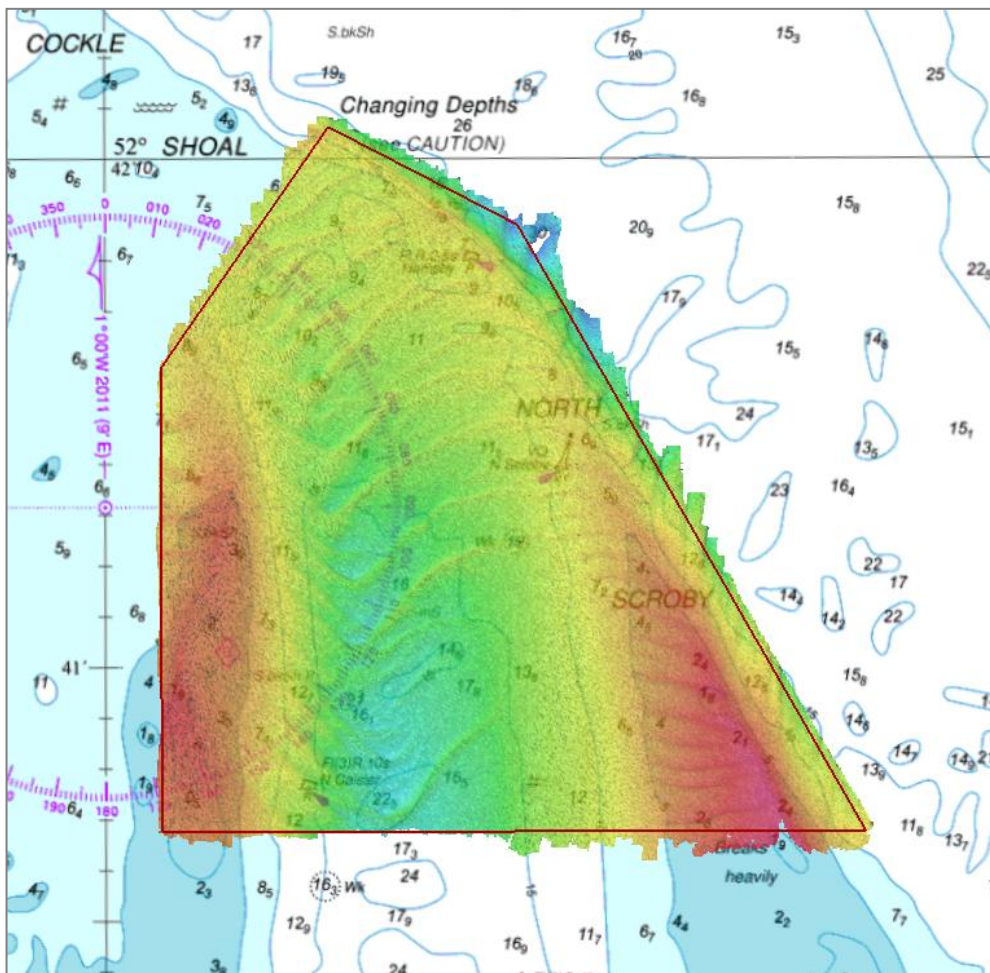




United Kingdom
Hydrographic Office

EAST ANGLIA COCKLE SHOAL

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREA EA3
FROM THE 2014 SURVEY



August 2015

ENGLAND - EAST ANGLIA

COCKLE SHOAL

Assessment EA3/2014

An assessment of the 2014 hydrographic survey of the area: to monitor recent seabed movement; to identify any implications for shipping; and to make recommendations for future surveys.

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CONTENTS

1. Executive Summary	3
2. Introduction	3
3. History	3
4. Description Of The Area	4
5. Shipping In The Area	4
6. 2011 Survey Details	5
7. 2014 Survey Details	5
8. Description Of Recent Bathymetric Change	5
9. Implications For Shipping	5
10. Recommendations For Future Surveys	6

ANNEXES

A. Area Specifications (Including Survey History)	7
B. Shipping Routes	8
C. Sun Illuminated View of the 2014 Survey Data overlaid on Chart BA1534	9
D. Sun Illuminated View of the 2014 Survey Data overlaid on Chart BA1534 and Cross Sections Locations	10
E. Cross Sections from the 2011 and 2014 Survey (See Annex D for locations)	11
F. Colour Banded Depth Plot from the 2011 Survey Showing Selected Depths	13
G. Colour Banded Depth Plot from the 2014 Survey Showing Selected Depths	14
H. Variability Plot Showing Bathymetric Changes between the 2011 and 2014 Survey Data	15
I. Composite Diagram of the 6 metre Contour from the 2011 and 2014 Surveys	16
J. Composite Diagram of the 9 metre Contour from the 2011 and 2014 Surveys	17
K. Composite Diagram of the 10 metre Contour from the 2011 and 2014 Surveys	18
L. Proposed New Limits for EA3 Full Survey Area	19

COCKLE SHOAL, 2014

1. EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1 Area EA3 is fully surveyed every 3 years, with two focused areas surveyed annually. It covers the north end of Caister Road, including part of the adjacent banks of Caister Shoal to the west, North Scroby to the east and Cockle Shoal to the north. It includes a buoyed approach into Caister Road between Cockle Shoal and North Scroby, where depths of more than 9 metres are available.
- 1.2 Ongoing changes to the banks observed in previous surveys have continued. The north end of Caister Shoal has moved eastwards by approximately 100 metres. Comparison of the 6 metre contour from 2011 and 2014 surveys show a northward advance of Caister Shoal towards Cockle Shoal. North Scroby bank has receded SSE by approximately 60 metres generally becoming deeper with indication that seabed materials are being transported to both the south and eastwards towards Scroby Sands Windfarm and Barley Picle outside area EA3 limits.
- 1.3 Depths available across much of the buoyed ridge into Caister Road are similar to those in the 2011 survey. However, there is evidence that sandwaves migrate across the buoyed access and hence still needs careful monitoring. Generally depths to the north and east of Hemsby buoy have become shoaler as the northeast limit of the bank has migrated seawards. However the minimum depths in the area have become deeper.

Reasons for Continuing to Resurvey the Area

- 1.4 The banks of Caister Shoal, Cockle Shoal and North Scroby, which form the northern limit of the Caister Road ebb channel, are subject to ongoing change in both their height and position. The area of most concern to vessels is the buoyed access into Caister Road. Sandwaves migrating northwards through Caister Road have the potential to affect depths over the bank in this area and, given these conditions, the area requires frequent resurveying to ensure the chart reflects the changes.

Recommendations

- 1.5 Minor adjustments to both the northern and eastern limits of EA3 should be made (see Annex L).
- 1.6 The re-survey frequency should be retained at 3 years.

2. INTRODUCTION

- 2.1 This Assessment is produced by the United Kingdom Hydrographic Office (UKHO) for the Maritime and Coastguard Agency (MCA).
- 2.2 Analysis of the Routine Resurvey Areas forms part of the Civil Hydrography Programme and the reports are made available to members of the Committee On Shipping Hydrography (COSH) through the UKHO website, before being presented to the Civil Hydrography Working Group. When approved, the recommendations are incorporated into the Routine Resurvey Programme. The report is governed by a Memorandum of Understanding between the Department for Transport (including the MCA) and the MOD (including the UKHO).

3. HISTORY

- 3.1 EA3 is one of the routine resurvey areas in the East Anglian Routine Resurvey Programme and covers part of a northern approach to Great Yarmouth and Lowestoft.

- 3.2 Prior to 1980 an area that includes EA3 was designated Area C. This area also covered Caister Road, Caister Shoal and North and Middle Scroby and had a 2 year survey interval.
- 3.3 In 1980 the areas were reorganised and Cockle Shoal was given the identifier A1. It was scheduled for annual surveying due to the buoyed channel crossing a bank and mobility of the seabed within the area. In 1997 A1 was given the identifier EA3 but with unchanged limits and survey interval.
- 3.4 In 2004 the limits were reduced following repositioning of the buoyed access to Caister Road (removing much of Cockle Shoal from the annual resurvey programme). In 2007 the limits were modified slightly, removing part of Caister Shoal and extending the limits eastwards to encompass migration of the Cockle Shoal.
- 3.5 In 2008 the survey interval was relaxed to 3 years for much of the area, but retaining annual surveying of two focused areas covering the buoyed entrance to Caister Road and Caister Shoal.
- 3.6 Details of EA3, including the survey history, are at Annex A. The area is abutted by EA1 to the north (fully surveyed every 12 years, with 3 year focused surveys) and EA4 to the south (fully surveyed every 12 years, with 3 and 6 year focused surveys of the channel limits).

4. DESCRIPTION OF THE AREA

- 4.1 Cockle Shoal is a broad ridge of sand at the head of Caister Road and links the banks of Caister Shoal and North Scroby. It was formed by an ebb-residual current transporting sediment northwards through Caister Road. Much of Cockle Shoal lies north of the current EA3 limits.
- 4.2 The banks are predominantly comprised of fine sand, but across the area range from fine sand to coarse sand with pebbles; three bottom samples were taken during 2011. Irregular symmetrical and asymmetrical sandwaves and megaripples dominate the area. Sandwaves and megaripples lying in Caister Road and across Cockle Shoal link up along the outer limit of the bank, effectively forming an outer ridge. This outer ridge is possibly created by the opposing, south-east bound, sediment transport regime on the eastern side of the bank. The 2014 survey data overlaid on the largest scale chart of the area BA1534 (INT1558) is presented in Annex C.
- 4.3 An indication of the direction of net sediment transport has been derived from the asymmetry and migration of sandwaves in the area and bank movements, as observed by the comparison of the 2011 and 2014 surveys and is shown by Annex D and Annex H.

5. SHIPPING IN THE AREA

- 5.1 Vessels bound to and from Great Yarmouth cross the area when approaching the port through Caister Road. Great Yarmouth Haven can accommodate vessel with a draught of up to 6.2 metres, subject to constraints on vessels beam, length and tidal cycle. Vessels with draughts of up to about 7 metres anchor in Yarmouth Road, usually to shelter from inclement weather.
- 5.2 Great Yarmouth Outer Harbour is dredged, in part, to accommodate vessels up to 10 metres draft.
- 5.3 Shipping data for the months of January, March, July and October 2012 was compared to the graphic produced for the 2011 report for area EA3. The data supports that shipping density and routes remain in broad accordance with that produced in 2011 and is reproduced in Annex B. Most of the vessels using this route approach the channel from the north and pass close to Hemsby buoy.

6. 2011 SURVEY DETAILS

- 6.1 The survey was conducted from 14th to the 16th May. Weather in the area was generally good throughout the survey period, with light to strong breezes experienced and slight to smooth sea states.
- 6.2 Survey data was acquired using a Kongsberg Maritime EM3002D multibeam echosounder. Observations calculated from the height component of the GPS position solution were used to reduce soundings to Chart Datum. Ellipsoidal Height to Chart Datum values were taken from the Vertical Offshore Reference Framework (VORF).
- 6.3 The survey achieved IHO Order 1a standard.

7. 2014 SURVEY DETAILS

- 7.1 The survey for area EA3 was conducted from 28th June to 7th July as part of HI1458. The weather experienced in the area was noted as being of slight to moderate seastate with wind stated as 3-4, Beaufort scale.
- 7.2 Survey data was acquired using a Kongsberg Maritime EM3002D multibeam echosounder. Observations calculated from the height component of the GPS position solution were used to reduce soundings to Chart Datum. Ellipsoidal Height to Chart Datum values were taken from the Vertical Offshore Reference Framework (VORF).
- 7.3 The survey achieved IHO Order 1a standard. The 2014 survey data overlaid on chart BA1534 (INT1558) is at Annex C.

8. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

- 8.1 Colour banded depth plots of the 2011 and 2014 Surveys are presented in Annex F and G respectively. A variability plot is at Annex H and comparison of the 6, 9 and 10 metre contours are at Annexes I, J and K respectively.
- 8.2 The northern end of Caister Road has started to narrow due to the eastward migration of Caster Shoal and the slower southerly recession of North Scroby. In the north of area EA3, Caister Shoal has moved eastwards by approximately 100 metres and has advanced northwards by 400 metres toward Cockle Shoal shown by a comparison of the 6m contour between the 2011 and 2014 surveys.
- 8.3 The data suggests that Cockle Shoal is continuing to move seawards into deeper water causing the general depths north and east of Hemsby buoy to become shoaler. However the minimum depths are becoming deeper. A minimum depth of 8.9 metres is found 120 metres north of Hemsby buoy, 0.9 metres deeper than in the 2011 survey. This reflects an ongoing change, with depths having increased from 3.4 metres in the first multibeam survey in 2004.
- 8.4 North Scroby bank has receded SSE by approximately 60 metres and has generally become deeper with indications that seabed materials being transported to the East and South towards Barley Picle and Scroby Sands Windfarm. The 10 metre contour to the south-east of EA3 area is no longer being fully encapsulated within the existing survey limits.

9. IMPLICATIONS FOR SHIPPING

- 9.1 Realignment of Caister Road is gradual and in line with developments over recent years. Although depths over North Scroby have generally deepened slightly, to the north and east of Hemsby Buoy the water depths have become shoaler, due to Cockle Shoal advancing seawards. The maximum depth in the buoyed entrance (Hemsby to North Scroby Buoy) across the bank into to Caister Road has generally shown a slight increase.

10. RECOMMENDATIONS FOR FUTURE SURVEYS

- 10.1 Small adjustments to the limits of EA3 should be made, reflecting ongoing migration of the banks, as shown in Annex L. The proposed limits are detailed below:

Full 3 Year Re-survey Area:

- a) 52°.67833 N 1°.75562 E
- b) 52°.69400 N 1°.75562 E
- c) 52°.70260 N 1°.76433 E
- d) 52°.70031 N 1°.77209 E
- e) 52°.67833 N 1°.79287 E

- 10.2 The limits above have been extended in to the existing EA1 area and therefore the limits for EA1 should be adjusted accordingly.
- 10.3 The 3 year resurvey frequency for the full area is considered appropriate.
- 10.4 The two annual focused survey areas should remain unchanged.

AREA SPECIFICATIONS

(Including Survey History)

AREA: EA3**REGION:** East Anglia**NAME:** Cockle Shoal**LIMITS:**

Full 3 year Limits:

Focused Annual Limits:

52°.67833 N	1°.75562 E	Area A	
52°.69400 N	1°.75562 E	52°.67833 N	1°.76160 E
52°.70135 N	1°.76315 E	52°.67833 N	1°.75795 E
52°.69913 N	1°.77040 E	52°.69500 N	1°.75670 E
52°.67833 N	1°.79000 E	52°.69500 N	1°.76080 E

Area co-ordinates are referred to WGS84

Area B	
52°.69913 N	1°.77040 E
52°.69000 N	1°.77900 E
52°.68798 N	1°.77398 E
52°.69866 N	1°.76500 E
52°.70003 N	1°.76745 E

AREA SIZE: Full 1.1 SQ NM (3.8SQ KM) / Focused 0.3 SQ NM (1SQ KM)**SURVEY INTERVAL:** Full 3 yr / Focused 1 yr**SURVEYS:** (Singlebeam surveys (prior to 2004) conducted at 1:25,000)

Year	Survey	File Ref	Data	Year	Survey	File Ref	Data
1985	K9599	H2337/84		2000	M3335	HH090/882/01	d
1986	K9820	H2338/85		2001	M3530	HH090/940/01	d
1987	M1028	H4021/86	t.	2002	M3708	HH090/986/01	t,d
1988	M1194	H6332/87	t,d	2003	M3900	HH091/019/01	d
1989	M1333	H3930/88	d	2004	M4131	HH091/073/01	m
1990	M1549	HH090/487/01	d	2005	M4265	HH091/109/01	m
1991	M1716	HH090/512/01	d	2006	M4525	HH091/161/01	m
1992	M1866	HH090/544/01	d	2007	M4629	HH091/221/01	m
1993	M2083	HH090/569/01	d	2008	M4786	20080-26400	m
1994	M2232	HH090/622/01	d	2009	HI1292	2009-29527	m
1995	M2456	HH090/660/01	t,d	2010	HI1338	2010-213940	m
1996	M2600	HH090/686/01	d	2011	HI1367	2011-106141	m
1997	M2796	HH090/732/01	d	2012	HI1397	2012-117402	m
1998	M2995	HH090/765/01	d	2013	HI1432	2013-261940	m
1999	M3176	HH090/844/01	t,d	2014	HI1458	2014-249144	m

KEY: t = seabed texture tracing, d = digital data, m = multibeam digital data

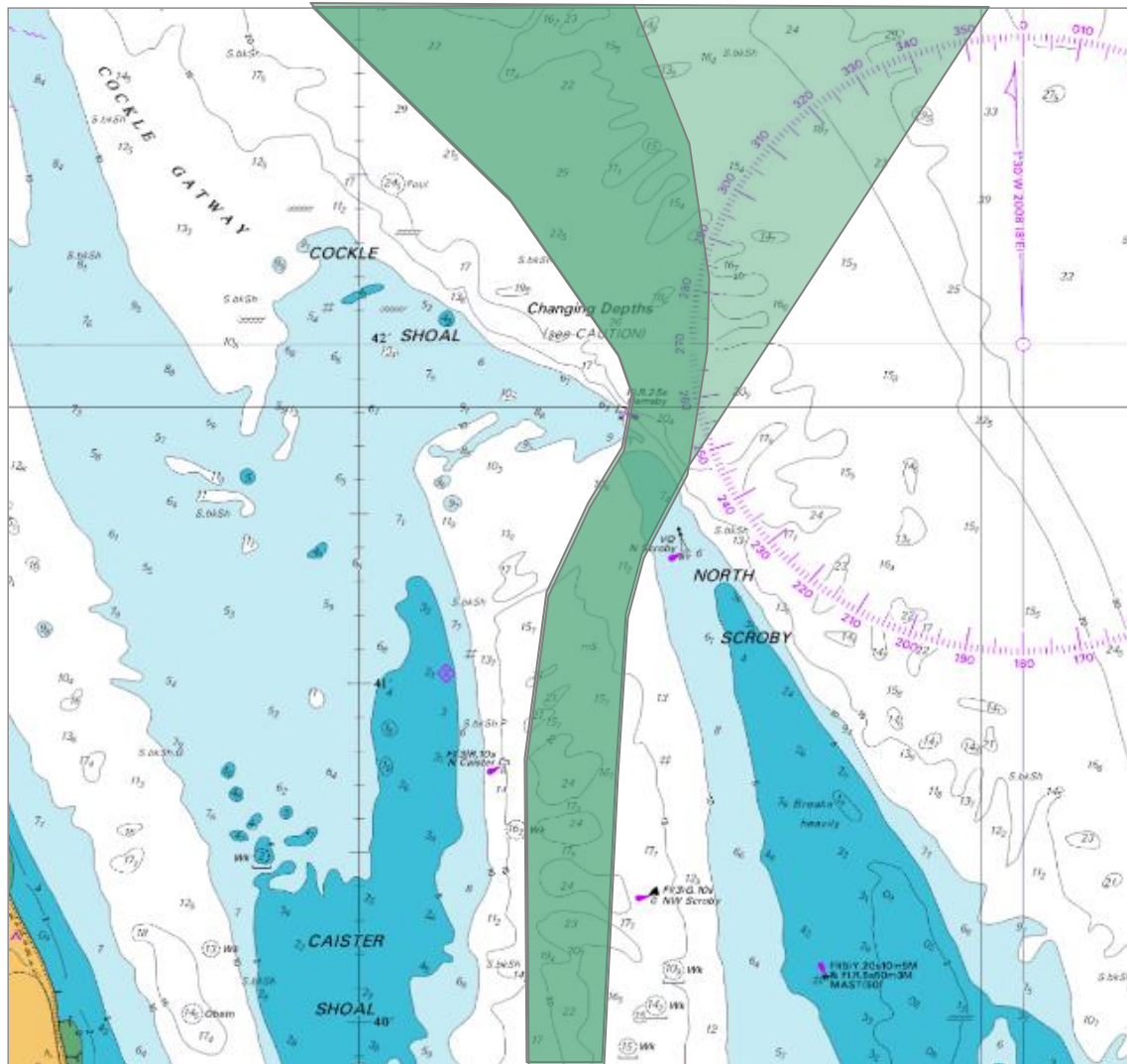
REPORTS: 1986 Latest survey included K9820 (H0423/86)
1995 Latest survey included M2456 (HA145/02/03/05)

ASSESSMENTS: Annually from 1996 on the above surveys

REMARKS: 1980 Area A1 established; part of old areas C and E1 (H3912/80)
1996 Area A1 Assessment - Increase western limits to include 10m contour
1997 Area identifier changed to EA3. Summary report 1997 (HA145/002/001/03)
2002 Area limits revised following changes to buoyage
2003 Area limits reduced
2005, 07, 08 Area limits adjusted to reflect migration of the banks
2008 Annual focused areas established
2011 Focused Area B extended to include wreck off southern point for 2012.

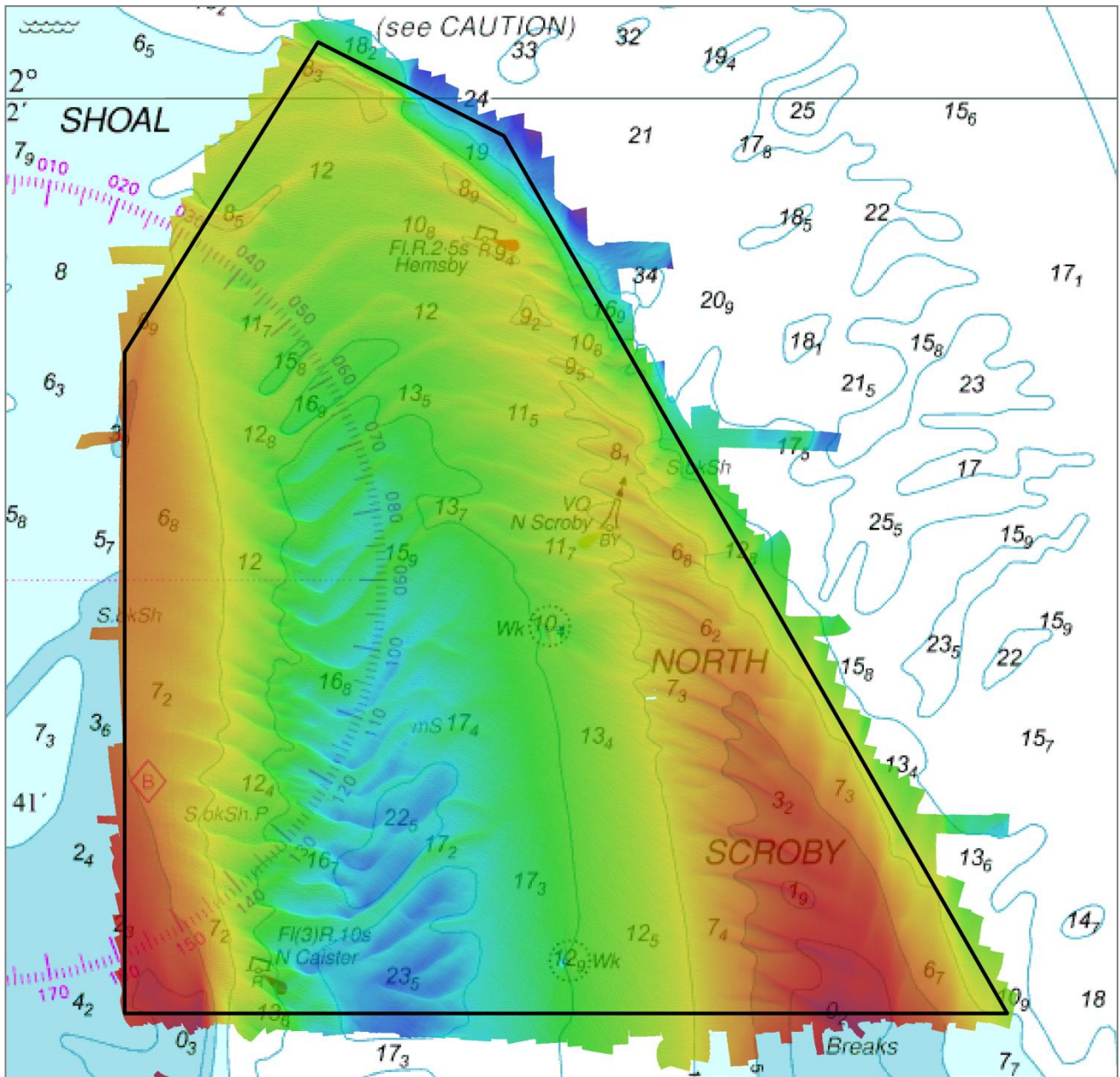
LARGEST SCALE CHART: BA 1534 (INT1558) 1:25,000

SHIPPING ROUTES

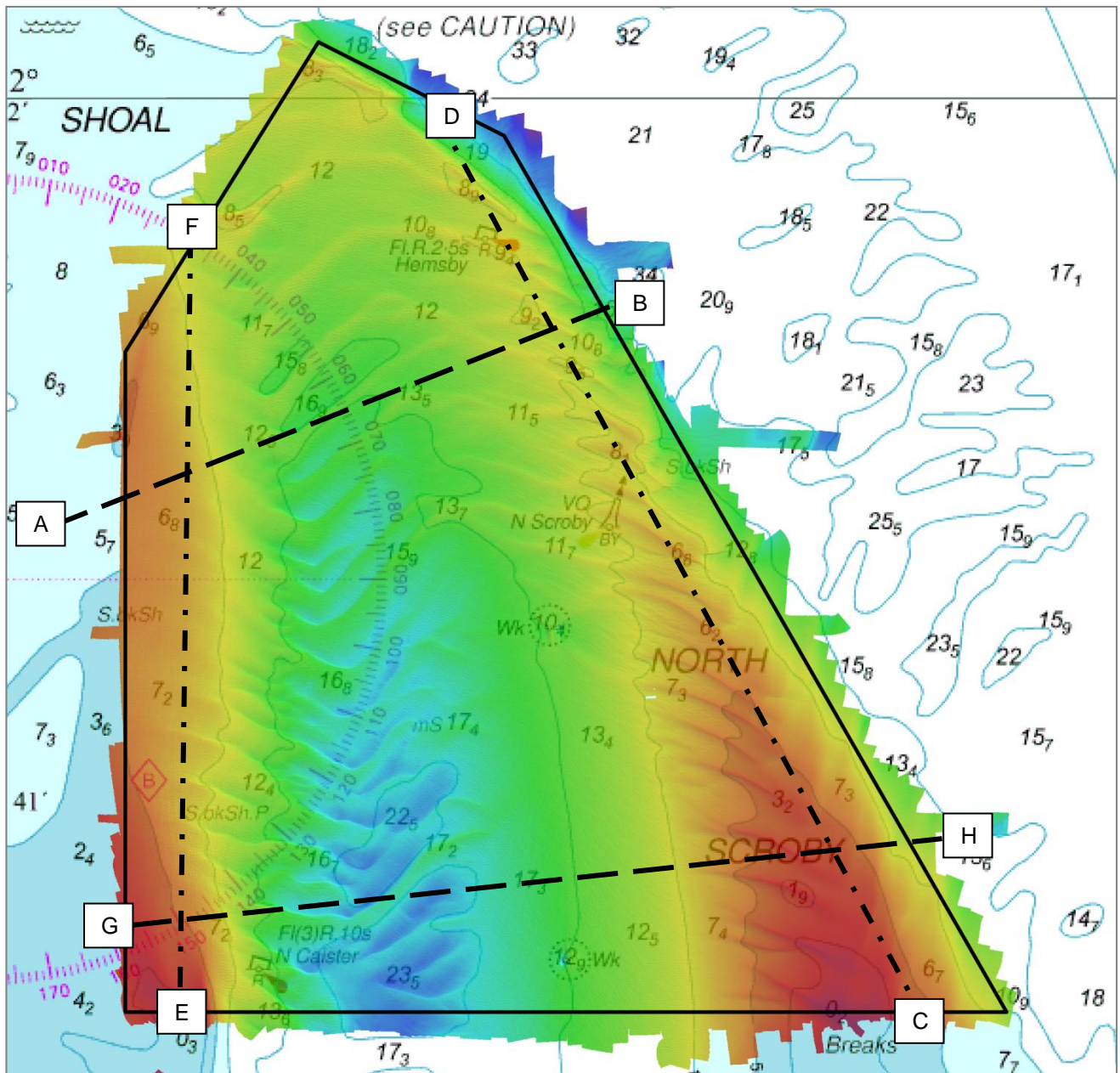


- Main traffic density
- Lower traffic density

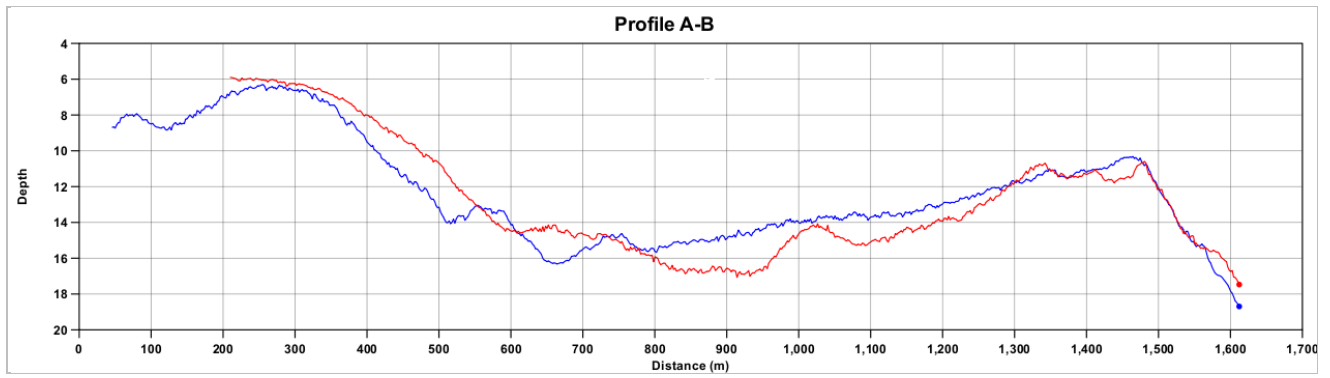
SUN ILLUMINATED VIEW OF THE 2014 SURVEY DATA
OVERLAID ON CHART BA1534



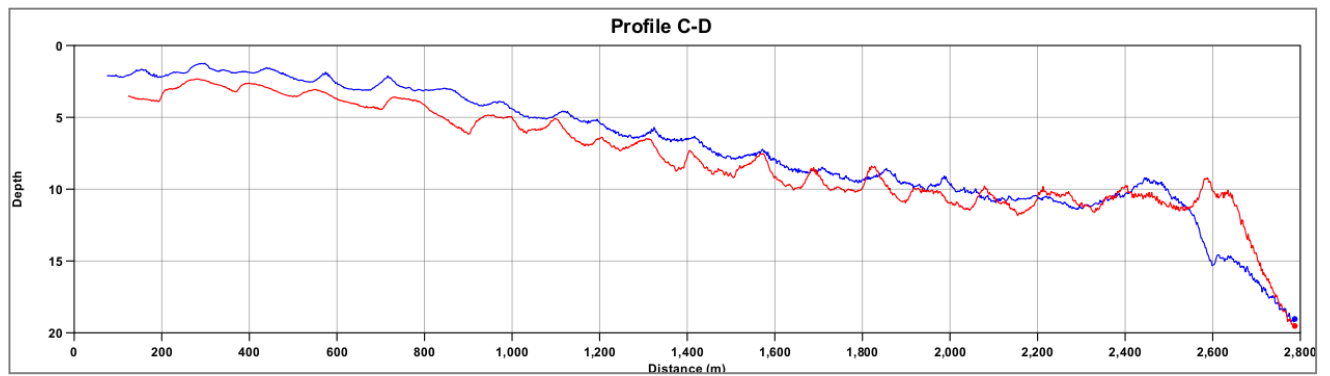
SUN ILLUMINATED VIEW OF THE 2014 SURVEY DATA
OVERLAID ON CHART BA1534
AND CROSS SECTION LOCATIONS



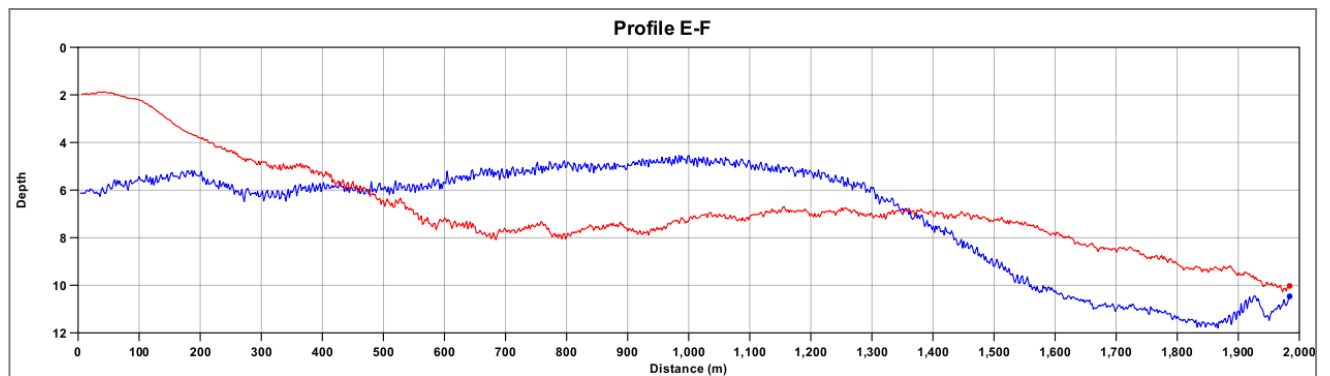
CROSS SECTIONS FROM THE 2011 and 2014 SURVEYS
(See Annexe D for locations)



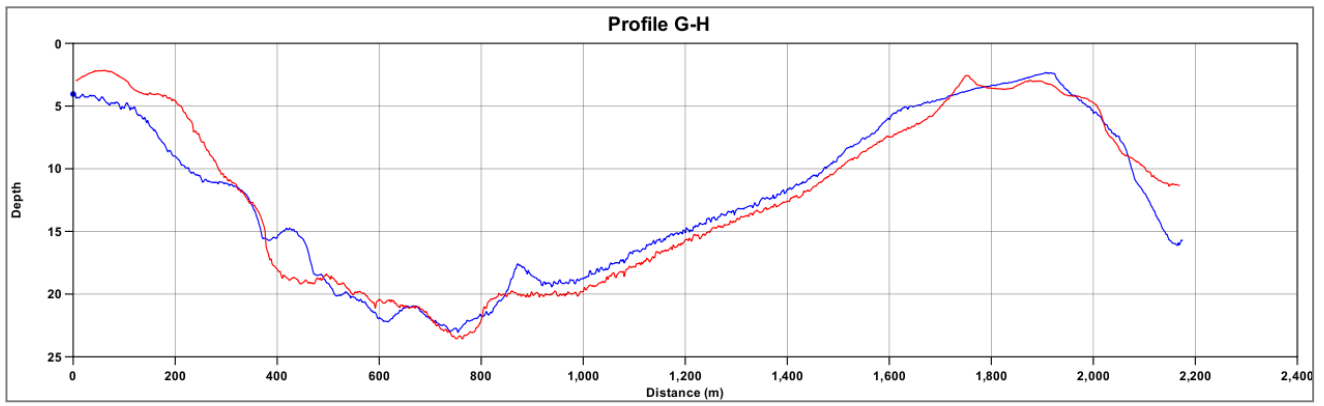
A B



C D





E F

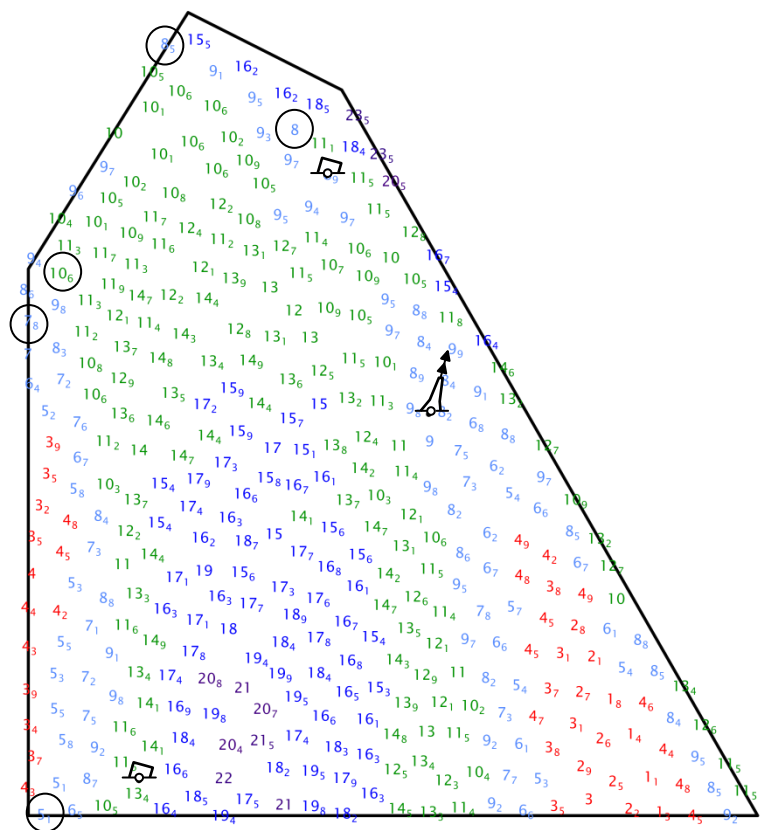


G

H

Year of Survey	
	2014
	2011

COLOUR BANDED DEPTH PLOT
 FROM THE 2011 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:25,000

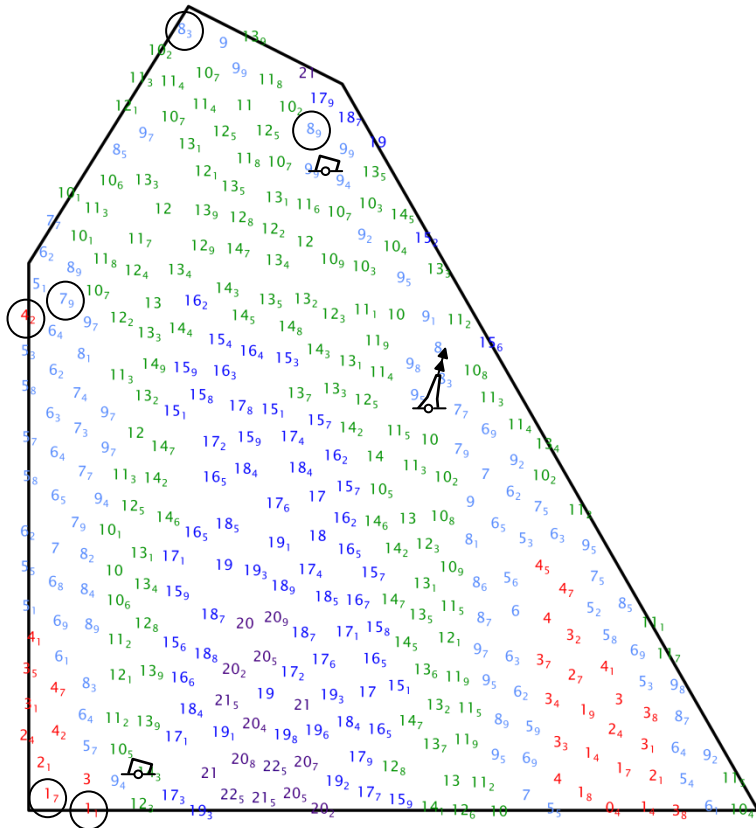


○ Selected depth comparisons

Depths in Metres	
	0.0 to 5.0
	5.1 to 10.0
	10.1 to 15.0
	15.1 to 20.0
	20.0 <



COLOUR BANDED DEPTH PLOT
 FROM THE 2014 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:25,000

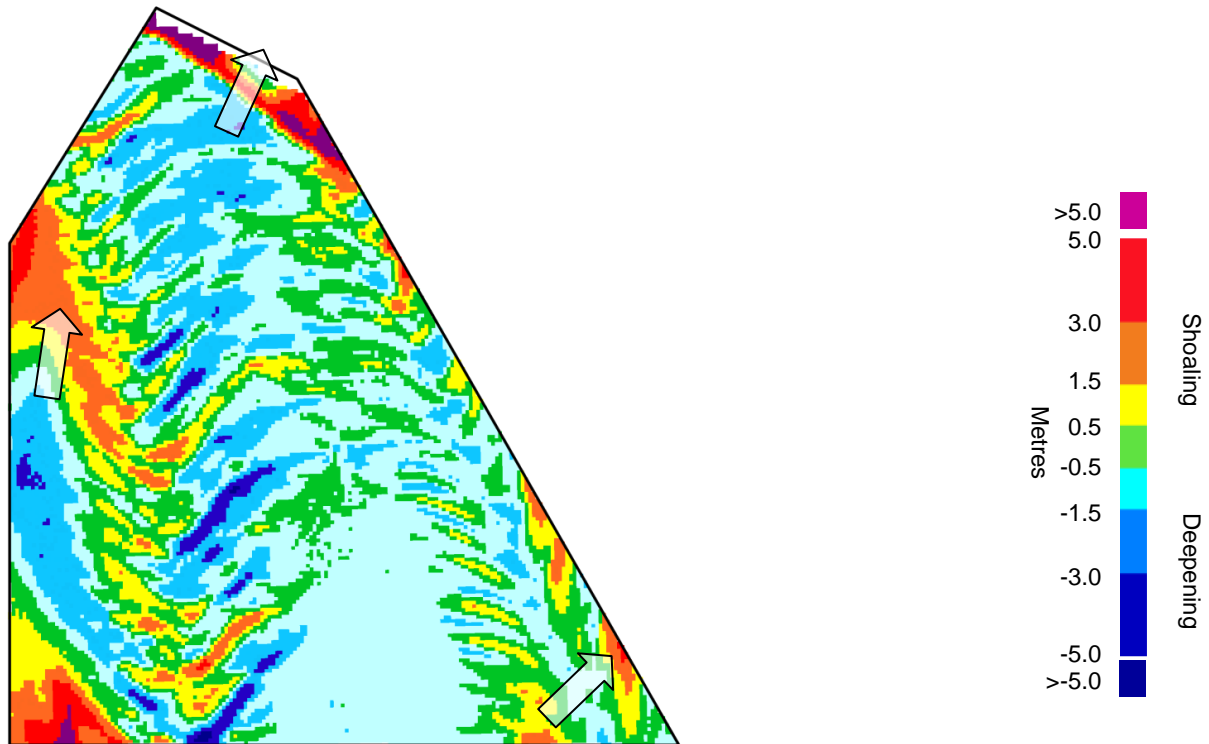


○ Selected depth comparisons

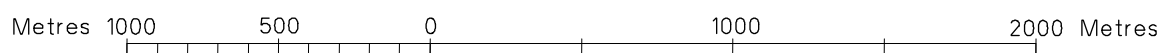
Depths in Metres	
	0.0 to 5.0
	5.1 to 10.0
	10.1 to 15.0
	15.1 to 20.0
	20.0 <



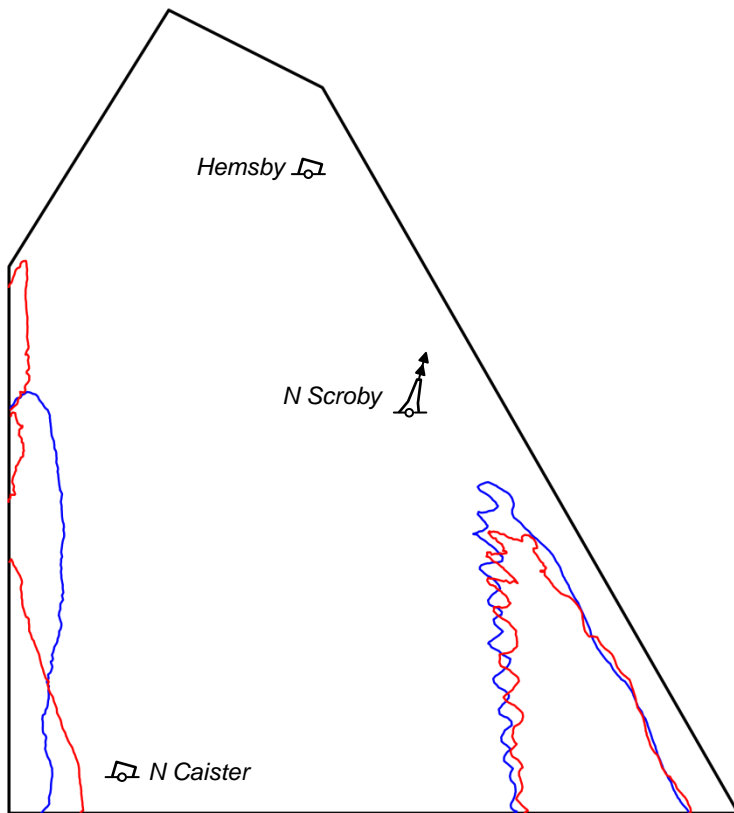
VARIABILITY PLOT SHOWING
BATHYMETRIC CHANGES BETWEEN THE 2011 AND 2014 SURVEY DATA
SCALE 1:25,000





Arrows indicate direction of net sediment transport highlighted in the variability data



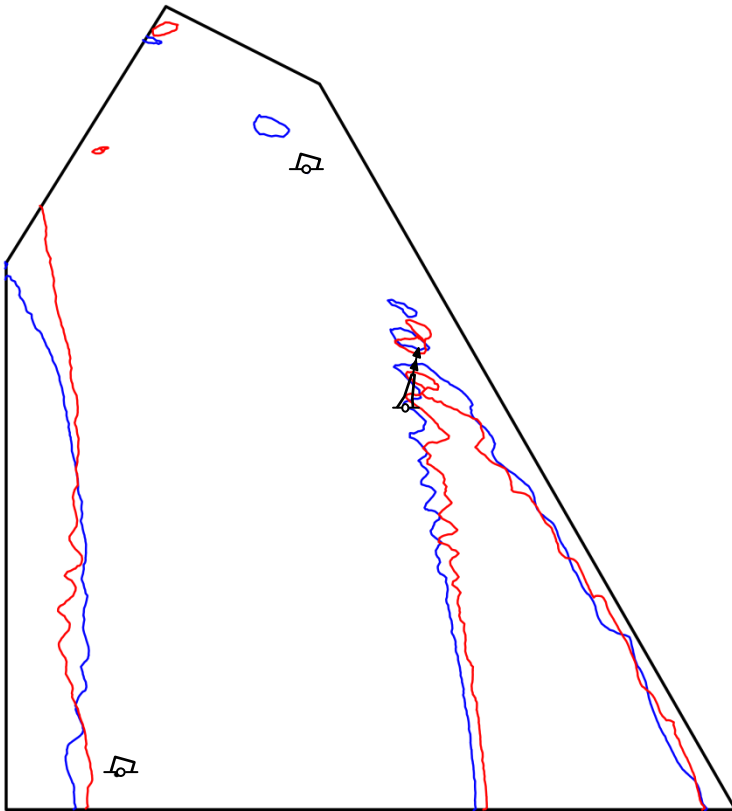
COMPOSITE DIAGRAM OF THE
6 METRE CONTOUR FROM THE 2011 AND 2014 SURVEYS
SCALE 1:25,000





Year of Survey	
	2014
	2011



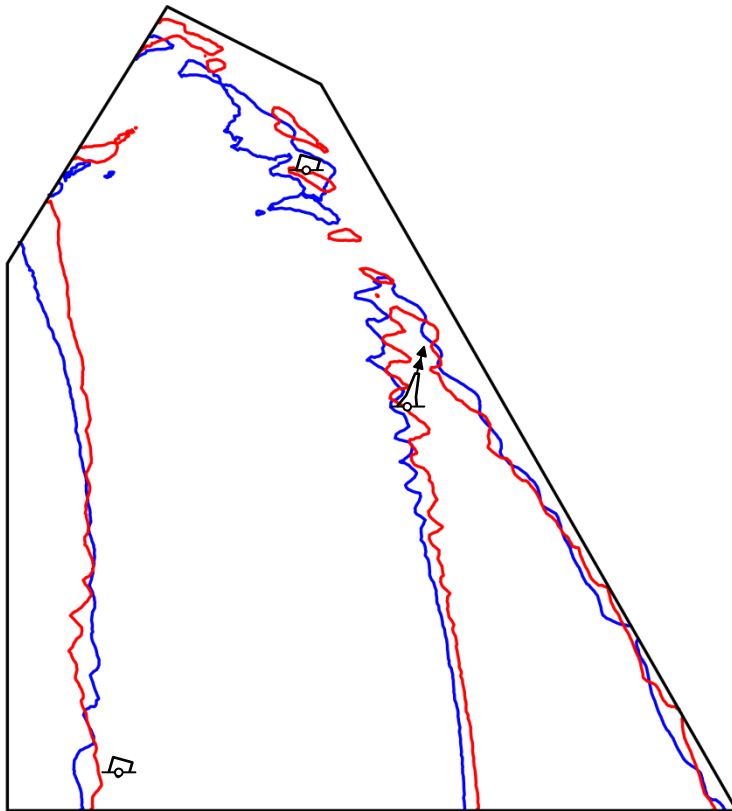
COMPOSITE DIAGRAM OF THE
9 METRE CONTOUR FROM THE 2011 AND 2014 SURVEYS
SCALE 1:25,000





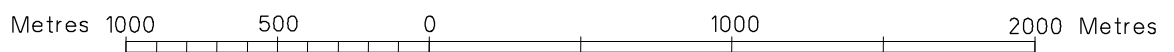
Year of Survey	
	2014
	2011



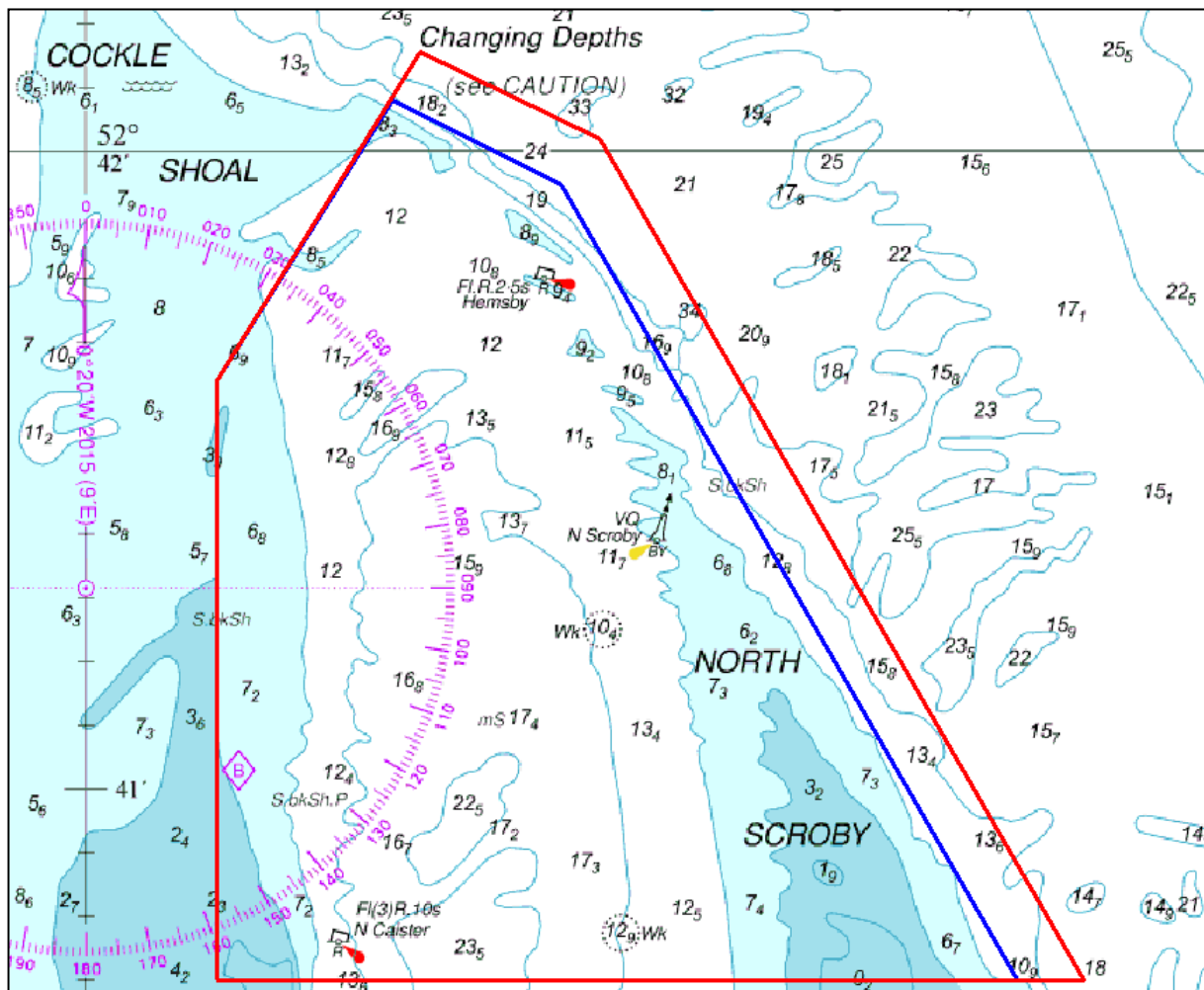
COMPOSITE DIAGRAM OF THE
 10 METRE CONTOUR FROM THE 2011 AND 2014 SURVEYS
 SCALE 1:25,000





Year of Survey	
	2014
	2011



PROPOSED NEW LIMITS FOR EA3 FULL SURVEY AREA



Proposed EA3 full survey area limits 4.4 km² / 1.3NM²

Area Limits	
	Proposed
	Current