H12289

NOAA Form 76-35A

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12289

LOCALITY

State:	Alaska
General Locality:	West of Prince of Wales Island
Sub-locality:	Portillo Channel to Point Cocos

2011

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

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Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12289**

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:	**Alaska**
General Locality:	**West of Prince of Wales Island**
Sub-Locality:	**Portillo Channel to Point Cocos**
Scale:	**20000**
Dates of Survey:	**09/22/2011 to 10/16/2011**
Instructions Dated:	**09/12/2011**
Project Number:	**OPR-O190-RA-11**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Richard T. Brennan, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**
H-Cell Compilation Units:	***meters at Mean Lower Low Water***

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Revisions and end notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12289

Project: OPR-O190-RA-11

Locality: West of Prince of Wales Island

Sublocality: Portillo Channel to Pt Cocos

Scale: 1:20000

September 2011 - October 2011

NOAA Ship *Rainier*

Chief of Party: Richard T. Brennan, CDR/NOAA

A. Area Surveyed

The project area is referred to as Sheet 1: "Portillo Channel to Pt. Cocos" within the project instructions. The area is 10 nm west of Craig, Alaska. This includes the waterways around Lulu Island and St. Ignace Island, in particular Portillo Channel, Port Real Marina, and Port Mayoral (Figure 1).

A.1 Survey Limits

Data was acquired within the following survey limits:

Northeast Limit	Southwest Limit
55.5333333333 N 133.366666667 W	55.3666666667 N 133.616666667 W

Table 1: Survey Limits

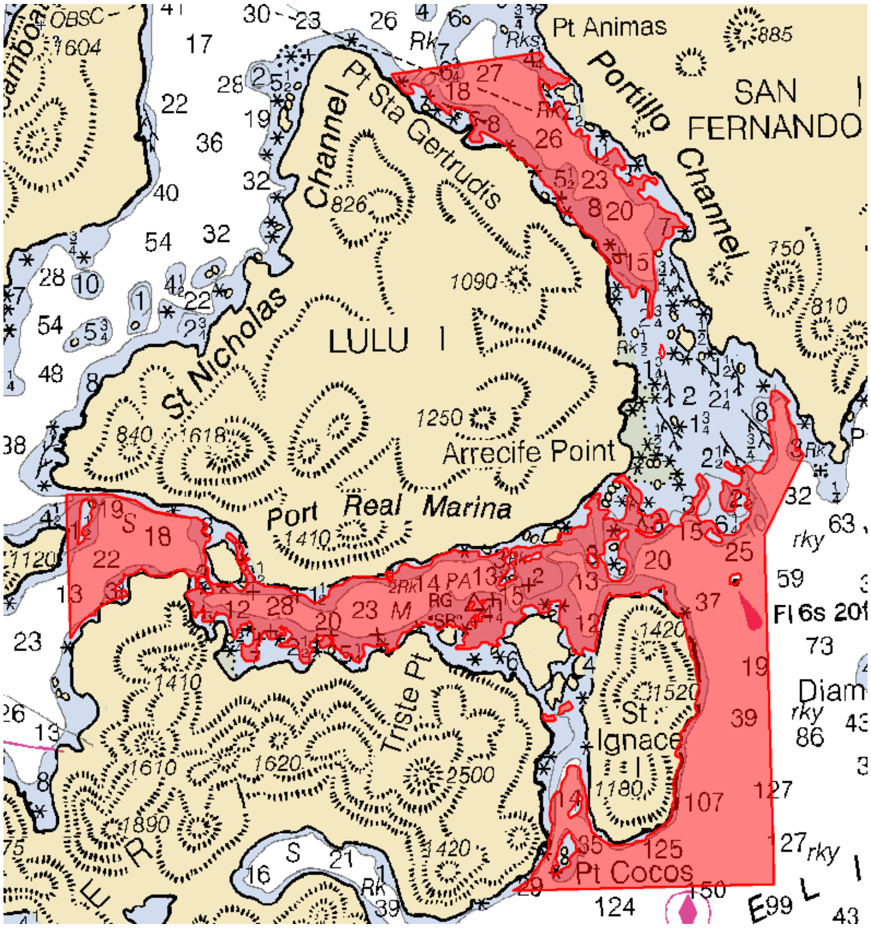


Figure 1: H12289 survey limits.

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

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12289 met complete multibeam coverage requirements, including the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSD, with one notable exception (Figure 2). Launch 2803 was equipped with a RESON 8125 with a tilted (34-degree) configuration. In contrast to the RESON 7125, used for the majority of data acquisition in survey H12289, the 8125 produces fewer beams (240 versus 512 beams) and only operates in an equi-angular mode. In an equi-angular paradigm, the further from nadir a beam is directed, the larger the horizontal spacing between its neighbors

(Figure 3); an increased beam spacing is only exacerbated by a tilted sonar mount. As such, the outer beams of 2803 seldom satisfy data density requirements (Figure 4). In spite of this limitation, 2803 was frequently employed for the purposes of acquiring bathymetric data around submerged hazards and immediately along the shoreline. In this way, while density requirements were not always met, the Hydrographer feels all submerged features were identified, and the data from 2803 is adequate to supersede previous data.

In order to extract some descriptive statistics of the data density achievements, the density layer of each finalized surface was queried within CARIS and then exported to Excel (Figure 5). In depths of 0 to 20 meters, where the HSSDM requires a gridding at a one meter resolution, 96.5% of the nodes have sufficient data density. The preceding depth range had the highest population of nodes that did not satisfy density requirements, which is to be expected (given the 8125 was only deployed in relatively shallow waters). All other depth ranges satisfied the data density requirements in at least 99% of the nodes. In total, the required data density was achieved in 97.7% of the nodes. This total number is biased by the one meter resolution nodes (simply because there are more of them); however, if one converts the nodes to their areal extents (i.e. a 1 meter node takes up 1 square meter of space, a 2 meter node takes up 4 square meters of space, etc.), then 99.2% of the survey area satisfies the data density requirements.

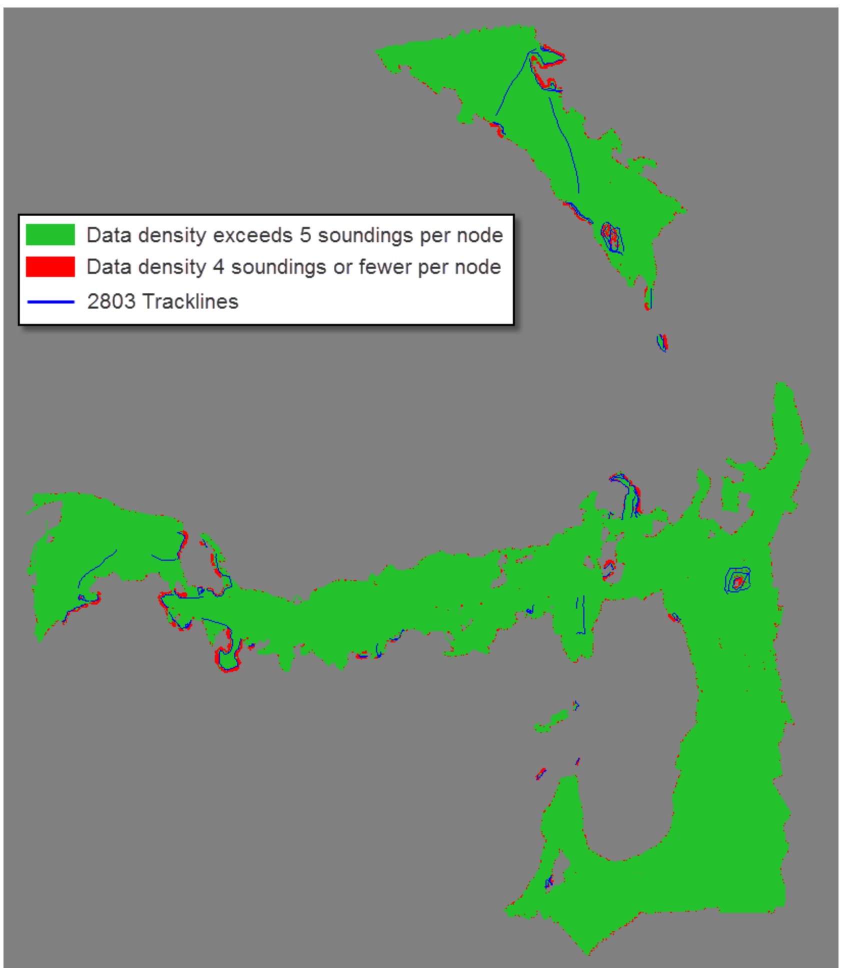


Figure 2: Sounding density plot for survey H12289. Areas highlighted in green contain at least the 5 requisite soundings per node; whereas, the red areas have a data density deficiency. For reference, the tracklines from 2803 (the only vessel equipped with a RESON 8125) are indicated in blue.

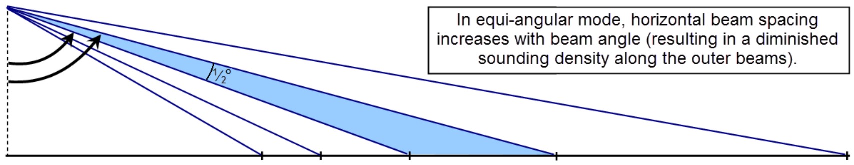


Figure 3: Cross section of a mulibeam swath when deployed in an equi-angular mode (as was the case with 2803). Note as beams are directed further from nadir, the horizontal beam spacing grows.

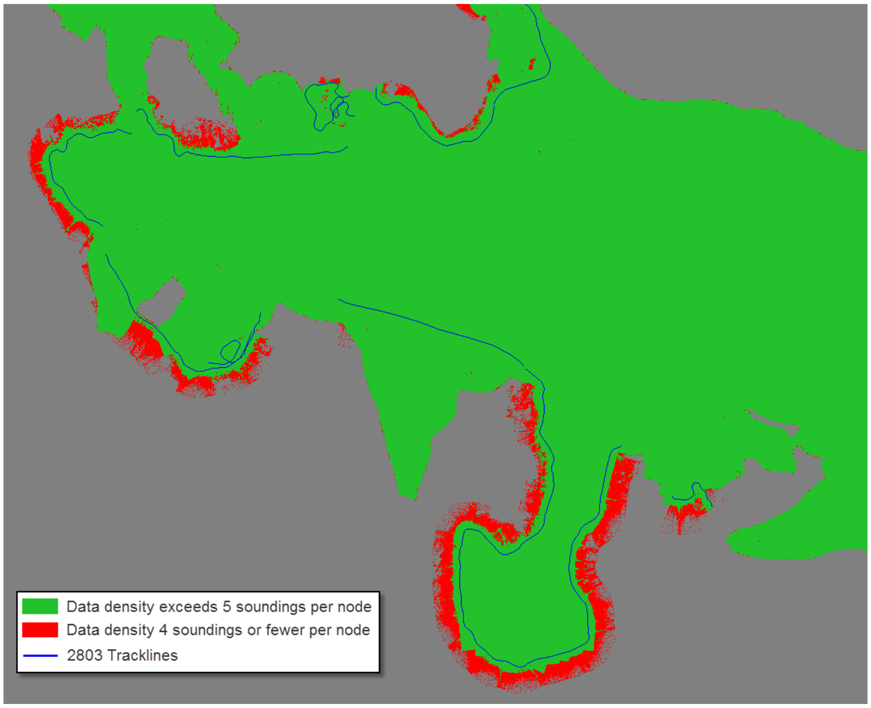


Figure 4: Close-up of sounding density plot for western portion of survey H12289. Note that in areas in which 2803 is deployed along the edges of the survey (blue tracklines), sounding density requirements are seldom met (highlighted in red).

Resolution	Depth range	Number of nodes	Fewer than five soundings per node	Percent of nodes with greater than five soundings per node
1m	0 - 20m	11,023,841	389,487	96.5%
2m	18 - 40m	5,637,844	4,969	99.9%
4m	36 - 80m	834,058	1,351	99.8%
8m	72 - 160m	80,720	500	99.4%
16m	144 - 320m	33,792	189	99.4%
	TOTAL:	17,610,255	396,496	97.7%
	TOTAL (by area):	60,736,977	511,363	99.2%

Figure 5: Summary table showing the percentage of nodes satisfying the 5 sounding density requirements, sub-divided by the appropriate depth ranges. Note: the final row has a unit of square meters, and sums the number of different resolution nodes into a common unit of area.

Data is adequate to supersede charted data in the common area. Soundings from red areas were not selected for charting. However, H12289 junctions with lidar data and modifications were made to accommodate features at chart scale. In addition, converting the nodes to their areal extents is not pertinent information because this is not the specification under section 5.2.2.2 of the Hydrographic Survey Specifications and Deliverables.

A.4 Survey Coverage

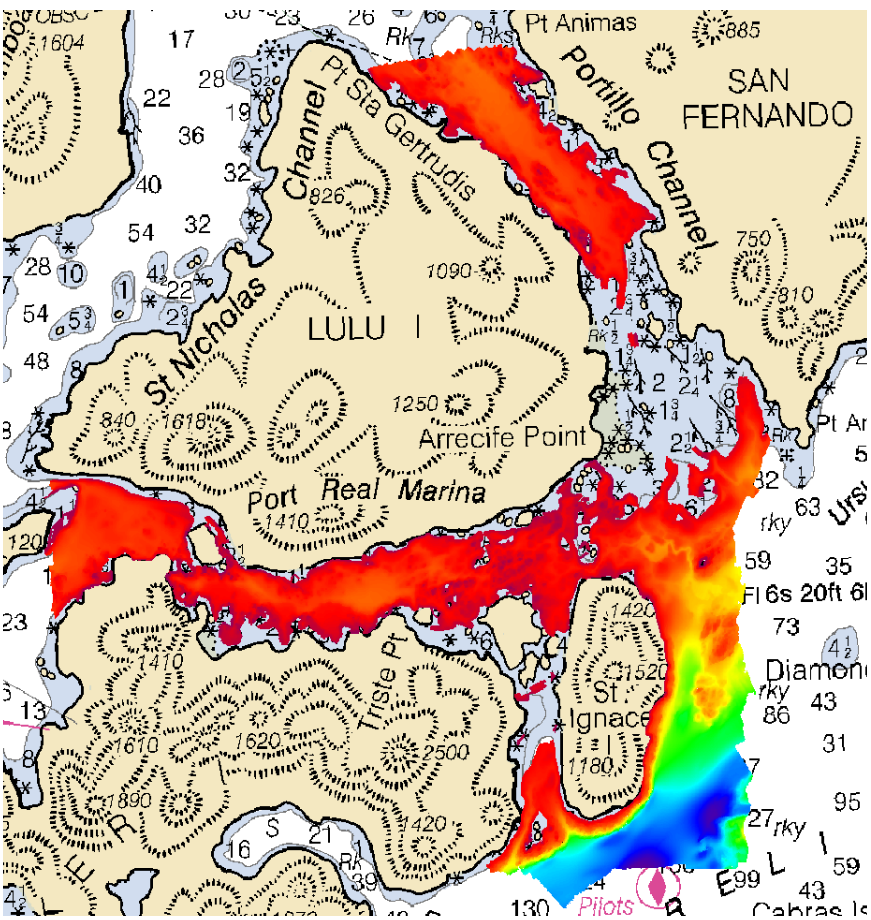


Figure 6: H12289 survey coverage.

Complete multibeam echosounder (MBES) coverage was achieved in the survey area in waters 4 meters and deeper (Figure 6), with a few exceptions described below. Areas where the 4-meter curve was not achieved were either surveyed to the kelp line, the Navigable Area Limit Line (NALL), or to a point in which there was good overlap with a junctioning survey. No vertical beam echosounder (VBES) data were acquired for this survey.

Holidays

A total of 41 holidays were identified within survey H12289; their locations and a broad classification are presented in Figure 7. Four holidays were located at the extreme eastern and western extents of the sheet limits. Due to their location, however, they overlapped well with the MBES junction surveys (Figure 8). Between survey H12289 and the MBES junction surveys, there is complete multibeam coverage of the survey area. Similarly, survey H12289 junctioned with four lidar surveys (see Section B.2 for a further discussion of the junction surveys). As such, there were 15 gaps in survey H12289's coverage that are completely filled by a lidar junction (Figure 9), while there were five holidays that were only partially addressed by lidar coverage (Figure 10). In the cases of partial overlap between survey H12289 and the lidar junction surveys, efforts were made (examination of backscatter and trends of seafloor slope) to ensure that all features, and their associated least depths, were identified.

In some instances, the survey crew was not capable of accessing all portions of the survey area. Most notable was the persistent presence of kelp within survey H12289. A tilted multibeam configuration was deployed in survey H12289 in an attempt to survey beneath the kelp; however, there were ultimately nine small areas with insufficient coverage due to kelp (Figure 11). In these cases, the kelp digitized within the shoreline Composite Source File (CSF) was either noted (if it encompassed the holiday), or modified to include the data gap (see Section A.6 for a further discussion of Shoreline processing).

While kelp was the predominant reason a survey launch was unable to access an area, there were three instances in which a launch did not access an area for safety considerations. For example, Figure 12 shows survey coverage did not extend to either the sheet limits nor much beyond the 8 meter contour. The confined space among the shoreline, the reef, and the kelp prohibited the launch from acquiring data to the full survey extents.

In one case (Figure 13), complete multibeam coverage was not acquired over a series of rocks. However, the area was closely examined within the CARIS Subset Editor, and the Hydrographer is confident the least depths, and location, of each feature are adequately represented.

Finally, there were four areas within survey H12289, that have lapses in coverage for no discernible reason (Figure 14). The upper two holidays of Figure 14 measure less than five meters in width and are located in areas that could be described as flat and featureless. The general bathymetry can be reasonably interpreted from neighboring soundings and it is unlikely any submerged features are lurking in these areas. While the lower two holidays of Figure 14 are larger in dimension, their immediate proximity to a larger hazard (i.e. the shoreline), with complete multibeam coverage inshore of the holidays, makes them navigationally insignificant.

Latitutde	Longitude	Holiday Type	Latitutde	Longitude	Holiday Type
55° 26.7' N	133° 36.8' W	MBES junction	55° 31.0' N	133° 26.8' W	Lidar partial junction
55° 26.2' N	133° 36.8' W	"	55° 25.7' N	133° 28.4' W	"
55° 25.2' N	133° 36.8' W	"	55° 25.8' N	133° 28.3' W	"
55° 23.6' N	133° 23.1' W	"	55° 25.7' N	133° 28.1' W	"
55° 25.9' N	133° 35.7' W	Lidar junction	55° 25.7' N	133° 23.5' W	"
55° 26.0' N	133° 35.4' W	"	55° 25.8' N	133° 33.6' W	NALL - Kelp
55° 25.1' N	133° 32.3' W	"	55° 31.1' N	133° 27.0' W	"
55° 31.1' N	133° 27.2' W	"	55° 29.6' N	133° 26.4' W	"
55° 30.8' N	133° 26.5' W	"	55° 29.6' N	133° 26.0' W	"
55° 29.5' N	133° 25.9' W	"	55° 29.5' N	133° 26.0' W	"
55° 29.4' N	133° 25.9' W	"	55° 26.3' N	133° 26.6' W	"
55° 26.1' N	133° 27.6' W	"	55° 26.4' N	133° 26.2' W	"
55° 26.4' N	133° 25.2' W	"	55° 26.3' N	133° 26.2' W	"
55° 26.4' N	133° 25.0' W	"	55° 26.4' N	133° 25.7' W	"
55° 25.5' N	133° 27.6' W	"	55° 26.0' N	133° 33.3' W	NALL - Safety
55° 25.4' N	133° 27.4' W	"	55° 25.3' N	133° 29.3' W	"
55° 25.0' N	133° 26.7' W	"	55° 25.6' N	133° 26.0' W	"
55° 22.9' N	133° 27.1' W	"	55° 25.8' N	133° 33.8' W	Least depth known
55° 22.7' N	133° 26.9' W	"	55° 25.1' N	133° 29.0' W	Gap in coverage
			55° 25.5' N	133° 36.4' W	"
			55° 24.6' N	133° 24.4' W	"
			55° 29.4' N	133° 25.8' W	"

Figure 7: Location of holidays identified within survey H12289. Each holiday has been classified according to whether the region overlaps with a junction survey, abuts with an unreachable area (due to kelp or launch safety considerations), or is a legitimate gap in coverage.

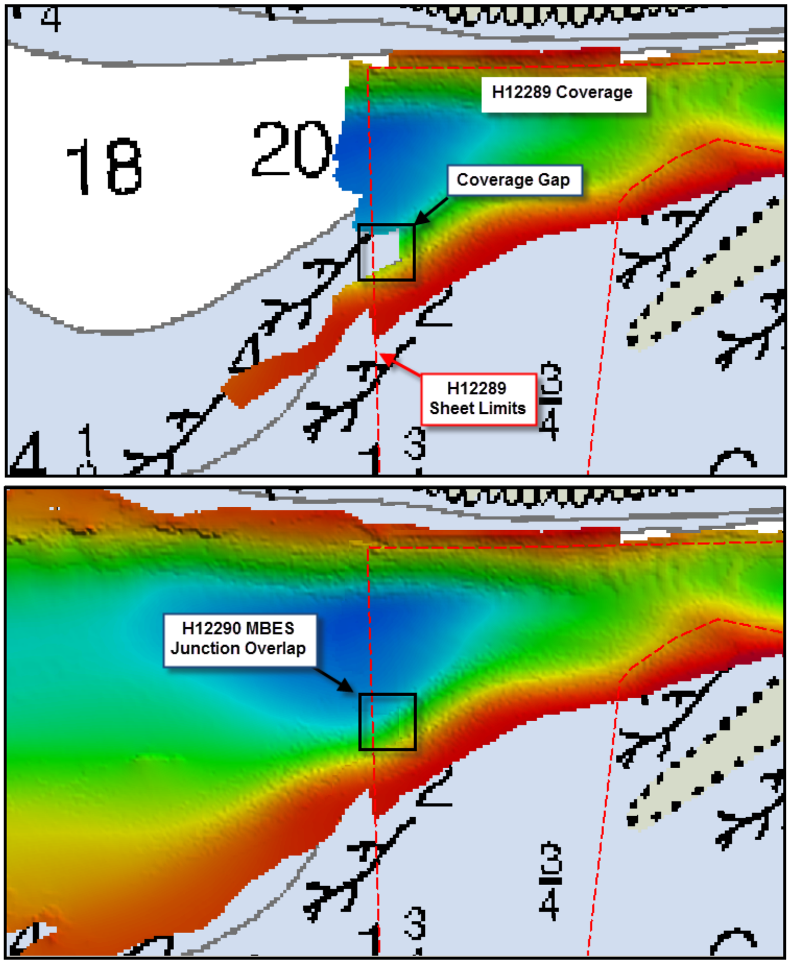


Figure 8: An example of a coverage gap in survey H12289 that is addressed through a junctioning MBES survey.

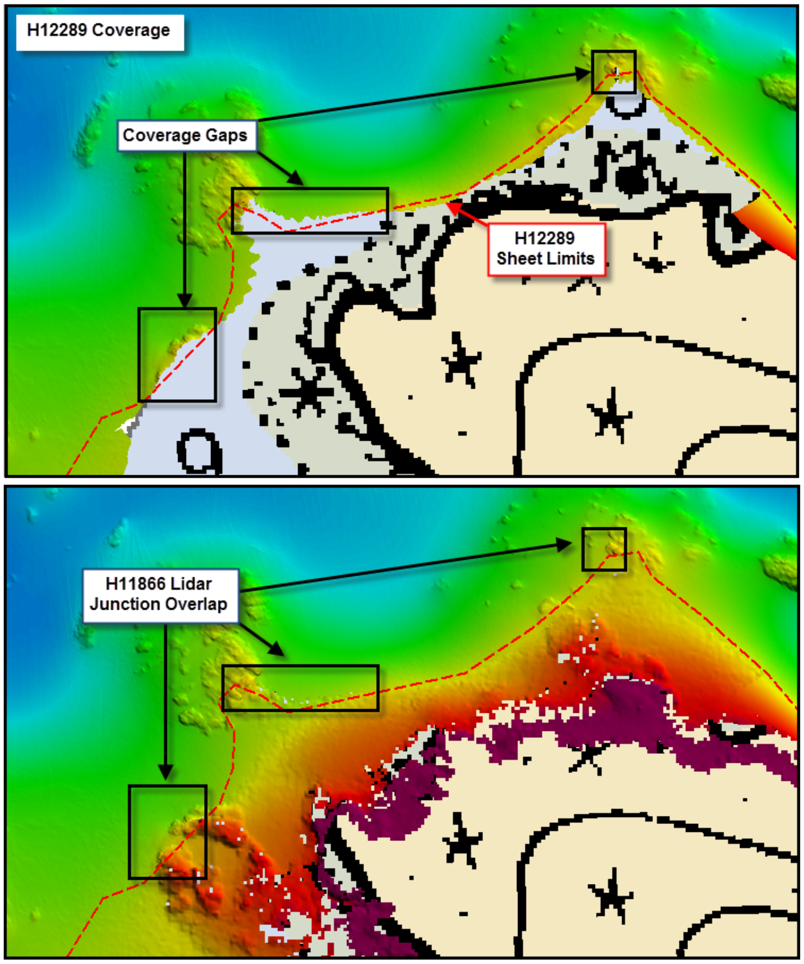


Figure 9: An example of a coverage gap in survey H12289 that is addressed through a junctioning lidar survey. While the lidar junctions do not have the sounding density of their MBES counterparts, the coverage is sufficient to declare "complete multibeam coverage" (when coupled with survey H12289).

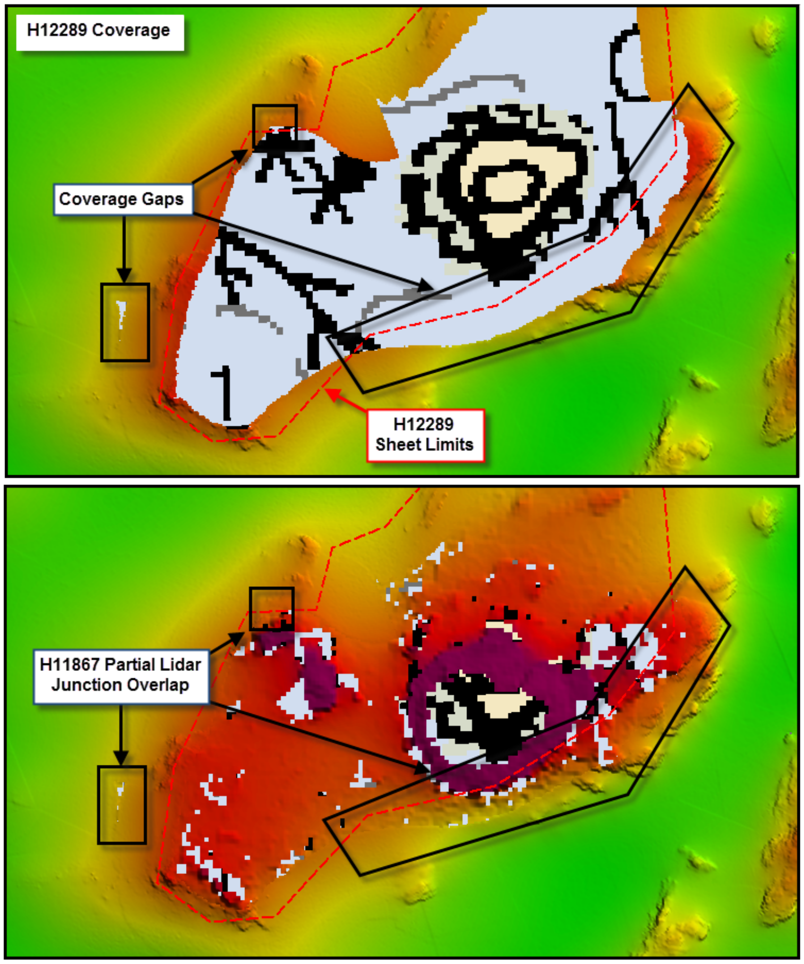


Figure 10: An example of a coverage gap in survey H12289 that is only partially addressed through a junctioning lidar survey. In these areas, extra efforts were made to ensure that the least depth of all features were properly identified.

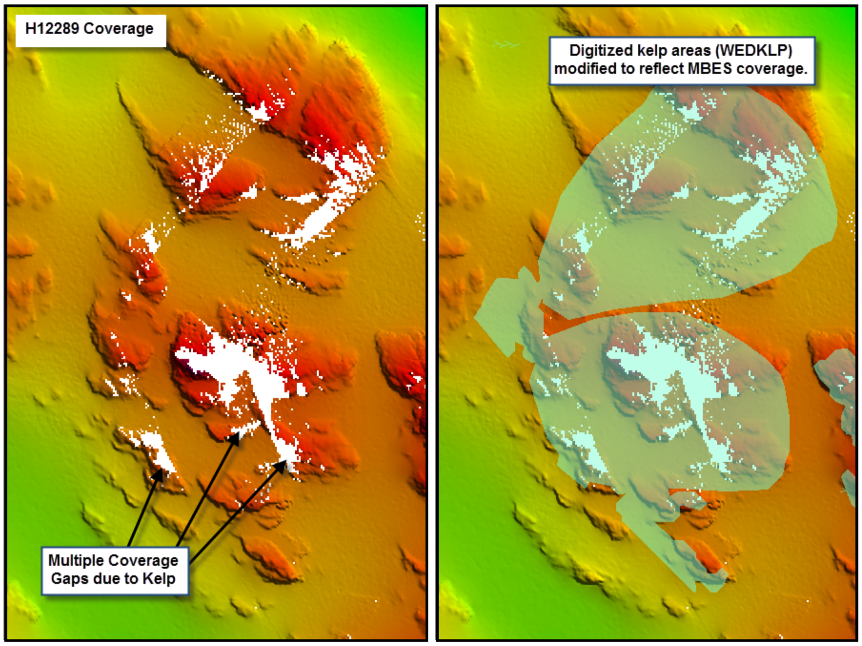


Figure 11: An example of the gaps in coverage caused by the abundant kelp throughout survey H12289. In several cases, the S-57 kelp areas (WEDKLP) were modified to encompass these holidays.

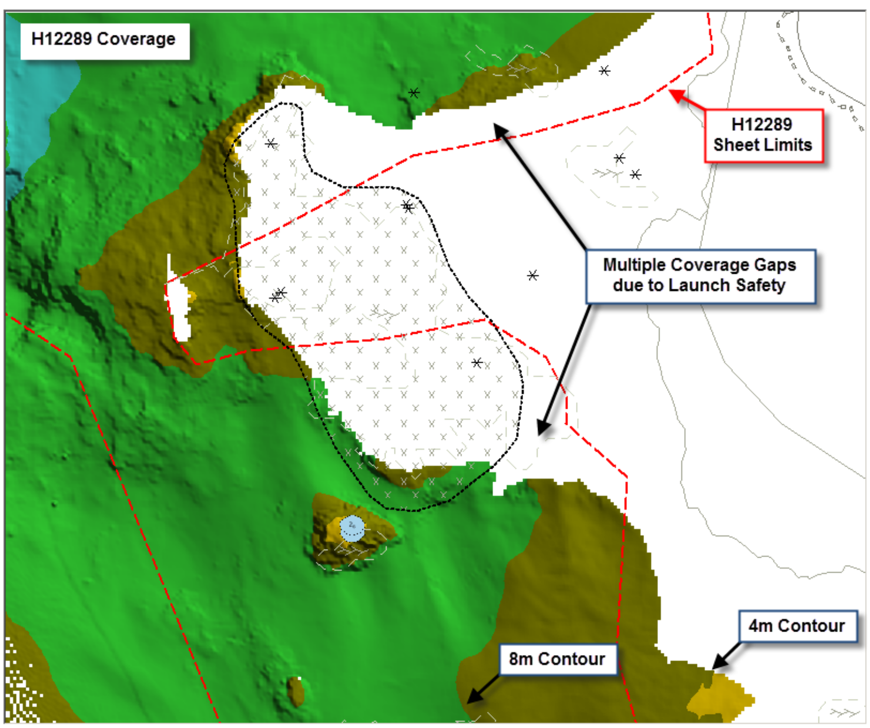


Figure 12: An example in which a holiday was left for launch safety considerations. Notice the confluence of the shallow water, the kelp area (grey dashed line), the obstruction area (black dotted area), and the narrow margins for turning the vessel.

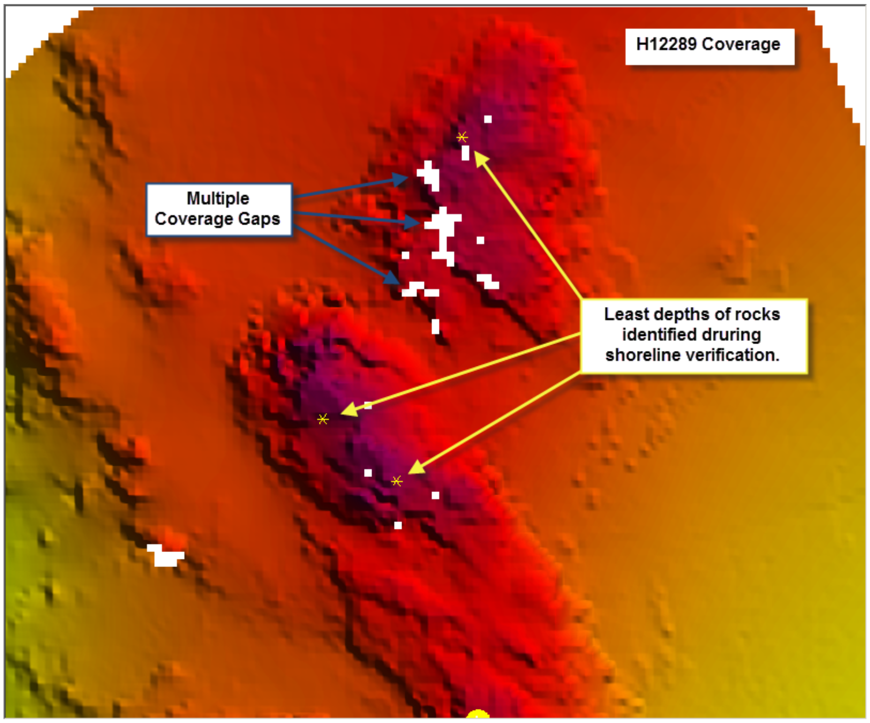


Figure 13: An example in which complete multibeam coverage was not obtained within survey H12289; however closer examination the data reveals the least depths of the features were identified.

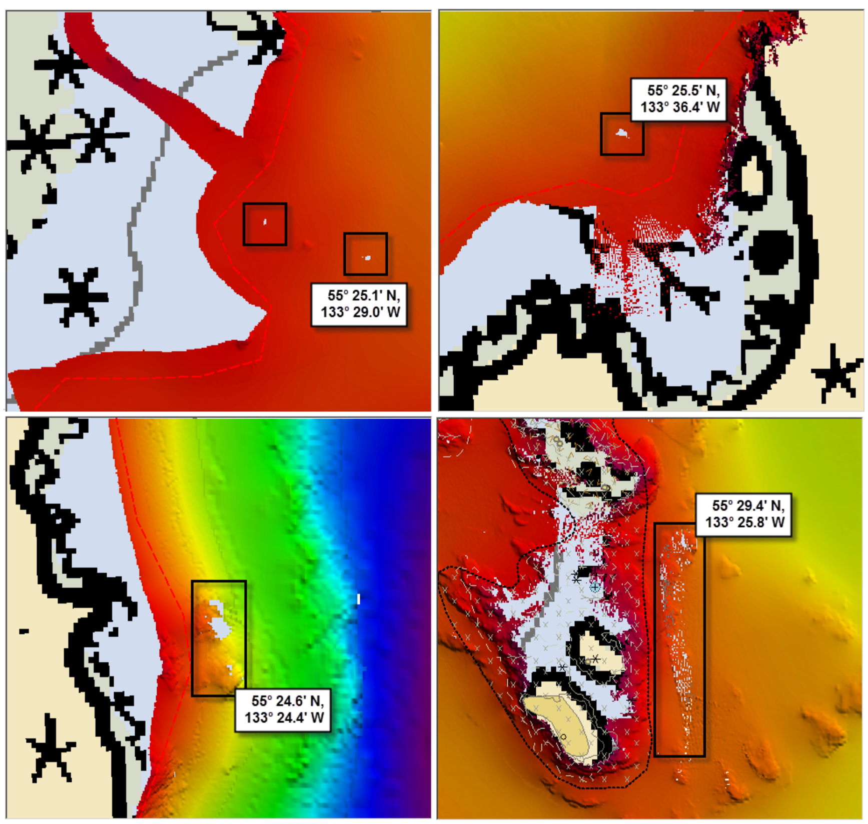


Figure 14: Four gaps in coverage within survey H12289. The upper two can be dismissed given the flat nature of the surrounding seabed. The lower two, while present in a more dynamic area, are not of navigational significance given their close proximity to the coastline.

All shoal areas and holidays were inspected at the branch. However, during Survey Acceptance Review two issues were noted. In the case of figure 13, least depths were not unequivocally obtained by the hydrographer and In the case of figure 14, the 'lower two' holidays are in fact potentially significant to navigation. Other than these holidays, data is adequate to supersede charted data in the common area. Furthermore several kelp point and area object have been modified for charting in areas were gaps in coverage were caused by the abundant kelp.

A.5 Survey Statistics

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

	HULL ID	***2801***	***2802***	***2803***	***2804***	***S221***	***Total***
LNM	**SBES Mainscheme**	0	0	0	0	0	0
	MBES Mainscheme	150.8	104.2	21.8	83.4	2.7	362.9
	Lidar Mainscheme	0	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0	0
	SBES/MBES Combo Mainscheme	0	0	0	0	0	0
	SBES/SSS Combo Mainscheme	0	0	0	0	0	0
	MBES/SSS Combo Mainscheme	0	0	0	0	0	0
	SBES/MBES Combo Crosslines	4.2	0	2.5	7.3	2.7	16.7
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							8
Number of DPs							8
Number of Items Items Investigated by Dive Ops							0
Total Number of SNM							21

Table 2: Hydrographic Survey Statistics

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

Survey Dates
09/22/2011
09/27/2011
09/29/2011
09/30/2011
10/01/2011
10/02/2011
10/03/2011
10/05/2011
10/06/2011
10/11/2011
10/12/2011
10/14/2011
10/15/2011
10/16/2011

Table 3: Dates of Hydrography

A.6 Shoreline

Limited shoreline verification was not performed for survey H12289 due to the unavailability of any suitable tide windows. The tilted 8125 multibeam sonar system was used to detect bottom features or objects near the shoreline (see Section A.3 - Survey Quality). Nearshore areas that could be ensonified by partial or complete multibeam coverage, where features or shoals exist, are given NOAA and S-57 attribution and are included for submission in the H12289_Final_Features_File.hob file.

The submitted HOB files were used in the compilation for this survey. During compilation, some modifications were made to accommodate features at chart scale.

A.7 Bottom Samples

Bottom Samples were acquired in accordance with the Project Instructions and the HSSD (Figure 15).

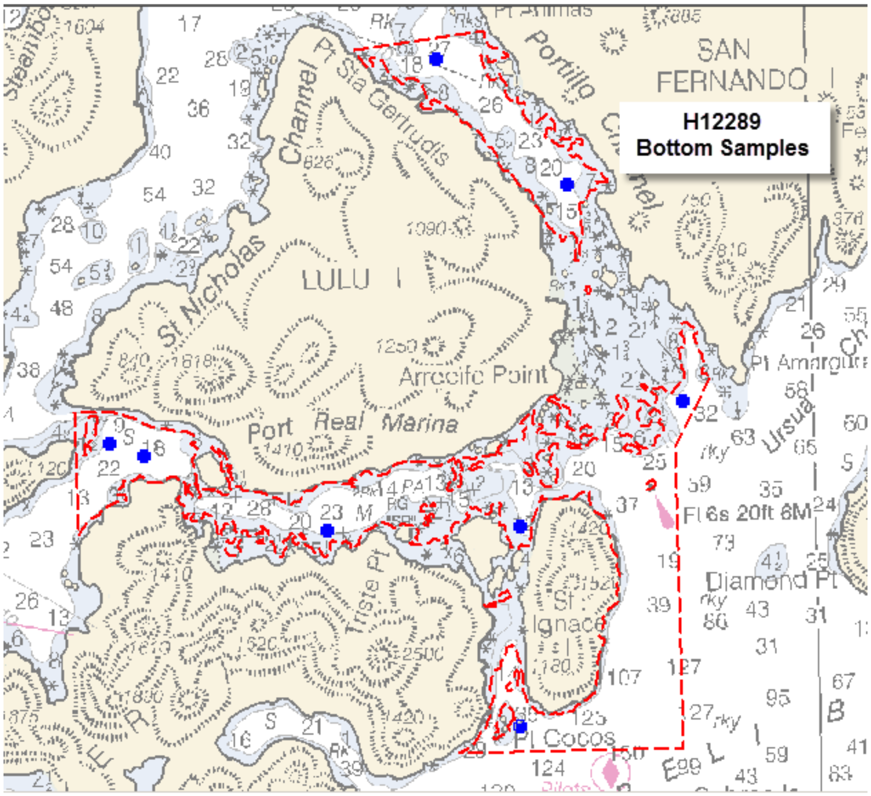


Figure 15: H12289 bottom sample locations.

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	***2801 (RA-4)***	***2802 (RA-5)***	***2803 (RA-3)***	***2804 (RA-6)***	***S221***
LOA	28 feet	28 feet	28 feet	28 feet	231 feet
Draft	3.5 feet	3.5 feet	3.5 feet	3.5 feet	16.5 feet

Table 4: Vessels Used

Data were acquired by NOAA Ship Rainier (S221) and her four survey launches (2801, 2802, 2803 and 2804) (Table 4). The vessels acquired shallow water multibeam (SWMB) soundings, sound velocity profiles, bottom samples and conducted shoreline verification.

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg	EM-710	MBES
Reson	7125	MBES
Reson	8125	MBES
Applanix	POS-MV V4	Vessel Attitude and Positioning System
Seabird	SBE 19 Plus	Conductivity, Temperature and Depth Sensor
Rolls Royce Odim Brooke Ocean Technology	MVP 200	Conductivity, Temperature and Depth Sensor
Reson	SVP 70	Sound Speed System
Reson	SVP 71	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines, acquired by 5 different sonars, accounted for 16.8 nautical miles, comprising 4.6% of main scheme hydrography (Figure 16) . A CUBE surface was created using strictly the main scheme lines, while a second surface was created using only the crosslines, from which a surface difference was generated (at a 1 meter resolution). Statistics were then derived from the difference surface and are shown in Figure 17. The average difference between the depths derived from the main scheme and crosslines was only 0.08 meters (well within the accuracy parameters stated in the HSSDM); however the standard deviation was 0.96 meters. The cause for the large standard deviation is likely twofold: the beam spacing of launch 2803's tilted RESON 8125 and the deeper depths associated with S221. Each cause is discussed in further detail below.

Launch 2803 was equipped with a RESON 8125 in a tilted configuration. Such a set-up is ideal for running close to shore, acquiring data up to the 0-meter curve; however, the system is less suited to running offshore (e.g. when acquiring crosslines) where the outer beams either never intersect the sea floor, or travel through a disproportionate length of water column, as compared to nadir. The result is a noisier ping in the outer beam, thus less agreement is expected with the main scheme hydrography. Figure 18 contrasts the differences in depths (as compared to the main scheme hydrography) for a cross line acquired with a RESON 7125 and 8125. Notice most of the 7125 crossline agrees with the main scheme to within 0.10 meters (highlighted in green - Figure 18); whereas the 8125 agreement is less. In particular, the outer beams of the 8125 approach disagreement exceeding 2.0 meters (small black spots - Figure 18). These large discrepancies with the 8125 are not of major concern though; given the 8125 is an equi-angular system (unlike the 7125) beams farther from nadir have a larger beam spacing, this beam spacing is exacerbated by tilting the sonar. Because the outer soundings are so sparse, they have very little influence in affecting the final delivered CUBE surfaces. Further, through the use of the CARIS QC report, the difference between crossline data and main scheme surfaces can be placed in the context of water depth (that is, the greater the water depth, the greater the allowable uncertainty as prescribed by the IHO accuracy requirements). Referring to Figure 19, one can see that up to 62.5-degrees from nadir, over 95% of the soundings acquired by the RESON 8125 satisfied IHO Order 1.

Unfortunately, there was a second artifact associated with the RESON 8125. All depths acquired with the 8125 during H12289 exhibited a 0.10 - 0.20 meter deep bias (Figure 20). After acquisition, a small error was detected within the sonar offset measurement, and a dynamic draft profile was reacquired for the vessel. The data was since reprocessed, and both corrections led to improved data integrity for the 8125. In spite of these improvements, a small offset is still present, though there are two mitigating factors: 1) the offset is within allowable IHO error; and 2) because the 8125 has a lesser data density, the CUBE surfaces tend away from the 8125 and towards the 7125 data.

Returning to the earlier discussion of the large standard deviation seen in the difference surface shown in Figure 17, the second cause is likely the crossline acquired by the ship, S221. Because of the relatively deeper depths acquired, approaching 280 meters (Figure 21 - Right), it is difficult to get a consistent depth. Figure 21 - Left, displays the difference surface for the S221 crossline, which frequently exceeds 1.0 meter (highlighted in red) and even exceeds 2.0 meters (highlighted in black). However, as discussed earlier, the CARIS QC report accounts for the fact that with increased water depth is an increased allowable uncertainty. A mutual QC report for both S221 and the launches' RESON 7125s are shown in Figure 22. Not only does 95% of the data within 67.5-degrees of nadir satisfy IHO Order 1, 95% of the data within 65.0-degrees of nadir satisfies IHO Special Order (not a requirement for this project). Nevertheless, the broad range of differences highlighted in Figure 21 (Left) leads to the large overall difference surface standard deviation shown in Figure 17. If the deep crossline acquired with S221 and the crosslines acquired with the RESON 8125 are withheld from the difference surface, then the mean difference is -0.07 meters with a standard deviation that decreases from 0.96 to 0.20 meters. Thus, 95% of the differences between the main scheme bathymetry and crosslines are between -0.47 and +0.33 meters, satisfying IHO Order 1 accuracy.

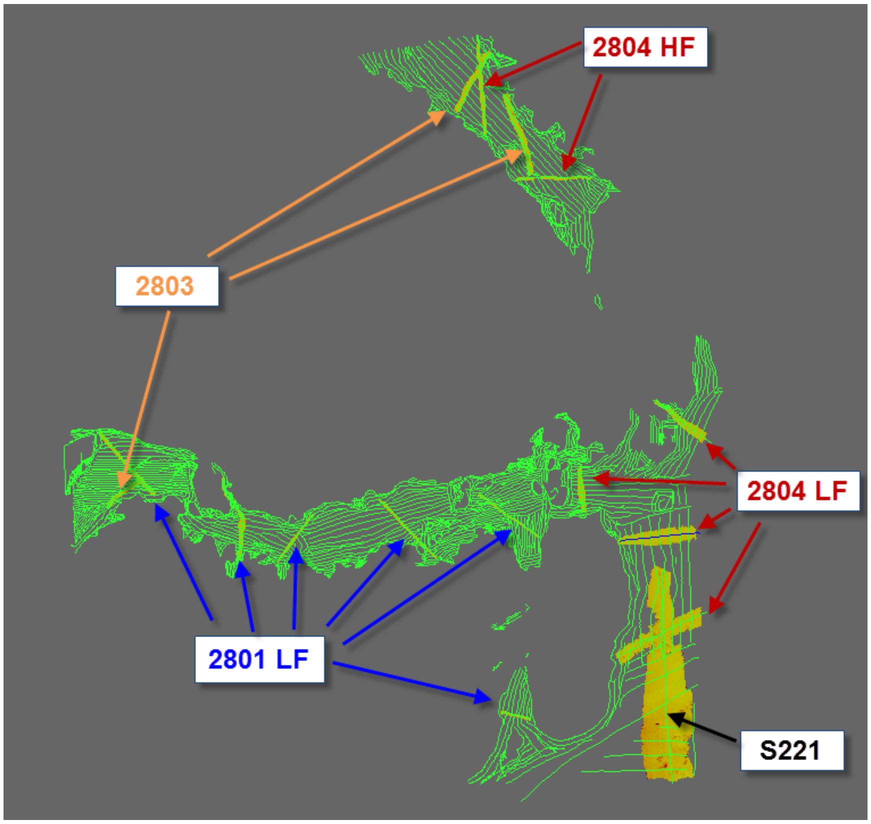


Figure 16: H12289 crossline distribution.

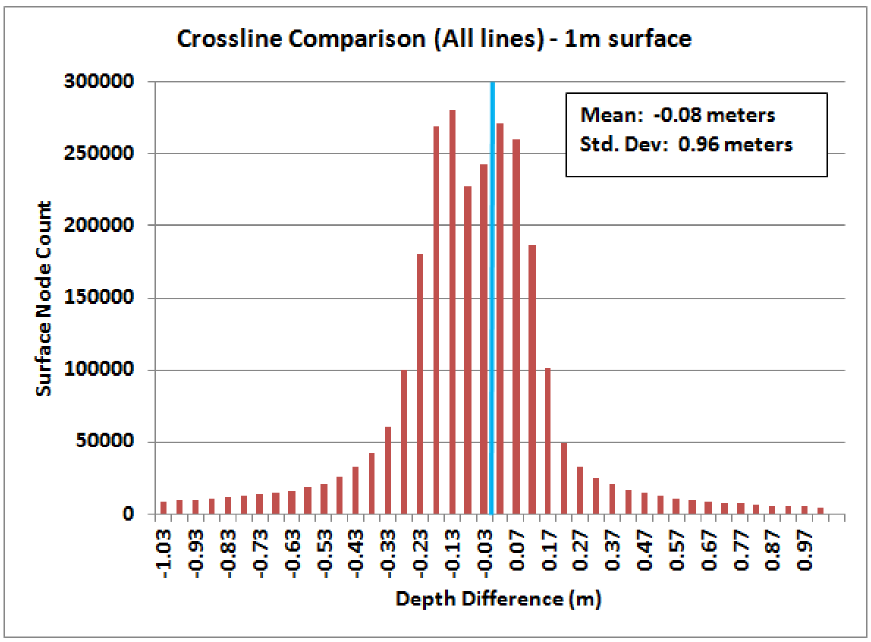


Figure 17: Histogram of 1 meter resolution difference surface between main scheme and crosslines. The average difference was 0.08 meters, but the standard deviation was 0.96 meters.

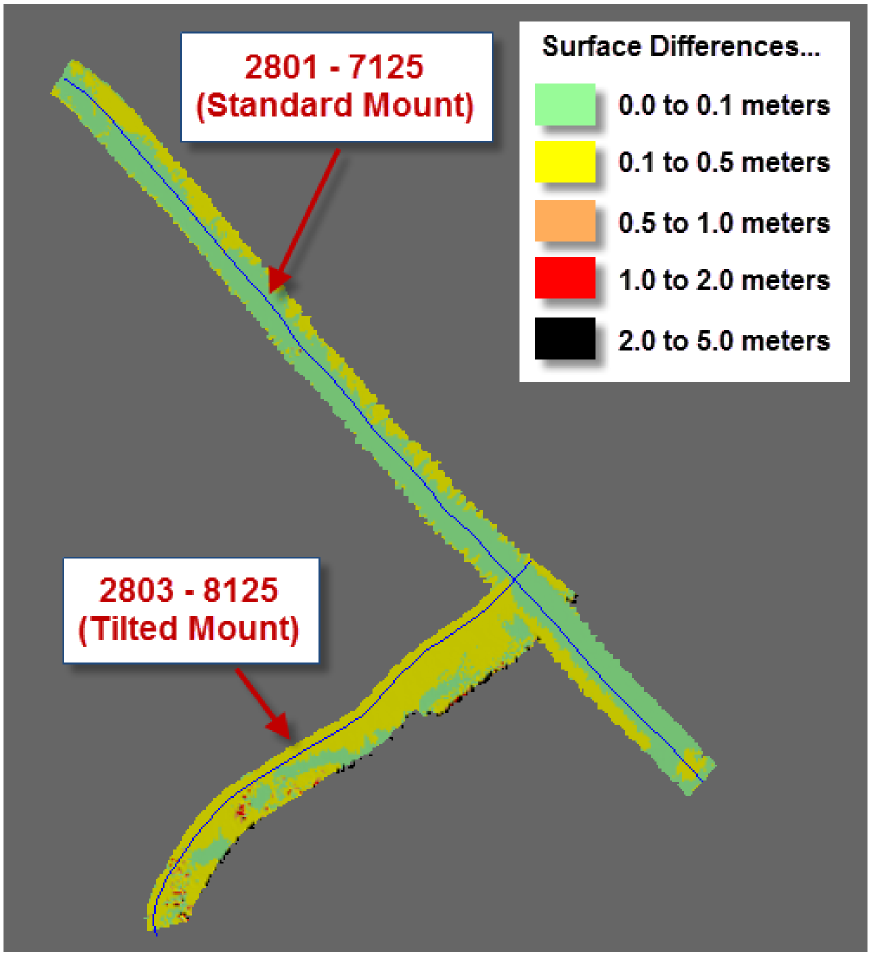


Figure 18: Difference surface derived from two crosslines (as compared to main scheme hydrography). Notice the 7125 crossline typically agreed to within 0.10 meters [green]; whereas, the 8125 agreement was less (approaching 2.00 meters [black] in the outer beams).

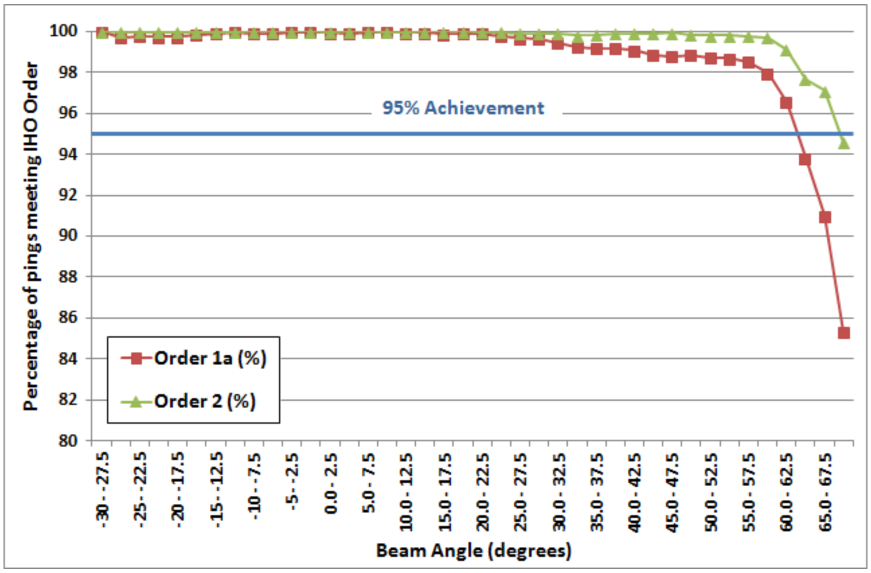


Figure 19: CARIS QC report for the RESON 8125 crosslines, showing the percentage of pings that satisfy a given IHO accuracy level (delineated by beam angle from nadir). In this case, 95% of the beams up to 62.5-degrees from nadir achieve IHO Order 1 accuracy.

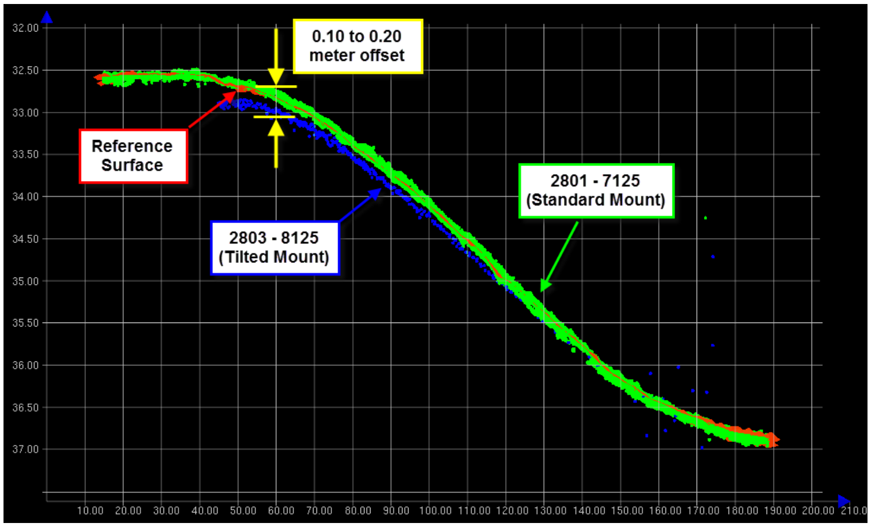


Figure 20: Vertical offset exhibited between RESON 8125 data (blue) and all other vessels (green). Notice the derived surface (red) tends to eschew the sparse 8125 data in favor of the more dense RESON 7125.

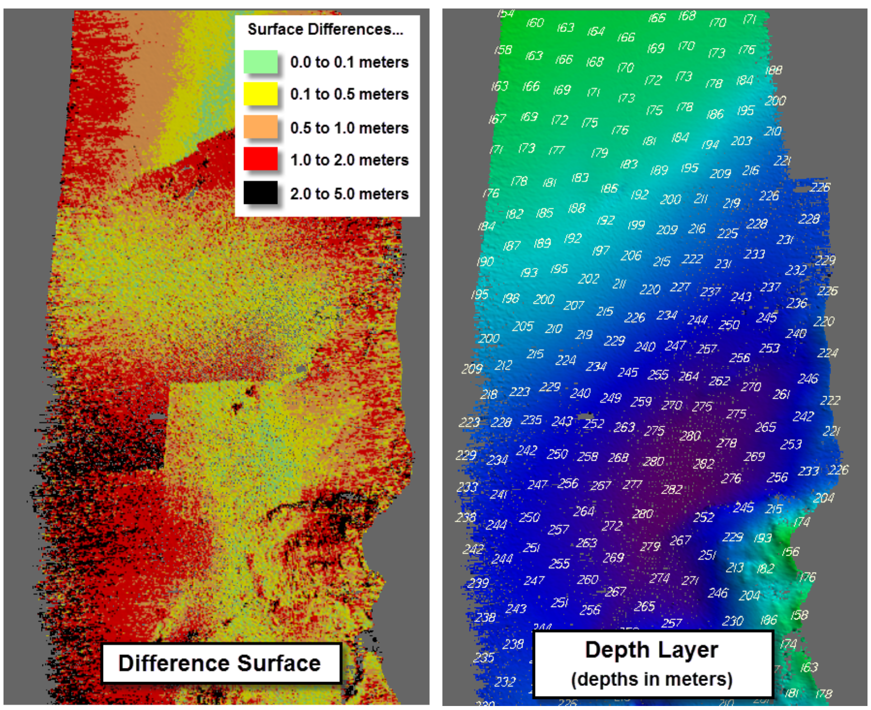


Figure 21: Left - Difference surface derived from S221 crossline (as compared to main scheme hydrography); right - associated depths (in meters) of corresponding difference surface.

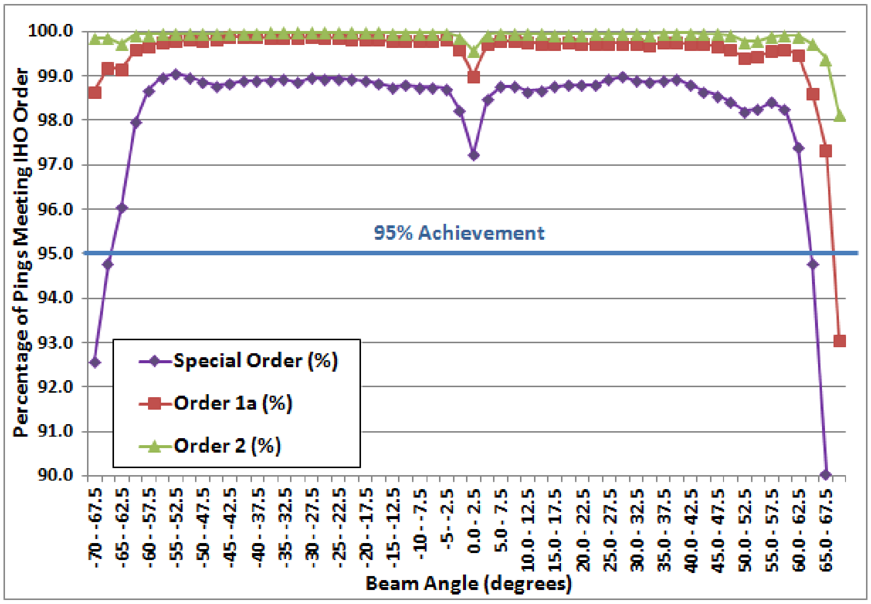


Figure 22: CARIS QC report for both S221 and survey launches (equipped with RESON 7125). Not only does 95% of data up to 67.5-degrees from nadir satisfies IHO Order 1, 95% of data up to 65.0-degrees from nadir satisfies IHO Special Order.

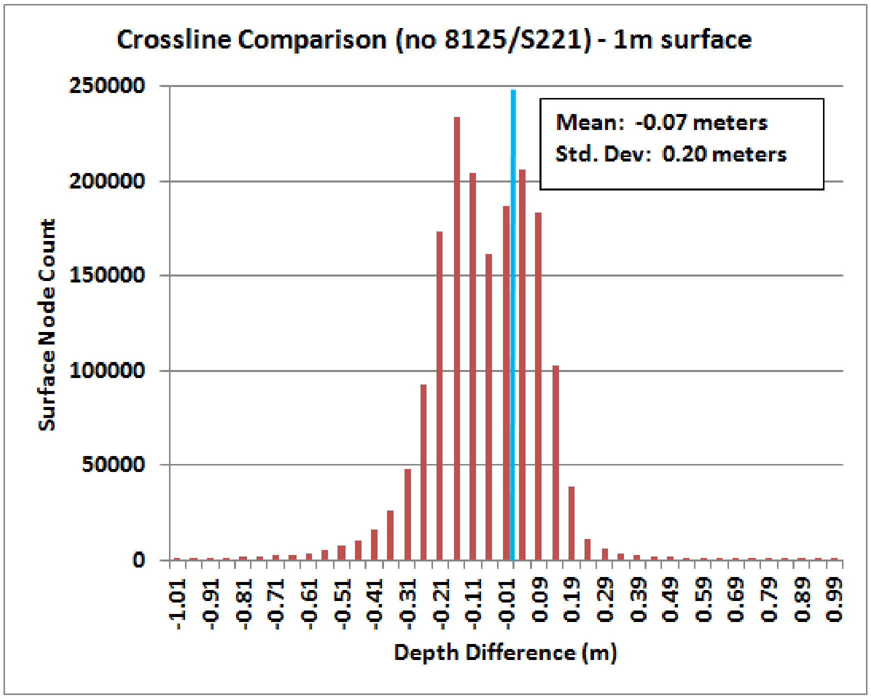


Figure 23: Histogram of 1 meter resolution difference surface between main scheme and crosslines, in which data from 8125 and S221 were withheld. The average difference was 0.07 meters, and the standard deviation decreased to 0.20 meters.

Data is adequate and within specification to supersede charted data in the common area.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0meters	0.095meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
2801 (RA-4)	3meters/second		0.15meters/second
2802 (RA-5)	3meters/second		0.15meters/second
2803 (RA-3)	3meters/second		0.15meters/second
2804 (RA-6)	3meters/second		0.15meters/second
S221		3meters/second	0.05meters/second

Table 7: Survey Specific Sound Speed TPU Values

Uncertainty values of submitted, finalized grids are calculated in CARIS using the "Greater of the Two" of among Total Propagated Uncertainty and standard deviation (scaled to 95%). To visualize the locations in which accuracy requirements were met, for each finalized surface, a custom "IHO" layer was created, based on the difference between calculated uncertainty of the nodes and the allowable IHO uncertainty (Figure 24). To quantify the extent to which accuracy requirements were met, the preceding "IHO" layers were queried within CARIS and then exported to Excel (Figure 25). Note: CARIS' own QC Surface Report tool was not fully used as the software would crash on the finer resolution surfaces (though the two methods produced the same results for surfaces in which both the Surface Report and the layer query were used). Overall, 99.8% of survey H12289 met the accuracy requirements stated in the HSSDM.

The greatest problems associated with achieving the desired accuracy levels were focused in three areas (highlighted in Figure 24): Arboles Island (Figure 26), St. Ignace Rock (Figure 27), and the Cone Island Daybeacon (Figure 28). Arboles Island and St. Ignace Rock were both located in areas with thick kelp patches. The kelp limited coverage and required heavy data editing. Further, Arboles Island and St. Ignace Rock were surveyed exclusively with the tilted RESON 8125 (see blue tracklines in Figures 26 and 27), which is not capable of producing as accurate a sounding set (for hardware related reasons) as the other sonars used in survey H11289.

Data in the vicinity of the Cone Island Daybeacon (Figure 28) experienced a different problem. Multibeam data was acquired concurrent with shoreline verification of Cone Island (day number 270), as such, the positioning and attitude systems were unlikely to be monitored as closely were the vessel strictly performing multibeam surveying. Loss of heading accuracy was reported in the vicinity of Cone Island on several occasions (though not on this particular day), due to GPS masking by the island. Further, the logged positioning and attitude file was later found to be corrupt, which prevented the generation and application of an SBET file (which may have improved reported data accuracy).

Multibeam data was closely examined within CARIS subset editor for all three of the previously mentioned areas. Beyond the kelp already discussed, there appear to be no artifacts within the data, which the Hydrographer considers good enough to supersede the charted soundings.

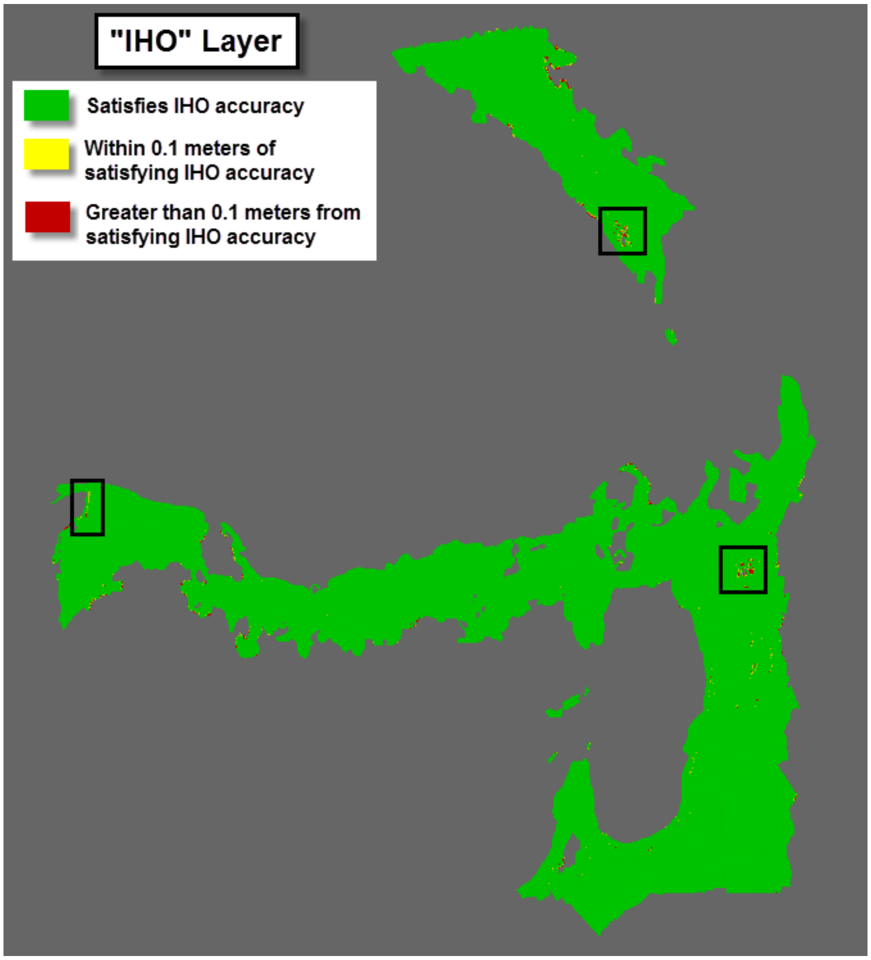


Figure 24: H12289 survey overview indicating areas in which IHO accuracy standards were met (highlighted in green). Three regions which proved problematic in achieving the required level of accuracy are indicated with the black squares and are shown in greater detail in Figures 26, 27 and 28.

Resolution	Depth range	IHO Order	Number of nodes	Nodes satisfying given IHO Order accuracy	Percent of nodes satisfying given IHO Order accuracy
1m	0 - 20m	Order 1	11,023,841	10,988,482	99.7%
2m	18 - 40m	Order 1	5,637,844	5,634,615	99.9%
4m	36 - 80m	Order 1	834,058	832,246	99.8%
8m	72 - 100m	Order 1	41,532	41,384	99.6%
8m	100 - 160m	Order 2	39,188	39,178	100.0%
16m	144 - 320m	Order 2	33,792	33,776	100.0%
		TOTAL:	17,610,255	17,569,681	**99.8%**
		TOTAL (by area):	58,228,945	58,138,110	**99.8%**

Figure 25: Summary table showing the percentage of nodes satisfying the indicated IHO accuracy level, sub-divided by the appropriate depth ranges.

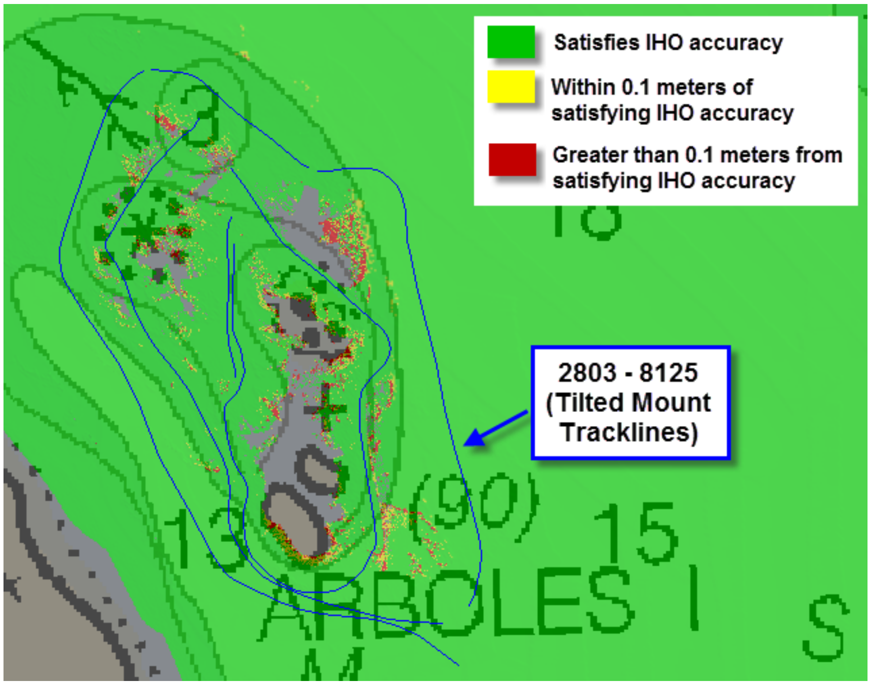


Figure 26: IHO accuracy layer in the vicinity of Arboles Island. Note: areas in which accuracy requirements are not being met have data acquired exclusively with the tilted RESON 8125 (tracklines indicated in blue).

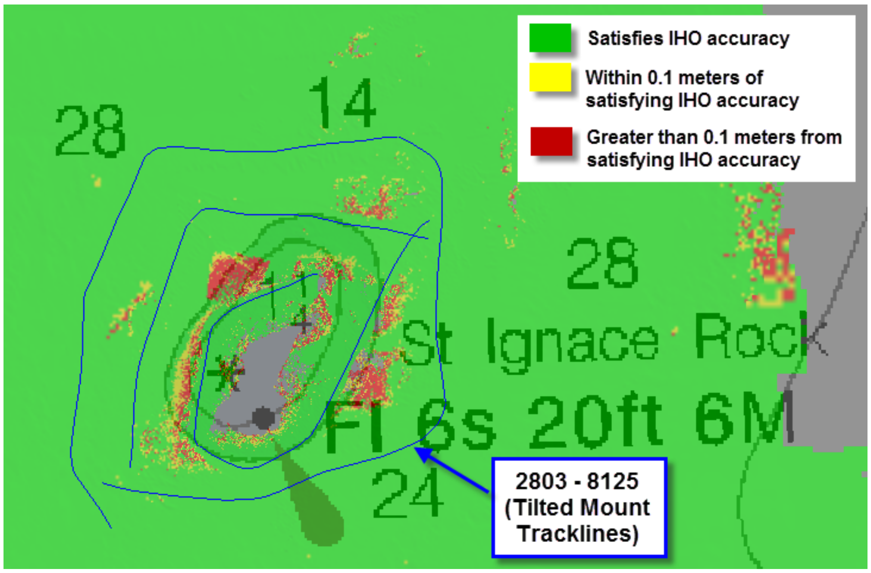


Figure 27: IHO accuracy layer in the vicinity of St. Ignace Rock. Note: areas in which accuracy requirements are not being met have data acquired exclusively with the tilted RESON 8125 (tracklines indicated in blue).

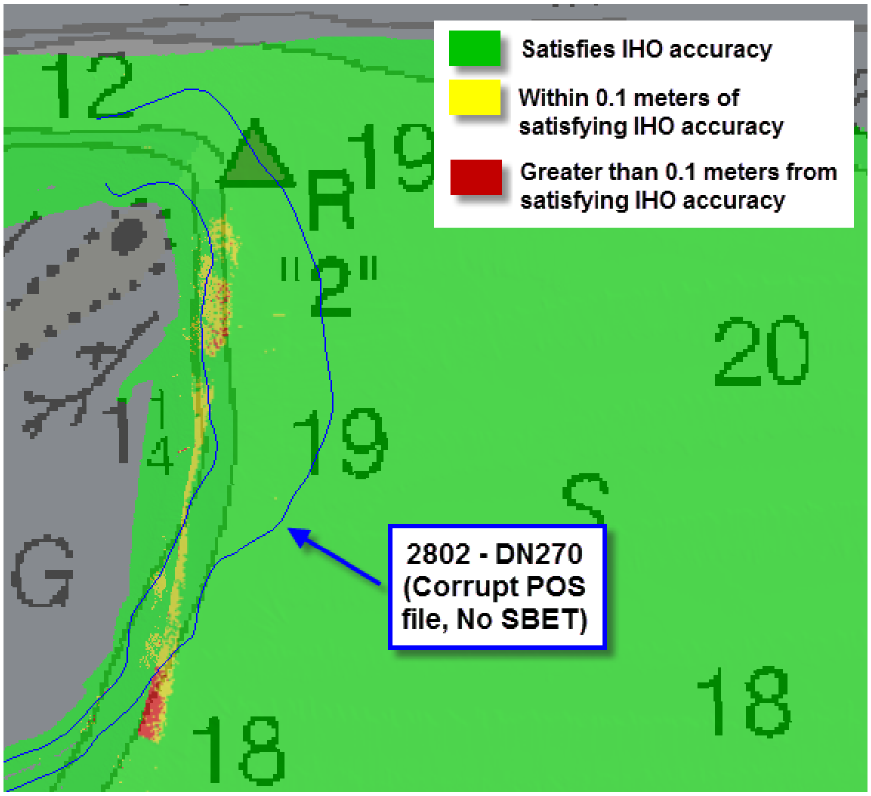


Figure 28: IHO accuracy layer in the vicinity of Cone Island Daybeacon. Note: areas in which accuracy requirements are not being met have data associated with a corrupt attitude file (tracklines indicated in blue). In particular, position and attitude could not be corrected in post-processing.

Data is within specification and is adequate to supersede charted data in the common area.

B.2.3 Junctions

Seven junction comparisons were completed for H12289 (Figure 29). Two junctioning surveys (H12290, H12292) were acquired concurrently with this survey; two junctioning surveys (H11849, H12030) were multibeam surveys completed between 2008 and 2009, respectively; and three junctioning surveys (H11865, H11866, H11867) were lidar surveys completed in 2008. Depth comparisons were performed using the CARIS Difference Surface (at the finest available resolution), from which descriptive statistics were generated. For the contemporary surveys, multibeam data was also examined in CARIS subset editor for consistency and agreement.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12290	1:20000	2011	NOAA Ship RAINIER	W
H12292	1:20000	2011	NOAA Ship RAINIER	S
H12030	1:20000	2009	NOAA Ship RAINIER	E
H11849	1:10000	2008	NOAA Ship RAINIER	N
H11865	1:10000	2008	Fugro LADS	NE
H11866	1:10000	2008	Fugro LADS	W
H11867	1:10000	2008	Fugro LADS	E

Table 8: Junctioning Surveys

<u>H12290</u>

On average, there was 150 meters of overlap between H12289 and H12290 (Figure 30). Depth differences in the areas of overlap averaged a difference of 0.03 meters with standard deviation of 0.13 meters, (Figure 31). In addition, inspection of the data in CARIS subset editor showed strong agreement between the datasets (Figure 32).

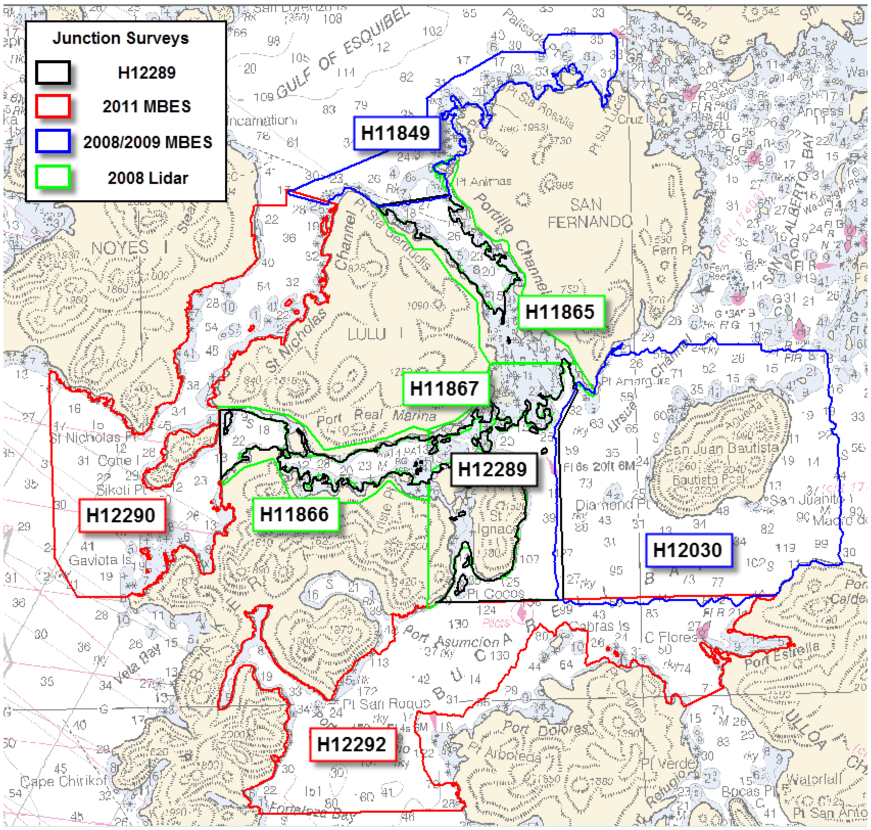


Figure 29: H12289 junction surveys.

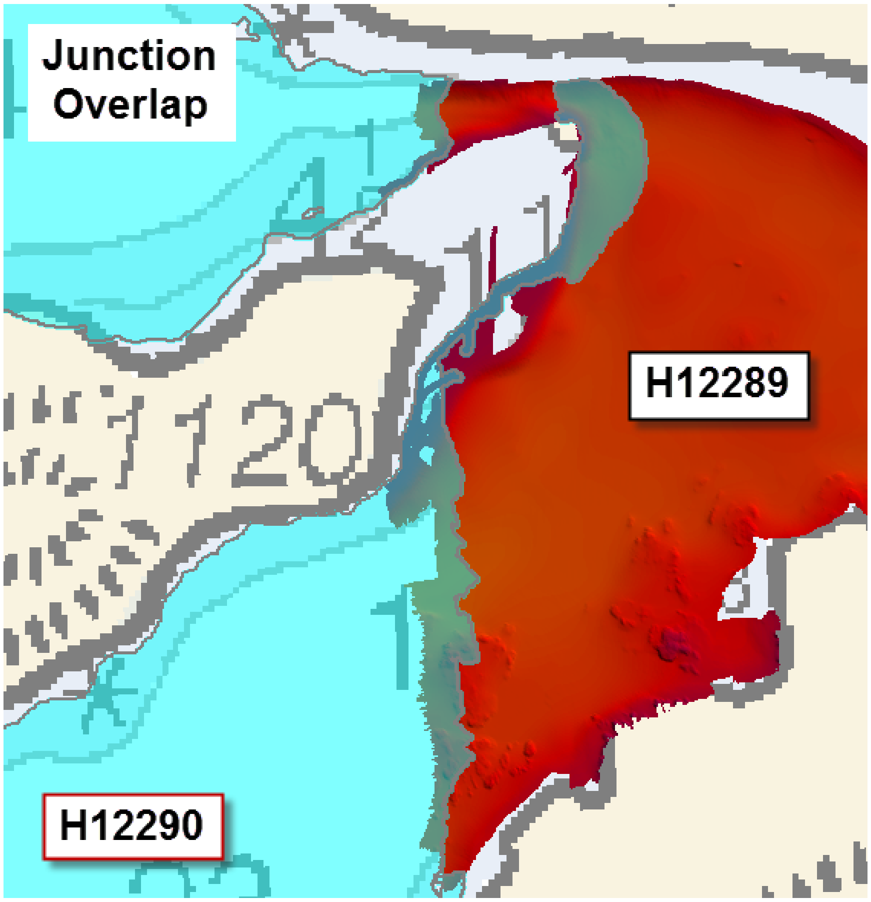


Figure 30: Junction between H12289 and H12290.

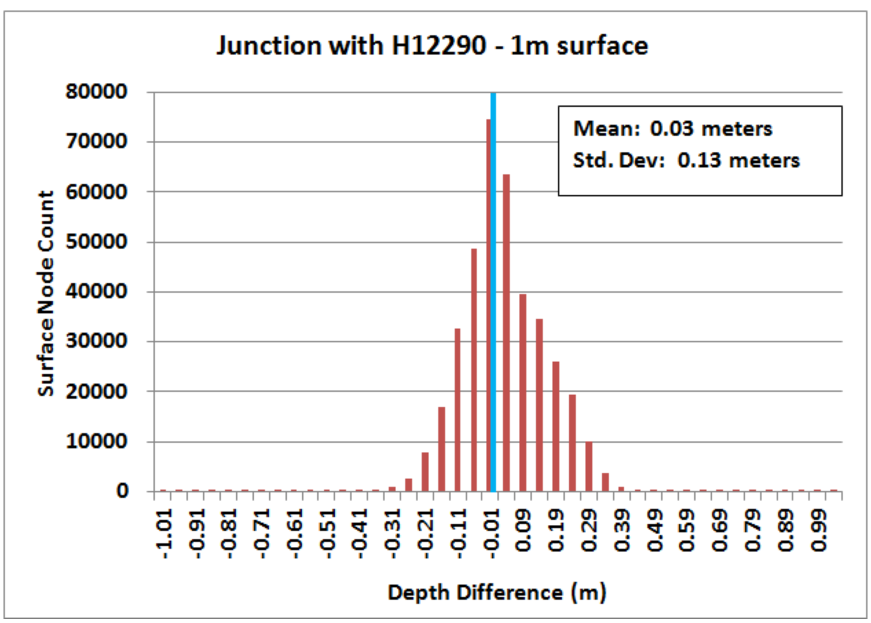


Figure 31: Difference surface statistics between junction of H12289 and H12290. Average difference was 0.03 meters.

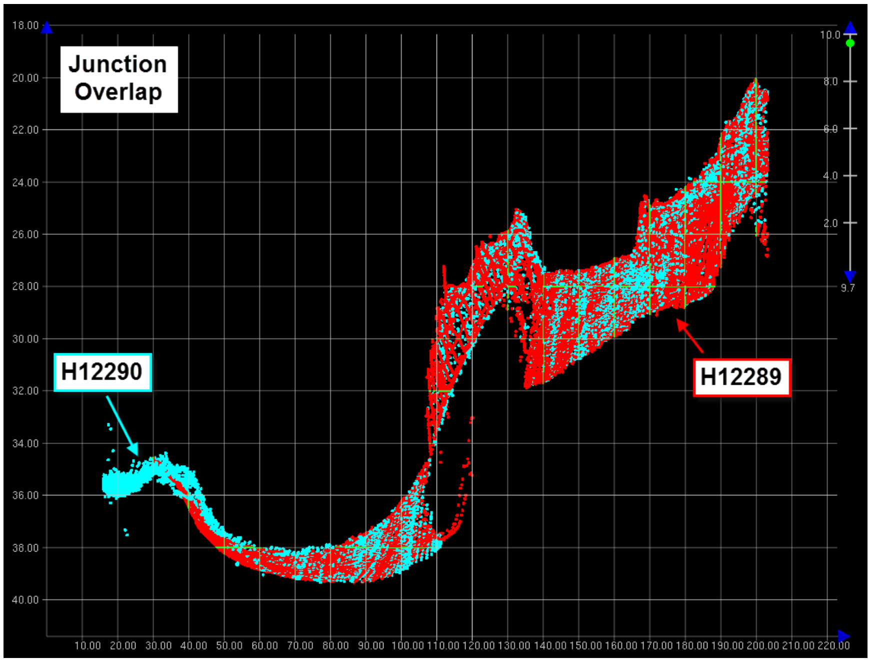


Figure 32: Cross section of multibeam data between junction of H12289 and H12290.

H12289 junctions with surveys H12290 to the West, H12292 to the South, H12030 to the East, H11849 to the North, H11865 to the Northeast, H11866 to the West and H11867 to the East.

H12292

On average, there was 400 meters of overlap between H12289 and H12292 (Figure 33). Depth differences in the areas of overlap averaged a difference of -0.07 meters with standard deviation of 0.86 meters, (Figure 34). This larger standard deviation owes chiefly to the extreme depths in the area of overlap (approximately 250 meters). In addition, inspection of the data in CARIS subset editor showed strong agreement between the two datasets (Figure 35). The only difference is the data from H12289 appears "fuzzier"; this is because, in the area of overlap, H12289 was acquired using a RESON 7125 Low frequency sonar; whereas, H12292 was acquired using the Kongsberg EM710 (a deep water system).

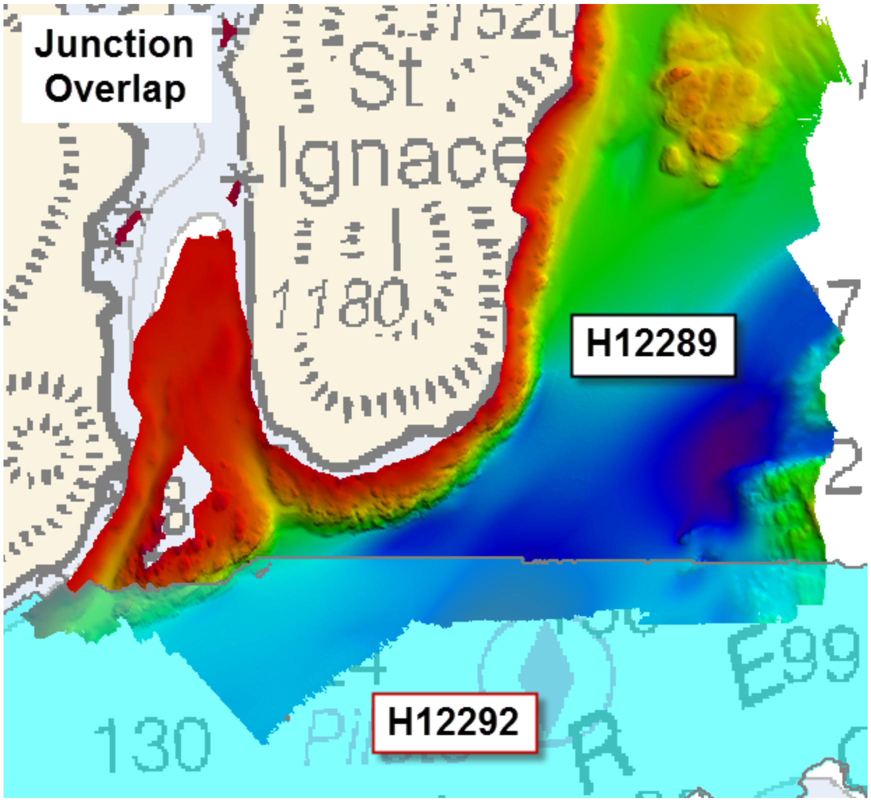


Figure 33: Junction between H12289 and H12292.

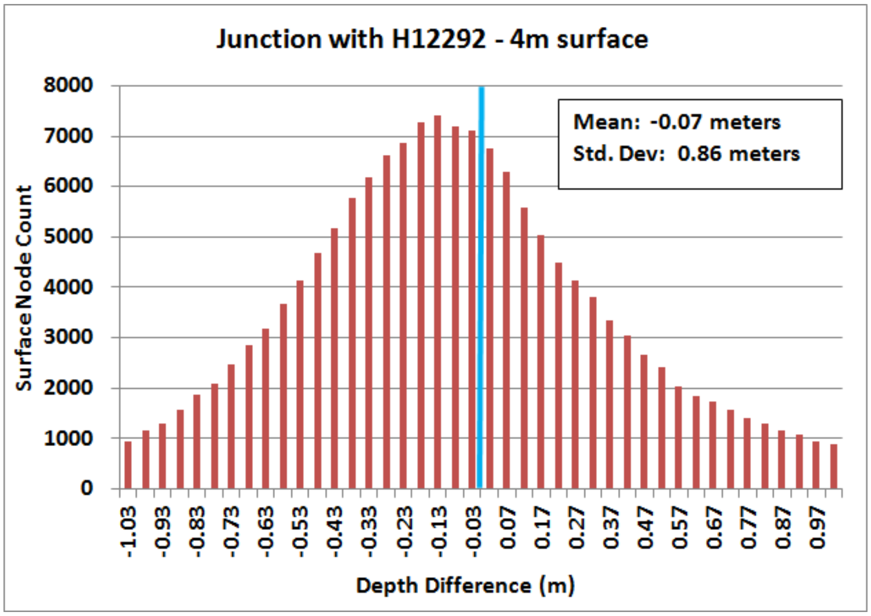


Figure 34: Difference surface statistics between junction of H12289 and H12292. Average difference was -0.07 meters.

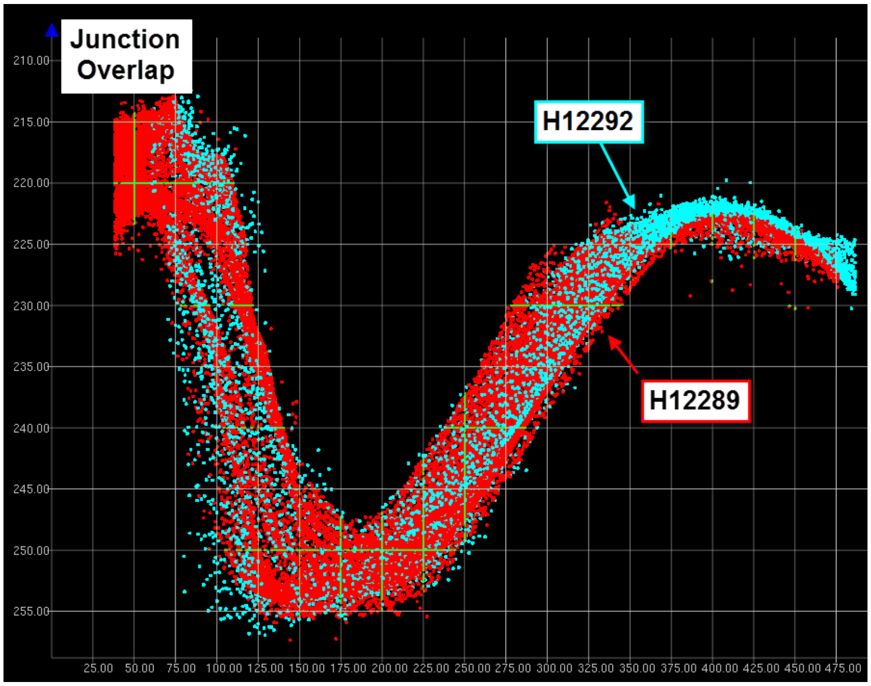


Figure 35: Cross section of multibeam data between junction of H12289 and H12292.

H12030

On average, there was 300 meters of overlap between H12289 and H12030 (Figure 36). Depth differences in the areas of overlap averaged a difference of 0.13 meters with standard deviation of 2.09 meters, (Figure 37). This larger standard deviation can be partially attributed to the extreme depths in some of the areas of overlap (exceeding 250 meters). There may be additional variability owing to the coarser resolution (8 meter) surfaces that were used in the differencing. In order to assess whether there was a geographic trend in the variability of the surfaces, the difference surface was closely examined (Figure 38). In this case, there was no spatial pattern to the difference in depths between the two surveys; the surveys compared equally in both shallow and deep waters.

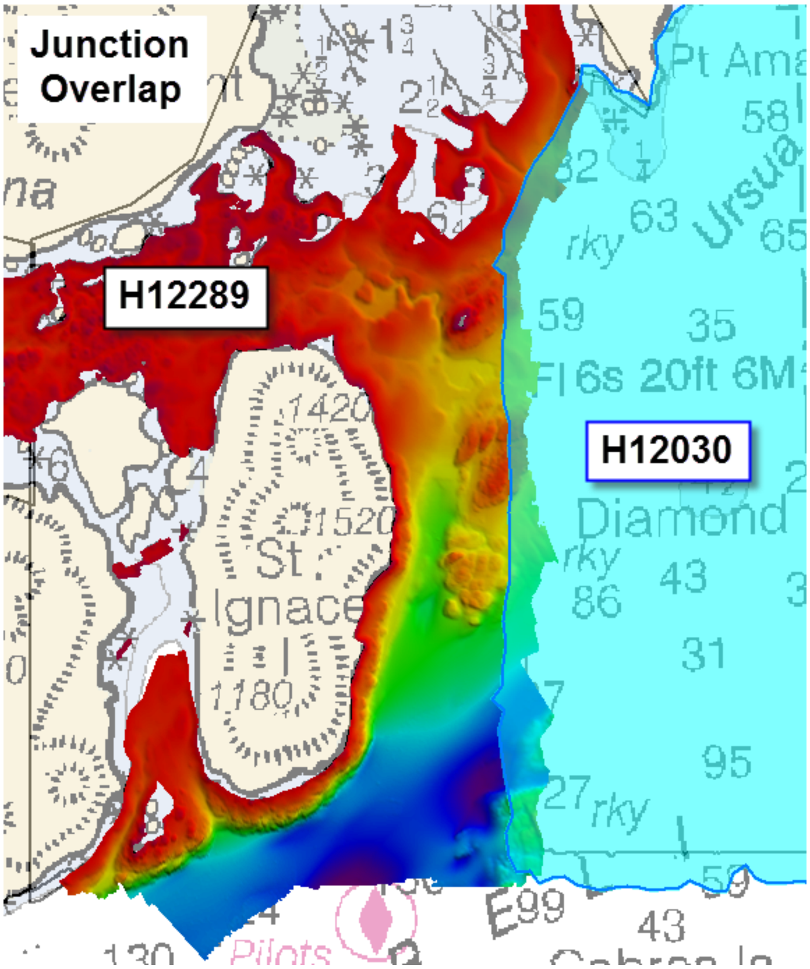


Figure 36: Junction between H12289 and H12030.

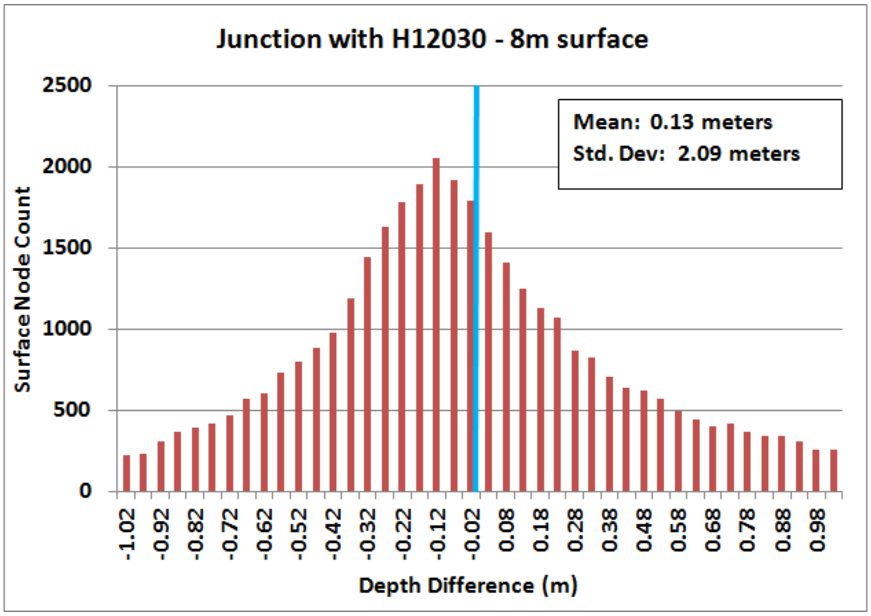


Figure 37: Difference surface statistics between junction of H12289 and H12030. Average difference was 0.13 meters.

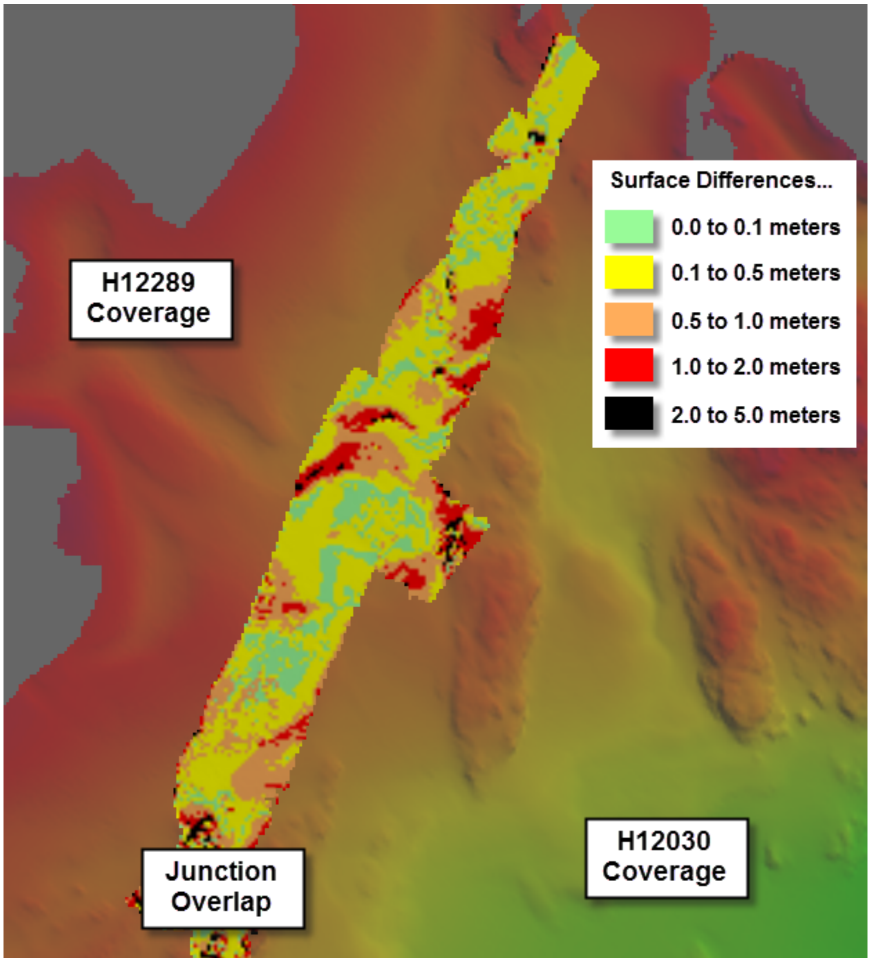


Figure 38: Difference surface between junction of H12289 and H12030. Depth differences range from 0.0 meters to 2.0 meters without any spacial pattern.

<u>H11849</u>

On average, there was 200 meters of overlap between H12289 and H11849 (Figure 39). Depth differences in the areas of overlap averaged a difference of 0.09 meters with standard deviation of 0.28 meters, (Figure 40). In order to assess whether there was a geographic trend in the variability of the surfaces, the difference surface was closely examined (Figure 41). In this case, there was no overall spatial pattern to the difference in depths between the two surveys; however, the greatest depth discrepancies were observed in regions with the greatest seafloor relief. This correlation between depth discrepancies and bottom relief may simply be a function of the gridding algorithms used.

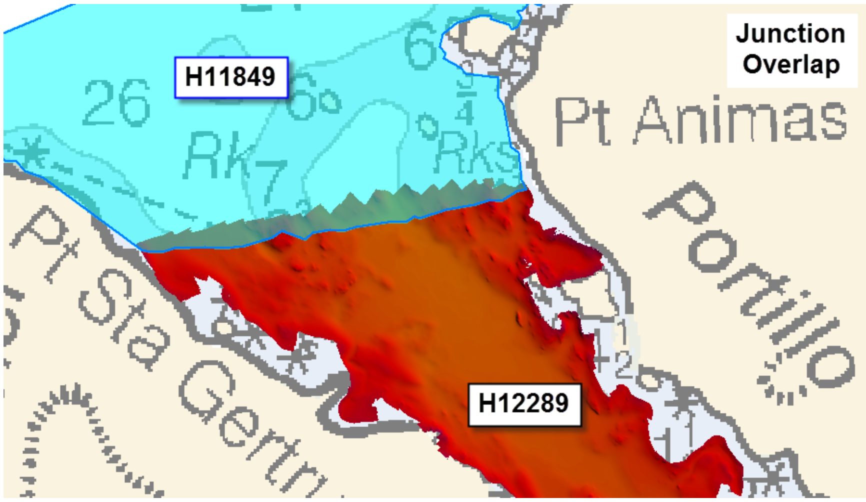


Figure 39: Junction between H12289 and H11849.

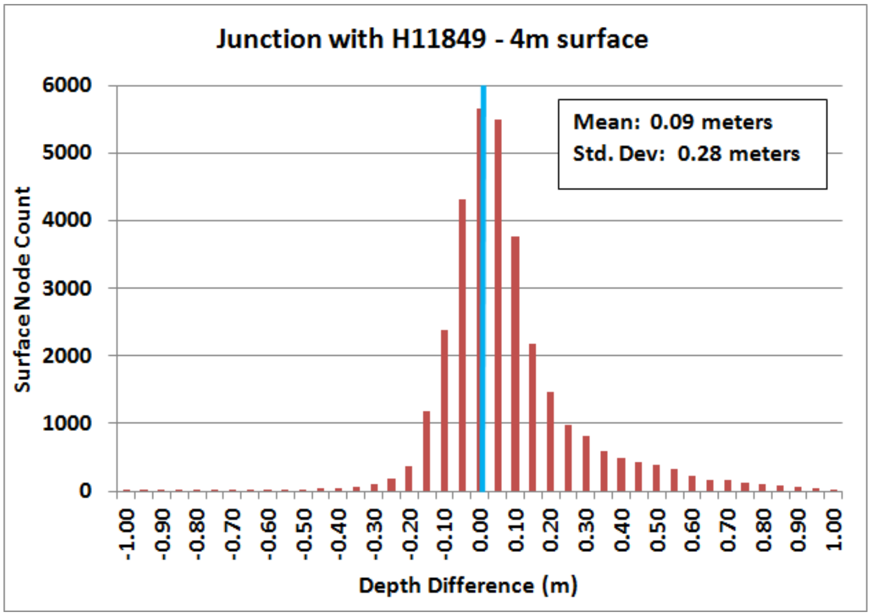


Figure 40: Difference surface statistics between junction of H12289 and H11849. Average difference was 0.09 meters.

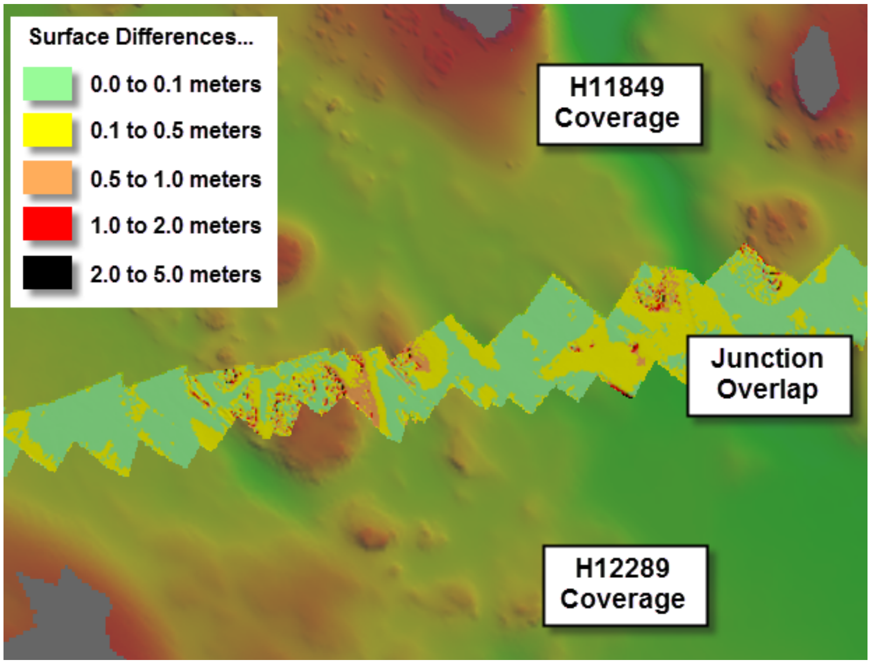


Figure 41: Difference surface between junction of H12289 and H11849.

H11865

On average, there was 80 meters of overlap between H12289 and H11865 (Figure 42). Depth differences in the areas of overlap averaged a difference of 0.05 meters with standard deviation of 0.45 meters, (Figure 43). In order to assess whether there was a geographic trend in the variability of the surfaces, the difference surface was closely examined (Figure 44). In this case, there was no overall spatial pattern to the difference in depths between the two surveys; however, two regions displayed greater depth discrepancies than any other: Arboles Island and Caracol Island (Figure 45). The two islands were similar in that they were both surrounded with heavy kelp beds which would have impeded both lidar and the tilted RESON 8125. It is to be expected that the soundings would be less reliable in these two areas.

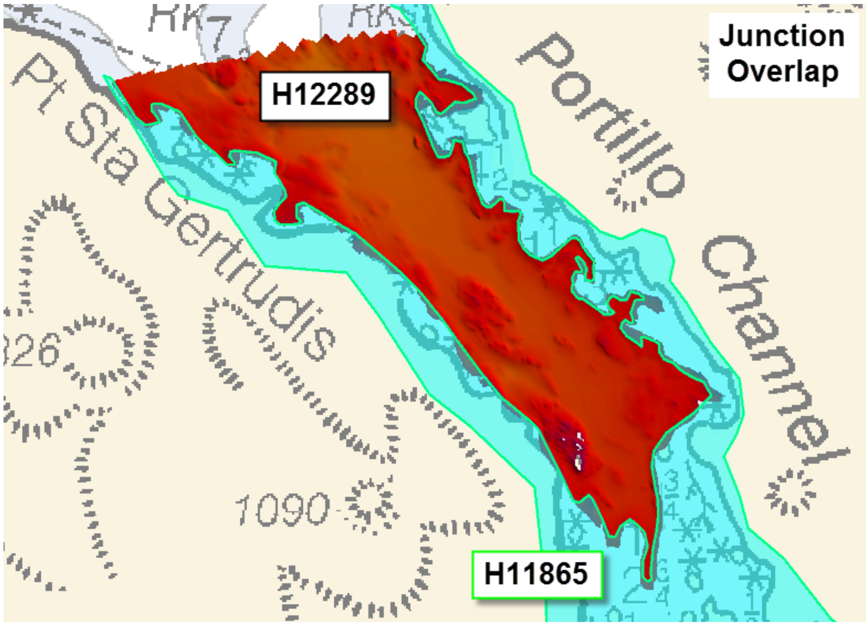


Figure 42: Junction between H12289 and H11865.

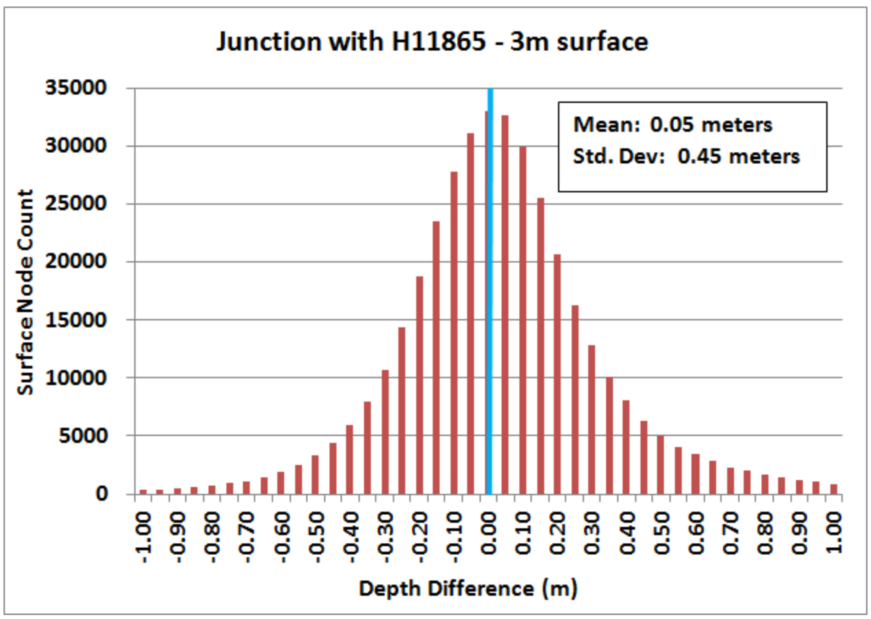


Figure 43: Difference surface statistics between junction of H12289 and H11865. Average difference was 0.05 meters.

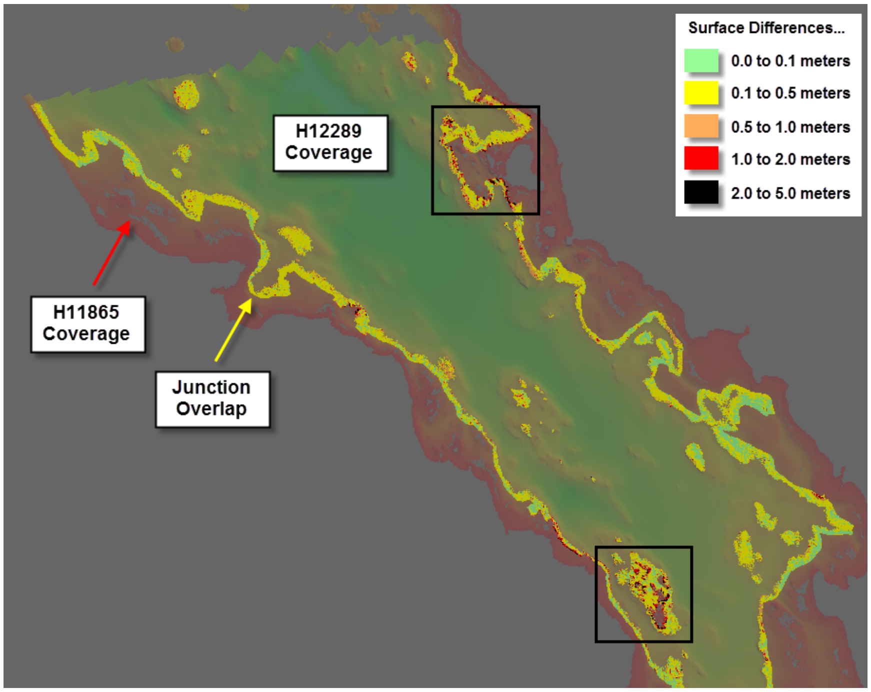


Figure 44: Difference surface between junction of H12289 and H11865. Two regions which showed the greatest differences in depths are indicated with the black squares and are shown in greater detail in Figure 45.

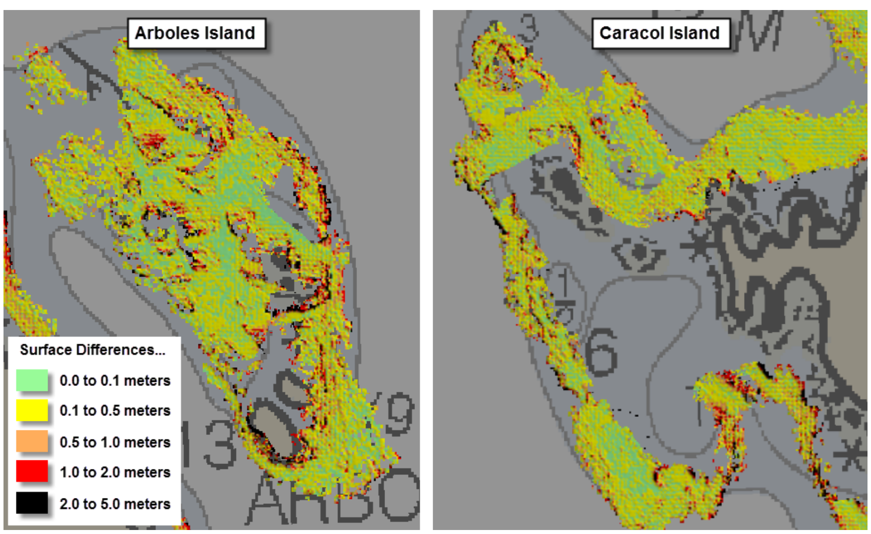


Figure 45: Difference surface between junction of H12289 and H11865 in the vicinity of Arboles Island (left) and Caracol Island (right). Both islands were heavily fouled with kelp which impeded bottom detection in both surveys.

<u>H11866</u>

On average, there was 80 meters of overlap (with some stretches of several hundred meters) between H12289 and H11866 (Figure 46). Depth differences in the areas of overlap averaged a difference of

0.07 meters with standard deviation of 0.41 meters, (Figure 47). In order to assess whether there was a geographic trend in the variability of the surfaces, the difference surface was closely examined (Figure 48). In this case, there was no overall spatial pattern to the difference in depths between the two surveys; however, one region (west of Pigeon Island) displayed greater depth discrepancies than any other (Figure 49). Review of the data shows the large depth differences coincide with areas of rapid change in depth (e.g. the edges of channels). Since depths match well to both sides of these rapid depth changes, the large depth differences can likely be attributed to the gridding algorithm more than an any actual systematic biases in measurement between the two surveys.

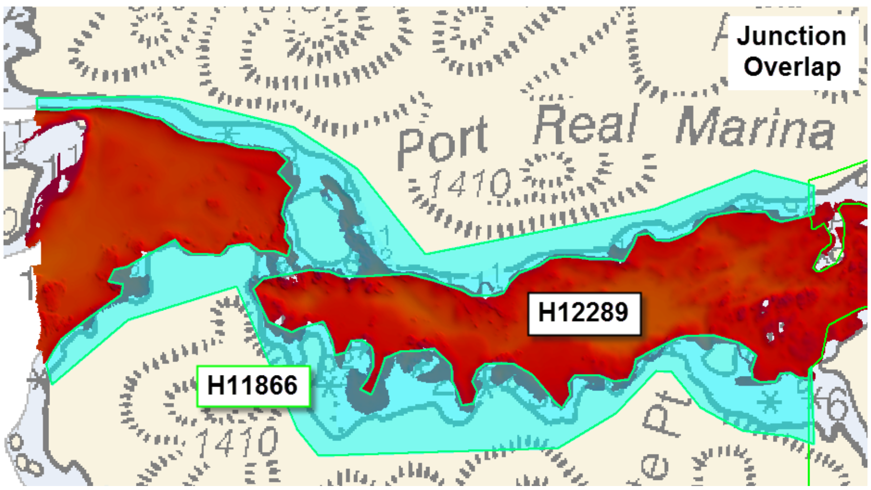


Figure 46: Junction between H12289 and H11866.

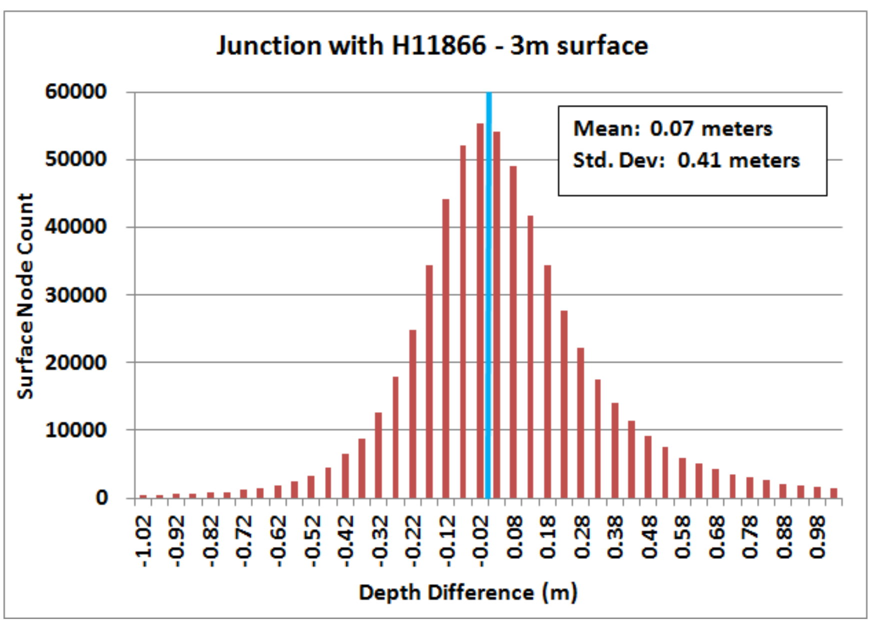


Figure 47: Difference surface statistics between junction of H12289 and H11866. Average difference was 0.07 meters.

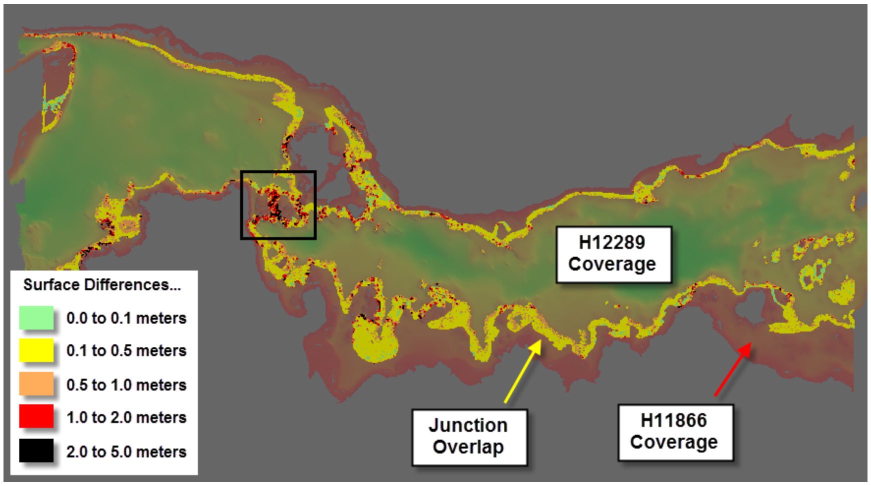


Figure 48: Difference surface between junction of H12289 and H11866. One region, which showed the greatest differences in depths, is indicated with the black square and shown in greater detail in Figure 49.

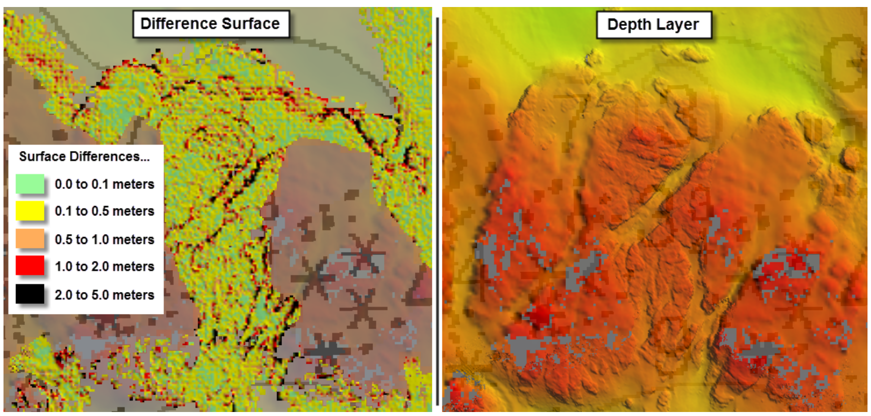


Figure 49: (Left) Difference surface between junction of H12289 and H11866 west of Pigeon Island; (Right) depth layer derived from both surveys. Note the area of greatest divergence in depths, coincides with areas of rapid change in depth (e.g. the edge of the channels).

<u>H11867</u>

On average, there was 100 meters of overlap (with some stretches of several hundred meters) between H12289 and H11867 (Figure 50). Depth differences in the areas of overlap averaged a difference of 0.03 meters with standard deviation of 0.39 meters, (Figure 51). In order to assess whether there was a geographic trend in the variability of the surfaces, the difference surface was closely examined (Figure 52). In this case, there was no overall spatial pattern to the difference in depths between the two surveys; however, one region (St. Ignace Rock) displayed greater depth discrepancies than any other (Figure 53). The cause for these depth discrepancies is likely a combination of those seen in junctions with the previous lidar surveys (H11865, H11866): St Ignace Rock was heavily fouled with kelp; and there was a large depth change over the feature, leading to possible gridding artifacts.

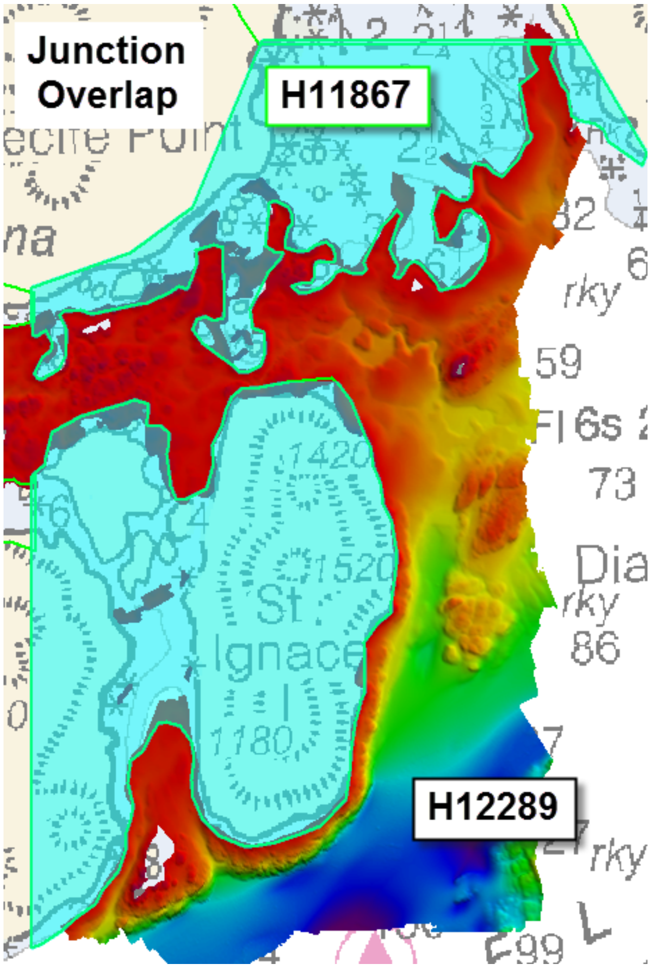


Figure 50: Junction between H12289 and H11867.

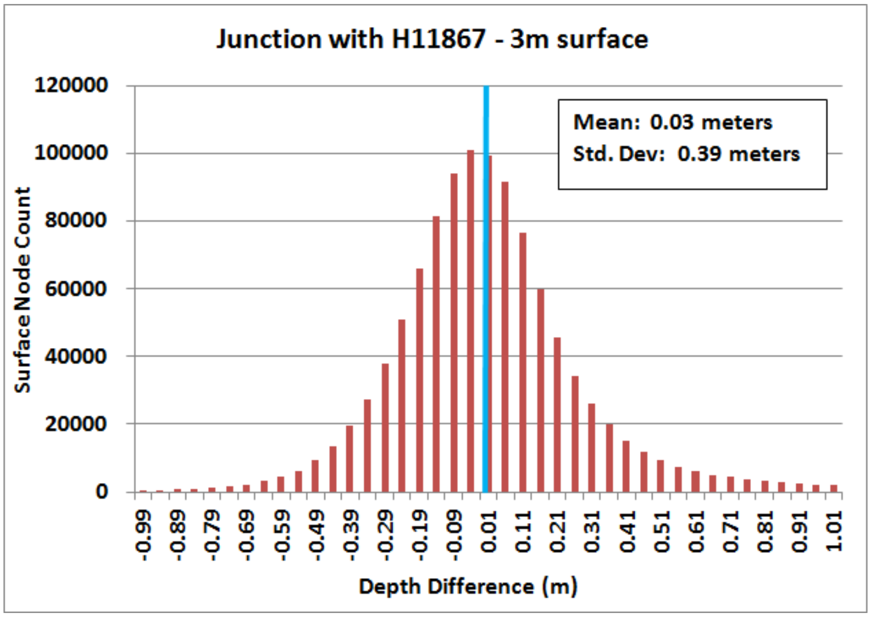


Figure 51: Difference surface statistics between junction of H12289 and H11867. Average difference was 0.03 meters.

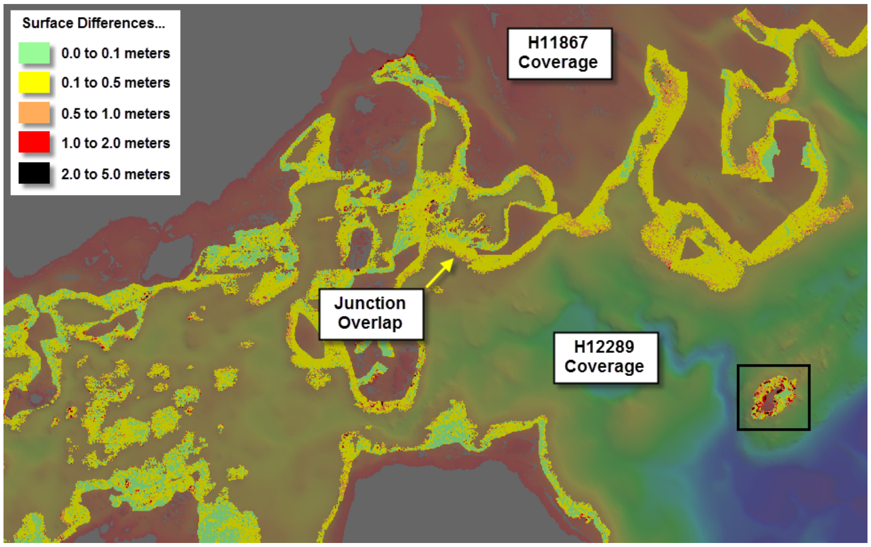


Figure 52: Difference surface between junction of H12289 and H11867. One region, which showed the greatest differences in depths, is indicated with the black square and shown in greater detail in Figure 53.

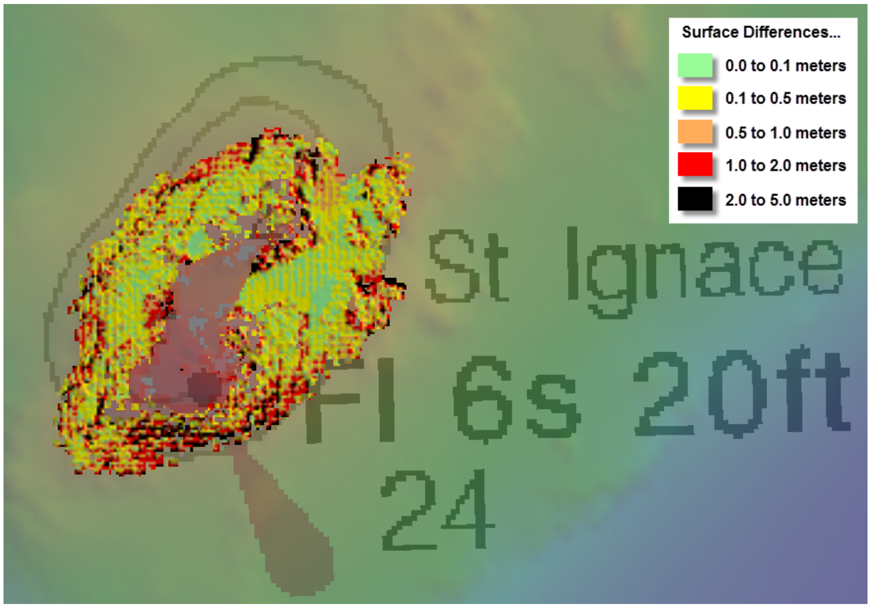


Figure 53: Difference surface between junction of H12289 and H11865 in the vicinity of Arboles Island (left) and Caracol Island (right). Both islands were heavily fouled with kelp which impeded bottom detection in both surveys.

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

B.2.5.1Navigation Time Latency for Tilted RESON 8125

On launch 2803, an integration problem between the RESON 8125 and the multibeam acquisition software, Hypack, led to a varying latency between the time stamps of the sonar and the time stamps of the vessel's navigation/attitude sensor, the POS M/V. The artifact first manifested on day number (DN) 276; was rectified the next time the boat was deployed on DN 278; but returned on DN 279 (due to an inappropriately reverted setting). The latency was identified and resolved using CARIS' multibeam calibration tool, with the navigation time latency being frequently updated in the CARIS HVF (Figure 54). To confirm the variation in timing wasn't random, the latency determined through the calibration tool, for both days 276 and 278, was plotted against the time elapsed from the first moment of acquisition for each respective day (Figure 55). In both cases, the sonar time latency varied linearly; approximately, for each minute elapsed in the acquisition computer, the sonar drifted 0.001 seconds further behind. This linear drift is what makes the removal of the artifact through the CARIS HVF simple to remove. Once all of the time latency values were determined and applied, all RESON 8125 data met the quality standards outlined in the HSSDM.

Date	Time	Time Correction (s)	Comments
2011-276	19:04	-2.16	H12289 276_1852 to 1958
2011-276	20:23	-2.26	H12289 276_2024 to 2113
2011-276	21:17	-2.32	H12289 276_2118 to 2204
2011-276	22:33	-2.36	H12289 276_2234 to 2238
2011-276	22:55	-2.41	H12289 276_2256 to 2315
2011-276	23:24	-2.46	H12289 276_2325 to 0011
2011-278	00:00	-0.03	H12289 278_1813 to 0014
2011-279	17:03	-0.03	H12289 279_1704 to 1710
2011-279	17:41	-0.07	H12292 279_1742
2011-279	18:04	-0.095	H12292 279_1805
2011-279	18:21	-0.11	H12292 279_1822 to 1836
2011-279	18:44	-0.13	H12292 279_1845
2011-279	19:01	-0.15	H12292 279_1902 to 1909
2011-279	19:13	-0.16	H12292 279_1914
2011-279	19:19	-0.17	H12292 279_1920 to 1925

Entries affecting survey H12289

Entries affecting survey H12292

Figure 54: Chronology of time latency errors associated with tilted RESON 8125. Those entries affecting survey H12289 are highlighted in blue.

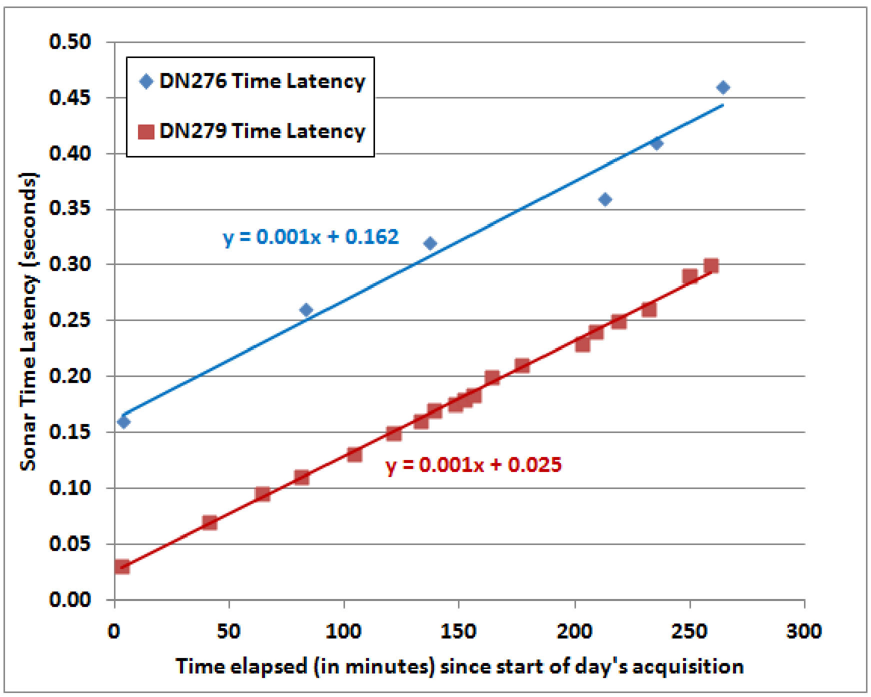


Figure 55: For day number 276 and 279, comparing the time elapsed since the start of the days' acquisition with the sonar time latency. In both cases, the same linear drift was noted.

Data is within specification and is adequate to supersede charted data in the common area. Corresponding emails are attached to this report.

B.2.5.1Corrupt and/or Missing Post-processed Attitude Files

Throughout acquisition for survey H12289, positioning and attitude information was logged separately for the purposes of post-processing heave (i.e. Applanix' True Heave) and post-processing position and attitude (i.e. Applanix' SBET). On three independent occasions, problems encountered during acquisition prevented the application of either the True Heave, SBET, or both (Figure 56). On DN 265, Launch 2804 inappropriately stopped logging near UTC midnight. As a result, True Heave could not be applied to line "28042011_2652353", while an SBET file could not be generated for line 28042011_2660000. On DN 270, Launch 2802 was performing shoreline verification of Cone Island. During processing the POS M/V file was found to be corrupt; as a result three low frequency lines (2802_2011__2702231, ...2251 and ...2302) and a single high frequency line (2801_2011__2710056) has neither True Heave nor SBET applied. On DN 276, the POS M/V of Launch 2803 lost connection with the secondary antenna, forcing the launch crew to manually restart the unit; however, an insufficient amount of buffer data was logged (five minutes recommended by Applanix) before resuming multibeam operations. As a result, three lines (2803_2011RA2762234, ...2237 and ...2238) do not have SBETs applied.

In all three of the preceding cases, multibeam data was closely examined in CARIS Subset Editor. In no case did the affected data show any difference from the neighboring (post-processed) survey lines. Thus, even with consideration to the lack of True Heave and SBETs data met the quality standards outlined in the HSSDM.

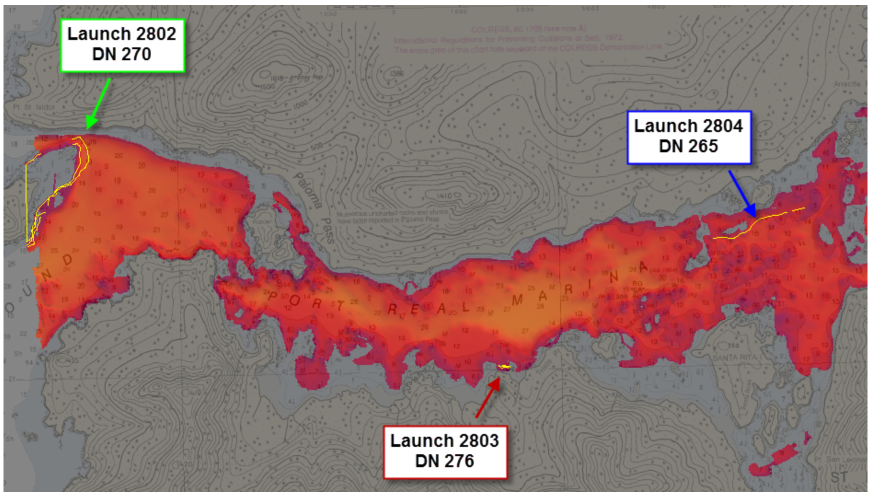


Figure 56: Locations of three sets of survey lines in which post-processing of heave, position and/or attitude was not possible.

Data is within specification and is adequate to supersede charted data in the common area.

B.2.5.1Unidentified Vertical Offset when Survey Data Referenced to Ellipse

All data for survey H12289 was ultimately delivered referenced to MLLW; however, for the purposes of quality control, GPS tides were computed and the sounding data was temporarily referenced to the ellipsoid. In most cases, the data integrity when referenced to the ellipse was of equal quality as when referenced to the tidal datum. The notable exception was Launch 2802 on DN 275. Multibeam data acquired on DN 275 was compared to all overlapping survey lines; depth differences were then noted both when referenced to both MLLW and the ellipse (Figure 57). When referenced to MLLW, the average difference between DN 275 data and all other data was 0.07 meters; however, once referenced to the ellipse the average difference increased to 0.77 meters. Despite reprocessing the data, the offset remained. Since the integrity of the vertical positioning had clearly been compromised through the application of the SBET, it is the opinion of the Hydrographer that the horizontal positioning may have also been affected by the SBET (though no horizontal errors were observed). As such, the SBET file was not applied to Launch 2802 on DN 275. It should again be stressed that, when referenced to MLLW, no artifacts were present and the quality standards outlined in the HSSDM have been met.

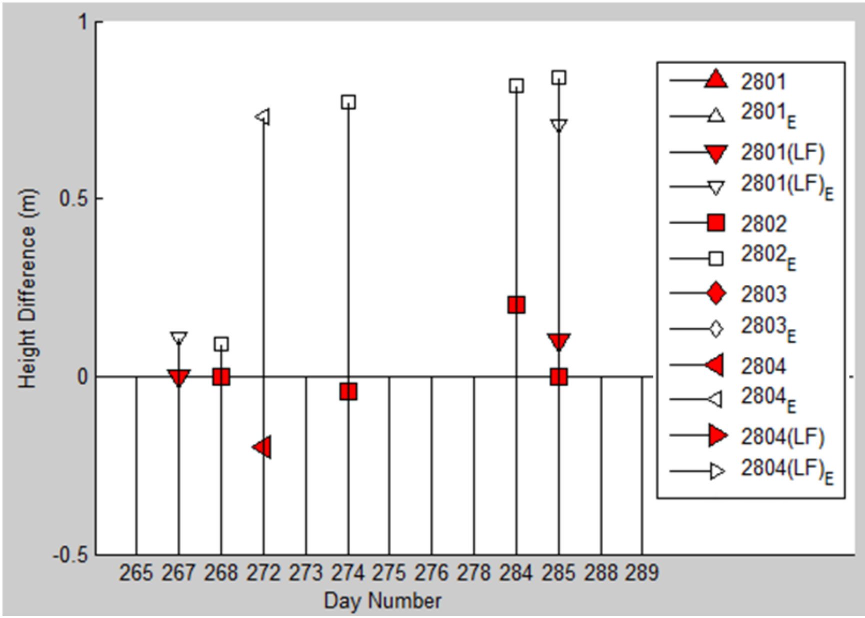


Figure 57: Depth differences between overlapping survey lines acquired on DN 275 versus all other days. Solid symbols represent differences referenced to MLLW; while the corresponding hollow symbols are referenced to the ellipse.

B.2.6 Factors Affecting Soundings

B.2.6.1 Sparse Data Due to Kelp

Near-shore data collection with the tilted RESON 8125 was at times hindered by thick kelp (Figure 58). Soundings associated with kelp were edited within CARIS Subset Editor whenever the CUBE surfaces were affected. This practice resulted, at times, in sparse data coverage.

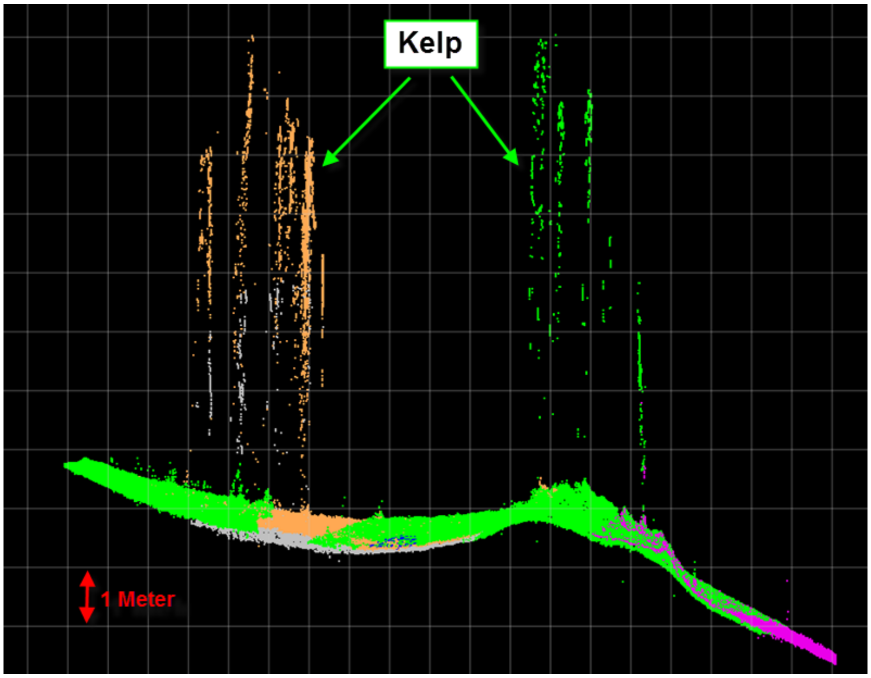


Figure 58: Kelp as seen in CARIS Subset Editor.

Data is within specification and is adequate to supersede charted data in the common area.

B.2.6.1 Tide-induced Depth Bias on Day Number 284

On DN 284, three survey launches acquired data on survey H12289 (Figure 59). When compared to overlapping survey lines acquired on different days, however, an average 0.10 meter depth bias was noticed (Figure 60). Consulting the acquisition logs, all launches reported winds of up to 20 knots with seas up to 2 feet on this day. Given the protected nature of survey H12289, this is suggestive of a larger weather system moving through the area. Unfortunately, the subordinate tide gauge (Block Island) was not functional to provide local water level corrections. Instead data from Sitka, AK, over 100 kilometers removed from the survey area, was used. In this case, the tidal zoning model may not have been at its most accurate. To determine whether a poor tidal model was related to the vertical offset, the multibeam data was referenced to the ellipse. Once referenced to the ellipse, the average difference between the overlapping survey lines reduced to only 0.03 meters (Figure 60). Again confirming there may have been a tidal bust on DN 284. It should be stressed that all differences in depths are within the allowable uncertainty margins, and met the quality standards outlined in the HSSDM.

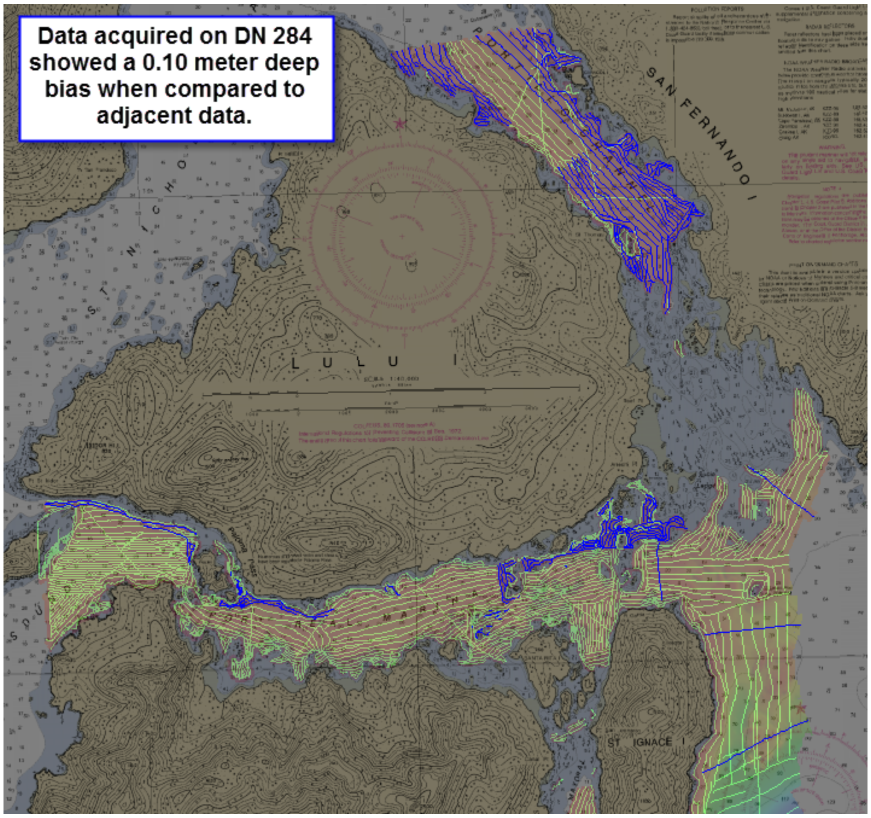


Figure 59: Distribution of survey lines acquired on DN 284 (highlighted in blue) that showed a 0.10 meter depth bias when compared to overlapping survey lines.

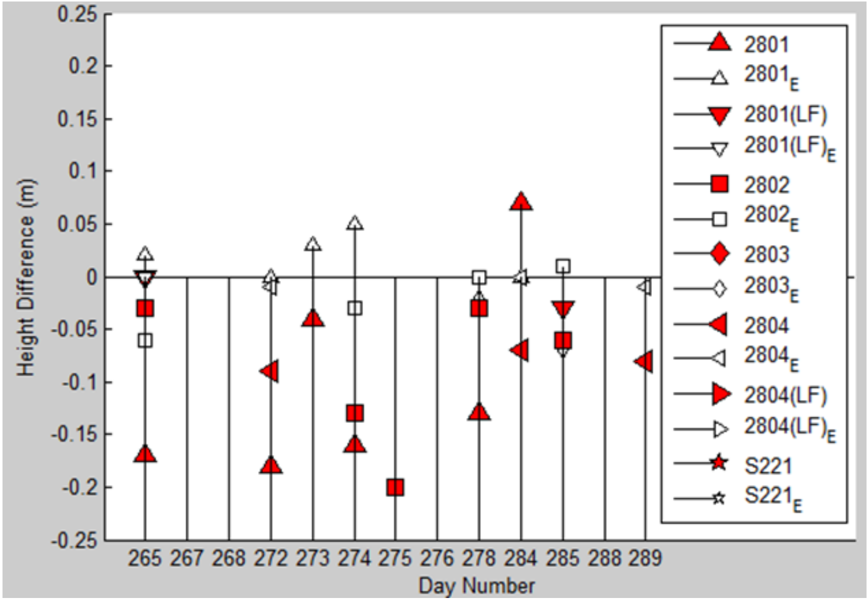


Figure 60: Depth differences between overlapping survey lines acquired on DN 284 versus all other days. Solid symbols represent differences referenced to MLLW; while the corresponding hollow symbols are referenced to the ellipse.

Data is within specification and is adequate to supersede charted data in the common area.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed profiles were acquired using the SBE-19 plus CTDs at discrete locations within the survey area at least once every four hours, or when surveying in a new area. On DN 289, Launch 2804 acquired multibeam data on two surveys: H11289 and (junctioning survey) H11290. A separate sound speed cast for survey H11289 was not performed, instead a cast from H11290 was copied into the H11289 project (Figure 61). Despite being outside the sheet limits, and five kilometers from the intended survey lines, the sound speed cast served as a good proxy for the local sound speed regime. Data was examined in CARIS Subset Editor, and no sound speed artifacts were detected.

Ultimately, sound speed casts were grouped by vessel and applied within CARIS using the "Nearest in distance within time (4 hours)" profile selection method. On DN 272, one cast was acquired by Launch 2801 (2011_272_211600.svp), which was also needed for Launch 2804. To fit with the "nearest in distance within time" paradigm, the time of the cast within 2804's concatenated file was edited from 2116 to 1816 (2011_272_181600.svp).

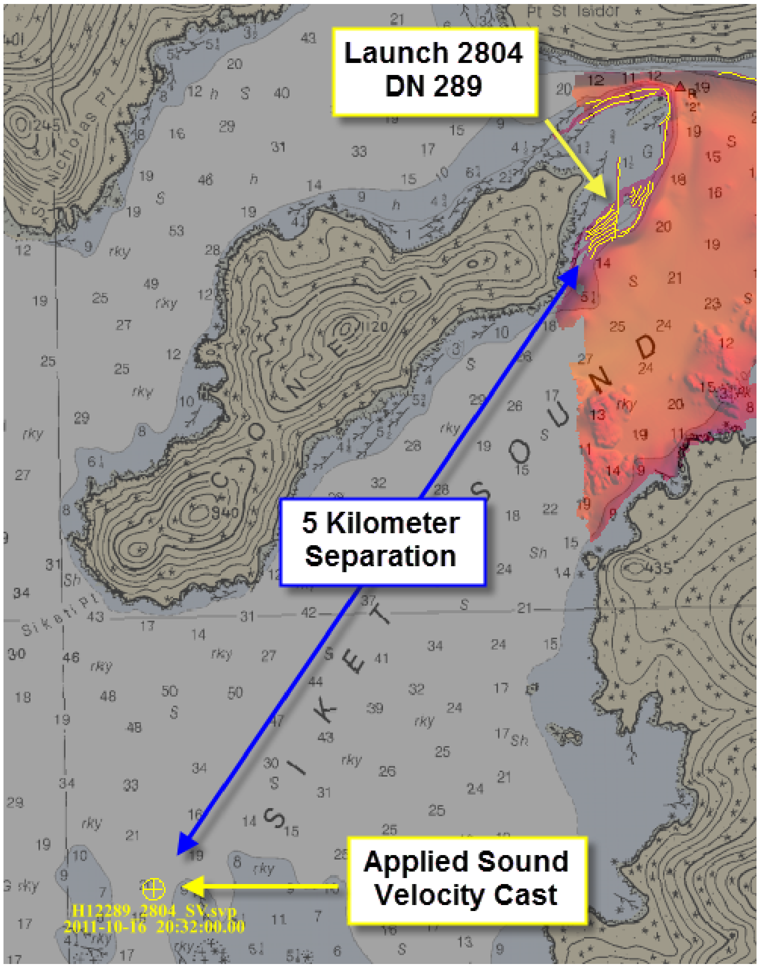


Figure 61: Single sound velocity cast taken approximately five kilometers outside the survey area.

Data is within specification and is adequate to supersede charted data in the common area.

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

Two multibeam lines were acquired in such a way that they spanned both survey H12289 and adjacent sheets: H12290 and H12292 (Figure 62). In order to clip the data outside of the sheet limits, a manual filter navigation filter was used during the CARIS conversion. For the line shared with H12290, all data west of 133-37' W was withheld from conversion; while the line shared with H12292 had all data south of 55-22' N withheld. Because the navigation was filtered in this way, the SBET navigation was not applied to these two lines (though vessel attitude was post-processed). Both lines were examined in CARIS Subset Editor and showed good agreement with their respective neighboring lines.

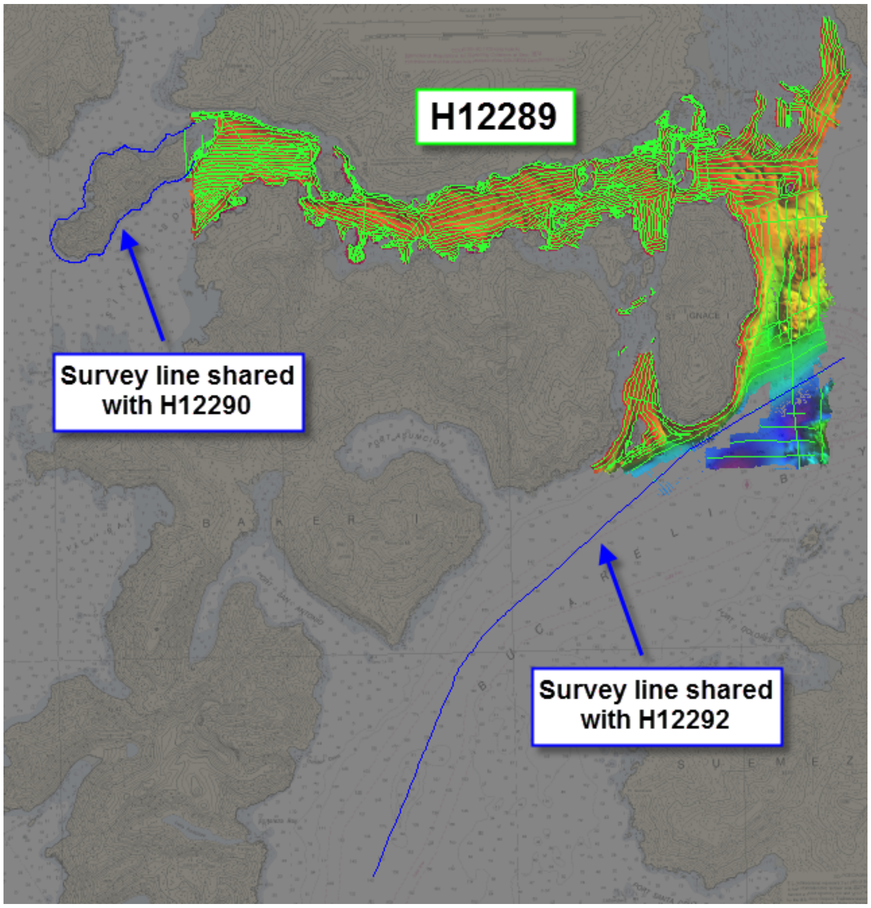


Figure 62: H12289 survey lines, including two survey lines simultaneously acquired on adjacent sheets (H11290 and H12292). Ultimately, both lines were clipped by applying a navigation filter in the data conversion step of CARIS.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data was acquired, but was not formally processed by Rainier personnel. However, periodic spot checks were performed to ensure backscatter quality. There were two gaps in the backscatter coverage: the RESON 8125 is not capable of logging backscatter, and 16 lines of backscatter were not logged for Launch 2804 on DN 272. The remaining data was sent to NGDC for archival.

B.5 Data Processing

B.5.1 Software Updates

The following software updates occurred after the submission of the DAPR:

Manufacturer	Name	Version	Service Pack	Hotfix	Installation Date	Use
Caris	HIPS/SIPS	7.1	2	0	07/01/2012	Processing
Caris	Notebook	3.1	1	1	07/01/2012	Acquisition and Processing

Table 9: Software Updates

The following Feature Object Catalog was used: NOAA profile

B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12289_QC_1m	CUBE	1 meters	0 meters - 290 meters	NOAA_1m	Complete MBES
H12289_QC_2m	CUBE	2 meters	0 meters - 290 meters	NOAA_2m	Complete MBES
H12289_QC_4m	CUBE	4 meters	0 meters - 290 meters	NOAA_4m	Complete MBES
H12289_QC_8m	CUBE	8 meters	0 meters - 290 meters	NOAA_8m	Complete MBES
H12289_QC_16m	CUBE	16 meters	0 meters - 290 meters	NOAA_16m	Complete MBES
H12289_QC_1m_0to20_Final	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H12289_QC_2m_18to40_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12289_QC_4m_36to80_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12289_QC_8m_72to160_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES
H12289_QC_16m_144to320_Final	CUBE	16 meters	144 meters - 290 meters	NOAA_16m	Complete MBES
H12289_QC_16m_Combined	CUBE	16 meters	0 meters - 290 meters	NOAA_16m	Complete MBES

Table 10: CARIS Surfaces

A modified approach was used in the selection of critical soundings within CARIS HIPS. Designated soundings, used to override the gridded CUBE surfaces in areas in which the model did not accurately reflect the shoal-most reliable sounding, were selected in accordance with 5.2.1.2 of the HSSDM (specifically, when the difference between the gridded surface and the shoaler sounding was greater than one-half the maximum allowable vertical uncertainty). A total of 26 designated soundings were selected for survey H12289 in this manner (Figure 63). In nine instances, the CUBE surface matched the multibeam data well enough to not require a designated sounding; however, a designated sounding was still used to create a feature for the purposes of updating the position/depth of a feature within the shoreline composite source file. Further discussion of these features are provided in Section D.2.1 - Shoreline. In no case were two designated soundings selected in such a way that they were within 2mm at the scale of the survey (40 meters).

One sounding was flagged as "Examined" to indicate a strange submerged feature (see Section D.2.8 - Significant Features).

Other than the preceding, data processing procedures conform to those detailed in the DAPR.

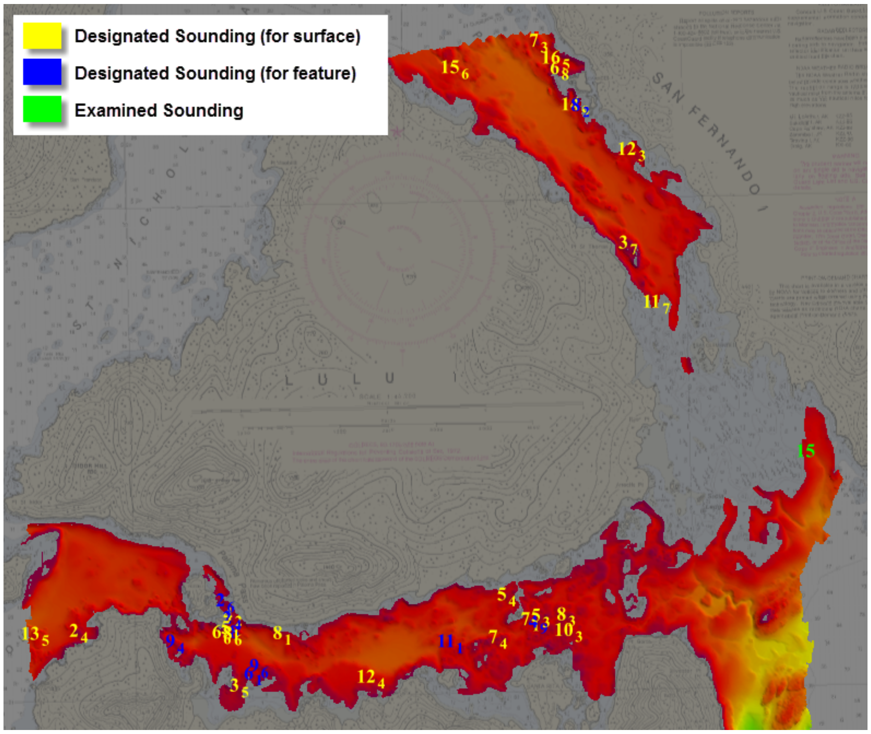


Figure 63: Overview of survey H12289 showing the 35 designated and 1 examined sounding. Soundings in yellow were selected for the purposes of forcing the CUBE surface to honor the shoal-most reliable sounding; whereas, blue soundings were selected to create a feature in CARIS Notebook.

C. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary tide station in Sitka, AK (9451600), served as control for datum determination and as a source for water level reducers for survey H12289. A complete description of the vertical and horizontal control for this survey can be found in the accompanying OPR-O190-RA-11 Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Sitka, AK	945-1600

Table 11: NWLON Tide Stations

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Block Island	945-0406

Table 12: Subordinate Tide Stations

File Name	Status
9451600.tid	Final Approved

Table 13: Water Level Files (.tid)

File Name	Status
O190RA2011CORP.zdf	Final

Table 14: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 10/16/2011. The final tide note was received on 10/18/2011.

Tide note is appended to this report.

One tide station was established for project OPR-O190-RA-11, Block Island, AK (9450406). This was a reoccupation of a historic station in the vicinity of Block Island Light and Daymark. Spikes in the observed tide data and inconsistent staff observations were eventually traced to movements of the unsecured orifice after the initial installation (and a later unsuccessful repair attempt). The resultant tidal data was determined to be unsalvageable and no data from this gauge was used to determine tidal correctors.

Applied water levels were based on data collected at Sitka, AK (9451600), and preliminary zoning was used as provided by CO-OPS. Preliminary tide zones were accepted as final, and final tides were applied to all data.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

<u>The following PPK methods were used for horizontal control:</u>

Single Base

In conjunction with this project, a GPS base station was established by Rainier personnel on Pigeon Island, located near the western entrance of Port Real Marina. Vessel kinematic data was post-processed using Applanix POSPac processing software, POSGNSS processing software and Single Base processing methods described in the DAPR. SBET and associated error (RMS) data was applied to all survey lines (with the exception of those lines noted in Section B.2.5.3 and B.2.5.4).

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Pigeon Island	n/a

Table 15: User Installed Base Stations

Differential GPS was used real-time, primarily for vessel navigation, in addition to serving as a backup method of positioning in the event of user-installed positioning data failure.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Level Island (295 kHz)

Table 16: USCG DGPS Stations

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
17405	1:40000	16	10/2008	03/03/2012	03/03/2012
17406	1:40000	7	02/2004	03/03/2012	03/03/2012
17400	1:229376	17	03/2007	03/03/2012	03/03/2012

Table 17: Largest Scale Raster Charts

<u>17405</u>

Chart comparison procedures were followed as outlined in Section 4.5 of the FPM and Section 8.1.4 - D.1 of the HSSDM, using CARIS HIPS and Notebook. An overview of the three raster charts (17400, 17405 and 17406) which intersect survey H12289 are shown in Figure 64. Chart 17406 is the largest scale chart that completely covers the survey area; whereas Chart 17400 is the smaller scale chart to cover the survey area. The two ENCs are equivalent in scope and content to the raster charts (US5AK4CM from Chart 17406 and US3AK40M from Chart 17400).

Chart 17405 (1:40,000) covers all of the survey area east of St. Ignace Island. It must be first noted that there is a 40 meter offset between Charts 17405 and 17406 (17405 being shifted west) (Figure 65). Of the two, survey H12289 better matches with Chart 17406.

The charted (17405) contours and the surveyed contours agree very well (Figure 66). Contours seldom differed by more than 50 meters, and when they did, it is likely attributed to smoothing. Charted (17405) soundings and surveyed soundings also agreed to within one fathom, in both the deep and shallow portions of the survey (Figure 67). A small shoal north of St. Ignace Rock (indicated by blue circle in Figure 67) was not detected.

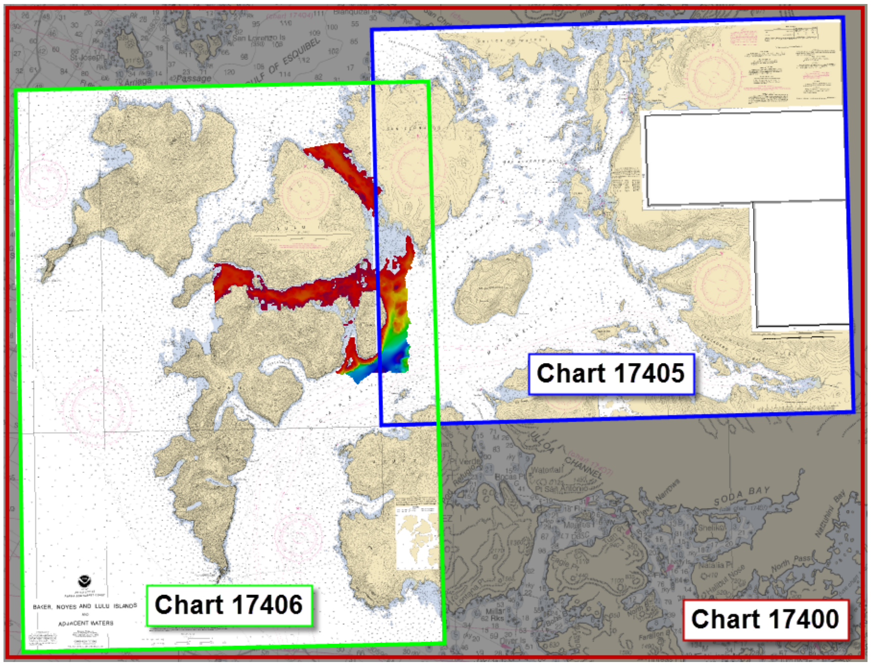


Figure 64: H12289 chart comparison.

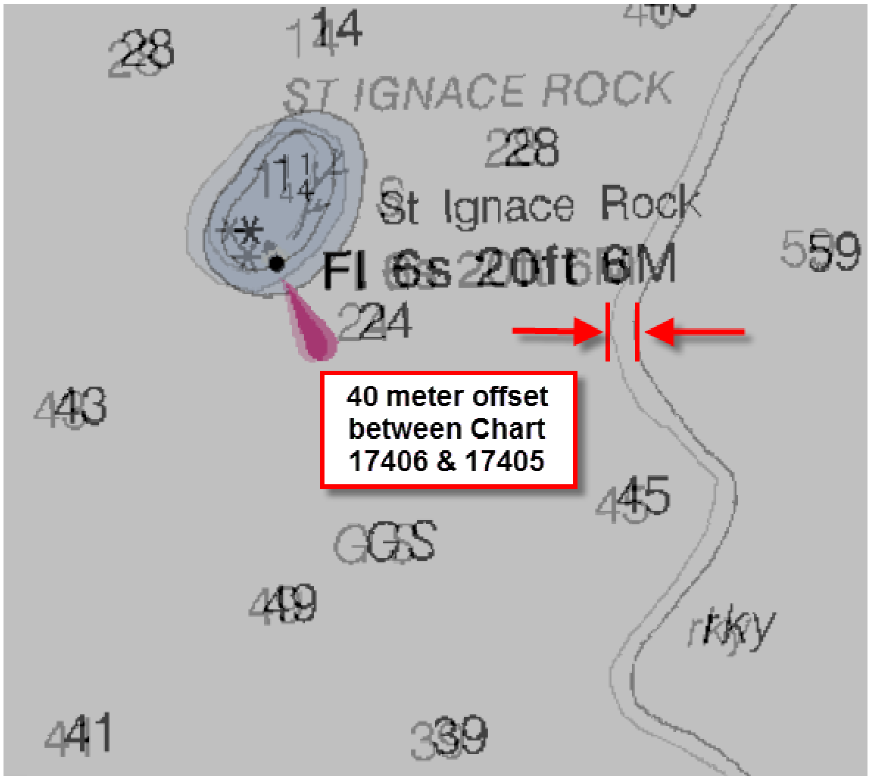


Figure 65: A 40 meter shift was noted between Charts 17405 and 17406 (17405 being located further west).

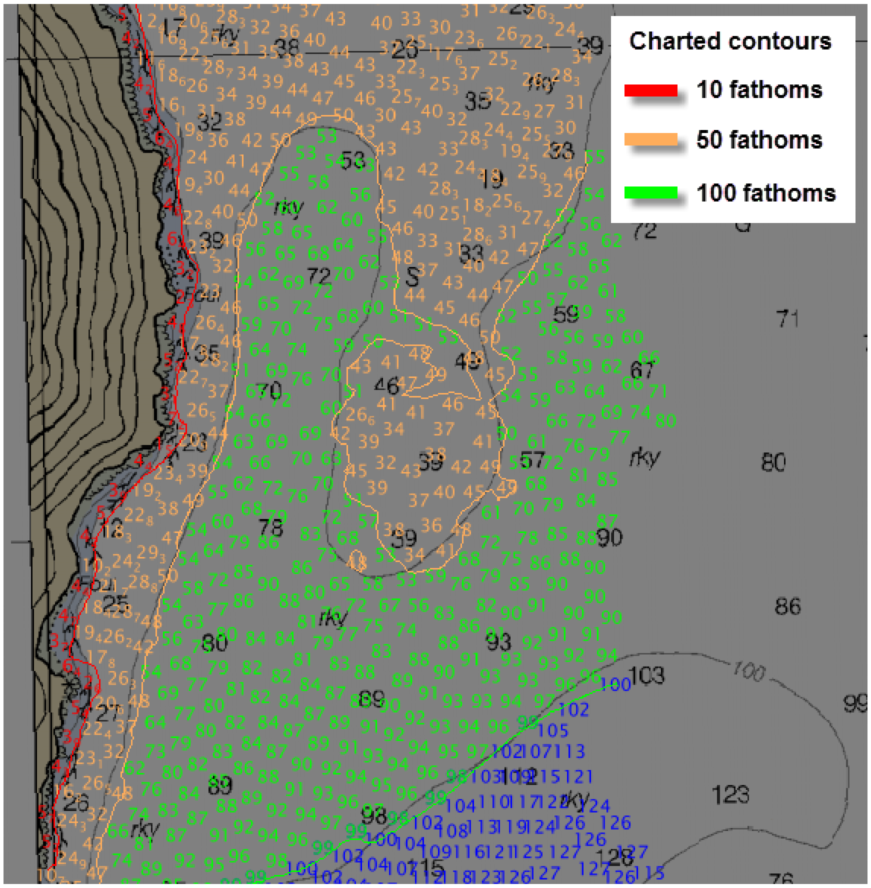


Figure 66: Comparison of charted (17405) 10, 50, 100 fathom contours with those derived from survey H12289. Contours did not deviate by more than 50 meters; likely a result of smoothing. All soundings in fathoms.

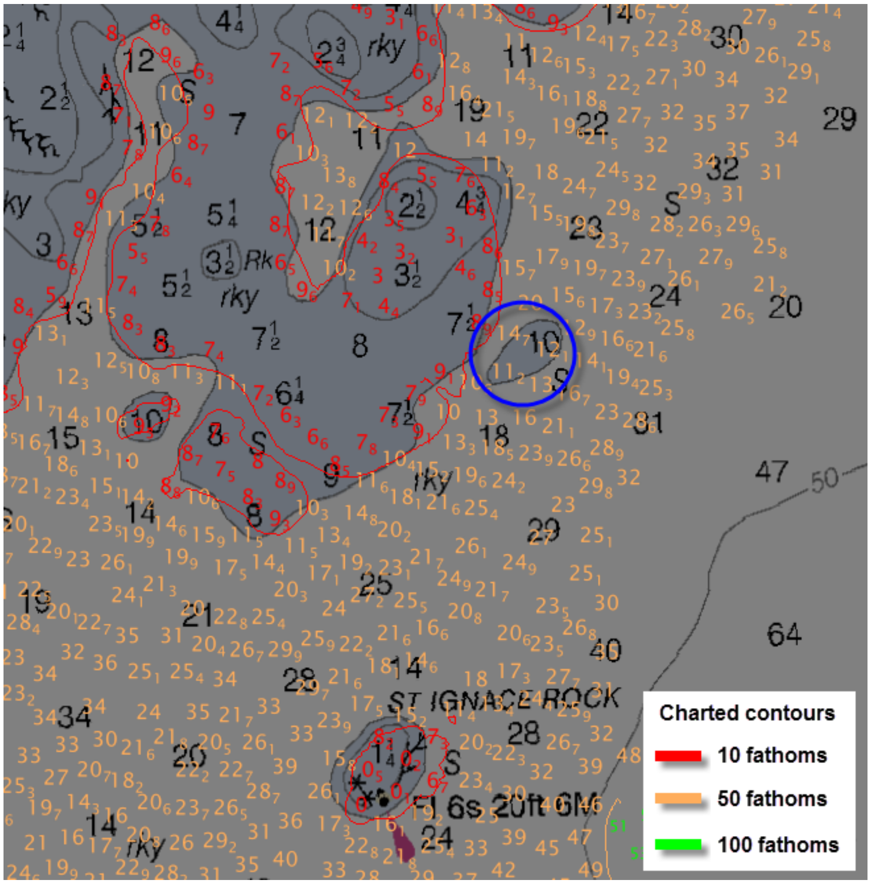


Figure 67: Comparison of charted (17405) soundings with those derived from survey H12289. One shoal north of St. Ignace Rock (indicated by blue circle) was not seen. Note the horizontal shifting of St. Ignace Rock (not seen when compared to Chart 17406). All sounding in fathoms.

<u>17406</u>

Chart 17406 (1:40,000) covers the entire survey area. Much like Chart 17405, the contours of 17406 match well with those of survey H12289. Even in the eastern portion of Port Real Marina, where there are abundant reefs, the contours match well, though with some generalizations taken by the cartographer (Figure 68).

Charted (17406) soundings tended to agree with the surveyed soundings to within one meter; however, there were several instances of shoals found within the survey that are not adequately identified on Chart 17406 (Figure 69). The six insets of Figure 70 highlight the greatest discrepancies. Inset A has a 7.4 fathom sounding on a charted 13 fathom (note: this feature was submitted as a DTON and has since been applied to the chart - see DTON section below). Inset B has a 7.6 fathom sounding on a charted 9 fathom shoal; in addition is a 9.4 fathom sounding next to a 12 fathom charted sounding that is located in the approach to the marked channel west of Pigeon Island. Inset C has an 8.5 fathom sounding, located 300 meters off the north shore, on a charted 11 fathom. Inset D has a 7.8 fathom and 9.3 fathom sounding in, what is charted to be, a 10 fathom channel east of Coposo Island. Inset E has an 8.9 fathom sounding on a charted 10 fathom sounding by Rana Reef. Finally, Inset F has an 8.6 fathom sounding in the vicinity of a charted 18 fathom sounding, at the north end of Portillo Channel.

It is believed there is one typographic error on Chart 17406. Between Santa Rita and Muerta Islands, there is a charted "1" fathom sounding; however it is not located within the blue tint of the chart (Figure 71). This sounding may have been a "10" or "11" which lost one of its digits. Nevertheless, the sounding should be updated.

The Hydrographer recommends updating the chart with the surveyed soundings and contours that more accurately represent the shoals.

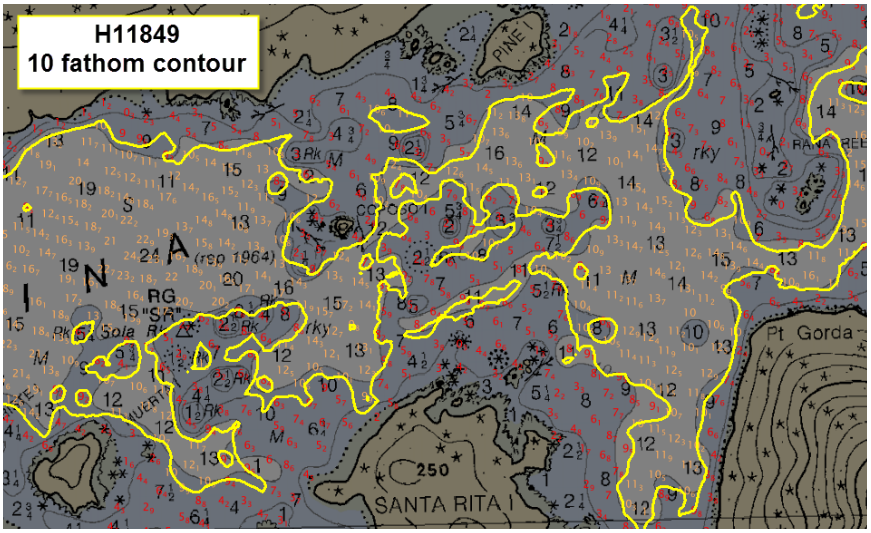


Figure 68: Sample of comparison between charted (17406) 10 fathom contour with that derived from survey H12289. All soundings in fathoms.

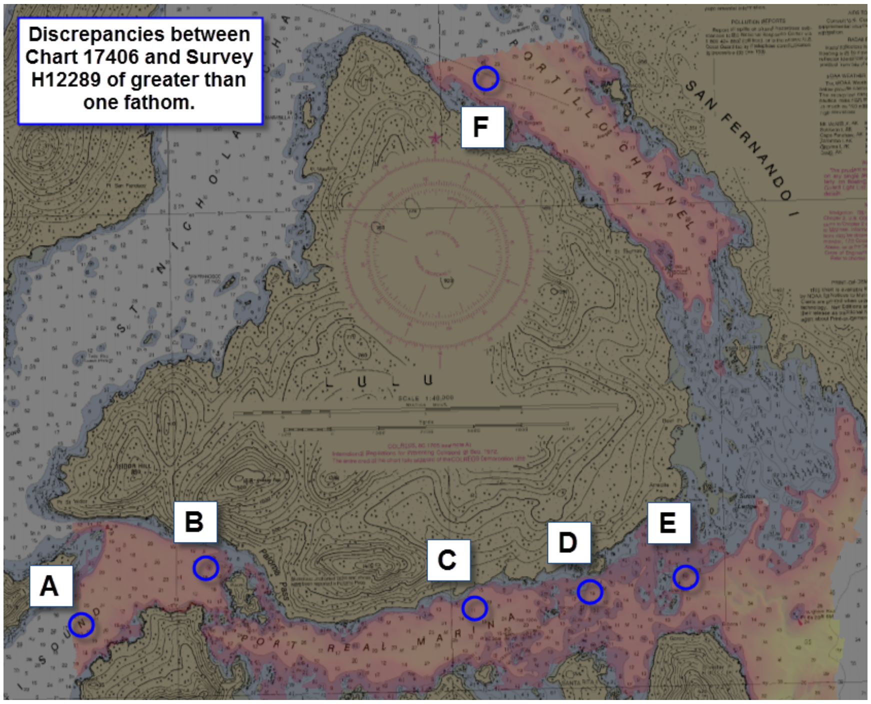


Figure 69: Depth discrepancies between Chart 17406 and survey H12289 of greater than one fathom. Shoals marked with blue circles are highlighted in Figure 68. All soundings in fathoms.

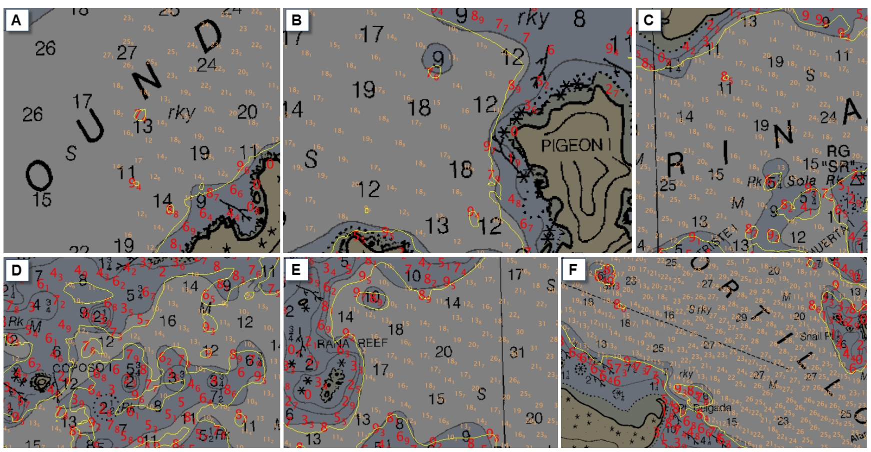


Figure 70: Six depth discrepancies of greater than one fathom between Chart 17406 and survey H12289. The magnitude of the discrepancies is discussed in the text. All soundings in fathoms.

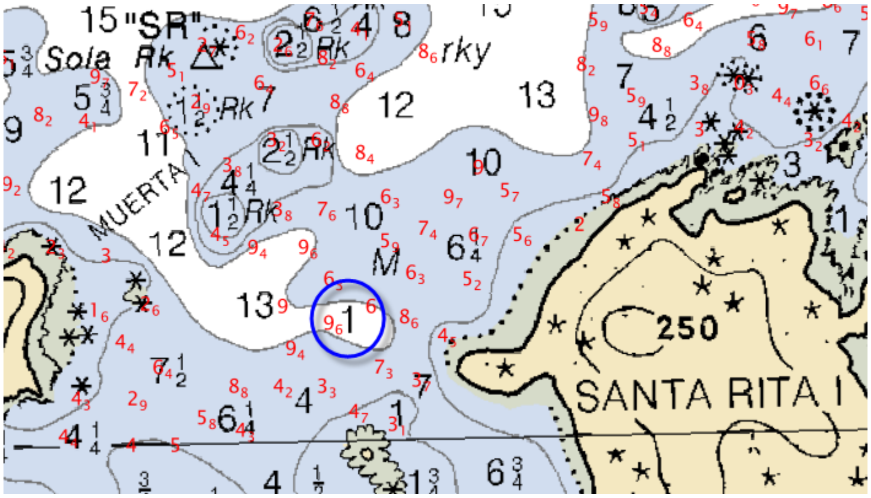


Figure 71: Possible erroneous "1" fathom sounding on Chart 17406. Surveyed soundings are shown in red. All soundings in fathoms.

<u>17400</u>

Chart 17400 (1:229,376) is the smallest scale chart available that covers the entire project area. Due to the coarse resolution of this chart, it was not used during data acquisition and is only mentioned in this report as a reference.

The charted (17400) contours matched the surveyed contours to within 200 meters (which is less than 1 millimeter at chart scale) (Figure 72). Soundings also matched to within one meter, with the exception of the DTON noted in Figure 67 (Inset A) - a 7.4 fathom sounding on top of a charted 13 fathom sounding.

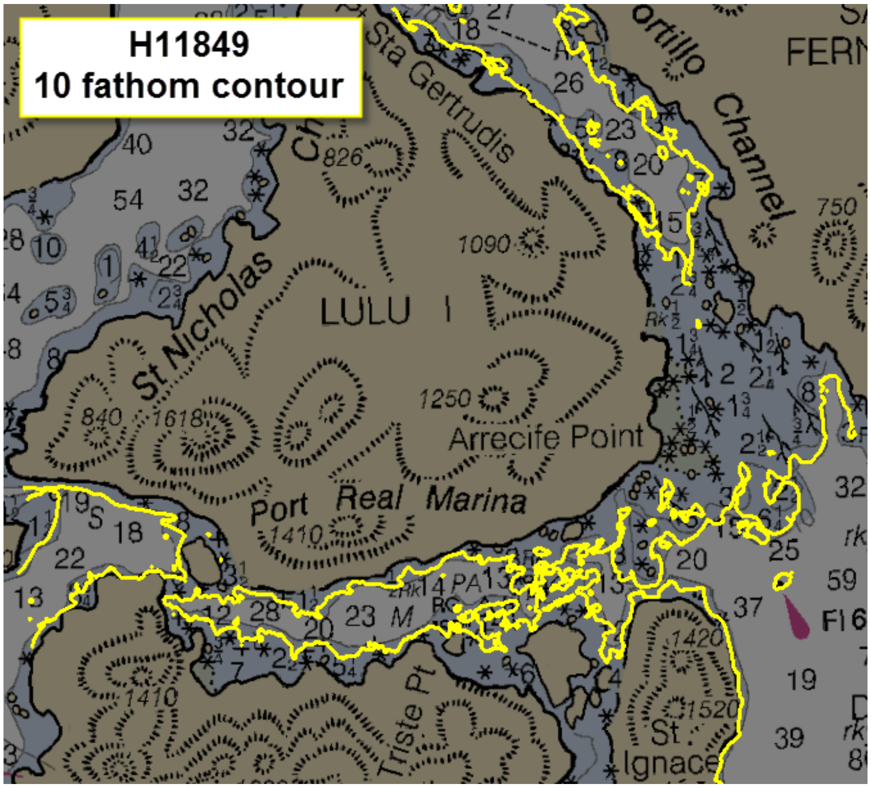


Figure 72: Sample of comparison between charted (17400) 10 fathom contour with that derived from survey H12289. The two contours were typically within 200 meters of each other.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US5AK4CM	1:40000	18	02/22/2010	02/22/2010	NO
US3AK40M	1:229376	2	05/05/2010	05/05/2010	NO

Table 18: Largest Scale ENCs

US5AK4CM

ENC US5AK4CM coincides with raster 17406. The depths and contours on the ENC match the raster, and the comparison between survey H12289 and the ENC is equivalent to the preceding comparison with Chart 17406.

US3AK40M

ENC US3AK40M coincides with raster 17400. The depths and contours on the ENC match the raster, and the comparison between survey H12289 and the ENC is equivalent to the preceding comparison with Chart 17400.

D.1.3 AWOIS Items

No AWOIS items were located within survey H12289.

D.1.4 Charted Features

No charted features were located within survey H12289.

D.1.5 Uncharted Features

No uncharted features were located within survey H12289.

D.1.6 Dangers to Navigation

The follwing DTON reports were submitted to the processing branch:

DTON Report Name	Date Submitted
Danger to Navigation - H12289.pdf	2012-01-20

Table 19: DTON Reports

Danger to Navigation Reports are included in Appendix I of this report.

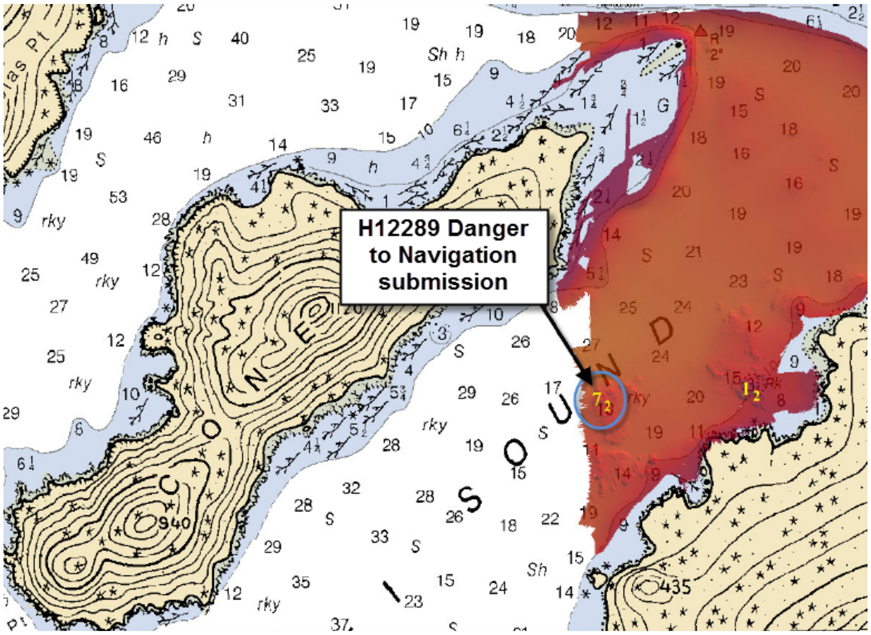


Figure 73: DTON submitted as part of survey H12289: a 7-fathom 2-foot shoal in the center of Siketi Sound on top of a charted (17406 and 17400) 13-fathom sounding. This DTON has since been published in the 9/2012 Notice to Mariners.

DTON report is appended to this report.

D.1.7 Shoal and Hazardous Features

All charted shoals were investigated as detailed earlier in the Section D.1.1 - Raster Chart comparison.

D.1.8 Channels

No channels, precautionary areas, safety fairways, traffic separation schemes or pilot boarding areas were located within survey H12289.

The pilot area is recommended to be retained.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification tide windows were available during the times of hydrography. Features provided in the Composite Source File that could be verified by partial or complete multibeam coverage were addressed. Modifications to features were performed within CARIS Notebook and are archived within the H12289_Final_Features_File.hob file.

There were a total of nine features (eight rocks and one kelp area) within survey H12289 that were classified as "Assigned", but were not addressed during shoreline verification. Attempts were made to identify these features; however environmental factors (kelp, submerged reefs) prevented access (Figure 74).

As part of survey H12289, 21 features were specially designated as lidar investigation items (using S-57 BUAARE objects). To avoid confusion, the BUAARE objects were maintained in a separate layer "H12289_LidarInvestigations.hob" and submitted as reference. All shoreline features associated with these lidar investigations included within the H12289_Final_Features_File.hob had their "keywrd" attribute populated with "lidar". Two lidar investigation objects (both listed as "Charted islets not found by lidar or imagery"), located near position 55-25.9' N, 133-35.0' W, had no associated feature contained within the original composite source file. Neither of these islets were seen during shoreline verification nor mainscheme multibeam acquisition (Figure 75). Referring to Chart 17406, the "islets" in question appear to be no more than ink blobs on the chart; as such, the Hydrographer did not digitize the islets only to subsequently flag them as "Delete". In this case, the lidar survey was correct, and the Hydrographer recommends these features not be carried forward to the ENC.

There was one lidar investigation item, located at position 55-26.47' N, 133-26.04' W, which received only partial multibeam coverage (Figure 76). The previously reported least depth was 4.5 meters; however, (though incomplete), multibeam coverage suggests a shoalest depth of at least 3.0 meters - a least depth could not be established due to kelp. The Hydrographer recommends relocating the lidar rock to the position indicated in the composite source file and has populated the "Quality of Sounding" attribute as "Depth Unknown".

A total of eighteen rocks had their positions or depths updated by multibeam via a designated sounding. While the original eighteen rocks were flagged as "Delete", and the designated soundings were flagged as "New" (each appropriately associated using their primary/secondary flagging), additional attribution was added to aid the reviewer in distinguishing these features (which were imported from HIPS via Pydro). The original rocks have a populated "keywrd" attribute of "feature superseded by designated sounding", and the designated soundings have an "keywrd" attribute of "designated sounding from Pydro". Because these depths were determined from multibeam soundings (rather than visual inspection), the attributes "observed time" and "observed depth" have been left unpopulated.

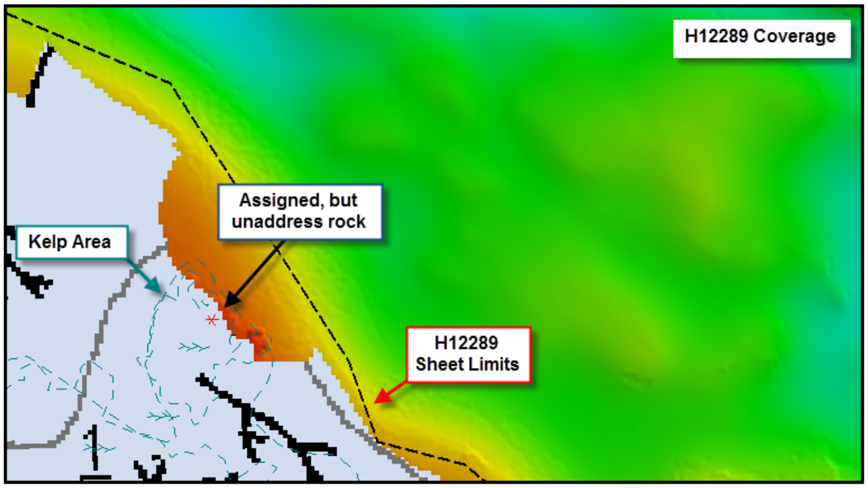


Figure 74: An example of an assigned, but unaddressed, feature within survey H12289. In this case, kelp prevented the field unit from addressing the submerged rock.

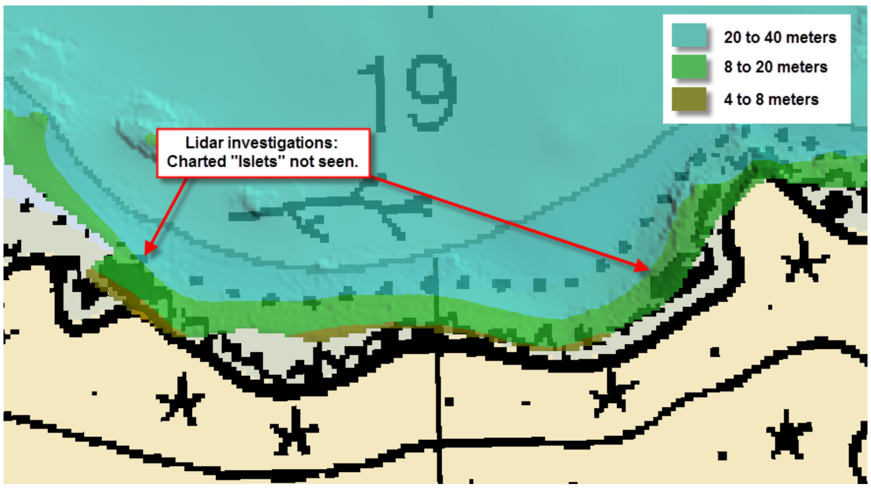


Figure 75: Two islets flagged as lidar investigation items, which were not detected within multibeam coverage, nor seen during shoreline verification.

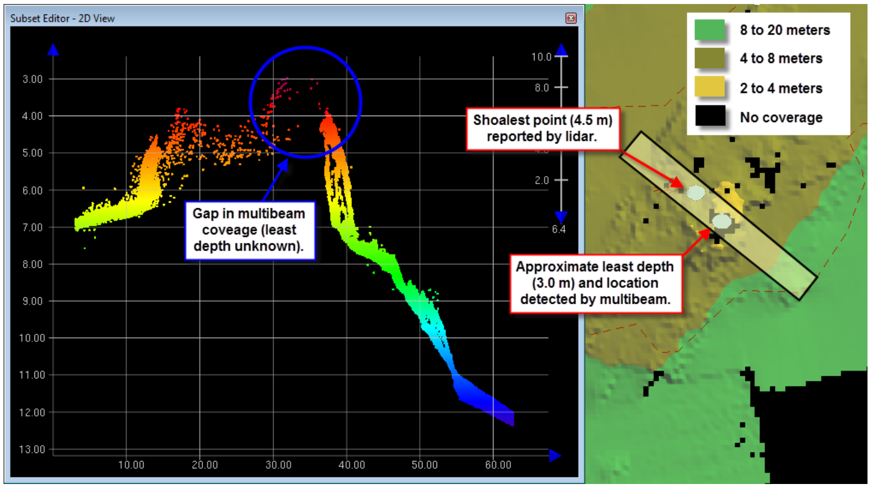


Figure 76: Cross section of bathymetry indicating a shoalest depth of at least 3.0 meters, but lacking the actual least depth of the feature due to kelp.

The submmited HOB files were used in the compilation of this survey. During compilation, some modifications were made to accommodate features at chart scale.

D.2.2 Prior Surveys

No prior surveys were reviewed in conjunction with survey H12289.

D.2.3 Aids to Navigation

Six ATONs were located within survey H12289 (Figure 77), though none were assigned. The aids were attributed as part of shoreline verification, and all were found to be serving their intended purpose.

24475	ST. IGNACE ROCK LIGHT	55-25-41.148N 133-23-42.774W	Fl W 6s	NR on skeleton tower.
24480	Sola Rock Daybeacon SR	55-25-31.524N 133-28-53.346W		JR on spindle.
24481	Pigeon Pass Daybeacon 5	55-25-45.762N 133-33-47.244W		SG on spindle.
24482	Pigeon Island Daybeacon 4	55-25-48.222N 133-34-09.180W		TR on steel pile.
24483	Pigeon Island Daybeacon 3	55-25-49.152N 133-34-00.732W		SG on spindle.
24484	Cone Island Daybeacon 2	55-26-46.104N 133-36-14.172W		TR on pile.

Figure 77: Excerpt from Light List showing the six ATONs contained within survey H12289.

D.2.4 Overhead Features

No overhead features were located within survey H12289.

D.2.5 Submarine Features

A submarine cable, shown on Chart 17406, terminates at the southern end of survey H12289 (Figure 78). The cable area was ensonified by complete multibeam coverage, and no features resembling a cable were found.

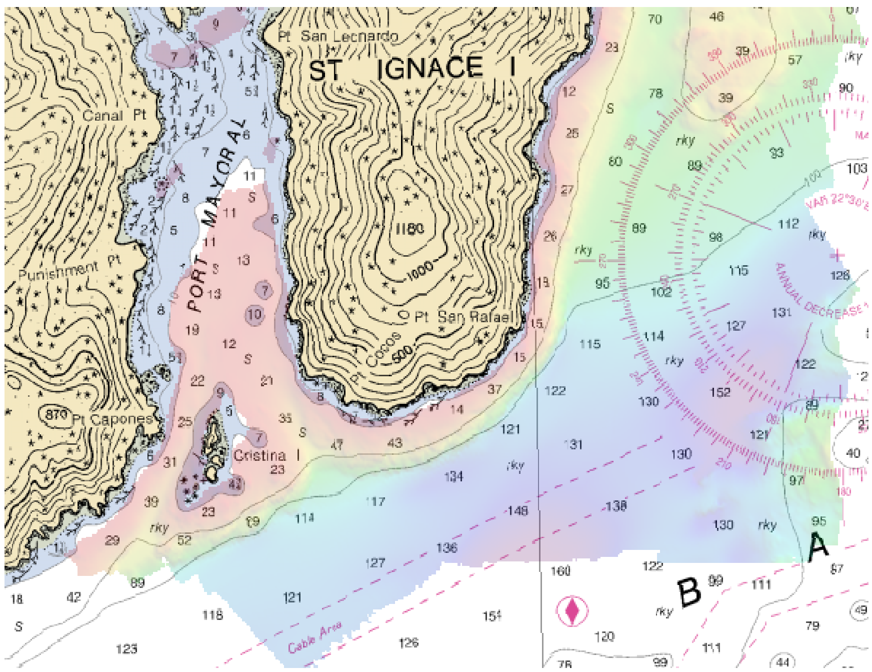


Figure 78: H12289 cable areas.

Cable area is recommended to be retained.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals were located within survey H12289, nor were any ferries observed to be operating in the area.

D.2.7 Platforms

No platforms were located within survey H12289.

D.2.8 Significant Features

With regard to significant submarine features, an unknown feature was detected within the multibeam data one kilometer northwest of Pt Amargura (Figure 79). The feature is located in 10 meters of water, extends 2 meters from the seafloor and was detected on reciprocal survey lines. Psuedo side scan of the feature was inconclusive. The shoal-most reliable sounding was flagged as "Examined" within CARIS Subset Editor, though no feature was designated in CARIS Notebook.

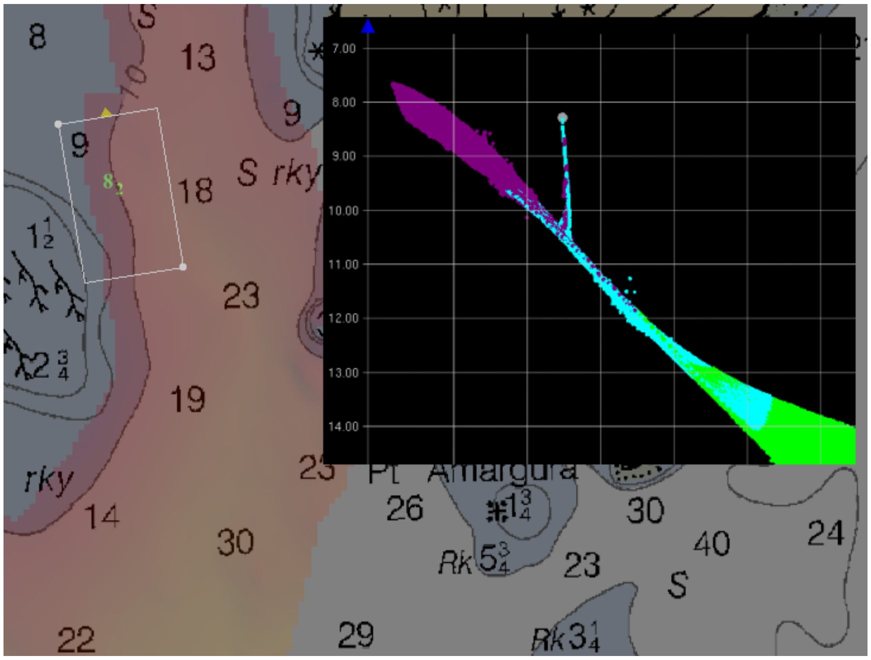


Figure 79: Unidentified feature located one kilometer northwest of Pt Amargura.

As already discussed in the Survey Acceptance Review. "This particular feature falls within 2mm of shoaler depths at the scale of the survey (40 meters) and therefore does not necessarily warrant designation under section 5.2.1.2 of the HSSDM"

D.2 Construction and Dredging

No construction or dredging was observed within survey H12289.

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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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.

Report Name	Report Date Sent
Horizontal and Vertical Control Report	2011-12-16
Tides and Water Levels Package	2011-11-16
Data Acquisition and Processing Report	2012-04-04

Approver Name	Approver Title	Approval Date	Signature
Richard T. Brennan, CDR/NOAA	Commanding Officer	07/08/2012	Richard T. Brennan 2012.07.21 12:59:49 -08'00'
Olivia A. Hauser, LT/NOAA	Field Operations Officer	07/08/2012	LT/NOAA Olivia Hauser 2012.07.21 12:51:42 -08'00'
James Jacobson	Hydrographic Chief Survey Technician	07/08/2012	Digitally signed by James Jacobson Reason: I have reviewed this document Date: 2012.07.21 12:56:02 -08'00'
Michael O. Gonsalves, LT/NOAA	Sheet Manager	07/08/2012	Michael O. Gonsalves 2012.07.21 12:50:24 -08'00'

F. Table of Acronyms

Acronym	Definition
AFF	Assigned Features File
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	Continually Operating Reference Staiton
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
ERZT	Ellipsoidally Referenced Zoned Tides
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
HSSDM	Hydrographic Survey Specifications and Deliverables Manual

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
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	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	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
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Porpagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Exectutive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

DANGER TO NAVIGATION

Registry Number: H12289
State: Alaska
Locality: West Prince of Wales Island
Sub-locality: Portillo Channel to Pt Cocos
Project Number: OPR-O190-RA-11
Survey Date: 09/22/2011

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
17406	7th	02/01/2004	1:40,000 (17406_1)	[L]NTM: ?
17400	17th	03/01/2007	1:229,376 (17400_1)	[L]NTM: ?
16016	21st	10/01/2007	1:969,756 (16016_1)	[L]NTM: ?
531	24th	07/01/2007	1:2,100,000 (531_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Shoal	13.55 m	55° 25' 41.5" N	133° 36' 47.0" W	---

Generated by Pydro v12.9(r4195) on Thu May 23 14:15:44 2013 [UTC]

1 - Item Data

1.1) Profile/Beam 366/206 / 2802_2011ra2652138

DANGER TO NAVIGATION

Survey Summary

Survey Position:	55° 25' 41.5" N, 133° 36' 47.0" W
Least Depth:	13.55 m (= 44.46 ft = 7.410 fm = 7 fm 2.46 ft)
TPU (±1.96σ):	**THU (TPEh)** ±0.121 m ; **TVU (TPEv)** ±0.210 m
Timestamp:	2011-265.21:39:49.112 (09/22/2011)
Survey Line:	h12289 / 2802_reson7125_hf_512 / 2011-265 / 2802_2011ra2652138
Profile/Beam:	366/206
Charts Affected:	17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

A 13.552 meter (7.42 fathom) shoal was noted in the center of Siketi Sound, located 2.09 kilometers (1.13 nautical miles) at a bearing of 196-deg from the Cone Island Daybeacon '2'.

Feature Correlation

Source	Feature	Range	Azimuth	Status
2802_2011ra2652138	366/206	0.00	000.0	Primary

Hydrographer Recommendations

The Hydrographer recommends updating the "13" fathom sounding on chart 17406 with a "7" fathom sounding at the noted location.

Cartographically-Rounded Depth (Affected Charts):

7 ¼fm (17406_1, 17400_1, 16016_1, 530_1)

7fm 2ft (531_1)

13.6m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1:	Sounding (SOUNDG)
Attributes:	QUASOU - 1:depth known
	SORDAT - 20111016
	SORIND - US,US,graph,H12289

TECSOU - 3:found by multi-beam

Office Notes

Do not concur with hydrographer recommendation. Chart sounding as 7 fathoms and 2 feet.

Feature Images

[Image file DToNImages/tmpeoxdne.jpg does not exist.]

[Image file DToNImages/tmpi8afs8.jpg does not exist.]

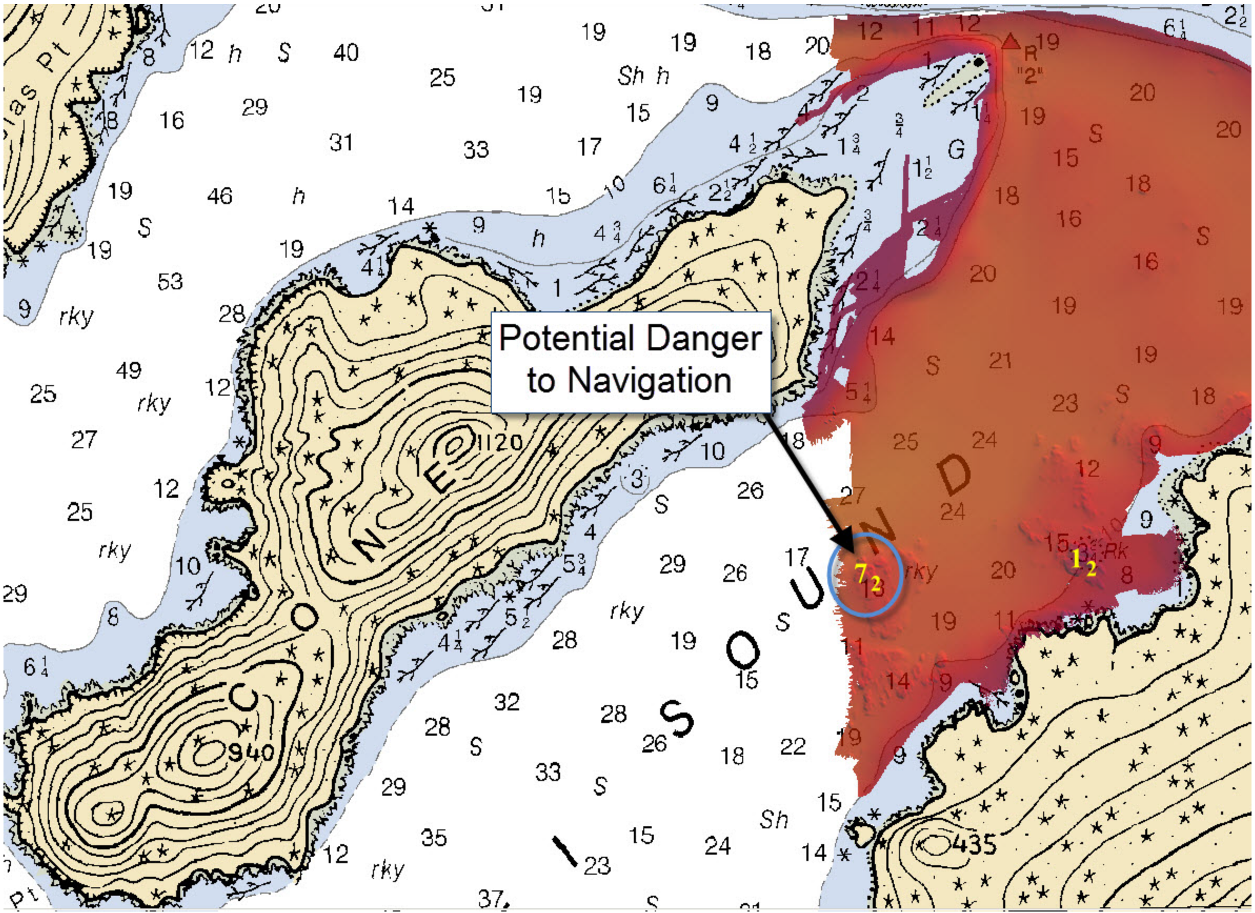


Figure 1.1.1

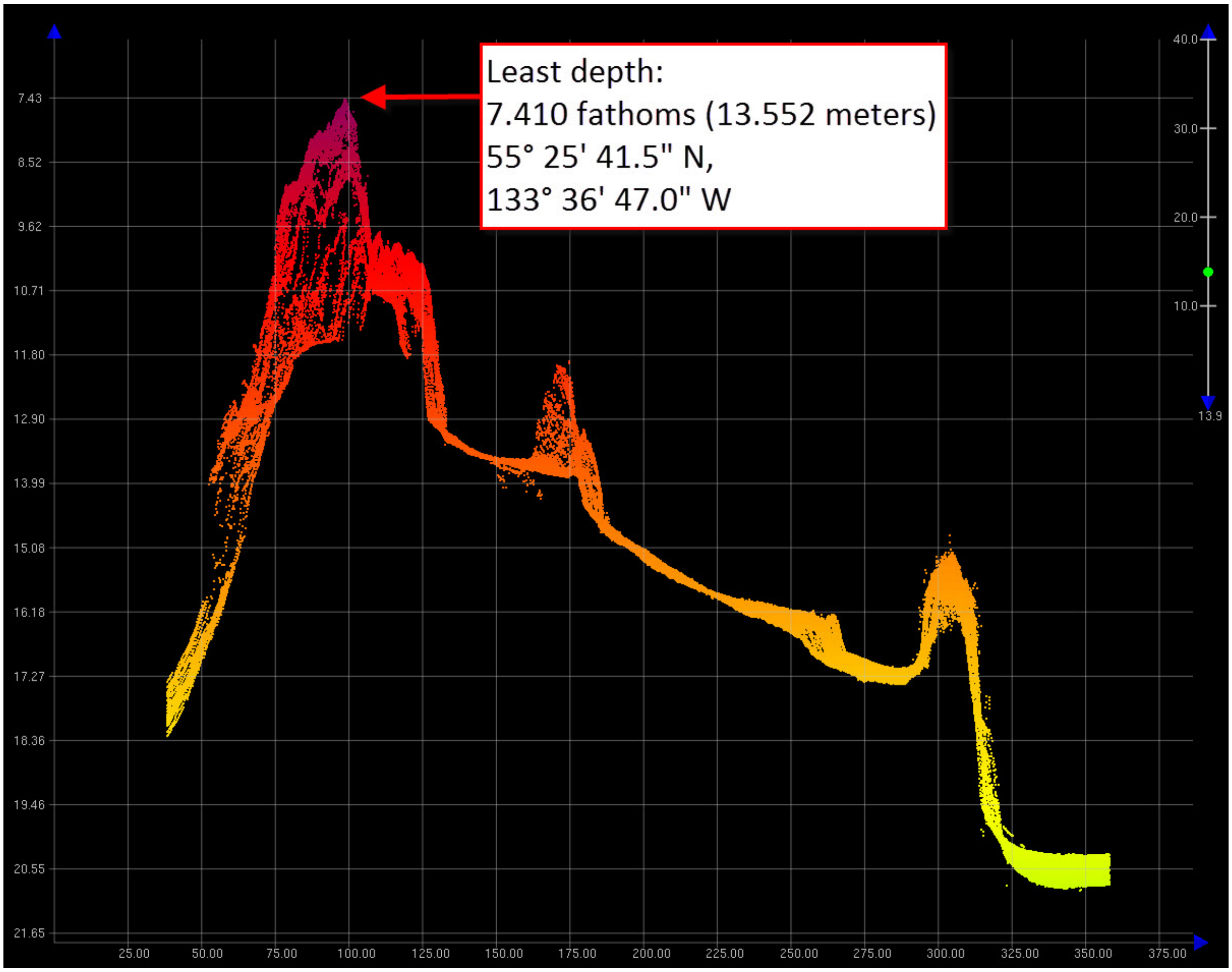

Least depth:
7.410 fathoms (13.552 meters)
55° 25' 41.5" N,
133° 36' 47.0" W
7.43
8.52
9.62
10.71
11.80
12.90
13.99
15.08
16.18
17.27
18.36
19.46
20.55
21.65
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
325.00
350.00
375.00
40.0
30.0
20.0
10.0
13.9

Figure 1.1.2

CARIS Customer Services support@caris.com Jun 4
to OPS.Rainier, me, Meghan.McGovern, CO.Rainier, Jon.Andvick, Rob.Downs, Steve.Brodet, Jeffrey.Fergus., Mary.Eric

Images are not displayed. Display images below - Always display images from support@caris.com

Dear OPS Rainier:

Please note that request number **01201376**, entitled "**Kongsberg EM710 Data Artifacts**" was updated as indicated below, by **Matthew Gudger** on **Monday, June 4, 2012 [09:39]**.

Comments have been added as follows:
Mike/Olivia,

It sounds like the results from SIS are similar to the HIPS results when the data is processed with or without SVC. Can you let us know if there are any major discrepancies between the data at that stage of processing? If there are no major discrepancies between these data sets then the motion issue would appear to be inherit in the data.

We have been comparing just the Heave and TrueHeave data and we can see instances were the Heave amplitude is greater than the TrueHeave amplitude by values up to 0.7m in both directions. This would easily account for the increased vertical error initially reported in this Service Request. So, while loading the TrueHeave data results in a degradation of the data quality, it appears that HIPS is loading the data correctly and the issue is with the raw data.

For clarification:

i. If the misalignment's were entered correctly in SIS then entering the misalignment's in the Swath1 section is doubly applying those values to the data.

On a side note, prior to working for CARIS I've seen similar issues with Heave and Pitch when the motion sensor was not mounted at the vessel's Centre of Gravity. I'm sure you've already vetted any such issues and I have no idea what your setup looks like but I thought I'd throw that out as a possible culprit to this artifact. Please let us know if you're finding any major discrepancies between the Heave processed HIPS data and the SIS data.

-Matthew

Please log in to the CARIS Online HelpDesk to respond.

Best Regards,
CARIS Customer Services
support@caris.com
http://support.caris.com
Tel: +1-506-458-8533   Fax: +1-506-459-3849

CARIS HelpDesk - Request 01201376 Survey/Kongsberg x

CARIS Customer Services support@caris.com Jun 6

to OPS.Rainier, me, Meghan.McGovern, CO.Rainier, Jon.Andvick, Rob.Downs, Steve.Brodet, Jeffrey.Fergus., Mary.Eric

Images are not displayed. Display images below - Always display images from support@caris.com

Dear OPS Rainier:

Please note that request number **01201376**, entitled "**Kongsberg EM710 Data Artifacts**" was updated as indicated below, by **Matthew Gudger** on **Wednesday, June 6, 2012 [09:53]**.

Comments have been added as follows:
Mike,

I'm not clear on your question about applying TrueHeave files to Kongsberg data in HIPS. You can import and Merge Kongsberg data and that should give the same results as SIS and you can apply TrueHeave to that. I've already done that and it results in a larger artifact in the data. From my testing it looks like the magnitude of the TrueHeave data would need to be larger than the Heave data in order to correct for the artifact we are seeing, but the TrueHeave data actually has a lower magnitude than the Heave data, thus resulting in a larger artifact.

-Matthew

Please log in to the CARIS Online HelpDesk to respond.

Best Regards,
CARIS Customer Services
support@caris.com
http://support.caris.com
Tel: +1-506-458-8533   Fax: +1-506-459-3849

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : October 18, 2011

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-O190-RA-2011
HYDROGRAPHIC SHEET: H12289

LOCALITY: Portillo Channel to Pt. Cocos, AK
TIME PERIOD: September 22 - October 16, 2011

TIDE STATION USED: 945-1600 Sitka, AK
Lat. 57° 03.1'N Long. 135° 20.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.791 meters

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project OPR-O190-RA-2011, H12289, during the time period between September 22 and October 16, 2011.

Please use the zoning file "O190RA2011CORP" submitted with the project instructions for OPR-O190-RA-2011. Zones PAC296, SA227 & SA250 are the applicable zones for H12289.

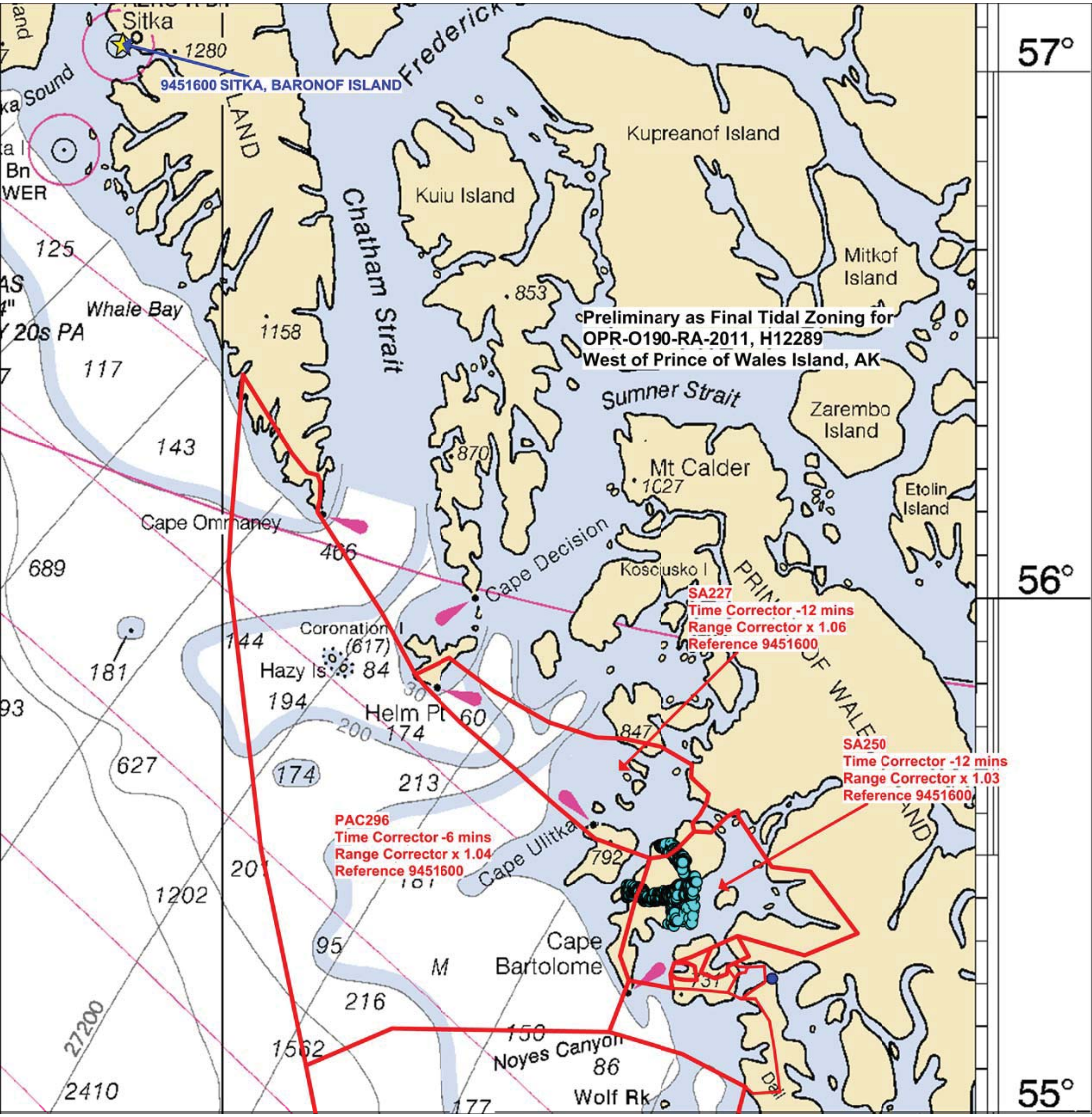
Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Gerald Hovis

Digitally signed by Gerald Hovis
DN: cn=Gerald Hovis, o=Center for Operational Oceanographic Products and Services, ou=NOAA/NOS/CO-OPS/OD/PSB, email=gerald.hovis@noaa.gov, c=US
Date: 2011.10.27 17:14:05 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH



9451600 SITKA, BARONOF ISLAND
Preliminary as Final Tidal Zoning for
OPR-O190-RA-2011, H12289
West of Prince of Wales Island, AK
SA227
Time Corrector -12 mins
Range Corrector x 1.06
Reference 9451600
SA250
Time Corrector -12 mins
Range Corrector x 1.03
Reference 9451600
PAC296
Time Corrector -6 mins
Range Corrector x 1.04
Reference 9451600
Sitka
Kupreanof Island
Kuiu Island
Chatham Strait
Mitkof Island
Sumner Strait
Zarembo Island
Mt Calder
Etolin Island
Cape Ommaney
Cape Decision
Kosciusko I
Coronation I
Hazy Is
Helm Pt
Cape Ulitka
Cape Bartolome
Noyes Canyon
Wolf Rk
Whale Bay
57°
56°
55°

APPROVAL PAGE

H12289

Data partially meet current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data are adequate to supplement inshore data adjacent to survey H12289 where new and shoaler than currently charted soundings and features were surveyed.

The following products will be sent to NGDC for archive:

- H12289_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12289_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

Peter Holmberg

Digitally signed by HOLMBERG.PETER.SCOTT.1365886101
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2013.06.07 14:19:03 -07'00'

Approved:______________________________

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and limited usage of updating NOAA's suite of nautical charts.

David J Zezula CDR/NOAA

David Zezula
for Russ Davies
2013.06.10 11:40:43 -07'00'

Approved:______________________________

Russ Davies
Cartographer, Pacific Hydrographic Branch