UK Acid Waters Monitoring Network (UKAWMN)
Llyn Cwm Mynach, Afon Hafren and Afon Gwy
Annual Summary Progress Report. April 09 - March 10
E. M. Shilland, L. Irvine & I. A. Malcolm
March 2010
UK ACID WATERS MONITORING NETWORK (UKAWMN) – CONTRACT 22 01 249

LLYN CWM MYNACH, AFON HAFREN AND AFON GWY

ANNUAL SUMMARY PROGRESS REPORT April 2009 - March 2010

REPORT TO THE WELSH ASSEMBLY GOVERNMENT, COUNTRYSIDE COUNCIL FOR WALES AND ENVIRONMENT AGENCY, WALES

Ewan M. Shilland¹, Lynne Irvine² & Ian A. Malcolm³

March 2010

¹ ECRC, UCL
² CEH Lancaster
³ Marine Scotland, Pitlochry
1 Table of Contents

1 Table of Contents .......................................................................................................................... 3
2 List of Figures ................................................................................................................................. 4
3 Llyn Cwm Mynach .......................................................................................................................... 5
  3.1 Summary Overview .................................................................................................................... 5
  3.2 Water Chemistry ....................................................................................................................... 5
  3.3 Sediment Traps ........................................................................................................................ 5
  3.4 Thermistors ............................................................................................................................. 6
  3.5 Epilithic Diatoms ..................................................................................................................... 6
  3.6 Macroinvertebrates .................................................................................................................. 6
  3.7 Fish .......................................................................................................................................... 6
  3.8 Aquatic Macrophytes .............................................................................................................. 6
  3.9 Data Management and Reporting .......................................................................................... 6
  3.10 Llyn Cwm Mynach Recent Publications ............................................................................... 7
  3.11 Llyn Cwm Mynach Bibliography .......................................................................................... 9
  3.12 Llyn Cwm Mynach Summary Data to March 2008 ............................................................. 18
    3.12.1 Spot sampled chemistry data .......................................................................................... 18
    3.12.2 Macroinvertebrate data .................................................................................................. 19
      3.12.2.1 Percentage abundance summary, Llyn Cwm Mynach ..................................................... 19
      3.12.2.1 Macroinvertebrate summary statistics, Llyn Cwm Mynach ............................................. 20
    3.12.3 Fish data (for outflow stream) ....................................................................................... 21
      3.12.3.1 Summary of Trout fry density (numbers m$^{-2}$), Llyn Cwm Mynach .......................... 21
      3.12.3.2 Summary of Trout parr density (numbers m$^{-2}$), Llyn Cwm Mynach ..................... 22
    3.12.4 Epilithic diatom data ....................................................................................................... 23
      3.12.4.1 Percentage abundance summary, Llyn Cwm Mynach ..................................................... 23
      3.12.4.1 Diatom summary statistics, Llyn Cwm Mynach ............................................................. 24
    3.12.5 Aquatic macrophyte data, Llyn Cwm Mynach ............................................................... 25
    3.12.6 Sediment trap data, Llyn Cwm Mynach ...................................................................... 26
    3.12.7 Thermistor data, Llyn Cwm Mynach ............................................................................ 27
4 Afon Hafren .................................................................................................................................. 28
  4.1 Summary Overview .................................................................................................................... 28
  4.2 Water Chemistry ....................................................................................................................... 28
  4.3 Epilithic Diatoms ..................................................................................................................... 29
  4.4 Macroinvertebrates .................................................................................................................. 29
  4.5 Fish .......................................................................................................................................... 29
  4.6 Aquatic Macrophytes .............................................................................................................. 29
  4.7 Data Management and Reporting .......................................................................................... 29
  4.8 Afon Hafren Recent Publications .......................................................................................... 30
  4.9 Afon Hafren Bibliography ....................................................................................................... 31
  4.10 Afon Hafren Summary Data to March 2008 ....................................................................... 43
    4.10.1 Spot sampled chemistry data .......................................................................................... 43
    4.10.2 Macroinvertebrate data .................................................................................................. 44
      4.10.2.1 Percentage abundance summary, Afon Hafren ............................................................... 44
      4.10.2.1 Macroinvertebrate summary statistics, Afon Hafren ..................................................... 45
    4.10.3 Fish data .......................................................................................................................... 46
      4.10.3.1 Summary of Trout fry density (numbers m$^{-2}$), Afon Hafren .................................. 46
      4.10.3.2 Summary of Trout parr density (numbers m$^{-2}$), Afon Hafren .............................. 47
    4.10.4 Epilithic diatom data ....................................................................................................... 48
2  **List of Figures**

Figure 1 Llyn Cwm Mynach. Looking southeast through the trees from the northern end of the lake. .... 5
Figure 2 Afon Hafren biological survey section 10th July 2009 ...................................................... 28
Figure 3 Afon Gwy biological survey section 10th July 2009 .......................................................... 51
3 Llyn Cwm Mynach

Figure 1 Llyn Cwm Mynach. Looking southeast through the trees from the northern end of the lake.

3.1 Summary Overview

Chemical and biological sample collection, analysis and data collation, quality control and archiving proceeded without any problems at Llyn Cwm Mynach during the period from April 2009 to March 2010.

3.2 Water Chemistry

Samples were collected by CEH in early June, September and December 2009, delivered to the analytical laboratories on schedule and have been analysed, quality controlled and archived in the UKAWMN central chemistry database at CEH Lancaster. March 2010 samples have been collected and are in the process of being analysed.

3.3 Sediment Traps

Sediment traps were recovered and replaced on the 4th of August 2009 by a team from ENSIS. Diatoms in the sediment retrieved from the traps are currently being analysed.
3.4 Thermistors

Lake top and bottom thermistors were removed and replaced on the 4th of August 2009 by a team from ENSIS. Both had functioned well during the previous year and the data were added to the ENSIS thermistor water temperature database.

3.5 Epilithic Diatoms

Epilithic diatoms were retrieved by a team from ENSIS from three sampling points around the lake on the 4th of August 2009. The samples have been made into slides and are currently in the process of being analysed.

3.6 Macroinvertebrates

Aquatic macroinvertebrates were sampled on the 17th April 2009 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. After quality screening the data was added to the UKAWMN biological database at ENSIS.

3.7 Fish

Fish surveying was performed on the 19th September 2009 by the Game and Wildlife Conservation Trust. The data has been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKAWMN biological database at ENSIS.

3.8 Aquatic Macrophytes

Aquatic macrophytes were not surveyed in 2009, according to the AWMN protocol of surveying lake sites every two years.

3.9 Data Management and Reporting

No problems or hiatus with the collation and transfer of data within methodological programmes, or to the UKAWMN databases occurred during the period.

The 2008-2009 annual report is nearly ready to be uploaded to the AWMN web page in late March 2010, and the section on Llyn Cwm Mynach appears in section 3.12 below.

An interpretative report detailing 20 years of the UKAWMN is undergoing a final edit and will also be published in 2010.

Further publications from the contract period utilizing data from Llyn Cwm Mynach are detailed in section 3.10 below. Section 3.11 provides a bibliography for the site.
3.10 Llyn Cwm Mynach Recent Publications


abundance. 1-12. School of Biological Sciences, Queen Mary University of London, London.

3.11 Llyn Cwm Mynach Bibliography


Evans, C. D., Monteith, D. T.& Harriman, R. (2001) Long-term variability in the deposition of marine ions at west coast sites in the UK Acid Waters Monitoring Network: impacts on


3.12 Llyn Cwm Mynach Summary Data to March 2008

3.12.1 Spot sampled chemistry data

<table>
<thead>
<tr>
<th>µeq l⁻¹, µg l⁻¹, mg l⁻¹</th>
<th>pH</th>
<th>ANC</th>
<th>Ca²⁺</th>
<th>Mg²⁺</th>
<th>Na⁺</th>
<th>K⁺</th>
<th>*Soluble Al</th>
<th>*Labile Al</th>
<th>Cl⁻</th>
<th>*SO₄²⁻</th>
<th>xSO₄²⁻</th>
<th>NO₃⁻</th>
<th>**DOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean 1° 5 yrs</td>
<td>5.35</td>
<td>7.68</td>
<td>77.79</td>
<td>67.45</td>
<td>291.02</td>
<td>3.36</td>
<td>110.75</td>
<td>66.58</td>
<td>337.67</td>
<td>88.32</td>
<td>52.91</td>
<td>9.40</td>
<td>2.50</td>
</tr>
<tr>
<td>08-09 mean</td>
<td>5.64</td>
<td>11.80</td>
<td>60.53</td>
<td>57.99</td>
<td>254.69</td>
<td>5.06</td>
<td>51.25</td>
<td>28.75</td>
<td>293.33</td>
<td>68.27</td>
<td>37.09</td>
<td>18.12</td>
<td>1.79</td>
</tr>
<tr>
<td>08-09 std dev</td>
<td>0.35</td>
<td>13.95</td>
<td>16.62</td>
<td>15.49</td>
<td>80.36</td>
<td>1.88</td>
<td>33.75</td>
<td>21.12</td>
<td>106.76</td>
<td>5.29</td>
<td>6.70</td>
<td>19.04</td>
<td>0.44</td>
</tr>
</tbody>
</table>
3.12.2 Macroinvertebrate data

3.12.2.1 Percentage abundance summary, Llyn Cwm Mynach
3.12.2.1 Macroinvertebrate summary statistics, Llyn Cwm Mynach
3.12.3 Fish data (for outflow stream)

3.12.3.1 Summary of Trout fry density (numbers m$^{-2}$), Llyn Cwm Mynach

![Graph showing Trout fry density over years]

Blue series = Reach 1  
Pink series = Reach 2  
Green series = Reach 3
3.12.3.2 Summary of Trout parr density (numbers m$^{-2}$), Llyn Cwm Mynach

![Graph showing trout parr density](image)

- Blue series = Reach 1
- Pink series = Reach 2
- Green series = Reach 3
3.12.4 Epilithic diatom data

3.12.4.1 Percentage abundance summary, Llyn Cwm Mynach
3.12.4.1 Diatom summary statistics, Llyn Cwm Mynach
### 3.12.5 Aquatic macrophyte data, Llyn Cwm Mynach

#### Species Scores (1-5)

<table>
<thead>
<tr>
<th>Species</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>Score 4</th>
<th>Score 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitella flexilis var. flexilis agg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marsupella emarginata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fontinalis sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amblystegium sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drepanoclados fluitans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filamentous green algae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potamogeton berchtoldii</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myriophyllum alterniflorum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nardia compressa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eleocharis palustris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuphar lutea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equisetum fluviatile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glyceria fluitans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus bulbosus var. fluitans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nymphaea alba</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utricularia sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Littorella uniflora</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranunculus flammula</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scapania undulata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus articulatus/Juncus acutiflorus indet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sphagnum sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potamogeton polygonifolius</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex rostrata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobelia dortmann</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potamogeton natans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoenoplectus lacustris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menyanthes trifoliata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus effusus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batrachospermum sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plecotonema sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrocotyle vulgaris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isoetes lacustris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eleocharis fluitans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eleocharis multiflora</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Score 1**: Low abundance.
- **Score 2**: Moderate abundance.
- **Score 3**: High abundance.
- **Score 4**: Very high abundance.
- **Score 5**: Dominant species.
3.12.6 Sediment trap data, Llyn Cwm Mynach

Relative percentage frequency of diatom taxa

- Nitzschia peminuta
- Achnanthes minutissima
- Frustulia rhomboides var. viridula
- Brachysira vitrea
- Fragilaria virens var. exigu
- Eunotia naegelii
- Eunotia exigua
- Peronia fibula
- Eunotia incisa
- Eunotia exgracilis
- Aulacoseira lirata var. alpigena
- Eunotia sp.
- Tabellaria flocculosa
- Eunotia denticulata
- Frustulia rhomboides var. saxonica
- Navicula leptostriata
- Tabellaria quadriseptata
- Brachysira brebissonii
- Tabellaria binalis
- Fragilaria sp.
- Cymbella aequalis
- Brachysira serians
- Surirella delicatissima
- Stenopterobia sigmatella

3.12.7 Thermistor data, Llyn Cwm Mynach
4 Afon Hafren

4.1 Summary Overview

Chemical and biological sample collection, analysis and data collation, quality control and archiving proceeded without any problems at Afon Hafren during the period from April 2009 to March 2010.

4.2 Water Chemistry

Samples were collected by CEH early every month throughout the period April 2009 to March 2010, delivered to the analytical laboratories on schedule and are in the process of being analysed, quality controlled and archived in the UKAWMN central chemistry database at CEH Lancaster.
4.3 Epilithic Diatoms

Epilithic diatoms were retrieved by a team from ENSIS from three sampling points in the stream on the 10th of July 2009, after high water levels had frustrated surveying efforts on an earlier visit. The samples have been made into slides and are currently in the process of being analysed.

4.4 Macroinvertebrates

Aquatic macroinvertebrates were sampled on the 17th April 2009 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. After quality screening the data was added to the UKAWMN biological database at ENSIS.

4.5 Fish

Fish surveying was performed on the 26th August 2009 by a team from the Environment Agency Wales. Unfortunately fish weights were not recorded. The data has been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKAWMN biological database at ENSIS.

4.6 Aquatic Macrophytes

Aquatic macrophytes were surveyed by a team from ENSIS on 10th of July 2009. Percentage cover scores were recorded and data will be added to the ENSIS biological database after microscope confirmation of bryophyte identifications.

4.7 Data Management and Reporting

No problems or hiatus with the collation and transfer of data within methodological programmes, or to the UKAWMN databases occurred during the period.

The 2008-2009 annual report is nearly ready to be uploaded to the AWMN web page in late March 2010, and the section on Afon Hafren appears in section 4.10 below.

An interpretative report detailing 20 years of the UKAWMN is undergoing a final edit and will also be published 2010.

Further publications from the contract period utilizing data from Afon Hafren are detailed in section 4.8 below. Section 4.9 provides a bibliography for the site.
4.8 Afon Hafren Recent Publications


### 4.9 Afon Hafren Bibliography


Rose, N. L. (1-1-1993) An Assessment of the Potential of the United Kingdom Acid Waters Monitoring Network to Monitor the Impact of Atmospheric Trace metals and...


4.10 Afon Hafren Summary Data to March 2008

4.10.1 Spot sampled chemistry data

<table>
<thead>
<tr>
<th>µeq l⁻¹, *µg l⁻¹, **mg l⁻¹</th>
<th>pH</th>
<th>ANC</th>
<th>Ca²⁺</th>
<th>Mg²⁺</th>
<th>Na⁺</th>
<th>K⁺</th>
<th>*Soluble Al</th>
<th>*Labile Al</th>
<th>Cl⁻</th>
<th>*SO₄²⁻</th>
<th>xSO₄²⁻</th>
<th>NO₃⁻</th>
<th>**DOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean 1°° 5 yrs</td>
<td>5.29</td>
<td>-2.40</td>
<td>47.91</td>
<td>66.41</td>
<td>200.39</td>
<td>3.16</td>
<td>170.00</td>
<td>101.71</td>
<td>82.97</td>
<td>59.79</td>
<td>5.29</td>
<td>-2.40</td>
<td></td>
</tr>
<tr>
<td>08-09 mean</td>
<td>5.37</td>
<td>16.62</td>
<td>32.38</td>
<td>54.20</td>
<td>165.63</td>
<td>2.71</td>
<td>91.92</td>
<td>36.25</td>
<td>182.10</td>
<td>63.79</td>
<td>44.70</td>
<td>3.37</td>
<td>16.62</td>
</tr>
<tr>
<td>08-09 std dev</td>
<td>0.63</td>
<td>19.18</td>
<td>6.46</td>
<td>7.79</td>
<td>17.43</td>
<td>1.68</td>
<td>65.33</td>
<td>32.67</td>
<td>24.75</td>
<td>6.08</td>
<td>5.28</td>
<td>0.63</td>
<td>19.18</td>
</tr>
</tbody>
</table>
4.10.2 Macroinvertebrate data

4.10.2.1 Percentage abundance summary, Afon Hafren
No sampling in 2001 due to Foot and Mouth restrictions.
4.10.3 Fish data

4.10.3.1 Summary of Trout fry density (numbers m$^{-2}$), Afon Hafren

Blue series = Reach 1
Pink series = Reach 2
Green series = Reach 3
4.10.3.2 Summary of Trout parr density (numbers m$^{-2}$), Afon Hafren

Blue series = Reach 1
Pink series = Reach 2
Green series = Reach 3
4.10.4 Epilithic diatom data

4.10.4.1 Percentage abundance summary, Afon Hafren

![Graph showing percentage abundance summary of epilithic diatom species in Afon Hafren.](image)
4.10.4.1 Diatom summary statistics, Afon Hafren
4.10.5 Aquatic macrophyte data, Afon Hafren

Percentage Species Cover

- **Atrichum sp.**
- **Ranunculus omiophyllus**
- **Juncus bulbosus var. fluitans**
- **Nardia compressa**
- **Juncus effusus**
- **Polytrichum commune**
- **Racomitrium aciculare**
- **Scapania undulata**
- **Hyocomium amoricum**
- **Sphagnum (aquatic indet.)**
- **Viola palustris**
- **Pellia sp.**
- **Filamentous green algae**

+ Represents <1% abundance
5 Afon Gwy

5.1 Summary Overview

Chemical and biological sample collection, analysis and data collation, quality control and archiving proceeded without any problems at Afon Gwy during the period from April 2009 to March 2010.

5.2 Water Chemistry

Samples were collected by CEH early every month throughout the period April 2009 to March 2010, delivered to the analytical laboratories on schedule and are in the process of being analysed, quality controlled and archived in the UKAWMN central chemistry database at CEH Lancaster. Unfortunately the water sample from 02/06/09 was lost.
5.3 Epilithic Diatoms

Epilithic diatoms were retrieved by a team from ENSIS from three sampling points in the stream on the 10th of July 2009. The samples have been made into slides and are currently in the process of being analysed.

5.4 Macroinvertebrates

Aquatic macroinvertebrates were sampled on the 17th April 2009 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. After quality screening the data was added to the UKAWMN biological database at ENSIS.

5.5 Fish

Fish surveying was performed on the 25th August 2009 by a team from the Environment Agency Wales. Unfortunately fish weights were not recorded. The data has been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKAWMN biological database at ENSIS. No Salmon were recorded in 2009.

5.6 Aquatic Macrophytes

Aquatic macrophytes were surveyed by a team from ENSIS on 10th of July 2009. Percentage cover scores were recorded and data will be added to the ENSIS biological database after microscope confirmation of bryophyte identifications.

5.7 Data Management and Reporting

No problems or hiatus with the collation and transfer of data within methodological programmes, or to the UKAWMN databases occurred during the period.

The 2008-2009 annual report is nearly ready to be uploaded to the AWMN web page in late March 2010, and the section on Afon Gwy appears in section 5.10 below.

An interpretative report detailing 20 years of the UKAWMN is undergoing a final edit and will also be published in 2010.

Further publications from the contract period utilizing data from Afon Gwy are detailed in section 5.8 below. Section 5.9 provides a bibliography for the site.
5.8 Afon Gwy Recent Publications


### 5.9 Afon Gwy Bibliography


5.10 Afon Gwy Summary Data to March 2008

5.10.1 Spot sampled chemistry data

<table>
<thead>
<tr>
<th>µeq l⁻¹, µg l⁻¹, mg l⁻¹</th>
<th>pH</th>
<th>ANC</th>
<th>Ca²⁺</th>
<th>Mg²⁺</th>
<th>Na⁺</th>
<th>K⁺</th>
<th>*Soluble Al</th>
<th>*Labile Al</th>
<th>Cl⁻</th>
<th>*SO₄²⁻</th>
<th>xSO₄²⁻</th>
<th>NO₃⁻</th>
<th>**DOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean 1st 5 yrs</td>
<td>5.51</td>
<td>14.13</td>
<td>40.42</td>
<td>53.22</td>
<td>147.31</td>
<td>3.24</td>
<td>106.64</td>
<td>53.64</td>
<td>159.84</td>
<td>65.67</td>
<td>48.91</td>
<td>8.65</td>
<td>1.98</td>
</tr>
<tr>
<td>08-09 mean</td>
<td>5.73</td>
<td>27.96</td>
<td>30.44</td>
<td>47.70</td>
<td>135.29</td>
<td>2.99</td>
<td>57.83</td>
<td>22.08</td>
<td>142.51</td>
<td>51.09</td>
<td>36.14</td>
<td>10.27</td>
<td>2.85</td>
</tr>
<tr>
<td>08-09 std dev</td>
<td>0.42</td>
<td>8.07</td>
<td>7.24</td>
<td>8.21</td>
<td>23.15</td>
<td>1.76</td>
<td>46.08</td>
<td>19.76</td>
<td>24.60</td>
<td>11.18</td>
<td>10.00</td>
<td>9.17</td>
<td>1.21</td>
</tr>
</tbody>
</table>
5.10.2 Macroinvertebrate data

5.10.2.1 Percentage abundance summary, Afon Gwy

No sampling in 2001 due to Foot and Mouth restrictions.
5.10.2.1 Macroinvertebrate summary statistics, Afon Gwy

No sampling in 2001 due to Foot and Mouth restrictions.
5.10.3 Fish data

5.10.3.1 Summary of Salmon fry densities (numbers m\(^{-2}\)), Afon Gwy

![Graph showing salmon fry densities over years]

Blue series = Reach 1
Pink series = Reach 2
Green series = Reach 3
5.10.3.2 Summary of Salmon parr densities (numbers m$^{-2}$), Afon Gwy

Blue series = Reach 1
Pink series = Reach 2
Green series = Reach 3
5.10.3.3 Summary of Trout fry density (numbers m$^{-2}$), Afon Gwy

Blue series = Reach 1
Pink series = Reach 2
Green series = Reach 3
5.10.3.4 Summary of Trout parr density (numbers m\(^{-2}\)), Afon Gwy

![Graph showing trout parr density over years for different reaches]

Blue series = Reach 1  
Pink series = Reach 2  
Green series = Reach 3
5.10.4 Epilithic diatom data

5.10.4.1 Percentage abundance summary, Afon Gwy

Eunotia curvata var. attenuata
Eunotia [vanheurckii var. 1]
Peronia fibula
Achnanthes minutissima
Eunotia minutissima
Eunotia sp.
Brachysira brebissonii
Tabellaria kuetschingiana
Eunotia vanheurckii var. intermedia

Eunotia exigua
Brachysira vitrea
Eunotia incisa
Eunotia paludosa
Fragilaria sp.
Tabellaria flocculosa
Surirella linearis

1991 1993 1995 1997 1999 2001 2003 2005 2007
5.10.4.2 Diatom summary statistics, Afon Gwy
### 5.10.5 Aquatic macrophyte data, Afon Gwy

#### Percentage Species Cover

<table>
<thead>
<tr>
<th>Species</th>
<th>1991</th>
<th>1993</th>
<th>1995</th>
<th>1997</th>
<th>1999</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polytrichum sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Racemitrium aciculare</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Juncus effusus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nardia compressa</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Scapania undulata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranunculus flammula</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus bulbosus var. fluitans</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemanaea sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pellia sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polytrichum commune</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyocomium armoricum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filamentous green algae</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ Represents <1% abundance