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Risk assessment of the FSA Scotland inshore shellfish monitoring programme: update for PSP, DSP and ASP in mussels and ASP in king scallops using data from Dec 2006 to Apr 2008

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1 INTRODUCTION

In Report S14036 a risk assessment of the inshore shellfish monitoring programme, based on toxin test results from April 2004 to November 2006, was carried out. The current report forms an extension of S14036, addressing the following two issues:

First, the data analysed in S14036 ended part-way through a reporting year, and to ensure the data set was complete and valid the analyses were extended to include data from December 2006 to March 2008. Statistical models describing the risk of any toxic events being undetected, as developed in S14036, were updated to include this new data on historical toxin profiles. Updates were obtained for DSP in mussels, PSP > 0, 40 and 80µg/100g in mussels, ASP > 5 µg/g in mussels, and ASP > 20µg/g in king scallop gonads.

Second, based on Report S14036 it also became apparent that there was often a discrepancy in the levels of PSP and DSP observed between mussels and Pacific oysters, with the latter often having lower levels (or absence) of the toxin than the corresponding mussel samples. Since mussels are used as the indicator species it was determined that there was a need to examine more closely the DSP and PSP levels in these two shellfish species.

This additional work will lead to further recommendations on how future monitoring of these areas could be refined to provide improved schemes that are either more cost effective or offer better protection to public health.

2 MATERIALS AND METHODS

The analyses underlying the findings in this report are an extension of those presented in Report S14036 (Holtrop 2008). As a consequence, the same groupings of pods into sites will be used, and the same statistical models will be applied. Full details of these can be found in Report S14036.

2.1 Assignment of new pods to existing Sites

The 2001/6 data yielded test results from 84 pods, which were then grouped into 25 Sites based on proximity and similarity of toxin profiles. The test results from Dec 2006 – Mar 2008 contained seven pods that were not used in the Apr 2001 – Nov 2006 data, namely pods 74, 19, 84, 85, 46, 18 and 3. In consultation with FSAS, these were assigned to Sites as follows:

Pods 18, 74:	G8
Pod 46:	G41
Pod 85:	G28
Pods 3, 84:	G10
Pod 19:	G16

Toxin level profiles of the new pods were compared against the profiles for the other pods in the same site (based on Dec 2006 – April 2008 data), and this showed good agreement.

2.2 Data cleansing

The Dec 2006 – Mar 2008 data contained several duplicate entries, resulting in the removal of 386 entries. The remaining data consisted of test results for 2636 mussel samples, 236 pacific oyster samples, and 22 king scallop samples.

2.3 Models

In Report S01026 (Holtrop & Horgan, 2004) and Report S14036 (Holtrop, 2008) models were developed that describe the probability of a sample exceeding a pre-defined toxin level. This probability was regarded as a function of Site, Year and Month. The statistical model used was a so-called hierarchical generalised linear model (Lee & Nelder 1996, Lee & Nelder 2001, McCullagh & Nelder 1989), where the probability of a toxin level exceeding a pre-defined cut-off level was modelled as a binomial model with logistic link. Month was regarded as a fixed effect, while Year, Site, Year by Site interaction and Year by Month interaction were considered as random effects. As described in Report S14036, the following models were selected:

Toxin and species	Model
DSP in mussels	fixed effect for Month, random effects for Year, Site, Year by Site and Year by Month
PSP > 0 µg/100g in mussels	fixed effect for Month, random effects for Year, Site, and Year by Month
PSP > 40 µg/100g in mussels	fixed effect for Month, random effects for Year and Site
PSP > 80 µg/100g in mussels	fixed effect for Month, random effects for Year and Site
ASP > 5 µg/g in mussels	fixed effect for Month, random effects for Year and Site
ASP > 20 µg/g in king scallop gonads	fixed effect for Month, random effects for Year and Site

These models were fitted to the April 2001 – March 2008 data, resulting in an estimated probability of exceeding field closure for a given site and a given month. These estimated probabilities were subsequently used in the risk assessment.

All statistical analyses were conducted using the HGLM routine in Genstat 10th edition, release 10.1 (VSN International Ltd, Hemel Hempstead, Herts., UK).

2.4 Risk assessment

For the monitoring scheme to be assessed (as was in place in 2006) the sampling frequencies were as follows:

- PSP: weekly all year round
- DSP: weekly from April to November, fortnightly in December, monthly from January to March
- ASP: weekly from July to November, fortnightly from April to June, monthly from December to March.

These frequencies are applicable to all sites and all shellfish species.

2.4.1 Risk assessment of present monitoring scheme

The aim of the sampling strategy employed in the monitoring programme is to maximise confidence that a harvesting site is clear (i.e. toxin levels are below field closure) when shellfish are harvested for human consumption. This is equivalent to minimising the risk that a site is unknowingly toxic. For the purposes of this study, this will be referred to as the 'risk of non-detection', and can be applied to any of the three toxins.

> Risk of non-detection is defined as the chance that a site is unknowingly toxic

In other words, it looks at the probability that the site is not sampled while toxin levels exceed field closure limits. It is assumed that a clear test result is valid for one week, so that weekly sampling corresponds to a risk of non-detection of zero. Let p denote the estimated probability of exceeding field closure, obtained from fitting models to the data as described in the previous Section. Then the risk of non-detection is as follows (full details are provided in Report S14036):

- Weekly sampling: risk of non-detection is zero
- Fortnightly sampling: risk of non-detection is 0.5 p
- Monthly sampling: risk of non-detection is 0.75 p

It should be noted that the risk of non-detection depends on two factors, namely (i) the chance that the field is toxic (i.e. probability that toxin levels exceed the field closure limit), and (ii) the sampling frequency.

2.4.2 Risk assessment of alternative monitoring schemes

Alternative sampling schemes were also developed such that the maximum risk of non-detection was set a pre-defined level R_{max}. In brief (full details in Report S14036):

- Let R_{max} denote the maximum acceptable risk of the field being unknowingly toxic (to be decided by FSAS).
- Calculate $p_{high} = 2\ R_{max}$.
- Calculate $p_{low} = 2/3\ p_{high}$.

- Based on estimates of p (which is the chance that toxicity levels exceed the field closure limit), develop a new monitoring scheme that is site and month specific, as follows.
    - When $p \leq p_{low}$, monthly monitoring is carried out.
    - When $p_{low} < p < p_{high}$, fortnightly monitoring is carried out.
    - When $p \geq p_{high}$, weekly monitoring is necessary.

Appropriate values for the maximum acceptable risk of non-detection (R_{max}) should be set by FSAS, but to illustrate the approach outlined above, two alternative sampling schemes were used in this report, based on $R_{max} = 5\%$ and $R_{max} = 1\%$.

- Maximum acceptable risk of non-detection is 5%, so that $p_{high} = 10\%$ and $p_{low} = 6.67\%$. Sampling frequency should be once a week when $p \geq 10\%$, once a fortnight when $6.67\% < p < 10\%$ and once a month when $p \leq 6.67\%$.
- Maximum acceptable risk of non-detection is 1%, so that $p_{high} = 2\%$ and $p_{low} = 1.33\%$. Sampling frequency should be once a week when $p \geq 2\%$, once a fortnight when $1.33\% < p < 2\%$ and once a month when $p \leq 1.33\%$.

2.5 Comparison of PSP and DSP test results in mussels and Pacific oysters

During Apr 2001 – Mar 2008, nine of the 806 Pacific oyster samples tested positive for DSP, and 2 of the 1088 Pacific oyster samples tested positive for PSP. Because of these low prevalences no formal statistical methods were used to compare the mussel and Pacific oyster test results, and summary statistics are presented instead.

3 RESULTS

The present report is concerned with test results of ASP, DSP and PSP in mussels, ASP in king scallops, and DSP and PSP in Pacific oysters. Results from other species/toxin combinations will not be presented. Detailed information on grouping of pods into sites and the statistical models used are given in Report S14036.

3.1 Summary of monitoring data

As for many pods only limited data were available, pods were previously combined into 25 sites (Table 1, Figure 1). The Dec 2006 – Mar 2008 data contained 7 new pods not referred to in the 2001/6 data set, and these were assigned to sites as follows: pods 18 and 74: site G8; pod 46: site G41; pod 85: site G28, pods 3 and 84: site G10, and pod 19: site G16. Toxin level profiles of these new pods were compared against the profiles for the other pods in the same site, based on Dec 2006 – April 2008 data, and this showed good agreement.

The Dec 2006 – Mar 2008 data contained test results for 2078 mussel samples, 184 Pacific oyster samples, and 22 king scallop gonad samples (compared with 3866, 894 and 164 during Apr 2001 – Nov 2006, respectively). The large number of mussel samples reflects the more frequent monitoring regime introduced in 2006.

Figure 2 and Table 2 show a summary of the test results over time.

3.1.1 Mussels

From 2001-2005 there was a decline in the presence of DSP in mussels (Fig 2a), but prevalence was high in 2006, followed by a decline in 2007. There were no sites for which DSP was consistently absent (Figure A1).

For PSP in mussels, a decline was observed in the maximum PSP levels detected from 2001-2005, but as with DSP, there was a rise in 2006 whereas 2007 levels dropped back to average (Fig 2b). The percentage of mussel samples testing positive for PSP fluctuated from 6.4% in 2004, 1.0% in 2005, 9.0% in 2006 and down to 0.7% in 2007. There were 7 sites for which PSP was always absent during Apr 2001 – Mar 2008 (Figure A2 – A4. These were Dumfries (127 samples), WC-LochFyne (246 samples), WC-LochEtive (318 samples), WC-LochCreran (244 samples), Mull-LochSpelve (130 samples), WC-LochLeven (251 samples) and NWC-Ullapool (184 samples).

ASP in mussels exceeded field closure limit in 7 out of 5798 samples analysed since 2001. The percentage of mussel samples exceeding 5µg ASP/g was also low; 0.8% in 2001, 1.9% in 2002, 2.2% in 2003, 2.1% in 2004, 1.7% in 2005, 0.1% in 2006 and 0.8% in 2007. (Table 2, Figure A5). For 8 of the 25 sites, all mussel samples had levels less than 5µg/g (Figure A5).

3.1.2 King scallop gonads

ASP is regarded to be a problem in king scallops, and this was clearly the case during 2001-2003 with 21 to 66% of the samples exceeding 20µg/g (i.e. field closure levels). Samples submitted for testing have been low since 2004, with only 48 samples in total from 2004 onwards. Of these, 7 had ASP levels exceeding field closure. Four of these occurred in 2007, resulting in 18% of the samples exceeding field closure during this year. WC-LochFyne is the only site sampled consistently throughout 2001/7 (Figure A6), but even for this site there are large gaps between samples (e.g. no samples during 2006).

3.1.3 Pacific oysters

The percentage of positive DSP samples in Pacific oysters was low, with only 9 samples positive out of 805 samples in total. Of these, 4 came from the same site (WC-LochFyne, Figure A7). During 2001 2.4% of the samples tested positive, with another peak in 2004 when 4.8% tested positive. In 2005 and 2006 none out of 60 and 157 samples, respectively, tested positive, and with 1/172 testing positive in 2007.

For PSP in Pacific oysters 1088 samples were tested from 2001 onwards (Table 2). Of these, two samples (in 2003) had levels between 0 and 40 µg/100g (see also Figure A8).

3.2 Models for 2001/8 data

The models developed in Report S14036 (Holtrop, 2008) were updated using all available test results from April 2001 to March 2008.

3.2.1 PSP in mussels

Figure 3a, b and c shows the estimated probability over time of PSP in mussels exceeding field closure limit, exceeding 40 µg/100g and exceeding 0 µg/100g, respectively. The estimated probability was high in 2001 then declined to low levels during 2004 and 2005. In 2006 levels went up again, followed by lower levels in 2007. Prevalence tended to vary between sites (see Figure 4) with some sites having prevalence well above average. Figure 5 allows for a more direct year-to-year comparison and shows that prevalences peaked in 2001 and 2006, while 2007 was just below average.

The mean prevalence of PSP in mussels for each site at each month of the year is shown in Tables 3-5. For convenience, the means from the previous results (based on April 2001 – November 2006 data) are also shown. Compared to the previous results, the estimated prevalence has increased for Mull-LochScridain and Shetland-SW-Vaila, while a decline was observed for Shetland-NW and Shetland-N-Balta. Highest prevalences tended to occur in Shetland (Figure 4). Toxin patterns over the twelve months of the year remained similar, on average.

The patterns for PSP > 80µg/100g, PSP > 40 µg/100g and PSP > 0 µg/100g were similar, except that the prevalence of positive PSP samples was higher (up to 12 %) for positive samples than it was for PSP > 40µg/100 (up to 9%) which in turn exceeded the prevalence of field closure levels (up to 4%).

In summary:

- PSP levels in 2007 were around or just below average.
- When looking at individual sites: some sites had worsened PSP levels during 2007, others had improved PSP levels.

3.2.2 DSP in mussels

The estimated probability of a positive DSP sample is shown in Figure 6 and 7. In 2001 the prevalence tended to be high, while in 2005 it was well below average. For 2007 the estimated prevalence was similar to the average prevalence over 7 years (Figure 7). This trend was observed across all sites, and as a consequence the estimated mean prevalence for each site, calculated over 7 years (Table 6) had gone down slightly for all sites, except for sites in West and South-West Shetland, where small increases were observed. DSP tended to be a problem at most sites, as shown in Figure 8.

DSP test results in mussels showed a significant site by year interaction, shown in Table 7. Again, it confirms that prevalence of DSP in mussels in 2007 was highest for the Shetland sites. This Table also demonstrates how prevalence varies over time over sites. For example, Eastcoast and Ayr-LochStriven showed high prevalences in 2001-2003 and 2005, whilst levels were low in 2004, 2006 and 2007. An opposite pattern was observed for e.g. Shetland-W, where prevalence was high in 2001, 2006 and 2007, whilst being low in 2002-2005.

In summary:

- DSP levels in 2007 were somewhat below average
- This was consistent across all sites except for West and SouthWest Shetland.

3.2.3 ASP > 5µg/g in mussels

ASP in mussels peaked in 2004 with up to 9 % of the samples exceeding 5µg/g (Figure 9 and 10), whilst levels were low in 2006 (less than 0.5%). Although in 2007 prevalence was increased, levels were still below average. Overall, prevalence was highest in September (Figure 10, 5% on average).

When looking at each site (Table 8), the estimated prevalence was down somewhat except for 2 sites in Shetland (Shetland-SE and Shetland-SW-Gruting), where increased prevalence was observed. Prevalences were highest on Mull, Skye, the Outer Hebrides and some of the Shetland sites. Also note the contrast between the north and the south of Shetland, with Shetland-N having no ASP exceeding 5 µg/g, while for the SE and SW sites the prevalence was relatively high (Figure 11).

In summary:

- Prevalence of ASP in mussels in 2007 was around or somewhat below average
- This was consistent across all sites except for Shetland-SE and Shetland-SW-Gruting

3.2.4 ASP > 20 µg/g in whole king scallops

During 2004-2007 only a limited number of king scallops were tested for ASP (ranging from 2 in total in 2006 to 22 in 2007, Table 2) and therefore the effect of year was not well-defined in the statistical models. Although it was included in the model fit, we will only discuss results summarised by site and month (Table 9). It can be seen that adding the 2007 data to the statistical analyses has hardly altered the previous findings. Prevalence was estimated to be high during Aug – Nov (up to 62%), and was relatively low earlier in the year.

In summary:

- Prevalence of ASP in king scallops was around average during 2007
- There were only a limited number of samples available during Dec 2006 – Mar 2008 so model results should be treated with caution.

4 RISK ASSESSMENT OF SAMPLING SCHEMES

Based on the revised prevalence estimates, a risk assessment was performed of the monitoring scheme put in place in 2006. The risk assessment looks at the risk of non-detection, which is defined as the probability that a site is unknowingly toxic. For simplicity, it is assumed that a clear test result is valid for one week and implies that weekly sampling would be safe (as the toxin status of a field would always be known).

Let p denote the chance that toxin levels exceed the field closure limit (Tables 3, 6, 8 and 9). Then the risk of non-detection is as follows (details in Materials and Methods):

- weekly sampling: risk of non-detection is zero,
- fortnightly sampling: risk of non-detection is 0.5 p,
- monthly sampling: risk of non-detection is 0.75 p.

Risk assessments were performed for DSP, PSP > 80 µg/100g and ASP > 5 µg/g in mussels (as mussels are currently used as indicator species), and for ASP > 20µg/g in king scallop gonads (as ASP frequently exceeded field closure limit in this species).

4.1 Risk assessment of present monitoring scheme

The monitoring scheme to be assessed (as was put in place in 2006) has the following sampling frequencies:

- PSP: weekly all year round
- DSP: weekly from April to November, fortnightly in December, monthly from January to March
- ASP: weekly from July to November, fortnightly from April to June, monthly from December to March

These frequencies are applicable to all sites and all shellfish species. The only exception is for ASP in king scallop gonads, which were tested weekly all year round.

PSP in mussels
Since the sampling regime being assessed at the time of this study involves weekly sampling for PSP from all sites, coupled with the assumption that a clear test result is valid for one week, the risk of non-detection is zero for PSP for all sites and all species.

DSP in mussels
The risk of non-detection was zero during April – November due to weekly sampling having taken place (Table 10). In December, when fortnightly sampling is applied, the risk is observed to increase to 2.9% for Ayr-LochStriven. During January-March the risk stays below 1%, despite sampling only once a month, except for Ayr-LochStriven which shows a risk up to 1.2% in March. These results, based on data from April 2001 to March 2008, are similar to the previous findings reported in S14036 (data from April 2001 to November 2006).

ASP in king scallop gonads
As weekly monitoring for ASP in king scallops took place at the time of this study, the risk of non-detection is zero for ASP in king scallop gonads for all sites.

ASP > 5µg/g in mussels
When testing was less than once a week, the risk of non-detection of ASP exceeding 5µg/g in mussels was 2% or less (Table 11). These findings are similar to those reported in S14036.

In summary:

- Inclusion of the Dec 2006 – Mar 2008 data in the risk assessment of the present monitoring scheme does not result in major changes to the findings reported in Report S14036.

4.2 Revised sampling schemes

In Report S14036 (Holtrop 2008) it was found that the presence of PSP in mussels could be site-specific and season-bound, and this is confirmed by the extra data from Dec 2006 – Mar 2008. For example, there were several sites for which the probability of testing positive (Table 5) for PSP was almost zero (Dumfries, WC-LochFyne, WC-LochEtive, WC-LochCreran, WC-LochLeven and NWC-Ullapool, none of these sites had positive test results). Likewise, the chance of testing positive (Table 5) was almost zero during Feb, Mar and Dec (again, no positive test results were obtained during these months).

For DSP in mussels (Table 6), it can be seen that DSP was much more prevalent at some sites (e.g. Ayr-LochStriven, WC-Lochaber) than others (WC-LochEtive, WC-LochLeven).

These findings indicate that re-allocation of sampling effort may be needed. The aim was to construct alternative sampling schemes such that the risk of non-detection does not exceed a pre-defined maximum value (denoted by R_{max}), while minimising the total number of samples required. Three possible sampling frequencies were considered, namely:

- once per month (monthly) when toxin levels are low,
- four times per month (weekly) when toxin levels are high,
- fortnightly for intermediate toxin levels,

where a month approximates four weeks. These alternative schemes were allowed to be site and time specific, so that each site was assigned its own monitoring scheme for which the sampling frequency could vary during the year.

For a given maximum acceptable risk of non-detection (denoted by R_{max}), alternative sampling schemes were constructed as follows.

- When toxin levels are high, with p exceeding p_{high}, weekly sampling is required.
- When toxin levels are low, with p less than p_{low}, monthly sampling will suffice.
- For intermediate toxin levels, with p exceeding p_{low} but less than p_{high}, fortnightly sampling is applied.

where p_{high} and p_{low} are cut-off levels that determine whether weekly sampling is necessary or monthly sampling will suffice. To minimise the number of samples needed, p_{high} and p_{low} were chosen as follows (details in Materials & Methods):

- let R_{max} denote the maximum acceptable risk of non-detection, which is set in advance,
- then $p_{high} = 2\ R_{max}$,
- and $p_{low} = 2/3\ p_{high}$.

To illustrate this approach, R_{max} was arbitrarily set at 1% and 5% for the purpose of this study, but it should be noted that the level of maximum acceptable risk of non-detection in Scotland should ultimately be the responsibility of the Food Standards Agency Scotland.

4.2.1 Risk assessment of alternative sampling schemes

Based on the approach outlined in the previous section, the following two alternative sampling schemes were constructed:

- Maximum acceptable risk of non-detection set at 5%, so that p_{high} = 10% and p_{low} = 6.67%. Sampling frequency should be increased to once a week when $p \geq 10\%$, once a fortnight when $6.67\% < p < 10\%$ and once a month when $p \leq 6.67\%$.
- Maximum acceptable risk of non-detection set at 1%, so that p_{high} = 2% and p_{low} = 1.33%. Sampling frequency should be increased to once a week when $p \geq 2\%$, once a fortnight when $1.33\% < p < 2\%$ and once a month when $p \leq 1.33\%$.

These schemes were implemented for PSP in mussels, DSP in mussels and ASP in mussels and king scallop gonads, based on the values of p (chance that toxin levels exceed field closure limit) given in Tables 3, 6, 8 and 9. The sampling frequencies required for each site, which correspond to maximum acceptable risk of non-detection of 5% and 1%, are shown in Tables 12, 13, 15 and 14.

PSP in mussels
In order to keep the risk of non-detection (i.e. the risk of missing PSP levels exceeding field closure) below 1%, monthly sampling would be sufficient during October – March. For 10 of the 25 sites, monthly sampling throughout the year would suffice (Table 12).

In addition, we also looked at sampling schemes that keep the risk of non-detection of positive PSP levels below 1% (Table 16). For 7 sites, monthly sampling would suffice, while for the remaining sites weekly sampling would be required during Apr – Oct.

These findings (for both PSP > 80 and PSP > 0 μg/100g) are similar to those reported in S14036.

DSP in mussels
To keep the maximum risk of non-detection (i.e. the risk of missing DSP in mussels) below 1%, weekly sampling would be required for most of the year, except for January and February, where monthly sampling would suffice. These frequencies would have to be applied to all sites, with the exception of WC-LochEtive, for which it appears that monthly sampling throughout the year would be sufficient (Table 13). These findings are similar to those reported in S14036.

ASP in king scallop gonads
Weekly sampling throughout the year would be required to keep the risk of not detecting ASP levels above those resulting in field closure (> 20μg/g) in king scallop gonads, with the exception of the month April, where monthly sampling would suffice (Table 14). These findings are slightly different compared to those in S14036 where it was concluded that monthly sampling would suffice for March instead in order to keep the risk of non-detection below 1%.

ASP > 5μg/g in mussels
For 9 sites monthly sampling throughout the year would suffice, while for the remaining sites weekly sampling would be required in summer (Jun-Sep) to keep the risk of non-detection below 1% (Table 15). These findings are similar to those reported in S14036.

In summary:

- The Dec 2006 – Mar 2008 data for mussels support the proposed alternative sampling schemes in Report S14036.
- For ASP in king scallop gonads the previous report suggested monthly sampling in March which is now no longer supported by the more recent data (but it should be noted that data on king scallops is limited)

5 COMPARISON OF DSP AND PSP IN PACIFIC OYSTERS AND MUSSELS

Historic data (April 2001 – March 2008) indicate that DSP and PSP have low prevalence in Pacific oysters, suggesting that it may be possible to reduce the monitoring frequency for these toxins in Pacific oysters. The case for reduced monitoring would be strengthened if presence of DSP or PSP in Pacific oysters tended to coincide with that in mussels, so that the use of mussels as indicator species would be sufficient to ensure safe harvesting of Pacific oysters.

5.1 DSP and PSP in Pacific oysters

During April 2001 – March 2008, 805 Pacific oyster samples were tested for DSP, of which 9 tested positive (details in Table 17). The positive DSP samples came from pods 53, 13, 15 (2 samples), 16, 6, 9 and 40 (2 samples).

For PSP, 1088 samples were tested during April 2001 – March 2008. Only two of these tested positive, and their values were at the limit of detection (28 and 29 µg/100g, Table 18). These samples came from pods 15 and 5.

5.2 Comparison against mussel samples

Table 19 summarises the numbers of mussel and Pacific oyster samples tested at each pod. It shows that test results for Pacific oysters are only available from a third of the pods (27 out of 85), and that there were a number of pods that had large numbers of Pacific oyster samples but with no or few mussel samples. These were pods 13, 15 (WC-LochFyne), 4 (WC-LochEtive), 12 (Mull-LochnaKeal) and 40 (Skye), and covered approximately half of all Pacific oyster samples (426/805 for DSP and 560/1088 for PSP). Furthermore, it should be noted that 6 out of 11 positive DSP and PSP samples in Pacific oysters (Table 17 and 18) came from these pods.

To investigate more closely whether positive Pacific oyster test results coincided with positive results in mussels, the test results were summarised per pod per week.

5.2.1 Comparison of weekly test results for DSP

For DSP, there were 163 instances for which samples from both species, obtained from the same pod during the same week, were tested. Of these, there were

- 138 instances for which both Pacific oyster and mussel samples tested negative
- 1 instance for which both Pacific oyster and mussel samples tested positive
- 2 instances for which Pacific oysters tested positive and mussels negative
- 22 instances for which Pacific oysters tested negative and mussels positive

In addition, there were 598 Pacific oyster weekly DSP test results per pod that had no corresponding (i.e. from the same pod during the same week) mussel sample. This included 6 positive Pacific oyster samples.

5.2.2 Comparison of weekly test results for PSP

For PSP, there were 157 instances for which samples from both species, obtained from the same pod during the same week, were tested. Of these, there were

- 154 instances for which both Pacific oyster and mussel samples tested negative
- No instances for which both Pacific oyster and mussel samples tested positive
- 1 instance for which Pacific oysters tested positive and mussels negative
- 2 instances for which Pacific oysters tested negative and mussels positive.

In addition, there were 855 Pacific oyster weekly PSP test results per pod that had no corresponding (i.e. from the same pod during the same week) mussel sample. This included one positive Pacific oyster sample.

5.2.3 Test results in mussels from the corresponding sites (group of pods)

Due to only limited data being available for comparing mussel and Pacific oyster test results obtained from the same pod during the same week, it was decided to look at the test results available for Pacific oysters and mussels for all pods that had been assigned to the same group (as described in Table 1). Full details are given in Appendix B, Tables B1 to B7, with a summaries provided in Tables 20 (DSP) and 21 (PSP).

Same group of pods, same week. Within the same group of pods, all positive DSP Pacific oyster samples have a corresponding mussel test result for the same week, although for only 1 out of 9 this result was also positive in the mussel. For one of the two positive PSP

Pacific oyster samples, a mussel test result for the same pod and same week is available, but PSP was not detected in this mussel sample.

Same group of pods, preceding four weeks. It is also useful to look at the mussel DSP and PSP test results for the corresponding (group of) pods during the four weeks preceding the toxic event in Pacific oysters, as a toxic event in mussels during this period would have implied field closure at the time of the Pacific oyster sample being taken (full details in Tables B1 to B7). For 4 out of the 9 DSP positive Pacific oyster samples the field would have been closed already, based on a mussel test result from the same group of pods during the preceding four weeks (Table 20). For the 2 Pacific oyster samples that tested positive for PSP, the field would have been open, as there were no positive mussel test results from the same group of pods during this period (Table 21).

Model-based comparisons. Instead of looking at observed test results in mussels, we can look at the *chance* (based on the models described earlier) of a mussel sample testing positive for the site and month corresponding to a positive Pacific oyster sample (DSP=1, PSP > 0). This is shown at the bottom of Tables 20 and 21. For 5 out of 9 positive DSP Pacific oyster results, the corresponding likelihood of detecting DSP in mussels was high, ranging from 13% to 58%. For two of the Pacific oyster DSP samples, the corresponding likelihood of detecting DSP in mussels was low, 2.8% or less. For the two Pacific oyster samples that tested positive for PSP, the corresponding likelihood of detecting PSP in mussels was low, 1.4% or less.

5.2.4 Summary and conclusions

A summary of the comparison between Pacific oysters and mussel test results for DSP and PSP is given below.

- Approximately half the Pacific oyster samples came from pods (pods 4, 12, 13, 15 and 40) that have few or no mussel samples tested.
- Some of these pods (e.g. pod 15 Colonsay/Islay) have no pods nearby for which mussels are tested.
- When looking at mussel test results for a group of pods, then during the 4 weeks preceding the toxic Pacific oyster sample, for 4 out of 11 cases at least one of the pods within the corresponding group would have been closed for harvesting already. Conversely, for 7 out of 11 cases of positive oyster samples, all pods in the relevant group would have been regarded as safe for harvesting.
- For 4 of the 11 positive Pacific oyster test results (2 DSP positives and 2 PSP positives) the estimated probability of a toxic mussel sample from the corresponding group of pods would have been small, 2.8% or less. For 5 positive DSP results in Pacific oysters, the estimated probability of toxic mussel sample from the corresponding group of pods was relatively high, ranging from 13 to 58%. The remaining positive DSP results in Pacific oysters corresponded to an estimated probability of positive DSP in mussels between 5 and 10%.

6 FINAL SUMMARY AND CONCLUSIONS

6.1 Updating the risk assessment with Dec 2006 – Mar 2008 data

In brief:

- Toxin profiles for 2007 tend to correspond to the average toxin profile observed during 2001/6. As a consequence, the model outcomes, risk assessment of the current monitoring scheme and development of alternative schemes are similar to those reported in Holtrop 2008.
- Only few test results on king scallops were reported in recent years so any results and conclusions with respect to this species should be treated cautiously.
- Issues discussed and comments made in Section 5 of Holtrop 2008 remain valid.
- Recommendations made in Section 6 of Holtrop 2008 remain valid.

6.2 Comparison of test results in Pacific oysters and mussels

A summary of the main findings from comparing DSP and PSP test results in Pacific oysters and mussels is given below:

- Prevalence of PSP in Pacific oysters was low; over 7 years only 2 (out of 1088) samples tested positive for PSP, with levels at the limit of detection.
- Prevalence of DSP in Pacific oysters was low; over 7 years only 9 (out of 806) samples tested positive for DSP.
- During Apr 2001 – Mar 2008 a discrepancy between the harvesting of Pacific oysters and harvesting of mussels was observed. For approximately half of the Pacific oyster samples no, or very few, mussel samples were tested from the same pod.
- This compromises the comparison of test results between Pacific oysters and mussels at the 'Pod-level'.
- Seven of the 11 positive Pacific oyster test results for either DSP or PSP came from pods from which no, or very few, mussel test results were available.
- Where no mussel test results were available from the same pod, mussel test results from the corresponding group of pods (as defined in Table 1) were used for comparison instead.
- Furthermore, the mussel test results from the corresponding group of pods during the four weeks preceding a toxic event in Pacific oysters were also considered.
- Although mussels tested positive for DSP and PSP much more frequently than Pacific oysters, when a positive result was found in Pacific oysters, more often than not (in 7 out of 11 cases) this coincided with a negative result in mussels from the corresponding group of pods, for up to 4 weeks prior to the Pacific oyster sample being taken.

Using mussels as indicator species for PSP in Pacific oysters may not be feasible. It should be kept in mind however, that over seven years only two Pacific oyster samples, out of more than a thousand samples tested, gave a positive test result for PSP, and that these two test results gave only low PSP levels (28 and 29 μg/100g).

Using mussels as indicator species for DSP in Pacific oysters may not be satisfactory either, although the picture here is mixed. For 4 out of 9 positive Pacific oyster samples, the chances of a positive DSP test result in mussels would have been relatively low, 10% or less, suggesting that mussel test results may not be indicative of DSP in Pacific oysters. On the other hand, for the remaining 5 positive DSP Pacific oyster samples the chance of a corresponding DSP test result in mussels ranged from 13 to 58%.

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TABLES

Table 1: Definition of site, pods covered by each site and a brief description of locations covered by each site. ID starting with G indicates a group of pods, followed by the pod number that had most data for that grouping. ID starting with P indicates an individual pod, and is followed by the corresponding pod number. Areas highlighted in bold relate to the dominant pod of the grouping. Pod numbers less than 100 refer to the FSAS definitions of pods as was introduced in November 2006, while pod numbers exceeding 100 were introduced to refer to areas that had data for 2001/4 only. Sites are arranged starting with the East Coast of Scotland, and then follow the coastline in approximately clockwise manner. Red: sites introduced since 2006.

Site[1]	ID	Pods	Description
Eastcoast	G80	20, 80, 107,111	**Forth Estuary**, Eyemouth, Montrose, Tay Estuary
Dumfries	G26	26, 27	**Loch Ryan**, Solway Firth
Ayr-LochStriven	G8	8, 18, 52, 53, 74, 108	**Loch Striven**, Arran, Clyde, Campbeltown, Barassie
WC-LochFyne	G16	13, 14, 15, 16, 17, 19, 109	**Loch Fyne**, Colonsay, West Loch Tarbert, Loch Craignish
WC-LochEtive	G10	3, 4, 6, 10, 84	**Loch Etive**, Seil Sound, Cadderlie, Kerrera
WC-LochCreran	G9	9, 11	**Loch Creran**, Loch Linnhe
Mull-LochSpelve	P5	5	**Loch Spelve**
Mull-LochScridain	P7	7	**Loch Scridain**
Mull-LochnaKeal	G1	1, 2, 12, 32	**Loch na Kael**, Tobermory, Aros, Loch a Chumhainn, Loch Teacuis, Loch Sunart
WC-LochLeven	G31	29, 31, 34	**Loch Leven**, Loch Eil
WC-Lochaber	G28	28, 30, 33, 85	**Ardtoe, Fascadale Bay, Glenuig Bay, Loch Ailort, Loch Moidart**, Arisaig, Loch Nevis, Loch Hourn, Kentra Bay
Skye	G41	40, 41, 42, 43, 45, 46	**Loch Eishort**, Loch Bracadale, Loch Dunvegan, Loch Snizort, Loch Ainort, Kyle, Loch Sligachan, Scalpay
NWC-LochTorridon	G35	35, 37	**Loch Torridon**, Loch Toscaig, Loch Kishorn
NWC-Ullapool	G39	36, 39	**Loch Ewe**, Ullapool, Little Loch Broom
NWC-other	G48	38,47, 48, 49, 50, 51, 78, 110	**Loch Laxford**, Kylesku, Kyle of Tongue, Kinlochbervie,Lochinver, Enard Bay, Tain
Lewis-LochRoag	G23	23, 24, 102	**Loch Roag,** Loch Tamnabaigh
LewisHarrisUist	G21	21, 22, 25, 26, 77, 101	**Loch Leurbost**, Broad Bay, Killegray, Loch Ceann Dibig, Loch Seaforth, Loch Stockinish, Liernish, Loch Carnan, Loch Eport, Loch Eynort, Benbecula, Sound of Eriskay
Orkney	G54	54, 103, 104, 105, 106	**Orkney;** Bay of Firth, Burray, Hatston, Inganess, Mill Sands, Otterswick, Scapa Flow, Stromness
Shetland-SE	G57	57, 59, 60, 62, 63, 67	**Sandsound Voe**, Stromness Voe, Wadbister Voe, Catfirth, Clift Sound
Shetland-SW-Gruting	P61	61	**Braewick Voe, Browland Voe, Gruting/Seli Voe**
Shetland-SW-Vaila	P68	68	**Vaila Sound**
Shetland-W	G58	58, 72	**Clousta Voe, Vementry Voe**, Papa Little
Shetland-NW	G64	64, 70, 71, 79	**Busta Voe**, Olna Firth, Ronas Voe, Ura Firth
Shetland-NE	G56	56, 65, 66, 81, 82	**Dales Voe, Scarva Ayre**, Basta Voe, Whalefirth Voe, North + South Uyea, Mid Yell Voe
Shetland-N-Balta	P69	69	**Baltasound Voe**

[1]WC, West Coast; NWC, North West Coast; S, South; W, West; N, North; E, East.

Table 2: Numbers of samples per toxin level for king scallops, mussels and pacific oysters for each year, from 1 April 2001 to 31 March 2008. Values resulting in field closure are shown in bold.

		DSP		PSP category[1]				ASP category[2]			
		0	**1**	0	0-40	40-80	**80+**	0	0-5	5-20	**20+**
King scallops[3]	2001	19	**1**	32	4			2	14	17	**11**
	2002	9		33					18	19	**10**
	2003	19		22					6	10	**31**
	2004	8		6	1				3	7	**3**
	2005	5		10					5	6	
	2006								1	1	
	2007	14		15					16	2	**4**
	2008										
Mussels	2001	533	**132**	552	20	23	**28**	323	299	4	**1**
	2002	547	**65**	551	5	11	**2**	211	360	10	**1**
	2003	708	**52**	681	7	12	**6**	314	398	15	**1**
	2004	587	**37**	102	3	4		229	333	12	
	2005	417	**10**	430	3	1		438	94	9	
	2006	714	**70**	688	18	39	**11**	661	83	1	
	2007	1812	**83**	2016	19	27	**8**		1819	10	**4**
	2008	177		546					168		
Pacific oysters	2001	81	**2**	82				42	35		
	2002	98	**1**	110	2			44	71	2	
	2003	154	**2**	155				77	84	3	
	2004	60	**3**	176				75	78	4	
	2005	60		139				139	23		
	2006	157		191				201	19		
	2007	171	**1**	186					166		
	2008	15		47					15		

[1]Categories for PSP are 0 µg/100g; >0 and < 40 (denoted by 0-40); ≥ 40 and < 80 (denoted by 40-80); ≥ 80 (denoted by 80+, is also field closure limit).
[2]Categories for ASP are 0 µg/g; >0 and < 5 (denoted by 0-5); ≥ 5 and < 20 (denoted by 5-20); ≥ 20 (denoted by 20+, is also field closure limit).
[3]DSP and PSP tested on whole king scallops, ASP tested on king scallop gonads.

Table 3: Estimated[1] probability that PSP levels in mussels exceed 80 µg/100g, for eachsite per month, averaged over 7 years. The value 0% represents a small positive number having a value of less than 0.05%. Probabilities of 1% and higher are shown in bold.

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Avg prev[2]		0.0	0.0	0.0	0.3	**3.0**	**4.4**	0.9	0.6	**1.2**	0.0	0.2	0.0
ID	Site		Avg[2]	0.1	0.1	0.1	0.4	**2.5**	**3.7**	0.8	**1.0**	**1.0**	0.1	0.2	0.1
G80	Eastcoast	0.4	0.4	0.0	0.0	0.0	0.2	**1.3**	**2.1**	0.4	0.5	0.5	0.0	0.1	0.0
G26	Dumfries	0.0	0.2	0.0	0.0	0.0	0.1	0.6	0.9	0.2	0.2	0.2	0.0	0.0	0.0
G8	Ayr-LochStriven	1.0	0.8	0.1	0.1	0.1	0.4	**2.3**	**3.6**	0.8	0.9	0.9	0.1	0.1	0.1
G16	WC-LochFyne	0.0	0.2	0.0	0.0	0.0	0.1	0.5	0.8	0.2	0.2	0.2	0.0	0.0	0.0
G10	WC-LochEtive	0.0	0.2	0.0	0.0	0.0	0.1	0.5	0.7	0.1	0.2	0.2	0.0	0.0	0.0
G9	WC-LochCreran	0.0	0.2	0.0	0.0	0.0	0.1	0.5	0.8	0.2	0.2	0.2	0.0	0.0	0.0
P5	Mull-LochSpelve	0.0	0.2	0.0	0.0	0.0	0.1	0.6	**1.0**	0.2	0.3	0.2	0.0	0.0	0.0
P7	Mull-LochScridain	0.6	**1.4**	0.1	0.1	0.1	0.7	**4.1**	**6.3**	**1.4**	**1.7**	**1.7**	0.1	0.3	0.1
G1	Mull-LochnaKeal	0.0	0.2	0.0	0.0	0.0	0.1	0.6	0.9	0.2	0.2	0.2	0.0	0.0	0.0
G31	WC-LochLeven	0.0	0.1	0.0	0.0	0.0	0.1	0.4	0.7	0.1	0.2	0.2	0.0	0.0	0.0
G28	WC-Lochaber	**1.5**	**1.2**	0.1	0.1	0.1	0.6	**3.6**	**5.5**	**1.2**	**1.5**	**1.4**	0.1	0.2	0.1
G41	Skye	**1.2**	1.0	0.1	0.1	0.1	0.5	**2.9**	**4.6**	1.0	**1.2**	**1.2**	0.1	0.2	0.1
G35	NWC-LochTorridon	**1.4**	**1.2**	0.1	0.1	0.1	0.6	**3.5**	**5.4**	**1.2**	**1.5**	**1.4**	0.1	0.2	0.1
G39	NWC-Ullapool	0.0	0.2	0.0	0.0	0.0	0.1	0.5	0.8	0.2	0.2	0.2	0.0	0.0	0.0
G48	NWC-other	0.6	0.8	0.1	0.1	0.1	0.4	**2.5**	**3.9**	0.8	**1.0**	1.0	0.1	0.2	0.1
G23	Lewis-LochRoag	0.5	0.4	0.0	0.0	0.0	0.2	**1.3**	**2.1**	0.4	0.5	0.5	0.0	0.1	0.0
G21	LewisHarrisUist	0.0	0.1	0.0	0.0	0.0	0.1	0.4	0.6	0.1	0.2	0.2	0.0	0.0	0.0
G54	Orkney	**2.3**	**2.1**	0.2	0.2	0.2	**1.1**	**6.0**	**9.1**	**2.1**	**2.6**	**2.5**	0.2	0.4	0.2
G57	Shetland-SE	0.0	0.4	0.0	0.0	0.0	0.2	**1.2**	**1.9**	0.4	0.5	0.5	0.0	0.1	0.0
P61	Shetland-SW-Gruting	0.0	0.2	0.0	0.0	0.0	0.1	0.6	0.9	0.2	0.2	0.2	0.0	0.0	0.0
P68	Shetland-SW-Vaila	0.5	**1.3**	0.1	0.1	0.1	0.7	**3.7**	**5.8**	**1.3**	**1.6**	**1.5**	0.1	0.2	0.1
G58	Shetland-W	**3.7**	**2.9**	0.2	0.2	0.2	**1.6**	**8.4**	**12.3**	**3.0**	**3.8**	**3.6**	0.2	0.6	0.2
G64	Shetland-NW	**4.0**	**3.0**	0.2	0.2	0.2	**1.7**	**8.6**	**12.7**	**3.1**	**3.9**	**3.7**	0.2	0.6	0.2
G56	Shetland-NE	0.5	0.4	0.0	0.0	0.0	0.2	**1.2**	**2.0**	0.4	0.5	0.5	0.0	0.1	0.0
P69	Shetland-N-Balta	**3.3**	**1.9**	0.1	0.1	0.1	**1.0**	**5.5**	**8.4**	**1.9**	**2.4**	**2.3**	0.1	0.4	0.1

[1]From HGLM with Site and Year as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev. (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 4: Estimated[1] probability (%) that PSP levels in mussels exceed 40µg/100g, for each site per month, averaged over 7 years. The value 0% represents a small positive number having a value of less than 0.5%. Probabilities of 1% and higher are shown in bold.

ID	Site	Avg prev[2]	Avg[2]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				1.1	0.0	0.0	0.3	**7.5**	**11.5**	**3.3**	**3.4**	**4.3**	**1.0**	0.2	0.0
				0.5	0.0	0.0	**1.2**	**7.3**	**9.0**	**3.5**	**4.2**	**4.0**	0.8	0.2	0.0
G80	Eastcoast	**2.1**	**1.9**	0	0	0	1	**5**	**7**	**2**	**3**	**3**	1	0	0
G26	Dumfries	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
G8	Ayr-LochStriven	**1.6**	**1.2**	0	0	0	0	**4**	**5**	**2**	**2**	**2**	0	0	0
G16	WC-LochFyne	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
G10	WC-LochEtive	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
G9	WC-LochCreran	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
P5	Mull-LochSpelve	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
P7	Mull-LochScridain	**3.4**	**6.2**	**1**	0	0	**3**	**18**	**21**	**9**	**10**	**10**	**2**	0	0
G1	Mull-LochnaKeal	**1.5**	**1.0**	0	0	0	0	**3**	**4**	**1**	**2**	**1**	0	0	0
G31	WC-LochLeven	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
G28	WC-Lochaber	**3.8**	**3.0**	1	0	0	**1**	**9**	**11**	**4**	**5**	**5**	1	0	0
G41	Skye	**5.9**	**4.3**	1	0	0	**2**	**12**	**15**	**6**	**7**	**7**	**1**	0	0
G35	NWC-LochTorridon	**3.0**	**2.4**	0	0	0	**1**	**7**	**9**	**3**	**4**	**4**	1	0	0
G39	NWC-Ullapool	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
G48	NWC-other	**1.1**	**2.4**	0	0	0	**1**	**7**	**9**	**3**	**4**	**4**	1	0	0
G23	Lewis-LochRoag	**1.6**	**1.3**	0	0	0	1	**4**	**5**	**2**	**2**	**2**	0	0	0
G21	LewisHarrisUist	0.1	0.4	0	0	0	0	**1**	**1**	0	1	1	0	0	0
G54	Orkney	**5.8**	**5.4**	**1**	0	0	**3**	**15**	**19**	**7**	**9**	**8**	**2**	0	0
G57	Shetland-SE	**2.0**	**2.1**	0	0	0	1	**6**	**8**	**3**	**3**	**3**	1	0	0
P61	Shetland-SW-Gruting	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
P68	Shetland-SW-Vaila	**5.9**	**7.1**	**2**	0	0	**4**	**20**	**24**	**10**	**12**	**11**	**2**	0	0
G58	Shetland-W	**8.0**	**9.0**	**2**	0	0	**5**	**25**	**29**	**13**	**15**	**15**	**3**	1	0
G64	Shetland-NW	**8.0**	**6.6**	**1**	0	0	**3**	**19**	**23**	**9**	**11**	**11**	**2**	0	0
G56	Shetland-NE	**7.0**	**5.0**	**1**	0	0	**2**	**14**	**17**	**7**	**8**	**8**	**2**	0	0
P69	Shetland-N-Balta	**6.3**	**4.4**	1	0	0	**2**	**13**	**16**	**6**	**7**	**7**	**1**	0	0

[1]From HGLM with Site and Year as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 5: Estimated[1] probability (%) that PSP levels in mussels tested positive (>0µg/100g), for each site per month, averaged over 7 years. The value 0% represents a small positive number having a value of less than 0.5%. Probabilities of 10% and higher are shown in bold.

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Avg prev[3]		0.7	0.0	0.0	1.1	**12.6**	**12.3**	5.2	6.2	4.8	1.5	0.3	0.0
ID	Site		Avg[2]	0.5	0.0	0.0	2.2	**12.0**	**10.7**	5.0	6.0	4.9	1.3	0.3	0.0
G80	Eastcoast	4.0	3.6	0	0	0	2	**13**	**12**	5	6	5	1	0	0
G26	Dumfries	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
G8	Ayr-LochStriven	1.5	1.1	0	0	0	1	4	4	1	2	1	0	0	0
G16	WC-LochFyne	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
G10	WC-LochEtive	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
G9	WC-LochCreran	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
P5	Mull-LochSpelve	0.2	0.3	0	0	0	0	1	1	0	0	0	0	0	0
P7	Mull-LochScridain	6.2	8.2	1	0	0	5	**27**	**23**	**12**	**14**	**11**	3	1	0
G1	Mull-LochnaKeal	1.5	1.0	0	0	0	0	4	4	1	1	1	0	0	0
G31	WC-LochLeven	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
G28	WC-Lochaber	6.0	4.5	1	0	0	3	**16**	**14**	6	7	6	2	0	0
G41	Skye	7.7	5.8	1	0	0	3	**20**	**18**	8	10	8	2	0	0
G35	NWC-LochTorridon	3.6	2.7	0	0	0	1	9	9	3	4	4	1	0	0
G39	NWC-Ullapool	0.1	0.2	0	0	0	0	1	1	0	0	0	0	0	0
G48	NWC-other	1.9	3.7	0	0	0	2	**13**	**12**	5	6	5	1	0	0
G23	Lewis-LochRoag	2.1	1.6	0	0	0	1	6	6	2	2	2	0	0	0
G21	LewisHarrisUist	1.5	1.6	0	0	0	1	6	6	2	2	2	0	0	0
G54	Orkney	7.5	7.0	1	0	0	4	**24**	**21**	10	**12**	10	3	1	0
G57	Shetland-SE	3.1	2.7	0	0	0	1	9	9	3	4	4	1	0	0
P61	Shetland-SW-Gruting	0.7	1.0	0	0	0	0	4	4	1	1	1	0	0	0
P68	Shetland-SW-Vaila	8.4	**10.3**	2	0	0	7	**33**	**28**	**15**	**18**	**14**	4	1	0
G58	Shetland-W	**10.8**	**11.8**	2	0	0	9	**38**	**31**	**18**	**22**	**16**	5	1	0
G64	Shetland-NW	9.9	9.7	1	0	0	7	**32**	**27**	**14**	**17**	**14**	4	1	0
G56	Shetland-NE	7.8	5.6	1	0	0	3	**19**	**17**	8	9	8	2	0	0
P69	Shetland-N-Balta	8.2	5.7	1	0	0	3	**20**	**17**	8	9	8	2	0	0

[1]From HGLM with Site, Year and Year by Month interaction as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 6: Estimated[1] probability (%) that DSP levels in mussels tested positive, for each site per month, averaged over 7 years. The value 0% represents a small positive number having a value of less than 0.5%. Probabilities of 10% and higher are shown in bold.

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Avg prev[2]		0.0	0.0	0.4	2.3	4.0	**11.5**	**12.8**	**12.8**	9.7	6.5	4.2	2.4
ID	Site		Avg[2]	0.0	0.0	0.3	1.9	4.1	**11.9**	**11.7**	**12.3**	8.4	5.4	3.6	1.7
G80	Eastcoast	8.2	7.5	0	0	0	3	8	**16**	**17**	**17**	**12**	7	7	2
G26	Dumfries	1.4	1.2	0	0	0	0	1	2	2	3	4	2	0	0
G8	Ayr-LochStriven	**14.2**	**12.3**	0	0	2	4	**11**	**23**	**24**	**27**	**23**	**18**	**10**	6
G16	WC-LochFyne	9.8	8.6	0	0	0	5	9	**22**	**18**	**19**	**12**	8	8	3
G10	WC-LochEtive	0.5	0.4	0	0	0	0	0	1	1	1	1	0	0	0
G9	WC-LochCreran	0.9	0.6	0	0	0	0	1	2	1	1	1	0	0	0
P5	Mull-LochSpelve	1.7	1.4	0	0	0	0	1	3	3	4	1	2	1	1
P7	Mull-LochScridain	4.4	4.1	0	0	0	1	2	9	9	**10**	8	6	3	2
G1	Mull-LochnaKeal	1.4	1.2	0	0	0	0	1	4	3	3	1	1	1	0
G31	WC-LochLeven	1.4	1.2	0	0	0	1	1	3	2	2	3	1	1	0
G28	WC-Lochaber	**12.0**	**10.2**	0	0	1	5	9	**23**	**24**	**23**	**15**	**10**	8	3
G41	Skye	**10.2**	8.6	0	0	1	3	6	**19**	**20**	**20**	**14**	**10**	7	3
G35	NWC-LochTorridon	5.4	4.5	0	0	0	3	2	7	7	10	**11**	9	4	3
G39	NWC-Ullapool	5.9	4.5	0	0	0	2	2	6	9	10	**11**	8	4	2
G48	NWC-other	8.6	7.0	0	0	1	3	3	**11**	**15**	**16**	**13**	**11**	7	4
G23	Lewis-LochRoag	4.5	3.9	0	0	0	1	2	10	**13**	**10**	7	2	2	1
G21	LewisHarrisUist	4.1	3.7	0	0	0	1	3	**10**	**11**	10	4	2	2	1
G54	Orkney	5.6	5.3	0	0	0	2	3	**11**	**13**	**13**	**11**	7	3	2
G57	Shetland-SE	5.0	4.4	0	0	0	1	3	**12**	9	**11**	8	5	2	1
P61	Shetland-SW-Gruting	6.3	6.5	0	0	0	2	6	**20**	**18**	**17**	8	3	3	1
P68	Shetland-SW-Vaila	6.6	8.2	0	0	0	4	**11**	**26**	**21**	**20**	9	2	3	1
G58	Shetland-W	6.0	7.3	0	0	0	2	7	**20**	**16**	**19**	**12**	7	3	2
G64	Shetland-NW	8.5	9.3	0	0	0	2	8	**25**	**23**	**24**	**14**	8	5	2
G56	Shetland-NE	3.6	3.3	0	0	0	1	2	7	7	8	6	4	3	1
P69	Shetland-N-Balta	2.5	2.4	0	0	0	1	2	7	5	7	3	2	1	1

[1]From HGLM with Site, Year, Year by Month and Year by Site as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 7: Estimated[1] probability (%) that DSP levels in mussels tested positive, for each site and each year, averaged over 12 months. The value 0% represents a small positive number having a value of less than 0.5%. Probabilities of 10% and higher are shown in bold.

				2001	2002	2003	2004	2005	2006	2007
		Avg prev[2]		9.7	6.8	5.9	4.2	2.1	4.7	
ID	Site		Avg[2]	9.6	6.8	5.8	4.1	2.0	3.3	3.2
G80	Eastcoast	8.3	7.5	6	**12**	**20**	1	**11**	1	1
G26	Dumfries	1.5	1.2	1	1	1	1	5	0	0
G8	Ayr-LochStriven	**14.3**	**12.3**	**19**	**30**	**10**	5	**18**	1	2
G16	WC-LochFyne	9.9	8.6	**18**	7	**19**	**12**	1	2	2
G10	WC-LochEtive	0.5	0.4	1	1	0	0	0	0	0
G9	WC-LochCreran	0.9	0.6	1	1	0	2	0	0	0
P5	Mull-LochSpelve	1.7	1.4	1	7	1	0	0	0	0
P7	Mull-LochScridain	4.5	4.1	**11**	8	4	1	0	2	2
G1	Mull-LochnaKeal	1.4	1.2	1	3	2	0	0	1	1
G31	WC-LochLeven	1.5	1.2	3	1	1	2	1	0	0
G28	WC-Lochaber	**12.1**	**10.2**	**21**	**11**	**17**	**13**	1	4	0
G41	Skye	**10.3**	8.6	**17**	**18**	8	9	1	3	0
G35	NWC-LochTorridon	5.5	4.5	**25**	2	1	3	0	0	0
G39	NWC-Ullapool	5.9	4.5	**21**	3	2	1	0	2	0
G48	NWC-other	8.6	7.0	**28**	**10**	5	1	1	2	0
G23	Lewis-LochRoag	4.5	3.9	2	3	4	1	0	7	1
G21	LewisHarrisUist	4.1	3.7	1	8	6	2	1	4	2
G54	Orkney	5.6	5.3	**15**	4	4	3	1	5	2
G57	Shetland-SE	5.1	4.4	9	6	1	4	0	4	6
P61	Shetland-SW-Gruting	6.3	6.5	2	8	6	7	1	10	8
P68	Shetland-SW-Vaila	6.7	8.2	2	2	**10**	**17**	1	**12**	**17**
G58	Shetland-W	6.0	7.3	**14**	5	3	7	1	9	**15**
G64	Shetland-NW	8.6	9.3	**12**	**10**	**11**	5	2	**11**	**14**
G56	Shetland-NE	3.6	3.3	10	4	6	1	0	1	2
P69	Shetland-N-Balta	2.5	2.4	2	7	1	4	0	1	2

[1]From HGLM with Site, Year, Year by Month and Year by Site as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 6 years was calculated, and for each year the probability over all sites over 12 months was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 8: Estimated[1] probability (%) that ASP levels in mussels > 5 µg/g, for each site per month, averaged over 6 years. The value of 0% represents a small positive number having a value of les than 0.5%. Probabilities of 1% and higher are shown in bold.

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Avg prev[2]		0.0	0.0	0.3	0.0	0.2	**1.1**	**1.8**	**1.8**	**5.6**	0.3	0.3	0.0
ID	Site		Avg[2]	0.0	0.0	0.3	0.0	0.2	0.9	**1.5**	**2.6**	**4.9**	0.2	0.2	0.0
G80	Eastcoast	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.0	0.0	0.0
G26	Dumfries	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0
G8	Ayr-LochStriven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
G16	WC-LochFyne	0.6	0.4	0.0	0.0	0.1	0.0	0.1	0.4	0.7	**1.2**	**2.4**	0.1	0.1	0.0
G10	WC-LochEtive	**1.1**	0.7	0.0	0.0	0.2	0.0	0.1	0.6	**1.1**	**2.0**	**3.9**	0.1	0.2	0.0
G9	WC-LochCreran	0.9	0.7	0.0	0.0	0.2	0.0	0.1	0.6	**1.1**	**1.9**	**3.9**	0.1	0.2	0.0
P5	Mull-LochSpelve	**1.7**	**1.9**	0.0	0.0	0.5	0.0	0.4	**1.8**	**3.1**	**5.5**	**10.4**	0.4	0.4	0.0
P7	Mull-LochScridain	**1.4**	**1.1**	0.0	0.0	0.3	0.0	0.2	1.0	**1.8**	**3.1**	**6.0**	0.2	0.2	0.0
G1	Mull-LochnaKeal	0.6	0.5	0.0	0.0	0.1	0.0	0.1	0.4	0.7	**1.3**	**2.6**	0.1	0.1	0.0
G31	WC-LochLeven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0
G28	WC-Lochaber	**1.3**	0.9	0.0	0.0	0.3	0.0	0.2	0.9	**1.5**	**2.7**	**5.3**	0.2	0.2	0.0
G41	Skye	**1.6**	**1.1**	0.0	0.0	0.3	0.0	0.2	1.0	**1.7**	**3.1**	**6.0**	0.2	0.2	0.0
G35	NWC-LochTorridon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0
G39	NWC-Ullapool	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.0	0.0	0.0
G48	NWC-other	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.5	**1.1**	0.0	0.0	0.0
G23	Lewis-LochRoag	**4.0**	**3.9**	0.0	0.0	**1.3**	0.0	0.8	**4.1**	**7.0**	**11.7**	**20.6**	0.9	**1.0**	0.0
G21	LewisHarrisUist	**1.6**	**1.4**	0.0	0.0	0.4	0.0	0.3	**1.3**	**2.3**	**4.1**	**7.9**	0.3	0.3	0.0
G54	Orkney	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.0	0.0	0.0
G57	Shetland-SE	**2.3**	**3.4**	0.0	0.0	**1.1**	0.0	0.7	**3.4**	**5.9**	**10.0**	**17.9**	0.8	0.9	0.0
P61	Shetland-SW-Gruting	**1.9**	**2.9**	0.0	0.0	0.9	0.0	0.6	**2.8**	**4.9**	**8.4**	**15.5**	0.6	0.7	0.0
P68	Shetland-SW-Vaila	**1.4**	**1.2**	0.0	0.0	0.3	0.0	0.2	**1.1**	**2.0**	**3.4**	**6.7**	0.2	0.3	0.0
G58	Shetland-W	0.4	0.3	0.0	0.0	0.1	0.0	0.1	0.3	0.5	0.9	**1.8**	0.1	0.1	0.0
G64	Shetland-NW	**1.2**	0.9	0.0	0.0	0.3	0.0	0.2	0.8	**1.5**	**2.6**	**5.2**	0.2	0.2	0.0
G56	Shetland-NE	1.0	0.7	0.0	0.0	0.2	0.0	0.1	0.6	**1.1**	**2.0**	**4.0**	0.1	0.2	0.0
P69	Shetland-N-Balta	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.0	0.0	0.0

[1]From HGLM with Site and Year as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 9: Estimated[1] probability (%) that ASP levels in king scallop gonads exceeded 20 µg/g, for each site per month, averaged over 7 years. Probabilities of 50% and higher are shown in bold.

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Avg prev[2]		8	12	0	0	22	11	17	**56**	41	**52**	38	23
ID	Site		Avg[2]	9	13	9	0	19	11	19	50	44	**54**	41	23
G16	WC-LochFyne	20	21	7	11	7	0	16	9	16	45	39	50	36	20
G41	Skye	24	25	9	14	9	0	19	12	20	**51**	45	**55**	42	24
G39	NWC-Ullapool	29	29	11	17	11	0	24	15	24	**58**	**51**	**62**	48	29
G64	Shetland-NW	20	22	7	11	7	0	16	9	16	46	40	50	36	20

[1]From HGLM with Site and Year as random effects and Month as fixed effect.

[2]For each site the average probability over 12 months over 7 years was calculated, and for each month the probability over all sites over 7 years was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 10: Risk of non-detection (%), i.e. probability that a site is unknowingly toxic, for DSP in mussels using the sampling frequencies introduced in 2006. Risk of non-detection of 1% or more shown in bold.

		Current frequency[1]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				1	1	1	4	4	4	4	4	4	4	4	2
		Avg prev[2]		0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**
ID	Site		Avg[2]	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
G80	Eastcoast	0.2	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
G26	Dumfries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
G8	Ayr-LochStriven	0.5	0.3	0.0	0.0	**1.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.9**
G16	WC-LochFyne	0.2	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**
G10	WC-LochEtive	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G9	WC-LochCreran	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
P5	Mull-LochSpelve	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
P7	Mull-LochScridain	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
G1	Mull-LochnaKeal	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
G31	WC-LochLeven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
G28	WC-Lochaber	0.3	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**
G41	Skye	0.3	0.2	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**
G35	NWC-LochTorridon	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.5**
G39	NWC-Ullapool	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**
G48	NWC-other	0.3	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.1**
G23	Lewis-LochRoag	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
G21	LewisHarrisUist	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
G54	Orkney	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
G57	Shetland-SE	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
P61	Shetland-SW-Gruting	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
P68	Shetland-SW-Vaila	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
G58	Shetland-W	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
G64	Shetland-NW	0.2	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.1**
G56	Shetland-NE	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
P69	Shetland-N-Balta	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

[2]For each site the average risk was calculated, and for each month the average risk was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 11: Risk of non-detection (%), i.e. probability that a site unknowingly exceeds 5 µg/g, for ASP in mussels using the sampling frequencies introduced in 2006. Risk of non-detection of 1% or more shown in bold.

		Current frequency[1]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				1	1	1	2	2	2	4	4	4	4	4	1
		Avg prev[2]		0.0	0.0	0.2	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0
ID	Site		Avg[2]	0.0	0.0	0.2	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
G80	Eastcoast	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G26	Dumfries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G8	Ayr-LochStriven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G16	WC-LochFyne	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
G10	WC-LochEtive	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0
G9	WC-LochCreran	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0
P5	Mull-LochSpelve	0.1	0.1	0.0	0.0	0.4	0.0	0.2	0.9	0.0	0.0	0.0	0.0	0.0	0.0
P7	Mull-LochScridain	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0
G1	Mull-LochnaKeal	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
G31	WC-LochLeven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G28	WC-Lochaber	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
G41	Skye	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0
G35	NWC-LochTorridon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G39	NWC-Ullapool	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G48	NWC-other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
G23	Lewis-LochRoag	0.4	0.3	0.0	0.0	0.9	0.0	0.4	**2.0**	0.0	0.0	0.0	0.0	0.0	0.0
G21	LewisHarrisUist	0.1	0.1	0.0	0.0	0.3	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0
G54	Orkney	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G57	Shetland-SE	0.2	0.2	0.0	0.0	0.8	0.0	0.3	**1.7**	0.0	0.0	0.0	0.0	0.0	0.0
P61	Shetland-SW-Gruting	0.2	0.2	0.0	0.0	0.7	0.0	0.3	**1.4**	0.0	0.0	0.0	0.0	0.0	0.0
P68	Shetland-SW-Vaila	0.1	0.1	0.0	0.0	0.3	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0
G58	Shetland-W	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
G64	Shetland-NW	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
G56	Shetland-NE	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0
P69	Shetland-N-Balta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

[2]For each site the average risk was calculated, and for each month the average risk was calculated. Avg prev (shown in blue) refers to averages based on 2001/6 data, as reported in Report S14036.

Table 12: Sampling frequencies (1 = once per month, 2 = every fortnight; 4 = every week) for sampling schemes with the maximum risk of non-detection (PSP exceeding field closure limit) set at 5 or 1%, for PSP in mussels. Sampling frequencies exceeding once per month are shown in bold.

		max risk 5%												max risk 1%											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Current frequency[1]	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
ID	Site																								
G80	Eastcoast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	1	1	1	1	1	1
G26	Dumfries	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G8	Ayr-LochStriven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	1	1	1	1	1
G16	WC-LochFyne	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G10	WC-LochEtive	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G9	WC-LochCreran	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P5	Mull-LochSpelve	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P7	Mull-LochScridain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**2**	**2**	**2**	1	1	1
G1	Mull-LochnaKeal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G31	WC-LochLeven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G28	WC-Lochaber	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	**2**	1	1	1
G41	Skye	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	1	1	1	1	1
G35	NWC-LochTorridon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	**2**	1	1	1
G39	NWC-Ullapool	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G48	NWC-other	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	1	1	1	1	1
G23	Lewis-LochRoag	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	1	1	1	1	1	1
G21	LewisHarrisUist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G54	Orkney	1	1	1	1	1	**2**	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	1	1	1
G57	Shetland-SE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	1	1	1	1	1	1
P61	Shetland-SW-Gruting	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P68	Shetland-SW-Vaila	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	**2**	1	1	1
G58	Shetland-W	1	1	1	1	**2**	**4**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1
G64	Shetland-NW	1	1	1	1	**2**	**4**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1
G56	Shetland-NE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	1	1	1	1	1	1
P69	Shetland-N-Balta	1	1	1	1	1	**2**	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**2**	**4**	**4**	1	1	1

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

Table 13: Sampling frequencies (1 = once per month, 2 = every fortnight; 4 = every week) for sampling schemes with the maximum risk of non-detection (DSP positive) set at 5 or 1%, for DSP in mussels. Sampling frequencies exceeding once per month are shown in bold.

		max risk 5%												max risk 1%									
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Current frequency[1]	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**
ID	Site																								
G80	Eastcoast	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**2**	**2**	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**
G26	Dumfries	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**2**	1	1
G8	Ayr-LochStriven	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G16	WC-LochFyne	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**2**	**2**	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G10	WC-LochEtive	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G9	WC-LochCreran	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	1	**2**	1	1	1	1
P5	Mull-LochSpelve	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**2**	**2**	1	1
P7	Mull-LochScridain	1	1	1	1	1	**2**	**2**	**4**	**2**	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**
G1	Mull-LochnaKeal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**4**	1	1	1	1
G31	WC-LochLeven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**2**	**4**	**4**	**2**	1	1
G28	WC-Lochaber	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**2**	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G41	Skye	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**2**	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G35	NWC-LochTorridon	1	1	1	1	1	**2**	**2**	**2**	**4**	**2**	1	1	1	1	1	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G39	NWC-Ullapool	1	1	1	1	1	1	**2**	**2**	**4**	**2**	1	1	1	1	1	**2**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G48	NWC-other	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**2**	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G23	Lewis-LochRoag	1	1	1	1	1	**2**	**4**	**4**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**2**	1
G21	LewisHarrisUist	1	1	1	1	1	**4**	**4**	**2**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
G54	Orkney	1	1	1	1	1	**4**	**4**	**4**	**4**	**2**	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**
G57	Shetland-SE	1	1	1	1	1	**4**	**2**	**4**	**2**	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
P61	Shetland-SW-Gruting	1	1	1	1	1	**4**	**4**	**4**	**2**	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
P68	Shetland-SW-Vaila	1	1	1	1	**4**	**4**	**4**	**4**	**2**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
G58	Shetland-W	1	1	1	1	1	**4**	**4**	**4**	**4**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**2**
G64	Shetland-NW	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**2**	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G56	Shetland-NE	1	1	1	1	1	**2**	**2**	**2**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
P69	Shetland-N-Balta	1	1	1	1	1	**2**	1	**2**	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	**2**	1

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

Table 14: Sampling frequencies (1 = once per month, 2 = every fortnight; 4 = every week) for sampling schemes with the maximum risk of non-detection (ASP exceeding field closure limit) set at 5 or 1%, for ASP in king scallop gonads. Sampling frequencies exceeding once per month are shown in bold.

		max risk 5%												max risk 1%									
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Current frequency[1]	1	1	1	**2**	**2**	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1	1	**2**	**2**	**2**	**4**	**4**	**4**	**4**	**4**	1
ID	Site																								
G16	WC-LochFyne	**2**	**4**	**2**	1	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G41	Skye	**2**	**4**	**2**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G39	NWC-Ullapool	**4**	**4**	**4**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
G64	Shetland-NW	**2**	**4**	**2**	1	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

Table 15: Sampling frequencies (1 = once per month, 2 = every fortnight; 4 = every week) for sampling schemes with the maximum risk of non-detection (ASP exceeding 5µg/g) set at 5 or 1%, for ASP in mussels. Sampling frequencies exceeding once per month are shown in bold.

		max risk 5%												max risk 1%									
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Current frequency[1]	**1**	**1**	**1**	**2**	**2**	**2**	**4**	**4**	**4**	**4**	**4**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**4**	**4**	**4**	**4**	**4**	**1**
ID	Site																								
G80	Eastcoast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G26	Dumfries	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G8	Ayr-LochStriven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G16	WC-LochFyne	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	1	1	1
G10	WC-LochEtive	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	1	1	1
G9	WC-LochCreran	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	1	1	1
P5	Mull-LochSpelve	1	1	1	1	1	1	1	1	**4**	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	1	1	1
P7	Mull-LochScridain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1
G1	Mull-LochnaKeal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	1	1	1
G31	WC-LochLeven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G28	WC-Lochaber	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1
G41	Skye	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1
G35	NWC-LochTorridon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G39	NWC-Ullapool	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G48	NWC-other	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G23	Lewis-LochRoag	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	1	1	1
G21	LewisHarrisUist	1	1	1	1	1	1	1	1	**2**	1	1	1	1	1	1	1	1	1	**4**	**4**	**4**	1	1	1
G54	Orkney	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G57	Shetland-SE	1	1	1	1	1	1	1	**2**	**4**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	1	1	1
P61	Shetland-SW-Gruting	1	1	1	1	1	1	1	**2**	**4**	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	1	1	1
P68	Shetland-SW-Vaila	1	1	1	1	1	1	1	1	**2**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1
G58	Shetland-W	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	1	1	1
G64	Shetland-NW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	1	1	1
G56	Shetland-NE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	1	1
P69	Shetland-N-Balta	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

Table 16: Sampling frequencies (1 = once per month, 2 = every fortnight; 4 = every week) for sampling schemes with the maximum risk of non-detection of positive PSP set at 5 or 1%, for PSP in mussels. Sampling frequencies exceeding once per month are shown in bold.

		max risk 5%												max risk 1%									
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Current frequency[1]	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
ID	Site																								
G80	Eastcoast	1	1	1	1	**4**	**4**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1
G26	Dumfries	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G8	Ayr-LochStriven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	**2**	1	1	1
G16	WC-LochFyne	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G10	WC-LochEtive	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G9	WC-LochCreran	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P5	Mull-LochSpelve	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P7	Mull-LochScridain	1	1	1	1	**4**	**4**	**4**	**4**	**4**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G1	Mull-LochnaKeal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	**2**	1	1	1
G31	WC-LochLeven	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G28	WC-Lochaber	1	1	1	1	**4**	**4**	1	**2**	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**2**	1	1
G41	Skye	1	1	1	1	**4**	**4**	**2**	**2**	**2**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G35	NWC-LochTorridon	1	1	1	1	**2**	**2**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1
G39	NWC-Ullapool	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G48	NWC-other	1	1	1	1	**4**	**4**	1	1	1	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	1	1	1
G23	Lewis-LochRoag	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**2**	**4**	**4**	1	1	1
G21	LewisHarrisUist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	**2**	**4**	**4**	1	1	1
G54	Orkney	1	1	1	1	**4**	**4**	**2**	**4**	**2**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G57	Shetland-SE	1	1	1	1	**2**	**2**	1	1	1	1	1	1	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1
P61	Shetland-SW-Gruting	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**4**	**4**	1	**2**	1	1	1	1
P68	Shetland-SW-Vaila	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1	**2**	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G58	Shetland-W	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1	**2**	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G64	Shetland-NW	1	1	1	**2**	**4**	**4**	**4**	**4**	**4**	1	1	1	**2**	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1
G56	Shetland-NE	1	1	1	1	**4**	**4**	**2**	**2**	**2**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**2**	1	1
P69	Shetland-N-Balta	1	1	1	1	**4**	**4**	**2**	**2**	**2**	1	1	1	1	1	1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1	1

[1]Current sampling frequency: 1=once per month, 2=fortnightly, 4=once per week.

Table 17: Summary of Pacific oyster samples that tested positive for DSP during April 2001 – March 2008.

Group	Groupname	Pod	Production Area[1]	Site Name[1]	Date Collected	week	year
G8	Ayr-LochStriven	53	Fairlie	Southannan	02/10/2001	40	2001
G16	WC-LochFyne	15	Islay	Loch Gruinart	17/09/2002	38	2002
G16	WC-LochFyne	16	Loch Fyne	The Point	22/07/2003	30	2003
G16	WC-LochFyne	15	Colonsay	The Strand	15/09/2004	38	2004
G16	WC-LochFyne	13	West Loch Tarbert: Loup Bay	Loup Bay	25/06/2007	26	2007
G10	WC-LochEtive	6	Seil Sound	North	25/11/2003	48	2003
G9	WC-LochCreran	9	Loch Creran	South Shian	15/10/2001	42	2001
G41	Skye	40	Loch Harport: Inner	Carbost	29/08/2004	36	2004
G41	Skye	40	Loch Harport: Inner	Carbost	12/09/2004	38	2004

[1]From original data files provided by FSAS.

Table 18: Summary of Pacific oyster samples that tested positive for PSP during April 2001 – March 2008.

Group	Groupname	Pod	Production Area[1]	Site Name[1]	Date Collected	PSP µg/100g	week	year
G16	WC-LochFyne	15	Colonsay	The Strand	26/05/2002	28	22	2002
P5	Mull-LochSpelve	5	Loch Spelve	not provided	28/05/2002	29	22	2002

[1]From original data files provided by FSAS.

Table 19: numbers of samples tested for DSP and PSP during April 2001 – March 2008.

			DSP		PSP	
Group	GroupName	Pod	Mussels	Pacific oysters	Mussels	Pacific oysters
G80	Eastcoast	20	12		12	
		80	47		40	
		107	12		12	
		111	46		38	
G26	Dumfries	26	69		64	
		27	73		63	
G8	Ayr-LochStriven	8	189	5	160	4
		52	35		21	
		53	106	39	100	41
		108	4		2	
		18	26		34	
G16	WC-LochFyne	13	1	106		124
		14	40	20	48	44
		15	11	77	18	86
		16	145	59	133	59
		19	37		47	
G10	WC-LochEtive	4	16	87	13	125
		6	53	55	60	60
		10	156		154	
		3	40		50	
		84	33		41	
G9	WC-LochCreran	9	144	63	150	97
		11	99	41	94	45
P5	Mull-LochSpelve	5	139		130	1
P7	Mull-LochScridain	7	146		149	
G1	Mull-LochnaKeal	1	137	5	140	14
		2	46	13	59	19
		12		67		120
		32	31		22	
G31	WC-LochLeven	29	22		17	
		31	170		177	
		34	65		57	
G28	WC-Lochaber	28	137	29	106	81
		30	63		60	
		33	65	7	54	9
		85	6		6	
G41	Skye	40	21	89	14	105
		41	168		160	
		42	43		45	1
		43	57		59	
		45	80		79	
		46	8		9	
G35	NWC-LochTorridon	35	148		139	
		37	72		80	2

G39	NWC-Ullapool	36	74		74	
		39	91		110	
G48	NWC-other	38	102		96	
		47	78		76	
		48	86		90	
		49	45		50	
		50	56	1	64	2
		51	41	33	52	32
		78	1		1	
		110	6	2	7	1
G23	Lewis-LochRoag	23	335		309	
		24	49		53	
		102	5		5	
G21	LewisHarrisUist	21	134		133	
		22	48		36	
		25	61	1	45	5
		76	5		13	
		77		1		1
G54	Orkney	54	3		1	
		103	50		49	
		104		2	1	5
		105	12		12	
G57	Shetland-SE	57	88		87	
		59	53		58	
		60	49		62	
		62	36		31	
		63	49		63	
		67	65		65	
P61	Shetland-SW-Gruting	61	177		158	
P68	Shetland-SW-Vaila	68	169		162	
G58	Shetland-W	58	131		129	
		72	110		91	
G64	Shetland-NW	64	141		140	
		70	101		112	
		71	92		100	
G56	Shetland-NE	56	93	1	79	3
		65	98		104	
		66	23		16	
		81	46		51	
		82	8		7	
P69	Shetland-N-Balta	69	115	2	105	2
		Total	5944	805	5813	1088

Table 20: Summary of DSP test results in mussels corresponding to Pacific oyster samples testing positive for DSP, from April 2001 to March 2008.

Information positive P. oyster samples:									
Date collected	02/10/01	17/09/02	22/07/03	15/09/04	25/06/07	25/11/03	15/10/01	29/08/04	12/09/04
Group	G8	G16	G16	G16	G16	G10	G9	G41	G41
Pod	53	15	16	15	13	6	9	40	40
test result	DSP=1	DSP=1	DSP=1	DSP=1	DSP=1	DSP=1	DSP=1	DSP=1	DSP=1
Data-based									
DSP > 0 in mussels, same week									
from same pod?	no	N/A[1]	yes	N/A	N/A	N/A	no	N/A	N/A
from same group of pods?	no	no	yes	no	No	no	no	no	no
DSP > 0 in mussels, preceding 4 weeks									
from same pod?	yes	N/A	yes	N/A	N/A	N/A	N/A	N/A	N/A
from same group of pods?	yes	no	yes	no	yes	no	N/A	yes	no
Open/closed[2]	closed	open	closed	open	closed	open	open	closed	open
Model-based	Probability of positive DSP in mussels, predicted from models								
Probability[3] (%) of DSP>0 in mussels	Oct 01	Sep 02	Jul 03	Sep 04	Jun 07	Nov 03	Oct 01	Aug 04	Sep 04
for corresponding year, month and site	46	4.8	58	13	13	0.6	2.8	19	9.6

[1]N/A: not available due to absence of samples.
[2]Assigned 'closed' if a positive mussel DSP test result was observed in the same group of pods for up to 4 weeks prior to occurrence of positive Pacific oyster sample.
[3]Based on models described in Material & Methods.

Table 21: Summary of PSP test results in mussels corresponding to Pacific oyster samples testing positive for PSP, from April 2001 to March 2008.

Information positive P. oyster samples:		
Date collected	26/05/02	28/05/02
Group	G16	P5
Pod	15	5
test result	PSP=28	PSP=29
Data-based		
PSP > 0 in mussels, same week		
from same pod?	N/A[1]	no
from same group of pods?	N/A	no
PSP > 0 in mussels, preceding 4 weeks		
from same pod?	N/A	no
from same group of pods?	no	no
Open/closed[2]	open	open
Model-based	Positive PSP	
Probability[3] (%) of PSP>0 in mussels	May 02	May 02
for corresponding year, month and site	1.0	1.4

[1]N/A: not available due to absence of samples.
[2]Assigned 'closed' if a positive mussel PSP test result was observed in the same group of pods for up to 4 weeks prior to occurrence of positive Pacific oyster sample.
[3]Based on models described in Material & Methods.

FIGURES

Figure 1: Scotland with individual pods (indicated by their pod number) and grouping of pods (Figure 1b), where closed circles in red indicate individual pods (2 pods on Mull and 3 pods in Shetland), open circles, in blue, indicate pods that are grouped.

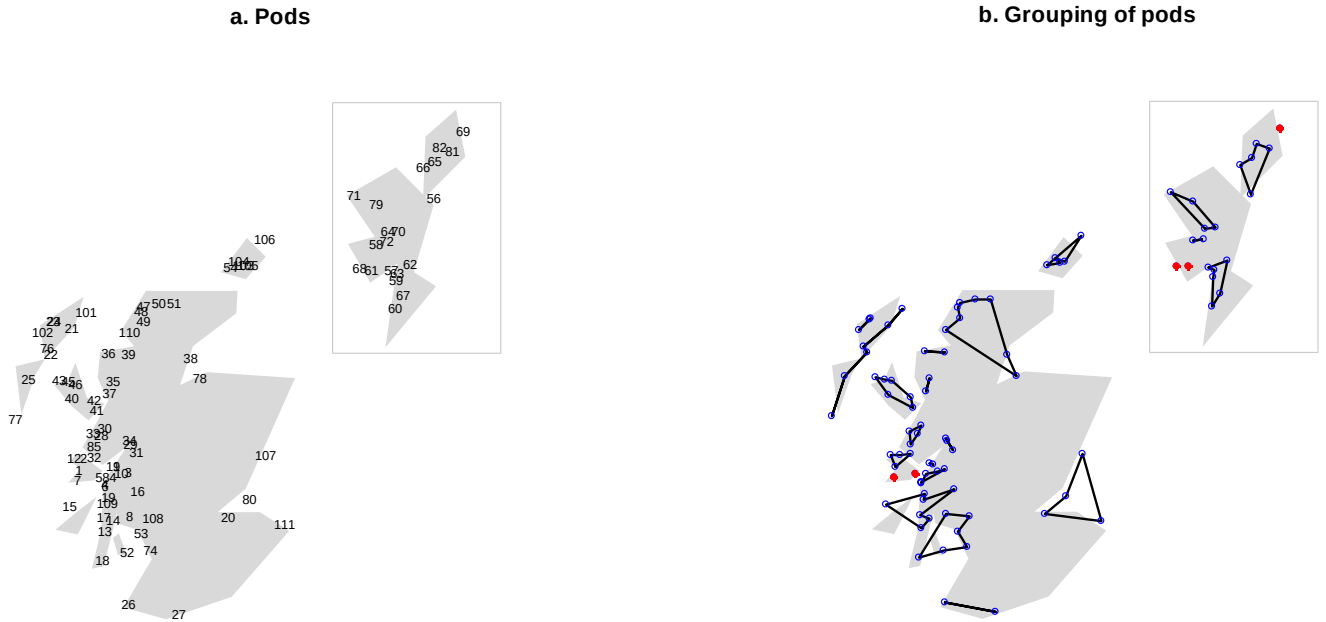


Figure 2: Toxin patterns over time for mussels, king scallops and pacific oysters. For DSP, the percentage of positive samples for each month is plotted (Fig 2a), for PSP and ASP the maximum observed toxicity is plotted for each month (Figs 2b and 2c). DSP and PSP in king scallops refers to the whole scallop, while for DSP the gonad test results have been used. Vertical lines indicate January of each year.

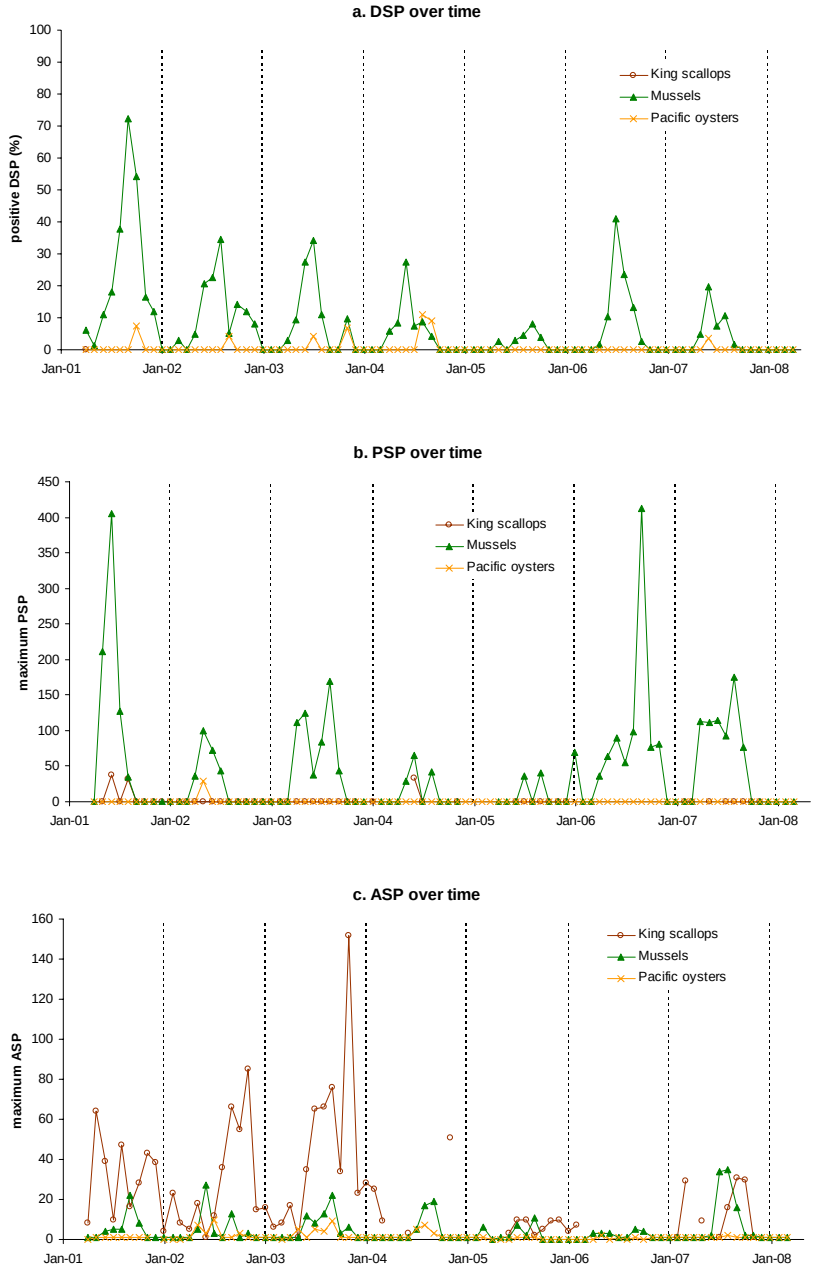


Figure 3: Estimated probability (%) of PSP > 80 ug/100g (Fig 3a), PSP > 40 µg/100g (Fig 3b) and PSP > 0µg/100g (Fig 3c) for each site.

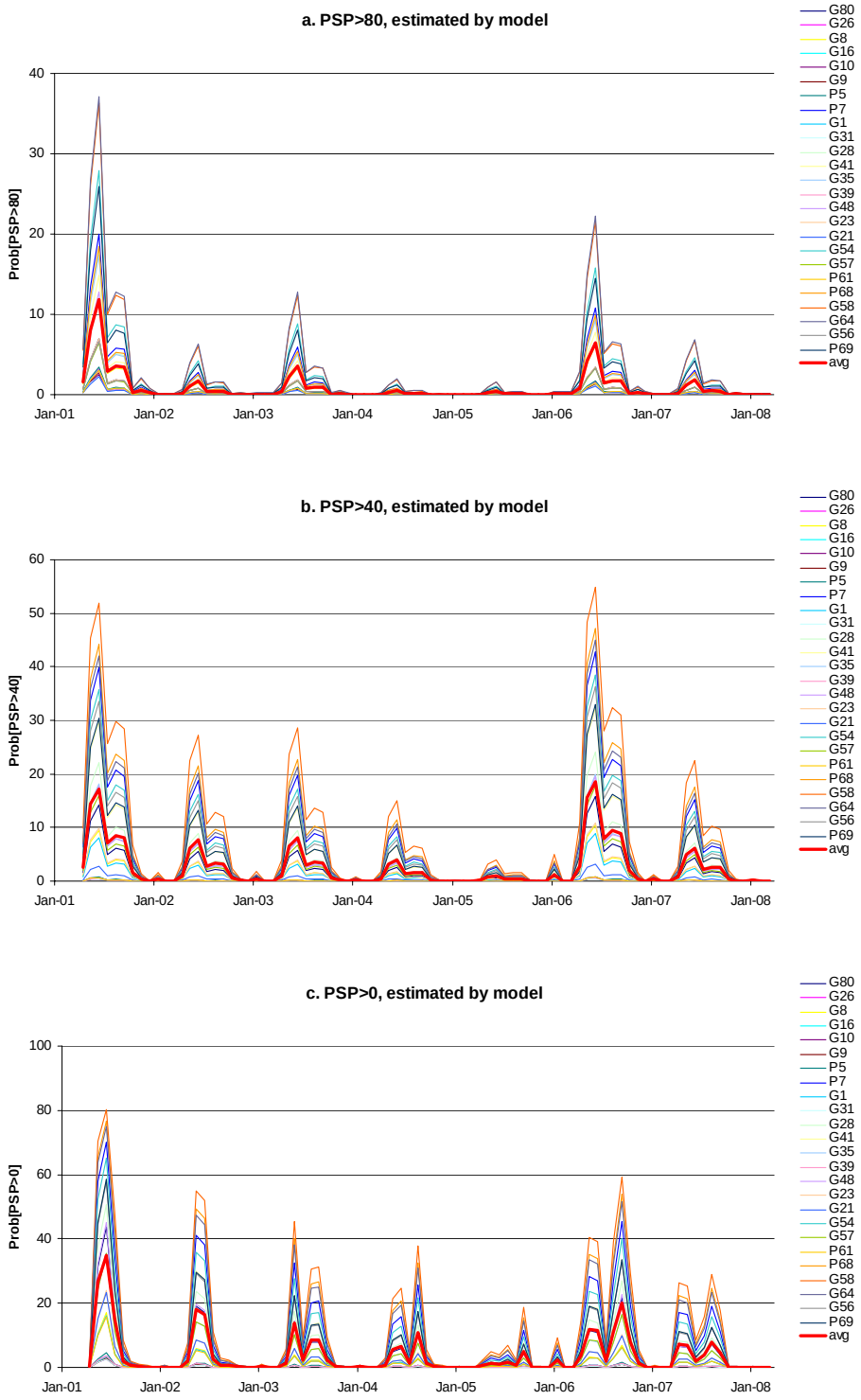
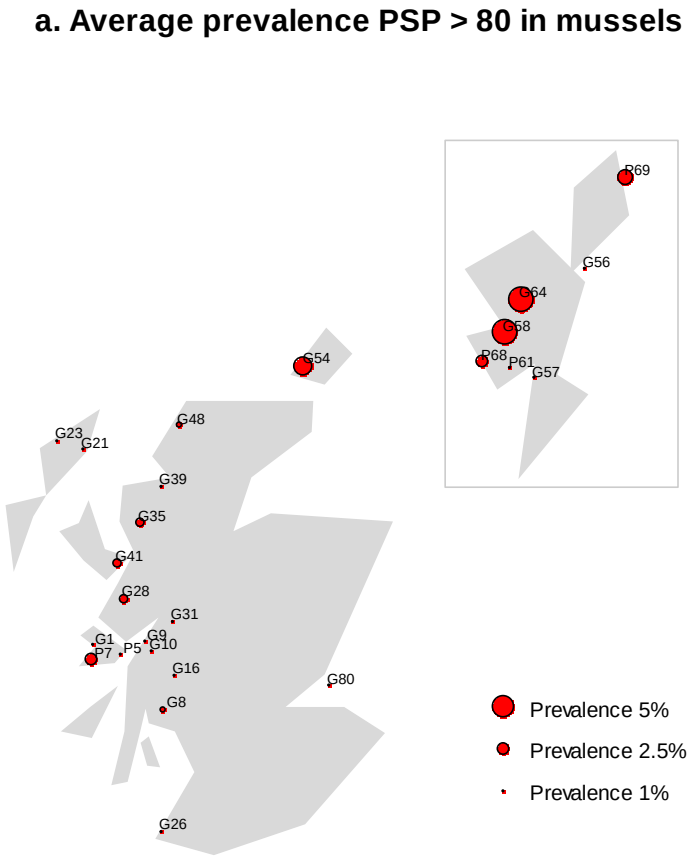
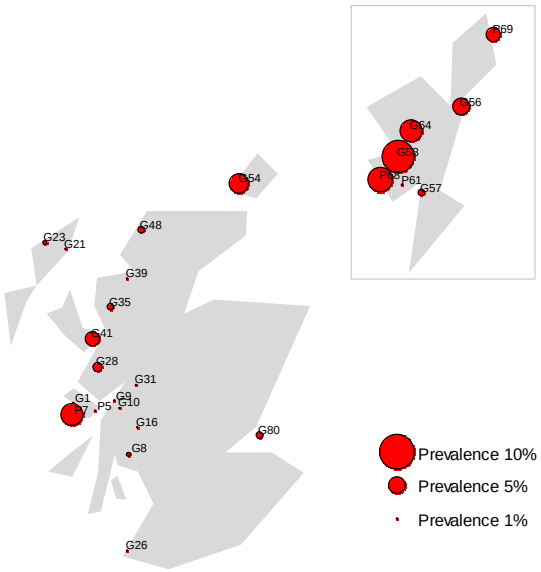


Figure 4: Estimated prevalence (%) of PSP in mussels (PSP > 80, PSP > 40, PSP > 0 in Figures 9a, 9b and 9c, respectively), for an average year and an average month. Although the outline of Shetland is shown enlarged, to keep findings compatible the sizes of the symbols are the same as for mainland Scotland.



b. Average prevalence PSP > 40 in mussels



c. Average prevalence PSP > 0 in mussels

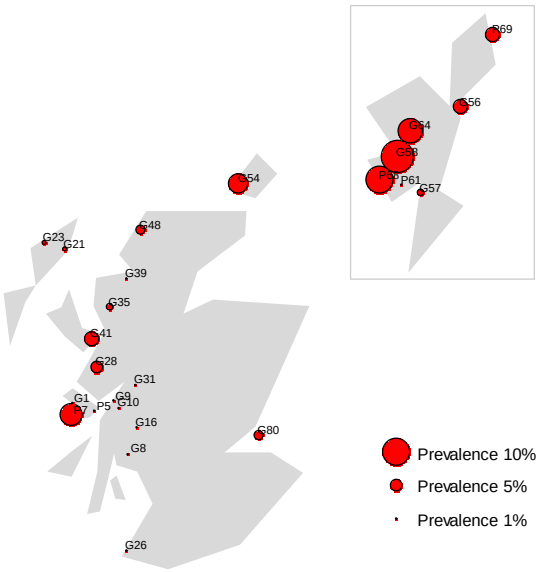
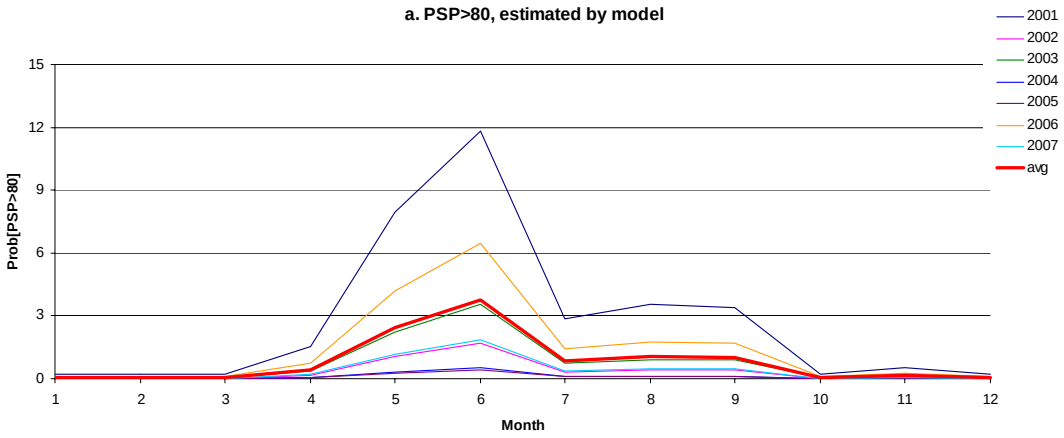
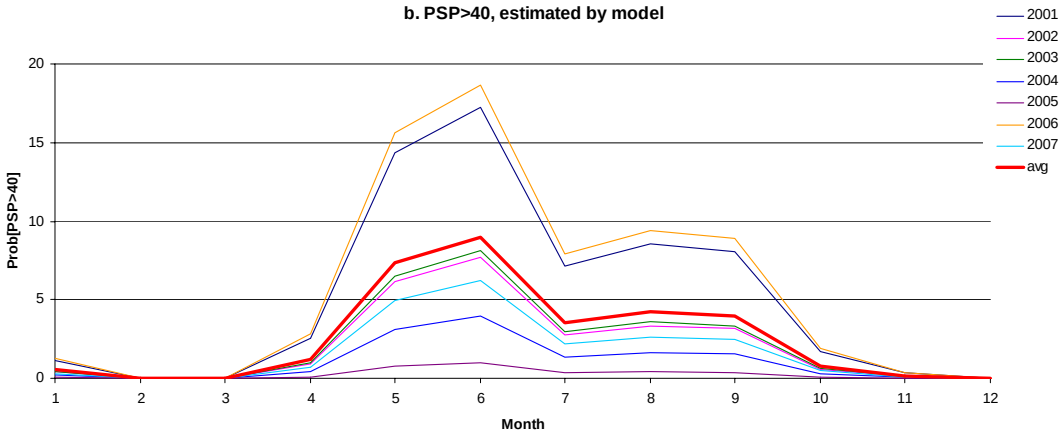


Figure 5: Estimated probability (%) of PSP in mussels exceeding field closure limit, 40µg/100g and exceeding 0 µg/100g, for each of 7 years.





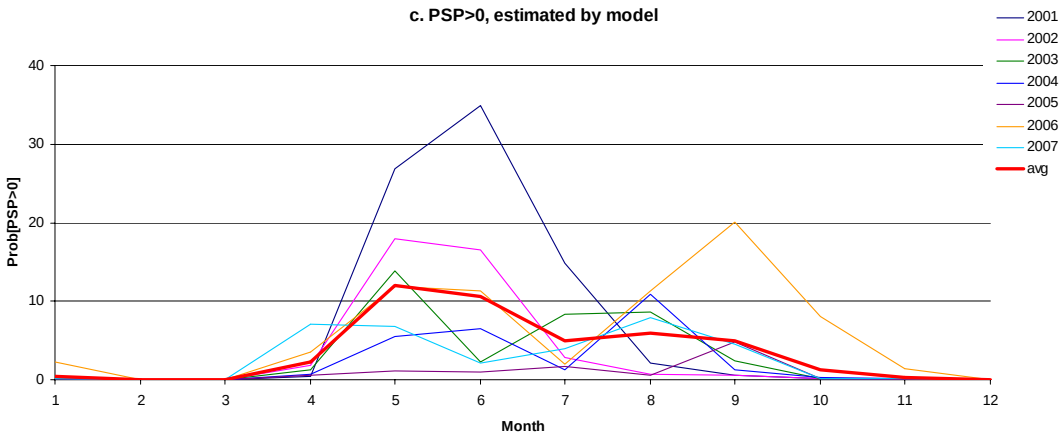


Figure 6: Estimated probability (%) of positive DSP in mussels, for each site.

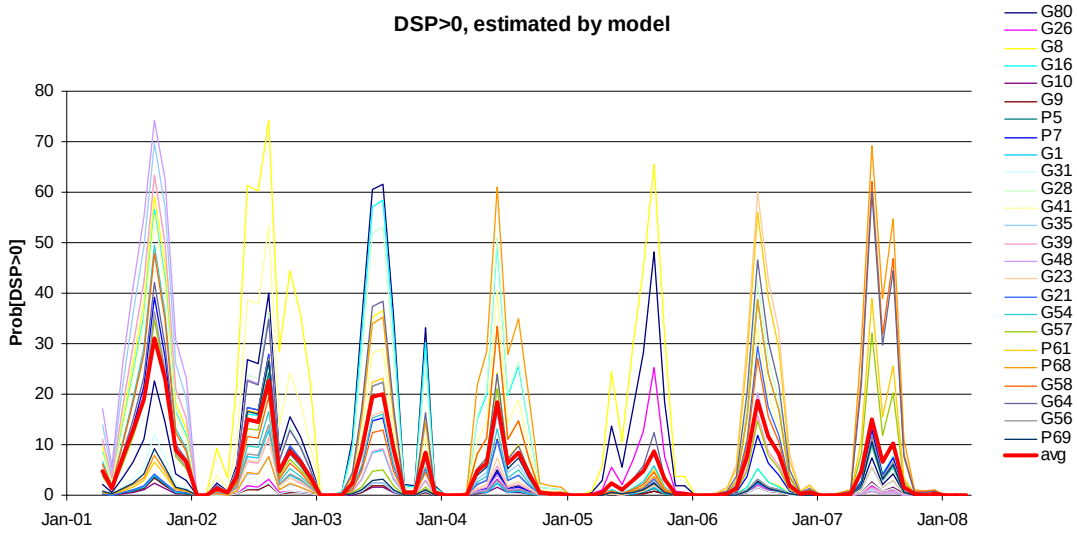


Figure 7: Estimated probability (%) of DSP in mussels testing positive for each of 7 years.

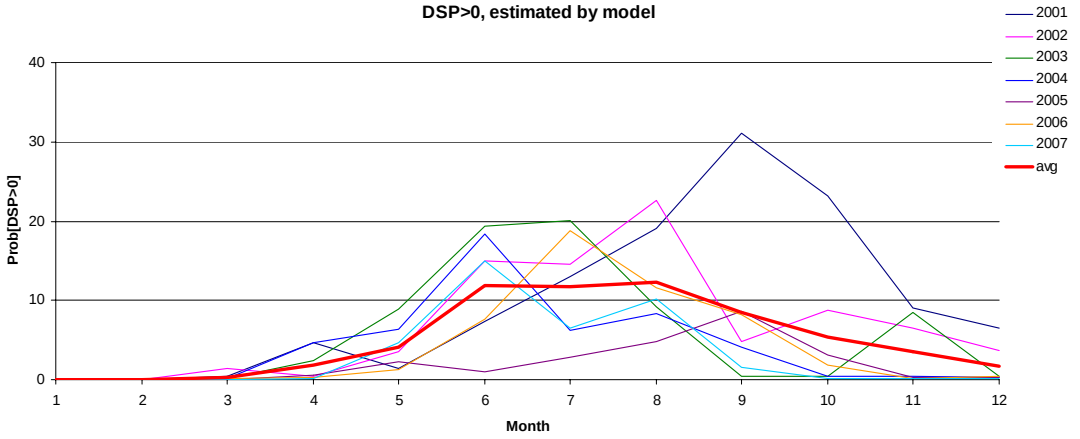


Figure 8: Estimated prevalence (%) of DSP in mussels, for an average year and an average month. Although the outline of Shetland is shown enlarged, to keep findings compatible the sizes of the symbols are the same as for mainland Scotland.

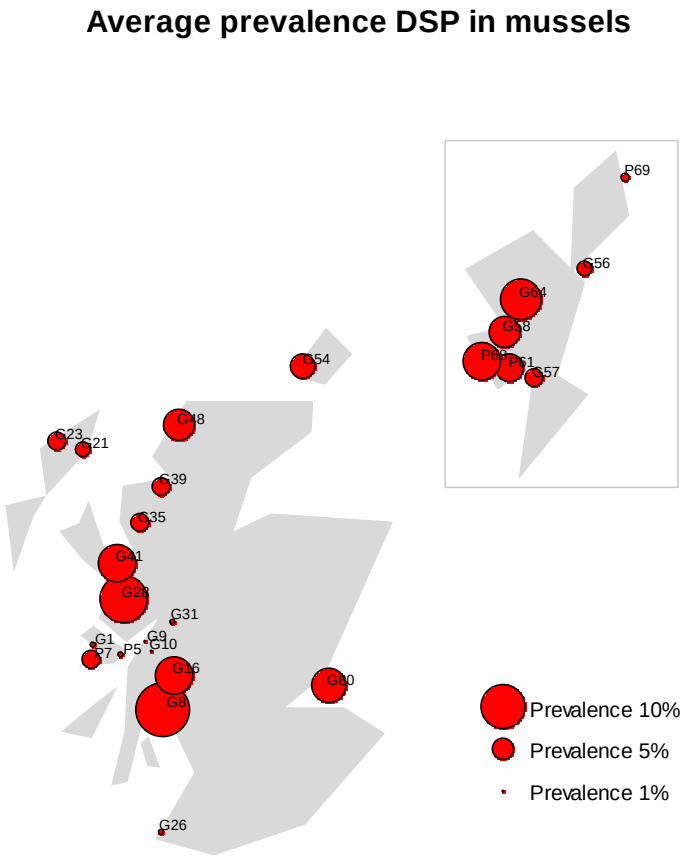


Figure 9: Estimated probability (%) of ASP > 5 µg/g in mussels, for each site.

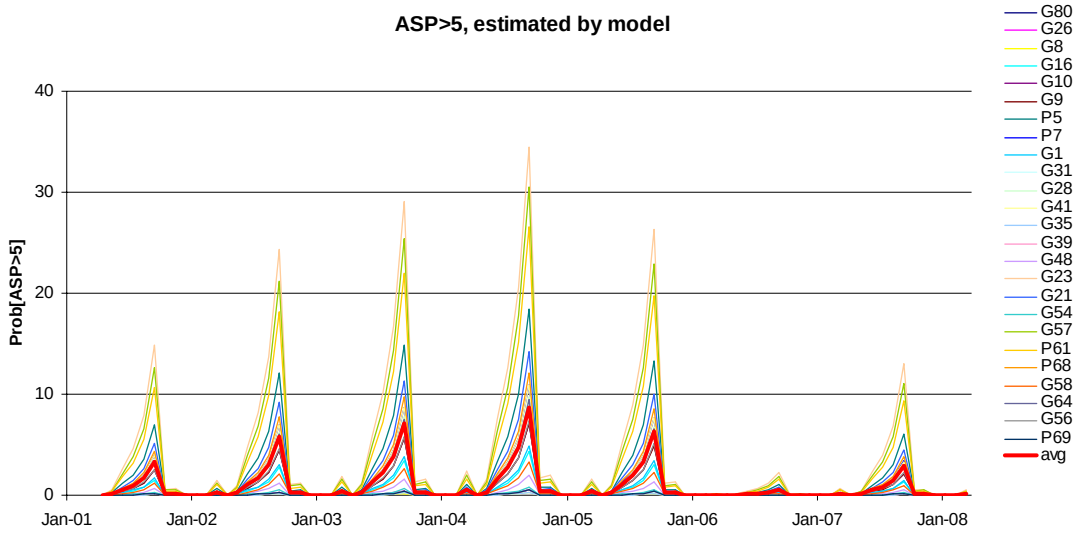


Figure 10: Estimated probability (%) of ASP in mussels > 5µg/g, for each of 7 years.

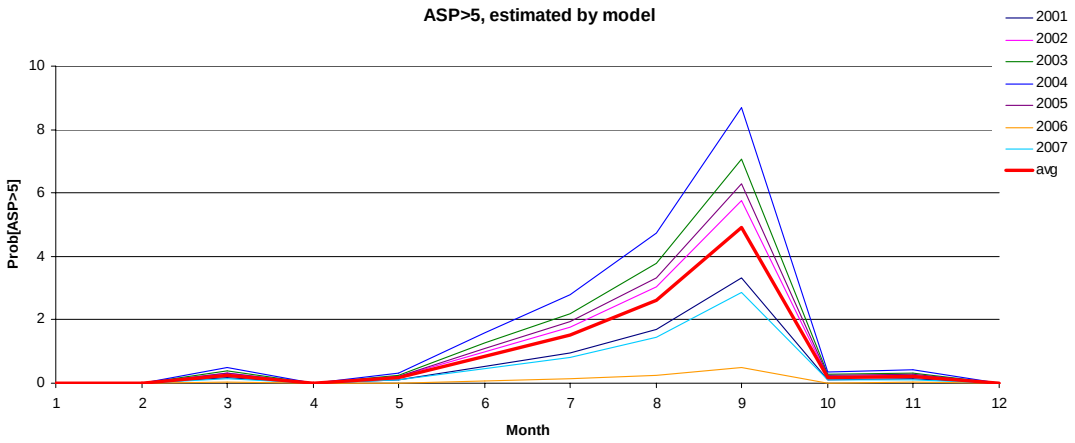
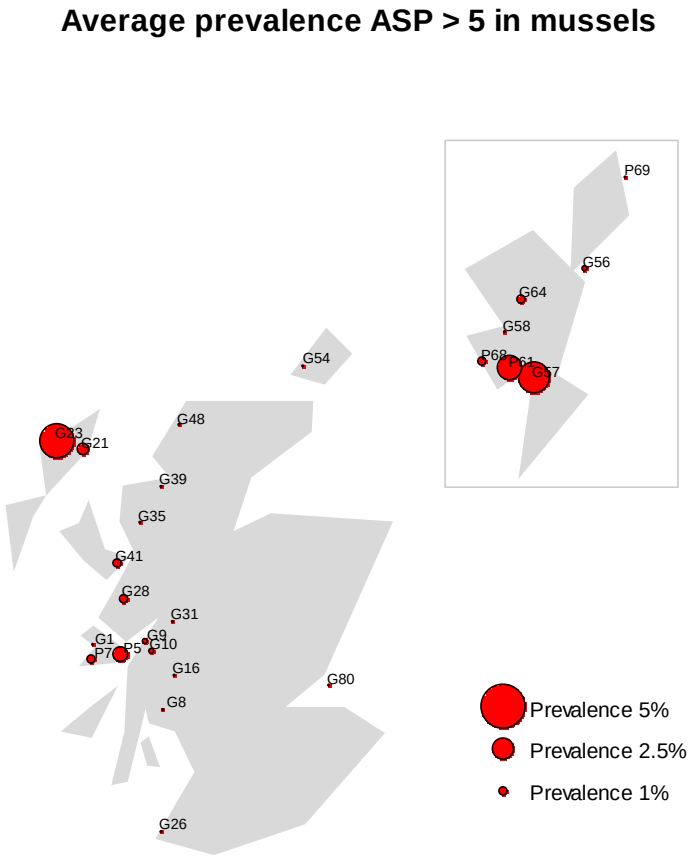


Figure 11: Estimated prevalence (%) of ASP > 5µg/g in mussels, for an average year and an average month. Although the outline of Shetland is shown enlarged, to keep findings compatible the sizes of the symbols are the same as for mainland Scotland.



APPENDIX A: RAW DATA

Figure A1: Proportion of mussel samples testing positive for DSP for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

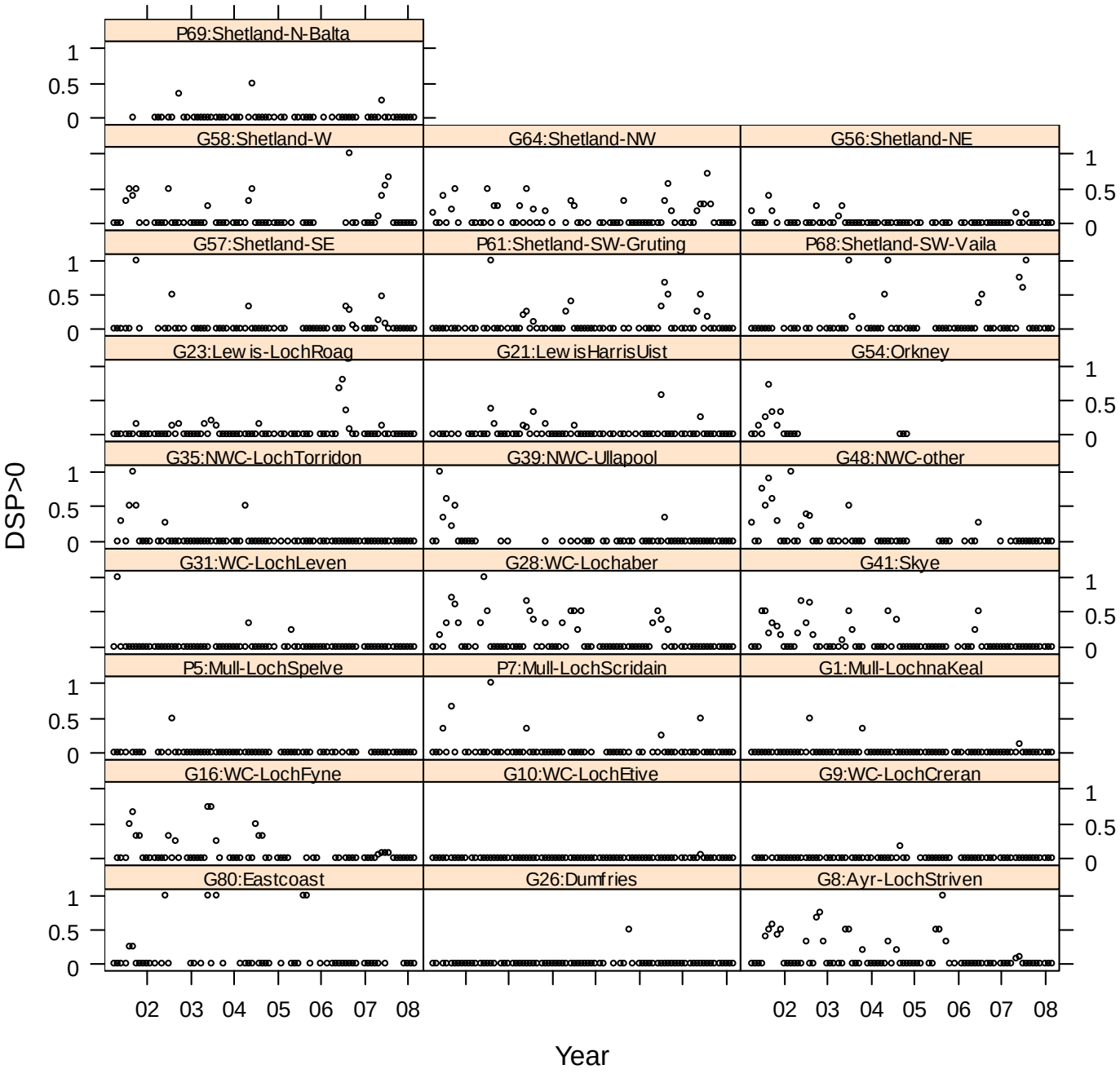


Figure A2: Proportion of mussel samples for which PSP > 0 µg/100g for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

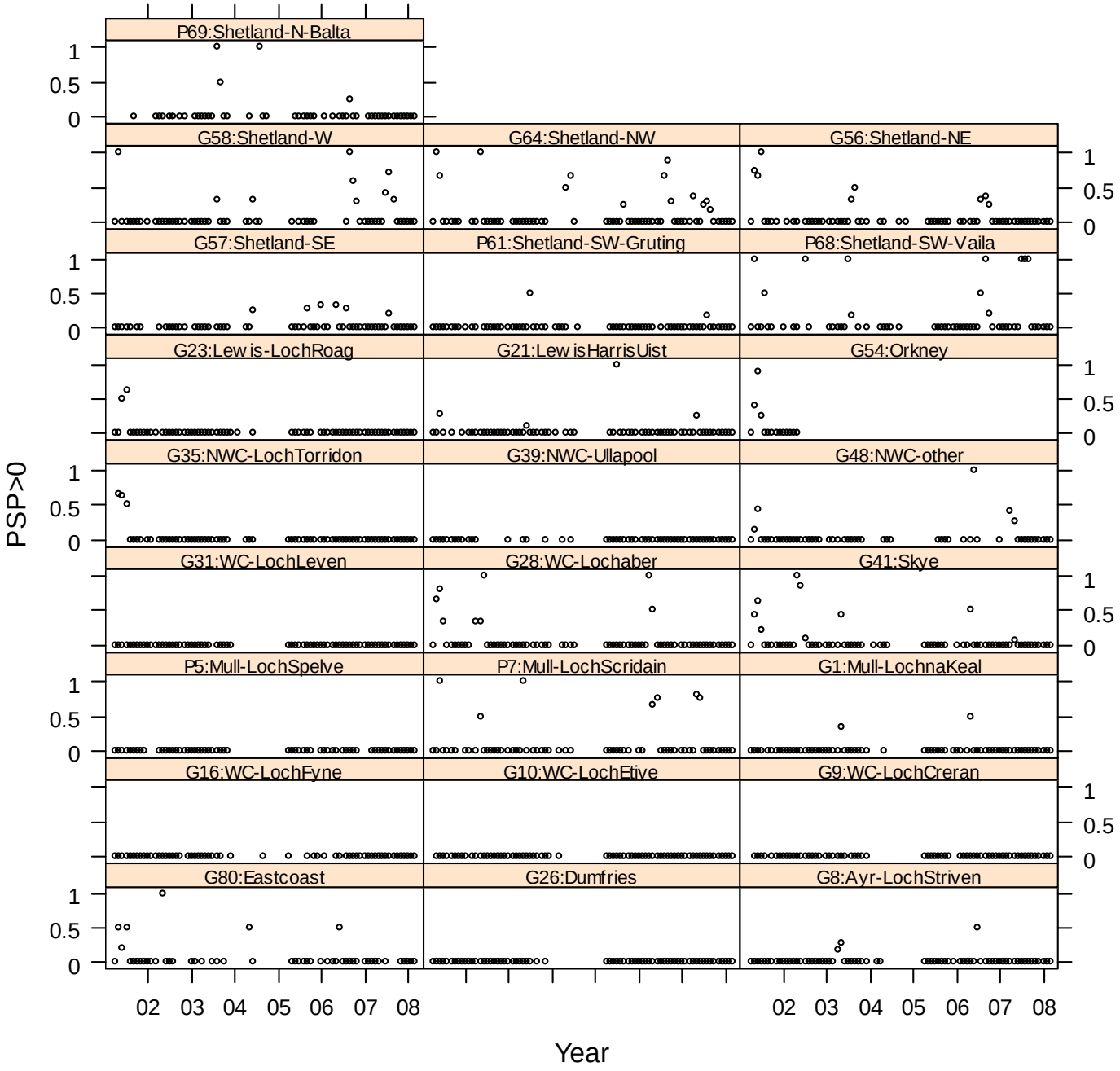


Figure A3: Proportion of mussel samples for which PSP > 40 µg/100g for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

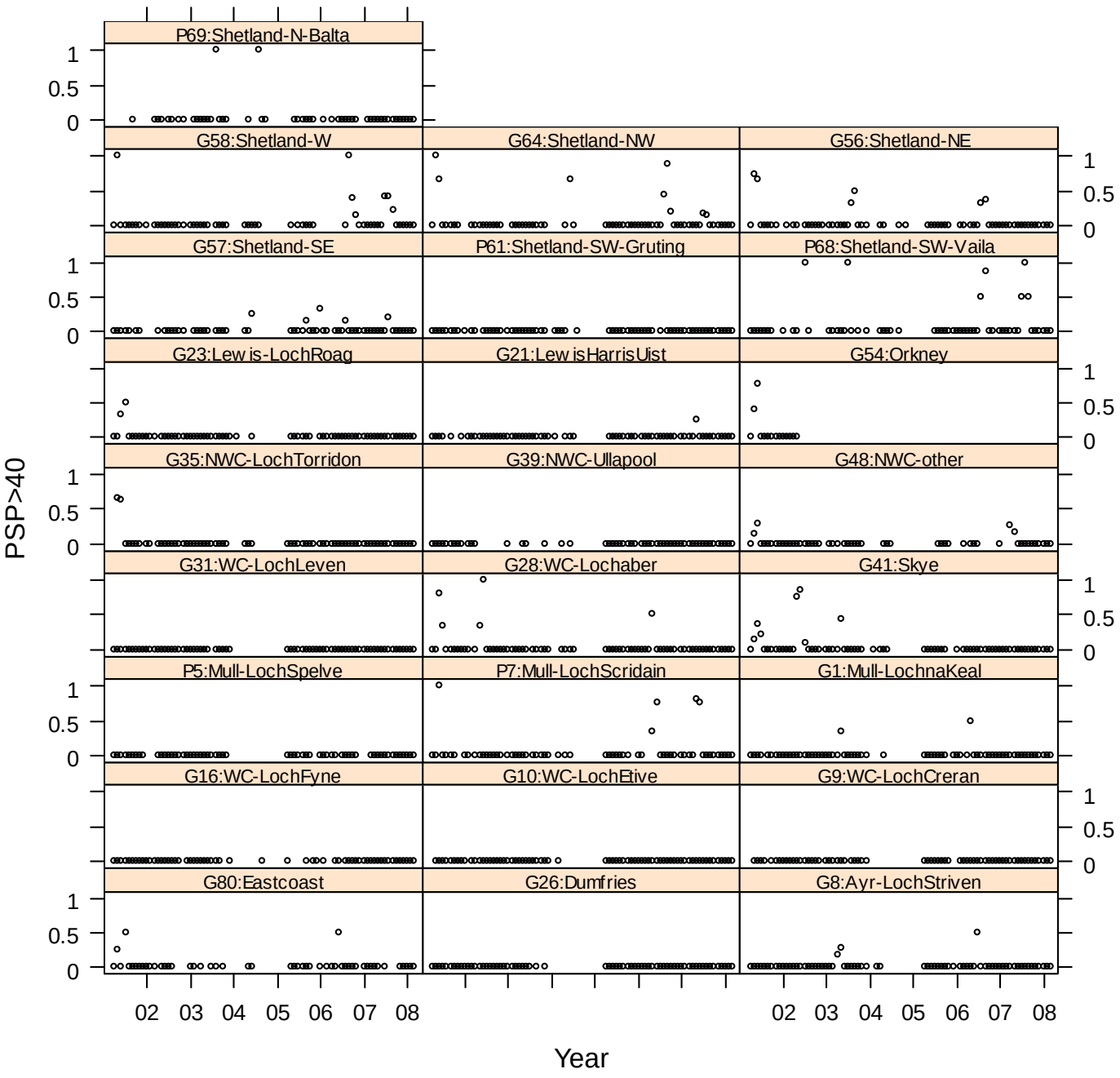


Figure A4: Proportion of mussel samples for which PSP > 80 µg/100g for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

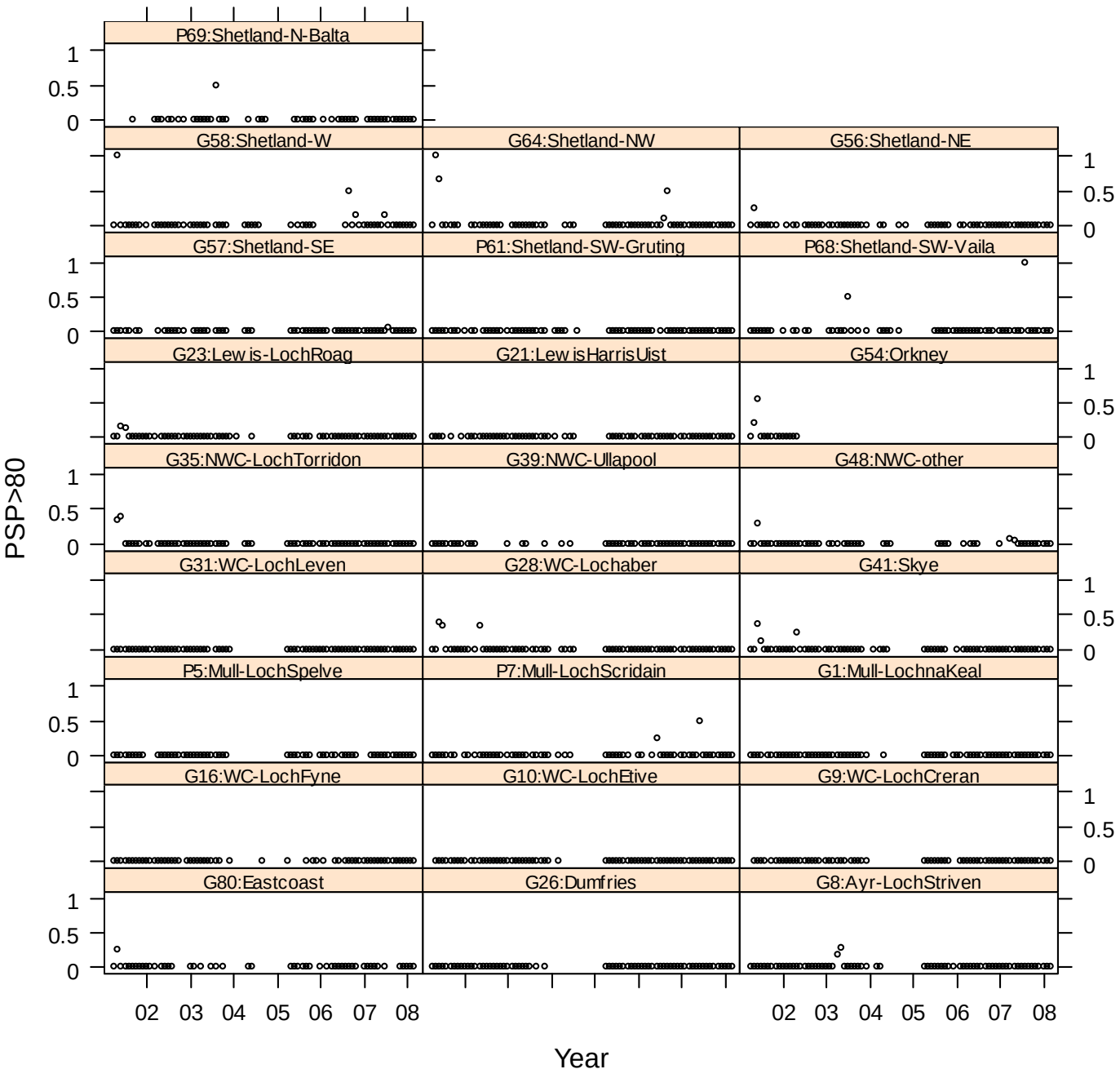


Figure A5: Proportion of mussel samples for which ASP > 5 µg/g for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

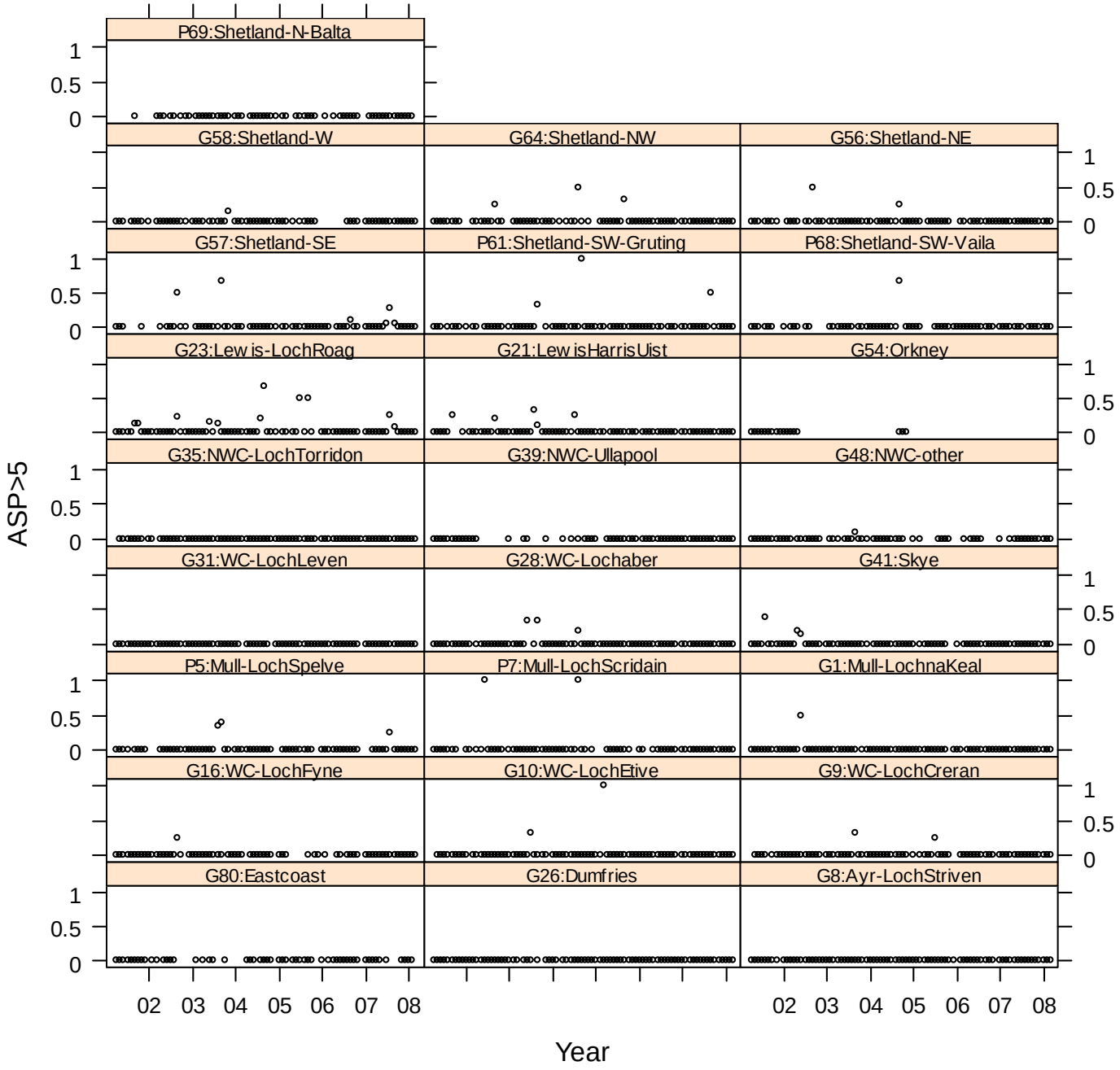


Figure A6: Proportion of king scallop gonad samples for which ASP > 20 µg/g for each month for each site. Rows of sites start from bottom left with Eastcoast, each row up follows the coastline of Scotland approximately clockwise.

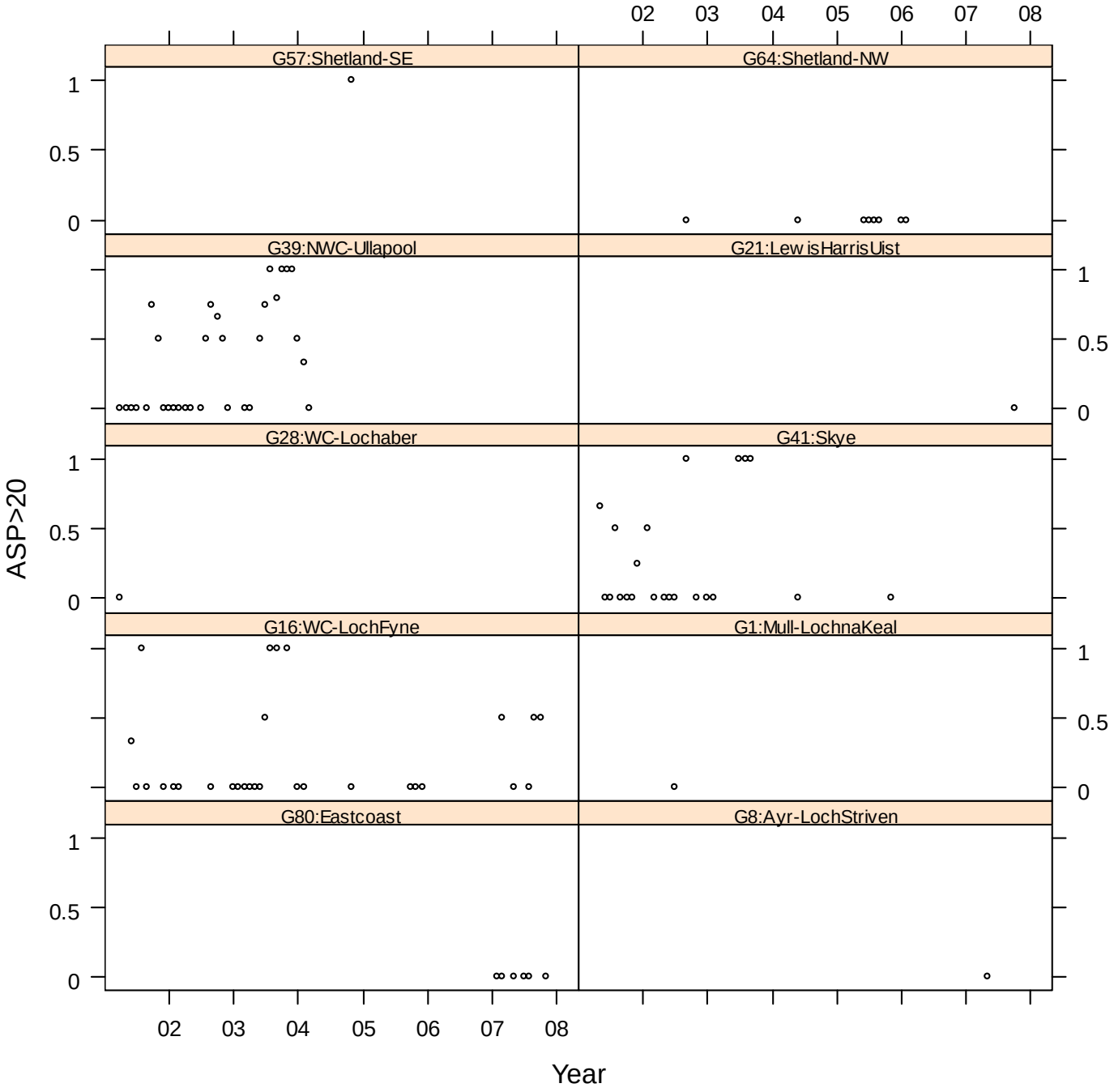


Figure A7: Proportion of pacific oyster samples testing positive for DSP for each month for each site. Rows of sites start from bottom left with Ayr, each row up follows the coastline of Scotland approximately clockwise.

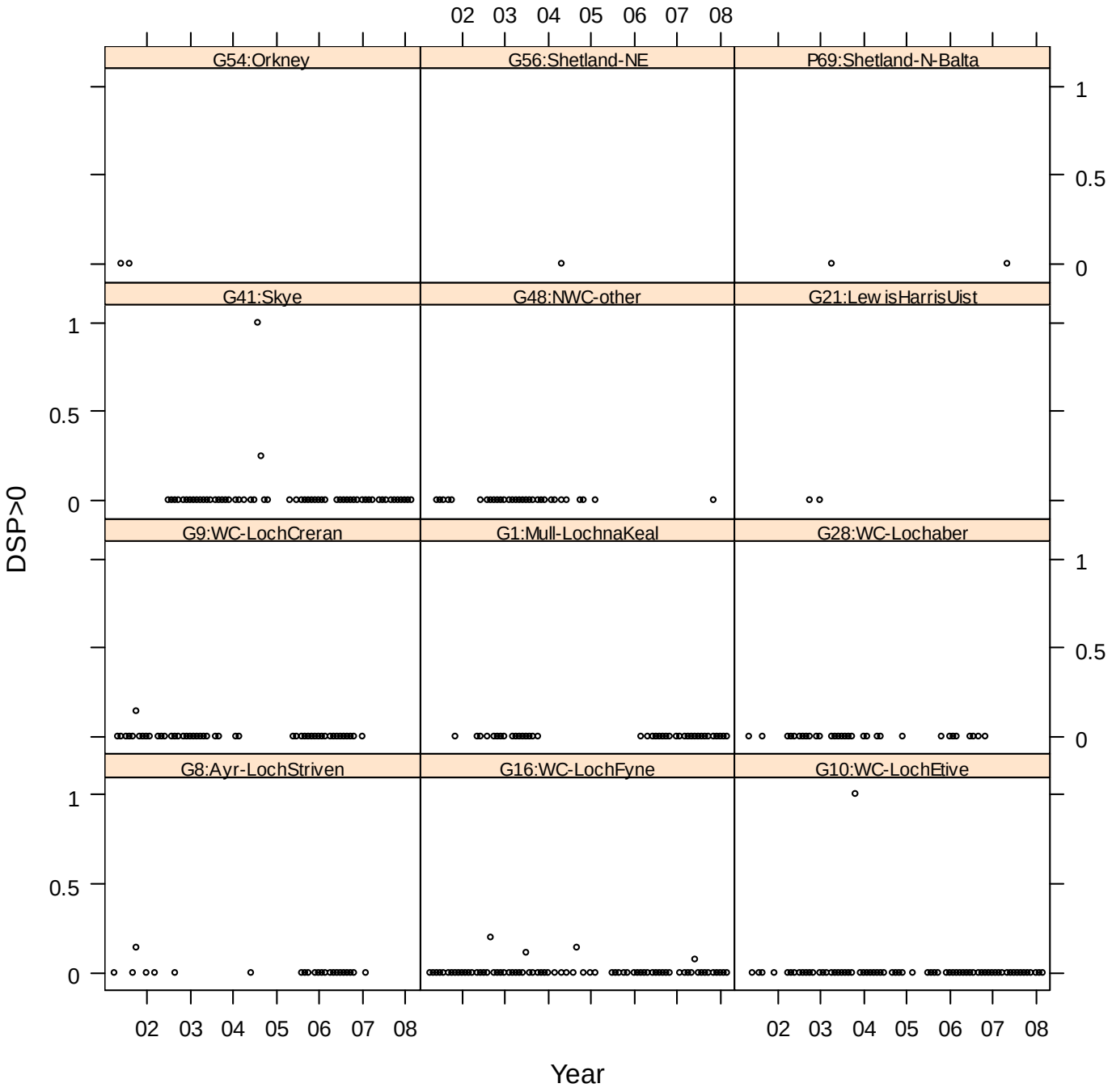
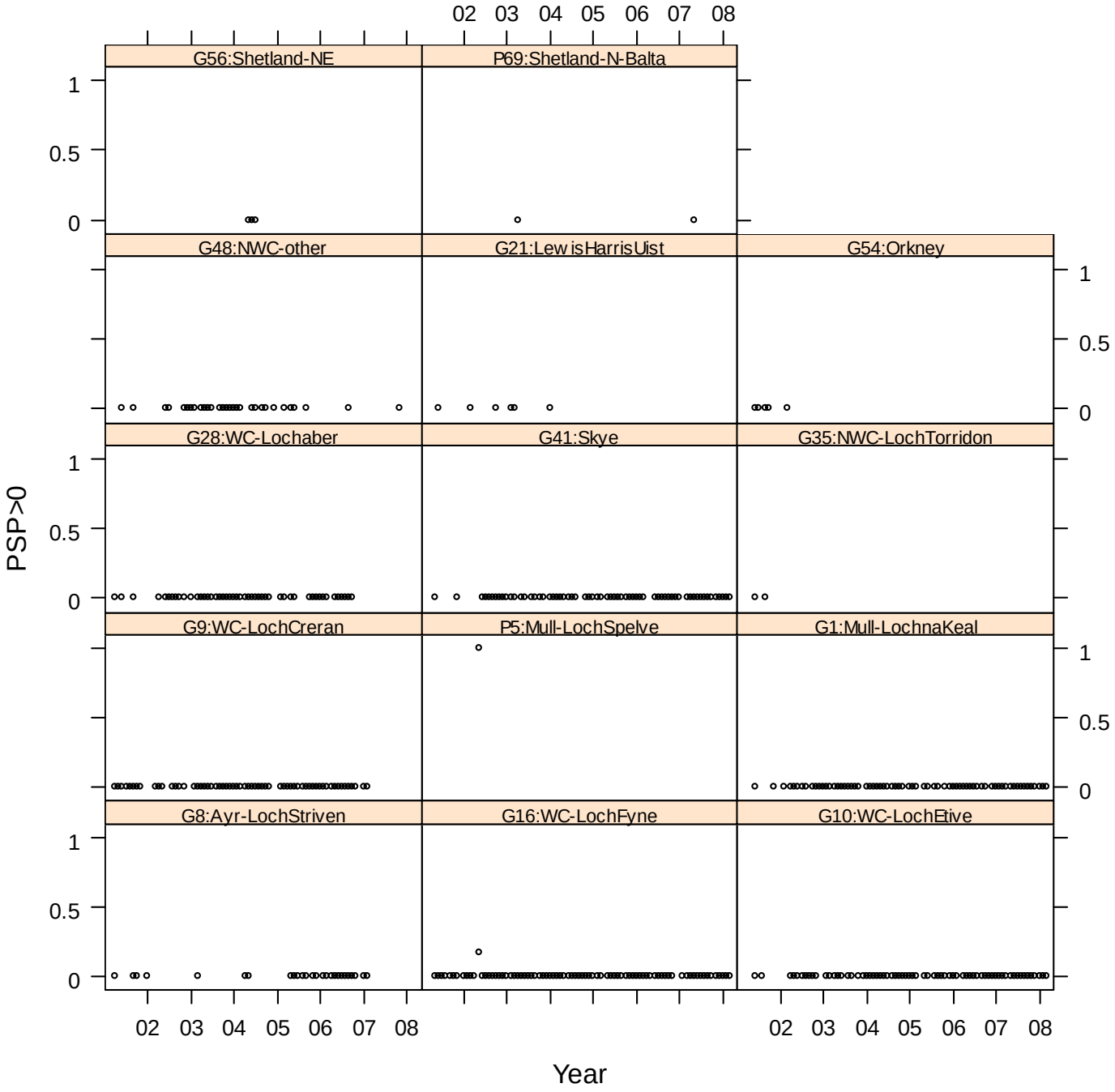


Figure A8: Proportion of pacific oyster samples for which PSP > 0 µg/100g for each month for each site. Rows of sites start from bottom left with Ayr, each row up follows the coastline of Scotland approximately clockwise.



APPENDIX B: PACIFIC OYSTERS VERSUS MUSSELS

Table B1: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during weeks 40 and 42 in 2001. Red = weeks when Pacific oysters tested positive, blue = (group of) pods where positive Pacific oyster samples were found.

Pacific oysters											
Group	Groupname	Pod	36	37	38	39	40	41	42	43	44
G8	Ayr-LochStriven	53		0	0	0	1	0	0	0	0
G16	WC-LochFyne	13	0	0	0				0		
		14						0			
		15							0		
		16	0	0	0	0				0	
G10	WC-LochEtive	6		0							
G9	WC-LochCreran	9	0	0	0	0	0	0	1	0	0
		11			0				0		
G1	Mull-LochnaKeal	1									0
G28	WC-Lochaber	28		0							
G48	NWC-other	51									0
		110	0								

Mussels											
Group	Groupname	Pod	36	37	38	39	40	41	42	43	44
G80	Eastcoast	80	0	0	0	0					
		107	0						0		
		111	1		1	0			0		
G26	Dumfries	26				0					
		27				0		0			
G8	Ayr-LochStriven	8	0						1		
		53		0	1	1	0	1	1	0	1
		108						0			
G16	WC-LochFyne	16	1	0	1		0	0		1	
G10	WC-LochEtive	6			0						
		10			0		0		0		0
G9	WC-LochCreran	9							0	0	0
P5	Mull-LochSpelve	5		0	0				0		0
P7	Mull-LochScridain	7	0	1		1		0	0	0	
G1	Mull-LochnaKeal	1			0				0		
		32			0						
G31	WC-LochLeven	31		0		0		0		0	
		34			0						
G28	WC-Lochaber	28		1	0.67	0	0				
		30	1	1	0.5	1	0	1		1	1
G41	Skye	40							1		
		41	0	0	0	0			0	0	0
		42			1						

		43							1		
		45					0	0	1		0
G35	NWC-LochTorridon	35	1			1					0
		37	1	1	1			1			0
G39	NWC-Ullapool	36	0	0	0	0	0	0	1	0	0
		39			1		1		1		
G48	NWC-other	38		1		1	0	0	1	0	0
		47	1		1	1		1	1		1
		48	1	1		1	1	1	1	0	0
		50				1					1
		110	0		1						
G23	Lewis-LochRoag	23	0	0	0	0	1	0	0	0	
G21	LewisHarrisUist	21	0								
		22	0								
		25	0	0							
G54	Orkney	103	0.33	1	1	1			0.25		1
		105	1						0		
G57	Shetland-SE	67								1	
P61	Shetland-SW-Gruting	61				0				0	
P68	Shetland-SW-Vaila	68				0				0	
G58	Shetland-W	58			0	0				0	
		72			1	1				1	
G64	Shetland-NW	64			0.5	0				0.5	
		70				0				1	
		71								0	
G56	Shetland-NE	56				0		0	0		
		65				0				0	
		66				1			1		0
		81				1				0	
P69	Shetland-N-Balta	69				0					

Table B2: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during week 38 in 2002. Red = week when Pacific oysters tested positive, blue = group of pods where positive Pacific oyster samples were found.

Pacific oysters									
Group	Groupname	Pod	34	35	36	37	38	39	40
G8	Ayr-LochStriven	8				0			
G16	WC-LochFyne	13					0	0	
		15				0	1		0
		16					0		
G10	WC-LochEtive	4			0			0	
		6					0	0	
G9	WC-LochCreran	9					0		
		11				0			
G1	Mull-LochnaKeal	2		0					
G28	WC-Lochaber	28	0				0		
G41	Skye	40		0		0			
G48	NWC-other	51	0				0		0

Mussels									
Group	Groupname	Pod	34	35	36	37	38	39	40
G26	Dumfries	27							0
G8	Ayr-LochStriven	8							1
		53				0			0
G16	WC-LochFyne	14		0				1	
		16			0		0		0
G10	WC-LochEtive	10	0		0		0		0
G9	WC-LochCreran	9	0		0		0		0
		11				0			
P5	Mull-LochSpelve	5	1	0	0	0		0	0
P7	Mull-LochScridain	7		1	0	0			0
G1	Mull-LochnaKeal	1	1		0	0		0	
		32					0		
G31	WC-LochLeven	31		0			0		
		34	0				0		
G28	WC-Lochaber	28	0			0	0		
		30	0	0			0		
		33	0						
G41	Skye	40	1						
		41	1	0	0		0		0
		42					0		
		43					0		
		45	0				1		
G35	NWC-LochTorridon	35	0		0		0		
		37	0				0		
G48	NWC-other	38	0	0	0	0	0	0	0

		47		0	0		0	0	0
		48	1	0	0	0	0	0	0
		49	1	0	0	0	0	0	
G23	Lewis-LochRoag	23	0	0	0	0		0	0
		102							0
G21	LewisHarrisUist	21		0		0	0	0	0
		22	0		1				
		25			0				0
G57	Shetland-SE	62			0	0			
P61	Shetland-SW-Gruting	61						0	0
G58	Shetland-W	58					0		
G64	Shetland-NW	64		0		0			
		70		0	0				
		71				1			0
G56	Shetland-NE	56				0			
		65						0	

Table B3: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during week 30 in 2003. Red = week when Pacific oysters tested positive, blue = pod where positive Pacific oyster samples were found.

Pacific oysters									
Group	Groupname	Pod	26	27	28	29	30	31	32
G16	WC-LochFyne	13		0		0		0	
		15				0		0	
		16	0	0	0	0	1	0	0
G10	WC-LochEtive	6					0		
G9	WC-LochCreran	9	0						0
G1	Mull-LochnaKeal	1				0			
		2				0			
		12				0			
G28	WC-Lochaber	28						0	
G41	Skye	40	0				0		0
G48	NWC-other	51						0	

Mussels									
Group	Groupname	Pod	26	27	28	29	30	31	32
G80	Eastcoast	80				0			
G26	Dumfries	26	0						
		27					0		0
G8	Ayr-LochStriven	8	1						
		52	1	1		1	0	1	
		53				0		0	
G16	WC-LochFyne	16	1	1	1	1	1	0	1
G10	WC-LochEtive	6				0			
		10	0				0		0
G9	WC-LochCreran	9	0						0
P5	Mull-LochSpelve	5	0				0		0
P7	Mull-LochScridain	7	0			0			0
G1	Mull-LochnaKeal	1		0		0		0	
		2				0			
		32						0	
G31	WC-LochLeven	31	0						
G28	WC-Lochaber	28						0	
		30						1	
G41	Skye	41	0			1	1	0	1
		43						0	
G35	NWC-LochTorridon	35	0				0		0
		37				0			
G48	NWC-other	38	0			0		0	
		47						1	
		48				1			
G23	Lewis-LochRoag	23	0	0		1	0	0	0.5
		24				0			

G21	LewisHarrisUist	21	0	0			0	0	
		22		0					1
		25		0					0
P61	Shetland-SW-Gruting	61		0		0		0	0
P68	Shetland-SW-Vaila	68						1	0.5
G58	Shetland-W	58							0
G64	Shetland-NW	64			0				
		70			0	0			0
G56	Shetland-NE	56			0				
		81			0				
P69	Shetland-N-Balta	69					0		0

Table B4: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during weeks 36 and 38 in 2004. Red = weeks when Pacific oysters tested positive, blue = (group of) pods where positive Pacific oyster samples were found.

Pacific oysters											
Group	Groupname	Pod	32	33	34	35	36	37	38	39	40
G16	WC-LochFyne	13							0		
		15							1	0	0
		16	0						0		
G10	WC-LochEtive	6						0	0	0	
G41	Skye	40					1	0	1	0	0

Mussels											
Group	Groupname	Pod	32	33	34	35	36	37	38	39	40
G80	Eastcoast	20									0
		80	0				0				
		111	0				0				
G26	Dumfries	26						0			
		27				0		0			
G8	Ayr-LochStriven	8	1		0		0	0	0	0	0
		52			0						0
		53			0				0		
G16	WC-LochFyne	16	1		0		0		0		1
G10	WC-LochEtive	4	0			0					
		10	0		0		0		0		0
G9	WC-LochCreran	9	0						1		0
		11	0						0		
P5	Mull-LochSpelve	5		0		0		0		0	
P7	Mull-LochScridain	7			0		0		0		
G1	Mull-LochnaKeal	1	0				0		0		
		32			0						
G31	WC-LochLeven	31		0		0			0		0
		34			0						0
G28	WC-Lochaber	28			0.33						1
		33			0						0
G41	Skye	41	0		0		0		0		0
		43	1								
		45	1								
G35	NWC-LochTorridon	35	0		0		0		0		0
G39	NWC-Ullapool	39	0								
G48	NWC-other	38	0	0					0	0	0
		48				0					
G23	Lewis-LochRoag	23	1	0	0	0					
		24				0			0		
G21	LewisHarrisUist	21					0		0		
		22	0			0					
		25	0					0			

G54	Orkney	54									0
G57	Shetland-SE	57		0						0	
		67								0	
P61	Shetland-SW-Gruting	61		0		0		0		0	
P68	Shetland-SW-Vaila	68			0			0			0
G58	Shetland-W	58	0							0	
		72		0				0		0	
G64	Shetland-NW	64	0	0	0	0	0	0	0		0
		70					0				
		71								0	
G56	Shetland-NE	56		0						0	
		65		0					0		
		81		0						0	
P69	Shetland-N-Balta	69				0		0		0	

Table B5: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during week 26 in 2007. Red = weeks when Pacific oysters tested positive, blue = (group of) pods where positive Pacific oyster samples were found

Pacific oysters									
Group	Groupname	Pod	22	23	24	25	26	27	28
G16	WC-LochFyne	13	0	0	0	0	1	0	0
		15		0	0	0	0	0	0
		16			0	0			
G10	WC-LochEtive	4	0	0	0	0	0	0	0
G1	Mull-LochnaKeal	12	0	0	0	0	0	0	0
G41	Skye	40		0		0		0	

Mussels									
Group	Groupname	Pod	22	23	24	25	26	27	28
G26	Dumfries	26			0		0		0
		27				0		0	
G8	Ayr-LochStriven	8	1	1	0	0	0	0	0
		53	0	0	0	0	0	0	0
		18			0				0
G16	WC-LochFyne	14	0	0	0	0	0	0	0
		15	1	0	0				
		16	0	1	0	0	0	0	0
		19	0	0	0	0	0	0	0
G10	WC-LochEtive	6	0	0	0	0	0	0	0
		10	0	0	0	0	0.5	0	0
		3	0	0	0	0	0	0	0
		84	0	0	0	0	0	0	0
G9	WC-LochCreran	9	0	0	0	0	0	0	0
		11	0	0	0	0	0	0	0
P5	Mull-LochSpelve	5	0	0	0	0	0	0	0
P7	Mull-LochScridain	7	0	1			0	0	0
G1	Mull-LochnaKeal	1	0	1	0	0	0	0	0
		2	0	0	0	0	0	0	0
G31	WC-LochLeven	31	0	0	0	0	0	0	0
		34	0	0	0	0	0	0	0
G28	WC-Lochaber	28		0	0		0	0	
		30	0		0				
		33							0
G41	Skye	41	0	0	0	0		0	0
		42		0	0	0		0	0
		43	0		0	0		0	0
		45	0	0	0	0		0	0
		46	0		0	0		0	0
G35	NWC-LochTorridon	35	0	0	0	0		0	0
		37	0	0	0	0		0	0
G39	NWC-Ullapool	36	0	0	0	0		0	0

		39	0	0	0	0	0	0	0
G48	NWC-other	38	0	0	0	0	0	0	0
		47	0	0	0	0	0	0	0
		48	0	0	0	0	0	0	0
		49			0	0	0	0	0
		50	0	0	0	0	0	0	0
		51	0	0	0	0	0	0	0
G23	Lewis-LochRoag	23	0	0		0	0	0	0
		24	0	1	0	0		0	0
G21	LewisHarrisUist	21	0	1	0	0	0	0	0
G57	Shetland-SE	57	0	1	1	1	1	0	0
		59		0		1		0	
		60	0	1	0	0	1	0	0
		62	0	1	0	0	1	1	
		63				1			
		67	0	0	0	0	0.5	0	0
P61	Shetland-SW-Gruting	61	0	1	0.5	0.33	0.33	0	0
P68	Shetland-SW-Vaila	68	0	0	1	1	1	0	0
G58	Shetland-W	58	0	0	0	0	1	0	0
		72	0	1	1	0	0.5	0.5	0
G64	Shetland-NW	64	0	0	0	0	0	0	0
		70	0	0		0	1	0	0
		71	0	1	1	0	0	0	0
G56	Shetland-NE	56						0	0
		65	0	0	0	0	0	0	0
		81	0	0	0	0			
P69	Shetland-N-Balta	69	0	1	0	0	0	0	0

Table B6: Proportion of samples that tested positive for DSP, focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during week 48 in 2003. Red = weeks when Pacific oysters tested positive, blue = (group of) pods where positive Pacific oyster samples were found.

Pacific oysters									
Group	Groupname	Pod	44	45	46	47	48	49	50
G16	WC-LochFyne	15			0		0		
		16						0	
G10	WC-LochEtive	4	0						0
		6					1	0	
G1	Mull-LochnaKeal	1	0						
		2	0						
		12	0						
G28	WC-Lochaber	28	0						
G41	Skye	40	0				0	0	
G48	NWC-other	51	0			0		0	

Mussels									
Group	Groupname	Pod	44	45	46	47	48	49	50
G26	Dumfries	26	0					0	
		27				0		0	
G8	Ayr-LochStriven	8	0		0		0	0	0
		52			0.5		0		
		53							0
G16	WC-LochFyne	16						0	
G10	WC-LochEtive	4	0				0		
		10							0
G9	WC-LochCreran	9				0		0	
		11					0		
P5	Mull-LochSpelve	5	0				0		0
P7	Mull-LochScridain	7				0		0	
G1	Mull-LochnaKeal	1	0		1		0	0	
		2	0						
		32	0				0		
G31	WC-LochLeven	31				0			0
		34	0				0		
G28	WC-Lochaber	28	0				1	0	
		30	0					0	
		33	0		0		0		
G41	Skye	41			0		0		
G35	NWC-LochTorridon	35	0		0		0		
G39	NWC-Ullapool	39					0		
G48	NWC-other	38			0		0		
		48				0			
		50	0			0			
G23	Lewis-LochRoag	23	0	0		0		0	
G21	LewisHarrisUist	21			0.5		0		

		22	0				0
		25		0		0	
G57	Shetland-SE	62	0				0
P61	Shetland-SW-Gruting	61	0				0
P68	Shetland-SW-Vaila	68	0				0
G58	Shetland-W	58		0		0	
		72	0				0
G64	Shetland-NW	64		1	0	0	0
		70					0
		71			0		
G56	Shetland-NE	56					0
		65		0			
		66		0			
		81		0			0
		82		0			
P69	Shetland-N-Balta	69		0	0		

Table B7: Average PSP test result (ug/100g), focussing on 4 weeks before and 2 weeks following toxic test result in Pacific oysters during week 22 in 2002. Red = week when Pacific oysters tested positive, blue = pods where positive Pacific oyster samples were found.

Pacific oysters									
Group	Groupname	Pod	18	19	20	21	22	23	24
G16	WC-LochFyne	13	0		0		0		0
		15	0		0		28		
		16				0			
G10	WC-LochEtive	6	0				0		
G9	WC-LochCreran	11	0						
P5	Mull-LochSpelve	5					29		
G1	Mull-LochnaKeal	2	0				0		

Mussels									
Group	Groupname	Pod	18	19	20	21	22	23	24
G80	Eastcoast	111					30		
G26	Dumfries	26					0		
		27		0					
G8	Ayr-LochStriven	8				0			
		53			0		0	0	
G16	WC-LochFyne	16				0			0
G10	WC-LochEtive	10	0			0		0	
G9	WC-LochCreran	9		0		0		0	
		11					0	0	0
P5	Mull-LochSpelve	5	0				0		0
P7	Mull-LochScridain	7		0	36				0
G1	Mull-LochnaKeal	1	0				0		0
		32				0			
G31	WC-LochLeven	31				0		0	
G28	WC-Lochaber	28				0			
		30					98		57
G41	Skye	40					51		
		41					100	64	73
		43					63		47
		45					39	47	
G35	NWC-LochTorridon	35					0		0
		37							0
G48	NWC-other	38	0		0	0			0
		110			0				
G23	Lewis-LochRoag	23		0			0	0	
G21	LewisHarrisUist	21		0				0	
		22		0				0	
		25						0	
G54	Orkney	103	0						
G57	Shetland-SE	59							0
P61	Shetland-SW-Gruting	61							0

P68	Shetland-SW-Vaila	68	0	0		
G58	Shetland-W	58		0		0
		72		0		
G64	Shetland-NW	64			32	
		70				0
G56	Shetland-NE	65		0		
P69	Shetland-N-Balta	69		0		