



Strangfords *Modiolus* reefs, the rise, the fall, and the road to recovery

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Ulster Wildlife Trust

40 Years +of Conservation (?) Management of Strangford Lough, Northern Ireland

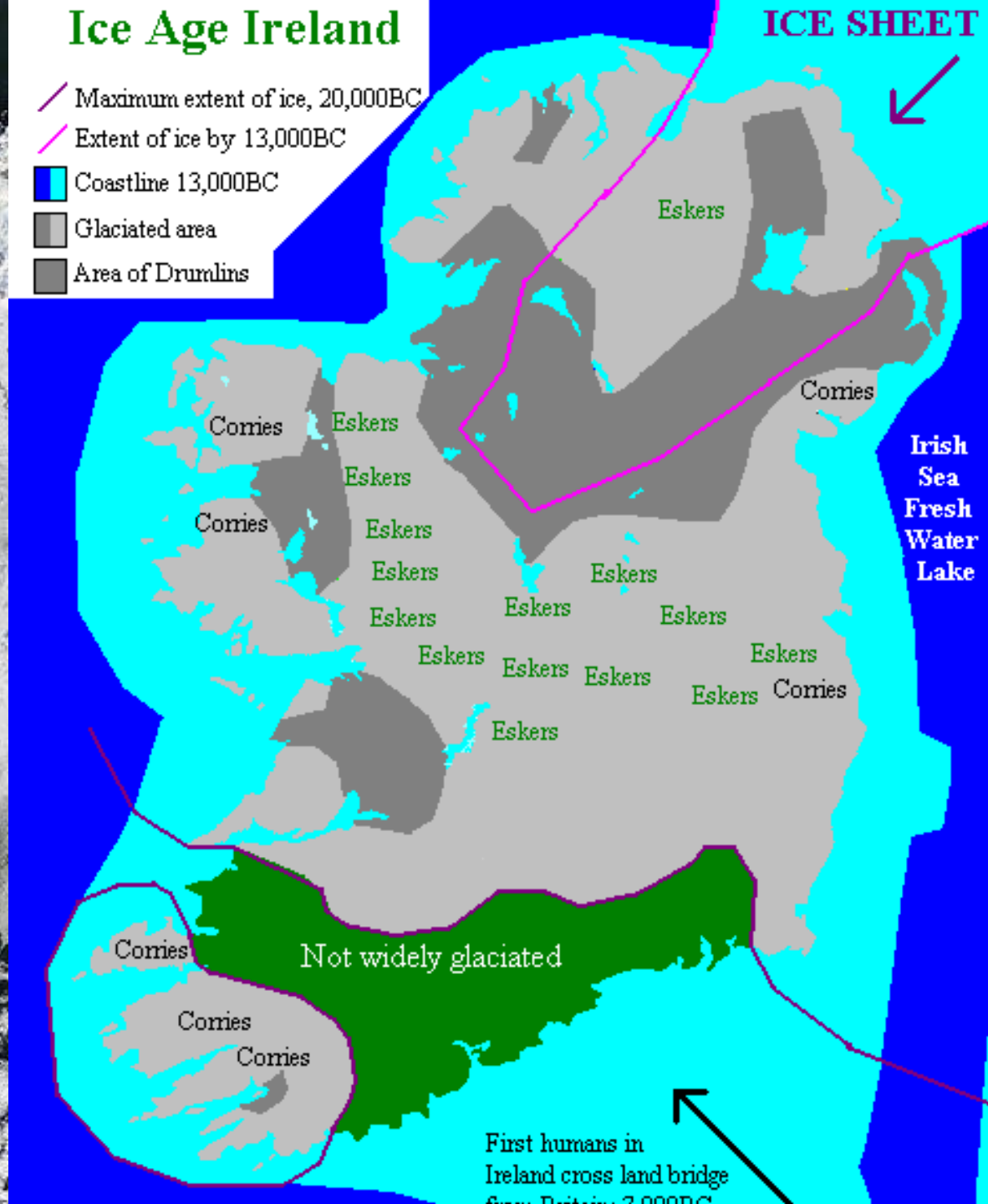
David G Erwin

Coastal Futures London 2003



Ice Age Ireland

- Maximum extent of ice, 20,000BC
- Extent of ice by 13,000BC
- Coastline 13,000BC
- Glaciated area
- Area of Drumlins



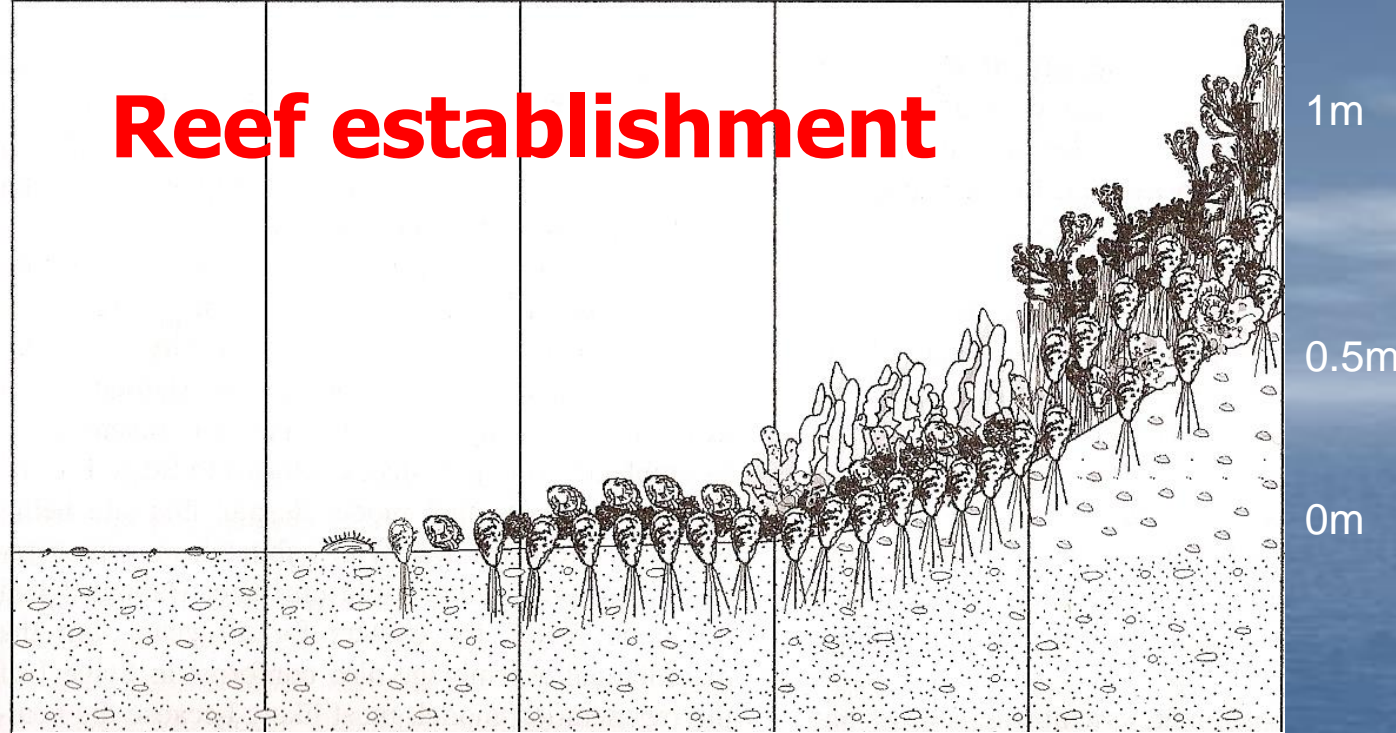
ICE SHEET

Irish Sea
Fresh Water
Lake

Not widely glaciated

First humans in
Ireland cross land bridge
from Britain 2,000BC

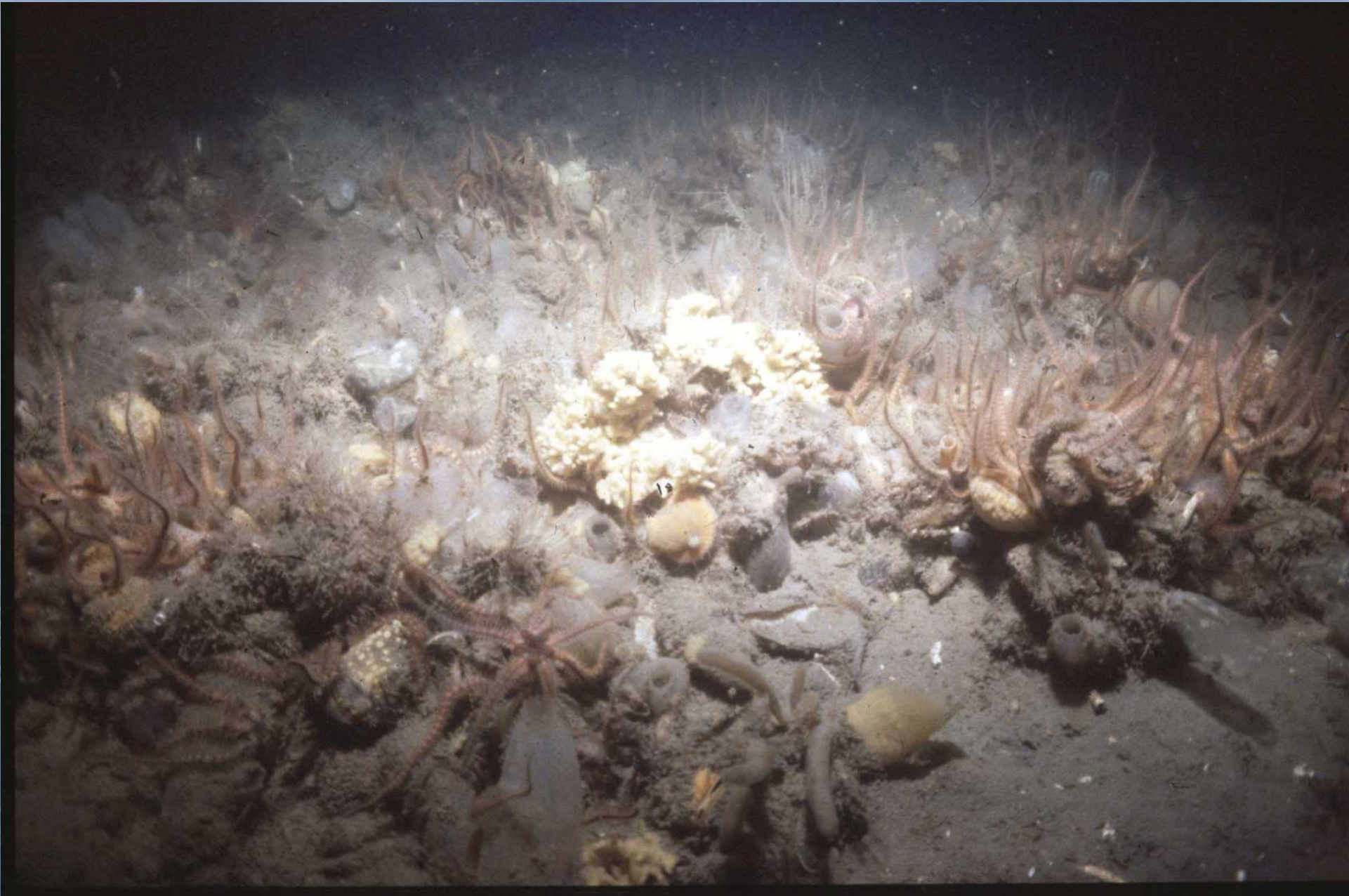
Reef establishment



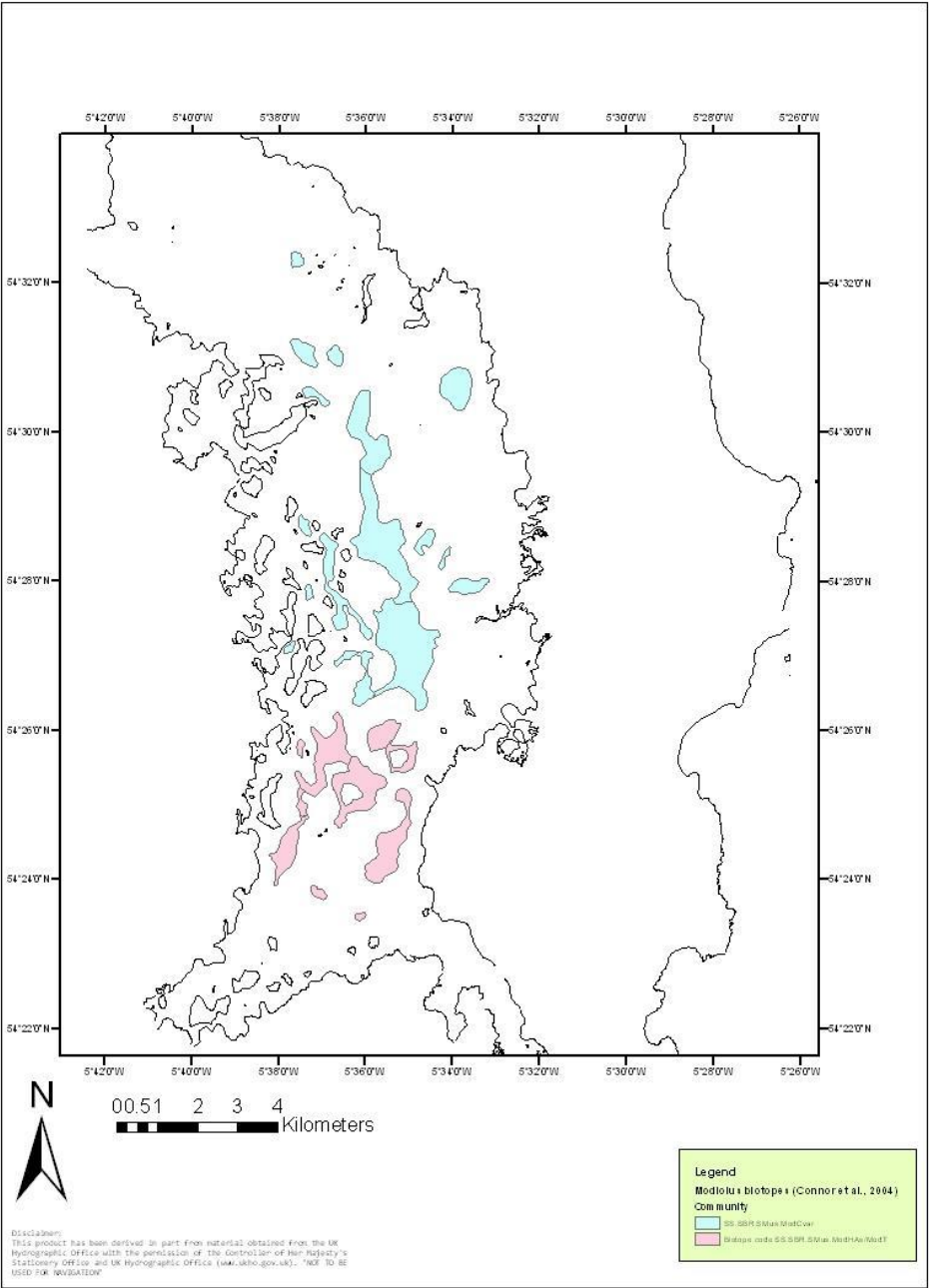
STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
Encrusting Bryozoa	Encrusting Bryozoa	Erect bryozoa	Erect bryozoa	Reef-forming bryozoa
Small bivalves	Mussels	Tunicates	Sponges	Echinoderms
	Oysters	Gastropods	Brittle Stars	Crabs
		Mussels	Tunicates	Bivalves
		Oysters	Gastropods	Tunicates
			Mussels	Gastropods
			Oysters	Mussels
			Anemone	Oysters
				Anemone

Macrofaunal succession/ regeneration after dredging.

Cranfield *et al.* 2004.
J Sea Res 52: 109-125







Projected hindcast of the historical distribution of *M. modiolus* biotopes in Strangford Lough based on data sources including Brown & Seed and Erwin et al. Pre -1986

SAC	153km ²
Reef	50km ²
Modiolus	18km ²

The Main Anthropogenic Impacts

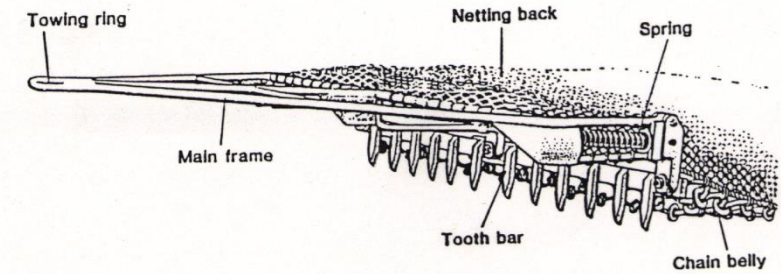
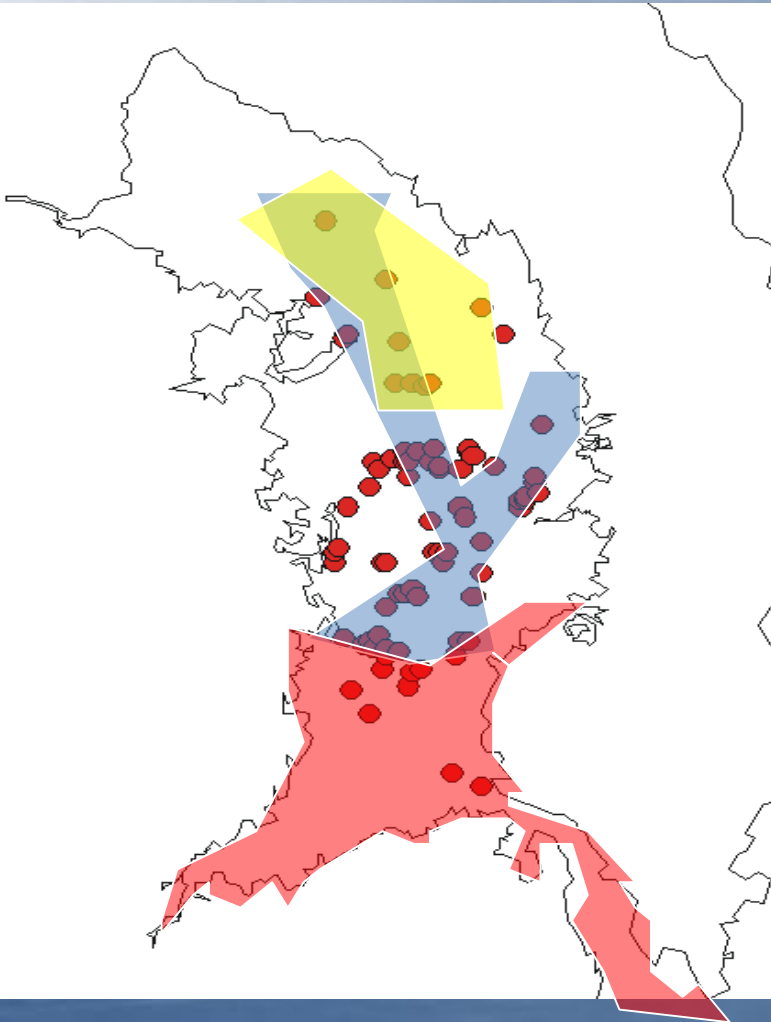


Figure 4c. Scallop Dredge (Mason, 1983)

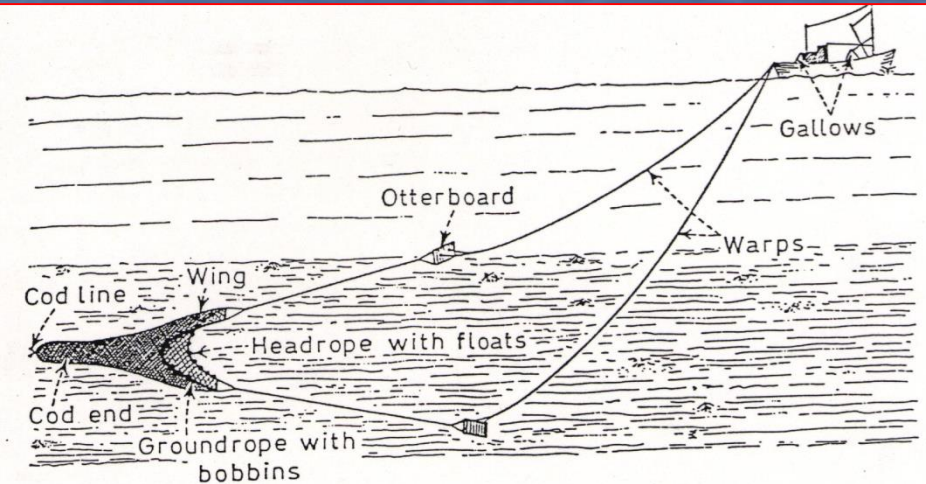
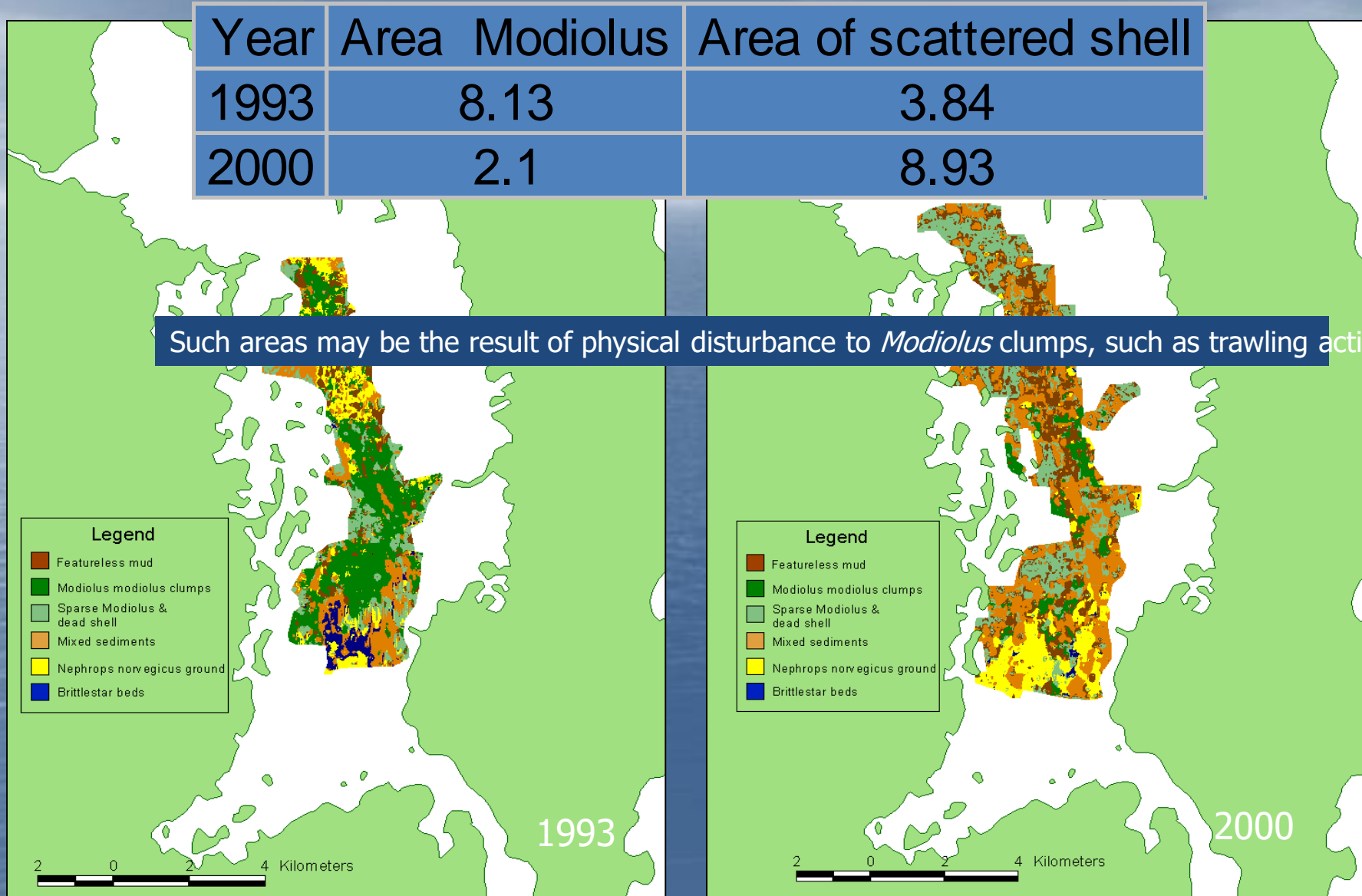


Figure 4b. The Otter Trawl

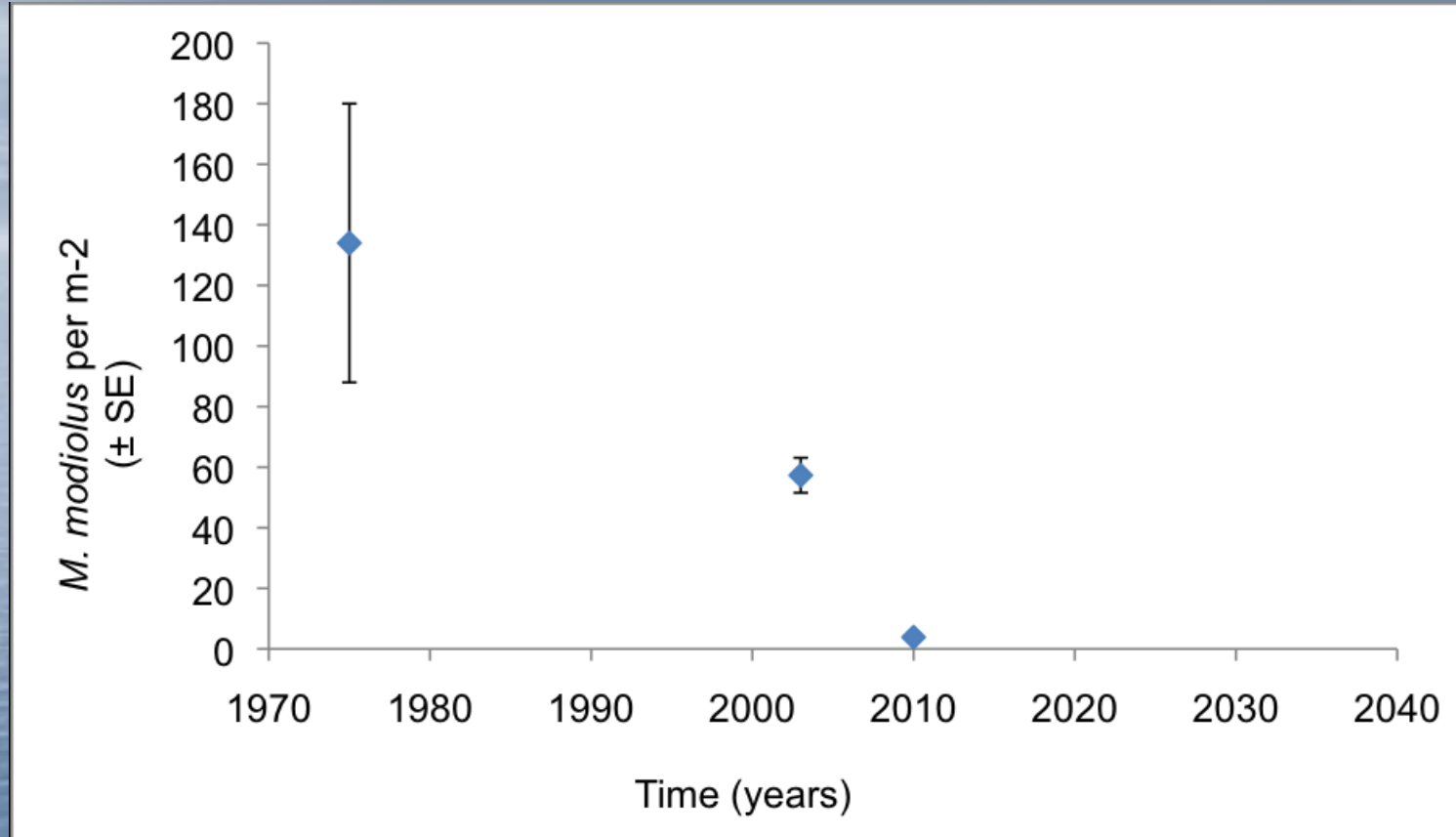


There was **no significant change** between 1993 and 2000 in the area of *Modiolus* habitat coverage;



- March 2003, Ulster Wildlife officially complains to the European Commission
- December 2003, DARD Minister follows the advice of the DOE Minister and introduces Ban on Mobile gear within the SAC
- Trawl/Dredge fleet switches over to Fixed gear pot fishing for Brown Crab, Lobster, Nephrops, Green Crab, Blue Velvet Swimming Crab, Buckie Whelks
- DOE commissions QUB to investigate cause of reef decline (SLECI)
- Both Departments prepare a Restoration Plan for the Lough

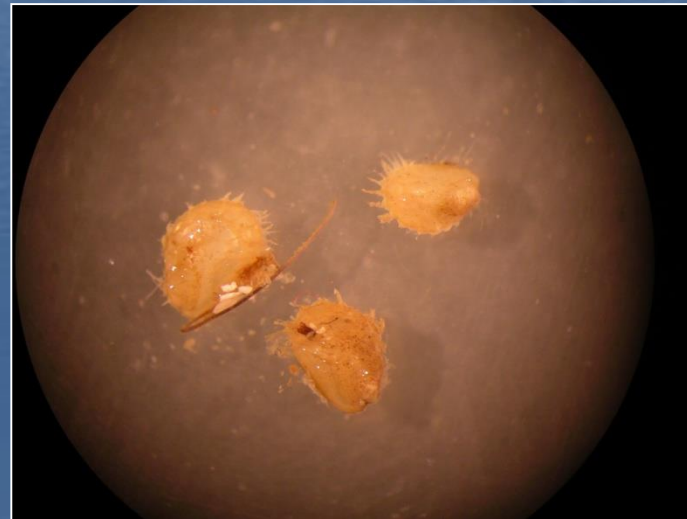
- SLECI finds trawling and dredging most likely cause of decline and advises proactive restoration.
- 2008 QUB Modiolus Restoration Research Group established
- Reefs are still declining
- Department establishes two small no take zones
- The no take zones extended to protect entirety of Modiolus habitat in 2011
- Bylaws introduced to prevent diving, mooring, anchoring



The changes in the mean (\pm SE) number of *M. modiolus* from 1970 to 2010 (years) at four sites (Bird Island Passage, Black Rocks, Long Sheelah and West Round Island Passage) in Strangford Lough. The number of quadrats varied through time (1975 $n = 17$, 2003 $n = 26$, 2010 $n = 30$).

INTERVENTION: Hatchery production of spat 2008-10

- Spawning of brood stock mussels can be induced through prolonged air exposure (partial desiccation).
- Fertilization rates were high
- At ambient temperature larvae reach pediveliger stage at day 30 .
- Active foot observed 38 days after fertilization.
- Settlement was achieved using empty *M.modiolus* shells.
- Spat measuring 1.5mm was obtained after 4 months.



1.5 mm laboratory reared spat

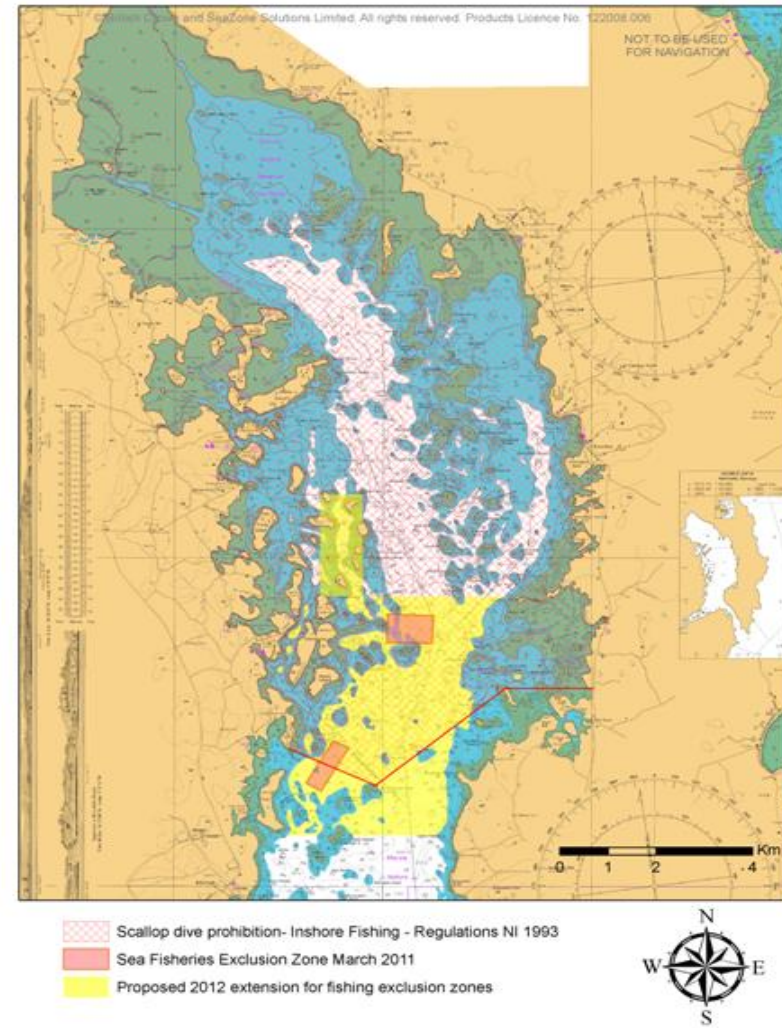
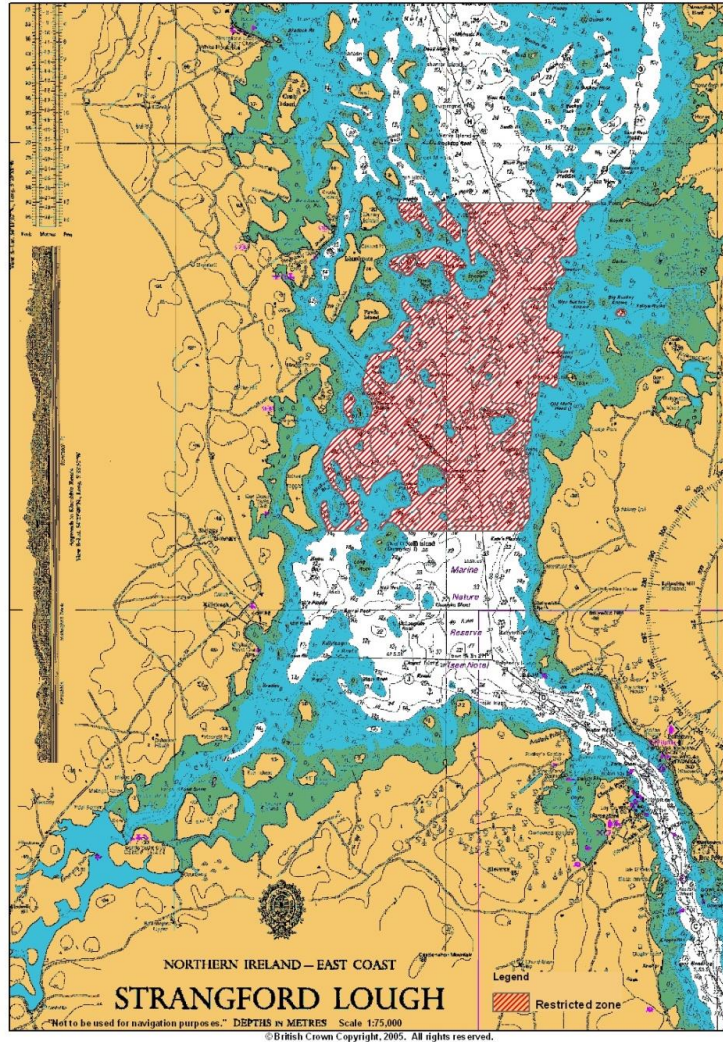


INTERVENTION: Artificial reef

•Baseline survey (April 2010)

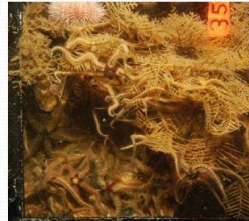


Revised Restoration Plan. Protection, Monitoring, Restoration



Marine Ranger
Fisheries officer
Pot fishery management plan
Further monitoring and intervention
research
Protection of a *Modiolus* bed within
The Irish Sea

Outer Ards



- Active restoration was not as successful as hoped and would require the translocation of significant amounts of *Modiolus* from other sites.
- Is it ethical to remove reef from an unprotected site to restore a damaged protected site
- 2011, following the introduction of total protection and following the recommendations of an expert workshop, it was agreed to allow nature to take its course and see if natural recovery would take place
- **Re-wilding!**

2003



Species decreasing

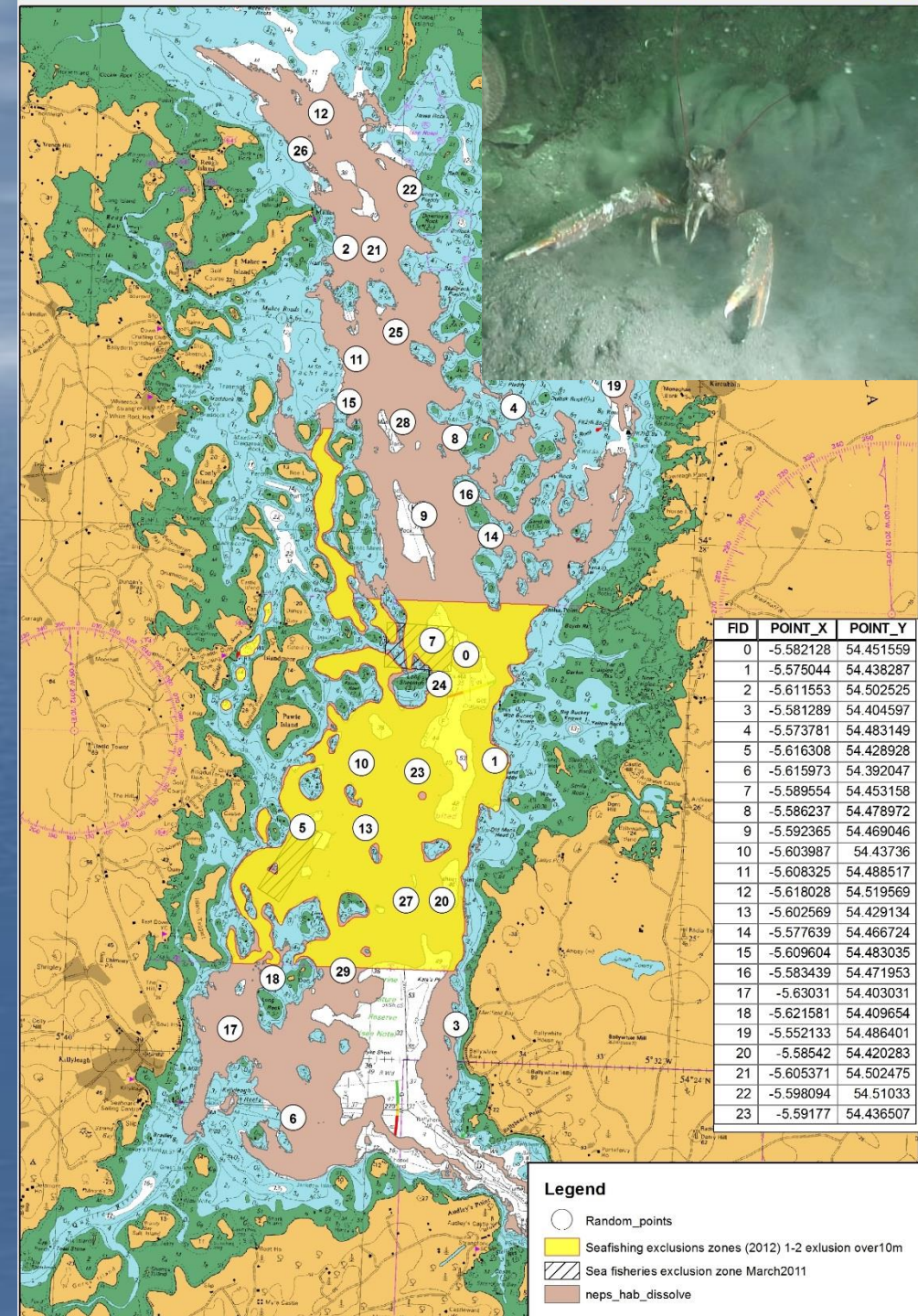
- *Spanioplion armaturum*
- *Iophon hyndmani*
- *Protula tubularia*
- *Modiolus modiolus*
- *Aequipecten opercularis*
- *Chlamys varia*
- *Munida rugosa*
- *Thyonidium drummondi*
- *Pyura microcosmus*
- *Corella parallelogramma*



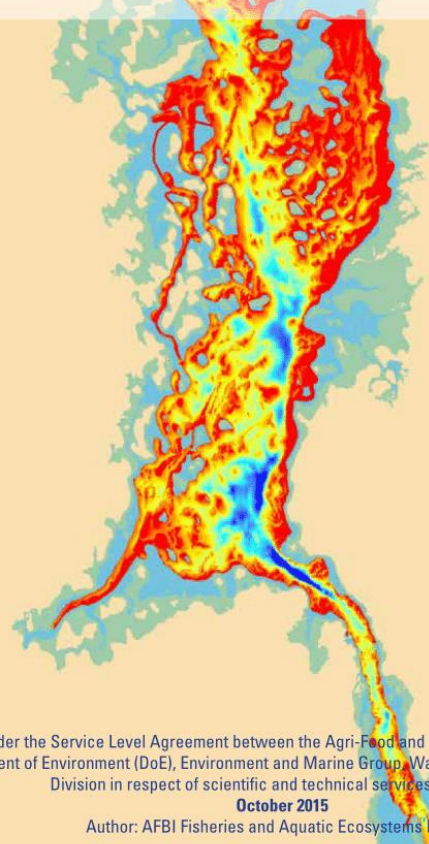
AFBI Nephrops Camera Survey



MarineTraffic.com



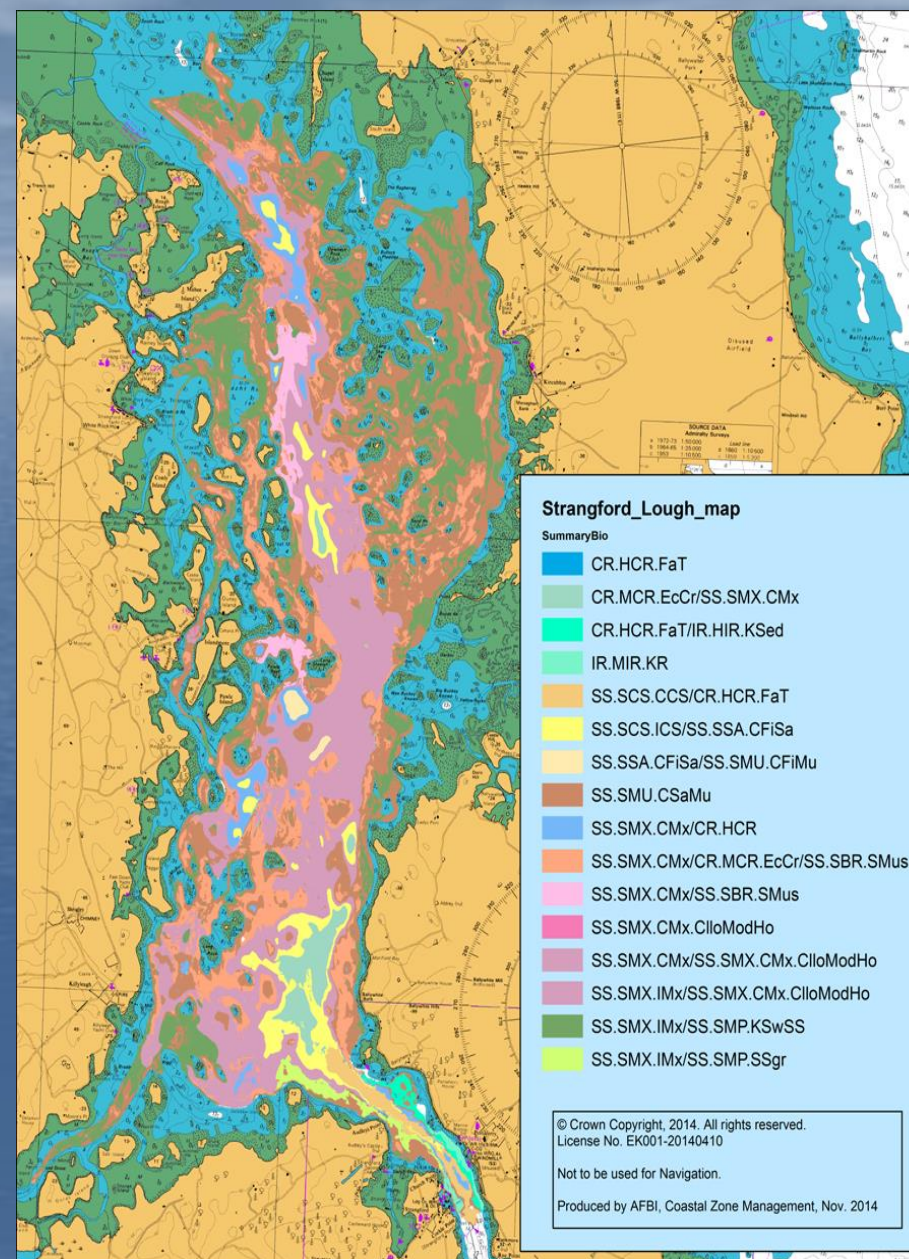
BATHYMETRIC & HABITAT MAP FOR STRANGFORD LOUGH (SPECIAL AREA OF CONSERVATION & MARINE CONSERVATION ZONE) NORTHERN IRELAND



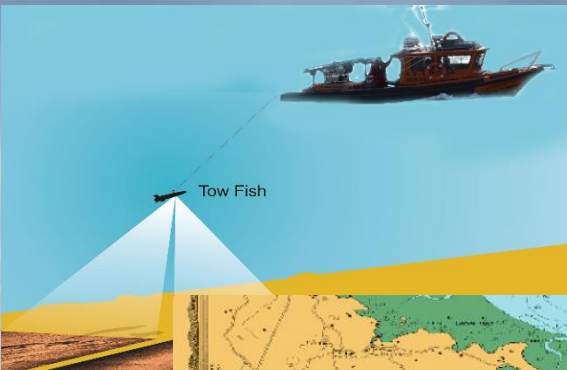
Delivered under the Service Level Agreement between the Agri-Food and Biosciences Institute (AFBI) and the Department of Environment (DoE), Environment and Marine Group, Water Management Unit & Marine Division in respect of scientific and technical services (2014-2015)

October 2015

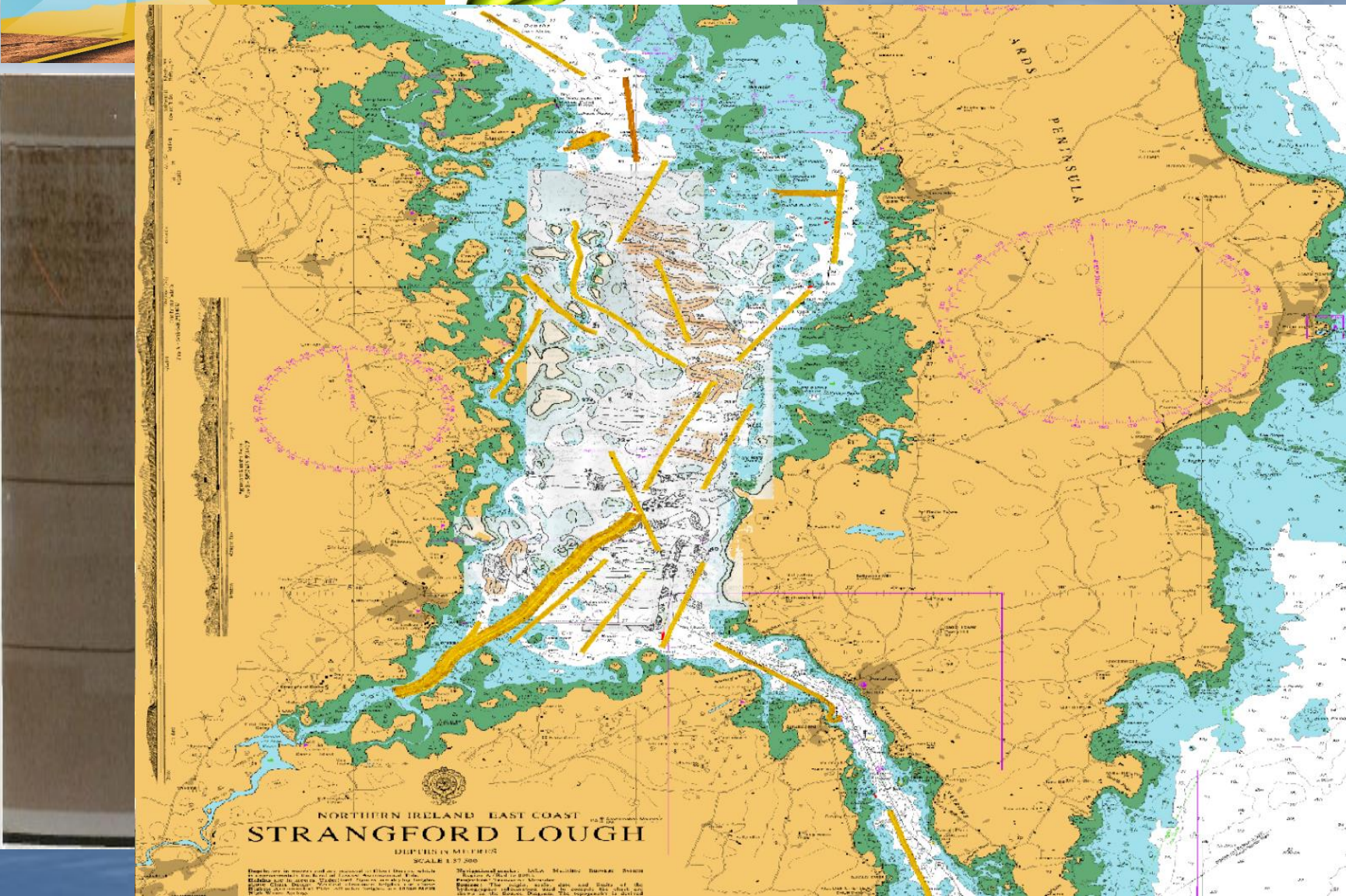
Author: AFBI Fisheries and Aquatic Ecosystems Branch

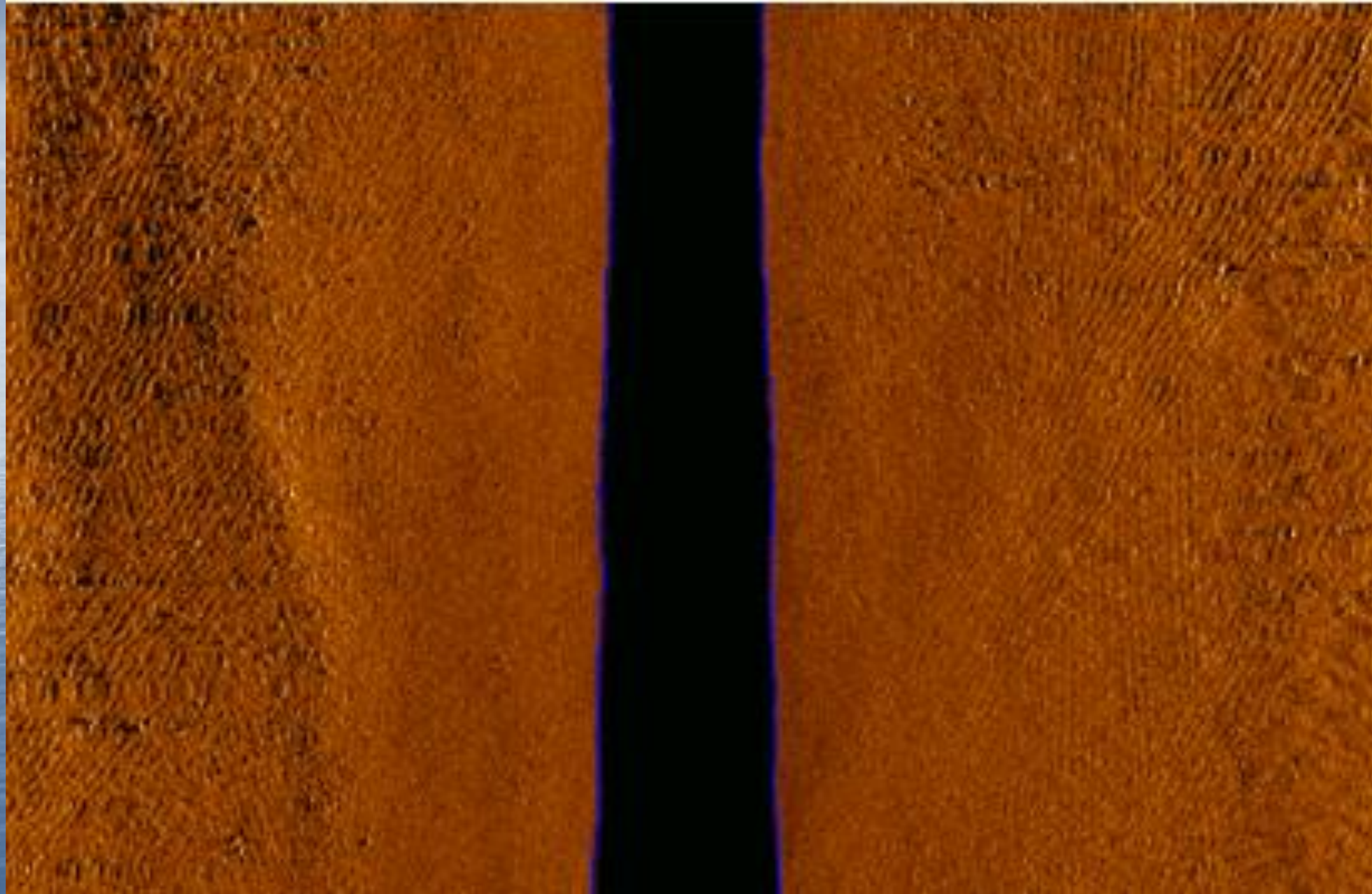


Strangford Lough - main			Strangford Narrows		
Summary Biotope Complex	m2	km2	Summary Biotope Complex	m2	km2
CR.HCR.FaT	5875	0.006	CR.HCR.FaT	391720	0.392
CR.HCR.FaT/IR.HIR.KSed	311525	0.312	CR.HCR.FaT/CR.HCR.XFa	337310	0.337
CR.MCR.EcCr/SS.SMX.CMx	1259525	1.260	CR.HCR.FaT/CR.MCR.EcCr	898508	0.899
IR.MIR.KR	175125	0.175	CR.HCR.XFa/CR.HCR.FaT/IR.MIR.KR	150730	0.151
SS.SCS.CCS/CR.HCR.FaT	720357	0.720	IR.HIR.KSed/IR.MIR.KR	673252	0.673
SS.SCS.ICS/SS.SSA.CFiSa	2844432	2.844	SS.SCS.CCS/CR.MCR.EcCr	638317	0.638
SS.SMU.CSaMu	17424248	17.424	SS.SSA.IFiSa	13611	0.014
SS.SMX.CMx.CIloModHo	4700	0.005			
SS.SMX.CMx/CR.HCR	1449475	1.449	TOTAL	3103448	3.103
SS.SMX.CMx/CR.MCR.EcCr/SS.SBR.SMus	7326000	7.326			
SS.SMX.CMx/SS.SBR.SMus	1056150	1.056			
SS.SMX.CMx/SS.SMX.CMx.CIloModHo	1713800	1.714			
SS.SMX.IMx/SS.SMP.KSwSS	10138987	10.139			
SS.SMX.IMx/SS.SMP.SSgr	475900	0.476			
SS.SMX.IMx/SS.SMX.CMx.CIloModHo	10981700	10.982			
SS.SSA.CFiSa/SS.SMU.CFiMu	196250	0.196			
TOTAL	56084049	56.084			
TOTALS	km2				
Sands and gravels	3.496				
Muds	17.620				
Potential Modiolus habitat	10.101				
Bedrock reef	1.372				
Stony reef	5.001				



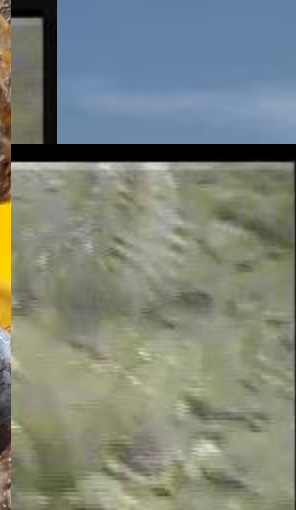
53km of survey lines
4,871,565m² of seabed

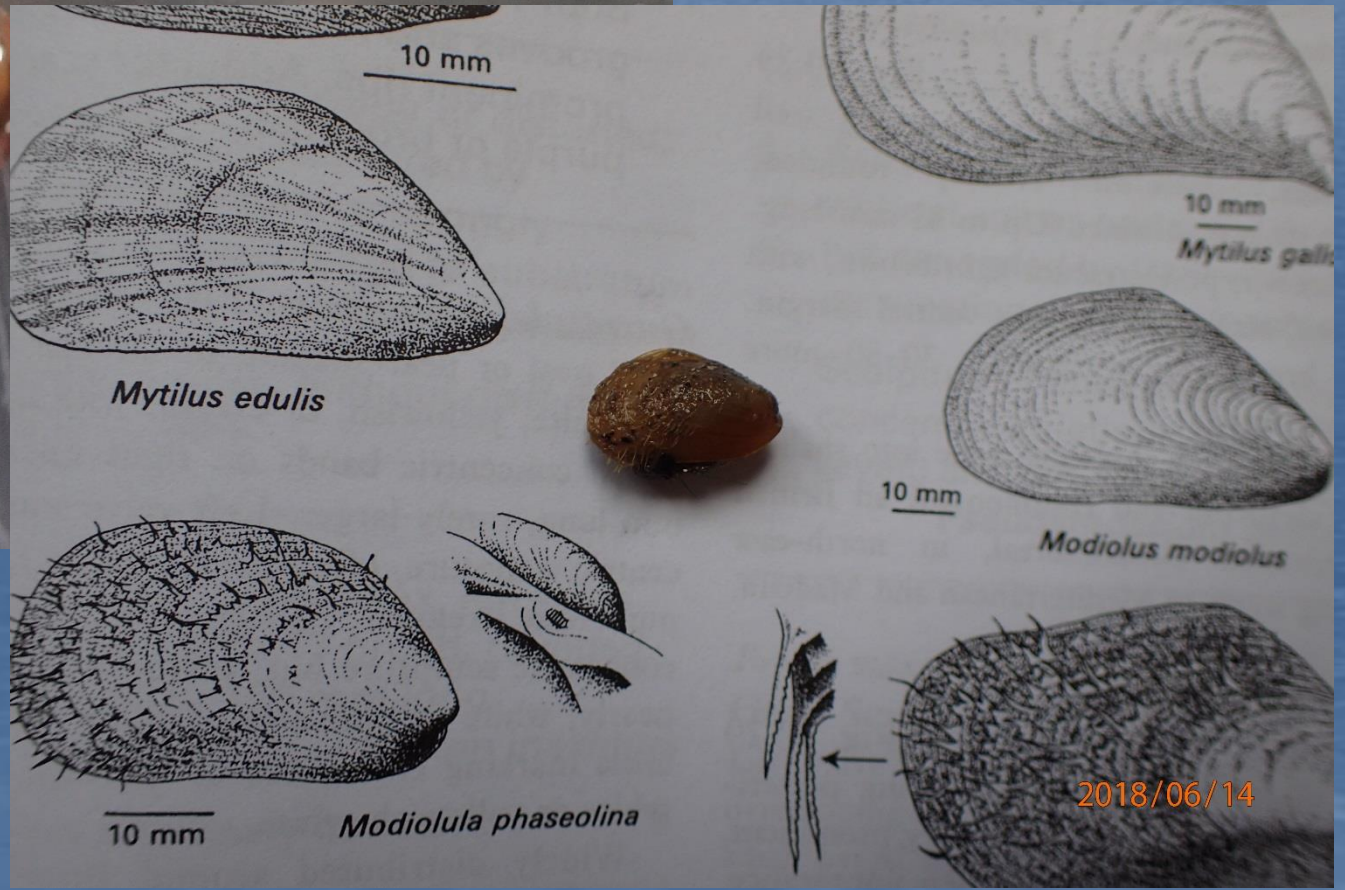
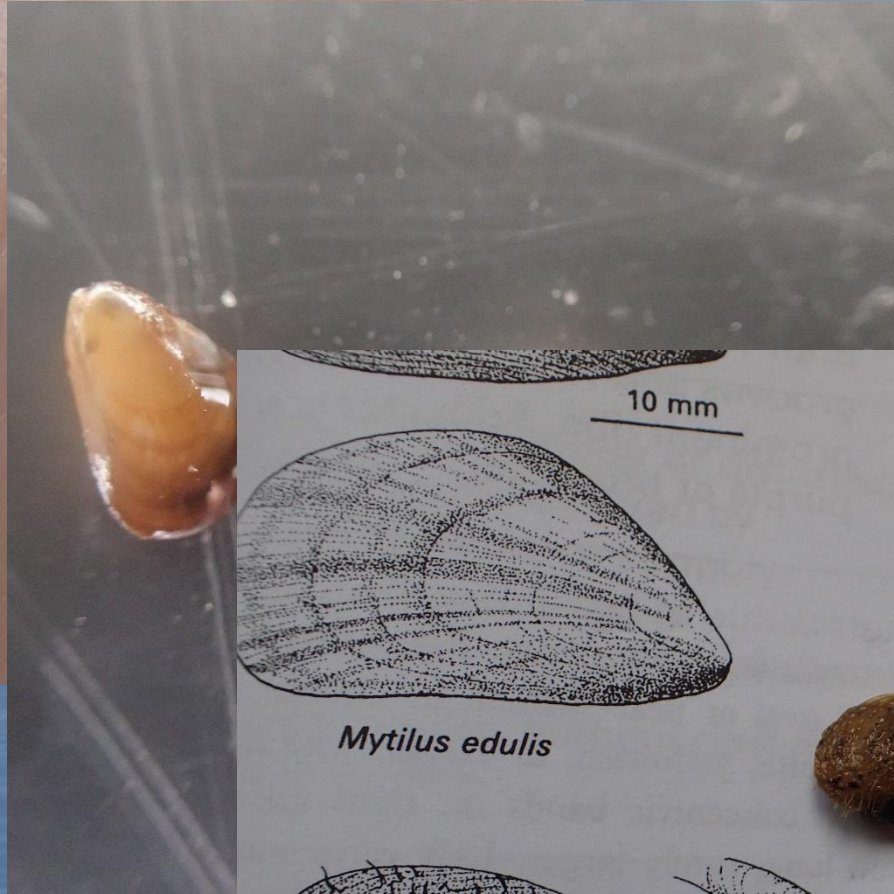






12.14 Km
6700 m²





2018/06/14



(a)



(b)



(c)



(d)

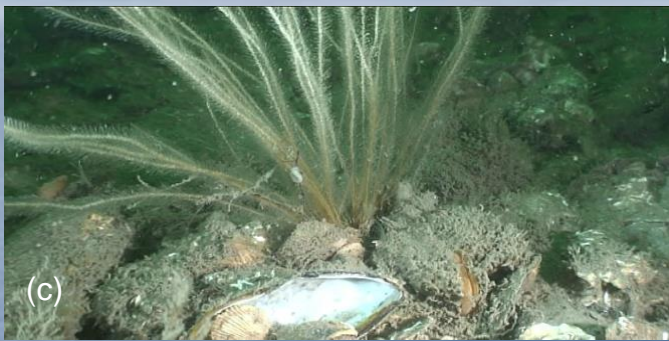
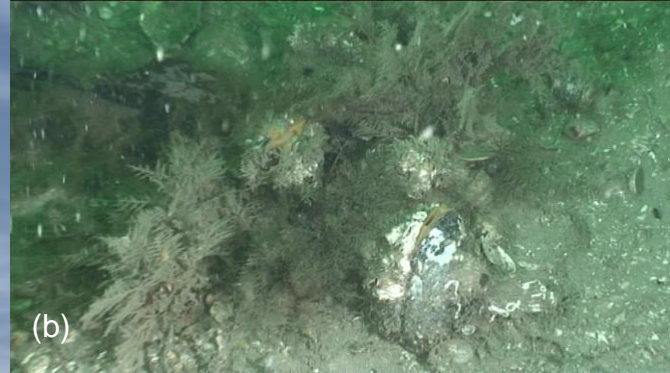


(e)



(f)

Photographs showing a) Sea pens *Virgularia mirabilis* on subtidal mud b) common tower shell *Turritella communis* and anemone) seagrass *Zostera marina* bed d) Dublin bay prawn *Nephrops norvegicus* e) burrowing anemone *Cerianthus lloydii*, elegant anemone *Sagartia elegans* and sponge *Suberites ficus* f) light bulb sea squirt *Clavelina lepadiformis*, sea squirt, sponge





Photographs showing a) dense *Ophiothrix fragilis* brittlestar bed b) *Ophiothrix fragilis* and anemone _ c) seven armed starfish *Luidia ciliaris* on brittlestar bed d) sunstar *Crossaster papposus* on brittlestar bed e) Antenna hydroid *Nemertesia antennina* on boulders on brittlestar bed f) black brittlestar *Ophiocomina nigra*, encrusting fauna and hydroids on boulders

AE1 17 489555 SLDC16 -17-18 - Spyball Survey plan and results [Read-Only] - Excel

FILE HOME HP Records Manager INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Open Save Save As Paste Copy Format Painter Clipboard Font Alignment Number Styles Cells Editing

B4 : X ✓ fx 3

1	Longitude_DDM	MCZ_Feature	Substrate_description	Comments
2	5 35.785	Sublittoral (subtidal) biogenic reefs - Modiolus	Shell on Mud and some pebbles. Frequent Dead Modiolus shell	Potentially alive. Potentially biog
3	5 37.376	Sublittoral (subtidal) biogenic reefs - Modiolus	Shell on Mud. Soft sediment with broken shell	Alive Modiolus. Frequent Dead M
4	5 35.268	Sublittoral (subtidal) biogenic reefs - Modiolus		Video corrupt. Re-do
5	5 35.333	Sublittoral (subtidal) biogenic reefs - Modiolus	Shell on Mud. Soft sediment with broken shell, some pebbles and mud froming lumps	Potentially biogenic reef. Some
6	5 34.96	Sublittoral (subtidal) biogenic reefs - Modiolus	Shell on Mud. Soft sediment with broken shell, some pebbles and mud froming lumps	Potentially alive. Potentially biog
7	5 34.956	Sublittoral (subtidal) biogenic reefs - Modiolus	Shell on Mud. Soft sediment with broken shell and mud froming lumps	Potentially alive. Potentially biog
8	5 35.93	Sublittoral		
9	5 35.623	Sublittoral		
10	5 35.936	Sublittoral		
11	5 35.455	Sublittoral		
12	5 35.603	Sublittoral		
13	5 35.606	Sublittoral		
14	5 35.436	Sublittoral		
15	5 35.446	Sublittoral		
16	5 35.358	Sublittoral		
17	5 34.76	Sublittoral		
18	5 34.815	Sublittoral		
19	5 35.173	Sublittoral		
20	5 36.397	Sublittoral		
21	5 36.277	Sublittoral		
22	-38.7842	Sublittoral		
23	-38.4805	Sublittoral		
24	-33.3381	Sublittoral		
25	-33.9304	Sublittoral		
26	-34.1452	Sublittoral		
27	-33.7437	Sublittoral		
28	-34.6042	Sublittoral		
29	-35.2241	Sublittoral		
30	-35.6115	Sublittoral		
31	-36.0077	Sublittoral		
32	-33.0557	Sublittoral		
33	-33.7348	Sublittoral		
34	-33.0207	Sublittoral		
35	-32.7337	Sublittoral		
36	-32.6888	Sublittoral		

AE1 17 489555 SLDC16 -17-18 - Spyball Survey plan and results [Read-Only] - Excel

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H84 : X ✓ fx 599_Job-X_170428_1423-170428_1426_Stn_83

1	Survey	Surveyors	Recorders	Priority	StationNo	SDC16_Station	Video_and_photo_ref	Boat_LatitudeS	Boat_LongitudeS	Boat_LatitudeE	Boat_LongitudeE	GI
1	SLDC17	Liz Pothanikat, Joe Breen, Clara Alvarez Alonso & Simon Exley	CAA	1	19	79	612_Job-X_170510_1407-170510_1428_Stn_19	54 24.9910	5 36.22887	54 24.9612	5 36.3981	
20	SLDC17	Liz Pothanikat, Joe Breen, Clara Alvarez Alonso & Simon Exley	CAA	1	20	83	608_Job-X_170510_1337-170510_1407_Stn_20_and_57	54 24.765	5 36.277	54 24.5825	5 36.2837	
22	SLDC17	Joe Breen, Sally Stewart-Moore, Clara Alvarez Alonso & Simon Exley (Queens)	SSM & CAA	1	22 New		591_Job-X_170428_1144-170428_1153_Stn_22	54 29.449	5 38.474	54 29.431	5 38.663	
23	SLDC17			1	23 New							
24	SLDC17			1	24 New							
25	SLDC17			1	25 New							
26	SLDC17	Liz Pothanikat, Joe Breen, Clara Alvarez Alonso & Simon Exley	CAA	1	26 New		605_Job-X_170510_1153-170510_1158_Stn_26	54 23.353	5 33.732	54 23.352	5 33.770	
27	SLDC17			1	27 New							
28	SLDC17			1	28 New							
29	SLDC17			1	29 New							
30	SLDC17			1	30 New							
31	SLDC17			1	31 New							
32	SLDC17	Liz Pothanikat, Joe Breen, Clara Alvarez Alonso & Simon Exley	CAA	1	32 New		604_Job-X_170510_1145-170510_1147_Stn_32	54 23.1988	5 33.7134	54 23.185	5 33.709	
33	SLDC17			1	33 New							
34	SLDC17			1	34 New							
35	SLDC17			1	35 New							
36	SLDC17			1	36 New							
37	SLDC17			1	37 New							
38	SLDC17			1	38 New							

SLDC17_survey_results_April Marine recorder sp list 2018 All tows final results GIS_Points_tows SL ...

6.3 Judging the condition of features

The following categories will be used to describe the condition of interest features:

- **Favourable - maintained.**

An interest feature should be recorded as *maintained* when its conservation objectives were being met at the previous assessment, and are still being met.

- **Favourable - recovered.**

An interest feature can be recorded as having *recovered* if it has regained favourable condition, having been recorded as unfavourable on the previous assessment.

2018

- **Unfavourable - recovering.**

An interest feature can be recorded as *recovering* after damage if it has begun to show, or is continuing to show, a trend towards favourable condition.

- **Unfavourable - no change.**

An interest feature may be retained in a more-or-less steady state by repeated or continuing damage; it is unfavourable but neither declining or recovering. In rare cases, an interest feature might not be able to regain its original condition following a damaging activity, but a new stable state might be achieved.

2003-20011

- **Unfavourable - declining.**

Decline is another possible consequence of a damaging activity. In this case, recovery is possible and may occur either spontaneously or if suitable management input is made.

- **Partially destroyed.**


It is possible to destroy sections or areas of certain features or to destroy parts of sites with no hope of reinstatement because part of the feature itself, or the habitat or processes essential to support it, has been removed or irretrievably altered.

- **Destroyed.**

The recording of a feature as destroyed will indicate the entire interest feature has been affected to such an extent that there is no hope of recovery, perhaps because its supporting habitat or processes have been removed or irretrievably altered.

SAC-Features	SAC-Sub-features	ASSI-Features	Condition-Assessment		
			2002-2007	2008-2013	2014-2018
Large shallow inlets and bays	Subtidal sand and gravel communities	N/A	Favourable	Not assessed	Favourable
	Subtidal fine sand and mud communities	N/A			Favourable
Coastal lagoon	Tide-swept communities	Intertidal rock and underboulder communities	Favourable	Not assessed	Favourable (Reported within condition assessment for SL3 ASSI)
Mudflats and sandflats not covered by seawater at low tide	Intertidal <i>Zostera</i> sp. beds	Intertidal mudflats and sandflats	Favourable	Not assessed	Favourable (Reported within condition assessment for SL ASSI part 1,2 and 3)
	Intertidal sand and gravel communities				
	Intertidal fine sand and mud communities				
Reefs					
	Intertidal rock and boulders communities	Intertidal rock and underboulder communities	Favourable	Not assessed	Favourable (Reported within condition assessment for SL ASSI part 1,2 and 3)
	Subtidal rock and boulders communities	N/A	Favourable	Not assessed	Favourable
	Subtidal rocky reef communities	N/A	Favourable	Not assessed	Favourable
	<i>Modiolus modiolus</i> beds	N/A	Unfavourable declining	Not assessed	Unfavourable - Recovering
<i>Phoca vitulina</i>	N/A	Common seal (Harbour seal)	Favourable	Not assessed	Unfavourable - Declining



An underwater photograph showing a jellyfish with a reddish-brown bell and a translucent, fringed margin. The jellyfish is positioned in the lower center of the frame. The background is a dark, greenish-brown seabed covered with various marine organisms, including small fish and coral. A white speech bubble is overlaid on the right side of the image, containing the text "Thank you, and please leave me in peace".

Thank you, and
please leave me
in peace