H12511

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12511

LOCALITY

State(s):	Connecticut
General Locality:	North Shore of Long Island Sound
Sub-locality:	Madison Reef

2020

CHIEF OF PARTY
LTJG Nicholas Azzopardi

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12511**

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):	**Connecticut**
General Locality:	**North Shore of Long Island Sound**
Sub-Locality:	**Madison Reef**
Scale:	**10000**
Dates of Survey:	**10/05/2020 to 11/19/2020**
Instructions Dated:	**09/10/2020**
Project Number:	**OPR-B370-NRT5-20**
Field Unit:	**NOAA Navigation Response Team - New London**
Chief of Party:	**LTJG Nicholas Azzopardi**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

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 18N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H12511

Project: OPR-B370-NRT5-20

Locality: North Shore of Long Island Sound

Sublocality: Madison Reef

Scale: 1:10000

October 2020 - November 2020

NOAA Navigation Response Team - New London

Chief of Party: LTJG Nicholas Azzopardi

A. Area Surveyed

The survey area covers a portion of Long Island Sound in which had not yet been surveyed to modern standards, with near-shore sections of the survey area being last acquired in the late 19th century. The assigned survey area is to the west of Hammonasset State Park, south of Madison, CT; and to the east of Half Acre Rock in Long Island Sound. The inshore limit of the survey area was the charted 12 foot contour, or the inshore Navigable Area Limit Line (NALL), defined by 3.5 meters or the limit of safe navigation. The survey covers approximately 11 square nautical miles. The area is generally trafficked by recreational yachts and fishing vessels from the nearby towns of Clinton, Madison, and Guilford.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 16' 9.45" N 72° 38' 50.35" W	41° 12' 47.76" N 72° 34' 18" W

Table 1: Survey Limits

Survey limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

A.2 Survey Purpose

This project is being conducted in support of NOAA's Office of Coast Survey to provide contemporary hydrographic data in order to update the nautical charting products and reduce the survey backlog within the

area. In addition, data from this project will support the Long Island Sound Seafloor Mapping Initiative in New York and Connecticut.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

The Grid QC tool within QC Tools was used to analyze multibeam echosounder (MBES) data density. The MBES surfaces meet the HSSD data density requirement.

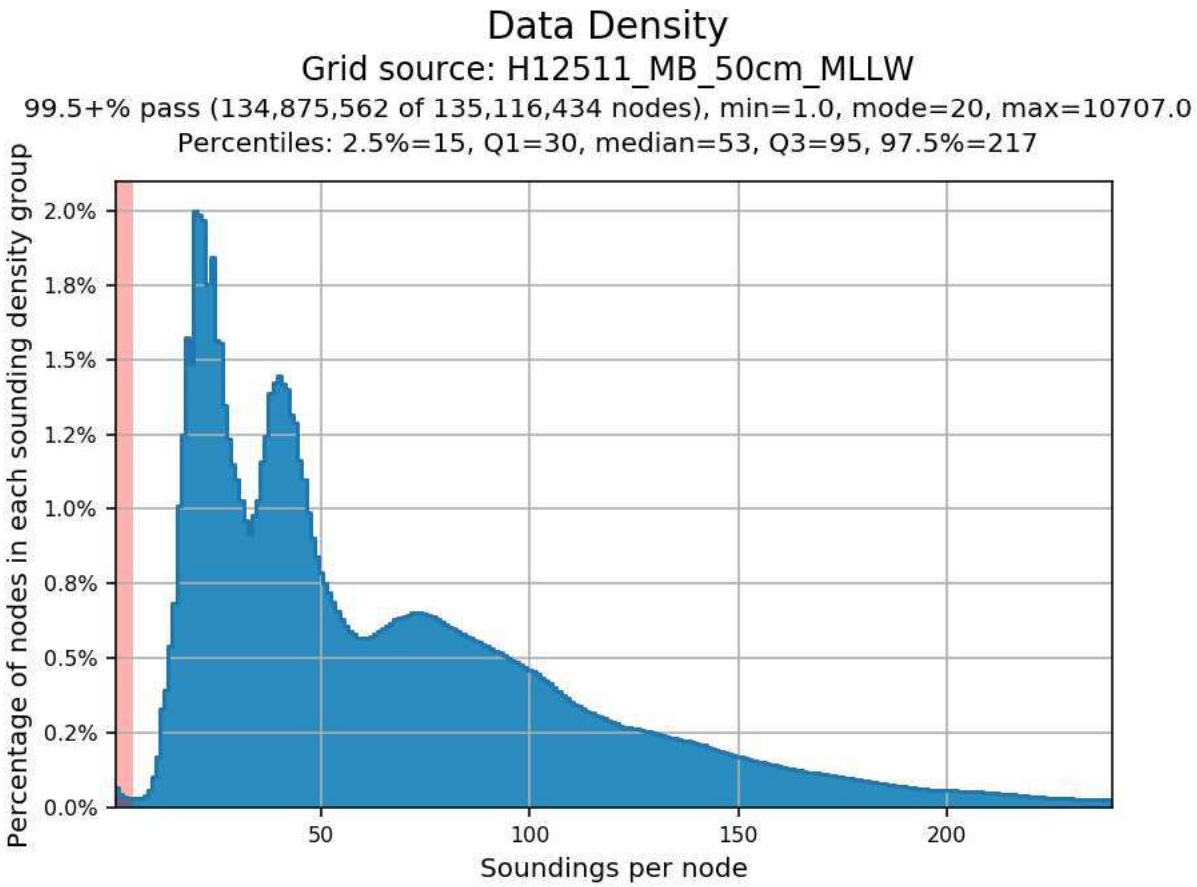

Figure 1: Pydro derived histogram plot showing HSSD object detection compliance of H12511 MBES data within the 50cm CUBE surface.

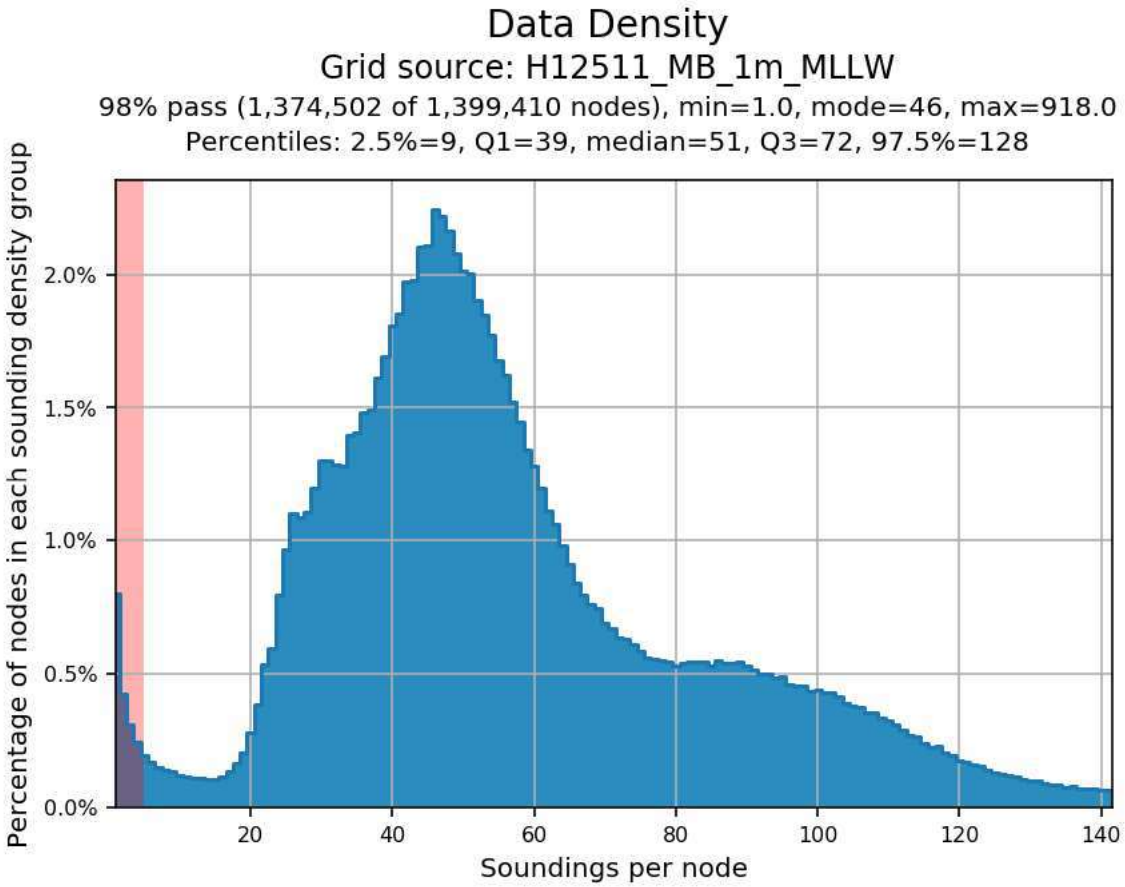

Figure 2: Pydro derived histogram plot showing HSSD object detection compliance of H12511 MBES data within the 1m CUBE surface.

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	Object Detection Coverage (Refer to HSSD Section 5.2.2.2)

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements listed above and in the HSSD with some exceptions. For H12511 100% MBES coverage was generally acquired offshore of the 8m depth contour, while 200% SSS with concurrent MBES and full MBES development of SSS contacts was generally acquired inshore of the 8m depth contour. Pydro Explorer's Flier Finder found 721 fliers within the H12511 50cm surface and 1627 fliers in the H12511 1m surface. However, most are on the edges of the sheet and edges of the SSS lines with set line spacing. Pydro Explorer's Holiday Finder found 617 holidays within the

H12511 1m surface, however, all holidays are either on the edges of the sheet or are covered by the H12511 50cm surface. Within the H12511 50cm surface, Pydro Explorer's Holiday Finder found 1298 holidays, which fall into three categories. Holidays caused by the SSS set line spacing which are covered by SSS data, holidays that are covered by the H12511 1m surface, and holidays caused by sonar blowouts, often due to increased sea state (see section B.2.6 for more information). These holidays were not able to be addressed due to increased inclement weather that forced the end of survey operations. All MBES holidays were investigated and do not appear to contain navigationally significant features.

Visual analysis of the SSS data has revealed 14 SSS holidays, 8 of which are UWTROCs that were not fully developed with MBES and 6 data gaps caused by blowouts. This holiday file has been included as a S57 file in the Side_Scan_Sonar_Contacts folder. All 8 UWTROCs found by SSS but not developed by MBES were imported into the FFF as such. Pydro Explorer's Scan Features tool flags each of these features for not having a VALSOU value populated, however, the contact height information has been documented for each feature.

One feature within the FFF gets flagged by Pydro Explorer's VALSOU check for having an improper VALSOU value when compared to the MBES surface. However, the flag is the result of a rounding error and should not be flagged.

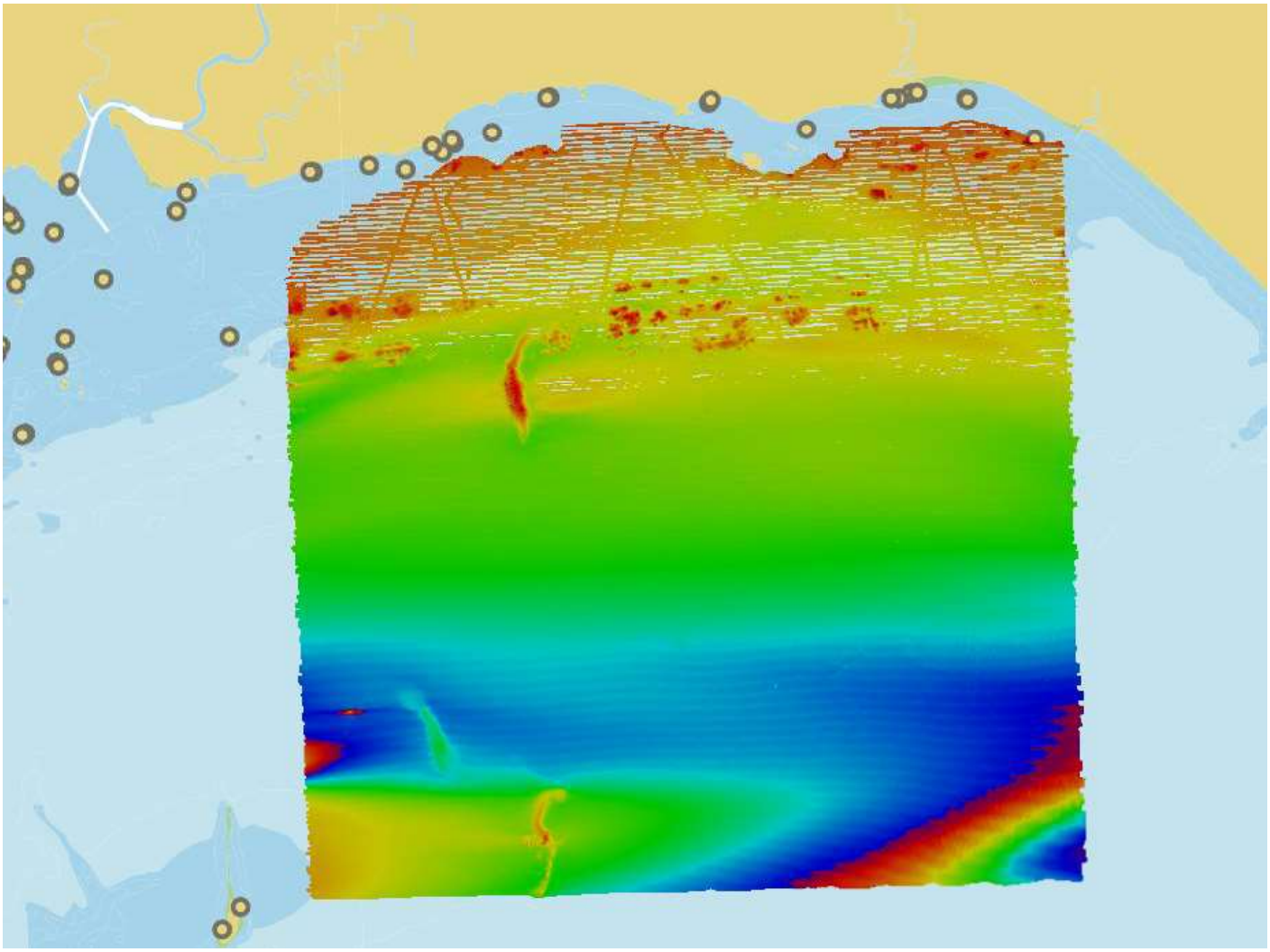

Figure 3: Survey coverage of H12511.

A.6 Survey Statistics

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

	HULL ID	*S3007*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	639.92	639.92
	Lidar Mainscheme	0	0
	SSS Mainscheme	188.69	188.69
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	188.69	188.69
	SBES/MBES Crosslines	22.10	22.10
	Lidar Crosslines	0	0
Number of Bottom Samples			10
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			10.69

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
10/05/2020	279
10/06/2020	280

Survey Dates	Day of the Year
10/08/2020	282
10/09/2020	283
10/14/2020	288
10/16/2020	290
10/19/2020	293
10/20/2020	294
10/21/2020	295
10/22/2020	296
10/27/2020	301
10/29/2020	303
11/04/2020	309
11/05/2020	310
11/06/2020	311
11/09/2020	314
11/11/2020	316
11/12/2020	317
11/13/2020	318
11/19/2020	324

Table 4: Dates of Hydrography

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	*S3007*
LOA	10.38 meters
Draft	0.6 meters

Table 5: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
YSI	CastAway-CTD	Conductivity, Temperature, and Depth Sensor
EdgeTech	4125	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	SVP 71	Sound Speed System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines acquired for this survey totaled 3.45% of mainscheme acquisition.

A 50cm CUBE surface was created using only mainscheme lines and a second 50cm CUBE surface was created using only crosslines. These surfaces were then input into the Pydro Tool "Compare Grids". The comparison passed HSSD specifications.

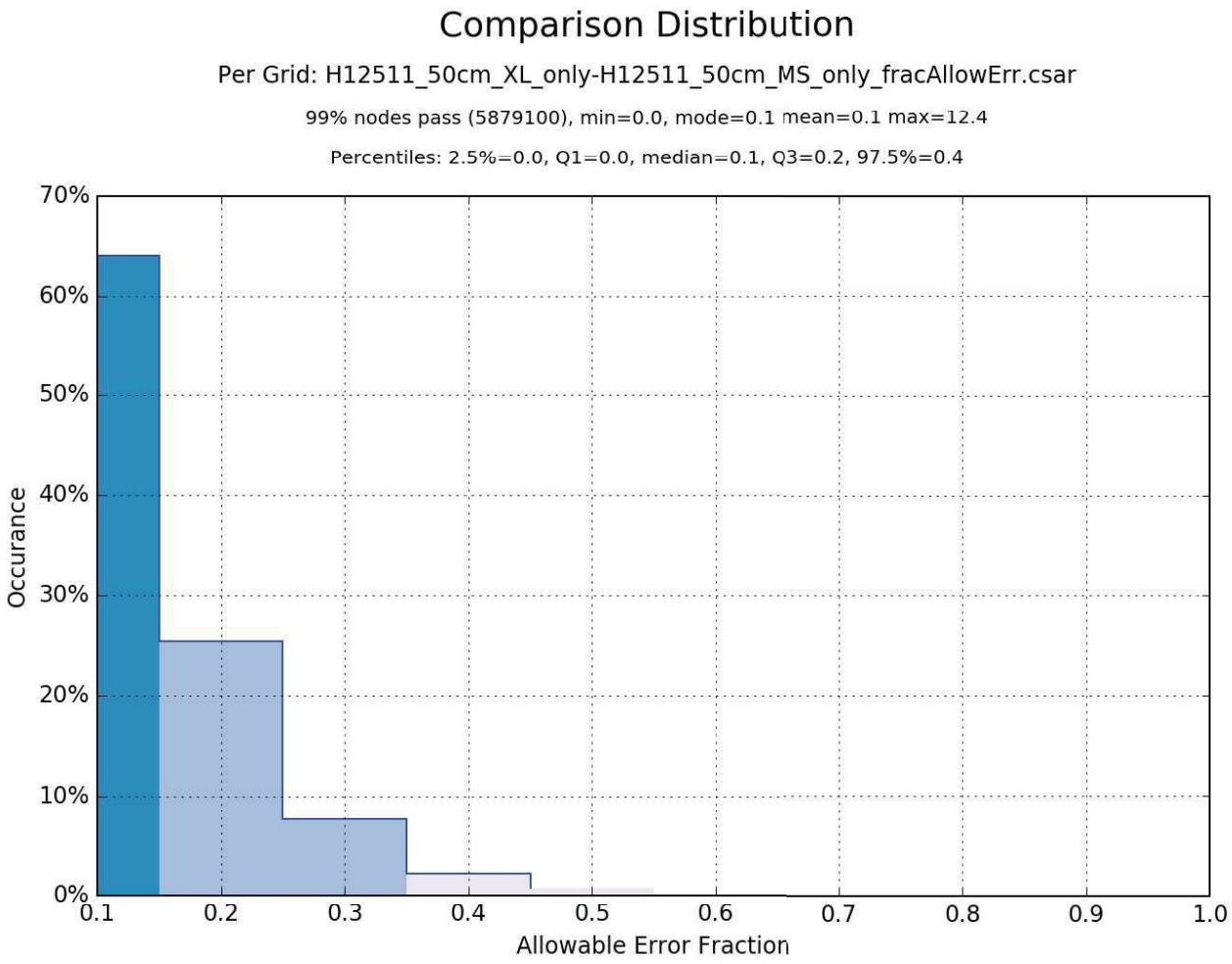

Figure 4: Pydro generated graph showing comparison between mainscheme and crosslines in H12511.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0 centimeters	9.5 centimeters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S3007	2 meters/second	N/A meters/second	N/A meters/second	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for H12511 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. The uncertainty for the VDatum model was provided to the field units in the Project Instructions. A visual inspection of the Uncertainty layer revealed the areas of higher uncertainty occur in the outer beams, and a visual inspection of the Density layer revealed the areas of lowest density are in the deepest areas of the survey.

In addition to the usual a priori estimates of uncertainty, some real time and post processed uncertainty sources were also incorporated into the depth estimates of the survey. Real-time uncertainties from the Kongsberg MBES sonars were incorporated and applied during post processing. Uncertainties associated with vessel roll, pitch, gyro, navigation, and heave were applied during post-processing. All of the aforementioned uncertainties were applied in CARIS. As stated, H12511 is an ellipsoidally referenced survey (ERS) and the tidal component was accomplished with a separation model.

B.2.3 Junctions

H12511 junctions with three other surveys. For each pair of surfaces, a difference surface was created by using the Compare Grids tool within Pydro Explorer. This surface was then visually inspected to notice any large differences between the junctioning surveys. Compare Grids also creates a Comparison Distribution graph that shows how many nodes pass IHO specifications.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12510	1:10000	2012	Navigation Response Team 5	E
H12484	1:10000	2012	NOAA Ship THOMAS JEFFERSON	W
H11252	1:10000	2004	NOAA Ship THOMAS JEFFERSON	S

Table 9: Junctioning Surveys

H12510

Overlap with survey H12510 was approximately 5.9km long and 100m wide, with depths in the junction area ranging from 3m to 26m. Analysis of the difference surface indicated a mean difference between 0.07m to 0.16m, and the one standard deviation between 0.11m to 0.20m. All comparison distribution graphs show 99% or more nodes pass IHO specifications.

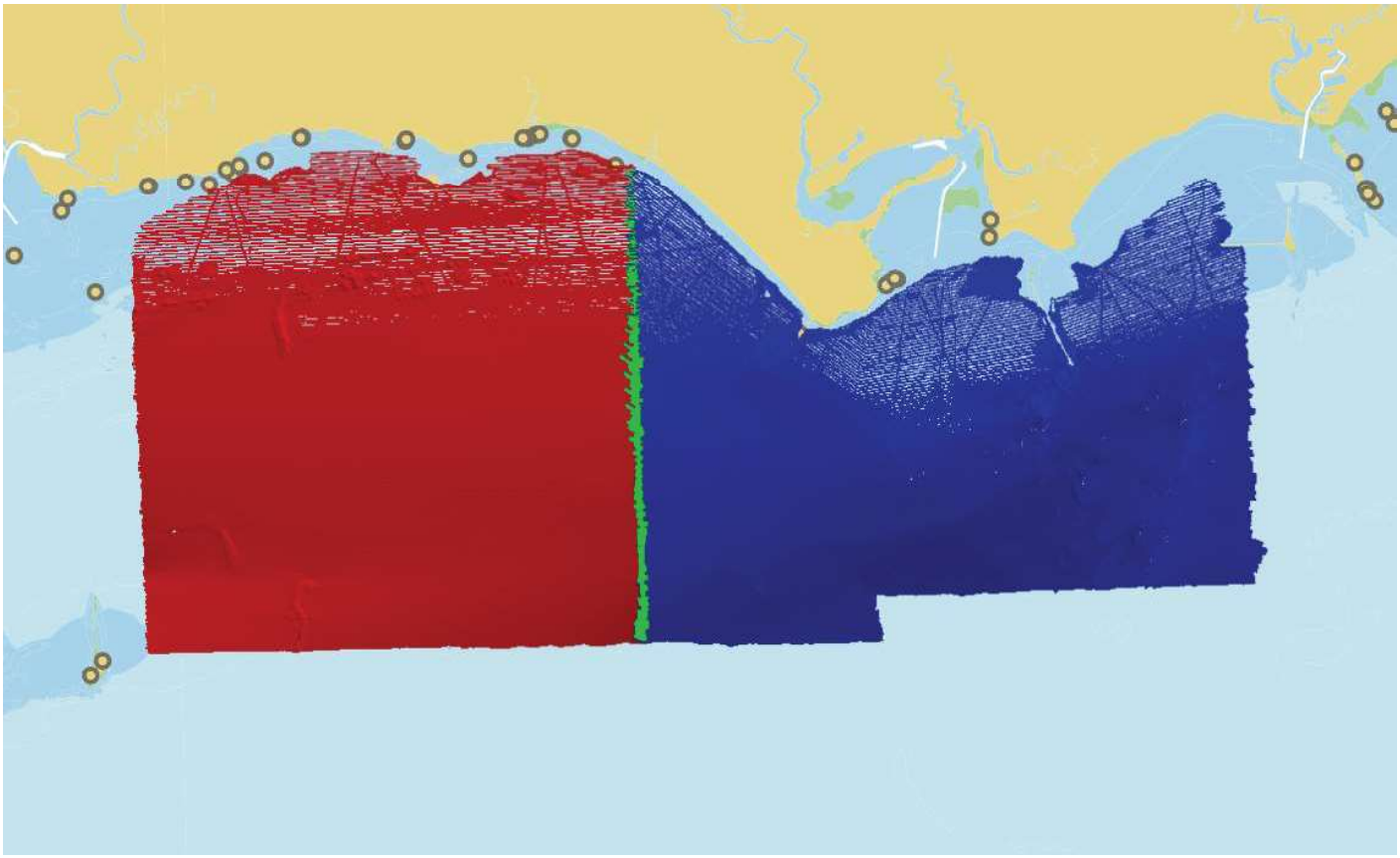

Figure 5: Overview of H12511 (red) and H12510 (blue) and their overlap (green).

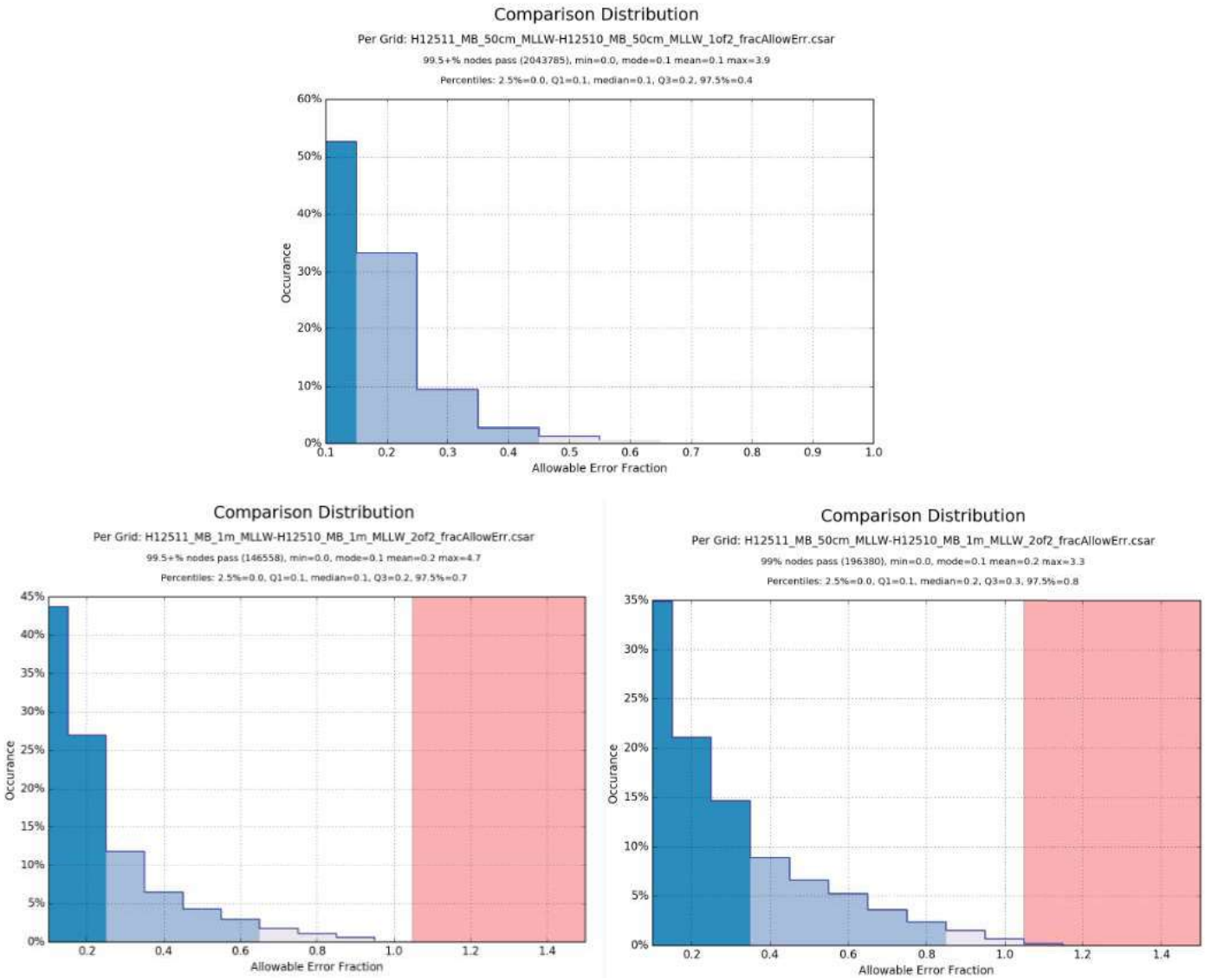

Figure 6: Comparison Distribution graphs that all show 99% or more nodes passing IHO specifications.

H12484

Overlap with survey H12484 was approximately 4.7km long and 75m wide, with depths in the junction area ranging from 1m to 20m. Analysis of the difference surface indicated a mean difference of -0.01m, and one standard deviation of 0.09m. The comparison distribution graph shows 99.5% of nodes pass IHO specifications.

Figure 7: Overview of H12511 (red) and H12484 (blue) and their overlap (green).

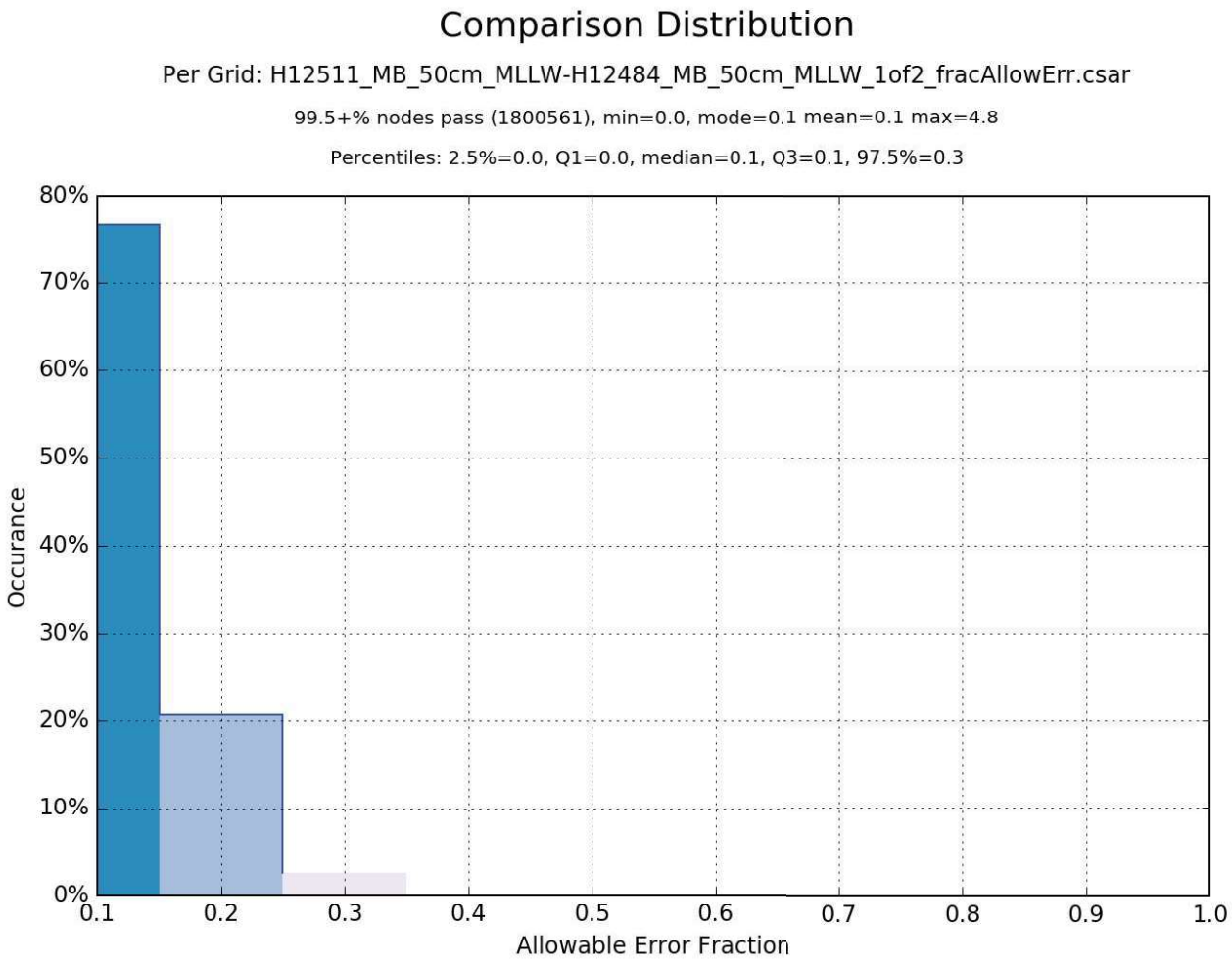

Figure 8: Comparison Distribution graph that shows 99.5% of nodes passing IHO specifications.

H11252

Overlap with survey H11252 was approximately 6.2km long and 66m wide, with depths in the junction area ranging from 6m to 26m. Analysis of the difference surface indicated a mean difference between -0.17m to 0.4m, and the one standard deviation between 0.19m to 0.27m. All comparison distribution graphs show 99.5% of nodes pass IHO specifications.

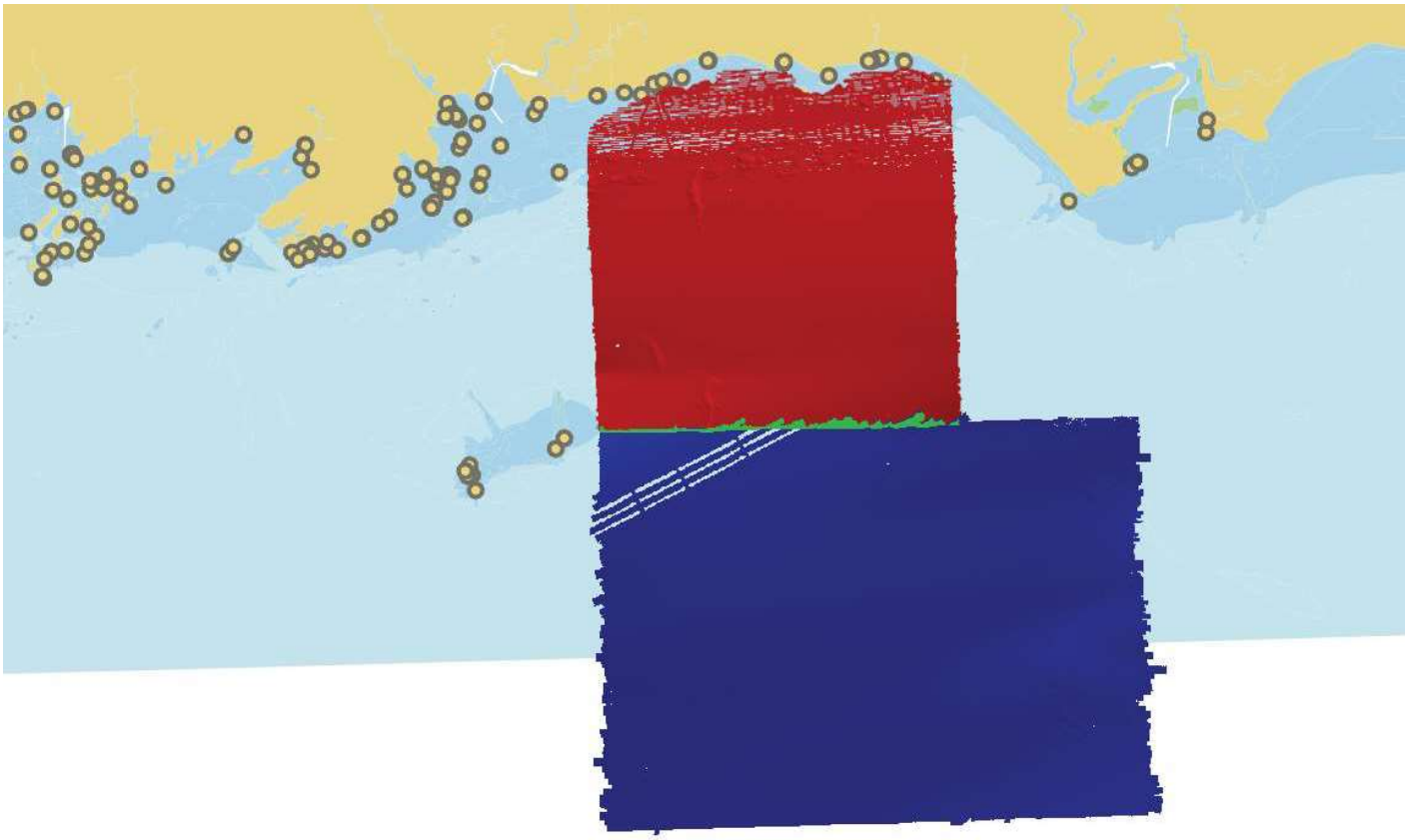

Figure 9: Overview of H12511 (red) and H11252 (blue) and their overlap (green).

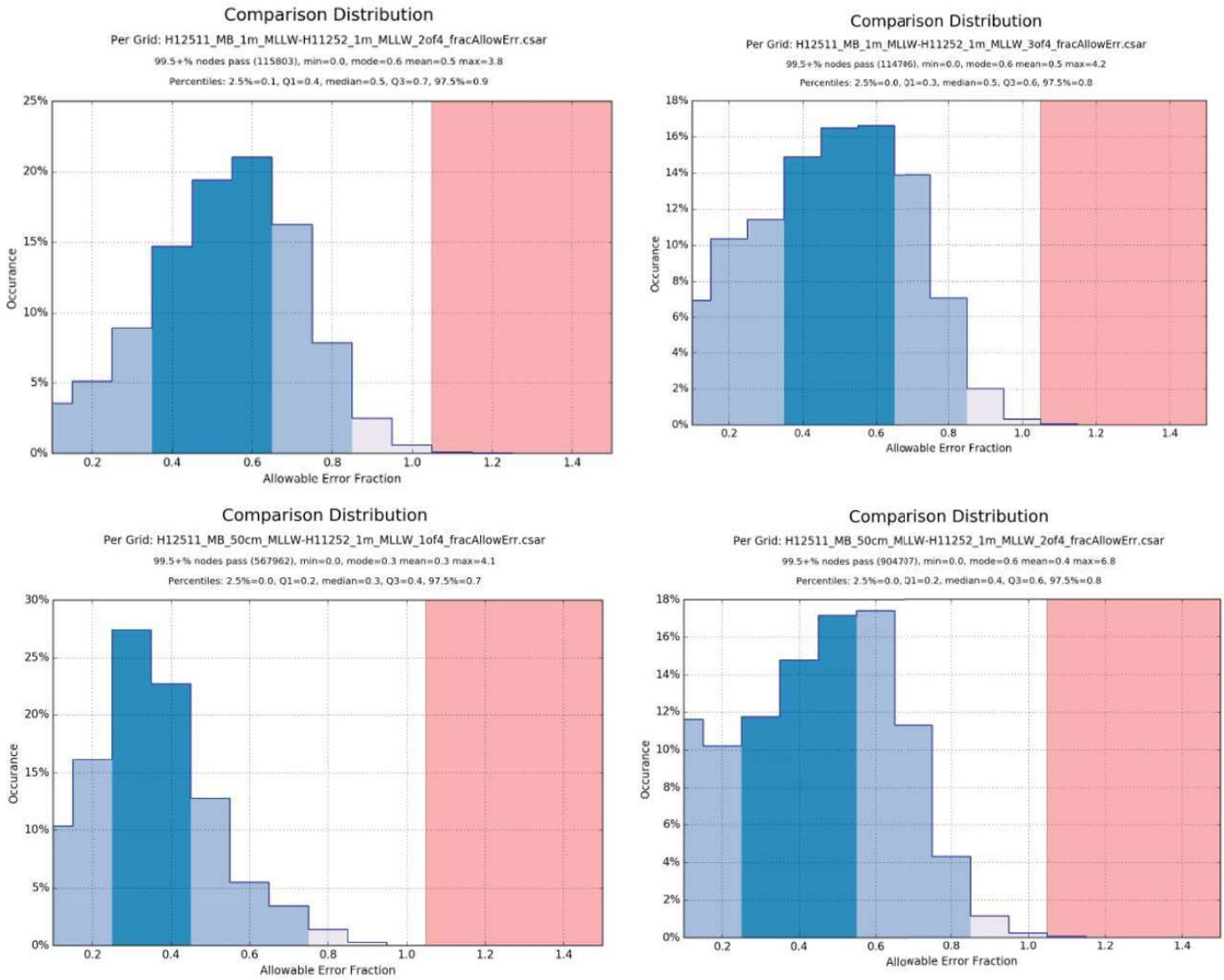

Figure 10: Comparison Distribution graphs that all show 99.5% of nodes passing IHO specifications.

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

Sea State

The unprotected nature of the sheet meant that the vessel was often exposed to conditions that were not conductive to collecting clean MBES data. This exacerbated the tendency of the EM 2040C MBES on S3007 to generate noise in the outer beams with elevated sea states. The result was that the data is littered with noise artifacts and small holidays, many of which were revealed post-acquisition in the grids after a detailed examination of the data and subsequently rejecting noise throughout the sheet. The soundings that were obvious noise affecting finalized grids were rejected by the hydrographer, but erroneous soundings not present in the grids may still exist.

Fish Schools

During survey operations many schools of fish were present near the surface. These schools of fish sometimes affected SSS data, and created SSS holidays.

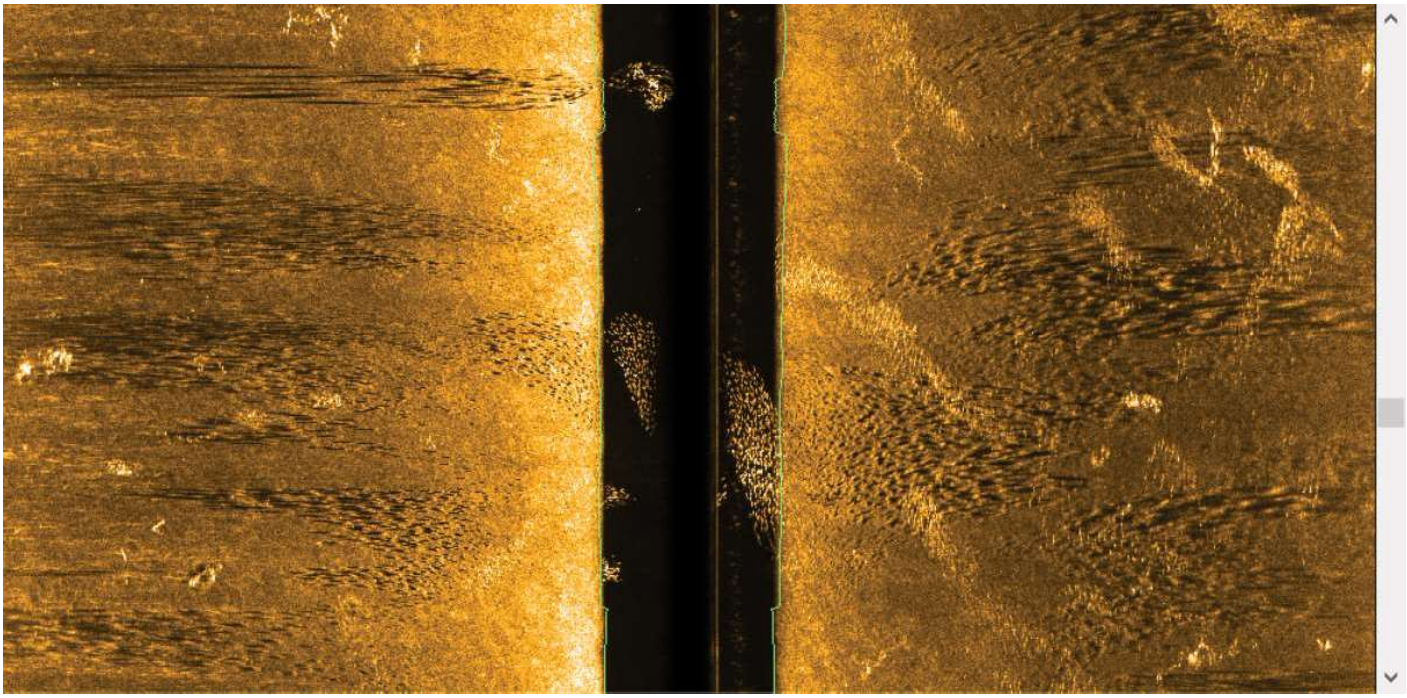

Figure 11: Example of Fish Schools affecting SSS data.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: At least once every 4 hours.

SVP casts were taken at least once every four hours in the deepest water nearest to the survey area being worked on. The SVP casts were applied to the MBES lines in CARIS using the "nearest in distance within time of 4 hours" method.

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.3.3 COVID-19 Considerations

While COVID-19 did not ultimately affect the survey tremendously once undertaken, it did cause the survey to be done at a later time of year than originally planned, which exacerbated the issues with sea state as the season started to turn to winter. Because of the weather and spiking COVID case counts in late November, a significant number of holidays were not collected as planned, specifically in the SW corner of the sheet.

B.4 Backscatter

Backscatter was not acquired for this survey.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2020.

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
H12511_MB_50cm_MLLW	CARIS Raster Surface (CUBE)	0.5 meters	0.1 meters - 20 meters	NOAA_0.5m	Object Detection
H12511_MB_50cm_MLLW_Final	CARIS Raster Surface (CUBE)	0.5 meters	0.4 meters - 20 meters	NOAA_0.5m	Object Detection

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12511_MB_1m_MLLW	CARIS Raster Surface (CUBE)	1 meters	18 meters - 27.9 meters	NOAA_1m	Object Detection
H12511_MB_1m_MLLW_Final	CARIS Raster Surface (CUBE)	1 meters	18 meters - 27.9 meters	NOAA_1m	Object Detection
H12511_SSSAB_900kHz_1of2	SSS Mosaic	1 meters	-	N/A	200% SSS
H12511_SSSAB_900kHz_2of2	SSS Mosaic	1 meters	-	N/A	200% SSS

Table 10: Submitted Surfaces

B.5.3 Side Scan Sonar Contact Correlation Waiver

A waiver has been given to revoke the requirements of HSSD 2021 section 6.1.3.5. on Side Scan Contact Correlation between SSS contacts and MBES features. The waiver has been added to the Supplemental Survey Records Correspondence folder.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-B370_Vdatum Limits_100m_NAD83-MLLW_geoid12b

Table 11: ERS method and SEP file

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 18.

The following PPK methods were used for horizontal control:

- Smart Base

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
BROOKFIELD	CTBR
MANSFIELD	CTMA
GROTON	CTGR
GUILFORD	CTGU
RIVERHEAD	NYRH

Table 12: CORS Base Stations

WAAS

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

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
US5CN15M	1:20000	14	07/11/2019	06/01/2020
US5CN16M	1:20000	17	12/13/2018	11/27/2019

Table 13: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

There are several rocky mounds located in H12511. All shoal H12511 rocky mounds are charted correctly, and no DTON report was created for this survey.

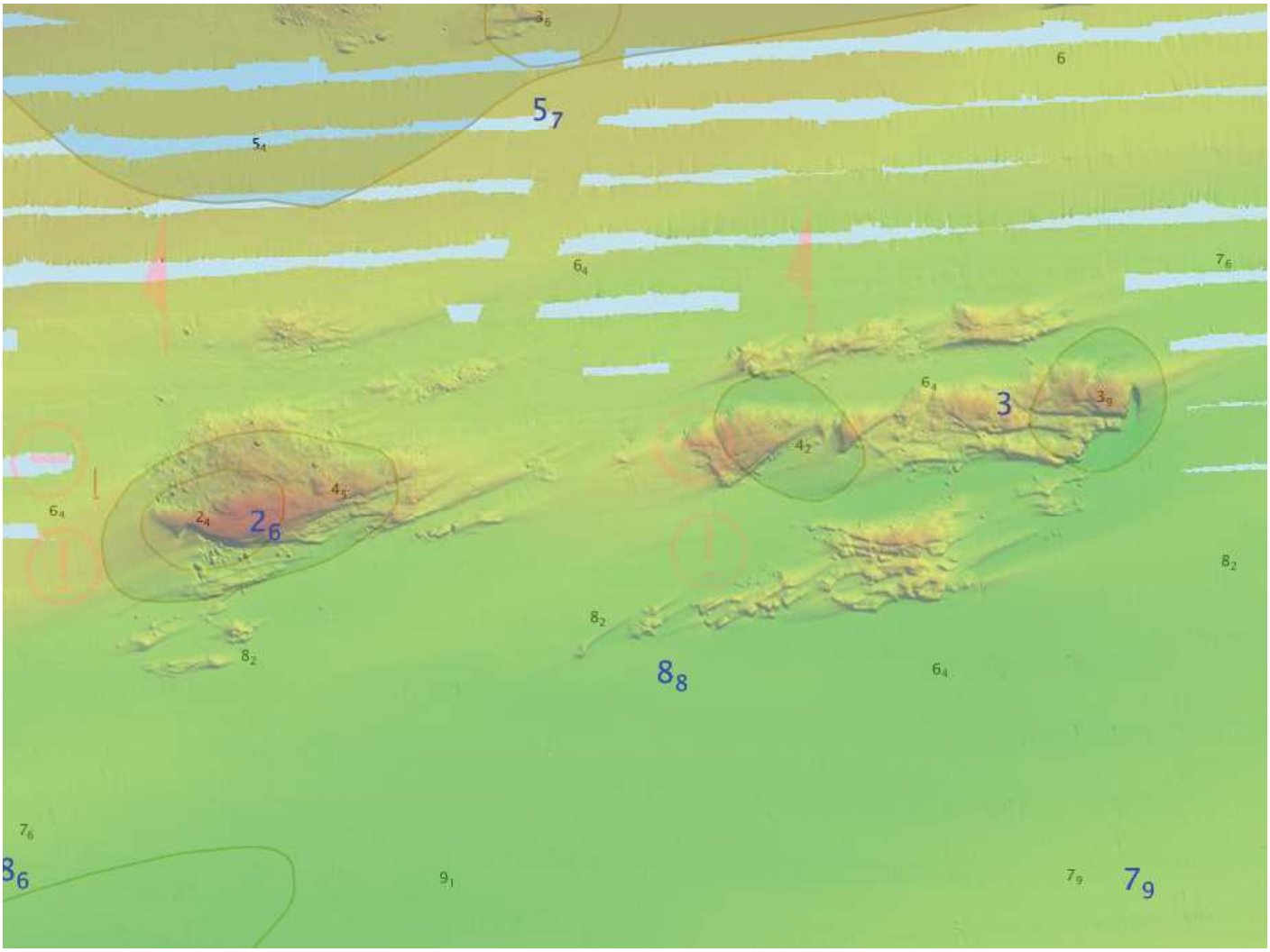

Figure 12: H12511 soundings (blue) are similar to charted soundings (light gray).

D.1.3 Charted Features

All charted features are discussed in the FFF. One charted feature to note was a LNDARE located in the NW corner of the sheet that remains covered with water at MLLW. This feature is recommended to be updated to a UWTROC, at a slightly different location, in the FFF.

D.1.4 Uncharted Features

There are multiple rock mounds located in the survey. Some of these mounds are not charted but could be accurately reflected with a sounding.

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

All ATONs were found to be on station and serving their intended purpose.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Ten bottom samples were collected, however, fifteen bottom samples were assigned. Due to weather and time constraints not all bottom samples were able to be acquired.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Submarine features exist for this survey, but were not investigated.

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
LTJG Nicholas Azzopardi	Chief of Party	06/10/2021	Digitally signed by AZZOPARDI.NICHOLAS.JAMES.1539165093 Date: 2021.06.10 09:54:44 -04'00'
PST Michael Bloom	Sheet Manager	06/10/2021	BLOOM.MICHAEL.GRAHAM.1029463049 Digitally signed by BLOOM.MICHAEL.GRAHAM.1029463049 Date: 2021.06.10 13:23:34 -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