



**Blue Carbon /Seagrass: Advanced Mooring System
Strangford Lough**

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1. EXECUTIVE SUMMARY

- 1.1** The 2023 winter survey of the AMS eco-moorings under test at Ballyhenry can be considered a success. Useful data was collected even though only the Seaflex© system was operational. The survey showed that the Seaflex© mooring eliminated anchor chain drag and the loss of seagrass. Although, seagrass coverage was less close to the mooring block this has more than likely been a result of back eddies and under-scaring from tidal velocities during ebbing and flooding tides.
- 1.2** The survey also revealed that the seagrass health at Ballyhenry can be considered in a good conservational state with high associated biodiversity for the winter months and good seagrass canopy height.
- 1.3** The failure of the Stirling© system, although disappointing for an AMS comparison, provided some valuable data on the impact which a traditional mooring block and chain will have on a seagrass habitat. The damage from chain drag at the Stirling© site was substantial with a maximum coverage of only 18% and coverage of <4% recorded within the majority of the survey plot.
- 1.4** The anchorage site currently in use within Ballyhenry Bay is approximately five hectares in size with a total of 22 moorings (excluding the trial AMS). A damage estimate can be calculated using the chain drag data from the Stirling© site and suggests that > 270m² of seagrass has been removed from the anchorage at Ballyhenry Bay through the use of traditional mooring systems. As this removal has been over a number of years it is likely that remedial restoration will be required, in conjunction with the use of an eco-mooring system, to return the damaged scar areas to a favourable state. The re-vegetation of damaged seagrass patches is a simple low-cost practical procedure to undertake and would be an advisable exercise for future work if eco-moorings are to be deployed in a large-scale.
- 1.5** Further monitoring of both AMS is required to assess longer-term viability, it is also important that a working Stirling© system is reviewed as it offers a more cost-effective alternative to the Seaflex©.
- 1.6** The mechanism resulting in the failure of the Stirling© system was identified. Failure was due to the deterioration of the rope ties attaching the net float buoys to both ground and rising chain. These ties have now been replaced with 8mm galvanised wire attached to the chains with shackles. (see Appendix 2)
- 1.7** The virtually absent scaring of seabed and the healthy surrounding seagrass offers an extremely positive outcome after only one-year into the eco-mooring trial. This demonstrates that a very effective mooring solution does exist to the seagrass damage from moorings in not only Ballyhenry Bay but throughout the seagrass expanses in Strangford Lough.
- 1.8** Stakeholder feedback was generally positive. However, it was caveated with a concern that the additional capital and maintenance costs associated with the Seaflex AMS would be difficult to sell to individual owners. On the other hand, as the Stirling system offered a relatively inexpensive derivative to the traditional mooring systems, and club mooring officers believed that this option could be easily and inexpensively implemented where seagrass beds were at risk.
- 1.9** Regarding the implementation of Stirling AMS, it was suggested that if a small grant was made available for the purchase and preparation of buoys, galvanised wire attachments and shackles the system could be implemented without objection.

2. INTRODUCTION

- 2.1 Advanced Mooring Systems (AMS) are used to reduce the impact of mooring on sensitive marine habitats including seagrass beds which are globally important for sequestering carbon, biodiversity, and ecosystem services.
- 2.2 Strangford Lough is a Special Area of Conservation (SAC)/Special Protected Area (SPA)/Marine Conservation Zone (MCZ)/Area of Special Scientific Interest (ASSI) and has significant seagrass beds, which are a protected habitat of the SAC.
- 2.3 AMS trials were established in March 2022 at Ballyhenry Bay on Strangford Lough to ascertain the suitability of two types of AMS – Stirling and Seaflex systems.
- 2.4 Other trials of AMS have shown that one size does not fit all as local circumstances play a large part in determining the effectiveness and efficiency of the systems. The Department of Agriculture Environment and Rural Affairs (DAERA) expect the trials at Ballyhenry Bay to show progress on a year-to-year basis aiming at a 3-5-year project timeline, with the results informing potential roll-out in other seagrass bed mooring areas within Strangford Lough and NI.
- 2.5 Cuan Marine Services have been tasked by Newry Mourne and Down District Council, to: -
- 2.5.1 Survey the two trial AMSs in Ballyhenry Bay and produce a report describing the condition of the two AMS installations and the seagrass beds.
 - 2.5.2 Identify all other factors currently impinging on the trial such as management, problems, costs, maintenance, stakeholder opinion, insurance, funding.
- 2.6 This is the first year that the UN has recognised World Seagrass Day (1st March) drawing attention to the recent efforts in conservation while highlighting the importance of declining seagrass meadows. Seagrasses are the only flowering plants that can live fully submerged in the marine environment with 60 known species of seagrass found across the globe from the arctic to the tropics (excluding Antarctica)

The seagrass habitat is globally important for providing ecosystem services which enhance biodiversity and sequester carbon. Seagrass can create complex 3D structures and is a recognised bioengineer, as it can alter the surrounding environment. Seagrass canopies can reduce water flow through the canopy structure, thereby stabilising substrates and maintaining water quality by trapping sediments within its matrix. Seagrasses also provide nursery grounds for juvenile fish, refuge and feeding grounds for many other marine species.

Seagrass meadows absorb and store carbon during photosynthesis, CO₂ is taken in and utilized for growth. In the winter months' additional carbon storage takes place as seagrass dies back, the subsequent die-back plant material gets trapped within the seagrass rhizomes/ root system ending up sequestered within the sediment. If this material is left undisturbed and continues to build up on the seafloor it can trap carbon for thousands of years. Although seagrass makes up just less than 0.2% of the ocean floor, seagrasses account for 10% of carbon buried annually. Seagrass meadows can capture 35 times more carbon than tropical rainforests making them a potential nature-based solution to address the ongoing climate and biodiversity crisis.

The UK has lost more than 90% of its seagrass meadows, with half of that being lost during the last 30 years. Globally seagrass loss equates to approximately two football pitches a day. Seagrasses experienced losses of at least 44% in the 1930s primarily through the spread of *Labyrinthula zosterae* a wasting disease (Green et al. 2021). It is a highly sensitive habitat to environmental disturbance such as pollution; from water side agricultural activities and sewage outfalls which reduces water clarity and quality for photosynthesis. Human threats include anchoring, trawling, dredging and coastal developments which can disturb the water column or physically



Figure 1. *Zostera marina* at Ballyhenry Bay dive survey

remove seagrass. Other physical pressures arise from extremes in temperature, spread of disease, sea level rise and competition with invasive species such as *Sargassum muticum*.

3. SEAGRASS IN STRANGFORD LOUGH

3.1 Strangford Lough, Northern Ireland, is home to three species of seagrass; *Zostera marina*, *Zostera noltii* and *Ruppia maritima*. Known as eelgrass, *Z. marina* is a long-bladed seagrass located on muddy to sandy shores at the low intertidal or subtidal zone (depth is light limited). *Z. marina* has two reproductive strategies including asexual reproduction through cloning and sexual reproduction through the dispersal of seeds.

3.2 The *Zostera marina* seagrass meadows in Strangford Lough have been recognized by the Joint Nature Conservation Committee as some of the most pristine habitats of their type in UK waters. The two expanses of seagrass habitat are located on the Castle Ward Bay and Ballyhenry Bay sides of the Lough (Figure 2.).

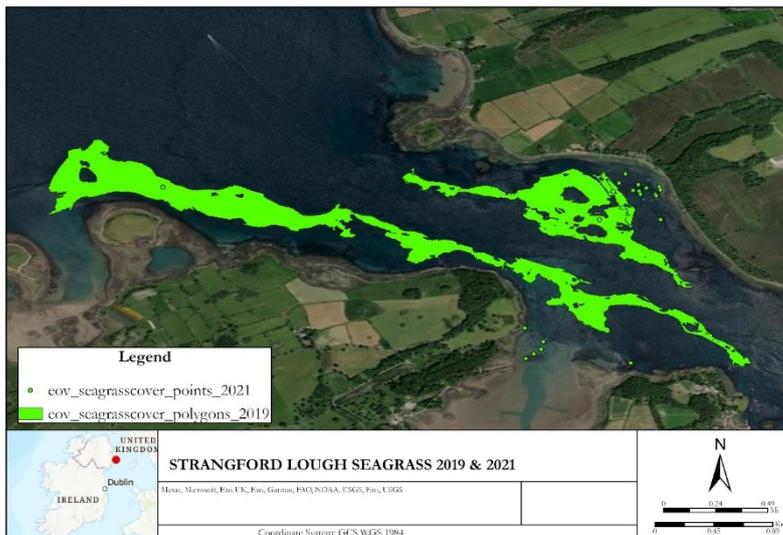


Figure 2. GIS layered seagrass habitat map displaying the total extent of seagrass meadow in the northern end of Strangford Lough ([EMODnet Seabed Habitats \(ices.dk\)](https://www.emodnet-seabedhabitats.org/)).

This layer shows the current known extent and distribution of Seagrass meadows in Strangford Lough, collated by EMODnet Seabed Habitats. The green polygon portions were last updated in 2019 with further individual points added in 2021.

The bays at both locations in figure 2, have been popular mooring sites for private boat owners in Strangford Lough for a number of years. As of March 2023 there is 22 moorings within a 4.5-hectare site at Ballyhenry Bay. The Department of Agriculture, Environment and Rural Affairs has voiced concerns over the possible detrimental impacts mooring chains may be having on the seagrass meadow at both bays.

3.3 In response Newry, Mourne and Down District Council have piloted a pioneering trial looking at alternative mooring systems which could remove the impact of mooring chain drag on the seabed and thereby protect the seagrass habitat.

3.4 A Habitats Regulations Assessment was submitted to Daera Marine Licencing Team on 21st February 2022 (Appendix 1) with permission to proceed with the trial granted on 28th February 2022.

3.5 Two types of Advanced Mooring Systems (AMS) were selected for the trial the Seaflex (Figure 3) and Stirling© (Figure 4). The Stirling© system works by having multiple buoys supporting the chain throughout the water column which should allow for changes in current speed and tidal levels without the chain reaching the seabed and ultimately scouring the seagrass. The second system trialled is the Seaflex which works like a rubber band, effectively part of the chain has a flexible system that allows for the changes in tide and current speeds.

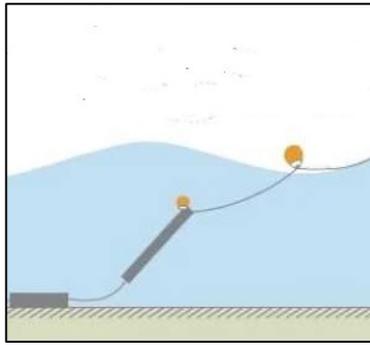


Figure 4 Seaflex System

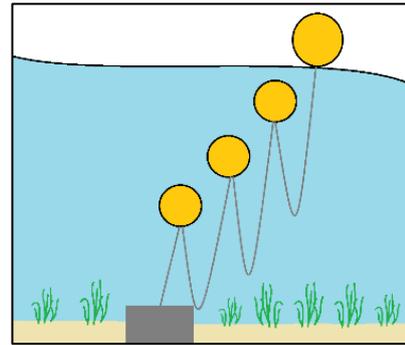
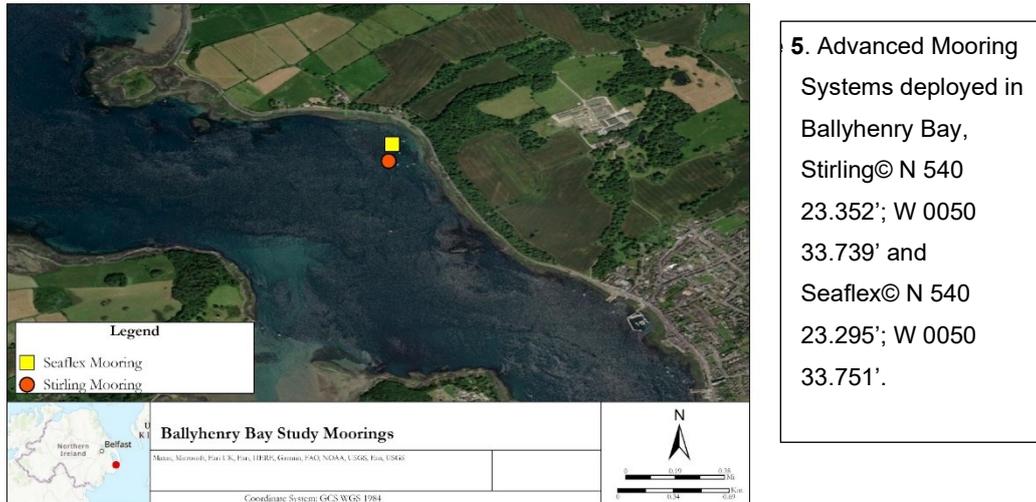


Figure Stirling System

3.6 The AMS trials began in March 2022 at Ballyhenry Bay with both systems located in close proximity to each other (Figure 5).

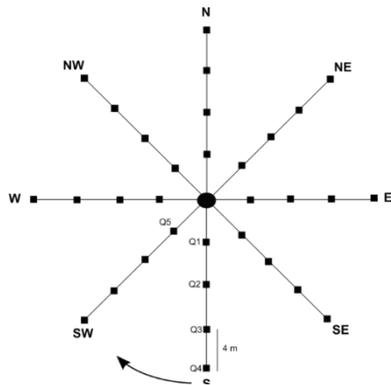


3.7 Similar trials of AMS have shown that one size does not fit all as local circumstances play a large part in determining the effectiveness and efficiency of the systems. Newry, Mourne and Down District Council and The Department of Agriculture Environment and Rural Affairs expect the trials at Ballyhenry Bay to show progress on a year-to-year basis aiming at a 3-5-year project timeline. It is envisaged that the results will inform potential roll-out in other seagrass bed mooring areas within Strangford Lough and NI. The aim of this study was to investigate the condition of the surrounding seagrass beds one-year post deployment of both type of the AMS's.

4. METHODS AMS COMPARISON

4.1 To investigate the seabed impact of each system a circular cardinal direction compass survey was employed at both Advanced Mooring Systems sites the Stirling© N 540 23.352'; W 0050 33.739' and Seaflex© N 540 23.295'; W 0050 33.751'. Scientific divers entered the water at the surface buoy of each mooring system. Divers descended the mooring rope and chain until contact was made with the mooring block. A transect line was attached to centre eye of the block; diver 1 swam a 16 m transect line for the following cardinal directions S, SW, W, NW, N, NE, E, (<https://1drv.ms/v/s!AifWZwDc3oacgsYoB5T3a62CKFN2UA?e=MQWyPI>) SE (Figure 6). Diver 2 carried out a video survey of transects SW, NW, NE and SE. A digital still survey was taken using four, 0.5 x 0.5m quadrats randomly placed within the S, N, E transect lines. Quadrats (n = 32) were analysed for % cover of seagrass and associated flora and fauna. Transient fauna within the survey area was noted using an in-situ visual census technique and from post survey video analysis undertaken by a skilled taxonomist.

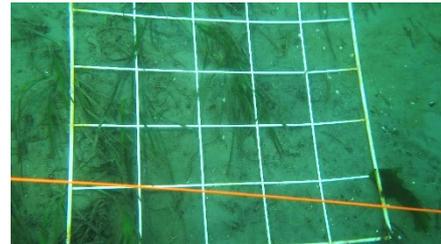
Substratum/sediment type and seagrass canopy height was assessed and measured in-situ at transect start, midway and finish point.



6. Compass rose showing where each quadrat was placed in relation to the direction.



7. Dr Millar attaching transect to central eye on mooring block.



8. Positioning quadrat prior to commencing survey of the Seaflex[®] AMS

5. SURVEY OUTCOMES / RESULTS

- 5.1 Divers descended Stirling[®] at N 54° 23.352'; W 005° 33.739' AMS to a maximum depth of 6.8m. It was apparent that the Stirling[®] AMS had failed at five float attachments along the chain length from the mooring block eye to 10m of chain leading to the surface buoy. As a consequence, the mooring chain had dragged the seabed causing a 10-15m circular scar around the block removing all seagrass within the circumference of the drag (Figures 9-11). No intact seagrass was discovered within the chain drag area, however, beyond the compass cardinal survey boundary sparse seagrass coverage was discovered in small clumps. As the diver travelled further from the mooring the seagrass root system became more intact with an increase in coverage.



Figure 9. Stirling[®] chain on seabed at mooring block due to float system failure.



Figure 10. Scarred seabed from Stirling[®] chain drag at 3m from mooring block.



5 Figure 11. Scarred seabed at 6m from Stirling[®] AMS mooring block.



Figure 12. Seagrass fragments at scarred seabed 12m from Stirling[®] AMS block.



Figure 13. Seagrass fragments at scarred seabed 18m from Stirling AMS block.

As no intact seagrass was recorded within the survey plot, all survey was provided by video analysis and non-quadrat stills.

- 5.2** Divers descended the Seaflex© N 540 23.295'; W 0050 33.751' AMS to a maximum depth of 4.2m. On inspection the system was in good working order. Seagrass was intact with dense coverage from the mooring block to the circumference boundary of the survey plot.

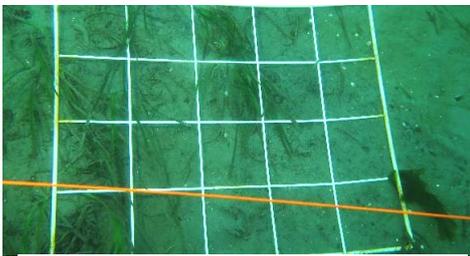


Figure 14. Seagrass coverage at Seaflex mooring block.

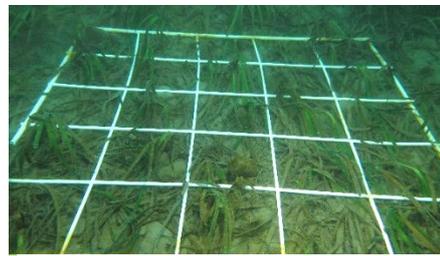


Figure 15. Seagrass coverage at Seaflex 3m from mooring block.



Figure 16. Seagrass coverage at Seaflex 6m from mooring block.

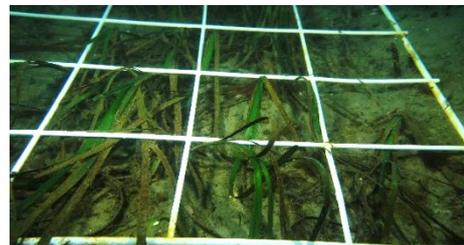


Figure 17. Seagrass coverage at Seaflex 12m from mooring block.



Figure 18. Seagrass coverage at Seaflex 18m from mooring block.

6. SUBSTRATE / SEDIMENT TYPE

- 6.1** Both AMS sites were situated on a clean, muddy sand substrate which aligned with the criteria from the Joint Nature Conservation Committee code for: - SS.SMp.SSgr.Zmar, which describes a *Zostera marina* bed on subtidal or infralittoral on clean or muddy sand substrate (Table 1).

| | |
|---------------|--|
| Salinity | Full (30-35 ppt), Variable (18-35 ppt) only in event of a freshwater run-off incident. |
| Wave exposure | Moderately exposed, Sheltered, |
| Tidal streams | Moderately strong (1-3 kn), Weak (>1 kn), Very weak on slack |
| Substratum | Clean sand to muddy fine sand or mud |
| Zone | Infralittoral to subtidal |
| Depth Band | 0-5 m, 5-10 m |

Table 1. Ballyhenry Bay physical habitat description for both AMS trial sites.

7. SEAGRASS HABITAT SPECIES COMPOSITION AND RECORDED MACROFAUNA

7.1 Both AMS sites were characterised by expanses of clean or muddy fine sand and sandy mud in shallow water (2-6 m depth) with dense stands of *Zostera marina*. Typically, seagrass habitats such as those at Ballyhenry which meet the SS.Smp.SSgr.Zmar UK Gov. biotope code have an associated flora and fauna community dominated by *Zostera* associated species. However, as the survey time was 03/2023 a number of summer sessile and motile species were not recorded. Though, this may not be the situation during the summer months when seasonal species richness increases.

A full list of associated characterising species has been constructed for seagrass bed biotopes throughout the seasons which meet the substrate/sediment type of those found at Ballyhenry (Table 2). Species which were recorded during the 03/2023 survey for each AMS site have been identified in the table below.

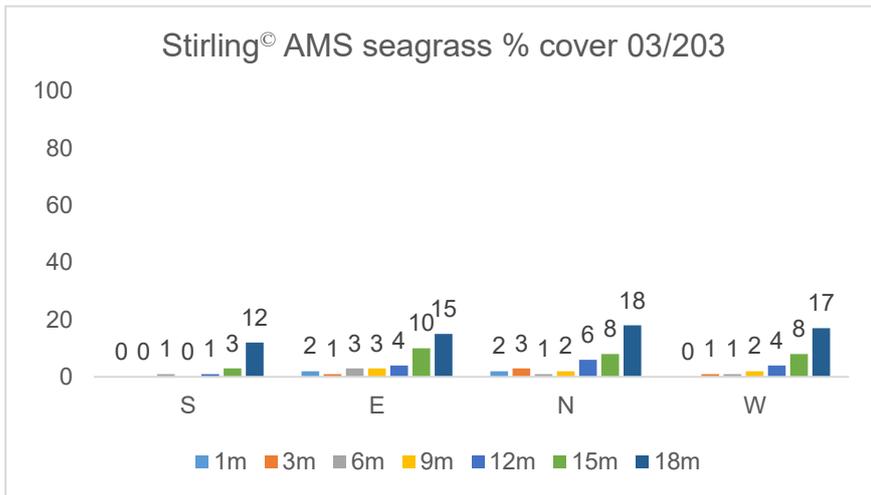
| Table 2. Species recorded during the 03/23 AMS Ballyhenry survey recorded in a characterising species list for a designated SS.SMp.SSgr.Zmar seagrass habitat (x present and 0 absent). | | | | | |
|--|--|-------------------|------------------------------------|---|--|
| Taxon | Importance of taxon for defining biotope (%) | Typical abundance | % records where taxon was recorded | Stirling [®] AMS 03/23 | Seaflex [®] AMS 03/23 |
| <i>Zostera marina</i> | 52 | Abundant | 81-100% | 0-10% | 70-90% |
| <i>Corophium volutator</i> | 9 | Abundant | 21-40% | 0 | 0 |
| <i>Nemertea</i> | 6 | Common | 41-60% | x | x |
| <i>Nematoda</i> | 5 | Commo | 21-40% | x | x |

| | | | | | |
|---------------------------------|--|-------------------|------------------------------------|---------------------------------|--------------------------------|
| <i>Scoloplos armiger</i> | 5 | Abundant | 41-60% | 0 | x |
| <i>Chorda filum</i> | 4 | Frequent | 21-40% | x | x |
| <i>Tubificoides benedii</i> | 4 | Frequent | 21-40% | 0 | 0 |
| <i>Ampelisca brevicornis</i> | 3 | Frequent | 21-40% | <i>Ampelisca sp. x</i> | <i>Ampelisc a sp. x</i> |
| <i>Anemonia viridis</i> | 3 | Occasional | 21-40% | 0 | 0 |
| <i>Arenicola marina</i> | 3 | Occasional | 21-40% | 0 | 0 |
| <i>Carcinus maenas</i> | 3 | Occasional | 41-60% | 0 | x |
| <i>Fabulina fabula</i> | 3 | Occasional | 21-40% | x | x |
| <i>Kurtiella bidentata</i> | 3 | Common | 21-40% | 0 | 0 |
| <i>Platynereis dumerilii</i> | 3 | Frequent | 21-40% | 0 | x |
| <i>Abra alba</i> | 2 | Common | 21-40% | Valves only | x |
| Taxon | Importance of taxon for defining biotope (%) | Typical abundance | % records where taxon was recorded | Stirling [®] AMS 03/23 | Seaflex [®] AMS 03/23 |
| <i>Asterias rubens</i> | 2 | Occasional | 21-40% | 0 | x |
| <i>Nototropis swammerdam ei</i> | 2 | | 21-40% | 0 | 0 |
| <i>Capitella capitata</i> | 2 | Common | 21-40% | 0 | 0 |
| <i>Dexamine spinosa</i> | 2 | Frequent | 21-40% | 0 | <i>Dexamine sp.</i> |
| <i>Tritia reticulata</i> | 2 | Occasional | 21-40% | x | x |
| <i>Saccharina latissima</i> | 2 | Occasional | 21-40% | x | x |

| | | | | | |
|-------------------------------|--|-------------------|------------------------------------|------------------------|-----------------------|
| <i>Pagurus bernhardus</i> | 2 | Occasional | 21-40% | 0 | x |
| <i>Thyasira flexuosa</i> | 2 | | 1-20% | x | 0 |
| <i>Urothoe elegans</i> | 2 | | 21-40% | 0 | 0 |
| <i>Ulva</i> | 2 | Occasional | 21-40% | x | x |
| <i>Palmaria palmata</i> | | | | x | x |
| <i>Idotea balthica</i> | 1 | | 21-40% | 0 | 0 |
| <i>Oligochaeta</i> | 1 | Frequent | 21-40% | 0 | 0 |
| <i>Amphipholis squamata</i> | 1 | Abundant | 21-40% | 0 | x |
| <i>Apseudopsis latreillii</i> | 1 | Frequent | 21-40% | 0 | 0 |
| <i>Cancer pagurus</i> | 1 | Frequent | 21-40% | 0 | x |
| <i>Liocarcinus depurator</i> | 1 | Common | 1-20% | 0 | x |
| <i>Necora puber</i> | 1 | Occasional | 21-40% | 0 | X |
| Taxon | Importance of taxon for defining biotope (%) | Typical abundance | % records where taxon was recorded | Stirling® AMS 03/23 | Seaflex® AMS 03/23 |
| <i>Leseurigobius friesii</i> | 1 | Common | 21-40% | x | x |
| <i>Sagartia elegans</i> | 1 | | 21-40% | 0 | x |

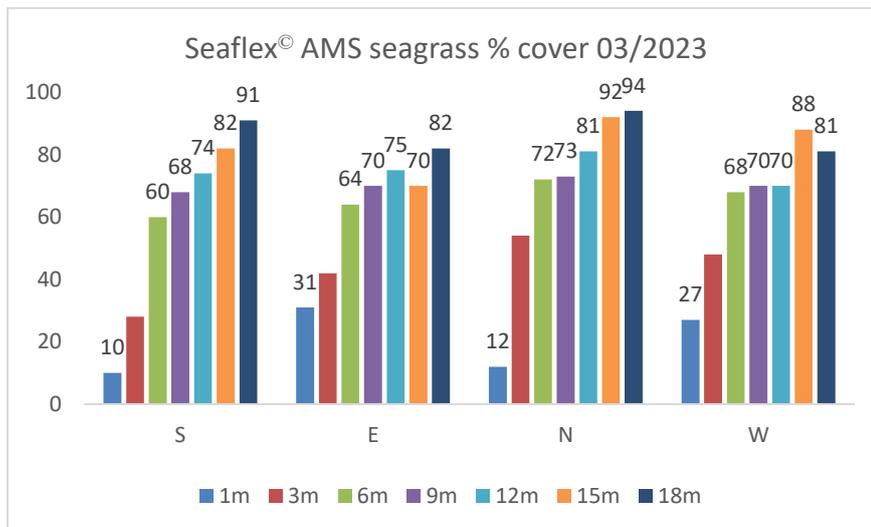
8. SEAGRASS PERCENTAGE COVER AT BALLYHENRY AMS SITES 03/2023

- 8.1** The percentage cover of seagrass at the AMS sites varied significantly. Results were derived from the analysis of the random gridded quadrat survey; percentages were calculated by counting the number of filled seagrass sections within the quadrat (Figures 14-18).
- 8.2** The percentage cover cannot be considered a true representation of the optimum seagrass coverage achievable from both systems as the Stirling© mooring was damaged and not in an operational state. Once the Stirling© system has been repaired and the survey replicated in 2024 a more accurate comparison will be possible.



19. Percentage seagrass cover at N 540 23.352'; W 0050 33.739' Stirling© AMS approximate transect points, travelling from mooring block (1m) in direction of compass cardinal point for 20m.

8.3 The Seaflex© mooring can be considered an excellent system if the maintenance of intact seagrass meadow is a priority. The survey showed that there was some seagrass loss at Seaflex©, but this was not due to chain drag as the AMS was in full working order. The seagrass loss was probably a result of back eddies and under-scar caused by changing tidal velocity over the tidal cycle.



20. Percentage seagrass cover at N 540 23.295'; W 0050 33.751' Seaflex© AMS approximate transect points, travelling from mooring block (1m) in direction of compass cardinal point for 20m.

9. SEAGRASS CANOPY HEIGHT

9.1 Seagrass canopies were measured *in-situ* at both AMS sites. It is important to note that canopy height was affected by the survey taking place in the winter months. All seagrasses experience some significant die-back during winter months due to storm action and reduced light exposure which limits the opportunities for growth. Indeed, many seagrass meadows in the northern hemisphere undergo a reduction in percentage cover as turbulence from winter storms can uproot patches of seagrass. This is especially true for shallow subtidal species like *Z. marina* which grow in depths of <7m, such as that found at Ballyhenry Bay.



21. Disrupted patch of *Z. marina* at the Seaflex© site approximately 5m from the mooring block at 4.2m deep.

- 9.2 Evidence of storm damage was recorded on the video footage and still images taken during the survey, when bare gaps and damaged seagrass blades were clearly evident (Figure 21).
- 9.3 Unfortunately, the Stirling© AMS site only had individual plants on the periphery of the survey plot as the chain drag was so extensive and therefore could not be considered a functional canopy. It's important to note that disturbance to seagrass can extend beyond the point of the initial damage as the root systems can be connected and intertwined for meters. Explaining why the seabed scar at the Stirling© site continued beyond the actual impact circumference of the mooring chain.
- 9.4 In contrast the survey showed seagrass at the Seaflex© AMS to be in a good conservational state, even with low winter light conditions and storm events, patches of >90% coverage were recorded. This was reflected in the overall canopy height; at depths below 5m seagrass blades/canopy averaged 210 mm in height. At depths of less than 5m seagrass blades/canopy averaged 290 mm. These canopy heights are representative of a healthy winter seagrass meadow.

10. EPIPHYTE / ALGAL % COVER

- 10.1 This metric was affected by the winter survey season. As a result, no significant coverage of algal species was recorded. The red seaweed *Palmaria palmata* and the green seaweed *Ulva lactuca* were among some patches of seagrass close to the Seaflex© mooring block. Loose strands of the brown seaweed *Laminaria saccharina* were also recorded within seagrass patches close to the periphery of Seaflex© plot.
- 10.2 Turbulence induced sedimentation on the seagrass blades hindered the identification of epiphyte algal species and if this metric is to be fully monitored, a return survey during summer months would be necessary.

11. STAKEHOLDER ENGAGEMENT

- 11.1 Between March and April 2023 Cuan Marine were engaged in delivering mooring maintenance services to the sailing clubs situated on the Lough. Having direct contact with respective club mooring officers presented an opportunity to discuss and explain the “raison d'être” of the project and receive direct feedback.
- 11.2 As stakeholders with vested interests in the environmental management and conservation of the Lough, generally positive feedback was received in respect to the overall environmental objectives of the project.
- 11.3 Feedback was caveated with a concern that the additional capital and maintenance costs associated with the Seaflex AMS would be difficult to sell to individual owners. However, on the other hand, as the Stirling system offered a relatively inexpensive derivative to the traditional mooring systems, club mooring officers believed that this option could be easily and inexpensively implemented where seagrass beds were at risk.
- 11.4 Regarding the implementation of Stirling AMS, it was suggested that if a small grant was made available for the purchase and preparation of buoys, galvanised wire attachments and shackles the system could be implemented without objection.

11.5 Cuan Marine Services were approached to lay down a mooring at Ballyhenry Bay by a vessel owner. After explaining that Ballyhenry Bay was an area identified as having seagrass beds and detailing the ongoing AMS trial project, the owner was more than happy to install a Stirling AMS.

Habitats Regulations Assessment

In accordance with Regulation 43(1) of the Conservation (Natural Habitats, etc) (Northern Ireland) 1995 (as amended), DAERA Marine and Fisheries Division has considered whether the project, plan or proposal either alone or in combination (neither being directly connected with or necessary to the management of the site) is likely to have a significant effect on the Natura 2000 site.

As part of that consideration, DAERA Marine and Fisheries Division has:-

(a) taken into account the mitigation measures contained in the project, plan or proposal, along with all legally enforceable obligations designed to avoid environmental effects; and

applied the precautionary approach set out in European Commission Guidance: "Managing Natura 2000 Sites"¹ and by the European Court of Justice in C-127/02, Waddenzee, paragraphs 56 and 59.2

"The authorisation of a plan or project may only be granted if the Competent National Authority is certain that it will not have any adverse effect on the integrity of the site concerned. That is where no reasonable scientific doubt remains as to the absence of such effect."

consulted the Department and have regard to any representations made by it within such reasonable time as the competent authority may specify for the purposes of the assessment or determining whether an assessment is required for a plan or project. This is required by Regulation 43(3), The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007. 3

Some notes and hyperlinks to assist completion of this template have been inserted to help the Competent Authority/Public body complete their HRA. These can be removed.

Web link references for the above:

European Commission Guidance: "Managing Natura 2000 Sites"

http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf

European Court of Justice in C-127/02, Waddenzee, paragraphs 56 and 59

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62002J0127:EN:PDF>

The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007

Stage 1: Test of Likely Significance

| | |
|---|--|
| Name of Project or Plan. | Installation of advanced mooring solutions as a management option to enhance the growth of seagrass in the Strangford Lough Marine Protected Areas |
| Reference (if available) | https://www.seaflex.com/products/seaflex-mooring-system/ |
| Name and location of Natura 2000 site (s) | Strangford Lough SAC Strangford Lough SPA Strangford Lough Ramsar |

| | |
|-----------------------------------|--|
| <p>Natura 2000 site features:</p> | <p>Strangford Lough SPA:</p> <p><i>Branta bernicla hrota</i> (Light Bellied Brent Geese)</p> <p><i>Calidris canutus</i> (Knot)</p> <p><i>Sterna hirundo</i> (Common Tern)</p> <p><i>Sterna paradisaea</i> (Arctic Tern)</p> <p><i>Sterna sandvicensis</i> (Sandwich Tern)</p> <p><i>Tringa tetanus</i> (Redshank)</p> <p><i>Limosa lapponica</i> (Bar-tailed Godwit)</p> <p><i>Tadorna tadorna</i> (Shelduck)</p> <p><i>Pluvialis apricaria</i> (Golden Plover)</p> <p>Strangford Lough SAC:</p> <p>Mudflats and sandflats not covered by seawater at low tide</p> <p>Coastal lagoons</p> <p>Large shallow inlets and bays</p> <p>Reefs</p> <p>Annual vegetation of drift lines</p> <p>Perennial vegetation of stony banks</p> <p><i>Salicornia</i> and other annuals colonising mud and sand</p> <p>Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)</p> <p><i>Phoca vitulina</i></p> <p>Strangford Lough Ramsar:</p> <p>The site qualifies under Criterion 3a by regularly supporting over 20,000 waterfowl in winter. The five year winter peak mean for the period 1992-93 to 1996-97 was approximately 70,200 waterfowl, comprising 48,700 waders and 21,500 wildfowl.</p> |
|-----------------------------------|--|

Description of the Project or Plan

- Location and Task Description

Strangford Lough is protected as an SAC/SPA/MCZ/ASSI where Seagrass beds are a protected habitat. Traditional moorings can scour the seabed with the dragging of the mooring chain and where such moorings are in sensitive habitats such as seagrass beds dragging of the mooring can lead to damage and destruction of this protected habitat. Advanced moorings are a potential solution to the problem. They aim to reduce/eliminate the impact to the seabed by stopping the scouring caused by mooring chains.

Seagrass beds are a blue carbon habitat, selected as such for their ability to fix and store carbon, in a similar way to how forests store carbon on land. They are a Northern Ireland Priority Marine Feature and on the Northern Ireland Priority Species list. They provide additional ecosystem services by acting as fish nursery areas, improving water quality and can protect the coast against storm damage.

Cuan Marine Services have been tasked with: -

Assessing the suitability of available advanced mooring systems (AMS) suitable for use in the Strangford Lough MPA and to propose and trial two different systems including an assessment of the liabilities, costs, and risks associated with each.

Recommending suitable AMS considering local conditions i.e., depths/tides/sediment type/vessel size/any other limitations and completing system specific installation designs.

Detailing all possible risks including design revisions and associated costs.

Produce a robust maintenance and safety plan for all eco-moorings.

Providing post installation costs for owners to include any additional insurance costs.

Engaging with mooring owners to establish buy-in for eco-mooring installation.

Completing all necessary statutory approvals and legal documentation (including with mooring owners) for installation and hand-over, to include but not limited to the Habitats Regulation Assessment (HRA).

Providing comparison between AMS trialed and the locally prevalent ground chain and riser system.

Provide all installation services to the two approved AMS.

Photograph the seabed before and after mooring installation and report findings.

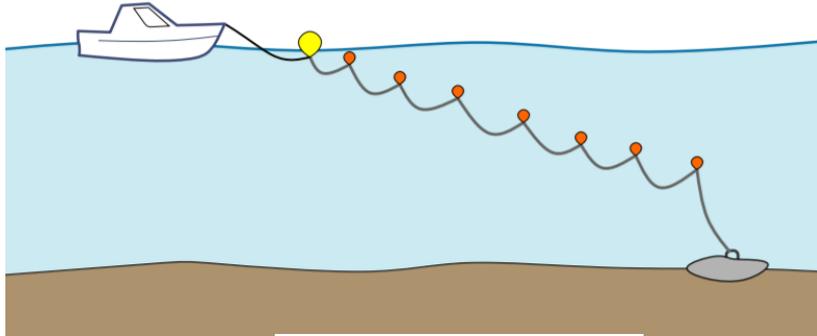
Ballyhenry Bay has been selected as an area within Strangford Lough with a good example of seagrass beds and where a significant numbers of vessel moor. Following a Spyball underwater survey, completed in association with DAERA on 13th January 2022 two moorings have been identified in Ballyhenry Bay as mooring sites suitable for the trial.

Methodology and Sequencing

Following an assessment of the physical environment two advanced mooring systems were considered suitable for trial.

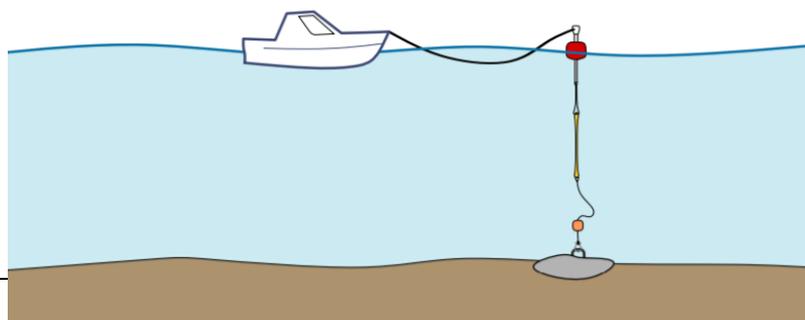
The Stirling (SAMS) system provides the least change from the traditional anchor and chain mooring in terms of construct. The rode itself is plain chain however rather than acting as a typical catenary with a section of ground chain, a series of small buoys or floats are attached along the length, keeping the chain suspended in the water column. In this instance, the buoyant properties replace the effect of the

mass of chain in the plain catenary, but still providing similar a spring effect but without interaction with the seabed. As with other AMS systems, the surface line (for vessel connection) can be equivalent to that used in a typical block and chain mooring, with the length driven by the boat owner or marina. Also, either traditional gravity anchors or helical screw anchors can be used.



Stirling (SAMS) AMS

Seaflex is a Swedish supplier of the similarly named product Seaflex AMS. The main part is a reinforced homogeneous rubber hawser. The system also includes a specific buoy type. The buoy incorporates a stiff arm at the top for connecting the surface line and at the bottom where a short sling joins to the top of the elastic rode. A length of synthetic line connects the rode to the anchor. The arrangement differs to that of the Hazelett in that the elastic rode is closer to the surface, whereas in the Hazelett system the rode is connected directly to the anchor. The Seaflex rode has novel elastomeric qualities, captured in modelling but not presented due to commercial sensitivity. The surface line (for vessel connection) can be equivalent to that used in a typical block and chain mooring, with the length specified by the boat owner or marina. It is possible to use either traditional gravity anchors or screw type anchors with the Seaflex arrangement.



Seaflex AMS

A Spyball underwater survey conducted in association with DAERA on 13th January 2022 at the Ballyhenry Bay site identified two existing mooring sites were suitable for trial. Where there was visual evidence of seagrass growth in the vicinity of these moorings, there was a distinct area within the immediate radius of each mooring block where there was no seagrass growth. This supported the hypothesis that mooring chain drag was scouring the seabed thus preventing growth.

Mooring Installations

Stirling (SAMS) AMS: - We will use the Multicat workboat Cuan Strand, an MCA registered vessel, to lift the existing mooring onto the deck and disconnect the mooring block. We will position the multi-Cat vessel and crane to ensure that the mooring is lifted vertically off the seabed thereby preventing drag and potential damage to seagrass harvests in the vicinity of the mooring block. A shot line will be deployed to mark the blocks exact position (with GPS co-ordinates recorded) to enable installation of the AMS at the same location.

The Stirling Advanced Mooring System (pre-assembled land side) will be connected to the mooring block and gently lowered in stages until it is approximately 1m from the seabed. Using an underwater camera, we will ensure that the mooring block is being located to its original position before finally lowering on to the seabed.

Upon deployment we will mobilise a diver at various times throughout the tidal cycle to photograph and ensure that the chain does not contact the seabed.

Seaflex AMS: -The existing mooring will be lifted on to the Multicat Cuan Strand which will be positioned such that the mooring is lifted vertically off the seabed thereby preventing drag and potential damage to seagrass harvests in the vicinity of the mooring block. A shot line will be deployed to mark the blocks exact position (with GPS co-ordinates recorded) to enable installation of the AMS at the same location.

The complete Seaflex mooring system (pre-assembled land side) will be attached to a new concrete mooring block complete with a centre fixing ring and lowered in stages until approximately 1m above the seabed. Using an underwater camera, we will ensure that the mooring block is being located to its original position before finally lowering on to the seabed.

Upon deployment we will mobilise a diver at various times throughout the tidal cycle to photograph and ensure that the synthetic line connecting the rode to the anchor block does not contact the seabed.

The removed pre-existing mooring system will be taken ashore, cleaned and stored should the requirement to redeploy arise.

AMS Maintenance

The two trial mooring systems will be inspected monthly from our Multicat workboat Cuan Strand using a remote underwater camera. We will be inspecting for: -

Degradation of mooring materials

Drift or drag of the mooring blocks by checking the GPS location of each anchor block

Camera inspection will be supplemented by a dive inspections every 3 months to complete a physical inspection of each system and to photograph and record the growth of seagrass in the vicinity of each mooring block, thereby enabling comparison with baseline records.

Reporting

Upon completion of the trial period a full report will be prepared and forwarded to the Newry Mourne and Down District Council Project Manager Mr Darren Rice

- Duration of construction, operation, de-commissioning etc;

Table 1 provides the key milestones which have been agreed with contractors for the project.

Table1: Key Milestones

| Date: | Milestone Description |
|--------------------|--|
| Early March 2022 | Installation of Seaflex and Stirling mooring systems in Ballyhenry Bay |
| Monthly thereafter | Inspection of mooring systems for material degradation and block drag |
| Quarterly | Dive inspection to physically inspect mooring integrity and to record (through photographs and video) the growth of seagrass in the vicinity of each mooring block, thereby enabling comparison with baseline records. |
| Spring 2024 | Report Findings and decommission Advanced Mooring Systems |

- Other.

Throughout the Projects timescale, Cuan Marine Services will Liaise and share collected data with the Marine Protected Areas Officer, DAERA.

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| Is the proposal directly connected with or necessary to management of the site for conservation of N2K features? | Yes |
|--|-----|

Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.

| | | |
|---|--|--------------|
| Mooring retrieval, refurbishment and deployment | Retrieval of existing mooring blocks and chains at site. Deploy new or refurbished mooring blocks and chains using multicat vessel | 1 day |
| Inspection | Monthly visual inspection of Advanced Mooring systems using Spyball or similar underwater video. | 16 half days |
| Physical dive inspection | Quarterly dive inspection to record growth of seagrass in the vicinity of the Advanced Mooring System | 16 half days |
| | | 2 days |
| Mooring retrieval. | Retrieval of mooring blocks and chains at site using multicat vessel | 1 day |
| | | |

| N2K Feature: Mention all features | Describe any likely direct or indirect effects to the N2K features arising as a result of: loss; reduction of habitat area; disturbance; habitat or species fragmentation; reduction in species density; changes in key indicators of conservation value (e.g. water quality, climate change). | Effect significant/not significant? Why? |
|---|--|--|
| Strangford Lough SPA: | | |
| Branta bernicla hrota (Light Bellied Brent Geese) | No impact foreseen with this species. | N/A |
| Calidris canutus (Knot) | As above | As above |
| Sterna hirundo (Common Tern) | As above | As above |
| Sterna paradisaea (Arctic Tern) | As above | As above |
| Sterna sandvicensis (Sandwich Tern) | As above | As above |
| Tringa tetanus (Redshank) | As above | As above |
| Strangford Lough SAC: | | |

| | | |
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| Mudflats and sandflats not covered by seawater at low tide | Unlikely event of fuel or hydraulic fluid leaking from Hiab crane and generator. | Not Significant. Quantities on board are low and for the specific use of Hiab crane which will be serviced in advance of the activities. Absorbent spillage pads will be stored on-board and available to mop up any small amount of fuel or hydraulic fluid. |
| Coastal lagoons | As above | As above |
| Large shallow inlets and bays | No impact is foreseen | |
| Reefs | No impact is foreseen | |
| Annual vegetation of drift lines | Negligible blockage and entanglement on mooring lines and turbines. | Not significant. The accessible lines and turbines will be cleared daily. |
| Perennial vegetation of stony banks | The mooring blocks and chains will be as per traditional pleasure craft moorings in the Crown estates licensed area. | The mooring blocks and chain will be deployed on the seabed and therefore overall the level of impact to benthic communities is considered limited. |
| | The noise and vibration during installation and retrieval. | Not significant. Multicat will deploy moorings and position the platform during deployment and retrieval. This is low level noise similar to other craft used in the area of the Strangford Narrows. |
| | The noise and vibration during inspection | Not significant. This low level noise is considered to be minimal in respect to the background noise levels in the narrows. |
| | No impact if foreseen | |
| Salicornia and other annuals colonising mud and sand | No impact if foreseen | |
| Atlantic salt meadows (Glauco-Puccinellietalia maritimae) | No impact if foreseen | |
| Phoca vitulina (harbour seal) | Risk of collision Harbour seals: | Not significant. The increase in the number of vessels will be marginal, one powerboat, a moored workboat |

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| | | <p>or multicat. Given that an estimated one additional vessels will be present at any one time (a moored multicat). Other than the single movements to and from the mooring, the principal vessel movements will be between the Portaferry quay side and the mooring for personnel transit.</p> <p>The ferry service runs for approximately 16 hours each day, 364 days per year, making a journey between the harbours every fifteen minutes. Therefore, the AMS Project does not represent a significant increase in the number of vessel movements in the Narrows in comparison.</p> <p>The routes taken will be regular and predictable and transits will occur at maximum speeds of 10 kts with a reduction to 4 kts if any marine mammals are sighted during transits. Because of the small number of additional vessels and the low number of vessel movements over the project timeframe</p> <p>The impact of any collision risk to seals or cetaceans in the Narrows as a result of the trials activities is considered to be negligible.</p> |
| Phoca vitulina (harbour seal) | Risk of disturbance to Harbour seals. There are seal haul out sites within proximity to this project, however, disturbance should be minimum and not considered significant. | Vessel traffic already operates in this area daily; near continuous ferry crossings between Strangford and Portaferry, a small number of creel fishing boats, charter RIBs, other |

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| | | <p>work boats, the RNLI lifeboat and occasional leisure craft. In particular, the ferry service runs for approximately 16 hours each day, 364 days per year, making a journey between the harbours every fifteen minutes.</p> <p>Therefore, RIB and small works vessel activity will not represent a significant increase in the amount of vessel noise experienced by marine mammals in the Narrows. Given the low number of vessel movements compared to baseline levels in the Narrows, the infrequent nature and short duration of activity, the impact is deemed negligible.</p> |
| | | |
| Strangford Lough Ramsar: | No impact if foreseen | Not Significant. |
| The site qualifies under Criterion 3a by regularly supporting over 20,000 waterfowl in winter. The five year winter peak mean for the period 1992-93 to 1996-97 was approximately 70,200 waterfowl, comprising 48,700 waders and 21,500 wildfowl. | No impact if foreseen | Not Significant. |
| Describe any potential effects on the Natura 2000 site as a whole in terms of: interference with the key relationships that define the structure or function of the site | | |
| | | |

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| Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site. | |
| Commercial Fisheries: | <p>Commercial fishing in Strangford Lough has declined rapidly in recent years. Concerns that the use of mobile fishing gear was causing severe damage to the seabed and, in particular, to the Modiolus reefs, has led to a temporary total ban of dredging and trawling within the lough (Royal Haskoning, 2005).</p> <p>The only fishing permitted within the Lough is potting. Potting only occurs in water less than 10 m deep in the Narrows. The small footprint of the tidal testing (including exclusion zone) will have negligible impact to potting activities. Pot fishing within the lough is for edible crab <i>Cancer Pagurus</i>, shore crab <i>Carcinus maenas</i>, velvet swimming crab <i>Necora puber</i>, lobomarus <i>gammarus</i>, whelk <i>Buccinum undatum</i>, and Dublin Bay prawn <i>Nephrops</i> spp.</p> <p>The <i>Nephrops</i> fishery is one of the largest in Northern Ireland in both volume and value; the majority of those crustaceans caught are by trawlers outside of the lough and in deeper water 30m to 50m+ but a few tonnes each year are caught by creel fishing within Strangford Lough. Therefore again this type of fishing within the Lough would be unaffected.</p> <p>The total value of County Down inshore fishery including Strangford Lough is around £5m per annum and is a small boat operations (1-2 man) using small nets and pots within inshore waters (within 12 miles offshore).</p> <p>Recreational angling also occurs within Strangford Lough with many chartered boats available to be hired for the purpose of fishing within the Lough.</p> <p>Therefore, the impact of the secluded research activities on commercial fisheries within Strangford Lough are negligible.</p> |
| Obstruction to Movement | The mooring location in Ballyhenry Bay is outside the main channel and away from ferry terminal and marinas in the narrows. |
| Shipping and Mobile Marine Fauna: | There is a negligible increase in vessel activity during the research. It's potential to impact upon mobile marine fauna that use Strangford Lough, such as fish species and marine mammals is small and unlikely. Basking sharks and marine mammals are mobile and able to move away from areas where the visual presence of the vessels may cause disturbance. |

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| | <p>However due to the short time frame of the research the magnitude of the impact will be negligible. Any impact caused due to noise, of which there is limited self-noise from turbines turning, is limited. The platform will be clearly visible and marked with lighting, similar to moored yachts in the vicinity. This will have limited impact on the marine mammals and fish that can easily detect the structure and move around it.</p> <p>Commercial shipping traffic through the Narrows is extremely low and as the research will be conducted within an area presently used as a mooring site for pleasure vessels the impact on shipping is negligible</p> |
| Is the potential scale or magnitude of any effect likely to be significant? : | |
| Alone? | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> |
| In-combination with other projects of plans? | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> |

| | |
|---|--|
| <p>List of Agencies / Organisations Consulted: Provide contact name and telephone or email address.</p> | |
| Habitats Regulations Assessment Summary | <p>In summary the temporary nature of the research, combined with the day light hours of inspection with divers and video instrumentation the impact on the N2K site is negligible.</p> <p>Similar research has been conducted by QUB for a number of years with no instances or complaints.</p> |

| | |
|---|---|
| Conclusion: Is the proposal likely to have a significant effect on an N2K site? | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> |
| | |

Data collected to carry out the assessment

| | |
|--|--|
| Who carried out the assessment? | |
| Sources of data | |
| Level of assessment completed | |
| Where can the full results of the assessment be accessed and viewed? | |

| | |
|----------------------|--|
| Summary of response. | |
|----------------------|--|

DO NOT PROCEED FURTHER IF YOU HAVE ESTABLISHED THAT THIS PROPOSAL IS UNLIKELY TO IMPACT A N2K SITE AND NO MITIGATION IS REQUIRED

