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Carcinus Ltd
Consultancy and Survey Specialists

Sanitary Survey - Review

West Mersea – 2021



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A sanitary survey relevant to the bivalve mollusc beds in West Mersea 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

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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) 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 West Mersea Review

This report reviews information and makes recommendations for a revised sampling plan for existing Pacific oyster (*Crassostrea gigas*), native oyster (*Ostrea edulis*) and hard clam (*Mercenaria mercenaria*) classification zones in West Mersea (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 December 2020. 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 March and April 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;

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

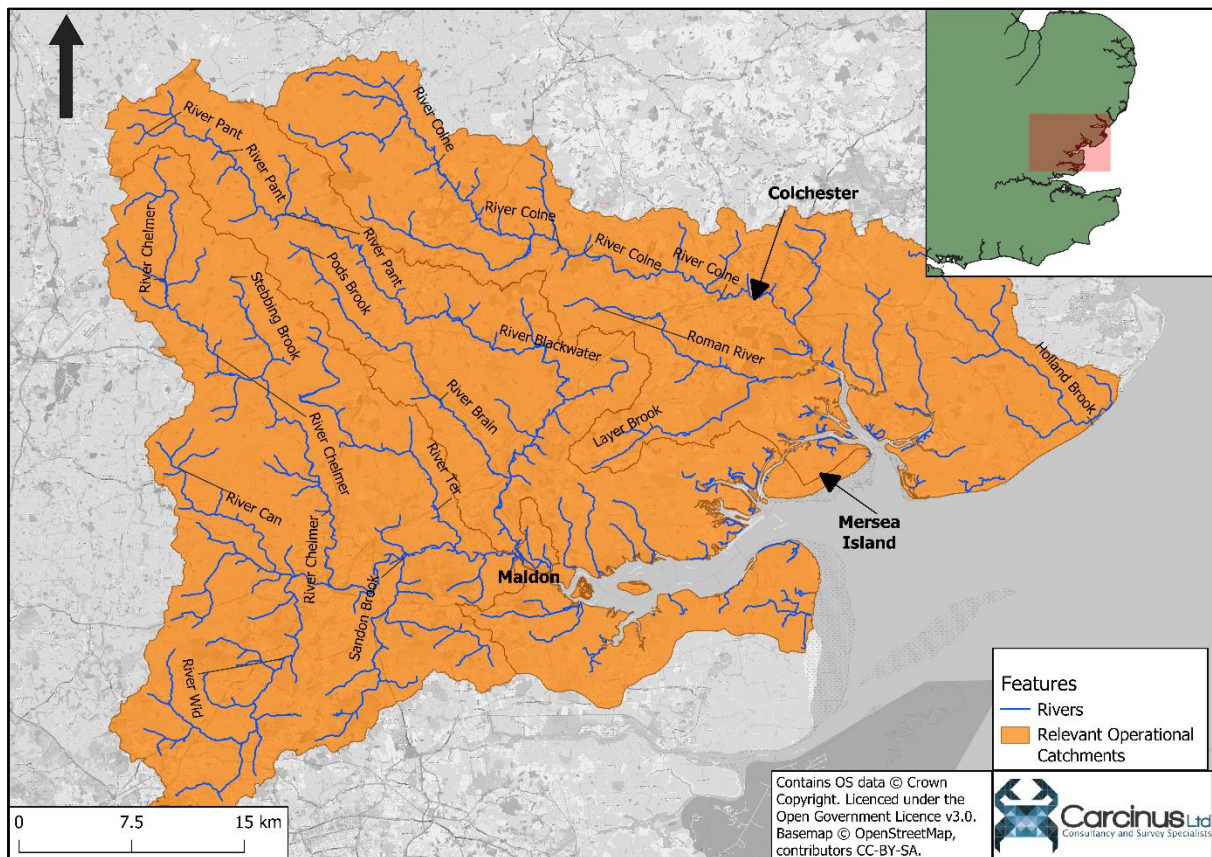


Figure 1.1 Location of West Mersea Bivalve Mollusc Production Area (BMPA).

1.3 Assumptions and limitations

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

- Accuracy of local intelligence provided by the Local Authorities and Environment Agency;
- The findings of this report are based on information and data sources up to and including January 2020;
- Only information that may impact on the microbial contamination was considered for this review; and

- Official Control monitoring data have been taken directly from the Cefas data hub¹, with no additional verification of the data undertaken. Results up to and including January 2020 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

Harvesting of shellfish within the West Mersea BMPA is under the jurisdiction of Kent & Essex Inshore Fisheries and Conservation Authority (KEIFCA) and is subject to the Area A Byelaws (KEIFCA, 2021). These byelaws set out the rights and restrictions that apply to fishermen wanting to utilise the fishing waters and applies to the entire area considered in this review. Under the byelaw, limits on harvesting mean that no more than 13.6 m³ of mussels or cockles within a 24 hour period can be harvested. Additionally, fishermen dredging for shellfish may not operate a dredge that has an opening that exceeds 2 m when fishing for mussels, 85 cm for scallops or 4 m for oysters. The byelaws also impose minimum landing sizes; no more than 10% (by weight) of landed mussels should be able to pass through a space of 18 mm width and no native oysters that fit through a circular ring 7 cm diameter may be removed, though this restriction does not apply to Pacific oysters. Furthermore, the KEIFCA reserves the right to close a fishery where the bed *“is so severely depleted as to require temporary closure in order to ensure recovery, or any bed or part of a bed contains mainly immature shellfish which in the interest of the protection and development of the fishery ought not to be disturbed for the time being, or any bed of transplanted shellfish ought not to be fished until it has become established...”*. The Tollesbury and Mersea (Blackwater) Fishery Order, 2019² confers the rights to a several order fishery in the outer Blackwater estuary, including the waters south of the eastern part of Mersea Island and the three creeks. The remainder of the shellfish beds are a public fishery. In addition, there are also private oyster layings, that are not controlled by KEIFCA.

The BMPA is under the jurisdiction of two different councils; Maldon District Council is responsible for the Tollesbury Fleets beds, with Colchester Borough Council responsible for the remainder. The BMPA sits immediately adjacent to two others; Blackwater to the south and east and Colne to the north. The BMPA covers the creeks around the Blackwater Estuary National Nature Reserve, and the waters south of Mersea Island to the mouth of the Colne Estuary. The fishery involves both wild and cultured stocks of the target species. At the time of the original sanitary survey, only Pacific and native oyster harvesting was taking place. Summaries of the classification zones for all currently harvested species are described in the following paragraphs.

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 Secretary of State, 2019. The Tollesbury and Mersea (Blackwater) Fishery Order, 2019. Available at: <https://www.legislation.gov.uk/uksi/2019/974/made>.

In addition to the species described below, an application for harvesting of Manilla clams from Salcott Channel (*Tapes* spp.) was made in 2017. This zone was classified in January 2018, but was subsequently downgraded to Class C, and declassified due to lack of commercial interest in harvesting Class C shellfish.

2.1.1 Pacific oyster

The original sanitary survey (conducted in 2013) describes that Pacific oysters are typically found in firmer intertidal areas throughout the BMPA, particularly on the southern shore of Mersea Island. No conservation controls are in place for this species, other than those described in the KEIFCA Byelaws (see above). The original sanitary survey recommended the creation of seven classification zones for Pacific oyster harvesting, covering approximately the entire BMPA. Five of these covered individual creeks and channels around the National Nature Reserve (*Little Ditch*, *Ray Creek*, *Salcott Channel*, *Strood Channel* and *Tollesbury North*), with two larger areas covering the waters south of Mersea Island (*Mersea Flats East* and *Mersea Flats West*). All these zones are currently active. A relay area for this species (as well as native oysters and hard clams), was declassified in September 2020 to be reclassified as a production area for Manilla clams (B13AK); sampling commenced in November 2020 towards classification for this new area.

Consultation with the Local Authorities responsible for the management of this BMPA indicated that Pacific oysters are the dominant species by landing weight in this fishery, with ~35,000 kg landed from *Tollesbury North*, 45,000 kg each from *Salcott Channel*, *Little Ditch* and *Ray Creek* and 50,000 Kg each from *Strood Channel*, *Mersea Flats East* and *Mersea Flats West*.

2.1.2 Native oyster

Native oyster stocks in the south east of England have declined significantly since historic levels. In an effort to conserve and restore these stocks, the Blackwater, Crouch, Roach and Colne Estuaries were designated as a Marine Conservation Zone (MCZ) (DEFRA, 2013). KEIFCA have imposed a flexible permit byelaw in the MCZ, which sets out further conservation controls on this species (KEFICA, 2018), limiting the total landings per harvesting trip to 250 kg, and subdividing the MCZ into smaller areas that can be permitted/prohibited more easily. The West Mersea BMPA falls into Harvesting Area 1 and 2 of this byelaw, and partially overlaps the Prohibited Area. The original sanitary survey described that the native oyster stocks are found in more subtidal waters than the Pacific oyster stocks. The most recently available stock assessment (Allison *et al.*, 2020) was conducted between 2008 and 2012 (prior to the original sanitary survey) and was used to support the MCZ designation. The original sanitary survey recommended classifying all the Pacific oyster CZs for native oysters as well, and all are still active. The *Mersea Flats West* CZ partially overlaps the 'Prohibited Area'.

Maldon District Council indicated that ~800 kg of native oysters are landed in the *Tollesbury North* CZ annually, although no landing statistics were available for any of the other CZs.

2.1.3 Hard clams

No classification zones were recommended for hard clams (*M. mercenaria*) in the original sanitary survey, although two CZs, *Tollesbury North* and *Salcott Channel* have been classified for the harvesting of this species since 2013 and 2017 respectively.

Consultation with the Local Authority responsible for the *Tollesbury North* CZ indicated that ~300 kg of this species were harvested each year.

2.2 Classification History

The original sanitary survey proposed the creation of 14 CZs; 7 each for Pacific and native oysters. There are currently 16 CZs, following the addition of the two hard clam CZs. CZs hold the same classification for each species, as all CZs are currently classified using Pacific oyster RMPs. Classifications are generally good; *Mersea Flats East*, *Ray Creek* and *Tollesbury North* all hold Class LT-B classifications, *Little Ditch* and *Mersea Flats West* hold Class A classifications and *Salcot Channel* holds a Class B. The location of all active CZs in the West Mersea BMPA are shown in Figure 2.1.

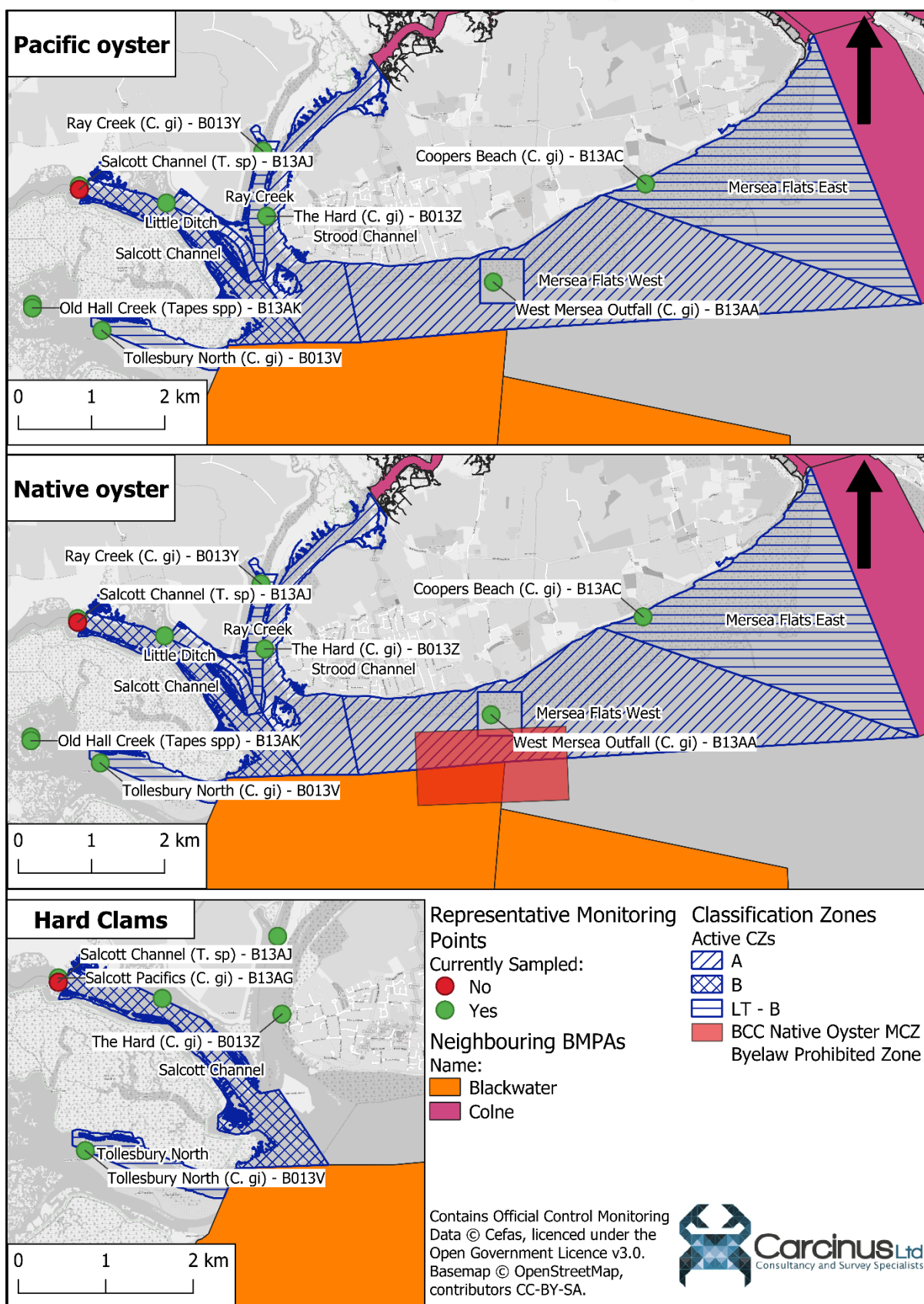


Figure 2.1 Current classification zones and associated RMPs for the different species harvested in the West Mersea BMPA.

3 Pollution sources

3.1 Human Population

The original sanitary survey cites population data from the 2001 Census of the United Kingdom. Since the publication of that document, the data from subsequent full UK 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 changes in the human population within the catchment. These censuses have been used as no further population data are freely available. Changes in total population within wards and human population densities in census Super Output Areas (lower layer) within or partially within the West Mersea catchment between the 2001 and 2011 censuses are shown in Figure 3.1 and Figure 3.2 respectively.

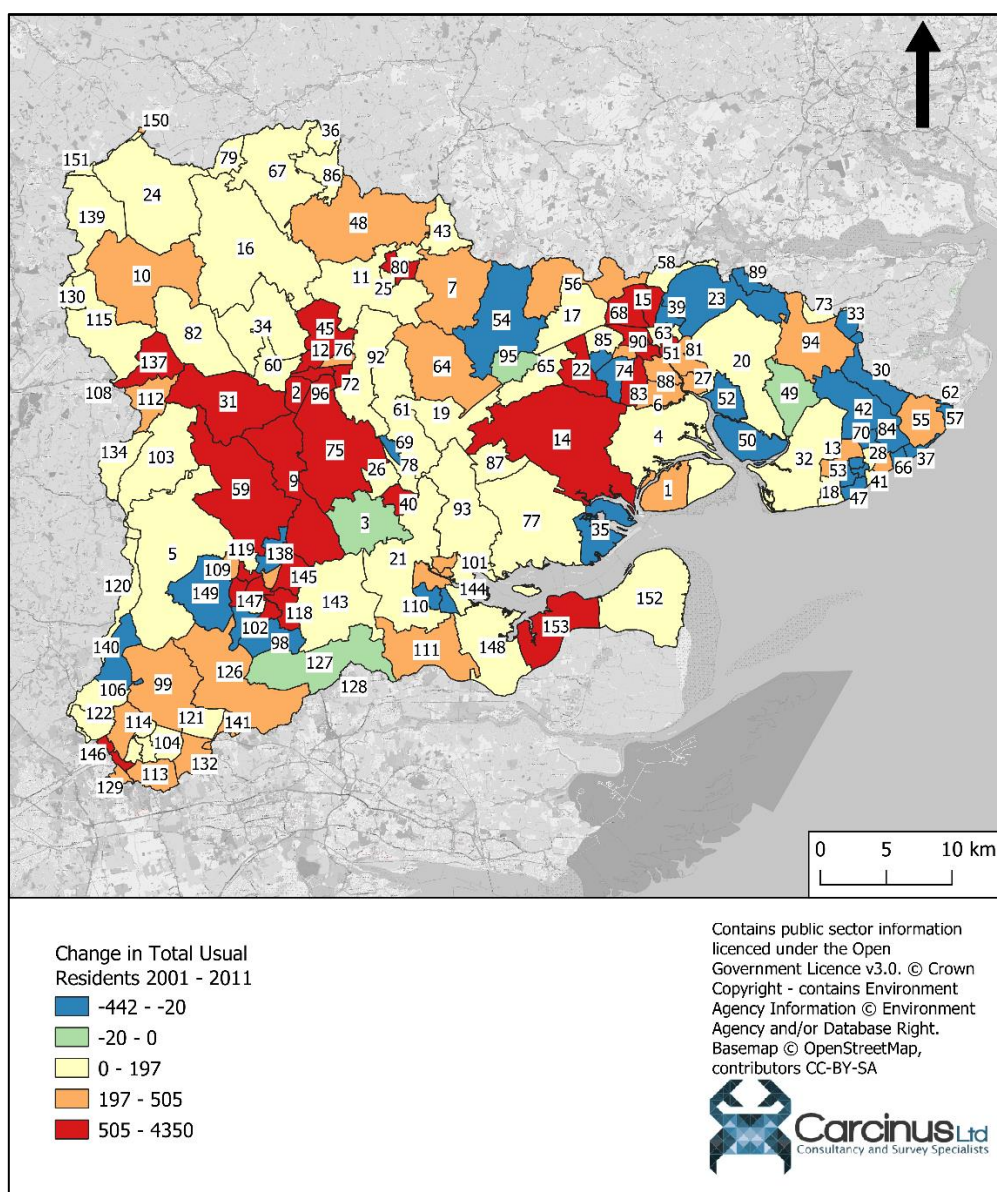


Figure 3.1 Population change between the 2001 and 2011 censuses for Wards and Electoral divisions (based on 2011 boundaries) that are within or partially within the Blackwater hydrological catchment (wards have been clipped to the boundary of the hydrological

catchment). 2001 Census data have been transposed to 2011 wards using the UK Data Service's GeoConvert tool (UK Data Service, 2021) to facilitate comparison. Numbers within wards are identifiers that can be used in combination with Appendix I to provide more detail.

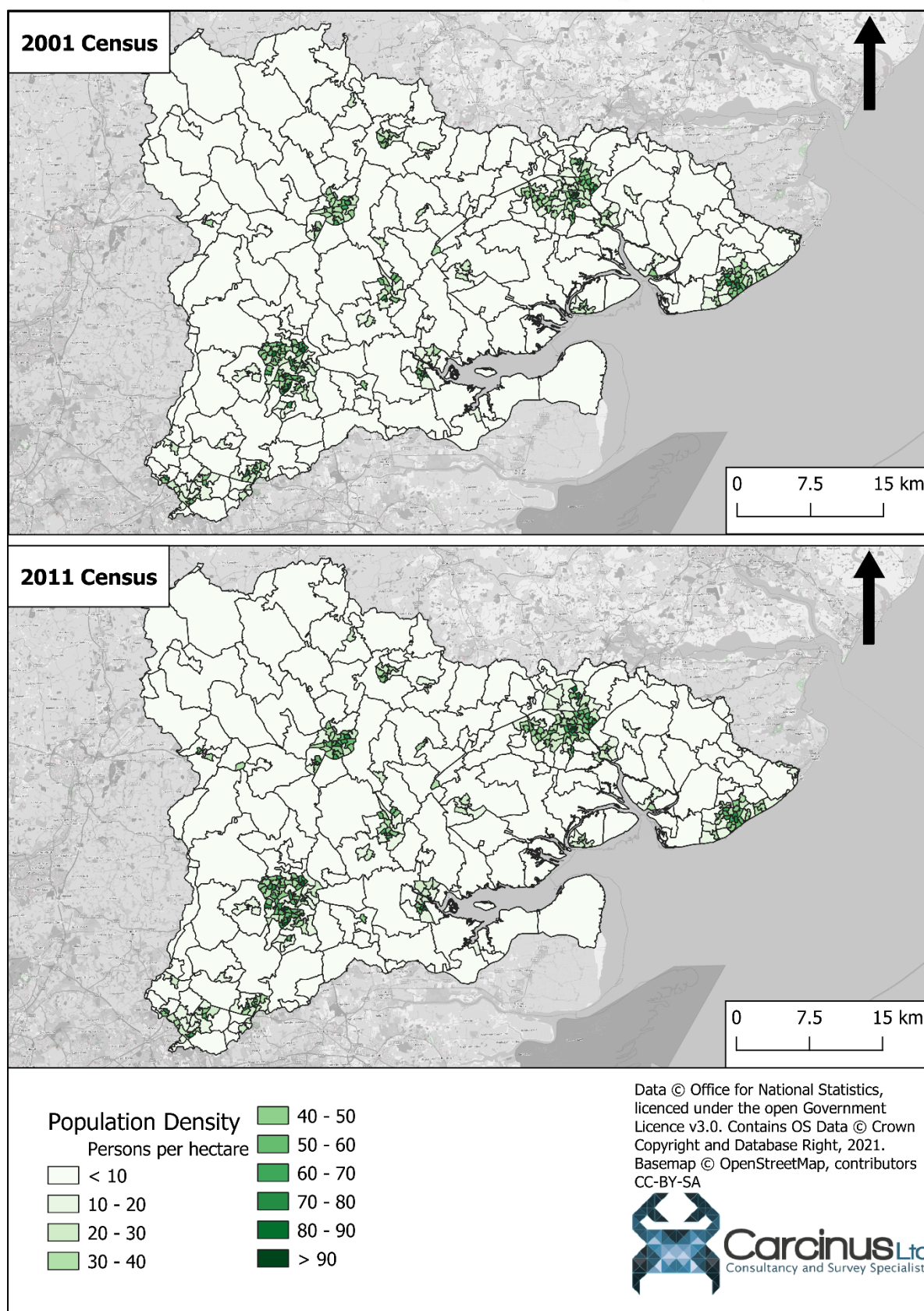


Figure 3.2 Human population density in 2001 and 2011 census Super Output Areas (lower layer) that intersect the West Mersea Catchment.

In general, population density has increased across the catchment, with 80% of wards showing an increase in population size. However, average population density remains low, at only 13.78 persons per hectare, with much of the catchment having densities of less than 10 persons per hectare (Figure 3.2). The main population centres remain around the towns of Maldon, Chelmsford and Braintree, along with the city of Colchester. A detailed breakdown of population change for individual wards is presented in Appendix I.

At the 2001 census, the total resident population within wards wholly or partially contained within the West Mersea catchment was 724,414 people. By the 2011 census, this had increased to 780,280 people, an increase of 7.71%. The population data for the 2011 census was collected two years before the original sanitary survey was published and so could be considered more relevant to that document. The next full census of the United Kingdom is scheduled to take place in the 2021 and the UK government estimates that the national population will increase by approximately 6.6% between 2011 and 2021 (Office for National Statistics, 2018). An increase of this proportion would see the approximate population residing within the West Mersea Catchment to 831,778 people. The potential for urban runoff remains greatest from the town of Maldon at the head of the Blackwater estuary, along with the small villages on Mersea Island. Impacts from sewage discharges will depend on the specific nature and locations of discharges, changes to which are discussed in the following section. Consultation with the LA did not indicate any additional significant housing developments have taken place since the original sanitary survey, or are scheduled to occur in the near future. However, without upgrades to assets within wastewater treatment network (WWTW), an increase in population would almost certainly lead to an increase in the loading to that network, which would therefore potentially cause increased bacterial loading to coastal receiving waters.

The original sanitary survey describes that the area sees a significant increase in its population during the summer months due to its popularity as a tourist destination. A study published in 2017 estimated that tourist numbers had increased 3.9% since 2014 (Creed, 2017). The LA indicated that tourism has continued to increase, particularly in the past 12 months as the Covid-19 pandemic restricted international travel. Peak tourism numbers are typically experienced in summer months, and so the loading to local WWTW and other sewage infrastructure would be greatest at this time.

Whilst there is no recently available population data for the catchment, it is very likely that the population will have increased between 5 and 10% since the publication of the original sanitary survey. However, the distribution of the main population centres within the catchment has not changed, and as such the recommendations made in the original sanitary survey to capture this source of pollution in RMP location remain valid.

3.2 Sewage

Details of all consented discharges in the vicinity of the West Mersea BMPA were taken from the most recent update to the EA's national permit database at the time of this report (November 2020). To match the survey area of the original sanitary survey, only those

discharges in the direct vicinity of the West Mersea shellfish beds have been considered. There are a significant number of consented discharges, both water-company owned and private, in the upper reaches of the catchment. However, these have been considered within the reviews of the Blackwater and Colne Sanitary Surveys (Carcinus, 2021a & 2021b), and the effect that the up-catchment discharges will have on background levels of diffuse contamination has been considered within the recommendations made in Section 8. The locations of these discharges are presented in Figure 3.3 , and further detail about continuous discharges is given in Table 3.1.

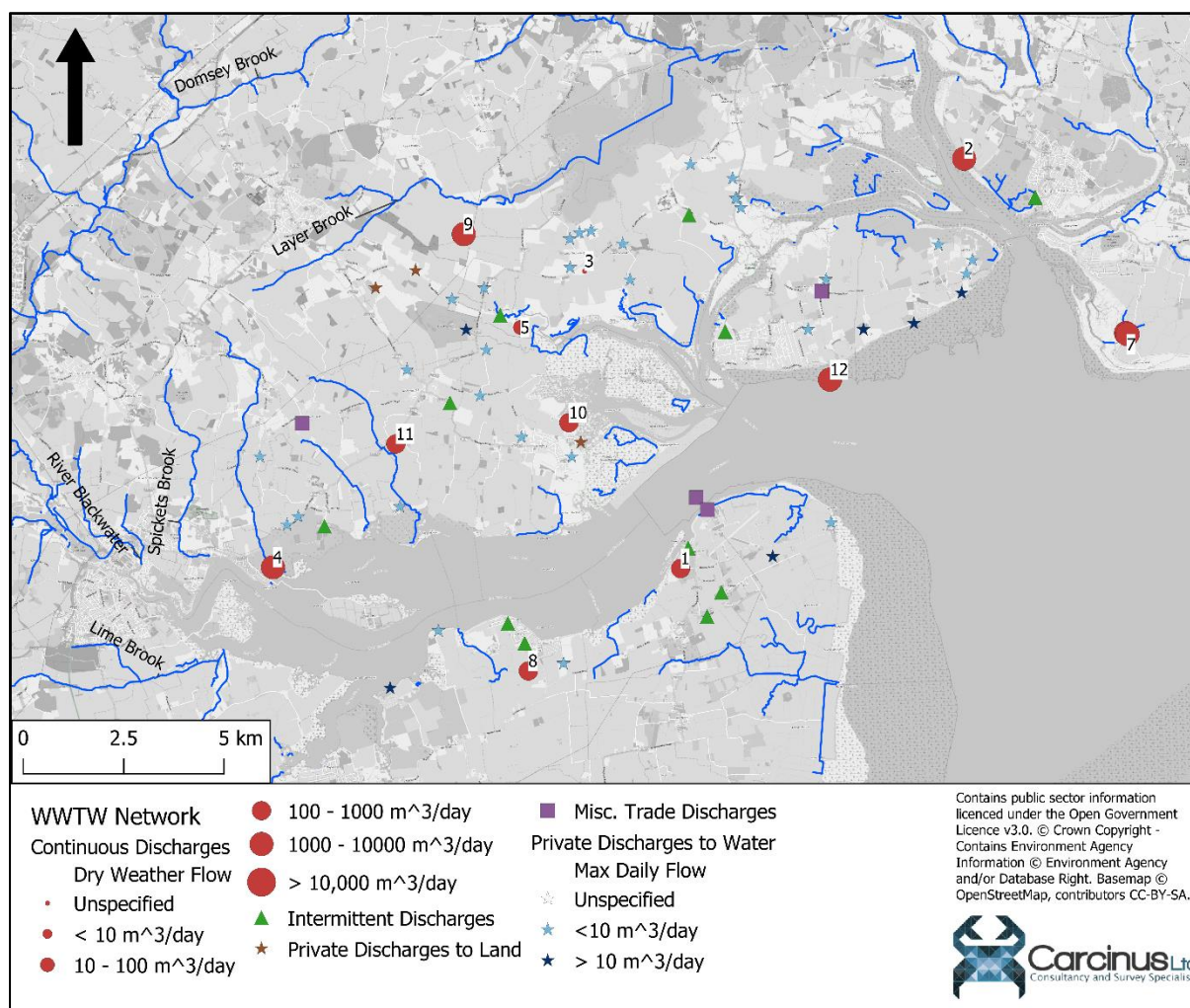


Figure 3.3 Locations of all consented discharges in the vicinity of the West Mersea BMPA. Labels refer to continuous discharges, details of which can be found in Table 3.1.

Table 3.1 Details of all continuous discharges in the vicinity of the West Mersea BMPA. Those discharges that have had decreases to their consented DWF are highlighted in green.

ID	Sewage Works	NGR	Treatment	DWF (m ³ /day)
1	BRADWELL-ON-SEA STW	TL9929007400	UNSPECIFIED	145

ID	Sewage Works	NGR	Treatment	DWF (m ³ /day)
2	BRIGHTLINGSEA STW	TM0635017600	UV DISINFECTION	2160
3	GREAT WIGBOROUGH STW	TL9690014800	BIOLOGICAL FILTRATION	Unspecified
4	MALDON WATER RECYCLING CENTRE	TL8914007430	ACTIVATED SLUDGE	6800
5	SALCOTT STW	TL9530013400	BIOLOGICAL FILTRATION	56
6	ST OSYTH STW	TM1038013260	BIOLOGICAL FILTRATION	1600
7	ST OSYTH STW	TM1042013230	BIOLOGICAL FILTRATION	1600
8	STONE ST LAWRENCE STW	TL9550004850	PASVEER DITCH	322
9	TIPTREE WATER RECYCLING CENTRE	TL9389015720	ACTIVATED SLUDGE	2400
10	TOLLESBURY WATER RECYCLING CENTRE	TL9651011030	BIOLOGICAL FILTRATION	600
11	TOLLESHUNT D'ARCY STW	TL9220010500	BIOLOGICAL FILTRATION	210
12	WEST MERSEA WATER RECYCLING CENTRE	TM0301012100	UV DISINFECTION	2000

The original sanitary survey only identified five continuous discharges in the immediate vicinity of the West Mersea BMPA (Figure II.1, p 39; Table II.1, p 40 of the original sanitary survey (Appendix II)). All five discharges are still active and have had no updates to the treatment methods used. Two of these, (Tiptree Water Recycling Centre and West Mersea Water Recycling Centre) have seen decreases to the consented Dry Weather Flow. It is not clear when this change occurred, however consultation with the Environment Agency indicated that these decreases were for administrative reasons and there is unlikely to have been a reduction in flow or loading to the BMPA. The original sanitary survey identified that Salcott Creek was most heavily impacted by water company owned works, given that three discharges (Great Wigborough, Salcott and Tiptree) drain to this water course. As all three are still active, the same is true currently. The West Mersea Water Recycling Centre continues to discharge directly to the *Mersea Flats West*. *E. coli* monitoring undertaken at the time of the original sanitary survey indicated that the treatment used was consistently effective, although the treatment method (UV disinfection) is known to be less effective at eliminating viruses (e.g. noroviruses) than bacteria (e.g. *E. coli*). This remains a potential cause for concern, given that this zone is currently classified as Class A for oysters.

In addition to the continuous discharges, the original sanitary survey identified six intermittent discharges (Table II.4, p 42 of the original sanitary survey (Appendix II)).

Intermittent discharges comprise Combined Storm Overflows (CSOs), storm tank overflows and pumping station emergency overflows. The Kingsland Road SSO has been sealed and is no longer operational. No spill event monitoring was available to the authors of the original sanitary survey or this review. However, as patterns of rainfall have remained similar (see Section 5), the frequencies of spill events are predicted to have remained similar. As such, the impact on bacterial loading as a result of spills are not expected to have changed, particularly as consultation with the LA and EA did not indicate any upgrades to intermittent discharges on the wastewater treatment network.

In addition to the water company owned discharges, the original sanitary survey identified 14 privately owned discharges. Several of these were located on the southern shore of Mersea Island, and consultation with the Environment Agency indicated that in recent years, several of these were found to be non-compliant with their consented discharge limits. The EA indicated that most of these have been upgraded to UV disinfection or connected to the main network and treated at water-company owned assets. This has likely reduced the risk they pose to the shellfishery off the south Mersea Island shore.

Overall, there have been some upgrades to the wastewater treatment network in the vicinity of the West Mersea BMPA that are likely to have slightly reduced the risk of faecal contamination to the shellfishery. However, as the highest risk areas have not changed since the original sanitary survey, the recommendations made in that report to capture this source of pollution remain valid.

3.3 Agricultural Sources

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

Overall, livestock populations increased by 15.17% between 2013 and 2016 (the most recent year for which data are available). However, within this overall figure are significant differences between Local Authority District and species. Tendring and Colchester saw overall increases of 77.95% and 66.73% respectively, whereas Epping Forest and Braintree saw decreases of 44.38% and 23.34% respectively. Across the entire catchment, the only livestock group that saw an increase was poultry, with population increasing by 16%.

Only a relatively small area of the catchment is covered by pasture (Figure 3.4), based on 2018 land cover data. The average livestock density in the catchment is relatively low relative to other areas of the country, at only 6.34 animals per hectare. The principal route of contamination of coastal waters by livestock is surface run-off carrying faecal matter to

coastal waters. Land cover maps indicate that only a few areas of pasture site adjacent to a water body, although some is present immediately upstream of the Old Hall and Tollesbury Wick Marshes at the western side of the BMPA. Therefore, whilst the overall significance of this source of contamination may be low, some point source pollution around these areas is possible, particularly during high-rainfall events that follow a prolonged dry period. These areas were described in the original sanitary survey as having pasture, and livestock were spotted during the shoreline survey for that report. The livestock population within the catchment will also vary throughout the year, with highest numbers occurring during Spring and lowest numbers when animals are sent to market in Autumn and winter.

Despite the fact that livestock populations have increased since the original sanitary survey, livestock densities are still relatively low and the probable routes of contamination remain unchanged. As such, the recommendations made in the original sanitary survey to capture this source of pollution remain valid.

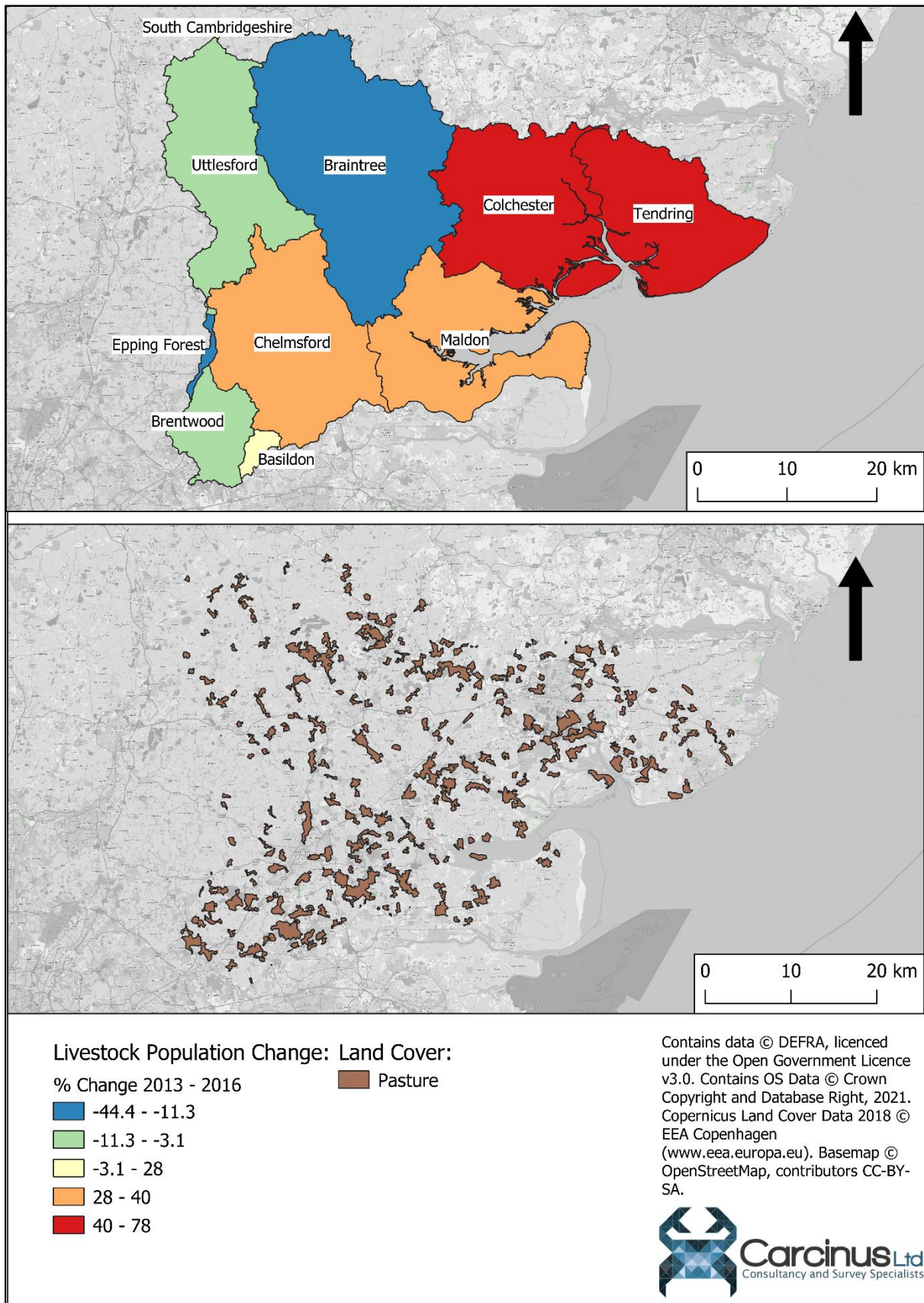


Figure 3.4 Livestock population change between 2013 and 2016 for Local Authority Districts and areas of pasture within the West Mersea Catchment.

Table 3.2 Livestock data for the West Mersea catchment between 2013 and 2016.

Local Authority District	Total LAD area (ha)	Area within catchment (ha)	Proportion LAD within	Proportion of catchment area	Livestock Population (adjusted)											
					Cattle			Sheep			Pigs			Poultry		
					201 3	201 6	% Diff	201 3	201 6	% Diff	201 3	201 6	% Diff	2013	2016	% Diff
Braintree	61,170.8 0	46,258.3 2	75.62 %	24.79%	4,116	3,593	- 12.70 %	5,618	5,188	-7.66%	8,713	6,887	- 20.96 %	363,30 9	276,983	-24%
Chelmsford	34,299.7 3	29,954.5 0	87.33 %	16.05%	1,614	2,177	34.91 %	1,905	1,603	- 15.86 %	2,759	3,712	34.54 %	195,96 9	253,166	29%
Colchester	34,677.3 2	28,401.3 8	81.90 %	15.22%	2,527	2,371	-6.18%	8,500	8,029	-5.54%	4,439	2,178	- 50.95 %	124,24 4	220,363	77%
Maldon	42,804.9 2	25,016.7 5	58.44 %	13.41%	2,518	2,342	-6.98%	4,208	3,923	-6.77%	1,871	5,087	171.90 %	391,07 3	521,247	33%
Tendring	36,617.0 3	22,320.6 9	60.96 %	11.96%	2,106	2,506	18.96 %	3,023	2,752	-8.96%	3,636	3,283	-9.72%	84,978	158,278	86%
Uttlesford	64,118.2 9	24,675.3 4	38.48 %	13.22%	1,166	1,119	-4.09%	1,863	1,838	-1.36%	2,304	2,222	-3.56%	53,974	49,653	-8%
Basildon	11,044.9 1	1,280.39	11.59 %	0.69%	120	120	-0.81%	116	#	N/A	4	#	N/A	355	474	34%
Brentwood	15,312.4 0	7,924.86	51.75 %	4.25%	96	39	- 58.96 %	200	210	5.08%	1,837	1,829	-0.43%	21,138	19,256	-9%
Epping Forest	33,898.4 1	742.89	2.19%	0.40%	67	58	- 12.99 %	126	135	7.01%	182	152	- 16.52 %	4,135	2,163	-48%

Local Authority District	Total LAD area (ha)	Area within catchment (ha)	Proportion LAD within	Proportion of catchment area	Livestock Population (adjusted)											
					Cattle			Sheep			Pigs			Poultry		
					201 3	201 6	% Diff	201 3	201 6	% Diff	201 3	201 6	% Diff	2013	2016	% Diff
South Cambridgeshire	90,168.7 2	21.94	0.02%	0.01%	2	2	-9.16%	3	3	14.74 %	1	1	- 11.39 %	40	53	31%
Total	424,112. 53	186,597. 07	44.00 %	100.00 %	14,77 9	14,22 2	-3.77%	24,90 3	24,36 5	-2.16%	22,66 1	22,09 3	-2.51%	969,75 3	1,128,0 14	16%

- Indicates that data have been suppressed to preserve anonymity of individual holdings

3.4 Wildlife

The BMPA is situated between the Blackwater and Colne estuaries, both of which contain a variety of habitats that support significant wildlife populations. The area is conferred protection under various national and international designations for the presence of these habitats and species, including as a Marine Conservation Zone (MCZ), Special Area of Conservation (SAC) and Ramsar site.

Faecal deposition on shellfish beds by waterbirds is recognised as a significant source of contamination. The original sanitary survey reported that in the five winters to 2010, an average total count of 96,215 overwintering and wildfowl were recorded collectively in the Blackwater and Colne estuaries (Holt *et al.*, 2012). In the five winters to 2019 (the most recent for which data are available, the total count was 110,928, an increase of 15.29%. Commonly sighted species include Brent Goose, Shelduck, Avocet and Dunlin. Wading birds forage (and therefore defecate) directly on shellfish beds, although their precise distributions will vary from year to year. Whilst the faecal deposition from waterbirds may be a significant contributor to the shellfish beds, it is difficult to make recommendations for RMP location to capture this source of pollution.

In addition to the populations of waterbirds, significant numbers of grey and harbour seals use the area around the BMPA. The most recent population estimate puts the number of grey seals at 3,243 and the number of harbour seals at 932 (Cox *et al.*, 2020). This number has increased by > 180% since 2013. However, these species show wide foraging ranges and as such any contamination is likely to be spatially and temporally variable, and as such will have limited impact on the overall level of bacteriological contamination experienced by the BMPA.

Despite the fact that bird and marine mammal populations have increased significantly since the original sanitary survey was conducted, it remains challenging to accurately account for this source of pollution in any updated sampling plan. No other wildlife species are likely to represent a significant source of contamination and as such the recommendations for RMP location made in the original sanitary survey are still valid.

3.5 Boats and Marinas

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

Tollesbury Marina remains the hub of recreational boating activity near the BMPA, with several hundred berths. There are further berths at West Mersea Yacht Club, as well as some additional marinas in the Blackwater Estuary. None of these marinas have pump-out facilities, the closest of which are located at the Royal Harbour Marina on the north Kent

coast (The Green Blue, 2019). Vessels large enough to contain onboard toilets are therefore likely to make occasional overboard discharges, particularly when transiting through the main navigational routes of the estuary or when moored overnight. Peak activity levels are likely to remain in the summer months, and the associated risk of contamination is therefore also highest at these times.

The waters around the BMPA are home to a fishing fleet of approximately 35 vessels, most < 10 m total length (UK Government, 2020). There have been no changes to the legislation governing overboard discharges from vessels, with restrictions placed on commercial vessels against overboard discharges within three nautical miles of land and guidance given to pleasure craft users to follow the same advice (RYA, 2020).

Consultation with the Local Authorities indicated that the numbers of houseboats in the waters around Mersea Island has increased in the last six years. There are no local byelaws in force that relate to waste disposal. The most recent survey of houseboats in the area was conducted in 2017 and found that most boats employed either maceration or no treatment whatsoever of sewage discharges. This could therefore represent a significant risk to shellfish growing waters in the vicinity, although, without specific information as to the locations, extent and timing of the overboard discharges made, it is difficult to account for this in the choice of RMP location.

The main areas at risk of contamination from overboard discharges have not changed significantly, and consultation with the LA did not indicate a significant increase in the extent of shipping activity. The original sanitary survey was not able to make concrete recommendations about RMP locations to capture this source of pollution due to the lack of specific data. The same is true for this review, and as such this source of contamination does not carry any additional weighting for consideration in any updated sampling plan.

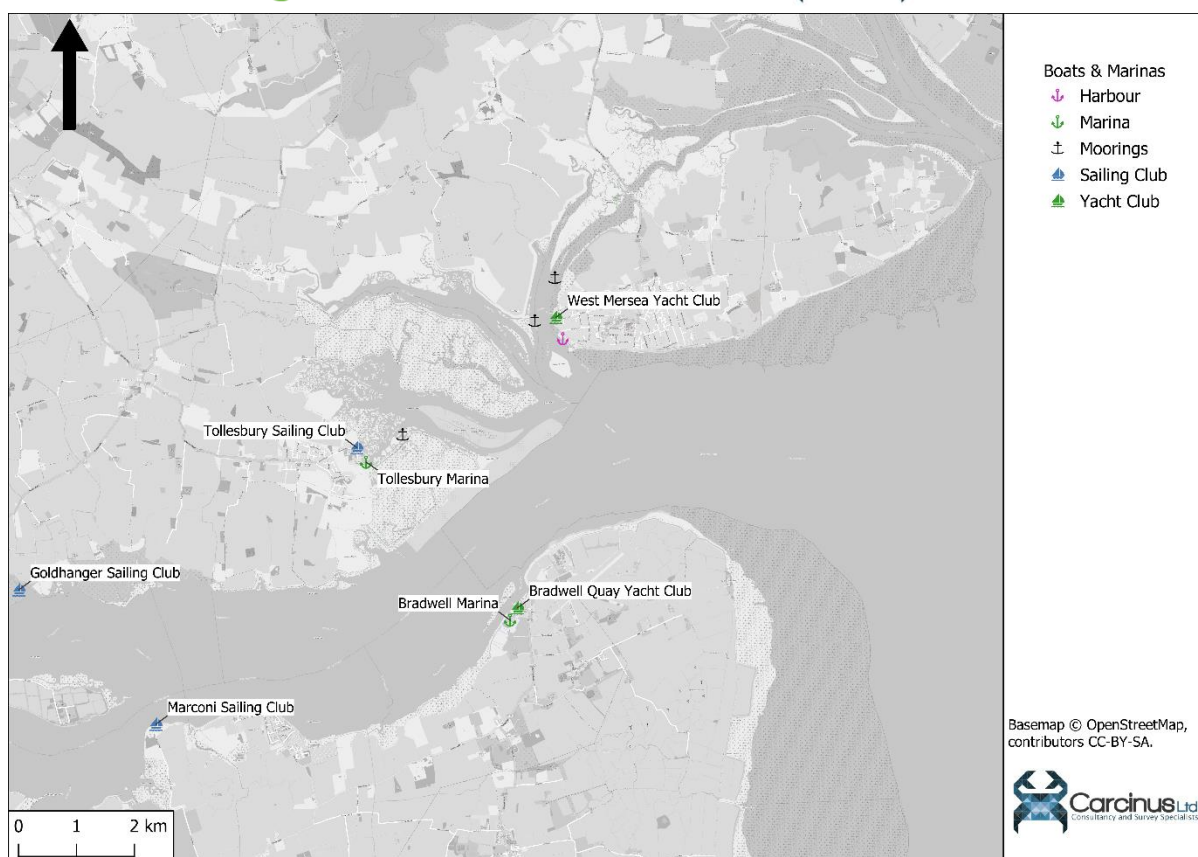


Figure 3.5 Locations of moorings, marinas and other boating activities near the West Mersea BMPA.

3.6 Other Sources of Contamination

The main urban fabric of the catchment remains centred some distance from the coastal waters of the BMPA. However, the village of West Mersea directly adjacent to the BMPA and Maldon at the head of the Blackwater Estuary are likely to contribute some contamination through utility misconnections. The geographical extent of urban settlements within the catchment have not increased significantly since the original sanitary survey (despite new housing developments), and therefore the risk that these settlements pose remains broadly similar.

Dog fouling represents a potentially significant source of diffuse pollution to coastal waters. There are a number of coastal paths and signposted walking routes around Tollesbury Wick and Old Hall Marshes (Visit Maldon District, 2021), as well as on the beaches of Mersea Island, and so contamination from dog fouling is expected to remain a minor source of contamination to this BMPA.

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

4 Hydrodynamics/Water Circulation

The bathymetric chart provided in the original sanitary survey (Figure IX.1, p 58) was printed in 2007, though the authors of that report were not certain on when the data had been gathered. As described in the original report, whilst minor changes to the bathymetry may have occurred, it is unlikely that significant variations in hydrography have occurred. The waters of the BMPA receive tidal inundation from flows up both the Blackwater and Colne estuaries. The Mersea flats will see slower currents than the main river channels, and the eastern end may see some contaminating influences from the ebb plume of the Colne, whereas the western end will receive ebb flow from the tidal channels and the River Blackwater.

Given that the hydrodynamic circulation in the BMPA is considered unlikely to have changed significantly since the original sanitary survey, the recommendations made in that document to capture circulating pollution remain valid.

5 Rainfall

No rainfall monitoring stations on or near Mersea Island were available. Rainfall data for the nearest weather station, Blackwater at Langford (NGR: TL835090), from 2010 – 2013 (pre sanitary survey data) and 2014 – 2017 (post sanitary survey data) were used to determine whether any changes in rainfall patterns had occurred since the original sanitary survey. Figure 5.1 shows the average daily rainfall totals for each month at the Langford monitoring station. Whilst rainfall has decreased slightly since the publication of the original sanitary survey, two sample t-tests indicated that there was no significant difference ($p = 0.405$) between the mean daily rainfall per month between the 2010 – 2013 and 2014 – 2017 period. Table 5.1 summarises the rainfall at the Langford monitoring station for the two periods.

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

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

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days Exceeding 10 mm	% Days Exceeding 20 mm
2010 - 2013	606.05	44.76	23.27	14.58
2014 - 2017	600.65	42.16	22.18	14.10

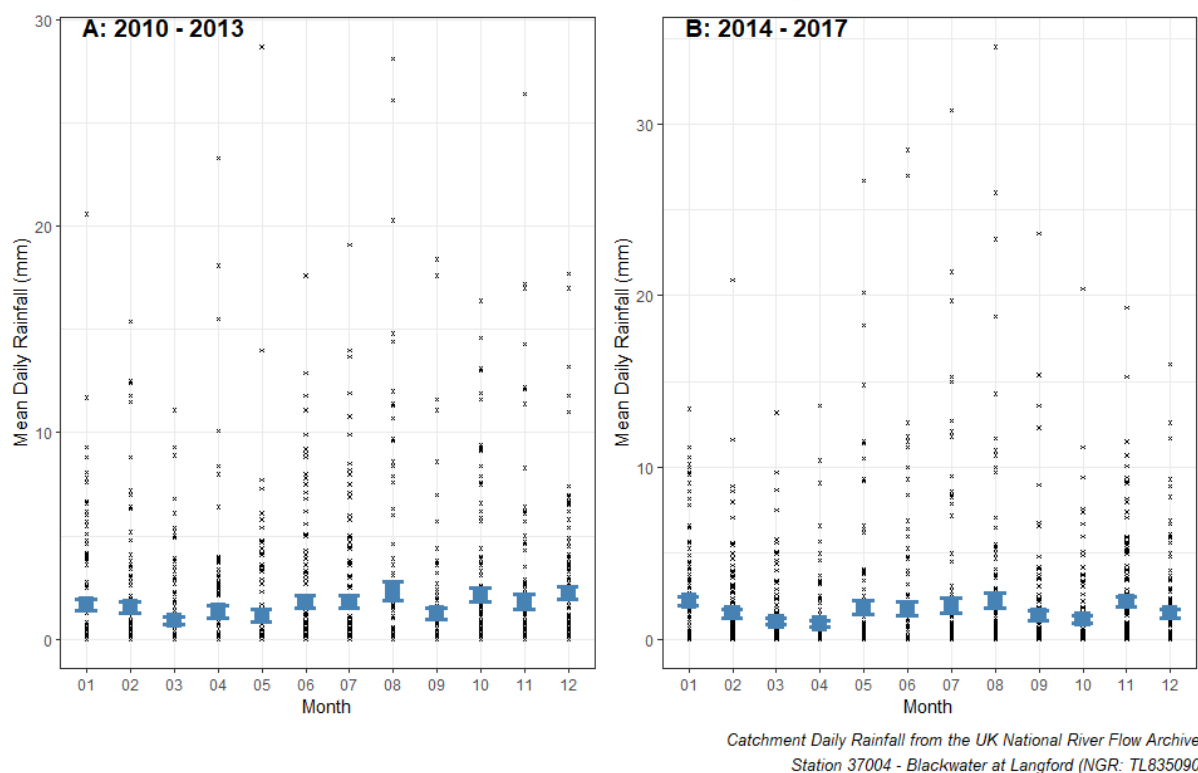


Figure 5.1 Mean daily rainfall (mm) per month for the Blackwater at Langford (TL835090) for the period (A) 2010 – 2013 (pre sanitary survey) and (B) 2014 – 2017 (post sanitary survey).

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

A total of 10 Representative Monitoring Points have been sampled within the West Mersea BMPA since the original sanitary survey was published in 2013. 8 of these are for Pacific oyster (*Crassostrea gigas*) and 2 are for *Tapes* spp. (one is specifically Manilla clam, *Tapes phillipinarum*). No monitoring data for either of the other classified species, native oysters (*Ostrea edulis*) or hard clams (*Mercenaria mercenaria*) are available, as these species are classified using Pacific oyster samples. None of the RMPs were sampled prior to the original sanitary survey. Five of the Pacific oyster RMPs have been sampled since April/May 2013, with the remaining three beginning in the summer of 2014. All Pacific oyster RMPs are currently sampled. One of the *Tapes* spp. RMPs (Salcott Channel (B13AJ)) was sampled from June 2017 to May 2018, and sampling at the other (Old Hall Creek (B13AK)) began in November 2020. It is not clear what prompted cessation of sampling, although the CZ this RMP was used to represent (Salcott Channel (*Tapes* spp.)) was never awarded a full classification. Summary statistics of the Official Control Monitoring history at all RMPs sampled since the original sanitary survey was published are presented in Table 6.1. The geometric mean results at each RMP are presented in Figure 6.1. All data have been accessed directly from the Cefas data hub¹ and have been taken at face value.

Table 6.1 Summary statistics of *E. coli* (MPN/100 g) from RMPs sampled from 2013 onwards (data cut off at January 2021).

Representative Monitoring Point	NGR	Species	No .	First Sample	Last Sample	Geometric Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Tollesbury North (C. gi) - B013V	TL97751145	Pacific Oyster	93	11/04/2013	06/01/2021	476.44	18	4,900	44.09	2.15	0
Ray Creek (C. gi) - B013Y	TL99951390	Pacific Oyster	87	22/05/2013	24/11/2020	180.25	18	2,300	19.54	0	0
The Hard (C. gi) - B013Z	TM00001301	Pacific Oyster	92	22/05/2013	24/11/2020	172.24	18	1,400	15.22	0	0
West Mersea Outfall (C. gi) - B13AA	TM03101211	Pacific Oyster	96	30/04/2013	03/12/2020	275.02	18	16,000	9.38	1.04	0
Coopers Beach (C. gi) - B13AC	TM05181345	Pacific Oyster	99	30/04/2013	03/12/2020	1011.90	18	28,000	31.31	4.04	0
Old Hall Creek Relay Area (C. gi) - B13AE	TL96801178	Pacific Oyster	83	11/06/2014	06/01/2021	521.22	18	3,300	49.40	0	0
Salcott Pacifics (C. gi) - B13AG	TL97441340	Pacific Oyster	77	05/08/2014	24/11/2020	1497.75	18	92,000	28.57	1.30	1.30
Little Ditch (C. gi) - B13AH	TL98631319	Pacific Oyster	77	08/09/2014	24/11/2020	2210.19	18	160,000	11.69	1.30	1.30
Salcott Channel (T. sp) - B13AJ	TL97441340	Tapes spp.	16	05/06/2017	10/05/2018	2562.5	130	7,900	93.75	18.75	0

Old Hall Creek (Tapes spp) - B13AK	TL96801178	Tapes spp.	4	11/11/2020	06/01/2021	3157.5	330	7,900	100	25	0
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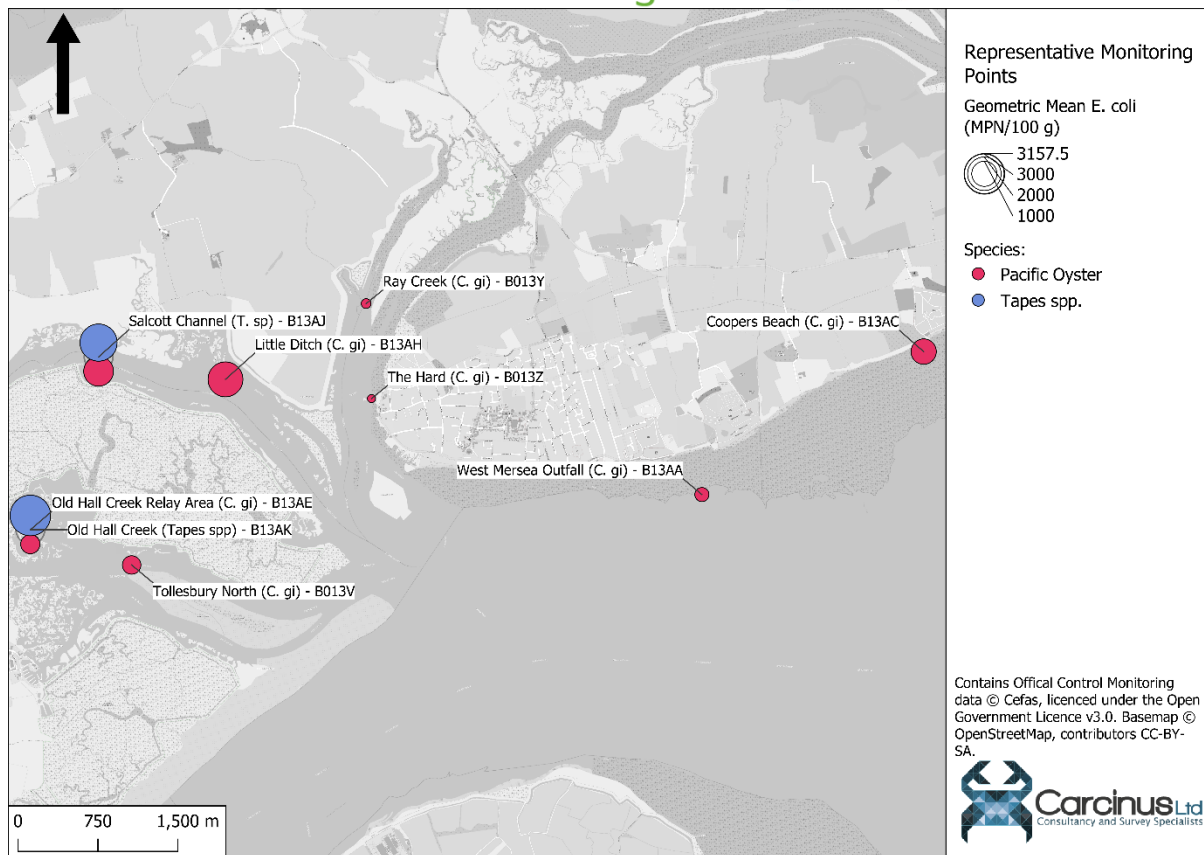


Figure 6.1 Geometric mean *E. coli* results from Official Control monitoring at bivalve RMPs within the West Mersea BMAP.

Monitoring results have been generally good across all RMPs, with the geometric mean results falling well within the Class B threshold of 4,600 MPN/100 g and two RMPs returning mean results of <230 MPN/100 g (the threshold for Class A). Only two RMPs (Salcott Pacifics (B13AG) and Little Ditch (B13AH)) ever returned results of >46,000 MPN/100 g (the Class C threshold). Generally, those RMPs farther up the creeks around Tollesbury Wick and Old Hall Marshes have returned higher levels of *E. coli*, perhaps reflecting the impact of sewage works nearby. The RMP adjacent to the West Mersea STW outfall (West Mersea Outfall (B13AA)) has a relatively low mean result, indicating that the treatment used at this outfall is effective in reducing the faecal load (at least of *E. coli* – see Section 3.2) to the shellfishery). The slightly elevated mean result from Coopers Beach (B13AC) relative to other RMPs in the BMAP perhaps indicates contaminating influences from the ebb plume of the Colne Estuary. No real comparison between species is possible, as Salcott Channel (B13AJ) was sampled for less than one year and only four samples have been collected from Old Hall Creek (B13AK), and the rest of the RMPs are all for Pacific oysters.

Figure 6.2 and Figure 6.3 present boxplots of *E. coli* monitoring results for RMPs sampled for Pacific oyster and *Tapes* spp. respectively. Despite apparent differences in mean results, one-way analysis of variance (ANOVA) tests indicated that no significant differences were found between any of the RMPs sampled for Pacific oyster ($p = 0.532$) or *Tapes* spp. ($p =$

0.706), perhaps due to large variation, particularly for Pacific oyster results. Little inference can be drawn from the *Tapes* spp results, as there is a ~2 year gap between sampling finishing at Salcott Channel (B13AJ) and starting at Old Hall Creek (B13AK).

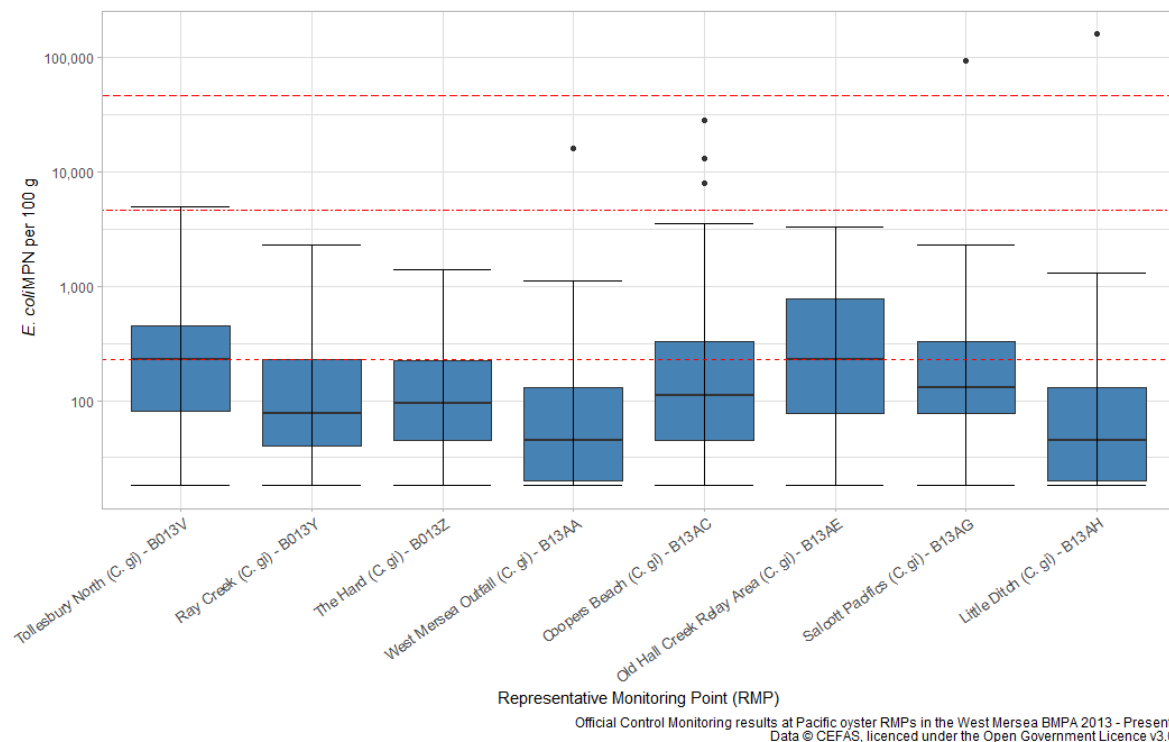
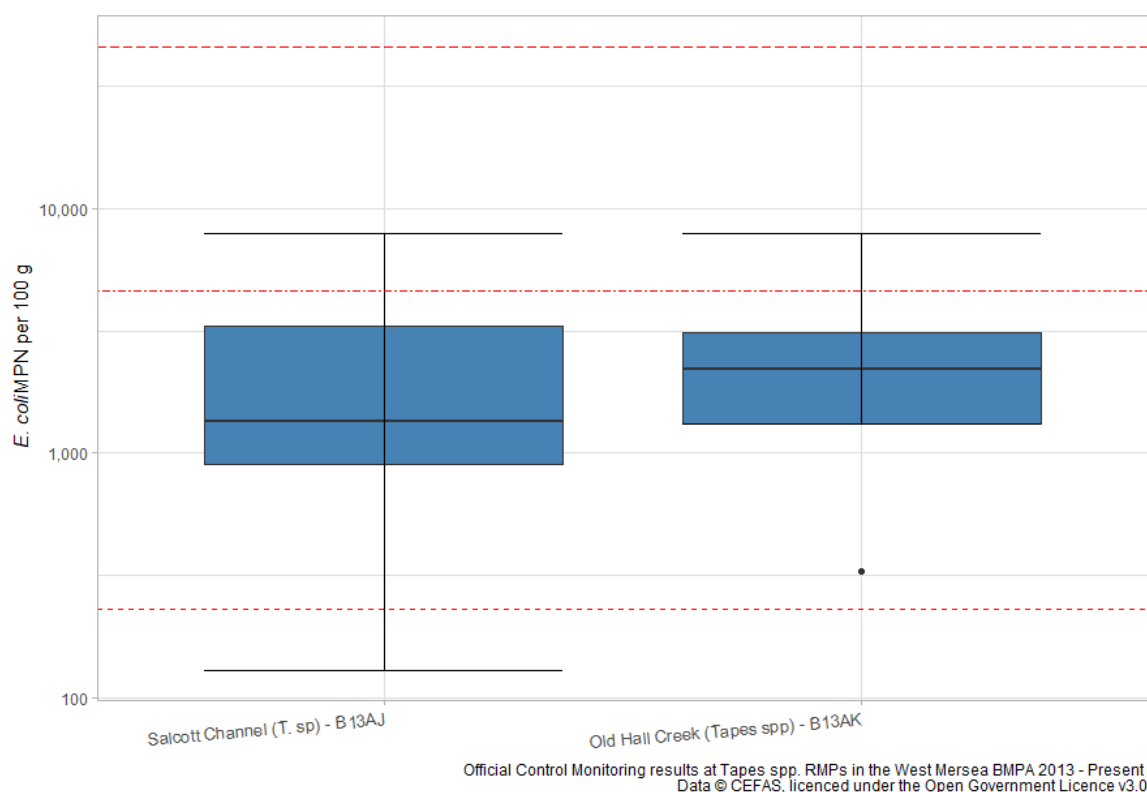


Figure 6.2 Boxplots of E. coli levels at Pacific oyster RMPs sampled within the West Mersea BMPA 2013-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points >1.5 x interquartile range).

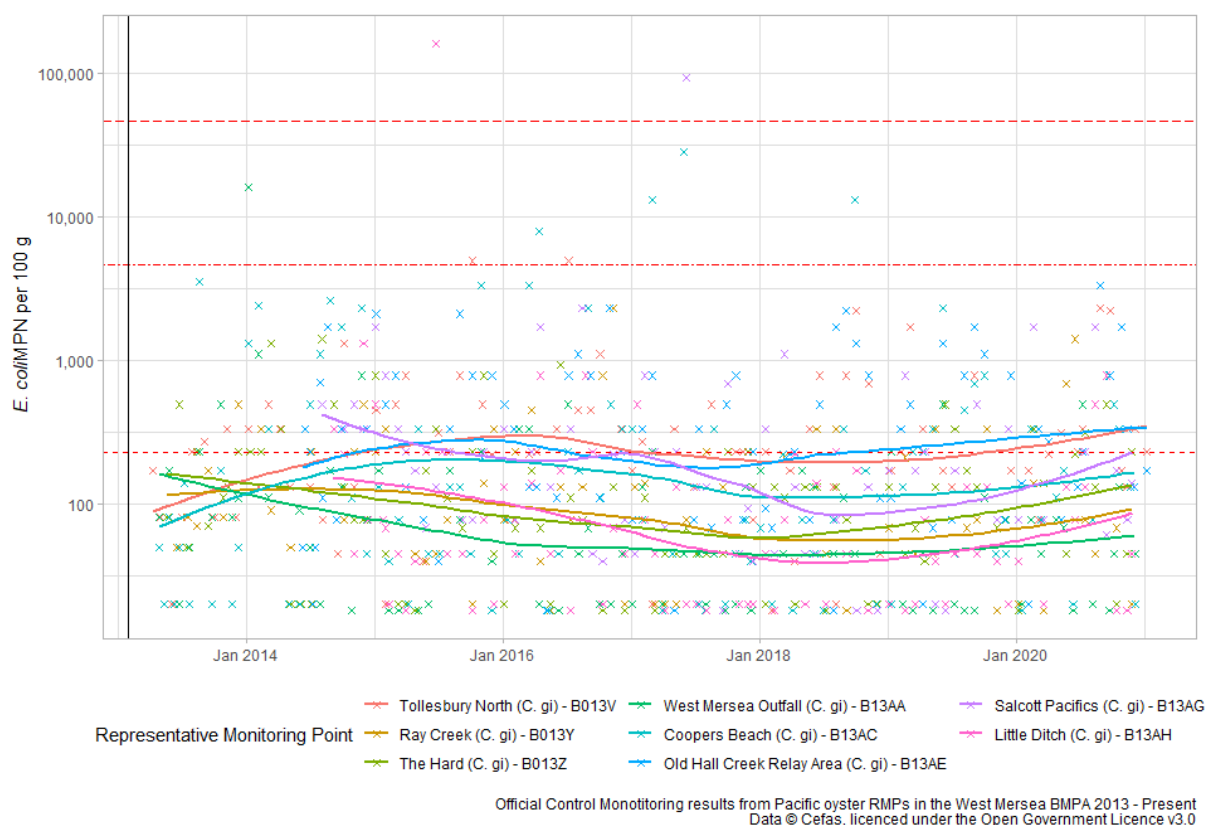


*Figure 6.3 Boxplots of *E. coli* levels at Tapes spp. RMPs sampled within the West Mersea BMPA 2013-Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value excluding outliers (points $>1.5 \times$ interquartile range).*

6.2 Overall temporal pattern in results

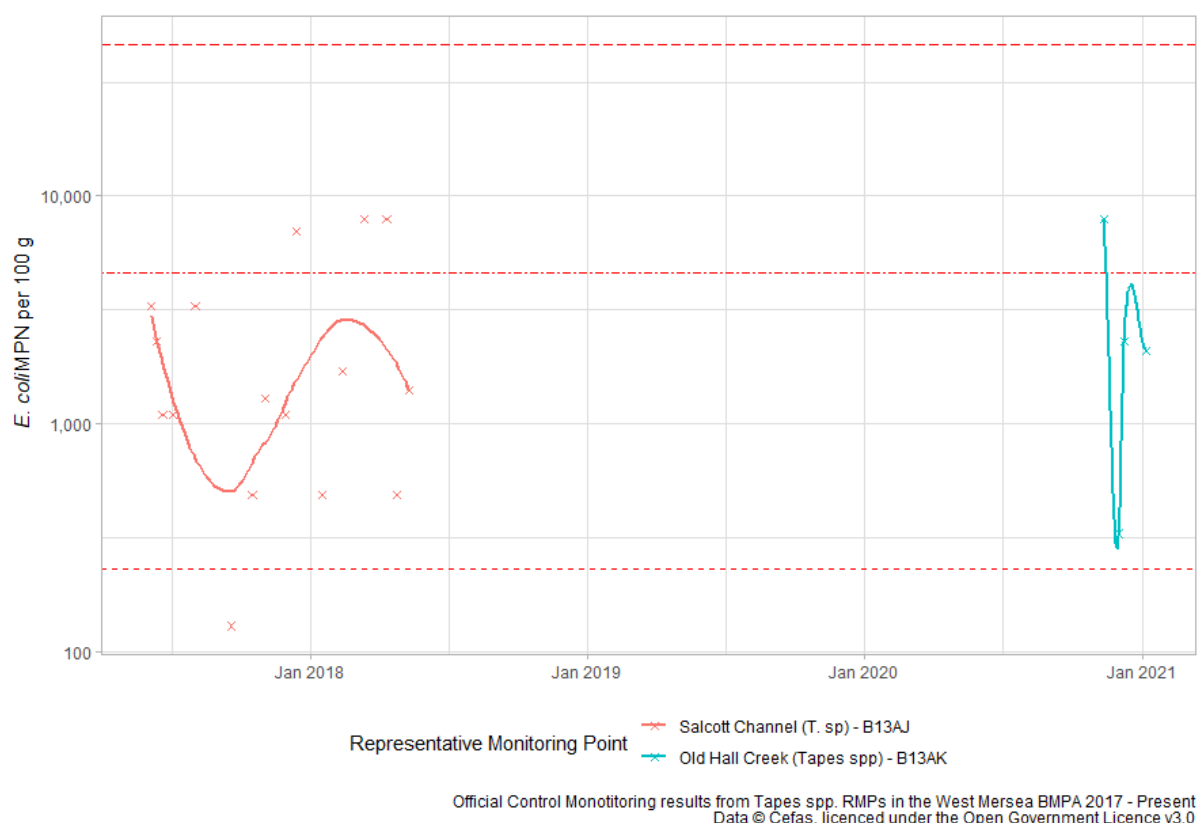
The overall pattern in shellfish flesh monitoring results for Pacific oyster and *Tapes* spp. RMPs within the West Mersea BMPA are shown in Figure 6.4 and Figure 6.5 respectively.

The *E. coli* levels at Pacific oyster RMPs have been generally consistent since the original sanitary survey (Figure 6.4), and all sites follow a similar trend; decreasing until approximately January 2018 and then starting to increase. It is not clear what may have caused this gradual increase. Whilst there is overlap in the raw data, the loess trend lines show a clearer separation of the RMPs with very low mean results e.g. Ray Creek (B013Y), The Hard (B013Z) and West Mersea Outfall (B13AA) from the other areas. These three RMPs are all located away from the main contaminating influences to this BPMA, the drainage channels around and through the saltmarsh to the west, the ebb plume of the Colne and the southern shore of Mersea Island.



*Figure 6.4 Timeseries of *E. coli* levels at Pacific oyster RMPs sampled within the West Mersea BMPA 2013 – Present. Scatter plots are overlaid with loess model fitted to data.*

Little inference can be gained from the timeseries of *Tapes* spp. monitoring data (Figure 6.5), given the short periods of time that data cover for each RMP. Monitoring results from Salcott Channel (B13AJ) indicate that a Class B classification would likely have been awarded to that zone. The same appears to be true for Old Hall Creek (B13AK), once sufficient samples have been collected and analysed.



*Figure 6.5 Timeseries of *E. coli* levels at *Tapes* spp. RMPs sampled within the West Mersea BMPA 2017 – Present. Scatter plots are overlaid with loess model fitted to data.*

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at the Pacific oyster RMPs within the West Mersea BMPA were investigated and are presented in Figure 6.6. 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 data across RMP and season respectively), as well as the interaction between them (i.e. exploring seasonal differences within a given RMP). Significance has been taken at the 0.05 level.

Despite some apparent differences by season, no significant differences were found either when RMPs were pooled ($p = 0.115$) or considered individually ($p = 0.302$). As such, seasonal classifications are unlikely to be appropriate for any of these RMPs.

No seasonal boxplots have been presented for *Tapes* spp. RMPs as with less than one year of data for each RMP, only one datapoint for each RMP is present, and thus ANOVA tests are not relevant.

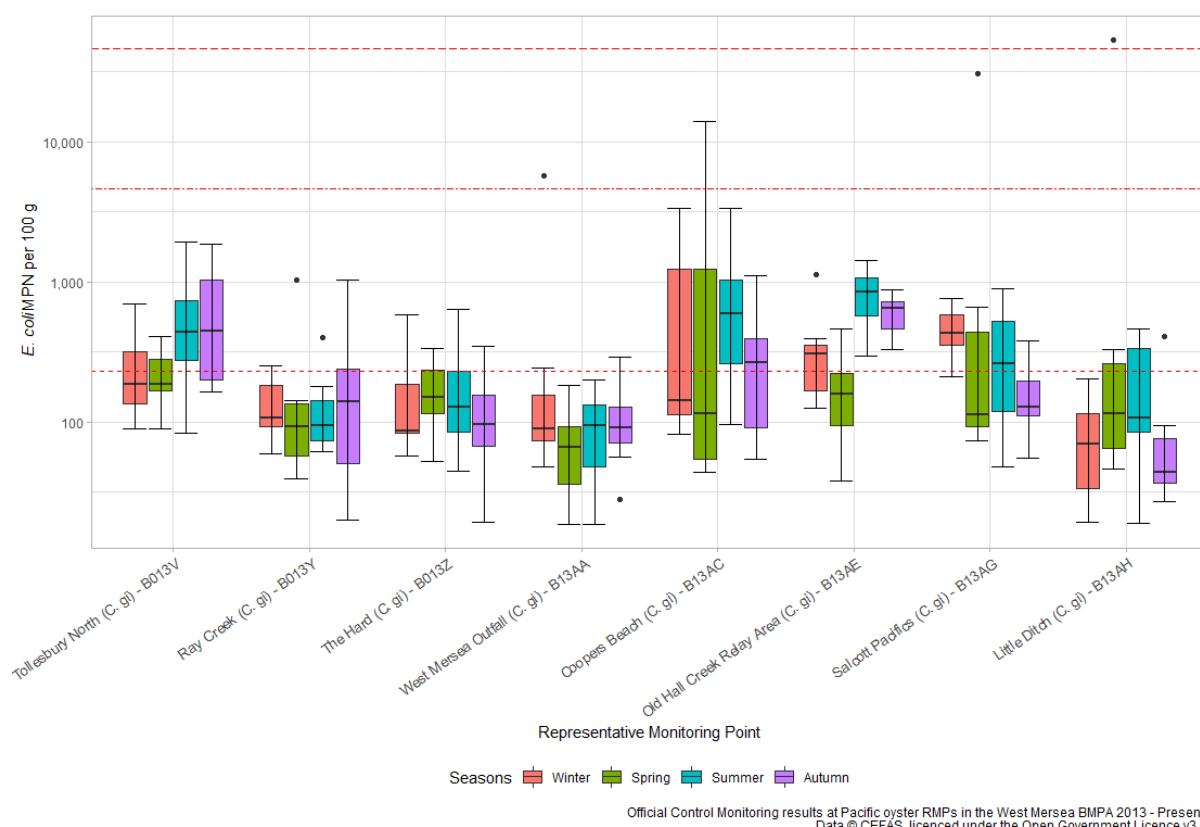


Figure 6.6 Boxplots of *E. coli* levels per season at Pacific oyster RMPs sampled within the West Mersea BMPA 2013 - present.

7 Conclusion and overall assessment

The West Mersea BMPA falls between the Blackwater and Colne BMPAs. Consultation with the Local Authorities that have jurisdiction this BMPA indicated that Pacific oysters (*Crassostrea gigas*) are the dominant fishery by weight, with annual landings of ~320,000 Kg. Native oysters (*Ostrea edulis*) and hard clams (*Mercenaria mercenaria*) are also harvested, albeit to a much lesser extent (800 kg and 300 kg respectively). All the classifications proposed in the original sanitary survey are currently active, with seven each for Pacific and native oysters (matching names and boundaries) and two for hard clams. A relay area for Pacific oysters was recently declassified.

The total population in Electoral Wards contained or partially contained within the West Mersea catchment increased by 7.71% between the 2001 and 2011 censuses (the most recent for which data are available). This population increase has been broadly consistent across the catchment, with 80% of wards showing an increase. Population densities remain relatively low, with the average number of persons per hectare only 13.78. Consultation with the Local Authority did not indicate that significant housing developments have occurred since the original sanitary survey was conducted, although any increase in population without upgrades to the wastewater treatment network would result in an increase in faecal loading to the estuary. Tourism is a key part of the economy in the region,

and population numbers increase significantly during summer months which will further increase the load on the sewerage network.

Consultation with the LA and EA, along with interrogation of the most recent update to the EA's consented discharge database, indicated that some changes to the wastewater treatment network have occurred since the original sanitary survey was published in 2013. Several of the discharges identified in the original document have had their consented DWF's reduced, which would likely lead to some reduction in faecal loading to the estuary. No changes to the treatment methods for any water company owned discharges have occurred, although several privately owned discharges on the south shore of Mersea Island have been upgraded to tertiary treatment, which would likely result in reduced faecal loading. No spill event monitoring was available for the intermittent discharges for comparison. Overall, it is assumed that the increase in loading caused by increasing population has been captured in the overheads of the consented discharge volumes, despite the fact that they have decreased. As such, the loading experienced by the estuary is not predicted to have changed significantly, and the hotspots of contamination are predicted to have remained the same.

The number of livestock living in Local Authority Districts wholly or partially contained within the West Mersea catchment increased by 15.17% between 2013 and 2016 (the most recent for which data are available), though within this are significant differences both within LAD and species. Livestock densities have remained low relative to other areas of the country, at 6.34 animals per hectare. Run off areas of pasture are located immediately adjacent to the estuary, particularly following significant rainfall events, may constitute a significant point source of bacteriological contamination. However, the overall risk from this source of contamination remains low.

The BMPA is situated within or near several internationally designated areas for wildlife conservation, including important populations of wading and overwintering birds. The 5-year average count of overwintering birds to 2018-2019 has increased 15.29% compared to the 5 winters to 2010. However, the precise distributions of these species are directly related to the distributions of their prey, and as such it is difficult to define the areas most at risk of pollution from avian faeces.

The waters within the West Mersea BMPA are popular with recreational boaters. There are several marinas, although as none have pump-out facilities, boats large enough to contain onboard toilets may make occasional overboard discharges. There is a small fishing fleet of ~35 boats in the area, although commercial shipping regulations mean these vessels are prohibited from making overboard discharges near to the coast. The LA indicated that the number of house boats around The Hard has increased since the original sanitary survey was published, however without specific information as to the number, locations and timing/extent of any discharges, it is difficult to define RMPs that accurately capture this source of pollution. No local byelaws regulating overboard discharges from houseboats are in force.

A total of 10 RMPs have been sampled within the West Mersea BMPA since the original sanitary was published in 2013. None of these were sampled prior to the original sanitary survey. Most of these RMPs are for Pacific oysters, with one RMP for *Tapes* spp. sampled between June 2017 and May 2018. Sampling at an additional RMP for *Tapes* spp. began in November 2020. *E. coli* levels have been broadly stable in the intervening period, and geometric mean results suggest that most contaminating influences originate from the head of the drainage channels near the Tollesbury Wick and Old Hall marshes.

No statistically significant seasonal variation in *E. coli* levels was found at any of the RMPs, both within a given RMP and between RMPs of a certain species. Seasonal classifications are therefore not appropriate for RMPs in this BMPA.

Based on the information available, there do not appear to have been any significant changes to the 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 the recommendations of the 2021 report and compared with the findings of the 2013 sanitary survey review for West Mersea, the FSA are content that the level of risk posed by the findings is low and does not warrant further review of the existing shoreline assessment. Additional clarification of uncertainties (i.e. relating to the increase in number of houseboats) will be sought during secondary consultation and the report updated where appropriate.

8 Recommendations

8.1 Pacific oyster

The original sanitary survey recommended the classification of seven classification zones for Pacific oyster harvesting. All are still active, and recommendations for these are described below and summarised in Table 8.1.

Little Ditch

This zone covers an area of 27.5 Ha and is the smaller of the two Salcott drainage channels. The original sanitary survey identified that most of the contaminating influences drain to the head of the channel, and that an RMP placed near that point would be representative. The RMP recommended in the original sanitary survey, Little Ditch (B13AH), remains in use. It is recommended that this continue as the main contaminating influences to this zone have not changed.

Mersea Flats East

This is the smaller of the two classification zones on the flats south of Mersea Island. There are several private discharges along the shoreline edge of this zone, and the original sanitary survey recommended placing an RMP near to the Coopers Beach Outfall. This RMP (Coopers Beach (B13AC)) is still in use. It is recommended that this RMP be retained, because whilst there is another private discharge to the east, the Coopers Beach outfall has a larger consented Max Daily Flow and unspecified treatment. It therefore poses a greater risk than

the outfall near Mersea Island Holiday park, as that one uses UV treatment. Any deterioration of the *Main Channel Outer CZ* in the Colne BMPA should be investigated, as ebb plumes from the River Colne are likely to also affect the eastern half of this CZ.

Mersea Flats West

This is the largest CZ in the West Mersea BMPA, and covers an area of ~750 Ha off the shore of Mersea Island. It meets the *Mersea Flats East CZ* on its eastern boundary, and the *Strood Channel* at its western boundary. The West Mersea STW discharges directly to this zone, and as a consequence the original sanitary survey recommended that the RMP be placed adjacent to the outfall. This RMP (West Mersea Outfall (B13AA)) remains representative of the main contaminating influences to this zone.

Ray Creek

This CZ covers the western section of Strood Channel. The CZ meets the *Strood Channel CZ* along its eastern boundary, and extends from the mouth of Strood Channel up to ~ TL 9986 1425. The original sanitary survey recommended that this zone be classified using samples taken from the upper end of the oyster lays. The RMP (Ray Creek (B013Y)) remains representative of the main contaminating influences, which are minor but generally comprise background contamination from its upstream end.

Salcott Channel

This CZ covers the larger southern half of the waterbody that its name is derived from. The main continuous discharges to the BMPA drain to the top of the zone, which could explain the higher mean *E. coli* levels recorded at the RMP (Salcott Pacifics (B13AG)) used to classify this zone. This RMP was recommended in the original sanitary survey and should be retained.

Strood Channel

This CZ is located adjacent to the *Ray Creek CZ*, on the western side of Mersea Island. It meets the *Pyefleet Channel CZ* (within the Colne BMPA) at its northern boundary. The original sanitary survey identified that the main contaminating influences to this zone originated from around West Mersea Village, including houseboats and moorings. That report recommended the use of an RMP at the hard, near the lifeboat station on the West Mersea Village foreshore. This RMP (The Hard (B013Z)) should be retained as it will still be representative of the diffuse contamination affecting this zone. Should any significant deterioration in monitoring results from the *Pyefleet Channel* or *Ray Creek* zones occur, these should be investigated carefully for potential connectivity with this zone.

Tollesbury North

This zone is the southernmost CZ within the West Mersea BMPA. It covers an area of 5.2 Ha and sits on the southern side of the Tollesbury Wick Marshes. The original sanitary survey identified that most of the pollution sources to this zone originated from the upstream end of the channel and recommended that an RMP at this end be used. This RMP (Tollesbury North (B013V)) should be retained as it is still representative of the main contaminating influences of this zone.

8.2 Native oyster

The original sanitary survey recommended that seven classification zones should be created for native oysters, with the same boundaries and names as the Pacific oyster CZs. Currently, all are classified using Pacific oyster samples. Class A shellfish can be directly consumed without any further treatment, although it is considered that there is sufficient data to continue the current sampling regime in this BMPA, rather than taking samples from all harvested species.

8.3 Hard clams

No hard clam classification zones were recommended in the original sanitary survey. There are currently two classification zones for this species; *Tollesbury North* and *Salcott Channel*. The boundaries and RMPs for these zones are the same as for the Pacific and native oyster CZs of the same name. A report commissioned by the FSA investigating the use of indicator species (Cefas, 2014) suggested that *C. gigas* are representative of *M. mercenaria*, and so it is recommended that the current RMPs for these zones be retained.

8.4 General Information

8.4.1 Location Reference

Production Area	West Mersea
Cefas Main Site Reference	M013
Ordnance survey 1:25,000	Explorer 184
Admiralty Chart	1975

8.4.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Pacific oyster (<i>Crassostrea gigas</i>)	Wild & Cultured	Year Round
Native oyster (<i>Ostrea edulis</i>)	Wild & Cultured	September to April
Hard clam (<i>Mercenaria mercenaria</i>)	Wild	Year Round

8.4.3 Local Enforcement Authority(s)

Name	Colchester Borough Council Rowan House, 33 Sheepen Road, Colchester, Essex CO3 3WG
Website	https://www.colchester.gov.uk/business/environmental-health/
Telephone number	01206 282581/2
E-mail address	customerservicecentre@colchester.gov.uk
Name	Maldon District Council Princes Road, Maldon Essex CM9 5DL
Website	https://www.maldon.gov.uk/info/20091/environmental_health
Telephone number	n/a
E-mail address	n/a

Table 8.1 Proposed sampling plan for the West Mersea BMPA.

<i>Classification Zone</i>	<i>RMP</i>	<i>RMP Name</i>	<i>NGR (OSGB 1936)</i>	<i>Lat/Long (WGS 1984)</i>	<i>Species Represented</i>	<i>Growing Method</i>	<i>Harvesting Technique</i>	<i>Sampling Method</i>	<i>Sampling Species</i>	<i>Tolerance</i>	<i>Frequency</i>
Little Ditch	B13AH	Little Ditch	TL 9863 1319	51°46.926'N, 00° 52.691'E	<i>C. gigas</i> ; <i>O. edulis</i>	Wild / culture	Hand / dredge	Hand	P oysters;	100 m	Monthly
Mersea Flats East	B13AC	Coopers Beach	TM 0518 1345	51°46.925'N, 00°58.390'E	<i>C. gigas</i> ; <i>O. edulis</i>	Wild	Hand / dredge	Hand	P oysters	100 m	Monthly
Mersea Flats West	B13AA	West Mersea Outfall	TM 0310 1211	51°46.248'N 00°56.536'E	<i>C. gigas</i> ; <i>O. edulis</i>	Wild	Hand / dredge	Hand	P oysters;	100 m	Monthly
Ray Creek	B013Y	Ray Creek	TL 9995 1390	51°47.281'N 00°53.862'E	<i>C. gigas</i> ; <i>O. edulis</i>	Wild / culture	Hand / dredge	Hand	P oysters	100 m	Monthly
Salcott Channel	B13AG	Salcott Pacifics	TL 9744 1340	51°47.065'N 00°51.665'E	<i>C. gigas</i> ; <i>O. edulis</i> ; <i>M. mercenaria</i>	Wild / culture	Hand / dredge	Hand	P oysters	100 m	Monthly
Strood Channel	B013Z	The Hard	TM 0000 1301	51°46.800'N 00°53.875'E	<i>C. gigas</i> ; <i>O. edulis</i>	Wild / culture	Hand / dredge	Hand	P oysters;	100 m	Monthly

<i>Classification Zone</i>	<i>RMP</i>	<i>RMP Name</i>	<i>NGR (OSGB 1936)</i>	<i>Lat/Long (WGS 1984)</i>	<i>Species Represented</i>	<i>Growing Method</i>	<i>Harvesting Technique</i>	<i>Sampling Method</i>	<i>Sampling Species</i>	<i>Tolerance</i>	<i>Frequency</i>
Tollesbury North	B013V	Tollesbury North	TL 9775 1145	51°46.008'N 00°51.867'E	<i>C. gigas</i> ; <i>O. edulis</i> ; <i>M.</i> <i>mercenaria</i>	Wild / culture	Hand / dredge	Hand	P oysters	100 m	Monthly

9 References

Allison, S., Hardy, M., Hayward, K., Cameron, T., & Underwood, G., 2020. *Strongholds of Ostrea edulis populations in estuaries in Essex, SE England and their association with traditional oyster aquaculture: Evidence to support a MPA designation*. Journal of the Marine Biological Association of the United Kingdom, 100(1), 27-36.
doi:10.1017/S0025315419001048.

Cefas, 2014. *A critical review of the current evidence for the potential use of indicator species to classify UK shellfish production areas*. Report No. FS512006. Centre for Environment Fisheries & Aquaculture Science, Weymouth UK.

Creed, R., 2017. *Tourism boom worth £189m to Maldon Economy*. Available [online] at: <https://www.maldonandburnhamstandard.co.uk/news/15004609.tourism-boom-worth-189m-to-maldon-economy/>. Accessed January 2021.

Cox, T., Barker, J., Bramley, J., Debney, A., Thompson, D. & Cucknell, A., 2020 *Population trends of harbour and grey seals in the Greater Thames Estuary*. Mammal Communications 6: 42-51, London.

DEFRA, 2013. *Blackwater, Crouch, Roach and Colne Marine Conservation Zone*. Available [online] at: <file:///D:/Downloads/Blackwater,%20Crouch,%20Roach%20and%20Colne%20MCZ%20Factsheet.pdf>. Accessed January 2021.

DEFRA, 2018. *Structure of the agricultural industry in England and the UK*. Available [online] at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672730/structure-june-eng-localauthority-09jan18.xls. Accessed January 2021.

European Commission, 2017. *Community Guide to the Principles of Good Practice for the Microbiological Classification and Monitoring of Bivalve Mollusc Production and Relaying Areas with regard to Regulation 854/2004*. Available [online] at: https://ec.europa.eu/food/sites/food/files/safety/docs/biosafety_fh_guidance_community_guide_bivalve_mollusc_monitoring_en.pdf. Accessed January 2020.

Holt, C., Austin, G., Calbrade, N., Mellan, H., Mitchell, C., Stroud, D., Wotton, S., Musgrove, A., 2011. *Waterbirds in the UK 2009/10*. The Wetland Bird Survey.

KEIFCA, 2018. *Blackwater, Crouch, Roach and Colne Estuaries Marine Conservation Zone Native Oyster Fishery Flexible Permit Byelaw*. Available [online] at: <https://www.kentandessex-ifca.gov.uk/wp-content/uploads/2020/11/BCRC-MCZ-signed-byelaw.pdf>. Accessed January 2021.

KEIFCA, 2021. *KEIFCA Byelaws: Area A Byelaws*. Available [online] at: <https://www.kentandessex-ifca.gov.uk/i-want-to-find-out-about/regulations/keifca-byelaws/byelaws-a/>. Accessed January 2021.

Office for National Statistics, 2018. *National Population Projections (2018 based)*. Available [online] at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2018based>. Accessed January 2021.

RYA, 2020. Waste Management. Available [online] at: <https://www.rya.org.uk/knowledge-advice/environmental-advice/Pages/waste-management.aspx>. Accessed January 2021.

UK Government, 2020. *UK Fishing Vessel Lists*. Available [online] at: <https://www.gov.uk/government/collections/uk-vessel-lists>. Accessed January 2021.

The Green Blue, 2019. *Coastal Pump Out Locations*. Available [online] at: <https://thegreenblue.org.uk/wp-content/uploads/2019/09/UK-Coastal-Pump-Out-Location-List.pdf>. Accessed January 2021.

UK Data Service, 2021. *Geoconvert Tool*. Available [online] at: <http://geoconvert.ukdataservice.ac.uk/>. Accessed January 2021.

Visit Maldon District, 2021. *Walking in the district*. Available [online] at: <https://www.visitmaldondistrict.co.uk/get-here-and-around/Walking-in-the-District.aspx>. Accessed January 2021.

Appendices

Appendix I. Breakdown of Population Change

ID	Electoral Ward	Total Usual Residents				Population Density (persons / ha)		
		2001 Census	2011 Census	Absolute Change	% Change	2001 Census	2011 Census	Absolute Change
1	West Mersea	6,925	7,183	258	3.73%	6.52	6.8	0.28
2	Great Notley and Braintree West	5,420	7,451	2,031	37.47%	13.53	18.6	5.07
3	Hatfield Peverel	4,384	4,376	-8	-0.18%	2.3	2.3	0.00
4	Pyefleet	2,435	2,596	161	6.61%	0.61	0.7	0.09
5	Chelmsford Rural West	2,695	2,764	69	2.56%	0.45	0.5	0.05
6	East Donyland	2,376	2,633	257	10.82%	4.49	5	0.51
7	The Three Colnes	4,848	5,241	393	8.11%	1.74	1.9	0.16
8	Braintree Central	6,502	8,622	2,120	32.61%	32.27	42.8	10.53
9	Boreham and The Leighs	5,093	6,306	1,213	23.82%	1.58	2	0.42
10	Thaxted	3,146	3,512	366	11.63%	0.81	0.9	0.09
11	Gosfield and Greenstead Green	2,460	2,465	5	0.20%	0.75	0.8	0.05
12	Bocking South	4,978	5,796	818	16.43%	19.31	22.5	3.19
13	Bockings Elm	4,337	4,549	212	4.89%	9.24	9.7	0.46
14	Birch and Winstree	4,846	5,651	805	16.61%	0.77	0.9	0.13
15	Highwoods	7,592	9,987	2,395	31.55%	22.39	29.5	7.11
16	Three Fields	3,818	3,967	149	3.90%	0.59	0.6	0.01
17	West Bergholt and Eight Ash Green	5,044	5,074	30	0.59%	2.99	3	0.01
18	Golf Green	4,665	4,799	134	2.87%	14.09	14.5	0.41
19	Kelvedon	5,019	5,148	129	2.57%	2.99	3.1	0.11

20	Thorrington, Frating, Elmstead and Great Bromley	4,642	4,687	45	0.97%	1.17	1.2	0.03
21	Wickham Bishops and Woodham	3,376	3,500	124	3.67%	0.88	0.9	0.02
22	Stanway	7,553	8,283	730	9.67%	8.29	9.1	0.81
23	Ardleigh and Little Bromley	2,370	2,311	-59	-2.49%	0.85	0.8	-0.05
24	The Sampfords	1,782	1,900	118	6.62%	0.35	0.4	0.05
25	Halstead Trinity	4,773	4,892	119	2.49%	42.3	43.3	1.00
26	Witham West	6,886	6,960	74	1.07%	14.58	14.7	0.12
27	Wivenhoe Quay	4,989	5,402	413	8.28%	20.93	22.7	1.77
28	St Marys	4,968	5,018	50	1.01%	46.85	47.3	0.45
29	St Pauls	4,552	4,751	199	4.37%	23.77	24.8	1.03
30	Beaumont and Thorpe	2,399	2,300	-99	-4.13%	0.75	0.7	-0.05
31	Felsted	3,153	5,525	2,372	75.23 %	1.02	1.8	0.78
32	St Osyth and Point Clear	4,119	4,277	158	3.84%	1.28	1.3	0.02
33	Great and Little Oakley	2,306	2,188	-118	-5.12%	1.26	1.2	-0.06
34	Panfield	2,036	2,063	27	1.33%	0.74	0.8	0.06
35	Tollesbury	2,033	1,977	-56	-2.75%	1.68	1.6	-0.08
36	Stour Valley North	2,131	2,166	35	1.64%	0.33	0.3	-0.03
37	Haven	2,108	2,051	-57	-2.70%	14.45	14.1	-0.35
38	Christ Church	4,201	4,482	281	6.69%	29.82	31.8	1.98
39	St John's	5,194	4,807	-387	-7.45%	21.05	19.5	-1.55
40	Witham South	6,154	9,018	2,864	46.54 %	15.98	23.4	7.42
41	Pier	4,810	4,836	26	0.54%	59.82	60.1	0.28
42	Little Clacton and Weeley	4,612	4,590	-22	-0.48%	2.71	2.7	-0.01
43	Stour Valley South	2,065	2,180	115	5.57%	0.5	0.5	0.00
44	Prettygate	7,730	7,396	-334	-4.32%	39.27	37.6	-1.67
45	Bocking North	4,215	4,728	513	12.17 %	3.44	3.9	0.46

46	Alton Park	5,178	4,841	-337	-6.51%	72.08	67.4	-4.68
47	St James	4,334	4,200	-134	-3.09%	22.3	21.6	-0.70
48	Hedingham and Maplestead	6,207	6,550	343	5.53%	1.04	1.1	0.06
49	Great Bentley	2,259	2,253	-6	-0.27%	1.73	1.7	-0.03
50	Brightlingsea	8,146	8,076	-70	-0.86%	7.21	7.1	-0.11
51	St Andrew's	9,362	10,991	1,629	17.40 %	49.61	58.2	8.59
52	Alresford	2,125	2,009	-116	-5.46%	3.12	3	-0.12
53	Rush Green	4,979	4,787	-192	-3.86%	27.53	26.5	-1.03
54	Great Tey	2,764	2,695	-69	-2.50%	0.75	0.7	-0.05
55	Holland and Kirby	4,519	4,724	205	4.54%	3.05	3.2	0.15
56	Fordham and Stour	5,113	5,332	219	4.28%	1.09	1.1	0.01
57	Frinton	4,089	4,002	-87	-2.13%	20.41	20	-0.41
58	Dedham and Langham	2,906	2,943	37	1.27%	1.29	1.3	0.01
59	Broomfield and The Walthams	7,477	8,063	586	7.84%	1.68	1.8	0.12
60	Rayne	2,162	2,299	137	6.34%	2.55	2.7	0.15
61	Bradwell, Silver End and Rivenhall	4,985	5,112	127	2.55%	2.05	2.1	0.05
62	Hamford	4,032	3,847	-185	-4.59%	29.96	28.6	-1.36
63	St Anne's	8,761	8,874	113	1.29%	39.79	40.3	0.51
64	Coggeshall and North Feering	4,778	5,201	423	8.85%	1.61	1.8	0.19
65	Copford and West Stanway	1,876	1,915	39	2.08%	1.7	1.7	0.00
66	St Bartholomew s	4,417	4,390	-27	-0.61%	33.96	33.8	-0.16
67	Upper Colne	2,121	2,145	24	1.13%	0.49	0.5	0.01
68	Mile End	6,215	10,565	4,350	69.99 %	8.12	13.8	5.68
69	Witham North	5,018	4,809	-209	-4.17%	21.09	20.2	-0.89
70	St Johns	4,799	4,662	-137	-2.85%	18.97	18.4	-0.57
71	Castle	7,032	9,996	2,964	42.15 %	20.05	28.5	8.45

72	Braintree East	6,118	7,557	1,439	23.52 %	32.89	40.6	7.71
73	Bradfield, Wrabness and Wix	2,229	2,233	4	0.18%	0.86	0.9	0.04
74	Shrub End	10,528	10,086	-442	-4.20%	19.09	18.3	-0.79
75	Black Notley and Terling	3,298	4,054	756	22.92 %	0.82	1	0.18
76	Bocking Blackwater	7,962	8,183	221	2.78%	39.34	40.4	1.06
77	Tolleshunt D'Arcy	3,926	4,065	139	3.54%	0.83	0.9	0.07
78	Witham Chipping Hill and Central	4,412	4,566	154	3.49%	14.46	15	0.54
79	Bumpstead	2,418	2,558	140	5.79%	0.79	0.8	0.01
80	Halstead St Andrew's	6,280	7,014	734	11.69 %	15.91	17.8	1.89
81	Wivenhoe Cross	4,146	4,623	477	11.51 %	8.48	9.5	1.02
82	Stebbing	1,510	1,560	50	3.31%	0.59	0.6	0.01
83	Berechurch	8,367	9,014	647	7.73%	16.91	18.2	1.29
84	Burrsville	2,109	2,027	-82	-3.89%	5.91	5.7	-0.21
85	Lexden	5,433	5,549	116	2.14%	11.88	12.1	0.22
86	Yeldham	2,041	2,175	134	6.57%	1.57	1.7	0.13
87	Tiptree	7,516	7,583	67	0.89%	9.02	9.1	0.08
88	Harbour	5,701	6,181	480	8.42%	13.2	14.3	1.10
89	Lawford	4,476	4,302	-174	-3.89%	4.07	3.9	-0.17
90	New Town	8,625	10,682	2,057	23.85 %	48.59	60.2	11.61
91	Peter Bruff	4,693	4,436	-257	-5.48%	54.71	51.7	-3.01
92	Cressing and Stisted	2,155	2,311	156	7.24%	0.94	1	0.06
93	Great Totham	3,463	3,660	197	5.69%	1.14	1.2	0.06
94	Manningtree, Mistley, Little Bentley and Tendring	4,365	4,603	238	5.45%	1.51	1.6	0.09
95	Marks Tey	2,566	2,551	-15	-0.58%	4.21	4.2	-0.01
96	Braintree South	6,535	7,477	942	14.41 %	36.16	41.4	5.24
97	South Weald	1,828	1,891	63	3.45%	1.53	1.6	0.07
98	Galleywood	5,898	5,738	-160	-2.71%	6.59	6.4	-0.19

99	Ingatestone, Fryerning and Mountnessing	5,640	5,966	326	5.78%	2.02	2.1	0.08
100	Hutton North	4,189	4,236	47	1.12%	27.01	27.3	0.29
101	Heybridge East	3,882	4,023	141	3.63%	7.54	7.8	0.26
102	Goat Hall	5,786	5,690	-96	-1.66%	14.61	14.4	-0.21
103	Barnston and High Easter	1,507	1,701	194	12.87%	0.54	0.6	0.06
104	Hutton East	3,477	3,661	184	5.29%	7.15	7.5	0.35
105	Trinity	5,830	6,295	465	7.98%	39.94	43.1	3.16
106	Brizes and Doddinghurst	5,923	5,958	35	0.59%	1.82	1.8	-0.02
107	Maldon South	4,056	4,015	-41	-1.01%	23.44	23.2	-0.24
108	Takeley and the Canfields	2,939	4,716	1,777	60.46%	0.97	1.6	0.63
109	St Andrews	8,644	9,081	437	5.06%	40.59	42.6	2.01
110	Maldon West	4,011	3,777	-234	-5.83%	14.11	13.3	-0.81
111	Purleigh	3,201	3,419	218	6.81%	0.78	0.8	0.02
112	Great Dunmow South	4,459	4,952	493	11.06%	3.55	3.9	0.35
113	Herongate, Ingrave and West Horndon	3,490	3,712	222	6.36%	1.76	1.9	0.14
114	Shenfield	5,144	5,432	288	5.60%	7.52	7.9	0.38
115	The Eastons	1,489	1,577	88	5.91%	0.52	0.5	-0.02
116	Great Baddow West	5,164	6,273	1,109	21.48%	27.1	32.9	5.80
117	Marconi	6,306	7,401	1,095	17.36%	44.35	52.1	7.75
118	Great Baddow East	7,853	8,377	524	6.67%	17.16	18.3	1.14

11 9	Patching Hall	8,776	8,939	163	1.86%	44.1	44.9	0.80
12 0	High Ongar, Willingale and The Rodings	2,081	2,237	156	7.50%	0.45	0.5	0.05
12 1	Billericay West	11,934	11,964	30	0.25%	22.5	22.6	0.10
12 2	Pilgrims Hatch	5,908	5,963	55	0.93%	12.57	12.7	0.13
12 3	Maldon North	3,812	4,239	427	11.20 %	8.87	9.9	1.03
12 4	Springfield North	8,999	8,807	-192	-2.13%	32.22	31.5	-0.72
12 5	Brentwood South	5,099	5,789	690	13.53 %	28.89	32.8	3.91
12 6	South Hanningfield, Stock and Margaretting	5,179	5,576	397	7.67%	1.19	1.3	0.11
12 7	Bicknacre and East and West Hanningfield	5,039	5,035	-4	-0.08%	1.5	1.5	0.00
12 8	Rettendon and Runwell	5,039	5,021	-18	-0.36%	2.17	2.2	0.03
12 9	Warley	5,662	5,973	311	5.49%	3.1	3.3	0.20
13 0	Elsenham and Henham	3,602	3,679	77	2.14%	1.56	1.6	0.04
13 1	Waterhouse Farm	4,985	6,319	1,334	26.76 %	22.96	29.1	6.14
13 2	Burstead	10,417	10,620	203	1.95%	5.42	5.5	0.08
13 3	Hutton South	3,786	3,826	40	1.06%	21.74	22	0.26
13 4	The Rodings	1,755	1,853	98	5.58%	0.53	0.6	0.07
13 5	Moulsham Lodge	5,484	5,624	140	2.55%	49.97	51.3	1.33
13 6	Hutton Central	3,674	3,855	181	4.93%	16.86	17.7	0.84
13 7	Great Dunmow North	2,537	3,878	1,341	52.86 %	2.36	3.6	1.24
13 8	The Lawns	5,610	5,402	-208	-3.71%	31.95	30.8	-1.15

13 9	Wimbish and Debden	2,303	2,407	104	4.52%	0.63	0.7	0.07
14 0	Tipps Cross	3,830	3,807	-23	-0.60%	2.51	2.5	-0.01
14 1	Billericay East	11,472	11,777	305	2.66%	21.55	22.1	0.55
14 2	Heybridge West	3,745	4,152	407	10.87 %	22.3	24.7	2.40
14 3	Little Baddow, Danbury and Sandon	8,091	8,285	194	2.40%	2.41	2.5	0.09
14 4	Maldon East	2,155	2,189	34	1.58%	6.31	6.4	0.09
14 5	Chelmer Village and Beaulieu Park	8,406	11,277	2,871	34.15 %	15.61	20.9	5.29
14 6	Brentwood North	5,919	6,485	566	9.56%	33.37	36.6	3.23
14 7	Moulsham and Central	8,457	10,201	1,744	20.62 %	30.24	36.5	6.26
14 8	Althorne	4,002	4,128	126	3.15%	1.07	1.1	0.03
14 9	Writtle	5,632	5,383	-249	-4.42%	3.12	3	-0.12
15 0	Balsham	4,465	4,682	217	4.86%	0.46	0.5	0.04
15 1	Ashdon	1,601	1,736	135	8.43%	0.5	0.5	0.00
15 2	Tillingham	2,181	2,182	1	0.05%	0.37	0.4	0.03
15 3	Mayland	3,795	4,360	565	14.89 %	1.43	1.6	0.17
Total (Average)		724,414	780,280	55,866	7.71%	12.89	13.78	0.89



EC Regulation 854/2004

**CLASSIFICATION OF BIVALVE
MOLLUSC PRODUCTION AREAS IN
ENGLAND AND WALES**

**SANITARY SURVEY REPORT
West Mersea**



2013

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Carcinus Ltd
Consultancy and Survey Specialists

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"



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