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Mapping Data Acquisition and Processing Summary Report

EX-22-08: EXPRESS: West Coast Mapping 2022 (Mapping)

Pacific Ocean, offshore of California and Oregon

San Diego, California to Newport, Oregon

October 16, 2022 to November 3, 2022

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Introduction

NOAA Ocean Exploration is dedicated to exploring the unknown ocean, unlocking its potential through scientific discovery, technological advancements, and data delivery. By working closely with partners across public, private, and academic sectors, we are filling gaps in our basic understanding of the marine environment. This allows us, collectively, to protect ocean health, sustainably manage our marine resources, accelerate our national economy, better understand our changing environment, and enhance appreciation of the importance of the ocean in our everyday lives.

With priority placed on exploration of deep waters and the waters of the U.S. Exclusive Economic Zone, NOAA Ocean Exploration applies the latest tools and technologies to explore previously unknown areas of the ocean, making discoveries of scientific, economic, and cultural value. By making collected data publicly available in increasingly innovative and accessible ways, we provide a unique and centralized national resource of critical ocean information. And, through live exploration video, online resources, training and educational opportunities, and public events, we share the excitement of ocean exploration with people around the world and inspire and engage the next generation of ocean scientists, engineers, and leaders.

Report Purpose

The purpose of this report is to briefly describe the acoustic seafloor, water column, and subseafloor mapping data collection and processing methods used by NOAA Ocean Exploration on NOAA Ship *Okeanos Explorer* during EXPRESS: West Coast Mapping 2022, EX-22-08, and to present a summary of mapping results and mapping-related expedition activities.

A detailed description of *Okeanos Explorer*'*s* mapping equipment and capabilities is available in the "NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report 2022", which is archived in the NOAA Central Library.[1]

For further information about general equipment calibration procedures, data acquisition, processing, reporting, and archiving, see the "NOAA Ocean Exploration Deepwater Exploration Mapping Procedures Manual V1", which is archived in the NOAA Central Library[2] and also available from the website.[3]

[1] https://doi.org/10.25923/g2ep-ae34

[2] https://doi.org/10.25923/jw71-ga98

[3] https://oceanexplorer.noaa.gov/data/publications/mapping-procedures.html

Expedition Objectives

EX-22-08 involved a transit northwest followed by focused mapping operations in deep water (>200 m) off the coast of California and Oregon. The expedition team conducted 24-hour-a-day exploratory mapping operations to fill priority mapping gaps and a detailed sub-bottom survey of a sponge reef south of the Channel Islands. The expedition concluded in Newport, Oregon, marking the end of operations on NOAA Ship *Okeanos Explorer* for the 2022 calendar year. Data from this expedition will improve knowledge of unexplored areas within the U.S. Exclusive Economic Zone and adjacent international waters.

The mapping work conducted during the EXPRESS: West Coast Mapping 2022 expedition resulted in high-resolution maps of the seafloor and acoustic backscatter data information about the seabed and water column. Acquired data fills critical mapping gaps in the region and directly support the objectives of the interagency EXpanding Pacific Research and Exploration of Submerged Systems (EXPRESS) campaign, including guiding wise use of living marine resources and habitats, informing ocean energy and mineral resource decisions, and improving offshore hazard assessments along the U.S. West Coast.

The complete objectives for this expedition are detailed in “Project Instructions: EX-22-08 EXPRESS: West Coast Mapping 2022 (Mapping)", which is archived in the NOAA Central Library.[4]

Operational Personnel

EX-22-08 included onboard operational personnel, inclusive of ship’s force and mission team, who participated in operational execution (see **Table 1**).

Table 1. EX-22-08 Onboard personnel.

Name	Role	Affiliation	Dates Aboard
Thomas Morrow	Expedition Coordinator	NOAA Ocean Exploration	10/14-11/8
Samuel Cuellar	Expedition Coordinator in training	NOAA Ocean Exploration	10/14-11/8
Marcel Peliks	Mapping Watch Lead	UCAR[1]	10/15-11/7
Anna Coulson	Mapping Watch Lead	UCAR[1]	10/15-11/7
CST Charlie Wilkins	Chief Survey Tech	OMAO[2]	10/15-11/7

[4] https://doi.org/10.25923/b55v-7h97

Name	Role	Affiliation	Dates Aboard
LT Hunter Brendel	Operations Officer	OMAO[2]	10/15-11/7
Chris Wright	Data Manager	GFOE[3]	10/15-11/7
Roland Brian	Videographer	GFOE[3]	10/15-11/7
Jennifer Clifton	Explorer-in-Training	UCAR[1]	10/15-11/7
Benjamin Stablow	Explorer-in-Training	UCAR[1]	10/15-11/7

[1] University Corporation for Atmospheric Research
[2] NOAA Office of Marine and Aviation Operations
[3] The Global Foundation for Ocean Exploration

Summary of Mapping Operations

NOAA Ocean Exploration mapped 26,945 square kilometers (sq km) of seafloor during the 19 days at sea for EX-22-08. Of the 26,945 sq km mapped, 20,241 sq km was deeper than 200 mand within the U.S. Exclusive Economic Zone and Territorial Sea. Multibeam bathymetry data coverage is shown in **Figure 1.**

Figure 1. Overview of bathymetric mapping coverage completed during EXPRESS: West Coast Mapping 2022 (EX-22-08). Depths are shown in meters below sea level (mbsl).

Mapping Statistics

Table 2 provides summary statistics of ocean mapping work during EX-22-08, October 16 - November 3, 2022 (UTC).

Table 2. Summary statistics of ocean mapping work during EX-22-08.

Statistic	Value
Ship's draft*: Start of expedition (10/16/2022) End of expedition (11/3/2022)	Fore: 16' 3.5''; Aft STBD: 15' 11.5"; Aft Port: 15' 4.5" Fore: 15' 7.5"; Aft STBD: 15' 4.5"; Aft Port: 16' 1.5"
Linear kilometers of survey with EM 304	3585.89
Square kilometers mapped with EM 304	26,944.80
Square kilometers mapped with EM 304 within U.S. waters deeper than 200 m	20,240.50
Number/data volume of EM 304 raw multibeam files (.kmall)	536 files/57.0 GB
Number/data volume of EM 304 water column multibeam files (.kmwcd)	533 files/117.9 GB
Number/data volume of EK60/EK80 water column split-beam files (.raw)	496/82.1 GB
Number/data volume of sub-bottom sonar files (.segy, .kea, .keb)	1213/3.7 GB
Number of expendable bathythermograph (XBT) casts	110
Number of conductivity, temperature, depth profiler (CTD) casts (including test casts)	0

*Prior to EX-21-01, and as a result of the full marine survey completed during the 2020/2021 drydock, it was determined that the draft markers on the bow are referenced to the bottom of the original hull, and not the base of the sonar blister on the fairing which is 16.5" lower, requiring that a +16.5" offset be applied to the draft measurements. The measurements listed in Table 3 reflect the +16.5" offset.

Mapping Sonar Setup

Kongsberg EM 304 Multibeam Sonar

NOAA Ship *Okeanos Explorer* is equipped with a 26 kilohertz (kHz) Kongsberg EM 304 MKII multibeam sonar, capable of detecting the seafloor in up to 10,000 m of water and conducting productive mapping operations in up to 8,000 m of water. The nominal transmit (TX) along track beamwidth is 0.5°, and the nominal receive (RX) acrosstrack beamwidth is 1.0°. The

system generates a 150° beam fan (75° port/75° starboard maximum angles), containing 512 beams with up to 800 soundings per ping cycle when in high-density mode. In waters shallower than approximately 3,300 m the system is able to operate in dual-swath mode, where one nominal ping cycle includes two swaths, resulting in up to 1,600 soundings. The multibeam sonar is used to collect seafloor bathymetry, seafloor backscatter, and water column backscatter.

Simrad EK60/EK80 Split-Beam Sonars

The ship is equipped with a suite of Simrad EK60/EK80 split-beam fisheries sonars: 18 kHz (EK60), 38 kHz (EK80), 70 kHz (EK80), 120 kHz (EK60), and 200 kHz (EK60). These systems are quantitative scientific echosounders calibrated to identify the target strength of water column acoustic reflectors, typically biological scattering layers, fish, or gas bubbles, providing additional information about water column characteristics and anomalies. In 2019, the 38 and 70 kHz transceivers were replaced with broadband units (WBTs). WBTs use frequency modulation to acquire higher resolution water column data allowing for the detection of finer features, improved depth capability without loss of range resolution, and support of broadband frequency response of targets.

These sonars were calibrated during EX-22-06 in the North Atlantic, and calibration values from that expedition were applied to the EK sonars for EX-22-08. New calibrations are scheduled during the 2023 field season in waters off the west coast of California and Oregon after dry dock maintenance. The latest EK calibration report at the time of publishing is available in the NOAA Central Library as a supplement to the "NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report 2022" and the calibration files are included with the dataset of each expedition to which they are relevant.[5]

Knudsen 3260 Sub-Bottom Profiler

The ship is equipped with a Knudsen 3260 sub-bottom profiler (SBP) that produces a frequency-modulated chirp signal with a central frequency of 3.5 kHz. This sonar is used to provide echogram images of shallow geological layers underneath the seafloor to a maximum depth of approximately 80 m below the seafloor. The sub-bottom profiler is operated to provide information about sub-seafloor stratigraphy and features.

[5] https://doi.org/10.25923/g2ep-ae34

Teledyne Acoustic Doppler Current Profilers

Two acoustic Doppler current profilers (ADCPs), a Teledyne Workhorse Mariner (300 kHz) and a Teledyne Ocean Surveyor (38 kHz), are installed on the ship. Depending on environmental conditions, the 300 kHz system provides ocean current data to approximately 70 m deep, and the 38 kHz system provides data to approximately 1,200 m deep. The 38 kHz system is capable of collecting data in narrowband and broadband frequency ranges. The ADCPs gather data prior to remotely operated vehicle (ROV) and conductivity, temperature, depth profiler (CTD) deployments in order to assess currents in support of safe operations. The ADCPs are typically not run concurrently with the other sonars during mapping operations due to issues of interference.

Data Acquisition Summary

Following port departure, data were collected with the ADCPs until the sea buoy was reached, at which point the ADCPs were secured. Then, data acquisition began with the EM 304, EK60/EK80 (18, 38, 70, 120, and 200 kHz), and the Knudsen 3260 sub-bottom profiler, with these sonars running concurrently using a Kongsberg Synchronization Unit (K-Sync).

Multibeam survey lines were planned to maximize either edge-matching of existing bathymetric data or data gap filling in areas with existing bathymetric coverage. In regions with no existing data, lines were optimized for potential discoveries and to complete relatively large contiguous areas to support interpretation of features from bathymetry and backscatter. A targeted sub-bottom profiler survey was conducted within the Channel Islands National Marine Sanctuary over a previously observed sponge mound feature. Based on navigation and observational data submitted by the scientific community, the survey was optimized to present the best imaging opportunities across previously observed features.

Throughout the expedition, multibeam data quality was monitored in real time by acquisition watchstanders. Ship speed was adjusted to maintain data quality and sounding density as necessary, and line spacing was planned to ensure one-quarter to one-third swath-width overlap between lines, depending on the environmental conditions and impact on the quality of the outer swath regions. Angles were generally left open (75°/75°) during transits to maximize data collection and were adjusted on both the port and starboard sides to ensure the best data quality and coverage. If outer beams were returning obviously spurious soundings (e.g., due to attenuation or low grazing angle), beam angles were gradually reduced and monitored closely until a high-quality swath was obtained. During a significant portion of EX-22-08, adverse weather conditions required tighter beam angles (as narrow as 42°/42°), reduced survey speeds

(~6 knots) into conditions, and one-half overlap to fill gaps on reciprocal lines traversed with conditions.

Real-time corrections to the data upon acquisition included: continuous application of surface sound speed obtained with a hull-mounted Reson SV-70 probe; application of water column sound speed profiles obtained with Sippican Deep Blue Expendable Bathythermographs (XBTs) and/or Seabird CTD 9/11; application of roll, pitch, and heave motion corrections obtained by either the POS MV 320 V5 or Seapath 320-R3 inertial position and orientation system (refer to the watch log to determine which system was the primary source used). No tidal corrections were applied to the raw or processed data. Sound speed profiles were conducted every four hours or more frequently as dictated by local oceanographic conditions (typically every two hours when operating near currents). Reson sound speed values were constantly compared against secondarily derived sound speed values from the ship's onboard thermosalinograph flow-through system as a quality assurance measure. On several occasions, changes in surface sound speed greater than 4 m/s over one hour called for more frequent XBT profiles. See log entries for more details.

Simrad EK60/EK80 split-beam water column sonar data were collected throughout the majority of the expedition. Data were monitored in real time for quality but were not post-processed. **Figure 2** shows the EK60/EK80 and Knudsen 3260 sub-bottom data collected during EX-22-08. **Figure 3** and **Figure 4** show detailed maps of targeted survey regions north of the Mendocino Fracture Zone and south of the Channel Islands (Knudsen sub-bottom collected only).

Figure 2. Simrad EK60/EK80 split-beam sonar and Knudsen sub-bottom data collection tracklines (in yellow) collected during EX-22-08.

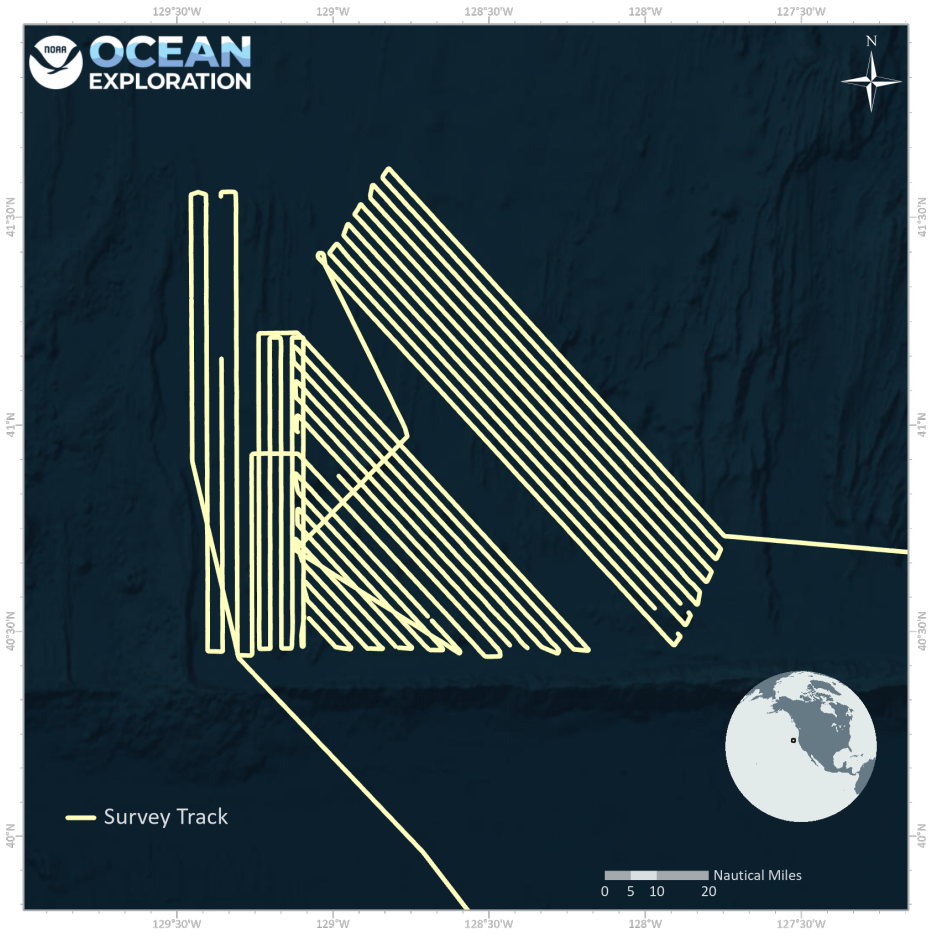

Figure 3. Focused survey EK60/EK80 and Knudsen tracklines (in yellow) collected during EX-22-08.

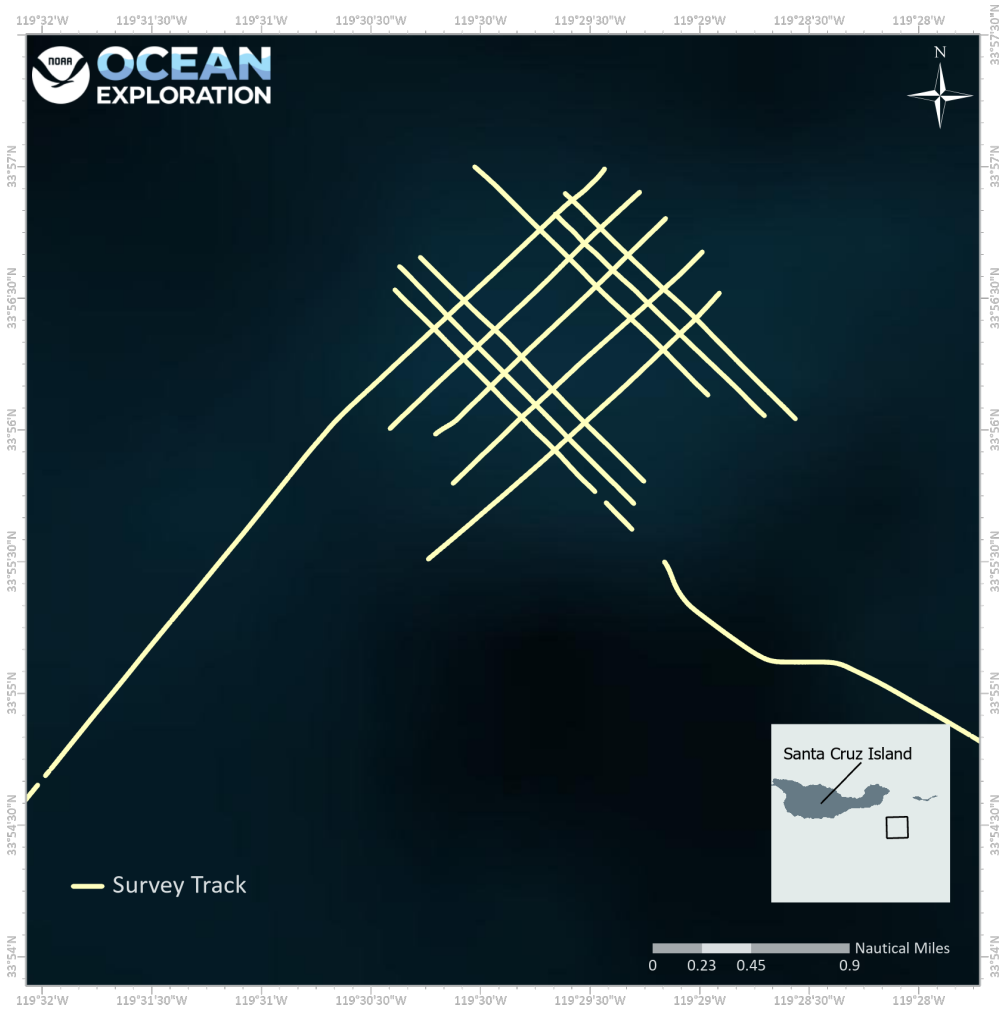

Figure 4. Sub-bottom profiler data collection tracklines (in yellow) collected during EX-22-08 focused survey in the Channel Islands National Marine Sanctuary.

Multibeam Sonar Bathymetric Data Processing and Quality Assessment

The bathymetry data were generated using a Kongsberg EM 304 MKII multibeam system, and recorded using Kongsberg's Seafloor Information System (SIS) software as *.kmall files. Collocated to the bathymetric data, bottom backscatter data were collected and stored within the *.kmall files, both as beam averaged backscatter values, and as full time series values (snippets) within each beam. Water column backscatter data were recorded separately within *.kmwcd files.

The full-resolution multibeam .kmall files (Level-00 data) were imported into QPS Qimera, and then processed and cleaned of noise and artifacts. Outlier soundings were removed using

multiple methods including automatic filtering and/or manual cleaning with the swath and subset editing tools. The default sound speed scheduling method used was "Nearest-in-Time." If another method was implemented, it will be noted in the associated log. Gridded digital terrain models were created using the weighted moving average algorithm and were exported in multiple formats using QPS Fledermaus software. Daily bathymetric surfaces were created and sent to shore. **Figure 5** shows the onboard multibeam data processing workflow.

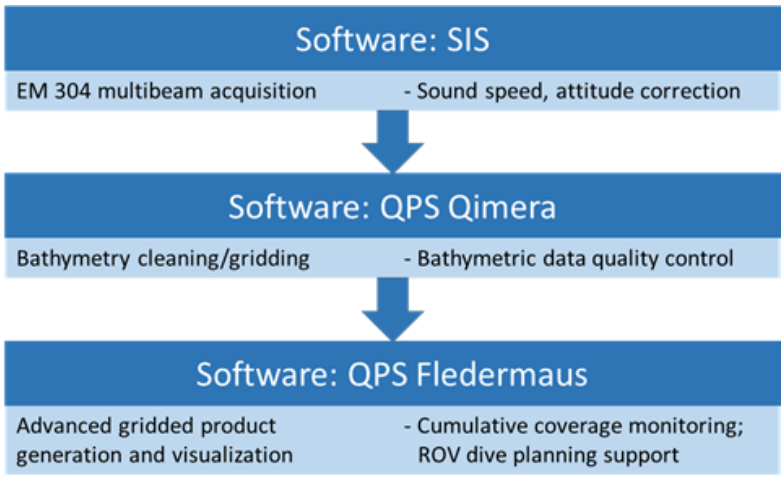

Figure 5. Shipboard multibeam data processing workflow.

On shore, the Mapping Team performed a final quality check of the data using QPS Qimera and Fledermaus software. This involved additional fine cleaning of soundings and minimization of residual artifacts from sound speed biases and field-cleaning errors. Depth values were compared from orthogonal lines (crosslines) to evaluate the consistency of the multibeam sonar data collected during the expedition.

A crossline analysis was completed using the Crosscheck Tool in QPS Qimera software to evaluate the data against the Order 1 S-44 standards set by the International Hydrographic Organization (IHO, 2008).

Each line of cleaned full resolution data was exported to a *.gsf file (Level-01 data). The processed and cleaned files were used to create a static surface in QPS Qimera. This final surface was re-projected into the field geographic WGS84 reference frame in QPS Fledermaus software and saved as a .sd file for archiving. Using QPS Fledermaus, this *.sd bathymetric grid file was then exported into ASCII XYZ text file (*.xyz), color *.tif, floating point *.tif, and Google Earth *.kmz file formats. The *.gsf files were used to create daily backscatter mosaics using QPS FMGT. All products maintain horizontal referencing to WGS84 (G1762) and vertical referencing to the assumed mean waterline. There is a complete accounting of each individually archived

multibeam data file and of each bathymetric surface product in the multibeam data acquisition and processing logs archived with the dataset.

Crossline Analysis

A crossline was run on October 27, 2022, as shown in **Figure 6**, and the results are presented in **Table 3**.

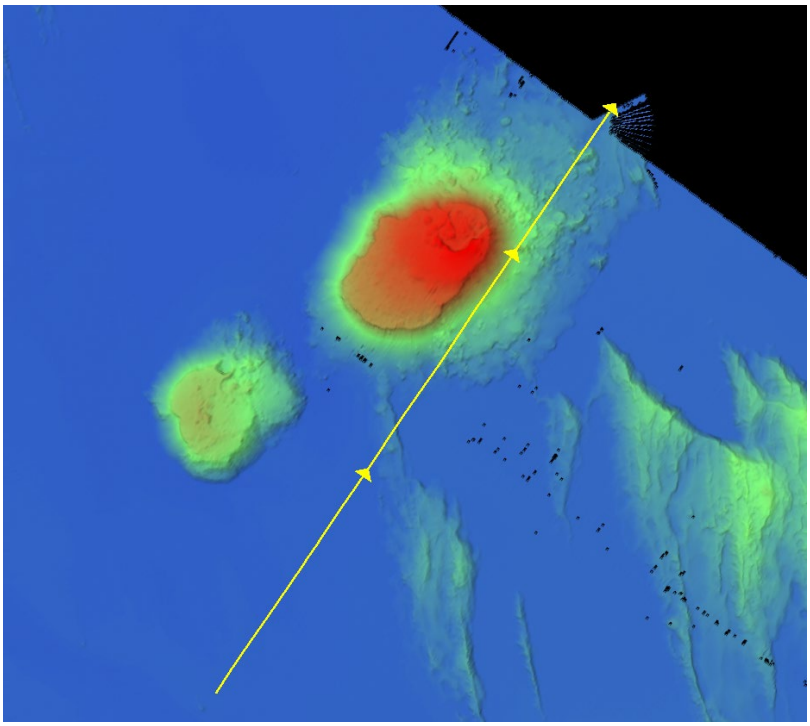

Figure 6. EX-22-08 crossline (shown in yellow) used for comparison against the bathymetric grid generated via orthogonal multibeam survey lines. Depth units are in meters.

Crossline files:

0321_20221027_032215_EX2208_MB.kmall
0322_20221027_042216_EX2208_MB.kmall
0323_20221027_052216_EX2208_MB.kmall

Mainscheme line files:

0143_20221022_043630_EX2208_MB.kmall
0144_20221022_053630_EX2208_MB.kmall
0155_20221022_134544_EX2208_MB.kmall
0156_20221022_144544_EX2208_MB.kmall
0163_20221022_182602_EX2208_MB.kmall

0164_20221022_192602_EX2208_MB.kmall
0172_20221023_032456_EX2208_MB.kmall
0173_20221023_042456_EX2208_MB.kmall
0180_20221023_084055_EX2208_MB.kmall
0181_20221023_094055_EX2208_MB.kmall
0192_20221023_182705_EX2208_MB.kmall
0193_20221023_192705_EX2208_MB.kmall
0201_20221024_005423_EX2208_MB.kmall
0213_20221024_100759_EX2208_MB.kmall
0214_20221024_110759_EX2208_MB.kmall
0282_20221026_031619_EX2208_MB.kmall
0290_20221026_080456_EX2208_MB.kmall
0291_20221026_090456_EX2208_MB.kmall
0295_20221026_102051_EX2208_MB.kmall
0304_20221026_160652_EX2208_MB.kmall
0305_20221026_170652_EX2208_MB.kmall
0306_20221026_180652_EX2208_MB.kmall
0310_20221026_190635_EX2208_MB.kmall
0311_20221026_200635_EX2208_MB.kmall

Table 3. Crosscheck results.

Statistic	Value
Number of points of comparison	897303
Grid cell size (m)	75.000
Difference mean (m)	0.700210
Difference median (m)	0.700210
Difference standard deviation (m)	4.429653
Difference range (m)	-69.20, 72.42
Mean + 2* standard deviation (m)	9.559516
Median + 2* standard deviation (m)	9.559516
Data mean (m)	-2960.810665
Reference mean (m)	-2961.510875
Data z-range (m)	-3263.11, -1391.36
Reference z-range (m)	-3252.38, -1397.43
Order 1 error limit (m)	38.502888

Statistic	Value
Order 1 # rejected	501
Order 1 p-statistic	0.000558
Order 1 survey	ACCEPTED

These results confirm that the data collected meet International Hydrographic Organization Order 1 specifications for data quality.

Acquisition and Processing Software

Table 4 provides a list of the acquisition and processing software versions that were used during EX-22-08.

Table 4. Versions of acquisition and processing software used during EX-22-08.

Software	Purpose	Version
SIS	EM 304	5.10.1
EK80	EK suite	21.15
EchoControl	Knudsen	4.09
UHDAS	ADCPs	14.04
AMVERSEAS	Autolaunch XBT	9.3.6
WinMK22	XBT	3.0.2
K-Sync	Synchronization	1.9.0
Qimera	Bathymetry	2.4.9
FMGT	Backscatter	7.10.1
FMMidwater	Water Column	7.9.4
Sound Speed Manager	Sound Velocity Profiles	2022.1.0
NRCan (SegJp2)	Sub-bottom	1.0
Fledermaus 7	Visualization/Data Analysis	7.8.12

Data Archiving Procedures

All mapping data collected by NOAA Ocean Exploration on *Okeanos Explorer* are archived and publicly available within 90 days of the end of each expedition via the National Centers for Environmental Information (NCEI) online archives. The complete data management plan (which describes the raw and processed data formats produced for this expedition) is available as an appendix in the “Project Instructions: EX-22-08, EXPRESS: West Coast Mapping”, which is

archived in the NOAA Central Library[6]. For each data type, raw data (Level 00), processed data (Level 01), derived products (Level 02), and ancillary files may be available, depending on the dataset and the level of staffing for the expedition. **Tables 5-9** describe the data archived for each dataset. For further information about proprietary software and freeware that can handle the varying data types, refer to the "NOAA OER Deepwater Exploration Mapping Procedures Manual."

Table 5. EM 304 bathymetry and seabed backscatter dataset.

Level	Description	File Type
Level 00	Raw multibeam files (in native sonar format) that include both raw bathymetry and backscatter (horizontal referencing = WGS84)	.kmall
Level 01	Processed multibeam files in generic sensor format that include bathymetry and backscatter (horizontal referencing = WGS84)	.gsf
Level 02	Gridded multibeam data and backscatter mosaics (horizontal referencing = WGS84)	.xyz, .tif, .tif (floating point GeoTIFF, .kmz, .sd, .scene
Ancillary files	Mapping watchstander log, weather log, sound speed profile log, multibeam acquisition and processing log, backscatter correction file, built-in self test logs, processing unit parameters, telnet session records	.xlsm, .xlsx, .txt

Table 6. EM 304 water column backscatter dataset.

Level	Description	File Type
Level 00	Raw multibeam files (in native sonar format) that include water column backscatter (horizontal referencing = WGS84)	.kmwcd
Level 01	n/a	n/a
Level 02	QPS Fledermaus objects such as beam fan, beam line, volume and/or track line;	.sd, .scene

[6] https://doi.org/10.25923/b55v-7h97

Level	Description	File Type
	produced if time and staffing allows (horizontal referencing = WGS84)	
Ancillary files	Mapping watchstander log, weather log, sound speed profile log, multibeam acquisition and processing log, water column data log, built-in self test logs, processing unit parameters, recorded telnet sessions	.xlsm, .xlsx, .txt

Table 7. EK60/EK80 split-beam echosounder dataset.

Level	Description	File Type
Level 00	Raw water column files provided in native sensor format (horizontal referencing = WGS84)	.raw, .idx
Level 01	n/a	n/a
Level 02	n/a	n/a
Ancillary files	Mapping watchstander log, weather log, EK data log, EK calibration report, calibration files and the raw files used for calibration	.xlsm, .xlsx, .txt, .pdf, .xml, .raw, .idx

Table 8. Knudsen 3260 sub-bottom profiler dataset.

Level	Description	File Type
Level 00	Raw sub-bottom files provided in native sonar format (horizontal referencing = WGS84)	.sgy, .kea, .keb
Level 01	Raw sub-bottom files converted to images and shapefiles of the tracklines; produced as time and staffing levels allow	.jpg, .shp
Level 02	n/a	n/a
Ancillary files	Mapping watchstander log, weather log, sub-bottom profiler data log	.xlsm, .xlsx

Table 9. Sound speed profiles dataset.

Level	Description	File Type
Level 00	Raw profile data for any XBT or CTD cast	.txt, .hex, .cnv

Level	Description	File Type
Level 01	Processed sound speed profiles created for multibeam data acquisition	.asvp
Level 02	n/a	n/a
Ancillary Files	Mapping watchstander log, sound speed profile log, profile locations as a shapefile and in Google Earth format, any associated calibration files	.xlsm, .xlsx, .shp, .kml, .cal, .xml, .pdf

All sonar data are permanently discoverable within the NCEI archives[7] and searchable through the Ocean Exploration Digital Atlas,[8] which provides access to all of the data collected during an expedition. The locations for specific data types (at the time of writing this report) are detailed in **Table 10**. For any challenges accessing data, send an inquiry to NCEI,[9] or contact the Ocean Exploration Mapping Team.[10]

Table 10. Locations of data collected during EX-22-08 (at the time of writing this report).

Data Type	Description	Location
EM 304 bathymetry and backscatter data	EM 304 bathymetric and backscatter data, supporting informational logs, and ancillary files are available through the NCEI Bathymetry Data Viewer	https://www.ncei.noaa.gov/maps/bathymetry/ Request raw sonar data (Kmalls) from ncei.info@noaa.gov with oer.info.mgmt@noaa.gov cc'd POSPac and BS correction files can be requested from oar.oer.exmappingteam@noaa.gov

[7] https://www.ngdc.noaa.gov/

[8] https://www.ncei.noaa.gov/maps/oer-digital-atlas/mapsOE.htm

[9] ncei.info@noaa.gov

[10] oar.oer.exmappingteam@noaa.gov

Data Type	Description	Location
Water column data (EM 304 and EK60/EK80)	EM 304 and EK60/EK80 water column data, supporting data, and informational logs are available through the NCEI Water Column Sonar Data Viewer	https://www.ncei.noaa.gov/maps/water-column-sonar/
Knudsen 3260 sub-bottom profiler data	Sub-bottom data, supporting data, and informational logs are available in the NCEI data archives	https://www.ncei.noaa.gov/maps/trackline-geophysics/
Sound speed profiles	Ancillary sound speed profiles are available along with all mapping data per expedition in the NCEI data archives, or within the oceanographic archive for the expedition.	https://www.ncei.noaa.gov/maps/bathymetry/ or through the oceanographic archives at: https://www.ncei.noaa.gov/
Reports	Reports are archived in the NOAA Central Library's Ocean Exploration Program (OEP) institutional repository	NOAA Central Library home: https://library.noaa.gov/ OEP institutional repository: https://repository.library.noaa.gov/cbrowse?pid=noaa%3A4&parentId=noaa%3A4

Expedition Schedule

Table 11. EX-22-08 schedule.

Date (UTC)	Activity
10/14	Mission personnel began to arrive in San Diego, CA
10/15	Mobilization and additional mission personnel arrived.
10/16	Depart San Diego, CA and transit to first target survey location
10/17	Arrive at CINMS target survey site A, focused survey, then transit mapping
10/18	Transit mapping to focus site B
10/19	Transit mapping to focus site B
10/20	Begin focused survey, site B

Date (UTC)	Activity
10/21-10/26	Focused survey, mapping polygon B
10/27	Cross check and transit to polygon C, begin mapping polygon C
10/27-10/30	Focused survey, mapping polygon C
10/31	Finished polygon C, departed survey area, beginning transit survey
11/1-11/2	Transit survey en route to Newport, OR
11/3	Arrive Newport, OR, begin demobilization
11/4	Finalized post-processing, offloaded data and systems shut down

References

Candio, S., Hoy, S., Morrow, T., Wilkins, C., and Copeland, A. (2022). 2022 NOAA Ship Okeanos Explorer Mapping Systems Readiness Report. Office of Ocean Exploration and Research, Office of Oceanic and Atmospheric Research, NOAA, Silver Spring, MD 20910. https://doi.org/10.25923/g2ep-ae34

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Appendix A: Daily Log Entries

The following entries were excerpted from each of the daily expedition situation reports provided by the onboard team to the onshore support team, and therefore are somewhat

informal in language. These are included to provide situational awareness for future users of the data collected during this expedition. All times are in local ship time (-8 hours from UTC).

October 15

Acquisition, mobilization, and startup procedures engaged. Survey powered up and ping tested all sonars. EM304 BIST reported a TX error to be investigated.

October 16

Departed San Diego at 0830, transited to first mapping objective site. Sonars and acquisition restarted underway and resolved intermittent voltage TX issue on EM304 BIST.

October 17

Overnight mapped a sponge reef target inside Channel Islands National Marine Sanctuary. EiT training continued. Sea state expected to increase over the coming days.

October 18

EM304 TX unit briefly had a voltage issue that was fixed by re-seating the TX card. A small transit data gap occurred during the dropout. EiTs continued to develop multibeam cleaning skills and learned how to create daily products.

October 19

Sea state continued to increase, winds exceeding 25 knots, and waves in excess of 8 ft. with a period of ~13s. CO advised conditions warrant continued attention, but no deviation from the planned mapping target. Training continued on the survey team.

October 20

Reached priority survey area and started survey pattern, adjusted for best ride and current conditions. The full survey will take approximately 11 days to complete, uninterrupted. EiTs were able to independently generate daily products, clean soundings, and watchstand with minimal supervision. Sea state is expected to improve over the next couple days.

October 21

Survey lines shifted from N/S to NW/SE to better align with conditions. Data quality continued to depend on heading. Estimated a few more days in this polygon before weather will force us to relocate.

October 22

CO advised morning conditions are about the limits of safe operations (40 knot gusts, ~12-14 ft seas). Conditions improved throughout the day, and look to stay reasonable for the next few days before a larger system moves in.

October 23

Weather and seas relaxed significantly and data quality improved.

October 24

Survey polygon B nearly completed. EC Morrow and EC-in-training Cuellar started compiling the Mapping Data Report.

October 25

Survey continued uninterrupted and developed several alternative line plans in preparation for weather-dependent planning discussions tomorrow.

October 26

Completed polygon B in the survey area north of Mendocino Ridge. Scientists from CINMS confirmed a successful result from the sponge reef survey on 16-17 OCT, and returned some images showing the recorded targets in sub-bottom profiles. They are working up the raw data within their process, and will remain in touch with mission personnel as they add the new survey into broader documentation.

After consulting with CO and OPS, the current weather plan is to move to polygon C, to the north, despite forecast conditions. As conditions worsen, mapping operations may need to be secured while the ship finds the ideal positioning to ride out wind and swell in a few days. CO, OPS, and EC decided against traveling south, ahead of the weather, since returning north to Newport would eventually require transit into and through conditions. This compromise maximizes time on station collecting new mapping data, while preserving the opportunity to safely weather conditions for a few days.

October 27

Calmer conditions than previous days produced high quality data. Data team and survey team identified an issue in the sub-bottom profiling workflow that can arise intermittently. After review, a fix was implemented and documented. No other issues to report.

October 28

Weather discussion this morning with EC, CO, XO, OPS evaluated the latest forecast and identified a weather window on Nov 3, 4, and 5 where conditions will favor crossing the bar into Newport. Conditions are expected to become worse on the 6th and jeopardize opportunities to get in.

Based on these discussions, and the forecasted worsening conditions over the early part of next week, we planned to depart mapping priority area C in favor of mapping areas of the Cascadia Margin, closer in to shore and further north, roughly 50-70 nm from Newport. This has the advantage of potentially gentler seas and allowing a shorter transit to Newport, which should enable us to stay out up to the end of the weather window on Nov 3-5 and make a short transit in before conditions worsen. Planned to continue mapping in priority area C until data quality deteriorates beyond usability or upon CO's recommendation, whichever comes first.

Survey made a minor modification to the SOP and water column processing workflow.

October 29

Survey team continued to collect data as conditions permitted, and prepared operations to transition to Cascadia Margin targets, in coordination with shoreside USGS partners. CTD is being broken down for winter maintenance and storage.

October 30

CTD disassembly started for off-season. Line plan and weather plan confirmed with CO for 31 OCT and remainder of mission. Mapping will continue along the Cascadia Margin on 1 NOV after a brief transit at the end of day on 31 OCT. XBT launcher tube 8 pin got stuck in an unusable position until the launcher can be emptied and further troubleshooted during daylight tomorrow.

October 31

CO determined that weather conditions will prohibit safe crossing and entry into Newport on November 4th and any day after, up to and through November 8th. CO plans to end the expedition and arrive in port on November 3rd, three days prior to the originally scheduled end date. Line plan has been altered to accommodate the revised date and Cascadia Margin mapping will commence tomorrow after a brief transit.

The XBT launcher was repaired by cycling pins.

November 1

Final line plan delivered to bridge. Mapping operations will likely cease around 2300 on 02 NOV (ship time) in preparation for transit and post-processing.

Survey identified POS ethernet logging issue and worked with data team to identify and document a solution.

November 2

Sea state remained elevated, but northward transit improved the ride and data quality. Survey updated SIS to v5.10.2 successfully. Castaway CTD, Sun Photometer, and ONC computers packed for shipping to winter repair/revision/maintenance locations.

November 3

Mapping secured at 23:55 on 02 NOV UTC. Post processing and wrap-up continued as we pulled into port. Ship arrived at 10:00 local time to MOC-P on 03 NOV. Post-processing and demobilization continued until system shutdown on 04 NOV.

November 4

Data team finalized onshore synchronization. Demobilized the control room and cleaned mission spaces. All mission systems shut down for winter repair period by 1600 ship time on 04 NOV.