Fisheries in EMS Habitats Regulations Assessment for Amber and Green risk categories

European Marine Site: Exe Estuary SPA

Fishing activities assessed: Crab Tiling

D&S IFCA Interaction ID	Fishing Activity	Feature(s)	Supporting habitat
HRA_UK9010081_AR39	Crab Tiling	• Non-breeding Avocet • Non-breeding Black-tailed godwit • Non-breeding Dark-bellied Brent goose • Non-breeding Dunlin • Non-breeding Grey plover • Non-breeding Oystercatcher • Non-breeding Slavonian grebe • Waterbird assemblage	Intertidal coarse sediment
HRA_UK9010081_P39			Intertidal mixed sediments
HRA_UK9010081_K39			Intertidal mud
HRA_UK9010081_L39			Intertidal sand and muddy sand

Version Control History			
Author	**Date**	**Comment**	**Version**
Katherine Stephenson	06/09/18	Final draft complete to be sent to NE.	1

Contents

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.

Site level assessments are being carried out in a manner that is consistent with the provisions of Article 6(3) of the Habitats Directive. The aim of this assessment is to determine whether management measures are required in order to ensure that fishing activity or activities will have no adverse effect on the integrity of the site. 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 Devon and Severn Inshore Fisheries and Conservation Authority (D&S IFCA) the fishing activity of “crab tiling” has a likely significant effect on the intertidal sediment features of the Exe Estuary SPA, and on the basis of this assessment whether or not it can be concluded that crab tiling will not have an adverse effect on the integrity of this EMS.

1.2 Documents reviewed to inform this assessment

- Natural England’s risk assessment Matrix of fishing activities and European habitat features and protected species
- Reference list (Annex 1)
- Natural England’s consultation advice (Annex 2)
- Site map(s) – sub-feature/feature location and extent (Annex 3)
- Fishing activity data (map(s), etc.) (Annex 4)

2. Information about the EMS

The Exe Estuary SPA includes both marine areas (i.e. land covered continuously or intermittently by tidal waters) and land which is not subject to tidal influence. Sub-features have been identified which describe the key habitats within the European marine site necessary to support the birds that qualify within the SPA. Bird usage of the site varies seasonally, with different areas being favoured over others at certain times of the year. The mussel beds in particular are important in supporting the wintering wader and wildfowl assemblage to enable them to acquire sufficient energy reserves to ensure population survival (English Nature, 2001 & Natural England, 2015). Figure 1 (Annex 3) shows the boundary of the Exe Estuary SPA.

2.1 Overview and qualifying features

The Exe Estuary SPA qualifies under Articles 4.1 and 4.2 of the EU Birds Directive by supporting the following interest features (Natural England, 2015):

- Non-breeding Avocet (*Recurvirostra avosetta*)
- Non-breeding Black-tailed godwit (*Limosa limosa islandica*)
- Non-breeding Dark-bellied Brent goose (*Branta bernicia bernicia*)
- Non-breeding Dunlin (*Calidris alpina alpina*)
- Non-breeding Grey plover (*Pluvialis squatarola*)
- Non-breeding Oystercatcher (*Haematopus ostralegus*)
- Non-breeding Slavonian grebe (*Podiceps auritus*)
- Waterbird assemblage

The key supporting habitats are:

- Circalittoral rock
- Freshwater and coastal grazing marsh
- Infralittoral rock
- Intertidal biogenic reef: mussel beds
- Intertidal coarse sediment
- Intertidal mixed sediments
- Intertidal mud
- Intertidal rock
- Intertidal sand & muddy sand
- Intertidal seagrass beds
- Intertidal stony reef
- Subtidal biogenic reefs: mussel beds
- Subtidal coarse sediment
- Subtidal mixed sediment
- Subtidal sand
- Subtidal seagrass beds
- Subtidal stony reef
- Water column
- Saltmarsh
    - Atlantic salt meadows (*Glauco-Puccinellietalla maritimae*)
    - Salicornia and other annuals colonising mud & sand
    - Spartina swards (*Spartinion maritimae*)

2.2 Conservation Objectives

The site's conservation objectives apply to the Special Protection Area and the individual species and/or assemblage of species for which the site has been classified.
The objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and 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 populations of the qualifying features
- the distribution of the qualifying features within the site

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

None – this site has no gear-feature interactions categorised as "red" risk.

4. Information about the fishing activities within the site

Devon and Severn IFCA undertakes crab tile surveys every four years to determine the current number of crab tiles and to see if there have been any changes. A baseline survey of crab tiles in the SPA was undertaken in 2000/2001 and then further surveys were carried out in 2003/2004, 2008, 2012 and 2016. These surveys have identified the activity is occurring at a high level within certain areas of the SPA. The material used for the majority of crab tiles consists of piping, corrugated iron, roof tiles and chimney pots. The majority of the crab tiles were deemed to be within recent use, with the exception of some that were almost buried. Most had seaweed and barnacle coverage on the tiles.

Crab tile survey results 2016:
Crab tiles were counted on the Exe Estuary using an Unmanned Aerial Vehicle (UAV), or drone as they are commonly referred to, mostly in August, September and one day in November 2016. A total of 23,835 crab tiles were counted. There was a 14% increase (Table 1) in crab tiles overall since 2012 on the Exe Estuary though levels of increases and decreases in numbers varied between locations (Table 2). However, the overall increase may be due to the increased accuracy of surveying using an UAV when compared to the traditional survey method on foot. As the traditional survey method has limitations such as inaccurate counts from areas that are difficult to reach and sometimes large expanses of tiles are estimated. Table 2 shows the breakdown of crab tiles within certain locations on the Exe Estuary compared to previous years. Figure 3 to Figure 11 (Annex 4) show the location of crab tiles on the Exe Estuary, the 2008 layers were not available at the time of writing and so are not included in the maps.

Table 1 - Comparison of crab tile counts from previous surveys on the Exe Estuary

Survey	Number of crab tiles	Difference	Percentage difference
2016	23,835	+2,838	+14%
2012	20,997	-5,451	-21%
2008	26,488	-3,814	-13%
2003/04	30,302	+3,506	+13%
2000/01	26,796	-	-

Table 2 - Breakdown of crab tile numbers and distribution on the Exe Estuary

Location	Area	2016	2012	2008	2003/04	2000/01
Dawlish Warren	EXE 04	93	148	152	410	0
	EXE 05	5,073	4,406	6,054	4,573	1,135
Cockwood-Starcross	EXE 06	5,237	3,188	4,720	6,375	3,400
North of Starcross	EXE 07	6,760	7,338	6,313	8,468	8,450
South of Powderham	EXE 08	2,317	1,757	2,765	3,303	4,876
North of Powderham	EXE 09	0	0	0	0	150
North of Lympstone	EXE 17	584	330	384	420	1,165
South of Lympstone	EXE 18	1,231	1,123	1,472	1,580	900
Middle of Exmouth and Lympstone	EXE 19	2,226	2,463	4,022	4,218	5,820
Exmouth	EXE 20	314	244	606	955	900

Intertidal handwork survey 2016:

During May and June 2016 D&S IFCA conducted survey visits to the estuary to identify the level of intertidal handwork occurring (results can be found in Annex 6). The surveys looked at shellfish collection, crab tiling, and bait digging. Crab tiling accounted for approximately one third of the total hand-gathering activity on the estuary, although it made up a higher percentage of the activity on the west shore (Figure 16). Throughout the survey the estuary was visited 16 times, with crab tilers being seen on eight of these visits. 10 crab tilers were observed over five weekday visits, and four tilers were seen over three weekend visits. This suggests that this activity occurs at slightly higher levels during weekdays, which is contrary to the general pattern of total hand-gathering activity (**Figure 18**). However, in line with the general pattern of hand-gathering activity (Figure 17), the majority of crab tiling took place on spring tides, with 11 crab tilers observed over seven visits which occurred on spring tides, whereas tilers were only seen on one visit coinciding with a neap tide (a total of three tilers). Therefore, it seems this activity is largely temporally limited by spring tides.

Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand-gathering (including crab tiling activity), which would allow the IFCA to monitor levels of this activity in the future, and adapt permit conditions to changes in effort/ environmental conditions if necessary.

Other fishing activities within the EMS are described in the Fishing Activity Report (Gray, 2015).

5. Test for Likely Significant Effect (LSE)
5.1 Table 3 – Assessment of LSE

1. Is the activity/activities directly connected with or necessary to the management of the site for nature conservation?	**No**	
2. What pressures (such as abrasion, disturbance) are potentially exerted by the gear type(s)	• Above water noise (Bird features - Sensitive) • Visual disturbance (Bird features - Sensitive) • Abrasion & disturbance of the substrate on the surface of the seabed (Supporting habitat - Sensitive) • Physical changes (to another seabed type) (Supporting habitat – Sensitive) • Removal of non-target species (Bird feature & supporting habitat – Sensitive) • Removal of target species (Supporting habitat – Sensitive) See Annex 7 for Pressures Audit Trail	
3. Is the feature potentially exposed to the pressure(s)?	**Yes.** D&S IFCA Byelaw 24 restricts the area where crab tiling can take place. However, the non-restricted area does overlap with this feature and supporting habitats.	
4. What are the potential effects/impacts of the pressure(s) on the feature, taking into account the exposure level?	The intertidal sediment supporting habitats have the following targets (Natural England, 2015): • Maintain the structure, function & supporting processes associated with the feature and its supporting habitat (all bird features) • Maintain the extent & distribution of suitable habitat which supports the feature for all necessary stages of the non-breeding/wintering period (all bird features) • Maintain the distribution, abundance & availability of the most important prey items (avocet, black-tailed godwit, dunlin, grey plover, Slavonian grebe) • Restore availability of key prey at preferred sizes (oystercatcher) • Maintain the structure, function & availability of the habitat, which supports the assemblage feature for all stages of the non-breeding period (waterbird assemblage) The bird features have the following target: • The frequency, duration &/or intensity of disturbance affecting foraging &/or roosting should not reach levels that substantially affect the feature. Given that the features/supporting habitats could be exposed to the pressures listed in Section 2 of this table, there is potential that these targets will not be met.	
5. Is the potential scale or magnitude of any effect likely to be significant?	**Alone**	**Unsure,** an interaction is present between crab tiling and the features of Exe Estuary SPA. Therefore an appropriate assessment has been carried out.
	In-combination	**See section 8 for more information**
6. Have NE been consulted on this LSE test? If yes, what was NE's advice?	NE has not been consulted at this time.	

6. Appropriate Assessment

6.1 Potential risks to features

The potential pressures, impacts and exposure by gear type(s) for each feature/sub-feature are summarised in Table 4.

Table 4 - Summary of Impacts

Feature/ Supporting habitat(s)	**Target Attributes/ Conservation Objectives**	**Potential pressure (such as abrasion, disturbance) exerted by gear type(s)**	**Potential ecological impacts of pressure exerted by the activity/activities on the feature** *(reference to conservation objectives)*	**Level of exposure of feature to pressure**	**Mitigation measures**
All bird features • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud • Intertidal sand & muddy sand	**Target Attribute:** • Supporting habitat: extent and distribution of supporting non-breeding habitat: Maintain the extent & distribution of suitable habitat which supports the feature for all necessary stages of the non-breeding/wintering period • Supporting habitat – conservation measures: Maintain the structure, function & supporting processes associated with the feature and its supporting habitat **Conservation Objective:** Maintain or restore:	Abrasion & disturbance of the substrate on the surface of the seabed. Penetration & disturbance of the substrate below the surface of the seabed, including abrasion Physical changes (to another seabed type).	Sheehan et al. (2010b) looked at the effects of crab tiling on three estuaries (Yealm, Erme and Avon) which had previously been unexposed to crab tiles. The study manipulated sites for a month with controls, tiled only, trampled only and crab tiled to determine the impact on macro-infaunal diversity. Trampling and crab tiling was conducted three times a week. Samples were taken after the final day of disturbance. They found the organic content of the sediment and sediment particle size was unaffected by crab tiling. Crab tiling made sediments more penetrable and infaunal assemblages differed most in the muddiest estuaries (Yealm and Erme). Non-trampled sites (controlled and tiled only) had similar measure of sediment stability and similar abundance to each other, whereas, the sediments in trampling only were least stable and had the lowest infaunal abundance. Crab tiled and trampled sites which were more stable than trampling only sites also had a greater abundance. Sheehan et al. (2010b) suggested that tramping was the mechanism that contributed most to the decrease in infaunal abundance rather than the presence of the tiles. In the Yealm, non-trampled plots had greater	Crab tile surveys undertaken in 2016 identified 23,835 crab tiles within the SPA. The overall number of crab tiles has decreased from 2003/04 by 22%, see Table 1 for more information. Annex 4, Figures 3-11 show the location of crab tiles within the SPA. Crab tiles are worked at low tide (mostly spring tides) during the day, all year round. Usually a patch of tiles is solely worked by one individual who owns those tiles. Crab tile owners usually work their tiles part time, as a hobby or as and when they need bait for recreational angling. Crab tilers only collect crabs which are over 40mm carapace width, not berried females and in the stage of pre-ecdysis (moulting stage) (Sheehan et al. 2008).	Devon and Severn IFCA monitors the number of crab tiles every four years. The next survey is due in 2020. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand-gathering (including crab tiling activity), which would allow the IFCA to

	• 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		abundances of oligochaetes, polychaetes and species of sabellid worm, gastropod, bivalve and shrimp (Sheehan et al. 2010b). Johnson et al. (2007) examined the effects of trampling from crab tiling activity on nematodes in mudflats in the Yealm Estuary. Plots were trampled six times over a two week period which significantly reduced nematode abundance. This might have been caused by meiofauna burrowing deeper into the sediment. However, 12-36 hours after activity ceased, species numbers had returned to control levels. Johnson et al. (2007) attributed the fast recovery to the dynamic nature of intertidal mudflats, which frequently experience natural disturbance. Additionally, abiotic factors (grain size, total organic content and penetrability) indicated that crab tiling made no significant changes to habitat structure. Crab tiles can be mistaken for rocks as they provide a structural habitat and allow organisms such as seaweeds and barnacles to attach in a typically homogenous environment. Additionally, at low tide, pools of water are often retained around the crab tiles.	Moulting crabs represent 10% of the crabs found under crab tiles (Sheehan et al. 2008). Trampling extent would be from the shore to the area of tiles, from tile to tile and then back to the shore line. These footprints are visible in the sediment until the tide homogenises the sediment again. Tiles are spread approximately 1m apart (Sheehan et al. 2010b). The potential area of sediment impacted from crab tiling within the SPA is approximately 1.9 hectares. An area worked is only impacted by trampling for a small time frame and recovery can be within 36 hours (Johnson et al. 2007). Intertidal mudflat communities are exposed naturally to repeat disturbances from tidal forces and currents (Johnson et al. 2007).	monitor levels of this activity in the future, and adapt permit conditions to changes in effort/ environmental conditions if necessary.
Waterbird assemblage • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud	**Target Attribute:** • Supporting habitat - quality of supporting non-breeding habitat: Maintain the structure, function & availability of the habitat, which supports the assemblage feature for all stages	Abrasion & disturbance of the substrate on the surface of the seabed. Physical changes (to another seabed type).	See above.	See above.	See above.

• Intertidal sand & muddy sand	(moulting, roosting, loafing, feeding) of the non-breeding period **Conservation Objective:** Maintain or restore: • 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				
Avocet, Black-tailed godwit, Dark-bellied Brent goose, Dunlin, Grey plover, Oyster-catcher • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud	**Target Attribute:** • Supporting habitat - Landscape: Maintain open and unobstructed terrain around nesting, roosting and feeding sites. • Connectivity with supporting habitats: Maintain safe passage of birds moving between roosting and feeding areas. **Conservation Objective:** Maintain or restore:	Physical change to another seabed type. Visual disturbance.	Crab tiling would not obstruct line of sight on the mudflats as crab tiles are less than 30cm off the sediment when inserted at a 45° angle. The approximate area of mudflats covered in the SPA by crab tiles is 2,979.4m² (if every tile had an area of 0.125m²). Crab tile size and shape vary with the type of material used from plastic piping, roof tiles and corrugated iron. The calculation is an approximate size for the collective types used. This is a worst case scenario estimate as not all crab tiles lie flat on the mudflats; most are inserted at a 45° angle. Sheehan et al. (2012) found the presence of crab tiles did not appear to negatively affect shorebird foraging behaviour in the Exe Estuary. Birds used the pools around crab tiles for feeding and little	Obstruction to the mudflats caused by crab tiling is not believed to be significant to prohibit bird features from feeding.	No mitigation measures necessary. Numbers of crab tiles are monitored every four years.

• Intertidal sand & muddy sand	• the extent and distribution of the habitats of the qualifying features • the structure and function of the habitats of the qualifying features		egret were seen fishing from crab tiles (Sheehan et al. 2012).		
Grey plover, Slavonian Grebe • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud Intertidal sand & muddy sand	**Target Attribute:** • Supporting habitat – food availability: Maintain (restore for oystercatcher) the distribution, abundance and availability of key food and prey items at preferred sizes. **Conservation Objective:** Maintain or restore: • the populations of the qualifying features • the distribution of the qualifying features within the site	Removal of target species. Removal of non-target species Abrasion & disturbance of the substrate on the surface of the seabed. Penetration & disturbance of the substrate below the surface of the seabed, including abrasion.	Sheehan et al. (2010b) looked at the effects of crab tiling on three estuaries (Yealm, Erme and Avon) which had previously been unexposed to crab tiles. The study manipulated sites for a month with controls, tiled only, trampled only and crab tiled to determine the impact on macro-infaunal diversity. Trampling and crab tiling was conducted three times a week. Samples were taken after the final day of disturbance. They found the organic content of the sediment and sediment particle size was unaffected by crab tiling. Crab tiling made sediments more penetrable and infaunal assemblages differed most in the muddiest estuaries (Yealm and Erme). Non-trampled sites (controlled and tiled only) had similar measure of sediment stability and similar abundance to each other, whereas, the sediments in trampling only were least stable and had the lowest infaunal abundance. Crab tiled and trampled sites which were more stable than trampling only sites also had a greater abundance. Sheehan et al. (2010b) suggested that tramping was the mechanism that contributed most to the decrease in infaunal abundance rather than the presence of the tiles. In the Yealm, non-trampled plots had greater abundances of oligochaetes, polychaetes and species of sabellid worm, gastropod, bivalve and shrimp (Sheehan et al. 2010b).	Crab tile surveys undertaken in 2016 identified 23,835 crab tiles within the SPA. The overall number of crab tiles has decreased from 2003/04 by 22%, see Table 1 for more information. Annex 4, Figures 3-11 show the location of crab tiles within the SPA. Crab tiles are worked at low tide (mostly spring tides) during the day, all year round. Usually a patch of tiles is solely worked by one individual who owns those tiles. Crab tile owners usually work their tiles part time, as a hobby or as and when they need bait for recreational angling. Crab tilers only collect crabs which are over 40mm carapace width, not berried females and in the stage of pre-ecdysis (moulting stage) (Sheehan et al. 2008). Moulting crabs represent 10% of the crabs found under crab tiles (Sheehan et al. 2008).	Devon and Severn IFCA monitors the number of crab tiles every four years. The next survey is due in 2020. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand-gathering (including crab tiling activity), which would allow the IFCA to monitor levels of this activity in the future, and adapt permit conditions

			Johnson et al. (2007) examined the effects of trampling from crab tiling activity on nematodes in mudflats in the Yealm Estuary. Plots were trampled six times over a two week period which significantly reduced nematode abundance. This might have been caused by meiofauna burrowing deeper into the sediment. However, 12-36 hours after activity ceased, species numbers had returned to control levels. Johnson et al. (2007) attributed the fast recovery to the dynamic nature of intertidal mudflats, which frequently experience natural disturbance. Additionally, abiotic factors (grain size, total organic content and penetrability) indicated that crab tiling made no significant changes to habitat structure. Crab tiles can be mistaken for rocks as they provide a structural habitat and allow organisms such as seaweeds and barnacles to attach in a typically homogenous environment. Additionally, at low tide, pools of water are often retained around the crab tiles. Sheehan et al. (2010a) used fixed underwater video cameras in tiled and non-tiled sites on Yealm estuary to determine crab distribution during high tide. They found crabs were significantly more abundant in tiled sites. Sheehan et al. (2008) assessed the effects of crab tiling on the population of the green crab *Carcinus maenas* in tiled (Plym, Teign and Exe) and non-tiled (Yealm, Fowey and Salcombe) estuaries. Crabs were caught by baited drop nets, sexed and measured. Tiled estuaries had significantly 63% more crabs than non-tiled estuaries. Crab populations were found to have different size structure such that tiled estuaries had a smaller proportion of large crabs and a	Trampling extent would be from the shore to the area of tiles, from tile to tile and then back to the shore line. These footprints are visible in the sediment until the tide homogenises the sediment again. Tiles are spread approximately 1m apart (Sheehan et al. 2010b). The potential area of sediment impacted from crab tiling within the SPA is approximately 1.9 hectares. An area worked is only impacted by trampling for a small time frame and recovery can be within 36 hours (Johnson et al. 2007). Intertidal mudflat communities are exposed naturally to repeat disturbances from tidal forces and currents (Johnson et al. 2007).	to changes in effort/ environmental conditions if necessary.

			smaller modal size call of 20-29mm compared to 30-39mm in non-tiled estuaries. The greater abundance of crabs in tiled estuaries could have adverse effects for associated estuarine fauna. Sheehan et al. (2010a) noted that oysters *Ostrea edulis* and mussels *Mytilus edulis* are an important part of adult *C. maenus* diet and therefore changes in crab population could potentially have an effect on the abundance of their prey species.		
All bird features (in relation to the intertidal sediment supporting habitats)	**Target Attribute:** • Disturbance caused by human activity: Reduce the frequency, duration and/or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed. **Conservation Objective:** Maintain or restore: • the populations of the qualifying features • the distribution of the qualifying features within the site	Above water noise. Visual disturbance.	Sheehan et al. (2012) found the presence of crab tiles did not appear to negatively affect shorebird foraging behaviour in the Exe Estuary. Shorebird species richness, abundance and species assemblage composition were not affected by the presence of crab tiles, compared to areas with no crab tiles. Sheehan et al. (2012) proposed that the crab tiles provide a structural habitat which can aggregate potential prey for bird species, such as crabs and gastropods attracting feeding shorebirds. Several studies have found that disturbance can have an effect on population levels and distribution of species: Liley et al. (2011) states that increased disturbance can lead to reduced breeding success. Disturbance can also result in otherwise suitable habitat being unused. This is further explained in Hockin et al. (1992), which shows disturbance can have an effect on breeding success through several factors e.g. nest abandonment, increased mortality of eggs due to predation & increased mortality of young through reduced feeding. Disturbance can reduce use of sites by birds, and can affect nest site	Crab tile surveys undertaken in 2016 identified 23,835 crab tiles within the SPA. The overall number of crab tiles has decreased from 2003/04 by 22%, see Table 1 for more information. Annex 4, Figures 3-11 show the location of crab tiles within the SPA. Crab tiles are worked at low tide (mostly spring tides), two hours either side of low, during the day, all year round. Usually a patch of tiles is solely worked by one individual who owns those tiles. Crab tile owners usually work their tiles part time, as a hobby or as and when they need bait for recreational angling. Servicing crab tiles is usually a slow, solitary and quiet process (Goss-Custard & Verboven, 1993). The amount of time a crab tiler is on an estuary is for an average of 90 minutes (Goss-	Devon and Severn IFCA monitor the number of crab tiles every four years. The next survey is due in 2020. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand-gathering (including crab tiling activity), which would allow the IFCA to monitor levels of this activity in the

			choice, having a negative effect on population density. It can also have a negative effect on energy budgets – time spent flying, reduces time spent feeding. Goss-Custard (2016) concluded that disturbance caused by crab collecting in the area studied on the Exe was “trivial and certainly nowhere near large enough to have a serious impact on the birds’ chances of surviving the winter in good condition”. Over the last five years the only feature bird species to show a decline on the Exe Estuary are the Avocet (-23%), Dunlin (-4%) and Grey plover (-37%), all others have increasing population numbers. Both Dunlin and Grey plover are declining nationally; therefore Avocet is the only species not following the national trend (Frost et al. 2017).	Custard, 2016). Disturbance would cause a temporary change in distribution and reduction in numbers where crab tiles are being worked. The extent of disturbance from human presence would be a tiler walking from the shore to the area of tiles, from tile to tile and then back to the shore line. Tiles are spread approximately 1m apart (Sheehan et al. 2010b). The area of mudflat exposed to crab tiling, and therefore potential disturbance within the SPA is approximately 176 hectares.	future, and adapt permit conditions to changes in effort/ environmental conditions if necessary.
	Target Attribute: • Non-breeding population - abundance/ Assemblage of species – abundance: Maintain/ restore the size of the non-breeding population at a level which is above 20,600 (waterfowl), 1,015 (black-tailed godwit), 350 (grey plover), 5,300 (dunlin), 531 (avocet), 2,650 (dark-bellied brent goose), 20 (slavonian grebe)	Above water noise Visual disturbance Removal of target species	See above rows.	See above rows.	See above rows.

	and 3,980 (oystercatcher) individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. • Assemblage of species – diversity: Maintain or increase the species diversity of the bird assemblage. **Conservation Objective:** Maintain or restore: • the populations of the qualifying features • the distribution of the qualifying features within the site				

7. Conclusion

Crab tiling occurs at a high level on the mudflats within the SPA, with 23,835 crab tiles within the Exe Estuary. The literature cited in the appropriate assessment has indicated that crab tiles do not change the habitat structure of the supporting habitats, with there being no change in total organic carbon and sediment grain size. Trampling causing penetrability of the sediment varied with Johnson et al. (2007) finding no difference and Sheehan et al. (2010b) found trampled plots where less stable and more penetrable. However, crab tiles do increase habitat complexity by allowing species such as seaweeds and barnacles to colonise a previously homogenous environment which may even attract feeding birds.

Trampling from crab tiling was found to lower infaunal abundance of nematodes, oligochaetes, polychaetes and species of sabellid worm, gastropod, bivalve and shrimp (Sheehan et al. 2010b; Johnson et al. 2007). Johnson et al. (2007) found that up to 36 hours after the activity ceased, species abundance returned to control levels. Recovery of intertidal mudflat communities is thought to be rapid as they are naturally exposed to repeat disturbances from tidal forces and currents (Johnson et al. 2007). Sheehan et al. (2012) found birds used the pools around crab tiles for feeding and little egret were seen fishing from crab tiles (Sheehan et al. 2012).

Areas of crab tiles are worked part time by their owners at spring low tides. Crab tilers are solitary and on the shore for approximately 90 minutes. Disturbance is only from the presence of crab tilers during this time. This disturbance may result in a temporary change in distribution and abundance of birds in vicinity of the crab tiles worked.

Crab tile numbers are monitored every four years with the next survey due in 2020. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand working (including crab tiling activity), which would allow the IFCA to monitor levels of this activity in the future, and adapt permit conditions to changes in effort/ environmental conditions if necessary. At the current number of crab tiles, the effect of removal of crabs and trampling to the sediment is not thought to significantly affect the presence, distribution and communities of the supporting habitats. Food availability and disturbance to the bird features will not cause long term change in distribution or permanent reduction in numbers where crab tiles are laid.

8. In-combination assessment

Crab tiling occurs alongside other fishing activities within the Exe Estuary SPA (Gray, 2015). Other fishing activities, occurring on this site, which may interact with the intertidal sediments are the elevator harvester, intertidal handwork and bait digging. The elevator harvester fishery has already undergone a HRA, which concluded it was not likely to have a significant effect in combination with other plans or projects. The low levels of intertidal handwork mean that there is no likelihood of significant adverse effect to the features considered in this assessment in-combination with crab tiling. Bait digging has not yet been assessed and the in-combination assessment with crab tiling will be carried out within the bait digging HRAs.

The impact of future plans or projects will require assessment in their own right, including accounting for any in-combination effects, alongside existing activities.

9. Summary of consultation with Natural England

N/A Natural England has not been consulted at this stage.

10. Integrity test

It can be concluded that crab tiling, alone or in-combination, within the Exe Estuary SPA does not adversely affect bird features and their supporting habitats assessed and that the conservation objects can be met. Management measures are not currently in place, however, Devon and Severn IFCA aim to implement a permitting byelaw that will cover hand-gathering (including crab tiling activity).

Annex 1: Reference list

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Annex 2: Natural England’s consultation advice

N/A Natural England has not been consulted at this stage.

Annex 3: Site Maps

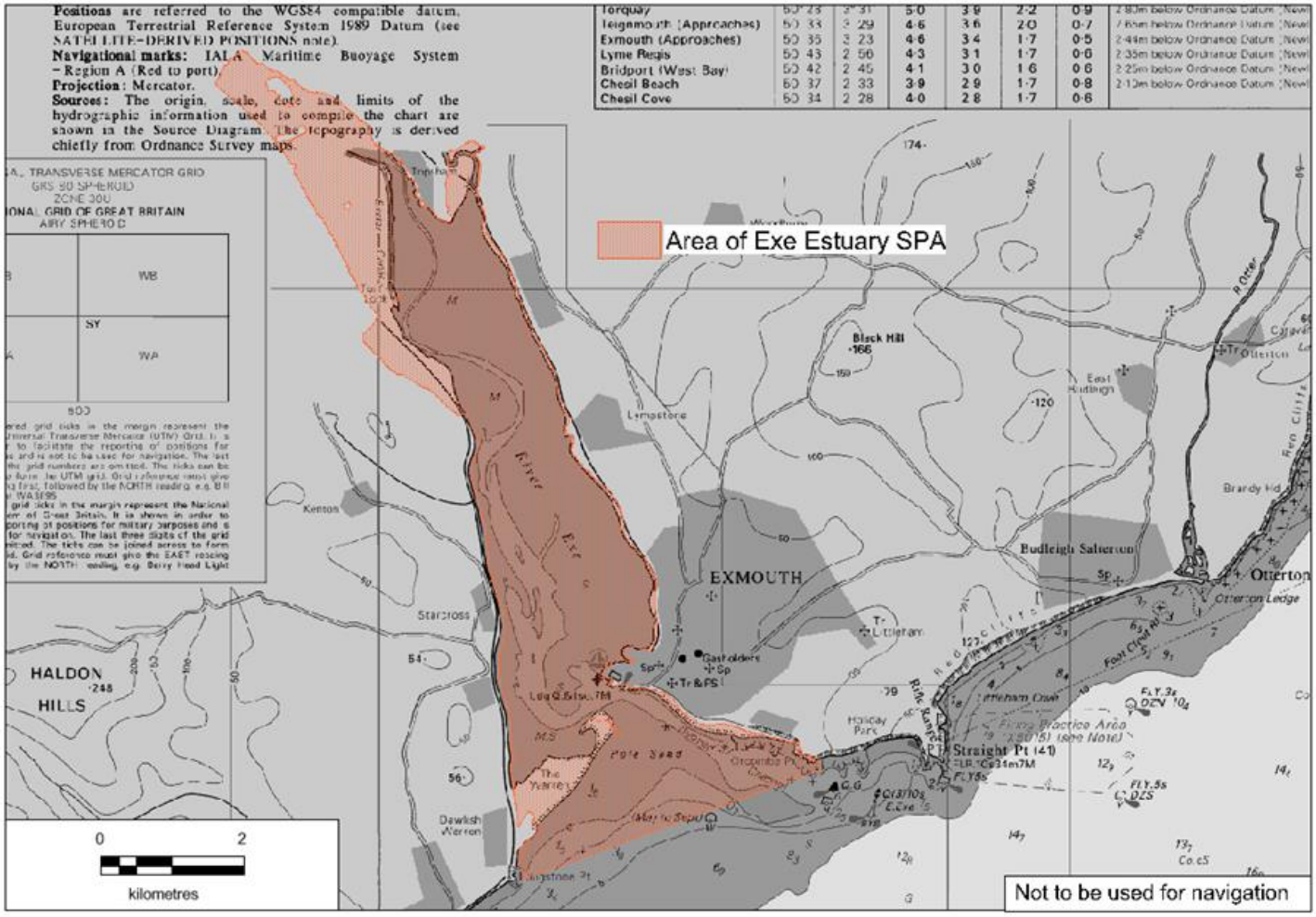


Figure 1 - Exe Estuary SPA boundary (shown in red)

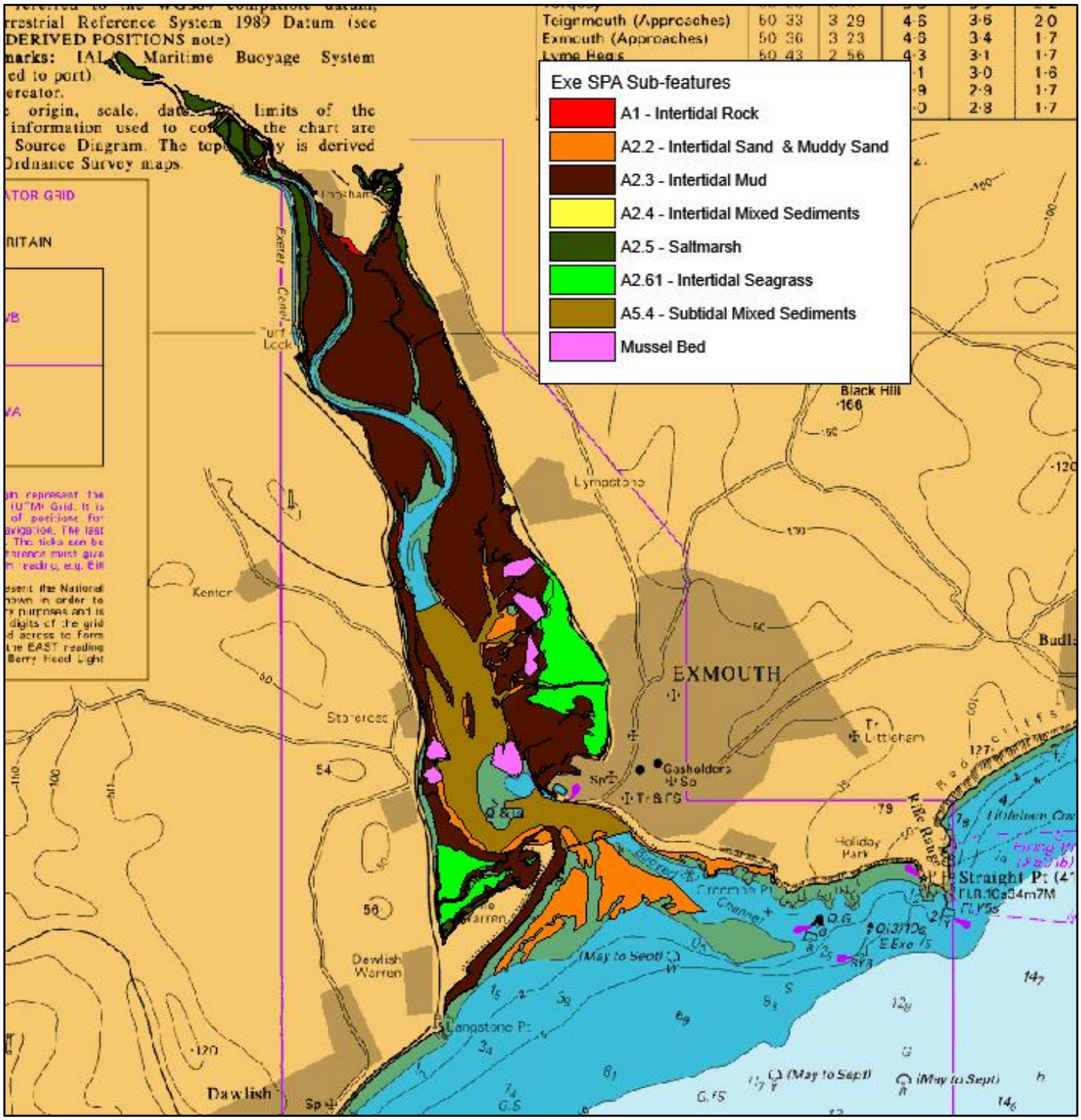


Figure 2 - Exe Estuary SPA sub-features (Natural England, 2015)

Annex 4: Fishing activity maps

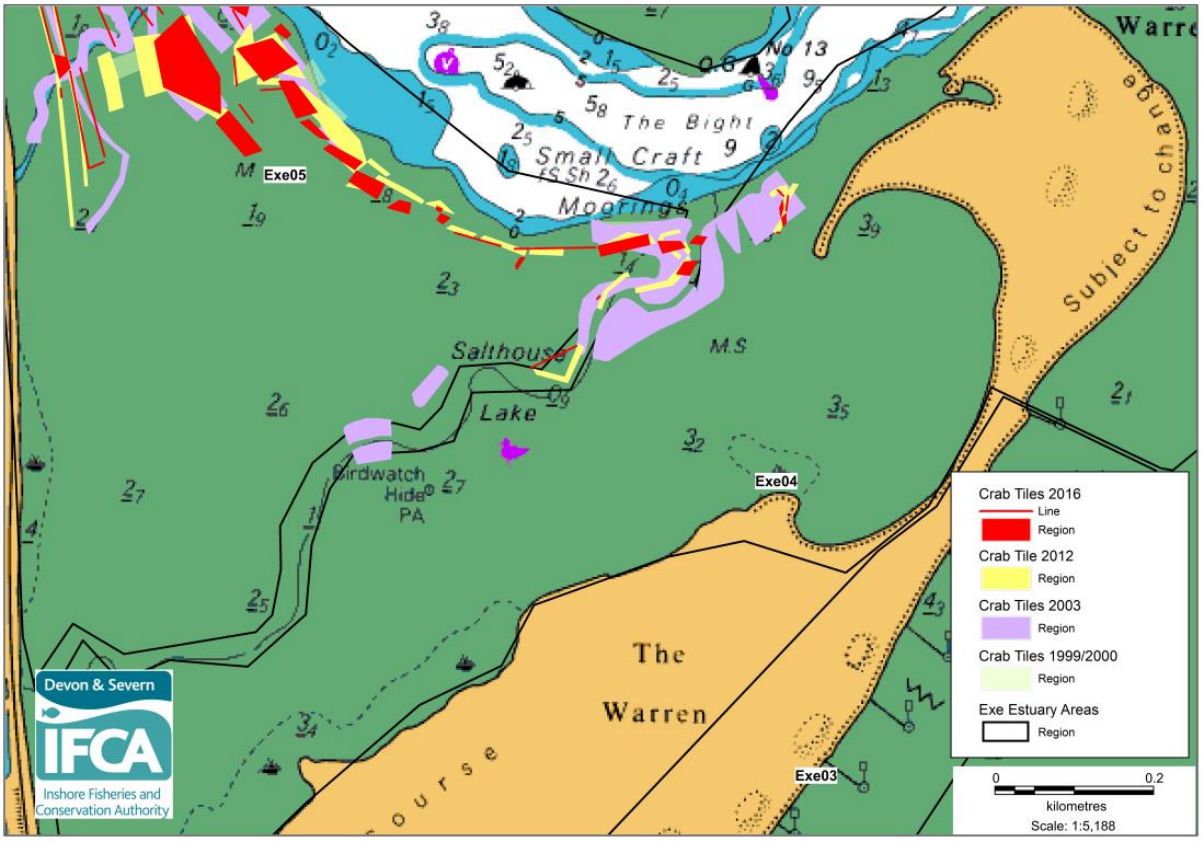


Figure 3 – Crab tiles on the Exe Estuary, Area Exe04

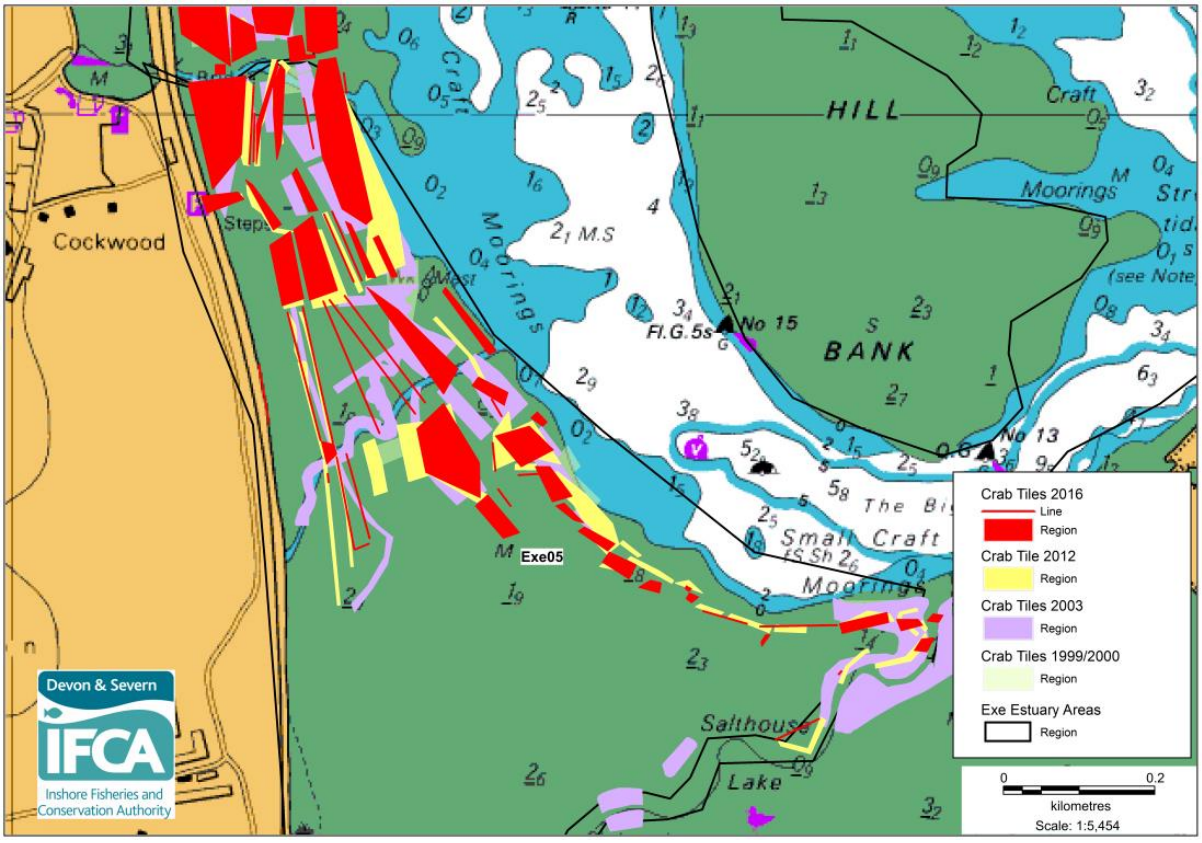


Figure 4 - Crab tiles on the Exe Estuary, Area Exe05

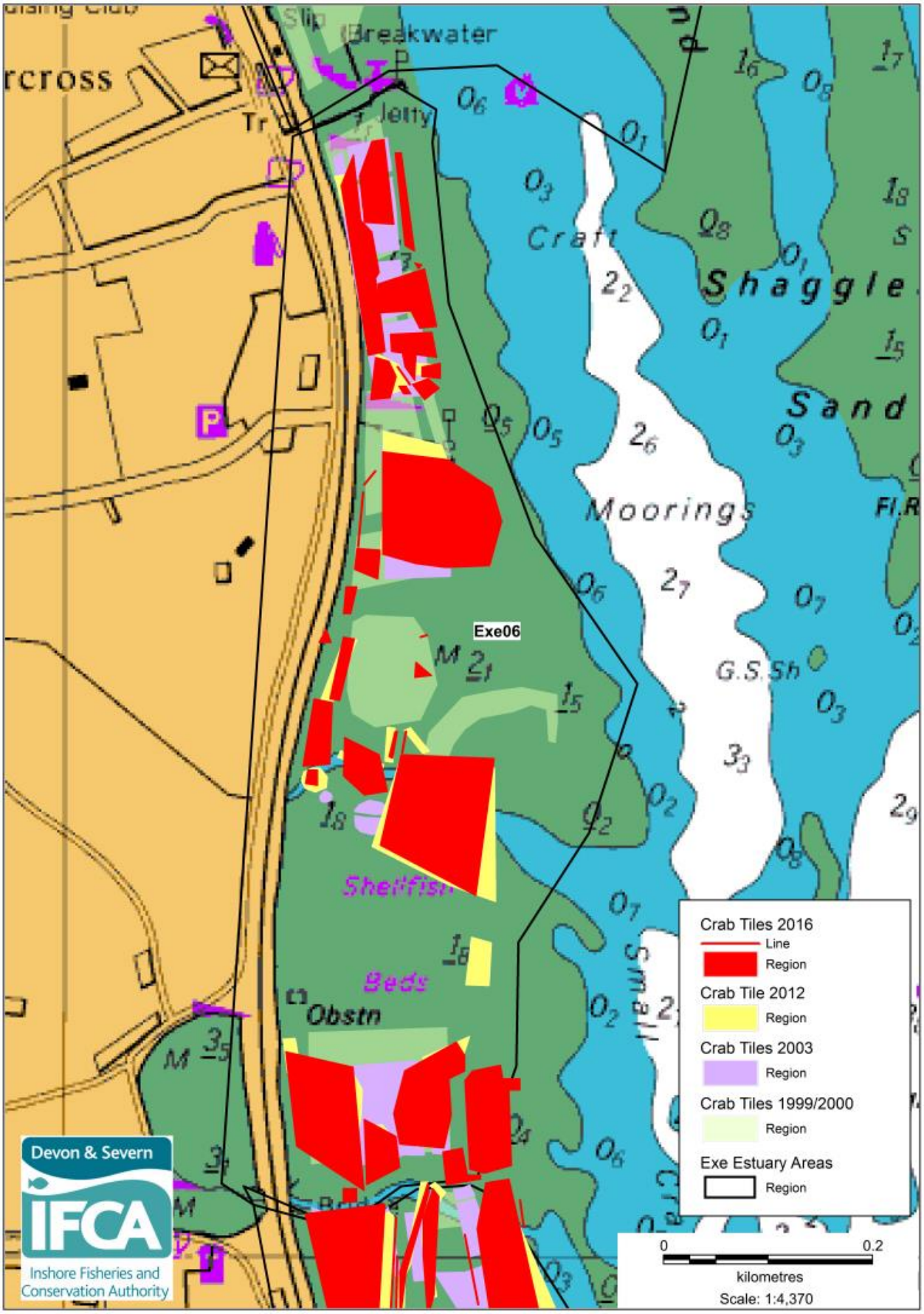


Figure 5 - Crab tiles on the Exe Estuary, Area Exe06

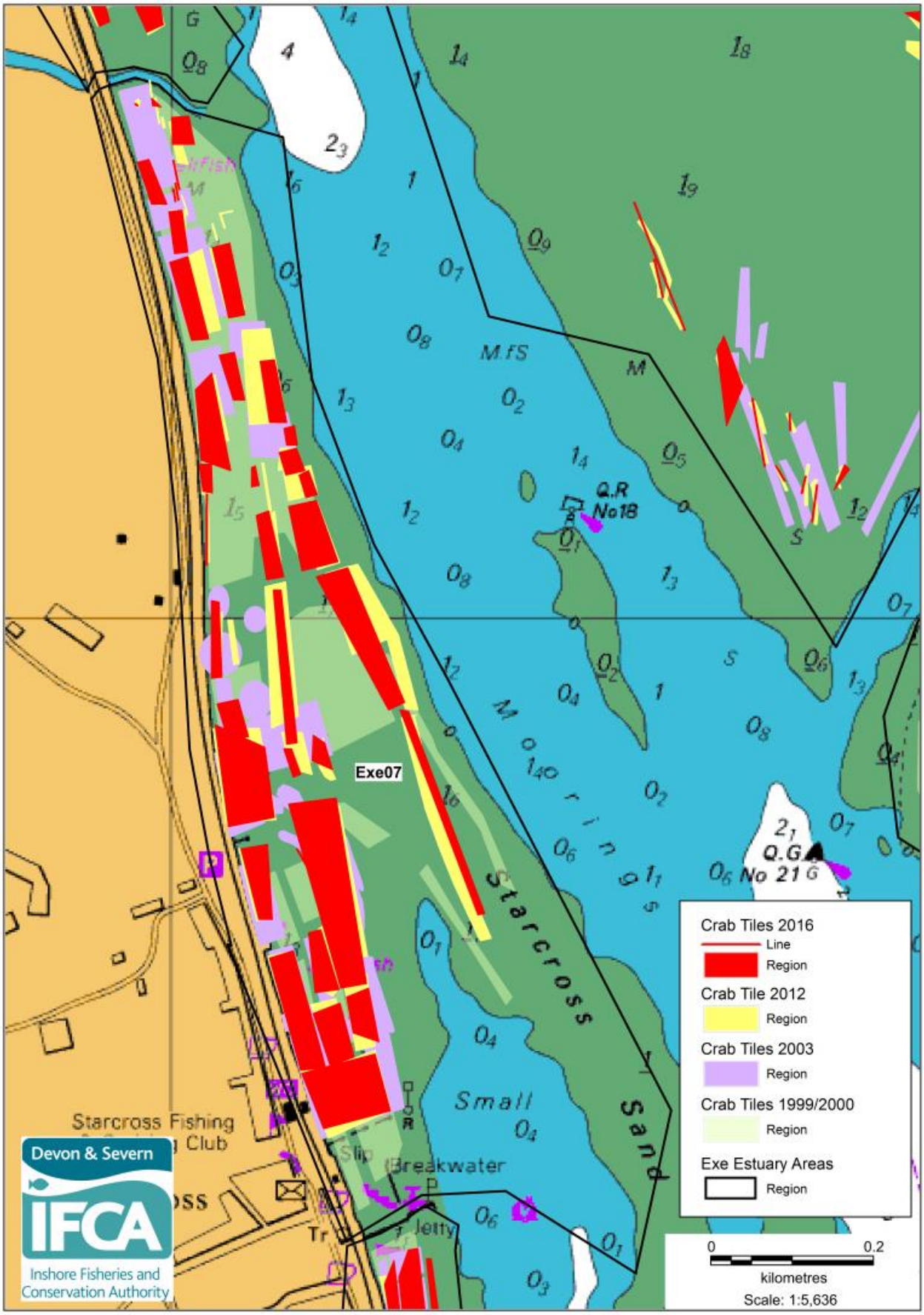


Figure 6 - Crab tiles on the Exe Estuary, Area Exe07

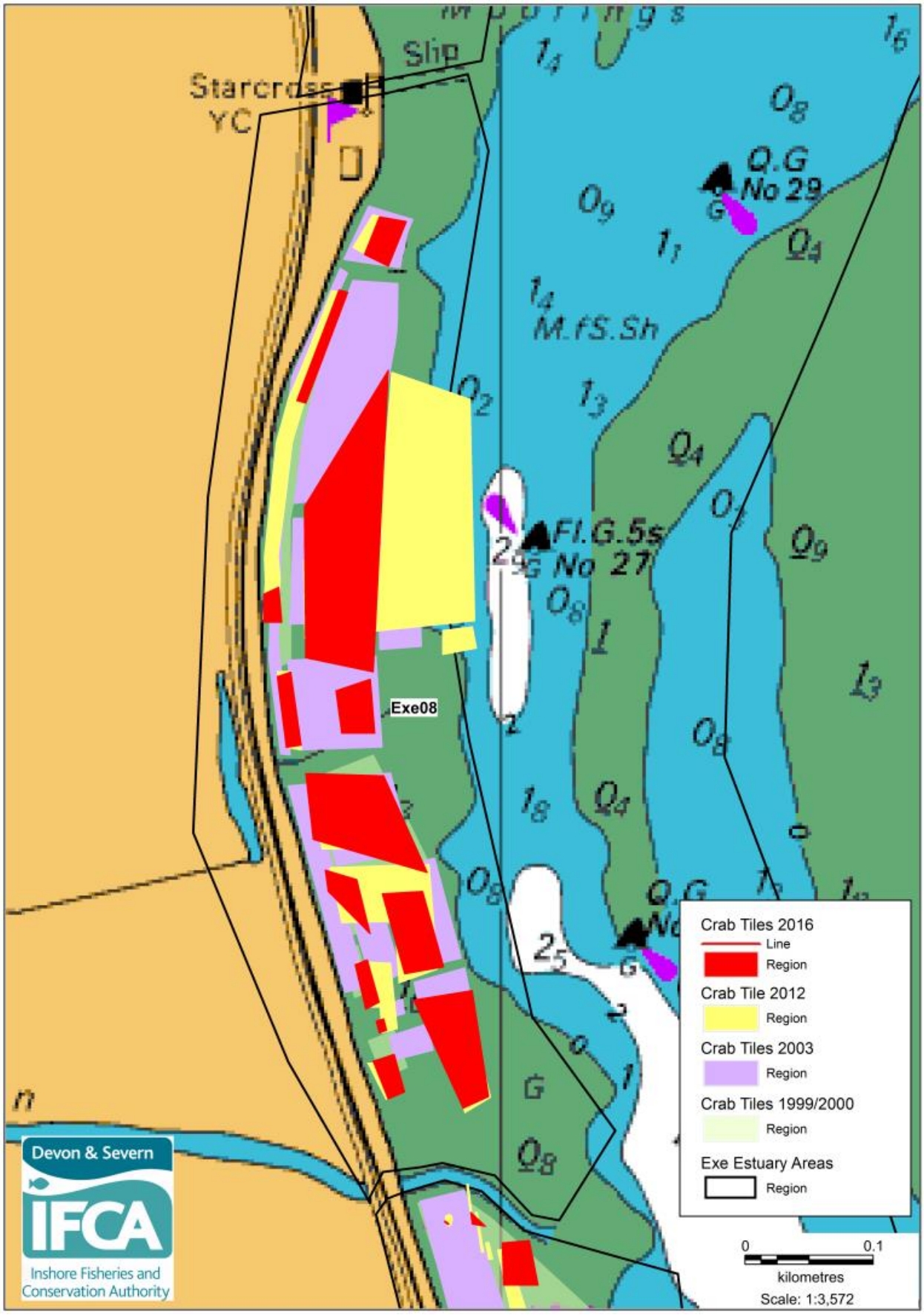


Figure 7 - Crab tiles on the Exe Estuary, Area Exe08

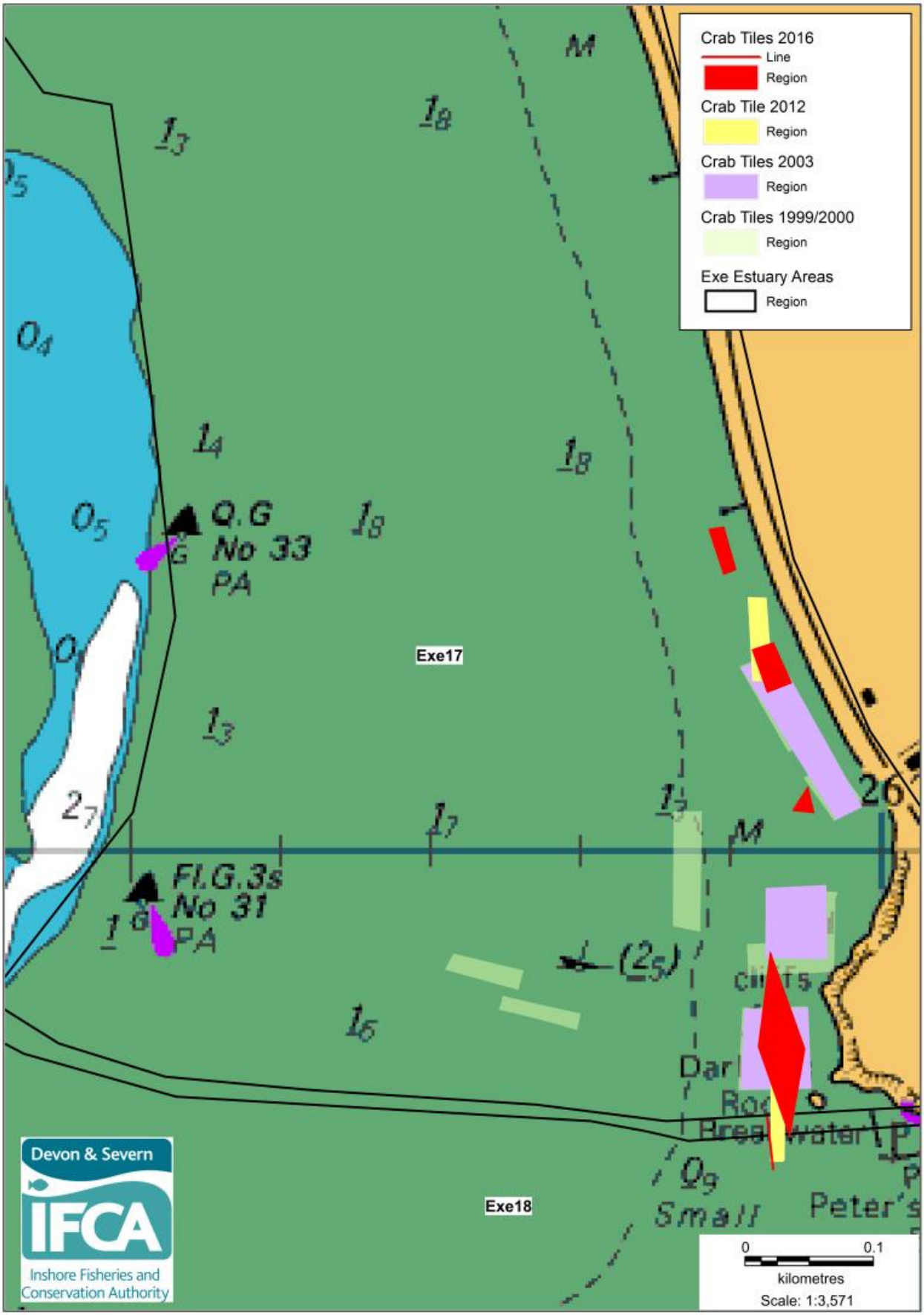


Figure 8 - Crab tiles on the Exe Estuary, Area Exe17

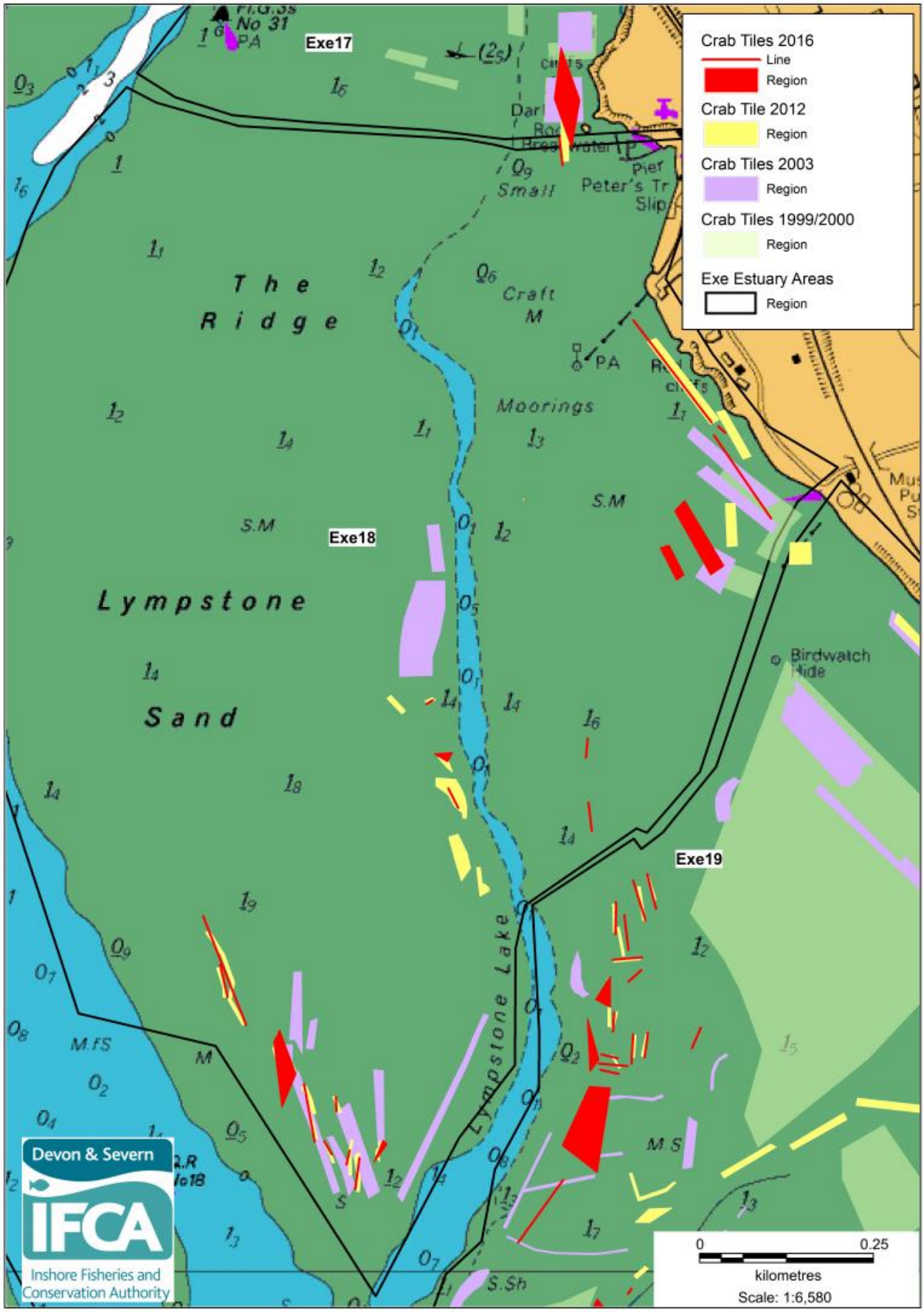


Figure 9 - Crab tiles on the Exe Estuary, Area Exe18

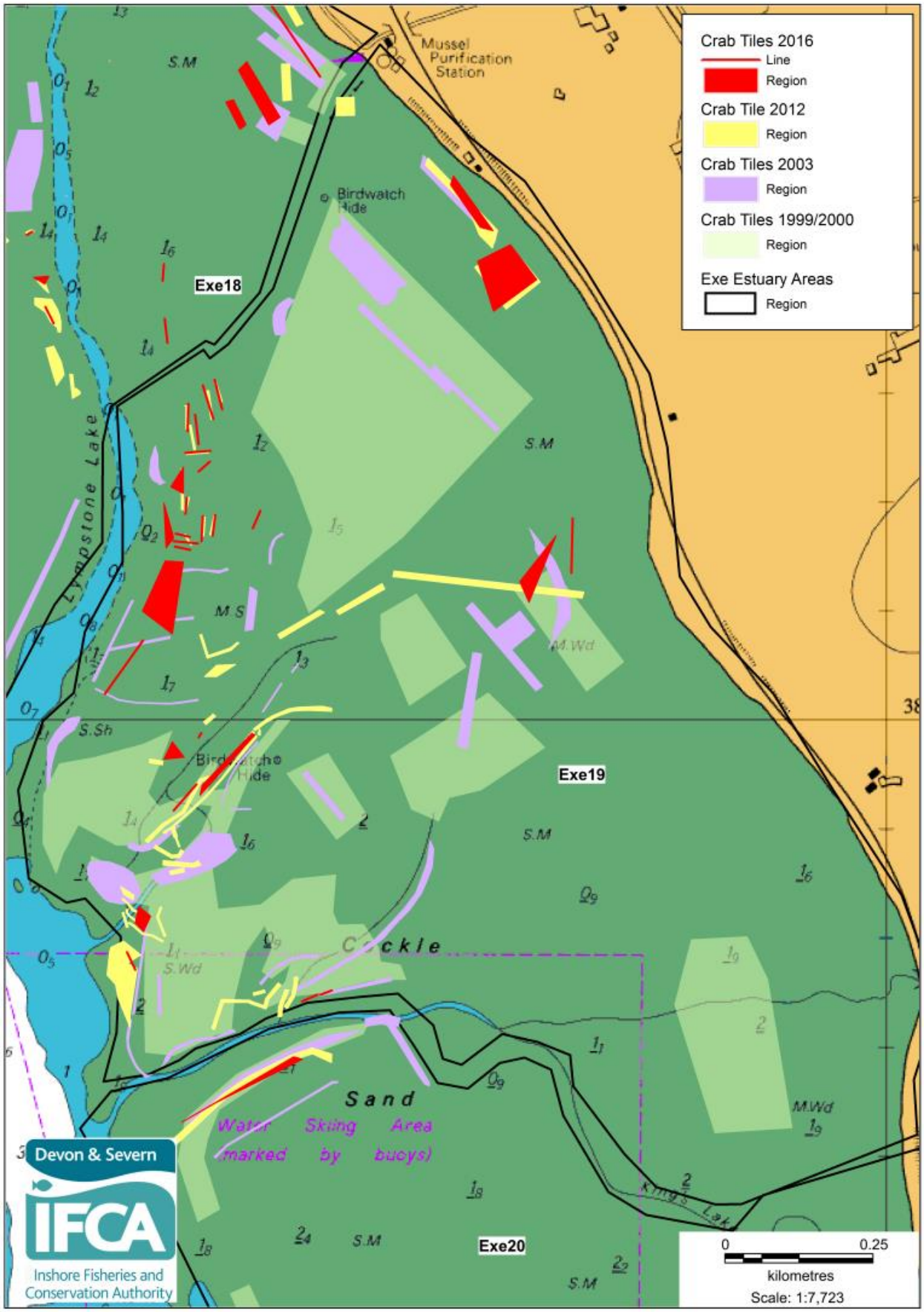


Figure 10 - Crab tiles on the Exe Estuary, Area Exe19

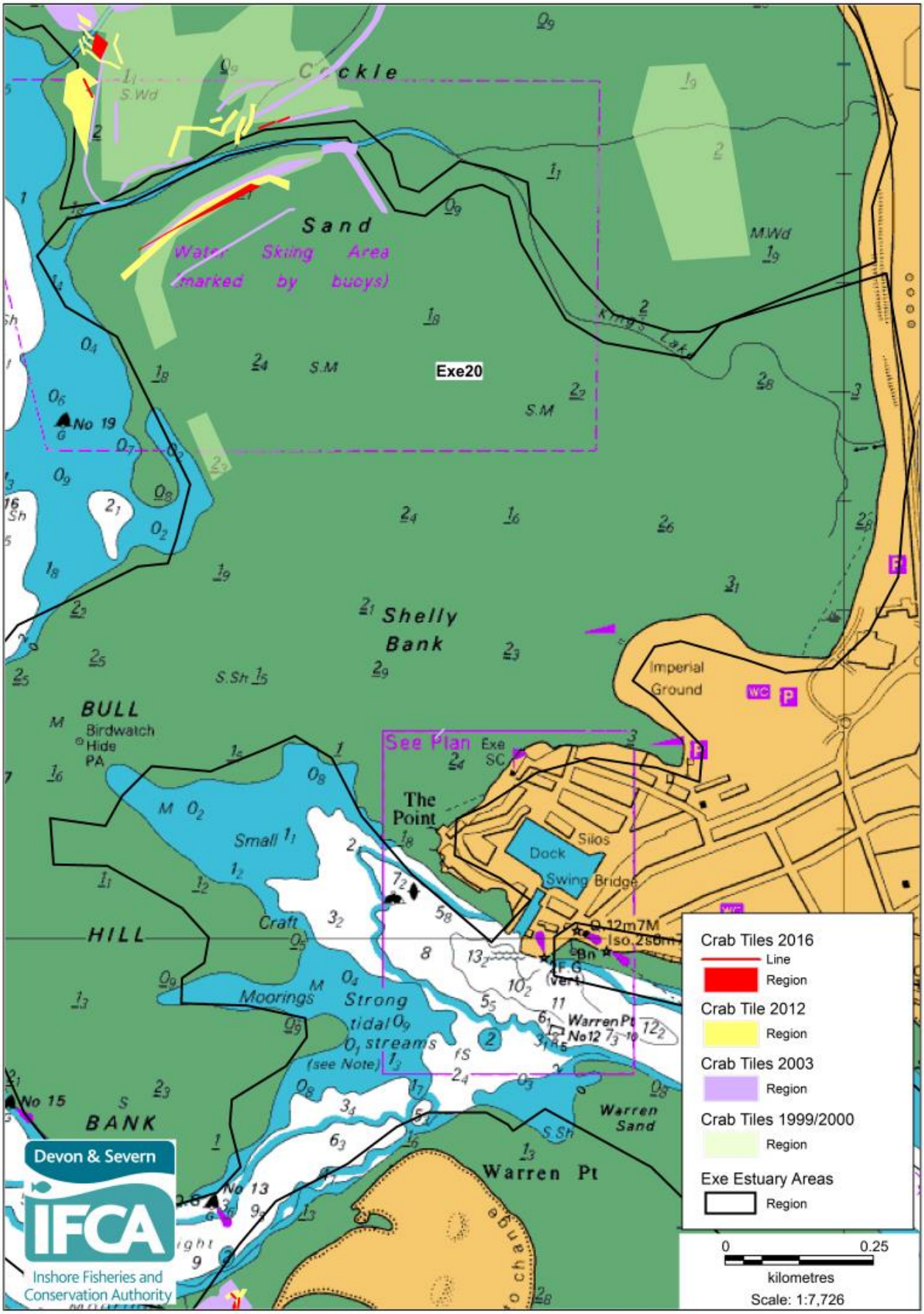


Figure 11 - Crab tiles on the Exe Estuary, Area Exe20

Annex 5: Bird usage of the Exe Estuary

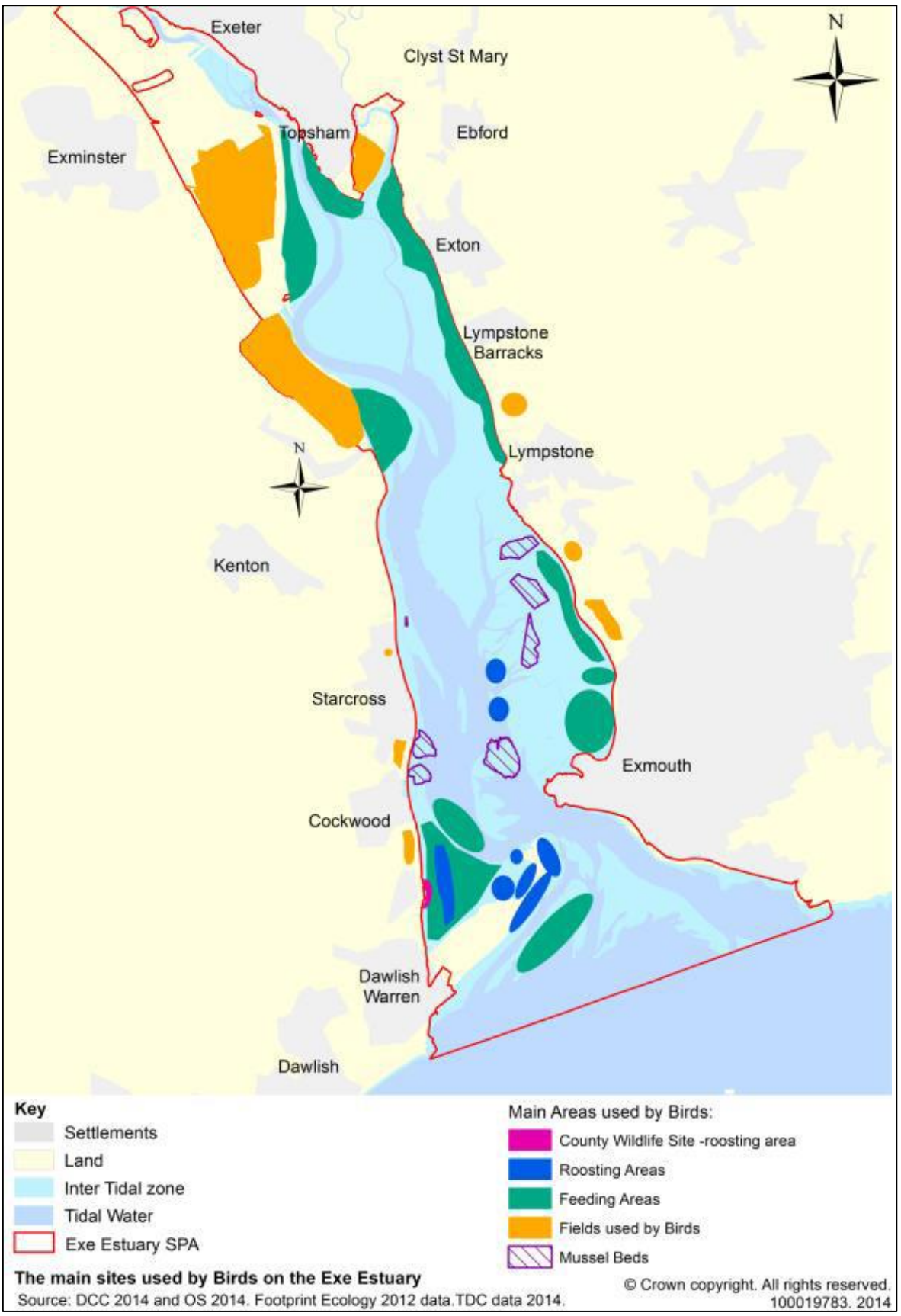


Figure 12 - Main sites used by birds on the Exe Estuary (EEMP, 2014)

Annex 6: Summary of Results of the D&S IFCA Intertidal Handwork Survey

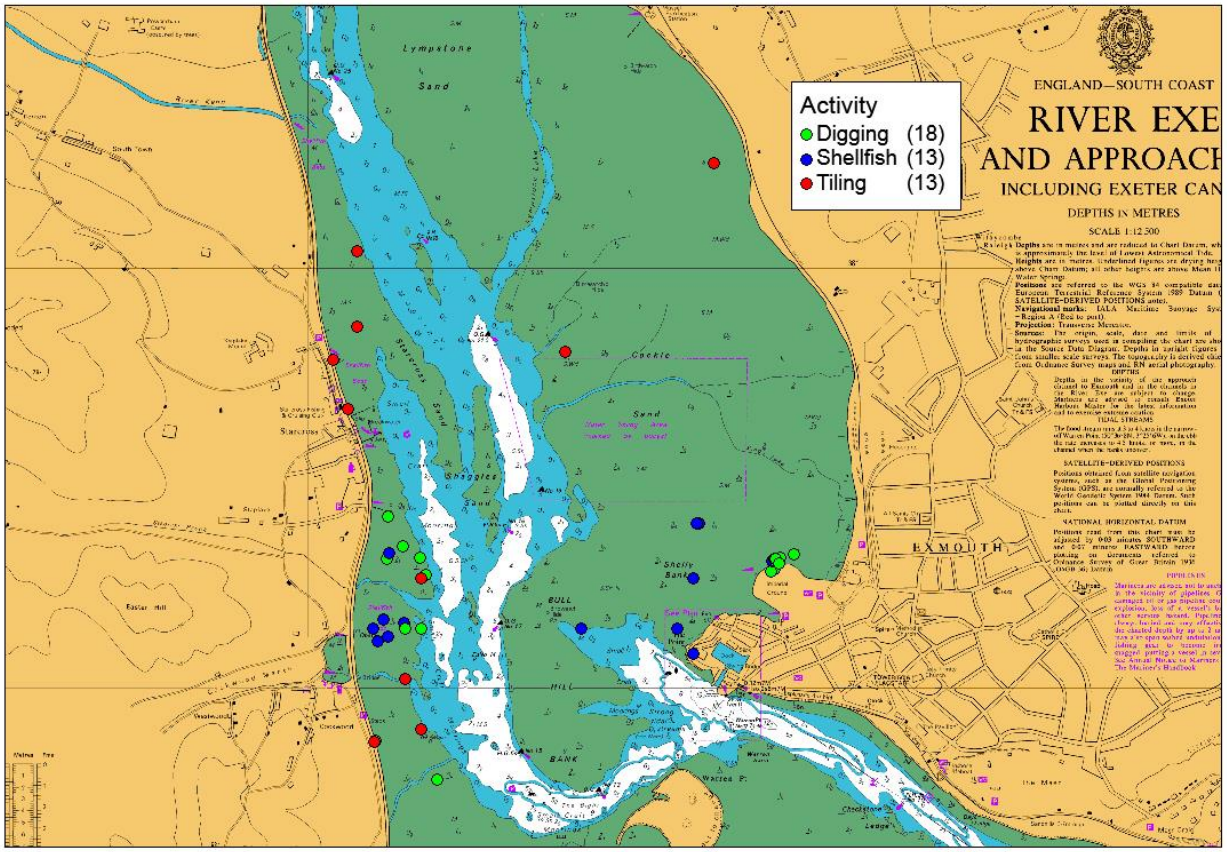


Figure 13 - Total people observed (recreational & commercial) working in the intertidal area, shown by activity; bait digging, shellfish collection, and crab tiling.

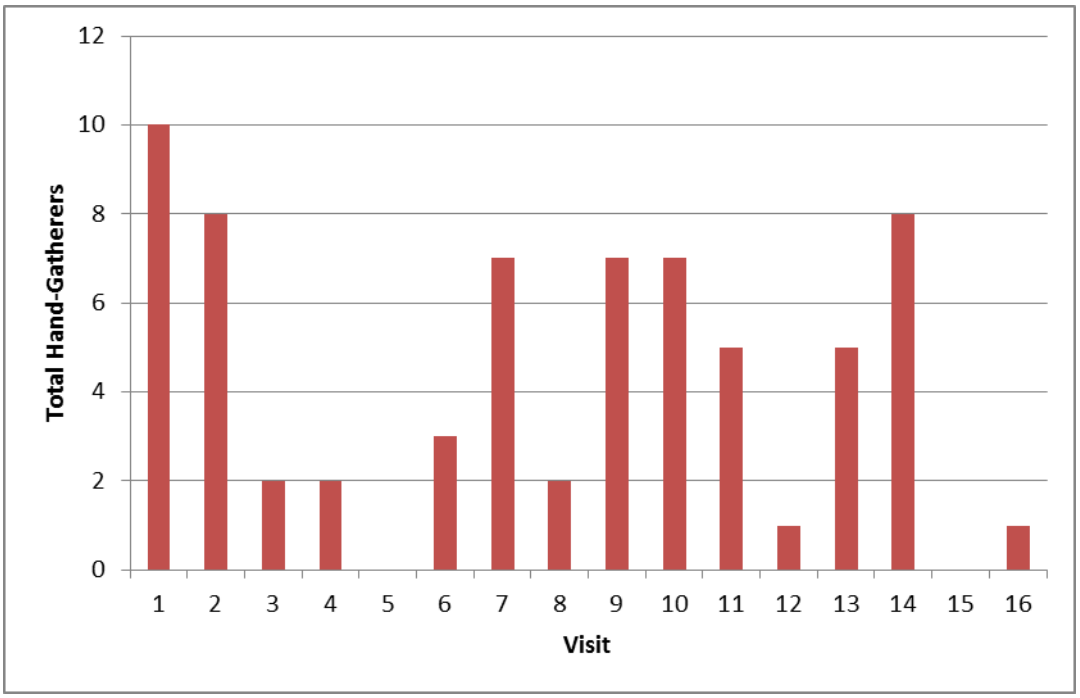
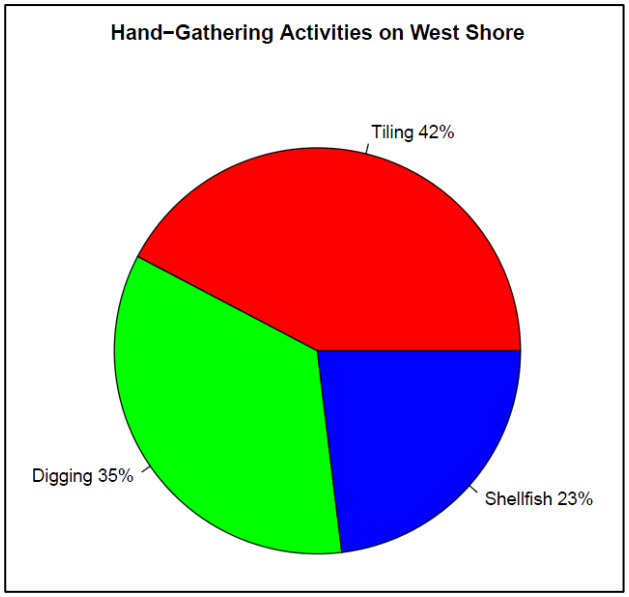


Figure 14 - Total people observed (recreational & commercial) during each visit.

a)



b)

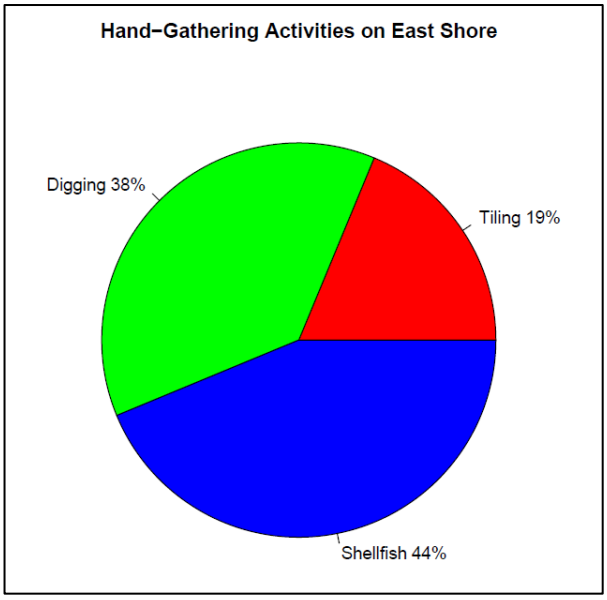


Figure 15 Proportions of each activity on the West Shore (a) and East Shore (b)

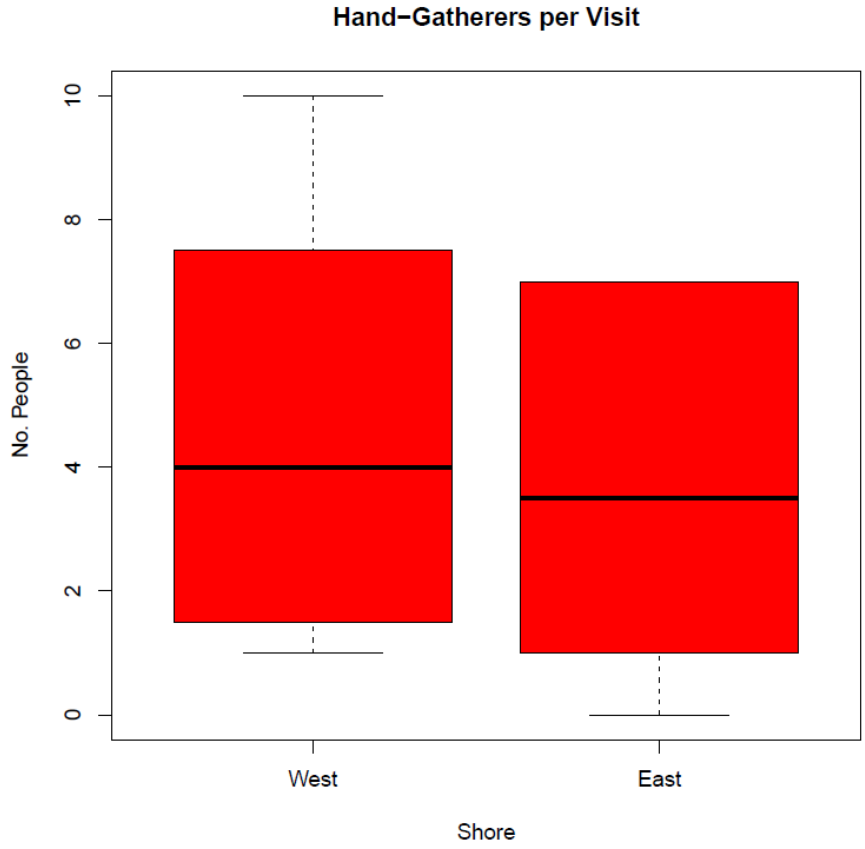


Figure 16 - Numbers of people working on each shore per visit

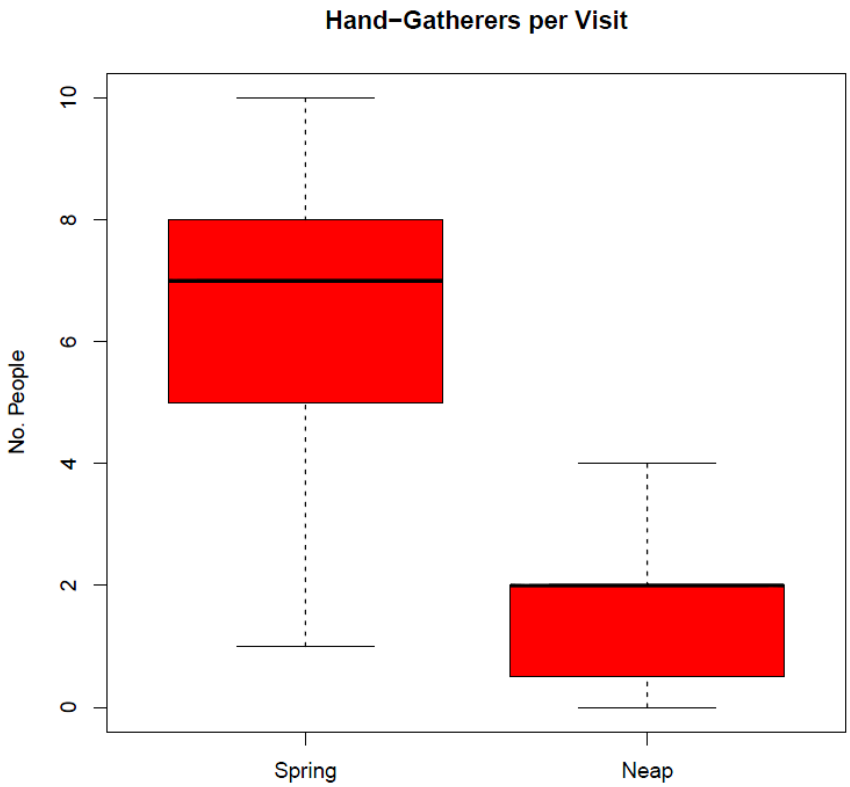


Figure 17 - Numbers of people working during spring and neap tide visits

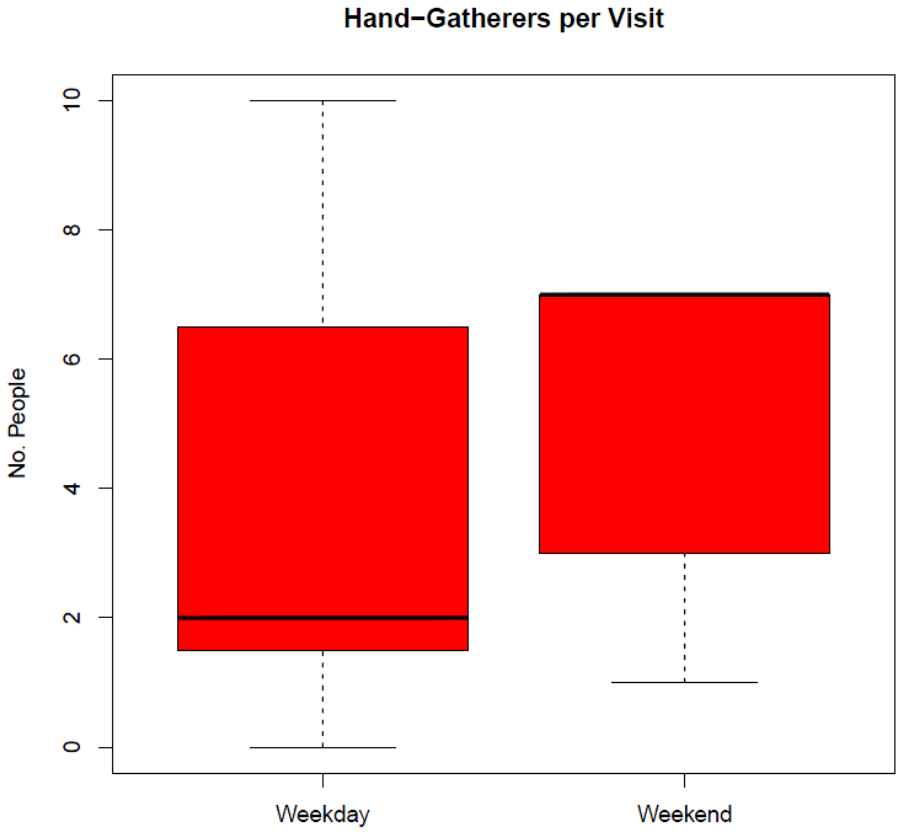


Figure 18 - Numbers of people working during weekday and weekend visits

Annex 7: Pressures Audit Trail

Sensitivities based on Conservation Advice (Natural England, 2015)

Table 5 – Bird features and supporting habitat pressure audit trail for shore-based activities

Pressure name	Bird features						Supporting habitat				Screening Justification
	Avocet, Non-breeding	Black-tailed godwit, Non-breeding	Dark-bellied Brent goose, Non-breeding	Dunlin, Non-breeding	Grey plover, Non-breeding	Oystercatcher, Non-breeding	Intertidal coarse sediment	Intertidal mixed sediments	Intertidal mud	Intertidal sand and muddy sand	
Abrasion/disturbance of the substrate on the surface of the seabed							NS	S	S	S	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Habitat structure changes - removal of substratum (extraction)							S	S	S	S	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion							NS	S	S	S	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Removal of non-target species	S	S	S	S	S	S		S	S	S	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Removal of target species								S	S	S	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Visual disturbance	S	S	S	S	S	S				NS	**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Above water noise	S	S	S	S	S	S					**IN -** Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)	S	S	S	S	S	S					**OUT –** Pressure not thought to be associated with activity.
Deoxygenation							NS	S	NS	S	**OUT** – Insufficient activity levels to pose risk at level of concern
Hydrocarbon & PAH contamination	IE	IE	IE	IE	IE	IE	NS	NS	NS	NS	**OUT -** Insufficient activity levels to pose risk of large scale pollution event
Introduction of light	S	S	S	S	S	S		IE	NS	S	**OUT –** Activity only occurs during daylight
Introduction or spread of invasive non-indigenous species (INIS)	NS	S	IE	S	S	S		S	S	S	**OUT –** Activity only occurs within local area and tiles are not moved between estuaries.

Litter	IE	IE	IE	IE	IE	IE	NA	NA	NA	NA	**OUT –** No litter associated with activity
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	IE	IE	IE	IE	IE	IE	NS	NS	NS	NS	**OUT -** Insufficient activity levels to pose risk of large scale pollution event
Transition elements & organo-metal (e.g. TBT) contamination	S	S	S	S	S	S	NS	NS	NS	NS	**OUT -** Insufficient activity levels to pose risk of large scale pollution event
Underwater noise changes			IE								**OUT –** Pressure not thought to be associated with activity.