is required by COSEWIC in 2010, and surveys to verify historic records of the species were conducted in 2009.

Investigators visited 98 beaches in southern British Columbia between April and August 2009 looking for presence (live individuals and/or shells) of Olympia oysters. Olympia oysters were found at 74 locations, 76 % of all sites examined. Three geographic areas were surveyed: West Coast Vancouver Island (Barkley, Clayoquot and Nootka Sounds), Strait of Georgia (eastern coast of Vancouver Island from Goldstream to Comox, Mainland Inlets/Sunshine Coast and Boundary Bay) and the Strait of Juan de Fuca (Victoria, Esquimalt and Sooke).

Generally, *O. lurida* was found to be widespread and abundant on the west coast of Vancouver Island, with populations forming dense reefs in many locations. The species was widespread in the Strait of Georgia, but abundance was relatively low and oysters tended to occupy cryptic habitats. Exceptions included moderately dense populations in Ladysmith Harbour, Hotham Sound and Jervis Inlet. The Gorge Waterway in Victoria Harbour was found to support abundant populations both in the intertidal and subtidal zones, with abundance increasing with depth. Previous observations of subtidal Olympia oyster reefs forming three-dimensional reef structures in the Gorge Waterway were confirmed.

Further surveys are required on the north-western coast of Vancouver Island, Johnstone and Queen Charlotte Straits and North Coast to supplement the understanding of the distribution and abundance of this species in British Columbia.

Résumé

Stanton, L.M., Norgard, T.C., MacConnachie, S.E.M., and Gillespie, G.E. 2011. Field verification of historic records of Olympia oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia - 2009. Can. Tech. Rep. Fish. Aquat. Sci. 2940: vi + 115 p.

Le Comité sur la situation des espèces en péril au Canada (COSEPAC) a désigné l'huître plate du Pacifique, *Ostrea lurida* Carpenter, 1864, en tant qu'espèce préoccupante en l'an 2000, et cette espèce a été inscrite en tant qu'espèce préoccupante à la liste de la *Loi sur les espèces en péril* en 2003. Le COSEPAC ayant besoin en 2010 d'un rapport de situation mis à jour, des relevés visant à vérifier sur le terrain les rapports historiques de l'espèce ont été effectués en 2009.

Les équipes de terrain ont visité 98 plages dans le sud de la Colombie-Britannique entre avril et août 2009 dans le but de déterminer si l'huître plate du Pacifique (individus vivants et/ou coquilles) y était présente. Ils ont prospecté trois régions géographiques : la côte Ouest de l'île de Vancouver (baies Barkley, Clayoquot et Nootka), le détroit de Georgia (côte est de l'île de Vancouver, de Goldstream à Comox, baie Boundary et inlets continentaux/région côtière Sunshine Coast) et le détroit de Juan de Fuca (Victoria, Esquimalt et Sooke).

En général, *O. lurida* était répandue et abondante sur la côte Ouest de l'île de Vancouver, où les populations formaient des récifs denses à de nombreux endroits. L'espèce était répandue dans le détroit de Georgia, mais elle y était relativement peu abondante et les huîtres avaient tendance à occuper des habitats cryptiques, à l'exception de populations modérément denses à Ladysmith Harbour, ainsi que dans la baie Hotham et l'inlet Jervis. La voie maritime Gorge, située dans le port de Victoria, abritait des populations abondantes, tant dans la zone intertidale que dans la zone subtidale, où l'abondance augmentait avec la profondeur. Les observations à l'effet que les récifs subtidaux d'huître plate du Pacifique forment des structures tridimensionnelles dans la voie maritime Gorge ont été confirmées.

D'autres relevés sont requis sur la côte nord-ouest de l'île de Vancouver, dans les détroits de Johnstone et de la Reine-Charlotte, ainsi que sur la côte Nord, pour mieux comprendre la répartition et l'abondance de cette espèce en Colombie-Britannique.

Introduction

The Olympia oyster, *Ostrea lurida* Carpenter, 1864, is the only oyster native to the west coast of North America (COSEWIC 2000; Gillespie 1999, 2009). Olympia oysters were the focus of commercial fisheries in western North America until the introduction of eastern oysters, *Crassostrea virginica*, in 1883 (Carlton and Mann 1996) and Pacific oysters, *Crassostrea gigas*, beginning in about 1912 in British Columbia (Elsley 1933, Quayle 1988; Bourne 1997). Both these species have established populations in British Columbia, as has the European flat oyster, *Ostrea edulis* (Gillespie 2007). The fishery was relatively small and declined due to overfishing and severely cold winters, which caused extensive mortalities. Pollution from pulp mills and antifouling paints has been implicated in Olympia oyster declines in Washington State (White *et al.* 2009a,b) and may have contributed to declines or inhibited recovery of British Columbia populations.

Considerable taxonomic debate has ensued since Harry (1985) synonymised *O. lurida* with *Ostreola conchaphila* (Carpenter, 1857). Recent morphological and molecular evidence does not support *Ostreola* as a genus distinct from *Ostrea* (Coan *et al.* 2000; Kirkendale *et al.* 2004; Lapègue *et al.* 2006; Shilts *et al.* 2007), although Coan and Valentich Scott (2007) placed *O. conchaphila* in the subgenus *Ostreola*, with the comment that some consider *Ostreola* a full genus. Polson *et al.* (2009) presented molecular evidence that two taxa existed and that the species present in temperate western North America was *Ostrea lurida*.

The Olympia oyster reaches the northern limit of its range in British Columbia (Gillespie 2009). Early reports placed the northern limit at Sitka, Alaska (Dall 1914, 1916); recent reports from Southeast Alaska do not describe dense aggregations nor document specific locations (*e.g.*, Paul and Feder 1976) and the species has not been found in Alaska despite investigation (Foster 1991; Polson and Zacherl 2009; Gillespie 2009). The northernmost documented occurrence is at Gale Passage, Campbell Island British Columbia, approximately 52°12'N, 128°24'W (Gillespie 2009).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reviewed the status of the Olympia oyster in Canada in 2000 and a status of Special Concern was designated (COSEWIC 2000, 2007). With the proclamation of the Species At Risk Act (SARA) in 2003, the Olympia oyster was listed as Special Concern under Schedule 3 of SARA. A management plan for this species was developed in 2008 and posted to the SARA public registry in 2009 (DFO 2009). The COSEWIC status report on Olympia oysters is due to be updated in 2010. As part of this update, field verification of sites known to support Olympia oyster populations, with collection of supporting voucher material, is required.

Exploratory surveys were conducted to verify the persistence of *Olympia* oyster populations at historic locations listed by Gillespie (2009) and other locations determined from recent new information. This report provides documentation of those surveys.

Methods

Sites for exploratory surveys were determined based on known locations and historic records of *Olympia* oysters in British Columbia (Gillespie 2009) (Table 1). High priority for exploratory surveys was placed on records characterized as ‘historic’ or those locations not examined since 1970 to confirm the presence or absence of *O. lurida*. Many localities were selected in consultation with local residents, shellfish farmers, Shorekeepers (a volunteers stewardship organization focusing on coastal marine habitats by local volunteers), and in the case of Victoria and Sooke, non-governmental organizations such as the World Fisheries Trust, and the T’Sooke First Nation. Sunshine Coast locations were selected from an independent bivalve survey completed by clam harvesters in the area in 2000. Surveys were conducted during daylight low tides of 1 m above chart datum (CD) or less during the summer of 2009.

In order to maximize the number of beaches visited in a single tide only qualitative presence/absence data were gathered. Specifically, individual beaches were scanned for suitable habitat (e.g. hard substrates such as boulder, cobble, shell, cement cinder blocks and standing water or shallow tide pools in the intertidal zone) and search effort was focussed on these particular areas. Additional habitat information was documented, including beach area, slope, substrate type, beach cover and whenever possible water temperature and surface salinity. Latitude and longitude of each beach was determined by a Lowrance Finder GPS (NAD 83). Supplementary information was gathered on both native and non-indigenous species of invertebrates observed on beaches. Data were recorded on paper (Appendix Figures 1 and 2) and entered into the Intertidal Bivalve database maintained by the Shellfish Data Unit at the Pacific Biological Station, Nanaimo BC.

Voucher specimens of live *Olympia* oysters were collected at locations exhibiting abundant or moderate populations; these specimens were geo-referenced and frozen. In areas with low population densities either a photo of a live specimen was taken on site or a shell was collected as a voucher. Voucher specimens were labelled with a unique number and DNA samples were prepared by excising a small portion of the mantle tissue and storing it in 95% ethanol until further analysis. All tissue and shell specimens were catalogued by the Royal British Columbia Museum, Victoria.

Surveys were conducted in the Gorge Waterway in partnership with the World Fisheries Trust. Broad brush surveys recorded presence/absence data as well as preliminary abundance estimates along 31 transects, spaced approximately 500m apart around the entire perimeter of the waterway, starting at the south side of the Johnson Street Bridge in Victoria. Only qualitative data is presented in this report; detailed analysis of these surveys will be presented separately.

Additional quantitative surveys were completed at six sites: Ladysmith Harbour and Swy-a-lana Lagoon on the East Coast of Vancouver Island, Harris Point in Barkley Sound, Baker Bay on the Mainland Inlets/Sunshine Coast, and Port Eliza Beaches 2 and 3 in Nootka Sound. These surveys were completed to test and develop new survey protocols for estimating relative abundance at potential index sites, as outlined in the Management Plan for *Olympia* oysters in Canada (DFO 2009). The results from these surveys can be found in Norgard et al. (2010).

Results

In April through August 2009, 98 beaches were investigated for *Olympia* oyster presence (live individuals and/or shells). Of the 98 sites visited *Olympia* oysters were observed to be present at 74 locations (76% of all sites examined)(Table 2 and Table 3). Three geographic areas were covered in Southern British Columbia: West Coast Vancouver Island (WCVI; Barkley, Clayoquot and Nootka Sounds), Strait of Georgia (eastern Vancouver Island from Goldstream to Comox, Mainland Inlets/Sunshine Coast and Boundary Bay) and Strait of Juan de Fuca (Victoria and Sooke)(Figure 1, Table 2 and Table 3, Appendix Table 1).

West Coast Vancouver Island

Barkley Sound

Barkley Sound opens on the Pacific Ocean between Ucluelet and Cape Beale and terminates at the head of Alberni Inlet. Two separate trips to Barkley Sound verified the presence of *O. lurida* on eight different beaches (Figure 2). In April 2009 two beaches were explored in the northeastern section of the sound, Harris Point and Hilliers Island. *Olympia* oysters were present on both beaches in high abundance and were found among and attached to Pacific oysters, *Crassostrea gigas*.

In May 2009, six additional *O. lurida* sites were confirmed during a green crab survey aboard the CCGS NEOCALIGUS. *Olympia* oysters at these locations were found mixed with Pacific oysters. Habitat characteristics for these locations were not recorded and photographs were not taken.

Clayoquot Sound

Clayoquot Sound opens onto the Pacific Ocean and is divided into southern (waters north and east of Vargas Island) and northern (waters north and west of Flores Island) portions (Figure 3 and Figure 4). In May 2009, 20 beaches were surveyed in northern Clayoquot Sound (Figure 3 and Figure 4). *Olympia* oysters were present at twelve or 60% of beaches and on most the substrate was cobble over sand with sparse Pacific oyster populations. *O. lurida* were primarily observed on the surface of rocks and

although easily found were scattered and exhibited a patchy distribution. At Bacchante Bay, individual Olympia oysters were found as scattered singles throughout the beach. *O. lurida* were not present on beaches along the Megin River, Beddingfield Bay and two of three beaches in Sulphur Pass.

Nootka Sound

Situated on the north central west coast of Vancouver Island, Port Eliza is a sheltered inlet slightly north of the entrance to Esperanza Inlet (Figure 5). During the first low tide cycle of August 2009 three beaches in Port Eliza Inlet were surveyed. All three beaches had mixed cobble and gravel over sand substrates and supported extremely abundant populations of *O. lurida*. Distinct age classes were observed settling on older live or dead Olympia oyster shell forming an oyster upon oyster complex. Beach 1 was the largest of all three beaches and contained the largest populations of both Pacific and Olympia oysters. Pacific oysters on beaches 2 and 3 were scattered and sparse.

Strait of Georgia

East Coast Vancouver Island

The east coast of Vancouver Island within the Strait of Georgia encompasses a large geographic area from Goldstream on the south east of Vancouver Island to Comox on central east coast of Vancouver Island. Twenty-seven beaches were surveyed in the area, of these 19 (70%) were found to support populations of *O. lurida*.

On the southeast coast of Vancouver Island Olympia oysters were present in low densities in Goldstream, Vesuvius Bay on Saltspring Island and the Shoal Islands located north of Crofton (Figure 6 and Figure 7). All three sites supporting Olympia oyster populations had a substrate of cobble sand and/or mud with Pacific oysters present. A small cryptic population of approximately 5-15 individuals of *O. lurida* were present under rocks in a creek in Goldstream. On the west coast of Saltspring Island a single Olympia oyster shell was found attached to a Pacific oyster at Vesuvius Bay. *O. lurida* were not observed on Fulford Bay, Price Road Beach or Cushion Creek on the southeast coast of Saltspring Island. Within the Shoal Islands, Olympia oysters were present in two separate locations: three individuals in a tidal pool near a creek and another small population at the northern end of the island attached to the underside of Pacific oyster shells found lying in a wet and muddy substrate near a freshwater stream. No live Olympia oysters were found in Mill, Cowichan, Genoa or Maple Bays.

On the mid-central coast of Vancouver Island, including areas such as Ladysmith, Nanaimo, Lantzville and Nanoose, *O. lurida* populations were observed in the highest densities within Ladysmith Harbour (Figure 8). In total seven beaches in Ladysmith Harbour were investigated all of which contained scattered populations or clusters of Olympia oysters with the exception of the Limberis Oyster Plant which supported a healthy and abundant population of *O. lurida*. On most beaches Olympia oysters were

found on the top of the sand/mud substrate or attached to Pacific oysters and in the case of Transfer beach, *O. lurida* was found under large boulders and cobbles. In Nanaimo, a moderate number of Olympia oysters were found attached to concrete forms within the artificial Swy-a-lana Lagoon. Surveys in Nanoose Bay focused on the northeast section of the sand flat adjacent to an oyster lease with only one live Olympia oyster observed. At Wall Beach, south of Parksville, *O. lurida* was present under boulders on the southern margin of the beach. No Olympia oysters were found on the long exposed boulder shoreline fronting Lantzville.

On the north central coast of Vancouver Island, six beaches were examined in the Comox area; *O. lurida* populations were observed in low densities consisting of scattered individuals (Figure 9). In Comox Harbour, only two Olympia oysters were discovered: one shell on the western side of the harbour and one live oyster on the eastern side near the Comox Hospital. Ships Point and Fanny Bay in Baynes Sound support high densities of shellfish farms and Olympia oysters were present on intertidal leases in low densities found either under rocks or attached to cement cinder blocks. Finally, a small cryptic population of Olympia oysters was observed under boulders on the north side of Union Bay.

Mainland Inlets/Sunshine Coast

All 21 (100%) beaches sampled on the southern Sunshine Coast were found to support moderate populations of Olympia oysters (Figure 10). The substrate for most beaches was boulder, cobble over sand with some boulders or gravel. In general, populations of *O. lurida* in Malaspina Strait were cryptic and present in lower numbers than beaches examined within Hotham Sound and Jervis Inlet, where populations were far more abundant and visible, occurring on the surface of rocks. In Hotham Sound and Jervis Inlet the most abundant populations of Olympia oysters were observed in Baker and St. Vincent Bays. In addition, very small Olympia oysters (<10mm in total length) were found attached to the underside of rocks in Hotham Sound; these were assumed to be new recruits from earlier in 2009.

Boundary Bay

Boundary Bay is a large bay situated on the border of the US and Canada on the BC mainland (Figure 11). This large bay stretches from the Municipality of Delta to Surrey and White Rock and was a historic center of Olympia oyster enhancement (Quayle 1969). Very few Olympia oysters were found on the three beaches examined, but only with a considerable amount of search effort,. One *O. lurida* shell was observed at Ward's Marina on the Nicomekl River in Surrey. This location had an extremely high density of Pacific oysters in a muddy substrate. At Crescent Beach and west of White Rock Boat Ramp, only a few shells and live Olympia oysters were observed on the underside of rocks. Both beaches had boulder, cobble, sand substrates, were extremely large and considerable amount search time (165 minutes) was expended before any live *O. lurida* were discovered.

Strait of Juan de Fuca

Victoria (Gorge and Esquimalt)

Olympia oyster surveys in Victoria focused on historic records in Esquimalt and known populations on the Gorge (Figure 7 and Figure 12). In the Gorge Waterway, Olympia oysters were present in 28 of 31 (90%) transects surveyed (Table 4). Substrate type along most areas of the Gorge consisted of mud with some cobble and sparse gravel. Populations varied from abundant to sparse depending on area. Quantitative results of these surveys will be documented elsewhere. The current investigation and past surveys (Archipelago Marine Research 2000) have demonstrated that there are significant subtidal Olympia oyster populations in the Gorge Waterway and Portage Inlet.

Esquimalt Harbour was a known historic location of Olympia oysters (Lord, *in* Carpenter 1864; Quayle 1960), however, surveys of four locations in the harbour and one in Esquimalt Lagoon did not record evidence of Olympia oysters. Although suitable habitat was present in Esquimalt Harbour (mud, cobble, boulder) no live Olympia oysters were observed on the five beaches sampled. Future surveys of the area may still discover oyster populations.

Sooke

In total seven beaches were investigated for potential Olympia oyster populations in Sooke (Figure 13). Only 4 (57%) were found to support scattered low density populations of *O. lurida*, including: Hutchinson Cove, Anderson Cove, Roche Cove and Cooper Cove. Anderson Cove had the highest density of Olympia oysters attached to a large metal structure. Roche Cove had an extremely large amount of dead Olympia oyster shell (>1000) lying exposed on the muddy surface. Both Cooper and Hutchinson Coves had scattered Olympia oyster populations. The substrate type varied from mud/cobble at Cooper Cove and Roche Cove to mud/gravel at Anderson Cove and sand/cobble at Hutchinson Cove. No live Olympia oysters were discovered on the outer more exposed coastal beaches at Whiffin Spit, Sooke Bay and Sooke Harbour.

Discussion

The decline of Olympia oysters due to overharvesting, introduction of non-indigenous species, pollution and severe cold winter temperatures in British Columbia has been well documented (Gillespie 1999, 2009). However, both qualitative and quantitative data on current population trends and the distribution of Olympia oysters in British Columbia is lacking. Exploratory surveys conducted during the summer of 2009 have provided the most current information on the status and distribution of Olympia oysters in British Columbia and have verified a number of historic populations that have either persisted or become re-established. Some historic populations (e.g. Comox

Harbour and Boundary Bay) were present in extremely low numbers and have the potential to become locally extirpated, as may be the case in Esquimalt Harbour.

In general, Olympia oysters were observed in high abundance on WCVI where large populations are clearly visible and exposed on the surface of the substrate. Higher densities and abundance may be a function of relatively pristine conditions relative to the Straits of Georgia and Juan de Fuca where pollution from pulp mills and antifouling paints may have contributed to declines or inhibited potential recovery (White *et al.* 2009 a,b). Populations within the Strait of Georgia exhibited low densities and were more cryptic. Scattered cryptic Olympia oysters were observed on the underside of rocks in many sites across the East Coast of Vancouver Island, Mainland Inlets/Sunshine coast and Boundary Bay.

Exceptions included Hotham Sound, Jervis Inlet and Ladysmith Harbour. Populations in Jervis Inlet and particularly in Hotham Sound had a high abundance of *O. lurida* attached to the upper and underside surfaces of rocks and Pacific oyster shells.

Olympia oyster populations were once extremely abundant in Ladysmith Harbour but were harvested commercially and thought to be severely depleted; only scattered individuals had been documented (D. Nikleva, Chemainus First Nation, pers.comm.). However, the beach adjacent to Limberis Oyster Processing Plant in Ladysmith Harbour was found to have a healthy population of *O. lurida* despite anthropogenic effects such as historic overharvesting and the introduction and culture of Pacific oysters in the area.

Historic populations of *O. lurida* in Baynes Sound, Fanny Bay and Comox harbour on the east coast of Vancouver Island had not been examined since 1891, 1914 and 1969, respectively (Table 1) but were found to support small cryptic populations in low densities. Comox harbour in particular was searched extensively at four different sites and only one shell and one live Olympia oyster were found. Similarly, Boundary Bay once the site supporting abundant Olympia oyster populations, was searched extensively at three separate locations and only a few shells and two live oysters were observed. Although no Olympia oysters were found on the east coast of Saltspring Island, there have been unconfirmed reports of *O. lurida* on other Saltspring Island beaches which should be examined in the future (Table 5).

In the Strait of Juan de Fuca, the historic populations of Olympia oysters in Esquimalt harbour were not verified and could be locally extirpated, whereas the population in the Gorge Waterway and Portage Inlet was found to be relatively abundant both intertidally and subtidally. Preliminary observations have found extensive oyster reefs in subtidal areas of the Gorge. Future work should confirm or refute the absence of Olympia oysters in Esquimalt Harbour and commence more intensive investigations of subtidal reefs in the Gorge Waterway.

Relatively large populations had been reported within the Sooke Basin (E. Helgeson, Coopers Cove Oyster Co., pers.comm; A. McNaughton, T'Sooke First Nation, pers.comm.) and were confirmed in our investigations. However, populations are

confined to more secluded areas such as Roche and Anderson Coves. During this study Roche and Anderson Coves were found to have a large number of dead Olympia oyster shells lying on the surface of the muddy substrate which indicates recent mortality from undetermined causes. Because the survey at Roche Cove was conducted during a rising tide, and Olympia oysters live relatively low in the intertidal zone, it is possible that they may be more abundant than was observed.

Survey methods evolved and the survey team's efficiency in locating Olympia oysters increased as the field season progressed. At the start of the field season on WCVI the survey team did not spend a great deal of time looking for cryptic oysters, but later in the field season surveyors were very efficient at identifying appropriate habitat and detecting *O. lurida* rapidly. Were the survey team to resurvey areas visited early in the season, it is possible they would increase the number of beaches on which Olympia oysters were found.

Sites for exploratory surveys were determined based on known locations and historic records of Olympia oysters in British Columbia (Gillespie 2009)(Table 1). High priority for exploratory surveys was placed on records characterized as 'historic' or those locations not examined since 1970 to confirm the presence or absence of *O. lurida*. Resource and temporal limitations, as well as difficulty accessing remote areas in a cost-effective manner, resulted in a lack of verification of priority sites on the northwest coast of Vancouver Island, Desolation Sound, Queen Charlotte Strait and the North Coast mainland inlets (Table 1). In addition, recent personal communications and evidence from previously unknown literature has resulted in an additional list of potential sites that require verification (Table 5). Future work should focus on these locations.

Although the surveys showed that some populations have been reduced to extremely low population numbers (e.g. Boundary Bay and Comox harbour) other populations have been shown to persist or have become re-established in British Columbia despite over-harvesting and both current and past anthropogenic effects. Confirmation of the current distribution and populations trends of Olympia oysters are critical components to managing a species of Special Concern and identifying populations at risk of location extirpation. Establishing index sites where quantitative surveys can be conducted for long-term monitoring will be necessary to understand recruitment, growth and population dynamics of Olympia oysters.

Acknowledgements

This work was funded by the Committee on the Status of Endangered Wildlife in Canada (through Environment Canada) and the SARA Monitoring Program of Fisheries and Oceans Canada. We thank Joachim Carolsfeld, Alica Donaldson and Amanda Fentiman of the World Fisheries Trust for collaborating on surveys and sharing data from the Gorge Waterway and Portage Inlet. We thank Leona Breckenridge, Gioia Breda, Yvonne Dawydiak, Eileen Kaarsemaker, Shari Ann Kuiper and Stan Olson, volunteer Shorekeepers, for assistance locating elusive Olympia oysters at Crescent Beach and White Rock. Also thank oyster growers Andrew Drydan (Evening Cove Oysters), Ed

Helgesen (Coopers Cove Oysters), Sally Kew (Mac's Oysters), Leo Limberis (Limberis Seafoods), and Alex Munro (Fanny Bay Oysters) for allowing us access to their leases and sharing knowledge of adjacent areas. We thank Darcy Kehler and Karen Steensma of Trinity Western University for sharing information collected by the marine biology field school on Saltspring Island and biologists Andrew McNaughton (T'Sooke First Nation) and Dave Nikleva (Chemainus First Nation) for sharing information. We also thank innumerable friends and colleagues who searched their memories for places they may have seen Olympia oysters in the past. Ray Lauzier provided helpful review comments on an earlier draft. Special thanks to Lindsay Orr, University of Victoria co-op student, for hours of field and data work with Olys this summer.

References

- Archipelago Marine Research Ltd. 2000. Subtidal survey of physical and biological features of Portage Inlet and the Gorge Waterway. Report submitted to Victoria and Esquimalt Harbours Environmental Action Program, Capital Regional District, Victoria, BC. 22 pp. + map folio.
- Bourne, N. 1997. Molluscan fisheries of British Columbia. NOAA Tech. Rep. NMFS 128: 115-130.
- Carlton, J.T., and Mann, R. 1996. Transfers and world-wide introductions. p. 691-706. *In*: V.S. Kennedy, R.I.E. Newell and A.F. Eble [eds.]. The Eastern Oyster, *Crassostrea virginica*. Maryland Sea Grant College Publication UM-SG-TS-96-01.
- Carpenter, P.P. 1864. Supplementary report on the present state of our knowledge with regard to Mollusca of the west coast of North America. Rept. British Assoc. Adv. Sci. 1863: 517-603.
- Coan, E.V., and Valentich Scott, P. 2007. Bivalvia. p. 807-859. *In*: J.T. Carlton [ed.]. The Light and Smith manual. Intertidal invertebrates from Central California to Oregon. 4th ed. University of California Press, Berkeley.
- Coan, E.V., Valentich Scott, P., and Bernard, F.R. 2000. Bivalve seashells of western North America. Marine bivalve mollusks from Arctic Alaska to Baja California. Santa Barbara Museum of Natural History Monographs No. 2. Studies in Biodiversity 2. 764 p.
- COSEWIC. 2000. COSEWIC assessment and status report on the Olympia oyster *Ostrea conchaphila* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 30 pp. (www.sararegistry.gc.ca/status/status_e.cfm).
- COSEWIC. 2007. Canadian species at risk, September 2007. Committee on the Status of Endangered Species in Canada. Ottawa. 84 p.

- Dall, W.H. 1914. Notes on west American oysters. *Nautilus* 28(1): 1-3.
- Dall, W.H. 1916. Checklist of the Recent bivalve mollusks (Pelecypoda) of the northwest coast of America from the Polar Sea to San Diego, California. Southwest Museum, Los Angeles. 44 p.
- DFO. 2009. Management plan for the Olympia oyster (*Ostrea conchaphila*) in Canada. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. v + 31 pp.
- Ellis, D.V., and Emerson, B. 1979. Native oysters, *Ostrea lurida*, in Checleset Bay. A report of a survey in 1978 to provide data relevant to Application No. 279. Report to the Ecological Reserves Unit. Manuscript 114.
- Elsley, C.R. 1933. Oysters in British Columbia. *Bull. Biol. Board Can.* 34. 34 p.
- Foster, N.R. 1991. Intertidal bivalves. A guide to the common marine bivalves of Alaska. University of Alaska Press, Fairbanks. 152 p.
- Gillespie, G.E. 1999. Status of the Olympia oyster, *Ostrea conchaphila*, in Canada. *Can. Stock Assess. Secretar. Res. Doc.* 99/150. 33 p.
- Gillespie, G.E. 2000. COSEWIC status report on the Olympia oyster *Ostrea conchaphila* in Canada. *In: COSEWIC assessment and update status report on the Olympia oyster *Ostrea conchaphila* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.* 1-30 p.
- Gillespie, G.E. 2007. Distribution of non-indigenous intertidal species on the Pacific coast of Canada. *Nipp. Suis. Gaikk.* 73: 1133-1137.
- Gillespie, G.E. 2009. Status of the Olympia oyster, *Ostrea lurida* Carpenter 1864, in British Columbia, Canada. *J. Shellfish Res.* 28(1): 59-68.
- Harry, H.W. 1985. Synopsis of the supraspecific classification of living oysters (Bivalvia: Gryphaeidae and Ostreidae). *Veliger* 28(2): 121-158.
- Kirkendale, L., Lee, T., Baker, P., and Foighil, D.Ó. 2004. Oysters of the Conch Republic (Florida Keys): a molecular phylogenetic study of *Parahyotissa mcgintyi*, *Teskeyostrea weberi* and *Ostreola equestris*. *Malacologia* 46: 309-326.
- Lapègue, S., Salah, I.B., Batista, F.M., Heurtebise, S., Neifar, L., and Boudry, P. 2006. Phylogeographic study of the dwarf oyster, *Ostreola stentina*, from Morocco, Portugal and Tunisia: evidence of a geographic disjunction with the closely related taxa, *Ostrea aupaoria* and *Ostreola equestris*. *Mar. Biol.* 150: 103-110.

- Norgard, T., Davies, S., Stanton, L., and Gillespie, G. 2010. Evaluation of survey methodologies for monitoring Olympia oyster (*Ostrea lurida* Carpenter, 1864) populations in British Columbia. Can. Sci. Advis. Sec. Res. Doc. 2010/006. iv + 56p.
- Paul, A.J., and Feder, H.M. 1976. Clam, mussel and oyster resources of Alaska. University of Alaska Institute of Marine Science Report 76-4. 41 p.
- Polson, M.P., Hewson, W.E., Eernisse, D.J., Baker, P.K., and Zacherl, D.C. 2009. You say *conchaphila*, I say *lurida*: molecular evidence for restricting the Olympia oyster (*Ostrea lurida* Carpenter 1864) to temperate western North America. J. Shellfish Res. 28(1): 11-21.
- Polson, M.P., and Zacherl, D.C. 2009. Geographical distribution and intertidal population status for the native West Coast oyster, *Ostrea lurida* Carpenter 1864, from Alaska to Baja. J. Shellfish Res. 28(1): 69-77.
- Quayle, D.B. 1960. The intertidal bivalves of British Columbia. BC Prov. Mus. Handbook 17. 104 p.
- Quayle, D.B. 1969. Pacific oyster culture in British Columbia. Fish. Res. Board Can. Bull. 169. 192 p.
- Quayle, D.B. 1988. Pacific oyster culture in British Columbia. Can. Bull. Fish. Aquat. Sci. 218. 241 p.
- Shilts, H.M., Pascual, M.S., and Foighil, D.Ó. 2007. Systematic, taxonomic and biogeographic relationship of Argentine flat oysters. Mol. Phylogen.Evol. 44: 467-473.
- White, J.L., Buhle, E.R., Ruesink, J.L., and Trimble, A.C. 2009a. Evaluation of Olympia oyster (*Ostrea lurida* Carpenter 1864) status and restoration techniques in Puget Sound, Washington, United States. J. Shellfish Res. 28(1): 107-112.
- White, J., Ruesink, J.L., and Trimble, A.C. 2009b. The nearly forgotten oyster: *Ostrea lurida* Carpenter 1864 (Olympia oyster) history and management in Washington State. J. Shellfish Res. 28(1): 43-49.

Table 1. Known locations of Olympia oyster, *Ostrea lurida*, in British Columbia, Canada (Gillespie 2009).

Geographic Area	Location	Comments
North Coast		
Milbanke Sound	Bardswell Group	Historic ¹
	Campbell Island	Historic ²
	Gale Passage	Present 2002 ³ , 2008 ^{4,5}
	Ormidale Harbour	Present 2007 ⁵
Queen Sound	Watt Bay	Abundant 1991 ⁶ , 2004 ⁷ , 2008 ⁴
Fitz Hugh Sound	Fish Egg Inlet	Historic ¹ , Abundant 1993 ⁸ , 2000 ⁹
Smith Inlet	Boswell Inlet	Abundant 2007 ⁴
Queen Charlotte Strait		
Queen Charlotte Strait	Blunden Harbour	Historic ^{1,2,10,11}
	Bradley Lagoon	Historic ¹² , Present 2000 ¹³
West Coast Vancouver Island		
Quatsino Sound	unknown	Historic ¹
Brooks Bay	Klaskino Inlet	Abundant 2001 ⁹ , 2002 ¹⁴ , 2007 ⁴
	Klaskino Anchorage	Present 2007 ⁴
Checleset Bay	Johnson Lagoon	Present 2000 ¹⁵
	Ououkinsh Inlet	Present 2002 ¹⁴
Kyuquot Sound	Amai Inlet	Abundant 1995 ¹⁶ , 2002 ¹⁴
	Cachalot Inlet	Abundant 2002 ¹⁴ , 2007 ¹⁷
	Easy Inlet	Present 1967 ¹⁸
	Kashutl River	Present 2007 ⁴
Nootka Sound	Canton Creek	Present 1995 ²⁰
	Espinosa Inlet	Present 2006 ⁴
	Hisnit Inlet	Present 2007 ⁴
	Inner Mary Basin	Abundant 1995 ¹⁹
	Little Espinosa Inlet	Present 2006 ⁴
	Malksope Inlet	Abundant 2007 ¹⁷
	Nesook Bay	Present 1995 ²⁰ , 2007 ⁴
	Port Eliza	Abundant 1995 ²⁰ , 2002 ¹⁴
	Queen Cove	Present 1995 ¹⁹ , 2006 ⁴
Tlupana Inlet	Present 1995 ²⁰	

Table 1. continued.

Geographic Area	Location	Comments
West Coast Vancouver Island		
Clayoquot Sound	Bottleneck Cove	Abundant 2003 ¹⁷
	Darr Island	Present 2007 ⁴
	Heelboom Bay	Present 2006 ⁴
	Lemmens Inlet	Present 2006 ⁴
	Mosquito Harbour	Abundant 2000 ⁹ , Present 2006 ⁴
	Pretty Girl Cove	Abundant 2003 ¹⁷ , Present 2006 ⁴
	Sydney Inlet	Abundant 2005/2006 ²¹
	Sydney River	Present 1976 ²²
	Sulphur Pass	Possibly present ²¹
	Tofino	Present 1926-1936 ²³
	Vargas Island	Present 2006 ²⁴
	Whitepine Cove	Present 2002 ¹⁴ , 2006 ⁴
	Young Bay	Present ¹⁷
	Barkley Sound	Ahmah Island
Alma Russell Island		Present 1997 ²⁵
Amphitrite Point		Present 1982 ²⁶
Brabant Island		Present 1997 ²⁵
Broken Group		Present 1999 ²⁷
Congreve Islands		Present 1997 ²⁵
Effingham Inlet		Abundant 1997 ²⁵
Fatty Basin		Present ¹⁵
Harris Point		Abundant 1997 ²⁵
Hillier Island		Abundant 2002 ¹⁴ , 2006/2007 ⁴
Jacques/Jarvis Lagoon		Present 1973 ²⁹ , 1997 ²⁵ , 2006 ⁴
Joes Bay		Present 2006 ⁴
Julia Passage		Present/Abundant 1997 ²⁵
Lucky Creek		Abundant 1993 ²⁷ , 2002 ¹⁴
Mayne Bay		Abundant 1997 ²⁵
Nettle Island		Present 1997 ²⁵
Pinkerton Island		Present 1997 ²⁵
Pipestem Inlet		Abundant 1995 ¹⁹ , Present 2006 ⁴
Snowden Island		Abundant 1993 ²⁹
South Stopper Island		Abundant 2007 ¹⁷
Toquart Bay	Historic ¹ , Present 1997 ²⁵	
Useless Inlet	Abundant 1995 ¹⁹ , Present 1961 ³⁰ , 2006 ⁴	
Vernon Bay	Abundant 1997 ²⁵ , 2006/2007 ¹⁷	

Table 1. continued.

Geographic Area	Location	Comments
Strait of Georgia		
Desolation Sound	Pendrell Sound	Historic ² , Present 1971-1977 ³¹⁻³⁵ , 2007 ⁴
Northern Gulf Islands	Talbot Cove	Present 2000 ³⁶
	Von Donop Inlet	Historic ² , Present 2007 ⁴
East Coast Vancouver Island	Baynes Sound	Historic ¹¹
	Comox Harbour	Historic ²
	Fanny Bay	Historic ³⁷
	Goldstream	Present 1996 ⁴
	Kuper Island	Historic ¹¹
	Ladysmith Harbour	Historic ^{10,11,38} , Present 1976/1977 ^{31,32} , 1998 ³⁹ , 2006 ⁴⁰
	Nanaimo	Present 1999, 2008 ⁴
Mainland Inlets	Nanoose Harbour	Historic ² , Present 1999 ⁴
	Hotham Sound	Present 1976/1977 ^{32,35}
	Malaspina Inlet	Historic ¹¹
	Sargeant Bay	Present ⁴¹
Boundary Bay	Boundary Bay	Historic ^{10,42} , Present 1997/1998 ⁴³
	Crescent	Present 1933/1934 ⁴⁴
Strait of Juan de Fuca		
Victoria	East Chatham Island	Present 2007 ⁴⁵
	Esquimalt Harbour	Historic ca. 1858 ⁴⁶ , ca. 1960 ¹⁰
	Gorge Waterway	Historic ^{2,11} , Present 2000 ⁴⁷
Sooke	Anderson Cove	Present 1999 ⁴⁸
	Ayum Creek	Present 2007 ⁴⁹
	Hutchinson Cove	Present 1999 ⁴⁸
	Roche Cove	Present 1999 ⁴⁸ , 2007 ⁴⁹
	Sooke	Historic ¹¹ , Present 1945-1963 ⁵⁰

References: 1 – Elsey (1933), 2 – Quayle (1969), 6 – Bourne *et al.* (1994), 7 – Gillespie and Bourne (2005b), 8 – Bourne and Heritage (1997), 9 – Gillespie *et al.* (2004), 10 – Quayle (1960), 11 – Newcombe (1891), 12 – Taylor (1895), 14 – Gillespie and Bourne (2005a), 16 – Kingzett *et al.* (1995b), 20 – Kingzett *et al.* (1995a), 31 – Heritage *et al.* (1976), 32 – Heritage *et al.* (1977), 33 – Bourne (1978), 34 – Bourne and Heritage (1979), 35 – Heritage and Bourne (1979), 37 – Thompson (1914), 38 – Stafford (1913b), 41 – Lamb and Hanby (2005), 42 – Stafford (1913a, 1913b, 1914, 1915, 1916, 1917), 46 – Lord, *in* Carpenter (1864), 47 – Archipelago Marine Research (2000).

Personal communications: 3 – T. Johansson, DFO; 4 – G. Gillespie, DFO, unpublished data; 5 – J. Carpenter, Heiltsuk First Nation; 13 – D. Schmidt, North Island

Biological Consulting; 15 – J. Watson, Vancouver Island University; 17 – S. Pilcher, BC Ministry of Agriculture and Lands; 19 – B. Kingzett, Blue Revolution Consulting; 21 – F. Bruhwiler, Parks Canada; 24 – B. Campbell, Parks Canada (ret.); 25 – N. and M. Truesdell, Barkley Sound; 27 – H. Holmes, Parks Canada; 29 – G. Meyer, DFO; 36 – D. Plested, Desolation Sound; 39 – D. Nikleva, Chemainus First Nation; 40 – J. Morrison, DFO; 43 – R. Forsyth, RBCM; 45 – D. Smith, Loligo Enterprises; 48 – E. Helgeson, Coopers Cove Oysters; 49 – A. McNaughton, T'Sooke First Nation.

Museum materials: 18 – RBCM 979-07242, 22 – RBCM 978-00029-015, 23 – RBCM 976-01228-037, 26 – RBCM 979-09591, 28 – RBCM 973-00237-015, 30 – RBCM 979-02365, 44 – RBCM 975-00794-003, 50 – RBCM 976-01210-025.

Table 2. Location and collection date of all voucher specimens including the beach codes for each location , voucher number and RBCM number.

Date	Beach	Beach Code	Voucher #	RBCM #
27/04/2009	Harris Point	24-10-006	OLY2009-001-001	010-00001-001
			OLY2009-001-002	010-00001-002
			OLY2009-001-003	010-00001-003
			OLY2009-001-004	010-00001-004
27/04/2009	Hiller Island	23-10-002	OLY2009-002-001	010-00002-001
			OLY2009-002-002	010-00002-002
08/05/2009	Darr Island	24-02-002	OLY2009-003-001	010-00003-001
08/05/2009	Head of Stewardson Inlet	24-02-003	OLY2009-004-001	010-00004-001
			OLY2009-004-002	010-00004-002
08/05/2009	Stewardson Inlet	24-02-004	OLY2009-005-001	010-00005-001
			OLY2009-005-002	010-00005-002
08/05/2009	Sydney Inlet 1	24-02-005	OLY2009-006-001	010-00006-001
			OLY2009-006-002	010-00006-002
			OLY2009-006-003	010-00006-003
			OLY2009-006-004	010-00006-004
			OLY2009-006-005	010-00006-005
			OLY2009-006-006	010-00006-006
08/05/2009	Sydney Inlet 3	24-02-007	OLY2009-007-001	010-00007-001
			OLY2009-007-002	010-00007-002
			OLY2009-007-003	010-00007-003
08/05/2009	Bottleneck Cove 1	24-02-008	OLY2009-008-001	010-00008-001
			OLY2009-008-002	010-00008-002
			OLY2009-008-003	010-00008-003
			OLY2009-008-004	010-00008-004
08/05/2009	Bottleneck Cove 2	24-02-009	OLY2009-009-001	010-00009-001
			OLY2009-009-002	010-00009-002
			OLY2009-009-003	010-00009-003
08/05/2009	Young Bay 1	24-02-011	OLY2009-010-001	010-00010-001
			OLY2009-010-002	010-00010-002
09/05/2009	Megin River 1	24-13-001	OLY2009-011-001	010-00011-001
09/05/2009	Bacchante Bay 1	24-13-004	OLY2009-012-001	010-00012-001
			OLY2009-012-002	010-00012-002
			OLY2009-012-003	010-00012-003
09/05/2009	Sulphur Passage 1	24-14-003	OLY2009-013-001	010-00013-001
11/05/2009	Congreve Island	23-04-002	OLY2009-014-001	010-00014-001
			OLY2009-014-002	010-00014-002
11/05/2009	Santa Maria Island	23-04-001	OLY2009-015-001	010-00015-001
			OLY2009-015-002	010-00015-002
12/05/2009	San Mateo Bay	23-03-002	OLY2009-016-001	010-00016-001
			OLY2009-016-002	010-00016-002

Table 2. continued.

Date	Beach	Beach Code	Voucher #	RBCM #
12/05/2009	Ritherdon Creek	23-03-001	OLY2009-017-001	010-00017-001
			OLY2009-017-002	010-00017-002
			OLY2009-017-003	010-00017-003
			OLY2009-017-004	010-00017-004
13/05/2009	Lucky Creek East	24-10-001	OLY2009-018-001	010-00018-001
			OLY2009-018-002	010-00018-002
			OLY2009-018-003	010-00018-003
13/05/2009	Toquart River	24-10-007	OLY2009-019-001	010-00019-001
			OLY2009-019-002	010-00019-002
22/05/2009	Vesuvius Bay-Saltspring Island	17-09-005	OLY2009-020-001	010-00020-001
22/05/2009	Shoal Island	17-09-004	OLY2009-021-001	010-00021-001
		17-09-005	OLY2009-021-002	010-00021-002
		17-09-006	OLY2009-021-003	010-00021-003
24/05/2009	Swy-a-lana Lagoon-Nanaimo Harbour	17-14-002	OLY2009-022-001	010-00022-001
		17-14-003	OLY2009-022-002	010-00022-002
24/05/2009	Limberis Plant-Ladysmith Harbour	17-07-021	OLY2009-023-001	010-00023-001
		17-07-022	OLY2009-023-002	010-00023-002
		17-07-023	OLY2009-023-003	010-00023-003
		17-07-024	OLY2009-023-004	010-00023-004
26/05/2009	Goldstream Transfer Beach-	19-12-001	OLY2009-024-001	010-00024-001
21/06/2009	Ladysmith Harbour Page Point-	17-07-023	OLY2009-025-001	010-00025-001
21/06/2009	Ladysmith Harbour	17-07-023	OLY2009-026-001	010-00026-001
			OLY2009-026-002	010-00026-002
			OLY2009-026-003	010-00026-003
			OLY2009-026-004	010-00026-004
			OLY2009-026-005	010-00026-005
21/06/2009	Raven Park-Ladysmith Harbour	17-07-022	OLY2009-027-001	010-00027-001
			OLY2009-027-002	010-00027-002
21/06/2009	Kulleet Bay-Ladysmith Harbour	17-05-003	OLY2009-028-001	010-00028-001
24/06/2009	Ship Point	14-08-004	OLY2009-029-001	010-00029-001
			OLY2009-029-002	010-00029-002
24/06/2009	Comox Harbour 1 (Breakwater)	14-14-002	OLY2009-030-001	010-00030-001

Table 2. continued.

Date	Beach	Beach Code	Voucher #	RBCM #
24/06/2009	Fanny Bay	14-08-006	OLY2009-031-001	010-00031-001
			OLY2009-031-002	010-00031-002
25/06/2009	Comox Harbour 2	14-14-001	OLY2009-032-001	010-00032-001
25/06/2009	Ship Point South	14-08-005	OLY2009-033-001	010-00033-001
	Union Bay Boat Ramp			010-00034-001
25/06/2009		14-15-001	OLY2009-034-001	
			OLY2009-034-002	010-00034-002
05/07/2009	Wall Beach	14-01-002	OLY2009-035-001	010-00035-001
			OLY2009-035-002	010-00035-002
08/07/2009	Portage Inlet-Gorge	19-01-006	OLY2009-036-001	010-00036-001
			OLY2009-036-002	010-00036-002
			OLY2009-036-003	010-00036-003
			OLY2009-036-004	010-00036-004
			OLY2009-036-005	010-00036-005
			OLY2009-036-006	010-00036-006
			OLY2009-036-007	010-00036-007
09/07/2009	Hutchinson Cove	20-07-004	OLY2009-037-001	010-00037-001
			OLY2009-037-002	010-00037-002
09/07/2009	Anderson Cove	20-07-003	OLY2009-038-001	010-00038-001
			OLY2009-038-002	010-00038-002
09/07/2009	Roche Cove	20-07-001	OLY2009-039-001	010-00039-001
			OLY2009-039-002	010-00039-002
09/07/2009	Cooper Cove	20-07-002	OLY2009-040-001	010-00040-001
20/08/2009	Maude Bay-Thunder Point	16-11-017	OLY2009-041-001	010-00041-001
			OLY2009-041-002	010-00041-002
20/08/2009	Saltery Bay	16-11-019	OLY2009-042-001	010-00042-001
20/08/2009	Fairview Bay	16-11-021	OLY2009-043-001	010-00043-001
20/08/2009	St. Vincent Bay East	16-12-001	OLY2009-044-001	010-00044-001
20/08/2009	Baker Bay-Hotham Sound	16-12-007	OLY2009-045-001	010-00045-001
20/08/2009	Harmony Islands-Hotham Sound	16-12-016	OLY2009-046-001	010-00046-001
21/08/2009	Back Eddy Marina-Egmont	16-09-009	OLY2009-047-001	010-00047-001
			OLY2009-047-002	010-00047-002
21/08/2009	Sargeant Bay	29-01-001	OLY2009-048-001	010-00048-001

Table 2. continued.

Date	Beach	Beach Code	Voucher #	RBCM #
21/08/2009	Thormanby Island South	16-01-003	OLY2009-049-001	010-00049-001
			OLY2009-049-002	010-00049-002
21/08/2009	Jeddah Point South	16-01-002	OLY2009-050-001	010-00050-001
	Smuggler's Cove			
21/08/2009	East	16-01-001	OLY2009-051-001	010-00051-001
			OLY2009-051-002	010-00051-002
21/08/2009	Wood Bay South	16-02-004	OLY2009-052-001	010-00052-001
			OLY2009-052-002	010-00052-002
21/08/2009	Whitestone Islands	16-02-002	OLY2009-053-001	010-00053-001
			OLY2009-053-002	010-00053-002
	Skardon Islands-			
21/08/2009	Pender Harbour	16-04-009	OLY2009-054-001	010-00054-001
22/08/2009	Frolander Bay	15-01-003	OLY2009-055-001	010-00055-001
	Green Bay-Nelson			
22/08/2009	Island	16-10-002	OLY2009-056-001	010-00056-001
			OLY2009-056-002	010-00056-002
22/08/2009	Jervis Inlet 1	16-13-006	OLY2009-057-001	010-00057-001
			OLY2009-057-002	010-00057-002
22/08/2009	Jervis Inlet 2	16-13-007	OLY2009-058-001	010-00058-001
22/08/2009	Jervis Inlet 3	16-13-008	OLY2009-059-001	010-00059-001
			OLY2009-059-002	010-00059-002
07/09/2009	Port Eliza 1	25-12-002	OLY2009-060-001	010-00060-001
			OLY2009-060-002	010-00060-002
			OLY2009-060-003	010-00060-003
07/09/2009	Port Eliza 2	25-12-001	OLY2009-061-001	010-00061-001
			OLY2009-061-002	010-00061-002
			OLY2009-061-003	010-00061-003
07/09/2009	Port Eliza 3	25-12-005	OLY2009-062-001	010-00062-001
			OLY2009-062-002	010-00062-002
	Ward's Marina-			
19/09/2009	Surret	29-08-002	OLY2009-063-001	010-00063-001
	24th Avenue			
19/09/2009	Crescent beach	29-08-003	OLY2009-064-001	010-00064-001
			OLY2009-064-002	010-00064-002

Table 3. Location, date sampled, number of beaches sampled and number with *O. lurida* from exploratory Olympia oyster surveys in British Columbia, 2009.

Geographic Area	Location	Date	Number of Beaches Surveyed	Number of Beaches with <i>O. lurida</i>
West Coast Vancouver Island	Barkley Sound	April 27,2009	8	8
		May 11-13,2009		
	Clayoquot Sound-North	May 8-9,2009	20	11
Strait of Georgia	Nootka Sound	August 4-6, 2009	3	3
	East Coast	May 22-27, 2009	27	19
	Vancouver Island	June 21-25, 2009		
		August 5,2009		
	Mainland Inlets/ Sunshine Coast	July 20-23, 2009	21	21
Strait of Juan de Fuca	Boundary Bay	August 19, 2009	3	3
	Victoria	July 6-31, 2009	11	6
	Sooke	August 2, 2009		
		July 9,2009	7	4
Total			98	74

Table 4. Presence or absence of *O. lurida* by location from exploratory Olympia oyster surveys in British Columbia, 2009.

Geographic Area	Location	Olympia Oysters Present
West Coast Vancouver Island		
Barkley Sound	Congreve Island	yes
	Harris Point	yes
	Hillier Island	yes
	Lucky Creek East	yes
	Ritherdon Creek	yes
	San Mateo Bay	yes
	Santa Maria Island	yes
	Toquart River	yes
Clayoquot Sound – North	Bacchante Bay	yes
	Beddingfield Bay 1	none
	Beddingfield Bay 2	none
	Bottleneck Cove 1	yes
	Bottleneck Cove 2	yes
	Bottleneck Cove 3	none
	Darr Island	yes
	Head of Stewardson Inlet	yes
	Megin River 1	yes
	Megin River 2	none
	Megin River 3	none
	Stewardson Inlet	yes
	Sulphur Passage 1	none
	Sulphur Passage 2	none
	Sulphur Passage 3	yes
	Sydney Inlet 1	yes
	Sydney Inlet 2	yes
Sydney Inlet 3	yes	
Young Bay 1	yes	
Young Bay 2	yes	
Nootka Sound	Port Eliza 1	yes
	Port Eliza 2	yes
	Port Eliza 3	yes

Table 4. Continued.

Geographic Area	Location	Olympia Oysters Present
Strait of Georgia		
Baynes Sound	Ship`s Point (Mac`s Oyster lease)	yes
	Ship`s Point South	yes
	Fanny Bay Oyster Plant	yes
	Comox Harbour	yes
	Comox Breakwater	yes
	Union Bay Boat Ramp	yes
Mainland Inlets - Sunshine Coast	Frolander bay	yes
	Sargeant Bay	yes
	Smuggler`s Cove East	yes
	South of Jeddian Point	yes
	South Thormanby island	yes
	Whitestone Islands	yes
	McNaughton Point north	yes
	Pipe Line south of Wood Bay	yes
	Skardon Islands, Pender Harbour	yes
	Back eddy marina	yes
	Green Bay	yes
	Maude Bay-Thunder Point	yes
	Saltery Bay	yes
	Fairview Bay	yes
	St Vincent Bay (East)	yes
	Baker Bay-Hotham Sound	yes
	Harmony Islands-waterfall Beach- Hotham Sound	yes
	Jervis Inlet 1	yes
	Jervis Inlet 2 (Samaurez bluff)	yes
	Jervis Inlet 3	yes
Quarry Bay	yes	

Table 4. continued.

Geographic Area	Location	Olympia Oysters Present
Strait of Georgia		
East Vancouver Island	Wall Beach	yes
	Nanoose - shellfish farm	yes
	Lantzville	none
	Nanaimo-Swy-a-lana Lagoon	yes
	Ladysmith-Limberis Plant	yes
	Coffin Point (Ladysmith Hr)	yes
	Evening Cove(Ladysmith Hr)	yes
	Kulleet Bay	yes
	Page Point (Oyster Harbour)	yes
	Raven Park	yes
	Transfer Beach	yes
	Shoal Island	yes
	Vesuvius Bay	Shell only
	Price Road Beach	none
	Cushion Creek	none
	Fulford Bay, Drummond Park	none
	Maple Bay	none
	Cowichan Bay Park	none
Genoa Bay	none	
Mill Bay Ferry Beach	none	
Goldstream	yes	
Strait of Juan de Fuca		
Victoria	Gorge Portage Inlet	yes
	Gorge Colquitz River Estuary	yes
	Gorge Upper	yes
	Gorge Lower	yes
	Stewart Ave. Esquimalt Hr.	none
	Portage inlet Park-Esquimalt	none
	Parsons Bridge Esquimalt	none
	Saxe Point Park	none
	Esquimalt Lagoon	none

Table 4. continued.

Strait of Juan de Fuca		
Sooke	Sooke Bay	none
	Sooke Harbour (Murray Park)	none
	Sooke Inlet - Whiffin Spit	none
	Roche Cove	yes
	Cooper Cove	yes
	Anderson Cove	yes
	Hutchinson Cove	yes
Boundary Bay	24th Ave, Crescent Beach	Shell only
	Ward's Marina	Shell only
	White Rock – West of Boat Ramp	yes
Total	Live Olympia oysters found	71
	Shell Only Location	3
	Beach without	24

Table 5. Potential Olympia oyster locations from personal communications and previously unknown literature records which require verification.

Geographic Area	Location	Comments
Quadra Island	Heriot Bay	Sally Kew, Mac Oysters, pers. comm.
Nanoose	Nanoose Bay	Creek on eastern shore of Nanoose Bay (C. Hand, DFO, pers. comm..)
Saltspring Island	Plumbush Beach (Walker Hook Rd)	May 2006 Trinity Western University field trip data
	Isabella Point (Fulford Harbour)	May 2002, May 2005 Trinity Western University field trip data
	Fernwood Beach	May 2002, May 2004 Trinity Western University field trip data
	Southey Point	May 2002 Trinity Western University field trip data
West Coast Vancouver Island	Acous Peninsula	Record of Native Oyster in Checleset Bay (Ellis and Emerson 1979)
	Klaskish Inlet	Letter from D.W Smith Provincial Government May 28, 1975 (Ellis and Emerson 1979)
Sunshine Coast	Multiple locations in northern Sunshine Coast and Sechelt Inlet	Clam harvester varnish clam survey information.

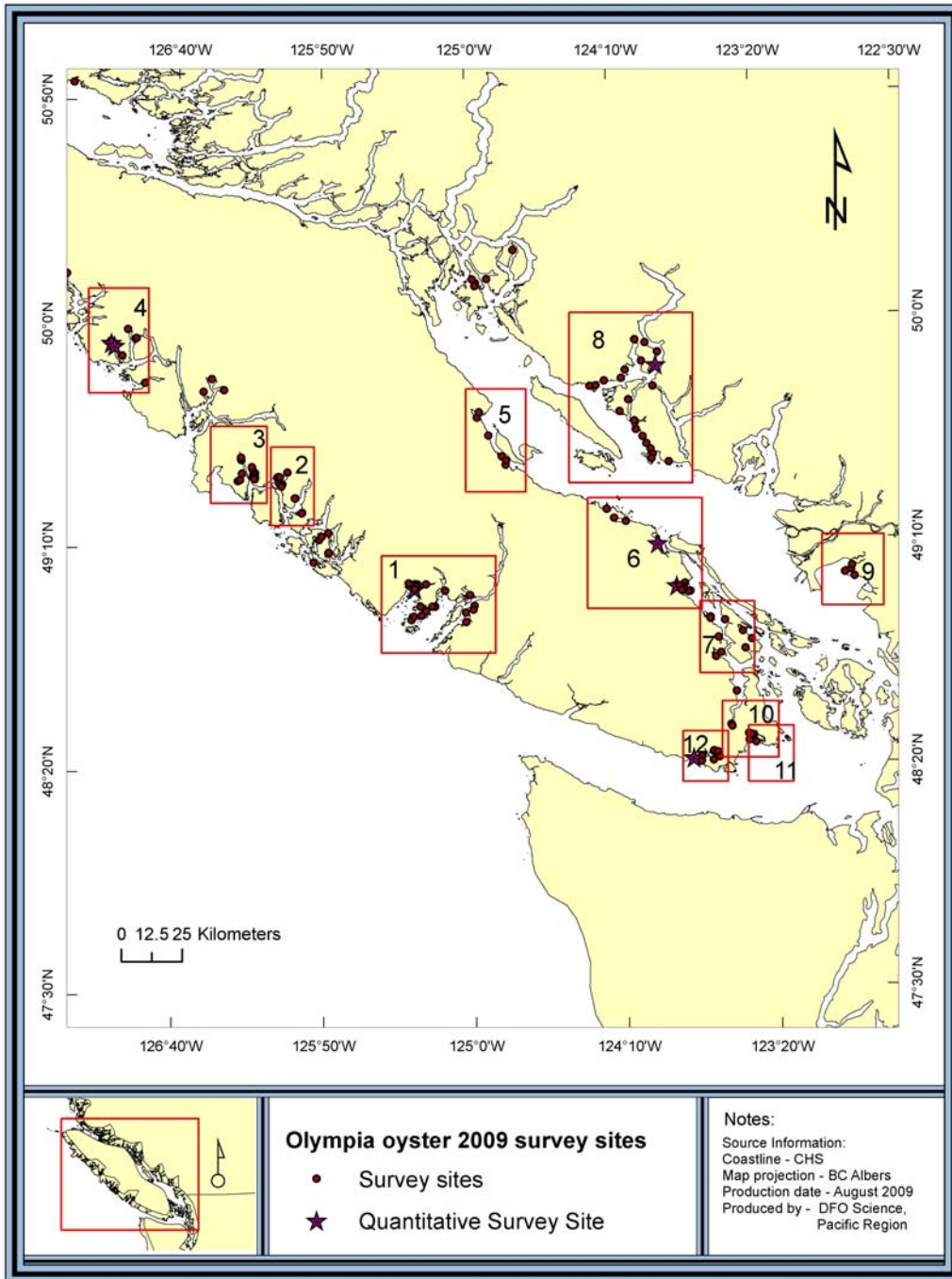


Figure 1. Olympia oyster survey locations from April to August 2009.

Legend: 1 – Barkley Sound; 2 – southern Clayoquot Sound; 3 – northern Clayoquot Sound; 4 – Nootka Sound; 5 – Baynes Sound; 6 – Nanoose Bay to Ladysmith; 7 – Shoal and Saltspring Islands; 8 – Sunshine Coast; 9 – Boundary Bay; 10 – Victoria; 11 – Gorge Waterway; 12 – Sooke.

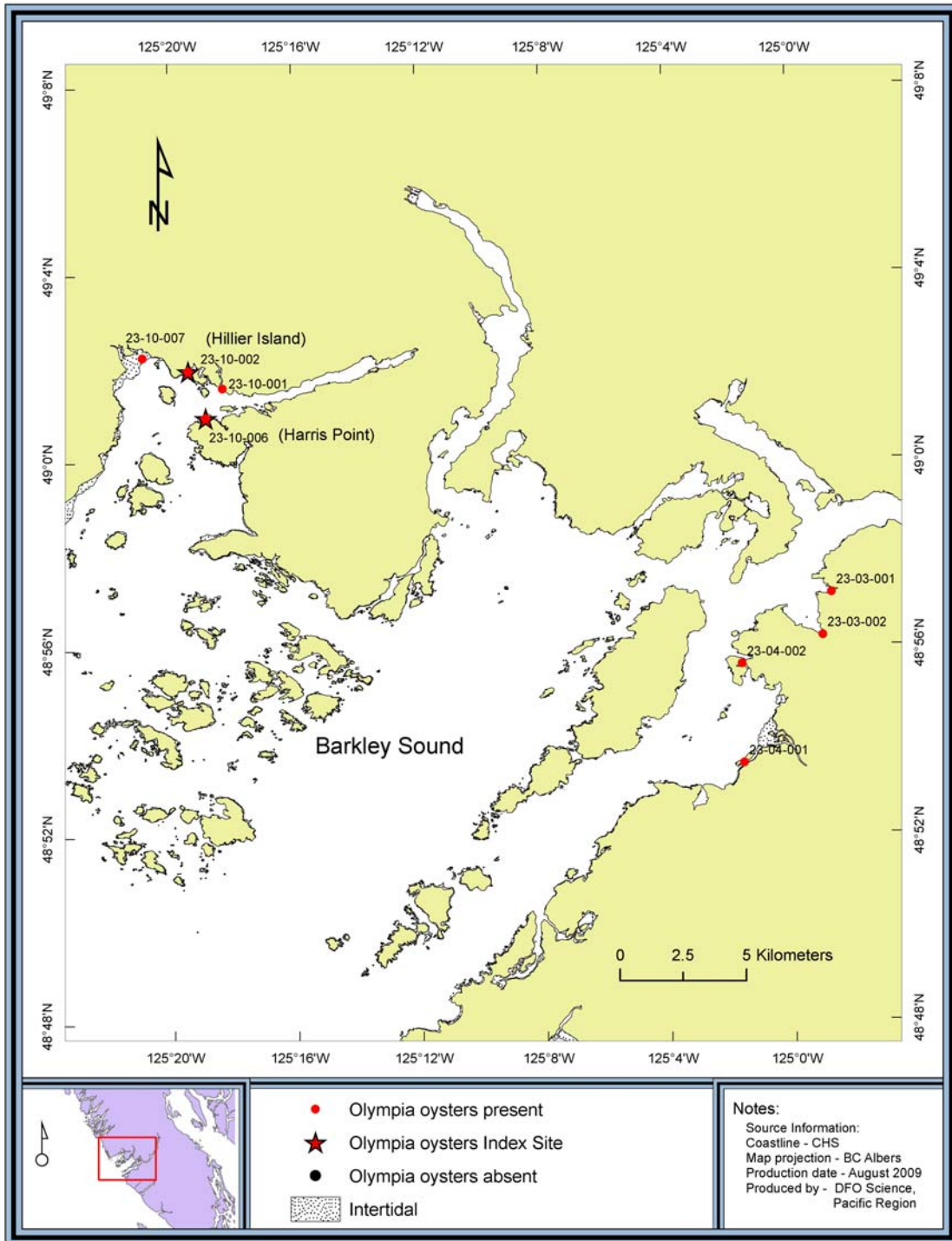


Figure 2. Olympia oyster survey locations in Barkley Sound.

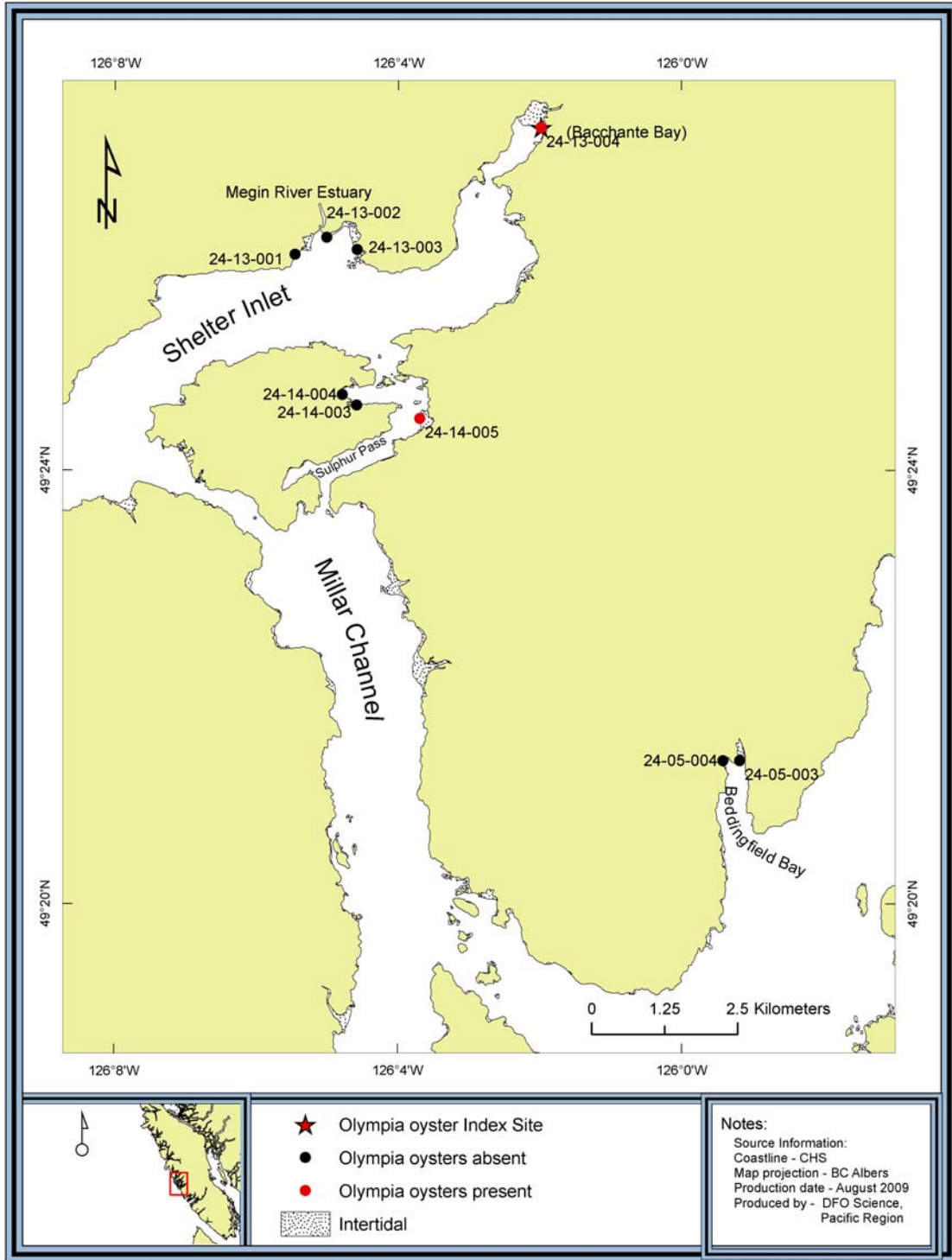


Figure 3. Olympia oyster survey locations in Northeast Clayoquot Sound.

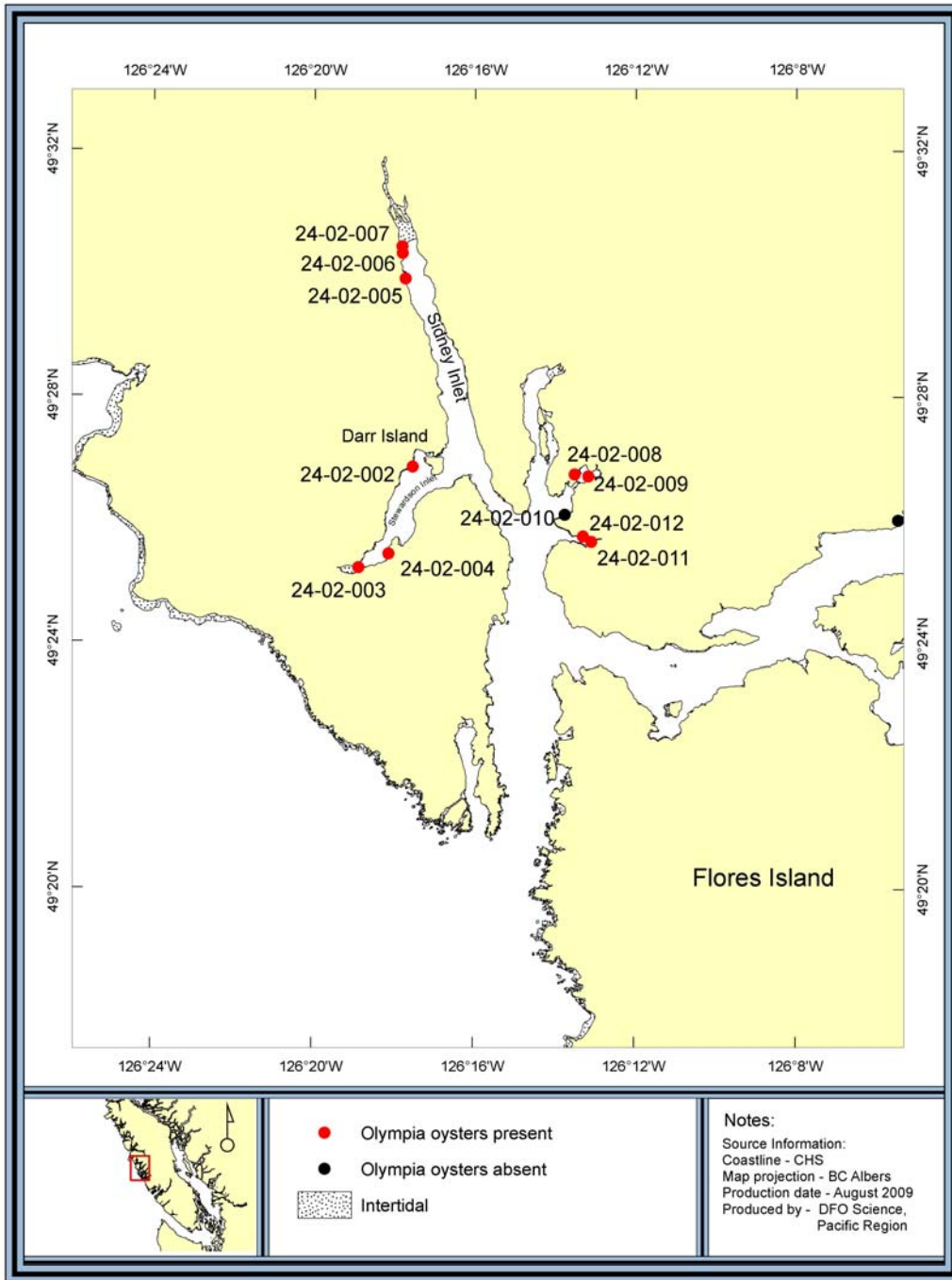


Figure 4. Olympia oyster survey locations in Northwest Clayoquot Sound.

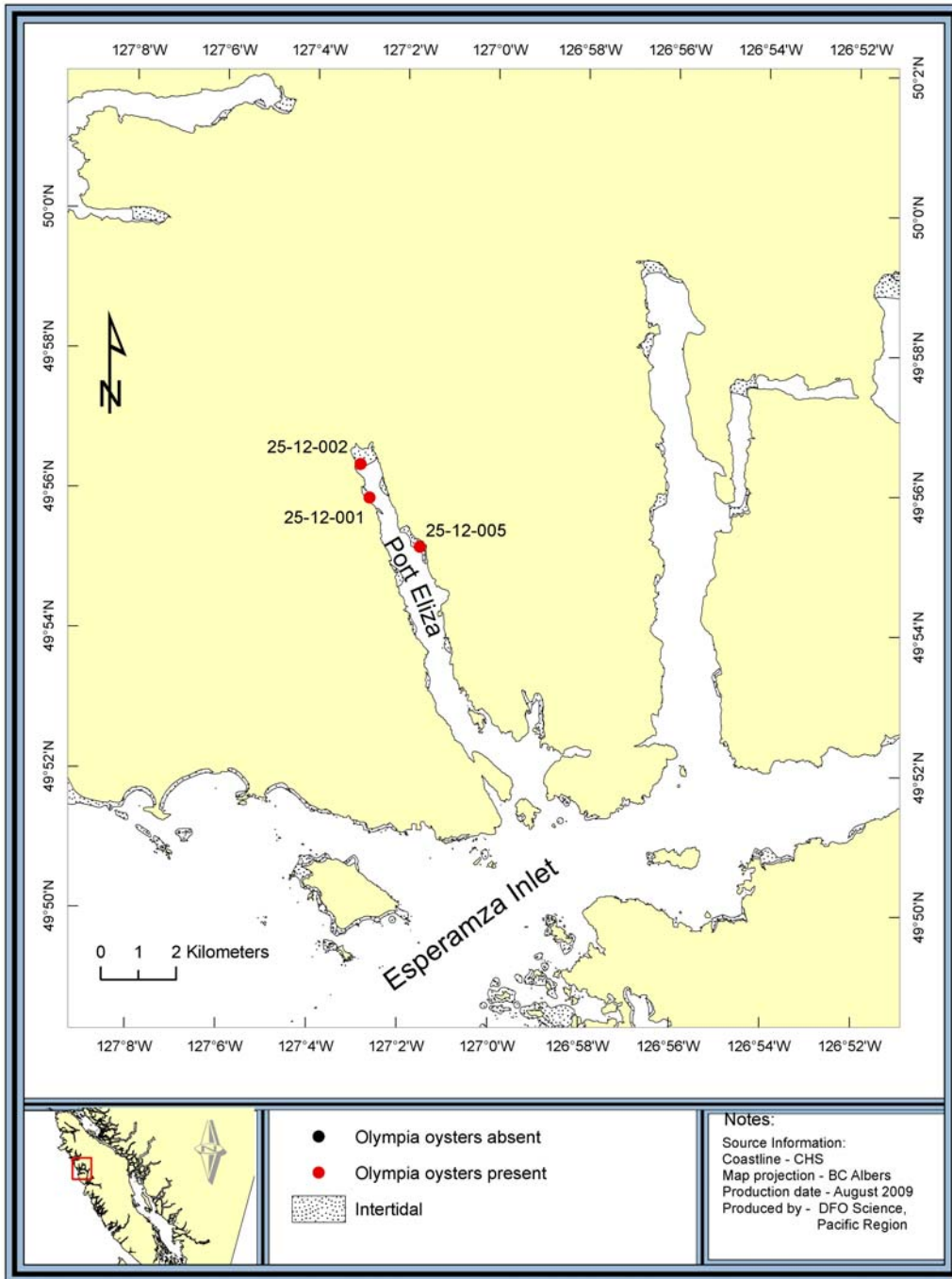


Figure 5. Olympia oyster survey locations in Nootka Sound.

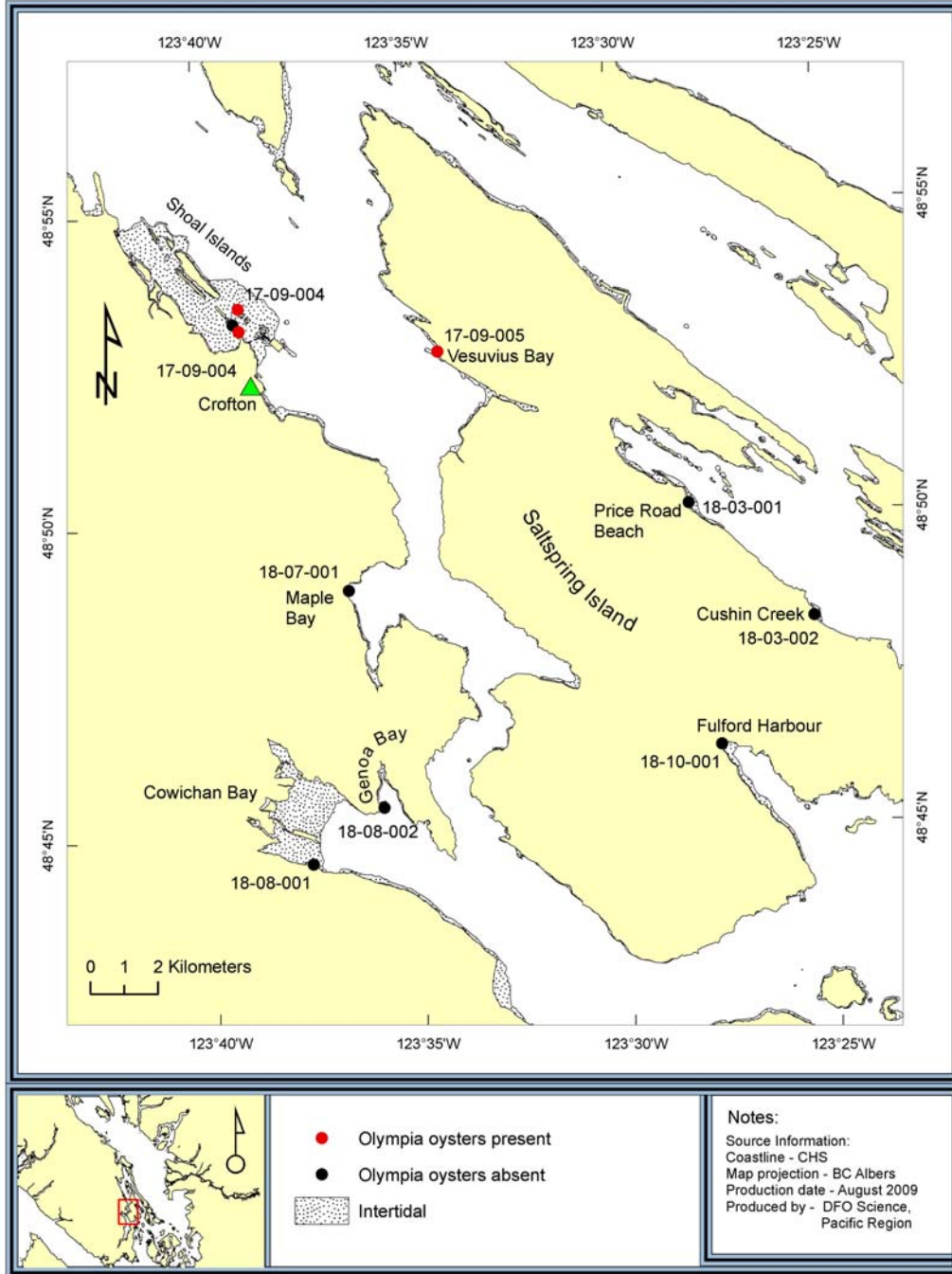


Figure 6. Olympia oyster survey locations in the Shoal and Saltspring Islands.

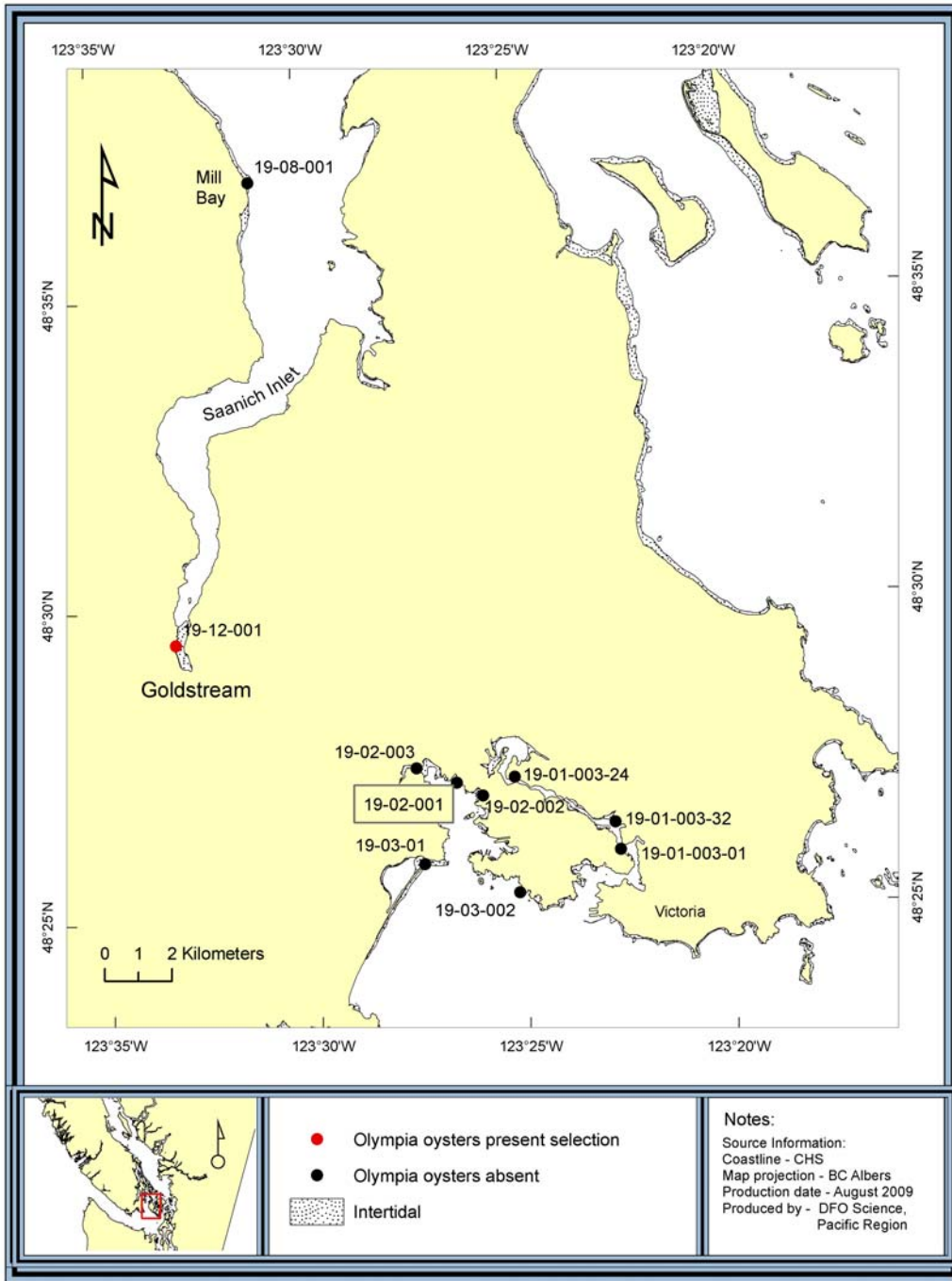


Figure 7. Olympia oyster survey locations in Goldstream and Esquimalt.

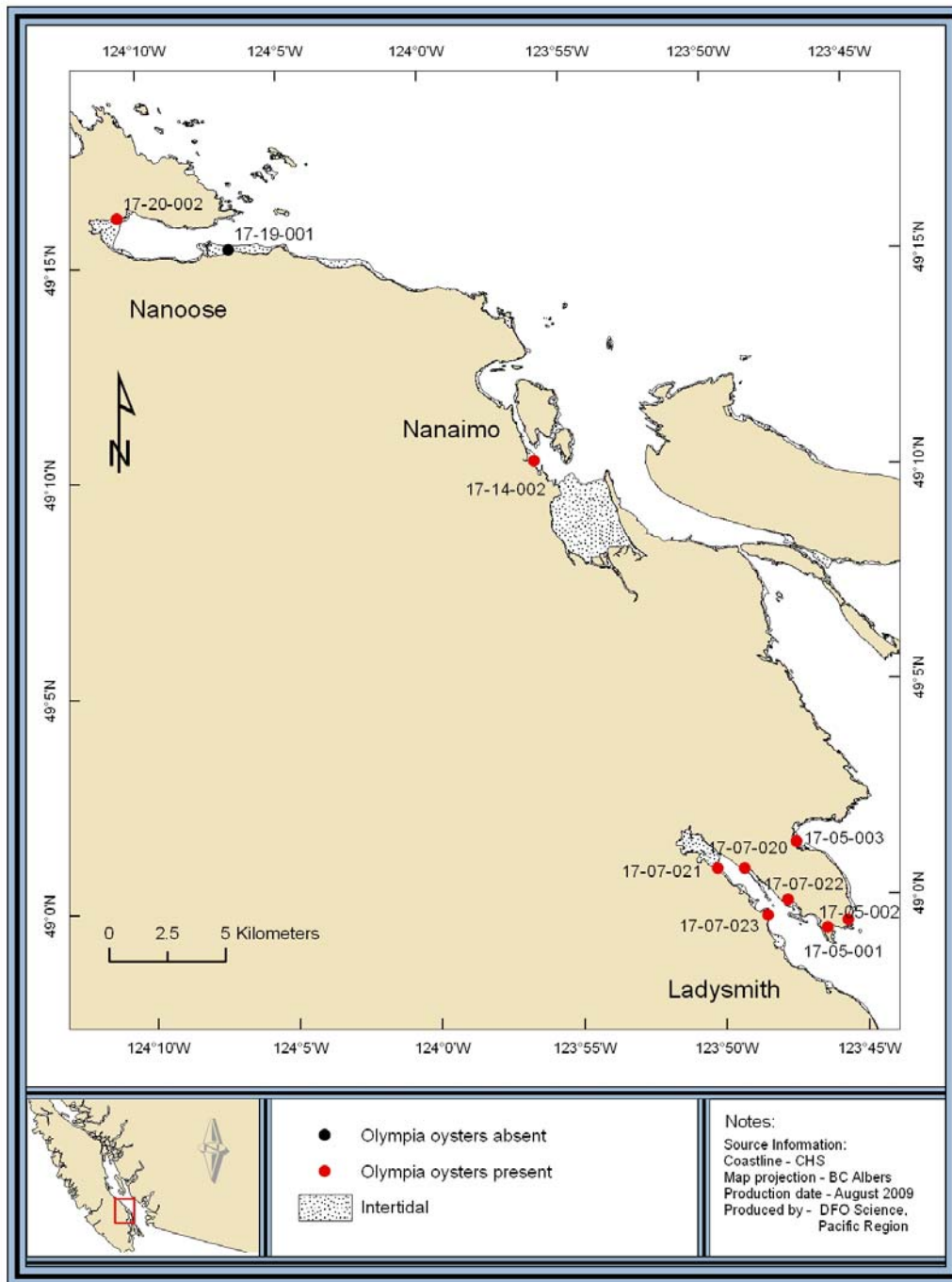


Figure 8. Olympia oyster survey locations from Nanoose to Ladysmith.

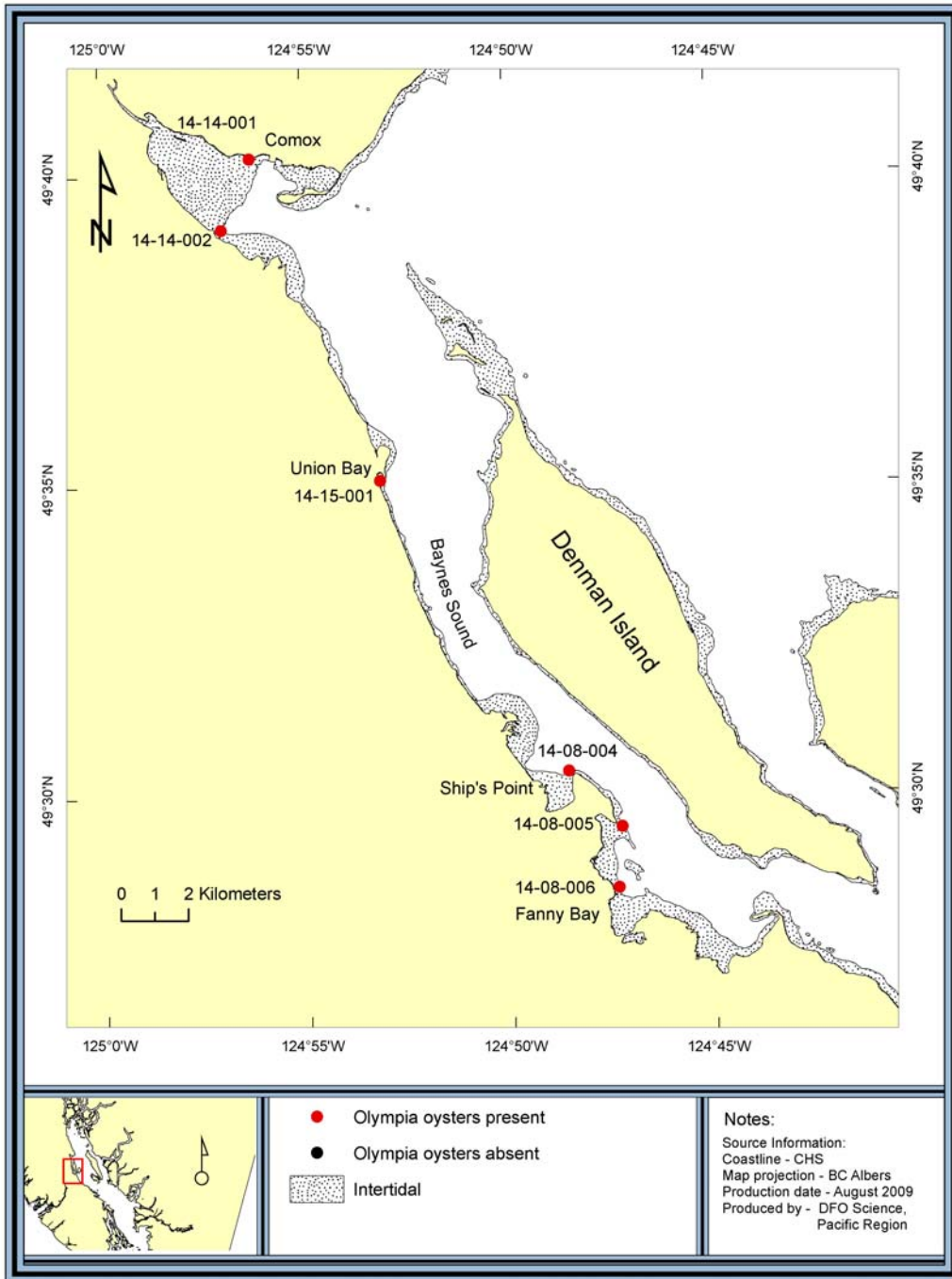


Figure 9. Olympia oyster survey locations in Baynes Sound.

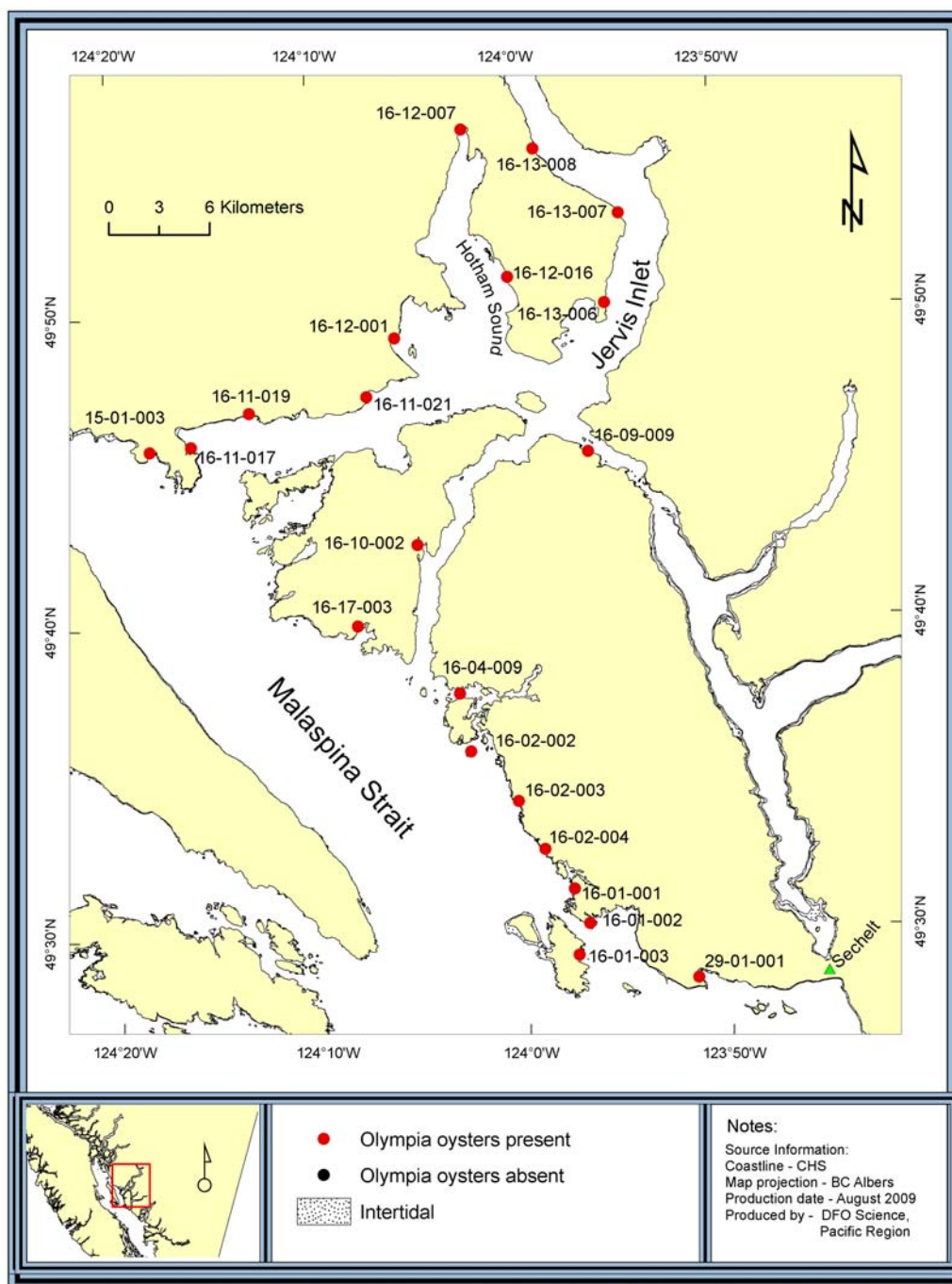


Figure 10. Olympia oyster survey locations in the Sunshine Coast and Mainland Inlets

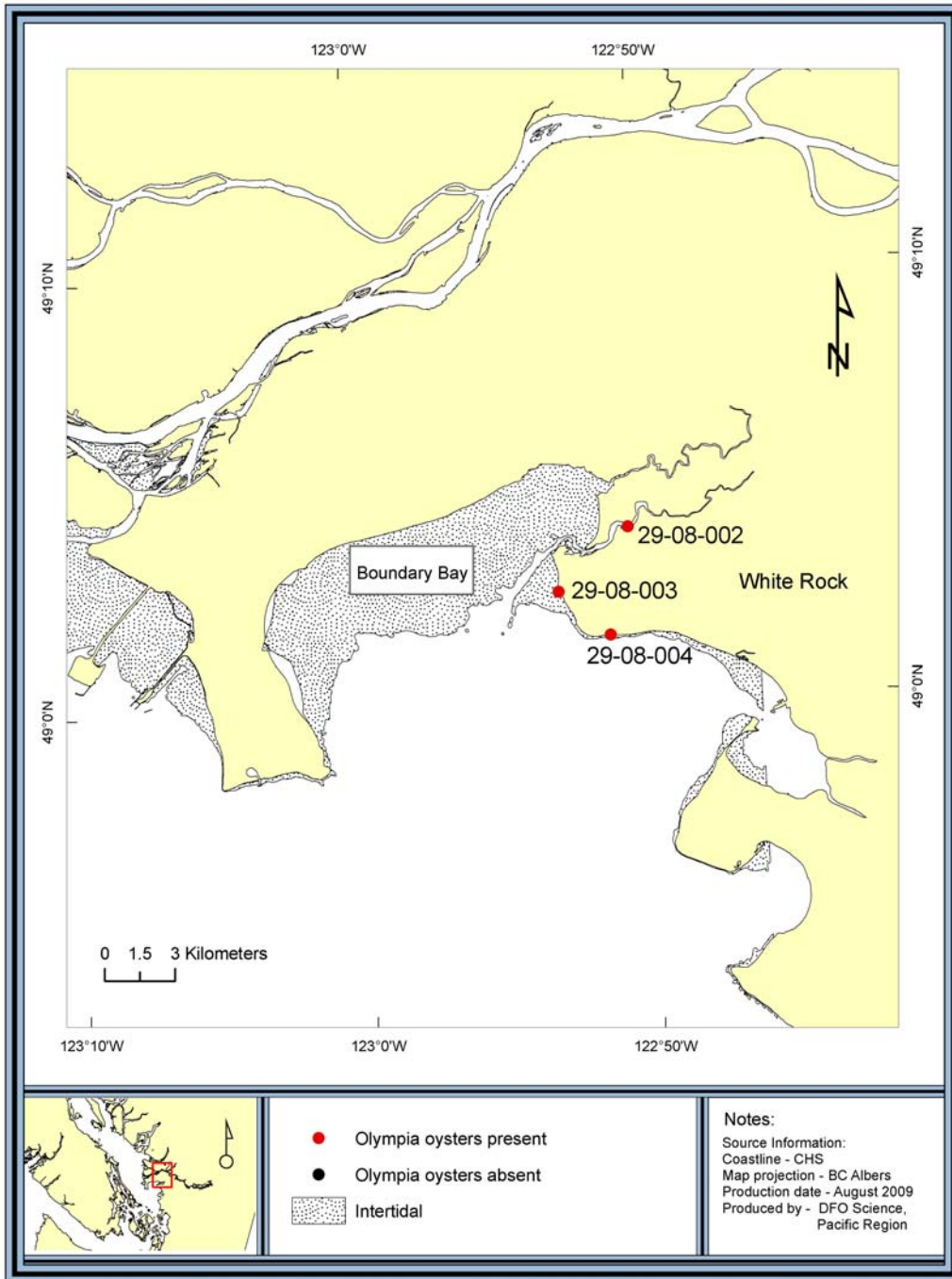


Figure 11. Olympia oyster survey locations in Boundary Bay.

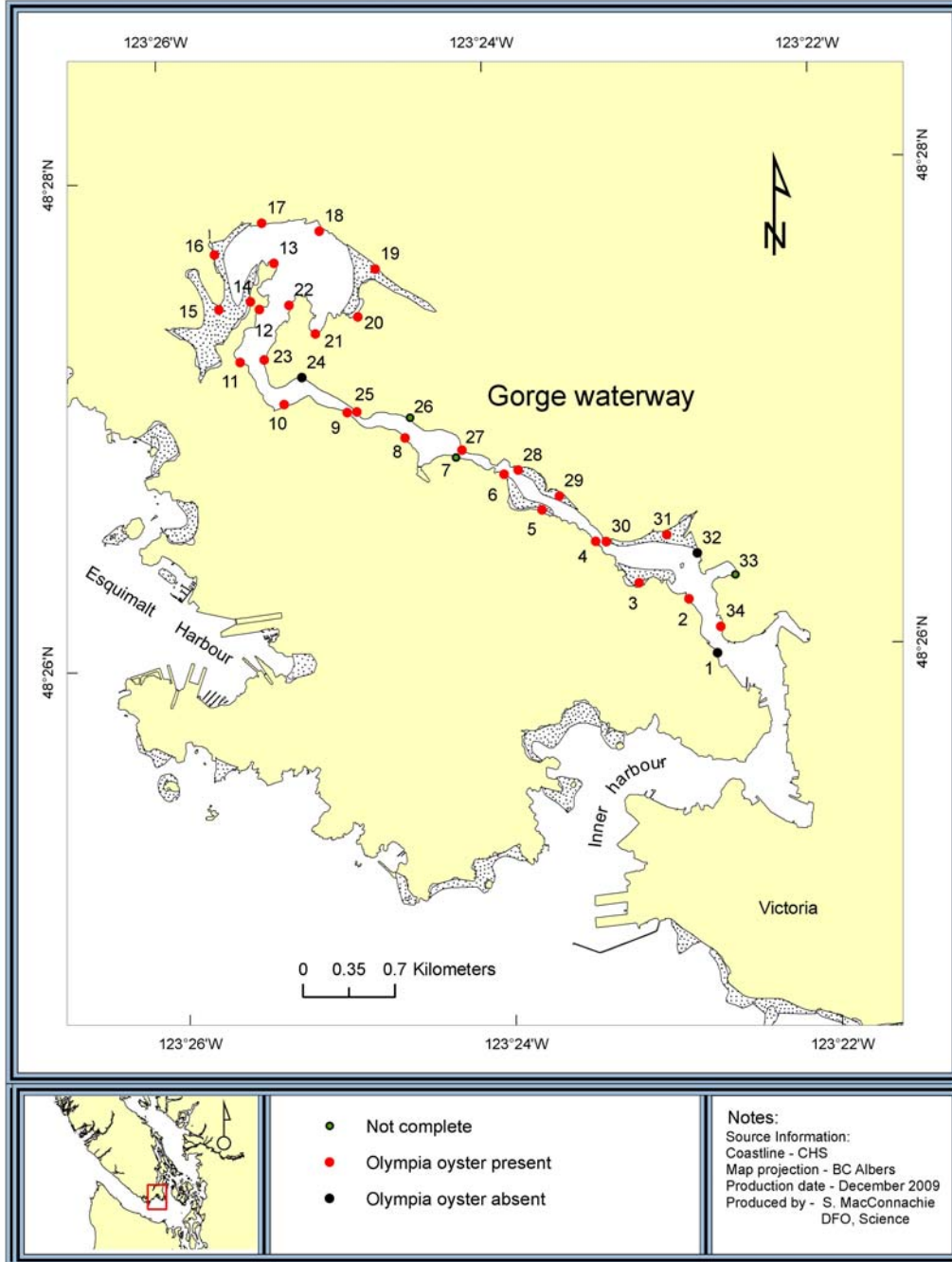


Figure 12. Olympia oyster survey locations in the Gorge Waterway.

These points were the original transect locations before the survey was completed and will need to be corrected with the latitude and longitude collected in the field. Transects 7, 26 and 33 were not completed. The Gorge is broken into 4 areas; Gorge Lower refers to the areas below the Tillicum Bridge transects 1-6 and 28-34, Gorge upper refers to Transects 8-12 and 22-27, Gorge Colquitz River Estuary refers to Transects 18 to 21, and Gorge Portage Inlets refers to transect 13-17.

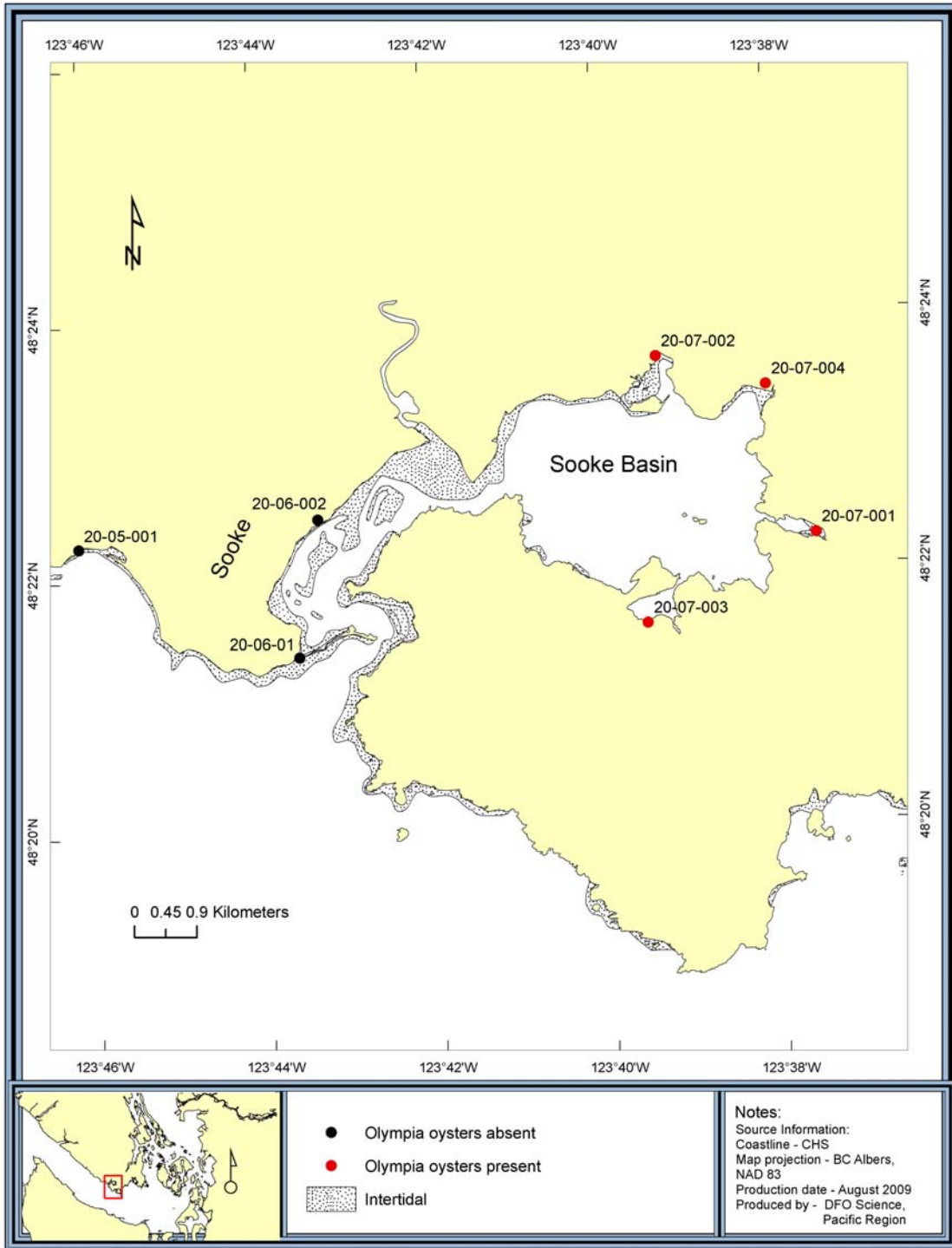


Figure 13. Olympia oyster survey locations in Sooke.

Appendices

Appendix Table 1. Documentation of beach and voucher information from exploratory Olympia oyster surveys in British Columbia in 2009.

West Coast Vancouver Island-Barkley Sound

Location	Beach # ¹	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher # ²	Substrate
Harris Point	24-10-006	27/04/09	07:00-09:00	0.25	49° 00.951'	125° 18.850'	OLY2009-001-001 OLY2009-001-002 OLY2009-001-003 OLY2009-001-004	Cobble, gravel, boulder, sand.
Observations								
The edge of the beach sloped upwards changing in substrate from sand, gravel and cobble to boulders and bedrock on the upper beach. Live Olympia oysters were extremely dense and were found attached to Pacific oysters. The highest density of Olympia oysters were observed in the flat low lying area of the beach which remained wet during low tide.								

42



¹ Beach # is an identifier from the Shellfish Data Unit intertidal survey database, consisting of Pacific Fisheries Management Area, subarea and sequential beach number within the subarea.

² There are two voucher numbers for each specimen; one for DFO databases and one for the Royal British Columbia Museum, where the collection is curated.

Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Hiller Island	23-10-002	27/04/09	10:00-11:30		49° 01.955'	125°19.402'	OLY2009-002-001 OLY2009-002-002	Cobble, gravel, bedrock
Observations								
Live Olympia oysters intermixed and attached to Pacific oysters. High density of <i>O. lurida</i> observed in tidal pools located on upper beach.								

43



Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Congreve Island	23-04-002	11/05/09	15:55-16:10		48° 55.613'	125°01.601'	OLY2009-014-001 OLY2009-014-002	
Observations								
Voucher specimens collected during a green crab survey.								

44

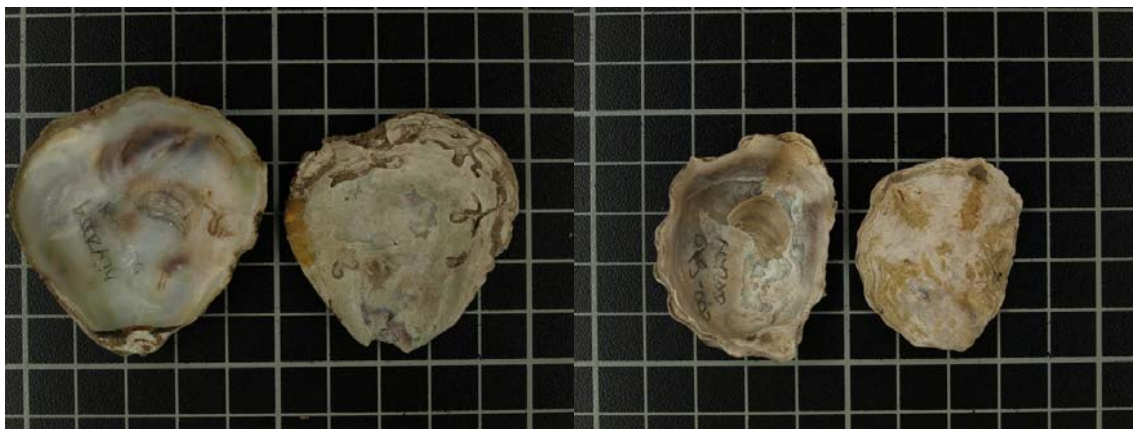


Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Santa Maria Island	23-04-001	11/05/09	16:22-16:40		48° 53.498'	125° 01.568'	OLY2009-015-001 OLY2009-015-002	
Observations								
Voucher specimens collected during a green crab survey.								

45



Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
San Mateo Bay	23-03-002	12/05/09	11:15-11:25		48° 56.203'	124°58.986 '	OLY2009-016-001 OLY2009-016-002	
Observations								
Voucher specimens collected during a green crab survey.								

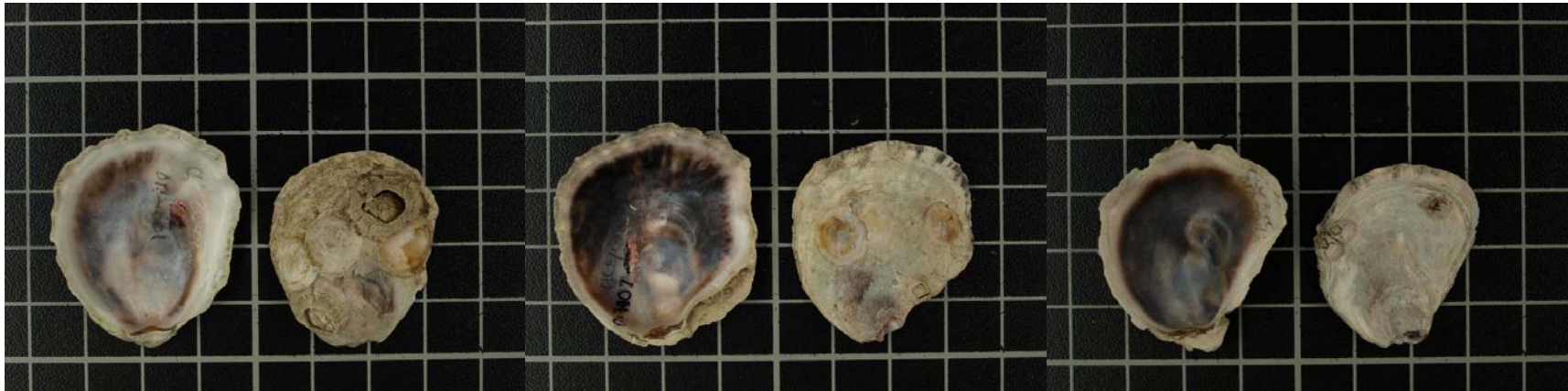
46



Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Ritherdon Creek	23-03-001	12/05/09	11:30-11:45		48° 57.115'	124°58.686'	OLY2009-017-001 OLY2009-017-002 OLY2009-017-003 OLY2009-017-004	
Observations								
Voucher specimens collected during a green crab survey.								



Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Lucky Creek East	24-10-001	13/05/09	13:45-13:55		49° 01.578'	125° 18.294'	OLY2009-018-001 OLY2009-018-002 OLY2009-018-003	
Observations								
Voucher specimens collected during a green crab survey.								

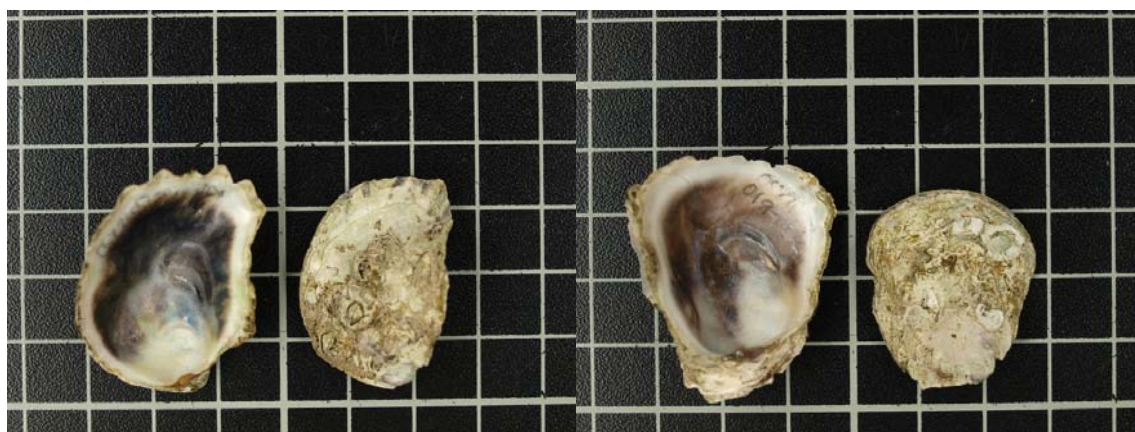
48



Appendix Table 1. cont'd.

West Coast Vancouver Island-Barkley Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Torquart River	24-10-007	13/05/09	14:00-14:15		48° 02.238'	125° 20.873'	OLY2009-019-001 OLY2009-019-002	
Observations								
Voucher specimens collected during a green crab survey.								



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Darr Island	24-02-002	08/05/09	06:30-07:00	n/a	49° 26.520'	126°17.291'	OLY2009-003-001	Cobble over sand
Observations								
Sparse <i>O. lurida</i> bed the whole length of beach, ≈ 300m x 10m band from top of <i>Enteromorpha sp.</i> in lower intertidal to edge of <i>fucus</i> in upper intertidal. Some Pacific oysters in patches along beach with a few <i>Olympia</i> oysters mixed in however, most were found in the low intertidal. This beach did have some freshwater runoff from a stream.								

50

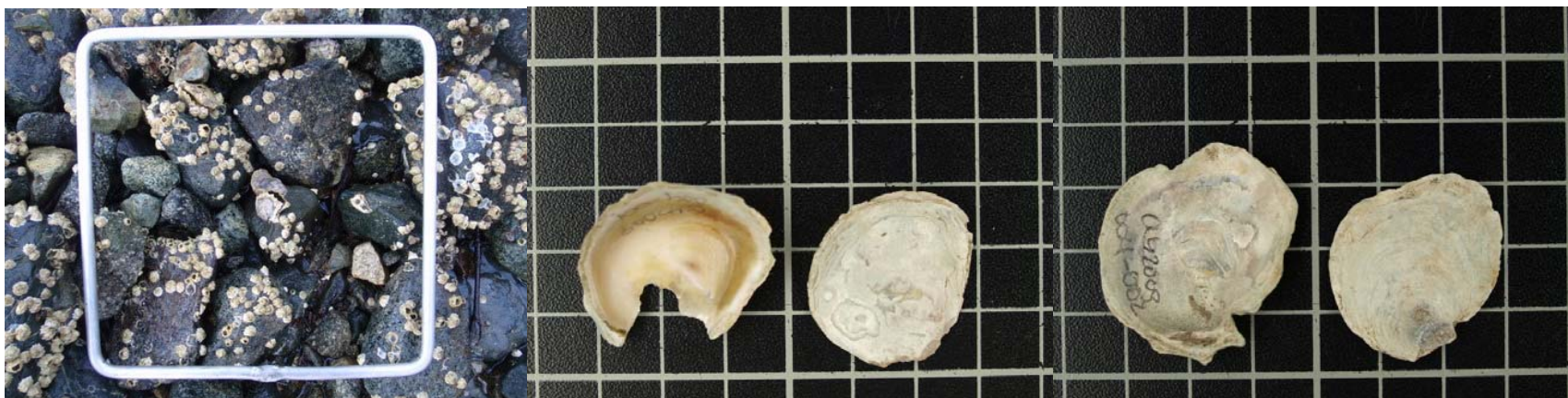


Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Head of Stewardson Inlet	24-02-003	08/05/09	07:09-07:10	n/a	49° 25.210'	126°18.864'	OLY2009-004-001 OLY2009-004-002	Large cobble to boulders over sand
Observations								
Small beach 20m x 10m. Very sparse, only 5 <i>Olympia</i> oysters observed. Pacific oysters present.								

51



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Stewardson Inlet	24-02-004	08/05/09	07:21-07:30		49° 25.438'	126°18.117'	OLY2009-005-001 OLY2009-005-002	Cobble
Observations								
Olympia oysters observed along whole length of beach forming a 3m wide band from the water line towards upper intertidal, most are $\approx 0.6\text{m}$ underwater. ≈ 5 live <i>O. lurida</i> per quadrat (0.25cm^2). Pacific oysters present.								

52



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Sydney Inlet 1	24-02-005	08/05/09	07:42-07:55		49° 29.911'	126°17.719'	OLY2009-006-001 OLY2009-006-002 OLY2009-006-003 OLY2009-006-004 OLY2009-006-005 OLY2009-006-006	Cobble over sand
Observations								
Eelgrass bed over most of lower beach. Olympia oysters sparse, attached to Pacific Oyster shells. \approx 3-5 live <i>O. lurida</i> per quadrat (0.25cm ²). Pacific beds are dense but only 2-5m in width.								

53



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Sydney Inlet 2	24-02-006	08/05/09	07:57-08:01	n/a	49° 30.327'	126° 17.789'	n/a	Cobble, boulder
Observations								
Olympia oysters sparse.								

54

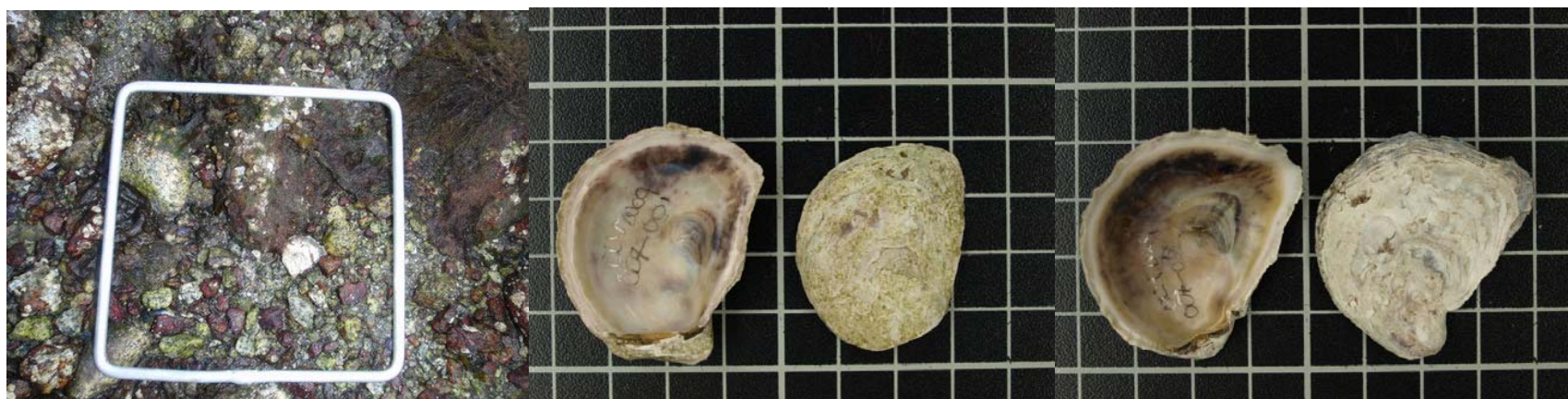


Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Sydney Inlet 3	24-02-007	08/05/09	08:02-08:05		49° 30.433'	126°17.800'	OLY2009-007-001 OLY2009-007-002 OLY2009-007-003	Cobble to boulder on sand
Observations								
Sulphur smell present at beach; Olympia oyster bed found in creek bed.								

55



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Bottle-neck Cove 1	24-02-008	08/05/09	08:29-08:38	n/a	49° 26.734'	126°13.495'	OLY2009-008-001 OLY2009-008-002 OLY2009-008-003 OLY2009-008-004	Cobble over sand
Observations								
Olympia oysters cover a 10mx 40m band along the water line. \approx 4-7 live <i>O. lurida</i> per quadrat (0.25cm ²). Pacific oysters present.								

56



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Bottle-neck Cove 2	24-02-009	08/05/09	08:44-09:02		49° 26.702'	126°13.155'	OLY2009-009-001 OLY2009-009-002 OLY2009-009-003	Cobble over sand
Observations								
Olympia oysters occupy a 50m x 10m area, \approx 2-6 live <i>O. lurida</i> per quadrat (0.25cm ²). Pacific oysters present.								



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Young Bay 1	24-02-011	08/05/09	09:30-09:38	n/a	49° 25.637'	126°13.081'	OLY2009-010-001 OLY2009-010-002	Boulder, cobble over sand
Observations								
Olympia oysters at mouth of river. Fairly large bed, but sparsely populated, found submerged under water. \approx 1-2 live <i>O. lurida</i> oysters per quadrat (0.25cm ²). Freshwater runoff from small creek.								

58



Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Young Bay 2	24-02-012	08/05/09	09:43-09:50	n/a	49° 25.725'	126°13.287'	n/a	Bedrock, boulder, cobble over sand
Observations								
Olympia oysters observed under 0.5m of water during incoming tide. Pacific oysters present.								

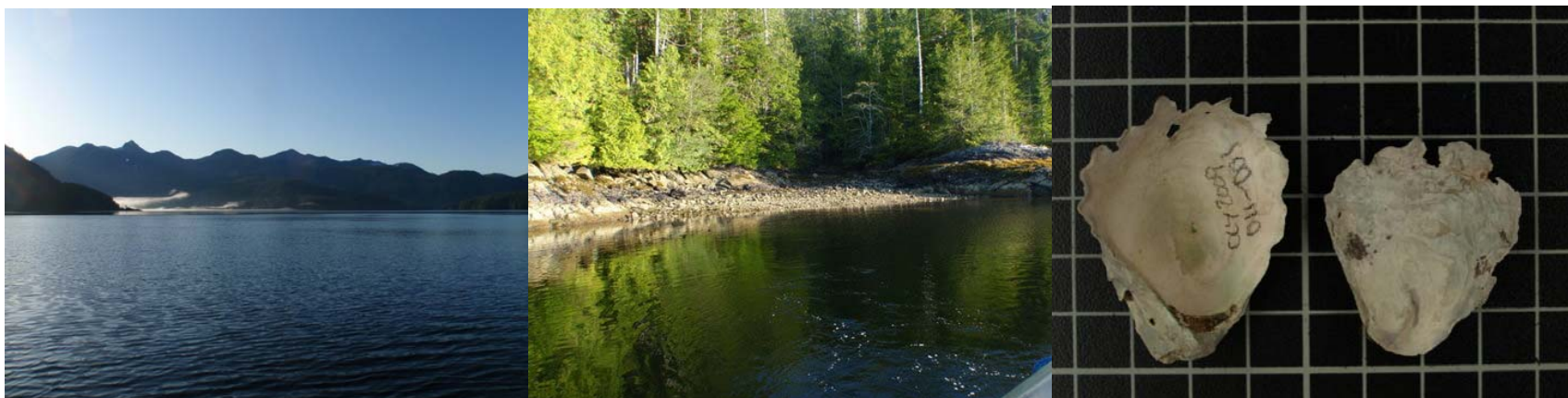


Appendix Table 1. cont'd.

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Megin River 1	24-13-001	09/05/09	07:02-07:17	n/a	49° 25.992'	126°05.452'	OLY2009-011-001	Cobble, boulder, bedrock
Observations								
Pacific oysters (possibly Olympia oysters?) submerged under water prior to low tide.								

60



Appendix Table 1. cont'd

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Bacchante Bay	24-13-004	09/05/09	08:08-08:25	n/a	49° 27.164'	126°01.979'	OLY2009-012-001 OLY2009-012-002 OLY2009-012-003	Small cobble over sand
Observations								
Performed a timed walk: observed 45 Olympia oysters in 18 minutes from 2 people looking. Pacific oysters present however, all were small in size.								

61



Appendix Table 1. cont'd

West Coast Vancouver Island - Clayoquot Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Sulphur Passage 1	24-14-005	09/05/09	09:08-09:23	n/a	49° 24.600'	126°00.000'	OLY2009-013-001	Cobble, gravel
Observations								
Sulphur Pass 1: Old abandoned aquaculture site on beach. One suspect Olympia oyster was observed and collected for identification. Pacific oysters present.								

62



Appendix Table 1. cont'd.

West Coast Vancouver Island – Nootka Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Port Eliza 1	25-12-002	04/08/09	08-:15-09:20	6	49° 56.134'	127° 02.899'	OLY2009-60-001 OLY2009-60-002 OLY2009-60-003	Gravel, cobble over sand
Observations								
Moderately large beach. Olympia oysters abundant on rocks and lying in sand and intermixed with Pacific oysters. Distinct age classes were observed settling on older live or dead Olympia oyster shell forming an oyster upon oyster complex. Dense Pacific oyster bed.								

63



Appendix Table 1. cont'd.

West Coast Vancouver Island – Nootka Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Port Eliza 2	25-12-001	06/08/09	06:35-09:05	3	49° 55.897'	127° 02.744'	OLY2009-061-001 OLY2009-061-002 OLY2009-061-003	Gravel, cobble over sand, boulder, bedrock

Observations

Beach divided by a creek. Olympia oysters observed in high densities at low tide line and in creek near center of beach. Highest density of *O. lurida* is found on the most southern side of the beach. A low number of Pacific oysters scattered throughout the beach. A quantitative survey was completed on this beach and will be reported in a separate document.

64



Appendix Table 1. cont'd.

West Coast Vancouver Island – Nootka Sound

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Port Eliza 3	25-12-005	05/08/09	06:00-09:35	3	49° 55.204'	127° 01.621'	OLY2009-062-001 OLY2009-062-002	Gravel, cobble over sand
Observations								
Beach divided by a creek. Olympia oysters observed in high densities at the low tide line and the southern side of the beach. A low number Pacific oysters scattered throughout the beach. A quantitative survey was completed on this beach and will be reported in a separate document. Water Temperature was 16°C, salinity 20‰.								

65

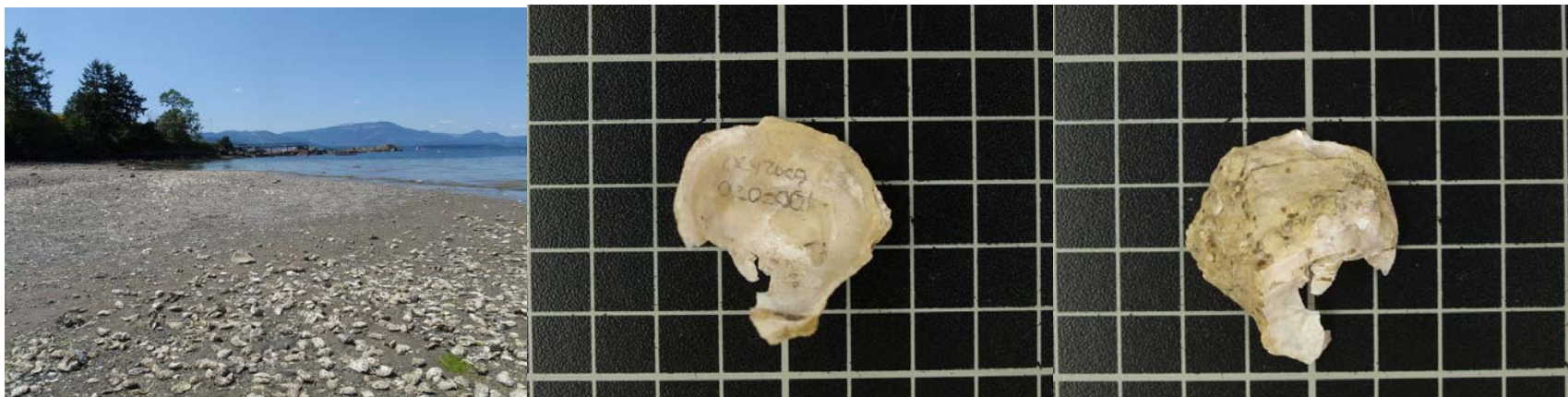


Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Vesuvius Bay-Saltspring Island	17-09-005	22/05/09	9:00-9:10	n/a	48° 52.716'	123°34.217'	OLY2009-020-001	Sand, cobble, gravel
Observations								
Boulders and bedrock are located on either side of the beach with a sandy area in the centre containing Pacific oysters. One Olympia oyster shell was found attached to a Pacific oyster shell on the most eastern side of the beach. Pacific oyster present at moderate abundance.								

66



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Shoal Island	17-09-004	22/05/09	9:40-10:50	n/a	48° 53.496'	123°39.014'	OLY2009-021-001 OLY2009-021-002 OLY2009-021-003	Sand, mud and a rocky tidal pool.
Observations								
Olympia oysters were present in two of the three locations investigated on the Shoal Islands. Three Olympia oysters were observed in tidal pools at the southern end of the southern most Island (near the park). <i>O. lurida</i> were also observed on the underside of Pacific oyster shells lying on a muddy substrate at the northern end of the northern Shoal Island.								



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Swy- a- lana Lagoon- Nanaimo Harbour	17-14-002	24/05/09 20/08/09	12:20- 12:45	n/a	49°10.271'	123°56.208'	OLY2009-022-001 OLY2009-022-002	Cobble and gravel, concrete blocks
Observations								
Artificial lagoon created by large concrete blocks, Olympia oysters attached to blocks on the outside and inside of the lagoon. <i>O. lurida</i> appear to be more abundant in number and larger in size on the inside of the lagoon. Water temperature on 20/08/09 was 21°C, salinity 26‰ in the lagoon, ocean temperature was 19°C, salinity 27‰. A quantitative survey was completed on this beach and will be reported in a separate document.								

88



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Limberis Plant-Ladysmith Harbour	17-07-021	24/05/09	10:05-10:40	n/a	49° 00.683'	123° 50.142'	OLY2009-023-001 OLY2009-023-002	Mud, gravel, oyster shell
Observations								
Healthy population of Olympia oysters approximately 100m south of plant forming a wide band approx. 10-20m in width (starting from Pacific oyster zone in high intertidal to mud in low intertidal) and approximately 1 km in length. A quantitative survey was completed on this beach and will be reported in a separate document.								

69



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Nanoose Bay	17-20-021	25/05/09	13:35-14:00		49°16.142'	124°10.734'	n/a	Sand, mud, gravel
Observations								
3 people searched the beach west from Pete Mcullin's oyster farm. Only one Olympia oyster was found a tidal pool. Also one European flat oyster was collected.								

70



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Gold-stream	19-12-001	26/05/09	14:20-15:00		48°16.458'	123°33.222'	OLY2009-024-001	Sand, mud, cobble
Observations								
Olympia oysters present on rocks on west side of freshwater stream on the Westside of the estuary. Approximately 5-15 individuals were found at this location. <i>O. lurida</i> were found scattered on the beach.								

71



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Transfer Beach-Ladysmith Harbour	17-07-023	21/06/09	10:15-10:45	1.5	48°59.573'	123°48.436'	OLY2009-025-001	Boulder and cobble
Observations								
Cryptic population of Olympia oysters observed under rocks in the eastern section of the park. There was approximately 3 <i>O. lurida</i> per quadrat (0.25cm ²). Pacific oysters present.								

72



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Page Point-Ladysmith Harbour	17-07-023	21/06/09	11:00-11:30		49°00.673'	123°49.206'	OLY2009-026-001 OLY2009-026-002 OLY2009-026-003 OLY2009-026-004 OLY2009-026-005	Sand, mud, gravel with a small amount of cobble
Observations								
Olympia oysters scattered and in clusters near tidal pools and in wet sandy areas, ≈ 2 <i>O. lurida</i> per quadrat (0.25cm ²). Pacific oysters present.								

73



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Raven Park-Ladysmith Harbour	17-07-022	21/06/09	11:45-12:00	2	49° 59.916'	123° 47.720'	OLY2009-027-001 OLY2009-027-002	Mud with gravel
Observations								
Small population of Olympia oysters scattered along high intertidal and laying in mud near park entrance. Pacific oysters present.								

74



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Kulleet Bay-Ladysmith Harbour	17-05-003	21/06/09	12:20-12:30		49°01.254'	123°47.349'	OLY2009-028-001	Sand, gravel
Observations								
Single scattered Olympia oyster populations at mid intertidal, only a small area of beach was examined. Pacific oysters present.								

75



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Coffin Point-Ladysmith Harbour	17-05-001	05/08/09	10:35-11:00		48°59.409'	123°45.613'	n/a	Sand, boulders, gravel
Observations								
Olympia oysters scattered and sparse, only five live oysters observed. Pacific oysters present.								

76



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Evening Cove-Ladysmith Harbour	17-05-002	05/08/09	11:15-12:30		48°59.245'	123°46.343'	n/a	Bedrock, sand, gravel, boulders
Observations								
Five live Olympia oysters observed, one in a tide pool created by a crevice in the bedrock on upper beach, one attached to old clam shell, two laying on sandy surface near a freshwater source and one at the water line attached to a rock. Pacific oysters present.								

77



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Ship Point	14-08-004	24/06/09	12:00-12:20	0.25	49°30.373'	124°48.582'	OLY2009-029-001 OLY2009-029-002	Sand with boulders, cobble and shell
Observations								
Single Olympia oysters scattered along beach and found attached to the underside of the rocks, lots of shells were seen. Pacific oysters present.								

78



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Ship Point South	14-08-005	25/06/09	16:10-16:45	2	49°29.469'	124°47.283'	OLY2009-033-001	Boulder, cobble
Observations								
Olympia oysters observed under cobble and boulders. Pacific oysters present.								

79



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Comox Harbour 1 (Break-water)	14-14-002	24/06/09	13:00-13:45	1	49°39.137'	124°56.969'	OLY2009-030-001	Boulders, cobble, sand, and shell
Observations								
One Olympia oyster shell observed in the cobble near the breakwater. No live <i>O. lurida</i> found. Pacific oysters present.								

80



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Comox Harbour 2	14-14-001	25/06/09	12:30-14:00	4	49°40.278'	124°56.253'	OLY2009-032-001	Cobble, gravel, mud, sand, and boulders
Observations								
Three locations were visited in Comox Harbour (Marina, Goose Spit, and the Hospital) Only one Olympia found at hospital site very high in the intertidal zone. Large number of dead manila clams from a winter kill on the lease by the marina								



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Fanny Bay Oyster Plan	14-08-006	24/06/09	14:45-15:20	1	49°28.489'	124°47.379'	OLY2009-031-001 OLY2009-031-002	Gravel, cobble, boulder, cinder blocks and some shell
Observations								
A few scattered Olympia oysters settled on cinder blocks, cobble and boulders devoid of barnacles. Pacific oysters present.								

82



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Union Bay Boat Ramp	14-15-001	25/06/09	14:55-15:15	0.5	49°35.077'	124°53.127'	OLY2009-034-001 OLY2009-034-002	Cobble, gravel, sand, boulders, some mud
Observations								
Scattered population of Olympia oysters observed under boulders on northeast side of bay beside cement pillars. Pacific oysters present.								

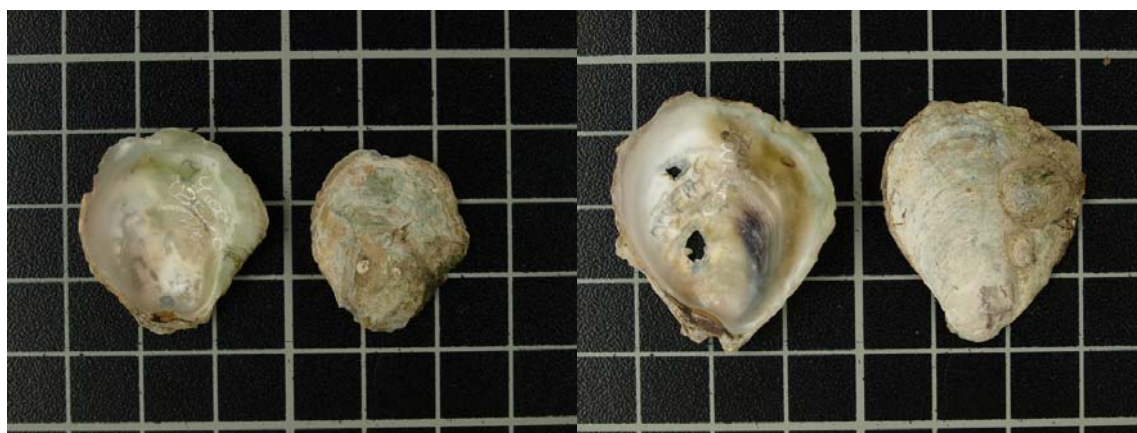
83



Appendix Table 1. cont'd.

East Coast Vancouver Island – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Wall Beach	00-00-000	5/07/09	12:00-13:00	1	49°18.188'	124°13.204'	OLY2009-035-001 OLY2009-035-002	Boulder, cobble and sand
Observations								
Olympia oysters were present at the southern most section of the beach. Found under boulders in the wet areas near the bedrock.								



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Maude Bay-Thunder Point	16-11-017	20/07/09	09:40-09:52	2	49°45.849'	124°16.036'	OLY2009-041-001 OLY2009-041-002	Cobble, boulder, sand, mud
Observations								
Olympia oysters in moderate abundance under cobbles and boulders at low intertidal. Some shells were found on the lower north side of beach in sand/mud substrate. Large bed of Pacific oysters on upper beach with no Olympia oysters present. Water temperature was 18°C, salinity 25‰.								

85



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Saltery Bay	16-11-019	20/07/09	10:20-10:38		49°46.902'	124°13.122'	OLY2009-042-001	Boulder and cobble over sand, patches of bare sand.
Observations								
Olympia oysters observed in low abundance west of boat ramp on and under cobbles and boulders. No Olympia oysters present east of boat ramp. Pacific oyster and mussel beds on upper beach. Water temperature was 18°C, salinity 25‰								

88



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Fairview Bay	16-11-021	20/07/09	10:58-11:14	0.25	48°47.355'	124°05.831'	OLY2009-043-001	Bedrock, boulder, cobble, gravel, and pea gravel
Observations								
Olympia oysters moderately abundant at low intertidal found on the surface and underside of boulders and cobble, directly on bedrock and some lying amongst the sand and gravel. Large bed of Pacific oysters and mussels on top of bedrock (large bluff). Water temperature was 18°C, salinity 26‰.								

87



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
St. Vincent Bay East	16-12-001	20/07/09	11:36-11:57	2	49°49.216'	124°05.831'	OLY2009-044-001	Boulder and cobble over sand and mud
Observations								
Abundant population of Olympia oysters to east of log dump. Attached to boulders, cobble and laying on surface, forming a 10m band from lower to upper portion of beach. Steep drop off at waterline. Pacific oysters present. Water temperature was 20°C, salinity 25‰.								

88



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Baker Bay-Hotham Sound	16-12-007	20/07/09	12:44-12:54	1.5	49°55.883'	124°02.242'	OLY2009-045-001	Cobble, gravel and a few boulders
Observations								
Northern Tip of Hotham Sound. Extremely abundant population of Olympia oysters, $\approx 4-10$ per quadrat (0.25m^2). Present on cobble, gravel, boulders and on Pacific oyster shell. Observed new recruitment of Olympia Oysters (total length $\leq 5\text{mm}$) on the underside of cobble and gravel. Dense Pacific oyster bed higher on beach. A quantitative survey was completed on this beach and will be reported in a separate document. Water temperature was 22°C , salinity 21‰ .								

68



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Harmony Islands-Hotham Sound	16-12-016	20/07/09	13:20-13:37	0.25	49°51.101'	123°00.139'	OLY2009-046-001	Boulder, cobble, gravel
Observations								
Scattered Olympia oyster population present under cobble and gravel at the tideline. Pacific oyster bed on upper beach. Water temperature was 21.5°C, salinity 22‰.								

90



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Back Eddy Marina- Egmont	16-09-009	21/07/09	08:30-08:43	0.1	49°45.431'	123°56.360'	OLY2009-047-001	Cobble and boulder
Observations								
Tide was still quite high only one shell was found, possibly more Olympia oysters under water. Pacific oysters present.								

16



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Sargeant Bay	29-01-001	21/07/09	10:27-10:53	2.5	48°28.428'	123°51.643'	OLY2009-048-001	Bedrock, boulder, cobble and sand
Observations								
Moderately large beach, covered mostly by sand. Walked the entire length of beach, Olympia oysters present on the rockier western side of the beach under cobble and boulders. Pacific oysters present. Water temperature was 15.5°C, salinity 27‰.								

92



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Thormanby Island South	16.01-003	21/07/09	11:25-11:35	0.25	49°29.253'	123°57.505'	OLY2009-049-001 OLY2009-049-002	Bedrock, cobble, gravel, and boulder
Observations								
A small beach/cove surrounded by bedrock; exposed to southerly winds with lots of driftwood being washed onto shore. Scattered Olympia oysters under rocks. Pacific oyster shell observed. Water temperature was 15.5°C, salinity 27‰.								

93



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Jeddah Point South	16-01-002	21/07/09	11:50-12:03	0.5	49°30.254'	123°56.927'	OLY2009-050-001	Bedrock, boulders, cobble and mud
Observations								
A small rocky plateau beach surrounded by bedrock; opens up into a large mudflat then narrows becoming rocky again at the high tide line. Scattered Olympia oysters under large boulders and rocks. No pacific oysters observed. Water temperature was 15°C, salinity 28‰.								

94



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Smug- gler's Cove East	16-01-001	21/07/09	12:25- 12:28	0.25	49°31.379'	123°57.648'	OLY2009-051-001 OLY2009-051-002	Cobble boulder and bedrock
Observations								
A small secluded cove exposed to northwest winds. Olympia oysters scattered but moderately abundant. No Pacific oysters observed. Water temperature was 18°C, salinity 25‰.								

95



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Wood Bay South	16-02-004	21/07/09	12:43-12:55	0.1	49°32.684'	123°59.039'	OLY2009-052-001 OLY2009-052-002	Gravel, cobble, boulder, bedrock
Observations								
A small beach near a pipe line. Olympia oyster shells observed under most rocks, live oysters under large boulders. No Pacific oysters observed. Water temperature was 18°C, salinity 25‰.								

96



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
McNaughton Point North	16-02-003	21/07/09	13:09-13:15	0.5	49°34.247'	124°00.283'	n/a	Sand, cobble, boulder, and bedrock
Observations								
Few live Olympia oysters attached to the underside of large boulders. Sand and logs at high intertidal, cobble, boulder and bedrock at low intertidal.								

97



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
White-stone Islands	16-02-002	21/07/09	13:25-13:33	0.1	49°35.880'	124°02.559'	OLY2009-053-001 OLY2009-053-002	Boulders, cobble, bedrock
Observations								
Small group of islands; arrived during rising tide observed only one Olympia oyster shell and many scars under rocks. Brachiopods present.								

98



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Skardon Islands- Pender Harbour	16-04-009	21/07/09	13:50-14:10	0.25	49°37.754'	124°03.046'	OLY2009-054-001	Bedrock, boulder, cobble, gravel and sand
Observations								
Small island; arrived during rising tide. Observed Olympia oyster shell and scars on and under rocks. A small number of live Olympia oysters seen in water. Large bed of Pacific oysters and mussels on upper beach/island. Water temperature was 18.5°C, Salinity 25‰.								

69



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Frolander Bay	15-01-003	22/07/09	11:20-11:40	0.5	49°45.715'	124°18.085'	OLY2009-055-001	Boulder, cobble over sand on upper beach, sand and eel grass on lower beach

Observations

A scattered and very sparse Olympia oyster population observed under rocks; many scars and only two live oysters observed. Some scars were present on upper portion of beach. Pacific oysters present. Water temperature was 16°C, salinity 27‰.

100



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Quarry Bay-Nelson Island	16-17-003	22/07/09	12:19-12:29	0.1	49°39.977'	124°07.991'	n/a	Bedrock, boulders, cobble, gravel and sand
Observations								
Small sand/gravel beach surrounded on either side by bedrock, boulders and cobble. Olympia oysters on east side of beach under rocks. Many scars with both shells attached and few live ones. Pacific oysters present. Water temperature was 18°C, salinity 27‰.								

101



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Green Bay-Nelson Island	16-10-002	22/07/09	12:56-13:01	0.1	49°42.550'	124°04.936'	OLY2009-056-001 OLY2009-056-002	Boulder, cobble and sand
Observations								
Small secluded bay; many Olympia oyster scars, few live ones visible under water at low tide line. A waterfall located in southwest end of bay. Water temperature was 19.5°C, salinity 22‰.								

102



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Jervis Inlet 1	16-13-006	22/07/09	13:35-1:44	0.2	49°50.202'	123°55.355'	OLY2009-57-001 OLY2009-57-002	Cobble, and gravel
Observations								
Olympia oysters on surface of rocks 1m above low tide line; dense population visible under water. Dense Pacific oyster bed on upper beach. Water temperature was 19°C, salinity 23 ‰.								

103



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Jervis Inlet 2	16-13-007	22/07/09	13:54-14:00	0.2	49°53.072'	123°54.537'	OLY2009-58-001	Large boulder, cobble
Observations								
Olympia oysters on top and bottom of rocks. Dense Pacific oyster bed.								



Appendix Table 1. cont'd.

Mainland Inlets – Strait of Georgia- Sunshine Coast

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Jervis Inlet 3	16-13-008	22/07/09	14:00-14:16	0.1	49°55.205'	123°58.702	OLY2009-059-001 OLY2009-059-002	Bedrock, boulder, and cobble
Observations								
Rising tide; a large number of Olympia oyster scars and a few live ones seen above water live and many observed submerged under water. Dense Pacific oyster bed. Water temperature was 20°C, salinity 22 ‰.								

105



Appendix Table 1. cont'd.

Boundary Bay – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Ward's Marina-Surrey	29-08-002	19/08/09	08:30-09:15	0.2	49°03.963'	122°50.527'	OLY2009-063-001	Mud and shell, boulder and cobble at high tide line
Observations								
Marina on Nicomekl River. Extremely muddy substrate supporting a large and dense Pacific oyster bed. Olympia oyster shell observed near the freshwater runoff amongst boulder and cobble.								

106



Appendix Table 1. cont'd.

Boundary Bay – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
24 th Avenue Crescent Beach	29-08-003	19/08/09	10:00-11:15	50	49°02.528'	122°53.049'	OLY2009-064-001 OLY2009-064-002	Cobble, boulder, gravel over sand
Observations								
Extremely large beach covered mostly by sand. Cobble and boulder on upper beach. One Olympia oyster shell (hinged) observed on large overturned boulder after a long search (75min). Scars observed on small metal structure. No live <i>O. lurida</i> observed. Few Pacific oysters present.								

107



Appendix Table 1. cont'd.

Boundary Bay – Strait of Georgia

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
White Rock Boat Ramp	29-08-004	19/08/09	11:30-13:00	30	49°01.510'	122°49.890'	n/a	Cobble, boulder, over sand
Observations								
Extremely large beach walked from boat ramp to west of Coldicutt Ravine. Olympia oysters scarce; 2 scars and 2 live oysters discovered under rocks approximately 600 west of Coldicutt after a long search (90min). Only one Pacific oyster observed east of Coldicutt Ravine.								



Appendix Table 1. cont'd.

Strait of Juan de Fuca – Victoria - Gorge

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Gorge-Portage Inlet	19-01-006	See Table 5	See Table 5	n/a	See Table 5	See Table 5	OLY2009-036-001	Cobble, gravel, mud, bedrock and shell
							OLY2009-036-002	
							OLY2009-036-003	
							OLY2009-036-004	
							OLY2009-036-005	
							OLY2009-036-006	
							OLY2009-036-007	
Observations								
Portage Inlet includes information from transects 13- 17. Olympia oysters present in the intertidal and also in the subtidal. Olympia oysters abundant.								

109



Appendix Table 1. cont'd.

Strait of Juan de Fuca – Victoria - Gorge

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Gorge-Colquitz River Estuary	19-01-005	See Table 5	See Table 5	n/a	See Table 5	See Table 5	n/a	Mud, cobble, boulders, gravel and shell
Observations Colquitz River Estuary includes information from transects 18-21. Pacific oysters present in small numbers. Olympia oyster present in the intertidal and also in the subtidal.								
Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Gorge-Upper	19-01-004	See Table 5	See Table 5	n/a	See Table 5	See Table 5	n/a	Cobble, mud, gravel, boulders, bedrock
Observations: Upper Gorge includes all information from transects 8-12, 22-25 and 27, Olympia oyster present in the intertidal and also in the subtidal. At transect 10, <i>O. lurida</i> were scattered in patches on rocks and pieces of wood but not found in mud. Olympia oysters observed on Bedrock and boulders in some transects. Poor visibility in some transects due to soft mud and fine sediment.								
Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude	Longitude	Voucher #	Substrate
Gorge-Lower	19-01-003	See Table 5	See Table 5	n/a	See Table 5	See Table 5	n/a	Cobble, boulder, mud, pebble, bedrock
Observations: Lower Gorge includes all information from transects 1-6, 28-32 and 34. Olympia oyster present in the intertidal and also in the subtidal. <i>O. lurida</i> on mud, cobble and cement blocks both dead and live specimens were observed at Transect 4 and 6. Olympia oyster were abundant at transect 30 found on old cement pillars.								

Pictures below are from work completed in the Gorge.

111



Appendix Table 1. cont'd.

Strait of Juan de Fuca - Sooke

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Hutchinson Cove	20-07-004	09/07/09	11:20-11:50	2	48°23.407'	123°38.040'	OLY2009-037-001 OLY2009-037-002	Sand, cobble
Observations								
Few live Olympia oysters present on mud and in creek. Lots of dead Olympia oysters both in creek and on large boulders at edge of beach.								



Appendix Table 1. cont'd.

Strait of Juan de Fuca - Sooke

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Anderson Cove	20-07-003	09/07/09	11:20-11:50	3	48°21.566'	123°39.500'	OLY2009-038-001 OLY2009-038-002	Mud, gravel, pea gravel and boulders at high intertidal
Observations								
Olympia oyster shells present in water. A large number of Olympia oysters, both dead and alive, (≈ 50) attached to a large metal structure (shown in the picture on the right). Dead clam shells covered entire beach. Pacific oysters present.								



Appendix Table 1. cont'd.

Strait of Juan de Fuca - Sooke

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Roche Cove	20-07-001	09/07/09	13:00-13:12	0.5	48°22.225'	123°34.492'	OLY2009-039-001 OLY2009-039-002	Mud, cobble
Observations								
A large number of dead clam and Olympia Oyster shells covering a large section of the beach. Only one live Olympia oyster observed in mud at low intertidal. More live Olympia oyster may have been already submerged by incoming tide. Pacific oysters present.								

114



Appendix Table 1. cont'd.

Strait of Juan de Fuca - Sooke

Location	Beach #	Date	Time on/off	Beach Area (ha)	Latitude (N)	Longitude (W)	Voucher #	Substrate
Cooper Cove	20-07-002	09/07/09	13:40-13:50	0.5	48°23.649'	123°39.316'	OLY2009-040-001	Mud, cobble
Observations								
A few dead shells and one live Olympia oyster were found in the creek. Tide was rising; therefore, many Olympia oysters may have been submerged. Pacific oyster shell observed.								

115

