Sanitary Survey - Review

Fal Estuary – 2021

Document No. – *J0591/20/11/06*

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Client	Food Standards Agency (FSA)
Project Title	Sanitary Survey Review
Document Title	Sanitary Survey Review - Fal Estuary
Document Number	J0591/20/11/06
Revision	3.1
Date	04 February 2021

Revisions

Revision No.	Date	Comment
1.0	03 December 2020	Draft for FSA Review
2.0	27 November	Draft for external consultation
3.1	29 January 2021	Final draft

Document QA and Approval

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Initial Consultation

Consultee	Date of consultation	Date of response
Cornwall County Council	07 September 2020	22 October 2020
Environment Agency	07 September 2020	21 October 2020

Consultation on draft report

Consultee	Date of consultation
Cornwall Port Health	08 December 2020
Environment Agency	08 December 2020
Local Action Group	08 December 2020

A sanitary survey relevant to the bivalve mollusc beds in both the upper and lower Fal Estuary was undertaken in 2010 in accordance with EC Regulation 854/2004 (which was replaced by retained EU

Law Regulation (EU) 2017/625, with sanitary survey requirements now specified in 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 revised sampling plans if required. Carcinus Ltd (Carcinus) undertook this work on behalf of the FSA. Carcinus 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, Cornwall County Council. The report is publicly available via the Carcinus Ltd website.

Recommended Bibliographic Citation:

Carcinus Ltd, 2020. Review of the upper and lower Fal Estuary 2010 Sanitary Surveys. 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 retained EU Law Regulation (EU) 2019/627.

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1 Introduction

1.1 Background

In line with Article 58 of retained EU Law (EC) Regulation 2019/627 and the EU Good Practice Guide (European Commission, 2017), Carcinus Ltd (Carcinus) is contracted to undertake reviews of sanitary surveys on behalf of the Food Standards Agency (FSA). The FSA undertakes targeted sanitary survey reviews to ensure public health protection measures continue to be appropriate.

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 complexity and risk. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Fal Estuary Review

This report reviews information and makes recommendations for a revised sampling plan for existing mussel (*Mytilus edulis*), Native oyster (*Ostrea edulis*), Pacific oyster (*Crassostrea gigas*) and Queen scallop (*Aequipectin opercularis*) Classification Zones (CZs) in the Fal Estuary (Figure 1.1). The previous sanitary surveys split the estuary into two halves, in line with the designated Bivalve Mollusc Production Areas (BMPAs). This review considers the pollution sources collectively, given the connectivity between the upper and lower parts of the estuary. It explores any changes to the main microbiological contamination sources that have taken place since the original sanitary surveys were conducted. Data for this review were gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with the Local Authorities (LAs) and Environment Agency responsible for the production area was undertaken in September and October 2020. This supporting local evidence 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 LAs and Local Action Group (LAG) members was undertaken in November 2020. 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 assessments originally conducted in 2010 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) Changes 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.

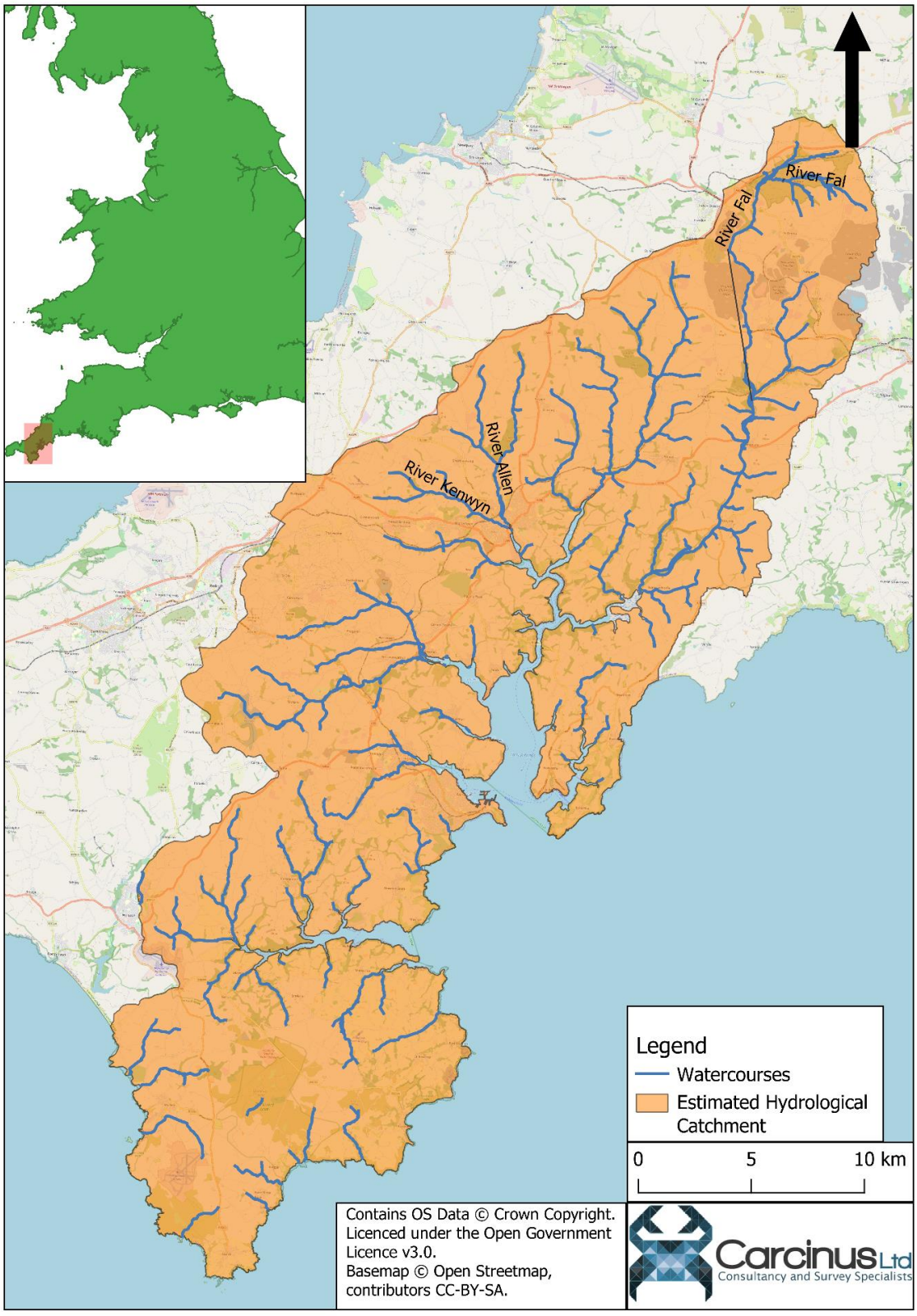

Figure 1.1. Location of Fal Estuary.

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 Authority and Environment Agency (EA);
- The findings of this report are based on information and data sources up to and including October 2020;
- 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, with no additional verification of the data undertaken. Results up to and including October 2020 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

Harvesting of shellfish within the Fal Estuary is controlled by the Fal Fishery Order 2016[1]. This order sets out the rights and restrictions that apply to fishermen wishing to utilise the fishing waters and applies to most of the estuary. Landed oysters must be larger than 67 mm, and mussels must be longer than 50 mm. Under the restrictions of the order, no mechanically powered vessel is permitted to carry out dredging activities (Cornwall IFCA, 2018), and dredging operations can only occur between 01 October to 31 March inclusive, though hand gathering can occur year round. For the purposes of shellfish classification, the Fal Estuary is divided into two halves; Fal Upper and Fal Lower. The original sanitary surveys, both conducted in 2010 (the Fal Lower review was amended in 2012 following additional information relating to fisheries and harvesting), recommended the designation of several CZs for the various harvested species.

In addition to the species described in the following paragraphs, applications for cockle harvesting in various areas have been received since the original sanitary surveys were published. However, pre-classification sampling indicated that Class C classifications were likely, and applications were not pursued due to a lack of commercial interest in harvesting Class C shellfish.

2.1.1 Fal (Upper)

The original sanitary survey describes that in 2009/2010, commercial activity in the upper Fal estuary was concentrated around the Maggoty Bank and Pill Creek areas for native oyster harvesting. The survey did not make recommendations for alterations to the existing CZs, which at that time comprised *Grimes Bar*, *Maggoty Bank*, *Coombe Creek*, *Tolverne* and *Turnaware Bar*, classified for native oysters (though the sanitary survey report only describes *Maggoty Bank*, *Coombe Creek* and *Tolverne*). All native oyster CZs active at the time of the original sanitary survey still possess active classifications. In addition, a CZ at *King Harry Reach* was classified in 2015.

Consultation with the local authorities indicated anecdotal evidence that the native oyster stock within the Fal estuary has declined since the last sanitary survey was conducted, and landing statistics support this conclusion. Based on Permit Statistics issued by the Cornwall Inshore Fisheries and Conservation Authority (IFCA), native oyster landings in the estuary declined from 90,461 kg in

[1] Secretary of State, 2016. The Fal Fishery Order 2016. Available at: https://www.legislation.gov.uk/uksi/2016/716/made

2014-15 (Street *et al.*, 2017) to 35,109 kg in the 2018-2019 season (the most recent for which data are available) (Stidwell *et al.*, 2019). This species is however, still the second largest (by landings weight) fishery within the Fal Estuary, after Queen Scallops. It is not clear what proportion of these landings are from native oyster beds within the Fal (Upper) area, however the CZs within the upper BMPA cover a smaller area than in the Fal (Lower) production area.

Similar to the native oyster harvesting areas, the original sanitary survey did not make recommendations for changes to any existing mussel CZs. It indicated that commercial activity was focussed on the Ruan Creek and King Harry Reach areas for mussel harvesting. At the time of the original sanitary survey, the following CZs possessed a classification for mussel harvesting: *Ruan Creek*, *Ruan Pontoon*, *Calenick Creek*, *Lambe Creek*, *Malpas*, *King Harry Reach*, *Turnaware Pontoon* and the *Tresilian river all beds*. The *Calenick Creek* CZ was declassified in 2012, and the *Lambe Creek*, *Malpas, Ruan Creek* and *Turnaware Pontoon* CZs were declassified in 2019 due to declining stock levels and a lack of commercial interest in harvesting Class C Mussels. The remaining CZs (*King Harry Reach* and *Ruan Pontoon*) described in the original sanitary survey are still active, with the addition of a CZ at *East Bank*, classified from 2019. The mussel landings in the 2018-2019 season were 3,366 kg (Stidwell *et al.*, 2019), significantly lower than the 20,626 kg landed in the 2016-2017 season (Street *et al.*, 2017). As with the native oyster landings, it is not clear what proportion were landed from CZs in the upper BMPA, however the classified zones is slightly larger in the upper production area than the lower.

In 2017, six CZs were designated for the harvesting of Pacific oyster. These are *Grimes Bar*, *Maggoty Bank*, *Coombe Creek*, *King Harry Reach*, *Tolverne* and *Turnaware Bar*, which match the boundaries of the currently classified zones for native oyster harvesting with the same names. Permit Statistics indicated that 1,147 kg of Pacific oyster were landed in the 2018-2019 season, the smallest classified shellfishery within the estuary.

2.1.2 Fal (Lower)

The original sanitary survey recommended dividing the naturally occurring native oyster beds in the lower estuary into seven zones (*Turnaware Bar, Restronguet Creek, Mylor Pool, Falmouth Wharves, Falmouth Bank, St Mawes and Mylor Creek*), each with its own Representative Monitoring Point (RMP). Of these CZs, *Turnaware Bar* is now considered to be part of the Fal (Upper) area, *Falmouth Wharves* was closed at the end of 2019 due to a lack of commercial activity and the CZs at *Falmouth Bank* and *St Mawes* were declassified in 2017. *Restronguet Creek* and *Mylor Creek* are still classified. Prior to the original sanitary survey, the *Mylor Pool* area was subdivided into three areas, *Mylor Bank, East Bank* and *Parson's* Bank. The *Mylor Pool* area is still classified, although this large zone was redivided into the *Parsons Bank, East Bank* and *Mylor Bank* CZs prior to these zones' classifications in 2016. A final CZ at *Percuil* has been classified since 2015, although this was not proposed in the original sanitary survey as, at that time, it was believed no stocks existed. The native oyster landings within the entire Fal estuary were 35,109 kg in the 2018-2019 season, and a larger area is classified within the lower BMPA.

In addition to the native oyster beds, the original survey recommended the designation of a single mussel CZ, *Mylor Creek*, which has been classified for shellfish harvesting since this date. In addition, the *St Just* and *Restronguet Creek* CZs have been classified since 2015 and 2016 respectively and the *East Bank Mussels* CZ has been classified since 2019. A relay area at *Percuil Relay* has been classified since 2015.

The original sanitary survey also made a recommendation for two CZs for queen scallops in the lower Fal estuary, one in the north east of the lower estuary (*Messack*) and one on the southern side of *St Mawes Bank*. These zones are not currently active and do not have a current classification, although consultation with the Local Authorities indicated that harvesting of two scallop species, queen scallops (*A. opercularis*) and variegated scallops (*Mimachlamys varia*) is taking place from the oyster fishery areas. Based in IFCA Permit Statistics estimated landings of these species were 82,860 kg in the 2018-2019 season, which therefore make them the largest species in terms of the output of the entire fishery. Permit statistics for previous seasons (Street *et al.* 2017), indicate that this fishery has expanded significantly in recent years. Unlike most other live bivalve mollusc (LBM) species, there is regulatory flexibility around scallops classification. Regulation (EU) 2019/627 sets out specific rules for the official control of these species when specific production or relaying areas are not classified (which is beyond the scope of this review).

Similar to the Fal (Upper) production area, several CZs for Pacific oyster harvesting in the lower Fal estuary were classified in 2017. These are *Falmouth Wharves, East Bank*, *Mylor Bank*, *Mylor Creek*, *Parsons Bank and Restronguet Creek*. The boundaries of these CZs match those of the native oyster CZs of the same name. The output from this fishery is small, only 1,147 kg in the 2018-2019 season across the entire Fal estuary.

For all harvested species in both parts of the estuary, the local authorities did not indicate that any changes to harvesting methodologies had occurred since the original sanitary survey was published; harvesting in all CZs except for mussels from *Mylor Creek* occurs via dredge (*Mylor Creek* is harvested by hand), and samples are taken from bagged individuals. Harvesting of native oysters within the Fal estuary is prescribed under The Fal Fishery Order 2016.

2.2 Classification History

At the time of the original sanitary survey, there were five CZs for native oyster harvesting within the Fal (Upper) production area, with an additional CZ classified in 2015. There are a further five native oyster CZs within the Fal (Lower) production area. These CZs cover most of the main channel of the estuary (Figure 2.1). The mussel CZs are significantly smaller and are generally located at the banks of the river. The Pacific oyster CZs have identical boundaries to the native oyster CZs with which they share a name.

The boundaries of all CZs have not changed since the original sanitary survey, except for the large CZ at *Mylor Pool* (for native oyster). At the time of the original sanitary survey, this CZ covered a wide area defined by lines crossing the main river channel at Loe Beach – Turnaware Point and just south of Penarrow Point – southern edge of the woodland at Tregear Vean. The enforceable lines also crossed the mouths of Restronguet Creek, St Just Pool and Mylor Creek. This CZ was classified based on samples from a single RMP, Mylor Pool (B33BG). This CZ has since been separated into three different CZs; *East Bank*, *Parsons Bank* and *Mylor Bank*. Each CZ is classified based on a single RMP within its boundaries. The current boundary of the *East Bank* CZ in St Just pool extends further into the main channel than at the time of the original sanitary survey, and the authors of this review are aware of industry interest in returning the boundary to its original position, due to the presence of wild oyster stock outside of the classified area (see discussion below).

Mussel and native oyster CZs are classified using samples of the harvested species from RMPs within the boundaries of the classification zone, however Pacific oyster CZs are classified using the native oyster samples.

Classification is relatively consistent throughout Fal (Upper) production area (Figure 2.1); all native oyster CZs hold a Class LT-B classification, except for the *King Harry Reach* CZ which has a Class B classification. Both mussel CZs in the production area hold a class B classification, and the Pacific oyster CZs hold the same classification as the native oyster CZs with which they share boundaries (as they share a single RMP for both species). All currently classified CZs within the Fal (Lower) production area hold an LT-B classification.

It should also be noted that the recently declassified zones in the production area held C classifications prior to their declassification, however, the zones were declassified due to a lack of commercial activity or interest in Class C shellfish..

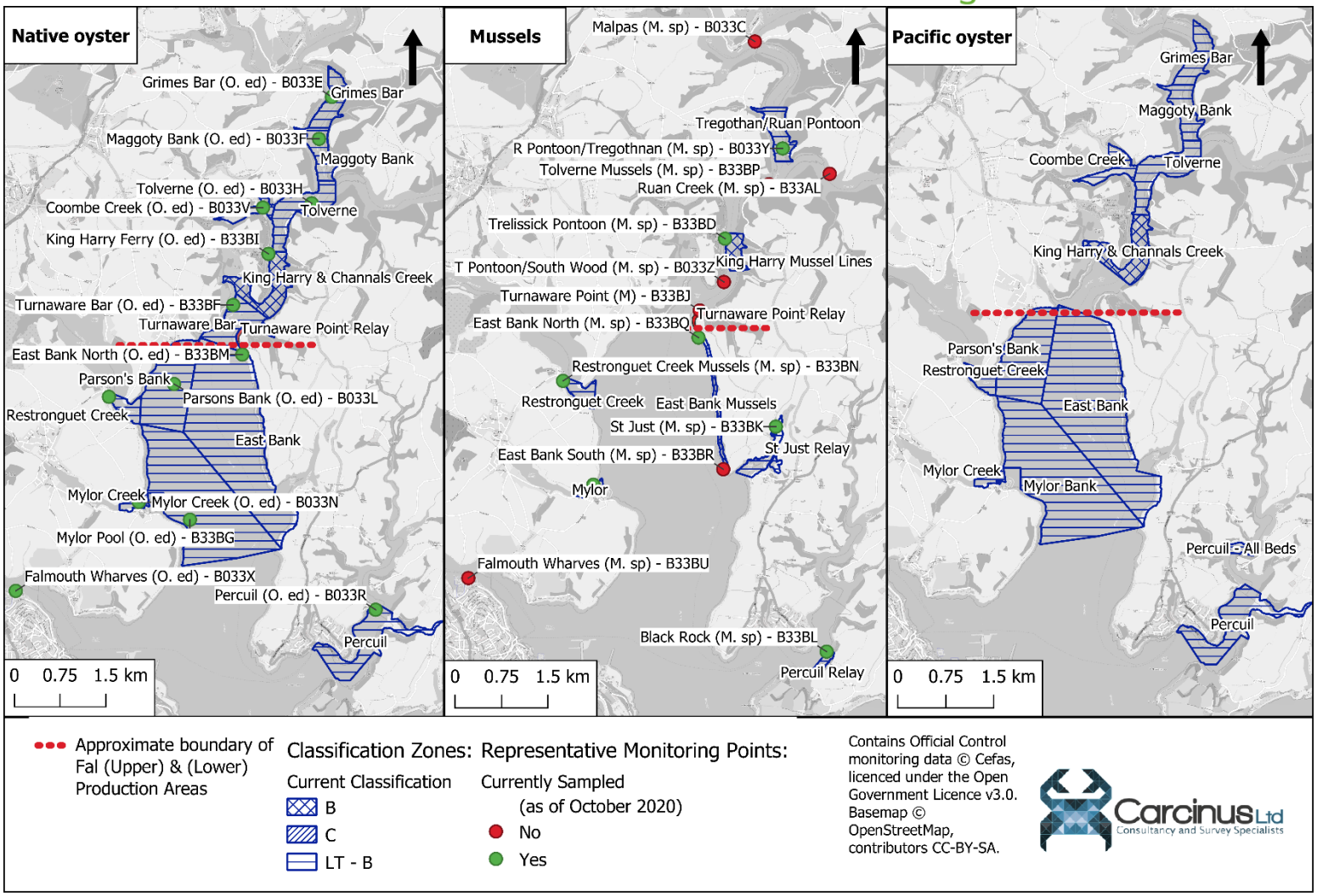

Figure 2.1 Current shellfish flesh Classification Zones and Representative Monitoring Points within the entire Fal Estuary.

3 Pollution sources

3.1 Human Population

The most recently available population data to the authors of the original sanitary surveys was that of the 2001 Census. The data collected during the subsequent census of 2011 has been made available since the publication of the original report, and so changes in the human population within the catchment between those two censuses are discussed here as no further population data are freely available.

Changes in the human population densities in census Super Output Areas (Lower Layer) and total population with wards within or partially within the Fal hydrological catchment between the 2001 and 2011 census are shown in Figure 3.1 and Figure 3.2 respectively. In general, population has increased across the whole catchment, particularly around the urban areas of Truro (35-38), Falmouth (5 – 9), Helston (11 &12) and Mabe (14) (Figure 3.2)[2]. Much of the catchment remains rural, with large areas in the north east and south of the catchment having population densities of < 1 person per hectare (Figure 3.1). A detailed breakdown of population change within each ward is presented in Appendix I: Breakdown of population change.

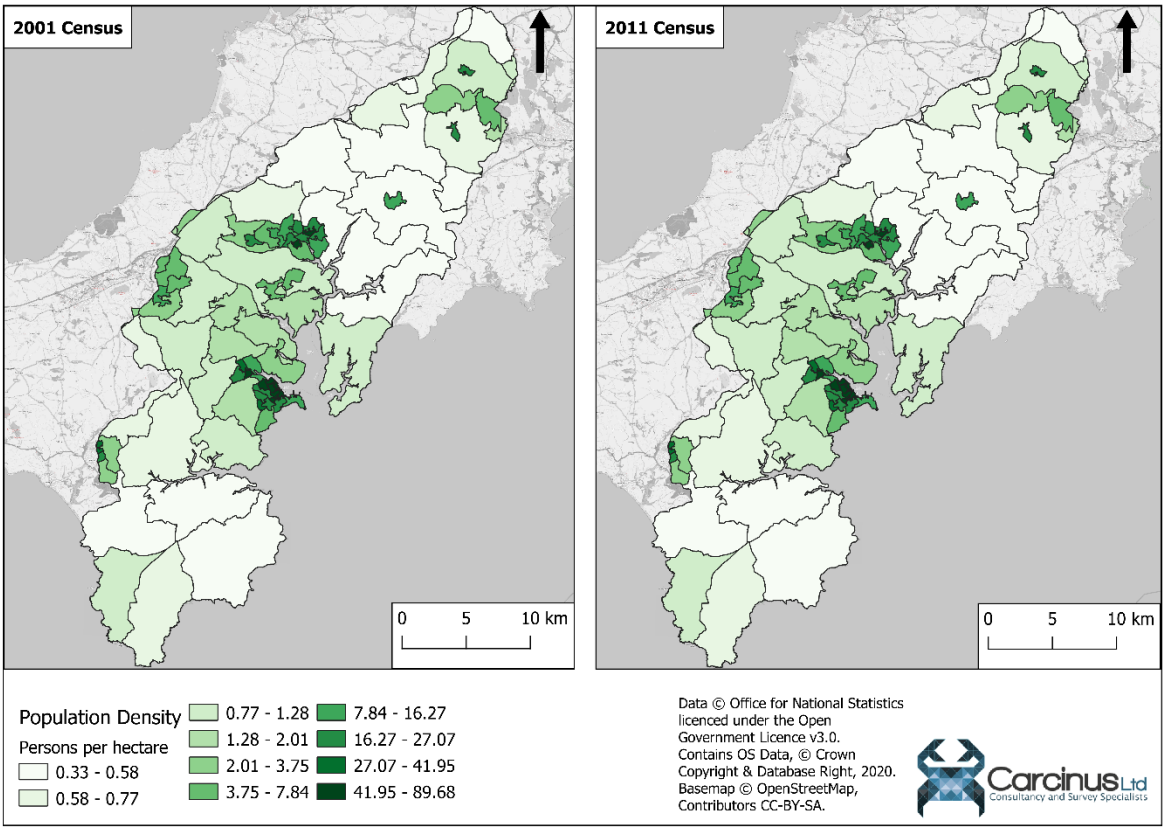

Figure 3.1 Human population density in 2001 and 2011 census Super Output Areas (Lower Layer) that are within or partially within the Fal Estuary hydrological catchment.

[2] Numbers in brackets are identifiers that are displayed in Figure 3.2.

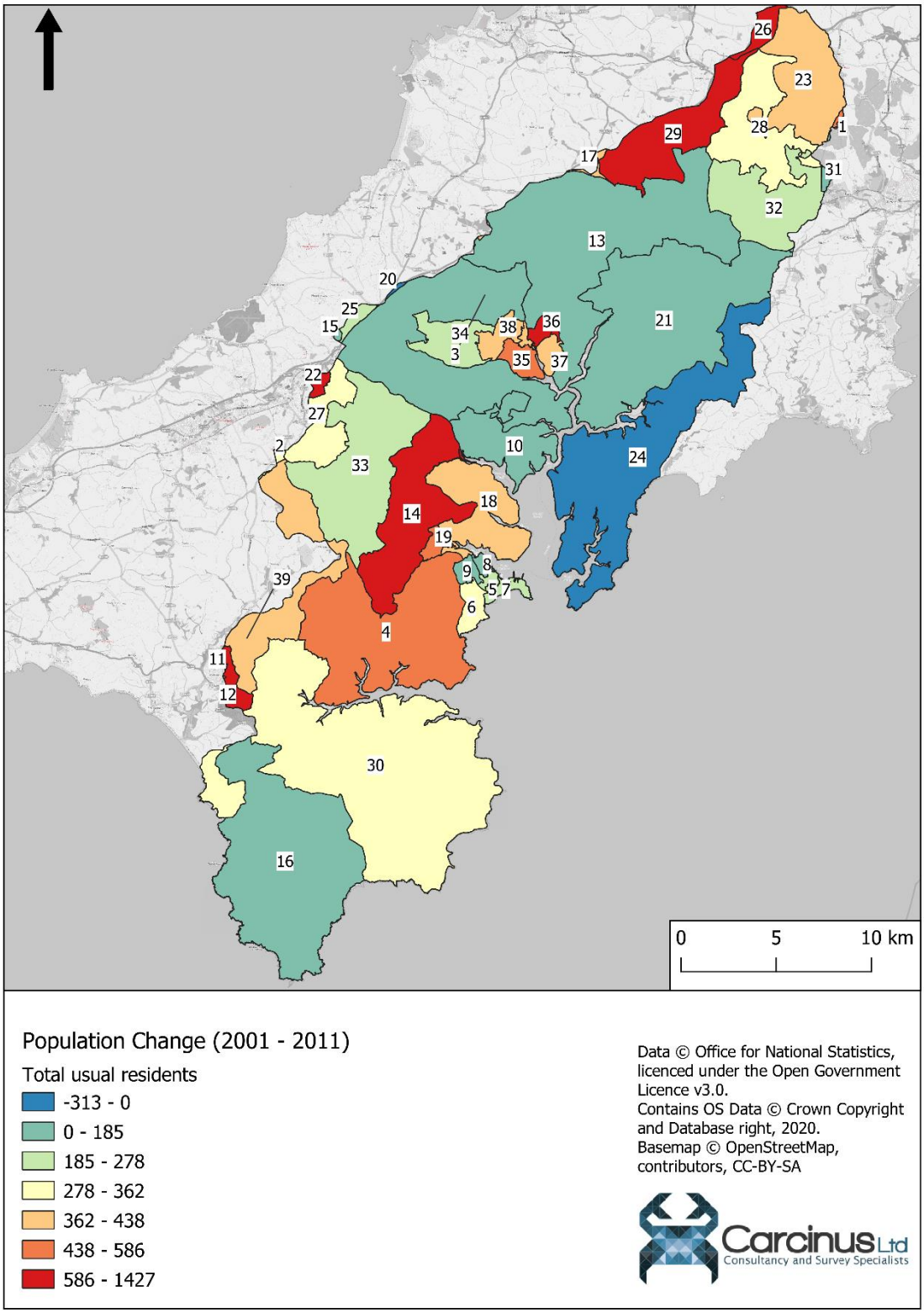

Figure 3.2 Population change between the 2001 - 2011 censuses for Wards and Electoral divisions (based on 2011 boundaries) that are within or partially within the Fal catchment (wards have been clipped to the boundary of the hydrological catchment). 2001 Census data have been transposed to 2011 wards using the UK Data Service's GeoConvert tool (UK Data Service, 2020) to facilitate comparison. Numbers within wards are identifiers that can be used in combination with Appendix I to provide more detail.

The total resident population of census Super Output Areas (Lower Layer) within or partially within the Fal catchment increased from 136,078 people at the 2001 census to 147,705 people at the 2011 census, an increase of 8.5%. The population data for the 2011 census was collected shortly after the original sanitary surveys were published and so could be considered more relevant to those documents. The next full census of the United Kingdom (UK) is scheduled to take place in 2021, and the UK government estimate that the national population will increase by approximately 6.6% 2011 and 2021 (Office for National Statistics, 2018). An increase of this proportion would see the approximate population residing within the Fal catchment increase to 156,454 people. The potential for contamination through urban runoff remains highest from the towns of Falmouth and Penryn, near the southern limit of CZs in the estuary, as these towns are near to the mouth of the Penryn river. Impacts from sewage will depend on the specific locations and nature of the discharges, changes to which are discussed in Section 3.2.

Tourism still represents a significant component of the local economy. Of the estimated four million tourist visitors to Cornwall each year, an estimated 49% are motivated by activities in and around Falmouth (Falmouth, 2020). Exact numbers of tourists to the area were not available for the current period, though it is likely that significant seasonal variation in visitor numbers exists. Higher numbers of tourists in summer months will lead to increase sewage discharges and an associated increase in faecal loading from sewage works serving the area. It is likely that the timing of seasonal fluctuations in populations have not changed significantly since the original sanitary survey.

Whilst there is no recently available population data for the catchment, it is likely that the population will have increased by a small proportion since the original sanitary surveys. However, the distribution of the main population centres in the catchment have not changed, and thus the recommendations for RMPs outlined in the original sanitary surveys are still valid.

3.2 Sewage

Details of all consented discharges within the Fal catchment were taken from the most recent update to the EA's national permit database at the time of sampling (October 2020). The locations of these discharges are shown in Figure 3.3.

The original sanitary surveys identified a total of 8 continuous discharges likely to contribute microbiological contamination the CZs (p70, Figure VII.1; p72, Table VII.1). The major discharges in terms of their daily flows were located around the urbanised areas of Falmouth, Penryn and Truro. The original sanitary surveys only considered those discharges within 4 km of a shellfish bed, and only one additional discharge within this distance has been consented since the publication of the original surveys (Table 3.1). No changes to the treatment methods in any of the discharges identified in both the original sanitary surveys and this review have occurred. All employ UV disinfection, except for Carnon Downs STW that employs biological filtration. Several of the discharges identified in this review that were beyond the spatial scope of the original sanitary survey employ secondary treatment, although these discharge to watercourses a significant distance from the estuary.

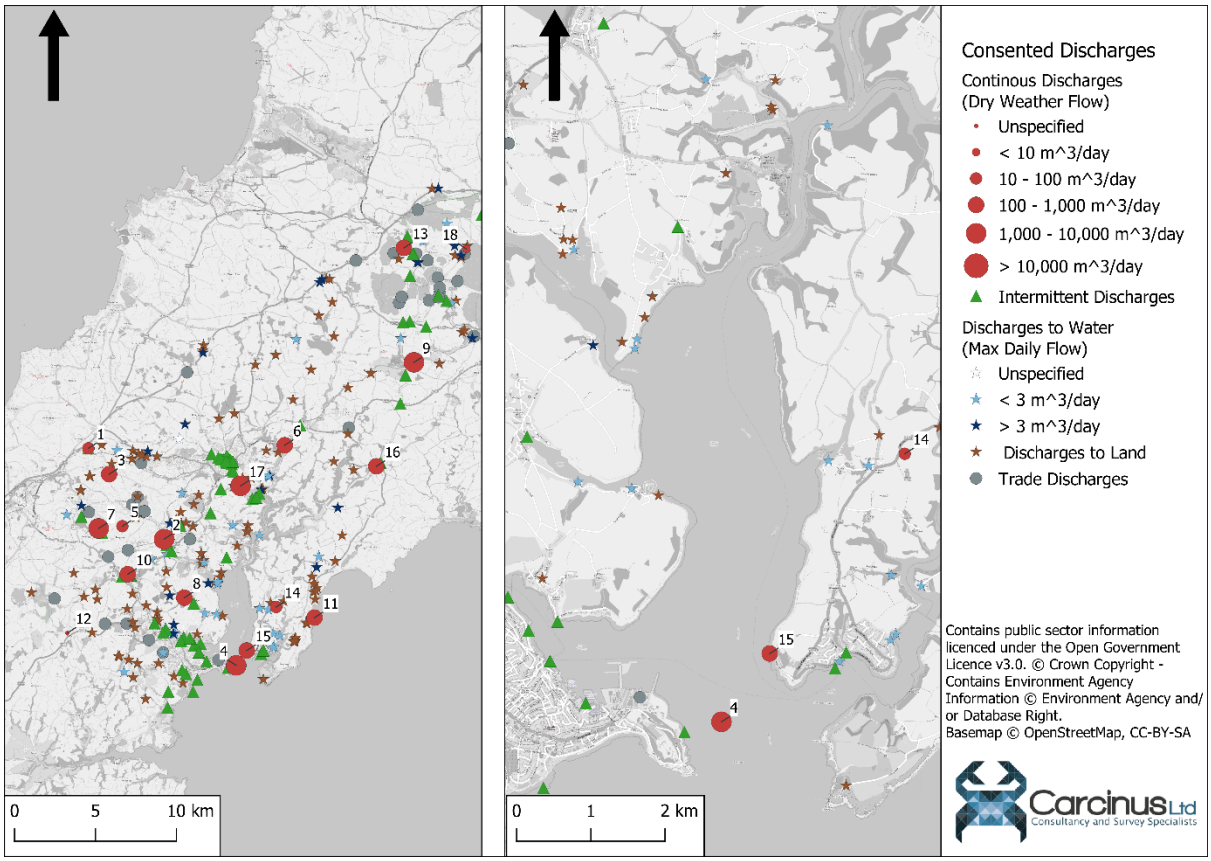

Figure 3.3 Locations of all consented discharges within the Fal catchment. Labels refer to continuous discharges, details of which can be found in Table 3.1.

Table 3.1 Details of all continuous discharges within the Fal catchment. Those discharges in direct proximity to the estuary that have become active since the original sanitary survey are highlighted in yellow.

No.	Sewage Works	NGR	Treatment	DWF (m^3/day
1	BLACKWATER STW	SW7400045610	ACTIVATED SLUDGE	68
2	CARNON DOWNS WWTW	SW7868040000	BIOLOGICAL FILTRATION	1010
3	CHACEWATER STW	SW7528044010	BIOLOGICAL FILTRATION	300
4	FALMOUTH SEWAGE TREATMENT WORKS	SW8314032200	UV DISINFECTION	9500
5	FROGPOOL STW	SW7610040800	BIOLOGICAL FILTRATION	80
6	LADOCK VALLEY STW	SW8614045800	UV DISINFECTION	675
7	LANNER ST DAY WASTEWATER TRMNT WRKS	SW7463540662	BIOLOGICAL FILTRATION	1390
8	MYLOR BRIDGE WWTW	SW7993036380	UV DISINFECTION	441
9	NORTH FAL STW (ST STEPHENS COOMBE)	SW9413050920	ACTIVATED SLUDGE	3186
10	PONSANOOTH STW	SW7643037830	BIOLOGICAL FILTRATION	720

11	PORTSCATHO SEWAGE TREATMENT WORKS	SW8798035150	BIOLOGICAL FILTRATION	261
12	RAME STW	SW7270034200	BIOLOGICAL FILTRATION	Unspecified
13	ST DENNIS WASTEWATER TREATMENT WORK	SW9351057990	BIOLOGICAL FILTRATION	370
14	ST JUST IN ROSELAND STW	SW8561035810	BIOLOGICAL FILTRATION	27
15	ST MAWES STW	SW8379033120	UV DISINFECTION	800
16	TREGONY STW	SW9180044500	BIOLOGICAL FILTRATION	180
17	TRURO (NEWHAM) STW	SW8341043290	UV DISINFECTION	7020
18	WHITEMOOR SEPTIC TANK	SW9737057930	SEPTIC TANK	4.8

The original sanitary surveys identified 50 intermittent discharges within 9.2 km of a shellfish bed. Intermittent discharges comprise Combined Storm Overflows (CSOs), storm tank overflows and pumping station emergency overflows. As with the continuous discharges, these were located around the major urban centres within the catchment. No additional intermittent discharges were identified through this review, although consultation with the EA indicated that several improvements to intermittent discharges, designed to improve Shellfish Waters within the estuary, have occurred or are planned to occur since the original sanitary surveys were conducted. These are summarised in Table 3.2. During AMP 5 (2010 – 2015), no material upgrades to the intermittent discharge network occurred. No updated spill event monitoring for intermittent discharges in the catchment is available, however the frequencies of spill events are predicted to be similar as the patterns of rainfall in the catchment have not changed significantly (Section 5). Accordingly, the impact on bacterial loading in the estuary as a result of spills is not expected to have got worse.

Table 3.2 Upgrades to intermittent discharges within the Fal catchment during the EA's AMP 6 and AMP 7 schedules.

Discharge Name	**NGR**	**Scheme details**	**(*Planned*) Date of Completion**
		AMP 6 (2015 – 2020)	
Newham New SPS CSO/EO	SW8292044140	Average of no more than 10 spills per annum >50m3 for the Aggregation; all CSOs draining to Newham STW (all CSOs not listed in this NEP were improved in earlier AMP periods). A spill is as defined by EA guidance. Must comply with EA screening requirements. Permanent Event Duration Monitoring and Telemetry Required	15/03/2018
Trelander Highway CSO	SW831745020	Average of no more than 10 spills per annum >50m3 for the	12/01/2018

		Aggregation; all CSOs draining to Newham STW (all CSOs not listed in this NEP were improved in earlier AMP periods). A spill is as defined by EA guidance. Must comply with EA screening requirements. Permanent Event Duration Monitoring and Telemetry Required	
Halvarras SPS EO	SW8156041590	Must comply with EA pumping station emergency overflow requirements. Permanent Event Duration Monitoring and Telemetry Required	23/03/2016
Campfield Hill CSO	SW8269044960	Average of no more than 10 spills per annum >50m3 for the Aggregation; all CSOs draining to Newham STW (all CSOs not listed in this NEP were improved in earlier AMP periods). A spill is as defined by EA guidance. Must comply with EA screening requirements. Permanent Event Duration Monitoring and Telemetry Required.	08/05/2017
		AMP (2020 – 2025)	
Castle Street CSO	SW8233044920	No more than 10 spills per annum shall be>50m3. (Applies to all CSOs draining to Newham STW). A spills is as defined by EA guidance.	*(30/06/2021)*
Tregony Bridge PS CSO/EO	SW92000044700	Must comply with EA screening Policy. Must comply with EA pumping station emergency overflow policy requirements.	*(31/03/2023)*

In addition to the water company owned discharges, there are still a number of privately owned discharges within the catchment. Few of these discharge directly to water near any of the CZs (Figure 3.3) and so will have limited impact on the bacterial loading experienced by the CZs.

The most at risk areas to contamination from this source, therefore, remain those CZs closest to the urbanised areas of the catchment, however, the faecal loading from these discharges is not expected to change significantly. Therefore, the recommendations made in the original sanitary surveys to capture this source of pollution remain valid.

3.3 Agricultural Sources

Direct comparison with the agricultural statistics for the entire Fal Catchment presented in the sanitary survey of the Fal (lower) production area was not possible, as no updated data for the catchments assessed were freely available. However, livestock data for the local authority district

(Cornwall) in which the Fal catchment falls were available for 2013 and 2016 (DEFRA, 2018). As the catchment represents a small proportion of the total district, the livestock data were adjusted to reflect the % of the district that falls in the catchment. This assumes that livestock are distributed uniformly throughout the district and, therefore, some inaccuracies within the data may be present. Changes in livestock numbers by type are presented in Table 3.3, and the area of the Fal catchment used for pasture is shown in Figure 3.4.

Table 3.3 Change in livestock numbers between 2013 and 2016 within the Cornwall Local Authority District.

Livestock Type	**Total Population (adjusted to entire catchment)**			**Population Density (based on area of pasture within catchment, #/Ha)**		
	2013	*2016*	*% Change*	*2013*	*2016*	*Absolute Change*
Cattle	63,070	61,559	-2.4%	3.68	3.59	-0.09
Pigs	9,010	10,143	+12.58%	0.53	0.59	+0.07
Sheep	92,269	96,505	+4.59%	5.39	5.64	+0.25
Poultry	141,376	215,518	+52.44%	8.25	12.59	+4.33
Total	**305,725**	**383,725**	**25.51%**	**17.86**	**22.42**	**4.56**

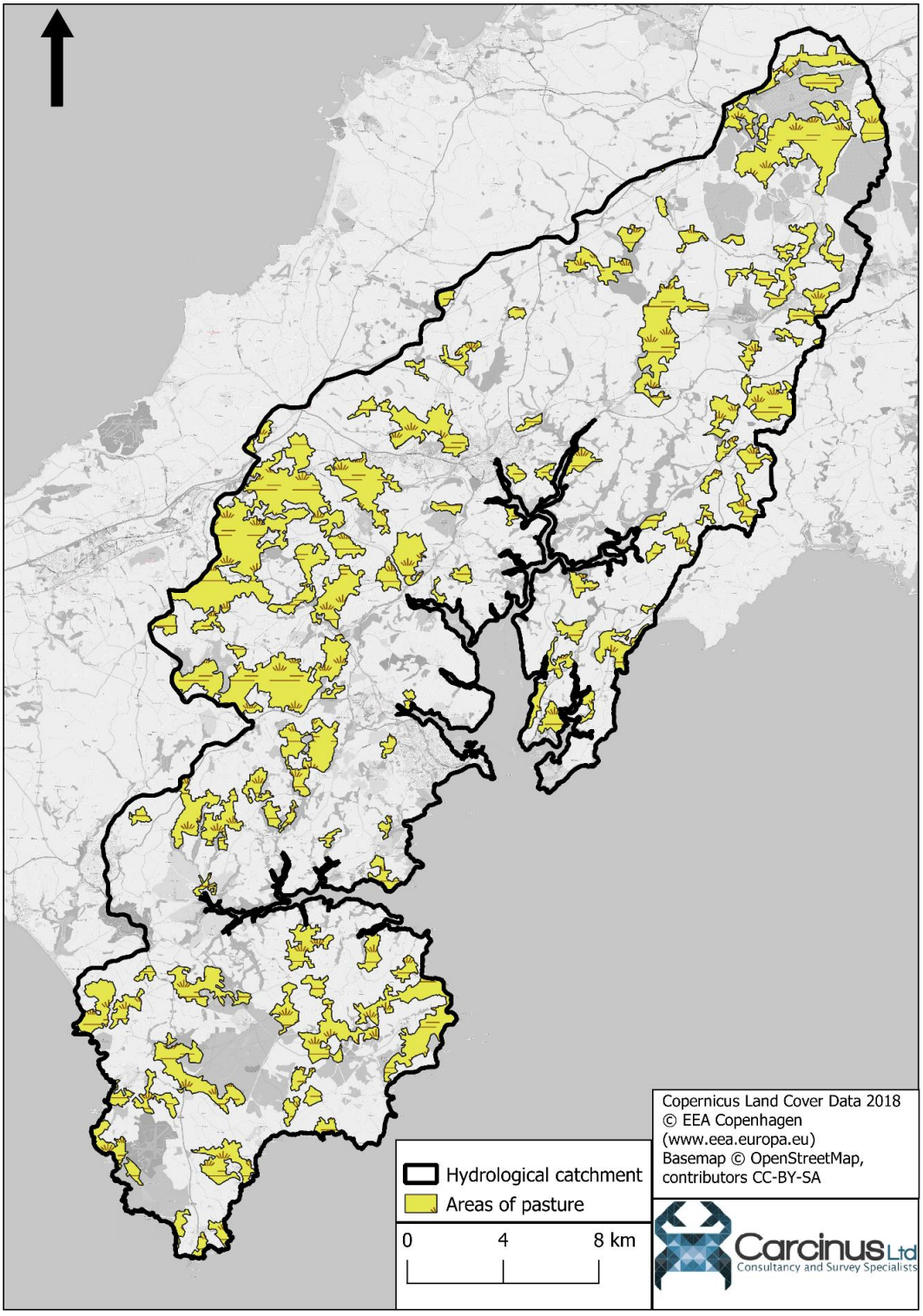

Figure 3.4 Areas of pasture within the Fal catchment, based on Copernicus Land Cover Data from 2018.

In 2016, a total of 383,725 livestock were present within the Fal catchment, an increase of more than 25%. All groups of livestock have increased between 2013 and 2016, apart from cattle. The greatest increase was in poultry, which increased by more than 50%, though the lack of granularity in the livestock data means that it is not possible to state what proportion of this change actually

occurred within the Fal catchment. Livestock data is not available at the same spatial scale as in the original sanitary surveys, however, it is likely that hotspots of density will remain the same. Furthermore, seasonality and probable routes of contamination by agricultural sources will have remained consistent since the original sanitary surveys.

Whilst livestock numbers (and associated faecal loading to the estuary) have increased significantly since the original surveys were conducted, the hotspots and seasonality of livestock densities are unlikely to have changed significantly. As such, the recommendations made in the original sanitary surveys to capture this source of contamination remain valid.

3.4 Wildlife

The Fal estuary consists of a variety of important intertidal and estuarine habitats, including sandbanks, mudflats and reefs. These habitats support a variety of wildlife species, including a nationally significant population of birds and wildlife. All the same statutory and non-statutory designated sites within the estuary still apply; these are:

- Fal and Helford Special Area of Conservation (SAC);
- Lower Fal and Helford Site of Special Scientific Importance (SSSI);
- Malpas Estuary SSSI; and
- Upper Fal Estuary and Woods SSSI.

The original sanitary surveys do not cite a precise number of wetland birds in the estuary at the time the studies were conducted. The five-year average to 2009/2010 of overwintering waterbirds in the Fal Complex was 4,371 (Holt *et al.*, 2011). The five-year average to the most recent season (2018/2019) had decreased to 2,438 birds (Frost *et al.*, 2020), a decrease of more than 44%. Wading bird species known to utilise the estuary include Redshank, Curlew, Dunlin, Golden Plover, Lapwing & Oystercatcher. In addition, wildfowl species such as Canada Goose, Teal, Wigeon, and Mallard also occupy the estuary in large numbers. Finally, Black-headed Gull, Herring Gull and Lesser Black-backed Gull also utilise the estuary. Geese and duck species within the estuary are more likely to forage grasslands and saltmarsh that ring the estuary, where their faeces will be carried into coastal waters through runoff or tidal inundation. The original sanitary surveys indicated that the intertidal rivers that drain into the main estuary have the densest aggregations of wading bird species, although their precise distributions will vary from year to year, depending on the distributions of their prey. Consequently, the spatial distribution of any faecal contamination will be variable, but it is likely to be temporally constrained to winter months when populations are highest.

The original surveys do not comment on the presence of other wildlife species, however, reports from around the time of the original surveys (Environment Agency, 2010) indicate that otters are present in the estuary. No updated reports are available, though it is likely that their numbers remain low and given their wide distribution, will have no material bearing on the sampling plan.

Grey seals are known to utilise the Fal estuary (Leeney *et al.*, 2010), though the precise number of resident animals is unknown. Furthermore, these animals show a wide foraging range and are unlikely to represent a significant source of contamination to the shellfishery.

Whilst there has been a significant decrease in the bird populations of the estuary since the original sanitary surveys, their unpredictable spatial distribution makes it challenging to choose RMP locations that will consistently capture this source of pollution. No other wildlife species are likely to

represent a significant source of contamination, and as such, the recommendations for RMP location made in the original sanitary survey are still valid.

3.5 Boats and Marinas

The discharge of sewage from boats is a potentially significant source of bacterial contamination of shellfisheries within the Exe estuary. Boating activities in the area have been derived through analysis of satellite imagery and various internet sources and compared to that described in the original sanitary surveys. Their geographical distributions are presented in Figure 3.5.

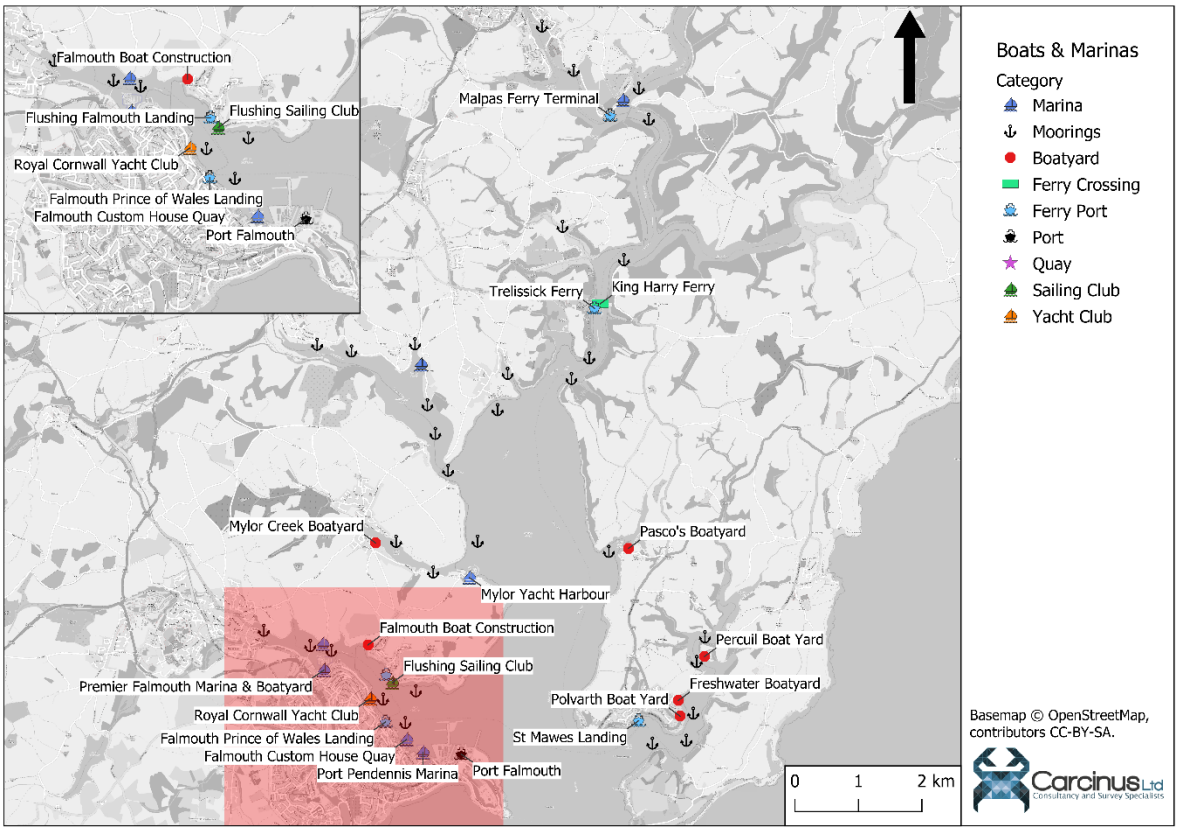

Figure 3.5 Locations of moorings, marinas and other boating activities within the Fal Estuary.

The Fal Estuary is the third largest natural harbour in the world, providing moorings and anchorages for both recreational and commercial vessels. The original sanitary surveys describe the presence of approximately 4,700 leisure craft moorings within the entire Fal Estuary. Whilst no recent data are available, a source published after the sanitary surveys were conducted states that approximately 4,500 moorings are present, of which 1,500 are within the port of Truro and 350 are in Penryn (Port of Truro, 2011). In addition to the moorings available to leisure craft, the Port of Falmouth has deep-water lay-up moorings for vessels up to 219 metres in length. The port handles cargo that includes bulk, bagged, packaged and palletised goods (UK Ports, 2020). Consultation with the Local Authority in charge of the region did not indicate any further changes to the boating activities within the estuary.

In addition to the marina berths and moorings, there are several sailing and water sports centres distributed throughout the estuary. The small recreational boats are not large enough to have onboard toilet facilities and are, therefore, unlikely to make overboard discharges. A single fishing

vessel under 10 m length lists Penryn as its home port. The closest pump-out facilities are approximately 40 km to the east, in Fowey Harbour (The Green Blue, 2020).

There have been no changes to the legislation governing overboard discharges from vessels, with restrictions placed on commercial vessels against overboard discharges within three nautical miles of land and guidance given to pleasure craft to follow the same advice (RYA, 2020). Private vessels of a sufficient size may still make occasional overboard discharges, either when moored / anchored overnight or when navigating through the calm of the estuary.

Based on the information available to the authors of this review, no significant changes to the levels of boating activity within the Fal Estuary are expected to have taken place since the original sanitary survey reviews were published. The areas of the BMPA most at risk of contamination, from boat-borne pollution, remain the dense areas of moorings and harbours at the mouth of the River Penryn and navigation routes through the estuary. Peak activity levels will continue to be during the summer months and so associated impacts will occur seasonally as well. The original sanitary survey did not make specific recommendations for the sampling plan based on this source of contamination due to difficulties accurately monitoring the locations, timings and volumes of such discharges. The same is true for any updated sampling plan.

3.6 Other Sources of Contamination

Urban fabric within the catchment remains concentrated in the towns of Falmouth/Penryn on the western side of the estuary and the city of Truro in the north of the catchment. There are some additional minor towns and villages such as St Mawes and Tresilian. Settlements near to waterbodies represent a potential source of diffuse pollution via utility misconnections and dog fouling. The geographical sizes of urban settlements within the catchment have not increased significantly, therefore the risk that these settlements pose remains broadly similar. Dog walking along the banks of the estuary will probably take place (and was identified during the shoreline surveys for the original sanitary surveys) and so dog fouling may represent a potential diffuse source of pollution to the near-shore coastal zone.

No evidence of significant changes to these sources of contamination exists. Therefore, it can be assumed that the RMP location recommendations made in the original sanitary survey will still capture the influence of these sources.

4 Hydrodynamics/Water Circulation

As described in the original sanitary surveys, the Fal Estuary is a flooded river valley (ria) with significant areas along the margins and in the tributaries that dry at low water. No evidence of significant changes to the hydrodynamics and routes of contamination circulation around the estuary exists; most sources will be carried from up-estuary and landward locations downstream throughout the estuary. RMP locations should continue to reflect the domination of up-estuary sources.

5 Rainfall

Rainfall data from the Kenwyn at Truro (NGR: SW819450) from 2003 – 2010 (pre sanitary surveys) and 2011 – 2017 were used to determine whether any changes in rainfall patterns had occurred since the original sanitary surveys were conducted. Figure 5.1 shows the average daily rainfall totals

for each month at this monitoring station. Whilst rainfall has been slightly higher since the publication of the sanitary surveys, two-sample t-tests revealed that there was no significant difference between the mean daily rainfall per month (p = 0.6456) between the 2003 – 2010 and 2011 – 2017 periods. Table 5.1 summarises the rainfall for the two periods.

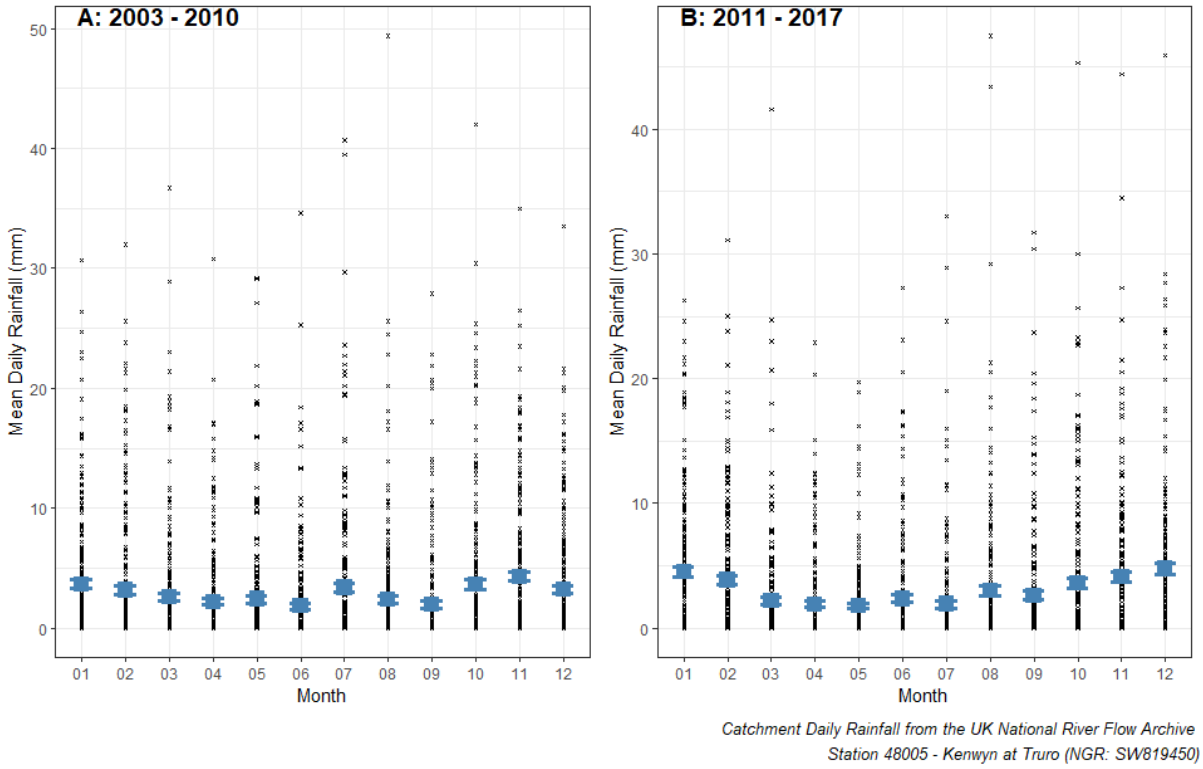

Figure 5.1 Mean daily rainfall (mm) per month for the Kenwyn at Truro monitoring station (NGR: SW819450) for the period 2003 – 2010 (pre sanitary surveys) and 2011 – 2017 (post sanitary surveys).

Table 5.1 Summary statistics for rainfall before and after sanitary survey.

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days > 10 mm rainfall	% Days > 20 mm rainfall
2003 - 2010	1060.28	38.60	32.03	19.88
2011 - 2017	1114.51	30.43	35.67	23.19

Rainfall leads to increased faecal loading through two factors; elevated levels of surface runoff and spill events from intermittent discharges. However, as the rainfall patterns have remained consistent across the two time periods, significantly increased bacterial loading due to these factors are unlikely and as such RMP recommendations made in the original sanitary surveys to capture the influence of runoff and spill events remain valid.

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

Since the original sanitary surveys were published, there have been a total of 29 RMPs that have been sampled in the Fal estuary, 13 for native oysters, 14 for mussels and two for cockles. Both cockle RMPs are in the Fal (Upper) production area, along with six native oyster RMPs and seven mussel RMPs. The remaining RMPs all fall within the Fal (Lower) production area. There are no RMPs

that take samples of Pacific oyster for classification purposes. Of these RMPs, nine in the Fal (Upper) area and five in the Fal (lower) area were sampled prior to the publication of the original sanitary surveys. Samples from RMPs at Restronguet Creek (B33BE), Turnaware Bar (B33BF) Mylor Pool (B33BG) were collected immediately following the original sanitary surveys. Samples from the remaining RMPs in the production area were collected following applications for new CZs in the intervening period. The geometric mean results of shellfish flesh monitoring for all RMPs sampled since the original sanitary surveys are presented in Figure 6.1. Summary statistics for these RMPs are shown in Table 6.1.

All but six of the RMPs, for which data are available, are currently sampled. Sampling at these six RMPs was suspended following the declassification of CZs for which they were used. The status of current CZs within the estuary is discussed in Section 2.2.

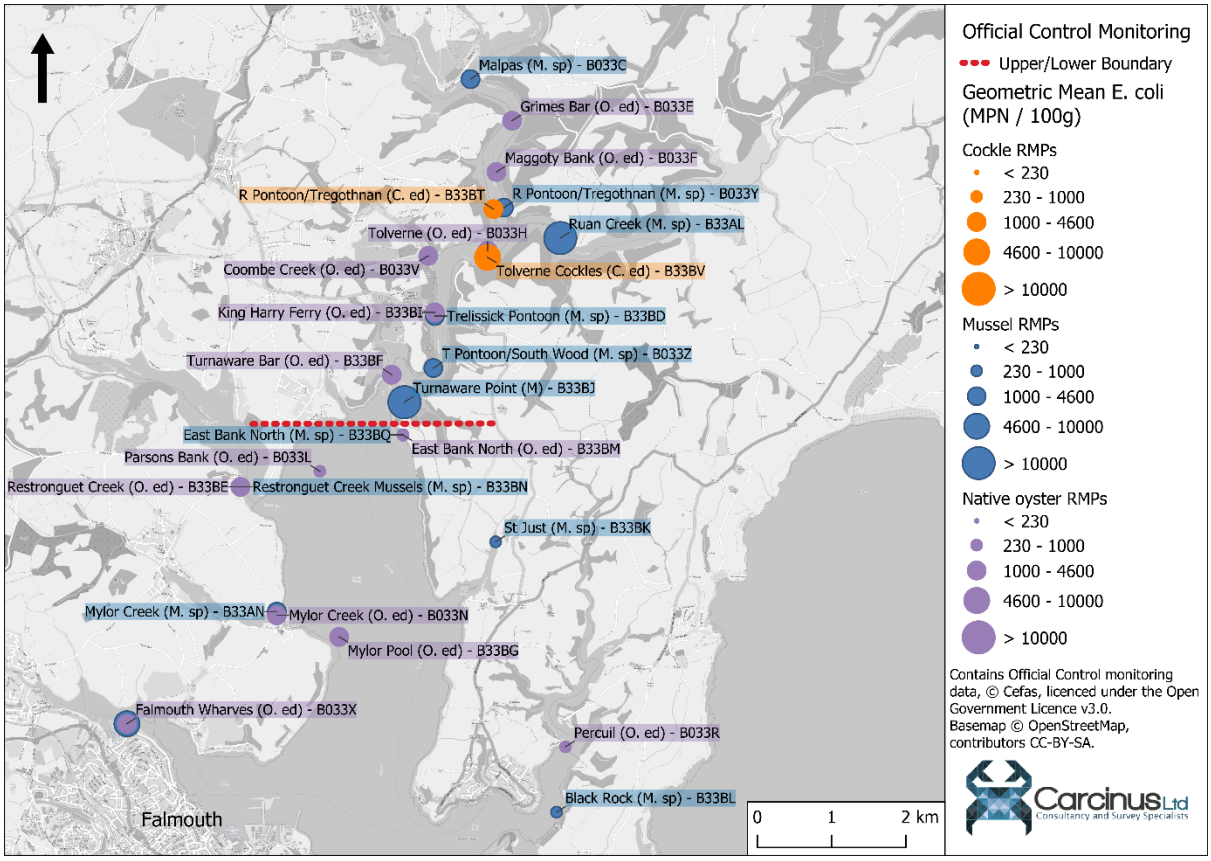

Figure 6.1 Geometric mean E. coli results from Official Control monitoring at bivalve RMPs sampled within the Fal estuary.

E. coli levels at all RMPs have been broadly similar throughout the estuary, with the mean *E. coli* levels typically falling between 1,000 – 5,000 MPN/100 g. All RMPs have returned results greater than 230 MPN/100 g and only three have not exceeded results greater than 4,600 MPN/100 g. Results from nine RMPs have exceeded 46,000 MPN/100g, though typically in <1% of samples. The highest mean *E. coli* levels were returned in samples from Turnaware Point (B33BJ), which was sampled for less than one year but in that time returned a mean *E. coli* level of 178,243.46 MPN/100 g, with nearly one quarter of samples greater than 46,000 MPN/100 g. There is no clear difference between species, although RMPs farther down the estuary generally had lower levels of *E. coli*.

Table 6.1 Summary statistics of E. coli results (MPN/100 g) from RMPs sampled from 2003 onwards. Data up to an including October 2020.

Classification Zone	NGR	No.	First Sample	Last Sample	*E. coli* MPN/100 g			% > 230	% > 4,600	% > 46,000
				Fal (Upper)	Geometric Mean	Min Value	Max Value			
Malpas (M. sp) - B033C	SW84574268	126	13/01/2003	03/09/2019	3392.86	130	54000	89.68	19.05	0.79
Grimes Bar (O. ed) - B033E	SW85134212	203	21/07/2003	20/10/2020	2222.93	18	35000	78.82	12.32	0.00
Maggoty Bank (O. ed) - B033F	SW84924143	202	13/01/2003	20/10/2020	1611.70	20	24000	67.33	6.93	0.00
Tolverne (O. ed) - B033H	SW84804037	201	13/01/2003	20/10/2020	1792.79	18	18000	75.62	9.45	0.00
Coombe Creek (O. ed) - B033V	SW84004030	194	13/01/2003	20/10/2020	1585.68	18	54000	65.46	6.19	0.52
R Pontoon/Tregothnan (M. sp) - B033Y	SW85024095	209	13/01/2003	20/10/2020	3607.07	18	92000	81.82	17.70	0.96
T Pontoon/South Wood (M. sp) - B033Z	SW84073879	189	13/01/2003	09/06/2020	4529.15	18	180000	70.37	17.46	2.12
Ruan Creek (M. sp) - B33AL	SW85784054	175	13/01/2003	01/10/2019	13749.13	18	1700000	85.71	20.57	1.14
Trelissick Pontoon (M. sp) - B33BD	SW84093949	125	02/09/2009	20/10/2020	2535.38	18	54000	73.60	9.60	0.80
Turnaware Bar (O. ed) - B33BF	SW83513870	109	12/04/2011	20/10/2020	1034.92	18	22000	57.80	3.67	0.00
King Harry Ferry (O. ed) - B33BI	SW84093954	86	21/01/2014	20/10/2020	1659.16	18	54000	75.58	5.81	1.16
Turnaware Point (M) - B33BJ	SW83683833	13	16/07/2014	14/04/2015	178243.46	45	1800000	69.23	23.08	23.08
Tolverne Mussels (M. sp) - B33BP	SW84804037	38	02/05/2017	22/09/2020	2377.32	78	24000	76.32	13.16	0.00

Classification Zone	NGR	No.	First Sample	Last Sample	*E. coli* MPN/100 g			% > 230	% > 4,600	% > 46,000
					Geometric Mean	Min Value	Max Value			
Fal (Upper)										
R Pontoon/Tregothnan (C. ed) - B33BT	SW84884093	10	09/07/2019	03/12/2019	2795.00	490	7900	100.00	30.00	0.00
Tolverne Cockles (C. ed) - B33BV	SW84804028	12	09/07/2019	24/02/2020	4654.17	330	13000	100.00	41.67	0.00
Fal (Lower)										
Parsons Bank (O. ed) - B033L	SW82543740	106	13/01/2003	20/10/2020	367.45	18	5400	32.08	0.94	0
Mylor Creek (O. ed) - B033N	SW81963546	199	13/01/2003	20/10/2020	1973.40	18	92000	51.76	6.53	0.50
Percuil (O. ed) - B033R	SW85853369	191	13/01/2003	21/10/2020	540.03	18	18000	35.08	1.57	0
Falmouth Wharves (O. ed) - B033X	SW79943400	189	13/01/2003	21/10/2020	3426.71	20	54000	85.19	19.04	0.53
Mylor Creek (M. sp) - B33AN	SW81963551	174	13/01/2003	20/10/2020	1202.58	18	18000	54.60	5.75	0
Restronguet Creek (O. ed) - B33BE	SW81473719	105	12/04/2011	20/10/2020	1033.19	20	16000	57.14	4.76	0
Mylor Pool (O. ed) - B33BG	SW82803517	103	12/04/2011	21/10/2020	2218.08	18	160000	36.89	2.91	0.97
St Just (M. sp) - B33BK	SW84913645	67	16/07/2014	21/10/2020	660.58	18	16000	23.88	2.99	0
Black Rock (M. sp) - B33BL	SW85733281	73	16/07/2014	21/10/2020	362.87	18	4900	27.40	2.74	0
East Bank North (O. ed) - B33BM	SW84063576	65	26/05/2015	20/10/2020	320.52	18	3300	26.15	0	0
Restronguet Creek Mussels (M. sp) - B33BN	SW81473719	59	10/11/2015	20/10/2020	1124.54	18	11000	66.10	6.78	0
East Bank North (M. sp) - B33BQ	SW83663789	46	18/04/2017	20/10/2020	353.8043	18	1700	39.13043	0	0

Classification Zone	NGR	No.	First Sample	Last Sample	*E. coli* MPN/100 g			% > 230	% > 4,600	% > 46,000
					Geometric Mean	Min Value	Max Value			
Fal (Upper)										
East Bank South (M. sp) - B33BR	SW84063576	13	16/05/2017	13/03/2018	214.0769	18	780	38.46154	0	0
Falmouth Wharves (M. sp) - B33BU	SW79943400	10	25/06/2019	10/12/2019	8504	210	35000	90	50	0

6.1.1 Fal (Upper)

Figure 6.2 - Figure 6.4 present box plots of *E. coli* monitoring results for RMPs sampled for mussels (Figure 6.2), native oysters (Figure 6.3) and cockles (Figure 6.4).

One-way analysis of variance (ANOVA) tests indicated that *E. coli* levels recorded at Turnaware Point (B33BJ) were significantly greater (p = 0) than those recorded at any other mussel RMP in the upper Fal estuary, though only 13 samples were collected at this RMP from July 2014 – 2015, at which time sampling ceased. These samples were collected for classification of the Turnaware Point relay area, although samples warranted a Prohibited classification which led to the cessation of sampling. No other significant differences were found between RMPs of either native oysters or cockles.

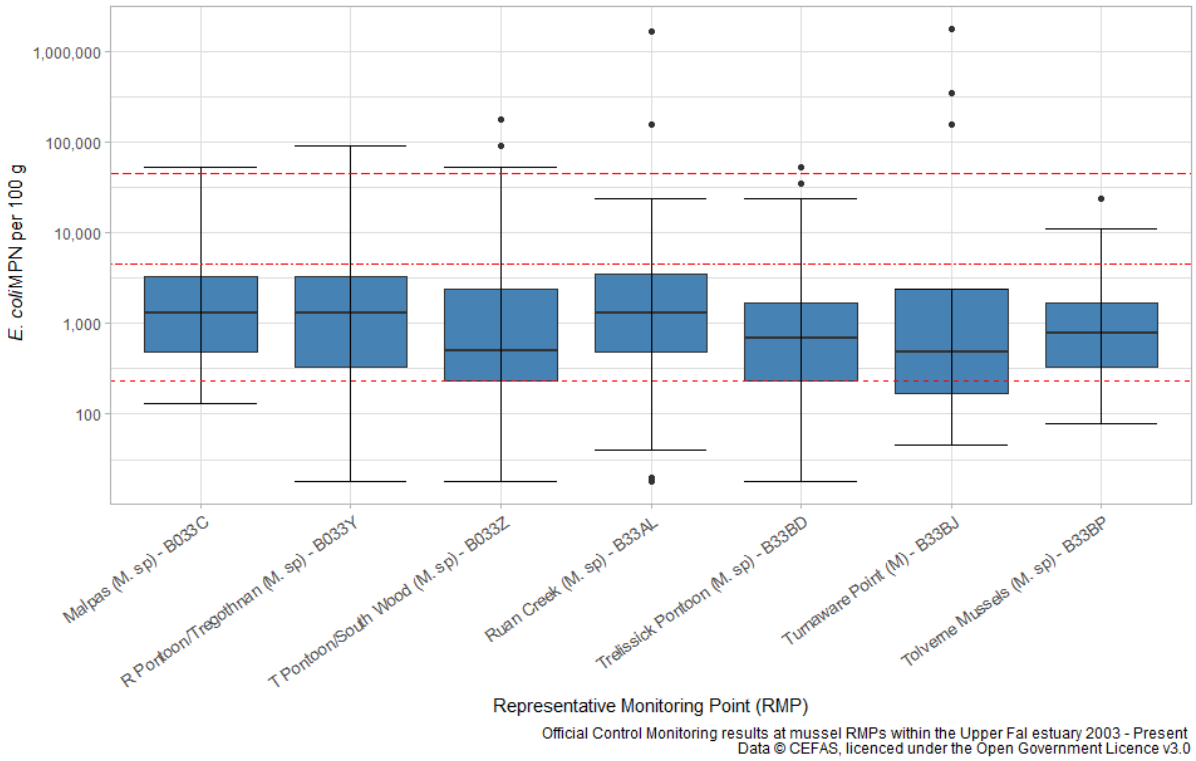

Figure 6.2 Boxplots of E. coli levels at mussel RMPs sampled within the upper Fal Estuary 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

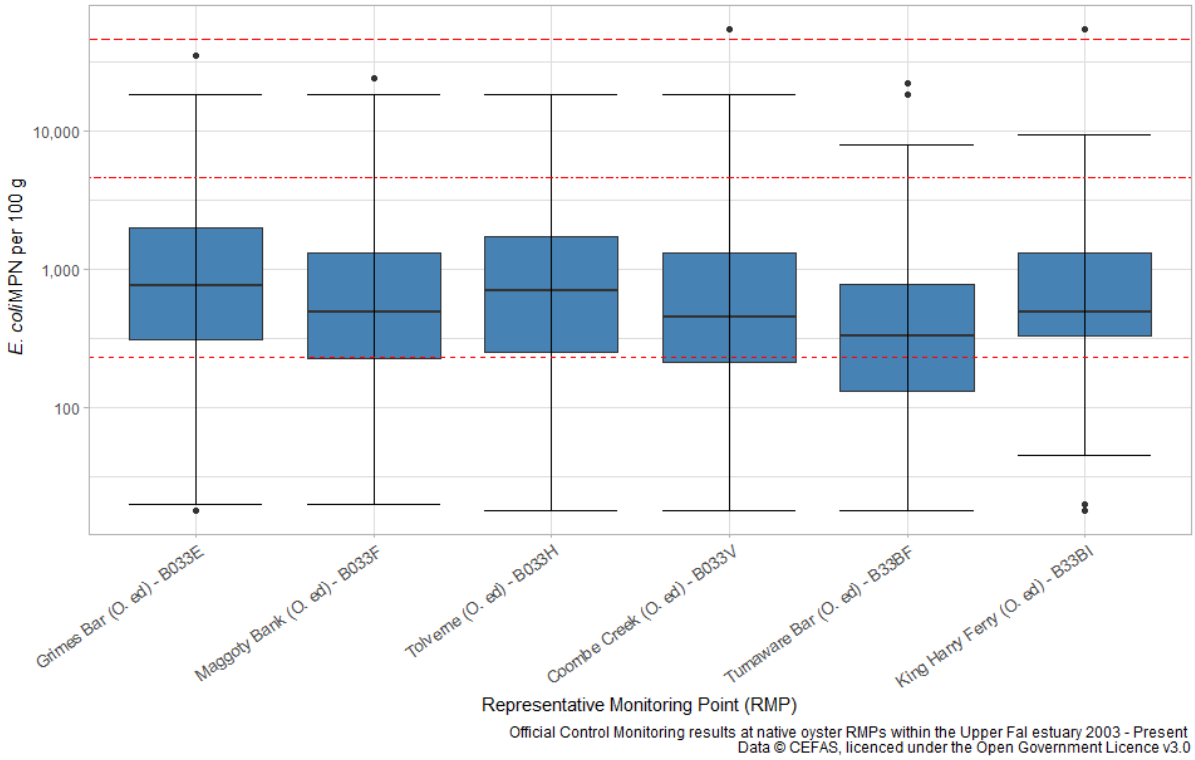

Figure 6.3 Boxplots of E. coli levels at native oyster RMPs sampled within the upper Fal Estuary 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

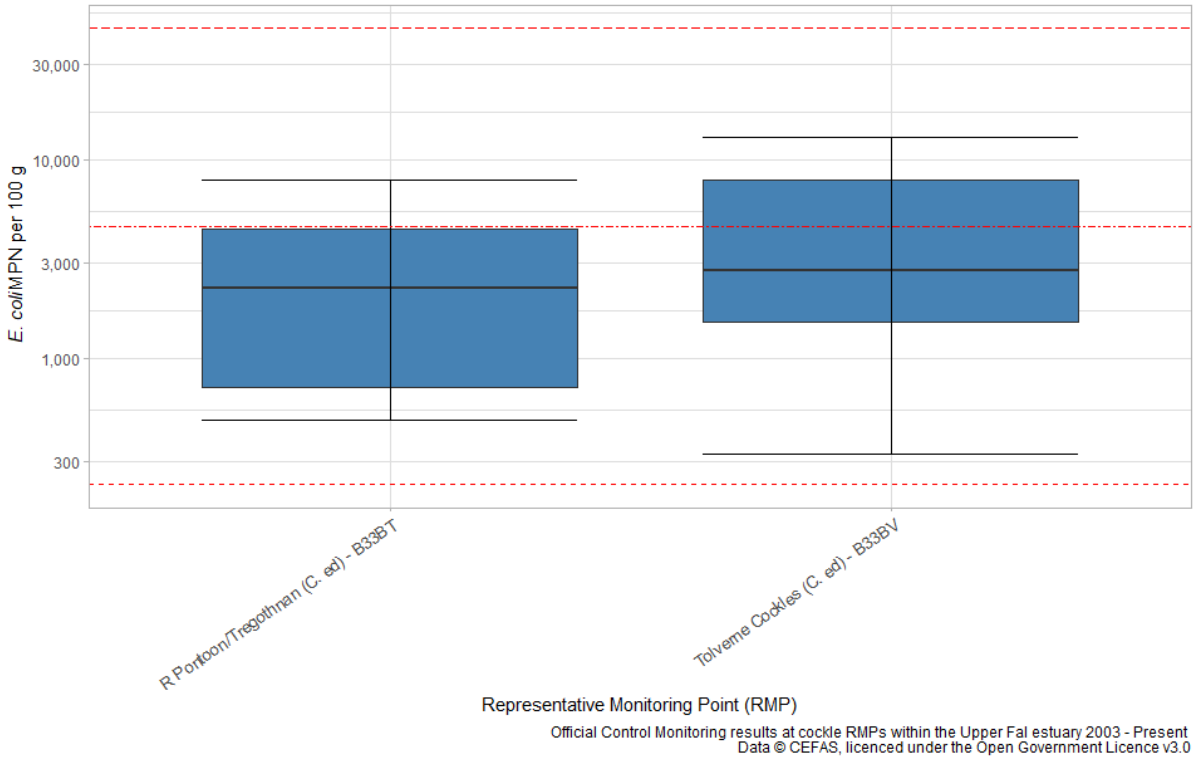

Figure 6.4 Boxplots of E. coli levels at cockle RMPs sampled within the upper Fal Estuary 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

6.1.2 Fal (Lower)

Boxplots of *E. coli* levels at RMPs sampled in the lower Fal Estuary for mussels and native oysters are presented in Figure 6.5 and Figure 6.6 respectively. No RMPs for cockles exist in this section of the BMPA.

One-way ANOVA tests indicated that *E. coli* levels at Falmouth Wharves (B33BU) were significantly greater than at any other mussel RMP (p = 0). Similarly, the native oyster samples taken from this RMP (B033X) were significantly greater than those collected at Parsons bank (p = 0.0059), Percuil (p = 0.0011), East Bank North (p = 0.03). No other significant differences between RMPS were found.

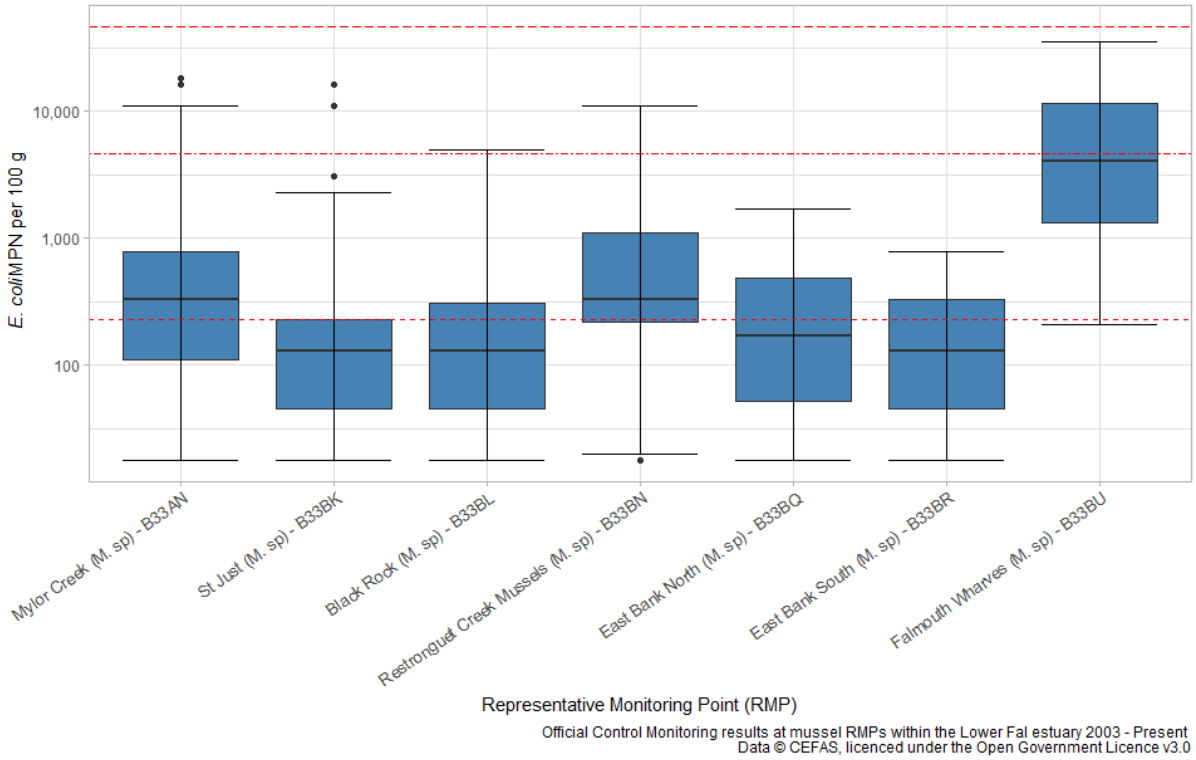

Figure 6.5 Boxplots of E. coli levels at mussel RMPs sampled within the lower Fal Estuary 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

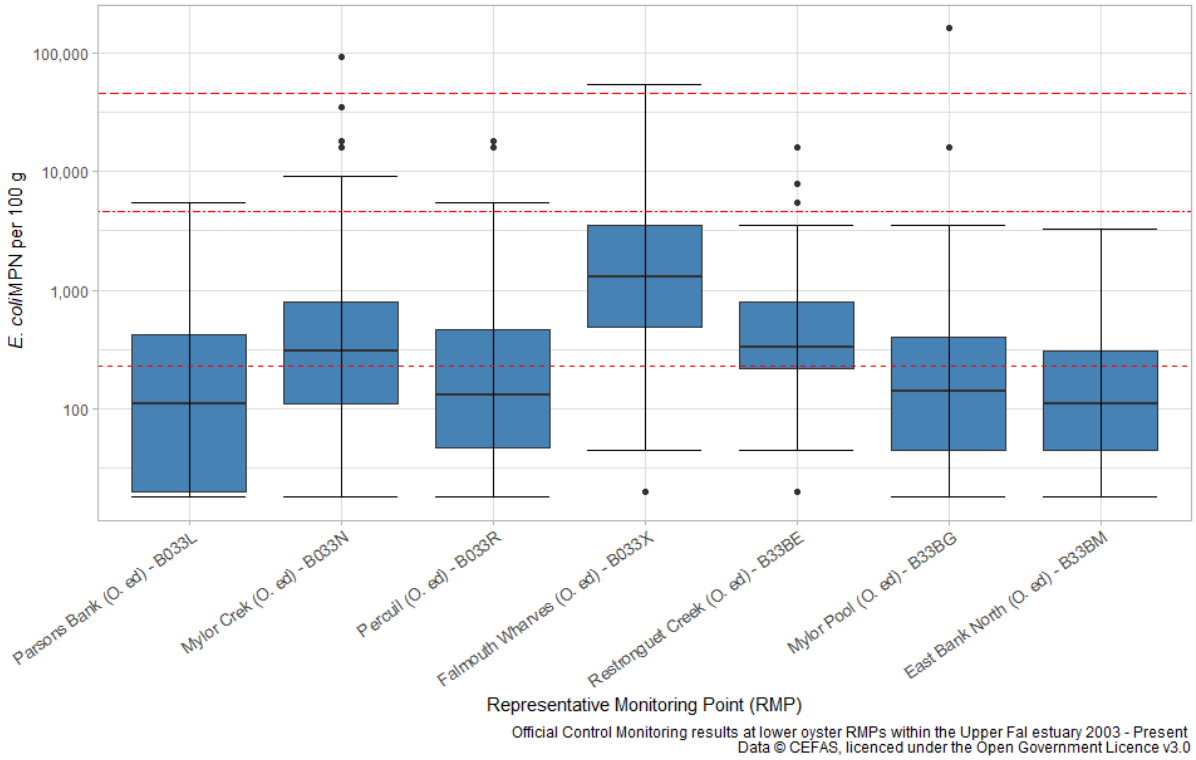

Figure 6.6 Boxplots of E. coli levels at native oyster RMPs sampled within the lower Fal Estuary 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

6.2 Overall temporal pattern in results

6.2.1 Fal (Upper)

The overall temporal pattern in shellfish flesh monitoring results for mussel, native oyster and cockle RMPs within the upper Fal estuary are presented in Figure 6.7, Figure 6.8 & Figure 6.9 respectively.

The *E. coli* levels recorded at the mussel RMPs sampled prior to the publication of the original sanitary survey remained relatively stable, with a slight increase (Figure 6.7). The loess trend line fitted to results from all four RMPs remained above the lower threshold of 230 *E. coli* MPN/100 g but below the higher threshold of 4,600 *E. coli* MPN/100 g. The same stability is evident in all RMPs sampled following the publication of the original sanitary survey, with the exception of Turnaware Point (B33BJ), which rapidly increased to levels above the highest threshold of 46,000 *E.coli* MPN/100 g, until sampling stopped, though the CZ classified using samples from this RMP was only ever awarded Prohibited status.

The same pattern is found in the native oyster RMPs, with *E. coli* loess trend lines generally falling above the lower threshold of 230 *E. coli* MPN/100 g but below the higher threshold of 4,600 *E. coli* MPN/100 g. A gradual decline in *E. coli* levels at all RMPs has occurred in the past two years (Figure 6.8).

Samples were only collected from cockle RMPs for approximately 18 months. In that time, levels of *E. coli* were variable, increasing from near to the lower threshold of 230 *E. coli* MPN/100 g *to* levels significantly above the middle threshold of 4,600 *E. coli* MPN/100 g (Figure 6.9).

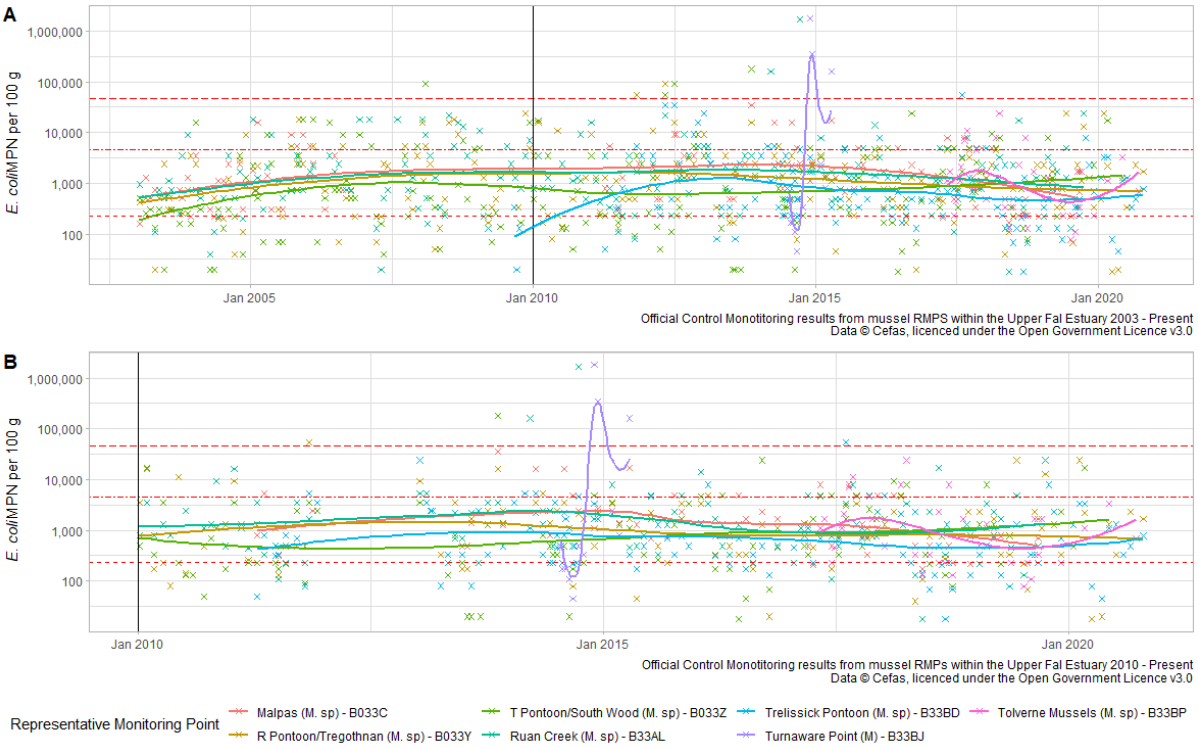

Figure 6.7 Timeseries of E. coli levels at mussel RMPs sampled within the upper Fal Estuary 2003 - present (A) and following the original sanitary survey in 2010 (B). Scatter plots are overlaid with loess model fitted to data.

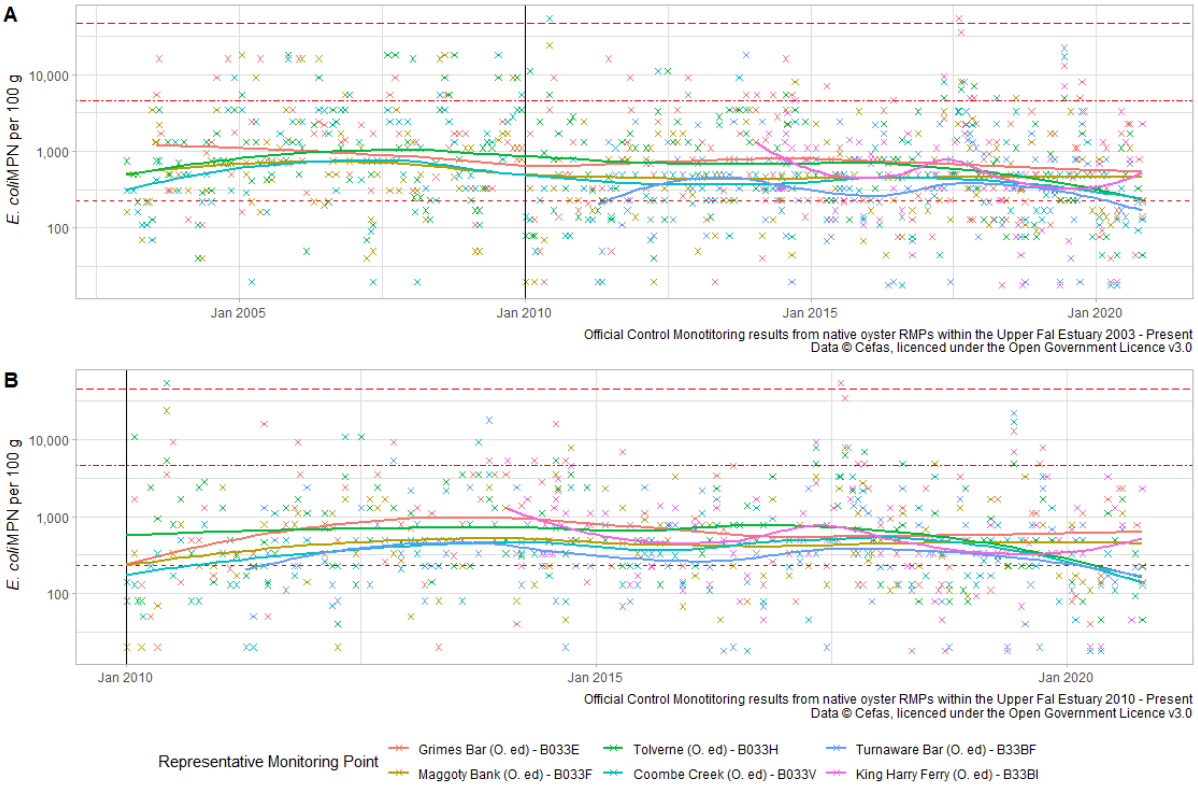

Figure 6.8 Timeseries of E. coli levels at native oyster RMPs sampled within the upper Fal Estuary 2003 - present (A) and following the original sanitary survey in 2010 (B). Scatter plots are overlaid with loess model fitted to data.

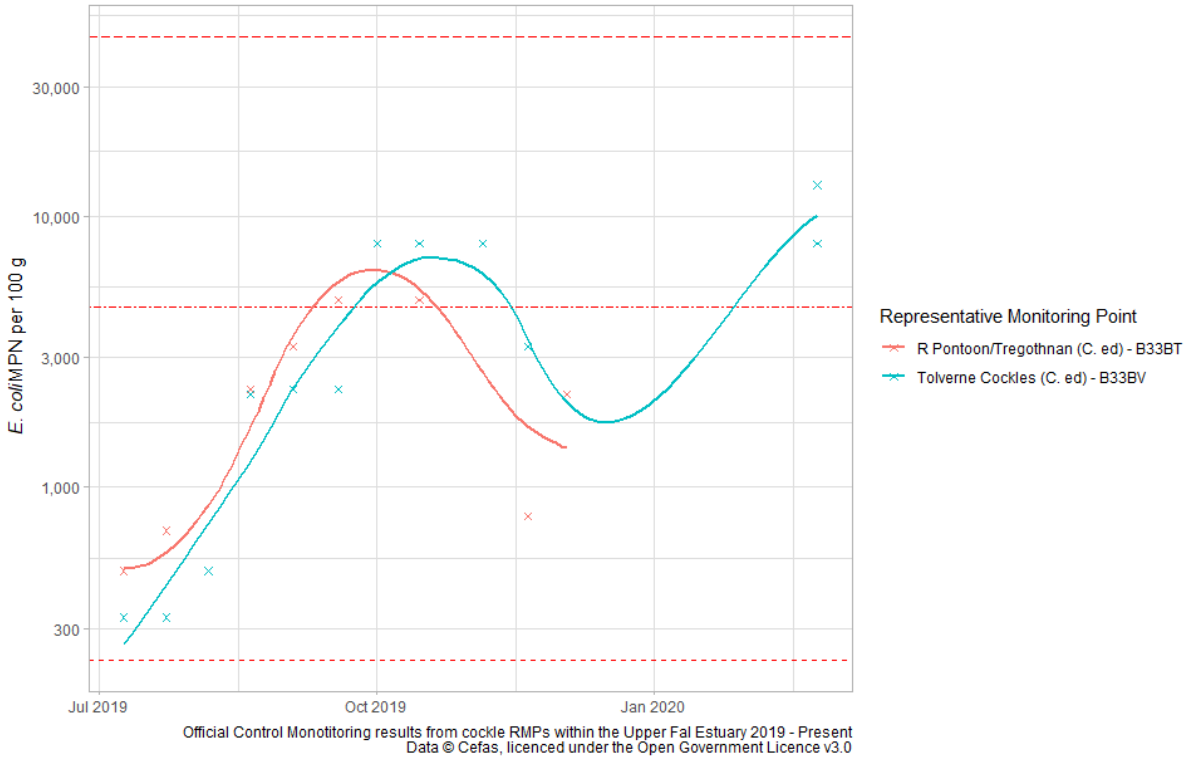

Figure 6.9 Timeseries of E. coli levels at cockle RMPs sampled within the upper Fal Estuary 2003 - present (A) and following the original sanitary survey in 2010 (B). Scatter plots are overlaid with loess model fitted to data.

6.2.2 Fal (Lower)

The overall temporal pattern in shellfish flesh monitoring results for mussel and native oyster RMPs sampled within the lower Fal Estuary are shown in Figure 6.10 and Figure 6.11 respectively.

Only one mussel RMP was sampled prior to the publication of the original sanitary survey in 2012, and similar to mussel RMPs in the upper estuary, *E. coli* levels were stable, falling between the thresholds of 230 MPN/100 g and 4,600 MPN/100 g. There is a gap in monitoring data for this RMP between August 2012 and July 2014, the cause of which is not clear based on the data available to the authors of this report. When sampling recommenced, the pattern of *E. coli* levels did not change. A similar stability is broadly shown across the other RMPs, with the exception of Falmouth Wharves (B33BU) and East Bank South (B33BR). These two RMPs showed very variable results for the short time they were sampled, though levels at Falmouth Wharves (B33BU) were significantly greater (see Section 6.1.2).

The native oyster RMPs also show stable *E. coli* levels in samples collected there, with Parson's Bank (B033L) having consistently lower *E. coli* levels than the other RMPs and Falmouth Wharves (B033X) having generally the highest *E. coli* levels. Falmouth Wharves (B033X) is situated near to the towns of Falmouth and Penryn, the two main urban centres on the banks of the estuary, which could explain the higher levels at this RMPs.

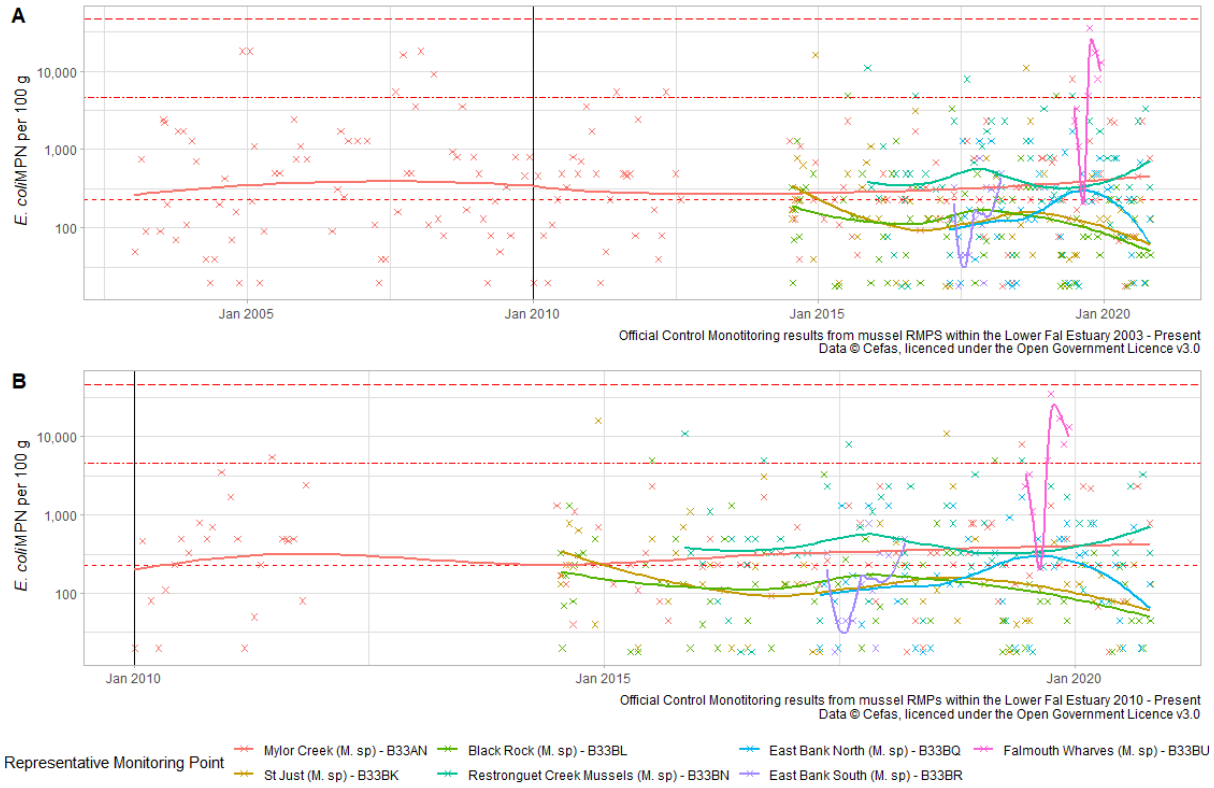

Figure 6.10 Timeseries of E. coli levels at mussel RMPs sampled within the lower Fal Estuary 2003 - present (A) and following the original sanitary survey in 2010 (B). Scatter plots are overlaid with loess model fitted to data.

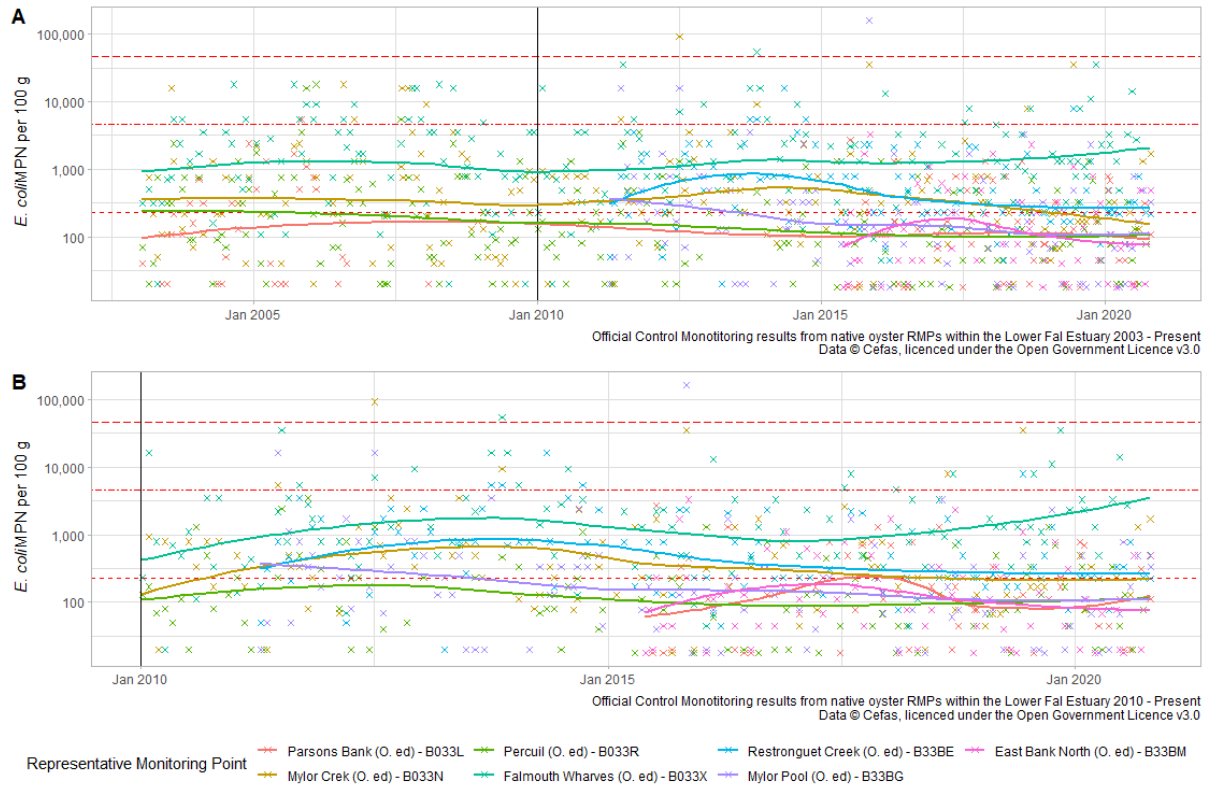

Figure 6.11 Timeseries of E. coli levels at native oyster RMPs sampled within the upper Fal Estuary 2003 - present (A) and following the original sanitary survey in 2010 (B). Scatter plots are overlaid with loess model fitted to data.

6.3 Seasonal patterns of results

6.3.1 Fal (Upper)

The seasonal patterns of *E. coli* levels at the various RMPs within the upper Fal estuary were investigated. The data for mussel RMPs are shown in Figure 6.12 and native oyster RMP data are shown in Figure 6.13. No seasonal data are presented for cockle RMPs, as the RMPs were not sampled for enough time to enable seasonal comparisons. The data for each year were averaged into the four seasons, with Winter comprising data from January – March, Spring from April – June, Summer from July – September and Autumn from October – December.

Two-way ANOVA tests did not reveal any significant seasonal differences by season at any of the RMPs for either species within the upper Fal estuary. Therefore, seasonal classifications are unlikely to be appropriate for any currently classified CZ in the Fal (Upper) production area.

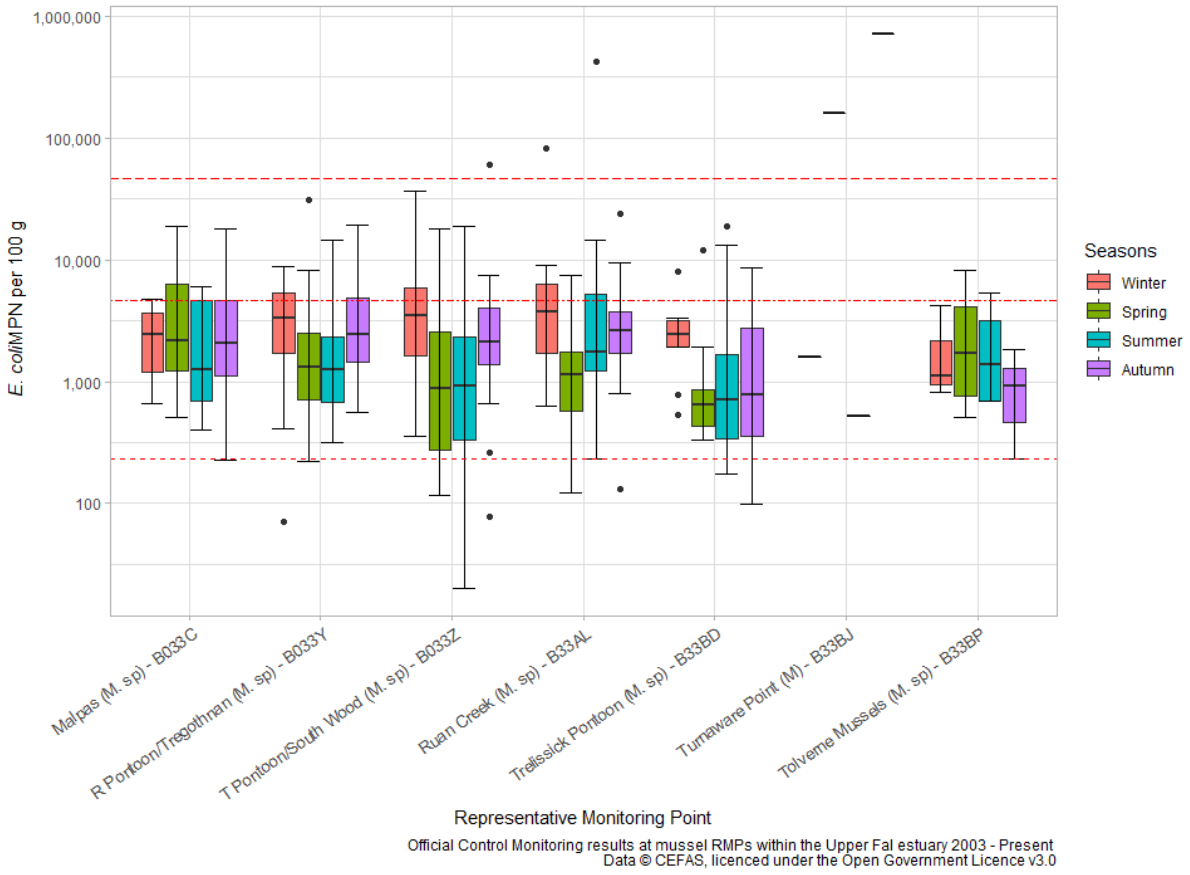

Figure 6.12 Boxplots of E. coli levels per season at mussel RMPs sampled within the upper Fal Estuary 2003 – Present.

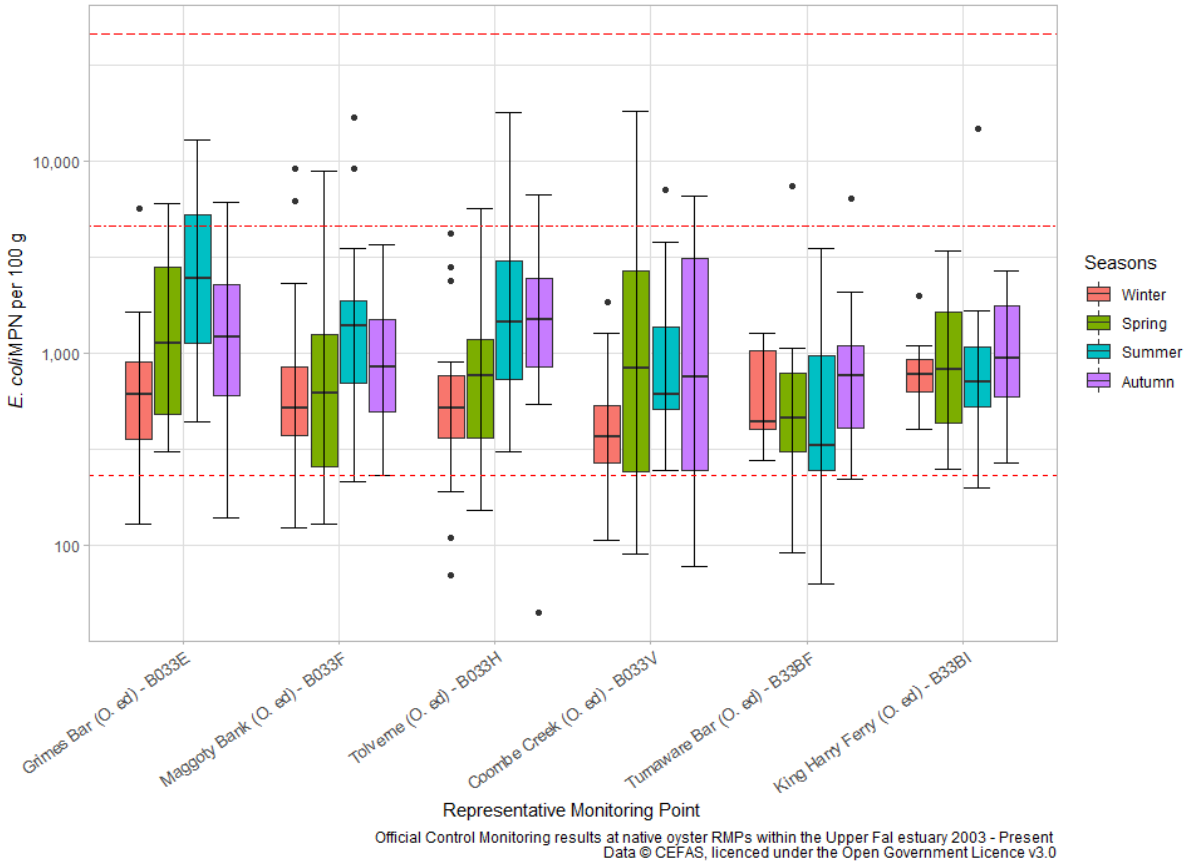

Figure 6.13 Boxplots of E. coli levels per season at native oyster RMPs sampled within the upper Fal Estuary 2003 – Present.

6.3.2 Fal (Lower)

As with RMPs in the upper section of the Fal estuary, the seasonal patterns of *E. coli* levels at the various RMPs within the lower Fal estuary were investigated. The data for mussel RMPs are shown in Figure 6.14 and for native oyster RMPs in Figure 6.15. The data for each year were averaged into the four seasons, with Winter comprising data from January – March, Spring from April – June, Summer from July – September and Autumn from October – December.

Independent of RMP, one way ANOVA tests indicated that *E. coli* levels were significantly greater in Autumn than in Spring ($p = 0.038$) at mussel RMPs, although further two-way ANOVA tests indicated that only *E. coli* levels in Autumn at Falmouth Wharves (B33BU) were significantly greater than results during either Spring or Summer at this RMP ($p = 0$). However, as this RMP was only sampled for six months, very little seasonal inference can be drawn.

At RMPs sampled for native oysters, one-way ANOVA tests indicated that *E. coli* levels during Autumn were significantly greater than levels during Winter ($p = 0.020$) or Spring (0.015), although further two-way ANOVA tests did not indicate any significant within-RMP differences by season.

Overall, analysis of the seasonal variation in *E. coli* levels means that seasonal classifications are unlikely to be appropriate for any currently classified CZ in the Fal (Lower) production area.

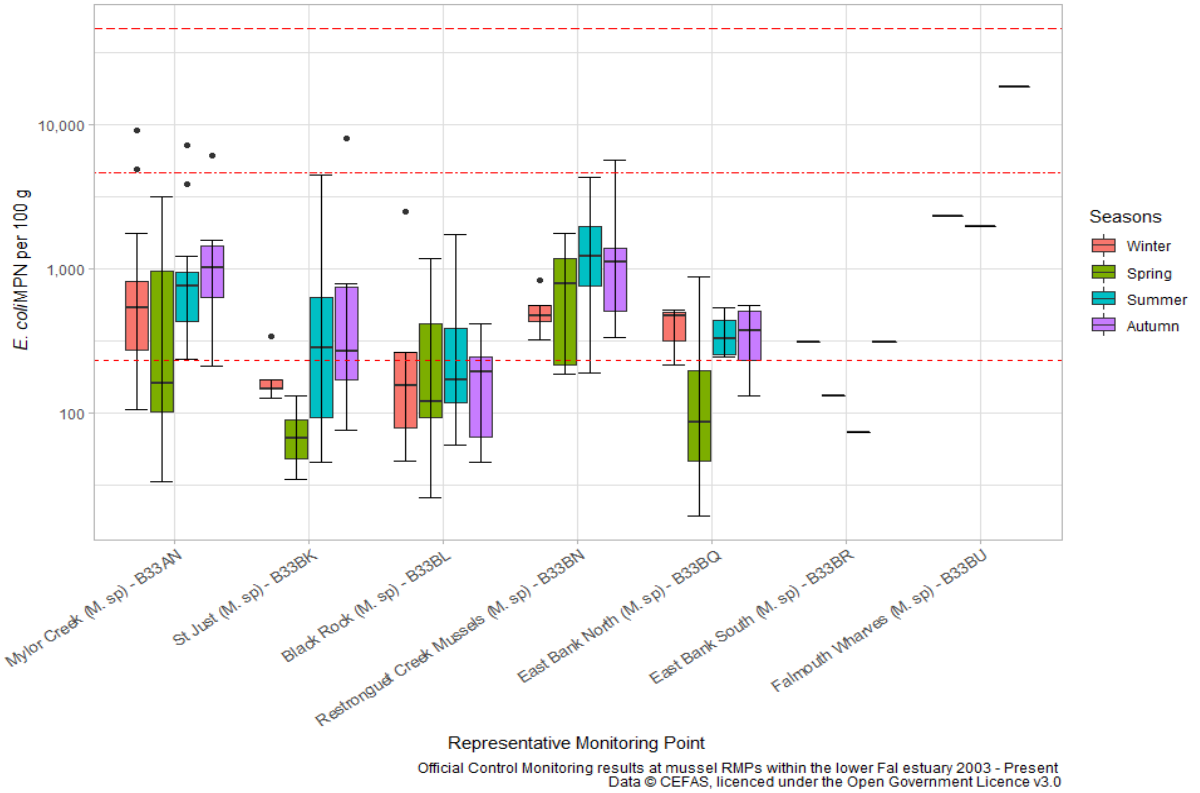

Figure 6.14 Boxplots of E. coli levels per season at mussel RMPs sampled within the lower Fal Estuary 2003 – Present.

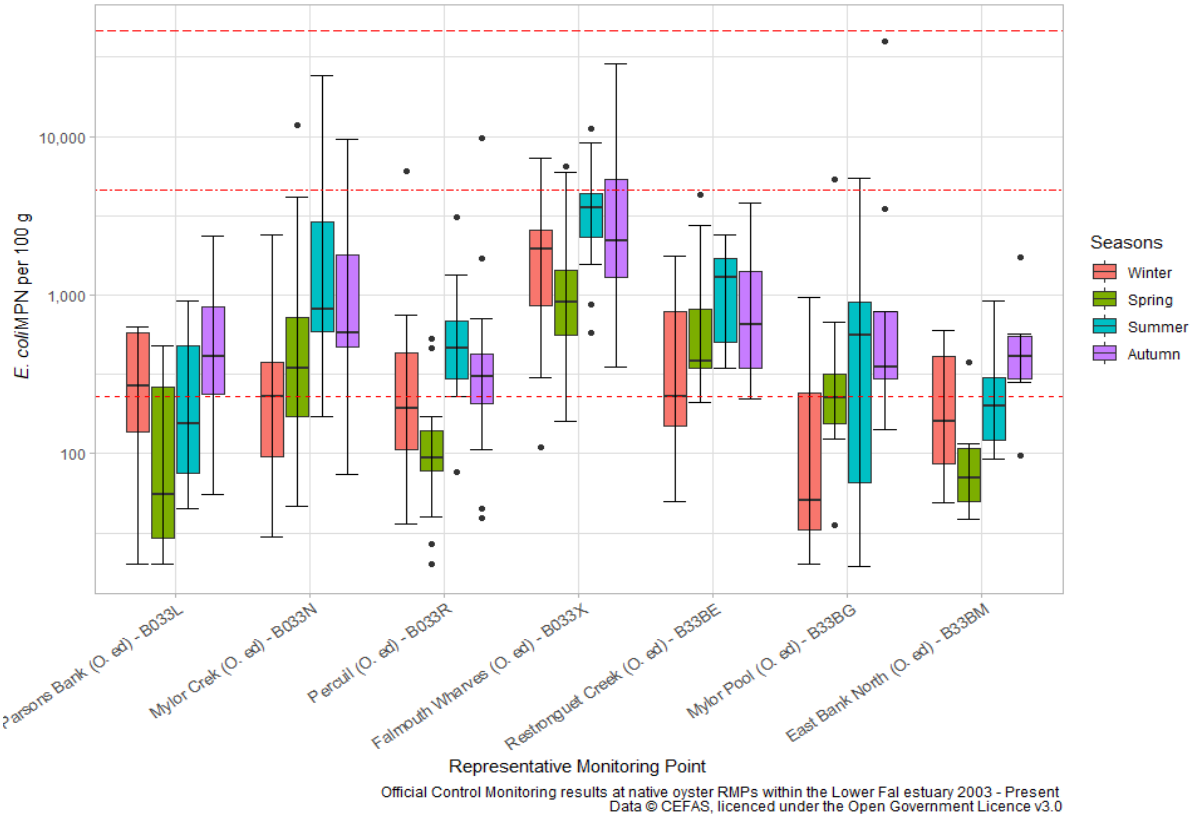

Figure 6.15 Boxplots of E. coli levels per season at native oyster RMPs sampled within the upper Fal Estuary 2003 – Present.

7 Conclusion and overall assessment

Consultation with the local authorities indicated that the dominant fishery (by landings weight) in the Fal estuary is the mussel fishery, with 47,446 kg landed in the 2018-2019 season. The Mussel CZs cover a smaller area than those classified for oyster harvesting, generally found at the banks of the main estuary. In the upper Fal, the active CZs for mussel harvesting are *King Harry Reach Mussel Line* and *Turnaware Pontoon/South wood*. In the lower Fal, active CZs are *Mylor Creek*, *Restronguet Creek*, *East Bank Mussels* and *St Just*.

Native oyster stocks have declined in the previous five years; however, CZs still cover a large area within the Fal, with most of the main estuary classified for harvesting across different CZs. In the Upper Fal, *Coombe Creek*, *Grimes Bar*, *King Harry Reach*, *Maggoty Bank*, *Tolverne* and *Turnaware Bar* all hold current classifications and are subject to active sampling. In the Lower Fal, active CZs are *Mylor Bank*, *East Bank*, *Parsons Bank*, *Mylor Creek* and *Restronguet creek*. All native oyster CZs are also classified for Pacific Oyster harvesting, although the output from this fishery is small; only 169 kg in the 2018-2019 season. Additionally, the authors of this review understand that wild scallops (*A. opercularis* & *M. varia*) are harvested from the oyster beds. No zones are classified for this species. Harvesting methods have not altered since the original sanitary surveys were conducted. The majority of beds are harvested via dredge, as harvesting methods for oysters is prescribed by the Fal Fishery Order 2016, which covers the majority of the estuary.

The total population in Lower Layer Super Output Areas within or partially within the Fal catchment increased by 8.5% between the 2001 and 2011 censuses (the most recent for which data are available). This population increase has mostly been within the urbanised areas of the catchment, and much of the catchment remains rural, with large areas in the north east and south of the catchment having population densities of < 1 person per hectare. This population increase will almost certainly have led to an increase in the volume of sewage discharges within the catchment, though the location of these discharges have not changed since the original sanitary surveys were published.

Livestock census data were only available at the Local Authority District level and indicate that the population of livestock increased by 25% between 2013 and 2016, though most of this is due to a 50% increase in poultry numbers. Overall, livestock densities in pasture areas within the catchment remain high, with 383,725 animals at a density 22.4 animals per hectare. Land cover maps indicate that there are some areas of pasture that directly border the estuary, and these remain a potentially significant point source of contamination during triggering events such as high rainfall and spring tides. However, the locations of, and loading from these sources are unlikely to have changed significantly and, as such, the steps taken to account for them in the choice of RMP are still appropriate.

The data from the most recent annual wetland bird survey (Frost *et al.*, 2020) indicate that the five-year average of overwintering waterbirds has decreased by more than 44% compared to the level in the five years up to the publication of the original sanitary surveys. However, the locations of these birds vary year-on-year and, as such, the potential contamination cannot be accurately and reliably captured by an RMP.

There remains a significant volume of both commercial and recreational shipping activity in the Fal estuary, with more than 4,500 moorings and a large commercial port in Falmouth. No legislative changes to permitted discharges from recreational vessels have occurred, and occasional overboard

discharges in the main navigational and mooring / anchoring zones may still occur. However, without specific data on the locations and number of houseboats, as well as comparative data for the original sanitary survey, it is difficult to advise how any discharges may affect bacteriological contamination.

A total of 29 RMPs have been sampled within the Fal estuary since the publication of the original sanitary surveys, of which 14 were sampled prior to the original surveys. Levels of *E. coli* within samples have remained broadly stable, with fitted trend lines consistently falling between 230 MPN/100 g and 4,600 MPN/100 g. There are some RMPs that showed significant variability, although typically they were only sampled for a very short period of time, likely due to the volatility of results. No clear differences in results between species were evident, although results from RMPs located in channels draining to the eastern side of the estuary were generally lower, perhaps indicating greater levels of contamination from both up-estuary sources and urban fabric to the west of the main channel.

There were very few significant differences in *E. coli* levels by season; where significant results were returned, this was often for RMPs that were only sampled for a short period of time, which reduces the inference that can be taken from those results.

Based on the information available, there does not appear to have been any significant changes to the sources of contamination into this estuary since the publication of the original sanitary survey. The authors of this review have not identified any knowledge gaps that would justify a full shoreline survey.

Having reviewed the recommendations of the 2020 report and compared with the findings of the 2010 sanitary survey review for the Fal Estuary (Upper and Lower (amended 2012)), the FSA are content that the level of risk posed by the findings is low and does not warrant a further review of the existing shoreline assessment.

8 Recommendations

8.1 Fal (Upper)

8.1.1 Mussels

Consultation with the local authorities indicated that several mussel CZs in the upper Fal estuary have recently been declassified. The *Lambe Creek*, *Malpas, Ruan Creek* and *Turnaware Pontoon* CZs were all declassified in 2019 due to declining stock levels and a lack of commercial interest. Recommendations for the remaining mussel CZs are described below and are summarised in Table 8.1.

King Harry Reach Mussel Line

This CZ is the farthest south of any mussel CZ in the upper Fal estuary. It covers an area of 15.8 Ha and is situated south of the King Harry Ferry crossing. It is currently classified from an RMP, at Trelissick Pontoon (B33BD), to capture both the point and diffuse contamination sources from farther up the estuary. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Turnaware Pontoon/South wood

This CZ is situated where the Truro River meets the River Fal and covers an area of 28.2 HA. It is currently classified from an RMP at R Pontoon/Tregothnan (B033Y), located at the southern end of

the CZ. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

8.1.2 Native oysters

A much wider area is classified for native oyster harvesting in the upper Fal estuary than for mussels; with the entire river from Tregnothan Gardens next to the Truro River to the boundary with the Fal (lower) are classified, including creeks and pools adjacent to the estuary. Very few changes to these CZs have occurred since the original sanitary survey, with only the *King Harry Reach* CZ added since the original survey. Recommendations for these CZs are described below and are summarised in Table 8.1.

Coombe Creek

This CZ is located in a creek (with which it shares a name) situated to the west of the main River Fal channel and covers an area of 17.1 Ha. It is currently classified based on samples from an RMP at Coombe Creek (B033V), which is located near to the mouth of the creek. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Grimes Bar

This is the most northerly native oyster CZ in the entire Fal estuary. It is located in the Truro River, and its southern boundary meets the northern edge of *Maggoty Bank*, near to Church Creek. It spans an area of 28.1 Ha and is currently classified based on samples from Grimes Bar (B033E), situated in the middle of the CZ. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

King Harry Reach

This CZ is the most recently classified zone in the upper Fal estuary for native oysters. Its northern boundary meets *Tolverne* and its southern boundary meets *Turnaware Bar*. It is also the only CZ in the upper to have a B rather than LT-B classification, although *E. coli* levels are very similar to other native oyster RMPs so it is likely a LT-B classification would be achievable. The RMP for this CZ is at King Harry Ferry (B33BI), slightly to the north of the Trelissick Pontoon (B33BD) RMP for the *King Harry Mussel Lines* CZ. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Maggoty Bank

This CZ meets *Grimes Bar* at its northern boundary and *Tolverne* at its southern edge, where the Truro River meets the River Fal. It is currently classified based on samples from an RMP at Maggoty Bank (B033F), located slightly to the northern end of the CZ in the middle of the channel. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Tolverne

This CZ meets *Maggoty Bank* at its northern edge, *Coombe Creek* on its western edge at the mouth of Coombe Creek and *King Harry Reach* at its southern boundary. It is the largest CZ in the Fal (Upper) area, covering 50.2 Ha. It is classified using samples from Tolverne (B033H), which is situated in the middle of the CZ. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Turnaware Bar

This CZ is the farthest south of any CZ in the Fal (Upper) area and meets the *King Harry Reach* CZ to the north and the *East Bank* CZ in the Fal (Lower) area. The *Turnaware Point Relay* CZ is found along

its eastern edge, though this CZ is currently prohibited. *Turnaware Bar* is classified from samples collected at Turnaware Bar (B33BF), situated near the north-eastern boundary of the CZ. The position of this RMP was set in the original survey of the Fal (Lower) area and was chosen to capture contamination from sewage discharges and other point and diffuse sources of pollution coming down the estuary on ebbing tides. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

8.1.3 Pacific oysters

The boundaries of the pacific oyster CZs in the upper Fal estuary match those of the native oyster CZs and are all classified from samples taken from the existing native oyster RMPs. It is recommended that this practice continue.

8.2 Fal (Lower)

8.2.1 Mussels

In the Fal (Lower) area, the CZs for mussels are located along the banks of the main river channel and in creeks that train into the main river. Only one mussel CZ was recommended in the original sanitary survey at *Mylor Creek*. Additional CZs at *St Just, Percuil Relay* and *Restronguet Creek* were classified in 2015, 2015 and 2016 respectively and *East Bank Mussels* was classified in 2019. Recommendations for these CZs are described below and are summarised in Table 8.1.

Mylor Creek

This CZ was recommended in the original sanitary survey and is located in a creek (of the same name) that is found on the western side of the main river channel. The CZ's eastern edge is the mouth of the creek and extends westwards for 500 m. It is currently classified based on samples, from Mylor Creek (B33AN), chosen as it is accessible at all states of the tide and away from boating activity using the quay there. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Restronguet Creek

This CZ is situated approximately 1,100 m further north than *Mylor Creek*, where it stretches from its eastern edge at the mouth of Restronguet Creek, 630 m north west up the creek. It has been classified since 2016 and is currently classified based on samples from Restronguet Creek Mussels (B33BN) at the western end of the CZ at the same location as the native oyster RMP. The location for this RMP was chosen to capture contamination delivered from the rivers Carnon and Kennal (Cefas, 2015). This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

East Bank Mussels

This CZ has been classified since 2019 and is located on the eastern side of the main estuary channel, where it stretches for 2 km from its northern edge near the southern boundary of the *Turnaware Bar* native oyster CZ, to its southern extent at the mouth of the St Just creek. It is located entirely within the *East Bank* native oyster CZ. When the CZ was first classified, it was classified based on samples from two RMPs, one at its northern end (East Bank North (B33BQ)) and one at its southern end (East Bank South (B33BR)), to capture the uncertainty around the north/south dominance of contaminating influences (Cefas, 2017). It is currently classified based on samples from only East Bank North (B33BQ), although samples from each end were not significantly different from one another. Classification based on samples from this single RMP is appropriate as it will be representative of the wider sources of contamination.

St Just

This CZ has been classified since 2015 and covers an area of 19.8 Ha in Saint Just Creek on the eastern side of the main river channel. It is currently classified based on samples from St Just (B33BK), which is located at the most upstream end of the creek. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

8.2.2 Native oysters

As in the upper section of the estuary, the native oyster CZs cover a much larger area of the estuary than the mussel CZs. Recommendations for the currently classified native oyster CZs in the lower Fal estuary are described in the following paragraphs and summarised in Table 8.1.

Mylor Bank

This CZ was proposed in the original sanitary survey, where its boundaries covered the entire main estuary channel from a northern boundary at Turnaware Bar, to a southern boundary just south of Penarrow Point – southern edge of the woodland at Tregear Vean (see Figure 5.1, p 41 of the original sanitary survey). Its area has since been reduced to cover a 254 Ha area on the western side of the channel, with its southern boundary unchanged but now meets the *East Bank* and *Parsons Bank* CZs to the north. It is currently classified using samples from the Mylor Pool (B33BG) RMP, which is situated near to the CZs western extent. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

East Bank

This CZ replaced the eastern half of the old *Mylor Bank* CZ, extending northwards to *Turnaware Bar*. It is a large CZ, covering nearly 300 Ha. Its boundary into Saint Just Creek has been modified from the original *Mylor Bank* extent. The current boundary protrudes less far into Saint Just Creek. It is not clear what prompted this change and consultation with the Local Authorities indicates that there is viable oyster stock outside the current boundary. It is recommended that these boundaries be reverted to their old extent to allow harvesting of this bed (Figure 8.1). It is currently sampled from a RMP in the far north of the zone (East Bank North (B33BM)), in the same position as the mussel RMP East Bank North B33BQ). This RMP is still representative of the main pollution sources to this CZ and does not need to be altered, despite the change in CZ boundary.

Parsons Bank

This CZ replaced the north-western part of the old *Mylor Bank CZ* and currently covers an area of 98 Ha. Along its western edge, it meets the *Restronguet Creek* CZ. It is currently classified based on samples from Parsons Bank (B033L), located in the middle of the CZ. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Mylor Creek

This CZ meets the *Mylor Bank* CZ at the mouth of Mylor Creek, where it extends 480 m into the creek. The edge of this CZ and the western edge of the *Mylor Bank* CZ have been set to avoid the Mylor Yacht Harbour. It is currently classified based on samples from Mylor Creek (B033N), located near the mouth of the creek. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Restronguet creek

This CZ extends from its eastern boundary with *Parsons Bank* 600 m up Restronguet Creek. The boundaries of this CZ match the mussel CZ of the same name. It is classified based on samples from Restronguet Creek (B33BE) RMP, the location of which was chosen to capture contamination

delivered from the rivers Carnon and Kennal. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

Percuil

This CZ has been classified since 2015, and covers a 66 Ha area in Porth Creek, with its south-western boundary from St Mawes – Drawler Plantation and its north-eastern boundary near Pelyn Creek. It is currently classified based on samples from Percuil (B033R) RMP at the most upstream extent of the river. This RMP is still representative of the main pollution sources to this CZ and does not need to be altered.

8.2.3 Pacific oysters

The boundaries of the pacific oyster CZs in the lower Fal estuary match those of the native oyster CZs and are all classified from samples taken from the existing native oyster RMPs. It is recommended that this practice continues.

8.3 General Information

8.3.1 Location Reference

Production Area	**Fal Estuary**
Cefas Main Site Reference	M033.
Ordnance survey 1:25,000	Explorer 103; OS Landranger 204; OS 105; and OS 104.
Admiralty Chart	Imray Y58; and No 147.

8.3.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Mussels (*Mytilus sp.*)	Wild & rafts & boys	01 October – 31 March inclusive (dredge); and Year-round (hand).
Native oyster (*Ostrea edulis*)	Wild	01 October – 31 March inclusive (dredge); and Year-round (hand).
Pacific oyster (*Crassostrea gigas*)	Wild	01 October – 31 March inclusive (dredge); and Year-round (hand).

8.3.3 Local Enforcement Authority(s)

Name	Cornwall Port Health Authority Port Health Office The Docks Falmouth Cornwall TR11 4NR
Website	https://www.cornwall.gov.uk/environment-and-planning/cornwall-port-health-authority/
Telephone number	01872 323090

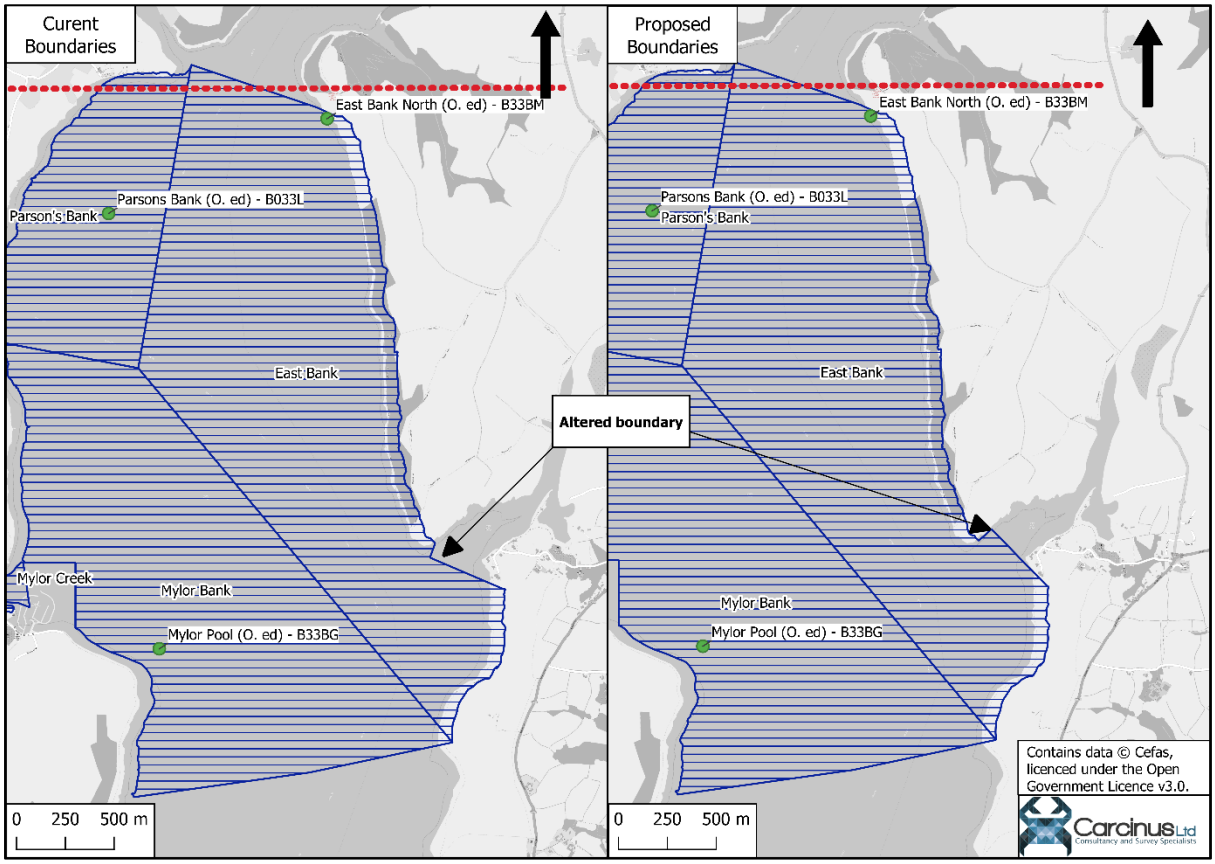

Figure 8.1 Proposed alterations to the East Bank CZ for native and Pacific oysters

Table 8.1 Proposed sampling plan for the Fal estuary.

Classification Zone	*RMP*	*RMP Name*	*NGR (OSGB 1936)*	*Lat/Long (WGS 1984)*	*Species Represented*	*Growing Method*	*Harvesting Technique*	*Sampling Method*	*Sampling Species*	*Tolerance*	*Frequency*
FAL UPPER											
King Harry Reach Mussel Line	B33BD	Trelissick Pontoon	SW 8409 3949	50°12.96'N 5° 1.67''W	Mussels	Hanging Lines	Hand Picked	Bagged	Mussels	10 m	Monthly
Turnaware Pontoon / South Wood	B033Y	R Pontoon / Tregothnan	SW 8407 3879	50°12.58'N 5° 1.66'W	Mussels	Wild	Dredge	Bagged	Mussels	10 m	Quarterly
Coombe Creek	B033V	Coombe Creek	SW 8400 4030	50°13.39'N 5° 1.77'W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
Grimes Bar	B033E	Grimes Bar	SW 8513 4212	50°14.40'N 5°0.88'W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
King Harry Reach	B33BI	King Harry Ferry	SW 8409 3954	50°12.98'N 5° 1.67'W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
Maggoty Bank	B033F	Maggoty Bank	SW 8492 4143	50°14.02'N 5° 1.04'W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
Tolverne	B044H	Tolverne	SW 8480 4037	50°13.45'N 5° 1.10'W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Quarterly
Turnaware Bar	B33BF	Turnaware Bar	SW 8351 3870	50°12.52N 5°2.13W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly

FAL LOWER											
Mylor Creek	B33AN	Mylor Creek	SW 8196 3551	50°10.76N 5°3.32W	Mussels	Wild	Dredge	Bagged	Mussel	10 m	Monthly
	B033N	Mylor Creek	SW 8196 3546	50°10.74N 5°3.32W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
Restronguet Creek	B33BN	Restronguet Creek Mussels	SW 8147 3719	50°11.65N 5°3.79W	Mussels	Wild	Dredge	Bagged	Mussel	10 m	Monthly
	B33BE	Restronguet Creek	SW 8147 3719	50°11.65N 5°3.79W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
East Bank Mussels	B33BQ	East Bank North	SW 8366 3789	50°12.08N 5°1.97W	Mussels	Seabed / relayed	Hand picked	Bagged	Mussel	10 m	Monthly
St Just	B33BK	St Just	SW 8491 3645	50°11.336N 5°0.874W	Mussels	Wild	Hand picked	Bagged	Mussel	10 m	Monthly
Mylor Bank	B33BG	Mylor Pool	SW 8280 3517	50°10.60N 5°2.60W	N. oyster P. oyster	Seabed / relayed	Hand picked	Bagged	N. oyster	10 m	Monthly
East Bank	B33BM	East Bank North	SW 8356 3783	50°12.05N 5°2.05W	N. oyster P. oyster	Seabed / relayed	Dredge	Bagged	N. oyster	10 m	Monthly
Parsons Bank	B033L	Parsons Bank	SW 8254 3740	50°11.80N 5°2.90W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly
Percuil	B033R	Percuil	SW 8585 3369	50°09'52"N , 05°00'00"W	N. oyster P. oyster	Wild	Dredge	Bagged	N. oyster	10 m	Monthly

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Appendices

Appendix I: Breakdown of population change

Electoral Ward	Label	Total Population (all usual residents)				Population Density		
		2001 Census	2011 Census	Absolute Change	% Change	2001 Census	2011 Census	Density Change
Bugle	1	3591.87	4164	572.13	15.93%	1.93	1.55	-0.38
Carn Brea South	2	3596.32	3877	280.68	7.80%	3.02	4.09	1.07
Chacewater and Kenwyn	3	3747.41	3870	122.59	3.27%	1.06	0.75	-0.31
Constantine	4	4135.15	4709	573.85	13.88%	0.99	0.99	0.00
Falmouth Arwenack	5	4431.57	4708	276.43	6.24%	26.90	69.62	42.73
Falmouth Boslowick	6	4580.83	4866	285.17	6.23%	13.24	15.85	2.61
Falmouth Gyllyngvase	7	3029.70	3270	240.30	7.93%	13.71	18.52	4.81
Falmouth Penwerris	8	4309.73	4444	134.27	3.12%	42.06	56.01	13.94
Falmouth Trescobeas	9	4423.17	4509	85.83	1.94%	35.59	30.55	-5.04
Feock and Kea	10	4386.31	4511	124.69	2.84%	1.19	3.14	1.95
Helston Central	11	3873.99	4400	526.01	13.58%	5.60	25.67	20.07
Helston North	12	5155.08	5813	657.92	12.76%	7.54	8.98	1.43
Ladock, St Clement and St Erme	13	4068.28	4241	172.72	4.25%	0.63	0.59	-0.04
Mabe	14	4375.39	5802	1426.61	32.61%	1.41	2.19	0.79
Mount Hawke and Portreath	15	4350.44	4401	50.56	1.16%	2.47	2.31	-0.16
Mullion	16	4300.32	4364	63.68	1.48%	1.71	0.71	-0.99
Newlyn and Goonhavern	17	4521.96	4933	411.04	9.09%	1.62	0.78	-0.84
Penryn East and Mylor	18	4816.32	5195	378.68	7.86%	7.20	3.14	-4.06

Penryn West	19	4040.44	4595	554.56	13.73%	11.98	30.17	18.19
Perranporth	20	4343.35	4270	-73.35	-1.69%	1.80	1.27	-0.53
Probus	21	3849.12	3953	103.88	2.70%	0.44	0.61	0.17
Redruth Central	22	3558.90	4154	595.10	16.72%	5.49	15.63	10.15
Roche	23	3501.96	3867	365.04	10.42%	0.56	1.10	0.55
Roseland	24	3688.13	3375	-313.13	-8.49%	0.56	0.45	-0.11
St Agnes	25	4312.59	4500	187.41	4.35%	2.28	1.76	-0.52
St Columb	26	4379.64	5050	670.36	15.31%	0.96	0.80	-0.16
St Day and Lanner	27	4174.21	4473	298.79	7.16%	3.55	4.45	0.90
St Dennis	28	4207.19	4560	352.81	8.39%	0.85	2.34	1.49
St Enoder	29	3833.73	4563	729.27	19.02%	0.65	1.28	0.63
St Keverne and Meneage	30	4921.42	5220	298.58	6.07%	0.99	0.51	-0.48
St Mewan	31	3639.03	3778	138.97	3.82%	0.77	1.14	0.37
St Stephen	32	4463.81	4722	258.19	5.78%	1.14	2.31	1.17
Stithians	33	4771.76	5023	251.24	5.27%	2.63	1.48	-1.15
Threemilestone and Gloweth	34	4019.04	4275	255.96	6.37%	3.29	5.57	2.28
Truro Boscawen	35	4490.44	4945	454.56	10.12%	13.65	16.63	2.98
Truro Moresk	36	3968.04	4692	723.96	18.24%	29.06	31.44	2.38
Truro Tregolls	37	4669.24	5105	435.76	9.33%	17.33	19.01	1.68
Truro Trehaverne	38	3632.52	4024	391.48	10.78%	6.59	12.04	5.45
Wendron	39	4563.56	4936	372.44	8.16%	1.83	0.72	-1.11

Cefas

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Upper Fal Estuary – Cornwall

2010

Follow hyperlink in image to view full report.

Appendix III: Fal Estuary (Lower) Sanitary Survey Report 2010 (amended 2012)

Cefas

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Fal Estuary (lower) and Percuil River

(Cornwall)

2010
(amended 2012)

Follow hyperlink in image to view full report.

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*"