OPENOCEAN
ROBOTICS

Uncrewed Surface Vehicles (USVs) for Shipping Risk Mitigation

Fritz Stahr, Ph.D.
Chief Technology Officer

FRITZ@OPENOCEANROBOTICS.COM

Crewed ships collecting ocean data are . . .

$50 - $100K/day Operational Expenses
$30M+ CAPEX

80% of the ocean is unmapped and unobserved

EXPENSIVE

Ships cost $50-100K per day to operate and $30M+ to build, and are in limited supply

DIFFICULT

Scheduling ships and people is difficult and costly

POLLUTING

Single ship emits 2,400 tonnes of greenhouse gases per year (same ~500 automobiles) and emits as much sound underwater as a rock concert

OPENOCEAN ROBOTICS

OPENOCEAN
ROBOTICS

Better data collection
for better decision making

Reduced OPEX
Reduced CAPEX

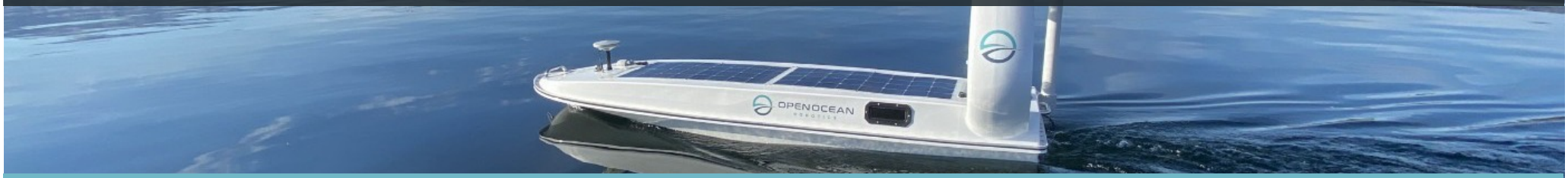
Open Ocean Robotics provides real-time ocean data collection and analysis using our proprietary solar powered uncrewed surface vehicles (USVs) to enable customers to more affordably, safely, and sustainably operate in the ocean environment.

Affordable
Our services are 95% cheaper than using a crewed ship.

Scalable
Uncrewed boats increase operational availability via remote piloting

Sustainable
Our USVs produce no greenhouse gases, no noise pollution, and no risk of oil spill

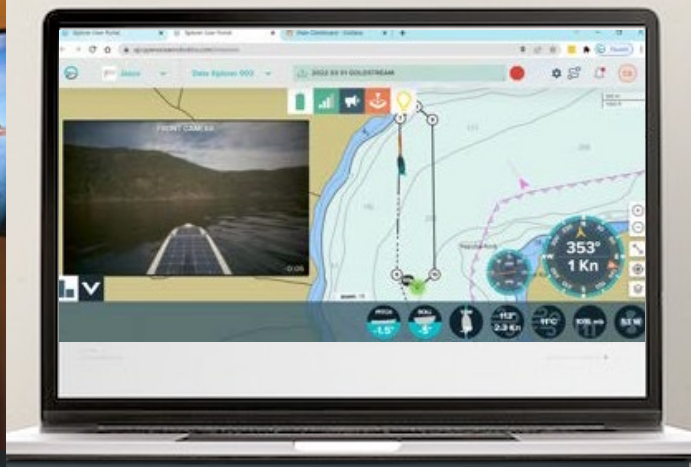
Ocean Data Services and USV Products



Your choice for Contractor-Owned-Contractor-Operated, or DataXplorer and XplorerView purchase & license.

Custom sensor integration available

Operate, view, and store, marine data



Plan & execute multiple missions

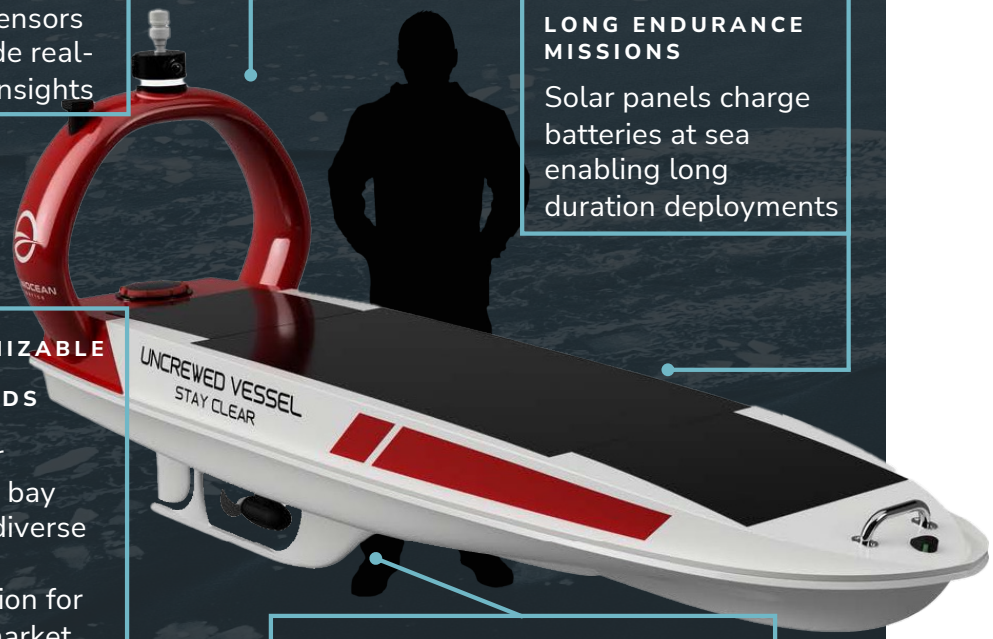
OPENOCEAN

DATAXPLORER™

CAMERAS & SENSORS
360° cameras and sensors provide real-time insights

PATENTED SELF-RIGHTING SYSTEM
High sea-state and surf-zone capable

LONG ENDURANCE MISSIONS
Solar panels charge batteries at sea enabling long duration deployments



CUSTOMIZABLE SENSOR PAYLOADS
Modular payload bay allows diverse sensor integration for broad market needs

SHALLOW WATER CAPABLE
Shallow draft and debris- shedding keel enable use in limited depth waters

BENEFITS

BEYOND THE HORIZON CONTROL
Satellite, cellular, or radio communications with real-time data delivery

QUIET & LOW PROFILE
Electric motor for optimal data collection and minimal environmental impact

EASY LOGISTICS
Shore or ship deployable, easy trailer or container transport

WATCH DATAXPLORER ON THE WATER

OPENOCEAN ROBOTICS

DataXplorer™ Models

DX MODEL	SENSORS	APPLICATIONS
BASELINE 	**CORE SENSORS** 360° Vis & LWIR camera, AIS transceiver Wind speed & direction, air temp & pressure Water depth, temperature & speed, single beam sonar	Maritime situational awareness Ship detection & monitoring Bathymetric mapping Weather monitoring
SECURITY 	**ADD-ON SENSORS** Multibeam and Side scan sonar Towed passive acoustic array & processing	Maritime intelligence, surveillance & reconnaissance (ISR) Illegal fishing detection and monitoring Border security and patrol
ENVIRONMENT 	**ADD-ON SENSORS** Profiling sensors for temperature, salinity, dissolved oxygen, Chlorophyll A, pCO_2, turbidity, pH Attached sensors for eDNA, hydrophones, ADCP	Scientific research and ecosystem monitoring Currents & marine mammal detection

DataXplorer Technical Specifications	
Length	3.6 meters (11.8 ft.)
Beam	0.9 meters (2.9 ft.)
Draft	0.5 meters (1.5 ft.)
Height (abv WL)	1.3 meters (4.3 ft.)
Dry weight*	132 kg (291 lbs)
Payload weight	65 kg (144 lbs)
Hull material	Fiberglass composite
Communications	Satellite, cellular, radio
Solar power	300 watts
Batteries	10.5 kWh (*dry weight above), 17.5 kWh opt.
Sensor spaces	Under- & in-hull, in air
Propulsion	Electric motor-pod
Speed through water	6 kts max., 2 kts cruise
Mission duration	>1 month, depending on solar input
Sea state & wind	Up to force 10 storm conditions
Deployment	Ramp, beach, ship

Environmental Monitoring

OUR SOLUTION

USV(s) equipped with:

- Base sensors (360° optical cameras, LWIR camera, AIS transceiver, weather station, water temp, speed, & depth sensor)
- Range of optional environmental sensors (temp, salinity, turbidity, chlorophyll, pH, pCO_2, / ADCP / eDNA / echosounders / hydrophones)

VALUE PROPOSITION

- More affordable, safer, and less environmental impact than ships or aircraft
- Able to monitor persistently for extended time periods
- Suitable for high sea-states and shallow waters
- Provides reliable data collection for decision making and impact and/or trend assessments

CUSTOMERS

- Transportation & Port Authorities
- Environmental Agencies
- Offshore & Renewable Energy Companies
- Marine Carbon Dioxide Removal (mCDR)
- Fisheries Agencies
- Research Institutions

OPENOCEAN ROBOTICS

Bathymetric Mapping

OUR SOLUTION

USV(s) equipped with:

- Base sensors (360° optical cameras, LWIR camera, AIS transceiver, weather station, water temp, speed, & depth sensor)
- Multibeam sonar, sidescan sonar, echosounder, imaging
- Provides customer with near real time acoustic and visual data for decision making, charting and disaster response

VALUE PROPOSITION

- More affordable, safer, and less environmental impact than ships or aircraft
- Able to monitor persistently for extended time periods
- Suitable for high sea-states and shallow waters

CUSTOMERS

- Transportation & Port Authorities
- Offshore & Renewable Energy Companies
- Marine Protected Areas Stakeholders
- Navies
- Fisheries Department

OPENOCEAN ROBOTICS

Defence & Security

OUR SOLUTION

USV(s) equipped with:

- Base sensors (360° optical cameras, LWIR camera, AIS transceiver, weather station, water temp, speed, & depth sensor)
- Optional vessel detection algorithms, passive acoustic monitoring system, radar and/or sonar systems
- Provides customer with near real time acoustic and visual data for decision making, action, and potential prosecution

VALUE PROPOSITION

- More affordable, safer, and less environmental impact than ships or aircraft
- Able to monitor persistently for extended time periods
- Suitable for high sea-states and shallow waters

CUSTOMERS

- Transportation & Port Authorities
- Navies
- Fisheries Agencies
- Marine Protected Area Stakeholders

OPENOCEAN ROBOTICS

PROJECT: PROTECTING ENDANGERED SOUTHERN RESIDENT KILLER WHALES

KEY OBJECTIVES:

- Real time detection of marine mammals
- Evaluate ability conduct acoustic mission while detecting other vessels and collecting ocean and atmospheric data
- Multiple data stream comparisons & analysis
- Evaluate and minimize USV self-noise

PROJECT SUPPORT:

- Dept. of Fisheries & Oceans (DFO) Canada Ecosystems and Oceans Science Contribution Framework
- Grant period: August 2021 - March 2023

OPENOCEAN
ROBOTICS

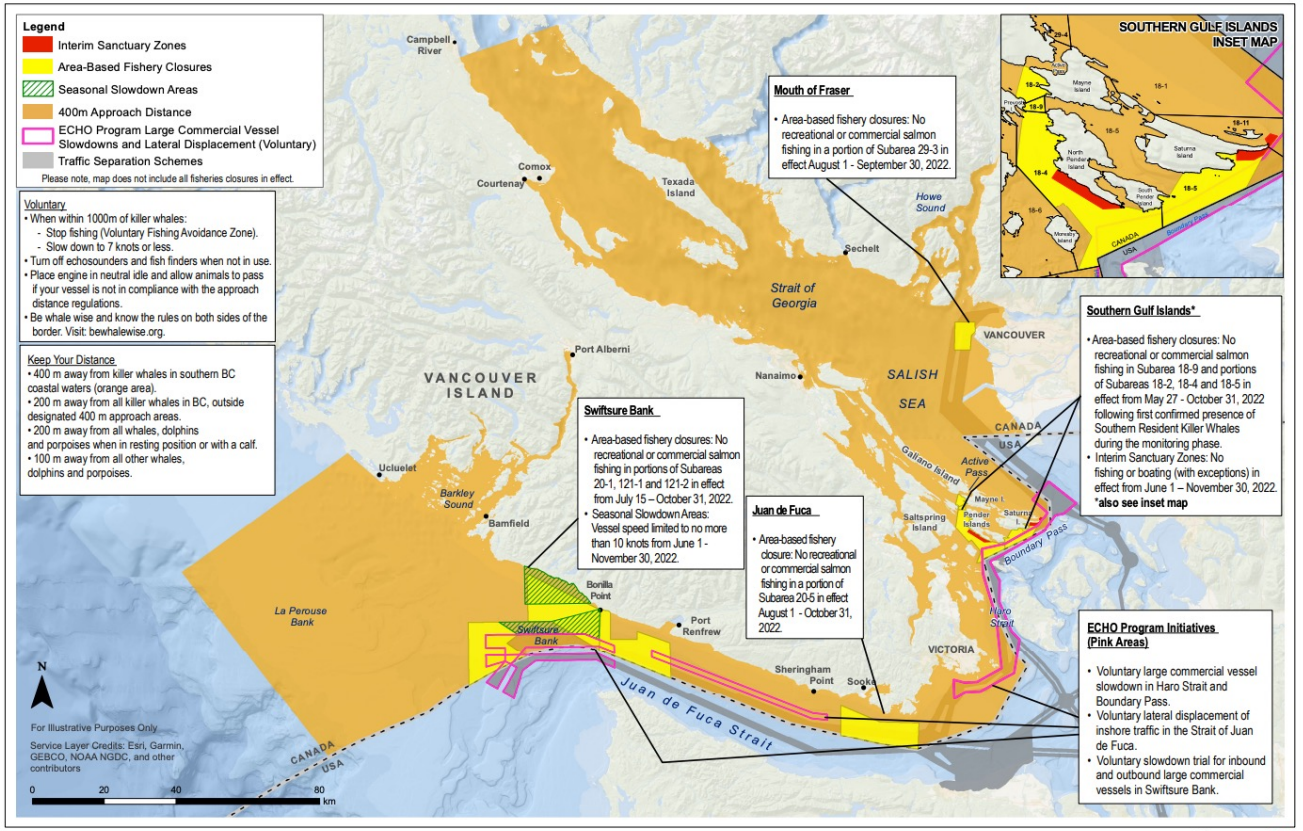
PROJECT BACKGROUND – INTERIM SANCTUARY ZONES (ISZs)

THREATS TO SRKW:

- Increased noise exposure impacts hearing, communication, and foraging
- Overfishing in critical habitat

SOLUTION:

- Interim Sanctuary Zones (ISZs) created to reduce impacts
- ISZs are seasonally enforced (Jun-Nov) but hard to monitor

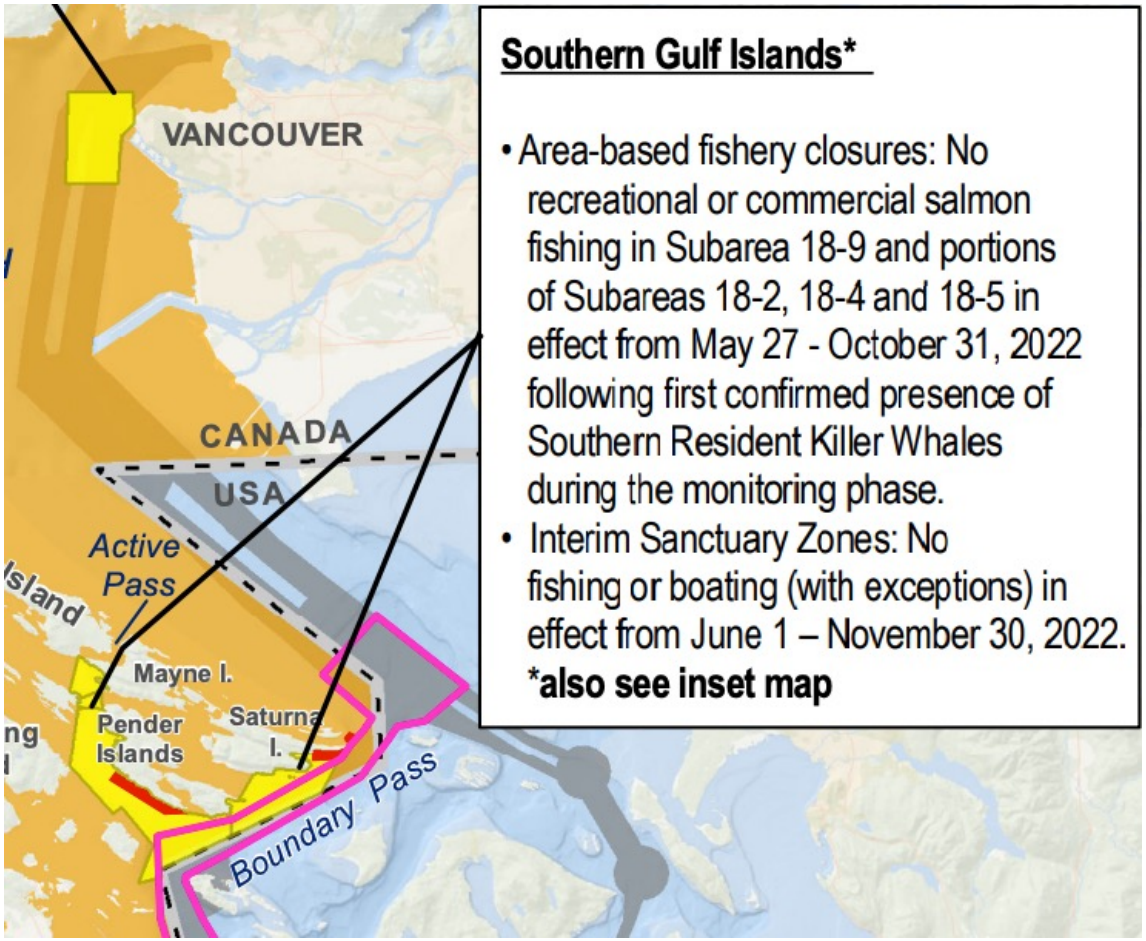


Overview of 2022 management measures to protect Southern Resident Killer Whales

Canada

OPENOCEAN ROBOTICS

PROJECT AREA - PENDER ISLAND INTERIM SANCTUARY ZONE



Southern Gulf Islands*

- Area-based fishery closures: No recreational or commercial salmon fishing in Subarea 18-9 and portions of Subareas 18-2, 18-4 and 18-5 in effect from May 27 - October 31, 2022 following first confirmed presence of Southern Resident Killer Whales during the monitoring phase.
- Interim Sanctuary Zones: No fishing or boating (with exceptions) in effect from June 1 – November 30, 2022.

***also see inset map**

- Boat traffic prohibited in Pender Island ISZ during mission - October 2022
- USV operated outside ISZ with cameras, towed acoustic array, ocean and atmospheric sensors
- Detections included Grey whales and various vessels, including non-AIS.

OPENOCEAN ROBOTICS

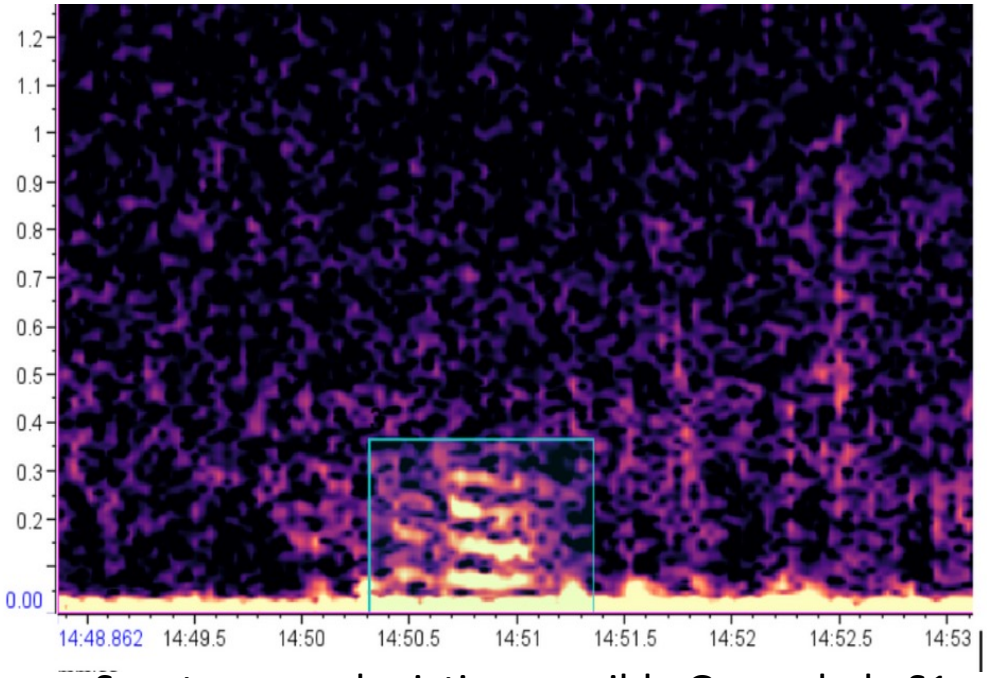
USV MONITORING OF PENDER ISLAND ISZ – OCT. 2022

MISSION 4 STATS

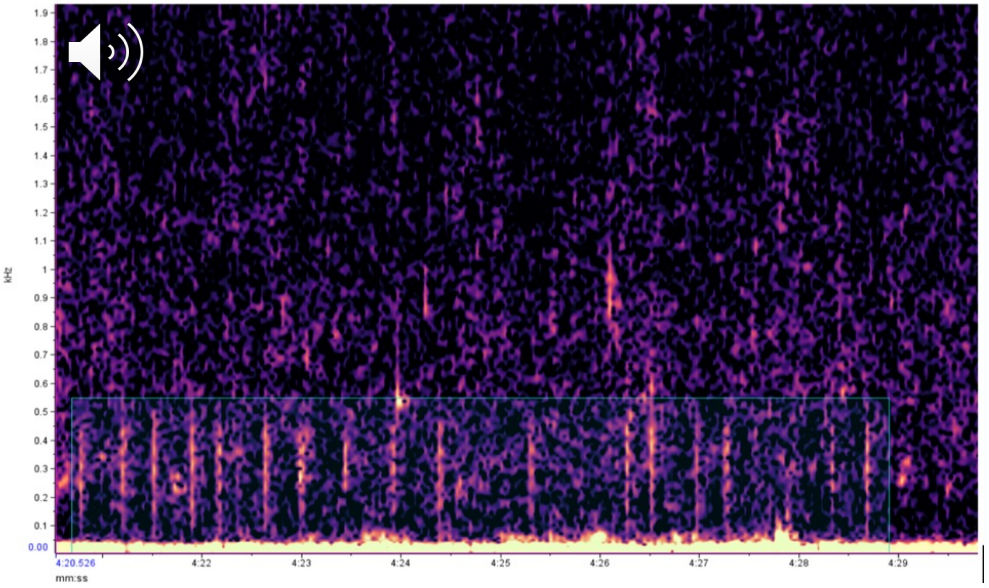
DATES:	**Oct. 3-7, 2022**
MISSION LENGTH:	**75 hours**
DISTANCE TRAVELLED:	**174 km (94 nm)**
AVG. USV SPEED:	**5.7 kph (3.1 kts)**
AVG. WIND SPEED:	**9.8 kph (5.3 kts)**
MAX. WIND SPEED:	**39 kph (21 kts)**

OPENOCEAN ROBOTICS

DETECTION OF MARINE MAMMALS WITH PASSIVE ACOUSTICS



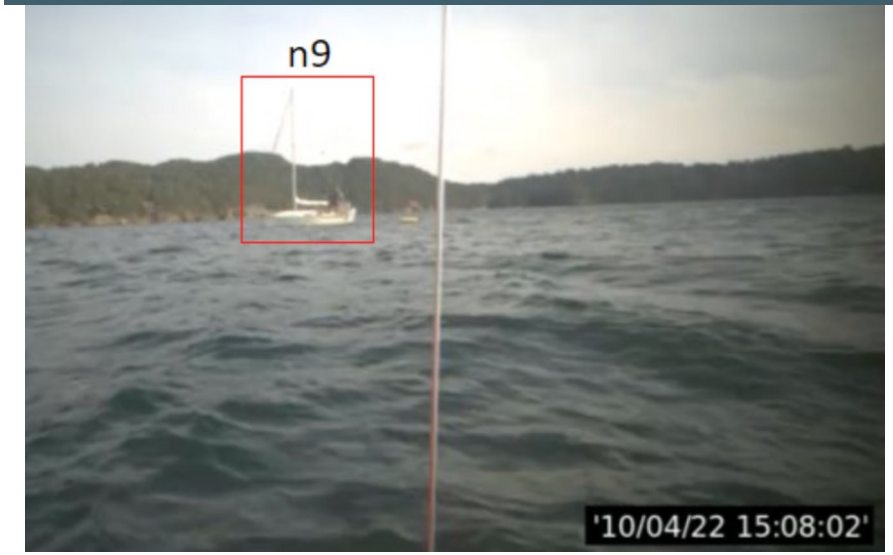
Spectrogram depicting possible Grey whale S1 calls (outlined by light blue box)

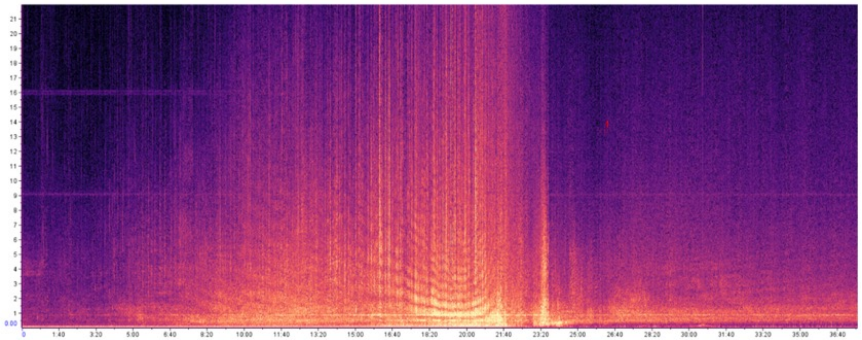


Spectrogram depicting a possible, unspecified Grey whale call (outlined by light blue box)

OPENOCEAN
ROBOTICS

DETECTION OF NON-AIS VESSELS WITH CAMERAS AND PASSIVE ACOUSTICS

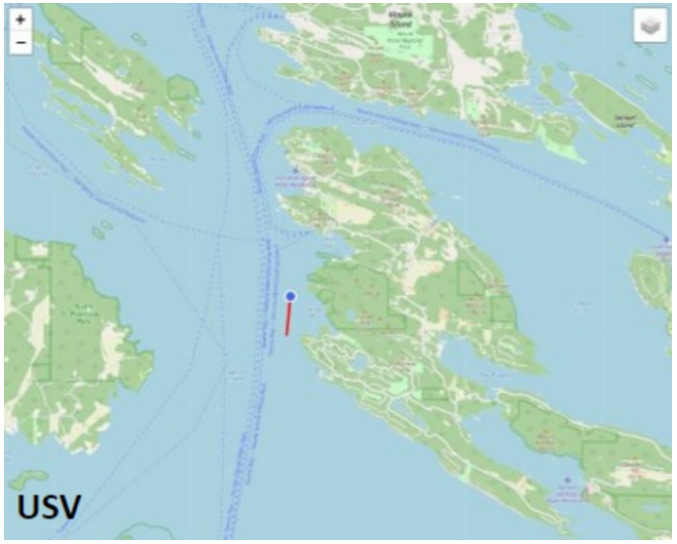




OOR watchkeepers identified 13 vessels not transmitting AIS signals during the visual data collection period.

Images are time-stamped and GPS tagged.

Acoustic data was analyzed 15 minutes before and after the estimated closest point of approach screenshot was taken.



OPENOCEAN
ROBOTICS

OPENOCEAN
ROBOTICS

PROTECTING OCEANS SUSTAINABLY

FRITZ STAHR
CTO

fritz@openoceanrobotics.com

http://www.openoceanrobotics.com/

in/fritz-stahr

250 514 6680