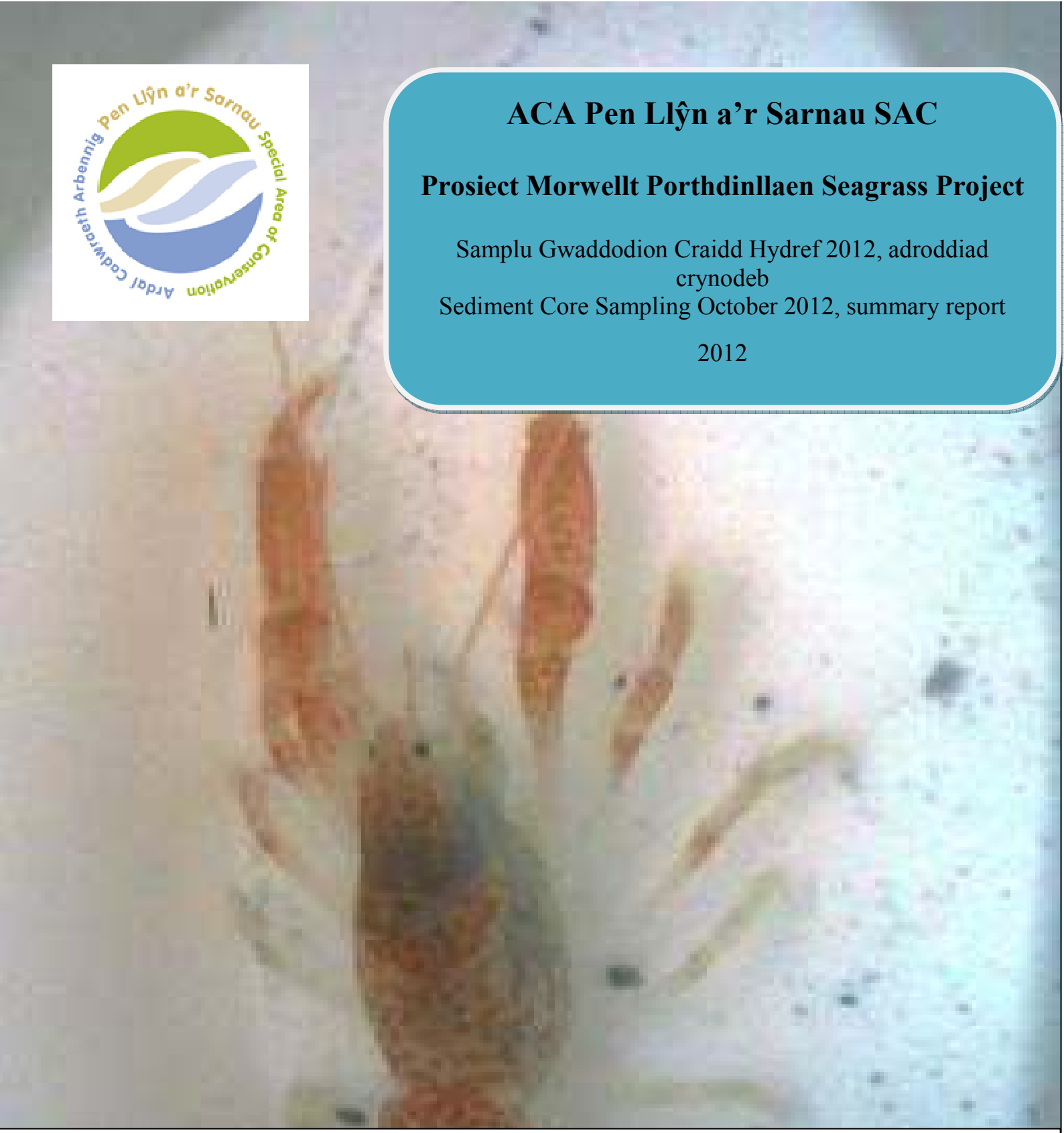
ACA Pen Llŷn a'r Sarnau SAC

Prosiect Morwellt Porthdinllaen Seagrass Project

Samplu Gwaddodion Craidd Hydref 2012, adroddiad crynodeb
Sediment Core Sampling October 2012, summary report

2012



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Adroddiad wedi darparu ar gyfer ACA Pen Llŷn a'r Sarnau / A report prepared for the Pen Llŷn a'r Sarnau SAC

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Contract number:	AS 410187 / NWS2486
Contractor:	Marine EcoSol
	(Marine Ecological Solutions Ltd., 41 High Street, Menai Bridge, Anglesey, LL59 5EF)
Contract Manager:	Alison Palmer Hargrave
Title:	**Porthdinllaen seagrass project (Pen Llŷn a'r Sarnau SAC) - Sediment Core Sampling October 2012, summary report**
Author(s):	**T. Stamp**
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Cover photograph:	Burrowing shrimp (probably *Upogebia* sp.) collected in the cores at some locations.

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Report .v1 prepared by:	Draft checked by:	Draft checked by:	Final project plan circulated (.FINAL) by:
Thomas Stamp 18th October 2012	Liz Morris 19th October 2012	Lucy Kay & Alison Palmer Hargrave 17th December 2012	Alison Palmer Hargrave

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1 CRYNODEB

Ar 10 Hydref, 2012, cynhaliwyd gwaith i gymryd samplau craidd gwaddodol ac isfilodaidd ym Mhorthdinllaen, gogledd Cymru. Gwnaed hyn i gynorthwyo i reoli'r gwely morwellt (*Zostera marina*) a geir yno, ac sydd wedi'i restru fel nodwedd bwysig dan Reoliad 35 yn Ardal Cadwraeth Arbennig Pen Llŷn a'r Sarnau. Tynnwyd samplau craidd o du mewn i'r gwely morwellt, o waddodion heb dyfiant gerllaw ac o du mewn i'r 'creithiau' a grëwyd gan yr angorfeydd yn yr harbwr allanol. Casglwyd cyfanswm o 24 o samplau craidd isfilodaidd a chasglwyd wyth sampl craidd i ddadansoddi maint gronynnau mewn wyth gorsaf samplo yn yr harbwr; tair ohonynt yn y gwely morwellt, tair yn y 'creithiau' angori a dwy yn y gwaddodion heb dyfiant yn yr ardal oddi amgylch. Prif nod yr arolwg hwn oedd asesu unrhyw wahaniaeth sylweddol rhwng y cymunedau isfilodaidd a nodweddion gwaddodol y tri math hyn o gynefin. Anfonwyd y samplau biolegol a gwaddodol i Thomson Unicomarine ac rydym ar hyn o bryd yn disgwyl am ddadansoddiad labordy ac ystadegol. Cynhaliwyd yr holl waith plymio gan dîm SCUBA proffesiynol oedd wedi'i hyfforddi'n llawn a'i gymeradwyo gan AGID, a dilynwyd y codau ymarfer a rheoliadau plymio yn y gwaith priodol. Roedd y prosiect hwn yn rhan o fenter llawer mwy sy'n anelu i ddeall ecoleg a bioleg y gwely morwellt ym Mhorthdinllaen yn well, gyda nod derfynol o ddatblygu angorfeydd sy'n fwy cyfeillgar i'r morwellt a thechnegau rheoli.

2 SUMMARY

On the 10th October 2012, sediment and infaunal core operations were conducted within Porthdinllaen, North Wales. These were conducted to aid in the management of the seagrass bed (*Zostera marina*) present, listed as an important feature under Regulation 35 for the Pen Llŷn a'r Sarnau Special Area of Conservation. Cores were extracted from within the seagrass bed, adjacent unvegetated sediment and within "scars" created by the moorings present within the outer harbour. A total of 24 infaunal cores and 8 cores for particle size analysis were collected at 8 sampling stations across the harbour; 3 within the seagrass bed, 3 within mooring "scars", and 2 within the surrounding unvegetated sediment. The aims of these cores were to assess any significant difference between the infaunal communities and sediment profiles of these three habitat types. The biological and sediment samples were sent to Thomson Unicomarine and are currently awaiting laboratory and statistical analyses. All diving was conducted by a fully qualified and endorsed HSE professional SCUBA team, following the appropriate codes of conduct and diving at work regulations. This project was a component of a much larger venture which aims to better understand the local ecology and biology of Porthdinllaen seagrass bed, with an ultimate goal of developing more seagrass friendly moorings and management techniques.

3 INTRODUCTION

As part of the management of the Pen Llŷn a'r Sarnau Special Area of Conservation (SAC), the SAC Officer has been working with the National Trust, local fishermen, boat owners and others to look at options to reduce the impact of moorings on the seagrass (*Zostera marina*) bed at Porthdinllaen, North Wales. In October 2012 Marine Ecological Solutions Ltd. (Marine EcoSol) was contracted by the Countryside Council for Wales (CCW) to undertake sediment coring at 9 stations at Porthdinllaen outer harbour (Project Officer Lucy Kay, contract NWS2486). The coring was a component of a broader programme of studies being undertaken as part of the overall seagrass project to improve understanding of the biology and ecology of the seagrass bed at

Porthdinllaen. This summary report was commissioned by Gwynedd Council to inform partners about the sediment coring work. Analysis of the samples will be documented in a separate report.

In peak season of 2012 45 moorings were recorded within the outer harbour at Porthdinllaen. The mooring designs are largely based on that illustrated within Figure 1: two anchor chains are linked to a central rising chain which is attached to a marker & landing buoys on the water's surface. The lengths of both the rising and anchor chains are dependant on the weight of the resident vessel and the depth in which the mooring is deployed. Due to the use of Porthdinllaen by both a variety of pleasure craft and commercial fishing vessels, the size of each mooring is variable across Porthdinllaen harbour.

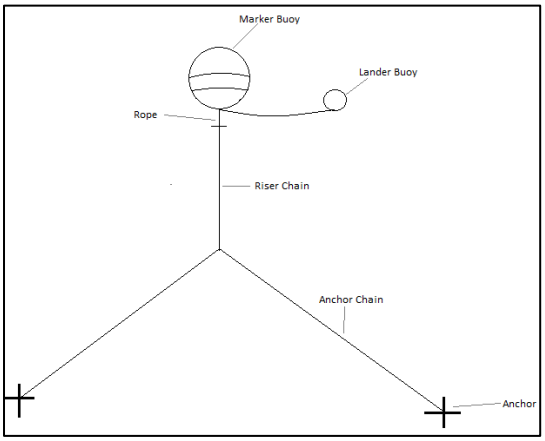

Figure 1: Two Anchor Mooring Design

Traditional mooring designs, such as those at Porthdinllaen, are known to interact with the surrounding benthic (seabed) habitats through the sweeping action of the rising chain (Egerton 2011), as the surface marker buoy rises and falls during each tidal cycle and are moved by the prevailing tidal currents. This sweeping action scours the surrounding seabed habitats, creating distinct "scars" within the seagrass bed and altering the species composition of the seabed habitat (Egerton 2011). The presence of seagrass supports many marine epifaunal and floral species (Connolly 1994, Milazzo *et al.* 2004, URL[1]: Marlin 2012), and there is also strong evidence to suggest that the presence of seagrass influences the community within the seabed sediment (infaunal community) (Webster *et al.* 1998) due to the presence of the seagrass rhizomes which act to stabilize, add structural complexity to, and increase oxygen transport within marine sediments (Webster *et al.* 1998, Milazzo *et al.* 2004).

Within the mooring scars at Porthdinllaen rhizome density is potentially reduced (Milazzo *et al.* 2004) and therefore the influence of the seagrass on the sediments is reduced or removed. Supporting the comments from the scientific literature are diver observations from Porthdinllaen which indicate that the lack of seagrass and rhizomes, in combination with the scarring action of the chain, potentially result in a lack of fine sediments in the area immediately surrounding moorings (Morris, *pers. comm*., 2012). As a result the infaunal community within mooring scar zones may be significantly different to that found within adjacent areas of dense seagrass.

The 2012 diver sediment coring was conducted at Porthdinllaen in order to investigate the influence of the mooring scars and seagrass on the sediment infauna and sediment characteristics. Cores were collected from within mooring scars, from dense areas of seagrass beds, and also from nearby areas of sediment where neither mooring scars nor seagrass were present.

4 METHODS

The location of representative sampling stations for the sediment cores was determined using the results of previous seagrass surveys undertaken by Marine EcoSol, CCW and volunteers (2008, 2009, 2010 and 2012) (Morris *et al.* 2008a &

2008b, Morris *et al*. 2009, Egerton 2011) (Figure 4). The 3 target habitat types for the sediment cores were:

1- Mooring scar (M),
2- Dense seagrass bed (SS),
3- Sediment with no seagrass shoots, outside of the moorings (S).

As previous data did not indicate suitable sediment sites where no seagrass was present, ad hoc searching for appropriate sample sites for this habitat type was adopted, at depths appropriate to seagrass. All sampling was conducted by divers.

All diving activity was conducted by a fully qualified and endorsed HSE professional scuba team operating under the Diving at Work regulations 1997 and following advice of the Scientific and Archaeological Approved Code of Practise. Marine Ecological Solutions was the appointed diving contractor. All diving was undertaken from a Maritime & Coastguard Agency (MCA) coded diving support vessel. Diving project plans were submitted to CCW, Gwynedd Council and the HSE prior to the day of diving. Each diver was equipped with through water voice communications, carried a surface marker buoy and alerted the surface team when and where sampling was conducted. Sampling sites were marked with a hand-held Garmin Map60 GPS (using WGS 84 as the datum).

At each sampling station descriptive notes were made on the depth, sediment characteristics and dominant epi-fauna/flora present within an approximate 3m radius around the core sampling area (Brazier 2001, Marine Monitoring Handbook Procedural Guideline No 3-8). In adaptation of the guidelines and with CCW's advice the following cores were taken within an area of $1m^2$ at each sampling station:

* three infaunal sample cores (0.0014 m^3), see Figure 2.
* one sediment core (0.00057 m^3) for Particle Size Analysis (PSA), see Figure 3.

All cores were individually sealed in zip lock plastic bags and transported to the surface. The infaunal samples were treated and stored separately by sieving each sample through a 0.5mm mesh on deck of the support vessel, and transferring the remaining material in the sieve to an appropriately marked container and preserving it with 4% formalin. A previous infaunal sample from the Porthdinllaen seagrass bed indicated that there may be a number of fragile infaunal species present in the sediment so care was taken when sieving the infaunal samples to try and reduce damage to the species in the sample. PSA sediment cores were sealed within zip-lock bags, transported to the surface and transferred to a container.

All biological and sediment samples were sent to Thomson Unicomarine and are currently awaiting laboratory and statistical analyses.

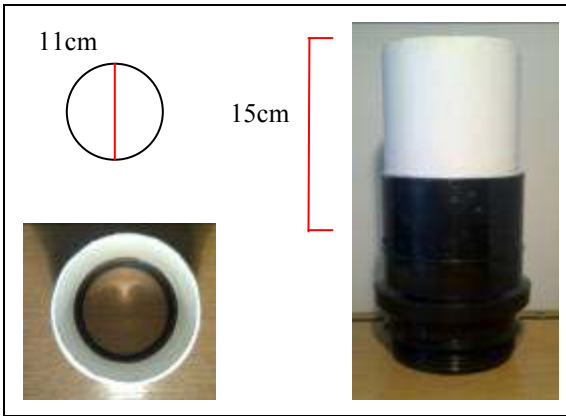

Figure 2: Infaunal core used for collection of

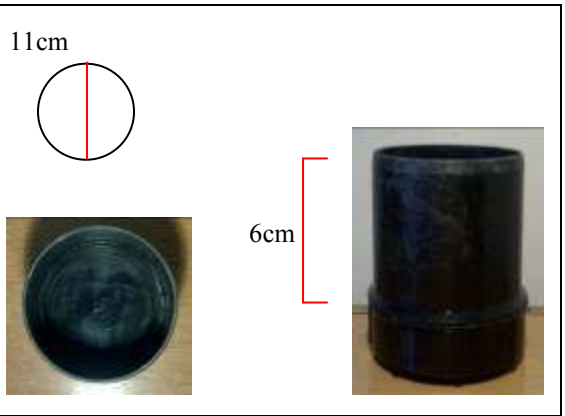

Figure 3: Sediment core used for collection of

sediment cores at Porthdinllaen on 10/10/2012. Core Diameter: 11cm, Core Penetrating Depth: 15cm, Core Volume: 0.0014 m^3	PSA samples at Porthdinllaen on 10/10/2012. Core Diameter:11cm, Core Penetrating Depth: 6cm, Core Volume: 0.00057 m^3

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5 RESULTS

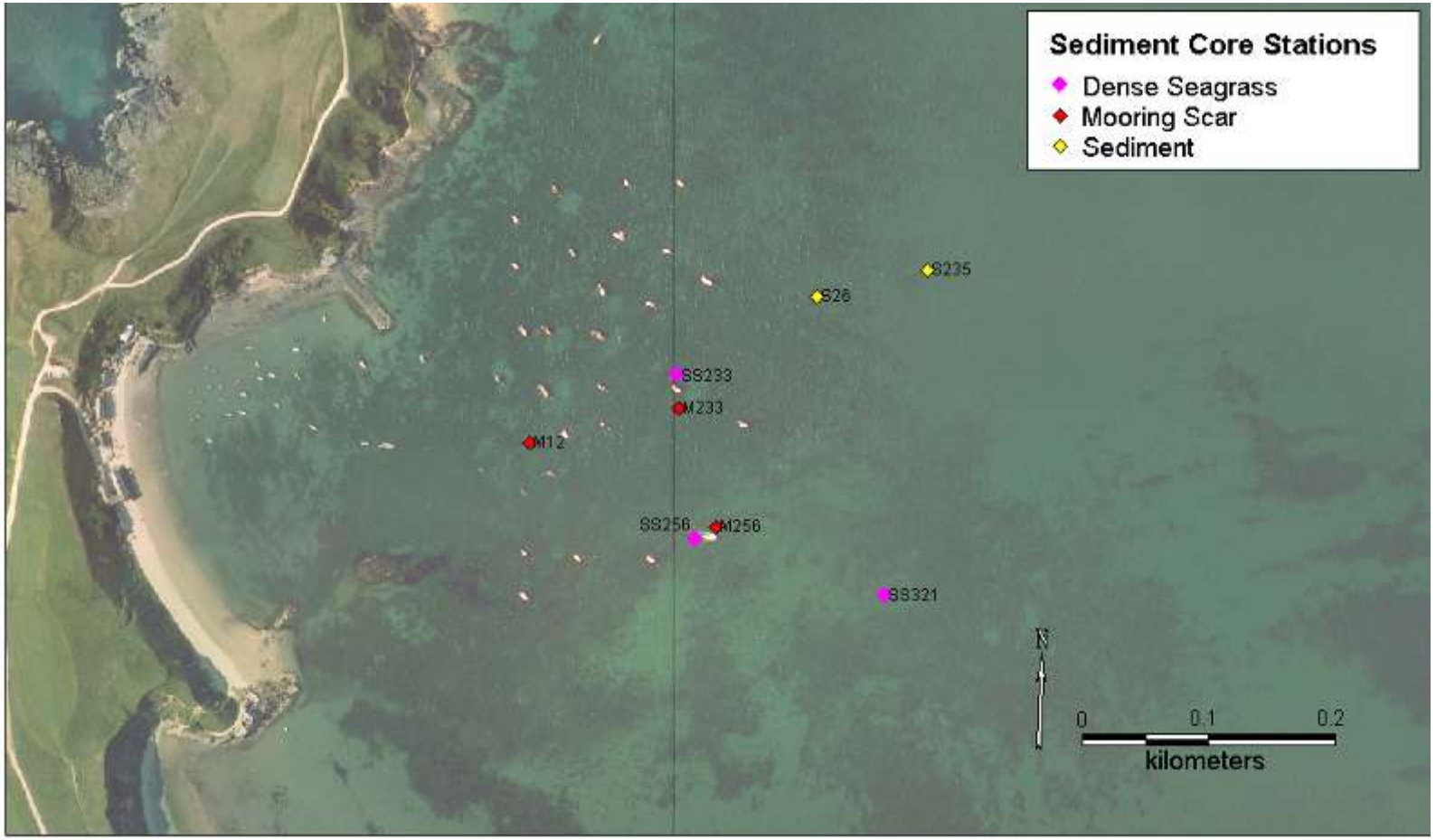

Figure 4: Map displaying sampling locations for Porthdinllaen sediment coring operations (10/10/2012). © This orthophotography has been produced by COWI A/S from digital photography captured by them in 2006. Licensed by the Welsh Government's Department for Environment to the Countryside Council for Wales.

24 infaunal and 8 sediment cores were collected by divers at Porthdinllaen on 10th October 2012. Station codes are displayed on the map in Figure 4. Samples were taken by scientific divers Harry Goudge, Jamie Ramday and Thomas Stamp, following Marine EcoSol Dive rules and under topside supervision of Liz Morris who was also responsible for sieving, storing and preserving the samples. Detail of diving operations is provided in Appendix 1.

Only two suitable sampling stations were located for sediment sites outside of mooring scars and without seagrass (labeled as sediment in Figure 4). Divers swam for long distances between SS321 and M256, and S26 in an attempt to locate sediments at suitable depths for seagrass to grow but without the presence of seagrass shoots or the impact of mooring. Seagrass was found to be patchy but extensive between SS321 and M256 and any sediment patches located in this area were too small for a rhizome free sampling station.

For all other targeted habitats (dense seagrass & mooring scars) three separate stations were easily identified. Table 1 provides the GPS position and summary information for all sampling stations. All cores were delivered on 11th October 2012 to CCW's Bangor HQ office, which were to be subsequently transported to Thomson Unicomarine for analysis of their faunal content (infaunal samples) and sediment characteristics (PSA samples). Notes on the preservation, storage and habitat present at each sample site are provided to Appendix 3.

Table 1: Summary table of the sampling stations sampled within the Porthdinllaen sediment coring works of 10/10/2012.

Mooring ID	Habitat Type	Time	Latitude	Longitude	Depth BCD (m)
S26	Sediment	10:10	52.94452	-4.55957	4.14
S235	Sediment	11:10	52.94473	-4.55828	4.94
M233	Mooring Scar	12:39	52.94368	-4.56115	3.1
SS233	Seagrass Bed	12:51	52.94392	-4.56118	3.07
M256	Mooring Scar	14:40	52.94285	-4.56067	2.76
SS256	Seagrass Bed	15:38	52.94275	-4.5609	2.62
SS321	Seagrass Bed	16:30	52.9424	-4.55865	3.29
M12	Mooring Scar	17:45	52.9434	-4.5629	1.74

At station M233 a large specimen of the Welsh Biodiversity Action Plan species ocean quahog *Arctica islandica* was recorded in one of the sample cores. No other specimens of this size were visually apparent within any of the other samples. A burrowing shrimp (see cover photo) potentially a *Upogebia* species, was also collected in cores from the same station. Diver notes indicate that daisy anemones, *Cereus pedunculatus,* and gobies, *Pomatoschistus sp.* were the dominant epifauna at the majority of sampling stations. Furthermore dragonets, *Callionymus spp.* were noted within all the habitat types, but not all sampling stations. Snakelock anemone, *Anemonia viridis,* was the only dominant epiphyte that occurred exclusively within the seagrass bed. Another species of note is Japweed, *Sargassum muticum*, which was found present at sampling station within both the seagrass bed and a mooring scar; sites SS233 and M256, this species however was not found to be dominating at either location. More detailed information about the diver observations of sediment characteristics, sediment features and dominant epifauna and flora at each sampling station is provided in Appendix 2.

6 CONCLUSIONS

Analysis of the results of the particle size (PSA) and infaunal laboratory analysis together with the information supplied in the current report will aim to identify whether there are any differences in infaunal community and sediment characteristics in mooring scar areas, dense areas of seagrass bed and adjacent areas of non-seagrass/non-mooring sediment. The analysis of the PSA and infaunal data will be reported on in a separate document

The lack of a third suitable non-seagrass/non-mooring sediment sampling site needs to be taken into account when the PSA and infaunal data is analysed because the reduced sampling effort in this target habitat will reduce the statistical power of the sediment site results.

Sediment components, features and epifaunal notes presented in Appendix 2 should be utilised in further analysis to assist in the explanation of the infaunal and PSA data. Also analysis may note that seagrass in SS321 was shorter, and potentially less dense, than that at other seagrass stations amongst the moorings. Further information on seagrass densities and epifauna should become available through a Marine EcoSol / MSc project that is linked to a volunteer diver project funded under the Welsh-Government funded Ecosystem Resilience and Diversity Fund; it would be helpful for this information to be taken into account in analysis for the sediment core data.

Of further note in relation to the core sample analysis is the relatively large specimen of *Arctica islandica* that was collected at M233. The large biomass of this individual is likely to account for a high proportion of the faunal biomass at station M233. Therefore if biomass analysis is undertaken, it should be noted that the *A. islandica* will strongly influence the inter-station similarity and influence the conclusions of the end report and should therefore be noted by the end analyst as a potential source of error within the dataset.

7 REFERENCES

Literature:

Brazier, P. 2001. Procedural guideline No. 3-8. Quantitative sampling of subtidal sediment biotopes and species using diver-operated cores. A chapter in *'The Marine Monitoring Handbook'*. JNCC, pp269-274.

Connolly, R. 1994. Removal of sea grass canopy: effects on small fish and their prey. Journal of Experimental Marine Biology & Ecology. 184 (1): 99-110

Egerton, J. 2011. Management of seagrass bed at Porthdinllaen. Initial investigation into the use of alternative mooring systems. Report for Gwynedd Council

Millazzo, M., Badalamenti, F., Ceccherellic, G., Chemello, R. 2004. Boat anchoring on *Posidonia oceanica* beds in a marine protected area (Italy, western Mediterranean): effect of anchor types in different anchoring stages. Journal of Experimental Marine Biology & Ecology. 299: 51-62

Morris, E.S. & Goudge, H. 2008 ***(a).*** Piloting the Use of Volunteer Divers in Subtidal Marine Monitoring in Wales: Preliminary Seagrass Surveys in Porthdinllaen and Milford Haven. CCW Marine Monitoring Interim Report.

Morris, E.S., Goudge, H. & Irving, R. 2008 ***(b).*** *Summary of 2008 Seagrass Surveys in Milford Haven and Porthdinllaen.* CCW Marine Monitoring Interim Report.

Morris, E.S., Hirst N., & Easter, J. 2009. *Summary of 2009 Seagrass Surveys in Porthdinllaen.* CCW Marine Monitoring Interim of the sea grass bed at Porthdinllaen. Initial investigation into the use of alternative mooring systems. Report for Gwynedd Council

Webster, P., Rowden, A., Attril, M. 1998. Effect of shoot density on the Infaunal Macro-invertebrate community within a *Zostera marina* seagrass bed. Estuarine, Coastal and Shelf Science. 47 (3): 351-357

Personal Communications:

Morris, E. 2012. Marine Ecologist, Marine Ecological Solutions Ltd. Conservation following several years experience diving amongst Porthdinllaen seagrass beds, October 19th, 2012.

Websites:

URL[1]: Marlin 2012. The Marine Life Network, http://www.marlin.ac.uk/speciesfullreview.php?speciesID=4600. Accessed on 18-10-12. Rechecked on 19-10-12.

APPENDIX 1: DETAILS OF DIVING OPERATIONS

Dive Details for Porthdinllaen Sediment Core Operations for 10/10/2012. Dive Site Abbreviations; M: Mooring Scar, S: Sediment with no Seagrass Present, SS: Dense Seagrass Bed

Dive Operation	Dive Site	Diver Name	Gas EAN (%)	Air		Dive Details			
				In	Out	Start	End	Duration (minutes)	Max Depth BCD (m)
1	S:26			220	40				
		Harry Goudge	30	200	80	09:54	11:35	82	5.2
				210	60				
		Thomas Stamp	30	210	60	09:54	11:35	82	5.2
2	M:233 + SS:233	Gujameer (Jamie) Ramday		220	90				
			21	220	90	11:45	13:20	90	3.12
				40					
		Harry Goudge	30	30		Standby Diver			
3	M:256 + SS:256			220	90				
		Harry Goudge	30	220	90	14:37	16:10	93	3.08
				210					
		Thomas Stamp	25	230		Standby Diver			
4	SS:321			200	80				
		Thomas Stamp	25	210	80	16:24	17:32	66	3.52
		Gujameer (Jamie) Ramday		90					
			21	90		Standby Diver			
5	M:12	Gujameer (Jamie) Ramday		90	40				
			21	90	40	17:40	18:15	33	1.75
				90					
		Harry Goudge	25	90		Standby Diver			

APPENDIX 2: DIVER NOTES ON SEDIMENT COMPOSITION, FEATURES AND EPIFAUNA

Table a: Information on the position and sediment composition for each sampling station. Sediment composition section refers to the percentage contribution of each sediment component to the total sediment composition, please refer below for explanation.

Sampling Station Details					Sediment composition (%)								
							Gravel		Sand				
Mooring ID	Time	Latitude	Longitude	Depth BCD (m)	Cobbles	Pebbles	Stone	Shell	Coarse	Medium	Fine	Mud	Live Shell
S26	10:10	52.94452	-4.55957	4.14		12		3		75		5	5
S235	11:10	52.94473	-4.55828	4.94		8		8	77			2	5
M233	12:39	52.94368	-4.56115	3.1		20			80				
SS233	12:51	52.94392	-4.56118	3.07		45		5	50				
M256	14:40	52.94285	-4.56067	2.76		30			60				10
SS256	15:38	52.94275	-4.5609	2.62		10			80				10
SS321	16:30	52.9424	-4.55865	3.29		5				70	20		5
M12	17:45	52.9434	-4.5629	1.74		75			25				

Each sediment component is assigned a percentage to which it is of the total sediment composition, please find below a tabular key with a worked example from Table a.

Sediment Composition									
		Gravel		Sand					
Cobbles	Pebbles	Stone	Shell	Coarse	Medium	Fine	Mud	Live Shell	Total
	12		3		75		5	5	100%

Table b: Detailed information on the sediment characteristics, other sediment features and dominant epifauna and flora present at each sampling station. Please refer to Table c for a list of abbreviations and details on ranking system used within Table b.

Mooring ID	Sediment Characteristics				Sediment Features: Present (P), Absent (blank)											
	Surface Relief	Firmness	Stability	Sorting	Tr	M/C	B/H	Tu	AM	W/d	R	SBL	SCL	Sc/M	SS/F	Dominant epifauna/ Flora
S26	1	3	2	3		P	P	P						P		*Buccinum undatum, Callionymus spp, Cereus pedunculatus, Pomatoschistus spp*
S235	1	3	2	2	P	P	P	P						P		*Callionymus spp, Cereus pedunculatus, Pomatoschistus spp, Rhodophyta spp*
M233	2	3	3	3	P	P		P						P		*Callionymus spp, Cereus pedunculatus, Pomatoschistus spp, Sargassum muticum (*noted as present but not dominant*)*
SS233	1	3	3	2										P		*Anemonia viridis, Cereus pedunculatus, Pomatoschistus spp, Zostera marina, Sargassum muticum (*noted as present but not dominant*)*
M256	2	1	2	4	P		P							P		*Cereus pedunculatus, Pomatoschistus spp*
SS256	1	3	1	2			P	P				P		P		*Callionymus spp, Cereus pedunculatus, Pomatoschistus spp, Zostera marina*
SS321	2	2	2	2		P	P	P				P		P		*Anemonia viridis, Callionymus spp, Zostera marina*
M12	2	2	1	2	P			P						P		*Cereus pedunculatus, Chorda filum, Crenilabrus melops*

Tabular key explaining diver notes on ranking system for sediment characteristics and abbreviations used within sediment features of Table b

Sediment Characteristics				Other Sediment Features (Present/ Absent)										
Surface Relief	Firmness	Stability	Sorting	Tr	M/C	B/H	Tu	AM	W/d	R	SBL	SCL	Sc/M	SS/F
Even-Uneven	Firm-Soft	Stable-Mobile	Well-Poor	Tracks	Mounds/ Casts	Burrows/ Holes	Tubes	Algal Mat	Waves/ Dunes (>10cm High)	Ripples (<10cm High)	Subsurface Black Layer	Subsurface coarse layer	Subsurface clay/ mud	Surface silt/ Flocculent
Ranked on a Scale of 1-5 e.g. 1= Even or 5 = Uneven														

APPENDIX 3: PORTHDINLLAEN SAMPLE SUMMARY TABLE

Client	Site	Size of sample tub	Station	Sample	Size of core	Sieved	Preservation method	Habitat	Collector
CCW	Porth Dinllaen	5 litre	**S26**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Fine sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**S26**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Fine sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**S26**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Fine sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**S235**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Coarse sediment, sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**S235**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Coarse sediment, sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**S235**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Sublittoral Sediment. Coarse sediment, sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M233**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M233**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M233**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M256**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles with some boulders. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M256**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles with some boulders. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M256**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles with some boulders. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M12**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Glacial clay? Sand and pebbles	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M12**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Glacial clay? Sand and pebbles	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**M12**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Mooring Scar. Glacial clay? Sand and pebbles	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS233**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS233**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS233**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS256**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS256**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS256**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS321**	**1 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS321**	**2 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	5 litre	**SS321**	**3 of 3**	0.0014 cubic metres (110mm diameter, 15cm deep)	0.5mm	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**S26**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**S235**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Sublittoral Sediment. Fine sand and pebbles. No Seagrass	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**M233**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**M256**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Mooring Scar. Coarse sediment of sand and pebbles with some boulders. No seagrass	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**M12**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Mooring Scar. Glacial clay? Sand and pebbles	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**SS233**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**SS256**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol
CCW	Porth Dinllaen	1 litre	**SS321**	**PSA**	0.00057cubic metres (110mm diameter, 6cm deep)	no	~4% Formalin	Dense sublittoral seagrass in fine sediments	Marine EcoSol