

***Arctica islandica* and Exploratory Drill Mud Survey**
23 June- 13 July 2004, R/V Prince Madog, Fladen Ground

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Abstract

Richardson and Fraser completed a scientific research cruise to the Fladen Ground, northern North Sea to collect live specimens and dead shells of *Arctica islandica* (Bivalvia). *Arctica islandica* is a long-lived bivalve with a shell that contains a series of annual growth increments and lives to great age (>100 years). Fifteen sites with either large *Arctica* populations or the suitable substrate for *Arctica* were targeted in and around the Fladen Ground area. *Arctica* were collected primarily using a newly designed and tested “*Arctica*” dredge from the various sites. A Day grab was also deployed at each site to collect specimens and sediment samples. A 2-m beam trawl was deployed at eleven sites with suitable substrate to collect clams. Underwater video observations at two sites (Stations B and F) were made of the seabed to assess the concentrations of shell material on the seabed and living clams. Over 4000 *Arctica* specimens were collected. Currently, over 1000 *Arctica* specimens have been archived (processed and logged). Selected shells of both live and dead collected *Arctica* will be resin-embedded and sectioned for sclerochronological analyses i.e. the growth increments in the shell will be counted to determine the shells age and measured to investigate changes in shell growth rates. Dead collected shells will be radiocarbon dated. On return to Menai Bridge, a small sample of *Arctica* were collected from Red Wharf Bay, Anglesey.

Hartley’s cruise returned to three exploratory drill holes that had been sealed. Samples were collected using a Day grab. Biota, hydrocarbon and sediment samples were collected in two parallel transects south of each site; an additional sampling station was included 6000 metres East of each site resulting in 22 sampling stations at each site. A multi-corer was deployed at two of the sites. In addition to the three well sites, three sites in the Donan Field were sampled using the Day Grab and multi-corer in a limited scheme.

Keywords: *Arctica islandica*, Fladen Ground, Northern North Sea, exploratory drill muds

Cruise personnel:

1. Dr Chris Richardson (SIC1) (School of Ocean Sciences, UWB)	Entire cruise
2. Dr Nicole Fraser (School of Ocean Sciences, UWB)	Entire cruise
3. Paul Butler (School of Ocean Sciences, UWB)	Entire cruise
4. Ivor Rees (School of Ocean Sciences, UWB)	24.06 –05.07
5. Sara Richardson (University of Leeds)	24.06 – 05.07
6. Aimee Oakham (School of Ocean Sciences, UWB)	24.06 – 05.07
7. Pedro Freitas (School of Ocean Sciences, UWB)	24.06 – 05.07
8. Laura Foster (University of St Andrews)	Entire cruise
9. Dr Jim Bennell (School of Ocean Sciences, UWB)	Entire cruise
10. Brian Long (School of Ocean Sciences, UWB)	05.07 – 13.07
11. Dr John Hartley (SIC2)(Hartley Anderson)	05.07 –10.07
12. Ian Harris (Univesity of East Anglia)	05.07 – 10.07
13. Claudio Bravo (School of Ocean Sciences, UWB)	10.07-13.07

Scientific objectives

Richardson/Fraser: To collect live and dead *Arctica islandica* shells primarily using a newly designed and tested “*Arctica*” dredge from various sites in the Fladen Ground. These specimens will be studied during a three year, NERC funded study: “Towards an absolute chronology for the marine environment: A 1000 year record from the North Sea.”

Hartley: To return to three exploratory drills that used water-based mud (WBM), low toxicity oil-based mud (OBM) and diesel OBM. These sites were surveyed in 1987, 1995, 1996, 1997 and 1998. These wells have since been decommissioned and are included in an ongoing survey of the effects of exploratory drill muds on marine fauna and recovery rates.

Cruise Overview

14.06.2004	Mobilisation at Menai Bridge.
23.06.	Staff for 1st leg of cruise transit to Peterhead to meet ship, overnight in Peterhead.
24.06-27.06	Rough weather keeps the ship in Peterhead for three days.
27.06	Transit to Fladen Ground to Station A in the morning. Side scan sonar at Station A starts at 16:22, sampling at 18:38. Transit overnight to Station F.
28.06	Side scan sonar at Station F starts at 04:26, sampling at 08:04. Transit overnight to Station B.
29.06	Side scan sonar at Station B starts at 03:58, sampling at 08:09. Transit to Station D. Side scan sonar at Station D starts at 21:44
30.06	Sampling at Station D starts at 08:08. Side scan sonar at Station G starts at 13:24, sampling at 14:19. Side scan sonar starts at Stations H (16:32) and I (17:41). Sampling at Stations I (18:28) and H (19:13) start. Transit overnight to Station E.
01.07	Side scan sonar at Station E starts at 09:05, sampling at 09:53. Transit to Station C. Side scan sonar at Station C starts at 14:32 and sampling starts at 15:02. Transit overnight to Station J.
02.07	Side scan sonar at Station J starts at 06:39, sampling at 09:04. Transit overnight to Station K.
03.07	Sampling at Station K at 08:07. Sampling at Stations L (13:50), O (14:47), P (15:42), M (17:24), N (17:42). Transit to Peterhead.
04.07	Peterhead
05.07	Crew change in Peterhead. Some scientific staff (S. Richardson, Rees and Oakham) leave ship. Hartley, Harris and Long join ship. Depart either after lunch or after dinner. Transit overnight to Hartley site 21/12.
06.07	Sample at Site 21/12 starting at 08:19. Transit to Forties Field start sampling at 19:41. Transit overnight to Site 16/27.
07.07	Sample at Site 16/27 starting at 08:09. Transit to Donan Field sites. Start sampling at 17:51. Transit overnight to Station I.
08.07	Sample at Station I starting at 07:58. Transit to Station H; sampling at H starting at 12:44. Transit to Station G; sampling at G starting at 15:19. Transit overnight to Site 14/11.
09.07	Sample at Site 14/11 starting at 08:01. Rough weather halts sampling at 14:25, transit to Inverness.
10.07	Arrive in Inverness. Disembarkation of Hartley and Harris. Bravo joins. Other staff remain on board for transit to Menai Bridge
11.07	Transit to Menai Bridge through Caledonian Canal.
12.07	Three cores from Loch Lochy within the Caledonian Canal for S. Mudge (UWB).
13.07	Sampling at three sites in Red Wharf Bay starting at 12:43. Arrive in Menai Bridge.
14.07	Demobilise in Menai Bridge

Station	Latitude			Longitude			Dead <i>Arctica</i>	Live <i>Arctica</i>	Total <i>Arctica</i>				
A	58	°	49.86	'	N	0	°	21.35	'	W	31	1	32
B	59	°	7.27	'	N	0	°	10.00	'	E	634	193	827
C	58	°	47.24	'	N	0	°	20.48	'	E	265	3	268
D	58	°	32.06	'	N	0	°	10.04	'	E	424	4	428
E	59	°	7.27	'	N	0	°	31.50	'	E	88	4	92
F	59	°	23.00	'	N	0	°	30.00	'	E	202	511	713
G	58	°	31.00	'	N	0	°	25.00	'	E	490	1	491
H	58	°	25.52	'	N	0	°	34.20	'	E	310	0	310
I	58	°	22.50	'	N	0	°	31.00	'	E	468	1	469
J	58	°	5.13	'	N	0	°	15.02	'	E	417	4	421
K	58	°	15.00	'	N	1	°	0.00	'	W	8	2	10
L	57	°	46.50	'	N	2	°	0.00	'	W	0	0	0
M	57	°	44.00	'	N	2	°	8.50	'	W	0	0	0
N	57	°	43.00	'	N	2	°	12.00	'	W	0	0	0
O	57	°	47.55	'	N	2	°	12.96	'	W	0	0	0
P	57	°	48.01	'	N	2	°	26.91	'	W	0	0	0
Forties Field	57	°	45.00	'	N	0	°	56.40	'	E	0	0	0

Table 1. Richardson & Fraser stations' positions in degrees and minutes (for details see Stations/Activities Log in the appendix).

Station	Latitude			Longitude						
21/12	57	°	38.85	'	N	0	°	20.49	'	E
16/27	58	°	3.99	'	N	1	°	16.19	'	E
14/11	58	°	35.9	'	N	0	°	58.39	'	E
Donan Field 15	58	°	22.7	'	N	0	°	52.86	'	E
Donan Field 1	58	°	22.00	'	N	0	°	53.00	'	E
Donan Field 3	58	°	22.00	'	N	0	°	52.00	'	E

Table 2. Hartley stations' positions in degrees and minutes (for details see Stations/Activities Log in the appendix).

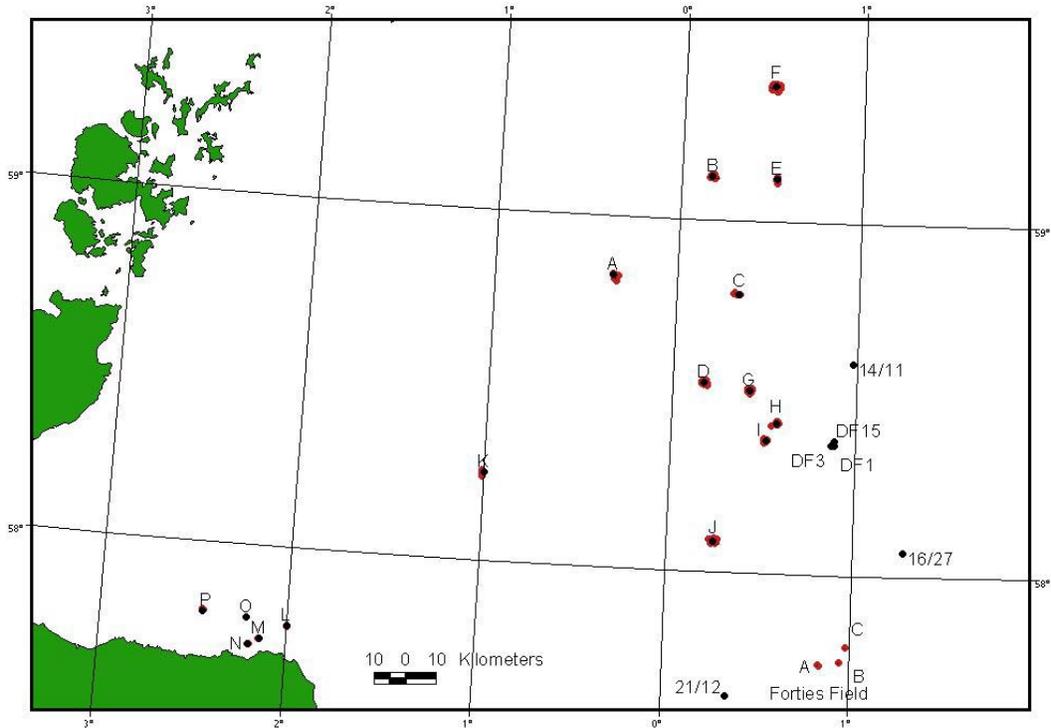


Figure 1. Map of the Fladen Ground stations with sampling stations indicated

Cruise Track Charts

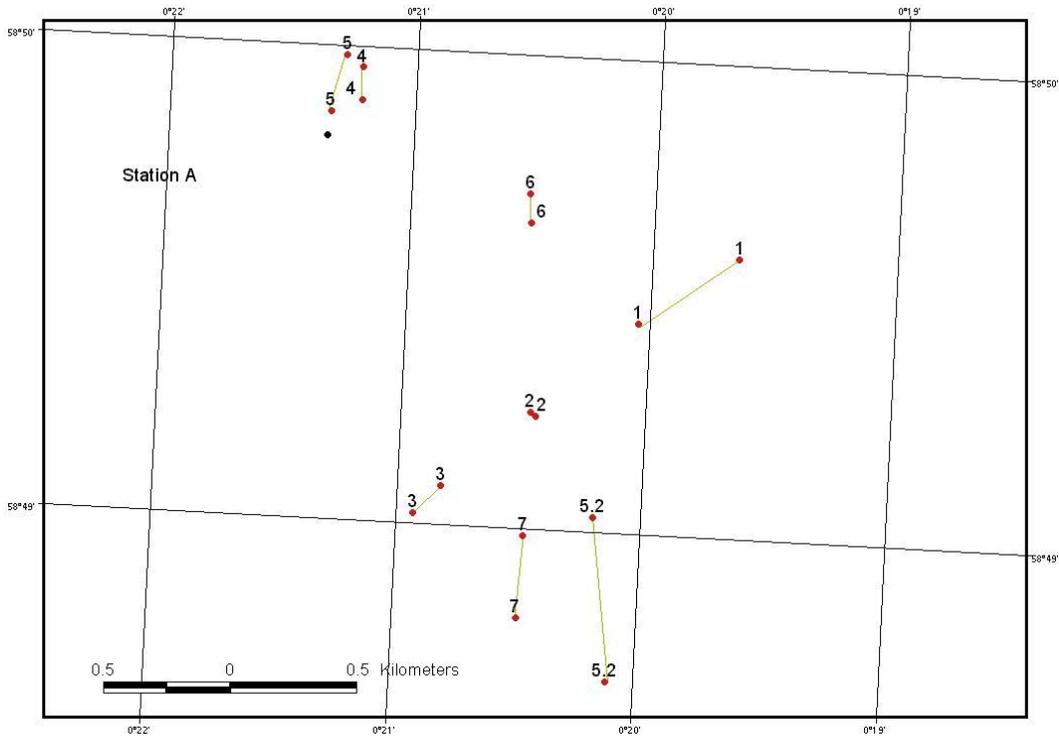


Figure 2. Station A tracks.

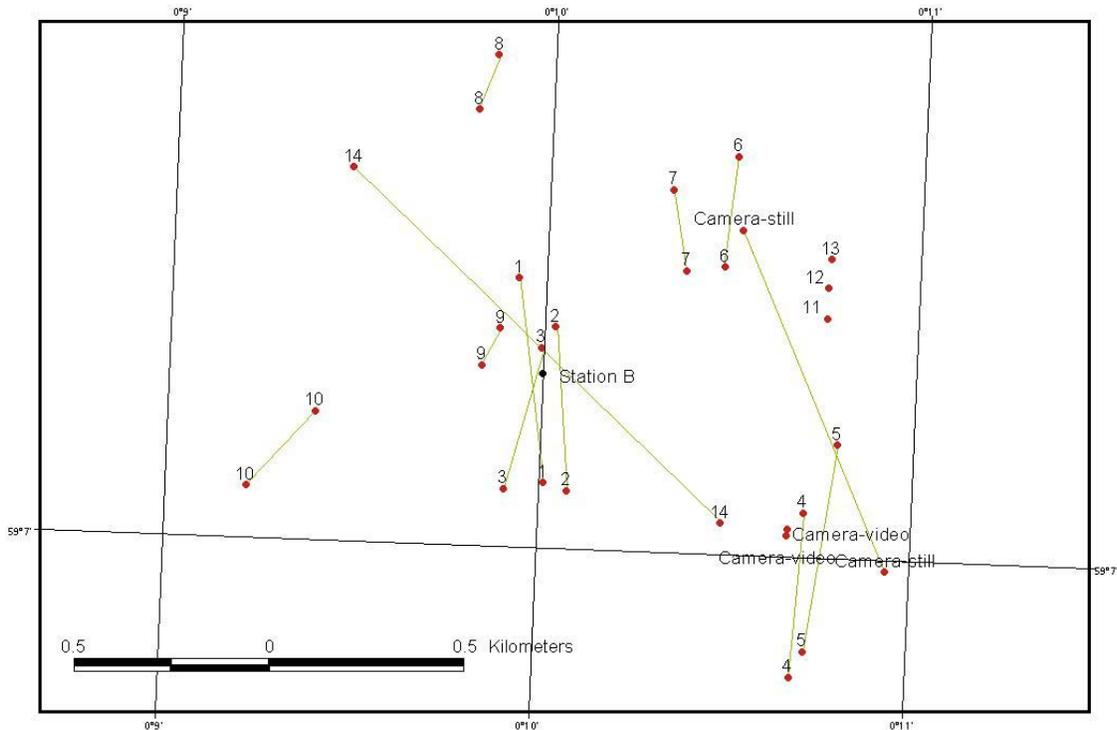


Figure 3. Station B tracks.

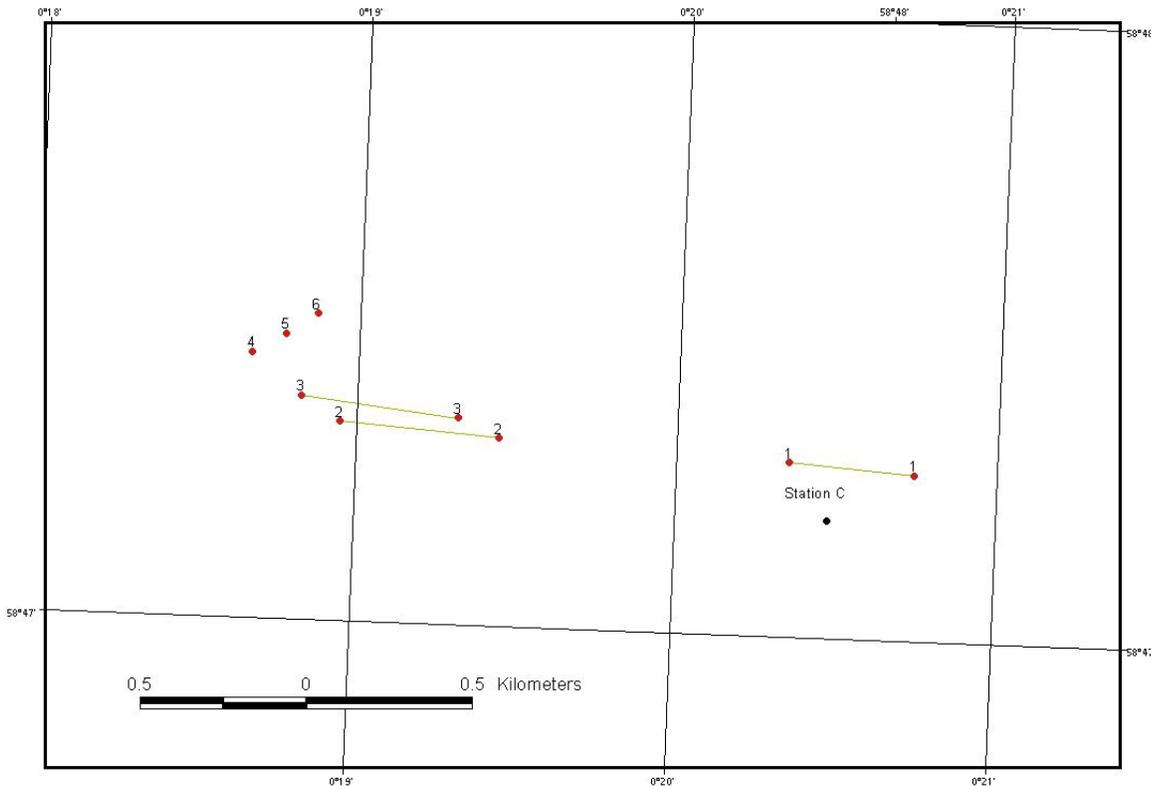


Figure 4. Station C tracks.

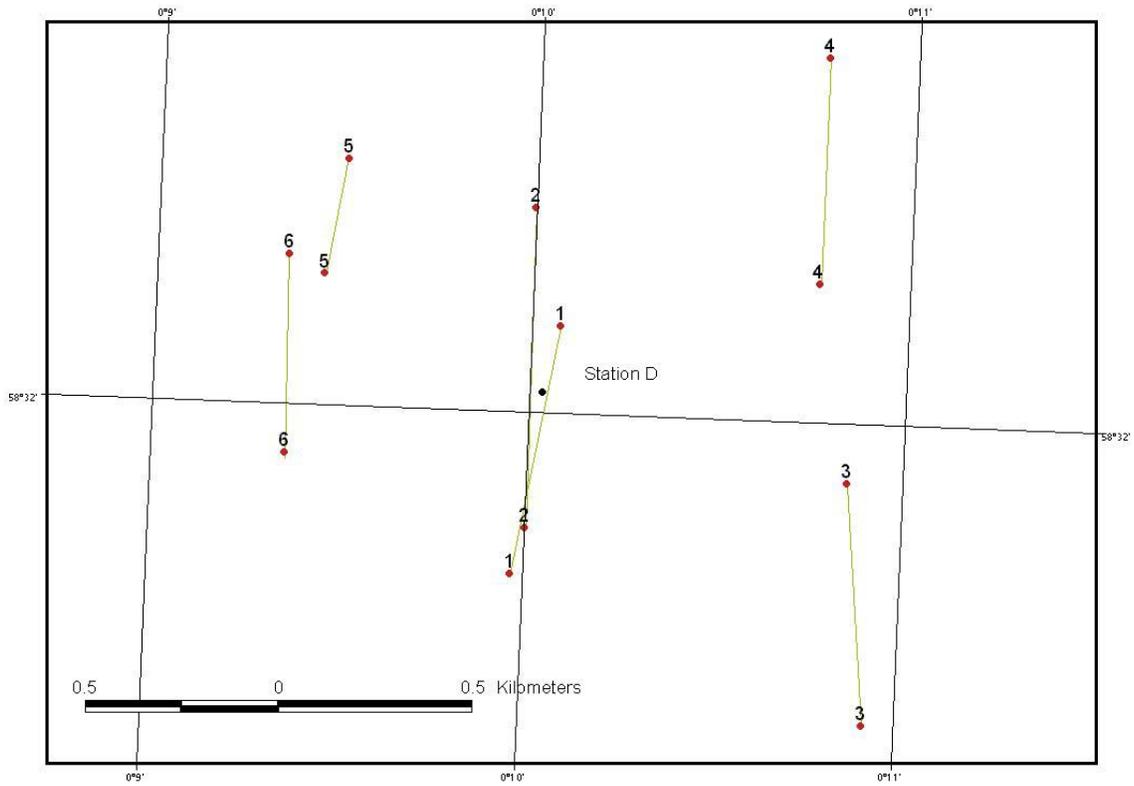


Figure 5. Station D tracks.

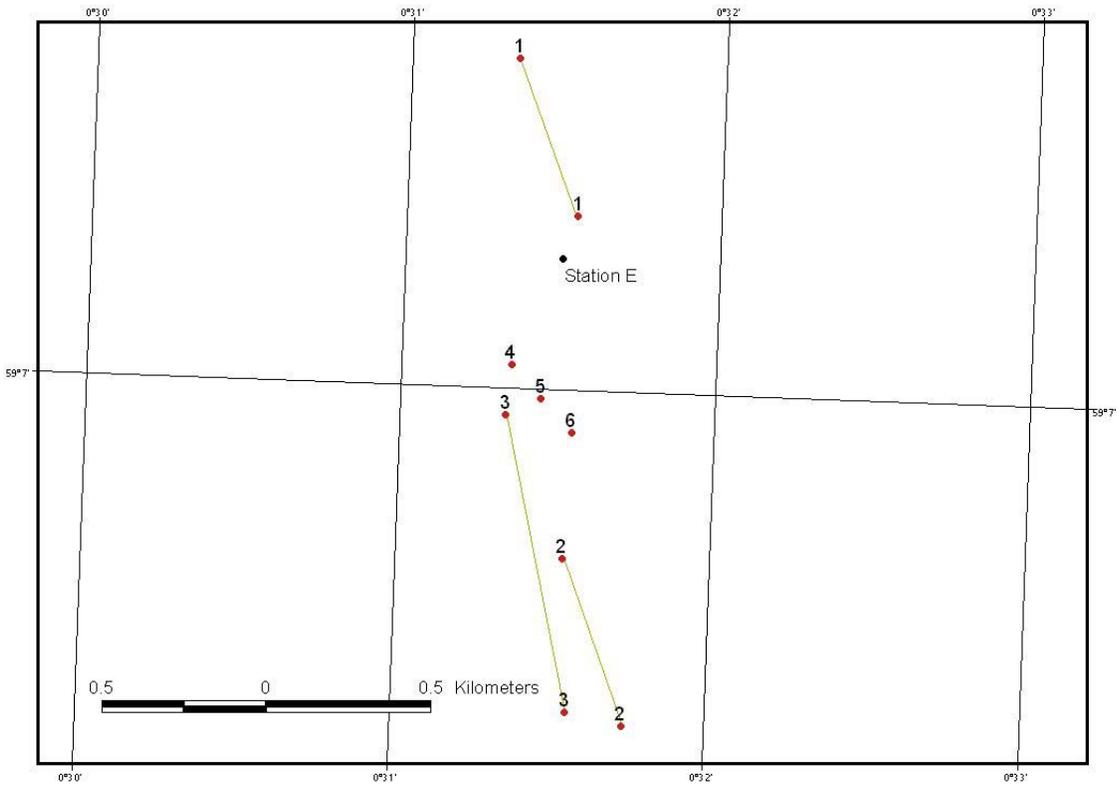


Figure 6. Station E tracks.

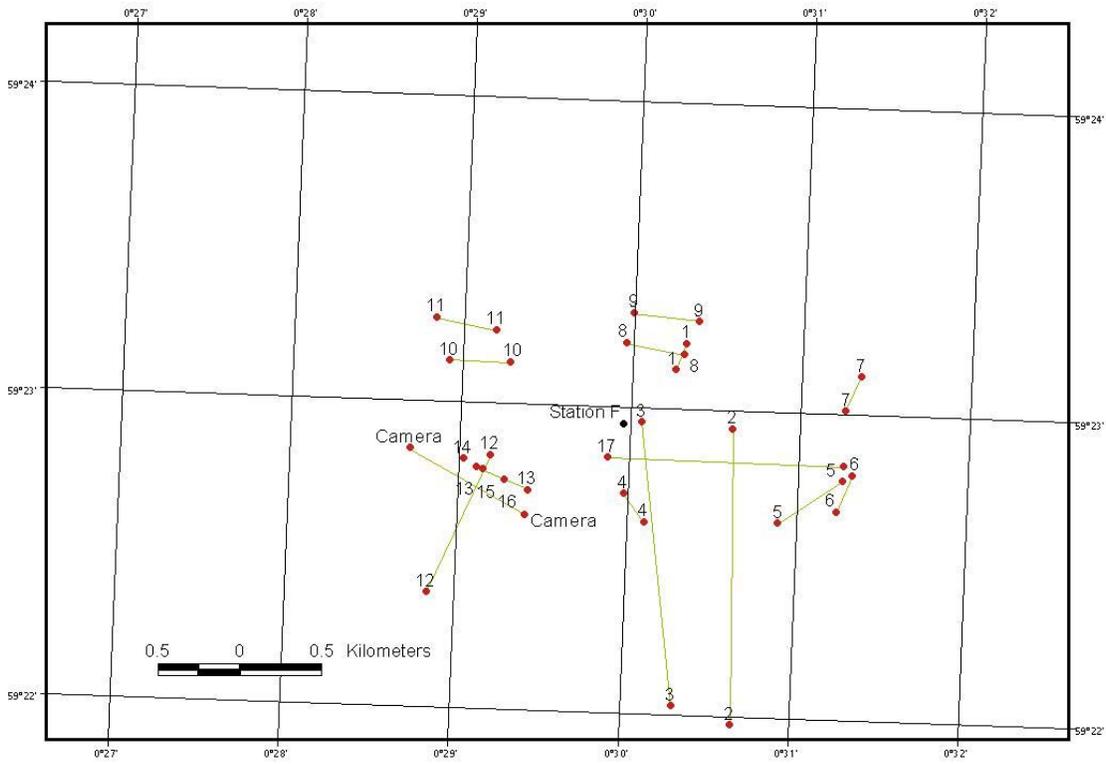


Figure 7. Station F tracks.

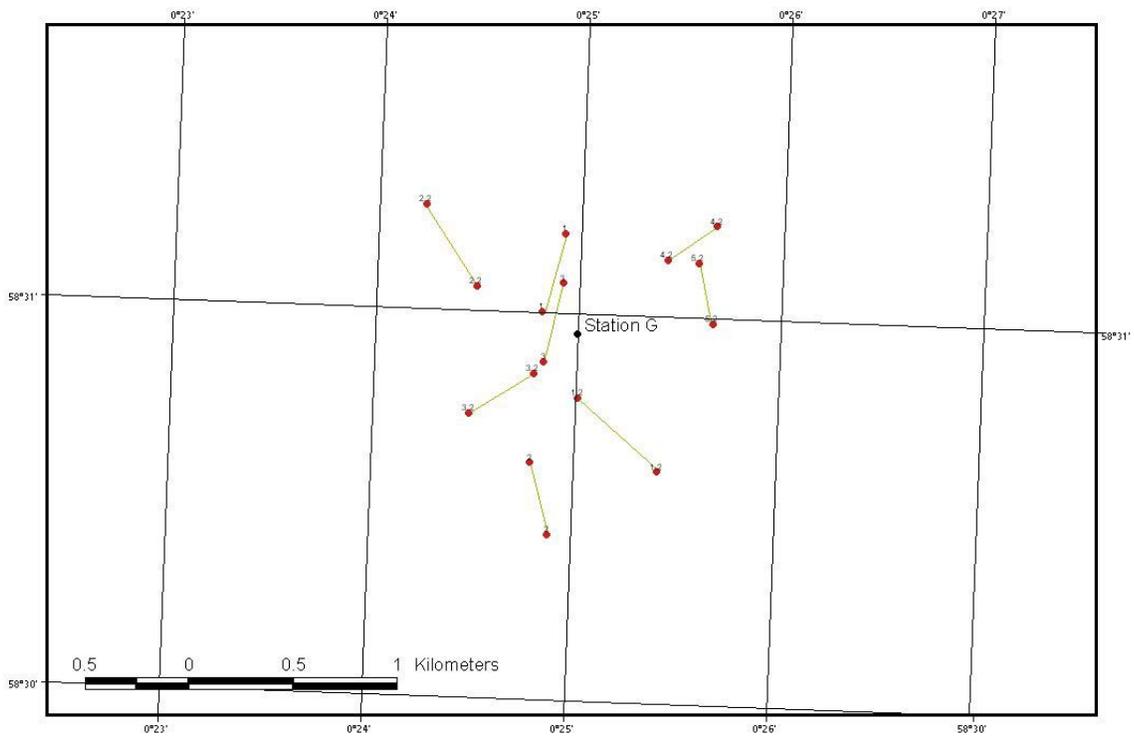


Figure 8. Station G tracks.

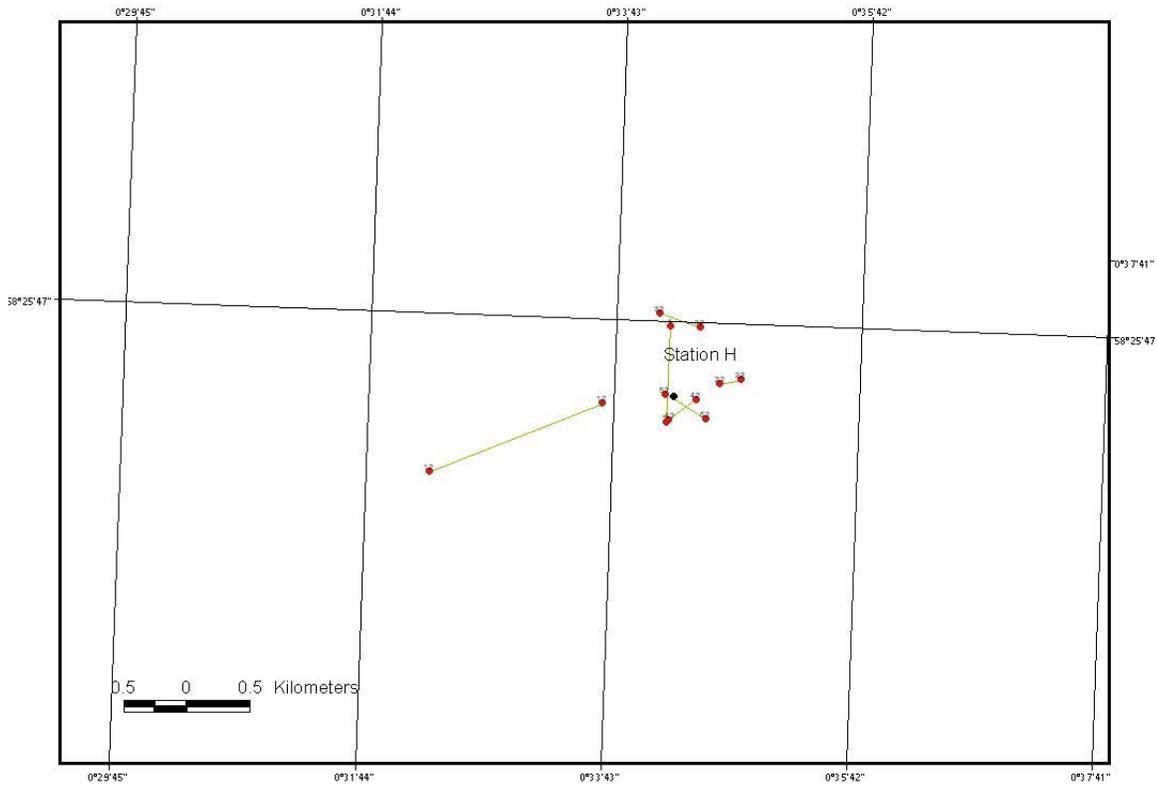


Figure 9. Station H tracks.

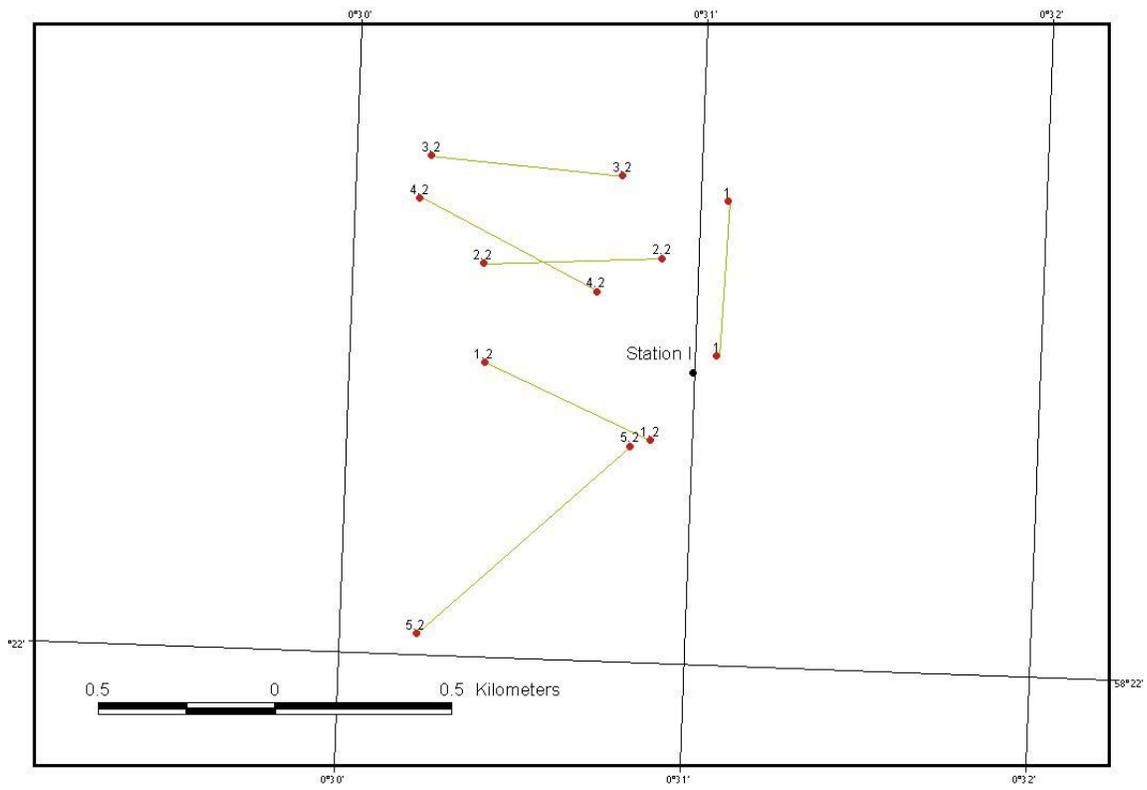


Figure 10. Station I tracks.

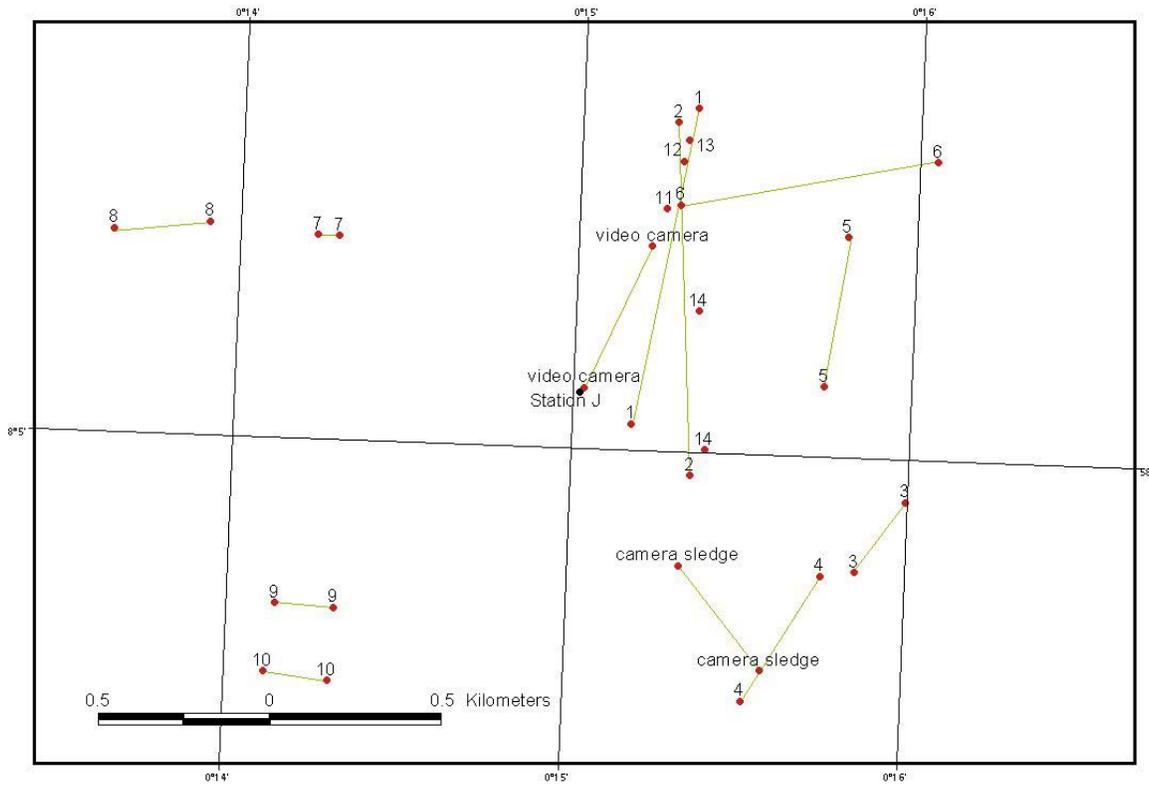


Figure 11. Station J tracks.

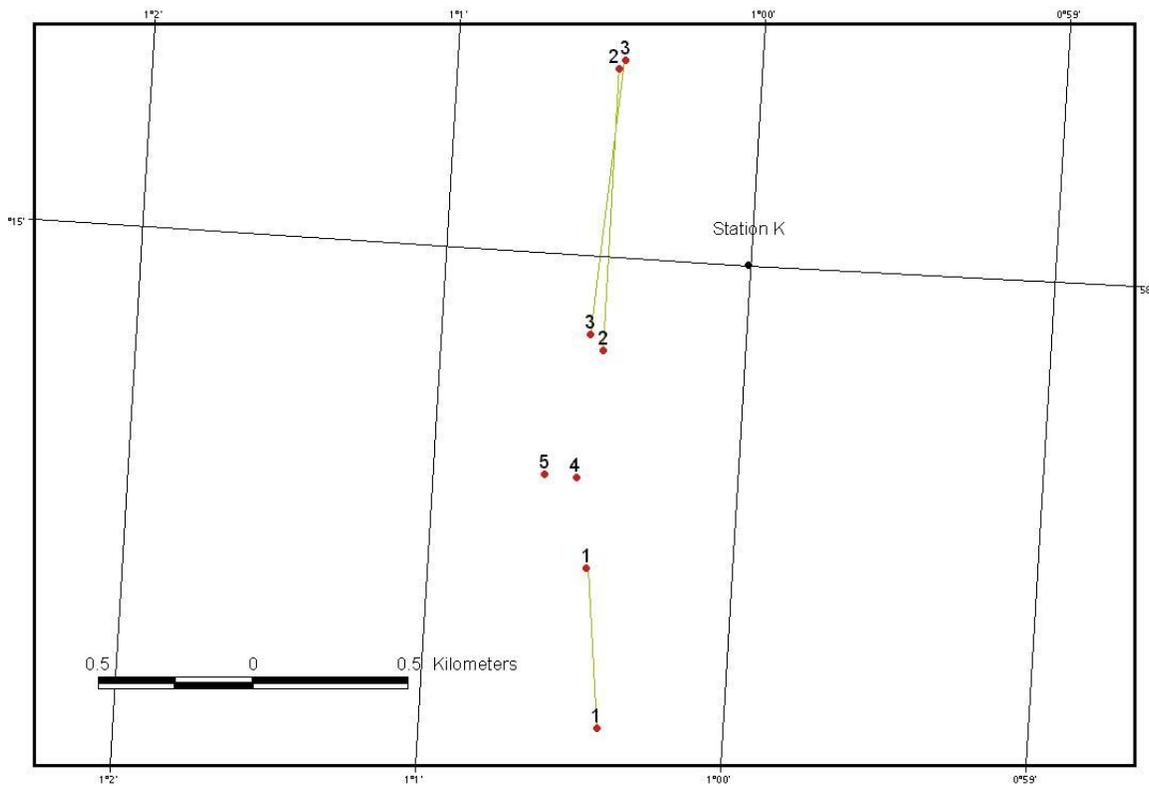


Figure 12. Station K tracks.

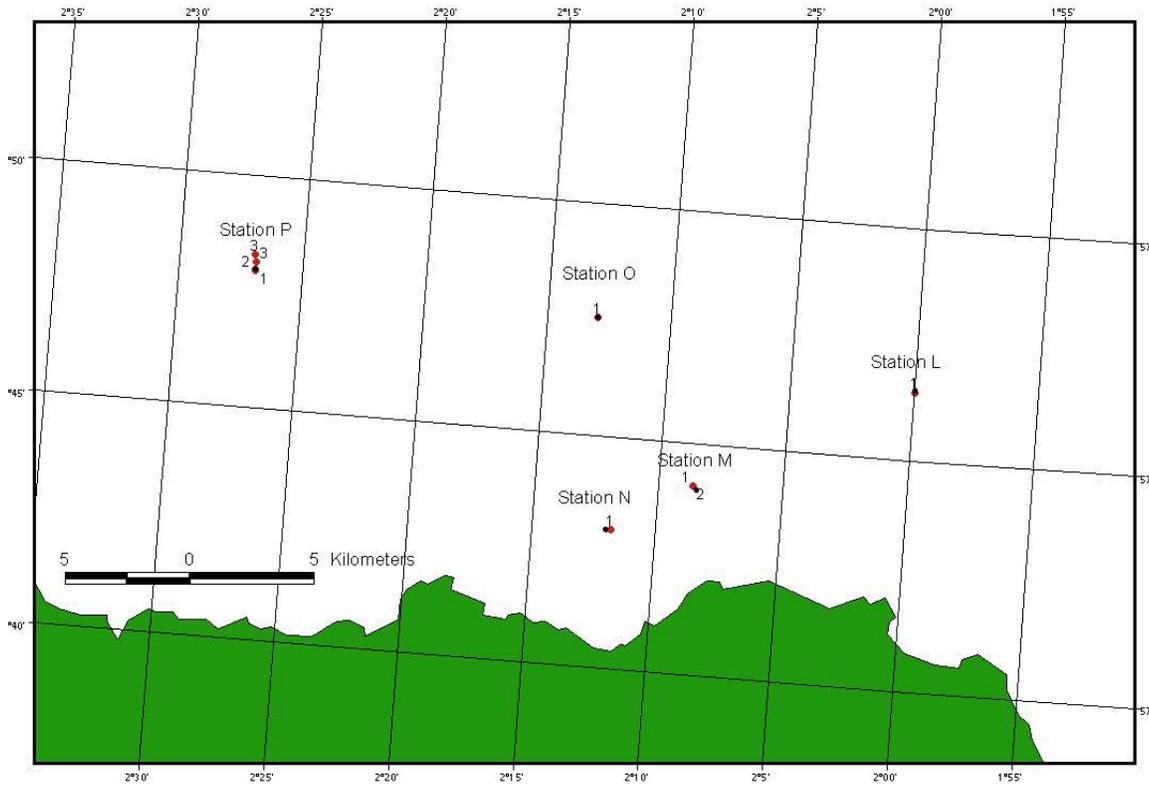


Figure 13. Station L-P tracks.

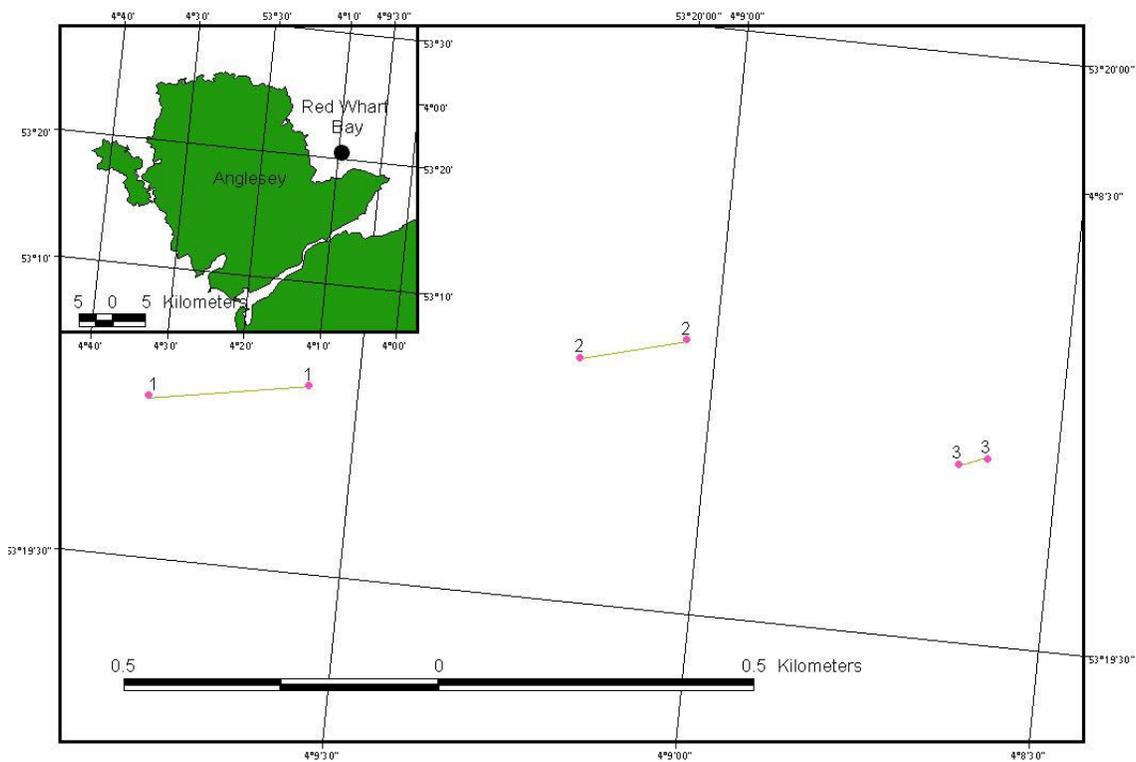


Figure 14. Red Wharf Bay station and tracks.

Detailed appendix of all stations, activities, methods notes follows.