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Nature Working Naturally™

License Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482). In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species (2011) and the EU Habitats Directive 92/43/EEC.

Appendix 5: Impact Assessment of *A. nodosum* harvesting activities on Clew Bay SAC

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Introduction

Overview: The section describes the scoring, decisions and results obtained during the hazard analysis of *A. nodosum* harvesting in Clew Bay.

Site Name: Clew Bay Complex (Site Code 1482)

Activity under assessment: Harvesting *A. nodosum* in Clew Bay. Assessors: Kieran J. Guinan, PhD. & Brian Fanning B. Eng (BioAtlantis Ltd).

Scope of current assessment:

- (a) Marine & Coastal species & habitats (as protected under Annex I & II of EU Habitats Directive 92/43/EEC).
- (b) Species & habitats of general interest.
- (c) *Ascophyllum nodosum* biotope and species therein.

NOTE: For a summary of the findings of this hazard analysis, please consult Section 3.3.6 and Tables 10, 11, 12 and 13 of the main text document.

Methodology employed:

This system outlined below was used in determining which hazard(s) require control measures. Identification of control measures was based on a 5x5 risk analysis matrix. Risk scores are calculated on basis of probability of hazard occurring multiplied by severity by which the respective hazard imposes on the species/habitat under assessment. High risk hazards (i.e. ≥ 15) automatically require a Natura Impact Statement (NIS). In the event of moderate risks being identified, it was deemed necessary to assess whether or not an NIS was required, through working with independent environmental consultants.

Figure 1: Risk calculations

Likelihood of Hazard Occurring:

1. Highly Improbable
2. Probable - annually
3. Infrequent - 2-3 times/year
4. Occasional - monthly
5. Frequent – weekly

Severity of Consequences:

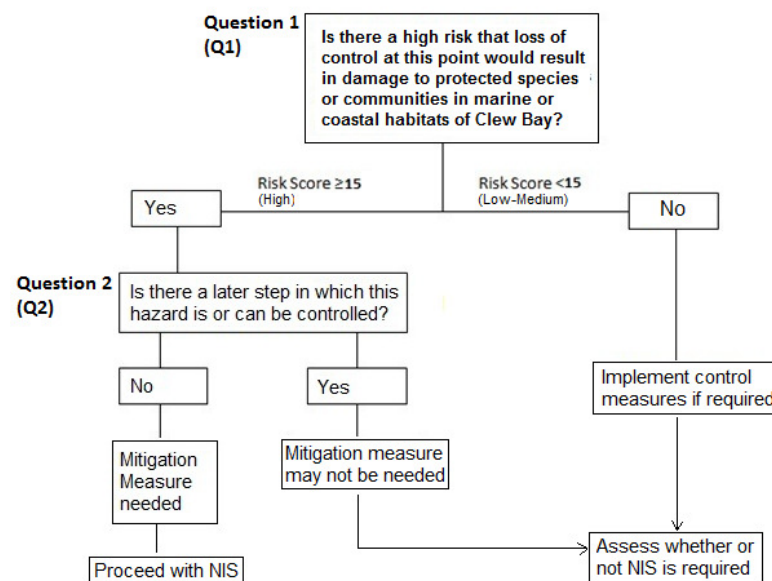
1. Low
2. Low to moderate
3. Moderate
4. Moderate to high
5. High

Risk Rating = Probability x Severity

		SEVERITY				
		5	4	3	2	1
PROBABILITY	5	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Risk Ratings are grouped into three categories:
 15 – 25: High risk, requiring mitigation measure;
 8 – 12: Moderate risk, establish control procedures;
 1 – 6: Low risk, establish control measures if appropriate.

Figure 2: Decision Tree



Results & Control measures

(a) Marine & Coastal species & habitats (as protected under Annex I & II of EU Habitats Directive 92/43/EEC).

(1) Permanent habitat area

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species	Non-conformance with harvest procedures leading to inadvertent removal of habitats, e.g. sand, shingle, stones, rock, debris, holdfasts).	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> Harvesters will be trained to ensure that no removal of permanent habitat occurs, i.e. <ul style="list-style-type: none"> No removal of sand, shingle, stone. No removal of <i>A. nodosum</i> holdfasts that could carry sand, shingle, stone. Resource Manager will inspect the harvest on connection and during the washing bagging operation on the collection vessel. <ul style="list-style-type: none"> If excessive sand, shingle or debris is observed in water separator or Mill, the harvester will be re-trained as required. Production Operators will inspect of incoming harvest via Goods Received Notes (GRNs) (See appendix 3). <ul style="list-style-type: none"> If sand, shingle or debris is present in harvested weed: <ul style="list-style-type: none"> -Removal by sand filter and decanter and clarifier. -Harvester undergoes re-training as required If stones or rocks are present: <ul style="list-style-type: none"> Harvester undergoes re-training as required. Non-conformance is reported, particularly in the serious event of <i>A. nodosum</i> holdfasts being present. 	EU Dir. 92/43/EEC & NPWS Target 1 of Objective 1, NPWS, 2011A, page 12.

Chemical: Synthetic and naturally occurring substances, cleaning residues, oil/grease, fuel, etc.	Fuel oil leak from harvest recovery/collection vessel caused by engine malfunction, fuel line rupture, etc. Non-conformance with procedures for storing and cleaning of boat.	1	3	A	no	n/a	yes	Routine maintenance of boat engine, etc Harvesters will be trained to ensure cleaning takes place in a manner which does not lead to wash off of cleaning agents into the environment, e.g. use of designated washing bays where available.	
Physical: Heat, cold, noise, vibration, mechanical hazards, ionising radiation (e.g. X-rays) and non-ionising radiation (e.g. microwaves), solar radiation. Presence of foreign matter (rubber, plastic, sand, stones, glass, metal, organic material)	Debris from the boat may inadvertently be deposited into the environment	1	3	A	no	n/a	yes	Appropriate removal of rubbish, debris or other foreign matter when at port.	

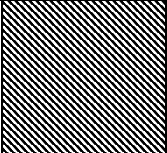

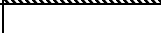


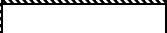
Hazard	Probability	Severity	Reason for Decision
Biological	2		Likelihood of sand and rocks being removed along with harvested <i>A. nodosum</i> is low as: (a) such materials may result in damage to production equipment and end product and (b) harvested <i>A. nodosum</i> will be collected in floating nets at high tide. This system ensures settlement to the seabed of any rarely occurring sand or rocks in the netting/harvested weed. In addition, <i>A. nodosum</i> will be harvested no less than 300mm above the holdfast. This reduces the likelihood of holdfasts being removed, which could otherwise, inadvertently lead to removal of attached pebbles or stones (see Appendix 4 for Code of Practise)
		5	In accordance with EU Dir. 92/43/EEC & NPWS, areas must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area (Ref: Target 1 of Obj. 1, NPWS, 2011A, pg. 12). Removal of habitat in the form of sand or rock would contravene this directive.
Chemical	1		It is highly improbable that a chemical hazard will occur given that no chemical wills be carried on board the boat, except for standard cleaning and hygiene equipment.
		3	Severity associated with chemical hazards coming in contact with the permanent habitat of Clew Bay could be significant, particularly to marine life which are sensitive to chemical toxins and could contravene Target 1 of Objective 1, NPWS, 2011A, page 12.
Physical	1		It is highly improbable that debris will inadvertently be deposited into the environment, as harvesters will be trained in general hygiene best practises and means of disposing of general and mechanical waste associated with the boat.
		3	Severity associated with physical waste is potentially significant as it could lead to damage to the permanent habitat area.

(2) Zostera Seagrass (and associated communities).

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required. .

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Regulatory Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Zostera Seagrass and associated communities).	Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	•Harvest of <i>A. nodosum</i> in these areas will not take place.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	1		It is highly improbable that the distribution, abundance, diversity or area occupied by Zostera Seagrass (and associated communities) will be altered due to harvesting of <i>A. nodosum</i> given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which <i>A. nodosum</i> will be harvested and (b) the sandy substrate supporting Zostera growth are insufficient to support <i>A. nodosum</i> and thus, will not be affected by harvest activities.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of Zostera Seagrass and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage these areas.
Chemical			n/a
Physical			n/a

(3) Maerl Dominated communities

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Maerl Dominated communities)	Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	•Harvest of <i>A. nodosum</i> in these areas will not take place.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	1		It is highly improbable that the distribution, abundance, diversity or area occupied by maerl and associated communities will be altered due to harvesting of <i>A. nodosum</i> given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which <i>A. nodosum</i> will be harvested and (b) the coarse, mixed, sandy mud and muddy sand sediment substrates which support maerl growth are insufficient to support <i>A. nodosum</i> and thus, will not be targeted for harvest activities.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of maerl and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage maerl and associated communities
Chemical /Physical			n/a
			n/a

(4) Polychaetes & bivalves community complex (Intertidal and sub-tidal Sandy mud areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Sandy mud with polychaetes & bivalves community complex)	Unauthorized harvest in mudflat/sandflat areas during low tide.	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> Ensure implementation of code of practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflats and sandflats (see Appendix 4) 	EU Dir. 92/43/ EEC & NPWS Maintain polychaete & bivalve community complex in Sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	2		It is highly improbable that the distribution, abundance, diversity or area of sandy mud occupied by polychaete & bivalve community complex will be altered due to harvesting of <i>A. nodosum</i> given that: (a) the intertidal sandy mud areas containing these communities exhibit little overlap with the rocky shorelines in which <i>A. nodosum</i> will be harvested and (b) sandy and muddy areas are insufficient to support growth of <i>A. nodosum</i> and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond mudflat/sandflat areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of polychaete & bivalve community complex in Sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical			n/a
			n/a

(5) *Nephtys cirrosa* community (clean, fine sand areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Fine sand dominated by <i>Nephtys cirrosa</i> community)	Unauthorized harvest in these protected areas during low tide.	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> Ensure implementation of Code of Practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond clean, fine sand areas in the south west of the complex (see Appendix 4) 	EU Dir. 92/43/ EEC & NPWS Maintain <i>Nephtys cirrosa</i> community in fine sand areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	2		The probability of <i>Nephtys cirrosa</i> communities and their habitat (clean, fine sand area) being altered due to harvest activities in Clew Bay is relatively low given that: (a) the fine sand areas containing this community exhibit little overlap with the rocky shorelines in which <i>A. nodosum</i> will be harvested and (b) fine sand areas are insufficient to support growth of <i>A. nodosum</i> and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond clean, fine sand areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of the <i>Nephtys cirrosa</i> community in fine sand areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical			n/a
			n/a

(6) *Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Damage to or removal of habitat required by <i>Tubificoides benedii</i> and <i>Pygospio elegans</i> communities (i.e. Intertidal sandy mud)	Use of boat to access rocky shorelines which lie beyond mudflats at low tide.	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> Ensure implementation of code of practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas, within which <i>Tubificoides benedii</i> and <i>Pygospio elegans</i> reside (see Appendix 4) 	EU Dir. 92/43/ EEC & NPWS Maintain <i>Tubificoides benedii</i> and <i>Pygospio elegans</i> community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		The probability of <i>Tubificoides benedii</i> & <i>Pygospio elegans</i> species and their habitat (intertidal sandy mud) being altered due to harvest activities in Clew Bay is relatively low given that: (a) <i>A. nodosum</i> does not grow on intertidal sandy mud substrate, and therefore will not be subjected to harvest activities. (b) in most areas, intertidal sandy mud areas exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines that lie beyond intertidal sandy mud areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires maintenance of <i>Tubificoides benedii</i> and <i>Pygospio elegans</i> community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.
Chemical : none identified			n/a
			n/a
Physical:			n/a
			n/a

(7) Shingle (pebbles and gravel)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Shingle (pebbles and gravel))	Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	•Harvest of <i>A. nodosum</i> in these areas will not take place.	EU Dir. 92/43/ EEC & NPWS Maintenance of single habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	1		It is highly improbable that distribution, abundance, diversity or area of shingle will be altered due to harvesting of <i>A. nodosum</i> given that: (a) shingle is insufficient to support growth of <i>A. nodosum</i> and thus, will not be targeted for harvest activities and (b) shingle will not be removed during harvest. In addition, a recent survey of 8 sites in Clew Bay found no incidence of single in the vicinity of <i>A. nodosum</i> growth areas (see Appendix 1).
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of single habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical			n/a
			n/a

(8) Reef

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Removal of habitat (i.e. reef)	Potential removal of small quantities of stones, rocks, etc	1	5	A	no	n/a	yes	Hand harvest techniques employed along rocky shores will ensure that <i>A. nodosum</i> is severed above point of contact with underlying substrate (see Appendix 4).	EU Dir. 92/43/ EEC & NPWS
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Maintenance of reef habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Physical: Disruption and damage reef.	Impact by boats	1	5	A	no	n/a	yes	A code of practice will be implemented to ensure that harvesters employ good boating practices, particularly when landing on shores (See Appendix 4).	

Hazard	Probability	Severity	Reason for Decision
Biological	1		It is highly improbable that distribution, abundance, diversity or area of reef will be altered due to harvesting of <i>A. nodosum</i> . While <i>Ascophyllum nodosum</i> may be harvested in from rocky shores which contain reef as underlying substrate, the hand harvesting technique used ensures that <i>A. nodosum</i> vegetative growth is severed well above the point of contact with reef. Contact with reef would also lead to damage to the harvesters sickle/blade, thus, reef will always be avoided.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of reef in a natural condition (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Chemical:			
			n/a
Physical:	1		It is highly improbable that reef will be damaged due to harvesting of <i>A. nodosum</i> given that: (a) harvesters will be using small boats to land on islands and coastal areas. Care will be taken in order to ensure that contact with reef is minimal, therefore avoiding any damage being inflicted on the vessel. (b) The harvest collection boat will be fitted with a depth can device to ensure that contact with the reef is avoided as it will damage both the reef and the boat
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of reef in a natural condition (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

(9) Mudflats and sandflats not covered by seawater at low tide.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk Assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	EU Dir. 92/43/ EEC & NPWS The permanent habitat area is stable or increasing, subject to natural processes (Ref: Target 1 of Objective 2, NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: disruption of intertidal sandy mud.	Use of boat during low tide to access rocky shorelines which lie beyond mudflat or sandflats.	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> Ensure implementation of Code of Practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas (see Appendix 4) 	

Hazard	Probability	Severity	Reason for Decision
Biological: none identified			n/a
			n/a
Chemical: none identified			n/a
			n/a
Physical: Disruption of intertidal sandy mud.	2		The probability of mudflats and sandflats being altered due to harvest activities in Clew Bay is relatively low given that: (a) this substrate is not suitable for <i>A. nodosum</i> growth will not be targeted for harvest activities and (b) in most areas, mudflats and sandflats exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines lie beyond mudflats and sandflats at low tide in particular, is very difficult and would be avoided by harvesters.
		5	EU Dir. 92/43/EEC & NPWS, requires maintenance of <i>Tubificoides benedii</i> and <i>Pygospio elegans</i> community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.

(10) Harbour seals: General population.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Decision Tree			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Human activities Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and entering the water, man-made energy (Ariel or underwater noise), deterioration of resources such as water quality or food source	Unauthorized presence of harvesters at haul out sites or activities known to cause seals to 'flush out' and enter the water.	2	5	A	no	n/a	yes	BioAtlantis will issue the "Code of Practice" for the Protection of the Harbour Seal (Appendix 4), to ensure that harvesters: <ul style="list-style-type: none"> • Have full knowledge of the sites in Clew Bay known to be relevant the harbour seal. • Full knowledge of harbour seal sites which have been excluded from this application. • Understand the steps required to ensure that all contact with seals is prevented from day to day. • Understand best practises for dealing with contact with seals should it occur and methods of reporting such incidents should they arise. • In rare cases where contact occurs, harvesting will cease immediately and harvesters will move to new location. • Harvesters follow clearly defined routes according to pre-planned schedules. • Engines will run at a constant rate in areas important to the harbour seal during sensitive times of the year, e.g. haul out sites and not enter within 100m of these sites at sensitive times of the season. • Avoid stalling or slowing down unnecessarily en route to harvest locations or pick up points (pier, etc). See Appendix4 for details of the "BioAtlantis Code of Practice" for the Protection of the Harbour Seal along with site-specific measures and general measures. For details on action limits, analytical procedures monitoring and corrective actions, see Table 11 of main text.	EU Dir. 92/43/EEC & NPWS Human activities should occur at levels that do not adversely affect the harbour seal population at the site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16)

Hazard	Probability	Severity	Reason for Decision
Human Activities	2		Contact with harbour seals at haul out sites will be minimal as harvest will not be permitted at haul out sites during sensitive times of year. Boats will also operate in a manner known to least affect seal behaviour (see Appendix 4 for details).
		5	EU Dir. 92/43/EEC & NPWS, requires that human activities should occur at levels that do not adversely affect the harbour seal population at the Clew Bay site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16). Seals are very sensitive to the presence of humans and activities in boats, which can lead to alterations in important behavioural activities such as 'flushing out' into water or leaving haul out sites.

(11) Harbour seals: species range

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	EU Dir. 92/43/ EEC & NPWS Species range should not be restricted by artificial barriers to site use (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Restriction of the harbour seal species range.	Presence of artificial barriers.	n/a	5	n/a	n/a	n/a	n/a	Physical barriers which could block access to harbour seals and site of importance to their species will not be installed in Clew Bay.	

Hazard	Probability	Severity	Reason for Decision
Biological:			n/a
			n/a
Chemical:			n/a
			n/a
Physical:	n/a		It is highly improbable that hand harvest of <i>A. nodosum</i> will restrict or affect the species range of harbour seals in Clew Bay due to the use of artificial physical barriers and no such barriers will be used in operations.
		5	EU Dir. 92/43/EEC & NPWS, requires that human activities should not involve the use of artificial barriers to site use, which could affect the range of the harbour seal species (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15). Restrictions on the range of harbour seals could have significantly negative effects on this protected species which would contravene EU Law.

(12) Harbour seals (Breeding sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and entering the water).	Unauthorized presence of harvesters in areas important to the harbour seal during breeding (between May-July)	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> No harvest at breeding sites between May-July. Boats operated using methods which have least affects on harbour seals. See "BioAtlantis Code of Practice" for protection of the harbour sea" for details (Appendix 4)	EU Dir. 92/43/ EEC & NPWS Breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Noise	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15). Human contact is a known risk factor which can negatively impact upon harbour seal breeding and activities which take place on thereafter.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(13) Harbour seals (Moulting sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and enter the water).	Unauthorized presence of harvesters in areas important to the harbour seal during moulting (between Aug-Sept)	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> No harvest at moulting sites between Aug-Sept. Boats operated using methods which have least affects on harbour seals. See "BioAtlantis Code of Practise" for protection of the harbour seal for details (Appendix 4).	EU Dir. 92/43/EEC & NPWS Moulting-out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that Moulting-out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15). Human contact is a known risk factor which can negatively impact upon harbour seal behaviour during times of moult.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(14) Harbour seals (Resting sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and enter the water).	Unauthorized presence of harvesters in areas important to the harbour seal during resting (between Nov-April)	2	5	A	no	n/a	yes	<ul style="list-style-type: none"> No harvest at resting sites between Oct-April. Boats operated using methods which have least affects on harbour seals. See "BioAtlantis Code of Practise" for protection of the harbour seal for details (Appendix 4).	EU Dir. 92/43/ EEC & NPWS Resting Haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

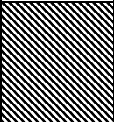







Hazard	Probability	Severity	Reason for Decision
Biological:	2		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that Resting Haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15). Harbour seal spend much of their time scanning their surrounding area during times of rest. Human contact can have negative impacts upon harbour seal resting behaviour, and can lead to seals leaving the area.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(15) Perennial vegetation of stony banks

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Perennial veg. of stony banks).	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest , storage and transport activities will be forbidden in these locations. Harvest must occur along rocky shorelines followed by immediate collection and transfer from nets to the boat and picked up via existing pier and road networks.	EU Dir. 92/43/ EEC & NPWS To maintain the favorable conservation condition (ref: Objective 1, NPWS, 2011B, pg. 6).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to vegetation found at or above the mean high water spring tide mark on shingle beaches.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	<ul style="list-style-type: none"> • Training: Harvesters will be trained to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will be recorded on GRNs (See Appendix 3). • Inspection of GRNs by QC at BioAtlantis. 	

Hazard	Prob-ability	Severity	Reason for Decision
Biological	1		It is highly improbable that Perennial vegetation of stony banks in Clew Bay will be affected due to harvesting of <i>A. nodosum</i> given that: (a) piers will be required to unload the boat - use of banks for this purpose will be forbidden, (b) <i>A. nodosum</i> does not grow in these locations, and therefore will not be subject to harvest activities, (c) contamination with other materials may result in damage production equipment and end product and (d) harvested weed will not be stored on land. This ensures no inadvertent co-removal of protected species such as perennial vegetation.
		5	EU Dir. 92/43/EEC & NPWS, requires that Perennial vegetation of stony banks are maintained in favourable condition (ref: Obj. 1, NPWS, 2011B, pg. 6). Any activities which would lead to removal of biological material could significantly damage these areas and would contravene this directive.
Chemical:			n/a
			n/a
Physical:	1		The probability of physically impacting upon Perennial vegetation of stony banks is exceptionally low given that: (a) <i>A. nodosum</i> does not grow in these environs and thus will not be subjected to harvest activities and (b) Harvesters will be trained to ensure that all transport activities will take place using established piers and roadways. Under no circumstances will transport be permitted to occur in these areas.
		5	Severity associated with disruption and damage to this environment is potentially significant as it could lead to damage to the permanent habitat area.

(16) Atlantic salt meadows

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Atlantic salt meadows)	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest, storage and transport activities will be forbidden in these locations. Harvest must occur along rocky shorelines rather than in the areas of mud or sand substrate which is required for Atlantic salt meadow environs & associated species.	EU Dir. 92/43/EEC & NPWS To restore the favourable conservation condition (ref: Objective 2, NPWS, 2011B, pg. 9)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to stands of vegetation which occur along sheltered coasts.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	<ul style="list-style-type: none"> Training: Harvesters will be trained to ensure that all transport activities take place using existing piers and roadways. Locations of harvest and pick-up points will recorded on GRNs (See Appendix 3). Inspection of GRNs by QC personnel at BioAtlantis HQ 	

Hazard	Prob-ability	Sever-ity	Reason for Decision
Biological:	1		It is highly improbable that Atlantic salt meadows in Clew Bay will be affected due to harvesting of <i>A. nodosum</i> given that: (a) established piers will be required to unload the boat - use of atlantic salt meadow areas for this purpose will be forbidden, (b) <i>Ascophyllum nodosum</i> does not grow in these locations, and therefore will not be subject to harvest activities, (c) contamination with other material may result in damage to production equipment and end product and (d) harvested weed will not be stored on land or in salt meadow areas. This ensures no inadvertent co-removal of protected species characteristic of Atlantic salt meadows.
		5	EU Dir. 92/43/EEC & NPWS, requires that the favourable conservation condition of Atlantic salt meadows be restored (ref: Objective 2, NPWS, 2011B, pg. 9). Any activities which would lead to removal of biological material could significantly damage these areas and would contravene this objective.
Chemical:			n/a
			n/a
Physical:	1		It is highly improbable that Atlantic salt meadows in Clew Bay will be altered due harvesting of <i>A. nodosum</i> given that: (a) <i>A. nodosum</i> does not grow on intertidal sandy mud substrate in these environs and thus will not be subjected to harvest activities and (b) Harvesters will be trained to ensure that all transport activities will take place using established piers and roadways. Under no circumstances will transport be permitted to occur in these areas.
		5	Severity associated with disruption and damage Atlantic Salt meadows is potentially significant as it could lead to damage to the permanent habitat area.

(17) Sand dune habitats

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Sand dune habitats)	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest , storage and transport activities will be forbidden in these locations. Harvest must occur along rocky followed by immediate collection and transfer from nets to the boat.	EU Dir. 92/43/EEC & NPWS To restore the favourable conservation condition. (ref: Objective 3, NPWS, 2011B, pg. 15).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to: Annual vegetation of drift lines along the high tidal mark of Clew Bay. Embryonic shifting dunes above the strandline. Shifting dunes.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	<ul style="list-style-type: none"> • Training: Harvesters will be trained to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will recorded on GRNS (See Appendix 3). • Inspection of GRNs by QC at BioAtlantis. 	

Hazard	Probability	Severity	Reason for Decision
Biological	1		It is highly improbable that sand dune habitats or species therein will be affected due to harvesting of <i>A. nodosum</i> given that: (a) Loading and transport activities will occur exclusively using established piers and road networks, (b) <i>Ascophyllum nodosum</i> does not grow in these locations, and therefore will not be subject to harvest activities, (c) contamination with other material may result in damage to production equipment/end product and (d) harvested weed will not be stored on land. This ensures no inadvertent co-removal of protected species in sand dune habitats.
		5	EU Dir. 92/43/EEC & NPWS, requires the favourable conservation condition of sand dune habitats be restored (ref: Objective 3, NPWS, 2011B, pg. 15). Any activities which would lead to removal of biological material could significantly damage these areas, thus contravening these objectives.
Chemical:			n/a
			n/a
Physical:	1		It is highly improbable that sand will be physically damaged due to harvesting of <i>A. nodosum</i> given that: (a) <i>A. nodosum</i> does not grow on in these environs and thus will not be subjected to harvest activities and (b) Harvesters will be trained to ensure that all transport activities will take place using established piers and roadways. Under no circumstances will transport be permitted to occur in these areas.
		5	Severity associated with disruption and damage to sand dune habitats is potentially significant as it could lead to damage to the permanent habitat area.

(18) Otter (*Lutra lutra*)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Negative impacts: <ul style="list-style-type: none"> • Distribution of positive survey sites • Extent of terrestrial habitat • Extent of marine habitat • Extent of freshwater (river) habitat. • Extent of freshwater (lake/lagoon) Exabitat. • Number of couching sites and holts • Decline in fish biomass • Increase in barriers to connectivity 	<ul style="list-style-type: none"> • Damage to freshwater habitats • Damage to marine habitats. • Damage to fish resources. • Blocking access to sites 	1	5	A	no	n/a	yes	<ul style="list-style-type: none"> • All freshwater habitats are excluded from harvest activities. • No activities in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace. No activity at the mouth of Lough Furnace. • BioAtlantis will manage activities in a sustainable manner to prevent excessive removal of <i>A. nodosum</i> and in turn, circumvent any potentially negative effects on species further along the food chain, e.g. fish & otters. Harvest will not exceed 20% per annum (see Table C1a, "<i>A. nodosum</i>", in the next section for details). See "BioAtlantis Code of Practise" for details (Appendix 4).	EU Dir. 92/43/ EEC The Wildlife Acts, 1976 and 2000 (Rep. of Ireland)
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		Hand harvesting of <i>A. nodosum</i> will occur in the intertidal zone with no activities in freshwater habitats. Hand harvesters will not engage in activities which would block sites of relevance to otters, including holt sites. There will be no barriers to block access to otters to and from and between sites. It is highly improbable that otter food supply will be depleted due to harvest activities in Clew Bay. In particular, Kelly et al., (2001), indicate that hand harvest is not associated with reductions in fish numbers within the <i>A. nodosum</i> biotope. In terms of potential direct effects on otters, recent assessments indicate that there are no significant relationships between the percentage occurrence of otters and human disturbance in SACs in Ireland (Bailey and Rochford 2006). Moreover, there are no differences in the occurrence of otters between sites within and outside of SACs.
		5	Otters are listed as a protected species under EU directives. Any activities which would negatively impact and contribute to the decline of this species would be severe. Otters are deemed to be in decline in many parts of Europe with risks including roads, fishing nets and lobster pots

			(NPWS 2007). Organochlorine pesticides are widely accepted as having severely reduced otter population sizes in the UK (Jones and Jones, 2002).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(19) Birds

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Negative impacts on habitats relevant to species of bird and their behaviour	This may occur due to: <ul style="list-style-type: none"> Excess removal of <i>A. nodosum</i> habitat, which constitutes part of the wider feeding, requirements of some species of bird in Clew Bay. Potential impact on algae as secondary food source (ref: NPWS 2013). Human disturbance at nesting colonies can lead to abandonment of nest or chicks. Human presence may lead to trampling of nests. Disturbance leading to flight events. 	1	5	A	no	n/a	yes	<p>BioAtlantis Ltd. will manage harvesting in a sustainable manner to ensure that excessive removal of <i>A. nodosum</i> does not occur and is limited to 20% per annum (see Table C1a, "<i>A. nodosum</i>", in the next section for details).</p> <p>Harvest at sites established by NPWS as important to important wintering and breeding species (data obtained from Susan Callaghan & Jochen Roller, NPWS, pers. comm. 03/12/2013), will not be harvested at sensitive times of year (see Appendix 6).</p> <p>See "BioAtlantis Code of Practise" for protection of bird species for more details (Appendix 4).</p>	Annex I of the E.U Birds Directive
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	1		Contact with breeding and wintering birds at sites specified by NPWS (Susan Callaghan & Jochen Roller , pers. comm. 03/12/2013) will be minimal. Harvest will not be permitted at these sites during sensitive times of year. See Appendix 6 for detailed description of the distribution, requirements and control measures for avian species of interest in Clew Bay. See Appendix 4 for Code of Practice.
		5	Protected species listed on Annex I of the E.U Birds Dir. include: Common Tern, Arctic Tern, Little Tern, Barnacle Goose, Great Northern Diver, Bar tailed Godwit. Activities which would negatively impact on these species would be severe and contravene EU regulations. Other species reaching

			important numbers in Clew Bay: Red-breasted Merganser, Ringed Plover, Barnacle Geese (present on islands in winter), Great Northern Diver, Brent Goose, Shelduck, Wigeon, Teal, Mallard, Oystercatcher, Cormorant, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(b) Species & habitats of general interest.

(1) Fish

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of zones important for feeding, reproduction and/or sheltering of fish species such as trout and salmon.	Excess removal of habitat in the form of <i>A. nodosum</i> due to mismanagement and overharvesting of resources.	1	2	A	no	n/a	yes	BioAtlantis Ltd. will manage harvesting activities in a sustainable manner to ensure that excessive removal of <i>A. nodosum</i> does not occur and is limited to 20% per annum (see Table C1a, " <i>A. nodosum</i> ", in the next section for details). In addition, no activities will take place in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace, thus preventing any impact during important life-cycle stages.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Prob-ability	Severity	Reason for Decision
Biological	1		In the absence of appropriate systems of management, monitoring and verification, there is increased likelihood of excess removal of <i>A. nodosum</i> which in turn, may impact upon species of fish who use these zones for feeding, reproduction and/or sheltering. However, it is highly improbable that fish numbers will be affected by harvest activities in Clew Bay given that: (a) Harvest of <i>A. nodosum</i> will be undertaken sustainably and will not exceed 20% per annum, thus ensuring maintenance of the <i>A. nodosum</i> habitat. (b) Important catchment areas such as Burrishoole will be excluded from all harvest-related activities. (b) Studies indicate that hand harvest of <i>A. nodosum</i> does not significantly effect fish and large mobile epifauna (Kelly et al., 2001).
		2	While there are no protected fish species in the Clew Bay complex, the Burrishoole Catchment area of Clew Bay represents an important habitat for migratory fish species such as trout and salmon, and is regarded as a major European and world index site. Post smolt and adult sea trout feed within the Clew bay area and along with some other fish species, may use <i>A. nodosum</i> zones to a certain extent for purposes which include feeding, reproduction or sheltering (Kelly et al., 2001 and references therein).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2) Lough Furnace

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Damage to a rare example of a permanently stratified lake environment.	Human activities in this area may damage this environment.	1	4	A	no	n/a	yes	Not applicable, as this area and it's associated lakes will be completely excluded from all harvest activities.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		It is highly improbable that this environment and it's associated species will be affected by activities due to hand harvesting, as these areas are excluded from the current application.
		4	Lough Furnace represents a rare deep, permanently stratified saline lake lagoon, located at the north-eastern corner of Clew Bay. Species on its exterior include: Common Reed (<i>Phragmites australis</i>), Common Club-rush (<i>Scirpus lacustris</i>), small patches of Great Fen-sedge (<i>Cladium mariscus</i>) and Bottle Sedge (<i>Carex rostrata</i>). Other important flora and fauna within this environment includes: two rare amphipods (<i>Lembos longipes</i> and <i>Leptocheirus pilosus</i>), <i>Neomysis integer</i> , <i>Jaera albifrons</i> , <i>J. ischiosetosa</i> and <i>J. nordmanni</i> , Irish species of tasselweed (<i>Ruppia maritima</i> and <i>R. cirrhosa</i>), eel, flounder, mullet, mallard nest and black-headed Gull. As this habitat is so rare, the potential impact of human activities on these environs and associated species are given a severity score of 4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3) The Rossmurrevagh area

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species	Removal of habitat due to harvest and storage of material.	1	5	A	no	n/a	yes	Harvest and storage activities will be forbidden in these locations. Harvest must occur along rocky shorelines followed by immediate collection and transfer from nets to the boat.	none
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to diverse environs.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	<ul style="list-style-type: none"> • Training: Harvesters will be trained to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will recorded on GRNs (see Appendix 3). • Inspection of GRNs by QC personnel at BioAtlantis HQ 	

Hazard	Prob-ability	Severity	Reason for Decision
Biological	1		It is highly improbable that the Rossmurrevagh area and it's associated species will be affected by activities due to hand harvesting given that: (a) <i>A. nodosum</i> does not grow in these locations, and therefore will not be subject to harvest activities, (b) Contamination with other material may damage production equipment and end product, (c) Harvested weed will not be stored on land. This ensures no inadvertent co-removal of protected species in the Rossmurrevagh area.
		5	The Rossmurrevagh area includes a diverse range of habitats along the seashore, dunes, coastal grassland, saltmarsh, bog and fen. This includes: <ul style="list-style-type: none"> • Bog/fen type vegetation: Bog Asphodel and Cuckooflower (<i>Cardamine pratensis</i>), Bog Mosses, sedges, Bog-myrtle (<i>Myrica gale</i>), Irish Heath, Soft Rush (<i>Juncus effusus</i>), Water Mint (<i>Mentha aquatica</i>) and Yellow Iris (<i>Iris pseudacorus</i>). • Coastal grassland species: Common Ragwort (<i>Senecio jacobaea</i>), Daisy (<i>Bellis perennis</i>), Dandelion (<i>Taraxacum officinale</i>), Heath Wood-rush (<i>Luzula multiflora</i>), Ribwort Plantain (<i>Plantago lanceolata</i>) and Yarrow (<i>Achillea millefolium</i>). • Saltmarsh vegetation (5 m wide): Common Saltmarsh-grass (<i>Puccinellia maritima</i>), Common Scurvygrass, Thrift & 'turf fucoids'. A number of species and locations within Rossmurrevagh are protected (e.g. dunes) and therefore, a severity score of 5 has been assigned.
Chemical:			n/a
			n/a
Physical:	1		Low probability of physical damage as harvesters will be trained to ensure that all transport activities will take place using established piers and roadways. Under no circumstances will transport be permitted to occur in these areas.
		5	Disruption and damage to the physical environs of this region may negatively impact upon biodiversity in the area. As certain aspects to this are protected under EU Law (e.g. dunes), a severity score of 5 has been assigned to potential hazards to the biology of this area.

(c) *Ascophyllum nodosum* biotope and species therein.

(1a) *A. nodosum* seaweed.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Excess removal of <i>A. nodosum</i> habitat.	Mismanagement and/or lack of oversight of activities relating to hand harvest of <i>A. nodosum</i> .	2	3	A	no	n/a	yes	<p>BioAtlantis Ltd. will manage harvesting activities in a sustainable manner to ensure that excessive removal of <i>A. nodosum</i> does not occur and is limited to 20% per annum. The harvest technique will involve cutting no less than 300mm above the holdfast. Important components of the management system include:</p> <ul style="list-style-type: none"> • Training: Compulsory training of harvesters to ensure competence in skills required to harvest <i>A. nodosum</i> in an environmentally friendly and sustainable manner. • Protocols and schedules: Activities carried out according to clearly defined protocols to ensure that (a) no damage to the environment or underlying growth substrate, and (b) re-growth and re-generation of the vegetation post-harvest is sufficiently facilitated. Standard protocols and methods will include: <ul style="list-style-type: none"> ➤ Site determination: identification of areas suitable for harvest, e.g. areas predominated by short <i>A. nodosum</i> fronds will not be harvested. ➤ Harvest Methods: Use of sickle/knife to cut 300mm above frond base, without damaging holdfast or underlying substrate. ➤ Method for bagging of cut weed in nets. ➤ Method for communicating with BioAtlantis HQ. ➤ Method for reporting incidents to BioAtlantis HQ. • Responsibility: Oversight, planning and teaching provided by Scientific, Engineering & Quality personnel along with regularly auditing to assess for compliance with procedures and for potential areas of improvement. 	None specified by NPWS or EU regulations. However, <i>A. nodosum</i> grows intertidally on reef substrate.

Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

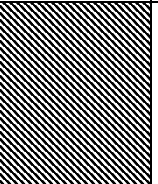
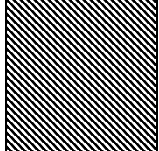








Hazard	Probability	Severity	Reason for Decision
Biological:	2		In the absence of strict oversight, the probability of excessive removal of <i>A. nodosum</i> habitat may occur. This was particularly evident in a recent survey of Clew Bay during which an areas previously characterised as having high density levels of <i>A. nodosum</i> , was found to have less cover than expected (see Appendix 1). The sites were characterised by an abundance of <i>A. nodosum</i> ‘stumps’, and evidence of two different types of harvest recent activities in the area was present. Moreover, <i>Fucus</i> sp. levels were notably dense within the <i>A. nodosum</i> zone, which may be consistent with studies by Kelly et al., (2001) and others which show that <i>Fucus</i> sp. coverage can increase as a result of hand harvesting of <i>A. nodosum</i> . To ensure that excessive removal of <i>A. nodosum</i> does not occur in Clew Bay, BioAtlantis will put a system in place which ensures that harvest activities are monitored, recorded, controlled and limited to 20% harvest per annum. This level of regulation is in keeping with the GMP+ Certification status of BioAtlantis, Ltd. and thus will ensure that the probability of over-harvesting of <i>A. nodosum</i> resources in Clew Bay is lowered.
		3	As this species is not protected under EU regulations, the severity associated overharvesting of <i>A. nodosum</i> on this species is reduced to reside within the range of 1-4. A moderate severity score of 3 was assigned given the significant effects which overharvesting can have on re-growth and re-generation of this species. However, high or moderate to high severity range would not be appropriate given that environmental impact assessment in Clew Bay (Kelly et al., 2001) demonstrate almost complete recovery of <i>A. nodosum</i> cover in less than two years post-harvest.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(1b) Fucus (*Fucus vesiculosus* Linnaeus and *Fucus serratus* Linnaeus)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of fucus	Overharvesting of <i>A. nodosum</i> and/or inadvertent harvest of nearby species of fucus.	2	3	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		Increases in the density of fucus species may occur due to hand harvesting of <i>A. nodosum</i> (Kelly et al., 2001). Indeed, a recent survey of Clew Bay found substantial evidence for high <i>Fucus</i> densities in areas found to have been subjected to recent harvest activities (See Appendix 1). However, the probability of inadvertent harvest of these fucoid species is low, given that: Harvest will be limited to larger vegetative growth of <i>A. nodosum</i> fronds, approx. 300mm above the base. Fucus is considered a contaminant and will be recorded as such in the GRN.
		3	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> or inadvertent harvest of these species is reduced to reside within the range of 1-4. However, a severity score of 3 was assigned given the important role of these species within the <i>A. nodosum</i> canopy and their presence in the Clew Bay complex (Kelly et al., 2001). A higher score of 4-5 is unjustified. This is due to the fact that overharvesting of <i>A. nodosum</i> is not detrimental to these species. In fact harvest of <i>A. nodosum</i> has been found to be associated with increased cover of <i>Fucus vesiculosus</i> in the Clew Bay region (Kelly et al., 2001).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2a): Red algae (e.g. *Polysiphonia lanosa* (Linnaeus) Tandy)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Role of *Polysiphonia lanosa* (Linnaeus) Tandy within the *A. nodosum* canopy:

In brief, *Polysiphonia lanosa* (Linnaeus) Tandy is a hemiparasitic species, predominately using *Ascophyllum nodosum* as a host and more rarely, *Fucus vesiculosus* (Guiry, M.D. & Guiry, G.M. 2013). This species is present throughout the north Atlantic in areas occupied by *A. nodosum* including Clew Bay SAC (Kelly et al., 2001).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of habitat important to epiphytes of <i>A. nodosum</i> , e.g. red algae, <i>Polysiphonia lanosa</i> (Linnaeus) Tandy	Overharvesting of <i>A. nodosum</i>	2	2	A	no	n/a	yes	As above in Table C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		As above in Section C1a (<i>A. nodosum</i>).
		2	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. However, a low-moderate severity score of 2 was assigned given the role of these species within the <i>A. nodosum</i> canopy and their presence in the Clew Bay complex (Kelly et al., 2001; see below for details). A higher score of 3-5 is unjustified. This is due to the fact that that these species also reside within other furoid biotopes such as <i>Fucus vesiculosus</i> , and thus, the hazard of overharvesting of <i>A. nodosum</i> would not represent a detrimental threat to the these populations. In addition, a recent survey of Clew Bay found this species to be relatively well represented in the <i>A. nodosum</i> biotope, occurring in 5 out of 8 1m ² quadrants which were assessed (See Appendix 1).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2b): Red algae (e.g. Mastocarpus stellatus (Stackhouse) Guiry)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Red algae Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse and Corallinaceae	Overharvesting of <i>A. nodosum</i>	1	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		It is highly improbable that Red algae, Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse will be altered due harvesting of <i>A. nodosum</i> given that: (a) The rare occurrence of these species within the <i>A. nodosum</i> canopy. (b) Harvest of <i>A. nodosum</i> will be limited to larger vegetative growth of <i>A. nodosum</i> fronds, approx. 300mm above the base, generally above the contact level with these species.
		2	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. A low severity score of 2 was assigned in the scenario of over-harvesting of <i>A. nodosum</i> . A higher score of 3-5 is unjustified as Red algae Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse and Corallinaceae growth are not known to be affected by <i>A. nodosum</i> harvesting.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2c): Ephemeral green algae

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong?)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Ephemeral green algae (e.g. <i>Cladophora rupestris</i> (Linnaeus) Kützinger, <i>Ulva</i> sp. Linnaeus and <i>Enteromorpha</i> sp. Link;	Overharvesting of <i>A. nodosum</i>	1	3	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		It is highly improbable that ephemeral green algae will be altered due harvesting of <i>A. nodosum</i> given the findings of Kelly et al., 2001, in which hand harvesting has no significant impact on ephemeral green algae over time. Also, species besides <i>A. nodosum</i> are considered as contaminants and will be recorded as such in the GRN.
		3	As these species are not protected under EU regulations the severity associated with overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. A moderate severity score of 3 was assigned given the important role of Ephemeral green algae in this zone. While occurring at low densities in <i>A. nodosum</i> biotope, alterations to ephemeral algae may lead to further alterations in herbivorous littorinid fauna (Kelly et al., 2011 and references therein). In turn, this has potential to decrease re-establishment of the fucoid canopies at the germling stage. However, vegetative reproduction rather than sexual reproduction is considered the most important mechanism in which the density of the <i>A. nodosum</i> population is maintained, most notably by generating shoot growth and subsequent increases in biomass for years thereafter.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2d): Other seaweed species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Role of *Lomentaria articulata* (Hudson) Lyngbye and *Membranoptera alata* (Hudson) Stackhouse, within the *A. nodosum* biotope:

Can occur on rocks and stones in pools, lower intertidal and subtidal (Guiry, M.D. & Guiry, G.M. 2013).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of other seaweed species: <i>Lomentaria articulata</i> (Hudson) Lyngbye and <i>Membranoptera alata</i> (Hudson) Stackhouse,	Overharvesting of <i>A. nodosum</i> and/or inadvertent harvest of nearby species of <i>Lomentaria articulata</i> (Hudson) Lyngbye and <i>Membranoptera alata</i> (Hudson) Stackhouse,	1	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		It is highly improbable that these species of seaweed will be altered due harvesting of <i>A. nodosum</i> given that: (a) Kelly et al., 2001, demonstrates an absence of <i>Lomentaria articulata</i> (Hudson) Lyngbye and <i>Membranoptera alata</i> (Hudson) Stackhouse in Clew Bay despite being present at low numbers on Connemara. (b) The frond length of these species generally does not exceed 200 mm and harvest will be limited to larger vegetative growth of <i>A. nodosum</i> fronds, approx. 300mm above the base. (c) species besides <i>A. nodosum</i> are considered as contaminants and will be recorded as such in the GRN.
		2	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> or inadvertent harvest of these species, is reduced to reside within the range of 1-4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3a): Winkles

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of winkles or removal of habitat important to Winkles.	Overharvesting of <i>A. nodosum</i>	3	3	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	3		As outlined in Section C1a above, there is low risk of excess removal of <i>A. nodosum</i> through hand harvesting. In addition, while Kelly et al (2001) show that reductions in number were observed in winter months, harvesting did not have an impact on the size distribution of <i>Littorina obtusata</i> at Clew Bay. However, positive correlations between <i>A. nodosum</i> density and winkles numbers were identified in the survey prepared in this application Clew Bay (Appendix 1). Therefore, there is potential for alterations in winkle numbers should overharvesting occur.
		3	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. However, a moderate severity score of 3 was assigned given the important position of winkles in the <i>A. nodosum</i> biotope and the apparent seasonal reductions of <i>Littorina obtusata</i> observed by Kelly et al., 2001. A higher severity score of 4-5 would be unjustified. This is due to the fact that that winkles also reside within other fucoid biotopes such as <i>fucus vesiculosus</i> , and thus, the hazard of overharvesting of <i>A. nodosum</i> would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3b): Limpets

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of limpets and/or habitat important to limpets.	Overharvesting of <i>A. nodosum</i>	3	3	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	3		As outlined Section C1a above, there is low likelihood of excess removal of <i>A. nodosum</i> through hand harvesting. As Kelly et al., (2001) demonstrate that hand harvesting of <i>A. nodosum</i> can be associated with increases and decreases in limpet density and size, a probability rating of 3 has been assigned for this potential hazard. While not statistically significant, a recent survey of Clew Bay (Appendix 1) also found a trend towards a positive correlations between <i>A. nodosum</i> density and limpet numbers (p=0.084). Therefore, there is likely to be some potential for alterations in wrinkle numbers should overharvesting occur.
		3	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. However, a moderate severity score of 3 was assigned given the important role of these species within the <i>A. nodosum</i> canopy and their presence in the Clew Bay complex (Kelly et al., 2001; see below for details). A higher score of 4-5 is unjustified. This is due to the fact that that these species also reside within other fucoid biotopes such as fucus vesiculosus, and thus, the hazard of overharvesting of <i>A. nodosum</i> would not represent a detrimental threat to these species.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3c): Barnacles

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of barnacles or habitat important to Barnacles	Overharvesting of <i>A. nodosum</i>	3	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	3		Boaden and Dring, 1980 reported a reduction in barnacle numbers due to <i>A. nodosum</i> harvest. These effects were not reported by Kelly et al., 2001. As outlined Section C1a above, there is a low likelihood of excess removal of <i>A. nodosum</i> through hand harvesting. This reduces the potential for negative effects on barnacle numbers.
		2	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. However, a low-moderate severity score of 2 was assigned as these species are widespread on rock substrate in the intertidal zone. A higher score of 3-5 is unjustified as these species also reside within other furoid biotopes such as fucus vesiculosus, and thus, the hazard of overharvesting of <i>A. nodosum</i> would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3d): Hydroid

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Hydroid (<i>Dynamena pumila</i> Linnaeus) or habitat important to these species.	Overharvesting of <i>A. nodosum</i>	3	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	3		As outlined Section C1a above, there is a low likelihood of excess removal of <i>A. nodosum</i> through hand harvesting. There is no evidence from the study by Kelly et al., (2001) that hand harvesting of <i>A. nodosum</i> in Clew bay is associated with alterations to density of hydroid species. However, their presence on the tips of <i>A. nodosum</i> increases the probability of altering their density.
		2	As these species are not protected under EU regulations the severity associated overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned given their presence and potential growth on tips of <i>A. nodosum</i> (Kelly et al., 2001; see below for details). A higher score of 3-5 is unjustified as <i>Dynamena pumila</i> Linnaeus species typically grows on other fucoid biotopes such as <i>Fucus serratus</i> . Hence , the overharvesting of <i>A. nodosum</i> should it occur, would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3e): Sponges

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Sponges (e.g., Leucosolenia sp. Bowerbank, Halichondria panicea Pallas and Hymeniacidon perleve Montagu)	Overharvesting of <i>A. nodosum</i>	2	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		While Boaden and Dring (1980) identified changes in density of Hymeniacidon and Halichondria species due to harvest of <i>A. nodosum</i> , numbers of these species in this biotope (in Clew Bay) were found to be very low (Kelly et al., 2001).
		2	As these species are not protected under EU regulations the severity associated with overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned. While hand harvesting of <i>A. nodosum</i> may be associated with reductions in sessile animals such as sponges, Halichondria panicea Pallas and Hymeniacidon perleve Montagu are more widespread and occur in more deeper waters. Leucosolenia sp. and Halichondria panicea were not found in upper or middle shores of Clew Bay where <i>A. nodosum</i> is found, while observed at low numbers increase in the lower zone (Kelly et al., 2001). Likewise, Hymeniacidon perleve were absent in the upper zone, at low levels in the middle zone while increasing into the lowers zone.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3f): Sea squirts

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard (What can go wrong)	Control Measure (What can I do about it?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Sea squirts (e.g. <i>Dendrodoa grossularia</i> van Beneden and <i>Asciidiella scabra</i> O.F. Müller)	Overharvesting of <i>A. nodosum</i>	1	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	1		Kelly et al., 2001, demonstrate that <i>Asciidiella</i> occur at low levels in the <i>A. nodosum</i> zone of Clew Bay.
		2	Since seasquirts such as <i>Asciidiella</i> are not protected under EU regulations, the severity associated with overharvesting of <i>A. nodosum</i> is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3g): Species/Habitat: Other Mobile species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

In the study by Kelly et al., 19 mobile animals were identified. However, in some cases, numbers were insufficient to allow for robust statistical analysis of the potential impact of hand harvesting of *A. nodosum*. Harvesting of *A. nodosum* did not have any significant effects on fish and other large mobile epifauna.

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological: Potential Alteration to density of or habitat important for Mobile species (Phylum Arthropoda (Amphipods, isopods crabs, Chironomida, Halacaridae, Ostracoda), Phylum Platyhelminthes (e.g. Turbellaria), Phylum Annelida, Phylum Foraminifera, Phylum Nematoda.	Overharvesting of <i>A. nodosum</i>	2	2	A	no	n/a	yes	As above in Section C1a (<i>A. nodosum</i>).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	2		The probability of overharvesting <i>A. nodosum</i> is outlined in Section C1a above. A higher score of 4-5 was unjustified as there is no evidence for alterations of these species in Clew Bay due to hand harvesting of <i>A. nodosum</i> . Of note, there was no recorded mobile species found in a recent survey of Clew Bay, either in dense or recently harvested areas (See Appendix 1).
		2	These species are not protected in EU or Irish Law, thus, the severity score is assigned between 1-4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a