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

European Marine Site: Severn Estuary SPA

Fishing activities assessed: Bait collection

Gear/feature interactions assessed:

D&S IFCA Interaction ID	Fishing Activity	Features(s)
HRA_UK9015022_AV40	Digging with forks	Bewicks Swan; European White-Fronted Goose; Dunlin; Redshank; Shelduck; Gadwall
HRA_UK9015022_AO40		Internationally Important Assemblage of Waterfowl

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 current level of effort of use of digging with forks has a likely significant effect on the interest features of the Severn Estuary SAC, and on the basis of this assessment whether or not it can be concluded that the current levels of activity relating to digging with forks 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[1]
- 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)

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[1] See Fisheries in EMS matrix:
http://www.marinemanagement.org.uk/protecting/conservation/documents/ems_fisheries/populated_matrix3.xls

2. Information about the EMS

The Severn Estuary is the largest coastal plain estuary in the United Kingdom and one of the largest estuaries in Europe. It has the second largest tidal range in the world and the tidal regime determines not only the structure of the estuary and individual habitats but also the conditions affecting it and the biological communities it therefore supports (Natural England and CCW, 2009). The Severn Estuary EMS includes both SAC and SPA designations which differ slightly in area although broadly overlap.

The Severn Estuary SAC includes the entire extent of the tidal influence from an upstream boundary between Frampton and Awre in Gloucestershire out seawards to a line drawn between Penarth Head in Wales and a location just west of Hinkley point in Somerset (Natural England and CCW, 2009). It includes subtidal and intertidal areas landward to the line of high ground and flood defences (banks and walls) that provide the limit of tidal inundation. The overall area of the European conservation designations is 73,715.4 ha of which roughly two thirds is composed of subtidal habitats and one third is composed of intertidal habitats. The Estuary is an over-arching feature of the EMS which incorporates all aspects of the physical, chemical and biological attributes of the estuary as an ecosystem (Natural England and CCW, 2009).

The estuary lies in the Severn Vale which includes the cities of Cardiff, Bristol, Newport and Gloucester, supporting a number of large-scale industries which exploit the estuaries natural resources.

2.1 Overview and qualifying features

Severn Estuary qualifies as a SPA under the EU Birds Directive for (Natural England, 2015):

- Annex I species
  - Bewick's swan (Cygnus columbianus)
- Regularly occurring migratory species
  - Greater white-fronted goose (Anser albifrons albifrons)
  - Dunlin (Calidris alpina alpina)
  - Redshank (Tringa totanus)
  - Shelduck (Tadorna tadorna)
  - Gadwell (Anas strepera)
- Internationally important assemblage >20,000 waterfowl, includes above species plus the following; Spotted redshank, Curlew, Whimbrel, Grey plover, Ringed plover, Tufted duck, Pochard, Pintail, Teal, Wigeon, Lapwing, Mallard and Shoveler (Natural England and CCW, 2009)
- Supporting habitats
  - Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
  - Coastal reedbeds
  - Freshwater and coastal grazing marsh
  - Intertidal mixed sediment
  - Intertidal mud
  - Intertidal rock
  - Intertidal sand and muddy sand
  - Intertidal seagrass beds
  - Subtidal seagrass beds

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)

The following features and sub-features of the Severn Estuary Severn Estuary SAC have been identified as high risk in relation to towed gear through the application of the Natural England risk matrix:

- **1130 Estuaries (SAC feature)**
    - High-risk sub-feature: Sabellaria spp. reef
    - High-risk sub-feature: Seagrass
- **1170 Reefs (SAC feature)**
    - High-risk sub-feature: Sabellaria spp.

Management has been implemented to protect the *Sabellaria*. The D&S IFCA Mobile Fishing Permit Byelaw prevents the use of towed gear throughout the whole of the portion of the Severn Estuary which sits within the Devon and Severn IFCA district. The document ‘Site Specific Assessment for Red High Risk Categories’ (D&S IFCA 2013) covers these actions. Seagrass only occurs in the Welsh portion of the district, so has been screened out of the D&S IFCA HRA process.

Severn site specific assessment for red hi

4. Information about the fishing activities within the site

D&S IFCA has carried out a detailed review of the fishing activities taking place within the Severn Estuary EMS (Ross, 2015). D&S IFCA carried out bait digging surveys between 2012 and 2015 and IFCA and a further report specifically focussed on bait digging activity has been produced (West, 2019).

Most of the bait digging effort is focused on sandy and muddy shorelines for *Arenicola marina*. *Allita virens* tends to be targeted in areas of sediment in areas of pebbles or stones. Bait digging effort at Hinkley Point, the only site surveyed where these more mixed sediments are targeted, appears to be much lower than at the sites where lugworms are targeted. D&S IFCA has not observed any sites where bait digging either occurs on or directly adjacent to *Sabellaria* or where trampling of *Sabellaria* occurs whilst accessing bait digging areas. Furthermore, the Association of Severn Estuary Relevant Authorities (ASERA), in partnership with D&S IFCA, has produced a code of conduct which specifically requests bait diggers to avoid areas of *Sabellaria* reef and saltmarsh which is actively promoted by all ASERA members, including D&S IFCA.

Fishing Activities occurring in the Seve

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)	**Bird feature(s):** • Above water noise • Removal of non-target species • Visual disturbance **See Annex 5 for pressures audit trail**	
3. Is the feature potentially exposed to the pressure(s)?	Yes, there are no current management measures in place so theoretically an interaction could occur.	
4. What are the potential effects/impacts of the pressure(s) on the feature, taking into account the exposure level?	Direct effects of bait digging can reduce the abundance of target bait species (such as lugworm and ragworm) and change the abundance, structure and diversity macrofaunal communities. Additionally, bait diggers can disturb birds which can impact on breeding success through several factors e.g. nest abandonment, increased mortality of eggs due to predation and increased mortality of young through reduced feeding.	
5. Is the potential scale or magnitude of any effect likely to be significant?	**Alone**	**Unsure,** there is potential for likely significant effect. 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?	**No,** not at this stage.	

6. Appropriate Assessment

An Appropriate Assessment is not required as the TLSE concluded that this activity would not have a significant effect, either alone or in-combination.

6.1 Potential risks to features

Table 2: Summary of Impacts

Feature/Sub feature(s)	Conservation Objective	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
Annex I species: - Bewick's swan Regularly occurring migratory species: - Greater white-fronted goose - Dunlin - Redshank - Shelduck - Gadwall Internationally important	The populations of the qualifying features: Maintain the 5 year peak mean population size for the… - Bewick's swan population is no less than 289 individuals - Wintering European white fronted goose population is no less than 3,002 individuals - Wintering dunlin population is no less than 41,683 individuals - Wintering redshank population is no less	Removal of non-target species	Both blow lugworm (*Arenicola marina*) and, to a lesser extent, king ragworm (*Alitta virens*) are targeted by bait diggers on the Severn Estuary. Contrasting evidence exists as to the *direct* environmental effects of bait digging for lugworm. Relative to other exploited intertidal invertebrates, blow lugworms are relatively resilient to exploitation and disturbance because of their relative fecundity and widespread distribution (Fowler, 1999). In addition, *A. marina* exhibit a marked annual cycle in the numbers and condition of individuals, so that any changes in population structure correlated to bait	A detailed review of bait digging activity in the Severn Estuary has been undertaken by D&S IFCA (West 2019). Key findings are as follows: - The majority of digging effort is for lugworm on the sandy beaches at Burnham on Sea, Berrow, Brean, Weston-Super-Mare and Sand Bay with more localised targeting of ragworm in some locations. - Bait digging effort is greatest in Autumn and Winter, thought to be due to the popularity of sea angling for	D&S IFCA worked with the Association of Severn Estuary Authorities (ASERA) to produce a bait digging code of conduct, published after the survey work discussed in this report took place. The code promotes back-filing of holes, encourages anglers to avoid saltmarsh and *Sabellaria* and to only take as much bait as they need. It

assemblage of waterfowl	than 2,013 individuals - Wintering shelduck population is no less than 2,892 individuals - Wintering gadwall population is no less than 330 -Waterfowl assemblage is no less than 68,026 individuals (ie the 5 year peak mean between 1988/9-1992/3) The distribution of the qualifying features within the site: Maintain aggregations of the… - Bewick's swan - European white-fronted goose - Dunlin - Redshank - Shelduck - Gadwall - Waterfowl aggregations at feeding, roosting and refuge sites are not subject to significant disturbance. The populations of the qualifying features: Maintain the 5 year peak mean population size for the: - Bewick's swan population is no less than 289 individuals - Wintering		digging, would have to control for these factors (Olive, 1993). Removal rates of 50-70% of worms in the area dug have been reported in the literature (Heilgenberg 1987, Blake 1979) but D&S IFCA observations suggest this may be much lower in some areas, especially where large areas of lugworm exist and holes are relatively well spread out. A wide range of responses by *A. marina* to exploitation or experimental simulations of exploitation have been found, relating to local environmental conditions and the intensity and distribution of bait digging activity. Olive (1993) describes the scenario which led to complete removal of all lugworms from a large area of a National Nature Reserve in Northumberland in 1984, with densities falling from >40m^{-2} to <1m^{-2}. When the site was closed to bait digging it repopulated within a matter of months, thanks to the presence of extensive non-exploited populations nearby. Similarly, lugworm populations in the Dutch Wadden Sea appear to be unaffected by large scale commercial exploitation, with an estimated 2 x 10^{7} individuals take annually. However, Cryer et al. (1987) found no recovery in worm densities after 6 months following experimental removal, although natural densities at the test site in South Wales were low (9-16 m^{-2}) and the survey ran through the less productive winter months. The capacity of a population to withstand bait digging activities	whiting and cod at this time of year. - Bait digging effort was relatively low with mean values of bait diggers per hour between 0.2-0.8 per hour and median values for the number of holes observed on a survey being close to 0. - The maximum number of bait diggers observed ranged between 2 and 4 diggers per survey depending on the site and year - There was some inter-annual variation in angling effort, possibly relating to the strength of the cod run - Bait digging was spatially limited at some sites depending on access points and the areas dug tend to be very small in relation to the size of the intertidal mudflats - The areas dug for worm tended to be very small in comparison to the overall available habitat - Digging primarily occurred around low tide although it was generally middle to upper shore areas which were dug due to the distance to walk out to low tide, the prevalence of muddy habitat in many areas and the danger involved in walking out on the mudflats	also informs anglers that ragworm may be more sensitive to exploitation in the Severn, and to restrict their take of these species, and to consider purchasing farmed ragworm. Little commercial bait collection takes place, but where it has been suspected to occur the individuals involved did dig significantly more frequently and for greater quantities of worm than the average recreational angler. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand working (including bait digging). Options for management will include, no action, voluntary measures and the potential introduction of a Hand Working Byelaw, which would allow the IFCA to monitor levels of this

	European white fronted goose population is no less than 3,002 individuals - Wintering dunlin population is no less than 41,683 individuals - Wintering redshank population is no less than 2,013 individuals - Wintering shelduck population is no less than 2,892 individuals - Wintering gadwall population is no less than 330 - Waterfowl assemblage is no less than 68,026 individuals (ie the 5 year peak mean between 1988/9-1992/3)		therefore relies on a number of factors including the size of the exploited area relative to the total lugworm bed, the presence of other lugworm beds nearby, the presence of nursery areas, the relative exploitation of adult and juvenile lugwprms, and the intensity and seasonality of bait digging. However, on the whole they are thought to be resilient to bait digging. King ragworm, *Alitta virens,* is a keystone intertidal species as prey for fish, birds and crustaceans, is a predator of other invertebrates and has an important role in bioturbation of the sediment (Watson et al. 2017a). King ragworm are generally found in more sheltered sediment areas but they can also be found in more mixed sediments (E West, Pers. Obs.). Differing reports exist of the life-history and population characteristics of *A.virens.* Whilst early studies of North American populations suggested a mean age at breeding of >3 years with the population dominated by 0-group individuals, a population from the Menai Straight, Wales was thought to mature later, and to have very few 0-group individual present. The latter population was therefore seen as being vulnerable to exploitation. On the North East coast of England, a study found similar densities (~15m^2 during the summer, ~3m^2 during the winter) of *A. virens* in both exploited and unexploited populations Blake (1979), suggesting that at least some populations are unaffected by bait	- Some commercial activity has occurred in the past and IFCA officers did observe two individuals who were thought to be digging commercially. These diggers dug considerably more often and for more lugworm compared to recreational diggers. - Anglers did not backfill holes This effort is significantly lower than that reported by Watson et al. in 2017b in the Solent. The study recorded an average of 3.14 collectors per tide and a mean collection rate per person per hour of 228 worms from direct measurements taken across three locations within the Solent European Marine Site (SEMS). Using a mean weight of A.virens collected by a commercial collector of 6.11g. In a separate report, D&S IFCA undertook extensive survey work to look at lugworm density in the Severn (Ross 2013). The report found that lugworm density and population structure (adults: juveniles) varied spatially between Burnham-On-Sea and Sand Bay, probably due to sediment characteristics and the sedimentary regime in the Severn. Distribution and densities were found to be very similar to those reported in a paper in the	activity in the future, and adapt to changes in effort/ environmental conditions if necessary. If the IFCA did introduce formal management this may include the requirement to back fill holes and trenches.

			digging. In other cases the change in macrofaunal community has been thought to benefit *A.virens*, due to its opportunistic nature (Evans et al. 2015). Estuary ragworm is used for bait by some anglers, who generally just report using ragworm which could be A.virens or *H. diversicolor* when fishing (although king ragworm is generally preferred). *H. diversicolor* is widely distributed throughout the North Temperate Zone from both the European and the North American coast of the Atlantic (Scaps 2002). *H. diversicolor* inhabits sandy muds but also gravels, clays and even turf (Scaps 2002). The species is able to tolerate great variations of temperature and salinity and to survive drastic conditions of hypoxia and is thus able to settle in naturally-fluctuant environments such as the upper waters of estuaries (Scaps 2002). Variation in the reproductive biology of this species over short distances has also been reported. Worms monitored near the mouth of the Humber estuary (England), spawning takes place in March; at the upriver end of the Humber; oocytes are spawned in June or July (Grant et al. 1990 in Scaps 2002). Individuals live up to 3 years, with maturity occurring somewhere between 1 and 2 years old. *H. diversicolor* is highly prone to predation by waders and shelducks, crabs, shrimps and small fish. In the Douro estuary it was estimated that 9.9tons of	1970's. The large area of intertidal mudflats and abundance of lugworm throughout the Severn suggest populations will be robust to exploitation.	

			H.diversicolor are dug, however the total annual biomass collected was substantially less than the productivity estimated for the entire intertidal area of the site. The ability of a variety of age classes to swim, burrow and be carried by bedload transport is thought to aid the rapid recolonization of disturbed sediments (Shull 1997). In the Tamar Estuary Davey & George (1986), found evidence that the larvae of *H.diversicolor* were tidally dispersed over a distance of 3 km. This suggests that, similar to *A.marina*, the resilience of a population of *H.diversicolor* to bait digging may depend on local population dynamics as well as the intensity of the activity. Bait digging can have adverse effects on a wide variety of species as a result of physical damage, burial, smothering and/or exposure to desiccation or predation to non-target invertebrates. Recovery of small short-lived invertebrates will usually occur within a year, but populations of larger, long-lived invertebrates may take much longer (Fowler, 1999). In some extreme cases local diversity may be reduced, which may be especially true in physically fragile environments such as eelgrass or mussel beds (Fowler, 1999). Similarly, Beukema (1995) found that within a 1km^2 area of the Dutch Wadden Sea, the local lugworm stock declined by more than double over a four-year mechanical digging period. As a result of this decline, total zoobenthic		

			biomass also declined, with short lived species showing a marked reduction during the digging period. Recovery of the benthos took several years, especially by the slower establishing species. However, if disturbance by digging is short term, benthic communities can recover within six months (Beukema, 1995). In a disturbance study in a range of estuarine habitats Dernie et al. (2003) found the total numbers of individuals and species in disturbed treatment areas were reduced significantly immediately post-disturbance and differences were still observable 15, 35 and 105 days after the simulated disturbance. There was no indication of an influx of opportunistic species into disturbed areas at any of the 16 sites (Dernie et al. 2003). Moshabi et al. (2015) also explored the impacts of bait digging on the macrofauna of intertidal mudflats. The fauna of their study area (the tidal mudflats of Kneiss Islands, Tunisia) was mainly composed of polychaetes, the more abundant families being the *Nereididae*, *Arenicolidae* (fishing target species) and the *Cirratulidae*. They found the number of taxa and abundance of individuals were affected by bait digging; the abundances estimated at the control stations were significantly higher than those estimated at the three stations before and after bait collection, with some polychaete species disappearing after		

			one month of bait digging. This indicates that the intertidal macrozoobenthic biodiversity at the impacted stations is affected by the bait digging activity, or possibly by trampling. Jackson and James (1979) investigated the effects of bait digging on cockle populations. They found that increased digging in an area caused higher cockle mortality, particular on smaller individuals. The cause of mortality was due to burial/smothering as individuals that were buried at a depth of 10cm rarely survived. Rossi et al. (2007) investigated the effects of trampling on mudflats, such as that associated with recreational activities like bait digging. They found that trampling clearly modified the abundance and population dynamics of the clam *Macoma balthica* and the cockle *Cerastoderma edule.* There was a negative impact on adults of both species, probably because footsteps directly killed or buried the animals, provoking asphyxia. However, trampling indirectly enhanced the recruitment rate of *M. balthica*. Small-sized *C. edule* showed no reaction to trampling. It is likely that small animals could recover more quickly because trampling occurred during the growing season and there was a continuous supply of larvae and juveniles. Trampling may also have weakened negative adult-juvenile interactions between adult cockles and juvenile *M.*		

			balthica, thus facilitating the recruitment. Rossi et al. (2007) concluded that human trampling is a relevant source of disturbance for the conservation and management of mudflats. During the growing season recovery can be fast, but in the long-term it might lead towards the dominance of *M. balthica* to the cost of *C. edule*, thereby affecting ecosystem functioning. Wynberg & Branch (1997) assessed the impacts of trampling associated with the use of suction pumps for the collection of prawns as bait, by comparing areas that had been sucked over with a prawn pump, to areas that had been trampled only. Prawn densities were depressed six weeks following both sucking and trampling but recovered by 32 weeks. Macrofaunal numbers declined in most treatment areas and macrofaunal community composition in the most-disturbed areas was distinct from that in other areas. They determined that the trampling itself has almost the same effect as sucking for prawns, on both the prawns and on the associated biota. It is important to note that the effects on macrofaunal communities can differ substantially between estuaries. For example, the mud content of an estuary can affect the resilience of the communities to bait digging. Although Dernie et al. (2003) found that it was not possible to predict the recovery rates of assemblages based on		

			percentage of silt and clay in the sediment, there was a good relationship between recovery rate and infilling rate, which is linked to the physical characteristics of the sediment. Clean sand habitats were the quickest to recover both in terms of physical and biological characteristics. Other studies have also found extended recovery times for estuaries with high mud content (Carvalho et al., 2013). The site-specific nature of the impacts of bait digging was also demonstrated by Watson et al. (2017a). They found that responses were both site and disturbance type specific. Their data also showed that responses were not consistent between species (e.g. *C. volutator* and *P. ulvae*) or even between those within the same trophic group. They, therefore, concluded that bait collection alters the macrofaunal community and the associated sediment characteristics across large spatial scales, but with the caveat that the strength (and type) of the response is site specific. Lugworm is an important prey item for the Grey Plover and the Bar-Tailed Godwits in the Severn (Goss-Custard et al., 1991). There is an important link between macrofaunal biomass (energy content) and the behaviour of wading birds. Wading birds have been shown to extend their feeding period, increase their attack rate, broaden their prey or move to different areas in order to cope		

			with reductions in infaunal biomass (Zwarts, 1993). Although the process of bait digging can directly target prey items for certain bird species, it can also indirectly impact the forging efficiency of wading birds through increased mortality of associated invertebrate fauna. For example, Shepherd and Boates (1999) found that foraging efficiency of sandpipers was significantly lower in areas targeted for bait digging of bloodworms. Foraging efficiency decreased by 68.5%. This species of bait is not a prey item for the sandpiper but the process of bait digging resulted in a 38% decrease in density of their amphipod prey, *Corophium volutator,* after one year of baitworm harvesting in the Bay of Fundy. This decrease was as a result of direct mortality and lower juvenile recruitment. It was also observed that sandpipers on dug regions took longer to build up fat deposits needed for migration. However, although the high mud content of many of the Severn Estuary's intertidal mud and sandflats might suggest that the habitat is more sensitive to disturbance, the extreme tidal range and exposed nature of the Severn intertidal mud & sand flats means that these habitats in the Severn are not comparable to low-energy sheltered mud habitats elsewhere. In other mud habitats, physical		

			disturbance from bait digging is often visible for extended periods of time, in the Severn holes are generally not visible after one tidal cycle, even though back filling does not occur.		
Annex I species: - Bewick's swan Regularly occurring migratory species: - Greater white-fronted goose - Dunlin - Redshank - Shelduck - Gadwall Internationally important assemblage of waterfowl	The populations of the qualifying features: Maintain the 5 year peak mean population size for the… - Bewick's swan population is no less than 289 individuals - Wintering European white fronted goose population is no less than 3,002 individuals - Wintering dunlin population is no less than 41,683 individuals - Wintering redshank population is no less than 2,013 individuals - Wintering shelduck population is no less than 2,892 individuals - Wintering gadwall population is no less than 330 - Waterfowl assemblage is no less than 68,026 individuals (ie the 5 year peak mean between 1988/9-1992/3)	- Above water noise - Visual disturbance	Bird disturbance is also a major concern, especially where peak bait digging coincides with peak bird abundance or intertidal activity (Townsend & O'Connor, 1993). A review by Hockin *et al.* (1992), shows disturbance can have an effect on breeding success through several factors e.g. nest abandonment, increased mortality of eggs due to predation and 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. Sustained, localised disturbance in feeding areas can lead to shifts to alternative feeding sites (Tasker *et al.* 2000). Bait collection has been found to induce a 'temporary loss of habitat' for some bird species, with bait collector numbers negatively correlating with wader and gull abundance (Watson et al., 2017a). Wildfowl, such as mute swans may be the least likely group to be vulnerable to disturbance, as many of these species are fed directly by	The ringed plover, grey plover, dunlin, curlew, redshank and shelduck predominantly forage intertidally (Burton *et al.* 2010). Noise and the presence of bait diggers may cause disturbance to bird species. Temporal peaks in bait digging (Autumn and Winter, West 2019) do coincide with the peak abundance of overwintering birds. However, the diggers presence is generally around low tide (West 2019) and bait digging activity is concentrated on the lower parts of the upper shore over relatively small areas (Annex 4, Figures 12-15). This reduces the pressure of disturbance as there is a large area available for birds to feed at low tide and the birds are often widely distributed across the intertidal area (Annex 3, Figures 2-8) but often with concentrations further out than the bait digging activity. Maximum numbers of bait diggers were recorded as 2-4 individuals, and these would often (but not always) be digging in close proximity to each other (E West pers obs).	D&S IFCA worked with the Association of Severn Estuary Authorities (ASERA) to produce a bait digging code of conduct, published after the survey work discussed in this report took place. The code promotes back-filing of holes, encourages anglers to avoid saltmarsh and *Sabellaria* and to only take as much bait as they need. It also informs anglers that ragworm may be more sensitive to exploitation in the Severn, and to restrict their take of these species, and to consider purchasing farmed ragworm. Little commercial bait collection takes place, but where it has been suspected to occur the

	The distribution of the qualifying features within the site: Maintain aggregations of the… - Bewick's swan - European white-fronted goose - Dunlin - Redshank - Shelduck - Gadwall - Waterfowl aggregations …at feeding, roosting and refuge sites are not subject to significant disturbance. The populations of the qualifying features: Maintain the 5 year peak mean population size for the… - Bewick's swan population is no less than 289 individuals - Wintering European white fronted goose population is no less than 3,002 individuals - Wintering dunlin population is no less than 41,683 individuals - Wintering redshank population is no less than 2,013		humans (Liley and Fearnley 2012, Watson et al. 2017a) Goss-Custard and Verboven (1993) found that the presence of people in areas used for feeding and breeding can alter the behaviour and distribution of estuarine birds. Meaning the birds may become displaced into areas with a lower prey density. A disturbance review by the Exe Estuary Management Partnership (2016) summarised that disturbance levels can be dictated by a number of factors such as noise level, amount of activity and number of people present. However, disturbance by bait collection generally occurs via visual (seeing the collector and responding as if they were a potential predator) and/or noise disturbance (causing distress via deviation from the "natural" ambient noise). Liley et al. (2011) found that whilst bait-digging and crab-tiling accounted for 7% of bird disturbance events in their study on the Exe Estuary, this was just a count of number of events, and bait-digging actually accounted for 16% of all major flight events. Liley et al. (2012) carried out observational surveys in Poole Harbour, recording activities which resulted in bird disturbance. For 93% of observations there was no response from birds, only 1% resulted in major flights. 1558 potential disturbance events were recorded over 63 hours of survey. During the 63 hours of	There has been a steady increase in winter shelduck population in the Severn estuary over the last 30 years (Burton *et al.* 2010; Cook *et al.* 2013). Cook *et al.* suggested that the environmental conditions remain relatively favourable and that the Severn Estuary is becoming increasingly important for shelduck, because the population is not tracking regional or country trends. Shelduck are most abundant in Bridgwater Bay, containing 71% of the total Severn Estuary population (Table 3, Annex 7) and it is an important moulting area for shelduck during later summer and autumn (Natural England, 2009; Burton *et al.* 2010). Moulting shelduck are present in high numbers in Bridgwater Bay between June and October. Mean counts of moulting shelduck between 2005 and 2014 from June to October were 1075, 2460, 3930, 2697 and 2334 respectively (Best, 2015). They are more vulnerable to disturbance when moulting due to their inability to fly away. However, they utilise a wide area of Bridgwater Bay and the frequency of disturbance likely to be caused by bait digging would not have an impact on the species. Additionally, peak bait digging activity would only overlap with the latter part of Shelduck	individuals involved did dig significantly more frequently and for greater quantities of worm than the average recreational angler. Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand working (including bait digging). Options for management will include, no action, voluntary measures and the potential introduction of a Hand Working Byelaw, which would allow the IFCA to monitor levels of this activity in the future, and adapt to changes in effort/ environmental conditions if necessary. If the IFCA did introduce formal management this may include the requirement to back fill holes and trenches.

	individuals - Wintering shelduck population is no less than 2,892 individuals - Wintering gadwall population is no less than 330 - Waterfowl assemblage is no less than 68,026 individuals (ie the 5 year peak mean between 1988/9-1992/3)		surveillance there were just five individual disturbance events involving bait collection, none resulted in the birds being flushed. Townsend and O'Connor (1993) found that disturbance caused by bait digging activity greatly reduced the extent of use of the Lindisfarne National Nature Reserve (NNR) by wigeon, bar-tailed godwit and redshank. However, significant increases in the populations of wildfowl were recorded in the year following a ban on bait digging. In addition to the disturbance to birds from bait digging, there have been several studies that have shown dog walkers can induce anti-predator responses in birds including increased vigilance (Randler, 2006) and early flight, as well as disturbing some species of breeding shorebirds from their nests (Lord et al., 2001) which may lead to a cascade of related responses that negatively affect birds, such as areas of intertidal habitat being unavailable to the birds (Liley et al., 2011). However, the impact of dog walkers on wading birds will be subject to the duration, frequency and location of disturbance as well as being species specific.	moulting, and much of it would fall outside this season. Other species in Bridgwater Bay which represent a high number of the total Severn Estuary population are grey plover (54%), dunlin (53%), lapwing (47%), spotted redshank (45%), redshank (43%) and ringed plover (36%). An additional eight other species are present in significant numbers (<30%) and can be seen in Table 3, Annex 7. Data from the first year of bait digging surveys suggest *relatively* high levels of bait digging (2 individuals observed) at Hinkley Point (West 2019) but no bait diggers were observed in 2014-2015. The low sampling effort for this site makes these results unreliable. Certainly, this site is harder to reach, and only targeted for ragworm, suggesting the relatively high levels observed in 2012-2013 at Hinkley Point may be mis-leading. Digging at Burnham-on-Sea peaked in the winter months, suggesting impacts on moulting shelduck might be minimal (West 2019). The parts of the shore dug at Burnham on Sea (Annex 4, Figure 12) also suggest that minimal disturbance will take place in comparison to the distribution of birds at low tide in Bridgwater Bay (Annex 3, Figures 2-4).	

				The sector Brean Down to Anchor Head encompasses Weston Bay (Annex 7, Figure 19). Weston Bay contains significant numbers of redshank (17%), gadwall (11%) and teal (11%) when compared to the Severn Estuary as a whole (Table 5, Annex 7). Another 12 species are also present in high numbers (<10%). Latham (2015) identified high tide waterbird roost sites situated at the southern end of the sector, which includes the Axe Estuary. The latest five year summary of WeBS data indicate the number of waterbirds within the sector peaked during the winter months (November to March). The number of redshank within the sector tends to peak during the autumn period (July to October), although this species is also present in high numbers during the winter period (Latham, 2015). The distribution of red shank at low tide in Weston Bay (Annex 3, Figure 8) suggests that bait digging activity at this site (Annex 4, Figure14) will not overlap significantly. Redshanks favour river mouths where there is freshwater input such as the River Axe (Burton *et al*. 2010) which is located within this sector. Sand Bay contains significant numbers of shelduck (14%),	

				ringed plover (4%), curlew (3%), grey plover (3%), redshank (3%) and dunlin (1%), see Table 4, Annex 3. The latest five-year summary WeBS data indicated that the sector from Anchor Head to Sand Point supports three SPA qualifying species: shelduck (Annex 3, Figure 5), dunlin (Annex 3, Figure 7) and redshank (Annex 3, Figure 6). According to the WeBS data the number of all three species tends to peak within the sector during the winter months. The sector supported, on average, 12% of the wintering shelduck population, 1.5% of the wintering dunlin population, and 1.2% of the wintering redshank population, of the entire Severn Estuary between 2008/09 and 2012/13 (Latham, 2015). There has been an increase in redshank numbers at Sand Bay within the last 30 years (Burton *et al.* 2010). In the south of Sand Bay, a mixed waterbird roost site in open water was identified, which was typically dominated by shelduck and black-headed gulls (Latham, 2015). WeBS interviews identified potential sources of disturbance in Sand Bay from jet skiing and lifeboat manoeuvres, predominantly during the summer months (Latham, 2015). As with other sites, bait digging activity at	

				Sand Bay (Annex 4, Figure 5) tends to occur much higher on the shore than peak bird counts at Sand Bay (Annex 3, Figures 5-7). Burton *et al.* (2010) analysed WeBS data in order to identify the status of birds in the Severn Estuary and Bristol Channel, compared to historic numbers and in relation to any site-specific or broad scale patterns. The study found that the proportion of wader numbers wintering in south west Britain and the Severn Estuary, are decreasing, with the highest declines in grey plovers and dunlins over the past 20 years. The decline is negatively correlated with mean winter temperatures. The decline of grey plovers and dunlins in the Severn Estuary may be a consequence of climate change, rather than site-specific issues (Austin and Rehfisch, 2005). The SPA Toolkit assessed Bewick's swan, white-fronted goose, dunlin, redshank, shelduck, gadwall, curlew and pintail from WeBS alerts as having no site-specific decline. The ringed plover was not assessed.	

7. Conclusion

Taking into account the information detailed in the Appropriate Assessment, it can be concluded that the current level of bait digging has no adverse effect on the integrity of the Severn Estuary SAC or SPA interest features. However, the management of bait collection should be considered by D&S IFCA if commercial bait digging activity commenced which could result in an adverse effect on the conservation objectives and site integrity of the SAC. Best practice outlined in ASERA's code of conduct should be actively promoted and encouraged.

8. In-combination assessment

8.1 Other fishing activities

The following fishing activities are either occurring or have not been able to have been ruled out as occurring in the Severn Estuary SPA.

Fish traps – Thought not to be occurring but hasn't been able to be ruled out. Therefore no in-combination effect thought to be possible.

Handlines – Thought not to be occurring but hasn't been able to be ruled out. Therefore no in-combination effect thought to be possible.

Drift nets, demersal and pelagic – Thought not to be occurring but haven't been able to be ruled out. Therefore no in-combination effect thought to be possible.

Purse seine – Thought not to be occurring but hasn't been able to be ruled out. Therefore no in-combination effect thought to be possible.

Shrimp push nets– Thought not to be occurring but hasn't been able to be ruled out. Therefore no in-combination effect thought to be possible.

Longlines, demersal and pelagic - Thought to be occurring at a very low level in the Severn Estuary. Due to the very low level of fishing activity relating to both activities it is thought that no in-combination effects will lead to the conservation objectives not being met for any of the bird features in this assessment.

Beach seine/ ringnets – Beach seines are thought to be occurring at a very low level and ring nets are not thought to be occurring in the Severn Estuary. Due to the very low level of fishing activity relating to both activities, it is thought that no in-combination effects will lead to the conservation objectives not being met for any of the bird features in this assessment.

Static netting - Fyke nets, stake nets, gill nets, trammels and entangling nets, are used in the Severn Estuary but at a low and decreasing level. Due to the low level of fishing activity and spatial and temporal distribution of bait digging effort in relation to the site as whole, it is thought that no in-combination effects will lead to the conservation objectives not being met for any of the features in this assessment.

D&S IFCA conclude there is no likelihood of significant adverse effect on the interest features from in-combination effects with other fishing activities addressed within section 8.1.

8.2 Other activities

The Severn Estuary is a large and complex European Marine Site with several large cities including Bristol, Gloucester, Newport and Cardiff and a number of major industrial areas within the catchment area. Currently there are a number of proposed plans or projects in the Severn Estuary EMS which could theoretically interact with the bird features addressed. These are in various stages of development – some are already occurring (e.g. Hinkley B, wildfowling), others are in the development stage with some on-the-ground activity (Hinkley C) and others are still in the early planning and development stages (e.g. Tidal Lagoons, Bridgwater Barrier, Coastal Path). These activities have been included following the informal advice from Natural England. Pressures which are highlighted in yellow are those thought to be most likely to be have an 'in-combination effect' with the fisheries activities described in this assessment.

Hinkley Point B & C

Static netting - Fyke nets, stake nets, gill nets, trammels and entangling nets, are used in the Severn Estuary but at a low and decreasing level. Due to the low level of fishing activity and spatial and temporal distribution of bait digging effort in relation to the site as whole, it is thought that no in-combination effects will lead to the conservation objectives not being met for any of the features in this assessment.

Description of activities

Hinkley Point nuclear power station sits on the edge of Bridgwater Bay on the edge of the Severn Estuary EMS. Hinkley Point B (HPB) has been active since 1976 and continues to operate. HPC is a proposed development for two new nuclear reactors currently being undertaken by EDF Energy, next to HPA and HPB.

Pressures

Because of the large-scale development of Hinkley C and decommissioning, it is impossible to consider all of the associated pressures from both direct operation of the site and the building of Hinkley C and the decommissioning of Hinkley B. It is possible that some of the works associated with both Hinkley B and Hinkley C may have similar pressures to those identified as being associated with fixed nets in the Severn Estuary.

In-combination assessment

Hinkley C has undergone an extensive Appropriate Assessment process with independent survey and monitoring through the BEEMS project, co-ordinated by Cefas. The extremely small-scale and localised potential impacts of fixed nets on the bird features are considered insignificant compared to any potential adverse relating to Hinkley developments. Devon and Severn IFCA sits on the Hinkley C Marine Technical forum and has good links with EDF so has a direct mechanism for staying up-to-date on Hinkley developments, if any of the planned work changes substantially. Therefore it is not thought that any in-combination effects will prevent the conservation objectives of the Severn Estuary EMS from being met.

Tidal Lagoons – Cardiff and Newport

Description of activities

Tidal Lagoon Power has proposed the development of two new Tidal Lagoons on the Welsh coast; one near Cardiff and one in the Newport area. Final designs or locations of the lagoons have not yet been determined but it is thought that they would encompass large areas of intertidal and subtidal habitat in the Severn Estuary.

Pressures

- Above water noise
- Barrier to species movement
- Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)
- Emergence regime changes – local, including tidal level change considerations
- Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC
- Introduction of light
- Introduction of other substances (solid, liquid or gas)
- Introduction or spread of non-indigenous species
- Litter
- Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals). Includes those priority substances listed in Annex II of Directive 2008/105/EC.
- Transition elements & organo-metal (e.g. TBT) contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.
- Visual disturbance

In-combination assessment
At the present time, there is not enough information to make a detailed judgement on in-combination effects from Tidal Lagoons. However, the scale and temporal and spatial distribution of bait digging is tiny in comparison to the potential of large-scale developments such as those proposed by the Tidal Lagoons. Therefore, any in-combination effect will be negligible compared to those of the lagoons alone.

Wildfowling

Description of activities
Wildfowling occurs in the Severn Estuary EMS. The majority is undertaken by wildfowling clubs, by Sites of Special Scientific Interest (SSSI) consent or National Nature Reserve (NNR) permits. However, there is still a certain amount of non-permitted wildfowling taking place. There are five wildfowling clubs on the English side of the Severn Estuary:

1) Highbridge, Huntspill & Burnham District Wildfowlers Club (HHBWC)

The club shoot over the Crown Estate land Bridgwater Bay SSSI, and also are primary shooters on the excepted (see Annex 6, Figure 11) NNR land at Bridgewater Bay. This is licenced by Natural England, via a permit system.

2) Bridgwater Bay Wildfowlers Association (BBWA)

At Bridgwater Bay, BBWA shoot over the NNR at Comwich which is licenced by Natural England via a permit system. BBWA are the other primary shooters on the excepted (see Annex 6, Figure 11) NNR land at Bridgwater Bay. BBWA also shoot over Crown Estate and Non-Crown Estate land on the River Axe.

3) Weston Sporting Club (WSC)

WSC shoot over Crown Estate and Non-Crown Estate land on (and adjacent to) the River Axe on the Severn Estuary

4) Clevedon Wildfowling Association (CWA)

The CWA shoot over Crown Estate and Non-Crown Estate land at Woodspring Bay on the Severn Estuary

5) Gloucestershire Wildfowlers Association (GWA)

The open season for wildfowling in England and Wales, above the mean high water mark is 1st September to 31st January. The open season for duck and goose species below the mean high water mark is 1st September to 20th February (BASC, 2015). Sunday shooting of wildfowl is not permitted and there may be local restrictions on shooting at night. The species that can be shot during their open season and are a Severn SPA feature are; Gadwall, Pintail, Pochard, Shoveler, Teal, Tufted duck, Wigeon, White fronted geese and Mallard (Wildlife and Countryside Act 1981).

Pressures

- Above water noise
- Litter
- Removal of target species
- Visual disturbance

In-combination assessment
Wildfowling occurs to the west of the fished area in Sellick Zone 1 (Annex 6, figure 11 and Annex 4, Figure 10). The pressures of visual disturbance and noise from bait digging could have an in-combination effect with wildfowling. Disturbance from wildfowling would be in the form of presence by wildfowlers and the noise from a fired shot. Wildfowling for ducks and goose species can only occur below mean high water between 1st September and 20th February (except on Sundays). Natural England has carried out HRAs for wildfowling licenses which conclude no adverse impact on site integrity. The spatial and temporal distribution of bait digging will have no impact on the features of the EMS and will occur at different times to the wildfowling (low vs high tide) so no adverse effect will occur.

Coastal Path

Description of activities
The South West Coast Path and the England Coast Path are to be extended from Minehead to Bristol. The final route of the coastal path has not yet been released. Minehead to Brean Down is now open to the public, coastal access rights came into force on 15th March 2016. There is a restricted coastal margin access to the saltmarsh and mudflats of Stert Flats (Bridgwater Bay). Coastal access from Brean Down to Aust is currently in development and expected to be open in 2017.

Pressures

- Above water noise
- Collision ABOVE water with static or moving objects not naturally found in the marine environment (e.g. boats, machinery, and structures)
- Barrier to species movement
- Visual disturbance
- Introduction of light
- Litter

In-combination assessment
At the present time, there is not enough information to make a detailed judgement on in-combination effects from the coast path development. Associated pressures would be from a result of construction work to create the coast path. Recreational activity is thought to increase due to the new coast path, as there will be access to previously inaccessible areas. Due to the lack of impact of bait digging and its limited spatial and temporal distribution, it is not thought that any in-combination effects will prevent the conservation objectives of the Severn Estuary EMS from being met.

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

D&S IFCA conclude there is no likelihood of significant adverse effect on the interest features from in-combination effects with other plans or projects addressed within section 8.2.

9. Summary of consultation with Natural England

N/A

10. Integrity test

It can be concluded that bait digging, alone or in-combination, within the Severn Estuary SAC & SPA will not adversely affect the features of the European Marine Site or prevent the conservation objectives being met.

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Annex 2: Natural England's consultation advice

Annex 3: Site Maps

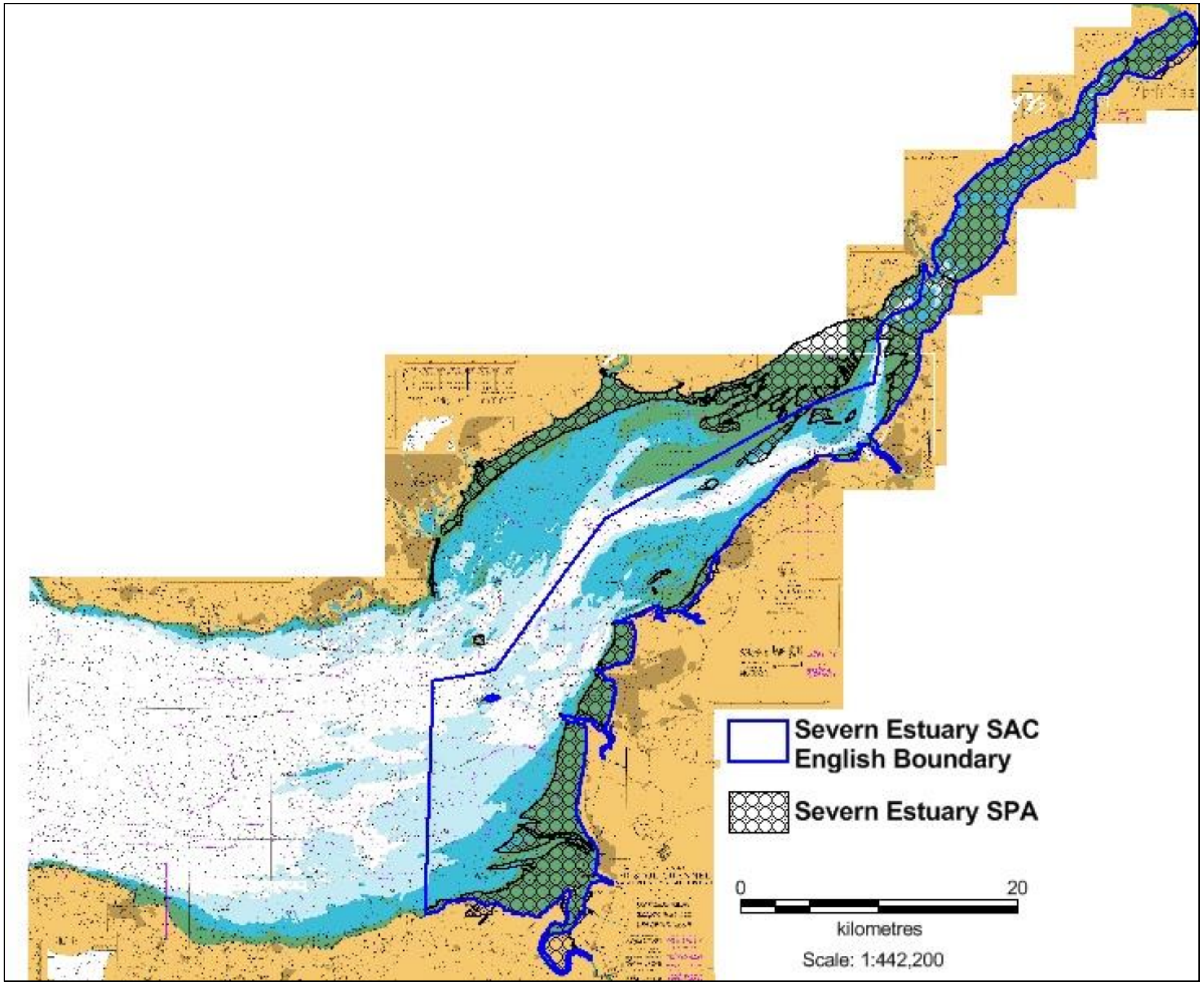

Figure 1 - Map showing the extent of the Severn Estuary SPA

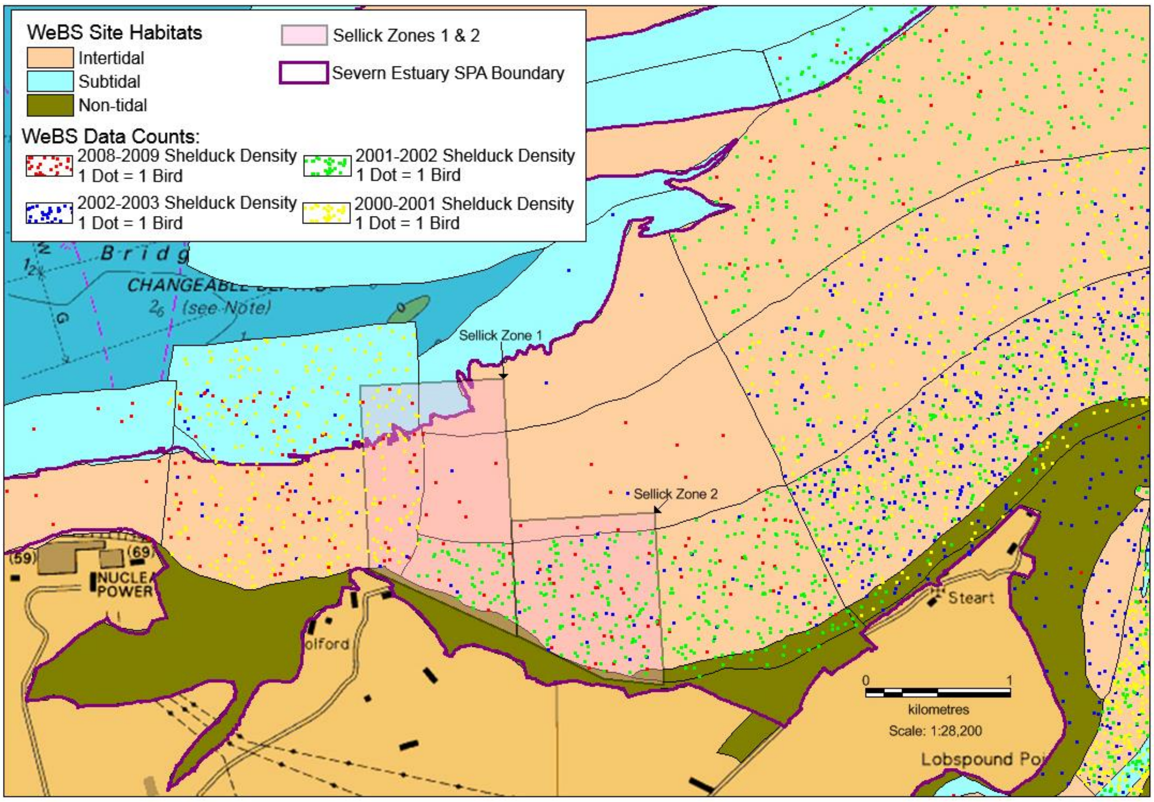

Figure 2 – WeBS low tide count data for Shelduck density in Bridgewater Bay

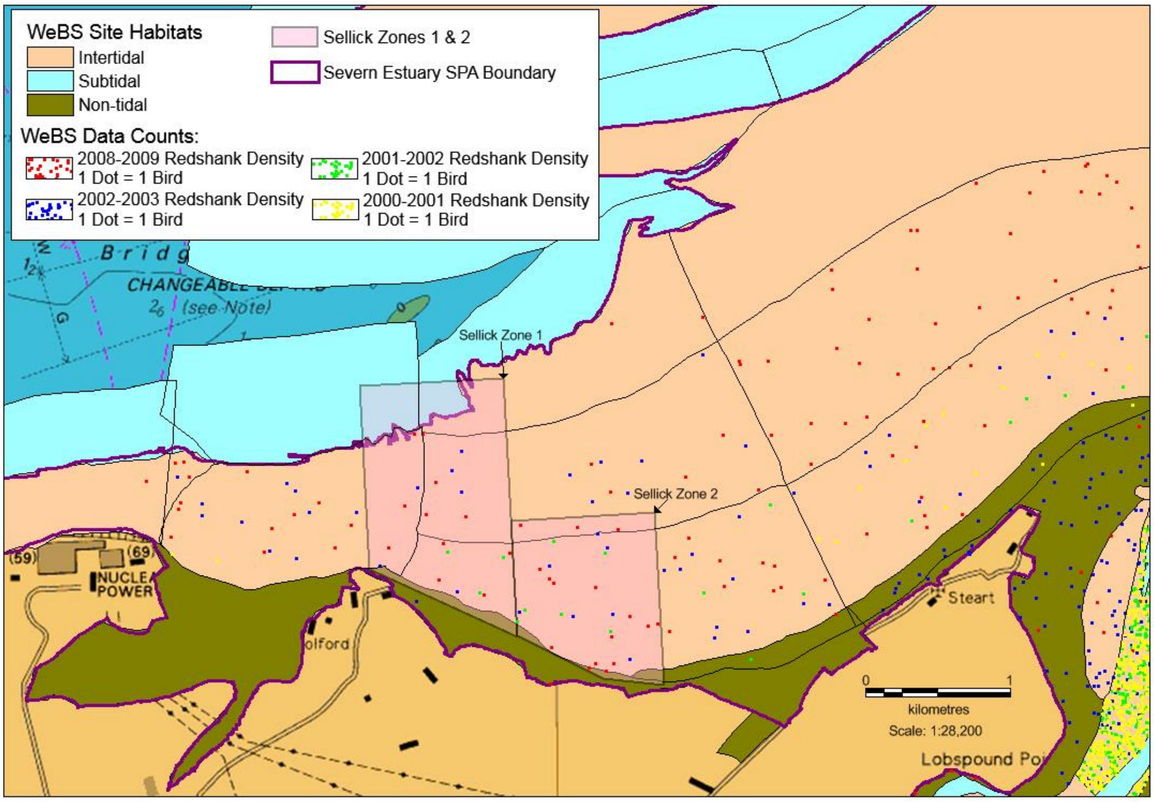

Figure 3 - WeBS low tide count data for Redshank density in Bridgewater Bay

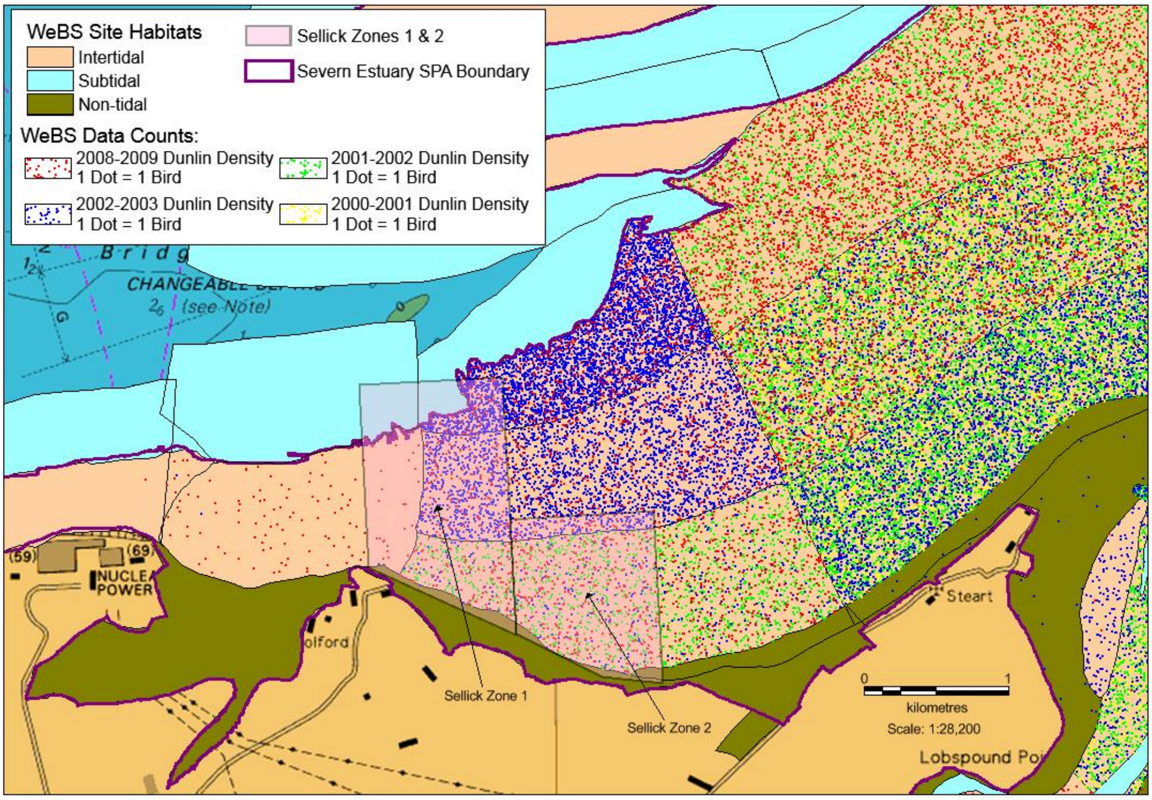

Figure 4 - WeBS low tide count data for Dunlin density in Bridgewater Bay

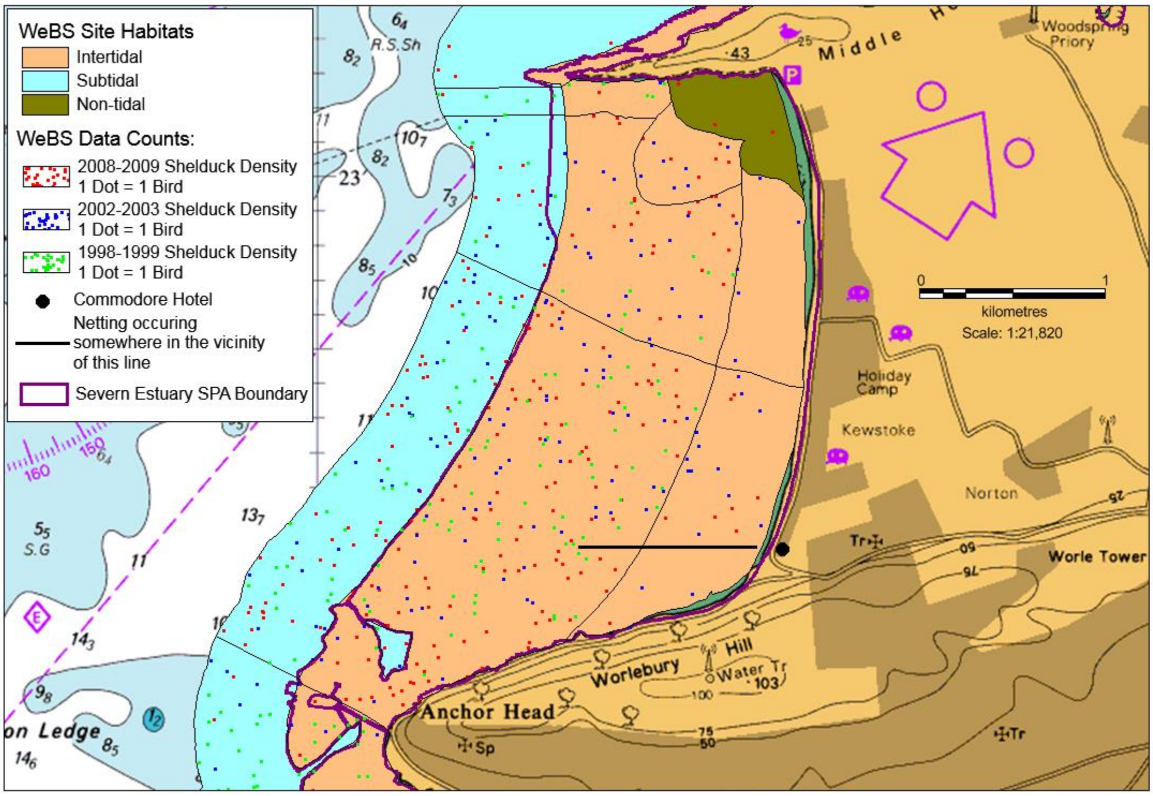

Figure 5 - Fishing Activity and WeBS data low tide count for Shelduck density in Sand Bay

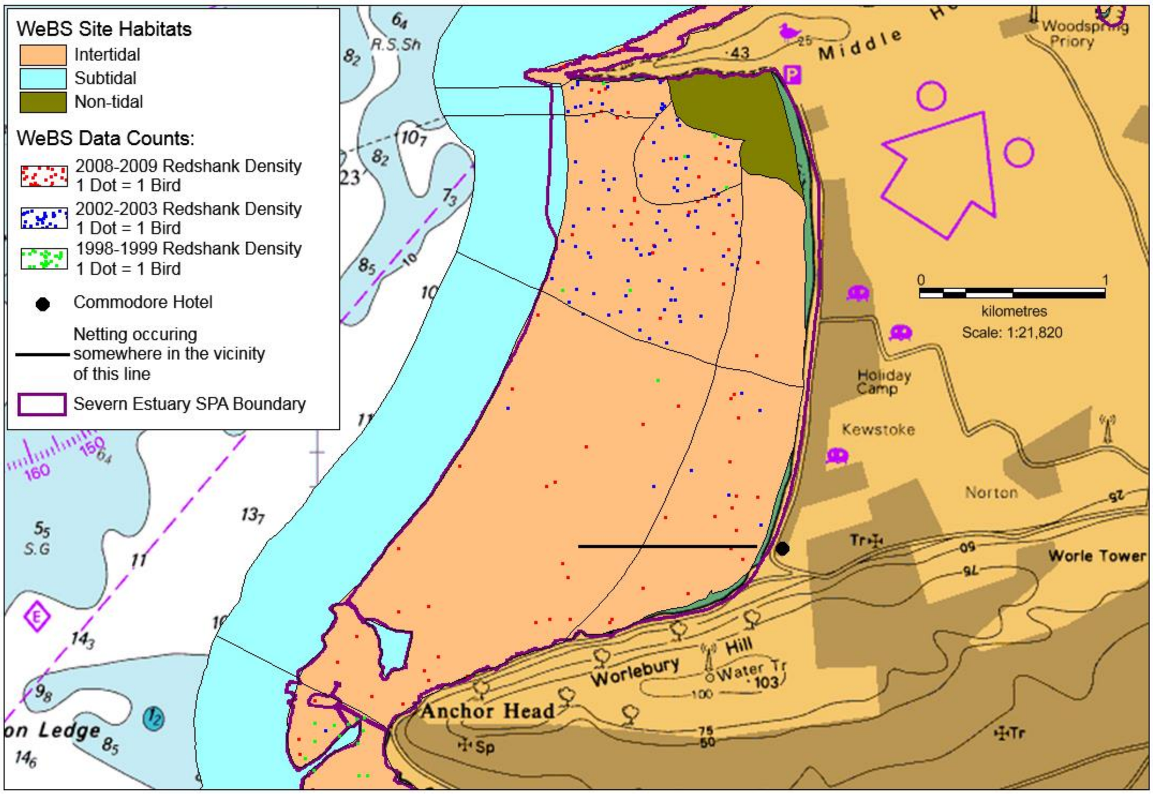

Figure 6 - Fishing Activity and WeBS low tide count data for Redshank density in Sand Bay

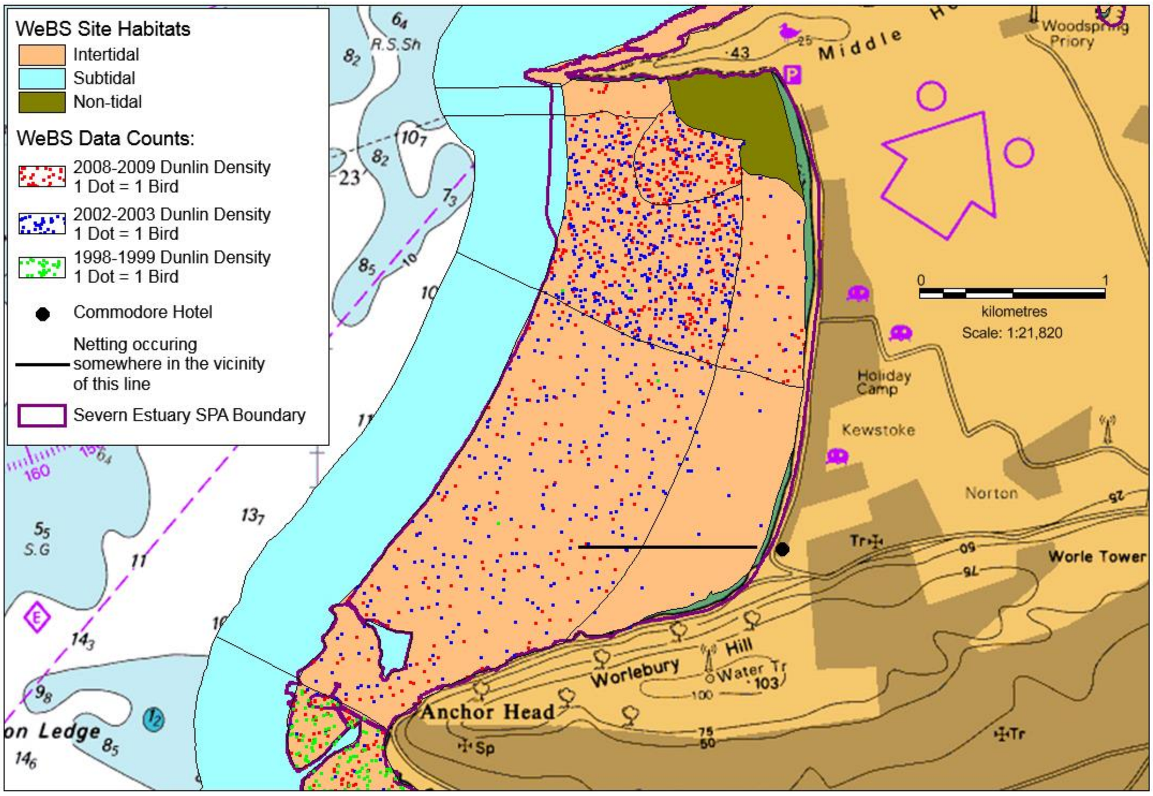

Figure 7 - Fishing Activity and WeBS low tide count data for Dunlin density in Sand Bay

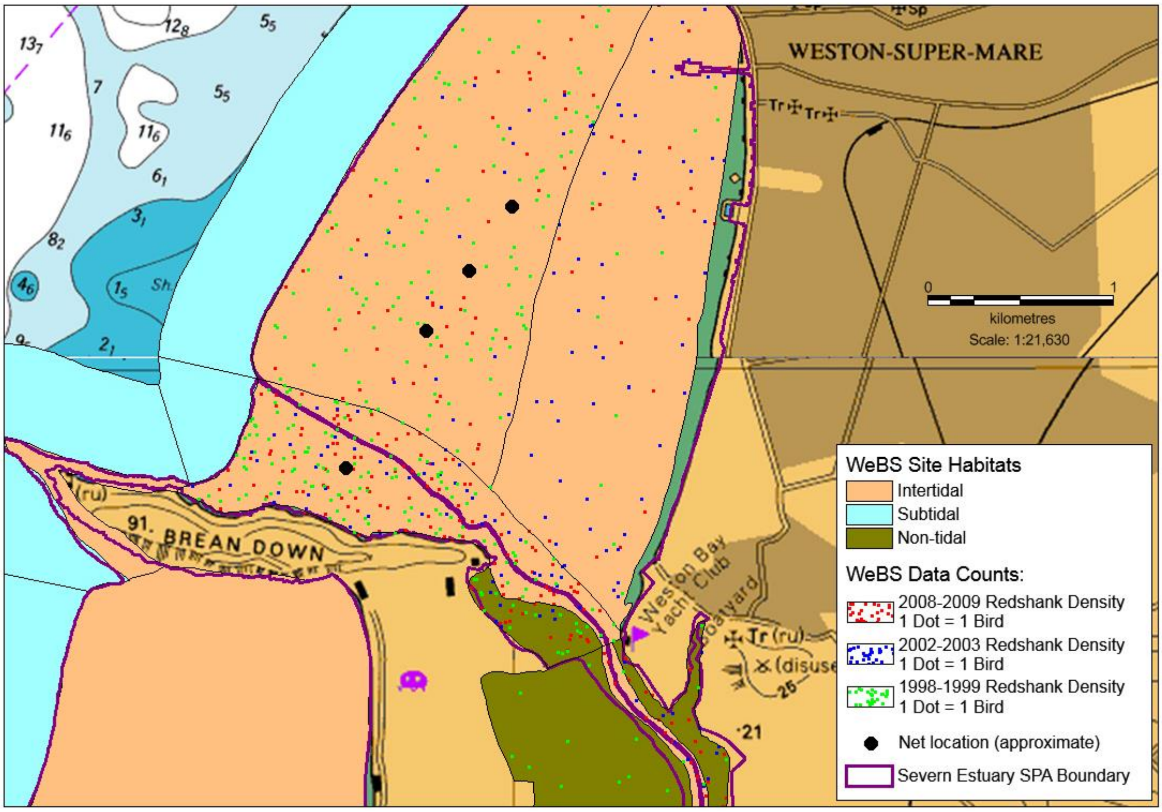

Figure 8 - Fishing Activity and WeBS low tide count data (November to February) for Redshank density in Weston Bay.

Annex 4: Fishing Activity Information

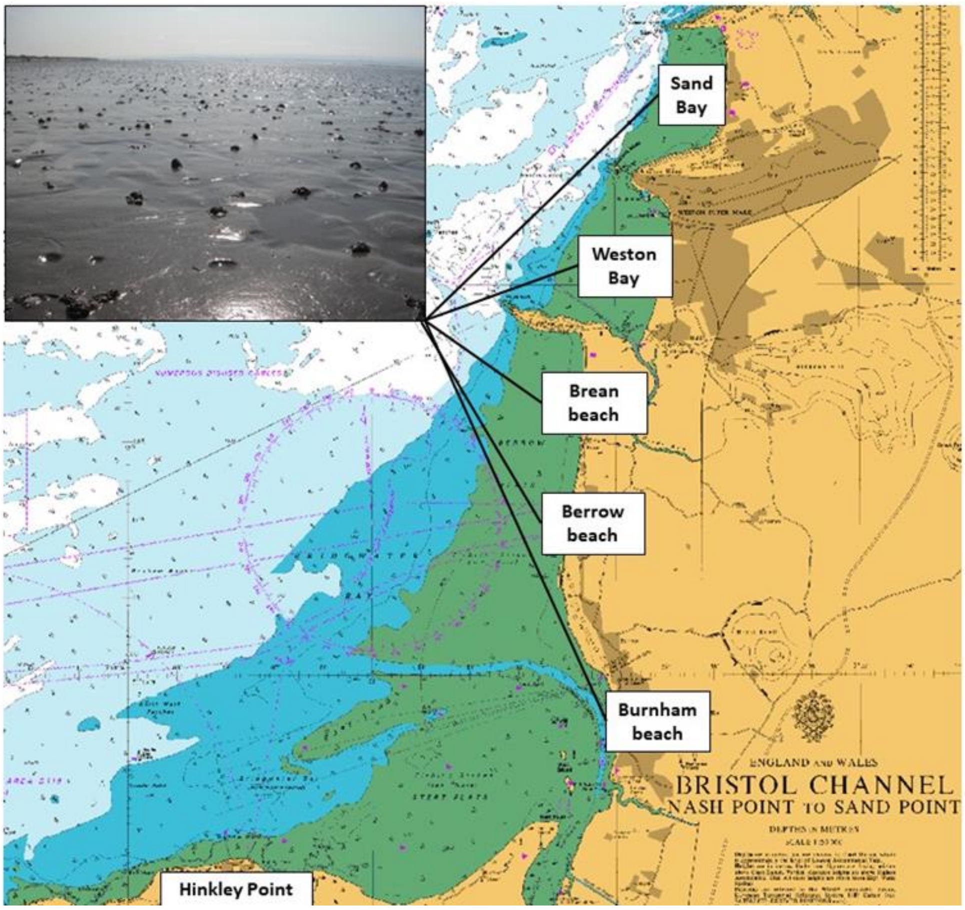

Figure 9. Survey locations for bait digging for lugworm (Weston Bay to Burnham-On-Sea) and ragworm (Hinkley Point) (see West 2019)

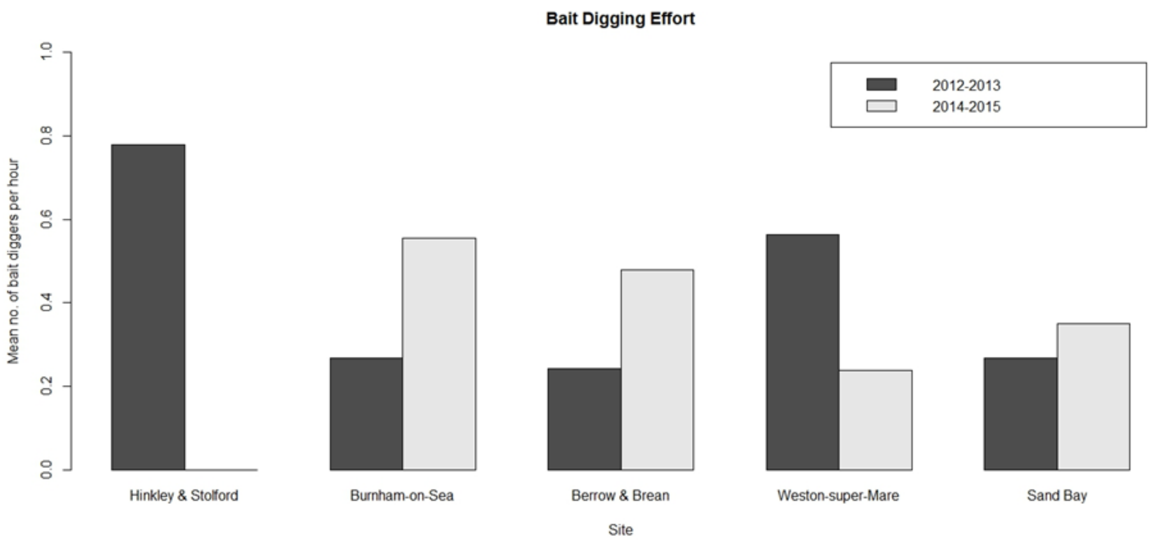

Figure 10. Mean number of bait diggers per hour for both sampling years (see West 2019)

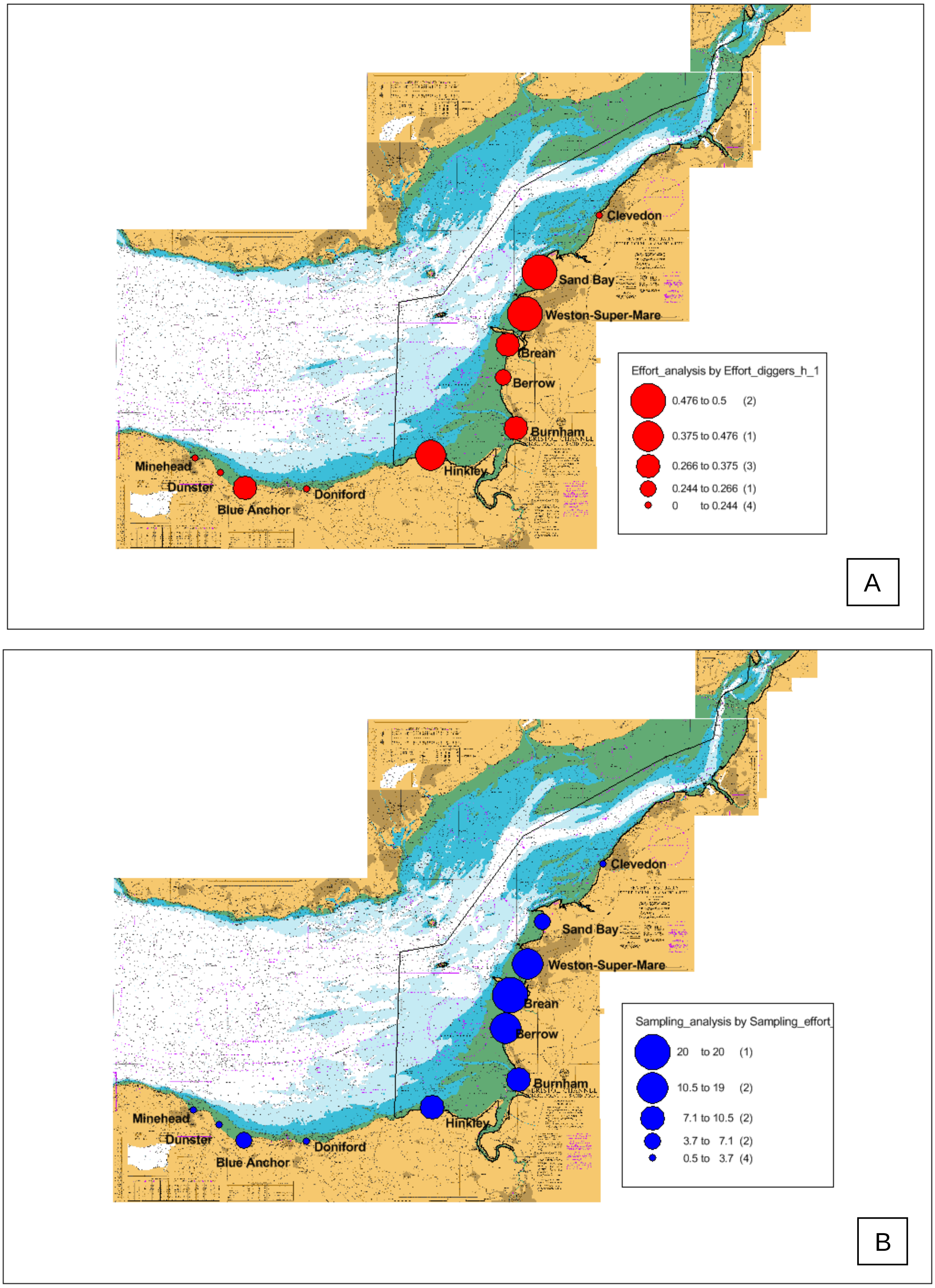

Figure 11 – Survey results 2012-2015, Popularity of different locations in the Severn Estuary for bait digging; A) bait digging intensity (number of bait diggers per sampling hour) and B) sampling effort across the sites.

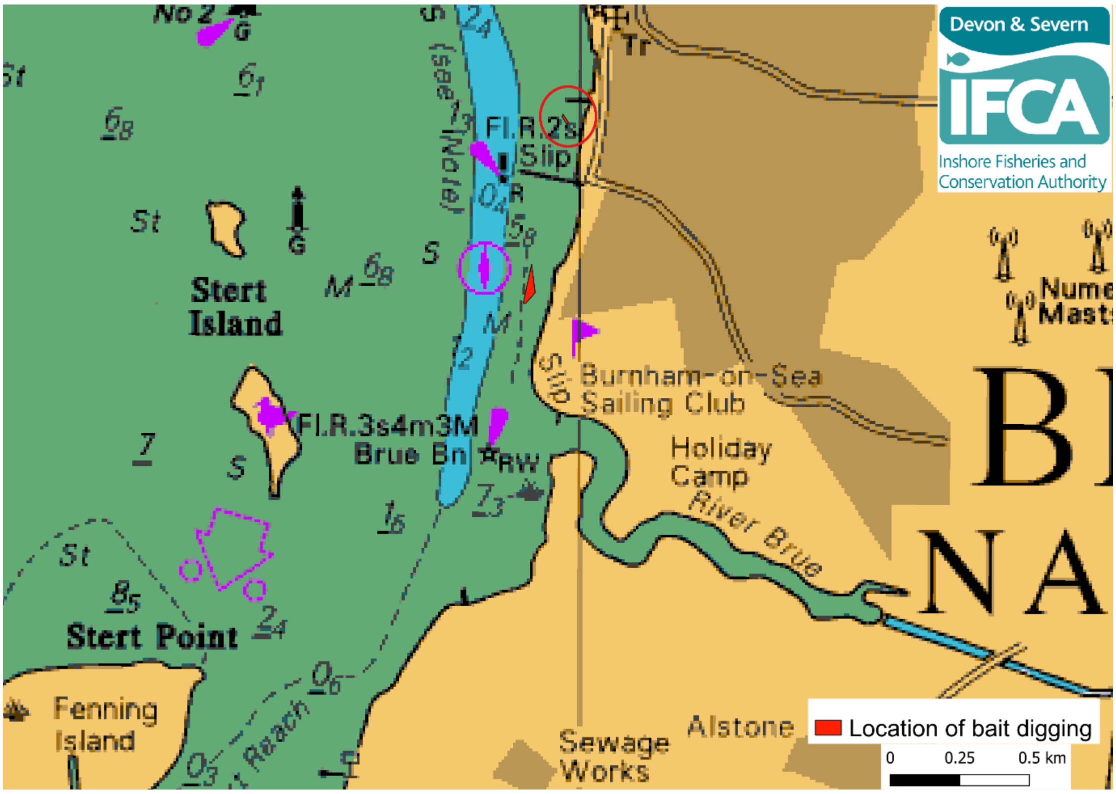

Figure 12. Location of bait digging activity observed at Burnham beach

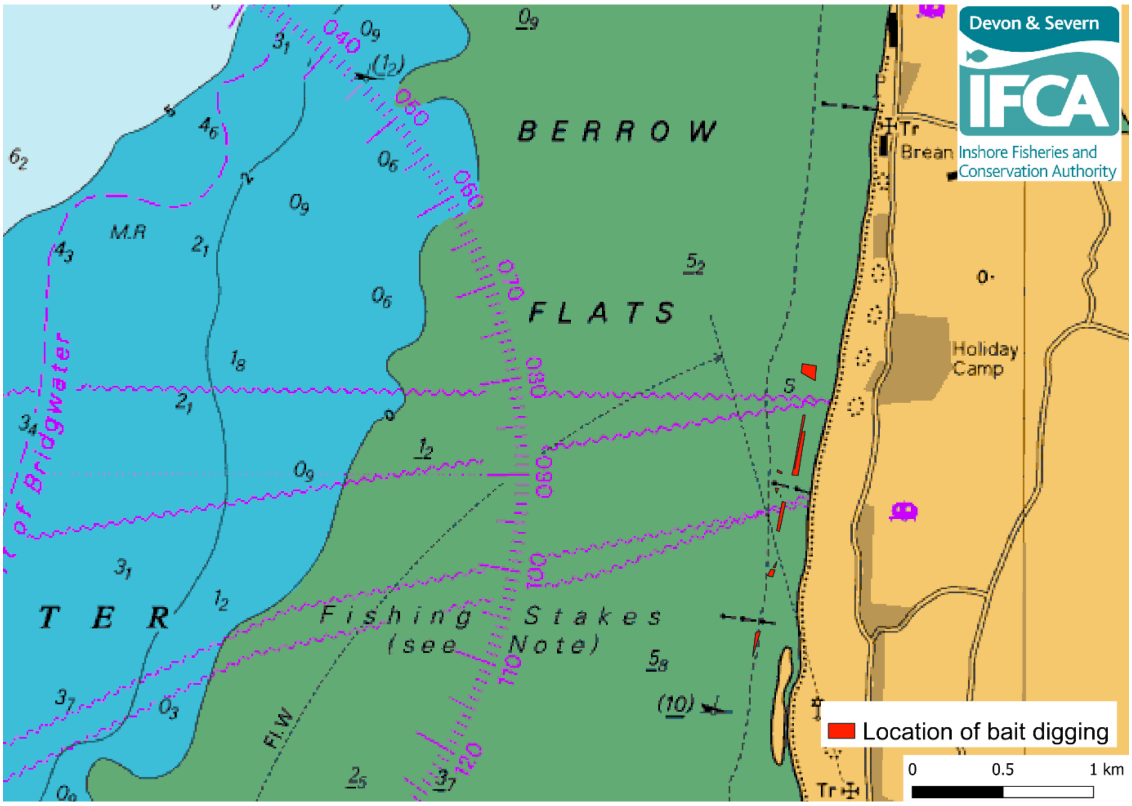

Figure 13. Location of bait digging activity observed at Berrow

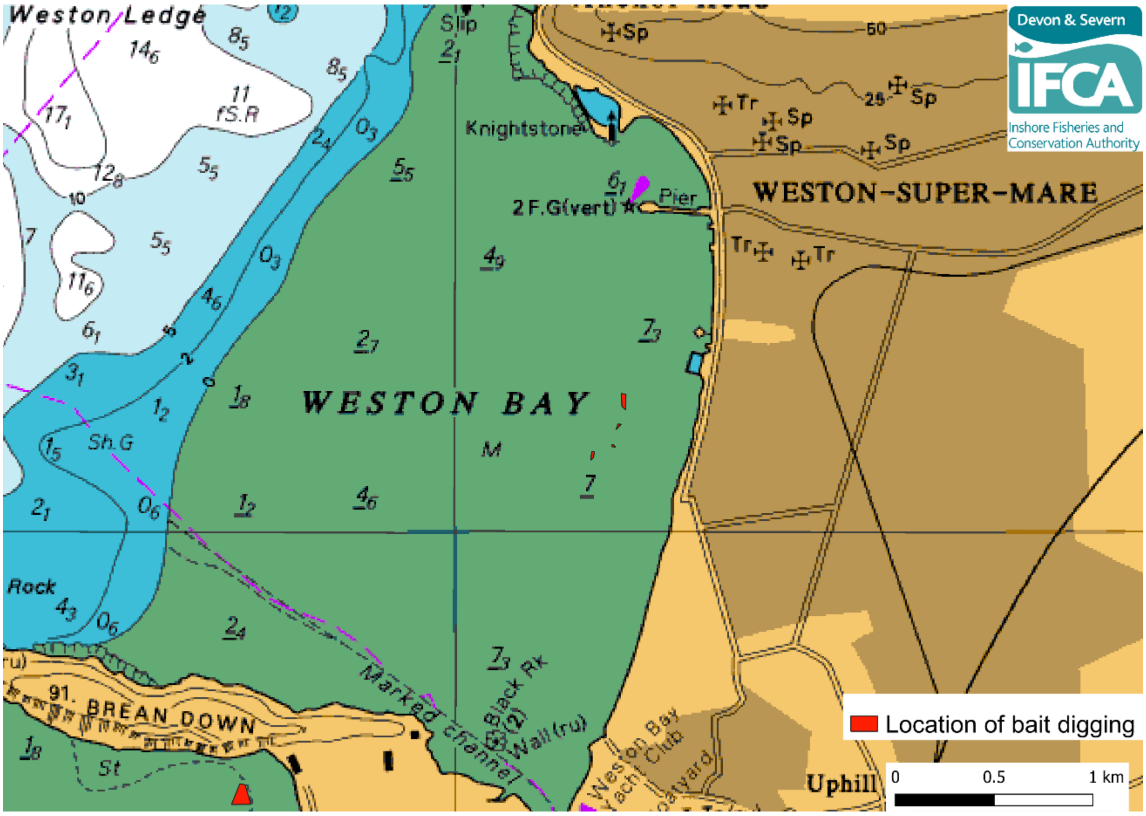

Figure 14. Location of bait digging activity observed at Weston Bay

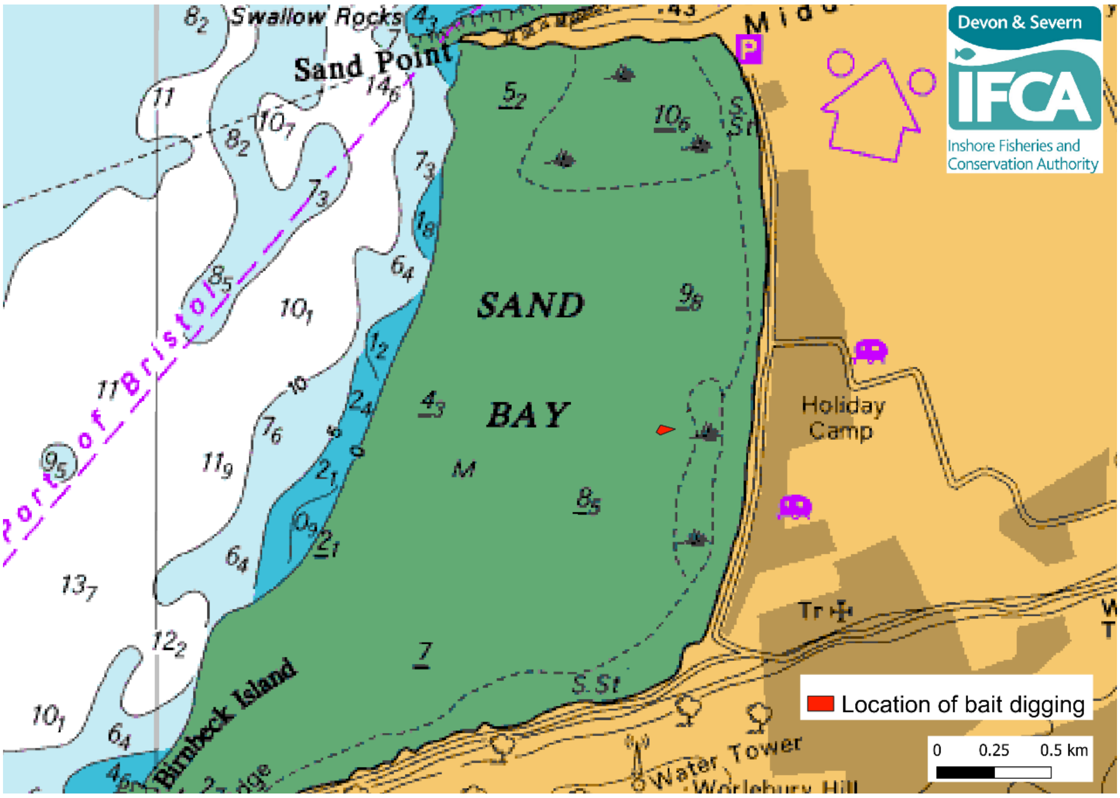

Figure 15. Location of bait digging activity observed at Sand Bay

Annex 5: Pressures Audit Trail

Pressure(s): Shore-based activities	Bird features							Screening Justification
	Bewick's swan	Dunlin	Gadwall	Greater White-Fronted Goose	Redshank	Shelduck	Internationally important assemblage >20,000 waterfowl	
Above water noise	**S**	**S**	**S**	**S**	**S**	**S**		**IN** – Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Changes in suspended solids (water clarity)			**NS**					**OUT** - Insufficient activity levels to pose risk of large scale pollution event
Collision BELOW water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures)			**NS**					**OUT** – Pressure not thought to be associated with activity
Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**		**OUT** - Insufficient activity levels to pose risk of large scale pollution event
Introduction of light	**S**	**S**	**IE**	**S**	**S**	**S**		**OUT** - Activity not thought to be occurring at night
Introduction of other substances (solid, liquid or gas)	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**		**OUT** - Insufficient activity levels to pose risk of large scale pollution event
Introduction or spread of non-indigenous species	**IE**	**S**	**NS**	**IE**	**S**	**S**		**OUT** – Activity operates in local area only so risk considered extremely low
Litter	**IE**	**IE**	**S**	**IE**	**IE**	**IE**		**OUT** – Activity not thought to be associated with litter
Removal of non-target species	**S**	**S**	**S**	**S**	**S**	**S**		**IN** – Need to consider intensity of activity
Synthetic compound contamination (incl. pesticides, antifoulants,	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**		**OUT** - Insufficient activity levels to pose risk of large scale pollution

pharmaceuticals). Includes those priority substances listed in Annex II of Directive 2008/105/EC.								event
Transition elements & organo-metal (e.g. TBT) contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	**S**	**S**	**IE**	**S**	**S**	**S**		**OUT** - Insufficient activity levels to pose risk of large scale pollution event
Underwater noise changes	**IE**		**IE**	**IE**		**IE**		**OUT** – Pressure not thought to be associated with activity
Visual disturbance	**S**	**S**	**S**	**S**	**S**	**S**		**IN** - Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure

Annex 6: In-Combination Map

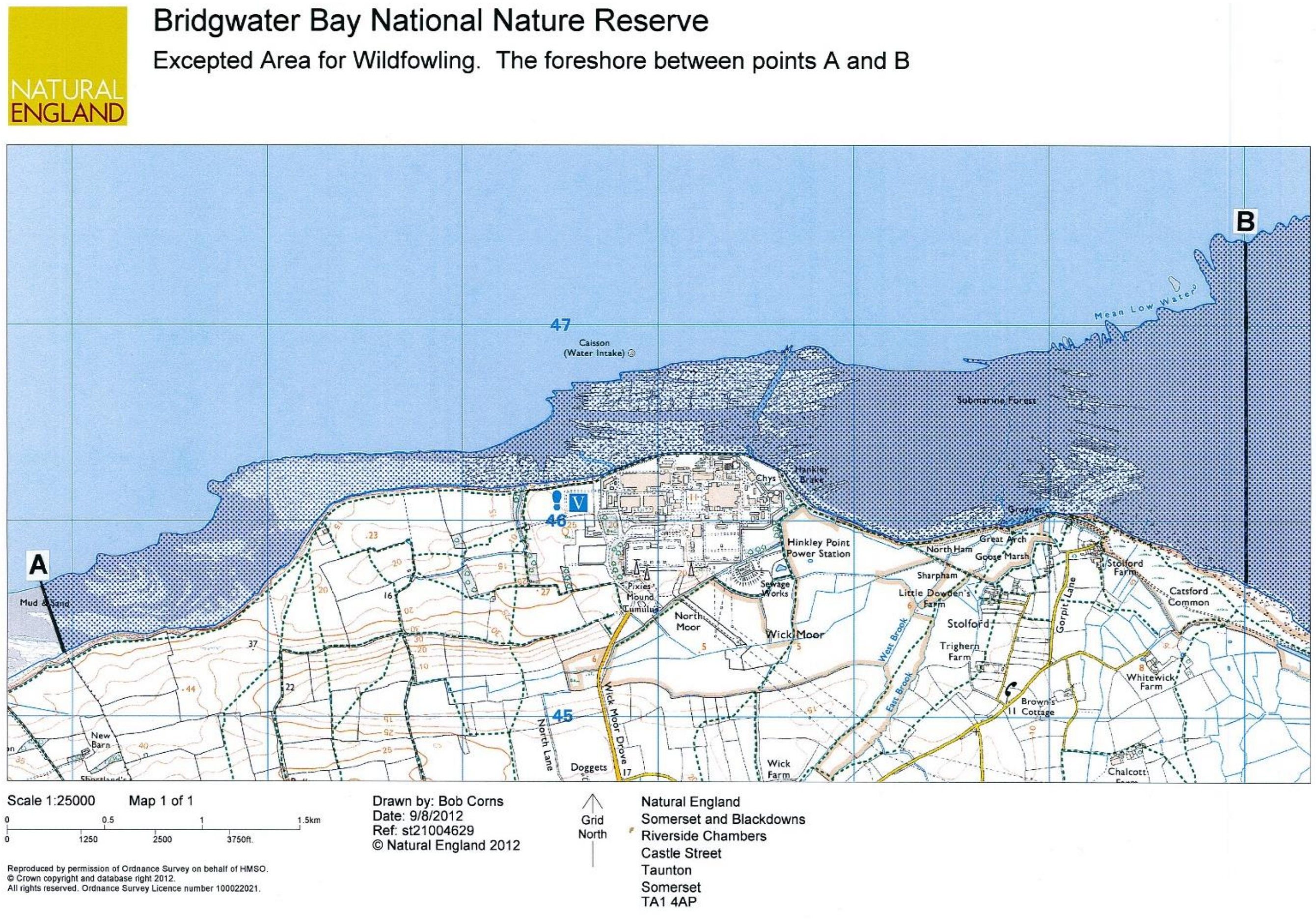

Figure 16 – Map of the excepted area (between lines A&B) for wildfowling in Bridgwater Bay, ©Natural England.

Annex 7: WeBS Core Peak Counts Data

Figure 17 – Bridgwater Bay, site code 13411 (BTO, 2016a)

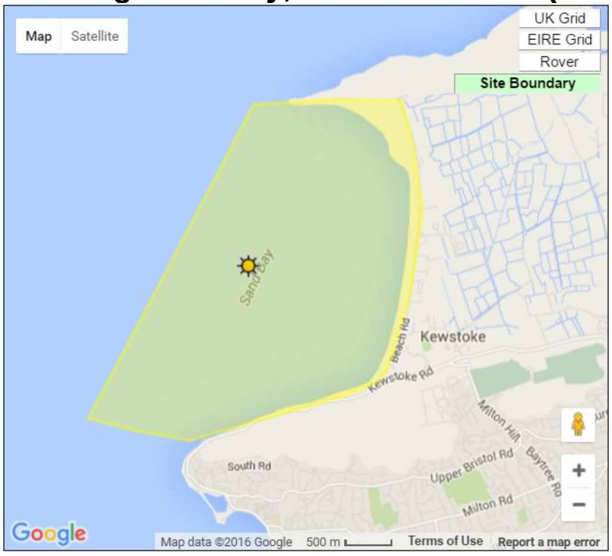

Figure 18 – Sand Bay, site code 14402 (BTO, 2016b)

Figure 19 – Axe Estuary, site code 14401 (BTO, 2016c)

Table 3: WeBS core counts data for the Bridgwater Bay, 13411 (Figure 12)

Species	2009-10	2010-11	2011-12	2012-13	2013-14	5 Year Mean Peak counts	Percentage of the whole Severn Estuary
Bewick's swan	0	0	0	0	0	0	0%
Curlew	1240	950	847	974	1136	1029.4	28%
Dunlin	9400	22000	17500	10004	8450	13470.8	53%
Spotted redshank	5	2	6	7	5	5	45%
Greater white-fronted goose	0	0	0	0	0	0	0%
Gadwall	0	0	3	0	2	1	0%
Grey plover	185	120	147	207	158	163.4	54%
Lapwing	3535	344	8189	5150	5345	4512.6	47%
Mallard	47	21	57	390	249	152.8	5%
Pochard	2	0	0	0	0	0.4	0%
Pintail	12	33	90	107	155	79.4	19%
Redshank	550	550	1399	1878	2670	1409.4	43%
Ringed plover	145	85	294	1410	135	413.8	36%
Shelduck	3200	1820	3243	3506	1746	2703	71%
Shoveler	16	1	10	4	60	18.2	4%
Teal	430	1200	475	1050	1505	932	17%
Tufted duck	20	0	0	82	3	21	3%
Whimbrel	27	19	33	91	29	39.8	20%
Wigeon	365	2200	609	852	1173	1039.8	14%

Table 4: WeBS core counts data for the Sand Bay, 14402 (Figure 13)

Species	2009-10	2010-11	2011-12	2012-13	2013-14	5 Year Mean Peak counts	Percentage of the whole Severn Estuary
Bewick's swan	0	0	0	0	0	0	0%
Curlew	105	115	110	155	145	126	3%
Dunlin	700	250	70	200	315	307	1%
Spotted redshank	0	0	0	0	0	0	0%
Greater white-fronted goose	0	0	0	0	0	0	0%
Gadwall	0	0	0	0	0	0	0%
Grey plover	0	14	20	0	12	9.2	3%
Lapwing	0	0	0	0	0	0	0%
Mallard	5	15	0	3	7	6	0%
Pochard	0	0	0	0	0	0	0%
Pintail	0	0	0	0	0	0	0%
Redshank	180	75	35	50	73	82.6	3%
Ringed plover	7	0	13	220	13	50.6	4%
Shelduck	450	720	490	540	365	528.75	14%
Shoveler	0	0	0	0	0	0	0%
Teal	0	0	0	0	0	0	0%
Tufted duck	0	0	0	0	0	0	0%
Whimbrel	0	1	0	0	3	0.8	0%
Wigeon	0	0	0	0	0	0	0%

Table 5: WeBS core counts data for the Axe Estuary, 14401 (Figure 14)

Species	2009-10	2010-11	2011-12	2012-13	2013-14	5 Year Mean Peak counts	Percentage of the whole Severn Estuary
Bewick's swan	0	0	0	0	0	0	0%
Curlew	87	66	37	62	91	68.6	2%
Dunlin	1011	884	400	300	552	629.4	2%
Spotted redshank	0	1	0	0	1	0.4	4%
Greater white-fronted goose	0	0	0	0	0	0	0%
Gadwall	18	41	22	3	31	23	11%
Grey plover	1	1	1	1	0	0.8	0%
Lapwing	560	700	210	500	600	514	5%
Mallard	154	113	112	138	180	139.4	5%
Pochard	61	52	58	7	1	35.8	7%
Pintail	0	0	2	1	0	0.6	0%
Redshank	261	624	568	665	657	555	17%
Ringed plover	29	35	13	22	25	24.8	2%
Shelduck	479	355	170	205	350	270	7%
Shoveler	18	7	10	7	8	10	2%
Teal	326	1050	800	436	291	580.6	11%
Tufted duck	39	24	20	17	14	22.8	3%
Whimbrel	4	9	1	0	1	3	1%
Wigeon	120	45	118	26	88	79.4	1%

Table 6: WeBS core counts data for the Severn Estuary

Species	2009-10	2010-11	2011-12	2012-13	2013-14	5 Year Mean Peak counts
Bewick's swan	303	311	193	270	125	240.4
Curlew	3731	4176	3091	3759	3546	3660.6
Dunlin	21640	31937	29338	23241	20248	25280.8
Spotted redshank	12	8	8	13	14	11
Greater white-fronted goose	300	560	280	191	238	313.8
Gadwall	193	224	234	178	208	207.4
Grey plover	256	249	384	366	254	301.8
Lapwing	7967	4455	12023	9943	13252	9528
Mallard	3086	3334	2846	2431	2916	2922.6
Pochard	593	734	474	426	334	512.2
Pintail	494	456	373	355	382	412
Redshank	2433	3349	3341	3217	4001	3268.2
Ringed plover	982	316	940	2625	816	1135.8
Shelduck	5148	2945	3977	4365	2692	3825.4
Shoveler	497	426	481	524	514	488.4
Teal	3882	4568	5553	7064	6008	5415
Tufted duck	896	1003	688	752	591	786
Whimbrel	226	209	138	298	141	202.4
Wigeon	7676	10284	7673	5961	6740	7666.8