Fisheries in European Sites Habitats Regulations Assessment for Amber and Green risk categories

NWIFCA-SF-EMS-003
Date completed: 4th April 2017
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Site: Solway Firth

European Designated Sites: UK0013025 Solway Firth Special Area of Conservation (SAC)
UK9005012 Upper Solway Flats and Marshes Special Protection Area (SPA)
UK11079 Upper Solway Flats and Marshes Ramsar
Solway Firth pSPA

European Marine Site: **Solway Firth**

Only features within the English part of the EMS are assessed by NWIFCA.

Qualifying Feature(s):

SAC and Ramsar

H1110. Sandbanks which are slightly covered by sea water all the time
H1130. Estuaries
H1140. Mudflats and sandflats not covered by seawater at low tide
H1170. Reefs
H1220. Perennial vegetation of stony banks; Coastal shingle vegetation outside the reach of waves (NON MARINE)
H1310. *Salicornia* and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand
H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); Atlantic salt meadows
H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland (NON MARINE)
S1095. *Petromyzon marinus*; Sea lamprey
S1099. *Lampetra fluviatilis*; River lamprey
S1106 *Salmo salar*: Atlantic Salmon (River Eden SAC Feature)
Natterjack toad (NON MARINE)

SPA and Ramsar

A001 *Gavia stellata*; Red throated diver (non-breeding) †
A038 Cygnus cygnus; Whooper swan (non-breeding)
A040 Anser brachyrhynchus; Pink-footed goose (non-breeding)
A045 Branta leucopsis; Barnacle goose (non-breeding)
A054 Anas acuta; Northern Pintail (non-breeding)
A062 Aythya marila; Greater Scaup (Ramsar only)
A130 Haematopus ostralegus; Eurasian oystercatcher (non-breeding)
A137 Charadris hiaticula; Ringed plover (non-breeding) †
A140 Pluvialis apricaria; European golden plover
A143 Calidris canutus; Red knot (non-breeding)
A157 Limosa lapponica; Bar-tailed godwit (non-breeding)
A160 Numenius arquata; Eurasian curlew (non-breeding)
A162 Tringa totanus; Common redshank (non-breeding)
Waterbird Assemblage

† Solway Firth pSPA feature

Site sub-feature/Notable communities(s):

SAC and Ramsar

Sandbanks which are slightly covered by sea water all the time – Subtidal coarse sediment, subtidal sand.
Estuaries - Intertidal mud, intertidal sand and muddy sand, intertidal mixed sediments, intertidal coarse sediment, intertidal stony reef, intertidal biogenic reef: mussel beds, intertidal biogenic reef: Sabellaria spp., subtidal biogenic reef: mussel beds, subtidal stony reef, subtidal biogenic reef: Sabellaria spp. subtidal coarse sediment, subtidal sand, subtidal mud, lower-mid saltmarsh, mid-upper saltmarsh, pioneer saltmarsh.
Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats – Intertidal mud, intertidal sand and muddy sand, intertidal mixed sediments, intertidal coarse sediment.
Reefs – Intertidal biogenic reef: mussel beds, intertidal biogenic reef: Sabellaria spp., intertidal rock, intertidal stony reef, subtidal biogenic reef: mussel beds, subtidal stony reef, subtidal stony reef, subtidal biogenic reef: Sabellaria spp., subtidal stony reef.
Perennial vegetation of stony banks
***Salicornia* and other annuals colonising mud and sand**
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (referred to as Saltmarsh) – lower to mid saltmarsh, mid to upper saltmarsh, pioneer saltmarsh.
Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland
River Lamprey
Sea Lamprey
Supporting habitat: Natterjack Toad (NON MARINE)- coastal sand dunes

SPA and Ramsar

Atlantic salt meadows (Glauco-puccinellietalia maritimae), freshwater and coastal grazing marsh, intertidal biogenic reef: mussel beds, intertidal biogenic reef: Sabellaria spp., intertidal coarse sediment, intertidal mixed sediments, intertidal mud, intertidal rock, intertidal sand and muddy sand, intertidal stony reef, subtidal biogenic reef: Sabellaria spp., subtidal sand, subtidal stony reef, water column, salicornia and other annuals colonising mud and sand.

Generic sub-feature(s):

Subtidal gravel & sand; Intertidal mud & sand; Intertidal gravel & sand; Saltmarsh spp., Sea lamprey; River lamprey; Subtidal boulder & cobble reef; Intertidal boulder & cobble reef; *Sabellaria* spp. Reef; Estuarine Birds; Benthic feeding Seabirds.

High Level Conservation Objectives:

Solway Firth SAC

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed above), and subject to natural change;
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;
 The extent and distribution of qualifying natural habitats and habitats of qualifying species
 The structure and function (including typical species) of qualifying natural habitats
 The structure and function of the habitats of qualifying species
 The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
 The populations of qualifying species, and,
 The distribution of qualifying species within the site.

Upper Solway Flats & Marshes SPA

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed above), and subject to natural change;
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;
 The extent and distribution of the habitats of the qualifying features
 The structure and function of the habitats of the qualifying features
 The supporting processes on which the habitats of the qualifying features rely
 The population of each of the qualifying features, and,
 The distribution of the qualifying features within the site.

Fishing activities assessed:

Gear type(s):
Towed Demersal **–** Beam Trawl (Shrimp – *Crangon crangon*)

1. Introduction

1.1 Need for an HRA assessment

In 2012, the Department for Environment, Food and Rural Affairs (Defra) announced a revised approach to the management of commercial fisheries in European Marine Sites (EMS). The objective of this revised approach is to ensure that all existing and potential commercial fishing activities are managed in accordance with Article 6 of the Habitats Directive.

This approach is being implemented using an evidence based, risk-prioritised, and phased basis. Risk prioritisation is informed by using a matrix of the generic sensitivity of the sub-features of EMS to a suite of fishing activities as a decision making tool. These sub-feature-activity combinations have been categorised according to specific definitions, as red, amber, green or blue.

Activity/feature interactions identified within the matrix as red risk have the highest priority for implementation of management measures by the end of 2013 in order to avoid the deterioration of Annex I features in line with obligations under Article 6(2) of the Habitats Directive.

Activity/feature interactions identified within the matrix as amber risk require a site-level assessment to determine whether management of an activity is required to conserve site features. Activity/feature interactions identified within the matrix as green also require a site level assessment if there are “in combination effects” with other plans or projects.

Some European Sites within the NWIFCA District consist of features that are not fully marine (eg. sand dunes) and therefore fall outwith of the EMS Review process. They have not been included in the original risk matrix. Due to the nature of some of the fisheries in the District, particularly intertidal fisheries, the NWIFCA has adopted the approach of carrying out full HRA on all the features (including non-marine) within European Sites to ensure that any potential risk from fishing activity has been identified and assessed.

Site level assessments are being carried out in a manner that is consistent with the provisions of Article 6(3) of the Habitats Directive, that is to determine that fishing activities are not having an adverse effect on the integrity of the site, to inform a judgement on whether or not appropriate steps are required to avoid the deterioration of natural habitats and the habitats of species as well as disturbances of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this directive.

If measures are required, the revised approach requires these to be implemented by 2016.

The purpose of this site specific assessment document is to assess whether or not in the view of NWIFCA the fishing activity shrimp beam trawling has a likely significant effect on the qualifying features of the Solway Firth European Site, and on the basis of this assessment whether or not it can be concluded that the shrimp beam trawling will not have an adverse effect on the integrity of this European Site.

1.2 Documents reviewed to inform this assessment

- Natural England's risk assessment Matrix of fishing activities and European habitat features and protected species[1]
- Reference list[2]
- Natural England's consultation advice
- Site map(s) – sub-feature/feature location and extent
- Fishing activity data (map(s), etc)

2. Information about the EMS

(See cover pages)
The Solway Firth European Site is a cross boundary site between England and Scotland, this assessment only covers the English/NWIFCA area.

3. Interest feature(s) of the EMS categorised as 'Red' risk and overview of management measure(s) (if applicable)

- Reefs: All bottom towed gear prohibited around area of *Sabellaria alevolata* reef by NWIFCA Byelaw 6.

4. Information about the fishing activities within the site

There are currently ten vessels that fish for shrimp that fish within the NWIFCA boundaries of the Solway Firth European Site: eight vessels from the Cumbrian fleet based at Silloth and Maryportn and two vessels from the Scottish fleet. The vessels range between 7m and 13.5m in length and are a variety of twin beams (typically 4.5m beam either side) and single beamers (with anything up to a 9m beam).The total beam length is restricted to 9m by CSFC Byelaw 14. The total weight of the gear including beam and net is approximately 500kg each side for twin beams or 1000kg for a 9m single beam. Operators are also restricted by mesh size and gear technical measures under CSFC Byelaw 14 and EC Council Regulation No. 850/98. All vessels use a veil which is a technical measure designed to reduce bycatch of non-shrimp species. Anecdotal information provided by fishers indicated a massive reduction in the amount of bycatch since using a veil.

The main shrimp season is from April to October. Many of the fishers who prosecute the shrimp fishery also prosecute a range of fisheries including mussel, cockle and scallop. If other fisheries are open and more lucrative than the shrimp fishery, effort will be concentrated on those. On average a full time fisher would fish between sixty and seventy tides a year. On an average day a vessel will do 6 tows at 90 minutes each at a speed of 2 knots. Typically high tide is targeted but boats will fish over low water. Vessels will fish both spring and neap tides but fishing can be restricted on some of the large spring tides and in strong winds particular in a south-westerly direction. The vessels will fish anywhere from Robin Rigg windfarm to Bowness-on-Solway targeting areas of sand on channel edges. The main area for shrimp in the NWIFCA district is around Silloth as indicated on the fishing activity map (Annex 4).

Catches can vary greatly from 25kg to 700kg for the day and a typical catch is around 200-300kg per day. Bycatch species include species of flatfish, turbot, brill, dab and plaice as well as thornback ray which do not make it into the net but instead get stuck in the veil.

[1] See Fisheries in EMS matrix:
http://www.marinemanagement.org.uk/protecting/conservation/documents/ems_fisheries/populated_matrix3.xls
[2] Reference list will include literature cited in the assessment (peer, grey and site specific evidence e.g. research, data on natural disturbance/energy levels etc)

Regulations Covering Beam Trawls for Shrimp from a Vessel

EC Council Regulation 850/98 (Commercial fishing vessels only)
Article 25 – Restrictions on fishing for shrimps to protect flatfish (Annex 6)

Regulations Covering Beam Trawls for Shrimp

North Western IFCA District

NWIFCA Byelaw 6	Protection for European Marine Site Features	(Annex 4 Map)

Cumbria SFC District

CSFC Byelaw 3	Size limits of boats allowed inside the district	
CSFC Byelaw 14	Shrimps and prawns	(Annex 6)
CSFC Byelaw 15	Vessels with a registered engine power > 221kw	

5. Test for Likely Significant Effect (LSE)

The Habitats Regulations Assessment (HRA) is a step-wise process and is first subject to a coarse test of whether a fishery will cause a likely significant effect on an EMS[3].

Is the activity/activities directly connected with or necessary to the management of the site for nature conservation? NO

5.1 Table 1: Assessment of LSE

Features: The following habitats have been screened out:-

- All sand dune and saltmarsh features and sub features have been screened out due to fishing activity happening from a boat. It is not considered that any of the fishing activities will have an effect on the coastal processes which saltmarsh and sand dune features and sub features require.
- All reef features have been screened out due to the protection under NWIFCA Byelaw 6 for *Sabellaria alveolata* reef, the fishing activity not occurring on any reef feature and most of the fishing activity outside the vicinity of any reef features.
- All habitats where fishing activity does not occur have been screened out

All features and sub features that fishing activity interacts with have been screen in to the table below. The follow habitats have been screened into the assessment:-

- Intertidal sand and muddy sand and subtidal sand, the NWIFCA undertook an exercise to overlay the fishing activity (Annex 4) onto mapping of the features and sub features of the SAC and the supporting habitats of the SPA (Annex 5). This has not been reproduced within the document as the detail gets lost in a reproduction. From this exercise and from communications with fishers, the following are identified as habitats where shrimp beam trawling occurs: intertidal sand and muddy sand, subtidal sand.
- All SPA and pSPA features (bird species).
- River and sea lamprey
- Atlantic salmon are a feature of the river Eden SAC and although not a feature within the Solway European Site, Salmon will migrate through the site on passage to and from the River Eden. Salmon area potentially a bycatch species so have been screened into the assessment.

Pressures: All pressures from the Advice on Operations table provided in the Upper Solway Flats and Marshes SPA and Solway Firth SAC Conservation Advice package have been screened out, other than the pressures in the following table due to:-

- the nature of the fishing activity
- the areas where the activity occurs
- the length of vessels (under 13m)
- the number of vessels prosecuting the fishery
- the gear used is relatively small and lightweight compared to conventional gear used elsewhere in Europe.

[3] Managing Natura 2000 sites: http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm

Qualifying Feature	Sub-feature	Potential pressure(s)	Sensitivity	Potential for Likely Significant Effect?	Justification and evidence
H1130. Estuaries H1140. Mudflats and sandflats not covered by seawater at low tide	Intertidal sand and muddy sand	Abrasion/disturbance of the substrate on the surface of the seabed	Sensitive	Yes	
		Changes in suspended solids (water clarity)	Not Sensitive	Yes	
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	Yes	
		Siltation rate changes, including smothering (depth of vertical sediment overburden)	Sensitive	Yes	
		Removal of target species (Shrimps)	Sensitive	Yes	
		Removal of non-target species (Shrimp beam trawling bycatch)	Sensitive	Yes	
H1110. Sandbanks which are slightly covered by sea water all the time H1130. Estuaries	Subtidal sand	Abrasion/disturbance of the substrate on the surface of the seabed	Sensitive	Yes	
		Changes in suspended solids (water clarity)	Sensitive	Yes	
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	Yes	
		Siltation rate changes, including smothering (depth of vertical sediment overburden)	Sensitive	Yes	
		Removal of target species (Shrimps)	Sensitive	Yes	
		Removal of non-target species (Shrimp beam trawling bycatch)	Sensitive	Yes	
S1095. *Petromyzon marinus*; Sea lamprey S1099. *Lampetra fluviatilis*; River lamprey		Collision below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	Sensitive	No	Evidence suggests that the majority of fishing related bycatch of lamprey occurs in eel traps and salmon traps in estuaries not in shrimp trawls (Sewell & Hiscock. 2005). Records of lamprey caught in trawls are rare with studies suggesting the size and shape of lamprey facilitate escape from the nets. Vessels targeting shrimp must also have a separator grid installed to minimise by-catch (Council Regulation EC 850/98). Anecdotal information from fishers, no known capture of Lamprey.
		Removal of non-target species	Sensitive	No	

S1106 *Salmo salar*: Atlantic Salmon (Adjoining SAC feature)		Collision below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures) Removal of non-target species	Sensitive Sensitive	No No	Anecdotal information from fishers, most fishers not catching any, two reports of one fish caught for the year of 2016. Unsure of species could be salmon or sea trout smolt due to difficultly in identification at smolt size. Due to very low levels of accidental catch, possibly different species and vessels targeting shrimp must also have a separator grid installed to minimise by-catch (Council Regulation EC 850/98), unlikely to have a significant effect on the overall population of salmon.
A001 *Gavia stellata*; Red throated diver † A038 Cygnus cygnus; Whooper swan A040 Anser brachyrhynchus; Pink-footed goose A045b Branta leucopsis; Barnacle goose A 054 Anas acuta; Northern Pintail (non-breeding) A062 Aythya marila; Greater Scaup (Ramsar only) A130 Haematopus ostralegus; Eurasian oystercatcher A137 Charadris hiaticula; Ringed plover (non-breeding) A140 Pluvialis apricaria; European golden plover A143 Calidris canutus; Red knot A160 Numenius arquata; Eurasian curlew A162 Tringa totanus; Common redshank A157 Limosa lapponica; Bar-tailed godwit	Supporting Habitats assessed above	Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures) Collision below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures) Removal of target species (shrimps) Removal of non-target species (marine species) Removal of non-target species (bird species)	Sensitive Sensitive Sensitive Sensitive Sensitive	Yes Yes Yes Yes Yes	All species have been taken through to AA. Only species which could collide with objects below the water taken through to AA. - Red throated diver - Scaup - Common scoter - Goosander - Cormorant All species have been taken through apart from whooper swan, pink footed goose and barnacle goose. Shrimps can be found in the diet of the other designated species All species have been taken through apart from whooper swan, pink footed goose and barnacle goose. Bycatch species can be found in the diet of the other species Only species which could collide with objects below the water taken through to AA. - Red throated diver - Scaup - Common scoter - Goosander - Cormorant

Waterbird Assemblage - *Tadorna tadorna*; Common shelduck - *Anas crecca* Teal - *Anas clypeata* Shoveler - *Pluvialis squatarola*; Grey plover - Calidris alba; Sanderling - Caladris alpine; Dunlin - *Arenaria interpres*; Turnstone - *Melanitta nigra*; Common scoter † - *Mergus merganser;* Goosander † - *Vanellus vanellus;* Lapwing † - *Phalacrocorax carbo;* Cormorant † - *Larus ridibundus;* Black-headed gull † - *Larus canus*; Common gull † - *Larus argentatus;* Herring gull † † Solway Firth pSPA features		Changes in suspended solids (water clarity) Visual disturbance	Sensitive Sensitive	Yes Yes	Only species which could collide with objects below the water taken through to AA. - Red throated diver - Scaup - Common scoter - Goosander - Cormorant All species taken through to AA

Is the potential scale or magnitude of any effect likely to be significant?[4]	**Alone** Yes **Comments :**	**OR In-combination[5]** Yes **Comments :** These activities also occur at the site: • Trawling (Nephrops) • Fixed nets • Potting • Drift nets • Longlines • Hand working (cockles and mussels) In combination effects will be assessed when all initial TLSEs for a site are completed.
Have NE been consulted on this LSE test? If yes, what was NE's advice?		Yes

[4] Yes or uncertain: completion of AA required. If no: LSE required only.
[5] If conclusion of LSE alone an in-combination assessment is not required.

6. Appropriate Assessment

6.1 Potential risks to SAC and SPA supporting habitat features

6.1.1 Pressures and Potential Impacts

Potential direct impacts to intertidal sand and muddy sand and subtidal sand features caused by shrimp beam trawling is change to substrate on the surface of the seabed through sediment compaction, sediment resuspension and removal of sediment, as well as damage to communities associated with the features and removal of target and non-target species. The potential indirect impact is smothering of fished and surrounding habitats and an increase in suspended solids (decreasing water clarity) due to the resuspension of sediment.

6.1.1.1 Abrasion/disturbance of the substrate on the surface of the seabed
Penetration and/or disturbance of the substrate below the surface of the seabed

Bergmen and Hup (1992) investigated the effects of a 12m beam trawl weighing 7 tonne with varying sizes of tickler chains on the macro fauna of sandy sediment. The study area was in the southern North Sea. Each study area was trawled three times over two days and sediment samples were taken up to two weeks after trawling. Species composition in the trawl and the fact the tracks made by the beam shoes were visible on side scan sonar 16hrs later provided evidence that tickler chains penetrated at least 6cm into the sediment surface. The sediment samples showed there was a significant decrease (40-60%) in the number of *Asterias rubens*, *Echinocardium cordatum*, *Lanice conchilega* and *Spiophanes bombyx*, whereas *Magelona papillicornis* showed an increase in number. The less abundant mollusc and polychaete species showed no change in number after trawling. It was concluded that the effect of beam trawling has a greater effect on the number of individuals living on the sediment (starfish and urchins). The larger individuals (larger bivalves) tend to live deeper or have better modes of escape.

Kaiser and Spencer (1996) investigated the effects of a commercial beam trawl weighing 3.5 tonnes fitted with tickler chains on a 4x2km² study area in Liverpool Bay. The areas were trawled to ensure disturbance by the fishing gear. It was observed that in some areas the physical characteristics of the surface sediment were changed. For example surface ripples being flattened but mega ripples not showing change. It is suggested that the tickler chain may have caused the sediment to become unconsolidated. The conclusion is that the particle size distribution was not affected and observed changes may only be in the superficial layers of the sediment. It was shown that beam trawling in stable sediment areas had a negative effect on the abundance and diversity of species. In the top twenty common species, 19 species showed a decrease in number, and nine of these changes were statistically significant. In areas characterised by mobile sediment which are subject to frequent natural disturbance there were no detectable differences, as the sediments are already mobile and subject to continuous change due to natural processes, so the effects of fishing activity on the sediment structure would soon be undetectable. Overall, fragile infaunal species have a greater vulnerability to damage.

Leth and Kuijpers (1996) investigated the physical effects of beam trawling in the Danish North Sea using side scan to observe trawl marks in the sediment. It was seen that in finer sediment areas the trawl marks were faint. In one area of coarse grained sediment there were very clear well preserved trawl marks. It appeared that the trawl marks had been filled with finer sediment assumed to be from the conditions created by the tickler chain.

Under normal working conditions beam trawls influence only the top layers of the sea bed up to 30mm on muddy ground and up to 10mm on sandy ground. Summary of results to date suggest average penetration

depth 4-7cm. The depth depends on the bottom type and structure of the ticklers and does not always penetrate as the gear moves over the seabed at speeds of 6-7 knots (Groot. 1995).

6.1.1.2 Removal of target species (Shrimps)

Removal of target species has the potential to affect the spatial distribution of intertidal sand and muddy sand communities, change the presence and abundance of typical species and change the species composition of component communities. Shrimp are an important food source for many marine species and a significant reduction of stock could affect the overall ecosystem function of the European Site.

6.1.1.3 Removal of non-target species (Shrimp beam trawling bycatch)

Lancaster and Frid (2002) looked at the fate of discarded juvenile brown shrimps in the Solway Firth. The fishing gear used was a 6m beam trawl with 21-23mm mesh fitted with a 30-65mm square mesh piece of net called a veil or sieve which is designed to reduce the catch of juvenile fish by up to 80%. The catch was then standardised to a 60 minute tow.

The study was taken on commercial fishing vessels between 1995 and 1997. Forty-seven hauls were sampled from commercial operators on forty three separate occasions throughout the study period. Tables 1 to 3 give a summary of the weight and percentage of each fraction and the weight and percentage of catch composition (shrimp, fish and other) of each fraction.

Table 1. Catch and riddle fraction composition by weight of commercial fishing vessels in the Solway Firth, study period1995-1997 (Lancaster and Frid. 2002)

Riddle Fraction	Composition of Fraction	Mean Weight (kg)	Mean proportion of haul (%)	Fate
Top	Large fish, crabs and debris	7.55	14.59	Discarded
Consumption	Consumption shrimps and fish	22.98	56.27	Cooked
Discards	Small shrimps and fish	13.2	29.13	Discarded

Table 2. Percentage of catch and riddle fraction composition by weight of commercial fishing vessels in the Solway Firth, study period1995-1997 (Lancaster and Frid. 2002)

Riddle Fraction	Percentage of *C. crangon*	Percentage of fish	Percentage of crab	Percentage of weed / trash
Top	2.0	90.5	3.7	3.4
Consumption	85.7	10.0	0.8	3.4
Discards	83.5	6.0	0.01	10.5
Total	**75.5**	**18.5**	**0.8**	**5.2**

Table 3. Weight of catch for composition of each riddle fraction of commercial fishing vessels in the Solway Firth, study period1995-1997 (Lancaster and Frid. 2002)

Riddle Fraction	Weight of *C. crangon* (kg)	Weight of fish (kg)	Weight of crab (kg)	Weight of weed / trash (kg)
Top	0.15	6.83	0.28	0.26
Consumption	19.69	2.30	0.18	0.78
Discards	11.02	0.79	0.01	1.39
Total	**30.87**	**9.92**	**0.46**	**2.42**

Lancaster and Frid (2002) found that 99% of discarded undersized shrimps were returned to the sea alive of which it was estimated that 92% would have survived after 24 hours. Taking into account bird and fish

predation, it was estimated that between 77 - 80% of all undersized shrimp entering a shrimp beam trawl in the Solway Firth would survive depending on the level of bird predation.

Berghahn et el. (1992) investigated the mortality of fish from the by-catch of shrimp beam trawlers in the North Sea. Trawl times were one hour using a cod end mesh size of 11-12mm. Berghahn found in the discard fraction 100 % mortality was observed for whiting (*Merlangius merlangus*) and 10% mortality for sculpin (*Myxocephalus scorpius*), hooknose (*Agonus catapbractus*), and eelpout (*Zoarces viviparus*). The survival of flatfish depended strongly on the species, size of the specimens as well as the catch and catch processing conditions, and ranged from 17 to 100%. It was observed that mortalities increased considerably after the catch passed through a sorting sieve.

6.1.1.4 Changes in suspended solids (water clarity)

Siltation rate changes, including smothering (depth of vertical sediment overburden)

There may be increased turbidity of the water column caused by dragging gear along (or close to) the seabed and disturbing sediments. An increase in suspended sediment can reduce light penetration and potentially reduce primary productivity and algae growth. Other organisms such as benthic fauna can become smothered which will reduce the ability of the organisms to feed. For organisms that are sessile, such as hydroids and bryozoan, smothering will reduce feeding and depending on the level of smothering will cause mortality.

6.1.2 Exposure of SAC and SPA supporting habitat features to pressures

6.1.2.1 Abrasion/disturbance of the substrate on the surface of the seabed
Penetration and/or disturbance of the substrate below the surface of the seabed

Most of the research into the effects of beam trawling on the structure, function and associated fauna of a sediment type has been performed using much larger and heavier beams. Shrimp beam trawling in the European Site uses lighter beams. Most research indicates that using heavy beam trawls between 3 and 7 tonnes will on average penetrate the substrate 4 to 7 cm depending on the substrate. It can therefore be inferred that any penetration of the beam trawls used by the Solway Firth fishers will be much less. The length of time in which the trawl marks are present in the sediment is very dependent on the energy levels of the environment. In high energy areas the trawl marks will soon be filled in by surrounding sediment and the sediment which has been displaced during the trawling activity.

There are ten vessels that commercially trawl for shrimp within the European Site. Four mainly fish on the Scottish side of the Solway and six fish on both the English and Scottish side but more regularly on the English side. On average operators will fish sixty to seventy days a year. The main fishing season is between spring and autumn with a lull in peak summer; some operators will fish throughout the year with less regularity and intensity.

The vessels fish anywhere from Robin Rigg windfarm to Bowness-on-Solway targeting areas of sand on channel edges. The main area for shrimp in the NWIFCA district is around Silloth as indicated on the fishing activity map (Annex 4). Operators target channels and naturally occurring depressions in the sandy substrate meaning the actual fished area is much smaller than indicated. An approximate footprint has been calculated using the following parameters:-

- 6 tows per day
- 3nm tow
- 9m total beam length
- 60 day fished per year
- 6 vessels fishing 75%, 2 vessels fishing 50% and 2 vessels fishing 25% of the time fishing within the NWIFCA jurisdiction of the European site.

This gives an approximate total yearly footprint of 107 sq. km within the European Site. The actual fished area is likely to be much smaller but will be fished a number of times over the year. This is because fishers target different areas until the catches are good then will concentrate on the area until the catches decrease.

Table 1 shows the sensitivity of habitat types to different demersal trawling intensities, and indicates that dynamic shallow water fine sands have the lowest sensitivities for each of the gear intensities. The natural environment in the Solway is highly dynamic and changeable. The channels and sandbanks are constantly changing and moving geographically and there is a lot of sediment movement which is shown by the continual high levels of suspended sediment in the water column. Anecdotal evidence of channels that were once fished completely filled in and become shallow over a very short period of time, with reports of changes in depth of over 10m. The natural habitat experiences high levels of energy and change which will affect the species which inhabit it. Due to the highly changeable environment and the intensity of fishing activity it is unlikely that abrasion, penetration and disturbance to the sediment and features will have an adverse effect on the integrity of the European Site.

Table 1 Sensitivity of habitat types to different demersal trawling intensities as identified by Hall et al. (2008), adapted from SIFCA (2016).

Gear type	Habitat type	Gear Intensity*			
		Heavy	Moderate	Light	Single pass
Demersal trawls	Subtidal stable muddy sands, sandy muds and muds	High	Medium	Low	Low
	Stable subtidal fine sands	Medium	Medium	Low	Low
	Dynamic, shallow water fine sands	Medium	Low	Low	Low
	Stable spp. rich mixed sediments	High	Medium	Medium	Low
	Unstable coarse sediments – robust fauna	Medium	Medium	Low	Low

*Gear activity levels are defined as: Heavy – daily in 2.5 nm x 2.5 nm; Moderate – 1 to 2 times a week in 2.5 nm x 2.5 nm; Light 1 to 2 times per month during a season in 2.5 nm x 2.5 nm; Single pass – One pass of fishing activity in a year.

6.1.2.2 Removal of target species (Shrimps)

The Solway has a long history of shrimp fishing going back hundreds of years. Catches of shrimp can vary greatly from 25kg to 700kg per day. A typical catch is between 200kg and 300kg for a trip. It is unlikely that the amount of shrimp removed by fishing would have a significant effect on the overall shrimp population; environmental factors have a much greater effect on the shrimp population. For example, anecdotes from fishermen suggest the building of Robin Rigg and the subsequent scouring round the turbines had a negative effect on shrimp populations. The shrimp population in the Site is variable year on year regardless of fishing effort. It is unlikely that the removal of shrimp at the current levels will have an adverse effect on the integrity of the European Site.

6.1.2.3 Removal of non-target species (Shrimp bycatch)

Mortality of bycatch in a shrimp fishery varies according to species, size of specimens and haul durations, as well as other factors such as total catch, composition, durations of catch processing and exposure to solar radiation. Within CSFC Byelaw 14 are measures to reduce the destruction of immature fish by ensuring that the total catch from the shrimp beam trawl is riddled as soon as practically possible and that immature fish that pass through the riddle must be returned to the sea. Article 25 of EC Council Regulation 850/98 sets out the requirements for all commercial vessels to have installed on board a functioning device designed to separate flatfish from common shrimps and fish with a separator trawl or a trawl with a sorting grid for the protection of flatfish. Larger fish mainly flatfish which are caught are kept if there is a market value for them or returned alive if not.

Lancaster and Frid (2002) found that the average percentage of fish in the total catch was 18.5% with the majority being larger specimens. The total average weight of small discarded fish caught in a 6m beam trawl towed for 60 minutes was 0.79kg and the majority of the discards consisted of juvenile shrimp (83.5%). The survival of flatfish depended strongly on the species, size of the specimens as well as the catch and catch processing conditions, and ranged from 17 to 100%. Larger flatfish have a higher survival rate as they are more resistant to being crushed and damaged. Lancaster and Frid (2002) estimated that the survival rates of discarded shrimps was between 77 - 80% taking into account bird predation. From results taken from the Solway Firth shrimp fishery and from discussions with fishermen, the majority of the discards is shrimp that is too small for processing and debris.

The amount of bycatch and survival rates of fish is unlikely to affect the overall fish populations of the European Site and is therefore unlikely that the removal of non-target species (shrimp trawling bycatch) at the current levels will have an adverse effect on the integrity of the European Site.

6.1.2.4 Changes in suspended solids (water clarity)
Siltation rate changes, including smothering (depth of vertical sediment overburden)

Beam trawling has the potential to decrease the water clarity by increasing the suspended solids in the water. Increasing the suspended solids can cause a change in siltation rates including smothering. The natural environment in the Solway is highly dynamic and changeable. The sediment is constantly shifting meaning that background levels of suspended sediment are already naturally high. As the operators use small lightweight beam trawls with shallow penetration depths the extra suspended solids from beam trawling is likely to be minimal and unlikely to have an adverse effect on the integrity of the European Site.

6.2 Potential risks to SPA features (birds)

6.2.1 Pressures and Potential Impacts

The potential impact of the removal of target and non-target species, change of water quality and visual disturbance to SPA bird features is that their condition, productivity and survivability could be decreased leading to an overall population decrease. The removal of target and non-target species has the potential to remove a food source for the qualifying bird species. A decrease in water clarity can affect the success rate of feeding for plunge and diving birds. Visual disturbance can cause an increase in the amount of energy which is used due to the extra flights and increased alertness the bird takes to avoid the activity, decrease the amount of feeding time and concentrate the number of individuals into a smaller area, which in turn increases competition rates and potentially decreases the availability of the food resource.

6.2.1.1/2 Removal of target species and non-target species (Shrimps and bycatch)

Some regional declines of seabirds have been related to fishing activity (Anker-Nilssen *et al.* 1997). There may be indirect effects to birds from fishing activity through removing and competing for prey resources, as seen in the North Sea where black-legged kittiwakes have declined by over 50% since 1990 during a period where there was an active lesser sandeel fishery (Frederiksen *et al.* 2004). This was also thought to be partly due to profound oceanographic changes at the same time (Frederiksen *et al.* 2004).

There may also be benefits from fishing to birds, where birds gain extra food through feeding on fishing offal and discards (Hudson & Furness, 1989; Campyhusen *et al.* 1996), or where numbers of small fish prey increase following the removal of larger predatory fish (Tasker *et al.* 2000; Furness, 1982). However there can be negative impacts too, where smaller fish are targeted by fishing activity, reducing the food available as prey to birds and leading to increased competition (Frederiksen *et al.* 2004; Tasker *et al.* 2000).

A study by Oro and Ruix (1997) assessed how discards from trawlers are used by seabirds - 'gulls and terns followed behind the trawlers, Procellariiformes were noted away from the stern…" and found that the discards at one of the two sites were unable to support the energy requirements of the scavenging seabird populations but could support them at the other site (Oro & Ruix, 1997). Camphuysen *et al.* (1995) showed species that profited most from scavenging, which included several gull species. In a study by Depestele et al. (2012) on the interactions between seabirds and fishery discards, lesser and greater black-backed gull were found to be associated with fishing vessels (potentially as scavengers), whilst little gull and black-headed gull were less frequently seen behind boats.

Walter and Becker (1997) investigated the occurrence and consumption of seabirds scavenging on shrimp trawler discards in the Wadden Sea. It was observed that the main scavengers were herring gull (*Larus argentatus*) and black-headed gull (*L. ridibundus*) with common gull (*L. canus*), lesser black-backed gull (*L. fuscus*), great black-backed gull (*L. marinus*), and common/arctic tern (*Sterna hirundo/paradisaea*) being less numerous. Herring gulls made up 45% of the birds counted but consumed 82% of the total number of discarded items. Out of the total number of items discarded seabirds consumed 41% of flatfish, 79% of round fish, 23% of invertebrates and 10% of the shrimp. When these percentages are applied to the total discards from the shrimping fleet of Lower Saxony it was estimated that the consumed discards met the energy demand of 60,000 birds for the year and suggest that discards may have a strong effect on the bird population of the Wadden Sea.

Seabird mortality from demersal trawling can be caused by birds becoming entangled in the net when it is being hauled or shot. Birds do not often become caught in the net when it is actively fishing. The birds which are at the highest risk are larger bodied birds such as petrels (Birdlife) and those which are attracted

to the vessel for an easy food source when the nets are being hauled, the catch is being sorted and the discards including offal are going back into the sea.

6.2.1.3 Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures).

Marine birds can be attracted to or become disorientated by artificial light sources, which can result in collision and therefore injury or death. Bird collisions with vessels, including fishing vessels, have been recorded with the risk being greatest at night for lighted ships near coastal areas and when the vessel is relatively close to large breeding aggregations of seabirds. Mortality can also be caused by the seabirds flying into the warps (Maree et al. 2014). The birds are attracted to the vessel as it is often an easy food source. The highest level of mortality is when the nets are being hauled, the catch is being sorted and the discards including offal are going back into the sea.

6.2.1.4 Collision below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures).

Marine birds particularly diving birds have the potential to collide with vessels under the water which could result in injury or death. Larger vessel and fast moving vessels are more likely to cause a collision due to the greater distances which have to be moved to avoid a large vessel and the speed that is needed to avoid a fast moving vessel.

Potential for birds to become entangled with nets underwater will be assessed in the SPA removal of non-target species section 6.2.1.2 (pressures) and 6.2.2.2 (exposure).

6.2.1.5 Changes in suspended solids (water clarity)

There may be increased turbidity of the water column caused by dragging gear along (or close to) the seabed and disturbing sediment. Cook and Burton (2010) used the extent that different bird species used vision in foraging to assess the sensitivities of birds to the direct effects of turbidity and found that foraging terns, guillemot and gannets particularly used their vision. “The decline in Sandwich Tern *Sterna sandvicensis* populations in the Netherlands has been linked with increases in turbidity (Essink 1999) showing that on some scales this can have impacts at the population level”. A study by Furness and Tasker (2000) identified tern species as being vulnerable when looking at terns cost of foraging, potential foraging range, ability to dive, amount of spare time in the daily budget and ability to switch diet. Any reduction of feeding success due to changes in suspended solids (water clarity) could have a greater effect on terns compared to other species which are able to adapt more easily and scored as less vulnerable such as gannets, fulmar, cormorant and guillemot. Due to the relative inflexibility of their foraging habitat selection, Eider and Common Scoter were also found to be sensitive to the indirect effects of sedimentation.

6.2.1.6 Visual Disturbance

Visual disturbance can cause an increase in the amount of energy which is used due to the extra flights and increased alertness the bird takes to avoid the activity, decrease the amount of feeding time and concentrate the number of individuals into a smaller area which in turn increases competition rates and potentially decreases the availability of the food resource.

6.2.2 Exposure to Pressures

6.2.2.1 Removal of target species (Shrimps)

Shrimps are not considered a targeted food source for the following bird features of the site as they do not rely on this prey as a food resource: pintail, greater scaup, oystercatcher, ringed plover, golden plover, knot, curlew, redshank, bar-tailed godwit, shelduck, teal, shoveler, grey plover, sanderling, dunlin, turnstone, common scoter and lapwing. Shrimps will occasionally be found in the diet of each of the species because as with most species of birds they are opportunistic and will feed on most food resources if they are available. It is therefore unlikely to affect the population and distribution of these species of birds.

Red throated diver, goosander, cormorant, black headed gull, herring gull and common gull all feed on shrimp but a larger part of their diet comes from the associated bycatch species (fish). It is unlikely that the amount of shrimp removed by fishing would have a significant effect on the overall shrimp population (section 6.1.2.2); environmental factors have a much greater effect on the shrimp population. It is therefore unlikely that the removal of target species through shrimp beam trawling is going to affect the population and distribution of these species of birds and the NWIFCA can conclude no adverse effect on the integrity of the European Site from this pressure.

6.2.2.2 Removal of non-target species (Shrimp beam trawling bycatch)

Fish are not considered a targeted food source for the following bird features of the site as they do not rely on this prey as a food resource: pintail, greater scaup, oystercatcher, ringed plover, golden plover, knot, curlew, redshank, bar-tailed godwit, shelduck, teal, shoveler, grey plover, sanderling, dunlin, turnstone, common scoter and lapwing. Fish will occasionally be found in the diet of each of the species because as with most species of birds they are opportunistic and will feed on most food resources if they are available. It is therefore unlikely to affect the population and distribution of these species of birds.

The gull species (black headed, common and herring) are opportunistic feeders and have a variety of food sources both marine and non-marine. Gulls will often exploit the easiest food source available. Gulls are known to feed on the bycatch from fishing activities such as shrimping and can often benefit, as fishing bycatch is often an easy food source (Walter and Becker, 1997) and requires minimal energy expenditure. It is therefore unlikely that shrimp beam trawling will have an effect on the population and distribution of these species of birds.

The primary source of food for red throated diver, goosander and cormorant is juvenile fish and smaller fish species. However the effect of shrimp beam trawling on prey availability, or the population and distribution of these bird species is likely to be negligible due to the following;

- the level of activity
- the low level of bycatch
- legislation to protect juvenile flatfish and reduce catches of fish species
- the survival rates of discarded fish (as assessed above in section 6.1.2.3)

The NWIFCA can therefore conclude that the removal of non-target species at the current levels is unlikely to have an adverse effect on the integrity of the European Site.

The beam length used in the Solway fishery is smaller in size than in other shrimp fisheries in Europe, and small in overall net size, which reduces the risk of the birds becoming entangled in the net. The SPA species at risk of entanglement are diving birds, red throated diver, scaup, common scoter, goosander and cormorant, and to a lesser extent gulls species.

The risk of bird entanglement is minimal for the following reasons:

- although fishing occurs throughout the year the concentration of fishing is seasonal (spring and autumn) when overwintering bird species numbers within the site are at the lowest;
- number of operators is low for the size of the pSPA area;
- fishing footprint is limited;
- operators target different areas at different times of the tide;
- fishing gear used is lightweight and relatively small;
- fishing vessel between 7m and 13.5m;
- speed at which the vessels travel is low;
- speed at which the vessels tow gear is low;
- majority of activity occurring during daylight;
- lights used during occasional night fishing are small and few;
- fishing does not occur close to large breeding aggregations;
- no known issues with birds becoming entangled with the shrimping gear in the site.

The NWIFCA can therefore conclude that any risk of adverse effect on the integrity of the European Site is unlikely due to this pressure.

6.2.2.3 Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures).

The risk of birds colliding with objects above water is minimal for the following reasons:

- although fishing occurs throughout the year the concentration of fishing is seasonal (spring and autumn) when overwintering bird species numbers within the site are at the lowest;
- number of operators is low for the size of the pSPA area;
- fishing footprint is limited;
- operators target different areas at different times of the tide;
- fishing gear used is lightweight and relatively small;
- fishing vessel between 7m and 13.5m;
- speed at which the vessels travel is low;
- speed at which the vessels tow gear is low;
- majority of activity occurring during daylight;
- lights used during occasional night fishing are small and few;
- fishing does not occur close to large breeding aggregations;
- no known issues with birds colliding with the shrimping gear in the site.

The NWIFCA can therefore conclude that any risk of adverse effect on the integrity of the European Site is unlikely due to this pressure.

6.2.2.4 Collision below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures).

The SPA features which could collide with objects below water are diving birds, red throated diver, scaup, common scoter, goosander and cormorant and to a less extent gulls species. The NWIFCA can conclude that it is unlikely that any birds will collide with objects below water and therefore no risk of adverse effect on the integrity of the European Site from this pressure, for the following reasons:

- although fishing occurs throughout the year the concentration of fishing is seasonal (spring and autumn) when overwintering bird species numbers within the site are at the lowest;
- number of operators is low for the size of the pSPA area;
- fishing footprint is limited;
- operators target different areas at different times of the tide;
- fishing gear used is lightweight and relatively small;
- fishing vessel between 7m and 13.5m;
- speed at which the vessels travel is low;
- speed at which the vessels tow gear is low;
- majority of activity occurring during daylight;
- lights used during occasional night fishing are small and few;
- fishing does not occur close to large breeding aggregations;
- no known issues with birds colliding with objects associated with the fishery in the site.

6.2.2.5 Changes in suspended solids (water clarity)

Beam trawling has the potential to decrease the water clarity by increasing the suspended solids in the water. For species which feed on fish (red throated diver, scaup, common scoter, goosander and cormorant) and rely on sight it has the potential to reduce feeding success rates. The natural environment in the Solway is highly dynamic and changeable. The sediment is constantly shifting meaning that background level of suspended sediment is already naturally high. Due to the operators using small lightweight beam trawls with shallow penetration depths, suspended solids levels from beam trawling are low compared to background levels, and are unlikely to affect the feeding success of these SPA features.

6.2.2.6 Visual Disturbance

It is unlikely that the ten vessels which fish in the European site will disturb waders; oystercatcher, ringed plover, golden plover, knot, curlew, redshank, bar tailed godwits, grey plover, sanderling, dunlin, turnstone and lapwing due to fishing being boat based and the birds spending the majority of time feeding on the intertidal areas. There is a small possibility that when the birds are flying they may be disturbed but due to the size of the vessels, the occasional activity when compared to the level of background vessel movement disturbance from the fishing activity will be minimal. The NWIFCA can conclude that that visual disturbance to waders will be minimal if any and therefore there is no risk of an adverse effect on the integrity of the European Site from this pressure.

Red throated diver, whooper swans, pink footed geese, barnacle geese, pintail, scaup, shelduck, teal, shover, scoter, goosander, cormorant are often found on the water, so there is a potential for disturbance by boat trawling. However visual disturbance will be minimal and any displacement temporary and short lived for the following reasons:

- although fishing occurs throughout the year the concentration of fishing is seasonal (spring and autumn) when overwintering bird species numbers within the site are at the lowest;
- number of operators is low for the size of the pSPA area;
- fishing footprint is limited;
- number of operators is low;
- operators target different areas at different times of the tide;
- very unlikely that all operators will be fishing at the same time;
- the number of days fishing are relatively low;
- the fishing gear used is lightweight and relatively small;
- fishing vessel under 7m and 13.5m;

- the speed at which the vessel travel is low;
- the speed at which the vessel tow is low;
- majority of activity occurs during daylight;
- vessel lights used during occasional night fishing are small and few;
- whooper swans, pink footed geese, shelduck, pintail, wigeon and goldeneye numbers are greatest during the winter when fishing effort is low.

The NWIFCA can therefore conclude that there is no risk of adverse effect on the integrity of the European Site from this pressure.

The gull species (black headed, common and herring) are unlikely to be disturbed by any fishing activity, gulls are opportunistic feeders and are more likely to be attracted to fishing activity as any easy food source rather than disturbed by it. It is therefore unlikely that visual disturbance on gulls from the fishing activity will have an adverse effect on the integrity of the European Site.

Table 2: Summary of Impacts

Feature/Sub feature(s)	Conservation Objective	Potential pressure[6] (such as abrasion, disturbance) exerted by gear type(s)[7]	Potential ecological impacts of pressure exerted by the activity/activities on the feature[8] *(reference to conservation objectives)*	Level of exposure[9] of feature to pressure	Mitigation measures[10]
Intertidal sand and muddy sand (Estuaries, mudflats and sandflats not covered by seawater at low water) **Subtidal sand** (Estuaries, sandbanks which are slightly covered by seawater all the time)	Maintain or restore the extent, distribution structure or function of the Intertidal sand and muddy sand.	Abrasion/disturbance of the substrate on the surface of the seabed	Potential to effect the:- - Extent and distribution - Presence and spatial distribution of intertidal sand and muddy sand communities - Presence and abundance of typical species - Species composition of component communities - Sediment composition and distribution	The natural environment is highly dynamic and changeable. Channels and sandbanks are constantly changing and moving geographically and there is a lot of sediment movement which is indicated by consistently high levels of suspended sediment in the water column, and from anecdotal evidence of channels that where once fished with a deeper depth of water now a shallow sand bank, with reports in differences of over 10m of sand. The habitat naturally experiences high levels of energy and change which will affect the species which inhabit it. Impacts of fishing activity against background levels is minimal. it is unlikely that abrasion, penetration and disturbance to the sediment and features will have an adverse effect on the integrity of the European Site.	None
		Changes in suspended solids (water clarity)	Potential to effect the:- - Water quality - turbidity		
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Potential to effect the:- - Extent and distribution - Presence and spatial distribution of intertidal sand and muddy sand communities - Presence and abundance of typical species - Species composition of component communities - Sediment composition and distribution		
		Siltation rate changes, including smothering (depth of vertical sediment overburden)	Potential to effect the:- - Extent and distribution - Presence and spatial distribution of intertidal sand and muddy sand communities - Presence and abundance of typical species - The species composition of component communities - Sediment composition and distribution - Sediment movement and hydrodynamic regime - Topography		

[6] Guidance and advice from NE.
[7] Group gear types where applicable and assess individually if more in depth assessment required.
[8] Document the sensitivity of the feature to that pressure (where available), including a site specific consideration of factors that will influence sensitivity.
[9] Evidence based e.g. activity evidenced and footprint quantified if possible, including current management measures that reduce/remove the feature's exposure to the activity.
[10] Detail how this reduces/removes the potential pressure/impact(s) on the feature e.g. spatial/temporal/effort restrictions that would be introduced.

		Removal of target species (Shrimps) Removal of non-target species (Shrimp beam trawling bycatch)	Potential to effect the:- - Presence and spatial distribution of intertidal sand and muddy sand communities - Presence and abundance of typical species - The species composition of component communities	Due to the scale of the activity, management measures in place, seasonality and the fact that environmental conditions are more likely to have an effect on the shrimp population, it is unlikely at current levels of activity that beam trawling for shrimp will significantly affect the shrimp and fish populations, and in turn the function of the SAC feature, and therefore will not have an adverse effect on the integrity of the European Site.	None
- Anas acuta; Northern Pintail - Aythya marila; Greater Scaup - Haematopus ostralegus; Eurasian oystercatcher - Charadris hiaticula; Ringed plover - Pluvialis apricaria; European golden plover - Calidris canutus; Red knot - Numenius arquata; Eurasian curlew - Tringa totanus; Common redshank - Limosa lapponica; Bar-tailed godwit - *Tadorna tadorna*; Common shelduck - *Anas crecca* Teal - *Anas clypeata* Shoveler - *Pluvialis squatarola*; Grey plover - Calidris alba; Sanderling - Caladris alpine; Dunlin - *Arenaria interpres*; Turnstone - *Melanitta nigra*; Common scoter - *Vanellus vanellus;* Lapwing		Removal of target species (Shrimps) Removal of non-target species (Shrimp beam trawling bycatch)	Potential to effect the:- - Food availability - Condition and survival of SPA species Abundance of SPA species	Shrimps and marine fish are not considered a key food resource for these species. The activity will not affect the population or distribution of the features, and will therefore not have an adverse effect on the integrity of the European Site.	None
		Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Assemblage diversity	Unlikely due to the number of operators, seasonality of fishing, areas fished and the size of gear.	None
- Gavia stellata; Red throated diver - *Mergus merganser;*		Removal of target species (Shrimps)	Potential to effect the:- - Food availability - Condition and survival of SPA species	Shrimps are eaten by all these species but are not considered the preferred target species over fish. Activity levels	None

Goosander - *Phalacrocorax carbo;* Cormorant - *Larus ridibundus;* Black-headed gull - *Larus canus*; Common gull - *Larus argentatus;* Herring gull			- Abundance of SPA species	in the European Site are not likely to have a significant impact on the shrimp population and will not affect the population or distribution of the features, and will therefore not have an adverse effect on the integrity of the European Site.	
		Removal of non-target species (Shrimp beam trawling bycatch)	Potential to effect the:- - Food availability - Condition and survival of SPA species - Abundance of SPA species	Small fish are the target prey for all of these species. Fishing activity levels and existing management measures reduce the amount of fish by-catch and increase survivability. It is unlikely that shrimp beam trawling will have a significant impact on the fish population and will not affect the population or distribution of the features, and will therefore not have an adverse effect on the integrity of the European Site.	None
- Gavia stellata; Red throated diver - Aythya marila; Greater Scaup - *Melanitta nigra*; Common scoter - *Mergus merganser;* Goosander - *Phalacrocorax carbo;* Cormorant - *Larus ridibundus;* Black-headed gull - *Larus canus*; Common gull - *Larus argentatus;* Herring gull		Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Assemblage diversity	Unlikely due to the number of operators, seasonality of fishing, areas fished and the size of gear.	None
		Collision below water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Assemblage diversity	Unlikely due to the number of operators, seasonality of fishing, areas fished and the size of gear.	None
		Changes in suspended solids (water clarity)	Potential to effect the:- - Food availability - Condition and survival of SPA species - Abundance of SPA species	The natural environment is highly dynamic and changeable. The sediment is constantly shifting meaning that background levels of suspended sediment is already naturally high, and due to operators using small lightweight beam trawls with shallow penetration depths extra suspended solids from beam trawling will not increase the turbidity of the water and therefore not have an adverse effect on the integrity of the European Site	None
- Haematopus ostralegus; Eurasian oystercatcher - Charadris hiaticula; Ringed plover - Pluvialis apricaria; European golden plover - Calidris canutus; Red knot - Numenius arquata;		Visual disturbance	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Extent and distribution of supporting habitat available whilst a fishing activity is occurring	Visual disturbance will be minimal due the waders being on the intertidal and the fishing activity is boat-based.	None

Eurasian curlew - Tringa totanus; Common redshank - Limosa lapponica; Bar-tailed godwit - *Pluvialis squatarola*; Grey plover - Calidris alba; Sanderling - Caladris alpine; Dunlin - *Arenaria interpres*; Turnstone - *Vanellus vanellus;* Lapwing					
- Gavia stellata; Red throated diver - Cygnus cygnus; Whooper swan - Anser brachyrhynchus; Pink-footed goose - Branta leucopsis; Barnacle goose - Anas acuta; Northern Pintail (non-breeding) - Aythya marila; Greater Scaup - *Tadorna tadorna*; Common shelduck - *Anas crecca* Teal - *Anas clypeata* Shoveler - *Melanitta nigra*; Common scoter - *Mergus merganser;* Goosander - *Phalacrocorax carbo;* Cormorant		Visual disturbance	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Extent and distribution of supporting habitat available whilst a fishing activity is occurring	Any visual disturbance will be minimal due the main fishing being seasonal, low number of operators, the size of the pSPA, operators fishing different days targeting different areas and different states of tide, relatively small vessels and gear, low speeds at which the vessel travel.	None
- *Larus ridibundus;* Black-headed gull - *Larus canus*; Common gull - *Larus argentatus;* Herring gull		Visual disturbance	Potential to effect the:- - Condition and survival of SPA species - Abundance of SPA species - Extent and distribution of supporting habitat available whilst a fishing activity is occurring	Gulls utilise a range of habitats both marine and terrestrial and likely to be attracted to the fishing as a food source opportunity. Any disturbance likely to minimal the low numbers of operators, the operators targeting different areas at different times of the tide, the vessels which are used are small, the majority of the fishing activity occurs during daylight.	None

7. Conclusion[11]

Taking into account the information detailed in the Appropriate Assessment, the NWIFCA can conclude that at the current level of beam trawling for shrimp there is no adverse effect on the integrity of the Solway Firth European Site interest features.

8. In-combination assessment[14]

In combination effects will be assessed in a separate document when all initial TLSEs for a site are completed.

9. Summary of consultation with Natural England

See attached advice from Natural England (Annex 2).

10. Integrity test

The NWIFCA can conclude that fishing using shrimp beam trawling has no adverse effect on the integrity of the Solway Firth European Site interest features.

[11] If conclusion of adverse affect alone an in-combination assessment is not required.

Annex 1: Reference list

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Annex 2: Natural England's consultation advice

Date: 3 May 2017
Our ref: 213328
Your ref: NWIFCA-SF-EMS-003

Jonathan Haines
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BY EMAIL ONLY

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Dear Jonathan

Formal Advice to NWIFCA: Fisheries in EMS Habitats Regulations Assessment for Amber Risk Categories in Solway Firth EMS, including gear types: towed demersal – beam trawl (shrimp – *Crangon crangon*) (NWIFCA-SF-EMS-003).

Thank you for your consultation on the above which was received by Natural England on 13 April 2017.

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

In 2012, the Department for Environment, Food and Rural Affairs (Defra) announced a revised approach to the management of commercial fisheries in EMSs[1]. The objective of this revised approach is to ensure that all existing and potential commercial fishing activities are managed in accordance with Article 6 of the Habitats Directive. This document states that for 'green' risk activities a site level assessment will be required if there are 'in combination effects' with other plans or projects. The Department's strong preference is that site level assessments be carried out in a manner that is consistent with the provisions of Article 6(3) of the Habitats Directive. Appropriate management measures should be put in place to ensure that the fishing activity or activities either 1) have no likely significant effect on a site in view of its conservation objectives or 2) following assessment, can be concluded to have no adverse effect on the integrity of the site.

Natural England has considered the Habitat Regulations Assessment (HRA) prepared by North Western Inshore Fisheries and Conservation Authority (IFCA) for the purposes of making an assessment consistent with the provisions of Article 6(3). Please accept this letter as Natural England's formal advice on the assessments and the conclusions they make. The assessments consider the effects of the following fishing activities on the Solway Firth (SAC), Upper Solway Flats and Marshes Special Protection Area (SPA), Solway Firth potential SPA (pSPA) and Upper Solway Flats and Marshes Ramsar:

- NWIFCA-SF-EMS-003: towed demersal – Beam trawl (*Crangon crangon*)

[1] Defra revised approach:
https://www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery

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The assessments presented in the HRA also consider the effects of this fishing activity on migratory Atlantic salmon *Salmo salar*, a qualifying feature of the adjacent River Eden SAC.

We are content that the best available and most up to date evidence has been used to carry out the HRA by North Western IFCA officers to determine whether management of an activity is required to conserve site features, and thus to ensure the protection of the features, from direct and indirect impacts, from the collection of marine fisheries resources.

We note that in combination effects will be assessed in a separate document when all initial Tests of Likely Significant Effects (tLSEs) for a site are completed.

Subject to the outcomes of the in combination assessments, it is Natural England's view that through their HRA, North Western IFCA officers appear to have appropriately identified those activities that are likely to have a significant effect in view of the site's conservation objectives, and whether management measures are required in order to ensure that the assessed fishing activity or activities will have no adverse effect on the integrity of the EMS.

It is Natural England's view that any foreseeable risk, or harm to the site has been appropriately assessed; and a robust mechanism for re-assessing that risk is in place. This view is based on our current knowledge of the impacts of these fishing activities on the designated features.

If you require any further comments or have any queries regarding the above please contact me to discuss them further.

Yours sincerely

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Natural England
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Tel: 0208 22 56003

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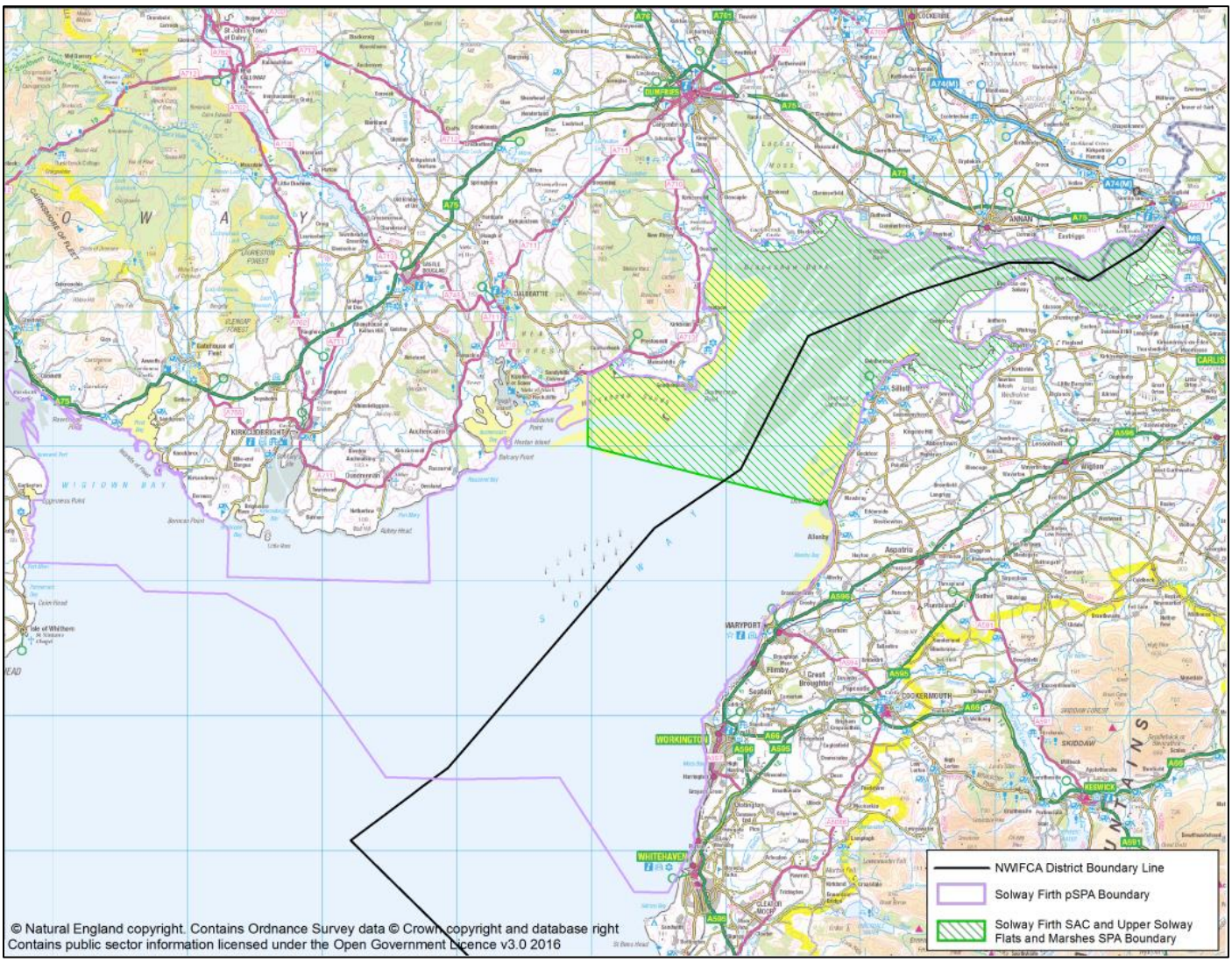
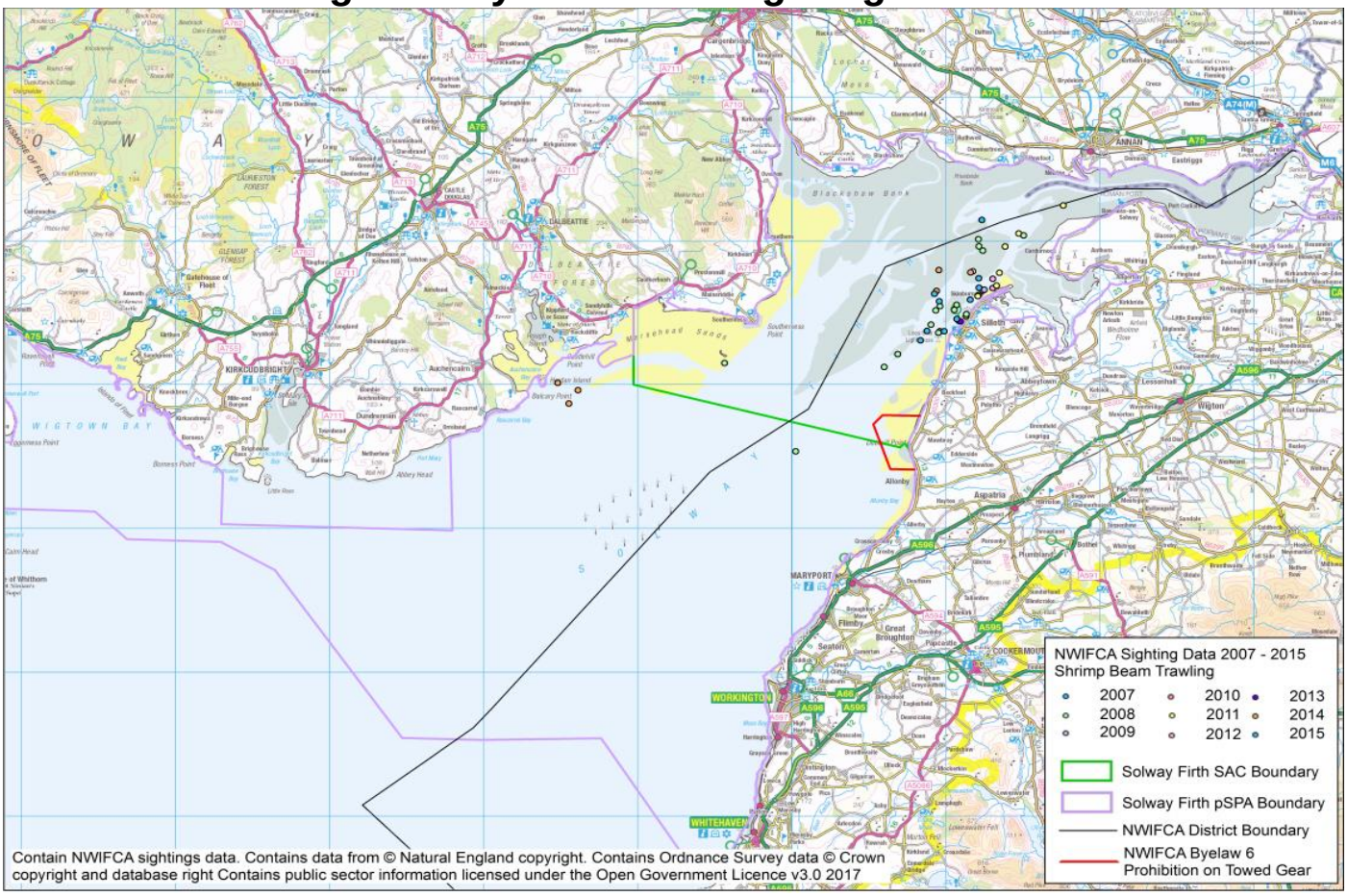
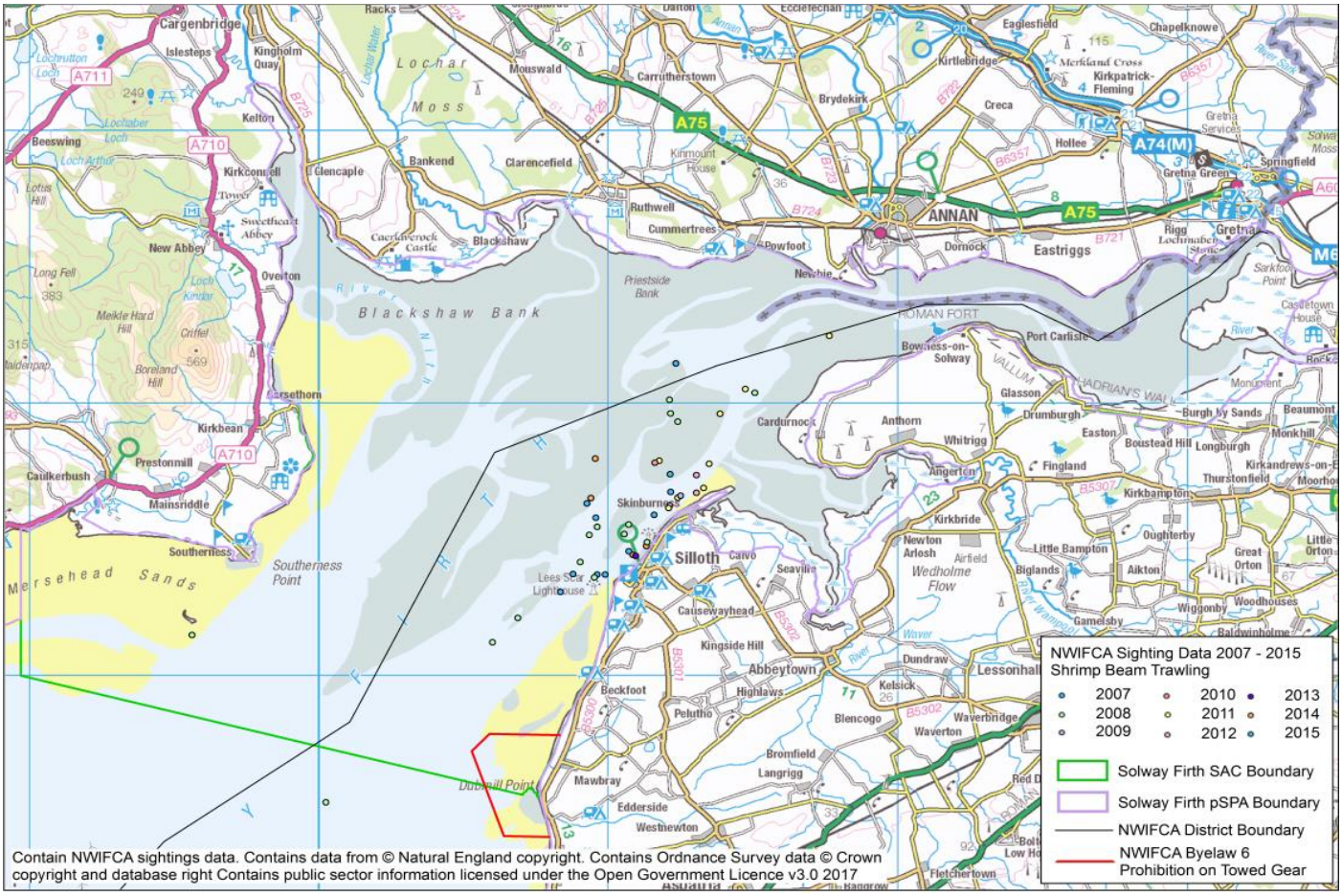
Annex 3: Site Map

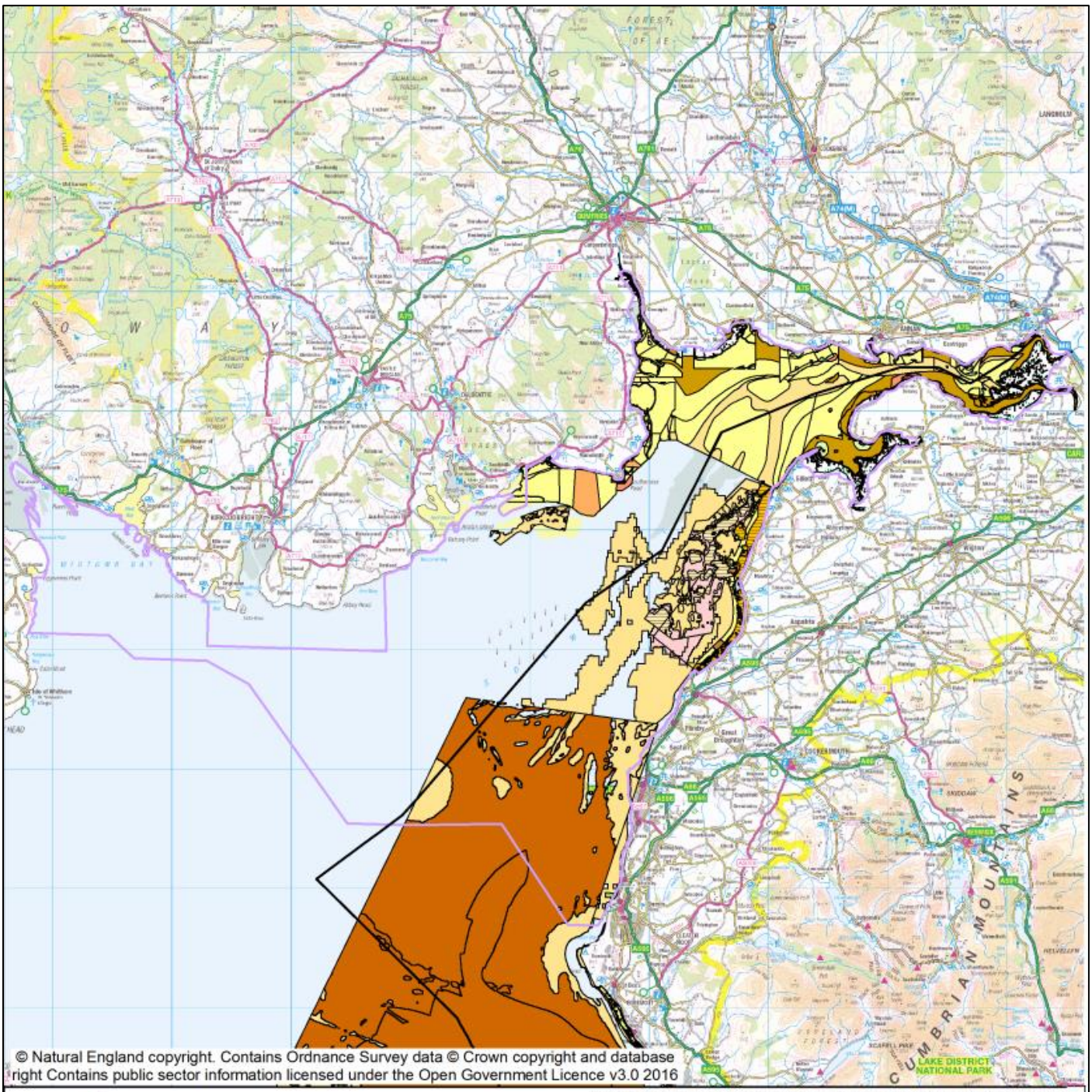


Annex 4 – Fishing Activity / NWIFCA Sightings Data 2007-2015





Annex 5: Broad Scale Habitat Mapping



Broad Scale Habitats

Broad scale habitat data from Natural England February 2016 release

Eunis Code	EMS Subfeature Common Name
A1	Intertidal rock
A2.1	Intertidal coarse sediment
A2.2	Intertidal sand and muddy sand
A2.3	Intertidal mud
A2.4	Intertidal mixed sediment
A2.5	Saltmarsh
A2.61	Intertidal seagrass beds
A2.71	Intertidal biogenic reef. Sabellaria spp.

Eunis Code	EMS Subfeature Commmon Name
A3	Infralittoral rock
A4	Circalittoral rock
A5.1	Subtidal coarse sediment
A5.2	Subtidal sand
A5.3	Subtidal mud
A5.4	Subtidal mixed sediment
SF_SH_5	Intertidal biogenic reef. mussels beds
SF_SH_6	Subtidal biogenic reef. mussel beds

Annex 6: Regulations on Shrimp Fishing within the Solway

EC Council Regulation 850/98 (Commercial fishing vessels only) Article 25

Restrictions on fishing for shrimps to protect flatfish

1. The retention on board of any quantity of common shrimps and Aesop shrimps caught with demersal towed nets having any mesh size between 16 and 31 millimetres shall be prohibited, unless the vessel has installed on board a functioning device designed to separate flatfish from common shrimps and Aesop shrimps following capture.
2. At the latest on 1 July 2002, a separator trawl or a trawl with a sorting grid shall be used to catch common shrimps and Aesop shrimps in conformity with detailed rules which Member States shall establish in accordance with Article 46. Such rules may be applicable only to nets towed by fishing vessels.
3. However, quantities of common shrimp or Aesop shrimp may be retained on board fishing vessels that do not comply with the provisions laid down in paragraphs 1 and 2, provided these quantities do not exceed 5 % of the total live weight of the marine organisms on board.

CSFC BYELAW 14 - SHRIMPS OR PRAWNS.
Byelaw confirmed 21.04.04

This byelaw applies to any part of the Cumbria Sea Fisheries Committee's district within a line drawn on the seaward side of the baselines 6 nautical miles from the baselines from which the breadth of the territorial sea adjacent to the United Kingdom is measured ("the district"). For the purpose of this paragraph "the baselines" means the baselines as they existed at 25 January 1983 in accordance with the Territorial Waters Order in Council 1964 (1965 III p.6452A) as amended by the Territorial Waters (Amendment) Order in Council 1979 (1979 II p.2866).

(a) No person shall use in fishing for shrimps or prawns, any beam trawl whereof the effective length of beam exceeds 9 metres, or in the case of an otter trawl, the length of headline exceeds 9 metres.

(b) No person shall use in fishing for shrimps or prawns, more than one beam trawl at any one time, unless the aggregate length of the beams does not exceed 9 metres.

(c) With a view to limiting the destruction of immature fish, every person in fishing for shrimps or prawns shall as soon as practicable after each haul, thoroughly sift the catch in a riddle, having a mesh such that the spaces between adjacent longitudinal wires are not less than 5 mm and the spaces between the adjacent lateral wires are not less than 60 mm.

(d) The immature sea fish that pass through such a riddle, must be returned to the sea forthwith unless the landing obligation under Article 15 of Regulation (EU) 1380/2013 requires the fish to be landed.

Explanatory Note: This byelaw prohibits the use of a beam or other trawl that exceeds 9 m in length. This measure is designed to protect shrimp and prawn stocks.

Paragraph (d) amended by The Inshore Fisheries and Conservation Authority (Miscellaneous Byelaw Amendments) (England) Order 2015 dated 30.11.15