# QUESTIONNAIRE

## Harmful Algal Bloom and Microbial Contamination Forecasting in Scotland

This short questionnaire aims to gather opinions from shellfish and fin-fish producers to help to tailor a PRIMROSE Harmful Algal Blooms forecast bulletin and possibly a microbial contamination early alert system to their needs.

The current Harmful Algal Bloom forecast bulletin is maintained by the Scottish Association for Marine Science (SAMS) and is available on www.habreports.org. The possibility and necessity for a microbial contamination early alert system will be assessed during the PRIMROSE project.

An example of the bulletin is available at the end of this questionnaire for any respondents unfamiliar with its current format.

The project builds on existing monitoring programmes carried out in the partners regions to estimate harmful blooms, shellfish toxins and microbial contamination to comply with EU regulations. It will add value to these programmes by re-use of valuable data that is already being generated.

*Project number: EAPA_182/2016*

1. **SAMS provides a weekly HAB forecast bulletin. Have you been accessing this information?**

   ☐ Yes

   ☐ No

   If **NO**, please give a reason why:

   ☐ Haven't heard of the bulletin before

   ☐ Do not find it useful

   ☐ Other

   If **other**, please list reasons why:

2. **How often do you consult the forecast bulletin?**

   ☐ Daily

   ☐ Weekly

   ☐ Fortnightly

   ☐ Monthly

   ☐ Other; please specify _____

3. **Have you been using the information in the forecasting bulletin to make decisions?**

   ☐ Yes

   ☐ No

If **YES**, what kind of decisions?

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| |

4. **In your opinion, does the forecast contain enough information to make it a useful tool?**

☐ Yes

☐ No

☐ Not applicable

If **NO**, what additional information should be included?

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| |

5. **Is there any information in the forecast which you do not find useful?**

☐ Yes

☐ No

If **YES**, please provide details:

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6. **The HAB forecast bulletin currently covers *Dinophysis* sp (DSP), *Prorocentrum lima* (DSP), *Alexandrium* (PSP), *Pseudo-nitzschia* (ASP) and *Karenia mikimotoi* (fish-killing species), and measures biotoxins. Would there be any other HAB species that you would be interested in?**

☐ Yes

☐ No

If **YES**, please provide details:

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| |

7. **Please rate usefulness of the following aspects of the bulletin (from 1 to 5):**

**1 = Very useful**
**2 = Quite useful**
**3 = Indifferent**
**4 = Of little use**
**5 = No use at all**

a) Current conditions

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

b) Sea surface currents and temperatures

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

c) Water movements

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

d) Mean wind direction and wind forecast

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

e) Phytoplankton general observations from the previous week

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

f) Biotoxin concentrations

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

g) Satellite-derived sea surface temperature

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

h) Satellite-derived chlorophyll images

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

i) Historical trends

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A

8. **Currently, the bulletin website summaries trends for the entire Scottish coastline, but only has a detailed model for the Shetland Islands. What other regions/areas would you suggest detailed models be developed for?**

9. **Currently, if you receive an indication (either via the weekly bulletin or by other means) that a harmful event is imminent in the area where your stock animals are kept, do you have any strategies/protocols in place to mitigate stock damage/financial losses?**

☐ Yes

☐ No

If **YES**, what strategies/protocols do you use, and are there any problems associated with them?

| |
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**10. Once a HAB event has arrived where your stock animals are kept, do you have any strategies/protocols in place to mitigate damage/losses?**

☐ Yes

☐ No

If **YES**, what strategies/protocols do you use, and are there any problems associated with them?

| |
|---|
| |

**11. How frequently should the HAB forecasting bulletin ideally be updated?**

☐ Daily

☐ Weekly

☐ Fortnightly

☐ Monthly

☐ Other; please specify _____

**12. What is the minimum timeframe for a short-term forecast to be useful to you?**

☐ Forecast available 72 hours in advance

☐ Forecast available 1 week in advance

☐ Forecast available 2 weeks in advance

☐ Other; please specify _____

**13. Would a long-term (seasonal/monthly) projection be of help to you?**

☐ Yes

☐ No

If **YES**, how would such a report affect any decisions you have to make?

| |
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| |

**14. Overall, how would you rate the current HAB forecast bulletin system?**

☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor

**15. What would encourage you to consult the HAB forecast bulletin more often? Please tick any that are applicable:**

☐ Simplification of website bulletin

☐ Availability of a mobile app

☐ Automated alert system e.g. alert message sent directly to your mobile phone

☐ Other; please specify _____

**16. Please provide any suggestions that would help improve the current HAB forecasting bulletin system:**

| |
|---|
| |

**17. SAMS hopes to develop a microbial contamination early alert system in the future. Would a microbial contamination early alert system for be useful to you?**

☐ Yes

☐ No

**18. Overall, how important would a microbial contamination early alert system be to you?**

☐ Crucial ☐ Very important ☐ Slightly important

☐ Not important ☐ Unimportant

**19. For both the HAB forecast bulletin and the microbial contamination early alert systems, what species would you be interested in?**

☐ *Dinophysis* sp (DSP)

☐ *Azadinium* (AZA)

☐ *Alexandrium* (PSP)

☐ *Pseudo-nitzschia* (ASP)

☐ *Karenia* (fish-killing species)

☐ Other; please specify _____

# YOUR INFORMATION

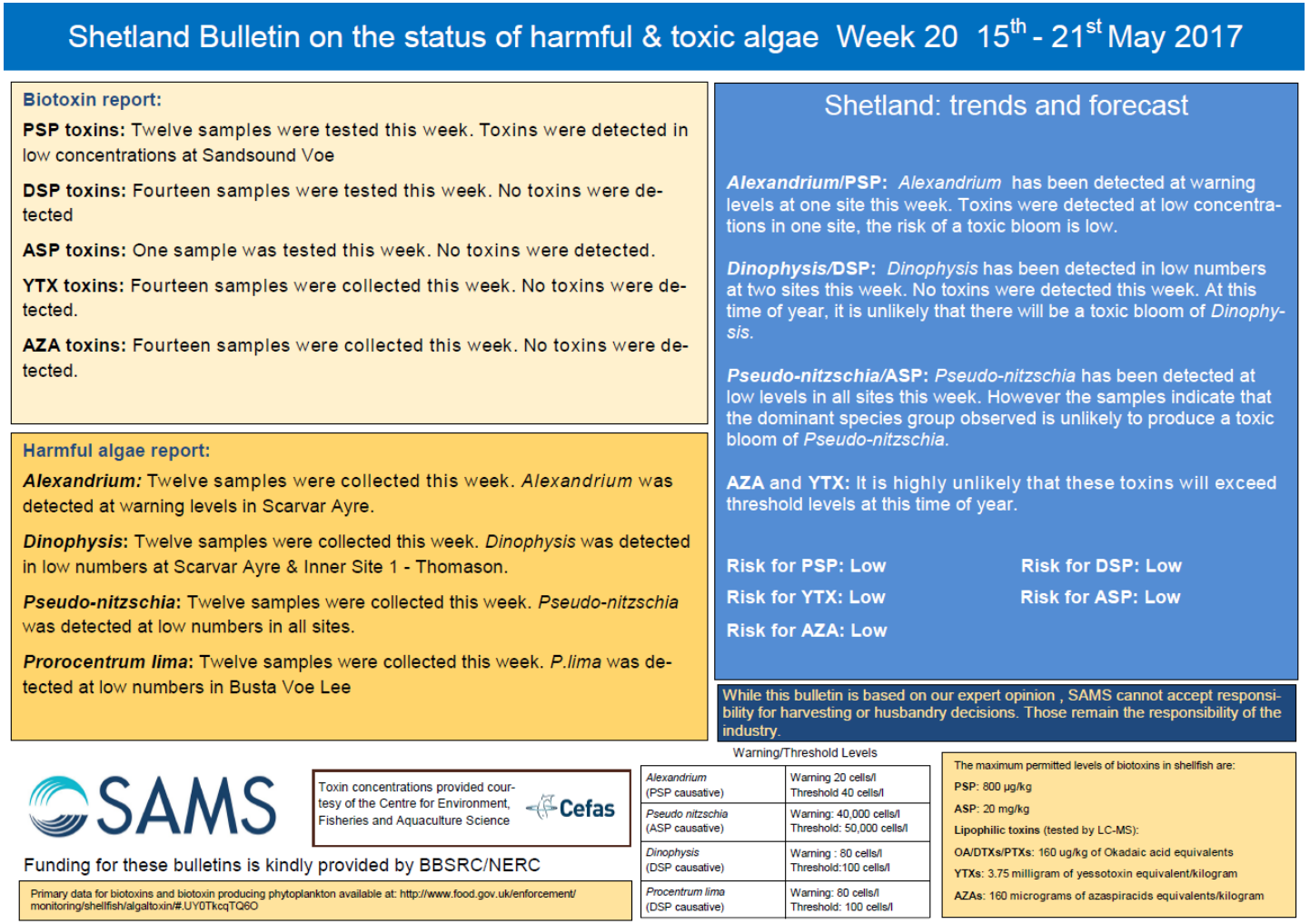
1. **What is your main business activity? Please tick all applicable:**

- ☐ Fin-fish producer (perch)
- ☐ Fin-fish producer (salmon)
- ☐ Fin-fish producer (other; please specify_____)
- ☐ Shellfish producer (abalone)
- ☐ Shellfish producer (mussels)
- ☐ Shellfish producer (oyster)
- ☐ Shellfish producer (scallops)
- ☐ Shellfish producer (hatchery)
- ☐ Shellfish producer (other; please specify_____)
- ☐ Seaweed producer
- ☐ Fin-fish processors
- ☐ Shellfish processors
- ☐ Aquaculture and seafood agency
- ☐ Seafood exporter
- ☐ Private research institute
- ☐ Public research institute
- ☐ University
- ☐ Other; please specify_____

2. **Please provide the location of where most of your business activity takes place:**

# EXAMPLE OF THE CURRENT BULLETIN AVAILABLE IN SCOTLAND

Below are screenshots from the existing weekly Irish HAB Bulletin (available via the SAMS HAB Reports website). These have been provided for any respondents that are unfamiliar with its current format. The example below is the HAB bulletin for The Shetlands, which is the only detailed bulletin currently available. The current bulletin has a total of 10 pages and is taken from Week 20 (2017); 15th to 21st of May.



## Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

**Biotoxin report:**

**PSP toxins:** Twelve samples were tested this week. Toxins were detected in low concentrations at Sandsound Voe

**DSP toxins:** Fourteen samples were tested this week. No toxins were detected

**ASP toxins:** One sample was tested this week. No toxins were detected.

**YTX toxins:** Fourteen samples were collected this week. No toxins were detected.

**AZA toxins:** Fourteen samples were collected this week. No toxins were detected.

**Harmful algae report:**

***Alexandrium:*** Twelve samples were collected this week. *Alexandrium* was detected at warning levels in Scarvar Ayre.

***Dinophysis*:** Twelve samples were collected this week. *Dinophysis* was detected in low numbers at Scarvar Ayre & Inner Site 1 - Thomason.

***Pseudo-nitzschia*:** Twelve samples were collected this week. *Pseudo-nitzschia* was detected at low numbers in all sites.

***Prorocentrum lima*:** Twelve samples were collected this week. *P.lima* was detected at low numbers in Busta Voe Lee

### Shetland: trends and forecast

***Alexandrium*/PSP:** *Alexandrium* has been detected at warning levels at one site this week. Toxins were detected at low concentrations in one site, the risk of a toxic bloom is low.

***Dinophysis*/DSP:** *Dinophysis* has been detected in low numbers at two sites this week. No toxins were detected this week. At this time of year, it is unlikely that there will be a toxic bloom of *Dinophysis*.

***Pseudo-nitzschia*/ASP:** *Pseudo-nitzschia* has been detected at low levels in all sites this week. However the samples indicate that the dominant species group observed is unlikely to produce a toxic bloom of *Pseudo-nitzschia*.

**AZA and YTX:** It is highly unlikely that these toxins will exceed threshold levels at this time of year.

**Risk for PSP: Low** **Risk for DSP: Low**

**Risk for YTX: Low** **Risk for ASP: Low**

**Risk for AZA: Low**

While this bulletin is based on our expert opinion , SAMS cannot accept responsibility for harvesting or husbandry decisions. Those remain the responsibility of the industry.

SAMS

Toxin concentrations provided courtesy of the Centre for Environment, Fisheries and Aquaculture Science Cefas

Funding for these bulletins is kindly provided by BBSRC/NERC

Primary data for biotoxins and biotoxin producing phytoplankton available at: http://www.food.gov.uk/enforcement/monitoring/shellfish/algaltoxin/#.UY0TkcqTQ6O

Warning/Threshold Levels

| | |
|---|---|
| *Alexandrium* (PSP causative) | Warning 20 cells/l Threshold 40 cells/l |
| *Pseudo nitzschia* (ASP causative) | Warning: 40,000 cells/l Threshold: 50,000 cells/l |
| *Dinophysis* (DSP causative) | Warning : 80 cells/l Threshold:100 cells/l |
| *Procentrum lima* (DSP causative) | Warning: 80 cells/l Threshold: 100 cells/l |

The maximum permitted levels of biotoxins in shellfish are:

**PSP**: 800 µg/kg

**ASP**: 20 mg/kg

**Lipophilic toxins** (tested by LC-MS):

**OA/DTXs/PTXs**: 160 ug/kg of Okadaic acid equivalents

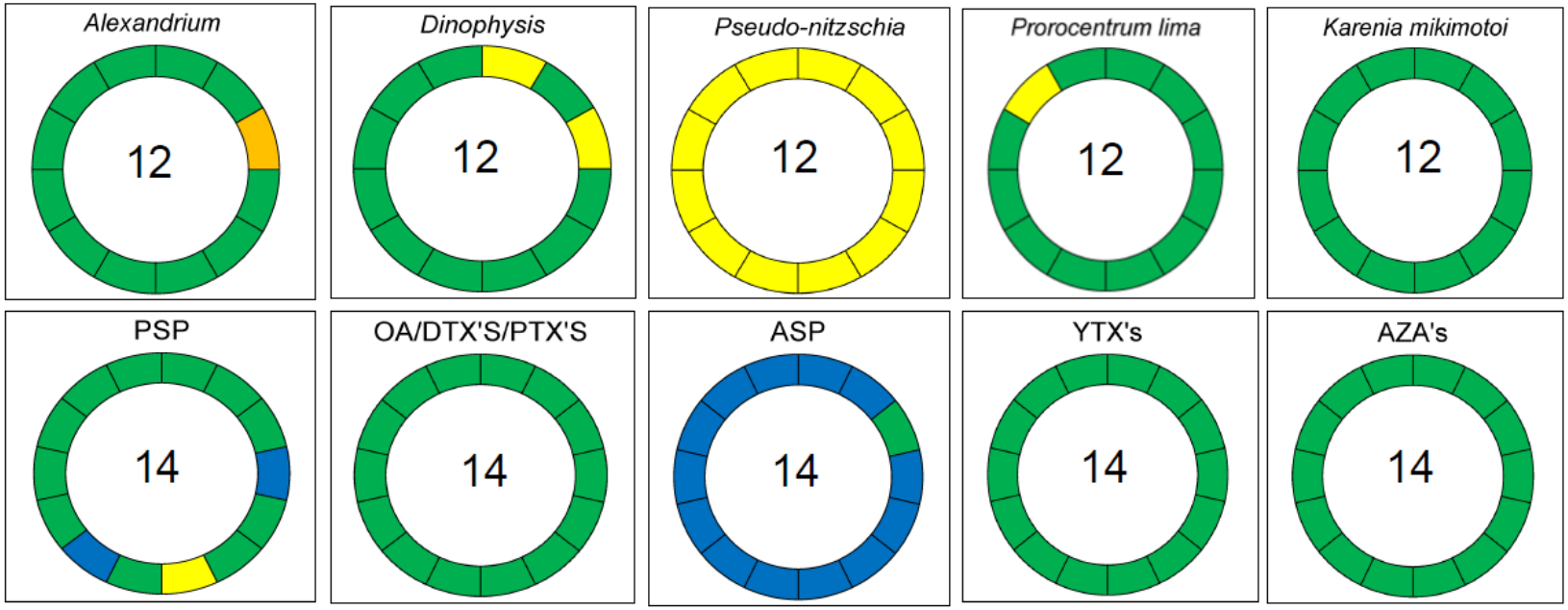
**YTXs**: 3.75 milligram of yessotoxin equivalent/kilogram

**AZAs**: 160 micrograms of azaspiracids equivalents/kilogram

**Page 1 of 10**

# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th- 21st May 2017

## Status of biotoxins & harmful algae present in Shetland




Segments - no of individual sites, Colours: Green, red, amber and yellow as per key. Blue - not analysed. Coloured segment indicates approximate position of site in Shetland

| Biotoxin & Species | | | | |
|---|---|---|---|---|
| PSP | <RL | RL - 399 µg/kg | 400 - 800 µg/kg | >800 µg/kg |
| OA/DTX/PTX | <RL | 1 - 79 µg/kg | 80 - 160 µg/kg | >160 µg/kg |
| ASP | <LOQ | LOQ - 9.9 mg/kg | 10 - 20 mg/kg | >20 mg/kg |
| YTX | <RL | 1 - 1.7 mg/kg | 1.8 - 3.75 mg/kg | >3.75 mg/kg |
| AZA | <RL | 1 - 79 µg/kg | 80 -160 µg/kg | >160 µg/kg |
| *Alexandrium* | <20 cells/l | n/a | 20 cells/l | ≥ 40 cells/l |
| *Dinophysis* | <20 cells/l | 20 - 79 cells/l | 80 - 99 cells/l | ≥100 cells/l |
| *Pseudo nitzschia* | <20 cells/l | 20 - 39,999 cells/l | 40,000 - 49,999 cells/l | ≥50,000 cells/l |
| *Prorocentrum lima* | <20 cells/l | 20 - 79 cells/l | 80 - 99 cells/l | ≥100 cells/l |

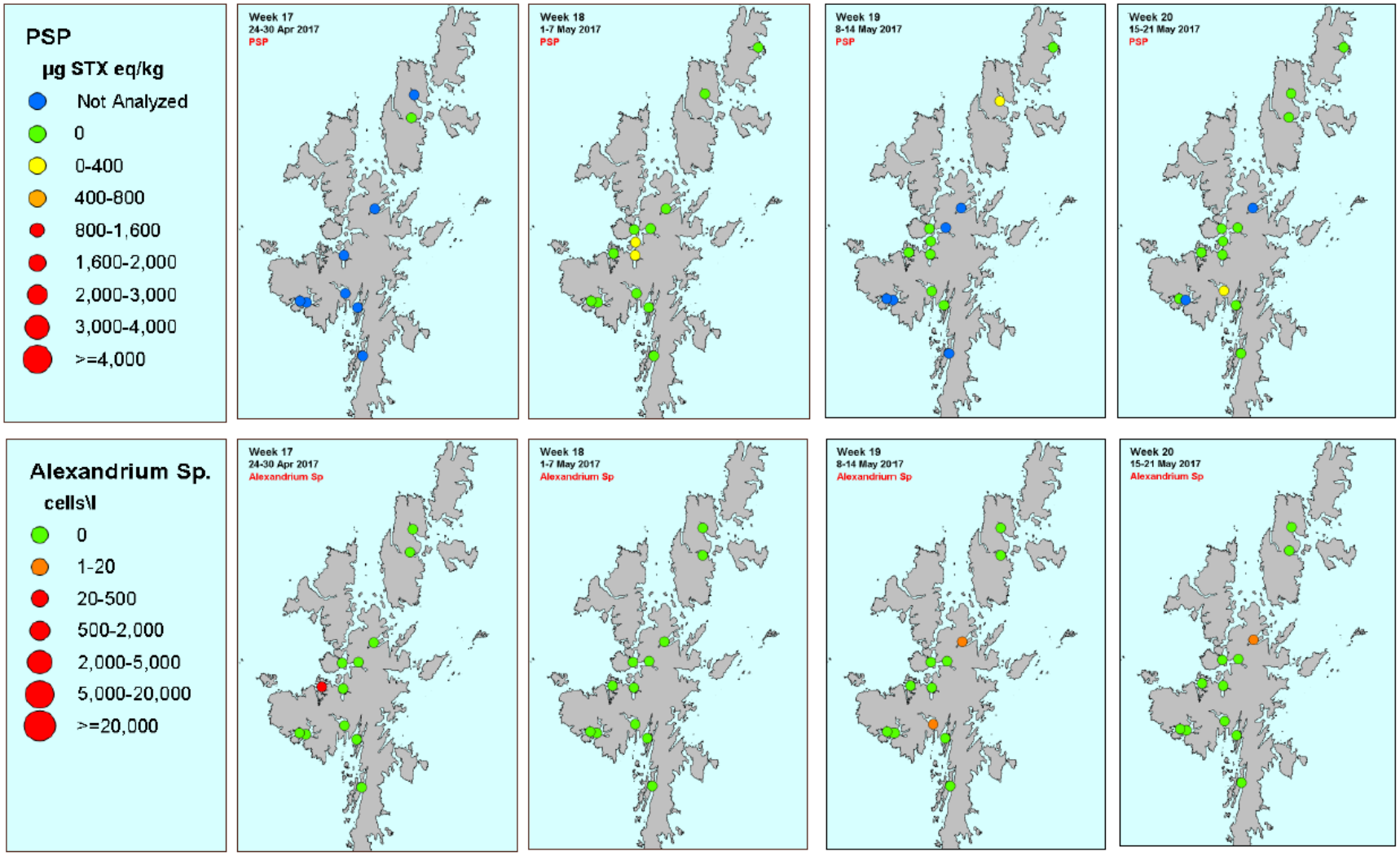
**NOTE:**

This page is intended as a quick overview of the situation in the Shetland Islands. If the status for a particular species or biotoxin is amber or red please check the relevant pages in the bulletin for more details and specific locations.

RL- reporting limit;
LOQ – Limit of quantification

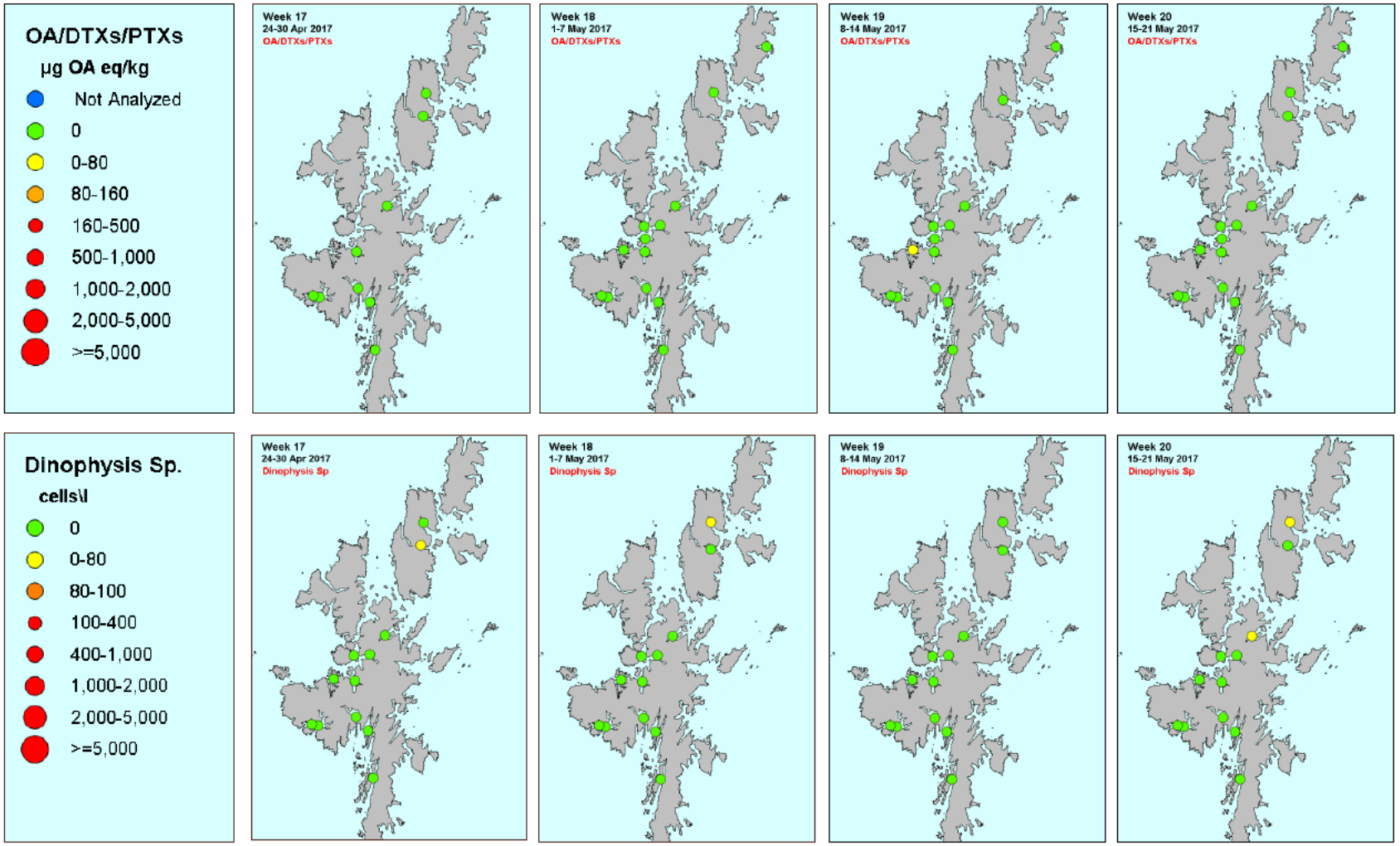
# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

## Paralytic shellfish poisoning toxins & causative phytoplankton



# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

## Diarrhetic shellfish poisoning toxins & causative phytoplankton



# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

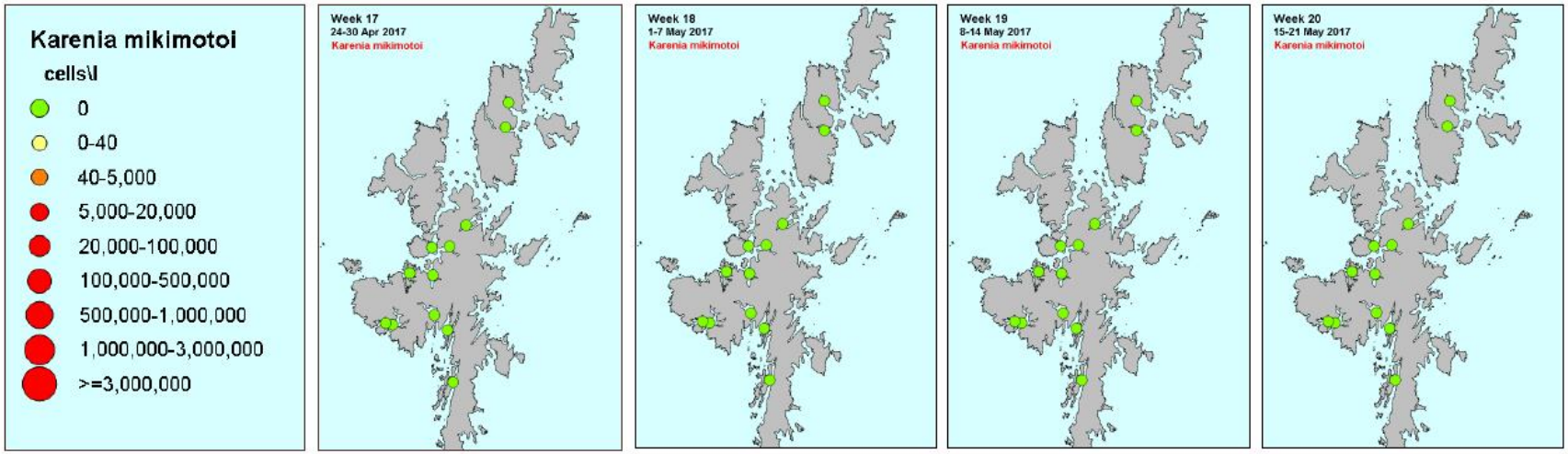
## Amnesic Shellfish Poisoning & causative phytoplankton

# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th- 21st May 2017

## Azaspiracid & Yessotoxin shellfish poisoning toxins

# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

## *Karenia mikimotoi*




**Chain forming Phytoplankton**

**High densities of chain forming diatoms including, but not limited to the genus, *Chaetoceros, Skeletonema, Leptocylindrus , Rhizosolenia, Thalassiosira, Corethron* and *Pseudo-nitzschia,* the centric species*Coscinodiscus wailesii,* and species with long spines such as *Ceratium* can cause debilitating damage to fish gills.**

**Status**

No *Karenia* was detected this week. Concentrations of chain forming diatoms (mostly *Chaetoceros sp.)* are high in Sandsound Voe (980,773cells/l). *Guinardia sp*. are at high numbers in Parkgate (779,917 cells/l), Busta Voe (1,371,800 cells/l), Slyde (479,703 cells/l) & in lower numbers at Seggi Bight & Braewick Voe. *Dactyliosolen sp.* bloom at Stream sound (927,354 cells/l) and a mixed diatom bloom at East of Linga (715,815 cells/l) . Concentrations in other sites are relatively low ranging between 90 - 190,000 cells/l.


A - *Chaetoceros sp.*

B - *Pseudo-nitzschia sp.*

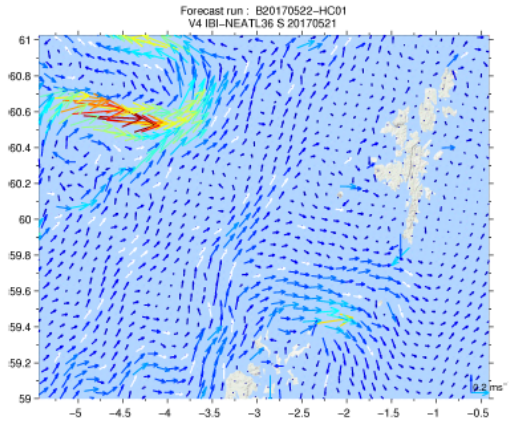
C - *Skeletonema sp.*

D - *Leptocylindrus danicus*

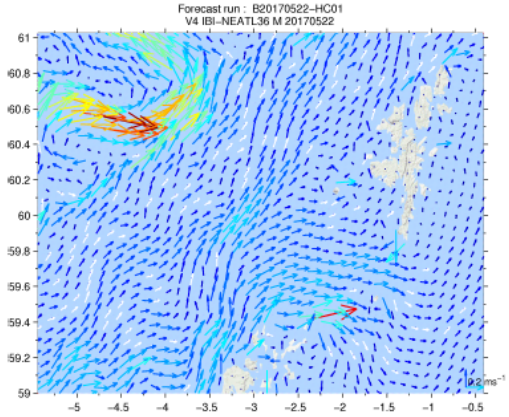
# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th - 21st May 2017

## Forecasted Sea Surface currents for the next five days

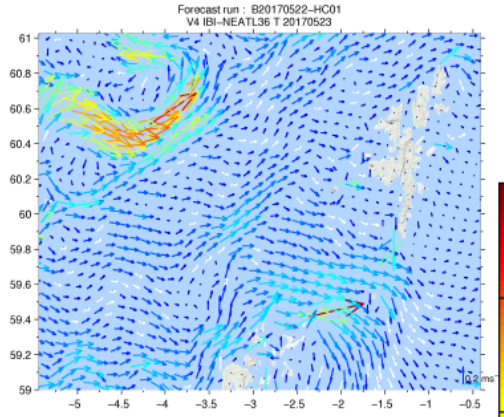
21 May 2017



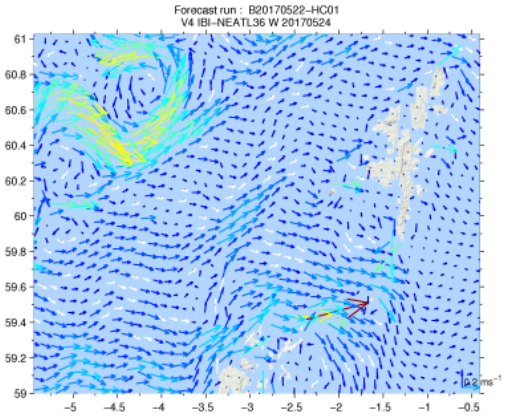

22 May 2017




23 May 2017

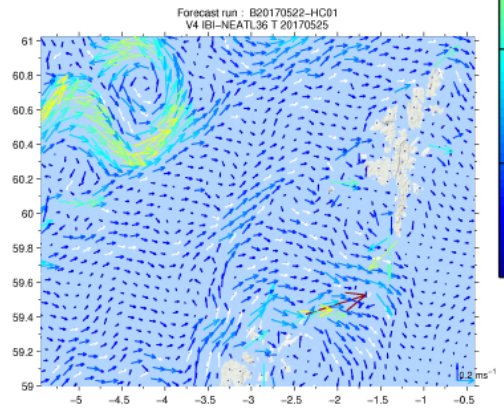


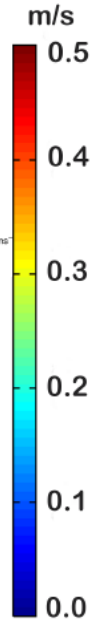

24 May 2017




These diagrams show the predicted current directions around Shetland for the next five days. Greens to reds indicate stronger currents. In general strong currents run parallel to the deep water channel between the Faroes and Shetland. Problems can arise when these currents turn Eastwards potentially carrying *Dinophysis* and *Karenia mikimotoi* blooms, from the shelf edge, into shore.

25 May 2017



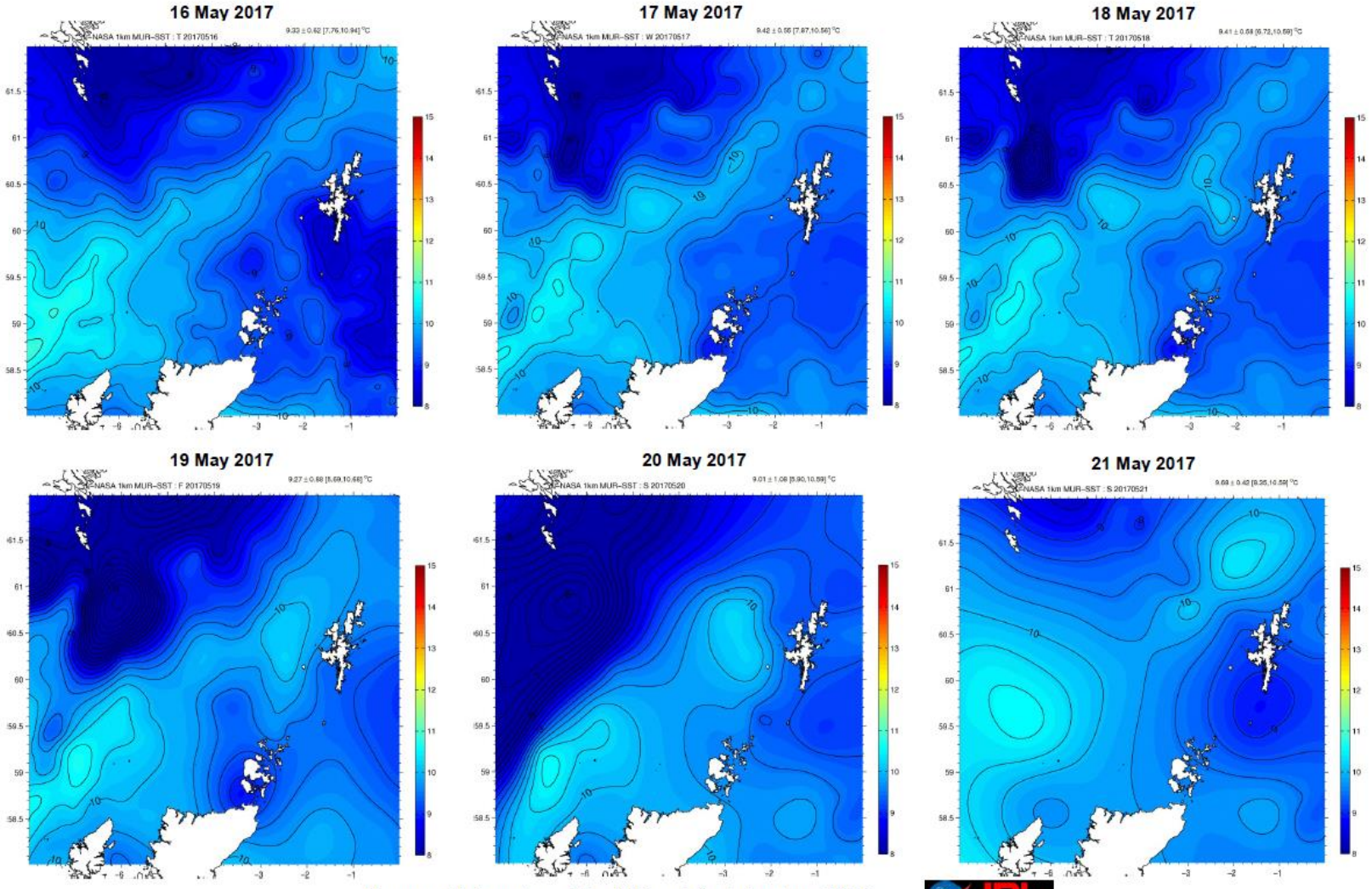




Forecast provided by the model-NEATL-PHY-1/36°-AF-D-PGS (IBI36QV4R1-PGS) courtesy of Mercator.

Mercator Ocean
Ocean Forecasters

# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th- 21st May 2017

Sea Surface temperature (°C) in preceding 6 days in the Shetland Islands

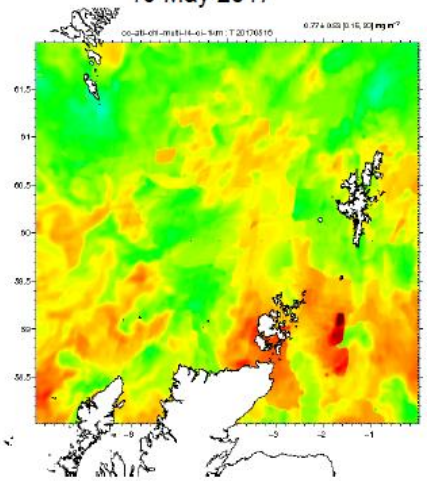



Maps provided courtesy of the Jet Propulsion Laboratory, NASA

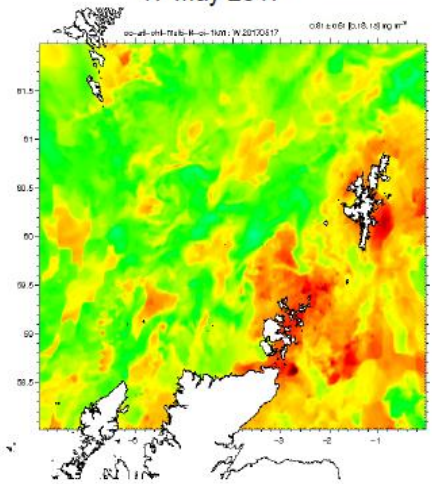
# Shetland Bulletin on the status of harmful & toxic algae Week 20 15th- 21st May 2017

## Chlorophyll concentrations (mg/m$^3$)

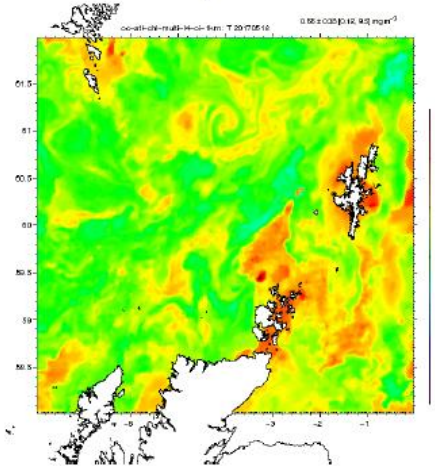
16 May 2017

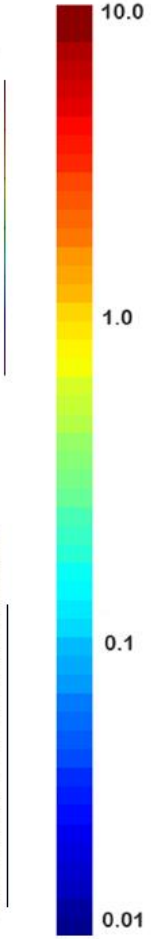


17 May 2017

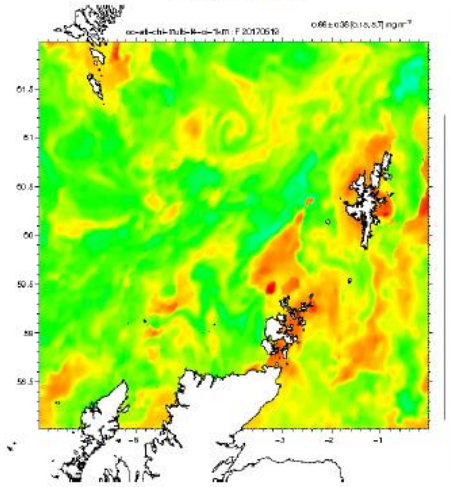


18 May 2017



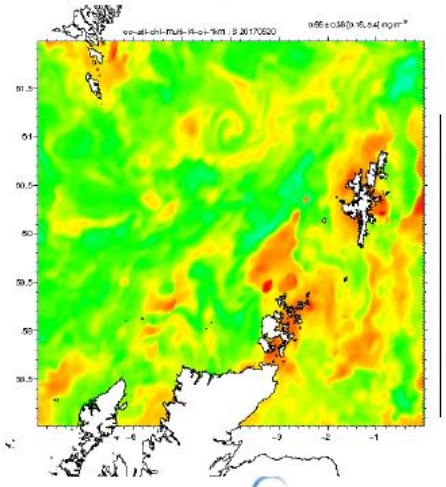



19 May 2017



These diagrams show the mass concentration of chlorophyll-a around Shetland. Yellows to reds indicate higher concentrations. However it should be noted that turbidity and the presence of organic material deposited into near shore areas can give false positive readings making the concentrations appear much higher than *in situ* observations would indicate. Blank areas or areas bounded by straight lines on the map are usually the result of data loss due, for example, to persistent cloud cover in which case the data has been interpolated and may not accurately depict the actual concentrations present.

20 May 2017



Images provided by the Ocean Colour atl-chl-L-L4 NRT-Observations-009-037dataset, courtesy of Copernicus. Copernicus