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Final Incident Support Information -Transocean Winner January 2018

Scottish Marine and Freshwater Science Vol 9 No 1

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This report presents the results of marine and freshwater scientific work carried out by Marine Scotland Science.

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Final Incident Support Information - Transocean Winner January 2018

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15 JANUARY 2018

1. Summary

Transocean Winner semi-submersible rig ran aground at 0652 local time at 58º 18.51'N 006º 46.2'W near Dalmore on the Isle of Lewis.

The Isle of Lewis coastline north of Loch Roag is characterised by uniform small sandy bays and rocky foreshore. Loch Roag is approximately 4 nm southwest of the incident.

The seabed in the immediate vicinity of the incident is characterised by a high energy environment dominated by sand, gravel and exposed bedrock.

Sensitivities local to the area are contained in Loch Roag comprising two special areas of conservation for saline lagoons and Atlantic salmon; and 27 active aquaculture sites. Other potential receptors such as offshore pipelines, telecommunication or power cables are not present.

Chemical baseline data derived from mussels collected from Loch Roag aquaculture sites from on-going monitoring campaigns coordinated by Food Standards Scotland, indicate hydrocarbon compound concentrations typical for a remote area with no local anthropogenic source.

Primary marine hazard associated with the incident is the 280 tonnes of diesel on-board the rig. The diesel is split between four separate storage tanks. Two tanks are known to have been breached with a combined potential loss of 53 m^3. Diesel comprises a number of light volatile hydrocarbon compounds that will readily evaporate. Poor weather will aid dissolution, spreading and evaporation of any diesel losses. Total additional fluids on-board the rig, excluding diesel, account for an additional 63 m^3 and are all in use within the rig's infrastructure. An ecotoxicological assessment based on MSDS information of the additional fluids that account for 95% of the total additional fluids indicates that they are non-bioaccumulative and biodegrade.

Two water samples collected from the Dalmore Bay foreshore were analysed by SEPA (9 August 2016). Low levels of weathered diesel were detected in both water samples, but no hydraulic fluid was found. No additional chemicals of concern were detected in the GCMS screens undertaken. Four additional baseline water samples were collected from Broad Bay on 23 August 2016 and are awaiting analysis for diesel. SEPA has also conducted ambient air monitoring 0.5 km southeast of the rig location. Four water samples collected from Broad Bay on 7 September 2016 showed had no detectable oil. Additional surface water samples collected on 24 October 2016 from three locations within Broad Bay showed hydrocarbon concentrations of <0.5 mg/l.

Twenty eight intertidal surface sediment samples have been collected from around the Isle of Lewis including Dalmore Bay and Broad Bay, and are awaiting analysis for a suite of analytical parameters.

MSS has analysed repeat baseline mussel and salmon samples collected from Loch Roag showing very low levels of PAH and n-alkanes, consistent with clean rope grown mussels and clean farmed salmon. None of the three repeat sample sets show evidence of petrogenic (diesel) contamination. The sensory panel test has recorded no taint for any of the salmon samples collected.

Modelling the total loss of 280 tonnes of diesel from the rig at Dalmore Bay using the weather conditions encountered indicated that the majority of the spill migrates towards the northeast along the Lewis coastline. Some residual diesel will migrate into the Loch Roag. Forced modelling has indicated that a continuous ten knot north easterly wind would drive the spill southwest towards Loch Roag. Modelling a release of 40 m^3 of diesel at Broad Bay with southerly and south-easterly winds showed the spill initially moving south, then beaching on the north coast of the bay before moving north east out of the bay and onto the North Minch.

The key sensitivity identified are the aquaculture sites in Loch Roag. However, the distance from the incident, hydrocarbon composition, modelled trajectory of a potential spill and the prevailing weather conditions encountered would greatly reduce the aquaculture risk to exposure from a diesel spill.

The port of refuge identified in the event of re-floating the Transocean Winner is Broad Bay located on the eastern seaboard of Lewis. The bay is close to the incident and provides the physical characteristics required for ease of access, mooring and protection from the prevailing weather to enable further survey work to be conducted in a safer environment.

In preparation to re-floating the rig, the salvers have safely recovered approximately 242 m^3 of diesel/water mix to the a supply vessel, significantly reducing the potential of pollutant loss during transit and anchorage in Broad Bay.

Surveillance flights on 21 and 22 August showed some very small patches of sheen not far from the rig off Dalmore Bay. During tow, an over flight showed small patches of sheen thought to be connected with the stabilisation works. Once the rig had been removed from Dalmore Bay an over flight recorded no evidence of a sheen.

2. Introduction

At 0423 local time on 8 August the MCA was advised that the towline between the Alp Forward tug and the Transocean Winner rig had parted. The tug was unable to recover the emergency tow line and the rig was reported grounded by the master of the tug at 0652 local time at 58º 18.51'N 006º 46.2'W near Dalmore on the Isle of Lewis. The situation arose because the Alp Forward lost control of the towing operation because of the weather conditions encountered during passage off the west of the Outer Hebrides.

3. Fluids Inventory

The estimated diesel inventory for the rig was 280 tonnes. The safety investigation conducted on 9 August 2016 determined that both starboard tanks were breached. One port tank was intact and another port tank was unable to be opened but appeared to be breached. The volume of diesel lost has not been quantified however the combined volume of the two known breached tanks was 53 m^3. Aerial surveillance did not report any sheen migrating from the rig which suggests that the release of diesel has reduced, is intermittent or has stopped.

All fluids on the rig are recorded in Appendix 1 with a total fluid volume of 253 m^3 comprising 190 m^3 of diesel. All additional fluids (excluding diesel) are in use in the rig's system i.e. they are not stored in containers in readiness for use. The total additional fluids (TAF) have a combined volume of 63 m^3. Table 1 below shows the fluid entries that account for 95% of the total inventory volume. The largest single entry for the additional fluids is 8 m^3 of 3% Stack Magic, 5% MEG, 92% water for use in the Blowout Prevention (BOP) set back area.

The inventory has been further refined to aggregate the fluids according to the Current Product entries (Table 2). The percentages for each current product is ranked from the highest to the lowest percentage. The top eight entries account for 95% of the total fluids inventory recorded for the Transocean Winner rig. After diesel, Castrol – Biobar 46 accounts for almost 7.5% of the total fluid inventory on the rig with a total of 19.4 m^3.

In readiness of re-floating the Transocean Winner, SOSREP made it a requirement for the removal of diesel from the rig to a standby vessel. On 21 August 2016, 242 m^3 of diesel/water mix was transferred to the Olympic Orion. A volume of diesel will remain on the rig for operational purposes of machinery etc. Four tanks will retain diesel comprising the settling tank(25.8 tonnes), day tank (25.8 tonnes),

emergency generator tank (1.8 tonnes) and intermediate bulk containers (4.2 tonnes).

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
82	Electrical Power Generation	Pontoon Tank 8P	95,000	Diesel Fuel	Spare Oil Inventory	37.56	37.56
83	Electrical Power Generation	Pontoon Tank 6P	42,000	Diesel Fuel	Spare Oil Inventory	16.61	54.17
85	Electrical Power Generation	Pontoon Tank 6S	41,000	Diesel Fuel	Spare Oil Inventory	16.21	70.38
84	Electrical Power Generation	Pontoon Tank 8S	12,000	Diesel Fuel	Spare Oil Inventory	4.74	75.12
71	LMRP and BOP	BOP Set Back Area	8,000	3% Stack Magic, 5% MEG, 92% water	Misc Tanks	3.16	78.28
59	Electrical Power Generation	Engine Room	6,000	Castrol - MHP 154	Misc Tanks	2.37	80.65
14	BOP Handling System	BOP Control / Koomey Room	5,000	Castrol - BioBar 46	Within Eqpt Piping	1.98	82.63
38	Pipehandling Equipment	Drill Floor	4,000	Castrol - BioBar 46	Within Eqpt Piping	1.58	84.21
41	Propulsion System	Thruster Room - Gear Box	3,000	Castrol - Alpha SP 100	Within Eqpt Piping	1.19	85.40
58	Materials Handling	BOP Carrier	2,000	Castrol - Alpha 46	Misc Tanks	0.79	86.19
61	Koomey Unit - Mixing Tank	BOP Control / Koomey Room	2,000	3% Stack Magic, 5% MEG, 92% water	Misc Tanks	0.79	86.98
31	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	87.61
32	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	88.25
33	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	88.88
34	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	89.51
20	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	89.99
21	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	90.46
22	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	90.93
23	Electrical Power	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	91.41

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
	Generation						
77	Electrical Power Generation	Engine Room - Oil Tank	1,200	Castrol - MHP 153	Spare Oil Inventory	0.47	91.88
13	Ballast/ Preload Systems	Hydraulic Room	1,000	Castrol - BioBar 22	Within Eqpt Piping	0.40	92.28
42	Propulsion System	Thruster Room - Pitch System	1,000	Castrol - Biobar 46	Within Eqpt Piping	0.40	92.67
65	Main Deck - Stbd Crane Foundation	Starboard Crane Foundation	1,000	Stack Magic (Concentrated)	Misc Tanks	0.40	93.07
66	Mezzanine Deck - BOP Setback Area	BOP Set Back Area	1,000	MEG (Concentrated)	Misc Tanks	0.40	93.46
78	Electrical Power Generation	Engine Room - Waste Oil Tank	900	Waste Oil	Spare Oil Inventory	0.36	93.82
60	High Pressure Mud Systems	Mud Pump Room	800	Castrol Tribol 1100/460) & Castrol Alpha SP 150	Misc Tanks	0.32	94.14
35	Materials Handling	Port Crane	800	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.32	94.45
36	Materials Handling	Starboard Crane	800	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.32	94.77
72	Mooring Winch System	Anchor Winch Storage Tanks	800	Castrol - BioBar 46	Spare Oil Inventory	0.32	95.09

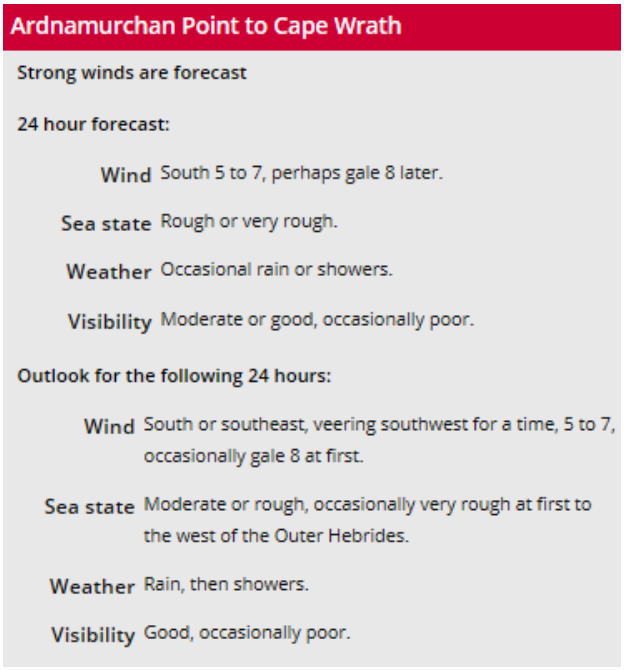
Table 1: Inventory of fluids associated with the Transocean Winner rig, including diesel, that account for 95 % of the total fluids volume. These have been expressed as a percentage of the total inventory, ranked from highest to lowest and included as a cumulative percentage increase.

Row Labels	Count of Volume (Litres)	Sum of Volume (Litres)	%	Cum %
Diesel Fuel	4	190,000	75.12	75.12
Castrol - BioBar 46	13	19,400	7.67	82.79
Castrol - MHP 154	6	10,805	4.27	87.06
3% Stack Magic, 5% MEG, 92% water	2	10,000	3.95	91.02
Castrol - Alpha SP 100	9	3,656	1.45	92.46
Castrol - Alpha 46	3	2,800	1.11	93.57
Castrol - BioBar 22	7	1,980	0.78	94.35
Castrol - Alpha SP 150	20	1,893	0.75	95.10

Table 2: Aggregation of the top eight different types of fluids on-board the Transocean Winner rig including diesel that account for 95% of the total inventory according to fluid type. These have been expressed as a percentage of the total inventory, ranked from highest to lowest and included as a cumulative percentage increase.

4. Forecast

Issued by the Met Office for 1200 UTC on 20 September 2016. Screen capture of inshore waters and strong winds Ardnamurchan Point to Cape Wrath (2016) | Met Office. [online] Available at: http://www.metoffice.gov.uk/public/weather/marine-inshore-waters#iw17 [Accessed 20 September 2016].



Ardnamurchan Point to Cape Wrath

Strong winds are forecast

24 hour forecast:

Wind	South 5 to 7, perhaps gale 8 later.
Sea state	Rough or very rough.
Weather	Occasional rain or showers.
Visibility	Moderate or good, occasionally poor.

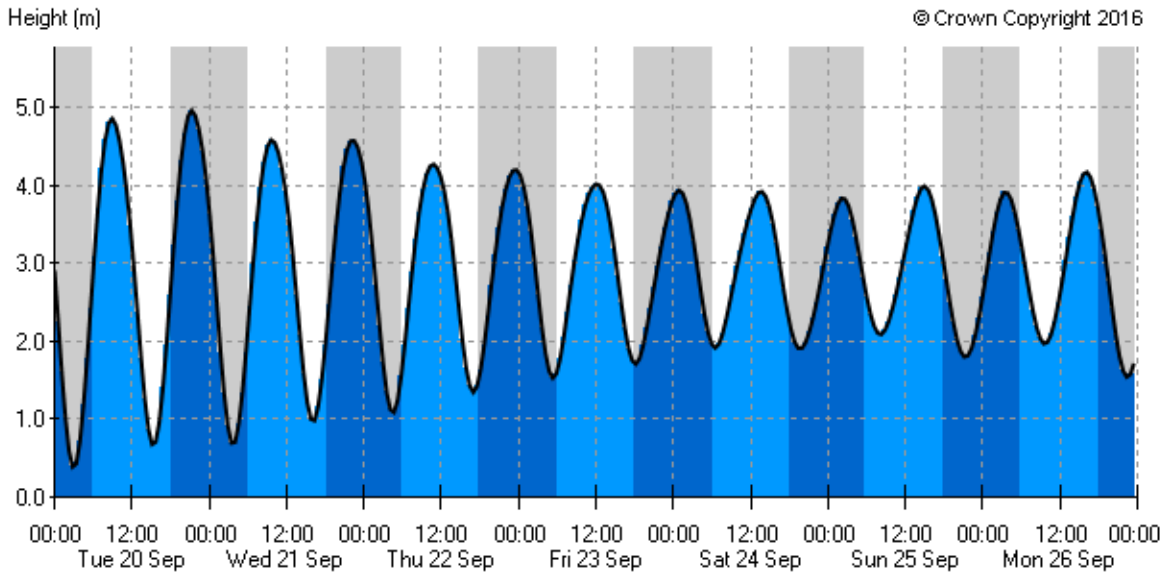
Outlook for the following 24 hours:

Wind	South or southeast, veering southwest for a time, 5 to 7, occasionally gale 8 at first.
Sea state	Moderate or rough, occasionally very rough at first to the west of the Outer Hebrides.
Weather	Rain, then showers.
Visibility	Good, occasionally poor.

Figure 1: Inshore forecast for Ardnamurchan Point to Cape Wrath and surge model residual forecast for Stornoway.

5. Tide Predictions

Issued by the UKHO Easytide online prediction for Stornoway



Note: the date shown underneath 12:00 on any given day is applicable to the previous and next periods of 12 hours

Tue 20 Sep			
LW	HW	LW	HW
02:59	08:53	15:19	21:17
0.4 m	4.9 m	0.7 m	5.0 m

Wed 21 Sep			
LW	HW	LW	HW
03:41	09:42	16:05	22:14
0.7 m	4.6 m	1.0 m	4.6 m

Thu 22 Sep			
LW	HW	LW	HW
04:27	10:43	16:58	23:28
1.1 m	4.3 m	1.4 m	4.2 m

Fri 23 Sep		
LW	HW	LW
05:20	12:07	18:05
1.5 m	4.0 m	1.7 m

Sat 24 Sep			
HW	LW	HW	LW
00:54	06:30	13:34	19:39
3.9 m	1.9 m	3.9 m	1.9 m

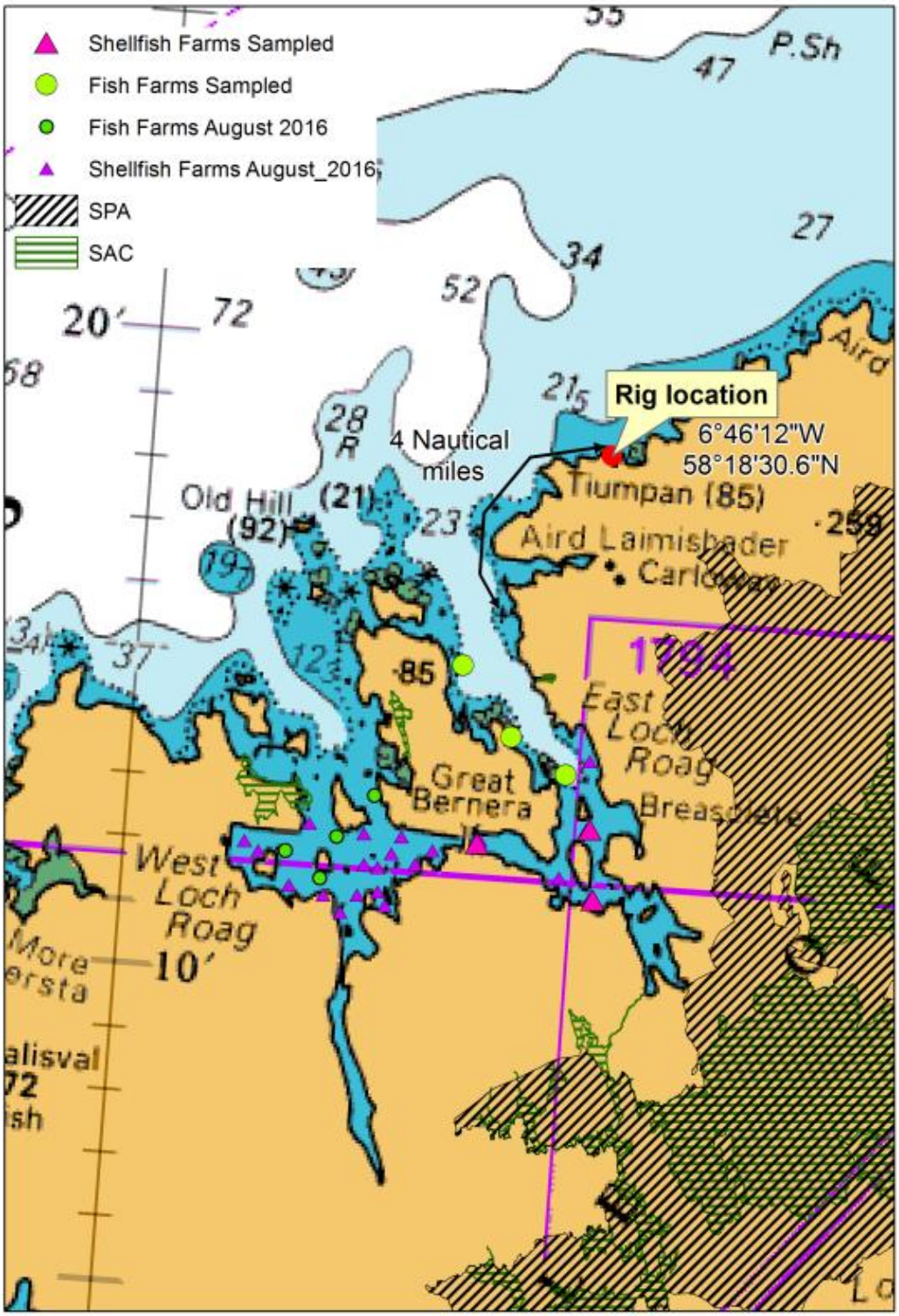
Sun 25 Sep			
HW	LW	HW	LW
02:16	08:05	14:55	21:18
3.8 m	2.1 m	4.0 m	1.8 m

Mon 26 Sep			
HW	LW	HW	LW
03:32	09:37	16:01	22:26
3.9 m	2.0 m	4.2 m	1.5 m

Predicted heights are in metres above Chart Datum

Figure 2: Seven day tidal prediction for Stornoway, Isle of Lewis.

6. Summary Map



Map 1: Summary of sensitivities in Loch Roag. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655.

Map 1 shows the location of the incident, associated sensitivities and aquaculture locations for the collection of shell and finfish samples .

7. Geography

Loch Roag to the Butt of Lewis trends SW to NE for a distance of approximately 27 nm. It is an extremely exposed stretch of coastline offering little protection from the prevailing weather conditions.

The main physical feature is Loch Roag trending NNW to SSE. The loch length is 7.5 nm with an area of approximately 68 km2 and a volume of 1,135.5 Mm3 (Edwards and Sharples, 1986). The tidal range is 3.6 m with a flushing time of 3.5 days. The estimated flux out of the system is 118,419 m3/yr.

The loch is split into East and West Loch Roag, the former with a larger area greater than 20 m depth. The 20 m contour is approximately 0.5 nm across East Loch Roag and extends back approximately 3 nm. However, the entrance to the loch is only slightly deeper than 20 m.

North towards the Butt of Lewis is a fairly uniform coastline comprising small bays and rocky foreshores (Figure 3). Southeast to the Butt of Lewis is Broad Bay with an area covering 28 km^2 (approximately 6 x 5 km). The distance to Broad Bay from the location of the incident is 40 nm.

Figure 3: Aerial snapshot of Dalmore Bay and the estimated location of the incident. Imagery ©2018 DigitalGlobe, Data SIO, NOAA, U.S Navy, NGA, GEBCO, TerraMetrics, Map data ©2018 Google.

8. Seabed

The seabed between East Loch Roag and the Butt of Lewis is principally composed of uneven bedrock and patches of boulders and cobbles on medium-coarse sand (Moore and Roberts, 2011). The substrate generally supports a low-diversity community, with crusts of coralline algae, Parasmittina trispinosa and Spirobranchus spp. coating the rock, which is heavily grazed by the high numbers of Echinus esculentus (CR.MCR.EcCr.FaAlCr). At most sites the community is supplemented by abundant or superabundant brittlestars, with either Ophiothrix fragilis or Ophiocomina nigra dominating locally (CR.MCR.EcCr.FaAlCr.Bri). The area is more exposed than is typical for such crust biotopes and this is reflected in the presence of an, albeit sparse, sponge fauna at some sites, including massive forms, such as Cliona celata and Pachymatisma johnstonia. Elevated tidal streams around the Butt of Lewis resulted in the profuse development of cushions of Corynactis viridis, as well as dense Alcyonium digitatum and brittlestars coating the rock (CR.MCR.EcCr.CarSp.Bri). There is an intrusion of deeper water off East Loch Roag. Sediment substrates are more prevalent here, mostly in the form of rippled fine-medium sand or waves of medium sand, which exhibit little visual evidence of

life (SS.SSa.CFiSa). Bedrock outcrops and areas of boulders and cobbles on sand supports a crust community, but this is enriched in places by dense Caryophyllia smithii, erect bryozoans including Porella compressa, Pentapora fascialis and Flustra foliacea, Corynactis viridis and a relatively diverse sponge fauna (CR.MCR.EcCr.CarSp.PenPcom and CR.MCR.EcCr.CarSp.Bri). None of the habitats recorded in this area are PMFs.

The following photographs (Figures 4-10) were collected during a previous MSS cruise and are representative of the seabed substrate in the immediate offshore area of the incident.

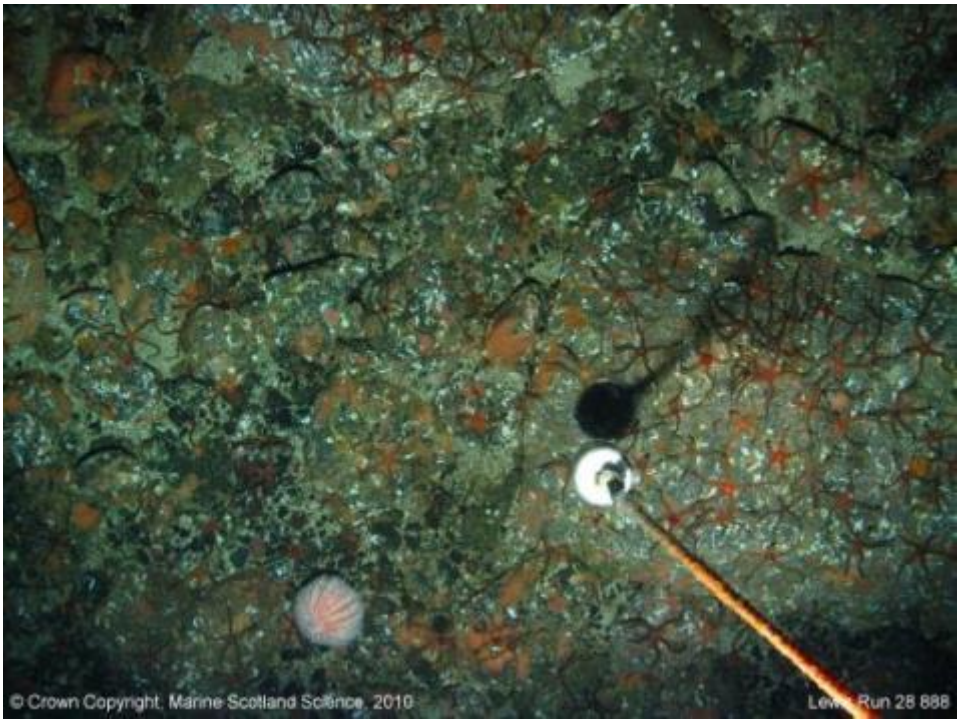


Figure 4: Seabed image typical for the area adjacent to the location of the incident.

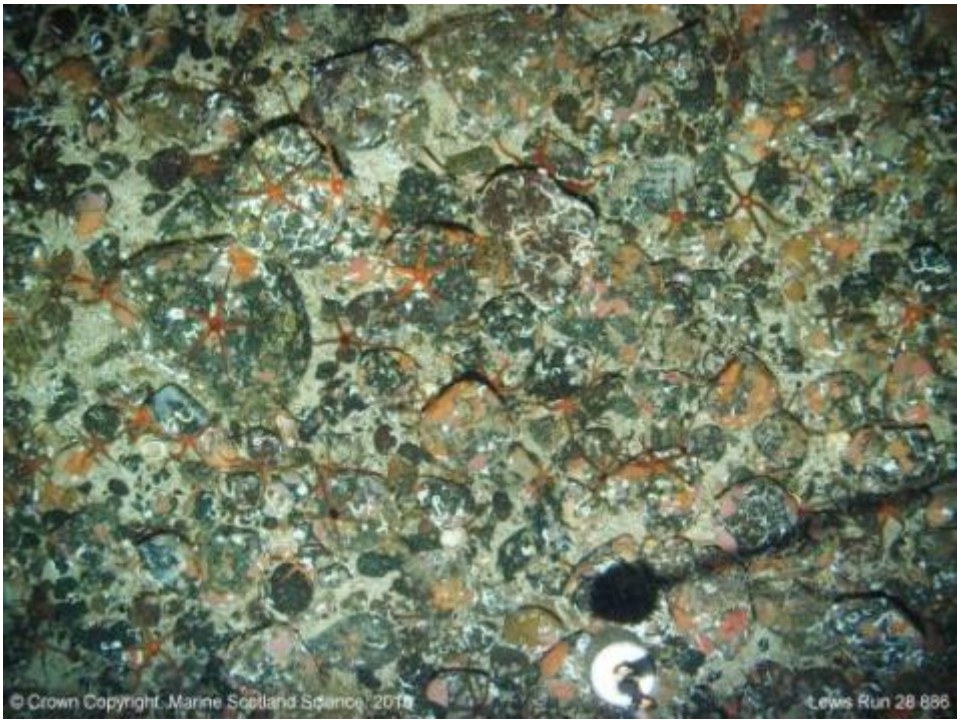


Figure 5: Seabed image typical for the area adjacent to the location of the incident.

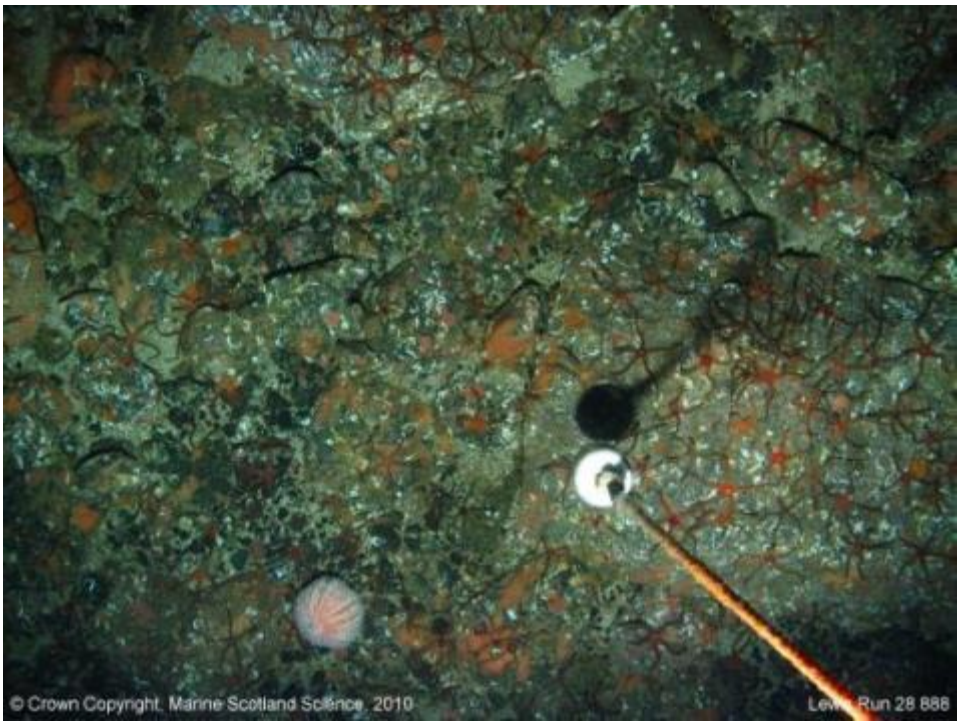


Figure 6: Seabed image typical for the area adjacent to the location of the incident.

Figure 7: Seabed image typical for the area adjacent to the location of the incident.

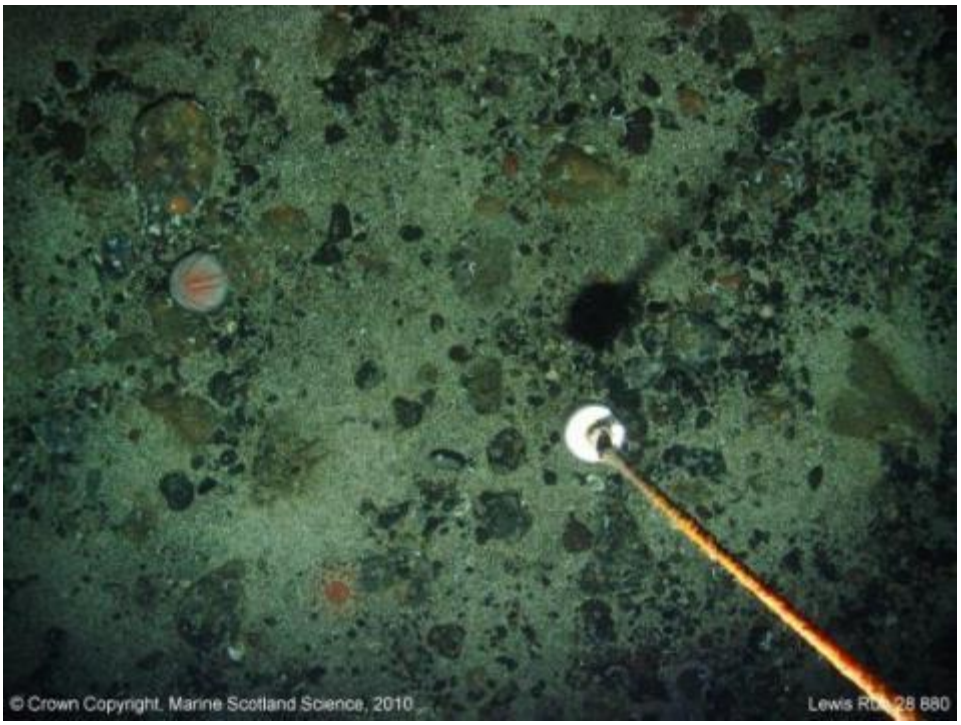


Figure 8: Seabed image typical for the area adjacent to the location of the incident.

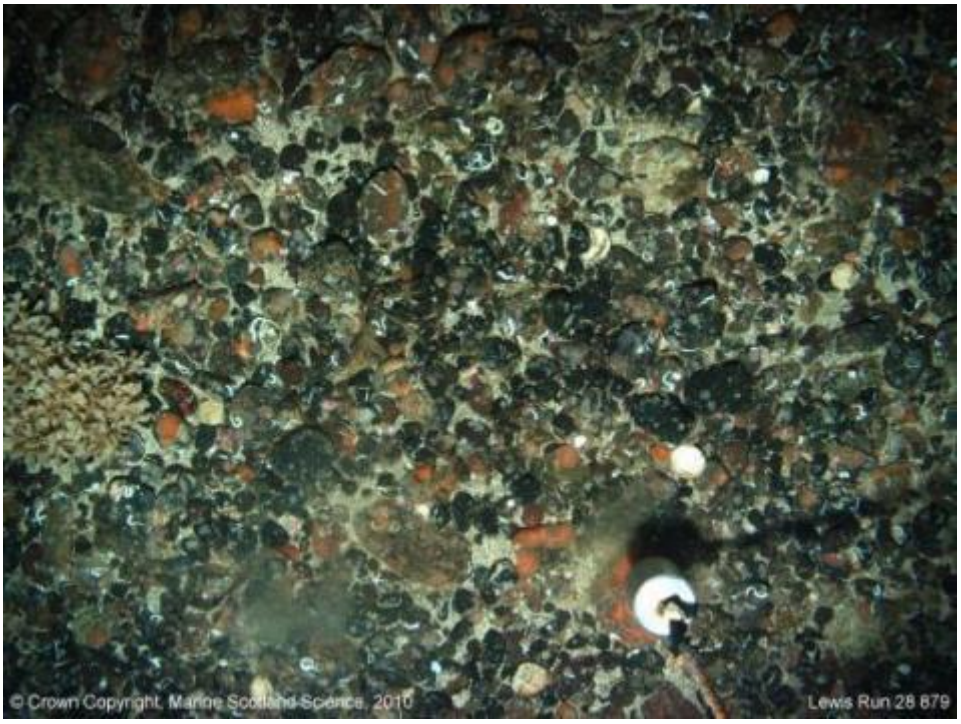


Figure 9: Seabed image typical for the area adjacent to the location of the incident.

Figure 10: Seabed image typical for the area adjacent to the location of the incident.

Broad Bay

Seabed video footage collected on behalf of Transocean from Broad Bay has been interpreted by Marine Scotland Science. The footage was collected using an ROV

and the interpretation is limited by the detail recorded. Typically the two video tows show a mixture of flat or rippled sand and mixed sediment habitats. The mixed sediment support a more diverse community of starfish and urchins and juvenile fish. Scallops could not be identified because of the detail provided by the video-footage. No evidence of *Nephrops* burrows was observed in the soft sediment. Logs of the seabed video-footage recording fauna and substrate are recorded in Appendix 7. The following photographs (Figures 11-13) were collected as part of the survey work conducted in Broad Bay.

Figure 11: Seabed image from the Broad Bay refuge location. Image provided by Oceaneering and Transocean (© Copyright Transocean)

Figure 12: Seabed image from the Broad Bay refuge location. Image provided by Oceaneering and Transocean (© Copyright Transocean)

Figure 13: Seabed image from the Broad Bay refuge location. Image provided by Oceaneering and Transocean (© Copyright Transocean)

9. Special Areas of Conservation

JNCC. [online] Available at: http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030255 and http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0017074 [Accessed 2016]

The Grimersta river and loch system (Langavat SAC) represents a high-quality salmon *Salmo salar* population in the Western Isles. The system has a high proportion of lacustrine rearing area for salmon, in contrast to their more usual preference for riverine conditions. These unusual habitat conditions are found elsewhere in the Atlantic salmon's range in Newfoundland and in parts of Iceland. Whilst there is considerable habitat diversity in the Grimersta, its overall productivity is limited by the oligotrophic conditions which are found throughout the system. Although a high proportion of the catchment is accessible to salmon, Grimersta's comparatively small size in relation to those on the mainland means that it only supports a small proportion of the Scottish salmon population, but it is the best salmon system in the Western Isles. Further to the south, the North Harris SAC also includes salmon as qualifying interest

Loch Roag Lagoons is a complex of silled lagoons illustrating the range of variation from freshwater to marine conditions on the Atlantic coast of the Hebrides. Tòb Valasay has a complex salinity regime, determined by the balance between fully marine water introduced over the sill and freshwater from run-off and small inlet streams. Its basins contain a diverse range of habitats, including rocky outcrops, boulders and muddy sand, with softer mud in the eastern basin, and boulders, cobbles and shell-gravel in the narrows. A range of communities are present, including beds of eelgrass Zostera spp. and tasselweed Ruppia spp., turfs of marine algae and stands of large brown algae. Loch Shader is a smaller lagoon that is mainly brackish in character. It has soft, sheltered mud and sand sediments, with some boulders and cobbles on the shore and in shallow water. These substrates support a characteristic range of species. The narrows consists of a bedrock and boulder sill, supporting a more diverse community with a variety of species, including kelp Laminaria spp., anemones and sponges.

10. Aquaculture Sites

The aquaculture sites in the immediate vicinity of the incident are contained within Loch Roag (Figure 1). There are a total of 27 active sites comprising seven finfish (Salmon) and 20 shellfish (mussel) farms. The majority of the finfish sites are

located in East Loch Roag while the shell fish sites are distributed around the top of West Loch Roag.

MSS has access to polycyclic aromatic hydrocarbon (PAH) temporal datasets ranging from 2014 to 2015 from an on-going monitoring programme conducted by Food Standards Scotland (Table 3). These include mussel samples collected from Loch Barraglom located at the top of Loch Roag. The analyses indicate typical levels of PAH given the location of the sampling sites and the absence of anthropogenic sources of PAH local to the area.

Site Name	**Loch Barraglom**	**Loch Barraglom**
SIN	**LH-185-120-08**	**LM 185 120 08**
NGR	**NB16673413**	**NB 1667 3417**
Collection Date:	**10/02/2015**	**17/02/2014**
Units	**ug/kg whole weight**	**ug/kg whole weight**
acenaphthylene	0.11	<0.06
acenaphthene	<0.3	<0.61
fluorene	<0.29	<0.68
phenanthrene	0.74	<1.11
anthracene	0.06	<0.08
fluoranthene	0.77	0.63
benzo[c]fluorene	0.04	0.04
pyrene	0.69	0.47i
benzo[ghi]fluoranthene	0.38	0.22
benz (a) anthracene	**0.16**	**0.14**
benzo[b]naphtho[2,1-d]thiophene	0.04	0.04
cyclopenta[c,d]pyrene	0.01	0.02
chrysene	**0.31**	**0.31**
5-methylchrysene	<0.01	<0.01
benzo[b]fluoranthene	**0.64**	**0.45**
benzo[j]fluoranthene	0.21	0.17
benzo[k]fluoranthene	0.21	0.15
benzo[e]pyrene	0.85	0.50
benzo[a]pyrene	**0.10**	**0.07**
indeno[1,2,3-cd]pyrene	0.30	0.19
dibenz[ah]anthracene	<0.04	<0.04
benzo-[g,h,i]perylene	0.43	0.26
anthanthrene	<0.1	<0.1
dibenzo[a,l]pyrene	<0.1	<0.1
dibenzo[a,e]pyrene	<0.11	<0.1
dibenzo[a,i]pyrene	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1
coronene	0.18	<0.1
PAH 4 Sum Lower ug/kg	**1.21**	**0.97**
PAH 4 Sum Upper ug/kg	**1.21**	**0.97**

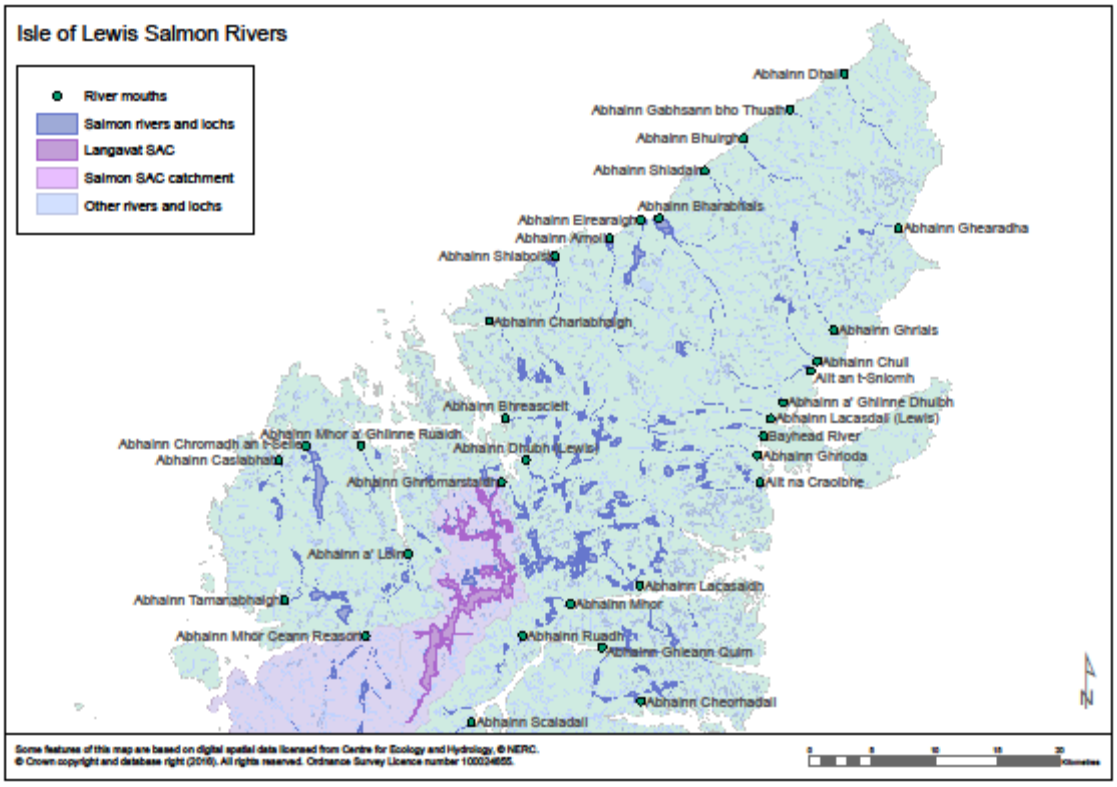
Table 3: Polycyclic aromatic hydrocarbon concentrations for mussel samples collected from aquaculture sites located in Loch Roag in 2014 and 2015.

11. Diadromous Fish

Salmon and sea trout occur in all the larger streams discharging onto the Lewis coastline and eels are also widely distributed.

The rivers containing salmon and the distribution of salmon within them are shown in Map 2. Adult salmon mainly return over the summer and autumn and salmon returning from sea feeding grounds in the North Atlantic. The distribution of sea trout in the rivers is similar to that of salmon but includes smaller coastal streams. The feeding grounds for the sea trout are believed to be relatively local to the natal rivers and streams and include both sea lochs and more open coast.

During the course of the incident there have been no reports received of issues related to diadromous fish.



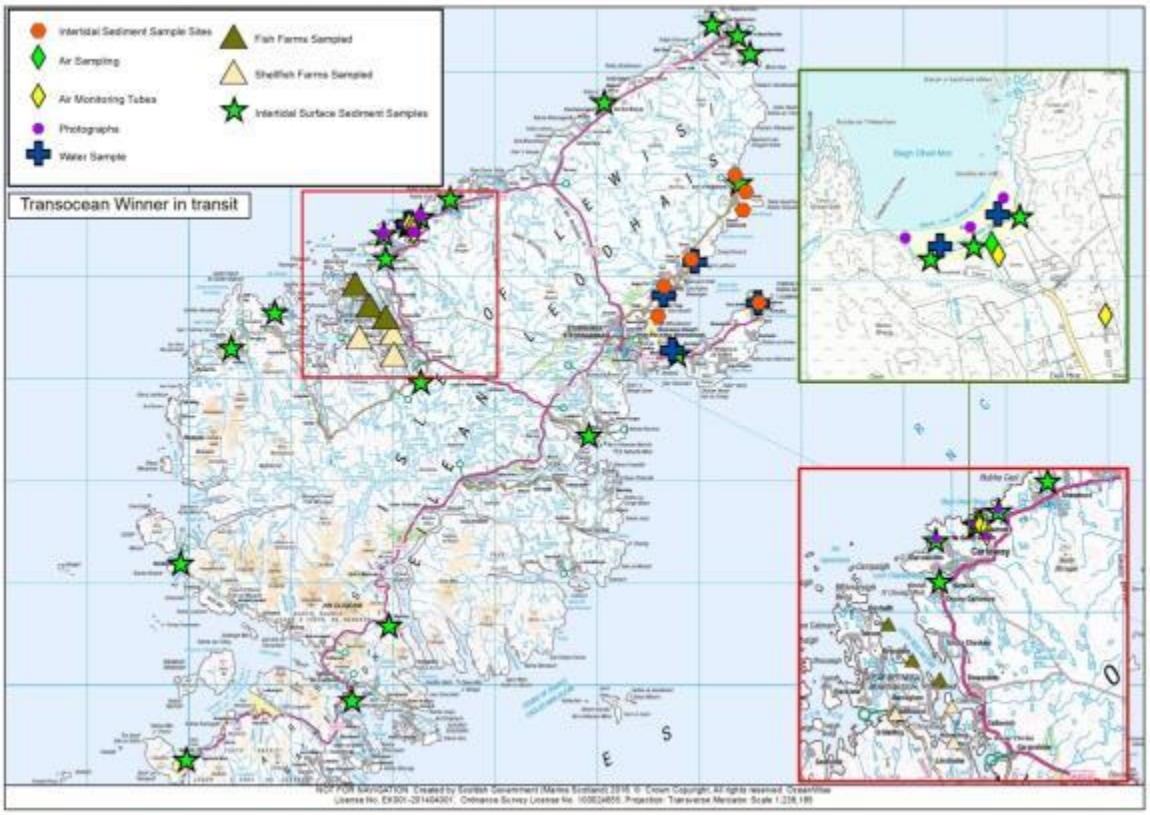
Map 2: Location of Salmon rivers on the Isle of Lewis. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655.

12. Cabling and Pipelines

There are no pipelines, power or telecommunication cables in the immediate vicinity of the incident.

13. Survey Results (see Appendix 5)

Map 2 below shows the location of the baseline survey samples collected during the management of the incident.



Map 3: Summary of baseline sampling locations on the Isle of Lewis. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655.

SEPA

SEPA collected two water samples on 9 August 2016 from Dalmore Bay. The results show the presence of weathered diesel but no trace indicative of hydraulic oils. An additional four samples were collected on 23 August 2016 from Broad Bay and are awaiting analysis.

SEPA carried out short term ambient air monitoring in the vicinity of the rig on 11, 12 and 13 August. The results of the monitoring are detailed in the Appendix 5. Longer term diffusion tubes were deployed on 16 August and will be analysed following the recommended exposure time of 14 days.

SEPA collected four water samples on 7 September 2016 from Broad Bay. The analytical results show no detectable oil in the samples.

Three additional water samples were collected by SEPA on 24 October 2016 from Portnaguran, Traigh Ghrais and Traigh Chuil. Each water sample recorded a total hydrocarbon concentration of < 0.5 mg/l.

MSS

The muscle and the liver of salmon collected on 11, 16,17 and 23 of August 2016 from three fish farms in Loch Roag were analysed for PAHs. Flesh from mussels were also collected from three farmed sites in Loch Roag and analysed for PAHs.

Mussels

- Although MSS look at a different suite of PAHs compared to FSS, the concentrations are similar to what is seen in the FSS historic shellfish data from Loch Roag.
- PAH concentrations in shellfish are seasonal and you would expect concentrations to be lower in August compared to winter.
- From previous MSS published worked Total PAH concentrations < 50 ug/kg wet weight would be considered low.
- Total PAHs were 9.97, 10.0 and 7.67 ug kg^{-1} wet weight for samples collected on 10 August 2016.
- Total PAH concentrations were 6.63, 5.18 and 7.65 µg kg^{-1} wet weight for samples collected on 16 August 2016.
- Total PAH concentrations were 6.36, 7.06 and 9.17 µg kg^{-1} wet weight for samples collected on 23 August 2016.
- The PAH concentrations are similar for different samples and what might be expected for farmed mussels collected from a clean site in August.
- *n*-alkane profiles for all samples collected showed no evidence of petrogenic contamination.

Salmon

- Total PAH concentrations in the salmon muscle collected on 11 August 2016 were 4.45, 10.62 and 32.99 µg kg^{-1} wet weight in the muscle and 48.65, 7.71, 14.28 µg kg^{-1} wet weight in the liver.

- Total PAH concentrations in the salmon muscle collected on 16/17 August 2016 were 9.69, 27.02 and 12.0 µg kg^{-1} wet weight. In two of the liver samples all PAHs were below the detection limit and in the third all but one PAH was below the detection limit.
- Concentrations were similar to farmed salmon muscle from reference sites. Following the *Braer* incident in 1993 reference farmed Shetland salmon, collected out with the Exclusion zone, were analysed for PAHs. Total PAH concentrations (2- to 6-ring parent and alkylated) in farmed salmon muscle tissue ranged from 9.0-83.0 µg kg^{-1} wet weight, with a mean of 29 µg kg^{-1} wet weight. In addition a control salmon (Shetland) muscle sample was analysed for PAHs alongside the 2^{nd} round of salmon samples. The total PAH concentration in this sample was 11.9 µg kg^{-1} wet weight.
- Total PAH concentrations in the salmon muscle collected on 23 August 2016 were 6.36, 7.06 and 9.17 µg kg^{-1} wet weight and typical of what you might expect for farmed mussels collected from a clean site in August.
- The control farmed salmon (muscle tissue only) from Shetland analysed at the same time gave a total PAH concentration of 10.50 µg kg^{-1} wet weight. One of the salmon (Eughlam) had been gutted before sending to MSS and, therefore, there was no liver sample. PAH concentrations in the two liver samples received were below the detection limit. PAH concentrations in the salmon muscle sampled on 23 August 2016 were low and similar to the two previous sampling occasions, with total PAH concentrations of 3.73, 9.83 and 8.67 µg kg^{-1} wet weight. The control farmed salmon (muscle tissue only) from Shetland analysed at the same time gave a total PAH concentration of 10.50 µg kg^{-1} wet weight. One of the salmon (Eughlam) had been gutted before sending to MSS and, therefore, there was no liver sample. PAH concentrations in the two liver samples received were below the detection limit.
- Concentrations for all samples collected were low in both the muscle and the liver with a number of PAH compounds being below the limit of detection.
- *n*-alkane profiles for all salmon samples collected for both the muscle and the liver showed no evidence of petrogenic contamination.
- In addition the sensory assessment of the salmon collected on 11, 16/17 and 23 August 2016 showed no evidence of petrogenic taint.

Tables containing all the mussel and salmon results to date is located in Appendix 5.

XODUS

Transocean engaged the services of XODUS to conduct an intertidal survey for surface sediments from 21 sites located around the Isle of Lewis from 11 to 15 August 2016. The samples were analysed for a suite of parameters including hydrocarbons, metals, particle size and total organic carbon. The sampling and analytical results documents are recorded as confidential and privileged and are not included in this document. An additional seven surface sediment samples were collected on 23 August 2016 from Broad Bay and will be analysed for the same parameters as described above.

Copies of the documents can be requested from Transocean Ltd.

RSPB

The RSPB has undertaken a bird survey along 33 km of coastline within 15 km of Dalmore Bay. No oiled birds were identified and the full report is located in Appendix 5.

14. Modelling (see Appendix 3)[1]

The predictions were done using the GNOME oil spill modelling tool, with forecast currents from the UK Met Office's Atlantic Margin Model, and winds from a NASA forecast product. The splots in the water are marked as black and the ones on the beach in red. Particles were released from 10 am 8 August 2016 for 24 hours following them for five days. The model was run assuming the total loss of 280 tonnes of diesel and used surface currents .

Based on the results of the simulations, as well as MSS knowledge of the general circulation of the region and the winds, it is likely that oil would reach the nearby coast including the entrance to Loch Roag before being transported to the NE over the coming days (Figures 14 to 16).

Tidal currents (from the OSU Tidal Prediction System) are predominantly parallel to the coastline except at the loch entrance where they would be parallel to the loch

[1] Any modelling-based forecasts produced should be treated with caution, interpreted with the help of specialists, and response/decision-making should not be based solely on modelling results. As with any model, results are dependent on the quality of the inputs used (e.g. environmental parameters and scenario inputs). If the same scenario was conducted in another model, with identical parameters and inputs, the results may show a degree of variance. This is expected as there will be differences between models. Model forecasts are very useful tools but no model can be expected to predict the future with 100% accuracy.

axis, and the residual (non-tidal) circulation is generally directed to the NE along the coast. Moreover, it seems wind conditions currently are from the NW until Tuesday sometime, pushing the oil onshore. With the high gale force winds the wind-driven circulation will dominate over the residual and tidal flow until the wind eases off by Tuesday. The simulations were run using diesel, a non-weathering release and with predicted winds and currents. Modelled output at two hourly is included in Appendix 3.

The majority of the diesel modelled migrates towards the NE tracking close to the coastline. Residual amounts of diesel migrate into East Loch Roag, identifying the farm sites in this area as a priority for baseline sampling. Figure 14 below summarises the modelled output over a 4.5 day period.

Based on the forecast for the next few days, modelling the diesel release from the incident has been extended from 10:00 on 11/08/2016 and shows the diesel migrating NE along the coast and then eastward into the northern part of the Minch. There is no SW migration towards Loch Roag. Figures 15 and 16 below summarise the modelled output over 4.5 day periods ending 00:00 on 20/08/2016.

08 Aug 2016 00:00 to 13 Aug 2016 00:00

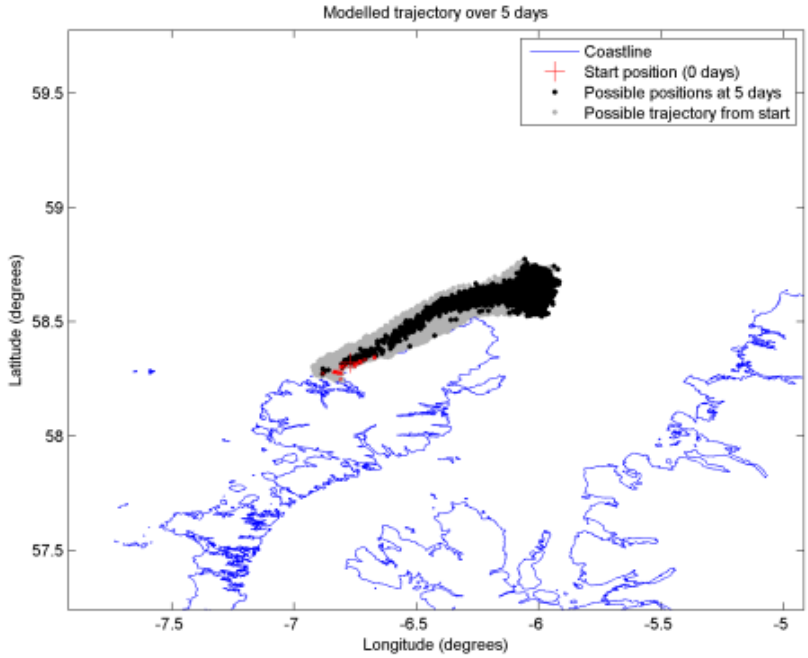


Figure 14: Oil spill predictions using GNOME modelling tool 8 August 2016 00:00 to 13 August 2016 00:00. Provided by Marine Scotland Science.

11 Aug 2016 10:00 to 16 Aug 2016 00:00

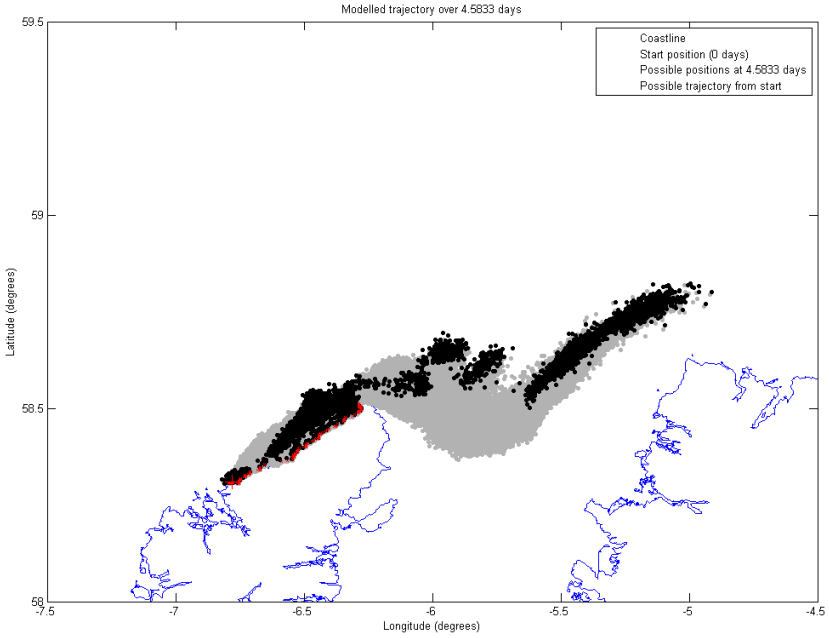


Figure 15: Oil spill predictions using GNOME modelling tool 11 August 2016 10:00 to 16 August 2016 00:00. Provided by Marine Scotland Science.

15 Aug 2016 06:00 to 20 Aug 2016 00:00

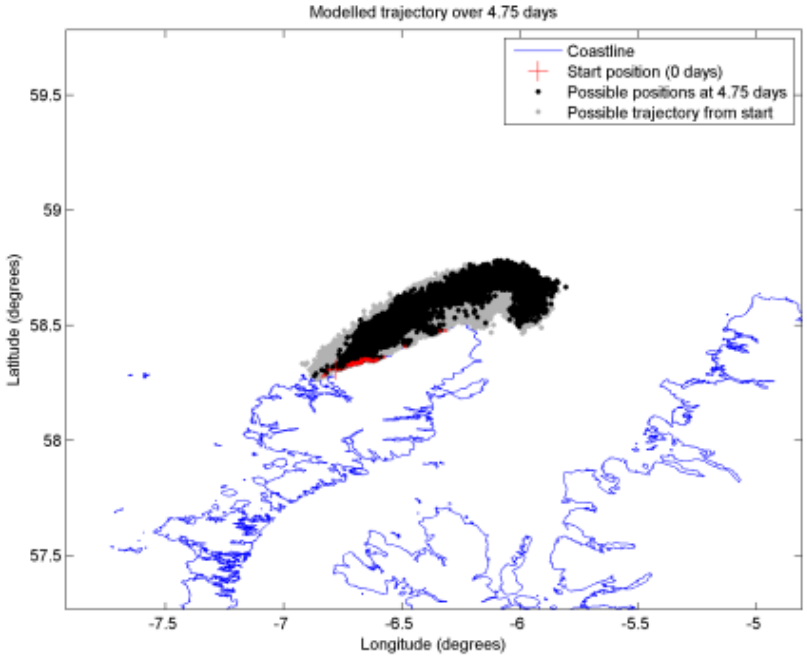


Figure 16: Oil spill predictions using GNOME modelling tool 15 August 2016 06:00 to 20 August 2016 00:00. Provided by Marine Scotland Science

The model was repeated using the same software, with forecast currents from the UK Met Office's Atlantic Margin Model, and **consistent winds from the NE at 30 knots**. The splots in the water are marked as black and the ones on the beach in red. Particles were released from 10:00 August 8 for 24 hours following them for five

days. The total inventory of diesel (280 m3) was released using surface currents. The particles are transported to the SW as far as the mouth of western Loch Roag.

The worst case for Loch Roag would be winds from the NE (transporting particles towards the mouth of Loch Roag) followed by a change in wind direction with winds from the NW which would then push the particles into the loch. The output looks similar for consistent winds at 10 and 20 knots. Figure 17 below shows the worst case modelled output after 4.5 days applying a 30 knot NE wind.

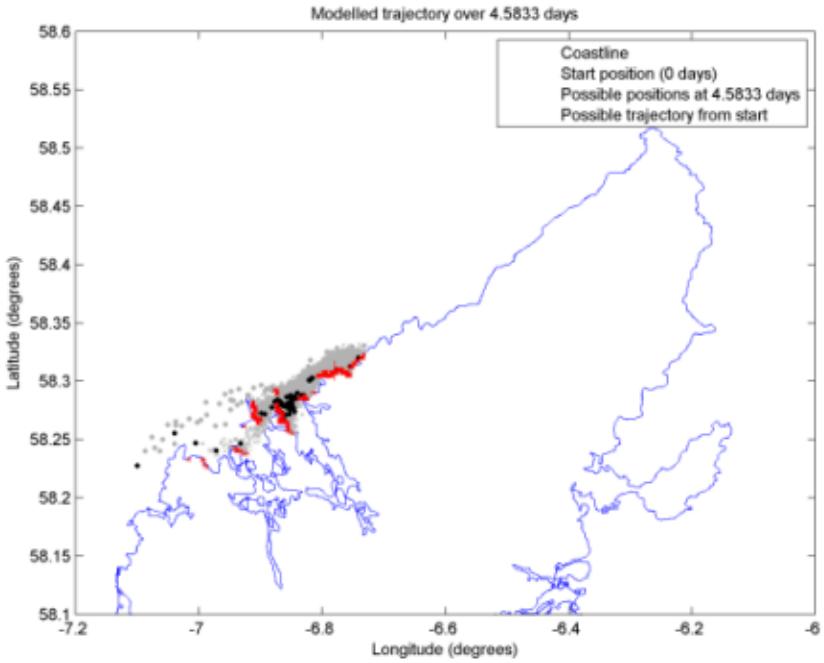


Figure 17: Forced oil spill predictions using GNOME modelling tool to determine the conditions resulting in the spill migrating to Loch Roag. Provided by Marine Scotland Science

The simulation for Broad Bay uses the same model applied to the earlier modelling for Dalmore Bay. Figure 18 shows a diesel spill of 40 m^3 released over ten hours with the model run for two days. The spill shows some initial beaching towards the south but then moves north, impacting the shore, and then off to the northeast side of Lewis onto open waters past the north Minch. The spill migration is consistent with S or SE winds used in the modelling.

24 Aug 2016 17:00 to 26 Aug 2016 17:00

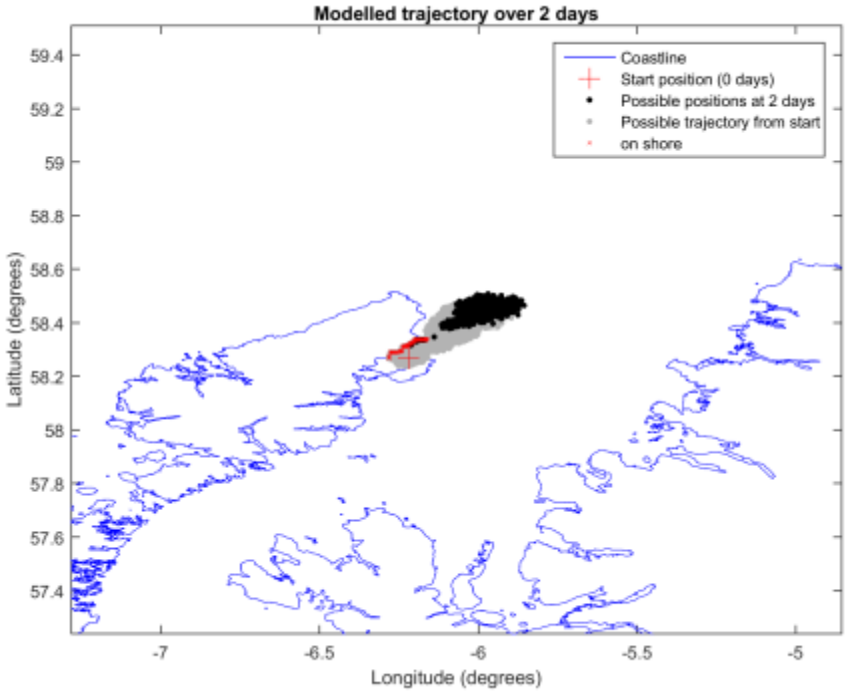


Figure 18: Oil spill predictions using GNOME modelling tool 24 August 2016 17:00 to 26 August 2016 17:00. Provided by Marine Scotland Science

Additional modelling has also been undertaken by the MCA for spills released in Dalmore Bay and Broad Bay. The migration of the plumes follows similar trends to those shown by the modelling conducted by MSS (see Appendix 3).

15. Risk Assessment

The main hazard associated with the incident is the diesel on-board the rig located in four midships compartments totalling 280 tonnes. Two compartments are in-tact, however, two compartments have been breached. The diesel lost is estimated at 53 m3. In order to mitigate any further losses the remaining diesel has been pumped to tanks above the water line in readiness for pumping off the rig prior to any attempt of refloating. Although a sheen on the water adjacent to the rig has been observed from land, its origin and composition have yet to be confirmed. Also contained on-board the rig are additional fluids principally for hydraulic purposes and lesser amounts of monoethylene glycol (see Appendix 2). Table 4 below provides an ecotoxicological summary of the additional fluids that account for 95% of the total additional fluids on the rig (see Appendix 1). The entries on the table below indicate that the additional fluids are non bioaccumulative and will biodegrade.

Chemical	Volume (L)	%	Cum %	From Chemical Data Sheets
Diesel Fuel	190,000	75.1	75.1	
Castrol - BioBar 46	19,400	7.7	82.8	High quality mineral oil. Insoluble in water. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.
Castrol - MHP 154	10,805	4.3	87.1	High performance lubricant. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.
3% Stack Magic, 5% MEG, 92% water	10,000	4.0	91.0	We believe “Stack Magic” is an environmentally safe Blow Out Preventer (BOP). It is water-based and designed to be allowed to be discharged to the marine environment. Data Sheet being located. There is no evidence to assume this chemical is hazardous. 5% MEG; We assume this is monoethylene glycol, but this should be confirmed. According to the MSDS from Sigma Aldrich (attached), MEG is classified as “harmful” and is toxic to kidneys on repeated exposure. It also: is miscible in water is not bioaccumulative or persistent has a Predicted No Effect Concn of 1 mg/L for marine waters has a Predicted No Effect Concn of 3.7 mg/L for marine sediment has a Predicted No Effect Concn of 10 mg/L aquatic intermittent release 10,000 L of the mixture at 5% v/v = 500 L of MEG @ 1.113 g/cm3 (20° C) = 556 kg. It needs to be dissolved in more than 556,000 m3 of water to be below the PNEC. This is a patch 1m deep and approx.. 700m by 700m – possibly reached within 2-3 hours of natural dispersion in a west coast tidal environment. We are not sure how the 1 mg/L PNEC was derived, as the toxicity data in the MSDS looks much less concerning: the fish 7-day NOEC is 32,000 mg/L and the 48-hr NOEC for daphnia is 24,000 mg/L. See MEG data sheet
Castrol - Alpha SP 100	3,656	1.4	92.5	High quality mineral oil. Insoluble in water. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.
Castrol - Alpha 46	2,800	1.1	93.6	High quality mineral oil. Insoluble in water. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.
Castrol - BioBar 22	1,980	0.8	94.4	High quality mineral oil. Insoluble in water. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.
Castrol - Alpha SP 150	1,893	0.7	95.1	High quality mineral oil. Insoluble in water. Ecological Information - Not classified as dangerous. Not expected to bioaccumulate. Will biodegrade.

Table 4: Ecotoxicological assessment of the additional fluids that account for 95% of the total additional fluids on the Transocean Winner rig.

The rig contains a significant quantity of diesel, however, diesel is made up of light volatile compounds that will almost completely evaporate in the first few days of a spill. Also the prevailing weather conditions associated with the site will contribute significantly to the dissolution and spreading of the diesel and its subsequent

degradation. Many of the additional fluids recorded in the above table are derived from aggregated volumes. Consequently any losses from specific sources would be of smaller volumes and unlikely to be released instantaneously reducing their exposure to the marine environment in the event of a spill.

The primary concern associated with the incident has been identified as the impact of diesel on the aquaculture sites in Loch Roag. As a precaution the Environment Group has advised that shellfish and finfish sites will be sampled to establish baseline concentrations for diesel, if this is required. The sites identified are:

Shellfish:
Loch Roag – Ceabhagh (LH-381-772-08) sample point NB20013450
Loch Roag – Eilean Chearstaigh (LH-344-791-08) sample point NB 20093245
Loch Roag – Barraglom (LH-185-120-08) sample point NB 16703410

Finfish:

Site ID	FS0752
Site Name	Taranaish
Address	East Loch Roag Breasclete Pier, Breasclete Isle of Lewis
Postcode	HS2 9DY
Operator	The Scottish Salmon Company
Date Last Updated	02/08/2016 04:32:09

Site ID	FS1233
Site Name	Eughlam
Address	Breasclete Pier Breasclete Isle of Lewis
Postcode	HS2 9ED
Operator	The Scottish Salmon Company
Date Last Updated	02/08/2016 04:32:09

Site ID	FS1091
Site Name	Vacasay
Address	Breasclete Pier Breasclete Isle of Lewis
Postcode	HS2 9DY
Operator	The Scottish Salmon Company
Date Last Updated	02/08/2016 04:32:09

However, for the reasons described above regarding the behaviour of diesel in the marine environment and the dominant migration of a spill towards the NE, the risk to the Loch Roag aquaculture industry will be low. The distance to Dalmore Bay from the location of the incident is approximately 0.3 nm and is 12 times closer than the entrance to Loch Roag.

The low risk is supported by two water samples from Dalmore Bay collected and analysed by SEPA which have shown low concentrations of weathered diesel and no evidence for hydraulic fluids. Also no additional chemicals of concern were detected in the GCMS screens undertaken. Mussel and salmon samples collected from Loch Roag have shown concentrations of PAH typical of clean farmed sites, and based on the n-alkane profiles, no evidence of petrogenic (diesel) contamination.

The aquaculture operators working out of Loch Roag have been contacted by MSS and kept up to date as the incident has developed. Standard mitigation to reduce the risks will be implemented by the finfish farmers by reducing the movement of salmon to the sea surface through the temporary reduction of their food supply. The majority of the shellfish farmers are located at the top of West Loch Roag, the furthest point from the potential entry of diesel into East Loch Roag.

Prior to refloating the rig 242 m^3 of diesel/water mix were safely transferred to the supply vessel Olympic Orion. The removal of such a significant proportion of the diesel inventory greatly reduces the hazard posed by the rig to the marine environment. The residual diesel on board the rig is approximately 57.6 tonnes split between four reservoirs, the largest being 25.8 tonnes. The rate of residual diesel consumption is estimated at 0.7 tonnes per day for the operation of generators and machinery.

16. Port of Refuge

The port of refuge identified for the Transocean Winner once re-floated will be Broad Bay. The bay is located approximately 80 km from the incident and provides a broad entrance of approximately 5.5 km between Creag Fhraoch and Rubna Meadhonach. The sea bed area >20 m depth of water within the bay is 15 km^2. The bay contains or is adjacent to a number of conservation designations (see Map 3 and Table 5 below).

The NE Lewis MPA protected features are Risso's dolphins, sand eels, quaternary glaciated channel/troughs, landscape of areal glacial scour, megascale glacial lineations and marine geomorphology of the Scottish shelf seabed - longitudinal bedform field.

The sand eel grounds identified do no coincide with Broad Bay. Risso's dolphin adjusted densities are between 0 to 0.05 (lowest scoring) for Broad Bay but can be >5 for the MPA. Broad Bay does coincide with a seabed of glacial scour, however,

this feature extends around the Isle of Lewis. Broad Bay does not coincide with glaciated channels or troughs or megascale glacial lineations.

The Tong Saltings SSSI is designated for breeding bird assemblages, mudflats, salt marsh and sand dunes. Map 1 below shows the SSSI extending down to the bay foreshore with the mud flats and salt marshes connected to the marine environment by an estuary located on the northern margin of the site.

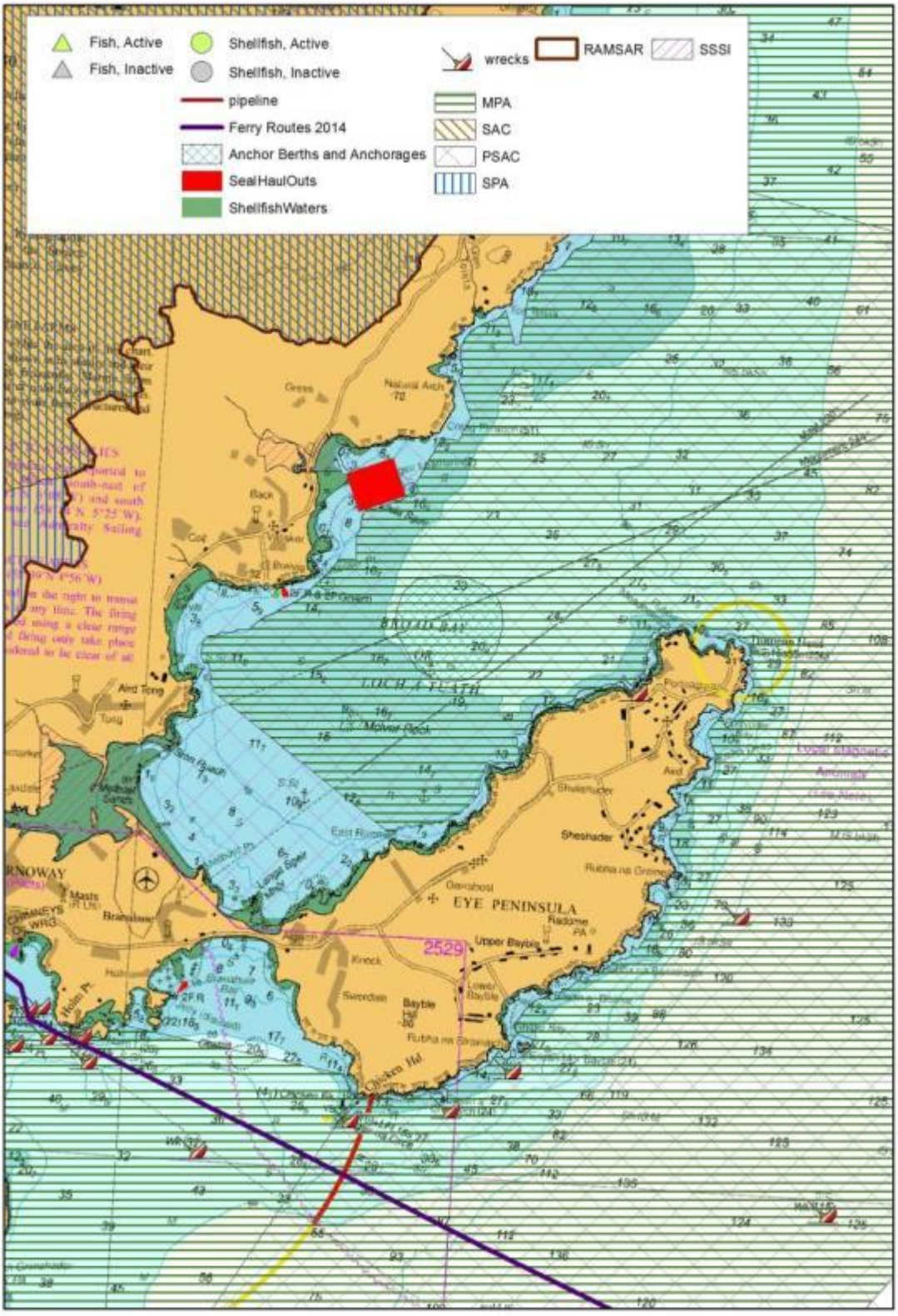
Prior to the relocations of the Transocean Winner Rig the majority of the diesel and hydraulic fluids will be removed. This greatly reduces the volume of potential pollutants on the rig that could enter Broad Bay. The prevailing weather conditions will take any fluids lost away from land and the SSSI. Since the rig will be located in a quiescent environment and protected from westerly and south-westerly winds, boom deployment will be more manageable adding to the mitigation in the unlikely event of a spill.

The hazard posed by the rig located in Broad Bay to the breeding bird assemblages associated with the Lewis Peatland SPA and Ramsar sites will also be reduced by the removal of diesel and additional fluids prior to re-floating. This will significantly reduce the potential pathway for exposure of the breeding birds to the residual pollutants on the rig.

Mobile commercial fishing within Broad Bay is prohibited. However, static gear can be deployed with the highest fishing activity associated with Nephrops, crab and lobster. Implementation of a temporary exclusion zone around the rig in Broad Bay could displace fishing activities. However, the displacement will be temporary while the necessary survey/maintenance work is conducted on the rig prior to passage on to its final destination port. The use of a 1000 m TEZ would cover 3.14 km^2 of the bay which is approximately 15 km^2 below the 20 m contour and also contains a charted anchorage.

The bay does not have any active aquaculture sites, pipelines, cables, wrecks or ferry routes.

The temporary nature of the refuge site, removal of diesel and additional fluids prior to re-floating and the limited activities currently active within Broad Bay should all contribute to reducing the potential interaction with the conservation designations and other legitimate users associated with the bay. The protected nature of the bay from prevailing weather conditions will also enable effective boom deployment to protect the bay in the unlikely event of a spill occurring.



Map 4: Summary of sensitivities in Broad Bay. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655

Physical	Value
Distance from incident km	80
Area of refuge based on >20 m contour km2 (bay entrance from Creag Fhraoch to Rubna Meadhonach)	15
Nearest land fall relative to anchorage	5
Width of entrance to refuge area km	5.5
Orientation of refuge (facing N,NE, E etc)	NE
Spill migration based on SW wind	NE

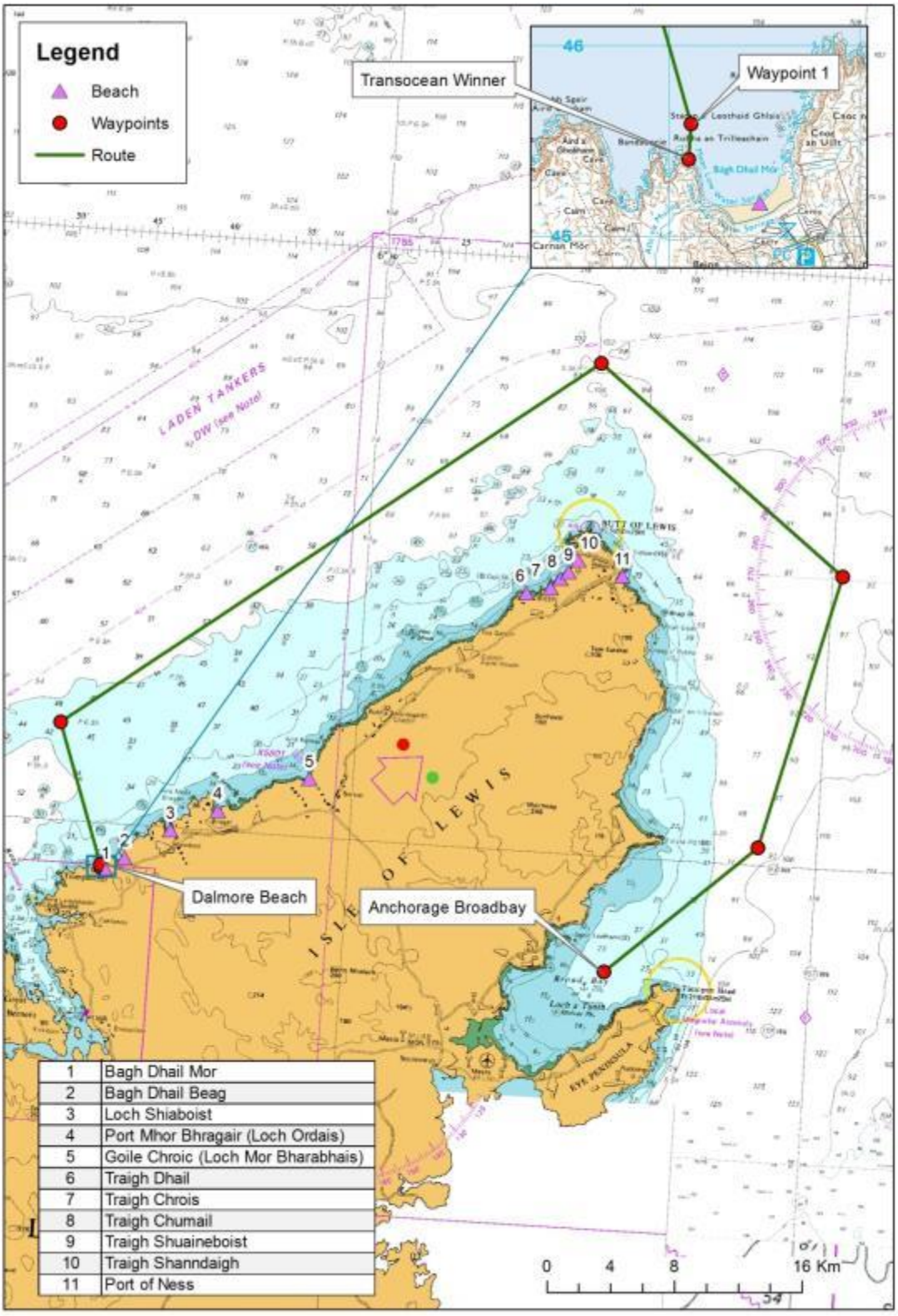
Designation	Protected Species and Habitat
MPA: NE Lewis	Risso's dolphins, sand eels, seabed bedforms and glacial features
pSAC	Harbour porpoise
SPA: Lewis Peatlands	Breeding site for Red and Black Throated Divers, Greenshanks and Golden Plovers
SSSI: Tong Saltings	Breeding bird assemblage, mudflats, salt marsh and sand dunes
Ramsar: Lewis Peatlands	Breeding bird assemblage

Other Designations	Absent or Present
Shellfish water designations	Absent
Seal haul out sites	Present

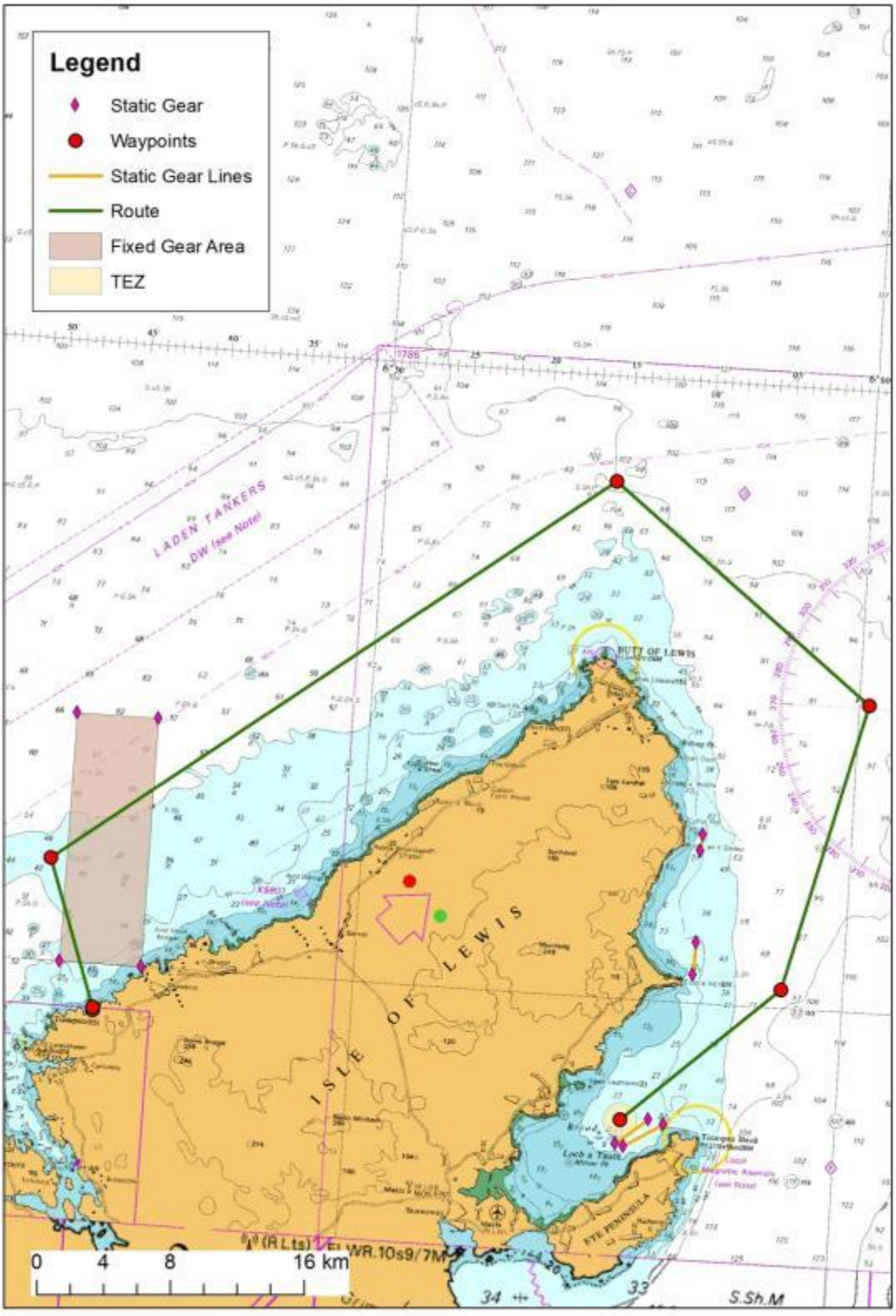
Activity	Absent or Present
Aquaculture	Absent
Pipelines and Cables	Absent
Commercial Fishing	Present ~15 based vessels (Scotmap). Highest activity from Nephrop trawls and crab/lobster static gear Broad Bay closed to trawling
Anchorages	Present
Ferry Routes	Absent
Wrecks	Absent

Table 5: Summary of physical properties, activities and potential sensitivities associated with Broad Bay.

The passage plan from the Dalmore Bay to Broad Bay is shown in Map 5 below. The rig will be towed approximately 10 km offshore around the coastline of Lewis to Broad Bay in waters that are typically >50 m in depth. The total distance is approximately 54 nm (100 km). The duration of the passage is estimated to be between 21.5 to 13.5 hrs based on a towing speed of 2.5 to 4 knots respectively. During passage the TEZ around the rig will increase to 750 m.



Map 5: Passage plan for the Transocean Winner rig from Dalmore Bay to Broad Bay. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655



Map 6: Static gear locations in relation to the proposed passage plan for the Transocean Winner rig. NOT FOR NAVIGATION. Created by Scottish Government (Marine Scotland) © Crown copyright and database right (2017), all rights reserved. OceanWise licence No. EK001-20140401. Ordnance Survey licence No. 100024655

Map 6 shows the location of commercial fishing using static gear in relation to the proposed passage plan for the Transocean Winner Rig to Broad Bay.

17. References

Edwards, A. and Sharples, F (1986) Scottish Sea Lochs: a Catalogue., Scottish Marine Biological Association/Nature Conservancy Council 250pp.

Moore, C. G. and Roberts, J. M. (2011). An assessment of the conservation importance of species and habitats identified during a series of recent research cruises around Scotland*. Scottish Natural Heritage Commissioned Report No. 446.*

18. Acknowledgments

The completion of this document would not have been possible without the assistance and support provided by a number of dedicated people and organisations:

Marine Scotland

Dr Lynda Webster, Dr Craig Robinson, Dr Marie Russell and Mr Eric Delgano for preparing, analysing and reporting on the farmed mussel and salmon samples collected from Loch Roag

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SEPA for sharing their analytical data and reports
MCA for sharing their oil spill modelling
RSPB for sharing their beached bird survey report
XODUS for sharing their intertidal survey report
Transocean Ltd for sharing information pertinent to the semi-submersible rig and survey data collected in response to the incident.

19. Appendix 1 Transocean Winner Fluids Inventory (including Diesel)

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
82	Electrical Power Generation	Pontoon Tank 8P	95,000	Diesel Fuel	Spare Oil Inventory	37.56	37.56
83	Electrical Power Generation	Pontoon Tank 6P	42,000	Diesel Fuel	Spare Oil Inventory	16.61	54.17
85	Electrical Power Generation	Pontoon Tank 6S	41,000	Diesel Fuel	Spare Oil Inventory	16.21	70.38
84	Electrical Power Generation	Pontoon Tank 8S	12,000	Diesel Fuel	Spare Oil Inventory	4.74	75.12
71	LMRP and BOP	BOP Set Back Area	8,000	3% Stack Magic, 5% MEG, 92% water	Misc Tanks	3.16	78.28
59	Electrical Power Generation	Engine Room	6,000	Castrol - MHP 154	Misc Tanks	2.37	80.65
14	BOP Handling System	BOP Control / Koomey Room	5,000	Castrol - BioBar 46	Within Eqpt Piping	1.98	82.63
38	Pipehandling Equipment	Drill Floor	4,000	Castrol - BioBar 46	Within Eqpt Piping	1.58	84.21
41	Propulsion System	Thruster Room - Gear Box	3,000	Castrol - Alpha SP 100	Within Eqpt Piping	1.19	85.40
58	Materials Handling	BOP Carrier	2,000	Castrol - Alpha 46	Misc Tanks	0.79	86.19
61	Koomey Unit - Mixing Tank	BOP Control / Koomey Room	2,000	3% Stack Magic, 5% MEG, 92% water	Misc Tanks	0.79	86.98
31	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	87.61
32	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	88.25
33	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	88.88
34	Mooring Winch System	Mooring Winches	1,600	Castrol - BioBar 46	Within Eqpt Piping	0.63	89.51
20	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	89.99
21	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	90.46

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
22	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	90.93
23	Electrical Power Generation	Generator Room	1,200	Castrol - MHP 154	Within Eqpt Piping	0.47	91.41
77	Electrical Power Generation	Engine Room - Oil Tank	1,200	Castrol - MHP 153	Spare Oil Inventory	0.47	91.88
13	Ballast/ Preload Systems	Hydraulic Room	1,000	Castrol - BioBar 22	Within Eqpt Piping	0.40	92.28
42	Propulsion System	Thruster Room - Pitch System	1,000	Castrol - Biobar 46	Within Eqpt Piping	0.40	92.67
65	Main Deck - Stbd Crane Foundation	Starboard Crane Foundation	1,000	Stack Magic (Concentrated)	Misc Tanks	0.40	93.07
66	Mezzanine Deck - BOP Setback Area	BOP Set Back Area	1,000	MEG (Concentrated)	Misc Tanks	0.40	93.46
78	Electrical Power Generation	Engine Room - Waste Oil Tank	900	Waste Oil	Spare Oil Inventory	0.36	93.82
60	High Pressure Mud Systems	Mud Pump Room	800	Castrol Tribol 1100/460) & Castrol Alpha SP 150	Misc Tanks	0.32	94.14
35	Materials Handling	Port Crane	800	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.32	94.45
36	Materials Handling	Starboard Crane	800	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.32	94.77
72	Mooring Winch System	Anchor Winch Storage Tanks	800	Castrol - BioBar 46	Spare Oil Inventory	0.32	95.09
37	Materials Handling	Pipehandling Crane	600	Castrol - Hyspin AWH-M 32	Within Eqpt Piping	0.24	95.32
62	Koomey Unit - Pilot Tank	BOP Control / Koomey Room	600	Aqualink	Misc Tanks	0.24	95.56
73	Propulsion System	Thurster Storage Tanks	600	Castrol - Alpha SP 100	Spare Oil Inventory	0.24	95.80
81	Electrical Power Generation	Engine Store	600	Castrol - BioBar 46	Spare Oil Inventory	0.24	96.03
26	High Pressure Mud Systems	Mud Pump Room	500	Castrol - Tribol 1100/460	Within Eqpt Piping	0.20	96.23
28	High Pressure Mud Systems	Mud Pump Room	500	Castrol - Tribol 1100/460	Within Eqpt Piping	0.20	96.43
30	High Pressure Mud Systems	Mud Pump Room	500	Castrol - Tribol 1100/460	Within Eqpt Piping	0.20	96.63

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
51	Mooring Winch System	Anchor Winch HPU Room	400	Castrol - BioBar 46	Misc Tanks	0.16	96.79
52	Mooring Winch System	Anchor Winch HPU Room	400	Castrol - BioBar 46	Misc Tanks	0.16	96.94
53	Mooring Winch System	Anchor Winch HPU Room	400	Castrol - BioBar 46	Misc Tanks	0.16	97.10
54	Mooring Winch System	Anchor Winch HPU Room	400	Castrol - BioBar 46	Misc Tanks	0.16	97.26
55	Propulsion System	Port Fwd Column Top	400	Castrol - Alpha 46	Misc Tanks	0.16	97.42
56	Propulsion System	Starboard Fwd Column Top	400	Castrol - Alpha 46	Misc Tanks	0.16	97.58
57		Hydraulic Room	400	Castrol - BioBar 22	Misc Tanks	0.16	97.73
74	Electrical Power Generation	Emergency Generator Room(in drums)	400	Castrol - 15/40W	Spare Oil Inventory	0.16	97.89
75	High Pressure Mud Systems	Mud Pump Tank Room	400	Tribol 460	Spare Oil Inventory	0.16	98.05
43	Survival Systems	Aft Lifeboat	250	Castrol - Alpha SP 150	Within Eqpt Piping	0.10	98.15
44	Survival Systems	Aft Lifeboat	250	Castrol - Alpha SP 150	Within Eqpt Piping	0.10	98.25
45	Survival Systems	Forward Lifeboat	250	Castrol - Alpha SP 150	Within Eqpt Piping	0.10	98.35
46	Survival Systems	Forward Lifeboat	250	Castrol - Alpha SP 150	Within Eqpt Piping	0.10	98.45
63	Koomey Unit - Day Tank	BOP Control / Koomey Room	200	Stack Magic	Misc Tanks	0.08	98.53
64	Koomey Unit - Day Tank	BOP Control / Koomey Room	200	MEG	Misc Tanks	0.08	98.60
69	Cement Unit - HPU	Cement Unit	200	Texmatic	Misc Tanks	0.08	98.68
76	High Pressure Mud Systems	Mud Pump Tank Room	200	Castrol - Omala SP 150	Spare Oil Inventory	0.08	98.76
19	Drillstring Rotating Equipment	Drawworks	175	Castrol - Alpha SP 150	Within Eqpt Piping	0.07	98.83
15	Derrick Hoisting System	Drawworks	150	Castrol - Alpha SP 150	Within Eqpt Piping	0.06	98.89
70	Cement Unit - HP Pumps	Cement Unit	150	80 x 40 Oil	Misc Tanks	0.06	98.95
24	Electrical Power	Emergency	120	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.05	99.00

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
	Generation	Generator Rm.					
47	Watertight Door Systems	Hydraulic Room	120	Castrol - BioBar 22	Within Eqpt Piping	0.05	99.05
48	Watertight Door Systems	Hydraulic Room	120	Castrol - BioBar 22	Within Eqpt Piping	0.05	99.09
49	Watertight Door Systems	Hydraulic Room	120	Castrol - BioBar 22	Within Eqpt Piping	0.05	99.14
50	Watertight Door Systems	Hydraulic Room	120	Castrol - BioBar 22	Within Eqpt Piping	0.05	99.19
18	Drillstring Rotating Equipment	Drawworks	114	Castrol - Alpha SP 150	Within Eqpt Piping	0.05	99.23
16	Derrick Hoisting System	Drawworks	100	Castrol - Hyspin AWH-M 32	Within Eqpt Piping	0.04	99.27
25	High Pressure Mud Systems	Mud Pump Room	100	Castrol - Alpha SP 150	Within Eqpt Piping	0.04	99.31
27	High Pressure Mud Systems	Mud Pump Room	100	Castrol - Alpha SP 150	Within Eqpt Piping	0.04	99.35
29	High Pressure Mud Systems	Mud Pump Room	100	Castrol - Alpha SP 150	Within Eqpt Piping	0.04	99.39
39	Personnel Handling	Hydraulic Room	100	Castrol - BioBar 32	Within Eqpt Piping	0.04	99.43
40	Personnel Handling	Hydraulic Room	100	Castrol - BioBar 32	Within Eqpt Piping	0.04	99.47
79	Compressed Air System	Compressor Room - Oil	100	Castrol - Aircol SR 68	Spare Oil Inventory	0.04	99.51
80	Various - Remote Valves	Pleiger Tank	100	Castrol - BioBar 22	Spare Oil Inventory	0.04	99.55
67	Cement Unit - Engines	Cement Unit	80	154 Oil	Misc Tanks	0.03	99.58
3	Compressed Air Systems	Compressor Room	70	Castrol - Aircol SR 46	Within Eqpt Piping	0.03	99.61
4	Compressed Air Systems	Compressor Room	70	Castrol - Aircol SR 46	Within Eqpt Piping	0.03	99.64
7	Compressed Air Systems	Compressor Room	70	Castrol - Aircol SR 46	Within Eqpt Piping	0.03	99.66
8	Compressed Air Systems	Compressor Room	70	Castrol - Aircol SR 46	Within Eqpt Piping	0.03	99.69

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
9	Compressed Air Systems	Compressor Room	70	Castrol - Aircol SR 46	Within Eqpt Piping	0.03	99.72
68	Cement Unit - Transmission Oil	Cement Unit	60	Texmatic	Misc Tanks	0.02	99.74
5	Compressed Air Systems	Compressor Room	45	Mobil - Rarus 827	Within Eqpt Piping	0.02	99.76
6	Compressed Air Systems	Compressor Room	45	Mobil - Rarus 827	Within Eqpt Piping	0.02	99.78
1	Accommodation	Compressor Room	40	Mobil - EAL Arctic 100	Within Eqpt Piping	0.02	99.79
2	Accommodation	Compressor Room	40	Mobil - EAL Arctic 100	Within Eqpt Piping	0.02	99.81
12	Compressed Air Systems	Compressor Room	30	Castrol - Aircol SR 46	Within Eqpt Piping	0.01	99.82
None	Mud Storage	Not shown	20	Castrol - Alpha SP 320	Within Eqpt Piping	0.01	99.83
None	Mud Storage	Not shown	20	Castrol - Alpha SP 320	Within Eqpt Piping	0.01	99.84
None	Mud Storage	Not shown	20	Castrol - Alpha SP 320	Within Eqpt Piping	0.01	99.85
None	Mud Storage	Not shown	20	Castrol - Alpha SP 320	Within Eqpt Piping	0.01	99.85
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.86
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.87
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.88
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.89
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.89
None	Materials Handling	Not shown	20	Castrol - Alpha SP 150	Within Eqpt Piping	0.01	99.90
10	Compressed Air Systems	Compressor Room	10	Castrol - Aircol SN 100	Within Eqpt Piping	0.00	99.90
11	Compressed Air Systems	Compressor Room	10	Castrol - Aircol SN 100	Within Eqpt Piping	0.00	99.91
17	Drillstring Rotating Equipment	Drawworks	10	Castrol - Alpha SP 150	Within Eqpt Piping	0.00	99.91
None	Well Control System	Not shown	10	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	99.92
None	Well Control System	Not shown	10	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	99.92
None	BOP Handling System	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.92
None	BOP Handling System	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.93

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
None	BOP Handling System	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.93
None	BOP Handling System	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.93
None	Mud Storage	Not shown	8	Castrol - Alpha SP 320	Within Eqpt Piping	0.00	99.94
None	Materials Handling	Not shown	8	Castrol - Alpha SP 150	Within Eqpt Piping	0.00	99.94
None	Pipehandling Equipment	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.94
None	Pipehandling Equipment	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.95
None	Pipehandling Equipment	Not shown	8	Castrol - Alpha SP 100	Within Eqpt Piping	0.00	99.95
None	Pipehandling Equipment	Not shown	8	Castrol - Alpha SP 150	Within Eqpt Piping	0.00	99.95
None	Rig Structure	Not shown	8	Castrol - Alpha SP 68	Within Eqpt Piping	0.00	99.96
None	Rig Structure	Not shown	8	Castrol - Alpha SP 150	Within Eqpt Piping	0.00	99.96
None	Riser Tensioning System	Not shown	8	Compenol	Within Eqpt Piping	0.00	99.96
None	Riser Tensioning System	Not shown	8	Compenol	Within Eqpt Piping	0.00	99.96
None	Riser Tensioning System	Not shown	8	Compenol	Within Eqpt Piping	0.00	99.97
None	Riser Tensioning System	Not shown	8	Compenol	Within Eqpt Piping	0.00	99.97
None	Electrical Power Generation	Not shown	7	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.00	99.97
None	Electrical Power Generation	Not shown	7	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.00	99.98
None	Electrical Power Generation	Not shown	7	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.00	99.98
None	Electrical Power Generation	Not shown	7	Castrol - Hyspin AWH-M 46	Within Eqpt Piping	0.00	99.98
None	Fuel Oil Systems	Not shown	5	Castrol - MHP 154	Within Eqpt Piping	0.00	99.98
None	Mud Storage	Not shown	5	Castrol - Alpha SP 320	Within Eqpt Piping	0.00	99.99
None	Mud Storage	Not shown	5	Castrol - Alpha SP 320	Within Eqpt Piping	0.00	99.99

Drawing Ref.	System / Application	Location	Volume (Litres)	Current Product	Inventory	%	Cum
None	Survival Systems	Not shown	5	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	99.99
None	Survival Systems	Not shown	5	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	99.99
None	Survival Systems	Not shown	5	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	99.99
None	Survival Systems	Not shown	5	Castrol - Tection Global 15W-40	Within Eqpt Piping	0.00	100.00
None	Riser Tensioning System	Not shown	5	Compenol	Within Eqpt Piping	0.00	100.00
None	Riser Tensioning System	Not shown	5	Compenol	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
None	Materials Handling	Not shown		Castrol - LMX/High Temp Grease	Within Eqpt Piping	0.00	100.00
Total			**252,930**			**100.00**	

Table 6: Inventory for the total fluids associated with the Transocean Winner rig including the diesel. These have been expressed as a percentage of the total inventory, ranked from highest to lowest and included as a cumulative percentage increase.

Row Labels	Count of Entries	Sum of Volume (Litres)	%	Cum %
Diesel Fuel	4	190,000	75.12	75.12
Castrol - BioBar 46	13	19,400	7.67	82.79
Castrol - MHP 154	6	10,805	4.27	87.06
3% Stack Magic, 5% MEG, 92% water	2	10,000	3.95	91.02
Castrol - Alpha SP 100	9	3,656	1.45	92.46
Castrol - Alpha 46	3	2,800	1.11	93.57
Castrol - BioBar 22	7	1,980	0.78	94.35
Castrol - Alpha SP 150	20	1,893	0.75	95.10
Castrol - Hyspin AWH-M 46	6	1,628	0.64	95.74
Castrol - Tribol 1100/460	3	1,500	0.59	96.34
Castrol - MHP 153	1	1,200	0.47	96.81
MEG (Concentrated)	1	1,000	0.40	97.21
Stack Magic (Concentrated)	1	1,000	0.40	97.60
Waste Oil	1	900	0.36	97.96
Castrol Tribol 1100/460) & Castrol Alpha SP 150	1	800	0.32	98.27
Castrol - Hyspin AWH-M 32	2	700	0.28	98.55
Aqualink	1	600	0.24	98.79
Castrol - 15/40W	1	400	0.16	98.95
Tribol 460	1	400	0.16	99.10
Castrol - Aircol SR 46	6	380	0.15	99.25
Texmatic	2	260	0.10	99.36
Castrol - BioBar 32	2	200	0.08	99.44
Castrol - Omala SP 150	1	200	0.08	99.51
MEG	1	200	0.08	99.59
Stack Magic	1	200	0.08	99.67
Castrol - Tection Global 15W-40	7	160	0.06	99.74
80 x 40 Oil	1	150	0.06	99.80
Castrol - Aircol SR 68	1	100	0.04	99.83

Row Labels	Count of Entries	Sum of Volume (Litres)	%	Cum %
Castrol - Alpha SP 320	7	98	0.04	99.87
Mobil - Rarus 827	2	90	0.04	99.91
Mobil - EAL Arctic 100	2	80	0.03	99.94
154 Oil	1	80	0.03	99.97
Compenol	6	42	0.02	99.99
Castrol - Aircol SN 100	2	20	0.01	100.00
Castrol - Alpha SP 68	1	8	0.00	100.00
Castrol - LMX/High Temp Grease			0.00	100.00
Grand Total	126	252,930	100.00	

Table 7: Aggregation of the different types of fluids on-board the Transocean Winner rig including diesel. These have been expressed as a percentage of the total inventory, ranked from highest to lowest and included as a cumulative percentage increase.

20. Appendix 2 Castrol Product and Safety Sheets

Alpha SP Range
https://thelubricantoracle.castrol.com/range/alpha-sp/directory-marine-services/en-GB

Biobar Range
https://thelubricantoracle.castrol.com/range/biobar/directory-marine-services/en-GB

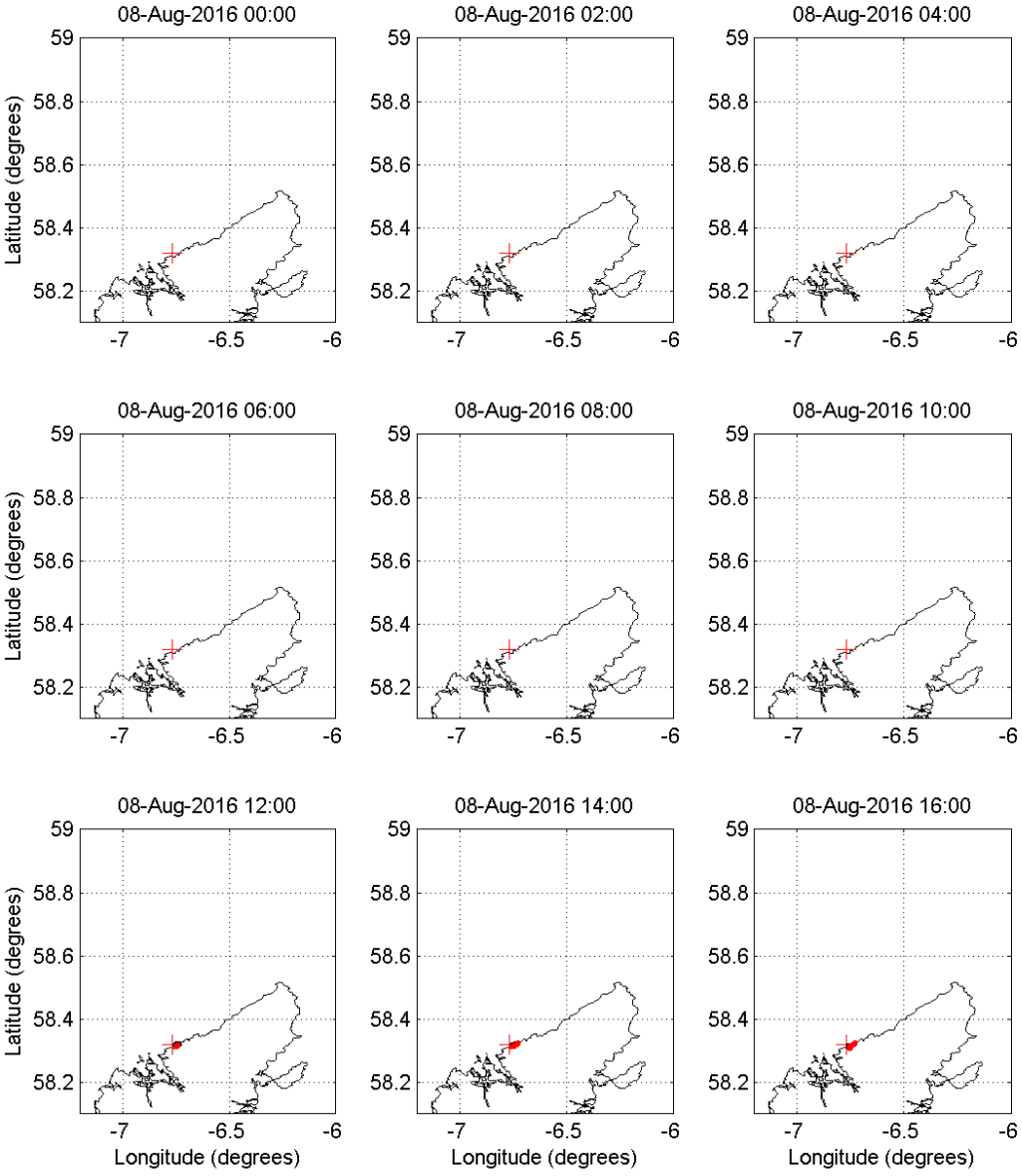
Hyspin AWH-M Range
https://thelubricantoracle.castrol.com/range/hyspin-awh-m/directory-marine-services/en-GB

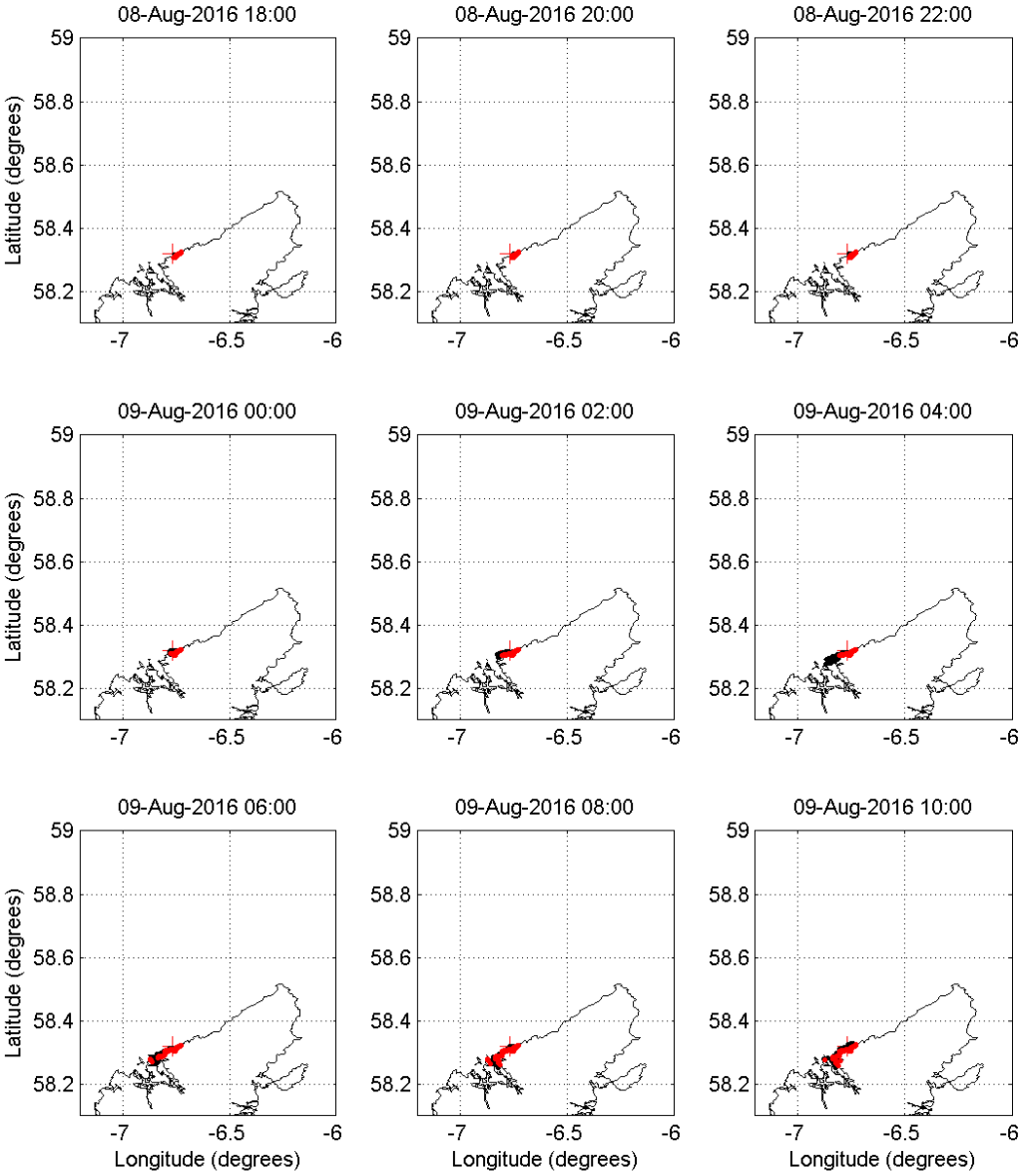
MHP Family
https://thelubricantoracle.castrol.com/family/mhp/directory-marine-services/en-GB

Tribol GR 3020/1000 PD Range
https://thelubricantoracle.castrol.com/Main/Search/Search.aspx?step=1&filters=0&notevisible=true&type=1&homefilter=true

21. Appendix 3 Modelling Output at 2 Hour Intervals

Dalmore Bay 08 August 2016 00:00 to 13 August 2016 00:00

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Longitude (degrees)
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58.6
58.4
58.2
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-6.5
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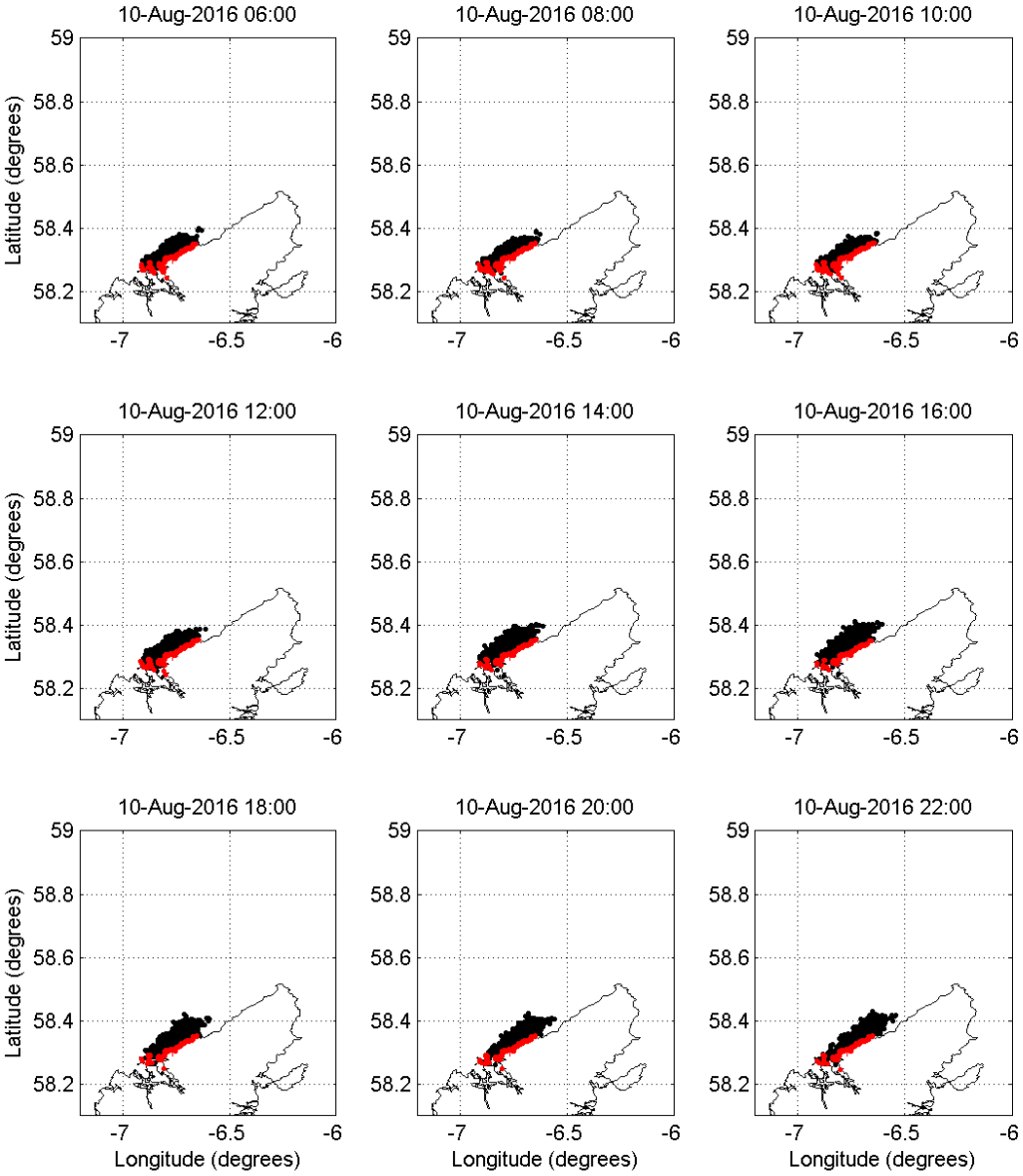
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10-Aug-2016 20:00
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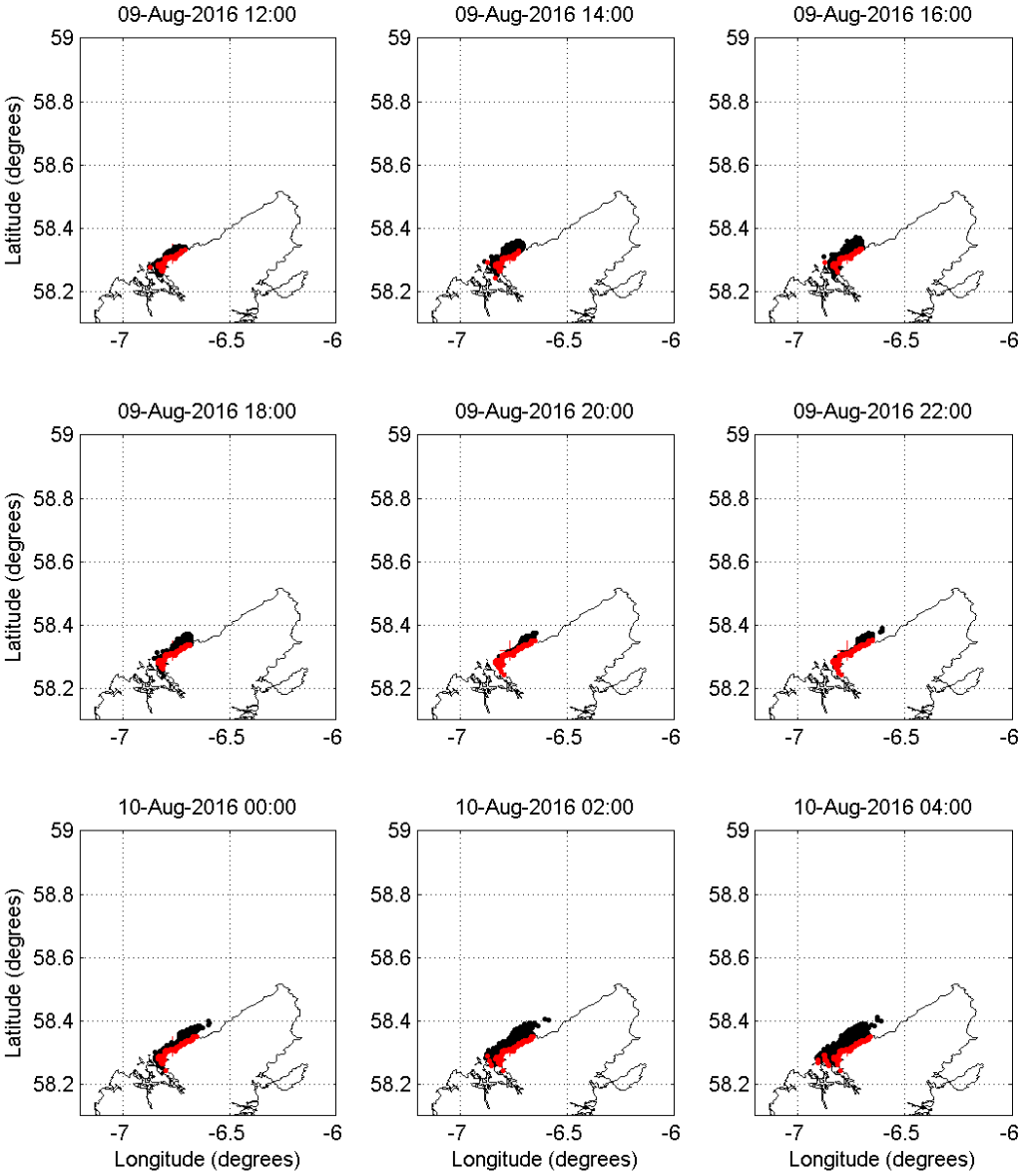
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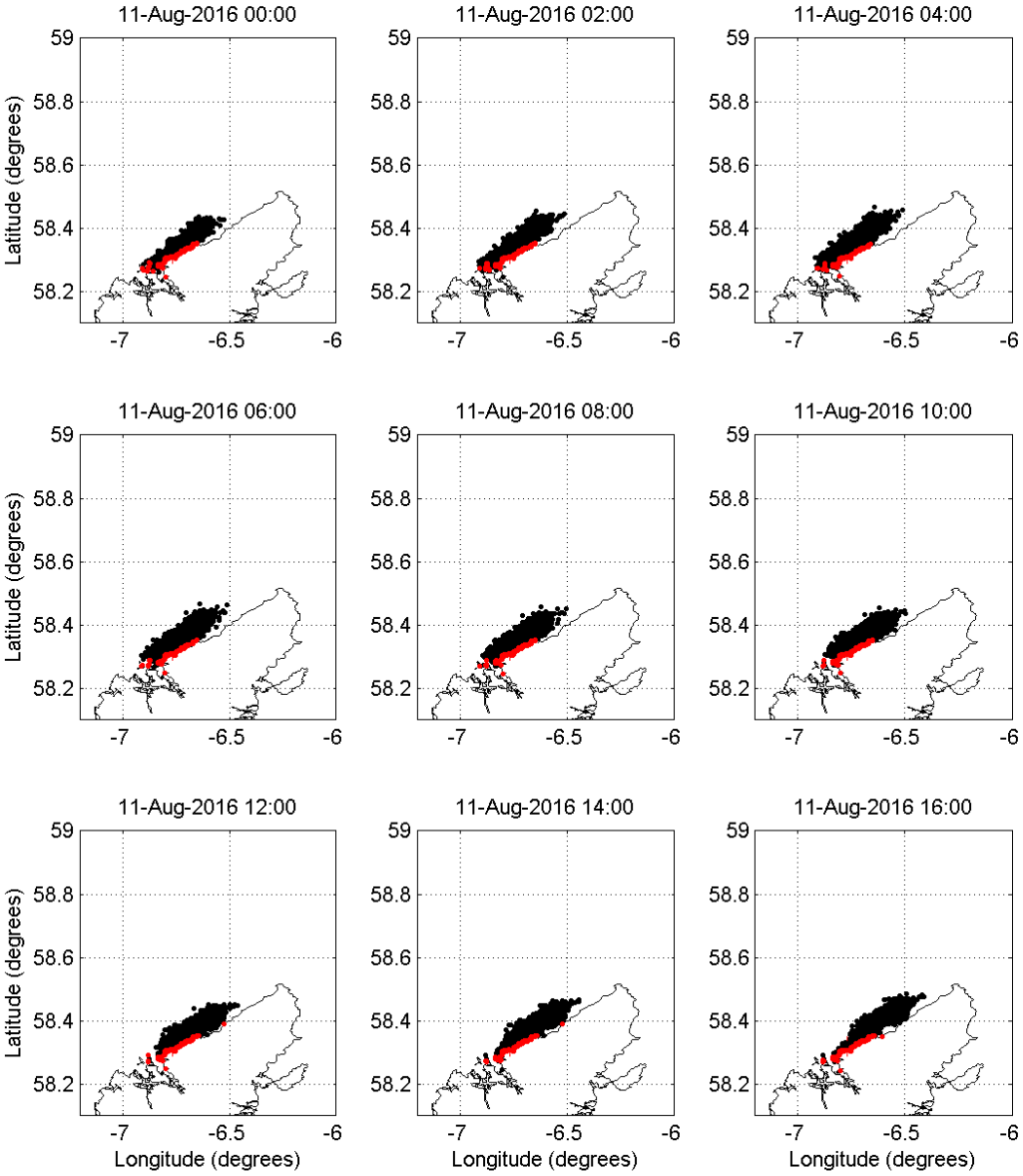
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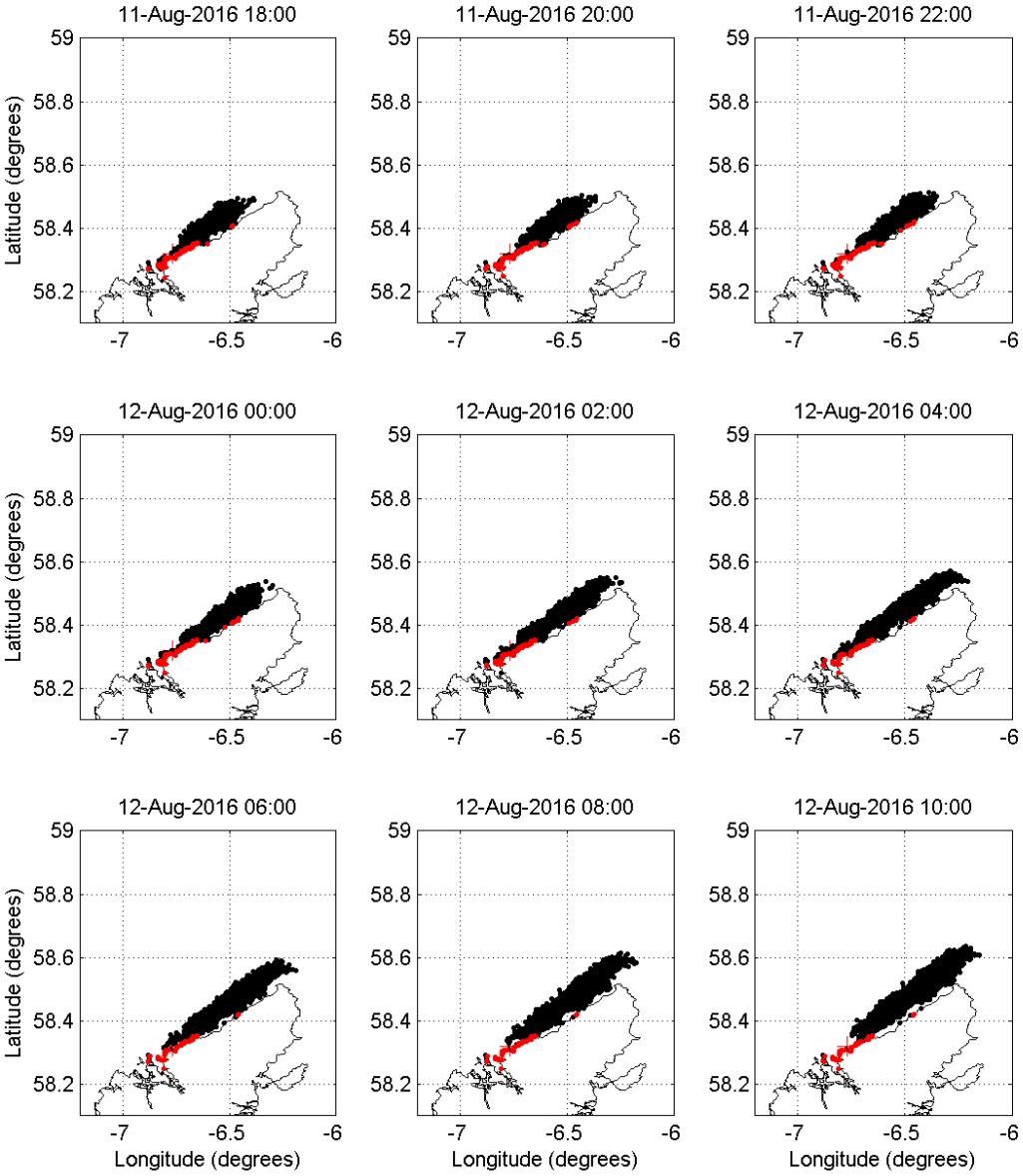
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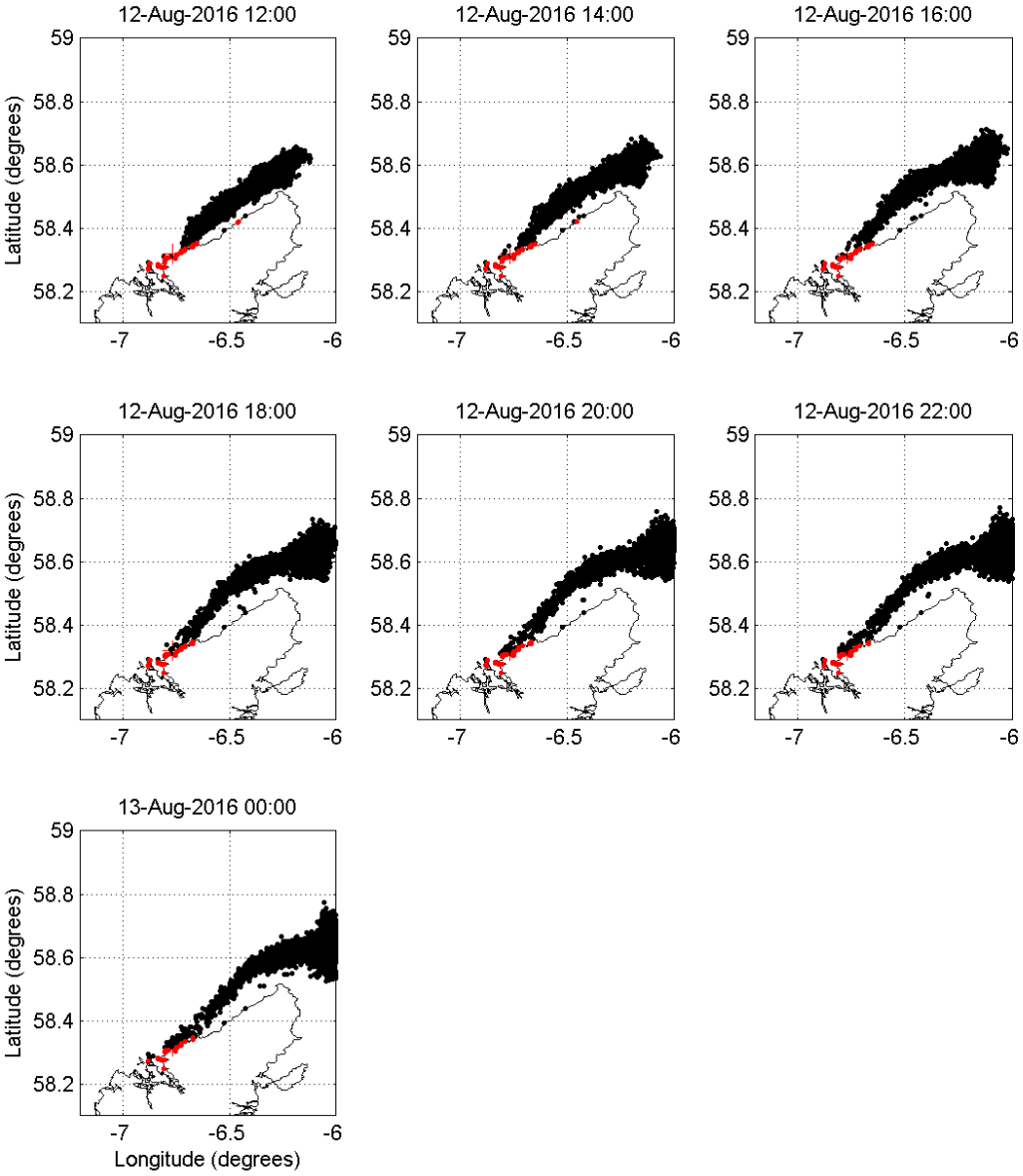
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Latitude (degrees)
Longitude (degrees)
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-6.5
-6

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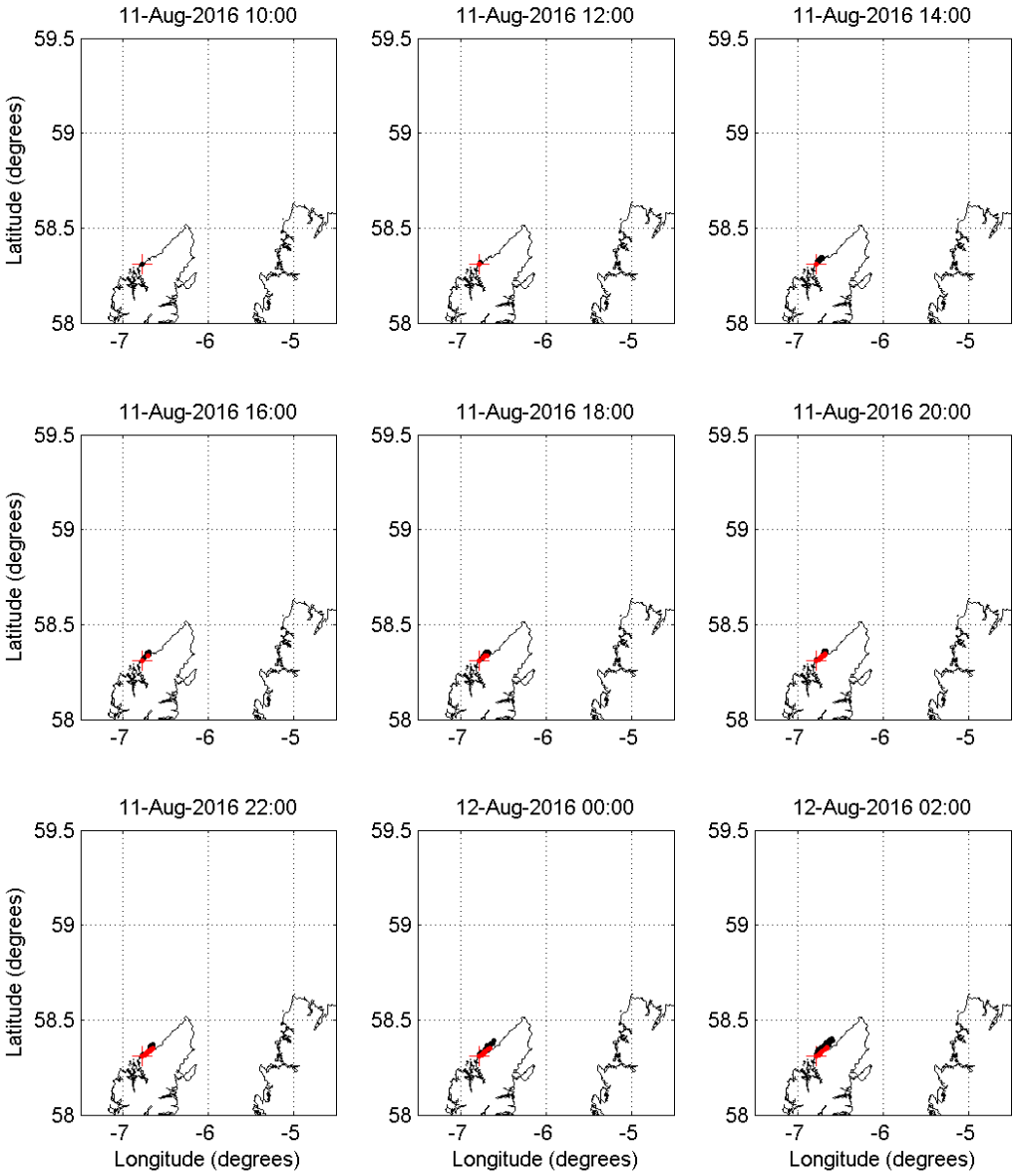

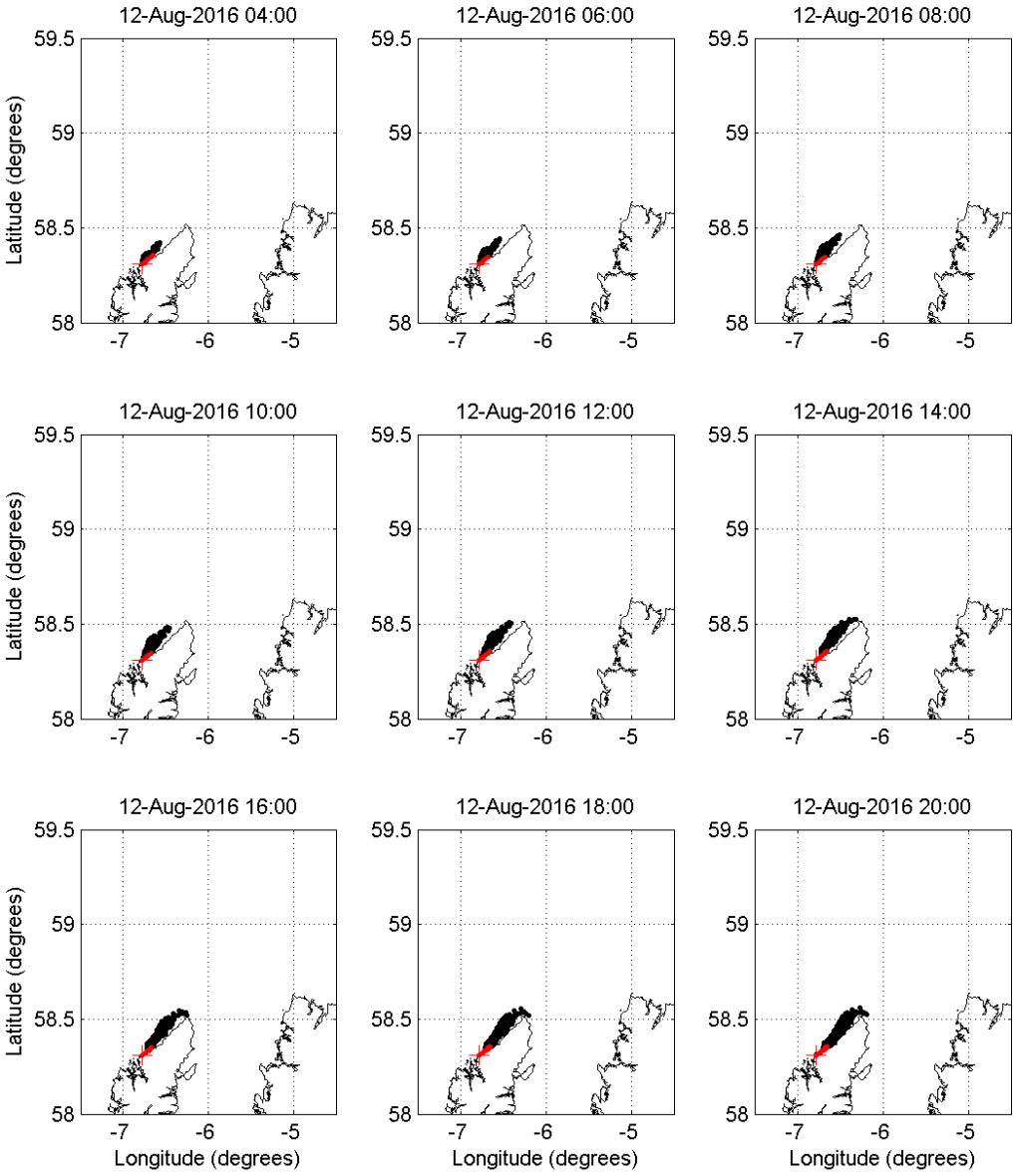
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58.5
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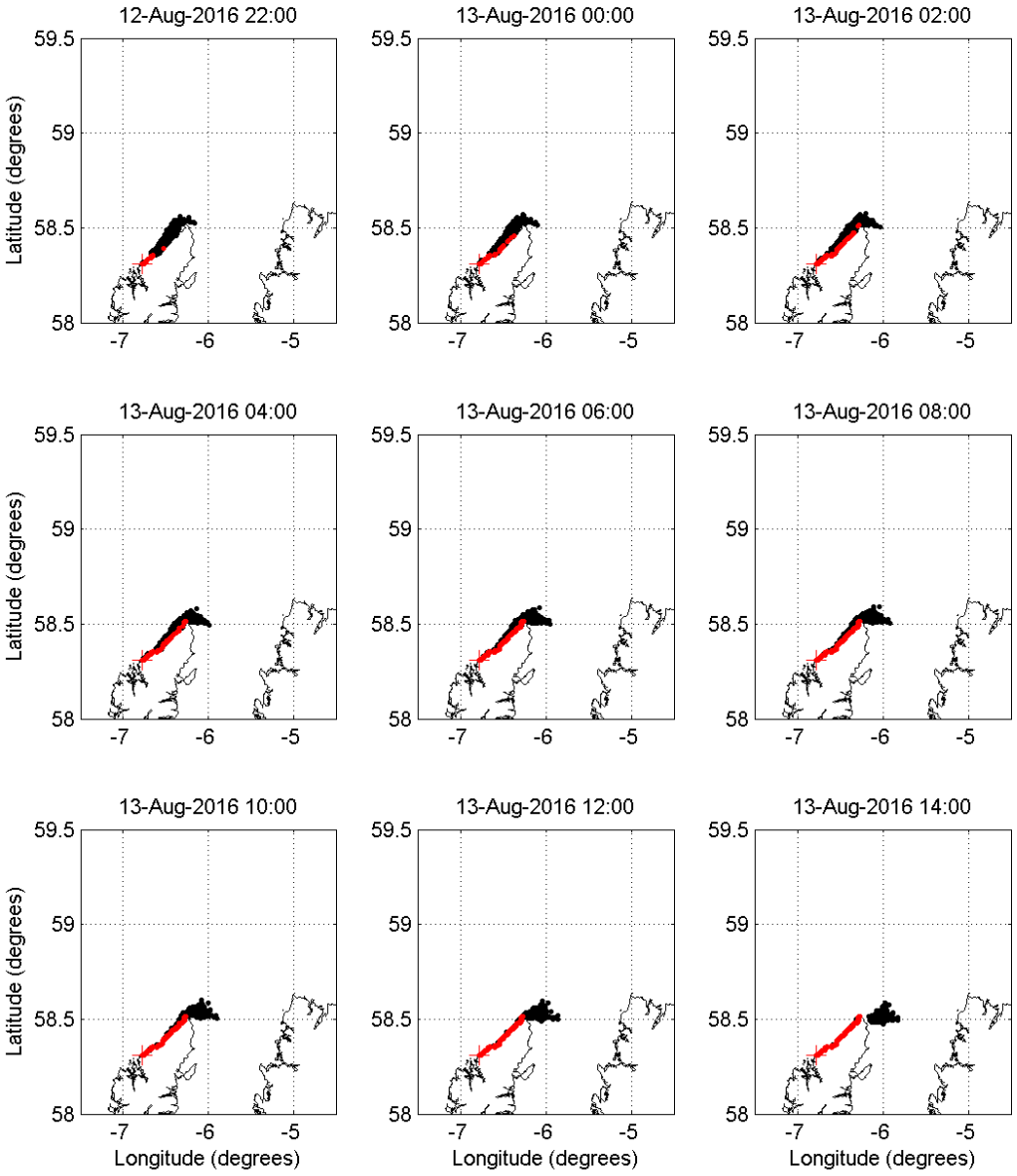
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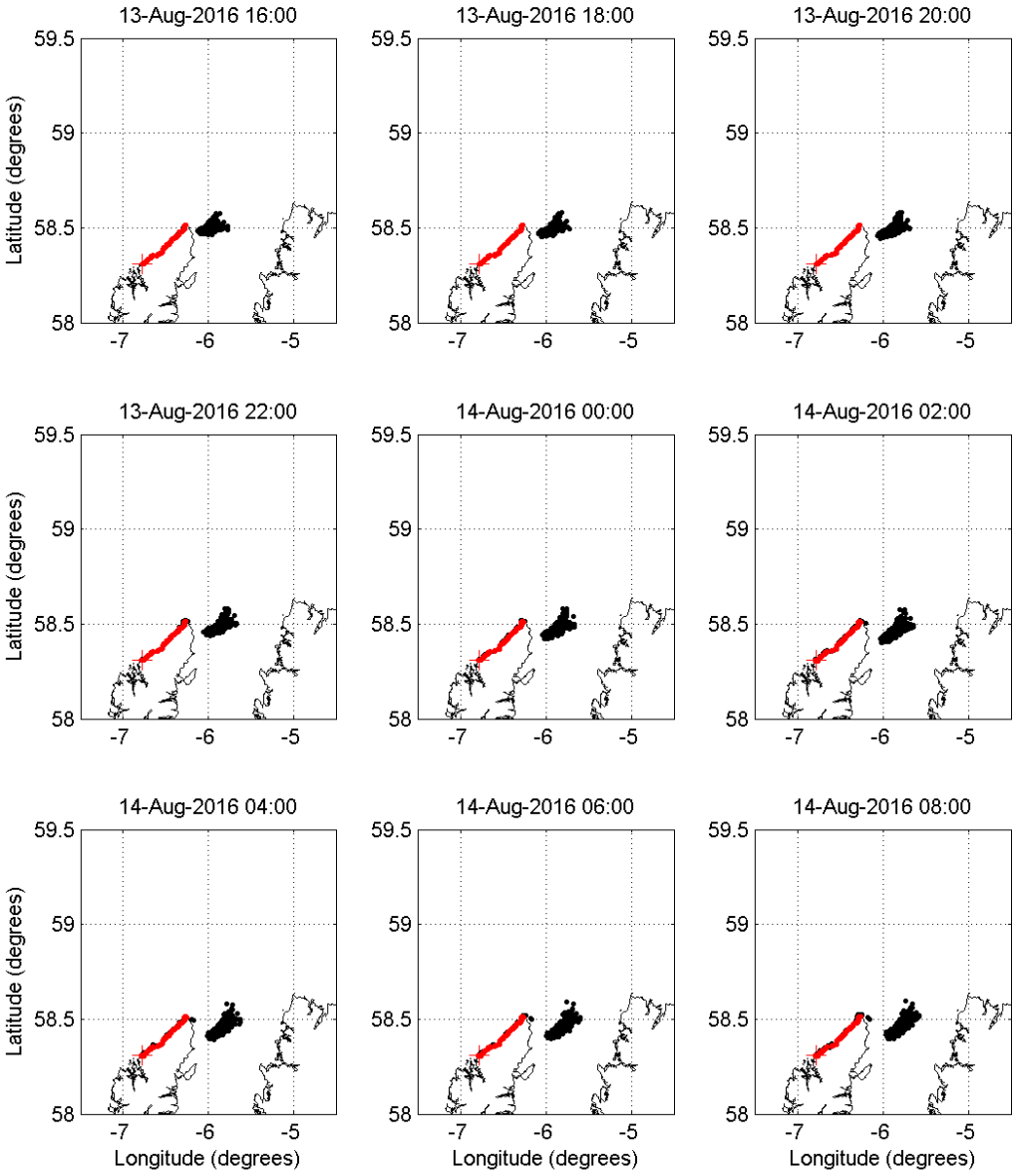
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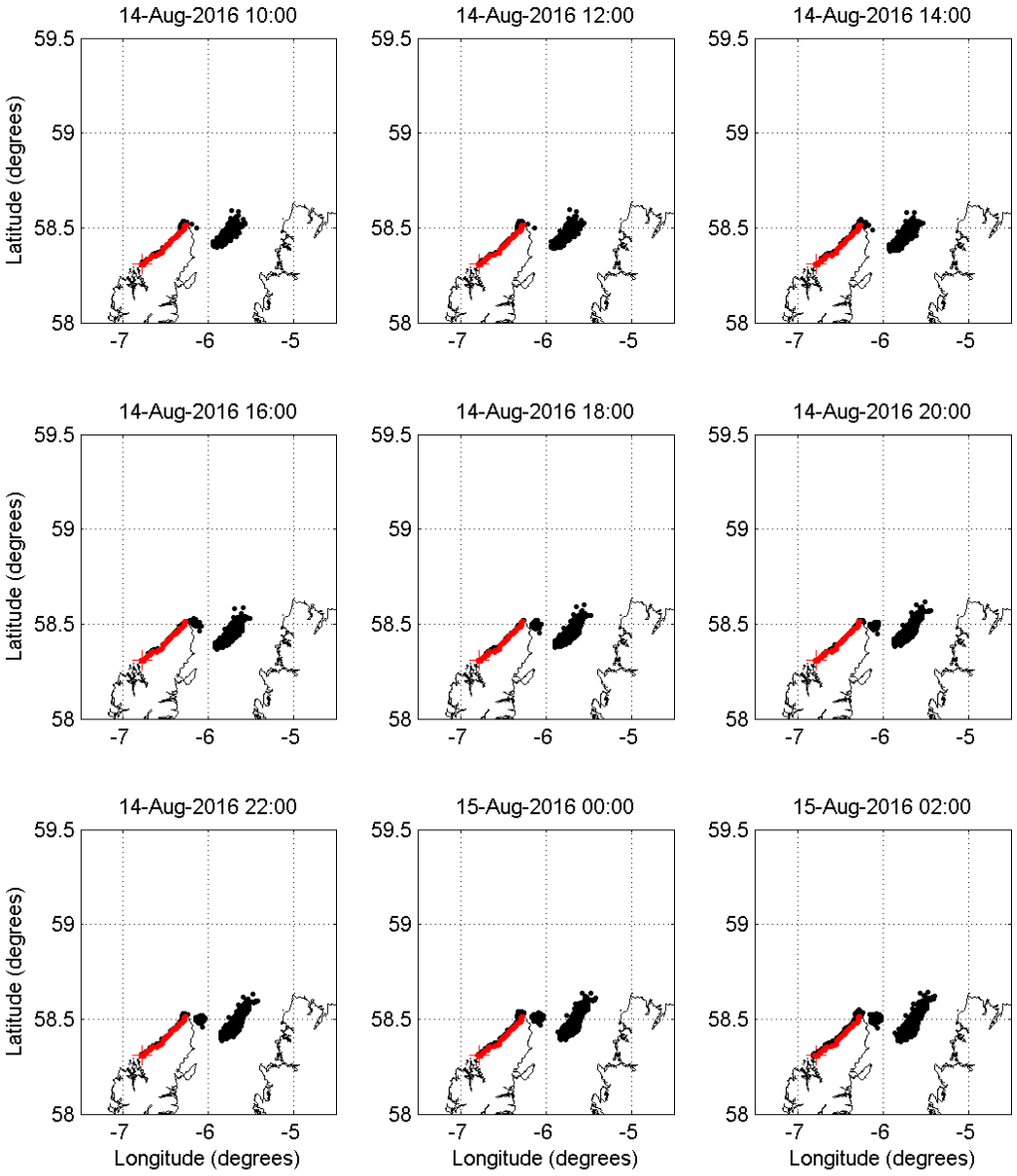
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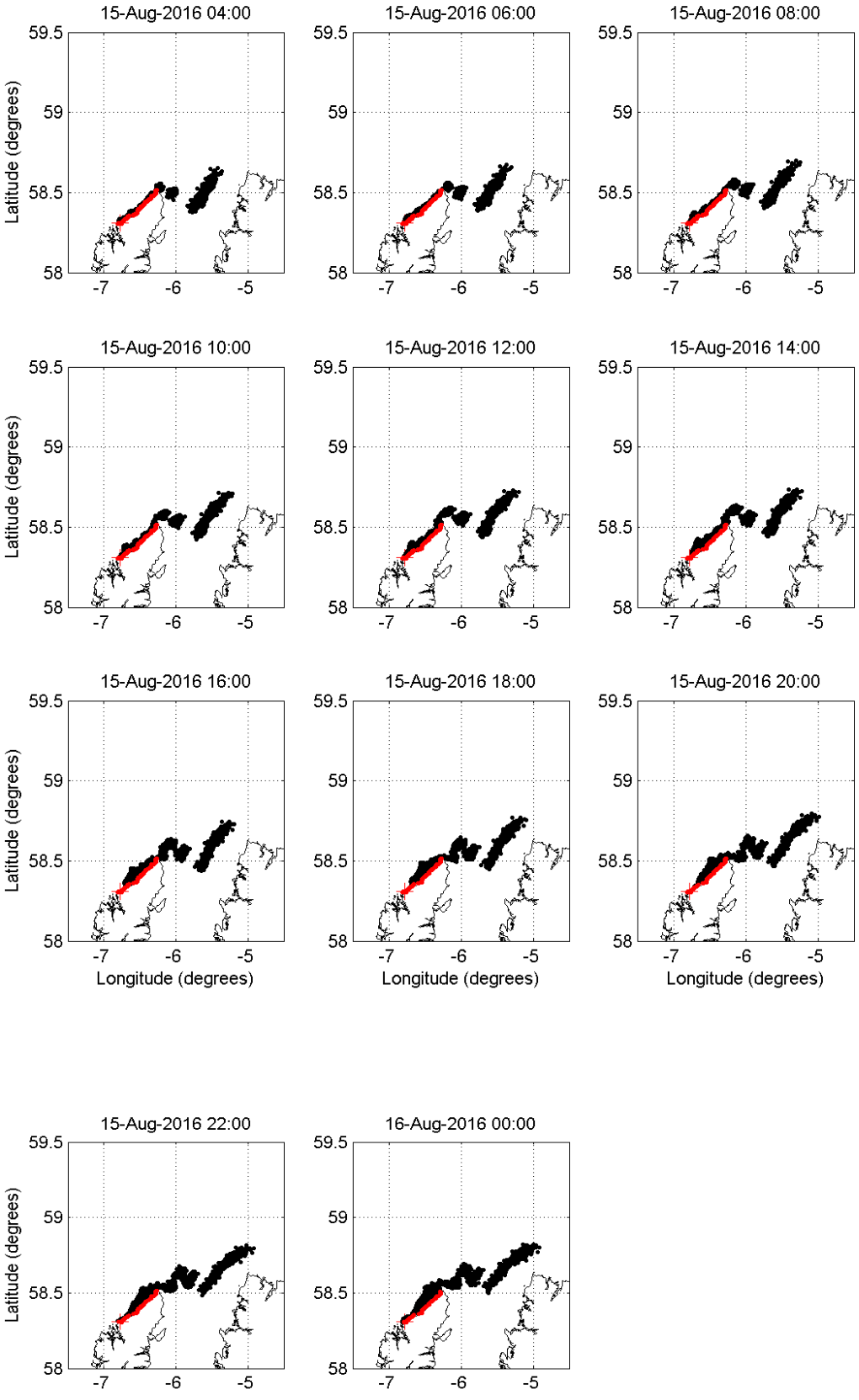
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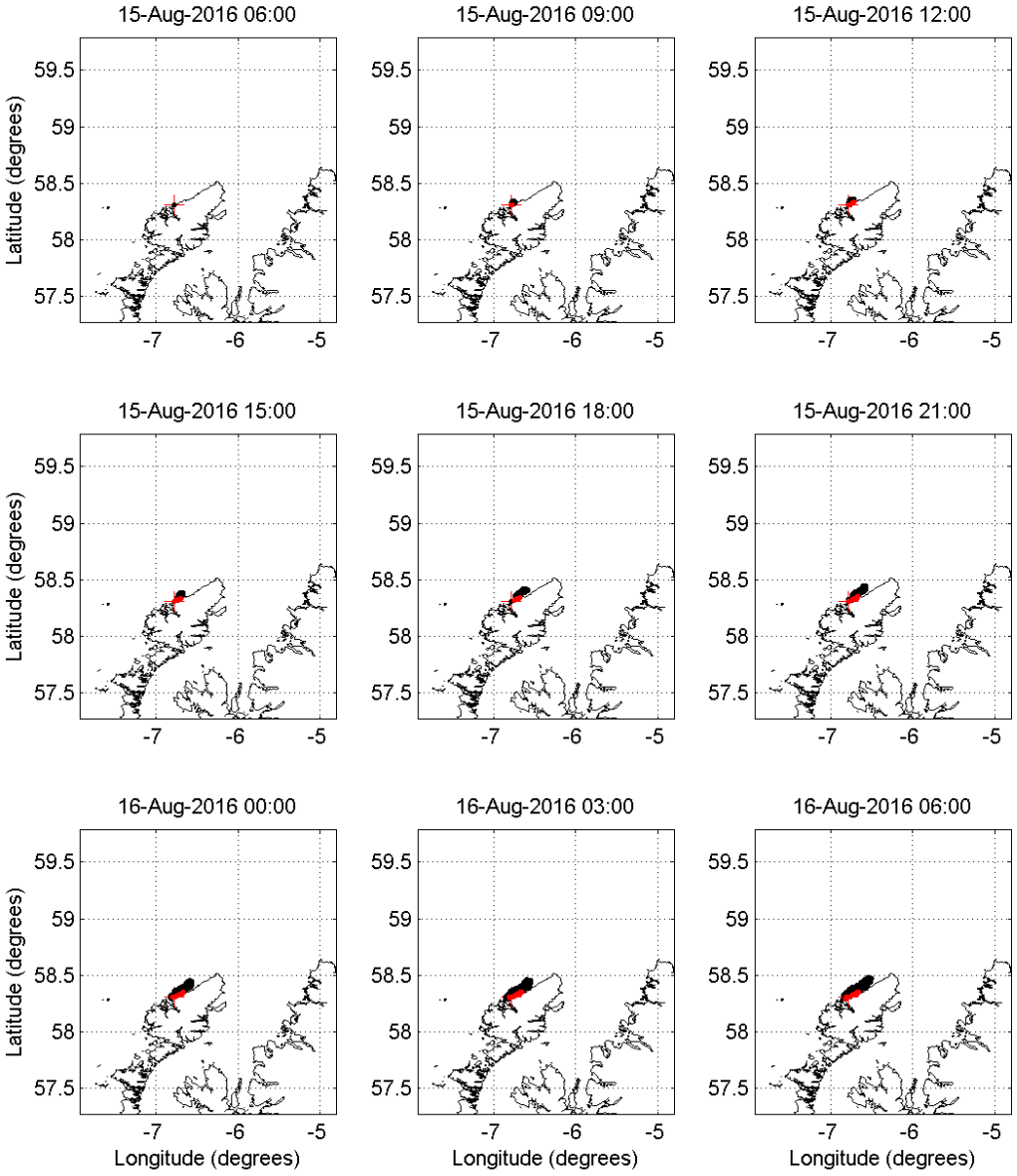
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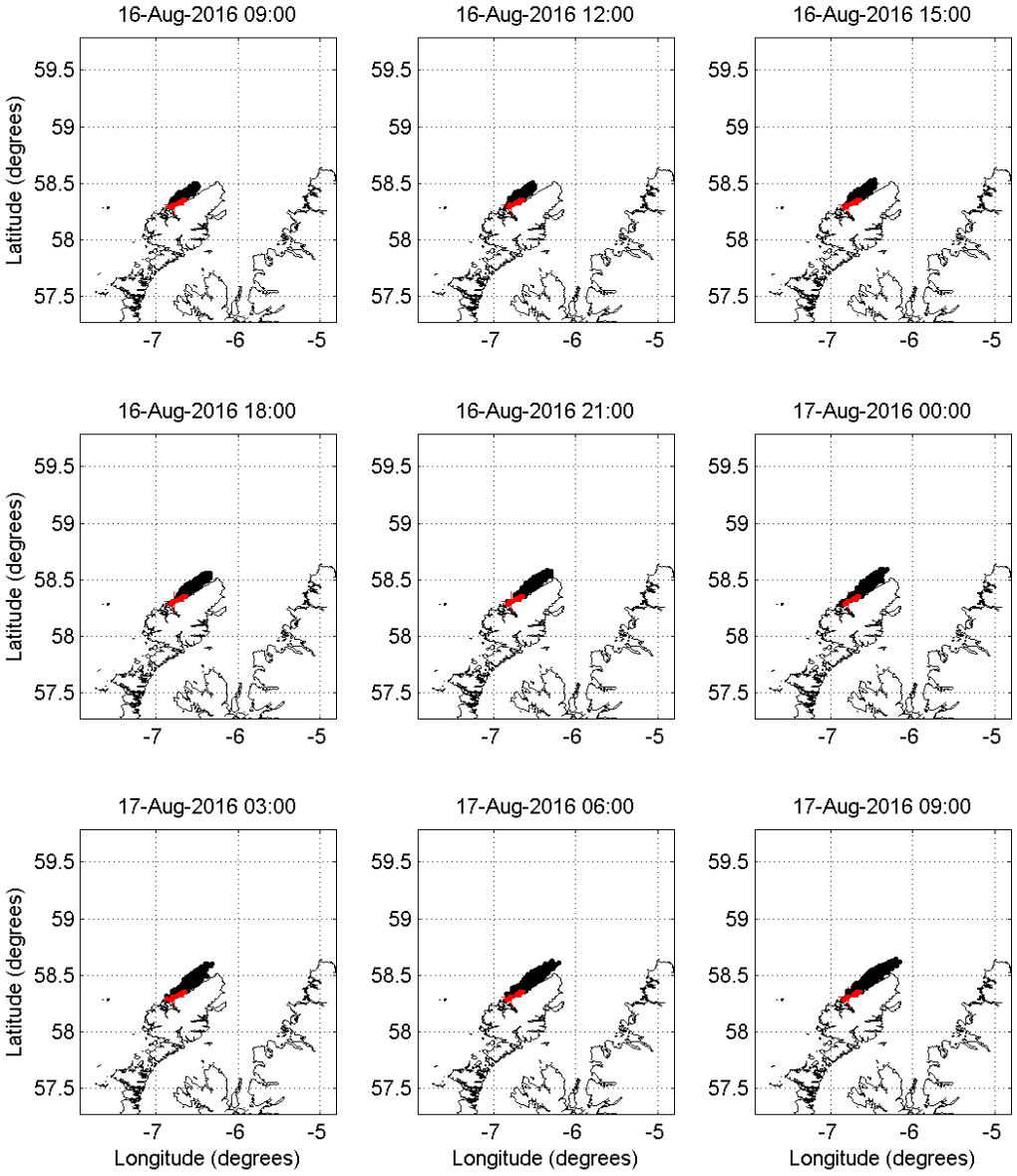
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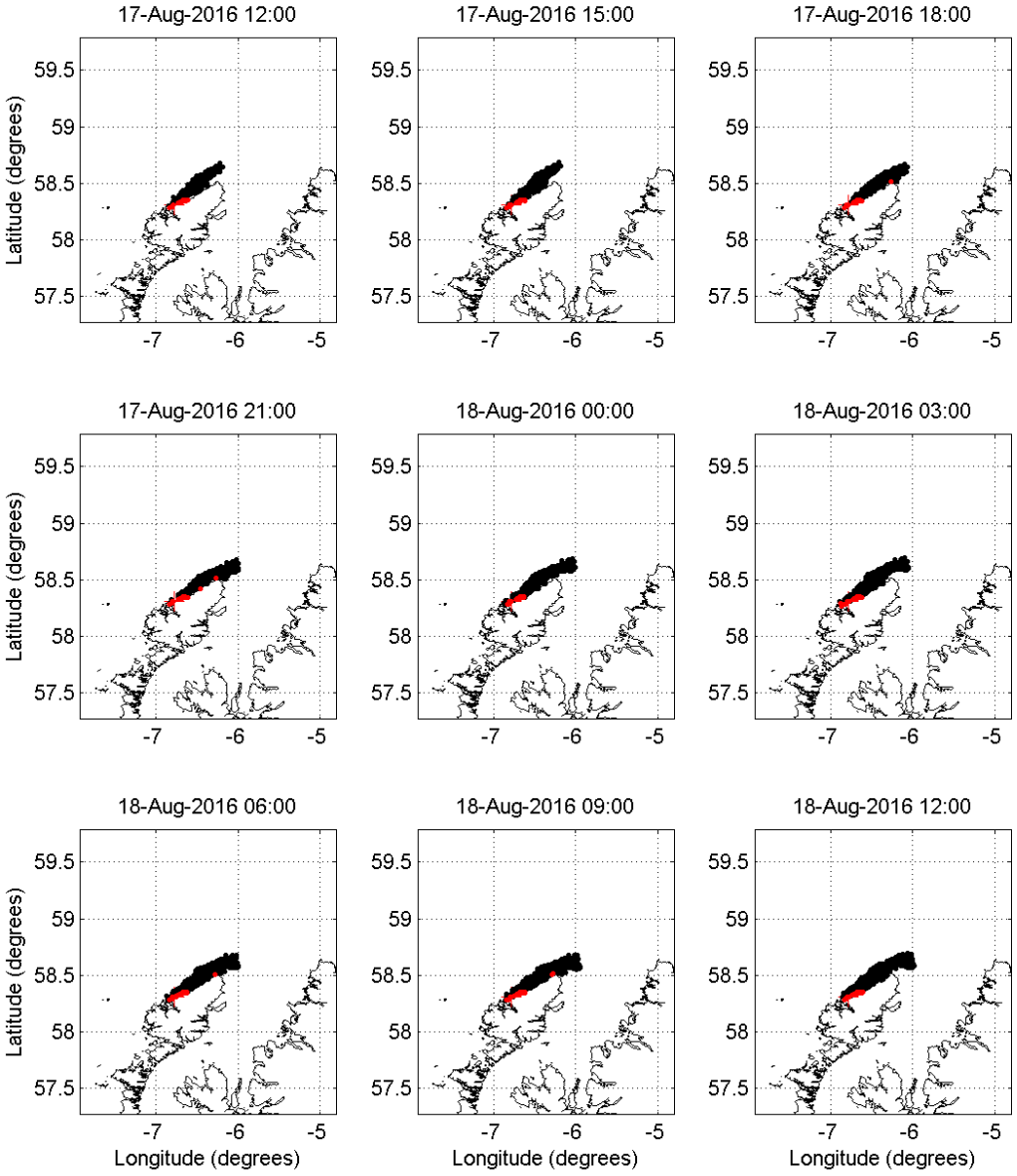
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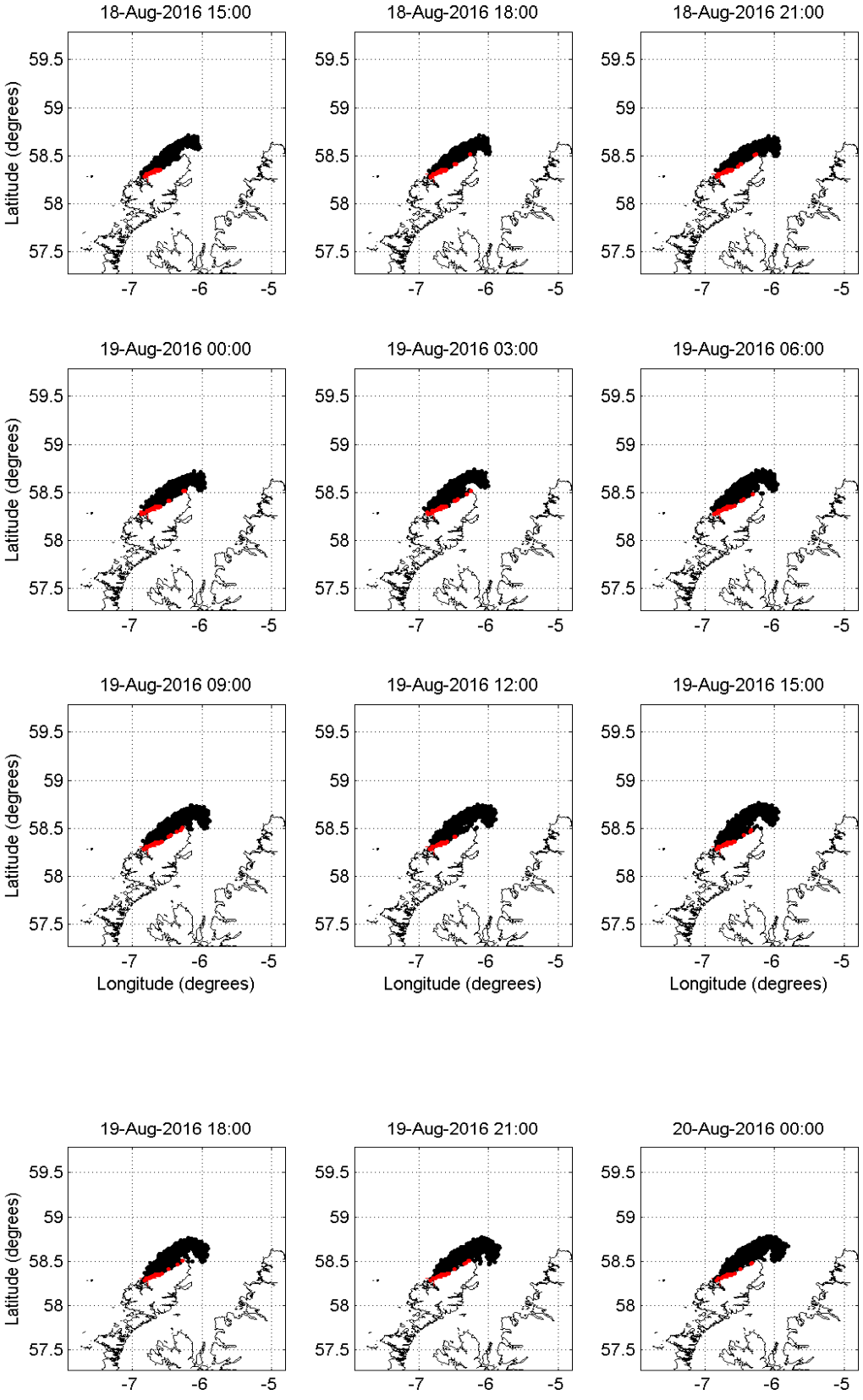
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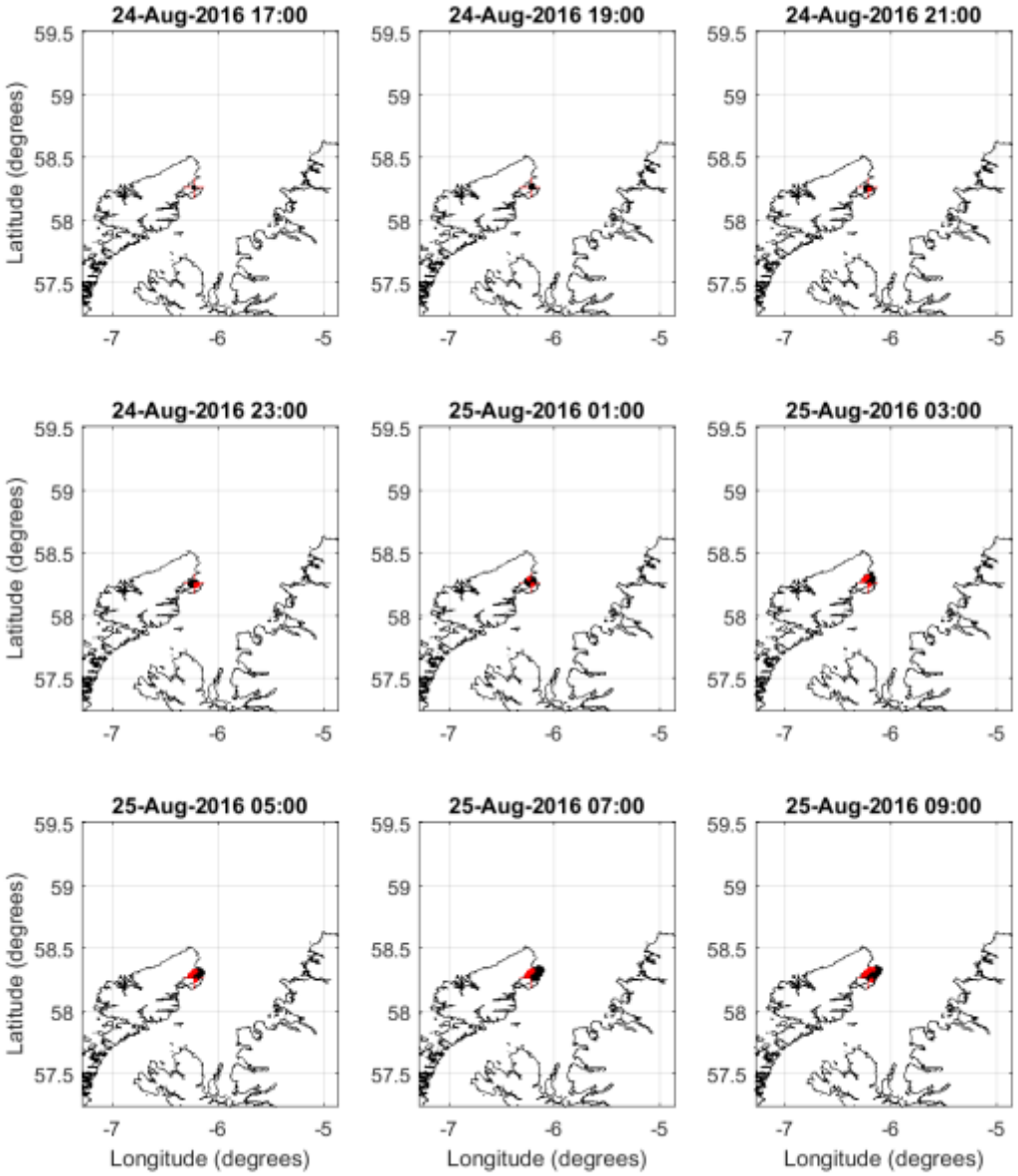
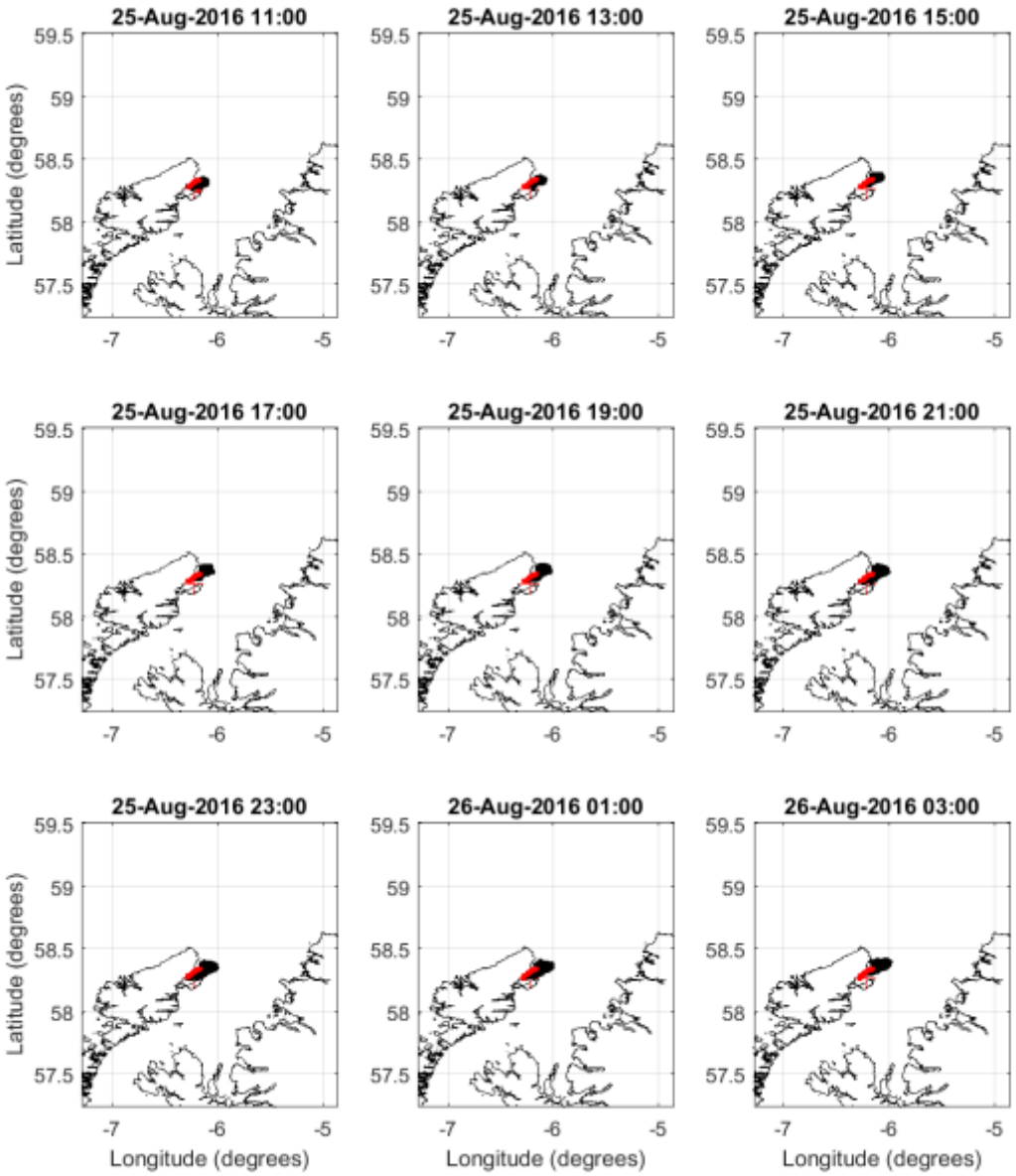
Broad Bay 24 August 2016 17:00 to 26 August 2016 17:00

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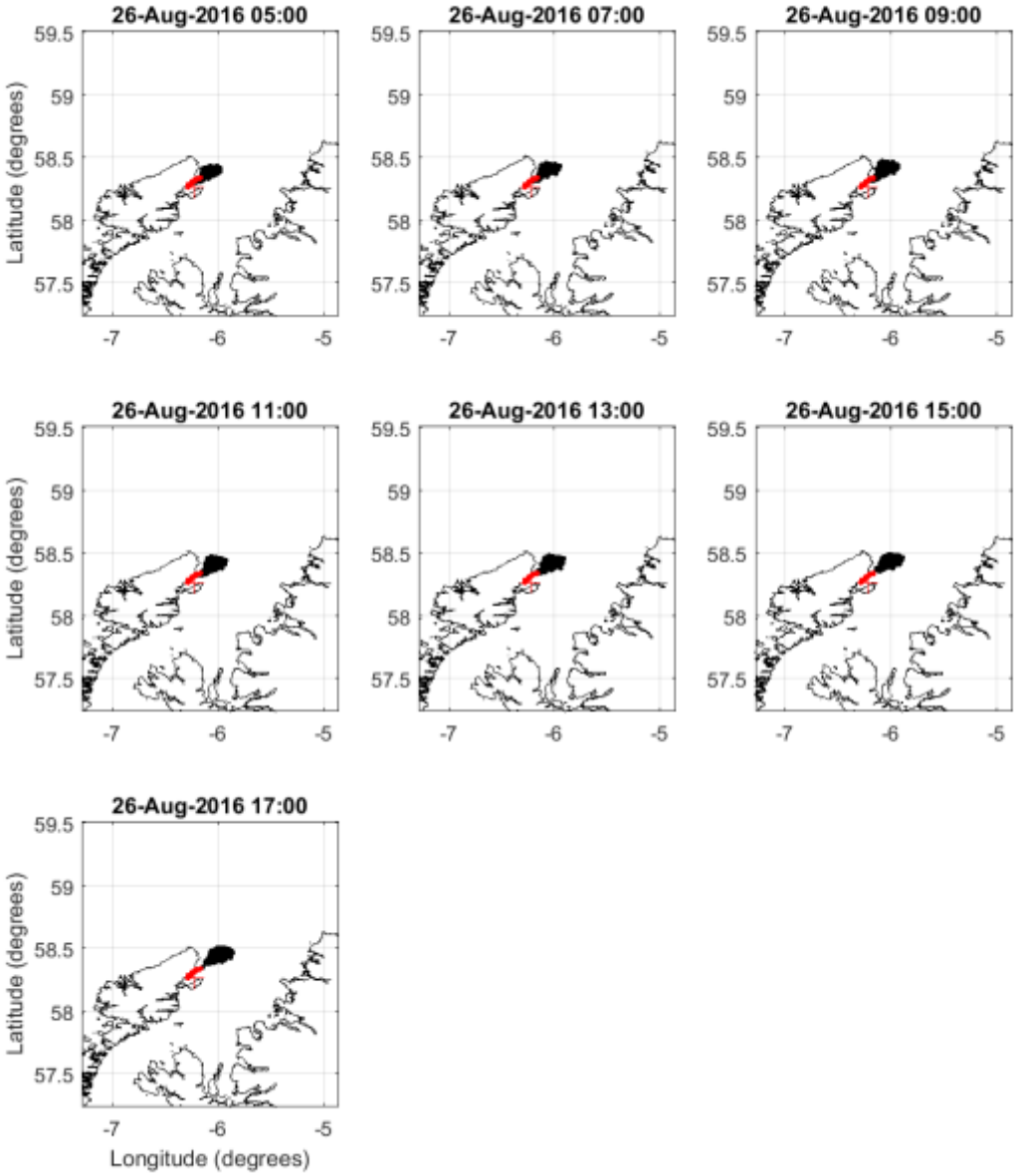

21.1 MCA Modelling for Dalmore Bay

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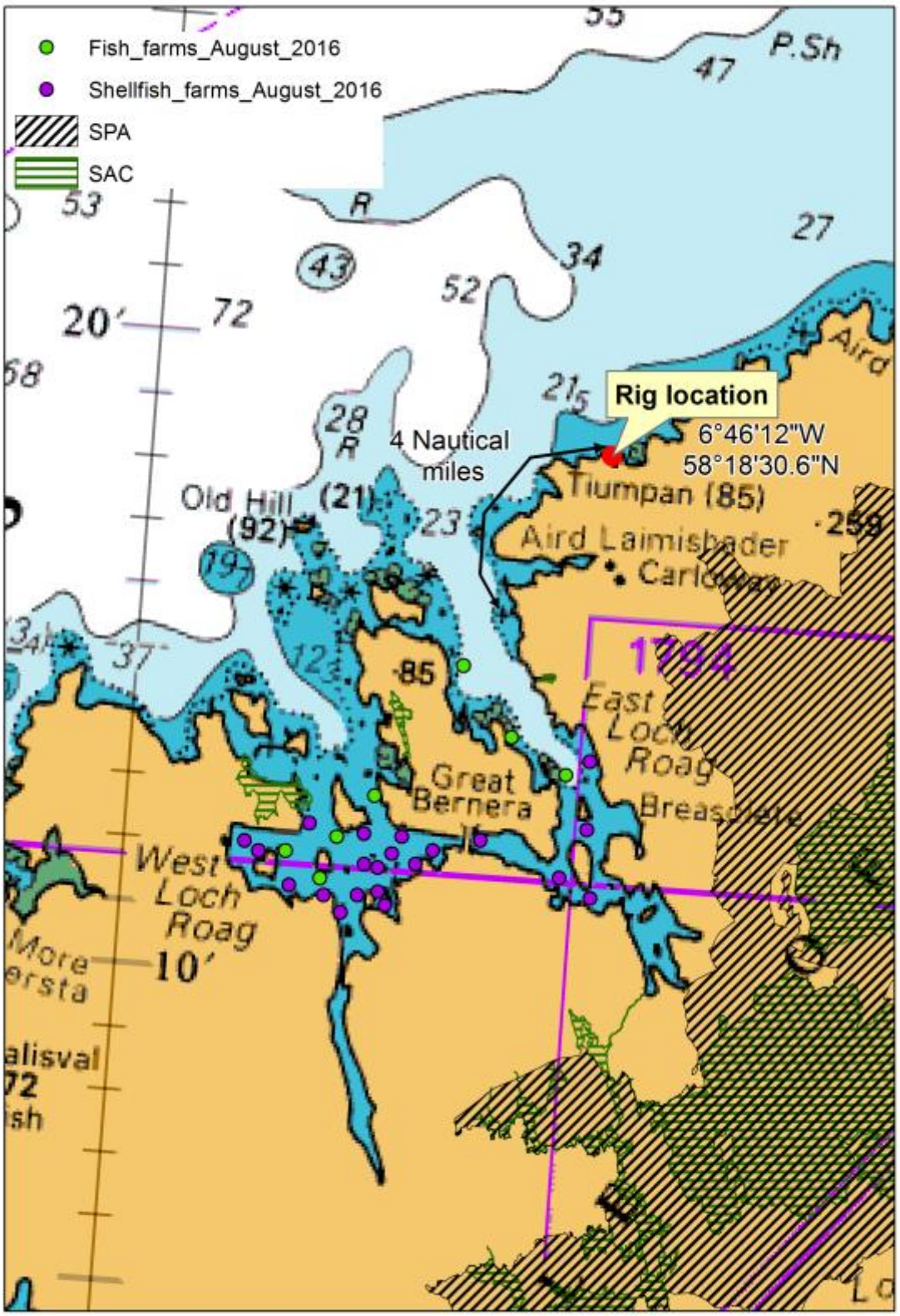
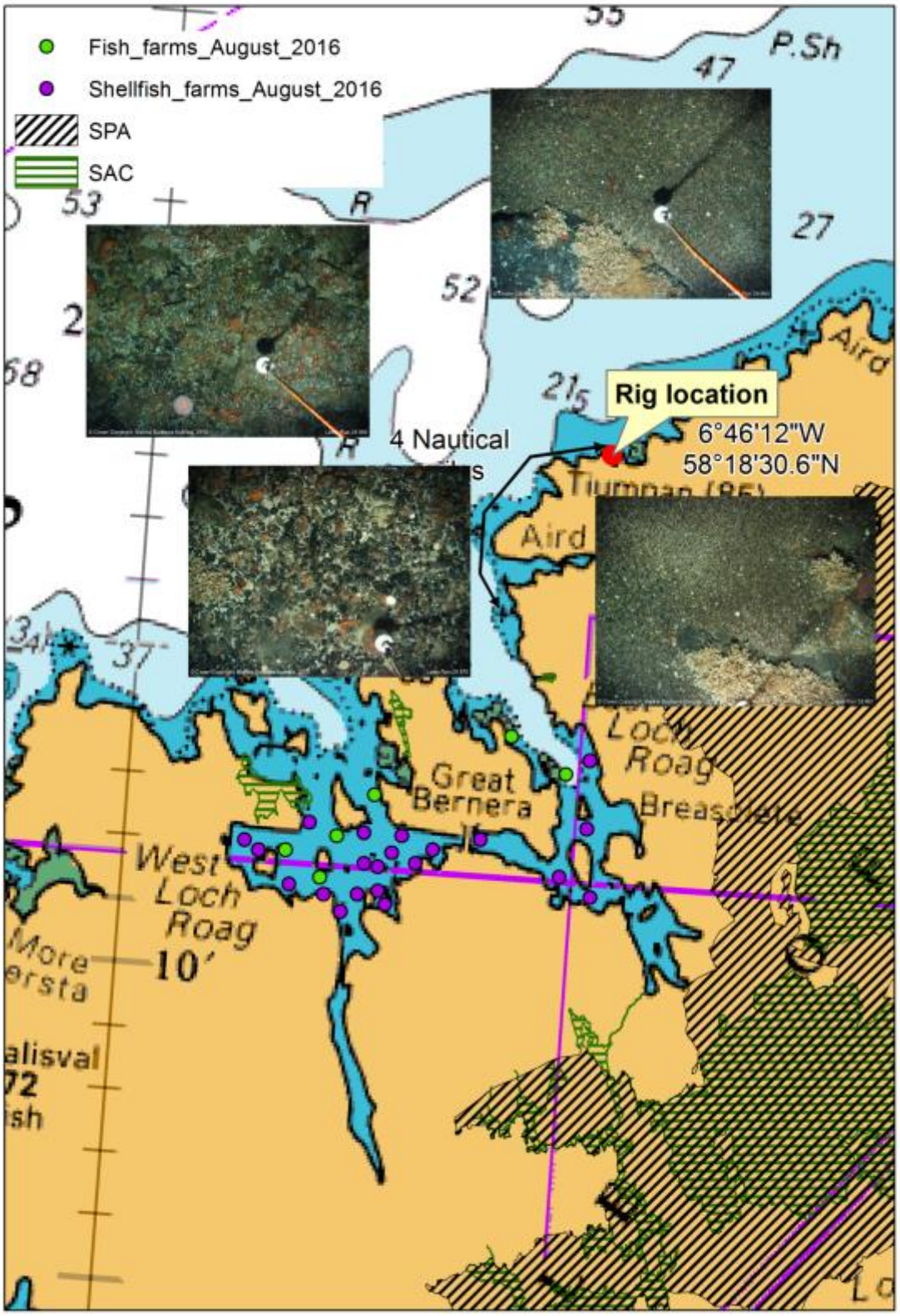
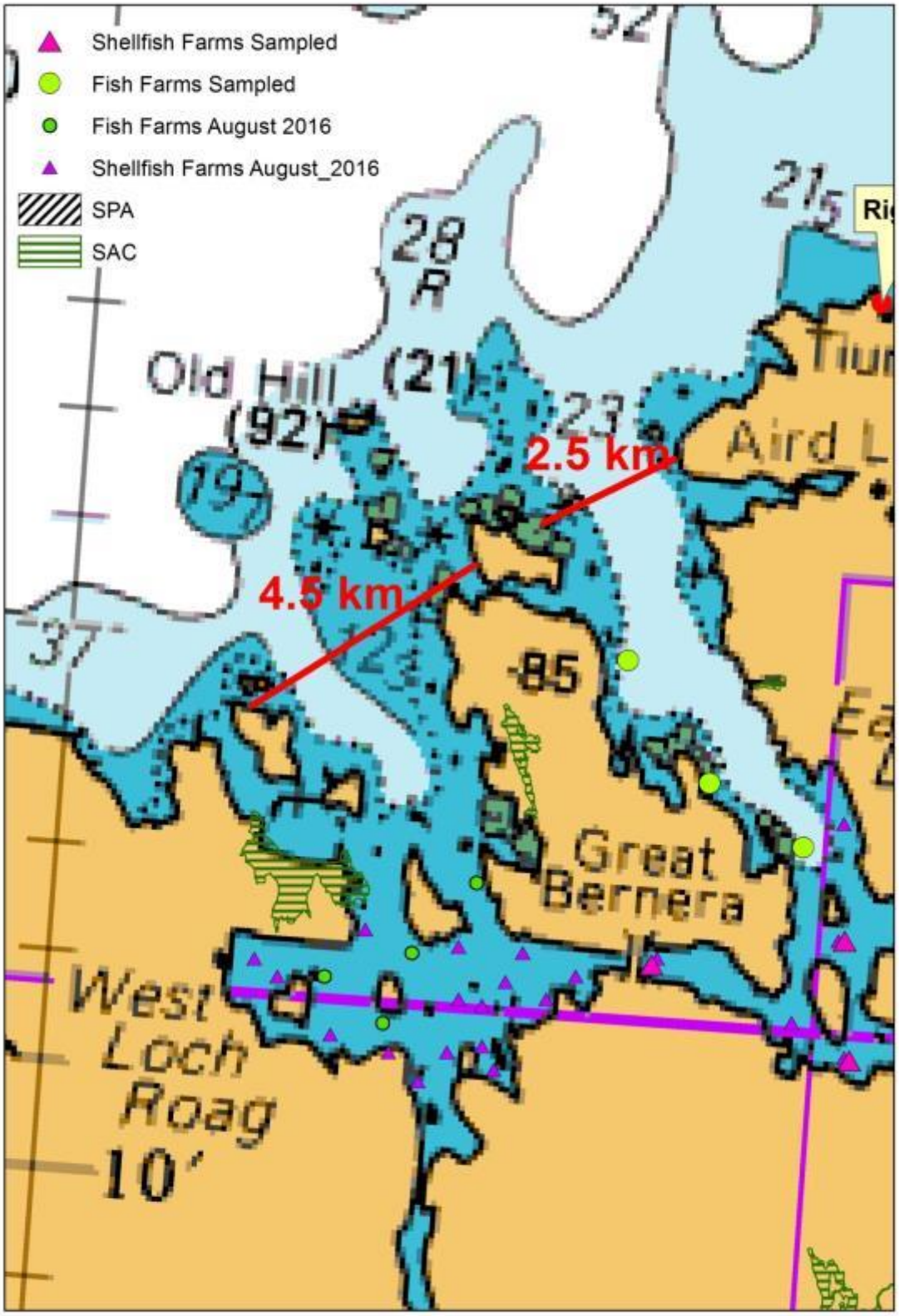
OILMAP Prediciton 40m3 loss 24082016.

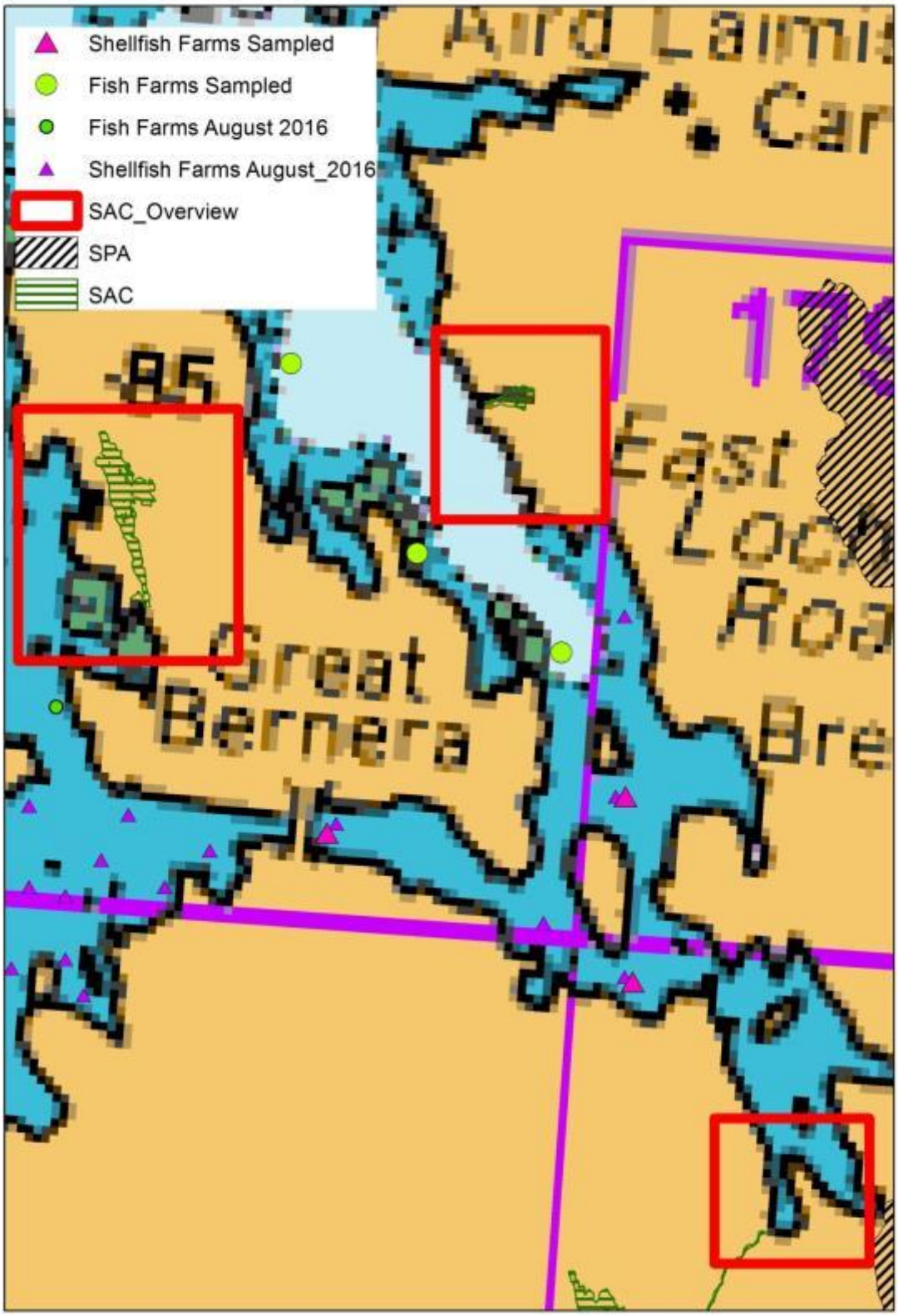
OILMAP Prediciton 40m3 loss 26082016.

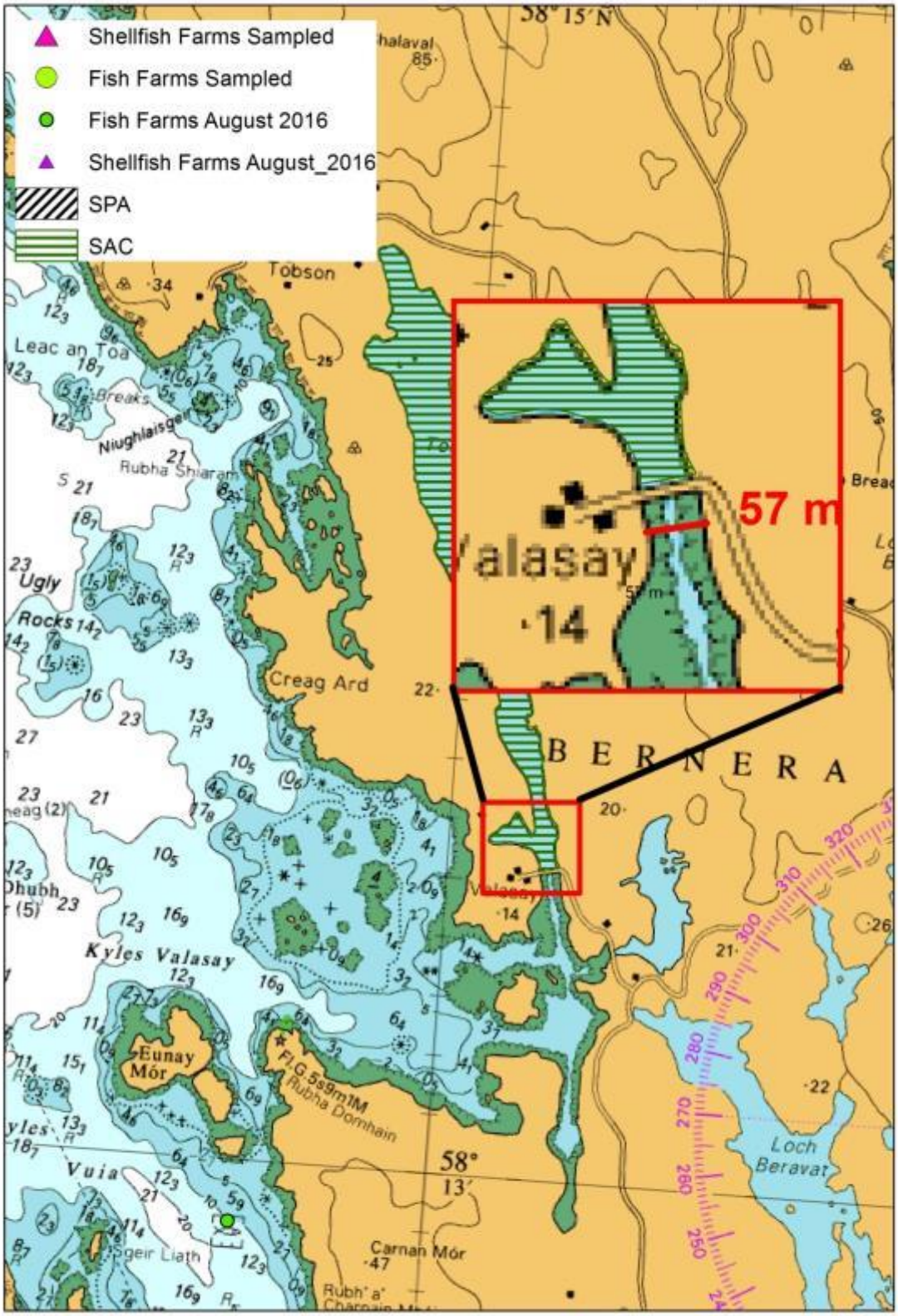
22. Appendix 4 Useful Maps











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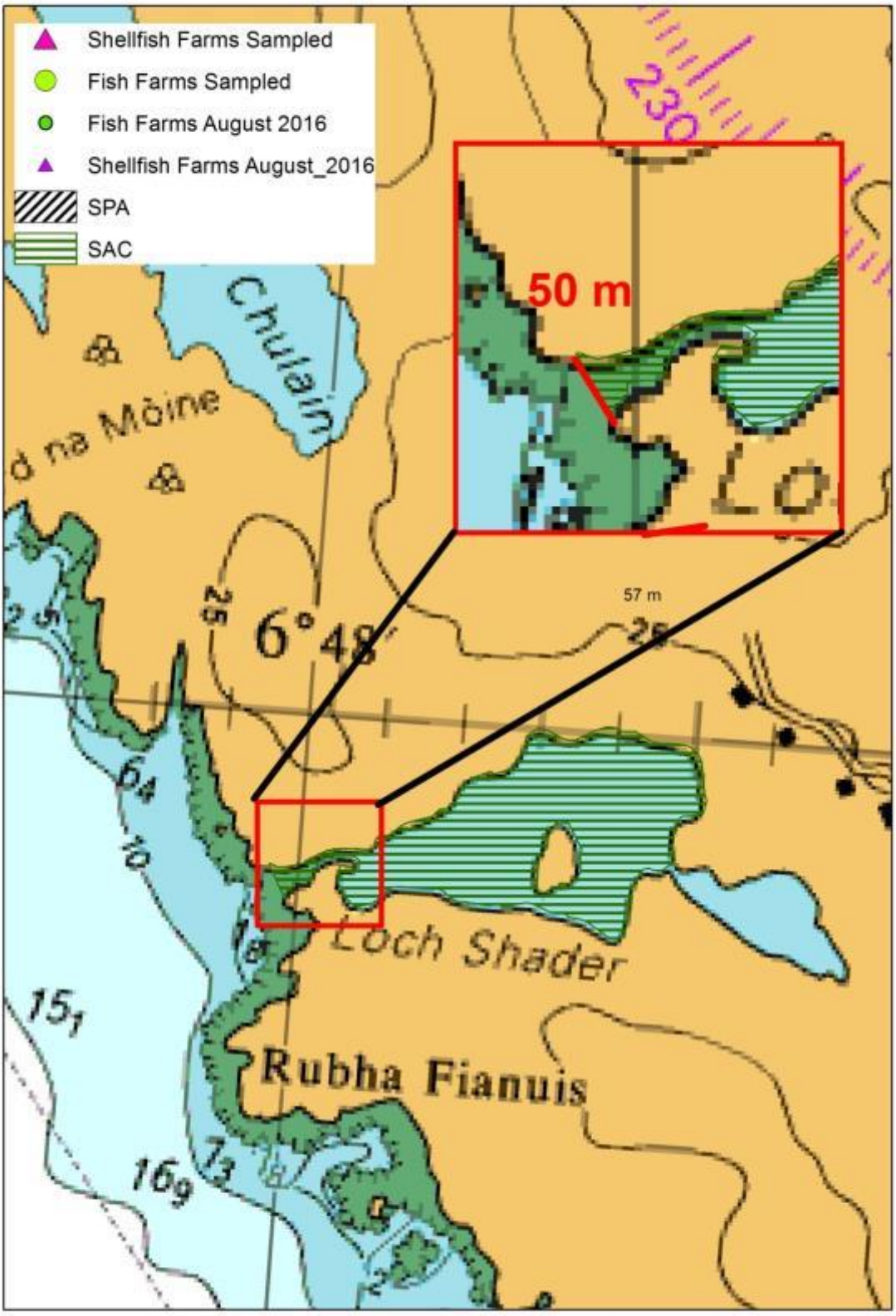
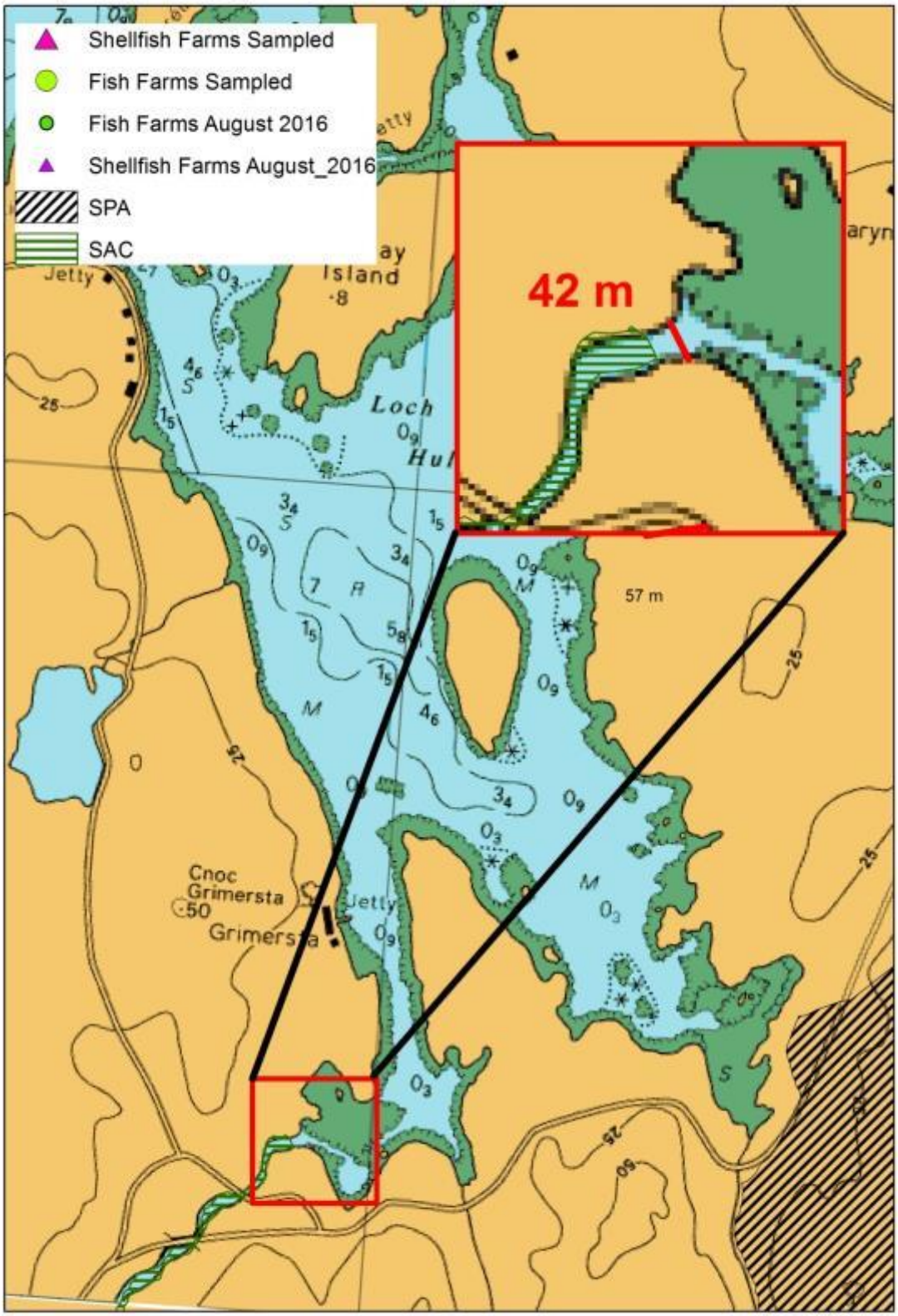
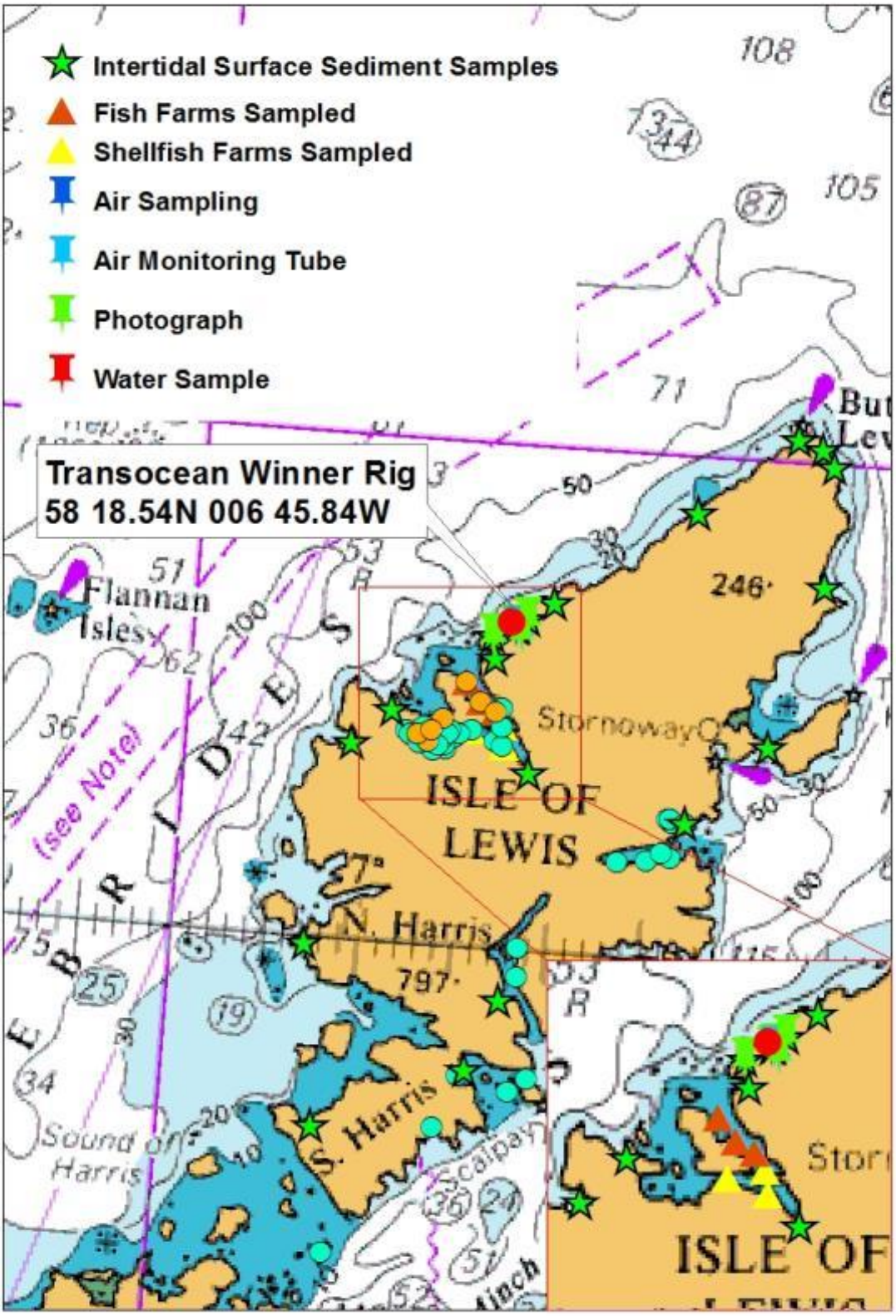






23. Appendix 5 Survey Results

Chemistry Department Report

Transocean Winner Oil Rig Incident at Dalmore Beach, Carloway, Isle of Lewis

CHEM/2016/079 v3
01 September 2016

	Name	Position	Signature	Date
Author(s)	Richard Sinnott	Senior Specialist Scientist		01 September 2016
Authoriser	Ashley Roberts	Unit Manager		01 September 2016

Summary

On the 8th August 2016 the Transocean Winner rig detached from the towing tug and grounded on rocks at Dalmore Beach on the Isle of Lewis. Following a safety inspection it was identified that there may have been a leak of diesel fuel oil. A hydrocarbon like substance was also identified on the shore, this was thought to be diesel although there were suggestions other hydraulic fluid oils may be present.

In response to the incident SEPA collected two water samples from the bay in order to ascertain the type of the oil, if any, present. Results from both samples identified low levels of weathered diesel; no other hydrocarbon based hydraulic fluid oils were identified.

Following odour complaints in the immediate vicinity, SEPA mobilised an air monitoring team who carried out ambient monitoring of benzene, toluene, ethyl benzene and m, o and p-xylene. These are commonly referred to as BTEX compounds and volatilise quickly from diesel fuel. Results from the monitoring showed that concentrations of benzene and toluene were above the limit of detection (LOD) for the equipment but below all health criteria compared. Results for ethyl benzene and m, o and p-xylene remained below LOD at all times.

Background

At 0423 on the 8th August 2016 the Maritime and Coastguard Agency (MCA) were informed that the Transocean Winner rig had detached from its towing vessel in adverse weather conditions. Recovery of the rig could not be made and it was grounded at Dalmore Beach on the Isle of Lewis at 0652.

The rig was known to be carrying 280 tonnes of diesel as well as additional fluids (32 m^3 in volume) which were stored in operating systems on the rig.

Following a safety investigation on the 9th August 2016 it was identified that up to three of the four diesel tanks had been breached with a maximum volume of 53m^3 of diesel lost. Aerial surveillance at the time did not identify any sheen from the rig, although on-site operations identified potential hydrocarbon contamination on the shoreline. Responding organisations also reported an odour in the air.

Methods

In response to the potential diesel leak SEPA collected two water samples from the shoreline on the 9th August 2016. Full details of the sampling times and locations can be found in Table 1.

The samples were analysed using the SEPA procedure ES-TORG-P-100 (Procedure for the Identification of Oil Type for Gasoline, Kerosene, Gas Oil, Diesel Oil, Light Fuel Oil and Medium Fuel Oil).

The purpose of this investigation was to ascertain the type of the oil, if any, in the samples submitted for analysis and also to determine whether or not there were any further components of concern present in the submitted beach water samples.

SEPA also mobilised air monitoring staff to collect data on ambient concentrations of benzene, toluene, ethyl benzene and m, o and p-xylene. These are referred to as BTEX compounds and are components of diesel that volatilise quickly. They are the most likely compounds to be detected in an incident of this type

The response team utilised a Gasmet DX-4030 FTIR instrument according to SEPA procedure ES-AHER-WP-002A (Sampling and Determination of Pollutants in Ambient Air Using the Gasmet DX-4030 FTIR Spectrometer). Short term sampling surveys were carried out on the 11th, 12th and 13th of August 2016.

With the duration of the incident unknown SEPA also deployed longer term diffusion tubes for monitoring Volatile Organic Carbons (VOCs). The tubes were deployed on the 16th August 2016 and the collection period is one fortnight.

Table 1: SEPA water and ambient monitoring locations

Description of Sample	NGR	Sample Type	Date and Time Sample Taken / Started
Dalmore Beach East	NB 21600 45210	Coastal Water	09/08/2016 12:35
Dalmore Beach West	NB 21420 45110	Coastal Water	09/08/2016 12:30
Dalmore Beach FTIR	NB 21582 45118	Ambient Air	11/08/2016 16:00 12/08/2016 17:45 13/08/2016 15:10
Diffusion Tube 1	NB 21603 45081	Ambient Air	16/08/2016
Diffusion Tube 2	NB 21939 44893	Ambient Air	16/08/2016
Diffusion Tube 3	NB 22016 44404	Ambient Air	16/08/2016

Results & Discussion

The full report for the oil typing analysis (CHEM/2016/077) can be found in Appendix 1.

Results show that each submitted sample was found to have oil present. Low levels of weathered diesel were detected in both water samples, but no hydraulic fluid was found. No additional chemicals of concern were detected in the GCMS screens undertaken.

Table 2 displays the results from the ambient BTEX monitoring carried out on the 11th– 13th August 2016. Average concentrations recorded for benzene and toluene were above the LOD of the monitoring instrument and above the expected background for the area. Levels of ethyl benzene and m, o and p-xylene were not detected above the LOD.

Table 2: Ambient concentrations of BTEX compounds collected on the 11th–13th August 2016

Component	Average Concentration (ppm)			Maximum Concentration (ppm)		
	11/08/16	12/08/16	13/08/16	11/08/16	12/08/16	13/08/16
Benzene	0.38	0.36	0.38	0.62	0.67	0.72
Toluene	0.29	0.16	0.40	0.95	0.22	1.32
Ethyl benzene	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
m-xylene	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
o-xylene	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
p-xylene	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12

The BTEX results were compared against relevant short term exposure limits and did not exceed any of the criteria. All data was passed to Health Protection Scotland (HPS) to advise on potential health effects.

At time of writing the diffusion tubes are in-situ, they are due to be collected on the 30th August 2016. This is to allow for sufficient exposure time.

Conclusions

Water samples collected the day after the grounding occurred showed low levels of weathered diesel. This report cannot confirm that this resulted from a leak from the rig.

Ambient air monitoring completed from the 11th–13th August showed levels of benzene and toluene above LOD but below all compared health related exposure limits. The values observed are higher than the expected background concentrations for this area. Ethyl benzene and m, o and p-xylene were not identified above the LOD for the instrument. A source for these results cannot be apportioned.

Diffusions tubes deployed around the grounded rig will be collected after a fortnight of exposure and will be analysed for total VOC concentrations. If results can be speciated then they will be extrapolated and compared against long term exposure values.

SEPA are not the lead on health. The air monitoring results were provided to HPS who have produced their own situation report.

Appendix 1

SEPA Analysis Report – Angus Smith Laboratory

Team Area: Hebrides and Central Highland **Report No: CHEM/2016/077**
Sample Media: COAST_WATER
Internal Distribution: Ross Hall, DL-OPS North - Hebrides & Central Highland

Dalmore Beach Oil Type and General Screen Investigation

1. Introduction

Following the grounding of the oil rig 'Transocean Winner' at Dalmore on the Isle of Lewis, samples were collected from two points on the beach the following day and delivered to ASB on Wednesday 10/08/2016. Concerns had been raised over the presence of diesel oil and hydraulic fuel stored on and utilised within the rig and the potential for this to have leaked to the beach.

The purpose of this investigation was to ascertain the type of the oil, if any, in the samples submitted for analysis and also to determine whether or not there were any further components of concern present in the submitted beach water samples. The samples described in Table 1 were analysed for the presence of oil and for further components using Gas Chromatography Mass Spectrometry (GC/MS) techniques.

Sample Number (Parent/Child/Grandchild)	Description Of Sample	Matrix	Date and Time Sample was taken	Sample Taken By	Sample Witnessed By
3039942 / 3039943 / 3039950	Dalmore Beach East	COAST_WATER	09/08/2016 12:35	Ross Hall	N/A
3039908 / 3039934 / 3039949	Dalmore Beach West	COAST_WATER	09/08/2016 12:30	Ross Hall	N/A

Table 1- Samples covered by this report

2. Methods

The samples were prepared and analysed for oil type as described in chemistry work procedure ES-TORG-P-100 and for a general screen using procedure ES-TORG-P-120. Samples were extracted into dichloromethane and analysed using Gas Chromatography-Mass Spectrometry (GC/MS).

Initial olfactory analysis did not detect any presence of oil in the samples. A diesel Ineos reference oil was run as a standard comparison using identical conditions. No hydraulic fuel reference standard was available to run.

Prepared By: David Thomson	Scientist	10/08/2016
Authorised By: Senior Scientist	Sue Bowers	11/08/2016
Angus Smith Building, 6 Parklands Avenue, Eurocentral, Holytown, North Lanarkshire, ML1 4WQ.		

3. Results and Discussion

The chromatograms for each of the samples submitted for analysis display the presence of a hydrocarbon spine, indicating oil is detectable in both of the samples. The chromatograms are included in the Appendix for further technical information.

3.1 Oil Type Identification

The chromatograms for both sample extracts showed a low intensity carbon range from C12-C23, followed by a general background baseline rise. Due to the low concentration of oil present and the nature of the sample, the heavier components of a typical diesel oil are not visible above the background noise. This suggests both samples contained a low concentration weathered diesel type oil. There are no visible typical peaks for hydraulic fluid in either sample.

3.2 General Screen for Further Components

The chromatograms for both sample extracts did not display any additional component peaks other than those typical of hydrocarbon oil.

4. Conclusions

Each submitted sample was found to have oil present. Low levels of weathered diesel were detected in both water samples, but no hydraulic fluid was found. No additional chemicals of concern were detected in the GCMS screens undertaken.

Team Area: Hebrides and Central Highland **Report No: CHEM/2016/077**
Sample Media: COAST_WATER
Internal Distribution: Ross Hall, DL-OPS North - Hebrides & Central Highland

APPENDIX:

Figure 1: Chromatogram of Process Blank

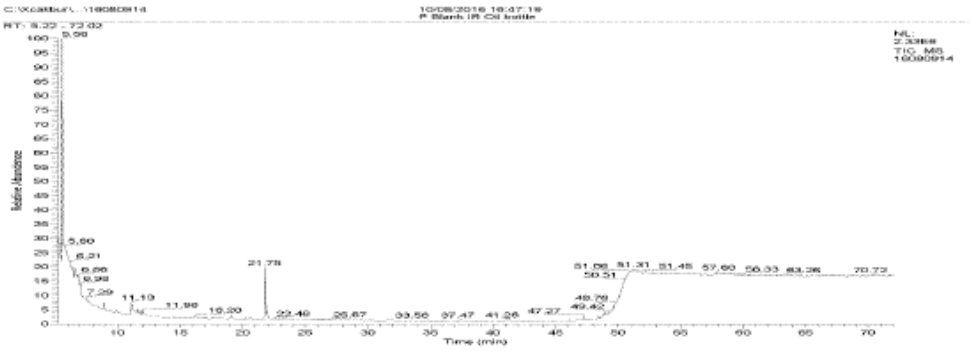


Figure 2: Oil Type Chromatogram of Dalmore Beach East

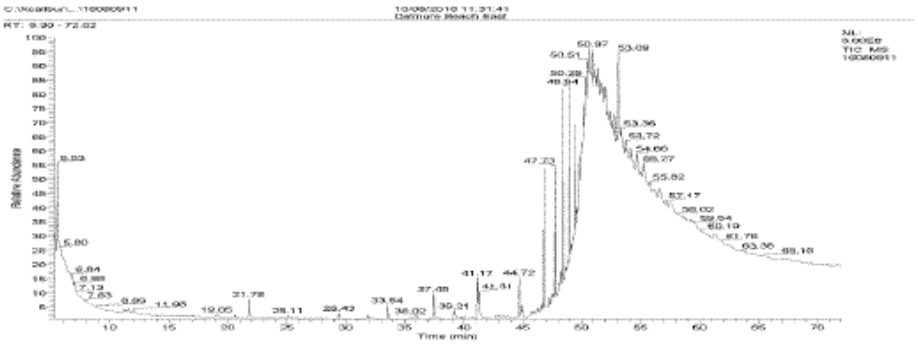


Figure 3: Oil Type Chromatogram of Dalmore Beach West

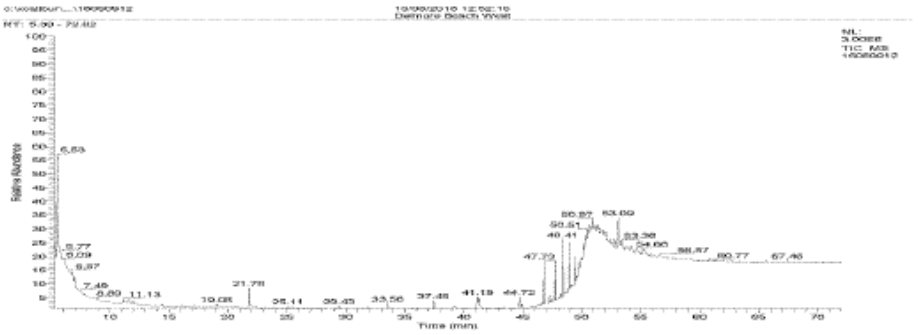


Figure 4: General Screen Chromatogram of Dalmore Beach East

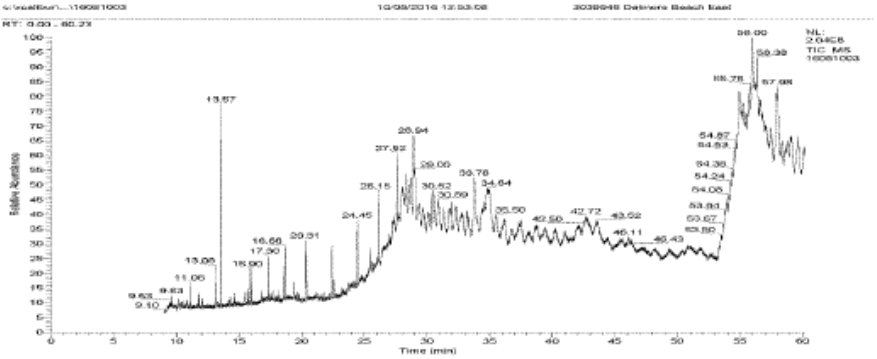
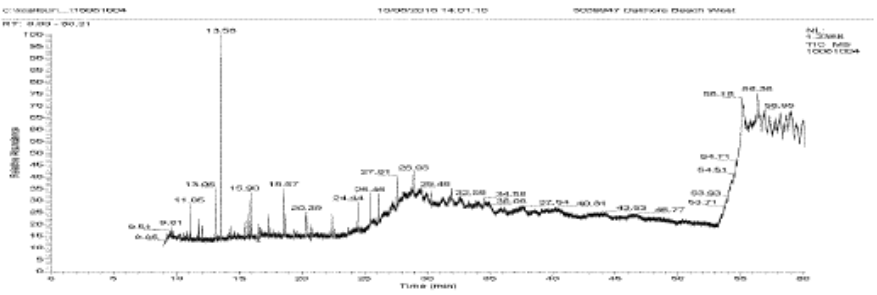


Figure 5: General Screen Chromatogram of Dalmore Beach West



SEPA Analysis Report – Angus Smith Laboratory

Team Area: Hebrides and Central Highland / NORTH **ReportNo: CHEM/2016/087**
Sample Media: COAST_WATER
Internal Distribution: Ruth MacLean, DL-OPS North - Hebrides & Central Highland

Broad Bay Oil Type Investigation

Introduction

The purpose of this investigation was to ascertain the type of the oil, if any, in the samples submitted for analysis.

The samples described in Table 1 were analysed for the presence of oil using Gas Chromatography Mass Spectrometry (GC/MS).

Sample Number (Parent/Child/Grandchild)	Description Of Sample	Matrix	Date and Time Sample was taken	Sample Taken By	Sample Witnessed By
3058975 / 3058977 / 3058991	Broad Bay at Mealabost, Isle of Lewis	COAST_WATER	07/09/2016 12:00	Ruth MacLean	N/A
3058962 / 3058972 / 3058990	Broad Bay at Portnaguran, Isle of Lewis	COAST_WATER	07/09/2016 09:30	Ruth MacLean	N/A
3058982 / 3058984 / 3058993	Broad Bay at Traigh Chuil, Isle of Lewis	COAST_WATER	07/09/2016 13:00	Ruth MacLean	N/A
3058978 / 3058980 / 3058992	Broad Bay at Traigh Ghrais, Isle of Lewis	COAST_WATER	07/09/2016 12:30	Ruth MacLean	N/A

Table 1- Samples covered by this report

Methods

The samples were prepared and analysed as described in chemistry work procedure ES-TORG-P-100.

Samples were extracted into dichloromethane and analysed using Gas Chromatography-Mass Spectrometry (GC/MS).

Based on initial olfactory analysis, Diesel, Light Fuel Oil and Medium Fuel Oil Ineos reference oils were run as standard comparisons using identical conditions.

Results and Discussion

The TICs (Total Ion Chromatograms) for the samples submitted for analysis exhibit no hydrocarbon spine, indicating no oil is detectable in the samples.

The TIC's for the process blank, samples **3058975 / 3058977 / 3058991**, **3058962 / 3058972 / 3058990**, **3058982 / 3058984 / 3058993** and **3058978 / 3058980 / 3058992** are shown in figures 1-5 respectively.

Oil Type Identification

No peaks were detected in the process blank TIC.

Samples **3058975 / 3058977 / 3058991**, **3058962 / 3058972 / 3058990**, **3058982 / 3058984 / 3058993** and **3058978 / 3058980 / 3058992** - no hydrocarbon spine is apparent so it can be concluded that there is no oil present in the samples

The oil reference standards used are gasoline, kerosene, gas oil/diesel oil, light fuel oil and medium fuel oil. Identification of oil type is limited to these types.

Conclusions

Initial inspection of samples **3058975 / 3058977 / 3058991**, **3058962 / 3058972 / 3058990**, **3058982 / 3058984 / 3058993** and **3058978 / 3058980 / 3058992** returned no odour or visible oil. In the extract TIC no hydrocarbon spine is apparent so it can be concluded there is no oil detectable in the samples.

Prepared By: David Thomson	Chemist	08/09/2016
Authorised By: Lucy Steven	Senior Chemist	12/09/16
Angus Smith Building, 6 Parklands Avenue, Eurocentral, Holytown, North Lanarkshire, ML1 4WQ.		

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*Note: Any opinions and interpretations expressed herein are outside the scope of UKAS accreditation. Tests marked with * in this document are not included in UKAS schedule for the laboratory. Results marked with ^ indicate that the handling of the sample for this analysis has deviated from the standard procedure and as a consequence the reliability of the results may be affected.*

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Analytical Report

Sample from : Broadbay at Portnaguran, Isle of Lewis

Date and Time of Sample: 24-Oct-16 at 15:15 | Location Code : 531014 | Version Number: 1

Sample Number : 3090987 | Taken By : Ruth Maclean

Sample Type: Marine/Coastal Water | Team Area: Hebrides and Central Highlands

Test Reference	Notes	Determinand	Result
ES-TORG-P-400	EC 10	Hydrocarbons by IR spectroscopy (3 peak)	<0.5 mg/L

Authorised By Fiona Wyllie - Chemistry Manager 14/11/2016

Notes:
AB - Test carried out in the Aberdeen laboratory
EC - Test carried out in the Eurocentral laboratory
- Test carried out by a UKAS accredited subcontractor
* - Test not included in UKAS schedule for the laboratory
§ - Flexible 17025 Accreditation

Results marked with the numbers below indicate that the handling of the sample for this analysis deviated from standard procedure in the ways noted. As a consequence the reliability of the result may be affected.

10 - Failure of the sample bottle delivery time target

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Analytical Report

Sample from : Broadbay at Traigh Ghrais, Isle of Lewis

Date and Time of Sample: 24-Oct-16 at 16:10
Location Code : 531016
Version Number: 1
Sample Number : 3090984
Taken By : Ruth Maclean
Sample Type: Marine/Coastal Water
Team Area: Hebrides and Central Highlands

Test Reference	Notes	Determinand	Result
ES-TORG-P-400	EC 10	Hydrocarbons by IR spectroscopy (3 peak)	<0.5 mg/L

Authorised By Fiona Wyllie - Chemistry Manager 14/11/2016

Notes:
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Results marked with the numbers below indicate that the handling of the sample for this analysis deviated from standard procedure in the ways noted. As a consequence the reliability of the result may be affected.

10 - Failure of the sample bottle delivery time target

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Analytical Report

Sample from : Broadbay at Traigh Chuil, Isle of Lewis

Date and Time of Sample: 24-Oct-16 at 16:25 | Location Code : 531017 | Version Number: 1

Sample Number : 3090979 | Taken By : Ruth Maclean

Sample Type: Marine/Coastal Water | Team Area: Hebrides and Central Highlands

Test Reference	Notes	Determinand	Result
ES-TORG-P-400	EC 10	Hydrocarbons by IR spectroscopy (3 peak)	<0.5 mg/L

Authorised By Fiona Wyllie - Chemistry Manager 14/11/2016

Notes:
AB - Test carried out in the Aberdeen laboratory
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- Test carried out by a UKAS accredited subcontractor
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Results marked with the numbers below indicate that the handling of the sample for this analysis deviated from standard procedure in the ways noted. As a consequence the reliability of the result may be affected.

10 - Failure of the sample bottle delivery time target

RSPB Scotland

RSPB Beached Bird Survey in response to the grounding of the 'Transocean Winner' oil rig at Dalmore, Isle of Lewis

Introduction

One of the RSPB's roles as set out in the National Contingency Plan for Marine Pollution from Shipping and Offshore Installations is to carry out surveys and provide information on which birds are at risk from pollution. Once it was established that a substantial but unknown quantity of fuel had leaked from the grounded rig at Dalmore it was decided that carrying out a beached bird survey of surrounding beaches could provide useful information about the impact on seabirds using this stretch of coastline. Shag, black guillemot, gannet, fulmar, red-throated diver, eider and several species of terns and gulls are some of the species that are known to breed on or forage along this coastline and could potentially be impacted by a pollution incident.

Method

The method employed was the same as for the national Beached Bird Survey which is carried out annually along stretches of the UK coastline to monitor the number of dead birds and the state of oiling as an indicator of the effects of pollution on seabirds.

The method involves walking along the high tide mark, looking above and below it along accessible sections of coastline in search of dead birds and sick live birds. For any birds found the state of oiling is categorised in the following way.

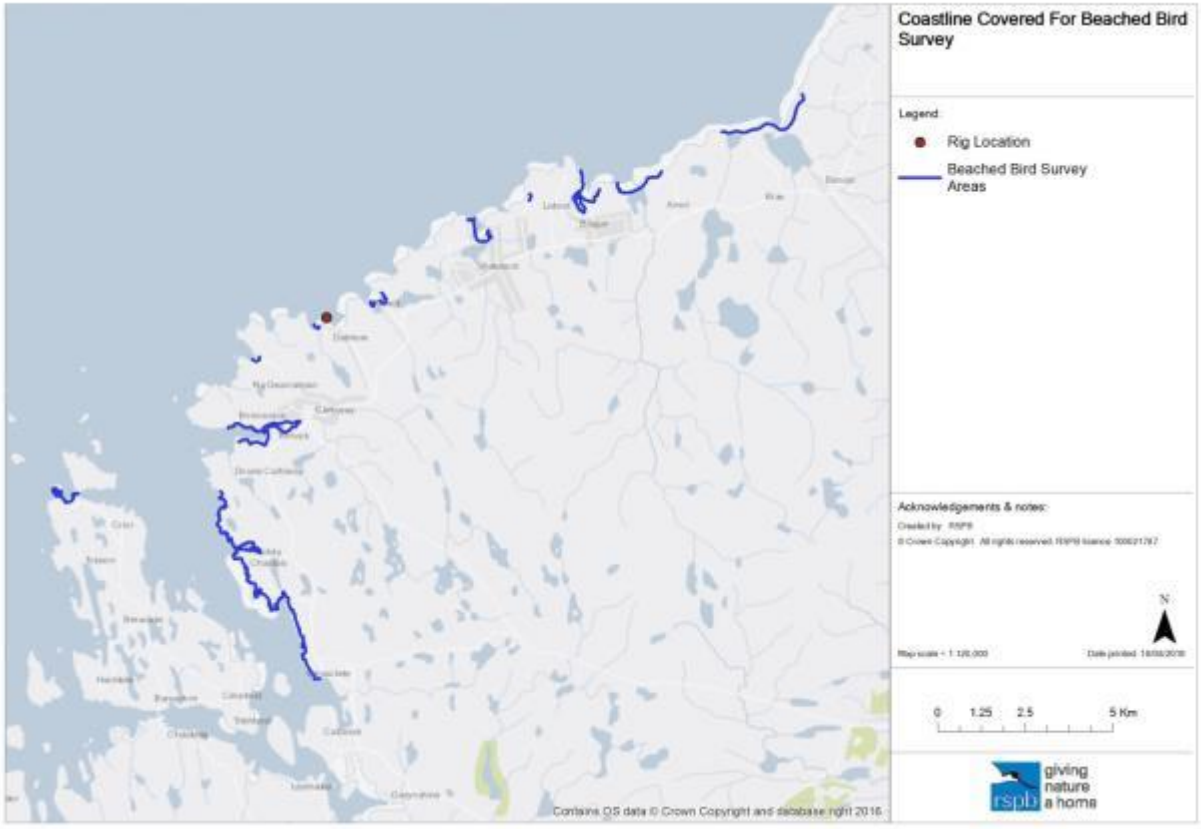
clean – unoiled
slight – less than half the surface of the corpse
heavy – corpse extensively covered.

Observers are also asked to look for signs of oil on the beaches and coastlines they visit.

In this survey any dead birds found were moved well above the high tide mark to avoid double counting should further surveys be necessary if there are further pollution incidents from the grounded rig.

Results

Thirty three km of coastline within 15km of Dalmore were covered during the beached bird survey carried out by RSPB staff and volunteers on the 14th and 15th August.



A total of nine bird corpses and five incomplete corpses were found during the survey. Several corpses were well decomposed and there were no signs of oiling. This equates to 0.3 dead birds per km of coastline. No sick or injured oiled birds were found. There were no signs of a sheen on the water or oil around any of the coastlines covered. The numbers and species found are summarised below.

Species	Whole corpse	Incomplete corpse (wings only)
Fulmar	1	
Shag	1	
Gannet	2	
Herring gull	1	1
Great black-backed gull		2
Kittiwake		1
Tern sp.	2	1
Skua sp.	1	
Unknown	1	

One of the terns and the skua were found tangled in fishing net but the cause of death is not know for the other dead birds. One dead sheep and a well decomposed dolphin were also noted on the survey.

Conclusion

The density of 0.3 dead birds recorded per km of coastline searched is not cause for concern and is within the range of the densities recorded around the UK coastline during the national beached bird survey in 2015 when there were no known pollution incidents. Since the grounding of the vessel on the 8th August, the prevailing wind direction has been onshore. In these conditions we would expect to detect seabird carcases and sick birds on the shore if pollution arising from the grounding of the rig was having a significant impact on the local bird population. The fact that few dead birds were found and no oiling was recorded is encouraging and suggests that at this stage the incident has not had a significant and immediate detrimental impact on the bird population in the area. The survey also forms a baseline that could be repeated if there is further loss of fuel or pollution from the rig.

Robin Reid
RSPB Western Isles Conservation Officer
16th Aug, 2016

Marine Scotland Science: Preliminary report for mussel and salmon samples collected from Loch Roag

DOI: 10.7489/1803-1

24. Appendix 6 Transocean Winner Drawings (All Drawings copyright Transocean)

Damage Tank Status.pdf

WIN-X002-03_r0.pdf

WIN-X002-02_r0.pdf

WIN-X002-01_r0.pdf

25. Appendix 7 Transocean Broad Bay Video Logs (All Logs copyright Transocean)

Transocean - Broad Bay -Video Log 1 - Se

Transocean - Broad Bay -Video Log 2- Sep