Application for Consent to conduct
Marine Scientific Research

Date: 14/01/2020

1. General Information

1.1 Cruise name and/or number:
Name: Advanced Mapping of Complex Marine Structures – 2020 Number: CE20010

1.2 Sponsoring Institution(s):	
Name:	Ulster University
Address:	2a Cromore Road, Coleraine, Co. Derry, Northern Ireland. BT52 1SA
Name of Director:	

1.3 Scientist in charge of the Project:	
Name:	Chris McGonigle
Country:	Ireland
Affiliation:	Ulster University
Address:	2a Cromore Road, Coleraine, Co. Derry, Northern Ireland. BT52 1SA
Telephone:	+44(0)2870124076
Fax:	
Email:	cd.mcgonigle@ulster.ac.uk
Website (for CV and photo):	https://pure.ulster.ac.uk/en/persons/chris-mc-gonigle

1.4 Entity(ies)/Participant(s) from coastal State involved in the planning of the project:	
Name:	Dr. John Howe
Affiliation:	Senior Lecturer in Marine Science, Scottish Association of Marine Sciences, UK
Address:	Scottish Marine Institute, Oban PA37 1QA
Telephone:	+44 (0)1631 559 257
Fax:	
Email:	John.Howe@sams.ac.uk
Website (for CV and photo):	
Name:	Dr. Alex Callaway
Affiliation:	Assistant Scientific Officer - Seabed Habitat Mapping, Agri-Food Biosciences Institute, NI
Address:	Agri-Food and Biosciences Institute 18a Newforge Lane, Belfast, Co Antrim Northern Ireland UK BT9 5PX
Telephone:	+44 (0)28 9025 5636
Fax:	
Email:	Alex.Callaway@afbini.gov.uk
Website (for CV and photo):	
Name:	Dr. Rory Quinn
Affiliation:	Reader in Marine Geophysics, Ulster University
Address:	2a Cromore Road, Coleraine, Co. Derry, Northern Ireland, BT52 1SA

Telephone:	+44 28 7012 4884
Fax:	
Email:	rj.quinn@ulster.ac.uk
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
This project aims is to acquire a remotely-sensed reference set of acoustic, optical and laser data for a methodological comparison of mapping fine-scale morphological and structural complexity on complex 3D structures below the surface. This will allow for development and analysis of acquisition protocols, processing workflows and other end-user applications from a range of sensors deployed on unmanned underwater vehicles (UUVs). The project will ultimately inform the wider community, including both academic and industrial sectors, about the relative merits and detractions of the different methodologies in a controlled in-situ experiment. Outcomes and Benefits This survey will help us to understand more about environmental controls on benthic communities that will help inform the conservation of priority Annex I habitat in Ireland, the UK and Europe. This benefits society as it will help to inform natural resource management by refining our understanding of process affecting ecological communities. Interdisciplinary collaboration allow participants to benefit from exposure to different legislative frameworks, which will facilitate knowledge transfer between the partner institutions.

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:
This work will contribute to some of the scope for Management and Monitoring of Marine Protected Areas (MarPAMM), administered by the SEUPB through Interreg VA. Further information is available here: http://www.mpa-management.eu/ . This work will make a contribution to the T2 Benthic Habitats package which is coordinated by the Agri-Food Biosciences Institute, Belfast.

2.3 Relevant previous or future research projects:
This proposal represents a continuation or development from the foundations of several European projects (legacy and ongoing), most notably: 1) Mapping European Seabed Habitats (MESH) Project JNCC was leading an international marine habitat mapping programme entitled 'Development of a framework for Mapping European Seabed Habitats, or MESH for short, which started in spring 2004 and finished in January 2008. The MESH partnership covered all five countries in the INTERREG (IIIb) north-west Europe area, drawing together scientific and technical habitat mapping skills, national data collation and management expertise, and experience in the use of habitat mapping in management and regulatory frameworks. 2) The Joint Irish Bathymetric Survey (JIBS). The Maritime and Coastguard Agency led the Joint Irish Bathymetric Survey (JIBS) Project, approved under the INTERREG IIIA Programme, with the Marine Institute as project partner. Objectives included joint seabed survey to satisfy the needs of many organisations. The JIBS project commenced on 10 April 2007 and was completed in June 2008. 3) INFOMAR is a DCCAE funded joint programme between the Geological Survey Ireland and the Marine Institute, surveying our unmapped marine territory

and creating a range of integrated mapping products of the physical, chemical and biological features of the seabed.

4) INIS Hydro is part of the EU funded INTERREG IVA Programme, Priority 2, Theme 2: Environment. Between 2011 and 2013 the INIS Hydro partnership conducted multibeam echo sounder bathymetric surveys of over 1,400 km2 of strategically important seabed off the west coast of Scotland and the east coast of Ireland and Northern Ireland generating data of IHO Order 1A quality.

2.4 Previous publications relating to the project:

Collier, J. S., & Brown, C. J. (2005). Correlation of sidescan backscatter with grain size distribution of surficial seabed sediments. *Marine Geology*, *214*(4), 431-449.

McGonigle, C., & Collier, J. S. (2014). Interlinking backscatter, grain size and benthic community structure. *Estuarine, Coastal and Shelf Science*, *147*, 123-136.

McGonigle, C., Brown, C., Quinn, R. and Grabowski, J., 2009, Evaluation of image-based multibeam sonar backscatter classification for benthic habitat discrimination and mapping at Stanton Banks, UK, Estuarine, Coastal and Shelf Science, 81(3): 423-437.

McGonigle, C., Brown, C. J., & Quinn, R. (2010). Insonification orientation and its relevance for image-based classification of multibeam backscatter. *ICES Journal of Marine Science: Journal du Conseil*, fsq015.

Hughes Clarke, J. 2015. Multispectral acoustic backscatter from multibeam, Improved classification potential. United States Hydrographic Conference 2015. March 16th -19th National Harbour, Maryland, USA.

Hughes Clarke, J., Iwanowska, K. K., Parrott, R., Duffy, G., Lamplugh, M., & Griffin, J. (2008). Inter-calibrating multi-source, multi-platform backscatter data sets to assist in compiling regional sediment type maps: Bay of Fundy. In Proceedings of the Canadian Hydrographic Conference and National Surveyors Conference.

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in Latitude and longitude in decimal degrees, including coordinates of cruise/track/way points/sampling stations). Please provide coordinates in a separate excel spreadsheet.

This proposal is based around two targets in the Malin Sea: 1) the shipwreck *SS Justicia* and 2) biogenic *Sabellaria* reef in the Skerries and Causeway SAC (Figure 2). These two sites have been selected based on current research activities at Ulster University. The areas were surveyed as part of the MESH and JIBS project, and existing MBES data is available for these sites. Repeat acoustic surveys at these sites will allow an assessment of change in the benthic environment which can be incorporated into final year dissertation projects, comparing the extant JIBS MBES data with the data acquired as part of the training exercises).

The first site of the SS Justicia is located in Irish waters and so is not subject to the issue of Diplomatic Clearance, but is described here for the sake of context. *SS Justicia*, a 32,234 gross-ton ocean liner, was built for the Holland America Line by Harland and Wolff in Belfast. After several trips as a troopship she was torpedoed by a German U-boat in 1918 while sailing unladen. Today, the wreck lies in 68 m of water, 45 km north-west of Malin Head in Republic of Ireland waters (55o 38 50.87N / 007o 56 55.07W).

The second site is in Northern Irish waters within the boundaries of the Causeway Skerries Special Area of Conservation, based around 55o 14.80N / 006o 39.70W –

approximately 2 nautical miles due north of Ramore Head, Portrush. This site contains biogenic *Sabellaria spinulosa* reef, which was discovered by the Agri-Food Biosciences Institute as part of the routine monitoring for Article 17 EC Habitats Directive and is located in UK territorial waters. Although the full extent of the feature is currently unknown, it is estimated to be a considerable size as determined using towed underwater video footage. There is a high level of structural complexity within this habitat type and it is a high conservation value target for our investigation.

Survey lines will be decided at the time of survey depending on weather conditions and time restraints, although the vessel (*RV Celtic Explorer*) will be operating on dynamic positioning whilst the UUV based survey operations are underway.

Several additional sites of high scientific interest are available in more sheltered conditions as contingency areas in the event of unfavourable survey conditions. These sites include Rathlin Island cMCZ, Loch Sunart MPA/ SAC and the Sound of Jura SAC, Red Bay SAC, Laconia Bank, Middle Bank, the Tuns Bank and the Causeway and Skerries SAC, all of which are of significant scientific and conservation interest.

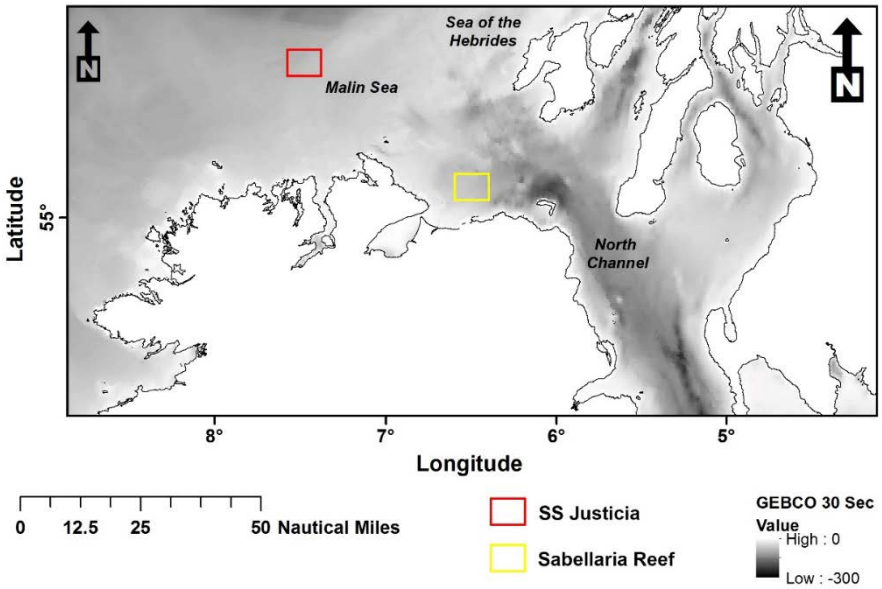


Figure 1. Location of the two priority areas (1) SS Justicia and (2) Sabellaria reef in the Causeway Skerries Special Area of Conservation, within the wider study domain of the Malin Sea, Sea of the Hebrides and the North Channel.

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.

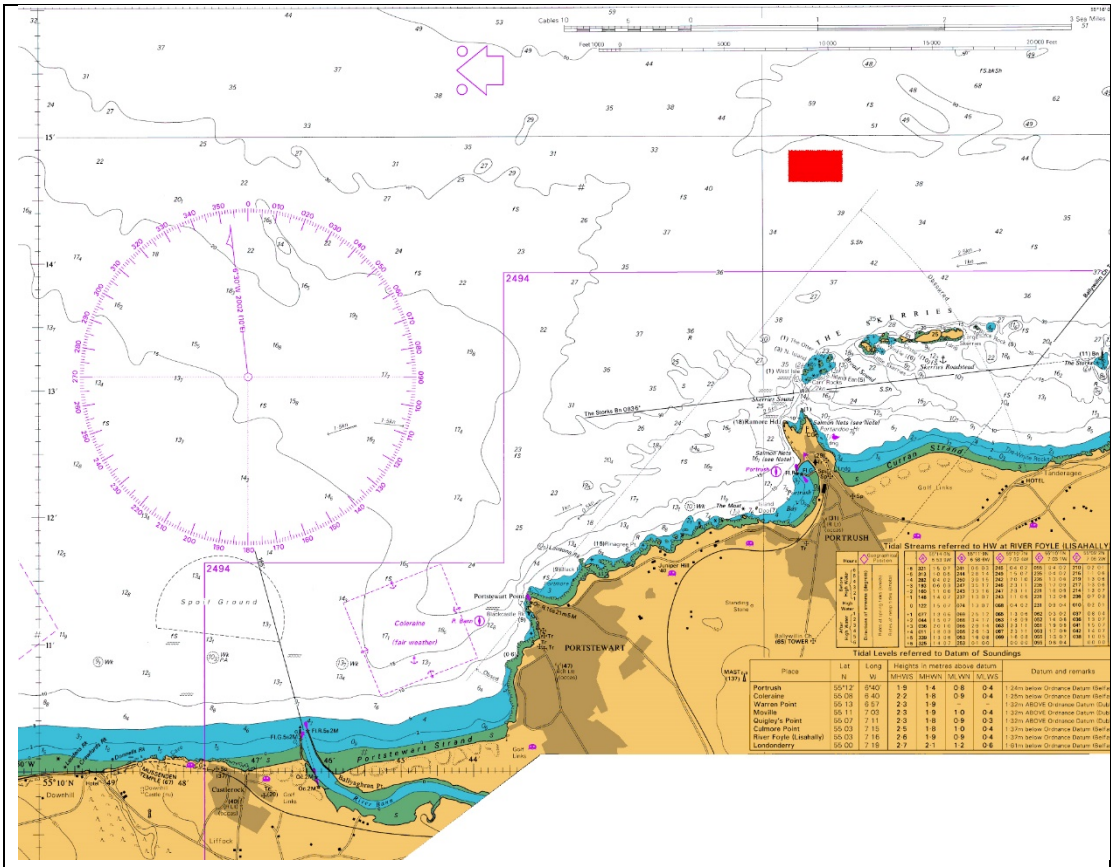


Figure 2: Detailed inset of priority area from Admiralty Chart 2499. The location of the Sabellaria Reef is indicated by the red box. All survey works for the vessel, ROV and AUV will be contained within these boundaries.

4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	Celtic Explorer
Type/Class:	Multipurpose Research Vessel D100 A1 ICE CLASS ID + UMS +SCM DP (CM)
Nationality (Flag State):	Irish
Identification Number (IMO/Lloyds No.):	IMO Number: 9244439
Owner:	Marine Institute
Operator:	P&O Maritime Services
Overall length (meters):	65.5
Maximum draught:	5.7m
Displacement/Gross Tonnage:	2425T
Propulsion:	2 x 1530 KW, 1000Rpm, 1 x 1020 KW, 1000 Rpm
Cruising & maximum speed:	10 & 16 knots
Call sign:	EI GB
INMARSAT number and method and capability of communication (including emergency frequencies):	00353 91 423397 / 00353 91 423433 00870 763066743 00 353 87 9678520 / 00 353 86 1735500
Name of Master:	Antony Hobin/Denis Rowan
Number of Crew:	13-15
Number of Scientists on board:	18-20 max

4.2 Particulars of Aircraft:	
Name:	n/a
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:	Teledyne Gavia Offshore Surveyor
Manufacturer and make/model:	Teledyne Gavia
Nationality (Flag State):	United Kingdom
Website for diagram & Specifications:	http://www.teledynemarine.com/gavia-auv
Owner:	NERC
Operator:	SAMS-John Howe
Overall length (meters):	2.5-3.8 m(module payload dependant)
Displacement/Gross tonnage:	95-135kg(module payload dependant)
Cruising & Maximum speed:	3 Knots cruising- 5 Knots maximum
Range/Endurance:	8 hours endurance
Method and capability of communication (including emergency frequencies):	Acoustic communications whilst underwater and wifi(250m range) and Iridium on surface
Details of sensor packages:	500 kHz Geoswath Plus- Interferometric Sonar Grasshopper Still Image Camera- 3.8f.p.s Science Bay containing CTD and Aanderaa oxygen optode 14-21 kHz Sub-Bottom Profiler External Go Pro Video and lights attachment system
Other relevant information:	2 x TESI Lithium Ion Batteries Kearfott T24 INS/600kHz DVL

4.4 other craft in the project, including its use:	
Name:	Marine Renewable Energy-ROV also known as Étáin),
Type/Class:	Light-workclass Intervention ROV
Nationality (Flag State):	Irish
Owner:	University of Limerick
Operator:	University of Limerick

Base Vehicle	
Chassis	Marine grade Aluminium frame with skid expansion
Max Payload	285kg
Max operating depth	2000m depth rating (LARS/TMS operations); 600m Free Swimming
Thrusters	Seven 100 kgf / 220 lbf Brushless DC Thrusters using StatorshieldTM Technology (4 horizontal, 3 vertical)
Weight in Air	1130kg
Forward speed (max)	2 m/s / 4 Knots
ROV Power supply	35kW, 3000V 400Hz
Embedded control & acquisition system	SubCAN Control System with MMRRC software OceanRINGS
Fibre/media converters	4 Pass Fibre Optic Connection with Focal CWDM

LARS/TMS Operations & Free Swimming Winch	
Length	2200m LARS Umbilical; 400m TMS tether 600m neutral Free Swimming tether
TMS frame	Type 3B Garage 316L Stainless Steel Frame

Instruments & Payload Sensors	
Multibeam sonar	Reson SeaBat 7125/7128 multibeam echsounder system
Forward Looking Sonar	Tritech SeaKing Dual Frequency Scanning Sonar
Sound velocity probe	Valeport UV-SVP (temperature & SVP)
Depth & altitude	Tritech PA500
Doppler Velocity Log	Nortek DVL 500kHz
GNSS (surface)	Applied Acoustics 106G RTK GNSS
Inertial navigation	iXBlue PHINS 6000 (High precision fibre optic INS)
Cameras	1 x Bowtech Explorer Pro (4000m) - Low Light monochrome Camera 3 x Sub-C 1Cam MK6 UHDF w/LiquidOptics – UHDF Colour Zoom Wide Angle Camera
Lights	4 x Bowtech 3200 LED Dimmable LED Light (3000m) 3 x Sub-C Lights for HD Cameras
Safety Systems	Novatech RF-700AR – VHF Beacon – Battery & Remote Antenna Novatech ST-400AR Xenon Flasher – Battery & Remote Flash Lamp
Manipulators	2 x Schilling Orion 7P
Hydraulic Power Unit	10kW HPU (13.4 HP, 207 BAR), Inc CARDEV filter

4.5 Particulars of methods, full description of scientific instruments to be used(for fishing gear specify type and dimension) and location

Types of samples and Measurements:	Methods to be used:	Instruments to be used:	To be carried out within 12nm (yes or no):
Acoustic data	Hull-mounted acoustic survey methodology	Multibeam sonar, Single beam sonar,	Yes
Biological samples (infauna and epifauna)	Grabs, ROV Holland 1	Day grab, Shipek grab,	Yes
Sediment grain size samples	Grabs	Day grab, Shipek grab	Yes
Video data	Underwater video surveys	Drop-down video frames; ROV Holland 1	Yes
Laser Line Scanner	Subsea LiDAR	ULS-500 Laser Line Scanner	Yes

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

No harmful substances will be used.

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

No drilling will be carried out.

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 explosives will be used.

5. Installations and Equipment

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 planned.

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:
The cruise is scheduled to take place between 08/05/2020 and 14/05/2020. First entry into UK waters 18:00 8th May 2020 – based on transit from the site in the Republic of Ireland. Survey works will be completed by 00:00 on 13/05/2020 exiting UK waters shortly thereafter.
6.2 Indicate if multiple entries are expected:
No.

7. Port Calls

7.1 Dates and Names of intended ports of call:
There may be a need to exchange some personnel mid-cruise depending on availability of representatives of coastal states. This could happen at Greencastle in Co. Donegal or Lisahally Co. Derry – this could likely happen as a small boat transfer rather than as a dedicated port call. AFBI have indicated their capacity to arrange something in this eventuality and this is something that they routinely organise. The dates for this would be finalised closer to the time, but it is likely that this would be mid-way through cruise to allow for personnel changeover.

7.2 Any special logistical requirements at ports of call:
N/a.

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

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:
The cruise will be run by UK scientists and the data will feed into UK Higher Education via the University of Ulster BSc Environmental Science degree programme.

Dr. Alex Callaway. Senior Scientific Officer - Seabed Habitat Mapping, Agri-Food Biosciences Institute, NI is part of the scientific personnel for this cruise. There will also be an invitation to DAERA Marine Division for further representation from Northern Ireland.

8.2 Proposed dates and ports for embarkation/disembarkation:
Mobilising in Galway (8th May 2020), Demobilising in Cork (14th of May 2020). Possibility of disembarkation on small boat transfer mid-cruise, in this event it will be organised locally by AFBI.

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:
All UK based partners (Ulster University, Scottish Association of Marine Sciences, Imperial College London) will have immediate access to data and samples. Cruise report available end of August 2019.

9.2 Anticipated dates of submission to the coastal State of the final report:
Cruise report available end of December 2020.

9.3 Proposed means for access by coastal State to data (including format) and samples:
All UK based partners (Ulster University, Scottish Association of Marine Sciences) will have immediate access to data and samples.

9.4 Proposed means to provide coastal State with assessment of data, samples and Research results:
Data and samples will be processed by Ulster University contract research staff and post-graduate students. Results will be published, if appropriate, in leading marine science journals. After a suitable embargo period, data will be freely available to UK government agencies (DEFRA, SNH, DAERA, AFBI, FRS etc.).

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples And research results:
Data and samples will be processed by Ulster University contract research staff and post-graduate students.

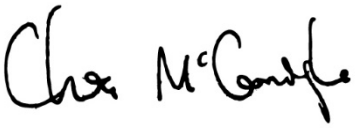
9.6 Proposed means of making results internationally available:
Research results will be published in leading marine science journals.

10. Other permits Submitted

10.1 Indicate other types of coastal state permits anticipated for this research (received or Pending):
Pending (Licensing Exemption – DAERA (NI), National Parks and Wildlife (RoI).

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: Chris McGonigle
Country: Northern Ireland
Affiliation: Ulster University
Address: 2a Cromore Road
Telephone: +44(0)2870124076
Fax:
Email: cd.mcgonigle@ulster.ac.uk