

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

Application for Consent to conduct Marine Scientific Research ICELAND

Date: 27th November 2015

1. General Information

1.1 Cruise name and/or number:
DY052

1.2 Sponsoring Institutions:	
Scottish Association for Marine Science (SAMS)	National Oceanography Centre (NOC)
Scottish Marine Institute, Oban, Argyll, PA37 1QA, UK	Waterfront Campus, European Way, Southampton, Hampshire SO14 3ZH
Director: Prof. Nicholas Owens	Director: Prof. Ed Hill

1.3 Scientist in charge of the Project:	
Name:	Stefan Francois Gary
Country:	Dual nationality – France and USA – although the science to be undertaken is UK funded.
Affiliation:	SAMS
Address:	Scottish Marine Institute, Oban, Argyll, PA37 1QA, UK
Telephone:	+44 (0) 1631 559 419
Fax:	+44 (0) 1631 559 001
Email:	stefan.gary@sams.ac.uk
Website (for CV and photo):	http://www.sams.ac.uk/stefan-gary

1.4 Entity(ies)/Participant(s) from coastal State involved in the planning of the project:	
Name:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

2. Description of Project

2.1 Nature and objectives of the project:

The cruise will be making the 2016 annual occupation of the Extended Ellett Line.

The Extended Ellett Line is a hydrographic section between Iceland and Scotland that is occupied annually by scientists from the National Oceanography Centre (NOC) and the Scottish Association for Marine Science (SAMS), UK. The measurement programme began as a seasonally-occupied hydrographic section in the Rockall Trough in 1975, building on early surface observations made underway from ocean weather ships. In 1996 the section was extended to Iceland, sampling three basins: the Rockall Trough, the Hatton-Rockall Basin and the Iceland Basin. These three basins form the main routes through which warm saline Atlantic water flows northwards into the Nordic Seas and Arctic Ocean. The section crosses the eastern North Atlantic subpolar gyre; as well as the net northward flow there is a large recirculation of the upper layers as part of the wind-driven gyre. During its passage through the region, the warm saline water is subjected to significant modification by exchange of heat and freshwater with the atmosphere. The two deep basins (Rockall Trough and Iceland Basin) contain southward flowing dense northern overflow waters, and Labrador Sea Water in the intermediate layers.

The specific objectives of the 2016 Extended Ellett Line cruise are:

- 1) To complete the annual Extended Ellett Line CTD section
- 2) To collect water samples for measuring biogeochemical properties including temperature, salinity, oxygen, nutrients, carbon, chlorophyll, and trace metals.
- 3) To collect underway measurements of surface currents, surface temperature, surface salinity, surface optical properties, bathymetry, and surface meteorology.
- 4) To complete epibenthic benthic sled tows at a deep location in the central Rockall Trough.
- 5) To deploy 2 to 4 Met Office Argo floats along the CTD section as part of the International Argo Project.
- 6) To obtain water column video and video of the seafloor during each CTD cast.
- 7) To listen for cetaceans with a hydrophone when other sampling work is not carried out.

2.2 If designated as part of a larger scale project, then provide the name of the project and the Organisation responsible for coordinating the project:

The Extended Ellett Line programme is jointly led by N. Penny Holliday at NOC and Stefan Gary at SAMS. projects.noc.ac.uk/ExtendedEllettLine/

The programme is also part of the UK NERC National Capability sustained measurement programme, coordinated by Ian Wright, National Oceanography Centre.

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

2.3 Relevant previous or future research projects:

The programme is part of a long-term strategic project to understand the physical forcing and response of the ocean west of the UK. The Extended Ellett Line programme began in 1975 and we anticipate that it will continue in the form of annual CTD sections (spring/summer) and at least annual glider sections in the winter.

Recent cruises that completed the section are:

DY031 RRS Discovery, 29 May – 17 June 2015. Cruise report at:
www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/15701/

JR302 RRS James Clark Ross, 6 June - 22 July 2014. Cruise report at:
www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/15037/

JC086 RRS James Cook, 6 - 26 May 2013. Cruise report at:
www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/13389/

D379 RRS Discovery, 30 Jul - 17 Aug 2012. Cruise report at:
www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/11412/

D365, RRS Discovery, 11 May - 2 Jun 2011. Cruise report at:
www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/10574/

2.4 Previous publications relating to the project:

Recent publications include the following.

Holliday, N.P., Cunningham, S.A, Johnson, C., Gary, S.F., Griffiths, C., Read, J.F., Sherwin, T., 2015. Multidecadal variability of potential temperature, salinity, and transport in the eastern subpolar North Atlantic, *Journal of Geophysical Research – Oceans*, doi:10.1002/2015JC010762.

Johnson, C., Inall, M., Hakkinen, S., 2013. Declining nutrient concentrations in the northeast Atlantic as a result of a weakening Subpolar gyre, *Deep Sea Research I*, 82, 95-107, <http://dx.doi.org/10.1016/j.dsr.2013.08.007>

Beszczyńska-Møller, A. and Dye, S.R. (Eds), 2013. ICES Report on Ocean Climate 2012. ICES Cooperative Research Report No 321, 73pp

Dye, S, Hughes, S.L., Tinker, J., Berry, D., Holliday, N.P., Kent, E.C., Kennington, K., Inall, M., Smyth, T., Nolan, G., Lyons, K., Andres, O., Beszczyńska-Møller, A., 2013a, Impacts of climate change on temperature (air and sea), *Marine Climate Change Impacts Partnership: science review, MCCIP Science Review 2013: 1-xxx*, published online Nov 13.

Dye, S, Holliday, N.P., Hughes, S.L., Inall, M., Kennington, K., Smyth, T., Tinker, J., Andres, O., Beszczyńska-Møller, A., 2013b, Impacts of climate change on salinity, *Climate Change Impacts Partnership: science review, MCCIP Science Review 2013: 1-xxx*, published online Nov 13.

MCCCIP, 2013. *Marine Climate Change Impacts Report Card 2013*, (Eds, Frost, M, Baxter, J.M., Bayliss-Brown, G.A., Buckley, P.J., Cox, M., Withers Harvey, N.), Summary Report, MCCIP, Lowestoft, 12pp.

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

Holliday, N.P. and Cunningham, S., 2013. The Extended Ellett Line: Discoveries From 65 Years of Marine Observations West of the UK. *Oceanography* 26(2):156–163, <http://dx.doi.org/10.5670/oceanog.2013.17>

Holliday, N.P., Cunningham, S., Griffiths, C., 2013. State of the eastern North Atlantic subpolar gyre: the Extended Ellett Line Programme, Annual Report No. 1. National Oceanography Centre Research and Consultancy Report No 36, 15pp.

Holt, J., Hughes, S., Hopkins, J., Wakelin, S.L., Holliday, N.P., Dye, S., Gonzalez-Pola, C., Saetre Hjollo, S., Mork, K-A., Nolan, G., Proctor, R., Read, J., Shammon, T., Sherwin, T., Smyth, T., Tattersall, G., Ward, B., Wiltshire, K., 2012. Multi-decadal variability and trends in the temperature of the northwest European continental shelf: a model-data synthesis, *Progress in Oceanography*, 106, 96-117

Hughes, S., Holliday, N.P., Gaillard, F. and ICES Working Group on Oceanic Hydrography. 2012. Variability in the ICES/NAFO region between 1950 and 2009: observations from the ICES Report on Ocean Climate. *ICES Journal of Marine Science*, 69, (5), 706-719. doi:10.1093/icesjms/fss044

Sherwin, T.J., Read, J.F., Holliday, N.P., Johnson, C., 2012. The impact of changes in the North Atlantic Gyre distribution on water mass characteristics in the Rockall Trough. *ICES Journal of Marine Science*; doi:10.1093/icesjms/fsr185.

Johnson, C., 2012. Tracing Wyville Thomson Ridge Overflow Water in the Rockall Trough, PhD Thesis, University of Aberdeen.

Dye, S.R., Nolan, G. D. and Beszczynska-Moller, A. (Eds), 2012, ICES Report on Ocean Climate 2011, ICES Cooperative Research Report No. 314, 77 pp.

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude, including coordinates of cruise track/way points).

The general area is north-eastern North Atlantic approximately between 5-22°W, 56-64°N.

The section waypoints (black circles on map) are as follows:

start at 63.3°N 20.2°W (close to Iceland coast)

line to 62.9°N 19.6°W

line to 62.0°N 20.0°W

line to 60.0°N 20.0°W

line to 57.6°N 13.6°W (close to Rockall)

line to 57.5°N 11.0°W (Anton Dohrn seamount)

line to, and end at 56.7°N 6.1°W (close to Scotland coast)

CTD casts will be made at the 71 stations defining the Extended Ellett Line (red dots on map) to measure and sample for water properties. On each cast, a downward looking video camera will video the water column and the sea floor. The CTD will get within 10 m of the bottom but will not touch the bottom.

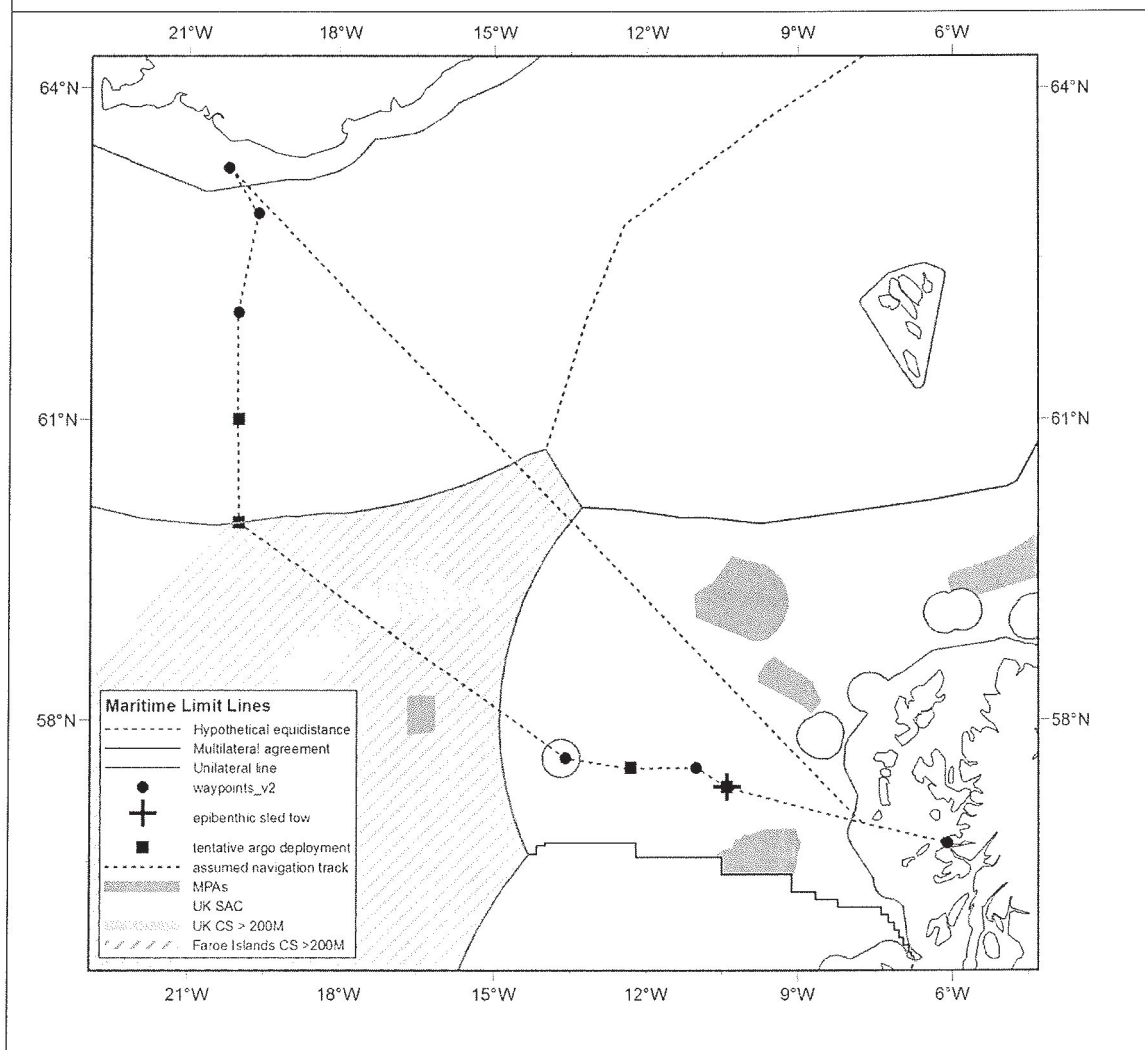
NATURAL ENVIRONMENTAL RESEARCH COUNCIL

The epibenthic benthic sled tows will be at Station M (57.3°N 10.4°W, black + on map).

Two to four subsurface Argo floats will be deployed at deep ocean locations along the CTD line. The exact locations and number of floats will be determined closer to the date of the cruise depending on the status and position of other International Argo Project floats in the area. Tentative locations for deployments are shown on the map with black squares at (62.0°N, 20.0°W), (61.0°N, 20.0°W), (57.5°N, 12.3°W), and (57.3°N, 10.4°W).

Along the anticipated cruise track (thin red line), we will tow a hydrophone in the water to listen for marine mammals. Our underway measurements of surface water properties and meteorological parameters will also be active continuously along the cruise track. Part of the cruise track is not on the Extended Ellett Line to allow for faster transit from port to the start of the hydrographic section. The cruise track may change to allow for bad weather.

3.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the location and depth of sampling stations, the tracks of survey lines, and the locations of installations and equipment.



NATURAL ENVIRONMENTAL RESEARCH COUNCIL

4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	Discovery
Type/Class:	Lloyds Register Lloyd's +100A1 Oceanographic Research Vessel, IWS, Ice Class 1D +LMC, UMS, DP(AM), Green Passport, Shipwright (SERS)
Nationality (Flag State):	British
Identification Number (IMO/Lloyds No.):	9588029
Owner:	Natural Environmental Research Council
Operator:	National Marine Facilities Sea Systems
Overall length (meters):	99.70 Metres
Maximum draft:	6.60 Metres
Displacement/Gross Tonnage:	Net Tonnage: 1785 Gross Tonnage: 5952
Propulsion:	Diesel Electric
Cruising & maximum speed:	12 Knots & 15 Knots Max Speed
Call sign:	2FGX5
INMARSAT number and method and capability of communication (including emergency frequencies):	00870773238856 (Voice) 00870783255483 (Fax) 0580 42359533 (Sat C)
Name of Master:	TBA
Number of Crew:	24
Number of Scientists on board:	28

4.2 Particulars of Aircraft:	
Name:	
Make/Model:	
Nationality (flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall Length (meters):	
Propulsion:	
Cruising & Maximum speed:	
Registration No.:	
Call Sign:	
Method and capability of communication (including emergency frequencies):	
Name of Pilot:	
Number of crew:	

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

Number of scientists on board:	
Details of sensor packages:	
Other relevant information:	

4.3 Particulars of Autonomous Underwater Vehicle (AUV):	
Name:	
Manufacturer and make/model:	
Nationality (Flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall length (meters):	
Displacement/Gross tonnage:	
Cruising & Maximum speed:	
Range/Endurance:	
Method and capability of communication (including emergency frequencies):	
Details of sensor packages:	
Other relevant information:	

4.4 Other craft in the project, including its use:
Two to four Argo floats, provided by the UK Met Office and conforming to the specifications of the International Argo Project, will be deployed.

4.5 Particulars of methods and scientific instruments:		
Types of samples and measurements:	Methods to be used:	Instruments to be used:
Water properties including temperature, salinity, velocity, oxygen, nutrients, carbon, chlorophyll, trace metals, water column video and video of the bottom.	CTD profiling package	Seabird CTD and water rosette system, RDI LADCP system, downward looking video camera and lights attached to the CTD frame
Underway sampling	Acoustic, Atmospheric and sea surface water sampling	ACDPs, echo sounders, thermosalinograph, transmissometer, fluorometer, anemometer, and light meters
Benthic ecology	Tow	Epibenthic sled
Passive acoustic monitoring for cetaceans	Tow	Hydrophone

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

4.6 Indicate nature and quantity of substances to be released into the marine environment:

None. Small quantities of laboratory agents will be used within the laboratories aboard the ship. All waste products will be disposed of on return to the UK.

4.7 Indicate whether drilling will be carried out. If yes, please specify:

No.

4.8 Indicate whether explosives will be used. If yes, please specify type and trade name, chemical content, depth of trade class and stowage, size, depth of detonation, frequency of detonation, and position in latitude and longitude:

No.

5. Installations and Equipment

5.1 Details of installations and equipment (including dates of laying, servicing, method and anticipated timeframe for recover, as far as possible exact locations and depth, and measurements):

None.

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms:

Expected First Entry: 9th June 2016

Final Departure: 23rd June 2016

6.2 Indicate if multiple entries are expected:

No multiple entries expected unless required by bad weather.

7. Port calls

7.1 Dates and Names of intended ports of call:

None

7.2 Any special logistical requirements at ports of call:

None.

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

7.3 Name/Address/Telephone of shipping agent (if available):

N/A

8. Participation of the representative of the coastal State

8.1 Modalities of the participation of the representative of the coastal State in the research project:

None

8.2 Proposed dates and ports for embarkation/disembarkation:

Embarkation: 3rd – 7th June 2016 Greenock, UK

Disembarkation: 25th – 29th June 2016 Greenock, UK

9. Access to data, samples and research results

9.1 Expected dates of submission to coastal State of preliminary report, which should include the expected dates of submission of the data and research results:

One month after the end of the cruise.

9.2 Anticipated dates of submission to the coastal State of the final report:

Six months after the end of the cruise.

9.3 Proposed means for access by coastal State to data (including format) and samples:

Data will be available through the British Oceanographic Data Centre (www.bodc.ac.uk)

9.4 Proposed means to provide coastal State with assessment of data, samples and research results:

Final data will be available through BODC.

Scientific results will be published in refereed journals and in marine status reports (including ICES and MCCIP).

NATURAL ENVIRONMENTAL RESEARCH COUNCIL

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples and research results:

The Extended Ellett Line Annual Report (NOC research and consultancy reports).

9.6 Proposed means of making results internationally available:

Final data to be submitted to BODC and CCHDO. Both organizations will freely distribute data to the public. Scientific results will be published in refereed journals and in marine status reports (including ICES and MCCIP)

10. Other permits submitted

10.1 Indicate other types of coastal state permits anticipated for this research (received or pending):

Marine Scotland

11. List of supporting documentation

11.1 List of attachments, such as additional forms required by the coastal State, etc.:

N/A

 Signature:

Contact information of the focal point:

Name: Stefan Gary

Country: France & USA

Affiliation: SAMS

Address: Scottish Marine Institute, Oban, Argyll, PA37 1QA, UK

Telephone: +44 (0) 1631 559 419

Fax: +44 (0) 1631 559 001

Email: stefan.gary@sams.ac.uk