Epifaunal Diversity on Dockside Surface Perimeters in Burrard Inlet and Fraser River Delta, British Columbia, Canada

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EPIFAUNAL DIVERSITY ON DOCKSIDE SURFACE PERIMETERS IN BURRARD INLET AND FRASER RIVER DELTA, BRITISH COLUMBIA, CANADA

By

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ABSTRACT

Sutherland, T.F., Mak, M.S.Y., Galvao, M.A., Sterling, A.M., O'Brien, C.S.B., Hoyle, M.A., Lindsay, C., Mortimor, J., and Covert, P.A. 2022. Epifaunal Diversity on Dockside Surface Perimeters in Burrard Inlet and Fraser River Delta, British Columbia, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3508: xv + 83 p.

Epifauna diversity was examined along surface perimeters of floating docks in Burrard Inlet and Fraser River Delta in southwestern British Columbia. Diversity estimates were obtained from video surveys collected over three depth-intervals: 1) Splash zone (SZ): depth-interval directly 15-cm above air-water interface; 2) Subsurface zone (SSZ): depth-interval (0-21 cm) below air-water interface; and 3) Deep-water zone (DZ): depth-interval below the SSZ (21-41 cm). Dock substrate consisted of combinations of wood, concrete, tires, plastic-floats, and metal, while epifauna and epiflora included anemones, tunicates, sponge, tube-worms, sea stars, bivalves, crabs, nudibranchs, urchins, barnacles, limpets, chitons, isopods, macroalgae and seagrass. Mussels ranged between 46% and 95% coverage across docks (median: 93%), while frequency of occurrence ranged between 85% and 100% (median: 99%), providing a biological-based substrate for other epifauna. The splash-zone consisted of outcropped mussels, encroached macroalgae from the waterline, and invertebrates above the waterline (limpets, chiton). If present, *Ulva* spp. typically formed a consistent narrow band (2-3 cm) above the waterline across all docks. Benthic (pipefish, sculpin) and pelagic (perch) fish were associated with epifaunal coverage and pelagic (open-water medium) settings. The Coast Guard Sea Island dock may experience episodic low-salinity intrusions supporting marine organisms at this site (ochre star, sculpin, limpet).

RÉSUMÉ

Sutherland, T.F., Mak, M.S.Y., Galvao, M.A., Sterling, A.M., O'Brien, C.S.B., Hoyle, M.A., Lindsay, C., Mortimor, J., and Covert, P.A. 2022. Epifaunal Diversity on Dockside Surface Perimeters in Burrard Inlet and Fraser River Delta, British Columbia, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3508: xv + 83 p.

On a examiné la diversité de l'épifaune sur les pourtours de quais flottants dans l'inlet Burrard et le delta du fleuve Fraser, dans le sud-ouest de la Colombie-Britannique. Les estimations de la diversité ont été dérivées de relevés vidéo effectués à trois intervalles de profondeur : 1) la zone d'éclaboussement, située directement au-dessus de l'interface air-eau (entre 0 et 15 cm); 2) la zone de subsurface, située directement sous l'interface air-eau (entre 0 et 21 cm); 3) la zone d'eau profonde, située directement sous la zone de subsurface (entre 21 et 41 cm). Le substrat des quais consistait en diverses combinaisons de bois, de béton, de pneus, de flotteurs en plastique et de métal, tandis que l'épifaune et l'épiflore comprenaient des anémones, des tuniciers, des éponges, des vers tubulaires, des étoiles de mer, des bivalves, des crabes, des nudibranches, des oursins, des anatifes, des patelles, des chitons, des isopodes, des macroalgues et des herbes marines. Des moules couvraient entre 46 et 95 % (médiane : 93 %) des pourtours des quais, tandis que leur fréquence d'occurrence se chiffrait entre 85 et 100 % (médiane : 99 %), fournissant un substrat biologique à d'autres organismes épifauniques. La zone d'éclaboussement comprenait des affleurements de moules, des empiétements de macroalgues à partir de la ligne de flottaison et des invertébrés (patelles, chitons) au-dessus de la ligne de flottaison. Lorsqu'elles étaient présentes, les *Ulva* spp. formaient généralement une bande étroite constante de deux ou trois centimètres au-dessus de la ligne de flottaison sur toute la longueur des quais. Des poissons benthiques (syngnathes, chabots) et pélagiques (perche) étaient associés à des substrats couverts d'organismes épifauniques (p. ex., moules) et des milieux pélagiques (eaux libres). Le quai de la base de Sea Island de la Garde côtière peut être épisodiquement soumis à des conditions de faible salinité pouvant soutenir des organismes marins (étoile ocrée, chabots, patelles).

1.0 INTRODUCTION

The Oceans Protection Plan (OPP) is designed to keep Canadian coastlines safe and clean for future generations. The Canadian government partners with Indigenous and coastal communities to provide confidence that commercial shipping is taking place in way that protects and sustains the economic, environmental, social, and cultural health of our oceans and coastline. In order to preserve and restore marine ecosystems, a coastal environmental baseline and cumulative effects program has been developed. BC's coastline has 2 of the 6 high-use areas across Canada's three coasts. These areas of interest have baseline survey plans that include monitoring protocols and environmental indicators that will help confirm status quo and detect changes in the ecosystem in the event of an oil spill in the future.

The faunal communities that are the most susceptible to oil spills are those associated with 1) intertidal and shallow-subtidal (0-30m; Page et al. 1996) environments as well as 2) shoreline installation settings. For example, low-density oil that floats on the seawater surface, provides a direct contact and consequent impact on intertidal zones (infaunal, rocky epifauna) as well as floating docks (structural epifauna (plumose anemones)). Alternately, a shallow subtidal community may be impacted 1) directly based on the oil thickness and seabed slope, and/or 2) indirectly through the scavenging of flocculated plankton (marine snow) by oil-contaminated water and subsequent deposition (Passow et al. 2012).

The objective of this study is to examine the diversity and distribution of both epifauna and macroalgae existing along dock perimeters in Burrard Inlet (BI) and the Fraser River Delta (FRD), British Columbia (BC), Canada. This subtidal baseline survey was recently proposed to augment both the existing BI intertidal and subtidal component of the Coastal Ecosystem Baseline Project (CEBP) for the 2020-2021 fiscal year.

2.0 STUDY SITE

Burrard Inlet is adjoined to the Strait of Georgia (SoG), which is bordered by BC mainland and Vancouver Island in the southwestern region of BC (Figure 1). A bearing between Point Gray (southshore) and Point Atkinson (northshore) marks the connection line between BI and the southeastern coast of the SoG. BI is oriented in an east-west direction with a length of 37 km and a width ranging between 0.5 – 4 km. BI is a sheltered fjord divided into 3 harbours (outer, central, and inner) that are divided by two land constrictions (first and second narrows) associated with shallow seabed sills. The Central and Inner Harbour basins are both approximately 65 m deep, with the connecting sills, shallowing to 15 m (First Narrows) and 19 m (Second Narrows), respectively. The combination of land constrictions and shallow sills, influences local hydrodynamic regimes, where currents at these junctures can reach up to 2 ms^{-1} during large tides (Thompson, 1981; Stacey et al. 2002).

According to Pickard (1961), BI experiences a two-layer estuarine circulation where freshwater input drives the surface flow towards the fjord entrance and entrains the deeper saline waters in the opposite direction. Typically the near-surface water is a thin brackish layer overlaying the deeper, more saline water which makes up 90% of the water column. The Capilano, Seymour, and Indian rivers are the main freshwater sources within BI and contribute significantly to

estuarine circulation. In addition, the Fraser River's seasonal high-flows (May-June), consisting of a snowmelt-driven freshet plume (uppermost 2-3m; 4 - 9 psu), extend into the SoG, wraps around Point Gray, and influences water-column salinity and stratification in the Outer Harbour of BI (Thomson, 1981). The seasonal surface temperature and salinity ranges in the SoG are greatest at the mouth of the Fraser River, with temperature ranging between 6 – 20 °C and salinity ranging from 17 – 30 psu. In general, the surface salinity in BI is usually > 18 psu, however when the Fraser River freshet enters BI, its salinity drops to levels greater than and equal to 9 psu (Thomsen, 1981). Freshwater inputs near the Second Narrows includes the Seymour River and Lynn Creek, which provide a mean annual discharge of 16 and 6 m^3 s^{-1}, respectively. In addition, the Capilano River, which connects to the First Narrows, has a mean annual discharge of 20 m^3 s^{-1}.

Both Indian Arm and Port Moody Arm extend from the eastern termination of BI's Inner Harbour. Indian Arm runs in a north-south orientation with a length of 20 km, a width of 2 km, and a maximum depth of 220 m. Indian Arm is separated from the BI Inner Harbour by a sill with a height of 29 m above the seabed. Freshwater runoff in Indian Arm is supplied from various sources: 1) Indian River runoff (low mean annual discharge of 12 m^3s^{-1}); 2) peripheral streams and rainfall (7m^3 s^{-1}); and 3) Buntzen power plant discharges (23 m^3s^{-1}) (Dunbar, 1985). Port Moody Arm runs in a northwest-southeast orientation with a length of 6.5km, width of 0.9km, and a maximum depth of 8.8 m. False Creek, which is located on the south shoreline of BI Outer Harbour, has a 3 km length, a width varying between 100 – 400 m, and a mean depth of 5 m. Since the video surveys of the floating dock perimeters were collected at the dock surface, the observed epifauna and epiflora would be exposed to brackish conditions of the surface water.

In general, the BI coastline is diverse with both natural and man-made beaches. The inner and central shoreline may consist of either rocky substrate, industrial facilities or seawalls. Extensive tidal flats can be found on the southern Outer Harbour, Maplewood Flats and Port Moody Inlet. The tidal amplitude is approximately 4 metres.

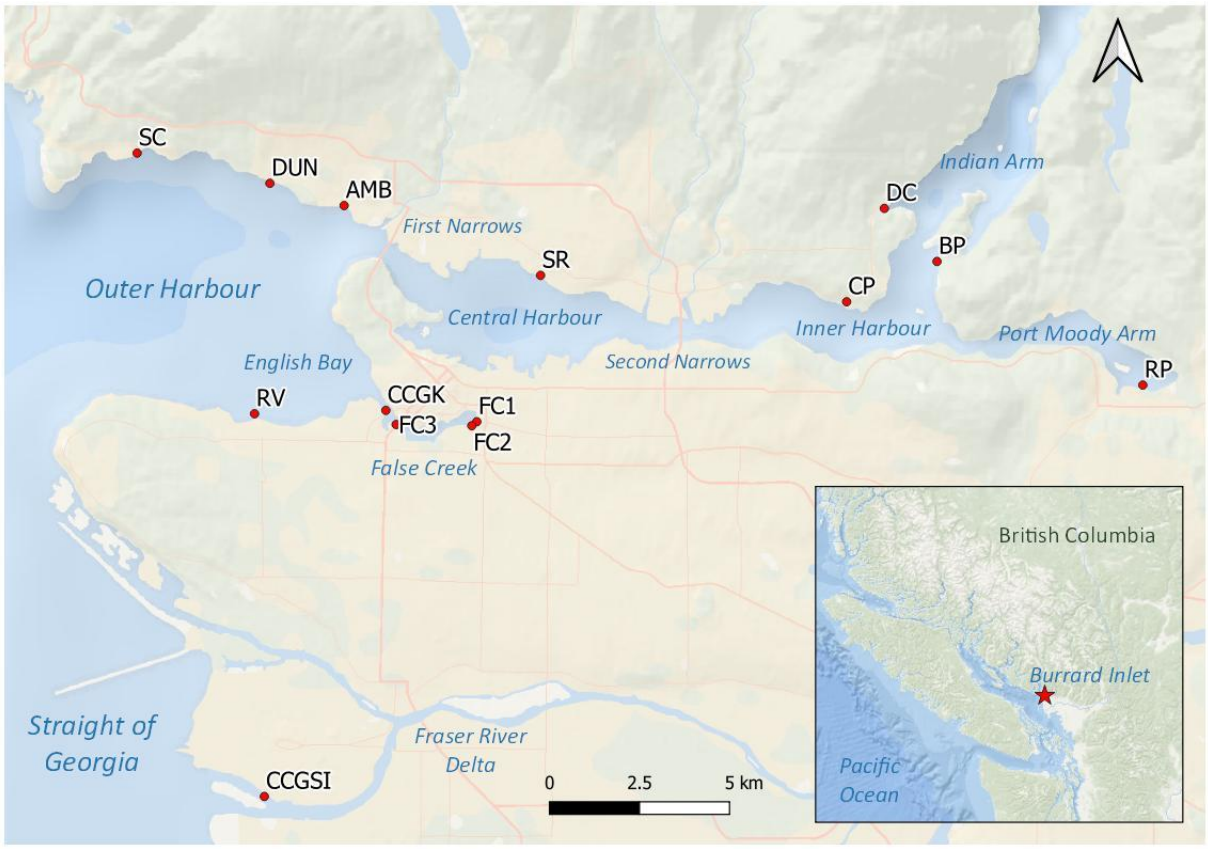

Figure 1: Location of surveyed docks in Burrard Inlet and Fraser River Delta in British Columbia, Canada.

3.0. METHODS

Dock selection: The surveyed docks were chosen based on the following conditions: 1) accessibility from land (federal or public access); and 2) non-private, recreational status (with the exception of the private RV dock). Alternately, recreational and residential docks used for mooring boats for private use were not considered; and 3) unobstructed dock perimeters to support continuous video-filming during a camera deployment along an individual transect. The surveyed docks outlined in Figure 1 are located in waterways that connect with the SoG adjacent to the mainland of southwestern BC (Figure 1). More specifically, the following docks were surveyed in BI: Sandy Cove (SC); Dundarave (DUN); Ambleside (AMB); Royal Vancouver Yacht Club (RV); St. Roch (SR); Cates Park (CP); Canadian Coast Guard Kitsilano (CGK); False Creek#3 (FC#3); False Creek#2 (FC#2); False Creek#1 (FC#1); Belcarra Park (BP); Deep Cove (DC); Rocky Point (RP); and Fraser River Delta: Canadian Coast Guard Sea Island (CCGSI) (Figure 1).

Video surveys of dockside substrate and epifauna: Video was collected along dock perimeters using a GoPro HERO8 video camera attached to a GoPole system for deployment. These video surveys were collected at 3 depth-intervals which spanned the air-water interface (0m): 1) Splash zone (SZ): depth-interval directly above the air-water interface (0 m to + 0.15 m); 2) Subsurface zone (SSZ): depth-interval directly below the air-water interface (0 m to - 0.21 m); and 3) Deepwater zone (DZ): depth-interval (-0.21 m to -0.41 m) directly below the lower border

of the SSZ depth-interval. Each video was collected as a continuous transect at a camera fly-speed of approximately 0.2 ms^{-1}. The video fly-speed was derived based on the start and finish survey times along with the survey length.

Video analyses for substrate and epifauna estimates: Each video survey transect was divided into a series of 0.5 m length-segments to provide both areal coverage (%) and/or abundance (No. m^{-2}) estimates of substrate or epifauna for each survey segment. A similar strategy was used for seabed-epifauna video surveys according to Sutherland *et al.* (2018, 2019). Substrate categories included an open-water medium that occurred as gaps between plastic-covered floatation blocks attached to a dock.

Graphical presentation: Observed areas of dock substrate and aggregate epifauna (e.g. mussels, barnacles) were documented as an areal proportion estimate, while individual epifauna were documented as counts per area (abundance) for each video segment. The presence and absence of epifauna are identified for each of the 3 depth-interval surveys at each dock (Table 1). The percent proportion of each substrate or aggregate epifaunal category for each dock are presented in pie-charts (Excel, 2022), while the proportional estimates are summarized in data tables. The abundance estimates of individual epifauna that relies on individual count data are presented in tables and depth-profile graphs within each dock section where appropriate (Sigmaplot 12^{TM}).

4.0 RESULTS

4.1 PRESENCE AND ABSENCE OF EPIFAUNA AND SUBSTRATE AT DOCK SITES

In general, mussels, *Ulva* spp., and other macroalgae spp. were present at each of the 13 marine docks surveyed. Other predominant taxa, such as, barnacles, limpets, and structural white-branching epifauna (SWB) fell within the 70 - 90% frequency range of occurrence across 10 – 11 docks. Encrusted macroalgae, *Fucus spp*., ochre sea star, kelp, blade macroalgae, plumose anemone, other anemones, feather duster worm, calcareous tube worms, chitons, and solitary and colonial tunicates were present at 2 – 4 docks (15 – 46%). Taxa that were considered to have a rare occurrence at a single dock consisted of sponge, crab, eelgrass (seagrass), painted anemone, green urchin, kelp isopod, branched macroalgae, leather sea star, other sea stars, opalescent nudibranch and bristly tunicate. In terms of epifauna and algal diversity, Belcarra Park, St. Roch, and Cates Park harboured 61-68% (17 – 19 taxa) of the 28 taxa observed in this study in the BI system. Epifauna and algal diversity on the remaining docks are as follows in a descending order: DUN (36%); RP, SC, AMB, FC3, FC2 (25%); RV, DC, (21%), FC1 (18%), CGK (14%). These trends may depend on the following: dock cleanup, grounding on seabed, substrate type, or other parameters.

Table 1: Presence or absence of both epifauna and algae taxa combined across three video depth-interval surveys at each of 13 docks in BI, British Columbia. Checkmark = present; No checkmark = absent; Blue = aggregate epifauna; Green = algae; Gray = solitary epifauna; SR = St. Roch; BP = Belcarra Park; CP = Cates Park; DUN = Dundarave; RP = Rocky Point; FC1 = False Creek #1; SC = Sandy Cove; AMB = Ambleside; FC3 = False Creek #3; FC2 = False Creek #2; RV = Royal Vancouver Yacht Club; DC = Deep Cove; CGK = Canadian Coast Guard Kitsilano; Freq = frequency, SWB = Structural white branching; WTT = White tuft tube-dwelling.

TAXA	DOCK													Freq
	SR	BP	CP	DUN	RP	FC1	SC	AMB	FC3	FC2	RV	DC	CGK	%
Mussel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Ulva spp.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Unidentified macroalgae	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
SWB epifauna	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	85
Barnacle	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		85
Limpet	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		77
Encrusted macroalgae	✓		✓	✓				✓	✓	✓				46
Fucus spp.		✓	✓	✓				✓						31
Ochre star	✓	✓	✓				✓							31
Kelp	✓	✓	✓				✓							31
Colonial tunicates	✓	✓	✓		✓									31
Blade macroalgae	✓		✓	✓										23
Unidentified anemone	✓	✓	✓											23
Plumose anemone		✓	✓		✓									23
Calcareous tube worm	✓	✓	✓											23
Feather duster worm	✓	✓	✓											23
Chiton	✓	✓	✓											23
Solitary tunicates					✓	✓								15
WTT worm or anemone					✓									8
Crab				✓										8
Seagrass			✓											8
Leather star		✓												8
Unidentified sea star		✓												8
Opalescent nudibranch		✓												8
Bristly tunicate		✓												8
Painted anemone	✓													8
Green urchin	✓													8
Kelp isopod	✓													8
Branched macroalgae	✓													8
Encrusting sponges	✓													8
Total number of taxa	20	19	18	11	9	5	7	7	7	7	6	6	4	
Freq of total taxa (%)	67	63	60	37	30	17	23	23	23	23	20	20	13	

Table 2: Presence or absence of both epifauna and alga taxa surveyed at 3 individual video depth-intervals at each of 13 docks in BI, BC. Checkmark = present; No checkmark = absent; Yellow = Depth-1 interval (0 + 0.15 m) ; Gray = Depth-2 (0 – 0.18 m) interval; Rose = Depth-3 interval (-0.18 to -0.36 m); SR = St. Roch; BP = Belcarra Park; CP = Cates Park; DUN = Dundarave; RP = Rocky Point; FC1 = False Creek #1; SC = Sandy Cove; RV = Royal Van Yacht Club; FC2 = False Creek #2; FC3 = False Creek #3; AMB = Ambleside; DC = Deep Cove; CGK = Canadian Coast Guard Kitsilano; SWB = Structural white branching; WTT = White tuft tube.

TAXA	DOCK NAME AND DEPTH INTERVAL (1, 2, 3)																																						
	SR			BP			CP			DUN			RP			FC1			SC			RV			FC2			FC3			AMB			DC			CGK		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Mussel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ulva spp.	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓		✓	✓	
Unidentified macroalgae	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
SWB epifauna		✓	✓		✓	✓		✓	✓			✓		✓	✓								✓	✓		✓	✓		✓	✓		✓			✓	✓		✓	
Barnacle		✓	✓	✓	✓	✓	✓		✓		✓		✓						✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓						
Limpet	✓	✓	✓	✓			✓	✓	✓	✓	✓					✓			✓			✓			✓			✓						✓					
Fucus spp.					✓	✓		✓	✓		✓	✓							✓	✓	✓										✓								
Encrusted macroalgae	✓						✓			✓	✓														✓			✓			✓								
Ochre star			✓		✓	✓		✓	✓											✓	✓																		
Kelp		✓	✓		✓	✓		✓	✓											✓	✓																		
Colonial tunicates		✓			✓	✓		✓						✓	✓																								
Blade macroalgae	✓						✓				✓																												
Plumose anemone					✓	✓		✓	✓					✓	✓																								
Chiton		✓	✓	✓	✓	✓			✓																														
Unidentified anemone		✓	✓		✓			✓																															
Calcareous tube worm		✓			✓	✓		✓	✓																														
Feather duster worm		✓	✓		✓	✓		✓	✓																														
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Green urchin		✓	✓																																				
Kelp isopod		✓																																					
Total number of taxa	7	16	14	5	17	14	7	14	14	5	8	6	3	6	6	3	3	2	6	7	7	4	4	4	4	5	5	5	4	4	5	5	3	4	5	4	2	4	2
Frequency of taxa (%)	23	53	47	17	57	47	23	47	47	17	27	20	10	20	20	10	10	7	20	23	23	13	13	13	13	17	17	17	13	13	17	17	10	13	17	13	7	13	7

Table 3: Presence or absence of epifauna and fish taxa combined across 3 video depth-interval surveys at each of 13 docks in BI, BC. Checkmark = present; No checkmark = absent; Blue = aggregate epifauna; Gray = individual epifauna; Purple = fish; SR = St. Roch; BP = Belcarra Park; RP = Rocky Point; DUN = Dundarave; FC1 = False Creek #1; CP = Cates Park; SC = Sandy Cove; RV = Royal Vancouver Yacht Club; FC3 = False Creek #3; DC = Deep Cove; FC2 = False Creek #2; AMB = Ambleside; CGK = Canadian Coast Guard Kitsilano; Freq = Frequency; SWB = Structural white branching; WTT = White tuft tube-dwelling.

TAXA	DOCK													Freq
	SR	BP	RP	DUN	FC1	CP	SC	RV	FC3	DC	FC2	AMB	CGK	%
Mussel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
SWB epifauna	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	85
Barnacle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		85
Limpet	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			77
Ochre star	✓	✓				✓	✓							31
Colonial tunicates	✓	✓	✓			✓								31
Unidentified anemone	✓	✓				✓								23
Plumose anemone		✓	✓			✓								23
Calcareous tube worm	✓	✓				✓								23
Feather duster worn	✓	✓				✓								23
Chiton	✓	✓				✓								23
Solitary tunicates			✓		✓									15
WTT worm or anemone			✓											8
Crab				✓										8
Leather sea star		✓												8
Unidentified sea star		✓												8
Opalescent nudibranch		✓												8
Bristly tunicate		✓												8
Painted anemone	✓													8
Green urchin	✓													8
Kelp isopod	✓													8
Encrusting sponge	✓													8
Total number of taxa	14	15	7	5	3	11	4	4	4	4	4	3	2	
Freq of total taxa (%)	64	68	32	23	14	50	18	18	18	18	18	14	9	
Perch		✓		✓		✓	✓							31
Pipefish			✓						✓				✓	23
Unidentified fish							✓	✓						15
Total number of taxa	0	1	1	1	0	1	2	1	1	0	0	0	1	

Table 4: Presence or absence of algae taxa combined across three video depth-interval surveys at each of 13 docks in BI, BC. Checkmark = present; No checkmark = absent; CP = Cates Park; SR = St. Roch; DUN = Dundarave; BP = Belcarra Park; AMB = Ambleside; SC = Sandy Cove; FC2 = False Creek #2; FC3 = False Creek #3; RV = Royal Van Yacht Club; DC = Deep Cove; CGK = Canadian Coast Guard Kitsilano; RP = Rocky Point; FC1 = False Creek #1; Freq = Frequency.

TAXA	DOCK													Freq
	CP	SR	DUN	BP	AMB	SC	FC2	FC3	RV	DC	CGK	RP	FC1	%
Ulva spp.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Unidentified macroalga	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Encrusted macroalgae	✓	✓	✓		✓		✓	✓						46
Kelp	✓	✓		✓		✓								31
Fucus spp.	✓		✓	✓	✓									31
Blade macroalgae	✓	✓	✓											23
Branched macroalgae		✓												8
Seagrass	✓													8
Total number of taxa	7	6	5	4	4	3	3	3	2	2	2	2	2	
Freq of total taxa (%)	88	75	63	50	50	38	38	38	25	25	25	25	25	

4.2 EPIFAUNA DIVERSITY ASSOCIATED WITH THE SURFACE PERIMETER OF FLOATING DOCKS

Each section below provides a summary of the following attributes characterizing each dock setting:

- Location within Burrard Inlet (Harbours, False Creek, Indian Arm, and Port Moody) and Fraser Delta.
- Top-down view of schematic diagram of dock dimensions.
- Relative percentage of epifaunal and/or substrate coverage.
- Vertical profile of epifaunal abundance according to three video-survey depth-intervals
- Epifaunal and fish abundance according to three video-survey depth-interval
- Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals.

4.2.1 SANDY COVE DOCK

4.2.1.1 Sandy Cove dock abstract

- The Sandy Cove (SC) dock is comprised of 4 types of substrate and medium: tire, wood, concrete, and open-water: 1) tires are mounted on the dockside perimeter of the wood-substrate at certain locations along the depth-interval #1 (SZ); 2) Concrete serves as a substrate for a small area (Transect 1, Segment 10) in the Splash zone (Depth-interval-1); and 3) dock-structure gaps support open-water medium.
- Epifauna and epifloral, associated with a combined richness value (9), were estimated as 1) percent coverage (mussels, barnacles, macroalgae) and 2) abundance recorded as No. m^{-2} (limpets, sea stars, and fish).
- The top 5 epifauna/substrate associated with average percent-coverage estimates consist of mussels (73.9%), wood (10.7%), macroalgae (6.7%), tire (2.3%), and open-water (4.3%).
- Epifauna associated with abundance estimates consist of limpet (3.3 No. m^{-2}) and ochre sea star (0.049 No. m^{-2}).
- Regarding the dock vertical profile of the video depth-intervals, a contrast in epifauna coverage is observed between the SZ depth-interval relative to that inhabiting submerged subsurface SSZ and DZ surveys, regardless of the differential survey lengths.
- Furthermore, limpets were limited to the SZ, while 2 ochre sea stars were found in depth-interval-2.
- Two fish taxa were observed in the video-recordings collected at this dock, where one taxa was identified as perch.
- In terms of the proportion of video coverage along the dock perimeter, 84.78% of the total dock-perimeter was surveyed, where 144.07 m of the total 171.00 m dock length and 27.29 m^2 of the total 32.17 m^2 dock area were surveyed across the depth-interval transects [Figure 3 (Schematic Diagram)] .

4.2.1.2 Sandy Cove dock location and schematic diagram

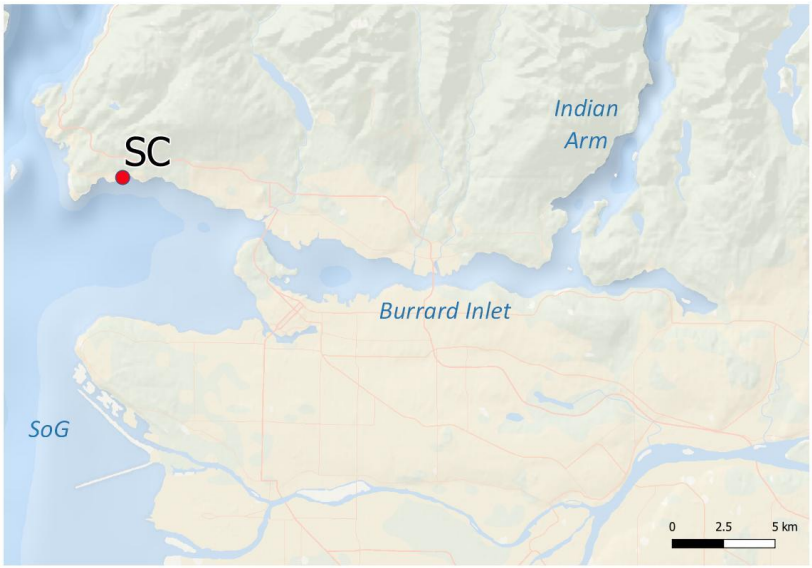

Figure 2: Location of the Sandy Cove dock on the north shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 20’ 24” N; 123° 13’ 59” W). Video surveys took place on August 11th, 13th, and 19th, 2020.

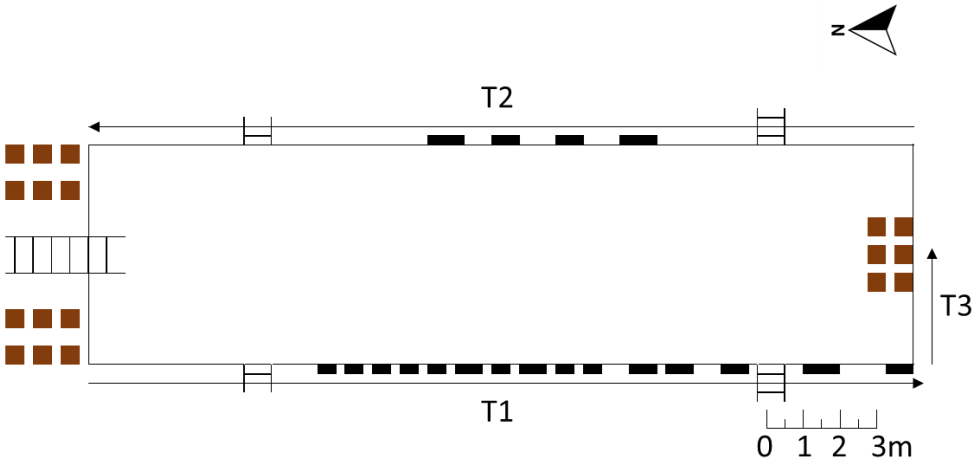

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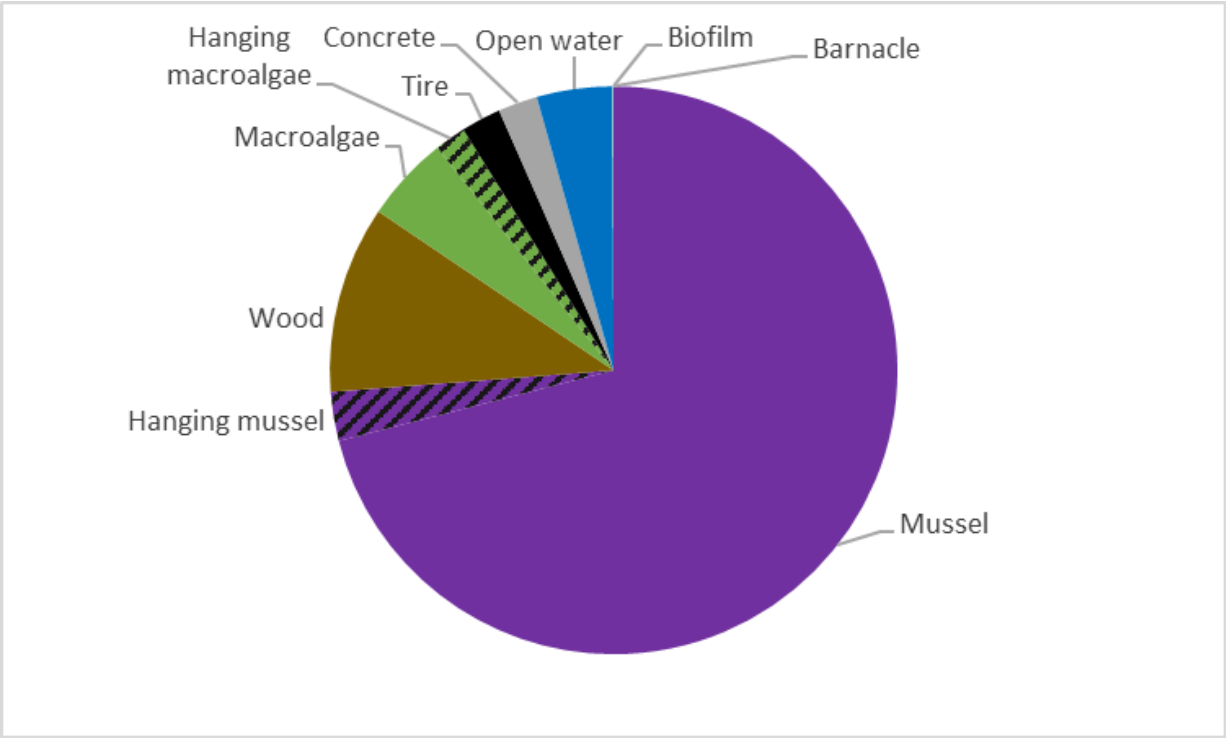
Figure 3: Schematic diagram of the Sandy Cove dock, where black segments and brown-squares represent individual tires and grouped wooden-pilings, respectively. Video surveys were collected at 3 individual transects (T1, T2, T3) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth interval. The entrance gangway is located on the north side of the dock, while 2 side-ladders are located on both the east and west side of the dock perimeter.

4.2.1.3 Relative proportion of Sandy Cove dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel (71.1%)		73.9
	Hanging mussel (2.8%)		
	Wood		10.7
	Macroalgae	*Ulva* spp. (2.5%)	6.7
		Fucus spp. (Trace)	
		Unidentified macroalgae (2.4%)	
	Hanging macroalgae	Hanging kelp (1.8%)	
	Tire		2.3
	Concrete		2.2
	Open water		4.3
	Biofilm		Trace
	Aggregated barnacles		Trace

Figure 4: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Sandy Cove dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 5: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the Sandy Cove Dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		71.1%	46.9%	82.4%	81.2%
	Hanging mussel		2.8%	0.0%	6.1%	2.8%
	Wood		10.7%	33.0%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	2.5%	4.7%	1.0%	1.5%
		Fucus spp.	Trace	Trace	Trace	Trace
		Unidentified macroalgae	2.4%	0.3%	3.3%	3.6%
	Hanging macroalgae	Hanging kelp	1.8%	0.0%	2.5%	2.7%
	Tire		2.3%	7.5%	0.0%	0.0%
	Concrete		2.2%	7.4%	0.0%	0.0%
	Open water		4.3%	0.4%	5.0%	8.3%
	Biofilm		Trace	0.0%	0.1%	0.01%
	Aggregated barnacles		Trace	Trace	Trace	Trace

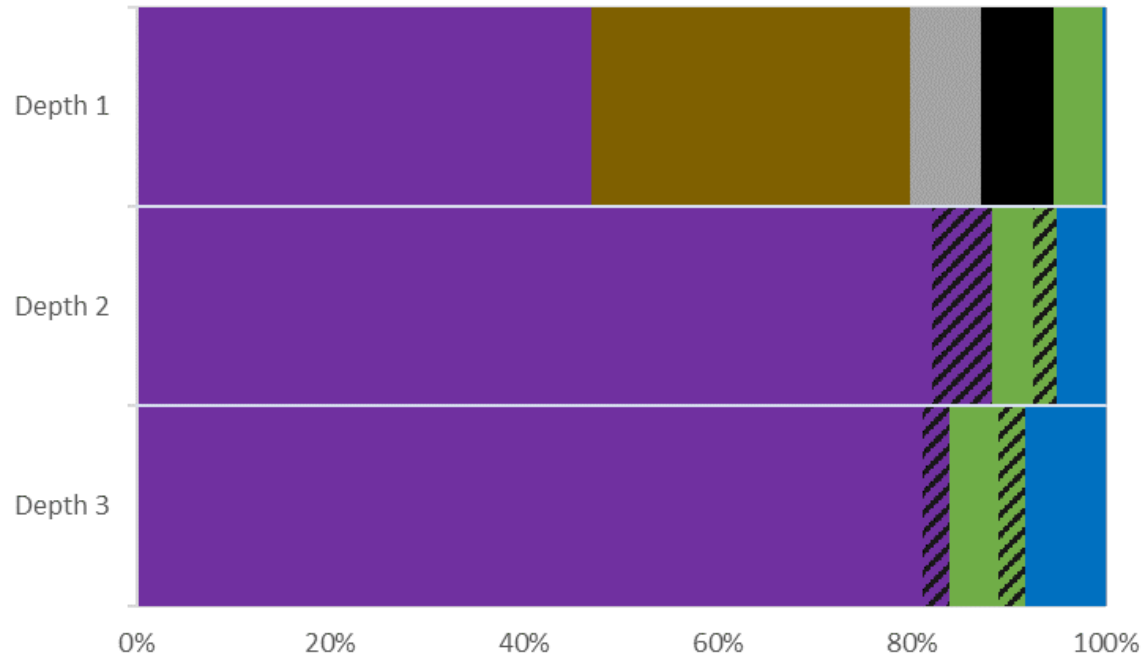


Figure 5: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three depth-interval video surveys at the Sandy Cove dock.

4.2.1.4 Abundance of solitary epifauna and fish at Sandy Cove dock

Table 6: Abundance of solitary epifauna and fish observed at Sandy Cove dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	3.3	11	0.0	0.0
Unidentified fish	1.1	0.0	2.5	0.78
Perch	0.37	0.0	0.0	1.2
Ochre star	0.049	0.0	0.14	0

4.2.1.5 Areal-proportion of dock surveyed by video at Sandy Cove

Table 7: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Sandy Cove.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock- Total	171.00	144.97	32.17	27.29
Depth-1	57.00	47.96	8.65	7.28
Depth-2	57.00	49.30	11.76	10.17
Depth-3	57.00	47.71	11.76	9.84
Depth-Average	57.00	48.32	10.72	9.10

4.2.2 DUNDARAVE DOCK

4.2.2.1 Dundarave dock abstract

- The Dundarave (DUN) dock is comprised of 3 types of substrate or medium: wood, tire, and open-water: 1) tires are mounted on the dockside perimeter of the wood-substrate at certain locations along the depth-interval #1 (SZ); 2) wood served as a substrate for all depth-intervals; and 3) open-water was observed in the lower area of the video image due to the shallowness of this dock.
- Epifauna and epifloral, associated with a combined richness value (11), were estimated as 1) percent coverage (mussels, barnacles, structural white branching (SWB) epifauna, macroalgae) and 2) abundance recorded at No. m^{-2} (limpet, crab).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussels (52.3%), wood (19.3%), open water (13.9%), unknown float (8.2%), and macroalgae (4.5%)
- Epifauna associated with abundance estimates consist of limpet (0.19 $No.m^{-2}$), and crab (0.064 $No.m^{-2}$).
- Regarding the dock vertical profile of the depth-interval videos, the first depth-interval differed relatively to the two sub-surface depth-intervals that resembled each other, with the exception of hanging mussels in open water.
- The limpets distribution was limited to the SZ, while the crabs were found in the DZ.
- 1 taxa of fish (perch) observed in the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 91.87% (91.88 m) of the total dock-perimeter length (100.02 m) was surveyed across three depth-interval transects, while 91.92% (17.29 m^2) of the total dock perimeter area (18.81 m^2) was surveyed across the depth-interval transects [Figure 7 (Schematic Diagram)].

4.2.2.2 Dundarave dock location and schematic diagram

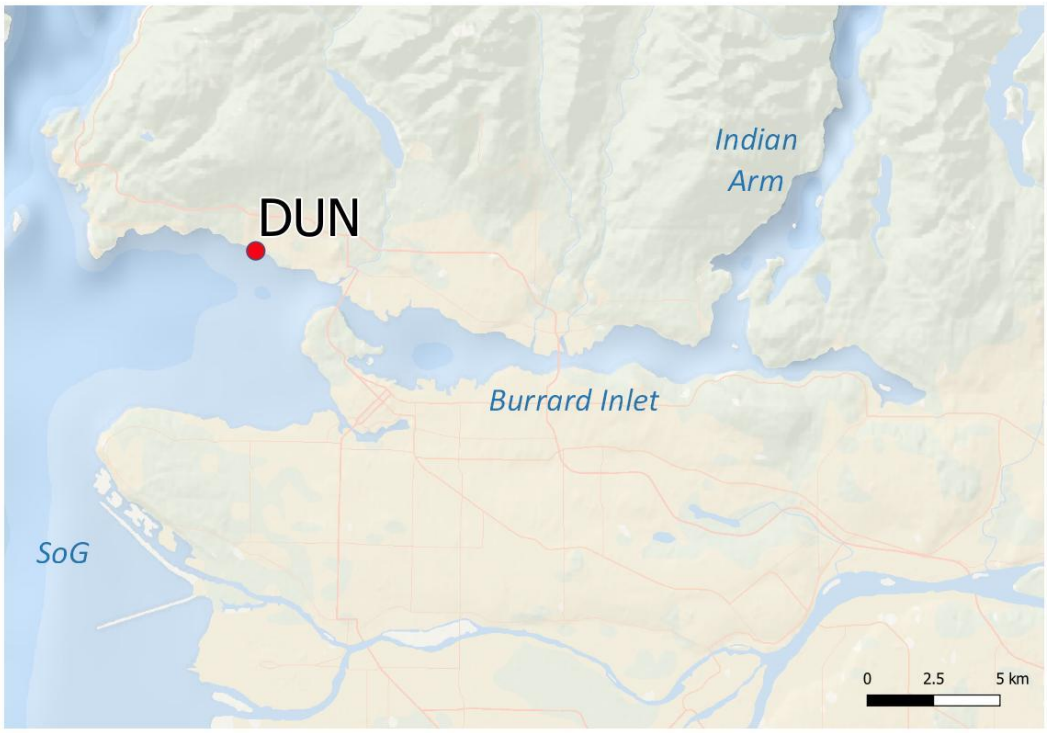


Figure 6: Location of the Dundarave dock on the north shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 19' 56" N; 123° 10' 57" W). Video surveys took place on August 11th, and 19th, 2020.

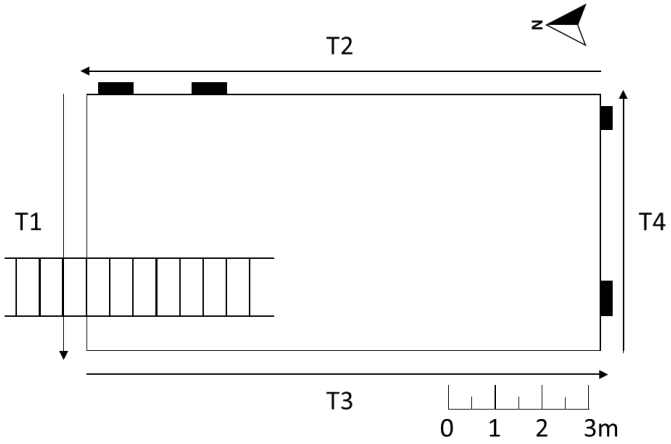
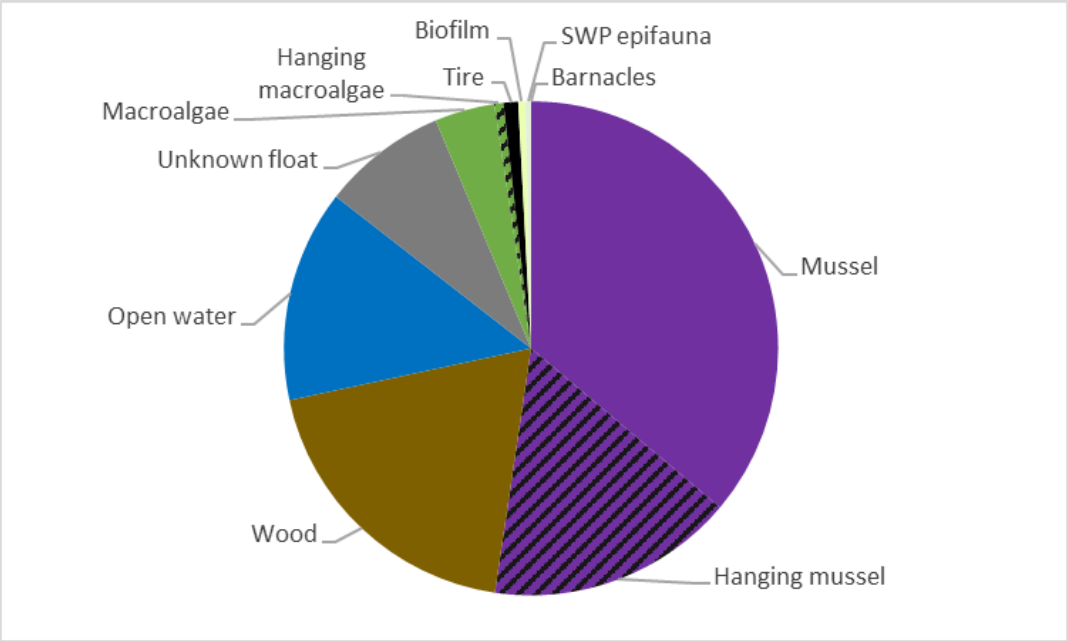


Figure 7: Schematic diagram of the Dundarave dock where black segments represent individual tires. Video surveys were collected along each of 4 transects (T1, T2, T3, T4) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth interval. The entrance ramp is located on the northwest corner of the dock.

4.2.2.3 Relative proportion of Dundarave dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups		Percentage (%)
Mussel (36.1%)		52.3
Hanging mussel (16.2%)		
Wood	Other wood (0.6%)	19.3
	Wood float (18.6%)	
Open water		13.9
Unknown float		8.2
Macroalgae	*Ulva* spp. (1.8%)	4.5
	Fucus spp. (Trace)	
	Bladed macroalgae (Trace)	
	Encrusted macroalgae (0.4%)	
	Unidentified macroalgae (1.7%)	
Hanging macroalgae	Hanging *Ulva* spp. (0.2%)	
	Hanging *Fucus* spp. (Trace)	
	Hanging unidentified macroalgae (0.4%)	
Tire		1.0
Biofilm		0.5
Structural white branching epifauna		0.4
Aggregated Barnacles		Trace

Figure 8: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Dundarave dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 8: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys at 3 dock depth-intervals at the Dundarave dock.

% coverage for epifauna, macroalgae substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		36.1%	12.6%	82.2%	14.0%
	Hanging mussel		16.2%	0.0%	0.2%	47.0%
	Wood	Other wood	0.6%	0.0%	1.6%	0.0%
		Wood float	18.6%	54.1%	2.0%	1.5%
	Open water		13.9%	0.0%	5.9%	34.3%
	Unknown float		8.2%	25.0%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	1.8%	43.7%	1.6%	0.0%
		Fucus spp.	Trace	0.0%	0.1%	0.0%
		Bladed macroalgae	Trace	0.0%	Trace	0.0%
		Encrusted macroalgae	0.4%	1.3%	0.0%	0.0%
		Unidentified macroalgae	1.7%	0.5%	4.6%	0.1%
	Hanging macroalgae	Hanging *Ulva* spp.	0.2%	0.0%	0.0%	0.6%
		Hanging *Fucus* spp.	Trace	0.0%	0.0%	Trace
		Hanging unidentified macroalgae	0.4%	0.0%	0.0%	1.0%
	Tire		1.0%	2.9%	0.0%	0.0%
	Biofilm		0.5%	0.0%	1.4%	0.0%
	Structural white branching epifauna		0.4%	0.0%	0.0%	1.0%
	Aggregated barnacles		Trace	Trace	Trace	0.0%

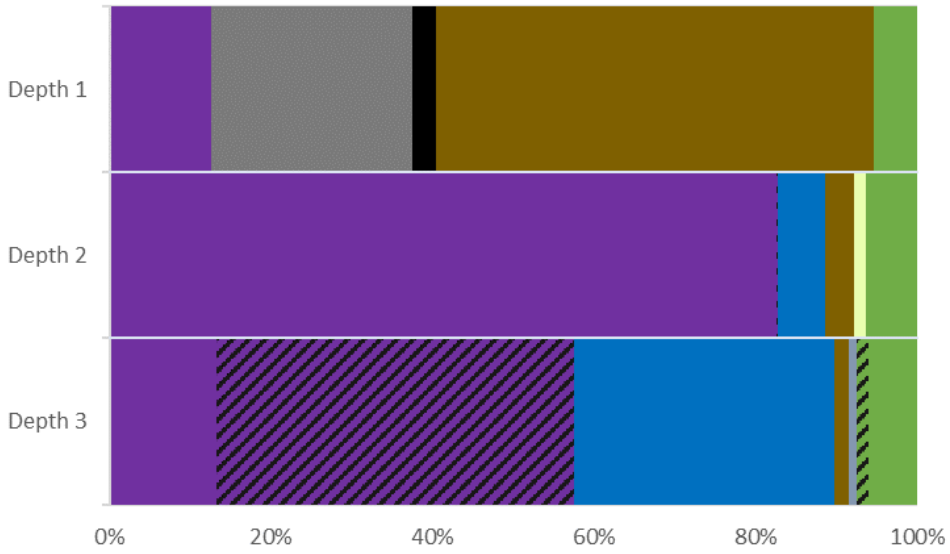


Figure 9: Relative proportion of epifauna and substrate coverage according to the three video depth-interval surveys at the Dundarave dock.

4.2.3.4 Abundance of solitary epifauna and fish at Dundarave dock

Table 9: Abundance of solitary epifauna and fish observed at Dundarave dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Perch	0.97	0.0	0.21	2.62
Limpet	0.19	0.61	0.0	0.0
Crab	0.064	0.0	0.0	0.20

4.2.3.5 Areal-proportion of dock surveyed by video at Dundarave

Table 10: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the Dundarave dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	100.02	91.88	18.81	17.29
Depth-1	33.34	30.44	5.06	4.62
Depth-2	33.34	30.50	6.88	6.29
Depth-3	33.34	30.94	6.88	6.38
Depth-Average	33.34	30.63	6.27	5.76

4.2.3 AMBLESIDE DOCK

4.2.3.1 Ambleside dock abstract

- The Ambleside (AMB) dock is comprised of 3 types of substrate or medium: wood, plastic, and open-water; 1) wood served as a substrate for dock depth-intervals 1, 2, and 3; 2) plastic provided a protective casing of mooring chains within the depth-interval-1 (SZ); and 3) open-water was observed in the lower area of the depth-interval-3 due to the shallowness of this dock.
- Epifauna and epifloral, associated with a combined richness value (7), were quantified with percent coverage estimates for mussels, barnacles, SWB epifauna, and macroalgae.
- The top 5 epifauna/substrates associated with coverage estimate consists of mussels (52.4%), wood (25.8%), open water (5.6%), macroalgae (12.8%), and plastic (2.1%)
- Regarding the vertical profile of video transects, a contrast in epifauna and substrate coverage is observed between the aerial-exposed splash-zone, above-water survey relative to those submerged subsurface surveys (SSZ, DZ), regardless of the differential survey lengths.
- No epifauna associated with abundance estimates were observed at this dock and fish were not observed in video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 72.26% (44.23 m) of the total dock-perimeter length (61.21 m) was surveyed across three depth-interval transects, while 72.54% (8.23 m^2) of the total dock perimeter area (11.34 m^2) was surveyed across the depth-interval transects [Figure 11 (Schematic Diagram)].
- This dock is located in a near-shore, shallow, and sloped-seabed setting, where the dock would rest on the seabed during certain low tides. Due to the grounding of the northwest dock corner on the seabed, video surveys were limited to depth-intervals 1 and 2 for Transect 3 and no surveys could be completed for the northern side of the dock.

4.2.3.2 Ambleside dock location and schematic diagram

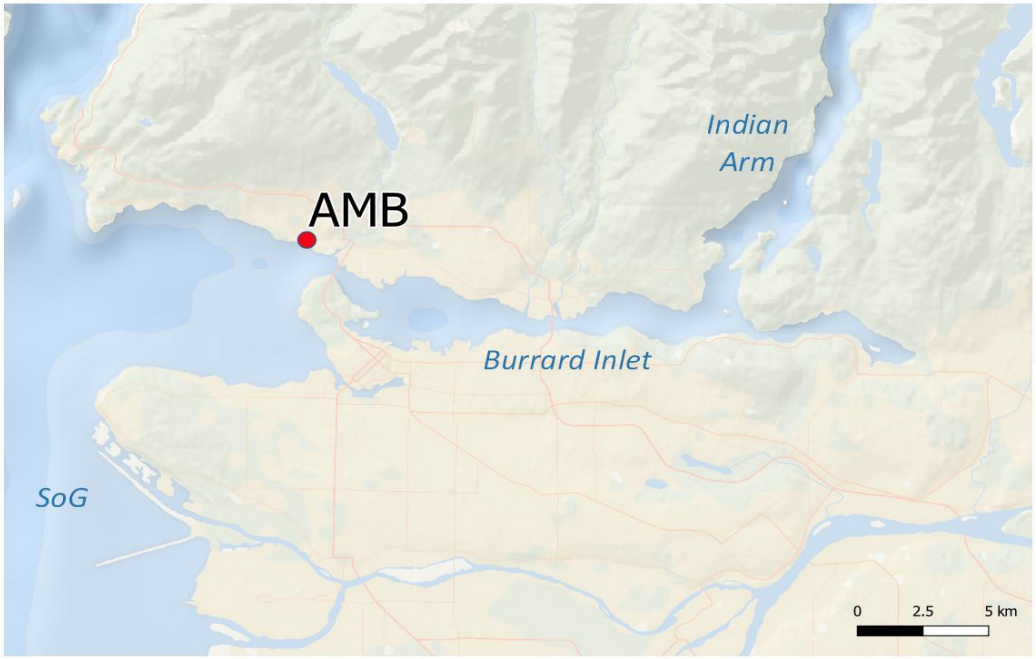


Figure 10: Location of the Ambleside dock on the north shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 19' 37" N; 123° 9' 15" W). Video surveys took place on October 1st, 2020.

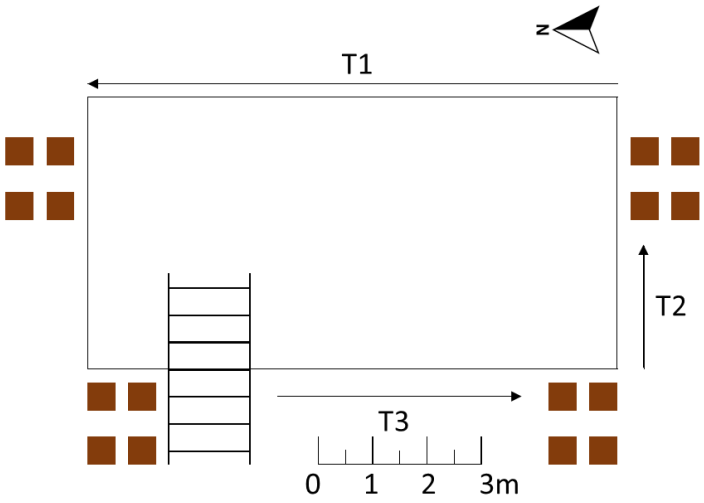
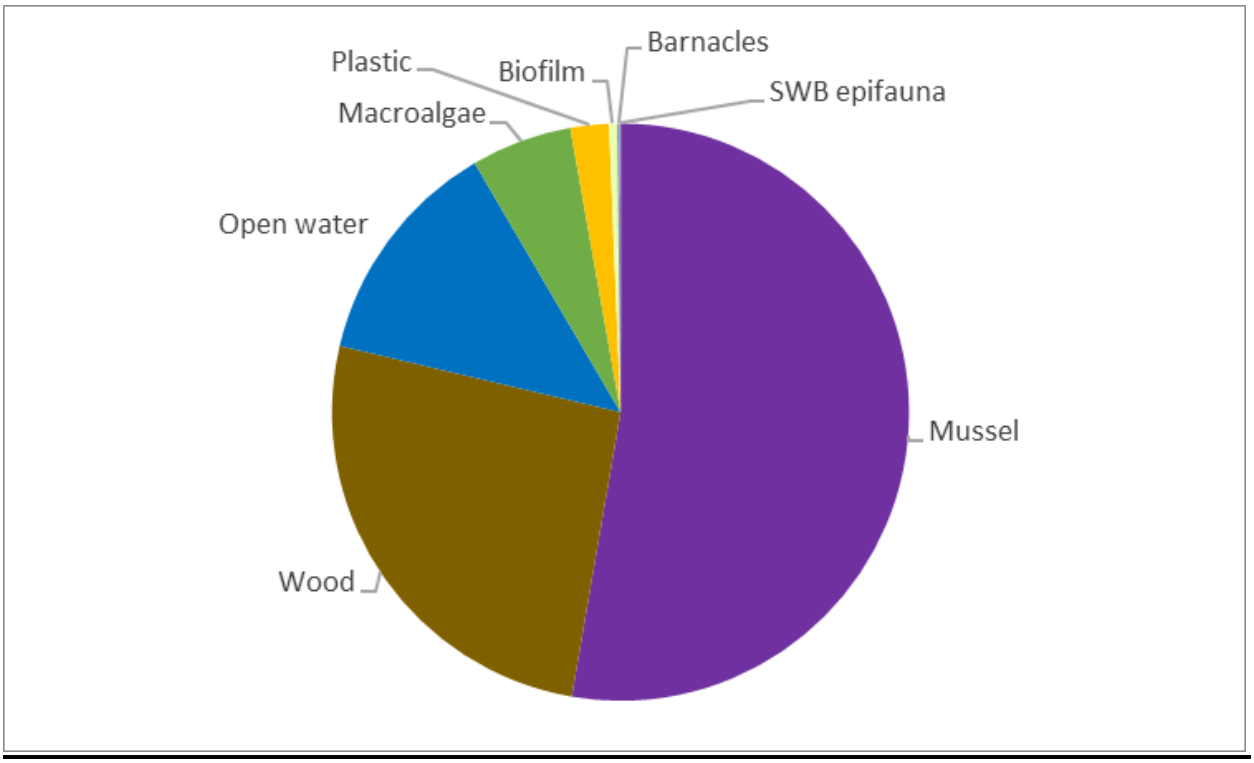


Figure 11: Schematic diagram of the Ambleside dock, where brown cluster-squares represent grouped wooden-pilings and the entrance gangway is located on the northwest side of the dock. Due to the grounding of the northwest dock corner on the seabed, all three video depth-interval surveys were completed for Transects 1 and 2, while only depth-intervals 1 and 2 were surveyed for Transect 3.

4.2.3.3 Relative proportion of Ambleside dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		52.4
	Wood		25.8
	Open water		5.6
	Macroalgae	*Ulva* spp. (0.4%)	12.8
		Fucus spp. (Trace)	
		Encrusted macroalgae (11.6%)	
		Unidentified macroalgae (0.7%)	
	Plastic		2.1
	Biofilm		0.2
	Aggregated barnacles		0.5
	Structural white branching epifauna		Trace

Figure 12: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Ambleside dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 11: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys at 3 dock depth-intervals at the Ambleside dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		52.4%	5.1%	88.8%	83.5%
	Wood		25.8%	66.5%	0.0%	0.0%
	Open water		5.6%	0.00%	8.8%	12.1%
	Macroalgae	*Ulva* spp.	0.4%	0.5%	0.2%	0.4%
		Fucus spp.	Trace	0.0%	0.0%	0.1%
		Encrusted macroalgae	11.6%	22.0%	0.0%	0.0%
		Unidentified macroalgae	0.7%	0.1%	0.1%	3.2%
	Plastic		2.1%	5.0%	0.0%	0.0%
	Biofilm		0.2%	0.00%	0.1%	0.7%
	Aggregated barnacles		0.5%	0.9%	Trace	0.0%
	Structural white branching epifauna		Trace	0.0%	Trace	0.0%

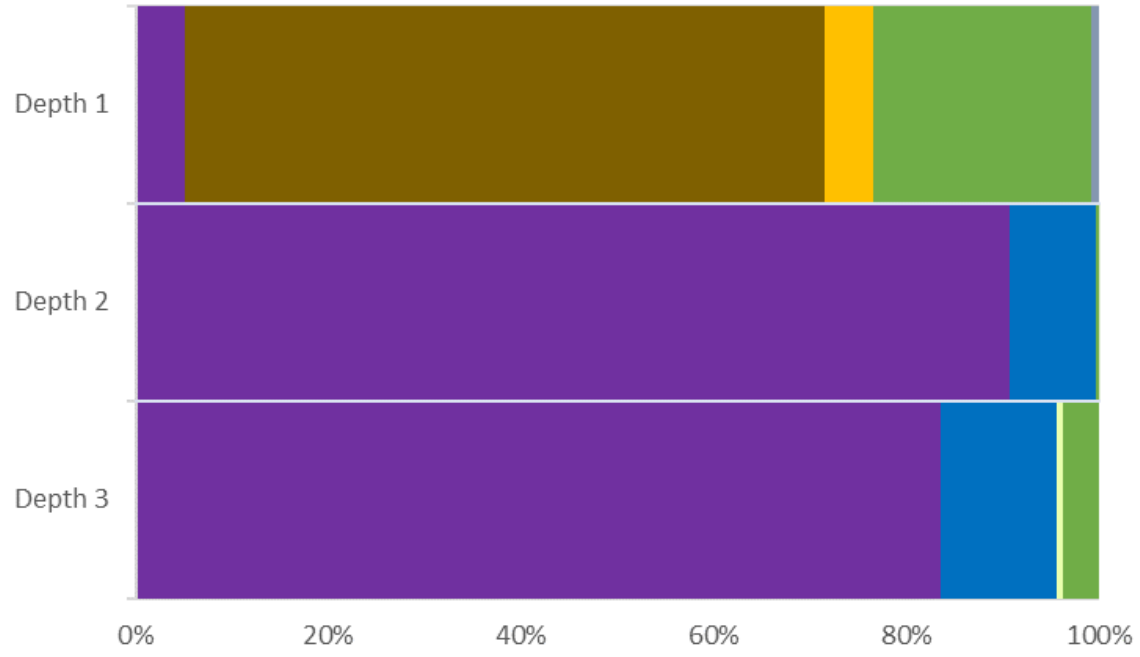


Figure 13: Relative proportion of epifauna and substrate coverage according to the three video depth-interval surveys at the Ambleside dock. Due to the grounding of the northwest dock on the seabed, video depth-interval surveys (1 and 2) were completed for Transects 1, 2, and 3, while video depth-interval-3 survey was completed for Transects 1 and 2.

4.2.3.4 Abundance of solitary epifauna and fish at Ambleside dock

- No solitary epifauna associated with abundance estimates were observed at this dock.

4.2.3.5 Areal-proportion of dock surveyed by video at Ambleside

Table 12: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the Ambleside dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	61.21	44.23	11.34	8.23
Depth-1	23.59	16.47	3.58	2.50
Depth-2	23.59	16.00	4.87	3.30
Depth-3	14.03	11.76	2.89	2.43
Depth-Average	20.40	14.74	3.78	2.74

4.2.4 ROYAL VANCOUVER YACHT CLUB DOCK

4.2.4.1 Royal Vancouver Yacht Club dock abstract

- The Royal Vancouver Yacht Club (RV) dock is comprised of 3 types of substrate and medium: concrete, plastic, and open-water: 1) concrete served as a substrate for depth-interval 1; and 2) plastic was visible in areas void of biological coverage in both depth-intervals 2 and 3; open-water was located between gaps in dock structure in transects 3 and 4.
- Epifaunal and epifloral, associated with a combined richness value (7), were estimated as 1) percent coverage (mussels, barnacles, SWB epifauna, macroalgae); and 2) abundance recorded as No. m^{-2} (limpet, fish).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussels (70.9%), concrete (23.8%), macroalgae (3.4%), SWB epifauna (1.0%), and biofilm (0.8%).
- Epifauna associated with abundance estimates consisted of limpets (0.24 No.m^{-2}).
- Regarding the dock vertical profile of the video depth-intervals, the two surveyed sub-surface depth-intervals have similar epifaunal composition relative to that of the aerially-exposed splash zone. Limpets were limited to the SZ.
- Unidentified fish were observed in the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 32.99% (240.47 m) of the total dock-perimeter length (729.00 m) was surveyed across three depth-interval transects, while 32.97% (45.20 m^2) of the total dock perimeter area (137.12 m^2) was surveyed across the depth-interval transects [Figure 15 (Schematic Diagram)].

4.2.4.2 Royal Vancouver Yacht Club dock location and schematic diagram

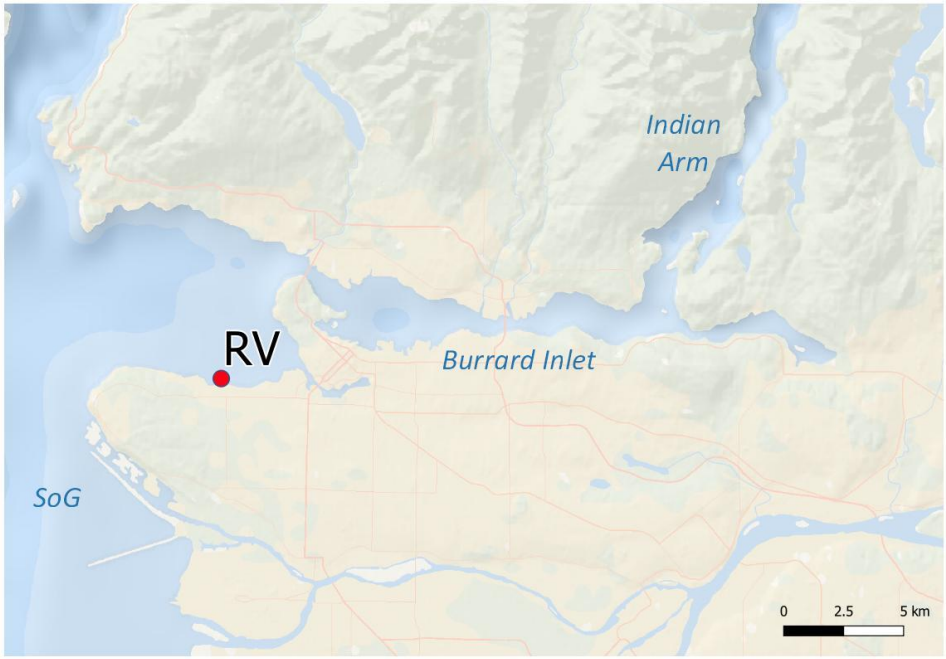


Figure 14: Location of the Royal Vancouver Yacht Club dock on the south shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 16' 31" N; 123° 11' 18" W). Video surveys took place on September 30th, 2020.

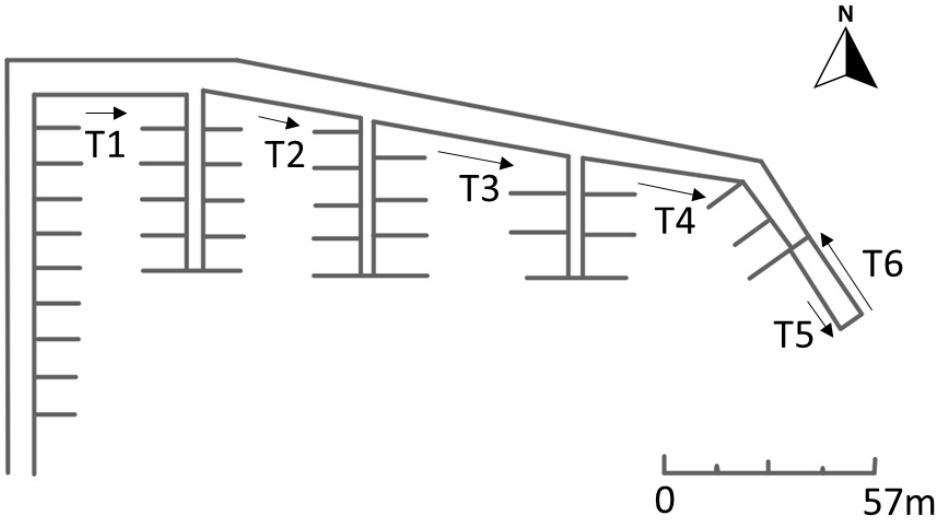
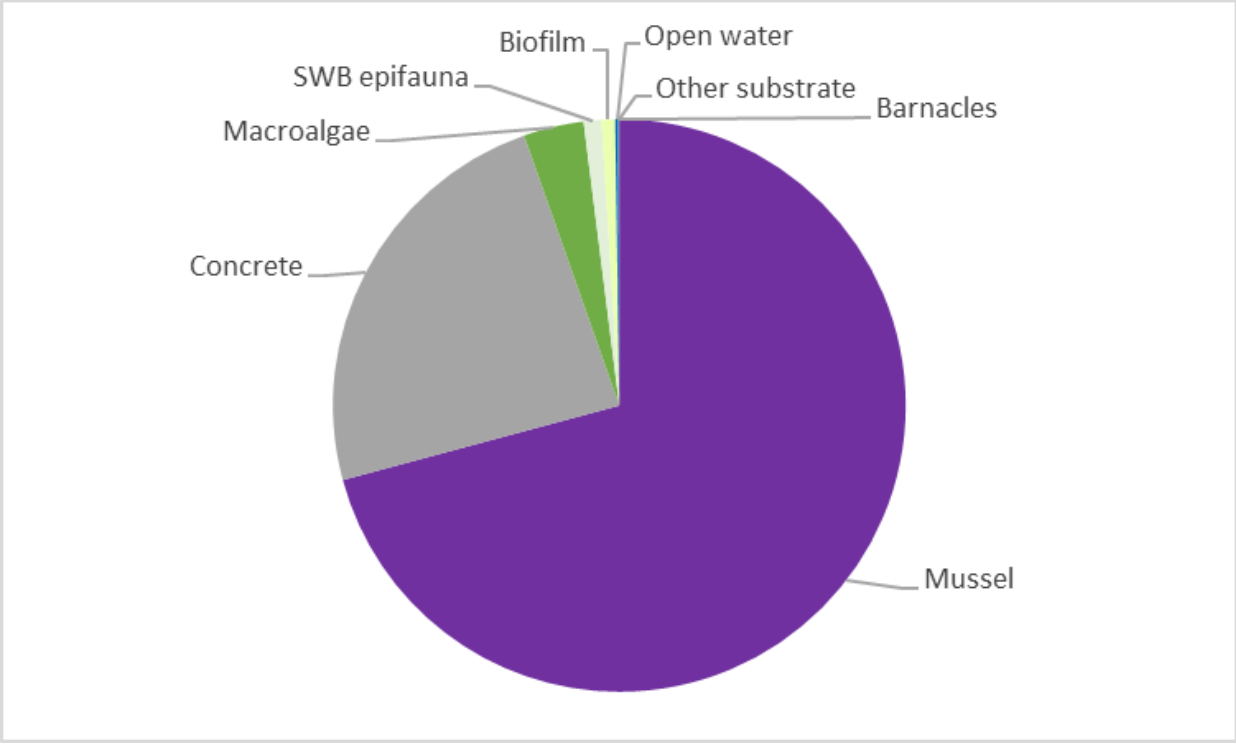


Figure 15: Schematic diagram of the Royal Vancouver Yacht Club dock. Video surveys were collected along each of 6 transects along the northern dock perimeter (T1, T2, T3, T4) and the outer joining dock (T5, T6). Each transect consisted of 3 video surveys collected at increasing depth intervals.

4.2.4.3 Relative proportion of Royal Vancouver Yacht Club dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		70.9
	Concrete		23.8
	Macroalgae	*Ulva* spp. (1.0%)	3.4
		Unidentified macroalgae (2.4%)	
	Structural white branching epifauna		1.0
	Biofilm		0.8
	Open water		0.2
	Other substrate	Plastic (Trace)	Trace
		Wood piling (Trace)	
	Aggregated barnacle		Trace

Figure 16: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Royal Vancouver Yacht Club dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 13: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys at 3 dock depth-intervals at the Royal Vancouver Yacht Club dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		70.9%	23.9%	94.2%	92.9%
	Concrete		23.8%	73.0%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	1.0%	2.8%	0.1%	0.1%
		Unidentified macroalgae	2.4%	0.0%	3.3%	3.9%
	Structural white branching epifauna		1.0%	0.0%	1.3%	1.3%
	Biofilm		0.8%	0.0%	0.9%	0.9%
	Open water		0.2%	0.2%	0.3%	0.3%
	Other substrate	Plastic	Trace	0.0%	Trace	0.1%
		Wood piling	Trace	0.0%	Trace	0.0%
	Aggregated barnacle		Trace	0.1%	Trace	Trace

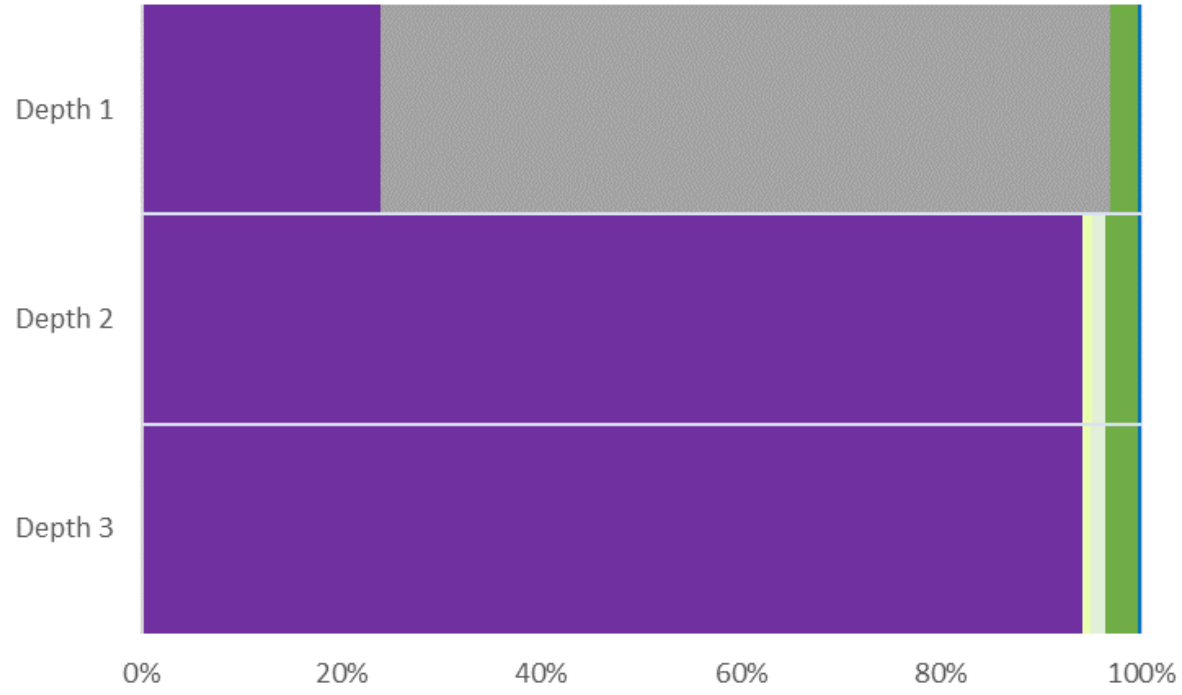


Figure 17: Relative proportion of epifauna and substrate coverage according to the three video depth-interval surveys at the Royal Vancouver Yacht Club dock.

4.2.4.4 Abundance of solitary epifauna and fish at Royal Vancouver Yacht Club dock

Table 14: Abundance of solitary epifauna and fish at 3 surveyed depth-intervals at the Royal

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.24	0.75	0.00	0.00
Unidentified fish	0.088	0.00	0.00	0.26

Vancouver Yacht Club dock.

4.2.4.5 Areal-proportion of dock surveyed by video at Royal Vancouver Yacht Club

Table 15: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the Royal Vancouver Yacht Club dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	729.00	240.47	137.12	45.20
Depth-1	243.00	80.99	36.86	12.24
Depth-2	243.00	80.99	50.13	16.37
Depth-3	243.00	80.99	50.13	16.60
Depth-Average	243.00	80.99	45.71	15.07

4.2.5 CANADIAN COAST GUARD KITSILANO DOCK

4.2.5.1 Canadian Coast Guard Kitsilano dock abstract

- The Canadian Coast Guard Kitsilano (CCGK) dock is comprised of 3 types of substrate and medium: concrete, plastic, and open-water: 1) concrete served as a substrate for depths 1, 2 and 3; 2) plastic was visible in areas void of biological coverage; and 3) open water observed in a gap between dock segments.
- Epifauna and epifloral, associated with a combined richness value (7), were estimated as 1) percent coverage (mussels, SWB epifauna, macroalgae); and 2) abundance recorded as as No. m^{-2} (fish).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussels (67.6%), concrete (27.1%), macroalgae (4.2%), biofilm (0.9%), and open water (0.1%).
- No epifauna associated with abundance estimates were observed at this dock.
- Regarding the dock vertical profile of the video depth-intervals, the two surveyed sub-surface depth-intervals have similar epifaunal composition relative to that of the aerially-exposed splash zone.
- 1 taxa of fish (pipefish) was observed in the video-recordings at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 17.86% (69.79 m) of the total dock-perimeter length (390.72 m) was surveyed across three depth-interval transects, while 17.74% (13.04 m^2) of the total dock perimeter area (73.49 m^2) was surveyed across the depth-interval transects [Figure 19 (Schematic Diagram)].

4.2.5.2 Canadian Coast Guard Kitsilano dock location and schematic diagram

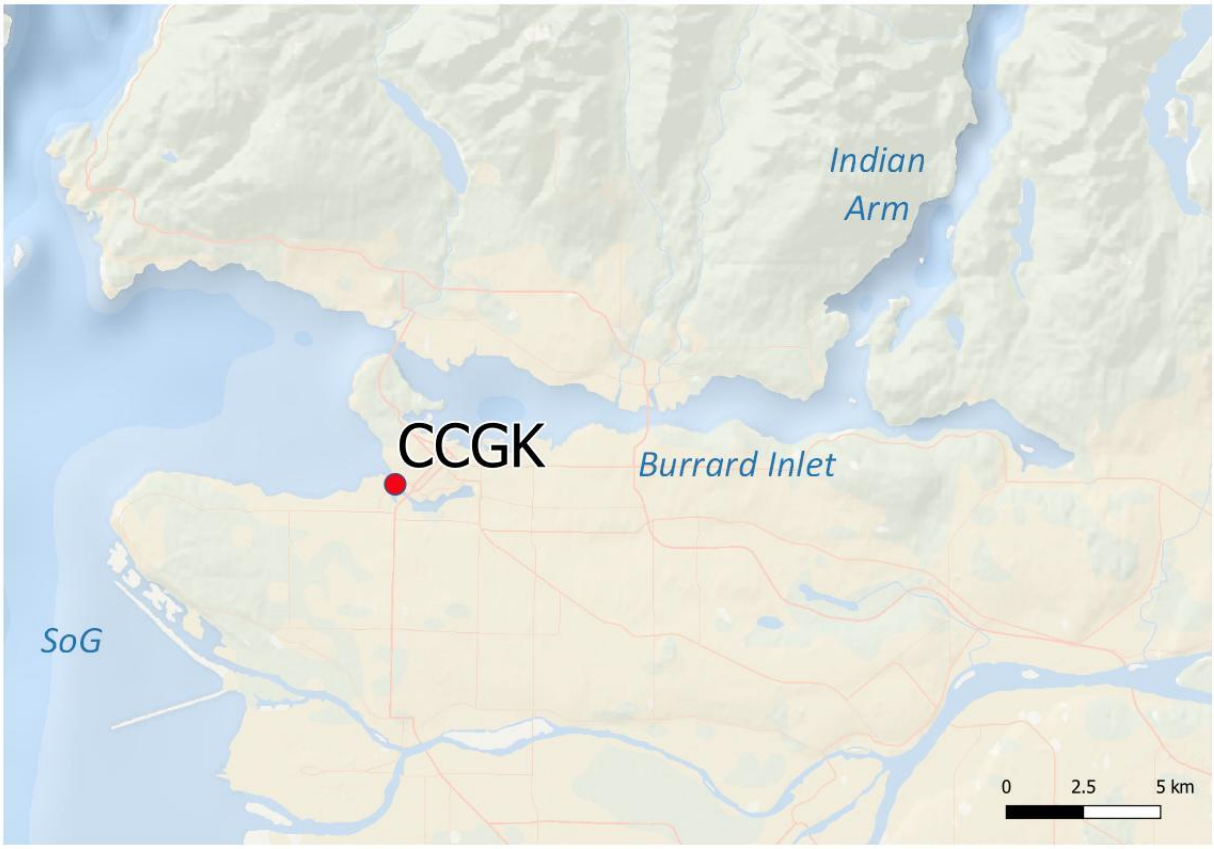


Figure 18: Location of the Canadian Coast Guard Kitsilano dock on the south shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 16' 34" N; 123° 8' 18" W). Video surveys took place on September 30th, 2020.

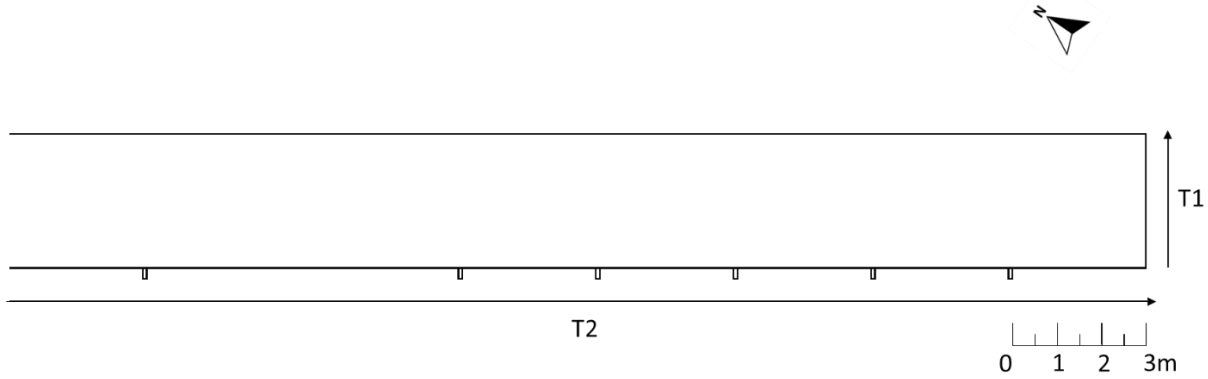
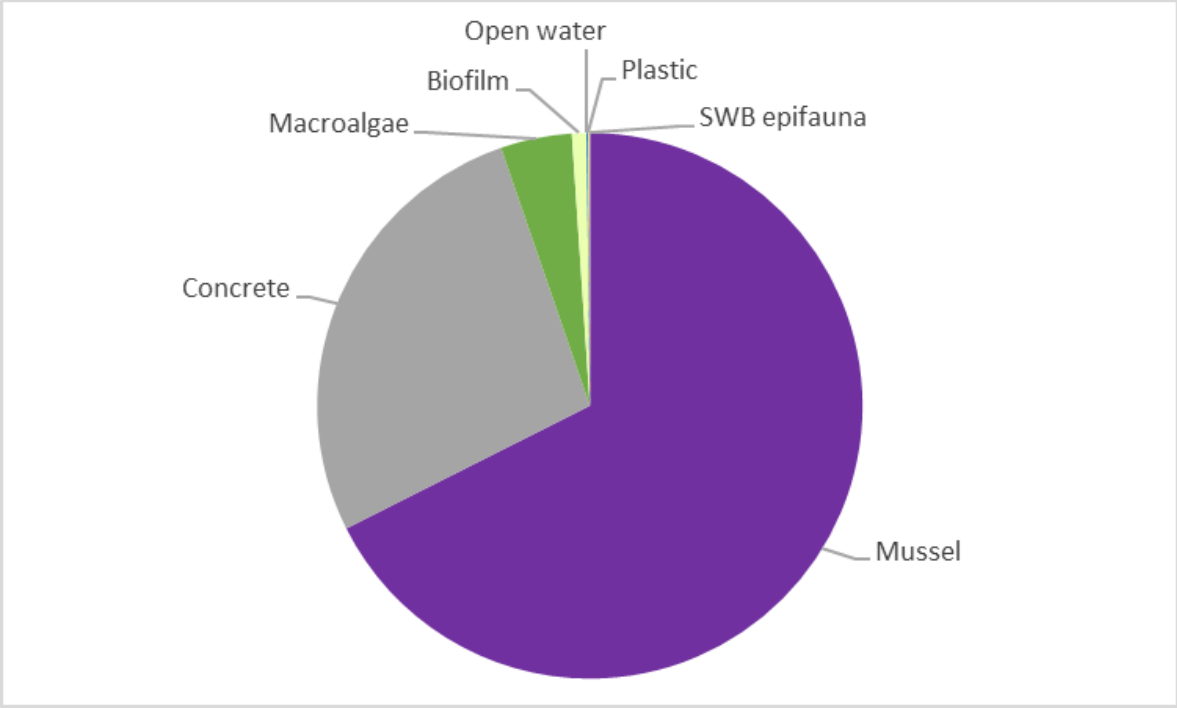


Figure 19: Schematic diagram of the Canadian Coast Guard Kitsilano dock. Video surveys were collected along each of 2 transects (T1, T2) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals.

4.2.5.3 Relative proportion of Canadian Coast Guard Kitsilano dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		67.6
	Concrete		27.1
	Macroalgae	*Ulva* spp. (2.5%)	4.2
		Unidentified macroalgae (1.7%)	
	Biofilm		0.9
	Open water		0.1
	Plastic		0.1
	Structural white branching epifauna		0.1

Figure 20: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Canadian Coast Guard Kitsilano dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 16: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the Canadian Coast Guard Kitsilano dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		67.6%	14.5%	93.0%	96.0%
	Concrete		27.1%	80.3%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	1.7%	5.2%	0.1%	0.0%
		Unidentified macroalgae	2.5%	0.0%	4.0%	3.6%
	Biofilm		0.9%	0.0%	2.5%	0.1%
	Open water		0.1%	0.0%	0.0%	0.3%
	Plastic		0.1%	0.0%	0.2%	0.0%
	Structural white branching epifauna		0.1%	0.0%	0.2%	0.0%

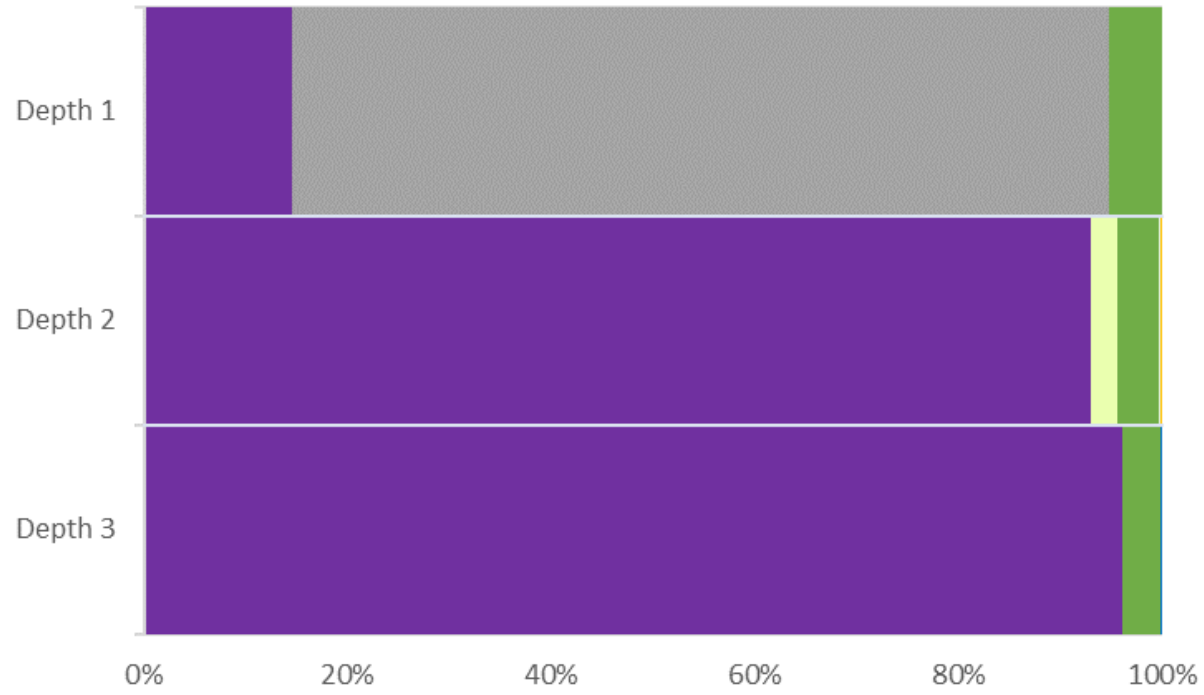


Figure 21: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the Canadian Coast Guard Kitsilano dock.

4.2.5.4 Abundance of solitary epifauna and fish at Canadian Coast Guard Kitsilano dock

Table 17: Abundance of solitary epifauna and fish observed at Canadian Coast Guard Kitsilano dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Pipefish	0.038	0	0	0.12

4.2.5.5 Areal-proportion of dock surveyed by video at Canadian Coast Guard Kitsilano dock.

Table 18: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Canadian Coast Guard Kitsilano dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	390.72	69.79	73.49	13.04
Depth-1	130.24	28.40	19.76	3.77
Depth-2	130.24	28.40	26.87	4.52
Depth-3	130.24	28.40	26.87	4.76
Depth-Average	130.24	28.40	24.50	4.35

4.2.6 FALSE CREEK #3: GRANVILLE ISLAND DOCK

4.2.6.1 False Creek #3 dock abstract

- The False Creek #3 (FC#3) dock is comprised of 3 types of substrates and medium: concrete, metal, and open-water: 1) concrete served as a substrate for depth-intervals 1, 2, and 3; 2) metal piling; and 3) open water gaps in the dock structures.
- Epifauna and epiflora, associated with a combined richness value (8), were estimated as 1) percent coverage (mussels, macroalgae, SWB epifauna, barnacle; and 2) abundance recorded as No. m^{-2} (limpet, pipefish).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussel (69.3%), concrete (26.5%), SWB epifauna (1.9%), macroalgae (1.2%), and open-water (0.6%).
- Epifauna associated with abundance estimates consist of limpet (0.038 No.m-2).
- Regarding the dock vertical profile of the video depth-intervals, the two surveyed sub-surface depth-intervals have similar epifaunal composition relative to that of the aerially-exposed splash zone. The limpet distribution was limited to the SZ.
- 1 taxa of fish (pipefish) was observed in the video-recordings at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 6.04 % (100.39 m) of the total dock-perimeter length (1662.24 m) was surveyed across three depth-interval transects, while 6.04% (18.87 m^2) of the total dock perimeter area (312.67 m^2) was surveyed across the depth-interval transects [Figure 23 (Schematic Diagram)].

4.2.6.2 False Creek #3 dock location and schematic diagram

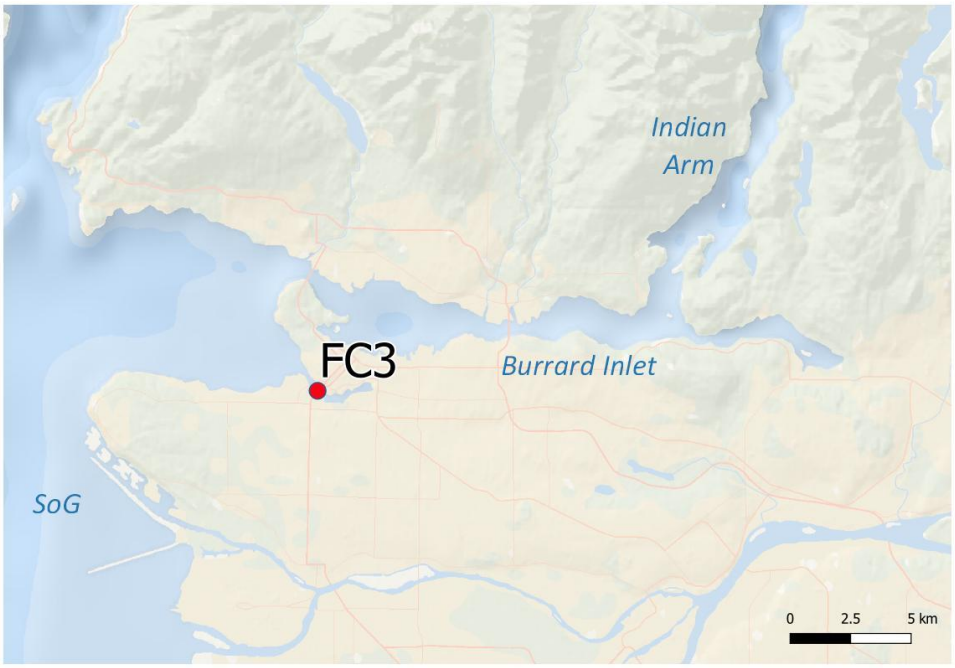


Figure 22: Location of the False Creek #3 dock in False Creek of the Outer Harbour of Burrard Inlet, British Columbia (49° 16' 21" N; 123° 8' 4" W). Video surveys took place on October 4th, 2020.

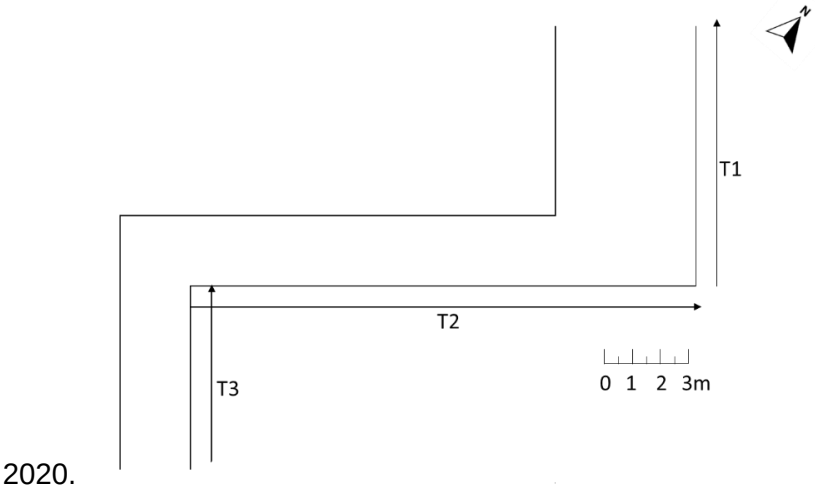
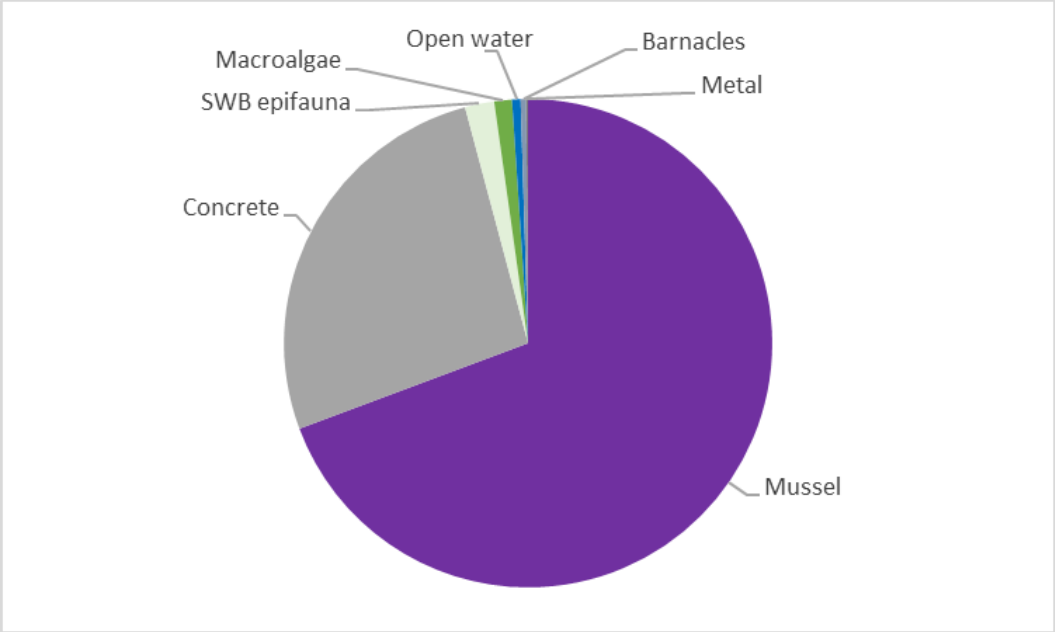


Figure 23: Schematic diagram of the False Creek #3 dock. Video surveys were collected along each of 3 transects (T1, T2, T3) along the dock system that surrounds Granville Island and northwest of Granville Bridge. Each transect consisted of 3 video surveys collected at increasing depth intervals.

4.2.6.3 Relative proportion of False Creek #3 dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		69.3
	Concrete		26.5
	Structural white branching epifauna		1.9
	Macroalgae	*Ulva* spp. (0.5%)	1.2
		Encrusted macroalgae (0.2%)	
		Unidentified macroalgae (0.5%)	
	Open water		0.6
	Aggregated barnacles		0.4
	Metal		0.1

Figure 24: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the False Creek #3 dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 19: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the False Creek #3 dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		69.3%	14.4%	96.0%	94.9%
	Concrete		26.5%	82.6%	0.0%	0.0%
	Structural white branching epifauna		1.9%	0.0%	2.3%	3.3%
	Macroalgae	Ulva spp.	0.5%	1.4%	0.0%	0.0%
		Encrusted macroalgae	0.2%	0.7%	0.0%	0.0%
		Unidentified macroalgae	0.5%	0.0%	0.6%	0.8%
	Open water		0.6%	0.7%	0.6%	0.4%
	Aggregated barnacles		0.4%	0.4%	0.4%	0.3%
	Metal		0.1%	0.0%	0.2%	0.2%

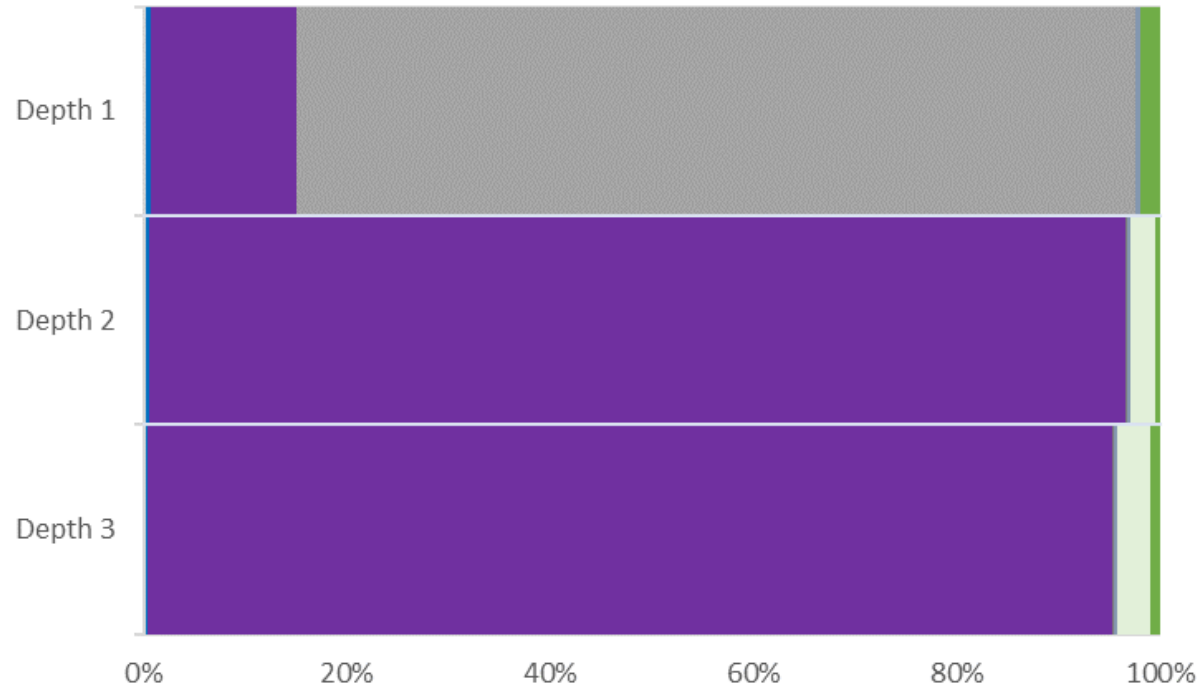


Figure 25: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the False Creek#3 dock.

4.2.6.4 Abundance of solitary epifauna and fish at False Creek #3 dock

Table 20: Abundance of solitary epifauna and fish observed at False Creek #3 dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.038	0.12	0.00	0.00
Pipefish	0.060	0.00	0.00	0.18

4.2.6.5 Areal-proportion of dock surveyed by video at False Creek #3

Table 21: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the False Creek #3 dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	1662.24	100.39	312.67	18.87
Depth-1	554.08	33.67	84.05	5.11
Depth-2	554.08	33.28	114.31	6.87
Depth-3	554.08	33.44	114.31	6.90
Depth-Average	554.08	33.46	104.22	6.29

4.2.7 FALSE CREEK #2: OLYMPIC VILLAGE DOCK

4.2.7.1 False Creek #2 dock abstract

- The False Creek #2 (FC#2) dock is comprised of 4 types of substrate and medium: concrete, plastic, metal, and open-water: 1) concrete served as a substrate for depth-intervals 1, 2, and 3; 2) plastic buoys were hung on the dockside in depth-interval #1 (Splash Zone); 3) metal pilings; and 4) open water gaps in the dock structures.
- Epifauna and epiflora, associated with a combined richness value (7), were estimated as 1) percent coverage (mussels, barnacles, SWB epifauna, macroalgae; and 2) abundance recorded as No. m^{-2} (limpets).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussels (51.1%), concrete (24.8%), macroalgae (10.7%), plastic (2.9%), and open-water (3.8%).
- Epifauna associated with abundance estimate consist of limpet (0.25 No.m^{-2})
- Regarding the dock vertical profile of the video depth-intervals, the two surveyed sub-surface depth-intervals have similar epifaunal composition relative to that of the aerially-exposed splash zone. The limpet distribution was limited to the SZ.
- No fish were observed within the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 60.24% (88.09 m) of the total dock-perimeter length (146.22 m) was surveyed across three depth-interval transects, while 60.00% (16.50 m^2) of the total dock perimeter area (27.50 m^2) was surveyed across the depth-interval transects [Figure 27 (Schematic Diagram)].

4.2.7.2 False Creek #2 dock location and schematic diagram

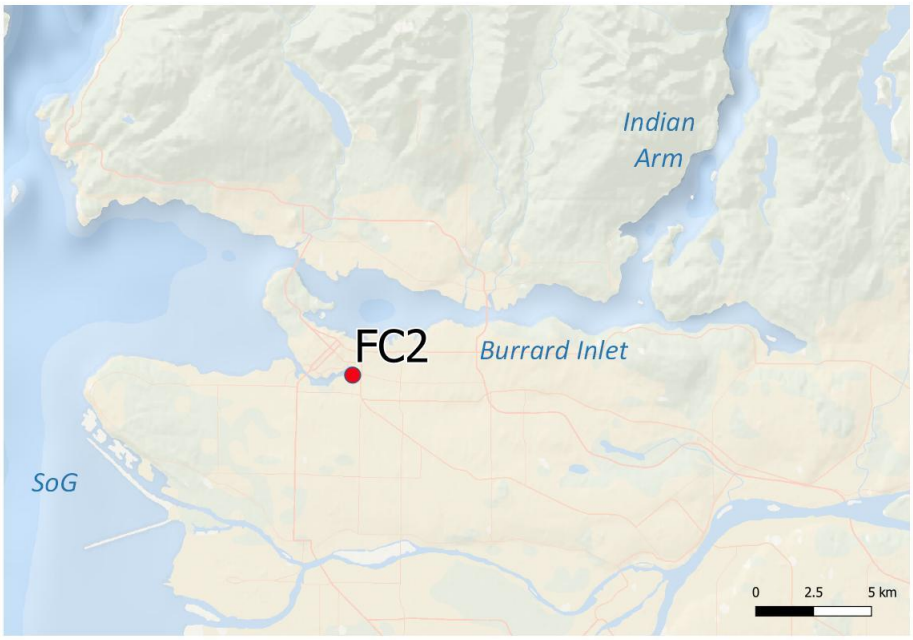


Figure 26: Location of the False Creek #2 dock in False Creek on the south shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 16’ 20” N; 123° 6’ 20” W). Video surveys took place on October 4th, 2020.

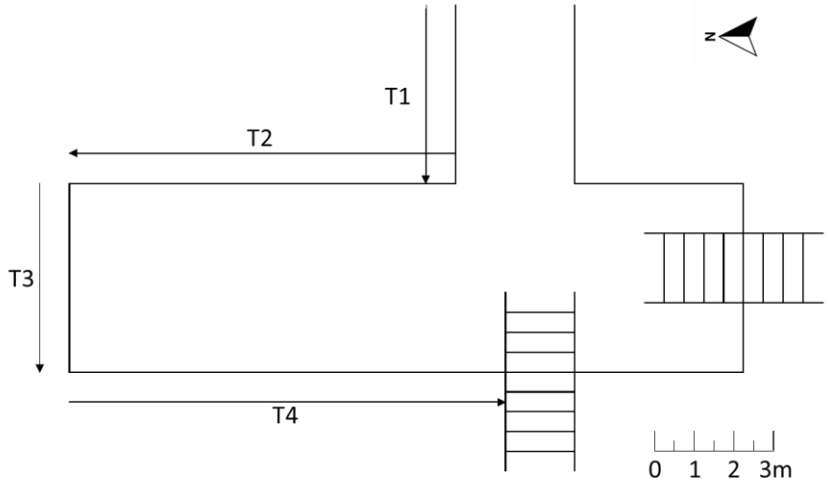
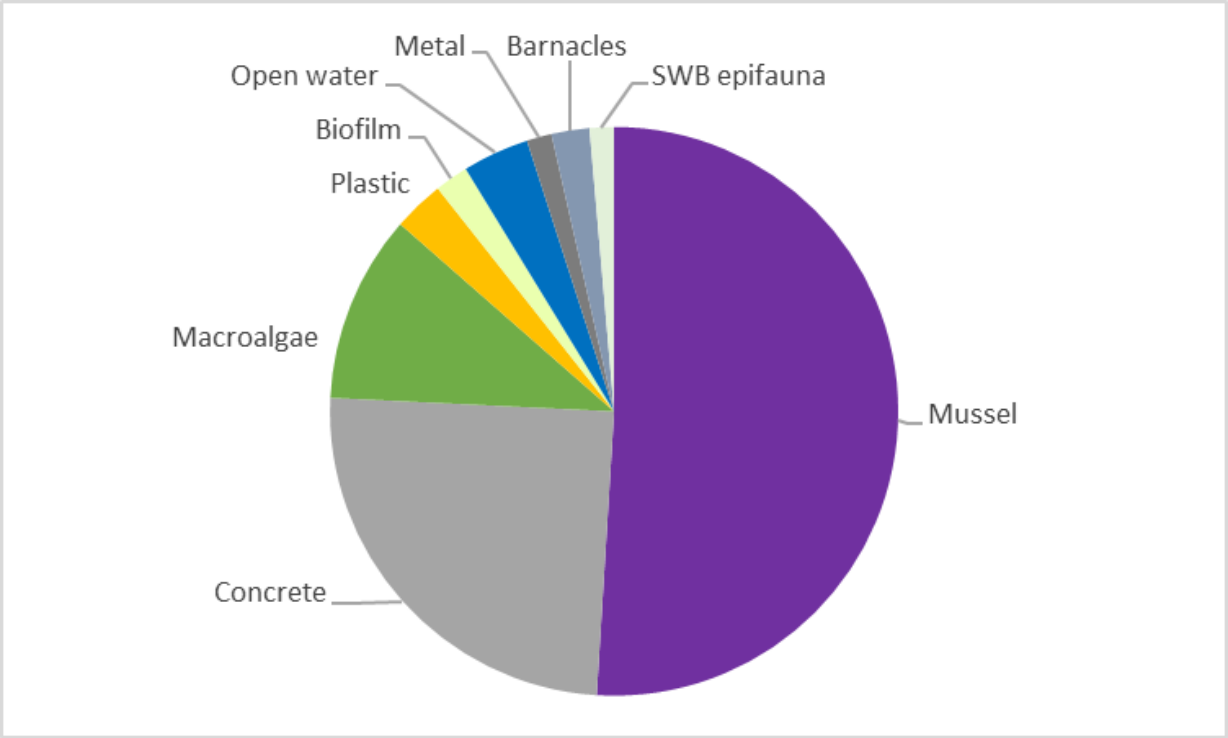


Figure 27: Schematic diagram of the False Creek #2 dock.. Video surveys were collected at 4 individual transects (T1, T2, T3, and T4) along the dock perimeter. Entrance gangways are located on the south and southwest sides of the dock.

4.2.7.3 Relative proportion of False Creek #2 dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		51.1
	Concrete		24.8
	Macroalgae	*Ulva* spp. (1.2%)	10.7
		Encrusted macroalgae (0.2%)	
		Unidentified macroalgae (9.3%)	
	Plastic		2.9
	Biofilm		1.9
	Open water		3.8
	Metal		1.4
	Aggregated barnacles		2.2
	Structural white branching epifauna		1.4

Figure 28: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the False Creek #2 dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 22: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the False Creek #2 dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		51.1%	6.6%	77.1%	71.3%
	Concrete		24.8%	72.13%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	1.2%	3.0%	0.2%	0.2%
		Encrusted macroalgae	0.2%	0.6%	0.0%	0.0%
		Unidentified macroalgae	9.3%	0.0%	11.5%	16.7%
	Plastic		2.9%	8.9%	0.0%	0.0%
	Biofilm		1.9%	0.0%	2.3%	3.7%
	Open water		3.8%	6.3%	1.4%	3.5%
	Metal		1.4%	2.3%	1.7%	0.3%
	Aggregated barnacles		2.2%	0.3%	3.9%	2.5%
	Structural white branching epifauna		1.4%	0.0%	2.5%	2.0%

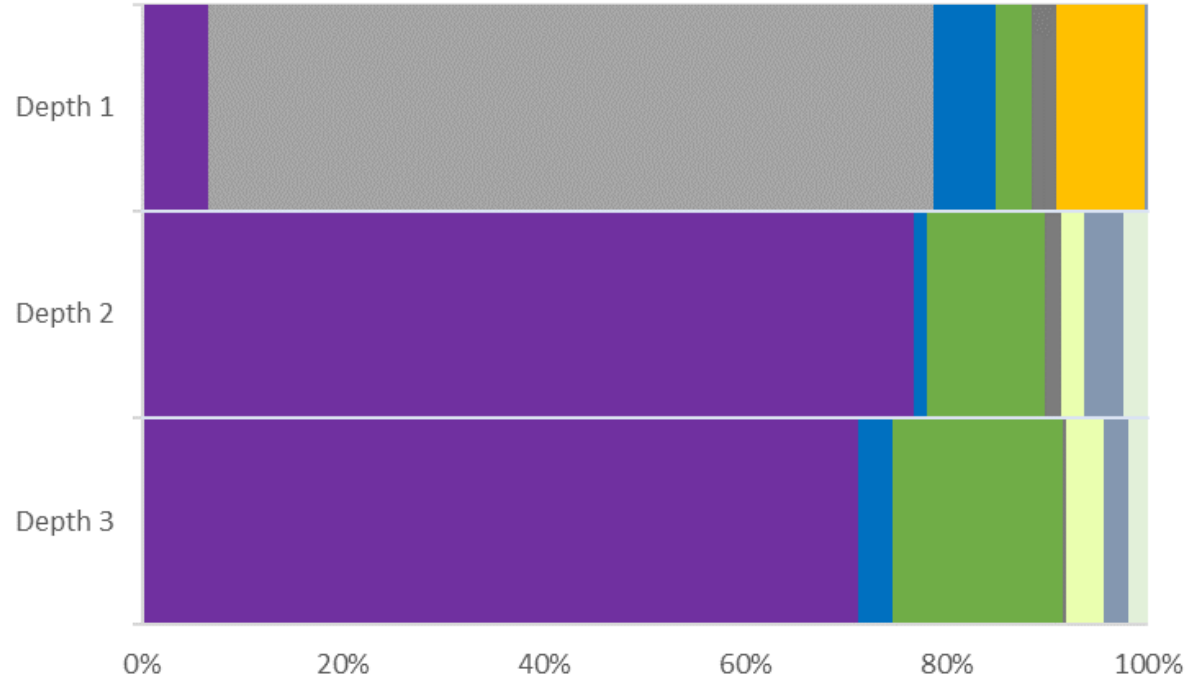


Figure 29: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the False Creek #2 dock.

4.2.7.4 Abundance of solitary epifauna and fish at False Creek #2 dock

Table 23: Abundance of solitary epifauna and fish observed at False Creek #2 dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.25	0.72	0.00	0.00

4.2.7.5 Areal-proportion of dock surveyed by video at False Creek #2

Table 24: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at False Creek #2 dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	146.22	88.09	27.50	16.50
Depth-1	48.74	30.60	7.39	4.64
Depth-2	48.74	27.61	10.06	5.70
Depth-3	48.74	29.88	10.06	6.16
Depth-Average	48.74	29.36	9.17	5.50

4.2.8 FALSE CREEK #1: SCIENCE WORLD DOCK

4.2.8.1 False Creek #1 dock abstract

- The False Creek #1 (FC#1) dock consists of a concrete substrate across all depth-intervals.
- Epifauna and epifloral, associated with a combined richness value (5), were estimated as 1) percent coverage (mussels, macroalgae); and 2) abundance recorded as No. m^{-2} (limpet, tunicate).
- Epifauna/substrate associated with coverage estimates consist of mussels (30.9%), concrete (33.0%), macroalgae (30.6%), and biofilm (5.7%).
- Epifauna associated with abundance estimates consisted of limpets (0.15 No.m^{-2}) and solitary tunicates (0.11 No.m^{-2}).
- Regarding the dock vertical profile of the video depth-intervals, the two sub-surface depths have similar epifaunal composition, relative to that of the aerially-exposed splash zone.
- No fish were observed in the video-recordings collected at this dock.
- One limpet was observed in the SZ and one solitary tunicate was observed in the SSZ.
- In terms of the proportion of video coverage along the dock perimeter, 41.30% (44.60 m) of the total dock-perimeter length (108.00 m) was surveyed across three depth-interval transects, while 41.25% (8.38 m^2) of the total dock perimeter area (20.31 m^2) was surveyed across the depth-interval transects [Figure 31 (Schematic Diagram)].

4.2.8.2 False Creek #1 dock location and schematic diagram

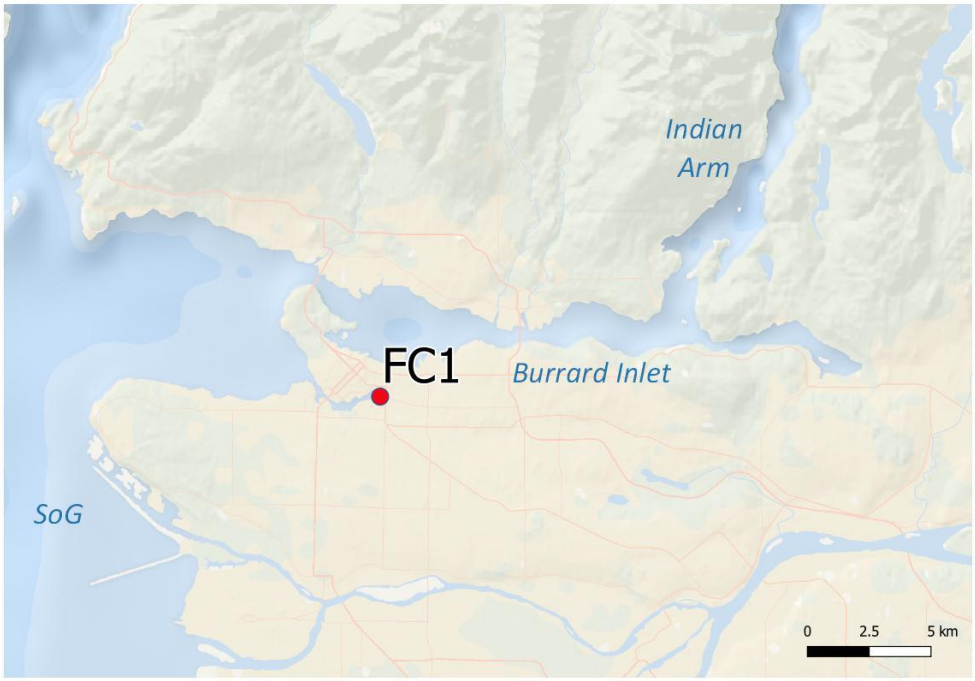


Figure 30: Location of the False Creek #1 dock in False Creek, Burrard Inlet, British Columbia (49° 16' 24" N; 123° 6' 13" W). Video surveys took place on October 4th, 2020.

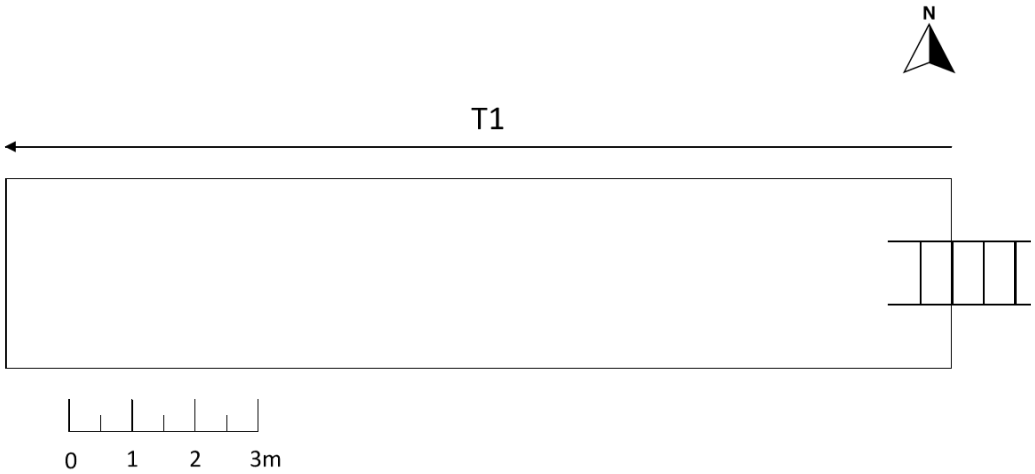
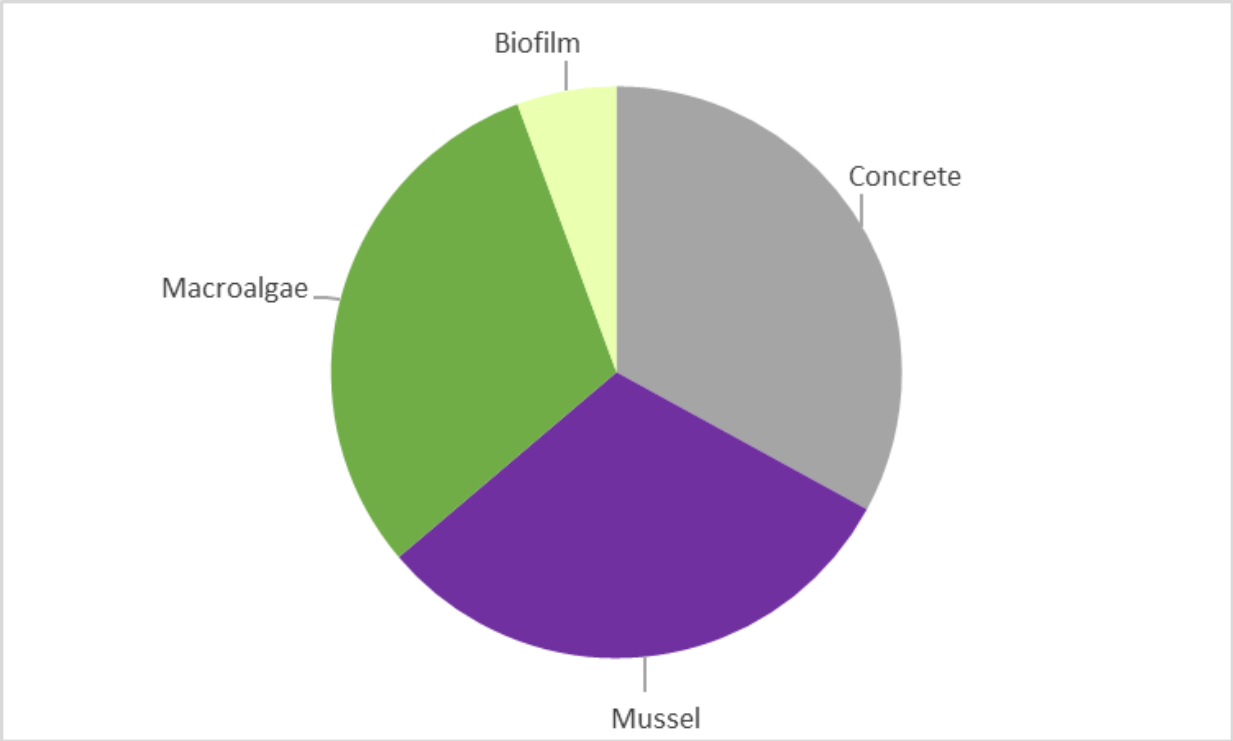


Figure 31: Schematic diagram of the False Creek (FC#1) dock. Video surveys were collected along 1 transect (T1) the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. The entrance ramp is located on the southeastern dockside.

4.2.8.3 Relative proportion of False Creek #1 dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Concrete		33.0
	Mussel		30.9
	Macroalgae	*Ulva* spp. (0.4%)	30.6
		Unidentified macroalgae (30.2%)	
	Biofilm		5.7

Figure 32: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the False Creek#1 dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 25: Relative proportion of epifauna, substrate, and biofilm coverage for both combined and individual video surveys at 3 dock depth-intervals at the False Creek #1 dock.

Coverage type			Average	Depth 1	Depth 2	Depth 3
	Concrete		33.0%	97.1%	0.0%	0.0%
	Mussel		30.9%	1.8%	52.2%	39.3%
	Macroalgae	*Ulva* spp.	0.4%	1.2%	0.0%	0.0%
		Unidentified macroalgae	30.2%	0.0%	39.7%	52.3%
	Biofilm		5.7%	0.0%	9.3%	8.3%

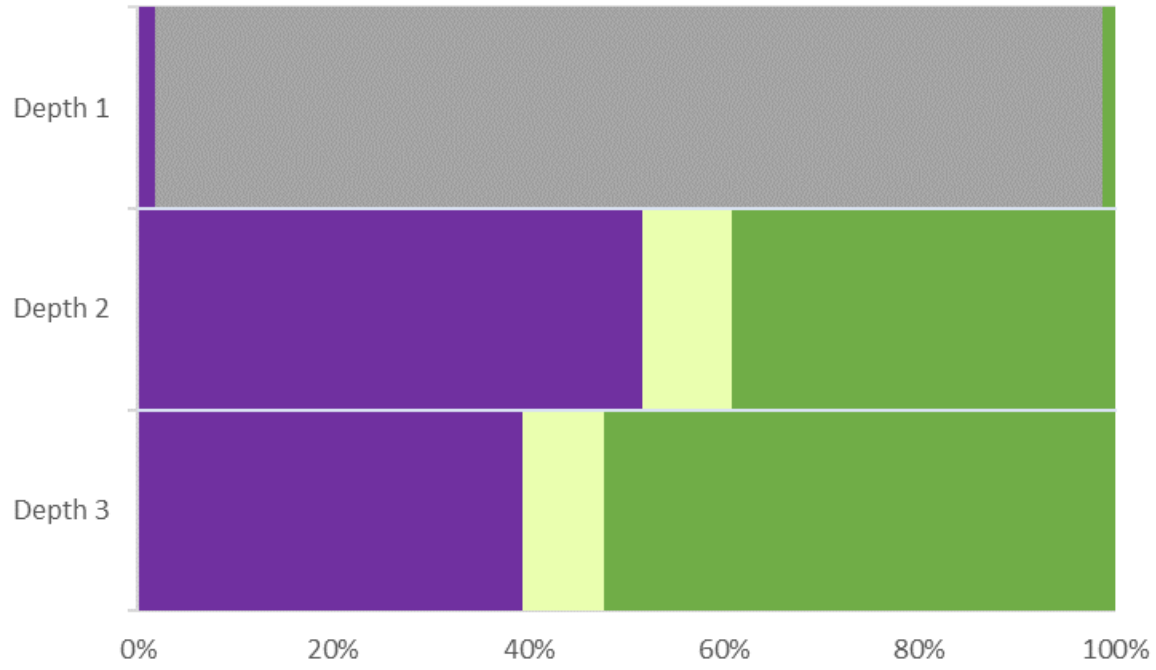


Figure 33: Relative proportion of epifauna, substrate, and biofilm coverage according to the three video depth-interval surveys at the False Creek #1 dock.

4.2.8.4 Abundance of solitary epifauna and fish at False Creek #1 dock

Table 26: Abundance of solitary epifauna and fish at 3 surveyed depth-intervals at the False Creek #1 dock (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.15	0.44	0.0	0.0
Solitary tunicate	0.11	0.0	0.32	0.0

4.2.8.5 Areal-proportion of dock surveyed by video at False Creek #1

Table 27: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the False Creek #1 dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	108.00	44.60	20.31	8.38
Depth-1	36.00	15.04	5.46	2.28
Depth-2	36.00	14.63	7.43	3.02
Depth-3	36.00	14.93	7.43	3.08
Depth-Average	36.00	14.87	6.77	2.79

4.2.9 ST. ROCH DOCK

4.2.9.1 St. Roch dock abstract

- The St. Roch (SR) dock is comprised of 2 types of substrate: concrete and tire: 1) concrete served as substrate for depth-intervals 1, 2, and 3; 2) tires were mounted on the dockside perimeter of depth-interval #1 (SZ).
- Epifauna and epifloral, associated with a combined richness value (20), were estimated as 1) percent coverage (mussels, barnacles, macroalgae, SWB epifauna, encrusting sponges, colonial tunicates); and 2) abundance recorded as No. m^{-2} (limpet, tube worms, urchins, anemones, sea stars, chiton, isopods).
- The top 5 epifauna/substrate associated with coverage percent estimates consist of mussel (69.8%), concrete (19.7%), macroalgae (3.7%), SWB epifauna (4.7%), and biofilm (2.6%).
- The top 5 epifauna associated with abundance density estimates consist of limpet (17 $No.m^{-2)}$, feather duster worm (2.5 $No.m^{-2}$), green urchin (0.87 $No.m^{-2}$), chiton (0.24 $No.m^{-2}$), and ochre star (0.28 $No.m^{-2}$).
- Regarding the dock vertical profile of the video depth-intervals, the two sub-surface depths have similar epifaunal composition relative to that of the aerially-exposed splash-zone.
- Differences between the two sub-surface depth-intervals (SSZ and DZ), are evident within the motile and sessile taxa level of individual epifauna.
- No fish were observed in the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 89.38% (185.40 m) of the total dock-perimeter length (207.42 m) was surveyed across three depth-interval transects, while 89.36% (34.87 m^2) of the total dock perimeter area (39.02 m^2) was surveyed across the depth-interval transects [Figure 35 (Schematic Diagram)].

4.2.9.2 St. Roch dock location and schematic diagram

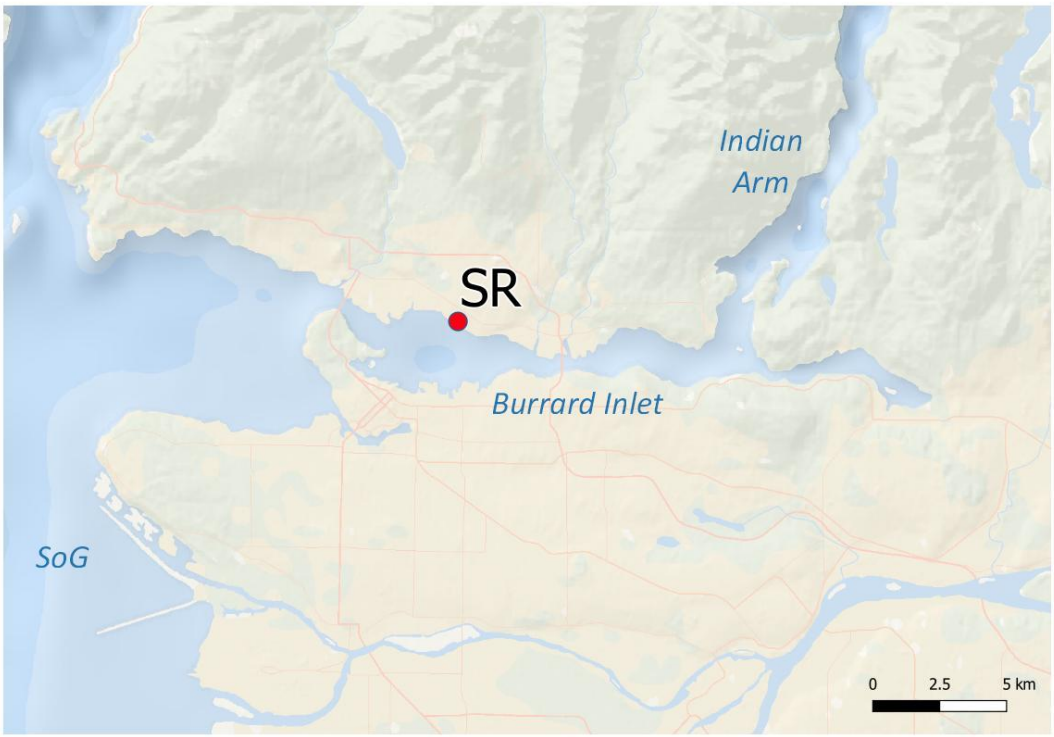


Figure 34: Location of the St. Roch dock on the north shore of the Outer Harbour of Burrard Inlet, British Columbia (49° 18' 35" N; 123° 47' 38" W). Video surveys took place on October 1st, 2020.

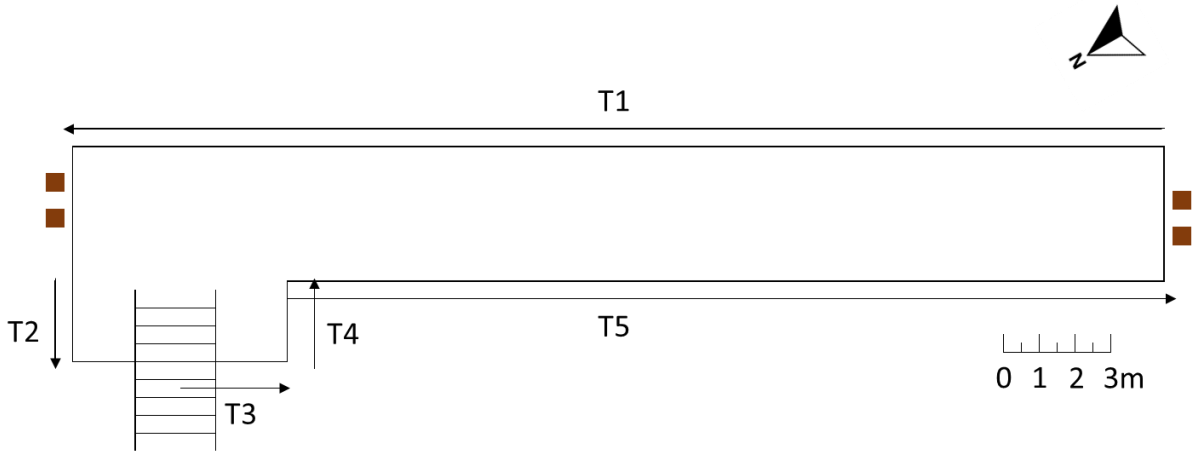
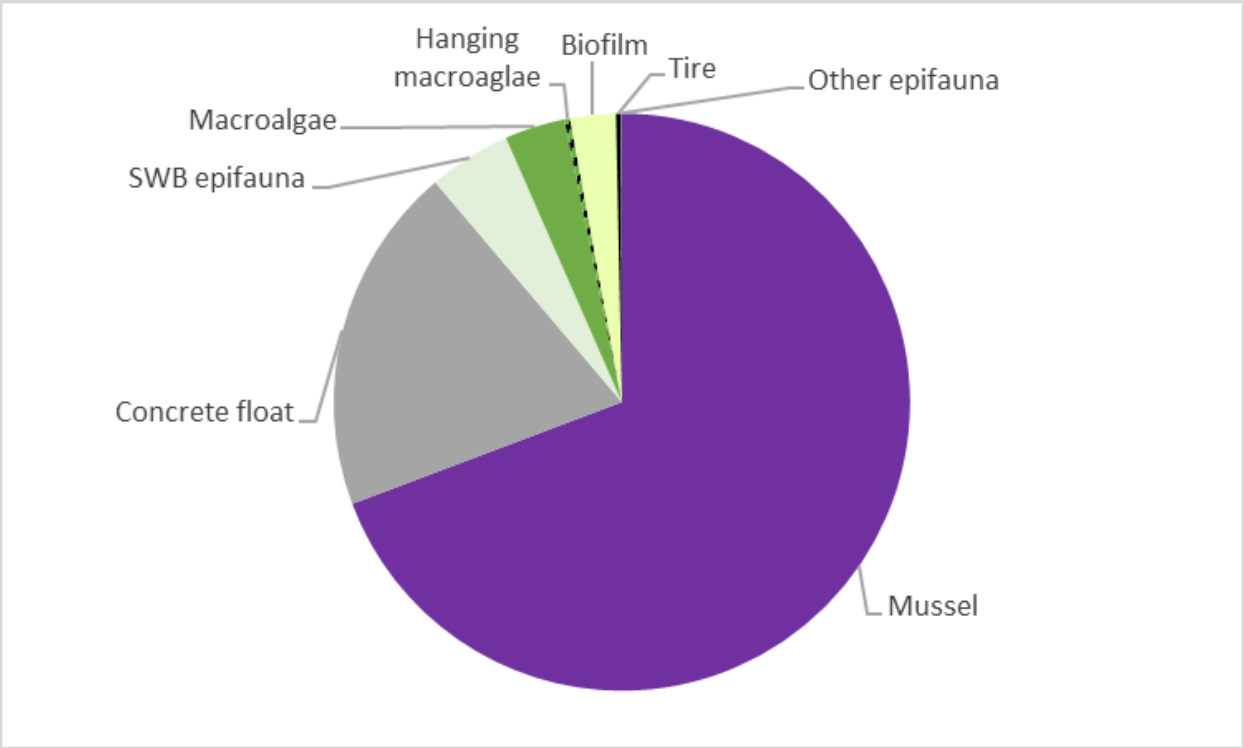


Figure 35: Schematic diagram of the St. Roch dock where a cluster of brown squares represent pilings. Video surveys were collected along 5 transects (T1, T2, T3, T4, T5) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. The entrance ramp is located at the northwest corner of the dock.

4.2.9.3 Relative proportion of St. Roch dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		69.8
	Concrete		19.7
	Macroalgae	*Ulva* spp. (0.5%)	3.7
		Bladed macroalgae (trace)	
		Branched macroalgae (1.5%)	
		Encrusted macroalgae (0.2%)	
		Unidentified macroalgae (1.2%)	
	Hanging macroalgae	Hanging kelp (0.3%)	
	Structural white branching epifauna		4.7
	Biofilm		2.6
	Tire		0.3
	Other epifauna	Barnacles (trace)	Trace
		Encrusting sponges (trace)	
		Colonial tunicate (trace)	

Figure 36: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the St. Roch dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 28: Relative proportion of epifauna and substrate coverage for both combined and individual video-surveys at 3 dock depth-intervals at the St. Roch dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		69.8%	33.1%	90.3%	85.8%
	Concrete		19.7%	59.1%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	0.5%	1.5%	Trace	Trace
		Bladed macroalgae	Trace	Trace	0.0%	0.0%
		Branched macroalgae	1.5%	4.9%	Trace	0.1%
		Encrusted macroalgae	0.2%	0.7%	0.0%	0.0%
		Unidentified macroalgae	1.2%	Trace	0.8%	1.2%
	Hanging macroalgae	Hanging kelp	0.3%	0.0%	0.5%	0.4%
	Structural white branching epifauna		4.7%	0.0%	7.1%	6.8%
	Biofilm		2.6%	0.0%	1.8%	5.9%
	Tire		0.3%	0.8%	0.0%	0.0%
	Other epifauna	Barnacles	Trace	0.0%	Trace	Trace
		Encrusting sponges	Trace	0.0%	Trace	0.1%
		Colonial tunicate	Trace	0.0%	Trace	Trace

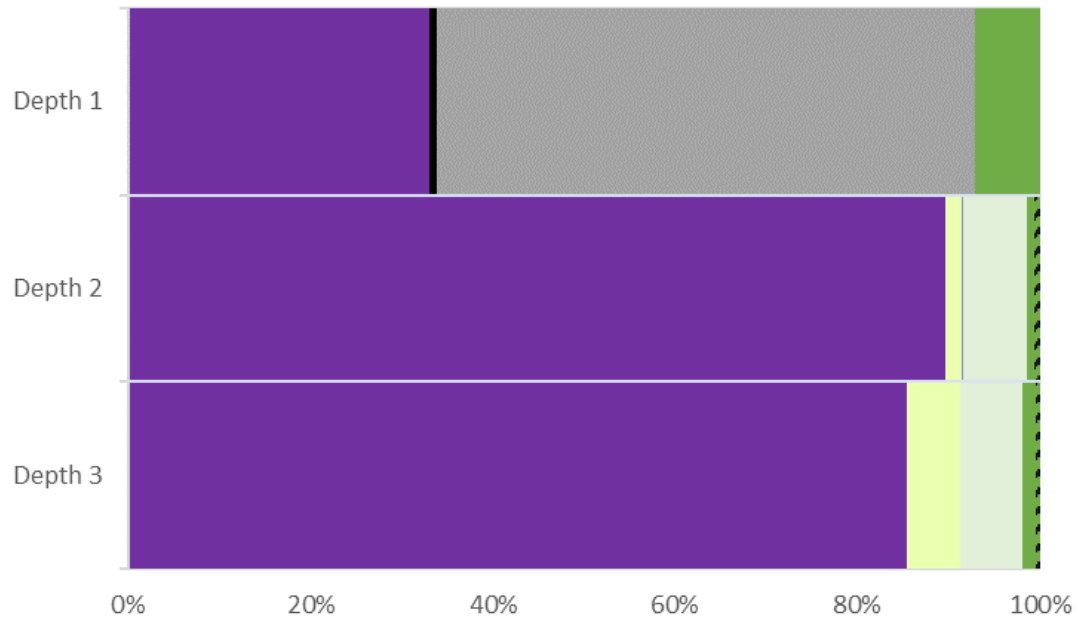


Figure 37: Relative proportion of epifauna, substrate, and open-water coverage according to the three video depth-interval surveys at St. Roch dock.

4.2.9.4 Abundance of solitary epifauna and fish at St. Roch dock

Table 29: Abundance of solitary epifauna and fish at 3 surveyed depth-intervals at the St. Roch dock (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth3
Limpet	17	52	0.99	0.53
Feather duster worm	2.5	0.00	3.0	4.1
Green urchin	0.87	0.00	0.32	2.2
Unidentified anemone	0.052	0.00	0.096	0.063
Painted anemone	0.033	0.00	0.040	0.063
Chiton	0.24	0.00	0.00	0.69
Ochre star	0.28	0.00	0.00	0.83
Calcareous tube worm	0.010	0.00	0.032	0.00
Kelp isopod	0.013	0.00	0.040	0.00

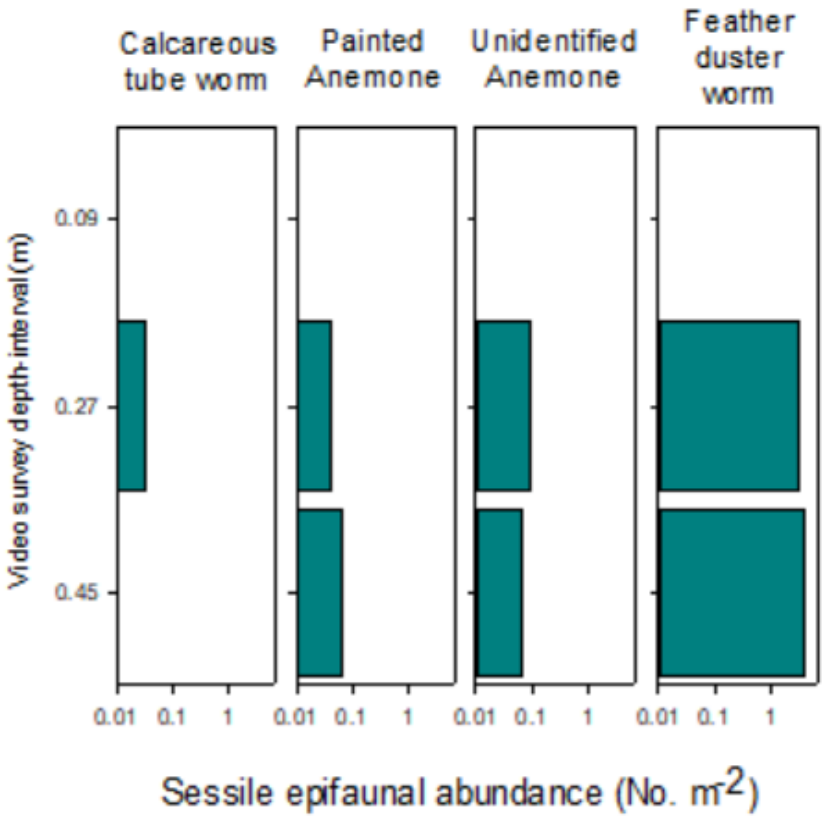


Figure 38: Sessile epifaunal abundance across three video depth-interval surveys at St. Roch dock.

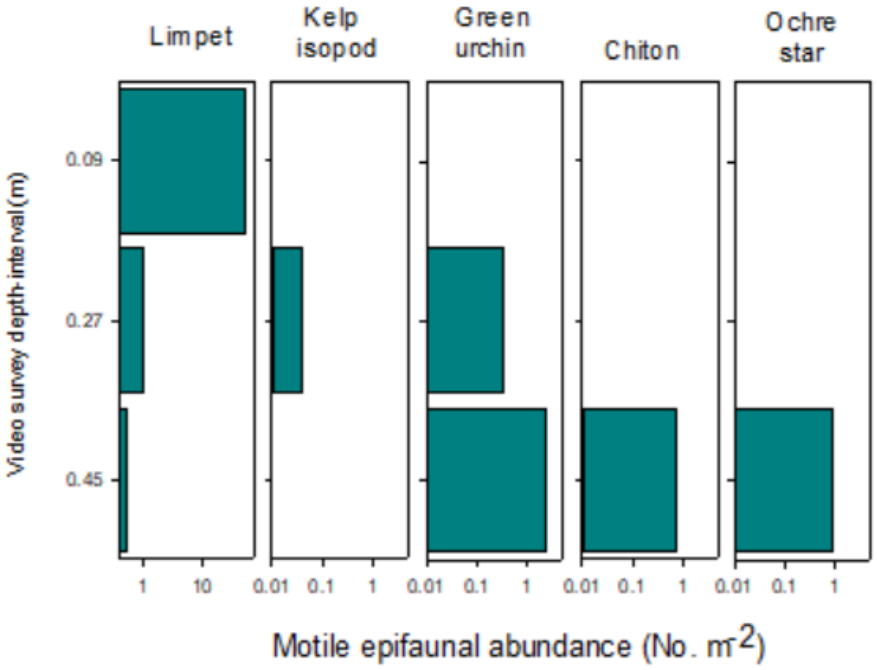


Figure 39: Motile epifaunal abundance across three video depth-interval surveys at St. Roch

4.2.9.5 Areal-proportion of dock surveyed by video at St. Roch

Table 30: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the St. Roch dock.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	207.42	185.40	39.02	34.87
Depth-1	69.14	61.95	10.49	9.40
Depth-2	69.14	61.62	14.26	12.71
Depth-3	69.14	61.83	14.26	12.76
Depth-Average	69.14	61.80	13.01	11.62

4.2.10 CATES PARK DOCK

4.2.10.1 Cates Park dock abstract

- The Cates Park (CP) dock is comprised of 3 types of substrate and medium: wood, plastic, and open water: 1) wood served as a substrate for depth-interval-1; 2) submerged plastic square flotations were attached to the underside of the floating dock at depth-intervals 1, 2 and 3; and 3) open-water occurred in gaps between plastic square flotations (depth-interval-2) and at the lower underside of the dock No. m^{-2} (depth-interval-3).
- Epifauna and epiflora, associated with a combined richness value (9), were estimated as 1) percent coverage (mussels, barnacles, macroalgae, SWB epifauna, colonial tunicates) and 2) abundance recorded as No. m^{-2} (limpet, tube worms, anemones, sea stars, chitons, and fish).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussel (40.6%), wood (13.0%), open water (21.1%), plastic (15.6%), and macroalgae/seagrass (3.6%)
- The top 5 epifauna associated with abundance estimates consist of feather duster worm (3.1No.m^{-2}), plumose anemone (1.5 No.m^{-2}), calcareous tube worm (1.3 No.m^{-2}), limpet (0.73 No.m^{-2}), and ochre star (0.21 No.m^{-2})
- Regarding the dock vertical profile of the video depth-intervals, epifuana estimated by both percent coverage have both a relatively high and even taxa diversity across the 3 video-survey depth-intervals relative to that across docks, with the exception of Belcarra Park. In addition, sessile epifauna distribution is limited to subsurface video surveys.
- One taxa of fish (perch) was observed in the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 97.24% (289.11 m) of the total dock-perimeter length (297.33 m) was surveyed across three depth-interval transects, while 97.27% (54.40 m^2) of the total dock perimeter area (55.93 m^2) was surveyed across the depth-interval transects [Figure 41 (Schematic Diagram)].

4.2.10.2 Cates Park dock location and schematic diagram

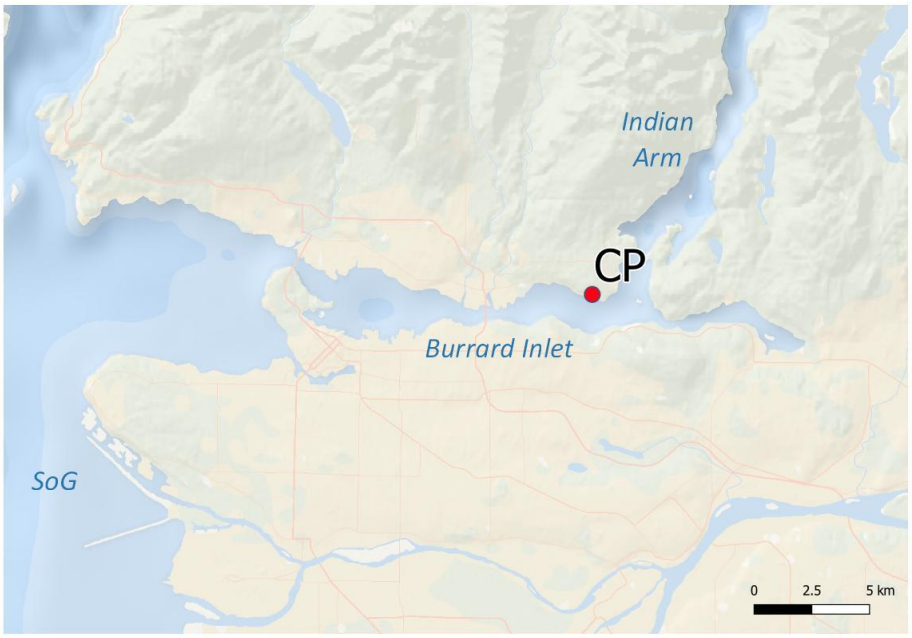


Figure 40: Location of the Cates Park dock on the northwest shore of Indian Arm in Burrard Inlet, British Columbia (49° 18’ 14” N; 122° 57’ 46” W). Video surveys took place on October 2nd, 2020.

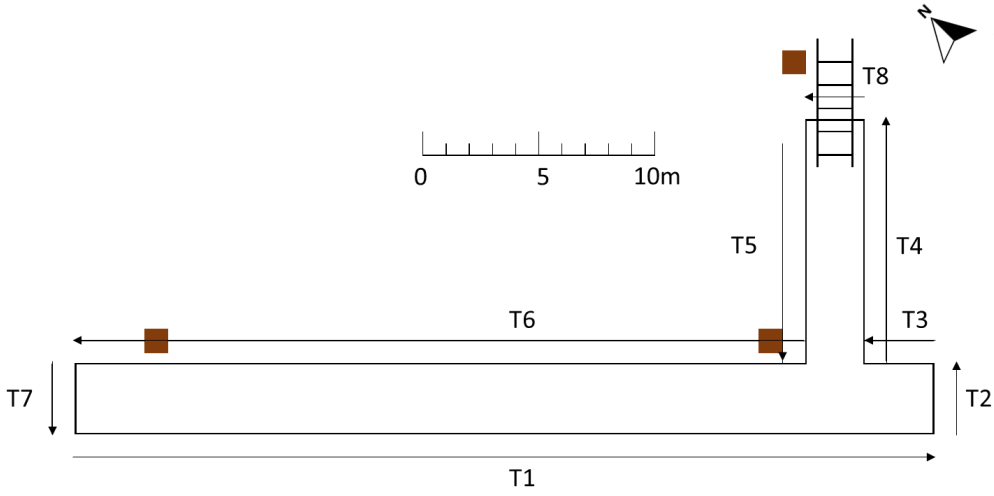
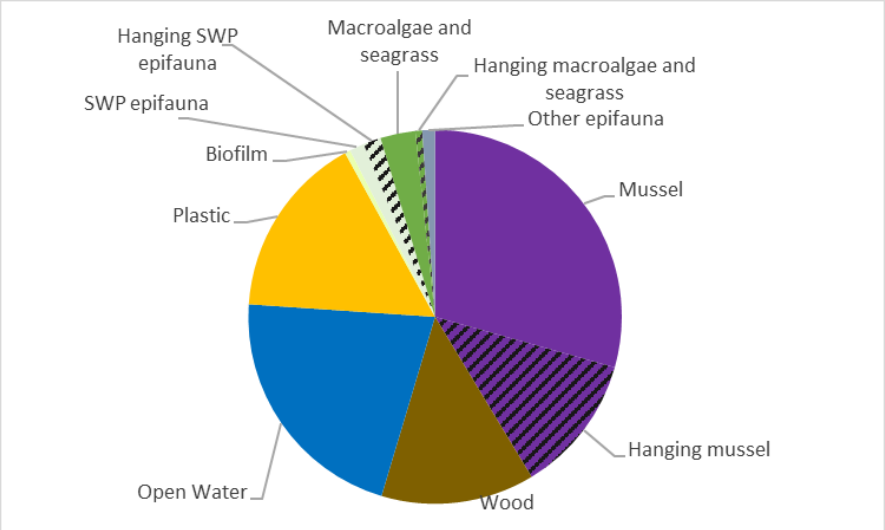


Figure 41: Schematic diagram of the Cates Park dock. Video surveys were collected along 2 transects (T1, T2, T3, T4, T5, T6, T7) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. An entrance gangway is located at the north end of the north-south oriented dock.

4.2.10.3 Relative proportion of Cates Park dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel (28.8%)		40.6
	Hanging mussel (11.8%)		
	Wood	Wood piling (Trace)	13.0
		Wood float (13.0%)	
	Open water		21.1
	Plastic		15.6
	Biofilm		0.5
	Structural white branching epifauna (1.2%)		2.7
	Hanging structural white branching epifauna (1.5%)		
	Macroalgae and seagrass	*Ulva* spp. (0.8%)	3.6
		Fucus spp. (Trace)	
		Bladed macroalgae (Trace)	
		Encrusted macroalgae (0.1%)	
		Seagrass (Trace)	
		Unidentified macroalgae (2.1%)	
	Hanging macroalgae and seagrass	Hanging kelp (0.5%)	
		Hanging *Ulva* spp. (Trace)	
		Hanging *Fucus* spp. (Trace)	
		Hanging Unidentified macroalgae (Trace)	
	Other epifauna	Aggregated barnacles (1.1%)	1.1
		Colonial tunicates (Trace)	

Figure 42: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Cates Park dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 31: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at Cates Park dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		28.8%	20.3%	56.9%	12.5%
	Hanging mussel		11.8%	0.0%	0.0%	30.6%
	Wood	Wood piling	Trace	Trace	6.4%	0.0%
		Wood float	13.0%	25.7%	0.0%	0.0%
	Open water		21.1%	7.5%	11.9%	40.0%
	Plastic		15.6%	25.7%	12.2%	9.1%
	Biofilm		0.5%	0.0%	0.1%	0.0%
	Structural white branching epifauna		1.2%	0.2%	3.2%	0.2%
	Hanging structural white branching epifauna		1.5%	0.0%	0.0%	0.1%
	Macroalgae and seagrass	*Ulva* spp.	0.8%	2.0%	0.4%	0.1%
		Fucus spp.	Trace	0.0%	0.1%	0.0%
		Bladed macroalgae	Trace	Trace	0.0%	0.0%
		Encrusted macroalgae	0.1%	0.2%	0.0%	0.0%
		Seagrass	Trace	0.0%	Trace	Trace
		Unidentified macroalgae	2.1%	0.4%	5.1%	0.2%
	Hanging macroalgae and seagrass	Hanging kelp	0.5%	0.0%	0.9 %	0.5%
		Hanging *Ulva* spp.	Trace	0.0%	0.0%	0.1%
		Hanging *Fucus* spp.	Trace	0.0%	0.0%	0.1%
		Hanging Unidentified macroalgae	1.5%	0.0%	0.0%	0.1%
	Other epifauna	Aggregated barnacles	1.1%	1.0%	2.9%	0.1%
		Colonial tunicates	Trace	0.00%	Trace	0.0%

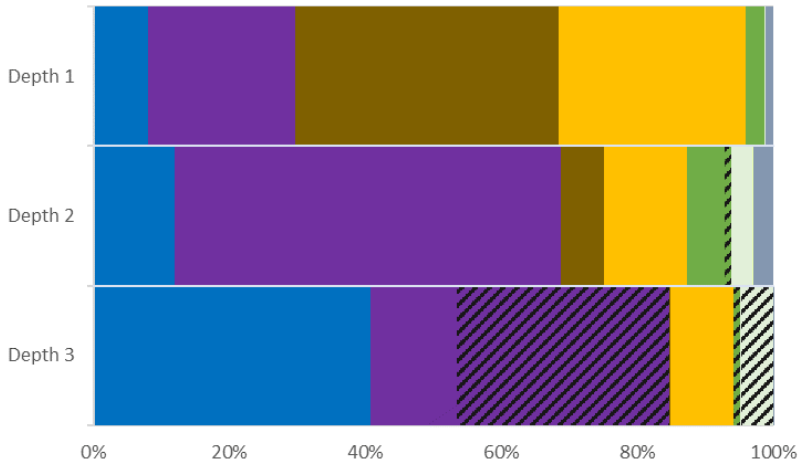


Figure 43: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the Cates Park dock.

4.2.10.4 Abundance of solitary epifauna and fish at Cates Park dock

Table 32: Abundance of solitary epifauna and fish observed at Cates Park dock across video-survey depth-intervals (No. m^{-2}).

Fauna Type	Average	Depth 1	Depth 2	Depth 3
Feather duster worm	3.1	0.00	1.4	7.8
Plumose anemone	1.5	0.00	0.085	4.4
Calcareous tube worm	1.3	0.00	2.1	1.7
Limpet	0.73	1.8	0.25	0.064
Ochre star	0.21	0.00	0.064	0.57
Unidentified anemone	0.035	0.00	0.10	0.00
Chiton	0.040	0.00	0.00	0.12
Perch	0.059	0.00	0.00	0.17

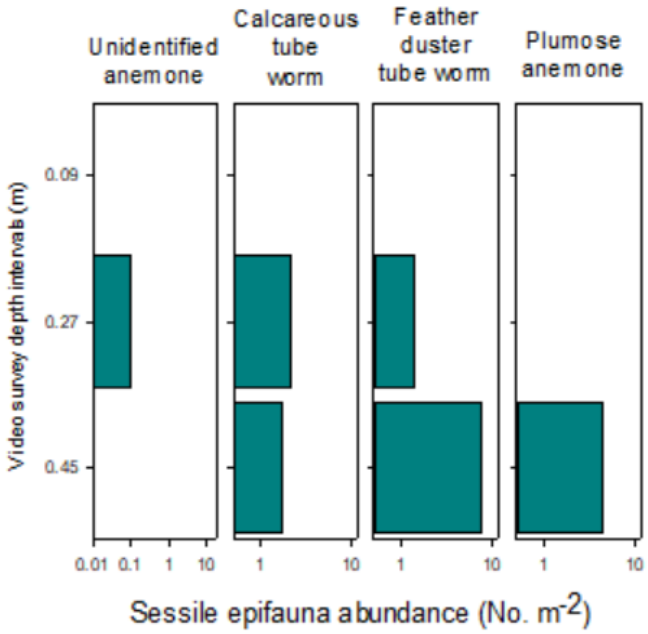


Figure 44: Sessile epifaunal abundance across three video depth-interval surveys at Cates Park dock.

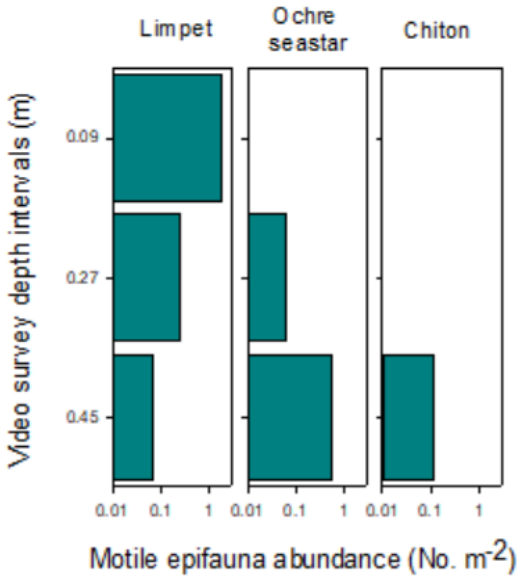


Figure 45: Motile epifaunal abundance across three video depth-interval surveys at Cates Park.

4.2.10.5 Areal-proportion of dock surveyed by video at Cates Park

Table 33: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Cates Park.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	297.33	289.11	55.93	54.40
Depth-1	99.11	98.06	15.03	14.57
Depth-2	99.11	98.17	20.45	20.05
Depth-3	99.11	95.88	20.45	19.78
Depth-Average	99.11	96.37	18.64	18.13

4.2.11 ROCKY POINT DOCK

4.2.11.1 Rocky Point dock abstract

- The Rocky Point (RP) dock is comprised of 3 types of substrate and medium: wood, plastic, and open-water: 1) wood served as a substrate for depth-intervals-1 and- 2; 2) plastic buoys attached to depth-interval-1; and 3) open-water was present in dock gaps at mid-Transect-1 and -3 and also at the lower limit of depth-interval-3.
- Epifauna and epifloral, associated with a combined richness value (10), were estimated as 1) percent coverage (mussels, barnacles, macroalgae, SWB epifauna, colonial tunicates); and 2) abundance recorded as No. m^{-2} (anemones, solitary tunicates, white tufted tube-dwelling (WTT) worms or anemones, and fish).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussel (50.3%), wood (21.1%), SWB epifauna (6.6%), open water (13.8%), and plastic (6.7%).
- Epifauna associated with abundance estimates consist of WTT worm or anemone (0.88 $No.m^{-2}$), unidentified solitary tunicate (0.21 $No.m^{-2}$), and plumose anemone (0.090 $No.m^{-2}$).
- Regarding the dock vertical profile of the video depth-intervals, the relative proportion of epifaunal/substrate composition does not present a vertical profile trend. The sessile epifauna distribution are limited to the subsurface depth intervals.
- One taxa of fish was observed in the video-recordings collected at this dock (pipefish).
- In terms of the proportion of video coverage along the dock perimeter, 92.59 % (195.88 m) of the total dock-perimeter length (211.56 m) was surveyed across three depth-interval transects, while 92.65 % (36.87 m^2) of the total dock perimeter area (39.79 m^2) was surveyed across the depth-interval transects [Figure 47 (Schematic Diagram)].

4.2.11.2 Rocky Point dock location and schematic diagram

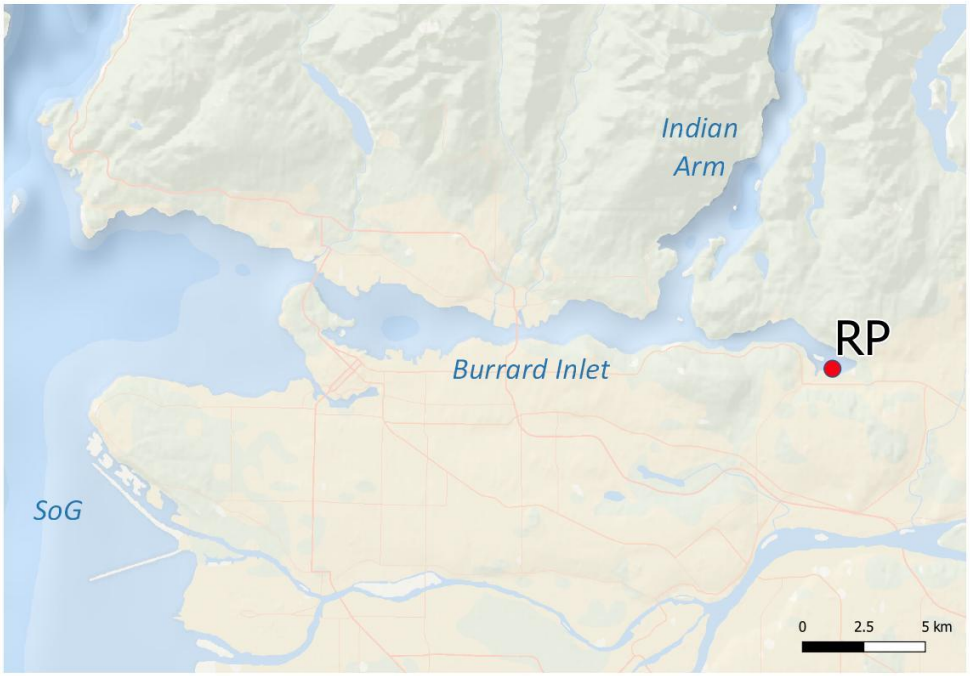


Figure 46: Location of the Rocky Point dock is at the inner termination of Port Moody Arm in Burrard Inlet, British Columbia (49° 16' 57" N; 122° 50' 60" W). Video surveys took place on October 3rd, 2020.

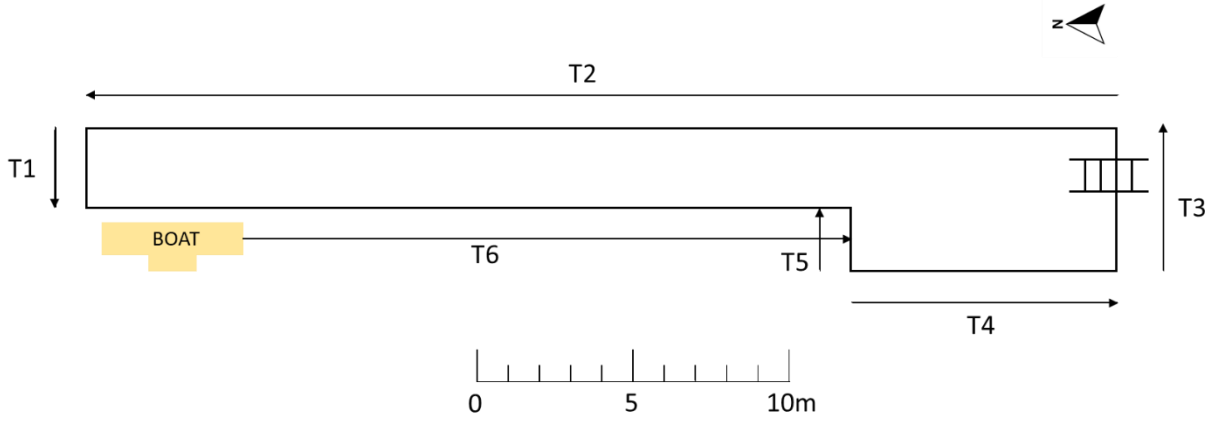
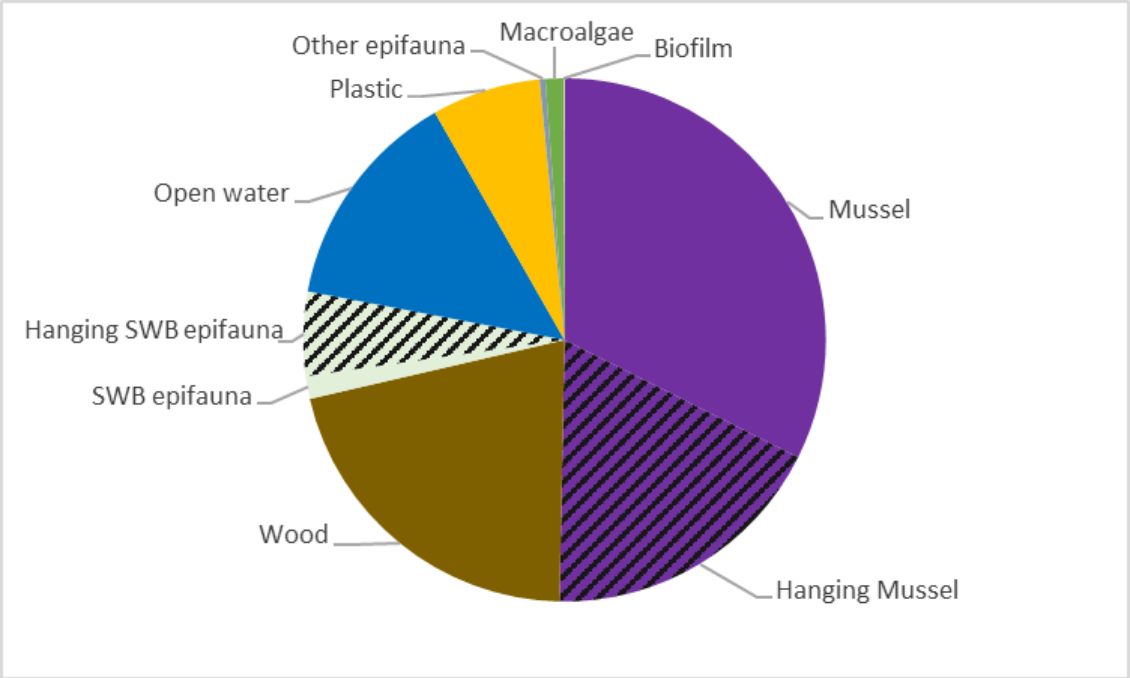


Figure 47: Schematic diagram of the Rocky Point dock. Video surveys were collected along each of the 6 transects (T1, T2, T3, T4, T5, T6) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. A boat obstructed video segments at all 3 depth-intervals on transect 6. An entrance gangway is located at the southern transect of the dock.

4.2.11.3 Relative proportion of Rocky Point dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel (32.4%)		50.3
	Hanging mussel (17.9%)		
	Wood	Wood piling (0.1%)	21.1
		Wood float (21.0%)	
	Structural white branching epifauna (1.4%)		6.6
	Hanging structural white branching epifauna (5.2%)		
	Open water		13.8
	Plastic		6.7
	Other epifauna	Barnacles (0.1%)	0.4
		Colonial tunicates (0.3%)	
	Macroalgae	*Ulva* spp. (1.1%)	1.1
		Unidentified macroalgae (trace)	
	Biofilm		0.1

Figure 48: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Rocky Point dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 34: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		32.4%	78.5%	88.3%	0.0%
	Hanging mussel		17.9%	0.0%	0.0%	53.9%
	Wood	Wood piling	0.1%	0.4%	0.0%	0.0%
		Wood float	21.0%	63.1%	0.0%	0.0%
	Structural white branching epifauna		1.4%	0.0%	4.4%	0.0%
	Hanging structural white branching epifauna		5.2%	0.0%	0.0%	15.3%
	Open water		13.8%	3.3%	6.9%	30.6%
	Plastic		6.7%	21.3%	0.0%	0.0%
	Other epifauna	Barnacles	0.1%	0.2%	0.0%	0.0%
		Colonial tunicates	0.3%	0.0%	0.4%	0.5%
	Macroalgae	*Ulva* spp.	1.1%	3.3%	0.00%	0.0%
		Unidentified macroalgae	Trace	0.0%	Trace	0.0%
	Biofilm		0.1%	0.0%	0.2%	0.0%

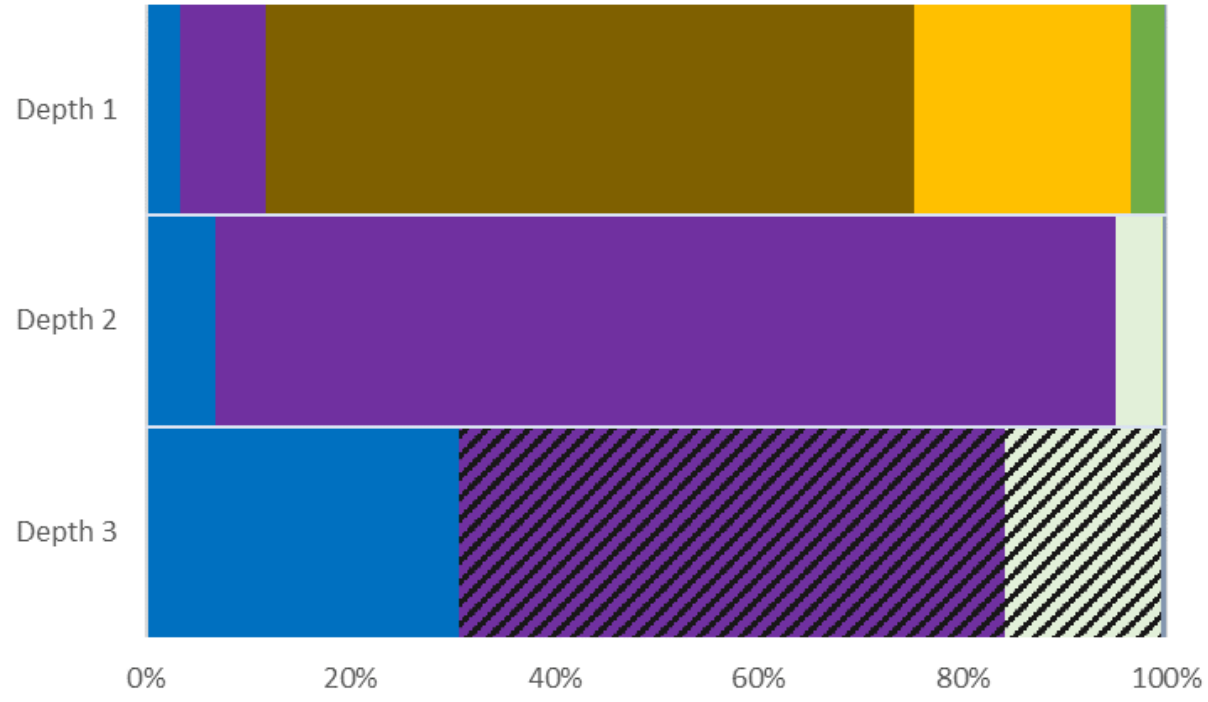


Figure 49: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the Rocky Point dock.

4.2.11.4 Abundance of solitary epifauna and fish at Rocky Point dock

Table 35: Abundance of solitary epifauna and fish observed at Rocky Point dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
White tuft tube-dwelling worm or anemone	0.88	0.0	1.75	0.92
Unidentified solitary tunicate	0.21	0.0	0.078	0.090
Plumose anemone	0.090	0.0	0.043	0.22
Pipefish	0.0082	0.0	0.0	0.024

4.2.11.5 Areal-proportion of dock surveyed by video at Rocky Point

Table 36: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Rocky Point.

	Length of existing dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	211.56	195.88	39.79	36.87
Depth-1	70.52	64.84	10.70	9.84
Depth-2	70.52	65.48	14.55	13.51
Depth-3	70.52	65.56	14.55	13.53
Depth-Average	70.52	65.29	13.26	12.29

4.2.12 BELCARRA PARK DOCK

4.2.12.1 Belcarra Park dock abstract

- The Belcarra Park (BP) dock is comprised of 5 types of substrate and medium: wood, plastic floatation, tires, metal and open-water: 1) wood and plastic floatation served as a substrate for depth-interval 1; 2) tires were mounted horizontally below the wooden dock and were present in all 3 depth-intervals; 3) metal served as a casing for plastic floatation and wooden pilings; and 4) open-water was present in dock gaps at depth-intervals-2 and -3 and also at the lower limit of depth-interval-3.
- Epifauna and epifloral, associated with a combined richness value (20), were estimated as 1) percent coverage (mussels, barnacles, macroalgae, SWB epifauna, colonial tunicates); and 2) abundance recorded as $No.m^{-2}$ (limpet, tube worms, anemones, sea stars, chitons, nudibranch, fish).
- The top 5 epifauna/substrate associated with coverage estimate consisted of mussel (45.4%), tire (15.2%), wood (16.1%), open-water (10.8%), SWB epifauna (5.1%).
- The top 5 epifauna associated with abundance estimate consist of plumose anemone (10 $No.m^{-2}$), feather duster worm (12 $No.m^{-2}$), ochre star (1.1 $No.m^{-2}$), calcareous tube worm (1.9 $No.m^{-2}$), and chiton (0.12 $No.m^{-2}$).
- One taxa of fish (perch) was observed in the video-recordings collected at this dock.
- Regarding the dock vertical profile of the video depth-intervals, there was an increase in open water medium along with hanging mussel, macrofauna, SWB epifauna. Macroalgae and mussel relative proportion peaked at the mid depth-interval (2). The sessile epifauna distribution are limited to the subsurface video survey transects.
- In terms of the proportion of video coverage along the dock perimeter, 78.51% (240.16 m) of the total dock-perimeter length (305.88 m) was surveyed across three depth-interval transects, while 78.62% (45.24 m^2) of the total dock perimeter area (57.54 m^2) was surveyed across the depth-interval transects [Figure 51 (Schematic Diagram)].

4.2.12.2 Belcarra Park dock location and schematic diagram

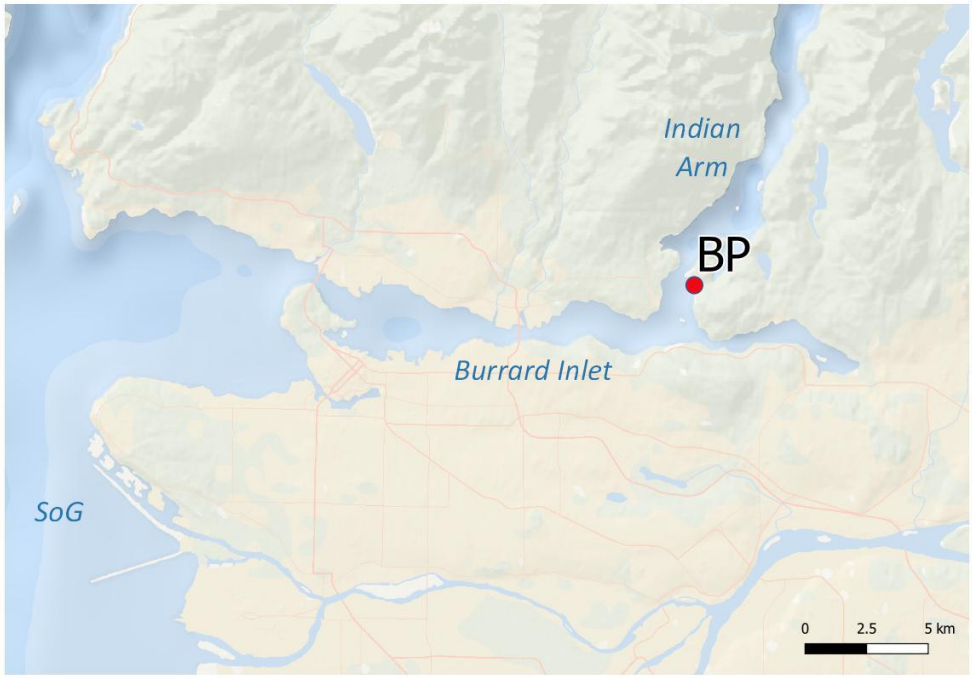


Figure 50: Location of the Belcarra Park dock on the southeast shore of Indian Arm in Burrard Inlet, British Columbia (49° 18' 47" N; 122° 55' 42" W). Video surveys took place on October 3rd, 2020.

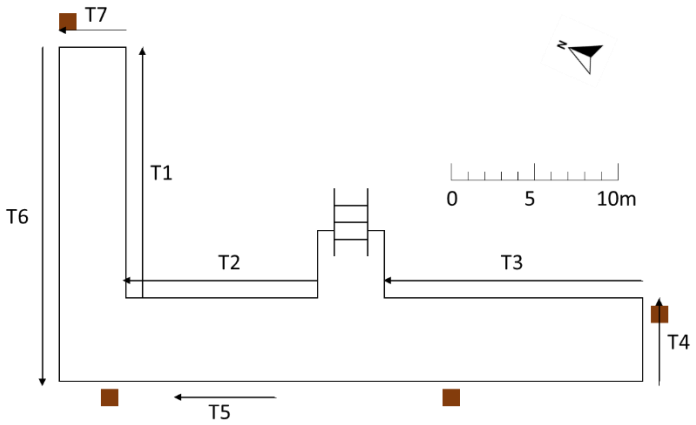
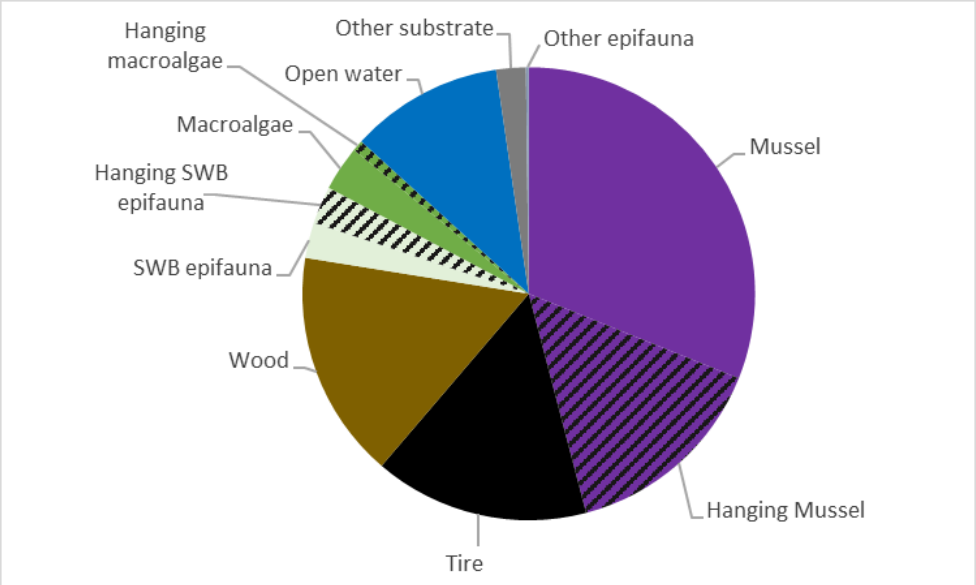


Figure 51: Schematic diagram of the Belcarra Park dock. Video surveys were collected along 7 transects (T1, T2, T3, T4, T5, T6, T7) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. An entrance gangway ladder is located at the mid-section between transects T2 and T3.

4.2.12.3 Relative proportion of Belcarra Park dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups		Percentage (%)
Mussel (30.7 %)		45.4
Hanging mussel (14.7%)		
Tire		15.2
Wood	Wood piling (0.4%)	16.1
	Wood float (15.7%)	
Structural white branching epifauna (2.5%)		5.1
Hanging structural white branching epifauna (2.6%)		
Macroalgae	*Ulva* spp. (0.4%)	4.0
	Fucus spp. (0.2%)	
	Unidentified macroalgae (2.6%)	
Hanging macroalgae	Hanging kelp (0.5%)	
	Hanging *Fucus* spp. (0.2%)	
	Hanging unidentified macroalgae (0.1%)	
Open water		10.8
Other substrate	Metal (1.9%)	2.1
	Plastic (0.2%)	
Other epifauna	Aggregated barnacles (0.2%)	0.2
	Colonial tunicates (Trace)	
	Colonial ascidian (Trace)	

Figure 52: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Belcarra Park dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 37: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at Belcarra Park dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		30.7%	15.4%	51.0%	26.2%
	Hanging mussel		14.7%	0.0%	16.5%	27.0%
	Tire		15.2%	29.2%	11.8%	4.2%
	Wood	Wood piling	0.4%	0.4%	0.5%	0.3%
		Wood float	15.7%	47.6%	0.0%	0.0%
	Structural white branching epifauna		2.5%	0.0%	4.0%	3.5%
	Hanging structural white branching epifauna		2.6%	0.0%	1.0%	7.0%
	Macroalgae	*Ulva* spp.	0.4%	1.0%	0.2%	0.0%
		Fucus spp.	0.2%	0.0%	0.6%	0.0%
		Unidentified macroalgae	2.6%	0.0%	6.8%	1.0%
	Hanging macroalgae	Hanging kelp	0.5%	0.0%	1.1%	0.3%
		Hanging *Fucus* spp.	0.2%	0.0%	0.1%	0.4%
		Hanging unidentified macroalgae	0.1%	0.0%	0.0%	0.4%
	Open water		10.8%	0.0%	4.8%	27.2%
	Other substrate	Metal	1.9%	5.5%	0.3%	0.1%
		Plastic	0.2%	0.6%	0.0%	0.0%
	Other epifauna	Aggregated barnacles	0.2%	0.2%	0.2%	0.1%
		Colonial tunicates	Trace	0.0%	Trace	Trace
		Colonial ascidian	Trace	0.0%	Trace	0.0%

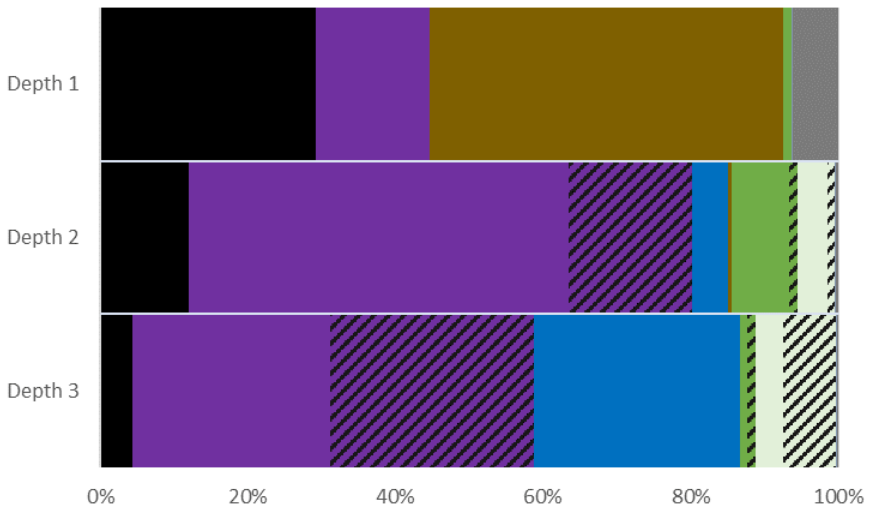


Figure 53: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at Belcarra Park dock.

4.2.12.4 Abundance of solitary epifauna and fish at Belcarra Park dock

Table 38: Abundance of solitary epifauna and fish observed at Belcarra Park dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Plumose anemone	10	0.00	15	15
Feather duster worm	12	0.00	21	14
Ochre star	1.1	0.00	3.0	0.35
Calcareous tube worm	1.9	0.00	3.8	1.8
Perch	0.20	0.00	0.12	0.48
Chiton	0.12	0.082	0.20	0.062
Limpet	0.082	0.24	0.00	0.00
Unidentified anemone	0.043	0.00	0.14	0.00
Opalescent nudibranch	0.023	0.00	0.034	0.045
Leather star	0.015	0.00	0.044	0.00
Unidentified sea star	0.015	0.00	0.00	0.045
Bristly tunicate	0.010	0.00	0.034	0.00

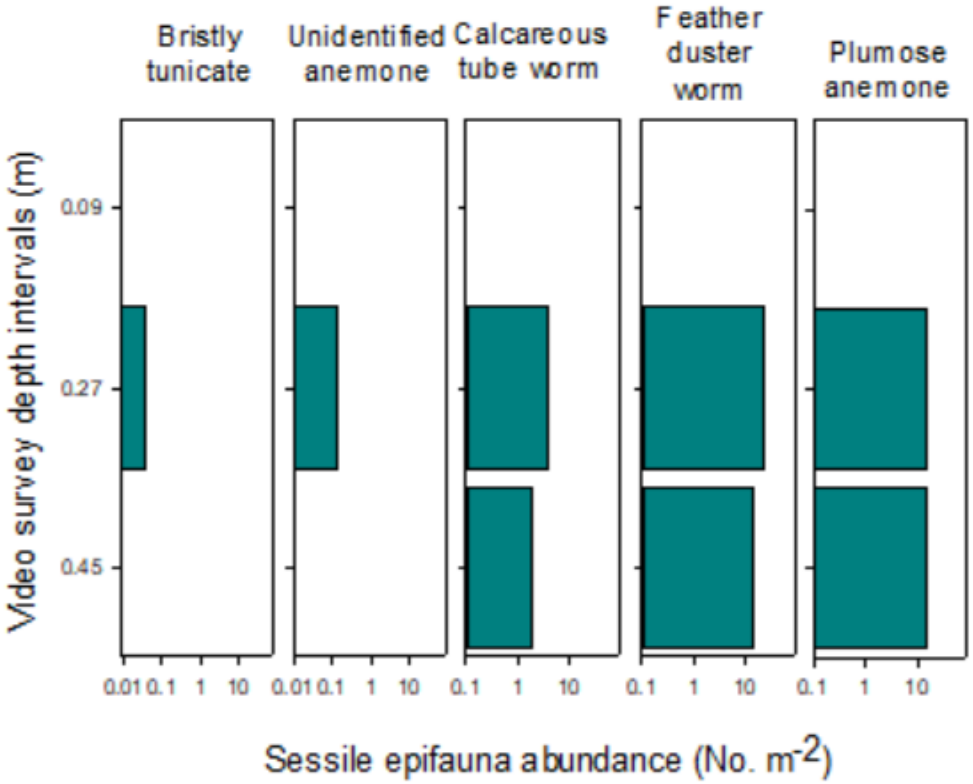


Figure 54: Sessile epifaunal abundance across three video depth-interval surveys at Belcarra Park dock.

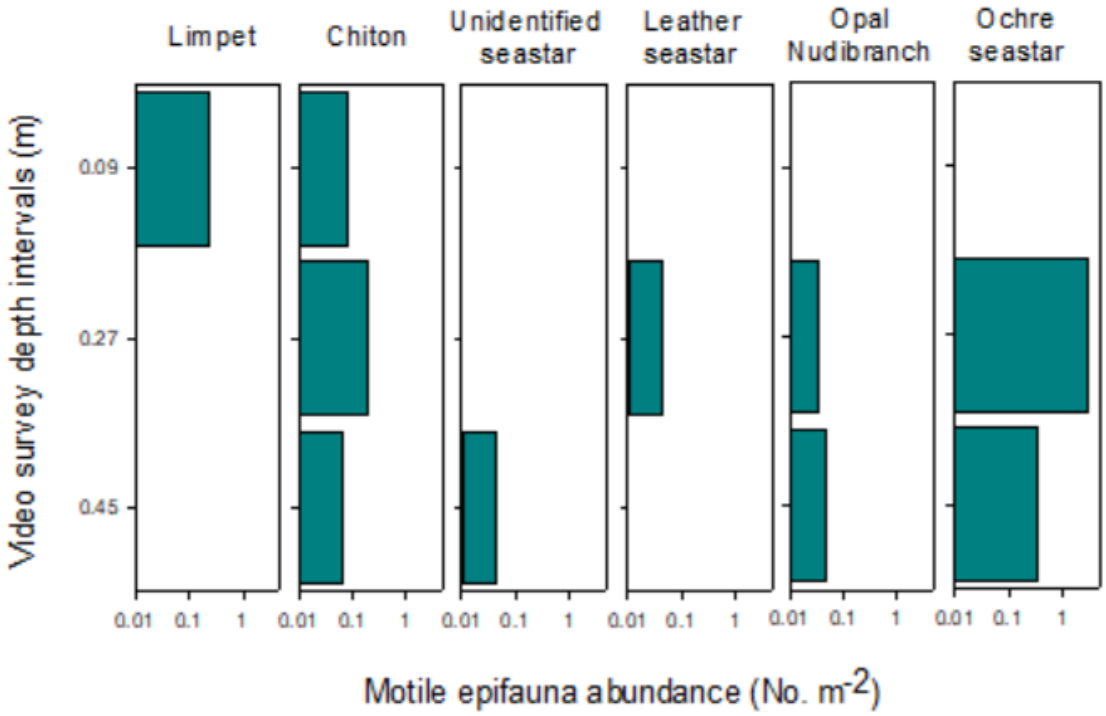


Figure 55: Motile epifaunal abundance across three video depth-interval surveys at Belcarra Park.

4.2.12.5 Areal-proportion of dock surveyed by video at Belcarra Park

Table 39: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Belcarra Park.

	Full length of dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	305.88	240.16	57.54	45.24
Depth-1	101.96	78.93	15.47	11.96
Depth-2	101.96	78.76	21.03	16.25
Depth-3	101.96	82.47	21.03	17.01
Depth-Average	101.96	80.05	19.18	15.08

4.2.13 DEEP COVE DOCK

4.2.13.1 Deep Cove dock abstract

- The Deep Cove (DC) dock is comprised of 5 combined types of substrate and medium: concrete, wood, plastic, metal, and open water: 1) concrete served as substrate for depth-intervals-1, 2, 3; 2) wood served as the dock railing along the dock perimeter; 3) plastic was visible in areas void of biological coverage in depth-interval-3; and 4) metal substrate and open-water medium were located at a joint between two dock segments.
- Epifauna and epifloral, associated with a combined richness value (6), were estimated as 1) percent coverage (mussels, barnacles, macroalgae, SWB epifauna); and 2) abundance recorded as as No. m^{-2} (limpet).
- The top 5 epifauna/substrate associated with coverage estimates consist of mussel (59.5%), concrete (19.9%), macroalgae (15.3%), wood (4.0%), and biofilm (1.0%).
- Epifauna associated with abundance estimate consists of limpet (0.27 No.m^{-2}).
- Regarding the dock vertical profile of the video depth-intervals, the two sub-surface depths have similar epifaunal composition relative to that of the splash-zone surface depth-interval.
- No fish were observed in the video-recordings collected at this dock.
- In terms of the proportion of video coverage along the dock perimeter, 31.59 % (92.32 m) of the total dock-perimeter length (292.20 m) was surveyed across three depth-interval transects, while 31.39% (17.25 m^2) of the total dock perimeter area (54.96 m^2) was surveyed across the depth-interval transects [Figure 57 (Schematic Diagram)].

4.2.13.2 Deep Cove dock location and schematic diagram

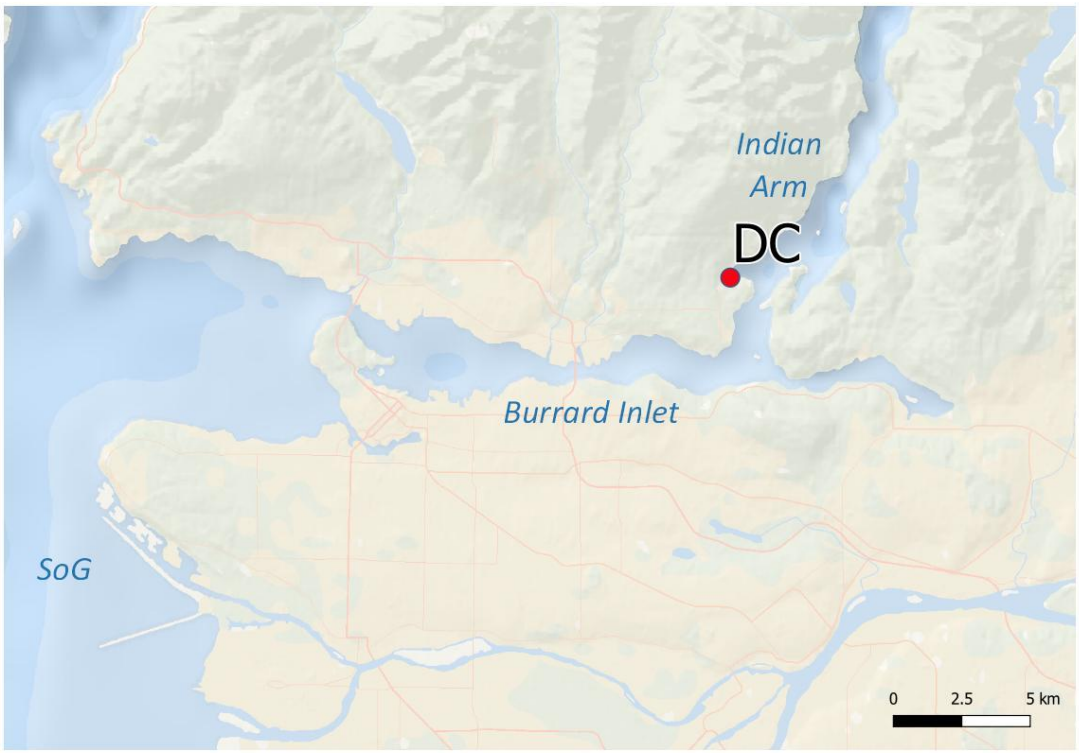


Figure 56: Location of the Deep Cove dock on the northwest shore of Indian Arm in Burrard Inlet, British Columbia (49° 19' 35" N; 122° 56' 54" W). Video surveys took place on October 2ndt, 2020.

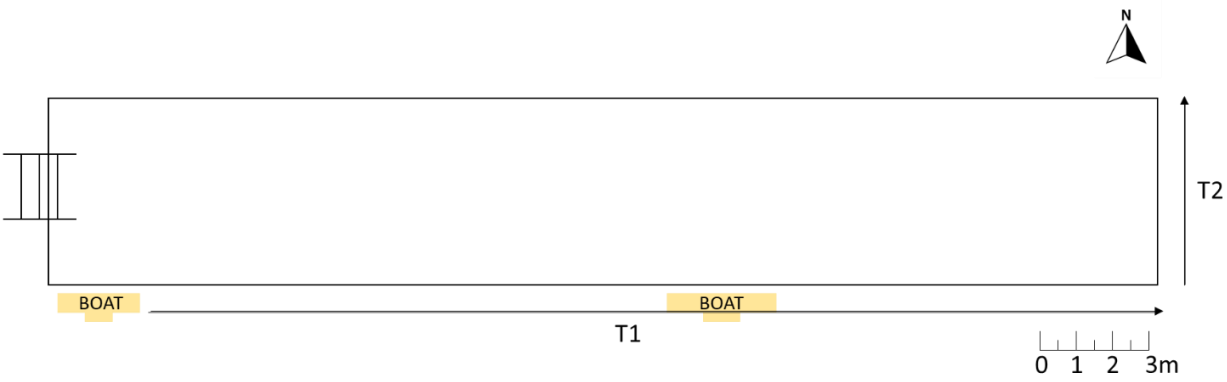
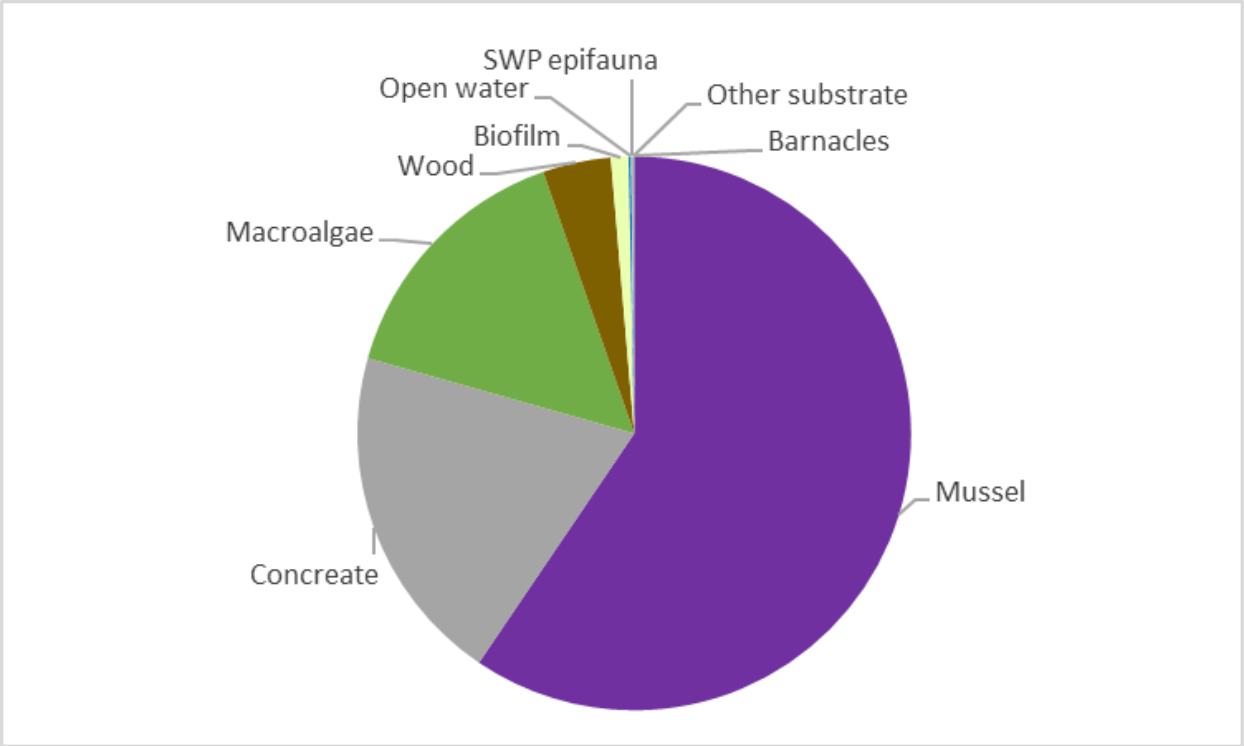


Figure 57: Schematic diagram of the Deep Cove dock. Video surveys were collected along 2 transects (T1, T2) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. Boats obstructed video segments at depth-intervals 2 and 3 on transect 1. An entrance gangway is located at the western side of the dock.

4.2.13.3 Relative proportion of Deep Cove dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Mussel		59.5
	Concrete		19.9
	Macroalgae	*Ulva* spp. (1.7%)	15.3
		Unidentified macroalgae (13.6%)	
	Wood		4.0
	Biofilm		1.0
	Open water		0.1
	Structural white branching epifauna		0.1
	Other substrate	Metal (Trace)	Trace
		Plastic (Trace)	
	Aggregated barnacles		Trace

Figure 58: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Deep Cove dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 40: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the Deep Cove dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Mussel		59.5%	29.9%	80.4%	72.6%
	Concrete		19.9%	54.3%	0.0%	0.0%
	Macroalgae	*Ulva* spp.	1.7%	4.7%	0.3%	0.0%
		Unidentified macroalgae	13.6%	0.7%	18.0%	24.4%
	Wood		4.0%	10.5%	0.0%	0.2%
	Biofilm		1.0%	0.0%	1.2%	2.1%
	Open water		0.1%	0.0%	0.0%	0.5%
	Structural white branching epifauna		0.1%	0.0%	0.1%	0.2%
	Other substrate	Metal	Trace	0.1%	0.0%	0.0%
		Plastic	Trace	0.0%	0.0%	0.1%
	Aggregated barnacles		Trace	0.0%	Trace	0.1%

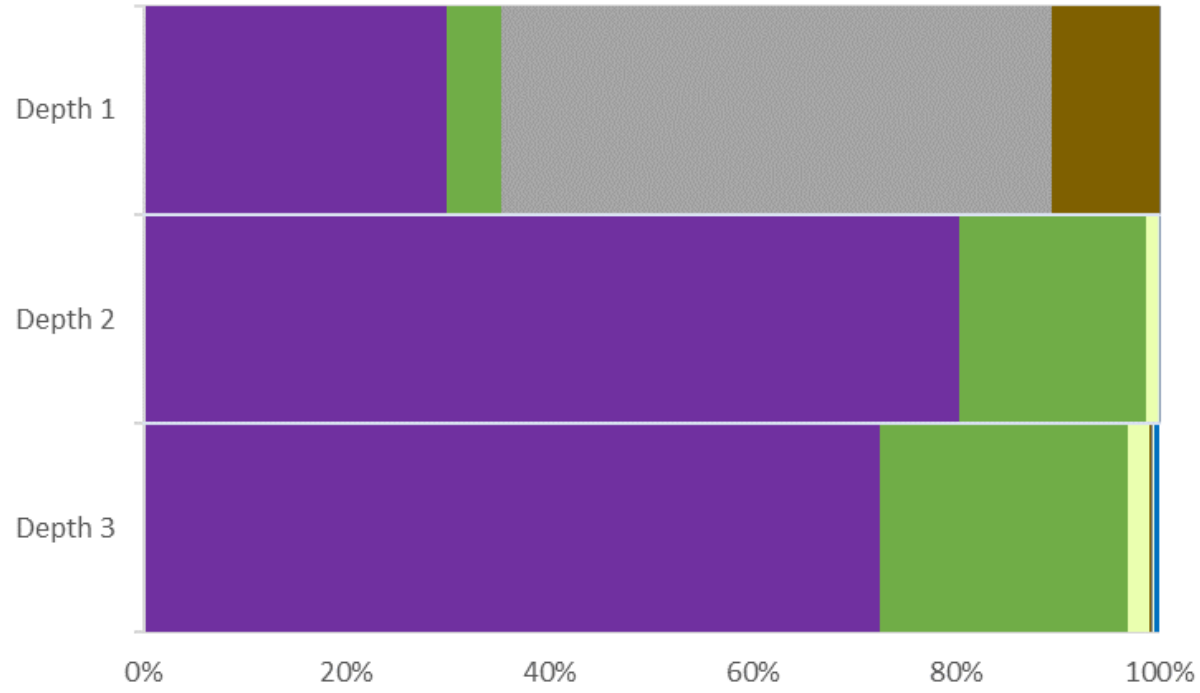


Figure 59: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the Deep Cove dock.

4.2.13.4 Abundance of solitary epifauna and fish at Deep Cove dock

Table 41: Abundance of solitary epifauna and fish observed at Deep Cove dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.27	0.71	0.00	0.00

4.2.13.5 Areal-proportion of dock surveyed by video at Deep Cove

Table 42: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at Deep Cove.

	Full length of dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	292.20	92.32	54.96	17.25
Depth-1	97.40	32.88	14.78	4.99
Depth-2	97.40	29.95	20.09	6.18
Depth-3	97.40	29.49	20.09	6.08
Depth-Average	97.40	30.77	18.32	5.75

4.2.14 CANADIAN COAST GUARD SEA ISLAND DOCK

4.2.14.1 Canadian Coast Guard Sea Island dock abstract

- The Canadian Coast Guard Sea Island (CCGSI) dock is comprised of 4 types of substrates and medium: concrete, plastic, wood, and open-water: 1) concrete and plastic serve as the dock surface, while wood serves as the dock rail; 2) open-water was located at joints between two dock segments.
- Epifauna and epifloral, associated with a combined richness value (6), were estimated as 1) percent coverage (long-filamentous macroalgae) and 2) abundance recorded as as No. m^{-2} (limpet, sea star, fish).
- The top 5 epifauna/substrate associated with coverage estimates consist of macroalgae (69.2%), concrete (19.8%), plastic (2.0%), wood (5.4%), and open water (0.2%).
- Epifauna associated with abundance estimates consist of limpet (0.033 No.m^{-2}) in the SZ, and ochre star (0.012 No.m^{-2}) in SSZ.
- One taxa of fish was observed in the video-recordings collected at this dock (sculpin).
- Regarding the dock vertical profile of the video depth-intervals, the two sub-surface depths have similar epifloral composition, which differs greatly from that of the splash zone exposed to air.
- In terms of the proportion of video coverage along the dock perimeter, 38.68% (175.26 m) of the total dock-perimeter length (453.09 m) was surveyed across three depth-interval transects, while 38.68% (32.96 m^2) of the total dock perimeter area (85.23 m^2) was surveyed across the depth-interval transects [Figure 61 (Schematic Diagram)].

4.2.14.2 Canadian Coast Guard Sea Island location and schematic diagram

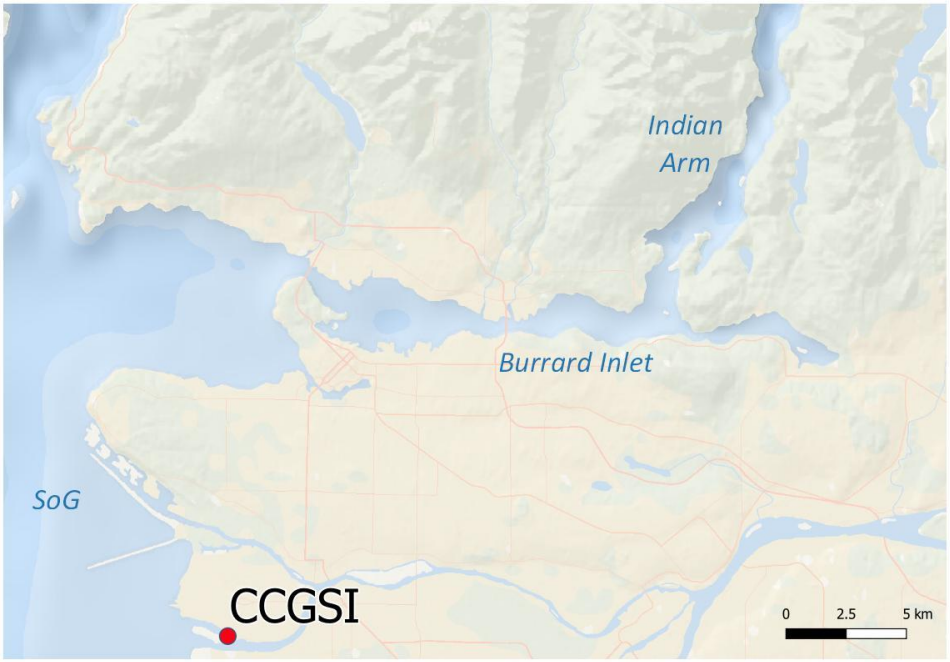


Figure 60: Location of the Canadian Coast Guard Sea Island dock in the Fraser River Delta, British Columbia (49° 10' 48" N; 123° 11' 5" W). Video surveys took place on October 5th, 2020.

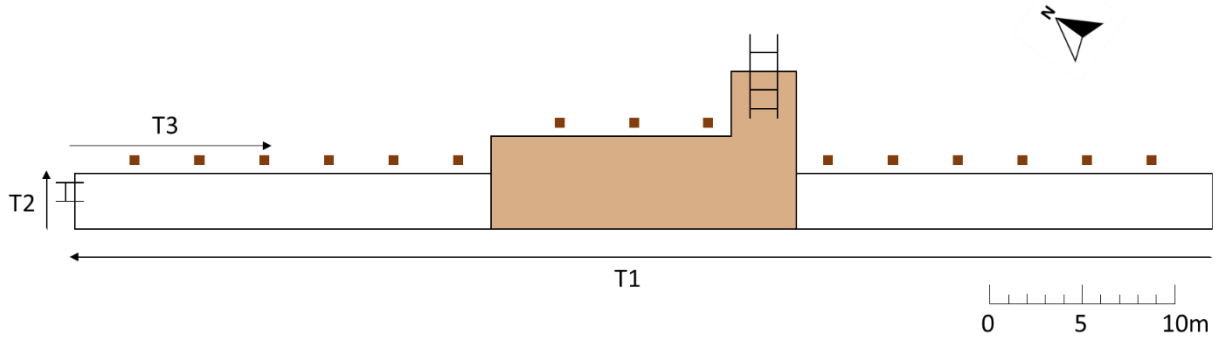
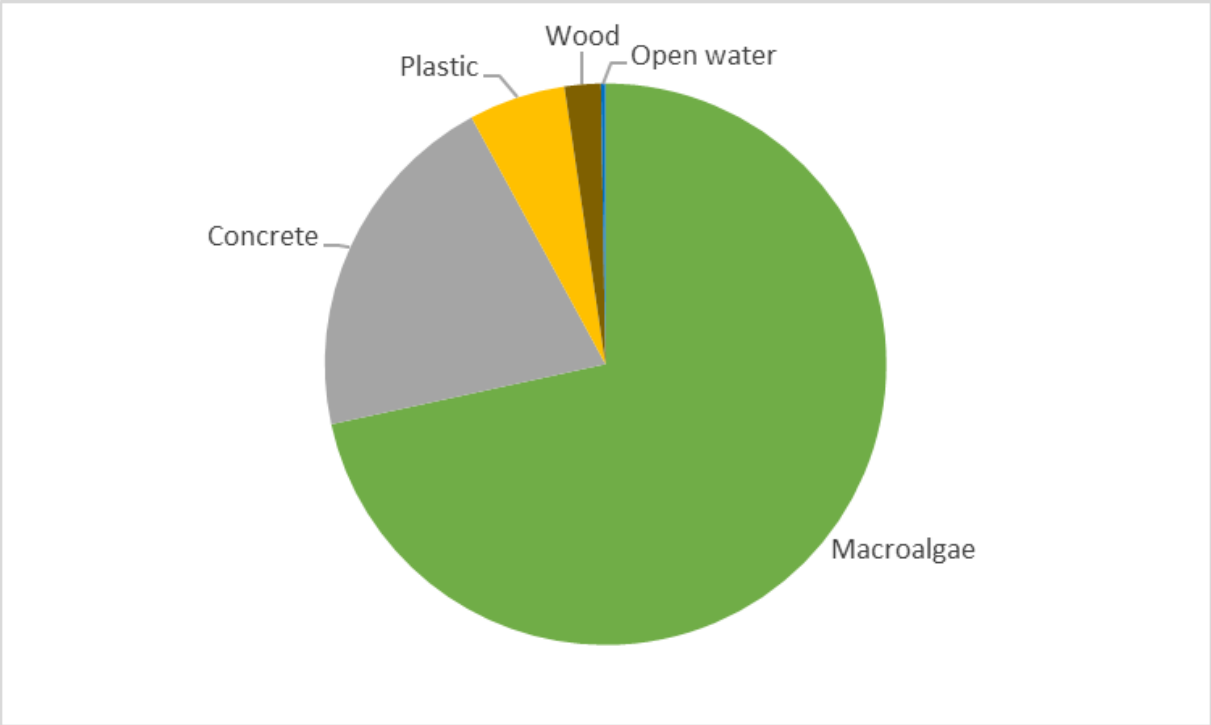


Figure 61: Schematic diagram of the Canadian Coast Guard Sea Island dock located at the entrance to the Fraser River Delta. Brown squares represent pilings. Video surveys were collected along each of the 3 transects (T1, T2, T3) along the dock perimeter. Each transect consisted of 3 video surveys collected at increasing depth intervals. An entrance gangway ladder is located at the middle portion of the dock.

4.2.14.3 Relative proportion of Canadian Coast Guard Sea Island dock substrate and aggregate epifauna



% coverage for epifauna, macroalgae, substrate groups			Percentage (%)
	Macroalgae	*Ulva* spp. (2.5%) (66.7%)	69.2
	Concrete		19.8
	Plastic		2.0
	Wood		5.4
	Open water		0.2

Figure 62: Relative proportion of epifauna, macroalgae, and substrate coverage estimated from video surveys collected at the Canadian Coast Guard Sea Island dock perimeter. Proportion estimates are outlined in the legend below the pie-chart.

Table 43: Relative proportion of epifauna and substrate coverage for both combined and individual video surveys collected at 3 dock depth-intervals at the Canadian Coast Guard Sea Island dock.

% coverage for epifauna, macroalgae, substrate groups			Average	Depth 1	Depth 2	Depth 3
	Macroalgae	*Ulva* spp.	2.5%	21.5%	0.0%	0.0%
		Unidentified macroalgae	66.7%	0.0%	100.0%	100.0%
	Concrete		19.8%	59.41%	0.0%	0.0%
	Plastic		2.0%	6.25%	0.0%	0.0%
	Wood		5.4%	16.2%	0.0%	0.0%
	Open water		0.2%	0.8%	0.0%	0.0%

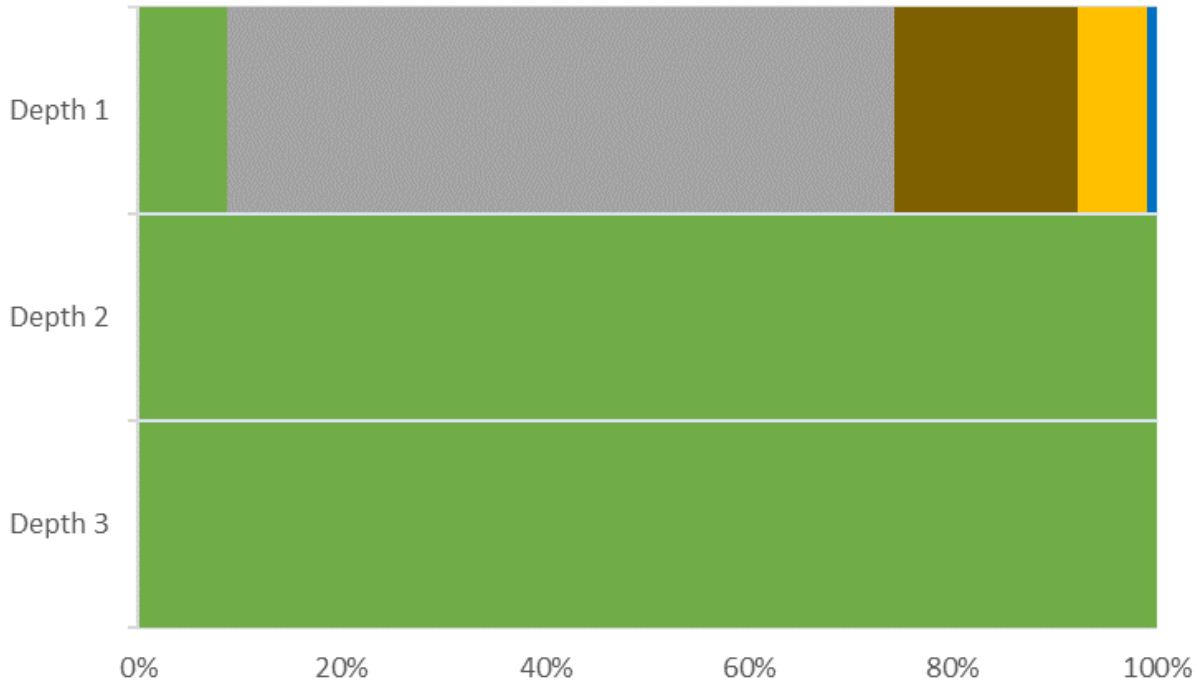


Figure 63: Relative proportion of epifauna, macroalgae, and substrate coverage according to the three video depth-interval surveys at the Canadian Coast Guard Sea Island dock.

4.2.14.4 Abundance of solitary epifauna and fish at Canadian Coast Guard Sea Island dock

Table 44: Abundance of solitary epifauna and fish observed at Canadian Coast Guard Sea Island dock across video-survey depth-intervals (No. m^{-2}).

Fauna type	Average	Depth 1	Depth 2	Depth 3
Limpet	0.033	0.10	0.00	0.00
Ochre star	0.012	0.00	0.037	0.00
Sculpin	0.014	0.00	0.00	0.039

4.2.14.5 Areal-proportion of dock surveyed by video at Canadian Coast Guard Sea Island

Table 45: Comparison of existing and surveyed dock surface-perimeter dimensions based on length and area estimates across three survey depth-intervals at the Canadian Coast Guard station at Sea Island.

	Full length of dock surface perimeter (m)	Survey length of dock-perimeter video-transects (m)	Area of existing surface dock perimeter (m^2)	Survey area of dock-perimeter video-transects (m^2)
Dock-Total	453.09	175.26	85.23	32.96
Depth-1	151.03	58.49	22.91	8.87
Depth-2	151.03	58.58	31.16	12.09
Depth-3	151.03	58.19	31.16	12.00
Depth-Average	151.03	58.42	28.41	10.99

SUMMARY

- Dock substrate composition ranged from 5 types at both the Deep Cove, (wood, open-water, metal, and plastic) and Belcarra Park (wood, tires, open-water, metal, and plastic) docks to 1 type at the False Creek#1 dock (concrete). Although the range in substrate frequency does not align with a range in epifaunal or macroalgal frequency, it appears that docks, characterized by several dominant, evenly-proportioned substrates (Belcarra Park, Cates Park), align with higher epifaunal diversity. The open-water medium can range from 1) a gap occurring between dock segments across all depth intervals or 2) a significant proportion of the lower limit of the depth-interval-3 (DZ), where open-water supports epifauna with other attachment, water-quality, and food requirements. Further, the open-water strata below the dock provides structural epifauna that can serve as secondary substrate for other epifauna; and/or protection from docking boat traffic. This scenario is seen within Belcarra Park and Cates Park, where the top dominant substrates consist of 1) wood, tires, and open-water; and 2) open-water, plastic-floatation, and wood, respectively. Although open water was not visible on the deepest depth-interval at St. Roch, dock-side under-water extension-platforms were present that harboured a dense cluster of feather-duster worms. This population may support recruitment for the dock-perimeter feather-duster population, providing a scenario that might occur with other structural taxa observed at this site.
- The following epifauna were unique observations (i.e. occurred once at a single dock) in this study: crab, kelp isopod, opalescent nudibranch, leather star, bristly tunicate, encrusting sponges, painted anemone, green urchin, sea grass, WTT worm or anemone, branched macroalgae.
- Pipefish occurrence were limited to docks in False Creek and Port Moody adjoined to Burrard Inlet.
- Future studies could include recruitment surveys on scraped docks, where larval settlement and population establishment is monitored to provide habitat preference associated with the variety of available dock substrates across BI. Industrial maintenance and community dock activities should also be monitored to account for interactions with colonized epifauna.

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