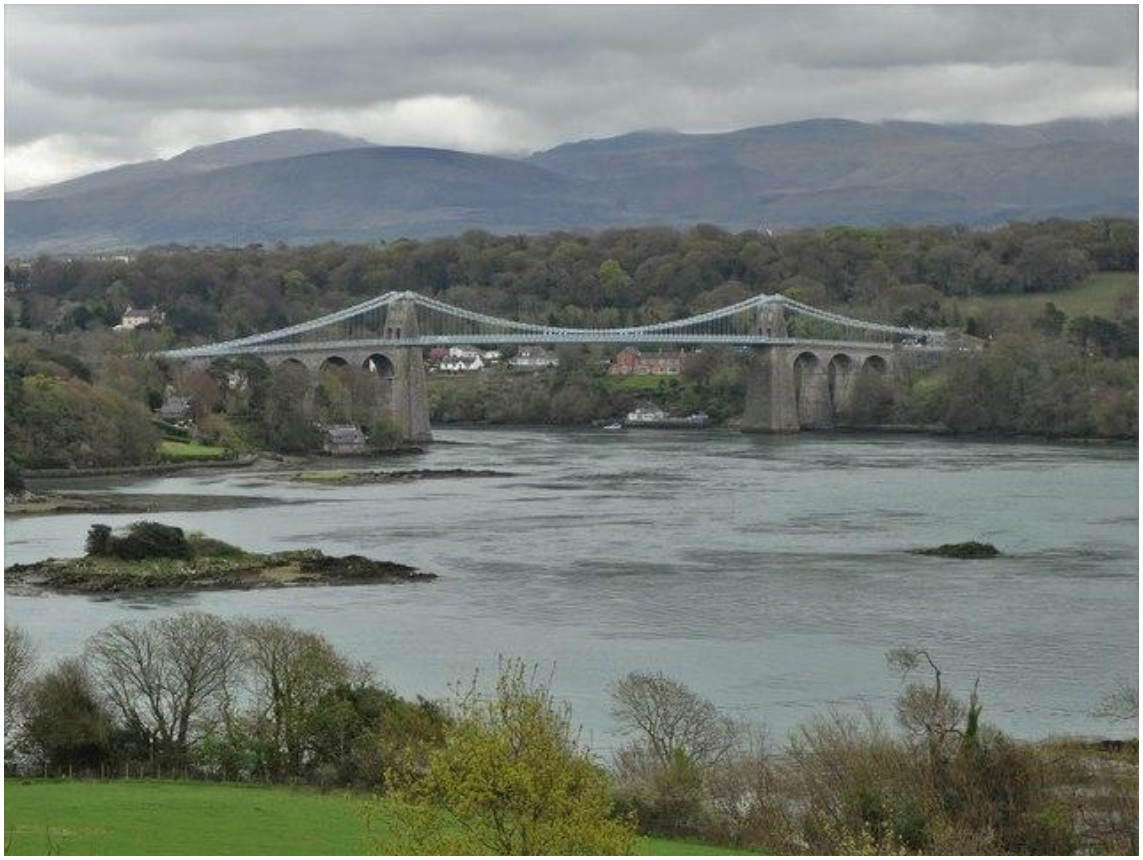
Sanitary Survey- Review

Menai Strait East & West – 2025



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Carcinus Ltd, Wessex House, Upper Market Street, Eastleigh, Hampshire, SO50 9FD.
Tel. 023 8129 0095
https://www.carcinus.co.uk/

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Document QA and Approval

	Name	Role	Date
Author	Joshua Baker	Senior Consultant	21 January 2025
Checked	Matthew Crabb	Director	24 January 2025
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Initial Consultation

Consultee	Date of consultation
Ynys Mon/ Isle of Anglesey County Council	June 2022 (updated in March 2023)
Conwy County Borough Council	June 2022 (updated in March 2023)
Cyngor Gwynedd /Gwynedd Council	July 2022 (updated in March 2023)
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Consultation on draft report

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Welsh Government	January 2024
Ynys Mon Council	January 2024
Natural Resources Wales	January 2024
Menai Strait Fishery Order Management Association (MSFOMA)	January 2024

A Sanitary Survey relevant to the bivalve mollusc beds in the Menai Strait East & West was undertaken in 2013 in accordance with Regulation (EC) 854/2004 (which is replaced by assimilated Regulation (EU) 2017/625, with sanitary survey requirements now specified in assimilated Regulation (EU) 2019/627). These reports 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, Conwy County Borough Council, Cyngor Gwynedd Gwynedd Council, Ynys Mon Isle of Anglesey County Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2025. Review of the Menai Strait East & West 2013 Sanitary Surveys. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in Wales and England under assimilated Regulation (EU) 2019/627.

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1 Introduction

1.1 Background

The Food Standards Agency (FSA) is responsible for carrying out Sanitary Surveys in classified production and relay areas in accordance with Article 58 of assimilated Regulation 2019/627 and the EU Good Practice Guide (European Commission, 2021). In line with these requirements, Sanitary Surveys must be reviewed to ensure public health protection measures continue to be appropriate. Carcinus is contracted to undertake reviews on behalf of the FSA.

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 previous 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 the outcome of the desktop report and identified risks. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Menai Strait East & West Review

The Menai Strait is a 30 km tidal channel that separates the Island of Anglesey from North Wales. The previous Sanitary Surveys assessed both parts of the strait, the western part from Fort Belan to the Britannia Bridge, and the eastern part from the Britannia Bridge to the Conwy separately, in line with the designated Bivalve Mollusc Production Areas (BMPAs). This review considers the pollution sources collectively, given the connectivity between the two areas. It reviews information and makes recommendations for a revised sampling plan for existing mussel (*Mytilus* spp.), cockle (*Cerastoderma edule*) and Pacific oyster (*Crassostrea gigas*) classification zones (CZs) in both parts of the Menai Strait (Figure 1.1). Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with Local Authorities (LAs) and Natural Resources Wales (NRW) responsible for the production area was undertaken in Summer 2022. This supporting local intelligence is valuable to assist with the review and was incorporated in the assessment process. This desktop assessment was produced in January and February 2023, and additional requests for consultation were made to the consultees listed above to check for additional information.

Following production of a draft report, a wider **external second round of consultation** with responsible LAs, Industry and other Local Action Group (LAG) members (including the Menai Strait Fishery Order Management Association (MSFOMA)) was undertaken in December 2023 and January 2024. 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. Further discussions regarding suitable locations for Official Control Sampling were had in autumn 2024 and the sampling plan was agreed in October and November 2024. This report was finalised in January 2025.

The review updates the assessments originally conducted in 2013 and sampling plans as necessary and the report should be 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.

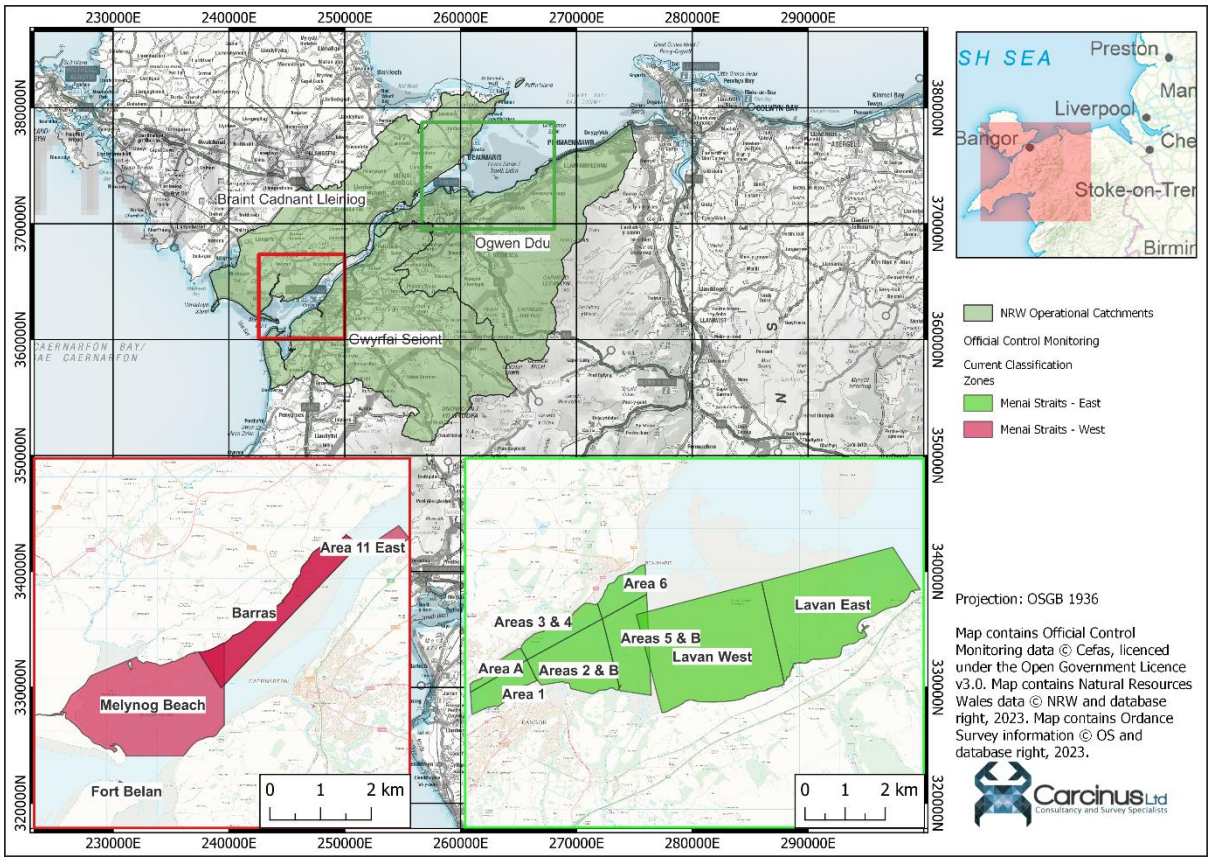


Figure 1.1 Location of the Menai Strait in north-west Wales. The locations of the Menai Strait - West and Menai Strait – East BMPAs are indicated by the red and green boxes, respectively.

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 LAs and NRW
- The findings of this report are based on information and data sources up to and including February 2023;
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data has been provided directly by Cefas, with no additional verification of the data undertaken. The data is also available on the data hub[1]. Results up to and including June 2024 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

2.1.1 Menai Strait East

The boundaries of the Menai Strait- East BMPA are defined as being the body of water stretching from the Britannia Bridge to the west, to a line drawn between the Trwyn Du Light House at NGR SH641815 and the Penmaenmawr Railway Station at NGR SH715764. The closest BMPAs to this are the Menai Strait- West and Anglesey Mussels, situated on the other side of the Britannia Bridge and of the northern part of Conwy Bay respectively.

The shellfish beds within the Menai Strait- East BMPA are under the jurisdiction of several different LAs for food hygiene purposes. These are Ynys Mon/ Isle of Anglesey County Council (CZs on the northern side of the Strait), Cyngor Gwynedd/Gwynedd Council (CZs on the southern side of the strait) and Conwy County Borough Council (CZs on the Lavan Sands).

The Menai Strait- East BMPA sees the harvest of cultured mussels and wild cockles. A description of the shellfishery for each of the harvested species is summarised in the following paragraphs.

Mussels

The harvest of mussels from within the Menai Strait East has been regulated under a several order since 1962. On 02 April 2022, the 'new' Menai Strait (East) Mussel and Oyster Fishery Order 2022[2] (the 2022 order) came into force, replacing the old order that expired at midnight on 01 April 2022. This Order grants a right of several fishery, and a right of regulating said fishery, to the Menai Strait Fishery Order Management Association (MSFOMA) for a period of 35 years. Under this Order, MSFOMA have designated an area

[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] The Menai Strait (East) Mussel and Oyster Fishery Order 2022. Available at: https://www.legislation.gov.uk/wsi/2022/213/pdfs/wsi_20220213_mi.pdf.

within the Order boundaries as the several fishery area (Figure 2.1). All mussel farming in the Menai Strait- East BMPA takes place from within this several fishery area.

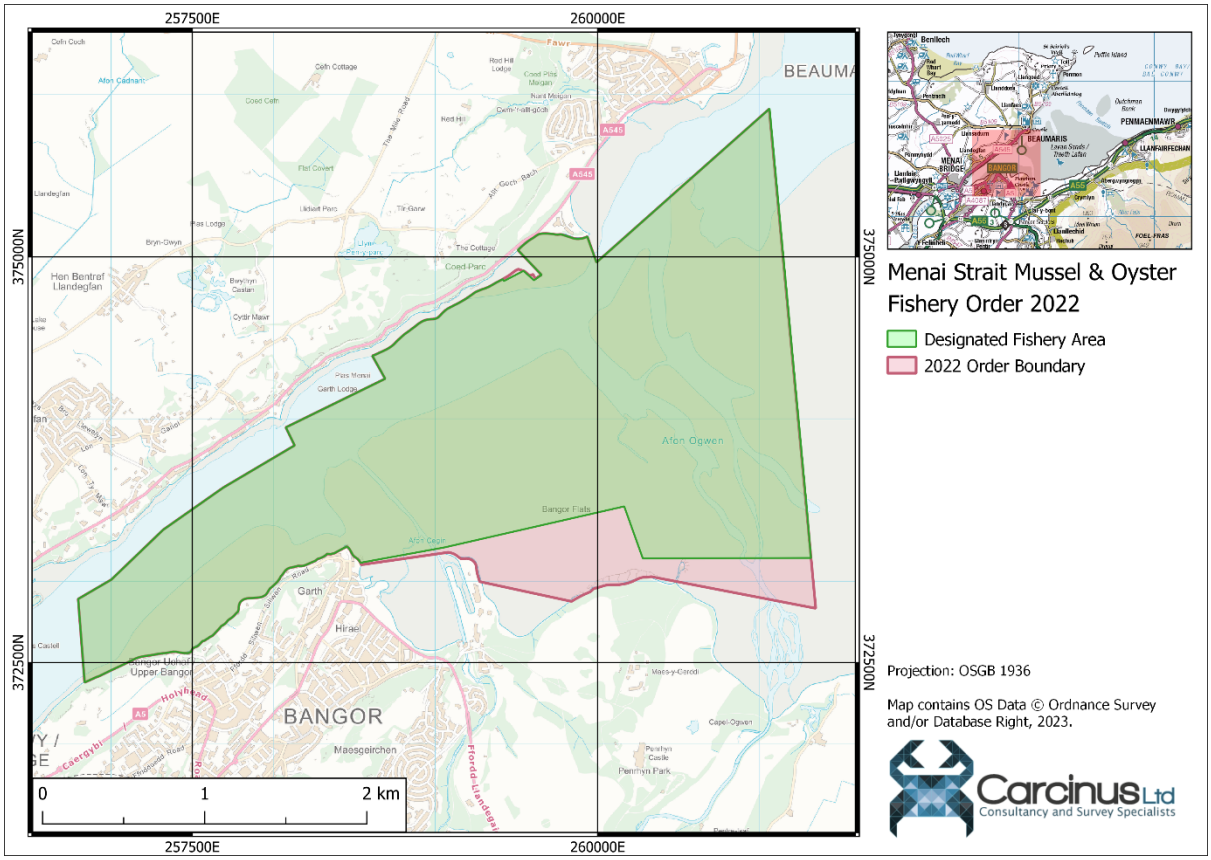


Figure 2.1 Boundaries of the Menai Strait (East) Mussel & Oyster Fishery Order 2022, and the designated fishery area within them.

Within the Fishery Order area, MSFOMA grant licences to fishermen to take mussels (by hand or rake), subject to one or more of the following controls (MSFOMA, 2020):

- Total Allowable Catch (TAC);
- Spatial controls to limit the area where fishing is possible; and
- Temporal controls to limit the area when fishing is possible.

Furthermore, MSFOMA may specify quotas for individual licensees, require licensees to submit fishery returns and close the fishery if necessary to maintain sustainable management. Information provided by Welsh Government during secondary consultation indicated that the last licences for wild mussel harvest in the Menai Strait – East BMPA were issued in 2012.

Within the designated Several Fishery area (shown in Figure 2.1) MSFOMA also issue eight leases for mussel cultivation layings along defined boundaries (MSFOMA, 2021). The boundaries of the CZs presented in Figure 2.3 broadly align with the extent of these layings. All current mussel harvesting within the Menai Strait – East BMPA takes place from within these layings and the harvesting/cultivation activities are conducted via boats at high water

(as access to and from Port of Penrhyn is tidally restricted). The process starts with seed mussel fished from naturally occurring but ephemeral areas elsewhere within the Irish sea (usually Caernarfon bay or Morecambe bay) which is then bought back by vessel to the leased areas in the Menai Strait - East. It is then re-laid in the upper intertidal for the purpose of fattening but also as a trigger for some physiological adaptation that make the mussel less prone to predation as it grows. After a season, these mussels are moved lower down the shore into areas that are submerged wholly or for longer over a tidal cycle. The mussels are then harvested when they reach appropriate market size and condition.

Cockles

The cockle fishery within the Menai Strait- East BMPA is not managed and regulated to the same degree as the mussel fishery. The harvest of cockles is regulated under The Cockles and Mussels (Specified Area) (Wales) Order 2011[3]. Under this legislation, no person may remove (by hand) more than five kilograms of cockles in any one day without a permit. No other harvest controls apply to this species. The cockle fishery operates in a separate area to the mussel harvest, focusing on the Lavan Sands area at the mouth of the Menai Strait.

Figures provided indicate that approximately 170 tonnes of cockles were removed from the Lavan Sands area between September 2021 and February 2022, with the largest harvest in September 2021. For the 2022/2023 year, the TAC was 1,384 tonnes and fishing only permitted on Wednesday – Sunday.

2.1.2 Menai Strait- West

The boundaries of the Menai Strait- West BMPA are defined as being the body of water stretching from the Britannia Bridge in the east to the eastern end of Caernarfon Bay (around NGR: SH442612). The closest BMPA to this is the Menai Strait- East on the other side of the Britannia Bridge.

The shellfish beds within the Menai Strait- West BMPA are under the jurisdiction of two different LAs for food hygiene purposes. These are Ynys Mon/ Isle of Anglesey County Council (CZs on the northern side of the Strait) and Cyngor Gwynedd/Gwynedd Council (CZs on the southern side of the Strait).

The Menai Strait- West BMPA sees the harvest of cultured mussels, cultured Pacific oysters and wild cockles. A description of the shellfishery for each of the harvested species is summarised in the following paragraphs.

Mussels

The harvest of mussels within the Menai Strait- West BMPA has previously been regulated under the Menai Strait (West) Fishery Order 1978. MSFOMA consulted on a new Order in

[3] The Cockles and Mussels (Specified Area) (Wales) Order 2011. Available at: https://www.legislation.gov.uk/wsi/2011/1988/made.

2015 and there were objections; to date Welsh Government have not subsequently 'made' this order.

The draft wording of this Order sets out the coordinates of four plots within the Menai-WestBMPA; mussel harvest is permitted in three of these (Plot A, B & C; Figure 2.2). Under the Order, the MSFOMA would grant leases to fishermen who operate the fishery.

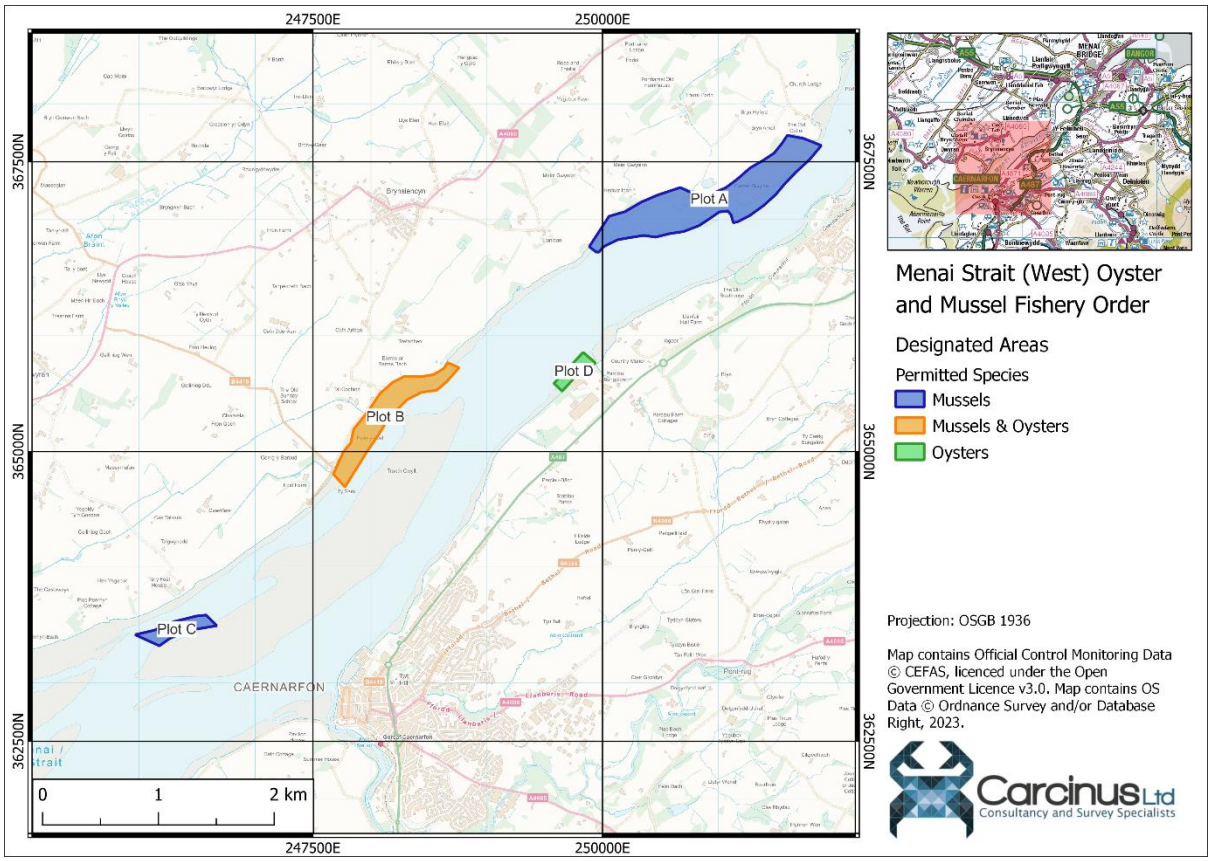


Figure 2.2 Designated shellfish plots as specified in the Menai Strait (West) Oyster and Mussel Fishery Order 2015[4] (note – this order is not yet 'made').

In addition to the Menai Strait West Order, the harvest of mussels is regulated under The Cockles and Mussels (Specified Area) (Wales) Order 2011[5]. Under this legislation, no person may remove (by hand) more than five kilograms of mussels in any one day without a permit. No other harvest controls apply to this species.

No landing statistics are available, as the output from this fishery is currently nil. We understand that there remains industry interest in maintaining the classification of the CZs described in Section 2.2.2 and so they are retained for consideration within this review.

[4] Menai Strait (West) Oyster and Mussel Fishery Order 2015. Available at: http://www.msfoma.org/wp-content/uploads/2015/10/DRAFT-Menai-Strait-West-Oyster-and-Mussel-Fishery-Order-2015.pdf

[5] The Cockles and Mussels (Specified Area) (Wales) Order 2011. Available at: https://www.legislation.gov.uk/wsi/2011/1988/made.

Pacific oysters

Two of the Plots specified in the draft wording for the Menai West Fishery Order 2015 confer a right of fishery for oysters (Plots C & D; Figure 2.2). No harvest controls apply to the fishing of this species within the Menai Strait- West BMPA, inside or outside the plots. The current landings from this fishery are unknown, but continued classification is required due to industry interest.

Cockles

The harvest of mussels is regulated under The Cockles and Mussels (Specified Area) (Wales) Order 2011[6]. Under this legislation, no person may remove (by hand) more than five kilograms of cockles in any one day without a permit. No other harvest controls apply to this species. In 2021, approximately 62 tonnes of cockles were harvested from the Cockle CZ of this BMPA, suggesting that it is the dominant fishery by weight. The Total Allowable Catch (TAC) for 2023/2024 is 168 tonnes of cockles, and 124 permits have been issued, although no gathering has commenced yet. The TAC for 2022/2023 was 359 Tonnes, and catch returns indicate 130 tonnes were taken.

2.2 Classification History

2.2.1 Menai Strait- East

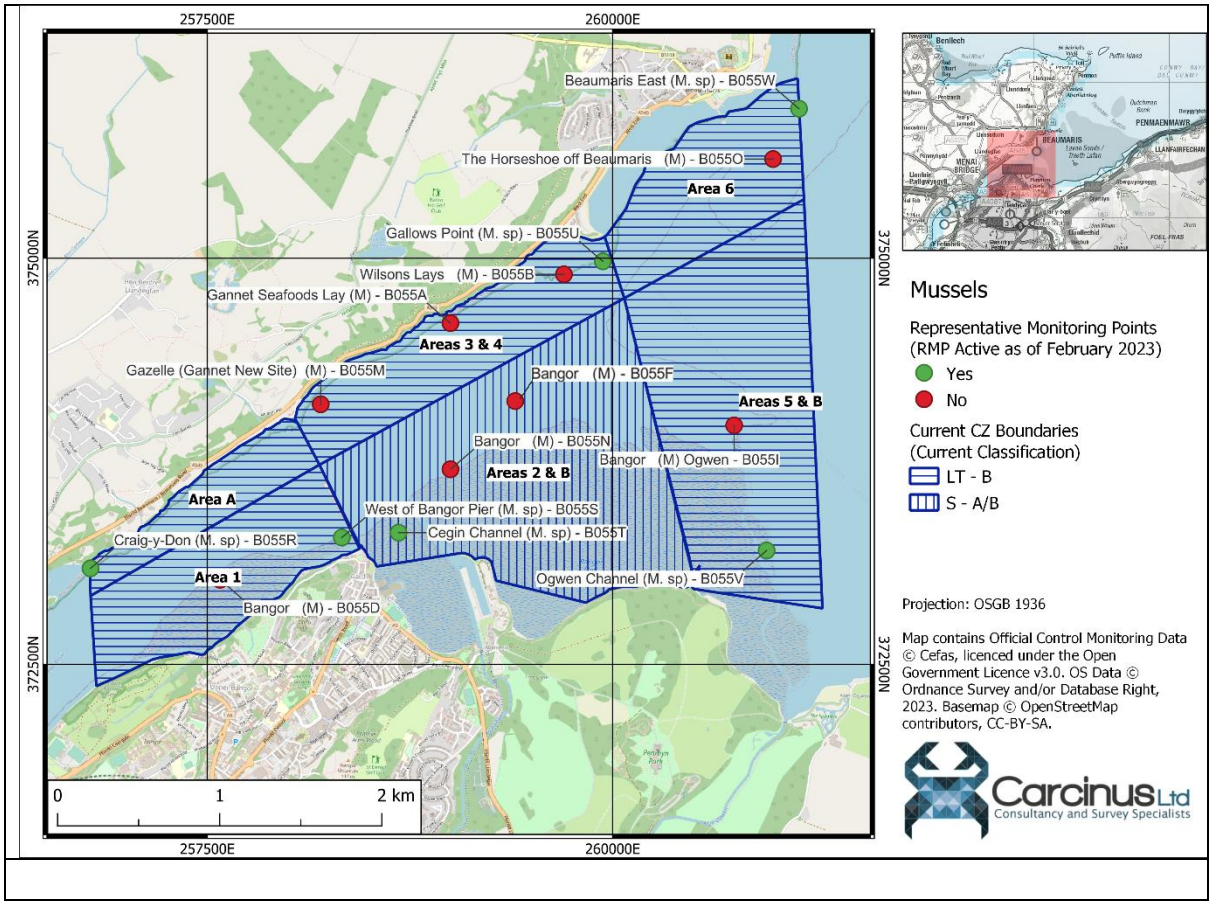
The 2013 Sanitary Survey of the Menai Strait – East recommended the creation of six Classification Zones (CZs) for mussels, two for cockles and one for razor clams. The mussel CZs formed one continuous zone in the mouth of the Menai Strait, the cockle zones were located on Lavan Sands, and the razor clam zone off Llanfairfechan. All mussel and cockle CZs recommended in the 2013 Sanitary Survey of the Menai Strait- East are currently active. The razor clam zone was never awarded a full classification. A summary of the currently active classification zones within the Menai Strait- East is presented in Table 2.1 and the location of all active CZs and associated Representative Monitoring Points (RMP)s is presented in Figure 2.3.

Table 2.1 Currently active Classification Zones in the Menai Strait- East BMPA.

Classification Zone	Species	Current Classification	Current RMP
Area 1	Mussels	B – LT	West of Bangor Pier (B055R)
Area 6	Mussels	B – LT	Beaumaris East (B055W)
Area A	Mussels	B – LT	Craig-y-Don (B055R)
Areas 2 & B	Mussels	Class A Season 1st October – 30th April,	Cegin Channel (B055T)

[6] The Cockles and Mussels (Specified Area) (Wales) Order 2011. Available at: https://www.legislation.gov.uk/wsi/2011/1988/made.

		reverting to Class B at all other times	
Areas 3 & 4	Mussels	B – LT	Gallows Point (B055U)
Areas 5 & B	Mussels	B – LT	Ogwen Channel (B055V)
Lavan East	Cockles	B – LT	Lavan Sands East (B055X)
Lavan West	Cockles	B – LT	Lavan Sands West (B055X)



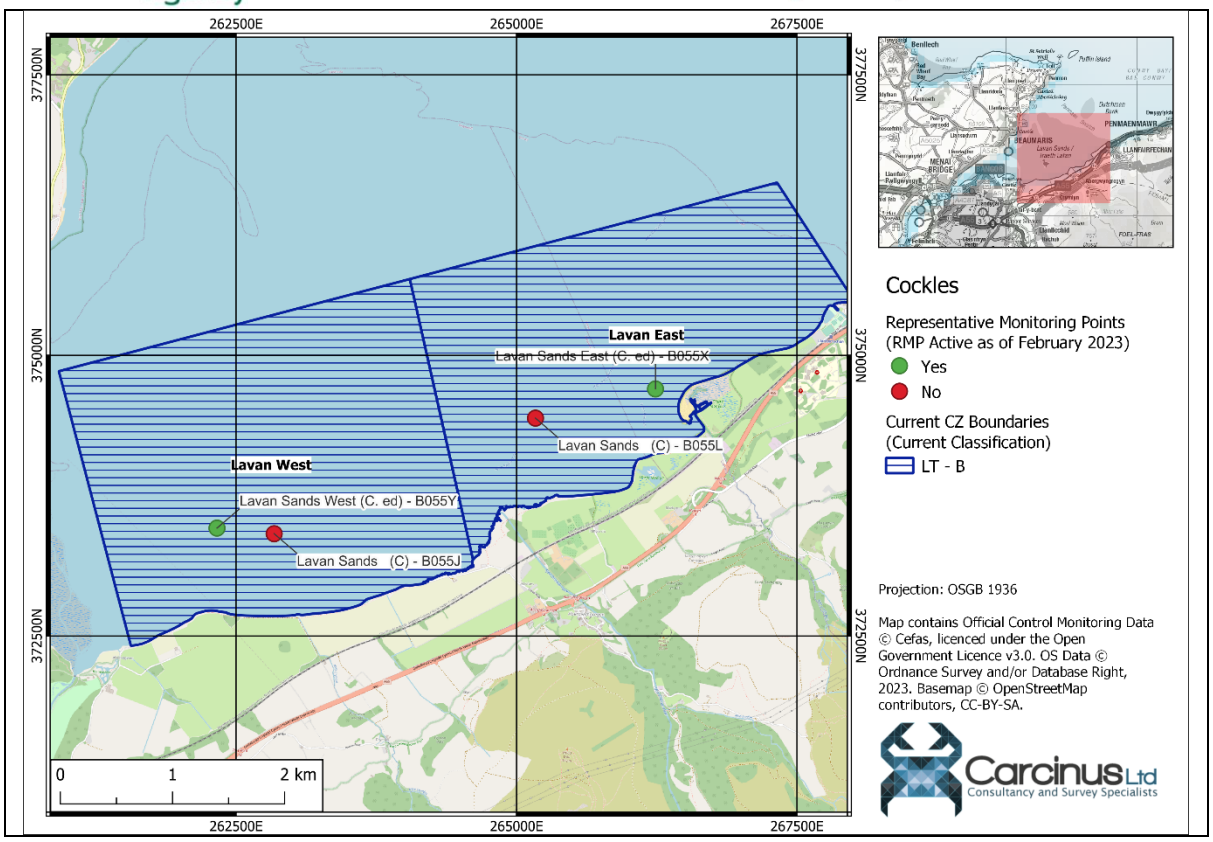


Figure 2.3 Current Classification Zones and associated Representative Monitoring Points in the Menai Strait- East BMPA.

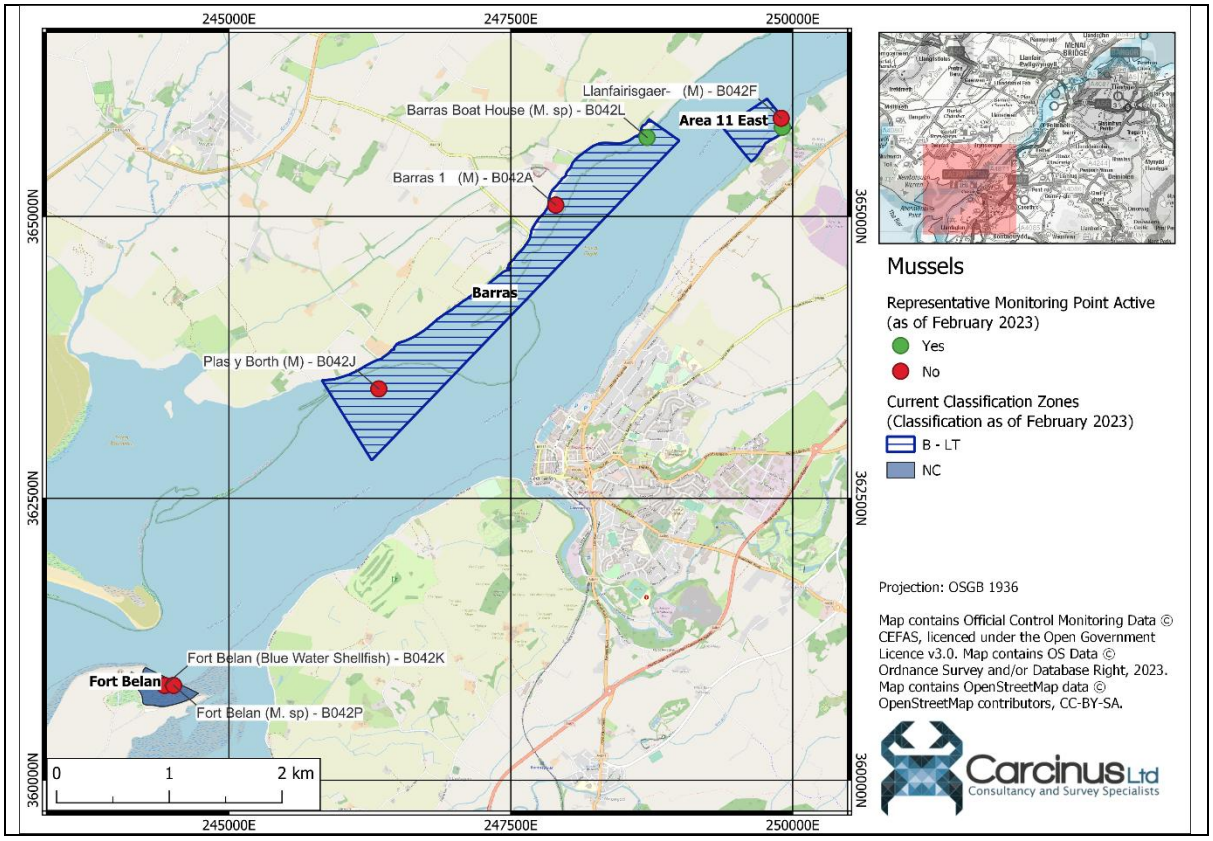
2.2.2 Menai Strait- West

The 2013 Sanitary Survey of the Menai Strait-West recommended the creation of five CZs for mussels (of which only two were active at the time of that report), three for Pacific oyster (of which two were active) and one for cockles. As of March 2023, two of the mussel zones (*Areas 1 – 3* and *Llanfair*) are active, as is one of the Pacific oyster zones (*Areas 1 – 3*) and the cockle zone. An additional mussel CZ, *Fort Belan*, is not currently classified but during initial consultations the LAs indicated that there was industry desire for reclassification. As such, it has been included for consideration throughout this report. A summary of the currently active classification zones within the Menai Strait- West is presented in Table 2.2 and the location of all currently active (and candidate) CZs and associated Representative Monitoring Points is shown in Figure 2.4. During initial consultations, it became clear that there were some discrepancies between the names used to refer to various CZs by different groups. Where possible, the CZ names used throughout this report are those used provided by the LA.

Table 2.2 Currently active Classification Zones in the Menai Strait- West BMPA.

Classification Zone	Species	Current Classification	Current RMP
Barras (aka Areas 1-3)	Mussels	B – LT	Barras Boat House (B042L)

Area 11 East (aka Llanfair; Llanfairisgaer)	Mussels	B – LT	Area 11 East (B042O)
Fort Belan	Mussels	Not currently classified	N/A
Barras (aka Areas 1-3)	Pacific oyster	B – LT	Barras Boat House (B042L)
Traeth Melynog (aka Melynog Beach)	Cockles	B – LT	Traeth Melynog (B042C)



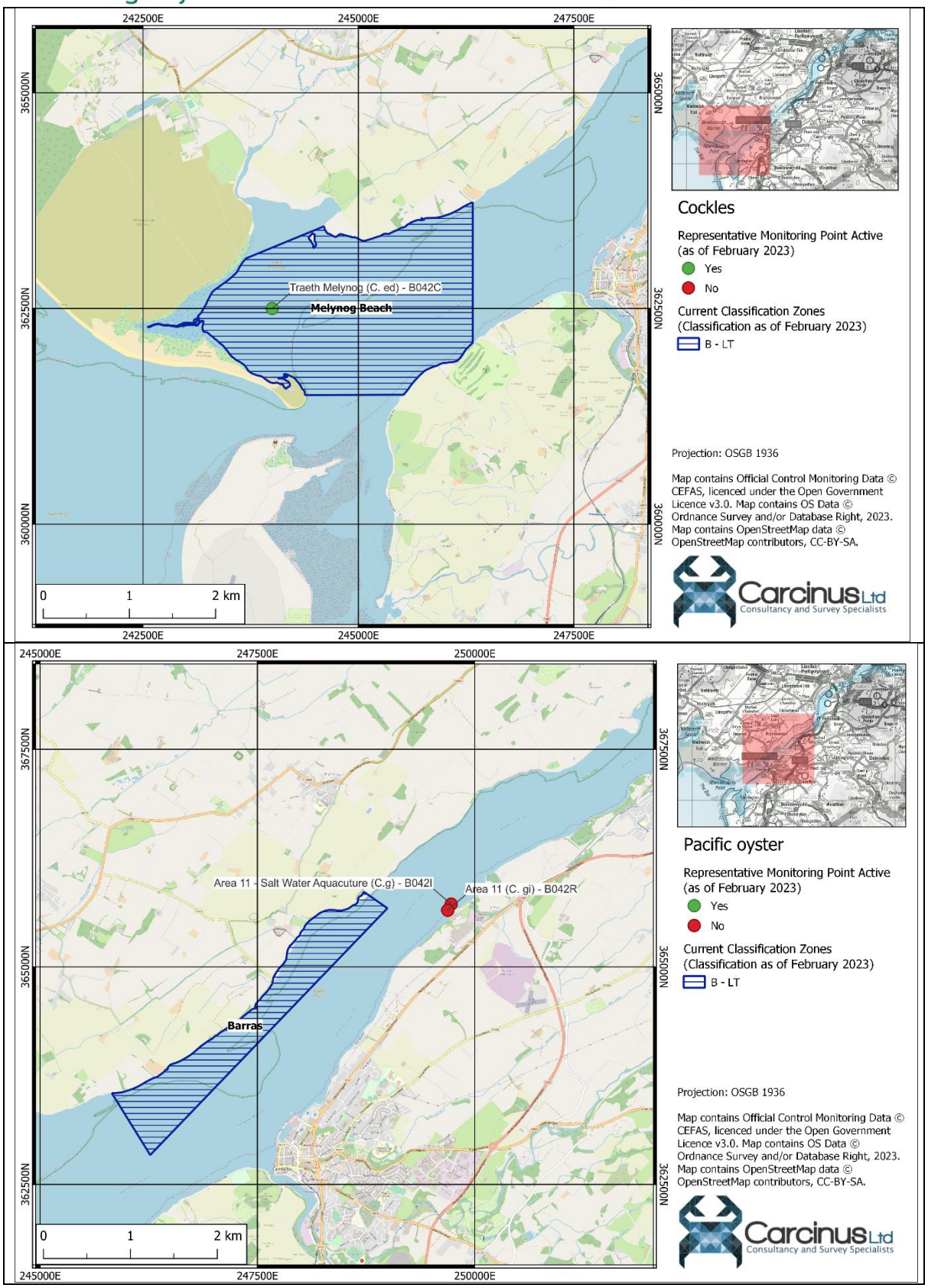


Figure 2.4 Current Classification Zones and associated Representative Monitoring Points in the Menai Straits- West BMPA.

3 Pollution sources

3.1 Human Population

The 2013 Sanitary Surveys of the Menai East and Menai West cite population statistics for the study area based on the 2011 Census of the United Kingdom. Preliminary results from the subsequent Census (conducted in March 2021) have since been published and so a comparison of these two surveys has been used to give an indication of changes in human population within the study area. Human population density within Census Super Output Areas (Lower Layer) in the vicinity of the Menai Strait at the 2011 and 2021 Censuses are presented in Figure 3.1.

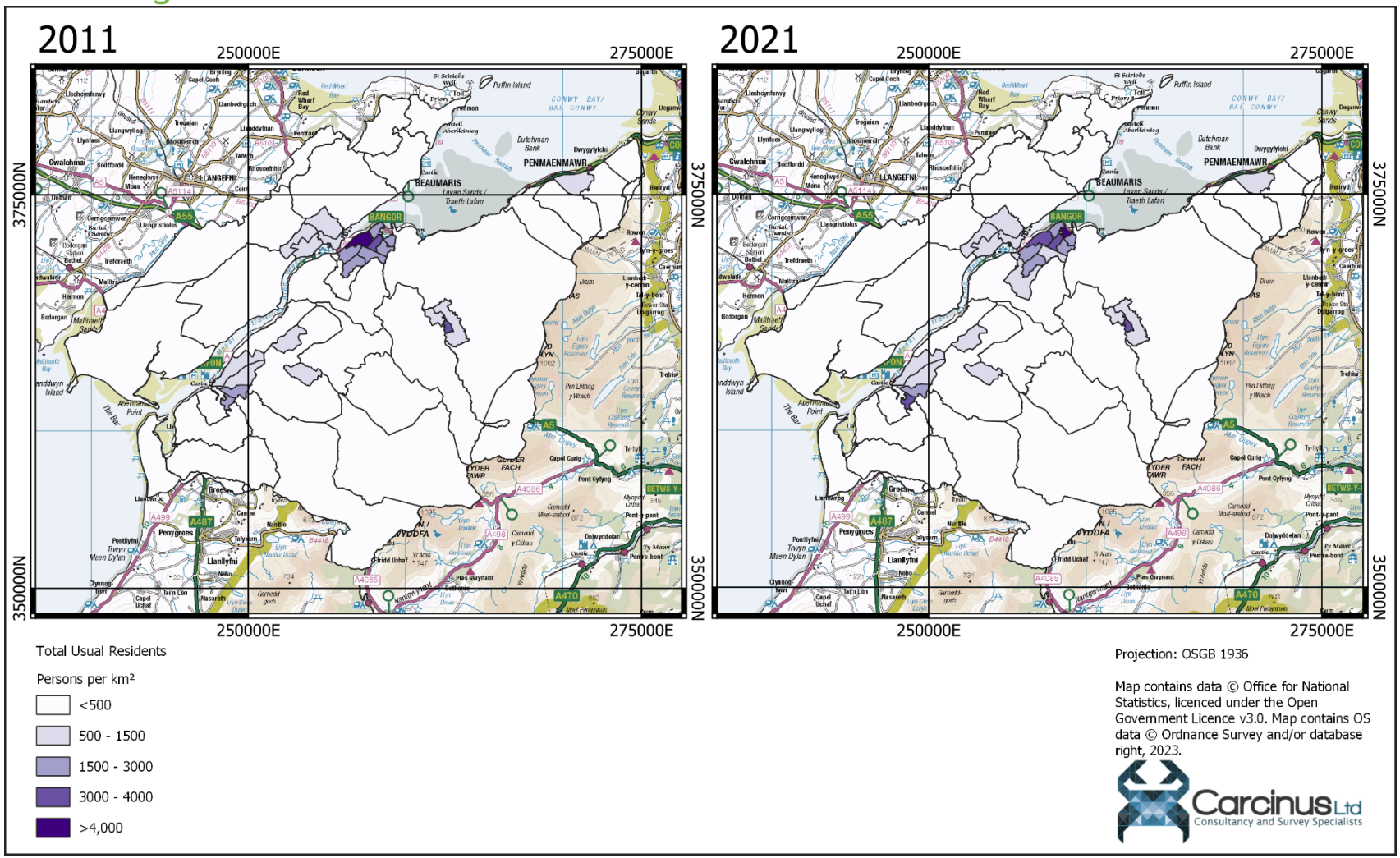


Figure 3.1 Human population density in Census Super Output Areas (lower layer) in the vicinity of the Menai Strait.

At the 2011 Census, the total usual resident population of the study area presented in Figure 3.1 was 93,845. By the 2021 Census, this had increased to 98,144, an increase of approximately 4.5%. Figure 3.1 also suggests that the main population centres of the catchment did not change between 2011 and 2021. The main population centre in the vicinity of the Menai- West BMPA is Caernarfon, on the south side of the Strait and Bangor, in the centre of the Strait on the southern bank. Urban related runoff from Bangor will impact both sides of the Strait but is more likely to impact the Menai- East BMPA because of its proximity. Both Caernarfon and Bangor are situated immediately adjacent to the coast, so there is some potential for direct impacts from urban runoff. Beyond these locations, the potential for urban runoff is slightly higher on the southern side of the Strait than the northern side, as population densities are slightly higher on the southern side. However, the risk of contamination is considered to be low in comparison to other sources (which are described in the subsequent parts of Section 3 of this report), as the population densities along the coasts are generally low (less than 500 persons per km^2), so the risks associated with urban diffuse pollution sources such as surface water misconnections is also likely to be low.

During initial consultations, the LA did not advise of any significant housing developments in the vicinity of the Menai Strait that have occurred since the original Sanitary Surveys were published. A search of the planning portals for the councils that border the Strait do not indicate that there have been any major developments since the original Sanitary Surveys were published. During initial consultations, NRW stated that there was a proposed planning submission for a large caravan park outside Caernarfon, and there were concerns over where the sewage from this park would have been treated. However, the planning portals indicate that at the time of writing (March 2023), no application had been submitted.

The previous surveys describe that the area has a slightly seasonal population, with an influx of tourists in summer months to the area due to a) the seaside location and b) the proximity of Eryri National Park in the upper reaches of the catchment. Those reports do not provide any specific population statistics, but estimates from 2019 (Rowlands, 2019) indicate that over 2 million people visit the island of Anglesey each year. Tourism statistics for Gwynedd (on the southern side of the strait), suggest that the number of visitors to the council increased from 6.63 million/year in 2013 to 7.80 million/year in 2019, an increase of 11.6% (Visit Snowdonia, 2020). A seasonal increase in population would increase the volumes of sewage received by sewage works serving the area. However, we received no information during initial consultations to suggest that the existing capacity is insufficient to handle this increase.

Comparison of the two most recent censuses suggest that the population within the study area has increased by 4.5%, but that the location of the main population centres within the catchment have not changed. There is a slightly higher risk of urban-associated runoff on the southern side of the Menai Strait as population densities are higher. Recent statistics

suggest that the number of tourists the area receives has increased since the original sanitary surveys were published in 2013, but we have received no information to suggest that the existing capacity is insufficient to handle this increase. Overall, the recommendations made in the original sanitary surveys to account for the impact of human populations remain valid.

3.2 Sewage

Details of all consented discharges within the study area have been taken from the most recent update to NRW's national permit database (Natural Resources Wales, 2022). The locations of these discharges are shown in Figure 3.2.

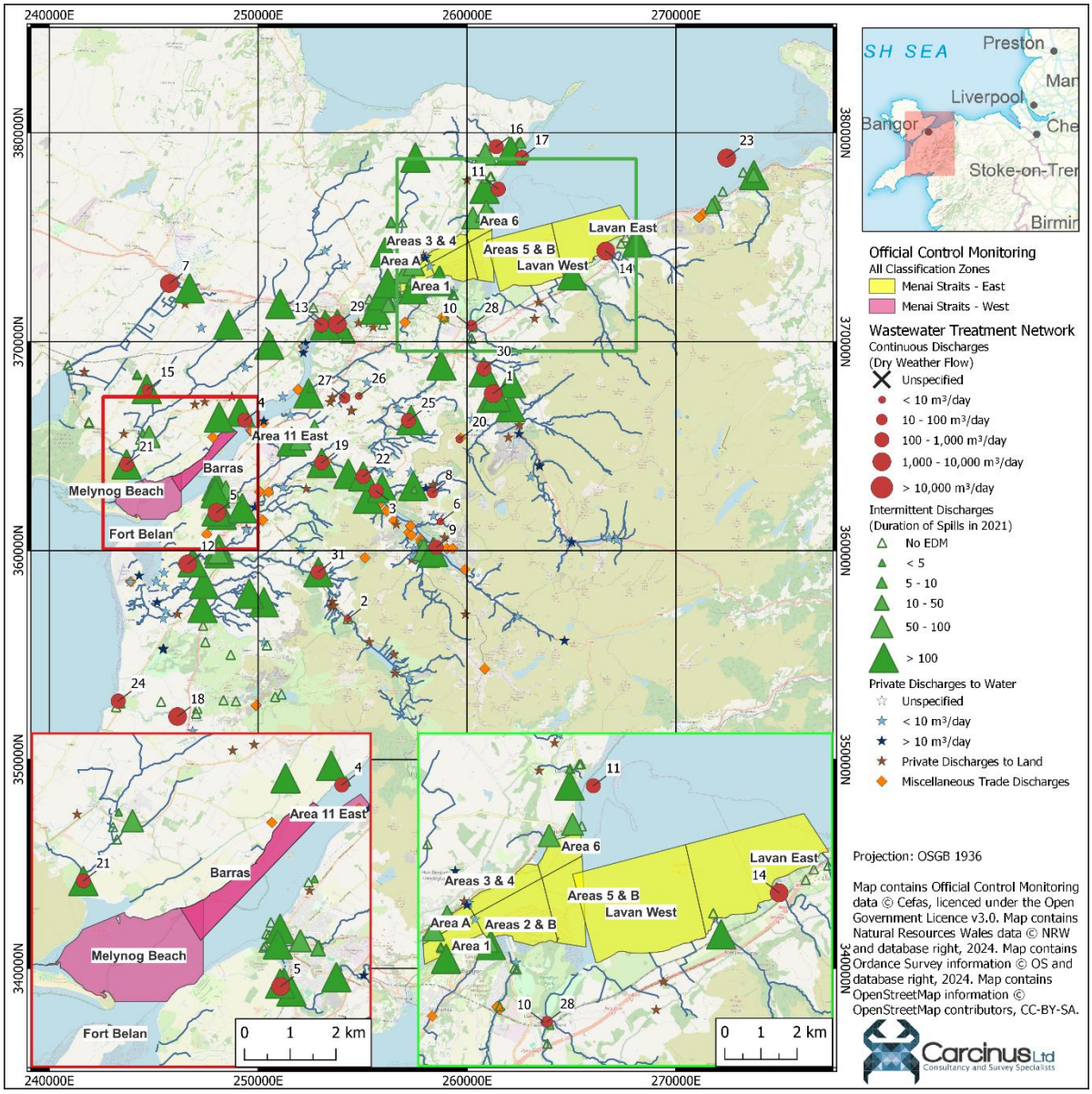


Figure 3.2 Locations of all consented discharges in the vicinity of the Menai Strait. Labels refer to continuous discharges, details of which are provided in Table 3.1. Detailed maps of the consented discharge network in the vicinity of the two BMPAs are shown in Figure 3.3 and Figure 3.4.

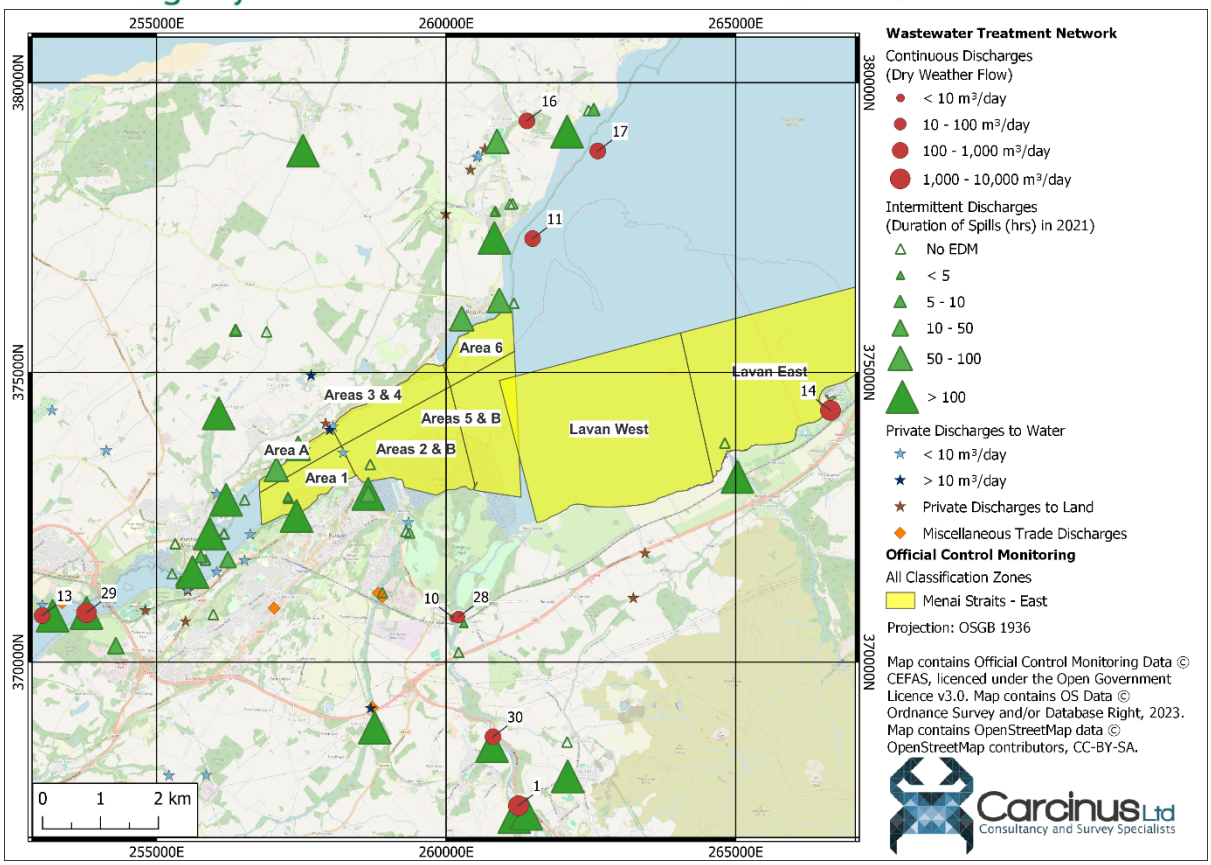


Figure 3.3 Consented discharges in the vicinity of the Menai Strait – East BMPA.

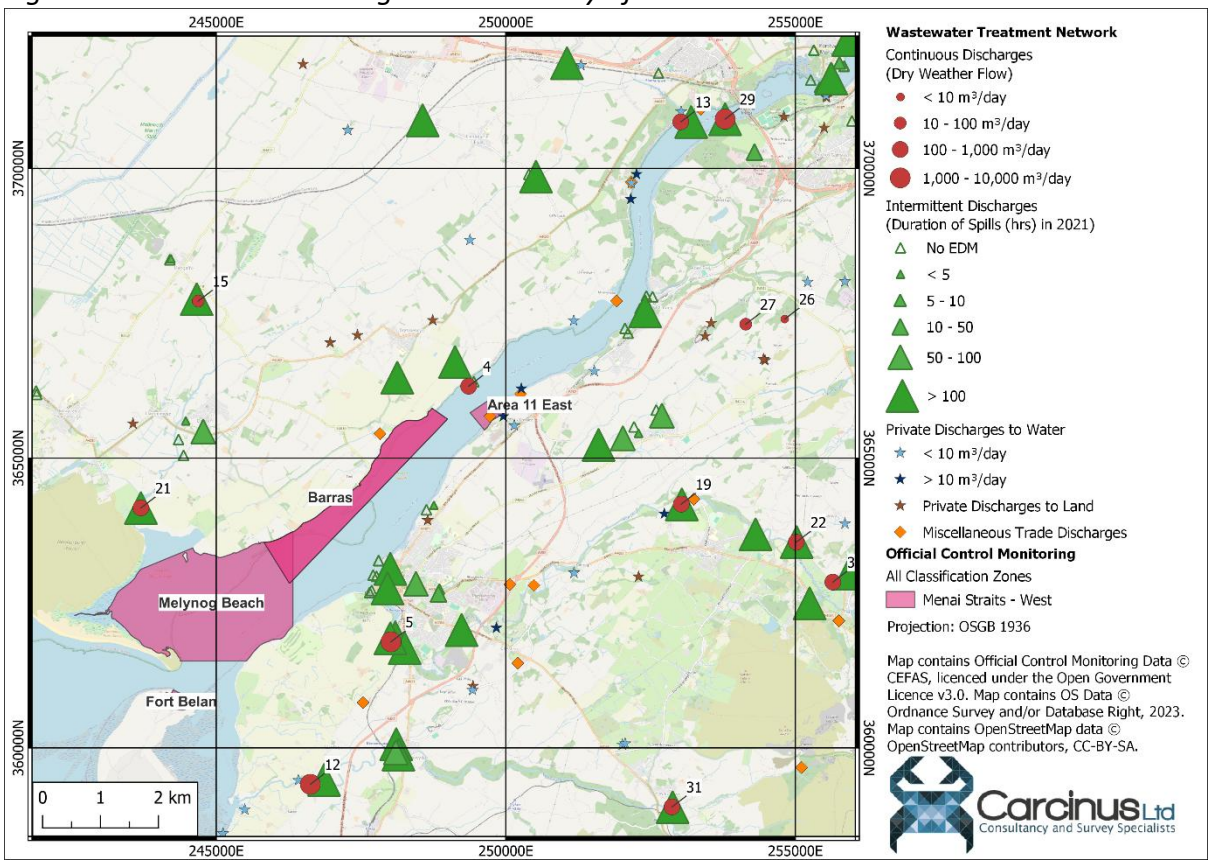


Figure 3.4 Consented Discharges in the vicinity of the Menai Strait - West BMPA.

Table 3.1 Details of all continuous discharges in the vicinity of the Menai Strait. Discharges that have seen decreases in consented discharge volume are highlighted in green and those that have seen increases are highlighted in yellow.

ID	Permit Number	Site Name	Outlet NGR	Receiving Environment	Treatment	Dry Weather Flow (m^3/day)	Distance to nearest CZ
1	CG0069901	BETHESDA STW (FINAL) BETHESDA	SH 61250 67520	RIVER OGWEN	01: BIOLOGICAL FILTRATION	1678.6	4.9
2	CG0325001	BETWS GARMON WTW	SH 54290 56740	AFON GWYRFAI	01: BIOLOGICAL FILTRATION	8.4	9.6
3	CG0134401	BRYNREFAIL STW	SH 55650 62860	CALEDFFRWD	01: BIOLOGICAL FILTRATION	418	6.374
4	CG0340901	BRYNSCIENCYN STW	SH 49360 66240	MENAI STRAIT	01: BIOLOGICAL FILTRATION	665	0.394
5	CG0078501	CAERNARFON STW	SH 48020 61830	AFON SEIONT	01: BIOLOGICAL FILTRATION	3352	1.715
6	AB3692FG	Capel Dinorwig WwTW	SH 58727 61397	Unnamed tributary of the Afon Fachwen	29: PACKAGE TREATMENT PLANT	6.6	9.78
7	CG0114101	GAERWEN WWTW FINAL EFFLUENT	SH 45743 72790	AFON CEFNI	01: BIOLOGICAL FILTRATION	1188.78	7.545
8	CG0110101	GALLT-Y-FOEL STW	SH 58340 62780	CALEDFFRWD	01: BIOLOGICAL FILTRATION	15	8.877
9	CG0089101	LLANBERIS WwTW	SH 58520 60160	AFON SEIONT	01: BIOLOGICAL FILTRATION	740	10.22
10	CG0108601	LLANDEGAI STW	SH 60130 70760	TRIB OF AFON OGWEN	01: BIOLOGICAL FILTRATION	8.2	2.14
11	CG0342901	LLANFAES WWTW	SH 61494 77308	MENAI STRAIT	01: BIOLOGICAL FILTRATION	702.5	1.252

ID	Permit Number	Site Name	Outlet NGR	Receiving Environment	Treatment	Dry Weather Flow (m^3/day)	Distance to nearest CZ
12	CG0078101	LLANFAGLAN WWTW FINAL EFFLUENT	SH 46626 59370	GWYRFAI	01: BIOLOGICAL FILTRATION	1305.5	2.397
13	CG0081101	LLANFAIR PG WWTW	SH 53024 70802	MENAI STRAIT	01: BIOLOGICAL FILTRATION	957.8	4.102
14	CG0077001	LLANFAIRFECHAN WWTW	SH 66639 74343	MENAI STRAIT	01: BIOLOGICAL FILTRATION	1468	0
15	CG0019201	LLANGAFFO STW	SH 44690 67710	TRIB OF RIVER BRAINT	01: BIOLOGICAL FILTRATION	64	4.029
16	CG0428701	LLANGOED STW ACCESS OFF B1509	SH 61397 79340	AFON BRENNIN	01: BIOLOGICAL FILTRATION	475.3	3.244
17	CG0084901	LLANGOED WWTW	SH 62620 78820	MENAI STRAIT	01: BIOLOGICAL FILTRATION	457.3	3.09
18	CG0087501	LLANLLYFNI CAERNARFON STW	SH 46140 52060	AFON LLYFNI	01: BIOLOGICAL FILTRATION	1353.6	9.46
19	CG0073901	LLANRUG WWTW FINAL	SH 53033 64206	AFON RHYTHALLT	01: BIOLOGICAL FILTRATION	897.6	3.431
20	CG0364703	MYNYDD LLANDEGAI WTW	SH 59630 65330	UNNAMED WATERCOURSE	06: SEPTIC TANK	0.1	7.339
21	CG0094101	NEWBOROUGH STW	SH 43700 64140	ESTUARY OF AFON BRAINT	01: BIOLOGICAL FILTRATION	570	0.979
22	CG0134101	PENISARWAUN WWTW FE	SH 55018 63548	AFON SEIONT	01: BIOLOGICAL FILTRATION	111	5.506
23	CG0141401	PENMAENMAWR WWTW PENMAENMAWR	SH 72430 78800	COASTAL WATERS OF CONWY BAY	01: BIOLOGICAL FILTRATION	2329.7	2.131

ID	Permit Number	Site Name	Outlet NGR	Receiving Environment	Treatment	Dry Weather Flow (m^3/day)	Distance to nearest CZ
24	CG0074601	PONTLLYFNI STW	SH 43300 52800	AFON LLYFNI	01: BIOLOGICAL FILTRATION	111.9	8.764
25	CG0086001	RHIWLAS STW	SH 57190 66230	CEGIN	01: BIOLOGICAL FILTRATION	315	6.147
26	CG0082201	SEION NO. 1 NEW STW	SH 54820 67400	TRIB. OF NANT Y GARTH	01: BIOLOGICAL FILTRATION	4.1	5.096
27	BB3199CT	Seion No2 STW	SH 54146 67311	Nant Cefn	06: SEPTIC TANK	13.1	4.431
28	CG0314701	TALYBONT STW	SH 60220 70780	AFON OGWEN	01: BIOLOGICAL FILTRATION	95	2.112
29	CG0366001	TREBORTH STW (FINAL) BANGOR	SH 53790 70850	MENAI STRAIT	22: UV DISINFECTION	9106.7	3.385
30	CG0133701	TREGARTH	SH 60810 68710	OGWEN	01: BIOLOGICAL FILTRATION	615.5	3.776
31	CG0134001	WAUNFAWR STW (FINAL EFFLUENT)	SH 52872 58980	AFON GWYRFAI	01: BIOLOGICAL FILTRATION	387	7.251

3.2.1 Continuous Discharges

The 2013 Sanitary Surveys discuss several continuous water company discharges that were made directly to the Strait. The Sanitary Survey of the Menai Strait – East only considers those discharges in the vicinity of that BMPA, whereas the Sanitary Survey of the Menai Strait – West considers the entire hydrological catchment. This survey has considered discharges across the entire catchment, although discharges from the upper reaches of the catchment will not have any direct impact on the bacteriological health of the BMPA due to the bacterial die off/dilution that will occur, but they will contribute to the overall level of background contamination in the coastal waters of the Menai Strait BMPA via the watercourses of the catchment. Both surveys identify the Treborth Sewage Treatment Works (STW) (ID 29 in Table 3.1), as the largest continuous water company discharge in the area. This discharge continues to be located just to the west of the Britannia Bridge, approximately 3.5 km from the CZs of Menai Strait – East and 6 km from the Menai Strait – West CZs (Figure 3.3 & Figure 3.4).The consented discharge volume and treatment methodology (UV disinfection) at this discharge has not changed and so the overall risk it causes to the bacteriological health of the shellfishery continues to be small.

In the Menai Strait – East area, Llanfair PG Wastewater Treatment Works (WWTW) (ID 13), Llanfairfechan WWTW (ID 14) and Llanfaes WWTW (ID 11) were all also identified to be potentially significant discharges (Figure 3.3). These are located 4.25 km west, within, and 1 km of the CZs respectively. No changes to either the treatment methodologies or consented discharge volumes have occurred, with all three discharges continuing to employ biological filtration. Contamination from discharges to the west of the CZs will be carried on an ebbing tide, and a flooding tide will carry contamination from discharges to the east of the CZs. The location of these discharges should be taken into consideration in the recommendations of any updated sampling plan for the Menai Strait – East area.

In the Menai Strait – West area, Llanfair PG WWTW (ID 13) also continues to be a potentially significant discharge as it is located 4 km east of the BMPA and continues to have a large (950 m^3/day) secondary treated discharge (Figure 3.4). Brynsciencyn STW (ID 4) is located 450 m from the *Area 11* CZ and 700 m from the *Barras* CZ. The consented discharge volume and treatment have not changed since the 2013 Sanitary Survey, and so the overall risk of contamination from this discharge remains similar. Newborough (ID 21) and Caernarfon (ID 5) STWs are also potentially significant sources of contamination. The discharge at Newborough is unchanged, but the consented discharge volume at Caernarfon has increased to 3352 m^3/day from 2840 m^3/day. The location of these discharges should be taken into consideration in the recommendations of any updated sampling plan for the Menai Strait – West area.

Continuous water company discharges from the upper reaches of the catchment will not have any direct impact on the bacteriological health of the BMPA due to the combination of some bacterial die off and some dilution that will occur. However, they will contribute to the overall level of background contamination in the coastal waters of the Menai Strait BMPA

via the watercourses of the catchment. They do not require any specific consideration within any updated sampling plan.

3.2.2 Intermittent Discharges

The 2013 Sanitary Surveys also discuss the potential impact of intermittent discharges in the Menai Strait catchment. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs) and Pumping Station Emergency Overflows (PSs). During Asset Management Period (AMP) 6 (2015 – 2020) and AMP7 (2020 – 2025), Event Duration Monitoring (EDM) was installed at several of the discharges within the catchment. Summary data for 2020 and 2021 was accessed from Dŵr Cymru/Welsh Water[7] Details of the EDM data from 2021 for those discharges in the Menai Strait catchment are presented in Appendix I. EDM data allows some interpretation of the frequency at which intermittent discharges in the catchment spilled.

The Menai Strait – East Sanitary Survey describes that the main cluster of intermittent discharges in the vicinity of that BMPA are around the Bangor and Menai Bridge area. Only one discharge in this area, Llanfaes PS (near ID 11 in Figure 3.3), had spill event monitoring. In the second half of 2012, the 2013 Sanitary Survey reported that this discharge spilled on 17 occasions. EDM data from 2020 and 2021 shows that this discharge spilled 76 times for more than 670 hrs in 2021 and 36 times for 400+ hrs in 2020. EDM data from the discharges in, within or near to the Menai Strait – East BMPA (east of the Menai Bridge) suggest that discharges are spilling relatively frequently, with only 4 of 22 not spilling at all, and 9 of 22 spilling for more than 1,000 hrs. Modelling undertaken by Dwr Cymru/Welsh Water has indicated issues with the Bangor Beach Road pumping station. An asset improvement scheme has been submitted into the current Water Industry National Environment Programme (WINEP) for funding and implementation during AMP8 (2025 – 2030). The presence of an intermittent discharge near to or within the CZs of this BMPA should be given additional consideration in any updated sampling plan, as the spills from intermittent discharges are generally untreated. There is likely to be a general gradient of increasing contamination from intermittent discharges as you move closer to the Menai Bridge/Bangor (due to the cluster of intermittent discharges in this area) but point sources within CZs in the outer strait should also be taken into consideration.

As discussed above, the Menai Strait – West Sanitary Survey considers discharges over a wider area, and consequently a greater number of discharges were fitted with EDM capability. These were Crossville CSO, Llanfaes PS, Llanfaglan WWTW Storm Tank & Storm Overflow and Waterloo Port Sewage Pumping Station. The Crossville CSO, Llanfaglan SO and Waterloo Port PS spilled less frequently 60, 63 and 1 times in 2021 compared to 60, 101 and 4 in 2012, but as described above the Llanfaes PS spilled more frequently in 2021 than 2012. The intermittent discharges likely to be of greatest concern for the CZs of the Menai Strait – West BMPA are the Newborough STW (34 spills in 2021) and the Brynsciencyn Settled Storm Overflow (99 spills in 2021), as well as those intermittent discharges in Caernarfon. The

[7] https://corporate.dwrcymru.com/en/community/environment/event-duration-monitoring

presence of an intermittent discharge near to or within the CZs of this BMPA should be given additional consideration in any updated sampling plan, as the spills from intermittent discharges are generally untreated.

As with the continuous water company discharges, intermittent discharges to the upper reaches of the catchments in the study area will not have any direct impact on the bacteriological health of the BMPA due to some bacterial die off and some dilution that will occur. This will not reduce contamination levels to zero, and so they will contribute to the overall level of background contamination in the coastal waters of the Menai Strait BMPA via the watercourses of the catchment.

3.2.3 Private Discharges

In addition to the water company owned discharges, privately owned discharges require consideration in any assessment of contamination sources affecting a shellfishery. The 2013 sanitary surveys describe that there are a large number of private discharges in the vicinity of the Menai Strait, and where specified, were usually treated by package plants. Many such discharges remain, limited information about these can be provided due to data protection requirements, but their locations are mapped in Figure 3.2. Most of the discharges within the Menai Strait are small (<10 m^3/day) and as a consequence do not require additional consideration, as the impact from water company owned discharges is far larger.

3.2.4 Conclusion

No significant upgrades to the wastewater treatment network within either the Menai Strait East or West have occurred since the original sanitary surveys were published in 2013. More discharges in the area are now fitted with EDM capability compared with that described in the original sanitary survey, allowing a greater appreciation for which intermittent discharges pose a greater risk to the bacteriological health of each BMPA. The data show that spills are happening relatively frequently from those discharges in the near vicinity of the BMPAs, and so presence of an intermittent discharge near to or within the CZs of this BMPA should be given additional consideration in any updated sampling plan, as the spills from intermittent discharges are generally untreated.

3.4 Agricultural Sources

A request was made to the Farming Statistics Office of Welsh Government for livestock populations within the study area presented in Figure 1.1. These data were made available under the Open Government Licence v3.0. Figure 3.5 presents the changes in livestock populations within the study area, broken down into the sub-catchments contained within this area. Table 3.2 shows the changes in total livestock populations within these sub-catchments.

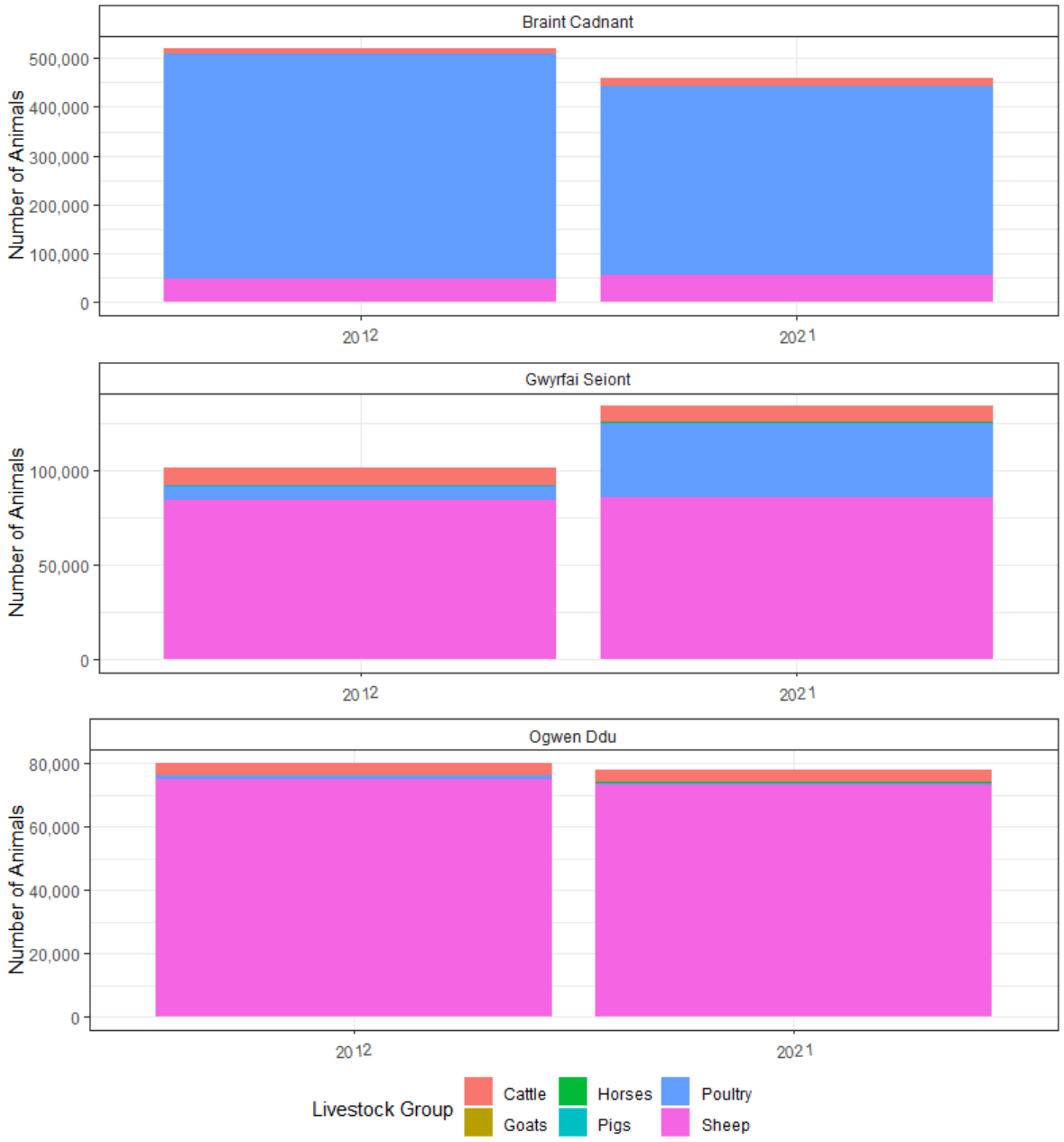


Figure 3.5 Changes in livestock population data for sub-catchments of the Menai Strait study area between 2012 and 2021. Data based on estimates from the Welsh Agricultural Survey.

Table 3.2 Summary of changes to total livestock populations in catchments near the Menai Strait between 2012 and 2021.

Catchment	2012 Population	2021 Population	% Change
Braint/Cadnant	519,121	458,579	-11.66%
Gwyrfai Seiont	101,435	134,576	32.67%
Ogwen Ddu	80,244	77877	-2.95%
TOTAL	700,800	671,032	-4.25%

The original sanitary surveys describe that the highest overall density of livestock was on Anglesey, and the data presented in Figure 3.5 support this, with the Braint/Cadnant catchment having more animals than the other two catchments combined. Poultry is the dominant livestock group in this catchment, whereas sheep are the most numerous in the other two. Only the Gwyrfai/Seiont catchment showed an increase in livestock populations, driven by a 400% increase in poultry populations within this area (although sheep are still more numerous). Overall, livestock populations within the study area have fallen by 11%. Across all groups of animals, the population size will vary throughout the year, with the highest numbers during spring and the lowest numbers when animals are sent to market in Autumn and Winter.

The principal route of contamination of coastal waters by livestock is surface runoff carrying faecal matter from areas of pasture immediately adjacent to coasts and estuaries. The change in land cover of the catchments near to the Menai Strait is shown in Figure 3.6. This figure shows that most of the land adjacent to the coastline on both the eastern and western halves of the Strait continues to be reserved for pasture. Pasture areas adjacent to shorelines represent the greatest contamination risk to the Classification Zones. This is because run-off from the land travels less distance before reaching the CZs, resulting in less dilution and *E. coli* die off. Run-off into rivers in the upper areas of the catchments will carry a lower risk of contamination. There continues to be very little land reserved for arable farming. Arable land can pose a risk to the bacteriological health of a BMPA through the application of slurry as fertiliser, but the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021[8], specifies that silage cannot be stored within 10 m of a coastal or inland water and other restrictions. During initial consultations, NRW stated that there were no known pollution concerns resulting from livestock runoff in the vicinity of the Menai Strait – East area. In the Menai – West area, NRW advised of farms on the mainland near Caernarfon that have received allegations regarding slurry pollution, although these allegations have not been proven. Contamination from livestock sources is still likely to represent a potentially significant source in the Menai Strait BMPAs.

[8] Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021. Available at: https://www.legislation.gov.uk/wsi/2021/77/contents/made

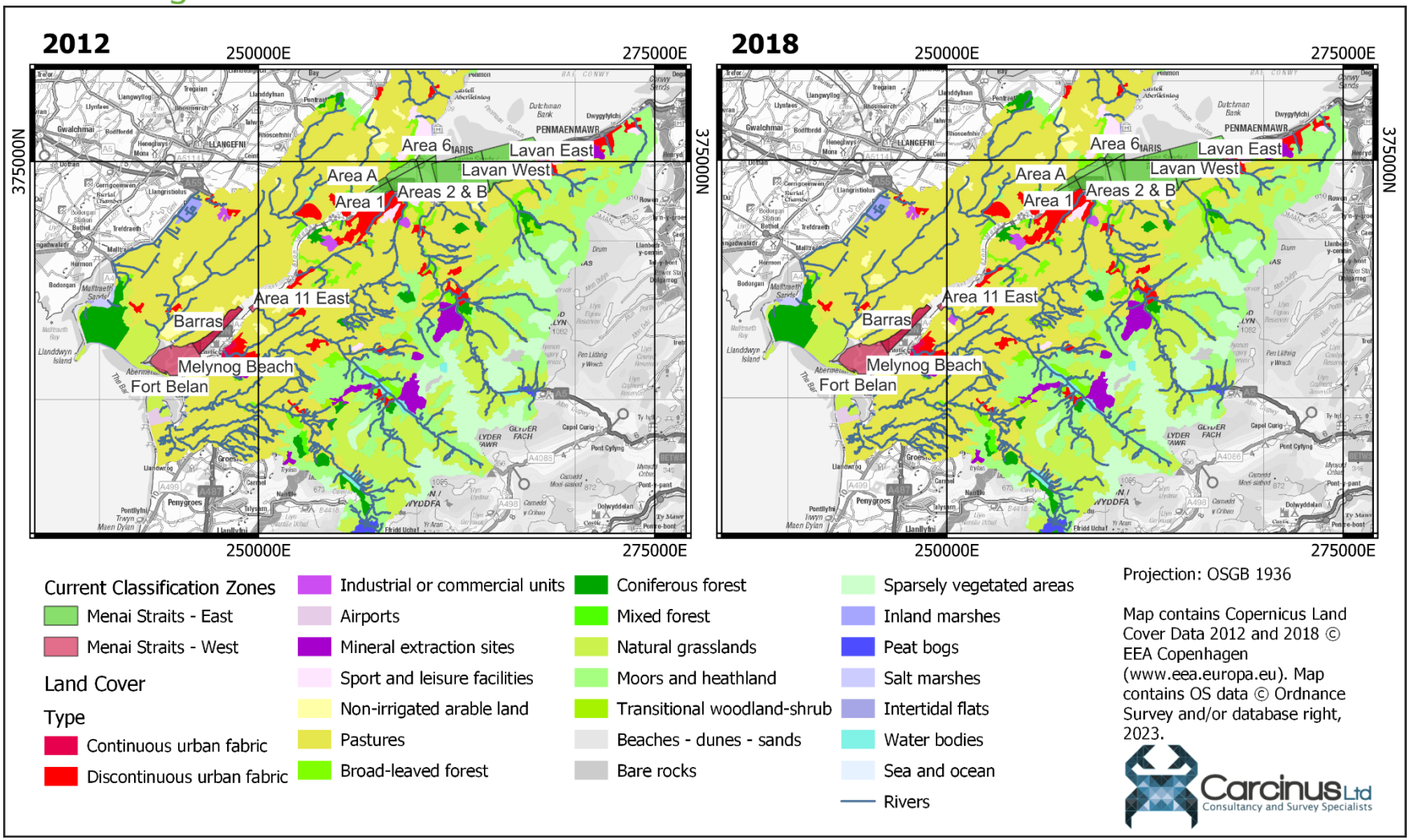


Figure 3.6 Change in land cover in the vicinity of the Menai Strait between 2012 and 2018.

The original sanitary surveys describe that there is a relatively high risk of agricultural pollution from surface runoff contaminating the shellfish beds in the Menai Strait all throughout the year. The pollution was considered to be higher following significant rainfall events, particularly following a prolonged dry period. Overall, the risk of this source of contamination is not considered to have changed significantly, as the livestock population in the area continues to be high and a significant proportion of the catchments are still reserved for pasture, with slurry spreading likely to occur on any arable areas. The recommendations in the original reports, namely positioning RMPs near to the mouth of any freshwater inputs (as these can be considered essentially point sources), should be retained.

3.5 Wildlife

The Menai Strait contains a variety of habitats that support a significant diversity of wildlife. The area is afforded protection under a variety of internationally and nationally designated sites, including the Menai Strait and Conwy Bay Special Area of Conservation (SAC), three Special Protection Areas (SPAs), several Sites of Special Scientific Interest (SSSI), National and Local Nature Reserves (NNR & LNR respectively).

The 2013 sanitary surveys describe that one of the wildlife groups most likely to contribute significant levels of faecal contamination to shellfish beds are wading and waterbirds (particularly overwintering species), this is because they typically forage (and defecate) directly on intertidal shellfish beds. The Wetland Bird Survey (coordinated by the British Trust for Ornithology) conduct regular bird counts in estuaries and embayments throughout the British Isles. Two of their monitoring locations are relevant to the shellfisheries in the Menai Strait. The Lavan Sands site is located within the waters of the Menai Strait – East BMPA and there are currently two cockle CZs in this area. The Traeth Melynog site is located within the Menai Strait – West BMPA and similarly is located in an area currently classified for cockle harvesting. Figure 3.7 and Figure 3.8 show the temporal trend in total overwintering waterbird counts from the winter of 2002/2003 to 2019/2020 (the most recent for which data are available) at these two locations.

3.5.1 Menai Strait - East

At Lavan Sands (Figure 3.7), waders are the dominant species group, with several thousand oyster catchers, curlew, dunlin and redshank observed each year. The average count of overwintering waterbirds (including gulls and terns) in the five winters to 2012/2013 was 19,022 (Austin *et al.*, 2014). In the five winters to 2019/2020, the average count was 20,964 (an increase of 10.21%). There are also nationally significant populations of the wading birds mentioned above, as well as Brent Goose, Green Shank and Little Egret.

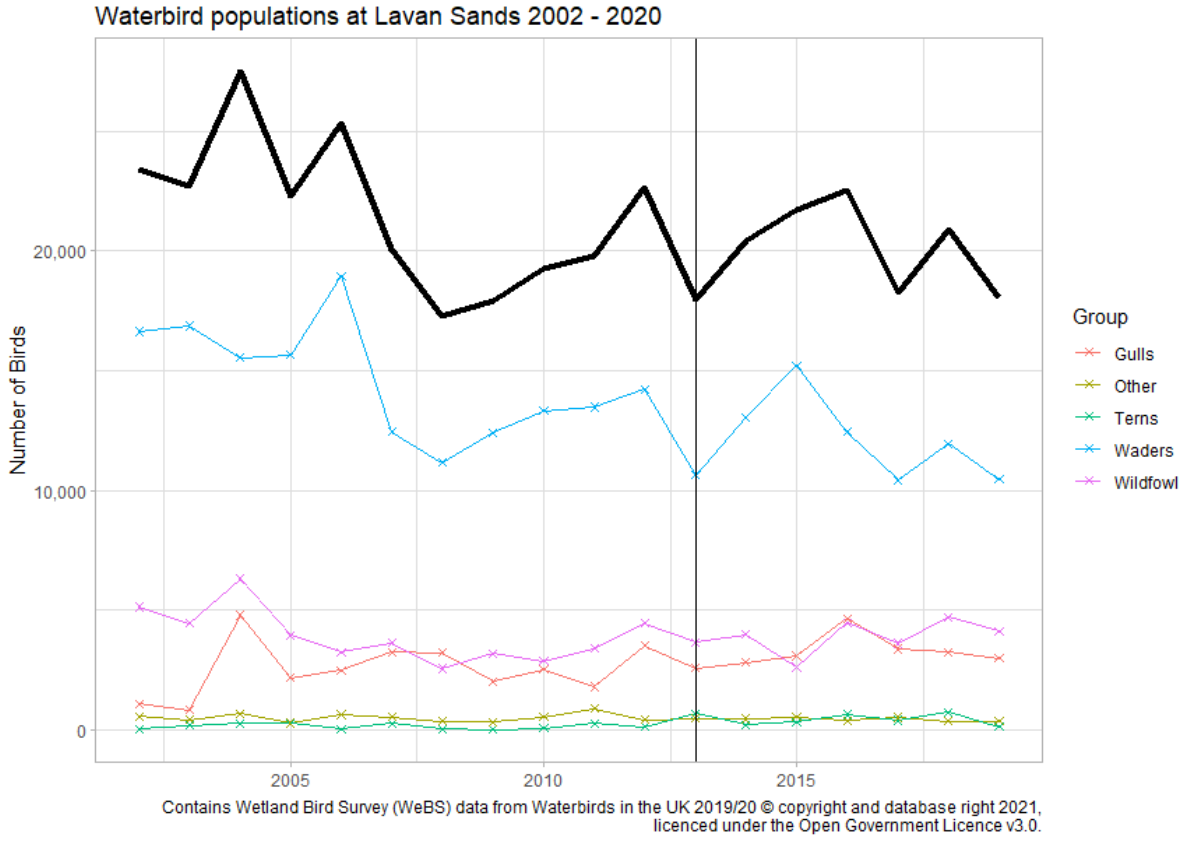


Figure 3.7 Temporal trend in waterbird counts on Lavan Sands. Data from the Wetland Bird Survey (Frost et al.*, 2021). Black line shows total waterbird population.*

3.5.2 Menai Strait - West

Waterbird populations at Traeth Melynog are much lower than at Lavan Sands (Figure 3.8), with annual counts varying between approximately 4,000 and 7,000 (compared to 15,000 to >25,000 at Lavan Sands). In addition, waders and wildfowl species are similarly populous, with nationally significant populations of Brent Goose and Pintail. In the five winters to 2012/2013, the average total count was 5,437. In the five winters to 2019/2020, the average total count was 6,354 (an increase of 16.87%).

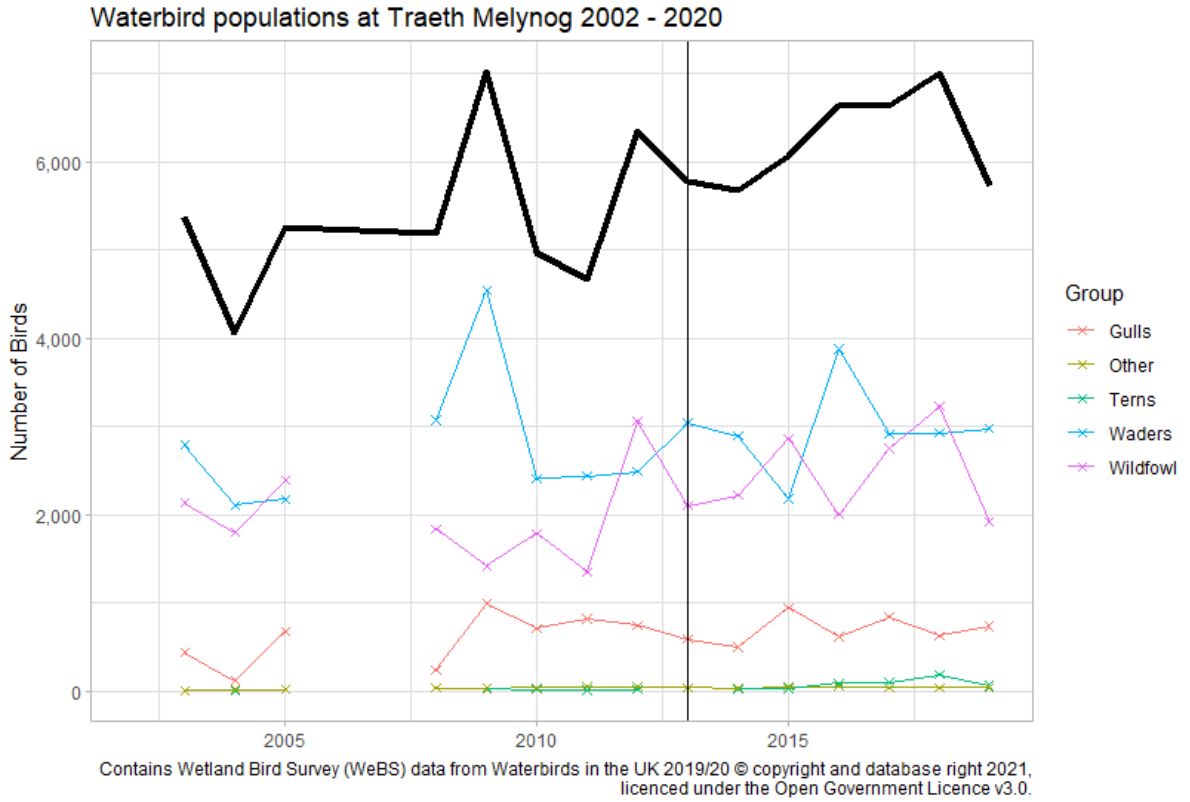


Figure 3.8 Temporal trend in waterbird counts on Traeth Melynog. Data from the Wetland Bird Survey (Frost et al., 2021). Black line shows total waterbird population.

3.5.3 Summary

The largest aggregations of waterbirds, and therefore the highest risk of contamination, will occur in Winter months. The distribution of waterbirds in the Strait will shift from year to year, driven by aggregations of their foraging resource. It is likely that the risk of contamination will be greater in the cockle CZs of the two BMPAs as this is where waterbirds have historically aggregated. It is also likely that contamination levels will be slightly higher in the Menai Strait – East BMPA than the Menai Strait – West, as the bird population is markedly higher. However, given the shifting distributions of waterbirds (and the contamination they cause) it is difficult to define RMPs that reliably capture this source of pollution, even though it may be a potentially significant source of pollution within the BMPA. This situation has not changed since the original sanitary survey was published.

Another wildlife group that has the potential to contribute bacteriological contamination of a shellfishery is marine mammals. Large numbers of grey seals are known to forage in the waters around the Menai Strait (Langley *et al.*, 2020), with highest numbers in Winter months (Westcott and Stringell, 2004). These animals generally have wide foraging ranges and so contamination from them is spatially and temporally variable. They can create hotspots of contamination near to their haul-out sites, but as none are known to be in the vicinity of the shellfish beds in either the eastern or western part of the Strait, no additional consideration is required in any updated sampling plan.

3.6 Boats and Marinas

The discharge of sewage from boats is a potentially significant source of contamination to the shellfish beds of the Menai Strait. Boating activities in the area have been derived from satellite imagery and compared to that described in the 2013 Sanitary Surveys. Their geographical positions in the eastern part of the Menai Strait are shown in Figure 3.9 and in the western part of the Menai Strait in Figure 3.10.

3.6.1 Menai Strait - East

The 2013 Sanitary Survey of the Menai Strait East describes that the Port of Penrhyn (within Bangor) handled a variety of cargo including slate, sand aggregates and scrap metal. The same activities are ongoing (Dickes Maritime Services, 2023), and the port currently handles approximately 20 shipments per year. This Port can handle vessels up to 100 m LOA (length overall) but can only operate 2-3 hours either side of high water. The legislation[9] governing the overboard discharge from merchant vessels has not changed since the original sanitary survey was published. As merchant vessels are prohibited from making overboard discharges within 3 nautical miles of land, no impact from this source is expected.

There continues to be a small fishing fleet in the area. One fishing vessel over 10 m and three vessels under 10 m list either Penrhyn or Bangor as their home port (gov.uk, 2024). A further four vessels over 10 m and 13 under 10 m list Conwy (10 km east of the Menai Strait – East BMPA) as their home port. These statistics are the same as those described in the 2013 Sanitary Survey of this BMPA.

There continues to be extensive recreational boating activity within the eastern Menai Strait. Port Penrhyn has berths for over 100 vessels (and off-water storage for up to 300) (Dickes Maritime Services, 2023), and there are a large number of moorings within the strait itself as well as marinas in the mouth of the River Conwy. Vessels of a sufficient size to contain on board toilets may make overboard discharges from time to time, particularly when moving through the main navigational channels or moored overnight away from the main marinas. There is no available data on the locations, timing and frequency of any overboard discharges to further inform RMP placement. Overall, the level of recreational boating activity in the Strait is considered to have remained similar to that described in the original sanitary survey, and consequently the risk of contamination will have remained similar.

The greatest risk of contamination will occur during Summer months when the number of boats using the Strait is at its highest. Comparison of the current situation with that described in the original survey suggests that the number of vessels hasn't increased. The recommendations made in that report to account for this source of pollution remain valid.

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

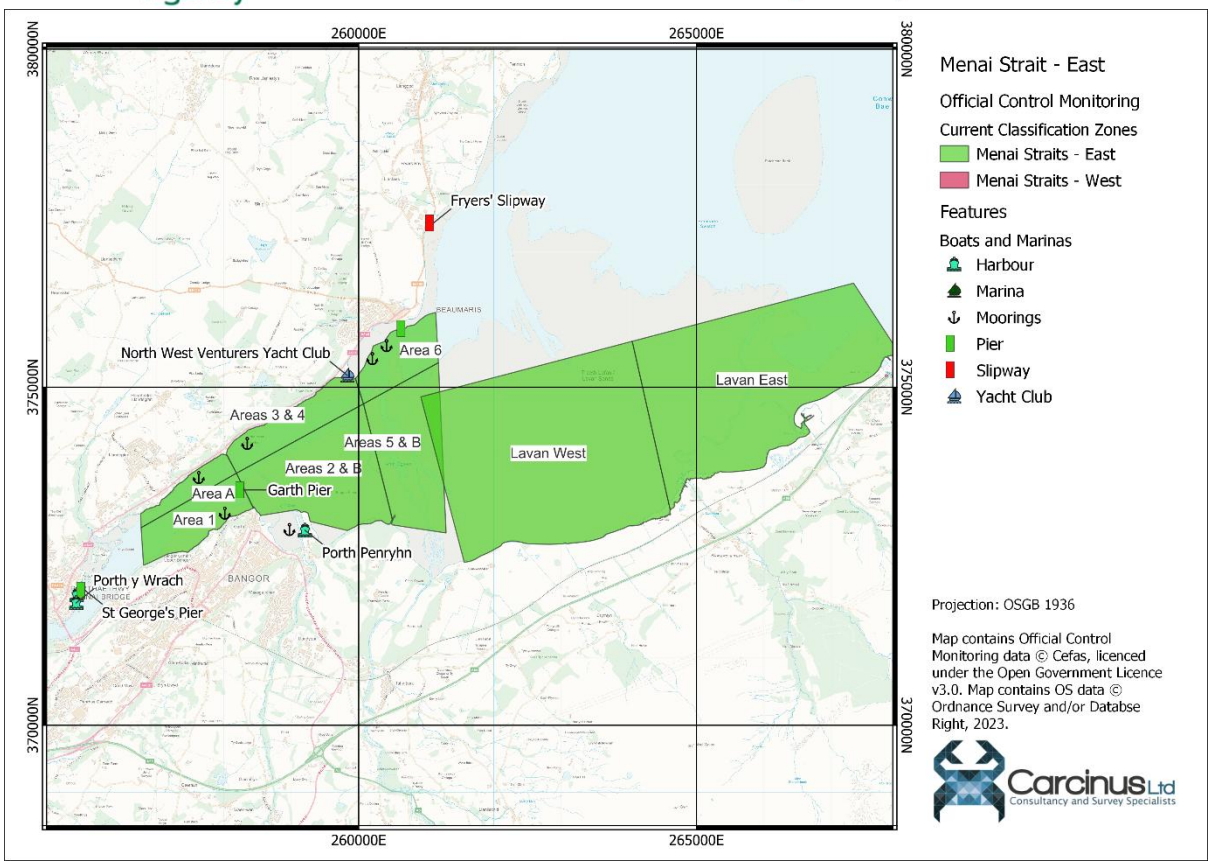


Figure 3.9 Locations of boats, marinas and other boating activities in the vicinity of the Menai Strait - East BMPA.

3.6.2 Menai Strait – West

The 2013 Sanitary Survey of the Menai Strait – West describes that most of the boating activity in the western part of the Strait is recreational or fishing-related, as there are no commercial ports in the area and passage through the Swellies (the tidal rapids in the middle of the Strait) can be challenging for larger vessels. This, combined with the fact that merchant vessels are prohibited from making overboard discharges within 3 nautical miles of land, means that no impacts from merchant shipping are expected.

The marinas described in the original sanitary survey, Port Dinorwic (Dinorwic Marina in Figure 3.10) and Victoria Dock (Caernarfon Marina) are still in use, and the number of berths offered is similar (approximately 280) (Practical Boat Owner, 2023; The Marine Group, 2023). There are also a number of moorings within the Strait. Similar to the eastern part of the Strait, vessels of a sufficient size to contain on board toilets may make overboard discharges from time to time, particularly when moving through the main navigational channels or moored overnight away from the main marinas. Overall, the level of recreational boating activity in the Strait is considered to have remained similar to that described in the original sanitary survey.

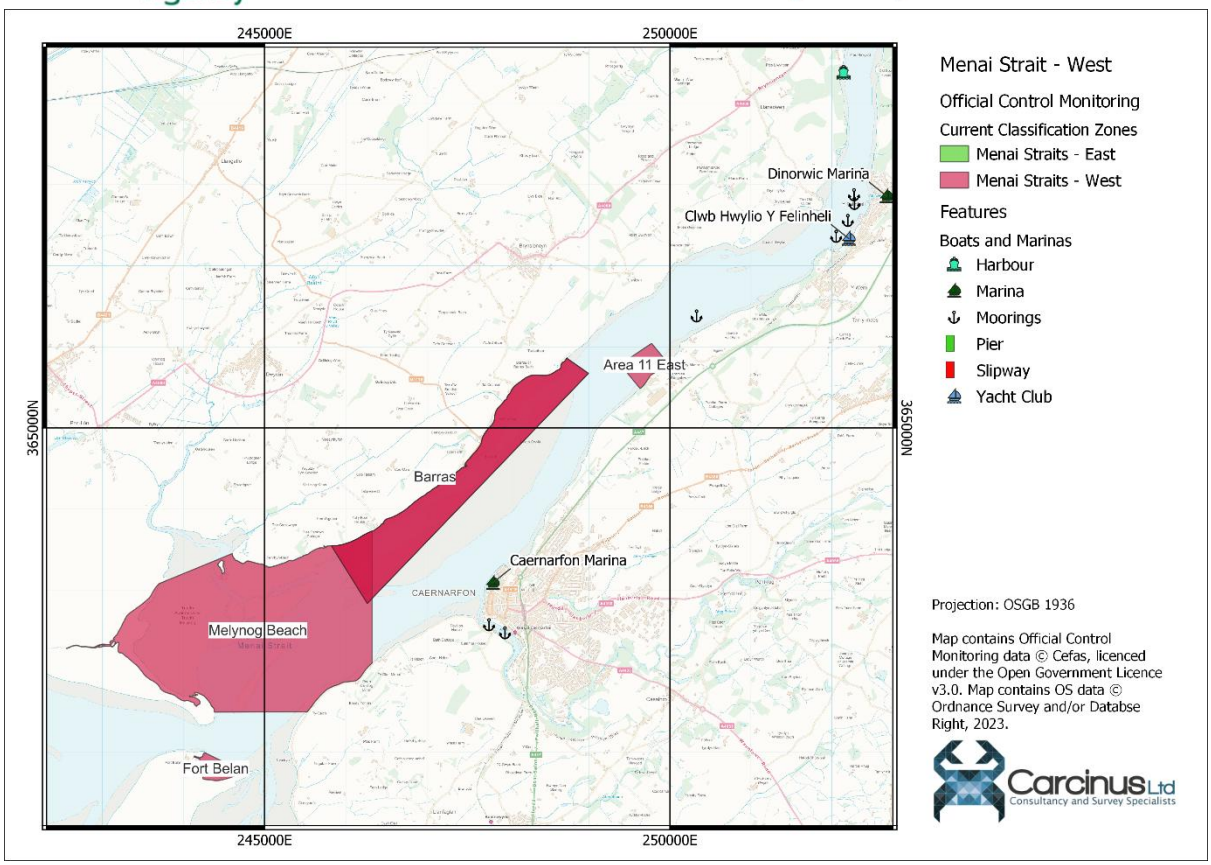


Figure 3.10 Locations of boats, marinas and other boating activities in the vicinity of the Menai Strait - West BMPA.

The greatest risk of contamination will occur during Summer months when the number of boats using the Strait is at its highest. Comparison of the current situation with that described in the original survey suggests that the number of vessels hasn't increased. The recommendations made in that report to account for this source of pollution remain valid.

3.7 Other Sources of Contamination

Utility misconnections are when foul water pipes are wrongly connected and enter surface waters without treatment, potentially putting raw sewage directly into watercourses via surface water drains. Areas which pose the greatest risk of this source of contamination are residential properties in very near vicinity to coastal waters. In the Menai Strait – East BMPA this is likely to be the Garth region of Bangor and within the Menai Strait – West BMPA this would be the town of Caernarfon, both of which are on the southern side of the respective BMPA. However, we have received no information to date that misconnections have a significant impact on this shellfish water.

Some impacts from dog fouling are expected, as dog walking along the coastline is likely to be relatively common. This is not expected to be a significant impact and does not require additional consideration in any updated sampling plan.

4 Hydrodynamics/Water Circulation

The Menai Strait is a 30 km long tidal channel separating the Isle of Anglesey from mainland Wales. The narrowest and shallowest point is the Swellies in the centre, where subtidal depths are <1 m. In the outer parts of the Strait intertidal areas become much wider, particularly on the southern (mainland) side in the eastern Strait and the northern (Anglesey) side in the western Strait. The bathymetric profile of the Strait is not considered to have changed significantly since the original sanitary survey was published.

Tidal ranges in this area are large (> 4 m), and ranges are higher in the eastern Strait than the western. Tidal circulation is likely to be the dominant force of water circulation in both BMPAs under most conditions. The fluvial/ebb plume from the water courses will create some hotspots of contamination, and can be considered point sources of contamination carrying pollution from farther up the catchment. The incoming tide enters the Menai Strait at its western end, but before it can reach the eastern end the tidal wave has passed around Anglesey and started to move up the Strait from the eastern end. These two tidal flows will meet each other at a point dependent on local climactic conditions. The higher tidal range in the eastern Strait results in a net western flow, but contamination from shoreline sources in both parts of the Strait will be spread in both directions along the shore (but won't reach the opposite bank).

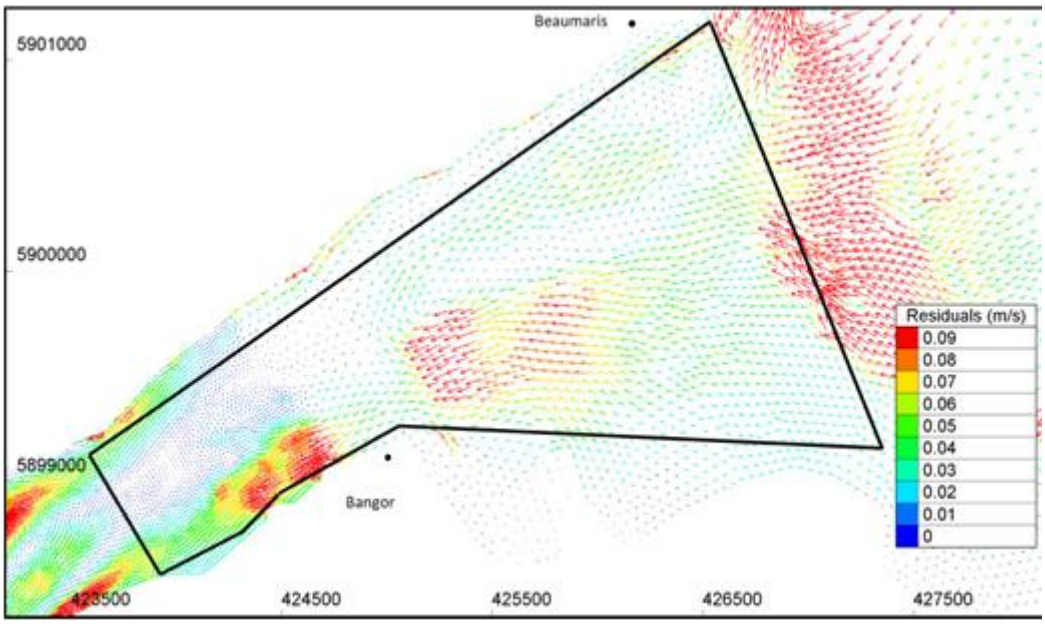


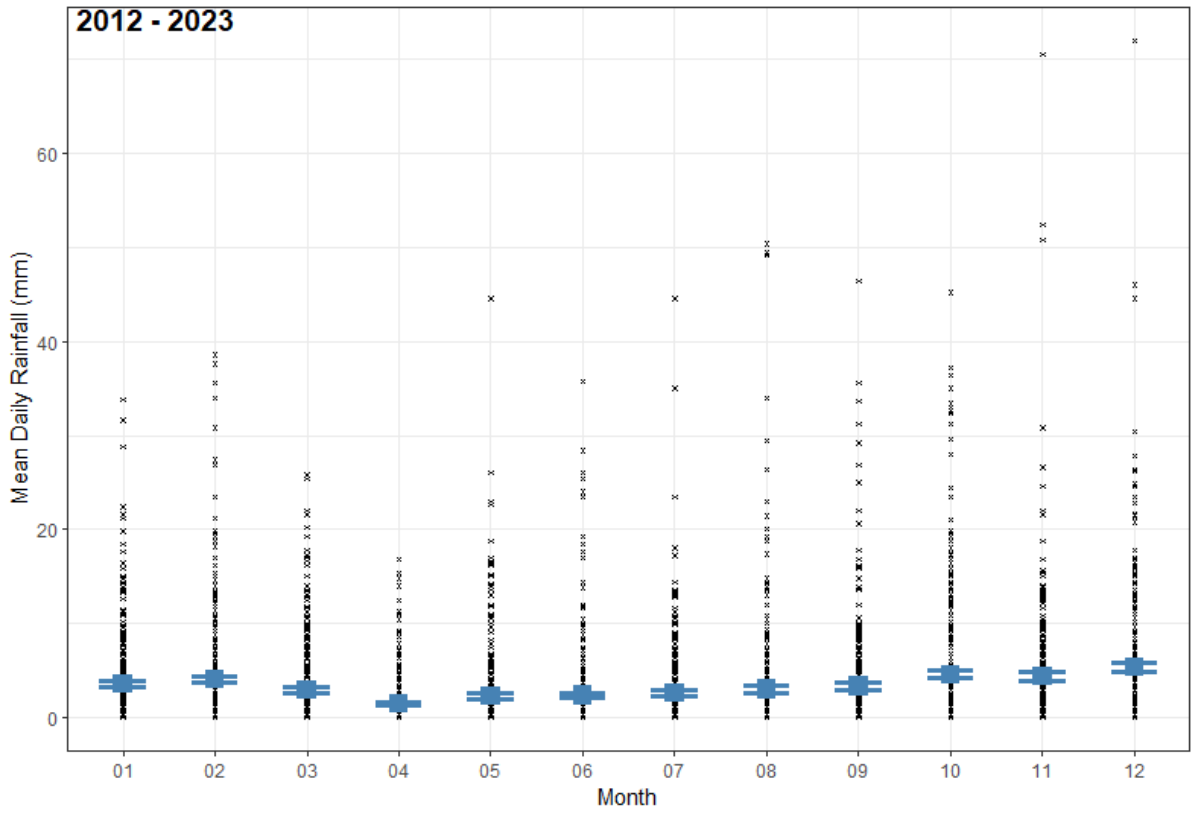
Figure 4.1 Map of the residual currents in the northeastern entrance of the Menai Strait after Demmer (2020). The black area approximates the limit of the 1962 Fishery Order.

The mouths of rivers should be considered point sources of contamination. A study of microbial source tracking in the Menai Strait indicated that the *E. coli* concentrations originating from the Afon Adda were significantly greater than those from the Afon Cegin and Afon Ogwen from January to October 2022 (Mannion *et al.*, 2022), but all returned *E. coli* results >10,000 CFU/100 ml.

There is no evidence that the patterns of water circulation in the Menai Strait have changed since the original Sanitary Surveys were published in 2013, and as such no update to the sampling plan is required on this basis. Consideration should still be given to significant shoreline contamination sources in the placement of RMPs in addition to more general patterns of water movement.

5 Rainfall

Rainfall data for the Afon Adda Tipping Bucket Raingauge (TBR) monitoring station at NGR SH 57036 70481 (ID: 990124) was requested from NRW. Data was only available from 2012 – Present but this station was chosen as it was considered to be the most representative of rainfall patterns in the vicinity of the Menai Strait (as it is located in Bangor). No statistical comparison of rainfall data for the period preceding and following the original sanitary survey is therefore possible, as there would only be one year of data prior to and approximately 10 post the publication of the 2013 Sanitary Surveys. The average daily rainfall totals per month at this monitoring station are presented in Figure 5.1.



Archive Daily Rainfall from the Adda Upstream TBR Main (#990124) at NGR SH 57036 70481
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Figure 5.1 Mean daily rainfall per month at the Afon Abba monitoring station for the period 2012 – 2023. Scatter shows individual days' rainfall totals within a given month and boxplots show the mean rainfall per month +/- Standard Error.

The 2013 Sanitary Survey of the Menai Strait – East reported rainfall statistics from the Parc Menai rainfall station, citing an average rainfall of 993 mm per year. The average annual rainfall recorded at the Afon Abba Tipping Bucket monitoring station since 2012 is more than 1,000 mm per year, with 20% of days having more than 20 mm of rainfall. Across the whole of the UK, the decade 2011 to 2020 was on average 4% wetter than 1981 – 2010 and 9% wetter than 1961 – 1990 (Kendon *et al.*, 2021), suggesting that rainfall levels are increasing. Furthermore, climate change scenarios indicate that winters are likely to be wetter and summers drier, which will have an impact on runoff. Figure 5.1 suggests that the wettest months are October – February, and levels of surface runoff are likely to be highest during these times. A recent modelling study undertaken by Bangor University (Mannion *et al.*, 2022) found significant correlations between high rainfall events and *E. coli* concentrations. Whilst no statistical comparison is possible, the data suggest that rainfall levels are slightly higher in the vicinity of the Menai Strait and so runoff levels may also be slightly higher.

6 Microbial Monitoring Results (July 2024 Update)

6.1 Official Control Monitoring

6.1.1 Summary Statistics and geographical variation.

Summary statistics for the Menai Strait – East and Menai Strait – West BMPAs areas are shown in 1. Mean Official Control Monitoring Results for *E. coli* concentrations at RMPs sampled in the Menai Strait are shown in Figure 6.1 for the Menai Strait East and Figure 6.4 for the Menai Strait West BMPAs.

Table 6.1 Summary statistics of Official Control monitoring at bivalve RMPs sampled in the Menai Strait East and West BMPAs. Data gathered directly from the Cefas datahub, with no additional verification of the data undertaken.

RMP (Species)	NGR	Species	No.	First Sample	Last Sample	Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
MENAI STRAIT - EAST											
Craig-y-Don (M. sp) - B055R	SH56787309	Mussel	96	10/02/2015	09/06/2024	217.07	18	3300	20.83	0.00	0.00
West of Bangor Pier (M. sp) - B055S	SH58337328	Mussel	103	10/02/2015	09/06/2024	259.77	18	3300	28.16	0.00	0.00
Cegin Channel (M. sp) - B055T	SH58687331	Mussel	100	10/02/2015	09/06/2024	219.92	18	2200	22.00	0.00	0.00
Gallows Point (M. sp) - B055U	SH59947498	Mussel	99	10/02/2015	09/06/2024	221.11	18	2300	24.24	0.00	0.00
Ogwen Channel (M. sp) - B055V	SH60957320	Mussel	99	10/03/2015	09/06/2024	346.66	18	7900	24.24	1.01	0.00
Beaumaris East (M. sp) - B055W	SH61157592	Mussel	99	10/02/2015	09/06/2024	222.93	18	1700	22.22	0.00	0.00
Lavan Sands East (C. ed) - B055X	SH66247470	Cockle	88	04/11/2014	24/06/2024	343.78	18	4900	34.09	1.14	0.00
Lavan Sands West (C. ed) - B055Y	SH62337346	Cockle	82	05/05/2015	24/06/2024	462.15	18	7900	32.93	2.44	0.00
MENAI STRAIT - WEST											
Traeth Melynog (C. ed) - B042C	SH44006250	Cockle	221	28/01/2003	19/06/2024	999.29	18	35000	47.51	4.52	0.00

RMP (Species)	NGR	Species	No.	First Sample	Last Sample	Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Barras Boat House (M. sp) - B042L	SH48716570	Mussel	95	07/01/2016	19/06/2024	587.87	18	7900	53.68	1.05	0.00
Area 11 East (M. sp) - B042O	SH49916579	Mussel	102	09/02/2015	09/06/2024	642.45	18	11000	45.10	1.96	0.00
Fort Belan (M. sp) - B042P	SH44516084	Mussel	34	16/02/2015	26/02/2019	168.53	20	490	23.53	0.00	0.00
Area 11 (C. gi) - B042R	SH49696565	Pacific oyster	67	24/02/2015	18/07/2022	235.18	18	1100	32.84	0.00	0.00

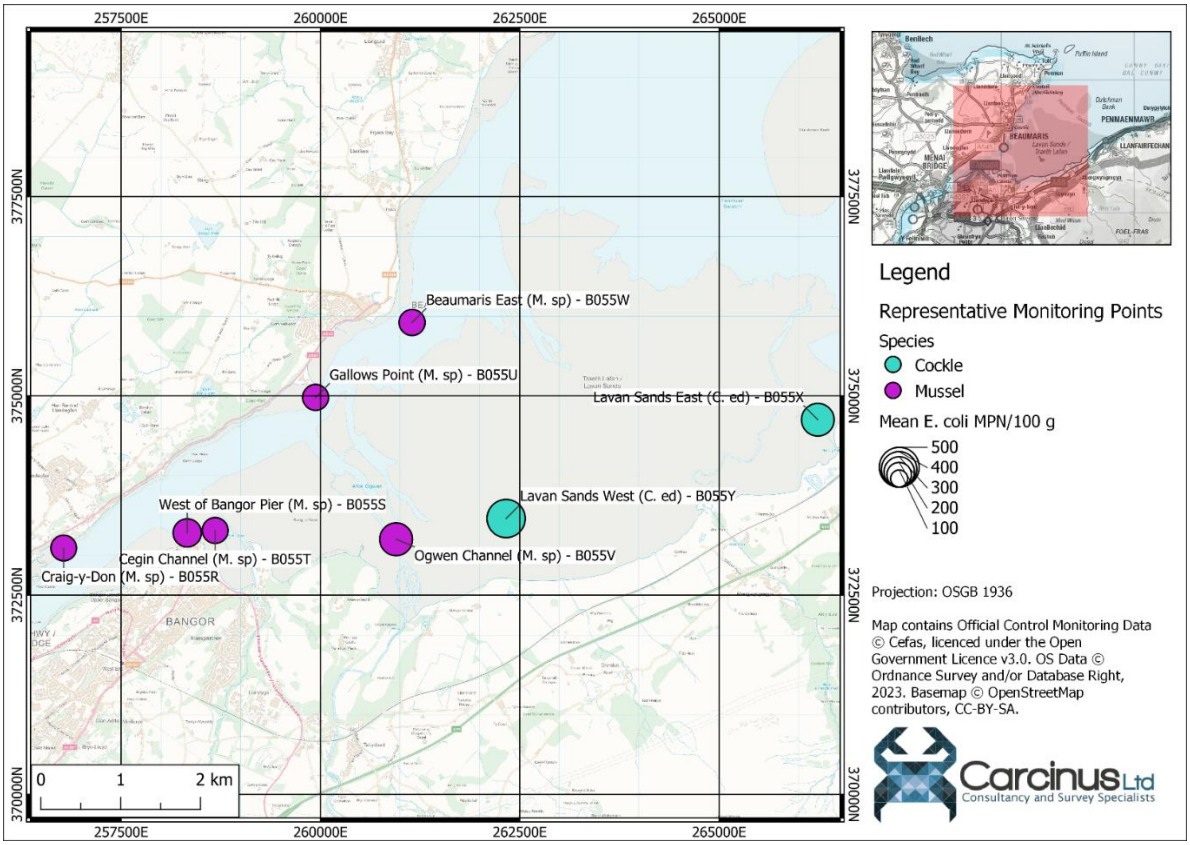

Figure 6.1 Mean Official Control monitoring results from Bivalve RMPs in the Menai Strait - East BMPA.

A total of eight RMPs have been sampled in the Menai Strait – East BMPA since the original Sanitary Survey was published in 2013. Prior to the publication of the 2013 report, a further ten RMPs were sampled, but sampling at all these RMPs stopped, following the recommendations of that report. No data is available for these RMPs on the Cefas Datahub. All eight of the RMPs recommended in the 2013 Sanitary Survey are currently sampled.

Of the RMPs that are currently sampled, only three have ever returned a result above 4,600 MPN/100 g. These are the Lavan Sands East and West (B055X & B055Y) cockle RMPs, as well as the Ogwen Channel (B055V) mussel RMP. At Ogwen Channel (B055V) this result was received in November 2019. No results above 4,600 MPN/100 g have been returned at Lavan Sands West (B055X) since 2017 and at Lavan Sands East (B055Y) since 2021. No RMPs have ever returned a result above 46,000 MPN/100 g. When considered spatially, there does not appear to be any distinct geographical pattern in the monitoring data. The RMPs in the outer Strait have returned slightly higher monitoring results, but this is more likely to be due to differences in the rates of *E. coli* uptake between cockles and mussels. A 2014 report by Cefas into the use of indicator species in UK BMPAs (Cefas, 2014) found that cockles generally accumulate *E. coli* to a similar or higher extent than mussels, so this is more likely

to explain the observed pattern. With no general geographic trend, greater attention should be paid to the presence of any point sources of contamination in CZs when defining any updated sampling plan.

Figure 6.3 and Figure 6.2 present box and violin plots of *E. coli* monitoring at bivalve RMPs within the Menai Strait – East BMPA. One-way analyses of variance tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the two RMPs. Significance was taken at the 0.5 level. All statistical analyses described in this section were undertaken in R (R Core Team, 2021).

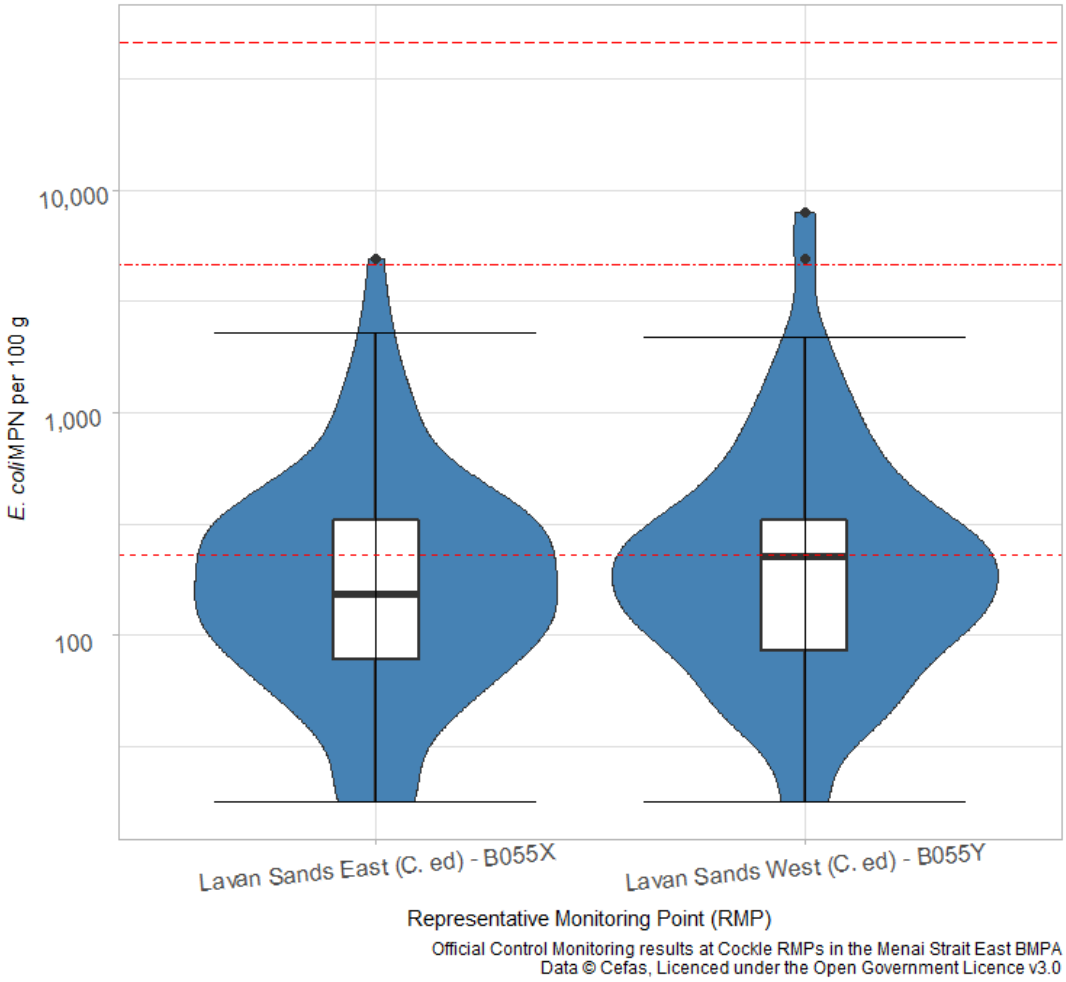

Figure 6.2 Box and violin plots of E. coli concentrations at cockle RMPs sampled in the Menai Strait – East BMPA since 2015. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Boxplots are overlaid on the distribution of the monitoring data. Dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

The highest median result at cockle RMPs in the Menai Strait – East (Figure 6.2) was recorded at Lavan Sands West (B055Y). The median result at both RMPs is below 230 MPN/100 g. No significant differences in the data were found.

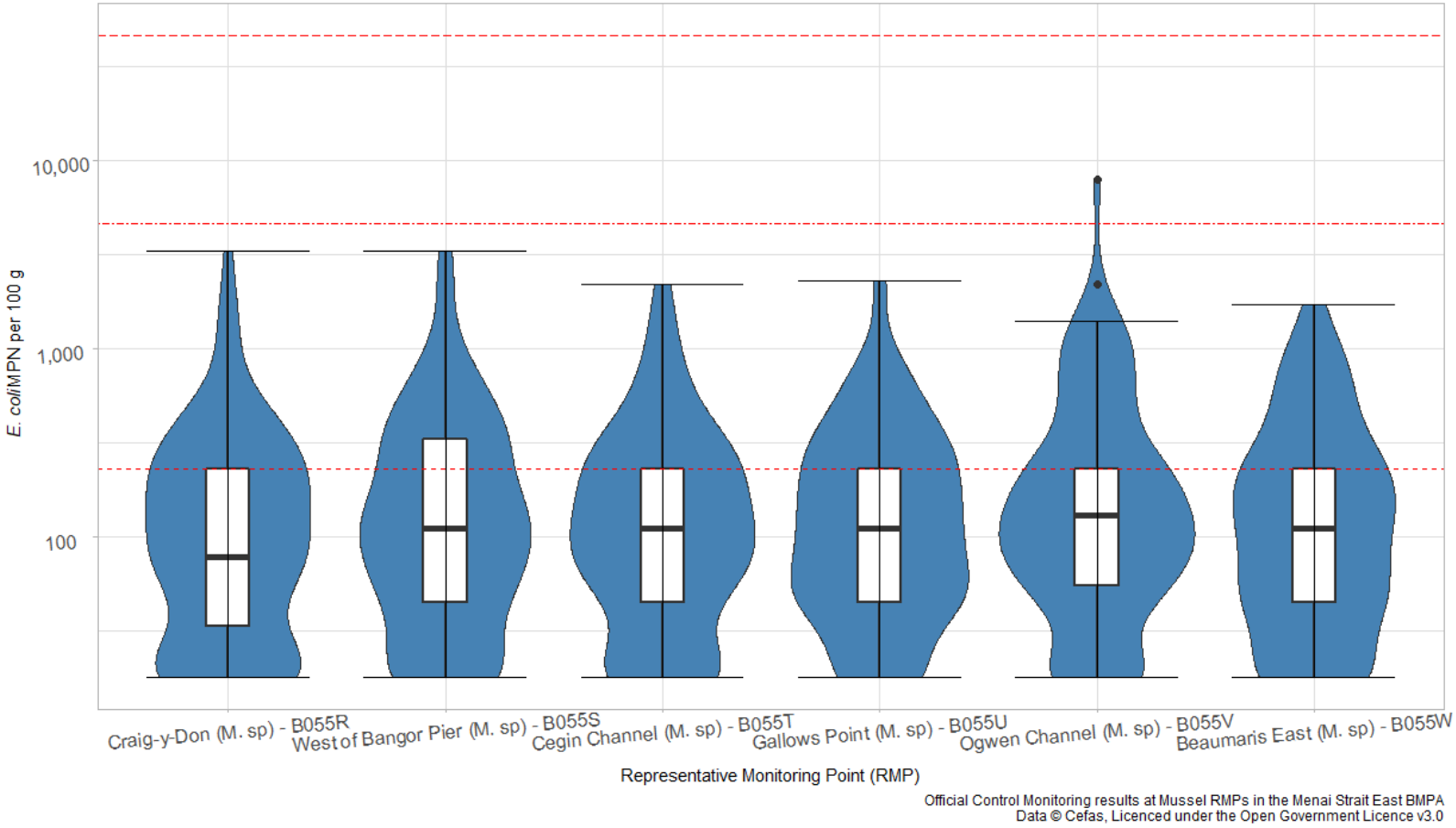

Figure 6.3 Box and violin plots of E. coli concentrations at mussel RMPs sampled in the Menai Strait – East BMPA since 2015. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Boxplots are overlaid on the distribution of the monitoring data. Dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

The highest median result in the mussel data was found at Ogwen Channel (B055V) and the lowest at Craig-y-Don (B055R). No significant differences were found in the monitoring data ($p>0.05$). The distribution of the monitoring data around the median was also consistent across RMPs.

Menai Strait - West

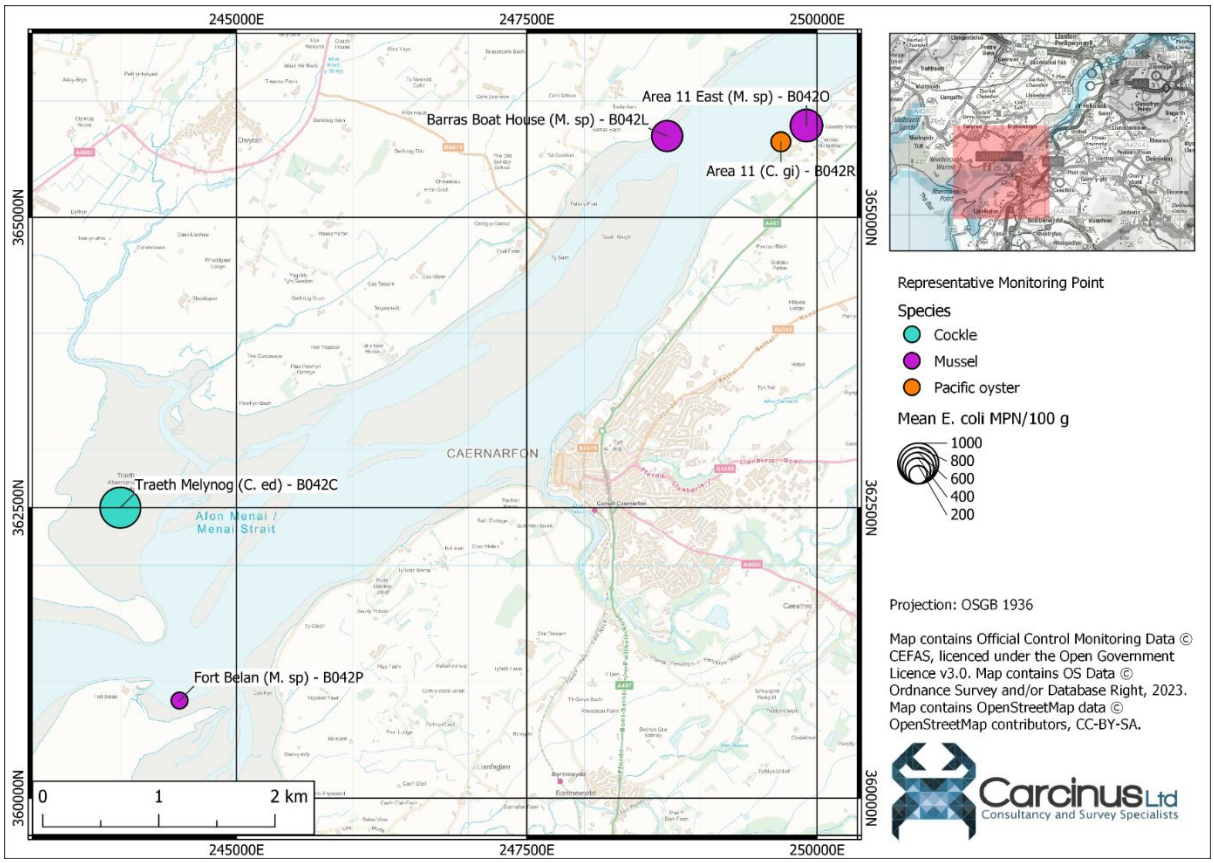

Figure 6.4 Mean Official Control monitoring results from Bivalve RMPs in the Menai Strait - West BMPA.

Monitoring data are available on the Cefas Datahub for a total of five RMPs within the Menai Strait – West BMPA. Of these only one (Traeth Melynog B042C) was sampled prior to the publication of the 2013 Sanitary Survey. Sampling at the remaining RMPs began in 2015 and 2016, following the recommendation of the 2013 report. Sampling at the Fort Belan B042P RMP stopped in 2019, and sampling at the Area 11 B042R RMP stopped in 2022. The other three RMPs are currently active. An application to reclassify the Fort Belan CZs is considered in this review.

Of the RMPs currently sampled, only the Traeth Melynog (B042C) RMP has ever returned a result above 4,600 MPN/100 g and 50% of the results from this RMP have exceeded 230 MPN/100 g, but no result has ever exceeded 46,000 MPN/100 g. The most recent result above 4,600 MPN/100 g was recorded in October 2023 (35,000 MPN/100 g). Comparison of

results between current RMPs and those previously monitored suggests that shellfish flesh hygiene in this BMPA has improved, as the proportion of results above 230 MPN/100 g recorded at all RMPs has fallen. When considered spatially, there does not appear to be any distinct geographical pattern in the monitoring data. The RMPs in the outer strait have returned slightly higher monitoring results, but this is more likely to be due to differences in the rates of E. coli uptake between cockles and mussels. A 2014 report by Cefas into the use of indicator species in UK BMPAs (Cefas, 2014) found that cockles generally accumulate *E. coli* to a similar or higher extent than mussels, so this is more likely to be explaining the observed pattern. With no general geographic trend, greater attention should be paid to the presence of any point sources of contamination in CZs when defining any updated sampling plan.

Figure 6.5 - Figure 6.7 present box and violin plots of *E. coli* monitoring at bivalve RMPs within the Menai Strait – East BMPA. One-way analyses of variance tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the two RMPs. Significance was taken at the 0.5 level. All statistical analyses described in this section were undertaken in R (R Core Team, 2021).

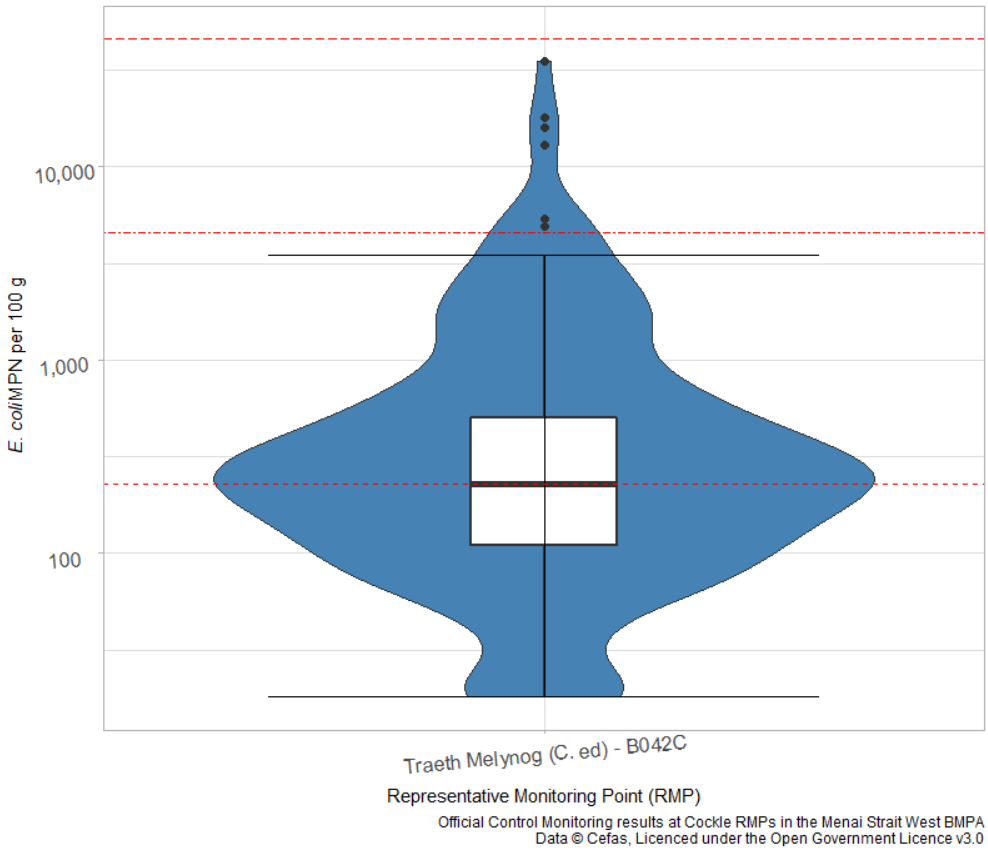

Figure 6.5 Box and violin plots of E. coli concentrations at Cockle RMPs sampled in the Menai Strait – West BMPA. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Boxplots are overlaid on the distribution of the monitoring data. Dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

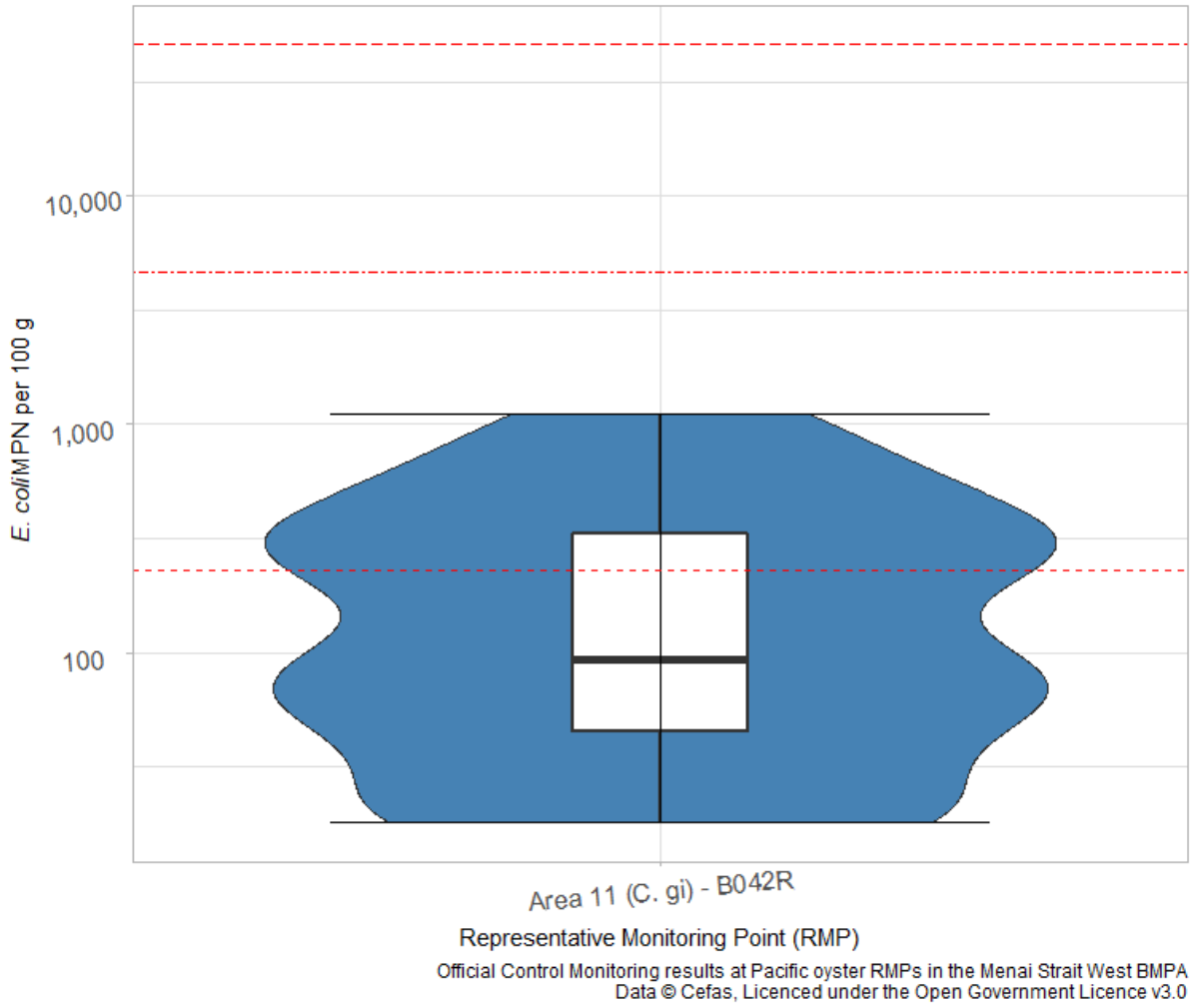

Figure 6.6 Box and violin plots of E. coli concentrations at Pacific oyster RMPs sampled in the Menai Strait – West BMPA. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Boxplots are overlaid on the distribution of the monitoring data. Dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

No statistical comparison of either the cockle (Figure 6.5) and Pacific Oyster (Figure 6.6) data is possible due to the differences in rates of *E. coli* uptake and clearance between different species. However, the median result at both RMPs is at or below the 230 MPN/100 g threshold.

Within the mussel data (Figure 6.7), the highest median result was found at Barras Boat House (B042L) and the lowest at Fort Belan (B042P). No significant differences were found in the data ($p>0.05$).

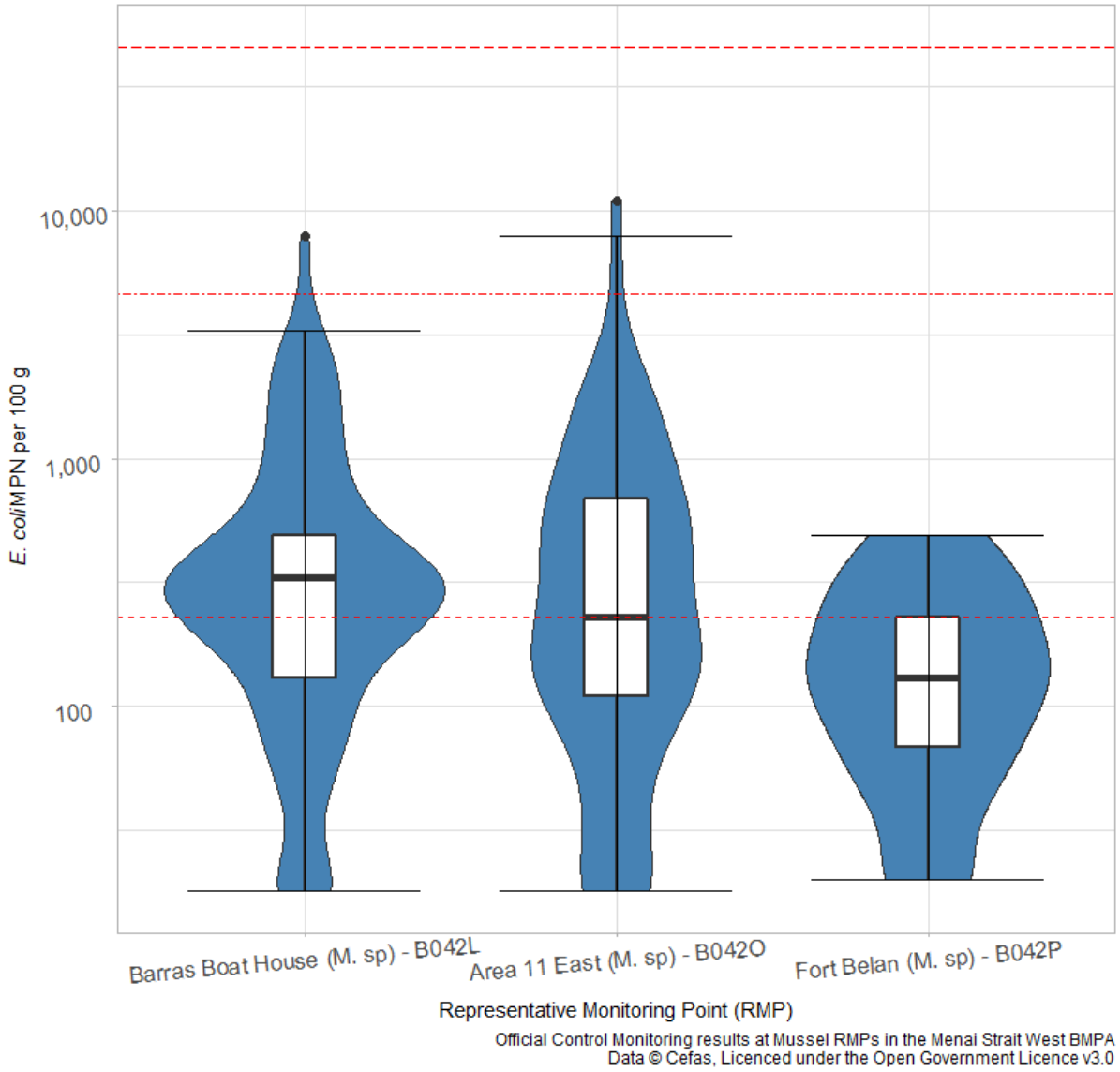

Figure 6.7 Box and violin plots of E. coli concentrations at mussel RMPs sampled in the Menai Strait – West BMPA. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5 x the interquartile range). Boxplots are overlaid on the distribution of the monitoring data. Dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.1.2 Overall temporal pattern in results

Menai Strait – East

The overall temporal pattern in shellfish flesh monitoring results at mussel and cockle RMPs in the Menai Strait – East BMPA are shown in Figure 6.8 and Figure 6.9 respectively.

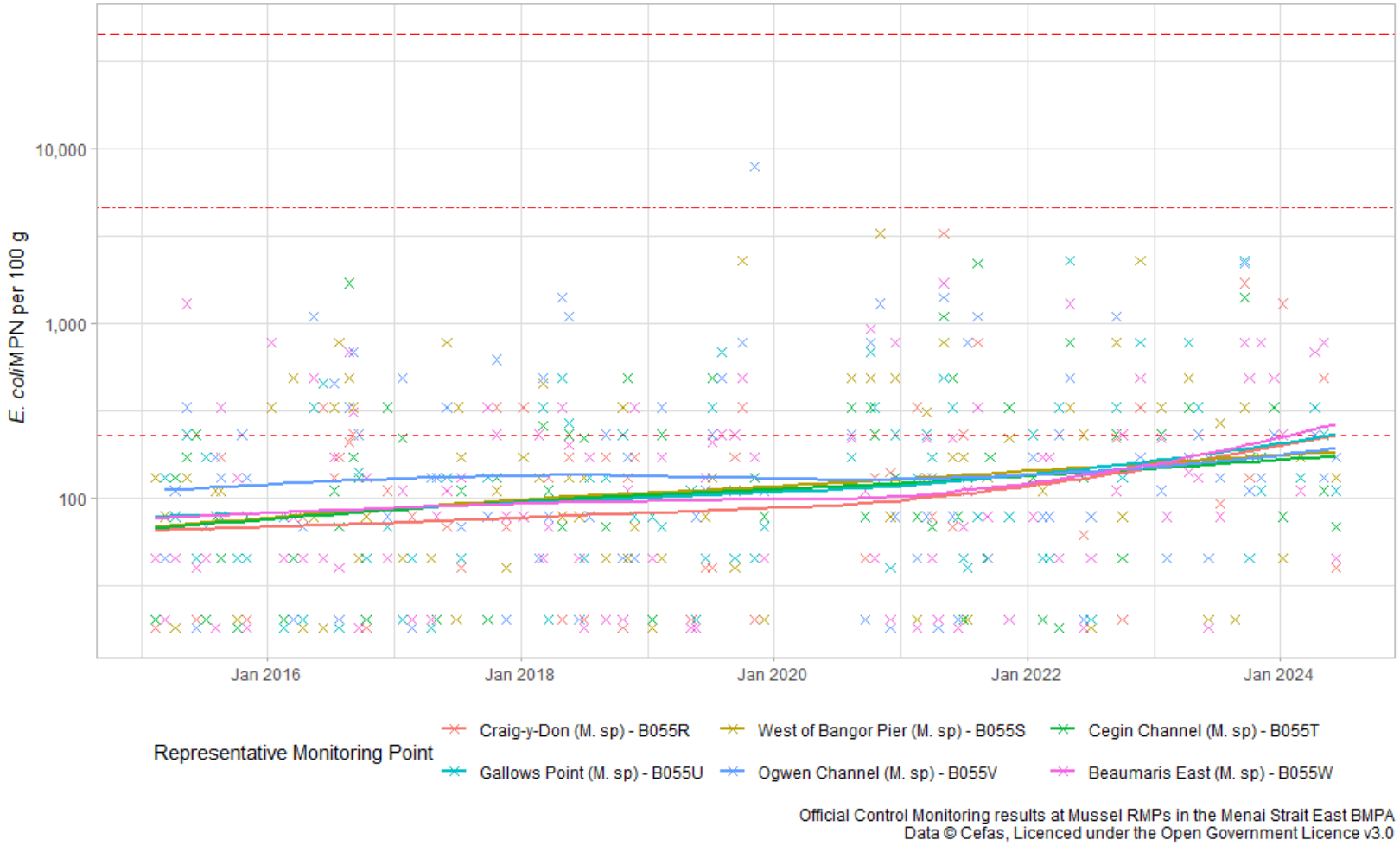

Figure 6.8 Timeseries of E. coli levels at mussel RMPs sampled in the Menai Strait – East. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

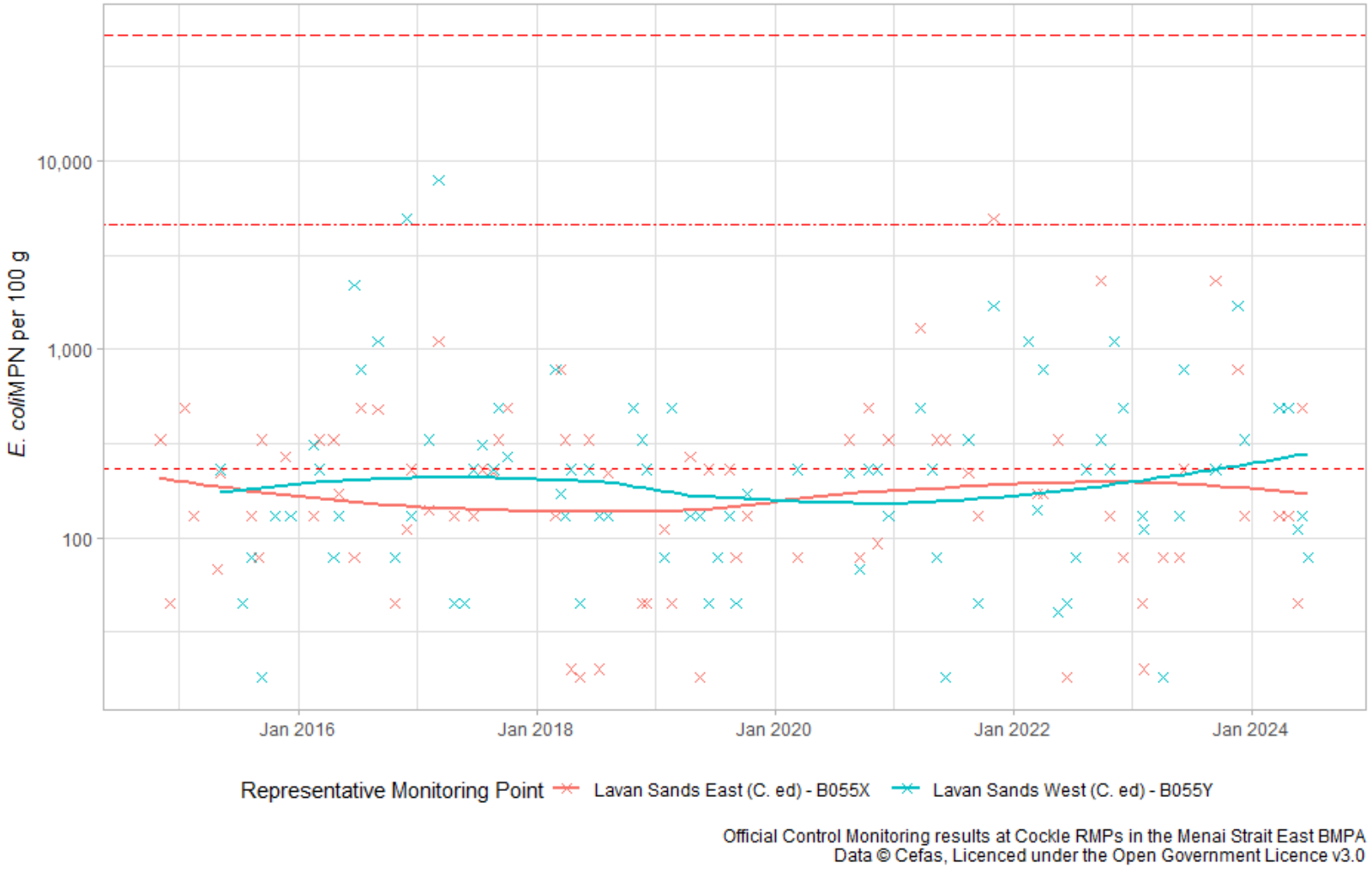

Figure 6.9 Timeseries of E. coli levels at cockle RMPs sampled in the Menai Strait – East. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Monitoring results from the mussel RMPs (Figure 6.8) show that from 2015 to 2021 the monitoring results were broadly stable for class B beds, and results from the different RMPs were also very similar. Since 2022, there has been an increase in the E. coli monitoring results.

Monitoring results from the cockle RMPs (Figure 6.9) show that the trend lines have also been relatively stable since 2015, with the loess model falling at or just below the 230 MPN/100 g threshold.

Menai Strait – West

The overall temporal pattern in shellfish flesh monitoring results at cockle, Pacific oyster and mussel and Pacific oyster RMPs in the Menai Strait – West are shown in Figure 6.10 Figure 6.11 and Figure 6.12 respectively.

The loess model fitted to the cockle data (Figure 6.10) shows that the concentration of *E. coli* in shellfish flesh samples is relatively stable, with the loess model falling at or around the 230 MPN/100 g threshold.

The Pacific Oyster data (Figure 6.11) also shows that shows that the concentration of *E. coli* in shellfish flesh samples is relatively stable, with the loess model below the 230 MPN/100 g threshold.

The mussel data (Figure 6.12) shows that monitoring data from the Area 11 East (B042O) and Barras Boat House (B042L) have been similar, falling at or around the 230 MPN/100 g threshold from 2015 – 2022. However, a few high results in 2023 (see Action States below for more detail) have led to the loess model trending upwards from 2022 – present.

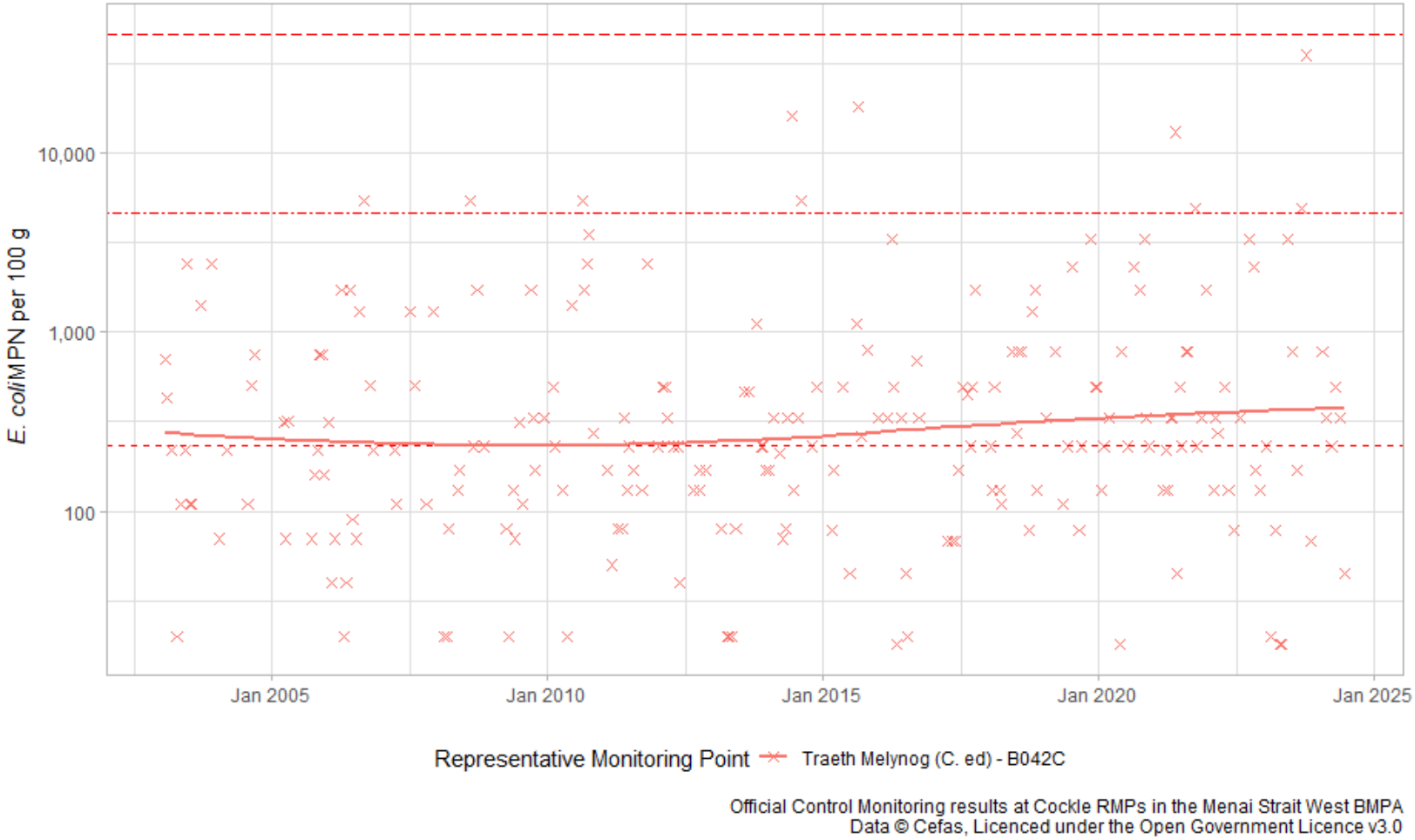

Figure 6.10 Timeseries of E. coli levels at cockle RMPs sampled in the Menai Strait – West. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

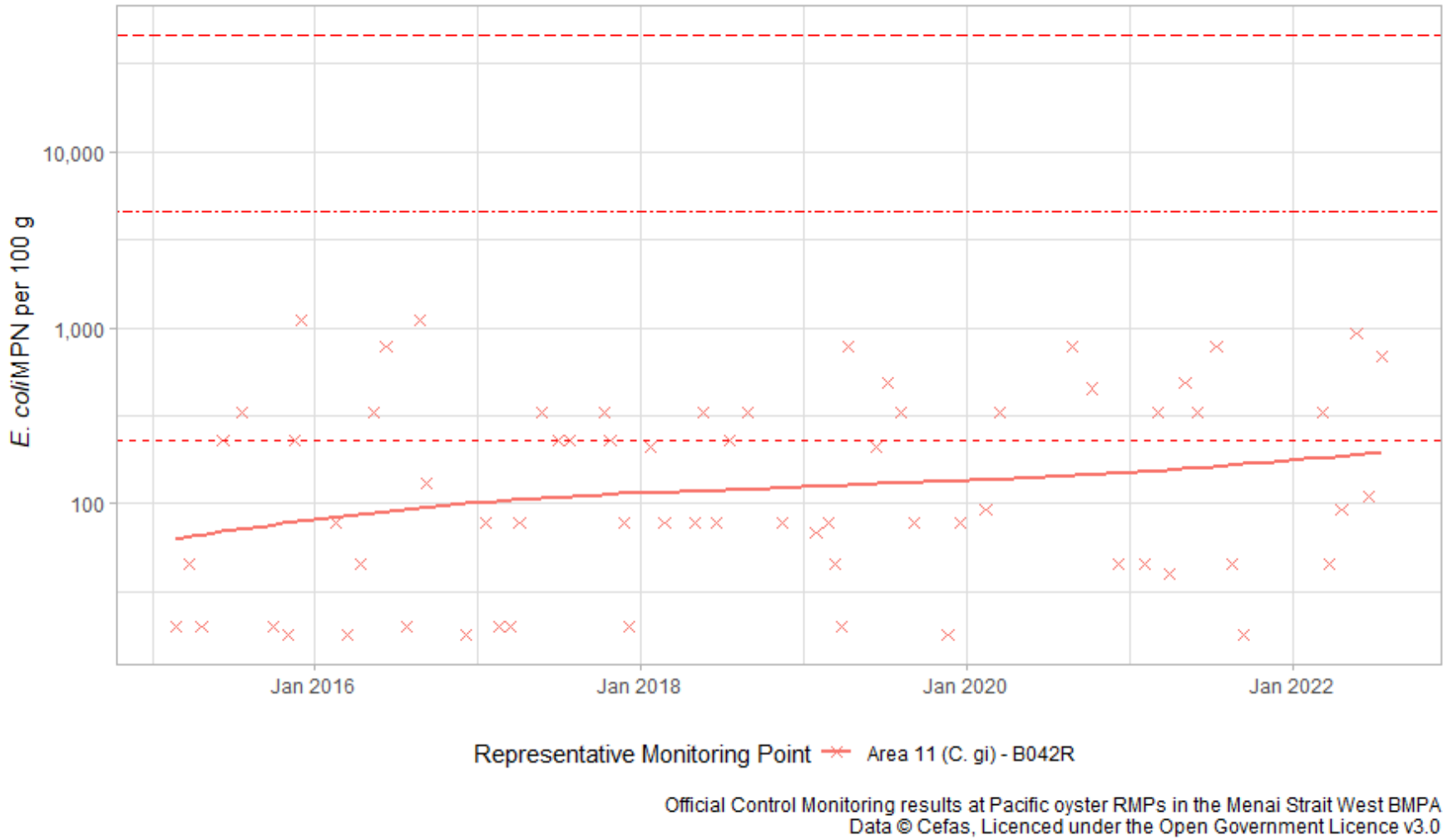

Figure 6.11 Timeseries of E. coli levels at Pacific oyster RMPs sampled in the Menai Strait – West. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

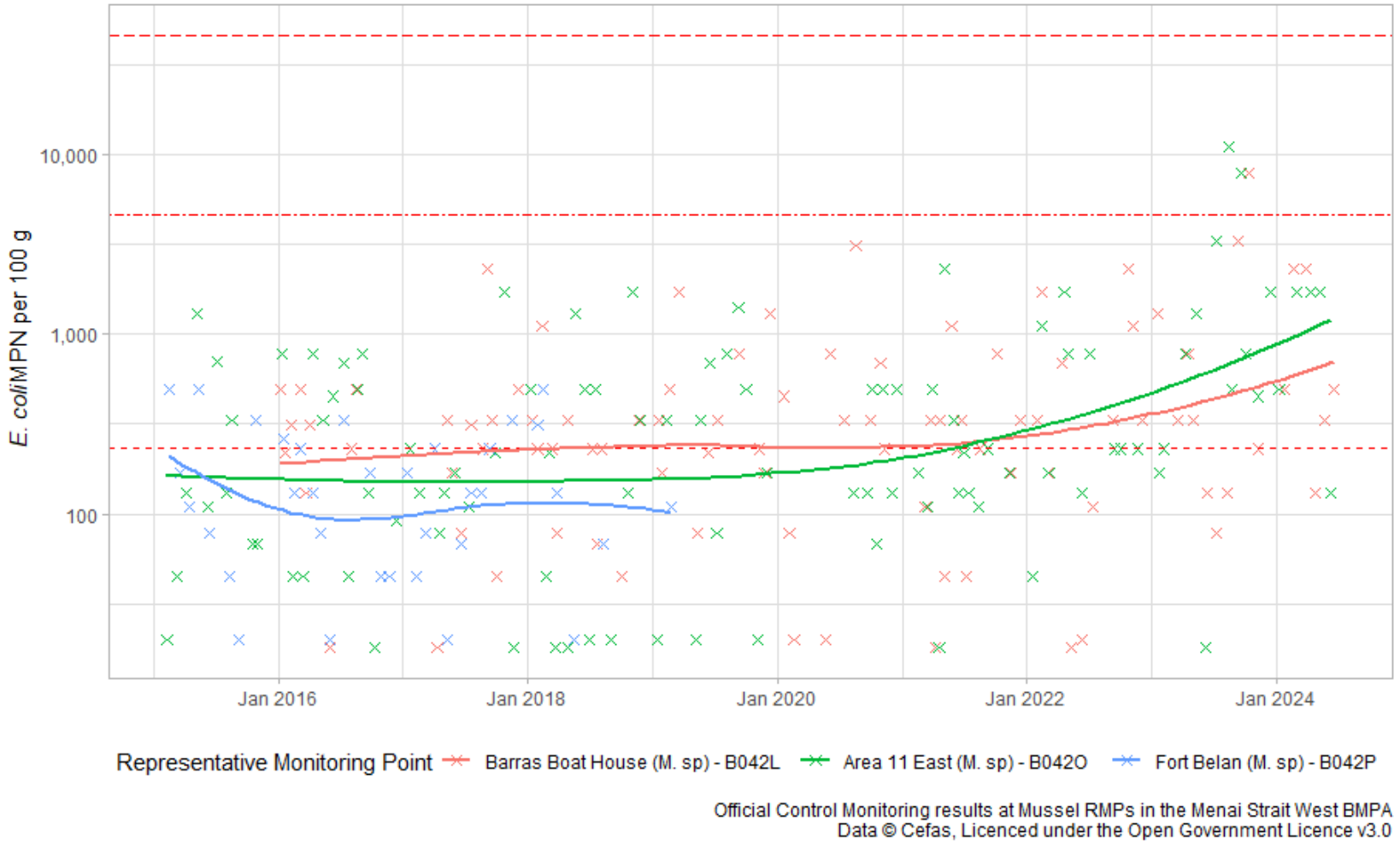

Figure 6.12 Timeseries of E. coli levels at mussel RMPs sampled in the Menai Strait – West. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.1.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at RMPs in the Menai Strait East and West BMPAs were investigated and are shown for the Menai Strait – East BMPA in Figure 6.13 - Figure 6.14 and for the Menai Strait – West BMPA in Figure 6.15 - Figure 6.17.

The data for each year were averaged into the four seasons, with, spring from March – May, summer from June – August, autumn from September – November and winter comprising data from December – February the following year. Two-way ANOVA testing was used to look for significant differences in the data, using both season and RMP (if there is more than one RMP for a given species) as independent factors (i.e., pooling the data across season and RMP respectively), as well as the interaction between them (i.e., exploring seasonal differences within the results for a given RMP). Significance was taken at the 0.05 level.

Menai Strait – East

Within the monitoring results from mussel RMPs (Figure 6.13), monitoring results from Winter were significantly lower than those in Spring ($p = 0.04$) and Autumn ($p = 0.001$). Results in Autumn were also significantly higher than those in Summer ($p = 0.004$). However, when the results for an individual RMP was considered no significant different results were observed. Higher results in Autumn could be driven by a number of factors, including additional loading to the wastewater treatment network or land run off due to increased rainfall.

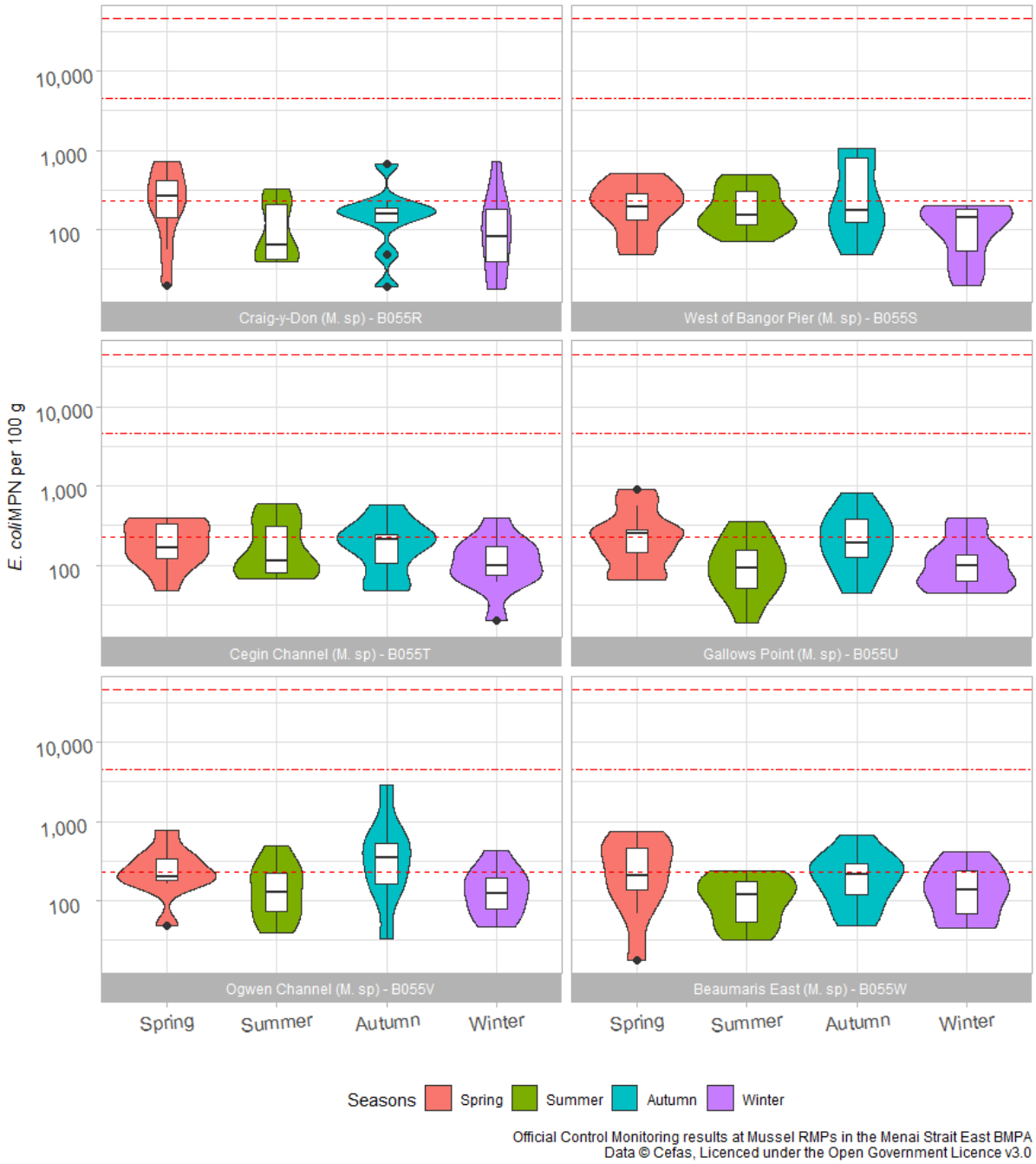

Figure 6.13 Box and violin plots of E. coli levels per season at mussel RMPs sampled within the Menai Strait – East BMPA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Within the cockle data (Figure 6.14), monitoring results from Autumn months were slightly higher than at other times of year, although no significant differences in the data were observed.

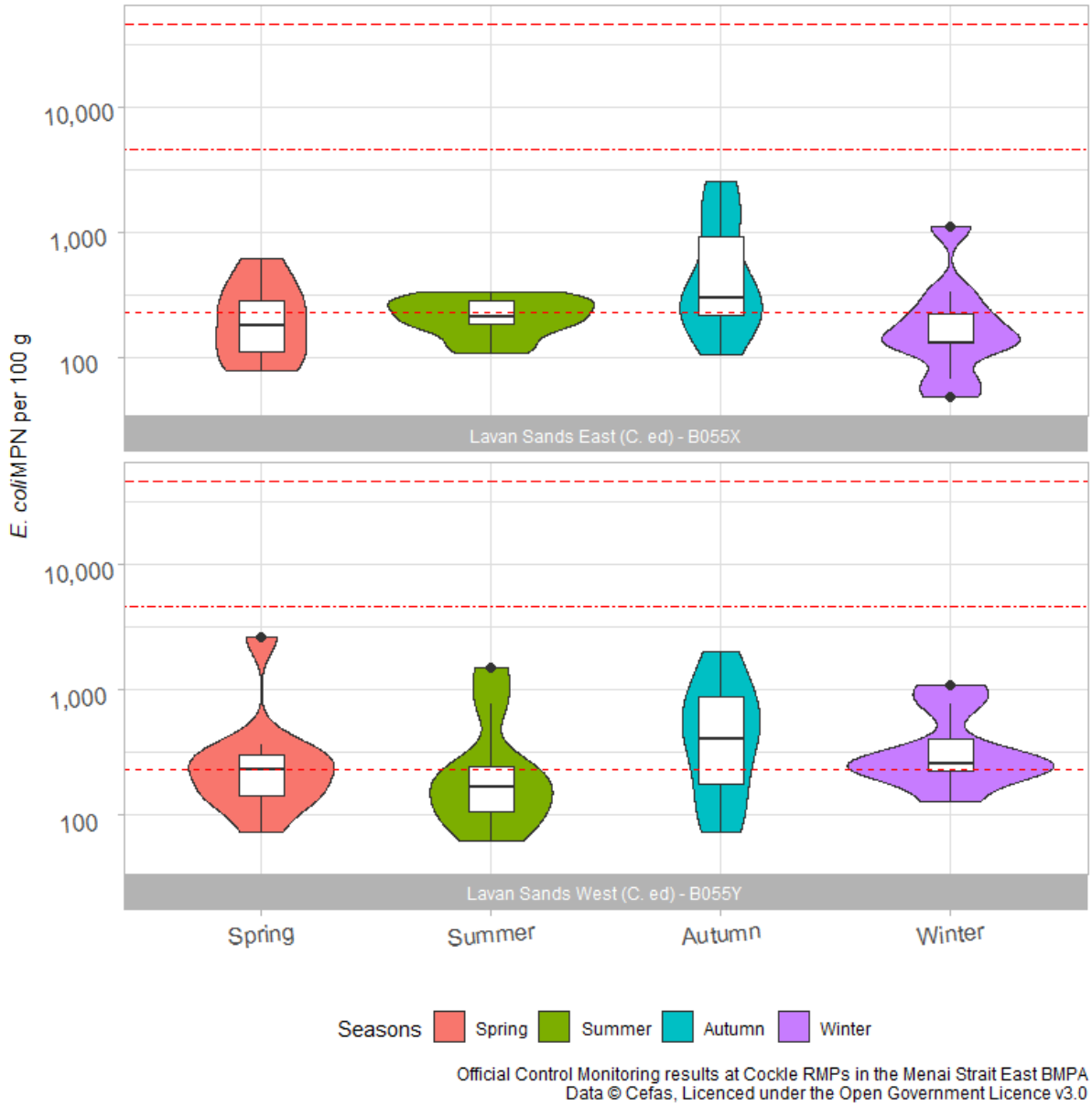

Figure 6.14 Box and violin plots of E. coli levels per season at cockle RMPs sampled within the Menai Strait – East BMPA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Menai Strait – West

Within the cockle data (Figure 6.15), monitoring results in Autumn were slightly higher than at other times of year, although the difference was not significant (p>0.05).

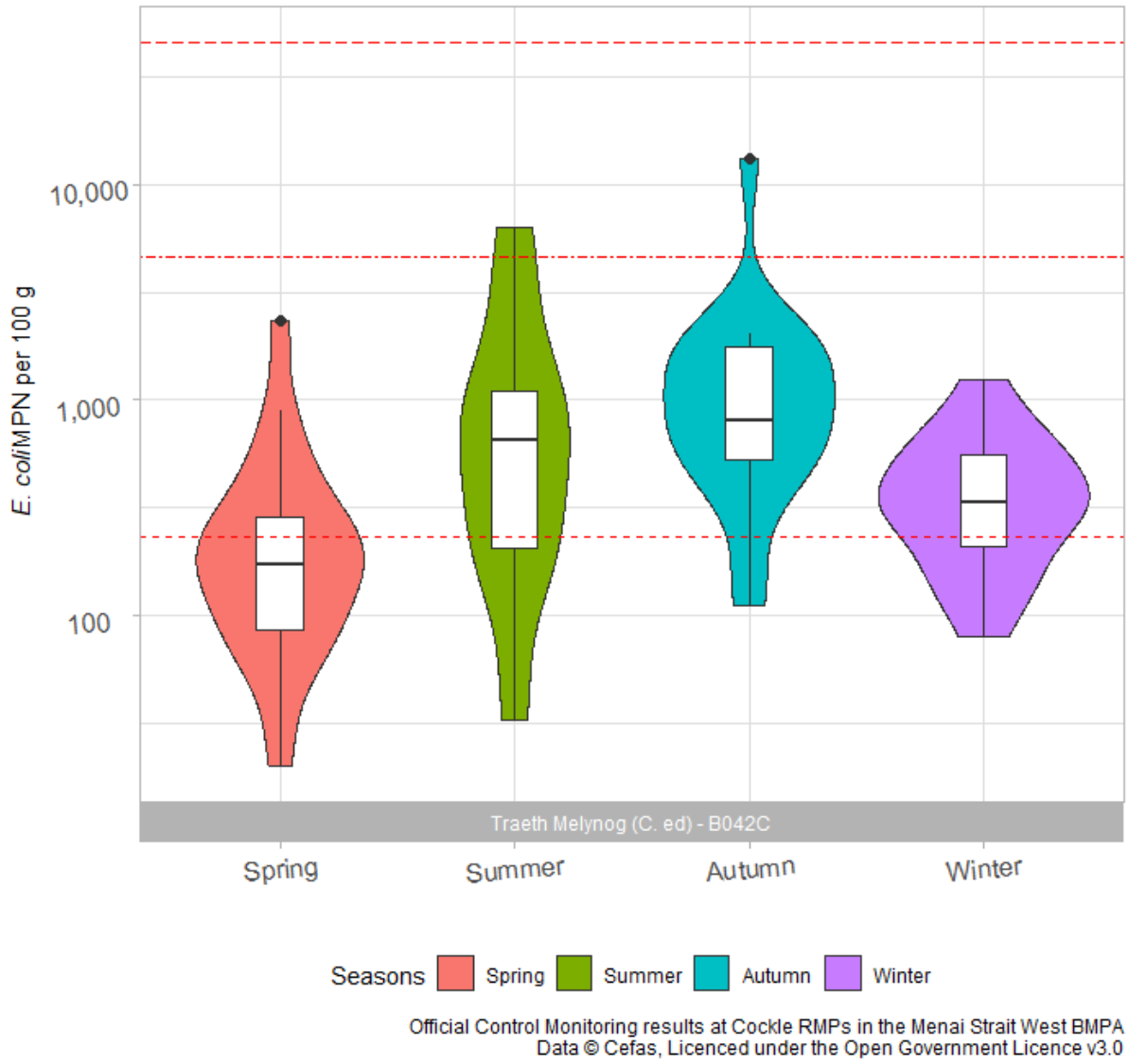

Figure 6.15 Box and violin plots of E. coli levels per season at cockle RMPs sampled within the Menai Strait – West BMPA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Within the Pacific Oyster data (Figure 6.16), monitoring results in Summer were higher than at other times of year, although the differences were not significant ($p>0.05$).

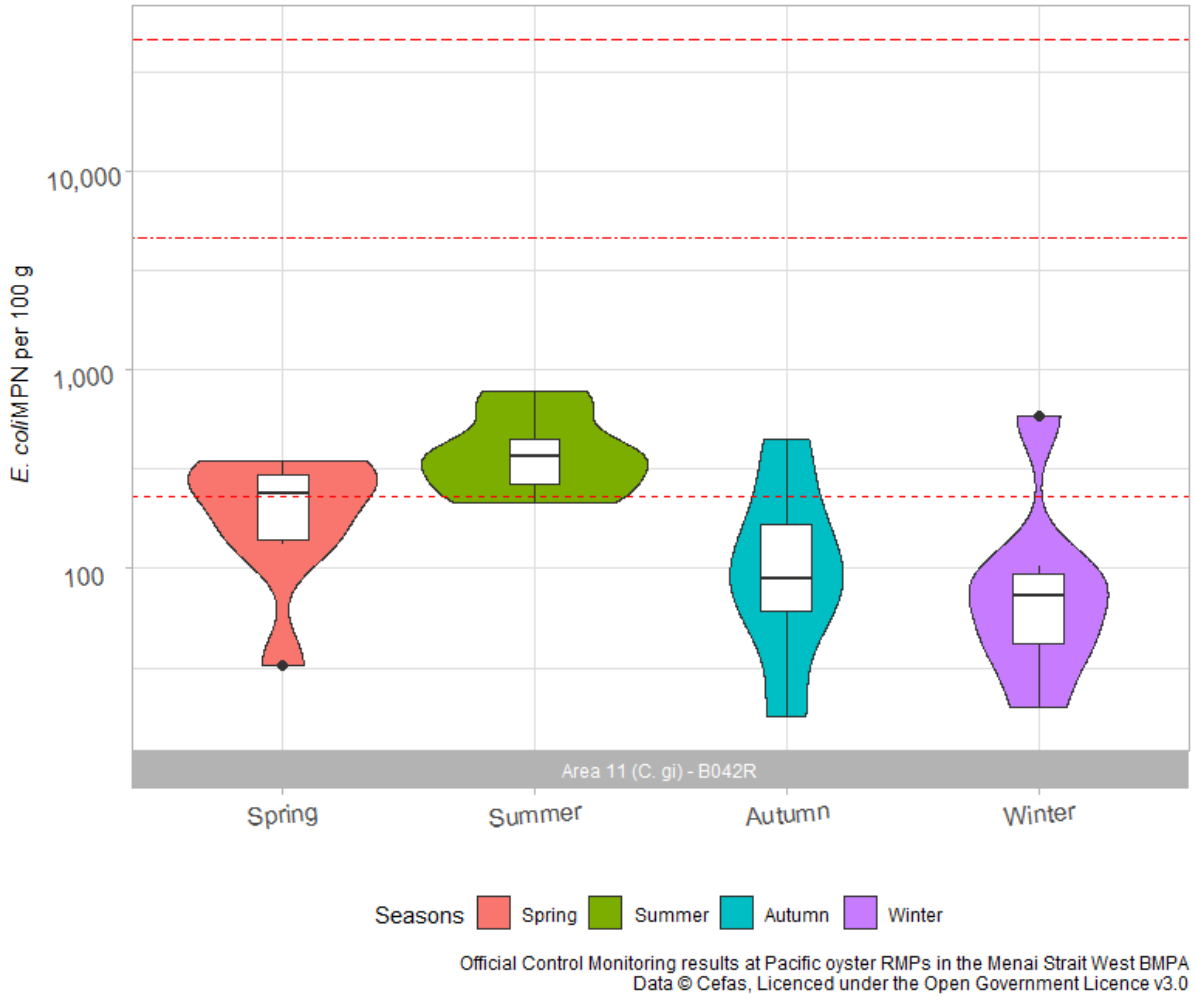

Figure 6.16 Box and violin plots of E. coli levels per season at Pacific oyster RMPs sampled within the Menai Strait – West BMPA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Within the mussel data (Figure 6.17), monitoring results in Summer months were significantly lower than in Autumn ($p = 0.029$) and Winter months ($p = 0.022$). This echoes the findings in the Menai Strait – East BMPA. Higher results in Autumn and Winter could be driven by a number of factors, including additional loading to the wastewater treatment network or land run off due to increased rainfall.

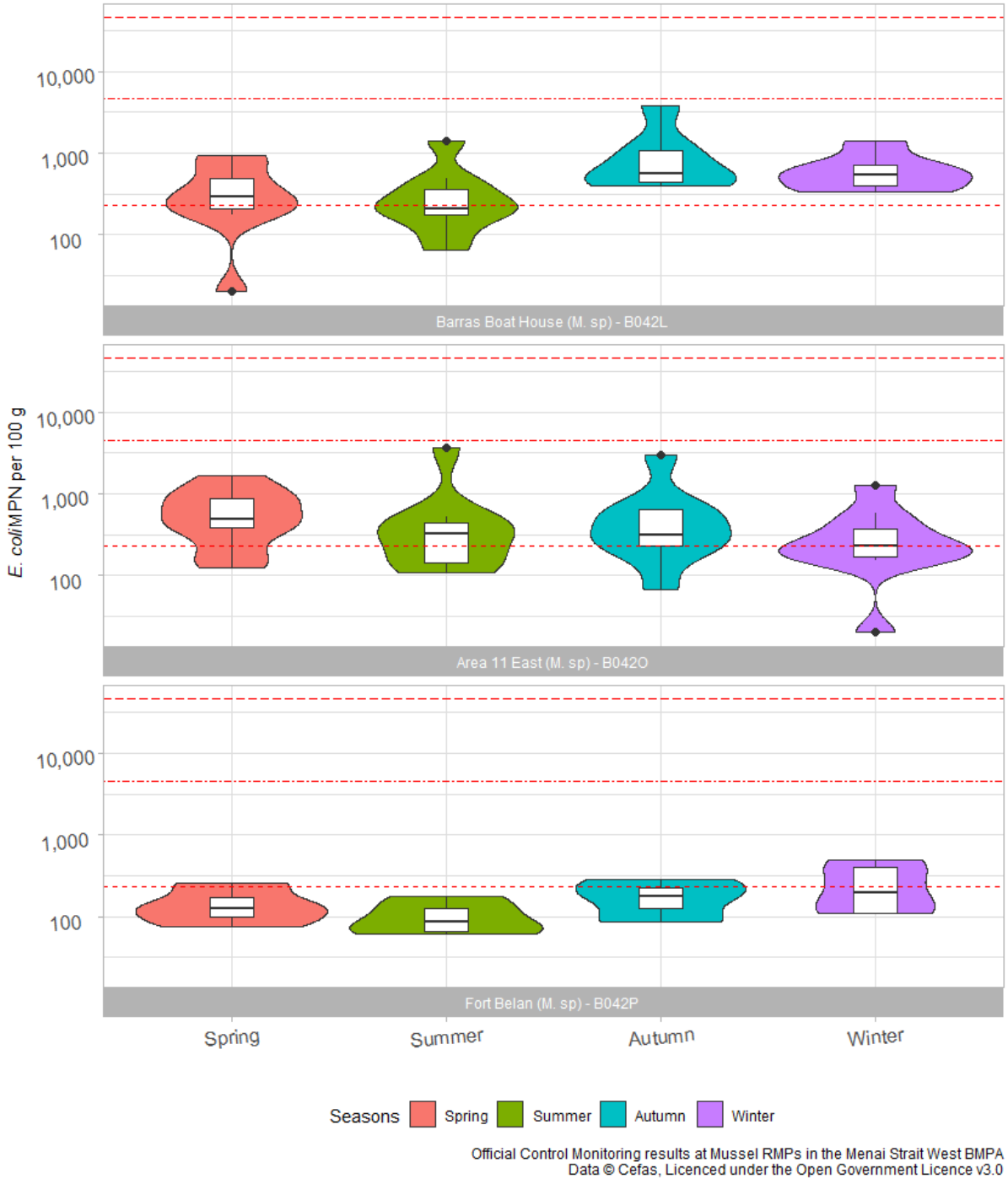

Figure 6.17 Box and violin plots of E. coli levels per season at mussel RMPs sampled within the Menai Strait – West BMPA. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.1.4 Action States

Menai Strait - East

Since the publication of the 2013 Sanitary Survey of the Menai Strait – East, the following Action State was triggered within the BMPA:

- On 4 May 2021, two RMPs (Cegin Channel B055T and Craig-y-don B005R) received results of 1100 & 3300 *E. coli* MPN/100 g respectively. Subsequent monthly sampling at Cegin Channel on 31 May and 31 June returned results of 490 and 78 *E. coli* MPN/100 g. Subsequent monthly sampling at Craig-y-don on the same dates returned results of 68 and <18 *E. coli* MPN/100 g. Whilst high rainfall and strong winds had been reported in the lead up to sampling, this was not reported to be a one in five-year rainfall event and no pollution incidents were noted. Therefore there were no grounds for these results to be waived. Both results were also found to not be 3SD and could not be removed from the dataset for the purposes of classifications.
- On 10 August 2021, a result of 2200 *E. coli* MPN/100 g was recorded at the Cegin Channel B055T RMP. This bed held an A classification at this time. Investigative sampling on 8 September 2021 returned a result of 45 *E. coli* MPN/100 g and subsequent monthly sampling on 15 September 2021 returned a result of 170 *E. coli* MPN/100 g. No exceptional rainfall or relevant pollution incidents were reported in the lead up to sampling, so there were no grounds for this result to be waived. This result was also found to not be 3SD and could not be removed from the dataset for the purposes of classifications.
- On 14 August 2023, a result of 22,000 *E. coli* MPN/100 g was recorded at the Beaumaris East B055W RMP. 'Cause for Concern' results were also recorded at Craig-y-Don B055R (17,000 *E. coli* MPN/100 g), Gallows Point B055U (17,000 *E. coli* MPN/100 g), Ogwen Channel (7,900 *E. coli* MPN/100 g) and West of Bangor Pier B055S (7,900 *E. coli* MPN/100 g). Investigative sampling on 18 September 2023 returned a result of 780 *E. coli* MPN/100 g and subsequent monthly sampling on 03 October, 07 November and 13 December 2023 returned results of 490, 780 and 490 *E. coli* MPN/100 g. Extremely high (> 1-in-5 year event) rainfall in the days preceding the sampling constituted grounds to waive the result, which is why there is no record of this sampling in Table 6.1.

Menai Strait – West

Since the publication of the 2013 Sanitary Survey of the Menai Strait – East, the following Action State was triggered within the BMPA:

- On 12 October 2023 a result of 35,000 *E. coli* MPN/100 g was recorded at Traeth Melynog B042C. A 'Cause for Concern' result was also recorded at Barras Boat House B042L (7,900 *E. coli* MPN/100 g). Subsequent investigative sampling on 09 November 2023 returned a result of 68 *E. coli* MPN/100 g and the subsequent monthly sampling on 24 January 2024 returned a result of 780 *E. coli* MPN/100 g. There were no grounds to waive the result in accordance with the waiver criteria.

7 Conclusion and overall assessment

The Menai Strait is the tidal channel that separates the Isle of Anglesey from mainland Wales. It contains two separate BMPAs, the Menai Strait – East and the Menai Strait West, both of which were last subject to a Sanitary Survey in 2013.

The shellfishery within the Menai Strait – East is under the jurisdiction of Cyngor Gwynedd/Gwynedd Council, Ynys Mon/ Isle of Anglesey County Council and Conwy County Borough Council for food hygiene purposes. Harvesting of mussels within the Menai Strait – East BMPA is controlled under the new Menai Strait (East) Mussel and Oyster Fishery Order 2022, which came into force in April 2022 and replaced the previous order. The mussel fishery is managed by the Menai Strait Fishery Order Management Association (MSFOMA), who have designated an area within the Order Boundaries as a several fishery area, and all harvesting takes place within the designated area on cultivated mussel beds using dredges. No hand gathering of mussels from wild beds has taken place for over 10 years. The cockle fishery in the Menai Strait East is regulated under Welsh National legislation, with catch limits and other controls. Between September 2021 and February 2022, 170 tonnes of cockles were removed from the Lavan Sands area.

The shellfishery within the Menai Strait – West is under the jurisdiction of Cyngor Gwynedd/Gwynedd Council and Ynys Mon/ Isle of Anglesey County Council for food hygiene purposes. There is currently no Several Order that applies to the shellfish of the Menai Strait – West. The wording of the draft Menai Strait (West) Oyster and Mussel Fishery Order 2015 sets out the legal nature of the fishery in the Menai Strait West, and specifies four areas for either mussel, oyster, or both, may be cultured, but this Order has not yet been made. The current output of the mussel and oyster fishery is unknown. Cockles are also harvested in the area, subject to Welsh National Legislation. In 2021, approximately 62 tonnes of cockles were harvested.

The results of the 2021 Census were compared to that of the 2011 Census to give an indication of population changes in the catchment since the 2013 Sanitary Surveys were published. The data suggest that the population of the catchment has increased by approximately 4.5%, but that the main population centres (Caernarfon, Bangor & Menai Bridge) have not changed. Most of the land in the catchment has a very sparse population, of less than 500 persons per km², and so the risk of urban-associated runoff is considered to be low. There is likely to be a seasonal influx of tourists during Summer months, but we have received no evidence to suggest that the existing wastewater treatment network is insufficient to handle this increase.

No changes to either the treatment methodology or consented discharge volume at continuous water company discharges discharging to the eastern Menai Strait have occurred since the original sanitary survey was published, and so the risk that these pose remains similar. In the western Menai Strait, the consented discharge volume at Caernarfon

has increased to 3352 m³/day from 2840 m³/day, meaning that the faecal loading is likely to have increased also. The availability of spill data from intermittent discharges means that greater appreciation of the potential impacts of these assets can be gained. This spill data suggests that intermittent discharges in both the eastern and western Menai Strait spilled relatively frequently (> 50 times) in 2021 and 2022. The presence of an intermittent discharge near to or within the CZs of this BMPA should be given additional consideration in any updated sampling plan, as the spills from intermittent discharges are generally untreated.

Livestock populations in the Menai Strait catchment fell by 4.25% between 2013 and 2021, although most of this fall was driven by a large decrease in poultry populations in the Braint/Cadnant sub-catchment. Land cover maps show that the land immediately adjacent to the shoreline of the Menai Strait is very often reserved for pasture, meaning that the risk of agricultural runoff, particularly during wet weather periods, is relatively high. The risk is not considered to have changed significantly since the original sanitary survey was published. During initial consultations, NRW stated that they were not aware of any significant pollution events arising from slurry application in the catchments draining to the Menai Strait.

The Menai Strait supports a variety of wildlife populations due to the diversity of intertidal and subtidal habitats present. The group that are most likely to contribute significant levels of contamination to the shellfishery are wading birds, as they forage and defecate directly on intertidal shellfish beds. Count data suggest that the risk of this pollution source is greater in the eastern strait than the western, as average counts are about three times higher in the Lavan Sands area than the Traeth Melynog area. It is hard to reliably account for this source of pollution however as the aggregations of birds will shift from year to year based on the distributions of their prey, but it is likely that the large intertidal cockle CZs will be at greater risk than the smaller mussel CZs, and during certain times of year this may be a potentially significant source of contamination.

The main risk of contamination from boats comes from recreational craft of a sufficient size to contain on-board toilets, as commercial vessels are prohibited from making overboard discharges within 3 nm of land. This is unchanged from the situation described in the original sanitary survey. The areas at risk will continue to be the main navigational areas and any clusters of moorings outside of the marinas, and contamination levels are likely to be highest in summer months. Overall, the risk is not considered to have changed significantly since the original sanitary surveys were published.

Official Control monitoring at RMPs in the eastern strait suggests that shellfish hygiene has remained relatively stable since 2015. The highest contamination levels were found in cockle RMPs in the outer strait, but this is more likely due to differences in rates of *E. coli* uptake and clearance rather than a geographically driven pattern. Monitoring results in Autumn tended to be higher than at other times of year. Elevated results in Autumn are

likely due to increased levels of runoff and loading to the sewerage network caused by increased rainfall.

Official Control monitoring at RMPs in the western strait suggests that shellfish hygiene at mussel and Pacific oyster RMPs has been deteriorating in recent years, but it is likely that this has been caused by an overall increase in background contamination levels rather than any specific point source. Results from Summer months tended to be lower than those recorded at other times of year. This is likely due to increased loading to the sewage network and land run off caused by increased rainfall.

Initial consultations indicated that there are a number of issues with current RMPs within both BMPAs, including safe access and availability of suitable stock for sampling. This desktop assessment has not identified any significant knowledge gaps in terms of sources and timing of contamination that would justify a shoreline survey.

Having reviewed and compared the desk-based study with the findings of the original sanitary surveys in 2013, the FSA are also content that a shoreline assessment is not required.

8 Recommendations

Recommendations for the various classification zones within the Menai Strait – East BMPA are described in Section 8.1 and summarised in Table 8.1. Recommendations for the Menai Strait – West BMPA are described in Section 8.2 and summarised in Table 8.2.

8.1 Menai Strait – East

8.1.1 Mussels

Under the Menai Strait (East) Mussel and Oyster Fishery Order 2022, MSFOMA have designated a several fishery area within the eastern Menai Strait, and we understand that all fishing activity must take place from within this area. Within the Order Area, MSFOMA designate eight separate lease areas, and have also provided information as to the precise areas of current harvesting activity within each lease area. As such, a general recommendation of ensuring that all RMPs are placed within actively harvested areas is given, so that RMPs can be considered representative of the shellfish being harvested and also the worst-case contamination to protect Public Health. This is likely to result in a change of sampling methodology; currently all RMP samples are collected by hand, but the harvesting areas are subtidal and so it will be necessary to collect the samples by boat. The existing sampling plan includes three Classification Zones covering more than one lease area, however during consultation, it was suggested that the CZ boundaries be amended to align with individual lease areas. Figure 8.1 presents the changes to RMPs boundaries summarised in the paragraphs below.

Area A

This CZ covers an area of 0.42 km² and is the farthest innermost CZ on the northern side of the Strait. It is currently classified based on samples from the Craig-y-Don B055R RMP, which is located at the innermost shoreline corner of the CZ. This position was

recommended in the original Sanitary Survey to capture contamination from large sewage treatment works to the west. Only a small proportion of the current zone boundaries are within the Several Fishery Area; all harvesting activity takes place in the south-eastern corner of the CZ. There are two intermittent discharges along the shoreline of this CZ, and it is recommended that the RMP be moved to the nearmost edge of the harvesting area to the northern shore between these two discharges, around SH 5743 7338.

Area 1

This zone covers an area of 0.98 km² on the southern side of the eastern Menai Strait. The 2013 Sanitary Survey recommended placing the RMP for this zone to the west of Bangor Pier, to capture contamination from the rivers Cegin and Ogwen, identified to be the main contaminating influences on this zone. Harvesting within this CZ takes place in the eastern side of the zone. The intermittent discharges within the zone (120 m west of the harvesting area) are not very active (spilling for less than 3 hrs in 2021), and so it is considered that the RMP should be kept on the eastern side of the harvesting area. The RMP should be moved 230 m northwest of its current position, to SH 5812 7341.

Area 3

This will be a new CZ, representing the western part of the previous *Areas 3 & 4 CZ*. The new CZ will cover an area of 0.58 km² and be bordered by the *Area A* CZ to the west, *Area 2* CZ to the south, and *Area 4* CZ to the east. The harvesting activity within this CZ takes place in the south-east part of the CZ. There are few direct sources of contamination to this CZ; the CZ is likely to be affected by releases from intermittent and private discharges further into (i.e. nearer the Menai Bridge) the Menai Strait. It is recommended that the RMP be placed at the nearshore western corner of the current harvesting activity, around SH 5860 7416. If harvesting activity expands shorewards or westwards, the RMP should be moved to the new nearshore western corner.

Area 4

This will be a new CZ, representing the eastern part of the previous *Areas 3 & 4 CZ*. The new CZ will cover an area of 0.26 km² and be bordered to the west by the new *Area 3 CZ*, to the south by the *Area 2* CZ and to the east by the *Area 6*. The historic RMP Gallows Point B055U should be used to represent this CZ moving forward as it is well placed to capture any contamination from intermittent discharges off Beaumaris as well as the Llanfaes WWTW (ID 11), and is present within the active harvesting area for this CZ.

Areas 3 & 4

This CZ should be declassified as the previous area is now classified under the separate *Area 3* and *Area 4* CZs.

Area 2

This will be a new CZ, representing all of the Area 2 lease area. The new zone will cover an area of 1.1 km² and be bordered to the west by the *Area 1 CZ*, to the north by the *Area 3* CZ, to the south by the new *Area B* CZ and to the west by the new *Area 5* CZ. The current area of harvesting activity within this CZ is in the northern part of the CZ. The Cegin Channel will

be the main source of contamination to this zone, and the RMP should be placed in a position as close to the mouth of the Cegin as stock allows within the Area 2 Harvesting Area (SH 5855 7372). As there are few direct sources of contamination to this zone (beyond the river Cegin), and the zone is large, the sampling tolerance is increased to 100 m to allow for stock shifts. A sampling tolerance of 100 m is generally considered to be the maximum tolerance that allows temporal consideration of the sampling results and should only be permitted where there are concerns over reliable stock availability in the identified location. The sample should always be taken as close to the mouth of the Cegin as stock or access allows.

Area B

This will be a new CZ, representing the entirety of Lease Area B / Ballast Bank, which was previously classified through the *Area 2 & B* and *Area 5 & B* CZ. The CZ will cover an area of 1.06 km², although currently harvesting only takes place from a smaller area in the north of the CZ. The CZ will receive contamination from both the Cegin Channel to the south west and the Ogwen Channel to the south east. The RMP for this zone should be placed at the mid-point of the southern edge of the current harvesting area, around SH 5996 7365, to capture contamination from both channels. If harvesting activity moves further shore-ward, the RMP should be moved to be at the new southern edge.

Areas 2 & B

This CZ should be declassified, as the area that it classified will now be covered by the separate *Area 2* and *Area B* CZs.

Area 6

This CZ is the outermost CZ on the northern side of the Strait and covers an area of 0.86 km². Harvesting within the *Area 6* CZ takes place on the eastern end of the CZ from the Horseshoe lease area. The 2013 Sanitary Survey identified that there were no major contaminating influences within the boundaries of the CZ itself, and that contamination occurred on a gradient with maximum concentrations at the eastern end of the zone. No changes to the contamination sources affecting this zone have been identified, and so it is recommended that the RMP be moved eastern edge of the Horseshoe harvesting area, around NGR: SH 6108 7560.

Area 5

This will be a new CZ, covering the entirety of the Area 5 lease area. It is the outermost CZ on the southern side of the strait, bordered to the north by the *Area 6* CZ and to the west by the *Area 2* and *Area B* CZs, covering a total area of 1.64 km². Harvesting within this CZ takes place from the middle of the CZ from the Ogwen Channel Harvesting Area. The 2013 Sanitary Survey identified that the river Ogwen was likely to be the main source of contamination to the area and recommended placing an RMP as close to the Ogwen drainage channel as possible. A recent modelling study undertaken by the University of Bangor supported this conclusion, finding a significant correlation between *E. coli* concentrations recorded in the Ogwen Channel and the B055V RMP. During initial

consultation, Gwynedd Council identified that stock levels in the current RMP area are low. The RMP should be moved to a position as close to the mouth of the Ogwen as stock allows, around NGR SH 6095 7378. As there are few direct sources of contamination to this zone (beyond the Ogwen Channel), and the zone is large, the sampling tolerance is increased to 100 m to allow for stock shifts.

Area 5 & B

This CZ should be declassified as the area that it classified will now be covered by the separate *Area 5* and *Area B* CZs.

8.1.2 Cockles

Lavan Sands East

This zone represents the eastern half of the Lavan Sands cockle bed and covers an area of 6.90 km². The 2013 sanitary survey identified that the Llainfairfechan STW (ID 14) was likely to be the most significant source of contamination affecting the zone and recommended placing an RMP adjacent to the drainage channel carrying this contamination over the zone. This discharge continues to be the main source of contamination affecting the bed and so the RMP should be retained.

Lavan Sands West

This zone represents the western half of the Lavan Sands cockle bed and covers an area of 8.2 km². The 2013 Sanitary Survey did not identify any point sources of contamination affecting the zone but did identify that diffuse contamination from the river Ogwen was likely to be dispersed over a relatively wide area due to the tidal circulation patterns in the area. It is recommended that this RMP be retained as its position continues to be representative of the contamination affecting this zone.

8.2 Menai Strait – West

8.2.1 Mussels

Barras

This zone is situated on the northern side of the Strait and covers an area of 1.78 km² from Tal-y-Foel house to Barras. Within the CZ are Plot B and Plot C of the designated areas specified in The Menai Strait (West) Oyster and Mussel Fishery Order 2015. In the 2013 survey, this zone is referred to as Areas 1 – 3, but consultation with the LA indicated that the preferred name is Barras. The 2013 Sanitary Survey recommended that the RMP be placed at the eastern end of the CZ in order to capture contamination from the Brynsiencyn STW. No change to the main contamination sources affecting this CZ have been identified, and so it is recommended that the RMP be retained.

Area 11 East

This is a small zone, covering an area of only 0.16 km² on the southern side of the Strait. Within the CZ is the Plot D as designated under the Menai Strait (West) Oyster and Mussel Fishery Order 2015. In the 2013 Sanitary Survey, this zone is referred to as Llanfairisgaer, but consultation with the LEA indicated that the preferred name moving forward is Llanfair. The 2013 Sanitary Survey identified that the small stream draining to this zone would likely

carry the most significant contamination and recommended placing the RMP at the eastern end of the zone to capture this. This RMP should be retained moving forward as the main sources of contamination have not changed.

Fort Belan

This CZ is not currently classified, but during initial consultations the LAs indicated that there was industry desire for reclassification, and so a recommendation is provided. This zone was discussed in the 2013 Sanitary Survey, and that report identified that there were no direct sources of contamination, but that some contamination may originate from the ebb plume of Foryd Bay, reaching the eastern end of the CZ first. It is recommended that the RMP proposed in the 2013 Sanitary Survey, at NGR SH 4451 6084, be reinstated should reclassification be required. This RMP is well placed to capture the main contamination source of this CZ which continues to be the ebb plume of Foryd Bay.

8.2.2 Cockles

Traeth Melynog

This CZ is situated at the mouth of the western Menai Strait and covers an area of 4.98 km². The 2013 Sanitary Survey identified that the main contaminating influence would be the discharge from Newborough STW (ID 21) which is positioned near the mouth of the Afon Braint. It recommended placing an RMP as close to the Braint drainage channel as possible, and as far upstream as stocks extend, to capture this contamination. The current RMP position is 1200 m south of the recommended position, and it is presumed that no stock exists at the location proposed in the 2013 Survey. The Newborough STW continues to be the main contaminating influence on this zone, and so we seek clarification from the LEA that the current RMP position represents the closest location to the Newborough STW outfall that stock exists. Should stock exist closer, the RMP should be moved to that location.

8.2.3 Pacific Oysters

Barras

This zone is currently classified based on samples from the Barras Boat House RMP B042L RMP. Mussels are considered to be appropriate indicator species for Pacific oysters (Cefas, 2014), and so this practice can continue.

8.3 General Information

8.3.1 Location Reference

Production Area	**Menai Strait - East**
Cefas Main Site Reference	M055
Ordnance survey 1:25,000	Explorer 263
Admiralty Chart	1464
Production Area	**Menai Strait – West**
Cefas Main Site Reference	M055
Ordnance survey 1:25,000	Explorer 263
Admiralty Chart	1464

8.3.2 Shellfishery (Menai Strait – East)

Species	Culture Method	Seasonality of Harvest
Mussels (*Mytilus* sp.)	Cultured	Year Round
Cockles (*Cerastoderma edule*)	Wild	Year Round

8.3.3 Shellfishery (Menai Strait – West)

Species	Culture Method	Seasonality of Harvest
Mussels (*Mytilus* sp.)	Cultured	Year Round
Cockles (*Cerastoderma edule*)	Wild	Year Round
Pacific oyster (*Crassostrea gigas*)	Cultured	Year Round

8.3.4 Local Authority(s)

Name	**Cyngor Gwynedd Council** Swyddfa Ardal Meirionnydd Cae Penarlag, Dolgellau Gwynedd LL40 2YB
Website	n/a
Telephone number	01766 771000
E-mail address	Bwyd@gwynedd.llwy.cymru
Name	**Ynys Mon Council** County Offices Anglesey LL77 7TW
Website	www.ynysmon.gov.uk

Telephone	01248 750057
E-mail address	Ehealth@ynysmon.llyw.cymru
Name	**Conwy County Borough Council** PO Box 1 Conwy LL30 9GN
Website	n/a
Telephone number	n/a
E-mail address	Foodsafety-healthandsafety@conwy.gov.uk

*Table 8.1 Proposed sampling plan for the Menai Strait – East 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
Area A	**TBC**	**Area A Northern Edge**	**SH 5743 7338**	**53°14.3'N, 004°08.26' W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	50 m	Monthly
Area 1	**TBC**	**Area 1 SE Corner**	**SH 5812 7341**	**53°14.316' N, 004°07.65' W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	50 m	Monthly
Area 3	**TBC**	**Area 3 NW Corner**	**SH 5860 7416**	**53° 14.73'N 04° 07.23'W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	50 m	Monthly
Areas 4	B055U	Gallows Point	SH 5994 7498	53°15.200' N 04°06.048' W	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	50 m	Monthly
Areas 3 & 4					***To be declassified***					
Areas 2	**TBC**	**Area 2 SW Corner**	**SH 5855 7372**	**53°14.5'N, 004°07.266' W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	**100 m**	Monthly
Area B	**TBC**	**Ballast Bank South**	**SH 5996 7365**	**53° 14.483'N, 004° 06.00'W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	**100 m**	Monthly
Areas 2 & B					***To be declassified***					

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Area 6	**TBC**	**Horseshoe**	**SH 6108 7560**	**53°14.566' N, 004°05.116' W**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	50 m	Monthly
Areas 5	**TBC**	**Ogwen Channel Southern Edge**	**SH 6095 7378**	**TBC**	Mussels	Bed Culture	Hand /Dredge	*Mytilus* sp.	**100 m**	Monthly
Lavan Sands East	B055X	Lavan Sands East	SH 6624 7470	53°15.143' N 04°00.380' W	Cockles	Hand (rake)	Hand (rake)	*C. edule*	50 m	Monthly
Lavan Sands West	B055Y	Lavan Sands West	SH 6233 73460	53°14.415' N 04°03.863' W	Cockles	Hand (rake)	Hand (rake)	*C. edule*	50 m	Monthly

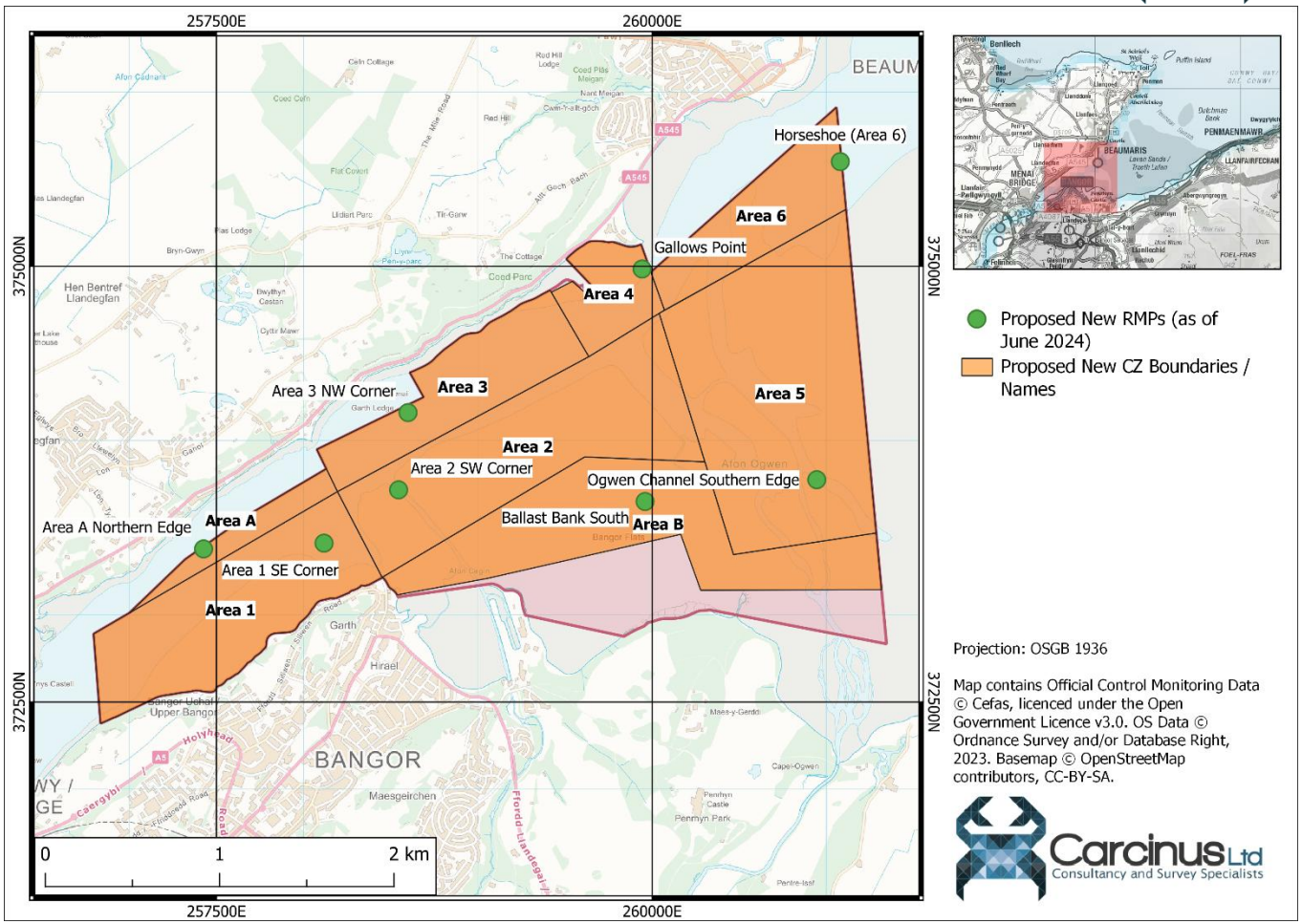

Figure 8.1 Proposed changes to CZ boundaries in the Menai Strait - East BMPA.

*Table 8.2 Proposed sampling plan for the Menai Strait – West 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
Barras	B042L	Barras Boat House	SH 4871 6570	53°10.011 'N 04°15.878'W	Mussels, P. oysters	Bed culture	Hand / Dredge	*Mytilus* sp.	10 m	Monthly
Llanfair	B042O	Area 11 East	SH 4991 6579	53°10.080'N 04°14.804'W	Mussels	Bed culture	Hand / Dredge	*Mytilus* sp.	10 m	Monthly
Fort Belan	**B042P**	**Fort Belan**	**SH 4451 6084**	**53°07.320'N 04°19.503'W**	**Mussels**	**Bed culture**	**Hand / Dredge**	***Mytilus* sp.**	**10 m**	**Monthly**
Traeth Melynog	**TBC**	**TBC**	**TBC**	**TBC**	Cockles	Hand	Hand	*C. edule*	50 m	Monthly

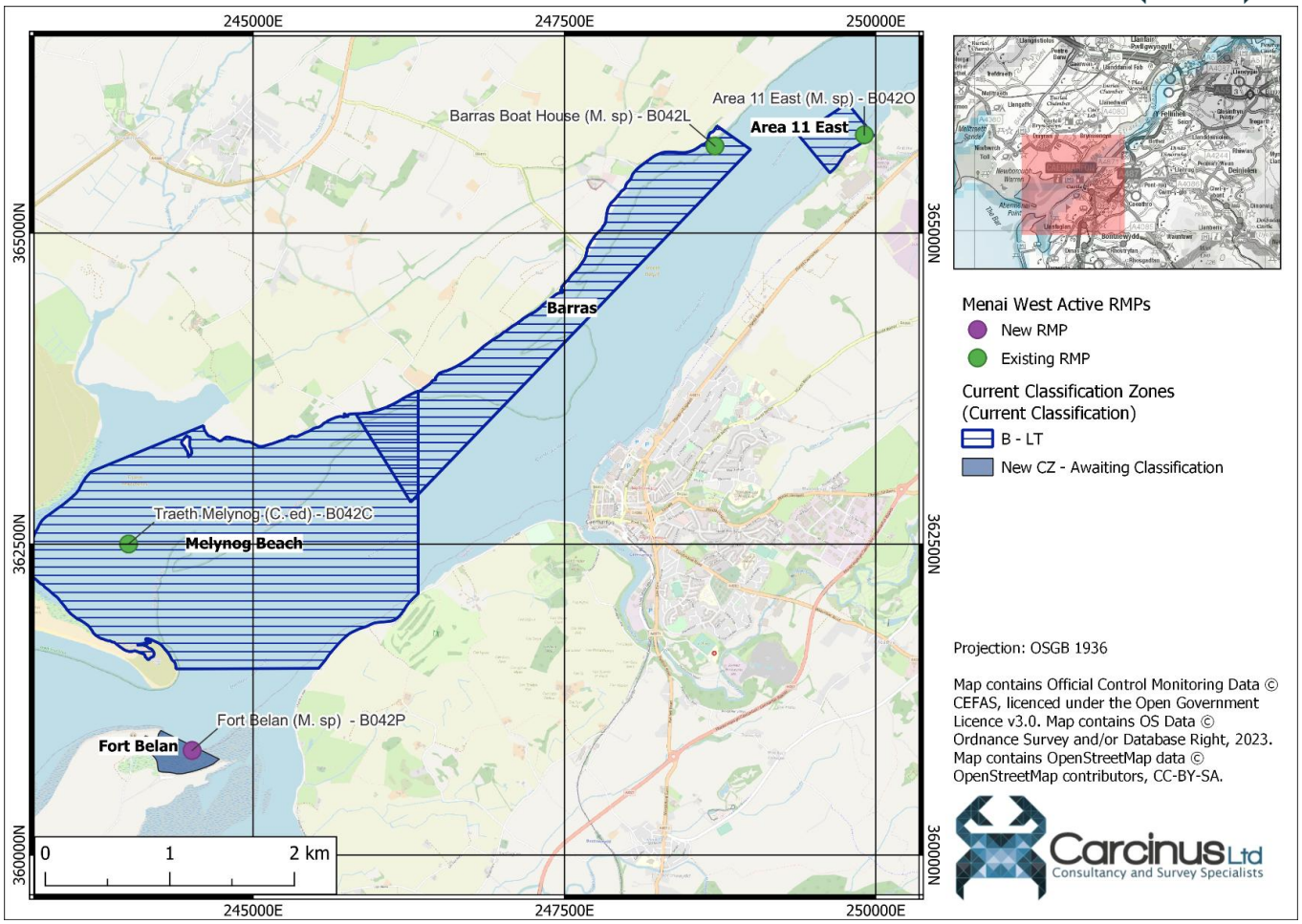

Figure 8.2 Proposed RMP changes for the Menai - West BMPA.

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Appendices

Appendix I. EDM Return for intermittent discharges in the vicinity of the Menai Strait in 2021

Site Name	Permit No.	Outlet NGR	Number of Spills in 2021	Duration of spills (hrs) in 2021	Distance to nearest CZ (km)
ABERGWYNGREGYN PUMPING STATION	CG0113902	SH6503373196	48	943	0.304
ANGLESEY ARMS PUMPING STATION	CG0139701	SH4768662716	0	0	1.106
BALACLAVA ROAD SEWAGE PUMPING ST	CG0163901	SH4797063120	0	0	1.031
BEACH ROAD PS BANGOR , Long Sea	CG0351702	SH5865572904	64	250.75	0.213
BEACH ROAD PS BANGOR , Short Sea Outfall	CG0351701	SH5865672904	17	35.25	0.213
BETHEL CSO BETHEL NEAR CAERRFON	CG0367101	SH5202465344	24	61	2.084
BETHEL SEWAGE TRANSFER PS	CG0085702	SH5160465229	185	3415.5	1.71
BETHEL SSO NO. 2	CG0085703	SH5229565430	1	0.25	2.335
BETHEL SSO NO. 3	CG0085704	SH5269865734	19	60.75	2.712
BETHESDA WWTW STORM	CG0437401	SH6138667381	130	1306.5	5.032
BONTNEWYDD SSO YSGOL GYNRADD BONTNE	CG0332501	SH4810359919	16	97.5	2.779
BRYNREFAIL MAIN SPS	CG0185101	SH5593763009	63	437	6.566
BRYNSIENCYN SEWAGE PUMPING STATION	CG0340903	SH4812866388	16	164.25	0.758
BRYNSIENCYN SEWAGE PUMPING STATION	CG0340904	SH4812866388	17	161.75	0.758
BRYNSIENCYN STW SETTLED STORM , ,	CG0340902	SH4912566660	99	1441	0.873
CAERRFON - BONTNEWYDD SSO NO	CG0076907	SH4814859884	111	704	2.836
CAERRFON - BONTNEWYDD SSO NO	CG0076908	SH4811060064	58	118	2.682
CAERRFON - GLANRHYD SSO NO.	CG0076906	SH4740358405	102	274.25	3.62
CAERRFON - RHOSTRYFAN SSO NO	CG0076903	SH5027357532	71	188	6.004
CAERRFON - RHOSTRYFAN SSO NO	CG0076904	SH4957157944	71	314.25	5.229
CAERRFON BANK QUAY PS	CG0078603	SH4776962960	0	0	0.997
CAERRFON MARGARET STREET - S	CG0163601	SH4845062831	82	83.75	1.577

Site Name	Permit No.	Outlet NGR	Number of Spills in 2021	Duration of spills (hrs) in 2021	Distance to nearest CZ (km)
CAERRFON PONT SEIONT PS	CG0163801	SH4825661720	18	157.25	1.967
CAERRFON WWTW INLET PUMP ST 6MM	CG0078601	SH4809461909	85	306	1.778
CAERRFON WWTW INLET PUMP ST 6MM	CG0415001	SH4800961890	34	404	1.695
CAERRFON WWTW STORM TANKS	CG0078502	SH4808761910	42	30.75	1.771
COLEG NORMAL SEWAGE PUMPING STATION	CG0415701	SH5623271770	6	25.75	0.834
CROSSVILLE CSO	CG0163701	SH4800863090	60	102.5	1.079
Crown St CSO, Caerrfon	Unpermitted-74868	SH4790462953	0	0	1.099
CWMYGLO SSO	CG0074101	SH5524962495	21	154.25	6.206
CYNLAI PS LLANGOED ANGLESEY	CG0147901	SH6255179538	5	9.25	3.71
DEINIOLEN - CLWT Y BONT - SSO	CG0134201	SH5746962936	1	1.75	8.006
DEINIOLEN - SSO	CG0134501	SH5742563094	130	820.75	7.91
DWYRAN BY SCHOOL - SSO	CG0180401	SH4447565643	5	1.75	2.194
DWYRAN RHYDWYN - SSO	CG0180501	SH4477765459	24	59	2.014
FELINHELI PS (ADJ TO QUAY TOILETS)	CG0349701	SH5253767785	0	0	3.241
FELINHELI PS (OPP SEA CADET CORPS)	CG0349401	SH5211467158	0	0	2.532
FELINHELI PS (QUAY COTTAGE) , ,	CG0349501	SH5240867534	26	288	2.987
FRON OGWEN PS	CG0083901	SH6117867324	110	1856.25	5.101
FRYARS BAY P.S- SCREENED EMERG	CG0312601	SH6110477905	0	0	1.799
GAERWEN STATION SPS	CG0168101	SH4856670831	62	724.25	4.938
GAERWEN WWTW STORM	CG0114102	SH4671372565	11	116.25	7
GLAENTRAETH ESTATE PS BANGOR ,	CG0365101	SH5931072257	0	0	0.729
GLASINFRYN SPS	CG0185201	SH5876868867	78	639	3.912
GLYN GARTH PS LLANDEGFAN	CG0146501	SH5744673690	17	85.75	0.031

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GORAD ROAD PS (STORM/EMERG) , ,	CG0353701	SH5741872523	0	0	0.043
GORAD ROAD PS (STORM/EMERG) , ,	CG0353702	SH5741872523	71	122.75	0.043
GORSLLWYD SEWAGE PUMPING STATION	CG0187201	SH5752978828	106	837.5	2
HEN GASTELL NO.5 - SSO	CG0076905	SH4733657262	83	481.25	4.609
LLANBERIS PS	CG0352001	SH5778860398	3	1	9.48
LLANBERIS SSO NO. 2	CG0072703	SH5815259724	36	86.5	10.169
LLANBERIS STW (STORM) LLANBERIS	CG0089101	SH5837859938	132	1135.75	10.227
LLANDDANIEL PONT Y CRUG SPS	CG0187101	SH5052469859	42	263.25	3.889
LLANDEGFAN (MEI) PUMPING STATION	CG0363801	SH5620072801	115	2114	0.587
LLANFAES PS (EMERGENCY) , ,	CG0342903	SH6083577765	3	4.25	1.687
LLANFAES WWTW STORM TANK	CG0342902	SH6083577320	76	676.25	1.252
LLANFAGLAN WWTW STORM OVERFLOW	CG0078102	SH4686459447	63	582	2.451
LLANFAIR PG SPS	CG0188401	SH5105971817	41	237.75	5.783
LLANFAIR PG WWTW	CG0081201	SH5320470802	111	698.75	3.936
LLANFAIRFECHAN - SSO	CG0162201	SH6811075050	24	65	0.428
LLANFAIRFECHAN HOSPITAL SPS	CG0184301	SH6737474706	0	0	0.342
LLANFAIRFECHAN SSO NO. 1	CG0077101	SH6813474762	43	147.25	0.659
LLANFAIRPWLL SSO NO. 2	CG0081202	SH5263971643	0	0	4.239
LLANGAFFO CAE BERLLAN SPS	CG0186901	SH4421968442	1	0.25	4.846
LLANGAFFO STW SSO	CG0019202	SH4466467744	138	480	4.071
LLANRUG WWTW STORM	CG0073902	SH5304264202	120	1631.75	3.441
LLANSADWRN PS	CG0187301	SH5636475728	3	7.75	2.311
LLANSADWRN PS	CG0082401	SH5636575729	0	0	2.311
LLEINIOG PS	CG0091801	SH6209079155	50	278	3.193

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LLYN Y FELIN PS	CG0363401	SH5532272041	0	0	1.529
LLYN Y FELIN PS (EMERGENCY OVERFLOW)	CG0363402	SH5532272041	0	0	1.529
MALLTRAETH VILLAGE PUMPING STATION and CSO	CG0147801	SH4089568882	-1	-1	6.443
MALLTRAETH VILLAGE PUMPING STATION and CSO	CG0183801	SH4089568882	-1	-1	6.443
MEIRION ROAD PS (STORM/EMERG)	CG0353801	SH5727072840	4	2.75	0
MIN-Y-NT CSO	CG0163501	SH4883962657	19	11.75	1.978
MOUNT FIELD P.S. BEAUMARIS ,	CG0342904	SH6091976242	0	0	0.2
MOUNT FIELD P.S. BEAUMARIS ,	CG0342905	SH6091976242	31	93	0.2
NEAR CASTLE GIFT SHOP LLANBERIS ,	CG0355801	SH5793760036	34	94.5	9.811
NEWBOROUGH MILLBANK SPS	CG0188301	SH4189066160	0	0	3.571
NEWBOROUGH STW	CG0326101	SH4370064140	34	111.25	0.979
Peblig Ind Est CSO, Peblig Mill, Ffordd Llanbeblig, Caeathro, Caerrfon, Gwynedd, LL55 2SE Caethro	DB3393HK	SH4923962034	28	129	2.698
PENISARWAUN WWTW	CG0134102	SH5502663552	126	827.75	5.512
PENMAENMAWR PROMEDE PS	CG0148301	SH7186076648	18	34.5	3.475
PENMAENMAWR WWTW PENMAENMAWR	CG0099501	SH7354277819	6	15.25	1.426
PENMAENMAWR WWTW PENMAENMAWR	CG0393801	SH7373277980	175	2574	1.179
PENMAENMAWR WWTW PENMAENMAWR	CG0393901	SH7371977989	23	34.25	1.186
PONT LLANDEGFAN SEWAGE PUMPING STAT	CG0055401	SH5607374294	90	1312.25	1.35
PONT RHYTHALLT PUMPING STATION	CG0074001	SH5431663685	132	1333.75	4.812
PONT Y BRENIN PS	CG0091701	SH6088078987	12	64.75	2.892
PS NO 2 (PORTH WRACH)	CG0363601	SH5576471824	15	7.25	1.183
PS NO 2 (PORTH WRACH) (EMERGENCY OVERFLOW)	CG0363602	SH5576471824	15	7.25	1.183
PS NO 3 (SUSPENSION BRIDGE)	CG0363701	SH5562271551	108	1365.5	1.446

Site Name	Permit No.	Outlet NGR	Number of Spills in 2021	Duration of spills (hrs) in 2021	Distance to nearest CZ (km)
PS NO 3 (SUSPENSION BRIDGE) (EMERGENCY OVERFLOW)	CG0363702	SH5562271551	108	1365.5	1.446
PUMPING STATION NO.1 (FAELOG CAUSEWAY)	CG0363501	SH5591772219	96	1065.5	0.911
PUMPING STATION NO.1 (FAELOG CAUSEWAY) (EMERGENCY OVERFLOW)	CG0363502	SH5591772219	96	1065.5	0.911
Rachub Maes Bleddyn CSO, Rachub, Gwynedd	MP3328XV	SH6210168029	68	431.5	4.414
RHIANFA PS LLANDEGFAN	CG0146401	SH5706973325	23	87.5	0.009
RHIWLAS STW	CG0086002	SH5731966244	114	463	6.142
ROCK TERRACE CSO BETHESDA	CG0164901	SH6207966871	64	548.75	5.563
SSO AT MILL LANE CAERRFON	CG0078606	SH4796062753	93	254.25	1.278
STATION ROAD CSO	CG0412401	SH7173276502	14	14.5	3.663
TALYBONT STW	CG0314702	SH6030870665	11	4.25	2.149
TREBORTH STW (FIL) BANGOR	CG0366201	SH5429770284	14	33.5	3.268
TREBORTH STW (FIL) BANGOR	CG0366101	SH5379070850	69	823.25	3.385
TREGARTH WWTW STORM TANKS	CG0083802	SH6079468550	140	2750	3.936
WATERLOO PORT SEWAGE PUMPING ST	CG0147101	SH4876064185	1	0.25	0.862
WAUNFAWR STW (STORM)	CG0134002	SH5288358976	102	1459.5	7.263
WEST END PS BEAUMARIS ANGLESEY	CG0146301	SH6027175928	24	73.25	0.232

Centre for Environment Fisheries & Aquaculture Science

www.cefas.defra.gov.uk

EC Regulation 854/2004

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SANITARY SURVEY REPORT

Menai Strait East

December 2013

Food Standards Agency

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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.

Contact Us

Carcinus Ltd

Wessex House

Upper Market Street

Eastleigh

Hampshire

SO50 9FD

Tel. 023 8129 0095

Email. enquiries@carcinus.co.uk

Web. https://www.carcinus.co.uk

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*"