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

European Marine Site: Exe Estuary SPA

Fishing activities assessed: Intertidal Handwork

D&S IFCA Interaction ID	Fishing Activity	Feature(s)	Supporting habitat
HRA_UK9010081_AR19	Hand working (access from vessel)	• 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_P19			Intertidal mixed sediments
HRA_UK9010081_K19			Intertidal mud
HRA_UK9010081_L19			Intertidal sand and muddy sand
HRA_UK9010081_AR20	Hand working (access from land)		Intertidal coarse sediment
HRA_UK9010081_P20			Intertidal mixed sediments
HRA_UK9010081_K20			Intertidal mud
HRA_UK9010081_L20			Intertidal sand & muddy sand

Version Control History				
Author	**Date**	**Comment**	**Version**	**Reviewed**
Katherine Stephenson	13/09/16	Final version sent to Natural England. NE formal advice received 25/11/16 – confirmed D&S IFCA assessment that no management required at this time.	1	
Katherine Stephenson	20/06/18	Table 2 (Section 6) updated to reflect latest stock data. Management recommended. Sections 7, 8, 9 & 10 also updated to reflect findings of Section 6.	2	Sarah Clark 05/08/2018 – minor amendments. Sent to NE 05/08/2018

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 activities “hand-working” have 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 hand-working 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

Handwork accessed from vessels is occurring at a low/very-low level. Although there are good shellfish beds on the estuary, they are mostly easily accessed from the land so there is little need to access from vessels.

Handwork accessed from land is occurring at a medium level across the whole estuary, although this is mostly recreational. The main areas for shellfish collection are Cockwood and Cocklesands, where there is very easy access to mussel beds. Some cockles and winkles are also collected in these areas, however the Exe currently has no classified area for cockle harvesting so this cannot occur commercially (but it does occur recreationally). 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. Shellfish collection made up approximately 1/3 of these activities, with slightly higher levels on the eastern shore (around Cockle Sands). The majority of the activity took place on spring tides, with slightly higher levels at weekends than on weekdays, so it is naturally temporally limited. The highest number of people seen working on the estuary at one time was 10, but the average for both shores was approx. 4 people. On the occasion when 10 people were seen, one family collecting cockles recreationally accounted for 6 people (4 adults, 2 children). These large groups do not occur frequently. Commercial activity was significantly lower than the recreational, with only one or two commercial hand-gatherers operating at any one time on the estuary. **This assessment only considers the commercial activity.**

Commercial harvesting of mussels (*Mytilus edulis*) can only take place on classified beds (Figure 3, Annex 4), there are currently no areas classified for other species (Cefas, 2015).

The IFCA has been informed that occasionally (large spring tides) two fishermen collect winkles around Lympstone. Winkles are subject to a minimum size (D&S IFCA Byelaw 10) whereby "No person shall remove from the fishery any winkle which will pass easily through a gauge within a square opening of 16mm measured over each side of the square". However, no activity was seen at Lympstone during the IFCA's Handgathering surveys. One commercial winkle collector was met twice on the D&S IFCA surveys. On both occasions he was at Cockwood but said that he works a different area (covering both sides of estuary) each time he comes down, so as not to overfish one

area. He collects approx. 30kg each visit (2-3 times a week), but relays undersize winkles immediately on the water's edge. He is the only regular winkle collector remaining on the Exe, due to lack of buyers and low prices.

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 1: 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) • 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,** there are currently no management measures prohibiting the use of handwork in the Exe Estuary SPA. However, the only bivalve molluscan species with classified harvesting areas is mussel (Annex 4) these areas coincide with areas of intertidal sediment (Figure 2, Annex 3). Winkle collection is permitted anywhere on the estuary, but is only believed to take place at a low level around Lympstone, which is classed as intertidal mud.	
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**	**Yes,** there is potential for likely significant effect.
	In-combination	See Section 8.
6. Have NE been consulted on this LSE test? If yes, what was NE's advice?	NE was formally consulted on an earlier version. See Section 9.	

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 2.

Table 2: 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:** • Maintain the structure, function & supporting processes associated with the feature and its supporting habitat • Maintain the extent & distribution of suitable habitat which supports the feature for all necessary stages of the non-breeding/wintering 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	Abrasion & disturbance of the substrate on the surface of the seabed.	Intertidal fishing activities have the potential to alter the distribution and composition of intertidal sediment communities through abrasive impacts of the activity or access. Mussel and winkle are usually collected by hand from the substrate surface (no digging/raking), therefore any abrasion would likely be caused by trampling when walking out to, and around, the shellfish areas. NB. Cockles can be collected by either hand or rake. However, currently this is only occurring recreationally so is not considered in this assessment.	Low level of exposure to these supporting habitats (Annex 6). Commercial mussel gathering is limited to the classified beds (Annex 4). A low level of commercial winkle collection occurs.	Intertidal handwork is not occurring at a high enough intensity to affect the extent, distribution, structure or function of the intertidal sediments. Therefore, no mitigation measures are necessary. Through the IFCA's Byelaw Review process, D&SIFCA will be reviewing all byelaws relating to hand-gathering. The IFCA intends to create a permitting byelaw for hand-gathering/estuarine activities, 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. This byelaw will cover both

	processes on which the habitats of the qualifying features rely				commercial and recreational activities.
Waterbird assemblage • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud • Intertidal sand & muddy sand	**Target Attribute:** • Maintain the structure, function & availability of the habitat, which supports the assemblage feature for all stages 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	Abrasion & disturbance of the substrate on the surface of the seabed.	Intertidal fishing activities have the potential to alter the distribution and composition of intertidal sediment communities through abrasive impacts of the activity or access. Mussel and winkle are usually collected by hand from the substrate surface (no digging/raking), therefore any abrasion would likely be caused by trampling when walking out to, and around, the shellfish areas. NB. Cockles can be collected by either hand or rake. However, currently this is only occurring recreationally so is not considered in this assessment.	Low level of exposure to these supporting habitats (Annex 6). Commercial mussel gathering is limited to the classified beds (Annex 4). A low level of commercial winkle collection occurs.	<u>No mitigation measures are necessary</u> (See above)
Avocet, black-tailed godwit, dunlin, grey plover, & Slavonian grebe • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud • Intertidal sand	**Target Attribute:** • Maintain the distribution, abundance & availability of the most important prey items **Conservation Objective:** Maintain or restore: • the populations of the qualifying features • the distribution of the qualifying features within the site	Removal of target species.	The responses of shorebird species to insufficient food supplies during the overwinter period include reduced individual body condition, increased mortality and reduced population sizes (Stillman et al., 2015).	Low level of exposure to these supporting habitats (Annex 6). Commercial mussel gathering is limited to the classified beds (Annex 4). A low level of commercial winkle collection occurs.	D&S IFCA conducts annual stock assessments on the mussel and cockle on the Exe Estuary. This allows the IFCA to monitor the stock over time. If the stock becomes severely depleted or contains mainly undersize/immature shellfish the IFCA has the ability to place a temporary closure on mussel beds (D&S IFCA Byelaw 9).

& muddy sand					Stock assessment data is also made available to Natural England, who has the ability to analyse it in terms of bird food availability. Through the IFCA's Byelaw Review process, D&SIFCA will be reviewing all byelaws relating to hand working and whether any new management measures should be introduced. The IFCA is considering whether to develop a permitting byelaw for hand-gathering/estuarine fishing activities, 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. This byelaw would cover both commercial and recreational activities. The 2017 stock assessments found that the stock levels of mussel have continued to decrease over the last few years, since the major loss in 2014 (Davies & Stephenson, 2017 and Stephenson 2016). In 2013 the intertidal mussel stock on the Exe was 1933

					tonnes, this fell to 99 tonnes following the 2014 storms and has continued to decline to 38.25 tonnes in 2017. This represents a loss of approximately 98% of the stock (Figure 12, Annex 7). Therefore, it is recommended that management of hand gathering should be considered in line with the development of a hand-Working byelaw, to aid the conservation objective of "maintain or restore".
Oystercatcher • Intertidal coarse sediment • Intertidal mixed sediment • Intertidal mud • Intertidal sand & muddy sand	**Target Attribute:** • Restore availability of key prey 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.	The responses of shorebird species to insufficient food supplies during the overwinter period include reduced individual body condition, increased mortality and reduced population sizes (Stillman et al., 2015).	The study by Stillman et al. (2015) found that even if no mussel lays were available, the model predicted 0% starvation among overwintering oystercatcher populations of ≤1500 individuals. For the maximum population size tested in the model (6000 individuals), overwinter starvation was predicted to cause the deaths of 35.9 ± 0.2 % (mean ± SD) of the total population. The latest WeBS data (Holt et al., 2015) estimates the oystercatcher population on the Exe Estuary to be 2,151, showing a slight increase over the last 5 years.	D&S IFCA conducts annual stock assessments on the mussel and cockle on the Exe Estuary. This allows the IFCA to monitor the stock over time. If the stock becomes severely depleted or contains mainly undersize/immature shellfish the IFCA has the ability to place a temporary closure on mussel beds (D&S IFCA Byelaw 9). Stock assessment data is also made available to Natural England, who has the ability to analyse to assess bird food availability. Stillman et al. (2015) concluded that the total biomass of mussel available was more than that required

					to support the population of oystercatchers. The decline in oystercatcher population numbers on the Exe may be due to factors other than the changes in mussel stocks. However, the 2017 stock assessments found that the stock levels of mussel have continued to decrease over the last few years, since the major loss in 2014 (Davies & Stephenson, 2017 and Stephenson 2016). In 2013 the intertidal mussel stock on the Exe was 1933 tonnes, this fell to 99 tonnes following the 2014 storms and has continued to decline to 38.25 tonnes in 2017. This represents a loss of approximately 98% of the stock (Figure 12, Annex 7). Therefore, it is recommended that management of hand gathering should be considered in line with the development of a hand-working byelaw, to aid the conservation objective of "maintain or restore".
All bird features (in relation to the intertidal sediment supporting habitats)	**Target Attribute:** • The frequency, duration &/or intensity of disturbance affecting foraging &/or roosting should not reach levels	Above water noise Visual disturbance	Several studies have found that disturbance can have an effect on population levels and distribution of species: Liley et al. (2011) states that	The Exe Estuary Disturbance Study (Liley, et al., 2011) lists "bait digging, crab tiling and other shellfishing" as the fourth highest cause of bird disturbance on the estuary,	Goss-Custard (2012) concluded that "there seems to be no convincing scientific case at present to require mitigation for the effects of new housing

	that substantially affect the feature. **Conservation Objective:** Maintain or restore: • the populations of the qualifying features • the distribution of the qualifying features within the site		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 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. However, Goss-Custard & Verboven (1993) observed, on the Exe Estuary, "local winkle and mussel pickers usually move rather little; having found a suitable place, they remain there for much of the tidal cycle. After the initial disturbance, the Oystercatchers settle down and even feed nearby". The study also suggested that, for the low levels levels of	with birds exhibiting some level of response to the activity during approximately 35% of encounters. Responses varied between "walk/swim", "short flight" and "major flight". This category of activities was shown to account for 16% of all major flight events witnessed during the study. However, it should be noted that as this category also includes bait digging and crab tiling (both of which occur at much higher levels than intertidal handwork and will be covered in separate assessments) the percentage of major flight events caused by intertidal handwork alone will be much lower. The D&S IFCA Intertidal Handwork Survey found that shellfish collection made up approx. 1/3 of the "bait digging, crab tiling and other shellfishing" activities, but this included recreational activity. Only one commercial winkle collector regularly works on the Exe. Goss-Custard (2012) noted that the Disturbance Study gives an exaggerated impression of the impact that activities of people actually have on the shorebirds that	developments on the shorebirds of the Exe estuary SPA". This would imply that no mitigation will be required for the current levels of activity on the estuary. Intertidal handwork is not occurring at sufficient levels to create disturbance at a high enough frequency, duration &/or intensity to affect the foraging &/or roosting of the bird features of this site. Therefore, <u>no mitigation is necessary</u>.

			disturbance that typically occur from these activities on the Exe, the effects on most birds might be insignificant because they can adapt their foraging behaviour. Goss-Custard (2016a) 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”, and suggests that this will also be the case for disturbance by other intertidal fishing activities.	feed on the exposed intertidal flats, due to a number of factors in the study. Therefore, less than 1-2% of bird foraging occurs at times/places where birds are at risk of being disturbed by people. The bird usage areas can be seen in the Exe Estuary Recreational Framework (EEMP, 2014) (Fig. 4, Annex 5). It is estimated that it would take15-30,000 people to visit the Exe Estuary regularly to reduce shorebird survival (Goss-Custard, 2016b).	

7. Conclusion

Intertidal handwork (accessed by land or vessel) is occurring at medium levels across the Exe Estuary SPA, but low levels on this supporting habitat. However, due to the continued decline of mussel stocks on the estuary it is recommended that management is considered for intertidal handgathering during the upcoming development of D&S IFCA's Hand-Working Byelaw, which may help to further the Conservation Objectives and Target Attributes.

8. In-combination assessment

Intertidal handwork occurs alongside other fishing activities within in the Exe Estuary SPA (Gray, 2015). Other fishing activities, occurring on this site, which may interact with the intertidal sediments are the elevator harvester, crab tiling 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, combined with the existing management previously described, mean that there is no likelihood of significant adverse effect to the features considered in this assessment in-combination with crab tiling and bait digging.

The Dawlish Warren Beach Management Scheme, to manage coastal flooding and erosion at Dawlish Warren and Exmouth Beach, is currently undergoing pre-application screening. There is currently little information to determine the in-combination impacts with intertidal handwork. However, the majority of the work will take place on the seaward side of Dawlish Warren, so it is not believed there will be any in-combination effects with intertidal handwork, which occurs within the estuary.

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

Natural England was formally consulted on Version 1 of this assessment in 2016. Their formal response concluded "It is Natural England's view that through their HRA, D&S IFCA officers appear to have appropriately identified those activities that are not 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.". See Annex 2.

10. Integrity test

Through the Appropriate Assessment (Section 6) it has been concluded that hand working (both accessed from land and from vessel) at current levels could have an adverse effect on the bird features, or the intertidal sediment supporting habitats of the Exe Estuary SPA, due to the depleted mussel stock levels on the Exe. Therefore, the introduction of management for hand gathering activities should be considered. The site is also a SSSI, therefore Natural England also have powers to manage operations likely to damage the special interest features.

Annex 1: Reference list

Cefas, 2016 https://www.cefas.co.uk/media/1460/exe-mytilus-spp.jpg

Davies, S. & Stephenson, K. (2017) Devon & Severn IFCA Report: Exe Estuary Mussel Stock Assessment 2017.

Devon & Severn IFCA Byelaws, 2015
https://www.devonandsevernifca.gov.uk/Enforcement/Permit-Byelaws

EEMP (2014) Exe Estuary Management Partnership: Exe Estuary Recreational Framework 2014

English Nature (2001) EXE ESTUARY: European marine site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

Goss-Custard, J. D. & Verboven, N (1993) Disturbance and feeding shorebirds on the Exe estuary. *Wader Study Group Bulletin* **68:** 59-66

Goss-Custard, J. D. (2012) A Critique of the Footprint Ecology Report on Disturbance of Shorebirds on the Exe Estuary

Goss-Custard, J. D. (2016a) Disturbance of shorebirds by crab collecting in the Voluntary Sensitive Area, Shutterton, Exe Estuary. Unpublished report.

Goss-Custard, J. D. (2016b) Mud, Birds and Poppycock. *In press: Bulletin of the British Ecological Society*

Gray (2015) Devon & Severn IFCA Report: Fishing Activities Currently Occurring in the Exe Estuary SPA

Hockin, D., Ounsted, M., Gorman, M., Hill, D., Keller, V., & Barker, M. A. (1992) Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *Journal of Environmental Management* **36:** 253-286

Holt, C.A., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Musgrove, A.J. (2015) Waterbirds in the UK 2013/14: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford. http://www.bto.org/volunteer-surveys/webs/publications/webs-annual-report

Liley, D., Cruickshanks, K., Waldon, J., & Fearnley, H. (2011) Exe Estuary Disturbance Study. Footprint Ecology.

MacAlister Elliott and Partners (2012) MSC Public Certification Report for the Exmouth mussel fishery.

Natural England (2015) Marine conservation advice for Special Protection Area: Exe Estuary (UK9010081)

Stephenson, K. (2016) Devon & Severn IFCA Report: Exe Estuary Mussel Stock Assessment 2016

Stillman, R. A., Goss-Custard, J. D., & Wood, K. A. (2015) Predicting the mussel food requirements of oystercatchers in the Exe Estuary. IPENS Report.

Annex 2: Natural England's consultation advice

Natural England was consulted on Version 1 of this assessment in October 2016. Their response is attached below:

NE formal advice Exe
SPA Hand working.pd

Annex 3: Site Maps

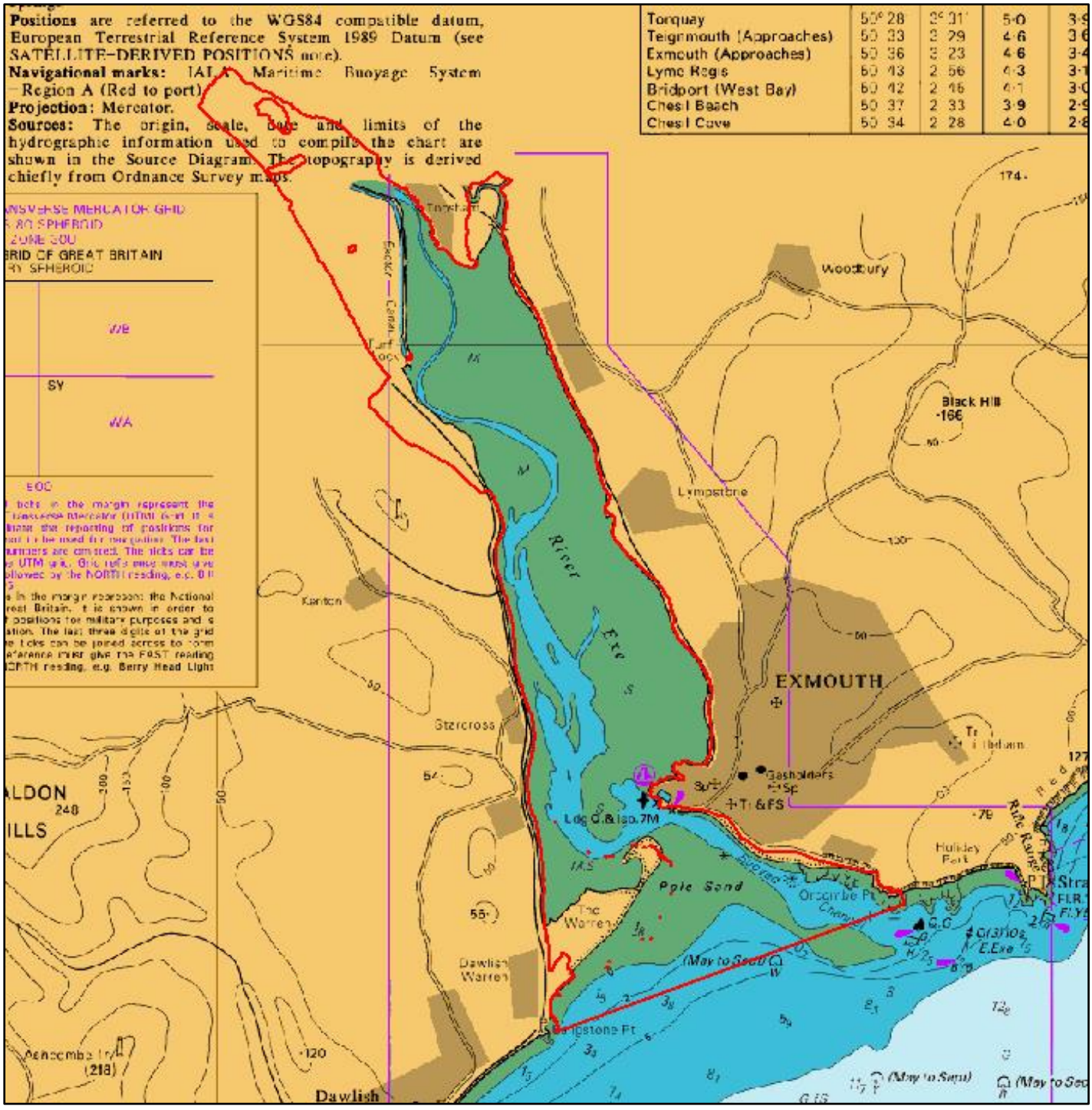


Figure 1 Exe Estuary SPA boundary (shown in red)

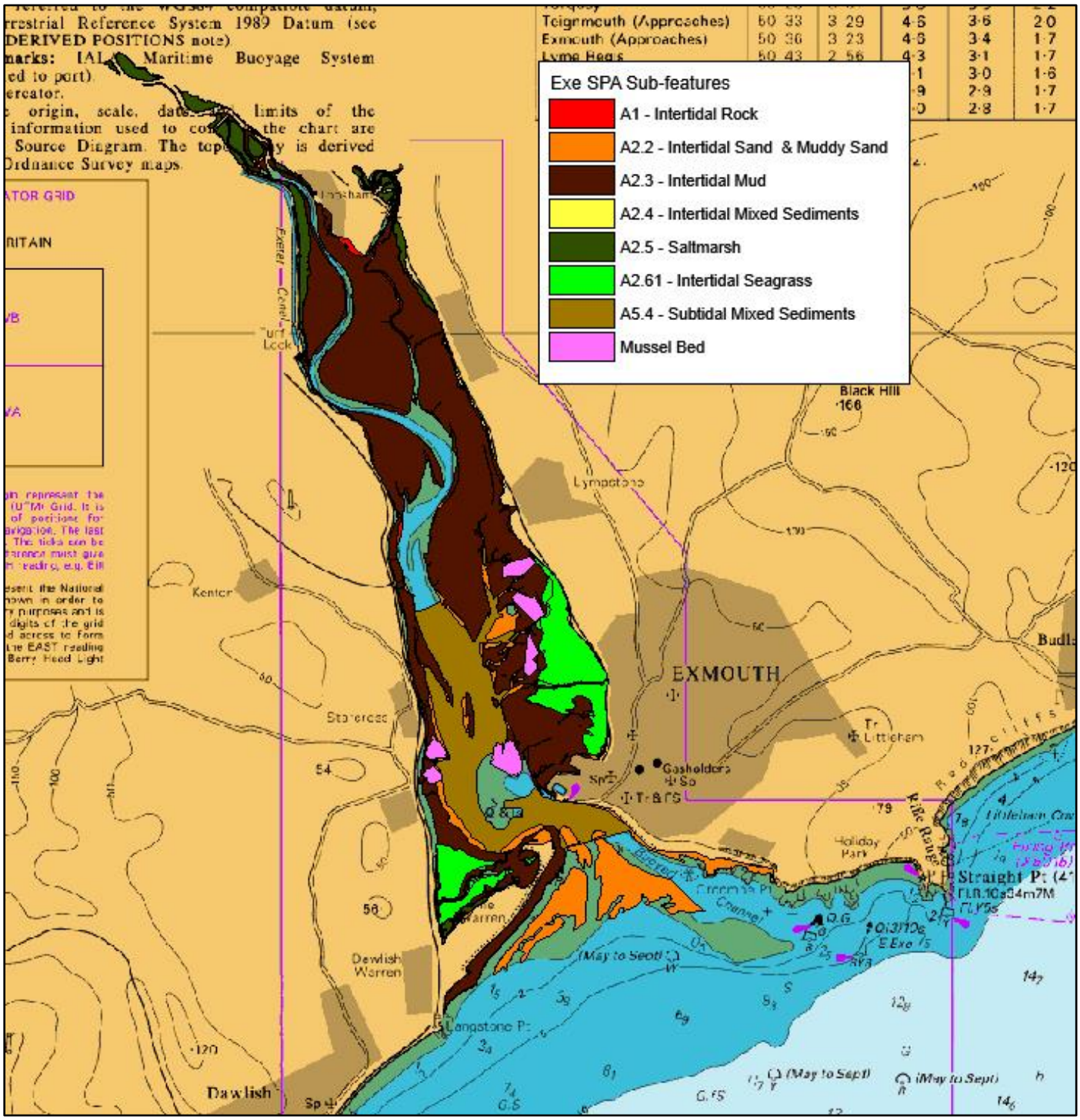
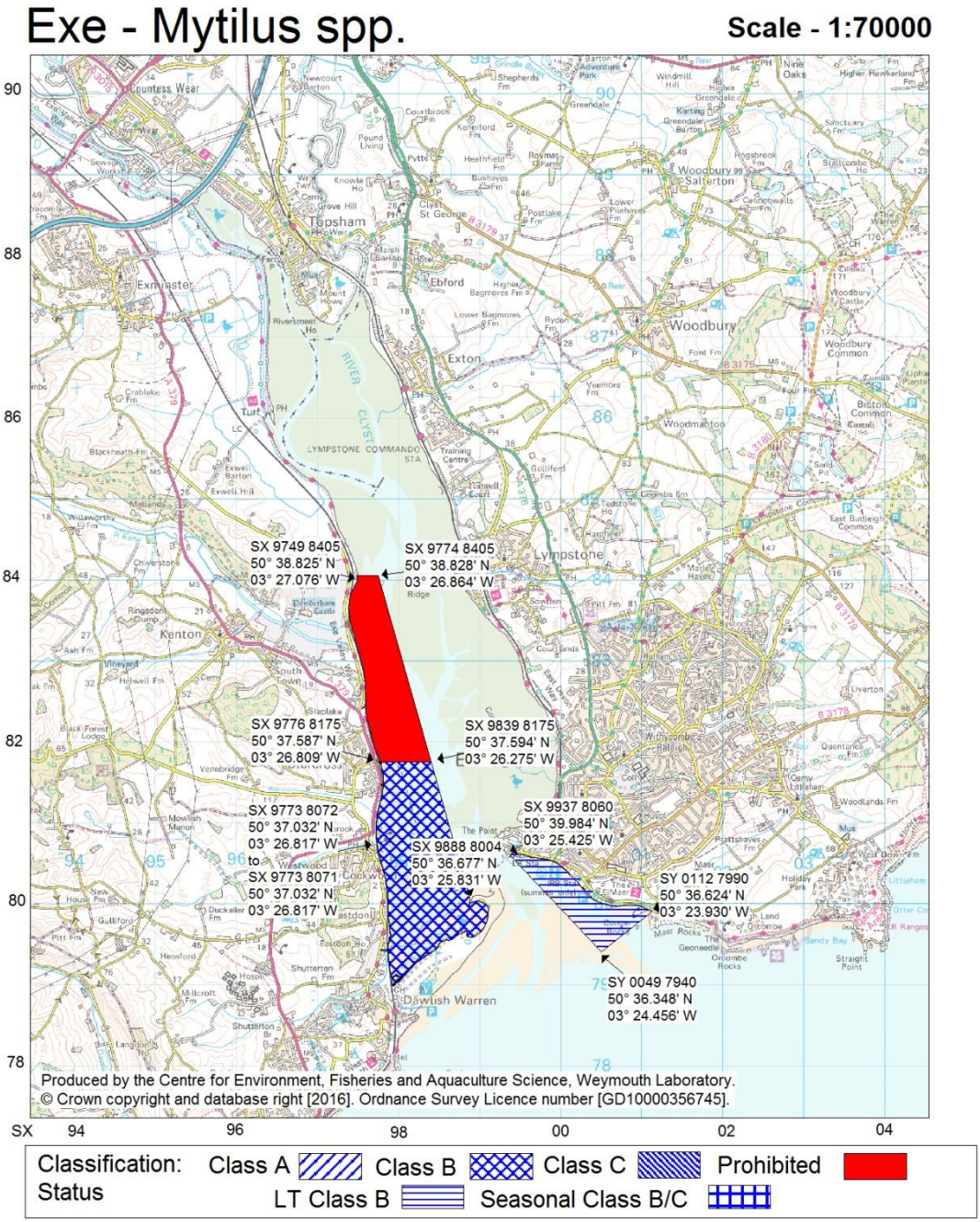


Figure 2 Exe Estuary SPA sub-features (Natural England, 2015)

Annex 4: Fishing activity maps



Classification of Bivalve Mollusc Production Areas: Effective from 1 April 2016

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84

Food Authority: Teignbridge District Council
East Devon District Council

Figure 3 Classified shellfish harvesting areas for the *Mytilus edulis* (Cefas, 2016)

Annex 5: Bird usage of the Exe Estuary

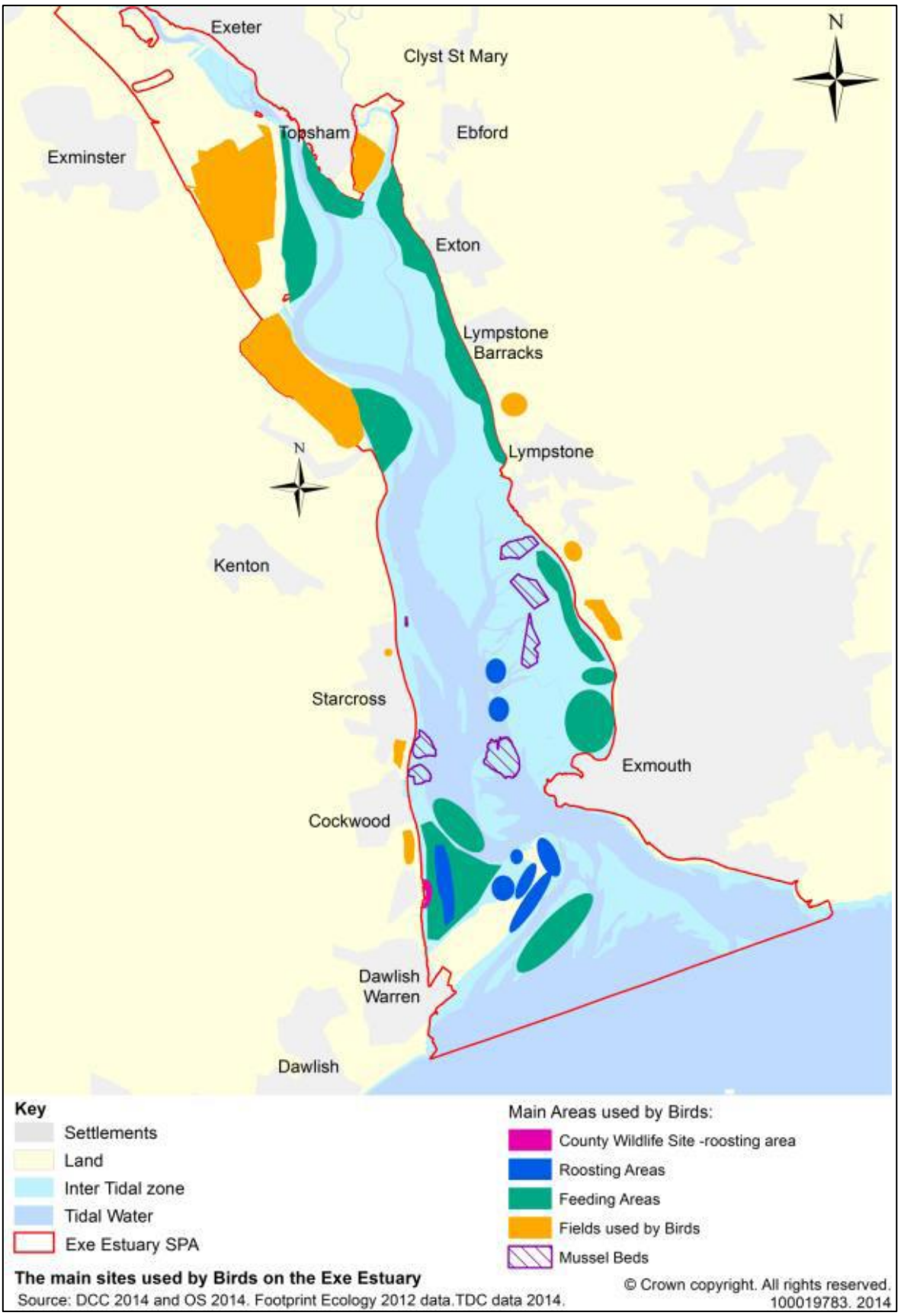


Figure 4 Main sites used by birds on the Exe Estuary (EEMP, 2014)

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

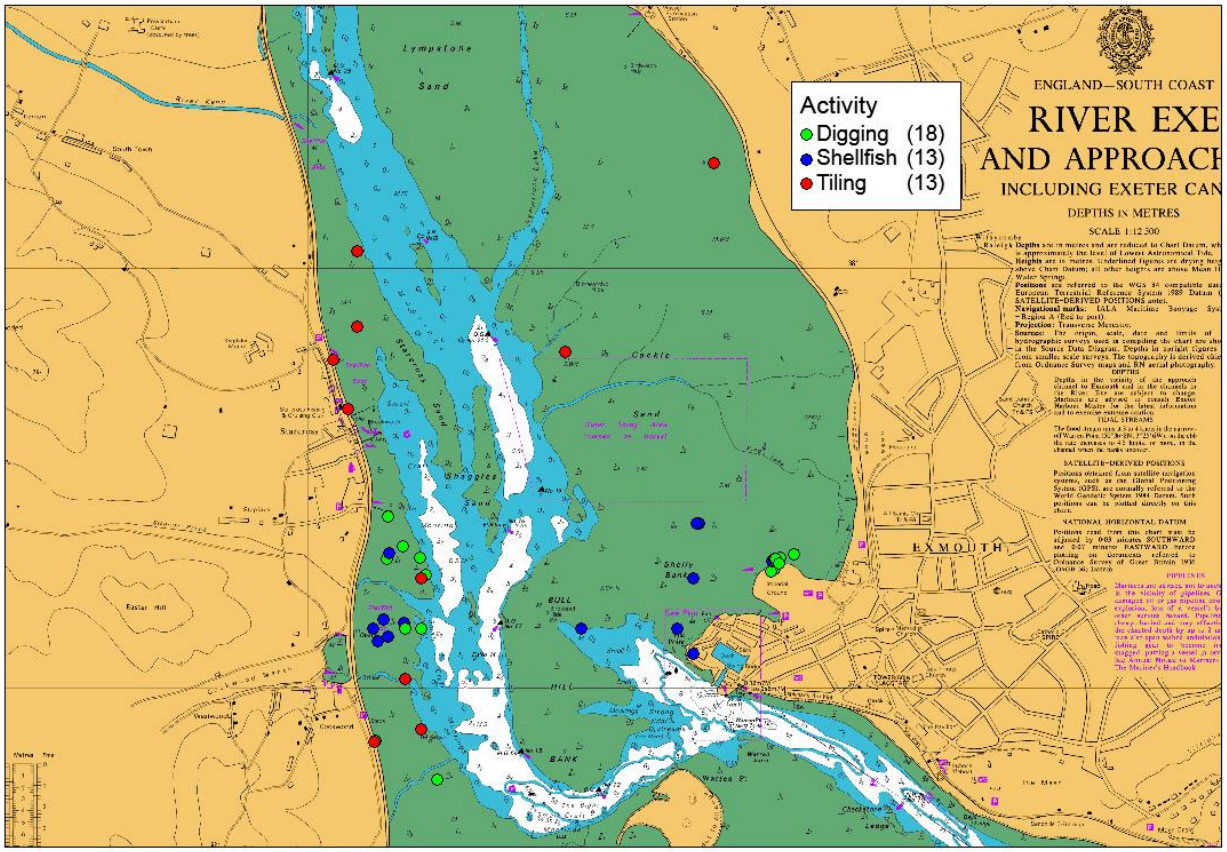


Figure 5 Total people observed (recreational & commercial) working in the intertidal area, shown by activity; bait digging, shellfish collection, and crab tiling.

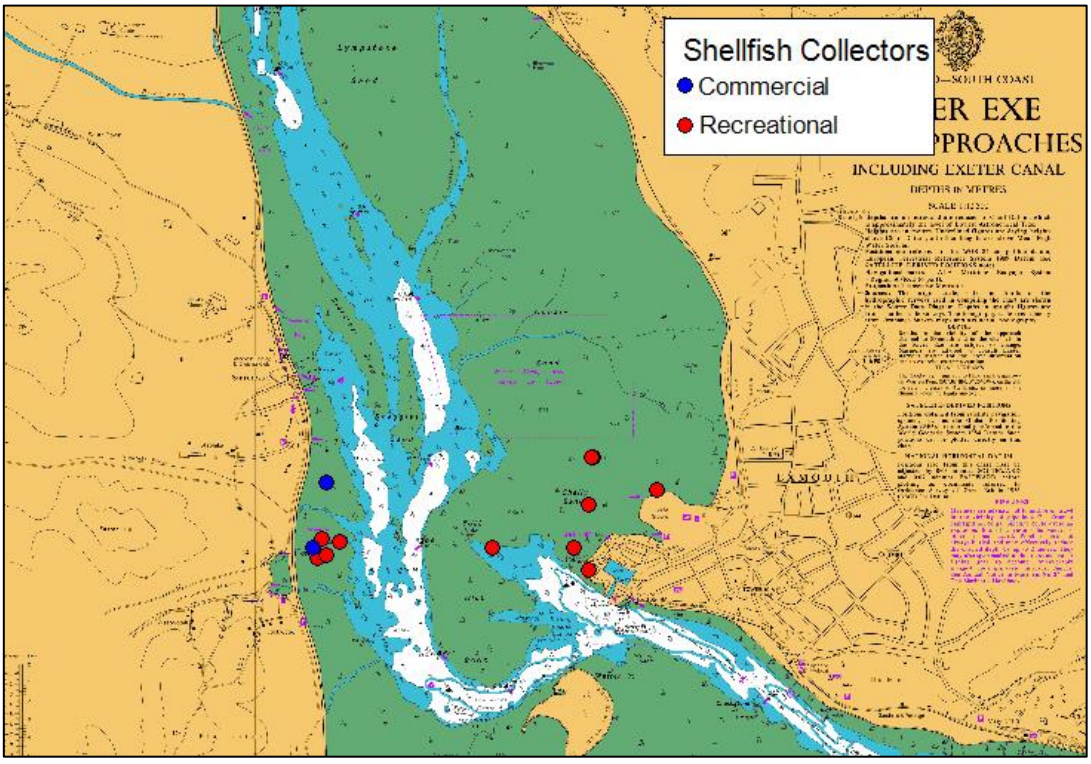


Figure 6 Total shellfish collectors observed, shown by commercial/recreational.

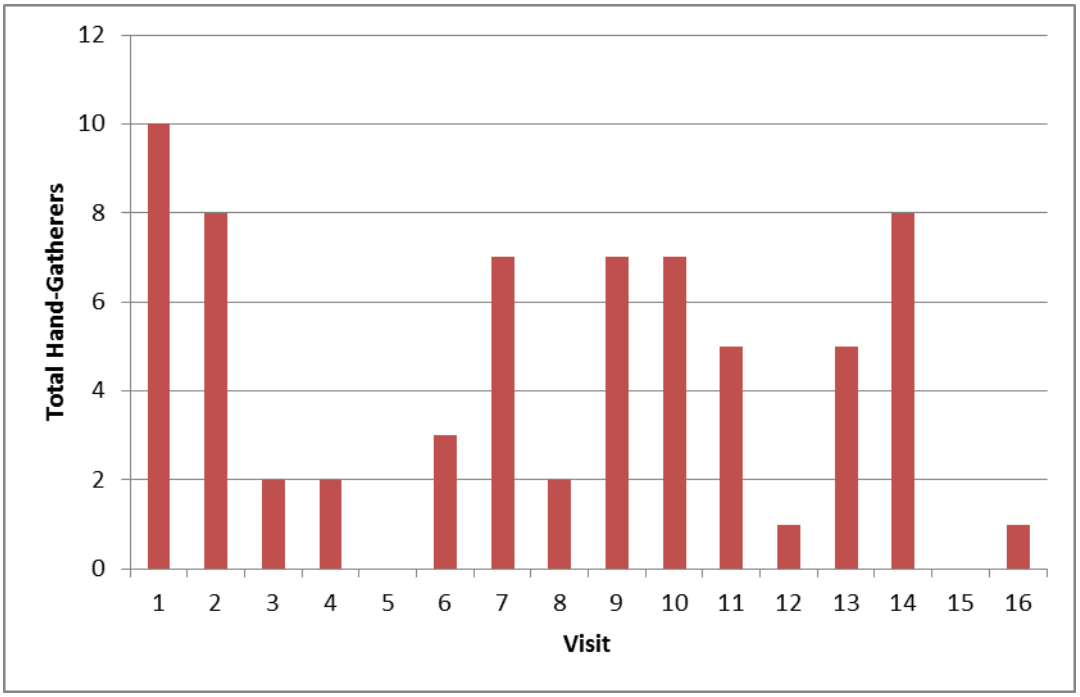
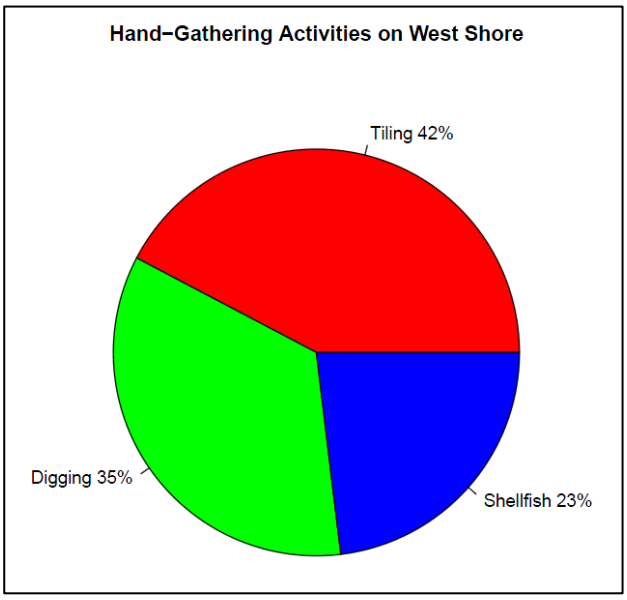


Figure 7 Total people observed (recreational & commercial) during each visit.

a)



b)

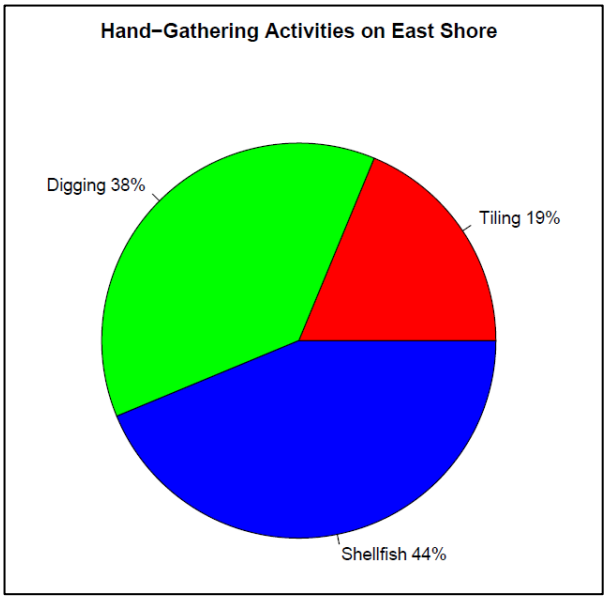


Figure 8 Proportions of each activity on the West Shore (a) and East Shore (b)

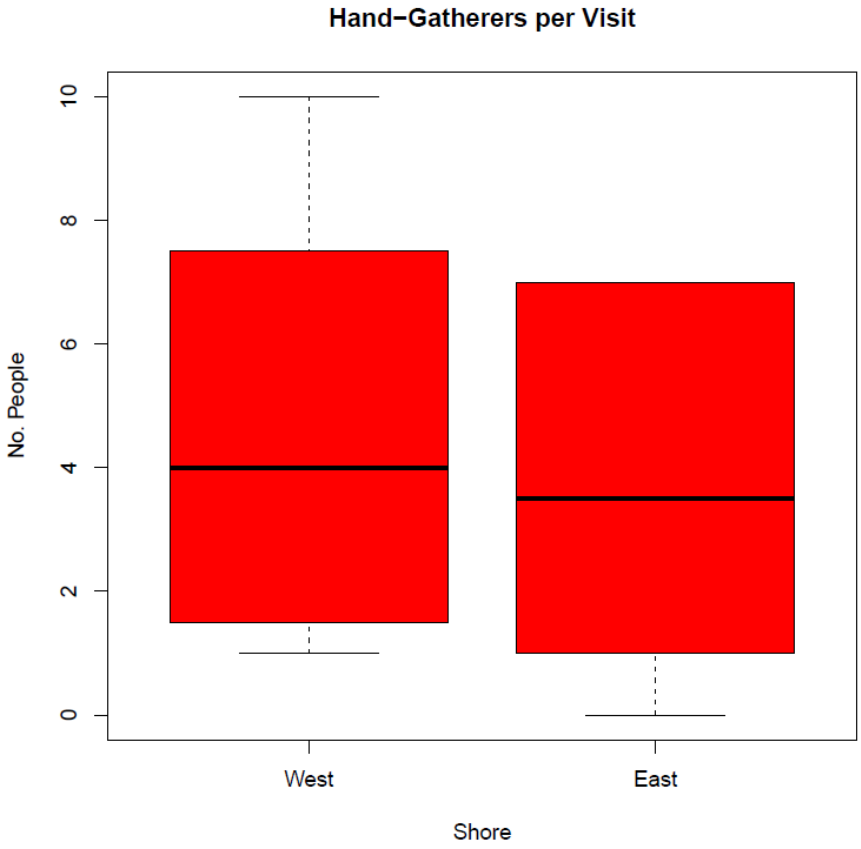


Figure 9 Numbers of people working on each shore per visit

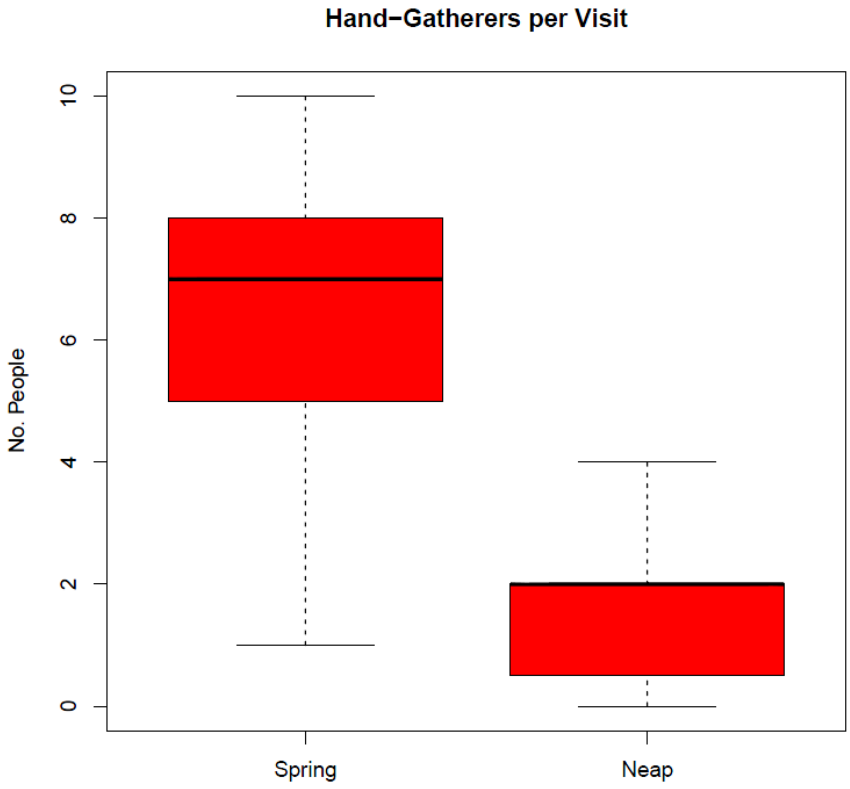


Figure 10 Numbers of people working during spring and neap tide visits

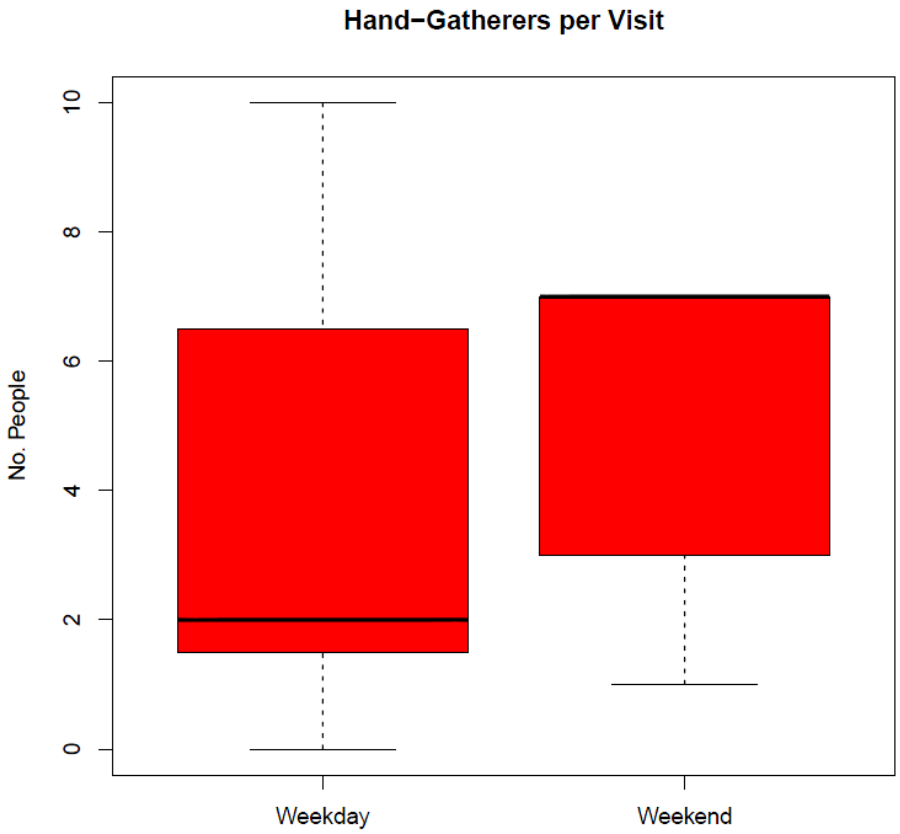


Figure 11 Numbers of people working during weekday and weekend visits

Annex 7: Intertidal mussel stock levels

Figure 12 shows the decline in intertidal mussel stock between 2013 and 2017. In 2013 the intertidal mussel stock on the Exe was 1933 tonnes, this fell to 99 tonnes following the 2014 storms and has continued to decline to 38.25 tonnes in 2017. This represents a loss of approximately 98% of the stock.

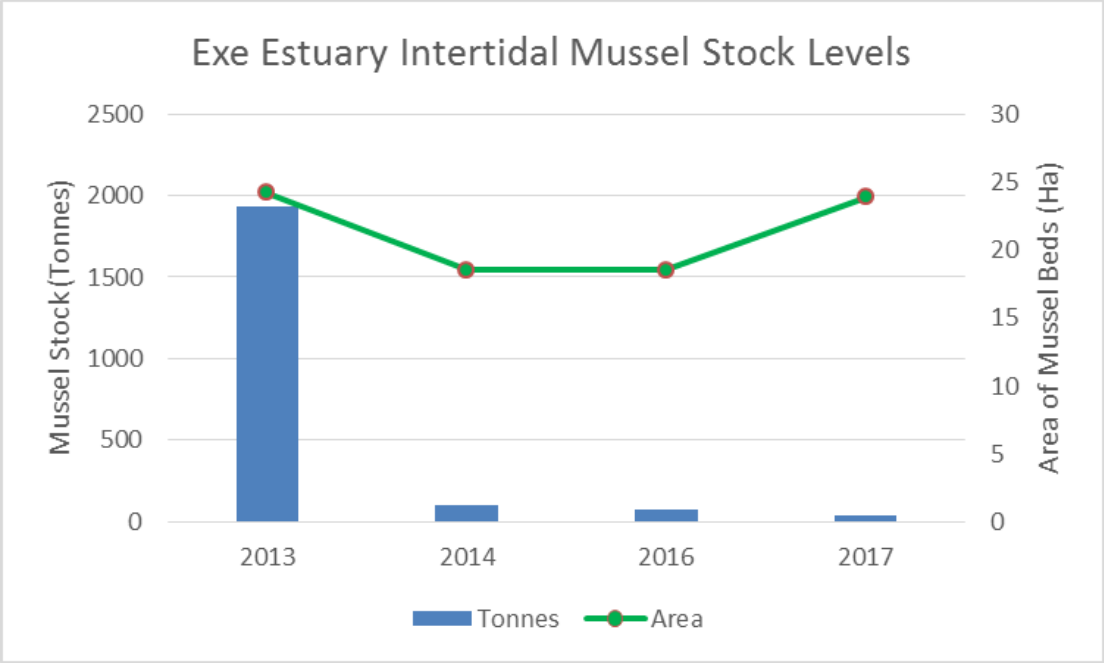


Figure 12 Mussel stock levels 2013-2017

Annex 8: Pressures Audit Trail

Sensitivities based on Conservation Advice (Natural England, 2015)

Shore-based activities	Feature/Sub-feature & Screen Justification				
	Bird Feature	Intertidal Coarse Sediment	Intertidal Mixed Sediments	Intertidal Mud	Intertidal Sand & Muddy Sand
Above water noise	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure				
Abrasion/disturbance of the substrate on the surface of the seabed		**Sensitivity: NS**	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.
Collision BELOW water with static or moving objects not naturally found in the marine environment	**Sensitivity: S** **OUT** - This interaction was only sensitive for Slavonian grebe with hand-working (access from vessel), so is considered extremely low risk.				
Deoxygenation		**Sensitivity: NS**	**Sensitivity: NS**	**Sensitivity: NS**	**Sensitivity: NS**
Genetic modification & translocation of indigenous species					**Sensitivity: IE** **OUT** - Insufficient activity levels within proximity to this habitat to pose risk.

Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	**Sensitivity: IE** **OUT** - Insufficient activity levels to pose risk of large scale pollution event	**Sensitivity: NS**	**Sensitivity: NS**	**Sensitivity: NS**	**Sensitivity: NS**
Introduction of light	**Sensitivity: S** **OUT** - Insufficient activity levels within proximity to this habitat to pose risk.				
Litter	**Sensitivity: IE (S for Slavonian grebe)** **OUT** – Low risk of litter from hand-gathering activities.	**Sensitivity: IE** **OUT** – Low risk of litter from hand-gathering activities.	**Sensitivity: IE** **OUT** – Low risk of litter from hand-gathering activities.	**Sensitivity: IE** **OUT** – Low risk of litter from hand-gathering activities.	**Sensitivity: IE** **OUT** – Low risk of litter from hand-gathering activities.
Penetration/disturbance of the substrate below the surface of the seabed, including abrasion		**Sensitivity: NS**	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern. Mussel & winkle gathering from surface of substrate.	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern. Mussel & winkle gathering from surface of substrate.	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern. Mussel & winkle gathering from surface of substrate.
Physical changes (to another seabed type)		**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern.	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern.	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern.	**Sensitivity: S** **OUT** - Insufficient activity levels to pose risk at level of concern.
Removal of non-target species	**Sensitivity: S** **OUT** – hand-gathering shellfish poses little risk of incidental by-catch.				**Sensitivity: S** **OUT** – hand-gathering shellfish poses little risk of incidental by-catch.
Removal of target species			**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.	**Sensitivity: S** **IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure.
Visual disturbance	**Sensitivity: S** **IN** - Need to consider				

	spatial scale/intensity of activity to determine likely magnitude of pressure				