FOOTPRINT ECOLOGY

Desktop Overview of Recreational Impact Pathways within the Plymouth Sound and Tamar Estuaries Marine Protected Area

Zoe Caals, Phil Saunders & Chris Panter

FOOTPRINT ECOLOGY, FOREST OFFICE, BERE ROAD,
WAREHAM, DORSET BH20 7PA
WWW.FOOTPRINT-ECOLOGY.CO.UK
01929 552444

Footprint Contract Reference: 757
Date: 1st July 2024
Version: Final
Recommended Citation: Caals, Z., Saunders, P. & Panter, C. (2024). Desktop Overview of Recreational Impact Pathways within the Plymouth Sound and Tamar Estuaries Marine Protected Area. Report by Footprint Ecology.

Contents

Acknowledgements

This study has been commissioned by Plymouth City Council. We are grateful to Liz Cole (Natural Infrastructure Officer) and Amelia Sturgeon (TECF Coordinator) for their advice, discussion and help with collating data sources.

Cover photo: Lynher River at St Germans © Footprint Ecology

1. Introduction

Overview

1.1 This report has been commissioned by Plymouth City Council to examine the ways in which marine recreation can negatively impact the important features of the Plymouth Sound and Estuaries Marine Protected Area (MPA). This work follows on from a previous study conducted by the Marine Biological Association (MBA) in 2016 (Griffiths, Arnold and Butler, 2016).

1.2 The results from this study will inform the design of visitor surveys, involving face-to-face interviews with recreational users, vantage point counts, an online survey and engagement with local stakeholders. The results from the visitor surveys will form a separate report, which will include a review of the zone of influence and recommendations for improving mitigation measures.

1.3 Both reports will help to inform future decision-making regarding the management of the MPA, ensuring the ongoing protection of its designated features. They will also contribute to the objectives of the LIFE Recreation ReMEDIES 'Save Our Seabed' project[1].

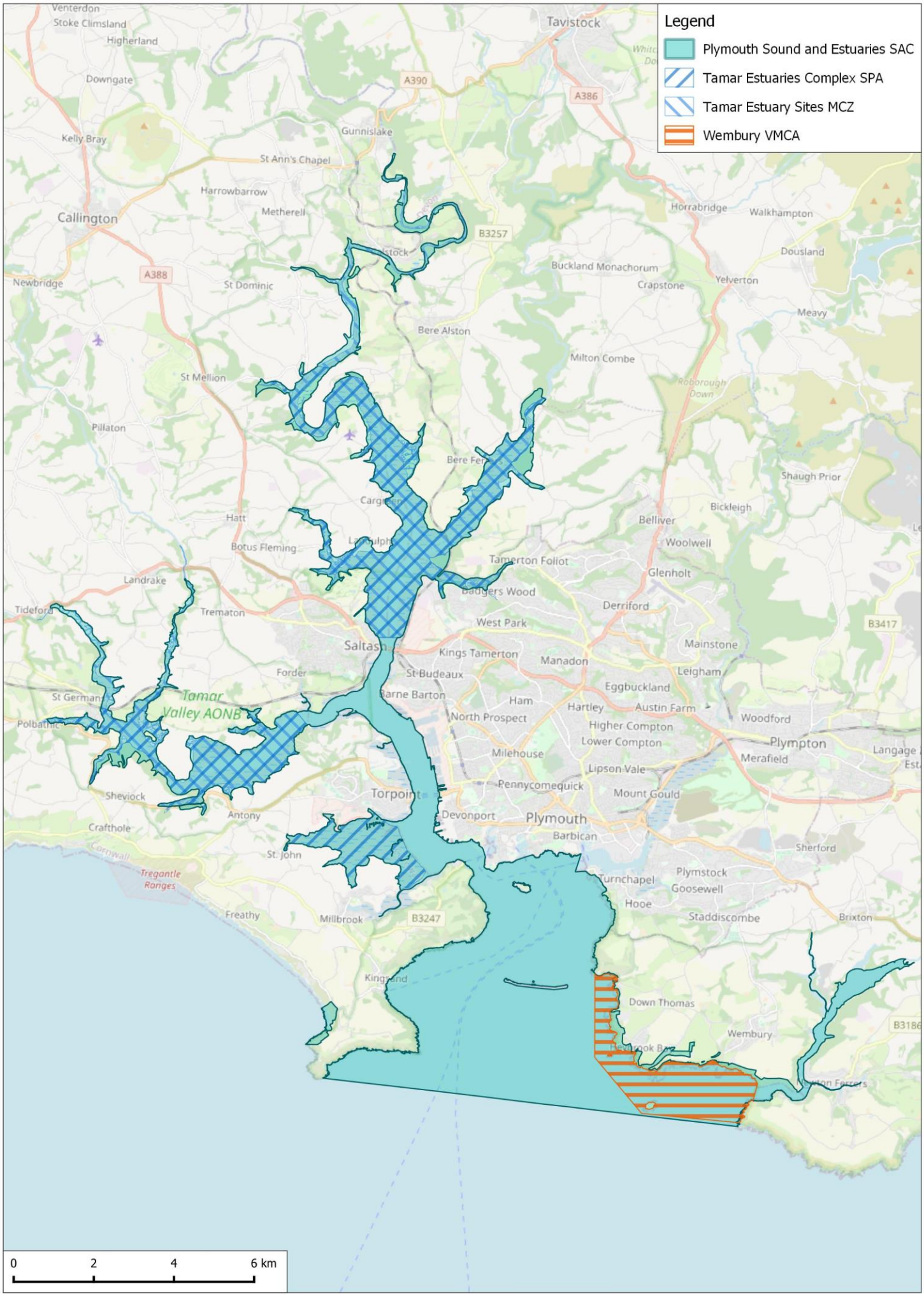
Plymouth Sound and Tamar Estuaries MPA

1.4 The Plymouth Sound and Tamar Estuaries MPA is an area of international importance that comprises the Plymouth Sound & Estuaries Special Area of Conservation (SAC), the Tamar Estuaries Complex Special Protection Area (SPA) and the Tamar Estuary Sites Marine Conservation Zone (MCZ) (see Map 1).

1.5 In addition to these three key marine designations, there is also a Voluntary Marine Conservation Area (VMCA) at Wembury Bay[2], and seven component Sites of Special Scientific Interest (SSSIs) covering estuaries, bays and cliffs within the SAC.

[1] https://saveourseabed.co.uk/the-project/
[2] https://www.wemburymarinecentre.org/wembury-marine-conservation-area-advisory-group

Map 1: Plymouth Sound and Tamar Estuaries Marine Protected Area (MPA)



2. Designated sites and their features

Plymouth Sound & Estuaries SAC

2.1 Plymouth Sound and Estuaries SAC is an unusual ria estuary and is at the intersection of multiple rivers. The designation comprises 6,402 hectares applying to the marine, intertidal and terrestrial edges. The designated area stetches out to sea between Rame Head and Gara Point in Wembury Bay, covering the Sound and stretching up to the entrance of the Cattewater, up to Lopwell on the River Tavy, to Gunnislake on the River Tamar, and up to Landrake and Tideford on the Rivers Lynher and Tiddy (see Map 1).

2.2 Specific Annex I features for which the site qualifies are:

- **1110 Sandbanks which are slightly covered by sea water all the time.** Areas of sandy sediments in the open coast, islets and the estuary support a distinctive flora and fauna, including important Common Eelgrass *Zostera marina* beds - which are estimated to have declined by more than 90%.
- **1130 Estuaries.** The Sound is a complex of several rivers with a complex changing salinity gradient and therefore a complex, local distinctive flora and fauna. Rocky habitats in these conditions are of particular note and rocky reefs in low saline conditions very unusual.
- **1160 Large shallow inlets and bays.** The complex of rivers also provides marine inlets with a high diversity of habitats and extremely rich Mediterranean-Atlantic communities.
- **1170 Reefs.** There are a wide variety of reefs, particularly the limestone reefs, which are often dominated by a dense hydroid and bryozoan turf. Associated uncommon species include the rare sea slug *Okenia elegans*, Trumpet Anemone *Aiptasia mutabilis* and nationally important Pink Sea-fan *Eunicella verrucosa*.
- **1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).** Along the estuaries, the complex transition from brackish to freshwater supports diverse salt meadow and reedbeds, which supports the only UK population of Triangular Club-rush *Schoenoplectus triqueter*.

2.3 Another Annex I habitat is present as a qualifying feature, but not as one of the primary reasons for selection: 1140 Mudflats and sandflats not covered by seawater at low tide.

2.4 Seagrass (Zostera sp.) is one of the sub-features of the SAC and is found in both intertidal and subtidal habitats. ReMEDIES are currently leading on

work that aims to restore four hectares of seagrass meadows in Jennycliff Bay. The planting area is protected by a voluntary no anchor zone (VNAZ).

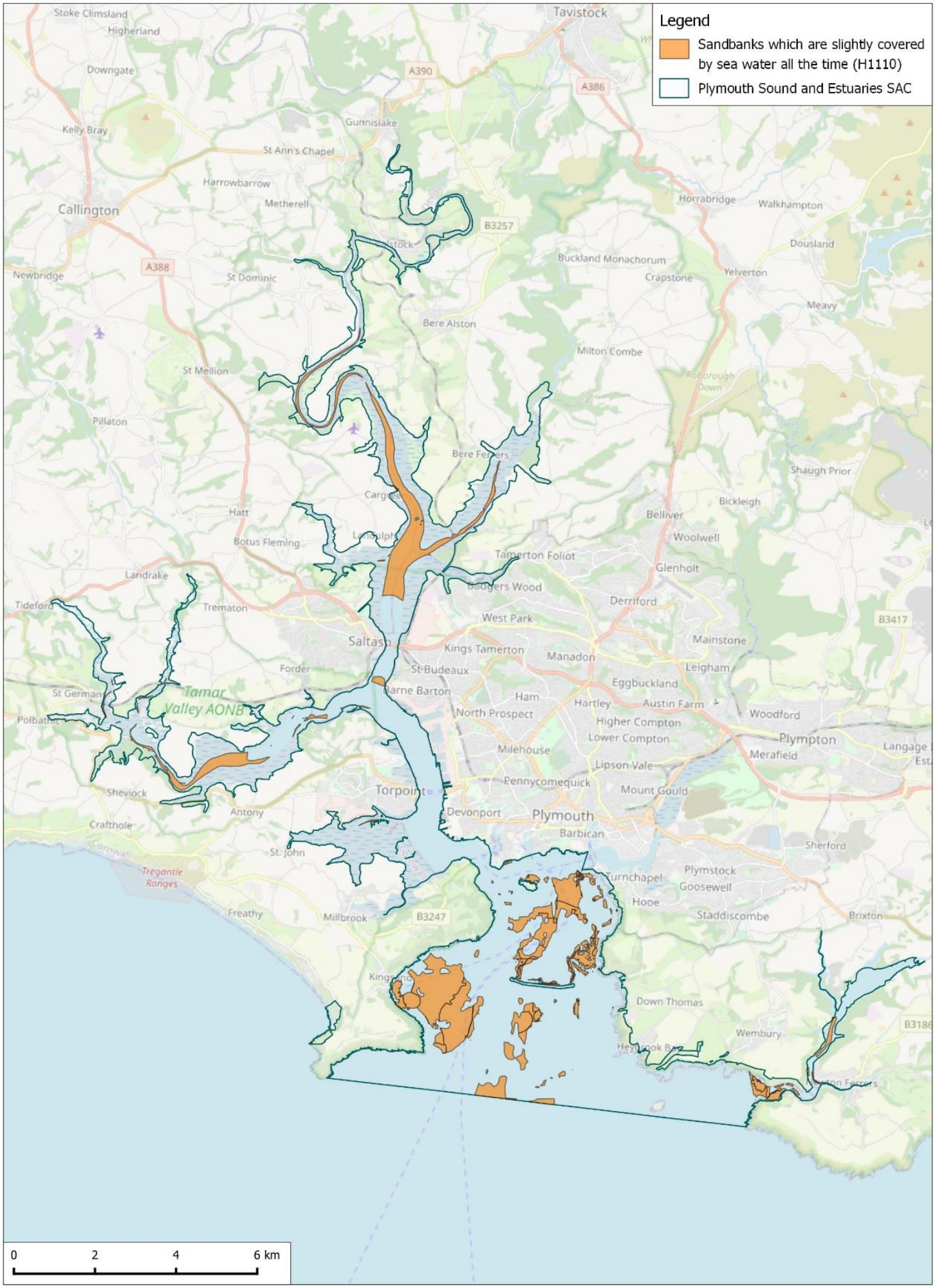
2.5 The SAC also qualifies for the Annex II species Shore Dock *Rumex rupestris* (1441). The rocky shores along the Sound are one of the strongholds for the species in the UK mainland. The population in 1999 comprised 15 colonies and 42 plants. Additionally, Allis Shad *Alosa alosa*, is present as an Annex II species, but not as a primary reason for site selection. More detailed information on the distribution of Allis Shad can be found in the Natural England Research Report NERR1947 (Hillman, 2020).

2.6 Maps 2-10 describe the distribution of the SAC qualifying features. Data for these maps was drawn from:

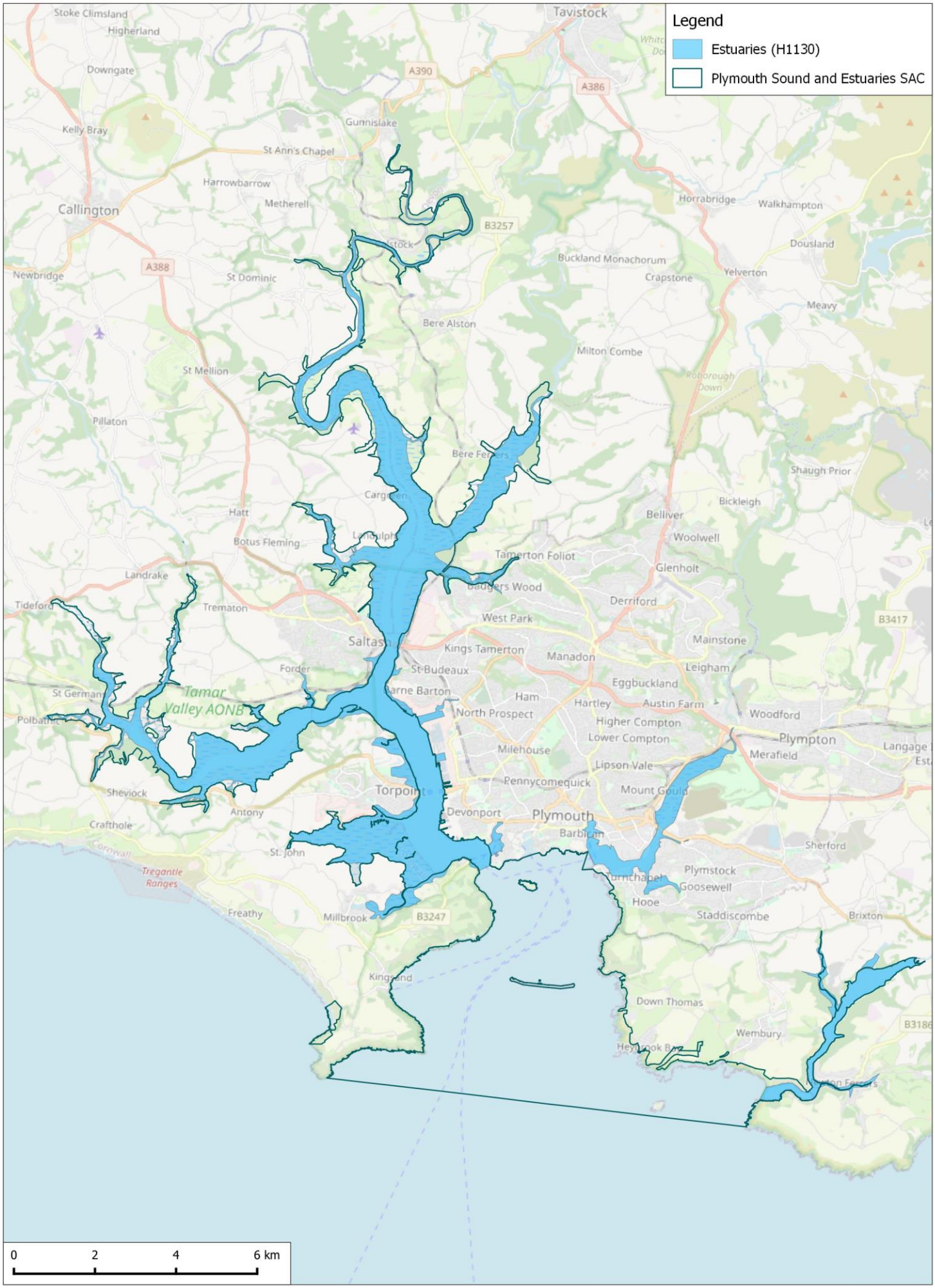
- Natural England Marine Designated Site Features dataset[3],
- Environment Agency Saltmarsh Extent and Zonation (Environment Agency, 2022),
- Natural England National Seagrass Layer[4],
- ReMEDIES seagrass restoration sites,
- National Biodiversity Network Atlas[5].

[3] https://naturalengland-defra.opendata.arcgis.com/maps/marine-designated-site-features-open-data-england-bng/about
[4] https://naturalengland-defra.opendata.arcgis.com/maps/e009f2adbc9b4028a34842b133c6636b/about
[5] https://nbnatlas.org/

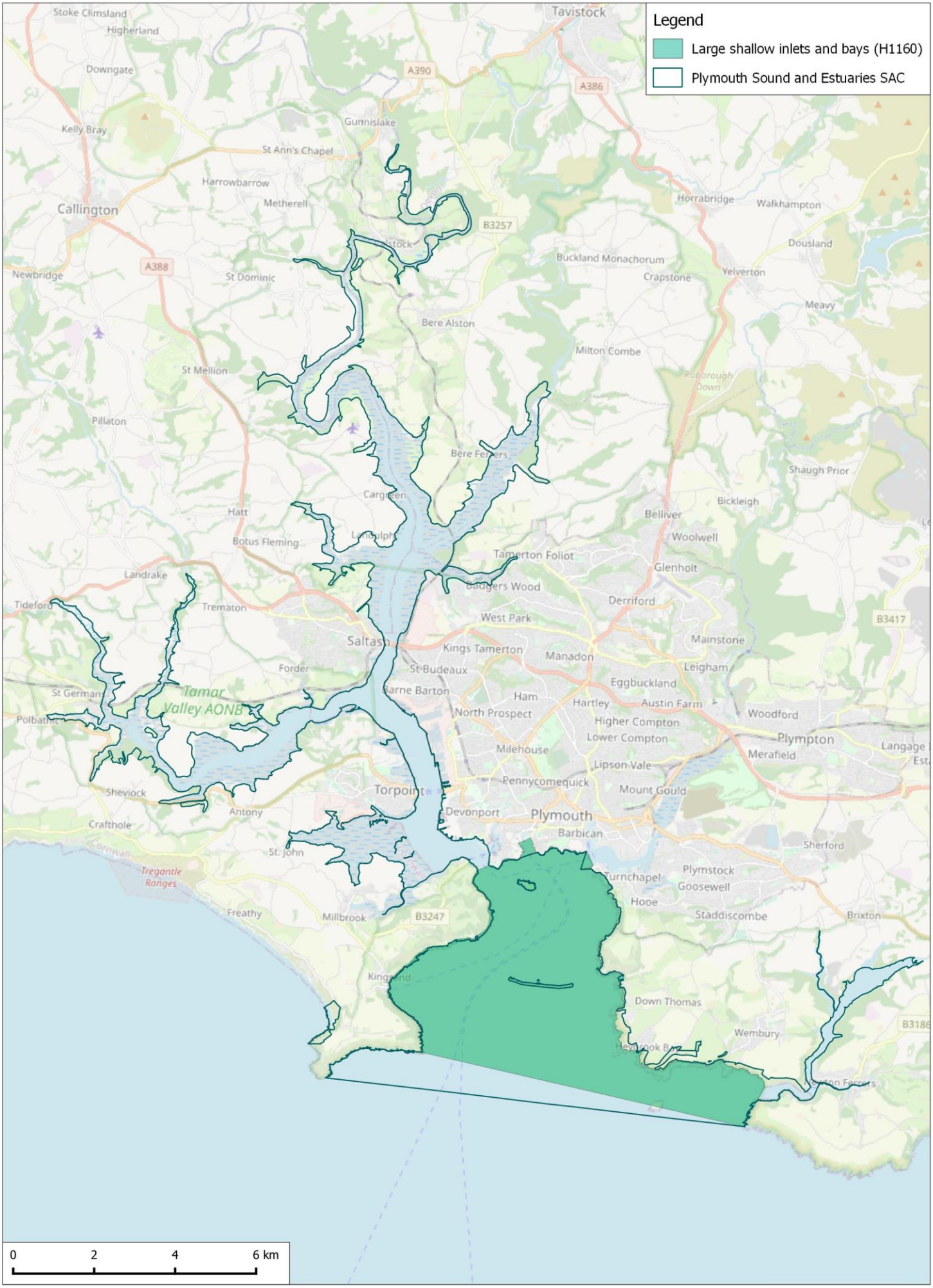
Map 2: SAC habitats - Sandbanks which are slightly covered by sea water all the time (H1110).
Source: Natural England



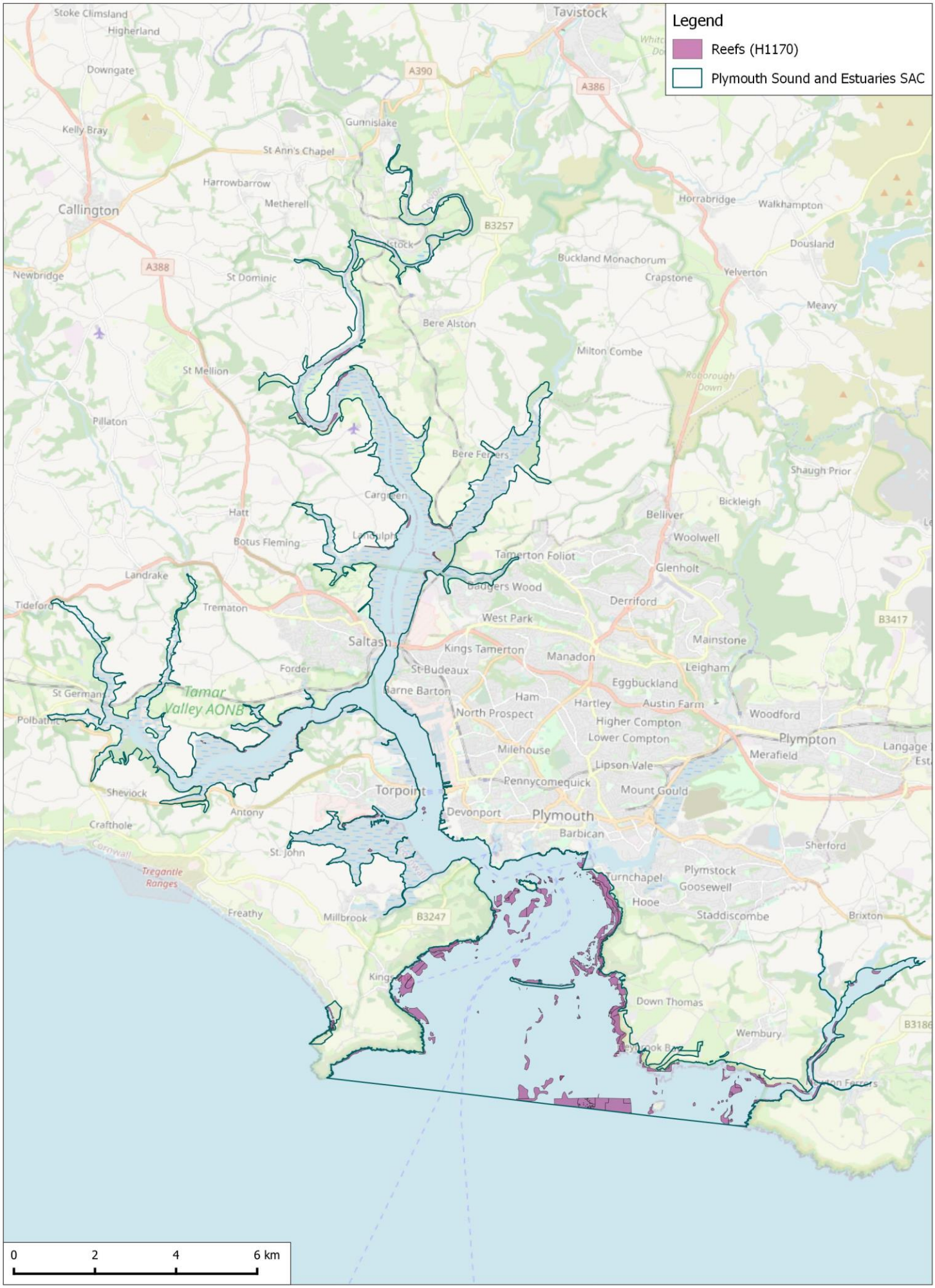
Map 3: SAC habitats - Estuaries (H1130).
Source: Natural England



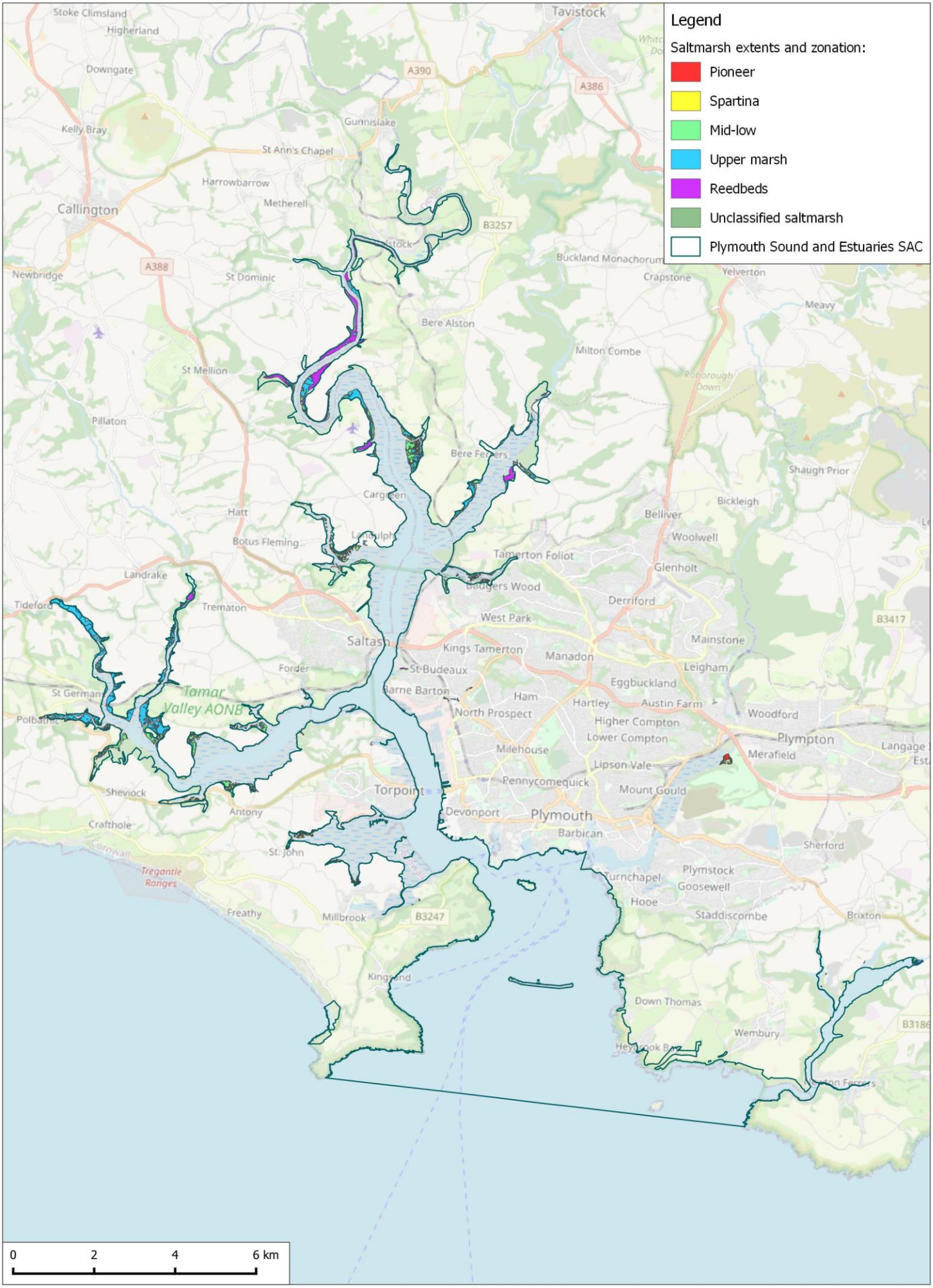
Map 4: SAC habitats - Large shallow inlets and bays (H1160).
Source: Natural England



Map 5: SAC habitats - Reefs (H1170).
Source: Natural England

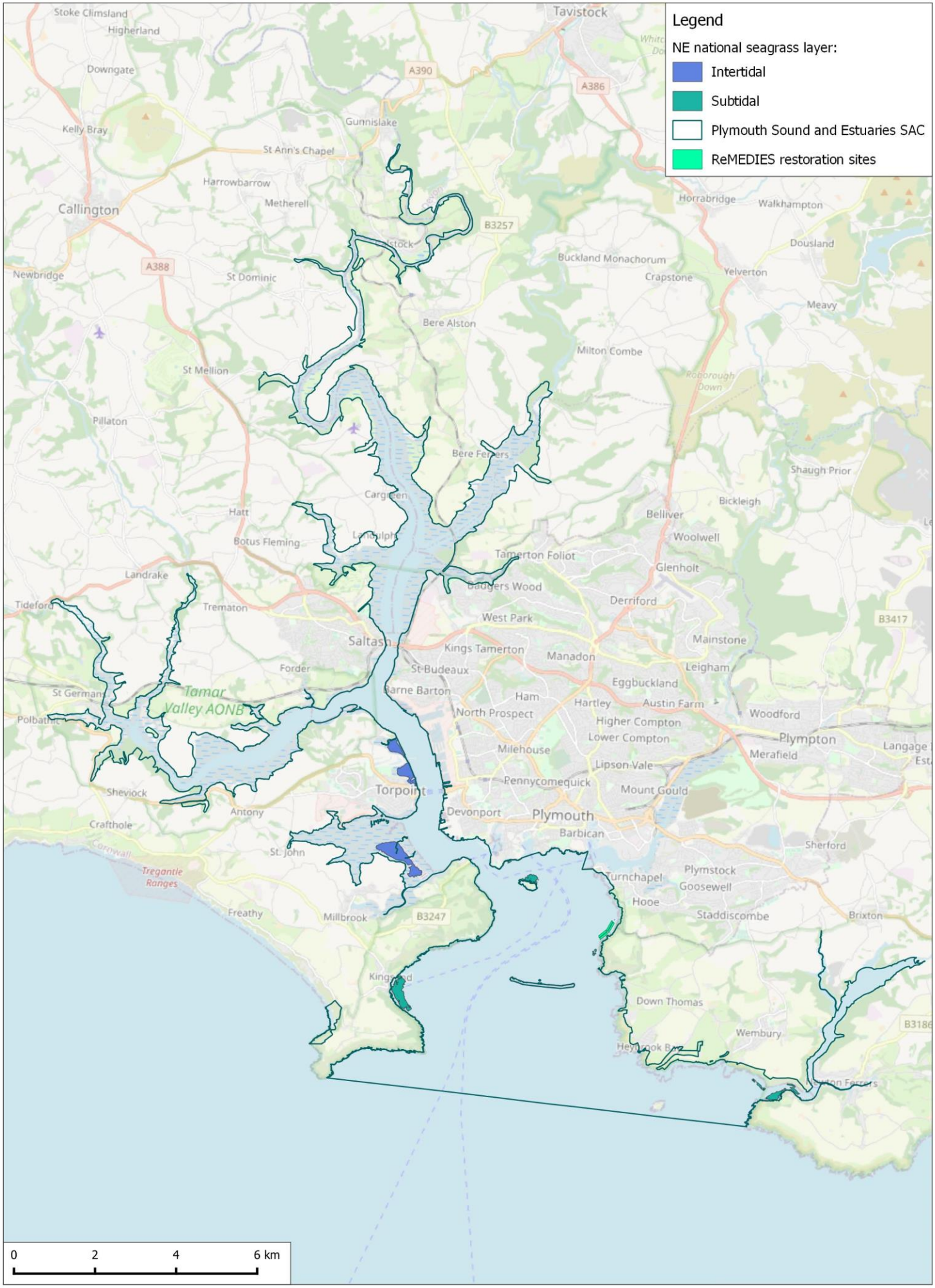


Map 6: SAC habitats - Atlantic salt meadows (H1330).
Source: Environment Agency

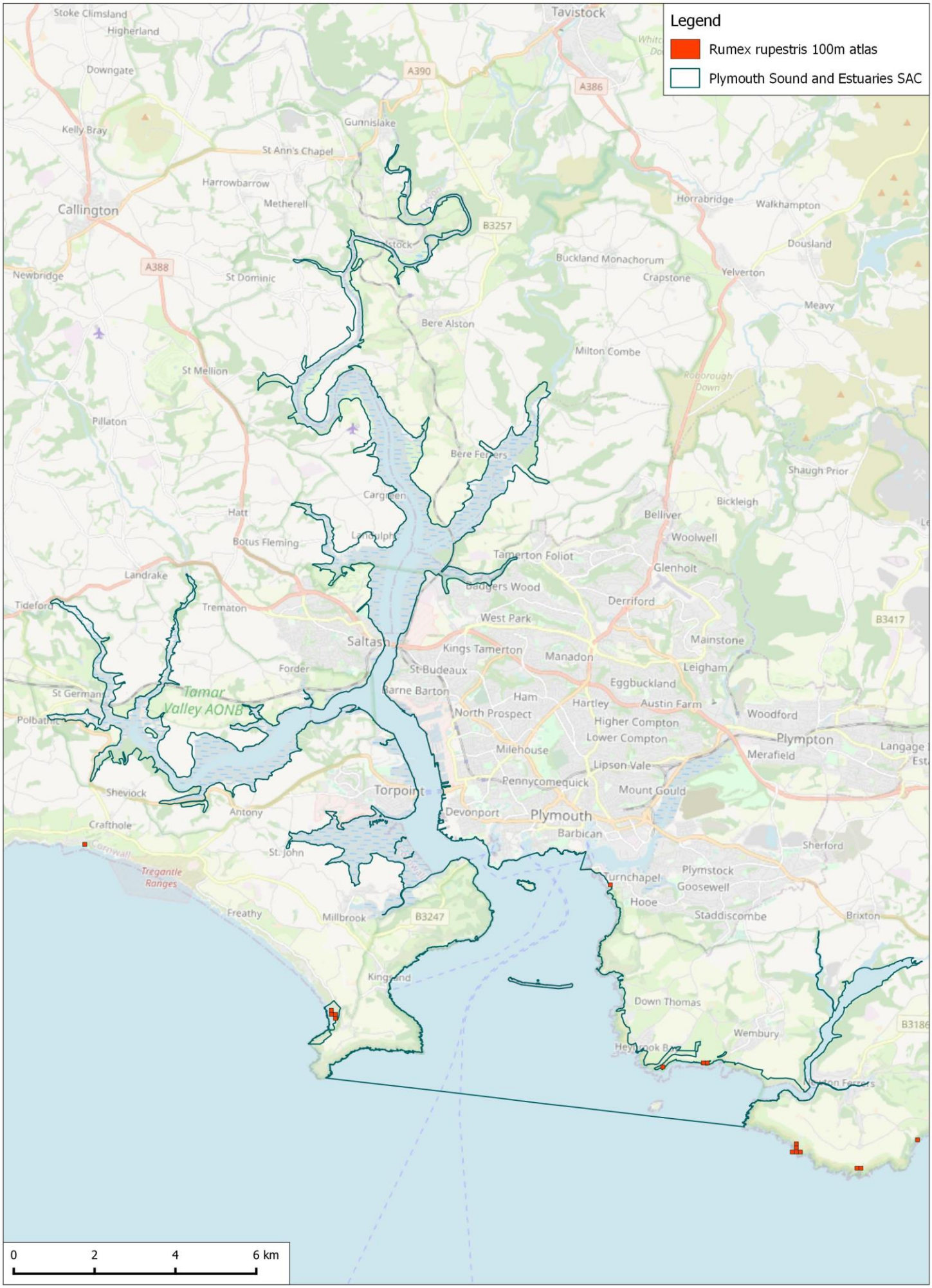


Map 7: SAC habitats - Mudflats and sandflats not covered by seawater at low tide (H1140).
Source: Natural England

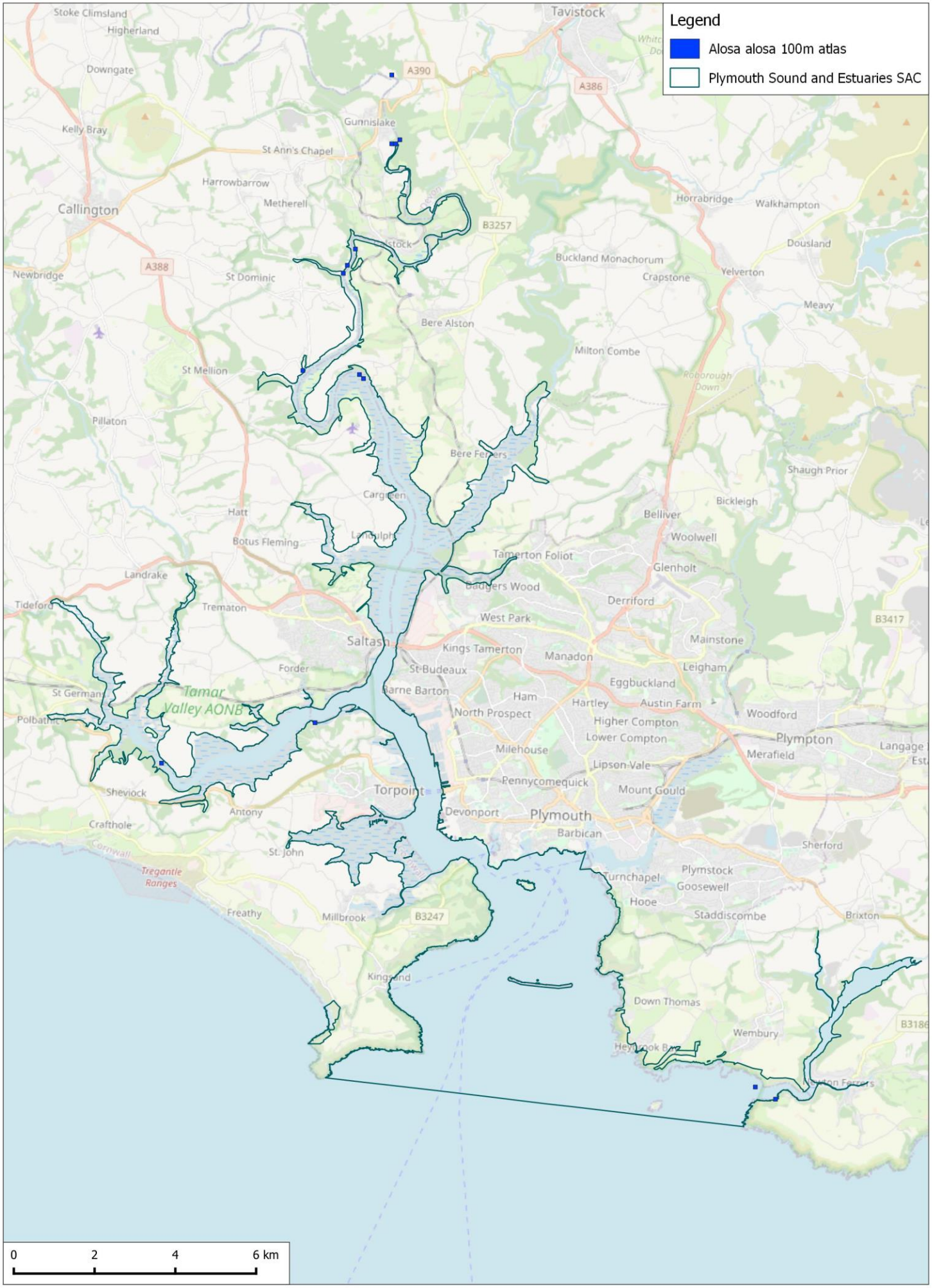
Map 8: Current extent of seagrass (Zostera sp.) within the SAC.
Sources: Natural England, ReMEDIES



Map 9: SAC species - Shore Dock *Rumex rupestris* (S1441).
Source: NBN Atlas



Map 10: SAC species - Allis Shad *Alosa alosa* (S1102).
Source: NBN Atlas



Tamar Estuaries Complex SPA

2.7 The upper estuary reaches of the SAC are also classified as an SPA, as shown in Map 1 (1,955 ha). For the Tamar Estuaries Complex SPA the qualifying features are the populations of Little Egret *Egretta garzetta* and Avocet *Recurvirostra avosetta*. Key areas within the SPA for these species include the upper parts of the Tamar, the Lynher River and St John's Lake. The extensive mudflats and saltmarsh communities present in these areas are important feeding and roosting grounds for both species as well as other waders and wildfowl.

2.8 The original 1996 SPA citation stated the Little Egret population had increased dramatically to 102 birds – equating to more than 20% of the British population. For Avocets, the original SPA citation stated a peak mean of 194, representing 19.4% of the British population (at the time), since then numbers have steadily increased to around 250-300 individuals.

2.9 Recent counts from the BTO Wetland Bird Survey are summarised for Little Egret in Map 11 and for Avocet in Map 12. The Little Egret counts usually peak in September or October, whereas the Avocet counts usually peak in January (Figure 1).

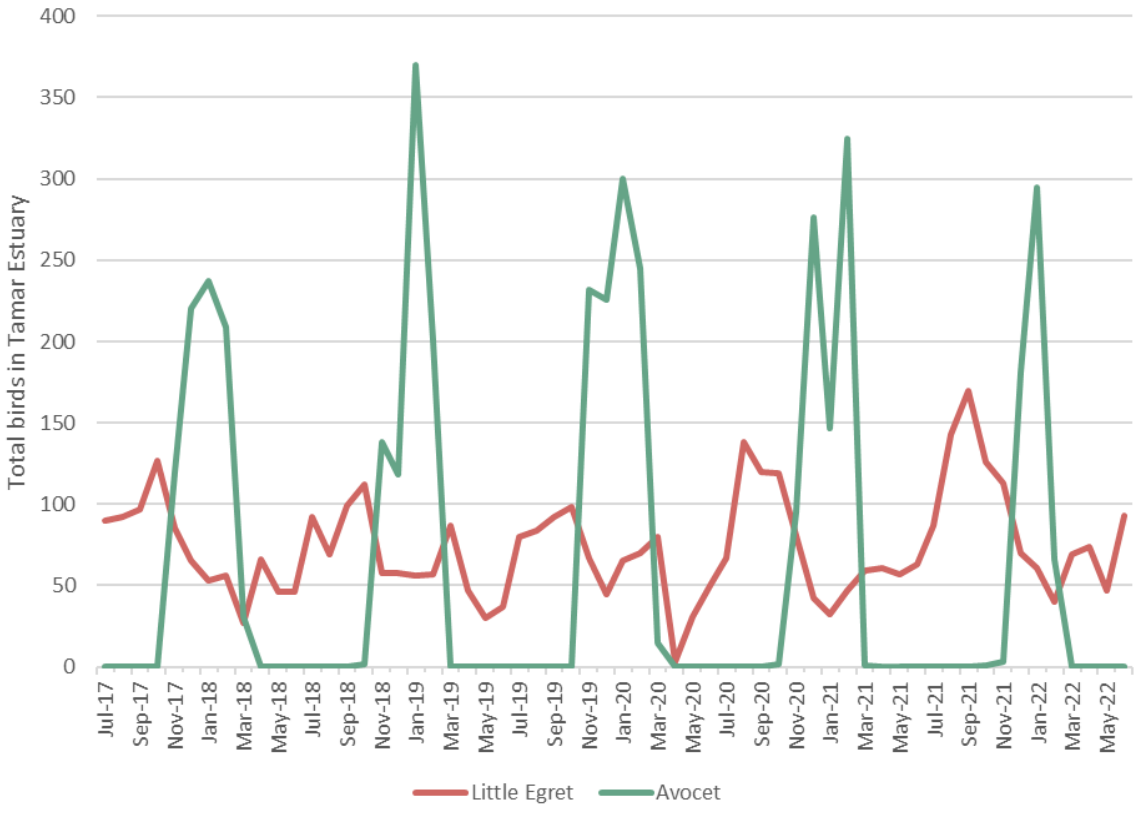
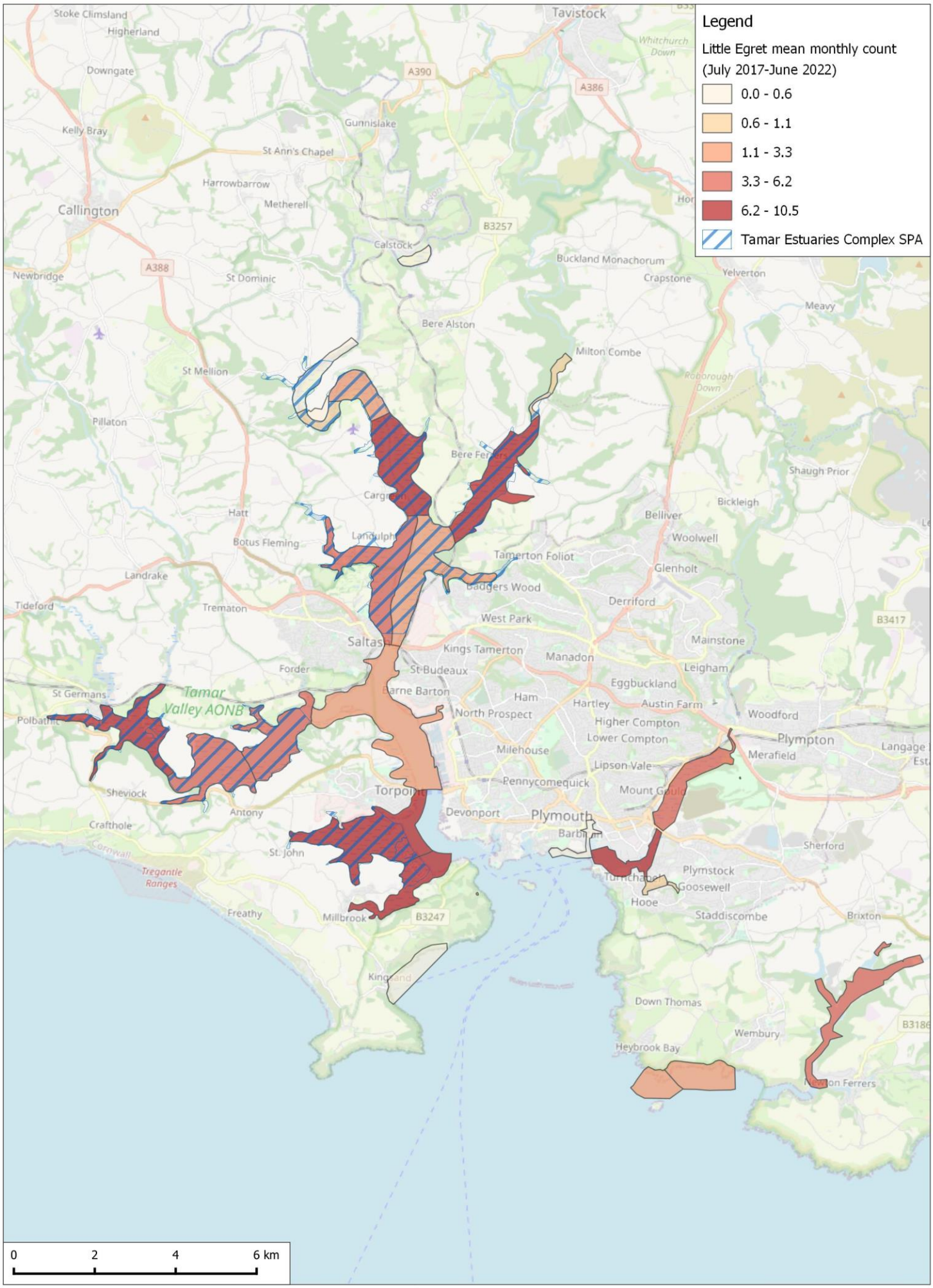
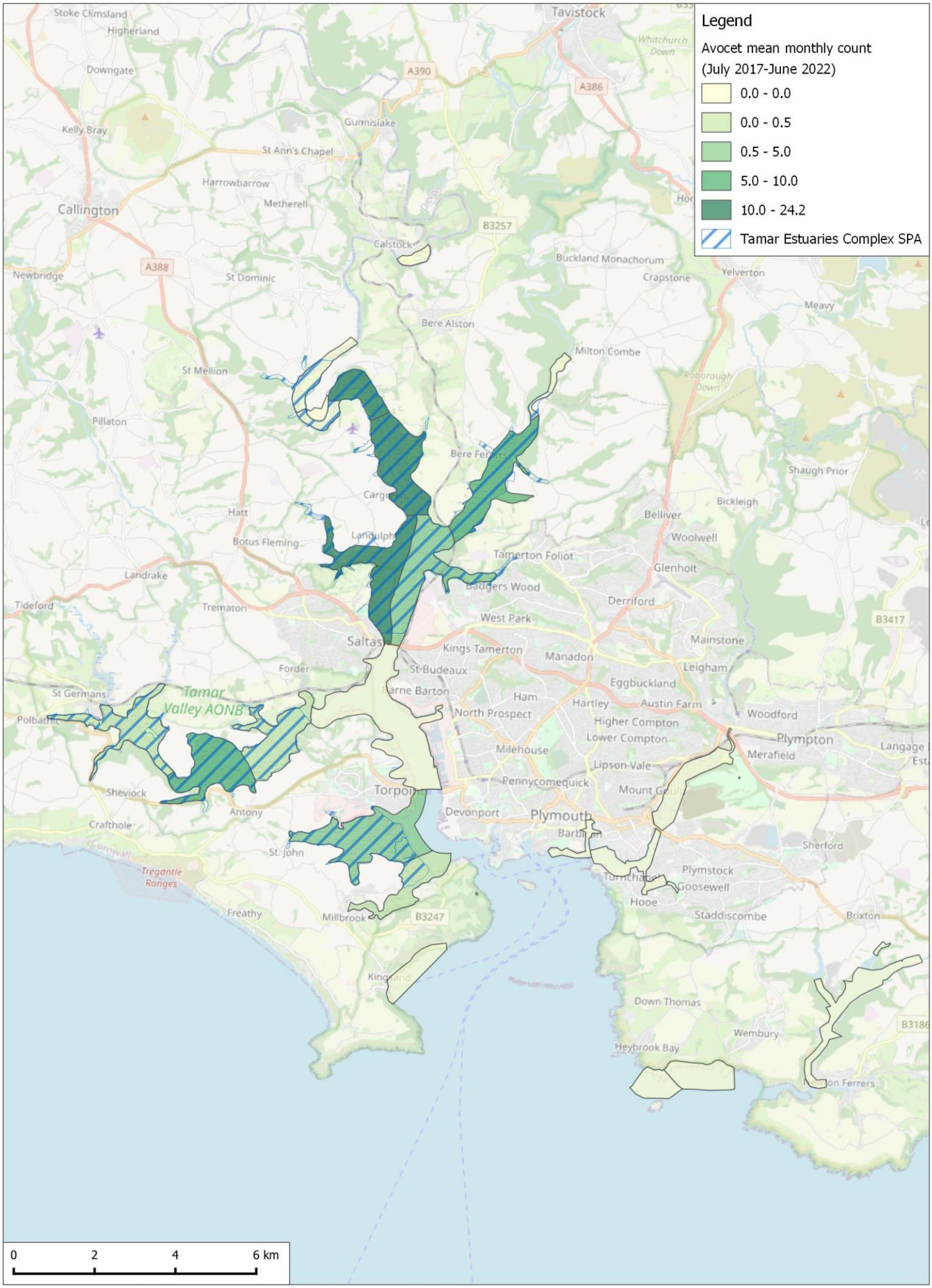


Figure 1: Total monthly counts of Little Egret and Avocet across the Tamar Estuary (2017-2022).

Map 11: SPA species - Little Egret *Egretta garzetta*.
Source: BTO Wetland Bird Survey (WeBS)



Map 12: SPA species - Avocet *Recurvirostra avosetta*.
Source: BTO Wetland Bird Survey (WeBS)



Tamar Estuary Sites MCZ

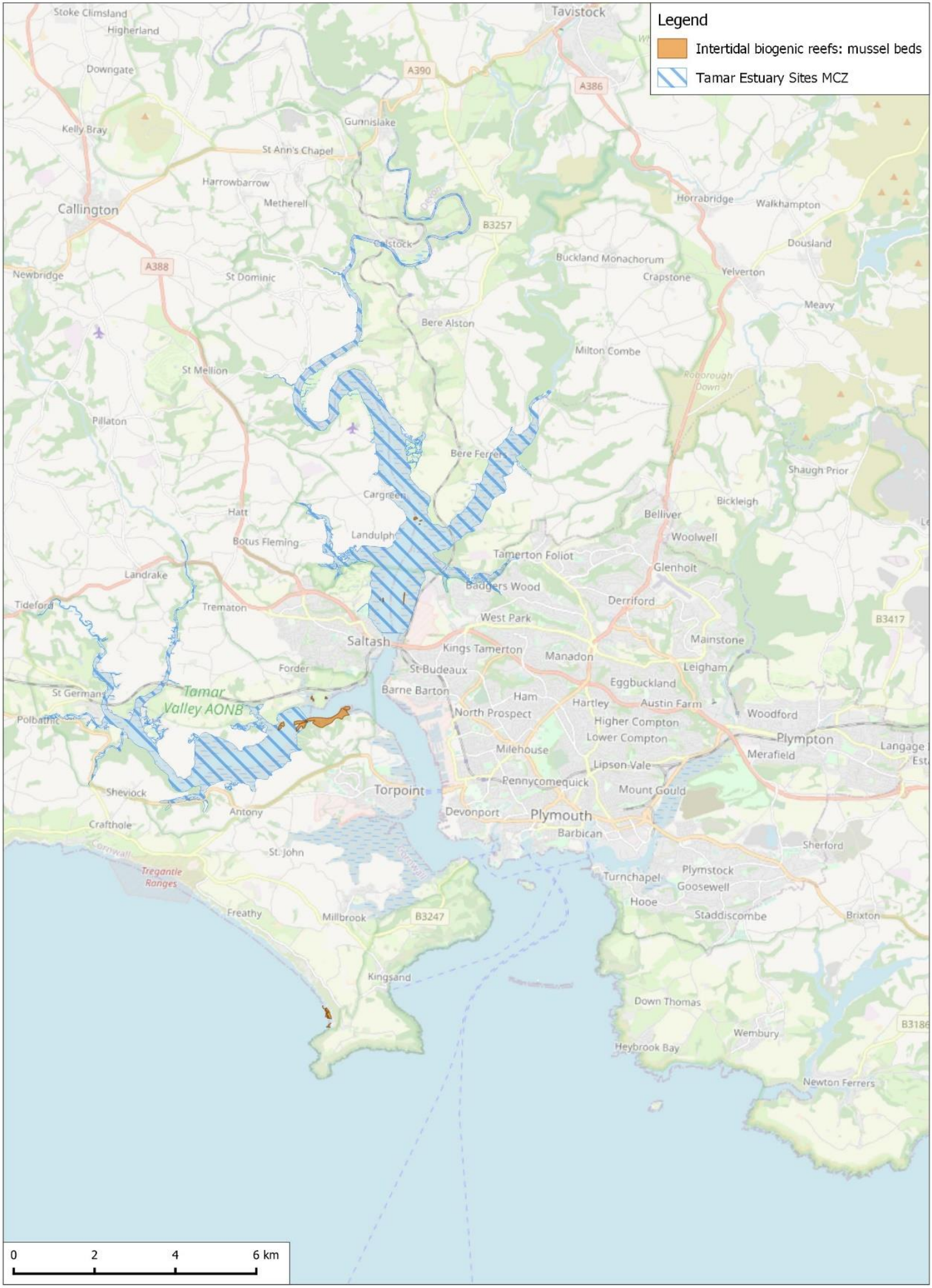
2.10 The Marine Conservation Zone covers a similar extent to the SPA, but excludes St John's, as shown in Map 1 (1,530 ha). The area provides a unique range of salinity gradients across several different habitats and tidal states, resulting in a highly diverse estuarine environment. Designated features are:

- **Blue Mussel, *Mytilus edulis* beds**. The intertidal and subtidal mussel beds are a priority habitat and are important in the formation of biogenic reefs. These are threatened by many non-native bivalves.
- **Intertidal biogenic reefs.** These reefs are made up by living and dead mussels, held together by the living mussels and the fauna which thrive in this habitat.
- **Intertidal coarse sediment.** The nature of the ria estuary means steep slopes and this topography is important and sediments are mobile in places and therefore can be barren or have important oligochaetes.
- **Native Oyster, *Ostrea edulis*.** The oysters are present on mussel beds, but have undergone significant declines, and this site is one of only six sites designated for the species in England. As with Blue Mussel, the Native Oyster is threatened by invasive non-native species and disease.
- **European Smelt, *Osmerus eperlanus*.** Smelt is a migratory fish which breeds within the site. Adults are known to spawn around the tidal limit at Gunnislake Weir, the only recorded spawning location in the south west of England. The larvae require areas of clean gravel to develop in before moving downstream into the estuarine zone.

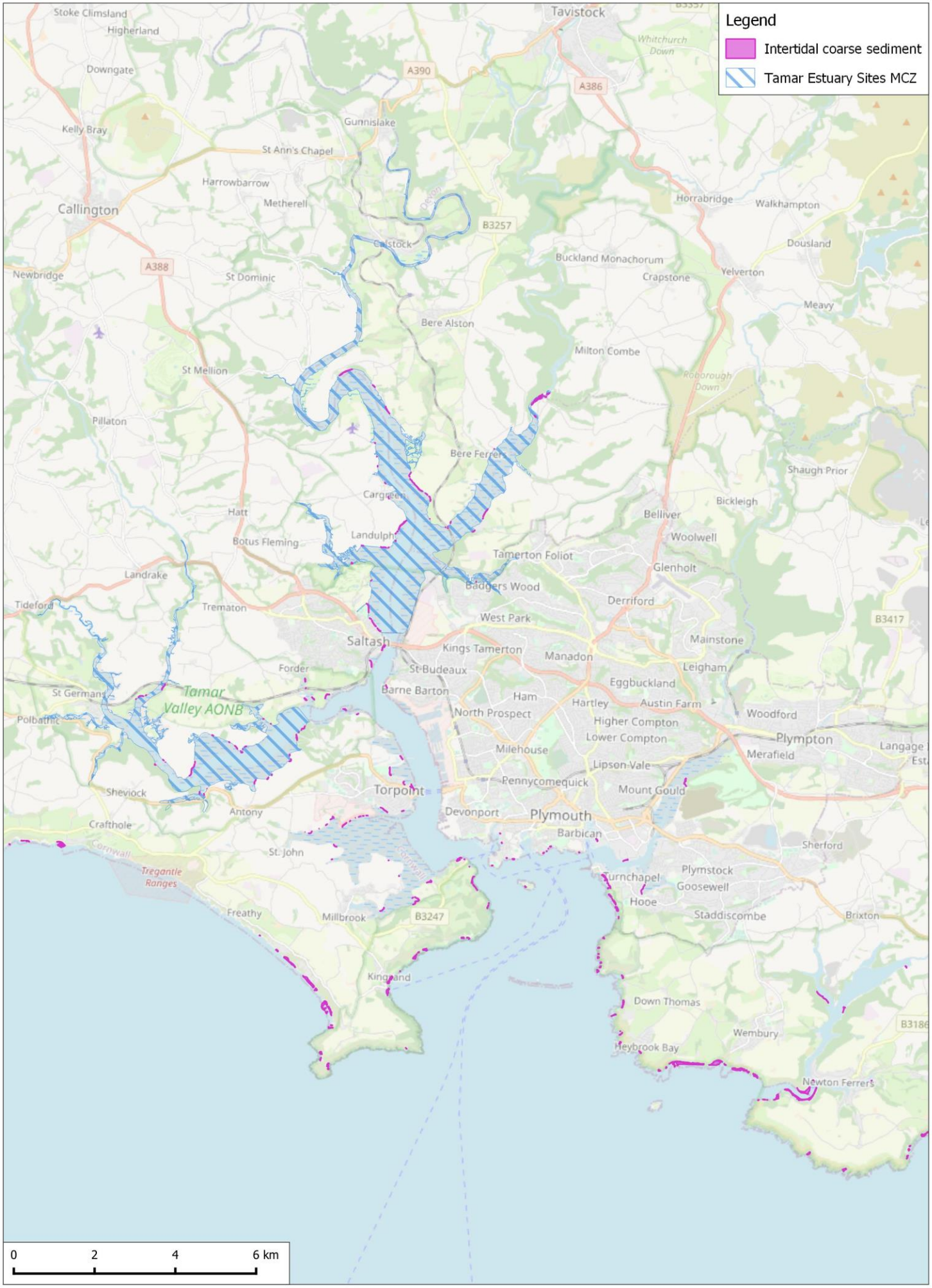
2.11 Maps 13 and 14 show the key habitats of the MCZ using the following Natural England datasets: Marine Annex I Habitats and MCZ Habitat Features of Conservation Importance. The main areas of mussel beds are on the River Lynher between Shillingham Point and Jupiter Point, and on the Tamar near Ernesettle and Weir Point.

2.12 Map 15 presents the locations of European Smelt using the Natural England MCZ Species Features of Conservation Importance dataset, supplemented with records from the NBN Atlas.

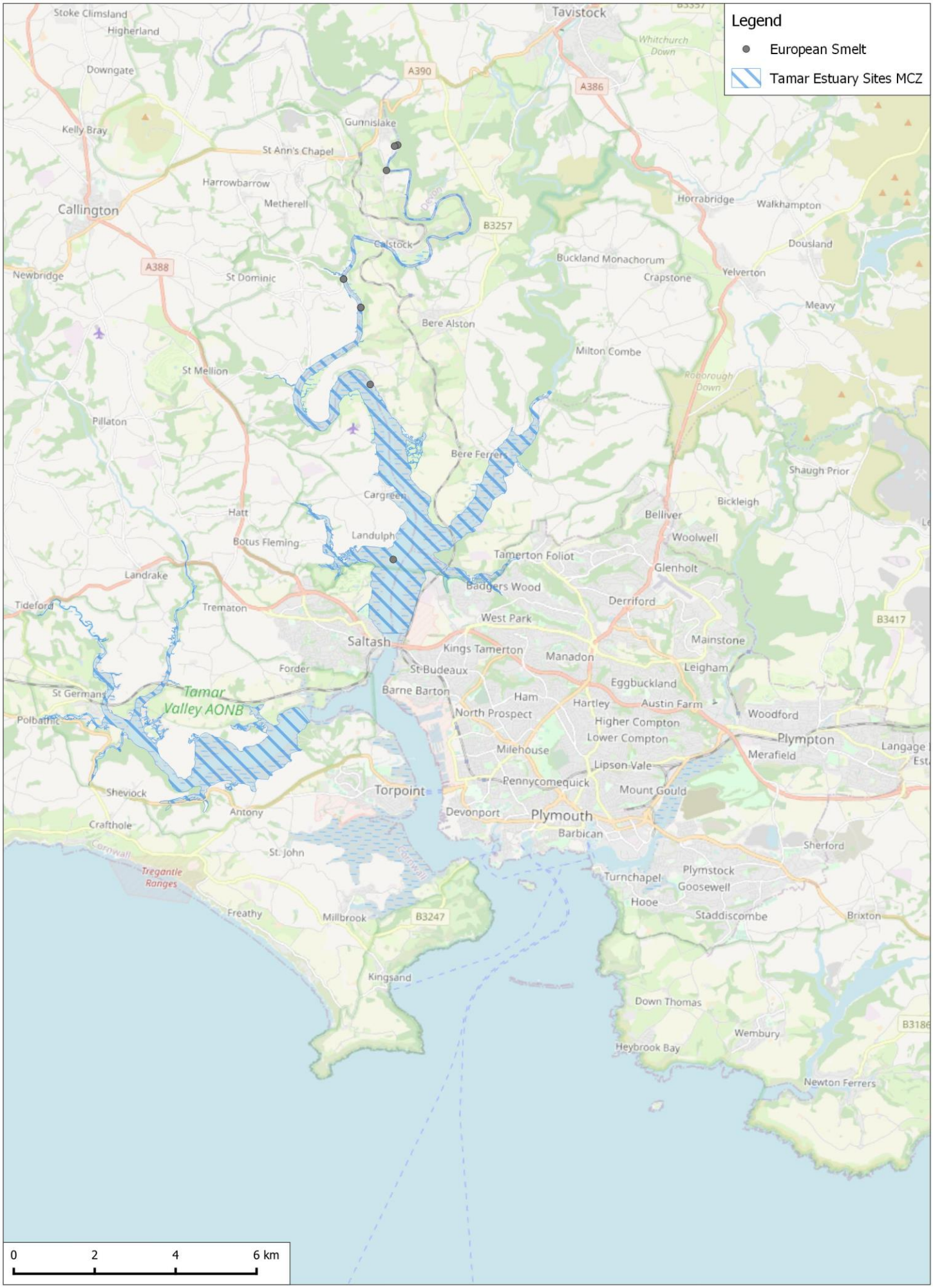
Map 13: MCZ habitat - Intertidal biogenic reefs (Blue Mussel *Mytilus edulis* beds).
Source: Natural England



Map 14: MCZ habitat - Intertidal coarse sediment
Source: Natural England



Map 15: MCZ species - European Smelt *Osmerus eperlanus*
Sources: Natural England, NBN Atlas



3. Recreational impact pathways

3.1 In the following sections we identify a variety of pathways through which recreation activities could potentially impact upon the qualifying features of the key designations of the MPA. Within each section we identify those qualifying features which are (potentially) particularly susceptible to each impact pathway, and provide references to relevant data sources, where available. We have categorised each pathway within one of five broader impact types, namely:

- Damage;
- Disturbance;
- Contamination;
- Fire; and,
- Other.

3.2 We find that the use of this framework allows for higher level consideration of impact types and can provide focus when discussing (e.g.) mitigation and/or management. Having outlined the impact pathways in the following sections, we summarise which of the MPA's qualifying features are potentially susceptible to the effects of each broad impact type in Table 1, and then identify a range of recreation activities which can lead to each of the impacts in Table 2.

Damage

Trampling

3.3 Trampling within terrestrial and intertidal areas can directly damage plants, lead to loss of vegetation and/or a change in plant species composition and cause compaction or poaching of the substrate, with implications for plant species composition (Liddle, 1975, 1997; Bayfield and Aitken, 1992). The level of trampling that will cause damage depends on a variety of factors, including soil type and moisture content, aspect and slope, season, microclimate, behaviour (e.g. walking up or down the slope) and the vegetation type (see Liley et al. 2010 for a review). Due to this range of factors, it is difficult to predict thresholds at which significant vegetation change will occur.

3.4 In suppressing plant growth and creating bare ground, trampling can also result in conditions suitable for some scarce plants and invertebrates. There is therefore a difficult balance to achieve between sufficient trampling to

create and maintain bare ground, and excessive wear that continually disturbs the substrate and damages or destroys any colonising species. Soil compaction and erosion issues are not only related to footfall (see Liddle, 1997 for review). Bicycles can damage soils and vegetation more than foot passage for example (Martin, Butler, & Klier, 2018). The illicit use of vehicles, such as 4x4s and quad bikes is likely to be especially damaging. Furthermore, the finalisation of access rights under the England Coast Path will potentially allow walkers to access areas of the coast down to the mean low water mark and this may lead to increased trampling in certain locations. This could lead to increased trampling within littoral locations within the MPA (such as Wembury and Polhawn) that support important populations of Shore Dock.

3.5 Trampling within intertidal areas or shallow water also has the potential to damage a range of features and habitats (see Saunders *et al.*, 2000 for review). These can include exposed shellfish aggregations (such as mussel beds), rocky shores (Addessi, 1994), seaweeds (Milazzo, Chemello, Badalamenti and Riggio, 2002) and seagrass beds (Travaille, Salinas-de-León and Bell, 2015). The scale of any resulting damage will relate to the activity undertaken, with individuals carrying or dragging equipment (e.g. water sports enthusiasts) likely to exert greater damage than swimmers alone. Alongside the attrition from feet and other forms of access, damage can arise from people turning over boulders, e.g. for bait collection (Stevčić *et al.*, 2018) or simply even people rockpooling and exploring.

Damage from boat launching to marine/coastal substrates

3.6 There is a potential for boats and other watercraft to cause damage, such as scouring, to marine and intertidal substrates during launching and beaching activities. Such activity is likely to cause greater impact within shallower areas of the MPA or in locations where raised rocky features, such as reefs and shellfish beds, are present. Such damage could comprise damage to, or removal of, marine vegetation or shellfish, and may be particularly evident or concentrated at popular launch/beaching locales.

Anchor damage to marine/coastal substrates

3.7 Damage from anchors and swing moorings to seagrass and other habitats is well documented (Collins, Suonpaa and Mallinson, 2010; Liley *et al.*, 2012; Broad, Rees and Davis, 2020), and the potential issue of anchoring-related damage to Eelgrass beds and reef features within the MPA is identified

within the Site Improvement Plan (SIP)[6] for the Plymouth Sound and Tamar Estuary (including the Plymouth Sound & Estuaries SAC and Tamar Estuaries Complex SPA). Anchors can pull up leaves and rhizomes of seagrass (Ceccherelli, Campo and Milazzo, 2007) and can also change the structure of seagrass beds (Collins, Suonpaa and Mallinson, 2010). Anchor scars have been measured up to 0.16m^2 (Liley *et al.*, 2012) while Collin's (2010) study in Dorset recorded bare patches of up to 4m^2 caused by the combined effects of anchor and chain scouring. Scars of 122m^2 have been attributed to swing moorings (Unsworth *et al.*, 2017), which comprise a weight, ground chain, riser chain and floating buoy.

3.8 While potentially more robust than seagrass beds due to the nature of the substrate, reefs may also be vulnerable to damage from anchors. Anchoring has the potential to both physically damage rocky substrates, such as reefs, through mechanical action and to also remove epiphytic algal and coral species (see Milazzo, et al. (2002) for a review of impacts). Damage to both substrates and 'floral' communities may also lead to localities becoming unsuitable for habitat specialist invertebrate species.

3.9 The impact of anchoring upon rocky marine substrates has been relatively understudied in a UK context, although the review carried out by Griffiths, et al. (2017) provided limited evidence for its occurrence. They did however indicate that when such damage does occur it is more likely to impact epiphytic species than to the underlying substrate.

Disturbance

3.10 Disturbance has been identified by Natural England as a generic issue across many European Marine Sites (see Coyle & Wiggins, 2010), and can be an issue for a range of species. Human disturbance can take many forms and may be related to pedestrians (including dogs with walkers), boats, personal watercraft, kayaks, fixed-wing aircraft and helicopters, or activities such as rockpooling and coasteering.

3.11 Disturbance linked to recreation has potential to impact upon the SPA's qualifying wintering Little Egret and Avocet populations, alongside the wider waterbird assemblage. As such, disturbance to wintering and passage waders and waterfowl can result in:

[6] https://publications.naturalengland.org.uk/publication/6283453993582592

- A reduction in the time spent feeding due to repeated flushing/increased vigilance (Bright, et al., 2003; Fitzpatrick & Bouchez, 1998; Stillman & Goss-Custard, 2002; Thomas, Kvitek, & Bretz, 2003; Yasué, 2005);
- Increased energetic costs (Nolet, et al., 2002; Stock & Hofeditz, 1997);
- Avoidance of areas of otherwise suitable habitat, potentially using poorer quality feeding/roosting sites instead (Burton,et al., 2002; Burton, Rehfisch, & Clark, 2002; Cryer, et al., 1987; Gill, 1996); and,
- Increased stress (Regel & Putz, 1997; Thiel, et al., 2011; Walker, et al., 2006; Weimerskirch et al., 2002)

3.12 The third point bears emphasising, as the absence of birds from a potentially suitable area of habitat within the MPA may be a result of current disturbance levels, rather than perceived habitat suitability. Furthermore, birds may be more or less susceptible at different points in their annual and daily cycles (e.g. within concentrated roosting flocks or more dispersed feeding aggregations).

3.13 Disturbance from water-based activities, including recreational watercraft, may also impact upon mobile species, such as fish (Graham and Cooke, 2008) and cetaceans (Hastie *et al.*, 2003; Bejder *et al.*, 2006), and the Plymouth Sound and Tamar Estuary SIP identifies disturbance and public access as having the potential to impact, either directly or indirectly, upon a range of qualifying features.

Contamination

Littering

3.14 Discarded glass and plastic refuse can perhaps lead to increased wildfire risk, alongside discarded cigarettes, and portable barbeques. Discarded plastics and fishing gear, in particular, can pose serious hazards to marine life (see review by Kühn, Rebolledo, & Franeker (2015)), with bird entanglement a noted risk in coastal areas. Furthermore, the Plymouth Sound and Tamar Estuary SIP identifies the present of significant quantities of angling debris at reef sites which have potential to smother the reefs and consequently affect their growth. It is not clear whether this refers to commercial or recreational fishing gear, but any increased level of recreational use of the site (and of shore-based fishing in particular) nevertheless has potential to lead to increased risks of killing, injury, or damage to the MPA's qualifying bird populations and reefs.

Marine pollution events

3.15 Potential exists for the occurrence of water-based pollution events as a result of recreation activity within the MPA, such as fuel leakage from recreational watercraft, with any such event potentially impacting upon sessile marine animal communities, such as mussel beds. Nevertheless, it is considered that any such occurrence is likely to be rare and localised in extent, with no mention of marine pollution within the Plymouth Sound and Tamar Estuary SIP.

Invasive species

3.16 Recreation is one of the major pathways for the spread of non-native species. A systematic review and meta-analysis by Anderson *et al.* (2015) found that the abundance and richness of non-native species was significantly higher at sites with recreation and showed a consistent pattern across terrestrial and aquatic environments and with a range of different activity types (e.g. horses, walkers). Allen, Brown & Stohlgren (2009) also found a positive relationship between the number of non-native species present on sites and the number of visitors.

3.17 The spread of non-native species can be associated with recreation use, and studies have shown people can be vectors for seeds over many kilometres (Wichmann et al., 2009). The spread of non-native marine organisms by equipment and watercraft (either on the hull or within ballast water) is also recognised as an increasing risk to marine sites (Bax *et al.*, 2001, 2003; Molnar *et al.*, 2008) and is identified as a key threat to the MPA within the Plymouth Sound and Tamar Estuary SIP. Species that are long-established and with stable populations may not necessarily be a cause for conservation concern - issues potentially relate to a small number of non-native species. The Tamar Estuaries Marine Biosecurity Plan (Wood *et al.*, 2018) identified 16 non-native species which already have a significant presence in the area.

3.18 Deliberate introductions are controlled by legislation (although may still occur illegally), but it is the unintentional dispersal of species that is of concern here. Detrimental impacts of non-native species on native biota within the UK relate to competition, predation, herbivory, habitat alteration, disease and genetic effects (i.e. hybridization) (Manchester and Bullock, 2000).

Dog fouling

3.19 Dog fouling is a widely recognised issue in low-nutrient semi-natural systems (Arnberger and Brandenburg, 2007; Groome, Denton and Smith, 2018; Harris, 2023). The resulting increase in nitrogen and phosphorus changes vegetation communities, encouraging bulky competitive species at the expense of less vigorous species adapted to low-nutrient situations. A change from typical species to rank species-poor grassland communities is a common sight along and on the margins of paths and tracks and around many car parks.

3.20 Urination is also an issue. This can result in the loss of lower plant communities at spots that are repeatedly utilised, such as trees, rocks etc. Contamination may also result from persistent veterinary compounds that are transferred into the aquatic environment by dogs splashing through any water bodies, such as streams. These may include worming treatments and external parasite treatments (Harris, 2023).

3.21 Dog fouling/urination along, and in proximity to, coastal paths and on beaches therefore has the potential to alter the composition of floral communities and could potentially have ramifications for the MPA's important Shore Dock population in particular.

Fire

3.22 Fire incidence can be linked to barbeques, campfires and arson and fire incidence on semi-natural habitats is linked to the amount of housing nearby, with areas with more development tending to have more fires (Kirby & Tantram, 1999).

3.23 While fires are unlikely to spread far or cause catastrophic damage along the terrestrial and intertidal margins of the MPA, even small patches of burnt vegetation can be damaging, for example from disposable barbeques resting on the ground. As such, fire has the potential to impact upon both those drier vegetation types classified within Atlantic salt meadows and extremely localised populations of Shore Dock within the MPA. With climate change, the risk of more extreme weather and prolonged dry spells and changing access patterns, fires are likely to be of more concern and risk (anon, 2017; Arnell, Freeman and Gazzard, 2021).

Other

Angling

3.24 Recreational angling, either from shore or watercraft, has potential to locally impact the populations of both European Smelt and Allis Shad within the MPA through killing or injury, although the latter species is subject to a high level of legal protection from anglers[7]. There is also limited potential for conflict to occur between anglers and fish-eating bird species, such as Little Egret. Any such incidences are however considered likely to be rare and isolated in extent.

Spearfishing

3.25 Spearfishing activity has the potential for localised impacts on fish populations within the MPA and may also lead to disturbance and physical damage of reefs and other marine substrates. Limited information is currently available concerning the likely risks of spearfishing within the MPA and they may be low, however.

Crab tiling and bait digging

3.26 Commercial crab tiling and bait digging is carried out across the MPA, and the Plymouth Sound and Tamar Estuary SIP identifies that an estimated 12,000 tiles are currently in place. Some of this activity is also considered likely to comprise recreational activity, and therefore falls within the remit of this report. Such activities have potential to decrease the availability and quality of food sources for the MPA's water bird population, including Little Egret, and reduce the extent of available foraging.

Harvesting / hand gathering

3.27 The collection and removal of material from coastal or intertidal habitats, including seaweed and driftwood, has potential to damage littoral habitats and increase the localised occurrence of e.g. trampling impacts. The ad hoc collection of Oysters or Mussels also has potential to cause physical damage to the supporting substrates, as well as remove animals from the MPA.

[7] https://www.gov.uk/government/publications/protected-marine-species/fish-including-seahorses-sharks-and-skates

Table 1: Susceptibility of the MPA's qualifying features to potential impacts of recreation.

Qualifying feature	Damage	Disturbance	Contamination	Fire	Other	Notes
Sandbanks	✓		✓			Risks posed by boat launch and anchor damage in particular.
Estuaries	✓		✓			
Large shallow inlets and bays	✓		✓			
Reefs	✓		✓			Unquantified impact of anchor damage currently.
Atlantic salt meadows	✓		✓	✓		
Mudflats and sandflats	✓		✓			
Shore Dock	✓		✓	✓	✓	Extremely limited distribution within the MPA means that even local impacts could have important effects.
Allis Shad	✓	✓	✓		✓	Afforded legal protection from killing or injury via angling.
Little Egret	✓	✓				Damage indirect effect to habitat used by the birds.
Avocet	✓	✓				Damage indirect effect to habitat used by the birds.
Intertidal biogenic reefs (Blue Mussel beds)	✓		✓		✓	
Intertidal coarse sediment	✓		✓			
Native Oyster	✓		✓		✓	
European Smelt	✓	✓	✓		✓	

Table 2: Potential impact pathways and the types of recreation that could cause them.

Activity	Damage	Disturbance	Contamination	Fire	Other	Notes
Angling (from shore)	✓	✓	✓	✓	✓	
Angling (from watercraft)	✓	✓	✓		✓	
Crab tiling & bait digging	✓	✓			✓	
Swimming & snorkelling	✓	✓				
Wind/Kite surfing	✓	✓	✓			
Jet skis	✓	✓	✓			
Canoeing/ Kayaking /Paddleboarding	✓	✓	✓			
Recreational boating	✓	✓	✓			
Rockpooling	✓	✓				
Scuba diving	✓	✓	✓			
Spearfishing	✓	✓			✓	
Harvesting	✓	✓			✓	
Coasteering	✓	✓				
Dog walking	✓	✓	✓			
Walking/hiking	✓	✓				
Bird/wildlife watching	✓	✓				
Camping	✓	✓	✓	✓		Includes wild camping.
Cycling	✓	✓				
Horse riding	✓	✓	✓			

4. Existing data on recreational use

4.1 The Plymouth Sound and Tamar Estuaries are popular for a wide range of marine recreation activities. Previous studies into marine recreation within the MPA include the MBA survey (Langmead *et al.*, 2017), the Natural England Commissioned Report NECR242 (Roberts, 2017), MMO1136 (Marine Management Organisation, 2019) and MMO1243 (Marine Management Organisation, 2021)

4.2 The following maps use a range of existing data sources to highlight the areas where each activity type is likely to take place.

4.3 Maps 16 and 17 show the boating facilities, speed limits and Automatic Identification System (AIS) data to indicate the intensity of boating activity in the area. The AIS map shows a concentration of boating activity within the Sound and the Cattewater, however there are several slipways and clubs further up the estuaries which may be used by smaller vessels that are less likely to carry AIS equipment.

4.4 The bathing areas (Map 18) are mostly bays within the Sound, which often coincide with where reefs and/or seagrass beds are present.

4.5 Access for terrestrial activities is summarised in Map 19, including the South West Coast Path which follows the coastline around the Sound. Some parts of the estuaries appear more difficult to access by land, for example around the River Lynher and the River Tavy.

4.6 Map 20 shows places suitable for launching kayaks, canoes and stand-up paddleboards, as recommended by British Canoeing. However, paddlesports users may also use other locations, especially given the portability of SUP boards.

4.7 Key sites used by scuba divers are shown in Map 21. This includes wreck dive sites (via the SHIPs Project[8]) along with other information found online regarding the location of popular reef/shore dive sites.

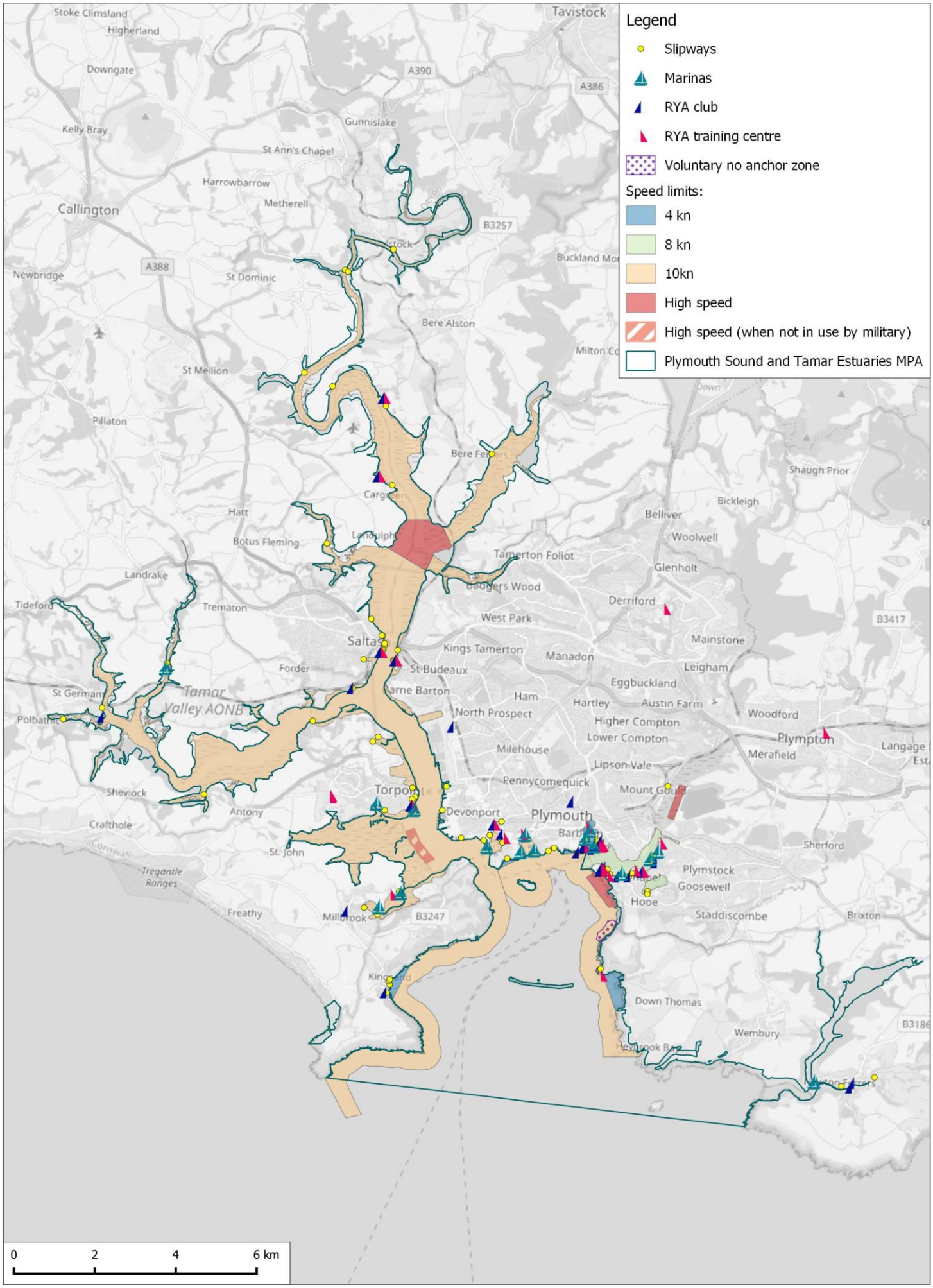
[8] https://shipsproject.org/sportwrecks.html

4.8 Both Cornwall IFCA and Devon and Severn IFCA carry out regular surveys of crab tiling, the most recent of which is summarised in Map 22, showing hotspots around Torpoint, Ernesettle and the Lynher River.

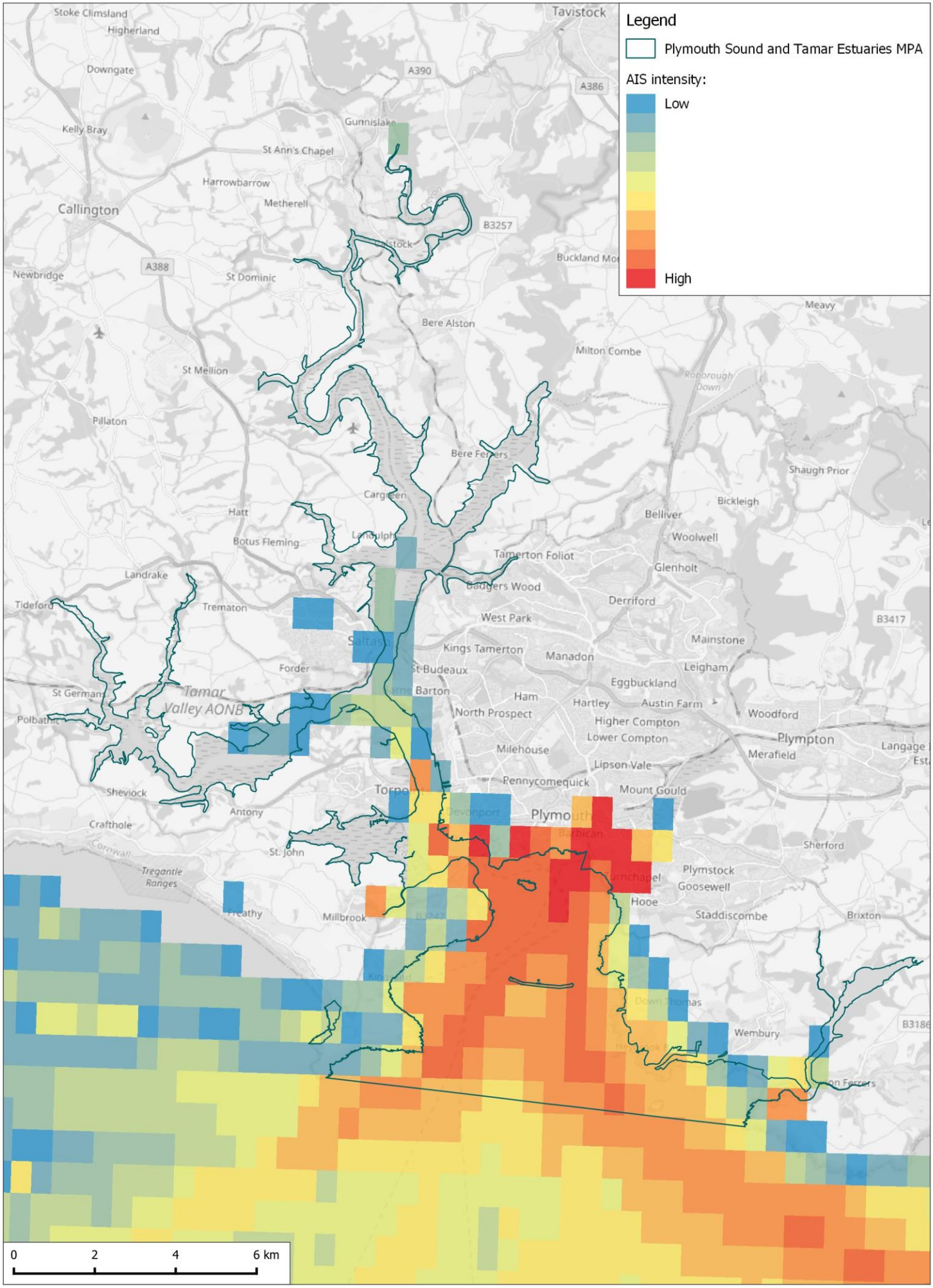
4.9 Map 23 shows data gathered in the MMO1136 study on popular areas for personal watercraft (e.g. jet skis) and towed watersports (e.g. waterskiing).

4.10 Finally, Maps 24 and 25 use data from MMO1163 (Marine Management Organisation, 2020) which was a project to map where sea angling commonly occurs. This included both shore angling and angling from a boat.

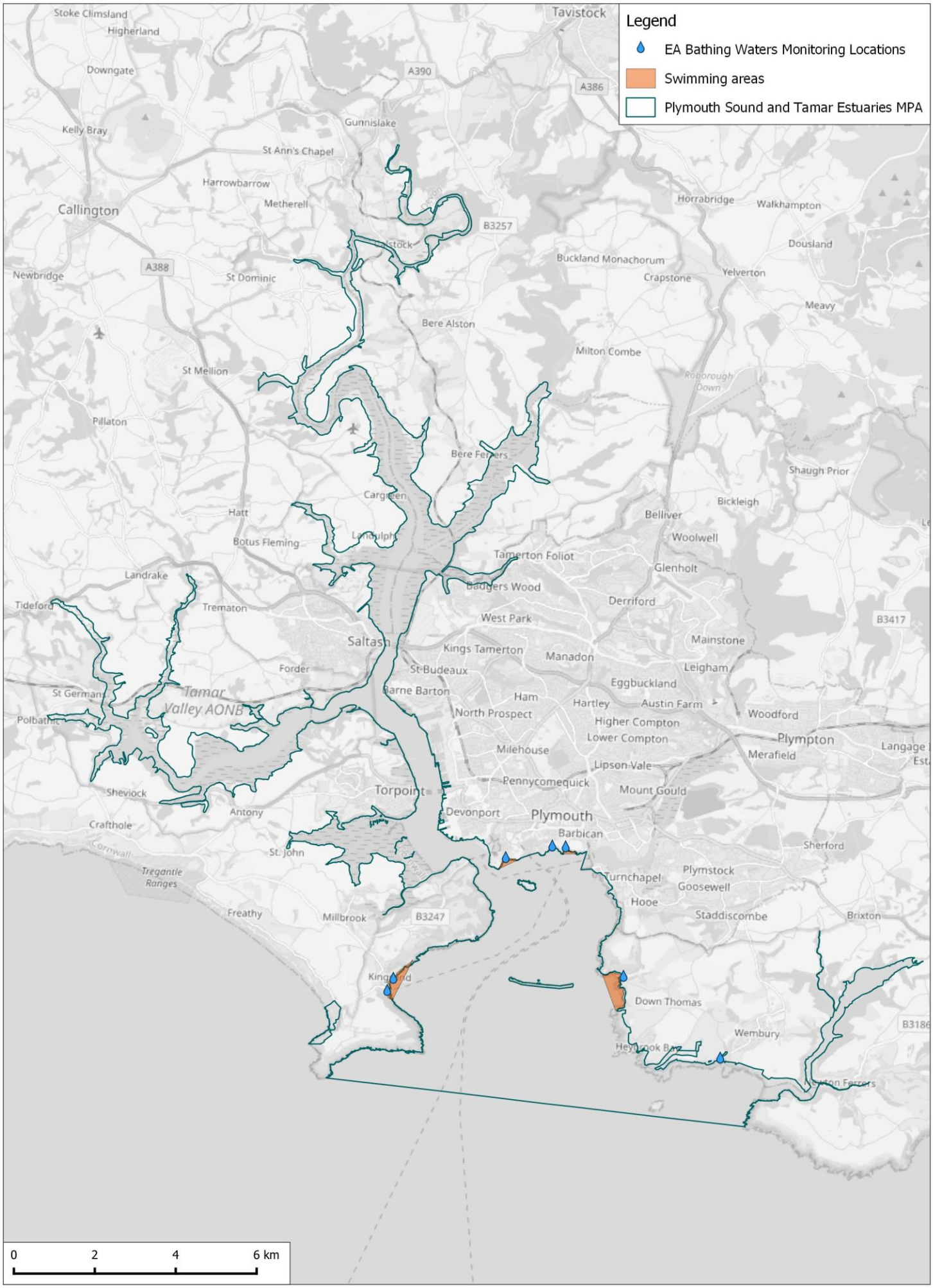
Map 16: Boating infrastructure and speed limits.
Sources: RYA, TECF



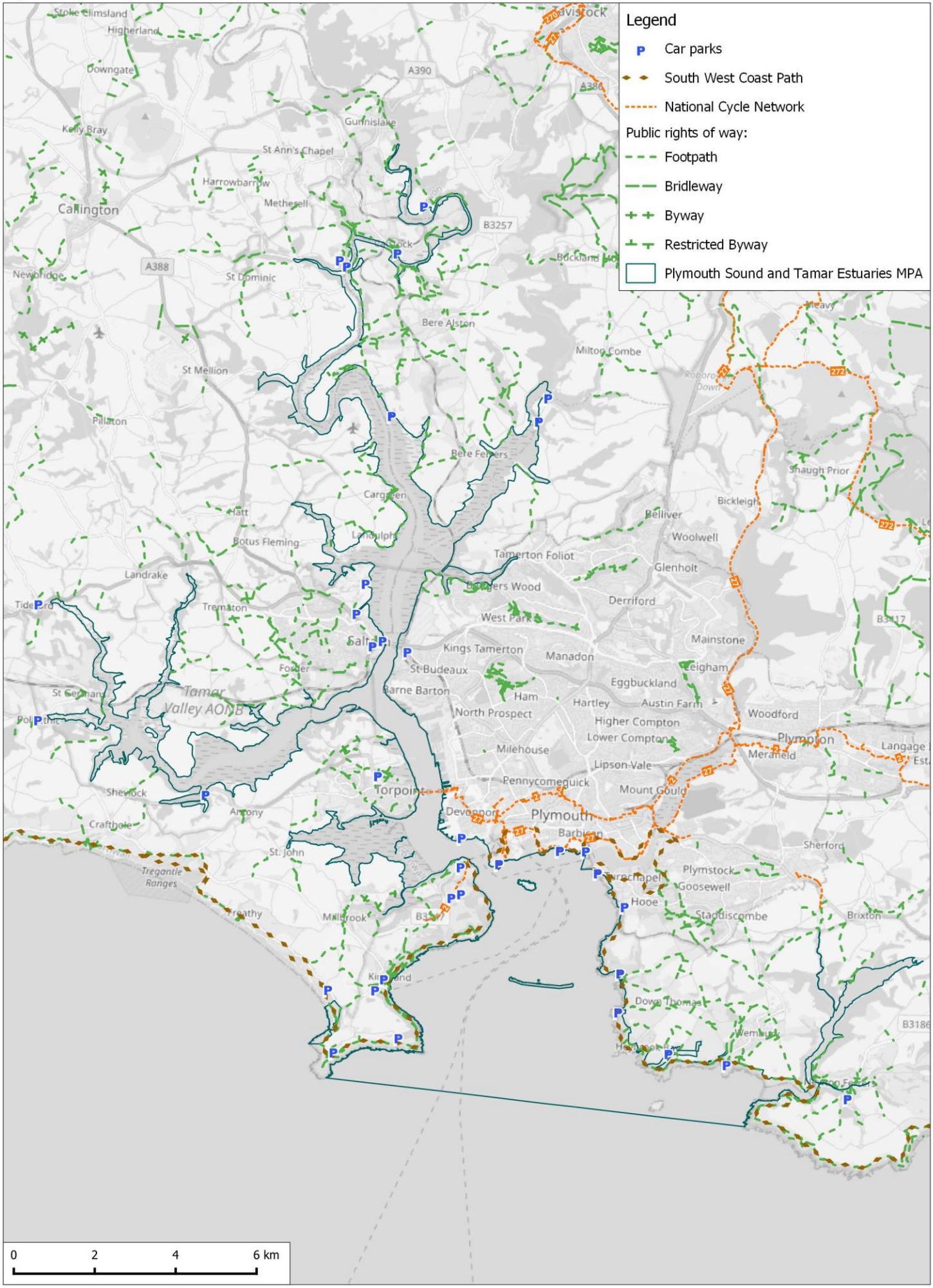
Map 17: RYA UK Coastal Atlas of Recreational Boating.
Source: RYA



Map 18: Swimming areas and bathing water monitoring.
Source: Environment Agency, TECF

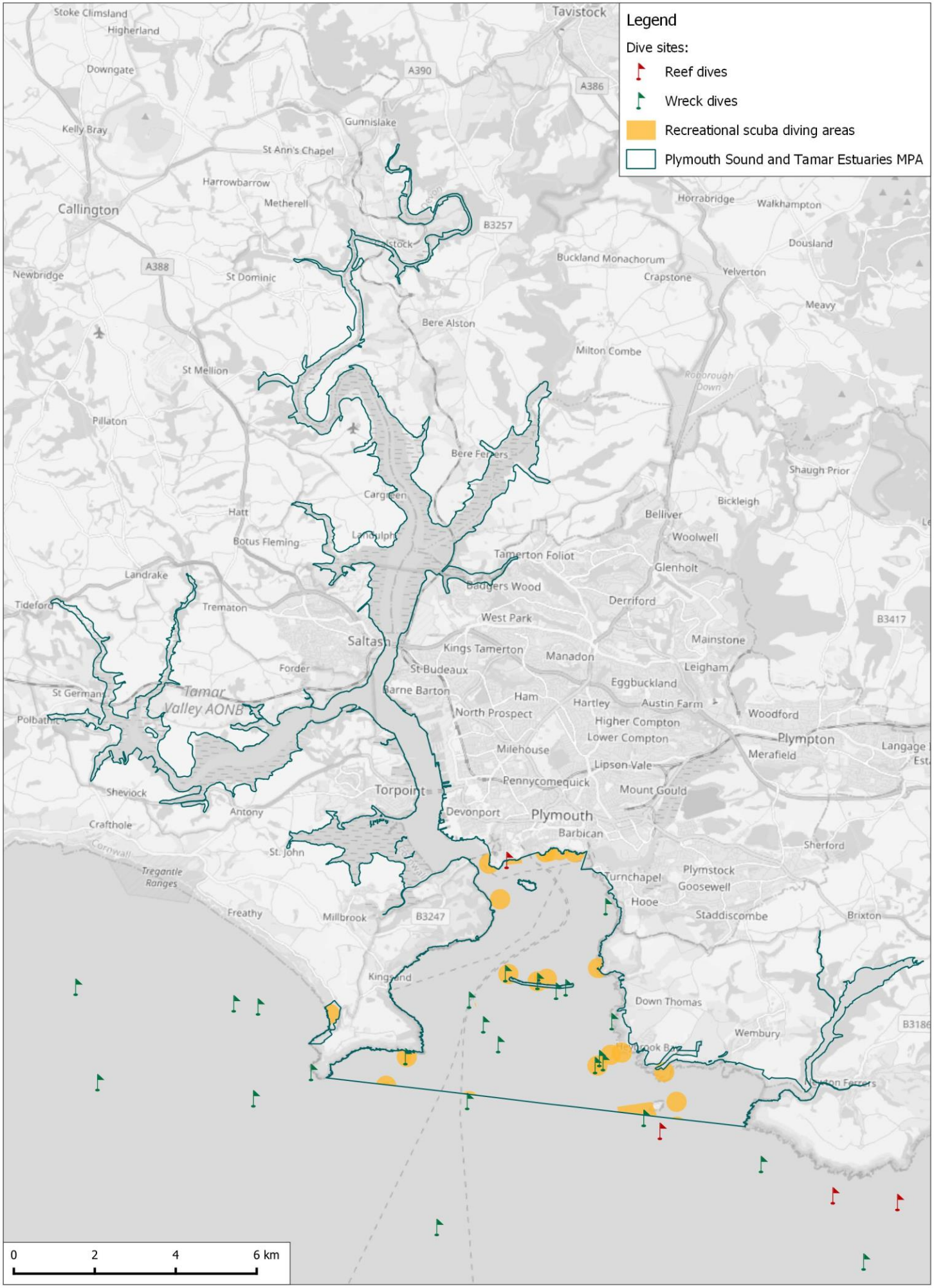


Map 19: Access infrastructure for terrestrial activities.
Sources: Plymouth City Council, Devon County Council, Cornwall Council, Natural England, Sustrans, OpenStreetMap

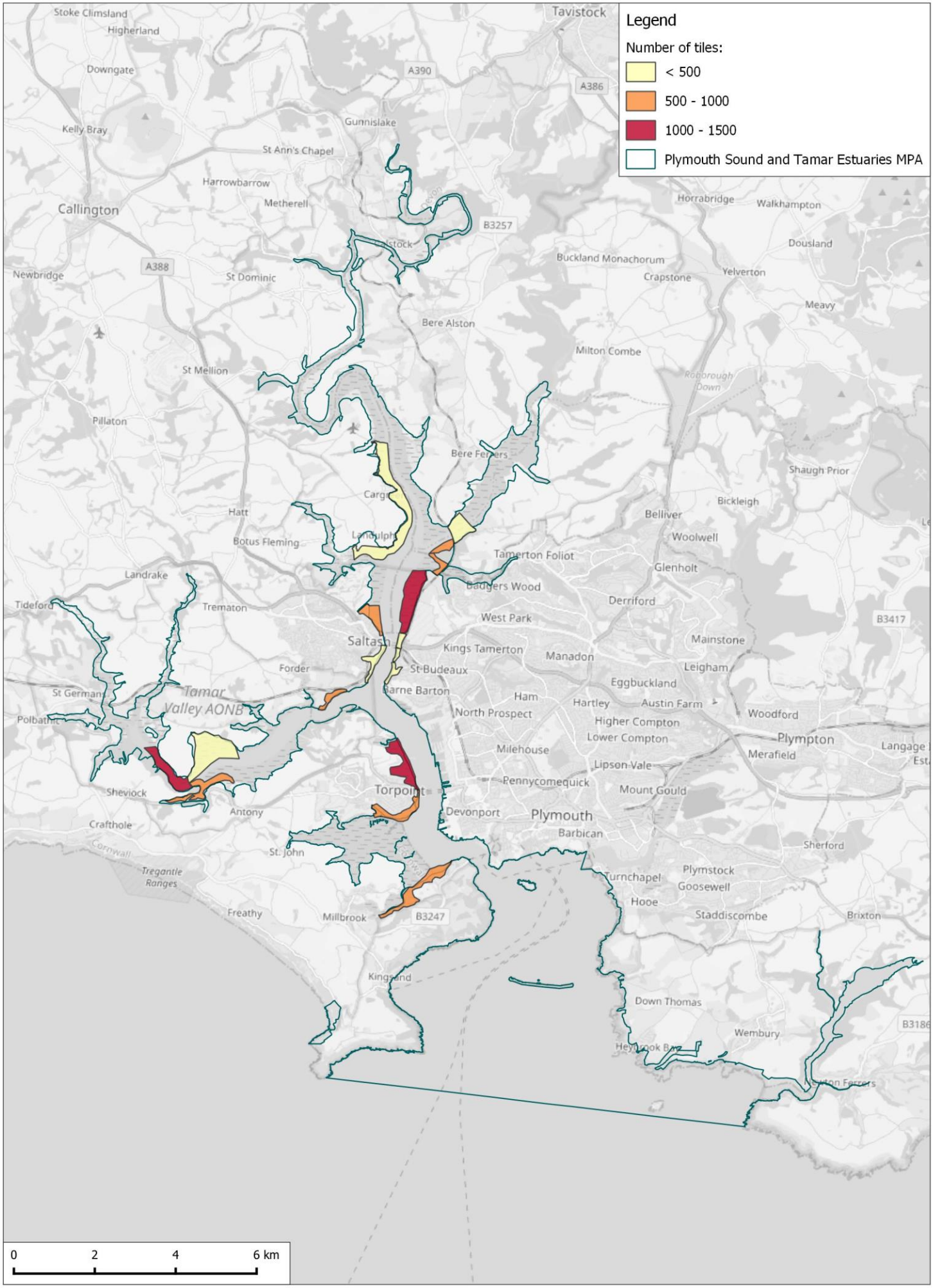


Map 20: Facilities for paddlesports (i.e. kayaking, canoeing, stand-up paddleboarding).
Sources: British Canoeing, Google Maps

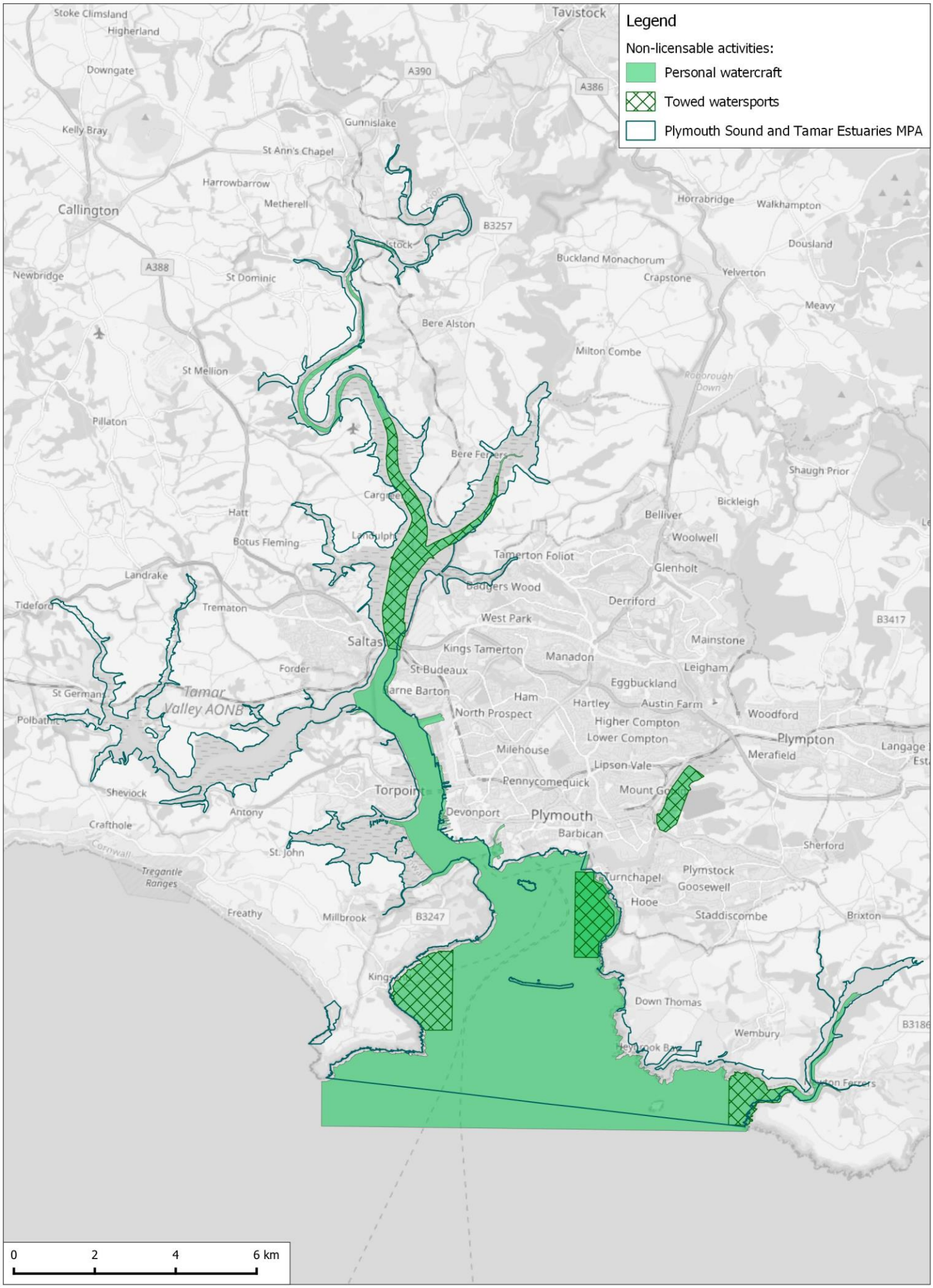
Map 21: Recreational scuba diving sites.
Sources: Marine Management Organisation (MMO1243), The SHIPs Project



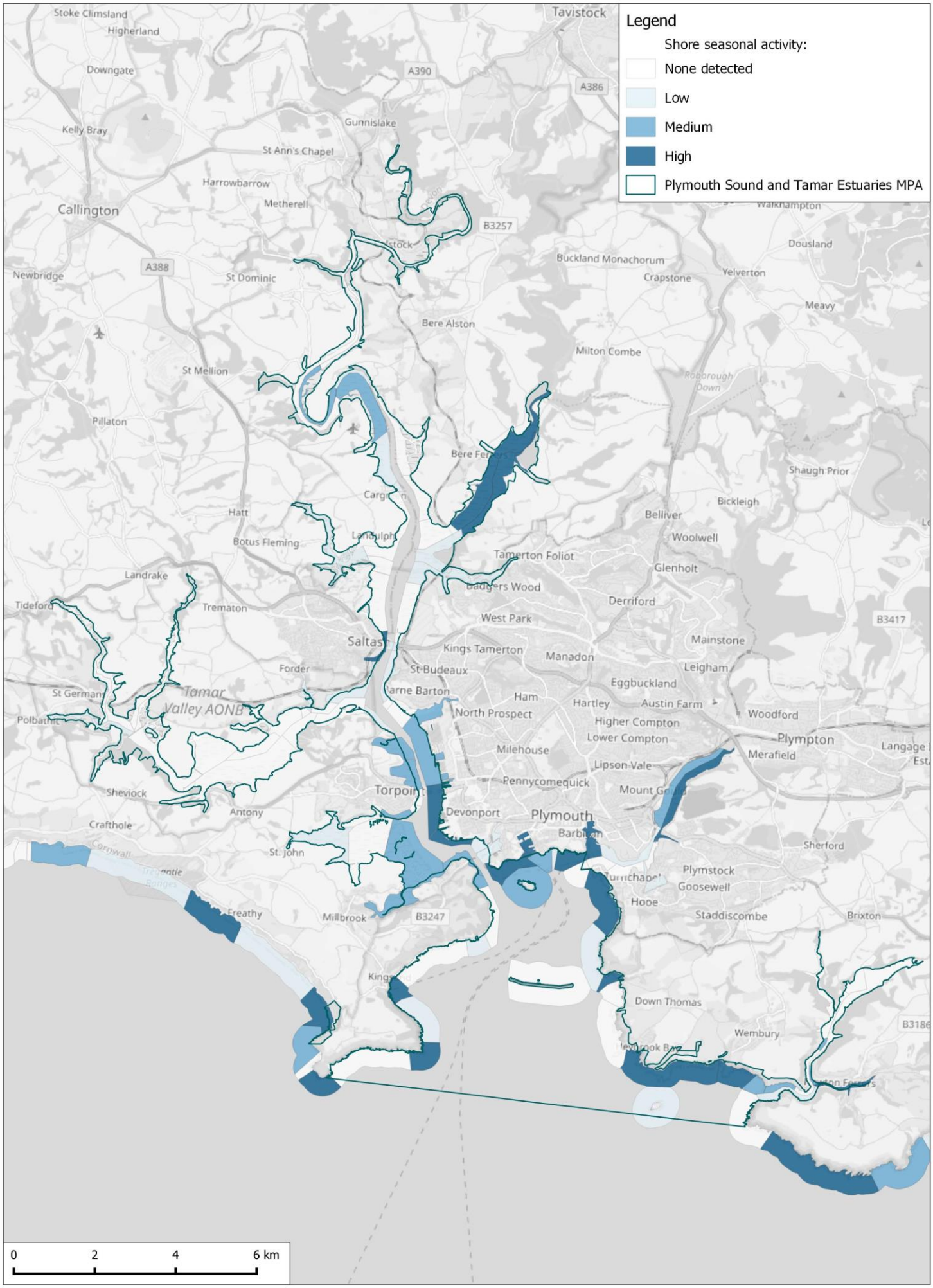
Map 22: Crab tiling on the River Tamar, 2020.
Sources: Cornwall IFCA, Devon and Severn IFCA



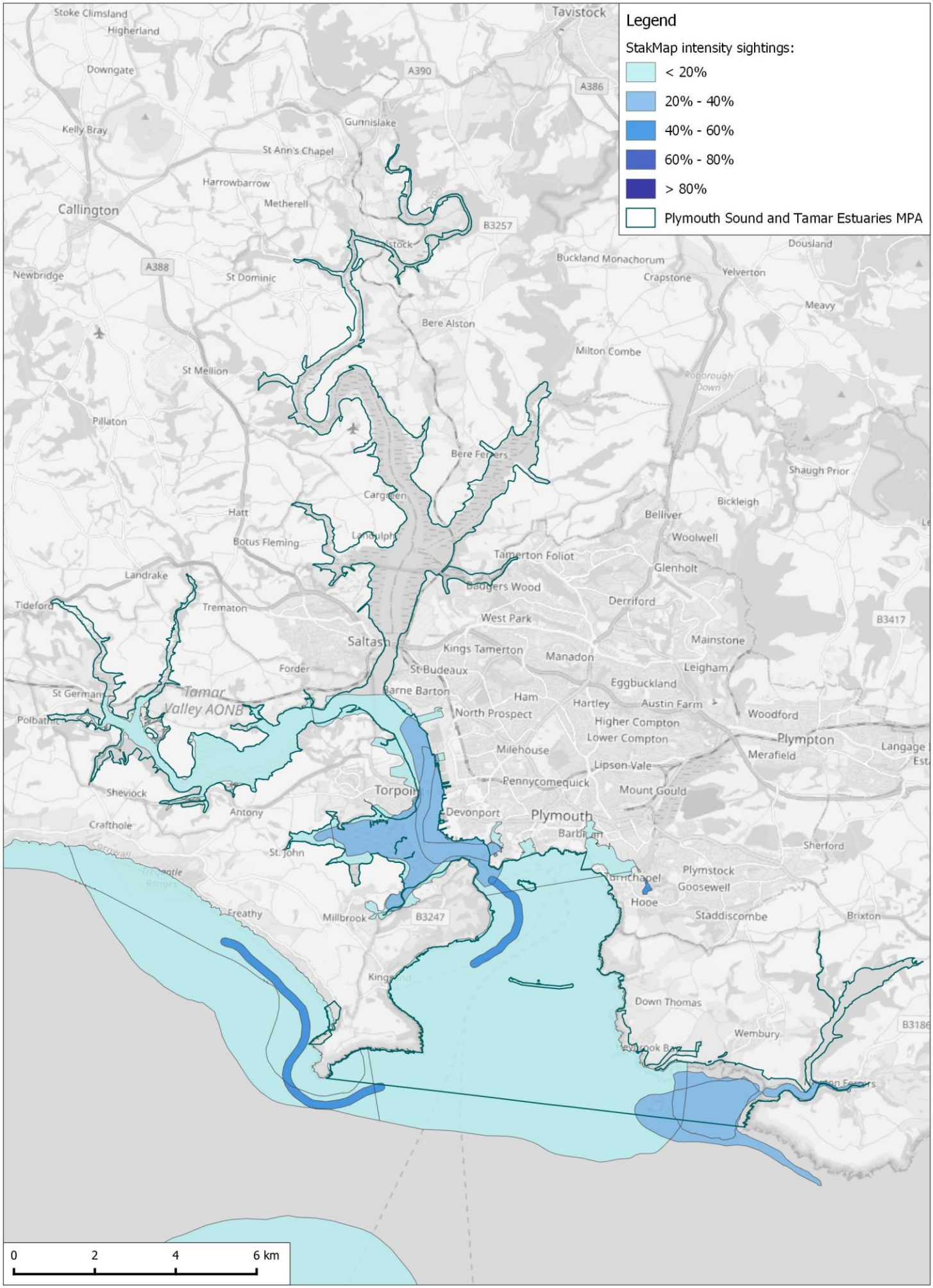
Map 23: Personal watercraft (e.g. Jet Skis) and towed watersports (e.g. waterskiing).
Sources: Marine Management Organisation (MMO1136)



Map 24: Areas used for shore angling.
Sources: Marine Management Organisation (MMO1163)



Map 25: Afloat marine anglers (including charters) derived from the StakMap surveys (2012).
Sources: Marine Management Organisation (MMO1163)



5. Discussion

5.1 This report is an initial desk study, compiling existing data to provide the basis for planning visitor survey work and to understand the current issues relevant to recreation use of the MPA. We have compiled data from a range of sources.

5.2 Outdoor recreation offers benefits to individuals' health and wellbeing, as well as opportunities for spending time in nature. However, any recreational activity has potential to impact negatively on the important habitats and species of the MPA. Therefore, understanding current recreation patterns and trends is important for effective management and mitigation.

5.3 The 2022 Watersports Participation Survey (The Nursery Research and Planning, 2023) found that 44.6% of adults regularly participate in watersports, an increase from 40.3% in 2020. This included 4.5% of adults who regularly participate in paddlesports, an increase from 2.8% in 2020. The portability of SUPs and inflatable kayaks means that they can be launched from a range of locations, so understanding where these are most frequently launched will be useful for mitigation e.g. with respect to signage and engagement.

5.4 Outdoor swimming has also grown in popularity over recent years, with Sport England estimating that over 606,000 people regularly participated in open water swimming (i.e. at least twice in the last 28 days) between November 2021 and November 2022[9].

5.5 The visitor surveys will provide up-to-date information on the types of activities that people are carrying out within the MPA and where exactly they are going during their visit. Once this data is digitised, it can be overlaid with some of the data on designated features to see where there may be concerns e.g. damage to the seabed.

[9] https://activelives.sportengland.org/

References

Addessi, L. (1994) 'Human disturbance and long-term changes on a rocky intertidal community', *Ecological Applications*, 4, pp. 786–797.

Anderson, L.G. *et al.* (2015) 'The Role of Tourism and Recreation in the Spread of Non-Native Species: A Systematic Review and Meta-Analysis', *PLOS ONE*. Edited by R. Britton, 10(10), p. e0140833. Available at: https://doi.org/10.1371/journal.pone.0140833.

anon (2017) 'Spreading like wildfire', *Nature Climate Change*, 7(11), p. 755. Available at: https://doi.org/10.1038/nclimate3432.

Arnberger, A. and Brandenburg, C. (2007) 'Past On-Site Experience, Crowding Perceptions, and Use Displacement of Visitor Groups to a Peri-Urban National Park', *Environmental Management*, 40(1), p. 34. Available at: https://doi.org/10.1007/s00267-004-0355-8.

Arnell, N.W., Freeman, A. and Gazzard, R. (2021) 'The effect of climate change on indicators of fire danger in the UK', *Environmental Research Letters*, 16(4), p. 044027. Available at: https://doi.org/10.1088/1748-9326/abd9f2.

Bax, N. *et al.* (2001) 'The Control of Biological Invasions in the World's Oceans', *Conservation Biology*, 15(5), pp. 1234–1246.

Bax, N. *et al.* (2003) 'Marine invasive alien species: a threat to global biodiversity', *Marine Policy*, 27(4), pp. 313–323. Available at: https://doi.org/10.1016/S0308-597X(03)00041-1.

Bayfield, N.G. and Aitken, R. (1992) *Managing the impacts of recreation on vegetation and soils: a review of techniques*. INSTITUTE OF TERRESTRIAL ECOLOGY (Natural Environment Research Council). Available at: http://nora.nerc.ac.uk/7904/.

Bejder, L. *et al.* (2006) 'Decline in Relative Abundance of Bottlenose Dolphins Exposed to Long-Term Disturbance', *Conservation Biology*, 20(6), pp. 1791–1798. Available at: https://doi.org/doi:10.1111/j.1523-1739.2006.00540.x.

Bright, A. *et al.* (2003) 'Effects of motorised boat passes on the time budgets of New Zealand dabchick, Poliocephalus rufopectus', *Wildlife Research*, 30(3), pp. 237–244.

Broad, A., Rees, M.J. and Davis, A.R. (2020) 'Anchor and chain scour as disturbance agents in benthic environments: trends in the literature and charting a course to more sustainable boating and shipping', *Marine Pollution Bulletin*, 161, p. 111683. Available at: https://doi.org/10.1016/j.marpolbul.2020.111683.

Burton, N.H., Rehfisch, M.M. and Clark, N.A. (2002) 'Impacts of disturbance from construction work on the densities and feeding behavior of waterbirds using the intertidal mudflats of Cardiff Bay, UK', *Environ Manage*, 30(6), pp. 865–71.

Burton, N.H.K. *et al.* (2002) 'Impacts of man-made landscape features on numbers of estuarine waterbirds at low tide', *Environ. Manage.*, 30(6), pp. 857–864.

Ceccherelli, G., Campo, D. and Milazzo, M. (2007) 'Short-term response of the slow growing seagrass Posidonia oceanica to simulated anchor impact', *Marine Environmental Research*, 63(4), pp. 341–349. Available at: https://doi.org/10.1016/j.marenvres.2006.10.004.

Collins, K.J., Suonpaa, A.M. and Mallinson, J.J. (2010) 'The impacts of anchoring and mooring in seagrass, Studland Bay, Dorset, UK', *Underwater Technology: The International Journal of the Society for Underwater*, 29(3), pp. 117–123.

Coyle, M. and Wiggins, S. (2010) *European Marine Site Risk Review*. Natural England Research Report NERR038. Natural England.

Cryer, M. *et al.* (1987) 'Disturbance of overwintering wildfowl by anglers at two reservoir sites in South Wales.', *Bird Study*, 34(3), pp. 191–199.

Environment Agency (2022) *The Extent and Zonation of Saltmarsh in England: 2016-2019*. Environment Agency.

Fitzpatrick, S. and Bouchez, B. (1998) 'Effects of recreational disturbance on the foraging behaviour of waders on a rocky beach', *Bird Study*, 45(Pt2), pp. 157–171.

Gill, J.A. (1996) 'Habitat choice in wintering pink-footed geese: quantifying the constraints determining winter site use', *Journal of Applied Ecology*, 33, pp. 884–892.

Graham, A.L. and Cooke, S.J. (2008) 'The effects of noise disturbance from various recreational boating activities common to inland waters on the cardiac physiology of a freshwater fish, the largemouth bass (Micropterus salmoides)', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 18(7), pp. 1315–1324. Available at: https://doi.org/10.1002/aqc.941.

Griffiths, C., Arnold, M. and Butler, J. (2016) *EMS Recreation Study Document 01. A brief investigation into the possible interaction and sensitivity of priority species and habitats to recreational activity within the Tamar Estuaries Management Plan area. A report for Plymouth City Council.* The Marine Biological Association.

Griffiths, C.A. *et al.* (2017) *Anchoring and Mooring Impacts in English and Welsh Marine Protected Areas: Reviewing sensitivity, activity, risk and management*. A report to Defra Impacts Evidence Group.

Groome, G., Denton, J. and Smith, P. (2018) *The impact of dogs on the environment*. CIEEM, pp. 12–16.

Harris, S. (2023) 'Beware the dog: the ecological and environmental impacts of pet dogs', *British Wildlife*, 34(7), pp. 487–496.

Hastie, G.D. *et al.* (2003) 'Bottlenose Dolphins increase breathing synchrony in response to boat traffic', *Marine Mammal Science*, 19(1), pp. 74–84. Available at: https://doi.org/10.1111/j.1748-7692.2003.tb01093.x.

Hillman, R. (2020) *Habitat mapping and monitoring of Allis shad (Alosa alosa) on the River Tamar. Natural England Research Report NERR1947.* Natural England.

Kühn, S., Rebolledo, E.L.B. and Franeker, J.A. van (2015) 'Deleterious Effects of Litter on Marine Life', in M. Bergmann, L. Gutow, and M. Klages (eds) *Marine Anthropogenic Litter*. Springer International Publishing, pp. 75–116. Available at: https://doi.org/10.1007/978-3-319-16510-3_4.

Langmead, O.A. *et al.* (2017) *EMS Recreation Study Document 03. Survey of recreational use within the Plymouth Sound and Estuaries European Marine Site*. Marine Biological Association of the UK.

Liddle, M.J. (1975) 'A selective review of the ecological effects of human trampling on natural ecosystems.', *Biological Conservation*, (5), pp. 251–255.

Liddle, M.J. (1997) *Recreation Ecology*. London: Chapman & Hall.

Liley, D. *et al.* (2012) *Identifying best practice in management of activities on Marine Protected Areas.* Footprint Ecology/Bright Angel Consultants/MARINElife Number 108.

Manchester, S.J. and Bullock, J.M. (2000) 'The impacts of nonnative species on UK biodiversity and the effectiveness of control.', *Journal of Applied Ecology*, 37, pp. 845–864.

Marine Management Organisation (2019) *Non-licensable Activity Impacts on Marine Protected Areas*. MMO1136. University of Hull / Marine Management Organisation.

Marine Management Organisation (2020) *Mapping Recreational Sea Anglers in English Waters*. MMO1163. Substance and Cefas / Marine Management Organisation.

Marine Management Organisation (2021) *High Priority Non-licensable Activities in MPAs*. MMO1243. ABPmer / Marine Management Organisation.

Milazzo, M., Chemello, R., Badalamenti, F. and Riggio, S. (2002) 'Short-term effect of human trampling on the upper infralittoral macroalgae of Ustica Island MPA (western Mediterranean, Italy)', *Journal of the Marine Biological Association of the UK*, 82, pp. 745–748.

Milazzo, M., Chemello, R., Badalamenti, F., Camarda, R., *et al.* (2002) 'The Impact of Human Recreational Activities in Marine Protected Areas: What Lessons Should Be Learnt in the Mediterranean Sea?', *Marine Ecology*, 23(2), pp. 280–290. Available at: https://doi.org/10.1111/j.1439-0485.2002.tb00026.x.

Molnar, J.L. *et al.* (2008) 'Assessing the global threat of invasive species to marine biodiversity', *Frontiers in Ecology and the Environment*, 6(9), pp. 485–492.

Nolet, B.A. *et al.* (2002) 'Habitat switching by Bewick's swans: maximization of average long-term energy gain?', *J. Anim. Ecol.*, 71(6), pp. 979–993.

Regel, J. and Putz, K. (1997) 'Effect of human disturbance on body temperature and energy expenditure in penguins', *Polar Biology*, 18(4), pp. 246–253.

Roberts, C. (2017) *Managing marine recreational activities: a review of evidence*. Natural England Commissioned Report 242. Report by ABPmer for Natural England.

Saunders, C. *et al.* (2000) *A review of the effects of recreational interactions within UK European marine sites*. UK CEED & Bournemouth University. Available at: file:///S:/reports%20%26%20pdfs/Papers%20linked%20to%20Endnote/CEED%20recreation%20marine%20sites.pdf.

Stevčić, Č. *et al.* (2018) 'Macroinvertebrate communities on rocky shores: Impact due to human visitors', *Estuarine, Coastal and Shelf Science*, 211, pp. 127–136. Available at: https://doi.org/10.1016/j.ecss.2017.11.026.

Stillman, R.A. and Goss-Custard, J.D. (2002) 'Seasonal changes in the response of oystercatchers Haematopus ostralegus to human disturbance', *J. Avian Biol.*, 33(4), pp. 358–365.

Stock, M. and Hofeditz, F. (1997) 'Compensatory limits: energy budgets of Brent Geese, Branta b. bernicla, the influence of human disturbance', *Journal für Ornithologie*, 138(4), pp. 387–411.

The Nursery Research and Planning (2023) *Watersports Participation Survey 2022*. The Nursery Research and Planning.

Thiel, D. *et al.* (2011) 'Winter tourism increases stress hormone levels in the Capercaillie Tetrao urogallus', *Ibis*, 153(1), pp. 122–133. Available at: https://doi.org/10.1111/j.1474-919X.2010.01083.x.

Thomas, K., Kvitek, R.G. and Bretz, C. (2003) 'Effects of human activity on the foraging behavior of sanderlings Calidris alba', *Biological Conservation*, 109(1), pp. 67–71. Available at: https://doi.org/10.1016/S0006-3207(02)00137-4.

Travaille, K.L., Salinas-de-León, P. and Bell, J.J. (2015) 'Indication of visitor trampling impacts on intertidal seagrass beds in a New Zealand marine reserve', *Ocean & Coastal Management*, 114, pp. 145–150. Available at: https://doi.org/10.1016/j.ocecoaman.2015.06.002.

Unsworth, R.K.F. *et al.* (2017) 'Rocking the Boat: Damage to Eelgrass by Swinging Boat Moorings', *Frontiers in Plant Science*, 8. Available at: https://doi.org/10.3389/fpls.2017.01309.

Walker, B.G., Dee Boersma, P. and Wingfield, J.C. (2006) 'Habituation of Adult Magellanic Penguins to Human Visitation as Expressed through Behavior and Corticosterone Secretion', *Conservation Biology*, 20(1), pp. 146–154.

Weimerskirch, H. *et al.* (2002) 'Heart rate and energy expenditure of incubating wandering albatrosses: basal levels, natural variation, and the effects of human disturbance', *J Exp Biol*, 205(Pt 4), pp. 475–83.

Wood, C. *et al.* (2018) *Tamar Estuaries Marine Biosecurity Plan 2018-2020*.

Yasué, M. (2005) 'The effects of human presence, flock size and prey density on shorebird foraging rates', *Journal of Ethology*, 23(2), pp. 199–204. Available at: https://doi.org/10.1007/s10164-005-0152-8.