H13670

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13670

LOCALITY

State(s):	Pennsylvania
General Locality:	Lake Erie
Sub-locality:	8 NM Northwest of Presque Isle

2022

CHIEF OF PARTY
Matthew J. Jaskoski, CDR/NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13670**

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s):	**Pennsylvania**
General Locality:	**Lake Erie**
Sub-Locality:	**8 NM Northwest of Presque Isle**
Scale:	**40000**
Dates of Survey:	**07/10/2022 to 08/13/2022**
Instructions Dated:	**08/02/2022**
Project Number:	**OPR-W386-TJ-22**
Field Unit:	**NOAA Ship *Thomas Jefferson***
Chief of Party:	**Matthew J. Jaskoski, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Low Water Datum IGLD-1985**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in NAD83 UTM 17N, LWD-IGLD 1985. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13670

Project: OPR-W386-TJ-22

Locality: Lake Erie

Sublocality: 8 NM Northwest of Presque Isle

Scale: 1:40000

July 2022 - August 2022

NOAA Ship *Thomas Jefferson*

Chief of Party: Matthew J. Jaskoski, CDR/NOAA

A. Area Surveyed

Survey H13670, located in Lake Erie within the sub locality of 8 NM Northwest of Presque Isle, was conducted in accordance with coverage requirements set forth in the Project Instructions OPR-W386-TJ-22 (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
42° 11' 11.98" N 80° 32' 21.93" W	42° 12' 40.92" N 80° 8' 20.77" W

Table 1: Survey Limits

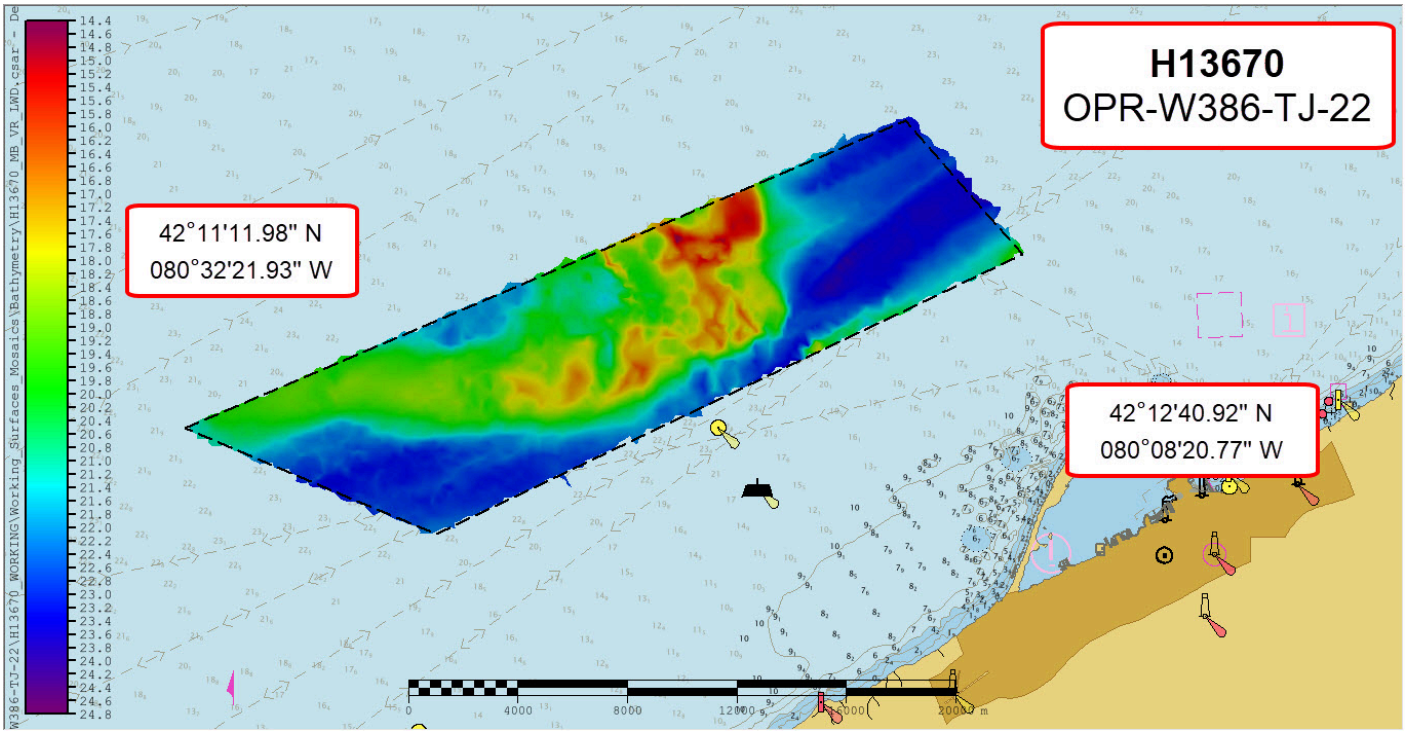


Figure 1: Survey layout for H13670, plotted over ENC US4PA21M. The dashed black line represents the survey limits set forth by the OPR-W386-TJ-22 Project Instructions

Survey data were acquired in accordance with the requirements set forth by the Project Instructions (PI) and the Hydrographic Survey Specifications and Deliverables (HSSD) dated March 2022. The survey area is approximately 53 square nautical miles.

A.2 Survey Purpose

The Port of Cleveland is one of the largest ports in the Great Lakes and ranks within the top 50 ports in the United States. Roughly 13 million tons of cargo are transported through Cleveland Harbor each year supporting over 20,000 jobs and $3.5 billion in annual economic activity(1). This project will provide modern bathymetric data for the Cleveland area as well as the vicinity of South Bass Island and Presque Isle. The project area was identified as a statistically significant hot spot within the 2018 hydrographic health model, a risk model that Coast Survey uses for evaluating priorities based upon navigational risks and the necessary quality of data to support modern traffic. Most of this area has not been surveyed since the 1940s, and experiences significant vessel traffic.

A modern bathymetric survey in this area will identify hazards and changes to the seafloor, provide critical data for updating National Ocean Service (NOS) nautical charting products and improve maritime safety. Survey data from this project is intended to supersede all prior survey data in the common area.

(1)http://www.portofcleveland.com/

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Complete coverage requirements were met utilizing 100% multibeam echo sounder (MBES) coverage as specified by the 2022 HSSD. Data Acquired in H13670 mets survey quality standards specified in the 2022 HSSD, including crosslines (see section B.2.1), NOAA allowable uncertainty (see section B.2.2), and density requirements (see Section B.5.2).

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)
All waters in survey area	Acquire backscatter data during all multibeam data acquistion (Refer to HSSD Section 6.2)

Table 2: Survey Coverage

Survey coverage is in accordance with requirements listed in Table 2 and in the 2022 HSSD. Coverage requirements were met with complete coverage multibeam echosounder (MBES) coverage (Figure 2).

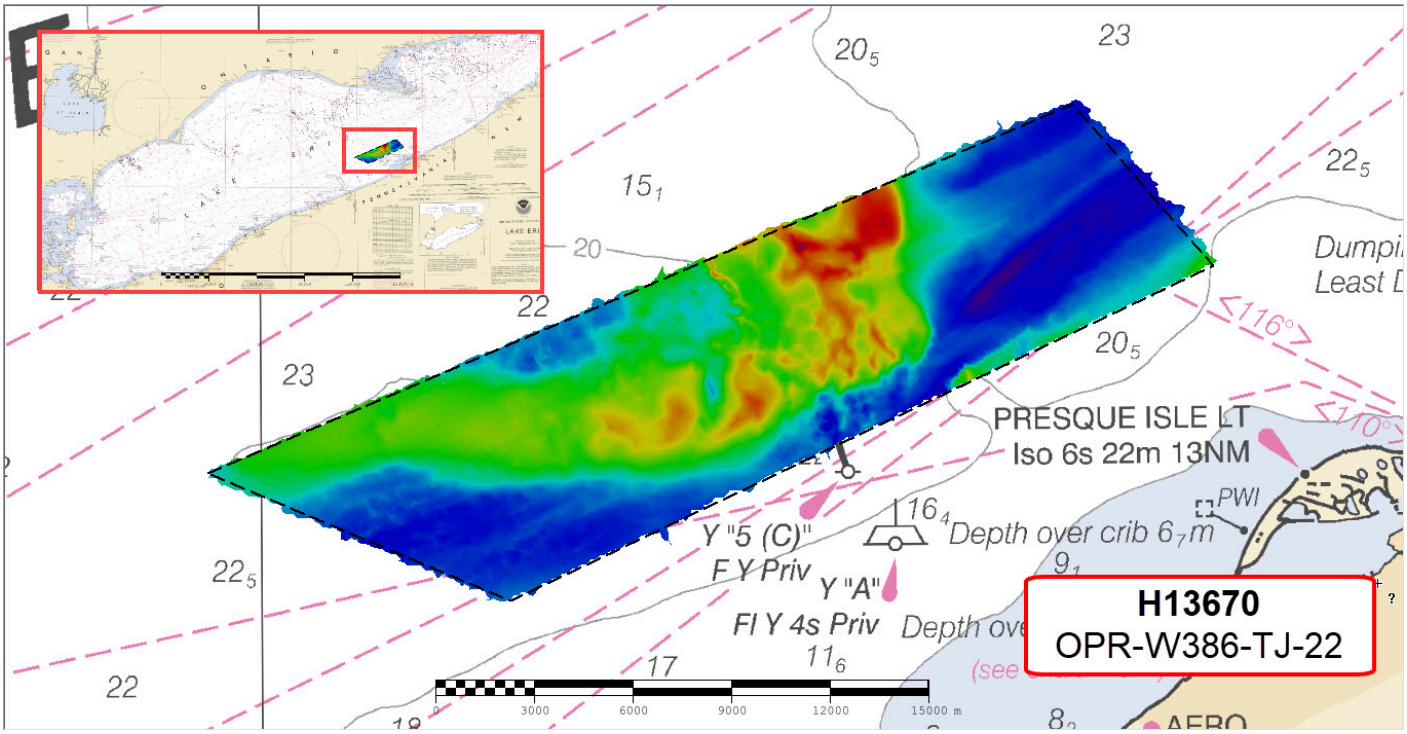


Figure 2: H13670 sheet limits and survey surface on RNC Chart 14820 in reference to the rest of Lake Erie.

A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	*S-222*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0
	MBES Mainscheme	1988.8	1988.8
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0
	SBES/MBES Crosslines	82.6	82.6
	Lidar Crosslines	0.0	0.0
Number of Bottom Samples			7
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			53.0

Table 3: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
07/10/2022	191
07/11/2022	192

Survey Dates	Day of the Year
07/13/2022	194
07/14/2022	195
07/15/2022	196
07/16/2022	197
07/17/2022	198
07/18/2022	199
07/19/2022	200
07/20/2022	201
07/26/2022	207
07/27/2022	208
07/28/2022	209
07/29/2022	210
07/30/2022	211
08/13/2022	225

Table 4: Dates of Hydrography

H13670 data was acquired using S-222 over 16 days.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	***S-222***
LOA	63.4 meters
Draft	4.6 meters

Table 5: Vessels Used

Figure 3: NOAA Ship Thomas Jefferson (S-222)

Figure 4: NOAA Ship Thomas Jefferson (S-222) after deploying a launch in Lake Erie.

S-222 is a Hydrographic Survey Vessel operated by the National Oceanic Atmospheric Administration and is home ported in Norfolk, VA (Figure 3 and 4).

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System
Valeport	Thru-Hull SVS	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

Vessel configurations, equipment operations, data acquisition, and processing were consistent with specifications described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

S222 collected 82.6 linear nautical miles of MBES crosslines and, or 4.15% of mainscheme MBES data.

The crosslines acquired represent good spatial and depth diversity for the assigned survey area (Figure 5).

A variable resolution (VR) Combined Uncertainty and Bathymetry Estimator (CUBE) surface of mainscheme data and a VR CUBE surface of crossline data were differenced using the "Compare Grids" tool in Pydro Explorer 19. The resulting mean was 0.04 m with a standard deviation of 0.06 m (Figure 5). Over 99.9% of nodes were compliant with IHO fraction of allowable error standards (Figure 6). Visual inspection of the difference surface indicated no systematic issues.

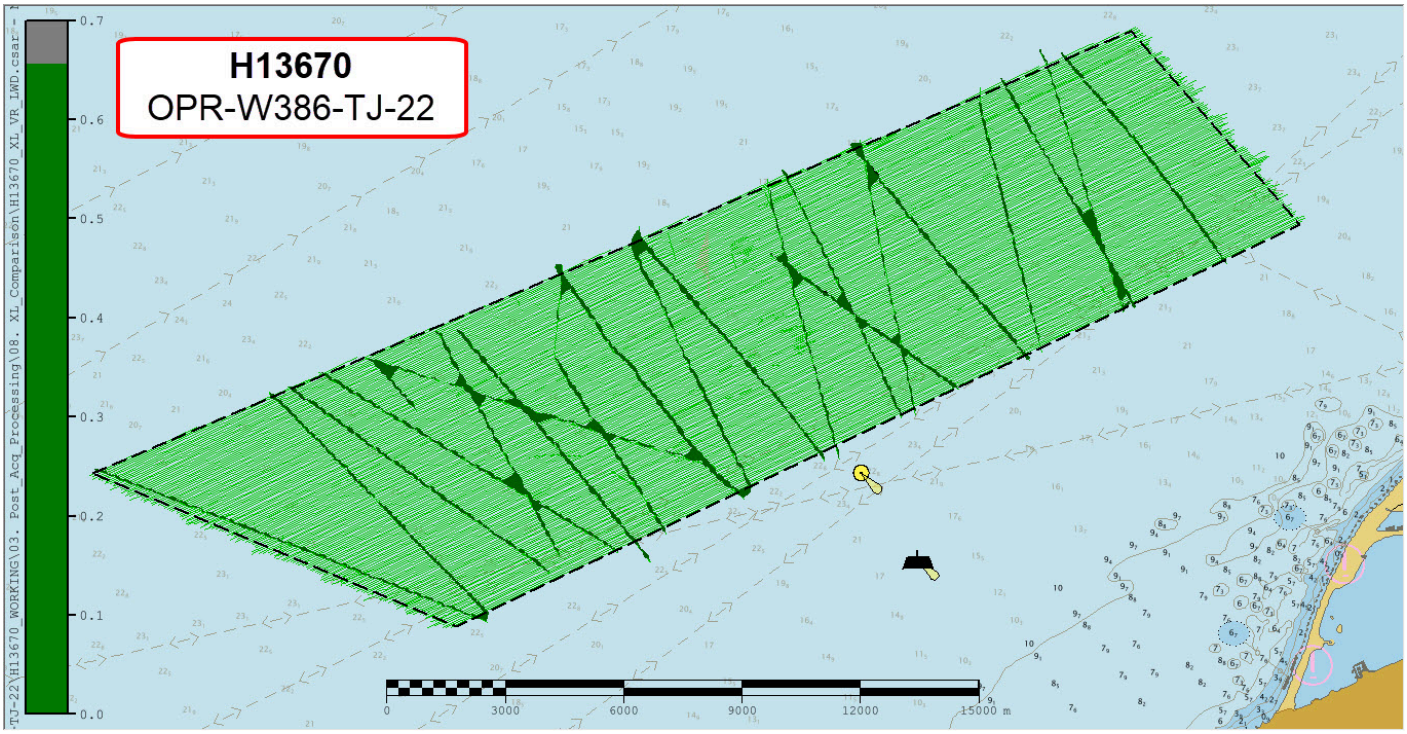
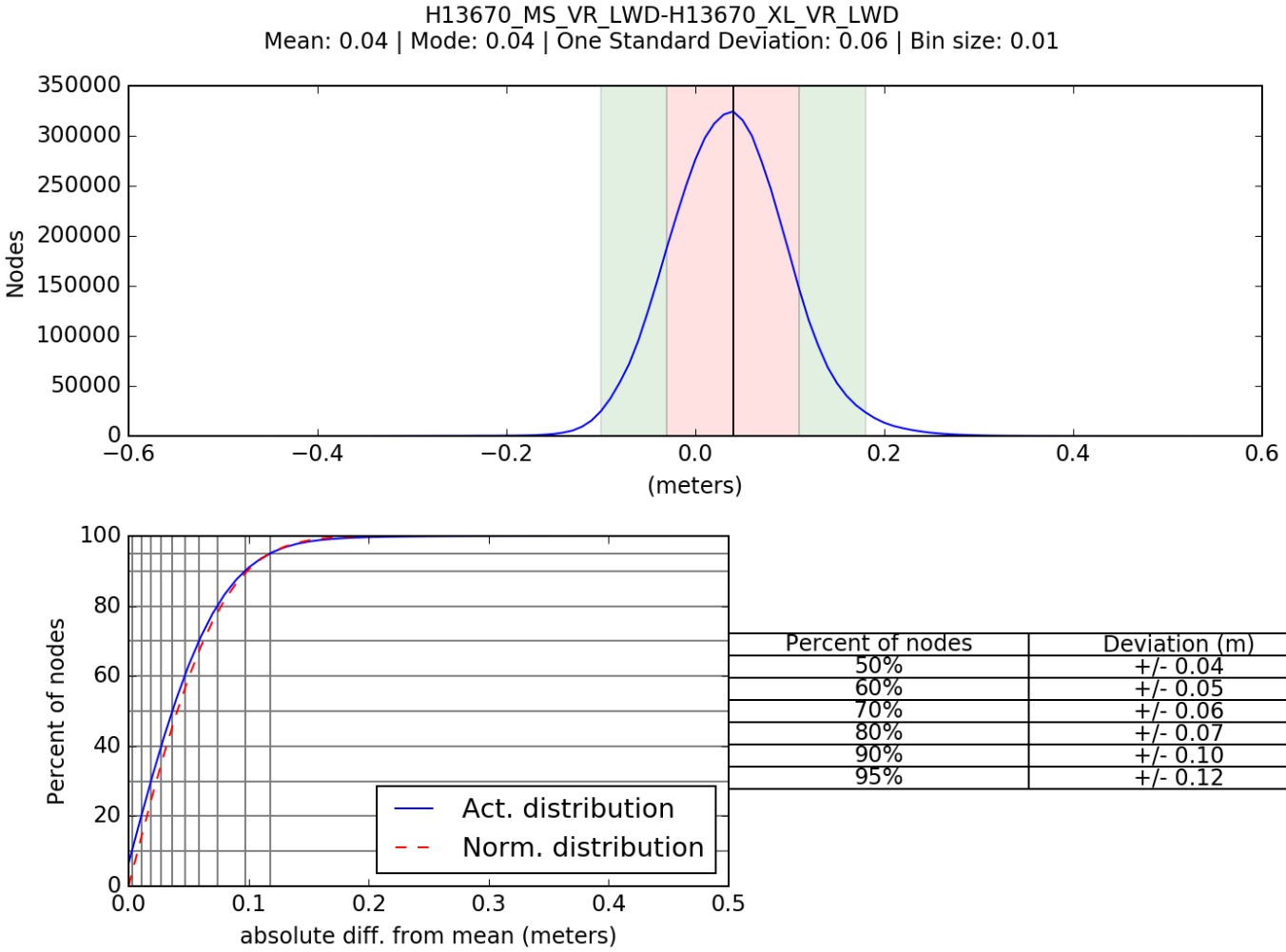


Figure 5: An overview of H13670's crosslines overlaid on the survey tracklines and chart showing good spatial distribution.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.10
95%	+/- 0.12

Figure 6: H13670 crossline/mainscheme comparison statistics

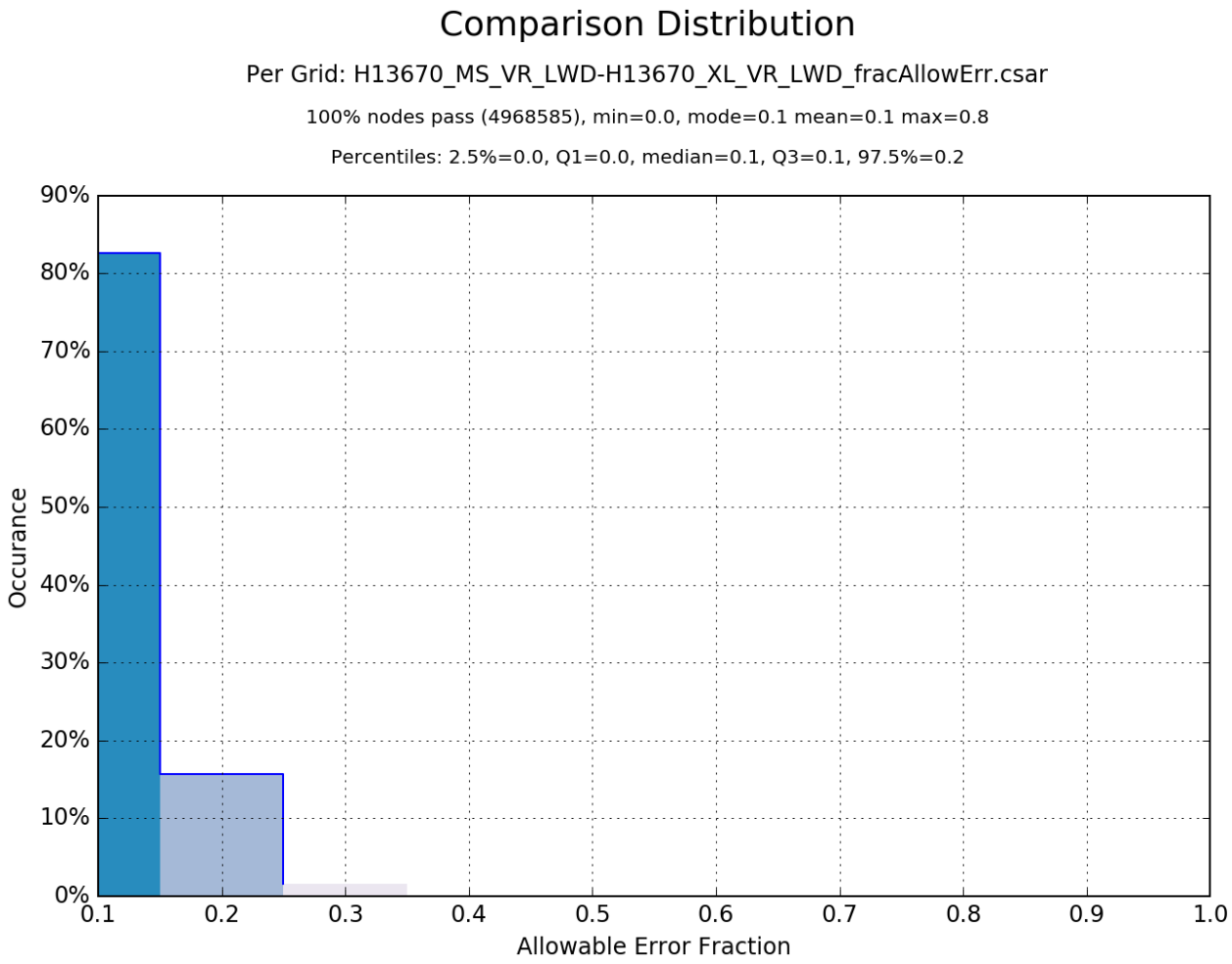


Figure 7: H13670 crossline fraction of allowable error statistics

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.045 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S-222	4.0 meters/second	4.0 meters/second	N/A meters/second	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The bathymetric surface's uncertainty layer is compliant with 2022 HSSD uncertainty standards. Over 99.5% of all nodes pass uncertainty standards (Figure 8).

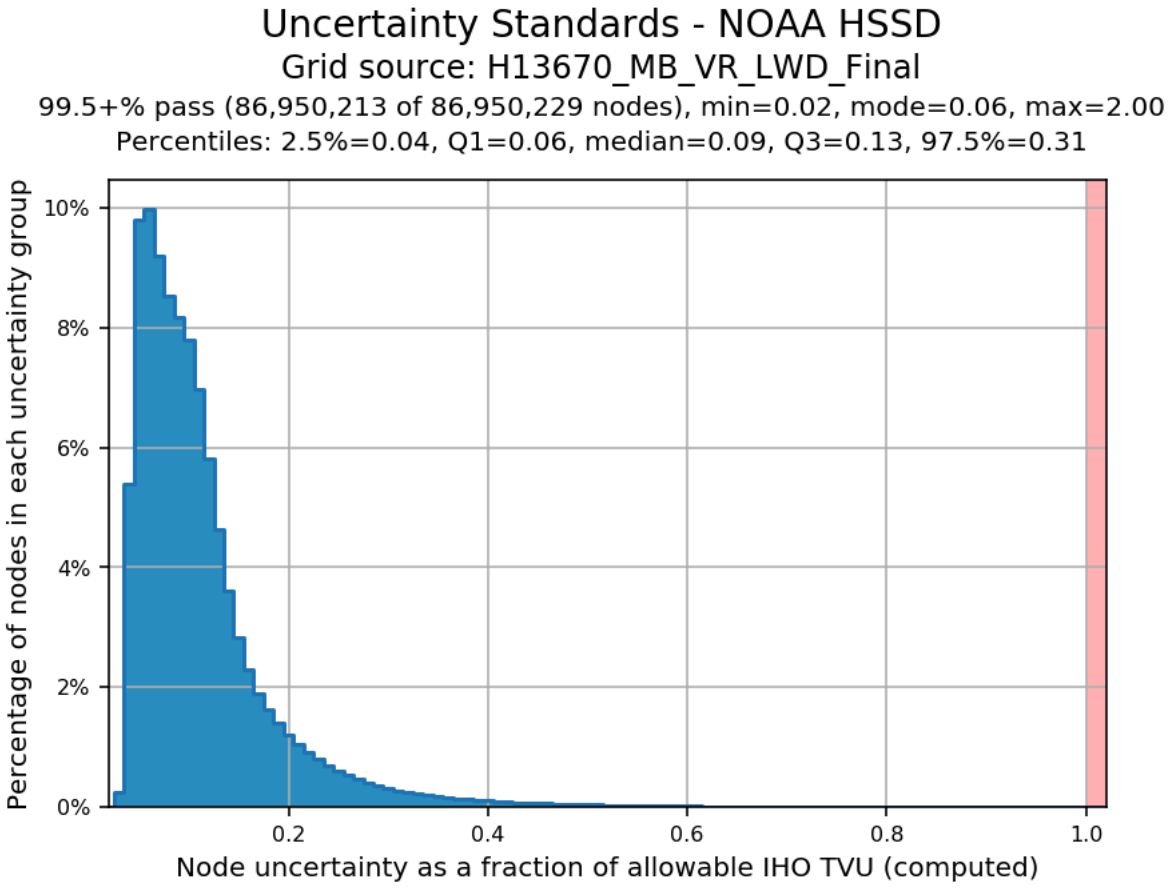


Figure 8: H13670 Uncertainty standards.

B.2.3 Junctions

H13670 junctions with two contemporary surveys conducted by NOAA Ship THOMAS JEFFERSON within project OPR-W386-TJ-22.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13611	1:5000	2022	NOAA Ship THOMAS JEFFERSON	S
H13683	1:5000	2022	NOAA Ship THOMAS JEFFERSON	E

Table 9: Junctioning Surveys

H13611

Please refer to the descriptive report for OPR-W386-TJ-22 H13611 for the junction analysis.

H13683

Please refer to the descriptive report for OPR-W386-TJ-22 H13683 for the junction analysis.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Sound Speed Refractions

H13670 is located in an area that exhibits intense thermal stratification. This layering greatly affects sound speed (Figures 10) and results in refraction that can be observed in the MBES surface (Figure 9). The impacts on sounding depth accuracy are within allowable uncertainty standards, as outlined in the 2022 HSSD.

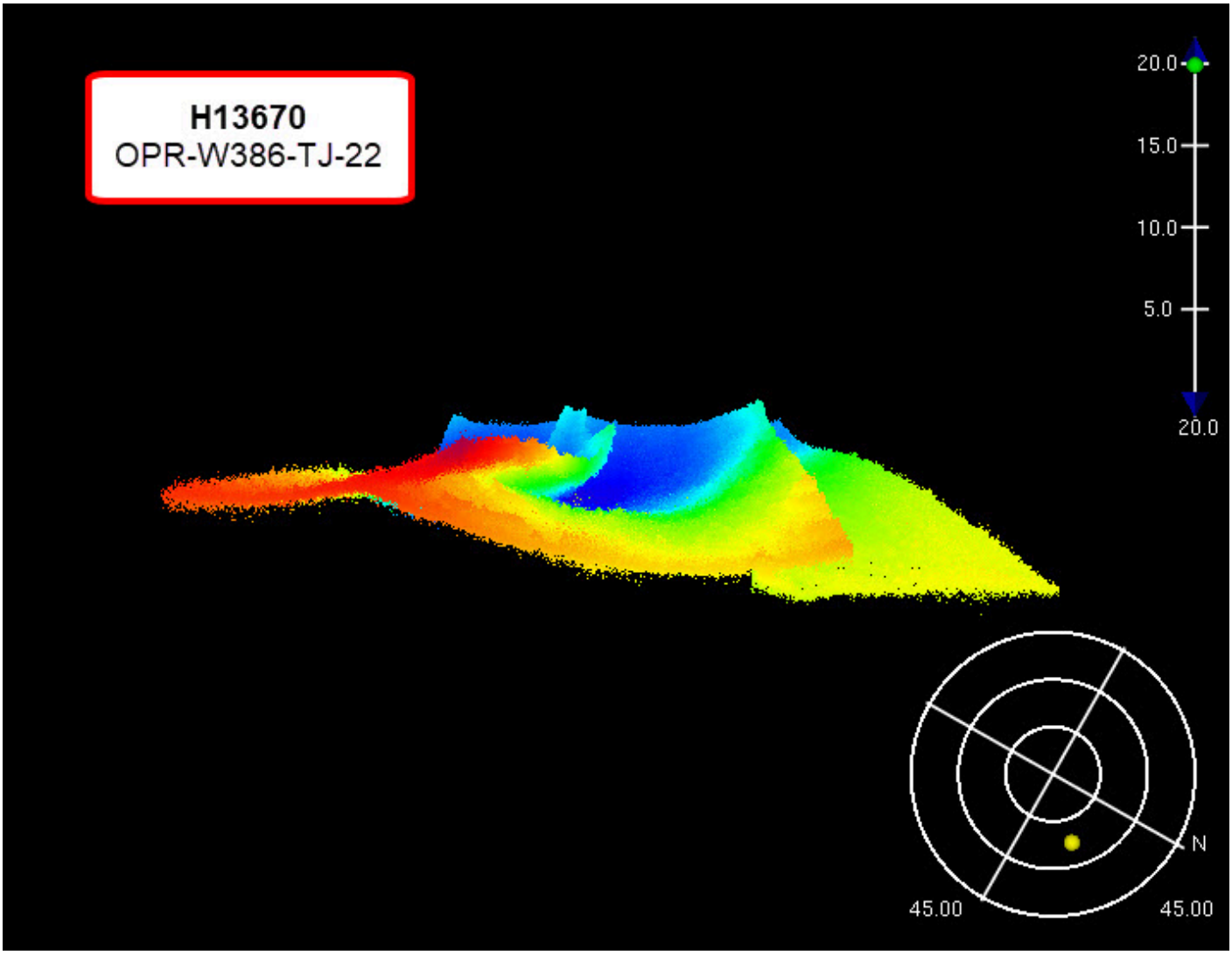


Figure 9: Example of the impact of sound speed seen throughout H13670 in Caris HIPs and SIPs subset 3D editor, with 20x exaggeration.

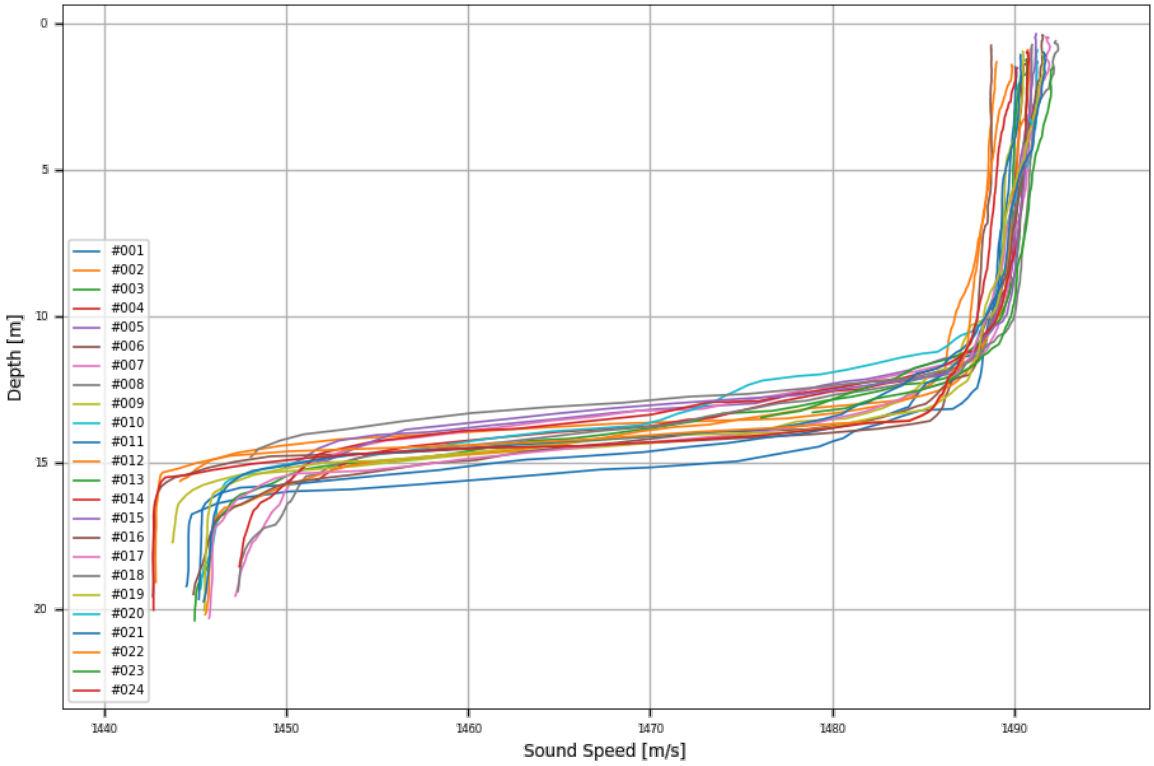


Figure 10: Examples of intense thermocline in sound speed data collected in Lake Erie on H13670 across 24 MVP-200 casts from Julian Day 197.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Static conductivity, temperature, and depth (CTD) casts were conducted at the start of acquisition each day and at a minimum of one every four hours during acquisition using an MVP 200 and Sea-bird Seacat 19+ V2 CTD. Cast frequency was increased in areas where a change in surface sound speed greater than two meters per second existed. All sound speed methods were used as detailed in the DAPR.

A total of 197 sound speed profiles were collected as part of acquisition of H13670 and display good spatial diversity (Figure 11). Five of these casts were located outside of the sheet limits. One cast is 1220 meters away from the assigned survey limits, but the profile is not applied to the survey data set. Sound Speed Profiles acquired are representative of the entire survey area. All sound speed profile data were concatenated into a master file for the sheet. MBES data were corrected by applying profiles nearest in distance in time (4 hours) using this master file.

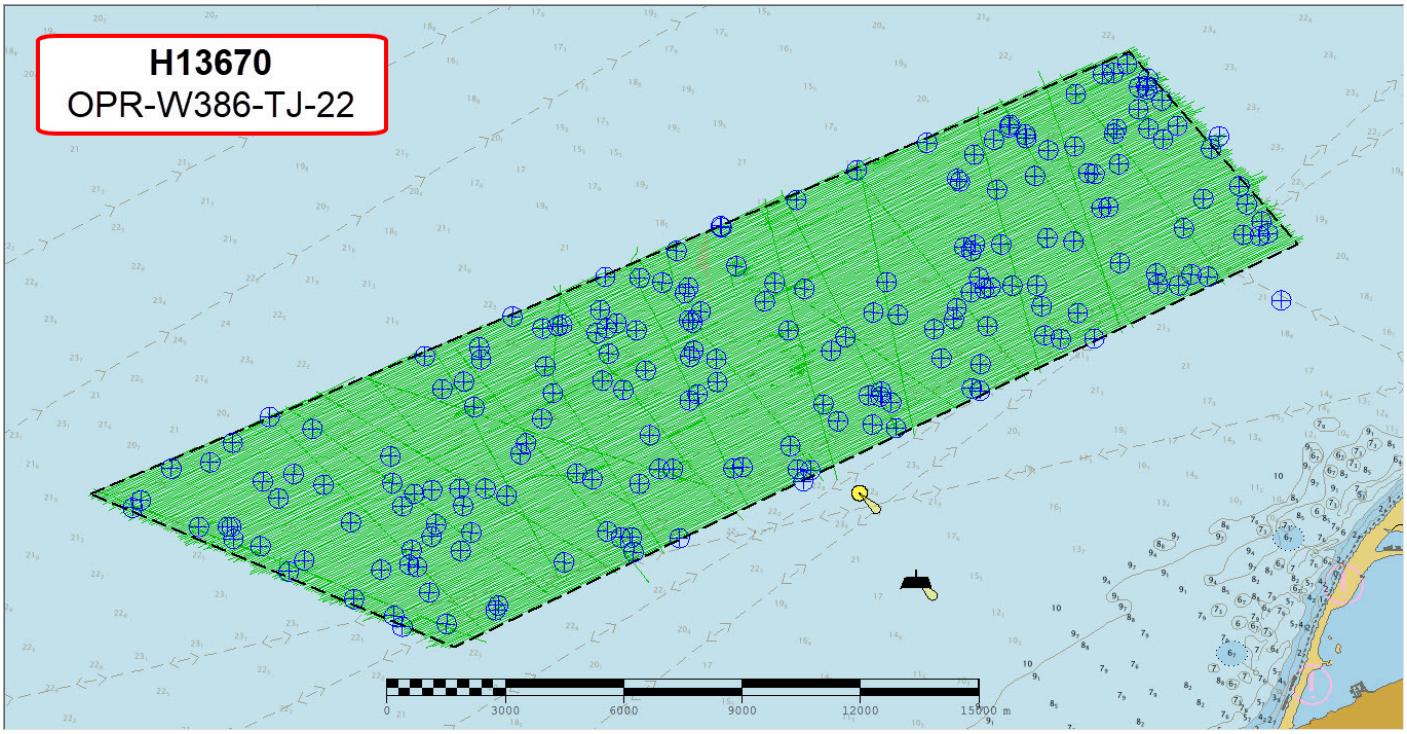


Figure 11: Overview of all sound speed casts collected on H13670.
Cast locations shown as blue targets overlaid on survey tracklines

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

All equipment and survey methods were used as detailed in the DAPR. Raw MBES backscatter was flagged as part of the .all file from the Kongsberg EM2040 systems. Backscatter was processed in QPS Fledermaus GeoCoder Toolbox (FMGT) software, and the exported geotiffs are included in the final processed data submission package (Figure 12).

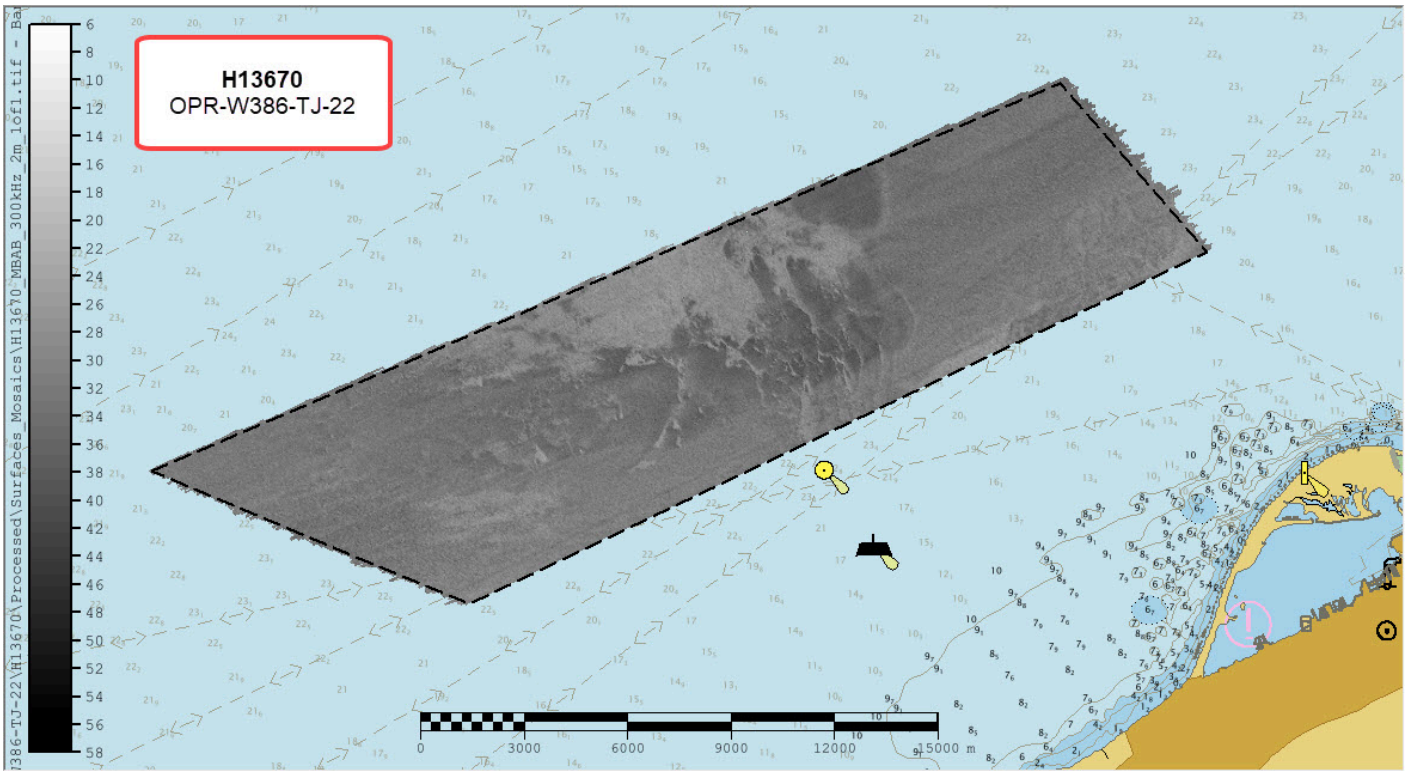


Figure 12: 300 kHz backscatter mosaic from data acquired by S-222.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

Feature Object Catalog NOAA Profile Version 2022 was used for all S-57 attribution in the Final Feature File (FFF). All other software were used as detailed in the DAPR.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13670_MB_VR_LWD	CARIS VR Surface (CUBE)	Variable Resolution	14.5 meters - 24.7 meters	NOAA_VR	Complete MBES
H13670_MB_VR_LWD_Final	CARIS VR Surface (CUBE)	Variable Resolution	14.5 meters - 24.7 meters	NOAA_VR	Complete MBES
H13670_MBAB_300kHz_2m_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES

Table 10: Submitted Surfaces

H13670_MB_VR_LWD_Final uncertainty layer is resolved from the maximum of H13670_MB_VR_LWD nodal TVU and standard deviation values. Complete Coverage requirements were met by 100% Multibeam Echo Sounder (MBES) coverage as specified under section 5.2.2.2 of the 2022 HSSD. There are no holidays present in the coverage achieved. All bathymetric grids for H13670 meet density requirements per the 2022 HSSD (Figure 13).

At the southern edge of H13670, the survey coverage meets the sheet limits but does not provide significant over lap. H13611, a contemporary survey from project OPR-W386-TJ-22, provides significant overlap with H13670 (Figure 14).

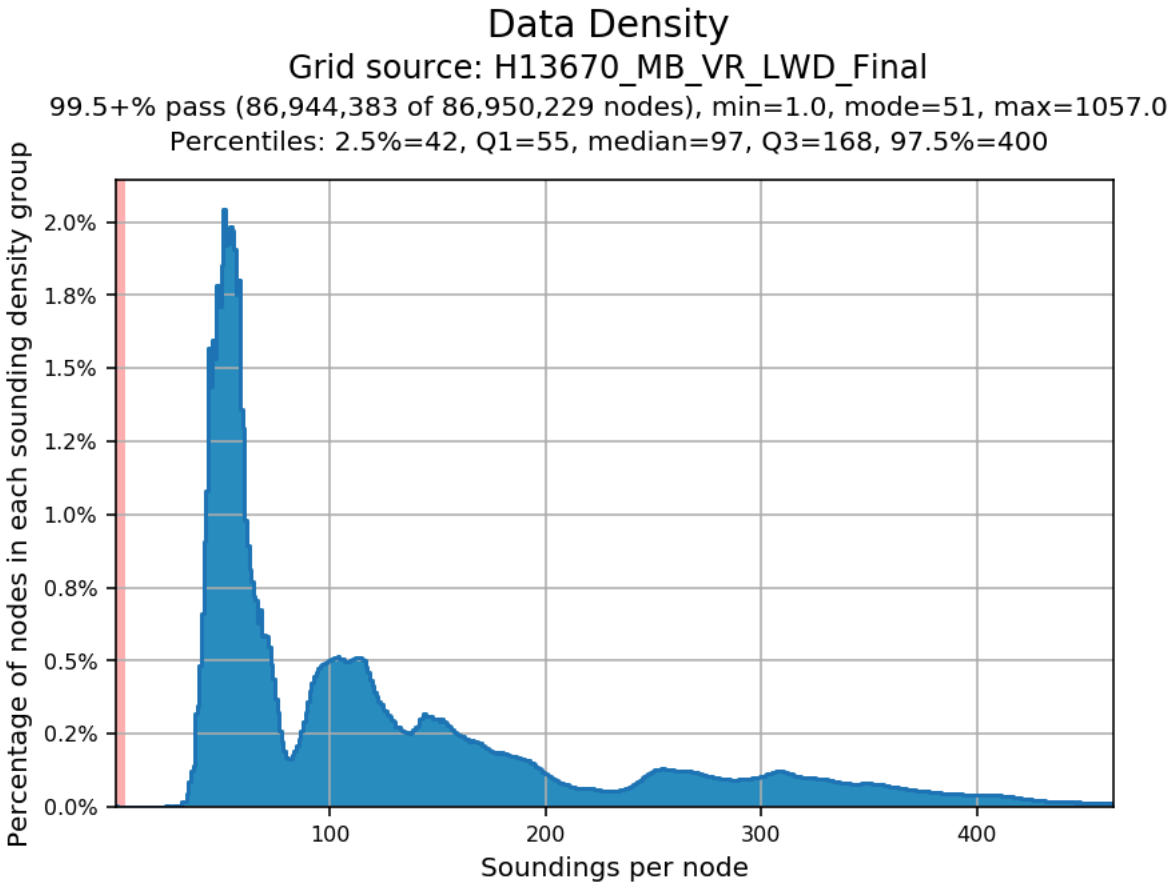


Figure 13: H13670 data density.

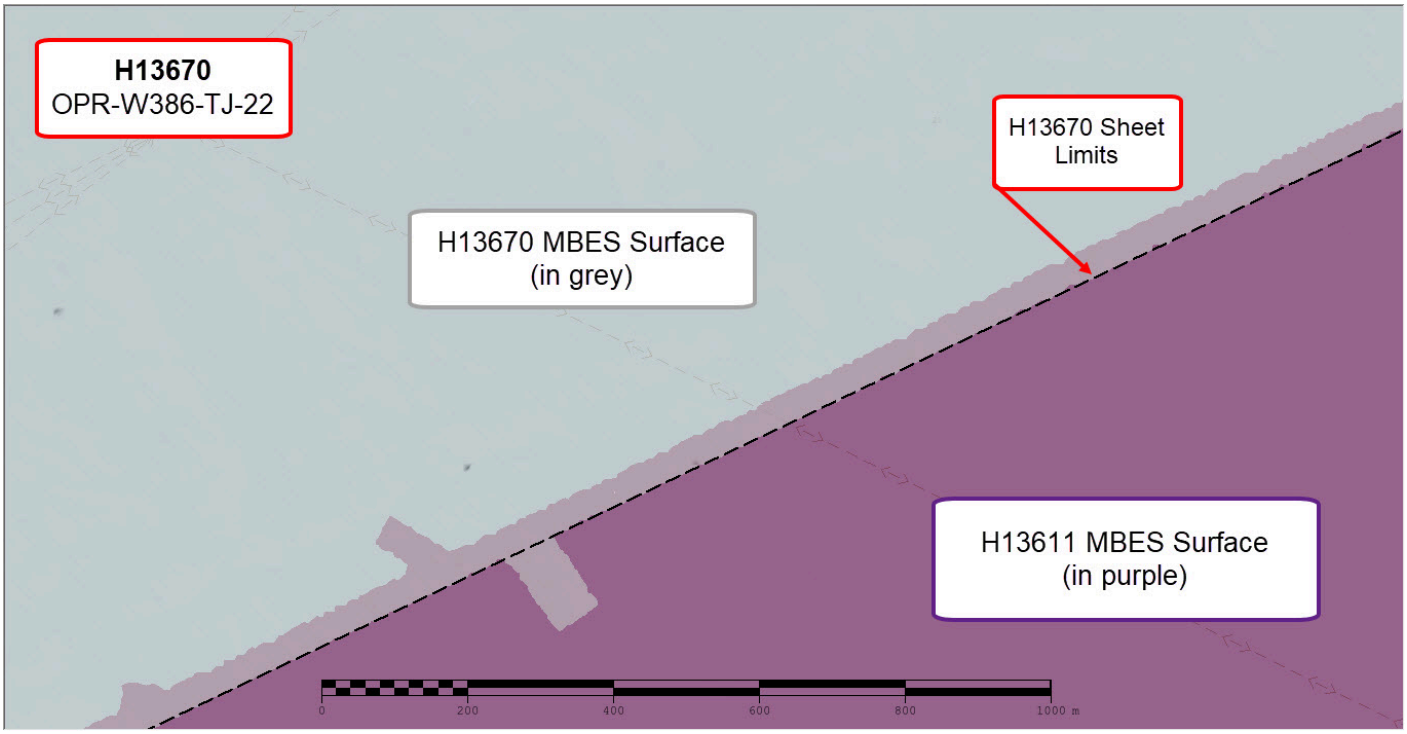


Figure 14: Example of H13670 southern sheet limits having significant overlap with H13611 from OPR-W386-TJ-22

C. Vertical and Horizontal Control

Field installed tide and GPS stations were not utilized for this survey. There is no HVCR report included with the submission of H13670.

C.1 Vertical Control

The vertical datum for this project is Low Water Datum IGLD-1985.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-W386-TJ-22_NAD83_2011_VDatum_LWD_IGLD85

Table 11: ERS method and SEP file

All soundings submitted for H13670 are reduced to LWD IGLD-85 using VDatum techniques as outlined in the DAPR.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 17.

RTK

Trimble PP-RTX service was used with an Applanix POS MV v5 system and POSPac MMS software for ERS control in accordance with the HSSD for H13670 MBES data from S-222.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition on S-222.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4PA21M	1:80000	14	09/02/2022	03/31/2022

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

Surveyed soundings and contours were compared against previously charted data on ENC US4PA21M. Depth values were found to be in general agreement with previously charted soundings. The hydrographer believes the surveyed soundings do not pose a hazard to navigation (Figure 15). Twelve newly discovered

features are included in the FFF and none were considered to be navigational hazards. No danger to navigation reports were submitted for this survey and all data acquired on H13670 are recommended to supersede prior data.

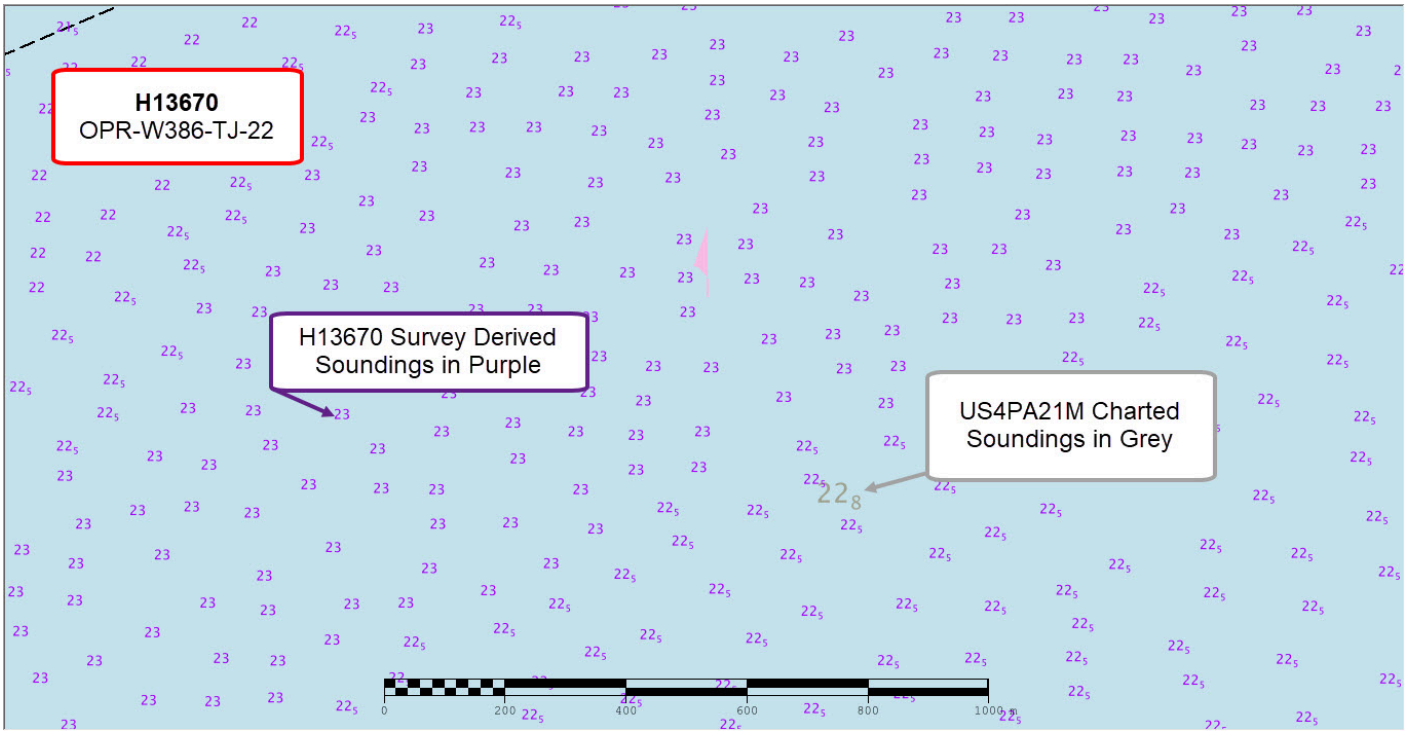


Figure 15: Examples of charted soundings compared to H13670 survey derived soundings.

D.1.3 Charted Features

Charted features exist for this survey, but were not investigated. There are seven recommended tracks located on the southern end of H13670 (Figure 16). These tracks were not assigned for investigation in the PRF for OPR-W386-TJ-22.

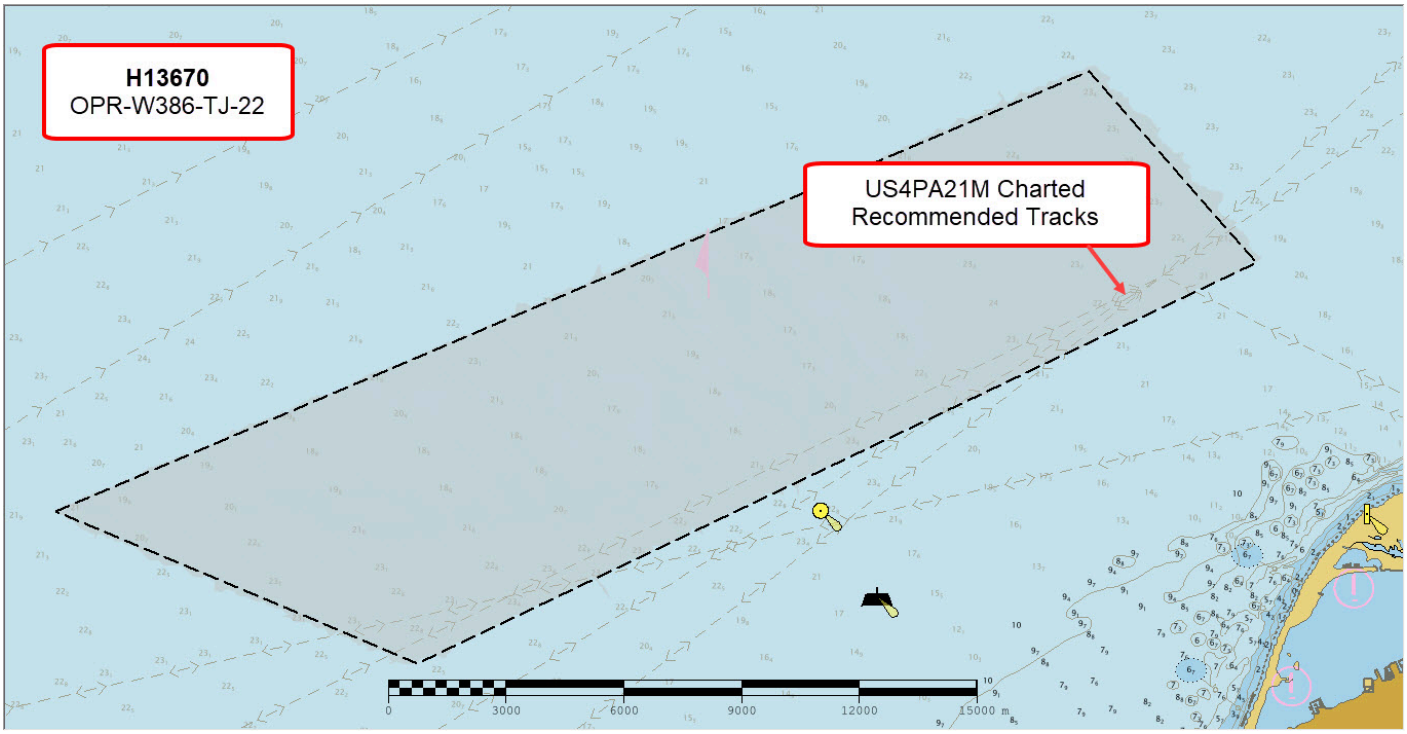


Figure 16: Recommend tracks charted in ENC US4PA21M that transit through H13670.

D.1.4 Uncharted Features

Twelve uncharted features were identified and investigated. None of the features were considered dangerous to navigation. Reference the FFF included with the submission of this project for further information.

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

No Aids to navigation (ATONs) exist for this survey.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Seven Bottom Samples were assigned in the OPR-W386-TJ-22 Project Reference File (PRF). All seven Bottom Samples were assigned, investigated, and are included in the FFF (Figure 17 and 18).

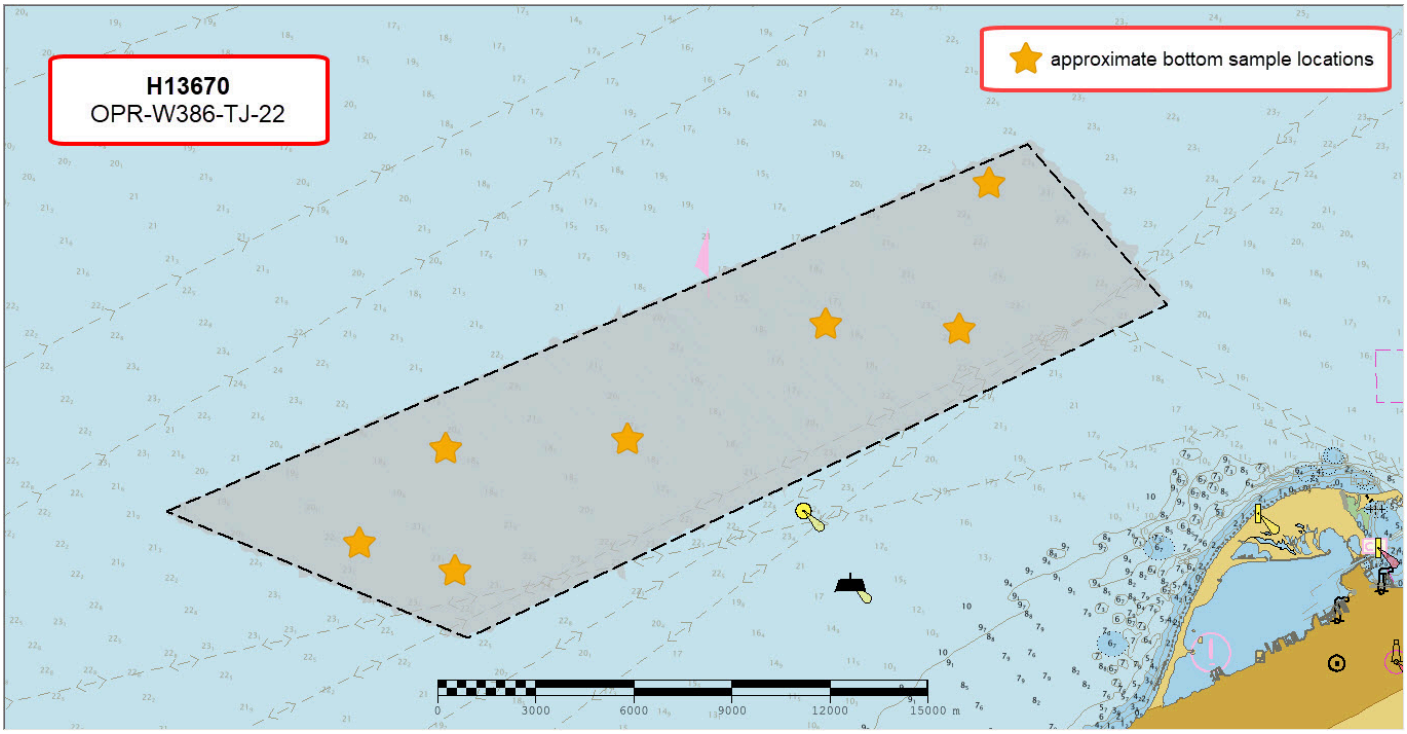


Figure 17: Approximate bottom sample collection locations for H13670.

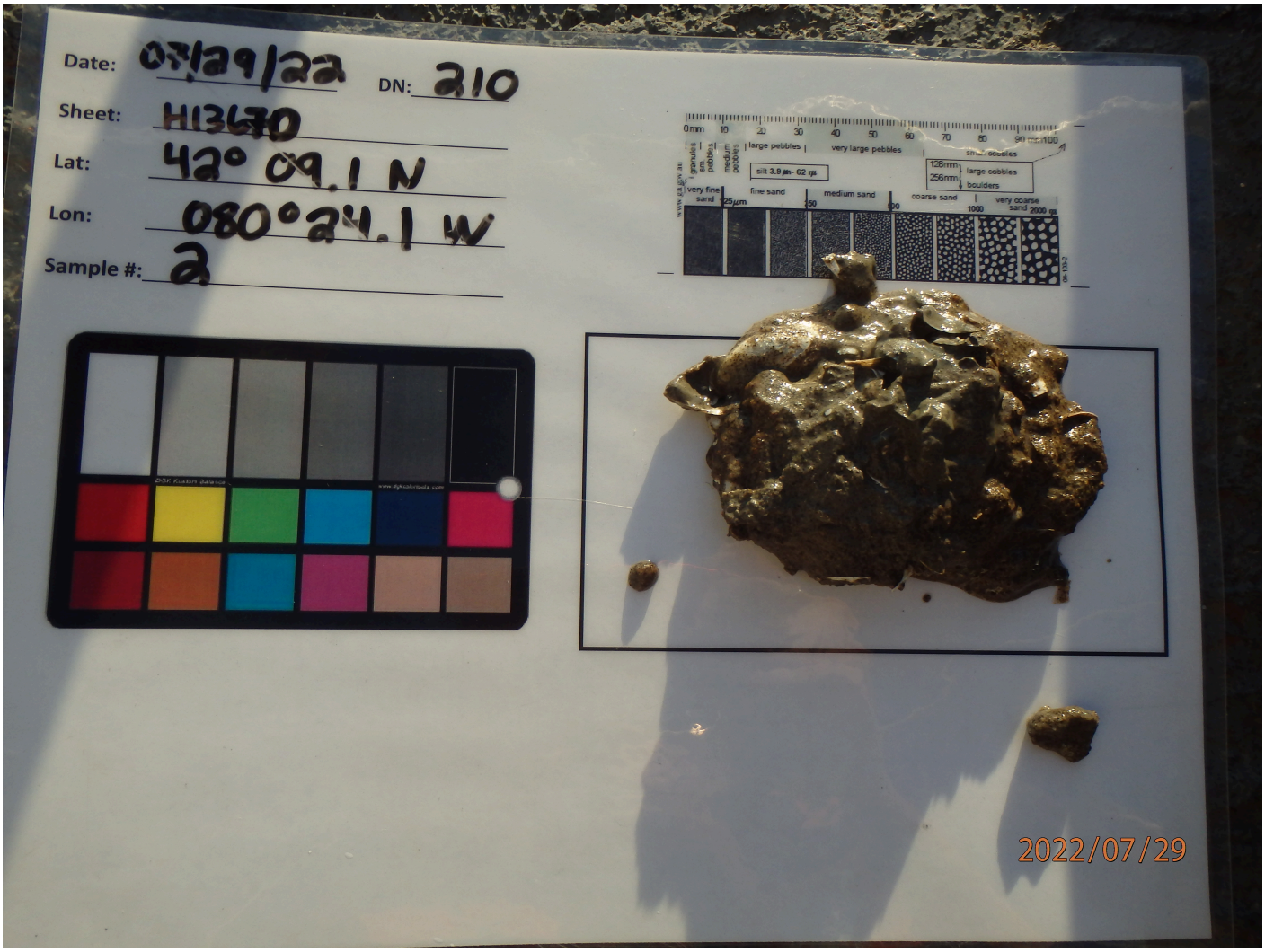


Figure 18: Example of a bottom sample collected in the H13670 survey area.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

No new surveys or further investigations are recommended for this area.

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Matthew J. Jaskoski, CDR/NOAA	Chief of Party	09/28/2022	JASKOSKI.MATTHEW.JACOB.1275636262 2022.09.24 08:38:01 -04'00'
Michelle M. Levano, LT/NOAA	Field Operations Officer	09/28/2022	Digitally signed by LEVANO.MICHELLE.MARIE.1516645888 Date: 2022.09.24 15:51:56 -04'00'
Erin K. Cziraki	Chief Survey Technician	09/28/2022	CZIRAKI.ERIN.KAYE.1550015338 Digitally signed by CZIRAKI.ERIN.KAYE.1550015338 Date: 2022.09.25 07:48:59 -04'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File