Sanitary Survey - Review

Porlock – 2024

Document No. – *J0591/2024/01/17*

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Client	Food Standards Agency (FSA)
Project Title	Sanitary Survey Review
Document Title	Sanitary Survey - Porlock
Document Number	J0591/2024/01/17
Revision	3.0
Date	23 April 2024

Revisions

Revision No.	Date	Comment
0.1	30 January 2024	Draft for internal review
1.0	31 January 2024	Draft for client review
2.0	06 March 2024	Draft for secondary consultation
3.0	23 April 2024	Final

Document QA and Approval

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Approved	Joshua Baker	Senior Consultant	06 March 2024

Initial Consultation

Consultee	Date of consultation
Somerset Council	December 2023
Environment Agency	December 2023

Consultation on draft report

Consultee	Date of consultation
Somerset Council	March 2024
Environmental Agency	March 2024
Devon & Severn IFCA	March 2024

A sanitary survey relevant to the bivalve mollusc beds in Porlock was undertaken in 2015 in accordance with Regulation (EC) 854/2004 (which was replaced by assimilated EU Law Regulation (EU) 2017/625, with sanitary survey requirements now specified in assimilated EU Law Regulation (EU) 2019/627). This provided appropriate hygiene classification zoning and monitoring plan based on the best available information with detailed supporting

evidence. In line with regulatory and EU guidance the Food Standards Agency undertake targeted sanitary survey reviews to ensure public health protection measures continue to be appropriate. This report provides a review of information and recommendations for a revised sampling plan if required. Carcinus Ltd. (Carcinus) undertook this work on behalf of the FSA. Carcinus Ltd accepts no liability for any costs, losses or liabilities arising from the reliance upon or use of the contents of this report other than by its client.

Dissemination

Food Standards Agency, Somerset Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2024. Review of the Porlock 2015 Sanitary Survey. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in England and Wales under assimilated EU Law Regulation (EU) 2019/627.

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1 Introduction

1.1 Background

The Food Standards Agency (FSA) is responsible for carrying out sanitary surveys in classified production and relay areas in accordance with Article 58 of assimilated (EU) Regulation 2019/627 and the EU Good Practice Guide (European Commission, 2021). In line with these requirements, sanitary surveys must be reviewed to ensure public health protection measures continue to be appropriate. Carcinus is contracted to undertake reviews on behalf of the FSA.

The report considers changes to bacterial contamination sources (primarily from faecal origin) and the associated loads of the faecal indicator organism *Escherichia coli* (*E. coli*) that may have taken place since the original sanitary survey was undertaken. It does not assess chemical contamination, or the risks associated with biotoxins. The assessment also determines the necessity and extent of a shoreline survey based on the outcome of the desktop report and identified risks. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Porlock Review

This report reviews information and makes recommendations for a revised sampling plan for existing Pacific oyster (*Crassostrea gigas*) classification zones in Porlock (Figure 1.1). This review explores changes to the main microbiological contamination sources that have taken place since the 2015 sanitary survey was conducted. Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with Local Authorities (LAs), Inshore Fisheries and Conservation Authorities (IFCAs) and the Environment Agency (EA) responsible for the production area was undertaken in December 2023. Responses were received from the Environment Agency and the Local Authority. This supporting local intelligence is valuable to assist with the review and was incorporated in the assessment process.

Following production of a draft report, a wider **external second round of consultation** with responsible Local Enforcement Authorities (LEAs), Industry and other Local Action Group (LAG) members was undertaken in March 2024. It is recognised that dissemination and inclusion of a wider stakeholder group, including local industry, is essential to sense-check findings and strengthen available evidence. The draft report is reviewed taking into account the feedback received.

The review updates the assessment originally conducted in 2015 and sampling plan as necessary and the report should read in conjunction with the previous survey.

Specifically, this review considers:
(a) Changes to the shellfishery (if any);
(b) Changes in microbiological monitoring results;

(c) Changes in sources of pollution impacting the production area or new evidence relating to the actual or potential impact of sources;

(d) Changes in land use of the area; and

(e) Change in environmental conditions.

Sections 2 - 6 detail the changes that have occurred to the shellfishery, environmental conditions and pollution sources within the catchment since the publication of the original sanitary survey. A summary of the changes is presented in section 7 and recommendations for an updated sampling plan are described in section 8.

1.3 Assumptions and limitations

This desktop assessment is subject to certain limitations and has been made based on several assumptions, namely:

- Accuracy of local intelligence provided by the Local Authorities and Environment Agency
- The findings of this report are based on information and data sources up to and including January 2024;
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data have been taken directly from the Cefas data hub[1], with no additional verification of the data undertaken. Results up to and including December 2023 have been used within this study. Any subsequent samples have not been included.

[1] Cefas shellfish bacteriological monitoring data hub. Available at: https://www.cefas.co.uk/data-and-publications/shellfish-classification-and-microbiological-monitoring/england-and-wales/.

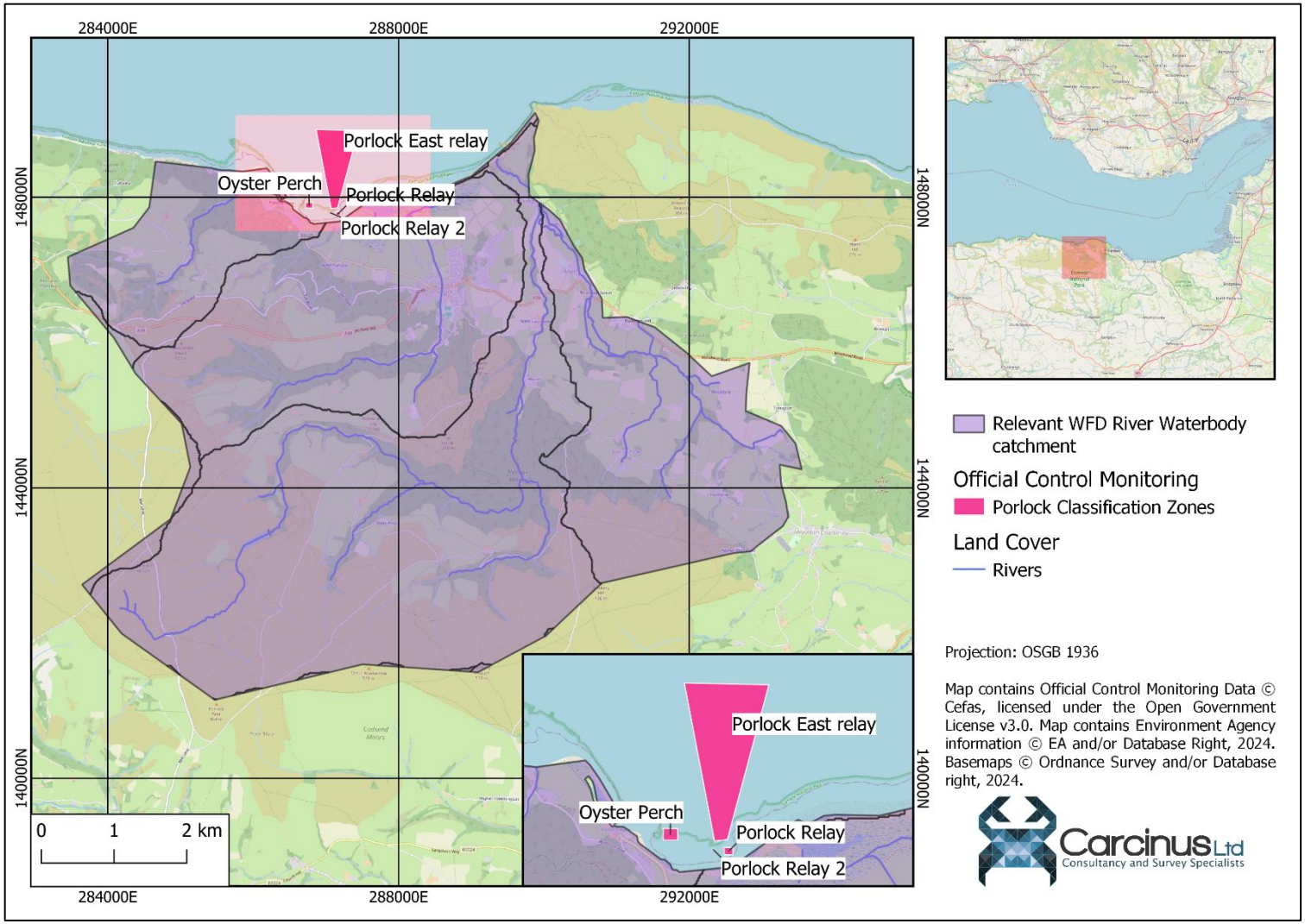

Figure 1.1 Location of the Porlock relaying area in Somerset. Inset map shows the locations of the Classification Zones within the BMPA.

2 Shellfisheries

2.1 Description of Shellfishery

The Porlock bivalve mollusc relaying area (BMRA) is situated on the coastline of the small village of Porlock, Somerset, in the outer Bristol Channel Figure 1.1. The Pacific oyster fishery is located on the sandy intertidal area of Porlock Bay. The closest BMPA is that of the Taw/Torridge production area (Cefas Site Reference M036) which is approx. 43 km south west. Porlock falls within Exmoor National Park.

The Local Enforcement Authority (LEA) for this fishery in terms of food hygiene Official Control purposes (including sampling) is Somerset West and Taunton Council. At the time of the original sanitary survey, the fishery was undergoing a pilot trial of Pacific oyster culture with plans to use the intertidal area for trestle culture and the subtidal for oyster cages. The area was also trialled for mussel harvesting between 2014 - 2015, however it was noted that high levels of bird predation caused this to be abandoned. If the oyster trials were successful, the plan was to expand rapidly and production projections were around 25 tonnes of Pacific oysters in 2018, with further expansion from then onwards. The current operation involves relaying Pacific Oysters, which mainly originate from the following BMPAs: Bigbury and Avon (Cefas Site Ref: M030), the Fal (M033), the Camel (M035) and one in Scotland (ref unknown). Further trails for native oysters and mussels have not yet been started, and may be planned for the future (pending relevant permissions being granted).

The area is owned by Porlock Manor Estate and the Crown Estate. At the time of writing (January 2024), no consultation response had been received from Devon and Severn Inshore Fisheries and Conservation Authority (D&S-IFCA), and the authors of this review have no information to suggest that this situation has changed. No D&S-IFCA byelaws apply to the harvesting of oysters within this shellfishery. This was confirmed by D&S-IFCA at secondary consultation.

A summary of the fishery for Pacific oysters is provided in the subsequent paragraphs.

2.1.1 Pacific oyster

At the time the original 2015 sanitary survey was written, the fishery was in the early stages of development. It was a community project initiated and managed by Porlock Futures Group (community interest company). The fishery consisted of trial Pacific oyster culture over eight trestles in two discrete blocks on the intertidal zone. It was planned for the intertidal to be used for trestle culture (whereby oysters would be hardened before going to market), and the subtidal would be for the majority of stocks grown in oyster cages. All harvesting would be by hand.

The initial trials in Porlock Bay were a success with high growth, low mortality, and class A status. Porlock Bay Oysters was then established as a commercial venture, and in 2019 a local businessman was able to provide necessary financial support to continue operations[2].

[2] https://www.porlockbayoysters.co.uk/pages/our-heritage

During initial consultations, the LEA stated the current commercial landings from Porlock Bay of relayed Pacific oysters is approximately 13 tonnes per year. There are currently no new areas in Porlock Bay that require classification.

2.1.2 Other Species

The 2015 Sanitary Survey mentions applying the same methods of culture to native oysters in Porlock, however the authors of this study have not been made aware of any further applications to harvest alternate species here.

Seeded mussel ropes were also trialled alongside Pacific oysters in 2014, however this was unsuccessful. During initial consultations for this study, the LEA stated they had received an enquiry regarding farming mussels since 2015 however it was not pursued.

2.2 Classification History

The 2015 Sanitary Survey gave recommendations for one RMP (representative Monitoring Point) to be located on the eastern-most extremity of the trestles on the lower intertidal. This RMP represented one Classification Zone (CZ). Currently, there are 4 CZs and 4 RMPs all for Pacific Oysters. The location and classification status of all active CZs and RMPs sampled in the area are presented in Table 2.1 and Figure 2.1. Please note, Porlock Relay (B094E) is currently used for sampling purposes only; there is no harvesting/relaying within that CZ but continued classification is required.

Table 2.1 Summary of all active Classification Zones in the Porlock BMPA.

Classification Zone	Species	Current Classification (as of September 2023)	RMP
Porlock East relay	Pacific oyster	A	Porlock East (C. gi) – B094D
Oyster Perch	Pacific oyster	A	Oyster Perch (C. gi) – B094F
Porlock Relay	Pacific oyster	A	Porlock Relay (C. gi) – B094E
Porlock Relay 2	Pacific oyster	A	Porlock Relay 2 (C. gi) – B094G

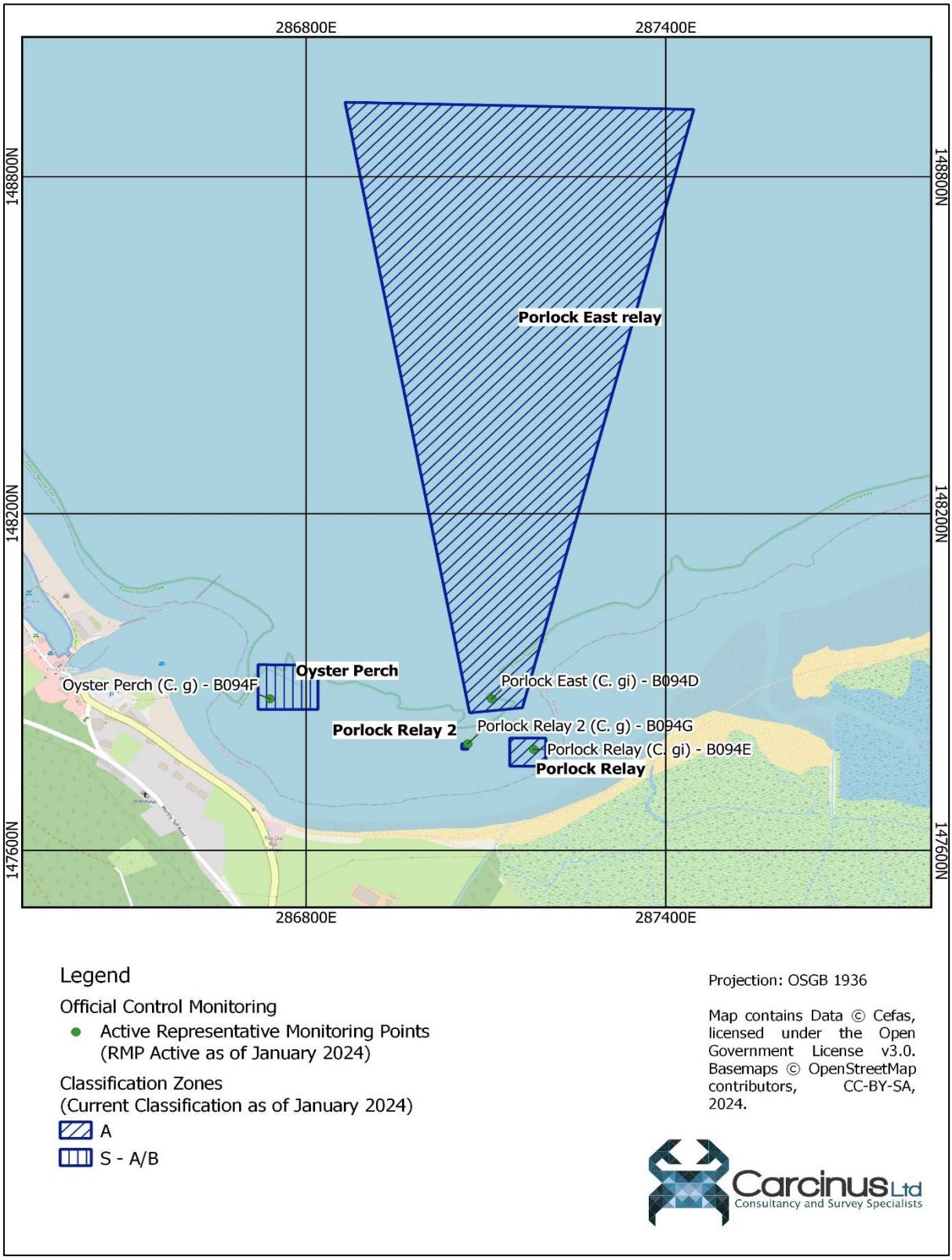

Figure 2.1 Current Classification Zones and associated Representative Monitoring Points in the Porlock bivalve mollusc relaying area.

3 Pollution sources

3.1 Human Population

The 2015 Sanitary Survey cites population data based on the 2011 Census of the United Kingdom. A subsequent census was conducted in March 2021 and so the results of the two censuses have been compared to give an indication in the changes in human population within the Porlock Catchment.

Figure 3.1 shows the human population density (persons per square kilometre) in Census Output Areas wholly or partially contained within the Porlock Catchment at the 2011 and 2021 Censuses. It shows that the population across the catchment has remained very rural, with the majority of the catchment having population densities of less than 100 people per square kilometre. The highest population densities are the town of Porlock itself, situated south of the CZs, and the neighbouring villages of Allerford and Bossington. The total population in the catchment was approximately 3,104 at the time of the last census (2011). The population in 2021 was approximately 3,138, an increase of approximately 1%. The Shellfish Water Action Plan for Porlock classifies the overall contribution of various sources of contamination to the shellfish water, but does not mention effects of population so it can be assumed this is relatively low.

The highest potential for urban associated runoff comes from the village of Porlock with closest proximity to the CZs. During initial consultations, the LA confirmed some small-scale housing development is likely to have occurred since the 2015 Sanitary Survey, but that this was generally one or two houses at a time and often involved upgrading/renovating existing properties rather than the construction of homes on a large scale. As these settlements are very small the overall level of urban runoff the shellfishery is likely to experience is small in comparison to other sources of contamination, which are discussed later in this report.

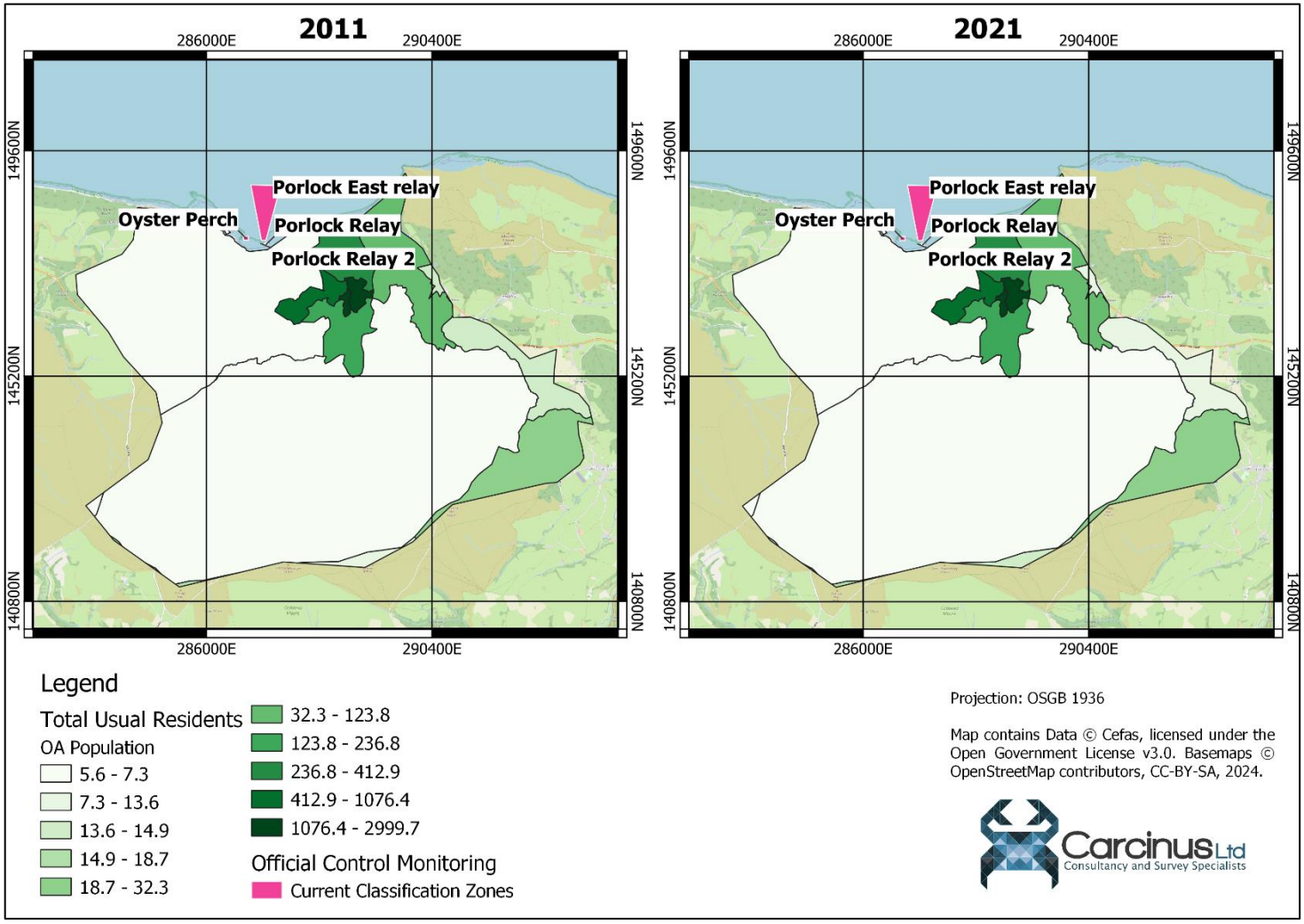

Figure 3.1 Human population density (persons per square kilometre) in Census Output Areas wholly or partially contained within the Porlock catchment at the 2011 and 2021 Censuses.

The 2015 Sanitary Survey does not include tourism statistics for Porlock but given the entire catchment is within Exmoor National Park, it is likely there are seasonal fluctuations in tourists to Porlock, with higher numbers visiting during the summer months. There are caravan and campsites within the catchment area as well as several bed and breakfasts, and hotels[3]. The peak population within the catchment is likely to occur in the summer months of June – September and will result in increased loading to the wastewater treatment network. During initial consultations, neither the LEA nor Environment Agency raised concerns regarding the adequacy of the network in handling this increase.

Analysis of Census data shows that there has been a 1% increase in populations between 2011 and 2021, but that the majority of the catchment is rural with population densities of less than 100 people per square kilometre. The main urban centres have not changed significantly since the 2015 Sanitary Survey was published, and the area continues to be a popular tourist destination. Overall, the recommendations made in the 2015 Sanitary Survey to account for the impact of human populations remains valid.

3.2 Sewage

Details of all consented discharges in the vicinity of the Porlock BMRA were taken from the most recent update to the Environment Agency's national permit database at the time of writing (November 2023 Update). The locations of these discharges within the catchment and near the Classification Zones are shown in Figure 3.2.

[3] https://www.porlock.co.uk/

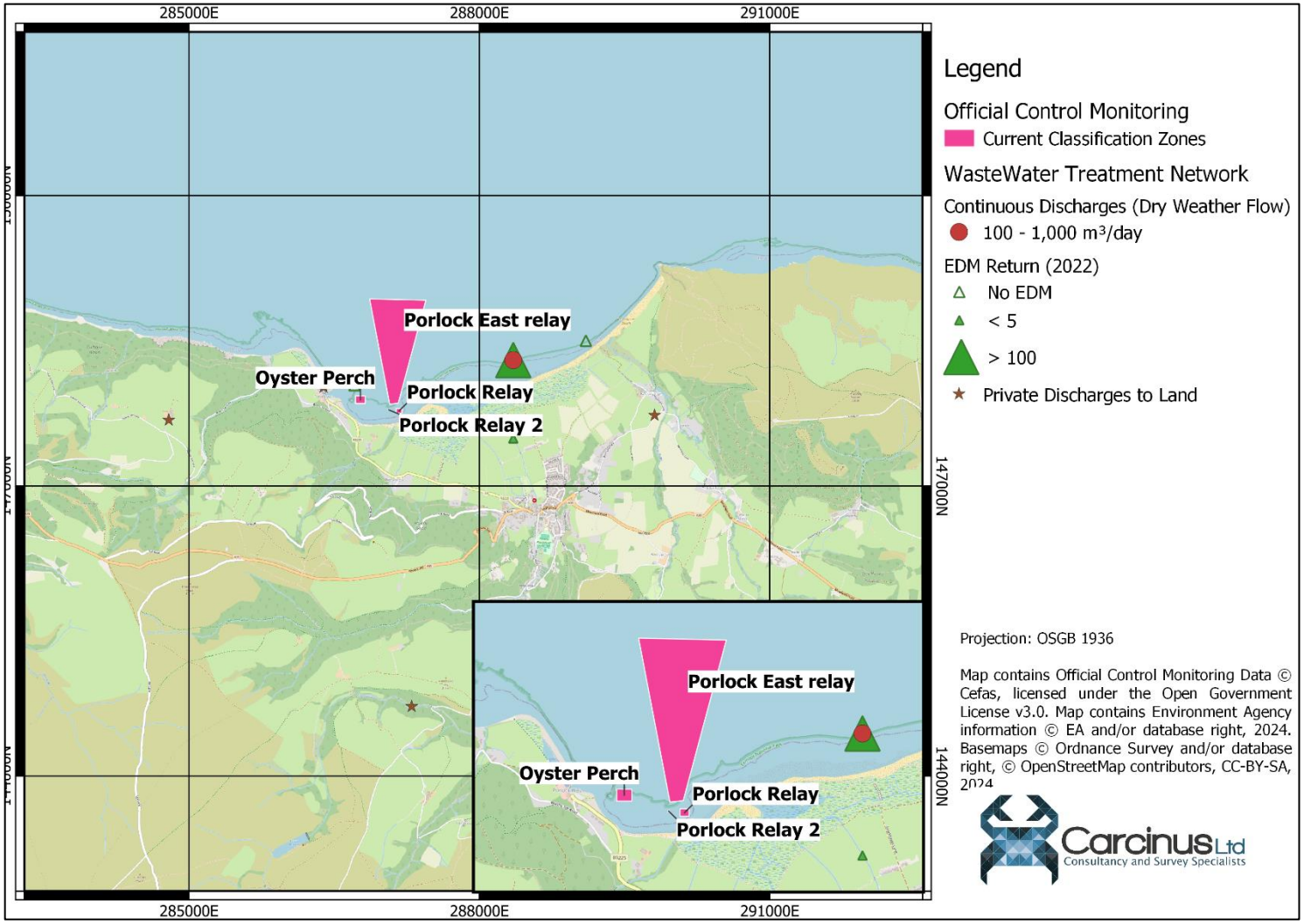

Figure 3.2 Location of all consented discharges in the Porlock Catchment. Details of consented discharges are shown in Table 3.1.

Table 3.1 Details of continuous discharges within the vicinity of the Porlock BMPA.

Discharge Name	Permit Number	Receiving Water	Outlet NGR	Treatment Methodology	DWF (m^3/day)	Distance (km) from centre of nearest CZ
PORLOCK WASTEWATER TREATMENT WORKS	100318	PORLOCK BAY HAWKCOMBESTREAM (C)	SS8835048300	MEMBRANE FILTRATION	668	1.2 (Porlock East Relay)

The 2015 Sanitary Survey identified one continuous discharge in the vicinity of the Porlock BMPA. This discharge is still active, remains the only continuous discharge in the catchment, and has seen no change in the treatment or dry weather flow (DWF) of 668 m^3/day. This discharge is to the east of the fishery, and the previous sanitary survey stated that the membrane plant is continuously effective at removing bacteria from the effluent, so the bacterial loading generated is very low. At initial consultation the EA stated that in 2019 the membrane bioreactor plant was taken offline to be replaced and modernised. The work was completed in August 2020. Bacterial die off and dilution is also likely to occur before any discharge from Porlock WWTW reaches the nearest CZ (Porlock East Relay) and so this continuous discharge is likely to have little influence on contamination in the fishery, as the 2015 survey indicated.

In addition to the continuous discharge identified, the 2015 Sanitary Survey shows four intermittent discharges with the potential to impact the bacteriological health of the BMRA. These four discharges remain in place today, and no additional intermittent discharges have been identified in the catchment. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs), Pumping Station Emergency Overflows (PSs), and Sewer Pumping Stations (SPSs). At the time of the 2015 survey, Porlock Weir PS was closed but has since reopened and discharges 160 m from the nearest CZ (*Oyster Perch*). Event Duration Monitoring (EDM) data shows 0 spills in 2022. Porlock CSO and Porlock STW discharge to Hawkcombe Stream at the same place approximately 1.5 km upstream. Porlock STW was identified in 2015 to have a potential impact on the shellfishery given its spill activity. In 2022, it spilled 11 times for 144.25 hours. Some bacterial die off will occur before discharge reaches the fishery given the distance to the nearest CZ (*Porlock East Relay*). Bossington PS discharges to the intertidal area about 2 km east of the fishery. Currently, there is no available spill data for the Bossington PS. The presence of intermittent discharges near Classification Zones should still be taken into consideration in any updated sampling plan. A shoreline survey was recommended to assess these intermittent discharges further, and this was carried out in January 2024.

Although the majority of properties within the survey area are served by water company sewerage infrastructure, there are also 4 permitted private discharges. These are all small, serving one or a small number of properties, and provide treatment via septic tank or small secondary treatment plants. Limited details of these private discharges can be provided due to data protection requirements. All 4 of these discharge to soakaway so should be of no impact on coastal waters assuming they are functioning correctly. Initial consultations with the EA suggested that there may be some unregistered private discharges within the catchment historically, but these are likely limited in number and discharge a small amount (< 10m^3 per day). No consideration for private discharges is necessary in any updated sampling plan.

At initial consultation the EA stated that Water Company investigations into asset performance across the catchment will be carried out in the future. At secondary consultation, the EA stated that Wessex Water are currently drafting plans to do this as part of the water industry national environment programme (WINEP), and that the complete agreed WINEP will not be available until December 2024. The deadline indicated by Defra for Shellfish Water Investigations is 30/04/2027.

3.3 Agricultural Sources

The 2015 Sanitary survey cites livestock data from 2013, with 24,891 sheep in the catchment and 790 cattle. Sheep were also observed on the low-lying grassland by the lagoon during the shoreline survey that accompanied this assessment. To provide an indication of changes in the livestock population of the catchment, a data request was made to the Farming Statistics Office for the Department of Environment, Food and Rural Affairs (DEFRA) for livestock populations within the catchment presented in Figure 1.1 for 2016 and 2021 based on the June Survey of Agriculture and Horticulture[4].

The data presented in Figure 3.3 shows that between 2016 and 2021 the number of Cattle in the catchment has increased by 231 and the number of Sheep has decreased by 708. This has led to an overall livestock decrease from 2016 to 2021. No pigs or poultry are noted in the catchment, and sheep are the dominant livestock group in both years.

The principal route of contamination of coastal waters by livestock is surface runoff carrying faecal matter. The land cover of the Porlock catchment in 2012 and 2018 is shown in Figure 3.4. The maps show that the majority of the catchment is rural which is to be expected given Porlock is located in Exmoor National Park. The main areas of urban fabric are located close to the shellfish beds, and then to the north and east the catchment is arable land and pasture. The remainder of the catchment is a mix of arable land, pasture, forest, and grassland/heathland. The maps show no increase in urban fabric, and therefore no increase in urban runoff. Pasture areas adjacent to shorelines represent the greatest contamination risk to the classification zones. This is due to runoff from the land travelling less distance before reaching the CZs, resulting in less dilution and *E. coli* die-off. Runoff from rivers further up the catchment will have a lower risk of contamination to the CZs, because the increased distance will result in greater dilution and *E. coli* die-off. These may however contribute to background levels of contamination in the CZs, particularly following significant rainfall events.

There is likely to be seasonality in levels of contamination originating from livestock. Numbers of sheep and cattle will increase significantly in the spring, with the birth of lambs and calves, and decrease in the autumn when animals are sent to market. During winter, cattle may be transferred from pastures to indoor sheds, and at these times slurry will be collected and stored for later application to fields and arable farmland. The timing of this is uncertain, although farms without large storage capacities are likely to spread during the winter and spring. The spreading of slurry to fields is controlled under the Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018, known as the Farming Rules for Water, which came into force in April 2018. This legislation lays out a set of rules that require good farming practice, so that farmers manage their land both to avoid water pollution and benefit their business. Rules include requiring farmers to judge when it

[4] June Survey of Agriculture and Horticulture. Further information available at: https://www.gov.uk/guidance/structure-of-the-agricultural-industry-survey-notes-and-guidance#june-survey-of-agriculture-and-horticulture-in-england.

is best to apply fertilisers, where to store manures and how to avoid pollution from soil erosion. Furthermore, silage and slurry storage for agricultural purposes is subject to The Water Resources (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO). All farmers must comply with the SSAFO regulations when building new slurry stores, or substantially altering (e.g., enlarging) existing ones. All stores must be built at least 10 m from any watercourse, including field drains or ditches, and be built or altered to last for at least 20 years with proper maintenance. Since 2021, the EA now has ART (Agricultural Regulatory Taskforce) Officers that have all been assigned a catchment and will engage, inspect, advise and if necessary, enforce the Silage, Slurry and Agricultural Fuel Oil regulations and the new (2018) Farming Rules for Water. In theory, these legislative changes should have reduced the pollution that this activity causes to shellfish beds.

During the January 2024 Shoreline Survey, many of the fields backing the saltmarsh contained livestock, with sheep and horses the main groups. It did not appear that any livestock had direct access to the marsh for grazing. Water samples taken from land runoff from these fields contained low concentrations of *E. coli*. Silage barrels were also observed in one of the fields.

The 2022 Shellfish Action Plan for the Porlock shellfish water does not include any additional information on farming, or work with the farming community. It assesses that the effect of agricultural contamination on contamination levels in the area is yet to be confirmed. During times of heavy rainfall, livestock runoff may contribute contamination to the saltmarsh that ultimately drains to Porlock Bay, although the pathway for contamination will be via the existing watercourses rather than direct deposition in the intertidal zone.

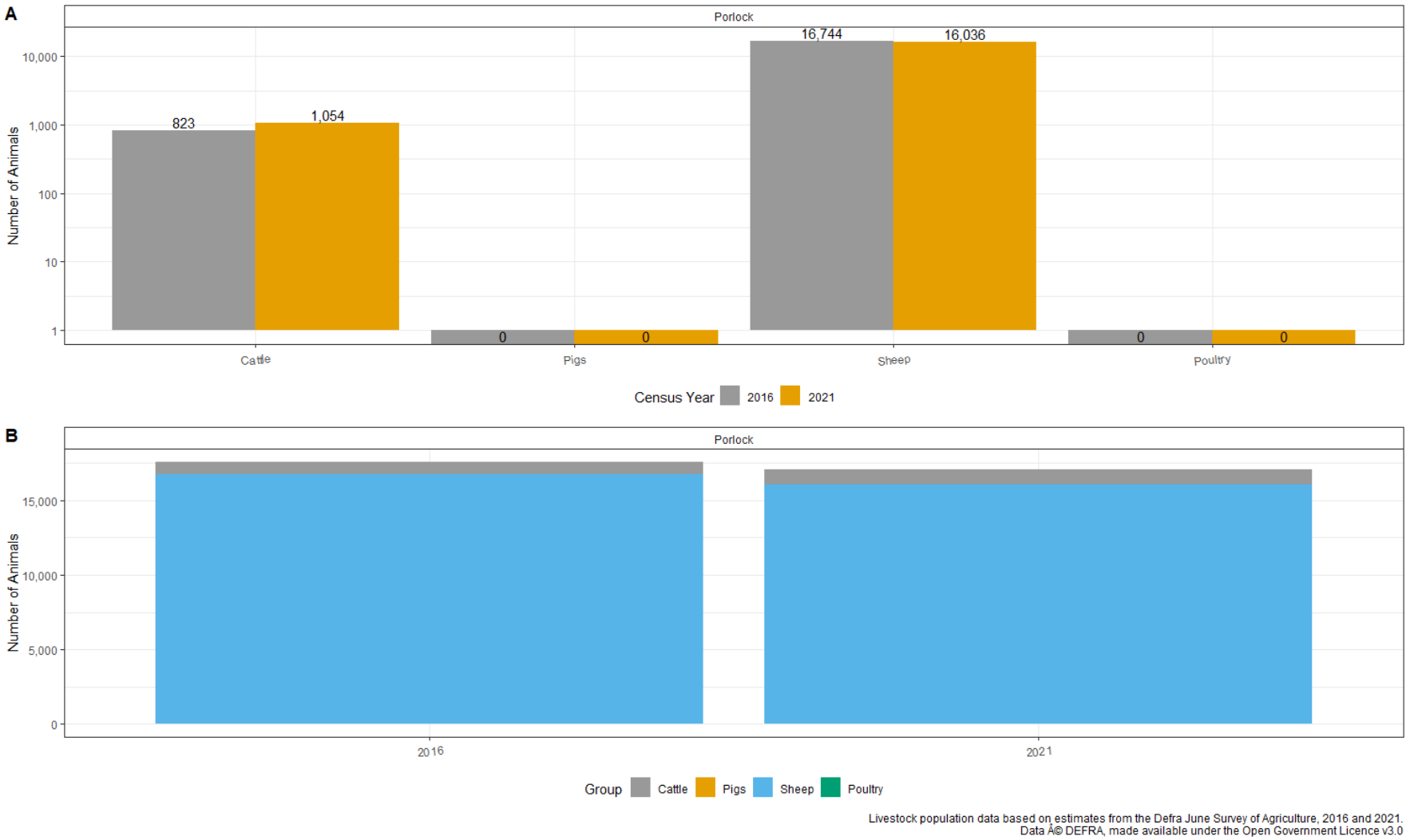

Figure 3.3 Changes in livestock populations in the Porlock BMRA catchment from 2016 and 2021.

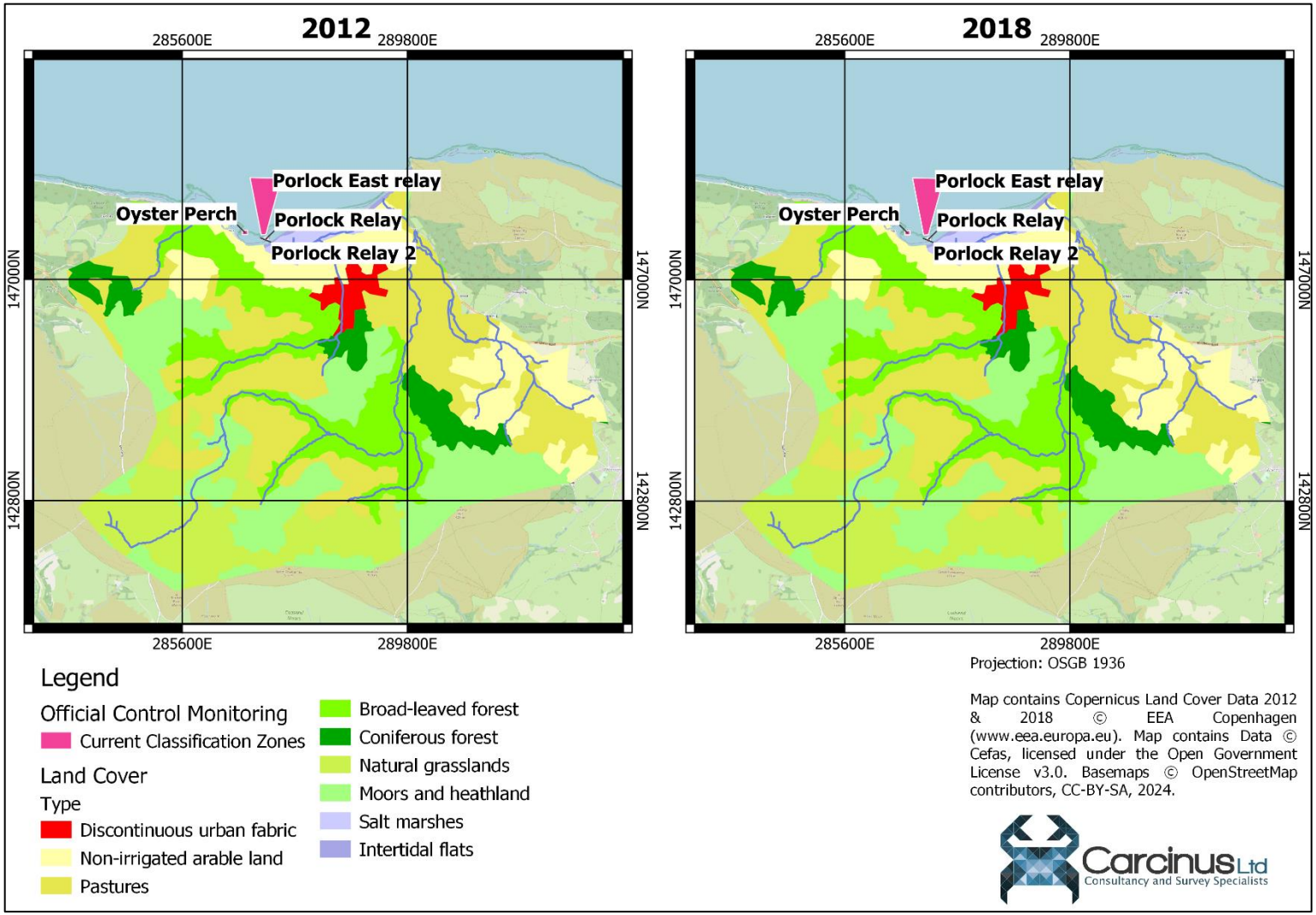

Figure 3.4 Land cover change in the Porlock catchment in 2012 and 2018.

3.4 Wildlife

Overwintering and wading birds often represent a potentially significant source of microbiological contamination to shellfisheries because avian species frequently forage (and therefore defecate) on areas of shellfish beds. There is a 158 Ha Site of Special Scientific Interest (SSSI) present at Porlock Bay[5] due to the shingle beach and saltmarsh habitat. This attracts various wildlife throughout the year.

Figure 3.5 shows the temporal trend in total overwintering waterbird counts from the winters of 2015/2016 to 2021/2022 (the most recent for which data are available) at Porlock Marsh. It shows that the dominant group in terms of population size are gulls, with small populations of other groups throughout.

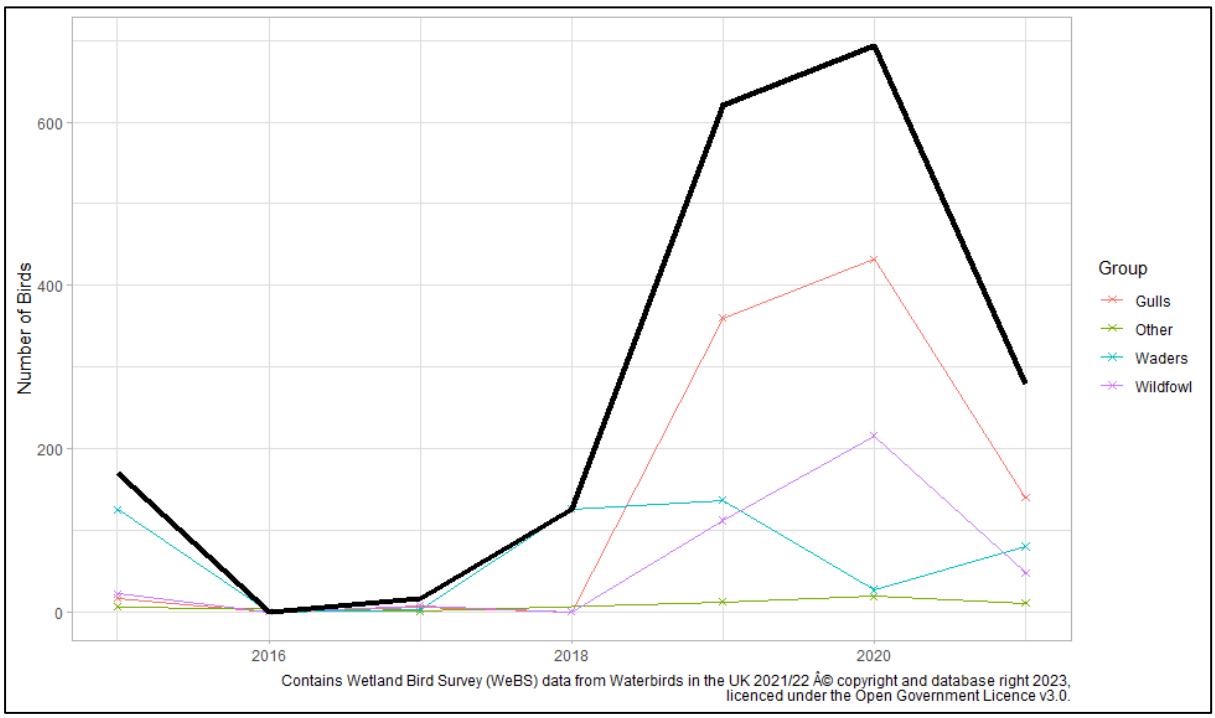

Figure 3.5 Temporal trend in waterbird counts from Porlock Bay. Data from the Wetland Bird Survey (Austin et al., 2023). Black line indicates total number of birds.

The 2015 sanitary survey describes that some overwintering birds use the saltmarsh, grassland, and intertidal area during the winter months, and the marsh is considered locally important for conservation. In the five winters to 2021/2022 an average of 178 waterbirds were counted (Austin *et al.*, 2023). A large increase in the total number of birds was seen between 2018 and 2020, which has since seen a decline. The largest aggregations of waterbirds, and therefore the highest risk of contamination due to defecation, will occur in winter months. The distribution of waterbirds within the estuary will be driven by the aggregations of their foraging resource, which will shift from year to year. The precise timing

[5] https://www.exmoor-nationalpark.gov.uk/__data/assets/pdf_file/0012/223410/Vision-Document.pdf

and locations of the contamination will therefore be variable, and it is challenging to define RMPs which reliably capture this source of pollution.

The closest seal populations to Porlock Bay identified in the 2015 Sanitary Survey are at Carmarthen Bay and Lundy Island. Marine mammals such as seals may also contribute some contamination, particularly when foraging in the area which is periodic. However, the area is not considered to be a significant habitat for this group and so any contamination will be occasional and minimal and does not need to be taken into consideration in the placement of RMPs for this BMPA. In addition, dolphins and harbour porpoises are also often sighted in small numbers within the survey area[6] but it is not possible to define an RMP location which will reliably capture their impacts given the spatial and temporal variation these species exhibit.

3.5 Boats and Marinas

The 2015 Sanitary survey mentions that the discharge of sewage from boats is a potential source of bacterial contamination to the fishery in Porlock Bay. Boating activities in the area have been derived through analysis of satellite imagery and various internet sources and compared to that described in the 2015 Sanitary Survey Review. Their geographical positions are shown in Figure 3.6.

Porlock Weir is a small drying harbour only accessible to smaller vessels around high water. Satellite imagery accessed at the time of writing this report shows between 30-40 small pleasure craft in and around the harbour. During the January 2024 Shoreline Survey, approximately 15 vessels were present in the harbour at low water, many of which were too small to contain onboard toilets. The vessels that are large enough to contain onboard toilets are unlikely to have holding tanks for sewage waste due to their size and so represent minimal risk of bacteriological contamination in the BMRA. Porlock does not have sewage pump-out facilities, and the nearest is Swansea (50 km across the Bristol Channel (*The Green Blue*, 2022). Currently, no fishing vessels list Porlock Harbour as their home port (gov.uk, 2024), however Porlock Weir Charters does advertise fishing trips in and around the Bay (*Porlock Weir Charters*, 2022). No vessels over 10 m are present in the catchment, most probably due to the restricted bathymetry. Bristol Channel is a major shipping lane, and therefore potential contamination may be present because of this. The legislation governing the release of overboard discharges from merchant vessels prohibits them from making overboard discharges within 3 nautical miles of land.

Boating activity in the bay is likely to be seasonal. Porlock is a popular tourist destination during summer months and consequently the levels of background contamination due to discharges from private vessels fitted with on-board toilets are likely to increase. It is not possible to predict the timing and severity of any impacts on the shellfishery as a result of this source of contamination, though the diffuse nature of it means it is unlikely to have

[6] https://www.somersetwildlife.org/what-we-do/restore-somersets-nature/create-living-landscapes/somersets-living-coast/seawatch

significant impact and does not need to be taken into consideration with regards to RMP location.

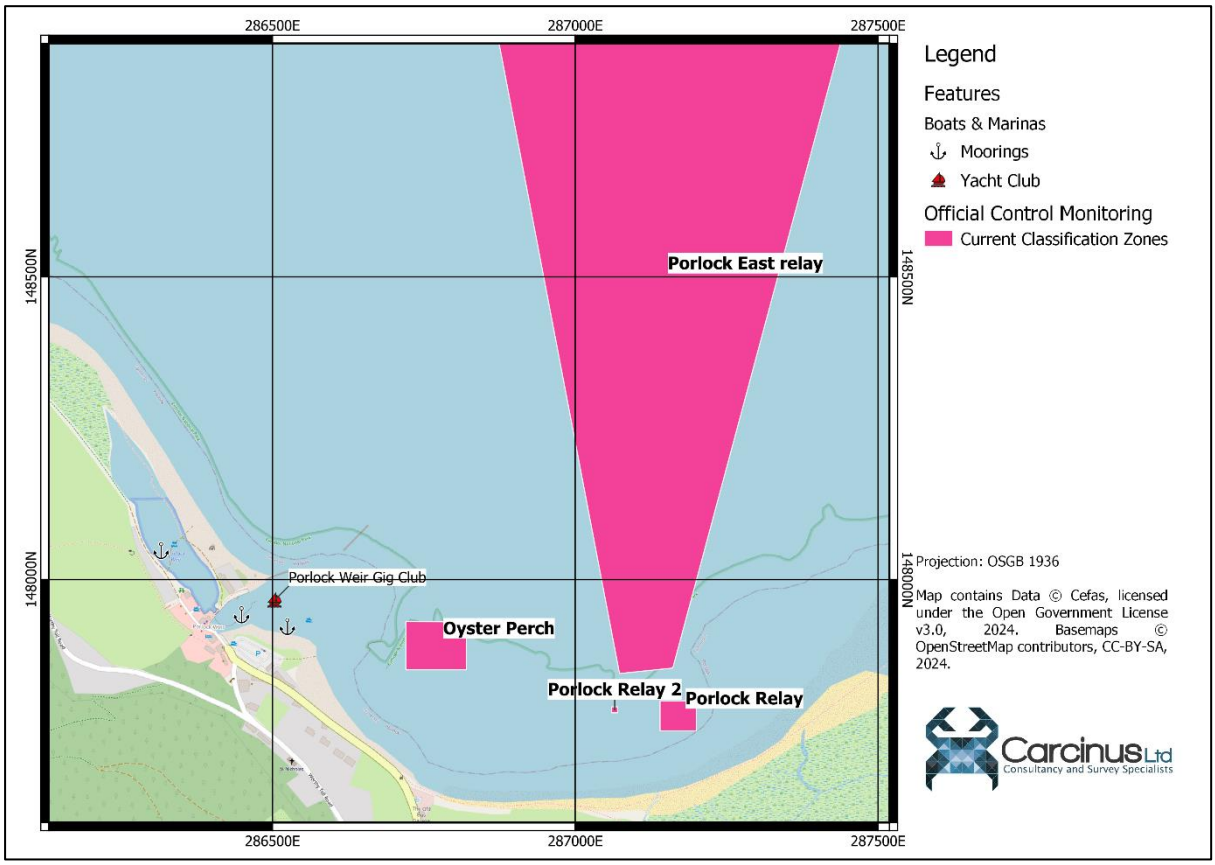

Figure 3.6 Locations of boats, marinas and other boating activities in the vicinity of the Porlock BMPA.

3.6 Other Sources of Contamination

Dog walking takes place on coastal paths and beaches around Porlock Bay and is therefore likely to represent a potential source of diffuse contamination to the near shore zone. Some dog waste was evident during the January 2024 Shoreline Survey. As a diffuse source, it will have little influence on the location of RMPs and so does not need further consideration.

Utility misconnections are when foul water pipes are wrongly connected and enter surface waters without treatment, potentially putting raw sewage directly into watercourses via surface water drains. To date, the EA has not carried out any misconnection work in the Porlock Bay catchment, and during consultation, stated that it is not considered to be a significant source of contamination. No evidence of misconnection (high *E. coli* concentrations in urban land drainage) was found during the January 2024 Shoreline Survey.

A flap valve was identified beneath the Porlock Weir Hotel during the January 2024 Shoreline Survey. Following secondary consultation, it was confirmed by the EA it is a Public Surface Water sewer linked to inland water courses and highway drainage. It may occasionally carry some contamination to the shellfish water, however during the shoreline

survey a water sample was taken as close to the valve as possible and contained a very low concentration of *E. coli* (26 CFU/100 ml). The flap valve is unlikely to have any significant impact on the BMRA.

4 Hydrodynamics/Water Circulation

Porlock Bay is a small and open embayment facing northwest into the Bristol Channel (outer). The bathymetry is relatively straightforward, sloping gently away to max. depth of 14 m (relative to chart datum) in the outer reaches of the bay. The openness of the location results in higher potential for dilution and water exchange particularly regarding contamination. Increases of current speed are noted at Gore Point (to the west) and Hurlstone (to the north-east). There is a small intertidal lagoon about 1 km east of Porlock Weir which Hawkcombe Stream discharges to, and potential contamination from this stream is therefore carried into Porlock Bay on the ebb tide. The saltmarsh behind Porlock Bay drains through a single breach in the cobble beach out into the embayment, 600 m east of the *Porlock Relay* CZ.

The tidal range in the area is large (2015 Sanitary survey states 9.3 m on spring tides and 3.9 m on neap tides, unchanged to date) which drives extensive water movement. Tides in the Bristol Channel flood in an easterly direction and ebb in a westerly direction. They are likely to be slower over shallower and more intertidal areas due to friction. The CZs are majority intertidal, with only *Porlock East relay* stretching out into subtidal. The dilution potential will be greater in subtidal areas than intertidal areas, where contamination may sit in intertidal pools some time.

5 Rainfall

A complete record of the rainfall data from the Lucott Farm rainfall monitoring station at NGR: SS 8745345013 (ID: 397156) was downloaded from the Environment Agency's hydrology data explorer[7]. This station was chosen as it is the closest monitoring station to the BMRA with records spanning dates preceding the publication of the 2015 Sanitary Survey. This monitoring station is 3 km south of the nearest CZ (*Porlock Relay*). The data were subdivided into 2008 – 2015 (pre-sanitary survey) and 2015 – present (post sanitary survey) and processed in R (R Core Team, 2021). These data were used to determine whether any changes in rainfall patterns had occurred since the original sanitary surveys were published. The rainfall data are summarised in Table 5.1 and the rainfall levels per month are shown in Figure 5.1.

[7] Environment Agency's Hydrology Data Explorer. Available at: https://environment.data.gov.uk/hydrology/explore#/landing.

Table 5.1 Summary statistics for rainfall preceding and following the 2015 Sanitary Survey Review.

Period	Mean Annual Rainfall	Percentage Dry Days	Percentage Days Exceeding 10 mm	Percentage Days Exceeding 20 mm
2008 - 2015	852.73	36.49	35.36	22.27
2015 - 2024	991.66	37.24	34.63	21.48

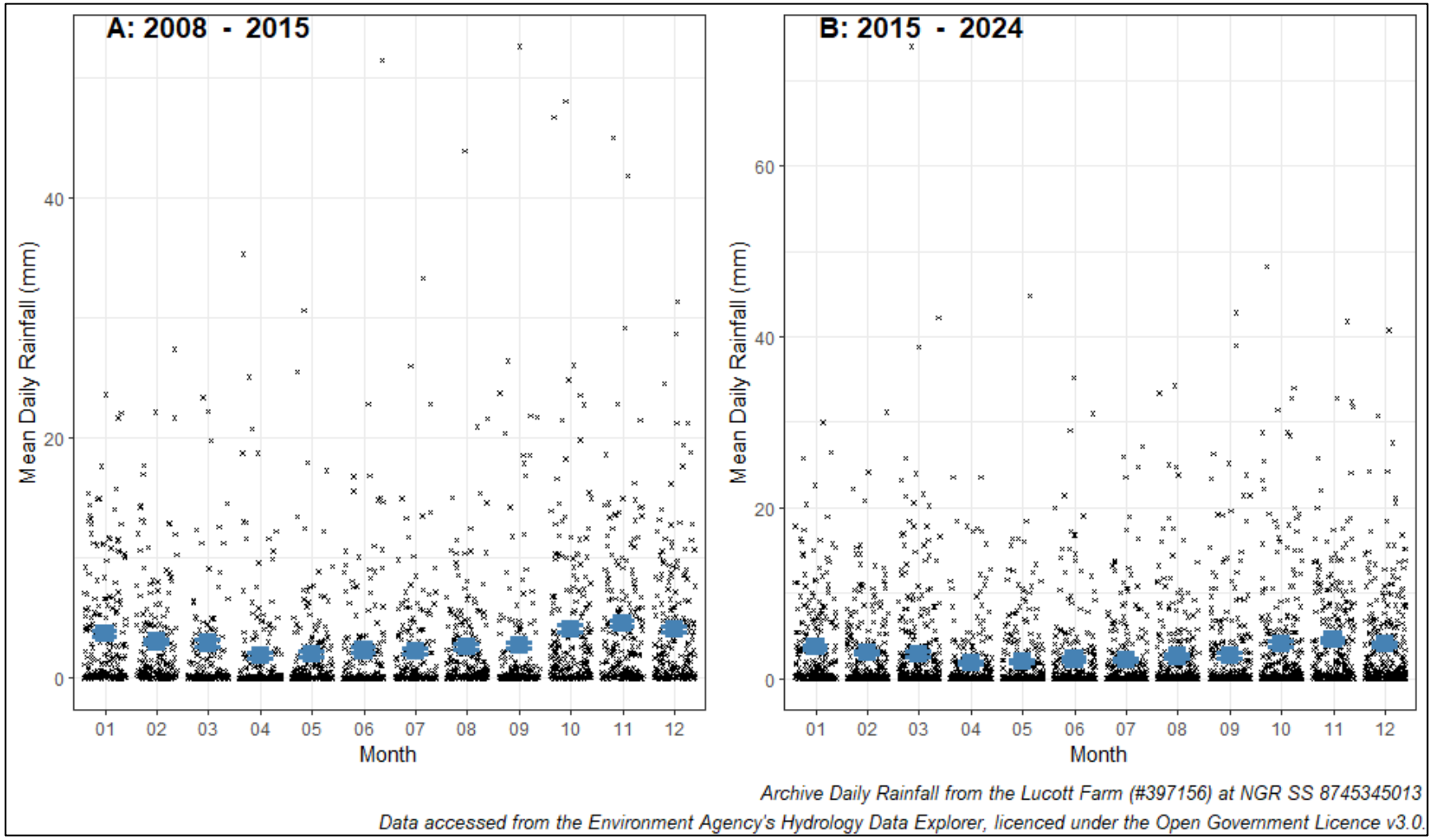

Figure 5.1 Mean daily rainfall per month at the Lucott Farm rainfall monitoring station at NGR: SS 8745345013 (ID: 397156) for the period (A) 2008 – 2015 and (B) 2015 – 2024.

The data shows that average annual rainfall has increased by 138.9 mm, but the percentage of days with heavy rainfall (>10 mm rain per day) has remained relatively unchanged. Average rainfall amounts of circa 1,000 mm per year also indicate that Porlock receives a significant volume of rainfall compared to other areas around the country. Two-sample t-tests indicated that there was no significant difference ($p > 0.05$) in the mean daily rainfall per month between the 2008 – 2015 and 2015 – 2024 periods, meaning that rainfall levels across the catchment have remained statistically similar.

Rainfall leads to increased faecal loading through two factors: elevated levels of surface runoff and increased spill events from intermittent discharges, particularly during periods of heavy rain. Rainfall levels during both periods were greatest in winter months (November – February), and so levels of runoff etc. would be expected to be greatest during this time. However, as the rainfall patterns have remained (statistically) similar across the two time periods, significantly altered bacterial loading due to these factors is unlikely and as such RMP recommendations made in the original sanitary survey to capture the influence of runoff and spill events remain valid.

6 Microbial Monitoring Results

6.1 Official Control Monitoring

6.1.1 Summary Statistics and geographical variation

Mean Official Control monitoring results for *E. coli* concentrations at RMPs sampled in the Porlock BMRA since 2010 are presented spatially in Figure 6.1 and summary statistics are presented in Table 6.1. Only monitoring data freely available for download from the Cefas datahub has been used in this section. No additional verification of the data has been undertaken.

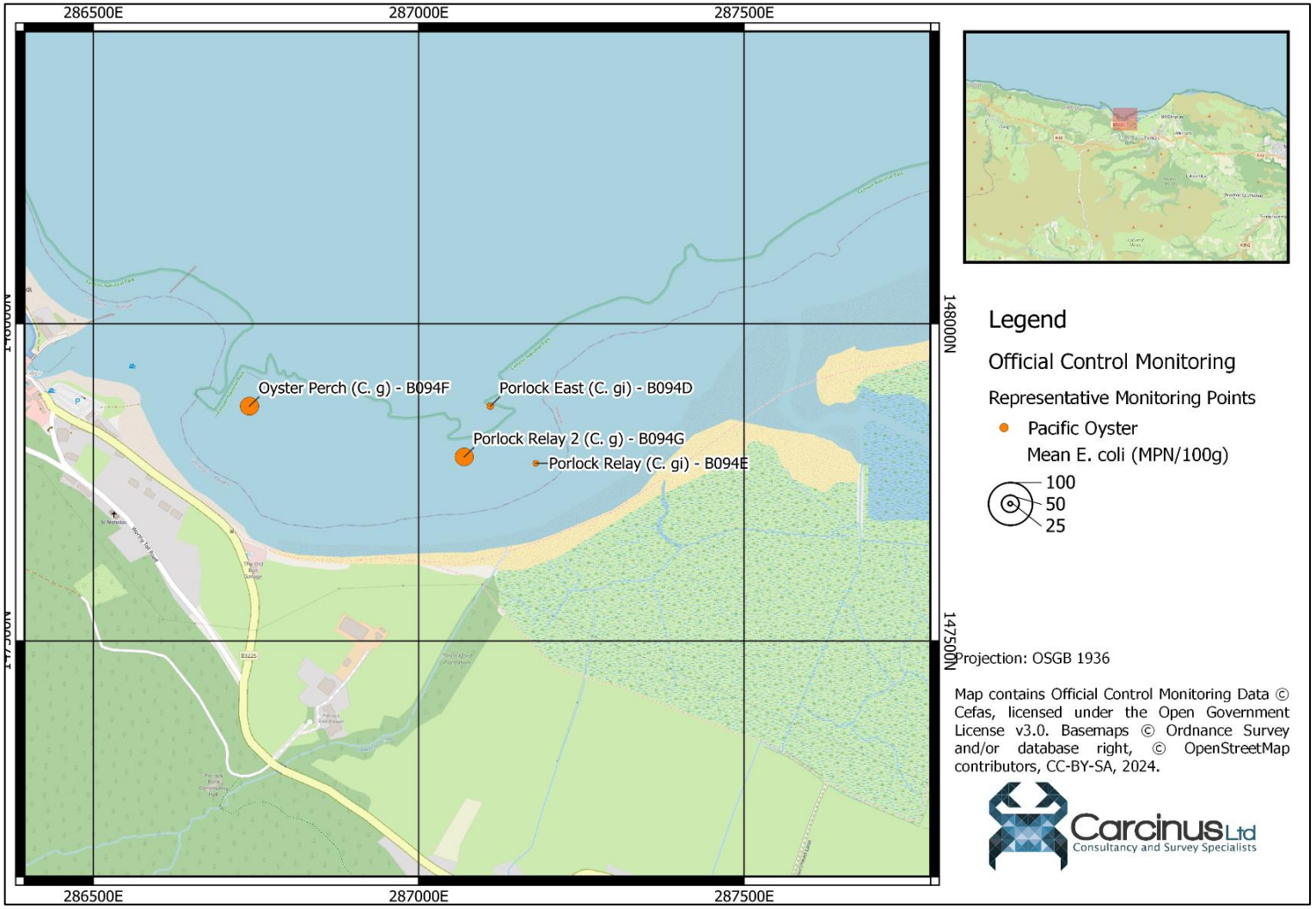

Figure 6.1 Mean E. coli results from Official Control monitoring at bivalve RMPs in the Porlock BMRA

Table 6.1 Summary statistics from Official Control monitoring at bivalve RMPs in the Porlock BMRA.

RMP (Species)	NGR	Species	No.	First Sample	Last Sample	Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Porlock East (C. gi) - B094D	SS87114787	Pacific oyster	91	06/06/2016	12/12/2023	47.76	18	330	1.10	0	0
Porlock Relay (C. gi) - B094E	SS87184778	Pacific oyster	92	23/05/2016	12/12/2023	47.58	18	490	1.09	0	0
Oyster Perch (C. gi) - B094F	SS86744787	Pacific oyster	83	13/12/2016	12/12/2023	64.33	18	1300	3.61	0	0
Porlock Relay 2 (C. gi) - B094G	SS87074779	Pacific oyster	41	04/08/2020	12/12/2023	64.05	18	490	4.88	0	0

The datahub provides Official Control Monitoring data for four RMPS, all of which are currently sampled for Pacific Oyster. Given that the 2015 Sanitary Survey was written before the area was classified, these RMPs were not sampled beforehand. Three RMPs began sampling in 2016, and one RMP (*Porlock Relay 2*) began sampling in 2020. None of the RMPs listed above have returned a result greater than 4,600 *E. coli* MPN/100 g. The highest value for *E. coli* at any of the four RMPs was taken at Oyster Perch and is 1,300 *E. coli* MPN/100 g. A result of 1700 *E. coli* MPN/100 g was recorded at Oyster Perch (B094F) on 13 January 2020, however, this was subsequently found to be statistically anomalous. When results are identified as anomalous, they do not count towards classification, but remain in the historical dataset to ensure that changes in trends are identified. This RMP is closest to Porlock Weir and boating activities, and therefore reinforces the need for a shoreline survey to investigate further potential sources of contamination. During the Shoreline Survey all shoreline water sources were found to be carrying very low (< 500 CFU/100 ml) concentrations of *E. coli*.

Figure 6.2 presents box and violin plots of *E. coli* monitoring at RMPs within the Porlock BMPA. One-way analyses of variance (ANOVA) tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the RMPs. Significance was taken at the 0.05 level[8]. All statistical analysis described in this section was undertaken in R (R Core Team, 2021).

No significant differences ($p > 0.05$) were found between monitoring data at any of the four RMPs for Pacific oyster in the Porlock BMRA.

[8] A p-value of <0.05 means that there is a greater than 95% probability that the observed differences between the groups didn't occur by chance.

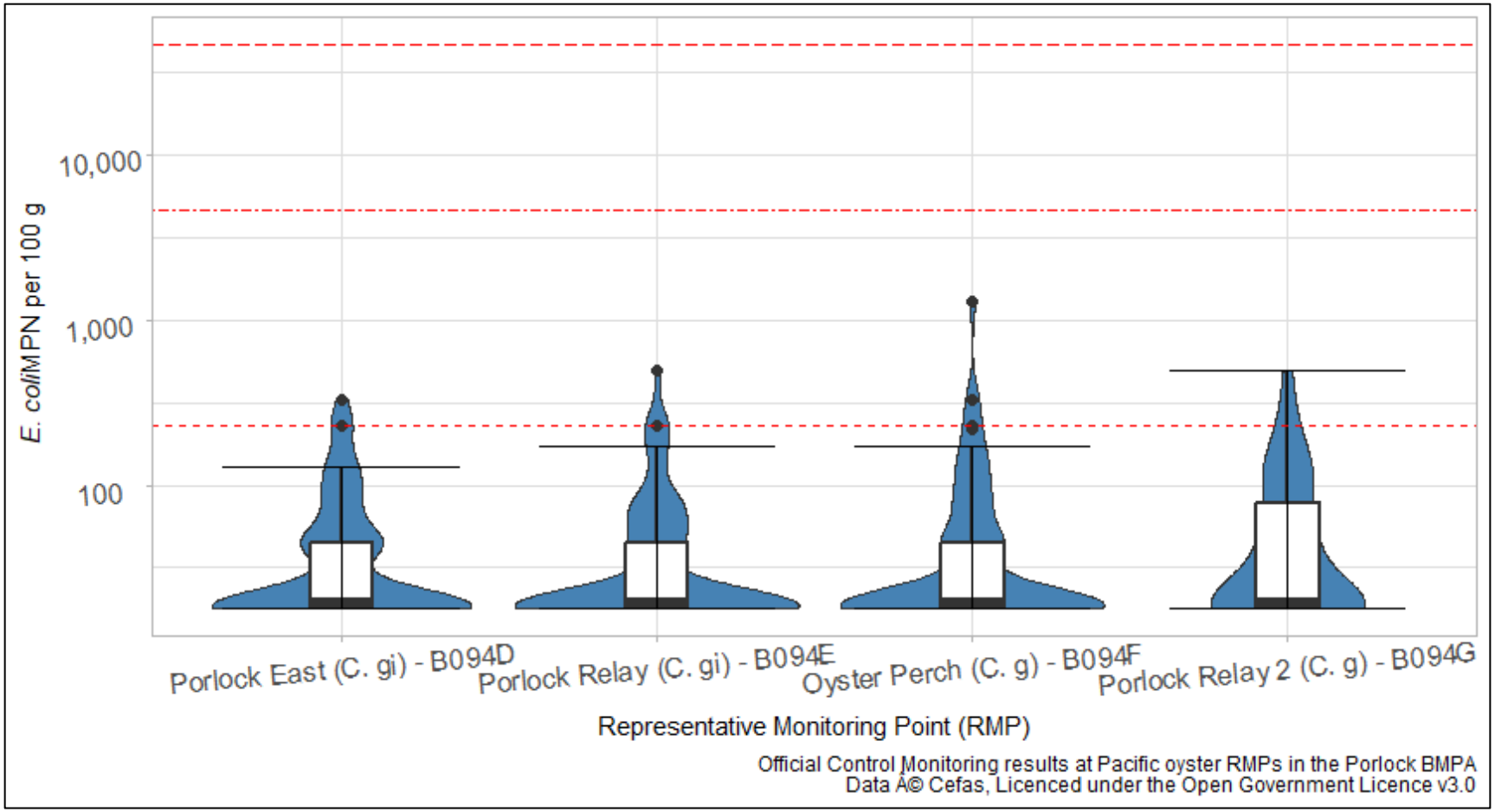

Figure 6.2 Box and violin plots of E. coli monitoring at Pacific oyster RMPs in the Porlock BMRA. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values, excluding outliers. Boxplots are overlaid on the distribution of the monitoring data. Horizontal dashed lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

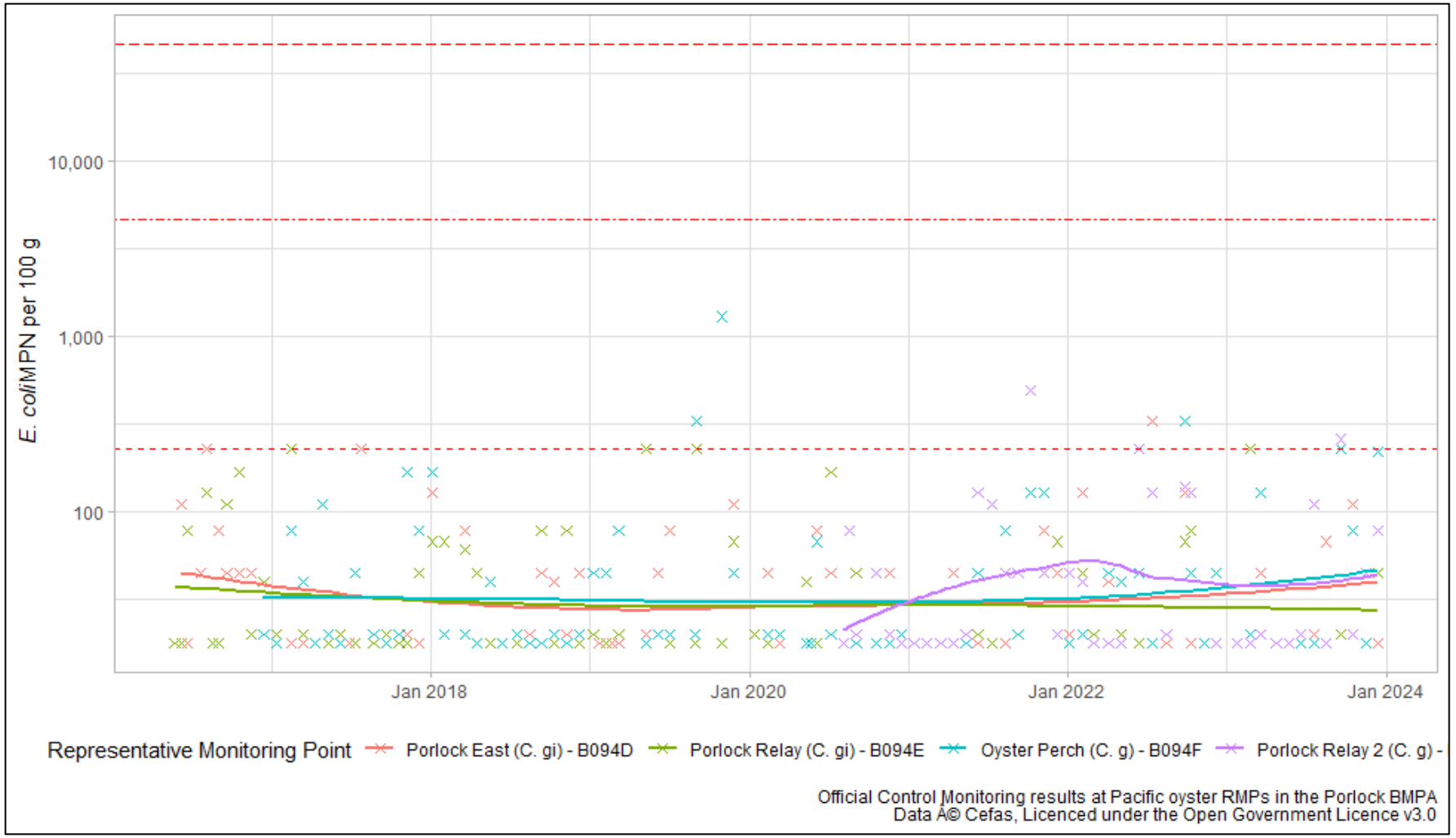

Figure 6.3 Timeseries of E. coli monitoring at Pacific oyster RMPs sampled in the Porlock BMRA since 2016. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 E. coli MPN/100 g.

6.1.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results within the Porlock BMRA are shown for pacific oysters in Figure 6.3.

The monitoring data suggests that the concentrations of *E. coli* in shellfish flesh samples at the three RMPs sampled since 2016 is relatively consistent with each other, and that Porlock Relay 2 has experienced the most variation since sampling started in 2020. However, the variation shown in the timeseries was not significant in section 6.1.1, and all four RMPs can be considered statistically similar in terms of temporal patterns in results.

6.1.3 Seasonal patterns of results

Seasonal patterns of *E. coli* concentrations at RMPs in the Porlock BMRA were investigated and shown for pacific oysters in Figure 6.4. The data for each year were averaged into the four seasons, spring from March – May, summer from June – August, autumn from September – November and winter comprising data from December – February the following year. Two-way ANOVA testing was used to look for significant differences in the data, using both season and RMP (if there is more than one RMP for a given species) as independent factors (i.e., pooling the data across season and RMP respectively), as well as the interaction between them (i.e., exploring seasonal differences within the results for a given RMP). Significance was taken at the 0.05 level.

Monitoring results from Autumn months were significantly higher than those collected in all other months when RMPs were grouped together ($p = 0.002$). This pattern is principally driven by a significant difference ($p = 0.038$) in the Autumn and Spring monitoring results at Oyster Perch RMP (B094F).

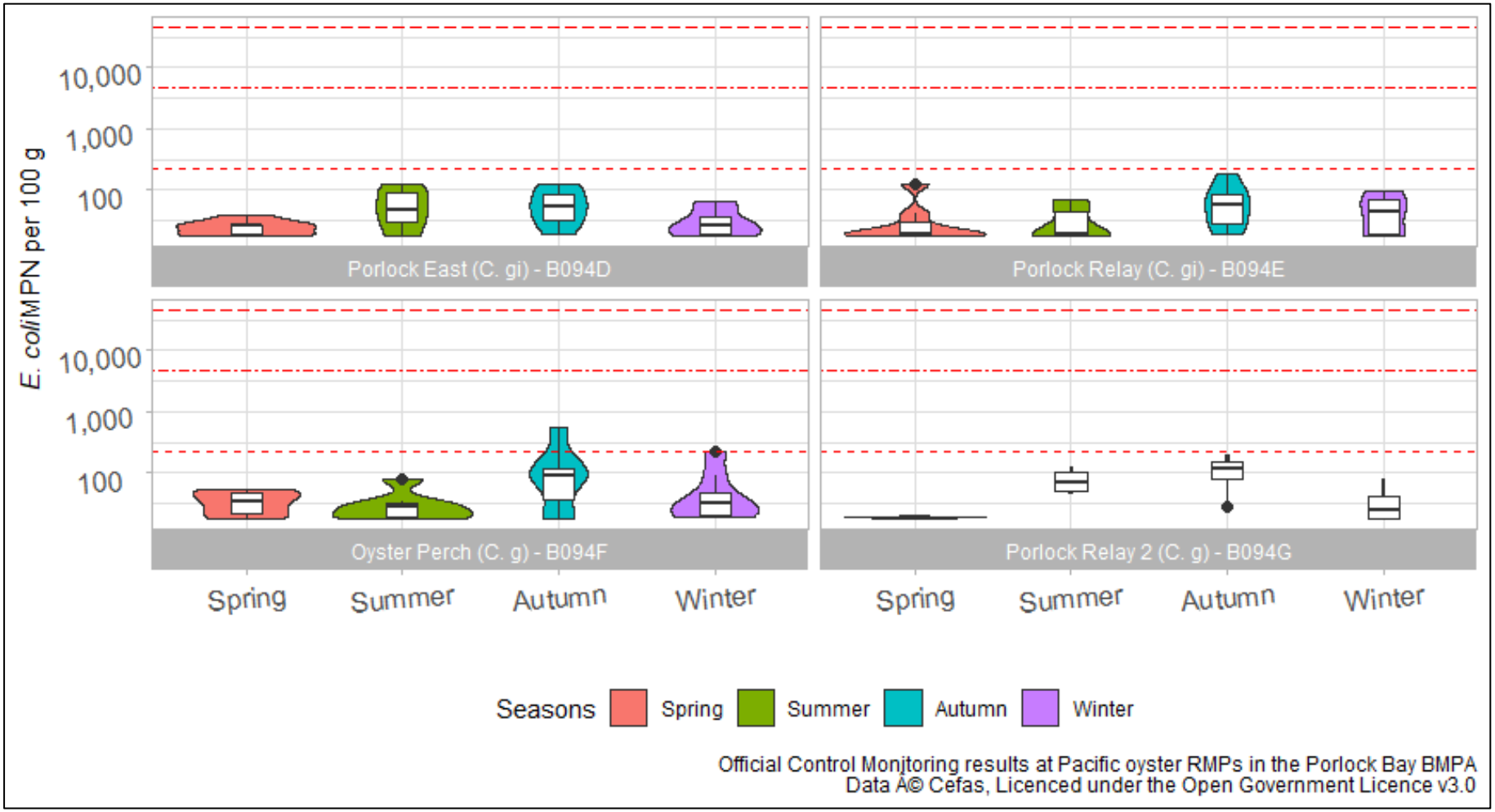

Figure 6.4 Box and violin plots of E. coli levels per season at pacific oyster RMPs sampled within the Porlock BMRA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.2 Action States

Since the publication of the 2015 Sanitary Survey of the Porlock BMRA, the following Action States have been triggered.

- On 13 January 2020, an Action State was triggered by a result of 1,700 *E. coli* MPN/100 g being recorded at Oyster Perch (B094F). This result was subsequently found to be statistically anomalous and was discounted for classification purposes.
- A result of 1,300 *E. coli* MPN/100 g on 30 October 2019 also triggered an action state at Oyster Perch (B094F). The investigation that followed this action state event did not identify significant (above the 1 in 5-year threshold) rainfall events, pollution incidents or significant releases from water company assets. The result was not found to be statistically anomalous and was retained for classification purposes.
- An Action State was triggered by a result of 1,700 *E. coli* MPN/100 g being recorded at Porlock Relay 2 (B094G) on 9 November 2022. This result was found to be statistically anomalous and was discounted for classification purposes.

6.3 Bathing Water Quality Monitoring

The status of EC bathing waters near to and within the BMRA is also of relevance to this assessment. Porlock Weir is a designated bathing water quality monitoring point and is currently classified as 'excellent'. This was also the case in 2022 and 2021. It should be noted that bathing water sampling only occurs during the bathing water season, which falls within the summer period (May to September inclusive) and therefore may not represent the potential for increased faecal loading during winter months.

7 Conclusion and overall assessment

The Porlock BMRA is located within Porlock Bay, near Porlock village in Somerset. The BMRA is currently classified for relaying Pacific oysters. Previously, some investigations were led into the potential to harvest mussels from the area. However, this was unsuccessful and the shellfishery was never classified for the production or relaying of *Mytilus* sp. The previous sanitary survey in 2015 was written before formal classification of any CZs, and since then the oyster fishery has become well-established, relaying c. 13 tonnes a year. Oysters are grown in cages and harvested by hand.

The results of the 2021 Census were compared to that of the 2011 Census to give an indication of changes in human population within the catchment since the publication of the 2015 Sanitary Survey. These data suggest that the population of the catchment remained similar between 2011 and 2021 with a marginal increase. The catchment remains rural with a population density of less than 100 people per square kilometre. The main population centre of the catchment is Porlock village. Urban associated runoff is not considered to be a significant source of contamination within this area. The area does receive a significant increase in population each year with tourism due to its location in Exmoor National Park; this is predominantly in summer months.

There is one continuous water company owned discharge within the Porlock catchment, reflecting the small population size. This discharge remains unchanged since to 2015 Sanitary survey with a dry weather flow (DWF) value of 668 m^3/day. In 2019 the membrane bioreactor plant at this discharge was taken offline to be replaced and modernised. The work was completed in August 2020. There are four intermittent discharges throughout the catchment. The EA advised during initial consultation that no upgrades to these have taken place since 2015, although are planned in the next asset management plan period (AMP 2025). No EDM data was available and so the authors cannot comment on the possible effect of this source of contamination on the BMPA. Given the historic nature of Porlock, some private discharges to land are also present. The presence of water company owned intermittent and privately owned discharges in the vicinity of the CZs should be taken into consideration in any updated sampling plan.

Land cover maps show that much of the catchment remains reserved for arable land, grassland, and forest. The Shellfish Water Action Plan published by the Environment Agency does not provide clarification on whether agricultural contamination (runoff) is a significant source of contamination within this shellfishery, however it was mentioned during initial consultations with the LEA and EA that after heavy rainfall events this could be the case. This is supported by higher monitoring results in the Autumn months, during when rainfall and the number of grazing animals is likely to be greater. Slurry is also spread onto fields during this time of year. The mouths of watercourses throughout the bay, such as the Hawkcombe Stream, can be considered point sources of this source of contamination.

Waterbird counts suggest that whilst Porlock Bay is not considered nationally or internationally important for populations of waterbird species, the bay continues to support them in small numbers. In the five winters to 2021/2022 an average of 178 waterbirds were found. Some minor impacts from either avian species or marine mammals may occur, but these are impossible to reliably predict and are therefore challenging to account for in any updated sampling plan.

The Bristol Channel is a major shipping lane and so some contamination may enter the BMRA through this source. Given the tidal action in the Bay, it is likely there will be significant dilution to any discharges. Porlock Weir is only big enough to support a very small number of boats, and entry is limited by tide. Porlock does not provide any pump out facilities. The greatest impacts from boats and boating activities are likely to occur in summer months, when vessel numbers are at their highest, but it is impossible to accurately predict the timing or volumes of any contamination. This source of contamination does not require consideration in any updated sampling plan.

There is monitoring data available for four Pacific oyster RMPs sampled within the Porlock BMRA. The monitoring results were found to be statistically similar across the RMPs in the Bay.

A Shoreline Survey of Porlock Bay was conducted in January 2024 to address identified knowledge gaps in the initial desk-top assessment, namely the potential impact of

intermittent discharges, freshwater courses and agricultural runoff. Watercourses draining to Porlock Bay are restricted to Hawkcombe Stream, Porlock Weir and the breach in the cobble beach that acts as the single drainage channel from the saltmarsh. Whilst there was evidence of land runoff from pastural farmland observed during the shoreline survey, all concentrations of *E. coli* in samples were very low (< 500 *E. coli* CFU/100 ml). No significant wildlife aggregations were observed, and the overwhelming majority of boats moored in Porlock Harbour were deemed too small to contain onboard toilets. None of the findings of the shoreline survey had an influence on RMP placement for the sampling plan recommended at the end of this report.

8 Recommendations

Recommendations for the various classification zones within the Porlock BMRA are summarised below and a recommended sampling plan is provided in Table 9.1.

8.1 Pacific oyster

Oyster Perch

This CZ is approximately 0.007 km^2 in size and located to the west within Porlock Bay. It is the closest CZ, and RMP (B094F), to Porlock Weir and therefore likely reliably captures any potential contamination from this source. It is recommended that this RMP be maintained as it is still representative of the main identified sources of contamination.

Porlock Relay

This CZ is approximately 0.003 km^2 in size and located to the East within Porlock Bay. This CZ is closest inshore, and therefore the current RMP (B094E) likely reliably captures contamination from runoff (agricultural or urban), including that brought in by waterways flowing into Porlock Bay like Hawkcombe Stream. It is recommended that this RMP be maintained as it is still representative of the main identified sources of.

Porlock Relay 2

This CZ is approximately 100 m^2 and is only used for sampling purposes (no harvesting/relaying of shellfish currently takes place in this CZ). It is recommended that this RMP (B094G) be maintained as it is still representative of the main identified sources of contamination.

Porlock East

Porlock East CZ is the only CZ recommended in the original 2015 Sanitary Survey. It is approximately 0.36 km^2 in size and stretches out from Porlock Bay into the subtidal. The 2015 Sanitary Survey recommended the RMP (B094D) be placed on the eastern-most extremity on the lower intertidal, due southwest of where the lagoon drains to the bay, to best capture its impacts while allowing reasonable access on foot by the sampling officer. This remains the case. Given the hydrography of Porlock Bay and evident water mixing in the subtidal, the most contamination is likely to be closest to the shoreline. It is recommended that this RMP be maintained as it is still representative of the main identified sources of contamination.

9 General Information

9.1 Location Reference

Production Area	**Porlock**
Cefas Main Site Reference	M094
Ordnance survey 1:25,000	Explorer 103
Admiralty Chart	No 147 / No 2400.11

9.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Pacific oyster *Crassostrea gigas*	Cultured	Year round

9.3 Local Enforcement Authority(s)

Name	**Somerset Council** Deane House Belverdere Rd Taunton TA1 1HE
Website	www.somerset.gov.uk
Telephone number	0300 123 2224
E-mail address	somersetwestenquiries@somerset.gov.uk

9.4 Sampling Plan

*Table 9.1 Proposed sampling plan for the Porlock BMRA. Suggested changes are given in **bold red** type.*

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Porlock East	**B094D**	**Porlock east**	SS 8711 4786	51°13’07”N , 003°37’04”W	Pacific oyster	Hand	Hand	Pacific oyster	10 m	Monthly
Oyster Perch	**B094F**	**Oyster Perch**	SS 8674 4787	51°13’08”N , 003°37’23”W	Pacific oyster	Hand	Hand	Pacific oyster	10 m	Monthly
Porlock Relay	**B094E**	**Polock relay**	SS 8718 4778	51°13’05”N , 003°37’00”W	Pacific oyster	Hand	Hand	Pacific oyster	10 m	Monthly
Porlock Relay 2	**B094G**	**Porlock relay 2**	SS 8707 4779	51°13’05”N , 003°37’06”W	Pacific oyster	Hand	Hand	Pacific oyster	10 m	Monthly

10 References

Austin, G.E. *et al.* (2023) *Waterbirds in the UK 2021/22: The Wetland Bird Survey.* Thetford: BTO/RSPB/JNCC.

European Commission (2021) *Community Guide to the Principles of Good Practice for the Microbiological Classification and Monitoring of Bivalve Mollusc Production and Relaying Areas with regard to Implementing Regulation 2019/627*. Issue 4. Available at: https://www.aesan.gob.es/en/CRLMB/docs/docs/procedimientos/Micro_Control_Guide_DEC_2021.pdf (Accessed: 24 October 2022).

gov.uk (2024) *UK fishing vessel lists*. Available at: https://www.gov.uk/government/collections/uk-vessel-lists (Accessed: 11 January 2024).

Porlock Weir Charters (2022) *Porlock Weir Charters*. Available at: https://porlockweircharters.co.uk/.

R Core Team (2021) 'R: A language and environment for statistical computing'. Vienna, Austria: R Foundation for Statistical Computing. Available at: https://www.R-project.org/ (Accessed: 8 June 2022).

The Green Blue (2022) *Pump-out directory*. Available at: https://thegreenblue.org.uk/resources/boat-user-resources/pump-out-directory/.

Appendices

Site Name	EA Permit	Type of discharge	Outlet NGR	Total Duration (Hours) of Spills in 2022	Number of Spills in 2022	Distance (km) to centre of nearest CZ
BOSSINGTON PUMPING STATION	100138	Pumping Station on Sewerage Network (water company)	SS8910048500			1.95
PORLOCK COMBINED SEWER OVERFLOW	100354	Storm Tank/CSO on Sewerage Network (water company)	SS8835047490	0.033	1	1.49
PORLOCK WASTEWATER TREATMENT WORKS (A)	100318	WwTW/Sewage Treatment Works (water company)	SS8835047490	144.25	11	1.49
PORLOCK WASTEWATER TREATMENT WORKS (B)	100318	WwTW/Sewage Treatment Works (water company)	SS8835048300			1.2
PORLOCK WEIR PUMPING STATION	100353	Pumping Station on Sewerage Network (water company)	SS8671048040	0	0	0.16

Centre for Environment
Fisheries & Aquaculture
Science

www.cefas.co.uk

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Porlock Bay

March 2015

A copy of the 2015 Report can be requested from the Food Standards Agency

Porlock Shoreline Survey

Report context

This report is designed to be read in conjunction with the desk-based assessment, to which this forms an appendix. It details the findings of the shoreline survey but does not repeat details of contamination sources detailed in the main report unless there is a specific need to (i.e., where there are differences between the situation described in the desk-based assessment and those observed during the shoreline survey). The desk-based assessment is based on data sources (including Official Control monitoring) up to and including December 2023. The description of the shellfishery presented within this report is based on the information contained in the desk-based assessment and information gathered during the Shoreline Survey.

The shoreline survey of the Porlock Bivalve Mollusc Relay Area (BMRA) was recommended in the desk-based assessment due to uncertainty over the impact of intermittent discharges throughout the catchment, and the presence of small streams that may act as a conduit for agricultural runoff to negatively impact the Classification Zones (CZs). The CZs of the Porlock BMRA are located in the far western side of Porlock Bay, near to Porlock Weir. The Shoreline survey covered the area from Bossington in the east of the bay to Porlock Weir in the west (matching the area surveyed in the 2015 Shoreline Survey), but in addition the footpath around the western headland was also surveyed. There are currently four CZs in the Porlock BMPA, all of which of which are Class A (*Oyster Perch*, *Porlock East Relay*, *Porlock Relay* and *Porlock Relay 2*).

General Information

Date (time)

30 January 2024 (11:00 – 15:00 UTC)

BMPA surveyed

Porlock (Cefas Site Reference: M094; Figure I)

Weather

Overhead	Beaufort	Precipitation in 7 days preceding survey[1]	Precipitation during survey
Cloudy	2 - 3	16.8 mm	None

Tidal predictions

	30 January 2024[2]	
	Time	**Height**
Low Water	02:20	2.14 m
High Water	08:58	9.29 m
Low Water	14:37	2.33 m
High Water	21:15	9.04 m

[1] Based on data from the Lucott Farm rain gauge (WISKI ID: 397156) at NGR SS 87453 45013. https://environment.data.gov.uk/hydrology/station/9cd31b89-fa6a-46c6-857e-95d77eaf22ef

[2] https://www.tidetimes.org.uk/porlock-bay-tide-times-20240130

Objectives

The shoreline survey is a physical survey of potential sources of contamination. During the survey, samples of freshwater or anthropogenic inputs to the area are collected for bacteriological (*E. coli*) testing to evaluate potential differences in levels of contamination entering the shellfish harvesting area; confirm the location of previously identified sources of potential contamination and to identify other potential sources of contamination that were not apparent in the desk-based assessment. A full list of recorded observations is provided in Table I and the locations of these observations are presented in Figure I. Photographs taken during the shoreline survey are referenced in Table I and presented in Figure III to Figure XXVI.

The shoreline survey was conducted over one day with all surveyors working together to survey the same area of shoreline, maximising safety whilst on site. The entire survey was conducted on foot, on a falling tide. Access to majority of the shoreline was possible as the beach consists of cobbles/boulders and the saltmarsh that backs onto the beach is itself backed by a public footpath. Overhead conditions during the survey were broken clouds, with no rainfall observed during the survey. 16.8 mm rain fell in the 7 days preceding the survey.

A series of small streams draining the areas of pasture were identified as flowing into the saltmarsh. Where possible (i.e. safe access and sufficient flow), water samples were taken. All the drainage channels in the saltmarsh are ultimately reaching the beach and Porlock Bay via a single breach in the cobble/boulder beach. The streams from Porlock Weir and Bossington empty into the back of the cobble beach, percolating through the cobbles into the bay. Water samples were taken from the point where both streams reach the beach. Finally, indicative water samples were taken from near to and within the *Oyster Perch* CZ. All water samples were kept cool and transported to the Food, Water and Environmental Microbiology (FEW) services Laboratory at Porton Down (FEW Porton), and tested for *E. coli* concentrations following established testing protocols (Method Ref: FNES39 (W2)). Laboratory analysis results and sample locations are presented in Table II and Figure II.

Description of Fishery

A full shellfish stock assessment is beyond the scope of a shoreline survey, and this report only presents observations made during the survey. The Porlock BMRA is wholly contained within Porlock Bay on the north coast of Somerset. At the time of writing, there are four Classification Zones, all of which are classified for relaying Pacific oysters *Crassostrea gigas*. The shellfishery involves relaying of Pacific oysters on trestles, several racks of which were observed during the shoreline survey (Figure XXIII). A water sample was collected from within the *Oyster Perch* CZ during the shoreline survey (Observation 21; WS13; Figure XXIII). The concentration of *E. coli* within this sample was extremely low, 4 CFU/100 ml.

Sources of contamination

Sewage discharges

Continuous discharges

The desktop assessment identified that there was one continuous water company owned discharge within Porlock Bay. This asset (Porlock WWTW) discharges via a long sea outfall that is permanently submerged at all states of time, and so the presence of it could not be confirmed during the shoreline survey. More detail of this discharge is provided in the main report.

Intermittent discharges

Five intermittent discharges identified in the desk-based assessment, Porlock WWTW CSO (discharging inland), Porlock WWTW Storm Overflow and Pumping Station, Porlock Weir Pumping Station and Bossington Pumping Station. Infrastructure associated with all of these assets, except for Porlock WWTW CSO, was identified during the shoreline survey and water samples were taken where possible. The location of the Porlock WWTW CSO was farther inland than the area surveyed which is why this outfall was not identified. WS05 (Figure XII; Observation 10) was taken approximately 250 m downstream of the outfall location.

Observation 12 (Figure XV) was what appeared to be ruins of historic sewerage infrastructure, but it was in a state of disrepair and there was no pipe/outfall to sample.

Freshwater inputs

Water courses draining to the Porlock BMRA are described in the main report. The main watercourses draining to Porlock Bay are Hawkcombe Stream (Figure XII) and Bossington Stream (Figure XIX), as well as a drainage channel leading from Porlock Weir (Figure XXI). Both the Bossington Stream and Porlock Weir drainage channel do not connect directly to the Bay, the watercourses discharge to the cobbles/boulders of the beach and percolate into the bay (Figure XVII). Hawkcombe stream drains to the bay via an area of saltmarsh, through an intertidal lagoon and a breach in the cobble bank (Figure XVI). In addition, there were several small streams carrying land runoff from the pastural fields that back onto the saltmarsh (Figure IX; Figure X; Figure XI). All these streams connect to the saltmarsh's drainage channels and ultimately mix with the Hawkcombe stream before draining out into Porlock Bay.

Water samples were collected from these streams/drainage channels where safely accessible and with sufficient flow to collect a sample (WS01 – WS06; Figure VII; Figure IX; Figure X; Figure XI; Figure XII; and Figure XIII). There was evidence of livestock and silage in the fields that back the saltmarsh, which can be indicative of additional loading. Despite this fact, and the fact that there had been some rainfall in the days preceding the Shoreline Survey (see Weather), concentrations of *E. coli* were low in all six samples, with a maximum *E. coli* concentration of 400 CFU/100 ml recorded at WS04.

Water samples were also collected from the 'mouths' of the streams within the survey area (WS11, WS07 and WS07A; Figure XVI; Figure XVII and Figure XXI). These samples returned very low concentrations of *E. coli*, 20, 27 and 140 CFU/100 ml respectively, indicating that at the time of the shoreline survey, very little faecal loading is being discharged to Porlock Bay from the streams in the area. An additional stream was observed farther round the western headland (Observation 23; WS14; Figure XXVI). This stream was located beneath a collection of 2-3 houses. The concentration of *E. coli* in this sample was 24 CFU/100 ml.

A flap valve was observed beneath the Porlock Weir Hotel (Observation 18; Figure XX). It was not clear whether any of the buildings around Porlock Weir were connected to this flap valve, or whether it was connected to inland streams. A water sample was collected from this valve as it was flowing at the time of survey (WS10) and contained a very low concentration of *E. coli* (26 CFU/100 ml).

In addition to the water sample collected within the *Oyster Perch* CZ, an additional sample was collected from a small beach drainage channel that ran near to the CZ (Observation 20; WS12; Figure XXII). This sample contained an extremely low concentration of *E. coli*, 5 CFU/100 ml.

The low concentrations of *E. coli* recorded throughout the freshwater inputs within the survey area, and the very low concentration of *E. coli* in the water immediately surrounding the CZs, suggests that the survey area is receiving only minimal faecal loading from shoreline sources. Any contamination from land runoff into the saltmarsh will enter the BMRA via the single breach in the cobble beach.

Boats and Shipping

Porlock Bay is a macrotidal environment, with approximately 8 m of tidal range during spring tides (and 4 m during neap tides). The desktop assessment identified that any boating activity in the area is likely to be centred around the tidal Harbour (Figure XXI). Approximately 15 vessels were observed moored within the harbour at low water during the shoreline survey (Figure XXV), many of which appeared to be too small to contain onboard toilets. The shoreline survey confirmed the conclusions of the desk-based assessment that the impact on microbiological contamination levels within the Porlock BMPA from boats and marinas is likely to be minimal.

Livestock

Many of the fields backing the saltmarsh contained livestock, with sheep and horses the main livestock groups identified (Figure VIII; Figure IX). There was some evidence of horse manure on the footpath near Bossington (Observation 15; Figure XVIII), but it did not appear that any livestock had direct access to the saltmarsh itself for grazing. All contamination/land runoff from the fields would enter the saltmarsh via the drainage channels discussed previously in this report. A set of silage barrels was observed in one of the fields (Observation 8; WS03; Figure X), and could present a source of contamination during times of spreading.

Wildlife

The area of saltmarsh behind Porlock Beach is designated as a Site of Special Scientific Interest due in part to the birds present. There were signs placed regularly throughout the footpaths in the area advising dog-walkers to be mindful of nesting birds between April-August (Figure XIV). Limited numbers of birds were observed during the shoreline survey, although it was conducted outside of peak times for nesting birds. Dog bins were present at both ends of the beach covered (Observation 1; Figure IV), but dog fouling was observed on the beach and footpaths during the survey (Observation 2; Figure V). This source of contamination is however still considered to be minor. No marine mammals (pinnipeds or cetaceans etc.) were observed during the shoreline survey.

Tables & Figures

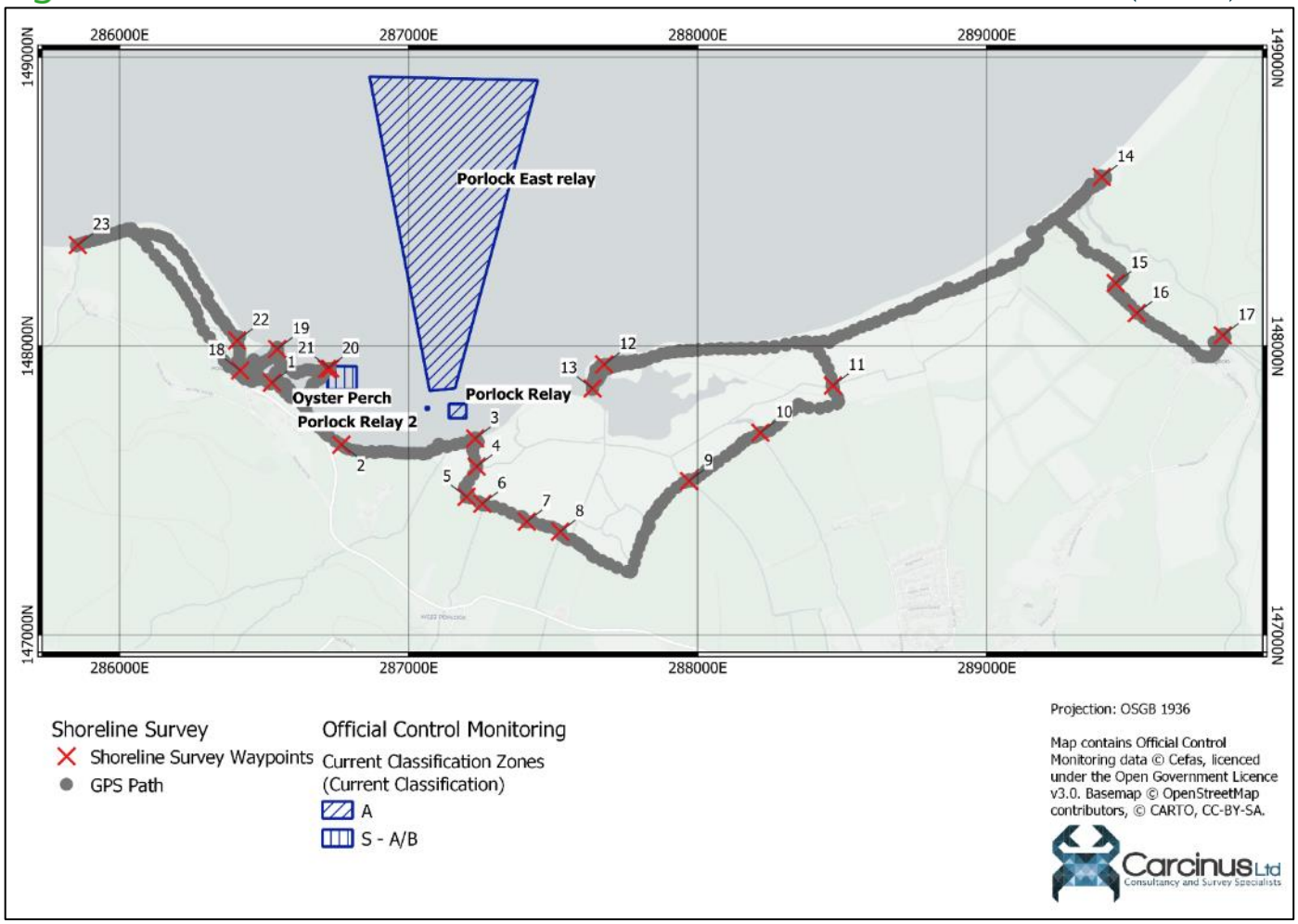

Figure I Path followed, and waypoints marked during the 30 January 2024 Shoreline Survey of Porlock, in relation to current Classification Zones. See Table I for more details of observations.

Table I Details of shoreline observations.

Observation ID	Date / Time	NGR	Comment/Notes	Photo
1	30/01/2024 11:35	SS 86530 47879	Dog waste bin by beach. Wessex Water assets present.	Figure III & Figure IV
2	30/01/2024 11:45	SS 86770 47664	Dog fouling frequent	Figure V
3	30/01/2024 11:54	SS 87233 47686	In line with yellow buoy, suspected RMP	Figure VI
4	30/01/2024 12:01	SS 87238 47588	WS01 (stream under bridge)	Figure VII
5	30/01/2024 12:04	SS 87203 47484	Ponies in field behind saltmarsh	Figure VIII
6	30/01/2024 12:06	SS 87258 47460	Stream from field with sheep present. WS02	Figure IX
7	30/01/2024 12:11	SS 87411 47398	More grazing pasture	No image
8	30/01/2024 12:15	SS 87527 47363	WS03. Field runoff, silage and sheep present in field	Figure X
9	30/01/2024 12:28	SS 87973 47535	WS04. Field runoff	Figure XI
10	30/01/2024 12:35	SS 88220 47706	WS05. Stream downstream from Porlock WWTW CSO	Figure XII
11	30/01/2024 12:44	SS 88421 47869	WS06. Stream under boardwalk.	Figure XIII
12	30/01/2024 12:58	SS 87679 47942	Ruins of old outfall, connected to saltmarsh.	Figure XV
13	30/01/2024 13:01	SS 87639 47859	Saltmarsh drainage to sea, clay bank present. WS07	Figure XVI
14	30/01/2024 13:38	SS 89400 48591	WS07A Bossington stream at beach	Figure XVII
15	30/01/2024 13:49	SS 89448 48223	Horses/Horse manure near Bossington PS	Figure XVIII
16	30/01/2024 13:52	SS 89522 48120	WS08. Stream by field (connects to Bossington PS)	No image
17	30/01/2024 14:01	SS 89819 48043	WS09 Stream near Bossington National Trust carpark	Figure XIX
18	30/01/2024 14:29	SS 86420 47921	WS10 Flap valve at Porlock Weir Hotel	Figure XX
19	30/01/2024 14:32	SS 86548 47995	WS11 Stream from Porlock Weir	Figure XXI
20	30/01/2024 14:41	SS 86720 47927	WS12 Beach runoff near oyster perch RMP	Figure XXII
21	30/01/2024 14:47	SS 86731 47928	WS13 Oyster Perch Trestles	Figure XXIII
22	30/01/2024 15:00	SS 86410 48025	Porlock Weir Pumping Station / Septic tank. No outfall visible.	Figure XXIV
23	30/01/2024 15:11	SS 85858 48355	WS14 Stream past houses round headland	Figure XXVI

Sample Results

Table II Results of *E. coli* concentration analysis on water samples collected during the 30 January 2024 Shoreline Survey of Porlock.

Water Sample No.	Observation ID	Date / Time	NGR	*E. coli* CFU/100 ml
WS01	4	30/01/2024 12:01	SS 87238 47588	40
WS02	6	30/01/2024 12:06	SS 87258 47460	50
WS03	8	30/01/2024 12:15	SS 87527 47363	50
WS04	9	30/01/2024 12:28	SS 87973 47535	400
WS05	10	30/01/2024 12:35	SS 88220 47706	120
WS06	11	30/01/2024 12:44	SS 88421 47869	50
WS07	13	30/01/2024 13:01	SS 87639 47859	27
WS07A	14	30/01/2024 13:38	SS 89400 48591	140
WS08	16	30/01/2024 13:52	SS 89522 48120	150
WS09	17	30/01/2024 14:01	SS 89819 48043	50
WS10	18	30/01/2024 14:29	SS 86420 47921	26
WS11	19	30/01/2024 14:32	SS 86548 47995	20
WS12	20	30/01/2024 14:41	SS 86720 47927	5
WS13	21	30/01/2024 14:47	SS 86731 47928	4
WS14	23	30/01/2024 15:11	SS 85858 48355	24

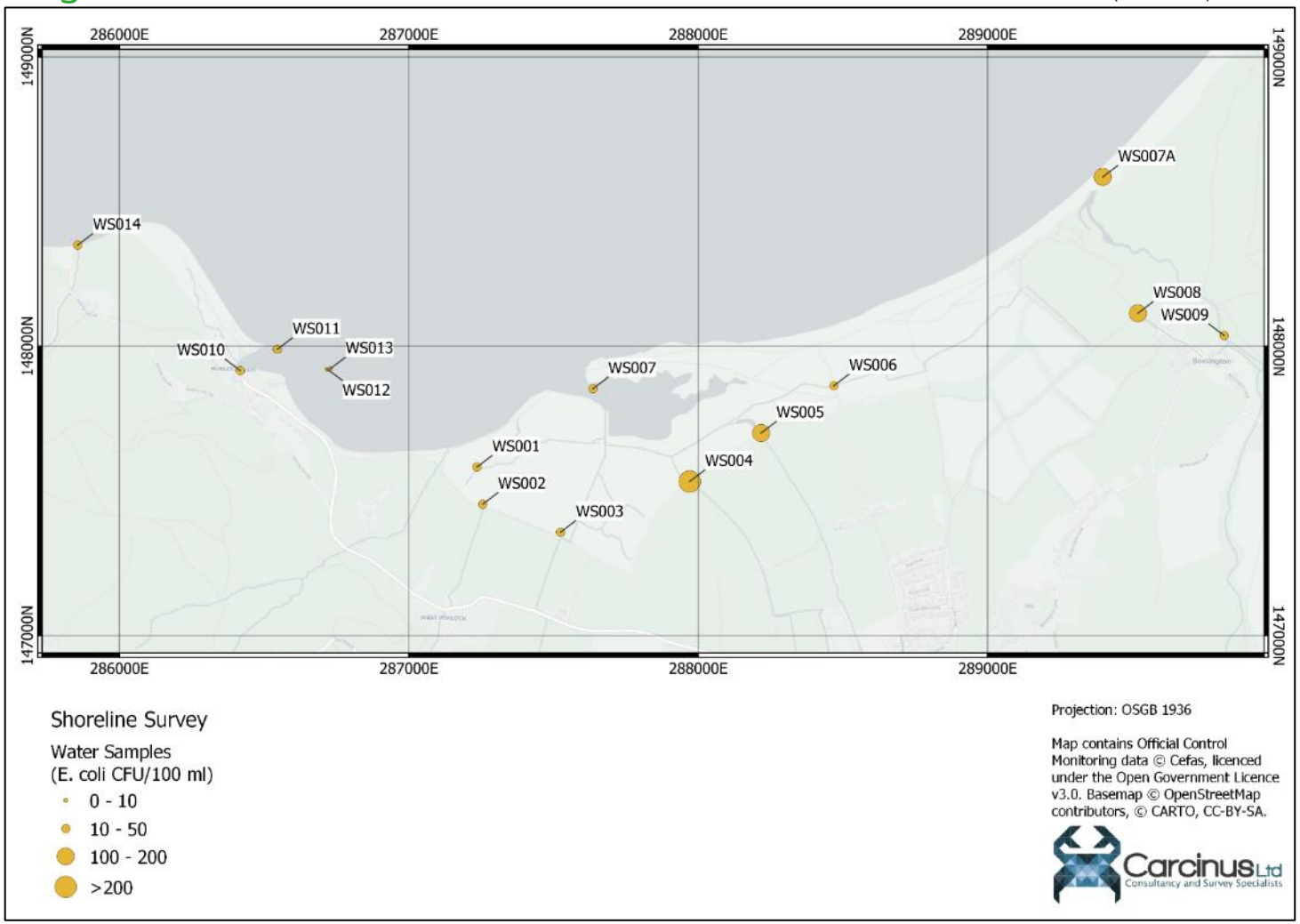

Figure II Concentration of *E. coli* in water samples collected during the 30 January 2024 Shoreline Survey of Porlock.

Figure III Wessex Water assets present near Porlock Weir (Observation 1).

Figure IV Dog waste bin near Porlock Weir (Observation 1)


Figure V Presence of dog fouling on beach (Observation 2).

Figure VI Yellow buoy is suspected RMP (Observation 3).

Figure VII Stream under bridge in saltmarsh (Observation 4; WS01).

Figure VIII Ponies in field behind saltmarsh (Observation 5).

Figure IX Stream from field with sheep present (Observation 6; WS02).

Figure X Field runoff, silage and sheep present in field behind (not visible) (Observation 8; WS03).

Figure XI Field runoff (Observation 9; WS04).

Figure XII Stream downstream from Porlock WWTW CSO (Observation 10; WS05).

Figure XIII Stream under boardwalk through saltmarsh (Observation 11; WS06).

Figure XIV Sign advising dog owners to be mindful of nesting birds on saltmarsh from April - August.

Figure XV Ruins of old outfall, connects to saltmarsh (Observation 12).

Figure XVI Saltmarsh drainage to sea (Observation 13; WS07).

Figure XVII Bossington stream at beach (Observation 14; WS07A).

Figure XVIII Horse manure near Bossington PS (Observation 15).

Figure XIX Stream near Bossington National Trust carpark (Observation 17; WS09).

Figure XX Flap valve below Porlock Weir Hotel (Observation 18, WS10).

Figure XXI Stream at Porlock Weir (Observation 19; WS11).

Figure XXII Beach runoff near Oyster Perch RMP (Observation 20; WS12).

Figure XXIII Oyster Perch trestles (Observation 21; WS13).

Figure XXIV Porlock Weir Pumping Station / Septic Tank (Observation 22).

Figure XXV Vessels moored at Porlock Weir Harbour.

Figure XXVI Stream below houses past headland (Observation 23; WS14).

About Carcinus Ltd

Carcinus Ltd is a leading provider of aquatic environmental consultancy and survey services in the UK.

Carcinus was established in 2016 by its directors after over 30 years combined experience of working within the marine and freshwater environment sector. From our base in Southampton, we provide environmental consultancy advice and support as well as ecological, topographic and hydrographic survey services to clients throughout the UK and overseas.

Our clients operate in a range of industry sectors including civil engineering and construction, ports and harbours, new and existing nuclear power, renewable energy (including offshore wind, tidal energy and wave energy), public sector, government, NGOs, transport and water.

Our aim is to offer professional, high quality and robust solutions to our clients, using the latest techniques, innovation and recognised best practice.

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Environmental Consultancy

Carcinus provides environmental consultancy services for both freshwater and marine environments. Our freshwater and marine environmental consultants provide services that include scoping studies, Environmental Impact Assessment (EIA) for ecological and human receptors, Habitats Regulations Appraisal (HRA), Water Framework Directive (WFD) assessments, project management, licensing and consent support, pre-dredge sediment assessments and options appraisal, stakeholder and regulator engagement, survey design and management and site selection and feasibility studies.

Ecological and Geophysical Surveys

Carcinus delivers ecology surveys in both marine and freshwater environments. Our staff are experienced in the design and implementation of ecological surveys, including marine subtidal and intertidal fish ecology and benthic ecology, freshwater fisheries, macro invertebrate sampling, macrophytes, marine mammals, birds, habitat mapping, River Habitat Surveys (RHS), phase 1 habitat surveys, catchment studies, water quality and sediment sampling and analysis, ichthyoplankton, zooplankton and phytoplankton.

In addition, we provide aerial, topographic, bathymetric and laser scan surveys for nearshore, coastal and riverine environments.

Our Vision

"*To be a dependable partner to our clients, providing robust and reliable environmental advice, services and support, enabling them to achieve project aims whilst taking due care of the sensitivity of the environment*"