Field Verification of Historic Records of Olympia Oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia – 2010 and 2011

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FIELD VERIFICATION OF HISTORIC RECORDS OF OLYMPIA OYSTERS (*Ostrea lurida* Carpenter, 1864) IN BRITISH COLUMBIA – 2010 and 2011

by

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Abstract

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The Olympia oyster, *Ostrea lurida* Carpenter, 1864, was designated in the Special Concern category 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 was published by COSEWIC in 2010, and surveys to verify historic records of the species were conducted between 2008 and 2011. This report documents the results of surveys conducted in 2010 and 2011.

Investigators visited 97 beaches around southern and central British Columbia as well as Haida Gwaii between May 2010 and July 2011 looking for evidence of *O. lurida*, both live and shell. *O. lurida* were found at 45 locations. Six geographic areas were surveyed: Northwest coast of Vancouver Island; Southwest coast of Vancouver Island, Juan de Fuca Strait; the Strait of Georgia; the Central Coast; and Haida Gwaii.

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. *O. lurida* was not widespread in the Central Coast, where populations appeared to be moderately abundant. *O. lurida* was not found in Haida Gwaii, where a fossil record had been recently reported.

Résumé

Finney, J.L., Norgard, T.C., Boutillier, P.D.G., MacConnachie, S.E.M., and Gillespie, G.E. 2012. Field verification of historic records of Olympia oysters (*Ostrea lurida* Carpenter, 1864) in British Columbia – 2010 and 2011. Can. Tech. Rep. Fish. Aquat. Sci. 3011: vii + 91 p.

L'huître plate du Pacifique (*Ostrea lurida*, Carpenter, 1864) a été désignée espèce préoccupante par le Comité sur la situation des espèces en péril au Canada (COSEPAC) en 2000, puis inscrite à la liste de la *Loi sur les espèces en péril* du Canada en 2003. Le COSEPAC a publié une mise à jour de son rapport de situation en 2010, et des relevés visant à vérifier les données historiques sur cette espèce ont été réalisés entre 2008 et 2011. Ce rapport présente les résultats des relevés effectués en 2010 et 2011.

Les enquêteurs ont visité 97 plages du sud et du centre de la Colombie-Britannique ainsi que de l'archipel Haida Gwaii entre mai 2010 et juillet 2011 afin de repérer des preuves de la présence d'*O. lurida* vivantes ou de leurs coquilles. Ils en ont découvert à 45 emplacements. Six secteurs géographiques ont été balayés : les côtes nord-ouest et sud-ouest de l'île de Vancouver, le détroit de Juan de Fuca, le détroit de Georgie, la côte centrale et l'archipel Haida Gwaii.

En général, on a découvert que l'*O. lurida* était répandue et se trouvait en quantités abondantes sur la côte ouest de l'île de Vancouver, ses populations formant des récifs denses à de nombreux endroits. L'espèce était également répandue dans le détroit de Georgie, mais en abondance relativement faible, et les huîtres avaient tendance à occuper des habitats cryptiques. L'*O. lurida* n'était pas répandue sur la côte centrale, où ses populations semblaient n'être que moyennement abondantes. Aucune *O. lurida* n'a été relevée sur l'archipel Haida Gwaii, où l'on avait récemment signalé l'existence d'un fossile de l'espèce.

Introduction

The Olympia oyster, *Ostrea lurida* Carpenter, 1864, is the only oyster native to the west coast of North America (COSEWIC 2000, 2011; 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 (BC)(Elsey 1933, Quayle 1988; Bourne 1997). Since their introduction, both species have established populations in BC, as has the European flat oyster, *Ostrea edulis* (Gillespie 2007). The Olympia oyster fishery was relatively small and declined due to overfishing and severely cold winters, which caused extensive mortalities. Pollution from pulp mills and antifouling paints have been implicated in Olympia oyster declines in Washington State (White *et al*. 2009a,b) and may have contributed to declines or inhibited recovery of BC 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 are distinct 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, 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 1 of SARA (Canada Gazette 2003). A management plan for this species was developed in 2008 and posted to the SARA Public Registry in 2009 (DFO 2009). Exploratory surveys were conducted in 2009 to verify the persistence of Olympia oyster populations at historic locations listed by Gillespie (2009) and other locations determined from recent new information. The results of those surveys were summarized in Stanton *et al.* (2011), and were included in the update of the COSEWIC status report on Olympia oysters in 2010 (COSEWIC 2011). After the 2011 COSEWIC review the status of Olympia oyster remained Special Concern.

Exploratory surveys were conducted in 2009 (Stanton *et al*. 2009), 2010 and 2011. The results of the 2010 and 2011 surveys are documented in this report. Additionally, thirteen index sites were quantitatively surveyed to provide a relative index of abundance of Olympia oysters. The results from the index site surveys are reported separately (Norgard *et al*., in prep.).

Methods

Olympia oyster surveys were conducted between May 2010 and July 2011 based on the availability of daylight low tide cycles, ≤ 1 m above chart datum (CD). Six geographical areas were surveyed: 1) Northwest coast of Vancouver Island; 2) Southwest coast of Vancouver Island; 3) Juan de Fuca Strait; 4) Strait of Georgia; 5) Central Coast; and 6) Haida Gwaii. In 2010 twenty-four days were spent on the West coast of Vancouver Island (WCVI) aboard the CCGS Vector where *O. lurida* exploratory surveys, quantitative index site surveys and Aquatic Invasive Species (AIS) surveys were undertaken. In 2011, 26 days were spent in the Central Coast and in Haida Gwaii aboard the CCGS Vector where exploratory surveys were undertaken. During both trips green crab and AIS surveys were also conducted. Additional exploratory and index site surveys were conducted in both years in Juan de Fuca Strait and the Strait of Georgia.

Sites for exploratory surveys were determined based on historic records of Olympia oysters in British Columbia (Gillespie 2009). A high priority was placed on records characterized as 'historic' or those locations not verified since 2000 in order to confirm the presence or absence of *O. lurida*. Index sites are pre-determined areas that are to be surveyed every five years using standardized survey protocols (DFO 2009, 2010). Thirteen index sites were chosen from across BC's southern coast to monitor changes in *O. lurida* relative abundance.

During the exploratory and AIS surveys, qualitative presence only data was gathered on *O. lurida*, as well as all other native and non- indigenous species of invertebrates observed. During the surveys, individual beaches were scanned for suitable *O. lurida* habitat (e.g. hard substrates such as boulder, cobble, shell, or cement cinder blocks and standing water or shallow tide pools in the intertidal zone) and search effort was concentrated on these particular areas. Additional habitat information was documented, including beach area, slope, substrate type, beach cover, water temperature, and surface salinity. Photographs were taken at each location to document the site features and coordinates for each beach were determined using Nobletech software or a handheld GPS. Data were recorded on field datasheets (Figure A1 & Figure A2) and entered into the Intertidal Bivalve database maintained by the Shellfish Data Unit at the Pacific Biological Station, Nanaimo BC.

Thirteen index sites, where *O. lurida* was known to occur, were quantitatively surveyed to determine the relative abundance of Olympia oysters at each site. Seven index sites were surveyed during the 2010 WCVI research cruise (Klaskino NE , Amai Southside, Port Eliza Beach 3, Darr Island, Bachante Bay, Hillier Island and Harris

Point). Two other index sites were surveyed in 2010 (Gorge 9 and Swy-a-lana Lagoon). The remaining four index sites were surveyed in July 2011 (Ayum Creek, Transfer Beach, Baker Bay, and Jervis Inlet 1). All index sites were surveyed with a two-stage random sampling design (Norgard *et al*., 2010). Geographical positioning system (GPS) simple random sampling surveys were done in conjunction with two-stage survey where possible. The results from the index site surveys are reported separately (Norgard *et al*., in prep.).

Voucher specimens of live Olympia oysters were collected at locations exhibiting moderate to abundant populations. In areas with low population densities, photos of live specimens were taken on site and a few scattered empty shells were collected as vouchers. Each voucher specimen was labelled with a unique identifier and photographed. The unique identifier has three parts, each separated by a hyphen. The first part is the letters OLY (for Olympia oyster) and the year (2010 or 2011). The second part is a three digit number representing the chronological beach collection number starting each year at 001. The final part is a three digit specimen collection number starting at 001 for each new collection location. Where multiple live voucher specimens were collected, DNA samples were taken. They were prepared by excising a small portion of the mantle tissue using sterile techniques, stored in vials of 95% ethanol and frozen for future analysis. All tissue and shell specimens were catalogued and stored at the Royal British Columbia Museum, Victoria.

Results

Between May 2010 and July 2011, 98 beaches were validated during exploratory surveys for Olympia oyster presence (live individuals and/or shells) (Figure 1). Out of 97 sites visited, Olympia oysters were observed to be present at 45 locations (46% of all exploratory sites examined, Table 1). Six geographic areas were covered in British Columbia: Northwest coast of Vancouver Island; Southwest coast of Vancouver Island; Juan de Fuca Strait; Strait of Georgia; Central Coast; and Haida Gwaii.

Northwest Coast of Vancouver Island

Quatsino Sound

Quatsino Sound is open to the Pacific Ocean between Lippy Point to the north and Kwakiutl Point to the south (Figure 2). There is a historic record of Olympia oyster presence in Quatsino Sound (Stanton *et al.,* 2011), so exploratory surveys were undertaken at six sites to try to verify this record (Table 2). Of these six sites only Winter Harbour (beach code 27-03-001) had evidence of *O. lurida* presence. One shell was found attached to a rock in a tidepool, but no live individuals were observed (Table A1).

Brooks Bay

Brooks Bay is open to the Pacific Ocean between Lawn Point to the north and Cape Cook to the south and leads inland via Klaskino and Klaskish Inlets (Figure 2).

Three sites were visited in Brooks Bay (Table 2). Klaskino is an index site and was surveyed on May 30, 2010 (Table A1). *O. lurida* is considered to be abundant in Klaskino (Gillespie 2009) and appeared to still be relatively abundant. Two sites in Klaskish Inlet were explored for evidence of Olympia oyster presence but none was found.

Kyuquot Sound

Kyuquot Sound is open to the Pacific Ocean between the community of Kyuquot to the north and Rugged Point to the south and leads inland via Kashutl, Tahsish and Amai Inlets (Figure 3). One site was visited in Amai Inlet and *O. lurida* was present at both (Table 2). *O. lurida* is considered historically abundant in Amai Inlet and this was found to still be the case (Kingzett et al. 1995). Amai Southside is an index site and was extensively surveyed on June 1, 2010 (Table A1) and several oysters were collected for vouchers from this location (Table A2).

Esperanza Inlet

For the purpose of this study, Esperanza Inlet is considered to be the geographic area that is open to the Pacific Ocean between Tatchu Point to the north and Ferrer Point to the south and leads inland via Nuchatlitz, Esperanza, Port Eliza, Espinosa, and Zeballos Inlets (Figure 3). In Stanton *et al*., 2011, this region was considered Nootka Sound. Four sites were visited in Esperanza Inlet, three of which had *O. lurida* (Table 2). Port Eliza Beach 3 is an Olympia oyster index site (Table A1) and historically abundant area (Gillespie 2009). This site was extensively surveyed on June 2, 2010 and vouchers were collected (Table A2). *O. lurida* presence was recorded in Espinosa Inlet by G. Gillespie in 2006 (Gillespie 2009), however the site explored in Espinosa Inlet (beach code 25-11-003) had no evidence of *O. lurida* presence. Two sites in Nuchatlitz Inlet were explored and *O. lurida* was found to be present at both attached to rock (Table A1). Vouchers were collected at both sites (Table A2).

Southwest Coast of Vancouver Island

North Clayoquot Sound

Clayoquot Sound opens onto the Pacific Ocean and is divided into northern waters and southern waters. The northern waters are considered to be north and west of Vargas Island (Figure 4). Five sites were visited in the northern area and *O. lurida* was found at all of them (Table 2). Two were Olympia oyster index sites (Darr Island and Bacchante Bay) and were extensively surveyed on June 10 and 11, 2010, respectively (Table A1). Vouchers were collected at Darr Island (Table A2). *O. lurida* were also found at three sites in Herbert Inlet, two during exploratory surveys and one during a green crab survey, confirming some historical accounts (Gillespie 2009**,** (Table A1) Vouchers were collected at all three beaches (Table A2)

South Clayoquot Sound

The southern waters of Clayoquot Sound are considered to be north and east of Vargas Island (Figure 4). Seven sites were visited in the southern area and *O. lurida* was

found to be present at five of them (Table 2). Most of the sites were explored during a circumnavigation of Meares Island on June 13, 2010. *Ostrea lurida* were found growing on cobble or under boulders and were at a low abundance in most areas (Table A1). Mosquito Harbour (beach code 24-10-002) and Adventure Cove (beach code 24-09-002) were the exceptions with medium *O. lurida* abundance. Olympia oysters were taken from these locations for tissue samples (Table A2).

Barkley Sound

Barkley Sound opens on the Pacific Ocean between Ucluelet and Cape Beale and terminates at the head of Alberni Inlet (Figure 5). Nine sites were visited and *O. lurida* was present at all (Table 2, Table A1). Two of these sites, Hillier Island and Harris Point, are Olympia oyster index sites and were historically abundant (Gillespie 2009). These sites were found to support abundant oyster populations, with *O. lurida* growing on *C. gigas*, cobble and boulder as well as loose on the sediment. Index site surveys were conducted on June 14-16, 2010. Four sites in the Pacific Rim National Park Reserve were explored with Parks Canada staff on June 16, 2010. *O. lurida* was found under rocks, on beach margins and occasionally as scattered singles. At Nettle Island (beach code 23-08-004) a European flat oyster (*O. edulis*) shell was found. Live *O. edulis* were found at Useless Inlet (beach code 23-06-001) along with the Japanese oyster drill (*Ocinebrina inornata*). Vouchers were collected at all beaches (Table A2).

Juan de Fuca Strait

The northern extent of Juan de Fuca Strait follows the coast of Vancouver Island from Carmanah Point (not shown on map) to Gonzales Point (Figure 6). Two index sites were surveyed in Juan de Fuca Strait: Gorge Waterway Victoria Site 9 and Ayum Creek in Sooke Basin (Table 2, Table A1).

The Gorge Waterway is a narrow inlet that connects Victoria Harbour to Portage Inlet. Substrate at index site 9 is mostly gravel with some cobble and wood on top of mud. Past investigations have found a significant population of subtidal Olympia oysters as well as an intertidal population (Archipelago Marine Research 2000). This site was surveyed on July 12th, 2011 by a crew from the World Fisheries Trust. Ayum Creek is located in the northern part of Sooke Basin just outside of an old mill pond. The site was visited by researchers from the Royal BC Museum on July 12, 2010 and 11 voucher samples were collected for DNA analysis (Table A2). The site was visited again by DFO researchers on July 4, 2011 and an index survey was conducted. Olympia oysters were sparsely distributed at this site and were found attached to small rocks.

Strait of Georgia

Nanaimo and Ladysmith

Two index sites were surveyed in Nanaimo and Ladysmith (Figure 7). Swy-a-lana Lagoon is an artificial lagoon located in downtown Nanaimo, and was surveyed on August 24, 2010. The site supports an abundant Olympia oyster population, and individuals were found attached to cobble, concrete walls, and as free individuals (Table A1). Vouchers were collected at Swy-a-lana (Table A2). Transfer Beach is located in Ladysmith and was surveyed on July 5, 2011. The site was found to have a moderate

population of Olympia oysters (Table A1). Oysters were found in the lower intertidal attached to boulders and cobble.

Jervis Inlet

Jervis Inlet is located on the Sunshine Coast and opens onto Malsapina Strait (Figure 8). In the summer of 2011 two index sites were surveyed in Jervis Inlet: Baker Bay and Jervis Inlet 1 (Table 2). Baker Bay is located in the northern tip of Hotham Sound and was surveyed on July 13, 2011. A small population of Olympia oysters was found very low in the intertidal zone on and under the boulders and cobbles on the beach (Table A1). There were a large number of Olympia oyster shells. Jervis Inlet 1 is located on the eastern side of Dacres Point and was surveyed on July 14, 2011. Olympia oysters were very sparse in this location, and were located very low in the intertidal zone on and under boulders and cobbles (Table A1).

Johnstone Strait

Three sites were surveyed on and around Quadra Island on July 9, 2010 (Figure 9). Live *O. lurida* were found at all three beaches (Table 2, Table A1). Heriot Island (beach code 13-13-002) is an aquaculture tenure. Oysters were found under boulders and rocks on the south side of the beach, and voucher samples were taken (Table A2). Only a few live oysters were found at Open Bay (beach code 13-13-03).

Central Coast

Smith Sound

Smith Sound opens to Queen Charlotte Sound between Kelp Head in the north and Cape Caution in the south (Figure 10). Between June 1 and 2, 2011, seven beaches were surveyed in Smith Sound and adjacent inlets. Live Olympia oysters were found attached to cobbles and boulders at the two sites surveyed in Boswell Inlet, though no evidence of Olympia oysters was found at sites in Smith Sound, Smith Inlet, and Naysash Inlet (Table 2, Table A1). Oysters were collected at both beaches in Boswell Inlet for vouchers and DNA samples (Table A2).

Klaquaek Channel

Klaquaek Channel is located to the east of Fitz Hugh Sound just north of Rivers Inlet (Figure 10). Five beaches were surveyed in the area in and around Klaquaek Channel on June 3, 2011 (Table 2). None of the beaches had any evidence of Olympia oysters.

Fish Egg Inlet

Fish Egg Inlet is located on the eastern edge of Fitz Hugh Sound, just north of Klaquaek Channel (Figure 10). Four beaches were surveyed in Fish Egg Inlet on June 4, 2011 (Table 2). Live Olympia oysters were found attached to bedrock and boulders in the head of Oyster Bay (beach code 09-12-007) and McClusky Bay (beach code 09-12-010) (Table A1). Oysters were collected at Oyster Bay for vouchers and DNA sampling (Table A2).

Kwakshua Channel

Kwakshua Channel runs between Calvert Island and Hecate Island. It opens to Fitz Hugh Sound to the east, and Hakai Passage to the north (Figure 10). On June 20, 2011, three beaches were surveyed in Kwakshua Channel (Table 2). No evidence of *O. lurida* was found.

Hunter Island

Hunter Island is located in north western Fitz Hugh Sound and is bounded by Queen Charlotte Sound to the east (Figure 11). Seven sites were visited around Hunter Island in June 2011, with only one site having Olympia oysters (Table 2). Three connected beaches in Watt Bay in Kilditdt Sound were surveyed on June 5, 2011. The lower beach and middle lagoon did not have any evidence of Olympia oysters. However, the highly diverse upper lagoon had a healthy population of Olympia oysters (Table A1). Oysters were collected for vouchers and DNA samples (Table A2). Four beaches were visited on the western side of Hunter Island in Cultus Sound on June 19, 2011. None of these beaches had evidence of Olympia oysters.

Bella Bella

Bella Bella is located on the eastern side of Campbell Island (Figure 11). Seven beaches around Bella Bella were visited in August 12-13 2010 and June 6, 2011. Olympia oyster shells were found on two beaches (beach codes 07-12-007 and 07-24-30) (Table 2, Table A 1), but no live oysters were found.

Milbanke Sound

Milbanke Sound extends east from Queen Charlotte Sound (Figure 11). Nine beaches in the southern end of Milbanke Sound were visited on August 12, 2010 and June 17-18, 2011 (one, beach 07-21-003, was visited twice) (Table 2). Olympia oyster shells were found at three beaches, and live oysters at one (beach code 07-21-032) (Table A1).

Haida Gwaii

Tasu Sound

Tasu Sound is located on the western side of Moresby Island and opens to the Pacific Ocean (Figure 12). Sutherland Brown (1968) reported fossilized Olympia oyster shells from Haida Gwaii and there were recent reports of shell from Tasu Sound (R. Jones, Council of Haida Nations, pers comm.) (Table 2). The site was visited on June 10, 2011, and carefully examined for evidence of fossilized Olympia oysters. Fossilized jingle shells (*Pododesmus sp.*), which closely resemble Olympia oyster shells, were found in the compacted sediment along the creek bank, but we found no evidence of Olympia oysters. Live Pacific oysters were found attached to rocks at this beach. These represent the first records of Pacific oysters on the western side of Haida Gwaii.

Skidegate Inlet

Skidegate Inlet is located between Graham Island and Moresby Island (Figure 12). Eight beaches were visited in this inlet between June 14 and 15, 2011 as a part of Aquatic Invasive Species (AIS) surveys (Table 2). Olympia oysters were not found on these beaches, though several Pacific oysters were found attached to rock.

Cumshewa Inlet

Cumshewa Inlet is located between Moresby Island and Louise Island and opens to Hecate Strait between Cumshewa Head and Skedans Point (Figure 12). Two beaches were visited in this inlet on June 16, 2011 as a part of AIS surveys (Table 2). No evidence of Olympia oysters were found on these beaches.

Discussion

The decline of Olympia oysters due to overharvesting, introduction of non-indigenous species, pollution and occasional winter mortality due to extreme cold winter temperatures in BC has been well documented (Gillespie 1999, 2009). However, both qualitative and quantitative data on current population trends and the distribution of Olympia oysters in BC is lacking. The exploratory surveys described in this document, as well as Stanton *et al.* (2011), provide the most current information on the status and distribution of Olympia oysters in BC. Surveys over the past three years have extensively covered the west coast of Vancouver Island, Juan de Fuca Strait, Strait of Georgia and the Central Coast, and nearly all of the historic records of *O. lurida* have been confirmed.

As reported in Stanton *et al.* (2011), Olympia oysters were generally observed in high abundance on the 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, antifouling paints and higher historical harvest may have contributed to declines or inhibited potential recovery (White *et al*. 2009a,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 and Sunshine Coast. A few small populations of Olympia oysters were observed on the Central Coast, and none were seen in Haida Gwaii.

A notable difference between the results in the current report and that of Stanton *et al.* (2011) is the apparent difference in the size of Olympia oyster populations in Jervis Inlet. Stanton *et al.* (2011) reported that populations of *O. lurida* in Jervis Inlet, particularly in Baker Bay in Hotham Sound, were highly abundant. However, in the surveys in 2011 surveyors only found small to moderate population of *O. lurida* in Baker Bay, and a very small population at Jervis Inlet 3. The apparent decline in population size could be due to a number of factors, including a large winter mortality of vulnerable newly recruited oysters. Both Baker Bay and Jervis Inlet 3 are index sites, so their population levels will continue to be monitored in the future. The results from these index surveys are summarized elsewhere (Norgard *et al*., in prep).

Although our surveys show that some populations have been reduced to extremely low population numbers (e.g., Transfer Beach, Johnstone Strait) other populations have shown persistence in BC despite over-harvesting and both current and past anthropogenic effects. Confirmation of the current distribution and population trends of Olympia oysters are critical components to managing a Special Concern species and identify populations at risk of local extirpation. Continued quantitative surveys of index sites for long-term monitoring will be necessary to assess recruitment, growth and better understand the population dynamics of Olympia oyster.

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. The authors would like to 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 Paige Erickson-McGee and Paul Vanden Brink for their help at Ayum Creek. We also thank Capt. Kent Reid, Capt. Mike Corfield and the crew of the CCGS VECTOR for their hospitality, support and assistance on surveys. We also thank innumerable friends and colleagues who searched their memories for places they may have seen Olympia oysters in the past. Special thanks to Paige Borrett University of Victoria co-op student, for hours of field and data work with Olympia oysters. We would also like to thank Sarah Davies for reviewing the paper.

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Tables

Table 1. Location, dates sampled, number of beaches sampled and number with Olympia oyster (*Ostrea lurida*, live or shell only) from all Olympia oyster surveys (exploratory and index site) in British Columbia, 2010 and 2011 by geographic area.

Geographic Area	Location	Date	No. Beaches Surveyed	No. with *O. lurida*
Northwest Coast Vancouver Island	Quatsino Sound	May 27-29, 2010	6	1
	Brooks Bay	May 30-31, 2010	3	1
	Kyuquot Sound	June 1, 2010	1	1
	Esperanza	June 2-4, 2010	4	3
Southwest Coast Vancouver Island	N. Clayoquot Sound	June 10-12, 2010	5	5
	S. Clayoquot Sound	June 13, 2010	7	5
	Barkley Sound	May 13, 2010 June 14-17, 2010	9	9
Juan de Fuca Strait	The Gorge	July 12, 2011	1	1
	Sooke Basin	July 12, 2010 July 4, 2011	1	1
Strait of Georgia	Nanaimo	August 24, 2010	1	1
	Ladysmith	July 5, 2011	1	1
	Jervis Inlet	July 13-14, 2011	2	2
	Johnstone Strait	July 9, 2010	3	3
Central Coast	Smith Sound	June 1-2, 2011	7	2
	Klaquaek Channel	June 3, 2011	5	0
	Fish Egg Inlet	June 4, 2011	4	2
	Kwakshua Channel	June 20, 2011	3	0
	Hunter Island	June 5 & 19, 2011	7	1
	Bella Bella	August 12-13, 2010 June 6, 2011	7	2
	Milbanke Sound	June 17-18, 2011 August 12, 2010	9	4
Haida Gwaii	Tasu Sound	June 10 2011	1	0
	Skidegate Inlet	June 14-15, 2011	8	0
	Cumshewa Inlet	June 16, 2011	2	0
Total			**97**	**45**

Table 2. Presence or absence of Olympia oyster (*Ostrea lurida*) by location from all Olympia oyster surveys (exploratory and index site) in British Columbia, 2010 and 2011.

1. Northwest Coast of Vancouver Island

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Quatsino Sound	27-May-10	27-03-002	Denard Creek	No
	28-May-10	27-03-001	Winter Harbour	Shell only
	28-May-10	27-03-004	Galato Creek	No
	28-May-10	27-07-002	Nordstrom Creek	No
	29-May-10	27-07-003	Koprino Harbour	No
	29-May-10	27-07-009	Koskimo	No
Brooks Bay	30-May-10	27-05-001	Klaskino Inlet (Index)	Yes
	31-May-10	27-06-002	Shields Cove	No
	31-May-10	27-06-003	Klaskish Basin	No
Kyuquot Sound	1-Jun-10	26-03-004	Amai Inlet	Yes
Esperanza	2-Jun-10	25-12-005	Port Eliza, Beach 3 (Index)	Yes
	3-Jun-10	25-13-004	Louis Lagoon	Yes
	3-Jun-10	25-14-003	Inner Basin	Yes
	4-Jun-10	25-11-003	Espinosa Inlet	No

2. Southwest Coast of Vancouver Island

Location	Date	Beach Code	Beach Name	*O. lurida* Present
North Clayquot Sound	10-Jun-10	24-02-002	Darr Island (Index)	Yes
	11-Jun-10	24-13-004	Bacchante Bay (Index)	Yes
	12-Jun-10	24-05-005	Moyeha Bay	Yes
	12-Jun-10	24-05-002	Big Whitepine Cove	Yes
	12-Jun-10	24-05-001	Little Whitepine Cove	Yes
South Clayquot Sound	13-Jun-10	24-09-002	Adventure Cove	Yes
	13-Jun-10	24-09-006	North Lemmens Inlet	Yes
	12-Jun-10	24-07-002	Cypress Bay	No
	13-Jun-10	24-09-005	Tsapee Narrows	Yes
	13-Jun-10	24-10-004	Heelboom Bay	Yes
	13-Jun-10	24-10-002	Mosquito Harbour	Yes
	13-Jun-10	24-09-007	Arakun Island	No

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Barkley Sound	14-Jun-10	23-10-005	Harris Point (Index)	Yes
	14-Jun-10	23-10-007	Cataract Bay	Yes
	15-Jun-10	23-10-002	Hillier Island (Index)	Yes
	16-Jun-10	23-08-003	Walsh Saddle	Yes
	16-Jun-10	23-08-002	Joe's Bay	Yes
	16-Jun-10	23-08-004	Nettle Island	Yes
	16-Jun-10	23-08-005	Hand Island	Yes
	17-Jun-10	23-06-001	Useless Inlet	Yes
	13-May-10	23-10-004	Pipestem Inlet	Yes

3. Juan de Fuca Strait

Location	Date	Beach Code	Beach Name	*O. lurida* Present
The Gorge	12-Jul-11	19-01-003	Gorge #9 (Index)	Yes
Sooke Basin	4-Jul-11	20-07-003	Ayum Creek (Index)	Yes

4. Strait of Georgia

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Nanaimo	24-Aug-10	17-17-002	Swy-a-lana Lagoon	Yes
Ladysmith	5-Jul-11	17-07-23	Transfer Beach (Index)	Yes
Jervis Inlet	13-Jul-11	16-12-007	Baker Bay (Index)	Yes
	14-Jul-11	16-13-006	Jervis Inlet 1 (Index)	Yes
Johnstone Strait	9-Jul-10	13-13-002	Heriot Island	Yes
	9-Jul-10	13-12-001	Village Bay	Yes
	9-Jul-10	13-13-003	Open Bay	Yes

5. Central Coast

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Smith Sound	1-Jun-11	10-06-002	Boswell Inlet 2	Yes
	1-Jun-11	10-06-001	Boswell Inlet 1	Yes
	1-Jun-11	10-12-001	Indian Island	No
	1-Jun-11	10-12-002	Broad Bay	No
	2-Jun-11	10-07-001	Naysash Creek	No
	2-Jun-11	10-07-002	Hickey Cove	No
	2-Jun-11	10-08-001	Quascilla Bay	No

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Klaquaek Channel	3-Jun-11	09-02-002	West Klaquaek Channel	No
	3-Jun-11	09-02-004	North Klaquaek Channel	No
	3-Jun-11	09-02-007	Wilson Bay	No
	3-Jun-11	09-11-001	Penrose Island	No
	3-Jun-11	09-11-002	Pierce Bay	No
Fish Egg Inlet	4-Jun-11	09-12-007	Head of Oyster Bay	Yes
	4-Jun-11	09-12-010	McClusky Bay	Yes
	4-Jun-11	09-12-003	Fish Egg Inlet	No
	4-Jun-11	09-12-006	Fish Trap Bay	No
Kwakshua Channel	20-Jun-11	08-02-001	Pruth Bay	No
	20-Jun-11	08-02-005	Hecate Island	No
	20-Jun-11	08-02-007	Keith Anchorage	No
Hunter Island	5-Jun-11	07-28-003	Watt Bay (Upper)	Yes
	5-Jun-11	07-28-003	Watt Bay (Middle)	No
	5-Jun-11	07-28-003	Watt Bay (Lower)	No
	19-Jun-11	07-25-004	Entrance Kinsman Inlet	No
	19-Jun-11	07-25-005	Sans Peur Passage	No
	19-Jun-11	07-25-006	Cultus Sound West	No
	19-Jun-11	07-25-007	Cultus Sound South	No
Bella Bella	6-Jun-11	07-17-009	Rainbow Island	No
	6-Jun-11	07-17-016	Kakushdish Inlet	No
	6-Jun-11	07-17-063	Kakushdish Harbour	No
	6-Jun-11	07-17-064	Kakushdish Harbour Narrows	No
	6-Jun-11	07-17-065	Gullchuck	No
	12-Aug-10	07-24-030	Raymond Beach	Shell only
	13-Aug-10	07-12-007	Ormidale Harbour	Shell only
Milbanke Sound	17-Jun-11	07-32-016	St. John Lagoon	Shell only
	17-Jun-11	07-32-001	St. John Harbour	No
	17-Jun-11	07-32-009	Athlone Island	No
	17-Jun-11	07-32-010	Wurtele Island	No
	17-Jun-11	07-32-017	Outside Yaaklele Lagoon	No
	18-Jun-11	07-21-032	Gale Passage, Upper Lagoon	Yes
	18-Jun-11 12-Aug-10	07-21-003	Gale Passage Beach 3	Shell only
	18-Jun-11	07-21-031	Gale Passage, Middle Lagoon	No
	12-Aug-10	07-21-030	Gale Passage South Beach	Shell only

6. Haida Gwaii

Location	Date	Beach Code	Beach Name	*O. lurida* Present
Tasu Sound	10-Jun-11	02-45-001	Flat Creek, Banni Bay	No
Skidegate Inlet	14-Jun-11	02-01-001	Cove South of Transit Island	No
	14-Jun-11	02-01-002	MacMillan Creek	No
	14-Jun-11	02-01-003	Boat Bay	No
	14-Jun-11	02-01-004	Maude Island West	No
	14-Jun-11	02-01-005	Leonite Point	No
	15-Jun-11	02-01-006	Christie Bay	No
	15-Jun-11	02-01-007	Saltspring Bay	No
	15-Jun-11	02-01-008	Head of Long Inlet	No
Cumshewa Inlet	16-Jun-11	02-04-001	Gillatt Arm	No
	16-Jun-11	02-04-002	Braverman Creek	No

Figures

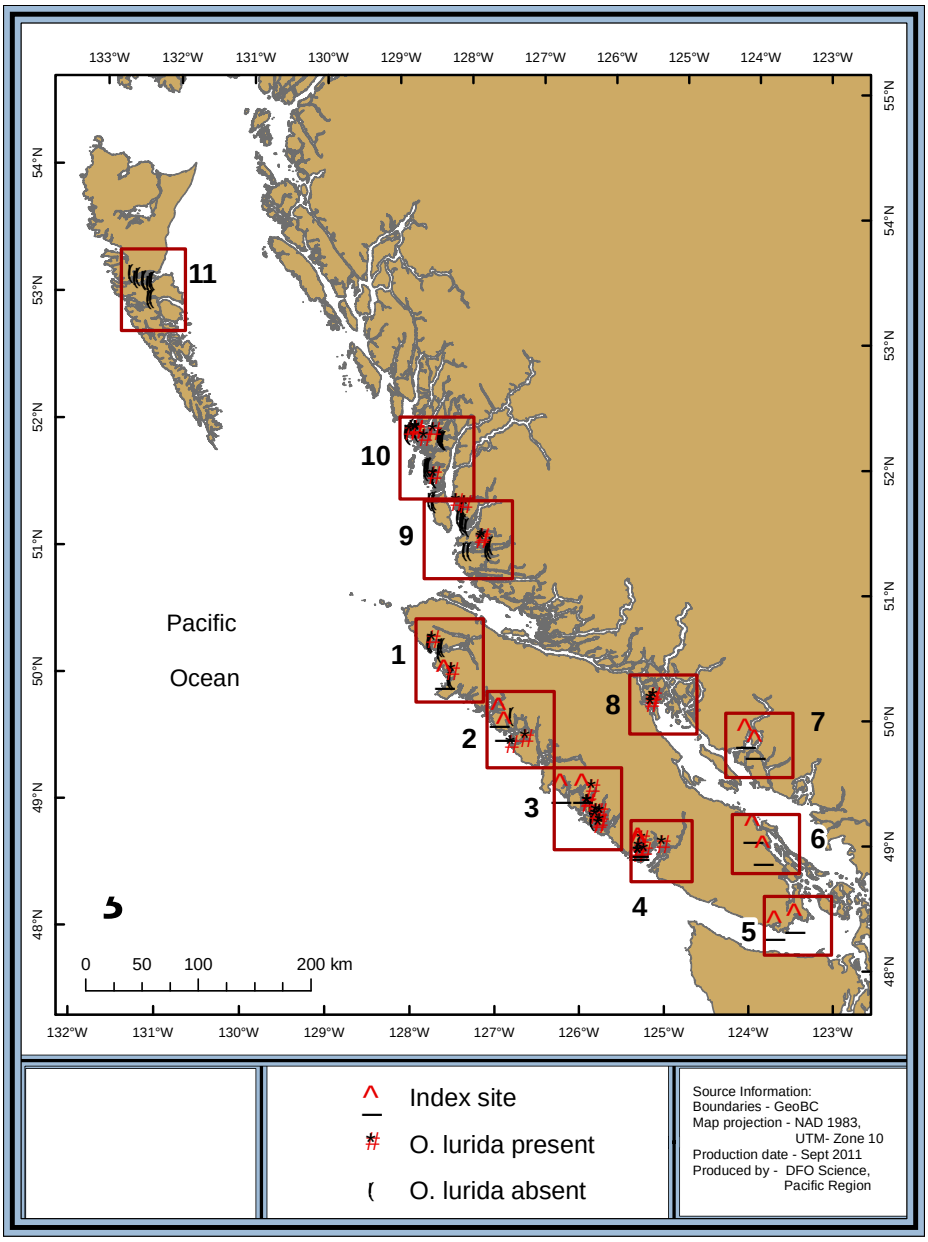

Figure 1. Olympia oyster (*Ostrea lurida*) locations surveyed in British Columbia in 2010 and 2011.

Boxes indicate map details in subsequent figures. Legend: 1) Quatsino Sound and Brooks Bay; 2) Kyuquot Sound and Esperanza; 3) Clayoquot Sound; 4) Barkley Sound; 5) Juan de Fuca Strait; 6) Nanaimo and Ladysmith; 7) Jervis Inlet; 8) Johnstone Strait; 9) Southern Central Coast; 10) Northern Central Coast; 11) Haida Gwaii.

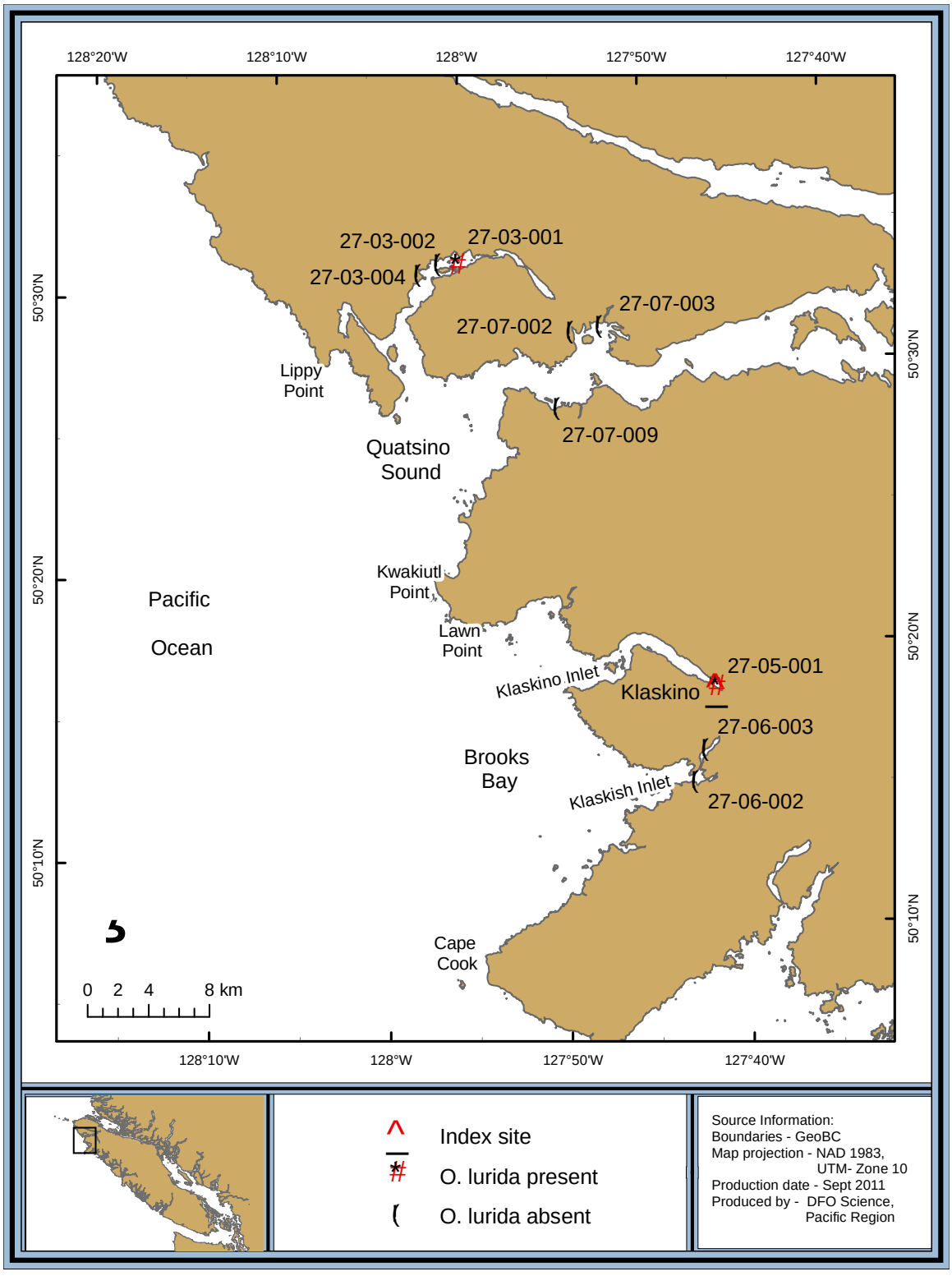

Figure 2. Olympia oyster (*Ostrea lurida*) survey locations in Quatsino Sound and Brooks Bay, 2010 and 2011.

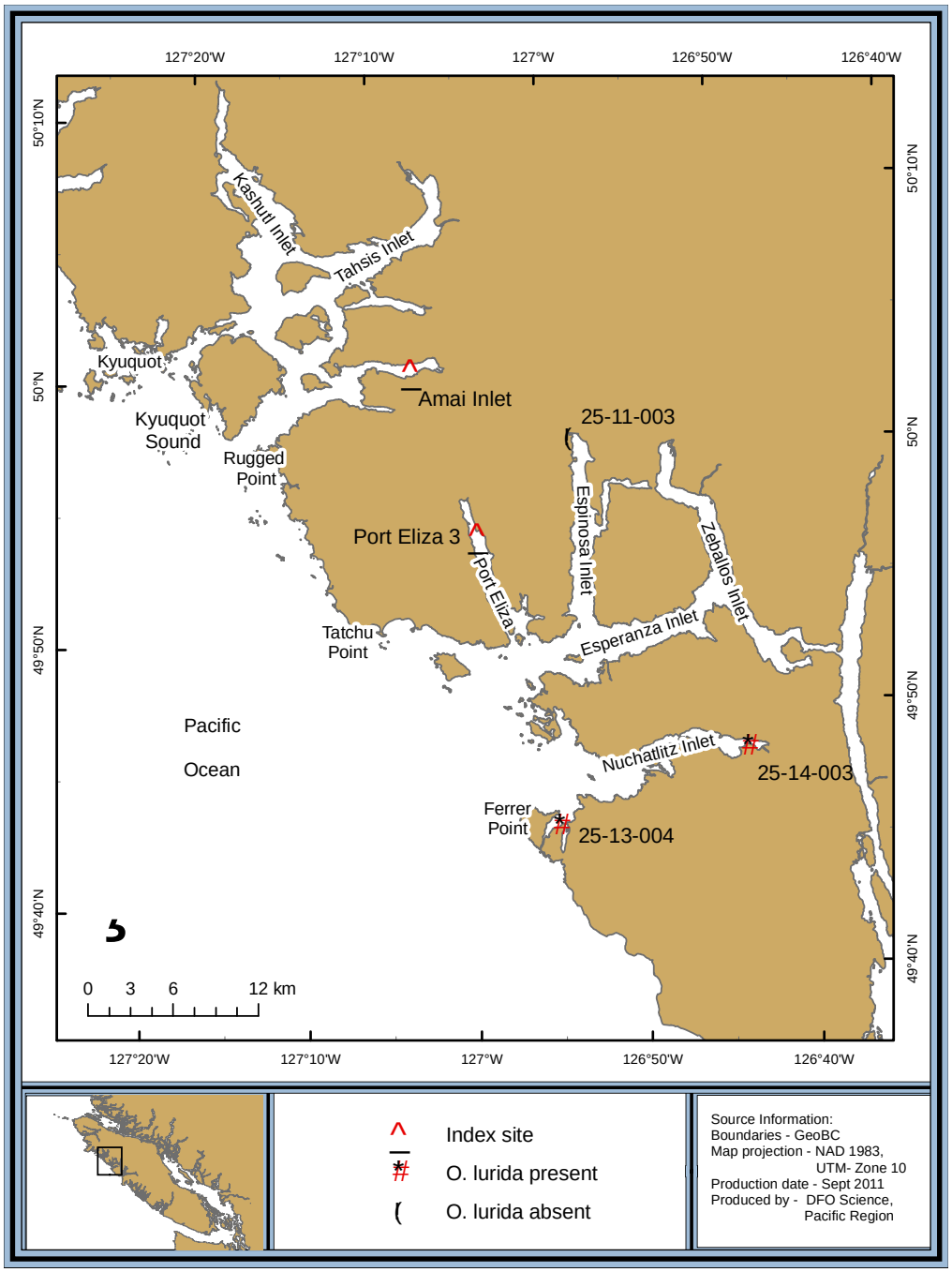

Figure 3. Olympia oyster (*Ostrea lurida*) survey locations in Kyuquot Sound and Esperanza Inlet, 2010 and 2011.

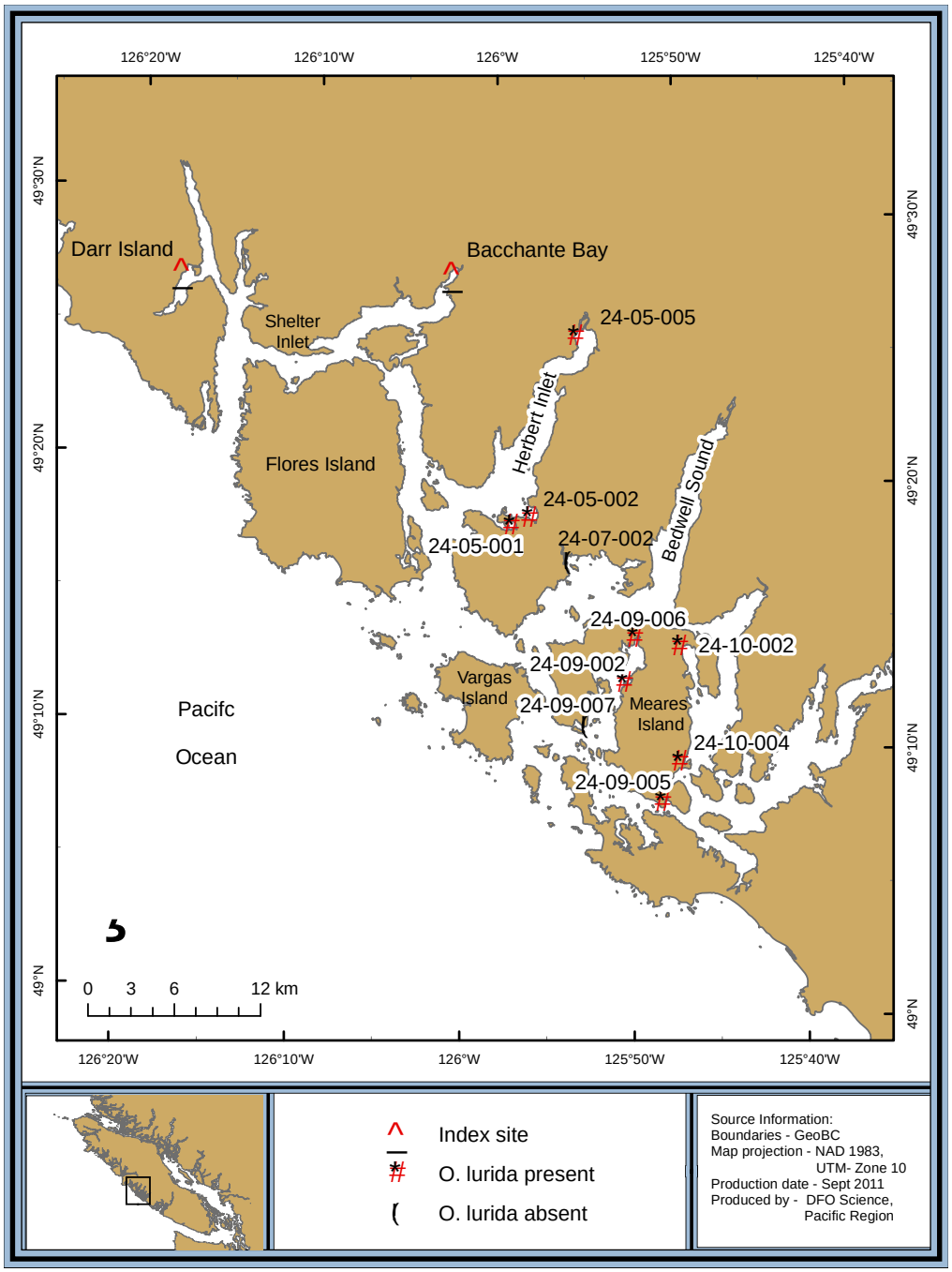

Figure 4. Olympia oyster (*Ostrea lurida*) survey locations in Clayoquot Sound, 2010 and 2011.

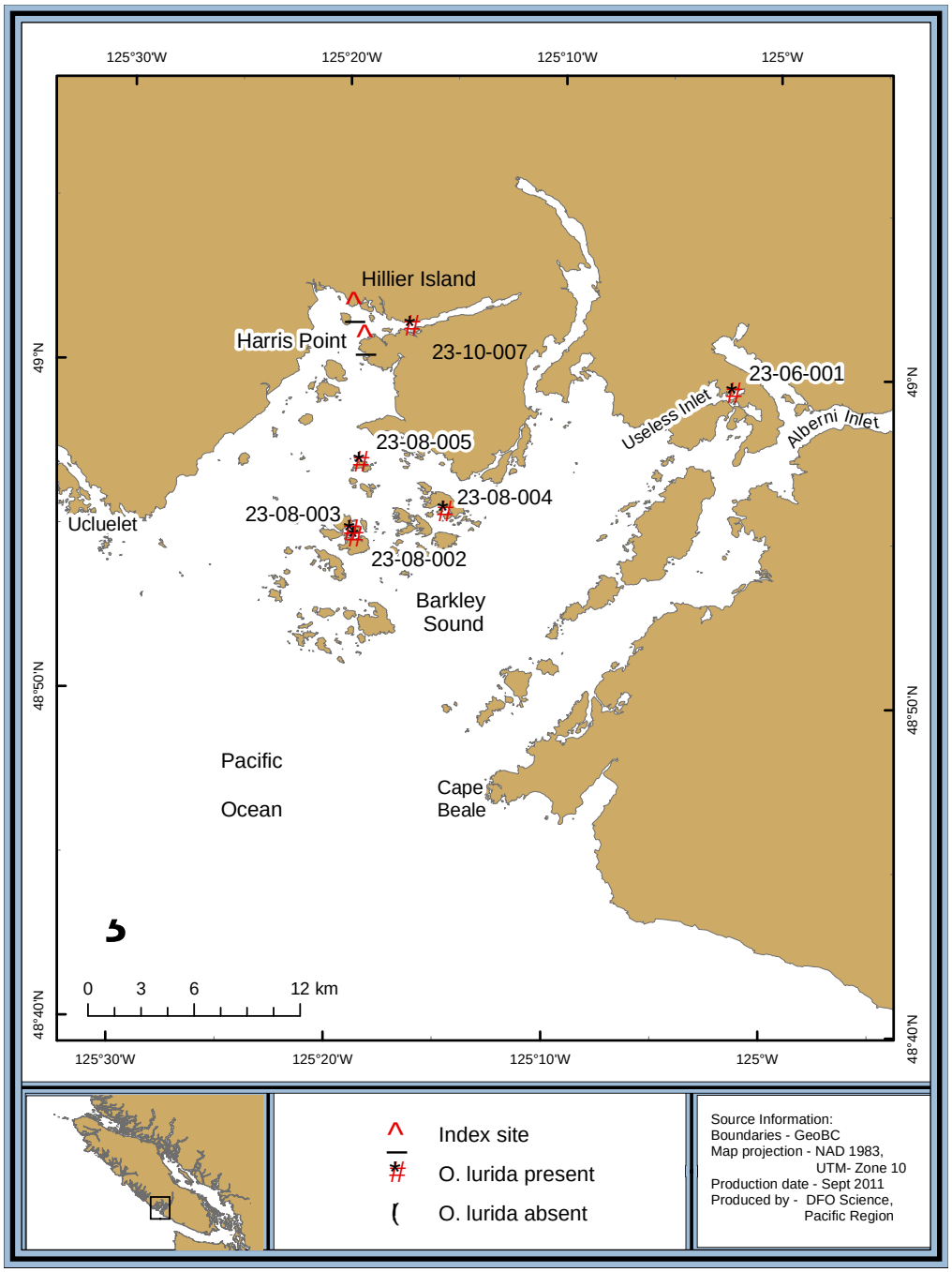

Figure 5. Olympia oyster (*Ostrea lurida*) survey locations in Barkley Sound, 2010 and 2011.

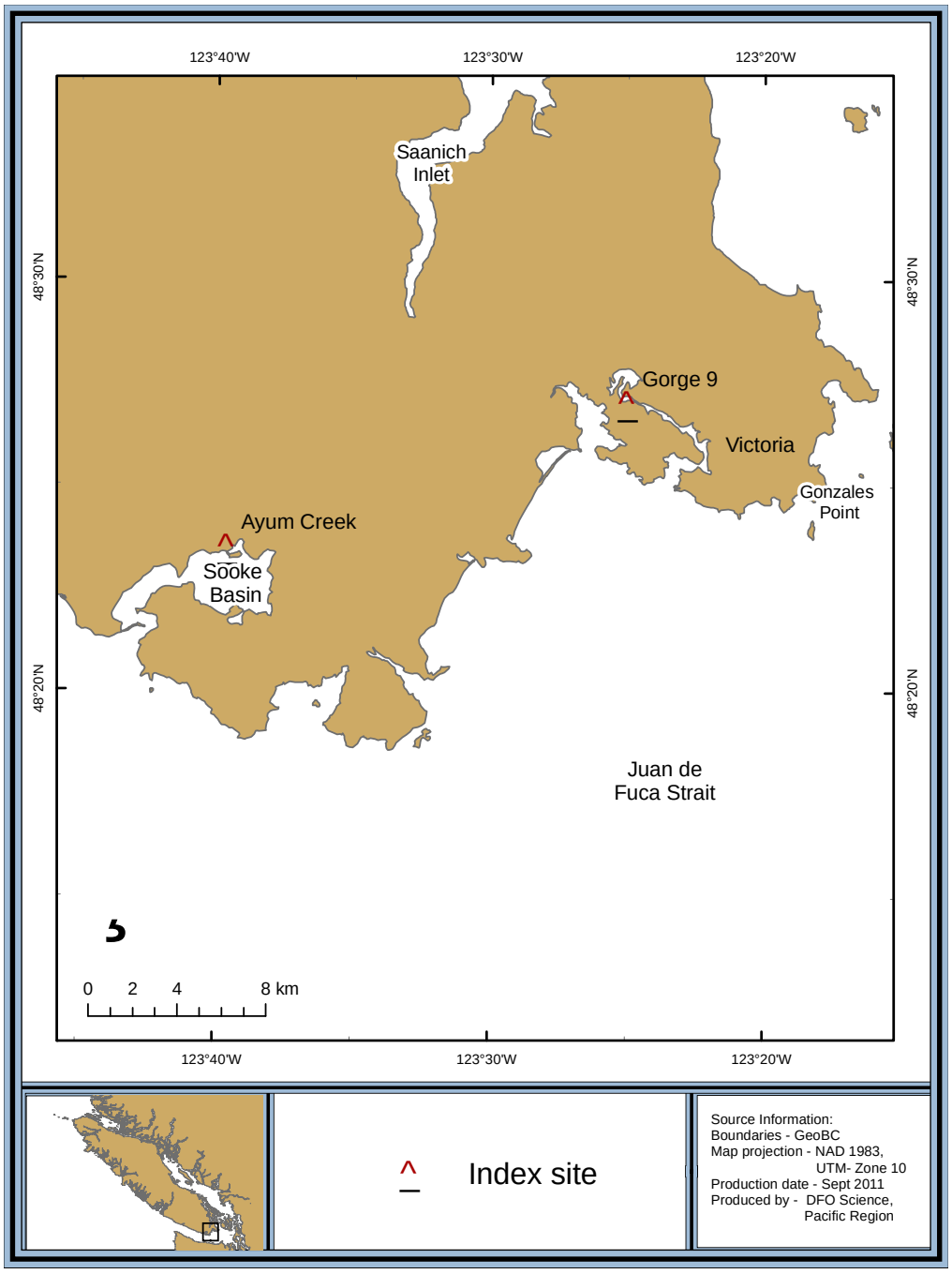

Figure 6. Olympia oyster (*Ostrea lurida*) survey locations in Juan de Fuca Strait, 2010 and 2011.

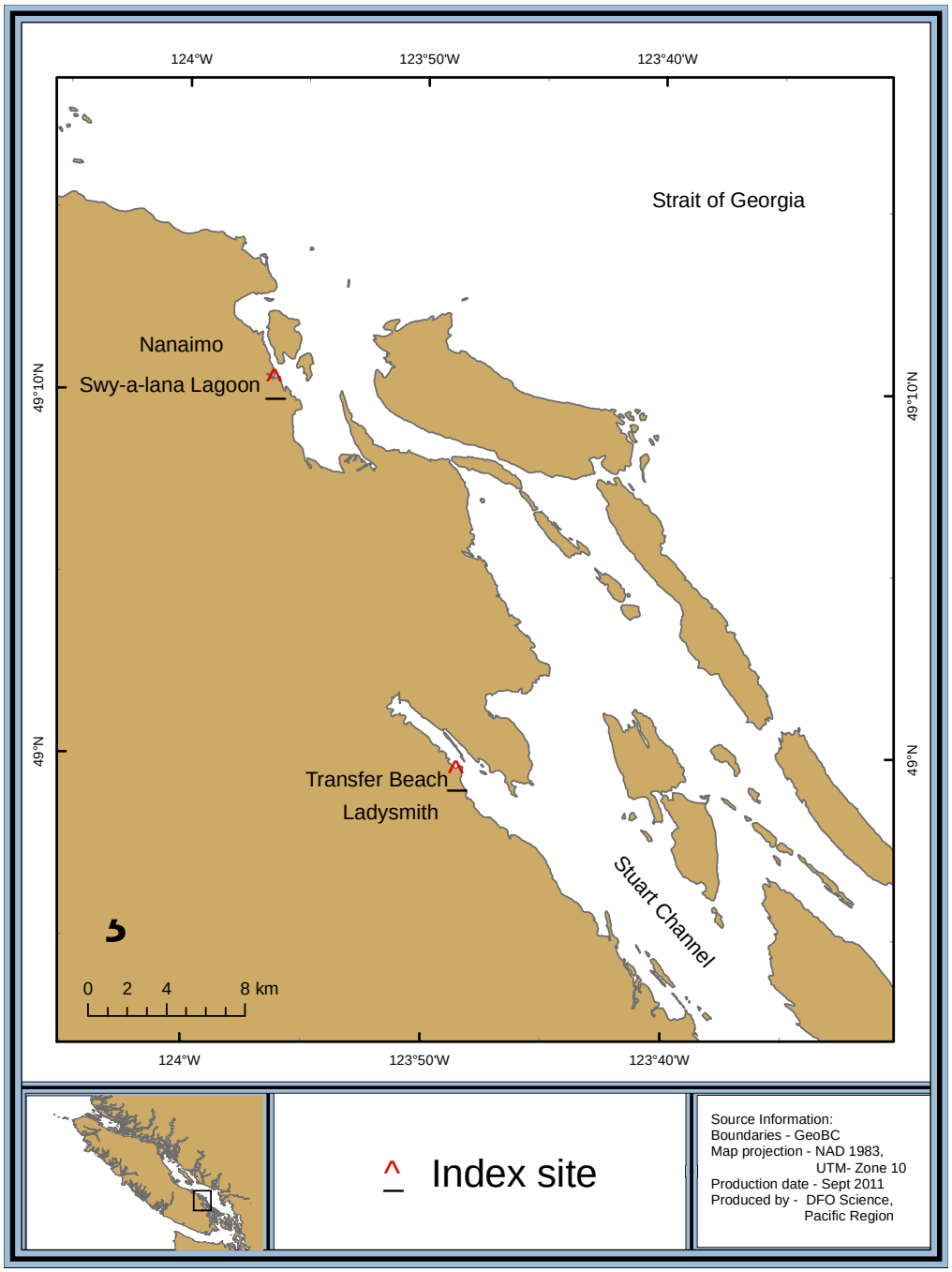

Figure 7. Olympia oyster (*Ostrea lurida*) survey locations in Nanaimo and Ladysmith, 2010 and 2011.

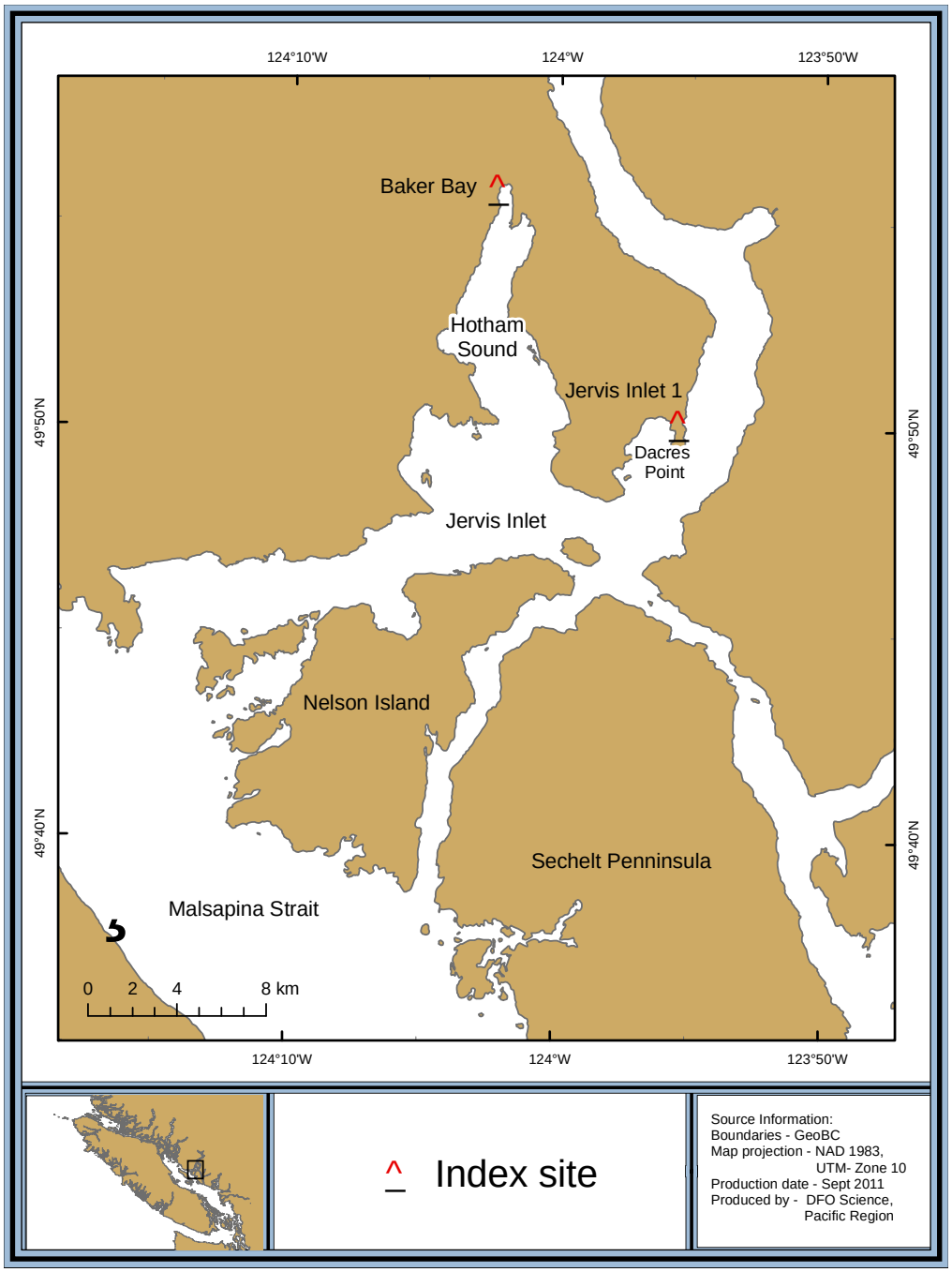

Figure 8. Olympia oyster (*Ostrea lurida*) survey locations in Jervis Inlet, 2010 and 2011.

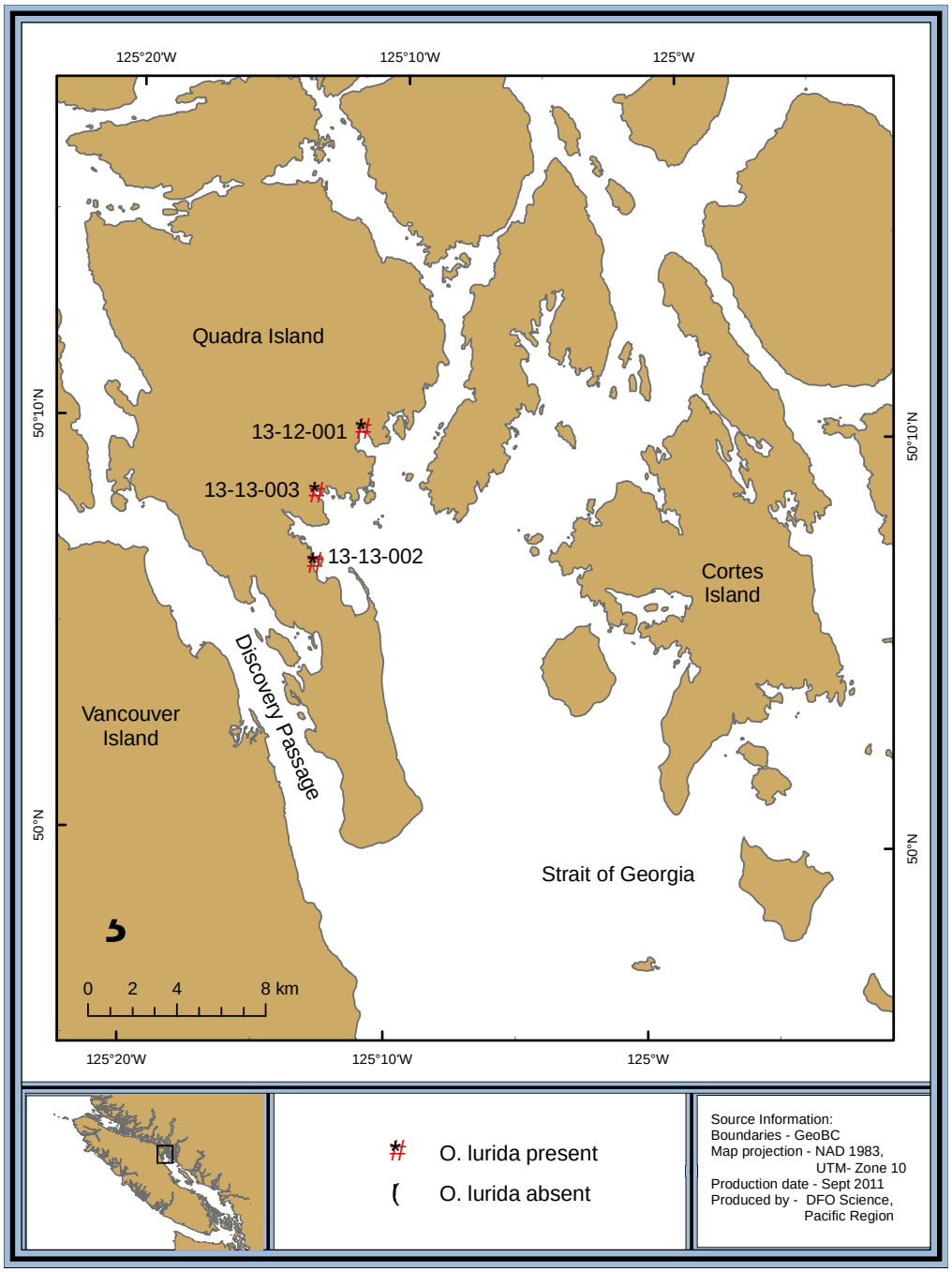

Figure 9. Olympia oyster (*Ostrea lurida*) survey locations in Johnstone Strait, 2010 and 2011.

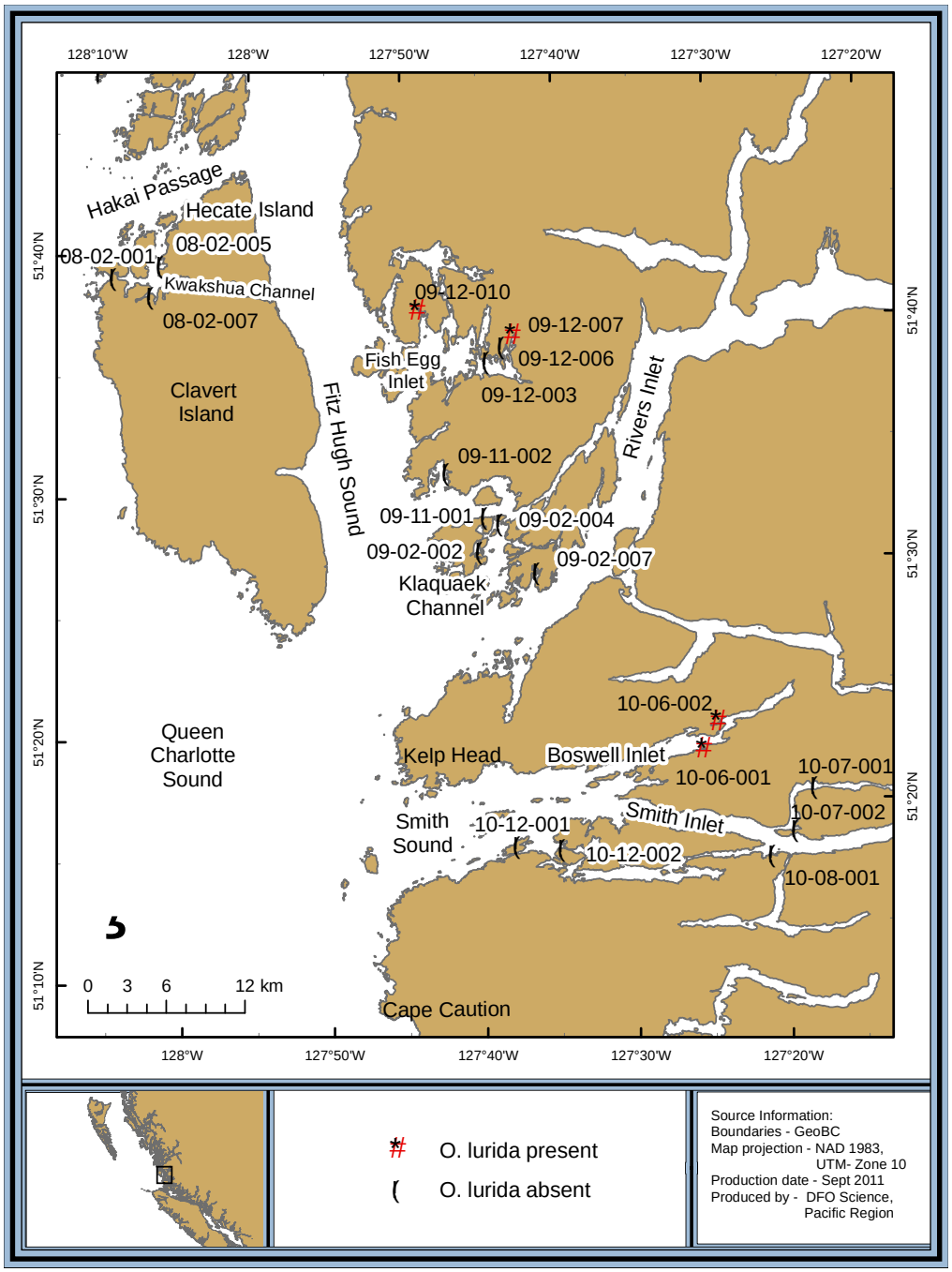

Figure 10. Olympia oyster (*Ostrea lurida*) survey locations in the southern Central Coast, 2010 and 2011.

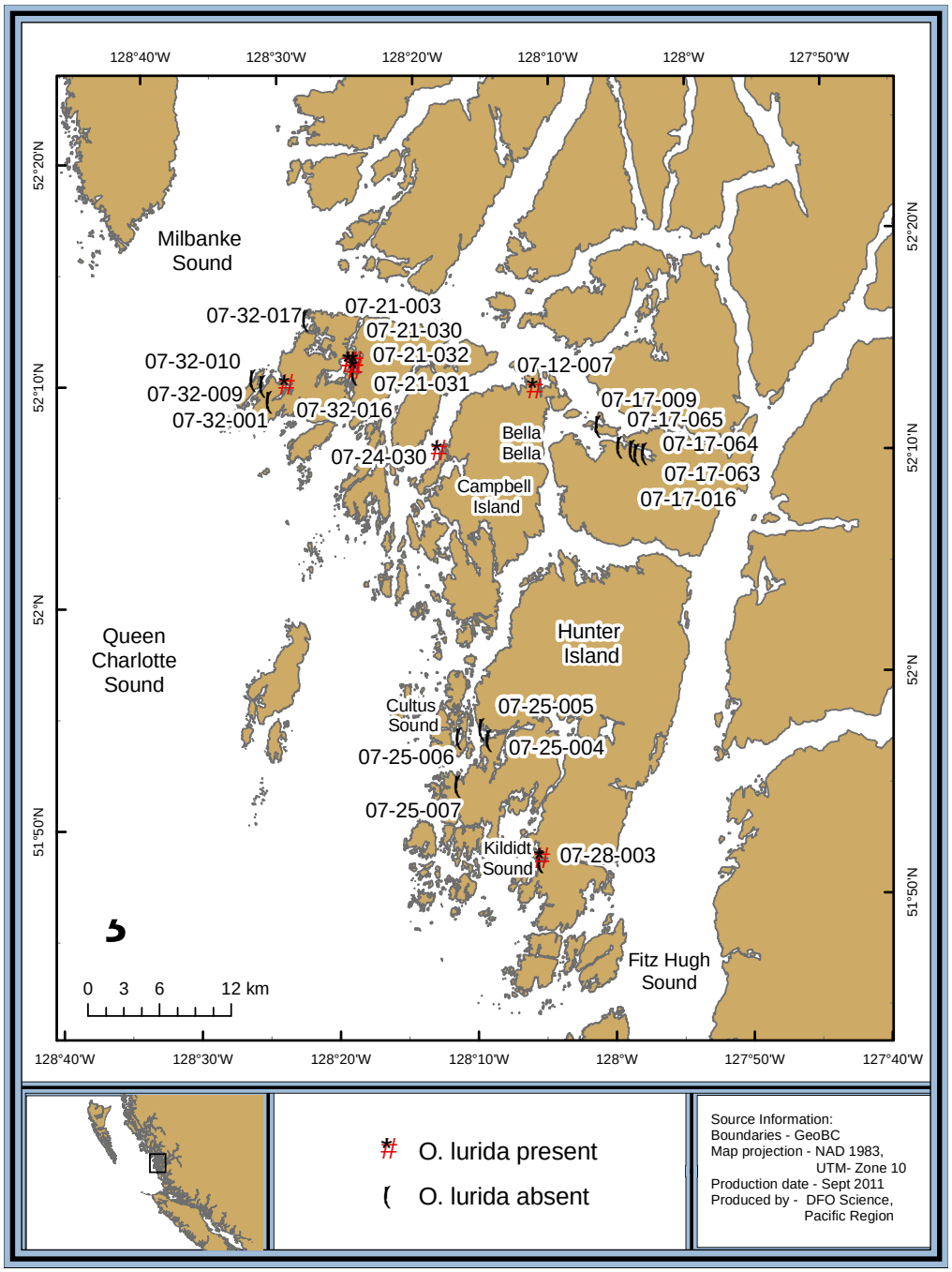

Figure 11. Olympia oyster (*Ostrea lurida*) survey locations in the northern Central Coast, 2010 and 2011.

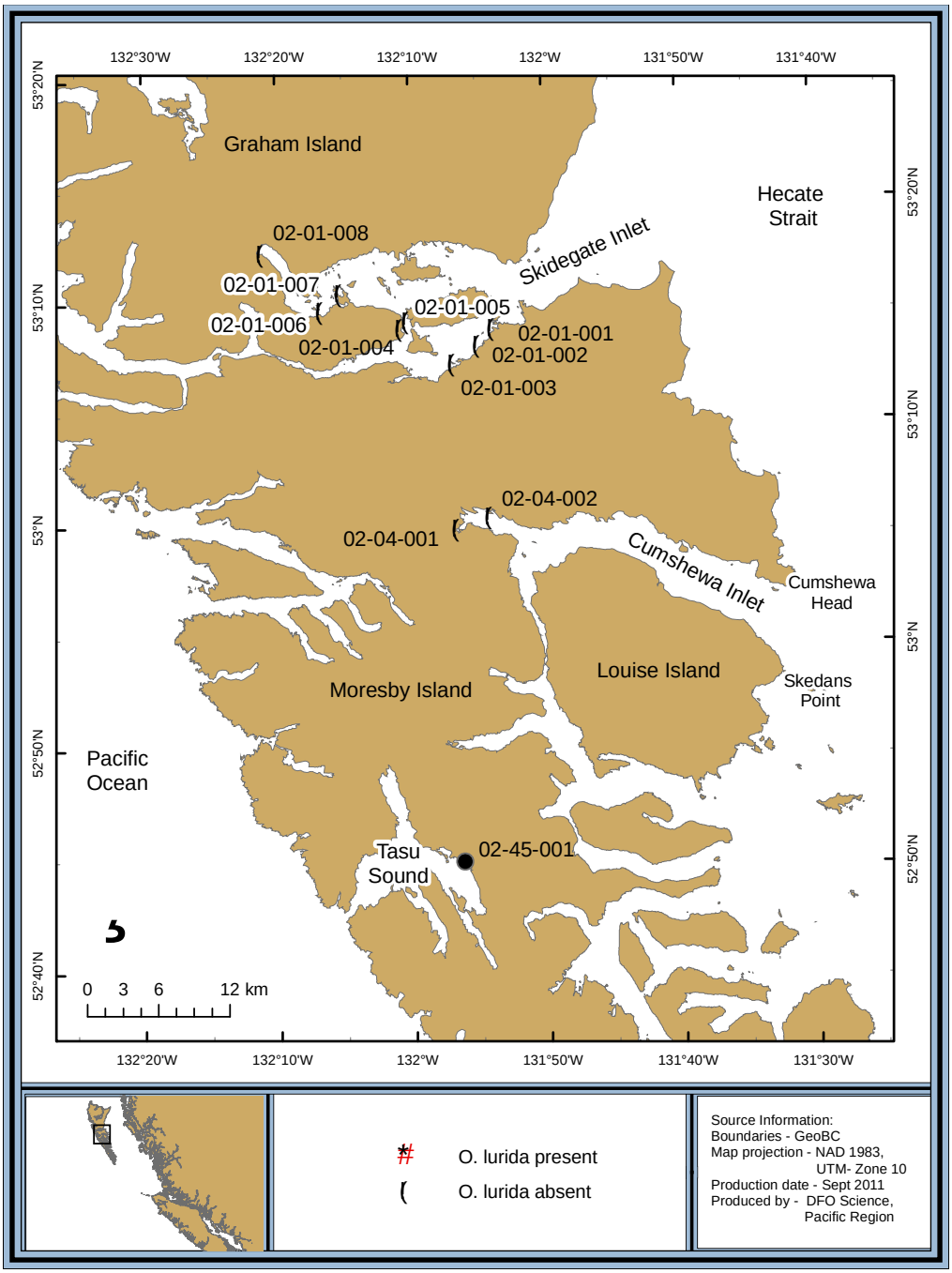

Figure 12. Olympia oyster (*Ostrea lurida*) survey locations in Haida Gwaii, 2010 and 2011.

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Appendix

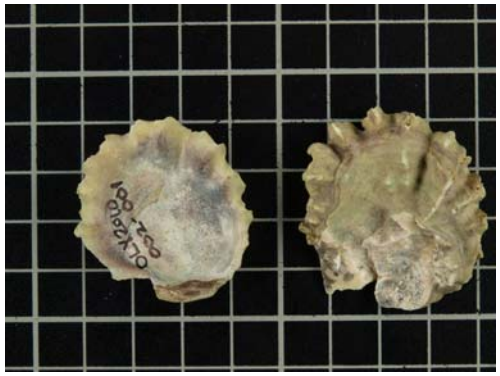
Table A 1. Documentation of beach and voucher information from exploratory Olympia oyster (*Ostrea lurida*) surveys in British Columbia in 2010 and 2011.

1. Northwest Coast of Vancouver Island

Beach Name	**Date**	**Beach Code**	**Time On**	**Time Off**	**Live/ Shell Only**	**Latitude (N)**	**Longitude (W)**	**Voucher numbers**
Winter Harbour	28-May-10	27-03-001	07:45	08:54	Shell Only	50.5355	-127.985	OLY2010-002-001

Substrate: Sand and mud with a few scattered boulders in the lower intertidal. Sand to pebbles with a few scattered boulders and a larger cluster of boulders in the mid to high intertidal.

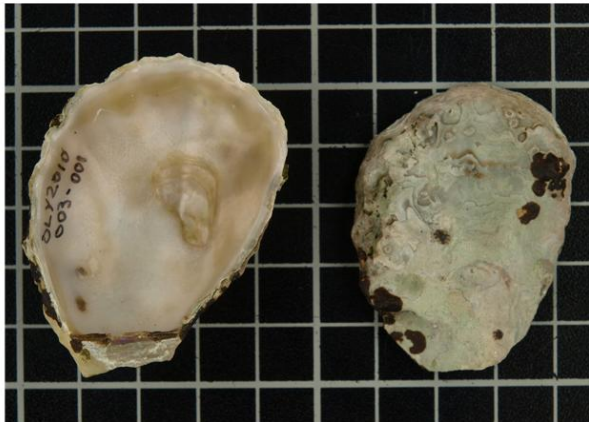
Observations: Large tide pools with lots of sea pens and bat stars. Small green crabs were found in one of the upper tide pools. Abundant jingle shells. One Olympia oyster shell was found.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Klaskino Inlet	30-May-10	27-05-001	07:50	11:20	Live	50.2975	-127.72	OLY2010-003-001 through OLY2010-003-030

Substrate: Gravel, silt, cobble and shell

Observations: Broad terrace with cobbles on upper half and gravel on lower half. Otters had pitted gravel portion extensively, clumping dead shell and live oysters.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Amai Inlet (Index)	1-Jun-10	26-03-004	09:00	12:00	Live	50.0227	-127.102	OLY2010-004-001 through OLY2010-004-020

Substrate: Gravel, cobble, and shell.

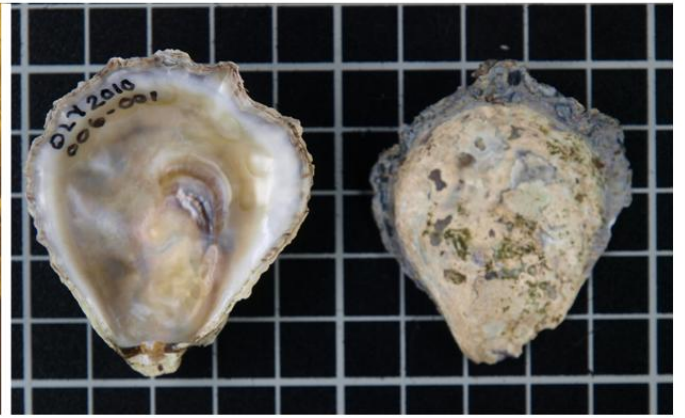
Observations: Beach covered in mussels, Pacific oysters, Manila clams, and Olympia oysters. The Olympia oyster population was low in the intertidal and interspersed amongst algae. The lower end of the population was too deep to survey. Olympia oysters were found living covered in red/brown filamentous algae.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Port Eliza Beach 3 (Index)	2-Jun-10	25-12-005	09:45	11:45	Live	49.9201	-127.027	OLY2010-006-001 through OLY2010-006-020

Substrate: Gravel, small rocks, and cobble.

Observations: There is a river with a relatively strong current running down centre of the bed. There has been logging nearby, and excess runoff was observed coming down the river from the erosion. There were quite a few Pacific oysters high on the beach. In the main Olympia oyster bed there were only a few scattered Pacific oysters.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Louis Lagoon	3-Jun-10	25-13-004	11:30	12:05	Live	49.74033	-126.931	OLY2010-007-001 OLY2010-007-002

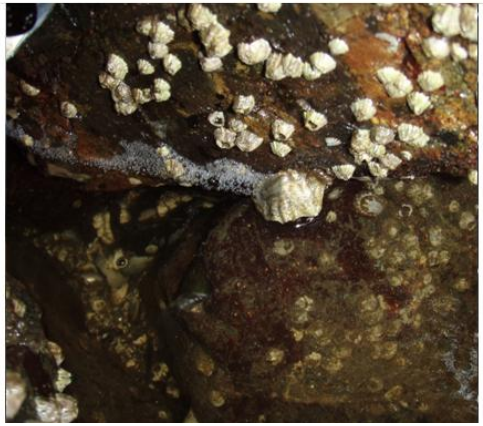
Substrate: Bedrock on side exposed to surf. Sand and gravel on the rest of the beach.

Observations: Olympia oysters were found but were not abundant. Photographs were taken rather than live voucher samples. Two shell vouchers were collected.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Inner Basin	3-Jun-10	25-14-003	12:48	13:15	Live	49.79682	-126.75	OLY2010-008-001 through OLY2010-008-020

Substrate: Sand and gravel with pebbles and rocks. Some silty and muddy areas.

Observations: Broad estuary with several channels. Flat beach with low salinity. There were lots of live softshell clams in the upper intertidal, and live Manila clams in the lower intertidal. One varnish clam shell was seen. Live Olympia oysters and shell were found in a creek on the south margin. There was no evidence of otters.

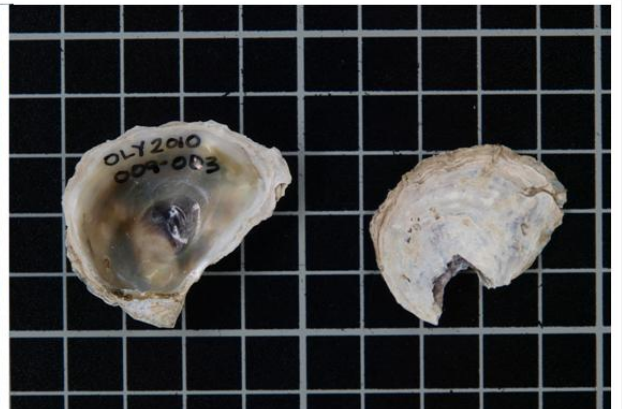


2. Southwest Coast of Vancouver Island

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Darr Island (Index)	10-Jun-10	24-02-002	05:15	07:40	Live	49.448	-126.292	OLY2010-009-001 through OLY2010-009-020

Substrate: Cobble, gravel, and boulders.

Observations: The beach has lots of boulders and cobble, which made the Olympia oyster survey challenging. Olympia oysters were patchily distributed throughout the beach. A patch about 100 m west of the main river area was surveyed. Most rocks were covered with barnacles. A yellow encrusting sponge was also observed.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Bacchante Bay (Index)	11-Jun-10	24-13-004	05:40	08:10	Live	49.45274	-126.033	None collected

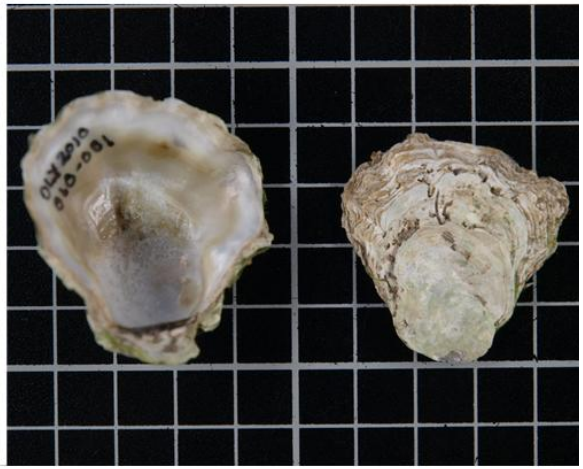
Substrate: Cobble and gravel.

Observations: Olympia oysters were found in very low densities (scattered singles). The first stratum was placed and a modified survey design was used (quadrat flip). A bed of Olympia oysters was found in a creek, and a second stratum was set up. The oysters in this bed were attached to rocks and had a higher density than the first stratum.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Moyeha Bay	12-Jun-10	24-05-005	05:19	07:00	Live	49.41632	-125.913	OLY2010-010-001 OLY2010-010-002

Substrate: Cobble and gravel.

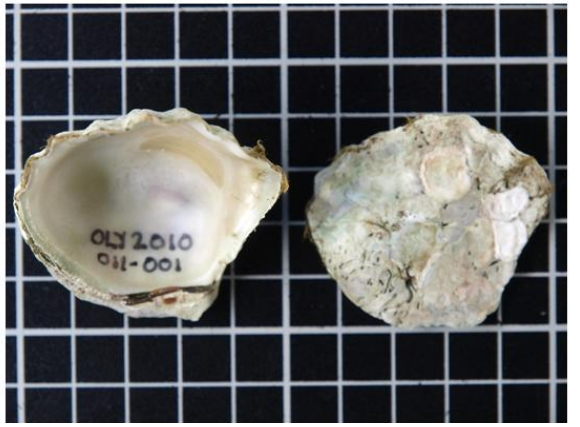
Observations: Olympia oysters were found in the southwest end of the bay. Oysters were found both attached to cobbles and free. The beach had low species diversity, and dropped off sharply at the edge of the intertidal zone. There was a dry creek bed on the beach.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Big Whitepine Cove	12-Jun-10	24-05-002	07:46	10:00	Live	49.30167	-125.95	OLY2010-011-001 through OLY2010-011-003

Substrate: Mudflat and boulders

Observations: None recorded



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Little Whitepine Cove	12-Jun-10	24-05-001	08:30	08:45	Live	49.2965	-125.967	OLY2010-012-001

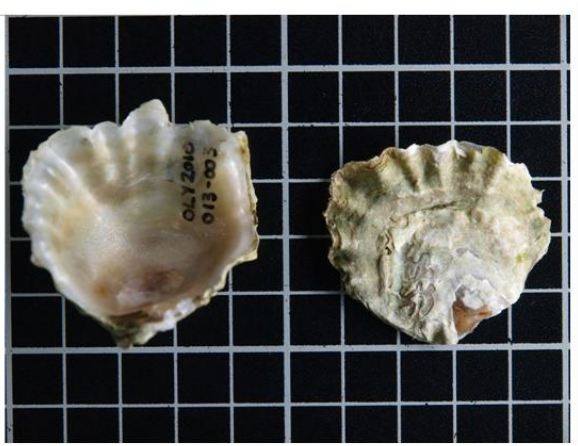
Substrate: Mud and sand.

Observations: This beach had an old salmon weir. The beach was briefly surveyed while collecting green crab traps.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Adventure Cove	13-Jun-10	24-09-002	06:31	07:10	Live	49.2008	-125.853	OLY2010-013-001 through OLY2010-013-010

Substrate: Mud, sand, and cobble.

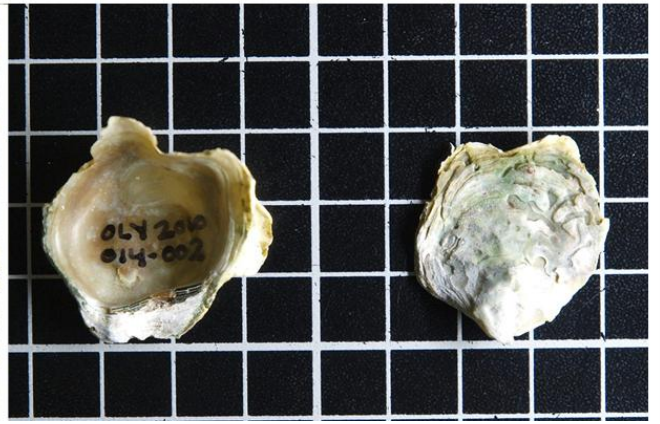
Observations: Olympia oysters were found scattered across the beach growing on cobble and oyster shell. The main population was found in cobble at northern end of the beach (mid intertidal). The lower section of the beach was very muddy.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
North Lemmens Inlet	13-Jun-10	24-09-006	07:25	07:45	Live	49.22925	-125.846	OLY2010-014-001 OLY2010-014-002

Substrate: Sand, cobble, boulder, and shell.

Observations: Olympia oyster shell vouchers were collected from boulders and cobble in the upper intertidal above the main beach. Live oysters were present but were not collected as samples had been gathered nearby in Adventure Cove. There was a 25 m by 5 m area with a high density of Olympia oysters.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Tsapee Narrows	13-Jun-10	24-09-005	08:09	08:31	Live	49.1275	-125.813	None collected

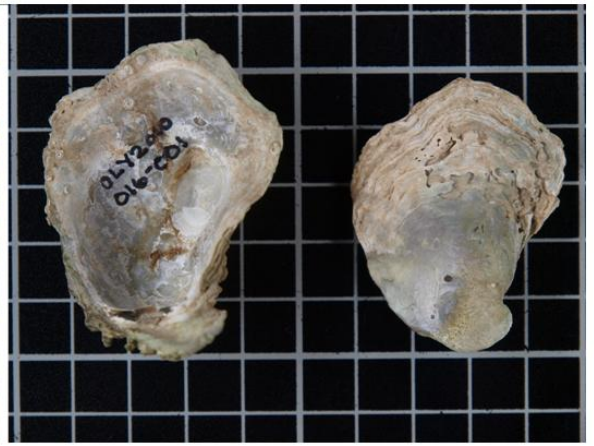
Substrate: Sand, cobble , boulder

Observations: A large sandy beach with cobble along the edge. Surveyors carefully examined the cobble on the northern side of the beach. Only one Olympia oyster was found attached to the bottom of a large boulder. The underside was covered with yellow encrusting sponge. No Olympia oyster were found on the rusting boat part.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Heelboom Bay	13-Jun-10	24-10-004	08:41	09:21	Live	49.15267	-125.798	OLY2010-016-001 through OLY2010-016-003

Substrate: Sand and shell. Boulder and cobble in the upper intertidal.

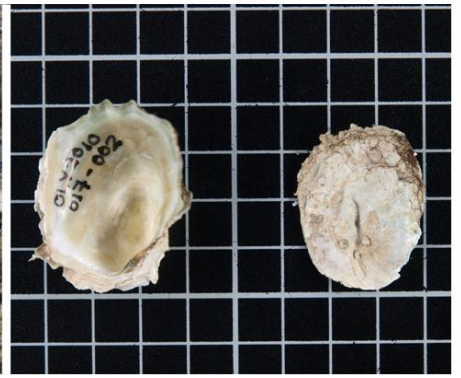
Observations: This beach is in the Meares Island tribal park and has a small cabin on the beach. The boulders had Olympia oyster scars and a few shells. One live individual was found under a rock (loose) at the most southern end of beach. This beach had lots of horse clam siphon shows and red rock crabs hiding under rocks.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Mosquito Harbour	13-Jun-10	24-10-002	09:29	10:02	Live	49.22517	-125.802	OLY2010-017-001 through OLY2010-017-008

Substrate: Sand and shell in the lower intertidal; boulder and cobble in the upper. Some bedrock.

Observations: Olympia oysters were abundant under cobbles and boulders just above the eelgrass. This beach had lots of diversity. Midshipmen were found with eggs under rocks. Horse clam siphon shows, yellow encrusting sponge, and a leopard nudibranch were also observed.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Harris Point (Index)	14-Jun-10	23-10-005	07:30	10:40	Live	49.01595	-125.3145	OLY2010-018-001 through OLY2010-018-020

Substrate: Gravel, some cobble, and boulders.

Observations: Olympia oyster “Shangri-la". Oysters were sampled in the stream bed and up into the lagoon. Index survey was completed.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Cataract Bay	14-Jun-10	23-10-007	Not recorded	Not recorded	Live	49.02125	-125.2792	OLY2010-019-001 through OLY2010-019-010

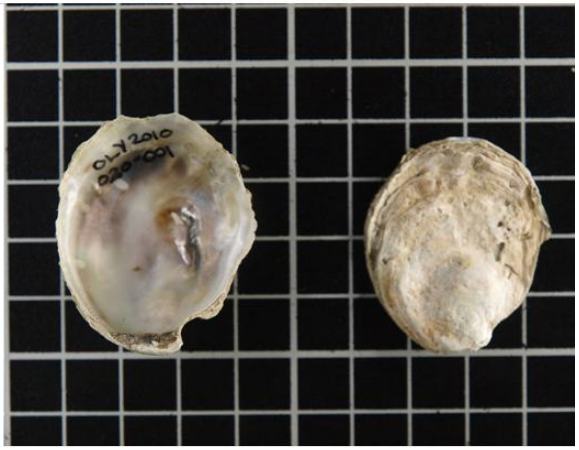
Substrate: Mud and boulders.

Observations: Small bay East of Cataract Creek mouth. The area has two small beaches. One beach did not have oysters and was very muddy. This beach was not surveyed. The other beach had a large population of Pacific and Olympia oysters, but they were mostly dead. Collected 10 Olympia oysters for DNA samples.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Hillier Island (Index)	15-Jun-10	23-10-002	07:30	11:15	Live	49.032	-125.3248	OLY2010-020-001 through OLY2010-020-020

Substrate: Gravel flats. Cobble, boulders and bedrock at margins were completely covered with Pacific oysters

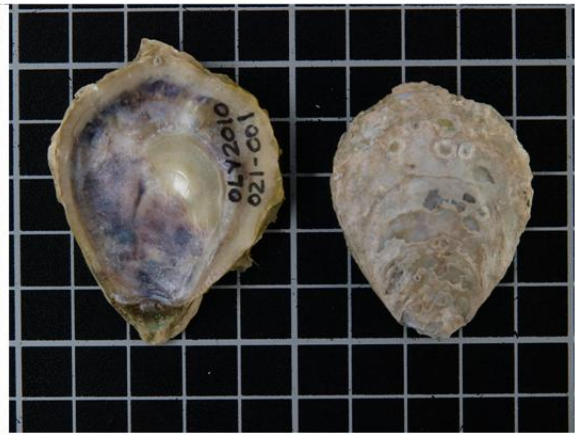
Observations: The mid intertidal zone had scattered Olympia singles in areas holding water. In the low intertidal towards the main creek bed there was a lot of dead shell. A large number of quadrats were attempted due to perceived low abundance, but a lot of new recruitment made it impossible for surveyors to complete the survey within one low tide. Surveyors returned to finish the next day (07:30-09:08, June 16). The survey baseline ran perpendicular to the main beach and parallel to the main creek. The approximate survey area plus additional upper creek and patchy areas of Olympia oysters was mapped.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Walsh Saddle	16-Jun-10	23-08-003	09:30	09:54	Live	48.91638	-125.3213	OLY2010-021-001

Substrate: Sand, shell, and cobble. Boulders and bedrock at margins.

Observations: This is a small beach that had a historical Olympia oyster record. Olympia oysters were found on rocks in the sand area of the beach and also on the cobble boulder areas around the edge. One rock had 5 Olympia oysters under it.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Joe's Bay	16-Jun-10	23-08-002	10:00	10:20	Live	48.91338	-125.3183	OLY2010-022-001

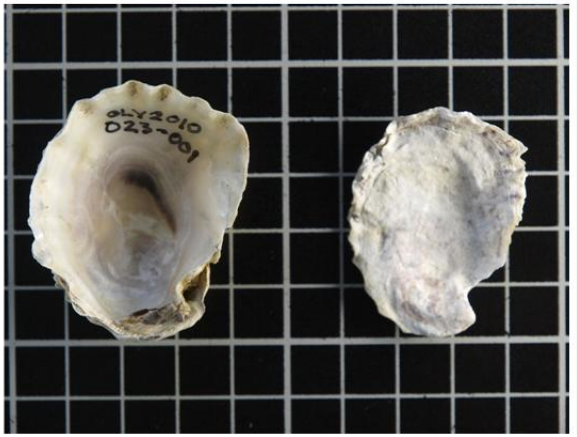
Substrate: Shell and gravel; boulders and bedrock at margins.

Observations: This beach is one of the Parks Canada Olympia oyster survey sites. Olympia oysters were seen on and under the rocks at the edges of the beach. A few single oysters were seen laying in the gravel on the beach flats. Parks also does clam surveys on this beach and are going to increase the survey area trying to include the Olympia oysters on the beach flats. One Olympia oyster shell was collected to voucher.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Nettle Island	16-Jun-10	23-08-004	10:31	10:53	Live	48.92785	-125.2494	OLY2010-023-001

Substrate: Sand, shell, and gravel; boulders and bedrock at margins.

Observations: The beach is directly behind the Parks Canada Warden's Cabin. Surveyors looked for European flat oysters but only found one shell. This site had lots of Olympia oysters on the rocks and growing on Pacific oysters. Farther up the beach there were lots of varnish clams. The Pacific oysters on this beach were very large. One Olympia oyster shell was collected to voucher.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Hand Island	16-Jun-10	23-08-005	11:04	11:20	Live	48.95145	-125.3155	OLY2010-024-001

Substrate: Sand, shell, cobble, and boulder. Boulders along margins.

Observations: Olympia oyster shells were seen on the north side of the beach, but not on the south side. Live oysters were found under rocks on the flats of the beach. One Olympia oyster shell was collected to voucher.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Useless Inlet	17-Jun-10	23-06-001	09:50	10:21	Live	48.9915	-125.0294	OLY2010-025-001 through OLY2010-025-025

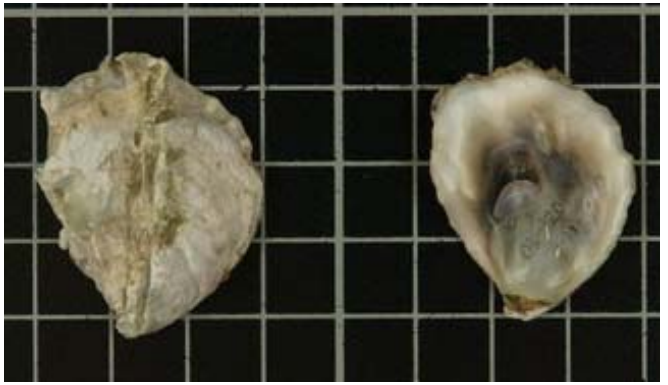
Substrate: Mud

Observations: The majority of the beach was sucking mud flats. There were lots of Olympia oysters around the margin of the beach. Live European flat oysters and Japanese oyster drills were observed. Pink/orange encrusting sponges were also observed.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Pipestem Inlet	13-May-10	23-10-004	12:00	1:00	Live	49.038	-125.2041	OLY2010-032-001 through OLY2010-032-020

Substrate: Gravel and some cobble on top of mud.

Observations: This site had a fairly dense population of Olympia oysters. Oysters were scattered individuals or attached to Pacific oyster shells and rocks.



`3. Juan de Fuca Strait

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Gorge # 9 (Index)	15-Jul-10 6-Aug-10	19-01-003	13:15 09:20	15:15 11:12	Live	48.45041	-123.415	OLY2010-032-001 through OLY2010-032-020

Substrate: Gravel and some cobble on top of mud.

Observations: This site had a large subtidal population as well as a fairly dense intertidal population of Olympia oysters.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Ayum Creek (Index)	4-Jul-11	20-07-003	11:35	12:20	Live	48.39167	-123.658	OLY2010-029-001 through OLY2010-029-011

Substrate: Mud and gravel.

Observations: Ayum Creek is located in the northern part of Sooke Basin in Cooper Cove. The beach has a low slope with a small creek that originates from a mill pond running through the middle of the beach.

4. Strait of Georgia

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Swy-a-lana Lagoon (Index)	24-Aug-10	17-14-002	9:00	14:00	Live	49.17118	-123.937	OLY2010-034-001 through OLY2010-034-020

Substrate: Cobble, concrete walls.

Observations: Swy-a-lana Lagoon is located in downtown Nanaimo. The site consists of three intertidal concrete terraces that separate the harbour from a small lagoon. Each level is filled with cobble, as are the areas immediately inside and outside the lagoon

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Transfer Beach (Index)	5-Jul-11	17-07-023	14:00	15:00	Live	48.99288	-123.807	None collected

Substrate: Boulders and cobble.

Observations: This beach is located in a park and is heavily used by people. The beach has a moderate slope. The beach has both Pacific and Olympia oysters. The Olympia oysters are restricted to the lower areas of the beach.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Baker Bay (Index)	13-Jul-11	16-12-007	11:15	12:30	Live	49.93138	-124.037	None collected

Substrate: Cobble.

Observations: The beach has a low slope. There are two creek beds running through the beach; a larger one on the west side of the beach and a smaller one approximately half way along the beach. Pacific oysters were abundant, while Olympia oysters were much sparser and only found in the smaller creek and in the lower part of the beach in between the two creek beds.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Jervis Inlet 1 (Index)	14-Jul-11	16-13-006	11:40	12:40	Live	49.8367	-123.923	None collected

Substrate: Boulders and cobble.

Observations: This site is located on the western shore of Jervis Inlet on the eastern side of Dacres Point. The beach has a moderate to high slope. Pacific oysters were present at the beach though were not abundant. Olympia oysters were sparse, hidden under rocks, and confined to the lower intertidal.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Heriot Island	9-Jul-10	13-13-002	09:30	10:30	Live	50.10857	-125.2162	OLY2010-026-001 through OLY2010-026-012

Substrate: Cobble and gravel. Boulder along margins

Observations: Flat saddle beach. Most of this beach is under Mac's Oyster lease. Olympia oysters were found under boulders and rocks east and south side of the beach.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Village Bay	9-Jul-10	13-12-001	10:45	11:08	Live	50.1635	-125.1884	None collected

Substrate: Bedrock, boulders, cobble, and shell.

Observations: Olympia oysters were found under rocks. A DNA sample was not taken.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Open Bay	9-Jul-10	13-13-003	11:30	11:55	Live	50.1373	-125.2162	None collected

Substrate: Sand, boulders, and bedrock.

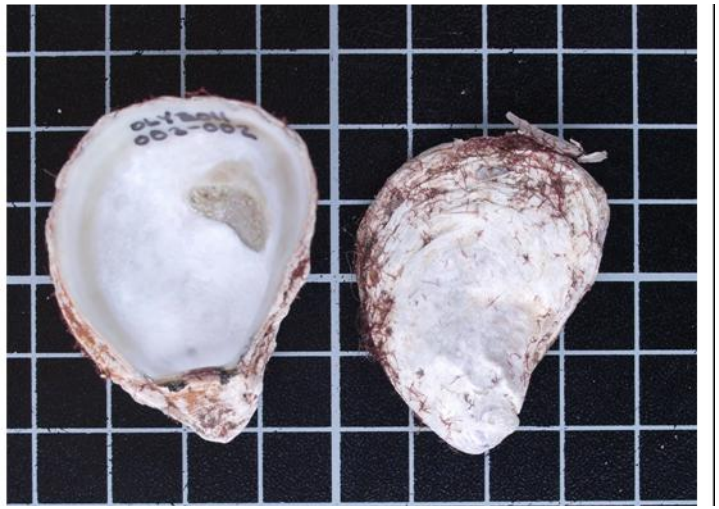
Observations: Olympia oysters were only found under a large overhang on the east side of the beach. There were only a few oysters so only pictures were collected as voucher samples.

5. Central Coast

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Boswell Inlet 2	1-Jun-11	10-06-002	06:30	07:00	Live	51.3779	-127.4344	OLY2011-001-001 through OLY2011-001-025

Substrate: Cobble with silt and a silty patch on the bottom third of the beach.

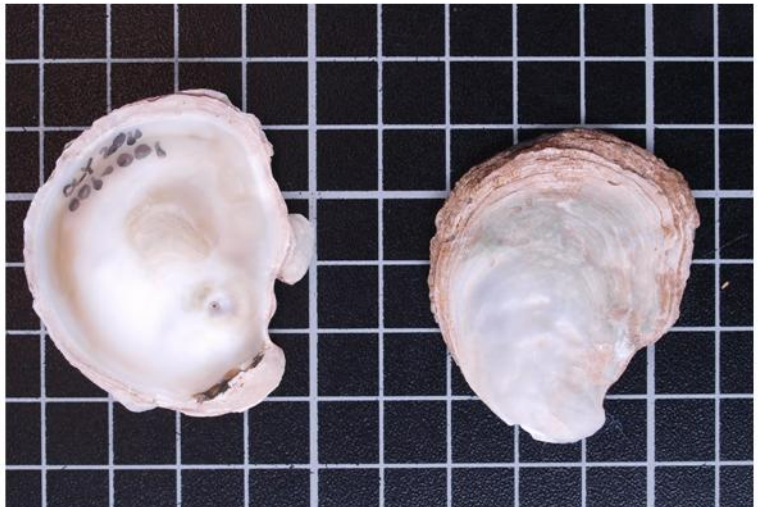
Observations: This beach is the top pocket beach on the narrows. Fine woody debris in the lower intertidal. There was a creek channel on west end. Olympia oysters found attached to rocks.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Boswell Inlet 1	1-Jun-11	10-06-001	07:10	07:40	Live	51.3584	-127.4482	OLY2011-002-001 through OLY2011-002-010

Substrate: Sand and slit. Bedrock and boulder margin.

Observations: There is a creek bed down the middle of the beach. There was moderate *Fucus* cover in the upper intertidal and eel grass in the lower.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Oyster Bay	4-Jun-11	09-12-007	09:30	10:00	Live	51.63367	-127.687	OLY2011-003-001 through OLY2011-003-018

Substrate: Sand, gravel, sucking mud, rock fringe, and some silt

Observations: There is a creek bed through middle of the beach. There is focus on the rocks with some filamentous green algae on the sand and gravel. Olympia oysters were found attached to the rocks. Some Manila clams were also observed.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
McClusky Bay	4-Jun-11	09-12-010	10:45	10:50	Live	51.64583	-127.7933	None collected

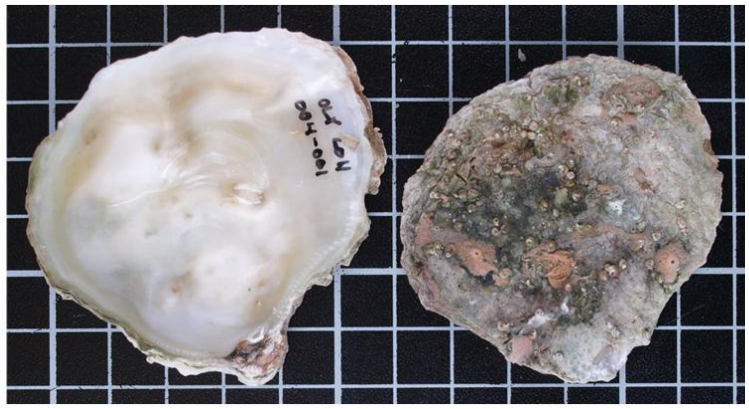
Substrate: Sand and silt, rock fringe.

Observations: The beach had sparse *Fucus* in the upper intertidal and eel grass in lower. Found live Olympia oysters and Manila clams. Lots of *Melibe leonina* eggs in the eel grass.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Watt Bay	5-Jun-11	07-28-003	10:15	11:00	Live	51.84	-128.1033	OLY2011-004-001 through OLY2011-004-018

Substrate: Boulders

Observations: This lagoon is the upper beach in a series of three in Watt Bay. Olympia oysters were found attached to rocks. There was lots of diversity in the lagoon.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Raymond Beach	12-Aug-10	07-24-030	11:00	12:00	Shell Only	52.1405	-128.2636	None collected

Substrate: Boulder and cobble with a sandy lagoon

Observations: This beach is a high lagoon that drains out into the low intertidal zone but never fully drains in a tide. Steve Wilson Sr. said that 40 years there used to be a large population of Olympia oysters. Oyster shells were found under the rocks on the southern side of the lagoon.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Ormidale Harbour/ Bachelor Bay	13-Aug-10	07-12-007	09:30	11:30	Shell Only	52.19218	-128.1521	None collected

Substrate: Cobble and gravel on sand

Observations: Three Olympia oyster shells were found attached to rock. No live oysters were found. This site has high diversity with lots of juveniles of many different species, such as urchins and sea cucumbers.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
St John Lagoon North	17-Jun-11	07-32-016	09:05	09:50	Shell Only	52.18095	-128.4557	None collected

Substrate: Sand and gravel. Boulder margin.

Observations: This beach connects an inlet to small lagoon. A creek-like channel connects the lagoon to the inlet on one side of the beach. There is eel grass in lower intertidal, *Fucus* in the upper. The beach has high diversity. One Olympia oyster shell was found.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Gale Passage Upper Lagoon	18-Jun-11	07-21-032	09:30	09:55	Live	52.20218	-128.374	None collected

Substrate: Gravel, some cobble.

Observations: This site is a low beach in the lagoon. Olympia oysters were reported here previously. One live oyster was found, as well as two shells. There was a brackish creek running down the center of the beach.

Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Gale Passage Beach 3	12-Aug-10	07-21-003	08:20	09:00	Shell Only	52.2019	-128.3799	None collected
	18-Jun-11	07-21-003	10:00	11:45	Shell Only	52.2019	-128.3799	None collected

Substrate: Bedrock, boulders, cobble, and patches of gravel.

Observations: Saddle beach with lagoon. Lots of tide pools. In 2010 three Olympia oyster shells were found. In 2011 two shells were found. Rocks were carefully examined for live Olympia oysters, but none were found. This lagoon had lots of diversity. The Olympia oyster shells were found in the same areas as jingles.



Beach Name	Date	Beach Code	Time On	Time Off	Live/ Shell Only	Latitude (N)	Longitude (W)	Voucher numbers
Gale Passage South of Beach 4	12-Aug-10	07-21-030	09:20	10:10	Shell Only	52.19717	-128.3739	None collected

Substrate: Bedrock, cobble, and boulders. Lots of old fish weirs

Observations: Lots of old fish weirs at this location. Steve Wilson Sr. had seen Olympia oysters in the upper lagoon many years ago (40+ years). One shell was found on the cobble beach. The coordinates for the location Steve Wilson Sr. had seen the oysters are 52.19555 N, -128.3726 W.

5   

5. Haida Gwaii

No observations of *O. lurida.*

Table A 2. Location and collection date of Olympia oyster (*Ostrea lurida*) voucher specimens including the beach codes for each location, voucher number, Royal BC Museum (RBCM) number, and DNA vial number.

1. Northwest Coast of Vancouver Island

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
28-May-10	Wedel Island	27-03-001	OLY2010-002-001	011-00091-001	NA
30-May-10	Klaskino Sound NE	27-05-001	OLY2010-003-001	011-00092-001	401
			OLY2010-003-002	011-00092-002	402
			OLY2010-003-003	011-00092-003	403
			OLY2010-003-004	011-00092-004	404
			OLY2010-003-005	011-00092-005	405
			OLY2010-003-006	011-00092-006	406
			OLY2010-003-007	011-00092-007	407
			OLY2010-003-008	011-00092-008	408
			OLY2010-003-009	011-00092-009	409
			OLY2010-003-010	011-00092-010	410
			OLY2010-003-011	011-00092-011	411
			OLY2010-003-012	011-00092-012	412
			OLY2010-003-013	011-00092-013	413
			OLY2010-003-014	011-00092-014	414
			OLY2010-003-015	011-00092-015	415
			OLY2010-003-016	011-00092-016	416
			OLY2010-003-017	011-00092-017	417
			OLY2010-003-018	011-00092-018	418
			OLY2010-003-019	011-00092-019	419
			OLY2010-003-020	011-00092-020	420
			OLY2010-003-021	011-00092-021	421
			OLY2010-003-022	011-00092-022	422
			OLY2010-003-023	011-00092-023	423
			OLY2010-003-024	011-00092-024	424
			OLY2010-003-025	011-00092-025	425
			OLY2010-003-026	011-00092-026	426
			OLY2010-003-027	011-00092-027	427
			OLY2010-003-028	011-00092-028	428
			OLY2010-003-029	011-00092-029	429
			OLY2010-003-030	011-00092-030	430

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
1-Jun-10	Amai Inlet	26-03-004	OLY2010-004-001	011-00093-001	431
			OLY2010-004-002	011-00093-002	432
			OLY2010-004-003	011-00093-003	433
			OLY2010-004-004	011-00093-004	434
			OLY2010-004-005	011-00093-005	435
			OLY2010-004-006	011-00093-006	436
			OLY2010-004-007	011-00093-007	437
			OLY2010-004-008	011-00093-008	438
			OLY2010-004-009	011-00093-009	439
			OLY2010-004-010	011-00093-010	440
			OLY2010-004-011	011-00093-011	441
			OLY2010-004-012	011-00093-012	442
			OLY2010-004-013	011-00093-013	443
			OLY2010-004-014	011-00093-014	444
			OLY2010-004-015	011-00093-015	445
			OLY2010-004-016	011-00093-016	446
			OLY2010-004-017	011-00093-017	447
			OLY2010-004-018	011-00093-018	448
			OLY2010-004-019	011-00093-019	449
			OLY2010-004-020	011-00093-020	450
01-Jun-10	Amai Head	26-03-005	OLY2010-005-001	011-00094-001	NA
			OLY2010-005-002	011-00094-002	NA
2-Jun-10	Port Eliza	25-12-005	OLY2010-006-001	011-00095-001	451
			OLY2010-006-002	011-00095-002	452
			OLY2010-006-003	011-00095-003	453
			OLY2010-006-004	011-00095-004	454
			OLY2010-006-005	011-00095-005	455
			OLY2010-006-006	011-00095-006	456
			OLY2010-006-007	011-00095-007	457
			OLY2010-006-008	011-00095-008	458
			OLY2010-006-009	011-00095-009	459
			OLY2010-006-010	011-00095-010	460
			OLY2010-006-011	011-00095-011	461
			OLY2010-006-012	011-00095-012	462
			OLY2010-006-013	011-00095-013	463

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-006-014	011-00095-014	464
			OLY2010-006-015	011-00095-015	465
			OLY2010-006-016	011-00095-016	466
			OLY2010-006-017	011-00095-017	467
			OLY2010-006-018	011-00095-018	468
			OLY2010-006-019	011-00095-019	469
			OLY2010-006-020	011-00095-020	470
3-Jun-10	Louis Lagoon	25-14-004	OLY2010-007-001	011-00096-001	NA
			OLY2010-007-002	011-00096-002	NA
3-Jun-10	Inner Basin	25-14-003	OLY2010-008-001	011-00097-001	471
			OLY2010-008-002	011-00097-002	472
			OLY2010-008-003	011-00097-003	473
			OLY2010-008-004	011-00097-004	474
			OLY2010-008-005	011-00097-005	475
			OLY2010-008-006	011-00097-006	476
			OLY2010-008-007	011-00097-007	477
			OLY2010-008-008	011-00097-008	478
			OLY2010-008-009	011-00097-009	479
			OLY2010-008-010	011-00097-010	480
			OLY2010-008-011	011-00097-011	481
			OLY2010-008-012	011-00097-012	482
			OLY2010-008-013	011-00097-013	483
			OLY2010-008-014	011-00097-014	484
			OLY2010-008-015	011-00097-015	485
			OLY2010-008-016	011-00097-016	486
			OLY2010-008-017	011-00097-017	487
			OLY2010-008-018	011-00097-018	488
			OLY2010-008-019	011-00097-019	489
			OLY2010-008-020	011-00097-020	490

2. Southwest Coast of Vancouver Island

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
10-Jun-10	Darr Island	24-02-002	OLY2010-009-001	011-00098-001	491
			OLY2010-009-002	011-00098-002	492

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-009-003	011-00098-003	493
			OLY2010-009-004	011-00098-004	494
			OLY2010-009-005	011-00098-005	495
			OLY2010-009-006	011-00098-006	496
			OLY2010-009-007	011-00098-007	497
			OLY2010-009-008	011-00098-008	498
			OLY2010-009-009	011-00098-009	499
			OLY2010-009-010	011-00098-010	500
			OLY2010-009-011	011-00098-011	501
			OLY2010-009-012	011-00098-012	502
			OLY2010-009-013	011-00098-013	503
			OLY2010-009-014	011-00098-014	504
			OLY2010-009-015	011-00098-015	505
			OLY2010-009-016	011-00098-016	506
			OLY2010-009-017	011-00098-017	507
			OLY2010-009-018	011-00098-018	508
			OLY2010-009-019	011-00098-019	509
			OLY2010-009-020	011-00098-020	510
12-Jun-10	Moyeha Bay	24-05-005	OLY2010-010-001	011-00099-001	NA
			OLY2010-010-002	011-00099-002	NA
12-Jun-10	White Pine Bay	24-05-002	OLY2010-011-001	011-00100-001	NA
			OLY2010-011-002	011-00100-002	NA
			OLY2010-011-003	011-00100-003	NA
12-Jun-10	Little White Pine Bay	24-05-001	OLY2010-012-001	011-00101-001	NA
13-Jun-10	Adventure Cove	24-09-002	OLY2010-013-001	011-00102-001	511
			OLY2010-013-002	011-00102-002	512
			OLY2010-013-003	011-00102-003	513
			OLY2010-013-004	011-00102-004	514
13-Jun-10	Adventure Cove	24-09-002	OLY2010-013-005	011-00102-005	515
			OLY2010-013-006	011-00102-006	516
			OLY2010-013-007	011-00102-007	517
			OLY2010-013-008	011-00102-008	518
			OLY2010-013-009	011-00102-009	519
			OLY2010-013-010	011-00102-010	520

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
13-Jun-10	Lemmens Inlet	24-09-006	OLY2010-014-001	011-00103-001	NA
			OLY2010-014-002	011-00103-002	NA
13-Jun-10	Tsapee Narrows[1]	24-09-006	OLY2010-015-001	NA	NA
13-Jun-10	Heelboom Bay[2]	24-10-004	OLY2010-016-001	011-00104-001	NA
			OLY2010-016-002	011-00104-002	NA
			OLY2010-016-003	011-00104-003	NA
13-Jun-10	Mosquito Harbour	24-10-002	OLY2010-017-001	011-00105-001	521
			OLY2010-017-002	011-00105-002	522
			OLY2010-017-003	011-00105-003	523
			OLY2010-017-004	011-00105-004	524
			OLY2010-017-005	011-00105-005	525
			OLY2010-017-006	011-00105-006	526
			OLY2010-017-007	011-00105-007	527
			OLY2010-017-008	011-00105-008	528
14-Jun-10	Harris Point	23-10-005	OLY2010-018-001	011-00106-001	540
			OLY2010-018-002	011-00106-002	541
			OLY2010-018-003	011-00106-003	542
			OLY2010-018-004	011-00106-004	543
			OLY2010-018-005	011-00106-005	544
			OLY2010-018-006	011-00106-006	545
			OLY2010-018-007	011-00106-007	546
			OLY2010-018-008	011-00106-008	547
			OLY2010-018-009	011-00106-009	548
14-Jun-10	Harris Point	23-10-005	OLY2010-018-010	011-00106-010	549
			OLY2010-018-011	011-00106-011	550
			OLY2010-018-012	011-00106-012	551
			OLY2010-018-013	011-00106-013	552

[1] No voucher was taken from Tsapee Narrows because no shell was found on the beach only. There is a photographic voucher of *O. lurida* live at the site because one live individual was found (Appendix Table 1).

[2] Vouchers OLY2010-016-002 and OLY2010-016-003 are both only half an *O. lurida* shell and are not a set.

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-018-014	011-00106-014	553
			OLY2010-018-015	011-00106-015	554
			OLY2010-018-016	011-00106-016	555
			OLY2010-018-017	011-00106-017	556
			OLY2010-018-018	011-00106-018	557
			OLY2010-018-019	011-00106-019	558
			OLY2010-018-020	011-00106-020	559
14-Jun-10	Cataract Bay	23-10-007	OLY2010-019-001	011-00107-001	560
			OLY2010-019-002	011-00107-002	561
			OLY2010-019-003	011-00107-003	562
			OLY2010-019-004	011-00107-004	563
			OLY2010-019-005	011-00107-005	564
			OLY2010-019-006	011-00107-006	565
			OLY2010-019-007	011-00107-007	566
			OLY2010-019-008	011-00107-008	567
			OLY2010-019-009	011-00107-009	568
			OLY2010-019-010	011-00107-010	569
15-Jun-10	Hillier Island	23-10-002	OLY2010-020-001	011-00108-001	571
			OLY2010-020-002	011-00108-002	572
			OLY2010-020-003	011-00108-003	573
			OLY2010-020-004	011-00108-004	574
			OLY2010-020-005	011-00108-005	575
			OLY2010-020-006	011-00108-006	576
			OLY2010-020-007	011-00108-007	577
			OLY2010-020-008	011-00108-008	578
			OLY2010-020-009	011-00108-009	579
			OLY2010-020-010	011-00108-010	580
			OLY2010-020-011	011-00108-011	581
			OLY2010-020-012	011-00108-012	582
			OLY2010-020-013	011-00108-013	583
			OLY2010-020-014	011-00108-014	584
			OLY2010-020-015	011-00108-015	585
			OLY2010-020-016	011-00108-016	586
			OLY2010-020-017	011-00108-017	587
			OLY2010-020-018	011-00108-018	588
			OLY2010-020-019	011-00108-019	589

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-020-020	011-00108-020	590
16-Jun-10	Walsh Island	23-08-003	OLY2010-021-001	011-00109-001	NA
16-Jun-10	Joe's Bay	23-08-002	OLY2010-022-001	011-00110-001	NA
16-Jun-10	Nettle Island	23-08-004	OLY2010-023-001	011-00111-001	NA
16-Jun-10	Hand Island	23-08-005	OLY2010-024-001	011-00112-001	NA
17-Jun-10	Useless Inlet	23-06-001	OLY2010-025-001	011-00113-001	761
			OLY2010-025-002	011-00113-002	762
			OLY2010-025-003	011-00113-003	763
			OLY2010-025-004	011-00113-004	764
			OLY2010-025-005	011-00113-005	765
			OLY2010-025-006	011-00113-006	766
			OLY2010-025-007	011-00113-007	767
			OLY2010-025-008	011-00113-008	768
			OLY2010-025-009	011-00113-009	769
			OLY2010-025-010	011-00113-010	770
			OLY2010-025-011	011-00113-011	771
			OLY2010-025-012	011-00113-012	772
			OLY2010-025-013	011-00113-013	773
			OLY2010-025-014	011-00113-014	774
			OLY2010-025-015	011-00113-015	775
			OLY2010-025-016	011-00113-016	776
			OLY2010-025-017	011-00113-017	777
			OLY2010-025-018	011-00113-018	778
			OLY2010-025-019	011-00113-019	779
13-May-10	Pipestem Inlet	23-10-004	OLY2010-001-001	011-00090-001	741
			OLY2010-001-002	011-00090-002	742
			OLY2010-001-003	011-00090-003	743
			OLY2010-001-004	011-00090-004	744
			OLY2010-001-005	011-00090-005	745
			OLY2010-001-006	011-00090-006	746
			OLY2010-001-007	011-00090-007	747
			OLY2010-001-008	011-00090-008	748
			OLY2010-001-009	011-00090-009	749
			OLY2010-001-010	011-00090-010	750
			OLY2010-001-011	011-00090-011	751

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-001-012	011-00090-012	752

3. Juan de Fuca Strait

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
12-Jul-10	Ayum Creek		OLY2010-029-001	011-00115-001	591
			OLY2010-029-002	011-00115-002	592
			OLY2010-029-003	011-00115-003	593
			OLY2010-029-004	011-00115-004	594
			OLY2010-029-005	011-00115-005	595
			OLY2010-029-006	011-00115-006	596
			OLY2010-029-007	011-00115-007	597
			OLY2010-029-008	011-00115-008	598
			OLY2010-029-009	011-00115-009	
			OLY2010-029-010	011-00115-010	600
			OLY2010-029-011	011-00115-011	601
12-Jul-10	Gorge Waterway (World Fisheries Trust Research Site)		OLY2010-030-001	011-00116-001	602
			OLY2010-030-002	011-00116-002	603
			OLY2010-030-003	011-00116-003	604
			OLY2010-030-004	011-00116-004	605
			OLY2010-030-005	011-00116-005	606
			OLY2010-030-006	011-00116-006	607
			OLY2010-030-007	011-00116-007	608
			OLY2010-030-008	011-00116-008	609
			OLY2010-030-009	011-00116-009	610
			OLY2010-30-010	011-00116-010	611
15-Jul-10	Gorge Site 9		OLY2010-032-001	011-00117-001	612
			OLY2010-032-002	011-00117-002	613
			OLY2010-032-003	011-00117-003	614
			OLY2010-032-004	011-00117-004	615
			OLY2010-032-005	011-00117-005	616
			OLY2010-032-006	011-00117-006	617
			OLY2010-032-007	011-00117-007	618
			OLY2010-032-008	011-00117-008	619
			OLY2010-032-009	011-00117-009	620

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-032-010	011-00117-010	621
			OLY2010-032-011	011-00117-011	622
			OLY2010-032-012	011-00117-012	623
			OLY2010-032-013	011-00117-013	624
			OLY2010-032-014	011-00117-014	625
			OLY2010-032-015	011-00117-015	626
			OLY2010-032-016	011-00117-016	627
			OLY2010-032-017	011-00117-017	628
			OLY2010-032-018	011-00117-018	629
			OLY2010-032-019	011-00117-019	630
			OLY2010-032-020	011-00117-020	631

4. Strait of Georgia

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
9-Jul-10	Heriot Island	13-13-002	OLY2010-026-001	011-00114-001	701
			OLY2010-026-002	011-00114-002	702
			OLY2010-026-003	011-00114-003	703
			OLY2010-026-004	011-00114-004	704
			OLY2010-026-005	011-00114-005	705
			OLY2010-026-006	011-00114-006	706
			OLY2010-026-007	011-00114-007	707
			OLY2010-026-008	011-00114-008	708
			OLY2010-026-009	011-00114-009	709
			OLY2010-026-010	011-00114-010	710
			OLY2010-026-011	011-00114-011	711
			OLY2010-026-012	011-00114-012	712
20-Aug-10	Ladysmith Harbour		OLY2010-033-001	011-00118-001	781
			OLY2010-033-002	011-00118-002	782
			OLY2010-033-003	011-00118-003	783
			OLY2010-033-004	011-00118-004	784
			OLY2010-033-005	011-00118-005	785
			OLY2010-033-006	011-00118-006	786
			OLY2010-033-007	011-00118-007	787
			OLY2010-033-008	011-00118-008	788
			OLY2010-033-009	011-00118-009	789

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-033-010	011-00118-010	790
			OLY2010-033-011	011-00118-011	791
			OLY2010-033-012	011-00118-012	792
			OLY2010-033-013	011-00118-013	793
			OLY2010-033-014	011-00118-014	794
			OLY2010-033-015	011-00118-015	795
			OLY2010-033-016	011-00118-016	796
			OLY2010-033-017	011-00118-017	797
			OLY2010-033-018	011-00118-018	798
			OLY2010-033-019	011-00118-019	799
			OLY2010-033-020	011-00118-020	800
			OLY2010-033-021	011-00118-021	753
			OLY2010-033-022	011-00118-022	754
			OLY2010-033-023	011-00118-023	755
			OLY2010-033-024	011-00118-024	756
			OLY2010-033-025	011-00118-025	757
			OLY2010-033-026	011-00118-026	758
			OLY2010-033-027	011-00118-027	759
5-Oct-10	Swy-a-Lana Lagoon		OLY2010-034-001	011-00119-001	721
			OLY2010-034-002	011-00119-002	722
			OLY2010-034-003	011-00119-003	723
			OLY2010-034-004	011-00119-004	724
			OLY2010-034-005	011-00119-005	725
			OLY2010-034-006	011-00119-006	726
			OLY2010-034-007	011-00119-007	727
			OLY2010-034-008	011-00119-008	728
			OLY2010-034-009	011-00119-009	729
			OLY2010-034-010	011-00119-010	730
			OLY2010-034-011	011-00119-011	731
			OLY2010-034-012	011-00119-012	732
			OLY2010-034-013	011-00119-013	733
			OLY2010-034-014	011-00119-014	734
			OLY2010-034-015	011-00119-015	735
			OLY2010-034-016	011-00119-016	736
			OLY2010-034-017	011-00119-017	737
			OLY2010-034-018	011-00119-018	738
			OLY2010-034-019	011-00119-019	739

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY2010-034-020	011-00119-020	740

5. Central Coast

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
12-Sep-10	Gale Pass		OLY2010-036-001	011-00120-001	NA
			OLY2010-037-001	011-00121-001	NA
12-Sep-10	Raymond Pass		OLY2010-038-001	011-00122-001	NA
			OLY2010-038-002	011-00122-002	NA
12-Sep-10	Bachelor Bay		OLY2010-039-001	011-00123-001	NA
01-Jun-11	Boswell Inlet 2	10-06-002	OLY 2011 001-001	011-00176-001	801
			OLY 2011 001-002	011-00176-002	802
			OLY 2011 001-003	011-00176-003	803
			OLY 2011 001-004	011-00176-004	804
			OLY 2011 001-005	011-00176-005	805
			OLY 2011 001-006	011-00176-006	806
			OLY 2011 001-007	011-00176-007	807
			OLY 2011 001-008	011-00176-008	808
			OLY 2011 001-009	011-00176-009	809
			OLY 2011 001-010	011-00176-010	810
			OLY 2011 001-011	011-00176-011	811
			OLY 2011 001-012	011-00176-012	812
			OLY 2011 001-013	011-00176-013	813
			OLY 2011 001-014	011-00176-014	814
			OLY 2011 001-015	011-00176-015	815
			OLY 2011 001-016	011-00176-016	816
			OLY 2011 001-017	011-00176-017	817
			OLY 2011 001-018	011-00176-018	818
			OLY 2011 001-019	011-00176-019	819
			OLY 2011 001-020	011-00176-020	820
			OLY 2011 001-021	011-00176-021	821

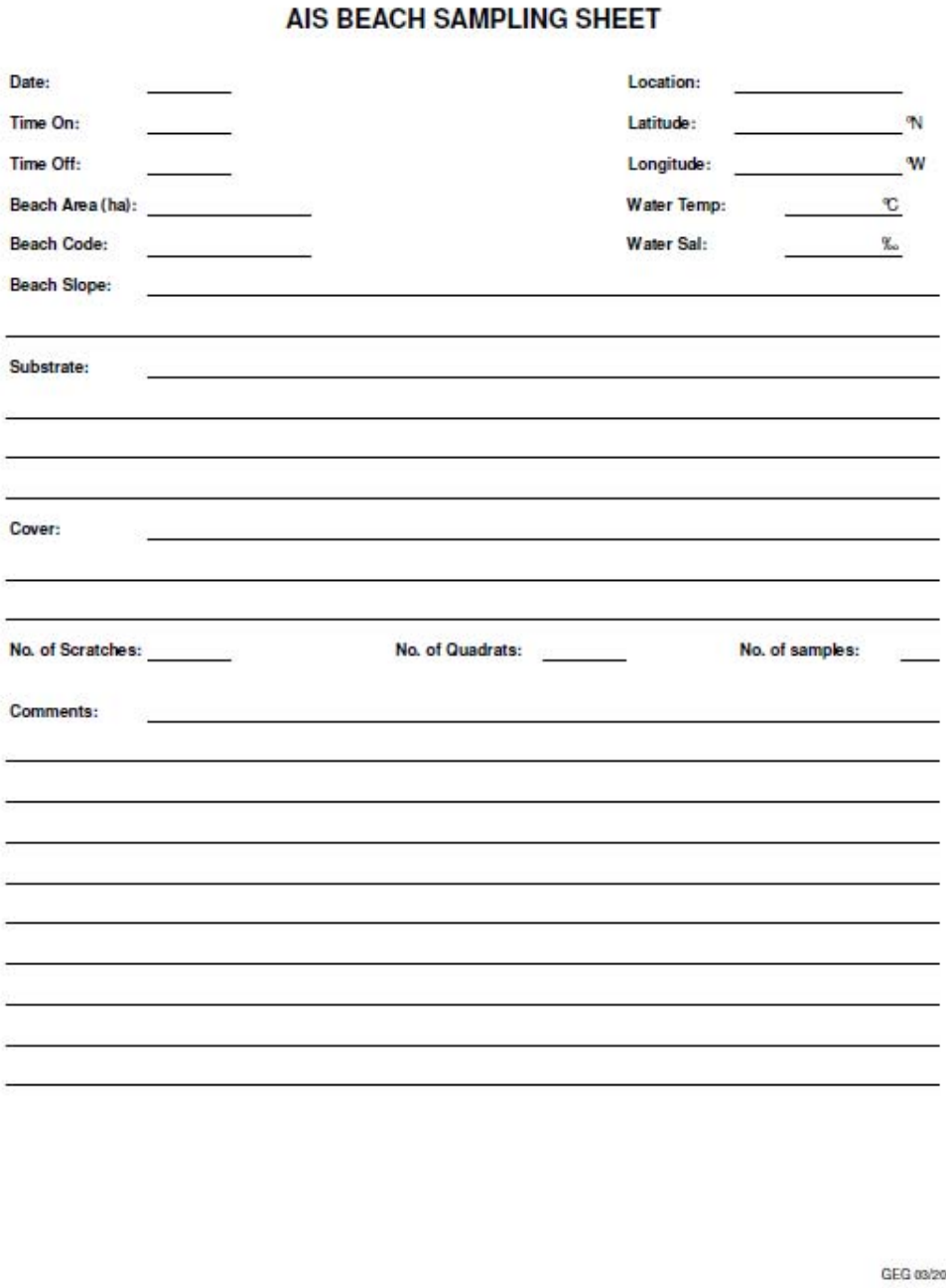
Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY 2011 001-022	011-00176-022	822
			OLY 2011 001-023	011-00176-023	823
			OLY 2011 001-024	011-00176-024	824
			OLY 2011 001-025	011-00176-025	825
01-Jun-11	Boswell Inlet 1	10-06-001	OLY 2011 002-001	011-00177-001	826
			OLY 2011 002-002	011-00177-002	827
			OLY 2011 002-003	011-00177-003	828
			OLY 2011 002-004	011-00177-004	829
			OLY 2011 002-005	011-00177-005	830
			OLY 2011 002-006	011-00177-006	831
			OLY 2011 002-007	011-00177-007	832
			OLY 2011 002-008	011-00177-008	833
			OLY 2011 002-009	011-00177-009	834
			OLY 2011 002-010	011-00177-010	835
04-Jun-11	Oyster Bay	09-12-007	OLY 2011 003-001	011-00191-001	836
			OLY 2011 003-002	011-00191-002	837
			OLY 2011 003-003	011-00191-003	838
			OLY 2011 003-004	011-00191-004	839
			OLY 2011 003-005	011-00191-005	840
			OLY 2011 003-006	011-00191-006	841
			OLY 2011 003-007	011-00191-007	842
			OLY 2011 003-008	011-00191-008	843
			OLY 2011 003-009	011-00191-009	844
			OLY 2011 003-010	011-00191-010	845
			OLY 2011 003-011	011-00191-011	846
			OLY 2011 003-012	011-00191-012	847
			OLY 2011 003-013	011-00191-013	848
			OLY 2011 003-014	011-00191-014	849
			OLY 2011 003-015	011-00191-015	850
			OLY 2011 003-016	011-00191-016	851
			OLY 2011 003-017	011-00191-017	852
			OLY 2011 003-018	011-00191-018	853
05-Jun-11	Watt Bay (upper)	07-28-003	OLY 2011 004-001	011-00196-001	854
			OLY 2011 004-002	011-00196-002	855
			OLY 2011 004-003	011-00196-003	856

Date	Beach Name	Beach Code	Voucher Number	RBCM Number	DNA Vial
			OLY 2011 004-004	011-00196-004	857
			OLY 2011 004-005	011-00196-005	858
			OLY 2011 004-006	011-00196-006	859
			OLY 2011 004-007	011-00196-007	860
			OLY 2011 004-008	011-00196-008	861
			OLY 2011 004-009	011-00196-009	862
			OLY 2011 004-010	011-00196-010	863
			OLY 2011 004-011	011-00196-011	864
			OLY 2011 004-012	011-00196-012	865
			OLY 2011 004-013	011-00196-013	866
			OLY 2011 004-014	011-00196-014	867
			OLY 2011 004-015	011-00196-015	868
			OLY 2011 004-016	011-00196-016	869
			OLY 2011 004-017	011-00196-017	870
			OLY 2011 004-018	011-00196-018	871

6. Haida Gwaii

None collected

Figure A 1. Field data sheet (front) used during exploratory Olympia oyster (*Ostrea lurida*) surveys in British Columbia in 2010 and 2011.



AIS BEACH SAMPLING SHEET

Date: _____ Location: _____

Time On: _____ Latitude: _____ °N

Time Off: _____ Longitude: _____ °W

Beach Area (ha): _____ Water Temp: _____ °C

Beach Code: _____ Water Sal: _____ ‰

Beach Slope: _____

Substrate: _____

Cover: _____

No. of Scratches: _____ No. of Quadrats: _____ No. of samples: ____

Comments: _____

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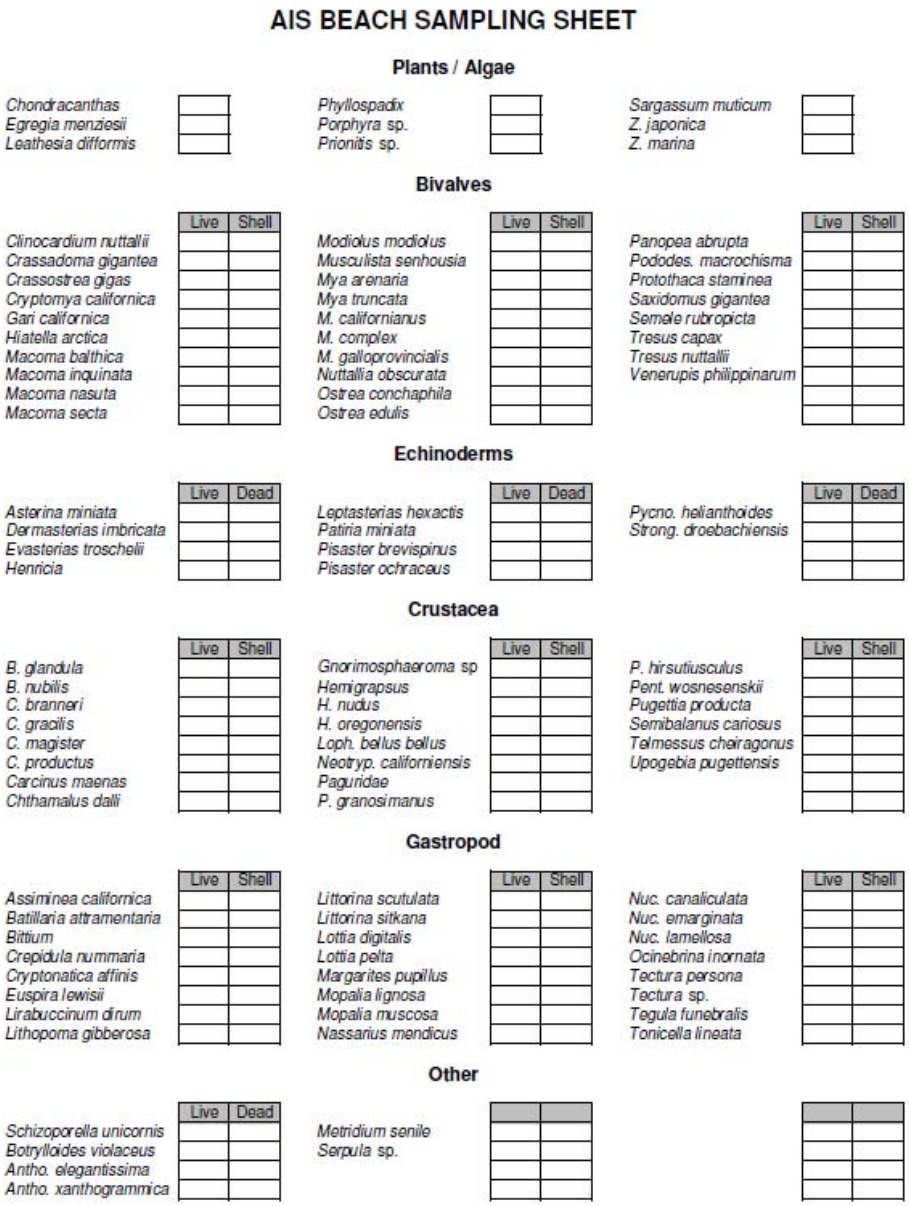
Figure A 2. Field data sheet (back) used during exploratory Olympia oyster (*Ostrea lurida*) surveys in British Columbia in 2010 and 2011.



AIS BEACH SAMPLING SHEET

Plants / Algae

Chondracanthas		*Phyllospadix*		*Sargassum muticum*	
Egregia menziesii		*Porphyra sp.*		*Z. japonica*	
Leathesia difformis		*Prionitis sp.*		*Z. marina*	

Bivalves

	Live	Shell		Live	Shell		Live	Shell
Clinocardium nuttallii			*Modiolus modiolus*			*Panopea abrupta*		
Crassadoma gigantea			*Musculista senhousia*			*Pododes. macrochisma*		
Crassostrea gigas			*Mya arenaria*			*Protothaca staminea*		
Cryptomya californica			*Mya truncata*			*Saxidomus gigantea*		
Gari californica			*M. californianus*			*Semele rubropicta*		
Hiatella arctica			*M. complex*			*Tresus capax*		
Macoma balthica			*M. galloprovincialis*			*Tresus nuttallii*		
Macoma inquinata			*Nuttallia obscurata*			*Venerupis philippinarum*		
Macoma nasuta			*Ostrea conchaphila*					
Macoma secta			*Ostrea edulis*					

Echinoderms

	Live	Dead		Live	Dead		Live	Dead
Asterina miniata			*Leptasterias hexactis*			*Pycno. helianthoides*		
Dermasterias imbricata			*Patiria miniata*			*Strong. droebachiensis*		
Evasterias troschelii			*Pisaster brevispinus*					
Henricia			*Pisaster ochraceus*					

Crustacea

	Live	Shell		Live	Shell		Live	Shell
B. glandula			*Gnorimosphaeroma sp*			*P. hirsutiusculus*		
B. nubilis			*Hemigrapsus*			*Pent. wosnesenskii*		
C. branneri			*H. nudus*			*Pugettia producta*		
C. gracilis			*H. oregonensis*			*Semibalanus cariosus*		
C. magister			*Loph. bellus bellus*			*Telmessus cheiragonus*		
C. productus			*Neotryp. californiensis*			*Upogebia pugettensis*		
Carcinus maenas			*Paguridae*					
Chthamalus dalli			*P. granosimanus*					

Gastropod

	Live	Shell		Live	Shell		Live	Shell
Assiminea californica			*Littorina scutulata*			*Nuc. canaliculata*		
Batillaria attramentaria			*Littorina sitkana*			*Nuc. emarginata*		
Bittium			*Lottia digitalis*			*Nuc. lamellosa*		
Crepidula nummaria			*Lottia pelta*			*Ocinebrina inornata*		
Cryptonatica affinis			*Margarites pupillus*			*Tectura persona*		
Euspira lewisii			*Mopalia lignosa*			*Tectura sp.*		
Lirabuccinum dirum			*Mopalia muscosa*			*Tegula funebralis*		
Lithopoma gibberosa			*Nassarius mendicus*			*Tonicella lineata*		

Other

	Live	Dead						
Schizoporella unicornis			*Metridium senile*					
Botrylloides violaceus			*Serpula sp.*					
Antho. elegantissima								
Antho. xanthogrammica								