

MAPPING DATA ACQUISITION AND PROCESSING SUMMARY REPORT

CRUISE EX-14-03 Exploration, East Coast (Mapping)

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1. Introduction

The NOAA Office of Ocean Exploration and Research is the only federal program dedicated to exploring our deep ocean, closing the prominent gap in our basic understanding of U.S. deep waters and seafloor and delivering the ocean information needed to strengthen the economy, health, and security of our nation.

Using the latest tools and technology, OER **explores** previously unknown areas of our deep ocean, making discoveries of scientific, economic, and cultural value. Through live video streams, online coverage, training opportunities, and real-time events, OER allows scientists, resource managers, students, members of the general public, and others to actively **experience** ocean exploration, expanding available expertise, cultivating the next generation of ocean explorers, and engaging the public in exploration activities. From this exploration, OER makes the collected data needed to **understand** our ocean publicly available, so we can maintain the health of our ocean, sustainably manage our marine resources, accelerate our national economy, and build a better appreciation of the value and importance of the ocean in our everyday lives.



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2. Report Purpose

The purpose of this report is to briefly describe the acoustic seafloor and water column mapping data collection and processing methods used during exploration expedition EX-14-03, and to present a summary of the overall mapping results and mapping related cruise activities.

3. Cruise Objectives

EX-14-03 was an exploration mapping cruise, commencing on May 7, 2014 in Tampa, Florida and concluding on May 22, 2014 in Davisville, Rhode Island. Multibeam, split beam, and subbottom profiler data collection in general occurred 24 hours per day. Exploratory mapping operations occurred entirely within the U.S. Exclusive Economic Zone.

Mapping operations were concentrated in the Atlantic Ocean offshore from Florida and Georgia, at a section of the Blake Plateau called Stetson Mesa. This mapping priority area was identified by science and management partners as Habitat Areas of Particular Concern (HAPC), due to the predicted presence of deep sea corals and other important commercial fishery habitat based on deep sea coral habitat modeling routines.

High resolution exploratory mapping also occurred near Monitor National Marine Sanctuary offshore Cape Hatteras to search for additional underwater cultural heritage sites.

The final transit to Rhode Island transit mapped along the continental shelf edge over several shelf-breaking canyons, in order to edge match and holiday fill gaps in previous *Okeanos* bathymetry data, and to revisit known gaseous seep locations.

Additional non-mapping operations included conductivity-temperature-depth (CTD) data collection, water sampling, and plankton sampling in the Blake Plateau region in support of the NOAA Northeast Fisheries Science Center (NEFSC)'s work to understand potential bluefin tuna spawning activity in the area, and also in support of the NOAA Ocean Acidification Program.

The objectives for this cruise are further detailed in the EX-14-03 Project Instructions, which are archived in the NOAA Central Library.

4. Summary of Mapping Results

Cruise Overview Map

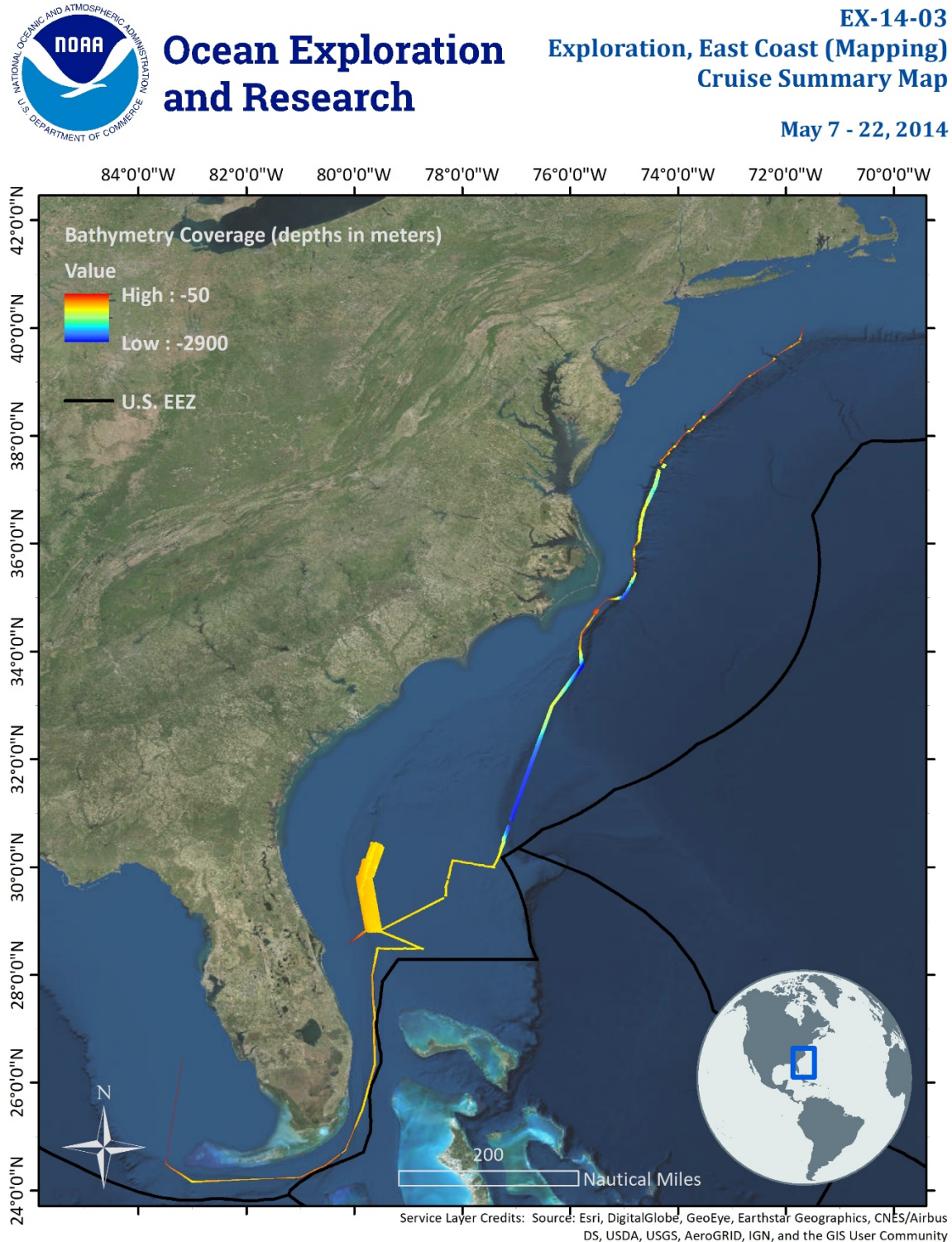


Figure 1. Cruise map showing overall EX-14-03 bathymetry coverage. Generated in ArcMap.

A 30 kilometer (16 nautical mile (nm)) wide 185 kilometer (100 nm) long section of Stetson Mesa on the Blake Plateau was mapped, revealing complex likely deep water coral reef habitat.



Ocean Exploration and Research

EX-14-03
Exploration, East Coast (Mapping)
Stetson Mesa Mapping Area
30 meter grid

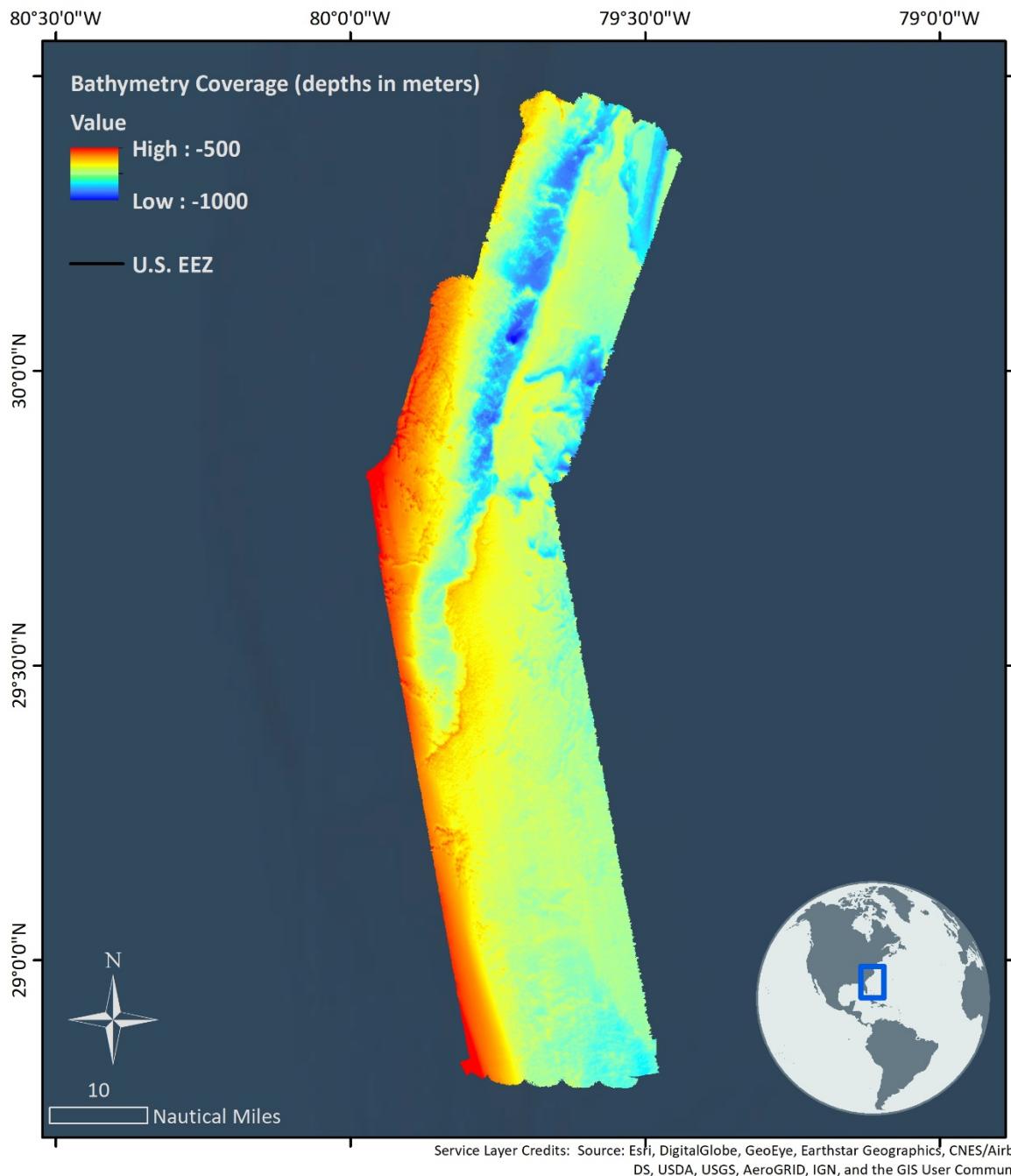


Figure 2. Map of bathymetry data (30m resolution) collected at Stetson Mesa on the Blake Plateau. Generated in ArcMap.



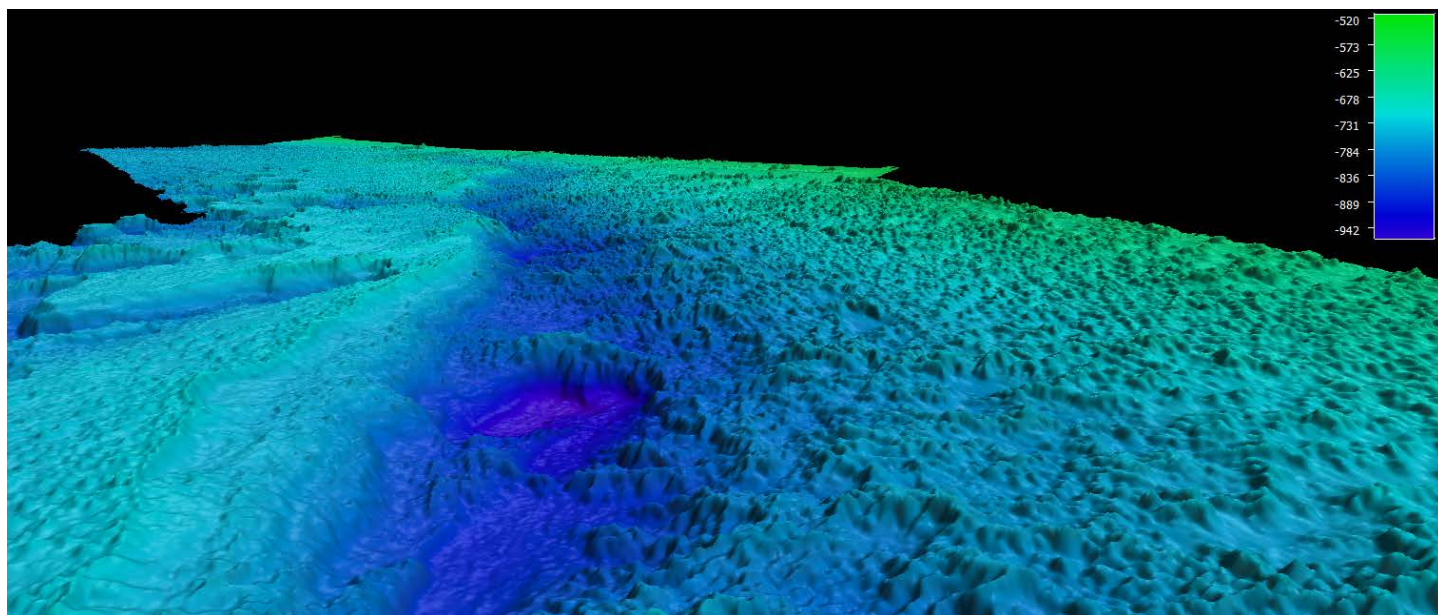


Figure 3. Screenshot looking southward of bathymetry collected over coral mounds at Stetson Mesa (30 m resolution). Color depth scale bar in meters. Generated in QPS Fledermaus.

Several groups of seeps were noted in the multibeam water column backscatter data field processing log. At the time of writing this report, the seeps had not been verified by expert data reviewers onshore.

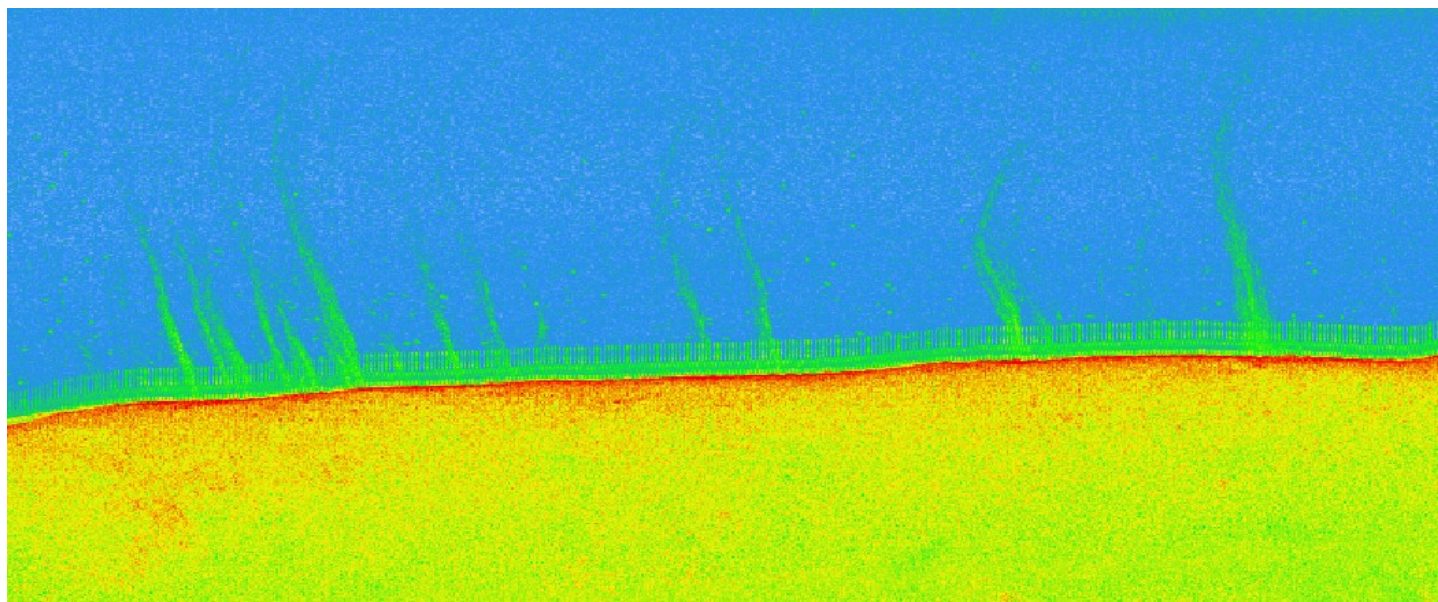


Figure 4. Screenshot of FM Midwater stack view showing several seeps observed in EM 302 water column backscatter data line 0238, collected during transit mapping.

5. Mapping Statistics

Dates of cruise *first day of sonar data collection	May 7* – 22, 2014
Ship's draft Start of cruise (05/07/2014) End of cruise (05/22/2014)	Fore: 14' 6", Aft: 13' 10.5" Fore: 14' 8"; Aft: 13' 11"
Linear kilometers of survey with EM 302	4,894
Square kilometers mapped with EM 302	15,894
Number / Data Volume of EM 302 raw bathymetric / bottom backscatter multibeam files (.all)	251 files/ 47 GB
Number / Data Volume of EM 302 water column multibeam files	251 files / 100 GB
Number / Data Volume of EK 60 water column split beam files (.raw)	321 / 15.3 GB
Number / Data Volume of subbottom sonar files (.seg, .kea, .keb)	255 / 3.5 GB
Number of XBT casts	119
Number of CTD casts (including test casts)	3



6. Mapping Sonar Setup

Kongsberg EM 302 Multibeam Sonar

The NOAA Ship *Okeanos Explorer* is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar capable of mapping the seafloor in 0 to 8000 meters of water. The system generates a 150° beam fan containing up to 432 soundings per ping in waters deeper than 3300 meters. In waters less than 3300 meters, the system is operated in multi-ping, or dual swath mode, and obtains up to 864 soundings per ping, by generating two swaths per ping cycle. The multibeam sonar is used to collect seafloor bathymetry, seafloor backscatter, and water column backscatter. Backscatter represents the strength of the acoustic signal reflected from some target, whether the seafloor or bubbles in the water column. Data were corrected for sound velocity in real-time using Reson SVP-70 data at the sonar head, and Expendable Bathythermographs (XBTs) conducted at intervals no greater than 6 hours, and as required by local oceanographic conditions.

Kongsberg EK-60 Split-Beam Sonars

The ship is also equipped with four Kongsberg EK 60 split beam fisheries sonars, 18, 70, 120, and 200 kHz. The 18 kHz transducer and transmits a 7° beam fan. These sonars are quantitative scientific echosounders calibrated to identify the target strength of water column acoustic reflectors - typically biological scattering layers, fish, or gas bubbles – providing additional information about water column characteristics and anomalies.

Knudsen Sub-bottom Profiler

Additionally, the ship is equipped with a Knudsen 3260 subbottom profiler that produces a frequency-modulated chirp signal with a central frequency of 3.5 kHz. This sonar is used to provide echogram images of shallow geological layers underneath the seafloor to a maximum depth of about 80 meters below the seafloor. The Sub-bottom profiler is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the multibeam sonar. The data generated by this sonar is fundamental in helping geologists interpret the shallow geology of the seafloor.

7. Data Acquisition Summary

Mapping operations included EM 302 multibeam, EK 60 split beam, and Knudsen subbottom profile data collection.

Survey lines were planned to maximize either bathymetry edge matching of existing data or data gap filling in areas where existing bathymetry coverage existed. In regions with no existing data, exploration transit lines were planned to optimize potential discoveries.



Throughout the cruise, multibeam data quality was monitored in real-time by acquisition watchstanders. Ship speed was adjusted to maintain data quality as necessary, line spacing was planned to ensure at least $\frac{1}{4}$ swath width overlap between lines at all times. Cutoff angles in SIS were generally adjusted on both the port and starboard side to ensure the best data quality and coverage.

Simrad EK 60 18 kHz split beam water column sonar data was collected continuously during the cruise. The screenshot below shows data holdings in www.ncei.noaa.gov (last accessed 4 April 2019).

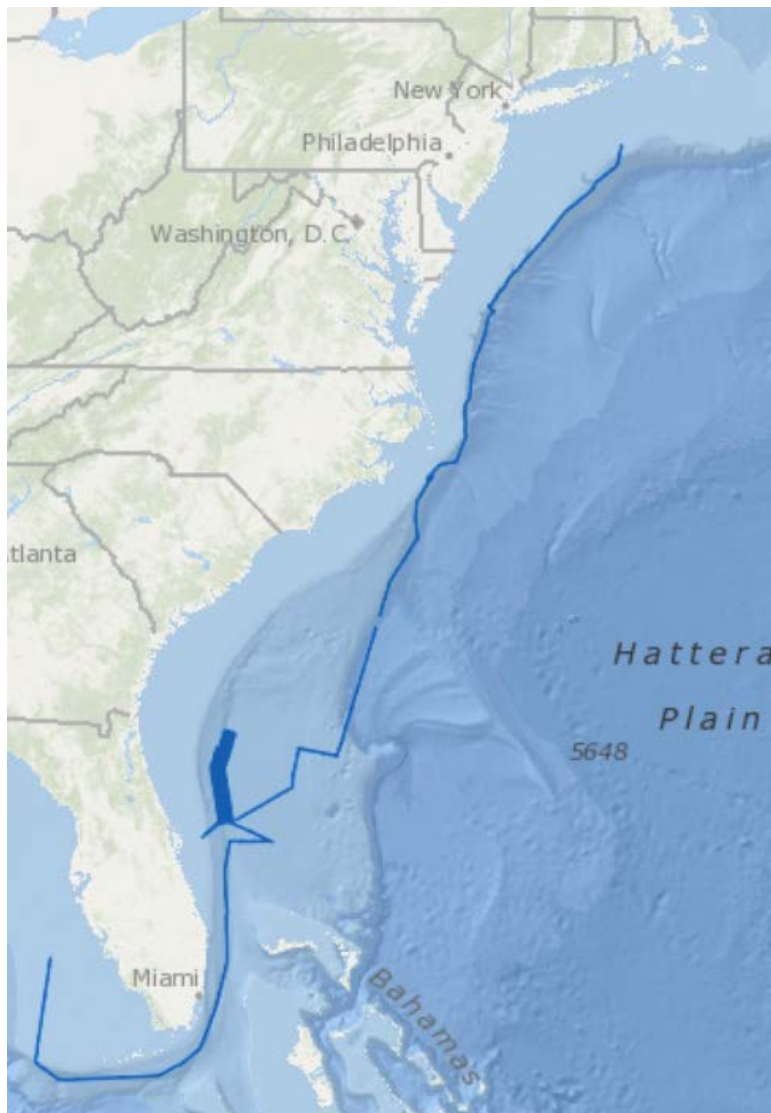


Figure 5. Screenshot of Simrad EK 60 18 kHz split beam sonar data tracklines collected during EX-14-03.

Knudsen 3260 subbottom profiler data was collected during daylight hours. The screenshot below shows data holdings in www.ncei.noaa.gov (last accessed 4 April 2019).



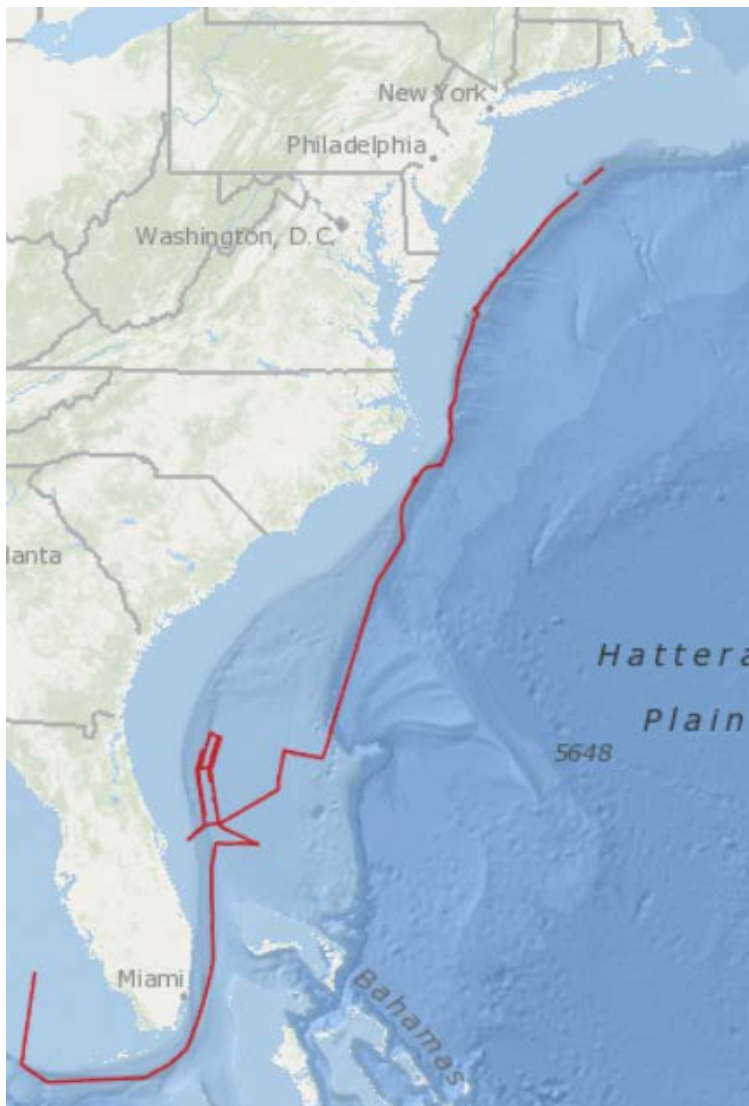


Figure 6. Screenshot of subbottom profiler data tracklines collected during EX-14-03.

8. Multibeam Sonar Data Quality Assessment and Data Processing

EM 302 Built-in Self Tests (BISTs) were run throughout the cruise to monitor multibeam sonar system status and are available as ancillary files in the sonar data archives. Raw multibeam bathymetry data files were acquired by SIS, then imported into Caris HIPS and SIPS multibeam sonar processing data. In Caris, attitude and navigation data stored in each file were checked, and erroneous soundings were flagged off. Gridded digital terrain models were created and posted to the ship's ftp site for daily transfer to shore. Final bathymetry QC was completed post-cruise onshore at the Center for Coastal and Ocean Mapping at the University of New Hampshire. With the vast majority of surveying completed in deep water, depth measurements were not adjusted for tides, as they are essentially insignificant as a percent of overall water depth.



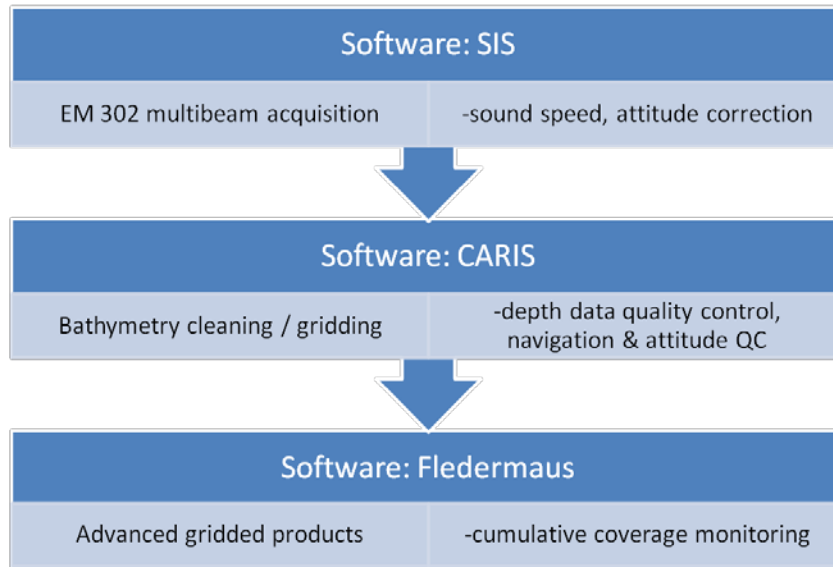


Figure 16. Shipboard multibeam data flow.

Crosslines

Comparing depth values from orthogonal survey lines is a standard hydrographic quality control measure to evaluate the consistency of the multibeam sonar data being collected during a cruise. Crossline analysis was conducted using the Crosscheck Tool in QPS Qimera software.

The mainscheme crosslines were

0042_20140511_023804_EX1403_MB.all
 0058_20140512_000011_EX1403_MB.all
 0060_20140512_005402_EX1403_MB.all
 0073_20140513_000034_EX1403_MB.all
 0075_20140513_004326_EX1403_MB.all
 0090_20140514_004444_EX1403_MB.all
 0101_20140514_164641_EX1403_MB.all
 0103_20140514_181644_EX1403_MB.all

The crossline was

0142_20140516_200032_EX1403_MB.all

The data passed the International Hydrographic Organization's standards for Order 2 surveys, which applies to surveys deeper than 200 meters. The statistical results are below.



Number of Points of Comparison 1437668
Data Mean -750.324677
Reference Mean -748.440752
Mean -1.883925
Median -6.655463
Standard Deviation 6.551227
Data Z – Range -846.65 -532.82
Ref. Z – Range -837.07 -538.49
Diff Z – Range -50.12 31.70
Mean + 2*stddev 14.986378
Median + 2*stddev 19.757916
Ord 2 Error Limit 17.243158
Ord 2 P-Statistic 0.021559
Ord 2 - # Rejected 30994
Order 2 Survey ACCEPTED

The annual multibeam patch test was conducted during cruise EX-14-01 and the results are available in the 2014 NOAA Ship *Okeanos Explorer* Survey Readiness Report which is available in the NOAA Central Library.

9. Data Archival Procedures

All mapping data collected by *Okeanos Explorer* are archived and publically available within 90 days of the end of each cruise via the National Centers for Environmental Information (NCEI) online archives. The complete data management plan which describes raw and processes data formats produced for this cruise is available as an appendix in the project instructions which is available in the NOAA Central Library.

Ancillary and supporting files are archived with the sonar datasets. These include:

EM 302 Multibeam bathymetry and bottom backscatter dataset:

- Mapping watchstander log
- Weather log
- Underway checklist
- Sound velocity profile log
- Multibeam acquisition and processing log
- Built-In-System-Tests (BISTs)
- Processor Unit Parameters
- Text files of telnet sessions on the EM 302 transceiver unit

Simrad EK split beam water column dataset:

- Mapping watchstander log
- Weather log
- Underway checklist
- EK data log

Knudsen 3260 Subbottom Profiler dataset:

- Mapping watchstander log
- Weather log
- Underway checklist
- Subbottom data log

EM 302 Multibeam water column dataset:

- Mapping watchstander log
- Weather log
- Underway checklist
- Sound velocity profile log
- Multibeam acquisition and processing log
- Built-In-System-Tests (BISTs)
- Processor Unit Parameters
- Text files of telnet sessions on the EM 302 transceiver unit
- MB WCD review log if data was reviewed for presence of seeps in FMMW

At the time of writing this report, the following DOIs were available as permanent links to sonar datasets:

EM 302 water column data <http://doi.org/10.7289/V53F4MH6>

EK 60 data <http://doi.org/10.7289/V5765C7X>

Sub-bottom data, supporting data, and informational logs are available in the NCEI Data Archives accessible at <https://www.ngdc.noaa.gov/> (last accessed 3/21/2019).

EM 302 bathymetry data, supporting informational logs, and ancillary files are available in the NCEI Data Archives accessible at <https://www.ngdc.noaa.gov/> (last accessed 3/21/2019).

10. Cruise Calendar

May 2014

Sun	Mon	Tues	Wed	Thur	Fri	Sat
			7 Depart dock from Tampa, FL. Sonar data collection begins 2100 EDT.	8 Transit mapping to survey working grounds.	9 Transit mapping to survey working grounds.	10 Transit mapping to survey working grounds. CTD casts and plankton tows.
11 Begin Stetson Mesa/Blake Plateau mapping.	12 Stetson Mesa/Blake Plateau mapping.	13 Stetson Mesa/Blake Plateau mapping.	14 Stetson Mesa/Blake Plateau mapping.	15 Last day of Stetson Mesa/Blake Plateau mapping. Transit to Cape Canaveral, Florida to pick up replacement plankton net gear for Bluefin Tuna ancillary project.	16 Arrived Cape Canaveral, Florida to pick up replacement plankton net gear. Start transit back to Stetson Mesa. Multibeam crossline completed.	17 CTD/plankton net operations. Sonar data collection intermittent.
18 Transit mapping to U-boat wreck search area near Monitor National Marine Sanctuary.	19 U-boat wreck search mapping near Monitor National Marine Sanctuary.	20 Transit mapping northward over Atlantic shelf breaking canyons and seeps.	21 Continue transit mapping northward over Atlantic shelf breaking canyons and seeps. Sonars secured in evening in shallow water during shelf transit to port.	22 End of cruise, alongside Davisville, Rhode Island.		

11. Daily Cruise Log Entries

Generated from the daily expedition situation reports. All times listed are in local ship time which was Eastern Daylight Savings Time (EDT) (-4 hours from Coordinated Universal Time (UTC))

May 5 and 6

Mission personnel begin to arrive to the ship in Tampa, Florida. Mapping Explorer-in-Training watch stander training and ship familiarization began.

May 7



EX-14-03 expedition began today, with a departure from the dock at Tampa at approximately 0915. Weather was sunny and calm. Exited Tampa Bay and began southward transit towards end of the Florida Keys. Began mapping operations at 2100 EDT when 45 meters depth was reached on the continental shelf along our planned trackline.

Mid-day trainings of new watch standers were conducted to familiarize them with shipboard procedures. Began 24 hr multibeam, split beam, and subbottom data collection during the 1600-0000 watch. Three watches were established. Data quality of the sonars was normal considering the shallow water depths. All systems operating normally.

The ship's operations officer provided a safety orientation to the science party. An Operations Meeting was held to discuss the timing and logistics of the plankton tows and CTD casts and coordinate the necessary support from several ship departments. The Teacher-at-Sea (TAS) was trained by ship personnel on how to conduct the sun photometer survey of opportunity measurements that will now be managed by OER in support of the NASA Maritime Aerosol Network project. TAS will assist NOAA Fisheries member of the science party in conducting the plankton tows and obtaining water samples following CTD casts. The Scientific Computing System (SCS) and all meteorological/oceanographic input sensors are running properly and automated mailers are being sent out to shore.

May 8

Transit mapping work continued today. Weather was sunny and windy, with sea state progressively increasing throughout the day as the ship moved into the Gulf Stream and against the wind/swell. Ship rounded the Florida Keys near Dry Tortugas in the morning and began eastward transit through the Florida Straits. Sonar data quality was good during the morning, moderate to poor later in the day due to the sea state, then improving to good by late evening. Fire emergency and abandon ship drills were completed today.

Sea state picked up overnight to swells of 2-4'. Some seasickness affecting mission personnel. The Knudsen sub-bottom profiler was operated at excessively high transmit power briefly in the morning before being turned down to normal power – additional guidance on power levels posted on control room white board. Normal map standing watches continue with ongoing training of new members of the mapping team. Increasing sea states in the afternoon and evening degraded the quality of all three sonars. Late evening changes in heading improved data quality to good again. This ship is making good time to the Blake Plateau region travelling with the Gulf Stream current.

The default rsync priorities are in effect, and the automated data transfer to shore has been successful.

May 9

Transit mapping work continued as the ship moved northward offshore of southeast (SE) Florida. Seas were moderate overnight with 5-7' swells, subsiding to 2-3' for most of the day. Data quality was moderate overnight, then becoming high in the morning and throughout the rest of the day. Preparation work for tomorrow's CTD and plankton tow operations.

The multibeam had some problems during the night in tracking the bottom, and data dropouts occurred at somewhat regular intervals for several sets of pings at a time. This was unusual given the moderate sea state but appeared to be related to the heading the ship was on and periodic larger sets of swells. Narrower swath coverage and slower survey speeds were used to improve data quality. During most of the day data quality was high on all sonars and the multibeam was operated at full swath coverage capability.

May 10

Transit mapping work continued as the ship moved northward offshore of SE Florida. Sonars were secured during the CTD cast, as the ship was stationary and drifting with the current. Sonars also secured following loss of the plankton net while a visual inspection of the ship's starboard propeller was conducted using a GoPro camera on a pole. During plankton tows, and during transit between tow sites, all sonars gathered data. Data quality was high all day. Focused mapping operations are planned to continue for the next five days within the Stetson Mesa area. Daily multibeam products, seafloor backscatter processing, and water column data processing has been keeping up with data collection.

May 11

Mapping work continued today within the Stetson Mesa region of the western Blake Plateau - the top priority large mapping area for this expedition. Seas were mild at 2-3' and data quality was high on all three sonars. This part of the Blake Plateau averages approximately 800 meters depth. However, the seafloor is very complex in this region with high rugosity and many pinnacle-shaped features. The mesa feature rises approximately 100 meters from the larger plateau, and on top of the mesa the pinnacle features vary in height from several meters up to about 30 meters tall.

We are running very long survey lines in a south-to-north orientation to minimize turns and avoid crabbing across the Gulf Stream current. Each line takes about 12 hours to run. The ship barely maintains survey speed against the current but can power down to running on only two engines when surveying with the current. Data quality was high all day. Daily multibeam products, seafloor backscatter processing, and water column data processing has been keeping up with data collection. No seeps discovered during the cruise thus far. Focused mapping operations are planned to continue for at least the next four days within this portion of the Blake Plateau.

May 12

Mapping work continued today within the Stetson Mesa region of the western Blake Plateau. Seas were mild at 2-3' for much of the day, with some periods of larger 3-5' swells. Data quality was high on all three sonars.

We continued to run long survey lines in a south-to-north orientation to minimize turns and avoid crabbing across the Gulf Stream current. The ship operates under full power against the current and tops out between 7-8 knots. Survey speeds are picked up to about 9 knots when heading northward on survey lines. Data quality was high all day. Evidence for several very small seeps has been found in the multibeam data, and are being searched for in the EK 60 data for confirmation.

May 13

Mapping work continued today within the Stetson Mesa region of the western Blake Plateau. Seas picked up a bit today, with swells ranging from 3-6'. Data quality was good on all three sonars, and the multibeam



maintained good swath coverage of the seafloor. A powerful but short-duration storm is forecasted to affect our survey area Thursday-Saturday. Areas along our trackline further north (Cape Fear to Cape Hatteras area) will be at the center of the storm and we must stay south of this area until the storm subsides if we are to collect any data.

We continued to run long survey lines in a south-to-north orientation. Data quality was good all day. Sea state picked up during the day creating some mild roll artifacts in the raw data, but multibeam swath coverage remained strong.

May 14

Mapping work continued today within the Stetson Mesa region of the western Blake Plateau. Seas increased slightly to 4-6'. Data quality was good on all three sonars, and the multibeam maintained good swath coverage of the seafloor.

Data quality was good all day. Two cross-lines will be run tonight across the large survey area mapped thus far. These cross-lines will help fill some small holidays in the multibeam coverage as well as providing a quality control check on the survey area. The ship's Electronic Technician (ET) fixed an issue with the heave data feed to the Knudsen SBP.

May 15

Today was the last full day allocated to mapping characterization of the Stetson Mesa region of the western Blake Plateau. Sea state was building throughout the day with swells in the morning at 4-6' increasing to 5-7'. Swath coverage of the EM 302 and survey speeds had to be reduced slightly to compensate for rougher sea conditions. Data quality was moderate and the multibeam was able to track bottom for the large majority of the day. Despite the small craft advisory in effect outside of Cape Canaveral, the plankton net gear pickup is still planned for Friday at noon. The ship is transiting from the southwest corner of the Stetson Mesa mapping area directly to Cape Canaveral.

Ship speed against the Gulf Stream and waves was very slow while surveying today, at about 6 knots. This slow speed necessitated modifications to some planned lines to save time. Almost the entire mapping priority box identified in the Project Instructions has been completed, with some area outside the box to the east also successfully surveyed. The sonar closet is being monitored, and temperatures have been in the low 70's much of the week, with today's late afternoon temperature rising up to almost 80.

May 16

The ship transited overnight from the Stetson Mesa mapping area to a nearshore rendezvous with a small boat outside of Cape Canaveral. The new plankton net and frame were quickly and successfully transferred from the small boat to the *Okeanos Explorer* at approximately 1030 EDT. The ship then immediately departed on a reciprocal transit to the southern end of the Stetson Mesa mapping area and ran a final cross-line of the survey area en route to the first CTD and plankton tow station (ETA of 0200 Saturday morning).

On the approach to Cape Canaveral the sonars were secured at about 50 meters depth. Sonars were turned back on in roughly the same area upon departing the shallow waters near the Cape. Conditions near

shore were mild, with 2-4' swells. When the ship went into deeper waters the conditions deteriorated rapidly to 5-7' swells and a somewhat confused sea state. Data quality was moderate for most of the day given the rough conditions, but loss of bottom detection was rare. The multibeam operated with slightly reduced max angles of 70 degrees per side (instead of the normal 75). The ETs worked on attempting to feed real-time salinity values to the EK 60 to improve the sound speed estimate utilized for the sonar's time of travel calculations. This evening the ship is on an eight hour NE transit from the area we mapped in Stetson Mesa to priority CTD and plankton tow sites identified by NOAA Fisheries.

May 17

Survey operations were slightly unusual today since we were transiting rapidly to plankton tow stations, then remaining almost stationary for 30-45 minutes at each station. The EK 60 was kept pinging and logging all day. The EM 302 was kept pinging, but only logged data during transits between stations. The Knudsen SBP was secured on station then set to ping/record during transits. The Expedition Coordinator supplemented mapping watches as needed and the Survey Technician shifted work hours around throughout the day to oversee the acquisition and troubleshooting of CTD data.

May 18

The ship spent the day transiting north towards Cape Hatteras while mapping. The next focused mapping area is near the Monitor National Marine Sanctuary, where we will be searching for a U-boat wreck. The data will be publicly released, so the SOP for restricted UCH data will not be necessary. Weather was mild and conditions were calm with 2-3' swells. Data quality was high on all three sonars.

It was a routine day of transit mapping for the survey team. The Expedition Coordinator compiled existing EX multibeam in the vicinity of the UCH search area and made gridded products to 1 m resolution to see if there was any evidence of wrecks. Watch leader Chris Stubbs compiled backscatter mosaics of this data. No compelling evidence of wrecks were found during these efforts. A detailed survey plan was developed for the priority search area for the next day's operations, with a strong focus on areas not previously mapped by EX.

May 19

Most of the day was spend conducting very high resolution surveying of an area near the Monitor National Marine Sanctuary, searching for possible shipwrecks. The data will be publicly released, so the SOP for restricted UCH data was not implemented. The crew and science party were instructed to keep all positional information confidential however. Sea conditions were moderate and variable during the day with swells ranging from 3-7'. Data quality was high on all three sonars. The survey work was highly successful, with the identification of four targets with the potential to be wrecks – only one of which appears to be a known/confirmed wreck site.

The ship arrived at the focused survey site at approximately 0800. Most of the survey work was done at 5 knots to increase data density. Multibeam data was very lightly cleaned and gridded into 1 and 5 meter digital terrain models to examine bathymetry for potential wrecks. The real-time backscatter display on the EM 302 was found to be the most useful wreck searching tool as much of the day was on a gently sloping seafloor of uniformly low backscatter and low relief (that appeared to be sand). Objects with high backscatter and approximately the size of shipwreck targets were noted with position, Hypack targets, and



screenshots of the backscatter display. The most promising four targets were each surveyed with three different line orientations (N-S, E-W, and diagonally) and captured in different parts of the multibeam swath to try to get good backscatter and bathymetry data on all targets. To increase sounding density, the max angles on the multibeam were narrowed and survey speeds kept low during return passes over the targets. At least one target was clearly visible in both the EK 60 and SBP sonars as a prominent bump in the seafloor. Data exchange and interpretation with the Monitor NMS will be ongoing. Some tide artifacts are present in the multibeam data given the shallow depths, slow survey speeds, and time spent at the survey area. Approximately 14 hours were spent at the focused survey area, with northward transit mapping resuming at about 2200.

May 20

Today was spent transit mapping over the Atlantic Canyons, filling occasional gaps in previously collected EX multibeam coverage and re-visiting previously discovered seep locations. Seas were mild and data quality was good through much of the day, but challenged by highly variable water masses that the ship was moving through.

The ship transited out of the main Gulf Stream current and into colder northern water masses today and we seemed to move between distinctive gyres with great variability in temperature and salinity. Trying to maintain accurate sound velocity profiles in these conditions was challenging and we had to deploy far more XBTs than normal. There was an early morning issue with the subbottom profiler having trouble with finding the bottom on steep canyon slopes, but this was resolved with setting changes. Several known seep locations were re-surveyed so that they could be compared with previous surveys in order to assess possible changes over time.

May 21

Today was spent continuing northward transit mapping along the shallow edge of the Atlantic Canyons, filling gaps in previously collected EX multibeam coverage and re-visiting previously discovered seep locations. Seas were very calm and data quality was high through most of the day. The ship had to make many maneuvers to avoid fishing vessels along the transit path.

Several known seep locations were re-surveyed so that they could be compared with previous surveys in order to assess possible changes over time. The ST and ETs tested a backup MK21 XBT acquisition board that utilizes Ethernet instead of the older USB model. The system was tested and had some initial challenges verifying connection with the XBT launcher. After some troubleshooting the system became operational. There were some XBT connectivity issues overnight and early morning that were resolved by trying the different acquisition board and perhaps by tightening a loose connection on the XBT launcher. ET and the EC had a discussion with Applanix about the POSMV IMU tumble test and the ETs logged IMU data to send to Applanix for feedback on the qualitative performance of the system. Mapping work was concluded for the cruise in the late evening and all sonars were secured. Preparation of the final data package was initiated for overnight transfer to the EC's hard drive. The three mapping interns completed their poster projects for the expedition.



12. References

The 2014 NOAA Ship *Okeanos Explorer* Survey Readiness Report can be obtained in the NOAA Central Library or by contacting the NOAA OER mapping team at oar.oer.exmappingteam@noaa.gov.

The EX-14-03 Project Instructions can be obtained from the NOAA Central Library. The EX-14-03 Data Management Plan is an appendix of the project instructions.

EM 302 water column data <http://doi.org/10.7289/V53F4MH6>

EK 60 data <http://doi.org/10.7289/V5765C7X>

Sub-bottom data, supporting data, and informational logs are available in the NCEI Data Archives accessible at <https://www.ngdc.noaa.gov/> (last accessed 3/21/2019).

EM 302 bathymetry data, supporting informational logs, and ancillary files are available in the NCEI Data Archives accessible at <https://www.ngdc.noaa.gov/> (last accessed 3/21/2019).

The following was used for reference throughout the cruise:

Sandwell, D. T., and W. H. F. Smith, Global marine gravity from retracked Geosat and ERS-1 altimetry: Ridge Segmentation versus spreading rate, J. Geophys. Res., 114, B01411, doi:10.1029/2008JB006008, 2009.

NOAA Nautical Charts

