

EMFF Operational
Programme 2014-2020

Marine
Biodiversity

EMFF Coastal Sediments Project

Achill Bay Survey Report

EMFF 2014-2020

Marine Institute Report Series



Ireland's EU Structural and
Investment Funds Programmes
2014 - 2020
Co-funded by the Irish Government
and the European Union



EUROPEAN UNION
This measure is part-financed
by the European Maritime
and Fisheries Fund



An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine



Marine Institute
Foras na Mara

Achill Bay Survey Report

August 2021



Conducted by INFOMAR for
European Maritime and Fisheries Fund.

INFOMAR is jointly managed by the Geological Survey Ireland and the Marine Institute.



An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications



INFOMAR
Integrated Mapping for the
Sustainable Development
of Ireland's Marine Resource



Geological Survey
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Marine Institute

EMFF Coastal Sediments Project – Achill Bay Survey Report

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Acknowledgements

The authors would like to thank the respective EMFF Biodiversity and Research Vessel Operations teams based at the Marine Institute for support and advice over the course of this project. The Advanced Mapping Services team provided logistical, administrative and GIS support throughout.

The Coastal Sediment Project was funded by the European Maritime Fisheries Fund (EMFF) and led by INFOMAR to conduct sediment sampling and environmental data collection surveys on areas of interest in Ireland’s coastal waters to develop high resolution sediment maps, create habitat maps and support ancillary EMFF projects coordinated by the Marine Institute.

The Marine Biodiversity Scheme is established under Union Priority 1 (Sustainable Fisheries) and Union Priority 6 (Integrated Maritime Policy) of Ireland’s Operational Programme (OP) under the EMFF and is co-funded by the Irish Government and the EU.

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Citation: O’Sullivan, D. & INFOMAR. 2021(a). Coastal Sediments Project – Achill Bay Survey Report, August 2021. EMFF 2014-2020 Marine Institute Report Series. Report prepared by INFOMAR on behalf of the Marine Institute, Galway 17 pp.



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Introduction

There is an ongoing requirement for high resolution substrate maps that accurately depict the sediment properties of the seabed and improve our knowledge of the marine environment. This Coastal Sediment Sampling Project, funded by the European Maritime Fisheries Fund (EMFF), will conduct intense sediment sampling and environmental data collection (including video) surveys on areas of interest in Ireland's coastal waters to develop high resolution sediment maps, create habitat maps and support ancillary EMFF projects coordinated by the Marine Institute.

INFOMAR, the national seabed mapping programme, aims to provide comprehensive and accessible marine datasets for Irish waters that underpin and add value to marine research, SOLAS Convention obligations and government policy. These products will foster growth within the national blue economy, maintain the health and integrity of our natural marine environment while facilitating international collaboration and best practice in the sustainable development of Ireland's marine resource. INFOMAR is jointly-managed by the Geological Survey Ireland and the Marine Institute.

Achill Bay was selected as the first leg of this survey programme as no multibeam data exists within the inner bay and a significant number of sediment samples were required to create accurate seabed classification charts and habitat maps. A strategic sampling campaign will target and retrieve sediment samples for Particle Size Analysis and increase the accuracy of key derived products such as substrate and habitat maps which are key to supporting Ireland's Marine Spatial Plan, and the Marine Strategy Framework Directive, identified as priority action(s) of the EMFF Operational Programme.

The primary aim of this survey was to conduct a ground-truthing sampling survey of Achill Bay and acquire sediment samples from predefined locations. In addition, video ground-truthing will be conducted using a GoPro camera and frame for manual deployment.

Methods

Site Selection

Sample locations were selected following a geospatial analysis of existing data within a GIS (ArcMap 10). Relevant spatial data included coarse seabed classification, ortho-imagery and LiDAR information already collected by INFOMAR. Locations were chosen to reflect expected depth ranges around the target area from very shallow inter-tidal to deeper waters at the entrance to the bay. Depth ranges were classified from LiDAR data. From high resolution ortho-imagery it was also possible to target certain areas and verify expected substrate, these included sand-banks and tidal channels. A total of 80 sites were chosen in advance of the survey upon final consultation with the charter vessels skipper (Figure 1).

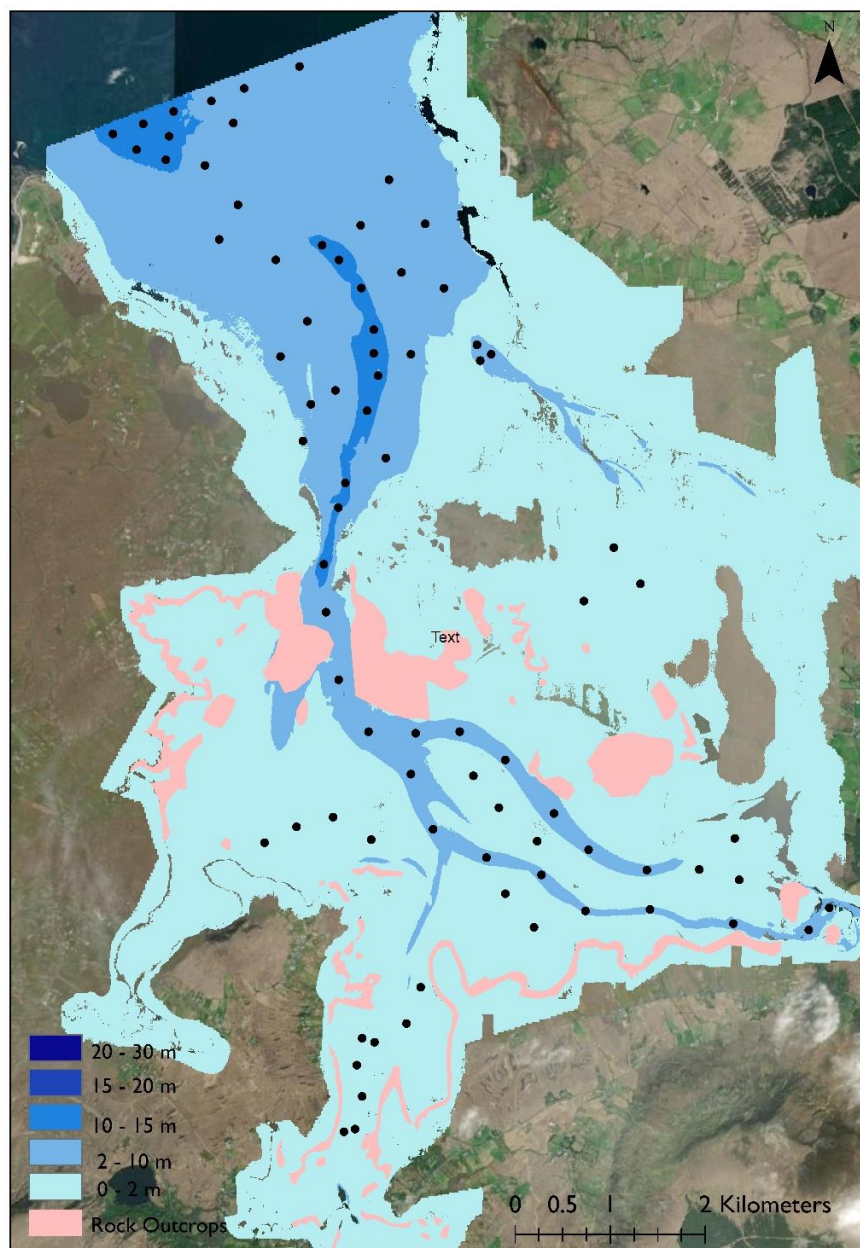


Figure 1. Existing ortho-imagery, LiDAR and seabed classification data from Achill Bay used to define 80 sediment sampling locations.

Vessel Charter

An Invitation to Tender document (attached as Appendix I) was prepared and shared with suitable candidates and local fishers via the North West Regional Inshore Fisheries Forum. Following receipt of three verbal quotes, Dulra na Mara (Figure 2), based out of Elly Bay / Blacksod, was awarded the tender based on the necessary requirements outlined in the tender including:

- Winch and galvanised cable for operation of grab.
- Expert local knowledge.
- Cost.
- GPS for positioning.
- Deck space for organisation of samples and survey equipment.
- Sheltered Work Space for Photographing and processing samples.
- Power-supply for laptop / camera.



Figure 2. Survey platform, Dulra na Mara, used to conduct Achill Bay sampling effort

The presence of a hydraulic A-frame and winch on the stern allowed for efficient sampling retrieval and initial processing. Two Van Veen grabs (with one retained as back-up), provided by the Marine Institute were the primary sampling equipment. A second smaller hand-grab also provided by the Marine Institute (Advanced Mapping Services) was included for shallow inter-tidal locations. Following consultation with the skipper, some inter-tidal locations were identified as only being accessible on high tides and/or with a smaller tender vessel.

Survey Operations & Equipment

It was anticipated that the survey would run for up to 12 hours per day for between 3-4 days, commencing early August 2021 or the first suitable weather window thereafter. Operations can generally only take place in < Force 4 conditions unless swell and wave heights are not significant. The survey was undertaken with one INFOMAR scientist, leading the sampling activities in accordance with the INFOMAR guidelines for ground-truthing, assisted by a deck-hand (provided by Dulra Na Mara and inclusive of quoted cost) and the skipper. The following equipment was prepared and provided by INFOMAR / Marine Institute:

- 2 Van Veen grabs
- Small hand-held grab
- Hand-held GPS
- Sampling equipment including labels, sampling bags, Maunsell Chart.
- GoPro Hero 9, deep-water casing, drop frame, diving torch.
- GIS plan with 80 sample locations identified, preprinted and provided in .gpx format
- Fish-Boxes for sample storage



Figure 3. Van Veen grab used to conduct survey

Sample analysis

Sediment samples were acquired using a Van Veen grab and were brought aboard, stored in a Fish Box, briefly described (colour via Maunsell chart, grain size, clade, biogenics) and photographed before being labelled and bagged. Samples were retained for post-survey Particle Size Analysis and will be included as an Appendix when finalised.

Video ground-truthing

Where the grab failed to retrieve any sediment after three attempts a camera-frame with Go-Pro 9 was manually lowered to the seabed for between 2-3 minutes to verify substrate. In some instances, both sediment and video were obtained on the same site.

Results

Mobilisation

Sample locations converted to .gpx format within ArcMap 10 and compatible with onboard Simrad plotter, were provided by the Marine Institute in advance. Following consultation with Dulra na Mara, it was decided to begin survey on Tuesday August 3rd 2021 a period midway between Spring and Neap tides. Relevant equipment was mobilised in Blacksod on Monday 2nd checked with skipper and a workable survey plan decided. Daily survey operations were conducted in conjunction with expected weather conditions and workable tides.

Sample Recovery

Once on each location, the grab sampler was lowered to the seafloor to collect sediment. Upon a failed recovery, up to three attempts were made before verifying the groundtype via GoPro video. Table 1 describes the co-ordinates of each site and the relevant data recorded at each. Figure 3 shows the location of 80 sampling stations and a brief description of ground type from any sediment recovered or inferred from non-recovery. In total 63 sediment samples were recovered with video recorded at the remaining 17 sites. Video and sediment was sampled at 6 sites. Twenty-one sites (046 -048 & 051 – 068) were too shallow to be sampled from the Dulra Na Mara. Instead a small punt was launched and navigated to each predefined survey location using a hand-held GPS. In depths < 2 m, the smaller hand-held grab was used to collect samples which were stored in individual buckets before being processed later on the primary survey platform.

Sample Images

A photo of each sample retrieved was taken on location and named accordingly. An example of some of the various ground types encountered in Achill Bay are shown in Figure 4. Although only brief descriptions were recorded on-board there is a clear distinction in granule size and type. Sample 002 was very coarse sand with broken mussel shells which suggested a nearby mussel bed. Very fine sand mixed with biological detritus was recorded at 006. The poor recovery is likely related to the jaws of the grab not closing properly over this material. Very fine silt was recovered at 018. Coarse sand of variable grain size was recovered at 032 while 078 shows much finer well-sorted sand. Finally, strong smelling, thick silt/clay was recovered in the southern most channel on the approach to the Achill sound bridge for Sample 051.

Date	Time	Sample Number	Location	Depth (m)	Latitude	Longitude	Sediment Recovered	Initial Description	Video
03/08/2021	11:00	001	16	12.5	53°59.626	9°55.646	N	Hard Ground	Y
03/08/2021	11:45	002	34	8	53°59.385	9°55.619	Y	Sand	N
03/08/2021	12:05	003	35	10	53°58.976	9°55.488	Y	Sand	N
03/08/2021	12:15	004	36	7.5	53°58.683	9°55.196	Y	Sand	N
03/08/2021	12:25	005	37	5	53°58.678	9°54.741	N	Hard Ground	Y
03/08/2021	12:45	006	38	5	53°58.69	9°54.317	Y	Silt	N
03/08/2021	12:50	007	39	9	53°58.533	9°53.876	N	Hard Ground	Y
03/08/2021	13:10	008	40	6	53°58.233	9°53.4	Y	Silt	N
03/08/2021	13:52	009	41	7.5	53°58.03	9°53.062	Y	Sand	N
03/08/2021	14:05	010	42	6	53°57.919	9°52.501	Y	Silt	N
03/08/2021	14:18	011	79	4	53°57.928	9°51.997	Y	Sand	Y
03/08/2021	14:42	012	78	4	53°58.105	9°51.66	Y	Silt	N
03/08/2021	14:49	013	80	4	53°57.87	9°51.612	Y	Sand	N
03/08/2021	15:00	014	49	5	53°57.621	9°51.663	Y	Sand	N
03/08/2021	15:17	015	50	7	53°57.591	9°50.937	N	Hard Ground	Y
03/08/2021	15:28	016	21	4	53°57.718	9°50.744	Y	Sand	Y
03/08/2021	16:00	017	48	5	53°57.695	9°52.466	Y	Sand	N
03/08/2021	16:07	018	47	5.5	53°57.681	9°53.086	Y	Silt	N
03/08/2021	16:20	019	46	6	53°57.884	9°53.515	Y	Sand	N
03/08/2021	16:32	020	45	7	53°57.978	9°54.045	Y	Sand	N
03/08/2021	16:43	021	44	10	53°58.135	9°54.563	Y	Sand	N
03/08/2021	16:50	022	43	9	53°58.447	9°54.784	Y	Sand	N
03/08/2021	17:22	023	15	13	53°59.952	9°55.513	N	Hard Ground	Y
03/08/2021	17:47	024	14	12	54°0.091	9°55.449	N	Hard Ground	Y
03/08/2021	18:00	025	32	6	54°0.235	9°55.062	Y	Sand	N
03/08/2021	18:10	026	59	4	54°0.326	9°55.863	Y	Sand	N
03/08/2021	18:23	027	13	12	54°0.502	9°55.25	N	Hard Ground	Y
03/08/2021	18:37	028	12	13	54°0.702	9°55.148	N	Hard Ground	Y
03/08/2021	18:47	029	11	12	54°0.829	9°55.194	N	Hard Ground	Y
04/08/2021	09:30	030	1	12.5	54°2.054	9°57.732	N	Hard Ground	Y
04/08/2021	09:49	031	2	12.5	54°2.114	9°57.44	Y	Sand	N
04/08/2021	09:58	032	3	12	54°2.187	9°57.147	Y	Sand	N
04/08/2021	10:07	033	17	10	54°2.247	9°56.787	Y	Sand	N
04/08/2021	10:15	034	18	10	54°2.323	9°56.47	Y	Sand	N
04/08/2021	10:26	035	19	9	54°2.449	9°55.943	Y	Sand	N
04/08/2021	10:40	036	20	8	54°2.127	9°56.573	Y	Sand	N
04/08/2021	10:50	037	5	7.5	54°2.044	9°57.19	Y	Sand	Y
04/08/2021	11:01	038	4	12	54°1.969	9°57.501	Y	Sand	N
04/08/2021	11:12	039	6	12	54°1.913	9°57.218	Y	Sand	N
04/08/2021	11:20	040	21	8	54°1.88	9°56.842	Y	Sand	N
04/08/2021	11:30	041	22	5	54°1.664	9°56.519	Y	Sand	N
04/08/2021	11:40	042	23	7.5	54°1.463	9°56.696	Y	Sand	Y
04/08/2021	11:54	043	24	5	54°1.353	9°56.143	Y	Sand	N
04/08/2021	12:04	044	7	18	54°1.437	9°55.703	N	Hard Ground	Y
04/08/2021	12:15	045	8	15	54°1.356	9°55.538	N	Hard Ground	Y

Date	Time	Sample Number	Location	Depth (m)	Latitude	Longitude	Sediment Recovered	Brief Description	Video
04/08/2021	13:03	046	53	3	54°0.881	9°54.043	Y	Sand	N
04/08/2021	13:13	047	54	3	54°0.925	9°53.802	Y	Sand	N
04/08/2021	13:22	048	52	3	54°1.066	9°54.036	Y	Sand	Y
04/08/2021	14:15	049	70	2	53°57.247	9°54.723	Y	Sand	N
04/08/2021	14:25	050	72	2.5	53°56.946	9°55.218	Y	Sand	N
04/08/2021	14:50	051	76	2	53°56.055	9°55.248	Y	Silt	N
04/08/2021	14:53	052	75	2	53°66.195	9°55.223	Y	Silt	N
04/08/2021	14:57	053	74	2	53°56.363	9°55.203	Y	Sand	N
04/08/2021	15:02	054	73	2	53°56.633	9°55.202	Y	Sand	N
04/08/2021	15:09	055	77	2	53°56.783	9°55.112	Y	Sand	N
04/08/2021	15:14	056	71	3	53°56.878	9°54.735	Y	Sand	N
04/08/2021	16:15	057	64	2	53°57.672	9°53.645	Y	Sand	N
04/08/2021	16:18	058	65	2	53°57.54	9°53.41	Y	Sand	N
04/08/2021	16:25	059	63	3	53°57.955	9°53.257	Y	Sand	N
04/08/2021	16:31	060	62	2	53°58.12	9°53.678	Y	Sand	N
04/08/2021	16:36	061	61	2	53°58.278	9°54.082	Y	Sand	N
04/08/2021	17:09	062	69	2	53°58.027	9°55.812	Y	Sand	N
04/08/2021	03:07	063	68	2	53°58.092	9°55.597	Y	Sand	N
04/08/2021	17:16	064	67	2	53°58.182	9°55.348	Y	Sand	N
04/08/2021	17:22	065	66	2	53°58.075	9°55.043	Y	Sand	N
04/08/2021	18:24	066	57	2	53°59.352	9°53.162	Y	Sand	N
04/08/2021	18:27	067	56	1	53°59.385	9°53.083	Y	Sand	N
04/08/2021	18:31	068	55	2	53°59.115	9°53.312	Y	Sand	Y
05/08/2021	10:15	069	26	9	54°1.813	9°55.074	N	Hard Ground	Y
05/08/2021	10:40	070	28	7.5	54°1.554	9°55.337	N	Hard Ground	Y
05/08/2021	10:57	071	27	7.5	54°1.567	9°54.713	Y	Sand	N
05/08/2021	11:04	072	29	7.5	54°1.291	9°54.937	Y	Sand	N
05/08/2021	11:17	073	30	5	54°1.203	9°54.525	Y	Sand	N
05/08/2021	11:29	074	9	7.5	54°1.202	9°55.323	N	Hard Ground	Y
05/08/2021	11:40	075	10	13	54°0.966	9°55.197	N	Hard Ground	Y
05/08/2021	11:53	076	31	5	54°0.827	9°54.832	Y	Sand	N
05/08/2021	12:08	077	33	11	54°0.616	9°55.56	N	Hard Ground	Y
05/08/2021	12:20	078	58	4	54°0.535	9°55.792	Y	Sand	N
05/08/2021	12:30	079	60	5.5	54°0.803	9°56.088	Y	Sand	N
05/08/2021	12:41	080	25	6	54°1.005	9°55.839	Y	Sand	N

Table 1. Co-ordinates and relevant data recorded at 80 sampling locations within Achill Bay as part of the current study.

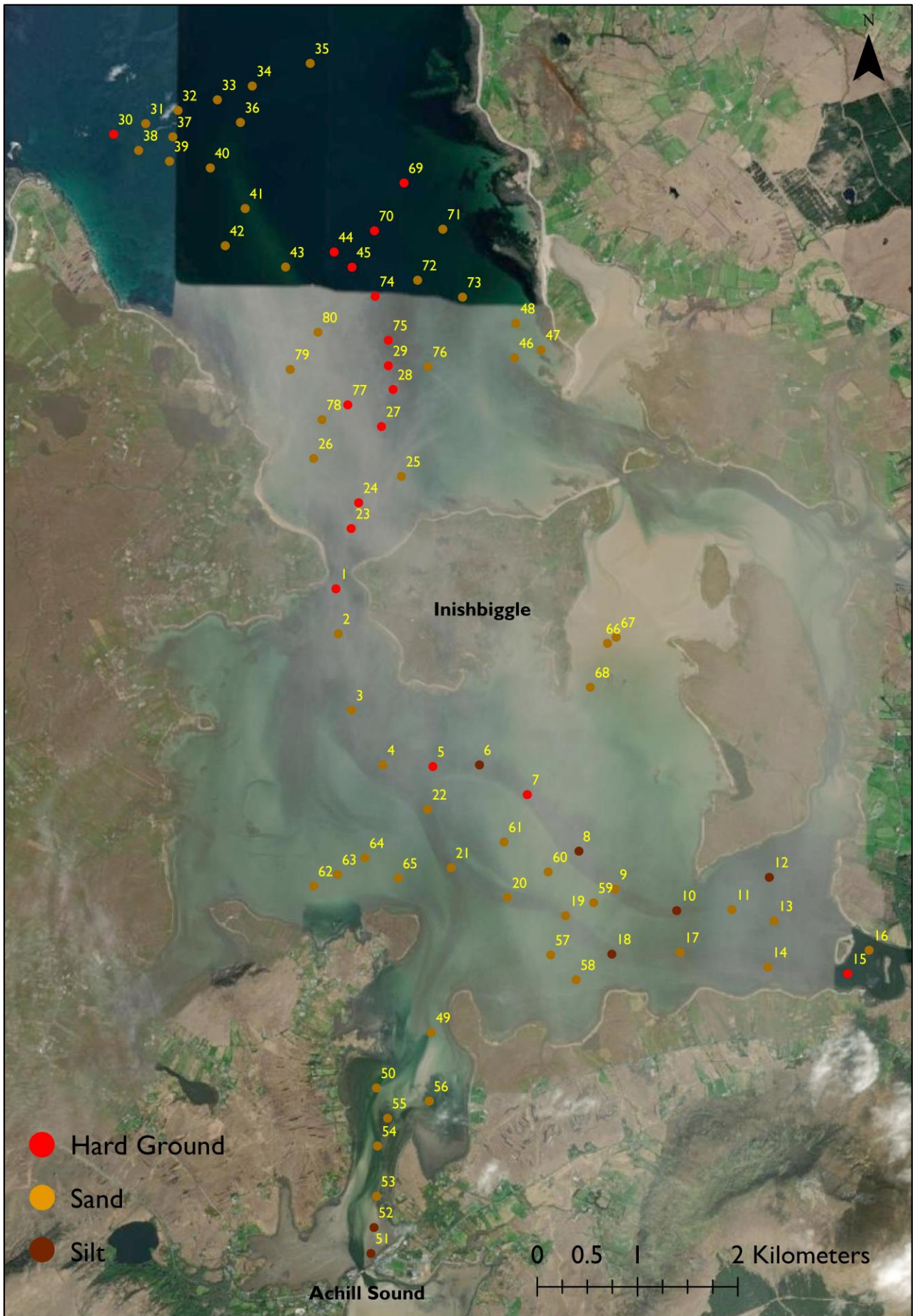


Figure 4. 80 sampling locations within Achill Bay and an initial brief description of sediment type present.



Figure 5. Sediment images from six locations sampled during the current survey. The images show the variability of substrate types in Achill Bay including (from top left) Very coarse sand with biogenic material; Very fine sand mixed with biological detritus; Very fine silt; Coarse sand of variable grain size; Fine well-sorted sand; Thick silt/clay.

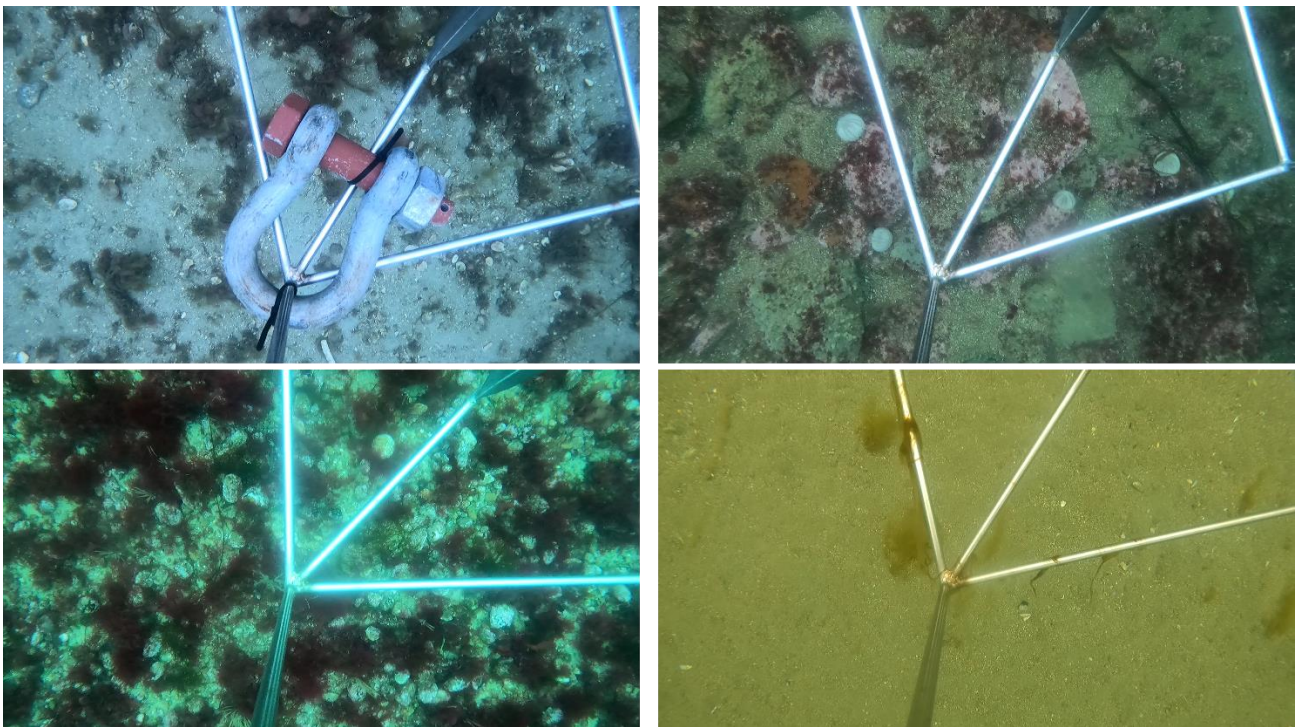


Figure 6. Still images from four camera drops to verify ground-type. Sample locations are, from top left 007; 023, 030 & 061. No sample was recovered from 7, 23 or 30 and the video confirms hard-ground was present. Sand was recovered from location 061 and verified with video.

Video

There were 23 video recordings taken with the GoPro. Of these, 17 were at locations where no sample was recovered following 3 grab attempts. The video at these sites verifies that hard ground was present. No detailed interpretation of the flora and fauna has yet been undertaken. Substrate type has been recorded as 'Hard ground' in all these cases but some differentiation of reef type is visible with cobbles, gravel and bedrock apparent at different locations. Figure 5 shows still images from four video recordings.

Discussion

Vessel selection was an important component of this survey. With a number of shallow intertidal sites, narrow channels and strong tidal currents to be navigated it was crucial to consult local knowledge. *Dulra na Mara* is a well-fitted vessel that operates as a local tour-boat, angling platform, seaweed harvester and research vessel as required. The captain and crew are local fishers and their knowledge of the bay allowed a safe and efficient survey. Use of a small tender vessel alongside the primary survey vessel to acquire samples from very shallow locations around Inishbiggle and near Achill Sound in the very south of the survey area were critical in sampling all 80 proposed sites. Although spring tides may have enabled the primary survey vessel to reach more sites, very strong currents associated with such tides would have hindered progress and made optimal grab deployment more difficult. The survey was conducted between spring and neap tides which ensured slower moving currents while the punt deployment accounted for shallow inter-tidal areas.

The eighty sites sampled during the survey were chosen based on predicted depth from LiDAR data and expected substrate type visible from high-resolution ortho-imagery. There was limited data from which to accurately select sampling locations but preliminary results suggest a positive relationship between LiDAR depth predictions and those measured on site. Substrate type evident in ortho-imagery is also correlated with initial survey findings. For example, inter-tidal sandbars visible in the imagery yielded generally good recovery of coarse, well-sorted material. In deeper channels, through which tidal flow is stronger and sediment scour is likely, there was mostly poor recovery or none at all with subsequent camera-drops verifying the presence of exposed hard-ground. Further Particle Size Analysis will reveal the exact make-up of sediment throughout the survey area from which high-resolution seabed classification charts and habitat maps can be prepared.

The survey was the first of four proposed under the European Maritime & Fisheries Fund Seabed Sediment and Ecosystem Data. It is anticipated that data collection will facilitate high resolution seabed classification charts in areas and bays of interest around the Irish coast. In Achill Bay, eighty sediment samples within a relatively small survey area will enable the production of high-confidence habitat maps in lieu of multibeam data and in support of the EMFFs Operational Programme for Marine Biodiversity.

Appendix I

Achill Bay Sediment Sampling - Invitation for quotes

INFOMAR, the national seabed mapping programme, managed by Geological Survey of Ireland & the Marine Institute wish to obtain reasonable quotes for the hire of a suitably qualified inshore fishing vessel and skipper to help conduct a sediment sampling survey in inner Achill Bay over 3 or four consecutive days in July or August (depending on availability).

Please provide a quote for a day rate for the vessel and skipper OR for a vessel, skipper and AB deckhand. The deckhand will be required to help process samples with the Marine Institute(MI) scientist or else the MI will provide two scientists.

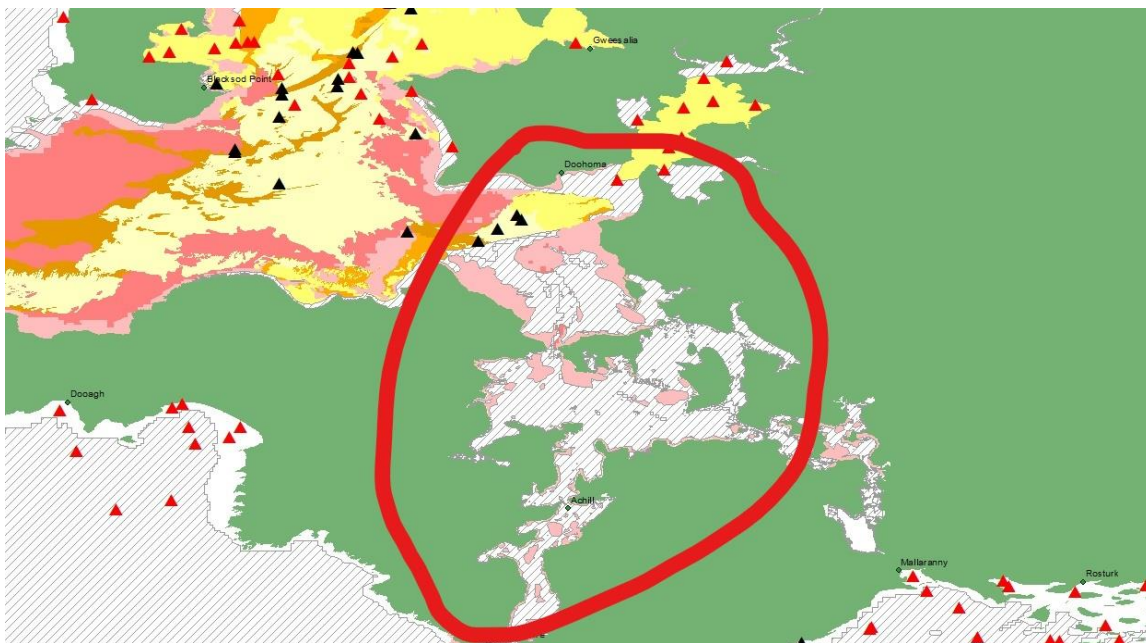
Summary of relevant requirements:

- 3-4 (12 hour) consecutive days or upon the collection of 120 samples.
- A registered, commercial or inshore fishing vessel.
- Motorised winch and cable capable of lifting 2-3 kg sediment sample onto deck and/or suitable work station. This requires a clearance of 1.5m between winch and side of boat. Please provide a picture of vessel in advance.
- Basic work station to process / label samples and deck space to store samples.
- Suitable GPS or plotter.
- Facilitate acquisition of video data via GoPro camera and lightweight frame for manual deployment.
- Final agreement subject to signed contract by both parties.

1.0 The INFOMAR Programme

INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) is a twenty year programme to map the physical, chemical and biological features of Ireland's seabed. INFOMAR is funded by the Department of the Environment, Climate and Communications (DECC), and delivered by joint management partners Geological Survey Ireland and the Marine Institute.

AS part of the EMFF Marine Biodiversity Scheme 2021, INFOMAR are conducting a series of sediment sampling surveys to ground-truth acoustic data and create high resolution seabed classification maps for selected areas of interest including inner Achill Bay, north of Achill Sound.



Survey Area

1.1 Summary of Requirements

The Marine Institute requires use of a suitable vessel and operator/s to conduct a groundtruthing sampling survey of inner Achill Bay. 80-120 grab samples (figure 2), 1 sample per location, will be obtained for processing aboard and retained for particle size analysis at a later date.

The survey will run for up to 12 hours per day for between 3-4 days, commencing July or August depending on availability. It is anticipated that operations will take place in a force 4 or less but where swell and wave heights are not significant operations may take place when winds are greater than force 4. Operations will take place on days deemed suitable by the Marine Institute employees. One or two scientists from the Marine Institute will be onboard to conduct sampling activities in accordance with the INFOMAR guidelines for ground-truthing.

A Grab Sampler and/or Shipek sampler will be provided by Marine Institute for sample acquisition. The applicant shall provide a vessel and one or two operators (Skipper and AB), with suitable deployment winch with enough clearance to bring sample aboard (1.5 metres) to a suitable work table. The vessel must have a suitable plotter and/or GPS for positioning.

Sample locations will be provided by the Marine Institute in degrees and decimal minutes. Sample locations will encompass depths from approximately 10m to the 40m.

1.2 Vessel

Vessel requirements

- Registered and insured commercial or inshore fishing vessel
- Winch and galvanised cable for operation of grab with enough clearance (1.5m to allow sample to be safely brought aboard with minimal loss of sediment).
- GPS for positioning.
- Deck space for organisation of samples.
- Work Space for processing samples (Labelling, recording & Photographing)
- Power supply for laptop

1.3 Equipment

To be supplied by the MI will include a suitable grab sampler capable of retrieving sediment from the seafloor. The grab will not require additional fittings or electrics other than attachment shackle and the relevant clearance to allow sample to be easily brought aboard vessel. Estimated clearance is 1.5 m and vessels suitability can be assessed via photo.

1.5 Personnel

At least three persons are required to properly conduct survey, skipper, primary scientist and one other AB deckhand which may be supplied by the Skipper or the MI as necessary. Please advise if you can supply an AB to work with the scientist on deck to process samples and help run survey.