NATURAL ENVIRONMENTAL RESEARCH COUNCIL

Application for Consent to conduct Marine Scientific Research
ICELAND

Date: 9th December 2015

1. General Information

1.1 Cruise name and/or number:
Discovery DY053

1.2 Sponsoring Institution(s):	
Name:	Scottish Association for Marine Science
Address:	Scottish Association for Marine Science, Scottish Marine Institute, Oban, Argyll, PA37 1QA
Name of Director:	Prof. Nicholas Owens

1.3 Scientist in charge of the Project:	
Name:	Prof. Stuart A. Cunningham
Country:	UK
Affiliation:	Scottish Association for Marine Science
Address:	Scottish Association for Marine Science, Scottish Marine Institute, Oban, Argyll, PA37 1QA
Telephone:	+44 (0)1631 559336
Fax:	
Email:	Stuart.Cunningham@sams.ac.uk
Website (for CV and photo):	http://www.sams.ac.uk/stuart-cunningham/?searchterm=cunningham

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):	

2. Description of Project

2.1 Nature and objectives of the project:
The UK Overturning in the Subpolar North Atlantic Program (UK-OSNAP) UK-OSNAP [http://www.ukosnap.org/] is a large project which aims to generate new knowledge and understanding of the North Atlantic Subpolar Gyre and its wider impacts on climate. It will entail activities in ocean measurement, modelling of the ocean and climate, and the analysis of results, requiring significant skills in those fields. Accordingly we assemble a team of experts from around the UK: from the National Oceanography Centre's two sites in Southampton and Liverpool, from the Scottish Association for Marine Science in Oban, from the Physics and Earth Sciences Departments of the University of Oxford, and from the Department of Earth, Ocean and Ecological Sciences of the University of Liverpool. OSNAP observing programme will have moorings, gliders and floats deployed for four years, beginning in 2014. This cruise is to recover moorings and gliders from the 2015-2016 deployment and to redeploy for the penultimate project year of observations 2016-1017.

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:
UK-OSNAP is a component of International-OSNAP. Professor Susan Lozier – Susan has responsibility for the coordination of international and national projects associated with OSNAP. As such, she has responsibility for integrating the measurements of OSNAP East and West to produce a continuous record of the North Atlantic subpolar AMOC, the overall goal of this international effort. She is also partnering with Amy Bower for the OSNAP Floats program, an effort designed to trace the pathways of overflow waters in the basin and to assess the connectivity of currents crossing the OSNAP line. Finally, Susan is responsible for program communication to international and U.S. OSNAP collaborators, the project website and the web-accessible OSNAP database maintained at Duke University. **M. Susan Lozier** Ronie-Richele Garcia-Johnson Professor of Ocean Sciences Earth and Ocean Sciences Nicholas School of the Environment 5119 Environment Hall Box 90328 Duke University Durham, NC 27708-0328 Phone: 919-681-8199 Fax: 919-684-5833 Email: mslozier@duke.edu Office: 5119 Environment Hall

2.3 Relevant previous or future research projects:
International & UK-OSNAP (2014-2018)

2.4 Previous publications relating to the project:

- Cunningham, S. A. (2015). R/V Knorr Cruise KN221-02. SAMS Cruise Report, Scottish Association for Marine Science. 288: 1-54.
- Barrier, Nicolas, Christophe Cassou, Julie Deshayes, and Anne-Marie Treguier, 2014. Response of North Atlantic Ocean Circulation to Atmospheric Weather Regimes. *J. Phys. Oceanogr.*, **44**, 179–201. doi: http://dx.doi.org/10.1175/JPO-D-12-0217.1
- Born, Andreas, and Thomas F. Stocker, 2014. Two Stable Equilibria of the Atlantic Subpolar Gyre. *J. Phys. Oceanogr.*, **44**, 246–264. doi: http://dx.doi.org/10.1175/JPO-D-13-073.1
- Bower, A.S., M.S. Lozier, S.F. Gary and C. Böning, 2009. Interior pathways of the Atlantic meridional overturning circulation. *Nature*, **458**, 243-247. doi: http://dx.doi.org/10.1038/nature07979
- Bower, A.S., M.S. Lozier, and S.F. Gary, 2011. The export of Labrador Sea Water from the subpolar North Atlantic: a Lagrangian perspective. *Deep Sea Research*, **58**, 1798-1818. doi: http://dx.doi.org/10.1016/j.dsr2.2010.10.060
- Burkholder, K.C. and M. S. Lozier, 2011. Subtropical to subpolar pathways in the North Atlantic. *Journal of Geophysical Research – Oceans*, **116**, C07017. doi: http://dx.doi.org/10.1029/2010JC006697
- Chafik, L., T. Rossby, and C. Schrum, 2014. On the spatial structure and temporal variability of poleward
transport between Scotland and Greenland. *Journal of Geophysical Research: Oceans*. doi: http://dx.doi.org/10.1002/2013JC009287
- Fischer, J., J. Karstensen, R. Zantopp, M. Visbeck, A. Biastoch, E. Behrens, C.W. Böning, D. Quadfasel, K. Jochumsen, H. Valdimarsson, S. Jónsson, S. Bacon, N.P. Holliday, S. Dye, M. Rhein, C. Mertens, 2014. Intra-seasonal variability of the DWBC in the western subpolar North Atlantic. *Progress in Oceanography.* doi: http://dx.doi.org/10.1016/j.pocean.2014.04.002
- Gary, S.F., M.S. Lozier, A. Biastoch, and C.W. Böning, 2012. Reconciling tracer and float observations of the export pathways of Labrador Sea Water, *Geophysical Research Letters*, **39**, L24606. doi: http://dx.doi.org/10.1029/2012GL053978
- Gary, S.F., M.S. Lozier, C. Böning, and A. Biastoch, 2011. Deciphering the pathways for the deep limb of the Meridional Overturning Circulation. *Deep Sea Research*, **58**, 1781-1797. doi: http://dx.doi.org/10.1016/j.dsr2.2010.10.059
- Lozier, M.S., 2012. Overturning in the North Atlantic. *Annual Review of Marine Science*, **4**, 291-315.
- Lozier, M.S., 2010. Deconstructing the Conveyor Belt. *Science*, **328**, 1507–1511.
- Lozier, M.S., S.F. Gary, and A.S. Bower, 2013. Simulated pathways of the overflow waters in the North Atlantic: subpolar to subtropical export. *Deep Sea Research II*, **85**, 147–153.
- Lozier, M.S., V. Roussenov, Mark S.C. Reed, and R.G. Williams, 2010. Opposing decadal changes for the North Atlantic meridional overturning circulation. *Nature Geosciences,* **3**, 728-734.
- Rypina, I.I., L.J. Pratt, and M.S. Lozier, 2011. Near-surface transport pathways in the North Atlantic ocean: looking for throughput from the subtropical to the subpolar gyre, *Journal of Physical Oceanography,* **41** (5), 911-925.
- Schloesser, F., R. Furue, J.P. McCreary, and A. Timmermann, 2014. Dynamics of the Atlantic meridional overturning circulation. Part 2: Forcing by winds and buoyancy. *Progress in Oceanography*, **120**, 154-176. doi: http://dx.doi.org/10.1016/j.pocean.2013.08.007
- Sévelleca, F. and A.V. Fedorov, 2014. Optimal excitation of AMOC decadal variability: links to the subpolar ocean. Progress in Oceanography,doi: http://dx.doi.org/10.1016/j.pocean.2014.02.006
- Sévellec, F., J. J.-M. Hirschi, and A.T. Blaker, 2013. On the Near-Inertial Resonance of the Atlantic Meridional Overturning Circulation. *J. Phys. Oceanogr.*, **43**, 2661–2672. doi: http://dx.doi.org/10.1175/JPO-D-13-092.1

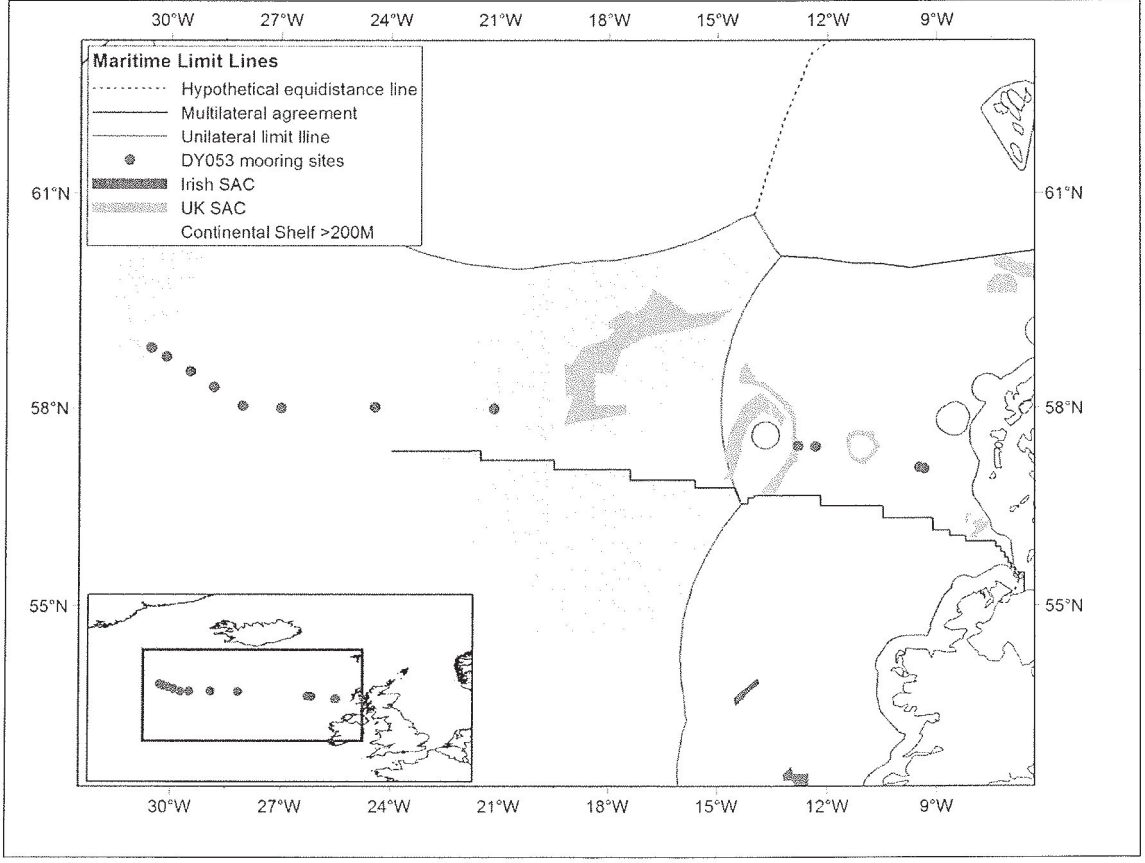
- Srokosz, M., M. Baringer, H. Bryden, S. Cunningham, T. Delworth, S. Lozier, J. Marotzke and R. Sutton, 2012. Past, present and future change in the Atlantic meridional overturning circulation, *Bull. Amer. Meteor. Soc.*, **93**, 1663–1676. doi: http://dx.doi.org/10.1175/BAMS-D-11-00151.1.
- Williams, R.G., V. Roussenov, D. Smith, and M.S. Lozier, 2014. Decadal evolution of ocean thermal anomalies in the North Atlantic: the effects of Ekman, overturning, and horizontal transport. *Journal of Climate*, **27**, 2, 698-719. doi: http://dx.doi.org/10.1175/JCLI-D-12-00234.1.
- Xu X.,H.E. Hurlburt, W. J. Schmitz Jr., R. Zantopp, J. Fischer, and P. J. Hogan, 2013. On the currents and transports connected with the atlantic meridional overturning circulation in the subpolar North Atlantic. *Journal of Geophysical Research*, **118**, 1, 502–516. doi: http://dx.doi.org/10.1002/jgrc.20065

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).

Subpolar North Atlantic: 9°W to 31°W ; 57°N to 58°N

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.



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:	
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:
None

4.5 Particulars of methods and scientific instruments:		
Types of samples and measurements:	Methods to be used:	Instruments to be used:

4.6 Indicate nature and quantity of substances to be released into the marine environment:
None

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):

Description		**Latitude Longitude**					**Date of laying**	**Date of recovery**
Mooring #	Site	Lat deg °N	Lat min	Lon deg °W	Lon min	Depth(m)	Depl. date	Rec. date
RT-ADCP1	ADCP1	57	06.17	9	20.27	746	20/06/2015	2017
RT-EB1	EB1	57	07.51	9	28.82	1809	21/06/2015	2017
RT-WB2	WB2	57	25.86	12	19.89	1803	22/06/2015	2017
RT-WB1	WB1	57	26.88	12	47.18	1608	22/06/2015	2017
M431	M1	58	52.33	30	31.73	1710	06/29/2015	2018
M435	D1	58	44.75	30	07.23	1740	07/03/2015	2018
M436	D2	58	31.93	29	27.53	2513	07/03/2015	2018
M437	D3	58	18.36	28	48.97	2175	07/02/2015	2018

M432	M2	58	02.28	28	01.39	2370	07/02/2015	2018
M438	D4	58	00.59	26	58.09	2670	07/01/2015	2018
M433	M3	58	01.04	24	25.09	2850	06/26/2015	2018
M434	M4	57	59.54	21	08.49	2920	06/24/2015	2018

Moorings equipped with a number of SeaBird microcat CTDs, Nortek Current meters, bottom pressure recorders. EB1, WB1, M1, M2, M3 are taught wire moorings from the sea-bed to ~100m subsurface. WB2, D1, D2, D3, D4 are taught wire moorings from the sea-bed to no closer than 1000m from the surface. ADCP1 is an acoustic current meter mounted in a trawl resistant frame.

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:
29th June 2015 28th July 2015
6.2 Indicate if multiple entries are expected:
NO

7. Port calls

7.1 Dates and Names of intended ports of call:
23rd to 27th July 2015, Reykjavik Iceland

7.2 Any special logistical requirements at ports of call:
None

7.3 Name/Address/Telephone of shipping agent (if available):
Nesskip Ltd, Austurströnd 1, 170 Seltjarnarnes (Reykjavik) Iceland Tel: +354 563 9900 Fax: +354 563 9919 email/web: operations@nesskip.is www.nesskip.is

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:

8.2 Proposed dates and ports for embarkation/disembarkation:
25th to 29th June 2015 Glasgow, UK 23rd to 27th July 2015, Reykjavik Iceland

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:
1st October 2016

9.2 Anticipated dates of submission to the coastal State of the final report:
1st October 2017

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:
www.o-snap.org www.ukosnap.org

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

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):
The Scottish Government: Marine Scotland [http://www.gov.scot/Topics/marine].

11. List of supporting documentation

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

Signature:

Contact information of the focal point:

Name: Stuart Cunningham

Country: UK

Affiliation: SAMS

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

Telephone: +44 (0)1631 559336

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