Centre for Environment Fisheries & Aquaculture Science

Cefas

The Biotoxin and Phytoplankton official control monitoring programmes for England and Wales

Summary report for 2021

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Glossary

ASP	Amnesic Shellfish Poisoning
AZA	Azaspiracid
Cefas	The Centre for Environment, Fisheries and Aquaculture Sciences
DA	Domoic Acid
DSP	Diarrhetic Shellfish Poisoning
DTX	Dinophysistoxin
FSA	Food Standards Agency
HPLC	High Performance Liquid Chromatography
LC-MS	Liquid Chromatography – Mass Spectrometry
LTs	Lipophilic toxins
MPL	Maximum permitted limit
ND	Not Detected
OA	Okadaic Acid
PSP	Paralytic Shellfish Poisoning
PTX	Pectenotoxin
STX	Saxitoxin
YTX	Yessotoxin

1. Introduction

This report describes the results of the Official Control Biotoxin Monitoring Programme for England and Wales for the period 1st January to 31st December 2021.

The laboratory testing for biotoxins in shellfish and potentially harmful phytoplankton in water samples, the co-ordination of the programme and its logistics were conducted by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) on behalf of the Food Standards Agency (FSA), the central competent authority for food safety. The programme aimed at delivering the testing required for the statutory monitoring of marine biotoxins in shellfish from classified production and relaying areas in England and Wales, and for identification and enumeration of potentially harmful micro-algae in selected shellfish harvesting areas, as required by retained European Commission (EC) regulations 2017/625 and 2074/2005. The delivery of the 2021 monitoring programme by Cefas continued throughout the COVID-19 pandemic with service maintained and delivered in a COVID secure manner.

All results of the FSA monitoring programme were compared to the maximum permitted levels stipulated in retained EC regulation 853/2004 (Section VII, Chapter V: Health standards for live bivalve molluscs), as summarised in Table 1 below. Toxin test results must not exceed these limits in either whole body or any edible part separately. Please note that for ease of reading, in the text of this report, toxin concentrations are shown as mg/kg or µg/kg, without reference to the toxin parent.

Table 1: Maximum permitted limits of toxins in shellfish flesh.

Toxin groups	Maximum permitted limits (MPL)
Amnesic shellfish poisoning (ASP) toxins	20 mg of Domoic/epi-domoic acid per kg of shellfish flesh
Lipophilic toxins (LTs)	For Diarrhetic shellfish poisoning toxins (DSP) and pectenotoxins (PTX) together: 160 µg of okadaic acid (OA) equivalents per kg of shellfish flesh OR For Yessotoxins (YTX): 3.75 mg of YTX equivalents per kg of shellfish flesh OR For Azaspiracids (AZA): 160 µg of AZA equivalents per kg of shellfish flesh
Paralytic shellfish poisoning (PSP) toxins	800 µg of saxitoxin (STX) equivalents per kg of shellfish flesh

All of the 55 classified English and Welsh shellfish production and relaying areas were monitored in 2021, giving a coverage rate of 100%. The location of the FSA shellfish monitoring points is shown in Figure 1 and that of the phytoplankton monitoring points is shown in Figure 2.

In addition, the Fowey classified production area was monitored in January 2021, however this area was declassified shortly after and monitoring therefore ceased.

A total of 950 shellfish samples and 937 phytoplankton samples were submitted for analysis in 2021. No samples were submitted in 2021 for the purpose of onshore verification of pectinidae.

1.89% of the shellfish samples (n=18) and 2.88% of the water samples (n=27) submitted to the laboratories were rejected in the reporting period. This was due to a variety of reasons (test not required, sample unsuitable for analysis, lab error).

The results of the shellfish and phytoplankton monitoring programme for the 12 months period are summarised below. Please note that all toxin results stated for Paralytic Shellfish Poisoning toxins and Lipophilic toxins refer to the high value calculated from the method uncertainty.

The full list of FSA monitoring results for 2021 are available at the following links:

- Biotoxin Results – FSA Open Data Catalogue
- Phytoplankton Results – FSA Open Data Catalogue

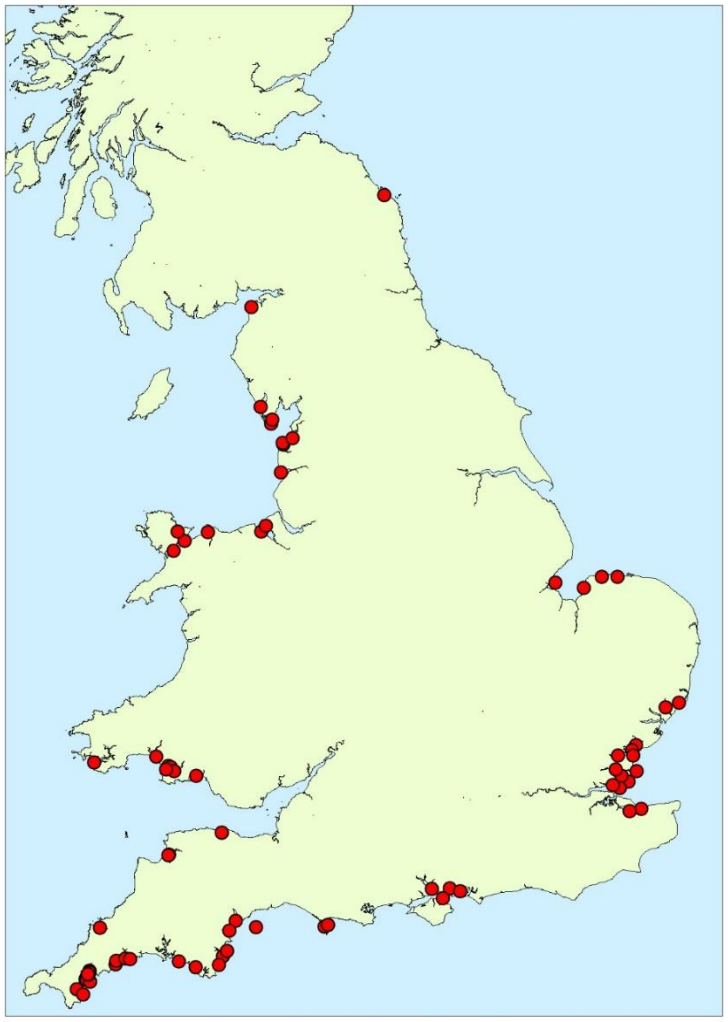

Figure 1: English and Welsh shellfish sampling locations for the 2021 FSA biotoxin monitoring programme.

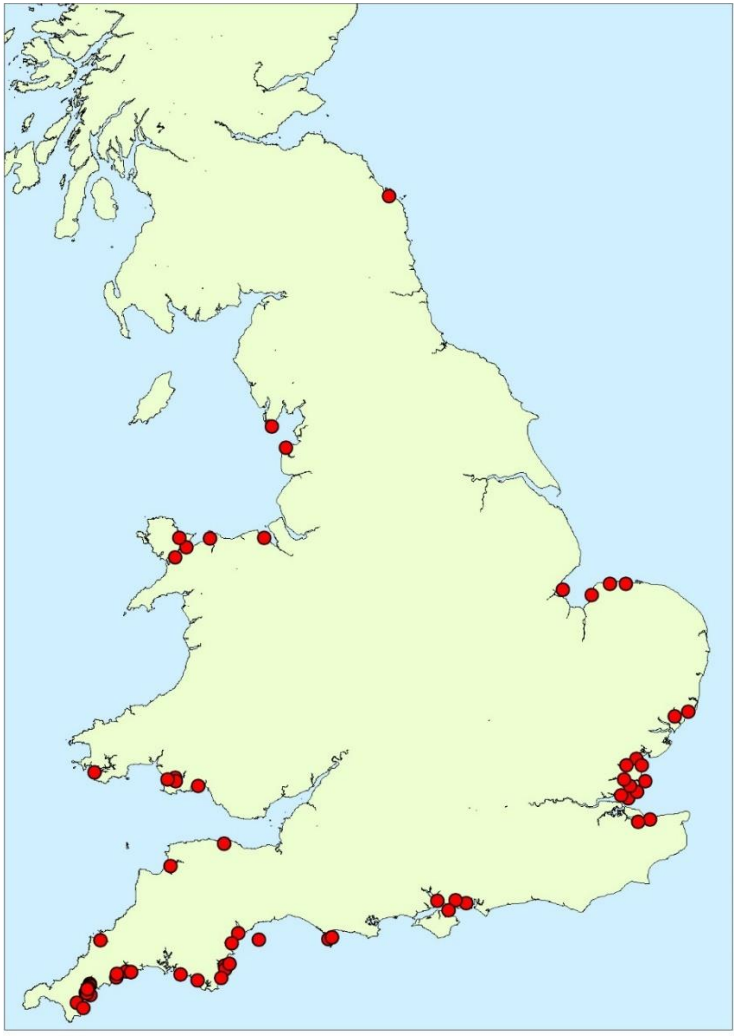

Figure 2: English and Welsh water sampling locations for the 2021 FSA phytoplankton monitoring programme.

2. Amnesic shellfish poisoning (ASP) toxins summary

A total of 769 shellfish samples were tested for ASP toxins using a high-performance liquid chromatography (HPLC) method. ASP toxins were detected in 31 samples from 18 production areas. The location of these production areas is shown in Figure 3.

Figure 3: Location of classified production and relaying areas where ASP toxins were detected in 2021 (all below MPL).

The greatest proportion of samples containing ASP toxins originated from the south west of England (19 samples). Shellfish species affected in England and Wales included mussels (4 samples), pacific oysters (16 samples), native oysters (4 samples) and surf clams (7 samples). None of the shellfish samples tested for ASP toxins in 2021 exceeded the MPL of 20 mg/kg.

In 2021, ASP toxin levels ranged from 1 to 4 mg/kg and no samples exceeded the trigger level of 10 mg/kg. Also, of note, 7 out of the 15 surf clams collected from the coast of Devon in 2021 and tested for ASP toxins were found to contain toxins between 1.3 and 4 mg/kg.

ASP toxin occurrence in 2021 was slightly lower than in 2020 when 41 samples from 22 production areas were found to contain ASP toxins (1 to 11 mg/kg), with the greatest proportion of samples originating from the south west of England.

3. Paralytic shellfish poisoning (PSP) toxins summary

A total of 796 shellfish samples were screened for PSP toxins using the HPLC semi-quantitative method. None of shellfish samples tested for PSP in 2021 exceeded the MPL of 800 µg/kg.

PSP toxins were recorded in 1 sample of Queen scallops from the Lower Fal production area. Toxin levels in this sample were found to be 226 µg/kg.

PSP occurrence remained low in 2021 and at levels comparable to 2020 with no results exceeding the maximum permitted limit. Overall, there has been a decline in PSP occurrence since its peak in 2011, when PSP toxins were detected in 44 samples.

Figure 4: Location of classified production and relaying areas where PSP toxins were detected in 2021 (all below MPL).

4. Lipophilic toxins (LTs) summary

A total of 885 samples were analysed for LTs using the Liquid Chromatography - tandem Mass Spectrometry (LC-MS/MS) method. The lipophilic toxins are sub-divided into three regulated groups each with a distinct MPL, as described in Table 1.

4.1. Okadaic Acid (OA), Dinophysistoxins (DTX) and Pectenotoxins (PTX)

This group of toxins were detected in 83 samples from 9 production areas in England. The location of these production areas is shown in Figure 5.

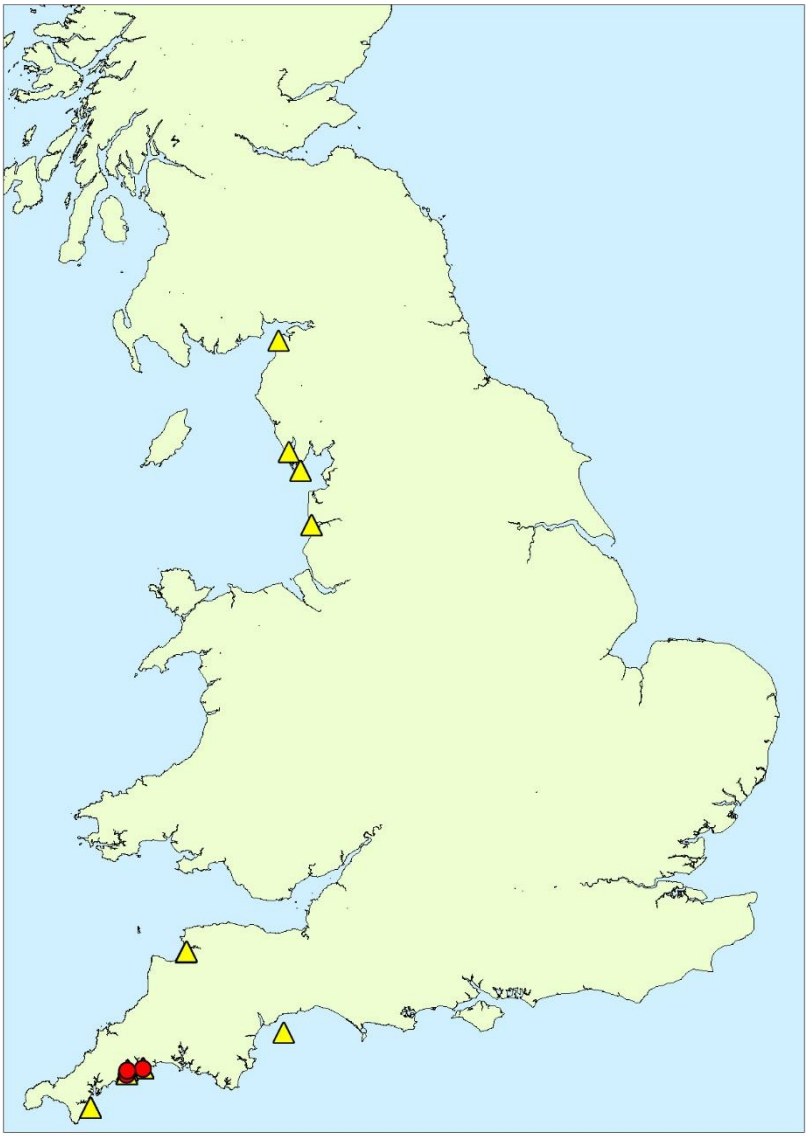

Figure 5: Location of classified production and relaying areas where lipophilic toxins were detected below the MPL (△) and above the MPL (●) in 2021.

Eight mussel samples returned results exceeding the MPL in 2021. All these samples originated from 3 production areas in south Cornwall.

OA group toxins were detected during the months of April to November 2021 and only affected samples of mussels. Results ranged from 16 to 292 µg OA eq./kg with the highest result recorded at St. Austell Bay, Ropehaven Outer in September 2021. Figure 6 displays the toxin results recorded in the mussel samples collected from that monitoring point and the results of the water monitoring programme for *Dinophysiaceae* at the site throughout 2021. The graph also displays the MPL and trigger level used for *Dinophysiaceae* (100 cells/L). Figure 6 shows that each toxin event was preceded by a significant increase in cell concentrations.

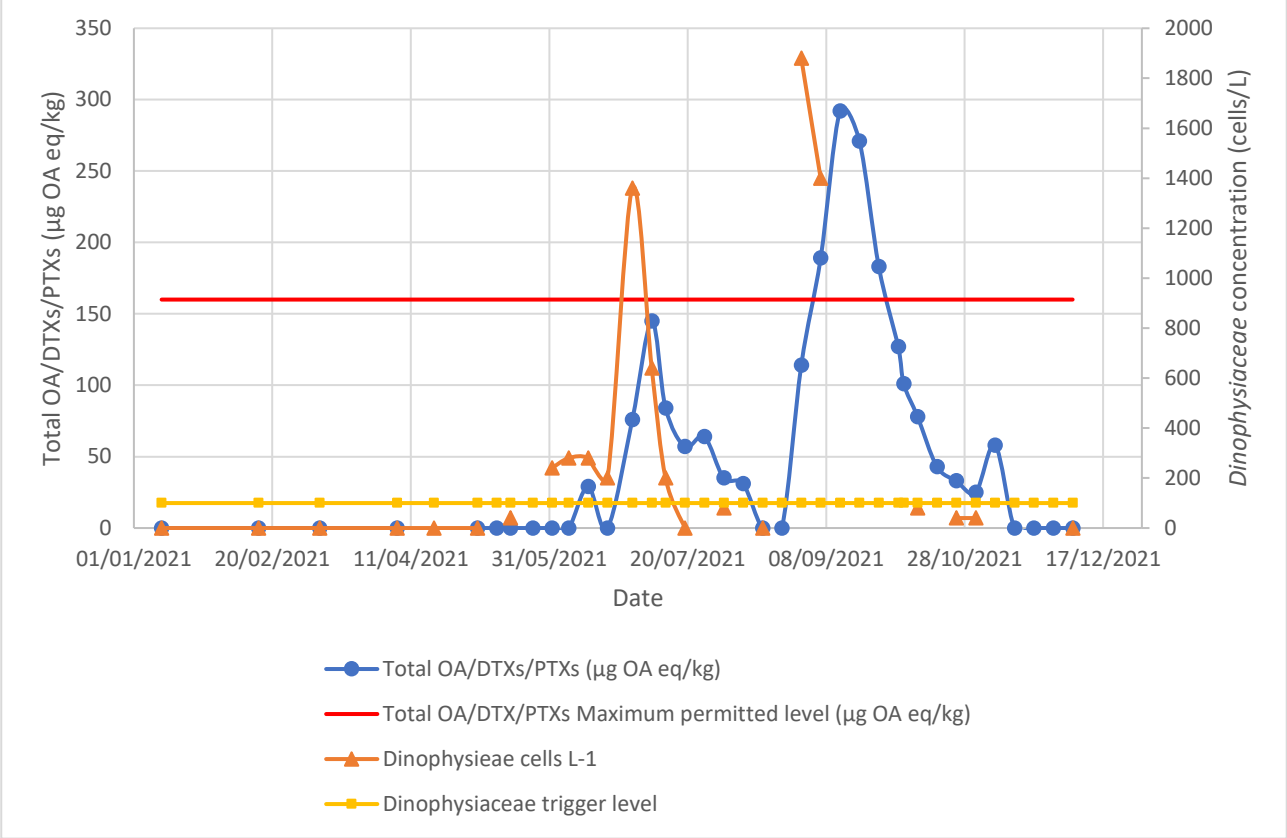

Figure 6: Levels of *Dinophysiaceae* and lipophilic toxins (OA/DTX/PTX group) recorded at the St. Austell Bay monitoring point during 2021

This level of detection is consistent with previous years although there is a high amount of variation. In 2018, 167 samples recorded OA/DTX/PTX toxins with 64 samples exceeding the MPL. In 2020, this toxin group was only detected in 15 samples and none of those exceeded the MPL.

4.2. Yessotoxins (YTXs)

YTXs were not detected in samples received in 2021. This is consistent with previous years, these toxins having only been detected once (in September 2014) since implementation of the LC-MS/MS method in 2011.

4.3. Azaspiracid group toxins (AZAs)

AZAs were not detected in samples received in 2021. The detection of this toxin group has varied widely since the LC-MS/MS method was introduced in 2011, with the number of detections ranging from not detected in 2017, 2018 & 2019 to 21 in 2015. However, levels have only rarely exceeded the MPL (3 times in 2015).

5. Phytoplankton monitoring summary

The results of the phytoplankton monitoring of classified production and relaying areas in England and Wales for 2021 are summarised below. Where the set trigger levels (Table 2) were exceeded, additional flesh and water samples were requested the following week.

Table 2: Trigger values for harmful algae monitoring.

Species	Species linked to	Trigger value (cells/Litre)	Number of samples exceeding trigger levels in 2021
***Alexandrium* species**	PSP	40 (presence)	39
Dinophysiaceae	LTs	100	51
Prorocentrum lima	LTs	100	9
***Pseudo-nitzschia* species**	ASP	150,000	10

Alexandrium species were recorded in 39 samples from 18 production areas, which is consistent with the previous year (see Figure 7). Recorded maximum cell density was lower than last year, with a density of 500 cells/L recorded in a sample collected from Falmouth (Upper): Ruan Pontoon, Tregothnan on 20 July and Helford: Porth Navas Quay on 3 August 2021. These levels are comparable to those recorded over the period 2013 to 2015, when annual recorded occurrences did not exceed 55 samples. This is in sharp contrast to 2016 when 107 occurrences were recorded and maximum recorded cell densities was 13,617,000 cells/L.

Figure 7: Location of classified production and relaying areas where *Alexandrium* species were detected above the trigger level in 2021.

Pseudo-nitzschia species were recorded in 454 samples from 49 production areas. The trigger level (set at 150,000 cells/L) was exceeded on 10 occasions from 7 production areas (see Figure 8). The highest cell density was recorded in a sample collected from Blakeney: Wells the Pool collected on 15 June (753,000 cells/L). The number of samples which exceed the trigger level for *Pseudo-nitzschia* species has fluctuated from year to year. There was a drop of 76.3% in the number of samples exceeding the trigger level compared to 2020.

Figure 8: Location of classified production and relaying areas where *Pseudo-nitzschia* species were detected above the trigger level in 2021.

Dinophysiaceae were recorded in 110 samples from 28 production areas. The trigger level (set at 100 cells/L) was exceeded by 51 samples from 15 production areas (See Figure 9). This is broadly similar to 2020. The maximum cell density recorded in 2021 was 2,960 cells/L in a sample collected from Mevagissey Bay: South Mevagissey Bottom on 06 September 2021.

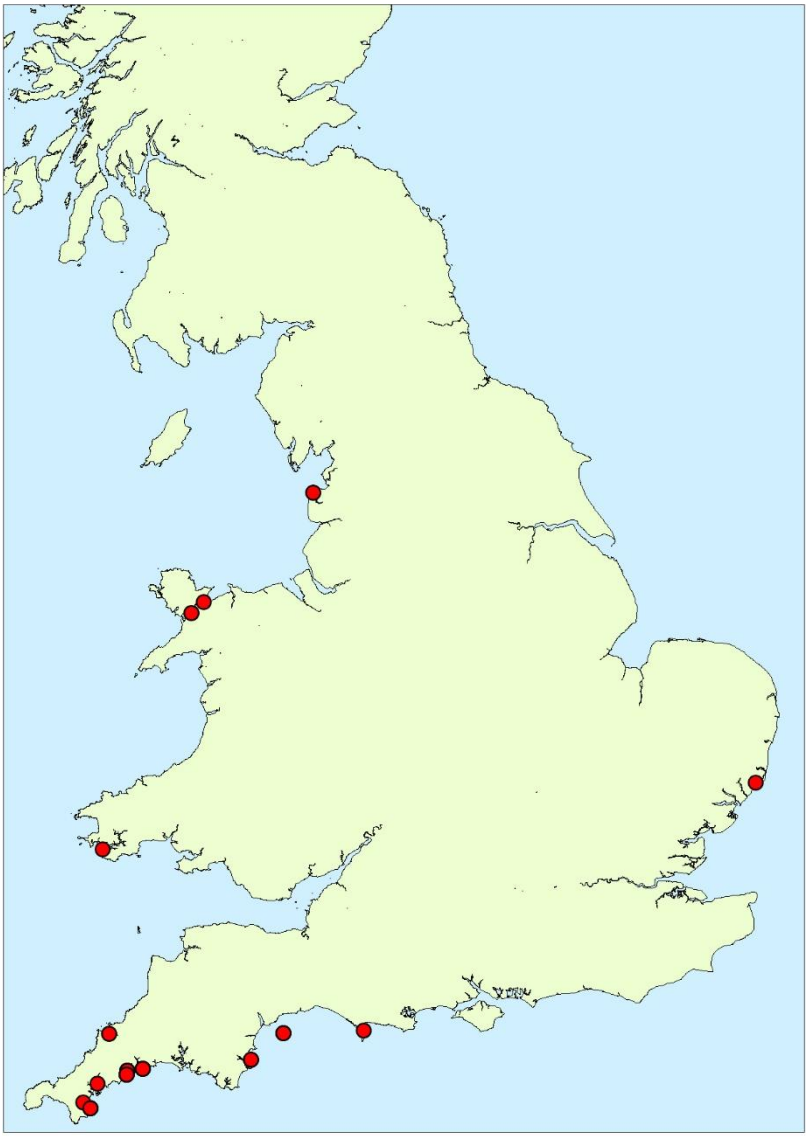

Figure 9: Location of classified production and relaying areas where *Dinophysiaceae* were detected above the trigger level in 2021.

Prorocentrum lima were detected in 19 samples from 9 production areas. The trigger level (set at 100 cells/L) was exceeded by 9 of these samples from 4 separate production areas (see Figure 10). The highest cell density was 18,520 cells/L in a sample collected from Burry Inlet: Machynys on 21 September 2021. These are much higher breach values compared to 2020 and the number of occurrences is slightly higher. *Prorocentrum lima* is considered an epi-benthic species, and it is likely that its detection in the water column is associated with sediment disturbance.

Figure 10: Location of classified production and relaying areas where *Prorocentrum lima* were detected above the trigger level in 2021.

Other species monitored through the Official Control programme that do not have trigger levels:

- *Prorocentrum cordatum* were recorded in 64 samples from 30 production areas. These figures are similar to 2020. The peak concentration was recorded at 1,574,000 cells/L, in a sample collected from Swansea PHA: Queens Dock on 5 July 2021.
- *Lingulodinium polyedrum* was recorded in 3 samples from 3 production areas in 2021. Levels recorded did not exceed 1,000 cells/L. *Protoceratium reticulatum* were also recorded in 3 samples from 3 production areas in 2021. Levels recorded did not exceed 200 cells/L. Both are typically recorded at low frequencies and densities in samples from English and Welsh shellfish production areas.

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