Sanitary Survey- Review

North Kent Coast – 2021

Document No. – *J0591/20/12/07*

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Client	Food Standards Agency (FSA)
Project Title	Sanitary Survey Review
Document Title	Sanitary Survey -North Kent Coast
Document Number	J0591/20/12/07
Revision	3.1
Date	21 May 2021

Revisions

Revision No.	Date	Comment
1.1	15 December 2020	Draft for FSA review
2.0	20 January 2021	Draft for external consultation
2.4	04 May 2021	Update following external consultation
3.1	25 June 2021	Final Document

Document QA and Approval

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Initial Consultation

Consultee	Date of consultation	Date of response
Canterbury City Council	15 October 2020	28 October 2020
Environment Agency	15 October 2020	02 November 2020

Consultation on draft report

Consultee	Date of consultation	Date of response
LAG	08 February 2021	08 March 2021
Environment Agency	08 February 2021	08 March 2021

A sanitary survey relevant to the bivalve mollusc beds in North Kent Coast was undertaken in 2011 in accordance with Regulation (EC) 854/2004 (which was replaced by retained EU

Law Regulation (EU) 2017/625, with sanitary survey requirements now specified in retained 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 (FSA) undertakes 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 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, Canterbury City Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd (Carcinus), 2021. Review of the North Kent Coast 2011 Sanitary Survey. Carcinus reports 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 North Kent Coast Review

This report reviews information and makes recommendations for a revised sampling plan for existing mussel (*Mytilus edulis*), cockle (*Cerastoderma edule*), soft shell clams (*Tapes* spp.), native (*Ostrea edulis*) and Pacific oyster (*Crassostrea gigas*) classification zones off the North Kent Coast (Figure 1.1). This review explores any changes to the main microbiological contamination sources that have taken place since the original sanitary survey was conducted. Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with the Local Authorities (LAs) and Environment Agency (EA) responsible for the production area was undertaken in October and November 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 January and February 2021. 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 2011 and sampling plan as necessary and the report should read in conjunction with the previous survey (which is presented in Appendix II).

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 (LA) and Environment Agency (EA).
- The findings of this report are based on information and data sources up to and including November 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 November 2020 have been used within this study. Any subsequent samples have not been included.

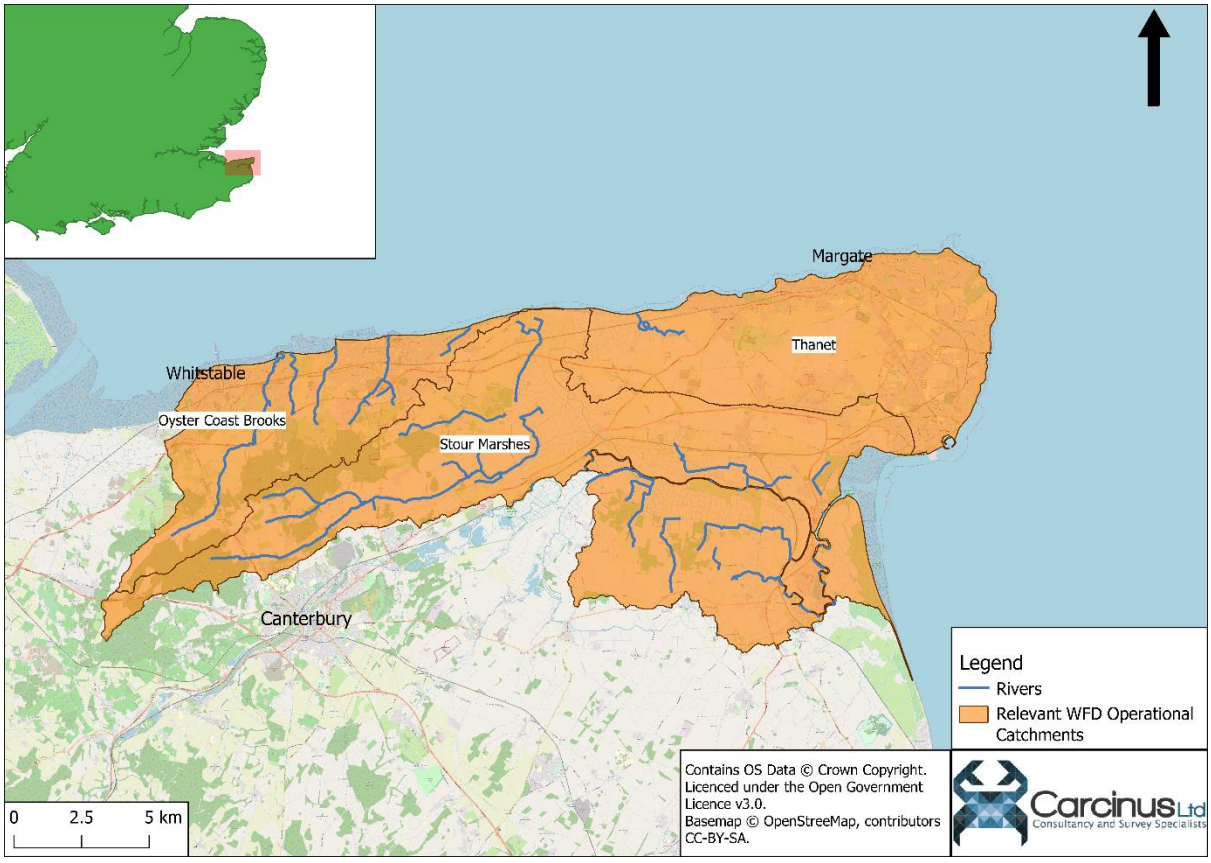

Figure 1.1 Overview of North Kent Coast.

2 Shellfisheries

2.1 Description of Shellfishery

Harvesting of shellfish in the waters off the North Kent coast is controlled under the Kent and Essex Inshore Fisheries and Conservation Authority (KEIFCA) Area A Byelaws (KEIFCA, 2020), except for those areas that are conferred rights under any historic right of Several Fishery, Act of Parliament, Royal Charter or other rights. These byelaws set out the rights and restrictions that apply to fishermen wanting to utilise the fishing waters and applies to the entire area considered in this review. Under the byelaw, limits on harvesting mean that no more than 13.6 m^3 of mussels within a 24-hour period may be harvested. Additionally, fishermen dredging for shellfish may not operate a dredge that has an opening that exceeds 2 m when fishing for mussels, 85 cm for scallops or 4 m for oysters. The byelaws also impose minimum landing sizes; no more than 10% (by weight) of landed mussels should be able to pass through a space 18 mm width and no oysters that fit through a circular ring 7 cm diameter may be removed, though this restriction does not apply to Pacific oysters. Furthermore, the KEIFCA reserves the right to close a fishery where the bed "*is so severely depleted as to require temporary closure in order to ensure recovery, or any bed or part of a bed contains mainly immature shellfish which in the interest of the protection and development of the fishery ought not to be disturbed for the time being, or any bed of transplanted shellfish ought not to be fished until it has become established…*".

The boundaries of the North Kent Bivalve Mollusc Production Area (BMPA) are not distinct, with the western boundary extending into the Swale BMPA and the northern boundary extending to the Thames Estuary BMPA. For the purposes of this review, only those classification zones identified as falling within the North Kent BMPA in the September 2020 update to the designated BMPAs in England and Wales (FSA, 2020) have been considered.

2.1.1 Pacific oysters

The original sanitary survey (undertaken in 2011) described that the Pacific oyster fishery off the North Kent coast was concentrated around two trestle cultivation sites off Whitstable. However, due to naturally occurring stocks across the entire intertidal zone, it recommended the creation of seven classification zones (CZs), forming one contiguous zone stretching from the western boundary to Nayland Rock in Margate. These CZs were: *Nayland Rock*, *Minnis Bay*, *Reculver*, *Hampton Pier*, *Swalecliffe*, *Swalecliffe Outfall*, *Westbeach* and *South Oaze*. Of these CZs, only *Hampton Pier*, *Swalecliffe*, *South Oaze* and *Westbeach* possess a current classification. These CZs are now concentrated on the western side of the Production Area (Figure 2.1). Based on the information available, *Nayland Rock* and *Minnis Bay* CZs appear not to have been ever formally awarded a classification for Pacific oyster harvesting. Consultation with the LA indicated that the trestle culture operations off Whitstable have increased in size, in part due to the decreased labour intensity of harvesting trestles as opposed to dredge.

No IFCA landing statistics are available for the Pacific oyster fishery, although consultation with the LAG indicated that production around the Whitstable Bay area is about 200-300 tonnes per year. No accurate statistics are available for other areas of the BMPA.

2.1.2 Native oysters

The original sanitary survey reported that naturally occurring native oyster beds were present in the western part of the BMPA, and made recommendations to divide the large, single CZs into 6 smaller CZs; *Swalecliffe outfall*, *Westbeach*, *South Oaze*, *Whitstable Bay, Off Leysdown* & *Kentish Flats*. The *Swalecliffe outfall* CZ was never awarded a classification, and the eastern boundary of the *Whitstable Bay* CZ has been moved westwards from its original position, in line with the eastern boundary of the *Kentish Flats* CZ to its current position on a line drawn north from TR 1068 6717 (Figure 2.1). The eastern part of the original CZ is now referred to as Hampton Pier, and extends from the eastern boundary of the *Kentish Flats* CZ to the eastern boundary of the *Swalecliffe* CZ (which is classified for Pacific oyster and mussels). The other CZs have remained as recommended in the original sanitary survey.

As no IFCA landing statistics are available for the native oyster fishery, the extent of fishing effort is based on consultation with the LA, who indicated that the current level of effort within this fishery is approximately 4 boats, removing several hundred oysters, several times a week in peak season.

2.1.3 Cockles

The original sanitary survey describes the presence of a significant cockle dredge fishery within the outer Thames Estuary. Within the survey area, the main beds lay off Leysdown, on the Hamm grounds, off Whitstable on the Pollard grounds, at Minnis Bay from the intertidal zone and offshore on Hook Spit and Margate Sands, although indicated that they may be present anywhere with a suitable sandy substrate. Based on this distribution, the original survey recommended the creation of the following CZs; *Pollard*, *Swale Entrance*, *Hook & Margate Sands*, *Minnis Bay* and *Swalecliffe Outfall*. Of these, only the *Pollard* and *Swale Entrance* CZs are active and it is not clear whether the remaining CZs were ever given an active classification. The *North Margate Sand and Pan Sands* CZ, which is TECFO[1] Area 15), covers part of the original *Hook & Margate Sands* CZ, although it does not extend as far south.

Consultation with the LA indicated that the cockle fishery is smaller than the oyster fisheries, with 2/3 boatloads of cockles landed over an approximate four-week period during the year. Again, it is not clear what proportion of this effort is within which CZ.

2.1.4 Mussels

The original sanitary survey describes that mussels in the survey area have a wide but patchy distribution, with most stock comprising undersized ‘seed’ mussels. It recommended that the classifications for this species align with those for native oysters (Section 2.1.1). Of

[1] TECFO – Thames Estuary Cockle Fishery Order, 1994. Available at: https://www.legislation.gov.uk/uksi/1994/2329/contents/made.

these CZs, only *South Oaze*, *Swalecliffe* and *Hampton Pier* possess a current classification. It is not clear what prompted the declassification of the remaining CZs, although it is likely due to lack of stock for harvesting/sampling, given the patchy and ephemeral nature of the stock for this fishery.

No estimate of the current landings from this fishery were available to the authors of this review.

2.1.5 *Tapes* spp.

The original sanitary survey recommended the inclusion of CZs across the entire North Kent coast for the harvesting of *Tapes* spp. (Manilla clams & Palourdes / native clams) within the sampling plan. These CZs were *Pollard*, *Minnis Bay*, *Swale Entrance*, *Swalecliffe Outfall*, *Swalecliffe*, *Hampton Pier*, *Reculver* & *Nayland Rock*. The Sanitary Survey identified that there was no need to classify the CZs covering the area from Whitstable to Nayland Rock as no commercial harvesting was taking place at present. Only the *Pollard* CZ currently holds a classification and it is not clear whether any of the other CZs were ever awarded a classification.

Consultation with the Local Authority indicated that stocks of this species exist in the same areas as cockles, although no stock is currently landed commercially.

2.2 Classification History

The sampling plan proposed in the original sanitary survey was complex, classifying a total of 34 CZs for the five different harvested species, covering the entirety of the North Kent Coast. Since publication, the boundaries of these CZs have not changed significantly (with the exception of the *Whitstable Bay* native oyster CZ). However, the majority of these CZs are not currently classified, and it is not clear whether classification was ever awarded. With the exception of the *North Margate Sand and Pan Sands* CZ, all the current CZs are concentrated in the area between the mouth of the River Swale and the village of Reculver.

The locations of all active CZs in the North Kent BMPA are shown in Figure 2.1. There are currently 17 CZs within the North Kent BMPA that have an active classification, with more than half having LT-B classifications (Figure 2.1). The *Hampton Pier* CZ has a Seasonal B/C classification for all three species, with the Class B season falling between 1st September – 31st January, reverting to Class C at all other times. Two CZs, *Kentish Flats* and *Off Leysdown*, both hold Class A classifications for native oyster harvesting.

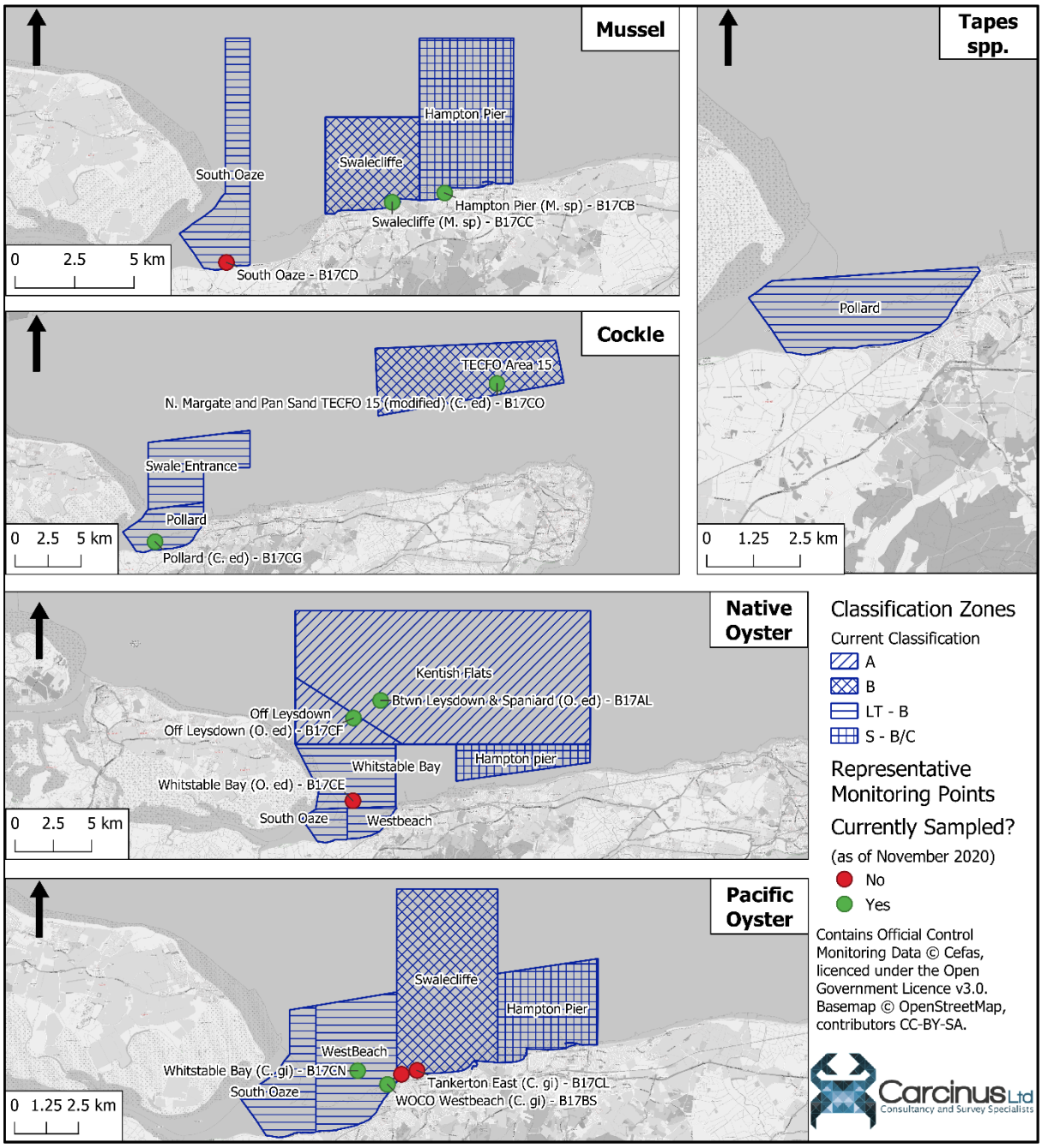

Figure 2.1 Current classification zones and associated Representative Monitoring Points (RMP)s.

3 Pollution sources

3.1 Human Population

The original sanitary survey cites population data from 2004. The data collected during the last full census of the United Kingdom conducted in 2011 has been compared to the data of the 2001 census to give an indication of changes in the human population within the catchment. These censuses have been used as no further population data are freely available. Population change has only been quantified in areas assessed in the original

sanitary survey; consultation with the LA indicated that significant increases in Faversham and the Isle of Sheppey have occurred, although these have not been quantified here. Changes in human population densities in census Super Output Areas (lower layer) and total population within wards within or partially within the North Kent catchment between the 2001 and 2011 censuses are shown in Figure 3.1 and Figure 3.2.

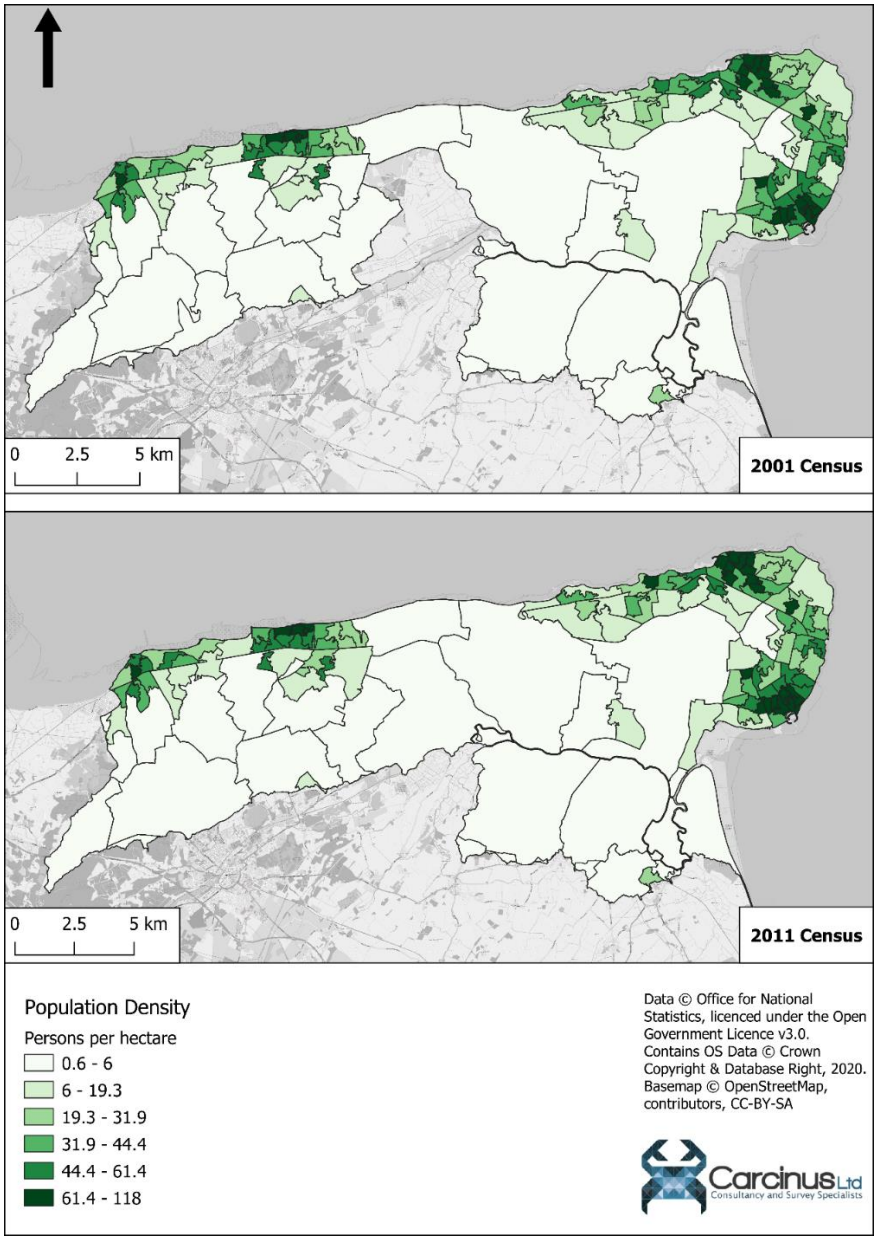

Figure 3.1 Human population density in 2001 and 2011 census Super Output Areas (lower layer) that intersect the North Kent coast catchment.

In general, population has increased across the catchment, particularly around the towns of Margate, Seasalter and Whitstable. Only 6 wards showed a decrease in population over the time period. Highest population densities remain along the coastline, particularly at the western and eastern extremes of the catchment. Much of the catchment beyond this

remains relatively rural, with population densities of <6 persons per hectare (Figure 3.1). The mean population density across the whole catchment is 13.42 persons per hectare. A detailed breakdown of population change for individual wards is presented in1Appendix I.

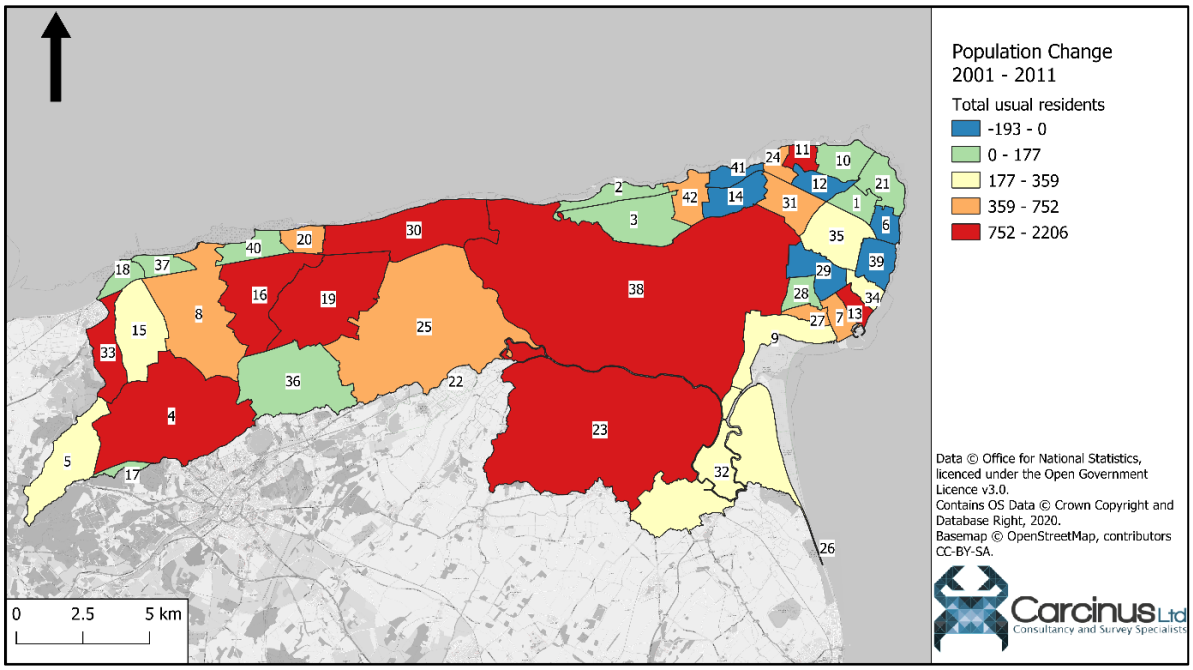

Figure 3.2 Population change between the 2001 and 2011 censuses for Wards and Electoral divisions (based on 2011 boundaries) that are within or partially within the North Kent Coast hydrological catchment (wards have been clipped to the boundary of the hydrological catchment). 2001 Census data have been 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.

At the 2001 census, the total resident population within wards wholly or partially contained within the North Kent catchment, was 233,654 people. By the 2011 census, this had increased to 250,392, an increase of 7.16%. The population data for the 2011 census was collected shortly before the original sanitary survey was published and so could be considered more relevant to that document. The next full census of the UK is scheduled to take place in the 2021 and the UK government estimates that the national population will increase by approximately 6.6% between 2011 and 2021 (Office for National Statistics, 2018). An increase of this proportion would see the approximate population residing within the North Kent catchment increase to 266,918. The potential for urban runoff remains highest from the towns of Whitstable and Seasalter at the western end and Margate at the eastern end. Impacts from sewage will depend on the specific locations and nature of the discharges, changes to which are discussed in Section 3.2. Consultation with the LA indicated that significant housing developments have started and are proposed in the catchment, without upgrades to the wastewater treatment network, this would potentially cause increased bacterial loading to coastal waters. At present, the LA is already aware of problems at Swalecliffe longrock with settlement tanks, and more detail has been sought from the LAG.

The original sanitary survey stated that a population increase of approximately 20% occurs during the summer months, due to the popularity of the catchment as a holiday destination. Updated numbers of tourists were not freely available, although Kent County Council estimates that the number of tourism industries within the county increased by 14.6% from 2014 – 2019 (Kent County Council, 2020). This increase is likely a result of increased numbers of tourists, and so the loading to the sewage network will be the greatest in the summer months.

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 last sanitary survey. However, the distribution of main population centres within the catchment has not changed, and as such the recommendations for RMP location are still valid.

3.2 Sewage

Details of all consented discharges in the vicinity of the North Kent Coast BMPA 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 survey identified a total of four continuous discharges to the North Kent Coastal Strip (p. 68, Figure VII.1; p. 66, Table VII.1). The most significant in terms of its contribution to the bacteriological contamination of the shellfishery was the Swalecliffe WWTW, with a Dry Weather Flow (DWF) of 7,608 m^3 / day. The permitted discharge, as well as the treatment (UV Disinfection) has not changed, meaning that when operational, the bacterial loading emitted from this discharge should be relatively low. All of the discharges identified in the original sanitary survey are still active and the additional discharges identified in this survey are all located a significant distance from the BMPA (including those on the Isle of Sheppey and around the Swale Estuary).

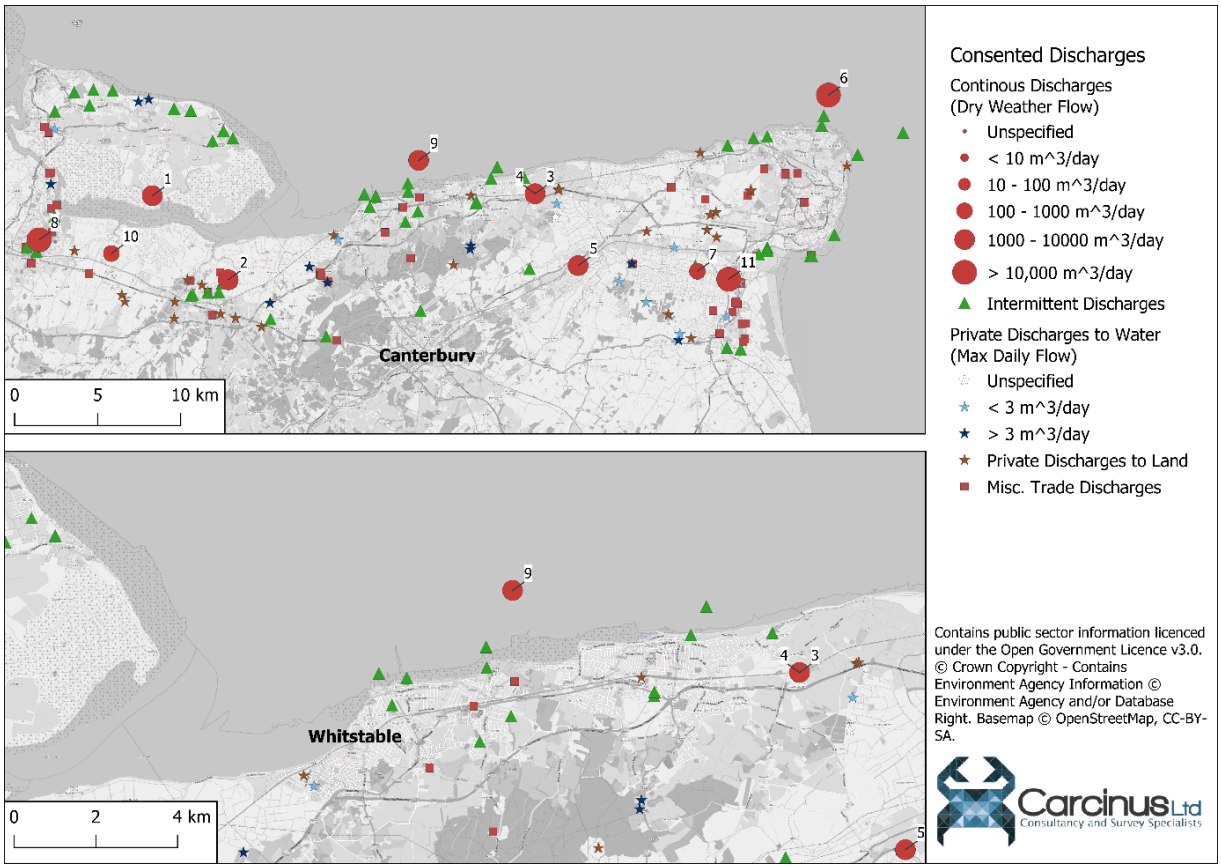

Figure 3.3 Locations of all consented discharges in the vicinity of the North Kent Coast BMPA. Labels refer to continuous discharges, details of which can be found in Table 3.1.

Table 3.1 Details of all continuous discharges in the vicinity of the North Kent Coast BMPA.

ID	Sewage Works	NGR	Treatment	DWF (m^3/day)
1	EASTCHURCH WWTW	TQ9810067400	BIOLOGICAL FILTRATION	4500
2	FAVERSHAM ABBEY FIELD S.T.W.	TR0267562337	BIOLOGICAL FILTRATION	7000
3	HERNE BAY STW	TR2117067521	CHEMICAL - PHOSPHATE STRIPPING	2867
4	HERNE BAY STW	TR2117067521	CHEMICAL - PHOSPHATE STRIPPING	5903
5	HERNE BAY STW	TR2376063190	CHEMICAL - PHOSPHATE STRIPPING	5903
6	MARGATE HEADWORKS	TR3885073460	ACTIVATED SLUDGE	29120
7	MINSTER IOT WWTW	TR3095062850	BIOLOGICAL FILTRATION	1000
8	SITTINGBOURNE WASTEWATER TMNT WORKS	TQ9128064740	BIOLOGICAL FILTRATION	11800

ID	Sewage Works	NGR	Treatment	DWF (m^3/day)
9	SWALECLIFFE WWTW	TR1415069530	UV DISINFECTION	7608
10	TEYNHAM S.T.W.	TQ9563063920	UNSPECIFIED	848
11	WEATHERLEES HILL A WWTW	TR3284062370	CHEMICAL & BIOLOGICAL	21435

In addition to the continuous discharges, the original sanitary survey identified a total of 39 intermittent discharges along the North Kent Coast coastal strip. Intermittent discharges comprise Combined Storm Overflows (CSOs), storm tank overflows and pumping station emergency overflows. These are distributed more ubiquitously around the catchment, although are mostly found in the urban centres of the survey area. Only one of the intermittent discharges identified in the original sanitary survey is no longer active (Goodstone Pumping station) and only one discharge (Churchwood Drive SPS) has since become active. No updated spill event monitoring for intermittent discharges in the catchment was available to the authors of this review, although as the patterns of rainfall in the catchment have not changed significantly (Section 5),the frequencies of spill events would be expected to be similar. However, the secondary round of consultation with the Environment Agency revealed that an investigation into intermittent discharges from WWTWs and CSOs in the area found that untreated sewage was being discharged into the BMPA. Furthermore, the EA indicated that Event Duration Monitoring at assets in the area revealed that 'significant' (>50 m^3) storm discharges have occurred more frequently than planned. As such, it is assumed that bacterial loading from intermittent discharges may have increased, although the routes of contamination are likely to have remained the same. The EA also clarified that the Swalecliffe WWTW discharges via a long sea outfall and a short sea outfall during certain storm conditions.

In addition to the water company owned discharges, there are still a number of privately owned discharges throughout the survey area. However, very few of these discharge directly to the shellfish waters, and so are not predicted to have a significant effect on the bacterial loading experienced by the shellfishery.

During consultation with the LAG concerns were expressed that existing WWTW network is at or near capacity and that continued increases in population will lead to direct declines in water quality within the BMPA. It is likely therefore that contamination from sewerage network discharges is a greater factor in the *E. coli* levels measured in shellfish samples than previously thought. However, the most at risk areas to contamination from this source, therefore, remain those CZs closest to the coastline of the catchment. Therefore, the recommendations made in the original sanitary surveys to capture this source of pollution remain valid.

3.3 Agricultural Sources

The original sanitary survey provides livestock population data based on the 2010 agricultural census. These data were not freely available to the authors of this review, however livestock population data for the four Local Authority Districts that fall within or partially within the North Kent catchment were available for 2013 and 2016 (DEFRA, 2018). As only a small proportion of some of the districts falls within the catchment, the livestock data have been adjusted to reflect the % of each district that falls within the catchment. This assumes that livestock are distributed uniformly throughout the district and, therefore, some inaccuracies may be present. Aggregate adjusted livestock population change data are presented in Figure 3.4 and Table 3.2.

Overall, the livestock population increased by 29.15% between 2013 and 2016, although this statistic is swayed by the low livestock numbers in Thanet. In 2013, the only livestock within the district were ~50 poultry, whereas in 2016 the only livestock were ~2000 sheep. This distorts the % total change across the entire catchment. If Thanet is disregarded, there is a 23% increase in livestock numbers. Only Swale (of which only 1.54% is within the catchment) showed a decrease in livestock numbers.

Very little of the catchment is reserved for areas of pasture (Figure 3.4); only 17.8% of the catchment being pasture according to 2018 Land Cover data. The average livestock density in the catchment is 51.8 animals per hectare in areas of pasture. The principal route of contamination of coastal waters by livestock is surface run-off carrying faecal matter to coastal waters. However, as very little of the pasture is directly adjacent to the shoreline and there are few major freshwater sources to the BMPA (see Figure 1.1), there is limited pathway for connectivity from this source of contamination. The Graveney marshes and surrounding areas are currently used for sheep grazing, although the development of the Cleve Hill Solar Park will see the land use of this area change away from sheep grazing.

The original sanitary survey reported a significant amount of arable land within the catchment. Recently available satellite imagery suggests that this arable land still exists. Application of organic fertiliser to fields may cause some contamination through runoff, though the timing and extent of this contamination is unclear.

Despite the fact that livestock population has increased significantly since the publication of the original sanitary survey, livestock population remains low and there is limited pathway for connectivity. As such, the recommendations made in the original sanitary survey for RMP locations are still valid.

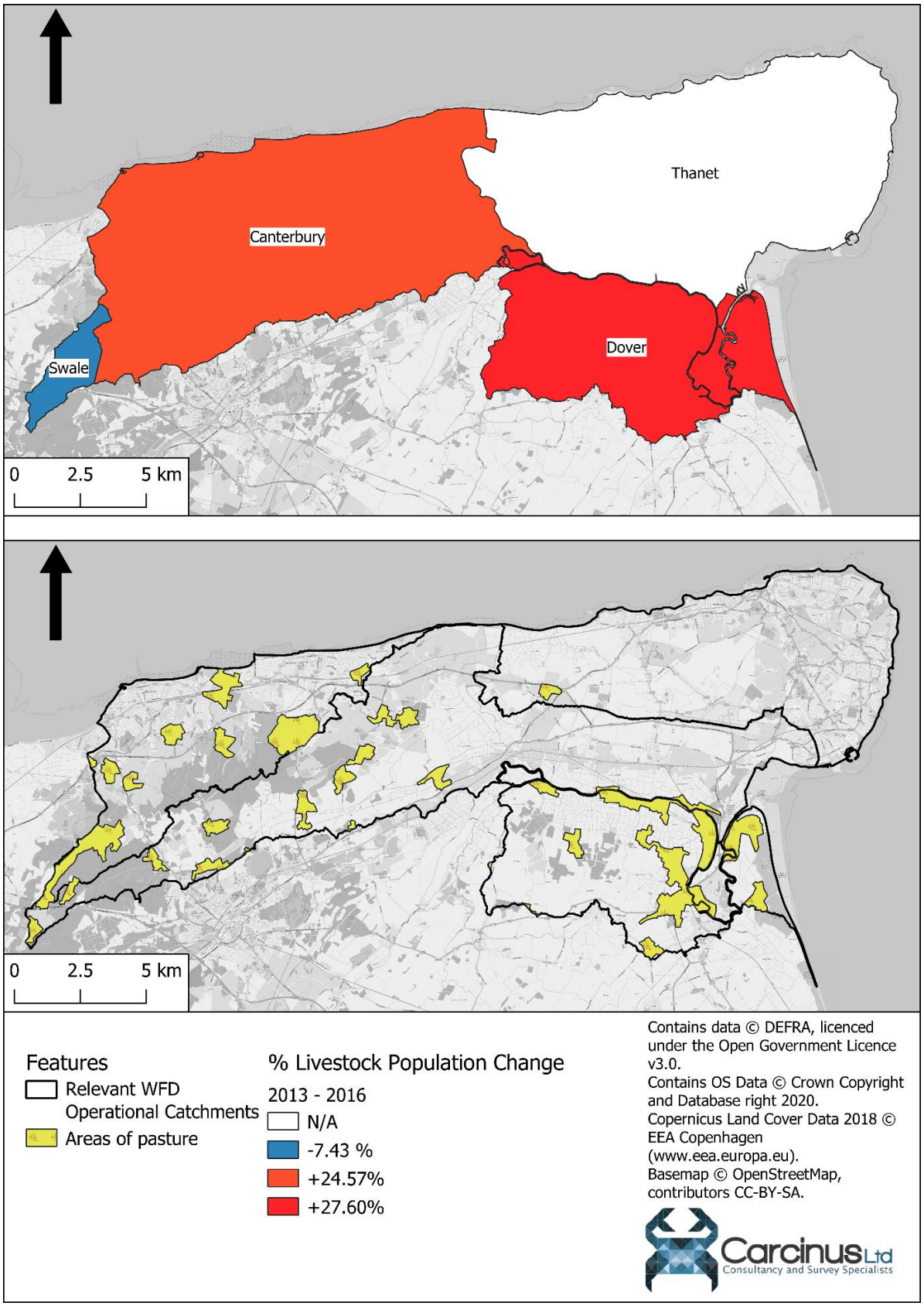

Figure 3.4 Livestock population change between 2013 and 2016 for Local Authority Districts and areas of pasture within the North Kent catchment.

Table 3.2 Livestock data for the North Kent Coast catchment in 2013 and 2016.

Local Authority District	Area Within Catchment (Ha)	% LAD within catchment	% Catchment Area	Number of livestock (Adjusted)											
				Cattle [5]			Sheep			Pigs			Poultry		
				2013	2016	% diff 2016/ 2013	2013	2016	% diff 2016/ 2013	2013	2016	% diff 2016/ 2013	2013	2016	% diff 2016/ 2013
CANTERBURY	10525	34.09%	39.79%	1537	1628	5.87%	4773	5324	11.55%	386	828	114.39%	23068	29298	27.01%
DOVER	5039	15.98%	19.05%	1093	1104	1.03%	1989	2005	0.79%	459	266	-41.99%	1190	2662	123.62%
SWALE	576	1.54%	2.18%	77	75	-2.39%	375	332	-11.60%	24	26	9.29%	1126	1050	-6.74%
THANET	10311	99.52%	38.98%	0	0	N/A	0	2084	N/A	0	0	N/A	47	0	-100.00%
Total	26451			2707	2807	3.68%	7137	9745	36.54%	869	1121	28.96%	25432	33010	29.80%

3.4 Wildlife

The North Kent Coast, Swale and Thames Estuaries contain habitats that support a variety of important wildlife. Due to this, various areas within and the BMPA have been designated as statutory and non-statutory sites:

- Marine Conservation Zone (MCZ)
    - Thanet Coast MCZ; and
    - The Swale Estuary SAC;
- Special Areas of Conservation (SAC)
    - Thanet Coast SAC;
    - Tankerton Slopes and Swalecliffe SAC; and
    - Margate and Long Sands SAC;
- Special Protection Areas (SPA)
    - Thanet Coast and Sandwich Bay SPA;
    - The Swale SPA; and
    - Outer Thames Estuary SPA
- Sites of Special Scientific Interest (SSSI)
    - The Swale SSSI; and
    - Thanet Coast SSSI
- Ramsar Sites
    - The Swale Ramsar Site;
    - Thanet Coast and Sandwich Bay Ramsar Site
- National Nature Reserves (NNR)
    - The Swale NNR

The majority of these designations are due to the presence of, or habitats that support, important populations of waterbirds. The original sanitary survey reported an average total count of 75,192 individuals within the Swale Estuary in the five winters to 2008/2009 (Callbrade *et al.*, 2010). The average count of the five years to 2018/2019 for the same area was 58,514 (Frost *et al.*, 2020), a decrease of 22.18%. However, as the neighbouring Thames and Medway estuaries also support tens of thousands of waterbirds, a significant number of birds are expected to utilise the intertidal waters within the BMPA. Species known to utilise the intertidal waters of the BMPA for foraging include Brent Goose, Shelduck, Widgeon, Oystercatchers and Avocets. Wading birds such as oystercatchers forage for prey (and defecate) directly onto the shellfish beds. The precise locations of these birds will vary from year-to-year and is driven by the distributions of their prey. As such, the spatial distribution of this source of contamination will be variable, but is likely to be temporally constrained to winter months when populations are highest. The area of the BMPA at highest risk from this form of contamination is the western end, closest to the dense bird aggregations in the Swale Estuary, but on a fine spatial scale the precise extent of contamination will be variable.

Harbour porpoise, grey and harbour seals are all still known to forage within the Thames Estuary and along the North Kent Coast (ZSL, 2015). These species show wide foraging ranges, and so potentially represent a source of diffuse contamination to the shellfishery. However, as this contamination is unpredictable both spatially and temporally, it remains difficult to define RMPs to capture this source and therefore does not need to be considered in any updated sampling plan.

Whilst bird populations have decreased since the original sanitary survey, the area still supports a significant population. Their unpredictable spatial distribution makes it challenging to choose RMP locations that will consistently capture this source of contamination, though highest risk areas are still likely to be at the western end of the BMPA. 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 North Kent Coast BMPA. Boating activities within the area have been derived through analysis of satellite imagery and various internet sources and compared to that described in the original sanitary survey. Their geographical distributions are presented in Figure 3.5.

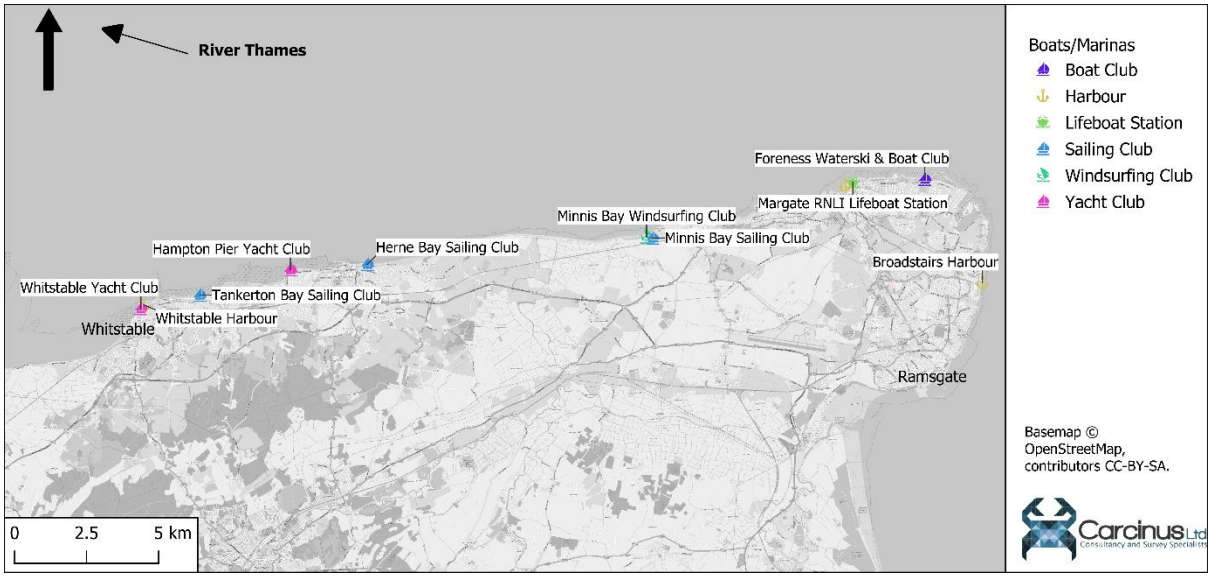

Figure 3.5 Locations of moorings, marinas and other boating activities near the North Kent Coast BMPA.

Approximately 7,000 cargo vessels visit ports in and around the Thames Estuary each year (DfT, 2018), though the main shipping channels are some distance north of the BMPA. The extent of recreational boating activity, particularly larger vessels more likely to contain on-board waste facilities, is restricted by the fact that the entire coastline dries at low tide. There are three small harbours along the coast, the largest of which is at Whitstable on the

western side of the BMPA. There are a number of sailing clubs across the coast and it is likely highest numbers occur during summer months, but these are unlikely to make any overboard discharges. Consultation with the LA did not indicate any further changes to the boating activity likely to significantly impact the water quality around the shellfish beds.

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 users to follow the same advice (RYA, 2020). The closest pump-out facilities are located at the Royal Ramsgate Marina, around the headland at the eastern end of the BMPA.

The hydrographic conditions along the North Kent coast limit the access of larger vessels likely to make overboard discharges. As such, no significant changes to the boating activity and the potential risk of contamination to the shellfishery have occurred. Any overboard discharges are likely to still be minor and spatially unpredictable and, as such, do not need to be factored into any updated sampling plan.

3.6 Other Sources of Contamination

Urban fabric within the catchment remains concentrated at the western and eastern ends of the coastline. There are some minor towns and villages throughout the catchment, such as Reculver, Brooksend and Calcott. Settlements near to waterbodies represent a potential source of diffuse pollution via utility misconnections and dog fouling. The geographical extent of urban settlements within the catchment have not increased significantly since the original sanitary survey (despite new housing developments), and therefore the risk that these settlements pose remains broadly similar.

The beaches along the North Kent Coastline remain a popular destination for dog walkers, particularly those closest to the main urban settlements at the western and eastern ends of the catchment. This remains a potential source of diffuse pollution to the near-shore coastal zone, and so would be most likely to affect those CZs closest to the coast. There is no evidence that their use has changed significantly.

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

It is unlikely that the bathymetry and hydrodynamics of the BMPA have changed significantly since the original sanitary survey. The bathymetric chart supplied in the original sanitary survey (Figure IV.1, p62), indicates that most of the substrate within 1 km of the coast is very shallow, <5 m below Chart Datum. Tides in the BMPA will flood in a westerly direction, and ebb in the opposite direction, meaning that contamination will be transported parallel to shore.

Given that the circulation of contamination within the BMPA is considered unlikely to have changed significantly since the original sanitary survey, no changes to the RMPs are recommended.

5 Rainfall

Rainfall data from the Sarre Penn at Calcott weather station (NGR: TR173624) from 2006 – 2011 (pre sanitary survey data) and 2012 – 2017 (post sanitary survey data) were used to determine whether any changes in rainfall patterns had occurred since the original sanitary survey. Figure 5.1 shows the average daily rainfall totals for each month at the Calcott monitoring station. Whilst rainfall has increased slightly since the publication of the original sanitary survey, two sample t-tests indicated that there was no significant difference between the mean daily rainfall per month ($p = 0.6939$) between the 2006 – 2011 and 2012 – 2017 periods. Table 5.1 summarises the rainfall at the Calcott monitoring station for the two periods.

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 survey to capture the influence of runoff and spill events remain valid.

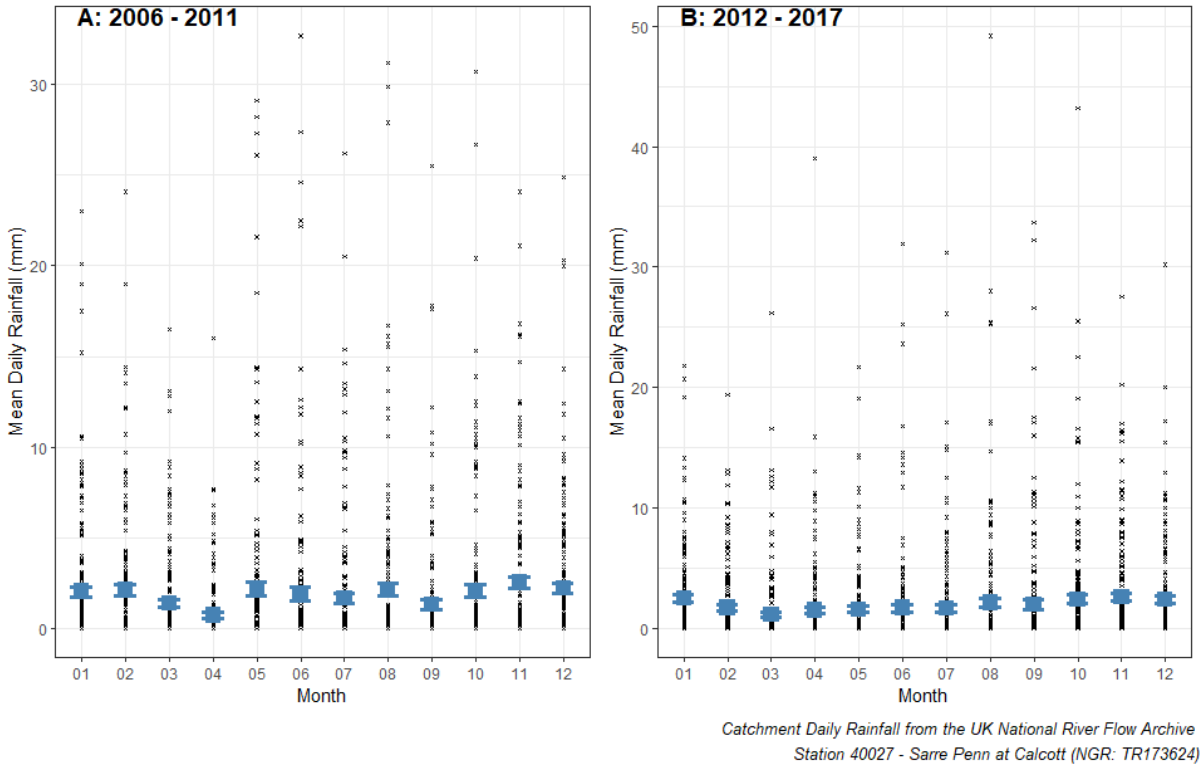

Figure 5.1 Mean daily rainfall (mm) per month for the Sarre Penn at Calcott monitoring station (NGR: TR173624) for the period (A) 2006 - 2011 (pre sanitary survey) and (B) 2012 - 2017 (post-sanitary survey).

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

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days Exceeding 10 mm	% Days Exceeding 20 mm
2006 - 2011	671.97	51.35	23.73	14.10
2012 - 2017	701.10	45.07	24.59	14.74

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

There are a total of 12 Representative Monitoring Points that have been sampled within the North Kent Coast BMPA since the original sanitary survey. Four of these are for Pacific oyster (*Crassostrea gigas*), three are for native oyster (*Ostrea edulis*) and mussel (*Mytilus edulis*) and two are for cockles (*Cerastoderma edule*). Only two of these RMPs (Btwn Leysdown & Spaniard (B17AL) & WOCO Westbeach (B17BS)) were sampled prior to the original sanitary survey. Sampling at the majority of the remaining RMPs began in February 2013, following the recommendations of the original sanitary survey. Sampling at the two Tankerton RMPs (B17CL & B17CM) began in 2017 following an application to harvest native oysters (Carcinus, 2018), though the LA indicated that harvesting at this bed was unlikely to proceed due to planning constraints for trestles, and the CZ for which the RMPs were chosen was never awarded a full classification. Sampling at the North Margate Sands and Pan Sand (B17CO) RMP began in March 2020, following an application to harvest wild cockles there (Carcinus, 2020). Sampling at the Whitsable Bay (B17CE) native oyster RMP ceased in August 2018 and was replaced by a Pacific oyster RMP (B17CN), due to a lack of availability of suitable native oyster stock and ease of dredging for Pacific oysters. The geometric mean results of shellfish flesh monitoring for all RMPs sampled since the original sanitary survey are presented in Figure 6.1. Summary Statistics are presented in Table 6.1.

All but four RMPs, for which data are available, are currently sampled. As discussed above, the Tankerton RMPs are no longer sampled due to a lack of industry interest, planning constraints and also related to refinement of extent of prohibited area around the WTW at Longrock Swalecliffe; classification is unlikely to go ahead. Sampling at the South Oaze (B17CD) RMP stopped in April 2015, due to limited access to the RMP location. The *South Oaze* CZ is currently classified based on samples from the Pollard (B17CG) RMP. No monitoring results from *Tapes* spp exist; the only *Tapes* spp. CZ, *Pollard* is also classified using samples from cockles (Pollard (B17CG)).

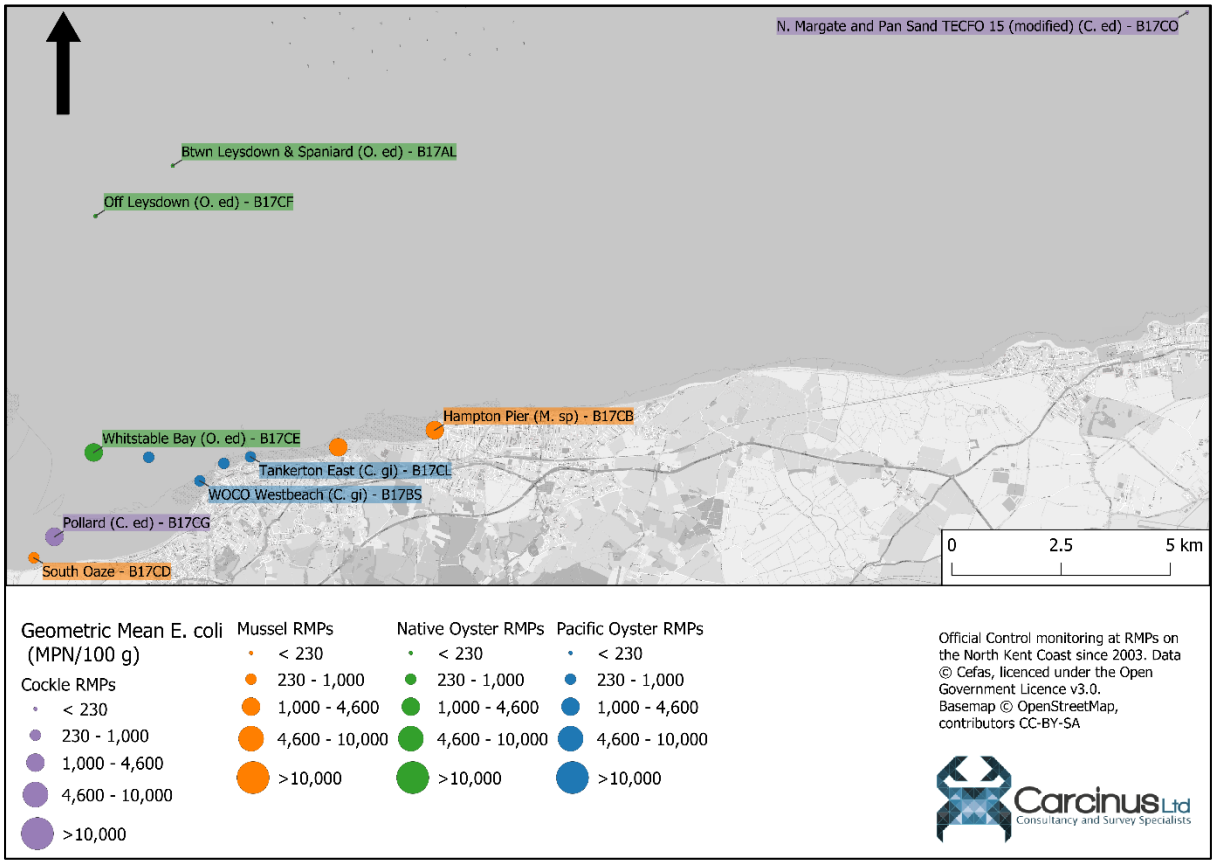

Figure 6.1 Geometric mean E. coli results from Official Control monitoring at bivalve RMPs within the North Kent Coast BMPA.

The three RMPs that are located farthest offshore show the lowest mean *E. coli* levels, with the mean values all less than the lower threshold of 230 MPN/100 g. However, relative to mean values in some other BMPAs around the country, mean values are relatively low; all RMPs have a mean of <4,000 MPN/100 g and only 50 % of RMPs have ever returned a result greater than the middle threshold of 4,600 MPN/100 g. There is no clear variation in the geometric mean *E. coli* level between species or on an east-west axis.

Table 6.1 Summary statistics of E. coli (MPN/100 g) from RMPs sampled from 2003 onwards (Data cut off at November 2020).

Site (Species)	NGR	Species	No.	First Sample	Last Sample	*E. coli* MPN/100 g			% > 230	% > 4,600	% > 46,000
						Geometric Mean	Min Value	Max Value			
Btwn Leysdown & Spaniard (O. ed) - B17AL	TR09707410	Native Oyster	182	17/03/2003	27/10/2020	32.96	18	500	0.55	0	0
WOCO Westbeach (C. gi) - B17BS	TR10326689	Pacific Oyster	126	28/04/2010	04/11/2020	348.07	18	2,400	38.89	0	0
Hampton Pier (M. sp) - B17CB	TR15706805	Mussel	92	13/02/2013	04/11/2020	3628.57	20	160,000	82.61	8.70	1.09
Swalecliffe (M. sp) - B17CC	TR13496766	Mussel	92	13/02/2013	04/11/2020	3992.32	45	160,000	63.04	6.52	2.17
South Oaze - B17CD	TR06526513	Mussel	24	16/04/2013	08/04/2015	672.08	50	2,400	75	0	0
Whitstable Bay (O. ed) - B17CE	TR07896754	Native Oyster	43	11/02/2013	21/08/2017	1205.14	18	35,000	39.53	2.33	0
Off Leysdown (O. ed) - B17CF	TR07937295	Native Oyster	80	11/02/2013	27/10/2020	40.68	18	330	1.25	0	0
Pollard (C. ed) - B17CG	TR06996561	Cockle	93	12/02/2013	04/11/2020	1569.89	20	17,000	70.97	6.45	0
Tankerton East (C. gi) - B17CL	TR11486744	Pacific Oyster	32	24/10/2017	08/06/2020	335.13	18	3,300	28.13	0	0
Tankerton West (C. gi) - B16CM	TR10876729	Pacific Oyster	23	24/10/2017	17/09/2019	479.22	18	7,900	8.70	4.35	0
Whitstable Bay (C. gi) - B17CN	TR09156743	Pacific Oyster	36	27/09/2017	27/10/2020	556.19	18	4,900	30.56	2.78	0

N. Margate and Pan Sand TECFO 15 (modified) (C. ed) - B17CO	TR32937761	Cockle	13	16/03/2020	14/10/2020	135.69	18	490	15.38	0	0

Figure 6.2 - Figure 6.5 present boxplots of *E. coli* monitoring results for RMPs sampled for native oyster (Figure 6.2), Pacific oyster (Figure 6.3), mussel (Figure 6.4) and cockles (Figure 6.5).

One-way analysis of variance (ANOVA) tests indicated that the mean monitoring result at Whitstable (B17CE) were significantly greater than both Off Leysdown (B17CF) and Btwn Leysdown & Spaniard (B17AL) ($p < 0.01$). It is also apparent that there was much greater variance in the results collected from Whitstable, even though far fewer results were collected at this RMP. No significant differences were found in any of the RMPs sampled for either Pacific oyster or mussels, although the mean result at Pollard (B17CG) was significantly greater than the result at North Margate Sand & Pan Sands (B17CO), though this is perhaps to be expected given the position of Pollard (B17CG) near to the mouth of the Swale Estuary, and North Margate Sand & Pan Sand (B17CO) approximately 6.8 km offshore.

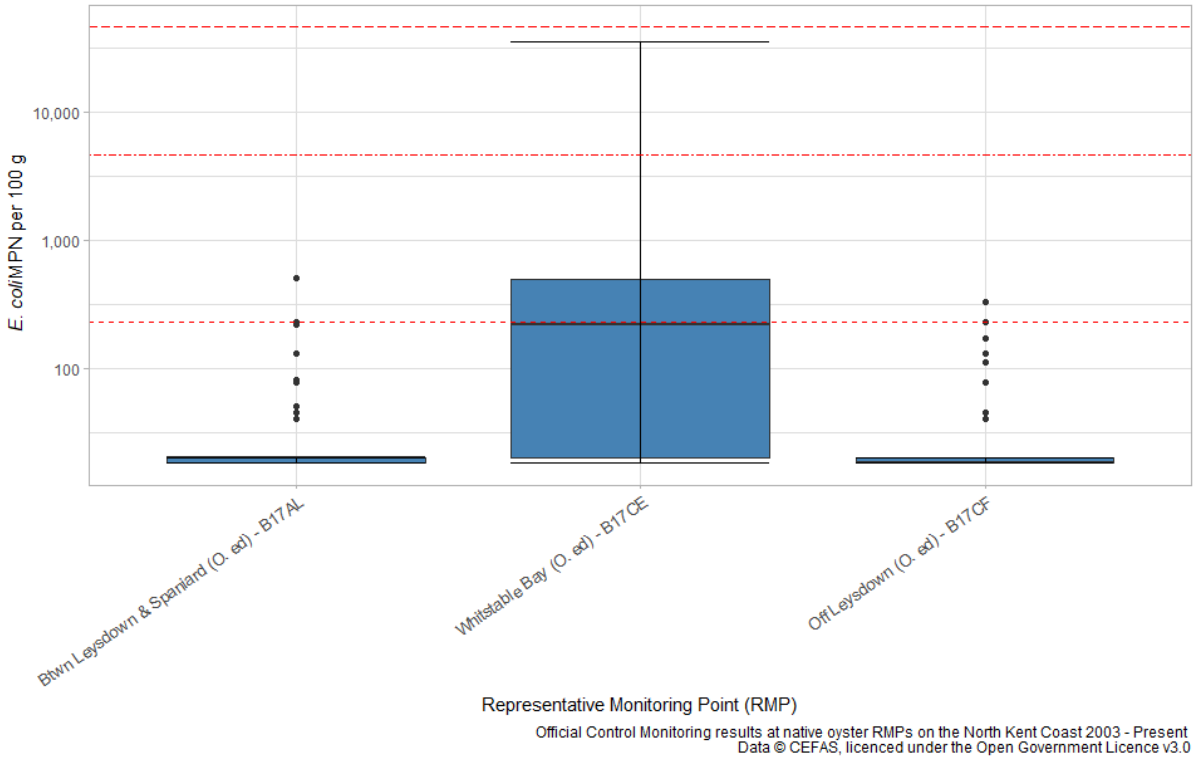

Figure 6.2 Boxplots of E. coli levels at native oyster RMPs sampled within the North Kent Coast BMPA 2003-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

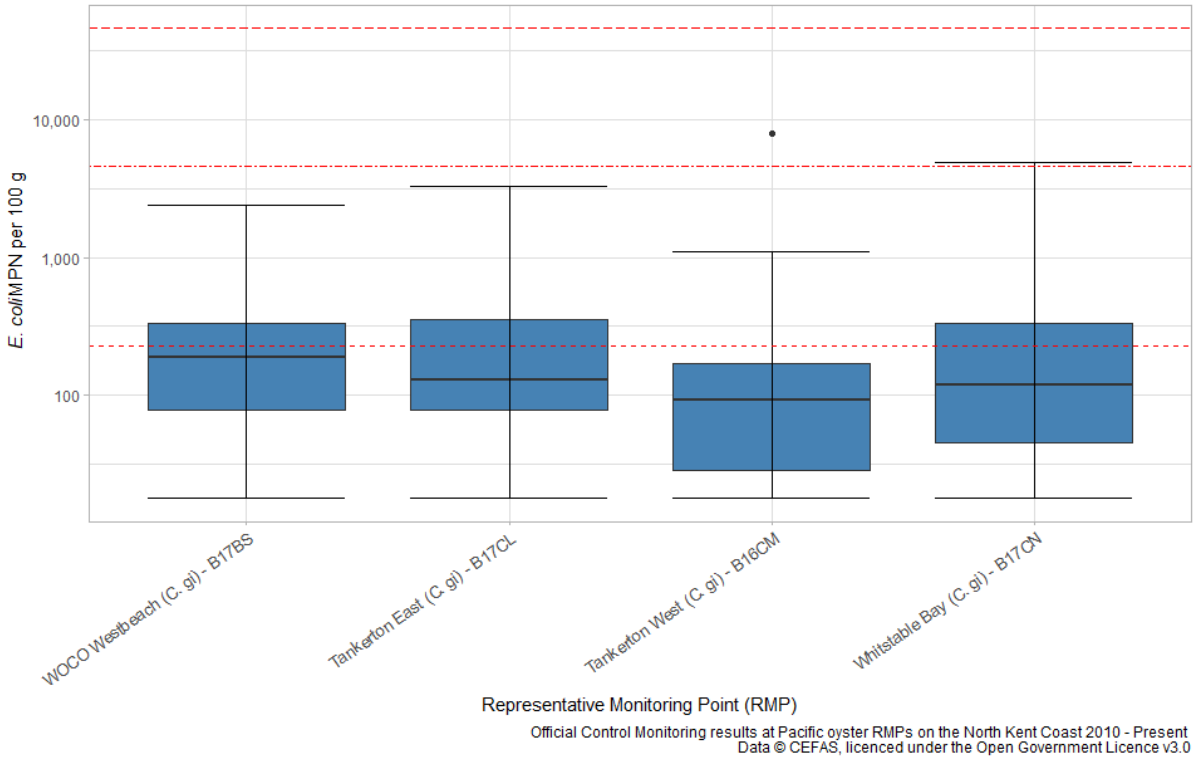

Figure 6.3 Boxplots of E. coli levels at Pacific oyster RMPs sampled within the North Kent Coast BMPA 2003-Present.

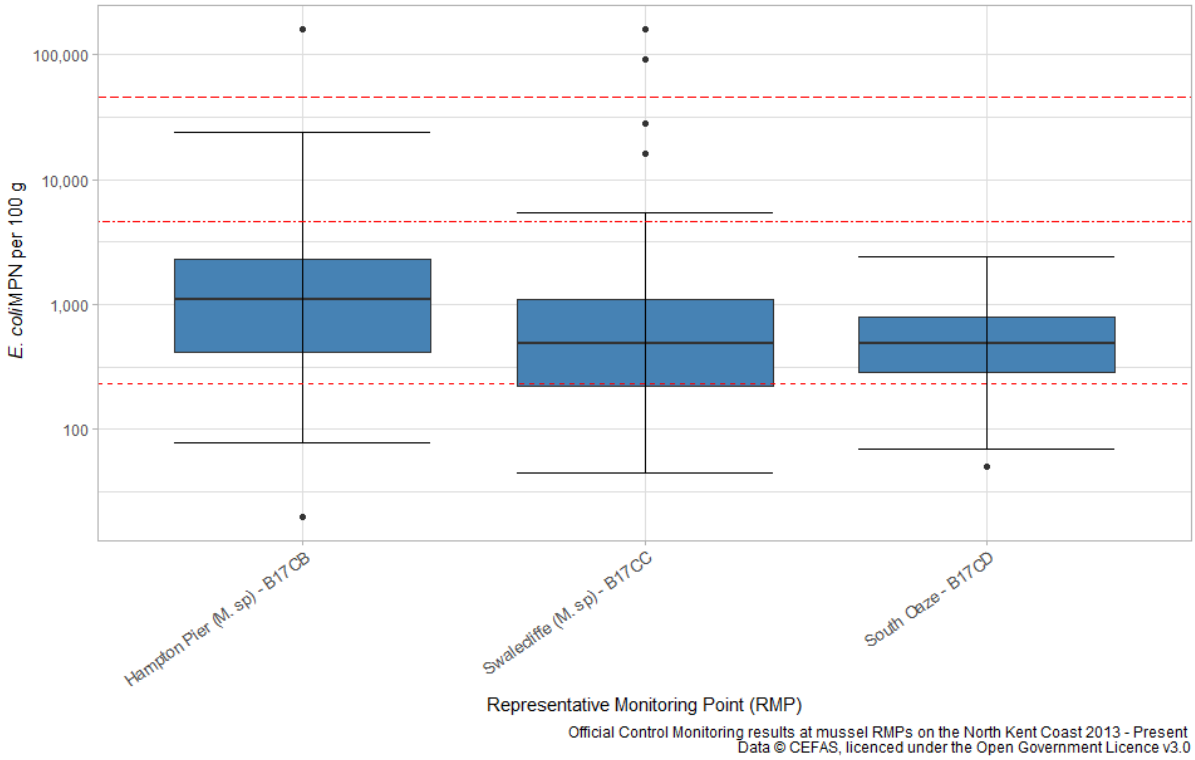

Figure 6.4 Boxplots of E. coli levels at mussel RMPs sampled within the North Kent Coast BMPA 2003-Present.

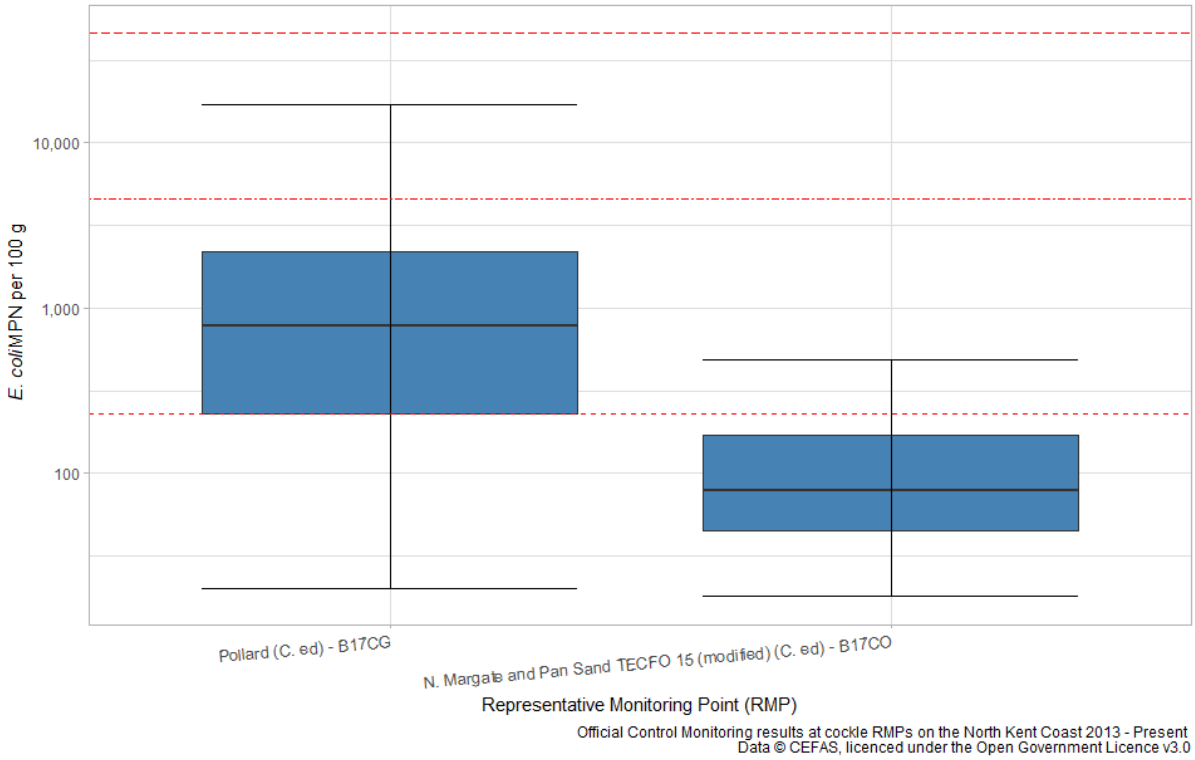

Figure 6.5 Boxplots of E. coli levels at cockle RMPs sampled within the North Kent Coast BMPA 2003-Present.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results for native & Pacific oyster, mussel and cockle RMPs within the North Kent Coast BMPA are shown in Figure 6.6, Figure 6.7, Figure 6.8 and Figure 6.9 respectively.

The *E. coli* levels recorded at Off Leysdown (B17CF) and Btwn Leysdown & Spaniard (B17AL) have remained consistently low for the duration of sampling, with the vast majority of results falling below the lower threshold of 230 MPN/100 g (Figure 6.6). This is likely due to the position of both RMPs 4.5 km and 6.7 km from the nearest coastline, respectively, and is reflected in both CZs to which they apply having Class A classifications. Monitoring results at Whitstable Bay (B17CE) were more variable for the short period of time this RMP was sampled, with most results falling near to the lowest threshold of 230 MPN/100 g. This RMP was replaced by an RMP harvesting Pacific oyster (B17CN, Figure 6.7) and the CZ (Whitstable Bay) currently holds a LT-B classification, reflecting stable results over a period of at least 5 years.

The Pacific oyster RMPs are all located in the nearshore zone, and all show broadly stable monitoring history, with most results falling around the lower threshold of 230 MPN/100 g and very few exceeding the higher threshold of 4,600 MPN/100 g. The CZs classified based on samples from these RMPs all hold LT-B classifications, reflecting stable results over a period of at least five years.

Whilst monitoring results at mussel RMPs have also been relatively stable (Figure 6.8), *E. coli* levels have generally been higher than at oyster RMPs. Whilst it was sampled, results from South Oaze (B17CD) showed a trend of increasing monitoring results. No clear trend at the other two RMPs is present. This is the only species sampled within this BMPA that has returned results above 46,000 MPN/100 g.

Monitoring results at Pollard (B17CG) have been relatively stable since monitoring began in 2017, with the loess trend line consistently falling between the lower threshold of 230 MPN/100 g and middle threshold of 4,600 MPN/100 g. Only 13 samples have been collected at the North Margate Sand & Pan Sands (B17CO) RMP, but these early results have indicated lower *E. coli* levels than at the other cockle RMP.

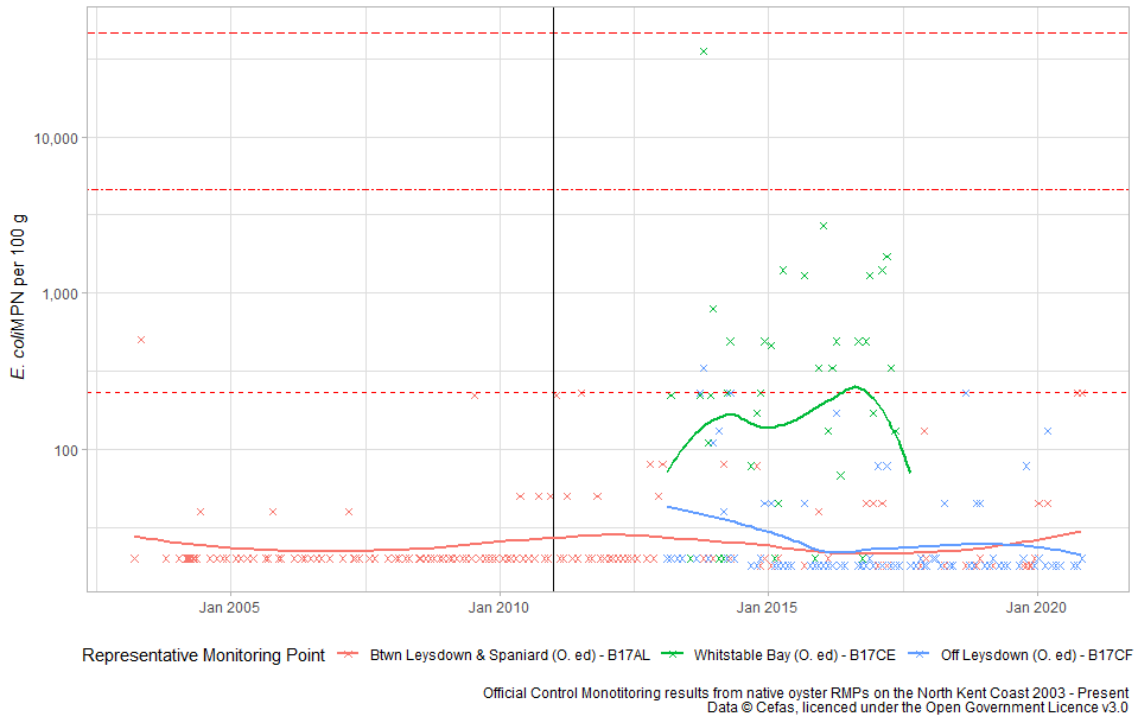

Figure 6.6 Timeseries of E. coli levels at native oyster RMPs sampled within the North Kent Coast BMPA 2003 – Present. Scatter plots are overlaid with loess model fitted to data.

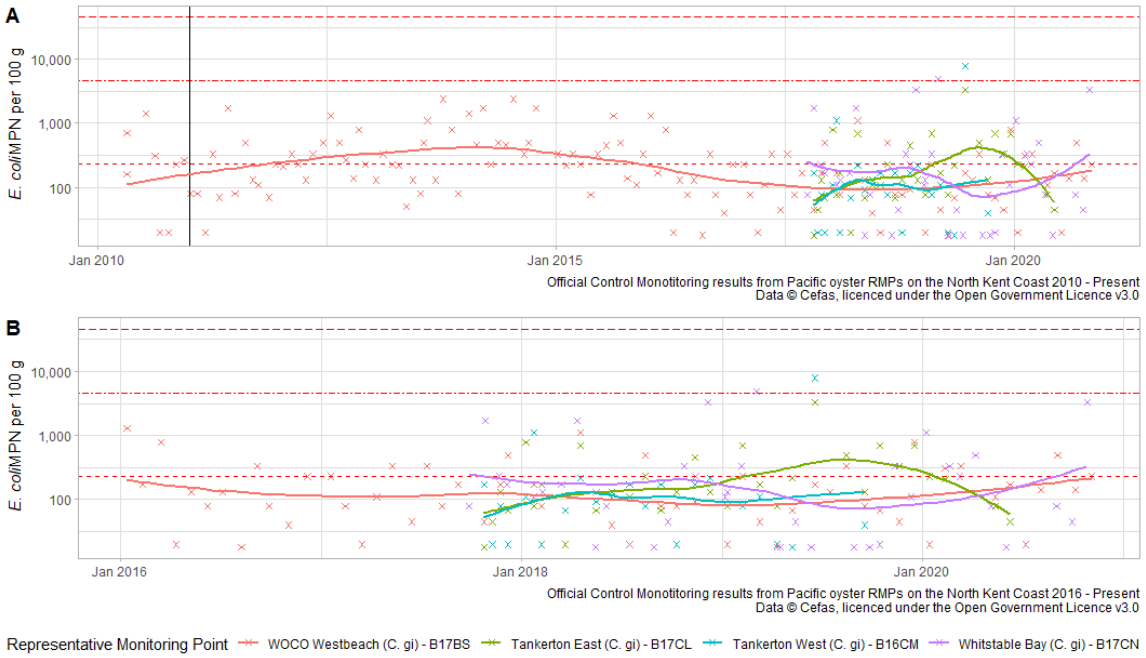

Figure 6.7 Timeseries of E. coli levels at Pacific oyster RMPs sampled within the North Kent Coast BMPA 2010 – Present (A) and following the sampling commencing at Tankerton RMPs (B). Scatter plots are overlaid with loess model fitted to data.

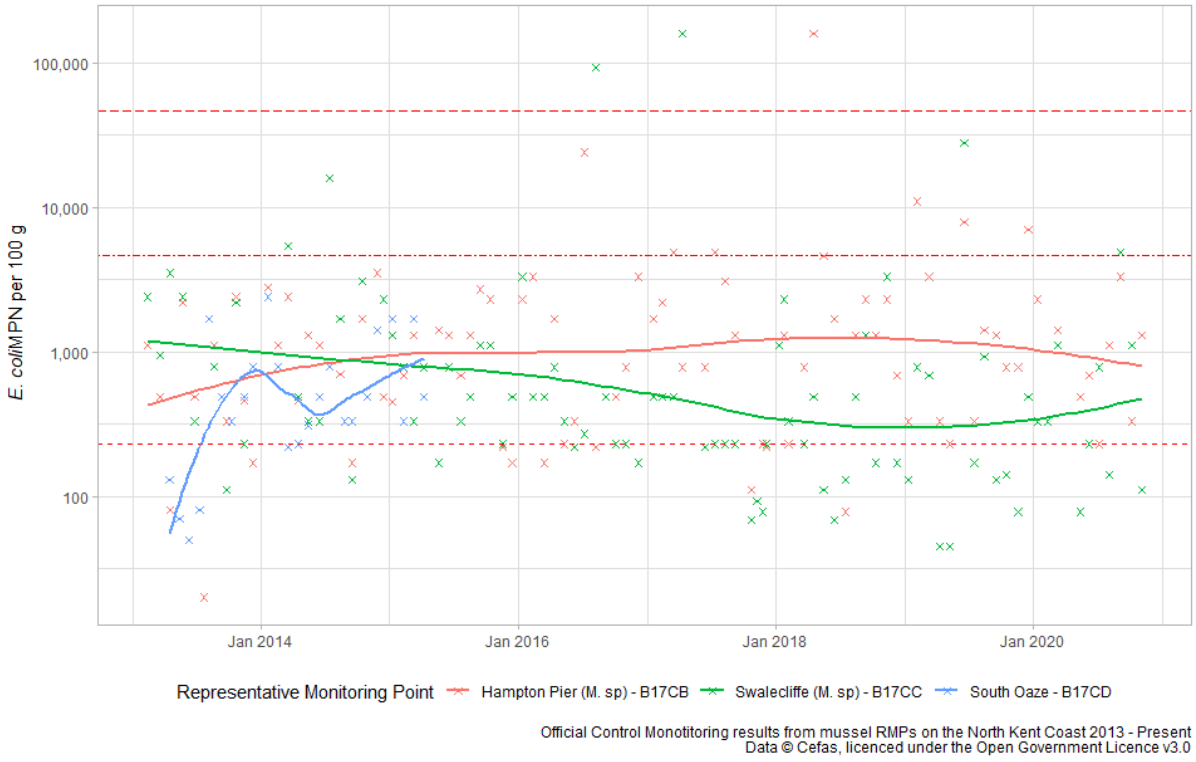

Figure 6.8 Timeseries of E. coli levels at mussel RMPs sampled within the North Kent Coast BMPA 2013 – Present. Scatter plots are overlaid with loess model fitted to data.

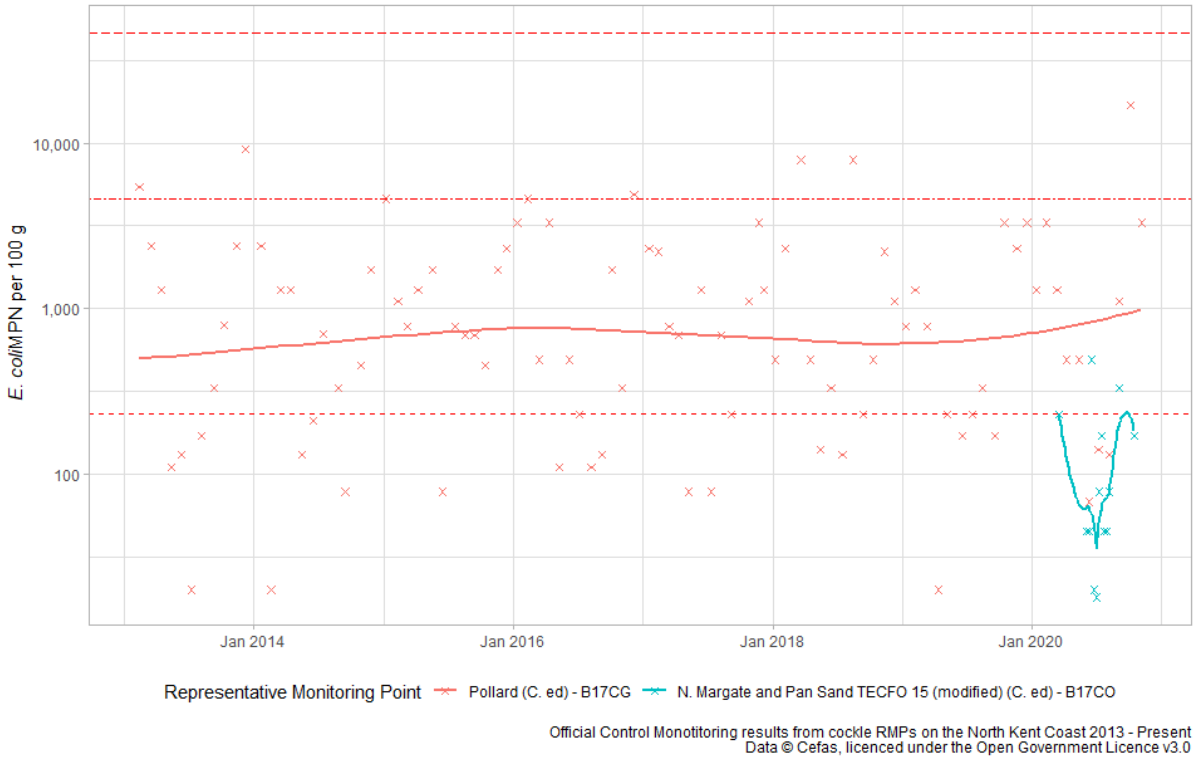

Figure 6.9 Timeseries of E. coli levels at cockle RMPs sampled within the North Kent Coast BMPA 2013 – Present. Scatter plots are overlaid with loess model fitted to data.

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at the various RMPs within the North Kent Coast BMPA were investigated and are presented in Figure 6.10 - Figure 6.13. 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 testing was used to look for significant differences in the data, using both season and RMP as independent factors (i.e. pooling the database across RMP and season respectively), as well as the interaction between them (i.e. exploring seasonal differences within a given RMP). Significance has been taken at the 0.05 level.

Two-way ANOVA tests did not reveal any significant differences at either Off Leysdown (B17CF) or Btwn Leysdown & Spaniard (B17AL) by season, although at Whitstable Bay (B17CE), results in Autumn were significantly greater than those during Winter ($p = 0.0044$), Summer ($p = 0.001$) or Spring ($p = 0.005$) (Figure 6.10). When RMP data were pooled, no significant differences by season were found.

In the case of samples from Pacific oysters (Figure 6.11), those from Whitstable Bay (B17CN) collected during Autumn were significantly greater than those collected during summer ($p = 0.043$). No other significant seasonal differences were found either within a single RMP or pooling the data across RMPs.

No seasonal differences were found in samples from any of the mussel RMPs (Figure 6.12) and, although irrespective of RMP, Autumn results were greater than spring; no significant differences within RMP were found (Figure 6.13).

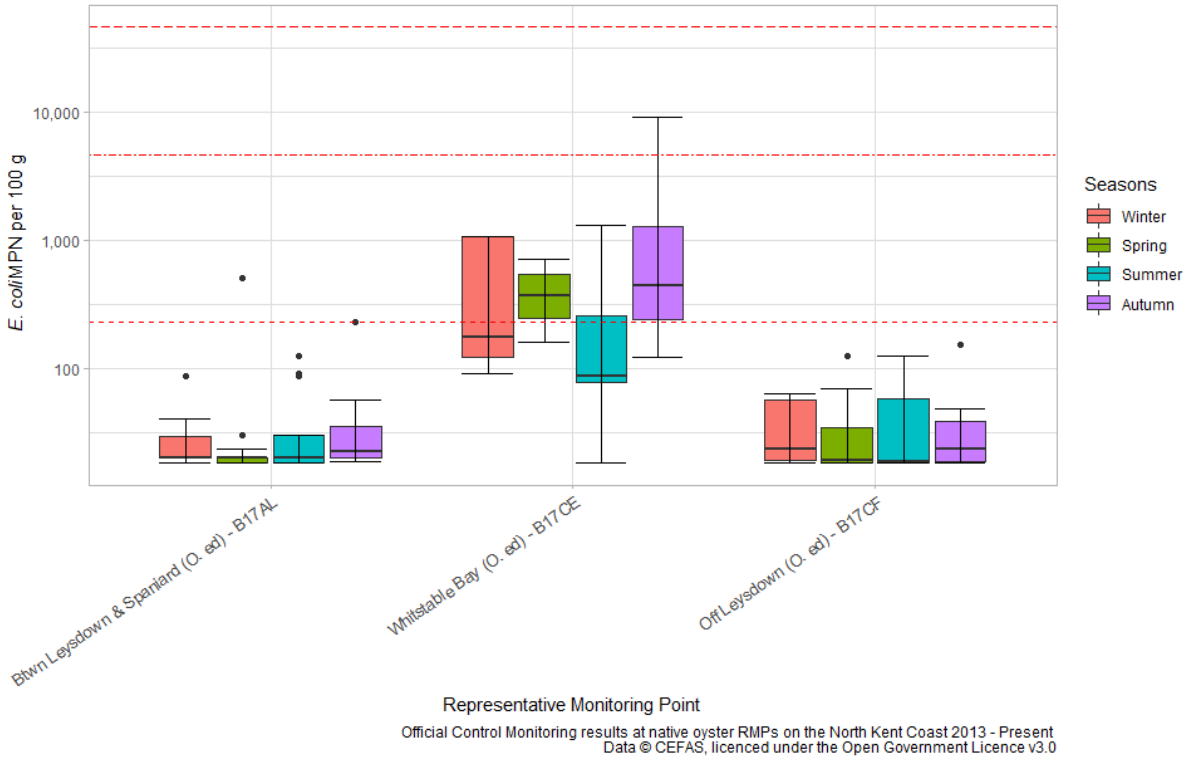

Figure 6.10 Boxplots of E. coli levels per season at native oyster RMPs sampled within the North Kent Coast BMPA 2003 - present.

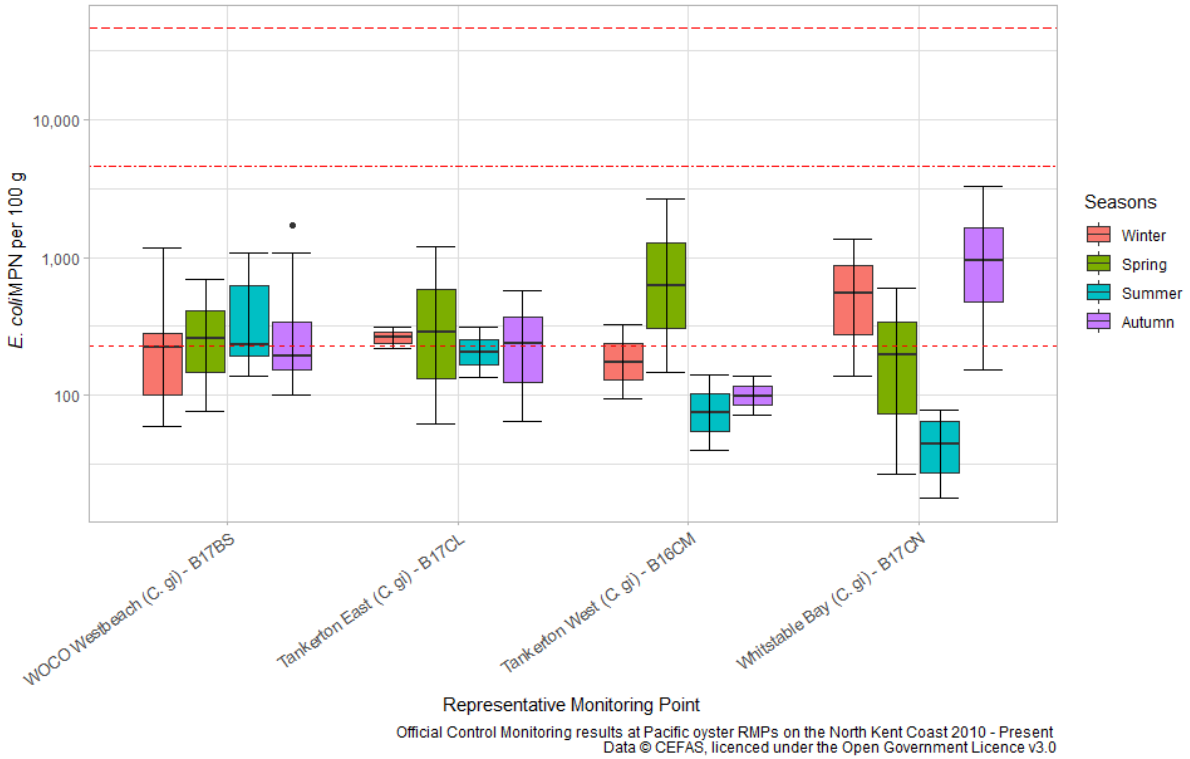

Figure 6.11 Boxplots of E. coli levels per season at Pacific oyster RMPs sampled within the North Kent Coast BMPA 2010 - present.

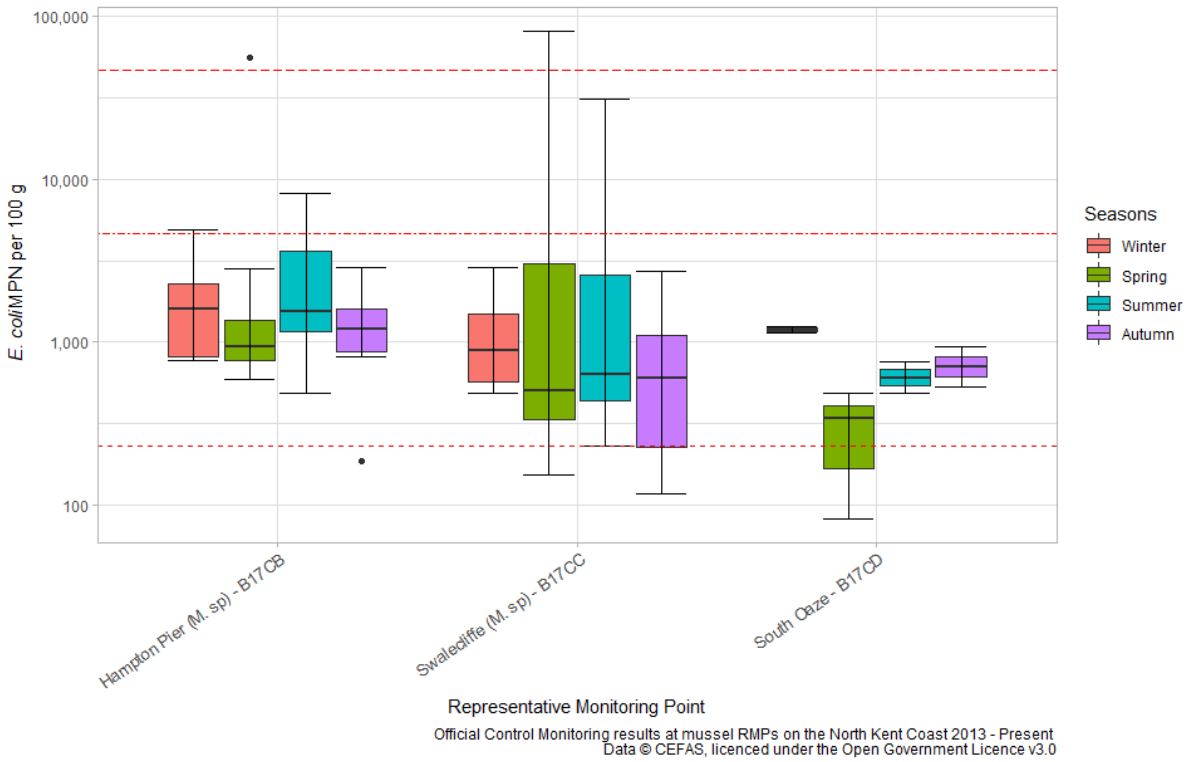

Figure 6.12 Boxplots of E. coli levels per season at mussel RMPs sampled within the North Kent Coast BMPA 2013 - present.

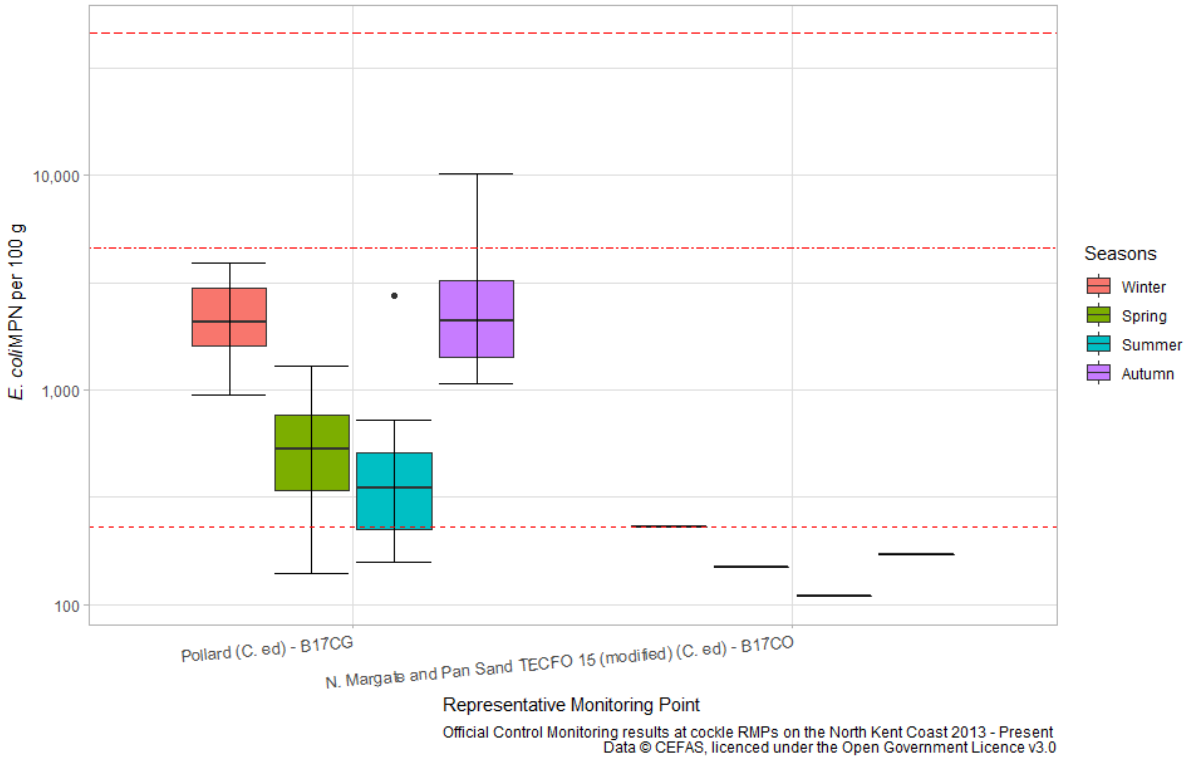

Figure 6.13 Boxplots of E. coli levels per season at cockle RMPs sampled within the North Kent Coast BMPA 2013 - present.

7 Conclusion and overall assessment

No IFCA landing statistics for this fishery were available, although consultation with the LA indicated that the dominant fishery by activity is Pacific Oysters. The North Kent Coast BMPA is characterised by overlapping CZs (Figure 2.1). The original sanitary survey recommended the creation of a series of CZs spanning the entire North Kent Coast from Whitstable to Margate, although currently the CZs are located on the western side of the coast, and nearshore CZs do not extend further east than Reculver. *Hampton Pier* and *South Oaze* are both classified for mussel, native & and Pacific oyster harvesting, although the boundaries for the species are different. *Pollard*, *Westbeach* and *Swalecliffe* are all classified for two species; *Pollard* for cockles and *Tapes* spp., *Westbeach* for native and Pacific oyster and *Swalecliffe* for mussel and Pacific oyster. *Swale Entrance* is classified for cockle harvesting, and large offshore areas are classified for native oyster (*Kentish Flats* & *Off Leysdown*) and cockle (*North Margate Sand and Pan Sands (TECFO Area 15)*).

The total population in Electoral Wards contained within or partially within the North Kent Coast catchment increased by 7.16% between the 2001 and 2011 censuses (the most recent for which data are available). This population increase has been broadly equal across the catchment, with only 4 wards showing a decrease. Population density across the catchment remains relatively low, with the majority of the catchment having a density of less than five persons per hectare. Consultation with the LA indicated that significant housing developments in the catchment are underway (or are planned). Increases in population will

almost certainly have led to an increase in sewage discharge volumes within the catchment, particularly via spill events if no major upgrades to the sewage infrastructure have occurred.

There have been no significant upgrades to the wastewater treatment network in the survey area. Despite the fact that the population has increased across the catchment, no changes to the permitted volumes of discharges or treatment methods have occurred. Secondary consultation with the Environment Agency indicated that there is evidence of increased 'significant' spill events from intermittent discharges in the BMPA, beyond the design specification. There is concern amongst the LAG that the current WWTW network does not have capacity to deal with increased loading from population changes and that the level of bacterial loading from this source is liable to increase. However, the likely hotspots of this contamination are not considered to have changed since the original sanitary survey.

The rural areas of the catchment are dominated by arable farmland rather than areas of pasture. The livestock population in Local Authority Districts within or partially within the catchment increased by nearly 30% between 2013 and 2016, although livestock densities generally remain fairly low. There are limited pathways for connectivity of this source of pollution, as there is very little pasture on the coastline and few watercourses in the catchment. There is the potential for run-off from fields spread with slurry to contribute to bacteriological contamination, however, without specific data on the timing and extents of this pollution, it is difficult to make recommendations for RMP location and the limited connectivity reduces the risk from these sources in comparison to other sources identified within the review.

The BMPA is intersected by several internationally designated areas for wading bird populations and the neighbouring Swale Estuary is home to nationally significant populations of overwintering birds. The five-year average count decreased by 22% relative to the number reported in the original sanitary survey. Despite this significant numbers of wading birds are expected to forage (and therefore transmit faecal contamination) on the shellfish beds within the BMPA. The area is also known to be a foraging location for cetaceans, but the temporally and spatially variable nature of this source of pollution makes it difficult to make recommendations for RMP location to capture this influence.

The North Kent Coast BMPA is characterised by a wide intertidal zone, which limits the access of larger vessels likely to make overboard discharges. No legislative changes to permitted discharges from recreational or commercial vessels have occurred and, therefore, occasional overboard discharges by recreational vessels may still occur, with the highest risk time of year during summer months.

A total of 12 RMPs have been sampled within the North Kent Coast BMPA since the publication of the original sanitary survey, of which only one was sampled prior. *E. coli* levels can be grouped into two general areas; offshore RMPs that have shown consistently low levels of *E. coli* (reflected in the Class A classification awarded to these areas) and inshore RMPs that have shown *E. coli* levels consistently between the lower threshold of 230 MPN/100 g and the middle threshold of 4,600 MPN/100 g (reflected in the LT-B

classification awarded to many of these areas). There are no clear differences in *E. coli* levels by species. This pattern is likely driven by the increased connectivity of nearshore RMPs to sources of contamination and a general approach of selecting RMPs at the nearshore edge of CZs should be taken.

There were very few significant differences in *E. coli* levels by season. Where significant differences were found, this was generally a case of results in Autumn being greater than at other times of year. A seasonal classification has been awarded to one CZ, classified for three species, though no seasonal differences in the RMP for this species were observed. Moving this RMP to a year-round classification may be possible if required. We understand that the LA/LAG would rather keep this zone (*Hampton Pier*) as a seasonal classification rather than a year-round classification at Class C.

Based on the information available, there does not appear to have been any significant changes to the sources of contamination into this BMPA 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 2021 report and compared with the findings of the 2011 sanitary survey review for the North Kent, the FSA are content that the level of risk posed by the findings is low and does not warrant a shoreline assessment. The newest classification at Margate Pan Sands was part of the shoreline survey undertaken when the whole area was surveyed in 2011.

8 Recommendations

Many of the CZs in the North Kent Coast BMPA are classified under the same name for different species, but with different boundaries for each species. As updated stock maps were unavailable to the authors of this review, a general recommendation of modifying CZ boundaries so that CZs of the same name for different species are identical is given. If stock maps indicating significant differences in distribution are given, we recommend at minimum altering the name of a given CZ to clearly state the species it refers to. A summary of the recommended changes to the sampling plan for this BMPA is presented in Table 8.1 and Figure 8.1.

8.1 Pacific Oyster

The original sanitary survey recommended the classification of eight classification zones, spanning the area from the Swale Estuary in the west of the BMPA to Nayland Rock in the east. Based on the information available, it is understood that the *Nayland Rock*, *Minnis Bay*, *Reculver* or *Swalecliffe Outfall* CZs were never awarded Classifications due to the difficulties of harvesting around the chalk reefs in these environments. The remaining CZs form one contiguous zone from Herne Bay Sailing Club to the approximate longitude of the London Array Onshore Substation. Recommendations for these remaining CZs are described below.

Hampton Pier Pacific oysters

This CZ is the farthest east of any Pacific oyster CZ in this BMPA, and currently covers an area of 13.13 Ha, with its western boundary meeting the eastern boundary of the *Swalecliffe* CZ and its eastern boundary a line drawn north from Herne Bay Sailing Club. The name 'Hampton Pier' is given to CZs for three separate species, although the boundaries are all different. The Pacific Oyster CZ is the smallest of the three, and it is recommended that the name of the CZ be modified to reflect the species (i.e. *Hampton Pier Pacific Oysters*), given that the boundaries are different. Like all *Hampton Pier* CZs, it is currently classified based on mussel samples from Hampton Pier (B17CB), located at the western end of Studd Hill Beach. There are two intermittent discharges at the eastern end of the CZ that represent the highest risk in terms of faecal contamination and our initial recommendation was to sample from a new RMP near these points. Consultation with the Local Authority indicated that limited stock exists in this zone and commercial activity is low. As such, it is recommended that this zone be declassified, and quarterly monitoring at the existing Hampton Pier (B17CB) RMP should take place in case of a desire for reclassification. Should reclassification be required, the RMP should be placed at the eastern boundary of the zone, as close as stock allows to the two intermittent discharges.

Swalecliffe Pacific oysters

The eastern boundary of this CZ meets the western boundary of the *Hampton Pier* CZ and extends until it meets the *Westbeach CZ* at a line drawn north from Whitstable Harbour. Like *Hampton Pier*, this CZ is also classified for mussel harvesting, although the boundaries of the Pacific oyster CZ extend approximately 3.3 km further out into the Thames Estuary than the mussel CZ. The northern boundary of the *Swalecliffe* Pacific oyster CZ is aligned with the northern boundary of the *Hampton Pier* mussel CZ. This CZ is currently classified based on mussel samples from Swalecliffe (B17CC). Monitoring results from the Tankerton RMPs (B16CL & B16CM) indicated that the intermittent discharges near those RMPs were not a significant influence, and as such the RMP is still representative. Presently, the outfall from Swalecliffe WWTW is not static, and a brook passing the works will be culverted. Following completion of these works, the RMP may need to be re-evaluated, although at present the current RMP location is still representative of the main contamination sources to this zone.

South Oaze Pacific oysters

This CZ is the farthest west of any Pacific Oyster CZ in the North Kent Coast BMPA and extends from its eastern boundary with the *Westbeach* CZ 700 m east of Seasalter Sailing Club to the mouth of the Swale (where it meets the *Swale Outer* CZ, part of the Swale BMPA). Like *Hampton Pier*, this CZ is classified for mussels, Pacific and native oyster, with different northern boundaries for each species. The northern boundary of the Pacific oyster CZ aligns with *Westbeach*'s northern boundary. For simplicity, it is recommended that the northern boundary of this CZ be moved southwards to align with the native oyster CZ (Figure 8.1) and a new *Whitstable Bay Pacific oysters* be created covering the area removed from this and the *Westbeach* CZ (see next paragraph). It is currently classified using cockle

samples from Pollard (B17CG), which is located approximately 600 m offshore. The authors of this review are aware of difficulties accessing harvestable mussel stock within the area, and it is considered appropriate to continue using this cockle RMP, as bioaccumulation of *E. coli* in cockles is greater than mussels, which is in turn greater than Pacific or native oysters (Cefas, 2014). This CZ was not included in the most recently published Cefas sampling plan for this BMPA, but has been reinstated based on the use of this RMP. Recommendations for changes to the position of the Pollard (B17CG) RMP are given below.

Westbeach Pacific oysters

This CZ is located between *South Oaze* (to the west) and *Swalecliffe* (to the east). Its northern boundary aligns with that of *South Oaze* (Pacific oysters) and *Swalecliffe* (mussels). This is farther north than the native oyster CZ because that CZ is clipped where it meets the *Whitstable Bay* native oyster CZ. As with the neighbouring *South Oaze* CZ, it is recommended that the northern boundary of this CZ be moved southwards to align with the native oyster CZ, and a new *Whitstable Bay Pacific oysters* be created (Figure 8.1), particularly as the existing *Whitstable Bay* native oyster CZ is classified using Pacific oysters. It is currently classified using samples from the RMP at the Whitstable Bay oyster trestles, WOCO Westbeach (B17BS) (one of only two RMPs sampled prior to the original sanitary survey), and it is recommended that this RMP continue to be used.

Whitstable Bay Pacific oysters

Following the reduction in size of the *South Oaze Pacific Oyster* and *Westbeach Pacific Oyster* CZs, it is recommended that a new CZ be created, matching the area lost from the other two CZs, as it is assumed this reflects the current stock extent, based on discussions with the LA. It should be classified based on samples from the existing Whitstable Bay (B17CN) RMP and should inherit the classification awarded to the *Whitstable Bay native oyster* CZ.

8.2 Native oyster

The native oyster CZs generally cover a large area, reflecting the wide but patchy naturally occurring oyster beds. The original sanitary survey recommended the classification of two intertidal two nearshore and one offshore CZs. Only the *Swalecliffe Outfall* CZ was never awarded a classification. The *Whitstable Bay* CZ has been reduced in size, and recommendations for this and the other remaining CZs are presented in the following paragraphs.

Hampton Pier native oysters

This CZ has very different boundaries to the Pacific oyster CZ of the same name. This CZ represents the eastern section of the original *Whitstable Bay* CZ and covers an area approximately 1 km from the shoreline, out to its northern border with the *Kentish Flats* CZ. The eastern boundary also matches that of the *Kentish Flats* CZ and extends northwards from a point approximately 1 km off of Reculver. This CZ is currently classified based on samples from the Hampton Pier (B17CB), which is not located within the boundaries of the native oyster CZ. Like the Pacific oyster and mussel CZs of the same name, this zone should

be declassified due to a lack of commercial harvesting and availability of stock in a representative monitoring location. Quarterly sampling at the current RMP (Hampton Pier B17CB) should continue. Should reclassification be required, an RMP nearer the Swalecliffe WWTW outfall should be used as this is likely to represent the highest in terms of faecal contamination.

Kentish Flats

This CZ covers a large offshore area (153 Ha). The eastern boundary of this CZ aligns with the *Hampton Pier* CZ and its south-western boundary meets the *Off Leysdown* CZ. It is currently classified based on samples from Btwn Leysdown & Spaniard (B17AL) RMP, one of only two RMPs to have been sampled prior to the publication of the original sanitary survey. This RMP is still considered to be representative, given the limited pathways of connectivity of nearshore sources of contamination to this CZ. However, it is proposed that the southwestern boundary of this zone be moved shoreward, to cover some of the area of the declassified *Off Leysdown* CZ (see next paragraph). A new RMP, midway between the Btwn Leysdown & Spaniard (B17AL) and Off Leysdown (B17CF) should be used to classify this zone (Figure 8.1).

Off Leysdown

This is the other nearshore native oyster CZ recommended by the original sanitary survey. Its north-east border meets the south-west edge of the *Kentish Flats* CZ and its southern border meets the northern edge of the *Whitstable Bay* CZ. It is currently sampled from Off Leysdown (B17CF); the authors of the original sanitary survey indicated a preference to sample from a point in the south-west corner of the CZ, to capture near-shore sources of contamination. Consultation with the Local Authority indicated that stock is very limited in this area and as such, it is recommended that this zone be declassified. The area of the zone with stock, thought to be that near the current Off Leysdown (B17CF) RMP should be incorporated into the *Kentish Flats* CZ (Figure 8.1).

South Oaze native oysters

This CZ is the farthest west of any native oyster CZ in the North Kent Coast BMPA. There are CZs of the same name for mussels and Pacific oysters, although the CZ for this species is the smallest of the three, with the northern boundary meeting the southern boundary of the *Whitstable Bay* CZ. This CZ is classified based on samples from Pollard (B17CG) RMP, due to a lack of accessible stock of other species. It is recommended that this practice continue. Recommendations for that RMP are given below.

Westbeach native oysters

This CZ is located south of the *Whitstable Bay* CZ, and east of the *South Oaze* CZ. The northern boundary of this CZ aligns with the *South Oaze native oyster* CZ and is farther south due to the presence of the *Whitstable Bay native oyster* CZ to the north. No changes to the boundaries of this CZ are recommended. This CZ is currently classified based on Pacific oyster samples from the Whitstable Bay oyster trestles, WOCO Westbeach (B17BS). This RMP will be representative of sources of contamination from the eastern section of the

CZ, although results from the Pollard (B17CG) RMP should be considered as well as these will be representative of contamination from the west, carried up the Swale.

Whitstable Bay native oysters

The southern boundary of this meets the northern boundary of the *South Oaze native oysters* and *Westbeach native oysters* CZs and extends northwards to the *Off Leysdown* CZ. No changes to the boundaries of this CZ are recommended, as it is recommended that the southern and western boundaries of the newly created Pacific oyster CZ (see previous section) should align with this CZ. The original sanitary survey recommended classification of this CZ using native oyster samples from Whitstable Bay (B17CE) RMP, although currently it is classified based on Pacific oyster samples from Whitstable Bay (B17CN) RMP, situated approximately 1.3 km east of the original RMP. It is recommended that this RMP continue to be used as it is representative of the main sources of contamination.

8.3 Mussels

The original sanitary survey recommended classifying a large area, extending from the coastline out to a line drawn along northing 174575 (OSGB: 1936) and from the Swale Estuary in the west to Nayland Rock in the east. This is farther north than was recommended for other species and was chosen to encompass the entire area of interest to mussel dredgers. The east/west boundaries of these CZs were to align with those of the Pacific oyster CZs. No classification was given to the *Whitstable Bay* CZ as there was no wild stock and the owners of the Whitstable Bay oyster trestles did not want bagged mussels on their trestles. Similar to the Pacific oyster CZs, it is not clear whether *Nayland Rock*, *Minnis Bay*, *Reculver* or *Swalecliffe Outfall* CZs were ever awarded Classifications. Recommendations for the remaining CZs are described in the following paragraphs.

Hampton Pier Mussels

This CZ is the farthest east of any zone classified for mussel harvesting in the North Kent Coast BMPA. The eastern and western boundaries align with those of the *Hampton Pier Pacific Oysters* CZ, although the northern boundary extends 2.7 – 3.3 km further than that CZ (the mussel CZ follows a northing line, whereas the Pacific oyster CZ lies approximately parallel to the coast). This CZ is currently classified based on samples from the Hampton Pier (B17CB) RMP. This RMP is still considered to be representative of the main sources of pollution to the western end of the CZ, which will be dominated by land run-off and potentially carried through the BMPA from the Swale Estuary. However, as above, the current RMP is not representative of the eastern end due to the proximity of two intermittent discharges to the zone. The Local Authority indicated that limited stock exists in this zone and commercial harvesting is minimal. As such we recommend declassifying the *Hampton Pier* CZ and the current RMP (Hampton Pier B17CB) should be sampled quarterly moving forward. Should reclassification be required, the RMP should be placed at the eastern extent of the stock, to capture the contamination from the two intermittent discharges.

Swalecliffe Mussels

The eastern boundary of this CZ meets the western boundary of the *Hampton Pier Mussels* CZ. The original sanitary survey recommended that the northern boundary should extend to align with the *Hampton Pier Mussels* CZ, although currently the northern boundary stops 3.3 km further south. This RMP currently used for this CZ is the Swalecliffe (B17CC) RMP, near where the Swalecliffe Brook drains out across Tankerton Beach. It is recommended that this RMP continue to be used, as it is located near to intermittent sewage discharges and therefore considered to be representative of the highest risk of contamination.

South Oaze Mussels

This CZ is located farthest west of any mussel CZ within the North Kent Coast BMPA. The western boundary of this RMP meets CZs in the Swale and Thames Estuary BMPAs. The northern boundary of the CZ extends much further north than the Pacific or native oyster CZs of the same name, extending to the same northing as the *Hampton Pier Mussels* CZ. This CZ is currently classified based on cockle samples from the Pollard (B17CG) RMP, due to a lack of accessible stock of other species. Consultation with the Local Authority indicated that no mussel stock exists in the northern part of the CZ. As such, clipping the boundary of this zone to that of the *South Oaze Native Oyster* is recommenced since the existing RMP (Pollard B17CG)) is not representative of the northern part of the zone (Figure 8.1). Recommendations for the Pollard (B17CG) RMP are given below.

8.4 Cockles

The original sanitary survey recommended the creation of the *Pollard*, *Minnis Bay*, *Swale Entrance*, *Swalecliffe Outfall* and *Hook & Margate Sands* CZs. The *Minnis Bay* and *Hook & Margate Sands* CZs were declassified in 2014, though it is not clear what prompted this action. Recommendations for the remaining CZs, including the additional *North Margate Sand and Pan Sands (TECFO Area 15)* CZ are described below.

Pollard Cockles

This CZ is located at the mouth of the Swale Estuary and borders CZs in the Swale BMPA. This CZ covers a similar area to those of the *South Oaze / Westbeach* CZs for other species, although it extends further north, meeting the *Swale Entrance* CZ at its northern extent. This CZ is currently classified based on samples from the Pollard (B17CG) RMP. This RMP is still considered to be representative of contamination in this zone. Consultation with the Local Authorities indicated that suitable sampling stock is hard to find at the current RMP and suggested moving the RMP location 100 m westwards (around TR 05878 65637). This new location is still representative of this zone and the others that the Pollard (B17CG) RMP was used to classify; *South Oaze Pacific oysters, native oysters* & *mussels*, as well as *Pollard Tapes* spp.. The new RMP should be given a new name and code (see Table 8.1).

Swale Entrance

This CZ extends from the northern boundary of the *Pollard* CZ and overlaps the *Off Leysdown* and *Kentish Flats* native oyster CZs. The CZ has a boundary with the *Swalecliffe Mussels* CZ along two of its edges. The original sanitary survey recommended using an RMP

at TR 0660 6814, at the south-western point of this CZ to classify this zone, although the Local Authority indicated that the zone is classified using mussel samples from Swale BC/8 (B076H) RMP, though this RMP is located outside the boundaries of the CZ. It is recommended that this RMP be retained as the shoreline location of the current RMP is likely to return higher *E. coli* monitoring results than a new RMP within the zone.

North Margate Sand and Pan Sands (TECFO Area 15)

This CZ covers an area of 5,380 Ha off the North Kent Coast and was only recently classified following recommendations made in an pRMP assessment (Carcinus, 2020). It is classified based on samples from North Margate and Pan Sand TECFO 15 (B17CO) RMP. This RMP was chosen to be representative of the main sources of pollution to this CZ and is still considered to be representative.

8.5 Tapes spp.

The original sanitary survey included CZs for *Tapes* spp. covering the entire North Kent Coast in the sampling plan, despite the fact that no commercial harvesting was taking place. The recommendations for the only CZ with an active classification for this species is described below.

Pollard Tapes spp.

The boundaries of this CZ are broadly similar to those of the *Pollard Cockles* CZ, although that CZ extends further north. This CZ is currently classified based on cockle samples from the Pollard (B17CG) RMP and it is recommended that the new location for this RMP (see above) should be used. Recommendations for that RMP are given above. Given that this CZ also covers the *Westbeach* CZ, consideration should be given to results from the WOCO Westbeach (B17BS) RMP.

8.6 General Information

8.6.1 Location Reference

Production Area	**North Kent Coast**
Cefas Main Site Reference	M017
Ordnance survey 1:25,000	OS Explorer 150
Admiralty Chart	1607 (Thames Estuary Southern Part) 2000.1 (Thames Estuary South)

8.6.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Native oyster (*Ostrea edulis*)	Wild	Open season September - April
Pacific oyster (*Crassostrea gigas*)	Wild & Cultured	Year round
Mussels (*Mytilus sp.*)	Wild	Year round
Cockles (*Cerastoderma edule*)	Wild	Open season June - November
Tapes spp.	Wild	Year round

8.6.3 Local Enforcement Authority(s)

Name	Canterbury City Council Military Road Canterbury CT1 1YW TR11 4NR
Website	N/A
Telephone number	01227 862222
E-mail address	envhealth@canterbury.gov.uk

*Table 8.1 Proposed sampling plan for the North Kent Coast BMPA. Suggested changes are given in **bold red type**.*

Classification Zone	*RMP*	*RMP Name*	*NGR (OSGB 1936)*	*Lat/Long (WGS 1984)*	*Species Represented*	*Growing Method*	*Harvesting Technique*	*Sampling Method*	*Sampling Species*	*Tolerance*	*Frequency*
Hampton Pier Pacific Oysters; Native Oysters; Mussels*	B17CB	Hampton Pier (M. sp)	TR 1570 6805 / TR 1848 6867	51°22.23'N 01°05.85'E / 51°22′30″N, 001°08′17″E	*C. gigas*; *O. edulis*; *Mytilus* spp.	Wild	Hand	Hand	*Mytilus* spp.	50 m	**Quarterly**
Swalecliffe Pacific Oysters; Mussels	B17CC	Swalecliffe	TR 1349 6766	51°22.07'N 01°03.94'E	*C. gigas*; *Mytilus* spp.	Wild	Hand	Hand	*Mytilus* spp.	50 m	Monthly
South Oaze Pacific Oysters; Native Oysters; Mussels	**TBC**	**TBC**	**TR 0580 6564**	**51°21′09″N, 000°57′19″E**	***C. gigas*; *O. edulis*; *Mytilus* spp.**	**Wild**	**Hand**	**Hand**	***C. edule***	**50 m**	**Monthly**

Classification Zone	*RMP*	*RMP Name*	*NGR (OSGB 1936)*	*Lat/Long (WGS 1984)*	*Species Represented*	*Growing Method*	*Harvesting Technique*	*Sampling Method*	*Sampling Species*	*Tolerance*	*Frequency*
Westbeach Pacific Oysters; Native Oysters	B17BS	WOCO Westbeach	TR 1032 6689	51°21.73'N 01°01.18'E	*C. gigas; O. edulis*	Wild / culture	Hand	Hand	*C. gigas*	100 m	Monthly
Whitstable Bay Pacific Oysters; Native Oysters	B17CN	Whitstable Bay (C. gi)	TR 0915 6743	51°22.04'N 01°0.19'E	*O. edulis;* ***C. gigas***	Wild	Dredge	Dredge	*C. gigas*	100 m	Year round
Kentish Flats	**TBC**	**TBC**	**TR 0898 7360**	**51°25'22"N, 001°00'16"E**	*O. edulis*	Wild	Dredge	Dredge	*O. edulis*	100 m	Monthly (July to April)
Off Leysdown*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pollard Cockles; *Tapes* spp.	**TBC**	**TBC**	**TR 0580 6564**	**51°21'09"N, 000°57'19"E**	*C. edule; Tapes* spp.	Wild	Hand	Hand	*C. edule*	50 m	Monthly

Classification Zone	*RMP*	*RMP Name*	*NGR (OSGB 1936)*	*Lat/Long (WGS 1984)*	*Species Represented*	*Growing Method*	*Harvesting Technique*	*Sampling Method*	*Sampling Species*	*Tolerance*	*Frequency*
Swale Entrance	B076H	Swale BC/8	TR 0560 6840	51°22.64'N 00°57.17'E	*C. edule*	Wild	Dredge	Dredge	*M. edulis*	100 m	Monthly
North Margate Sand and Pan Sands (TECFO Area 15)	B17CO	North Margate and Pan Sands TECFO 15	TR 3292 7760	51°26'58"N, 001°21'03"E	*C. edule*	Wild	Dredge	Dredge	*C. edule*	250 m	Monthly
***Zone to be declassified**											

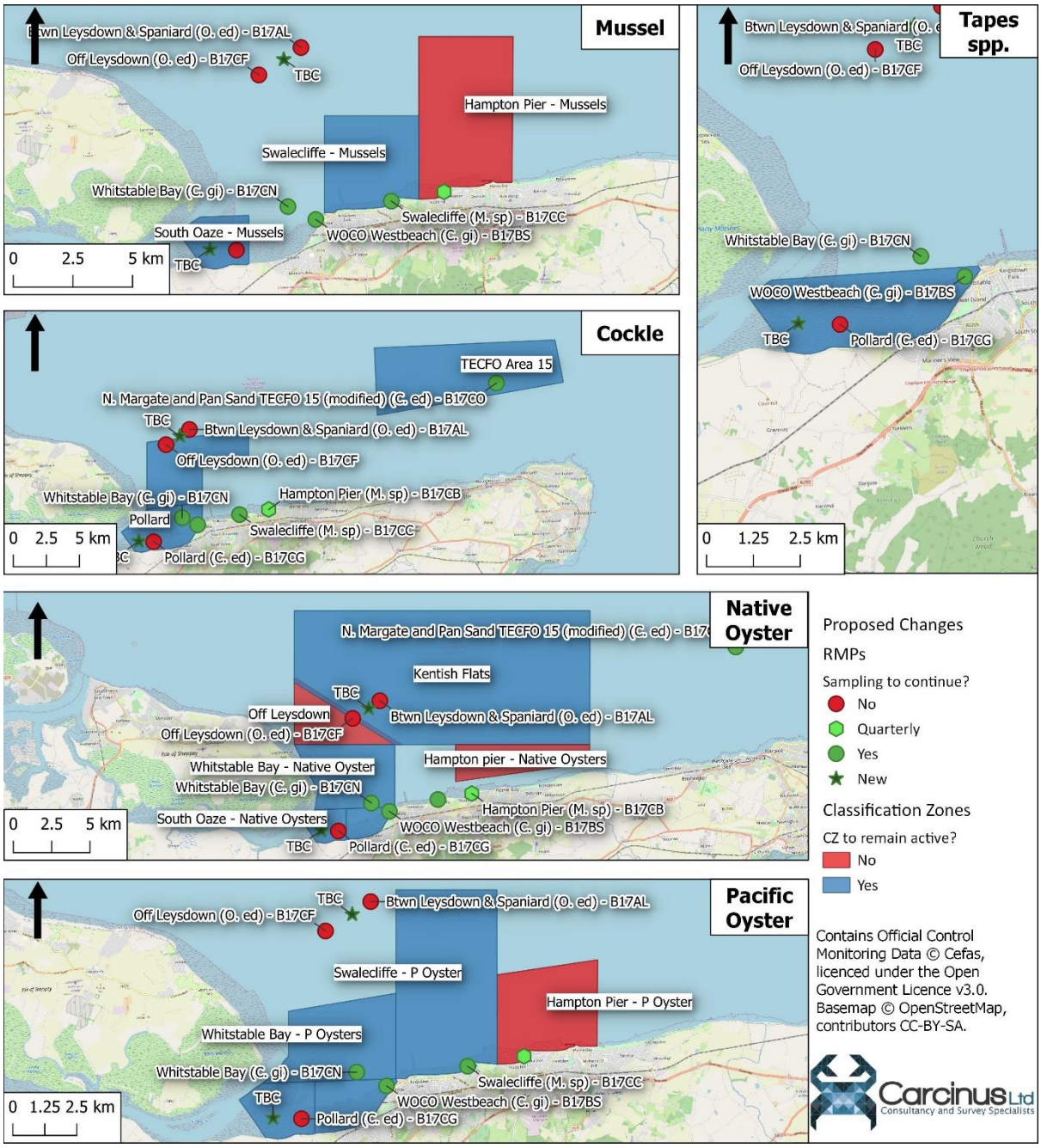

Figure 8.1 Proposed Classification Zone boundaries and RMPs for the North Kent Coast BMPA.

9 References

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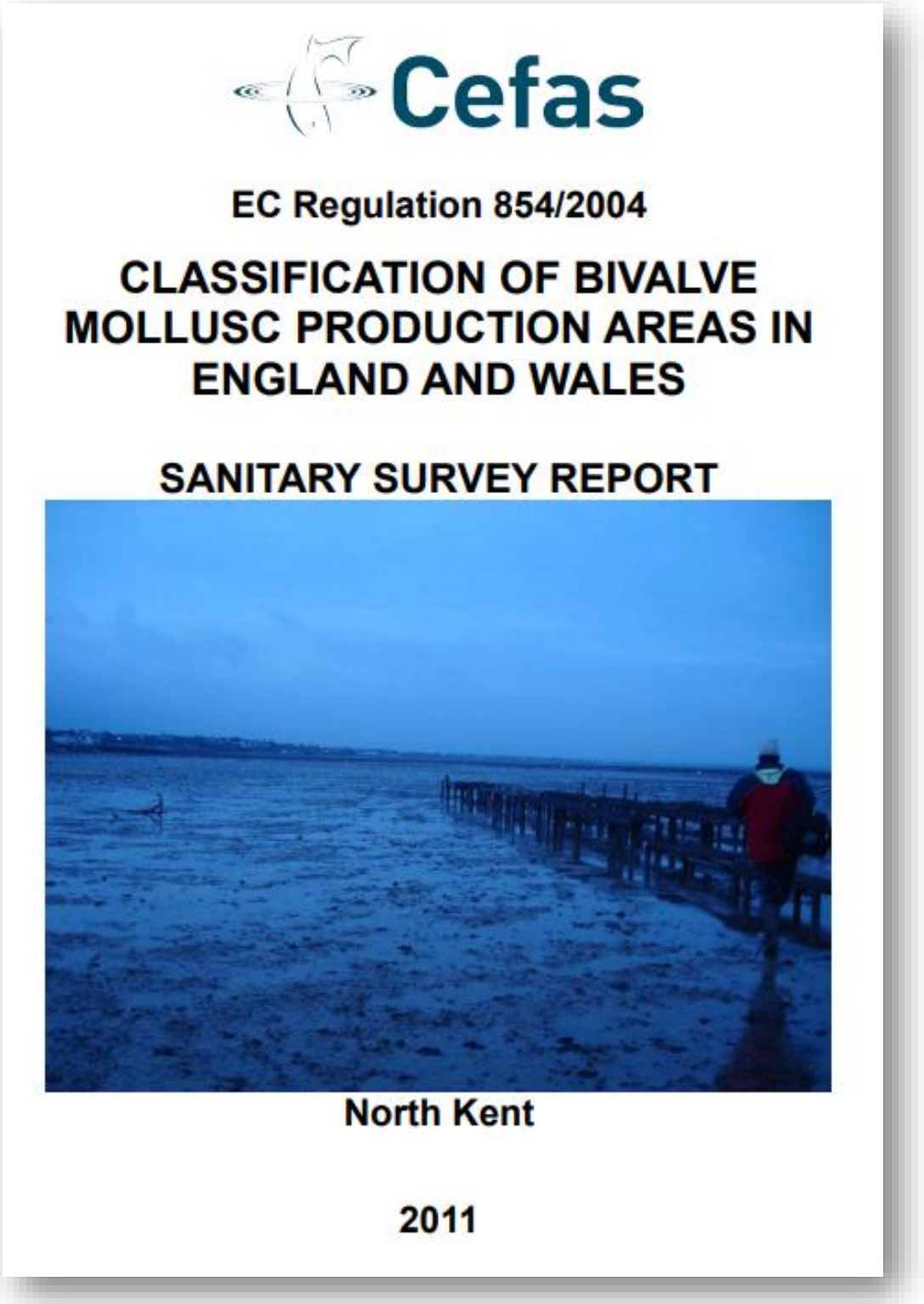
Appendices

Appendix I. Breakdown of Population Change

ID	Electoral Ward	Total Population				Population Density (Persons/Ha)		
		2001 Census	2011 Census	Absolute Change	% Change	2001 Census	2011 Census	% Change
1	Harbledown	2593	2656	63	2.43%	1.89	1.94	2.59%
2	West Bay	6221	6398	177	2.85%	30.82	31.70	2.86%
3	Tankerton	4583	4613	30	0.65%	34.75	34.98	0.67%
4	Marshside	2685	3302	617	22.98%	0.92	1.13	23.06%
5	Boughton and Courtenay	5316	5626	310	5.83%	0.83	0.88	6.03%
6	Sturry North	2782	2804	22	0.79%	2.40	2.41	0.60%
7	Blean Forest	4677	6176	1499	32.05%	2.39	3.15	31.84%
8	Chestfield and Swalecliffe	7916	8398	482	6.09%	7.24	7.68	6.02%
9	Heron	8478	8841	363	4.28%	58.70	61.21	4.27%
10	Thanet Villages	5886	6738	852	14.48%	1.01	1.16	14.44%
11	Little Stour	2567	2718	151	5.88%	0.85	0.90	6.36%
12	Little Stour and Ashstone	6244	7011	767	12.28%	0.95	1.07	12.29%
13	Greenhill and Eddington	5211	6039	828	15.89%	7.02	8.13	15.82%
14	Gorrell	5883	6124	241	4.10%	10.93	11.38	4.10%
15	Seasalter	6899	7967	1068	15.48%	6.20	7.16	15.41%
16	Harbour	5698	5791	93	1.63%	47.08	47.86	1.66%
17	Herne and Broomfield	7339	8440	1101	15.00%	6.69	7.70	15.04%
18	Reculver	7939	8845	906	11.41%	8.63	9.61	11.36%
19	Dane Valley	7978	7819	-159	-1.99%	49.48	48.49	-2.01%
20	Nethercourt	4204	4588	384	9.13%	48.88	53.34	9.13%
21	Salmestone	5409	5768	359	6.64%	19.03	20.29	6.63%
22	Northwood	6570	6510	-60	-0.91%	24.93	24.70	-0.92%
23	Sandwich	6685	7043	358	5.36%	1.90	2.00	5.36%
24	St Peters	6761	7042	281	4.16%	15.89	16.55	4.15%

25	Newington	5009	5044	35	0.70%	37.98	38.25	0.71%
26	Birchington South	6159	6261	102	1.66%	10.98	11.16	1.67%
27	Cliffsend and Pegwell	4444	4703	259	5.83%	11.59	12.26	5.78%
28	Westgate-on-Sea	6594	6996	402	6.10%	30.42	32.28	6.10%
29	Central Harbour	7550	8240	690	9.14%	54.53	58.17	6.68%
30	Middle Deal and Sholden	7236	7414	178	2.46%	7.57	7.75	2.42%
31	Birchington North	3668	3700	32	0.87%	21.25	21.44	0.88%
32	Garlinge	4858	4849	-9	-0.19%	19.57	19.53	-0.21%
33	Margate Central	4770	5383	613	12.85%	54.34	61.33	12.86%
34	Bradstowe	4071	4067	-4	-0.10%	34.30	34.27	-0.10%
35	Cliftonville East	6113	6268	155	2.54%	26.83	27.51	2.53%
36	Viking	7100	7023	-77	-1.08%	34.17	33.80	-1.08%
37	Kingsgate	1970	2147	177	8.98%	8.36	9.12	9.03%
38	Sir Moses Montefiore	4844	5123	279	5.76%	45.07	47.67	5.78%
39	Eastcliff	7018	8022	1004	14.31%	72.11	82.43	14.31%
40	Beacon Road	4468	4624	156	3.49%	30.13	31.18	3.49%
41	Westbrook	4319	4126	-193	-4.47%	41.55	39.70	-4.46%
42	Cliftonville West	6939	9145	2206	31.79%	74.64	98.35	31.77%

Appendix II. North Kent Coast Sanitary Survey, 2011



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*"