UCL ENVIRONMENTAL CHANGE RESEARCH CENTRE

UK Upland Waters Monitoring Network (UKUWMN)

Llyn Llagi, Llyn Cwm Mynach, Afon Hafren and Afon Gwy

Annual Summary Progress Report. April 14 - March 15

E. M. Shilland, D. T. Monteith, K. Millidine, I. A. Malcolm & D. Norris

March 2015

UK UPLAND WATERS MONITORING NETWORK (UKUWMN) – CONTRACT 22 01 249

LLYN LLAGI, LLYN CWM MYNACH, AFON HAFREN AND AFON GWY

ANNUAL SUMMARY PROGRESS REPORT April 2015 - March 2015

REPORT TO THE WELSH ASSEMBLY GOVERNMENT AND NATURAL RESOURCES WALES

Ewan M. Shilland[1], Don T. Monteith[2], Karen Millidine[3], Ian A. Malcolm[3] & Dave Norris[4]

March 2015

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[2] CEH Lancaster
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[4] CEH Bangor

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Cover photo: underwater at Afon Gwy, July 2015. All photographs © Ewan Shilland

3 Llyn Llagi

Figure 1 Llyn Llagi. Looking towards Snowdon, 23rd Feb 2015.

3.1 Summary Overview

Chemical and biological sample collection, analysis and data collation, quality control and archiving proceeded without any problems at Llyn Llagi during the period from April 2014 to March 2015.

Sponge samples from the site, collected in 2012 and sent off to Karen Evans, a PhD student at Liverpool University, were identified as being of two species, *Spongilla lacustris* and *Racekiela ryderii.*

3.2 Water Chemistry

Samples were collected by CEH in early June, September and December 2014, delivered to the analytical laboratories on schedule and have been analysed, quality controlled and archived in the UKUWMN central chemistry database at CEH Lancaster. March 2015 samples have been collected and are in the process of being analysed.

3.3 Sediment Traps

Sediment traps were recovered and replaced on the 30th of July 2014 by a team from ENSIS. Diatoms and Spheroidial Carbonaceous Particles in the sediment retrieved from the traps are currently being analysed.

3.4 Thermistors

Lake top and bottom thermistors and the thermistor chain were removed and replaced on the 30th of July 2014 by a team from ENSIS. All had functioned well during the previous year and the data were added to the ENSIS and MS 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 30th of July 2014. 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 16th April 2014 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. The data is in the process of being quality screened before being added to the UKUWMN biological database at ENSIS.

3.7 Fish

Fish surveying was performed on the 30th September 2014 by the Game and Wildlife Conservation Trust. The data have been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKUWMN biological database at ENSIS.

3.8 Aquatic Macrophytes

Aquatic macrophytes were not surveyed at Llyn Llagi in 2014.

3.9 Data Management and Reporting

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

The 2013-2014 annual report has been uploaded to the UKUWMN web page. The section on Llyn Llagi appears in section 3.11 below.

The UKUWMN website page detailing Llyn Llagi is here:
http://awmn.defra.gov.uk/sites/site_15.php

Further publications from the contract period utilizing UKUWMN data from Llyn Llagi are detailed in section 3.10 below.

3.10 Llyn Llagi Recent UKUWMN Output

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Garmo, O. A., Skjelkvale, B. L., Wit, H. A., Colombo, L., Curtis, C., Folster, J., Hoffmann, A., Hruska, J., Hogasen, T., Jeffries, D. S., Keller, W. B., Kram, P., Majer, V., Monteith, D. T., Paterson, A. M., Rogora, M., Rzychon, D., Steingruber, S., Stoddard, J., Vuorenmaa, J.

& Worsztynowicz, A. (2014) Trends in Surface Water Chemistry in Acidified Areas in Europe and North America from 1990 to 2008. *Water Air and Soil Pollution*, **225**, 1-14.

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Shibata, H., Branquinho, C., McDowell, W., Mitchell, M., Monteith, D., Tang, J., Arvola, L., Cruz, C., Cusack, D., Halada, L., Kopjìek, J., M+íguas, C., Sajidu, S., Schubert, H., Tokuchi, N. & Zeíhora, J. (2014) Consequence of altered nitrogen cycles in the coupled human and ecological system under changing climate: The need for long-term and site-based research. *AMBIO* 1-16.

Shilland, E. M., Monteith, D. T., Millidine, K. & Malcolm, I. A. (2014) The United Kingdom Upland Waters Monitoring Network Data Report for 2012-2013 (year 25). Report to the Department for Environment, Food and Rural Affairs (Contract EPG 1/3/160). 1-259. ENSIS Ltd. Environmental Change Research Centre, University College London, London.

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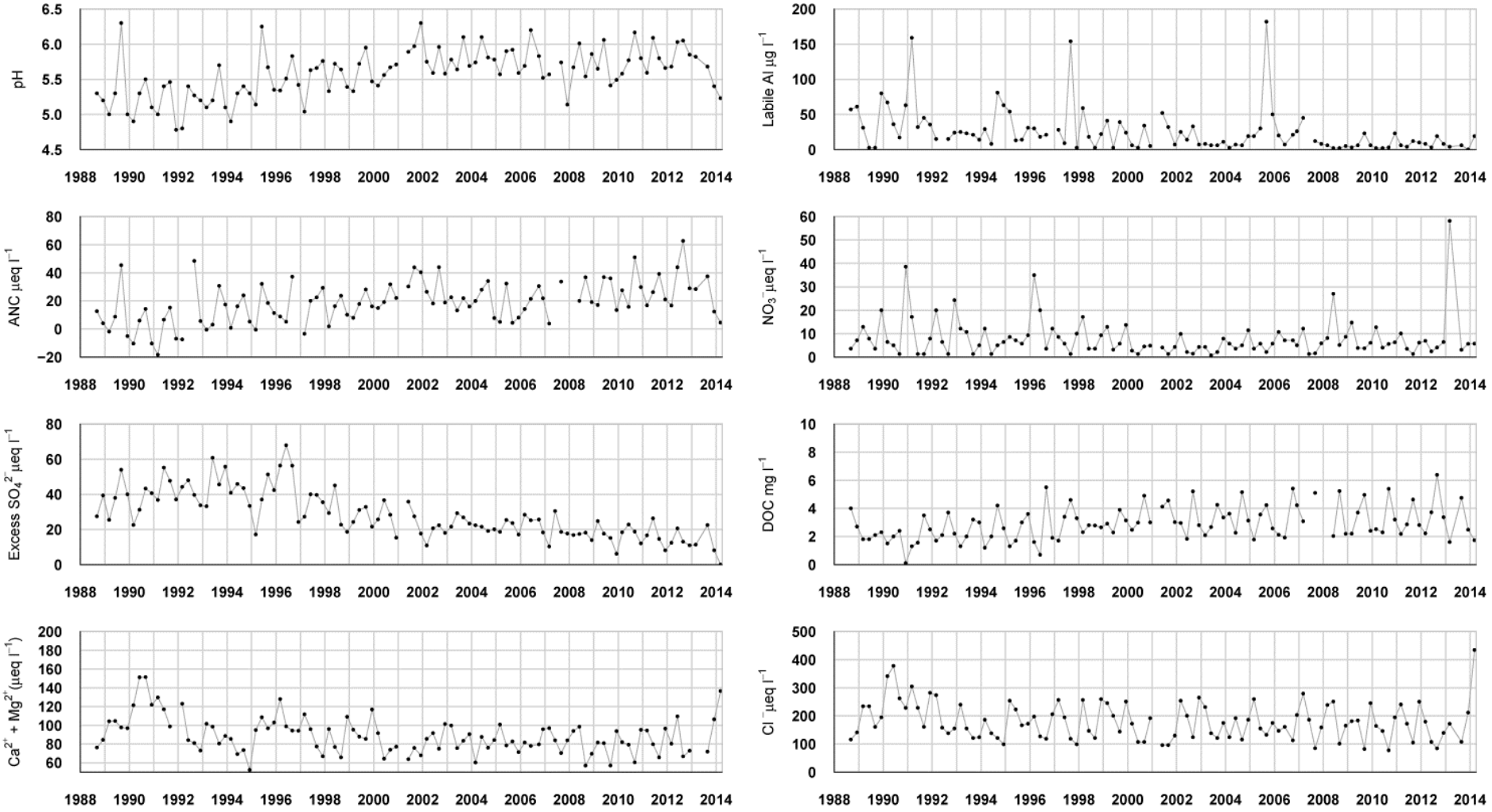
Stockdale, A., Tipping, E., Fjellheim, A., Garmo, O. A., Hildrew, A. G., Lofts, S., Monteith, D. T., Ormerod, S. J. & Shilland, E. M. (2014) Recovery of macroinvertebrate species richness in acidified upland waters assessed with a field toxicity model. *Ecological Indicators*, **37, Part B**, 341-350.

Winterbottom, J. H. & Orton, S. E. (2014) United Kingdom Acid Waters Monitoring Network Invertebrate Survey. Twenty Seventh Year: 2014. Summary of species identification and abundance. 1-10. School of Biological Sciences, Queen Mary University of London, London.

3.11 Llyn Llagi Summary Data to March 2015

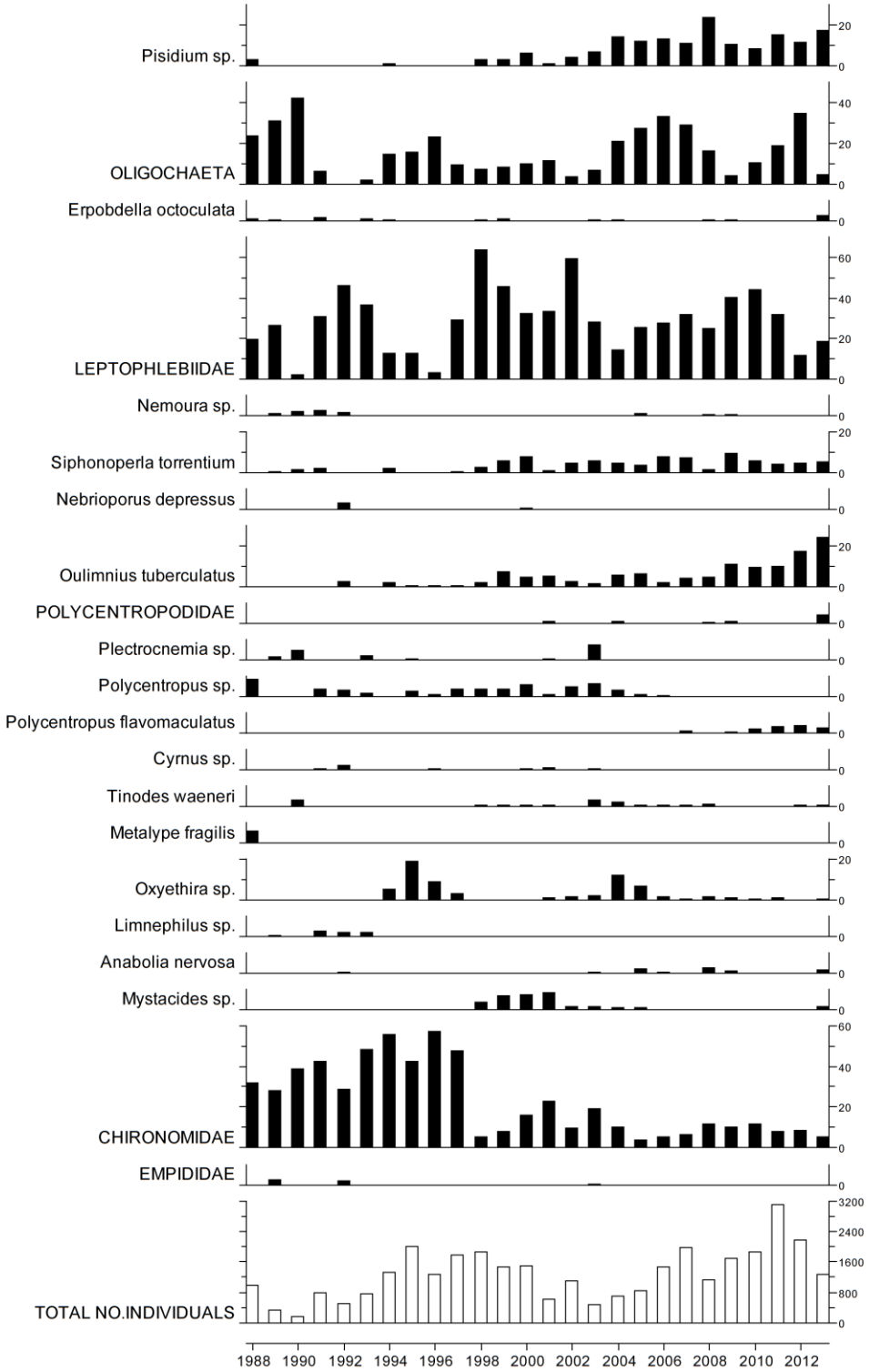
3.11.1 Spot sampled chemistry data



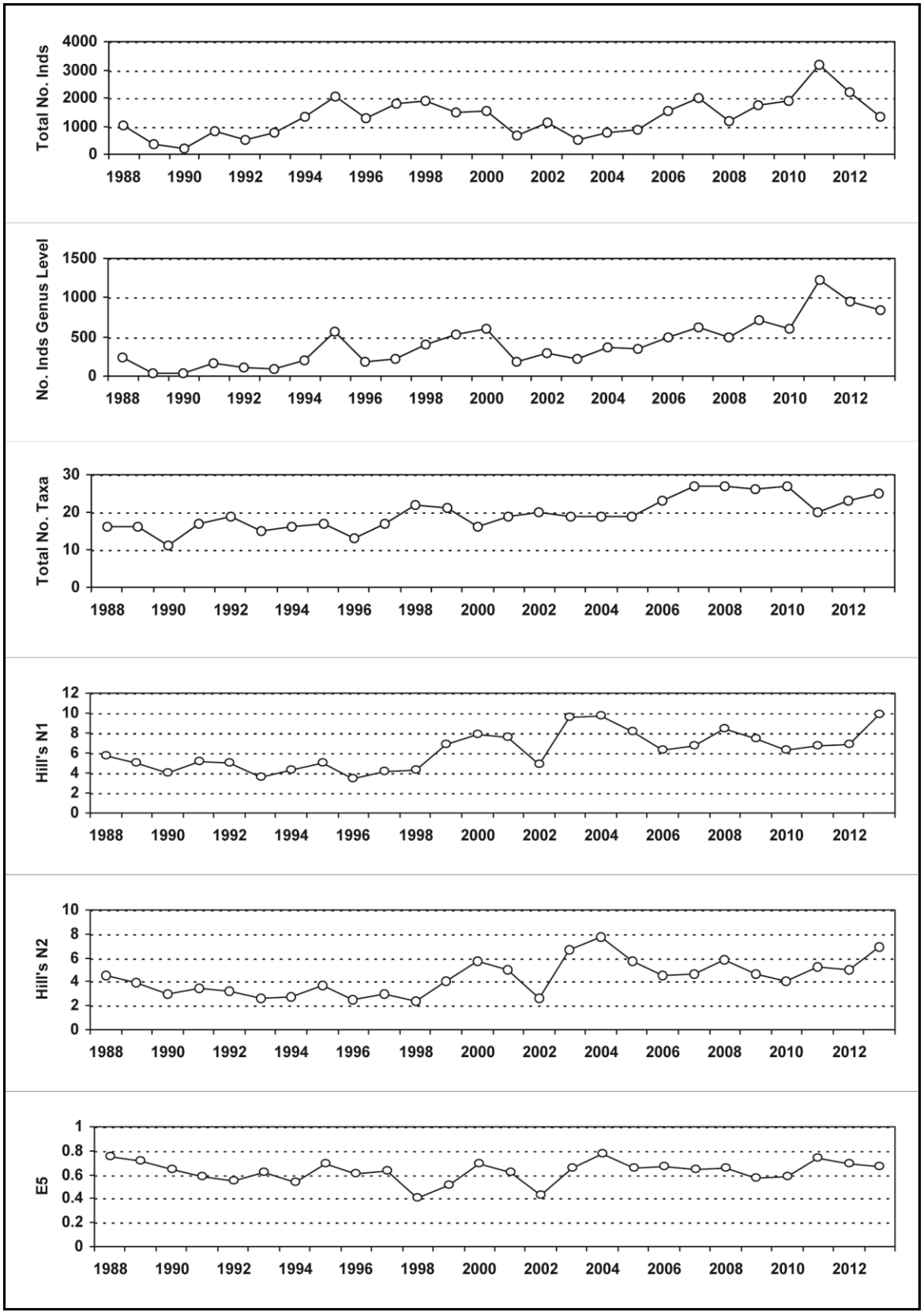
µeq l $^{-1}$, *µg l $^{-1}$, **mg l $^{-1}$	pH	ANC	Ca $^{2+}$	Mg $^{2+}$	Na $^{+}$	K $^{+}$	*Soluble Al	*Labile Al	Cl $^{-}$	*SO_4^{2-}	xSO_4^{2-}	NO_3^{-}	**DOC
Mean 1st 5 yrs	5.23	5.71	56.70	49.69	185.75	3.54	75.37	41.61	219.33	62.91	39.91	10.44	2.13
13-14 mean	5.44	18.06	51.18	53.74	196.04	4.39	31.33	8.33	251.17	103.55	9.92	4.81	2.99
13-14 std dev	0.23	17.19	10.67	22.11	110.15	1.84	6.11	9.71	166.85	63.92	11.79	1.51	1.57

3.11.2 Macroinvertebrate data

3.11.2.1 Percentage abundance summary, Llyn Llagi

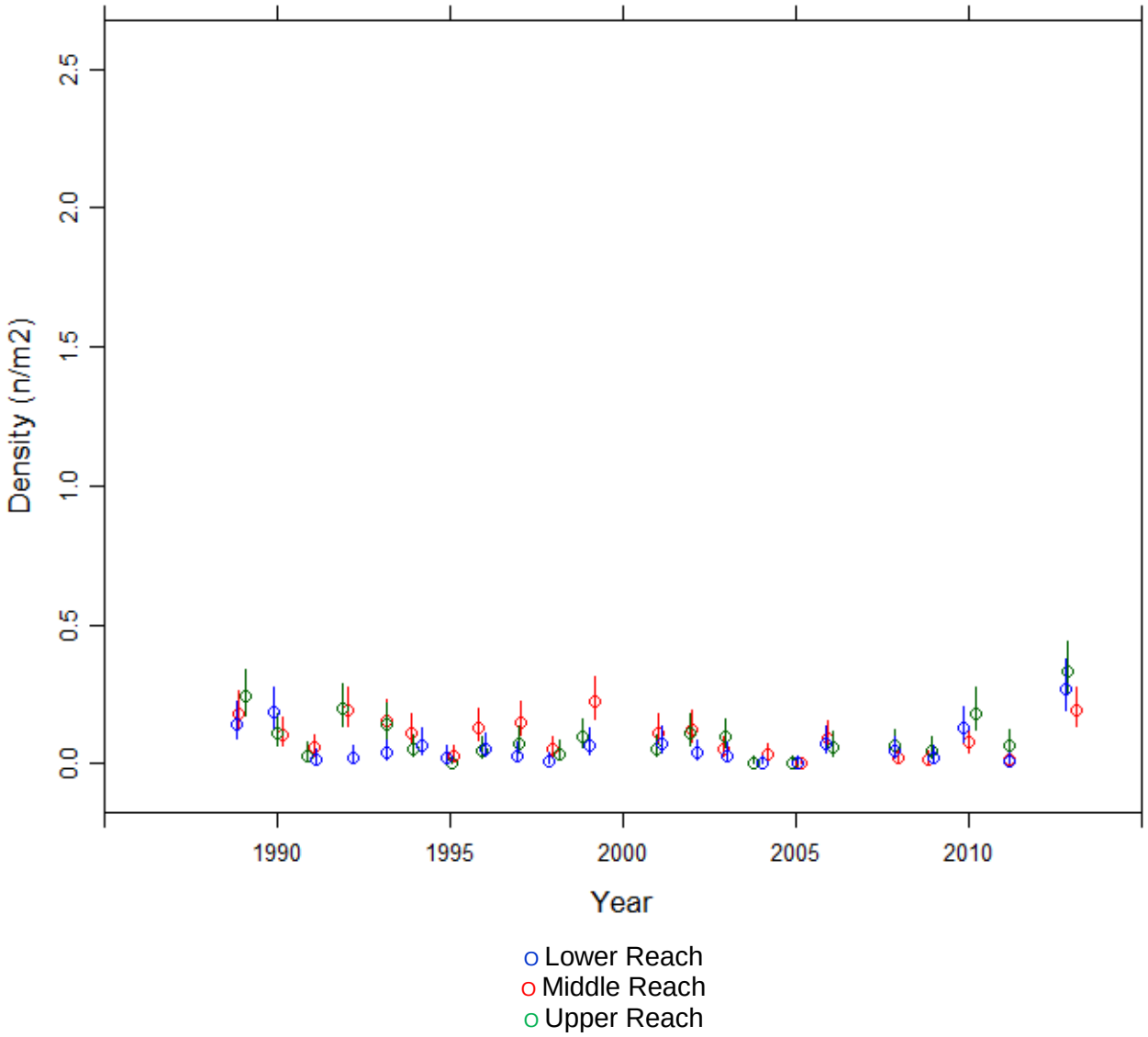


3.11.2.1 Macroinvertebrate summary statistics, Llyn Llagi

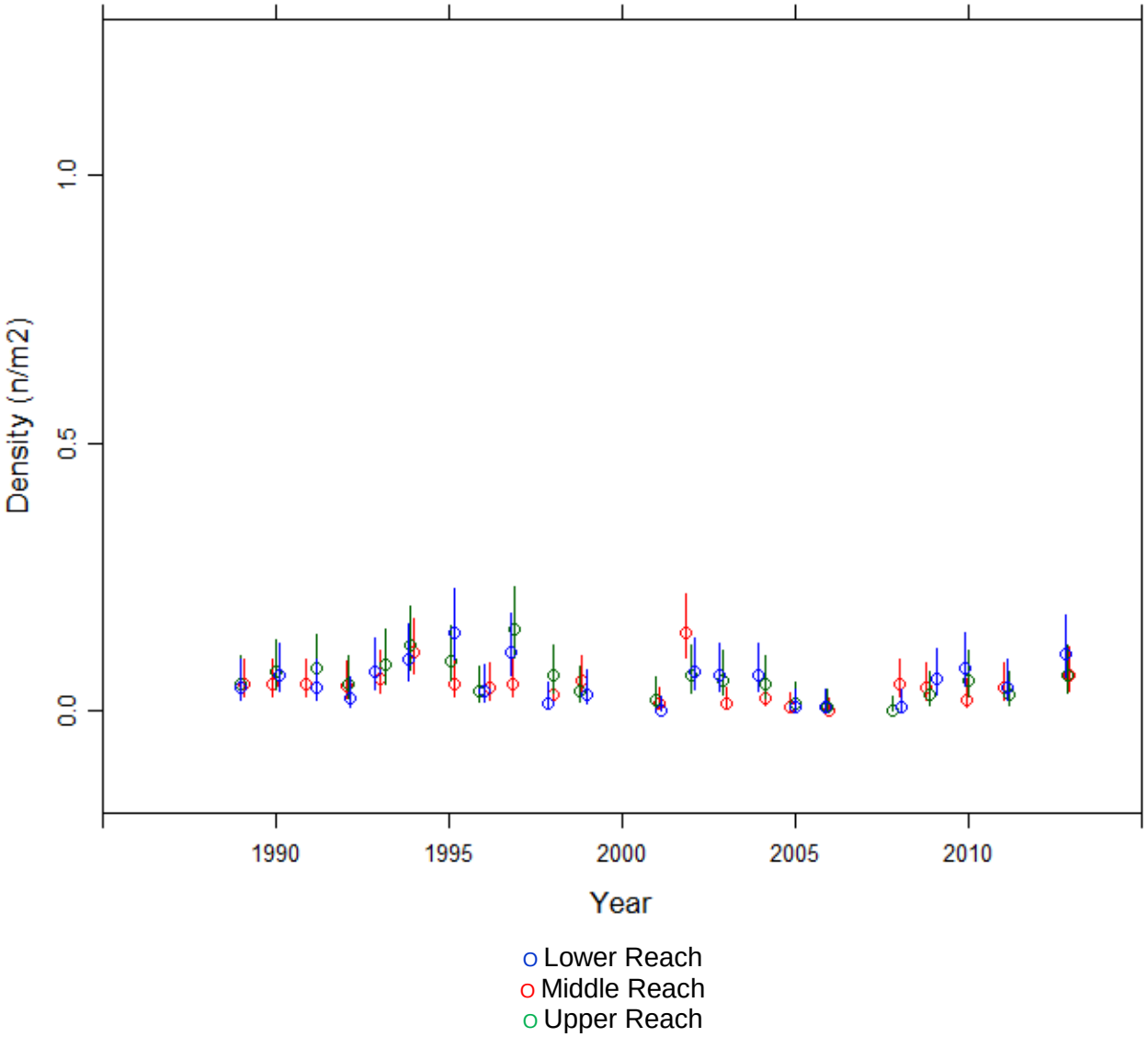


3.11.3 Fish data (for outflow stream)

3.11.3.1 Summary of Trout fry density (numbers m^{-2}), Llyn Llagi

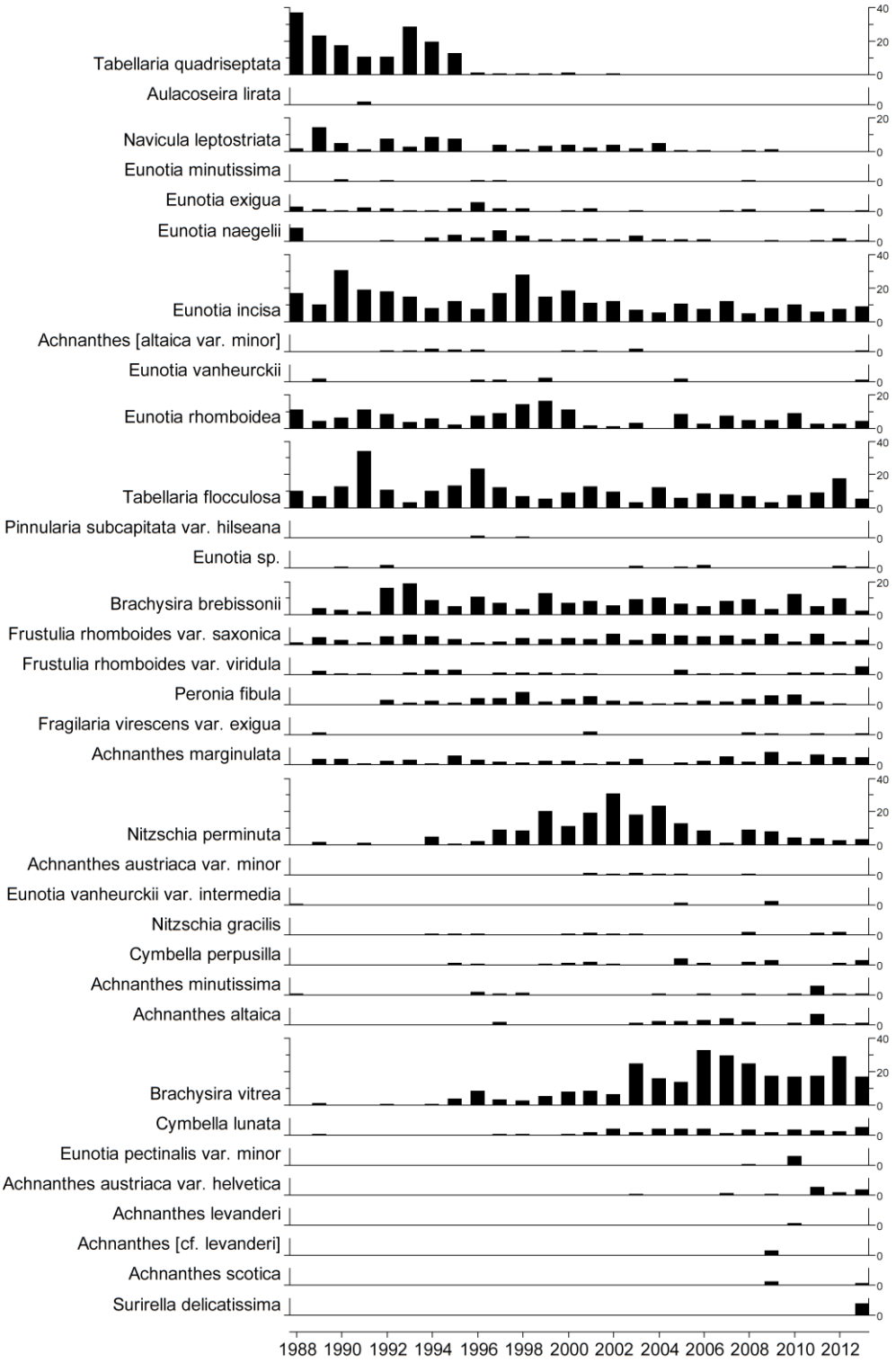


3.11.3.2 Summary of Trout parr density (numbers m^{-2}), Llyn Llagi

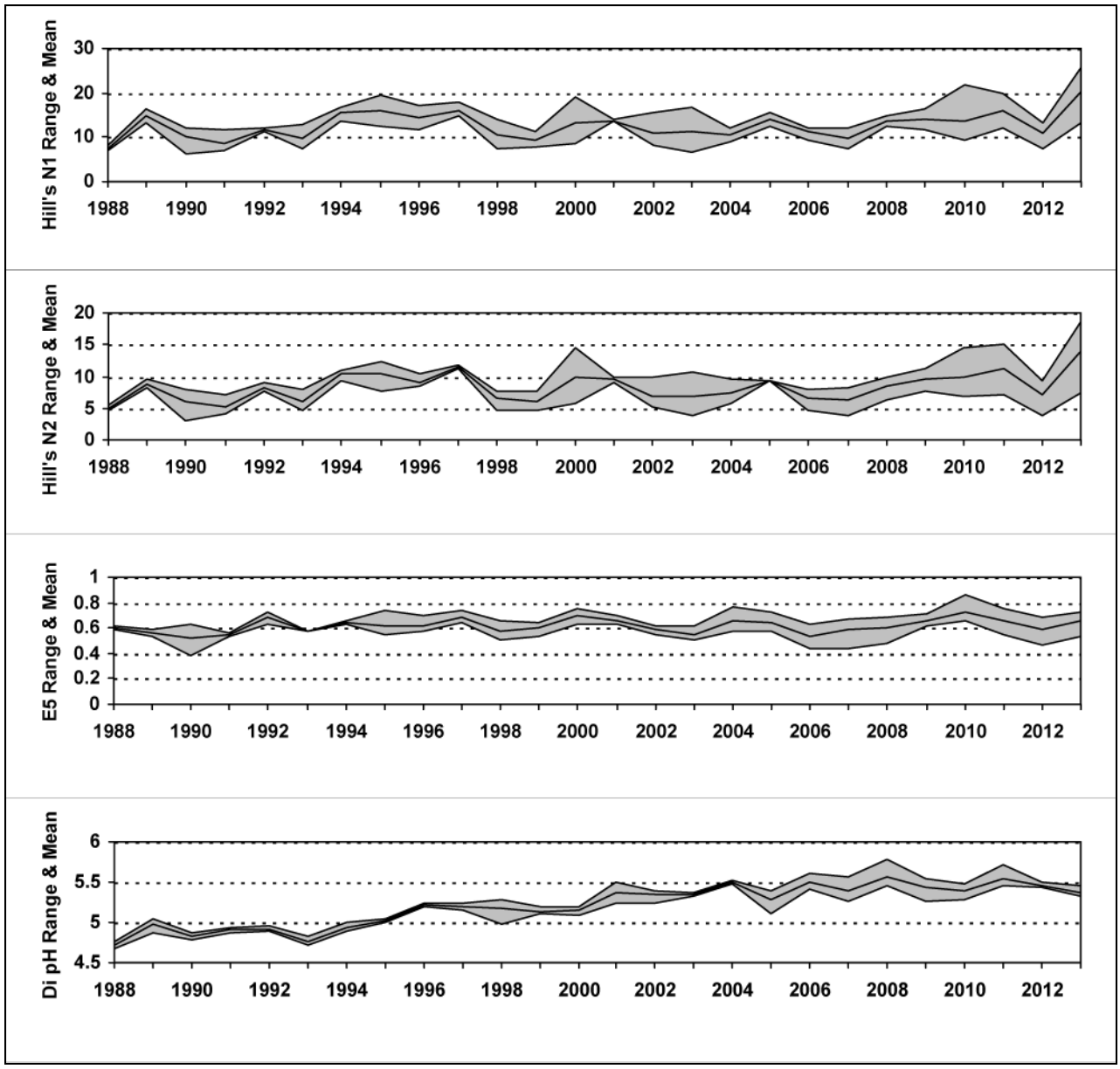


3.11.4 Epilithic diatom data

3.11.4.1 Percentage abundance summary, Llyn Llagi

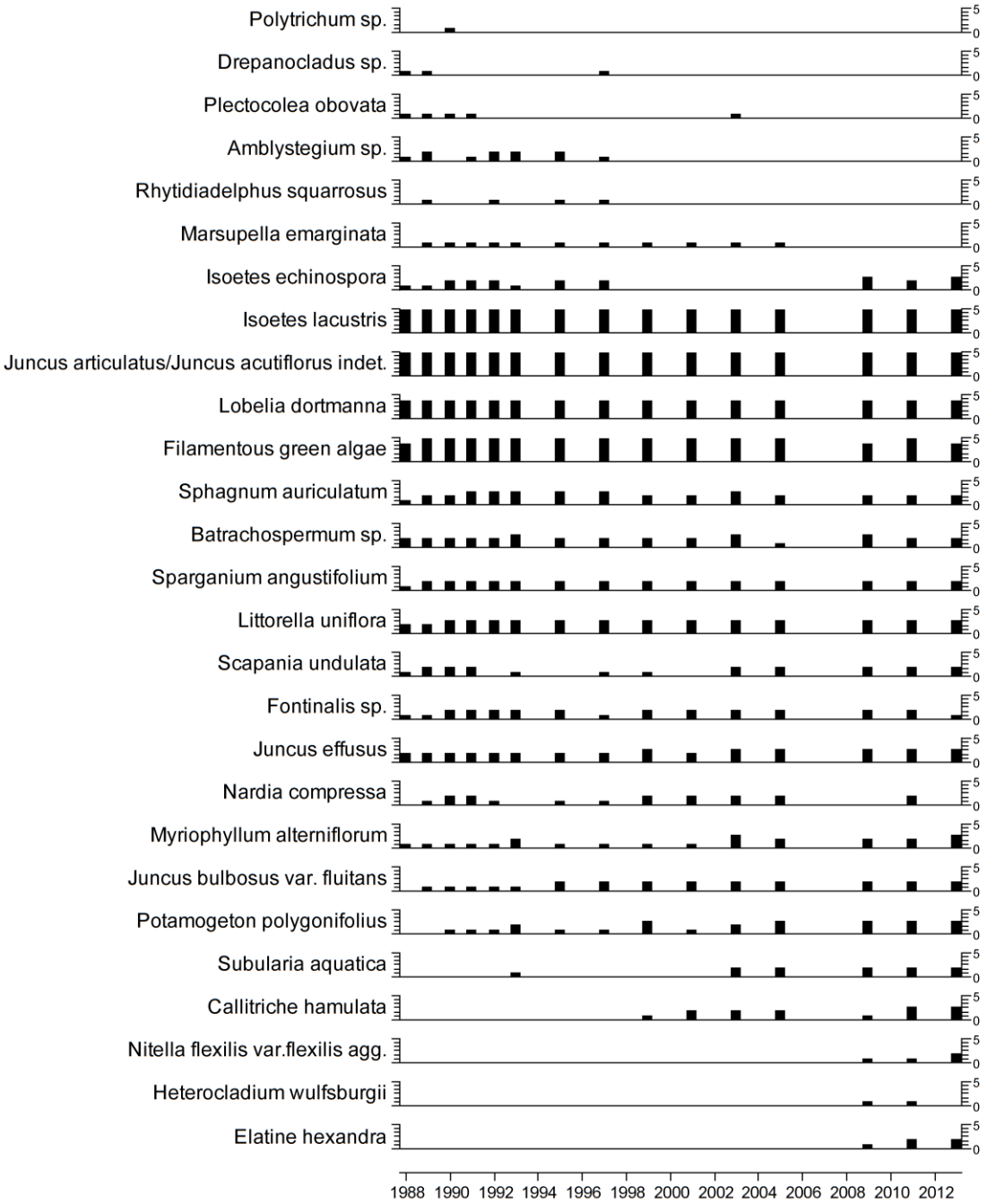


3.11.4.1 Diatom summary statistics, Llyn Llagi



3.11.5 Aquatic macrophyte data, Llyn Llagi

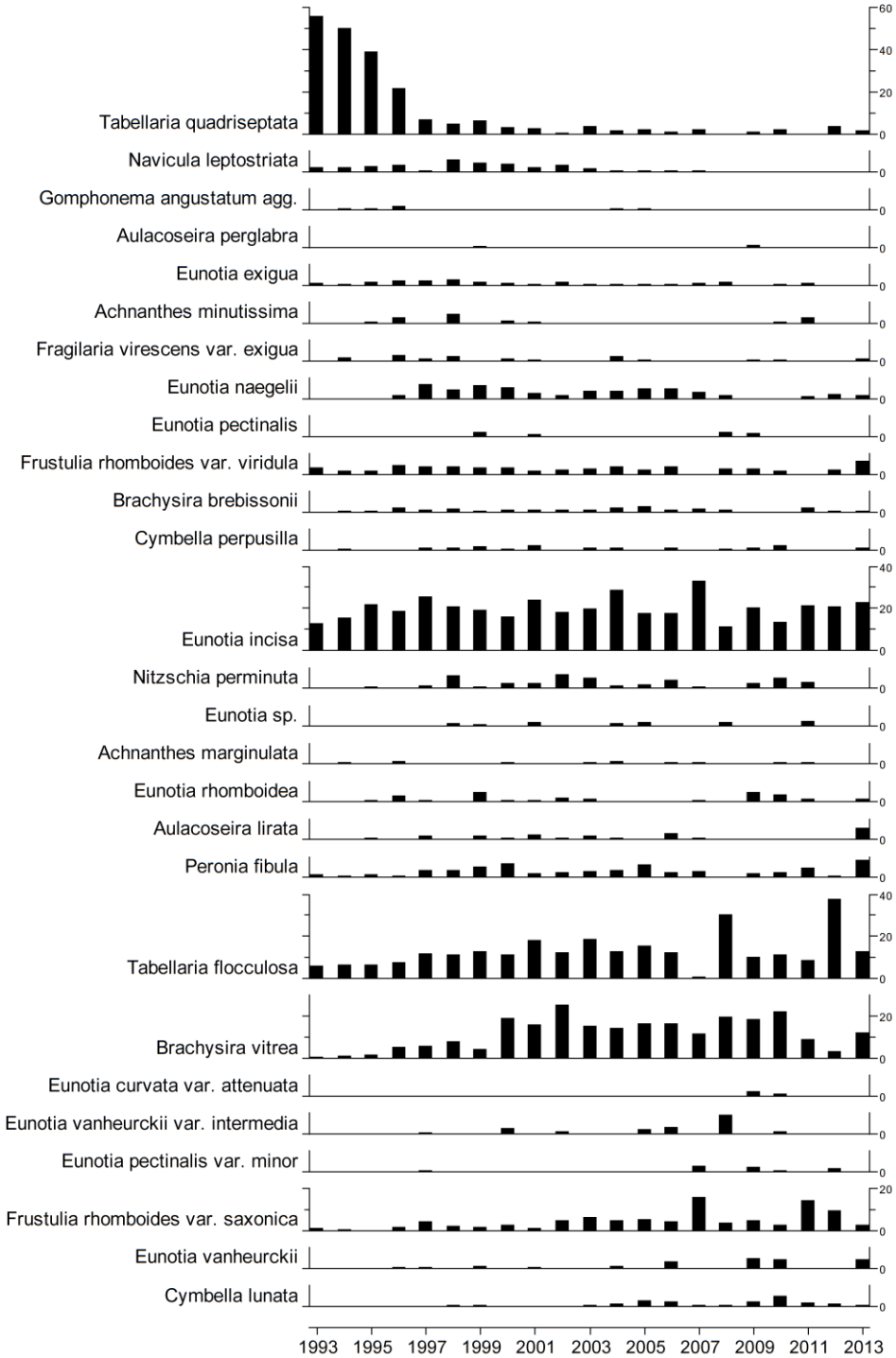
Species Scores (1-5)



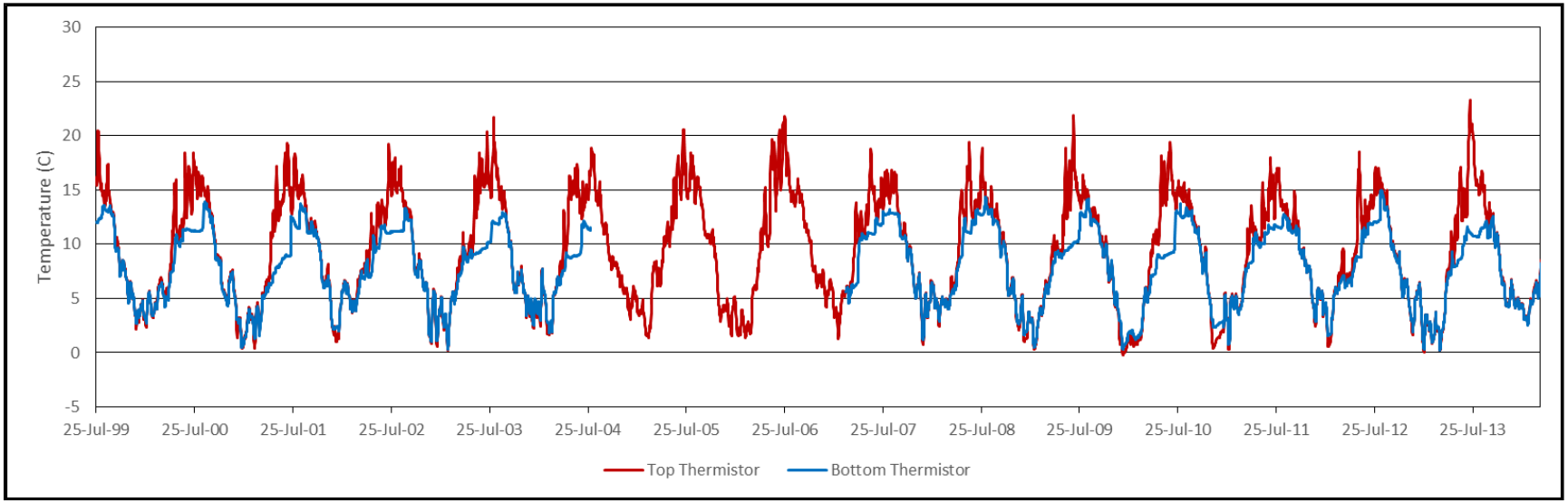
No survey in 2007 due to funding cuts

3.11.6 Sediment trap data, Llyn Llagi

Relative percentage frequency of diatom taxa

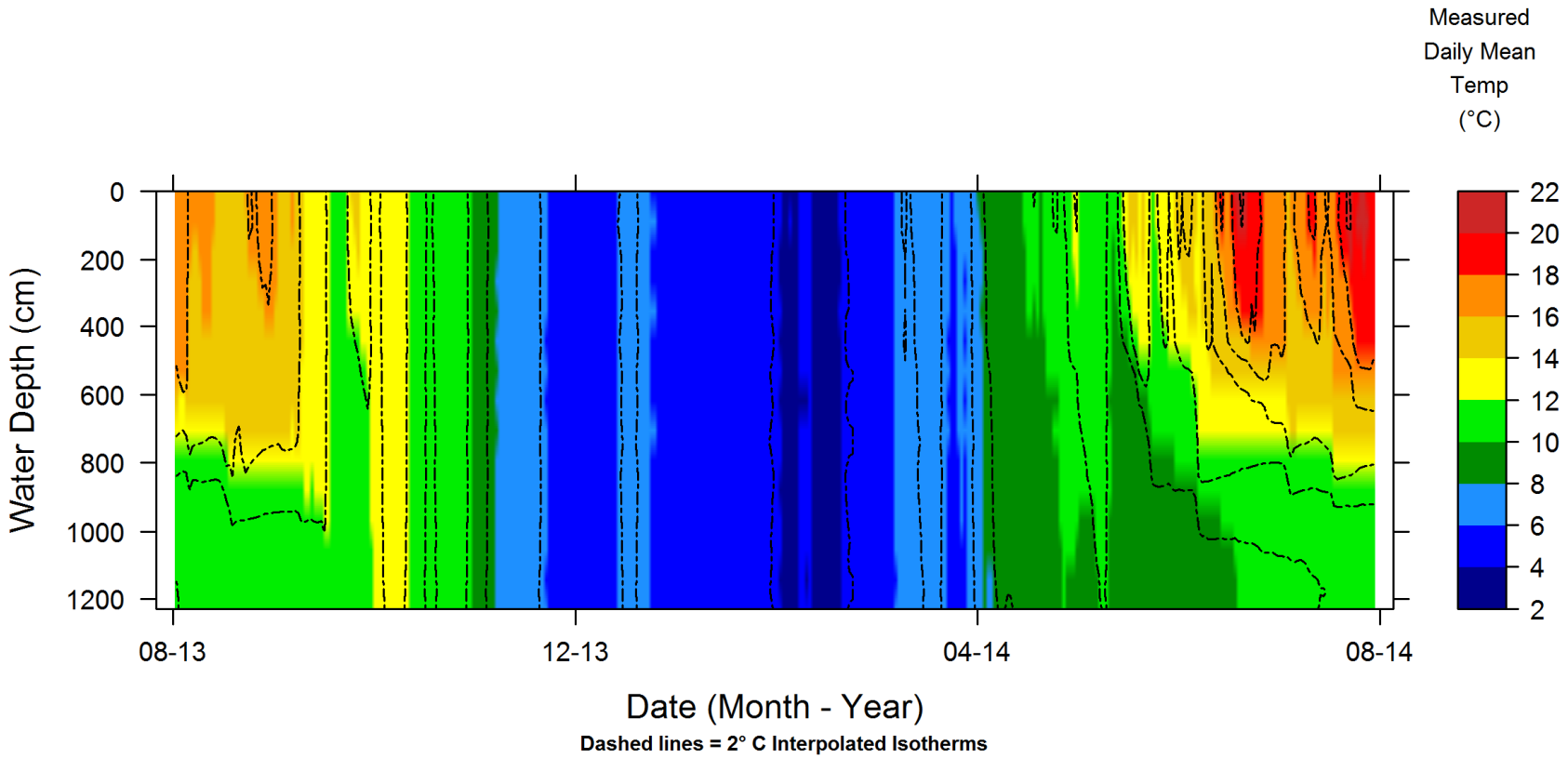


3.11.7 Sediment trap thermistor data, Llyn Llagi

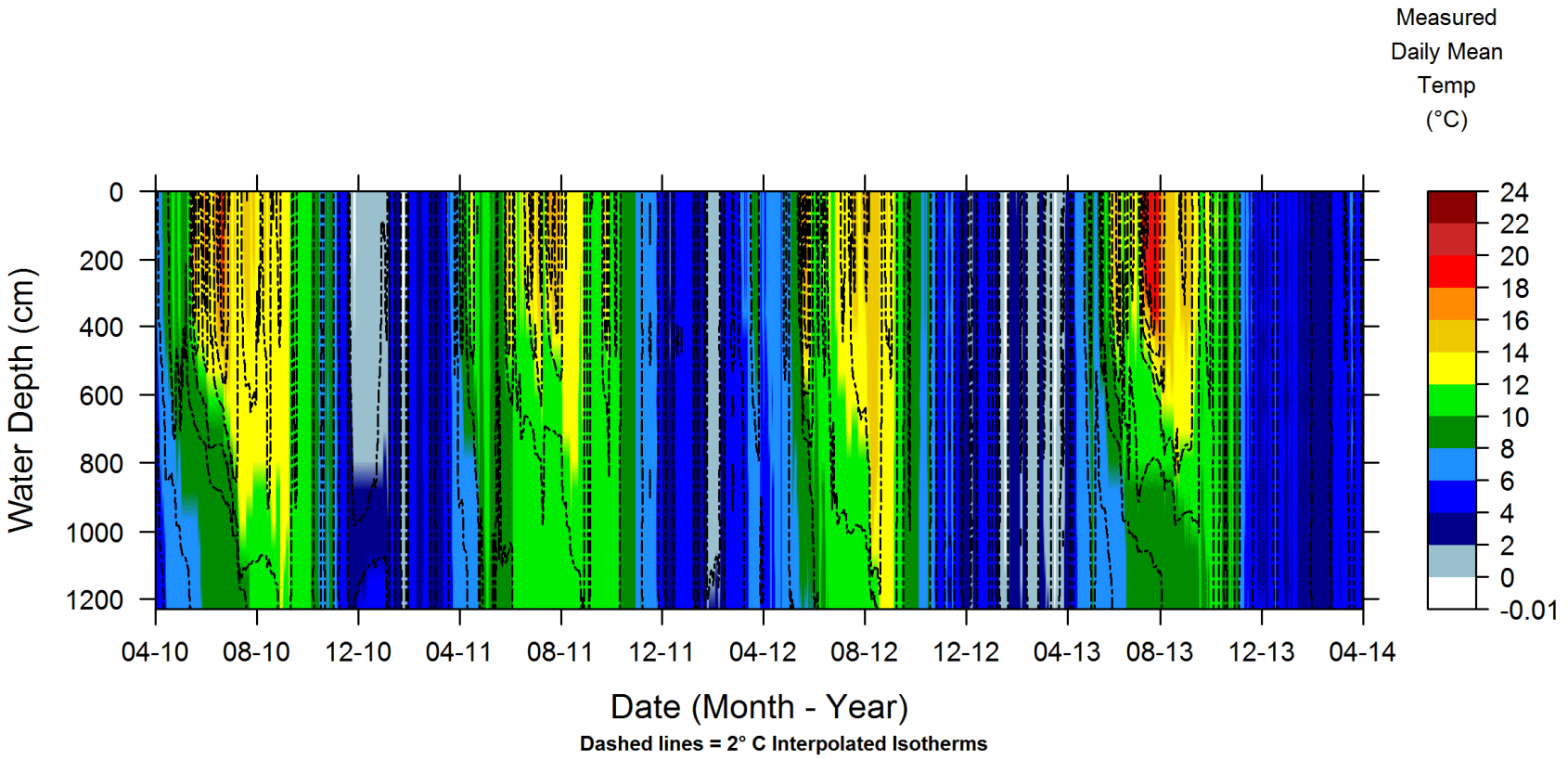


3.11.8 Thermistor chain data, Llyn Llagi

3.11.8.1 Annual detail, Llyn Llagi 2014 - 2015

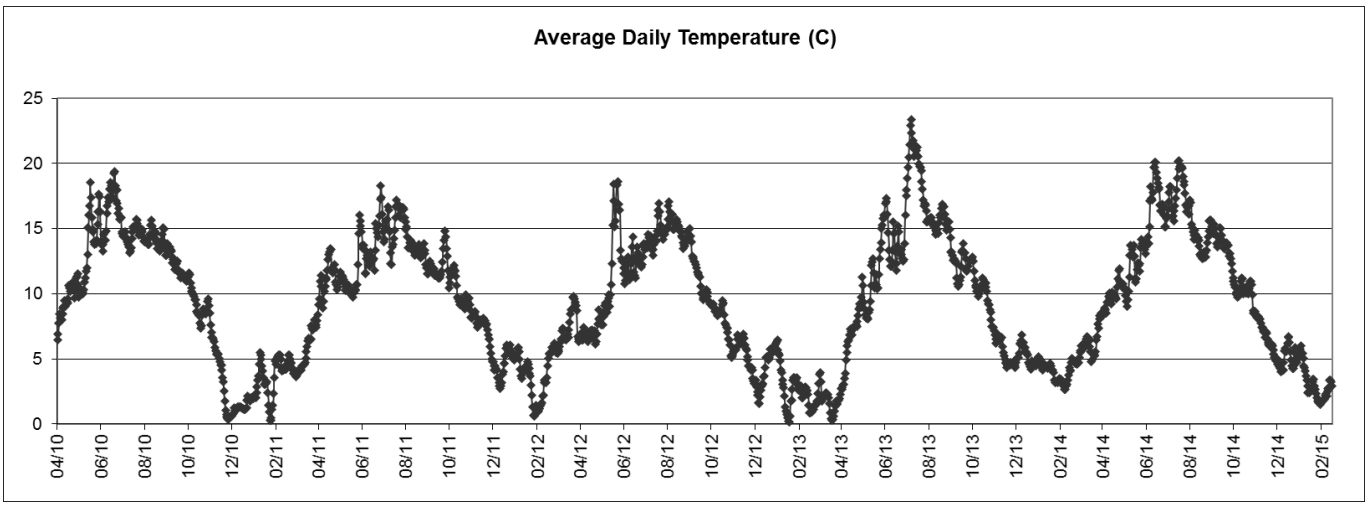


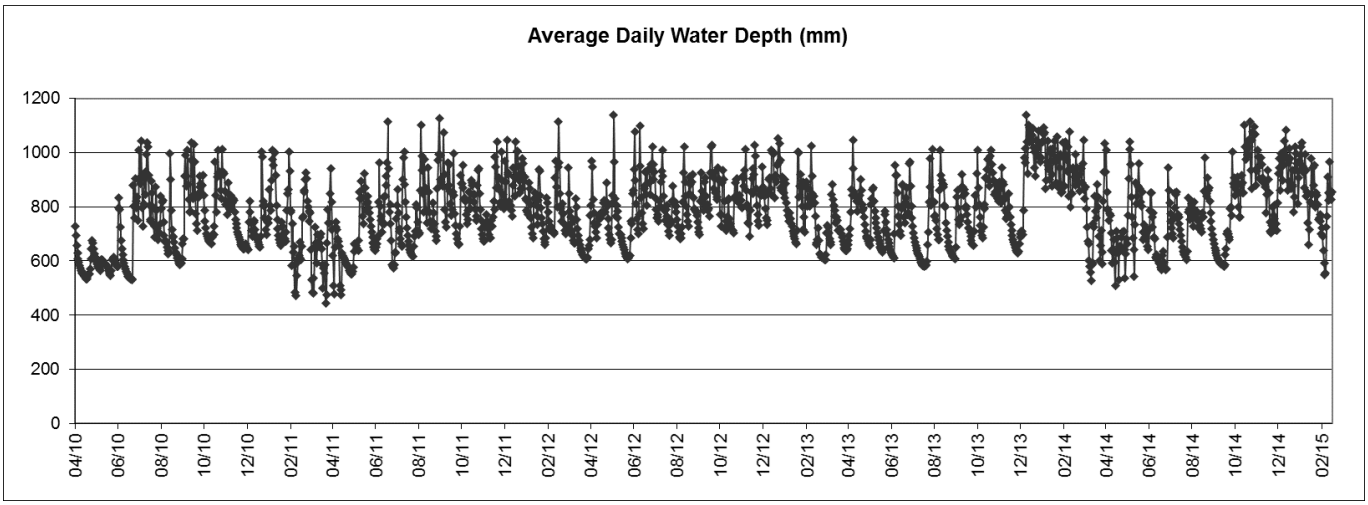
3.11.8.2 Llyn Llagi 2010 - 2015



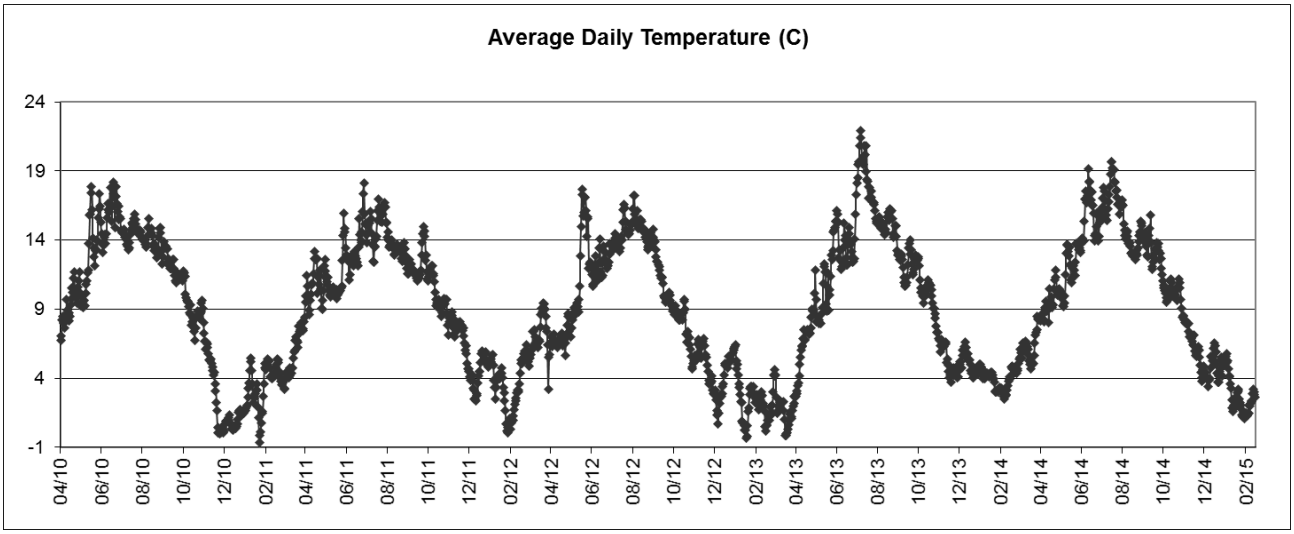
3.11.9 Automatic sensor data, Llyn Llagi

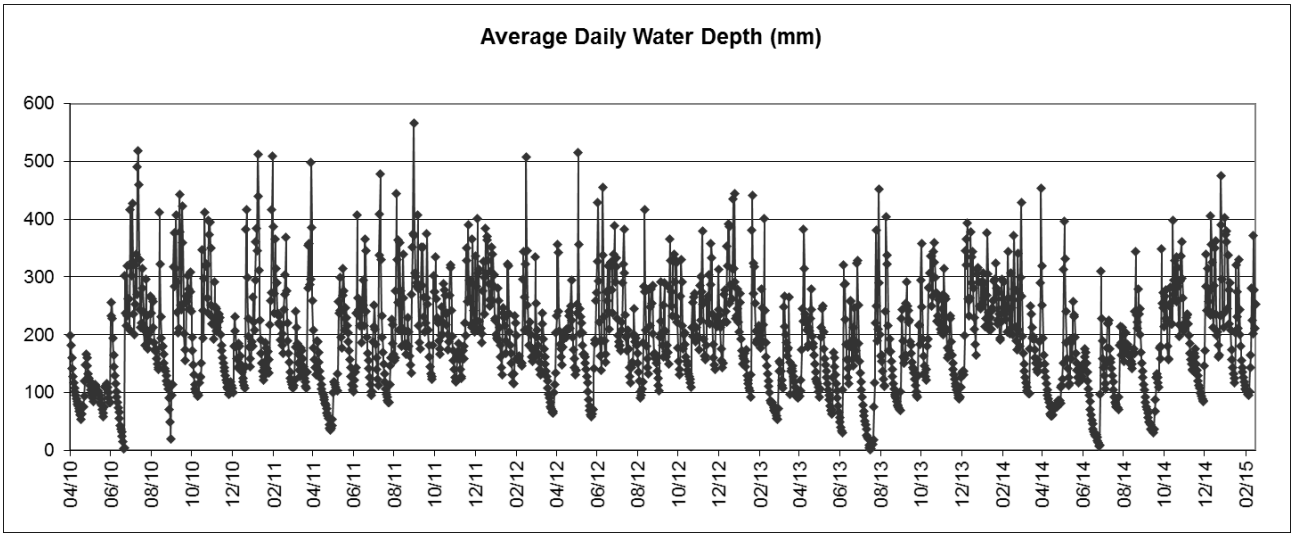
3.11.9.1 Lake sensor data, Llyn Llagi

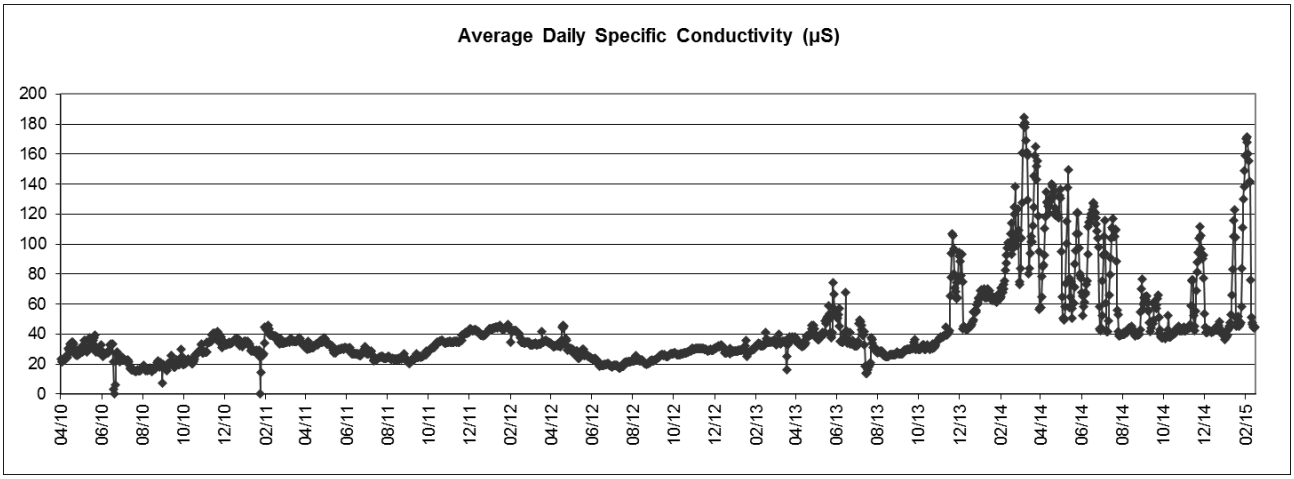




3.11.9.2 Outflow sensor data, Llyn Llagi







4 Llyn Cwm Mynach

Figure 2 Llyn Cwm Mynach. Looking southeast from the North West end of the lake, 29th July 2015.

4.1 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 2014 to March 2015.

A supplementary project has been instigated by CEH and the Woodland Trust to look at the effects of differing forestry practices in the catchment, with water samples being analysed at CEH Bangor.

4.2 Water Chemistry

Samples were collected by CEH in early June, September and December 2014, delivered to the analytical laboratories on schedule and have been analysed, quality controlled and archived in the UKUWMN central chemistry database at CEH Lancaster. March 2015 samples have been collected and are in the process of being analysed.

4.3 Sediment Traps

Sediment traps were recovered and replaced on the 29th of July 2014 by a team from ENSIS. Diatoms and Spheroidial Carbonaceous Particles in the sediment retrieved from the traps are currently being analysed.

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Lake top and bottom thermistors and the thermistor chain were removed and replaced on the 29th of July 2014 by a team from ENSIS. All had functioned well during the previous

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Epilithic diatoms were retrieved by a team from ENSIS from three sampling points around the lake on the 29th of July 2014. The samples have been made into slides and are currently in the process of being analysed.

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Aquatic macroinvertebrates were sampled on the 16th April 2014 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. The data is in the process of being quality screened before being added to the UKUWMN biological database at ENSIS.

4.7 Fish

Fish surveying was performed on the 1st October 2014 by the Game and Wildlife Conservation Trust. The data have been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKUWMN biological database at ENSIS.

4.8 Aquatic Macrophytes

Aquatic macrophytes were surveyed by a team from ENSIS on 29th of July 2014 using both UKUWMN and CSM standard methodologies. Data will be added to the ENSIS biological database after microscope confirmation of bryophyte identifications.

4.9 Data Management and Reporting

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

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Shilland, E. M., Monteith, D. T., Millidine, K. & Malcolm, I. A. (2014) The United Kingdom Upland Waters Monitoring Network Data Report for 2012-2013 (year 25). Report to the Department for Environment, Food and Rural Affairs (Contract EPG 1/3/160). 1-259. ENSIS Ltd. Environmental Change Research Centre, University College London, London.

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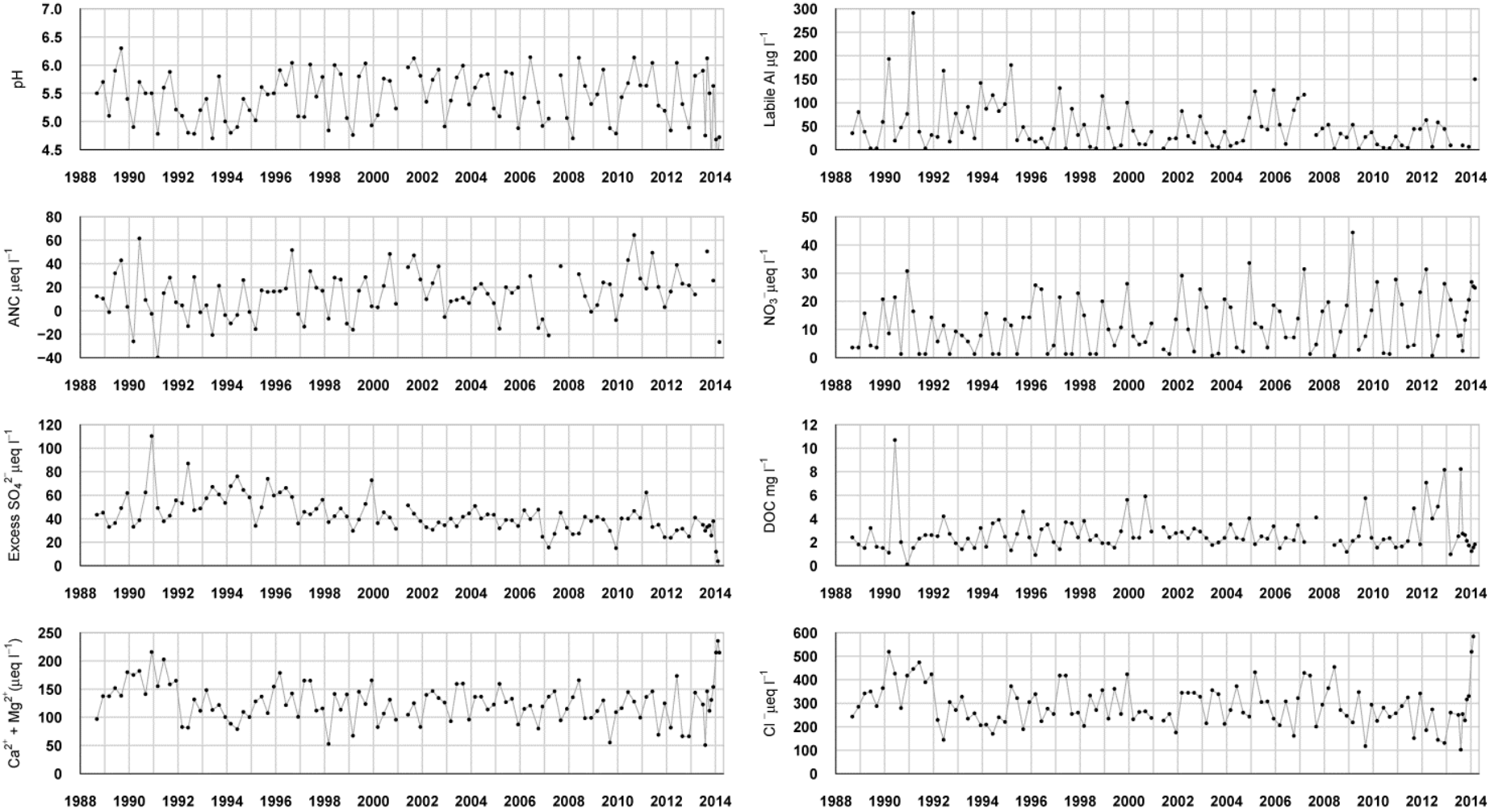
Winterbottom, J. H. & Orton, S. E. (2014) United Kingdom Acid Waters Monitoring Network Invertebrate Survey. Twenty Seventh Year: 2014. Summary of species identification and

abundance. 1-10. School of Biological Sciences, Queen Mary University of London, London.

4.11 Llyn Cwm Mynach Summary Data to March 2014

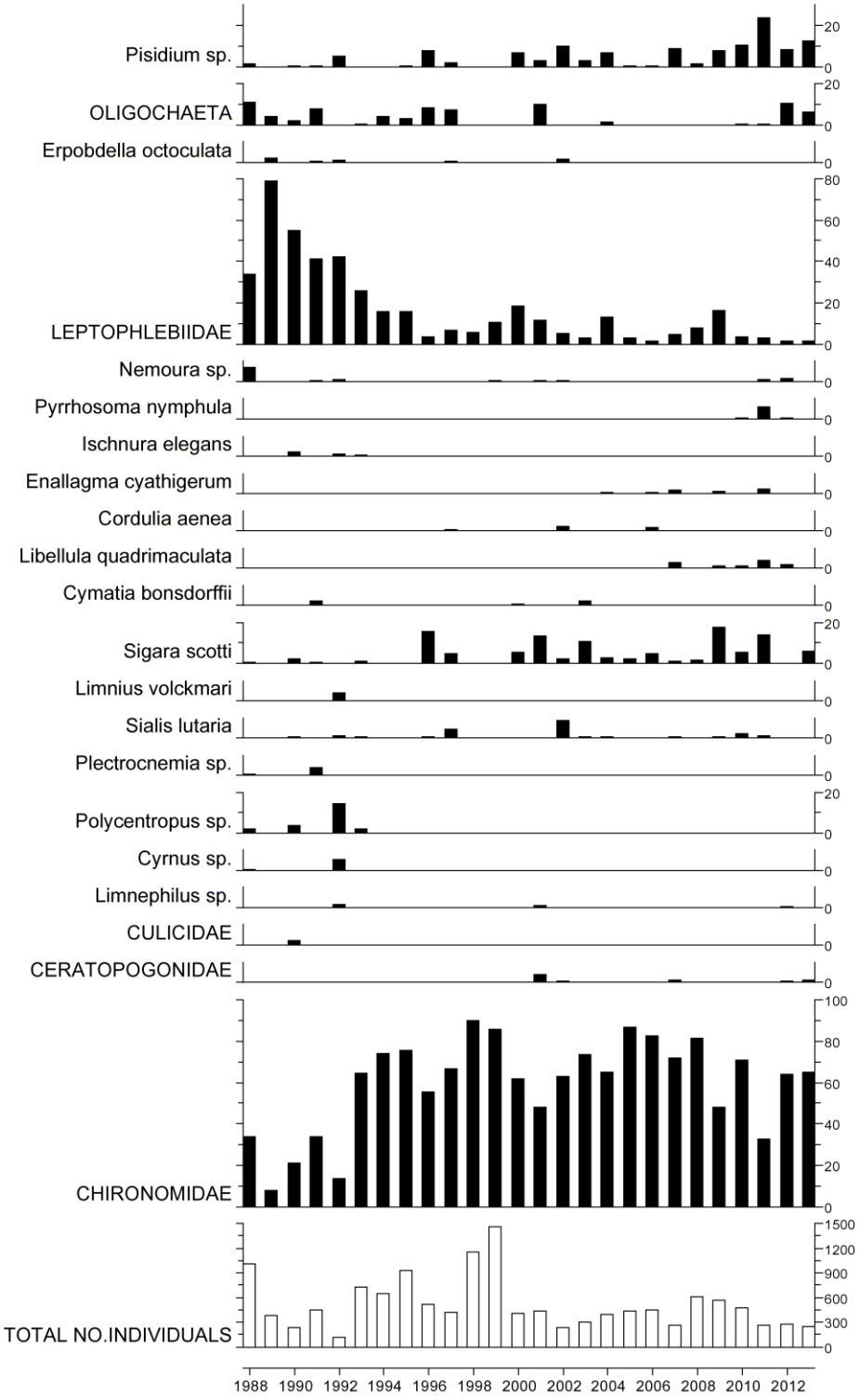
4.11.1 Spot sampled chemistry data



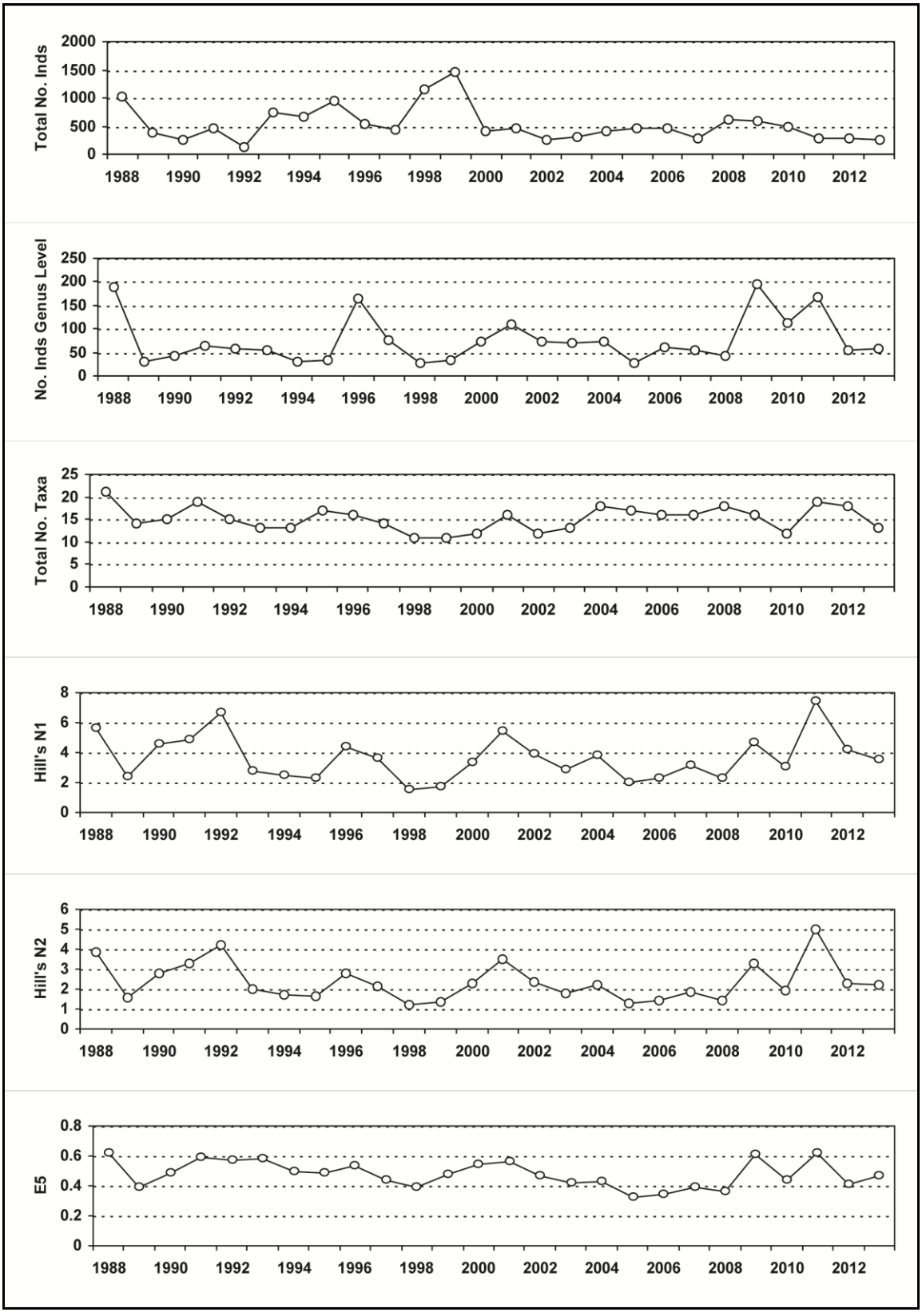
µeq l $^{-1}$, *µg l $^{-1}$, **mg l $^{-1}$	pH	ANC	Ca $^{2+}$	Mg $^{2+}$	Na $^{+}$	K $^{+}$	*Soluble Al	*Labile Al	Cl $^{-}$	*SO_4^{2-}	xSO_4^{2-}	NO_3^{-}	**DOC
Mean 1st 5 yrs	5.35	7.68	77.79	67.45	291.02	3.36	110.75	66.58	337.67	88.32	52.91	9.40	2.50
13-14 mean	5.10	16.45	71.91	81.53	307.55	6.38	75.00	55.00	364.34	54.57	22.96	16.10	2.72
13-14 std dev	0.69	39.40	21.93	39.67	129.47	2.72	96.19	82.29	194.06	13.41	15.24	8.86	2.13

4.11.2 Macroinvertebrate data

4.11.2.1 Percentage abundance summary, Llyn Cwm Mynach

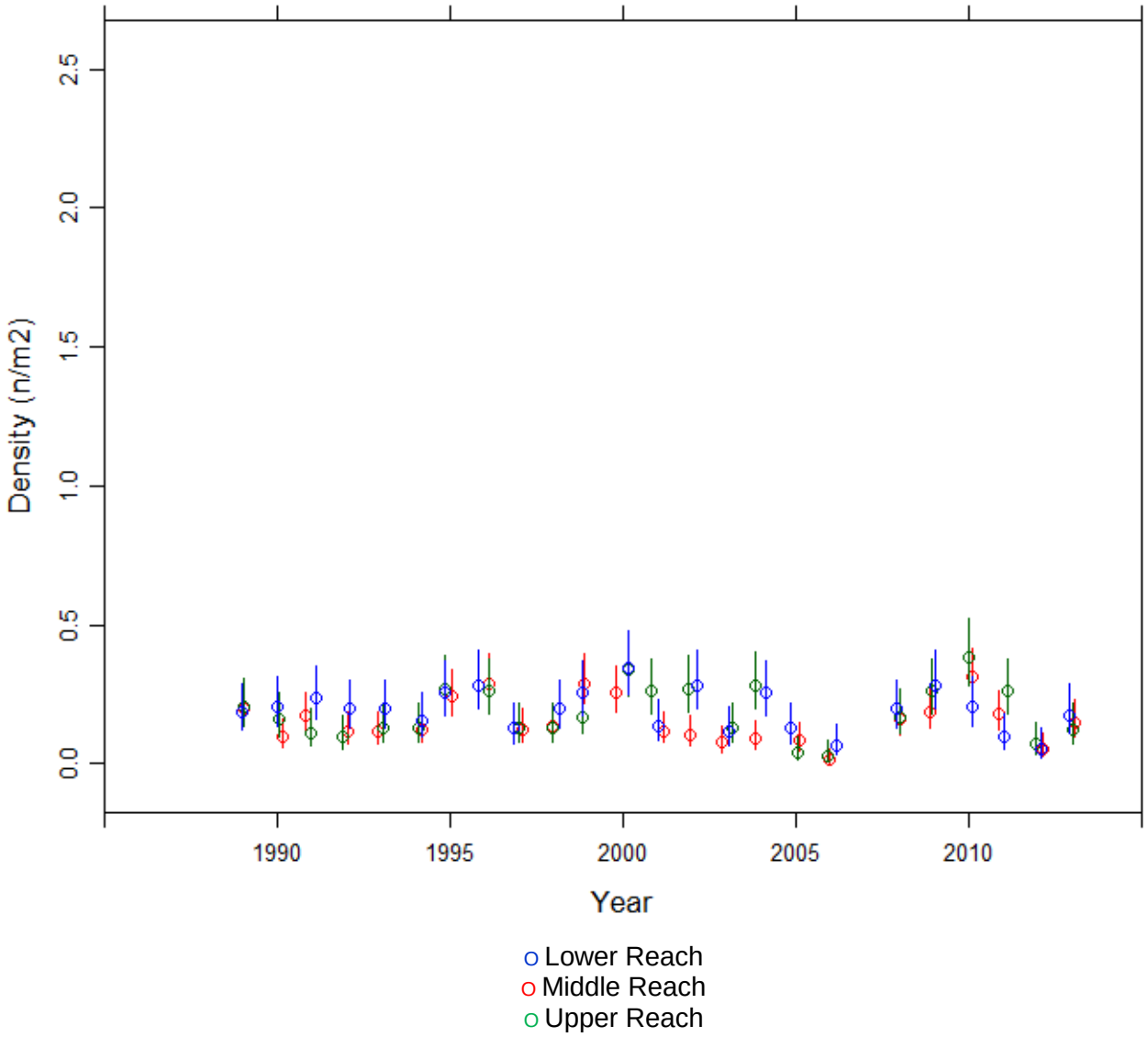


4.11.2.1 Macroinvertebrate summary statistics, Llyn Cwm Mynach

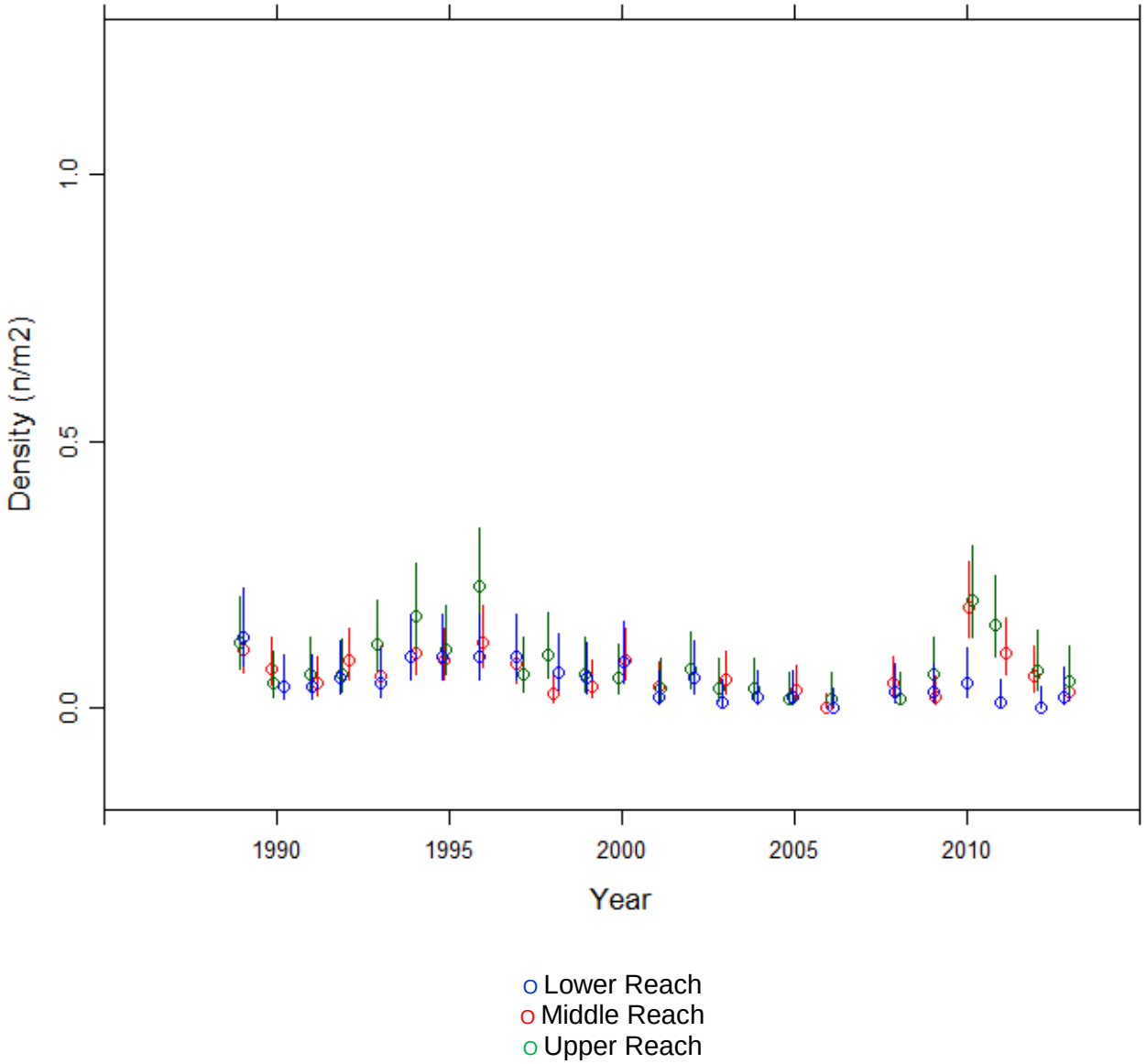


4.11.3 Fish data (for outflow stream)

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

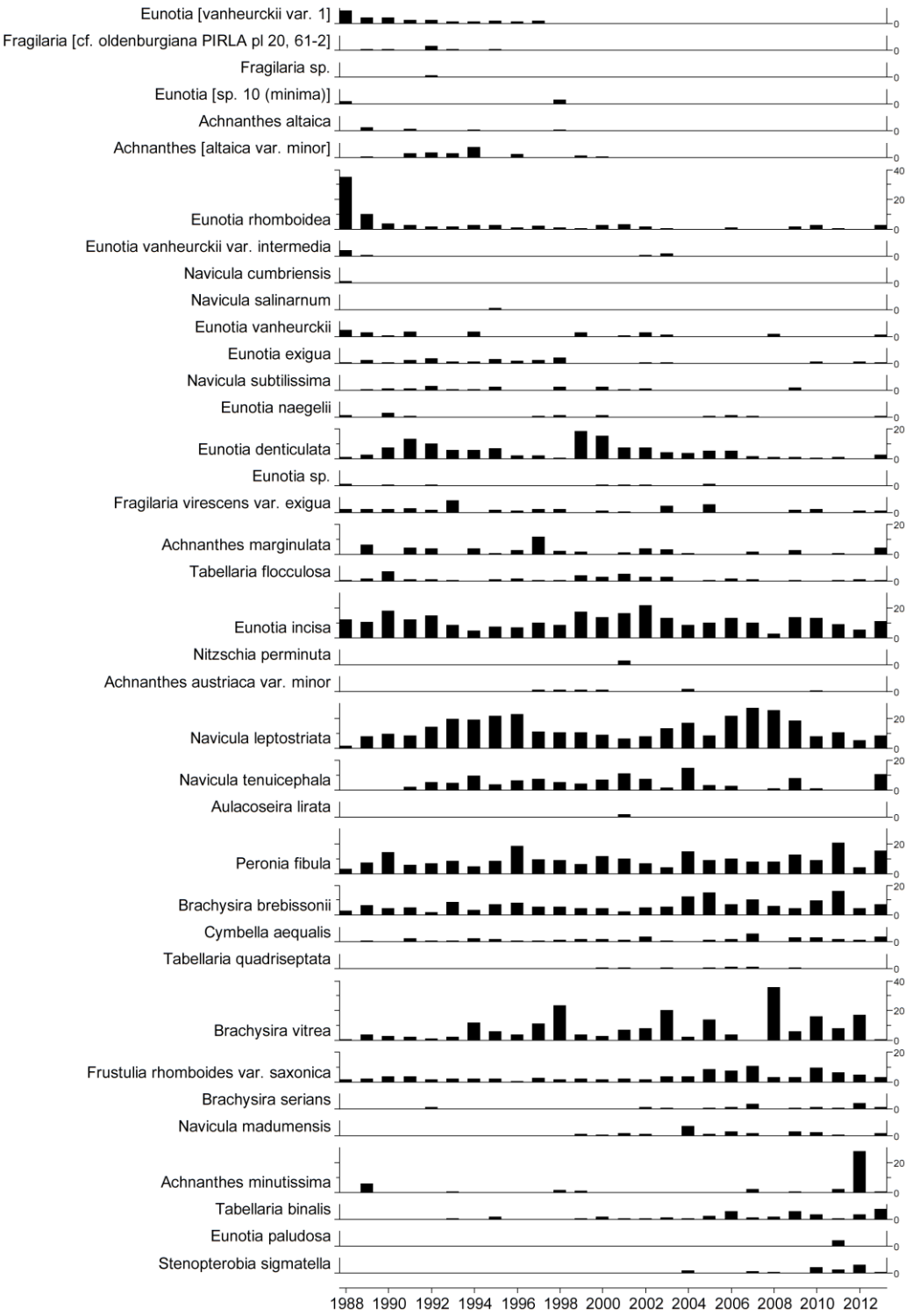


4.11.3.2 Summary of Trout parr density (numbers m^{-2}), Llyn Cwm Mynach

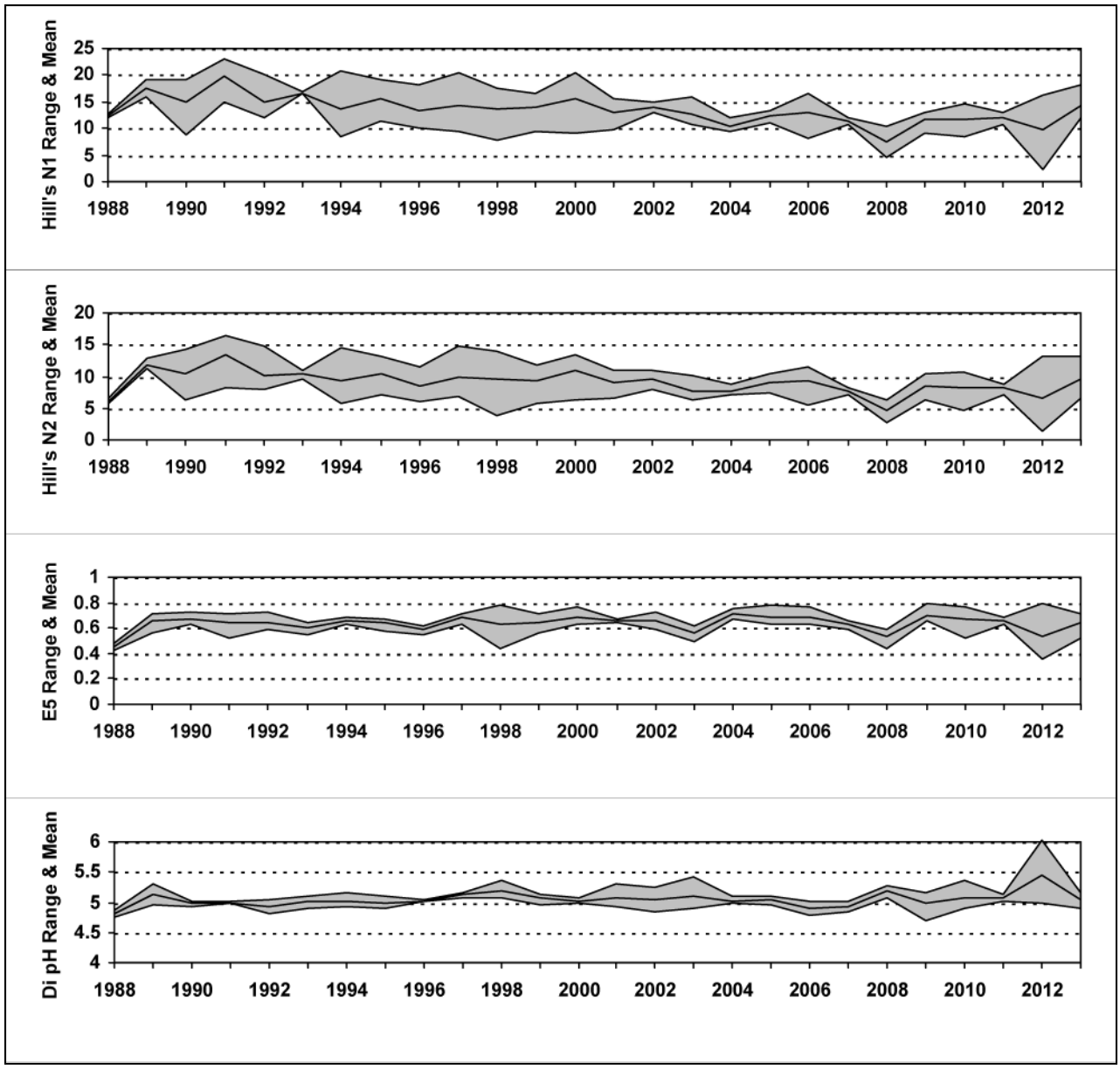


4.11.4 Epilithic diatom data

4.11.4.1 Percentage abundance summary, Llyn Cwm Mynach

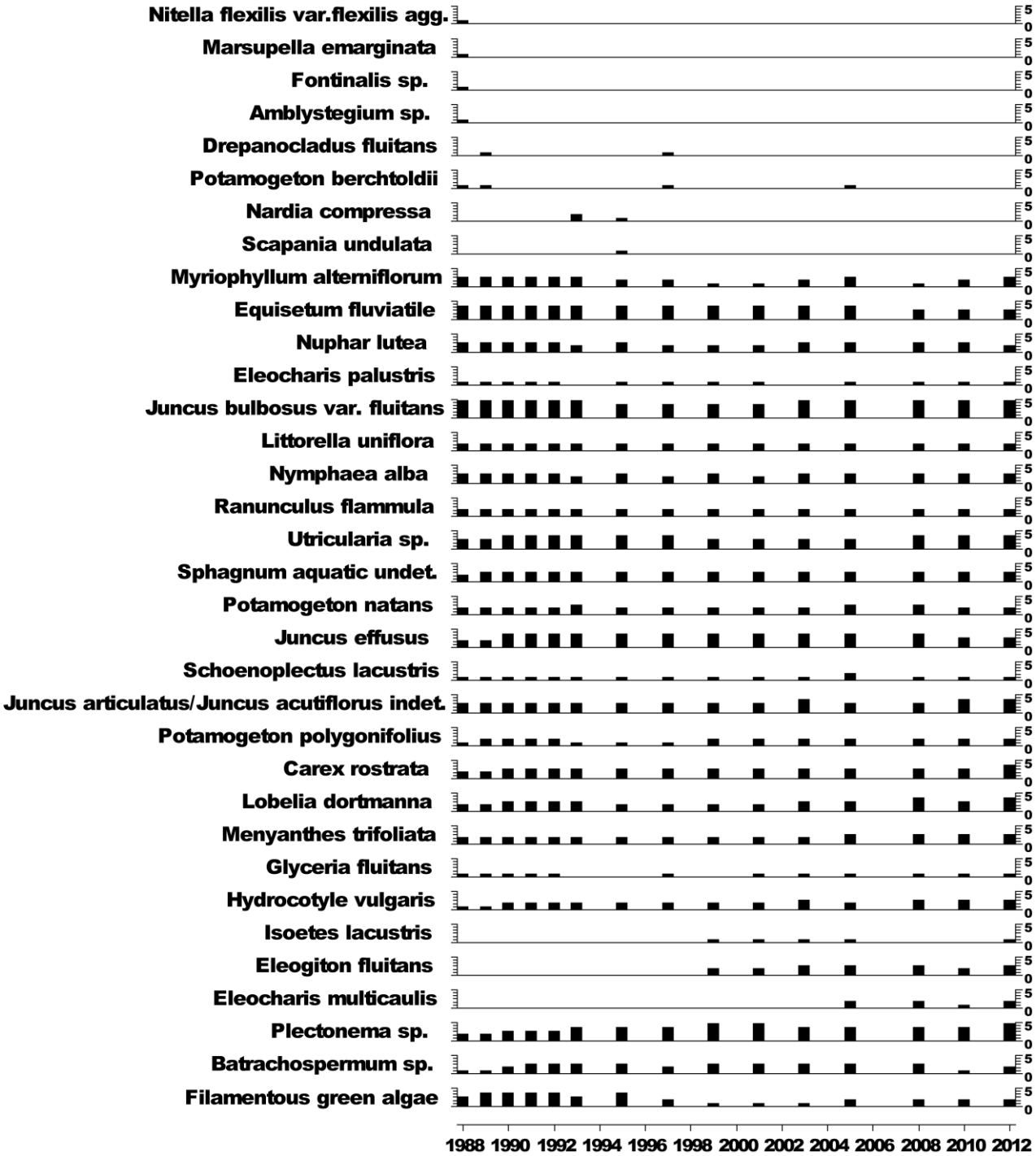


4.11.4.2 Diatom summary statistics, Llyn Cwm Mynach



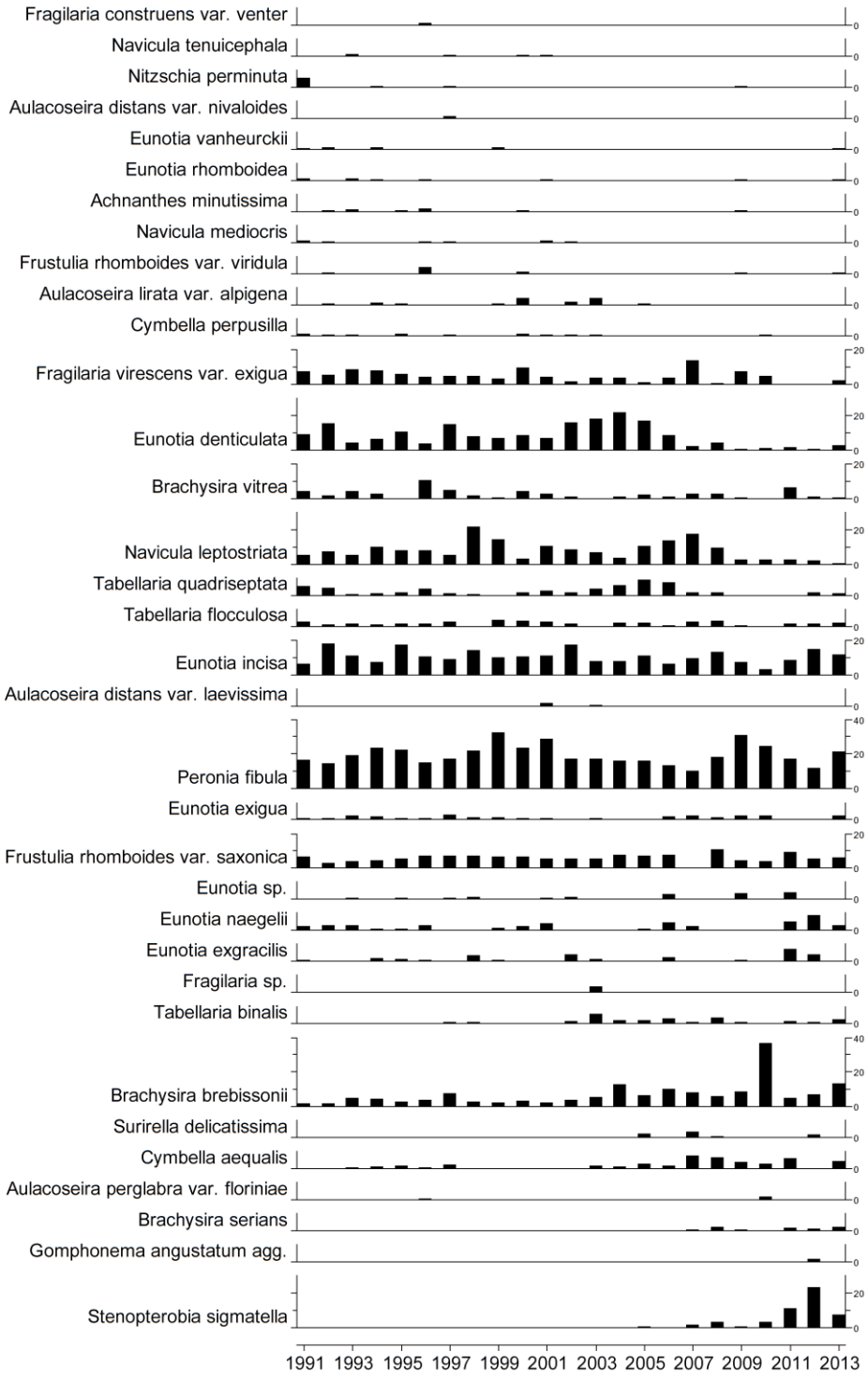
4.11.5 Aquatic macrophyte data, Llyn Cwm Mynach

Species Scores (1-5)

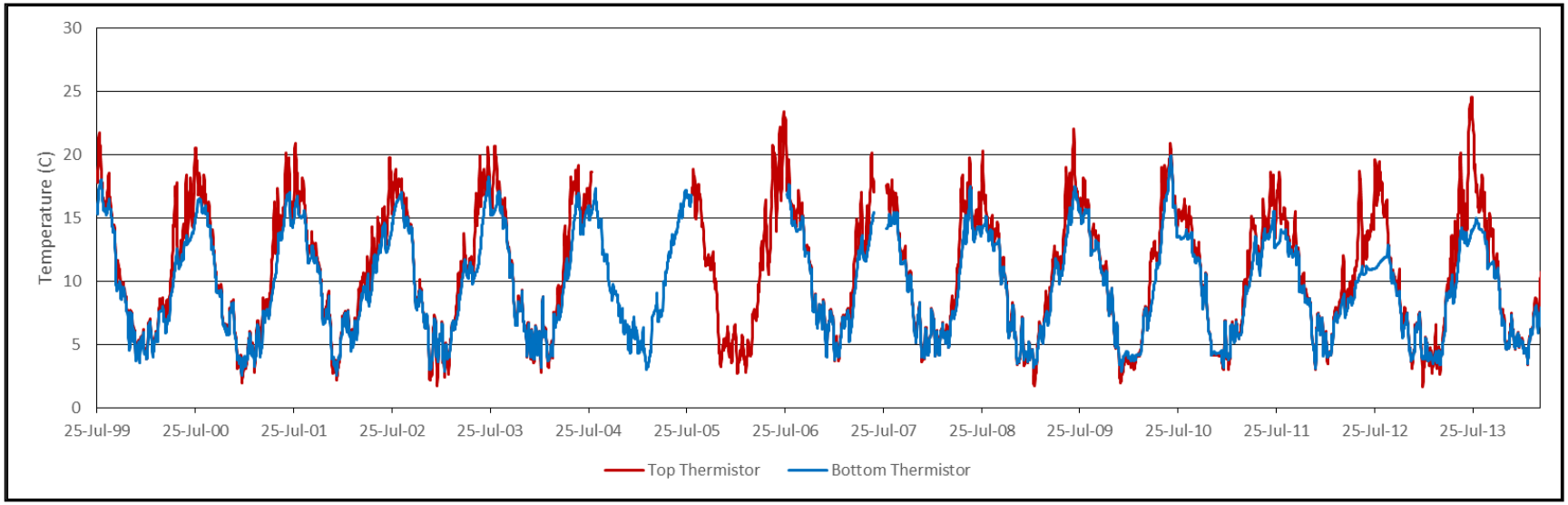


4.11.6 Sediment trap data, Llyn Cwm Mynach

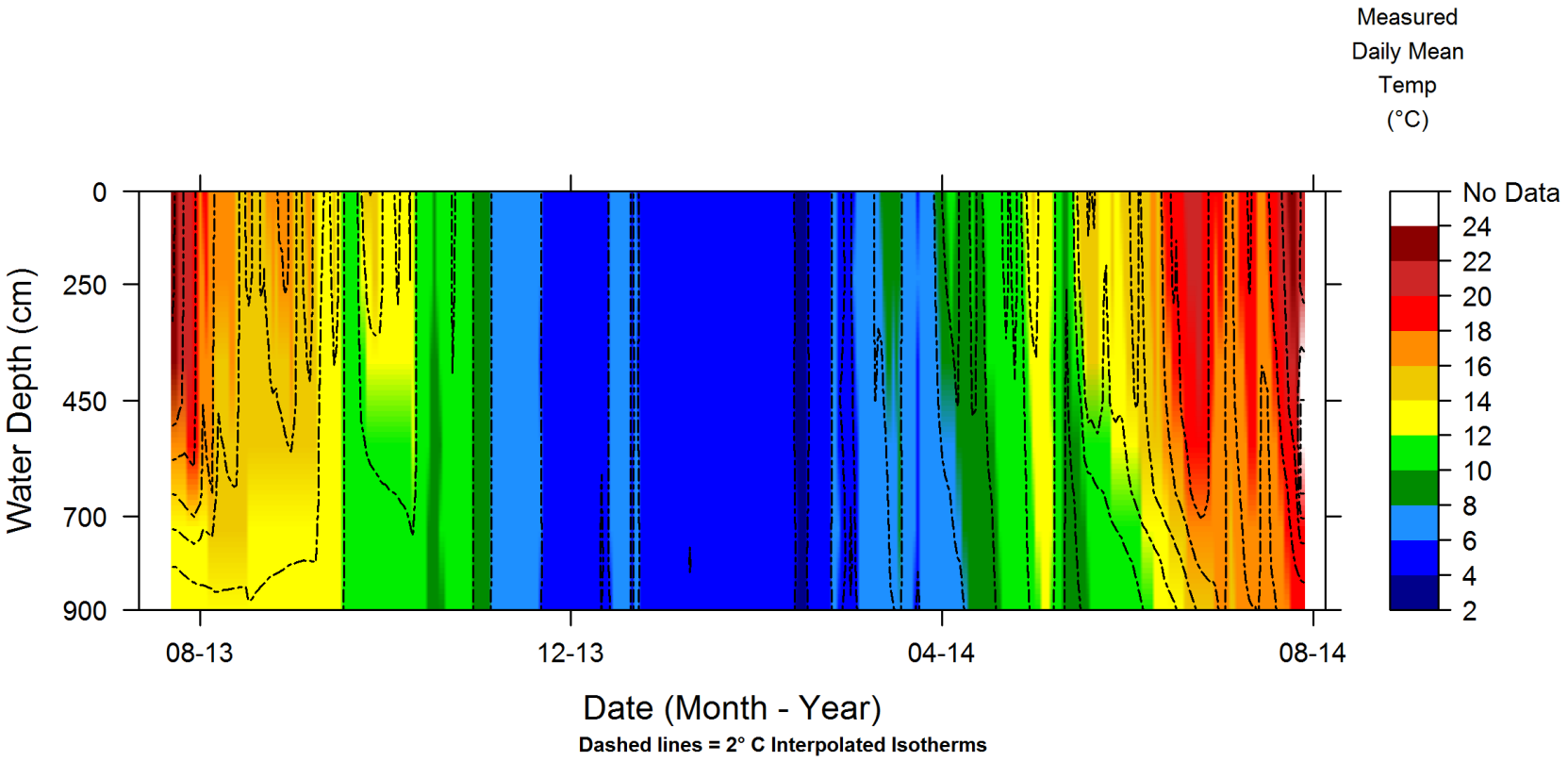
Relative percentage frequency of diatom taxa



4.11.7 Sediment trap thermistor data, Llyn Cwm Mynach



4.11.8 Thermistor chain data, Llyn Cwm Mynach



5 Afon Hafren

Figure 3 Afon Hafren biological survey section 2nd July 2015

5.1 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 2014 to March 2015.

5.2 Water Chemistry

Samples were collected by CEH early every month throughout the period April 2014 to March 2015, delivered to the analytical laboratories on schedule and are in the process of being analysed, quality controlled and archived in the UKUWMN central chemistry database at CEH Lancaster.

5.3 Thermistors

The CEH thermistor at Afon Hafren functioned well throughout the period April 2014 to March 2015. Data up to January 2015 have been downloaded, checked and archived in the central ENSIS and MS temperature database.

5.4 Epilithic Diatoms

Epilithic diatoms were retrieved by a team from ENSIS from three sampling points in the stream on the 2nd of July 2014. The samples have been made into slides and are currently in the process of being analysed.

5.5 Macroinvertebrates

Aquatic macroinvertebrates were sampled on the 16th April 2014 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. The data is in the process of being quality screened before being added to the UKUWMN biological database at ENSIS.

5.6 Fish

Fish surveying was performed on the 2nd October 2014 by a team from the Game and Wildlife Conservation Trust. The data have been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKUWMN biological database at ENSIS.

5.7 Aquatic Macrophytes

Aquatic macrophytes were surveyed by a team from ENSIS on 2nd of July 2014. Percentage cover scores were recorded and data will be added to the ENSIS biological database after microscope confirmation of bryophyte identifications.

5.8 Data Management and Reporting

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

The 2013-2014 annual report has been uploaded to the UKUWMN web page. The section on on Afon Hafren appears in section 5.10 below.

The UKUWMN website page detailing Afon Hafren can be found here:
http://awmn.defra.gov.uk/sites/site_17.php

Further publications from the contract period utilizing UKUWMN data from Afon Hafren are detailed in section 5.9 below.

5.9 Afon Hafren Recent UKUWMN Output

Herndon, E. M., Dere, A. L., Sullivan, P. L., Norris, D., Reynolds, B. & Brantley, S. L. (2015) Biotic controls on solute distribution and transport in headwater catchments. *Hydrol.Earth Syst.Sci.Discuss.* , **12**, 213-243.

Monteith, D. T., Henrys, P. A., Evans, C. D., Malcolm, I. A., Shilland, E. M. & Pereira, M. G. (2015) Spatial controls on dissolved organic carbon in upland waters inferred from a simple statistical model. *Biogeochemistry* 1-15.

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Battarbee, R. W. (2014) SWAP: the aftermath. University of Bergen, April 25th 2014.

Battarbee, R. W., Shilland, E. M., Kernan, M., Monteith, D. T. & Curtis, C. J. (2014) Recovery of acidified surface waters from acidification in the United Kingdom after twenty years of chemical and biological monitoring (1988–2008). *Ecological Indicators*, **37, Part B**, 267-273.

Curtis, C. J. & Simpson, G. L. (2014) Trends in bulk deposition of acidity in the UK, 1988–2007, assessed using additive models. *Ecological Indicators*, **37, Part B**, 274-286.

Curtis, C. J., Battarbee, R. W., Monteith, D. T. & Shilland, E. M. (2014) The future of upland water ecosystems of the UK in the 21st century: A synthesis. *Ecological Indicators*, **37, Part B**, 412-430.

Escudero-Onate, C. (2014) International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes. Intercomparison 1428:pH, Conductivity, Alkalinity, NO3-N, Cl, SO4,Ca, Mg, Na, K, TOC, Al, Fe, Mn, Cd, Pb, Cu, Ni and Zn. 1-88. NIVA, Oslo, Norway.

Fjellheim, A., Johannessen, A. & Svanevik Landes, T. (2014) International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes. Biological intercalibration: Invertebrates 1713. ICP Waters Report 118/2014, 1-25. NIVA, Oslo, Norway.

Helliwell, R. C., Aherne, J., MacDougall, G., Nisbet, T. R., Lawson, D., Cosby, B. J. & Evans, C. D. (2014) Past acidification and recovery of surface waters, soils and ecology

in the United Kingdom: Prospects for the future under current deposition and land use protocols. *Ecological Indicators*, **37, Part B**, 381-395.

Kleemola, S. & Forsius, M. (2014) 23rd Annual Report. Convention on Long-range Transboundary Air Pollution. International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems. 1-64. Finnish Environment Institute, Helsinki.

Malcolm, I. A., Bacon, P. J., Middlemas, S. J., Fryer, R. J., Shilland, E. M. & Collen, P. (2014) Relationships between hydrochemistry and the presence of juvenile brown trout (Salmo trutta) in headwater streams recovering from acidification. *Ecological Indicators*, **37, Part B**, 351-364.

Monteith, D. T., Shilland, E. M., Battarbee, R. W., Evans, C. D., Hildrew, A. G. & Malcolm, I. A. (2014) Recovery of water chemistry and biology in the UK: latest status and emerging issues. Proceedings of the 26th Meeting of the ICP Waters Task Force in Grimstad, Norway October 8-10 2014.

Monteith, D. T., Evans, C. D., Henrys, P. A., Simpson, G. L. & Malcolm, I. A. (2014) Trends in the hydrochemistry of acid-sensitive surface waters in the UK 1988ΓÇô2008. *Ecological Indicators*, **37, Part B**, 287-303.

Murphy, J. F., Winterbottom, J. H., Orton, S., Simpson, G. L., Shilland, E. M. & Hildrew, A. G. (2014) Evidence of recovery from acidification in the macroinvertebrate assemblages of UK fresh waters: A 20-year time series. *Ecological Indicators*, **37, Part B**, 330-340.

Rowe, E. C., Tipping, E., Posch, M., Oulehle, F., Cooper, D. M., Jones, T. G., Burden, A., Hall, J. & Evans, C. D. (2014) Predicting nitrogen and acidity effects on long-term dynamics of dissolved organic matter. *Environmental Pollution*, **184**, 271-282.

Shilland, E. M., Irvine, L., Millidine, K. & Malcolm, I. A. (2014) UK Upland Waters Monitoring Network (UKUWMN) - Contract 22 01 249 Llyn Llagi, Llyn Cwm Mynach, Afon Hafren and Afon Gwy Annual Summary Progress Report April 2013 - March 2014. Report to the Welsh Government and Natural Resources Wales. 1-64. ENSIS Ltd, Environmental Change Research Centre, University College London, London.

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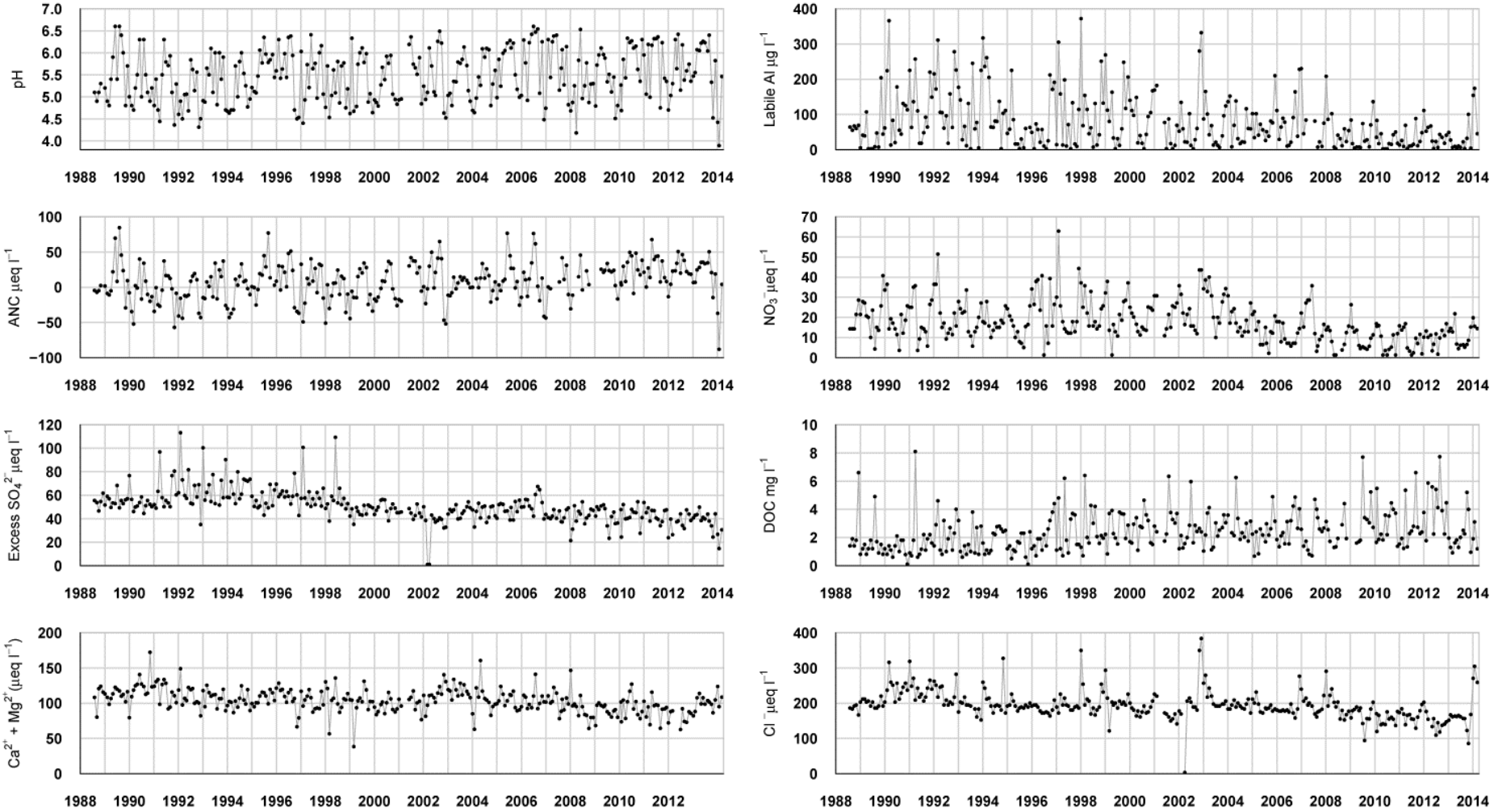
Winterbottom, J. H. & Orton, S. E. (2014) United Kingdom Acid Waters Monitoring Network Invertebrate Survey. Twenty Seventh Year: 2014. Summary of species identification and abundance. 1-10. School of Biological Sciences, Queen Mary University of London, London.

5.10 Afon Hafren Summary Data to March 2014

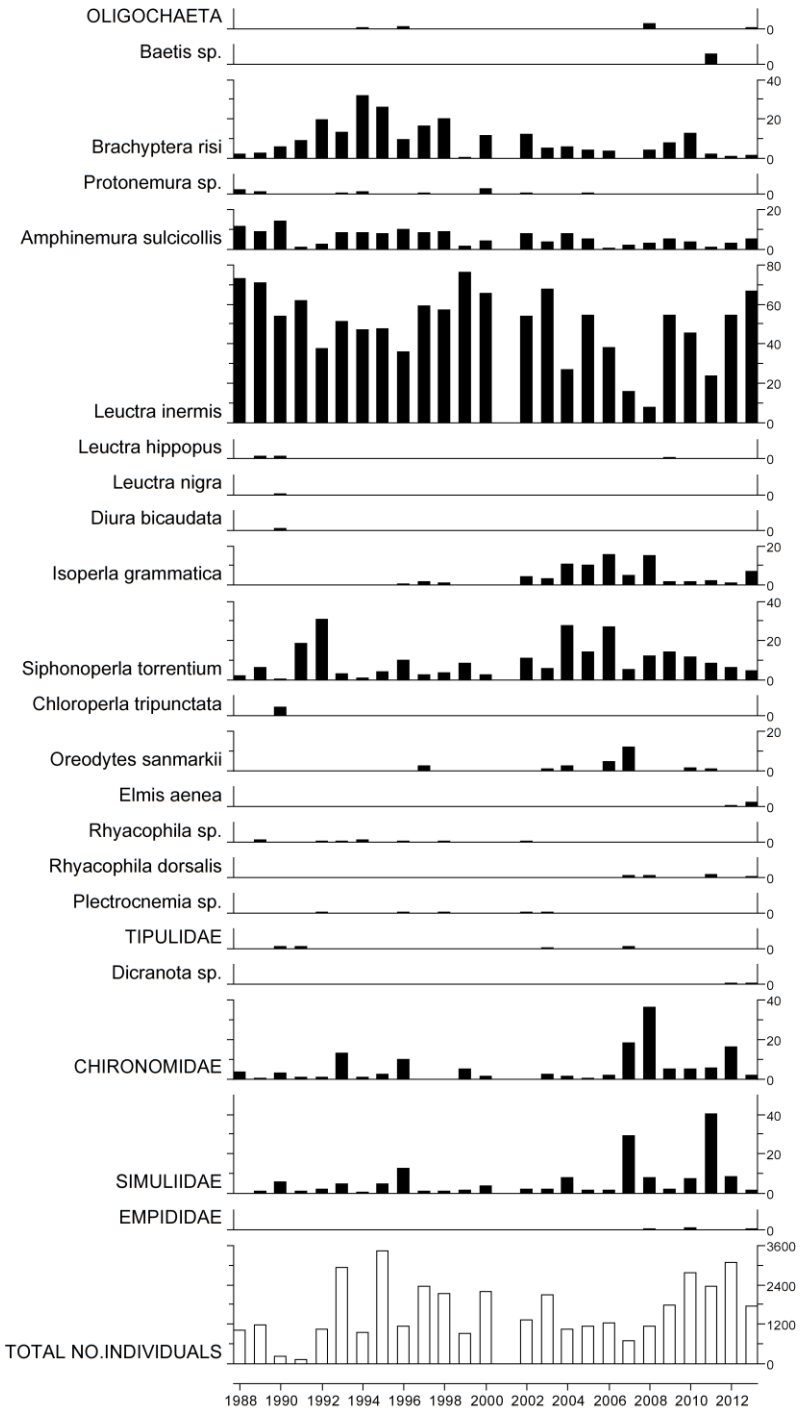
5.10.1 Spot sampled chemistry data



µeq l $^{-1}$, *µg l $^{-1}$, **mg l $^{-1}$	pH	ANC	Ca $^{2+}$	Mg $^{2+}$	Na $^{+}$	K $^{+}$	*Soluble Al	*Labile Al	Cl $^{-}$	*SO_4^{2-}	xSO_4^{2-}	NO_3^{-}	**DOC
Mean 1st 5 yrs	5.29	-2.40	47.91	66.41	200.39	3.16	170.00	101.71	221.09	82.97	59.79	20.58	1.76
13-14 mean	5.55	10.01	39.04	64.41	179.33	5.96	90.25	46.92	181.11	56.90	35.39	10.89	2.32
13-14 std dev	0.84	39.41	5.33	7.06	28.17	1.58	79.26	61.33	63.69	9.69	9.92	6.11	1.24

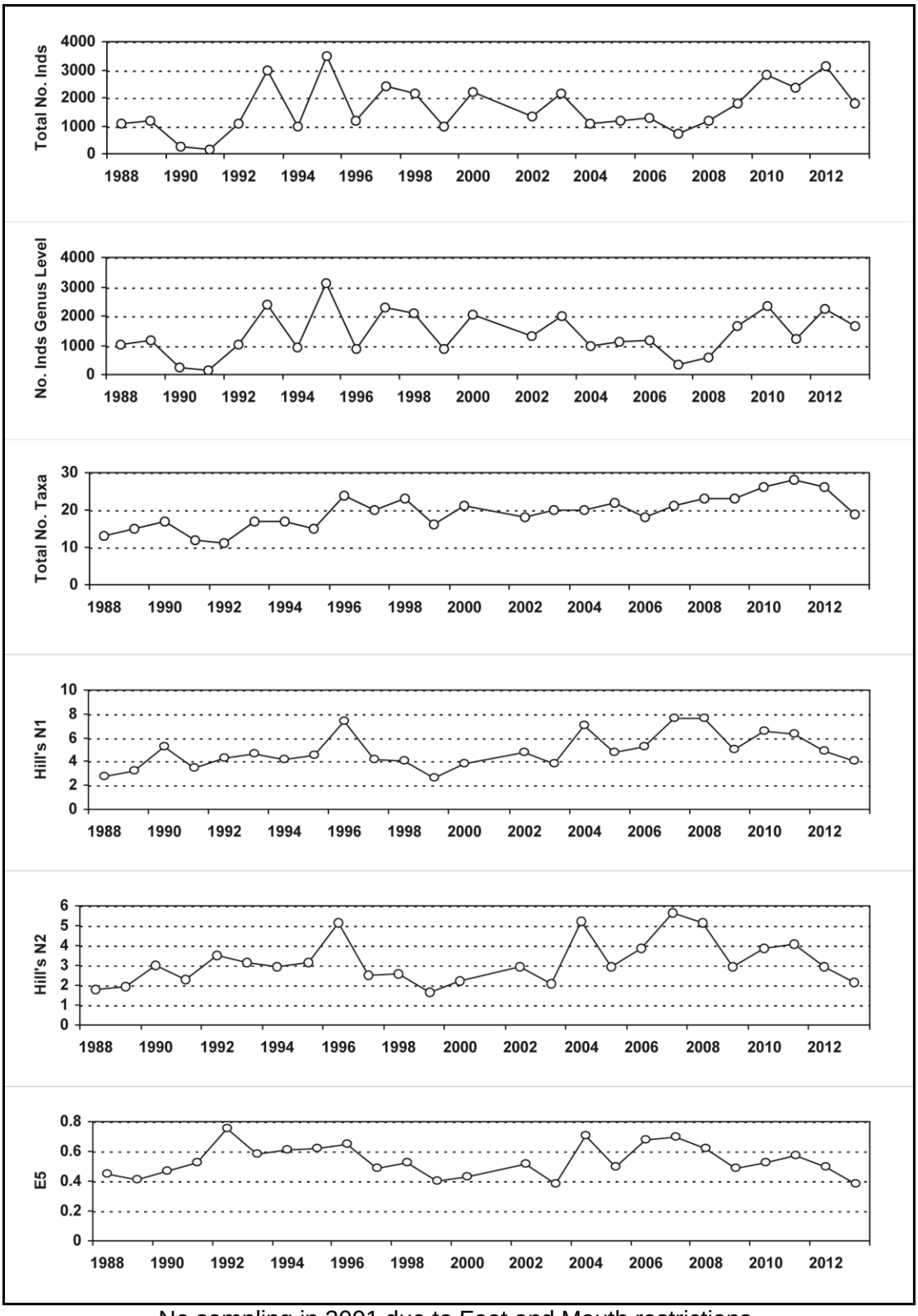
5.10.2 Macroinvertebrate data

5.10.2.1 Percentage abundance summary, Afon Hafren



No sampling in 2001 due to Foot and Mouth restrictions.

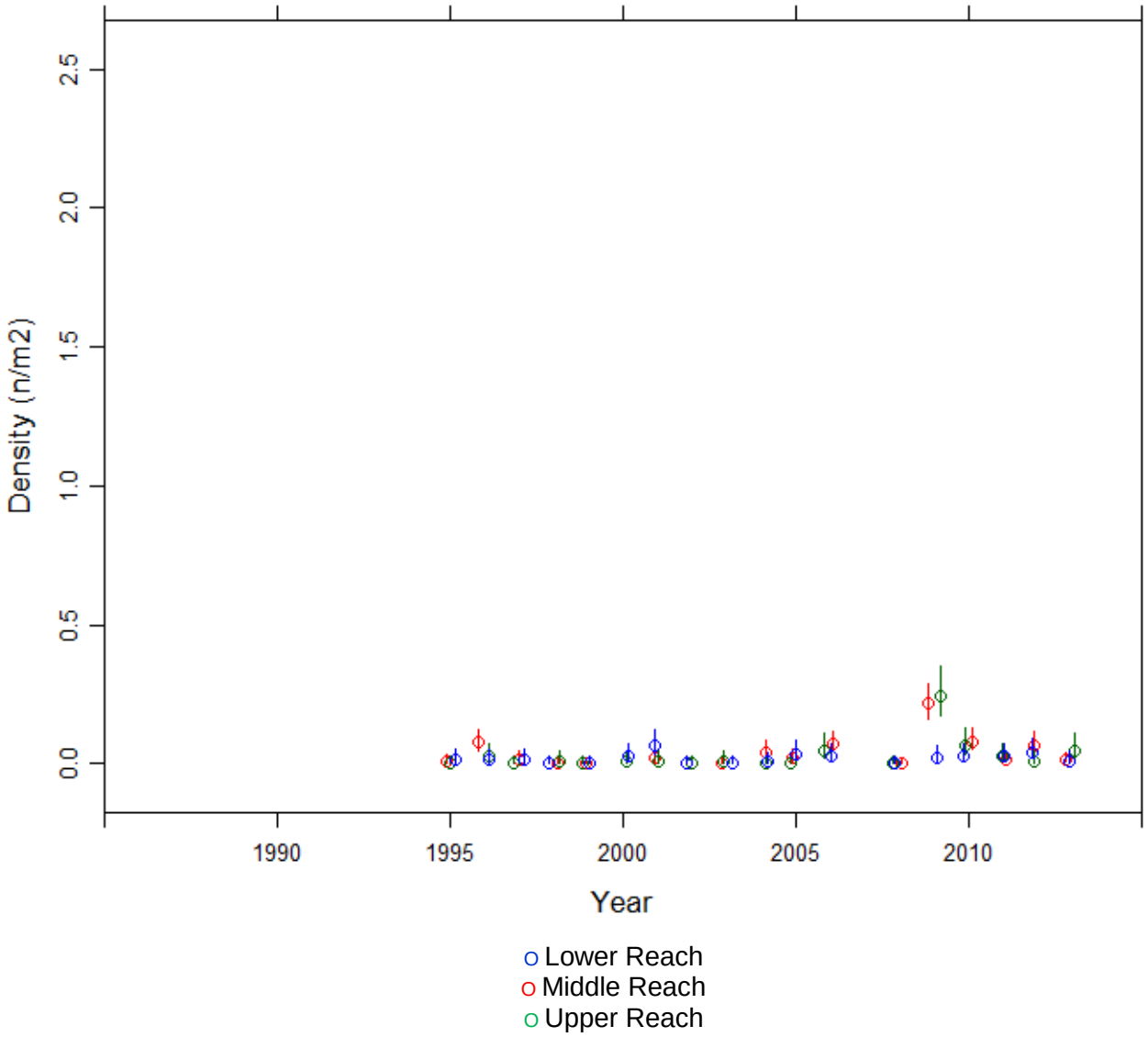
5.10.2.1 Macroinvertebrate summary statistics, Afon Hafren



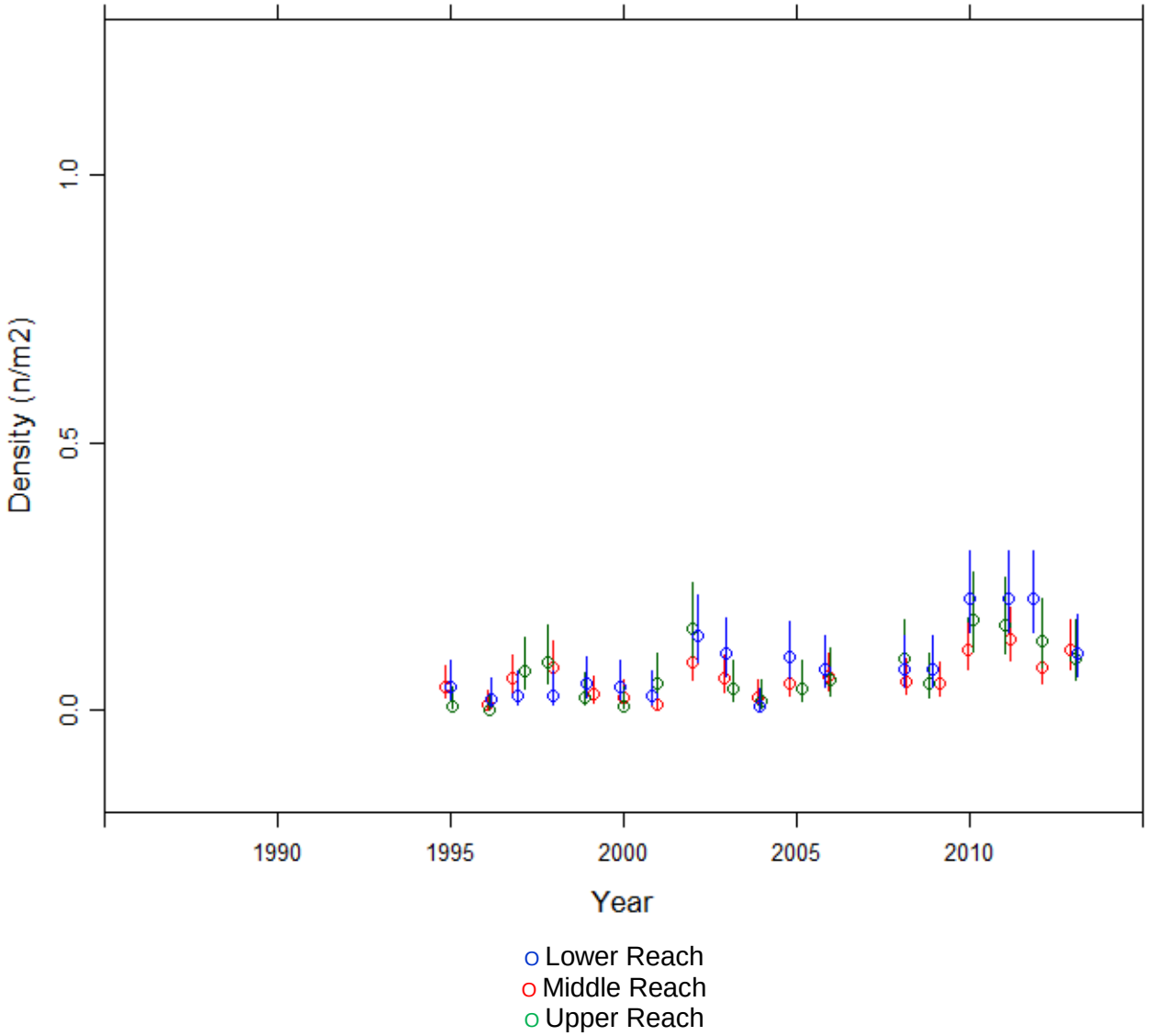
No sampling in 2001 due to Foot and Mouth restrictions.

5.10.3 Fish data

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

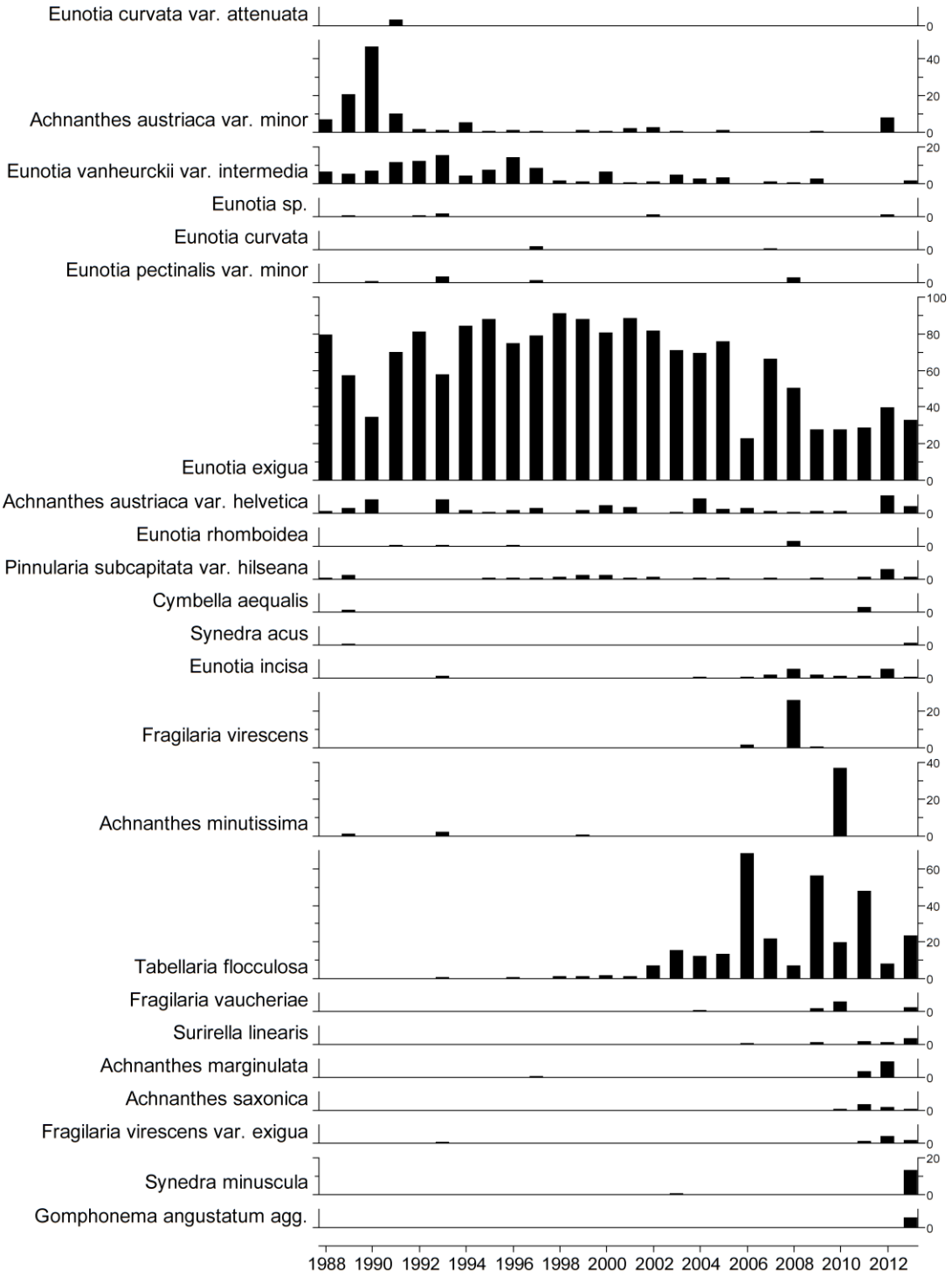


5.10.3.2 Summary of Trout parr density (numbers m^{-2}), Afon Hafren

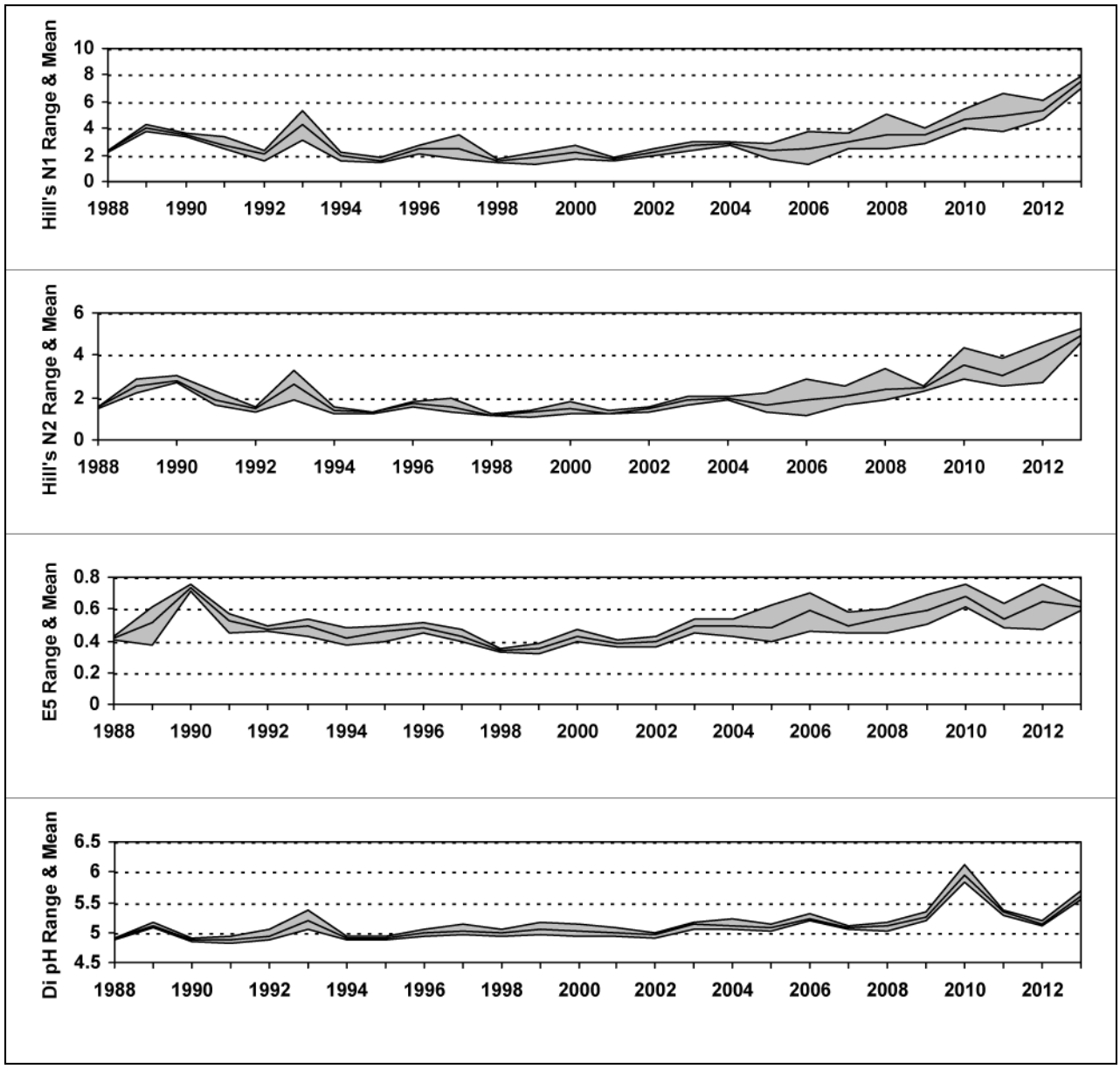


5.10.4 Epilithic diatom data

5.10.4.1 Percentage abundance summary, Afon Hafren

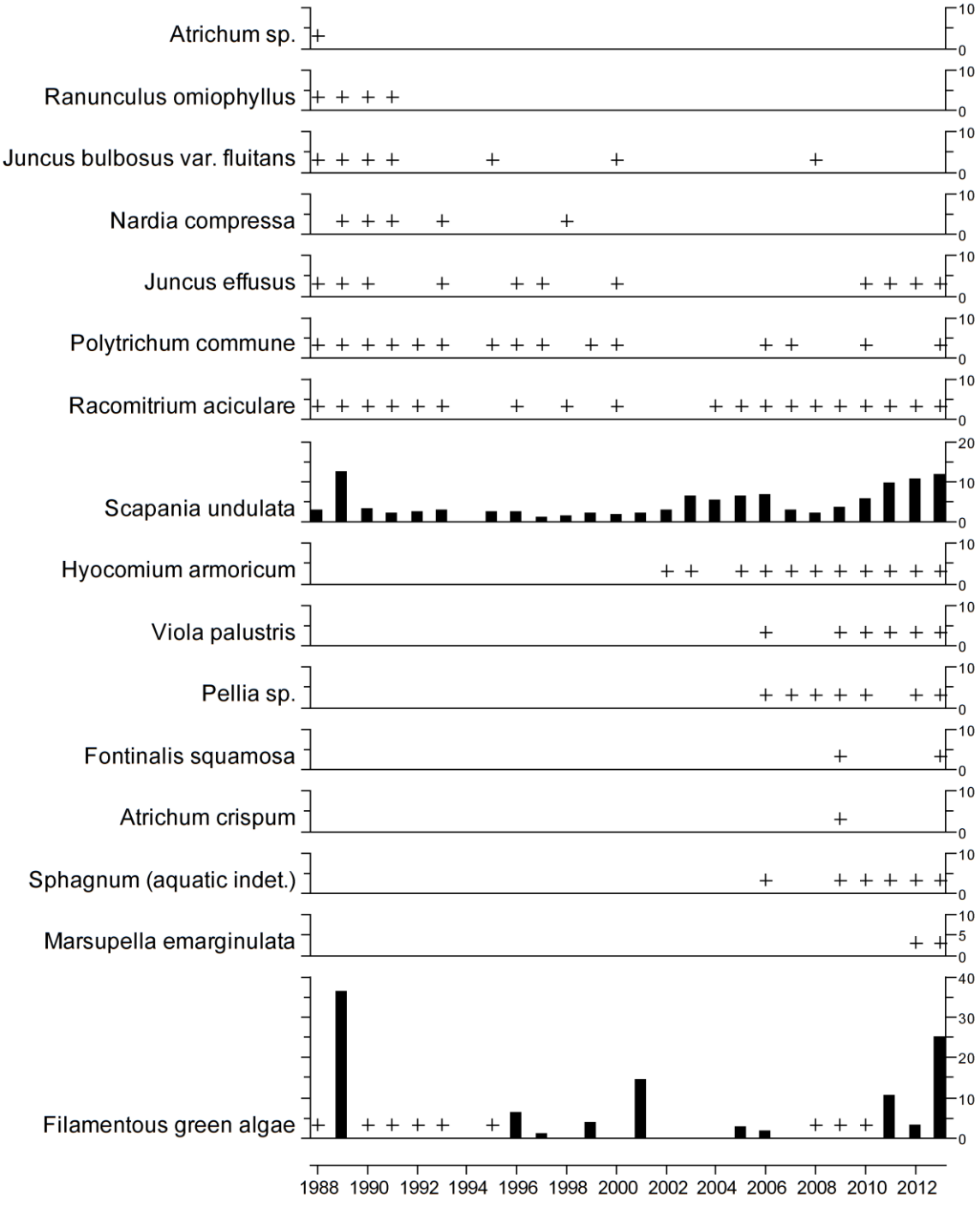


5.10.4.1 Diatom summary statistics, Afon Hafren



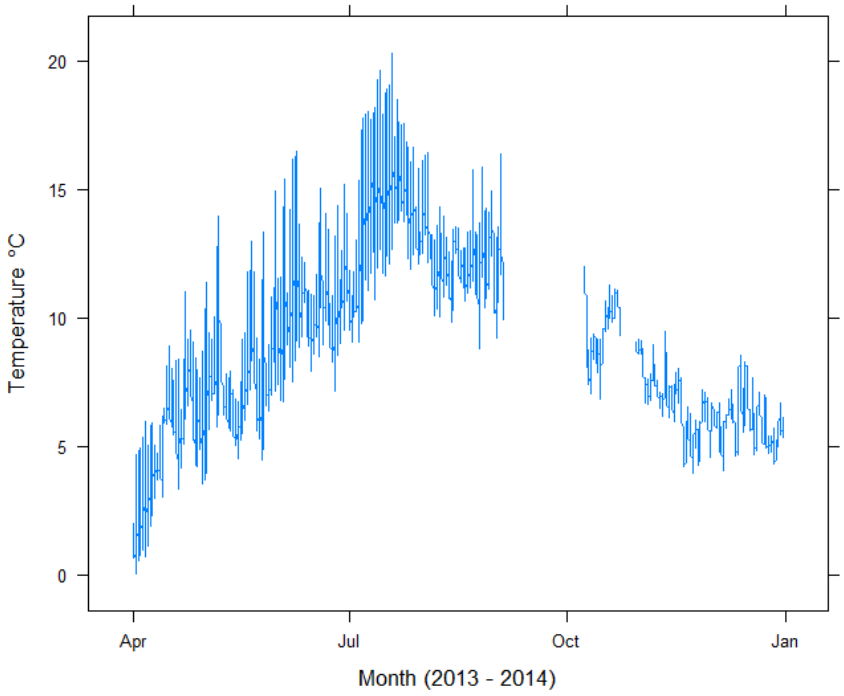
5.10.5 Aquatic macrophyte data, Afon Hafren

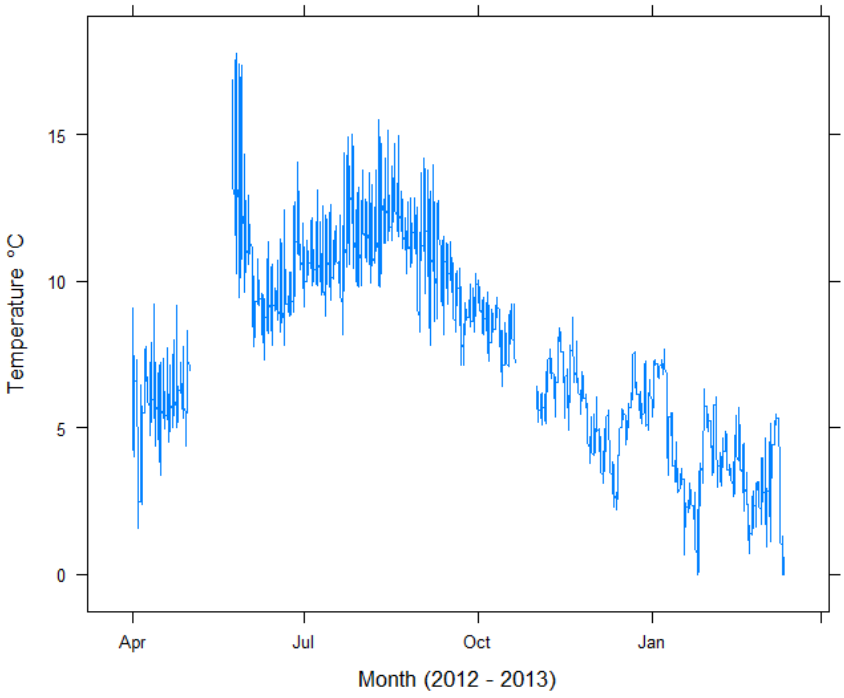
Percentage Species Cover

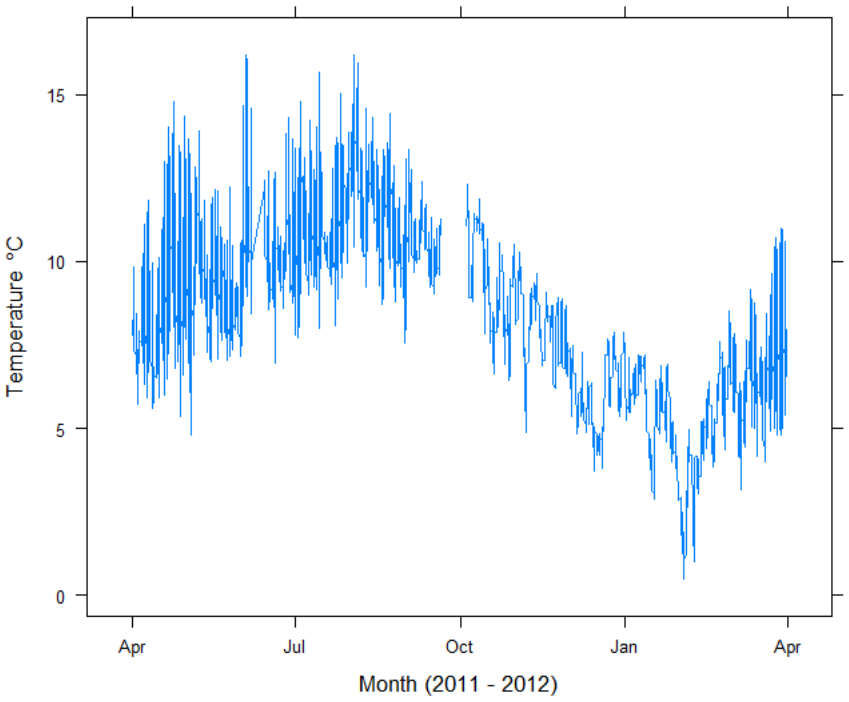


+ Represents <0.5% abundance

5.10.6 Thermistor data, Afon Hafren







Gaps due to thermistor malfunction

6 Afon Gwy

Figure 4 Afon Gwy biological survey section 2nd July 2015

6.1 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 2014 to March 2015.

6.2 Water Chemistry

Samples were collected by CEH early every month throughout the period April 2014 to March 2015, delivered to the analytical laboratories on schedule and are in the process of being analysed, quality controlled and archived in the UKUWMN central chemistry database at CEH Lancaster.

6.3 Thermistors

A thermistor, supplied by Marine Scotland, was downloaded and replaced on 2nd of July 2014 by a team from ENSIS Ltd. It had functioned well during the previous year and the data were added to the ENSIS and MS thermistor water temperature database.

6.4 Epilithic Diatoms

Epilithic diatoms were retrieved by a team from ENSIS from three sampling points in the stream on the 2nd of July 2014. The samples have been made into slides and are currently in the process of being analysed.

6.5 Macroinvertebrates

Aquatic macroinvertebrates were sampled on the 16th April 2014 by a team from QMuL. Five 1 minute kick samples were performed. The samples were counted and the data sent to ENSIS Ltd. The data is in the process of being quality screened before being added to the UKUWMN biological database at ENSIS.

6.6 Fish

Fish surveying was performed on the 2nd October 2014 by a team from the Game and Wildlife Conservation Trust. The data have been forwarded to ENSIS Ltd. After quality screening the data will be added to the UKUWMN biological database at ENSIS. No Salmon were recorded in 2014.

6.7 Aquatic Macrophytes

Aquatic macrophytes were surveyed by a team from ENSIS on 2nd of July 2014. Percentage cover scores were recorded and data will be added to the ENSIS biological database after microscope confirmation of bryophyte identifications.

6.8 Data Management and Reporting

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

The 2013-2014 annual report has been uploaded to the UKUWMN web page. The section on on Afon Gwy appears in section 6.10 below.

The UKUWMN website page detailing Afon Gwy can be found here:
http://awmn.defra.gov.uk/sites/site_18.php

Further publications from the contract period utilizing UKUWMN data from Afon Gwy are detailed in section 6.9 below.

6.9 Afon Gwy Recent UKUWMN Output

Monteith, D. T., Henrys, P. A., Evans, C. D., Malcolm, I. A., Shilland, E. M. & Pereira, M. G. (2015) Spatial controls on dissolved organic carbon in upland waters inferred from a simple statistical model. *Biogeochemistry* 1-15.

Battarbee, R. W. (2014) Upland waters in the UK: from acid rain to climate change. Seminar, University of St Andrews, March 26th 2014.

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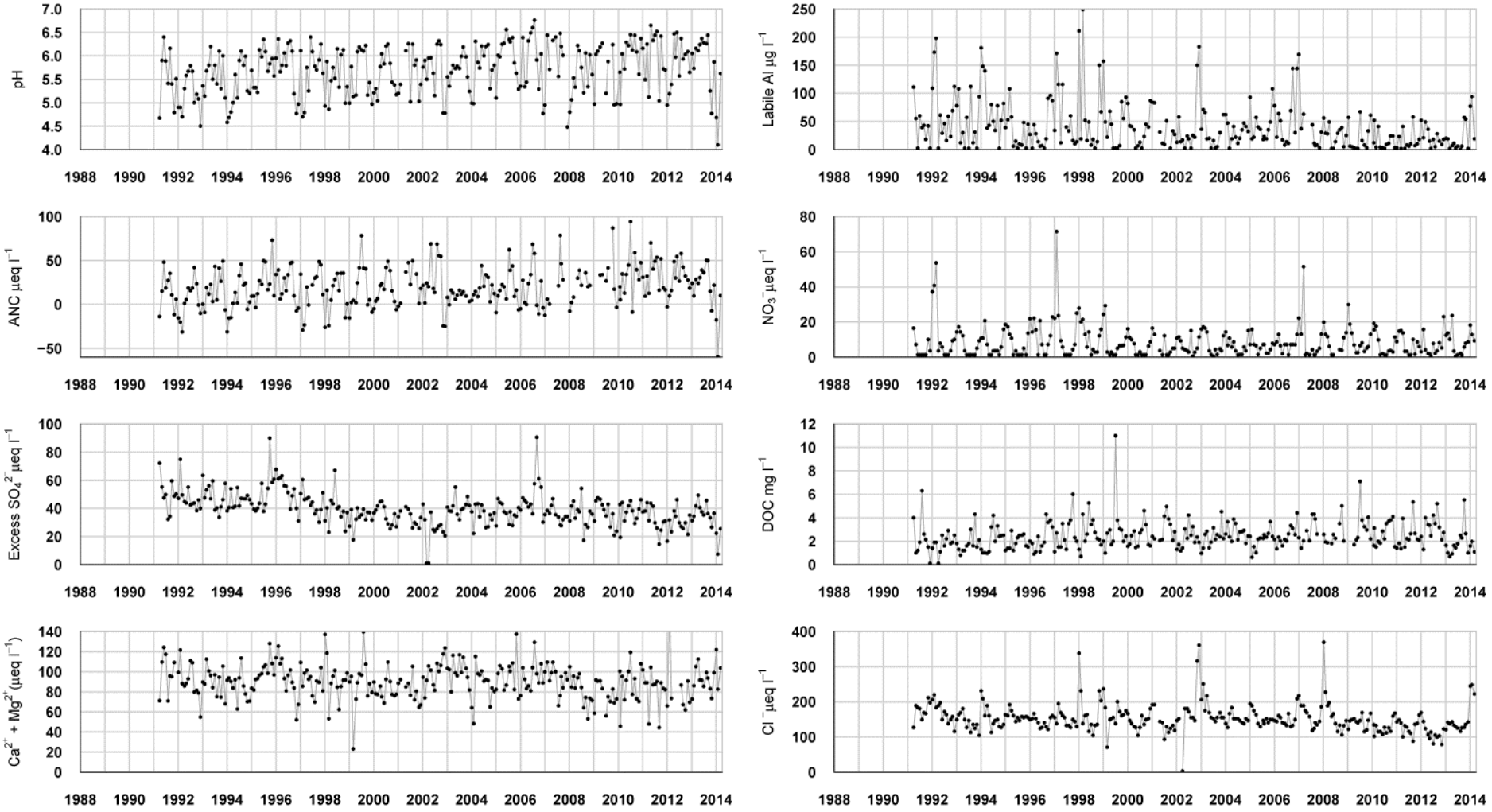
6.10 Afon Gwy Summary Data to March 2014

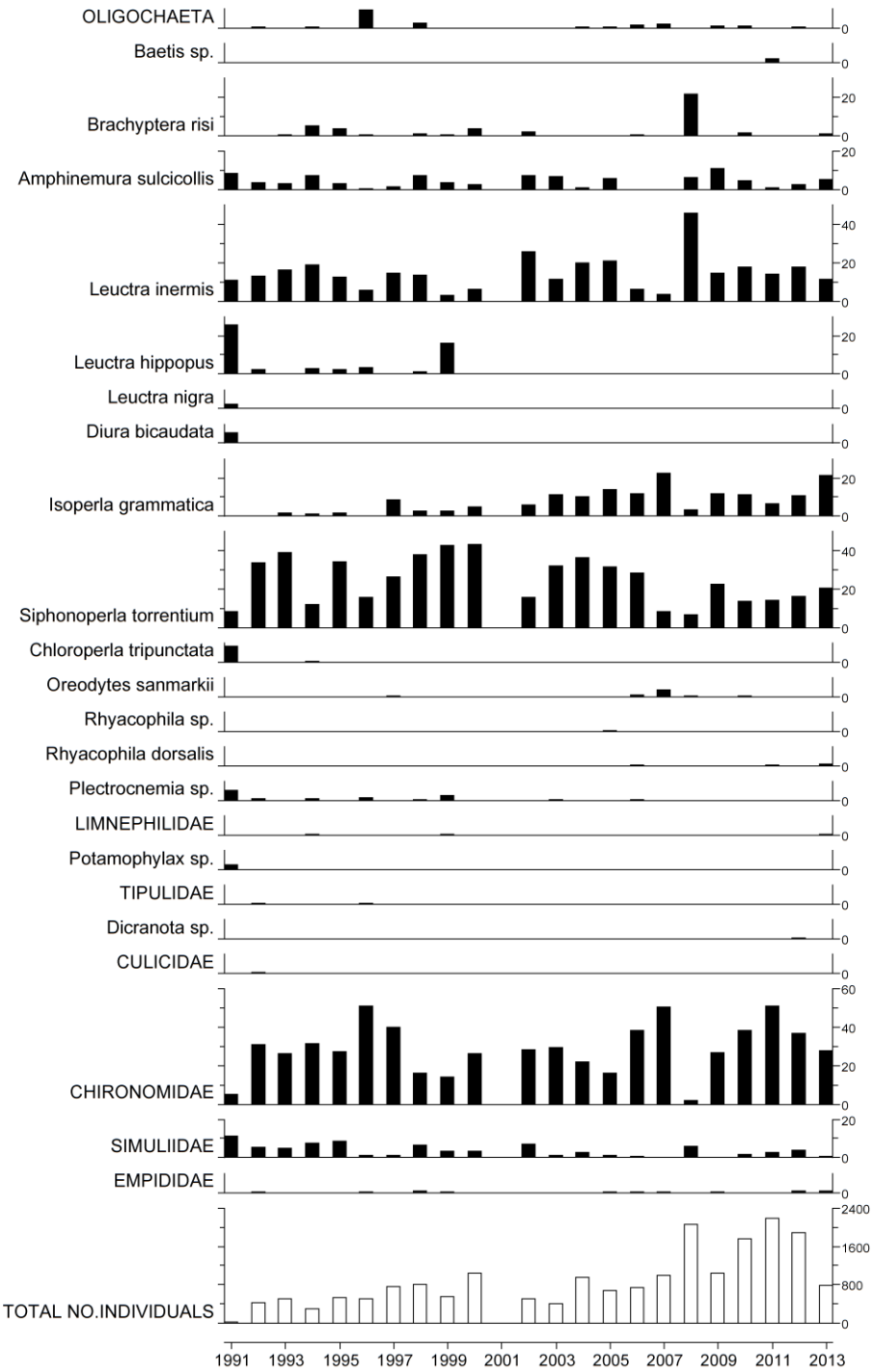
6.10.1 Spot sampled chemistry data



µeq l $^{-1}$, *µg l $^{-1}$, **mg l $^{-1}$	pH	ANC	Ca $^{2+}$	Mg $^{2+}$	Na $^{+}$	K $^{+}$	*Soluble Al	*Labile Al	Cl $^{-}$	*SO_4^{2-}	xSO_4^{2-}	NO_3^{-}	**DOC
Mean 1st 5 yrs	5.51	14.13	40.42	53.22	147.31	3.24	106.64	53.64	159.84	65.67	48.91	8.65	1.98
13-14 mean	5.67	15.93	37.77	57.06	148.30	5.25	52.58	28.00	157.80	53.45	33.00	7.87	2.03
13-14 std dev	0.79	31.66	6.52	8.75	30.65	2.13	41.08	33.22	49.65	7.92	11.28	7.28	1.23

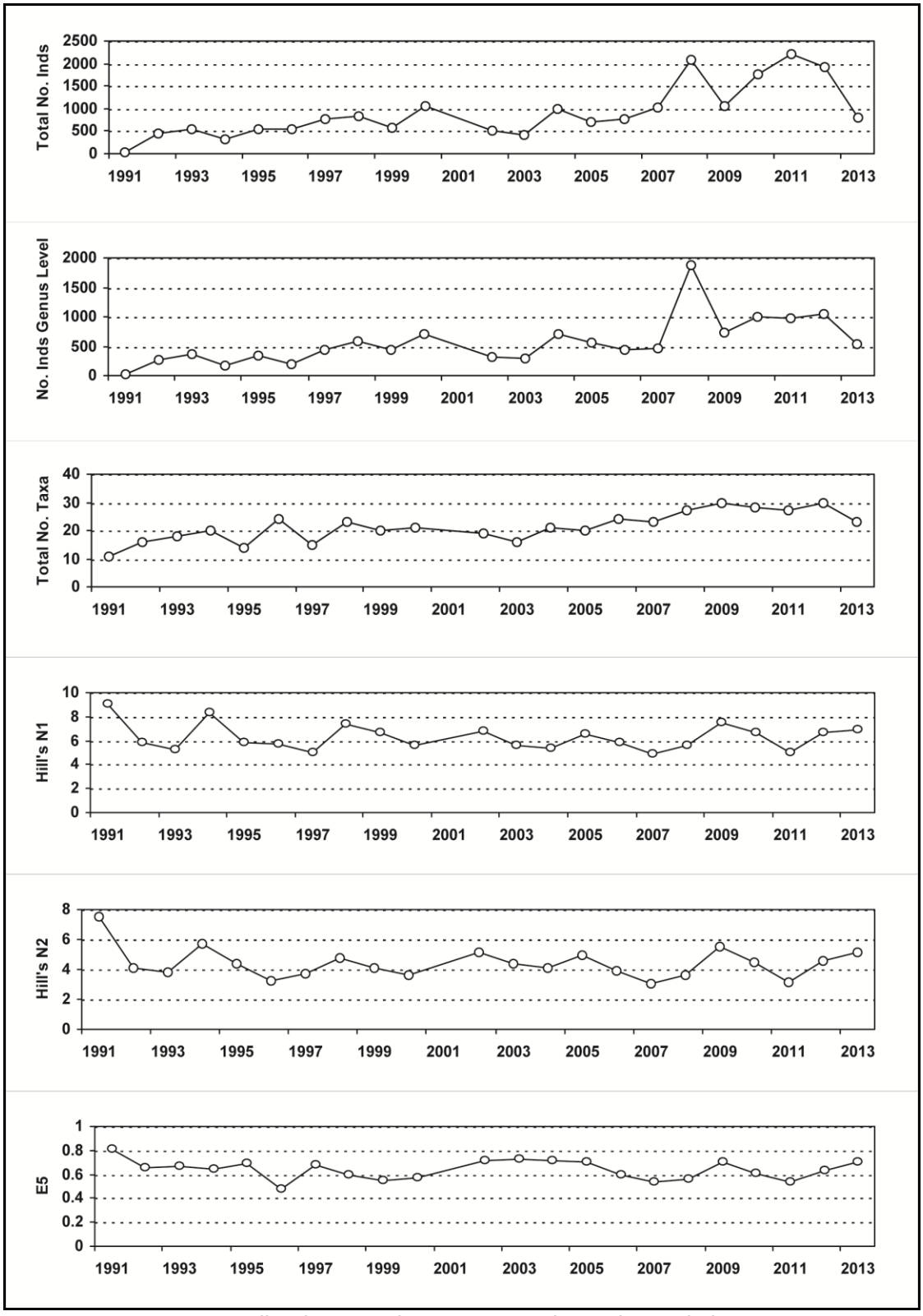
6.10.2 Macroinvertebrate data

6.10.2.1 Percentage abundance summary, Afon Gwy



No sampling in 2001 due to Foot and Mouth restrictions.

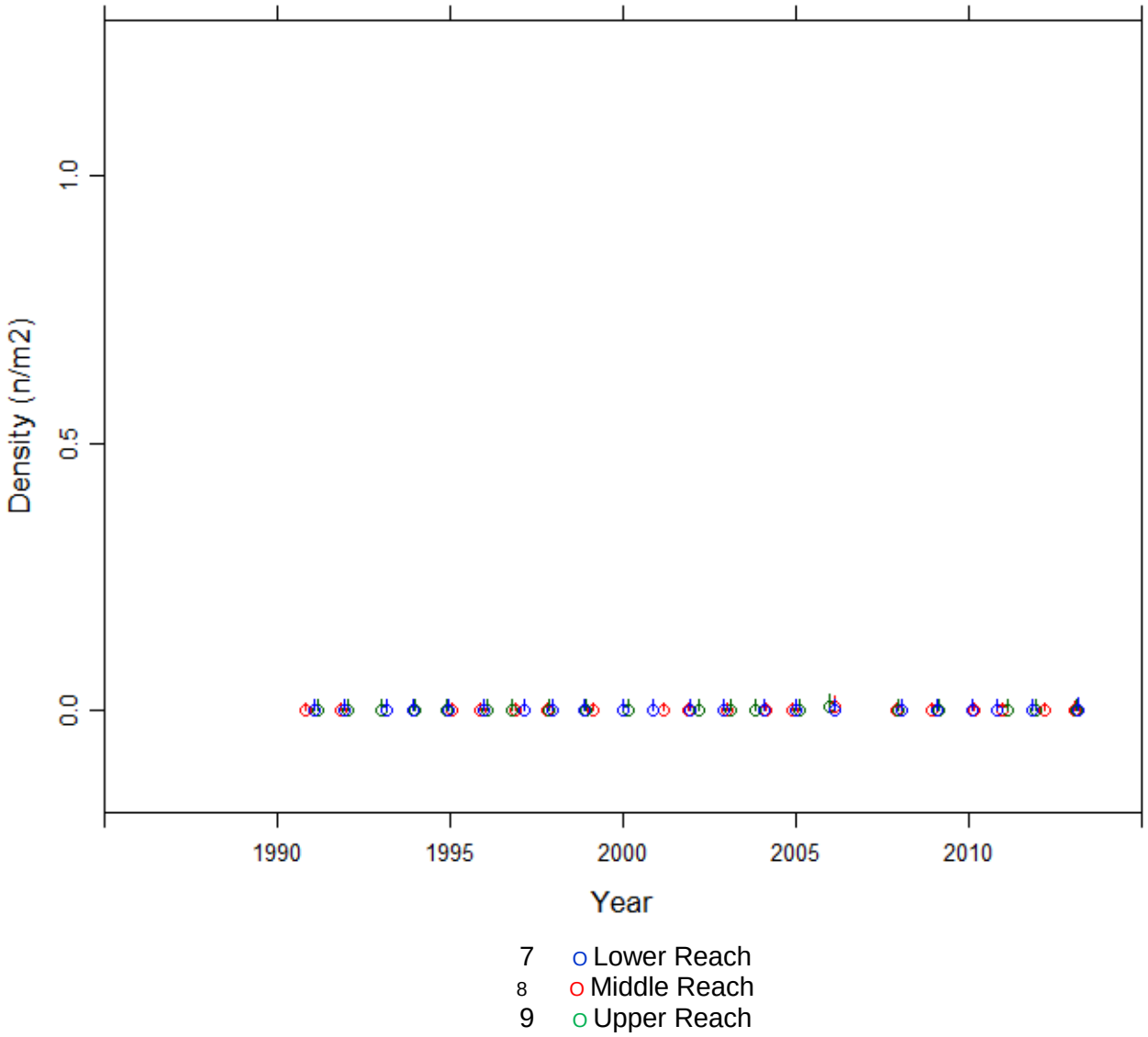
6.10.2.2 Macroinvertebrate summary statistics, Afon Gwy



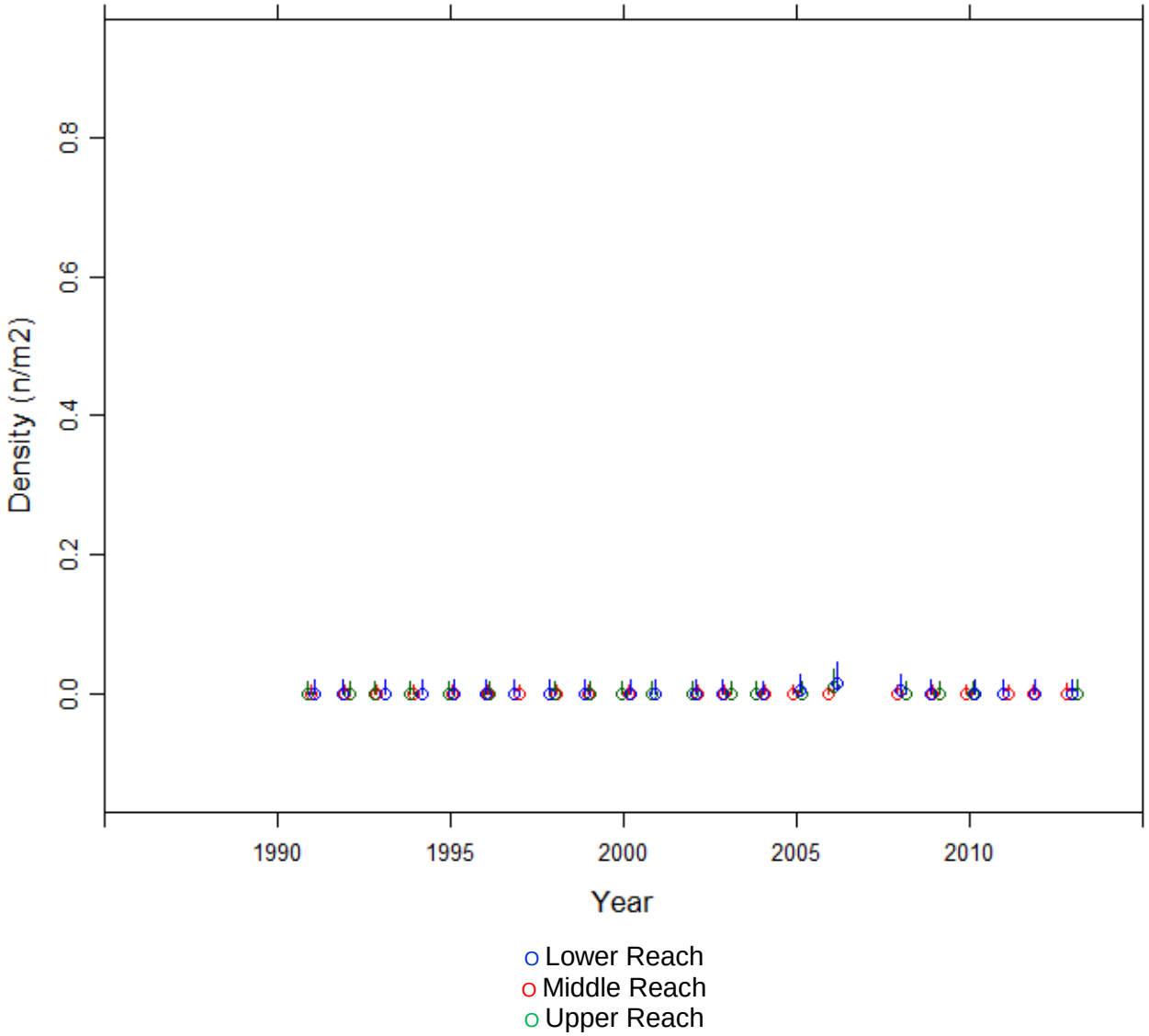
No sampling in 2001 due to Foot and Mouth restrictions.

6.10.3 Fish data

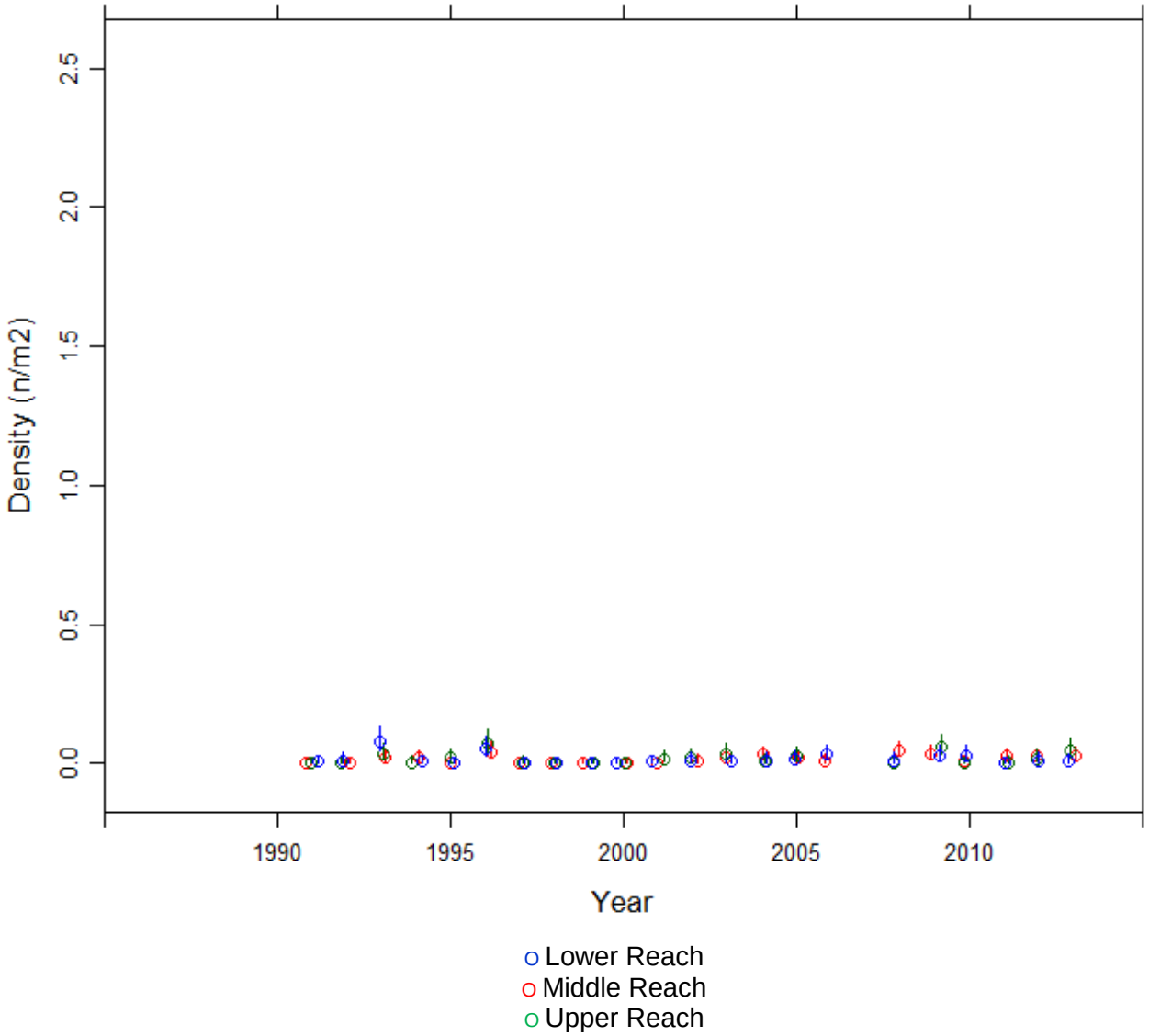
6.10.3.1 Summary of Salmon fry densities (numbers m^{-2}), Afon Gwy



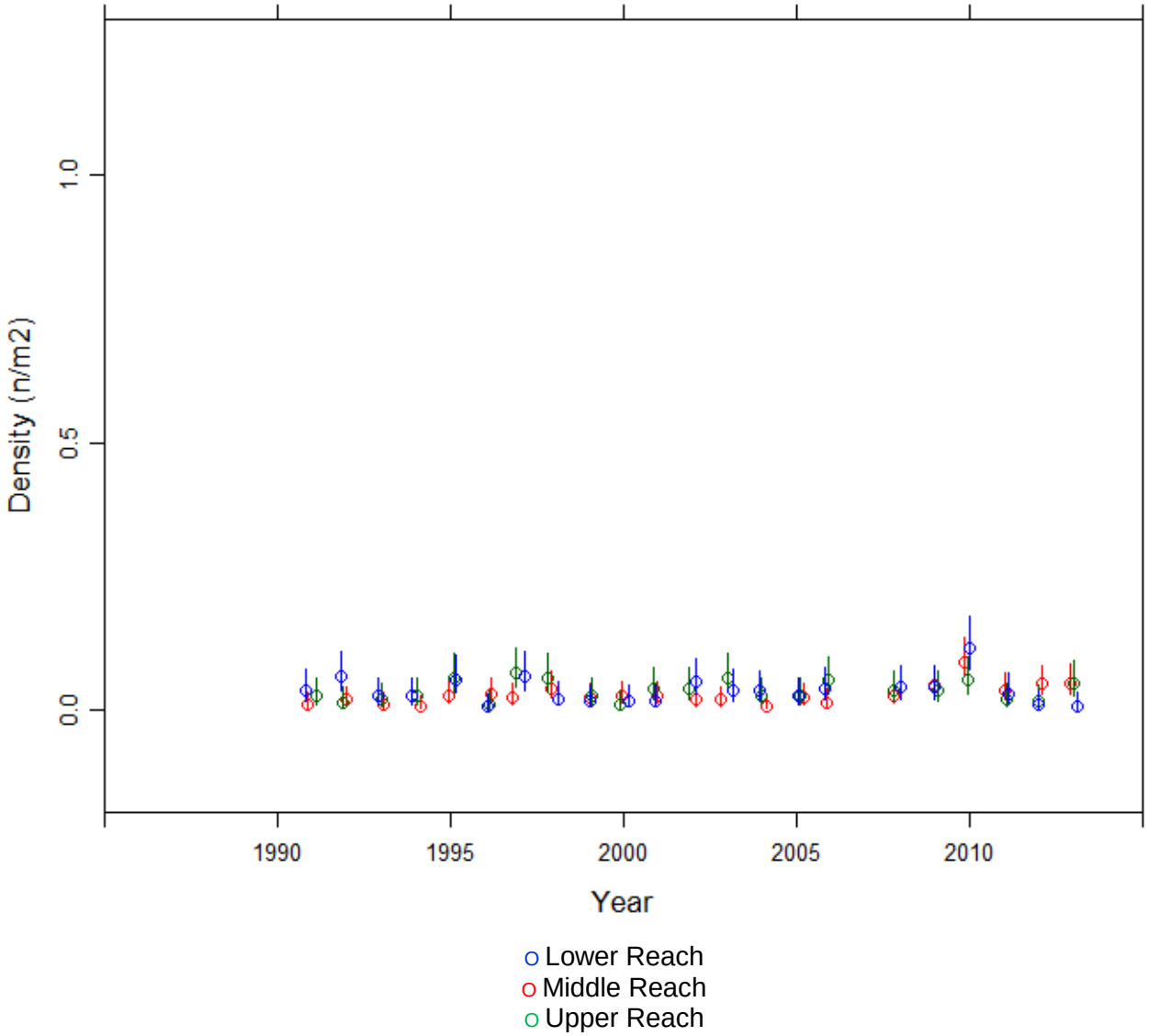
9.1.1.1Summary of Salmon parr densities (numbers m^{-2}), Afon Gwy



9.1.1.2Summary of Trout fry density (numbers m^{-2}), Afon Gwy

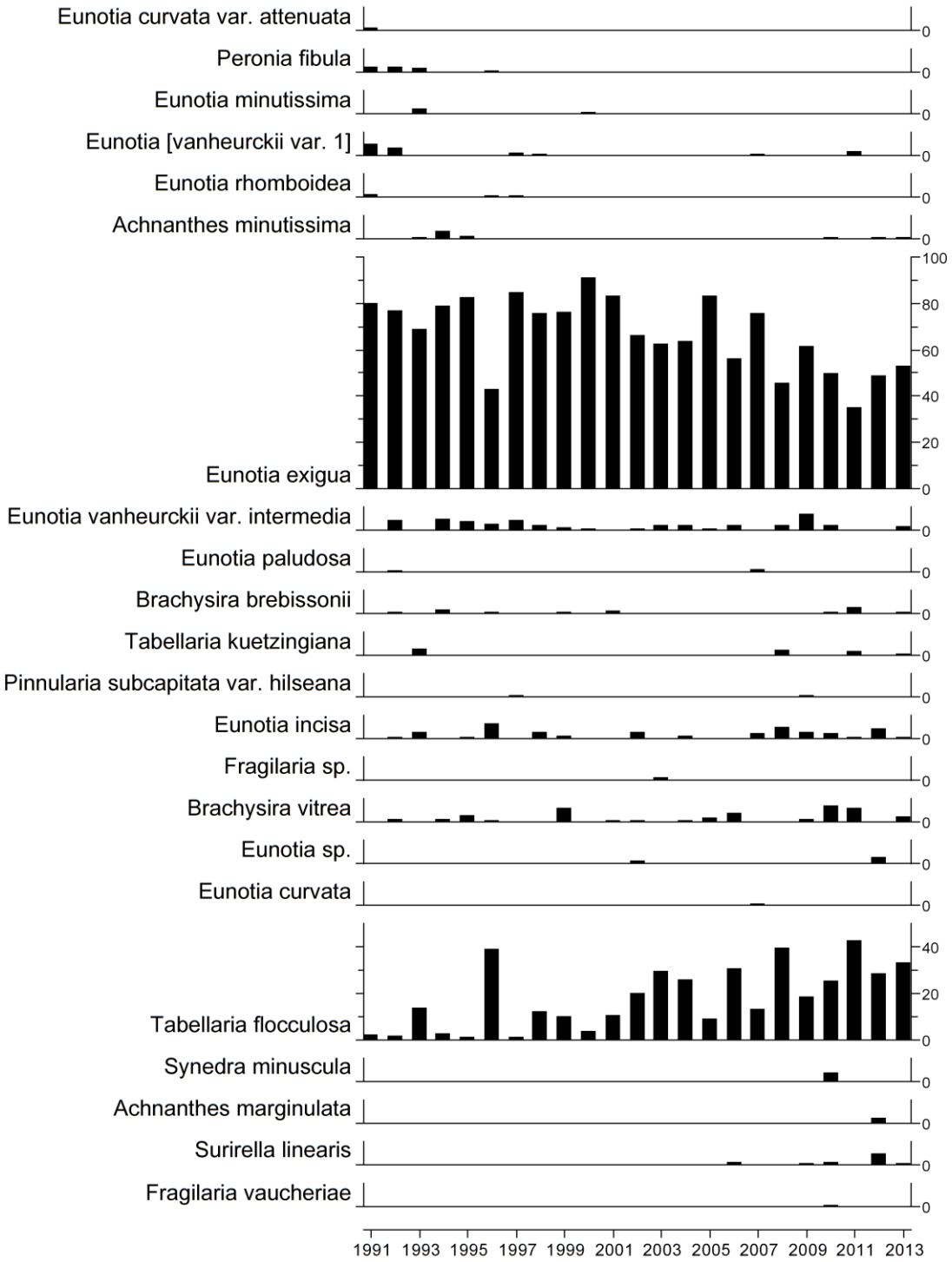


9.1.1.3Summary of Trout parr density (numbers m^{-2}), Afon Gwy

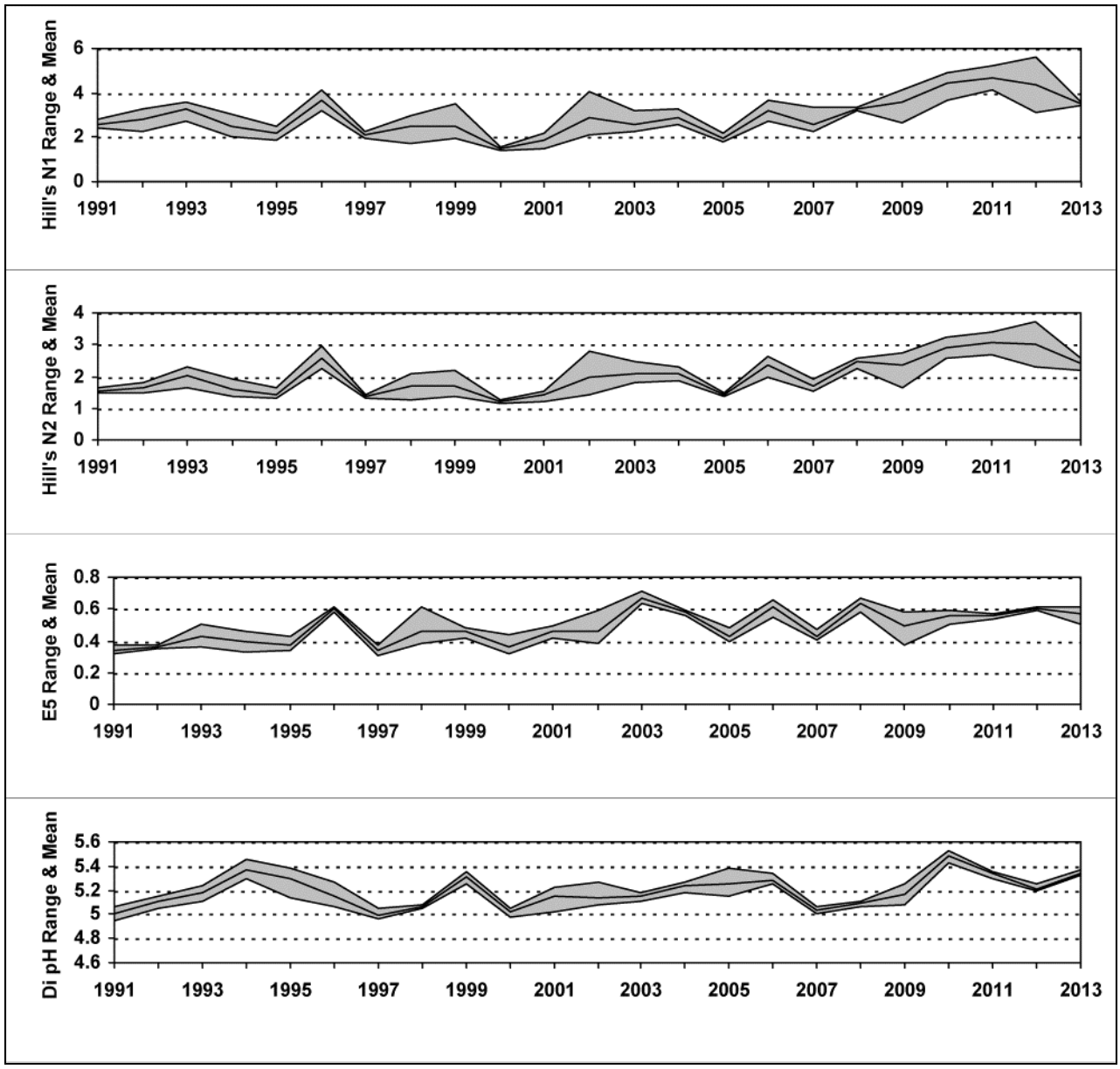


9.1.2 Epilithic diatom data

9.1.2.1Percentage abundance summary, Afon Gwy

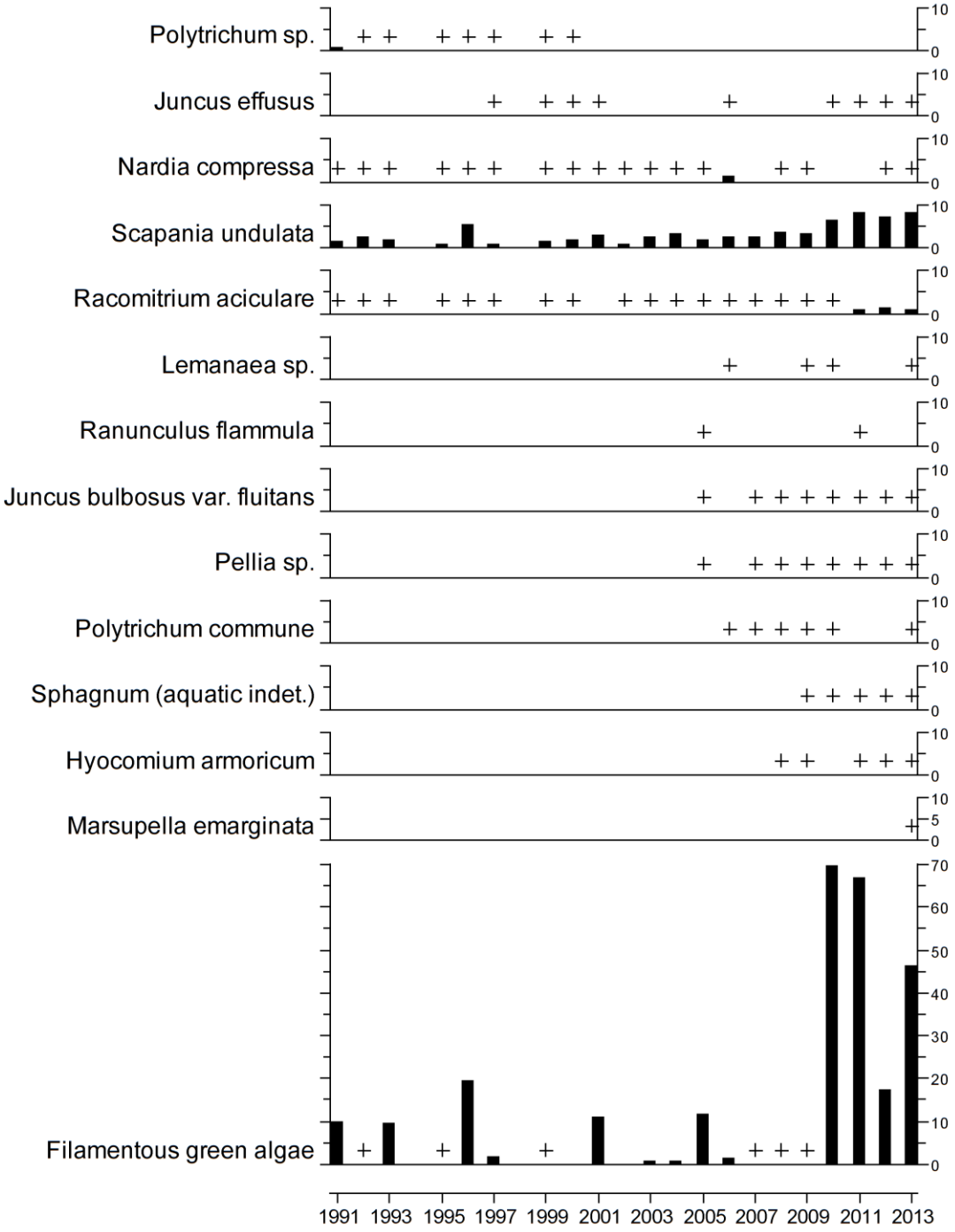


9.1.2.2Diatom summary statistics, Afon Gwy



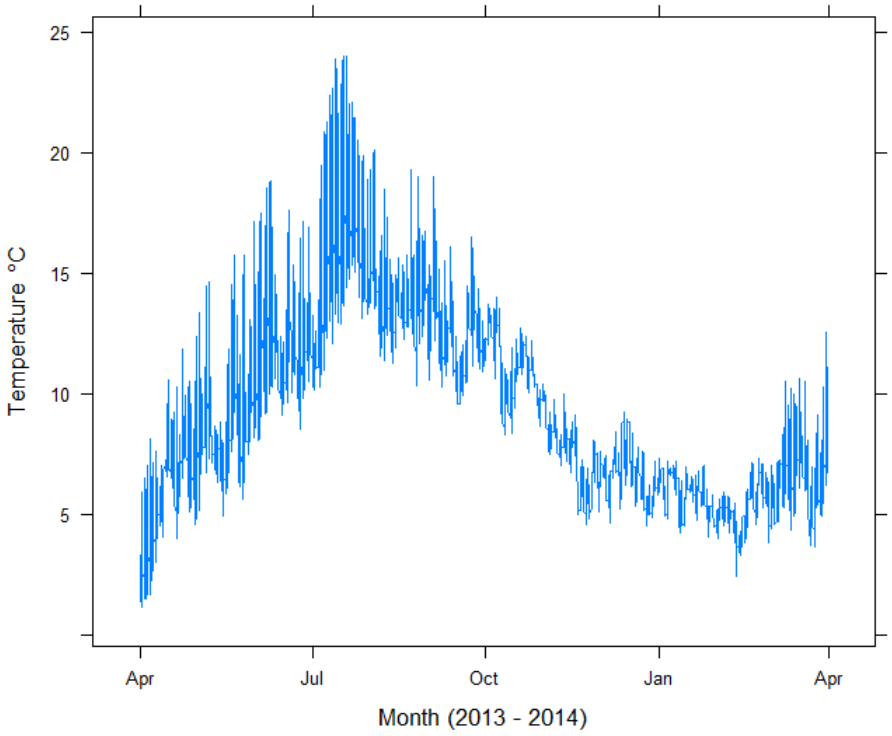
9.1.3 Aquatic macrophyte data, Afon Gwy

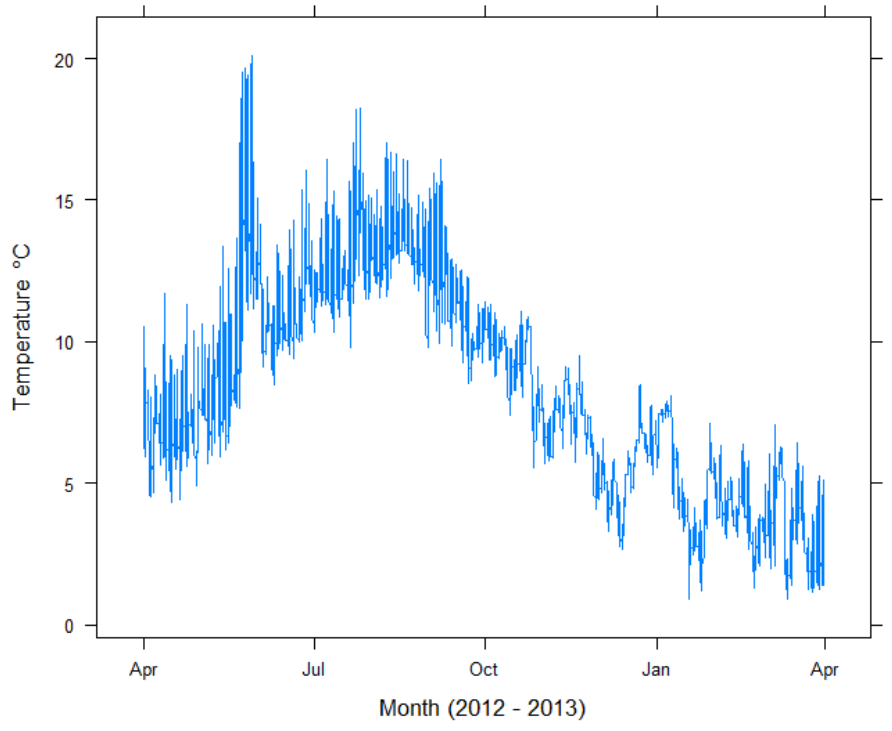
Percentage Species Cover

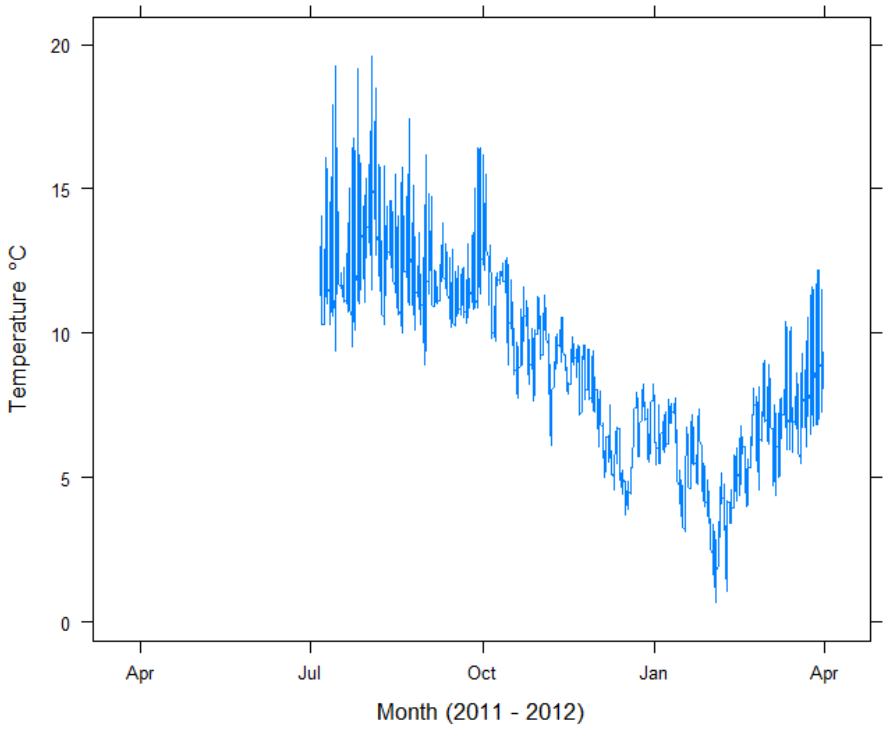


+ Represents <0.9% abundance

9.1.4 Thermistor data, Afon Gwy






Temperature °C
20
15
10
5
0
Apr
Jul
Oct
Jan
Apr
Month (2011 - 2012)