Sanitary Survey - Review

Blakeney – 2021

Document No. – *J0591/21/09/10*

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Document QA and Approval

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Initial Consultation

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Environment Agency	28 July 2021	06 August 2021
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Consultation on draft report

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North Norfolk District Council	22 October 2021	15 November 2021

A sanitary survey relevant to the bivalve mollusc beds in Blakeney was undertaken in 2010 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 undertake targeted sanitary survey reviews to ensure public health protection measures continue to be appropriate. This report provides a review of information and recommendations for a revised sampling plan if required. Carcinus Ltd. (Carcinus) undertook this work on behalf of the FSA. Carcinus Ltd accepts no liability for any costs, losses or liabilities arising from the reliance upon or use of the contents of this report other than by its client.

Dissemination

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

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Carcinus Ltd., 2021. Review of the Blakeney 2010 Sanitary Survey. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in England and Wales under retained EU Law Regulation (EU) 2019/627.

Contents

List of figures

List of tables

1 Introduction

1.1 Background

In line with Article 58 of retained EU Law Regulation (EU) 2019/627 and the EU Good Practice Guide (European Commission, 2017) and, Carcinus is contracted to undertake reviews of sanitary surveys on behalf of the Food Standards Agency. The FSA undertake 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 Blakeney Review

This report reviews information and makes recommendations for a revised sampling plan for existing mussel (*Mytilus edulis*) and Pacific oyster (*Crassostrea gigas*) classification zones in Blakeney (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 Local Authorities (LAs) and the Environment Agency (EA) responsible for the production area was undertaken in August 2021. This supporting local intelligence is valuable to assist with the review and was incorporated in the assessment process.

Following production of a draft report, a wider **external second round of consultation** with LAs and Local Action Group (LAG) members was undertaken in October 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 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) Change in environmental conditions;

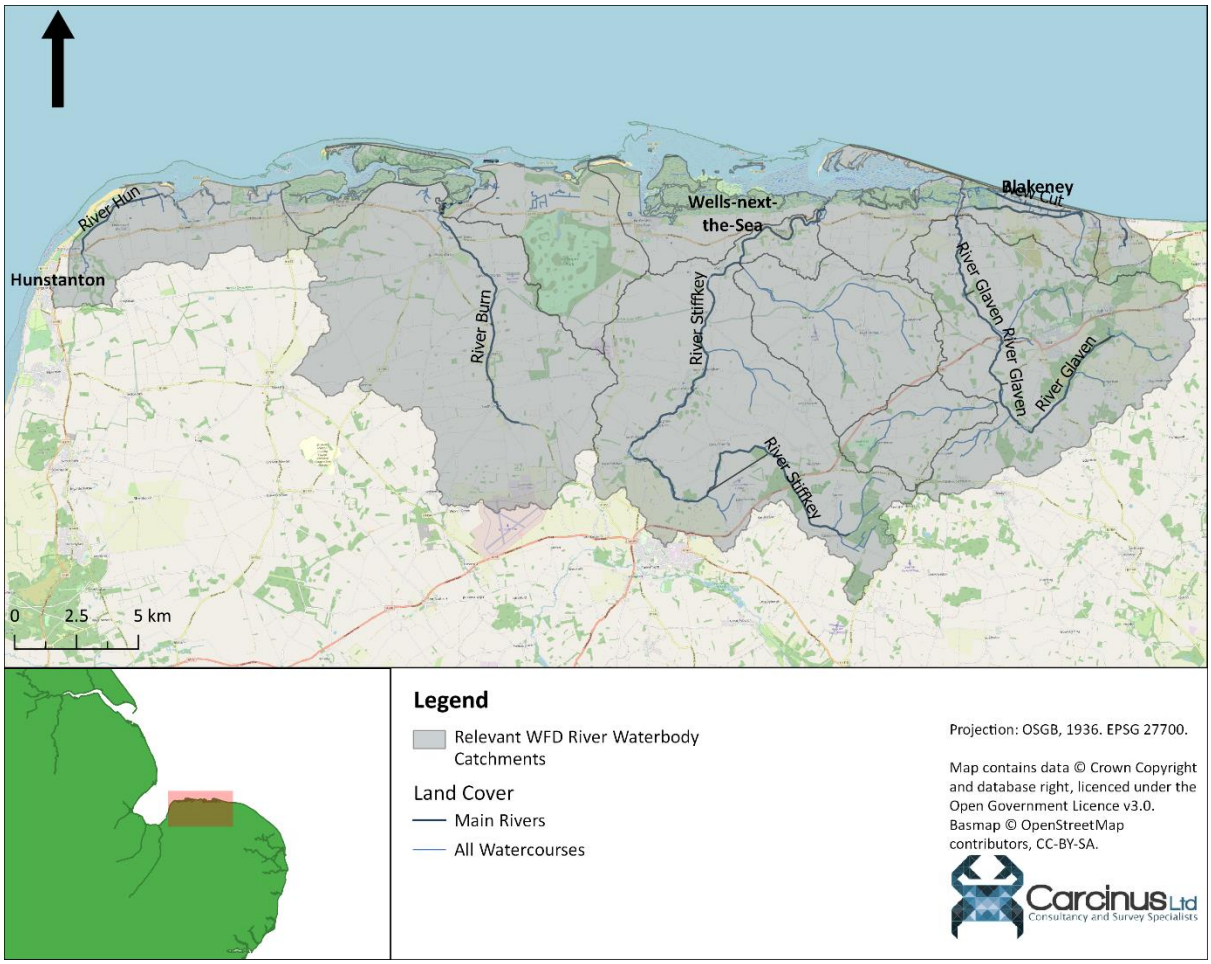

Figure 1.1 Location of Blakeney and Wells-next-the-Sea on the north Norfolk coast.

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

1.3 Assumptions and limitations

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

- Accuracy of local intelligence provided by the Local Authorities and Environment Agency
- The findings of this report are based on information and data sources up to and including August 2021;
- Only information that may impact on the microbial contamination was considered for this review; and

- Official Control monitoring data have been taken directly from the Cefas data hub[1], with no additional verification of the data undertaken. Results up to and including August 2021 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

The boundaries of the Blakeney Bivalve Mollusc Production Area (BMPA) are hard to define, with distinct and separate Classification Zones (CZs) on the central north Norfolk Coast. For the purposes of this review, the boundary is taken to be the same as that of the 2010 sanitary survey, an area between Blakeney Harbour and East of Holkham Bay, including Wells Harbour and Blakeney Spit Pools. The closest BMPA is The Wash, 25 km east of Wells-next-the-Sea. This stretch of coast is characterised by large areas of mobile sand subject to variable marine conditions.

Harvesting of shellfish within the vicinity of Wells Harbour is regulated by the Harbour Commissioners under the Wells Harbour Shellfishery Order (1972), which is in force until 2032. No Several, Regulating or Hybrid Orders apply to the Blakeney part of the BMPA. The original sanitary survey describes that the BMPA involved harvesting of farmed bivalve molluscs, although consultation with the Local Enforcement Authority (LEA), North Norfolk District Council, indicated that the current commercial focus is on wild harvest of the classified species. The following paragraphs detail the current CZs and fishery output for the species harvested in the Blakeney BMPA. The original sanitary survey describes that cockles (*Cerastoderma edule*) have previously been commercially exploited within the boundary of this BMPA, although the lack of current commercial activity for this species has been attributed to poor recruitment and/or high rates of juvenile mortality.

2.1.1 Mussels

The original sanitary survey, conducted in 2010, was prompted by an application to harvest wild mussels at Wells-next-the-Sea Harbour. It recommended the creation of three CZs for this species (including the application zone): *Wells Harbour*, *Wells – The Pool* and *Simpool Head*. The *Wells Harbour* zone was never awarded a full classification, although at the time of writing the draft report *Wells – The Pool* and *Simpool Head* do hold active classifications. Since the initial consultation, the *Simpool Head* zone has been temporarily declassified due to a lack of commercial interest.

Consultation with the LEA indicated that the throughput from the *Wells – The Pool* zone are 500 kg per week during the active season (which runs from October to March). The throughput from the *Simpool Head* zone is 100 kg per week during the season. The throughput at the time of the original sanitary survey is not known.

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

2.1.2 Pacific oyster

The original sanitary survey recommended the creation of a single CZ for this species, *South Side*. This zone is currently active, and consultation with the LEA indicated that the throughput from this zone is < 1 tonne during the season.

2.2 Classification History

The sampling plan recommended in the original sanitary included a total of four classification zones: three for mussels and one for Pacific oysters, each with its own Representative Monitoring Point (RMP). There are currently only three zones, as the *Wells Harbour* zone was never awarded a full classification. The *Wells – The Pool* mussel zone and *South Side* oyster zone have continually held a classification and are classified 'B' and 'Long-Term B (LT-BB-LT)' respectively. The *Simpool Head* zone was Declassified between 2016 and 2018, although it currently holds a 'B' classification. The location of all active classification zones and associated RMPs within the Blakeney BMPA are shown in Figure 2.1.

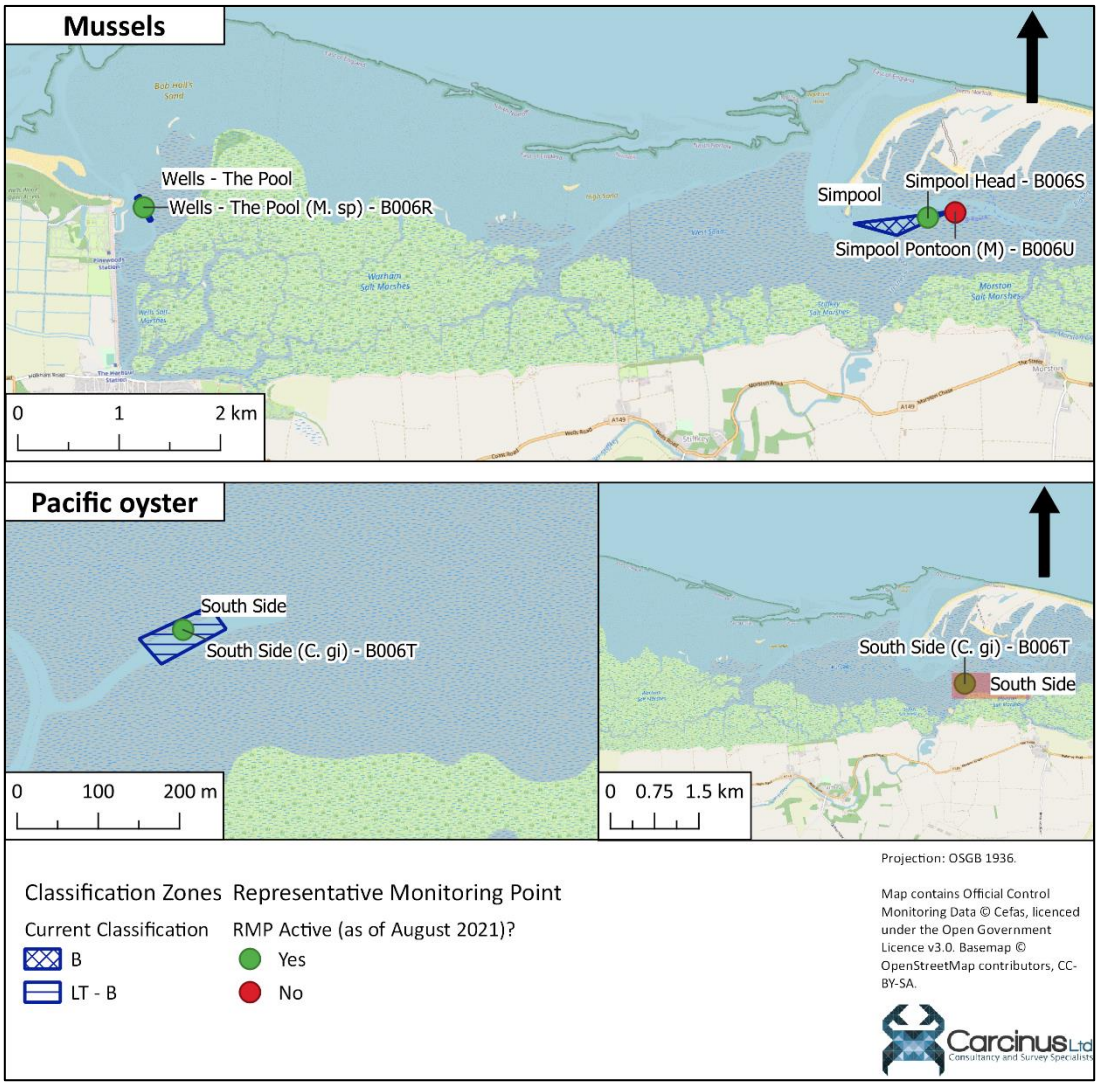

Figure 2.1 Current Classification Zones and associated Representative Monitoring Points in the Blakeney BMPA.

3 Pollution sources

3.1 Human Population

The original sanitary survey cites population data from 2004, although it is likely that it is derived from the 2001 Census of the United Kingdom. Since the publication of that document, the data from the subsequent full census of 2011 has been made available, and so this data has been compared to that of the 2001 census to give an indication of the changes in human population within the catchment. These data have been used as no further population data are freely available (the results of the March 2021 census are not yet available). Changes in human population density in census Super Output Areas (lower layer) and changes in total population within Electoral Wards wholly or partially contained within the Wells-next-the-Sea / Blakeney catchment between the 2001 and 2011 censuses are shown in Figure 3.1 and Figure 3.2.

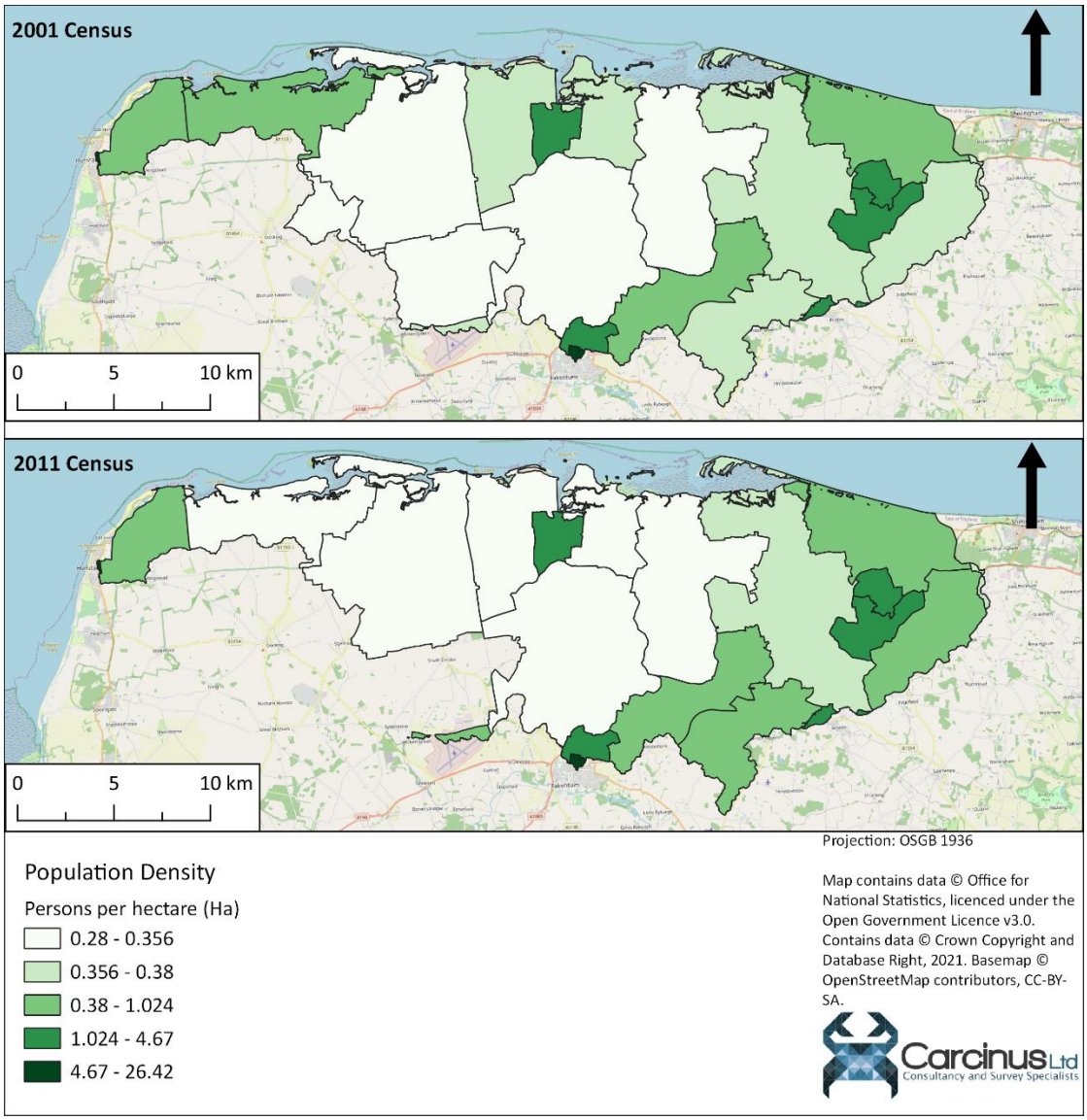

Figure 3.1 Human population density in 2001 and 2011 Census Super Output Areas (lower layer) that intersect the Blakeney catchment.

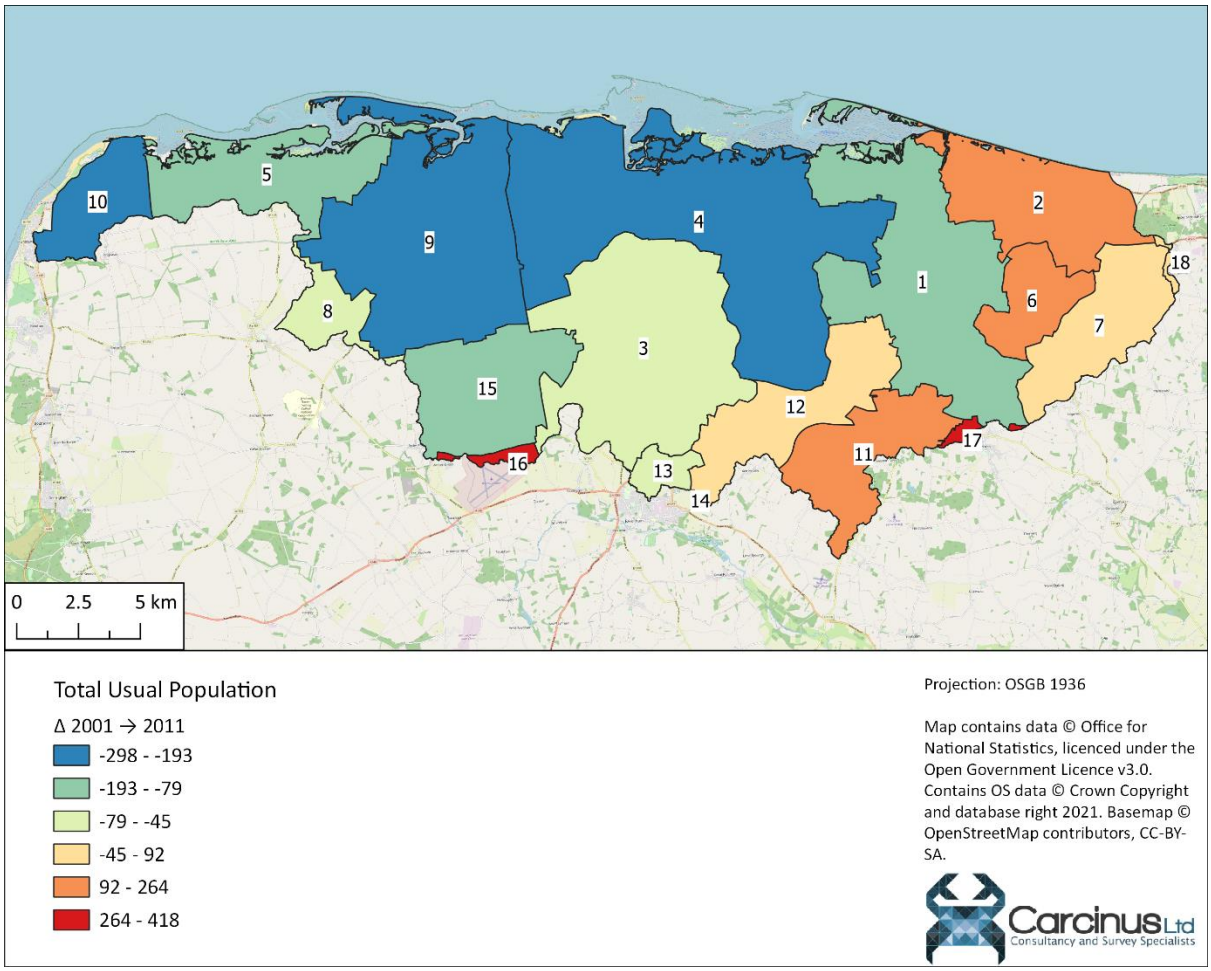

Figure 3.2 Population changes between the 2001 and 2011 censuses in Wards and Electoral Divisions (based on 2011 boundaries) that are within or partially within the Blakeney catchment[2]. Numbers within wards are identifiers that can be used in combination with Appendix I to provide more detail.

Across the entire catchment, population has remained relatively stable, with 9 of 19 wards showing an increase in population and 10 showing a decrease. Population density across the catchment remains fairly low, with only three catchments having a total population density of more than 2 people per hectare. Generally, the eastern and southern parts of the catchment have higher population densities, particularly around Fakenham and Briston. These are also the areas that have shown the most marked increase in population size. Conversely, the large wards adjacent to the coastline have shown the greatest fall in population size.

At the 2001 census, the total resident population within wards wholly or partially contained within the Blakeney catchment was 47,851. By the time of the 2011 census, this had increased to 48,078, an increase of only 0.47%. The population for the 2011 census was

[2] 2001 Census data have been transposed to 2011 wards using the UK Data Service's GeoConvert tool (UK Data Service, 2021) to facilitate comparison.

collected only one year after the original sanitary survey was conducted and so could be considered more relevant to that document. Whilst the full results of the March 2021 census have not yet been published, the UK Government estimates that the national population will have increased 6.6% between 2011 and 2021 (ons.gov.uk, 2021). An increase of this proportion would see the approximate population within the catchment increase to 51,251 (though it is likely that the real increase will not have been as significant). The potential for greatest potential for urban runoff remains highest from Wells-next-the-Sea and Blakeney. Impacts from sewage discharges will depend on the specific nature and locations of such discharges, changes to which are discussed in the next section. Consultation with the LEA did not indicate that any significant new housing developments had occurred, and given that the population in the coastal towns was found to decrease between 2001 and 2011, the risk from urban runoff and loading to the wastewater treatment network (WWTN) may have decreased slightly.

Whilst the area has a relatively low continuous population, the region is very popular with tourists with the population swelling from 2,500 to 12,000 at the height of the summer tourist season (Wells Coastal Community Team, 2016). The number of tourists is likely to have been even higher in recent months as the Covid-19 pandemic has restricted foreign travel. The peak numbers of tourists are likely to occur in the summer months, and the increased loading to the WWTN will therefore occur during this time. It is assumed that the WWTN capacity is sufficient to accommodate this increase.

Comparison of the two most recently available census data indicates that the population in the catchment has remained relatively stable. The area still receives a high volume of tourism, and given that the main population centres have remained the same, the recommendations for RMP location based on this source of contamination remain the same as is described in the original sanitary survey.

3.2 Sewage

Details of all consented discharges within the Blakeney catchment were taken from the most recent update to the Environment Agency (EA)'s national permit database at the time of this report (August 2021). The locations of these discharges are shown in Figure 3.3.

The original sanitary survey only considered those discharges that had the potential to be sources of microbiological contamination to the shellfish beds. All three continuous discharges identified in the 2012 report (Table VII.1, p 54) are still consented, and the treatment methodologies and consented discharges for the Wells-next-the-Sea and Cley-next-the-Sea Sewage Treatment Works (STWs) are unchanged; both discharges employ UV disinfection and so are likely to be of little consequence to the bacteriological health of the shellfisheries. The discharge database queried for this report does not list the treatment methodology and consented discharge rate for the Stiffkey STW. During secondary consultation, the Environment Agency stated that the current permit for this discharge does not specify a permitted volume as the population the STW serves is <250. Based this value, they estimated that the dry weather flow would be around 35 m^3/day, and stated that the

STW employs primary settlement, biological filters and secondary settlement. . None of the additional continuous discharges identified through this review are likely to be of significant influence on the levels of contamination experienced by the BMPA. Consultation with the EA and LEA did not indicate any further changes to the continuous discharges within the catchment.

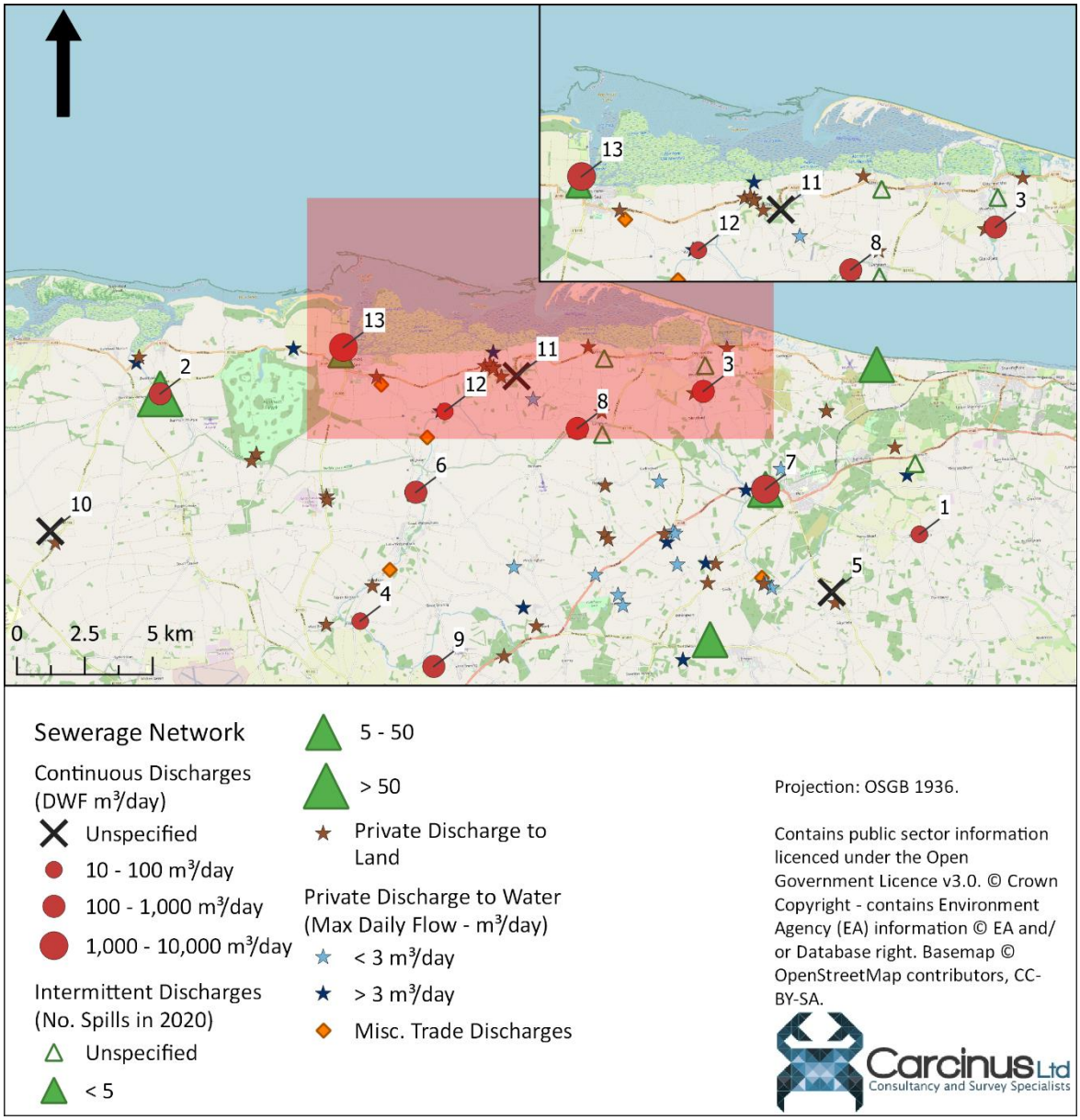

Figure 3.3 Locations of all consented discharges in the Blakeney BMPA catchment. Labels refer to continuous discharges, details of which are presented in TABLE. Details of spill data from intermittent discharges are presented in Appendix II.

Table 3.1 Details of continuous discharges in the Blakeney catchment.

ID	Sewage Treatment Works	Permit Number	NGR	Treatment	DWF (m^3/day)
1	BACONSTHORPE STW	AW4NF106X	TG1250037200	UNSPECIFIED	18
2	BURNHAM MARKET WATER RECYCLING CTR	AEENF1265	TF8453042380	UV DISINFECTION	780
3	CLEY NEXT THE SEA STW	AW4NF94	TG0454042470	UV DISINFECTION	650
4	EAST BARSHAM STW	AW4NF398X	TF9190034000	BIOLOGICAL FILTRATION	13
5	EDGEFIELD STW	AEENF319	TG0927035060	UNSPECIFIED	Unspecified
6	GREAT WALSINGHAM STW	AEENF12038	TF9395038750	BIOLOGICAL FILTRATION	419
7	HOLT MAIN ROAD WRC	AW4NF118AW	TG0683038860	BIOLOGICAL FILTRATION	1090
8	LANGHAM WRC (AKA BINHAM WRC)	AEENF1295	TF9990041100	BIOLOGICAL FILTRATION	240
9	LITTLE SNORING WRC	AW4NF398	TF9461032330	BIOLOGICAL FILTRATION	287
10	PREMISES REAR 1 STATION ROAD	PRELF8483	TF8048037310	BIODISC	Unspecified
11	STIFFKEY STW	AEENF117	TF9766043030	UNSPECIFIED	Unspecified
12	WARHAM STW	AEENF12280	TF9502041730	UNSPECIFIED	17
13	WELLS-NEXT-THE-SEA STW	AEENF12033	TF9128044090	UV DISINFECTION	1125

In addition to the continuous discharges, the original sanitary survey identified a total of five intermittent discharges with the potential to impact the BMPA. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs) and Pumping Station Emergency Overflows (PSs). During Action Management Plan (AMP) 6 and AMP7, Event Duration Monitoring (EDM) was installed at several of the discharges within the catchment, and summary data for 2020 was published by the Environment Agency in March 2021 (Environment Agency, 2021). Details of these data for those discharges in the vicinity of the Harbour are presented in Appendix II. The single datapoint for each discharge was joined to the main discharge database using the permit number. Beyond the data manipulation described above, the data have been taken at face value, and some locations in the consented discharge database may be erroneous, meaning that the point appears in the wrong location. Some EDM returns had multiple meters on a single discharge activity, in this case we have presented all reported spill counts as individual values, unless the comment indicated that the meters were not working properly in which case the values were nulled. The EDM returns 'Activity Reference' field did not reliably distinguish between

emergency overflows and storm overflows, therefore we have included all of these in the intermittent discharge category.

The original sanitary survey presents EDM data for only two of these intermittent discharges: Wells-next-the-Sea STW CSO and Freeman Street CSO, which both spilled only twice in 2009. No EDM data is available for the former discharge, although the data indicate that the Freeman Street CSO did not spill at all in 2020. The other intermittent discharges, except for Morston Road PS, are all still active. Consultation with the EA and LEA did not indicate any further changes to intermittent discharges in the catchment.

In addition to the water company owned discharges, the original sanitary survey identified that there were a number of private discharges that were of potential significance, though the water company discharges were of greater importance in the development of the sampling plan. Several private discharges to water remain, although most are a significant distance from the BMPA.

No evidence that significant changes to the wastewater treatment network in the vicinity of the Blakeney BMPA have taken place since the original sanitary survey was published exists. As such, the recommendations made in the original sanitary survey to account for this source of contamination remain valid.

3.3 Agricultural Sources

Livestock census data have been obtained for 2013 and 2016 (Defra, 2018) for Local Authority Districts that fall within or partially within the Blakeney catchment. No more recent data are available, but these data have been used to give an indication of livestock population trends in the period since the original sanitary survey was published. As only a proportion of each district falls within the catchment, the livestock data have been adjusted to reflect the percentage of each district that falls within the catchment. This assumes that the livestock are uniformly distributed throughout the district and therefore some inaccuracies may be present. The percentage change in total livestock population for each district is shown in Figure 3.4. Changes in livestock population data for each District, broken down by livestock group, are shown in Table 3.2.

Only two Local Authority Districts fall within the Blakeney catchment, North Norfolk and Kings Lynn & West Norfolk, which showed a fall of 12.85% and an increase of 10.26% respectively. The dominant livestock group in terms of population size remains poultry, although the greatest percentage change came in the sheep populations within Kings Lynn and West Norfolk, which increased by 20.3% from 2013 to 2016. Across all groups of animals, the livestock population will vary throughout the year, with the highest numbers occurring during Spring and the lowest numbers when animals are sent to market in Autumn and Winter.

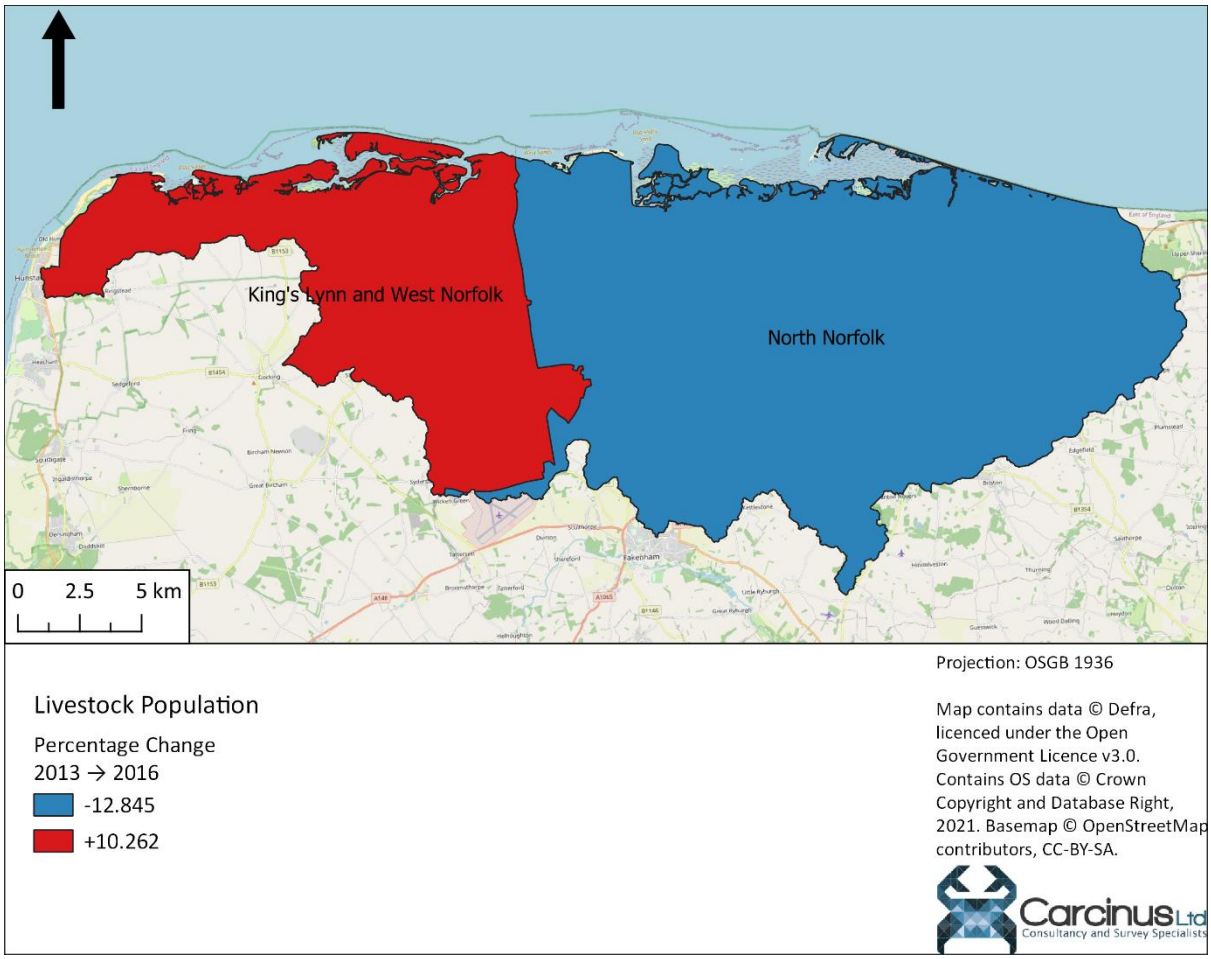

Figure 3.4 Livestock population change between 2013 and 2016 for Local Authority Districts wholly or partially contained within the Blakeney catchment.

Table 3.2 Livestock population data for Local Authority Districts wholly or partially within the Blakeney catchment.

				Adjusted Cattle Population			Adjusted Sheep Population			Adjusted Pig Population			Adjusted Poultry Population		
Local Authority District (LAD)	LAD Area (Ha)	LAD Area in catchment (Ha)	% of LAD in catchment	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
King's Lynn and West Norfolk	143,856	13,554	9.42%	866	830	-4.09%	2,014	2,423	20.31%	10,438	10,100	-3.24%	40,750	46,263	13.53%
North Norfolk	96,368	31,235	32.41%	3,785	3,463	-8.49%	5,553	5,781	4.11%	23,175	20,816	-10.18%	622,879	541,145	-13.12%
Total	240,224	44,789	18.64%	4,650	4,293	-7.67%	7,568	8,205	8.42%	33,614	30,915	-8.03%	663,629	587,408	-11.49%

The principal route of contamination of coastal waters by livestock is surface run-off carrying faecal matter. Figure 3.5 shows how land cover has changed throughout the catchment between 2012 and 2018. It shows that whilst most of the catchment is reserved for non-irrigated arable land, there are several small areas of pasture immediately adjacent to the shoreline, particularly around Wells-next-the-Sea. These areas immediately adjacent to the coast may contribute some faecal contamination to the shellfish beds, particularly during heavy rainfall that follows an extended dry period. Application of slurry as fertiliser to areas of arable farmland may also result in contamination to coastal waters and freshwater sources via surface runoff.

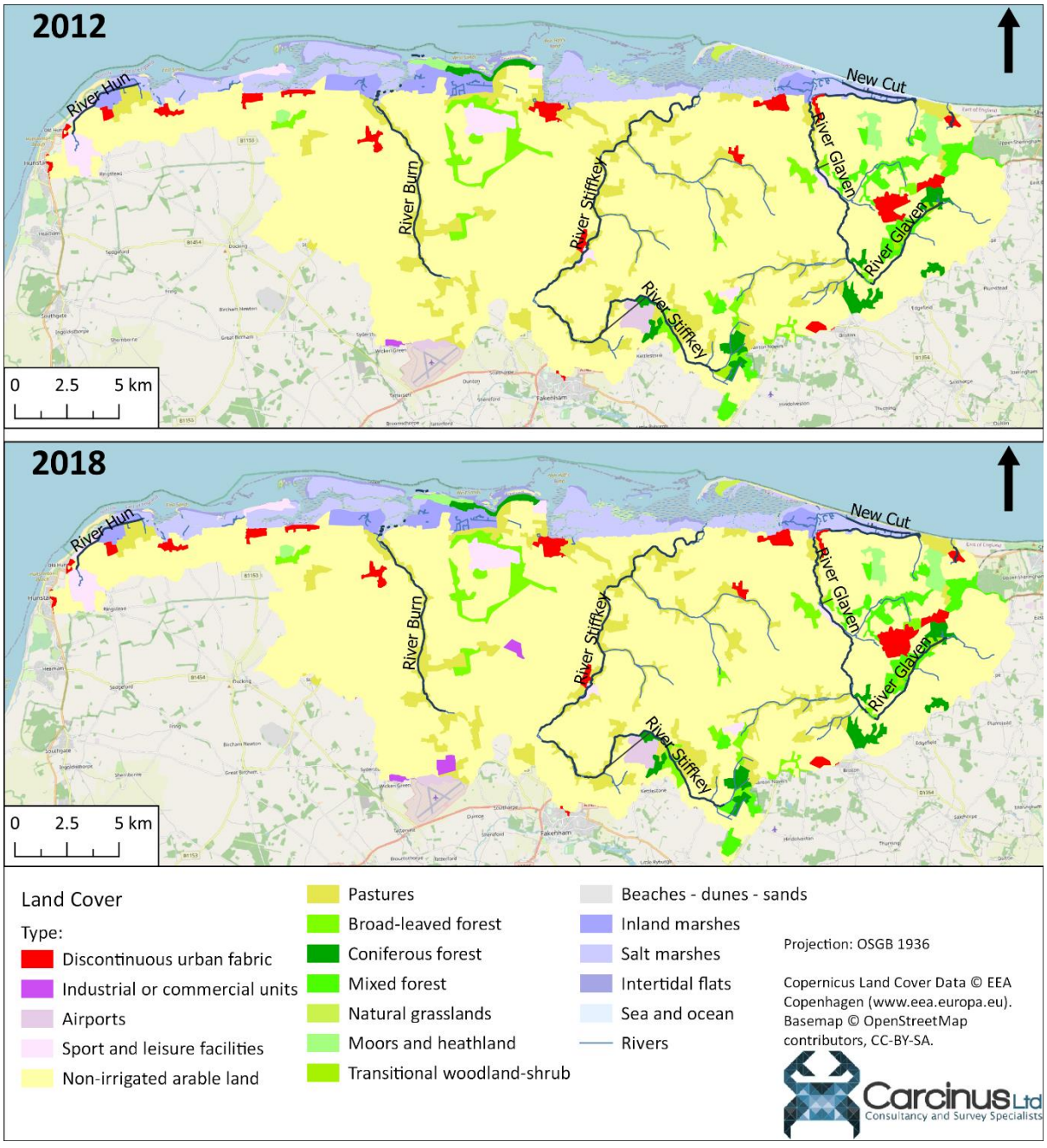

Figure 3.5 Changes in the land cover across the Blakeney catchment between 2012 and 2018.

Livestock populations have fallen across the catchment, and the overall livestock density remains relatively low, at approximately 14 animals per hectare. There are some areas of pasture immediately adjacent to the shoreline, near the shellfish beds. However, as the geographical extent of these pasture areas has not changed significantly, the overall risk to the shellfishery remains similar to that at the time of the original sanitary survey. As such, the recommendations made in the original survey to capture this form of pollution remain valid.

3.4 Wildlife

The north Norfolk coast contains a wide variety of habitats that supports a diverse range of flora and fauna. As a result of this, large areas are conferred protection through international and national designations, including as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) and Ramsar sites, though no additional designations have been awarded since 2010, when the original sanitary survey was conducted.

These designations have been applied in part due to significant populations of overwintering waterbirds. Waterbirds represent a potentially significant source of faecal contamination to the BMPA as they typically forage (and defecate) directly on intertidal shellfish beds. The original sanitary survey cites bird-count data from a Wells Channel Deepening and Jetty Project. Updated data at the same spatial scale are not available, although the results of the Wetland Bird survey for the five winters to 2009-10 (Holt *et al.*, 2011) and five winters to 2019-2020 (Frost *et al.*, 2021) suggest that the average total count of waterbirds (including gulls and terns) on the north Norfolk coast decreased from 206,745 to 143,325, a drop of 30.7%. However, this still represents a significant number of waterbirds, and includes internationally significant populations of Geese, Plover, Godwit and Tern. A Cefas investigation into the factors controlling water quality in the Stiffkey and Glaven catchments (Cefas, 2017) found that the average daily loadings of *E. coli* from birds at Blakeney point were $3.5x10^{11}$ cfu/day, similar to the loadings from the River Stiffkey.

The areas of highest risk to contamination from wading birds are intertidal shellfish beds, as the birds forage for food. However, the precise locations of the shellfish, and therefore the avian pollution, are likely to vary slightly from year to year. As such, it is difficult to accurately define RMP locations that will reliably account for this source of pollution, though the CZs in the BMPA are small. The same was true however in the original sanitary survey.

In addition to the waterbird populations, the original sanitary survey notes the presence of a large population of both grey and common seals 10 km east of the BMPA at Blakeney Point. The size of this population has increased significantly in recent years (nationaltrust.org.uk, 2021) and the number of pups born in 2020 is expected to be around 4,000. These animals have fairly large foraging ranges and will likely utilise the waters of the BMPA when submerged by the tide. Consultation with the LEA indicated that there was concern as to the impact that the faeces from these animals may have. A Cefas investigation into the factors controlling water quality in the Stiffkey and Glaven catchments (Cefas, 2017) found that the

average daily loadings of *E. coli* from birds at Blakeney point were $1.2x10^{14}$ cfu/day, significantly higher than the loadings from the River Stiffkey. However, due to the temporal and spatial variability of this source of pollution, it is not feasible to reliably account for it in any updated sampling plan.

The two main groups of animals likely to contribute faecal contamination to the BMPA are waterbirds and seals foraging from Blakeney Point. However, it remains challenging to account for the pollution from wildlife in any updated sampling plan due to the spatial and temporal variability of the pollution source.

3.5 Boats and Marinas

The coastline around Wells-next-the-Sea and Blakeney is very active with boat users, and the discharge of sewage from boats is a potentially significant source of contamination of shellfisheries within the Blakeney BMPA. 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 survey. Their geographical positions are presented in Figure 3.6.

The waters of the BMPA remain very popular with boat users, with a large number of pontoons, slipways and marinas distributed along the shoreline. Since the turn of the millennium, the level of recreational boating activity around Wells-next-the-Sea and Blakeney has increased, though the number is not expected to have increased since the original sanitary survey as the mooring locations and harbours mentioned in that report (Figure VIII, p 59) all appear to still be in use. Peak numbers throughout the year are likely to be during the summer months. There are pump-out facilities at the harbour, and vessels moored in the marina are forbidden from making overboard discharges whilst moored-up. That being said, vessels of a sufficient size to contain on-board toilets are still liable to make occasional overboard discharges, particularly when transiting to and from the harbours or when moored slightly offshore. The highest risk areas are therefore the main navigational channels or offshore mooring locations, though the risk from this source of pollution has not increased significantly since the original sanitary survey was published. However, during initial consultations, the LEA indicated the number of house boats moored just east of the CZs off Blakeney had increased. The extent of this increase is not known, and the LEA indicated during secondary consultation that there is no known regulatory framework governing the overboard discharges from houseboats in the area. Without specific information as to the volume/timing of discharges from houseboats, it is very difficult to account for any pollution they cause. This uncertainty is mitigated by the fact that the locations of the houseboats is some distance from the Classification Zones, and so any pollution is likely to undergo dilution before reaching the shellfish beds.

There remains a small, but active fishing fleet utilising the waters of the BMPA, with 11 vessels < 10 m and 3 vessels > 10 m (gov.uk, 2021), a slight increase on the number described in the original sanitary survey report. There is a harbour ferry that offers tours of the coastline, as well as other vessels offering organised angling trips. Commercial vessels

are not considered to be a significant risk to the bacteriological health of the BMPA, as vessels of this type are prohibited from making overboard discharges within 3 nautical miles of land[3].

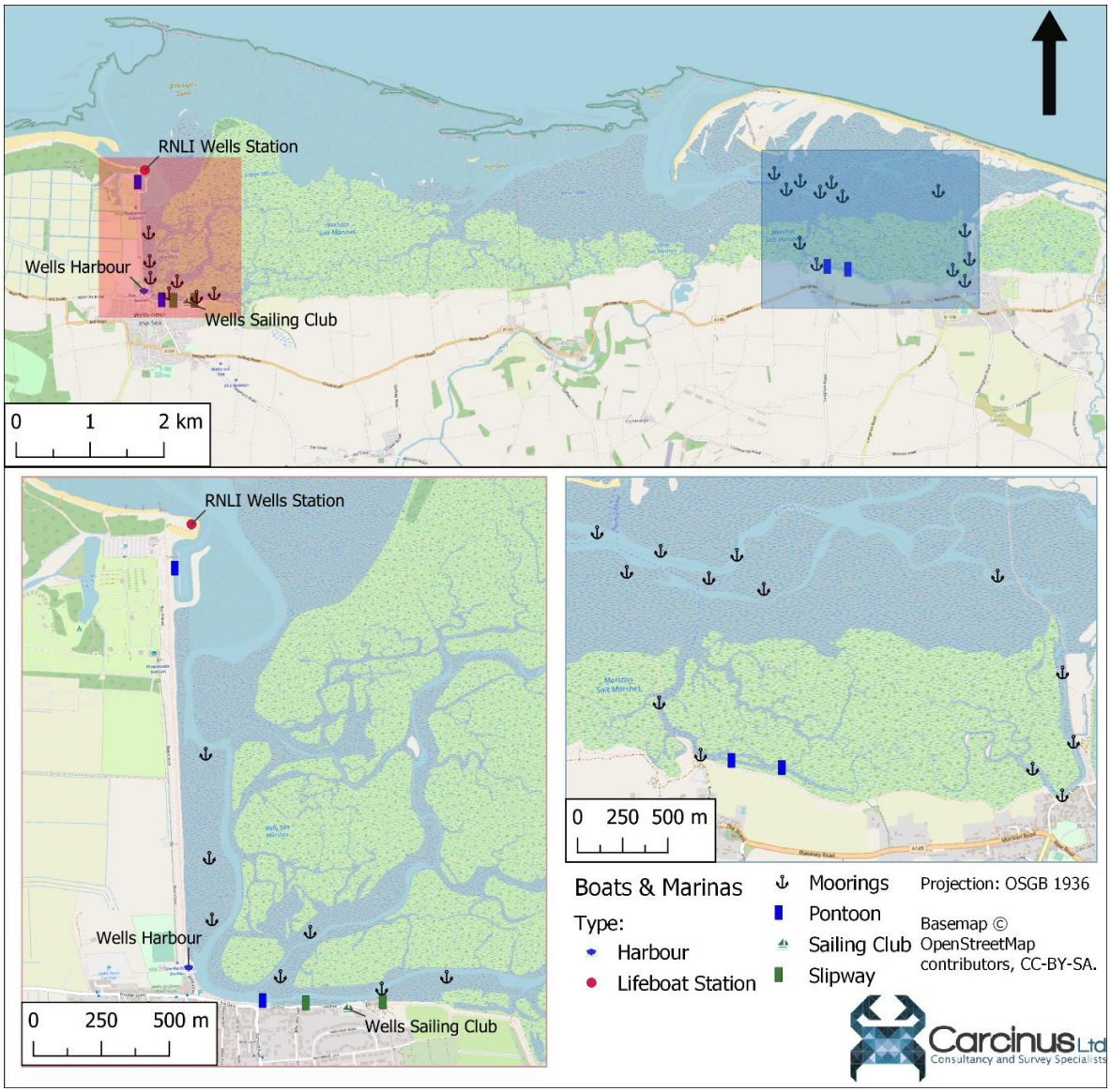

Figure 3.6 Locations of marinas, moorings and other boating activities in the vicinity of Blakeney BMPA.

Whilst the waters around Wells-next-the-Sea and Blakeney still have a high level of recreational and commercial boating activity, it is considered unlikely that the level of this activity has changed significantly since the original sanitary survey was published. As such, the recommendations made in the original sanitary survey remain valid, with RMP positions taking into account pollution from Wells harbour and the inner areas of Blakeney lagoon.

[3] The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.

3.6 Other Sources of Contamination

Urban fabric within the catchment is sparse, but the areas most likely to contribute diffuse microbiological contamination to the BMPA are Wells-next-the-Sea and Blakeney, through utility misconnections and dog fouling. Land cover maps (Figure 3.5) suggest that these settlements have not increased in size significantly, and as such the risk of this source of contamination remains broadly similar.

4 Hydrodynamics/Water Circulation

There are no major watercourses that drain to Wells harbour on the western side of the BMPA. The Rivers Stiffkey and Graven drain through Blakeney, on the eastern end of the BMPA, which will carry contamination from up-catchment sources over the CZs off Blakeney.

The original sanitary survey presents bathymetric data that was generated in 2009, and states that most of the coast dries completely at low tide, particularly along the margins of the navigational channel and the saltmarsh, and most of the classified beds had regions that would be exposed at low tide. An Environment Agency report on the Coastal Morphology of the Norfolk coast between Wells-next-the-Sea and Blakeney (Environment Agency, 2013) found that the saltmarsh areas have been relatively stable, and the major bathymetric change has been the dredging of the outer Wells Harbour in 2010. Other sections of the coastline have also been relatively stable with no major accretion or erosion, and therefore water circulation patterns will have remained consistent.

The area generally has a semi-diurnal tidal pattern, although the specific tidal conditions are very variable due to different weather conditions, tidal effects and storm conditions. The offshore tidal stream generally follows a NW/SE bearing. The original sanitary survey recommended placing the Wells Harbour RMP on the eastern end of the bed, as in the inshore areas around Wells Harbour, the complex hydrodynamics means that there are some areas of the inner channel that are not flushed as regularly as outer areas. These areas may retain contamination to a greater extent, and therefore RMPs positioned near to these areas would be most representative of contamination. It is considered unlikely that tidal circulation patterns would have changed significantly, and therefore this recommendation is still valid.

The original sanitary survey identified that water exchange between the Blakeney lagoon and the sea occurs through the Blakeney Channel, and that mussel beds at the mouth of the lagoon would be impacted by pollution from the wider catchment, via the Rivers Stiffkey and Graven. This pattern of circulation is still likely to be the case, and therefore the recommendations made in the original sanitary survey remain valid.

5 Rainfall

Rainfall data for the Stiffkey at Warham monitoring station (NGR: TF944413) from 2004 – 2010 (pre sanitary survey) and 2011 – 2017 (post sanitary survey) were taken from the

National River Flow Archives (NRFA)[4] (NRFA, 2021) and were processed in R (R Core Team, 2021) using the 'rnrfa' package (Vitolo, 2016). These data were used to determine whether changes in rainfall patterns had occurred since the original sanitary survey. Figure 5.1 shows the average daily rainfall totals per month at the Warham monitoring station. The monitoring results are summarised in Table 5.1.

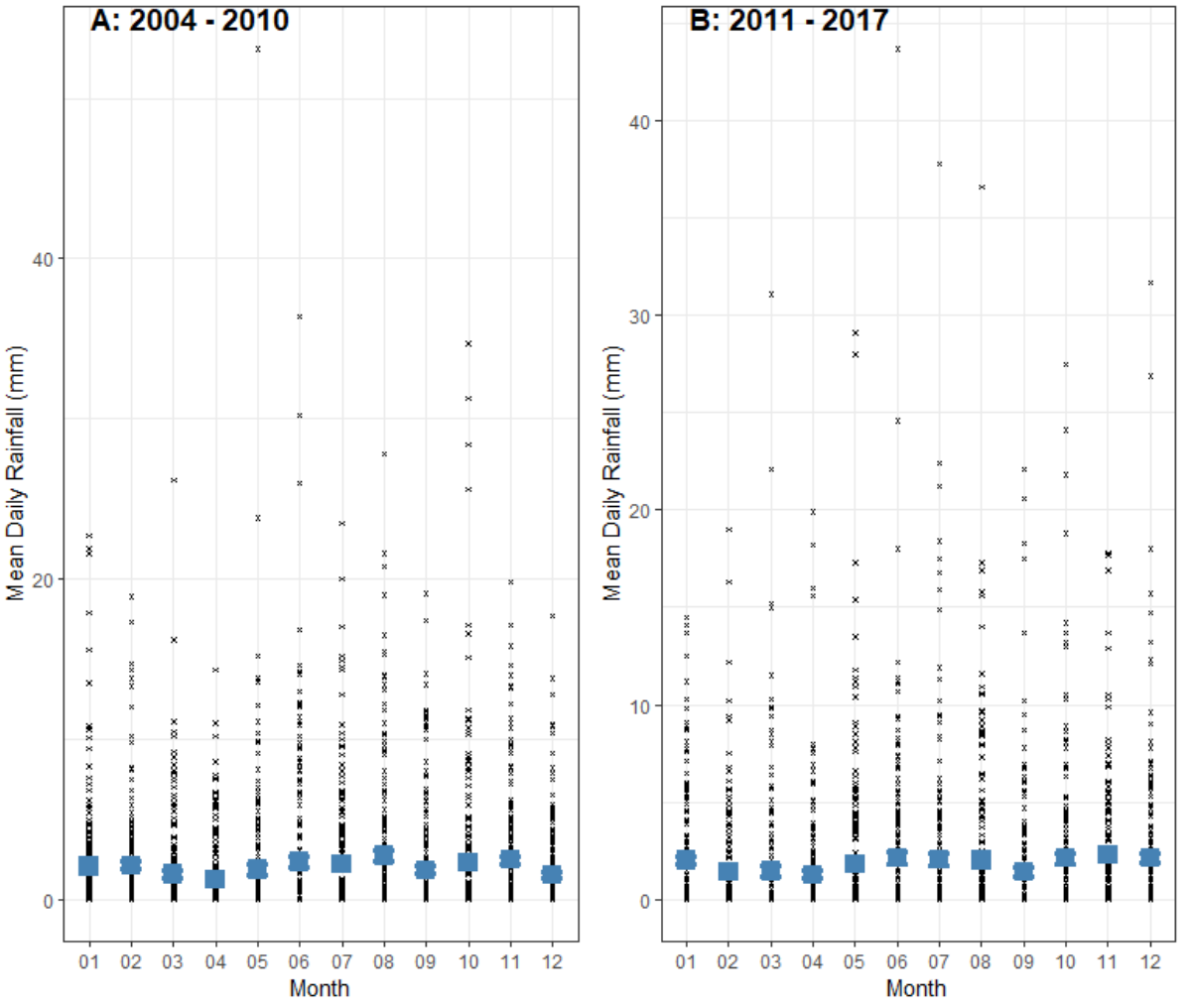

Figure 5.1 Mean daily rainfall per month for the Stiffkey at Warham monitoring station (NGR: TF944413) for the periods (A) 2004 – 2010 and (B) 2013 – 2017.

Table 5.1 Summary statistics for rainfall for the 6 years preceding and following the original sanitary, from the Stiffkey at Warham monitoring station.

PERIOD	MEAN ANNUAL RAINFALL (MM)	% DRY DAYS	% DAYS > 10 MM RAINFALL	% DAYS > 20 MM RAINFALL
2004 - 2010	733.61	40.32	28.12	16.97
2011 - 2017	670.20	41.45	26.09	17.09

[4] Note – Catchment Daily Rainfall data is only available up to 2017 for monitoring stations on the NRFA.

The data suggest that overall the area sees less rainfall, with the mean annual rainfall falling and the % dry days increasing. The % days with heavy rainfall (>20 mm) has increased slightly. Two sample t-tests indicated that there was no significant difference ($p > 0.05$) in the mean daily rainfall per month between the 2004 – 2010 and the 2011 – 2017 periods.

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

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

There are a total of four RMPs that have been sampled within the Blakeney BMPA since the original sanitary survey was published. Three of these were for mussels (*Mytilus edulis*) and one for Pacific oyster (*Crassostrea gigas*). Sampling at all four RMPs began after the publication of the original report, with sampling at three starting in May and June 2010, and at the final one (Simpool Pontoon, B006U) in February 2015. This RMP is also the only one not currently sampled, with sampling stopping in January 2016 after only 16 samples had been collected. The LEA indicated during initial consultations that this was due to poor quality results limiting the commercial viability of the bed. The geometric mean results of Official Control Monitoring for all RMPs sampled since 2010 (that have had a sample taken in the last five years) are presented in Figure 6.1 and summary statistics are presented in Table 6.1. All data have been taken directly from the Cefas datahub[1] and have been taken at face value.

The geometric mean monitoring result from all four RMPs is relatively similar, ranging from ~1,200 MPN/100 g (South Side, B006T) to ~2,500 MPN/100 g. Compared to other BMPAs around the country, these results are relatively high, and all RMPs have had more than 2/3 of results exceeding the Class A threshold of 230 MPN/100 g. Two of the RMPs, Wells – The Pool (B006R) and Simpool Head (B006S) have returned results of 92,000 MPN/100 g, well above the maximum threshold of 46,000 MPN/100 g.

All RMPs are located a similar distance offshore and there does not appear to be any distinct geographic pattern in the mean geometric mean monitoring results. The hydrodynamics affecting the RMPs around Blakeney are relatively separate from the RMP off Wells Harbour and so any geographical trend would likely be due to this factor rather than the relative nearshore/offshore position of the RMPs.

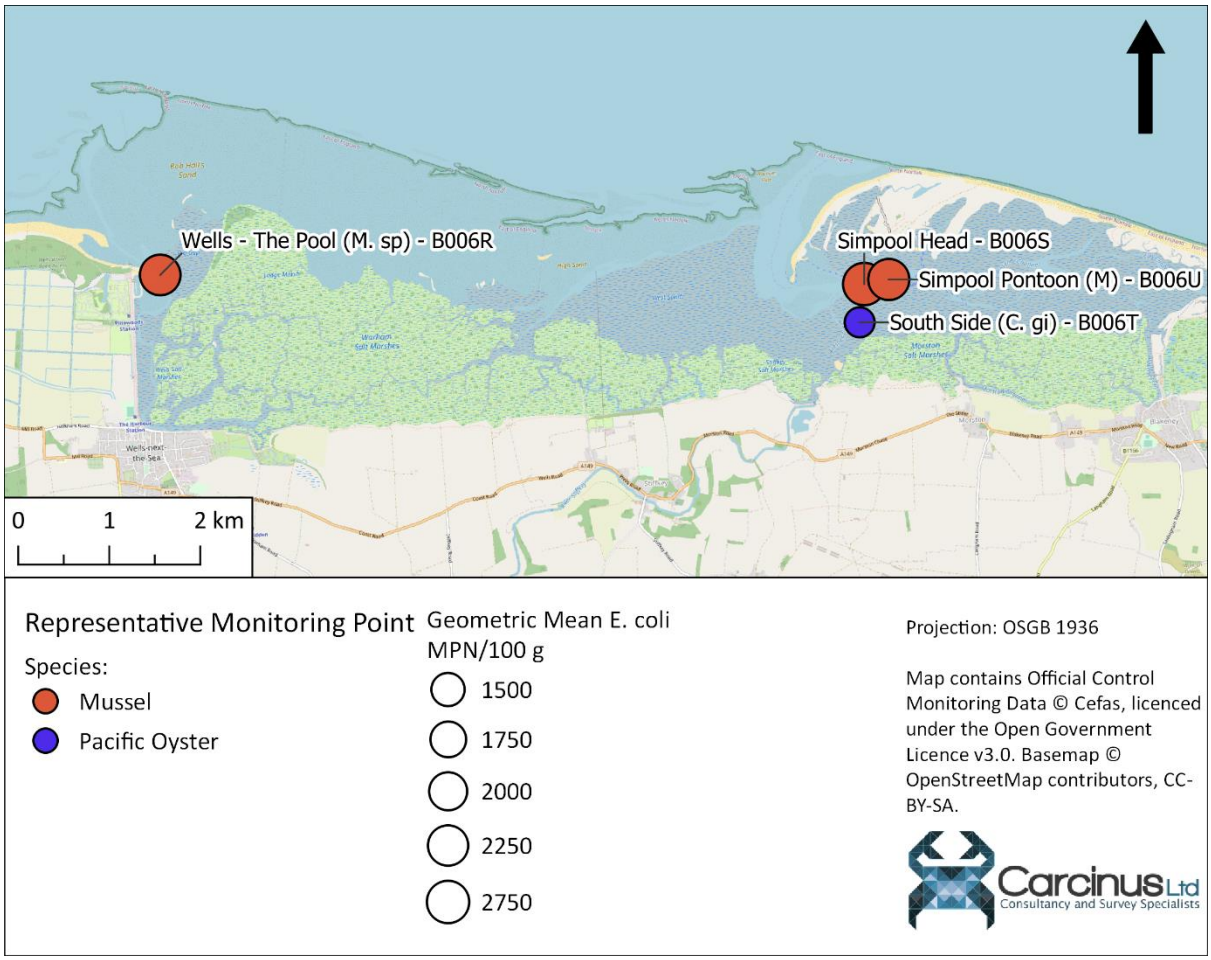

Figure 6.1 Geometric Mean E. coli results from Official Control Monitoring at bivalve RMPs within the Blakeney BMPA.

Table 6.1 Summary statistics of Official Control E. coli (MPN/100 g) monitoring at bivalve RMPs sampled since the original sanitary survey. Data was cut off at August 2021.

						E. coli (MPN/100 g)					
RMP Name	***NGR***	***Species***	***No.***	***First Sample***	***Last Sample***	***Geo Mean***	***Min Value***	***Max Value***	***% > 230***	***% > 4,600***	***% > 46,000***
Wells - The Pool (M. sp) - B006R	TF91804549	Mussel	134	08/06/2010	05/08/2021	2,289.05	20	92000	76.12	5.22	1.49
Simpool Head - B006S	TF99544539	Mussel	103	10/05/2010	19/08/2021	2,503.50	20	92000	72.82	10.68	0.97
South Side (C. gi) - B006T	TF99494497	Pacific Oyster	134	08/06/2010	05/08/2021	1,197.95	18	17000	68.66	3.73	0.00
Simpool Pontoon (M) - B006U	TF99814544	Mussel	16	18/02/2015	12/01/2016	2,348.00	20	7900	81.25	25.00	0.00

Figure 6.2 and Figure 6.3 present boxplots of *E. coli* monitoring results from the various mussel and Pacific oyster RMPs, respectively. One-way analyses of variance (ANOVA) tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the various RMPs. Significance has been taken at the 0.05 level. All statistical analysis described in this section was undertaken in R (R Core Team, 2020). Despite some visual differences in the data, ANOVA tests indicated that there were no significant differences ($p = 0.984$) between the monitoring results from the different mussel RMPs. No comparison is possible for the Pacific oyster data as there is only one RMP that utilises this species.

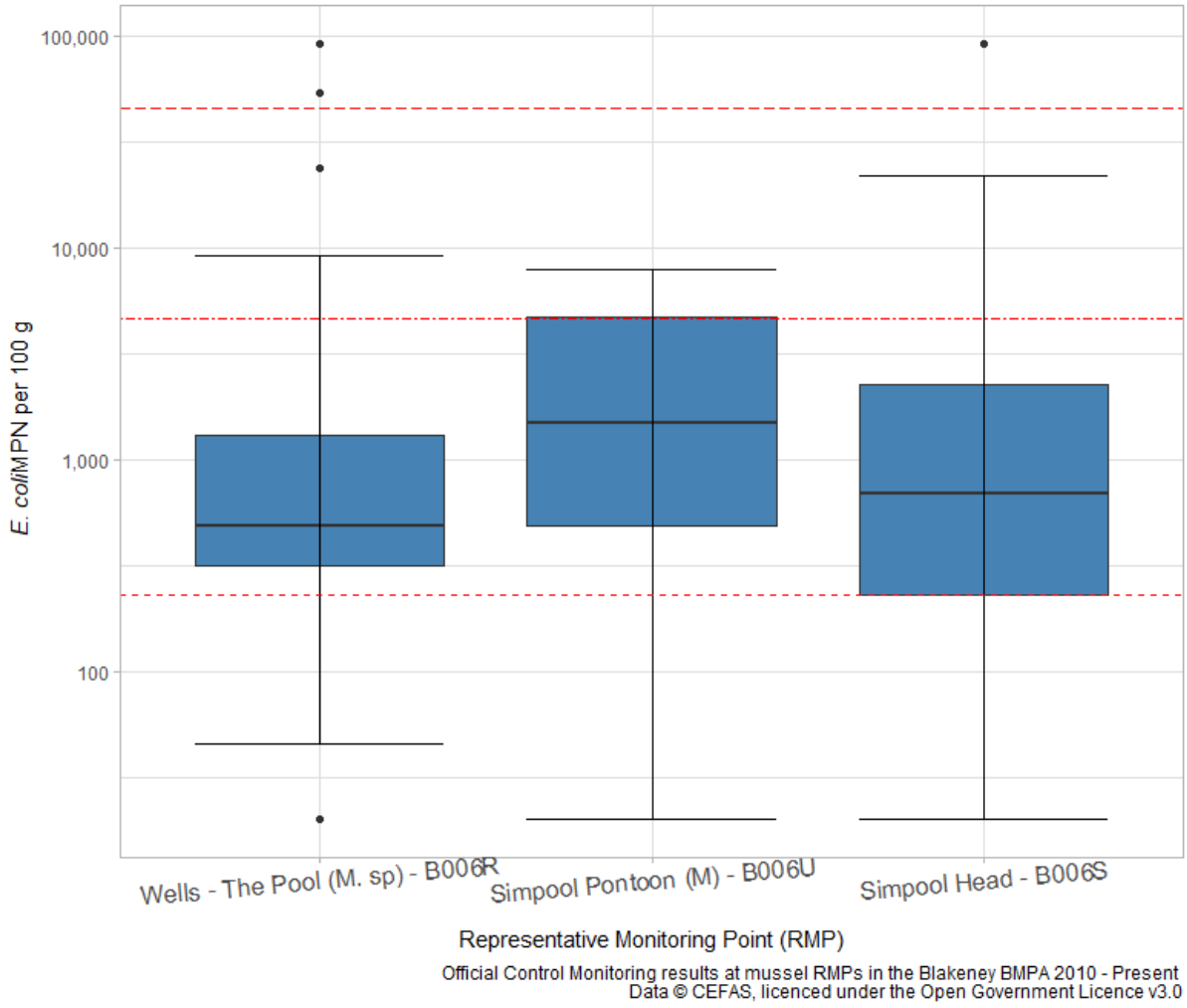

Figure 6.2 Boxplots of E. coli levels at mussel RMPs sampled within the Blakeney BMPA 2010 – Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum / maximum values, excluding outliers (points >1.5x the interquartile range).

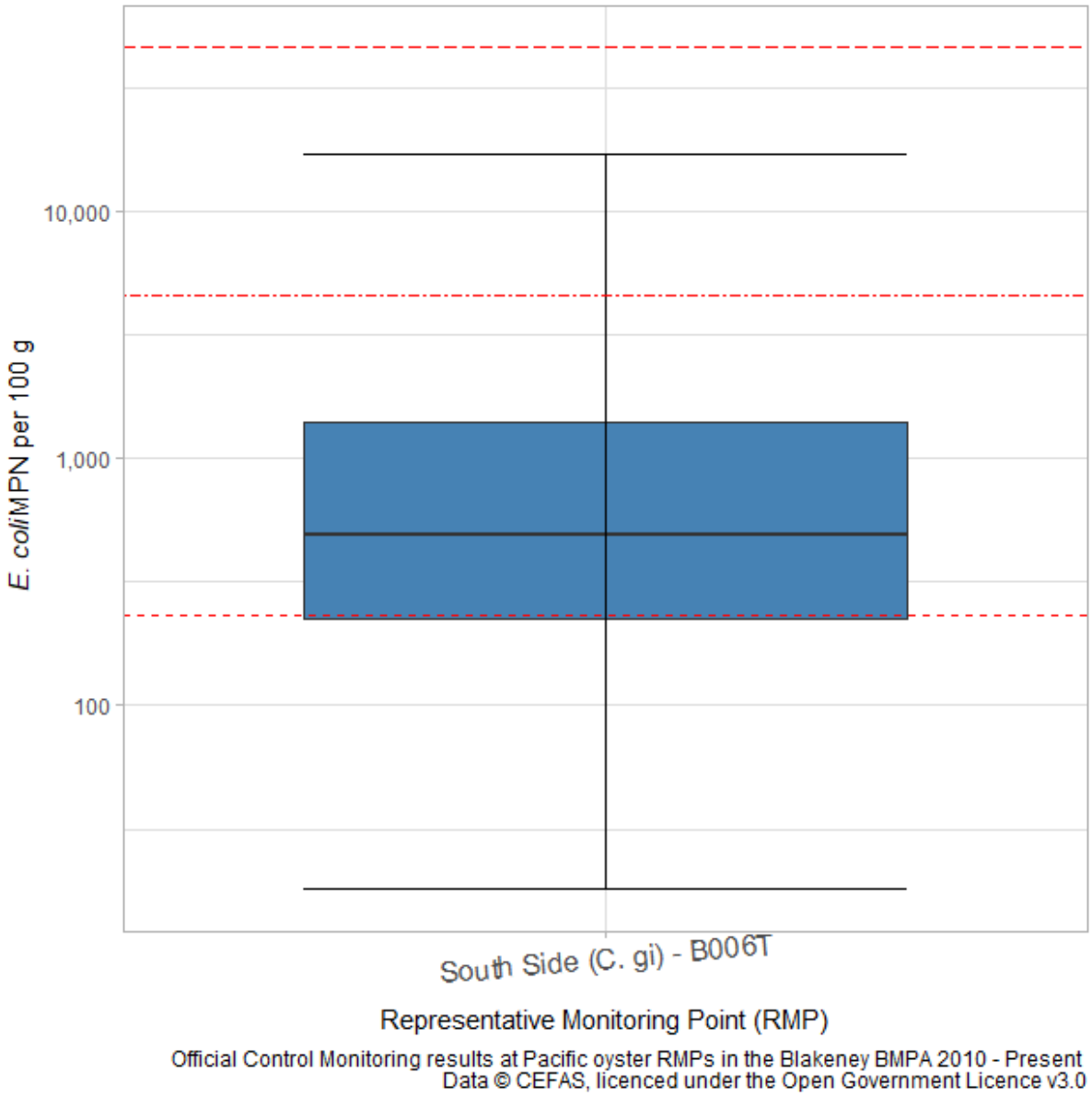

Figure 6.3 Boxplots of E. coli levels at Pacific oyster RMPs sampled within the Blakeney BMPA 2010 – Present.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results for RMPs within the Blakeney BMPA is shown in Figure 6.4 (mussels) and Figure 6.5 (Pacific oyster).

None of the mussel RMPs were sampled prior to the publication of the original sanitary survey. The trend line fitted to the data collected at Wells – The Pool (B006R) suggests that monitoring results have been generally stable since 2010, although from 2015 – 2017 there was an improvement in water quality, which has since been followed by declining water quality. The initial trend in the monitoring results from Simpool Head (B006S) was one of declining water quality, although since late 2014 the trend has been stable, or even one of slightly improving water quality. However, the trend has been gradually increasing in recent

years. The trend line fitted to the Simpool Pontoon (B006U) data is very variable, although this is most likely due to the relatively low number of samples at this point compared to other mussel RMPs.

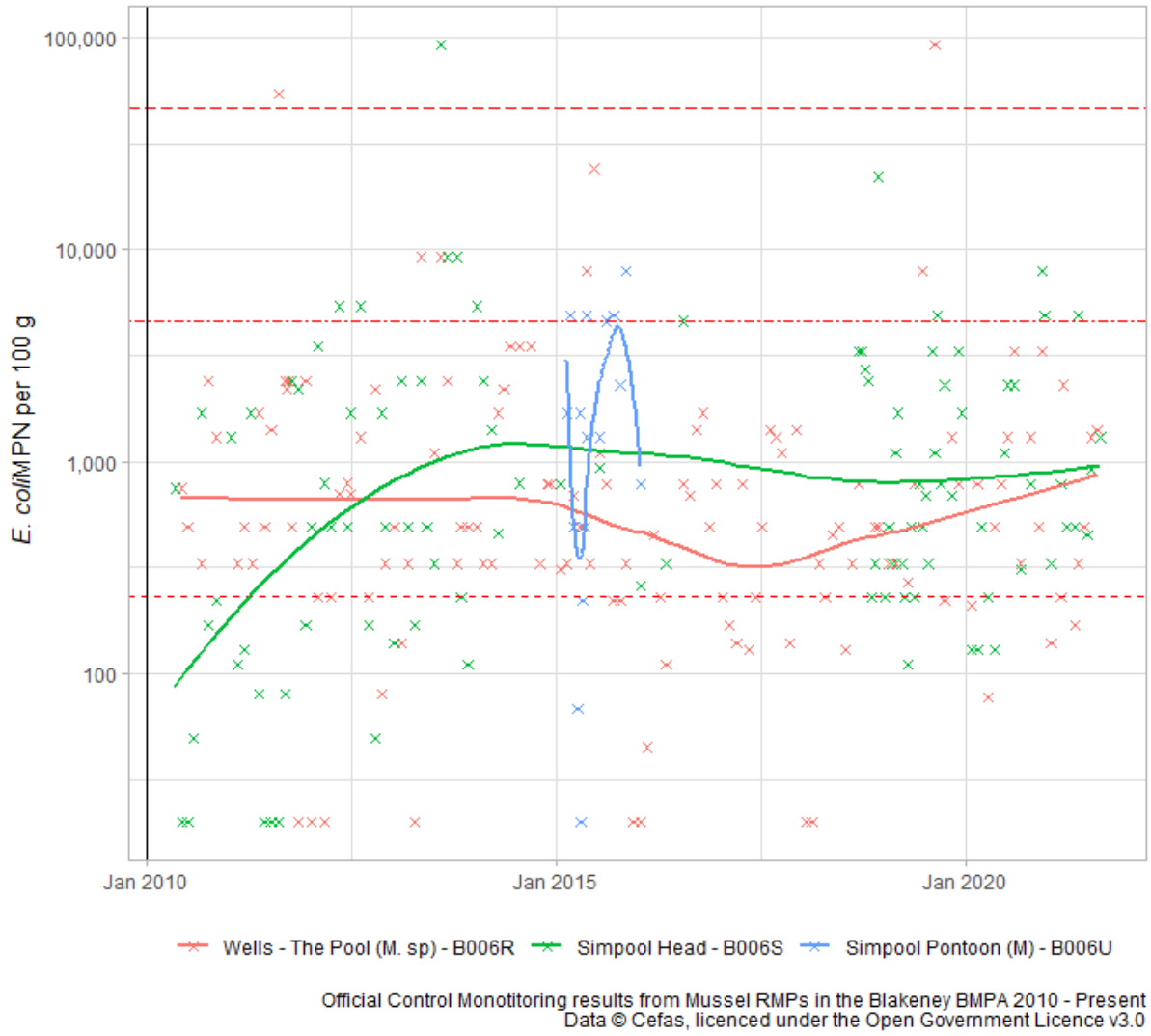

Figure 6.4 Timeseries of E. coli levels at mussel RMPs sampled in the Blakeney BMPA 2010 – Present. Scatter plots are overlaid with loess models fitted to the data.

The loess model fitted to the data from South Side (B006T) shows that the monitoring results have been generally stable, with the trend line always falling between the Class A threshold of 230 MPN/100 g and 4,600 MPN/100 g. In recent years, the trend has been one of declining water quality, although the cause of this is not clear as high results are interspersed with low ones.

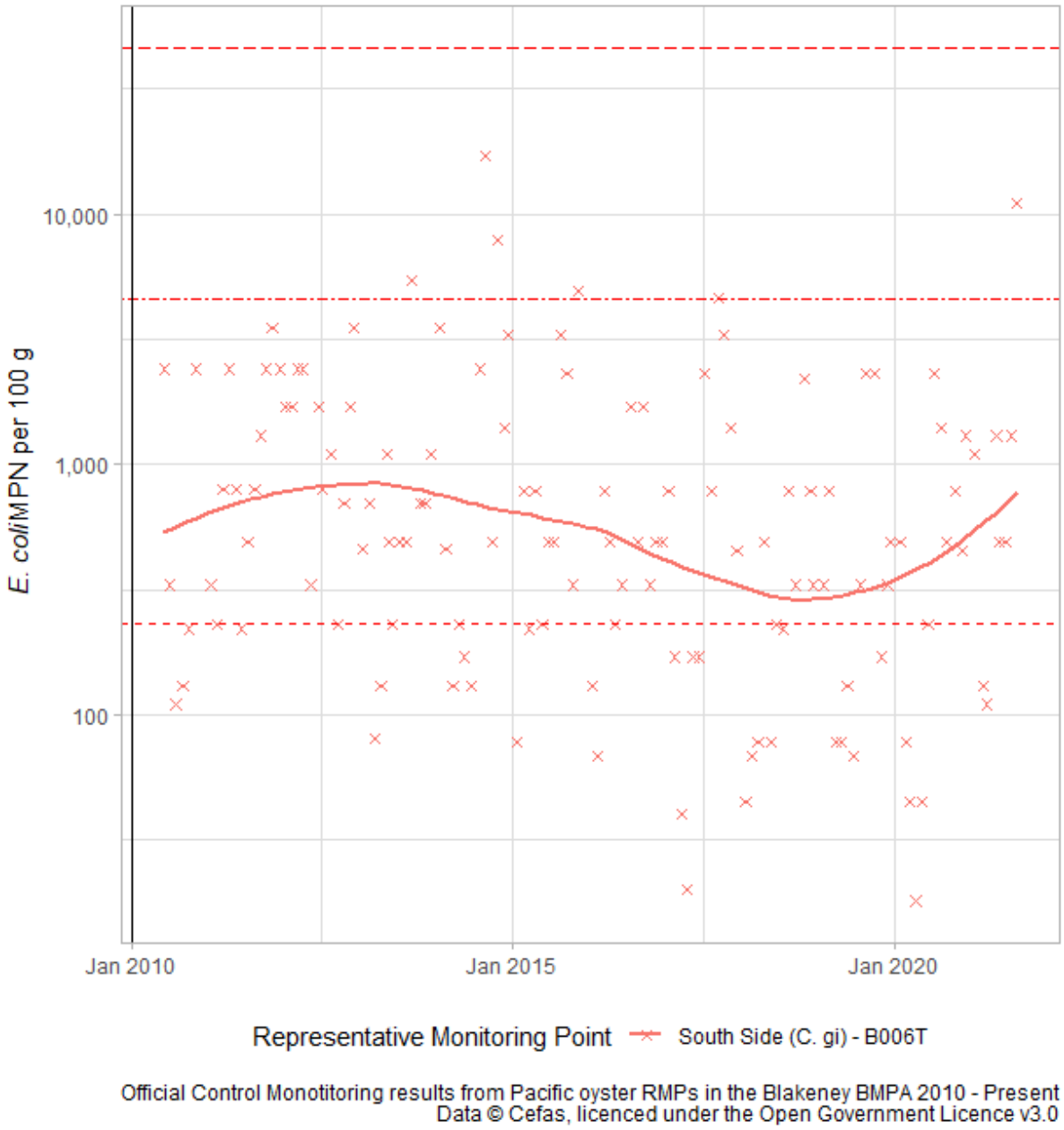

Figure 6.5 Timeseries of E. coli levels at Pacific RMPs sampled in the Blakeney BMPA 2010 – Present. Scatter plot is overlaid with a loess model fitted to the data.

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at the various RMPs within the Blakeney BMPA were investigated are shown for mussel RMPs in Figure 6.6 and for Pacific oyster in Figure 6.5. 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 for significant differences in the data, using both season and RMP (if there is more than one RMP for a given species) as independent factors (i.e., pooling the data across season and RMP

respectively), as well as the interaction between them (i.e., exploring seasonal differences within the results from a given RMP). Significance was taken at the 0.05 level.

When the data were pooled across the mussel RMPs, results from summer months were significantly higher than those from winter months (p = 0.042). No other significant differences were found when the data were pooled, or when differences within a specific RMP were considered.

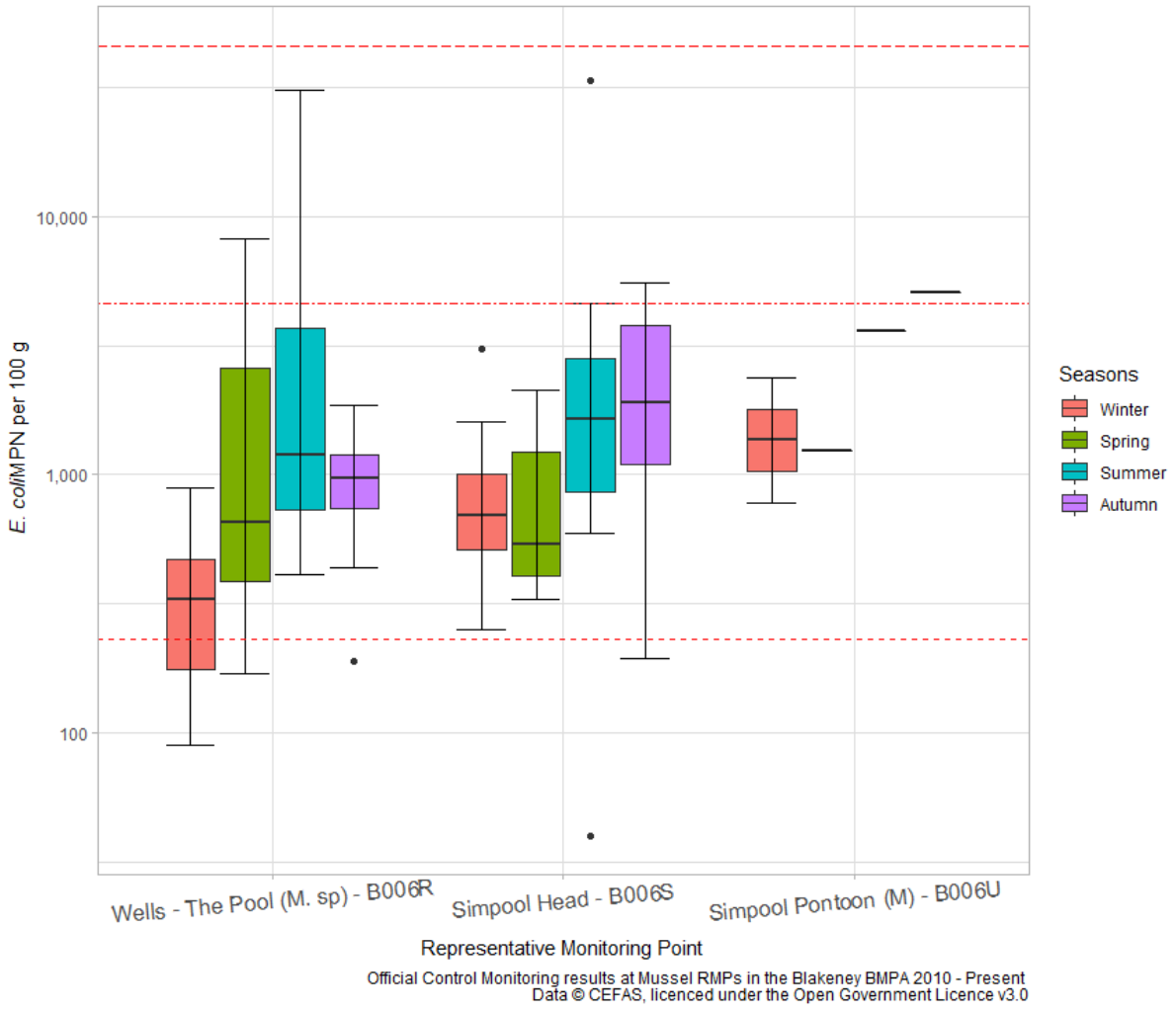

Figure 6.6 Boxplots of E. coli levels per season at mussel RMPs sampled within the Blakeney BMPA 2010 - Present.

One-way ANOVA tests were carried out on the Pacific oyster data as there was only one RMP for this species. These tests indicated that results collected in summer months were significantly greater than those from both winter (p = 0.025) and spring (p = 0.032) months.

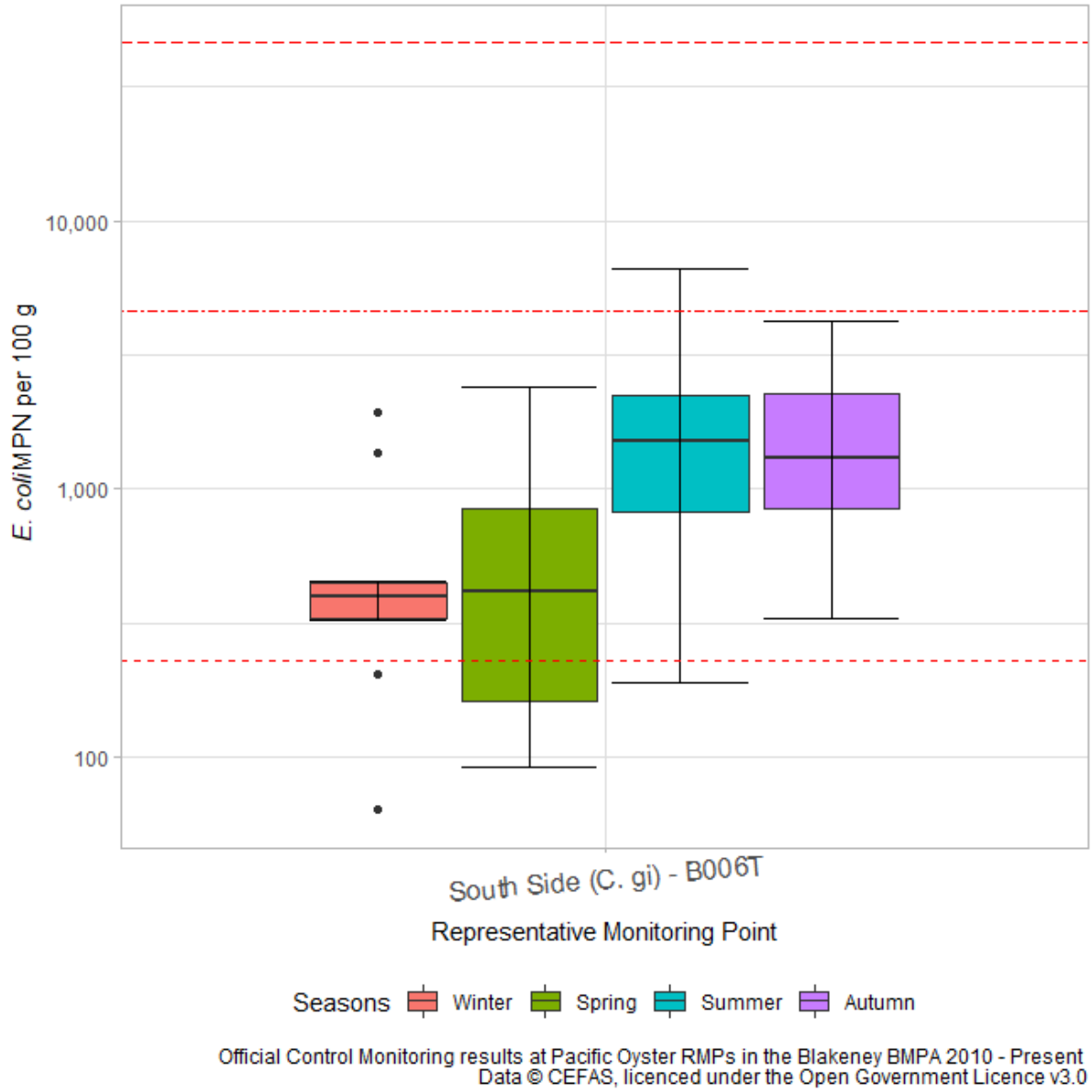

Figure 6.7 Boxplots of E. coli levels per season at Pacific oyster RMPs sampled within the Blakeney BMPA 2010 - Present.

7 Conclusion and overall assessment

The Blakeney BMPA covers the stretch of water off the north Norfolk coast between Wells Harbour and Blakeney Harbour, it is characterised by highly dynamic marine conditions. Historically, the area has supported a commercial fishery of a variety of bivalve mollusc species, although currently it involves the harvest of wild mussels and Pacific oyster, from Classification Zones off Wells Harbour and near Blakeney. Harvesting of shellfish in the Wells-next-the-Sea area is regulated by the Eastern IFCA under the Wells Harbour Shellfishery Order (1972), but no regulated or several order applies to the beds off Blakeney. The original sanitary survey was prompted by an application to harvest wild mussels near Wells Harbour, and recommended the creation of this, along with three other CZs (two for

mussels and one for Pacific oyster). There are currently three CZs, as the Wells Harbour zone was never awarded a formal classification.

The total population in Electoral Wards wholly or partially contained within the catchment remained relatively stable between the 2001 and 2011 censuses, increasing by only 0.47% (the results of the 2021 census are not yet available). Across the catchment, the high population density areas generally showed an increase in population size, whereas the low population density areas (most of the catchment) showed a slight fall. Average population density remains relatively low across the catchment. The LEA did not suggest that any significant housing developments had occurred in the coastal towns of Wells-next-the-Sea and Blakeney, and as such the risk of surface run off or utility misconnections negatively impacting the BMPA is not likely to have increased significantly. The area also receives a significant number of tourists each year, and the numbers are likely to have been greater in the last 18 months due to the Covid-19 pandemic causing foreign travel restrictions. It is assumed that the existing WWTN has built-in capacity to handle the summer increases in population size.

Compared to the catchments of other BMPAs around the country, there are comparatively few sewage discharges likely to be of significance to the bacteriological health of the BMPA. Both main continuous discharges employ UV disinfection, and the available EDM data suggests that intermittent discharges spill relatively infrequently. Based on the data available to the authors of this review and consultations with the EA and LEA, the recommendations made in the original sanitary survey to capture this source of pollution remain valid.

The total livestock population within the catchment was estimated to have remained relatively stable within the catchment between 2013 and 2016, with one district showing a fall of 12.85% and the other an increase of 10.26%. Poultry remain the dominant species in terms of total population size. Most of the catchment is reserved for arable farming, and application of slurry to these fields may cause some contamination of the BMPA through run-off into watercourses. Additionally, there are some areas of pasture immediately adjacent to the shoreline which are most likely to contribute contamination. The significance of this pollution source, and the risk it therefore poses to the shellfishery, is not adjudged to have increased significantly and therefore the recommendations made in the original sanitary survey to capture it remain valid.

The stretch of the Norfolk coast in which the Blakeney BMPA is situated is conferred protection under a variety of statutory and non-statutory designations, due in part to the large populations of wildlife. The two most significant groups of animals likely to impact the bacteriological health of the BMPA are the seal and waterbird populations. Seal populations have increased dramatically in recent years and a 2017 Cefas report into the sources of contamination in this region found that the population at Blakeney Point contribute $1.2x10^{14}$ cfu/day. Whilst waterbird populations fell compared to the time of the original sanitary survey, there are still large, internationally significant populations of several

species. The contamination that these two groups of animals cause will vary spatially and temporally, and so it is impossible to define RMP locations to reliably capture it in any updated sampling plan.

Wells and Blakeney harbours are very popular with recreational boaters, and the peak numbers are expected to occur during the summer months. However, the Harbour Commissioners prohibit any overboard discharges in the vicinity of the harbour, and so whilst vessels of a sufficient size to contain on board toilets may occasionally make overboard discharges, they are likely restricted to the most offshore parts of the BMPA. There is also a small, but active fishing fleet and several commercial pleasure cruisers, although these vessels are not considered to be of significance to the bacteriological health of the BMPA as they are legislatively prohibited from making overboard discharges within 3 nm of land.

A total of four RMPs have been sampled within the BMPA since the original sanitary was published, none of which were sampled prior. Three of these have been sampled continually since the 2010 report was published, and the remaining RMP (Simpool Pontoon, B006U) was sampled for a single year between 2015 and 2016. Sampling at this RMP was stopped due to the received results meaning the bed would not be commercially viable due to required treatment methods. Mean monitoring results have been relatively similar, and no significant differences were found between the different RMPs. Timeseries plots of the results also indicate a general stability in water quality, although it appears to be declining in recent years, though the cause is not certain. Results from summer months were found to be significantly higher than at other times of year.

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

Having reviewed and compared the desk-based study with the findings of the initial sanitary survey in 2010, the FSA are also content that a shoreline assessment is not required unless further information following secondary consultation suggests there may be an increase in the level of public health risk.

8 Recommendations

The Blakeney BMPA currently has three active RMPs that are used to classify a total of three classification zones, two for mussels and one for Pacific oyster. Recommendations for all active CZs are described below and summarised in Table 8.1.

8.1 Mussel

Wells – The Pool

This is a small zone on the western end of the BMPA, covering an area of only 1.2 Ha. In the original sanitary survey, it was recommended that a new RMP be created in the middle of the bed to adequately capture the contamination draining to this zone. This RMP (Wells –

The Pool, B006R) has been in use since then and it is recommended that it be retained as the small size of this RMP limits the choices of RMP location.

Simpool Head

This zone is located on the eastern end of the BMPA and covers an area of 8 Ha. It sits approximately 300 m north of the *South Side* Pacific oyster zone. The original sanitary survey recommended creating a new RMP, situated at the eastern end of the CZ to capture contamination originating from the Morston Channel. The RMP instated after the 2012 survey, Simpool Head (B006S), should be retained as the sources of contamination have not altered significantly. Consideration should also be given to monitoring results from the South Side (B006T) RMP, as this may capture contamination from Freshes Creek, which will likely pass over the shellfish bed on an ebbing tide.

8.2 Pacific oyster

South Side

This zone only covers an area of 0.34 Ha, and as such choices for RMP location are limited. It is currently sampled from the South Side (B006T) RMP, located in the centre of the bed. It is recommended that this RMP be retained as it will still be representative of the main sources of contamination on this zone.

8.3 General Information

8.3.1 Location Reference

Production Area	**Blakeney**
Cefas Main Site Reference	M006
Ordnance survey 1:25,000	Explorer 251: North Norfolk Coast Central
Admiralty Chart	Admiralty 108: Approaches to the Wash

8.3.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Mussel (*Mytilus edulis*)	Wild	October – March
Pacific oyster (*Crassostrea gigas*)	Farmed	Year-round

8.3.3 Local Enforcement Authority(s)

Name	North Norfolk District Council Council Offices Holt Road Cromer Norfolk NR27 9EN
Website	https://www.north-norfolk.gov.uk/
Telephone number	01263 516085
E-mail address	Ep@north-norfolk.gov.uk

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

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Wells – The Pool (*Mytilus* spp.)	B006R	Wells – The Pool	TF91804549	52° 58.35'N 0° 51.30'E	Mussels	Hand-picked	Hand-picked	*M. edulis*	10 m	Monthly
Simpool Head (*Mytilus* spp.)	B006S	Simpool Head	TF99544539	52° 58.12'N 0° 58.20'E	Mussels	Hand-picked	Hand-picked		10 m	Monthly
South Side (*C. gigas*)	B006T	South Side	TF99494497	52° 57.90'N 0° 58.14'E	P oyster	Hand-picked	Hand-picked	*C. gigas*	10 m	Monthly

9 References

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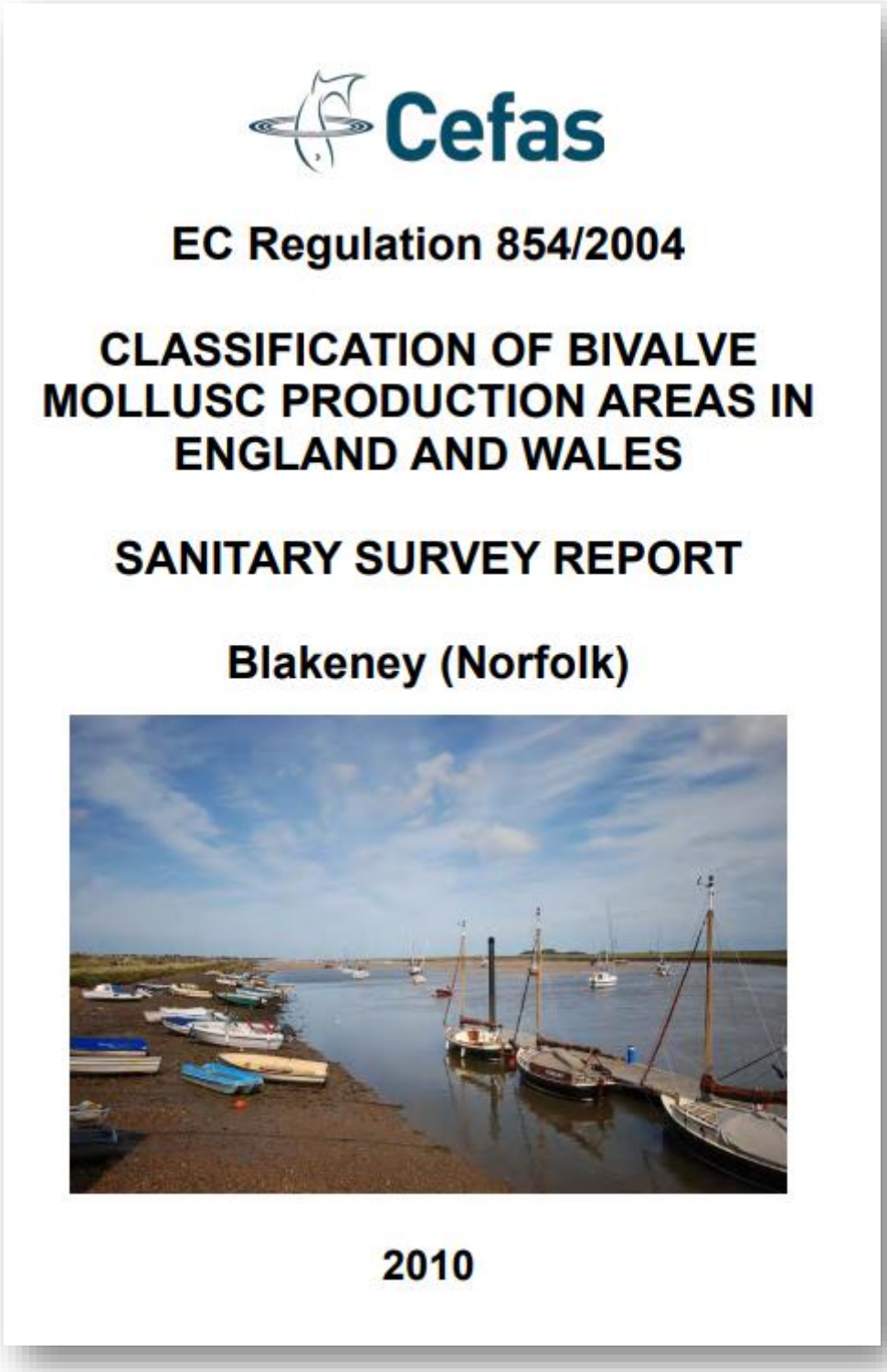
Appendices

Appendix I. Breakdown of population change within Electoral Wards

ID	Ward	Total Usual Residents			Population Density (P/Ha)		
		2001 Census	2011 Census	Change	2001 Census	2011 Census	Change
1	Glaven Valley	2,159	2,044	-115	0.38	0.40	+0.02
2	High Heath	1,780	1,894	+114	0.58	0.60	+0.02
3	Walsingham	2,232	2,167	-65	0.34	0.30	-0.04
4	Priory	4,206	3,908	-298	0.48	0.40	-0.08
5	Brancaster	1,484	1,293	-191	0.39	0.30	-0.09
6	Holt	3,550	3,810	+260	2.91	3.10	+0.19
7	Corpusty	2,241	2,322	+81	0.37	0.40	+0.03
8	Docking	2,006	1,937	-69	0.28	0.30	+0.02
9	Burnham	1,917	1,714	-203	0.32	0.30	-0.02
10	Hunstanton	5,685	5,420	-265	2.03	1.90	-0.13
11	Astley	2,103	2,244	+141	0.37	0.40	+0.03
12	Wensum	2,298	2,305	+7	0.50	0.50	+0.00
13	Lancaster North	3,658	3,600	-58	6.69	6.10	-0.59
14	Lancaster South	3,699	4,017	+318	11.40	12.70	+1.30
15	Rudham	2,228	2,128	-100	0.29	0.30	+0.01
16	The Raynhams	2,237	2,521	+284	0.38	0.40	+0.02
17	Briston	2,021	2,439	+418	1.69	2.00	+0.31
18	Chaucer	2,347	2,315	-32	0.65	0.60	-0.05
TOTAL / *Average*		47,851	48,078	+227	*1.67*	*1.72*	*+0.05*

Discharge Name	Permit Number	Receiving Environment	NGR	Treatment (if any)	Total Duration (hours) of all spills prior to processing through	Counted spills using 12-24hr counting method
BODHAM-THE STREET/HART LANE SP	AEENF2362	Trib R Glaven	TG1235039800	NONE	No EDM fitted	No EDM fitted
BURNHAM MARKET WATER RECYCLING CTR	AEENF1265	THE RIVER BURN	TF8453042380	PRIMARY SETTLEMENT	413.4	115
CLEY PS	AW4NF1960	Unknown Trib.	TG0461243419	SCREENING	No EDM fitted	No EDM fitted
GREAT WALSINGHAM STW	AEENF12038	River Stiffkey	TF9395038750	UNSPECIFIED	No EDM fitted	No EDM fitted
HOLLOW LA PS	AEENF12014	trib of River Stiffkey	TG0082040880	SCREENING	No EDM fitted	No EDM fitted
HOLME NEXT THE SEA - BEECH ROAD PS	AW4NF193X	River Hun	TF6991043570	SCREENING	158.3	15
HOLT MAIN ROAD WRC	AW4NF118AW	TRIB OF RIVER GLAVEN	TG0683038860	SCREENING	17.25	2
HUNSTANTON SMUGGLERS LANE PS	ASENF12024	A TRIBUTARY OF THE RIVER HUN	TF6873042740	SCREENING	55.76667	40
LANGHAM WRC (AKA BINHAM WRC)	AEENF1295	River Stiffkey NT	TF9990041100	UNSPECIFIED	No EDM fitted	No EDM fitted
MELTON CONTABLE - BURGH BECK PS	AEENF12431	TRIB OF RIVER GLAVEN	TG0479033320	SCREENING	28.25	5
MORSTON SPS	AW4NF1914	Unknown Trib.	TG0089043680	SCREENING	No EDM fitted	No EDM fitted

Discharge Name	Permit Number	Receiving Environment	NGR	Treatment (if any)	Total Duration (hours) of all spills prior to processing through	Counted spills using 12-24hr counting method
WELLS - FREEMAN ST CSO	AEENF12015	unnamed marsh dyke North Sea	TF9119043820	NONE	0	0
WELLS-NEXT-THE-SEA STW	AEENF12033	tributary Wells Creek	TF9128044080	PRIMARY SETTLEMENT	No EDM fitted	No EDM fitted
WEYBOURNE BEACH LANE PUMPING STATIO	AEENF12379	POND TO TRIB TO WEYBOURNE HOPE	TG1093043460	SCREENING	5.75	1
WHITEHALL FARM SPS	AW1NF2897	Trib Marsh Dyke System	TF7082043460	SCREENING	No EDM fitted	No EDM fitted



Follow link 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*"