Coastal Biodiversity Survey (PAC2021-035) in the Strait of Georgia and Central Coast of Pacific Canada: 2021 Cruise Report

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COASTAL BIODIVERSITY SURVEY (PAC2021-035) IN THE STRAIT OF GEORGIA AND CENTRAL COAST OF PACIFIC CANADA: 2021 CRUISE REPORT

by

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Abstract

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From April 16th – May 7th, 2021, Fisheries and Oceans Canada conducted a coastal biodiversity survey (PAC2021-035) aboard the Canadian Coast Guard Ship *Vector* to characterise intertidal and subtidal biodiversity along British Columbia's Central and South Coasts in support of marine conservation and emergency response initiatives. The survey was completed in three legs, each with distinct objectives. During Leg 1, 26 dives using a Remotely Operated Vehicle (ROV) were completed to ground-truth rockfish habitat and glass sponge reefs in the Strait of Georgia and Queen Charlotte Strait (South Coast). During Leg 2, nearshore sites in Higgins Passage and Finlayson Channel (Central Coast) were surveyed using a range of techniques: beach seining, environmental DNA (eDNA), infauna/epifauna surveys, baited remote underwater video surveys (BRUVs), and aquatic invasive species surveys, including trapping for European Green Crab. Each technique detected a unique suite of species, highlighting the complementary nature of the sampling plan. In Leg 3, ROV work resumed with the goal of exploring Milbanke Sound and Finlayson Channel (Central Coast) for *Lophelia* coral aggregations and glass sponge reefs. Ship-based eDNA collections across varying depths also supported a Genome Canada funded collaboration with McGill University and Hakai Institute. The baseline information collected during this survey will support marine conservation and planning initiatives and contribute to long-term monitoring of these areas.

Résumé

Proudfoot, B., Robb, C.K., Paleczny, M., Gale, K.S.P., Snow, B., Clark, A., Shepard, T., Vanier, A., Burke, L., Westfall, K., Dudas, S., Rubidge, E.M., and Norgard, T. 2025. Coastal Biodiversity Survey (PAC2021-035) in the Strait of Georgia and Central Coast of Pacific Canada: 2021 Cruise Report. Can. Tech. Rep. Fish. Aquat. Sci. 3700: x + 80 p. https://doi.org/10.60825/kexg-5103

Du 16 avril au 7 mai 2021, Pêches et Océans Canada a mené un relevé sur la biodiversité côtière (Pac2021-035) à bord du Navire de la Garde côtière canadienne *Vector* afin de caractériser la biodiversité intertidale et infratidale le long de la côte centrale et de la côte sud de la Colombie-Britannique pour appuyer les initiatives de conservation marine et d'intervention en cas d'urgence. Trois étapes composaient le relevé et comportaient des objectifs distincts. Au cours de l'étape 1, on a effectué 26 plongées à l'aide d'un véhicule sous-marin téléguidé (VTG) pour valider l'habitat des sébastes et les locations où vivent des récifs d'éponges siliceuses dans le détroit de Georgia et le détroit de la Reine-Charlotte (côte sud). Au cours de l'étape 2, on a étudié des sites côtiers dans le passage Higgins et le chenal Finlayson (côte centrale) à l'aide d'une série de techniques : pêche à la senne sur la plage, étude de l'ADN environnemental (ADNe), relevés sur l'endofaune et l'épifaune, relevés par système vidéo sous-marin contrôlé à distance et appâté, et relevés sur les espèces aquatiques envahissantes, ce qui comprend la pêche au casier du crabe vert. Chaque technique a permis de détecter un ensemble unique d'espèces, ce qui met en évidence la nature complémentaire du plan d'échantillonnage. Dans l'étape 3, on a repris les travaux à l'aide du VTG dans le but d'explorer le détroit de Milbanke et le chenal Finlayson (côte centrale) pour trouver des regroupements de coraux *Lophelia* et des récifs d'éponges siliceuses. Les collections d'ADNe embarquées à différentes profondeurs ont également appuyé une collaboration financée par Génome Canada avec l'Université McGill et l'Institut Hakai. Les renseignements de référence recueillis au cours de ces relevés appuieront les initiatives de conservation marine et la planification d'initiatives, et contribueront à la surveillance à long terme de cette région.

Introduction

From April 16 – May 7, 2021, Fisheries and Oceans Canada (DFO) conducted a coastal biodiversity survey (PAC 2021-035) aboard the Canadian Coast Guard Ship (CCGS) *Vector* in collaboration with Kitasoo Xai'xais and Heiltsuk Nations. The surveys were completed to assess nearshore and subtidal habitats in the Pacific South and Central Coasts of Canada and collect baseline data that could be used to inform marine planning and management initiatives (e.g., Marine Conservation Targets (MCT) initiative), including the monitoring of species and habitats identified as ecological conservation priorities for MPA network planning in the Northern Shelf Bioregion (MPA Network BC Northern Shelf Initiative 2023).

The collaborative survey was divided into three legs of approximately 1 week each with crew changes between each leg (Table 1). Each leg had distinct goals and objectives. The primary goal of Leg 1 (April 16-20) was to use a Remotely Operated Vehicle (ROV) to ground-truth rockfish habitat and the locations of glass sponge reefs in the Strait of Georgia and Queen Charlotte Strait (South Coast, Figure 1). Leg 2 (April 21-30) took place in Higgins Passage and Finlayson Channel in and around areas since identified as potential marine conservation areas through MPA Network planning (Central Coast, Figure 1). A suite of different sampling methods was performed by the Science crew during Leg 2 to support monitoring objectives. These sampling methods included water sampling for environmental DNA (eDNA) analysis, intertidal beach surveys, image collection with baited underwater video systems (BRUVs), beach seining, aquatic invasive species (AIS) surveys, and trapping for invasive European Green Crab (*Carcinus maenas*). Leg 2 activities also involved collecting eDNA water samples at across multiple depths at two sites to better understand if eDNA can discern species compositional changes from the benthos, the water column, and the surface. In Leg 3 (April 30-May 7), ROV work resumed with the goal of exploring Milbanke Sound and Finlayson Channel (Central Coast) to provide further evidence of *Lophelia* coral aggregations and glass sponge reefs.

Table 1. Science staff on the 2021 coastal biodiversity survey (PAC2021-035). Only four scientists participated in each leg of the survey in accordance with Covid-19 protocols.

Science Staff	Primary Role
Tammy Norgard (DFO)	Chief Scientist, intertidal biodiversity surveys, AIS species surveys, ROV surveys (Legs 2, 3)
Sarah Dudas (DFO)	Chief Scientist, intertidal biodiversity surveys, ROV surveys (Legs 1, 2)
Emily Rubidge (DFO)	Beach seines, BRUV surveys, eDNA (Leg 2)
Katie Gale (DFO)	Beach seines, BRUV surveys, eDNA (Leg 2)
Ben Snow (DFO)	ROV surveys (Leg 1)
Andy Vanier (DFO)	ROV surveys (Leg 1,3)
Andy Clark (DFO)	ROV surveys (Leg 1,3)
Trevor Shepard (contractor)	ROV surveys (Leg 3)

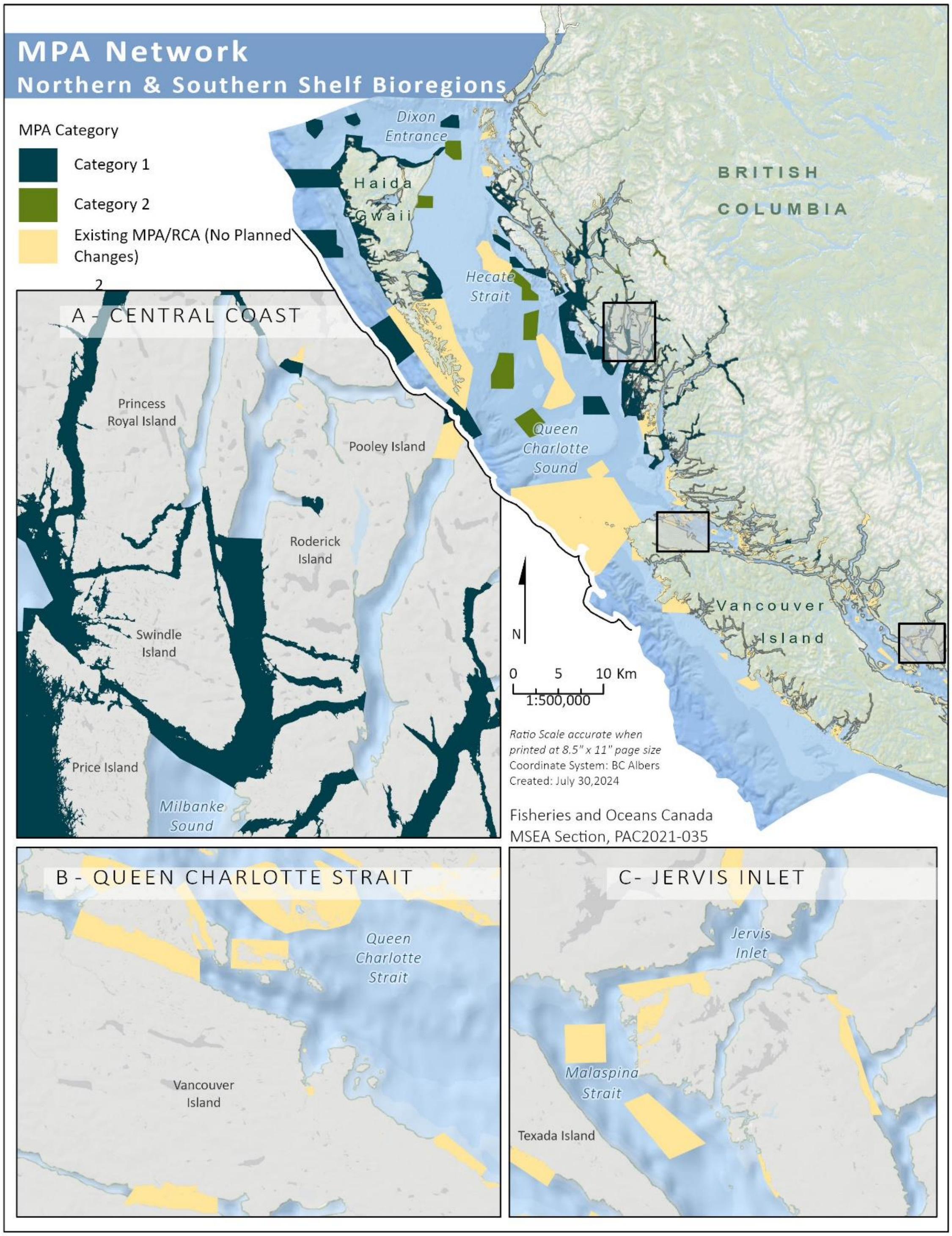

Figure 1. Inset maps showing focal areas of survey effort in 2021 and existing or proposed Marine Protected Areas (MPAs) or Rockfish Conservation Areas (RCAs). Category 1 sites are recommended to be implemented by 2025 and Category 2 by 2030 (MPA Network BC Northern Shelf Initiative 2023).

This report follows the same general structure as the three legs of the coastal biodiversity survey and is separated into sections focused on the ROV surveys (Leg 1 and Leg 3), nearshore biodiversity surveys (Leg 2), and ship-based water sampling (Leg 2). Each section outlines the goals, methods, and preliminary results from the various survey techniques that were conducted. Technical reports detailing the protocols associated with each survey technique are currently in development. Within the nearshore biodiversity surveys section, site summaries are included that provide a general description of each area and summarize the complementary information that was collected using the different survey techniques, highlighting the species observed using each approach.

Remotely Operated Vehicle (ROV) Surveys (Legs 1 and 3)

Objectives

1. Conduct ROV surveys to inform potential boundary adjustments to Rockfish Conservation Areas (RCAs) in the Strait of Georgia, particularly those likely to support coral or sponge, by gathering biological information (i.e., potential rockfish habitat) in adjacent areas (Leg 1).
2. Ground-truth areas identified by Natural Resources Canada (NRCan) as having prospective sponge reefs (Queen Charlotte Strait[1]; Leg 1; Figure 2).
3. Explore aggregations of live and dead *Lophelia pertusa* (=*Desmophyllum pertusum*) coral debris off Swindle Island (Central Coast) that were discovered during an ROV survey in May 2019 (Leg 3).
4. Conduct dives along Sea Cucumber Dive Survey Transects provided by the Kitasoo Xai'xais Nation to quantify sea cucumber presence and abundance, with a focus on the deeper ends of the survey transects (Leg 3).

Methods

ROV Video and Still Camera Configurations

ROV surveys were conducted using the Phantom ROV (Deep Ocean Engineering) – a science-class ROV which has served a range of DFO Pacific marine research programs, and which can operate to a maximum depth of 300 m. Several cameras were mounted onto the ROV including an Insite Pacific MiniZeus high-definition (HD) video camera, a Rogue still camera, and four standard definition video cameras that were used for piloting the ROV: a Deep Ocean Engineering camera, which was primarily set in a forward-facing position but could also be switched to show a rear-view by means of a toggle switch on the pilot's control console, two Insite Pacific Aurora+ accessory cameras mounted on the upper frame of the ROV that provided forward looking and umbilical views, and a fourth Canon G5X camera. The piloting cameras were used to provide situational awareness for the pilot, rather than for species identification and classification.

Imagery from the HD video and still cameras was used for species identification and substrate classifications. ROV video camera specifications are listed in the Phantom ROV components table (Table 2).

[1] Areas identified by Natural Resources Canada (NRCan) as having prospective glass sponge reef were classified based on available geophysical data (e.g., acoustic backscatter and sub-bottom profiles, morphological characteristics).

Imagery Data and Metadata Collected

While on transect, HD video was continuously recorded with the MiniZeus HD video camera. The MiniZeus camera's tilt was controlled by ROV pilots, and was set to an oblique angle relative to the seafloor (slightly forward and down). The camera was typically operated with the zoom set as far out (i.e., the widest field of view) as possible. The zoom was adjusted when examining specimens of interest. The MiniZeus zoom level, focus level, and lens aperture extents were output by the camera and recorded. A PA500 Tritech altimeter mounted in-line with the MiniZeus camera lens provided the slant range or the line of sight distance between the camera lens and the seafloor in the center field of view. Text based overlays were added to the MiniZeus HD video in real-time using a Video Logix, Proteus V video overlay device. Overlaid data included:

- cruise name
- dive number
- date
- time
- ship's GPS position
- ROV heading
- ROV altitude
- depth sourced from the Conductivity Temperature Depth (CTD) sensor
- Back up depth sourced from the ROV's onboard pressure sensor

Two copies of the HD video were recorded: one with the overlaid text data and one without any overlaid data displayed. The 1080p30 HD video was recorded using a custom-built HD recorder that recorded at a bit rate of 50 Mbps, 4:2:0 chroma subsampling, h.264 compression and MP4 file format. Each of the SD video feeds was recorded using an Axis P7304 video encoder.

Lighting and Scaling Lasers

The ROV was equipped with six lights: four DeepSea Power and Light LED lights and two Remote Ocean Systems floodlights. The subsea light specifications are listed in Table 2. Three cameras (MiniZeus HD Camera, the pilot camera, and the Rogue still camera) were each fitted with a pair of scaling lasers spaced 10 cm apart and oriented to point in the center of each camera's field of view. These lasers were used to measure the size of objects underwater and to provide a reference of scale when using the zoom function of the cameras. The pilot camera had red lasers projecting horizontally relative to the seafloor. The MiniZeus HD camera had green lasers projecting horizontally relative to the seafloor. The Rogue camera had red lasers projecting vertically relative to the seafloor.

Water Quality and Ancillary Sensors

An RBR Concerto CTD with an attached Rinko III dissolved oxygen sensor was integrated into the ROV to provide real-time data capture of the in-situ water quality. A secondary depth data source was provided by an internal sensor on the ROV; its output was visible on the pilot display and was continuously recorded. A RoweTech Doppler Velocity logger (DVL) provided continuous speed over ground data and altitude of the ROV above the seafloor. An Imagenex Digital Multi-Frequency Imaging Sonar (881A) was used during the ROV dives to provide ROV situational awareness. The sonar data was not recorded.

Tracking and Navigation

An underwater acoustic positioning system provided tracking and navigation for the ROV. The components of the acoustic positioning system included a GPS, hydrophone, acoustic transponders, and an EdgeTech ultra-short baseline Broadband Acoustic Tracking System (BATS) topside unit. The system measures the time difference of acoustic pulses between hydrophone and transponders and calculates a range and angle from the ship for each transponder. Triangulation calculations combined with the position and heading from the ship's GPS provided real-time underwater acoustic positions and tracking of each transponder.

The ship's heading, latitude, and longitude data were collected using a Hemisphere V500 GPS Antenna mounted on the upper deck of the ship. The hydrophone was pole-mounted, 5.35 m below the sea surface on the port side of the ship. The hydrophone was extended below the ship's hull and below the surface bubble layer to optimize acoustic communication with the transponders. An Applied Acoustics 1000 series transponder was fitted on the clump weight. The ROV was equipped with three transponders (two Applied Acoustic 300 series and one EdgeTech), which were used in combination to optimize the accuracy of the ROV's position. The Xylem Hypack navigation software (2021 version) produced a real-time map view of the positions of the ship, the ROV, and the clump weight along the transect. Bathymetry data was integrated into the displayed view when available. The Hypack map was displayed on the ROV's piloting monitor and a secondary, mirrored output was provided to a monitor on the ship's bridge.

ROV Deployment and Dive Parameters

The ROV was deployed from the ship's starboard A-frame using a 4.7 mm winch wire affixed to a 280 kg lead clump weight. The ROV's tether was taped to the winch wire upon deployment to minimize the drag of the tether on the ROV. While on transect, the ROV was driven at speeds up to one knot, but more typically 0.5 knots. A video Logix Proteus II model on-screen-display system overlaid the ROV's heading, depth, and umbilical turns onto the pilot's standard definition video display. The ROV was driven in close proximity to the seafloor, with the goal of maintaining a target altitude of 0.5 to 1 m above the seafloor when on transect. Transects typically ran from deep to shallow, which provides optimal camera angles.

Table 2. Description of the Phantom ROV components on the PAC2022-036 cruise.

ROV Component	Manufacturer	Specifications/Model Information
MiniZeus HD Camera	Insite Pacific Inc	MiniZeus 1920x1080 pixels with tilt control. Zoom, focus, aperture, and slant range to target logged at 1 Hz.
Pilot Standard Definition Camera	Deep Ocean Engineering	Standard definition video (576i) with zoom, focus, tilt control
'Rogue' Digital Still Camera	NDST Program	Canon G5X still camera, 24 Megapixel, no separate strobe used. Pitch and roll sensor logged at 1 Hz.
Rear Standard Definition Camera	Deep Ocean Engineering	Standard definition video, selectable with pilot camera, 576i
Forward facing and umbilical Standard Definition Cameras	Insite Pacific Inc.	2x Aurora+ standard definition video cameras, 480i
Scaling Lasers	AGO Environmental Electronics Custom Fabrication	Green horizontal 10cm spacing lasers on Mini Zeus camera Red vertical 10cm spacing lasers on Cyclops camera Red horizontal 10cm spacing lasers on Pilot camera
Video Overlay	Videologix	Proteus V
Pilot Display Overlay	VideoLogix	Proteus II
HD Video Recording	Blackmagic Design Ltd.	HyperDeck (HYPERD/ST2) 50Mbps, H.264/.mp4, 1080p/30 fps

ROV Component	Manufacturer	Specifications/Model Information
	Non-Destructive Survey Tools Program custom PC	50Mbps, H.264/.mp4, 1080p/30 fps
SD Video Recording	Axis	P7304 Encoder, H.264/.mp4, 10 Mbps, 480p/30 fps
Lighting	DeepSea Power and Lights	Two SLS-5200 LED, 6000K, 7500 Lumens Two SeaLite Six UNI-W LED, 5800K, 1750 Lumens
	Remote Ocean Systems	Two Q-LED II LED, 5600K, 4500 Lumens
NTP Time Synchronization	TimeMachine Inc.	TM1000A, 10 second update rate
ROV Heading	Deep Ocean Engineering	Stock sensor on ROV
GPS Position and Heading	Hemisphere GNSS	ModelV100, 1 Hz update rate
Altimeter on MiniZeus	Tritech International Ltd.	PA500, 500kHz, 6° conical beam width
Digital multi-frequency imaging sonar	Imagenex Technology Corp.	Model 881A, Range 1-200m
Doppler Velocity Logger	Rowe Technologies Inc.	Model SeaPilot, Update rate 1 Hz (Speed over ground, Altitude)
Acoustic Tracking	EdgeTech	USBL Broadband Acoustic Tracking System, TrackMan v.1.0.16.6
		Hydrophone Model 4213C-B
Transponders	EdgeTech	Model 4370, with remote head (on ROV)
	Applied Acoustics Underwater Technologies	Two 300 series models (one on ROV, one on clump weight)
		Model 1019 (on clump weight)
CTD	RBR Ltd.	Concerto3 (2 Hz sampling frequency)
Fast Optical dissolved oxygen	JFE Advantech Co. Ltd.	Rinko III Model ARO-CAV (2 Hz sampling frequency)
Dynamic Motion Sensor	TSS Ltd.	DM RP2-25, output rate 30 Hz

Results

Leg 1 – Strait of Georgia and Queen Charlotte Strait

Three dives (P100000, P10001, P10002) were completed just outside Skookumchuck Narrows at the mouth of Sechelt Inlet, 4-5 km northwest of Skookumchuck Narrows RCA (Figure 2B, Table 3). Two dives (P10003, P10004) were completed in Jervis Inlet, 1-3 km northeast of Hardy Island RCA (Figure 2B, Table 3). One dive (P10005) was completed in Hardy Bay just north of Port Hardy (Figure 2A, Table 3).

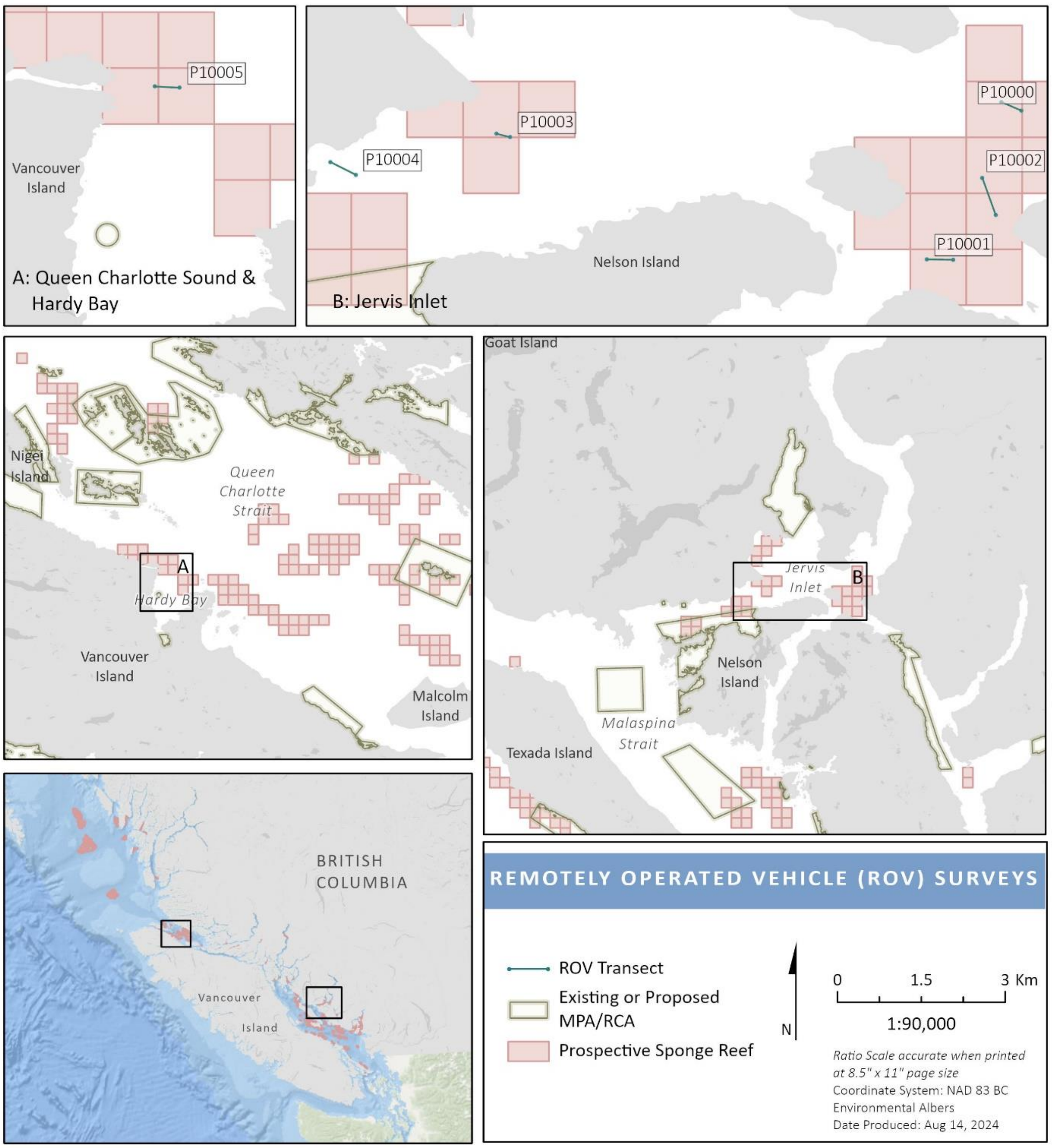

Figure 2. Locations of ROV transects completed in the Strait of Georgia and Queen Charlotte Strait on Leg 1 of PAC 2021-035 to assess rockfish conservation area (RCA) boundaries and areas of prospective sponge reef identified by Natural Resources Canada (NRCan).

A summary of the ROV dives from Leg 1 is shown in Table 3. Video from transects P10000, P10001, P10002, P10003 and P10004 were annotated for individual corals, boot sponges, most fishes, percent cover categories of reef-building glass sponge, and presence of substrate categories (Table 3, Table 4, Figure 2); annotation results and the complete annotation protocol developed for this survey will be presented in DFO (in prep)[2]. Video from transect P10005 was only annotated for substrate type, including categories for reef-building glass sponge.

Five dives (P10000, P10001, P10002, P10003, P10005) were conducted on prospective glass sponge reef polygons identified by NRCan based on interpretation of available multibeam bathymetry and acoustic backscatter data. Live reef-building glass sponges, including cloud sponge *Aphrocallistes vastus* and goblet sponge *Heterochone calyx*, were observed on five transects (P10000-P10004). Relatively high cover (30-60%) of live reef-building glass sponge was observed on at P10003 off Culloden Point (Figure 3). Visual evidence of reef formation (reef-building glass sponge growing atop previous generations) was observed on P10003 and P10000 (Figure 3). Sponge rubble (i.e., broken dead sponge) was most common on P10000, where it covered approximately 30% of the transect area (Figure 3).

A variety of fish and invertebrate species were observed during the dives, such as spotted ratfish (*Hydrolagus colliei*), walleye pollock (*Theragra chalcogramma*), lingcod (*Ophiodon elongatus*), squat lobster (*Munida quadraspina*), and sunflower sea star (*Pycnopodia helianthoides*) (Table 4, Appendix I). Rockfish (*Sebastes* spp.) were observed on every transect (Figure 4). Plainfin Midshipman fish (*Porichthys notatus*) were found on both transects in Jervis Inlet (P10003, P10004). For example, on dive P10003, Plainfin Midshipman were observed at 157 m (Table 4, Figure 4). The annotated list of fish, coral, and sponge species is shown in Appendix I.

[2] DFO. In Prep. Mapping sponges, corals, and rockfishes in and around Rockfish Conservation Areas in Jervis Inlet, Pacific Canada. DFO Can. Sci. Advis. Sec. Sci. Resp.

Table 3. Summary of ROV dives completed on Leg 1 of PAC 2021-035. Primary objectives are: Rockfish = Find rockfish habitat close to nearby RCA; Sponge Reef = Survey NRCan high confidence potential sponge reef. Each Dive ID includes a link to the video available through Ocean Networks Canada's SeaTube.

Date	Dive #	Dive ID	Location	Start Position (decimal degrees)	End Position (decimal degrees)	Bottom Depth Range (m)	Dive Duration	Bottom Duration	Primary Objective	Notes
18 Apr	1	P10000	Skookumchuck Narrows	49.794935, -123.944006	49.796433, -123.949005	84-240	02:29:44	01:10:33	Rockfish, Prospective Sponge Reef	Reef formation, Sponge rubble
18 Apr	2	P10001	Skookumchuck Narrows	49.771480, -123.968573	49.771290, -123.962043	78-177	01:29:00	01:07:52	Rockfish, Prospective Sponge Reef	Sponge rubble
19 Apr	3	P10002	Skookumchuck Narrows	49.784315, -123.954211	49.778304, -123.951166	42-209	02:46:18	02:07:00	Prospective Sponge Reef	Reef status not visually confirmed
19 Apr	4	P10003	Culloden Point, Jervis Inlet	49.792990, -124.071164	49.793610, -124.074496	90-182	01:29:35	00:51:33	Rockfish, Prospective Sponge Reef	Reef formation
19 Apr	5	P10004	Fairview Bay, Jervis Inlet	49.787622, -124.109725	49.789771, -124.115900	45-239	02:17:00	01:33:04	Rockfish	-
20 Apr	6	P10005	Hardy Bay	50.767767, -127.469274	50.767883, -127.475580	98-174	01:31:19	00:53:50	Prospective Sponge Reef	Reef status not visually confirmed
Total	**6**	**-**	**-**	**-**	**-**	**42-240**	**12:01:56**	**07:43:52**	-	-

Table 4. Dive notes and transect summaries, including fish and invertebrate species noted in the dive logs, for ROV dives completed on Leg 1 of PAC 2021-035. Further fish, coral, and sponge species details from annotations for dives P10000-P10004 are found in Appendix I.

Dive ID	Dive Location	Dive Notes	Transect Summary	Species Notes
P10000	Skookumchuck Narrows	Phantom depth not working; issues with winch at start	Decent sponge coverage, looked like quite a bit of dead sponge; lots of silt, looked like it might be covering dead sponge; loads of squat lobsters; mainly flat rock covered in silt but some wall areas	Sponges, bright yellow sponge, bubblegum coral, ctenophore, flatfish, rockfish, sea star, squat lobster, anemone
P10001	Skookumchuck Narrows	Phantom depth not working	Some sponge and coral but not a lot; mix of silty sediment with rock; few rockfish and some coral and sponge	Bubblegum coral, sponges, plumose anemones, quillback rockfish, rockfish, skate
P10002	Skookumchuck Narrows	Still camera memory got full in the dive but cleared quickly so won't be much of a gap. Lens cap was on rear pilot cam and Starboard front light on ROV.	Much of this transect in a boot sponge field that has mat (silt/bacteria/hydroid?) over much of it; lots of squat lobsters; quite a few smaller fish (e.g., sculpins), a few different species of sea stars and some anemones; not a lot of hard substrate but did see some bubblegum corals	Walleye pollock, sponges, boot sponge, finger sponge, lamp shells, sculpin, anemones, burrowing anemone, plumose anemone, bubblegum coral, rockfish, greenstriped rockfish, quillback rockfish, skate egg case, lingcod, sea star, sunflower star
P10003	Culloden Point, Jervis Inlet	Current issues around 90 m, was right around max ebb	Lots of cloud sponge, not a reef but maybe a garden; plainfin midshipman; started with silty substrate and then changed to dead sponge rubble; little rocky substrate	Pollock, sponges, cloud sponge, boot sponge, cookie star, plainfin midshipman, flatfish, rockfish, quillback rockfish, yelloweye rockfish, sea cucumber
P10004	Fairview Bay, Jervis Inlet	-	Some glass sponge throughout and a tiny bit of coral; plainfin midshipman, octopus moving and inking; lots of silt again, some bit pits; some wall, some boulder	Sponges, boot sponge, cloud sponge, skates, ratfish, squat lobster, lamp shells, bubblegum coral, anemones, sunflower star, plainfin midshipman, greenstriped rockfish, quillback rockfish, yelloweye rockfish, lingcod, flatfish, octopus, nudibranch
P10005	Hardy Bay	Still camera stopped from 17:32:09-17:37:56	Lots of rockfish for most of dive; silt covered sponge on a ridge; most of transect was riding top of the ridge; lots of fish	Brittle star, yelloweye rockfish, greenstriped rockfish, black rockfish, yellowtail rockfish, quillback rockfish, rockfish, lingcod, cloud sponge, cookie star, sea urchin, sea cucumber, sea star, flatfish

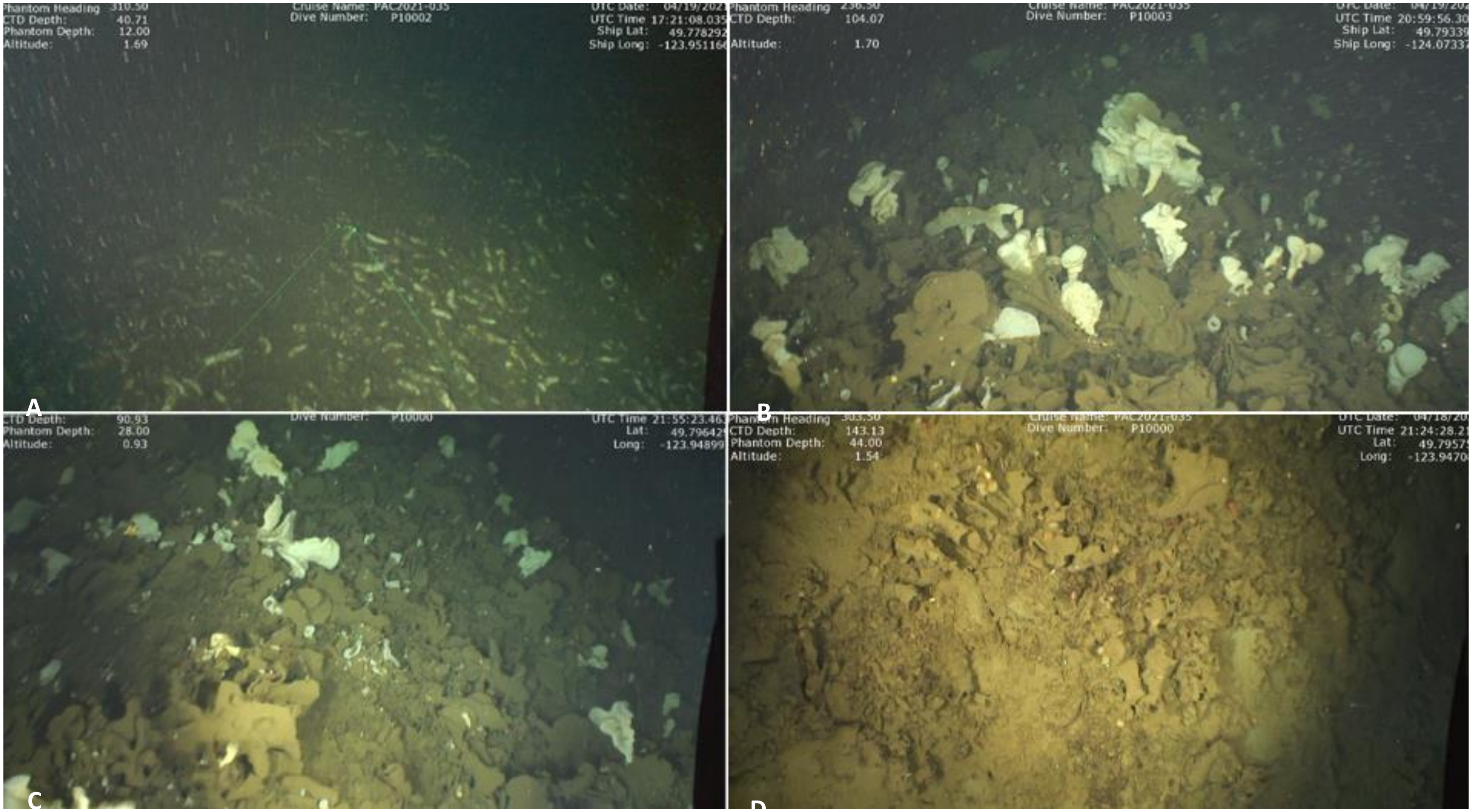

Figure 3. Still images from ROV dives showing: high densities of boot sponges (Rossellidae) observed on dive P10002 (A), reef-forming Aphrocallistidae observed on dives P10003 (B) and P10000 (C), and sponge rubble observed on dive P10000 (D) (photo credit: ROV team, DFO).

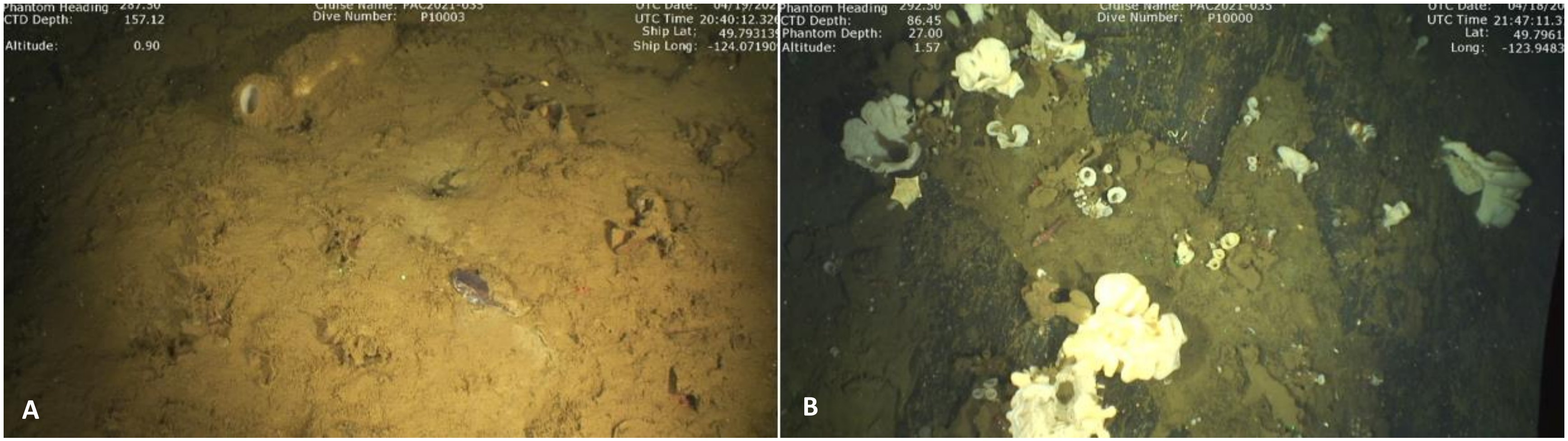

Figure 4. Still images from ROV dives showing: A) Plainfin Midshipman (*Porichthys notatus*) observed on dive P10003, and B) Quillback Rockfish (*Sebastes maliger*) and Greenstriped Rockfish (*Sebastes elongatus*) observed on dive P10000 (photo credit: ROV team, DFO).

Leg 3 – Central Coast

Leg 3 ROV dives were completed in Milbanke Sound and Finlayson Channel on the Central Coast (Table 5, Table 6, Figure 5). The primary goal of Leg 3 was to explore aggregations of live and dead *Lophelia pertusa* (=*Desmophyllum pertusum*) coral debris off Swindle Island that were discovered during an ROV survey in May 2019 (PAC2019-015) and confirmed with sediment grab samples captured along the same dive transect during a 2020 survey (PAC2020-069). *Lophelia* is a cold-water stony coral that forms reef structures and is known to occur worldwide; however, prior to 2019, the only recorded live *Lophelia* reef in Canada was in the Atlantic Ocean, at the mouth of the Laurentian Channel (Buhl-Mortensen et al. 2017). In the Pacific, dead *Lophelia* debris was observed off Vancouver Island in 2004-2005 (Conway et al. 2007), but no living reef structures were known previously (Boutillier et al. 2019).

In light of the potential ecological significance of the *Lophelia* aggregations, ROV dives in 2021 were planned to explore the area around the aggregations observed in 2019. Potential reef sites of interest, assumed to be glass sponges, were identified using ship-based mapping completed by NRCan.

Annotation of substrate and reef cover was completed using the ACFOR scale for the following transects P10008-15, P10017, P10019-20, P10023-27. The ACFOR scale is a qualitative scale used to estimate the abundance/percent cover of species or substrate types. The acronym stands for the name of each category: Abundant (>80%), Common (61-80%), Frequent (31-60%), Occasional (5-30%), Rare (<5%). Annotation of substrate and sea cucumber abundance was completed for P10007, P10018, P10021-22.

Dives in Milbanke Sound and near Pidwell Reef (where *L. pertusa* aggregations were previously observed) showed more *Lophelia* debris. Amongst the debris, some individual alive *Lophelia* were observed. A dive targeting an interesting ridge structure in Finlayson Channel (P10027, Figure 5A, Table 5) revealed an extensive live, healthy *Lophelia* reef structure, concentrated at depths of approximately 180 m. Figure 6 shows imagery of healthy reef-forming coral *Lophelia pertusa.* A future publication[3] is planned to share further details from the 2019-2022 surveys that led to the discovery of the *Lophelia* reef, known now by its Wakashan name q̓áuc̓íwísuxv.

ROV dives were completed in Sheep Passage (north Finlayson Channel) to search for sponges and corals. A healthy sponge garden was found near Carter Bay (P10015; Figure 5C, Table 5). ROV dives in Finlayson Channel along Sea Cucumber Dive Survey Transects provided by the Kitasoo Xai'xais Nation (P10021, P10022) showed large shell piles (possibly butter clam (*Saxidomus gigantea*) and geoduck (*Panopea generosa*)) at depths of over 100 m (Table 6, Figure 7). Sea cucumber species observed during dives P10021 and P10022 are listed in Appendix II. Dives completed in Milbanke Sound focused on ground-truthing suspected sponge reefs based on data from NRCan. Healthy sponge reefs were found on all the areas surveyed (Figure 5B, Figure 8, Table 5).

[3] Du Preez, C. et al. In Prep. The ecological description of the first known cold-water coral reef in Pacific Canada.

Table 5. Summary of ROV dives completed on Leg 3 of PAC 2021-035. Objectives are: Sea Cucumber = Sea cucumber transect; Lophelia = Search for Lophelia; Sponge Reef = Survey NRCan high confidence potential sponge reef. Each Dive ID includes a link to the video available through Ocean Networks Canada's SeaTube.

Date	Dive #	Dive ID	Location	Start Position (decimal degrees)	End Position (decimal degrees)	Bottom Depth Range (m)	Dive Duration	Bottom Duration	Primary Objective	Notes
1 May	7	P10007	Factor Islets, Finlayson Channel	52.417335, -128.426787	52.416867, -128.432490	88-180	01:40:00	01:03:00	Sea Cucumber	-
1 May	8	P10008	Pidwell Reef, Milbanke Sound	52.430922, -128.552884	52.431456, -128.556410	60-235	01:24:00	00:42:00	Lophelia	-
1 May	9	P10009	Pidwell Reef, Milbanke Sound	52.430334, -128.553356	52.430995, -128.556316	88-236	01:04:00	00:31:00	Lophelia	-
1 May	10	P10010	Pidwell Reef, Milbanke Sound	52.428545, -128.556887	52.430323, -128.557660	95-243	01:11:00	01:29:00	Lophelia	-
2 May	11	P10011	Pidwell Reef, Milbanke Sound	52.428562, -128.567182	52.430158, -128.558197	99-227	01:17:00	00:34:00	Lophelia	-
2 May	12	P10012	Pidwell Reef, Milbanke Sound	52.428294, -128.557825	52.429622, -128.558529	~119-212	00:49:00	00:17:00	Lophelia	-
2 May	13	P10013	Pidwell Reef, Milbanke Sound	52.427274, -128.559071	52.429124, -128.561009	160-210	00:49:00	00:15:00	Lophelia	-
2 May	14	P10014	Milbanke Sound	52.421703, -128.557144	52.429049, -128.548237	200-262	01:53:00	01:24:47	Sponge Reef	-
3 May	15	P10015	Carter Point, Sheep Passage	52.815923, -128.391637	52.8166, -128.391900	96-291	01:14:00	00:32:00	Coral and Sponge	-
3 May	16	P10016	Kid Bay	-	-	-	-	-	-	Aborted dive
3 May	17	P10017	Ridge between Finlayson Channel and Sheep Passage	52.816779, -128.42356	52.812851, -128.415340	42-172	01:23:00	01:11:00	Coral and Sponge	-
3 May	18	P10018	North Finlayson Channel	52.732958, -128.476182	52.73301, -128.480298	68-290	01:23:00	00:48:00	Sea Cucumber	-
4 May	19	P10019	Milbanke Sound, near mouth of Higgins Passage	52.440054, -128.606045	52.439923, -128.610191	109-174	00:52:00	00:37:00	Sponge Reef	-
4 May	20	P10020	Pidwell Reef, Milbanke Sound	52.427125, -128.566982	52.435263, -128.566538	52-212	01:54:00	01:24:00	Lophelia	-

Date	Dive #	Dive ID	Location	Start Position (decimal degrees)	End Position (decimal degrees)	Bottom Depth Range (m)	Dive Duration	Bottom Duration	Primary Objective	Notes
4 May	21	P10021	Legace Point, Finlayson Channel	52.466299, -128.426794	52.466164, -128.423999	104-286	01:16:00	00:37:41	Sea Cucumber	-
4 May	22	P10022	Swindle Point, Finlayson Channel	52.483417, -128.464962	52.483612, -128.468991	123-267	01:29:00	00:51:00	Sea Cucumber	-
5 May	23	P10023	Milbanke Sound	52.403898, -128.602973	52.411759, -128.609145	128-184	01:24:00	00:56:00	Sponge Reef	-
5 May	24	P10024	Milbanke Sound	52.40791, -128.600792	52.413272, -128.598896	162-177	01:24:00	00:54:00	Sponge Reef	-
5 May	25	P10025	Milbanke Sound	52.416786, -128.567443	52.429509, -128.562497	167-270	02:01:00	01:30:00	Lophelia	-
5 May	26	P10026	Milbanke Sound	52.413022, -128.58096	52.424289, -128.592183	126-243	01:43:00	01:09:46	Sponge Reef	-
6 May	27	P10027	Finlayson Channel	52.431779, -128.455723	52.44, -128.448747	140-260	02:22:00	01:43:00	Lophelia	Live Lophelia reef
Total	**20**	**-**	**-**	**-**	**-**	**42-291**	**28:33:00**	**18:29:14**	**-**	**-**

Table 6. Dive notes and transect summaries, including fish and invertebrate species noted in the dive logs, for ROV dives completed on Leg 2 of PAC 2021-035. For all dives, rogue camera lasers were deemed unreliable and turned off. Further sea cucumber species details are found in Appendix II.

Dive ID	Dive Location	Dive Notes	Transect Summary	Species Notes
P10007	Factor Islets, Finlayson Channel	ROV was light weighted; transect 31 for sea cucumber survey	Boot sponge and glass sponges; mud and rockwall	Glass sponge, boot sponge, sponge, skates, box crab, sea cucumber, sea star, cod, flatfish, snakeback prickleback, sea whip, sea urchin, stubby squid
P10008	Pidwell Reef, Milbanke Sound	Came off wall a few times	*Primnoa* on wall; no *Lophelia*; large school of yellowtail rockfish on top of wall	Coral, red sea urchin, rockfish, boot sponge, cloud sponge, glass sponge, lingcod, jingle shell, yellowtail rockfish, quillback rockfish, sea whip
P10009	Pidwell Reef, Milbanke Sound	-	No *Lophelia*; lots of *Primnoa* and lots of fish at 90 metres up; rocky, bedrock	Sponge, *Farrea* sponge, yellow sponge, *Primnoa* coral, bubblegum coral, coral, octopus, *Solaster*
P10010	Pidwell Reef, Milbanke Sound	-	*Lophelia* and yellow sponge; lots of *Primnoa* and cloud sponge; lost longline gear	*Lophelia*, coral, sponge, yellow sponge, glass sponge, nudibranchs, lingcod, zooanthids, greenstrip rockfish, quillback rockfish
P10011	Pidwell Reef, Milbanke Sound	-	Fishing line	*Lophelia*, cloud sponge, yellow encrusting sponge, *Farrea* sponge, brachiopods, bubblegum coral, compound tunicate, sea star
P10012	Pidwell Reef, Milbanke Sound	-	Just *Lophelia* in the deep; fishing line	Coral, worms
P10013	Pidwell Reef, Milbanke Sound	Dive stopped for crew change when saw no more lophelia	*Lophelia*	*Lophelia*, *Farrea* sponge
P10014	Milbanke Sound	Logging was left on; transect in 3 legs with turn in it (P100014b is extension of P100014 to reach shallowest point of 200 m; P100014c connects to north)	Mounds on bottom were *Lophelia* mounds, dead mounds; there were some bunches of live coral	*Lophelia*, sablefish, brittle star, skate, worm, flatfish
P10015	Carter Point, Sheep Passage	Had to end dive when ship got close to shore (when just observed sponge garden)	Large sponge garden at 96 m	Brachiopods, brittle stars, tube worm (*Serpula*), compound tunicate, yelloweye rockfish (juvenile), rockfish, long spine sea cucumber, *Farrea* sponge, cloud sponge, finger sponge, sponge, rose star

Dive ID	Dive Location	Dive Notes	Transect Summary	Species Notes
P10017	Ridge between Finlayson Channel and Sheep Passage	-	Lots of dead coral bits at start of dive; many rockfish, lots of sea cucumbers at end of dive	Coral, *Stylaster* coral, cup coral, bubblegum coral, sponge, finger sponge, sea pen, *Calistoma* snail, hydroids, nudibranch, boccacio, greenstriped rockfish, quillback rockfish, yellowtail rockfish, rockfish, lingcod, jingle shell, sea cucumber, sea urchin, sea star
P10018	North Finlayson Channel	Sea cucumber transect 60; moved along line to reach starting point; line was too deep	Donut fish	Donut fish, predatory tunicate, compound tunicate, sponge, boot sponge, finger sponge, *Farrea* sponge, cup coral, bubblegum coral, long spine sea cucumber, California sea cucumber, sea cucumber, hydroids, flatfish, box crab, siphonophore, rockfish, greenstriped rockfish, hermit crab, sea anemone, sea pen, sea whip
P10019	Milbanke Sound, near mouth of Higgins Passage	Sea cucumber transect 4; suspected sponge reef	Sponge rubble observed; plastic tarp	Pacific herring, sponge, boot sponge, hairy tunicate, compound tunicate, rockfish, sea star, sea cucumber, sea urchin, fungal mat
P10020	Pidwell Reef, Milbanke Sound	-	-	Tube worm, ratfish, skate, sea whip, coral, prawn, hermit crab, sculpin, boot sponge, *Farrea* sponge, finger sponge, stick coral, *Swiftia* coral, bubblegum coral, rockfish, copper rockfish, quillback rockfish, yellowtail rockfish, lingcod, box crab, hairy tunicate, flatfish, sea cucumber, squat lobster, brachiopods, hydroids, jingle shell, plumose anemone
P10021	Legace Point, Finlayson Channel	Sea cucumber transect 9; hypack may have missed early part of descent because did not restart immediately at surface	Many butter clam shells	Sponge, finger sponge, cloud sponge, Pacific halibut, nudibranch, compound tunicate, rockfish, sea cucumber, clams, butter clam, geoduck (or horse clam)
P10022	Swindle Point, Finlayson Channel	Sea cucumber transect 5; end of dive went off transect and up slope at an angle	Garbage	Sponge, boot sponge, black eelpout, sea cucumber, skate, tiger rockfish, rockfish, shortspine thornyhead, giant Pacific octopus, worm, sculpin, predatory tunicate, clam shell bed, long spine sea cucumber, squid

Dive ID	Dive Location	Dive Notes	Transect Summary	Species Notes
P10023	Milbanke Sound	Suspected sponge reef; ship carried on same course at end of transect	Huge sponge gardens	Flatfish, boot sponge, cloud sponge, coral, skate, rockfish, *Swiftia* coral, *Farrea* sponge, cushion star, octopus
P10024	Milbanke Sound	Up and over suspected sponge reef	Sponge reef; small coral and some sponges upside down (potential fishing impact)	Boot sponge, *Farrea* sponge, cloud sponge, bubblegum coral, *Swiftia* coral, coral, rockfish, crab, sculpin, tube worm (*Serpula*), compound tunicate,
P10025	Milbanke Sound	Training dive; done high and fast to look for lophelia	Live *Lophelia* on mound or wall	*Lophelia*, bubblegum coral, swiftia coral, coral, ratfish, flatfish, octopus, rockfish, lingcod, skate, sea whip
P10026	Milbanke Sound	Suspected sponge reef; extended transect on deeper end to look for lophelia	Lots of sponge; sponge gardens on second half of dive; no *Lophelia*	Sablefish, *Swiftia* coral, sea whip, crinoids, skate, cloud sponge, finger sponge, sponge, octopus, rockfish, Pacific cod, crab
P10027	Finlayson Channel	Transect on ridge in middle of channel	Unexpected *Lopehlia* sponge on ridge between 240-170 m; *Lophelia* sponge in abundance; saw egg cases on coral more than once	*Lophelia*, bubblegum coral (some with egg cases), *Stylaster* coral, *Farrea* sponge, sponge, tube worm, tunicate, compound tunicate, brachiopods, skate, red sculpin, cetaphore, box crab, nudibranch, octopus

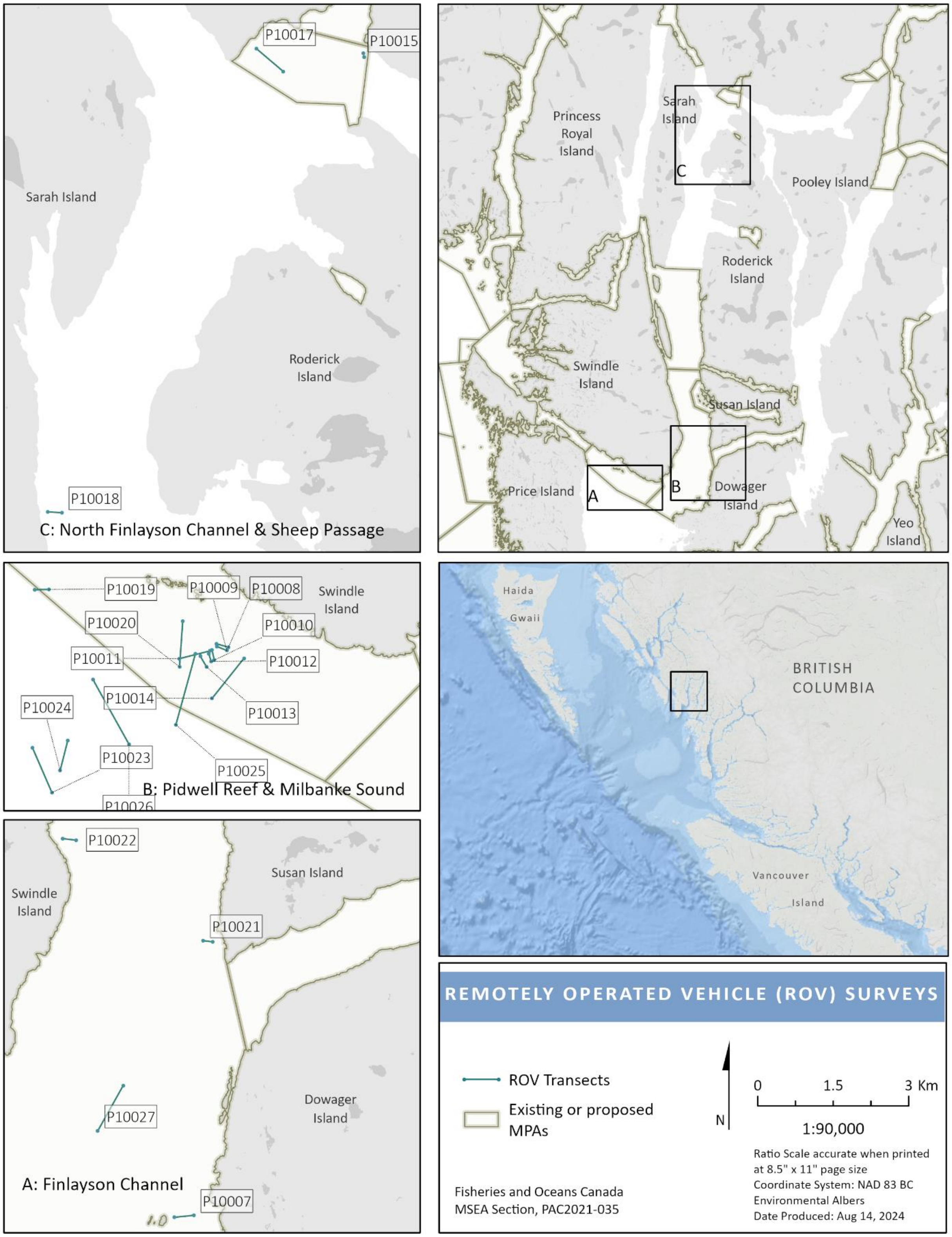

Figure 5. Locations of ROV transects completed in in Finlayson Channel and Milbanke Sound on Leg 3 of PAC 2021-035.

Figure 6. Still images from ROV dives showing the reef-forming coral *Lophelia pertusa* captured during PAC2021-035. Green lasers (upper right) are 10 cm apart. (photo credit: ROV team, DFO).

Figure 7. Still images of shell piles observed on ROV dive P10021 in Finlayson Channel during PAC2021-035 (photo credit: ROV team, DFO).

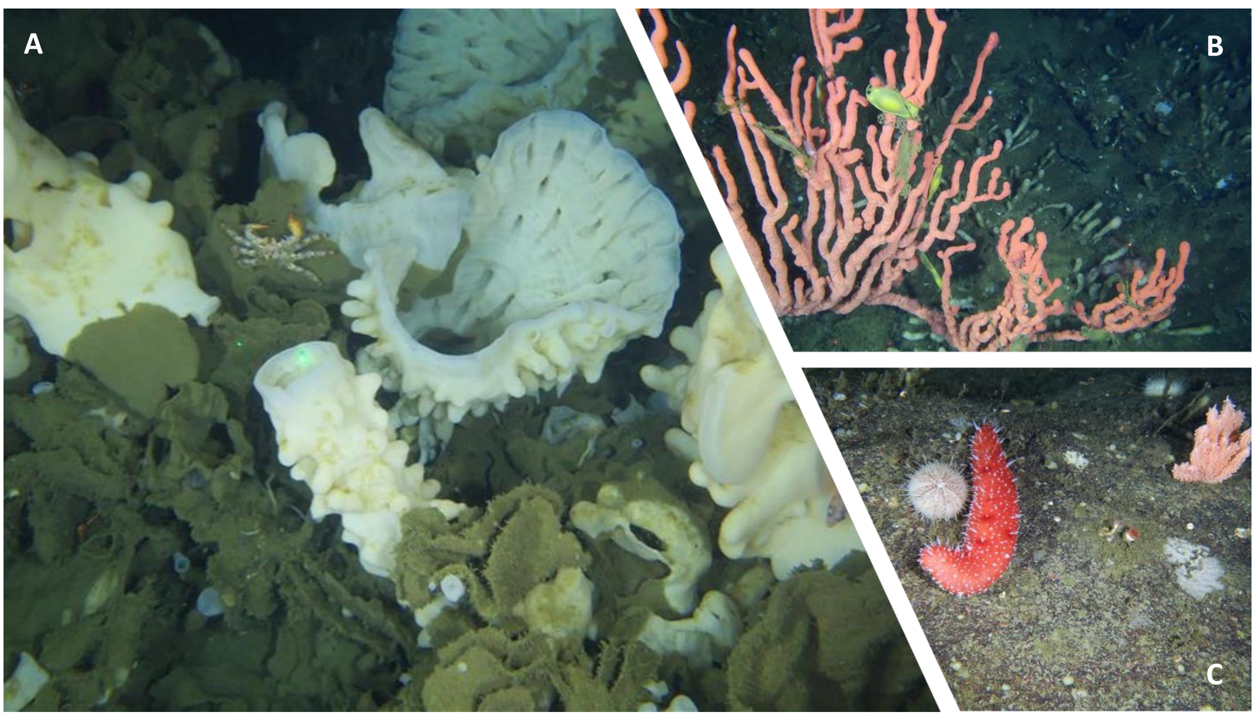

Figure 8. Additional still images from ROV dives in Finlayson Channel (A) and Millbanke Sound (B, C) during PAC2021-035 (photo credit: ROV team, DFO).

Nearshore Biodiversity Surveys – Central Coast (Leg 2)

Site Identification

A preliminary list of potential beaches to target was created prior to the survey by first identifying areas of continuous eelgrass. These areas were determined using eelgrass layers[4] compiled by the BC Marine Conservation Analysis (BCMCA Project Team 2011) and imagery available through Google Earth. The eelgrass areas that overlapped nearshore habitat richness hotspots[5] (Rubidge et al. 2018) were prioritized. Final sites were selected during the trip based on accessibility, actual amount of eelgrass present (i.e., enough to successfully seine with the beach seine protocol), and the suitability of adjacent beach areas for other survey activities (e.g., intertidal biodiversity surveys).

Survey Types and Objectives

Two nearshore sites, West Lohbrunner Saddle and Price Lagoon, were selected and surveyed during the low tides (i.e., < 1.0 m mean lowest low water) that occurred during Leg 2 (April 21-30, 2021) (Figure 9, Figure 10). A suite of nearshore biodiversity surveys were conducted at each site (Table 7, Table 8). Additional sites in close proximity to the main nearshore site were selected for some survey types based on their suitability for the relevant survey protocol. For example, while the intertidal biodiversity survey was conducted at the beach at West Lohbrunner, the beach seines and eDNA water collection were instead done at East Lohbrunner due to the presence of eelgrass. Green crab trapping was completed at the two nearshore sites and several additional locations (Table 8). Utilizing multiple methods to survey across environments and species at nearshore sites can provide a more complete ecological understanding of the habitats and species at each site. Objectives for each survey type are outlined in Table 7.

Figure 9. Survey team unloading gear for rapid species biodiversity and green crab surveys at Carter Bay.

[4] https://bcmca.ca/?s=Eelgrass

[5] mpattmetadata.s3.amazonaws.com/mpatt_eco_areas_richness_nearshorehabitat.html

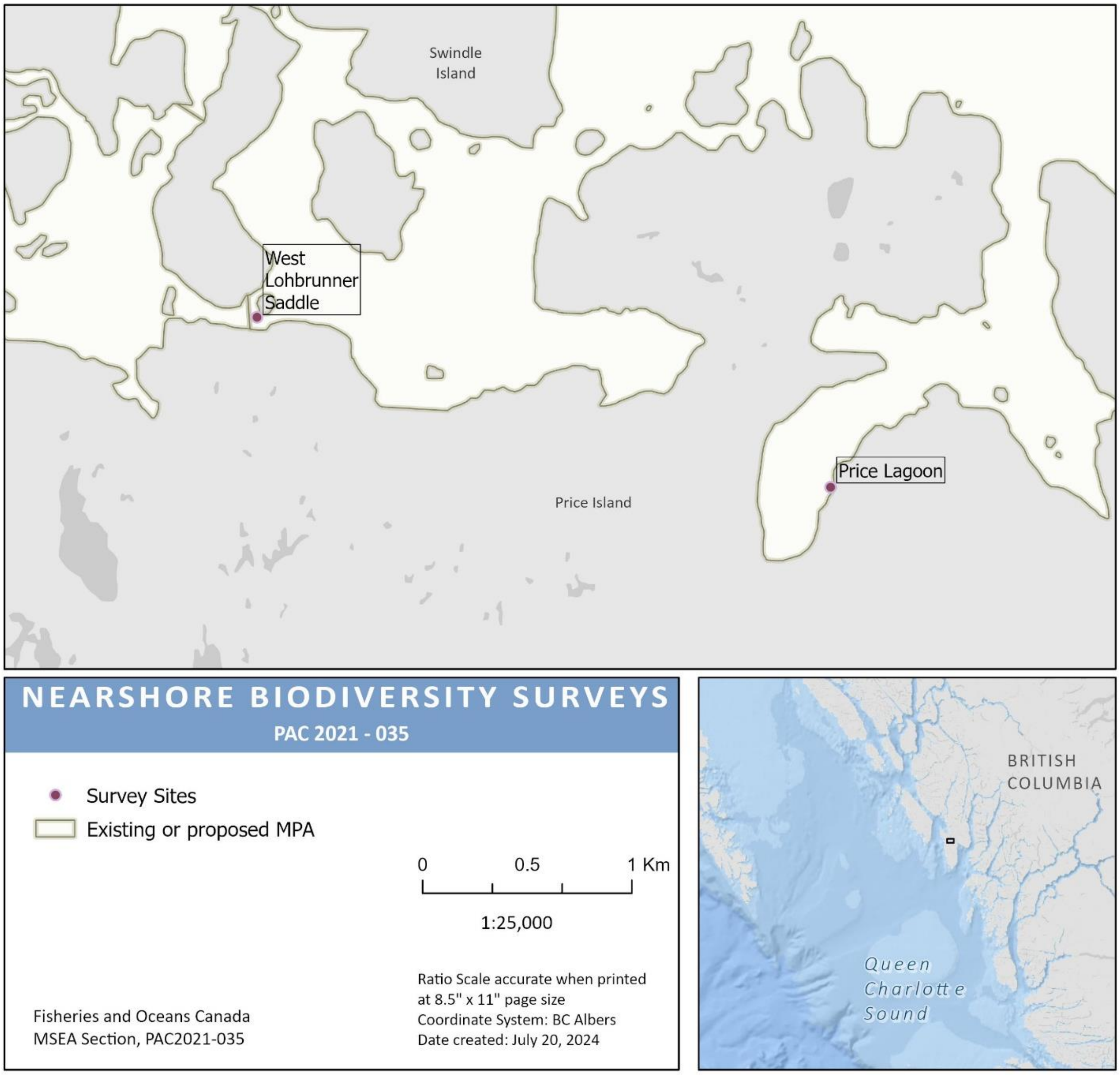

Figure 10. Map of nearshore biodiversity survey locations completed during the PAC2021-035 survey.

Table 7. Nearshore biodiversity survey objectives by survey type.

Survey Type	Objective(s)
Intertidal Biodiversity	• Obtain baseline information on biological diversity in intertidal environments to support monitoring, marine spatial planning and emergency response planning
Rapid Species Biodiversity Checklist	• Document the presence of intertidal invasive species • Document the presence of non-invasive species from a pre-defined list of common intertidal species
Shore-based eDNA	• Use eDNA metabarcoding to conduct rapid biodiversity assessments of proposed and existing MPAs to provide baseline information on species presence/absence • Further develop and test eDNA metabarcoding as a tool that can be used in management and decision making • Sample eDNA at intertidal sites with paired beach seines and BRUVs to allow for complementary assessments of nearshore fish diversity
Baited Remote Underwater Video (BRUV)	• Use BRUVs to gather information on site occupancy, size distribution and relative abundance of nearshore fish communities to establish a baseline against which to measure future changes • Sample a variety of nearshore subtidal habitat types, from seagrass beds to sandy-bottomed ecosystems, to characterize diversity across different habitats
Beach Seine	• Use beach seining to gather baseline information on fish species diversity, size distribution and relative abundance of nearshore fish communities to establish a baseline against which to measure future changes • Sample a variety of nearshore subtidal habitat types, from seagrass beds to sandy-bottomed ecosystems, to characterize diversity across different habitats
Green Crab Trapping	• Assess the presence of invasive European Green Crab at select intertidal sites

Table 8. Summary of surveys completed at the Nearshore Biodiversity sites. Coordinates are the average of all surveys at that site. X indicates the survey was conducted at that site; - indicates it was not. Biodiv.= Biodiversity.

Date	Site Name	Latitude (decimal degrees)	Longitude (decimal degrees)	Intertidal Biodiv.	eDNA (shore)	BRUV	Seine	Rapid Biodiv.	Green Crab	Site Description
21-24 Apr	Carter Bay	52.83195	-128.391	-	-	x	-	x	x	-
24 Apr	Bolin Bay	52.836	-128.219	-	-	-	-	-	x	-
24 Apr	Griffin Booms	52.7331	-128.349	-	-	-	-	-	x	-
24 Apr	Griffin North	52.751	-128.354	-	-	-	-	-	x	-
24 Apr	Higgins Pass - Beach 2	52.491	-128.669	-	-	-	-	x	-	-
24 Apr	Windy Bay	52.7778	-128.207	-	-	-	-	-	x	-
25-26 Apr	West Lohbrunner Saddle	52.47495	-128.726	x	-	x	-	x	-	West side of beach between Lohbrunner and Price Islands. Beach exists only at low tide. Cobble/gravel turning to shell and mud at water line. Lots of Ulva, but no eelgrass observed. Sheltered.
25 & 27 Apr	East Lohbrunner Saddle	52.47479	-128.725	-	x	-	x	-	-	East side of beach between Lohbrunner and Price Islands. Beach exists only at low tide. Cobble/gravel turning to shell and mud at water line. Less shell than west side. Eelgrass visible at low tide. Sheltered.
27 Apr	Price Bay	52.4741	-128.696	-	-	-	-	-	x	-
27-28 Apr	Lohbrunner Channel	52.48864	-128.729	-	-	x	-	-	x	Rocky tidal channel on north side of Lohbrunner Island with decent amount of current.
27-28 Apr	Price Lagoon	52.46742	-128.687	x	x	x	x	x	x	Large muddy bay, beach only exists at low tide. Lots of eelgrass. Several freshwater inputs. Very sheltered. Rapid Species Biodiversity Checklist conducted on the east side of the bay. BRUV completed on east arm approx. 1 km away from other samples.
29 Apr	Higgins Pass – Beach 1	52.47762	-128.638	-	-	-	-	x	-	-
29 Apr	Higgins Pass – Beach 3	52.49499	-128.679	-	-	-	-	x	-	-

The following sections describe the methods and preliminary results for the eDNA water collection, baited remote underwater video (BRUV) trials, beach seining, intertidal biodiversity surveys, and aquatic invasive species surveys.

Intertidal Biodiversity surveys

Methods

Comprehensive intertidal biodiversity surveys were performed at two locations in Higgins Passage (West Lohbrunner Saddle and Price Lagoon; Figure 10, Figure 11). Methods will be detailed in an upcoming technical report[6] and are also described in Cox et al. (2017). Briefly, the methods were:

1. The site was set up for random stratified sampling within intertidal zones, delineated by 40 m baselines set up parallel to the shoreline at 3.0, 2.2, 1.5 and 0.8 m above chart datum (Figure 12). Five transects were set perpendicular to the baselines and 10 m apart (i.e., at 0, 10, 20, 30 and 40 metres) and one 0.5 m x 0.5 m quadrat was placed at a random distance along each transect within each intertidal zone (Figure 12).
2. Cover classes (seaweed and abiotic, as defined on the data sheet and field ID sheet), and their percent contribution to a single cover layer, were recorded for each quadrat.
3. Epifaunal organisms were identified and counted in 10 randomly selected squares of a gridded 0.5 m x 0.5 m quadrat with 100 squares.
4. Where soft substrate was present, sediment samples were taken from randomly selected soft-sediment quadrats. Three different types of sediment samples were collected: 200 mL (core diameter 5 cm, depth 10 cm) for grain size analysis, 15 mL (core diameter 2.5 cm, depth 3 cm) for meiofauna identification, and 10 mL (core diameter 1.5 cm, depth 5 cm) for organic content analysis.
5. Where soft substrate was present, infaunal bivalves were excavated, sifted, identified, counted, and measured. Organisms were sampled by excavating two 5-gallon buckets from the quadrat, then sieving through a 5 mm mesh bag.
6. The larger and/or mobile organisms that were not captured in quadrat data (e.g., crabs, sea stars) were surveyed within 1 m of each baseline.

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[6] Dudas, S., Gillespie, K., Cox, K., and Paleczny, M. In prep. Intertidal Biodiversity Protocol.

Figure 11. Site photos and example quadrat photos for intertidal survey sites: West Lohbrunner Saddle (A,B) and Price Lagoon (C,D) (photo credit: Intertidal team, DFO).

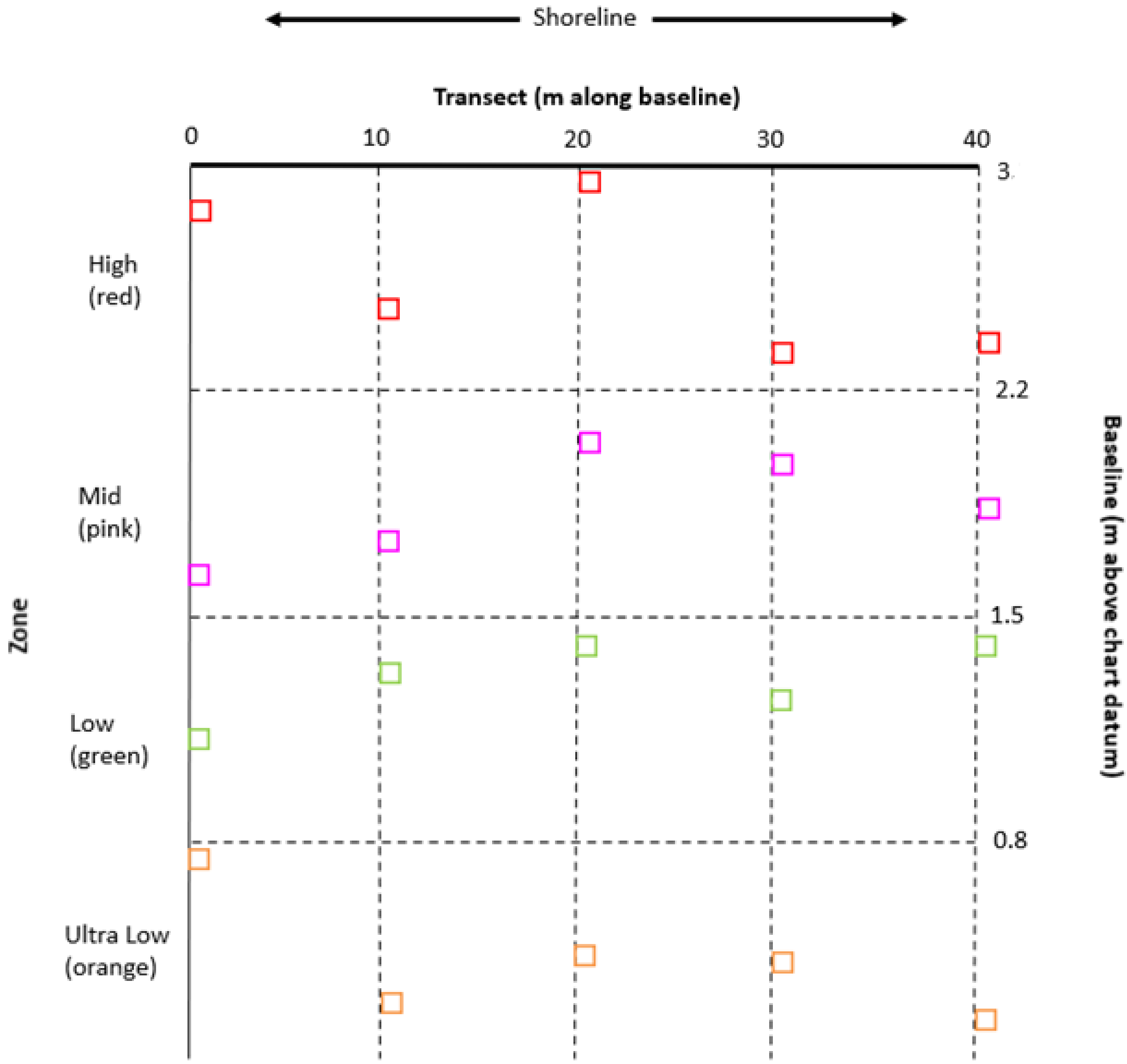

Figure 12. Site layout for intertidal biodiversity surveys. A 40 m baseline is placed parallel to the shoreline at the 3.3 metre tidal height (thick horizontal line). Intertidal zones (high, mid, low, ultra low) are delineated by marking additional baselines at 2.2, 1.5 and 0.8 metre tidal heights (dashed horizontal lines). A transect line is placed perpendicular to the shoreline at 0 metres along the baseline (vertical line). Transect lines are also marked at 10, 20, 30, and 40 metres along the baseline (vertical dashed lines). Survey quadrat flags are placed following a stratified random design, with one quadrat per zone randomly placed on each transect (colored by zone).

Results

Intertidal biodiversity surveys (including epifauna, infauna, and sediment samples) were conducted at two sites (Table 9). Site cover results are summarized in Table 10. Bivalve abundance results are summarized in Table 11. Epifauna abundance results are summarized in Table 12. Sediment analysis results are summarized in Appendix III (chemical analysis), Appendix IV (grain size), and Appendix V (meiofauna biomass).

Table 9. Summary of intertidal survey activities per site.

Site	Epifauna survey quadrats (count)	Infauna survey quadrats (count)	Sediment sample quadrats (count)
West Lohbrunner Saddle	9	9	9
Price Lagoon	9	7	6
Total count	**18**	**16**	**15**

Table 10. Seaweed and abiotic cover categories and their percent cover within survey site quadrat area (9 quadrats x 0.25 m^2 = 2.25 m^2 per site). Types are ranked by overall abundance, and cover category records by overall abundance within them.

Type	Cover Categories	W. Lohbrunner Saddle (% cover in quadrats)	Price Lagoon (% cover in quadrats)
Seaweed - Chlorophyta	*Ulva*	60	32
Seaweed - Chlorophyta	thin green turf	0	<1
Abiotic	Gravel	15	0
Abiotic	Cobble	9	16
Abiotic	Boulder	0	21
Abiotic	Sand	4	11
Abiotic	Shell	7	3
Abiotic	Sand/mud	0	7
Abiotic	Pea gravel	0	4
Seaweed - Phaeophyceae	*Fucus*	6	3
Seaweed - Phaeophyceae	*Melanosiphon*	0	<1
Seaweed	thin brown or red turf	<1	1
-	**Total number of cover categories**	**7**	**11**

Table 11. Bivalve taxa and their total number of individuals observed per survey site quadrat volume (9 quadrats per site = 2.25 m^2 x 0.25 m deep = 0.0526 m^3 per site). Records are ordered from highest to lowest total count.

Common name	Latin name	West Lohbrunner Saddle (individuals in all quadrats)	Price Lagoon (individuals in all quadrats)
Pointed macoma	*Macoma inquinata*	1	159
Softshell clam	*Mya arenaria*	11	37
Butter clam	*Saxidomus gigantea*	32	7
Bent-nose macoma	*Macoma nasuta*	0	31
Pacific littleneck clam	*Protothaca staminea*	27	4
Heart cockle	*Clinocardium nuttallii*	8	6
Manila clam	*Venerupis philippinarum*	9	0
Macoma	*Macoma*	1	6
Baltic macoma	*Macoma balthica*	0	1
Total count of bivalve taxa	**-**	**7**	**8**

Table 12. Epifaunal taxa and their total number of individuals observed at each site, ordered from highest to lowest total count across all quadrats.

Common name	Latin name	West Lohbrunner Saddle	Price Lagoon
Acorn barnacle	*Balanus glandula*	141	462
Little brown barnacle	*Chthamalus dalli*	48	21
Shield limpet	*Lottia pelta*	12	0
Checkered periwinkle	*Littorina scutulata*	1	4
Mask limpet	*Lottia persona*	1	2
Limpet	-	2	0
Plate limpet	*Lottia scutum*	2	0
Mussel	-	0	1
Worm	-	1	0
Total count of epifaunal taxa	**-**	**8**	**5**

Rapid Species Biodiversity Checklist

Methods
Rapid Species Biodiversity Checklist surveys (previously referred to as the Intertidal Aquatic Invasive Species survey) were conducted at six sites (Table 8), including the two intertidal sites (West Lohbrunner Saddle and Price Lagoon). At each site, the survey was completed by walking the beach and inspecting habitat at each tide zone to observe, identify, and record the presence of native and non-native species. Survey effort was not standardized, but time and area were recorded. Non-native and native species were recorded on a checklist (Appendix VI). A protocol document is currently in preparation[7].

Results
Species detected during Rapid Species Biodiversity Checklist surveys are shown in Figure 13**,** Table 13. A live European Green Crab (*Carcinus maenas*) was observed at West Lohbrunner Saddle, and moults were observed at Higgins Pass – Beach 2.

Figure 13. Blue mud shrimp (*Upogebia pugettensis*) observed at Price Lagoon.

[7] Davies, S.C., Hodes, V., Norgard, T., Dudas, S., and Bigg, M. In prep. Rapid Species Biodiversity Checklist Protocol.

Table 13: Fish and invertebrate species observed during Rapid Species Biodiversity Checklist surveys. The * indicates that the detection is from a shell/moult only (i.e., no live occurrences). ^Fewer species were recorded due to the limited time available for the survey at Higgins Pass – Beach 3.

Latin Name	Common Name	Carter Bay	Higgins Pass - Beach 1	Higgins Pass - Beach 2	Higgins Pass - Beach 3^	Price Lagoon	West Lohbrunner Saddle
Haliotidae	Abalone	Observed, but location not provided per Species at Risk guidance (DFO 2012)					
Balanus glandula	Acorn Barnacle	X	X	X	X	X	X
Phascolosoma agassizii	Agassiz's Peanut Worm	-	-	X	-	-	-
Actiniaria	Anemone	-	-	X	-	-	-
Macoma balthica	Baltic Macoma	X*	-	-	-	-	-
Patiria miniata	Bat Star	-	X	-	-	-	-
Macoma nasuta	Bent-Nose Macoma	X*	X*	X*	X*	X	-
Bittium sp.	Bittium sea snail	-	-	X	-	X	-
Katharina tunicata	Black Katy Chiton	-	X	-	-	-	-
Lophopanopeus bellus bellus	Black-Clawed Crab	X	-	X	-	-	-
Upogebia pugettensis	Blue Mud Shrimp	-	-	-	-	X	-
Mytilus edulis complex	Blue Mussel	X	X	X*	-	X	-
Ophiuroidea	Brittle Star	-	-	-	-	-	X
Saxidomus gigantea	Butter Clam	X*	X*	X*	X*	X	X
Cancridae	Cancer Crabs	-	-	X	-	-	-
Nucella canaliculata	Channeled Dogwinkle	-	X	-	-	-	-
Littorina scutulata	Checkered Periwinkle	X	X	-	-	X	X
Mopalia sp.	Chiton	-	-	-	-	X	X
Metridium senile	Clonal Plumose Anemone	-	-	X	-	-	-
Desmophyllum dianthus	Cockscomb Cup Coral	-	-	X	-	-	-
Didemnum sp.	Colonial tunicate	-	-	X	-	-	-
Pholis laeta	Crescent Gunnel	-	-	X	-	-	-
Acanthodoris sp.	Dorid nudibranch	-	-	X	-	-	-
Metacarcinus magister	Dungeness Crab	X	X*	-	-	X	-
Nucella emarginata	Emarginate Dogwinkle	-	X	X	-	X	-

Latin Name	Common Name	Carter Bay	Higgins Pass - Beach 1	Higgins Pass - Beach 2	Higgins Pass - Beach 3^	Price Lagoon	West Lohbrunner Saddle
Tresus capax	Fat Gaper	X*	-	X*	X*	X*	-
Nucella lamellosa	Frilled Dogwinkle	X	-	X	-	-	-
Callianassa sp.	Ghost Shrimp	-	-	-	-	-	X
Upogebiidae	Ghost Shrimp	X	-	-	-	-	-
Anthopleura xanthogrammica	Giant Green Anemone	-	X	-	-	-	-
Carcinus maenas	European Green Crab	-	-	X*	-	-	X
Pododesmus macrochisma	Green False-Jingle	X*	X*	X	-	-	-
Hemigrapsus oregonensis	Green Shore Crab	X	X	X	X	-	-
Pagurus hirsutiusculus	Hairy Hermit Crab	-	X	-	-	-	-
Halosauridae	Halosaurs	-	-	X	-	-	-
Ocenebra inornata	Japanese Rocksnail	-	-	X	-	-	-
Pugettia sp.	Kelp Crab	-	-	X	-	-	-
Fissurellidae	Keyhole Limpet	-	-	X	-	-	-
Dermasterias imbricata	Leather Star	-	X	X	-	-	X
Euspira lewisii	Lewis' Moonsnail	-	X*	X	-	-	
Chthamalus dalli	Little Brown Barnacle	-	X	-	X*	X	X
Orthasterias koehleri	Long-Armed Sea Star	X	-	-	-	-	-
Venerupis philippinarum	Manila Clam	-	X*	-	-	X*	X
Lottia persona	Mask Limpet	-	X*	X	-	X	X
Euspira sp.	Moonsnail	-	-	-	X*	X	-
Evasterias troschelii	Mottled Star	-	X	X	-	-	-
Leukoma staminea	Native Littleneck Clam	X*	X*	X	X*	X	X
Modiolus modiolus	Northern Horsemussel	-	-	-	-	X*	
Clinocardium nuttallii	Nuttall Cockle	X*	X*	X*	X*	X	X
Cucumaria miniata	Orange Sea Cucumber	-	-	X	-	-	-
Metandrocarpa taylori	Orange Social Tunicate	-	X	X	-	-	-
Tresus nuttallii	Pacific Gaper	-	X*	X*	X*	-	-

Latin Name	Common Name	Carter Bay	Higgins Pass - Beach 1	Higgins Pass - Beach 2	Higgins Pass - Beach 3^	Price Lagoon	West Lohbrunner Saddle
Pisaster brevispinus	Pink Short-Spined Star	-	X	-	-	-	-
Lottia scutum	Plate Limpet	-	X*	X*	-	-	-
Macoma inquinata	Pointed Macoma	X*	X*	X*	-	X	-
Hemigrapsus nudus	Purple Shore Crab	-	X	-	X	-	-
Pisaster ochraceus	Ochre Seastar	-	X	X	-	-	X
Glebocarcinus oregonensis	Pygmy Rock Crab	-	-	-	-	-	X
Cancer productus	Red Rock Crab	-	X	-	X*	X	-
Pholis ornata	Saddleback Gunnel	X	-	X	-	-	-
Crangon nigricauda	Sand Crangon	-	-	X	-	-	-
Urticina sp.	Sea anemone	-	-	-	-	-	X
Eupentacta sp.	Sea cucumber	-	-	X	-	-	-
Calliostoma sp.	Sea snail	-	-	X	-	-	-
Littorina sp.	Sea Snail	-	-	X*	-	-	-
Aplidium sp.	Sea squirt	-	-	X	-	-	-
Nudibranchia	Seaslugs	-	-	X	-	-	-
Henricia sp.	Seastar	-	X	X	-	-	-
Lottia pelta	Shield Limpet	X*	X	X	X	X	X
Dendrobranchiata	Shrimp	-	-	-	-	X	-
Littorina sitkana	Sitka Periwinkle	-	X	-	-	-	-
Mya arenaria	Softshell Clam	X*	X*	X*	X*	X	X
Halocynthia sp.	Solitary ascidian	-	-	X	-	-	-
Asteroidea	Seastar	-	-	X	-	-	-
Semibalanus cariosus	Thatched Barnacle	-	X	-	-	-	-
Sedentaria	Tube Worms	-	-	-	-	X	-
Turbinidae	Turban Snail	-	X	X	-	-	-
Scaphopoda	Tusk Or Tooth Shell	-	-	-	-	X*	-
Bryozoa	-	-	X	X	-	-	-

Latin Name	Common Name	Carter Bay	Higgins Pass - Beach 1	Higgins Pass - Beach 2	Higgins Pass - Beach 3^	Price Lagoon	West Lohbrunner Saddle
Cephalaspidea	-	-	-	-	-	X	-
Chelyosoma sp.	-	-	-	X	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	X	-	-	-
Diplosoma listerianum	-	-	X	-	-	-	-
Polycirrus californicus	-	-	-	X	-	-	-

Shore-based eDNA Water Collection

Methods

Water for eDNA analysis was collected at two locations (East Lohbrunner Saddle and Price Lagoon; Figure 14) to use in eDNA metabarcoding analyses to assess intertidal and subtidal fish and invertebrate communities at the sites. Surface water samples were collected from the dive skiff using a 1.5 L Nalgene bottle attached to a pole. Bottles were sterilized with 10% bleach solution and rinsed well in tap water before being placed in individual Ziploc bags. To ensure no traces of bleach remained in the bottle, the bottle was filled and rinsed with seawater three times prior to collecting the sample. The bottle was then held approximately 30 cm below the surface, filled with seawater and closed. Samples were stored on ice in a cooler for transport to the *Vector* lab. At each station, three replicate samples were collected. One field blank (1.0 L distilled water) was collected at each site by opening the bottle for approximately the length of time required to collected an individual sample (~1 minute). The filled bottles were placed back in the Ziploc bag and put into a cooler with ice packs, before being frozen at -4ºC on the *Vector*.

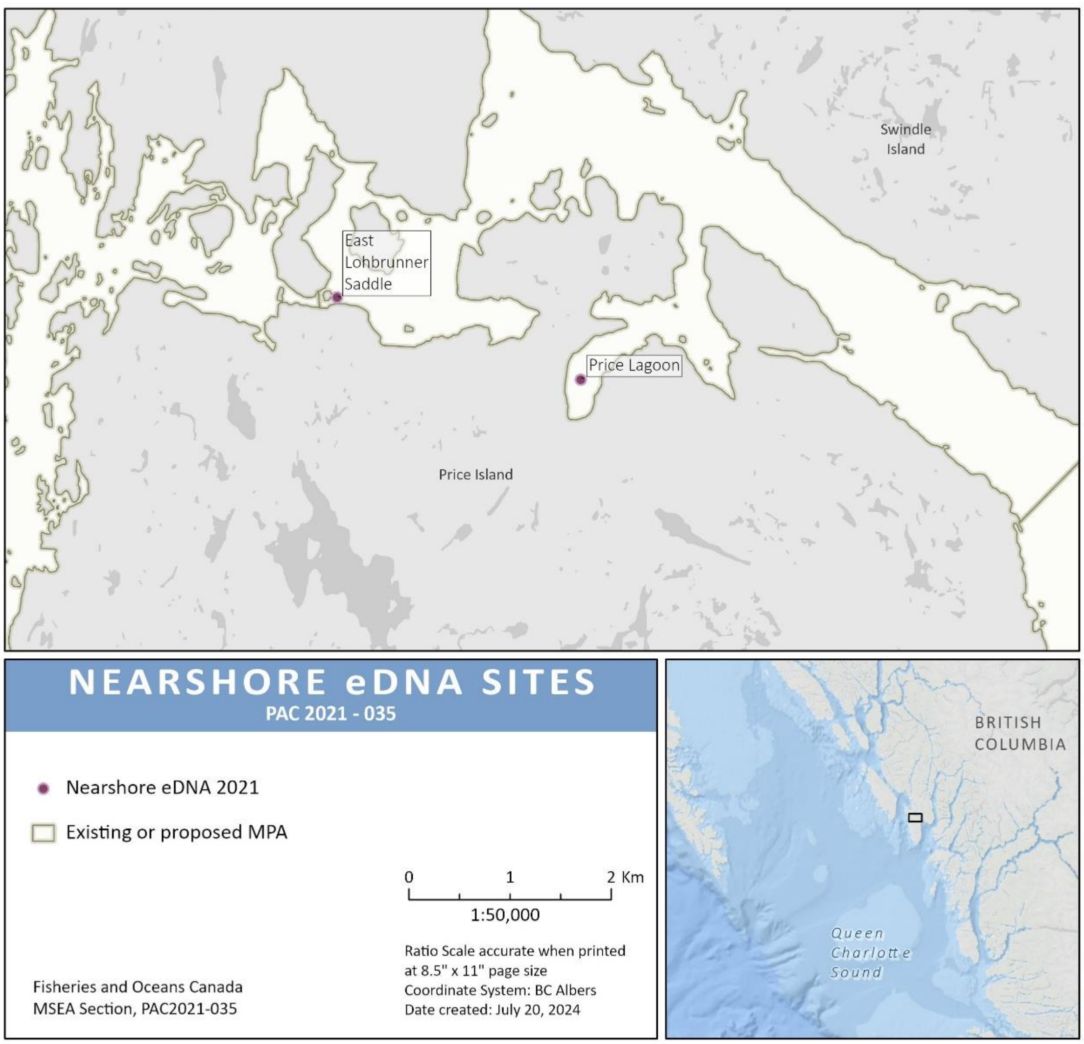

Figure 14. Map of nearshore eDNA sample site locations in at East Lohbrunner Saddle and Price Lagoon.

The frozen samples were transported to DFO's Institute of Ocean Sciences (IOS) in Sidney to be filtered later. Once filtered, samples were sent to the Center for Environmental Genomics Applications for DNA extraction and analysis. In addition to providing baseline biodiversity information, the data from the metabarcoding can provide a complementary assessment to the fish data collected using BRUVs and beach seines.

Results

Details of eDNA sample collection are provided in Table 14. The shore-based eDNA biodiversity samples at two sites detected 261 invertebrate taxa from 15 phyla with 63 taxa identified to the species level. The fish genetic markers (12S and 16S) gave poor results due to lab processing issues. These samples are currently being rerun. Refer to Appendix VII for full species by site matrices for invertebrates.

Table 14. Nearshore eDNA sample details. One blank per day was collected at each station. Coordinates are the average of the 3 samples.

Site	Date	Latitude (decimal degrees)	Longitude (decimal degrees)	#bottles/station	Depths sampled (m)
East Lohbrunner Saddle	25 Apr	52.47492	-128.725	3	0.3
Price Lagoon	28 Apr	52.46846	-128.689	3	0.3
Blanks	Daily	-	-	2	-
Total	-	-	-	**8**	-

Beach Seining

Methods

Beach seine surveys were completed to gather baseline information on fish species diversity, size distribution, and relative abundance on April 27, 2021 at East Lohbrunner Saddle and Price Lagoon (Table 8). Eelgrass habitat was targeted at both sites.

Three seine sets, approximately 10 m apart, were completed at each beach using a seine 3.1 m high, 9.2 m wide, with 9 m length bridles and a mesh size of 0.4 cm. For each set, one person would walk one bridle into the water, perpendicular to shore, while another person stayed on shore to anchor the lagging end. Once the first person was as far from shore as safely possible (usually to their lower chest, max ~1.5 m), they would turn and walk parallel to shore for the width of the net (approx. 10 m), then turn back towards shore. As the net swept around, the second person would pull the lagging bridle to keep the net parallel to shore and to keep the leadline on the seafloor. A third person was usually needed to lift the leadline as the net was pulled onto the beach so the float and leadlines did not tangle and the fish did not escape. All fish in the net were transferred using hands or dip nets into buckets of seawater (7.5 and 20 L) containing battery-operated air bubblers. All fish were identified and counted. Whole fish were preserved in 95% ethanol as needed for taxonomic voucher specimens and to create the reference genetic library needed for the eDNA analysis.

Results

At East Lohbrunner Saddle, 89 individuals belonging to 11 species were caught. At Price Lagoon, 79 individuals of nine species were caught. Of the fifteen species found, five were found only found at East Lohbrunner Saddle, three were only found at Price Lagoon, and the remaining six were found at both (Figure 15,

Table 15).

Relatively few fish were collected this year compared to the seine samples taken in May 2019 in nearby areas, where an average of 347 individuals belonging to 13 species were found at seven sites. Eelgrass bed size and density tends to peak in June/July, so fewer fish might have been seen in 2021 because the eelgrass beds might have been smaller than they were during the 2019 survey, which occurred about a month later in the year.

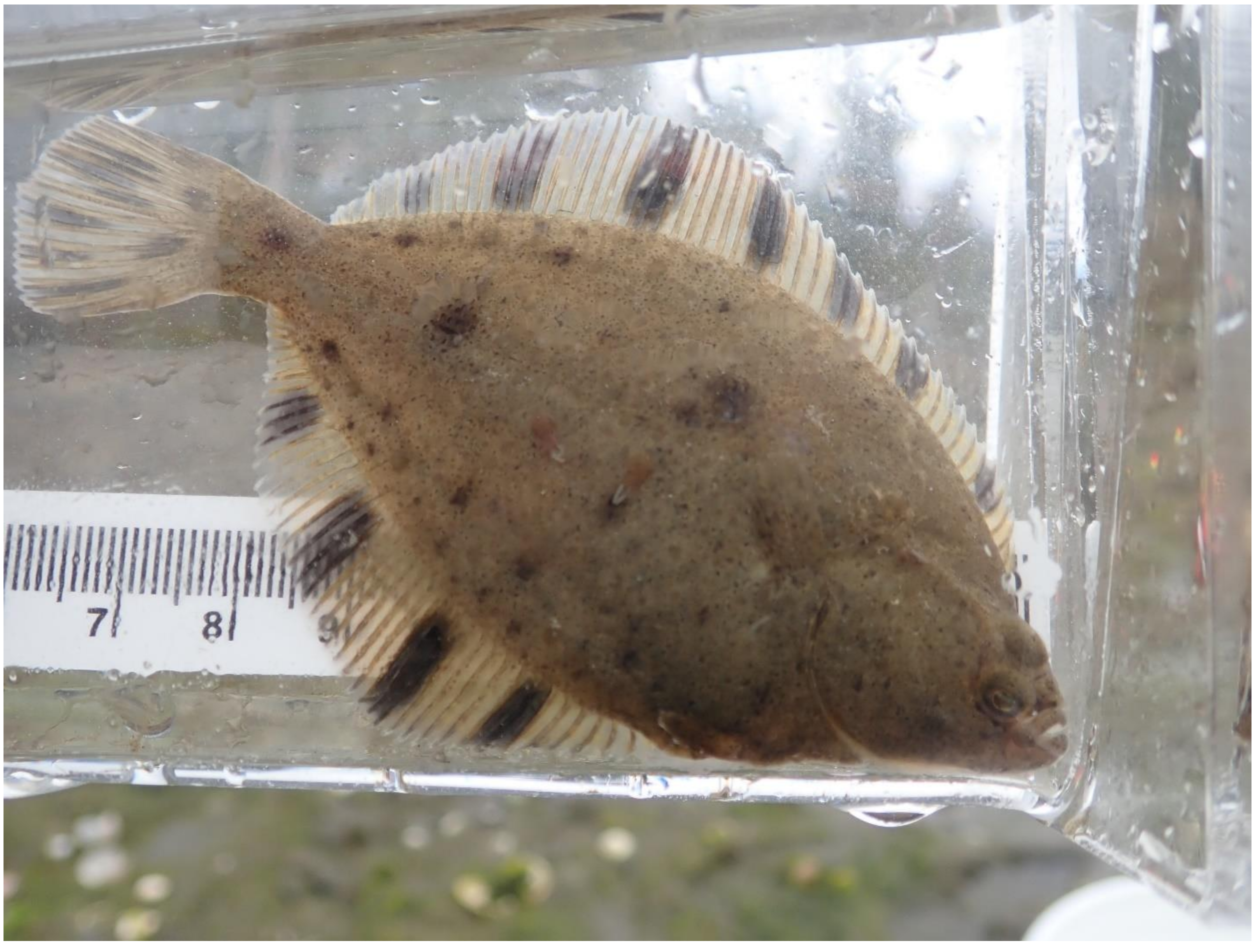

Figure 15. Starry flounder (*Platichthys stellatus*) collected in beach seines at Price Lagoon.

Table 15. Fish caught in beach seines.

Latin Name	Common Name	East Lohbrunner Saddle	Price Lagoon
Oncorhynchus keta	Chum Salmon	44	6
Pholis laeta	Crescent Gunnel	7	–
Parophrys vetulus	English Sole	–	4
Rimicola muscarum	Kelp Clingfish	–	23
Anoplarchus purpurescens	High Cockscomb	1	–
Artedius fenestralis	Padded Sculpin	16	–
Oncorhynchus gorbuscha	Pink Salmon	11	7
Syngnathus leptorhynchus	Bay Pipefish	4	18
-	Sole sp. (juvenile)	1	8
Leptocottus armatus	Staghorn Sculpin	1	1
Platichthys stellatus	Starry Flounder	–	7
Gasterosteus aculeatus	Threespine Stickleback	2	5
Oligocottus maculosus	Tidepool Sculpin	1	–
Aulorhynchus flavidus	Tubesnout	1	–
Total individuals	**-**	**89**	**79**
Total taxa	**-**	**11**	**9**

Baited Remote Underwater Video (BRUV) Trials

Methods

BRUV systems (Figure 16) were deployed at seven locations in Higgins Passage (Figure 17) to collect imagery of nearshore fishes and invertebrates. Each BRUV system was composed of two GoPro Hero7 cameras – each secured in a waterproof housing (SeaGIS, Bacchus Marsh, Victoria, Australia) attached to a metal bar, which fit into a metal frame (Figure 16). A ~2 m pole with an attached bait jar extended into the field of view of the cameras, with the bait jar placed 1.5 m in front of the cameras. The two camera housings were fixed in place and pointed forward at a slight inward angle to allow for stereo-imagery analysis (i.e., to accurately measure the size of objects in the video). In each housing, a camera fit inside a mount that was attached to a piece of clear Plexiglass, and was secured in the mount with an aluminum bracket. The Plexiglass front was placed into the housing and secured with two draw latches. Each camera was individually numbered and could only be used with the housing with which it was calibrated; the position of the cameras and housings is fixed and must be re-calibrated if changed. The camera housing bar has two slots that friction-fit onto the frame, and was secured with bungee cords. Four 2 lb lead weights were secured to the bottom of the frame to keep the system from moving underwater, and a length of rope corresponding to the deployment depth at each site was attached via a 4-point bridle to the top of the frame, with a float attached for retrieval. A hydrophone (SoundTrap, Ocean Instruments) was attached to the camera frame to record potential sounds from fish recorded in the video.

Prior to deployment, the bait jar was filled with ~500 g of previously-frozen Pacific Herring (*Clupea pallasii*), and the camera housing bar and bridle line was secured to the main frame. A Secchi disk was used to assess water clarity and a CTD Castaway was deployed to collect temperature, salinity, and depth profiles of each deployment location. After the cameras were turned on and secured into the housings, a clapperboard marked with the date, site name, and camera ID numbers was clapped in front of the two cameras to allow the videos to be synchronized during annotation. The BRUV was then deployed over the side of the boat. When the BRUV touched the bottom, the line was pulled up slightly and released again to ensure the BRUV settled flat on the seafloor. BRUVs video length was limited by the battery life of the GoPros.

BRUVs were deployed nine times at seven stations (Figure 17). The cameras did not record properly on the morning of 26 April, so the two East Lohhbrunner Saddle sites were repeated that afternoon. Table 16 shows the details of the BRUV deployments.

Results

Details of the BRUV deployments are shown in Table 16. Preliminary viewing of the video showed few fish, and those that were observed seemed incidental (i.e., not attracted to the bait pole). Possible reasons for the lack of fish could include the early time of year (eelgrass beds and juvenile fish were both still very small), poor visibility (not enough ambient light at ~6 am, extensive particulate matter in water), and improper bait (whole herring may not have produced a strong enough scent plume, or the fish in the area were not attracted to the herring bait). Fish and invertebrate taxa observed during BRUV deployments are noted in Table 17 and Figure 18.

Figure 16. Front (A) and side (B) view of BRUVs. Note in photo of front view, bait pole and cameras are not installed (photo credit: L. Burke, DFO).

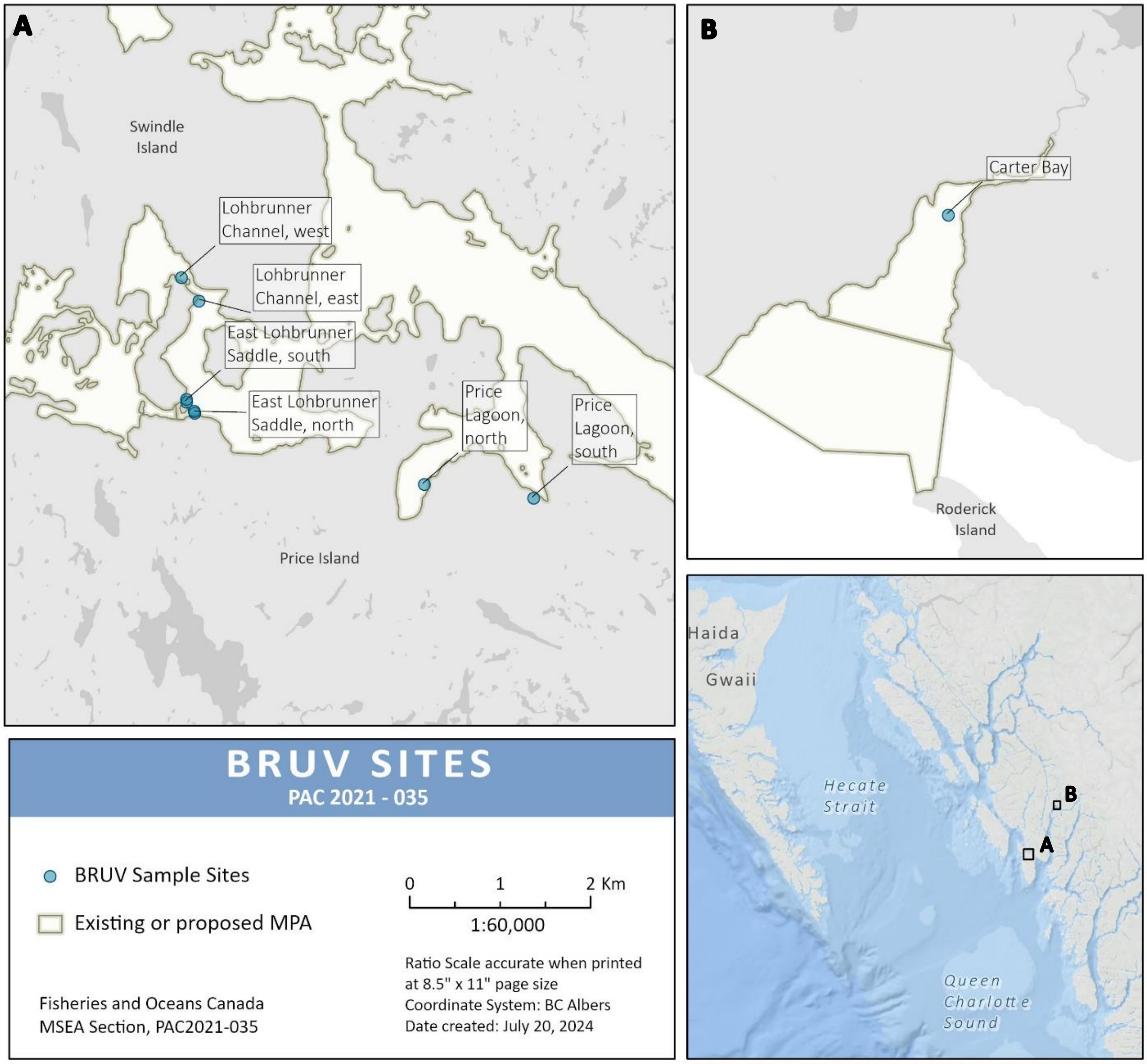

Figure 17. Map of Baited Remote Underwater Video (BRUV) deployment sites during the PAC2021-035 survey.

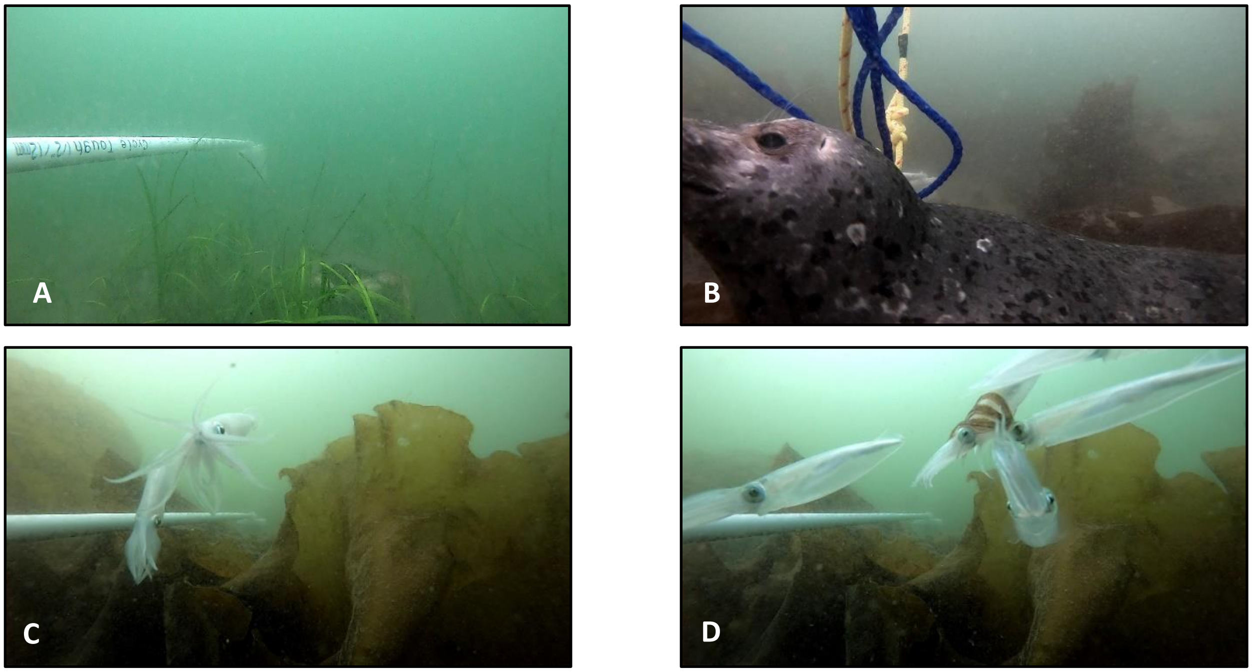

Figure 18. Examples of animals observed in the BRUV videos: A) Dungeness crab (*Metacarcinus magister*), B) Harbour seal (*Phoca vitulina*), C/D) Opal squid (*Loligo opalescens*) (photo credits: BRUV team, DFO).

Table 16. Details on Baited Remote Underwater Vehicle (BRUV) deployments. Substrate and algae details may not be noted when video was not annotated. Coordinates are in Decimal Degrees (DD) and Time is in Pacific Daylight Time (PDT). *End time not recorded, estimated from video.

Date	Site Name	Latitude (DD)	Longitude (DD)	Time in (PDT)	Video length (min)	Depth (m)	Camera number	Substrate	Algae	Notes
24 Apr	Carter Bay	52.83119	-128.39172	16:45	105	5.7	1034, 1035	Mixed fines	Red branched algae, diatom mats	Annotated.
26 Apr	East Lohbrunner Saddle, north	52.47463	-128.72455	5:52	258	4.0	1046, 1049	-	-	Neither camera recorded.
	East Lohbrunner Saddle, south	52.47568	-128.726	6:05	253	4.0	1034, 1035	-	-	Only 1034 camera recorded. Not annotated.
	East Lohbrunner Saddle, north	52.47595	-128.72604	13:53	147	8.4	1034, 1035	Not visible.	*Agarum* spp., brown foliose algae	Repeat deployment. Annotated.
	East Lohbrunner Saddle, south	52.47481	-128.72468	14:00	140	9.8	1046, 1049	Mixed fines	*Agarum* spp.	Repeat deployment. Annotated.
27 Apr	Price Lagoon, north	52.46841	-128.68673	14:06	139	4.4	1034, 1035	Mixed fines	*Zostera marina*	Annotated.
	Price Lagoon, south	52.46748	-128.66879	14:21	134	5.1	1046, 1049	Mixed fines	*Zostera marina*	Annotated.
28 Apr	Lohbrunner Channel, west	52.48799	-128.72764	12:57	72	4.4	1034, 1035	-	Brown foliose algae	Deployment lines in field of view. Not annotated.
	Lohbrunner Channel, east	52.48572	-128.72459	13:14	*61	4.2	1046, 1049	-	*Agarum* spp., *Zostera marina, Ulva*	Deployment lines in field of view. Not annotated.

Table 17. Fish and invertebrate taxa observed on BRUV deployments during the PAC 2021-035 survey.

Latin Name	Common Name	Carter Bay	East Lohbrunner Saddle, north	East Lohbrunner Saddle, south	Price Lagoon, north	Price Lagoon, south
Rhinogobiops nicholsii	Blackeye goby	-	-	X	-	-
Cancer sp.	Cancer crabs	-	X	-	X	-
Metacarcinus magister	Dungeness crab	X-	-	-	X	X
Phoca vitulina	Harbour seal	X	-	-	-	-
Telmessus cheiragonus	Helmet crab	-	X	-	-	-
Hemilepidotus	Irish lords	-	-	X	-	-
Hexagrammos decagrammus	Kelp greenling	-	-	X	-	-
Loligo opalescens	Opal Squid	-	X	-	-	-
Cancer productus	Red rock crab	-	-	X	-	-
Asteroidea	Sea Star	X	-	-	-	-
Total taxa per site	**-**	**3**	**3**	**4**	**2**	**1**

Aquatic Invasive Species – European Green Crab

Methods

Green crab surveys were conducted at 11 locations from April 23-28, 2021 (Figure 20, Table 18), following the protocol in Gillespie et al. (2015). This protocol involves deploying six Fukui traps, baited with Pacific Herring, set 10 m apart, and attached to a 60 m groundline. Traps are set across the intertidal zone and are deployed for 24 hrs, when possible. All species caught in the traps are recorded and all crab species are measured.

Results

Four green crabs (three males, mean width 55 mm; one gravid female, width 33 mm) were caught at Lohbrunner North, and two were caught at Higgins West (one male, width 55 mm; one female, width 48 mm) (Figure 19, Figure 20). No green crabs were caught at: Lohbrunner North and Higgins West in Higgins Passage.

An additional live gravid female was observed during the beach survey with the Rapid Species Biodiversity checklist at West Lohbrunner Saddle, and moults were found at the Higgins Pass – Beach 2 site.

Green crab tissue was sampled for potential future population genetics studies but further analyses have not been completed as of the date of this report.

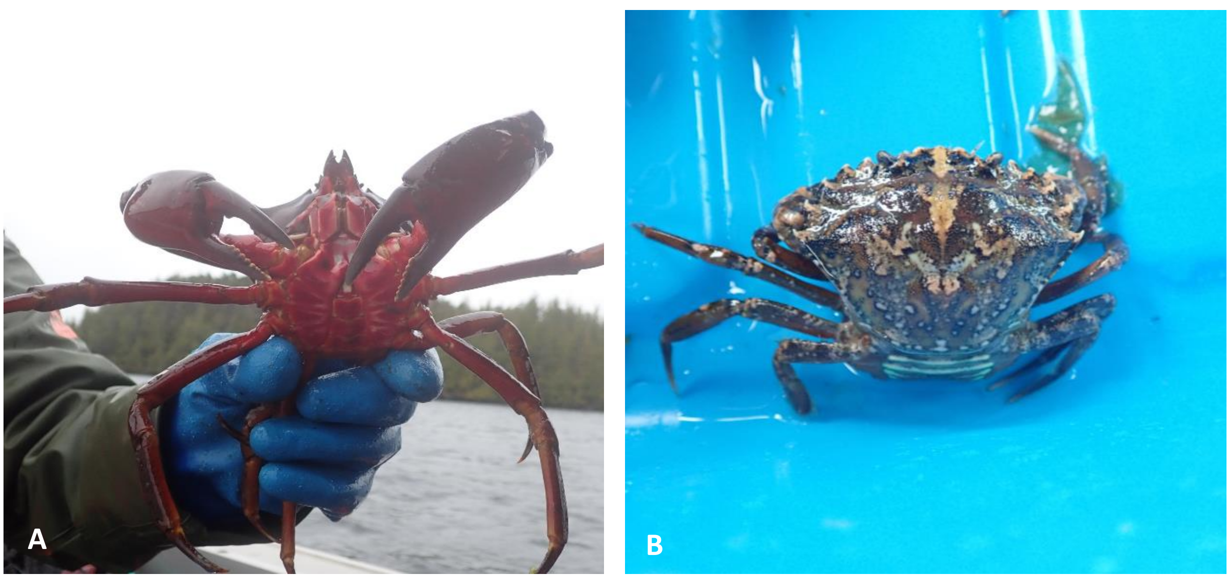

Figure 19. Example photos of crab species caught during green crab surveys: A) Northern Kelp Crab (*Pugettia producta*), B) European Green Crab (*Carcinus maenas*).

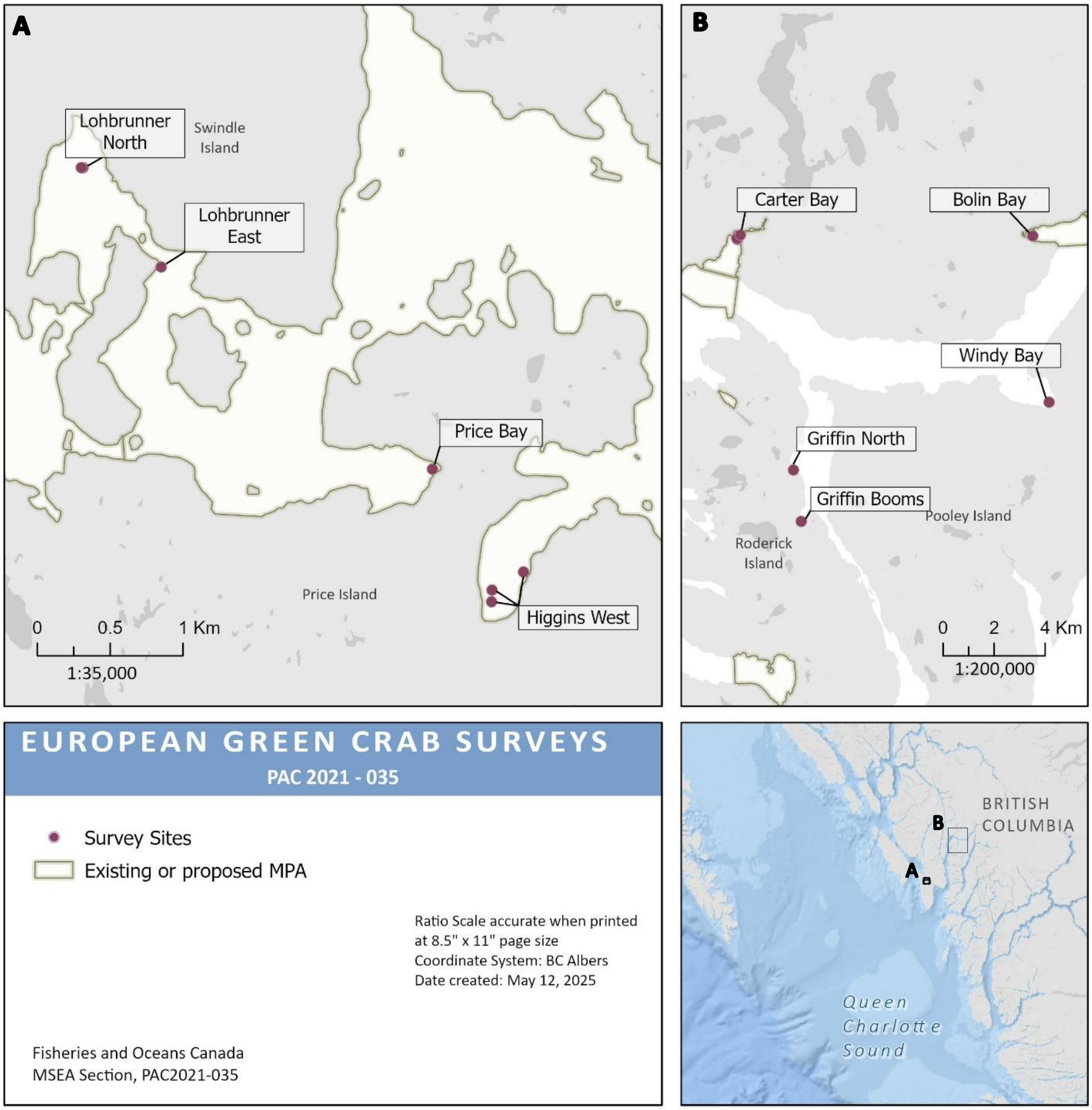

Figure 20. Map of green crab survey locations from the PAC2021-035 research survey.

Table 18. Number of individuals of crab species caught in European Green Crab traps and details of trap deployments.

Site	Date	Latitude (decimal degrees)	Longitude (decimal degrees)	Duration (hours)	Number of Traps	European Green Crab (*Carcinus maenas*)	Dungeness Crab *(Metacarcinus magister)*	Graceful Crab (*Metacarcinus gracilis*)	Red Rock Crab (*Cancer productus*)	Northern Kelp Crab (*Pugettia producta*)
Carter Bay	23 Apr	52.8315	-128.392	21	6	0	8	0	1	0
Carter Bay	23 Apr	52.8318	-128.392	21	6	0	16	0	1	0
Griffin Booms	24 Apr	52.7331	-128.349	22	6	0	0	10	0	0
Griffin North	24 Apr	52.751	-128.354	23	6	0	0	0	0	0
Windy Bay	24 Apr	52.7778	-128.207	23	6	0	1	0	0	0
Bolin Bay	24 Apr	52.836	-128.219	19	6	0	3	0	0	0
Lohbrunner Channel (North)	27 Apr	52.4918	-128.733	25	6	0	9	0	4	0
Price Bay	27 Apr	52.4741	-128.696	25	6	0	8	0	8	0
Price Lagoon (Higgins West)	27 Apr	52.468	-128.687	24	6	0	8	1	5	0
Price Lagoon (Higgins West)	27 Apr	52.4668	-128.69	23	6	0	21	2	0	0
Lohbrunner Channel (North)	27 Apr	52.4918	-128.733	24	6	4	0	0	2	0
Lohbrunner Channel (East)	27 Apr	52.4859	-128.725	24	6	0	0	0	9	8
Price Lagoon (Higgins West)	28 Apr	52.4661	-128.69	21	6	2	7	0	0	0
Totals	-	-	-	**295**	**78**	**6**	**81**	**13**	**30**	**4**

Ship-based eDNA Water Collection

Objectives

1. Collect baseline biodiversity information using eDNA metabarcoding from seawater from throughout the MCT area
2. Collect eDNA samples at multiple depths to determine how far from the seafloor water would need to be collected to detect benthic communities (as part of collaborative project - details here)

To better understand how far from the seafloor water would need to be collected in order to detect benthic communities, water was collected at the seafloor and at ascending intervals ending at the surface (Table 19, Table 20). At each of two locations (near Pidwell Reef, where the *Lophelia* aggregation was observed in 2019, and off Fawn Point near Carter Bay), six stations with gradually decreasing bottom depths (200, 100, 50, 30, 20, and 5 m) were selected. Two to six depths were sampled at each station (more depths at deeper sites), with three replicates completed for each depth.

Table 19. Site description and summary of surveys completed for ship-based eDNA water collection. Further details on the sampling performed at each site are found in Table 21.

Site	CTD	eDNA	Description/Notes
Pidwell Reef (“*Lophelia*”)	X	X	North Milbanke Sound, between Price and Swindle Islands. Six stations from deep slope south of Pidwell Reef north towards Swindle Island. *Lohelia* coral debris was observed at the 200 m station here in 2019 via visual surveys. Relatively exposed.
Fawn Point	X	X	Six stations along south side of sill separating Sheep Passage and Finlayson Channel. Fawn Point is the point just north of Kid Bay, where a fish farm is located, and south of Carter Bay. Relatively sheltered. Coral aggregations are known to occur in the area.

Table 20. Sampling design for eDNA water collection. This protocol was carried out at two sites: Pidwell Reef (*Lophelia*) and Fawn Point.

	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	
Niskins per cast	6	5	3	2	2	2	
# of casts (replicates)	3	3	3	3	3	3	
Blanks	1	1	1	1	1	1	
Total filters per station	19	16	10	7	7	7	66 (x2 locations = 132)
Depths sampled	1 m	1 m	1 m	1 m	1 m	1 m	
	30 m	30 m	30 m	30 m	20 m	5 m	
	50 m	50 m	50 m	–	–	–	
	100 m	80 m	–	–	–	–	
	150 m	100 m	–	–	–	–	
	200 m	–	–	–	–	–	

The CTD and water sampling consisted of a SBE19plus + SBE ECO55 water sampler ("mini-rosette") with six 4 L Niskins (Figure 21). Bottles were tripped on the upcast using time-at-depth as a controller for the pylon. Additional sensors included a SBE43 (dissolved oxygen) and a ECO FLRT Fluorometer (Wetlabs). The ECO was programmed to trigger 5 m above bottom after being held at the target depth for 3 minutes. Bottles were tripped at bottom of the cast, 5 m and 2 m depths. The ships sounder (EK80, Kongsberg) was used to determine bottom depth. Deployment conditions included a 10 m soak for one minute before returning to surface to commence the cast. Descent/ascent rates were 0.5 m/s.

The mini-rosette was deployed off the starboard side A-frame of the *Vector* using the work winch and wire set up for the ROV deployment (Figure 21A). At recovery, the mini-rosette was placed on a platform made of 2x4 wood (~6" high, Figure 21B). Water sampling took place after bottle integrity checks were complete (i.e., ensuring that bottles were completely sealed). To sample the water, clean gloves were used and a clean (bleach-washed and de-ionized water rinsed) piece of 5/8" silicone tubing, ~6" long was attached to the spigot and used to transfer water into a 1 L Kangaroo gravity feeding bag (Cardinal Health, Dublin, OH). Once filled, the gravity bag was placed into a Ziploc bag and put into a cooler, where a person working in the lab with sterile gloves could retrieve it. One blank was completed at the end of each station (12 blanks total), consisting of a gravity bag pre-filled with de-ionized water, which was opened on deck and had a clean silicone tube inserted before being put into a Ziploc bag and into the cooler with the other samples.

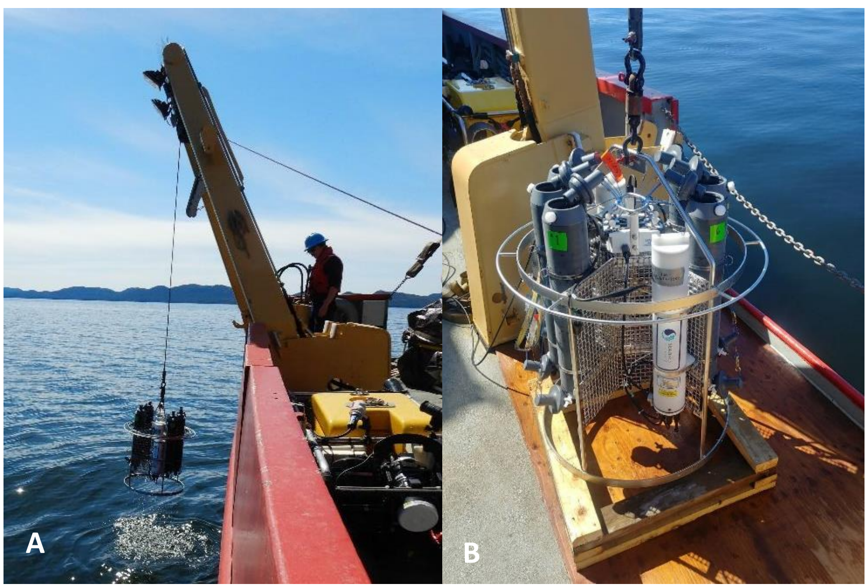

Figure 21. SBE 55 ECO mini-rosette water sampler: A) during deployment from the side A-frame, and B) on deck (photo credit: eDNA team, DFO).

Methods

<u>*Small Boat Launch CTD and Water Sampling for eDNA*</u>

Shallow stations (5-30 m bottom depth) were sampled from a 24' skiff (*Palmira*) using individual 1.7 L Niskin bottles (General Oceanics, Miami, FL) that were manually triggered with bronze messengers (Go Devil 31oz, General Oceanics) (Figure 22). The setup involved a ¼" AmSteel-Blue line (Samson Rope, Ferndale, WA) strung through a crab pot hauler (Brutus Pacific Pro – Scotty Mount, Ace Line Hauler, Nanaimo, BC), with two 5 lb cannonballs and a CastAway-CTD (Sontek, San Diego, CA) secured with 1 m of line to the end thimble. Flagging tape threaded through the line marked 5 m increments. A Niskin was attached to the line just above the thimble splice (~1.25 m above the bottom cannonball), and lowered to the seafloor. A second Niskin was attached to the line so that it sat just below the water surface. Single Niskins are designed to be triggered in series, with all bottles on the line having messengers that trigger the next bottle when closed. Initial casts attempted to trigger the Niskins in series, but boat movement from wind and current made it difficult to maintain a straight vertical line that ensured bottle closure; messengers sent on angled lines tended to hit the side of the Niskin plunger without triggering it. To ensure that the bottles closed, and to avoid the cannonballs being caught on rocks on the seafloor, the protocol was modified so that the bottom bottle was triggered and pulled up to ~5-10 m before attaching and triggering the surface bottle. This resulted in successful bottle closures, but did cause some difference in bottle closure location between the top and bottom bottles because of drift.

The Niskins were removed from the line and hung on the back of the skiff (Figure 22B). Water was collected from the Niskins in the same manner as described above, except that the spigots were first wiped with Lysol disinfectant wipes to reduce contamination resulting of increased potential contact (with the gunnel, clothing, hands, etc.) during recovery. The gravity bags were placed in individual Ziploc bags in a cooler, which were returned to the *Vector* for filtering after each station.

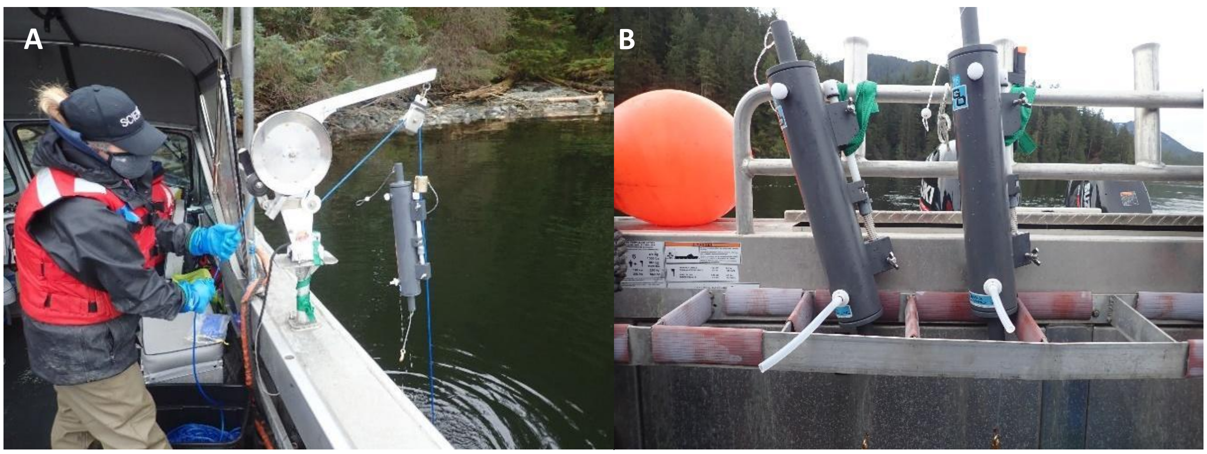

Figure 22. (A) Single Niskin recovery, (B) Niskins hung on back of boat for sampling (photo credit: eDNA team, DFO).

<u>*Water filtering*</u>

Bench surfaces in the lab were cleaned with 10% bleach solution and clean lab bench paper was laid down to delineate clean surfaces. Each Kangaroo gravity bag was hung from a portable coat rack in the lab (Figure 23) and a labelled 0.22 µm polyvinylidene fluoride (PVDF) Sterivex cartridge filter (Fisher Scientific) was attached to the tubing end via a luer lock adapter. The filter was then clamped to a 1 L beaker used to measure the filtrate volume. The flow control valve was opened and the start time was recorded. New, clean gloves were used for each kangaroo gravity bag/filter set up.

The goal was to filter 900 ml of water from each sample, which varied but generally took about 2 hours to gravity-filter. If more than 800 ml was filtered after 1.5 hours, it was given an additional 30 minutes to complete. If less than 800 ml was filtered after 1.5 hours, the gravity method was stopped, a piece of peristaltic pump tubing was attached via a variable width tubing adapter, and the remaining ~100 ml was filtered using a peristaltic pump.

When the filters were complete, they were removed from the tubing and air was pushed through a sterile 50 ml syringe to force all remaining liquid out of the filter. A luer cap was attached to the outflow end of the Sterivex filter, an Acrodisc filter was attached to the inflow end, and a 5 ml syringe pre-loaded with 2.5 ml Longmire's solution was attached to the Acrodisc (Figure 24). The Sterivex was pointed up and was filled with Longmire's (1.8-1.9 ml; the remaining volume is lost to the Acrodisc and syringe tip). The syringe and Acrodisc were removed, a luer cap was placed on the inflow end of the Sterivex, and the filter was placed in an individual Whirlpack bag. Samples were stored in the refrigerator until the end of the cruise, at which time they were placed in a cooler with ice packs and transported to Hakai Institute staff in Campbell River for DNA extraction and analysis.

The 132 water samples were filtered over four days (45 each on April 22 and 23, and 21 each on April 24 and 25). Including prep and cleanup, the each days with 45 samples required about 12 hours of work.

Figure 23. Kangaroo gravity bags hung to passively filter water for eDNA analysis (photo credit: eDNA team, DFO).

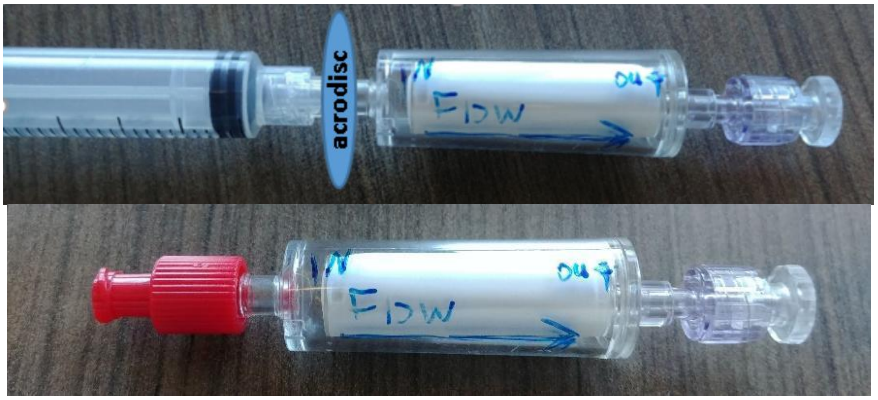

Figure 24. Sterivex filters, showing configuration for addition of Longmire's solution (top) and final capping before storage (bottom). Direction of water flow is from left to right (photo credit: eDNA team, DFO).

<u>DNA extraction, eDNA metabarcoding and bioinformatics</u>

All eDNA samples were sent to the Hakai Institute for genomic analyses. DNA was extracted from filters and two genetic markers were used for the metabarcoding: one that targets fish (12S) and one general biodiversity marker (CO1) that works well for many marine invertebrates. Lab analyses and bioinformatics were completed by the Marna Genomics Lab, Hakai Institute. CTD data can be accessed through the Institute of Oceans Sciences Water Properties database[8].

Results

A total of 133 samples were collected across 12 sites (Figure 25 and Table 21). Table 22 shows fish species richness (number of taxa) detected using eDNA at the seafloor and at ascending depth intervals at the Lophelia and Fawn sites. Ship-based eDNA fish and invertebrate species lists are provided in Appendix VIII, IX, X, and XI**Error! Reference source not found.**

The ship-based eDNA samples detected 23 fish species, 22 genera, and 16 families. The ship-based eDNA samples detected 33 macroinvertebrate species, 43 genera, 42 families in 8 phyla. Ten fish species and four invertebrate taxa identified as conservation priorities for the Northern Shelf Bioregion Marine Protected Area Network (Gale et al. 2019) were detected in the ship-based eDNA samples.

[8] https://www.waterproperties.ca

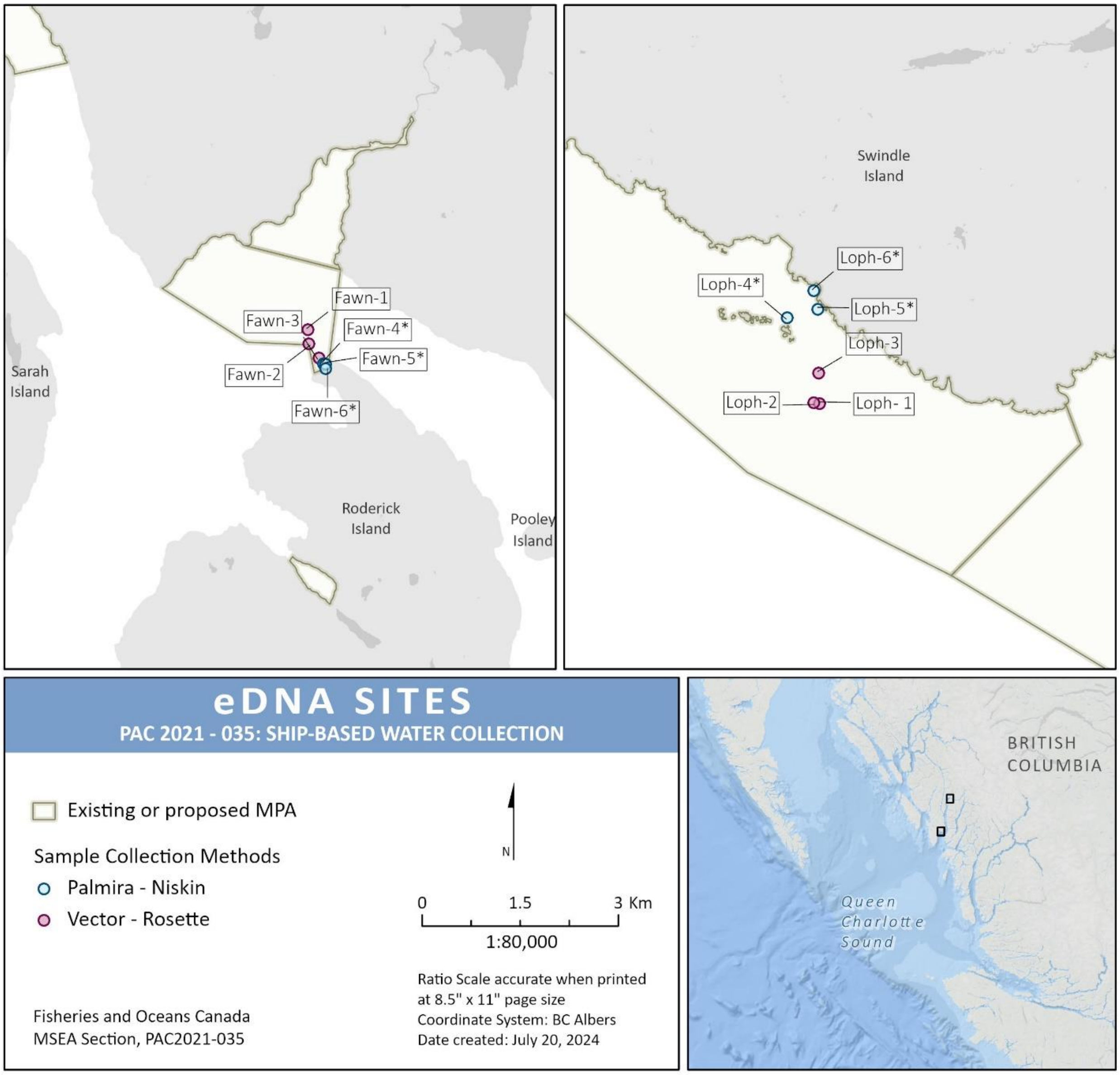

Figure 25. Location of eDNA ship based water collection sites, represented by collection method. 1.5 L Niskin samples collected from the 24’ skiff shown in blue and rosette samples from the Vector shown in pink.

Table 21. Details of shipboard eDNA water collection. Samples from the *Palmira* were collected with a 1.5 L Niskin with CTD data collected with the CastAway-CTD, and those from on the *Vector* were collected with a mini-rosette with CTD data collected with the Seabird 19Plus CTD.

Station	Vessel	Cast Number	Date Sampled	Sample Longitude (decimal degrees)	Sample Latitude (decimal degrees)	Target Depths (m)	# Filters
Loph - 1	*Vector*	Loph-1_1	22 Apr	-128.5543867	52.43046833	200, 150, 100, 50, 30, 1	6
		Loph-1_2	22 Apr	-128.5543817	52.43050667	200, 150, 100, 50, 30, 1	6
		Loph-1_3	22 Apr	-128.5542767	52.430555	200, 150, 100, 50, 30, 1	6
		Loph-1_5	22 Apr	-128.5540117	52.43082	30 (recast)	1
Loph-2	*Vector*	Loph-2_1	22 Apr	-128.5552350	52.43101667	100, 80, 50, 30, 1	5
		Loph-2_2	22 Apr	-128.5555050	52.430505	100, 80, 50, 30, 1	5
		Loph-2_3	22 Apr	-128.5559317	52.430605	100, 80, 50, 30, 1	5
Loph-3	*Vector*	Loph-3_1	22 Apr	-128.5541017	52.43479333	50, 30, 1	3
		Loph-3_2	22 Apr	-128.5549800	52.43482	50, 30, 1	3
		Loph-3_3	22 Apr	-128.5548583	52.43476833	50, 30, 1	3
Loph-4*	*Palmira*	Loph-4_1	25 Apr	-128.5623230	52.44222402	30, 1	2
		Loph-4_2	25 Apr	-128.5615520	52.44221002	30, 1	2
		Loph-4_3	25 Apr	-128.5627120	52.44227003	30, 1	2
Loph-5*	*Palmira*	Loph-5_1	25 Apr	-128.5553420	52.44352397	20, 1	2
		Loph-5_2	25 Apr	-128.5555000	52.44356403	20, 1	2
		Loph-5_3	25 Apr	-128.5554170	52.44354903	20, 1	2
Loph-6*	*Palmira*	Loph-6_1	25 Apr	-128.5565140	52.44606704	5, 1	2
		Loph-6_2	25 Apr	-128.5564390	52.446017	5, 1	2
		Loph-6_3	25 Apr	-128.5565240	52.44598498	5, 1	2
Fawn-1	*Vector*	Fawn-1_1	23 Apr	-128.3970633	52.80947333	200, 150, 100, 50, 30, 1	6
		Fawn-1_2	23 Apr	-128.3974917	52.809295	200, 150, 100, 50, 30, 1	6
		Fawn-1_3	23 Apr	-128.3970450	52.80943833	200, 150, 100, 50, 30, 1	6
Fawn-2	*Vector*	Fawn-2_1	23 Apr	-128.3966333	52.80752833	100, 80, 50, 30, 1	5
		Fawn-2_2	23 Apr	-128.3967167	52.80748667	100, 80, 50, 30, 1	5
		Fawn-2_3	23 Apr	-128.3973417	52.80741833	100, 80, 50, 30, 1	5
Fawn-3	*Vector*	Fawn-3_1	23 Apr	-128.3948850	52.80517167	50, 30, 1	3
		Fawn-3_2	23 Apr	-128.3941767	52.80605167	50, 30, 1	3
		Fawn-3_3	23 Apr	-128.3944217	52.80551	50, 30, 1	3
Fawn-4*	*Palmira*	Fawn-4_1	25 Apr	-128.3931530	52.80494903	30, 1	2
		Fawn-4_2	25 Apr	-128.3935300	52.80481601	30, 1	2
		Fawn-4_3	25 Apr	-128.3935990	52.80470202	30, 1	2
Fawn-5*	*Palmira*	Fawn-5_1	25 Apr	-128.3928690	52.80480201	20, 1	2
		Fawn-5_2	25 Apr	-128.3929930	52.80480201	20, 1	2
		Fawn-5_3	25 Apr	-128.3929930	52.80463697	20, 1	2
Fawn-6*	*Palmira*	Fawn-6_1	25 Apr	-128.3929760	52.80409299	5, 1	2
		Fawn-6_2	25 Apr	-128.3927540	52.80422903	5, 1	2
		Fawn-6_3	25 Apr	-128.3929850	52.804124	5, 1	2

Blanks	-	-	1/station	-	-	-	12
Total		**-**	**-**	**-**	**-**	**-**	**133**

Table 22. Fish species richness (number of taxa) detected at ascending depths at the Lophelia and Fawn sites. Further species details can be found in Appendix VIII and IX.

	1 m	**2 m**	**5 m**	**20 m**	**30 m**	**50 m**	**80 m**	**100 m**	**150 m**	**200 m**
Loph-1	4	-	-	-	5	1	-	4	4	6
Loph-2	2	-	-	-	2	3	3	6	-	-
Loph-3	3	-	-	-	5	1	-	-	-	-
Loph-4	4	-	-	-	4	-	-	-	-	-
Loph-5	7	-	-	3	-	-	-	-	-	-
Loph-6	7	-	5	-	-	-	-	-	-	-
Fawn-1	4	-	-	-	3	6	-	2	4	2
Fawn-2	5	5	-	-	3	4	4	2	-	-
Fawn-3	5	-	-	-	2	5	-	-	-	-
Fawn-4	6	-	-	-	2	-	-	-	-	-
Fawn-5	6	-	-	4	-	-	-	-	-	-
Fawn-6	2	-	5	-	-	-	-	-	-	-

Acknowledgements

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[9] https://msea.science/rov/cruises/PAC2021-035-1, https://msea.science/rov/cruises/PAC2021-035-2

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Appendices

Appendix I. Fish, coral, and sponge taxa identified during the annotation of the video from the ROV dives completed on Leg 1 of PAC 2021-035 (P10000-P10004).

Dive ID	Latin Name	Common Name
P10000	Merluccius	Hake
P10000	Rhabdocalyptus dawsoni	Boot Sponge
P10000	Paragorgia pacifica	Bubblegum Coral
P10000	Sebastolobus alascanus	Shortspine Thornyhead
P10000	Hippoglossus stenolepis	Pacific Halibut
P10000	Sebastes ruberrimus	Yelloweye Rockfish
P10000	Sebastes maliger	Quillback Rockfish
P10000	Sebastes elongatus	Greenstriped Rockfish
P10000	Pleuronectiformes	Flatfishes
P10000	Sebastes	Rockfishes
P10001	Merluccius	Hake
P10001	Rhabdocalyptus dawsoni	Boot Sponge
P10001	Sebastes diploproa	Splitnose Rockfish
P10001	Paragorgia pacifica	Bubblegum Coral
P10001	Sebastes maliger	Quillback Rockfish
P10001	Chimaeridae	Ratfishes
P10001	Pleuronectiformes	Flatfishes
P10001	Sebastes elongatus	Greenstriped Rockfish
P10001	Sebastes helvomaculatus	Rosethorn Rockfish
P10001	Rajidae	Skates
P10001	Sebastes	Rockfishes
P10002	Merluccius	Hake
P10002	Gadus macrocephalus	Pacific Cod
P10002	Rhabdocalyptus dawsoni	Boot Sponge
P10002	Paragorgia pacifica	Bubblegum Coral
P10002	Pleuronectiformes	Flatfishes
P10002	Sebastes elongatus	Greenstriped Rockfish
P10002	Rossellidae	Glass Sponges
P10002	Sebastes	Rockfishes
P10002	Ophiodon elongatus	Lingcod
P10002	Sebastes maliger	Quillback Rockfish
P10003	Merluccius	Hake
P10003	Rhabdocalyptus dawsoni	Boot Sponge
P10003	Rossellidae	Glass Sponges
P10003	Pleuronectiformes	Flatfishes
P10003	Sebastes maliger	Quillback Rockfish
P10003	Sebastes	Rockfishes

Dive ID	Latin Name	Common Name
P10003	Sebastes elongatus	Greenstriped Rockfish
P10003	Sebastes ruberrimus	Yelloweye Rockfish
P10004	Rhabdocalyptus dawsoni	Boot Sponge
P10004	Sebastolobus alascanus	Shortspine Thornyhead
P10004	Chimaeridae	Ratfishes
P10004	Merluccius	Hake
P10004	Sebastes diploproa	Splitnose Rockfish
P10004	Rajidae	Skates
P10004	Paragorgia pacifica	Bubblegum Coral
P10004	Squalidae	Dogfish Sharks
P10004	Sebastes	Rockfishes
P10004	Sebastes elongatus	Greenstriped Rockfish
P10004	Pleuronectiformes	Flatfishes
P10004	Sebastes ruberrimus	Yelloweye Rockfish
P10004	Sebastes maliger	Quillback Rockfish
P10004	Ophiodon elongatus	Lingcod

Appendix II. Sea cucumber species identified during the annotation of the video from the ROV dives conducted along Sea Cucumber Dive Survey Transects during Leg 3 of PAC 2021-035 (P10007, P10018, P10021, P10022).

Dive ID	Latin Name	Common Name
P10007	Apostichopus californicus	Giant Red California Sea Cucumber
P10018	Synallactes challengeri	Papillose Sea Cucumber
P10018	Apostichopus californicus	Giant Red California Sea Cucumber
P10021	Apostichopus californicus	Giant Red California Sea Cucumber
P10021	Apostichopus leukothele	Whitespotted Sea Cucumber
P10022	Apostichopus californicus	Giant Red California Sea Cucumber
P10022	Synallactes challengeri	Papillose Sea Cucumber

Appendix III. Intertidal sediment core chemical analysis results (Biologica Environmental Services). Intertidal zone refers to height above mean low water elevation (chart datum): low (0.8-1.5 m), mid (1.5-2.2 m), and high (2.2-3.3 m). *The RDL is the lowest concentration that can be accurately quantified and reported for a sample.

Site	Intertidal Zone	Quadrat	Total Organic Carbon (%)	Total Carbon (%)	Total Sulphur (%)	Total Nitrogen (%)	Total Inorganic Carbon (%)
Lohbrunner	low	3	1.3	3.6	0.62	<0.20	2.3
		6	2.2	2.3	0.38	<0.20	0.13
		9	1.2	1.6	0.32	<0.20	0.37
	mid	2	0.68	0.93	0.26	<0.20	0.25
		5	0.96	0.93	0.25	<0.20	<0.050
		8	0.50	1.0	0.23	<0.20	0.53
	high	1	0.25	0.47	0.15	<0.20	0.22
		4	1.8	1.7	0.16	<0.20	<0.050
		7	1.0	1.1	0.15	<0.20	0.060
Price Lagoon	low	3	0.15	0.16	0.13	<0.20	<0.050
		9	0.56	0.56	0.17	<0.20	<0.050
	mid	2	0.90	0.90	0.13	<0.20	<0.050
		6	0.69	0.63	0.11	<0.20	<0.050
		8	0.65	0.71	0.12	<0.20	0.060
		5	0.77	1.5	0.14	<0.20	0.72
Reportable Detection Limit (RDL)*	-	**-**	**0.050**	**0.050**	**0.060**	**0.20**	**0.050**

Appendix IV. Intertidal sediment grain size analysis results (Biologica Environmental Services). Zone refers to height above mean low water elevation (chart datum): low (0.8-1.5 m), mid (1.5-2.2 m), and high (2.2-3.3 m).

Site	Zone	Quadrat	Cobble (>65.0 mm)	Gravel – Coarse (32.0-65.0 mm)	Gravel – Fine (2.00-32.0 mm)	Sand – Coarse (0.500-2.00 mm)	Sand – Medium (0.250-0.500 mm)	Sand – Fine (0.063-0.250 mm)	Mud/Silt/Clay (<0.063 mm)
Lohbrunner	Low	3	0.00	0.00	20.62	49.53	23.13	6.23	0.49
		6	0.00	0.00	36.06	35.53	19.76	8.24	0.41
		9	0.00	0.00	50.20	31.84	10.74	6.80	0.41
	Mid	2	0.00	0.00	37.00	36.59	16.48	9.59	0.34
		5	0.00	0.00	33.86	42.40	16.14	7.29	0.32
		8	0.00	0.00	45.60	28.69	15.36	10.04	0.31
	High	1	0.00	0.00	74.41	13.17	6.62	5.13	0.68
		4	0.00	0.00	57.63	24.61	10.46	6.62	0.68
		7	0.00	17.21	58.43	14.21	5.08	4.42	0.66
Price Lagoon	Low	3	0.00	0.00	22.72	41.72	17.69	14.64	3.23
		9	0.00	0.00	6.50	21.68	22.66	41.31	7.85
	Mid	2	0.00	0.00	34.13	28.39	10.62	22.75	4.12
		6	0.00	0.00	10.51	33.32	19.62	31.11	5.44
		8	0.00	0.00	20.13	25.04	13.51	32.74	8.57
		5	0.00	0.00	31.96	19.34	10.93	27.92	9.84

Appendix V. Intertidal sediment meiofauna analysis results (Biologica Environmental Services). Zone refers to height above mean low water elevation (chart datum): low (0.8-1.5 m), mid (1.5-2.2 m), and high (2.2-3.3 m).

Higher Taxon	Lowest Possible Taxon Identified	Total abundance (count of individuals) per quadrat														
		Lohbrunner site									Price Lagoon site					
		Low zone			Mid zone			High zone			Low zone		Mid zone			
		Q3	Q6	Q9	Q2	Q5	Q8	Q1	Q4	Q7	Q3	Q9	Q2	Q6	Q8	Q5
Annelida	Errantia	2	2	15	2	7	-	1	-	1	-	-	-	1	-	-
Annelida	Oligochaeta	-	-	-	1	3	2	55	35	130	1	2	1	1	14	38
Annelida	Sedentaria	-	-	-	-	2	5	-	1	1	-	3	-	8	3	5
Arthropoda	Acari	1	14	39	5	5	3	10	14	45	-	1	1	-	-	28
Arthropoda	Amphipoda	-	-	-	-	-	-	-	-	-	-	-	1	-	6	1
Arthropoda	Chironomidae	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1
Arthropoda	Cladocera	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1
Arthropoda	Coleoptera	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Arthropoda	Collembola	-	-	-	-	-	-	2	3	-	-	-	-	-	-	-
Arthropoda	Crustacea (nauplius)	13	10	99	48	75	155	132	14	29	20	98	106	109	64	202
Arthropoda	Cumacea	-	-	-	-	-	-	-	-	-	-	-	4	-	12	5
Arthropoda	Harpacticoida	77	64	154	102	194	164	67	69	277	29	294	201	214	92	280
Arthropoda	Ostracoda	7	8	6	21	23	12	26	24	41	4	30	48	59	42	43
Arthropoda	Tanaidacea	-	-	-	7	-	2	-	-	-	-	1	1	5	-	-
Miscellaneous	Anthozoa	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Egg/egg mass	11	7	7	3	5	8	41	-	35	23	110	17	141	157	162
Miscellaneous	Foraminifera	-	-	2	1	1	3	2	2	4	24	1	1	-	12	3
Miscellaneous	Hydrozoa	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	Invertebrate larvae		2	4	31	11	5	17	2	13	-	-	6	2	7	27
Miscellaneous	Nemertea	1	8	7	8	-	7	4	-	5	1	-	-	-	5	20
Miscellaneous	Platyhelminthes	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Miscellaneous	Rotifera	-	4	3	2	2	2	-	1	-	2	1	-	2	10	7
Mollusca	Bivalvia	1	-	7	-	-	-	-	-	-	-	1	-	-	-	1
Mollusca	Gastropoda	-	-	-	1	-	2	1	-	-	-	-	-	-	1	7

Higher Taxon	Lowest Possible Taxon Identified	Total abundance (count of individuals) per quadrat														
		Lohbrunner site									Price Lagoon site					
		Low zone			Mid zone			High zone			Low zone		Mid zone			
		Q3	Q6	Q9	Q2	Q5	Q8	Q1	Q4	Q7	Q3	Q9	Q2	Q6	Q8	Q5
Nematoda	Desmoscolecidae	153	12	-	1	-	-	-	-	-	1	-	-	-	-	-
Nematoda	Nematoda	393	276	458	804	320	1,602	343	229	864	682	-	831	1,572	1,739	1,484
Nematoda	*Richtersia* sp.	50	9	8	5	1	13	2	-	-	-	-	-	21	-	3
Total Abundance (count individuals):		**709**	**417**	**811**	**1,045**	**649**	**1,985**	**705**	**395**	**1,446**	**787**	**542**	**1,219**	**2,135**	**2,166**	**2,318**
Total Wet Weight (g):		**4.83E-03**	**3.90E-03**	**7.09E-03**	**9.03E-03**	**6.28E-03**	**1.64E-02**	**7.19E-03**	**5.24E-03**	**1.82E-02**	**6.52E-03**	**5.07E-03**	**1.08E-02**	**1.77E-02**	**1.78E-02**	**2.01E-02**

Appendix VI. Rapid Species Biodiversity datasheet (formerly Aquatic Invasive Species Beach Sampling).

AIS BEACH SAMPLING SHEET

Date: ________ Location: ________________

Time On: ________ Latitude: ________________°N

Time Off: ________ Longitude: ________________°W

Beach Area (ha): ________________ Water Temp: ________°C

Beach Code: ________________ Water Sal: ________‰

Sampler Full Names: ________________________________ Sampling Group: ____________

Beach Slope: ____

Substrate: ____

Cover: ____

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

Comments: ____

GEG 03/2009

AIS BEACH SAMPLING SHEET

Plants / Algae

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

Bivalves

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

Echinoderms

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

Crustacea

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

Gastropod

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

Other

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

Appendix VII. Invertebrate taxa detected at 2 intertidal sites at East Lohbrunner Saddle (LOH) and Price Lagoon (PL) in Higgins Passage from 2021 eDNA samples as detected by COI markers. Samples were collected from shore. Note that fish samples are being re-run.

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Chamaedrilus			X
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Mesenchytraeus			X
Annelida	Clitellata	Haplotaxida	Naididae	Nais			X
Annelida	Clitellata	Haplotaxida					X
Annelida	Polychaeta	Eunicida	Lumbrineridae				X
Annelida	Polychaeta	Eunicida	Onuphidae	Onuphis			X
Annelida	Polychaeta	Eunicida	Onuphidae				X
Annelida	Polychaeta	Eunicida					X
Annelida	Polychaeta	Phyllodocida	Goniadidae	Glycinde	*Glycinde picta*		X
Annelida	Polychaeta	Phyllodocida	Goniadidae	Glycinde			X
Annelida	Polychaeta	Phyllodocida	Hesionidae				X
Annelida	Polychaeta	Phyllodocida	Nereididae	Alitta		X	X
Annelida	Polychaeta	Phyllodocida	Nereididae	Platynereis			X
Annelida	Polychaeta	Phyllodocida	Nereididae				X
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eteone	*Eteone longa*		X
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eteone			X
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Pterocirrus	*Pterocirrus montereyensis*	X	
Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe	*Harmothoe fragilis*	X	
Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe		X	X
Annelida	Polychaeta	Phyllodocida	Syllidae	Synmerosyllis		X	
Annelida	Polychaeta	Phyllodocida	Syllidae	Typosyllis		X	
Annelida	Polychaeta	Phyllodocida	Syllidae			X	
Annelida	Polychaeta	Phyllodocida				X	X
Annelida	Polychaeta	Sabellida	Oweniidae	Galathowenia	*Galathowenia oculata*		X
Annelida	Polychaeta	Sabellida	Oweniidae				X
Annelida	Polychaeta	Sabellida	Serpulidae	Serpula	*Serpula vermicularis*	X	X
Annelida	Polychaeta	Sabellida				X	X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Annelida	Polychaeta	Spionida	Spionidae	Boccardia	*Boccardia proboscidea*		X
Annelida	Polychaeta	Spionida	Spionidae	Dipolydora			X
Annelida	Polychaeta	Spionida	Spionidae	Laonice		X	
Annelida	Polychaeta	Spionida	Spionidae	Polydora			X
Annelida	Polychaeta	Spionida	Spionidae	Pseudopolydora	*Pseudopolydora paucibranchiata*	X	
Annelida	Polychaeta	Spionida	Spionidae	Pygospio		X	
Annelida	Polychaeta	Spionida	Spionidae	Rhynchospio	*Rhynchospio arenincola*	X	X
Annelida	Polychaeta	Spionida	Spionidae			X	
Annelida	Polychaeta	Spionida				X	X
Annelida	Polychaeta	Terebellida	Pectinariidae	Pectinaria			X
Annelida	Polychaeta	Terebellida	Terebellidae	Amphitritides			X
Annelida	Polychaeta	Terebellida	Terebellidae	Biremis	*Biremis blandi*		X
Annelida	Polychaeta	Terebellida	Terebellidae	Biremis			X
Annelida	Polychaeta	Terebellida	Terebellidae	Neoamphitrite	*Neoamphitrite robusta*		X
Annelida	Polychaeta	Terebellida	Terebellidae				X
Annelida	Polychaeta	Terebellida					X
Annelida	Polychaeta	Unclassified	Capitellidae	Heteromastus			X
Annelida	Polychaeta	Unclassified	Capitellidae	Notomastus		X	
Annelida	Polychaeta	Unclassified	Capitellidae			X	X
Annelida	Polychaeta	Unclassified	Opheliidae	Armandia	*Armandia brevis*	X	X
Annelida	Polychaeta	Unclassified	Opheliidae	Armandia			X
Annelida	Polychaeta	Unclassified	Opheliidae			X	X
Annelida	Polychaeta	Unclassified	Orbiniidae	Leitoscoloplos			X
Annelida	Polychaeta	Unclassified	Saccocirridae	Saccocirrus		X	
Annelida	Polychaeta					X	X
Arthropoda	Arachnida	Mesostigmata	Veigaiidae	Veigaia			X
Arthropoda	Arachnida	Sarcoptiformes	Banksinomidae	Banksinoma			X
Arthropoda	Arachnida	Sarcoptiformes	Hemileiidae	Hemileius	*Hemileius microclava*		X
Arthropoda	Arachnida	Sarcoptiformes	Hemileiidae	Hemileius			X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Arthropoda	Arachnida	Sarcoptiformes	Synichotritiidae	Synichotritia	*Synichotritia caroli*		X
Arthropoda	Arachnida	Sarcoptiformes	Synichotritiidae	Synichotritia			X
Arthropoda	Arachnida	Sarcoptiformes	Xenillidae				X
Arthropoda	Arachnida	Sarcoptiformes					X
Arthropoda	Arachnida	Trombidiformes	Penthaleidae	Penthaleus			X
Arthropoda	Arachnida	Trombidiformes					X
Arthropoda	Branchiopoda	Diplostraca	Podonidae	Evadne	*Evadne nordmanni*	X	X
Arthropoda	Branchiopoda	Diplostraca	Podonidae	Podon	*Podon leuckartii*		X
Arthropoda	Branchiopoda	Diplostraca					X
Arthropoda	Hexanauplia	Calanoida	Acartiidae	Acartia	*Acartia hudsonica*	X	X
Arthropoda	Hexanauplia	Calanoida	Acartiidae	Acartia	*Acartia longiremis*	X	X
Arthropoda	Hexanauplia	Calanoida	Acartiidae	Acartia			X
Arthropoda	Hexanauplia	Calanoida	Acartiidae				X
Arthropoda	Hexanauplia	Calanoida	Centropagidae	Centropages	*Centropages abdominalis*		X
Arthropoda	Hexanauplia	Calanoida	Clausocalanidae	Pseudocalanus	*Pseudocalanus minutus*		X
Arthropoda	Hexanauplia	Calanoida	Clausocalanidae	Pseudocalanus			X
Arthropoda	Hexanauplia	Calanoida	Clausocalanidae				X
Arthropoda	Hexanauplia	Calanoida	Paracalanidae	Paracalanus		X	
Arthropoda	Hexanauplia	Calanoida					X
Arthropoda	Hexanauplia	Cyclopoida	Cyclopidae	Diacyclops			X
Arthropoda	Hexanauplia	Cyclopoida	Cyclopinidae	Cyclopina			X
Arthropoda	Hexanauplia	Cyclopoida	Cyclopinidae				X
Arthropoda	Hexanauplia	Cyclopoida	Oithonidae			X	X
Arthropoda	Hexanauplia	Cyclopoida					X
Arthropoda	Hexanauplia	Harpacticoida	Miraciidae				X
Arthropoda	Hexanauplia	Harpacticoida	Tisbidae	Tisbe			X
Arthropoda	Hexanauplia	Harpacticoida					X
Arthropoda	Hexanauplia	Poecilostomatoida	Lichomolgidae	Herrmannella	*Herrmannella hoonsooi*		X
Arthropoda	Hexanauplia	Poecilostomatoida	Lichomolgidae	Herrmannella			X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Arthropoda	Hexanauplia	Poecilostomatoida	Lichomolgidae				X
Arthropoda	Hexanauplia	Poecilostomatoida					X
Arthropoda	Hexanauplia					X	
Arthropoda	Insecta	Diptera	Chironomidae				X
Arthropoda	Insecta	Diptera					X
Arthropoda	Insecta	Hemiptera	Corixidae	Callicorixa			X
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Euphausia	*Euphausia pacifica*		X
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Euphausia			X
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae				X
Arthropoda	Malacostraca	Euphausiacea					X
Arthropoda	Malacostraca	Isopoda	Bopyridae	Orthione			X
Arthropoda	Malacostraca	Isopoda					X
Arthropoda	Thecostraca	Balanomorpha	Balanidae	Balanus	*Balanus glandula*	X	X
Arthropoda	Thecostraca	Balanomorpha	Balanidae	Balanus	*Balanus nubilus*		X
Arthropoda	Thecostraca	Balanomorpha	Balanidae	Balanus		X	X
Arthropoda	Thecostraca	Balanomorpha	Balanidae	Semibalanus	*Semibalanus balanoides*		X
Arthropoda	Thecostraca	Balanomorpha	Balanidae				X
Arthropoda	Thecostraca	Balanomorpha	Chthamalidae	Chthamalus			X
Arthropoda	Thecostraca	Balanomorpha	Chthamalidae			X	X
Arthropoda	Thecostraca	Balanomorpha					X
Bryozoa	Gymnolaemata	Ctenostomatida	Alcyonidiidae	Alcyonidium		X	
Chordata	Ascidiacea	Phlebobranchia	Ascidiidae	Ascidia		X	
Chordata	Ascidiacea	Phlebobranchia	Ascidiidae			X	
Chordata	Ascidiacea	Phlebobranchia	Perophoridae	Perophora	*Perophora japonica*	X	
Chordata	Ascidiacea	Phlebobranchia	Perophoridae			X	
Chordata	Ascidiacea	Phlebobranchia				X	
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	*Cnemidocarpa finmarkiensis*	X	
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa		X	
Chordata	Ascidiacea	Stolidobranchia	Styelidae			X	

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Chordata	Ascidiacea	Stolidobranchia				X	
Cnidaria	Anthozoa	Actiniaria	Metridiidae	Metridium	*Metridium senile*	X	X
Cnidaria	Anthozoa	Actiniaria	Metridiidae				X
Cnidaria	Anthozoa	Actiniaria				X	X
Cnidaria	Hydrozoa	Anthoathecata	Clavidae	Rhizogeton	*Rhizogeton nudus*		X
Cnidaria	Hydrozoa	Anthoathecata	Corynidae	Sarsia	*Sarsia tubulosa*		X
Cnidaria	Hydrozoa	Anthoathecata	Corynidae	Sarsia			X
Cnidaria	Hydrozoa	Anthoathecata	Hydractiniidae	Schuchertinia			X
Cnidaria	Hydrozoa	Anthoathecata					X
Cnidaria	Hydrozoa	Leptothecata					X
Cnidaria	Scyphozoa	Semaeostomeae	Ulmaridae	Aurelia	*Aurelia aurita*		X
Echinodermata	Asteroidea	Brisingida					X
Echinodermata	Asteroidea	Forcipulatida	Asteriidae	Stylasterias	*Stylasterias forreri*		X
Echinodermata	Asteroidea	Forcipulatida	Asteriidae				X
Echinodermata	Asteroidea	Forcipulatida					X
Echinodermata	Asteroidea	Valvatida	Poraniidae	Dermasterias	*Dermasterias imbricata*		X
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	Mesocentrotus	*Mesocentrotus franciscanus*	X	X
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	Strongylocentrotus	*Strongylocentrotus droebachiensis*	X	
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	Strongylocentrotus	*Strongylocentrotus purpuratus*		X
Echinodermata	Echinoidea	Camarodonta				X	X
Echinodermata	Holothuroidea	Dendrochirotida	Cucumariidae	Cucumaria	*Cucumaria miniata*		X
Echinodermata	Holothuroidea	Dendrochirotida	Cucumariidae	Cucumaria			X
Echinodermata	Holothuroidea	Dendrochirotida	Cucumariidae				X
Echinodermata	Holothuroidea	Dendrochirotida	Sclerodactylidae	Sclerodactyla	*Sclerodactyla multipes*		X
Echinodermata	Holothuroidea	Dendrochirotida					X
Echinodermata	Ophiuroidea	Amphilepidida	Ophiactidae	Ophiopholis		X	
Mollusca	Bivalvia	Cardiida	Cardiidae	Clinocardium	*Clinocardium nuttallii*		X
Mollusca	Bivalvia	Cardiida	Tellinidae	Macoma	*Macoma nasuta*		X
Mollusca	Bivalvia	Lucinida					X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Mollusca	Bivalvia	Myida	Hiatellidae	Hiatella		X	
Mollusca	Bivalvia	Myida	Hiatellidae	Panopea	*Panopea generosa*	X	X
Mollusca	Bivalvia	Myida	Myidae	Mya	*Mya arenaria*		X
Mollusca	Bivalvia	Myida	Myidae				X
Mollusca	Bivalvia	Myida					X
Mollusca	Bivalvia	Mytilida	Mytilidae	Mytilus	*Mytilus californianus*		X
Mollusca	Bivalvia	Mytilida	Mytilidae	Mytilus	*Mytilus trossulus*	X	X
Mollusca	Bivalvia	Mytilida	Mytilidae	Mytilus		X	X
Mollusca	Bivalvia	Pectinida	Anomiidae	Anomia	*Anomia ephippium*	X	X
Mollusca	Bivalvia	Pectinida	Anomiidae	Pododesmus			X
Mollusca	Bivalvia	Pectinida	Anomiidae				X
Mollusca	Bivalvia	Pectinida	Pectinidae				X
Mollusca	Bivalvia	Pectinida				X	X
Mollusca	Bivalvia	Venerida	Mactridae	Spisula			X
Mollusca	Bivalvia	Venerida	Mactridae	Tresus	*Tresus capax*		X
Mollusca	Bivalvia	Venerida	Mactridae				X
Mollusca	Bivalvia	Venerida	Veneridae	Humilaria	*Humilaria kennerleyi*	X	X
Mollusca	Bivalvia	Venerida	Veneridae	Saxidomus	*Saxidomus gigantea*	X	X
Mollusca	Bivalvia	Venerida	Veneridae	Saxidomus			X
Mollusca	Bivalvia	Venerida	Veneridae			X	X
Mollusca	Bivalvia	Venerida	Vesicomyidae				X
Mollusca	Bivalvia	Venerida					X
Mollusca	Gastropoda	Cephalaspidea	Aglajidae	Melanochlamys	*Melanochlamys diomedea*		X
Mollusca	Gastropoda	Littorinimorpha	Lacunidae	Lacuna	*Lacuna variegata*		X
Mollusca	Gastropoda	Littorinimorpha	Lacunidae	Lacuna			X
Mollusca	Gastropoda	Littorinimorpha	Lacunidae				X
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Littorina	*Littorina littorea*		X
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Littorina	*Littorina plena*		X
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Littorina			X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Mollusca	Gastropoda	Littorinimorpha	Littorinidae				X
Mollusca	Gastropoda	Littorinimorpha					X
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Lirabuccinum	*Lirabuccinum dirum*		X
Mollusca	Gastropoda	Neogastropoda					X
Mollusca	Gastropoda	Unclassified	Lottiidae	Lottia	*Lottia digitalis*	X	
Mollusca	Gastropoda	Unclassified	Lottiidae	Lottia	*Lottia paradigitalis*	X	X
Mollusca	Gastropoda	Unclassified	Lottiidae	Lottia	*Lottia persona*	X	X
Mollusca	Gastropoda	Unclassified	Lottiidae	Lottia	*Lottia scutum*	X	X
Mollusca	Gastropoda	Unclassified	Lottiidae	Lottia		X	
Mollusca	Gastropoda	Unclassified	Lottiidae	Testudinalia	*Testudinalia testudinalis*		X
Mollusca	Gastropoda						X
Mollusca	Polyplacophora	Chitonida	Mopaliidae	Mopalia			X
Mollusca	Polyplacophora	Chitonida	Mopaliidae				X
Nematoda	Chromadorea	Chromadorida	Chromadoridae				X
Nematoda	Chromadorea	Desmodorida					X
Nematoda	Chromadorea	Monhysterida	Monhysteridae	Eumonhystera			X
Nematoda	Chromadorea	Monhysterida	Monhysteridae				X
Nematoda	Chromadorea	Monhysterida	Xyalidae				X
Nematoda	Chromadorea	Monhysterida					X
Nematoda	Chromadorea	Plectida	Haliplectidae	Haliplectus			X
Nematoda	Chromadorea	Rhabditida	Tylenchidae	Filenchus	*Filenchus misellus*		X
Nematoda	Chromadorea	Rhabditida	Tylenchidae				X
Nemertea	Palaeonemertea	Unclassified	Cephalotrichidae	Cephalothrix	*Cephalothrix spiralis*		X
Nemertea	Palaeonemertea	Unclassified	Cephalotrichidae	Cephalothrix			X
Nemertea	Palaeonemertea	Unclassified	Cephalotrichidae				X
Nemertea	Palaeonemertea						X
Nemertea	Pilidiophora	Heteronemertea	Lineidae	Cerebratulus			X
Nemertea	Pilidiophora	Heteronemertea	Lineidae	Micrura			X
Nemertea	Pilidiophora	Heteronemertea	Lineidae				X

Phylum	Class	Order	Family	Genus	Species	LOH	PL
Nemertea	Pilidiophora	Heteronemertea					X
Phoronida	Unclassified	Unclassified	Phoronidae	Phoronis		X	X
Phoronida	Unclassified	Unclassified	Phoronidae	Phoronopsis	*Phoronopsis harmeri*	X	X
Phoronida	Unclassified	Unclassified	Phoronidae	Phoronopsis			X
Phoronida	Unclassified	Unclassified	Phoronidae				X
Platyhelminthes	Rhabditophora	Macrostomida	Microstomidae	Microstomum	*Microstomum compositum*		X
Platyhelminthes	Rhabditophora	Macrostomida	Microstomidae	Microstomum			X
Platyhelminthes	Rhabditophora	Macrostomida	Microstomidae				X
Platyhelminthes	Rhabditophora	Macrostomida					X
Porifera	Demospongiae	Haplosclerida					X
Porifera	Demospongiae	Suberitida	Halichondriidae				X
Porifera	Demospongiae	Suberitida					X
Rotifera	Eurotatoria	Adinetida					X
Rotifera	Eurotatoria	Ploima	Synchaetidae	Synchaeta		X	X
Rotifera	Eurotatoria	Ploima	Synchaetidae			X	X
Rotifera	Eurotatoria	Ploima				X	X
Rotifera	Eurotatoria						X
Sipuncula	Unclassified	Phascolosomatiformes	Phascolosomatidae	Phascolosoma	*Phascolosoma agassizii*	X	
Sipuncula	Unclassified	Phascolosomatiformes	Phascolosomatidae	Phascolosoma		X	
Sipuncula	Unclassified	Phascolosomatiformes	Phascolosomatidae			X	
Sipuncula	Unclassified	Phascolosomatiformes				X	
Xenacoelomorpha	Unclassified	Acoela	Actinoposthiidae	Pelophila			X
Total						**70**	**191**

Appendix VIII. Fish taxa detected at the Lophelia Genome Canada Project site from 2021 eDNA samples as detected by 12S markers. Note that the markers lacked species-level resolution capability for specific genera (e.g., rockfish and cod species). Samples were collected from the CCGS *Vector* or the 24' skiff, depending on depth and proximity to shore. The * denotes species listed as ecological conservation priorities for the Northern Shelf Bioregion MPA Network (Gale et al. 2019). In addition, several species in the genus *Sebastes* are network ecological conservation priorities.

Family	Genus	Species	Common Name	Loph - 1						Loph - 2					Loph - 3			Loph - 4		Loph - 5		Loph - 6	
				1 m	30 m	50 m	100 m	150 m	200 m	1 m	30 m	50 m	80 m	100 m	1 m	30 m	50 m	1 m	30 m	1 m	20 m	1 m	5 m
Gadidae	*Gadus*	*Gadus chalcogrammus*	Alaska Pollock	X	X	-	-	X	X	-	-	-	X	X	X	X	-	X	-	-	-	-	-
Salmonidae	*Salmo*	*Salmo salar*	Atlantic Salmon	X	X	-	X	-	X	-	X	-	-	X	-	-	-	X	X	X	X	X	X
Stichaedae	*Xiphister*	*Xiphister atropurpureus*	Black Prickleback	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-
Jordaniidae	*Scorpaenichthys*	*Scorpaenichthys marmoratus*	Cabezon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-
Salmonidae	*Oncorhynchus*	*Oncorhynchus tshawytscha*	Chinook Salmon*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholidae	*Pholis*	*Pholis laeta*	Crescent Gunnel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Pleuronectidae	*Microstomus*	*Microstomus pacificus*	Dover Sole*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stichaedae	*Anoplarchus*	*Anoplarchus purpurescens*	High Cockscomb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexagrammidae	*Hexagrammos*	*Hexagrammos decagrammus*	Kelp Greenling	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexagrammidae	*Ophiodon*	*Ophiodon elongatus*	Lingcod*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Merlucciidae	*Merluccius*	*Merluccius productus*	North Pacific Hake*	-	X	-	-	X	-	-	-	-	-	X	X	-	-	-	-	-	-	-	X
Bathylagidae	*Leuroglossus*	*Leuroglossus schmidti*	Northern Smoothtongue*	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Clupeidae	*Clupea*	*Clupea pallasii*	Pacific Herring*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pleuronectidae	*Lepidopsetta*	*Lepidopsetta bilineata*	Pacific Rock Sole*	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Hexagrammidae	*Oxylebius*	*Oxylebius pictus*	Painted Greenling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Zoarcidae	*Lycodapus*	*Lycodapus mandibularis*	Pallid Eelpout	-	-	-	-	-	X	X	-	-	X	-	-	X	-	-	-	-	-	-	-
Salmonidae	*Oncorhynchus*	*Oncorhynchus gorbuscha*	Pink Salmon*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cottidae	*Cottus*	*Cottus asper*	Prickly Sculpin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Embioticidae	*Cymatogaster*	*Cymatogaster aggregata*	Shiner Perch*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cottidae	*Cottus*	*Cottus cognatus*	Slimy Sculpin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liparidae	*Liparis*	*Liparis fucensis*	Slipskin Snailfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Chimaeridae	*Hydrolagus*	*Hydrolagus colliei*	Spotted Ratfish	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Cottidae	*Oligocottus*	*Oligocottus maculosus*	Tidepool Sculpin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Anarhichadidae	*Anarrhichthys*	*Anarrhichthys ocellatus*	Wolf Eel*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Gadidae				-	-	-	X	-	X	-	-	X	-	X	-	X	-	-	-	X	-	-	-

Sebastidae	*Sebastes*			-	X	-	-	-	-	-	-	X	-	-	-	-	-	-	X	X	X	X	-
Count = 17	**Count = 23**	**Count = 24**	**Count = 24**	**4**	**5**	**1**	**4**	**4**	**6**	**2**	**2**	**3**	**3**	**6**	**3**	**5**	**1**	**4**	**4**	**7**	**3**	**7**	**5**

Appendix IX. Fish taxa detected at the Fawn Genome Canada Project site from 2021 eDNA samples as detected by 12S markers. Note that the markers lacked species-level resolution capability for specific genera (e.g., rockfish and cod species). Samples were collected from the CCGS *Vector* or the 24' skiff, depending on depth and proximity to shore. The * denotes species listed as ecological conservation priorities for the Northern Shelf Bioregion MPA Network (Gale et al. 2019). In addition, several species in the genus *Sebastes* are network ecological conservation priorities.

Family	**Genus**	**Species**	**Common Name**	**Fawn - 1**						**Fawn -2**						**Fawn - 3**			**Fawn - 4**		**Fawn - 5**		**Fawn - 6**	
				1 m	**30 m**	**50 m**	**100 m**	**150 m**	**200 m**	**1 m**	**2 m**	**30 m**	**50 m**	**80 m**	**100 m**	**1 m**	**30 m**	**50 m**	**1 m**	**30 m**	**1 m**	**20 m**	**1 m**	**5 m**
Gadidae	*Gadus*	*Gadus chalcogrammus*	Alaska Pollock	-	-	X	X	X	X	X	-	-	X	X	-	-	X	-	-	-	-	-	-	X
Salmonidae	*Salmo*	*Salmo salar*	Atlantic Salmon	X	X	X	-	-	-	X	X	X	-	X	-	X	-	X	X	-	X	X	X	X
Stichaedae	*Xiphister*	*Xiphister atropurpureus*	Black Prickleback	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salmonidae	*Oncorhynchus*	*Oncorhynchus tshawytscha*	Chinook Salmon*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Pleuronectidae	*Microstomus*	*Microstomus pacificus*	Dover Sole*	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Stichaedae	*Anoplarchus*	*Anoplarchus purpurescens*	High Cockscomb	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Hexagrammidae	*Ophiodon*	*Ophiodon elongatus*	Lingcod*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-
Merlucciidae	*Merluccius*	*Merluccius productus*	North Pacific Hake*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Bathylagidae	*Leuroglossus*	*Leuroglossus schmidti*	Northern Smoothtongue*	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Clupeidae	*Clupea*	*Clupea pallasii*	Pacific Herring*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pleuronectidae	*Lepidopsetta*	*Lepidopsetta bilineata*	Pacific Rock Sole*	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Zoarcidae	*Lycodapus*	*Lycodapus mandibularis*	Pallid Eelpout	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-	X	-	-	-	-	X
Salmonidae	*Oncorhynchus*	*Oncorhynchus gorbuscha*	Pink Salmon*	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	-	-	-
Cottidae	*Cottus*	*Cottus asper*	Prickly Sculpin	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastidae	*Sebastes*			-	X	X	-	X	-	X	X	-	-	-	-	X	-	X	X	-	X	X	-	-
Embioticidae	*Cymatogaster*	*Cymatogaster aggregata*	Shiner Perch*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Cottidae	*Cottus*	*Cottus cognatus*	Slimy Sculpin	X	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-
Chimaeridae	*Hydrolagus*	*Hydrolagus colliei*	Spotted Ratfish	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	X
Gadidae				-	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-	-
Count = 13	**Count = 16**	**Count = 17**	**Count = 17**	**4**	**3**	**6**	**2**	**4**	**2**	**5**	**5**	**3**	**4**	**4**	**2**	**5**	**2**	**5**	**6**	**2**	**6**	**4**	**2**	**5**

Appendix X. Invertebrate taxa detected at the Lophelia Genome Canada Project site from 2021 eDNA samples as detected by CO1 markers. Samples were collected from the CCG Vector off a 24' skiff, depending on depth and proximity to shore. The * denotes species listed as ecological conservation priorities for the Northern Shelf Bioregion MPA Network (Gale et al. 2019). In addition, the network ecological conservation priority 'other crustacean zooplankton' could include several of the taxa listed in the table.

Phylum	Class	Order	Family	Genus	Scientific Name	Loph - 1						Loph - 2					Loph - 3			Loph - 4		Loph - 5		Loph - 6	
						1 m	30 m	50 m	100 m	150 m	200 m	1 m	30 m	50 m	80 m	100 m	1 m	30 m	50 m	1 m	30 m	1 m	20 m	1 m	5 m
Annelida	Polychaeta	Eunicida				X	X	-	-	-	-	X	X	X	-	-	X	X	X	X	X	X	X	X	X
Annelida	Polychaeta	Phyllodocida	Polynoidae	*Halosydna*	*Halosydna brevisetosa*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Annelida	Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*Lepidonotus squamatus*	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-
Annelida	Polychaeta	Phyllodocida	Polynoidae			X	-	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	X	-	X
Annelida	Polychaeta	Phyllodocida				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Annelida	Polychaeta	Sabellida	Sabellidae	*Chone*		-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Spionida	Spionidae			-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Terebellida	Cirratulidae	*Dodecaceria*		X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Annelida	Polychaeta		Capitellidae	*Dasybranchus*		-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta		Capitellidae	*Mediomastus*		X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Annelida	Polychaeta		Chaetopteridae	*Spiochaetopterus*		-	-	-	-	-	-	X	-	-	-	-	X	-	X	-	-	X	-	X	X
Annelida	Polychaeta		Opheliidae	*Armandia*	*Armandia brevis*	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X
Annelida	Polychaeta					-	-	-	-	-	-	-	X	X	-	-	-	-	X	X	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Acartiidae	*Acartia*	*Acartia longiremis*	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Calanidae			-	-	-	-	X	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Centropagidae	*Centropages*	*Centropages abdominalis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-
Arthropoda	Copepoda	Calanoida	Clausocalanidae	*Microcalanus*	*Microcalanus pygmaeus*	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Arthropoda	Copepoda	Calanoida	Clausocalanidae	*Microcalanus*		-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Clausocalanidae	*Pseudocalanus*	*Pseudocalanus mimus*	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Clausocalanidae			X	X	-	-	X	-	X	-	-	-	-	X	-	-	X	X	X	X	X	X
Arthropoda	Copepoda	Calanoida	Eucalanidae	*Eucalanus*	*Eucalanus bungii*	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-
Arthropoda	Copepoda	Calanoida	Metridinidae	*Metridia*	*Metridia okhotensis*	X	-	X	-	-	X	X	-	-	-	-	-	-	-	-	-	X	X	-	X
Arthropoda	Copepoda	Calanoida	Metridinidae	*Metridia*	*Metridia pacifica*	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Arthropoda	Copepoda	Cyclopoida	Oithonidae	*Oithona*	*Oithona similis*	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	X	X	X	X

Phylum	Class	Order	Family	Genus	Scientific Name	Loph - 1						Loph - 2					Loph - 3			Loph - 4		Loph - 5		Loph - 6	
						1 m	30 m	50 m	100 m	150 m	200 m	1 m	30 m	50 m	80 m	100 m	1 m	30 m	50 m	1 m	30 m	1 m	20 m	1 m	5 m
Arthropoda	Hexanauplia					-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Malacostraca	Euphausiacea*				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Arthropoda	Malacostraca	Mysida	Mysidae	*Michthyops*	*Michthyops parvus*	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-
Arthropoda	Thecostraca	Balanomorpha	Balanidae	*Balanus*		-	-	-	-	-	-	X	X	-	-	-	X	-	-	-	X	-	-	-	-
Arthropoda	Thecostraca	Balanomorpha	Balanidae	*Semibalanus*	*Semibalanus cariosus*	X	-	-	-	-	-	X	-	-	-	-	X	-	X	X	-	X	-	X	X
Arthropoda	Thecostraca	Balanomorpha	Balanidae			-	X	-	-	-	-	X	X	-	-	-	X	-	X	X	-	X	X	-	X
Arthropoda	Thecostraca	Balanomorpha	Chthamalidae			-	X	X	-	X	-	X	X	X	X	-	X	X	X	-	X	-	X	X	X
Cnidaria	Hydrozoa	Siphonophorae	Agalmatidae	*Nanomia*	*Nanomia bijuga*	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
Echinodermata	Asteroidea	Forcipulatida	Asteriidae	*Pisaster*	*Pisaster brevispinus*	-	-	-	-	-	-	-	-	X	X	-	-	X	-	-	-	-	-	-	-
Echinodermata	Asteroidea	Forcipulatida	Asteriidae			-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Echinodermata	Asteroidea	Valvatida	Asteropseidae	*Dermasterias*	*Dermasterias imbricata*	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	*Mesocentrotus*		-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	X	-
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	*Strongylocentrotus*	*Strongylocentrotus droebachiensis**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X
Echinodermata	Echinoidea	Camarodonta	Strongylocentrotidae	*Strongylocentrotus*		-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
Echinodermata	Echinoidea	Spatangoida	Schizasteridae	*Brisaster*		-	-	-	-	-	-	-	-	X	X	-	-	-	X	-	-	-	-	-	-
Echinodermata	Holothuroidea	Apodida	Chiridotidae	*Chiridota*		X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	X	-	X
Echinodermata	Holothuroidea	Dendrochirotida	Cucumariidae	*Cucumaria*	*Cucumaria miniata*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Echinodermata	Holothuroidea	Dendrochirotida	Cucumariidae	*Cucumaria*	*Cucumaria pallida*	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	X	X	X	-
Echinodermata	Holothuroidea	Dendrochirotida	Psolidae	*Psolus*	*Psolus chitonoides*	X	X	X	-	-	-	X	-	-	-	-	X	-	-	-	X	X	-	X	X
Echinodermata	Holothuroidea					X	-	-	-	-	-	X	-	-	-	-	-	X	X	-	-	-	-	-	X
Echinodermata	Ophiuroidea					-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Bivalvia	Adapedonta	Hiatellidae	*Panopea*	*Panopea Generosa**	X	X	-	-	-	-	X	-	-	-	-	X	-	X	X	X	X	X	X	X
Mollusca	Bivalvia	Mytilida	Mytilidae	*Mytilus*	*Mytilus californianus**	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	X

Phylum	Class	Order	Family	Genus	Scientific Name	Loph - 1						Loph - 2					Loph - 3			Loph - 4		Loph - 5		Loph - 6	
						1 m	30 m	50 m	100 m	150 m	200 m	1 m	30 m	50 m	80 m	100 m	1 m	30 m	50 m	1 m	30 m	1 m	20 m	1 m	5 m
Mollusca	Bivalvia	Mytilida	Mytilidae			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Mollusca	Bivalvia	Mytilida				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Mollusca	Bivalvia	Venerida	Veneridae	*Humilaria*	*Humilaria kennerleyi*	X	X	X	-	-	-	X	-	-	X	-	X	-	X	-	X	X	-	X	X
Mollusca	Bivalvia	Venerida	Veneridae	*Saxidomus*		X	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	X	-	-	-
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	*Littorina**		X	-	-	-	-	-	X	-	-	-	-	X	-	X	-	-	X	-	X	X
Mollusca	Gastropoda		Lottiidae	*Lottia*		-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-	-	X
Mollusca	Polyplacophora					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Mollusca						X	X	X	-	-	-	X	-	X	-	-	X	X	X	X	X	X	X	X	X
Phoronida			Phoronidae	*Phoronopsis*	*Phoronopsis harmeri*	-	-	-	-	-	-	X	-	-	X	-	X	-	-	X	X	-	-	X	X
Rotifera	Eurotatoria	Ploima	Synchaetidae	*Synchaeta*	*Synchaeta pectinata*	-	-	`	-	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-
Rotifera	Eurotatoria	Ploima	Synchaetidae	*Synchaeta*	*Synchaeta triophthalma*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Rotifera	Eurotatoria	Ploima				-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Count = 7	**Count = 14**	**Count = 22**	**Count = 32**	**Count = 35**	**Count = 27**	**16**	**13**	**5**	**0**	**4**	**1**	**26**	**6**	**7**	**6**	**2**	**19**	**7**	**16**	**14**	**14**	**18**	**13**	**24**	**25**

Appendix XI. Invertebrate taxa detected at the Fawn Genome Canada Project site from 2021 eDNA samples as detected by CO1 markers. Samples were collected from the CCG Vector of a 24’ skiff, depending on depth and proximity to shore. The * denotes species listed as ecological conservation priorities for the Northern Shelf Bioregion MPA Network (Gale et al. 2019). In addition, the network ecological conservation priority ‘other crustacean zooplankton’ could include several of the taxa listed in the table.

Phylum	**Class**	**Order**	**Family**	**Genus**	**Scientific Name**	**Fawn - 1**						**Fawn -2**						**Fawn - 3**			**Fawn - 4**		**Fawn - 5**		**Fawn - 6**	
						1 m	**30 m**	**50 m**	**100 m**	**150 m**	**200 m**	**1 m**	**2 m**	**30 m**	**50 m**	**80 m**	**100 m**	**1 m**	**30 m**	**50 m**	**1 m**	**30 m**	**1 m**	**20 m**	**1 m**	**5 m**
Annelida		Sipuncula	Phascolosomatidae	*Phascolosoma*	*Phascolosoma agassizii*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Annelida	Polychaeta	Echiuroidea	Thalassematidae	*Arhynchite*	*Arhynchite pugettensis*	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta		Capitellidae	*Mediomastus*		-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta		Chaetopteridae	*Spiochaetopterus*		-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-
Annelida	Polychaeta		Oweniidae			-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-
Annelida	Polychaeta	Phyllodocida	Nereididae	*Nereis*		-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Phyllodocida				X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Annelida	Polychaeta	Sabellida	Sabellidae	*Eudistylia*	*Eudistylia vancouveri*	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Spionida	Spionidae	*Polydora*		-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Spionida	Spionidae			X	X	X	X	-	-	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X
Annelida	Polychaeta	Terebellida	Flabelligeridae	*Pherusa*		X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Polychaeta	Terebellida	Terebellidae			-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-
Annelida	Polychaeta					-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	X
Arthropoda	Copepoda	Calanoida	Acartiidae	*Acartia*	*Acartia longiremis*	X	X	-	-	-	-	X	X	-	-	-	-	X	X	X	X	-	X	X	X	X
Arthropoda	Copepoda	Calanoida	Aetideidae	*Aetideus*		-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Clausocalanidae	*Pseudocalanus*	*Pseudocalanus mimus*	X	-	-	-	-	-	X	X	-	-	-	-	X	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Calanoida	Metridinidae	*Metridia*	*Metridia okhotensis*	X	X	-	-	-	-	-	-	-	X	-	X	-	X	-	-	-	-	X	-	X
Arthropoda	Copepoda	Calanoida	Metridinidae	*Metridia*	*Metridia pacifica*	X	X	-	-	-	-	-	-	-	X	-	X	X	X	X	-	-	-	-	-	X
Arthropoda	Copepoda	Cyclopoida	Oithonidae	*Oithona*	*Oithona similis*	X	-	-	-	-	X	X	-	-	-	-	-	-	X	-	X	-	-	X	X	X
Arthropoda	Copepoda	Cyclopoida	Oncaeidae			-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Copepoda	Cyclopoida				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	X
Arthropoda	Hexanauplia					X	-	-	X	-	-	-	-	-	X	-	-	X	X	X	-	X	-	-	-	X
Arthropoda	Malacostraca	Euphausiacea*				X	-	-	-	-	-	X	X	-	-	-	-	X	-	-	X	-	-	-	X	X
Arthropoda	Thecostraca	Balanomorpha	Balanidae	*Semibalanus*	*Semibalanus cariosus*	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X

Phylum	Class	Order	Family	Genus	Scientific Name	Fawn - 1						Fawn -2						Fawn - 3			Fawn - 4		Fawn - 5		Fawn - 6	
						1 m	**30 m**	**50 m**	**100 m**	**150 m**	**200 m**	**1 m**	**2 m**	**30 m**	**50 m**	**80 m**	**100 m**	**1 m**	**30 m**	**50 m**	**1 m**	**30 m**	**1 m**	**20 m**	**1 m**	**5 m**
Arthropoda	Thecostraca	Balanomorpha	Balanidae			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X
Arthropoda	Thecostraca	Balanomorpha	Chthamalidae			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
Bryozoa	Gymnolaemata	Ctenostomatida	Alcyonidiidae			-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Cnidaria	Hydrozoa	Siphonophorae	Agalmatidae	*Nanomia*	*Nanomia bijuga*	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinoder mata	Asteroidea	Forcipulatida	Asteriidae			X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Echinoder mata	Echinoidea	Camarodonta	Strongylocentrotidae	*Mesocentrotus*		-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	X
Echinoder mata	Echinoidea	Camarodonta	Strongylocentrotidae	*Strongylocentr otus*	*Strongylocentrotus droebachiensis**	X	-	-	-	-	-	-	-	X	-	-	-	-	X	-	X	-	X	-	X	X
Echinoder mata	Echinoidea	Camarodonta	Strongylocentrotidae	*Strongylocentr otus*		X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Echinoder mata	Holothuroidea	Dendrochirotida	Cucumariidae	*Cucumaria*	*Cucumaria miniata*	-	X	-	X	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-
Echinoder mata	Holothuroidea	Dendrochirotida	Phyllophoridae	*Pentamera*		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Mollusca	Bivalvia	Adapedonta	Hiatellidae	*Panopea*	*Panopea Generosa**	-	-	-	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-
Mollusca	Bivalvia	Mytilida	Mytilidae			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Mollusca	Bivalvia	Mytilida				-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Bivalvia	Venerida	Veneridae	*Humilaria*	*Humilaria kennerleyi*	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-	X	-	X
Mollusca	Bivalvia	Venerida	Veneridae	*Saxidomus*		X	X	-	-	-	-	X	X	-	-	-	-	X	X	-	X	-	X	X	X	X
Mollusca						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Phoronida			Phoronidae	*Phoronopsis*	*Phoronopsis harmeri*	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	X	-	X	X
Rotifera	Eurotatoria	Ploima				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Count = 8	**Count = 12**	**Count = 19**	**Count = 28**	**Count = 23**	**Count = 16**	**17**	**6**	**1**	**6**	**3**	**1**	**10**	**7**	**3**	**5**	**2**	**3**	**14**	**12**	**6**	**11**	**4**	**9**	**8**	**13**	**20**