

Geological Survey of Canada cruise report 2025006PGC: PACSAFE Leg 3 and Endeavour Ridge ocean-bottom seismometer deployments from the CCGS John P. Tully

A.P. Plourde¹, R. Dave², T.E. Hobbs², R. Kung², G. Cairns³, J. Thibodeau³, T. Wilson³, L. Yakuden⁴, N. Redick⁵, E. Lucas⁶, C. Motuzas⁷

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- [1] Natural Resources Canada, Geological Survey of Canada (Atlantic). Dartmouth, Nova Scotia, Canada.
- [2] Natural Resources Canada, Geological Survey of Canada (Pacific). Vancouver and Sidney, British Columbia, Canada.
- [3] National Facility for Seismological Investigations (NFSI), Department of Earth and Environmental Sciences, Dalhousie University. Halifax, Nova Scotia, Canada.
- [4] Department of Earth and Ocean Sciences, University of Victoria. Victoria, British Columbia, Canada.
- [5] Department of Earth and Planetary Sciences, University of California, Davis. Davis, California, USA.
- [6] Department of Earth and Planetary Sciences, McGill University. Montréal, Quebec, Canada.
- [7] Department of Earth Sciences, University of Western Ontario. London, Ontario, Canada.

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Abstract

In August 2025, the Geological Survey of Canada participated in a research cruise on the Canadian Coast Guard Ship (CCGS) John P. Tully to recover and deploy ocean-bottom seismometers (OBS), in order to monitor earthquakes offshore British Columbia. The cruise involved two projects using the same pool of OBS: 1) the third annual cruise of the PACSAFE project, which aims to investigate earthquake hazard between offshore northern Vancouver Island and Haida Gwaii, and 2) the second annual cruise of a project monitoring a major seafloor rifting event at the Endeavour Ridge. The pool of OBS used for these two projects is owned and operated by the National Facility for Seismological Investigations (NFSI) at Dalhousie University. The Endeavour work took place first; it involved the recovery of five OBS deployed in summer 2024 and their redeployment along with 15 additional OBS (20 total deployments), with 16 of the OBS deployed in a dense grid (roughly 5 km spacing) over the most seismically active zone, surrounding several major hydrothermal vent fields. The PACSAFE portion of the cruise saw the recovery of 21 OBS from offshore SW Moresby Island, Haida Gwaii, over the Queen Charlotte Plate Boundary, and the deployment of 21 OBS offshore northwestern Vancouver Island, over the Explorer Microplate, the northernmost segment of the Cascadia Subduction Zone. As of writing this report, two of the Endeavour OBS deployments surfaced prematurely, one was recovered immediately on this cruise, the other was recovered in September 2025 by the RV Atlantis after drifting south into U.S. waters. The remaining 39 OBS are expected to be recovered in summer 2026, with separate cruises for two projects, both led by other project partners. In addition to the OBS work, on this cruise we collected CHIRP 3.5 kHz Knudsen sub-bottom profiler data over several major faults, and other locations opportunistically.

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1 Introduction

This report describes a 2025 research cruise for which the main purpose was the recovery and deployment of ocean-bottom seismometers (OBS), in order to monitor offshore earthquakes. The cruise involved two broader projects with distinct scientific objectives; however, the projects have overlapping teams, are nearby geographically, and rely on the same OBS. We refer to the two projects as the “PACSAFE” and “Endeavour” projects, and describe their objectives and histories below.

1.1 PACSAFE project background

Pacific Coast Seismic Assessment for Faults and Earthquakes (PACSAFE) is a multi-year project stemming from a Natural Sciences and Engineering Research Council (NSERC) Alliance Grant, originally titled *Earthquake Hazards on Canada’s Pacific Coast* (lead PI Michael Bostock at the University of British Columbia). The project is a collaboration of Natural Resources Canada (NRCan, and specifically the Geological Survey Canada or GSC), the National Facility for Seismological Investigations (NFSI) at Dalhousie University, the University of British Columbia, and the University of Victoria.

The PACSAFE project was created shortly after the NFSI began obtaining 120 broadband OBS (see Appendix A1 for equipment specifications). It aimed to deploy OBS, over a five-year period, over five distinct segments of the complex plate-tectonic fault system offshore Vancouver Island and Haida Gwaii, British Columbia. The region centers around the Queen Charlotte Triple Junction of the North American, Pacific, and Juan de Fuca Plates ([Rohr and Furlong, 1995](#)), where the Cascadia Subduction Zone (CSZ) terminates northward at the Explorer Microplate ([Hutchinson et al., 2020](#); [Littel et al., 2023](#)), and transitions into the Queen Charlotte Plate Boundary (QCPB). This transition region has at least four structures with the capacity to host M7+ earthquake, excluding the CSZ: i) the Nootka Fault Zone (NFZ), a left-lateral transform separating the Explorer and Juan de Fuca plates ([Hutchinson et al., 2019](#); [Savard et al., 2020](#); [Merrill et al., 2022](#)), ii) the Revere-Dellwood Fault (RDF), a right-lateral transform connecting the Explorer Ridge to the QCPB, iii) the Queen Charlotte Fault (QCF), a major transform that accommodates much of the right-lateral motion between the Pacific and North American plates, and iv) the Haida Gwaii Thrust (HGT) that sits seaward of the QCF, accommodates converge of the Pacific and North American plates, and that together with the QCF makes up the QCPB ([Gosselin et al., 2015](#); [Hyndman, 2015](#); [Kao et al., 2015](#); [Riedel et al., 2021](#); [Oliva et al., 2024](#)). The region is broadly seismically active beyond these four structures, including within the Explorer Microplate and at the Sovanco Fracture Zone (SFZ), a right-lateral transform between the Explorer and Pacific plates ([Lister, 1989](#); [Davis and Currie, 1993](#); [Littel et al., 2023](#)). These tectonic features and the PACSAFE deployments to date are shown in Figure 1.

PACSAFE aims to provide fundamental knowledge of earthquakes and tectonic processes in the region, ultimately contributing to improved seismic, tsunami, and submarine landslide hazard models that inform risk reduction in coastal British Columbia. The project was funded in early 2022, but the first deployment occurred in October 2023, after a planned 2022 deployment was canceled due to a COVID outbreak. The two successful legs of the PACSAFE project to date are described below; note that these descriptions focus on the OBS deployments, although both cruises had other components including gravity coring and sub-bottom profiler transects. All legs to date have used the Canadian Coast Guard Ship (CCGS) John P. Tully (hereafter, the “Tully”) as a research vessel, departing from the Institute of Ocean Science (IOS) in Sidney, BC, which houses the GSC-Pacific.

1.1.1 PACSAFE Leg 1 (2023)

In the lead-up to the 2023 cruise, stormy weather forecasts suggested significant ship-time would be lost sheltering away from exposed waters. This led the science party to choose the RDF and paleo-QCF region offshore northwestern Vancouver Island (50.0°–50.9°N) as the first PACSAFE target region, given that it is relatively close to protected waters and had a denser array of OBS than other regions, minimizing the operational time required ([NFSI, 2023](#)). The cruise, which embarked with 29 OBS aboard and spanned October 11–27, is referred to as PACSAFE Leg 1 in

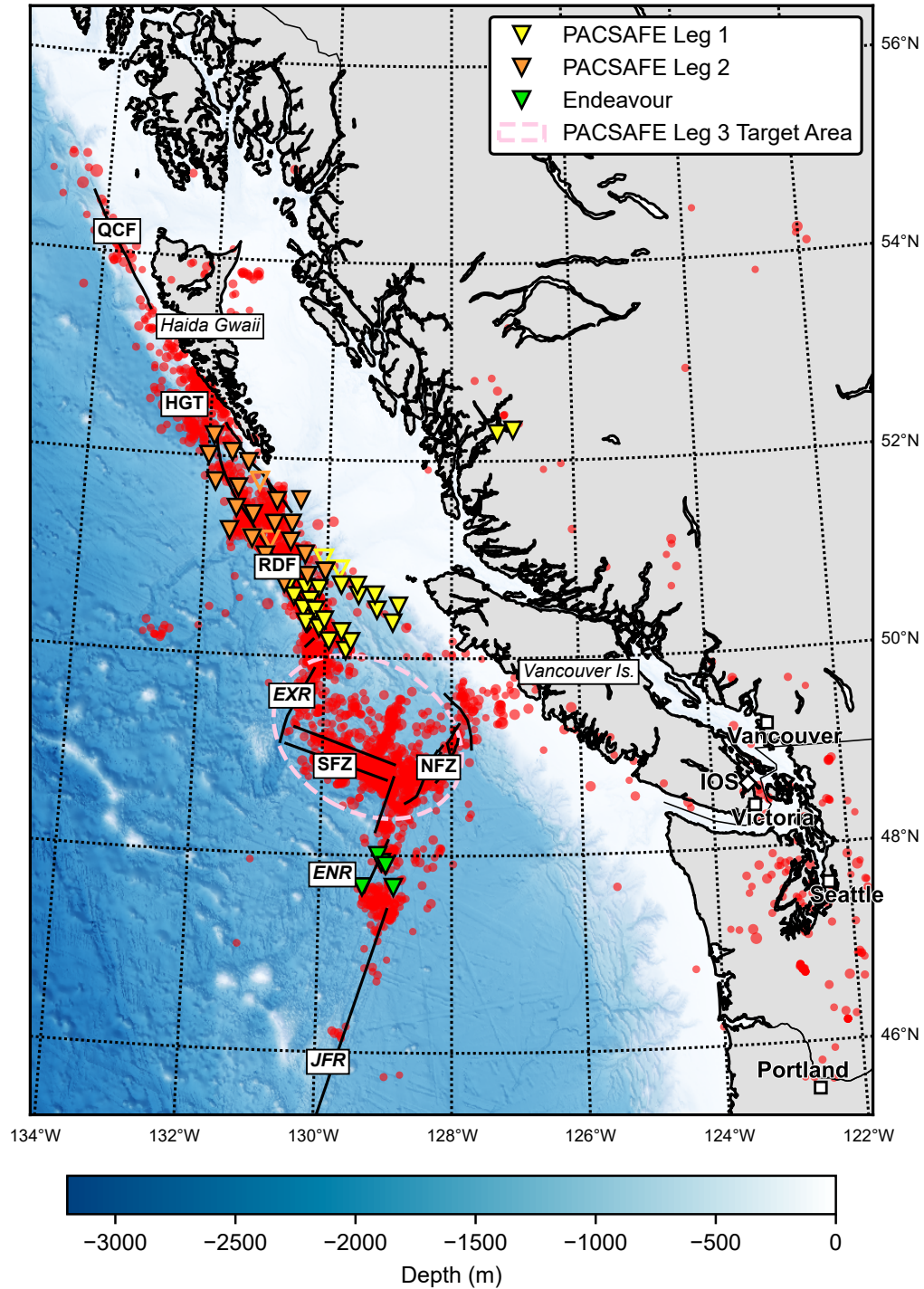


Figure 1. Map of overall PACSAFE and Endeavour project study areas with OBS deployed to date and a target region for PACSAFE Leg 3 highlighted. Filled triangles indicate OBS that were recovered normally; hollow triangles indicate OBS that were deployed but surfaced prematurely, whether the instrument was recovered or lost. Earthquakes of $M > 3.5$ from the National Earthquake Database (NEDB, [NRCAN, 1985](#)) are plotted as red dots, scaled by magnitude. Bathymetry was downloaded at 30-arc-second resolution from the U.S. National Oceanic and Atmospheric Association (NOAA) Centers for Environmental Information. Abbreviations used: ENR = Endeavour Ridge, EXR = Explorer Ridge, HGT = Haida Gwaii Thrust, JFR = Juan de Fuca Ridge, NFZ = Nootka Fault Zone, QCF = Queen Charlotte Fault, RDF = Revere-Dellwood Fault, SFZ = Sovanco Fracture Zone.

Table 1. List of investigators and collaborators on the PACSAFE NSERC Alliance proposal.

Principal Investigator (PI)	Michael Bostock	University of British Columbia
Co-Investigators (co-PIs)	Mladen Nedimović	Dalhousie University
	Simon Peacock	University of British Columbia
	Edwin Nissen	University of Victoria
	Miao Zhang	Dalhousie University
Collaborators	Honn Kao	NRCan / GSC-Pacific
	Tiegan Hobbs	NRCan / GSC-Pacific
	Gwyn Lintern	NRCan / GSC-Pacific
	Alexandre Plourde	NRCan / GSC-Atlantic
	Kristin Rohr	NRCan / GSC-Pacific
	Andrew Schaeffer	NRCan / GSC-Pacific
	Tianhoazhe Sun	NRCan / GSC-Pacific
	Kelin Wang	NRCan / GSC-Pacific

this report, but also has unique identification numbers assigned by the CCG (PAC 2023-059), NRCan (2023005PGC), and the NFSI (NFSI-005-2023-02). Of the 29 OBS brought aboard, 28 were deployed (Table 2, Figure 2); one OBS could not be deployed due to a technical malfunction during clock synchronization. Two of these deployments (L1BC1, L1BC2) were in Burke Channel, away from the main target region, when weather conditions did not allow work in open seas. Due to weather-imposed time constraints, seafloor positions were only determined for nine of the deployments (including the two in Burke Channel), leaving the remaining positioning to be completed on the recovery cruise in 2024.

In the weeks following PACSAFE Leg 1, two OBS deployed over the RDF region surfaced prematurely, notifying the NFSI via their Apollo recovery beacons. One (L129) was recovered by the CCGS Tanu on November 27, 2023 and returned to the Institute of Ocean Sciences (IOS), before eventually being shipped back to the NFSI in Halifax, NS. The other (L127) remains lost, with the last transmission from its recovery beacon received on December 12, 2023, from near the rocky coastline of Long Island, Alaska. A third OBS (L109) released prematurely in May 2024 and was quickly recovered by the CCGS Atlantic Raven. 25 OBS remained on the seafloor at the time of the recovery cruise, including the two in Burke Channel.

1.1.2 PACSAFE Leg 2 (2024)

The second leg of the PACSAFE program spanned July 11–31, 2024, again aboard the Tully. It saw recovery of the OBS deployed in Leg 1 and their deployment over the southern QCF (51-52.5°N), southwest of Moresby Island in southern Haida Gwaii. This cruise again had distinct IDs assigned by the CCG (PAC 2024-068), NRCan (2024003PGC), and the NFSI (NFSI-009-2024-03).

Weather during the cruise was largely cooperative, and operationally the cruise went quite smoothly. Positions were obtained for the 16 OBS that were not positioned during Leg 1, and all 25 Leg 1 OBS that remained on the seafloor were recovered, although the two deployed in Burke Channel (L1BC1, L1BC2) were recovered in the final days of the cruise and were not redeployed. Of the 23 non-Burke-Channel OBS recovered, three had technical issues that meant they could not be redeployed; however, four new OBS were brought aboard, so a total of 24 OBS were available to be deployed. All of them were deployed; however, one OBS (L206A) unexpectedly released from the seafloor on the same day it was deployed and was quickly recovered. Another OBS was then deployed in approximately the same location (L206B), leaving 23 on the seafloor at the end of the cruise (Table 3, Figure 3).

Two more OBS surfaced unexpectedly in the following weeks, but both drifted south and were able to be recovered in mid-September. L205 was opportunistically (and generously) recovered by the Scripps Institute of Oceanography

Table 2. OBS deployed in PACSAFE Leg 1 (2023), a majority of which were recovered in PACSAFE Leg 2 (2024). Note that station codes have been altered from T200 in the original cruise report ([NFSI, 2023](#)) to L100, to create a sequential numbering scheme for PACSAFE deployments.

OBS recovered normally during PACSAFE Leg 2					
Station	Latitude (°)	Latitude (°)	Depth (m)	Deployment Date	Recovery Date
L101	50.8222	-130.3069	1893	2023-10-19	2024-07-18
L102	50.7447	-130.5935	2418	2023-10-20	2024-07-19
L103	50.6089	-130.5179	2426	2023-10-14	2024-07-19
L104	50.6983	-130.3369	1754	2023-10-14	2024-07-18
L105	50.6929	-130.1197	2070	2023-10-15	2024-07-18
L106	50.5725	-130.2560	2018	2023-10-14	2024-07-19
L107	50.4857	-130.3659	2520	2023-10-20	2024-07-19
L108	50.4742	-130.1702	1890	2023-10-20	2024-07-19
L110	50.3481	-130.3182	2381	2023-10-20	2024-07-19
L111	50.2954	-130.1035	2174	2023-10-20	2024-07-17
L112	50.3757	-130.0219	1742	2023-10-20	2024-07-17
L113	50.0720	-129.6743	2410	2023-10-21	2024-07-17
L114	50.1632	-129.5963	1944	2023-10-20	2024-07-17
L115	50.2619	-129.7459	1964	2023-10-20	2024-07-17
L116	50.1650	-129.9433	2288	2023-10-21	2024-07-17
L120	50.3589	-128.9352	2012	2023-10-21	2024-07-15
L121	50.5310	-128.8464	1676	2023-10-21	2024-07-15
L122	50.4867	-129.1881	2010	2023-10-23	2024-07-16
L123	50.6396	-129.2247	1692	2023-10-23	2024-07-16
L124	50.6330	-129.4852	1975	2023-10-23	2024-07-16
L125	50.7353	-129.5088	1867	2023-10-23	2024-07-16
L126	50.7347	-129.7646	2014	2023-10-24	2024-07-16
L128	50.8690	-130.0265	2136	2023-10-24	2024-07-18
L1BC1	52.3118	-126.9836	481	2023-10-17	2024-07-28
L1BC2	52.2781	-127.2439	565	2023-10-18	2024-07-28

OBS that surfaced prematurely						
Station	Latitude (°)	Latitude (°)	Depth (m)	Deployment Date	Release Date	Recovery Date
L109	50.4115	-130.2100	2529	2023-10-20	2024-05-27	2024-05-29
L127	50.8918	-129.7966	1940	2023-10-24	2023-11-15	lost
L129	50.9990	-130.0563	2066	2023-10-24	2023-11-21	2023-11-27

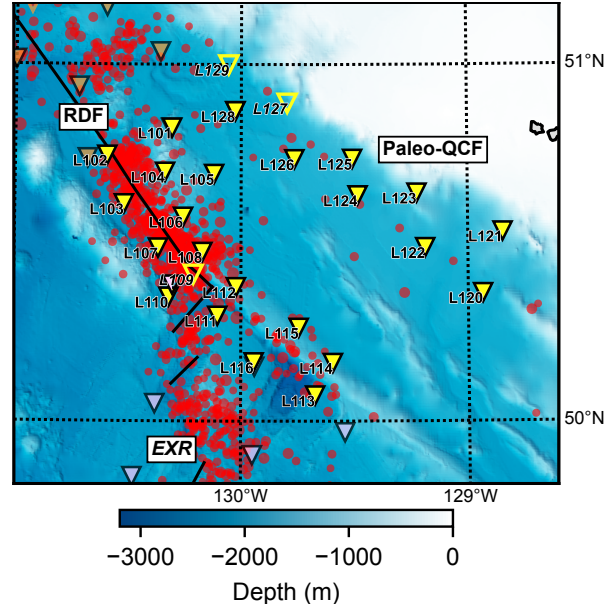


Figure 2. Zoomed-in map on PACSAFE Leg 1 deployments (except L1BC1, L1BC2) with labels of individual station codes. See Figure 1 caption for more detail.

team on the U.S. University-National Oceanographic Laboratory System (UNOLS) ship RV Atlantis and shipped back to the NFSI from California, and L216 was recovered by contracting a small research vessel (RV Zephyr) operated by Outbound Marine LLC. The loss of these two OBS left 21 to be recovered on the 2025 cruise, as well as the two from Burke Channel which were returned to IOS.

1.2 Endeavour project background

The Endeavour Segment of the Juan de Fuca Ridge had several documented earthquake swarms associated with diking events from 2000–2005 ([Krauss et al., 2023](#)). For the following decade there was relatively little seismicity in the region ([Krauss et al., 2025](#)). However, since 2018, earthquake rates have been gradually increasing, as observed by five of the cabled OBS in the NEPTUNE cabled observatory operated by [Ocean Networks Canada \(ONC, 2009; Mihály et al., 2025\)](#), shown in Figure 4. In March 2024, there was an earthquake swarm that garnered significant media attention (e.g. CBC: Deepsea eruption expected off B.C. after intense quake activity. March 12, 2024.). If the event is similar to that in the early 2000s, further swarms within the following year are likely to follow. To improve our ability to resolve source properties of upcoming earthquakes and shed light on the dynamics of these diking events, a U.S. National Science Foundation (NSF) project (PI William Wilcock, University of Washington) titled *EXTension on the ENDeavour Segment (EXTEND): Illuminating the seafloor spreading cycle* suggested to supplement NEPTUNE with freefall OBS. The project aimed to keep five NFSI OBS in the region for 5 years (2024–29), with an additional 15 (total 20 NFSI OBS) for the forecasted peak of the diking event in 2025–26.

As the NSF award did not include funding for 2025 ship time, support for the 2025 deployment was supplemented by an NSERC Discovery Grant Ship Time proposal *Submarine Volcano Eruption Monitoring at the Endeavour Segment Offshore BC* awarded in November 2024 (PI Miao Zhang). The award was valued for 9 days of ship-time on the Tully at the “Other Government Department” rate; however, because the Tully schedule for 2025 had been determined weeks prior, the award’s dollar-amount was insufficient to complete the work on a commercial research vessel, so an additional proposal was submitted to the Marine Environmental Observation, Prediction and Response Network (MEOPAR) Strategic Support Horizon ship time fund (PI Miao Zhang, awarded in March 2025).

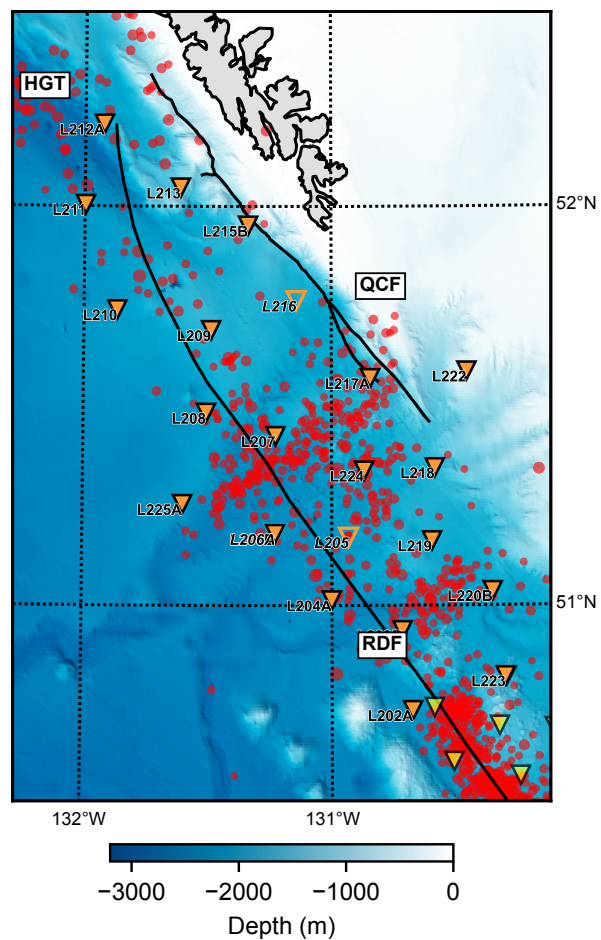


Figure 3. Zoomed-in map on PACSAFE Leg 2 deployments with labels of individual station codes. See Figure 1 caption for more detail.

Table 3. OBS deployed in PACSAFE Leg 2 (2023)

OBS expected to be recovered on PACSAFE Leg 3				
Station	Latitude (°)	Latitude (°)	Depth (m)	Deployment Date
L201	50.8695	-130.0264	2135	2024-07-18
L202A	50.7370	-130.6797	2434	2024-07-20
L203B	50.9374	-130.7196	2379	2024-07-20
L204A	51.0128	-131.0006	2468	2024-07-20
L206B	51.1794	-131.2268	2495	2024-07-21
L207	51.4246	-131.2254	2420	2024-07-21
L208	51.4826	-131.5049	2369	2024-07-21
L209	51.6898	-131.4853	1960	2024-07-21
L210	51.7406	-131.8655	2331	2024-07-23
L211	52.0037	-131.9965	2452	2024-07-23
L212A	52.2052	-131.9231	2382	2024-07-23
L213	52.0467	-131.6110	1623	2024-07-23
L215B	51.9518	-131.3367	1556	2024-07-22
L217A	51.5693	-130.8440	2011	2024-07-22
L218	51.3450	-130.5863	1943	2024-07-22
L219	51.1621	-130.5995	2028	2024-07-20
L220	51.0358	-130.3592	2165	2024-07-20
L222	51.5866	-130.4554	508	2024-07-22
L223	50.8219	-130.3116	1896	2024-07-18
L224	51.3375	-130.8697	2239	2024-07-22
L225A	51.2537	-131.5989	2391	2024-07-21

OBS that surfaced prematurely						
Station	Latitude (°)	Latitude (°)	Depth (m)	Deployment Date	Release Date	Recovery Date
L205	51.1710	-130.9333	2313	2024-07-20	2024-07-31	2024-09-12
L206A	51.1794	-131.2268	2495	2024-07-21	2024-07-21	2024-07-21
L216	51.7640	-131.1409	2135	2024-07-22	2024-08-19	2024-09-13

Table 4. List of investigators and collaborators on the Endeavour Ridge project, on any of the three funding awards (NSF, NSERC, MEOPAR), in alphabetical order by institution.

Miao Zhang	Dalhousie University
Mladen Nedimović	Dalhousie University
Alexandre Plourde	NRCan / GSC-Atlantic
Martin Heesemann	Ocean Networks Canada
Jesse Hutchinson	Ocean Networks Canada
Steve Mihaly	Ocean Networks Canada
Laurence Coogan	University of Victoria
William Wilcock	University of Washington
Marine Denolle	University of Washington

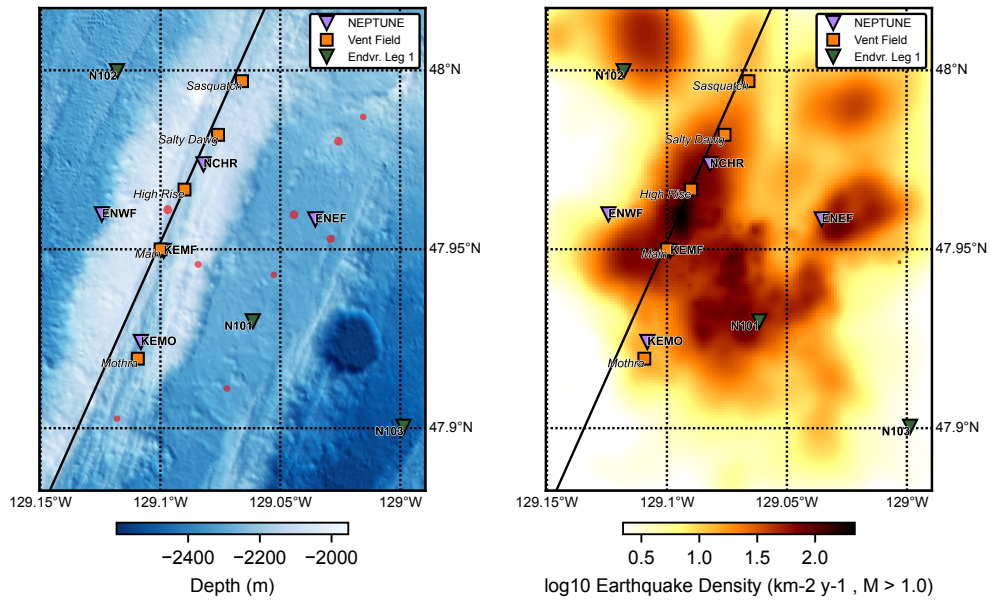


Figure 4. Maps of the Endeavour Ridge study region showing the five NEPTUNE cabled OBS (ONC, 2009), major hydrothermal vent fields, and three of the five Leg 1 Endeavour Aquarius OBS deployments (N104 and N105 are ~20 km south, at 47.68°N). **(left)** $M > 3.5$ earthquakes from the NEDB catalog as red dots. Bathymetry is 30 m resolution courtesy of ONC. **(right)** Earthquake density (with a logarithmic colour scale) derived from the ONC Endeavour Catalog ($M > 1$, April 2022 – August 2025 data).

Table 5. OBS deployed at Endeavour Ridge in June 2024. The station codes N100 were chosen in the lead-up to the 2025 cruise; they were previously referred to as OBS01–05

Station	Latitude (°)	Latitude (°)	Depth (m)	Deployment Date
N101	47.9299	-129.0615	2321	2025-06-08
N102	47.9998	-129.1182	2329	2025-06-07
N103	47.9004	-128.9987	2559	2025-06-09
N104	47.6804	-129.3495	2762	2025-06-09
N105	47.6789	-128.8783	2650	2025-06-09

1.3 2024 Endeavour OBS deployment

Five of the NFSI, Aquarius OBS (not to be confused with the five NEPTUNE cabled OBS) were deployed by ONC on June 7–8, 2024 from the EV Nautilus, owned and operated by the Ocean Exploration Trust (Figure 4). The deployment was part of Nautilus Expedition NA161 (June 6–27, 2024), which was live-streamed on YouTube as part of *Nautilus Live*. No instruments were known to have surfaced, so all five were expected to be recovered on this 2025 cruise.

1.4 Lead-up to 2025 cruise

After the PACSAFE Leg 2 cruise in 2024, the Explorer Microplate was selected as the location for the 3rd PACSAFE OBS deployment and 21 days aboard the Tully (August 5–26, 2025) were secured at the October planning meeting led by *Fisheries and Oceans Canada* (DFO) Science. In the following weeks, it became clear that the NFSI could not supply additional OBS to the project and that one OBS recovered from Burke Channel was unfit to be redeployed. With 21 OBS on the seafloor, the maximum number of 2025 PACSAFE deployments was 22, although there would likely be fewer based on previous OBS attrition rates. The 21 days of ship-time was then estimated to be more than necessary, so PACSAFE PIs planned on releasing three days of ship-time. Meanwhile, even with the second ship-time award, the Endeavour project faced budget constraints if it were to use a commercial vessel. As the two projects are nearby geographically (~30 km separate their nearest planned OBS sites), and they rely on the same equipment and technical staff, the teams agreed to combine efforts to complete both project-legs on the 21-day Tully cruise originally reserved for PACSAFE. Similarly, although ONC originally planned on recovering the five N100 OBS on a separate cruise, the other Endeavour (and PACSAFE) team members agreed to recover them on this cruise.

1.5 Objectives for 2025 cruise

With the two OBS projects sharing the cruise, the principal objectives (not in order of priority or operation) were:

1. Recover 21 PACSAFE OBS from offshore Haida Gwaii. Download data, charge batteries, and prepare them for redeployment.
2. Redeploy the recovered PACSAFE OBS, plus the one available at IOS, over the Explorer Microplate. We estimated this would be ~19–20 deployments given the typical rate of lost and malfunctioning OBS.
3. Recover the five Endeavour OBS deployed by ONC in 2024. Download data, charge batteries, and prepare them for redeployment.
4. Redeploy the five Endeavour OBS, plus 15 of the additional OBS shipped from the NFSI to IOS before the cruise.
5. Collect CHIRP (3.5 kHz Knudsen sub-bottom profiler; see Appendix A1 for equipment specifications) data of selected submarine canyon and potential fault scarp targets, as well as other locations opportunistically.

Given that the cruise began with 16 OBS on deck designated for the Endeavour project, we began the cruise with the Endeavour recoveries and deployments, which emptied metal storage crates to receive recovered PACSAFE OBS. When the Endeavour work was complete (or a rough time threshold was reached), we would sail north to begin the PACSAFE recoveries, and end with PACSAFE deployments.

Acoustic positioning with either a “dunker” or Ultra-Short Baseline (USBL) system (see Appendix A1 for equipment specifications) is part of the deployment procedure as it is required to know the precise position (to ~10s of m) of OBS on the seafloor. To optimize the use of daytime hours (07h00–19h00) when the CCG bosun support was available, previous PACSAFE cruises often skipped positioning OBS initially after deployments and instead returned to complete positioning at night (19h00–07h00). The same strategy was planned for this cruise, and it was also agreed that deploying/recovering OBS would be prioritized over positioning if time was running short, as there would be a chance to position instruments before recovering the OBS next year. Unlike previous PACSAFE cruises, there was no gravity coring or other sampling component.

2 Field Party

The science party of this research expedition had 11 members from six institutions, and are listed in Table 6. A selection of CCGS crew and officers are listed in Table 7.

Table 6. List of science party members on this research cruise, sorted by institution.

Name	Role	Affiliation
Riddhi Dave	Co-chief scientist	NRCan / GSC-Pacific
Tiegan Hobbs	Co-chief scientist	NRCan / GSC-Pacific
Alexandre Plourde	Co-chief scientist	NRCan / GSC-Atlantic
Robert Kung	GIS specialist	NRCan / GSC-Pacific
Graeme Cairns	OBS specialist	Dalhousie University / NFSI
John Thibodeau	OBS specialist	Dalhousie University / NFSI
Tamara Wilson	Field Technician	Dalhousie University
Erica Lucas	Postdoctoral Fellow	McGill University
Lekima Yakuden	Graduate Student	University of Victoria
Nathalie Redick	Graduate Student	University of California, Davis
Charlotte Motuzas	Graduate Student	University of Western Ontario

Table 7. A subset of the CCGS officers and crew aboard the Tully for this cruise.

Name	Role
Dustin Flahr	Commanding Officer
Allan Ramsay	Chief Officer
Dave Bolten	Second Officer
Adam Davis	Third Officer
Peter Lange	Bosun (or Boatswain)
Owen MacLeod	Bosun's Mate
Finley Libertore-Lloyd	Leading Deckhand
Cole Haddock	Leading Deckhand

3 Daily Narrative of Events

This section provides a general description of activities undertaken on each day of the cruise, as well as some events preceding and following the cruise. For each day we list the OBS deployed, recovered, and located, as well as CHIRP lines completed. Launch coordinates are given for OBS deployments; final seafloor positions with depths, as computed by an acoustic survey with USBL, are given for each OBS positioned. For CHIRP lines only numbers are provided in this section; start- and end-times and positions are listed in the following section (Table 12). Note that OBS positioned and CHIRP lines completed from 00h00-07h00 day are generally included in descriptions of the previous day, as they fit more naturally as a continuation of the 19h00-00h00 activities. The times in this section are local Pacific Daylight Time (PDT), UTC-7.

Pre-Mobilization

About three weeks before the cruise, on July 11, 2025, the NFSI shipped deck units and other equipment required for OBS deployments, as well as 16 OBS for the Endeavour project, to IOS. Whereas similar shipments in previous years arrived within about one week, this shipment experienced significant delays. One week before the cruise, the earliest possible delivery date was identified August 5, coinciding with mobilization day. We informed CCG of the likely delay, and committed to remaining at IOS until August 6 so that CCG could schedule various repairs.. Given the delayed shipment, most Science Crew members who were not local to Sidney/Victoria, BC delayed their travel to arrive on August 4, or the morning of August 5.

In previous PACSAFE legs, NFSI staff arrived at IOS several days prior to mobilization to prepare instruments (charge OBS batteries, etc.). Having to mobilize immediately once the shipment arrived would place considerable stress on the NFSI OBS technicians in early days of the cruise, although there did appear to be just enough time to have all the OBS charged before the end of the ~28 hour transit to Endeavour.

Note that 16 OBS plus the five on the seafloor (deployed in 2024) is 21, one more than the 20 planned Endeavour deployments, providing a small buffer in case an instrument was not recovered or was determined to be unfit for redeployment.

Tuesday, August 5, 2025 (Mobilization)

NFSI staff arrived at IOS mid-morning to do what preparations they could before the road shipment arrived. Metal OBS-storage crates were removed from storage; some were transported to the jetty to be loaded onto the ship empty, and 16 of them were initially kept at the GSC hangar so that the OBS arriving in the road shipment—which were in plastic, folding crates—could be transferred to metal crates consistent with the newly developed Lithium Battery Safety Plan. Loading of empty crates and other gear began shortly after our Tully time officially started at 12h30. The road shipment arrived at 14h00, which allowed the OBS, ballast, and remainder of the gear to be transported to the jetty by 17h00 and loaded onto the Tully by 19h00. 30 total metal crates were loaded (17 with OBS), as well as four pallets with 15 steel anchor plates each (ballast).

During the loading, some science crew began the lab setup, and a deck plan was created and agreed upon with the bosun. OBS preparation began shortly after loading and four were charging by 20h00. We were told by officers of the Tully that their Chief Engineer was not expected to arrive before early afternoon the next day.

Wednesday, August 6, 2025

In the morning, the Science Crew continued lab setup, and Tom Carson (GSC) helped with the installation of the winch for the USBL pole. The deck crew also installed the pole in the morning, although there was troubleshooting required to connect the USBL cable to the pole. The deck crew preferred to run the cable through the pole, rather than

attaching it to the outside, but after attempting two methods to run the wire through it became clear that a narrow point within the pole prevented passing the cable, so the cable was secured to the outside of the pole with zipties and tape, as it was in previous years.

Multiple technical issues arose with the CHIRP; it was first not communicating with the Tully's GPS, which was eventually solved by connecting it to the Science Lab network instead of the bridge feed, and then there appeared to be a connection issue to the transducer (which was eventually solved by Tully Engineering).

By 16h30 the Chief Engineer was onboard and the Science Crew was prepped; we departed IOS at 18h20, en route to Endeavour. OBS charging continued throughout the day.

Thursday, August 7, 2025

We were in transit to Endeavour for the entire day. Given that no work could be done before 07h00, we steamed at a speed to give us an arrival time at the first Endeavour station of 05h30 Friday.

CHIRP Lines: 2 and 3

Friday, August 8, 2025

Although we were on site at N212 at 07h00, the OBS technicians needed some more time to prepare. The Captain also informed us that the Chief Engineer required ~30 m of time with the engine shut off to inspect the transmission, so we agreed it was optimal to do that first thing in the morning. N212 was launched at 08h12, and we proceeded to complete 9 deployments and 3 recoveries in the central cluster, mainly on the eastern side of Endeavour Ridge (except at N103/N203). We operated in "kick-and-run" mode, not waiting for the OBS to reach the seafloor and position it, because we could return and position it at night. The dunker was used to communicate with the OBS for the first few minutes of its descent to check that it appeared to be operating normally.

To position the instruments at night, given the short distance between stations in the main Endeavour cluster we decided to keep the USBL pole down for the whole night and traverse from station to station at 2 knots. We had expected to be able to communicate with several OBS at once using the USBL, but found that there appeared to be an effective range of 1.5 to 3 km (epicentral distance), so we were usually communicating with a maximum of two OBS. We also asked the bridge to stop steaming and drift when we were overtop each OBS and retrieved the accelerometer and magnetometer measurements (for tilt and azimuthal orientation, respectively) which added 5–10 minutes at each site. At N203 the USBL could ping the instrument but not retrieve data; after ~20 minutes of trying we attempted the dunker instead, which was successful. The same issue (and solution) occurred at N206, but the reason why the USBL did not work is not clear. After N207 was deployed, the sequence was adjusted to pop–deploy–recover for N101 and N201 to save time, since the deployment site of N201 coincided with the recovery site of N101. The same sequence was followed for N102 and N202.

Note on positioning data collected August 8: When we first attempted to invert for each OBS position in the CASIUS software from Sonardyne, the program crashed. We believed this was due to the anomalously large file from recording continuously throughout the night, but we were not sure at first if data for individual stations could be extracted and inverted individually. For this reason, we decided to reposition N210, N211, and N212 the following night (the three closest to that day's deployments), and no position for those OBS are listed here. Data from this night were eventually inverted for positions for the remaining five OBS (on August 21 and 22). Those positions are listed here, but the one for N207 had unusually high uncertainties—it did not even converge on the first inversion attempt with automatic parameters—as well as anomalously high drift, so we ended up deciding to reposition it on August 22.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	N212	08h12	47.9813	-129.0056	
	N209	08h46	47.9354	-128.9970	
	N203	10h40	47.9030	-129.0127	
	N206	13h01	47.8658	-129.0294	
	N207	13h52	46.8935	-129.0889	
	N201	14h51	47.9291	-129.0586	
	N210	16h04	47.9567	-129.0586	
	N202	17h33	48.0008	-129.1208	
	N211	18h33	47.9810	-129.0454	
OBS Recovered:	N103	12h17			
	N101	15h24			
	N102	17h56			
OBS Positioned:	N212	20h00			
	N211	21h50			
	N210	22h40			
	N209	00h30 +1	47.9374	-128.9994	2468
	N201	01h45 +1	47.9300	-129.0581	2320
	N207	03h15 +1	47.8943	-129.0923	2445
	N203	05h15 +1	47.9038	-129.0134	2542
	N206	06h30 +1	47.8659	-129.0298	2594

CHIRP Lines: 4 to 17

Saturday, August 9, 2025

The plan was to begin the day at 07h00 at the southeast Endeavour OBS N105/N205. However, after the delays due to USBL technical issues overnight, we only finished locating the final OBS (N206) at 06h30, and had to wait until 07h00 before the deck crew was available to lift the USBL pole so we could increase speed steaming south, to N205. We arrived onsite at 08h20 and had a relatively complex sequence of i) lowering the USBL pole, ii) deploying N205, iii) recovering N105, and iv) positioning N205, before raising the USBL and departing. Having one OBS sinking and one rising in parallel made this quite efficient, and everything but positioning was complete by 09h35. Because that was the beginning of the deck-crew coffee break, we let the USBL collect data until 10h00. We repeated this sequence at N104/N204 before returning to the central cluster and deploying five OBS in kick-and-run mode. For both N204 and N208, there were issues with the signal briefly stopping on the VHF and OBS beacon, which were quickly fixed before deployment.

The nighttime OBS-positioning began at N214, just after it was deployed. We then located the 5 other central-cluster deployments from that day, and collected more position data on N210, N211, and N212, all with the USBL. We did a mix of slow steaming with the USBL down, between nearby stations, and raising/lowering the USBL for longer transit legs. We were approaching the site of N217 by 06h30+1, to begin the daily deployments just after 07h00+1.

Positions reported here for N210, N211, and N212 are computed using only data collected this night, not the previous night.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	N205	08h30	47.6793	-128.8784	
	N204	12h25	47.6800	-129.3495	
	N208	15h55	47.9250	-129.1481	
	N215	16h48	48.0150	-129.1665	
	N216	17h37	48.0352	-129.1187	
	N213	18h18	48.0048	-129.0775	
	N214	18h54	48.0235	-129.0178	
OBS Recovered:	N105	09h27			
	N104	13h18			
OBS Positioned:	N205	09h58	47.6785	-128.8771	2638
	N204	13h52	47.6799	-129.3490	2752
	N214	19h53	48.0231	-129.0182	2307
	N208	21h55	47.9252	-129.1479	2406
	N215	23h20	48.0137	-129.1669	2234
	N202	00h30 +1	48.0007	-129.1190	2326
	N213	01h25 +1	48.0044	-129.0778	2135
	N211	02h30 +1	47.9814	-129.0465	2310
	N212	03h25 +1	47.9821	-129.0052	2272
	N210	04h45 +1	47.9571	-129.0592	2336
	N216	05h53 +1	48.0336	-129.1182	2376

CHIRP Lines: 18 to 24

Sunday, August 10, 2025

We had planned to spend a half-day to finish the four Endeavour deployments, doing kick-and-runs with the intention to come back and position the OBS after the PACSAFE redeployments, if there was time. The four deployments were completed roughly on schedule, and we were steaming north by 12h30. Three hours into the trip, we noticed an alert that N219, one of four OBS just deployed, had surfaced. We decided to return and recover it immediately, which required an agreement with the captain and bosun to work past 19h00. There were also high winds and larger waves beginning (3-4 m), making the recovery a challenge. At 19h37 it was on deck and we began steaming north once again; given the sea state and time of day we could not attempt another deployment.

Given that none of the N100 OBS recovered or new OBS brought aboard were found to be unfit for deployment, the PACSAFE project inherited the 16th OBS brought aboard for Endeavour.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	N217	07h32	48.0455	-129.0706	
	N218	08h42	48.0733	-129.1087	
	N219	10h10	48.1984	-129.2358	
	N220	12h25	48.1987	-128.8856	
OBS Recovered:	<i>N219</i>	19h37	48.1515	-129.2011	

CHIRP Lines: 25 to 30

Monday, August 11, 2025

Most of the day was spent in transit. We arrived at the first PACSAFE station (L201) at 14h15 and could only complete two recoveries before 19h00. We then steamed towards the continental margin to collect CHIRP lines over canyons

off of southern Goose Island Bank ($\sim 51^\circ$ latitude) for the night. We stopped collecting CHIRP at about 04h30+1 and steamed to L220.

At 15h37, we received an alert that another of the northern OBS of the Endeavour deployment had surfaced (N220). Returning to recover it right away would have consumed too much ship-time, so we left it and hoped for a favourable drift that would make it possible to retrieve it when we returned south later in the cruise, although these hopes were diminished the next day when we stopped receiving GPS updates, likely suggesting that the OBS had flipped upside down.

		Time (PDT)
OBS Recovered:	L201	15h46
	L223	18h53

CHIRP Lines: 31 to 38

Tuesday, August 12, 2025

The USBL was lowered over L220 shortly after 07h00, but we had communication issues with the USBL and eventually lowered the dunker. After retrieving status and sending the burn code with the dunker, L220 was on deck at 08h27. Four more OBS were recovered in the day. At L222, it took 55 minutes between the first burn command and the instrument releasing from its anchor, much longer than usual; it released just as we were about to move on to the next station. At night, CHIRP lines were run over the eastern Moresby Channel, between the RDF and QCF, north of the Tuzo Wilson Volcanic Field.

The NFSI technicians hypothesized that the slow burn at L222 was caused by a film of biological material, and that the instrument was safe to redeploy. However, two other instruments were found to be unfit for redeployment: the OBS recovered from L220 would not charge and L218 showed signs of water ingress in the humidity sensor records.

		Time (PDT)
OBS Recovered:	L220	08h27
	L219	11h00
	L218	13h10
	L222	16h25
	L217A	18h54

CHIRP Lines: 39 to 48

Wednesday, August 13, 2025

A relatively straightforward day of PACSAFE OBS recoveries with no significant issues. Transit between each site was 1–2 h which again limited us to 5 recoveries. The USBL was used except in cases where we approached during a deck-crew break, such that lowering the pole would cause a delay, in which case we used the dunker.

At night we ran CHIRP lines up and down the continental slope offshore Moresby Island, until we had to transit to arrive at L212A for 07h00+1.

		Time (PDT)
OBS Recovered:	L224	08h06
	L207	10h39
	L209	13h44
	L215B	16h23
	L213	18h45

CHIRP Lines: 49 to 56

Thursday, August 14, 2025

A third full day of PACSAFE OBS recoveries. Longer transits between some sites limited us to completing four recoveries, as was expected, despite no significant issues or delays. At night, we ran CHIRP lines over western Moresby Channel (west of the RDF), finishing at L225A to begin recoveries at 07h00+1.

		Time (PDT)
OBS Recovered:	L212A	08h14
	L211	10h46
	L210	14h06
	L208	17h39

CHIRP Lines: 57 to 64

Friday, August 15, 2025

Wind, waves, and swell had begun increasing overnight, and waves exceeded 2 m by the time we recovered L225A at 07h59. That recovery went smoothly, and we proceeded to L206B. During the recovery of L206B, dynamic load from the crane, following a larger wave, bent the OBS lifting frame and bent a rod that connects the pressure case, buoyancy, and lifting frame. Conditions as obtained from the bridge on this recovery were 1) Wind: 20-25 knots SW, 2) Swell: 2-2.5 m. After this, the sea state continued to worsen, and further OBS/deck activities were ruled out for the rest of the day. We began running a CHIRP line heading east towards submarine canyons on the slope, with a track prepared to profile several more canyons.

		Time (PDT)
OBS Recovered:	L225A	07h59
	L206B	10h52

CHIRP Lines: 65 to 68

Saturday, August 16, 2025

The sea state worsened throughout the night and reached 4+ m waves by morning. At 04h30 the bridge asked if we could alter course from the CHIRP line (heading SW) to a course straight into the swell, which we accommodated. At 07h30 we tried steaming north to another line segment that was close to west-to-east, but data quality from the early part of the line was very low so we told the bridge they could hold a weather pattern. At 20h18 we began a line from on top of the shelf down a canyon and west toward L204A, but the data quality remained poor so we turned off the CHIRP again at 22h00. Later in the night, as we slowly steamed west, the sea was beginning to calm and we restarted the CHIRP at 03h44+1 as we approached the RDF extension. We observed a depression in CHIRP data that may be a surface expression of the fault.

CHIRP Lines: 69 to 74

Sunday, August 17, 2025

We were onsite at L204A at 07h00, and were pleasantly surprised that the sea was calm enough to begin the final 3 recoveries. At each station, we opted to establish communication with the dunker while the USBL pole was being deployed, which should typically save time. The third recovery was completed in the early afternoon, leaving time to steam ~3 h to the south and deploy the first two PACSAFE Leg 3 instruments (L301 then L303). After deploying L303, we stayed onsite to position it right away, then returned to L301. However, when attempting to position L301, we were unable to communicate with it (even to “ping” it) with either the USBL or the dunker. We aborted attempts

after about an hour, at 23h35. This may mean that the instrument is dead and unrecoverable, but it is also possible the issue is only with outgoing communication from the OBS, and that it will respond to a burn command when we return to recover next year.

We had planned an indirect route towards L308 to begin deployments the following day there and to collect CHIRP data on the way, but we needed to cruise at 10 knots to reach L308 by 06h30+1 and the incoming data was low-quality, so we turned it off shortly after departing L301.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	L301	16h21	50.3821	-130.3027	
	L303	18h41	50.1514	-129.9392	
OBS Recovered:	L204A	07h27			
	L203B	10h37			
	L202A	13h27			
OBS Positioned:	L303	20h11	50.1528	-129.9406	2284

CHIRP Lines: 75 to 81

Monday, August 18, 2025

We began the day with a smooth deployment at L308, which was overboard at 07h17, and continued the day with no major incidents or delays, finishing five deployments by 16h00. After the final deployment we took advantage of the remaining crane-working-hours to replace the bent rod and lifting frame on the OBS recovered from L223. NFSI technicians had already straightened the bent rod, allowing the OBS's buoyancy to be lifted cleanly off its pressure case, and the whole operation went smoothly. This meant all but two of the recovered PACSAFE OBS were redeployable, leaving us 21 OBS to deploy in total for PACSAFE Leg 3, including those already deployed (19 of 21 PACSAFE recovered from Leg 2, one previously deployed in Burke Channel, and one extra from the Endeavour project).

The last deployment of the day was L304, and we waited onsite to position it immediately using the USBL. We then backtracked through the day's deployments throughout the night to position each of them, lowering and raising the USBL at each. We had difficulties positioning L308 until we sent a command to re-boost the OBS's return signal to maximum power, which should normally have already been applied after retrieving its metadata. We still hit the expected schedule and were onsite L309 at 07h20+1. We were over rocky terrain most of the night and the CHIRP data had poor seafloor penetration, so we turned off the CHIRP for the night at 22h40.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	L308	07h17	49.5050	-130.5662	
	L307	09h42	49.8451	-130.4739	
	L302	11h11	50.0498	-130.3759	
	L306	13h54	49.9038	-129.9513	
	L304	15h59	49.9667	-129.5444	
OBS Positioned:	L304	17h35	49.9687	-129.5437	2084
	L306	20h35	49.9046	-129.9504	2566
	L302	00h01 +1	50.0495	-130.3769	2458
	L307	01h44 +1	49.8443	-130.4737	2422
	L308	04h47 +1	49.5048	-130.5636	2691

CHIRP Lines: 82 to 87

Tuesday, August 19, 2025

The weather had been improving since the previous morning, and Tuesday we enjoyed sunshine and calm seas. We completed five deployments, with average transits of about 2 hours between stations in the sparser, western side of the PACSAFE Leg 3 array. The deployments all went smoothly. We ended the day at L311 and stayed onsite to position it. Overnight, we backtracked through three other OBS deployed that day to position them. We left the positioning of L314 for the following night because it resulted in less overall steaming, and put us in position to deploy L316 at 07h00+1.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	L309	07h29	49.1438	-130.3684	
	L315	10h08	48.9280	-130.0348	
	L314	12h35	49.1417	-129.5470	
	L310	15h15	49.4203	-129.9966	
	L311	17h36	49.5419	-129.6003	
OBS Positioned:	L311	19h05	49.5422	-129.5970	2426
	L310	21h37	49.4197	-129.9936	2426
	L309	00h47 +1	49.1448	-130.3687	2608
	L315	03h16 +1	48.9284	-130.0356	2780

CHIRP Lines: 88 to 95

Wednesday, August 20, 2025

Another day of sunshine and very calm seas. We deployed five OBS and had no significant delays. We observed unusual voltage fluctuations across the burnwire prior to deploying L321, but deemed it unlikely to be a risk. The deck crew was extremely efficient and typically had the OBS overboard 2-3 minutes after stopping at the station; between arriving onsite and retrieving the dunker was only about 15 minutes. The last deployment of the day was L318, but rather than stay onsite to position it, we left that task for the following night and began backtracking through earlier deployments, including L314 from the previous day.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	L316	07h08	48.7538	-129.3563	
	L317	09h09	49.0249	-129.1587	
	L321	11h15	49.3260	-129.1147	
	L312	12h53	49.3351	-128.7651	
	L318	14h58	49.0397	-128.5944	
OBS Positioned:	L312	18h04	49.3344	-128.7633	2392
	L321	20h10	49.3257	-129.1122	2423
	L314	23h00	49.1424	-129.5463	2458
	L317	01h19 +1	49.0251	-129.1585	2414
	L316	03h34 +1	48.7542	-129.3574	2817

CHIRP Lines: 96 to 105

Thursday, August 21, 2025

Calm seas and sunny skies continued into Thursday for the final four PACSAFE Leg 3 deployments. The first two deployments (L305 and L313) went smoothly; they were kick-and-runs and we were only onsite for 20 minutes each. The third station (L320) would have been less efficient to transit back to, so we planned on staying on-site to position

it right away.

In the pre-deployment checks at L320, there was a problematically high voltage across the pressure case of >4 V. The NFSI team was able to quickly prepare the other remaining OBS, which was launched at 12h14. We stayed onsite to position the OBS, but found that communication became extremely unreliable as it neared the seafloor. We never received a complete status message on the USBL or dunker, and only received three positioning pings (on the USBL). Meanwhile, the NFSI team was also trying to diagnose and repair the remaining OBS. Given that the 4 V is close to the voltage expected for the external-hydrophone/APG, they tried deactivating that circuit, which dropped the voltage to 260 mV (still higher than the usual tens of mV, but deemed acceptable).

We eventually moved on from trying to communicate with L320 and proceeded to L319 to drop the final functioning OBS on board (freshly repaired). However, when tracking its descent with the dunker, we lost all response from the OBS after it passed 600 m depth. For both L319 and L320, we sent a command to change the timed-release to November 2026, but did not receive confirmation. We presume that they are most likely recording data normally and the issue is only with communication, but we cannot rule out that they are now flooded and unrecoverable. It will likely only be determined when we attempt to recover next year.

After L319, we started heading south towards Endeavour Ridge, and along the way, returned to three earlier-deployed OBS to position them with the USBL.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Deployed:	L305	07h16	48.8118	-128.8121	
	L313	09h05	48.5454	-128.7988	
	L320	12h14	48.6934	-128.2190	
	L319	18h24	49.1229	-128.2031	
OBS Positioned:	L320	15h30	48.6934	-128.2191	2541
	L318	22h56	49.0382	-128.5943	2506
	L305	01h05 +1	48.8164	-128.8119	2583
	L313	03h26 +1	48.5458	-128.7990	2502

CHIRP Lines: 106 to 113

Friday, August 22, 2025

We arrived in the Endeavour region to position OBS shortly after 07h00. First were N218 and N217, which we skipped positioning earlier in the cruise when we were more concerned about time. We put the USBL down and up at each site despite the short transit in between, and it only took about an hour to position them both. We then had about an hour transit south to N207, which had been positioned after its deployment on August 8, but that estimate showed high uncertainty and high drift. The new position estimate was consistent with the first, suggesting the instrument did drift about 250 m from its launch location (about 10% water depth), higher than any other deployment on this cruise. This concluded OBS work for the cruise; we then started steaming NW towards Esperanza Inlet on Vancouver Island.

		Time (PDT)	Latitude	Longitude	Depth (m)
OBS Positioned:	N218	07h20	48.0738	-129.1079	2492
	N217	08h10	48.0448	-129.0711	2351
	N207	09h38	47.8944	-129.0919	2412

CHIRP Lines: 114 to 119

Saturday, August 23, 2025

Soon after midnight we arrived in Esperanza Inlet and began a CHIRP line going east into the inlet, and then north up Espinosa Inlet (west of Espinosa Island). After exiting Esperanza Inlet, at 04h00, we also attempted to observe evidence of a southern extension of a N-S–striking fault on western Nootka Island. At 05h30 we began a SW-NE transect through the entrance to Nootka Sound over an offshore extension of the West Coast Fault, and followed this with two other parallel transects. We then anchored and took a shore leave to Yuquot (Friendship Cove), where there is a CCGS lighthouse. In the mid-afternoon when everyone was back from shore leave, we proceeded with CHIRP lines up Tahsis Inlet and back before another pass of the West Coast Fault as we exited Nootka Sound.

CHIRP Lines: 114 to 130

Sunday, August 24, 2025

At 02h00 we began a series of SSW–NNE CHIRP transects over an area with potential reverse faults, between the Hesquiat Peninsula and Flores Island. At 06h22, we left this area to begin a few other short transects south of Flores Island. That target region had two potential reverse faults and one potential normal fault, but was also in a shallow, shoal-filled area and the data quality turned out to be very poor, so at 08h45 we turned around and started back towards open water. We ran the CHIRP as we started steaming SE, until 15h09 when we approached the area Pacific Rim National Park and turned it off for a final time. We then began packing up the lab computers and other equipment.

At 14h00, we received the first GPS update from N220 since August 12, likely indicating it had flipped back upright. However, it had drifted significantly south, into U.S. waters offshore central Washington.

CHIRP Lines: 131 to 145

Monday, August 25, 2025 (Demobilization)

We arrived in Patricia Bay (Sidney) in the early morning and waited until 07h00 to begin docking at IOS. After docking, the ship was refueled, and we finished packing the lab for unloading. Shortly after 10h00, fueling was complete and the deck crew began unloading the three OBS remaining onboard, the other science gear, and the empty OBS stillage crates. We transported the OBS and science gear to the hangar via forklift, but left the empty crates on the jetty until the following day because no one was available to drive a flatbed. The USBL pole was disassembled and unloaded in the afternoon.

The NFSI team separated their gear into air and land shipments, weighed them, and otherwise prepared them for shipping. They also opened up the OBS that surfaced and was recovered (N219) and saw evidence of water ingress through the cables, consistent with several previous OBS that surfaced prematurely. Other science crew who were local to BC or who were able to book an early flight departed throughout the day.

Tuesday, August 26, 2025 (Demobilization)

We brought the remaining stillage crates from the jetty to near the storage container before 09h00, and then in the afternoon, loaded all the metal and plastic folding crates (for both the PACSAFE and Endeavour projects) in the container. We also continued preparing the NFSI air and land shipments to return gear and OBS to Halifax.

Post-Cruise

As the OBS from N220 drifted south into U.S. waters, William Wilcock (PI on the Endeavour from the University of Washington) took the lead on exploring recovery options. On September 5, he connected with the PI team of a

research cruise about to start on the RV Atlantis (UNOLS) out of Newport, Oregon, who generously offered to recover the drifter. The recovery went smoothly and it was onboard the next morning, September 6 at 06h07 PDT.

4 Summary of Data Collected

A map encompassing the full OBS deployment history for the PACSAFE and Endeavour projects is presented in Figure 5, with Figures 6 and 7 providing more detailed views of 2025 deployments for the two projects. Tables 8 and 9 list OBS seafloor positions and start/end times for PACSAFE Leg 2 and Endeavour Leg 1 deployments, respectively (OBS recovered on this cruise). Tables 10 and 11 list positions and start times for OBS deployed on the cruise. Table 12 lists the CHIRP lines collected on the cruise, which are also mapped in Figure 8. Example CHIRP data from two profiles over the Moresby Channel (south of Moresby Island) collected during PACSAFE Leg 2 recoveries, are shown in Figure 9.

Table 8. Final list of PACSAFE L200 OBS stations recovered on this cruise, with surveyed seafloor positions and start/end times in UTC. Depths are in m. Start times refer to release from the ship (before sinking and settling on seafloor), and end times refer to when they are on deck (after rising from the seafloor).

	Latitude	Longitude	Depth	Launch Time (UTC)	Rec. Time (UTC)
L201	50.8696	-130.0266	2136	2024-07-18T15:59	2025-08-11T22:46
L202A	50.7370	-130.6797	2433	2024-07-20T17:52	2025-08-17T20:27
L203B	50.9374	-130.7196	2379	2024-07-20T19:47	2025-08-17T17:37
L204A	51.0128	-131.0006	2468	2024-07-20T21:18	2025-08-17T14:27
L206B	51.1795	-131.2267	2488	2024-07-21T19:44	2025-08-15T17:52
L207	51.4246	-131.2254	2415	2024-07-21T21:36	2025-08-13T17:39
L208	51.4825	-131.5055	2374	2024-07-21T22:58	2025-08-15T00:39
L209	51.6898	-131.4859	1962	2024-07-22T00:35	2025-08-13T20:44
L210	51.7403	-131.8658	2330	2024-07-23T17:04	2025-08-14T21:06
L211	52.0038	-131.9967	2448	2024-07-23T20:33	2025-08-14T17:46
L212A	52.2054	-131.9235	2383	2024-07-23T22:12	2025-08-14T15:14
L213	52.0467	-131.6112	1625	2024-07-23T14:34	2025-08-14T01:45
L215B	51.9520	-131.3372	1557	2024-07-22T14:16	2025-08-13T23:23
L217A	51.5692	-130.8445	2007	2024-07-22T17:59	2025-08-13T01:54
L218	51.3450	-130.5863	1943	2024-07-22T21:14	2025-08-12T20:10
L219	51.1621	-130.5995	2028	2024-07-21T01:33	2025-08-12T18:00
L220	51.0358	-130.3592	2165	2024-07-20T15:17	2025-08-12T15:27
L222	51.5866	-130.4554	508	2024-07-22T23:05	2025-08-12T23:25
L223	50.8220	-130.3118	1897	2024-07-18T22:28	2025-08-12T01:53
L224	51.3375	-130.8697	2239	2024-07-22T19:43	2025-08-13T15:06
L225A	51.2536	-131.5992	2390	2024-07-21T16:20	2025-08-15T14:59

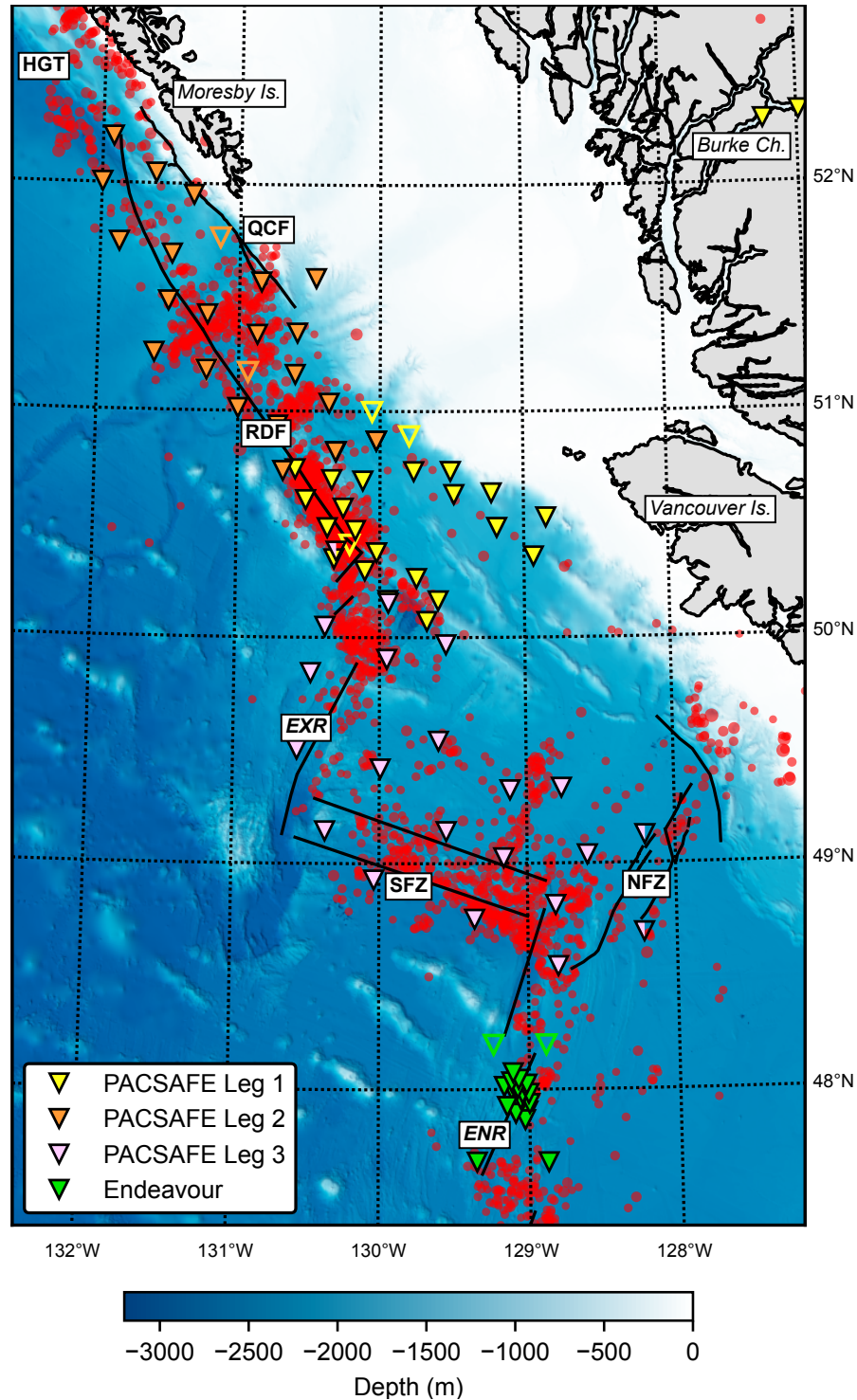


Figure 5. Map of the combined PACSAFE Legs 1-3 and Endeavour study areas. Filled triangles indicate OBS that were recovered normally (PACSAFE Legs 1-2) or are expected to be recovered in 2026 (PACSAFE Leg 3, Endeavour Leg 2). Endeavour Leg 1 sites are almost coincident with five of the Leg 2 sites and are not plotted here. Hollow triangles indicate OBS that were deployed but surfaced prematurely, whether the instrument was recovered or lost. Half-filled, half-hollow triangle indicate OBS that we could not communicate with properly on the seafloor. Earthquake of $M > 3.5$ from the National Earthquake Database (NEDB, [NRCAN, 1985](#)) are plotted as red dots, scaled by magnitude. Bathymetry model was downloaded at three-arc-second resolution from the U.S. National Oceanic and Atmospheric Association (NOAA) Centers for Environmental Information. Abbreviations used: ENR = Endeavour Ridge, EXR = Explorer Ridge, HGT = Haida Gwaii Thrust, NFZ = Nootka Fault Zone, QCF = Queen Charlotte Fault, RDF = Revere-Dellwood Fault, SFZ = Sovanco Fracture Zone.

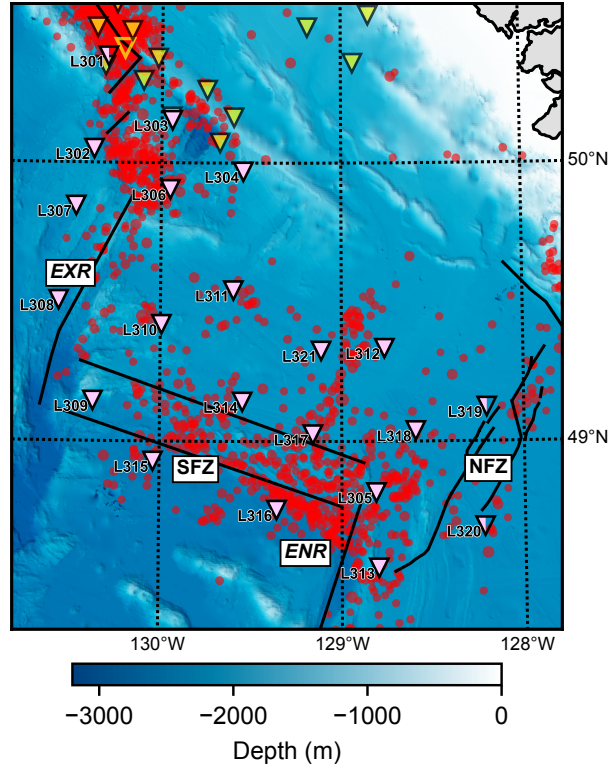


Figure 6. Zoomed-in map on PACSAFE Leg 3 deployments with labels of individual station codes. See Figure 5 caption for more detail.

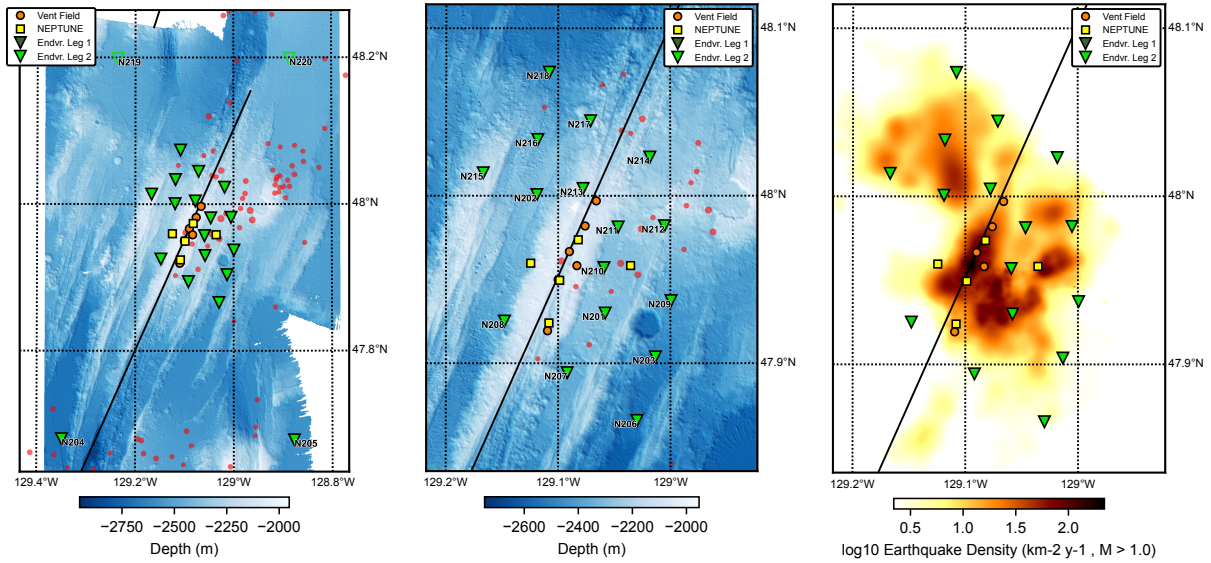


Figure 7. Maps of the Endeavour OBS deployment. The five Leg 1 (N100) deployments, recovered on this cruise, mostly plot immediately underneath the corresponding Leg 2 (N200) deployment, but a slight shift between N103 and N203 is visible. **(left)** Full Endeavour Leg 2 OBS array, with the NEPTUNE cabled OBS (ONC, 2009) and major hydrothermal vent fields, as well as $M > 3.5$ earthquakes from the NEDB catalog as red dots. Bathymetry is 30 m resolution courtesy of ONC. **(center)** Zoomed-in view of the central OBS cluster with station code labels. **(right)** Earthquake density under the central cluster (with a logarithmic colour scale), derived from the ONC Endeavour Catalog ($M > 1$, April 2022 – August 2025 data).

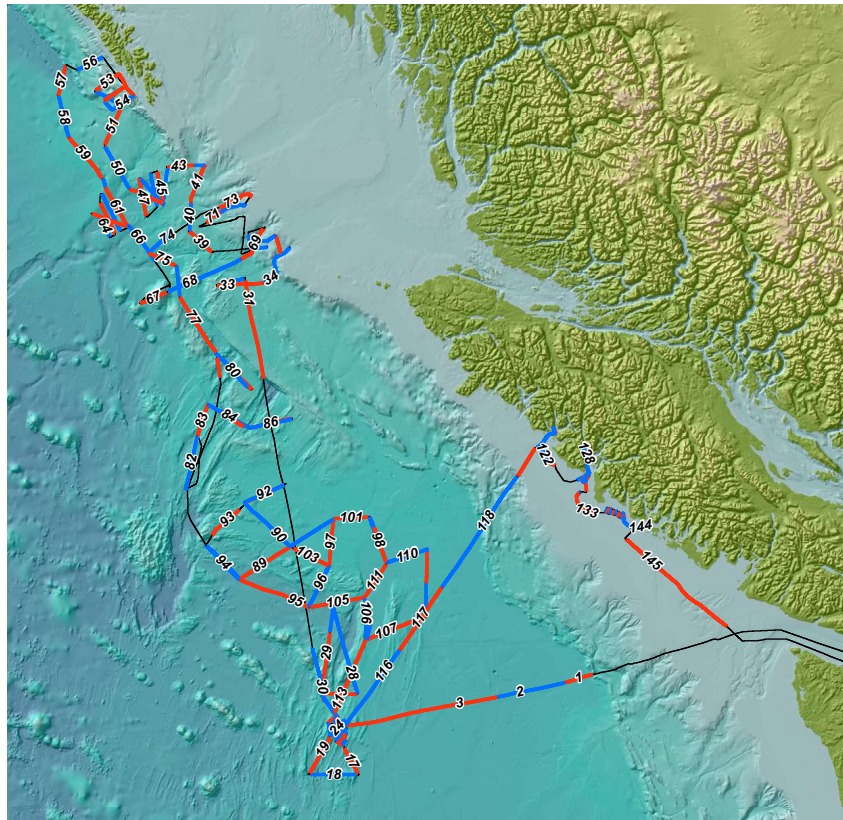


Figure 8. Map of CHIRP data collected. CHIRP lines alternate red (odd numbers) and blue (even numbers) colours on top of the thinner black line, representing the cruise track. Note that some labels are missing, especially in regions with many short tracks such as the Endeavour Ridge and offshore Flores Island.

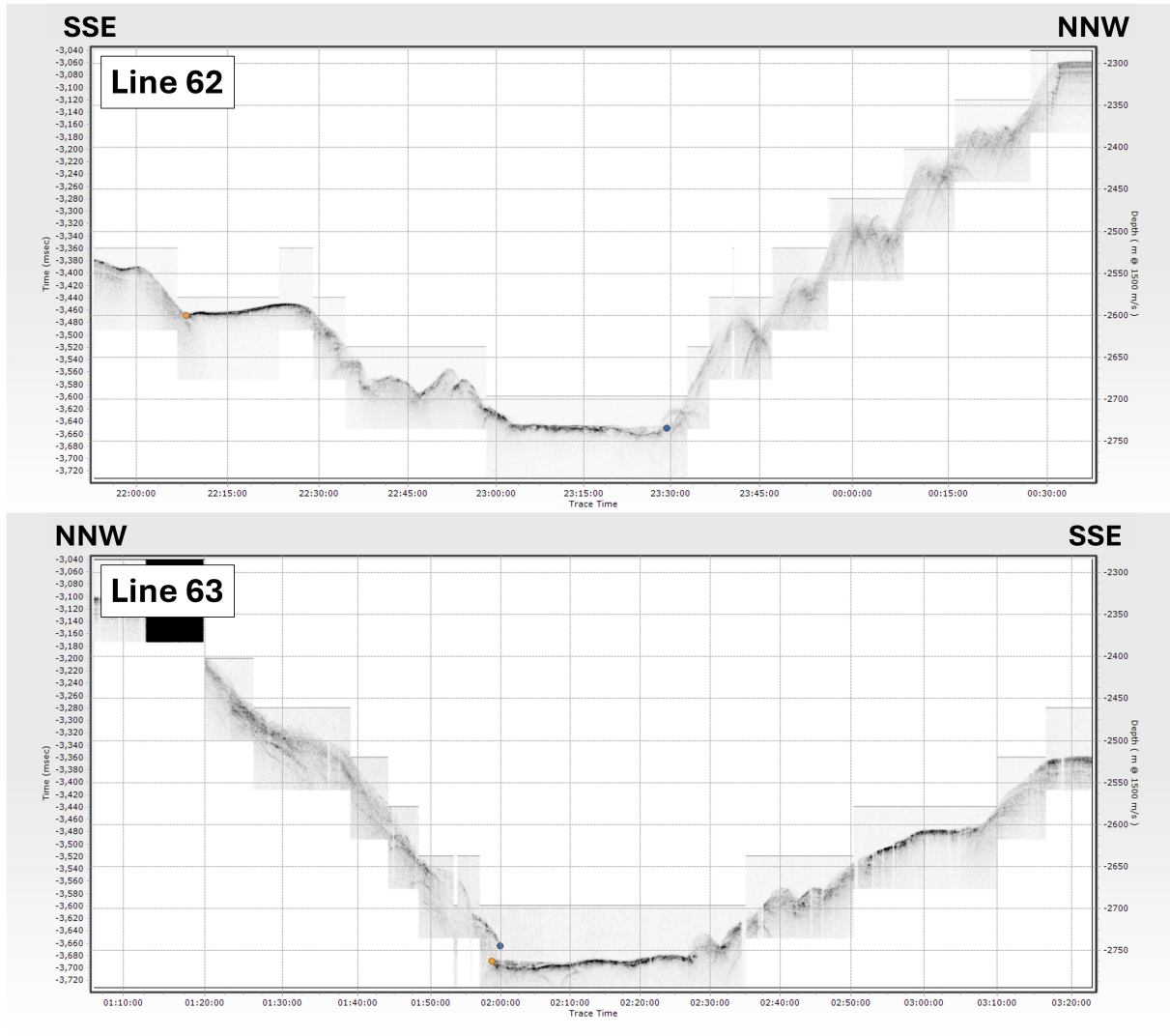


Figure 9. Example CHIRP profiles, over Moresby Channel, visualized with software from [Courtney \(2013\)](#). (top) Line 62, from SSE to NNW. (bottom) Line 63, from NNW to SSE, ~6 km WSW of Line 62; see Figure 8 for locations. Note that the horizontal axis is in time, so vertical exaggeration is unconstrained.

Table 9. Final list of Endeavour N100 OBS stations recovered on this cruise, with surveyed seafloor positions and start/end times in UTC.

	Latitude	Longitude	Depth	Launch Time (UTC)	Rec. Time (UTC)
N101	47.9299	-129.0615	2321	2024-06-08T03:03	2025-08-08T22:24
N102	47.9998	-129.1182	2329	2024-06-07T18:59	2025-08-09T00:56
N103	47.9004	-128.9987	2559	2024-06-09T00:08	2025-08-08T19:17
N104	47.6804	-129.3495	2762	2024-06-09T07:22	2025-08-09T20:21
N105	47.6789	-128.8783	2650	2024-06-09T03:18	2025-08-09T16:27

Table 10. Final list of PACSAFE L300 OBS stations deployed on this cruise, with surveyed seafloor positions and start times in UTC.

OBS presumably on seafloor as of writing				
	Latitude	Longitude	Depth	Launch Time (UTC)
<i>L301</i>	<i>50.3821</i>	<i>-130.3027</i>	2532	2025-08-17T23:21
L302	50.0495	-130.3769	2458	2025-08-18T18:11
L303	50.1528	-129.9406	2284	2025-08-18T01:41
L304	49.9687	-129.5437	2084	2025-08-18T22:59
L305	48.8164	-128.8119	2583	2025-08-21T14:16
L306	49.9046	-129.9504	2566	2025-08-18T20:54
L307	49.8443	-130.4737	2422	2025-08-18T16:42
L308	49.5048	-130.5636	2691	2025-08-18T14:17
L309	49.1448	-130.3687	2608	2025-08-19T14:29
L310	49.4197	-129.9936	2426	2025-08-19T22:15
L311	49.5422	-129.5970	2426	2025-08-20T00:36
L312	49.3344	-128.7633	2392	2025-08-20T19:53
L313	48.5458	-128.7990	2502	2025-08-21T16:05
L314	49.1424	-129.5463	2458	2025-08-19T19:35
L315	48.9284	-130.0356	2780	2025-08-19T17:08
L316	48.7542	-129.3574	2817	2025-08-20T14:08
L317	49.0251	-129.1585	2414	2025-08-20T16:09
L318	49.0382	-128.5943	2506	2025-08-20T21:58
<i>L319</i>	<i>49.1229</i>	<i>-128.2035</i>	2473	2025-08-22T01:24
<i>L320</i>	<i>48.6934</i>	<i>-128.2191</i>	2554	2025-08-21T19:14
L321	49.3257	-129.1122	2423	2025-08-20T18:15

Table 11. Final list of Endeavour N200 OBS stations deployed on this cruise, with surveyed seafloor positions and start times in UTC.

OBS remaining on seafloor as of writing					
	Latitude	Longitude	Depth	Launch Time (UTC)	
N201	47.9300	-129.0581	2320	2025-08-08T21:51	
N202	48.0007	-129.1190	2326	2025-08-09T00:33	
N203	47.9038	-129.0134	2542	2025-08-08T17:40	
N204	47.6799	-129.3490	2752	2025-08-09T19:25	
N205	47.6785	-128.8771	2638	2025-08-09T15:30	
N206	47.8659	-129.0298	2594	2025-08-08T20:01	
N207	47.8944	-129.0919	2412	2025-08-08T20:52	
N208	47.9252	-129.1479	2406	2025-08-09T22:55	
N209	47.9374	-128.9994	2468	2025-08-08T15:46	
N210	47.9571	-129.0592	2336	2025-08-08T23:04	
N211	47.9814	-129.0465	2310	2025-08-09T01:33	
N212	47.9821	-129.0052	2272	2025-08-08T15:12	
N213	48.0044	-129.0778	2135	2025-08-10T01:18	
N214	48.0231	-129.0182	2307	2025-08-10T01:54	
N215	48.0137	-129.1669	2234	2025-08-09T23:48	
N216	48.0336	-129.1182	2376	2025-08-10T00:37	
N217	48.0448	-129.0711	2351	2025-08-10T14:32	
N218	48.0738	-129.1079	2492	2025-08-10T15:42	
Prematurely Released OBS					
	Latitude	Longitude	Depth	Launch Time (UTC)	Rec. Time (UTC)
N219	48.1984	-129.2358	2564	2025-08-10T17:10	2025-08-11T02:37
N220	48.1987	-128.8856	2520	2025-08-10T19:25	2025-09-06T13:07

Table 12. Description of CHIRP data collected. The first four digits of the Profile Names correspond to the numbers listed in Section 3.

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0002_219_1700_000	Approach to Endeavour	2025-08-08T00:00	48.2506	-126.8832	04:00	48.1673	-127.5394
0003_219_2100_000	Approach to Endeavour, arrival at N212	2025-08-08T04:00	48.1672	-127.5402	12:58	47.9928	-128.9854
0004_220_0825_000	Transit N212 to N209; <i>Switched computer calendar to UTC time</i>	2025-08-08T15:25	47.9816	-129.0068	15:46	47.9353	-128.9967
0005_220_1715_000	Transit N209 to N103/N203	2025-08-08T17:16	47.9357	-128.9993	17:42	47.9029	-129.0126
0006_220_1926_000	Transit N203 to N206	2025-08-08T19:26	47.8990	-128.9948	19:44	47.8662	-129.0269
0007_220_2013_000	Transit N206 to N207	2025-08-08T20:13	47.8670	-129.0278	20:36	47.8926	-129.0887
0008_2025_220_2107	Transit N207 to N101/N201	2025-08-08T21:07	47.8947	-129.0866	21:26	47.9278	-129.0635
0009_2025_220_2233	Transit N201 to N210	2025-08-08T22:34	47.9298	-129.0552	22:48	47.9555	-129.0586
0010_2025_220_2314	Transit N210 to N102/N202	2025-08-08T23:14	47.9569	-129.0554	23:44	47.9987	-129.1146
0011_2025_221_0108	Transit N202 to N211	2025-08-09T01:08	48.0009	-129.1079	01:28	47.9820	-129.0471
0012_2025_221_0336	Transit N210 to N209 (USBL down)	2025-08-09T03:36	47.9810	-129.0098	07:19	47.9361	-128.9976
0013_2025_221_0723	Transit N209 to N201 (USBL down)	2025-08-09T07:23	47.9351	-128.9975	08:32	47.9300	-129.0505
0014_2025_221_0854	Transit N201 to N207 (USBL down)	2025-08-09T08:54	47.9284	-129.0584	10:11	47.8945	-129.0897
0015_2025_221_1026	Transit N207 to N203 (USBL down)	2025-08-09T10:26	47.8931	-129.0812	11:36	47.9010	-129.0164
0016_2025_221_1226	Transit N203 to N206 (USBL down)	2025-08-09T12:26	47.8956	-129.0042	13:17	47.8720	-129.0261
0017_2025_221_1410	Transit N206 to N205 (USBL down)	2025-08-09T14:10	47.8494	-129.0095	15:12	47.6844	-128.8809
0018_2025_221_1712	Transit N205 to N204	2025-08-09T17:12	47.6771	-128.8946	19:01	47.6786	-129.3338
0019_2025_221_2108	Transit N204 to N208	2025-08-09T21:08	47.6863	-129.3393	22:49	47.9263	-129.1499
0020_2025_221_2307	Transit N208 to N215	2025-08-09T23:07	47.9248	-129.1468	23:46	48.0143	-129.1663
0021_2025_222_0000	Transit N215 to N216	2025-08-10T00:00	48.0155	-129.1602	00:33	48.0352	-129.1188
0022_2025_222_0049	Transit N216 to N213	2025-08-10T00:49	48.0329	-129.1154	01:06	48.0050	-129.0795
0023_2025_222_0130	Transit N213 to N214	2025-08-10T01:30	48.0028	-129.0762	01:49	48.0223	-129.0180
0024_2025_222_0301	Transit N214 to N208	2025-08-10T03:01	48.0207	-129.0091	04:27	47.9267	-129.1440
0025_2025_222_1447	Transit N217 to N218	2025-08-10T14:47	48.0460	-129.0728	15:30	48.0733	-129.1081
0026_2025_222_1559	Transit N218 to N219	2025-08-10T15:59	48.0733	-129.1095	16:54	48.1943	-129.2324
0027_2025_222_1724	Transit N219 to N220	2025-08-10T17:24	48.1987	-129.2363	19:09	48.1987	-128.8856
0028_2025_222_1938	Transit N to PACSAFE; turn back S to surfaced OBS	2025-08-10T19:38	48.1987	-128.8820	23:59	48.5946	-129.1505
0029_2025_223_0000	Continued transit to surfaced OBS N219	2025-08-11T00:00	48.5915	-129.1510	02:25	48.1523	-129.2072

Table 12 (continued). Description of CHIRP data.

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0030_2025_223_0249	Transit north to PACSAFE; stopped for heavy seas	2025-08-11T02:49	48.1479	-129.2034	05:08	48.4915	-129.3192
0031_2025_223_1709	Transit to L201	2025-08-11T17:09	50.2197	-129.8227	21:29	50.8538	-130.0177
0032_2025_223_2255	Transit L201 to L223	2025-08-11T22:55	50.8659	-130.0280	23:53	50.8338	-130.2352
0033_2025_224_0210	Transit L223 to L220	2025-08-12T02:10	50.8156	-130.3044	04:00	50.8396	-129.8220
0034_2025_224_0400	Goose Island Bank; SW to NE up canyon	2025-08-12T04:00	50.8398	-129.8212	07:07	51.0680	-129.5700
0035_2025_224_0739	Goose Island Bank; SSE to NNW onto shelf	2025-08-12T07:39	51.0298	-129.6576	08:47	51.1430	-129.7107
0036_2025_224_0852	Goose Island Bank; W down canyon wall	2025-08-12T08:52	51.1438	-129.7164	10:11	51.1051	-129.8990
0037_2025_224_1014	Goose Island Bank; S down canyon floor	2025-08-12T10:14	51.1007	-129.9022	10:42	51.0607	-129.9240
0038_2025_224_1042	Goose Island Bank; E up from canyon floor to shelf	2025-08-12T10:42	51.0606	-129.9239	11:33	51.0689	-129.7962
0039_2025_224_1543	Transit L220 to L219	2025-08-12T15:43	51.0321	-130.3628	17:04	51.1598	-130.5967
0040_2025_224_1806	Transit L219 to L218	2025-08-12T18:06	51.1641	-130.5946	19:19	51.3428	-130.5840
0041_2025_224_2017	Transit L218 to L222	2025-08-12T20:17	51.3454	-130.5849	21:58	51.5856	-130.4513
0042_2025_224_2330	Transit L222 to L217A	2025-08-12T23:30	51.5888	-130.4479	23:59	51.5867	-130.5618
0043_2025_225_0000	Continue transit L222 to L217A	2025-08-13T00:00	51.5866	-130.5638	01:10	51.5700	-130.8388
0044_2025_225_0221	Transit to L224 for start of night sub-bottom lines for Leki	2025-08-13T02:21	51.5635	-130.8344	03:44	51.3650	-130.8640
0045_2025_225_0407	East Moresby Channel Line 1	2025-08-13T04:07	51.3385	-130.8702	06:13	51.5407	-130.9405
0046_2025_225_0639	East Moresby Channel Line 2	2025-08-13T06:39	51.5252	-131.0104	08:52	51.3165	-130.9321
0047_2025_225_0935	East Moresby Channel Line 3	2025-08-13T09:35	51.2560	-131.0432	12:04	51.4936	-131.1256
0048_2025_225_1210	Transit to L224	2025-08-13T12:10	51.4901	-131.1082	13:50	51.3376	-130.8696
0049_2025_225_1521	Transit L224 to L207	2025-08-13T15:21	51.3379	-130.8748	16:51	51.4242	-131.2246
0050_2025_225_1750	Transit L207 to L209	2025-08-13T17:50	51.4280	-131.2244	19:47	51.6896	-131.4877
0051_2025_225_2054	Transit L209 to L215B	2025-08-13T20:54	51.6985	-131.4906	22:33	51.9492	-131.3355
0052_2025_226_0000	Transit L215B to L213	2025-08-14T00:00	51.9841	-131.4059	00:58	52.0448	-131.6072
0053_2025_226_0307	Canyons off Moresby; L213 up-slope	2025-08-14T03:07	52.0495	-131.6034	05:58	52.0222	-131.2096
0054_2025_226_0558	Canyons off Moresby; Down-slope segment	2025-08-14T05:58	52.0220	-131.2099	08:08	51.9840	-131.5103
0055_2025_226_0808	Canyons off Moresby; Up-slope segment	2025-08-14T08:08	51.9842	-131.5104	09:48	52.0813	-131.3016

Table 12 (continued). Description of CHIRP data.

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0056_2025_226_1119	Canyons off Moresby; Down-slope to L212A	2025-08-14T11:19	52.2657	-131.5448	13:13	52.1766	-131.8058
0057_2025_226_1529	Transit L212A to L211	2025-08-14T15:29	52.1986	-131.9278	16:43	52.0070	-131.9946
0058_2025_226_1806	Transit L211 to L210	2025-08-14T18:06	52.0051	-131.9887	19:45	51.7427	-131.8666
0059_2025_226_2114	Transit L210 to L208	2025-08-14T21:14	51.7405	-131.8659	23:18	51.4854	-131.5069
0060_2025_227_0058	Transit L208 to west Moresby Channel	2025-08-15T00:58	51.4875	-131.4989	01:27	51.4285	-131.4686
0061_2025_227_0127	West Moresby Channel Line 1	2025-08-15T01:27	51.4280	-131.4684	04:22	51.1826	-131.2298
0062_2025_227_0453	West Moresby Channel Line 2	2025-08-15T04:53	51.1529	-131.3032	07:36	51.3847	-131.5014
0063_2025_227_0806	West Moresby Channel Line 3	2025-08-15T08:06	51.3293	-131.5174	10:22	51.1341	-131.3559
0064_2025_227_1044	West Moresby Channel Line 4	2025-08-15T10:44	51.1141	-131.4126	12:16	51.2472	-131.5226
0065_2025_227_1517	Transit L225A to L206B	2025-08-15T15:17	51.2574	-131.5955	16:50	51.1832	-131.2243
0066_2025_227_1802	Transit L206B to L204A; stopped due to heavy seas	2025-08-15T18:02	51.1873	-131.2226	19:56	50.9698	-130.9466
0067_2025_228_0003	Dellwood seamount and fault crossing	2025-08-16T00:03	50.6900	-131.0799	01:55	50.7658	-130.8144
0068_2025_228_0203	Dellwood zone to slope canyons	2025-08-16T02:03	50.7695	-130.8011	07:13	50.9897	-130.0606
0069_2025_228_0713	Traversing canyon slope, almost no data	2025-08-16T07:13	50.9900	-130.0600	09:49	51.1853	-129.8356
0070_2025_228_1122	Down-slope; stopped recording due to excessive roll	2025-08-16T11:22	51.1459	-129.9905	12:24	51.0523	-129.9626
0071_2025_228_2241	Conditions improved; started recording	2025-08-16T22:41	51.2191	-130.4237	23:59	51.2905	-130.2772
0072_2025_229_0000	Goose Island Bank; Up-canyon	2025-08-17T00:00	51.2908	-130.2763	01:48	51.3454	-130.0279
0073_2025_229_0218	Goose Island Bank; Down-canyon	2025-08-17T02:18	51.3872	-129.9857	04:59	51.3193	-130.2940
0074_2025_229_1044	MPA boundary to 204A, crossing RDF extension	2025-08-17T10:44	51.1421	-130.7620	13:02	51.0257	-130.9851
0075_2025_229_1532	Transit L204A to L203B	2025-08-17T15:32	51.0157	-131.0037	16:42	50.9400	-130.7277
0076_2025_229_1743	Transit L203B to L202A	2025-08-17T17:43	50.9403	-130.7181	19:09	50.7398	-130.6785
0077_2025_229_2033	Transit L202A to L301	2025-08-17T20:33	50.7390	-130.6780	23:15	50.3836	-130.3025
0078_2025_229_2332	Transit L301 to L303	2025-08-17T23:32	50.3815	-130.3037	23:59	50.3293	-130.2221
0079_2025_230_0000	Continue transit L301 to L303	2025-08-18T00:00	50.3286	-130.2209	01:32	50.1517	-129.9365
0080_2025_230_0332	Transit L303 to L301	2025-08-18T03:33	50.1666	-129.9802	05:24	50.3779	-130.2978
0081_2025_230_0641	Transit L303 to L308; stopped recording due to poor data	2025-08-18T06:53	50.3526	-130.2917	07:39	50.2272	-130.2584

Table 12 (continued). Description of CHIRP data.

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0082_2025_230_1439	Transit L308 to L307	2025-08-18T14:39	49.5059	-130.5704	16:37	49.8435	-130.4734
0083_2025_230_1657	Transit L307 to L302	2025-08-18T16:57	49.8477	-130.4742	18:05	50.0463	-130.3766
0084_2025_230_1824	Transit L302 to L306	2025-08-18T18:24	50.0512	-130.3746	20:21	49.9047	-129.9551
0085_2025_230_2108	Transit L306 to L304	2025-08-18T21:08	49.9055	-129.9395	22:45	49.9668	-129.5460
0086_2025_231_0117	Transit L304 to L306	2025-08-19T01:17	49.9649	-129.5312	03:03	49.9036	-129.9568
0087_2025_231_0441	Transit; stopped recording due to poor data	2025-08-19T04:41	49.9134	-130.0131	05:40	50.0014	-130.2324
0088_2025_231_1455	Transit L309 to L315; start delayed because of whale sighting	2025-08-19T14:55	49.1230	-130.3278	17:02	48.9297	-130.0341
0089_2025_231_1726	Transit L315 to L314	2025-08-19T17:26	48.9293	-130.0369	19:33	49.1410	-129.5468
0090_2025_231_1945	Transit L314 to L310	2025-08-19T19:45	49.1453	-129.5478	22:07	49.4111	-129.9837
0091_2025_231_2227	Transit L310 to L311	2025-08-19T22:27	49.4238	-129.9965	23:59	49.5133	-129.6911
0092_2025_232_0218	Transit L311 to L310	2025-08-20T02:18	49.5397	-129.6056	04:04	49.4238	-129.9959
0093_2025_232_0507	Transit L310 to L309	2025-08-20T05:07	49.3782	-130.0441	06:33	49.2111	-130.3069
0094_2025_232_0805	Transit L309 to L315	2025-08-20T08:05	49.1420	-130.3630	09:50	48.9287	-130.0396
0095_2025_232_1027	Transit L315 to L316	2025-08-20T10:27	48.9233	-130.0198	14:03	48.7532	-129.3559
0096_2025_232_1421	Transit L316 to L317	2025-08-20T14:21	48.7546	-129.3578	16:09	49.0249	-129.1585
0097_2025_232_1624	Transit L317 to L321	2025-08-20T16:24	49.0249	-129.1577	18:12	49.3256	-129.1145
0098_2025_232_2005	Transit L312 to L318	2025-08-20T20:05	49.3340	-128.7654	21:54	49.0397	-128.5967
0099_2025_232_2218	Transit L318 to L312	2025-08-20T22:18	49.0416	-128.6009	23:59	49.2688	-128.7204
0100_2025_233_0000	Continue transit L318 to L312	2025-08-21T00:00	49.2697	-128.7210	00:49	49.3356	-128.7633
0101_2025_233_0120	Transit L312 to L321	2025-08-21T01:20	49.3341	-128.7748	02:43	49.3253	-129.1096
0102_2025_233_0323	Transit L321 to L314	2025-08-21T03:23	49.3197	-129.1191	05:23	49.1426	-129.5461
0103_2025_233_0621	Transit L314 to L317	2025-08-21T06:21	49.1328	-129.5082	07:47	49.0233	-129.1632
0104_2025_233_0834	Transit L317 to L316	2025-08-21T08:34	49.0029	-129.1714	10:05	48.7550	-129.3527
0105_2025_233_1047	Transit L316 to L305	2025-08-21T10:47	48.7544	-129.3386	13:56	48.8177	-128.8147
0106_2025_233_1428	Transit L305 to L313	2025-08-21T14:28	48.8169	-128.8115	16:00	48.5493	-128.7979
0107_2025_233_1622	Transit L313 to L320	2025-08-21T16:22	48.5463	-128.7952	19:11	48.6934	-128.2194
0108_2025_233_2241	Transit L320 to L319	2025-08-21T22:41	48.6940	-128.2179	23:59	48.9063	-128.2119

Table 12 (continued). Description of CHIRP data.

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0109_2025_234_0000	Continuing transit L320 to L319	2025-08-22T00:00	48.9073	-128.2118	01:20	49.1219	-128.2030
0110_2025_234_0349	Transit L319 to L318	2025-08-22T02:49	49.1228	-128.2006	05:21	49.0426	-128.5862
0111_2025_234_0609	Transit L318 to L305	2025-08-22T06:09	49.0289	-128.6030	07:34	48.8199	-128.8134
0112_2025_234_0847	Transit L305 to L313	2025-08-22T08:47	48.7594	-128.7914	10:10	48.5457	-128.7965
0113_2025_234_1047	Transit L313 to N218	2025-08-22T10:47	48.5453	-128.8033	14:03	48.0720	-129.1074
0114_2025_234_1432	Transit N218 to N217	2025-08-22T14:32	48.0658	-129.1026	14:47	48.0451	-129.0704
0115_2025_234_1521	Transit N217 to N207	2025-08-22T15:22	48.0447	-129.0740	16:10	47.9002	-129.0867
0116_2025_234_1649	Long transit to Esperanza Inlet	2025-08-22T16:49	47.8959	-129.0938	21:00	48.4788	-128.4744
0117_2025_234_2100	Continue transit to Esperanza Inlet	2025-08-22T21:00	48.4791	-128.4740	23:59	48.8805	-128.0575
0118_2025_235_0000	Continue transit to Esperanza Inlet; up-slope	2025-08-23T00:00	48.8812	-128.0567	05:26	49.5829	-127.3004
0119_2025_235_0528	Continue transit to Esperanza Inlet; Shelf	2025-08-23T05:29	49.5872	-127.2952	06:50	49.7632	-127.1120
0120_2025_235_0653	Entry into Esperanza Inlet	2025-08-23T06:53	49.7678	-127.0990	08:30	49.8568	-126.8987
0121_2025_235_0834	Exit from Esperanza Inlet	2025-08-23T08:34	49.8591	-126.8983	08:59	49.8883	-126.9270
0122_2025_235_0903	Transit to fault W of Nootka Is.	2025-08-23T09:03	49.8914	-126.9267	10:53	49.6695	-126.9898
0123_2025_235_1054	Crossing fault W of Nootka Is.	2025-08-23T10:54	49.6693	-126.9895	11:23	49.6482	-126.9240
0124_2025_235_1236	Nootka Sound Entrance Line 1 (SW-NE)	2025-08-23T12:36	49.5501	-126.7112	13:39	49.5995	-126.5907
0125_2025_235_1353	Nootka Sound Entrance Line 2 (NE-SW)	2025-08-23T13:53	49.5840	-126.6041	14:27	49.5438	-126.6606
0126_2025_235_1436	Nootka Sound Entrance Line 3 (SW-NE)	2025-08-23T14:36	49.5344	-126.6463	15:17	49.5775	-126.5913
0127_2025_235_2225	Up Tahsis Inlet	2025-08-23T22:25	49.6091	-126.5950	23:59	49.7444	-126.6285
0128_2025_236_0000	Down Tahsis Inlet; Nootka Sound	2025-08-24T00:00	49.7447	-126.6286	02:22	49.5818	-126.5887
0129_2025_236_0222	Nootka Sound; Hesquiat Peninsula	2025-08-24T02:22	49.5816	-126.5889	03:07	49.5274	-126.6229
0130_2025_236_0354	Nootka Sound Entrance Line 4 (NE-SW)	2025-08-24T03:55	49.5986	-126.5782	05:07	49.5274	-126.6229
0131_2025_236_0514	Leaving Nootka Sound	2025-08-24T05:14	49.5150	-126.6227	05:37	49.4770	-126.6203
0132_2025_236_0607	Short line; poor data quality	2025-08-24T06:07	49.4727	-126.6796	06:13	49.4668	-126.6925
0133_2025_236_0614	Transit to potential fault W of Flores Is.	2025-08-24T06:14	49.4667	-126.6928	08:18	49.3386	-126.5541
0134_2025_236_0906	Potential fault W of Flores Line 1 (SW-NE)	2025-08-24T09:06	49.3351	-126.4396	09:28	49.3672	-126.4142

Table 12 (continued). Description of CHIRP data .

Profile Name	Description	Start			End		
		Time (UTC)	Latitude	Longitude	Time	Latitude	Longitude
0135_2025_236_0937	Potential fault W of Flores Line 2 (NE-SW)	2025-08-24T09:37	49.3638	-126.3900	10:00	49.3313	-126.4175
0136_2025_236_1013	Potential fault W of Flores Line 3 (SW-NE)	2025-08-24T10:13	49.3251	-126.3946	10:35	49.3560	-126.3739
0137_2025_236_1048	Potential fault W of Flores Line 4 (NE-SW)	2025-08-24T10:48	49.3477	-126.3471	11:07	49.3203	-126.3641
0138_2025_236_1118	Potential fault W of Flores Line 5 (SW-NE)	2025-08-24T11:18	49.3142	-126.3419	11:40	49.3410	-126.3211
0139_2025_236_1151	Potential fault W of Flores Line 6 (NE-SW)	2025-08-24T11:51	49.3331	-126.2999	12:12	49.3036	-126.3163
0140_2025_236_1229	Potential fault W of Flores Line 8 (SW-NE)	2025-08-24T12:29	49.2952	-126.2785	12:57	49.3284	-126.2801
0141_2025_236_1306	Potential fault W of Flores Line 7 (NE-SW)	2025-08-24T13:06	49.3142	-126.2894	13:13	49.3041	-126.2948
0142_2025_236_1313	Transit to continuation of potential fault S of Flores	2025-08-24T13:13	49.3039	-126.2949	13:22	49.2988	-126.2798
0143_2025_236_1322	Potential fault S of Flores Line 1 (SW-NE); shallow water	2025-08-24T13:22	49.2987	-126.2794	13:39	49.3140	-126.2576
0144_2025_236_1345	Potential fault S of Flores Line 1 (NE-SW); shallow water	2025-08-24T13:45	49.3079	-126.2551	16:15	49.2329	-126.1159
0145_2025_236_1707	Transit SE to Juan de Fuca strait	2025-08-24T17:07	49.1580	-126.2459	22:09	48.5719	-125.3020

5 Discussion and Next Steps

Overall, this August 2025 cruise for PACSAFE and Endeavour OBS projects went quite smoothly. All 21 PACSAFE OBS and 5 Endeavour OBS that were deployed, excluding the two PACSAFE OBS that surfaced prematurely, were successfully recovered and appear to have high data quality. Three of the 26 OBS recovered were found to be unfit for redeployment, which is a fairly typical ratio when compared to previous NFSI OBS deployments. Two of the 41 OBS deployed surfaced prematurely (as of the time of writing), both from the Endeavour project, which is a normal ratio compared to previous deployments. Three of the PACSAFE deployments (L301, L319, L320) had severe acoustic-communication issues and it is possible they are not operating properly. That will likely only be determined when attempting to recover them in summer 2026. The other 36 OBS deployed (18 per project) were robustly positioned with the USBL.

We had relatively little time lost to weather or mechanical issues on this cruise, and ended up with time to devote to collecting CHIRP data after the OBS work was complete. In addition to having long periods of calm seas, we were also consistently able to perform OBS operations in 2-3 m seas, which had not always been the case on previous cruises. This cruise was also the first time that the USBL was routinely used to position OBS, due to the new winch and the CCGS accommodating its deployment at night (i.e. without a bosun present). We estimate an average positioning time of 35-40 min with the USBL, including time to lower and raise the USBL pole, vs. closer to 60 min with the dunker. The total time saved is complicated to estimate due to the limited OBS work we could accomplish at night, but this was certainly a significant time savings.

The PACSAFE Leg 3 OBS array used a much coarser station-spacing than previous legs, on the order of 35 km, vs. roughly 25 km for Leg 2 and <20 km for Leg 1. This will limit the ability to resolve smaller earthquakes and contribute to high uncertainties on hypocentral depths for many locations. However, it allowed the array to cover many targets of interest including the SFZ, the southern NFZ, and the EXR. The array kept a bit tighter OBS-spacing at the northern EXR where it is highly segmented just south of the RDF-intersection; this region has been observed to be extremely seismically active in the PACSAFE Leg 1 data. We also opted for a closer station-spacing around the Albatross Fault Zone, a left-lateral transform sub-parallel to the EXR and NFZ ([Littel et al., 2023](#)) that appears as a prominent lineation of earthquakes between L312 and L321 in Figure 6. PACSAFE Leg 3 data should allow a much more precise resolution of these features via earthquake hypocenters, and its wide footprint facilitates a variety of tomographic options to study the Explorer Microplate.

In contrast to the coarse PACSAFE Leg 3 array, the Endeavour Leg 2 deployments are easily the densest NFSI/GSC OBS deployment to date, with station spacings on the order of 5 km (for the 16 inner-cluster OBS). This dense spacing is necessary to allow for depth-resolution of earthquakes in the region, given their limited depth-extent in the newly formed, hot oceanic lithosphere. At the time of writing (October 2025), earthquake-rates have been trending downwards through 2025 from the very high rates seen in 2024 (Figure 10). Although we are hoping for further swarms with 1000s of earthquakes per month (like those in March 2024 and July 2024) to occur during this OBS deployment, there were still over 400 earthquakes in the September 2025 ONC catalog. Data from OBS deployed on this cruise will provide even higher detection capability and allow for more precise hypocenters and faulting mechanisms, which provides an exciting opportunity to study the mechanics of the rifting cycle.

We expect the 2026 PACSAFE and Endeavour OBS operations to occur on separate cruises. The PACSAFE project has again applied to use the Tully, but scheduling has not yet occurred as of writing. Due to uncertainties in the PACSAFE-project funding structure, it is yet to be determined whether the 2026 PACSAFE cruise will involve redeployment of OBS, or if it will be a recovery-only cruise. If funding allows, the intention is to redeploy OBS over the northern QCF. The Endeavour OBS are expected to be recovered using a UNOLS vessel, funded by the NSF proposal (PI Wilcock), and that cruise should see redeployment of five OBS for the following year.

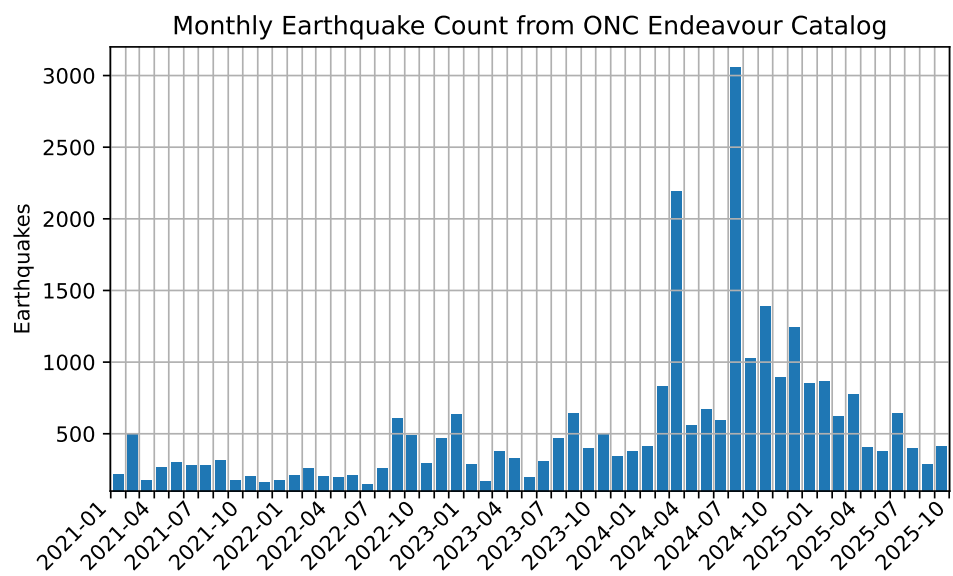


Figure 10. Monthly earthquake counts in ONC Endeavour Earthquake Catalog, based on NEPTUNE cabled OBS data, from January 2021 to September 2025.

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Appendix A1: Equipment Specifications

Ocean-bottom seismometers (OBS)

The OBS used for both the PACSAFE and Endeavour projects are owned and managed by the National Facility for Seismological Investigations (NFSI) at Dalhousie University, which stems from a \$15M grant from the Canadian Foundation for Innovation. The OBS are a new model, *Aquarius*, manufactured by Güralp Systems Ltd. The unit contains a three-component broadband seismometer, sampled at 250 sps, as well as a magnetometer (to assess instrument orientation), micro-electromechanical system (MEMS) accelerometer (to assess instrument tilt) and further supplementary sensors for temperature, humidity, absolute pressure, and supply voltage. The Aquarius can optionally have an external hydrophone mounted, but these were not included in the PACSAFE or Endeavour deployments.

The main electronic housing is a pressure case made of 7000 series rolled aluminum, which is rated for depths up to 6000 m. This housing contains sensors and data acquisition circuitry powered by rechargeable lithium-ion batteries that can power ~15 months of seafloor data acquisition and an 6 additional months of hibernation. Under normal operations, the instruments are recovered by sending an acoustic signal to trigger current through a burn-wire which then releases the OBS from steel anchors, but burn-wire can also be triggered by a backup timer or critical battery level. An image of an Aquarius is shown in Figure A1 and further specifications are listed in Table A1.

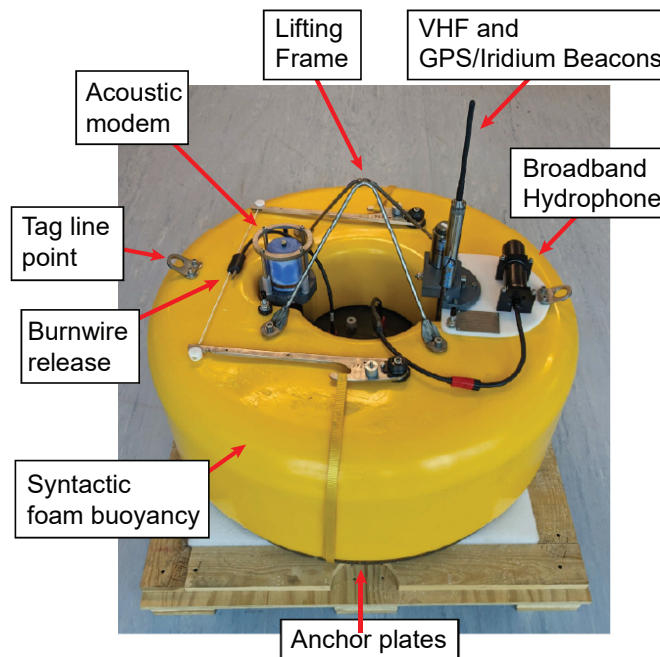


Figure A1. Güralp Aquarius OBS in the lab.

Table A1. Güralp Aquarius OBS specifications, reflecting NFSI customizations.

Feature	Specification
Seismic sensor	• Broadband triaxial force-feedback sensor • 250 samples per second • Flat response from 120 s to 100 Hz • Nominal velocity response 2000 V/ms⁻¹ • Tilt tolerance $\pm 90^\circ$
Absolute Pressure Gauge	• Keller PA-10L. Accuracy 0.25%
Hydrophone	<i>Not available for the PACSAFE and Endeavour projects.</i> • High Tech HTI-04-PCA/ULF • 100 samples per second • Passband 100 s to 8 kHz; Sensitivity -194 dB re: 1V/μPa
Additional Channels & State of Health	• Three-component digital compass with MEMS accelerometer and magnetometer • Temperature, humidity, and supply voltage sensors
Data Logger	• Güralp Ultra-Low Power Digitizer board with Certimus computer
Data Storage & Recording formats	• 128 GB dual redundant flash cards • Data stored in miniSEED format • Metadata stored in dataless SEED, RESP, and StationXML format
ADC & Sample Rates	• 24-bit low power 4-channel delta-sigma • Sample rate typically 250 Hz for seismic channels and 5 Hz for auxiliary sensors
Clock	• Double-compensated microprocessor-controlled VCXO • Locked to GPS time before each deployment • Uncorrected drift typically < 1 ms/day • Linear drift correction applied post-deployment
Power	• Lithium-Ion battery packs: 468 LG INR 18650 MJ1 cells • Total energy: 5954 Wh $\rightarrow$ autonomy of 15–18 months depending on application • Charge time approx. 1 hr/month of deployment
Acoustic Communication	• Sonardyne 6G LMF omnidirectional transceiver • Used with surface transponder or USBL systems • Communication rates up to 9000 bps
Release Mechanism	• Burnwire triggered by acoustic command, timed release, or critical battery level
Recovery Tracking Beacons	• Xeos Apollo Mono Iridium GPS LED Flasher beacon • Xeos XMB-11K VHF beacon

Table A1 (continued).

Feature	Specification
Pressure Case	• 7000 series rolled aluminium, anodized • Pressure rated to 6000 m • Weight: 89 kg in air; 44.6 kg in seawater
Syntactic Foam Flotation	• Weight: 150 kg in air; 86 kg uplift in seawater
Ballast	• Two 12.70-m-thick steel plates per OBS (44W soft steel) • Weight: 89 kg in air, 77.4 kg in seawater (total, for the two plates)
Full Dimensions with Flotation and Ballast	• 1000 mm diameter cylinder • Height to top of buoyancy: 459 mm • Height to top of lifting frame: 725 mm
Full Instrument Weight / Buoyancy	• Air weight: 239 kg instrument + 89 kg ballast = 328 kg • In-water weight: $44.6 + 77.4 - 86 = 36$ kg • Buoyancy without ballast: $86 - 44.6 = 41.4$ kg
Sink/Rise Rate	• Sink rate 0.6 m/s, Rise rate 1.5 m/s

USBL Pole and Directional Dunker

Two independent acoustic systems were used for locating and communicating with OBS instruments deployed on the seafloor: (1) a Directional Dunker (Sonardyne Modem 6 Mini-Dunker LBL and Telemetry Transceiver System Type 8244-3156), and (2) an Ultra-Short Baseline (USBL) system (Sonardyne LMF Ranger 2 Type 8084 Gyro Ultra-Short Baseline 7000 Positioning System).

The Directional Dunker is lowered by hand over the side of the vessel via a ruggedized cable. It is nominally able to communicate with instruments to depths of 6000m. It works as an acoustic modem to communicate with instruments on the seafloor or in the water column and can provide range measurements but not direction. For determining the location of an OBS on the seafloor using the dunker, we conducted acoustic triangulation surveys by moving the ship to 3–4 measurement points at a distance of between approximately 1/3 to 1/2 of the water depth, measured horizontally from the estimated seafloor location (or drop location) to the ship.

The USBL system combines a 6th generation directional High-Performance Transceiver (HPT) and a Lodestar Attitude and Heading Reference System / Inertial Navigation System in the same housing. With the mechanical alignment of the Attitude and Heading Reference System fixed relative to the HPT's acoustic array, the requirement for a total system calibration to determine the alignment of the ship's motion sensors to the transceiver is, in many situations, eliminated. The LMF 7000 model is optimized for deep water. The system comes with a Navigation Computer which runs the Ranger 2 software application. For this cruise, the GyroUSBL was mounted on a pivoting pole over the port side of the ship. The pole was retracted during transits and deployed during operations to communicate with the instrument. For location surveys using the USBL, the ship is asked to move along an L-shaped or semi-circular transit route centred around the estimated seafloor location (or drop location) of the seafloor instrument, with the radius being 1/3 to 1/2 of the water depth.

Knudsen CHIRP 3260 echosounder

Echosounder surveys were conducted with a Knudsen CHIRP 3260 3.5 kHz sub-bottom profiler attached to the hull of this ship (generally just referred to as CHIRP in this report). The CHIRP was typically run on any transect between stations unless the data quality was deemed too poor for it to be worthwhile, which generally occurred when the sea state was very rough, when we were transiting at 10 knots (full speed), and/or when the seafloor was rocky and rough. It was also turned off during acoustic communication with the OBS and when marine mammals were spotted within 1 km of the ship. Dedicated tracklines for CHIRP data were sometimes run, particularly at night when there was no OBS positioning to do in the region. The Tully is also equipped with a Simrad EK80 split-beam 18 kHz echosounder for water column and bathymetry data, but that was not functional for this cruise.

Appendix A2: Daily Weather Summary

Table A2. Daily weather observations, including Tully wheelhouse log notes for August 5–23; the reported air temperatures, visibilities, weather codes, and sea states are as recorded at noon, or at the record closest to noon.

Date	First Daytime Station	Air Temp.	Visibility	Weather	Sea State (m)
05	IOS (Loading)	15°C	>20 km (98)	Clear (02)	–
06	IOS (Transit)	16°C	4-10 km (96)	Raining overnight; sunny by evening (20)	1
07	Transit	16°C	>20 km (98)	Calm sunny day (02)	1-2
08	N212	17°C	>20 km (98)	Some rain overnight. Calm, overcast day (02)	1
09	N205	16°C	>20 km (98)	Variable skies with some sun throughout day (02)	1
10	N217	17°C	>20 km (98)	Overcast, strong winds (> 20 kn), waves increasing over the day, reaching 3-4 m at 20h00 (01)	1-2
11	L201	16°C	200-500 m (92)	Overcast overnight but clear at sunrise, then foggy midday (45)	2
12	L220	15°C	>20 km (98)	Fog before dawn, then clear skies from early morning to night (02)	2
13	L224	14°C	>20 km (98)	Mainly sunny in the morning, but heavily clouded by sunset (02)	1
14	L212A	14°C	2-4 km (95)	Overcast with light rain off and on all day (51)	1
15	L225A	15°C	>20 km (98)	Cloud cover building throughout day, high winds, choppy seas (01)	2
16	L204A	16°C	>20 km (98)	Skies cleared late morning, clouded over again and drizzled in the evening (02)	3-5
17	L204A	14°C	>20 km (98)	Overcast with showers off and on all day (50)	1-2
18	L308	15°C	>20 km (98)	Raining off and on in the morning, hard at times (60)	1-2
19	L309	16°C	>20 km (98)	Scattered clouds, seas calming (01)	1
20	L316	18°C	>50 km (99)	Clear blue sky, calm (01)	1
21	L305	16°C	>20 km (98)	Partial cloud off-and-on, glassy calm seas (02)	< 1
22	N218	17°C	>20 km (98)	Overcast in morning, clearing throughout day (02)	< 1
23	Nootka Sound	18°C	>20 km (98)	Warm, clear skies (01)	1
24	Flores Island			Sunny and warm, with calm seas	
25	IOS			Hot and sunny with little wind	
26	IOS			Continued hot, sunny, calm	

Appendix A3: Biological Material Retrieved from OBS Deployments

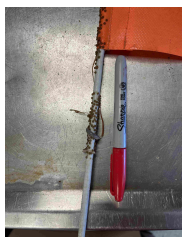
A range of biological material was incidentally retrieved from Ocean Bottom Seismometers (OBS) recovered during the PACSAFE cruise, including several from within Marine Protected Areas (MPAs). Given the sensitivity of these regions, systematic documentation of all retrieved material, including photographs, measurements, and metadata such as latitude, longitude, recovery depth, and instrument identification, was prioritized to ensure traceability and compliance with MPA data standards. Detailed recording is essential for understanding potential ecological interactions between deployed instruments and benthic organisms, particularly where repeated observations may indicate behavioural or habitat preferences.

The most common and notable material consisted of gelatinous, egg-like aggregates observed on nearly all recovered OBS units. These were most frequently attached to the fiberglass identification flags and, less commonly, to the VHF beacon housings. The clusters typically occurred in vertical chains of one to eight eggs and exhibited a gradational colour spectrum from milky white through pale yellow to brown, suggesting a range of developmental stages. Several clusters displayed ocular-like pigmentation patterns consistent with early embryonic differentiation typical of fish egg masses, likely from the family *Liparidae* (snailfishes), as preliminarily noted by DFO experts.

Three representative clusters were sampled from one recovery location (L219) on the 12th August to capture the observed gradational differences. These samples were initially double-bagged and stored at -80°C aboard ship for preservation. Upon arrival at the Institute of Ocean Sciences (IOS), they were transferred under the supervision of DFO personnel for long-term storage and processing. Subsamples were preserved in 95% ethanol (duplicates prepared, with one retained as a reference at IOS and the other designated for genetic analysis at the Hakai Institute). An additional portion was preserved in 75% ethanol to maintain morphological integrity, while the remainder was kept frozen at -80°C . This split-preservation strategy was selected to maximize potential for both molecular and morphological analyses.

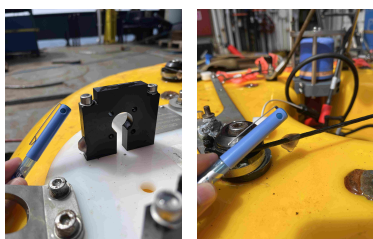
At present, the subsamples are stored alongside other biological tissue samples collected by DFO in September 2025, pending shipment for genetic sequencing. Preliminary species identification will rely on DNA barcoding at Hakai, with morphological reference material archived at IOS. No additional analyses are currently planned for the remaining frozen material, though they have been retained to support any future investigations relevant to the marine ecosystem monitoring or potential ecological interactions associated with seafloor instrumentation.

Table A3. Observed biological material attached to OBS recovered from the ThT Marine Protected Area. Note that N219 surfaced 67 minutes after deployment and did not reach the seafloor. Dates refer to when the OBS was recovered, in local time (PDT).



Station N102. Small, amber-brown spherical egg masses attached in dense clusters along the OBS flag rod, likely representing early-stage benthic fish eggs.

Date and Time	2025-08-08 17:56
Latitude	47.9998
Longitude	-129.1182
Depth (m)	2329



Station N105. Single gelatinous egg capsule attached to the OBS recovery line and instrument bracket.

Date and Time	2025-08-09 13:18
Latitude	47.6789
Longitude	-128.8783
Depth (m)	2650



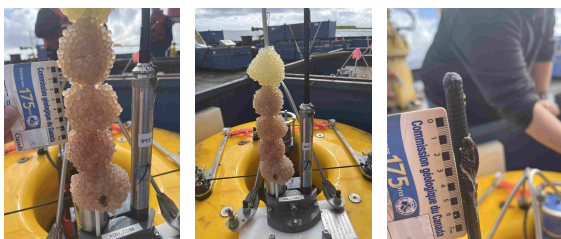
Station L223. Large vertical cluster of pale, translucent fish-egg masses attached to the OBS rod.

Date and Time	2025-08-11 18:53
Latitude	50.8220
Longitude	-130.3118
Depth (m)	1897



Station L204A. Clusters of translucent, developing fish eggs—some with visible embryonic eyes.

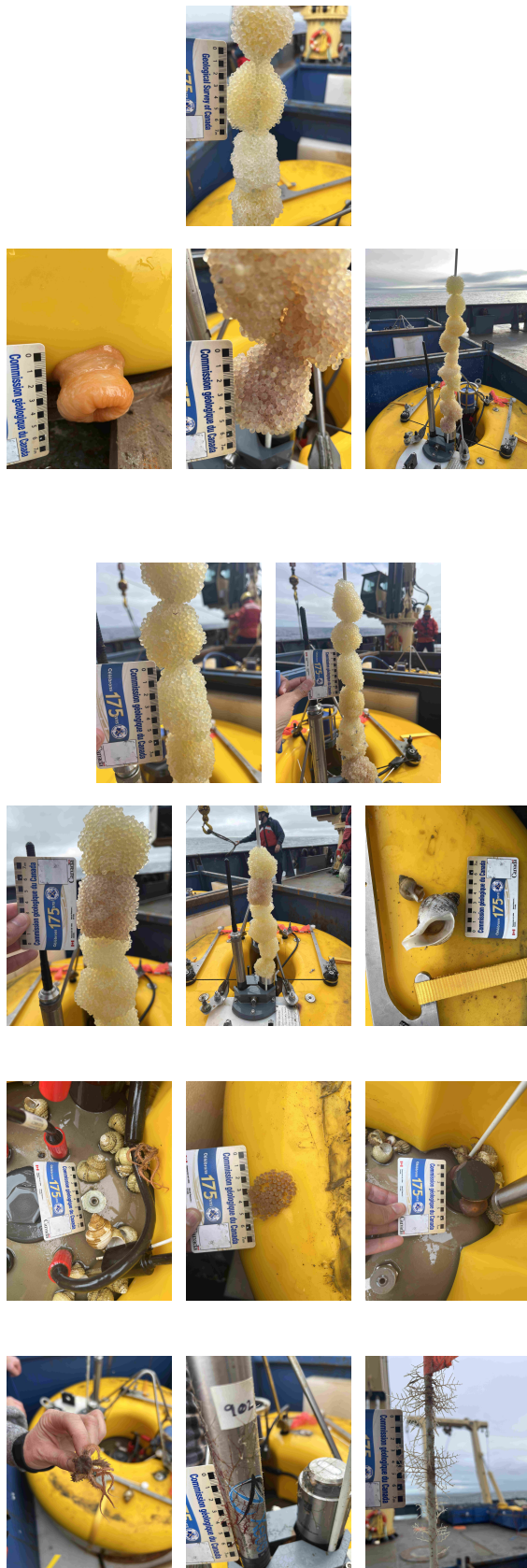
Date and Time	2025-08-17 07:27
Latitude	51.0128
Longitude	-131.0006
Depth (m)	2468



Station L203B. Multi-lobed clusters of translucent fish eggs in varying developmental stages—including some with visible eyes—attached to the OBS rods and components, along with occasional individual egg capsules.

Date and Time	2025-08-17 10:37
Latitude	50.937
Longitude	-130.720
Depth (m)	2379

Table A4. Observed biological material attached to OBS recovered from outside the ThT Marine Protected Area. Dates refer to when the OBS was recovered, in local time (PDT).



Station L201. Large pale clusters of tightly packed translucent fish eggs attached in multiple lobes along the OBS rod.

Date and Time	2025-08-11 15:46
Latitude	50.8220
Longitude	-130.3118
Depth (m)	1897

Station L217A. Large multi-lobed clusters of translucent fish eggs at varying developmental stages attached along the OBS rod, with an additional soft orange benthic organism adhered to the instrument body.

Date and Time	2025-08-12 18:54
Latitude	51.5692
Longitude	-130.8445
Depth (m)	2007

Station L218. Pale multi-lobed clusters of tightly packed translucent fish eggs attached vertically along the OBS rod.

Date and Time	2025-08-12 13:10
Latitude	51.3450
Longitude	-130.5863
Depth (m)	1943

Station L219. Multi-lobed clusters of pale to pinkish translucent fish eggs attached vertically along the OBS rod, accompanied by a detached gastropod shell found on the instrument.

Date and Time	2025-08-12 11:00
Latitude	51.1621
Longitude	-130.5995
Depth (m)	2028

Station L222. Small clusters of pinkish-brown fish eggs adhered to the OBS float, accompanied by several gastropod shells and a brittle star recovered from the instrument well.

Date and Time	2025-08-12 16:25
Latitude	51.5866
Longitude	-130.4554
Depth (m)	508

Station L222. A brittle star, fine red filamentous growth on instrument surfaces, and branching white hydroid colonies attached to the OBS components.

Date and Time	2025-08-12 16:25
Latitude	51.5866
Longitude	-130.4554
Depth (m)	508



Station L224. Small stalked tunicates attached along the OBS rods, accompanied by clusters of pale egg masses lower on the frame.

Date and Time	2025-08-13 08:06
Latitude	51.3375
Longitude	-130.8697
Depth (m)	2239



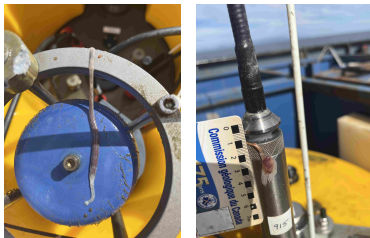
Station L207. Clusters of translucent yellow egg masses attached to the OBS mast, with a few slender brown polychaete worms and a large whelk shell found inside the float well.

Date and Time	2025-08-13 10:39
Latitude	51.4246
Longitude	-131.2254
Depth (m)	2415



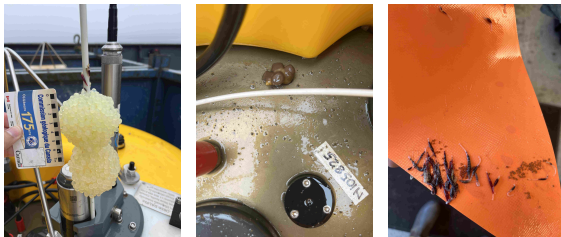
Station L209. Large clusters of yellow-to-amber egg clusters covering the OBS mast.

Date and Time	2025-08-13 13:44
Latitude	51.6898
Longitude	-131.4859
Depth (m)	1962



Station L215B. Small parasitic copepod-like animal and an elongate gelatinous ribbon-worm-type organism attached to the OBS frame.

Date and Time	2025-08-13 16:23
Latitude	51.9520
Longitude	-131.3372
Depth (m)	1557



Station L211. Small brown egg cluster on the OBS float, assorted worms and tiny egg masses on an orange sheet, and pale clustered egg sacs attached to the OBS recovery flagpole.

Date and Time	2025-08-14 10:46
Latitude	52.0038
Longitude	-131.9967
Depth (m)	2448



Station L210. Pale yellow clustered egg masses attached to the OBS flagpole near instrument housing.

Date and Time	2025-08-14 14:06
Latitude	51.7403
Longitude	-131.8658
Depth (m)	2330



Station L208. A tiny deep-sea crab and various invertebrate larvae were found attached to the OBS alongside multiple dense clusters of gelatinous egg masses.

Date and Time	2025-08-14 17:39
Latitude	51.4825
Longitude	-131.5055
Depth (m)	2374



Station L206B. A small patch of mixed invertebrate larvae and egg debris was stuck along the OBS flag pole.

Date and Time	2025-08-15 10:52
Latitude	51.1795
Longitude	-131.2267
Depth (m)	2488