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FRV *Scotia*

Cruise 0809S

REPORT

5 – 24 June 2009

Personnel

A Weetman
C Shand
A Tait
N Campbell
L Allan
C Mesquita
H Dobby
A McLay
E Heywood

M Robertson
P Copland

Loading: Aberdeen 2 June 2009
Sailing: Aberdeen 5 June 2009
Half landing: Greenock, 14 June 2009
Unloading: Aberdeen 24 June 2009

Days allocated by project: 8 days RV0904 10665 (North Sea)
12 days RV0905 10666 (West Coast)

Gear

2 x *Scotia* BT175 60mm prawn trawls
Day grab and table
Towed UWTV sledge and UWTV drop frame
2 x 600m umbilical towing cables, OE 14366 video camera and associated TV equipment (including back up)
2 x Box corers
7 Sample collectors for box corer, 4 wooden supporting pallets for sample collectors and 2 pallet trucks

Objectives

1. To obtain estimates of the abundance and distribution of *Nephrops* burrows in the Fladen Ground, The North Minch, the South Minch, in the Firth of Clyde and at Devil's Hole. If time permits stations in the Sound of Jura and at the Noup will also be surveyed.

2. To use the TV footage to record occurrence of other benthic fauna and evidence of commercial trawling activity.

3. To collect sediment samples at each station.

4. To carry out trawling for *Nephrops*, based on one haul in each sediment stratum in each of the main survey areas, and to obtain samples of *Nephrops* for size composition analysis.

5. To collect samples of *Nephrops* for comparison of reproductive condition and morphometrics in each of the different survey areas (Functional Units)

6. To deploy the box corer sediment sampler in the Clyde on several occasions, and to resin cast burrows found within the samples.

7. To carry out trials on the new swathe system whilst in the Clyde.

8. To collect EK60 Roxann data throughout the cruise.

Narrative

All scientific staff were on board FRV *Scotia* by 11:00 on Friday 5 June 2009, after which the vessel sailed at 12:30. *Scotia* headed for the Southern Trench in the Moray Firth, where a training session involving the deployment and recovery of the TV sledge was undertaken. Following this, *Scotia* made way to the Fladen grounds arriving there at 22:00. All staff were present at the first station; however the positioning of additional equipment on the sledge and difficult sea conditions resulted in the sledge making poor contact with the sea bed, and TV operations were postponed until daylight when the sea had settled and the equipment issue was addressed. Over the next three days, *Scotia* generally worked in an anti clockwise direction around Fladen with a fishing trawl in the evening of each day. On the night of 8 June, after fishing was completed, the trawl was streamed out and towed with the cod end open to meet with anti bio-fouling guidelines. TV operations continued until midnight on 9 June before the vessel made for the west coast. This early departure from the east coast was to accommodate the SIC to be put ashore at Scrabster for personal reasons; which was completed utilising the work boat early on the morning of 10 June. This left 11 TV stations remaining in Fladen to be surveyed on the return leg of the cruise. At this point H Dobby took on the role of SIC.

The vessel was at the first station in the North Minch by 14:30 on 10 June, and continued to work down the west side of the Minch, which included a fishing trawl, until the evening of 11 June when *Scotia* moved in to the South Minch.

Throughout the day, TV stations on the west side of the South Minch were completed and a fishing trawl was carried out that evening. After trawling, the net was cleaned again and the vessel progressed on to the Clyde, arriving at the first station to the east of Campbeltown at 10:00 on Saturday 13 June. Work continued up the west side of Arran, including a station in Loch Fyne, until the morning of 14 June where *Scotia* entered the Clyde Port Authority area in preparation for a half landing at Greenock.

During the half landing there was a change of scientific staff, where A Weetman resumed the role of SIC.

At 09:00 on the 15 June, *Scotia* headed back into the Clyde, working south on the east side of Arran. Three successful box core sediment samples had been achieved before a trawl was carried out in Ayr Bay. During the trawl work up period, staff from the Fishing Technology and Fish Behaviour Group and Environmental Impact Group carried out a SVP (Sound Velocity Profile) and swathe survey. The remaining TV stations in the Clyde, 3 more

box core samples and a trawl were completed by 14:00 on 16 June, after which the vessel moved on to the Sound of Jura. All the Jura stations were completed by 06:30 on 17 June, which was followed by a fishing trawl and the net being cleaned again. A further three box cores were taken in the Sound of Jura, and more swathe work following a SVP.

By the evening of 17 June, *Scotia* had passed through the Sound of Islay and for the first time in the cruise since leaving the Moray Firth, poor weather was encountered. Although the sea had settled a little by midnight allowing stations off Tiree to be completed in the early part of the morning of 18 June, some stations were relocated east towards Ardnamurchan to provide some shelter from the Force 9 south westerly wind, and this approach proved to have some success. At 11:00 the work boat successfully transferred scientific staff ashore to Ardtoe, as the scheduled venue of Mallaig was deemed unsuitable in the prevailing weather conditions. Again due to the weather forecast, it was decided that the TV stations remaining in the west of the South Minch would remain unachievable in the time remaining, therefore alternative stations in the more sheltered areas to the east of the South Minch were generated, using the standard approach and protocols. However, only half of these new stations were workable such was the strength and direction of the wind, and so with 4 stations incomplete in the South Minch, *Scotia* moved north to begin work in the North Minch.

After surveying a site in Loch Dunvegan, *Scotia* lay in Loch Snizort during the hours of darkness on 19 June, as the possibility of creels being present in the loch was very high. After completing two incident free TV stations in Sniizort *Scotia* sailed to Rona and trawled on the morning of 19 June. By 18:00 that same day all the stations in the Torridon/Raasay area had been completed, with only one station being relocated due to creels. The vessel then proceeded to the north east area of the Minch and carried out a trawl before continuing with TV operations, completing all North Minch work by early on 20 June. The trawl was again cleaned before setting off for Fladen, arriving at the most south westerly of the remaining stations at 20:00, in perfect working conditions. TV operations continued until the early morning on 21 June when a fishing trawl was carried out, with very poor returns in respect to *Nephrops* catches. TV work continued in a north easterly direction completing all the scheduled stations by 18:00 on 21 June. A further fishing trawl was carried out within the Fladen grounds at 23:00 on 21 June whilst *en route* south to Devils Hole. This trawl was far more successful than the previous one and the catch was worked up as the vessel steamed south. *Scotia* arrived at Devils Hole at 12:00 on 22 June, where TV work was carried out in bright, calm conditions, with few commercial vessels working in the immediate area; which resulted in excellent water clarity. However, as the programme progressed more to the south and west, there was a greater presence of commercial vessels working in the area. Following a trawl on the evening of 22 June that provided few samples, TV operations carried on through the night, followed by another trawl in the early morning. This shorter tow (30 minutes) targeted a narrow, short gully and provided a significant return which was worked up whilst the net was thoroughly cleaned. The final scheduled station had zero visibility as there was a great deal of fishing activity in the area and so an additional station was added to the plan. This was successfully carried out by mid afternoon on 23 June, after which the vessel made way for Aberdeen. During this time, all scientific work spaces were thoroughly cleaned, scientific equipment was packed away in the transit cages and general preparations were made for the end of the cruise.

The vessel was met by the pilot vessel early on the morning of 24 June and was tied up alongside the pier by 07:00. Following the unloading of all scientific and fishing gear, the debrief took place, after which all staff left the vessel.

Results

The following table summarises the number of TV stations that were completed successfully and the number of fishing trawls carried out in each of the areas surveyed.

Area	Number of TV Stations	Number of Fishing Trawls	Number of Sediment Samples
Fladen	60	4	59
North Minch	39	3	37
South Minch	34	1	30
Clyde	40	2	39
Jura	12	1	12
Devils Hole	14	2	14

Two methods were used to create the positions of the selected TV stations in some of the areas. In all but the Devils Hole, the traditional stratified random approach was used, based on the strata being the sediment type. In the North Minch, South Minch and Devils Hole data from the Vessel Monitoring System (VMS) were also used to generate stations. These stations (10 in each the North and South Minch and all 15 stations at Devils Hole) were based on commercial activity of vessel 15m or over in length where they were targeting *Nephrops*. Combining these two approaches follows on from the Moray Firth survey in January 2009 (0109A) where it was attempted to establish the extent of commercially viable *Nephrops* habitat outwith the boundaries established by the BGS (British Geological Survey) data; as VMS data highlighted effort beyond the suitable sediment as defined BGS by charts. The final analysis of this data will be assessed further on return to Aberdeen.

Four staff on this cruise had suitable training and experience in verifying the video footage for absolute numbers of *Nephrops* burrows. Due to this, 63% of all the footage gathered was reviewed at sea and available for assessment purposes.

In addition to *Nephrops* burrows, a record was made from each 10 minute video clip of the abundance of various varieties of seapens, fish and crustaceans, as well as the water clarity, seabed composition, and if there were any indications of trawler activity recorded. Some TV sites had to be relocated due to weather or the presence of creels.

Approximately 500 still images were taken using the digital stills camera. These images recorded various species of fish; crustaceans; *Nephrops* burrows; anthropogenic activity and benthic habitats. These images will be used in future presentations and documents for illustration purposes.

Throughout the survey 191 sediment samples were taken, with all but at 4 stations using the mini Van Veen grab sampler mounted on the sledge. The remaining 4 sites required the use of the Day Grab, as the mini van Veen had malfunctioned. All samples were frozen at sea and will be analysed on return to Aberdeen. The 8 sites where no samples were taken was due to the rocky terrain at that position, located within the areas North Minch (2 sites); South Minch (4 sites); Clyde (1 site); and at Fladen (1 site).

13 fishing trawls were carried out, with varying success. Where *Nephrops* were caught, a representative sample was taken for a simple length frequency distribution, with the ovaries being staged for those females within the sample.

A further 25 males and 25 females covering the full length frequency distribution within each trawl were also sampled for growth rate parameters and sexual maturity. 14 observations

were made on each of these individuals and analysis on these data will be carried out at the Marine Laboratory Aberdeen.

In addition another sub set of 50 *Nephrops*, selected at random, were measured for total weight, tail weight, carapace length and tail length, as requested by Marine Scotland Compliance and Licensing.

Area	**Len. Freq. Dist'n**	**Morphometrics**	**Tail Len. Compliance**
Fladen	1091	194	151
North Minch	1208	149	151
South Minch	306	47	50
Clyde	783	100	100
Snd. Of Jura	539	51	51
Devils Hole	364	47	51

Dr Augley from the Population Biology Group requested otoliths to be collected from 1 and 2 year old, west coast cod, which targeted individuals in the 20- 60cm length range. Four samples were collected from the west coast throughout the 7 trawls, but in addition to the request 20 samples were collected from the east trawls.

Each sample included data on haul number, date, overall length, and maturity stage. These otoliths will be used in otolith core trace element analysis for population mapping.

The aim of the resin casting was to establish if the method of using a box corer and resin was suitable to cast *Nephrops* burrows at depths beyond the reach of non-specialist divers; and if so how the methodology could be improved upon for future sampling to establish *Nephrops* size and burrow entrance correlations, which on balance was achieved.

Two locations in the Clyde, one in the Sound of Jura and one to the north of Colonsay were sampled by the box corer, as indicated in the plots below. In total 10 samples were taken at various depths, ranging from 47m to 97m with high *Nephrops* and non-*Nephrops* burrow densities. Following a standard TV station survey, a suitable site would be identified and the box corer deployed. On recovery the box containing the sample was stored in a secure and safe area and the surface of the sample that contained any additional points of interest were photographed. Using a 20ml. syringe and a fine rubber tube, a polyester resin mix was introduced to observed burrows entrance. Some polychete entrances were too narrow to cast, and in many occasions the resin did not penetrate the complex sufficiently. However 10 burrows were injected with resin and produced acceptable representations of the complexes. Two of the casts illustrate *Nephrops* complexes; and one of the casts was from a tube worm, which when removed from the sediment sampler, had the tube still attached to the cast. As the oxygen levels fell whilst the resin was setting over the 12 hour curing period, many other species surfaced from within the sediment including two Liocarcinus (carapace width 4mm), worms, shrimps, and two *Nephrops* (carapace lengths 5mm and 4mm). In a sample taken in the Clyde a *Nephrops* (carapace length <3mm) was found on the surface of the sample where one of the two *Nephrops* complexes were successfully cast; although it was not conclusive that the observed *Nephrops* occupied the burrows sampled.

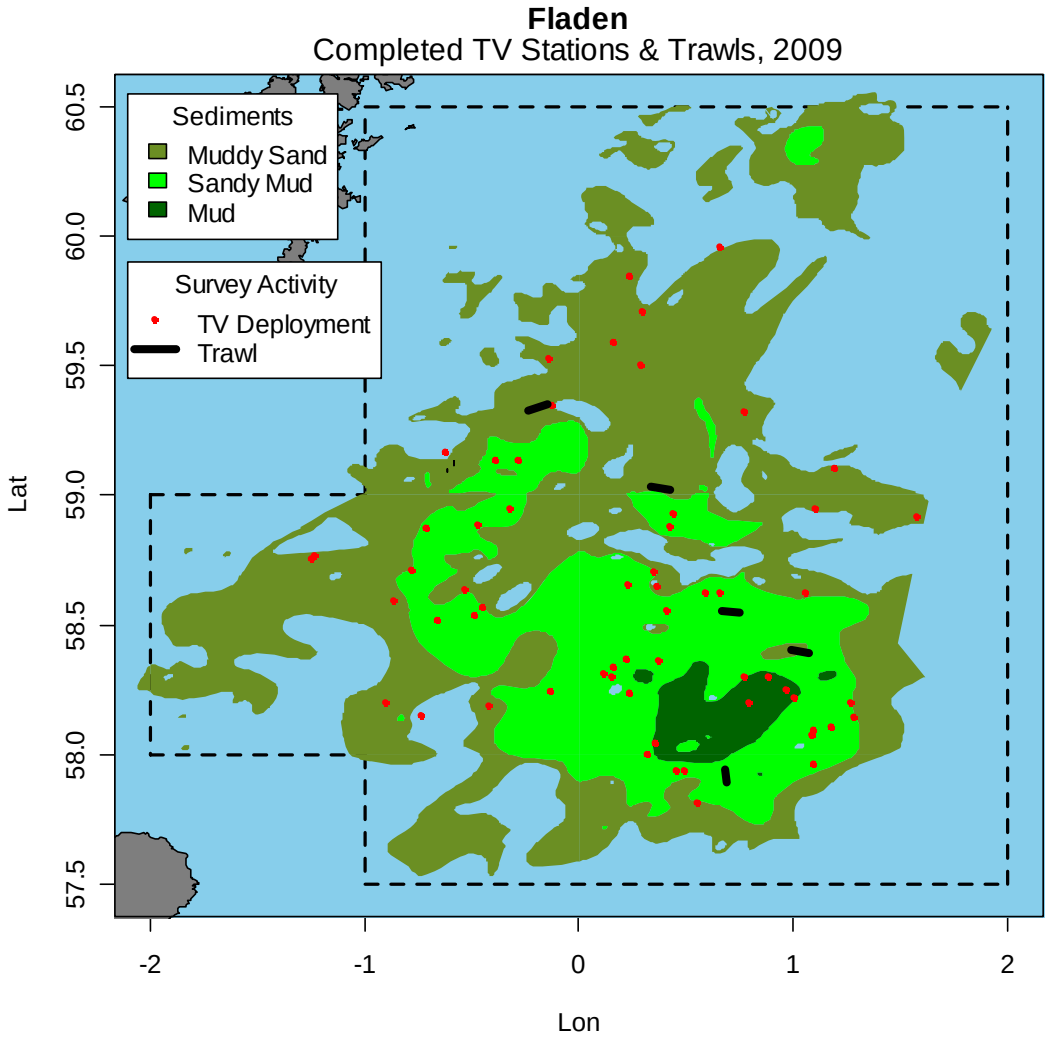
In preparation for the following Wet Renewables cruise (0909S), four exercises were carried out to test the replacement Motion module on the swathe system. As indicated in the charts below two trials were carried out in the Clyde whilst the contents of the fishing tow was being worked up, one carried out in the sound of Jura, and in rougher conditions the final test was carried out whilst *en route* between TV stations to the north of Colonsay. Whilst in the Clyde

the same ground was examined twice by the system to reduce variance in results, where as outwith the Clyde the testing was carried out on a single track/trajectory. Between sites, significant alterations were made on both settings and output formats (e.g. ship's bridge display). At the point where swathe work ceased, the system was working to a satisfactory level and FTFB staff had achieved what they had set out to do.

Throughout the cruise the EK60 Roxann ground truthing acoustic system was in operation. Recorded data from this unit was downloaded on a regular basis and will be merged with data collected n previous surveys, and in the long term provide a substrate map on grounds covered on *Nephrops* TV surveys.

Submitted:
A Weetman
7 July 2009

Approved:
I Gibb
28 July 2009.


Fladen
Completed TV Stations & Trawls, 2009
Sediments
Muddy Sand
Sandy Mud
Mud
Survey Activity
TV Deployment
Trawl
Lat
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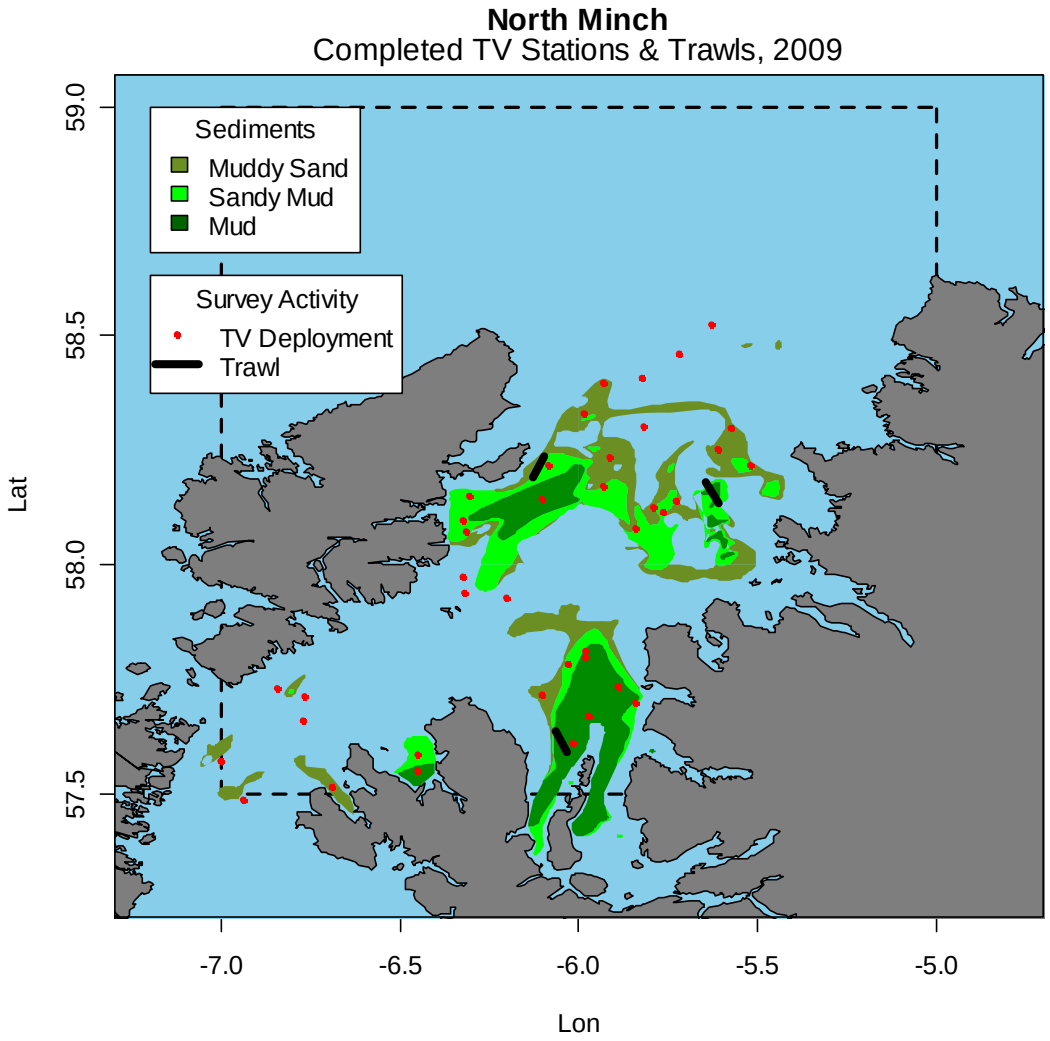
60.0
59.5
59.0
58.5
58.0
57.5
-2
-1
0
1
2
Lon


North Minch
Completed TV Stations & Trawls, 2009
Sediments
Muddy Sand
Sandy Mud
Mud
Survey Activity
TV Deployment
Trawl
Lat
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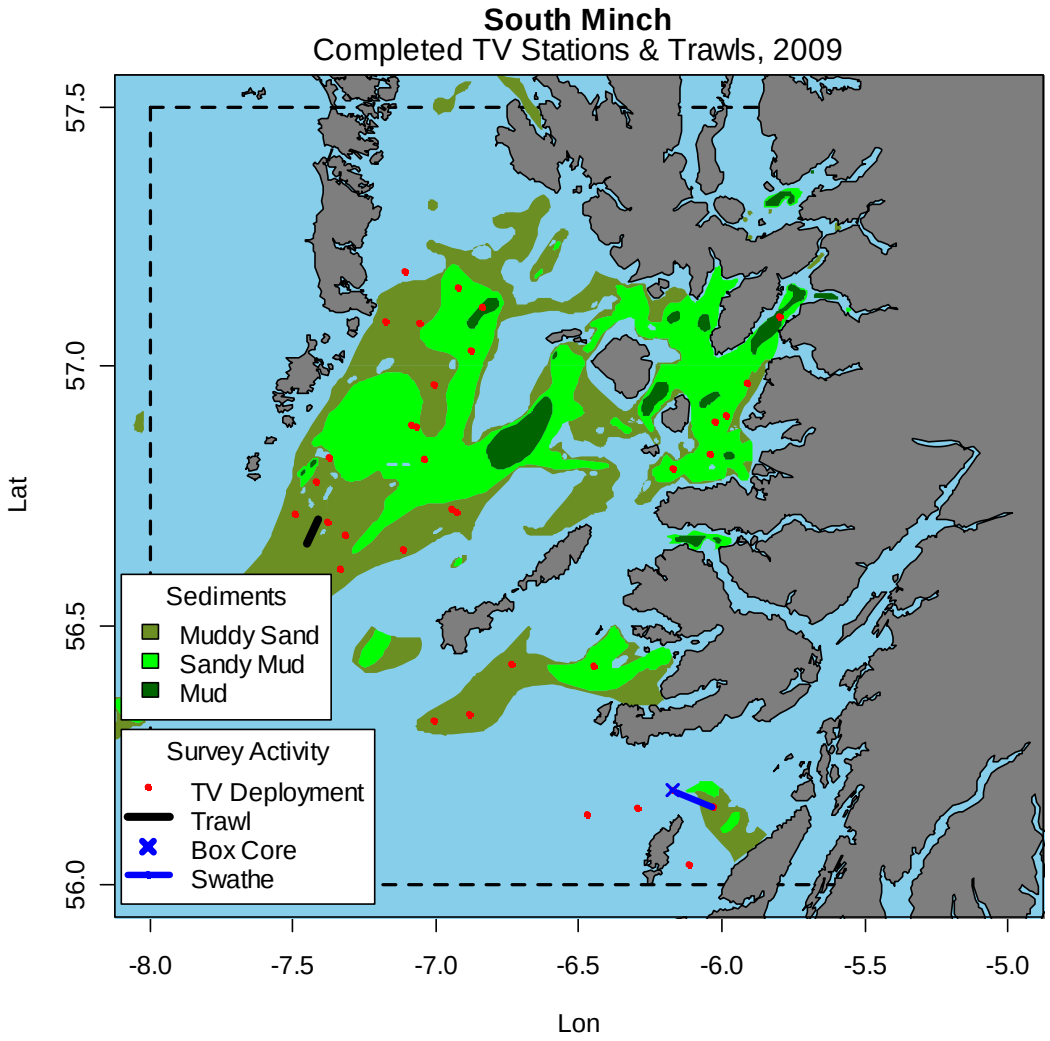
58.5
58.0
57.5
-7.0
-6.5
-6.0
-5.5
-5.0
Lon


South Minch
Completed TV Stations & Trawls, 2009
Lat
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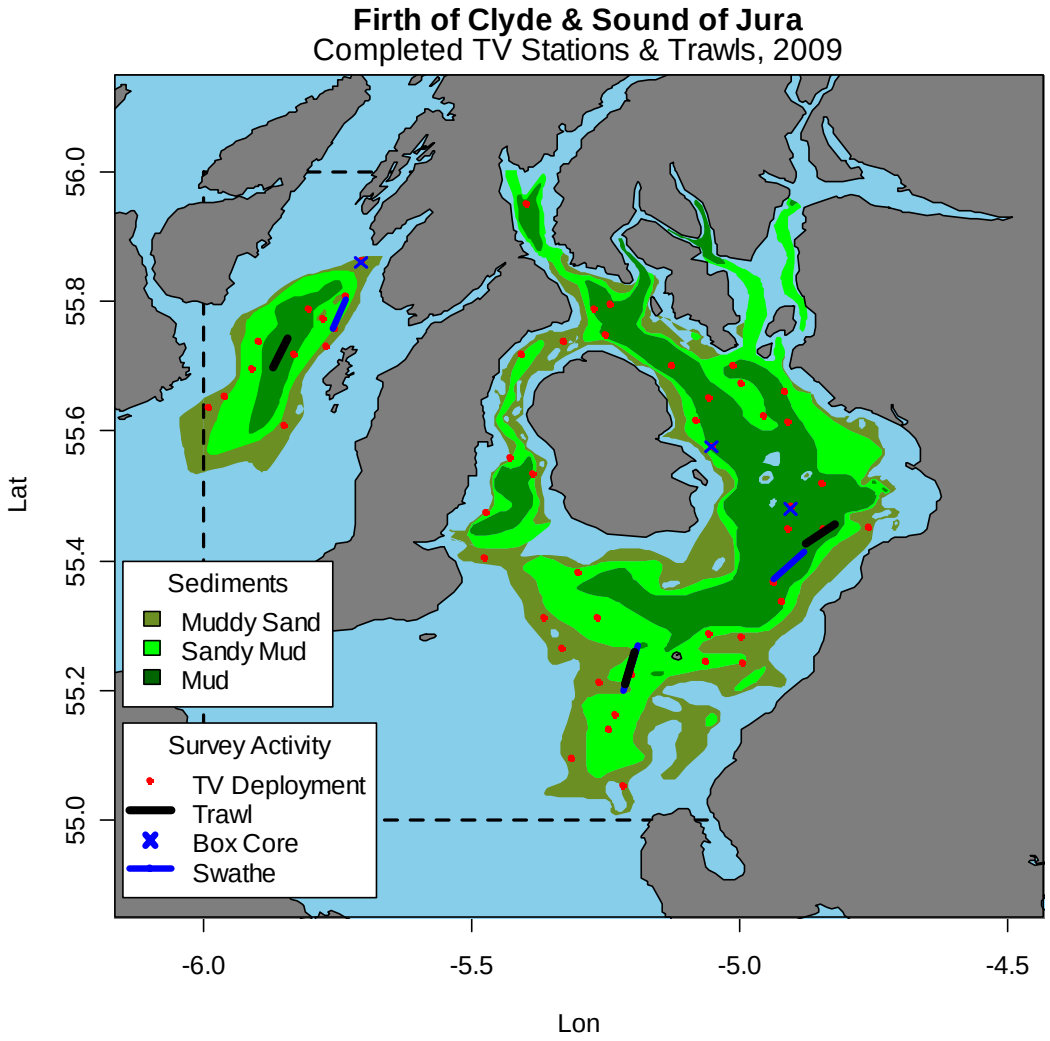
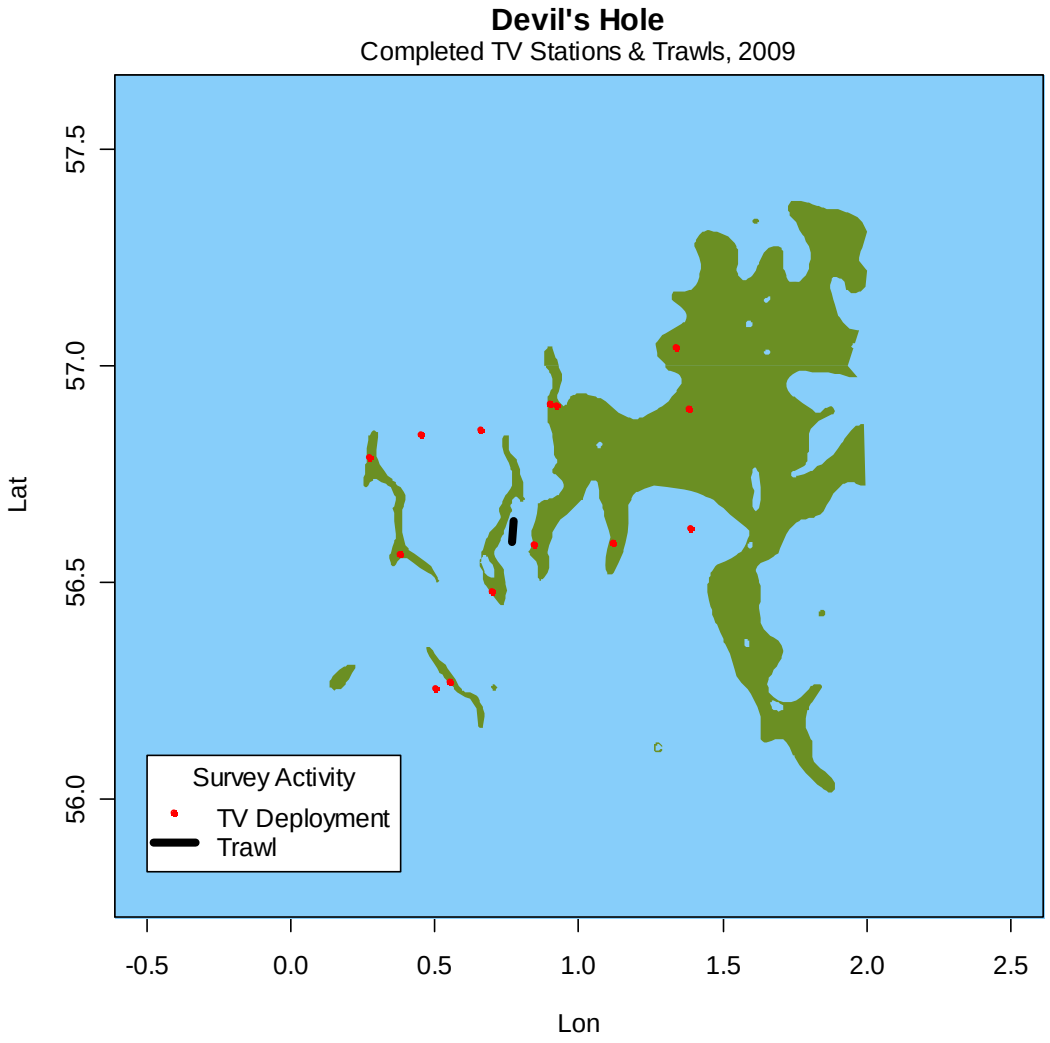
57.0
56.5
56.0
-8.0
-7.5
-7.0
-6.5
-6.0
-5.5
-5.0
Lon
Sediments
Muddy Sand
Sandy Mud
Mud
Survey Activity
TV Deployment
Trawl
Box Core
Swathe


Firth of Clyde & Sound of Jura
Completed TV Stations & Trawls, 2009
Lat
56.0
55.8
55.6
55.4
55.2
55.0
Sediments
Muddy Sand
Sandy Mud
Mud
Survey Activity
TV Deployment
Trawl
Box Core
Swathe
-6.0
-5.5
-5.0
-4.5
Lon


Devil's Hole
Completed TV Stations & Trawls, 2009
Lat
57.5
57.0
56.5
56.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
Lon
Survey Activity
TV Deployment
Trawl