Sanitary Survey- Review

Chichester Harbour – 2021

Document No. – *J0591/21/08/06*

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Client	Food Standards Agency (FSA)
Project Title	Sanitary Survey Review
Document Title	Chichester Harbour Sanitary Survey Review
Document Number	J0591/21/08/06
Revision	3.0
Date	12 October 2021

Revisions

Revision No.	Date	Comment
0.1	19 August 2021	Draft for internal review
1.0	20 August 2021	Draft for FSA Review
2.0	25 August 2021	Draft for secondary consultation
3.0	12 October 2021	Final document

Document QA and Approval

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Initial Consultation

Consultee	Date of consultation	Date of response
Chichester District Council	20 May 2021	08 June 2021
Havant Borough Council	20 May 2021	08 June 2021
Environment Agency	20 May 2021	04 June 2021

Consultation on draft report

Consultee	Date of consultation	Date of response
Chichester District Council	27 August 2021	17 September 2021
Havant Borough Council	27 August 2021	17 September 2021
Environment Agency	27 August 2021	13 September 2021

A sanitary survey relevant to the bivalve mollusc beds in Chichester Harbour was undertaken in 2013 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, Chichester District Council, Havant Borough Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2021. Review of the Chichester Harbour 2013 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 Chichester Harbour Review

This report reviews information and makes recommendations for a revised sampling plan for existing native oyster (*Ostrea edulis*) classification zones in Chichester Harbour (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 May and June 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 September 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 2013 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;

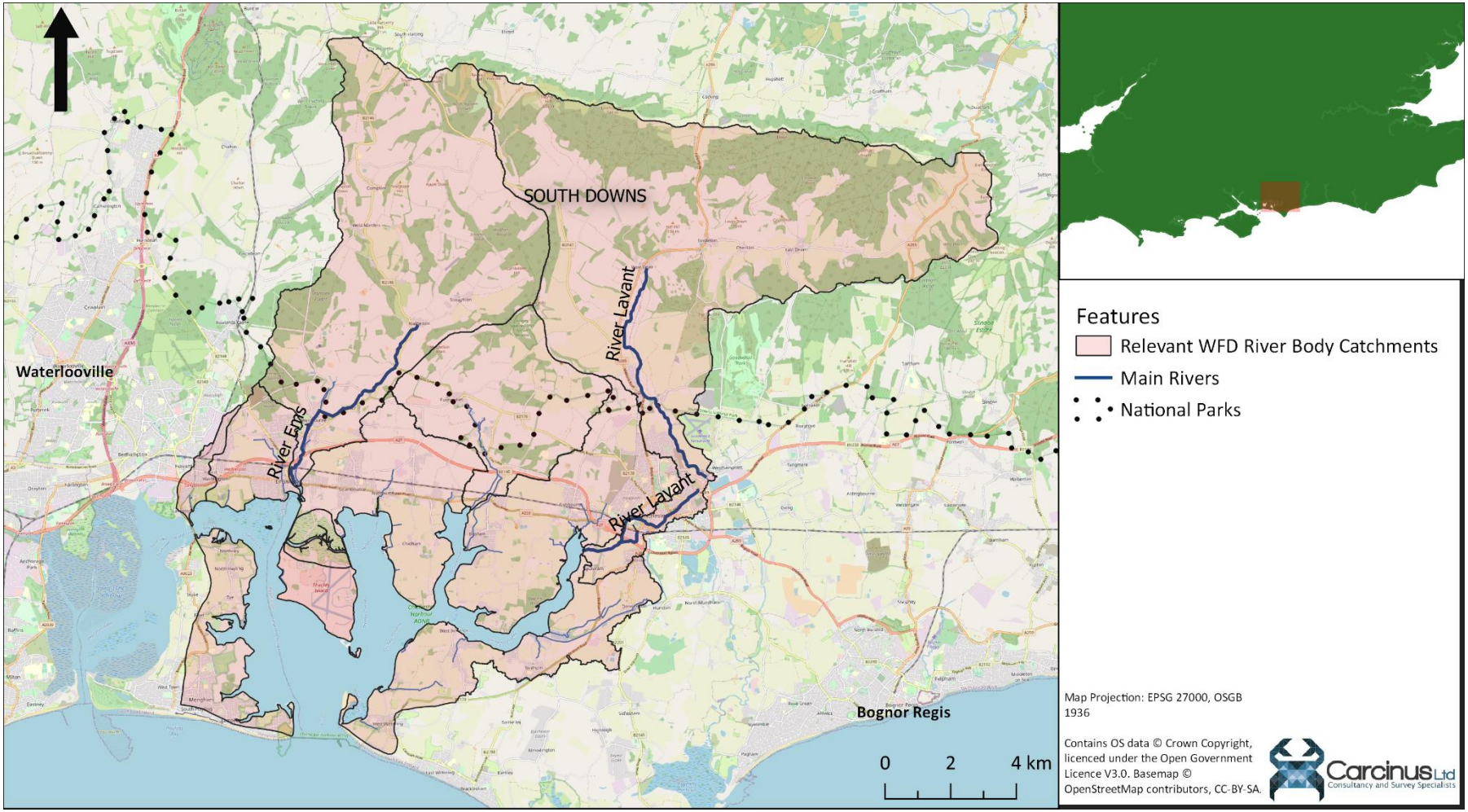

Figure 1.1 Location of Chichester Harbour.

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 June 2021;
- Only information that may impact on the microbial contamination was considered for this review;
- 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 June 2021 have been used within this study. Any subsequent samples have not been included; and
- Beyond the data processing steps outlined in Section 3.2, data from the Environment Agency's national permit database[2] and the Event Duration Monitoring summaries[3] have been taken at face value.

2 Shellfisheries

2.1 Description of Shellfishery

Chichester Harbour is a natural harbour situated on the south coast of England (Figure 1.1) and covers an area of approximately 30 km². At its southern end, a mouth approximately 1.4 km across connects the harbour with the Solent. In the north-western corner, a narrow channel connects the harbour with Langstone Harbour.

Harvesting of bivalve molluscs within the harbour is regulated by the Sussex Inshore Fisheries and Conservation Authority (SIFCA) under the Chichester Harbour Oyster Permit Byelaw 2014[4]. Under this byelaw, the taking of native oysters by any means is prohibited within Chichester Harbour unless the fisherman has been issued a commercial permit. Commercial permit holders are also subject to certain restrictions, including a ban on taking undersized oysters (any oyster (other than Portuguese and Pacific oysters) that will pass through a ring of 70 mm internal diameter), limits on allowed fishing gear and temporal

[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] Environment Agency Database of Consented Discharges to Controlled Waters with Conditions. Available at: https://data.gov.uk/dataset/55b8eaa8-60df-48a8-929a-060891b7a109/consented-discharges-to-controlled-waters-with-conditions.
[3] Environment Agency Event Duration Monitoring Summaries. Available at: https://environment.data.gov.uk/dataset/21e15f12-0df8-4bfc-b763-45226c16a8ac.
[4] SIFCA Chichester Harbour Oyster Permit Byelaw 2014: https://secure.toolkitfiles.co.uk/clients/34087/sitedata/files/Oyster-Permit-Byelaw.pdf.

restrictions. No fishing is allowed before 8 am or after 2 pm Monday – Friday, or on weekends. Furthermore, the fishery has a closed season from 1st March to 31st October Inclusive.

Chichester Harbour contains internationally important habitats and species (see Section 3.4). Due to this, the SIFCA imposed the Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method Byelaw[5]. This byelaw prohibits the use of any bottom-towed fishing gear or hand gathering / digging within four specified areas in order to protect the habitats in those locations. Details of these areas are presented in the Byelaw text.

Under Paragraph 23 of the Byelaw, the SIFCA reserves the right to prohibit the oyster fishery for the purposes of managing the sustainable exploitation of oysters within the harbour. The oyster fishery was not opened for the season beginning November 2020 due to a lack of stock density in the Emsworth and Thorney Channels. As such, there is no current output from this fishery. The following paragraphs briefly summarise the recommendations made in the original sanitary survey for the designation of classification zones (CZs) for the various species and state the current status of these zones.

The main shellfishery within the harbour is harvesting of wild native oysters and is under the jurisdiction of Chichester District and Havant Borough Councils for the Food Hygiene purposes (the Local Enforcement Authority, LEA). The original sanitary survey recommended the creation of five CZs for these species, with Representative Monitoring Points (RMPs) in the subtidal channels reflecting the subtidal distribution of the species. The boundaries of these zones were chosen to reflect the hydrographic separation of the main channels within the harbour. These were Upper Chichester Channel (now known as *Dell Quay*), Lower Chichester Channel (now known as *Cobnor*), *Bosham Channel*, *Thorney* and *Emsworth Channel.* The only CZs with an active classification are *Emsworth Channel* and *Thorney*; the *Bosham Channel* zone was never awarded a full classification, and *Dell Quay* and *Cobnor* were declassified in 2017.

The original sanitary survey states that at that time (late 2013), there was interest in harvesting various species of clams (*Tapes* spp. and *M. mercenaria*) and cockles (*Cerastoderma edule*). Areas in the north of the harbour were briefly classified for these species, but no zones are currently active, and at present the only classified species is native oyster. During secondary consultation, the LEA indicated that the number of Pacific oysters (*Crassostrea gigas*) within the BMPA is growing and is now the dominant species around Dell Quay. The LEA did not express a desire to classify this species for harvesting, however.

2.2 Classification History

The sampling plan proposed in the original sanitary survey created a total of nine classification zones, five for native oysters and two each for *Tapes* spp. clams and cockles.

[5] SIFCA Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method Byelaw: https://secure.toolkitfiles.co.uk/clients/34087/sitedata/files/Prohibition-Fishing-Method-byelaw.pdf.

None of the *Tapes* spp. or cockle zones are currently active, and only two native oyster zones have an active classification.

The location of all active CZs in the Chichester Harbour Bivalve Mollusc Production Area (BMPA) are shown in Figure 2.1. The *Emsworth Channel* CZ has a long-term B (LT-B) classification, indicating stable results over the past 5 years. The *Thorney* zone currently has a C classification, which it has held since 2019. The zone was downgraded from a LT-B classification in 2017 due to a series of exceptionally high results (i.e., >46,000 MPN/100 g). The *Prinstead* zone is currently prohibited for all species.

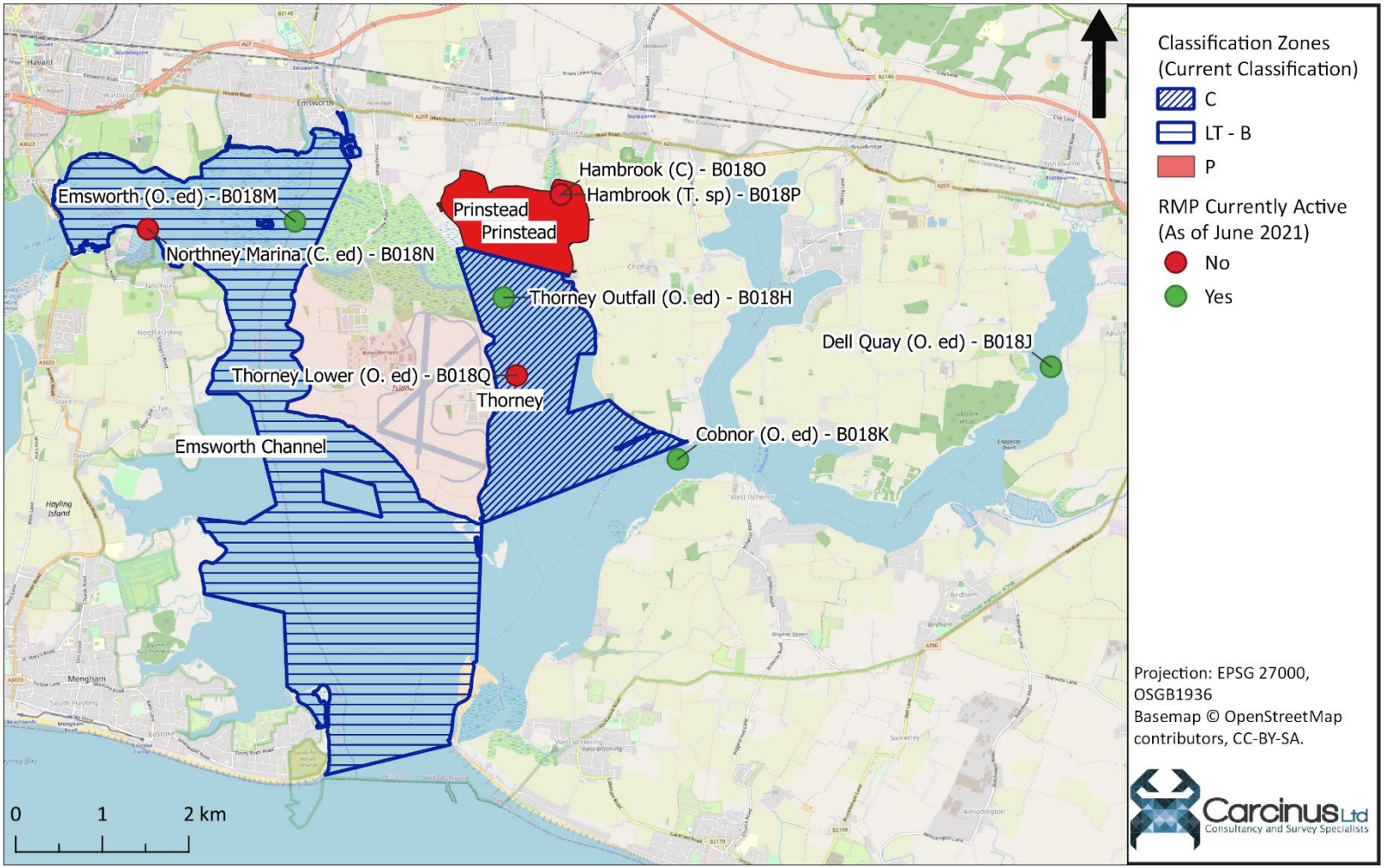

Figure 2.1 Current Classification Zones and associated Representative Monitoring Points for the species currently harvested within the Chichester Harbour BMPA.

3 Pollution sources

3.1 Human Population

The 2013 sanitary survey of Chichester Harbour cites census data from the 2011 Census of the United Kingdom. No updated census data for the catchment were available to the authors of this review; the next full census of the United Kingdom took place in March 2021, although the data is not yet available. The original sanitary survey stated that the total population of the catchment was approximately 106,000. The UK government estimates that the national population will have increased by approximately 6.6% between 2011 and 2021 (ons.gov.uk, 2021), an increase of this proportion would see the total population increase to 113,000.

The areas of highest population density in the catchment are described in the original sanitary survey to be around Hayling Island on the west side of the harbour, Emsworth to the northwest and Chichester to the northeast. Figure 3.1 shows how land cover has changed in the catchment between 2012 and 2018 (no further update to land cover estimates were available to the authors of this review) and indicates that the sizes of these settlements have increased slightly in that period. Consultation with the LEA indicated that there have been many new housing developments built within the catchment, most likely in the main urban areas described above. Without upgrades to the wastewater treatment network (WWTN), an increase in population would almost certainly lead to an increase in the loading to WWTN and would therefore potentially cause increased bacterial loading to coastal waters. Built-up areas on the banks of the harbour will continue to contribute contamination to the shellfisheries through urban runoff from utility misconnections or dog fouling. The area likely to be at highest risk from this source of pollution is the Emsworth Channel, given its proximity to Emsworth and Havant. Impacts from sewage will depend on the specific locations, volumes and nature of discharges, changes to which are discussed in 3.2.

The original sanitary survey reported that the District of Chichester received approximately 5.7 million tourists per year at the time that report was produced, of which 1.3 million visited Chichester Harbour itself. In 2017, the number visiting the district had increased to approximately 7.5 million (Visit Chichester, 2019). It is likely that this number has continued to increase, particularly in the last 18 months as the Covid-19 pandemic has increased tourist numbers to UK seaside destinations as foreign travel has been restricted. Significant population increases are therefore still expected during summer months, which will increase the load to the sewerage network in the region.

Whilst there is no recently available population data for the catchment, it is likely that the population will have increased since the last sanitary survey was published. However, the distribution of main population centres in the catchment has not changed, and therefore the recommendations made in that document to account for this source of pollution in choosing RMP locations remains valid.

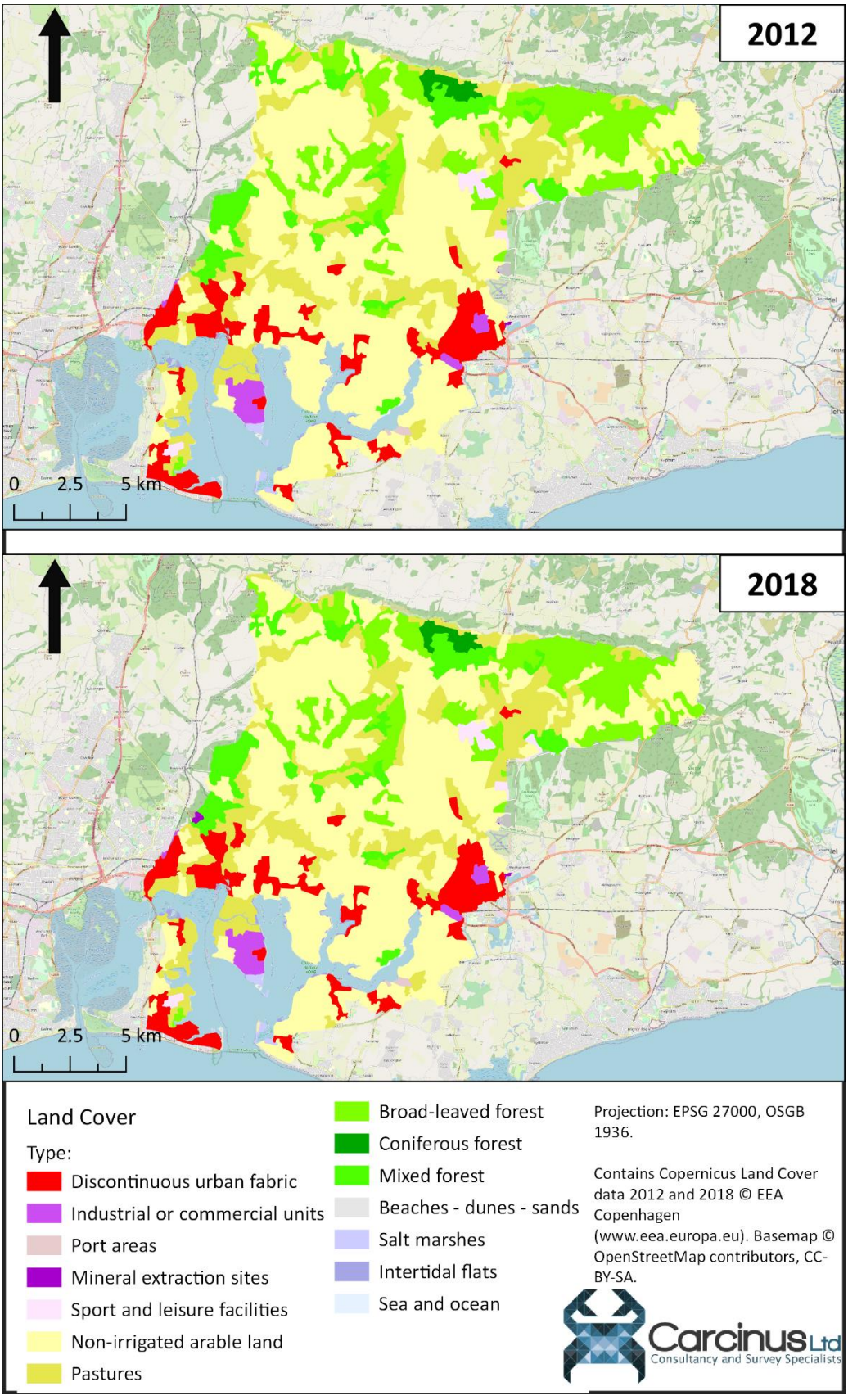

Figure 3.1 Land cover change within the Chichester Harbour Catchment between 2012 and 2018.

3.2 Sewage

Details of all consented discharges within the Chichester Harbour catchment were taken from the most recent update to the Environment Agency (EA)'s national permit database at the time of this report (April 2021). The locations of these discharges are shown in Figure 3.2.

The original sanitary survey identified a total of eight continuous discharges within Chichester Harbour's catchment (Figure II.1, p 48; Table II.1, p 49). Of these, only two discharged directly to Chichester Harbour, both of which received UV disinfection. The consented discharge volumes from these discharges have not changed, nor have the treatment methodologies. Only one additional discharge was identified (Table 3.1), although this has a relatively small permitted discharge volume and employs UV disinfection which should, when operational, significantly reduce the bacteriological contamination caused by it. No other significant changes to either the treatment methodologies or permitted discharges for the remaining discharges have occurred, and no major upgrades were indicated by the Environment Agency during initial consultation. As such, the risk from this source of contamination is considered to have remained similar.

Table 3.1 Details of all continuous discharges within Chichester Harbour's catchment. Those discharges not listed in the original sanitary survey are highlighted in yellow.

ID	Sewage Works	Permit Number	NGR	Treatment	DWF (m^3 / day)
1	BOSHAM WWTW	W00133	SU8088001940	UV DISINFECTION	1221
2	CHICHESTER WWTW	W00137	SU8387003750	UV DISINFECTION	13524
3	HILLSIDE COTTAGES WEST STOKE WWTW	P04112	SU8332008360	PACKAGE TREATMENT PLANT	4
4	LAVANT WWTW	W00359	SU8637007930	BIOLOGICAL FILTRATION	1696
5	LYE LANE WEST STOKE WWTW	W00064	SU8285008390	SEPTIC TANK	15.4
6	THORNHAM WWTW	W00354	SU7582004730	BIOLOGICAL FILTRATION	6565
7	WEST MARDEN WWTW	W00330	SU7715013330	BIOLOGICAL FILTRATION	40
8	WHITEHOUSE FARM DEVELOPMENT WWTW	EPRSB3338AD	SU8435005281	UV DISINFECTION	(Max Flow) 708

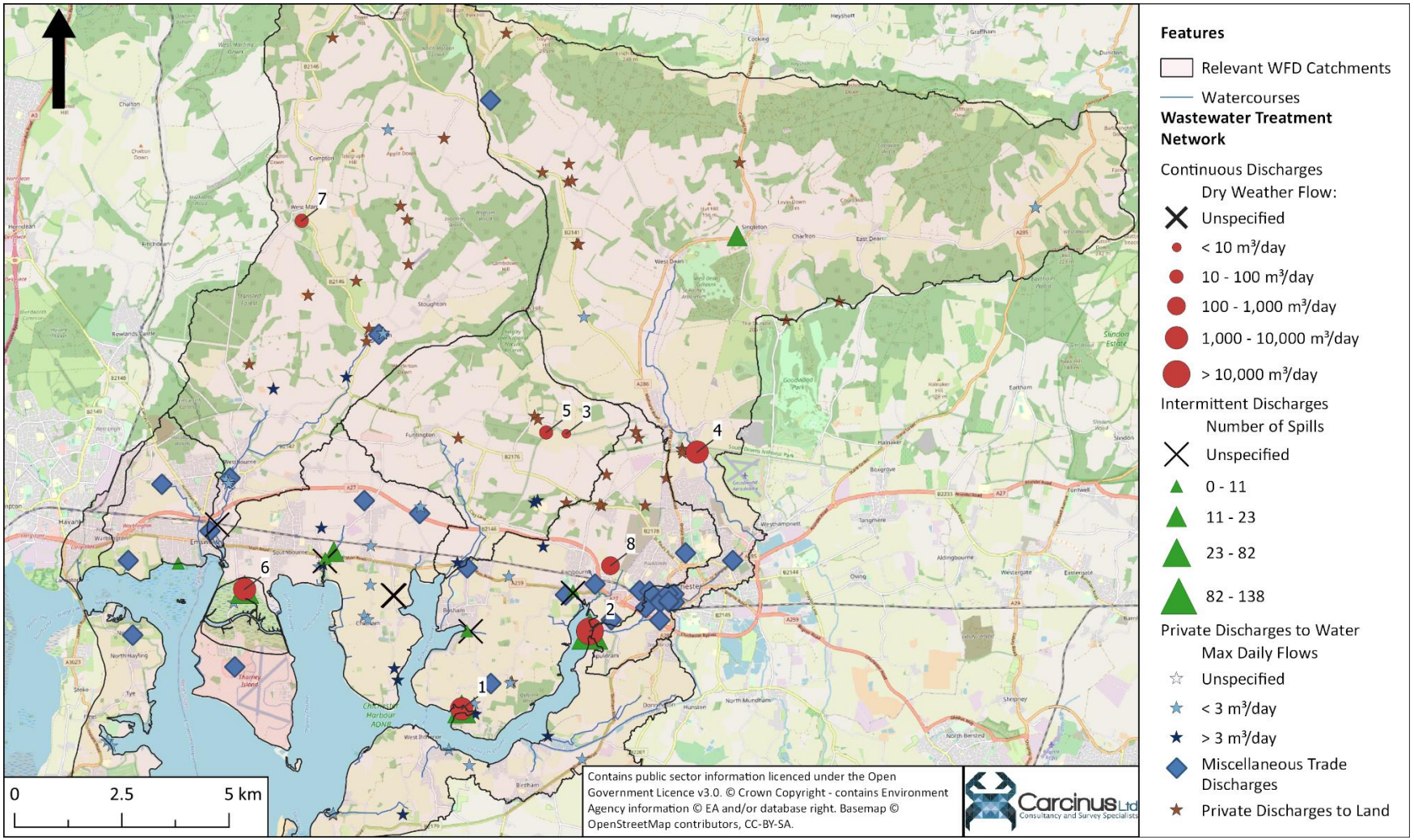

Figure 3.2 Locations of all consented discharges in the Chichester Harbour catchment. Labels refer to continuous discharges, details of which can be found in Table 3.1.

In addition to the continuous discharges, the original sanitary survey identified a total of 18 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 Asset Management Plans (AMP)6 and 7, (five-year periods that water companies use to plan performance upgrades etc.) Event Duration Monitoring (EDM) was installed at several of the discharges within the Harbour's 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 I. The EDM data were found to have multiple datapoints of the number of spills and the sum of spilling hours, and so before the dataset could be joined to the main consented discharge database, the data were pooled by both Discharge Name (i.e. Sewage Treatment Works) and Folio (Permit) Number. Following this, the single datapoint for each discharge was joined to the main discharge database using the permit number. Beyond the data processing 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 intermittent spill monitoring data from five discharges, and the values for both the total number of spill events recorded and the mean duration of a spill event are approximately similar. EDM technology has since been fitted to a number of other discharges within the catchment, although the data from these indicate that spill events are less frequent than at Bosham STW, Chichester STW and the Taylors Lane Bosham WWPS. Consultation with the Environment Agency indicated that UV disinfection was installed on the Chichester WwTW storm discharge in March 2014, which will likely significantly reduce the contamination caused by spills from this point. An issue with a defective manhole chamber on Hayling Island was resolved in 2017, and monitoring has indicated a reduction in contamination from the associated outfall. An Environment Agency investigation into intermittent discharges from wastewater treatment works and CSOs was carried out from 2010 – 2015 lead to prosecution of Southern Water Services Limited. This investigation showed that Bosham, Chichester and Thornham WwTWs allowed 468 spills for a total of 14,279 hours in the period studied. There is no evidence of additional spills since then, although it may still be the case that intermittent discharges are causing more contamination than expected, and additional consideration should be given to the proximity of an intermittent discharge to a CZ in any updated sampling plan.

Finally, the original sanitary survey presents the details of 18 private discharges with permitted maximum discharges above 5 m^3 / day. These discharges all remain, although most are located in the upper reaches of the catchment and so will contribute

contamination to watercourses upstream of the Harbour. Some other private discharges are located around the Harbour, although most have small permitted maximum daily flows and are so unlikely to contribute significant levels of contamination to the BMPA.

There have been no significant changes to any of the continuous discharges within the catchment, and the EDM from the years prior to the original sanitary survey and this review indicate a similar spill frequency. However, an Environment Agency investigation between 2010 and 2015 revealed that the spill frequency was much greater than originally reported. Whilst there is no evidence of additional spills since the investigation was completed, consideration should be given to the proximity of an intermittent discharge to a CZ in any updated sampling plan.

3.3 Agricultural Sources

Figure 3.1 indicates that a significant area of the catchment remains reserved for pasture, particularly in the upper reaches. Figure 3.3 and Table 3.2 show the changes in livestock populations wholly or partially contained within the Chichester Harbour catchment from 2013 to 2016 (no more recent data are available) (Defra, 2018). As only a small proportion of some of the districts fall within the catchment, the livestock data have been adjusted to reflect the proportion of each district that is contained within the catchment. This assumes that the livestock are distributed uniformly, and therefore some inaccuracies may be present.

Overall, livestock populations increased by 35.46% between 2013 and 2016, and only one district (East Hampshire) showed a decrease in livestock populations in that period. Havant showed the largest increase, with the total population more than doubling. The group that showed the largest increase in population was poultry, increasing by 117.67% and becoming the dominant species in terms of population size. Overall livestock density did not change particularly in the time period and remains relatively low at 1.2 animals per hectare.

The principal route of contamination of coastal waters by livestock is surface run-off carrying faecal matter. Based on 2018 land cover data (Figure 3.1), there are several areas of pasture situated immediately adjacent to the harbour, particularly on Hayling Island and Thorney Island. Whilst the overall effect of this form of contamination is likely to be relatively minor, point source impacts may occur following high rainfall events, particularly following a prolonged dry period. The locations and extents of the pasture adjacent to the BMPA have not changed noticeably since the original sanitary survey was published. Information provided by the Environment Agency on previous EA investigations into sources and routes of faecal contamination around Thorney Island indicated that some of the identified *E. coli* is of ruminant (cattle) origin. The livestock population within the catchment will also vary throughout the year, with the largest population (and associated magnitude of contamination) occurring during Spring and smallest (and lowest magnitude of contamination) during Autumn and Winter when animals are sent to market.

Livestock populations have risen within the catchment, although the locations and extent of land reserved to pasture has not changed significantly and livestock densities remain low. As

such the probable routes of contamination, and the risk of pollution from this source, remain similar to those conditions described in the original sanitary survey. As such, the recommendations made in that document in terms of RMP location remain valid.

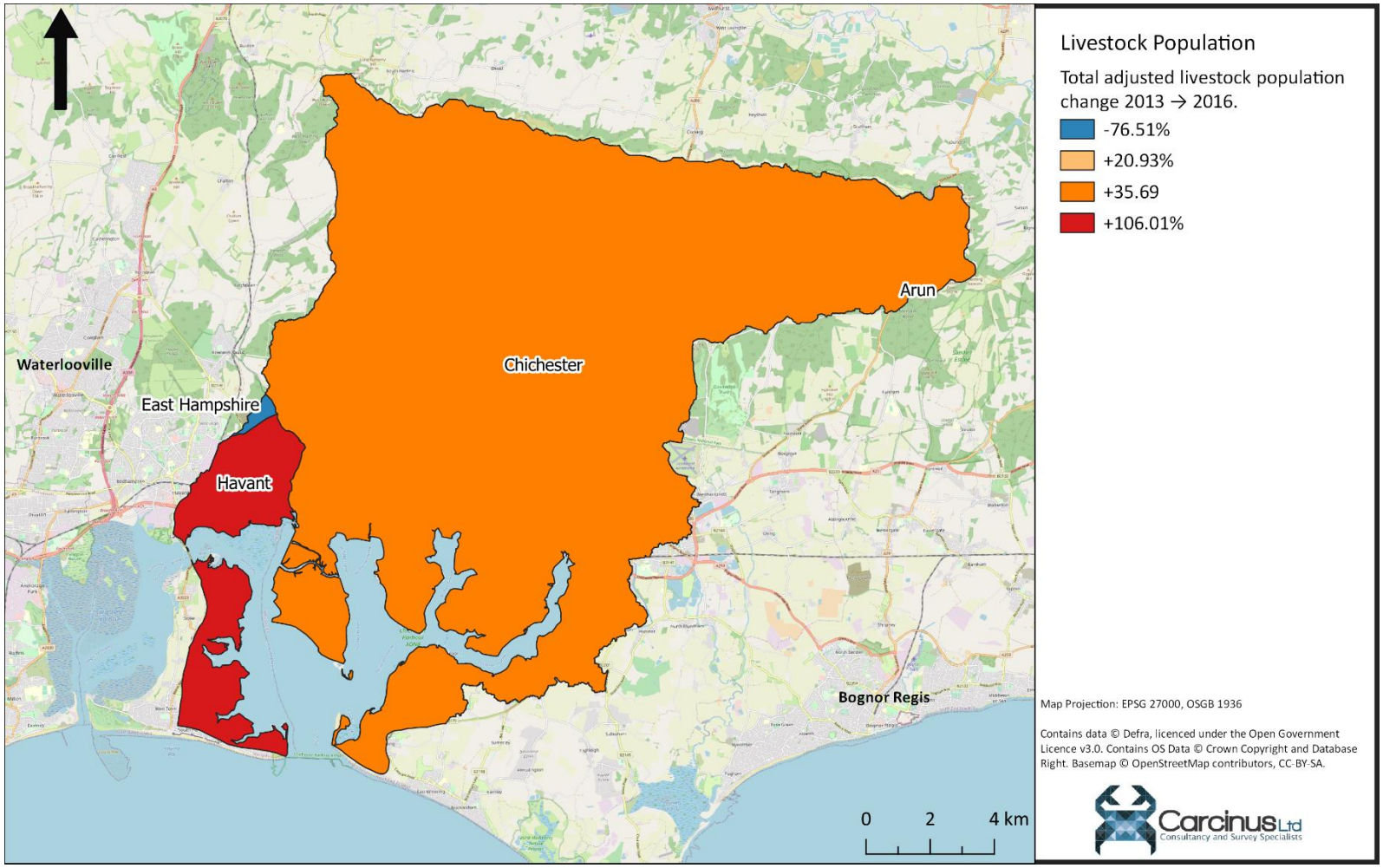

Figure 3.3 Livestock population change in Local Authority Districts (2016 Boundaries) within or partially within the Chichester Harbour catchment.

Table 3.2 Changes in livestock populations for Local Authority Districts wholly or partially contained within the Chichester Harbour catchment between 2013 and 2016.

LAD Name	Total LAD Area (Ha)	A w/in (Ha)	% Within Catchment	% of Catchment	Cattle			Sheep			Pigs			Poultry		
					2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
East Hampshire	51,477.4	56.9	0.110%	0.225%	11	10	-13.57%	41	33	-20.36%	6	3	-52.04%	234	23	-90.02%
Havant*	19,532.0	1,832.5	9.382%	7.263%	173	103	-40.73%	0	30	N/A	0	0	N/A	200	637	218.46%
Chichester	78,671.3	23,341.1	29.669%	92.509%	5,448	4,813	-11.64%	11,812	10,779	-8.75%	2,862	4,800	67.70%	8,082	17,879	121.21%
Arun**	29,538.0	0.9	0.003%	0.004%	0	0	-1.92%	0	1	45.64%	0	0	-34.90%	1	1	10.49%

LAD Name	Total LAD Area (Ha)	A w/in (Ha)	% Within Catchment	% of Catchment	Cattle			Sheep			Pigs			Poultry		
					2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
TOTAL	179,218.7	25,231.3	14.079%	100.000%	5,632	4,926	-12.54%	11,854	10,842	-8.54%	2,868	4,803	67.45%	8,517	18,540	117.67%

*As Portsmouth & Gosport & Fareham & Havant **As Adur & Arun & Worthing

3.4 Wildlife

Chichester Harbour contains a variety of natural habitats that support a significant diversity of wildlife species. As a result of this, the harbour and surrounding areas are conferred protection under a variety of statutory designations, including as a Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and Area of Outstanding Natural Beauty (AONB).

The justification for some of these designations is due to the presence of seagrass (*Zostera* spp.) habitats within the harbour. As a result of this, the Sussex IFCA have imposed the Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method Byelaw[5]. This byelaw prohibits the use of bottom towed gear, hand gathering or digging in several specified areas across the harbour.

Additionally, these designations are due in part to the significant populations of overwintering waterbirds. These species represent a potentially significant source of faecal contamination to BMPAs as they typically forage for food and defecate directly on shellfish beds. In the five winters to 2012/2013, the average count of overwintering birds was 49,457 (Austin *et al.*, 2014). In the five winters to 2019/2020 (the most recent for which data are available), the average count was 41,881 (a decrease of 15.32%) and included internationally significant populations of Brent Goose and nationally significant populations of Shelduck, Curlew and Dunlin, amongst others. Whilst the faecal contamination from this species could be a significant cause of bacteriological contamination of the shellfishery, the precise distribution of the animals will vary from year to year, as it is driven by the distribution of their prey. As a result of this, the original sanitary survey did not make recommendations for RMP location based on waterbird populations, and neither does this review.

There remains a small resident population of harbour seals (*Phoca vitulina*) in Chichester Harbour (Thompson *et al.*, 2019). There could be some point source impacts near to their haul-out site on the intertidal mudflats, however the spatial variability in foraging behaviour (and therefore defecation) means that the overall contamination caused by this species is likely to be minor, and therefore does not require further consideration in any updated sampling plan.

Waterbird populations are the main group likely to contribute significant amounts of bacteriological contamination to the BMPA, although 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 discharge of sewage from boats is a potentially significant source of bacteriological contamination of shellfisheries within the Chichester Harbour BMPA. Boating activities within the harbour 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 3.4.

Chichester Harbour is extremely popular with recreational boat users/owners; the original sanitary survey describes that there are around 2,250 berths for pleasure craft within the harbour across the various marinas. The 2019 – 2024 Chichester Harbour Management Plan (Chichester Harbour Conservancy, 2019) states that the harbour sustains approximately 5,200 marina berths and moorings and has a resident fleet of 10,500 boats. There are two pump-out facilities within the harbour, one at the Harbour Office, Itchenor and one at Premier Marina, Chichester (Chichester Harbour Conservancy, 2021b). This is one more location than reported in the original sanitary survey. Despite this, vessels large enough to contain on-board toilets are liable to make overboard discharges from time to time, particularly when transiting through the main navigational channels or when moored overnight away from the marinas. Given the level of pleasure craft activity within the harbour, contamination from this source could be a significant source of pollution. Details of EA investigations into poor water quality around Northney Marina provided during initial consultation indicated that EA officers believed that sporadic contamination from boats may be a cause of poor results from cockle beds in the north of the harbour. Despite this, because it is difficult to predict the location, timing and volume of any such discharges, it is difficult to define RMP locations to capture this source of pollution. However, consideration should be given to a density of moorings within a Classification Zone, if no other point sources of contamination exist.

The harbour also maintains a small but active fishing fleet (Chichester Harbour Conservancy, 2019), although there are still no commercial ports within the harbour meaning that merchant shipping vessels are unlikely to enter. Furthermore, no changes to the legislation governing discharges from commercial vessels have occurred, and they are prohibited from making overboard discharges within 3 nm of land[6], so it is very unlikely that there will be any impact from this source.

Whilst Chichester Harbour is exceptionally popular with pleasure craft users, there is no evidence that the main locations for this, or the volume of use has changed significantly since the original sanitary survey. The number of pleasure craft users is still likely to be highest during the summer months, and the associated risk is therefore also highest at this time of year. No additional weighting to this source of contamination is therefore required from this review.

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

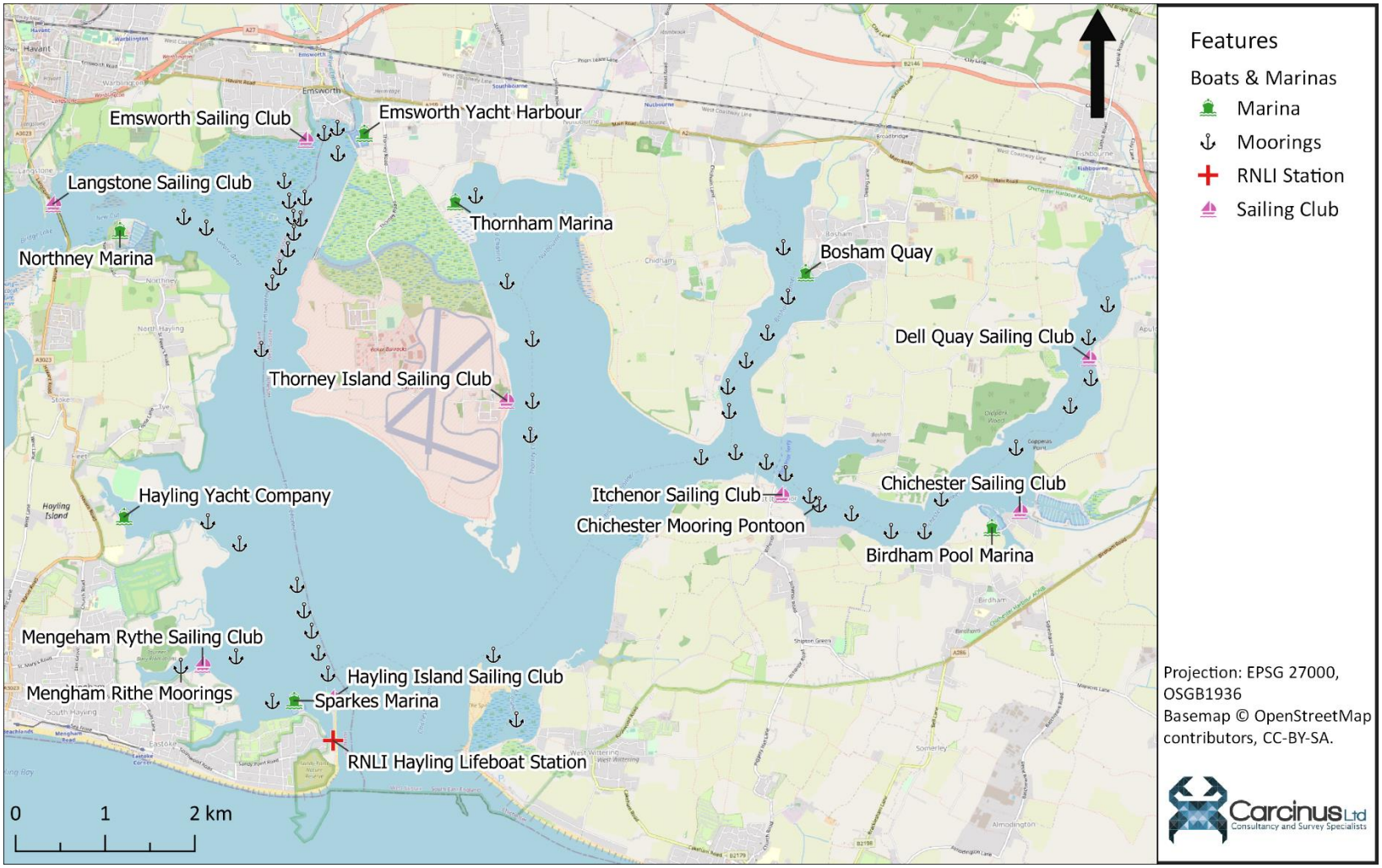

Figure 3.4 Locations of moorings, marinas and other boating activities within Chichester Harbour.

3.6 Other Sources of Contamination

Urban fabric within the catchment remains located in two main areas, on the northern side of the harbour (Emsworth & Chichester) and on the western side (Hayling Island). These settlements close to the waterbody remain a greater risk of diffuse microbiological contamination through utility misconnections and dog fouling. Land cover maps (Figure 3.1) indicate that the geographical extent of these settlements has increased slightly since the original sanitary survey was published, and so the risk that they pose is slightly elevated, although as the contamination is diffuse it is difficult to define an RMP to capture it, other than to follow a general trend of locating RMPs on the shoreline side of Classification Zones.

There are a number of advertised walks around Chichester Harbour, many of which follow paths that run immediately adjacent to the shoreline (Chichester Harbour Conservancy, 2021c), meaning that there may be some impact from dog fouling in the nearshore zone. The extent of this source of contamination is not assessed to have changed significantly since the original survey was published.

No evidence of significant changes to these sources of contamination exists, other than a slight increase in the geographic extent of some areas of urban fabric. 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

The overall structure of Chichester Harbour has not changed significantly since the original sanitary survey; it remains a shallow semi-enclosed tidal inlet with four main channels (Emworth, Thorney, Thornham and Chichester Channels). Figure 4.1 presents an illustration of sediment (and therefore water movement) around Chichester Harbour, and indicates that sediment generally moves into the harbour and into the deeper waters in the mid channels. Tides in the region will generally flood north up the main channels and south out to sea. Ebbing tides at the entrance to the Harbour can travel at up to 6 knots during spring tides (Chichester Harbour Conservancy, 2021a). Near the mouth of the Harbour, pollution sources will be transported over a wider area than in the shallow channels in the North side of the Harbour, where contamination will not be dispersed as readily.

There is no evidence that the patterns of water circulation around the harbour have changed significantly since the original sanitary survey was published. As such, the recommendations made in the original sanitary survey to account for tidal patterns and hydrodynamics remain valid.

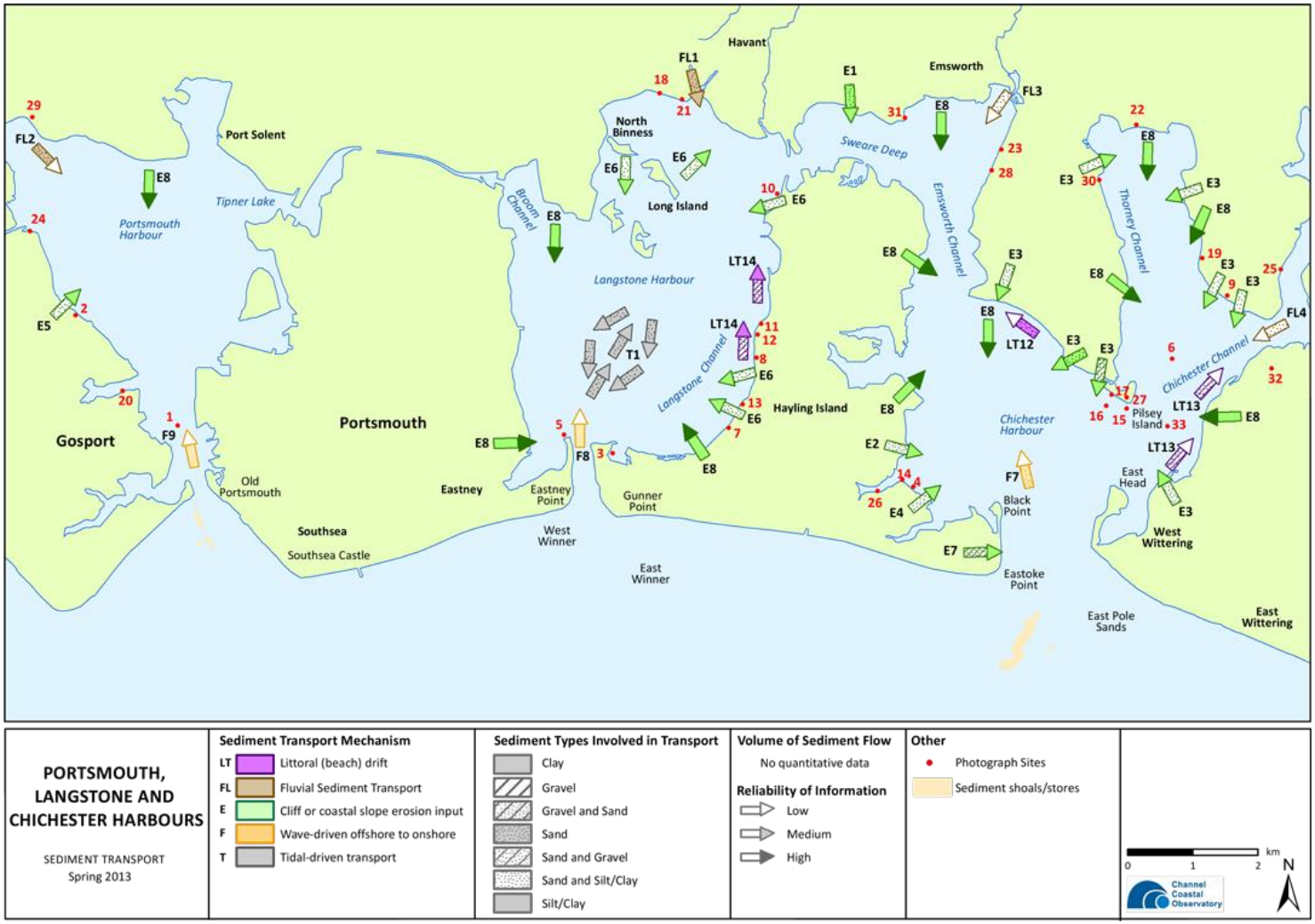

Figure 4.1 Sediment transport around Chichester, Langstone and Portsmouth Harbours (SCOPAC, 2013).

5 Rainfall

Rainfall data for the Ems at Westbourne monitoring station (NGR: SU755073) from 2008 – 2012 (pre sanitary survey) and 2013 – 2017 (post sanitary survey) were taken from the National River Flow Archives (NRFA)[7] (NRFA, 2021) and processed in R (R Core Team, 2020) using the 'rnrfa' package (Vitolo, 2016). These data were used to determine whether any changes in rainfall patterns had occurred since the original sanitary survey. The monitoring results are summarised in Table 5.1 and the mean daily rainfall per month between the 2008 – 2012 and 2013 – 2017 periods are presented in Figure 5.1.

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

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days > 10 mm	% Days > 20 mm
2008 - 2012	1005.50	46.96	28.35	18.66
2013 - 2017	997.78	45.24	30.39	18.73

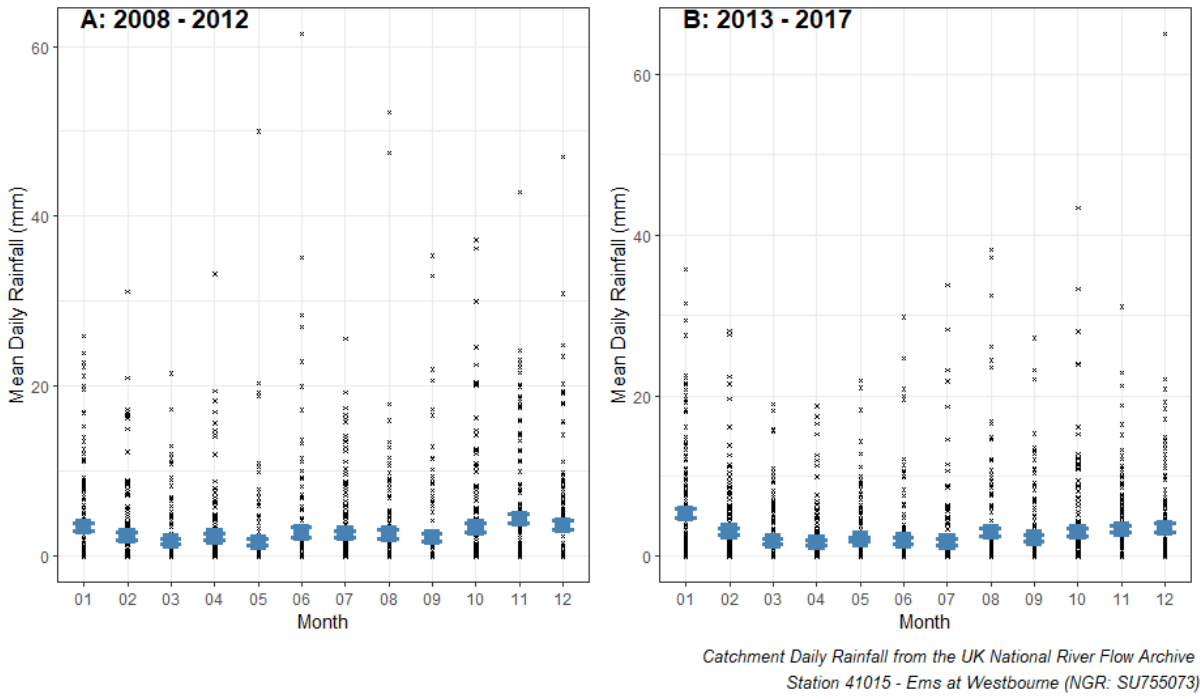

Figure 5.1 Mean daily rainfall (mm) per month for the Ems at Westbourne (NGR: SU755073) monitoring station for the period (A) 2008 - 2012 and (B) 2013 - 2017.

Whilst rainfall has fallen slightly since the original sanitary survey was published, two sample t-tests indicated that there was no significant difference (p = 0.812) in the mean daily rainfall per month between the 2008 – 2012 and 2013 – 2017 periods.

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

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 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

A total of eight RMPs have been sampled within the Chichester Harbour BMPA since the original sanitary survey was published, five of which involved sampling of native oysters (*Ostrea edulis*), two of cockles (*Cerastoderma edule*) and one of *Tapes* spp. clams. Of these RMPs, only one (Thorney Outfall, B018H) was sampled prior to the original sanitary survey being published. Sampling three RMPs began immediately after the original sanitary survey (Dell Quay (B018J) and Cobnor (B018K) in December 2013 and Emsworth (B018M) in February 2014. Sampling at Thorney Lower (B018Q) began in June 2018 and was stopped in July 2020. This RMP was proposed to classify a new native oyster CZ (*Thorney Lower*) within the Thorney Channel whilst the *Thorney Channel* zone was prohibited (Carcinus, 2018). Sampling at the two cockle RMPs (Northney Marina (B018N) and Hambrook (B018O)) began in summer 2016 and was stopped in September 2018 and May 2016 respectively following a series of high results. The latter is in the same location as the Hambrook *Tapes* RMP (B018P), sampling at which began around the time that sampling at the cockle RMP (B018O) stopped .The geometric mean results of Official Control monitoring at these RMPs 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 datahub only presents the data of RMPs where a sample has been collected in the last five years and so it is possible that monitoring data for other locations exists, but it is not considered in this report.

There are fairly sizeable differences in the geometric mean *E. coli* levels at RMPs across the BMPA, with the mean result at Northney Marina (B018N) being more than 11,000 MPN/100 g, more than double the value from any other RMP. More than 13% of the results from this RMP have been above the middle threshold of 4,600 MPN/100 g nearly 5% of results have exceeded 46,000 MPN/100 g, the highest threshold in the FSA's classification protocol. Two RMPs (Emsworth (B018M) and Cobnor (B018K)) have mean values of <1,000 MPN/100 g. Generally, the RMPs are located in separate channels within the harbour, and it is clear that Thorney Channel has elevated levels of contamination relative to the other channels of the harbour. It is also apparent that RMPs located nearer to shorelines have returned higher monitoring results, and so if no other point sources exist a general recommendation of locating RMPs at the nearshore side of CZs is given.

Environment Agency officers undertook investigations around the Hambrook Channel from 2016 – 2018, following high monitoring results in the upper Thornham Channel (Hambrook RMPs). However, these investigations did not identify any sources of pollution, and the

RMPs are not currently monitored and harvesting of shellfish in the area is currently prohibited. EA officers also conducted monitoring around Northney Marina in 2017 and 2018, following a string of high results from the RMP (B018N) in this location. Results from these investigations indicated that no land-based pollution was coming from the marina or Hayling island. The EA suspect that the poor results may have been caused by sporadic boat waste discharges (Udal, Ian; *pers. comm.* 04 June 2021).

Figure 6.2 presents a boxplot of *E. coli* monitoring results from native oyster RMPs within the Chichester Harbour BMPA. One-way analyses of variance (ANOVA) tests were used to investigate the statistical significance of any differences between monitoring results from the various RMPs. All statistical analysis described in this section was undertaken in R (R Core Team, 2020). Despite some visual differences in the mean values, the tests indicated that there were no significant differences between the monitoring results ($p = 0.147$). This could be due to large variance in the data, where even though the Thorney Outfall (B018H) RMP has a higher mean, frequent low results at this RMP have also occurred.

Figure 6.3 presents the boxplots of monitoring results from cockle RMPs within the Chichester Harbour BMPA. ANOVA testing indicated that there is no significant difference between the monitoring results from the two RMPs ($p = 0.448$). The boxplot of monitoring results from the Hambrook *Tapes* RMP is presented in Figure 6.4. It is not appropriate to compare the results from RMPs for different species due to the variation in rates of *E. coli* up-take by different species.

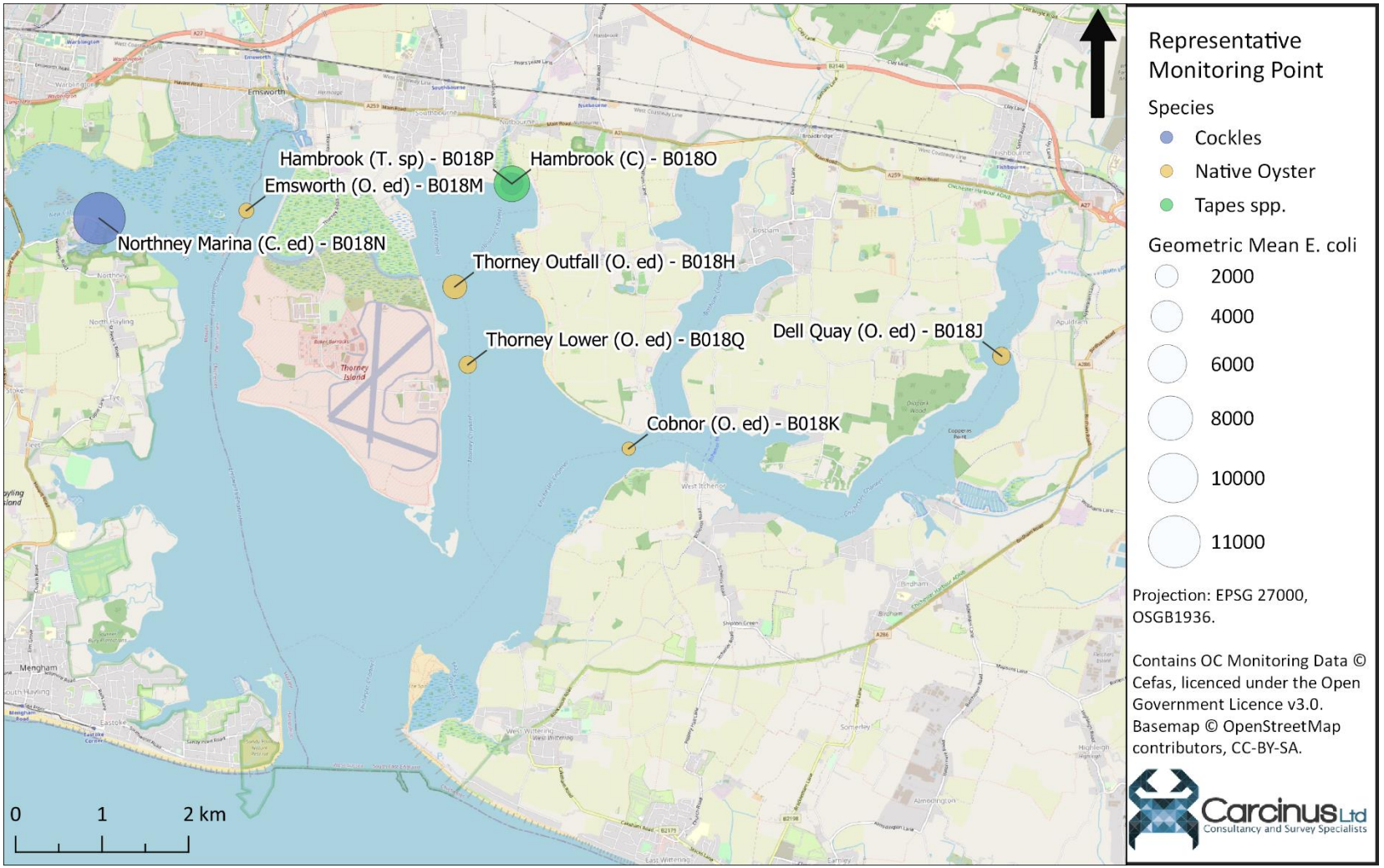

Figure 6.1 Geometric mean E. coli monitoring results from Official Control monitoring at bivalve RMPs within the Chichester Harbour BMPA.

Table 6.1 Summary statistics of E. coli (MPN/100 g) from RMPs sampled since the original sanitary survey. Data cut of at June 2021.

							E. coli (MPN/100 g)					
ID	**BMCZ_Full**	**NGR**	**Species**	**No.**	**First Sample**	**Last Sample**	**Geometric Mean**	**Min Value**	**Max Value**	**% > 230**	**% >4,600**	**% > 46,000**
1	Thorney Outfall (O. ed) - B018H	SU77100360	Native Oyster	206	03/02/2003	09/06/2021	2242.71	18	92000	68.45	11.17	0.97
2	Dell Quay (O. ed) - B018J	SU83420280	Native Oyster	70	16/12/2013	09/06/2021	1115.74	18	17000	61.43	7.14	0.00
3	Cobnor (O. ed) - B018K	SU79110173	Native Oyster	69	16/12/2013	09/06/2021	524.32	40	5400	47.83	1.45	0.00
4	Emsworth (O. ed) - B018M	SU74690448	Native Oyster	84	03/02/2014	09/06/2021	720.58	18	9200	52.38	2.38	0.00
5	Northney Marina (C. ed) - B018N	SU72990439	Cockles	46	17/06/2014	03/09/2018	112420	20	490000	91.30	13.04	4.35
6	Hambrook (C) - B018O	SU77760479	Cockles	25	10/07/2014	05/05/2016	1786.32	20	7900	76.00	12.00	0
7	Hambrook (T. sp) - B018P	SU77760479	*Tapes* spp.	23	16/03/2016	21/05/2019	5237.39	220	54000	95.65	21.74	4.35
8	Thorney Lower (O. ed) - B018Q	SU77250270	Native Oyster	23	14/06/2018	20/07/2020	1078.48	45	7000	78.26	4.35	0.00

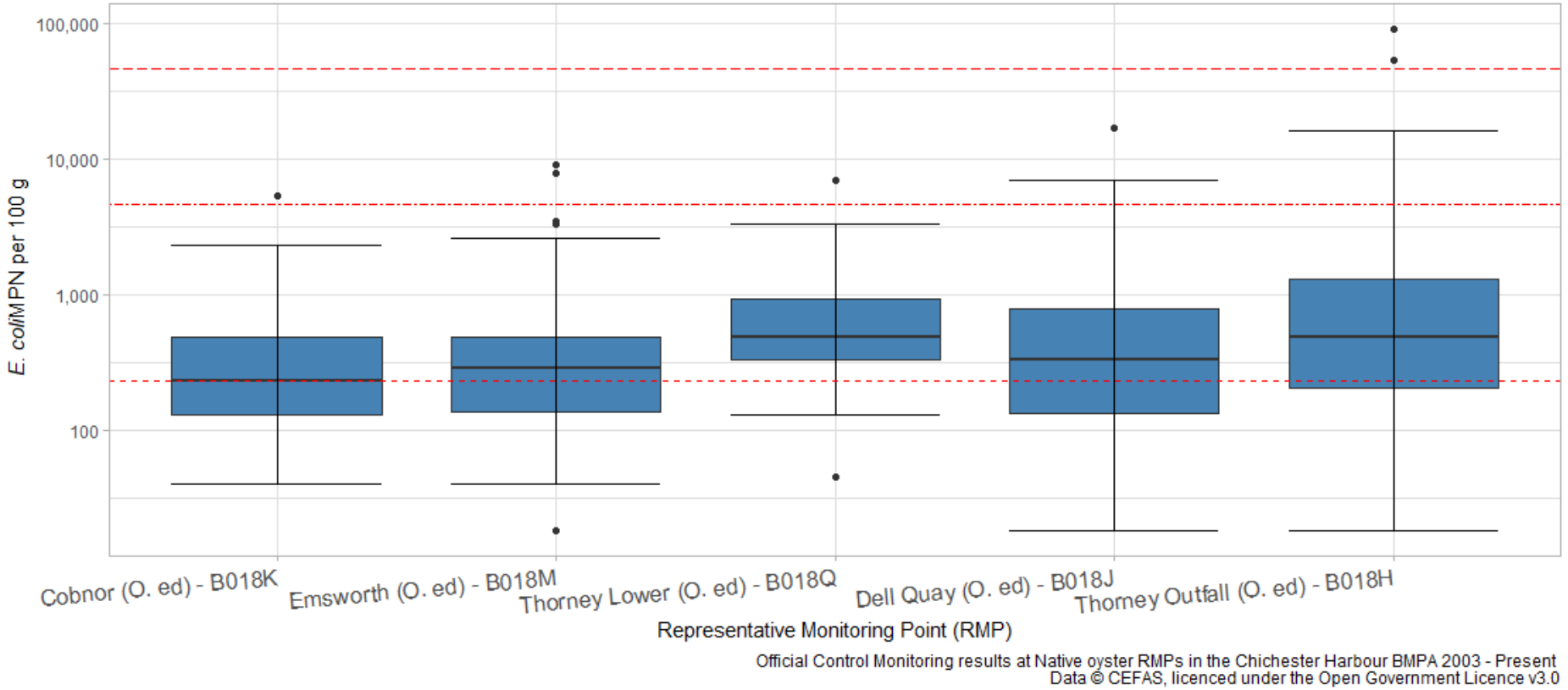

Figure 6.2 Boxplots of E. coli levels at native oyster RMPs sampled within the Chichester Harbour BMPA 2003 – Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum / maximum values excluding outliers (points >1.5 x the interquartile range).

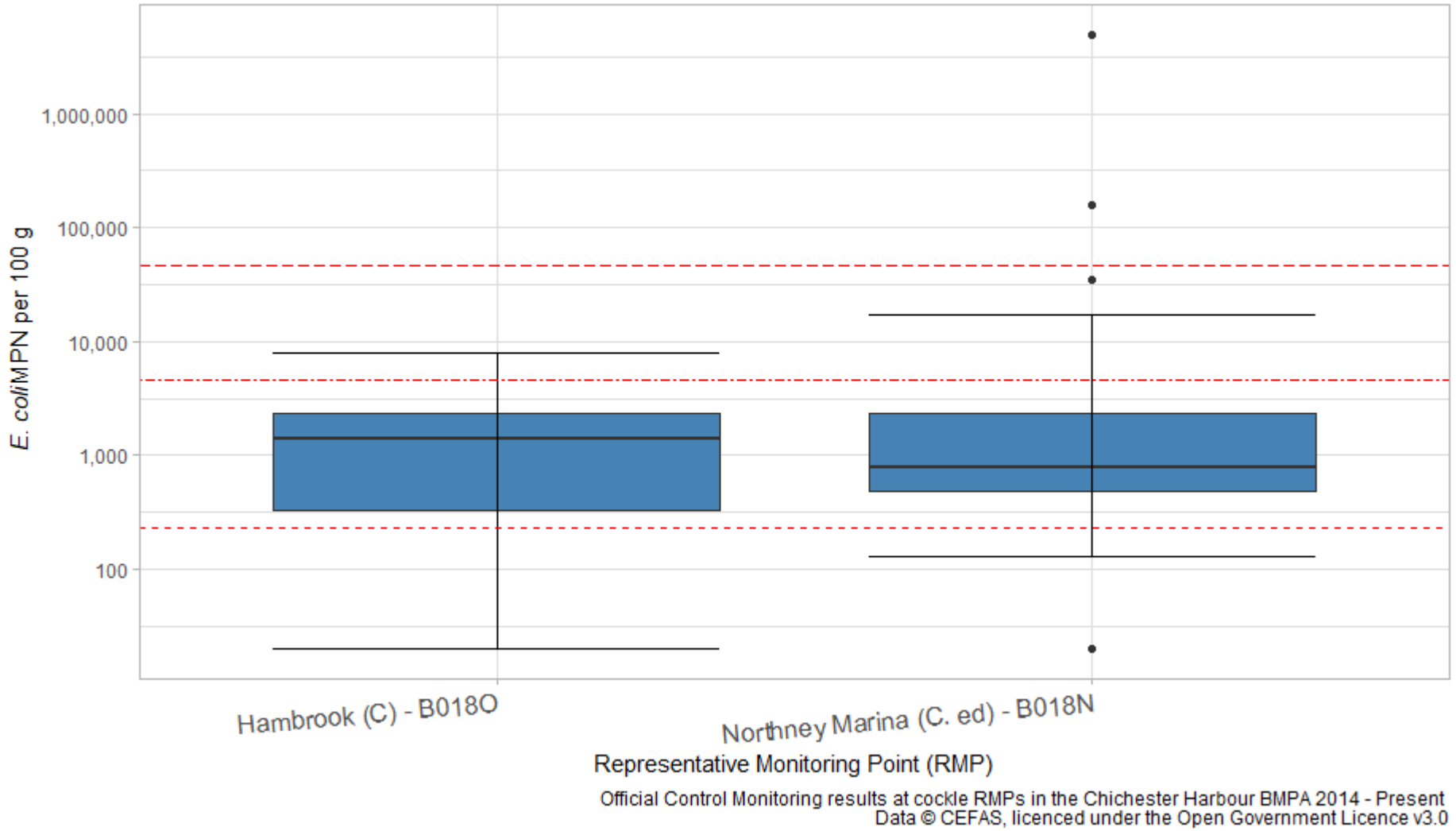

Figure 6.3 Boxplots of E. coli levels at cockle RMPs sampled within the Chichester Harbour BMPA 2014 – Present.

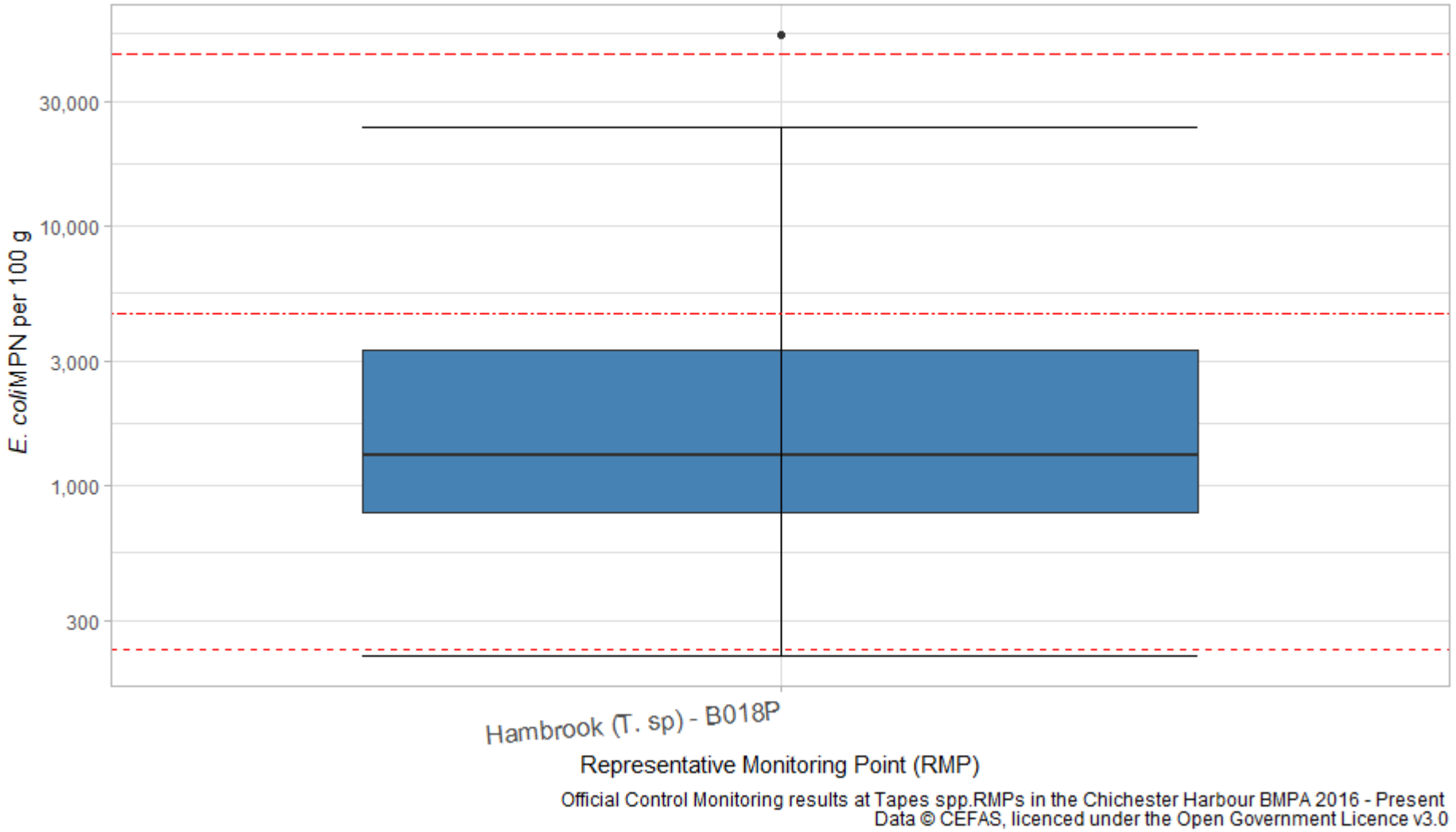

Figure 6.4 Boxplot of E. coli levels at Tapes spp. RMPs sampled within the Chichester Harbour BMPA 2016 - Present.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results from the native oyster RMPs sampled within the Chichester Harbour BMPA are shown in Figure 6.5.

The loess model fitted to the only RMP sampled prior to the original sanitary survey (Thorney Outfall (B018H)), shows relative stability, with a gradual increased from 2003 until a peak in 2015, after which the trend in results is one of decreasing *E. coli* levels. However, despite this the trend line still sits above all other RMPs sampled from the 2015 – mid-2020. After this point, the trend line from Dell Quay (B018J) sits above that of Thorney Outfall. When sampling at the Dell Quay (B018J), Cobnor (B018K) and Emsworth (B018M) began after the original sanitary survey, the trend lines show a rapid decrease to around the low threshold of 230 MPN/100 g and have remained relatively stable since then, although since 2020 as mentioned above, the trend in Dell Quay (B018J) results increased and the trend in results from Emsworth (B018M) shows falling results.

Figure 6.6 and Figure 6.7 present the timeseries of monitoring results from RMPs for cockles and *Tapes* spp. respectively. The monitoring results from Northney Marina (B018N) show a relatively stable trend, although occasional exceptionally high results are visible within the scatter plot. Results from Hambrook (B018O) a trend of decreasing monitoring results (i.e., improving water quality) until sampling stopped in May 2016. The monitoring results from the Hambrook (B018P) RMP begin with very low values, although the trend after this is very variable. No sampling at either the Northney Marina (B018N) and Hambrook (B018P) RMPs was undertaken over the winter of 2017/2018, following a string of high results. This gap in sampling may have skewed the loess model fitted to the data (Figure 6.7).

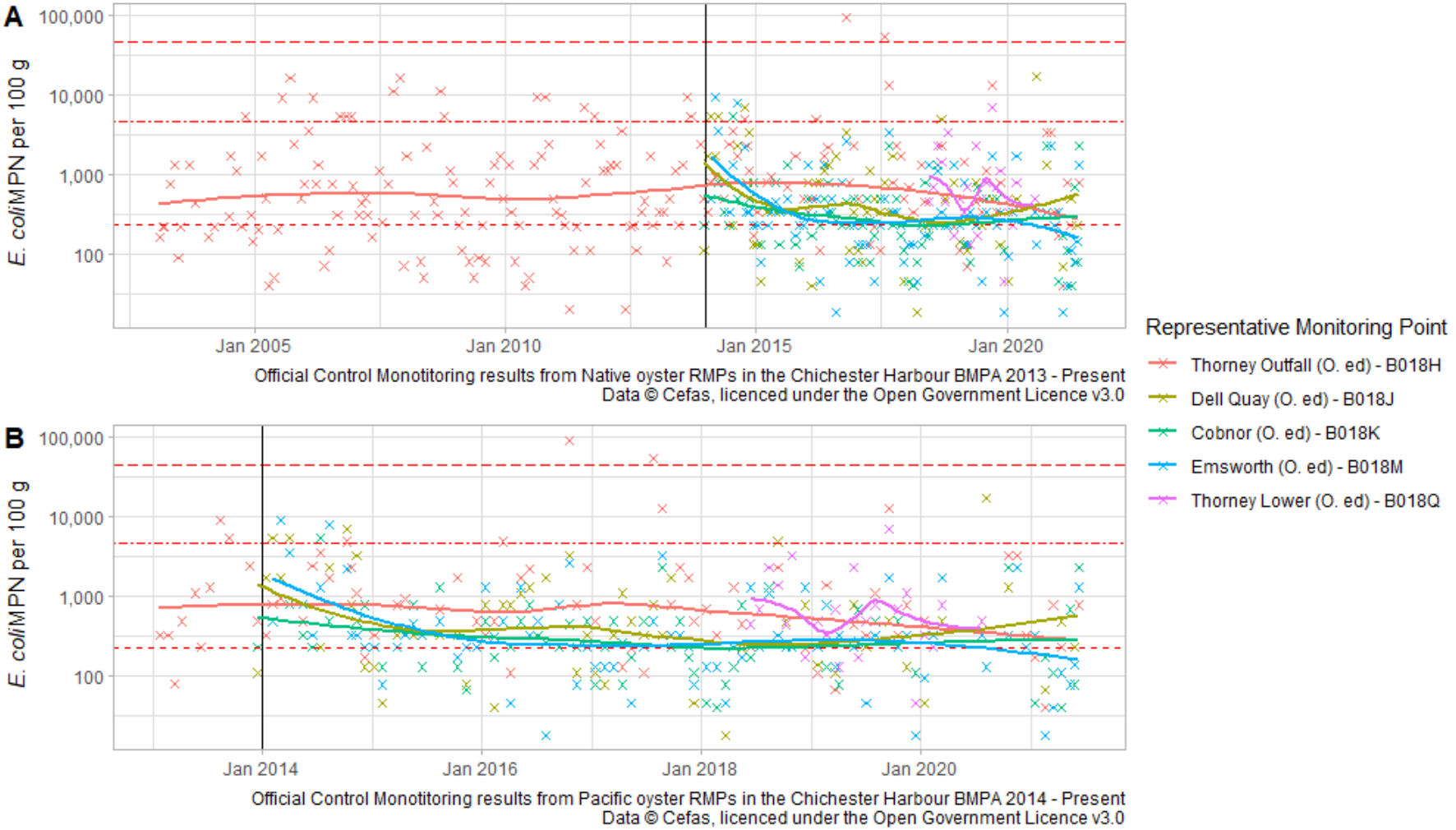

Figure 6.5 Timeseries of E. coli levels at native oyster RMPs sampled in the Chichester Harbour BMPA 2003 - Present. Scatter plots are overlaid within a loess model fitted to the data.

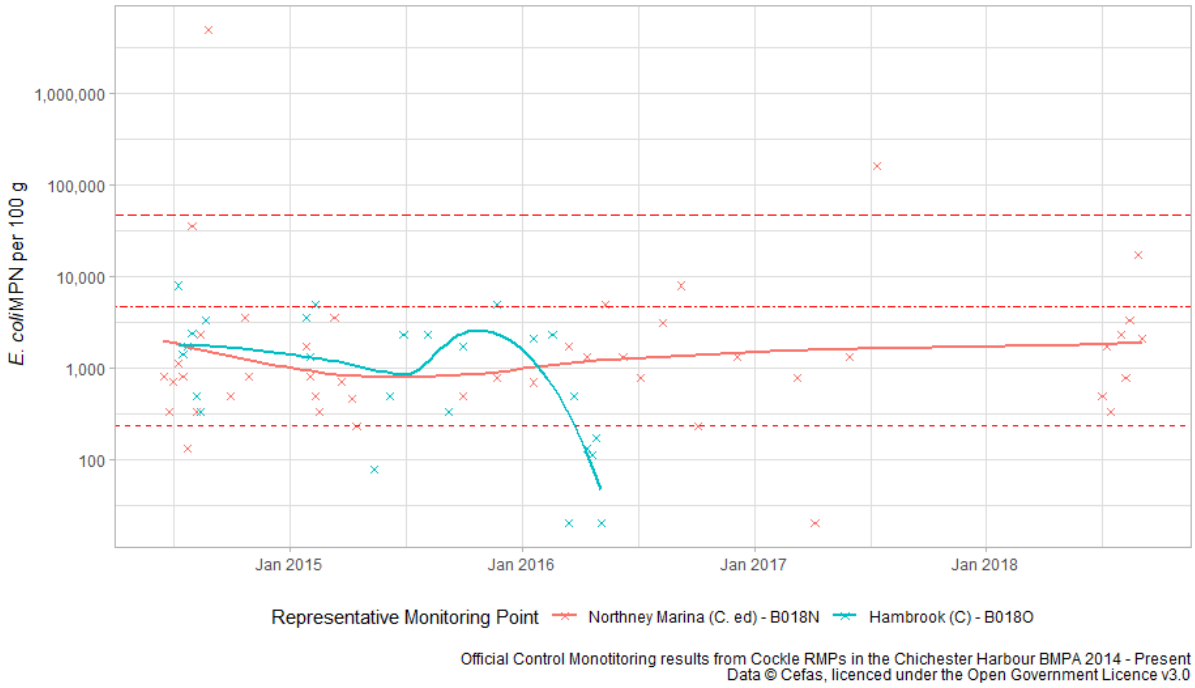

Figure 6.6 Timeseries of E. coli levels at cockle RMPs sampled in the Chichester Harbour BMPA 2014 - Present. Scatter plots are overlaid with a loess model fitted to the data.

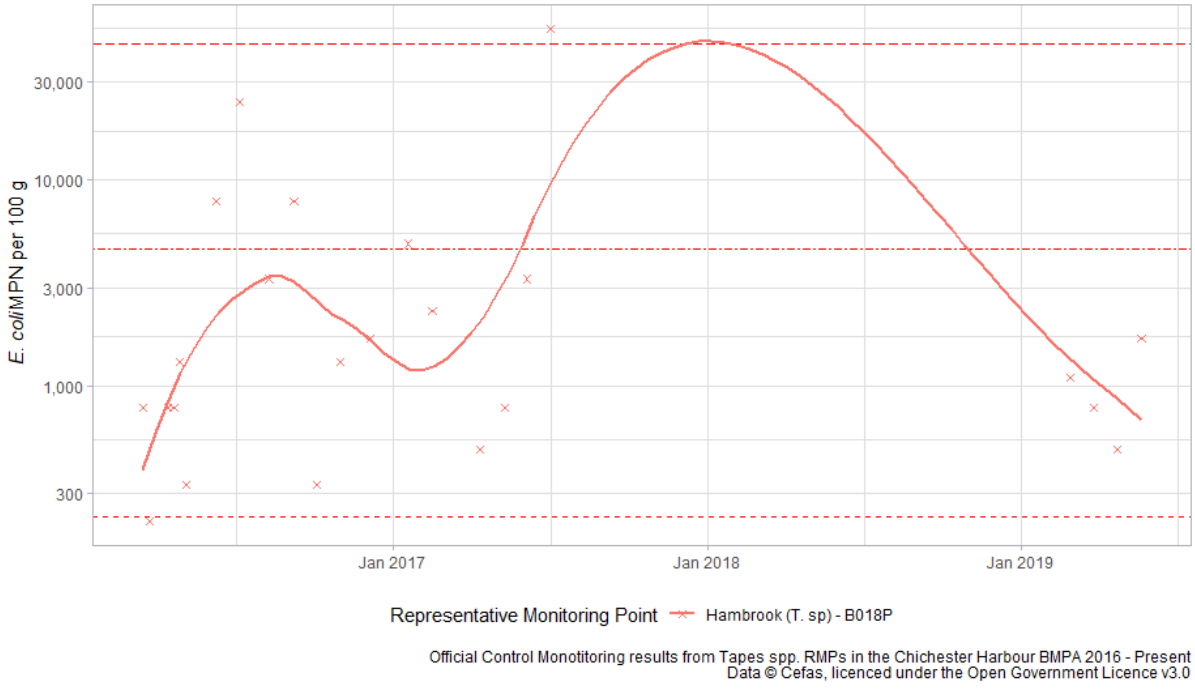

Figure 6.7 Timeseries of E. coli levels at Tapes spp. RMPs sampled within the Chichester Harbour BMPA 2016 – Present. Scatter plot is overlaid with a loess model fitted to the data.

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at the various RMPs within the Chichester Harbour BMPA were investigated and are presented in Figure 6.8. 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 was taken at the 0.05 level.

Two-way ANOVA tests revealed that results from Summer were significantly greater than those from Spring ($p = 0.00752$), but that no other significant differences were found either across native oyster RMPs or within the data from an individual RMP. The elevated values from summer may be due to the high levels of tourism (both on land and visiting pleasure craft) that use Chichester Harbour in summer months.

Figure 6.9 and Figure 6.10 show the seasonal patterns in *E. coli* results at cockle and *Tapes* RMPs respectively. Despite the results from summer months at the Northney Marina (B018N) RMP being much greater than the results from other times of year, and the results from Hambrook (B018O) being lower in spring than at other times of year, no seasonal differences were found when data from RMPs was either considered individually or pooled across RMPs.

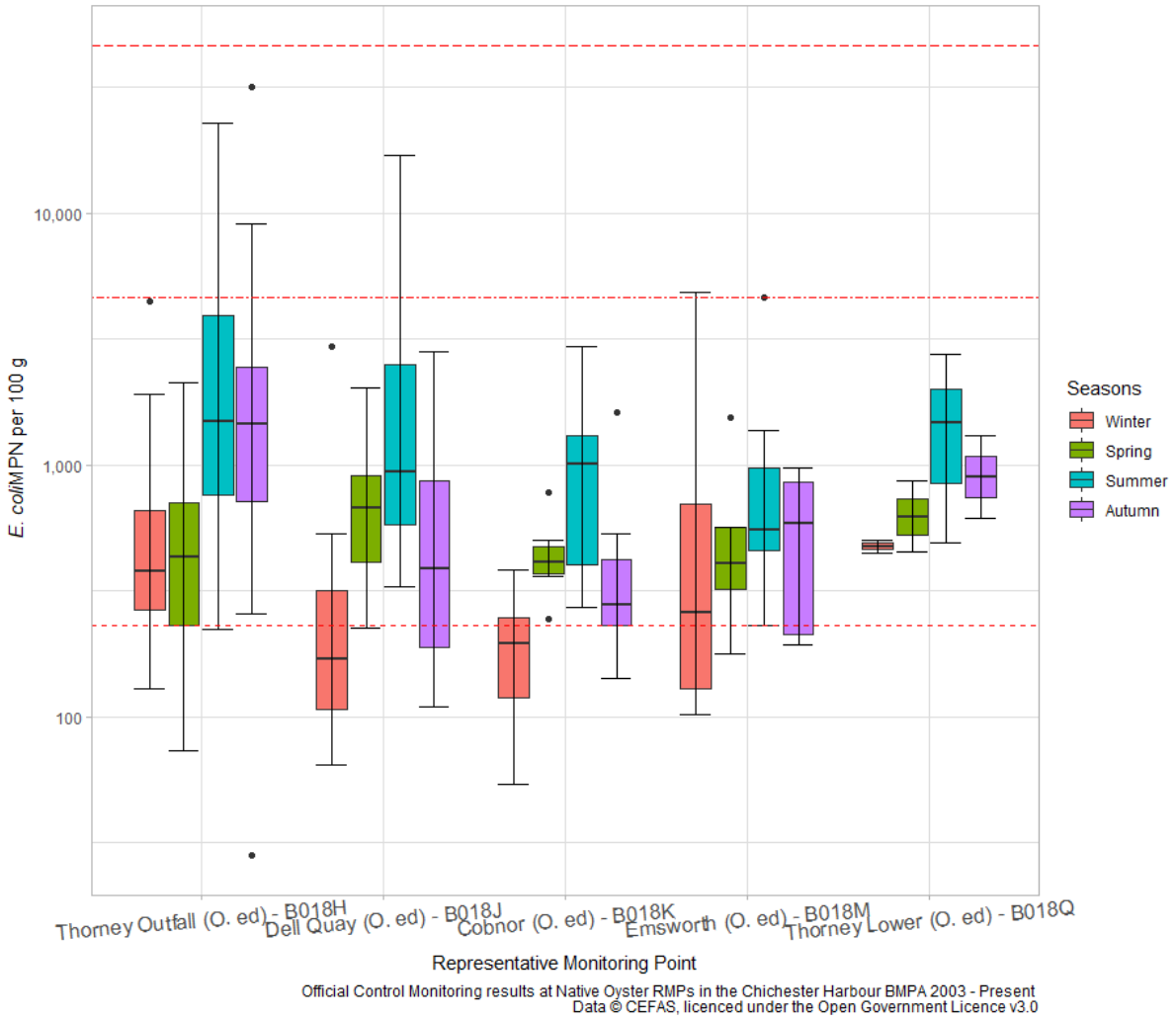

Figure 6.8 Boxplots of E. coli levels per season at native oyster RMPs sampled within the Chichester Harbour BMPA 2003 - Present.

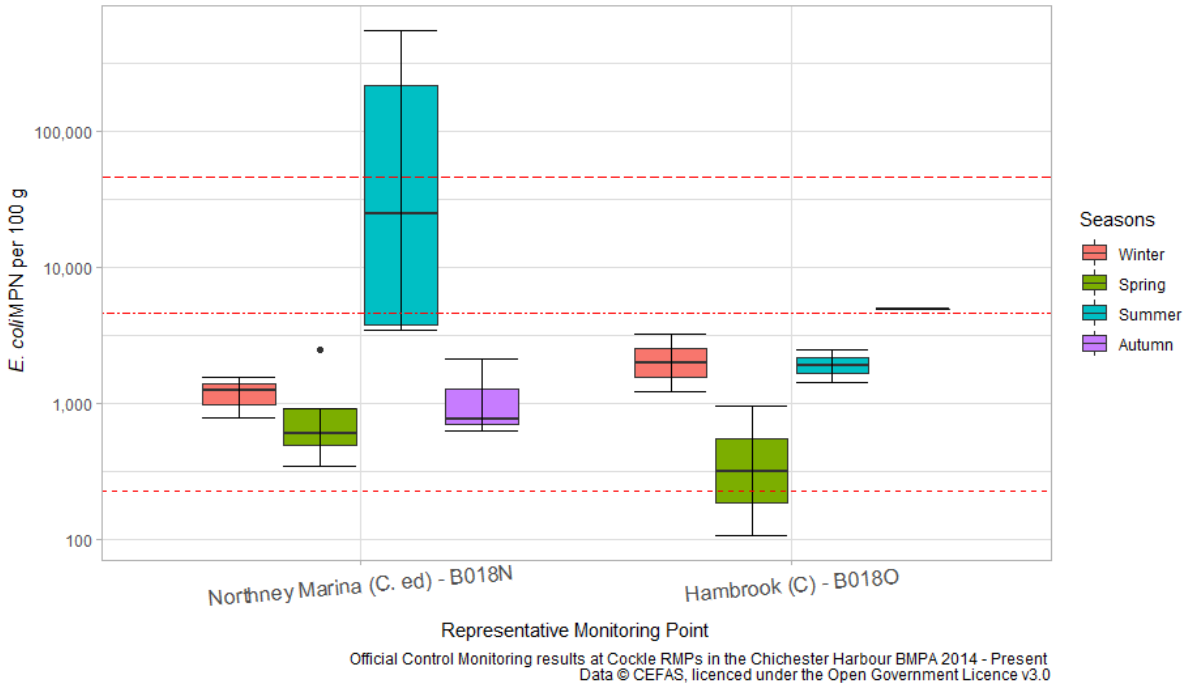

Figure 6.9 Boxplots of E. coli levels per season at cockle RMPs in the Chichester Harbour BMPA from 2014 – Present.

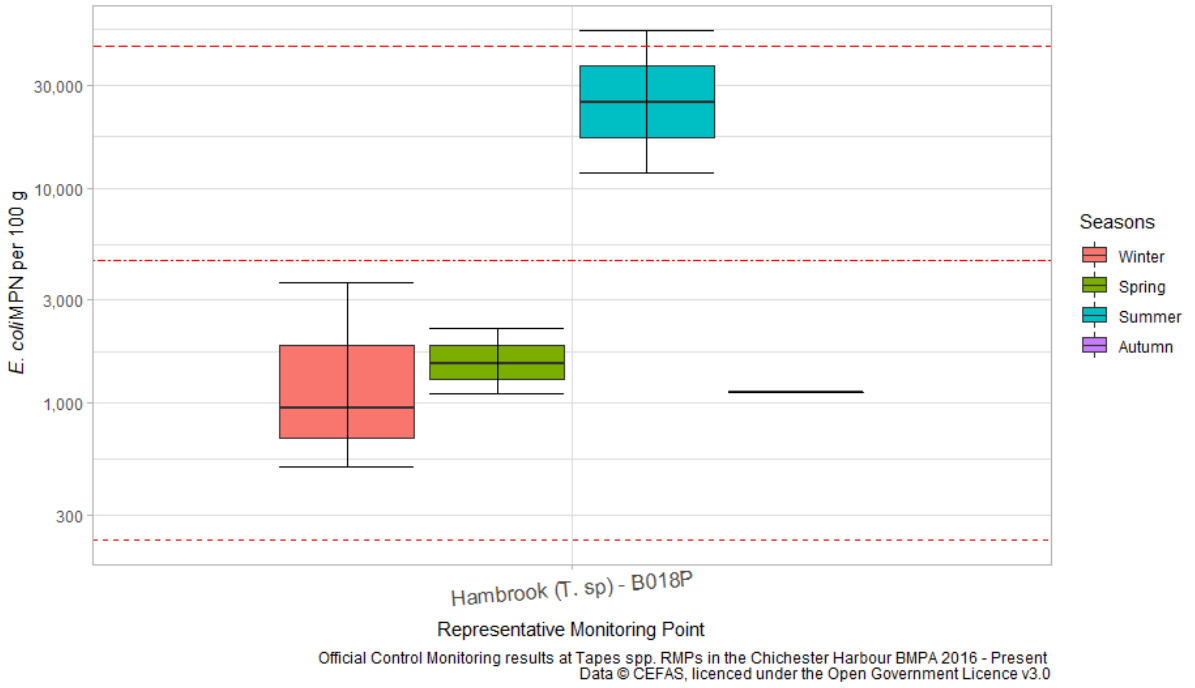

Figure 6.10 Boxplots of E. coli levels per season at Tapes spp. RMPs in the Chichester Harbour BMPA from 2016 - Present.

7 Conclusion and overall assessment

Chichester Harbour is a large, naturally occurring harbour on the south coast of England. The harbour is hydrologically connected to Langstone Harbour to the west and the Solent at

its mouth. It supports a natural oyster fishery, although the Sussex IFCA did not open the fishery for the 2020 – 2021 season to prevent over-exploitation due to a lack of stock. Currently, a large area of the harbour is classified, although the area has declined since the original sanitary survey was published.

No updated population data was available to the authors of this review, as the results of the March 2021 Census of the United Kingdom are not yet available. The UK Government estimates that the national population will have increased by 6.6% between 2011 and 2021, which would see the total population increase to 113,000 (based on the population estimated presented in the original sanitary survey). Land cover maps indicate that the main areas of urban fabric have not changed significantly, although the geographical extent of these settlements has increased slightly. Most of the catchment outside these areas remains rural, although population size increases will almost certainly have led to increases in sewage discharges and associated urban runoff through utility misconnections.

The original sanitary survey identified that of the eight active discharges at that time, only two were located within Chichester Harbour. No changes to either the treatment methodologies or the permitted discharge volume for these discharges have occurred, and only one additional discharge was identified. Comparisons of Event Duration Monitoring data indicates that (for those discharges where comparison is possible) the frequency of reported spills has remained similar, although an Environment Agency investigation found that the actual number of spills between 2010 – 2015 far exceeded the reported number, and so consideration should be given to the proximity of an intermittent discharge to any Classification Zone. In addition to these water company-owned discharges, there are a number of private discharges around the harbour, although most have relatively low permitted discharge volumes.

The total livestock population within the catchment was estimated to have increased by 35.6 % between 2013 and 2016 (no more recently collected livestock population are available). Whilst a relatively small proportion of the catchment is reserved for pasture, there are two areas (Hayling Island and Thorney Island) that have pasture immediately adjacent to the shoreline. These areas represent the highest risk of faecal contamination through runoff, and Environment Agency investigations into the sources of contamination around Thorney Island indicated the presence of ruminant (cattle) derived *E. coli* in samples. However, the risk of contamination is not considered to have increased particularly as the area of pasture has not changed significantly. Consideration should still be given to the pasture areas sitting next to the coast in any updated sampling plan.

Chichester Harbour contains internationally important habitats and wildlife and is conferred protection through a variety of national and international designations. Sussex IFCA, who regulate the fishery, prohibit fishing activity using any bottom-towed gear in several areas of the harbour as a result of this. The average count of overwintering waterbirds decreased by 15.32% between the five years to 2012/2013 and the five years to 2019/2020 (the most recent for which data are available). The large population of these birds (>40,000) that

remain do represent a potentially significant risk to the shellfishery, although the spatial and temporal variability in this source of pollution make it challenging to account for it in determining RMP positions.

Chichester Harbour is home to some 5,200 marina berths and moorings and is the registered location of 10,500 pleasure craft. Whilst there are several marinas throughout the harbour, only two provide pump-out facilities. As such, the number of vessels throughout the harbour means that overboard discharges are likely to occur fairly regularly, particularly during the summer months and in the main navigational channels. It is difficult to accurately define RMPs to capture this source of pollution without knowing the precise nature, timing and volume of any discharges, although in the absence of any point shoreline sources, consideration should be given to the proximity of mooring areas / navigational channels to classification zones. There is no commercial shipping activity to speak of within the Harbour, so the risk from these vessels is minimal and does not require additional consideration within any updated sampling plan.

A total of eight RMPs have been sampled since the original sanitary survey was published, one of which was sampled prior. RMPs in the upper reaches of the Harbour have returned higher *E. coli* monitoring results than those RMPs farther down; more than 13% of samples from Northney Marina (B018N) have been above 4,600 MPN/100 g and nearly 5% of results have been >46,000 MPN/100 g. Despite apparent differences in the mean results, no significant differences in the monitoring results from the RMPs from any species were found. When data were pooled into different seasons, monitoring results collected in summer were significantly greater than those collected in spring (for native oyster RMPs), perhaps due to the increased population during summer months caused by tourism to the region.

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 2013, 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

8.1 Sampling Plan

The original sanitary survey recommended the creation of nine Classification Zones, five for native oysters and two each for *Tapes* spp. clams and cockles. Currently, only two native oyster zones hold active classifications within the estuary. Recommendations for these Classification Zones are given below and are summarised in Table 8.1. Recommendations are also given for the Dell Quay (B018J) and Cobnor (B018K) RMPs, which are not used to

classify active CZs but are still sampled quarterly in order to facilitate reclassification in the future.

Emsworth Channel

This is a large zone on the west side of Chichester Harbour that covers an area of more than 1,300 Ha, extending from the northern shoreline down to the mouth of the Harbour. The original sanitary survey identified that the main contaminating influences on this zone were the River Ems and other smaller watercourses discharging to the northern end of the zone, as well as concentrations of moorings in its uppermost and lowermost reaches. It recommended positioning an RMP (Emsworth, B018M) as far north as possible within Emsworth Channel to capture contamination from the River Ems. During secondary consultation, the LEA indicated that the current RMP location is as far north as oysters extend within the channel. The presence of pasture on both the west and east side of the CZ could contribute some contamination through surface runoff, although on balance the current RMP position is representative of the contamination sources and should be retained.

Thorney

This zone covers an area of nearly 370 Ha and is situated in the Thorney Channel. The Prohibited *Prinstead* cockle/clam zone is situated to the north of this one. The original sanitary survey recommended retaining the existing Thorney Outfall (B018H) RMP as it was considered that the contamination from the Thorney STW (via the Great Deep) would be of greater significance than the Ham Brook that discharges to the head of the zone. The cause of occasional high results at this RMP was investigated by the Environment Agency, although no definitive cause could be found and DNA analysis of *E. coli* samples indicated that the contamination was primarily of human origin. It is recommended that this RMP be retained.

Other RMPs

Dell Quay (B018J)

This RMP was proposed in the original sanitary survey to classify the *Upper Chichester Channel* (*Dell Quay*) zone. This zone was declassified in 2017, due to a lack of commercial activity the location of the RMP was chosen due to its proximity to the Chichester STW storm tanks. These remain likely to contribute the most significant contamination to this zone and so it is recommended that this RMP be retained.

Cobnor (B018K)

This RMP was proposed in the original sanitary survey to classify the *Lower Chichester Channel* (*Cobnor*) zone, which was declassified in 2017 due to a lack of commercial activity. Few point source impacts to this zone were identified in the original sanitary survey, and the position of the RMP was chosen to capture contamination coming downstream, through the *Upper Chichester Channel* (*Dell Quay*) zone. It is recommended that this RMP be retained as

it is well placed to capture contamination from both Bosham and Chichester Channel that will pass over the RMP on an ebbing tide.

8.2 General Information

8.2.1 Location Reference

Production Area	**Chichester Harbour**
Cefas Main Site Reference	M018
Ordnance survey 1:25,000	Explorer 120
Admiralty Chart	3418

8.2.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Native oysters (*Ostrea edulis*)	Wild	Closed Season March – October. Additional closures on discretion of Sussex IFCA to prevent overexploitation of stock.

8.2.3 Local Enforcement Authority(s)

Name	**Chichester District Council** Environmental Protection East Pallant House Chichester West Sussex PO19 1TY
Website	http://www.chichester.gov.uk/environmentandhealth
Telephone number	01243 534598
E-mail address	environmentalprotect@chichester.gov.uk
Name	**Havant Borough Council** Public Service Plaza Civic Centre Road, Havant, PO9 2AX
Website	https://www.havant.gov.uk/environmental-health
Telephone number	023 9244 6016
E-mail address	n/a

*Table 8.1 Proposed sampling plan for the Chichester Harbour 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
Emsworth Channel (*O. edulis*)	B018M	Emsworth	SU 7469 0448	50° 50.10'N, 00° 56.44'W	Native oysters	Dredge	Dredge / deployment bag	*O. edulis*	100 m / 10 m	Monthly
Thorney (*O. edulis*)	B018H	Thorney Outfall	SU 7710 0360	50° 49.61'N, 00° 54.40W	Native oysters	Dredge	Dredge / deployment bag	*O. edulis*	100 m / 10 m	Monthly
N/A	B018J	Dell Quay	SU 8342 0280	50° 49.12'N, 00° 49.03'W	Native oysters	N/A	Dredge / Deployment bag	*O. edulis*	100 m / 10 m	Quarterly
N/A	B018K	Cobnor	SU 7911 0173	50° 48.58'N, 00° 52.71'W	Native oysters	N/A	Dredge / Deployment bag	*O. edulis*	100 m / 10 m	Quarterly

9 References

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Appendices

Appendix I. Details of intermittent discharge EDM monitoring data for 2020

Discharge Name	Permit Number (Folio)	Receiving Waters	Permit Effective Date	Outlet NGR	Treatment (If Applicable)	Sum of spills (hours) via the 12-14 hr counting method	Count of Spills
BOSHAM WWTW	W00133	CHICHESTER HARBOUR CHANNEL	12/04/2019	SU8088001940	PRIMARY SETTLEMENT	1140.33	82
CHICHESTER WWTW	W00137	CHICHESTER HARBOUR	31/03/2014	SU8387003750	PRIMARY SETTLEMENT	2726.8	138
CHIDHAM LANE PUMPING STATION	W00451	SALINE ESTUARY	03/01/1980	SU7928004590	UNSPECIFIED	0	0
CHIDHAM LANE SPS CHIDHAM	A01248	DITCH TO CHICHESTER HARBOUR	01/04/2008	SU7931004580	SCREENING	0	0
CSO BREAKERS YARD NUTBOURNE	A01485	THE HAM BROOK	31/03/2018	SU7790005610	SCREENING	216.86	23
FISHERY LANE PS	A00355	CHICHESTER HARBOUR	27/04/2006	SZ7373098710	SCREENING	1.04	1
KINGS ROAD EMSWORTH CSO	H02829	NORE RITHE/EMSWORTH HARBOUR	31/03/2013	SU7427105341	SCREENING	37.38	6

Discharge Name	Permit Number (Folio)	Receiving Waters	Permit Effective Date	Outlet NGR	Treatment (If Applicable)	Sum of spills (hours) via the 12-14 hr counting method	Count of Spills
LAVANT WWTW	W00359	RIVER LAVANT & GW VIA WETLAND	12/04/2018	SU8639007880	REEDBED	244.73	11
LUMLEY ROAD PUMPING STATION	A00291	RIVER EMS	01/06/1994	SU7518006240	UNSPECIFIED	0	0
MAIN ROAD FISHBOURNE CSO	NPSWQD000450	TRIB OF CHICHESTER HARBOUR	31/03/2018	SU8348004690	SCREENING	36.8	5
MILL LANE WPS	NPSWQD002203	TRIB OF CHICHESTER HARBOUR	08/08/2008	SU8347704643	NO TREATMENT REQUIRED - GOOD ENGINEERING DESIGN	0	0
PUMPING STATION IN FIELD NUMBER	W00322	RIVER LAVANT	31/03/2018	SU8730012980	NONE	267.54	18
SCHOOL LANE PS	A01069	HAM BROOK	13/07/2001	SU7769005390	NONE	0	0

Discharge Name	Permit Number (Folio)	Receiving Waters	Permit Effective Date	Outlet NGR	Treatment (If Applicable)	Sum of spills (hours) via the 12-14 hr counting method	Count of Spills
SCHOOL LANE SEWAGE P.S.	W00450	FRESHWATER RIVER	03/01/1980	SU7770005450	UNSPECIFIED	0.32	1
SEWAGE PUMPING STATION, BOSHAM	S01072	SALINE ESTUARY	26/02/1964	SU8109003750	UNSPECIFIED	0	0
TAYLORS LANE BOSHAM, WWPS	A01219	CHICHESTER HARBOUR	22/02/2005	SU8100003760	SCREENING	84.36	8
THORNHAM WWTW	W00354	CHICHESTER HBR VIA LITTLE DEEP	31/05/2015	SU7582004730	SCREENING	636.7	49
WOODBINE COTTAGE	W00316	UNNAMED DRAIN	27/01/1979	SU7387007270	UNSPECIFIED		

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CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Chichester Harbour

November 2013

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*"