



**UCL**



**UK Upland Waters Monitoring Network (UKUWMN)  
Allt na Coire Nan Con, Loch Chon and Loch Grannoch  
Annual Summary Progress Report to Forest Research. April 16 - March 17**

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

**UK UPLAND WATERS MONITORING NETWORK  
(UKUWMN)**

**ALLT NA COIRE NAN CON, LOCH CHON AND LOCH  
GRANNOCH**

**ANNUAL SUMMARY PROGRESS REPORT TO FOREST  
RESEARCH. April 2016 - March 2017.**

**Ewan M. Shilland<sup>1</sup>, Don T. Monteith<sup>2</sup>, Karen Millidine<sup>3</sup> & Iain A.  
Malcolm<sup>3</sup>**

**2017**

<sup>1</sup> ENSIS Ltd, ECRC, UCL

<sup>2</sup> CEH Lancaster

<sup>3</sup> Marine Scotland, Pitlochry

Cover Photo: Loch Grannoch, 8<sup>th</sup> August 2016 © Ewan Shilland

# 1 TABLE OF CONTENTS

1	TABLE OF CONTENTS	3
2	INTRODUCTION	5
3	LOCATION OF UKUWMN SITES	6
4	SUMMARY OF WORK UNDERTAKEN 2016-2017	7
4.1	Summary Overview	7
4.2	Water Chemistry	7
4.3	Sediment Traps	7
4.4	Thermistors	8
4.5	Epilithic Diatoms	8
4.6	Macroinvertebrates	8
4.7	Fish	8
4.8	Macrophytes	8
4.9	Data Management and Reporting	8
5	DATA FORMAT	9
6	REFERENCES	11
7	SITE DATA	12
7.1	Allt na Coire nan Con	12
7.1.1	Spot sampled chemistry data	12
7.1.2	Macroinvertebrate data	13
7.1.2.1	Percentage abundance summary, Allt na Coire nan Con	13
7.1.2.2	Summary statistics, Allt na Coire nan Con	14
7.1.3	Fish data	15
7.1.3.1	Summary of Salmon fry densities (numbers m <sup>-2</sup> ), Allt na Coire nan Con	15
7.1.3.2	Summary of Salmon parr densities (numbers m <sup>-2</sup> ), Allt na Coire nan Con	16
7.1.3.3	Summary of Trout fry densities (numbers m <sup>-2</sup> ), Allt na Coire nan Con	17
7.1.3.4	Summary of Trout parr densities (numbers m <sup>-2</sup> ), Allt na Coire nan Con	18
7.1.4	Epilithic diatom data	19
7.1.4.1	Percentage abundance summary, Allt na Coire nan Con	19
7.1.4.2	Summary statistics, Allt na Coire nan Con	20
7.1.5	Aquatic macrophyte data, Allt na Coire nan Con	21

7.1.6	Thermistor data, Allt na Coire nan Con	22
<b>7.2</b>	<b>Loch Chon</b>	<b>25</b>
7.2.1	Spot sampled chemistry data	25
7.2.2	Macroinvertebrate data	26
7.2.2.1	Percentage abundance summary, Loch Chon	26
7.2.2.2	Summary statistics, Loch Chon	27
7.2.3	Fish data (for outflow stream)	28
7.2.3.1	Summary of Trout fry densities (numbers m <sup>-2</sup> ), Loch Chon	28
7.2.3.2	Summary of Trout parr densities (numbers m <sup>-2</sup> ), Loch Chon	29
7.2.4	Epilithic diatom data	30
7.2.4.1	Percentage abundance summary, Loch Chon	30
7.2.4.2	Summary statistics, Loch Chon	31
7.2.5	Aquatic macrophyte data, Loch Chon	32
7.2.6	Sediment trap diatom data, Loch Chon	33
7.2.7	Sediment trap thermistor data, Loch Chon	34
7.2.8	Thermistor chain data, Loch Chon	35
<b>7.3</b>	<b>Loch Grannoch</b>	<b>36</b>
7.3.1	Spot sampled chemistry data	36
7.3.2	Macroinvertebrate data	37
7.3.2.1	Percentage abundance summary, Loch Grannoch	37
7.3.2.2	Summary statistics, Loch Grannoch	38
7.3.3	Fish data (for outflow stream)	39
7.3.3.1	Summary of Trout fry densities (numbers m <sup>-2</sup> ), Loch Grannoch	39
7.3.3.2	Summary of Trout parr densities (numbers m <sup>-2</sup> ), Loch Grannoch	40
7.3.4	Epilithic diatom data	41
7.3.4.1	Percentage abundance summary, Loch Grannoch	41
7.3.4.2	Summary statistics, Loch Grannoch	42
7.3.5	Aquatic macrophyte data, Loch Grannoch	43
7.3.6	Sediment trap diatom data, Loch Grannoch	44
7.3.7	Sediment trap thermistor data, Loch Grannoch	45
7.3.8	Thermistor chain data, Loch Grannoch	46

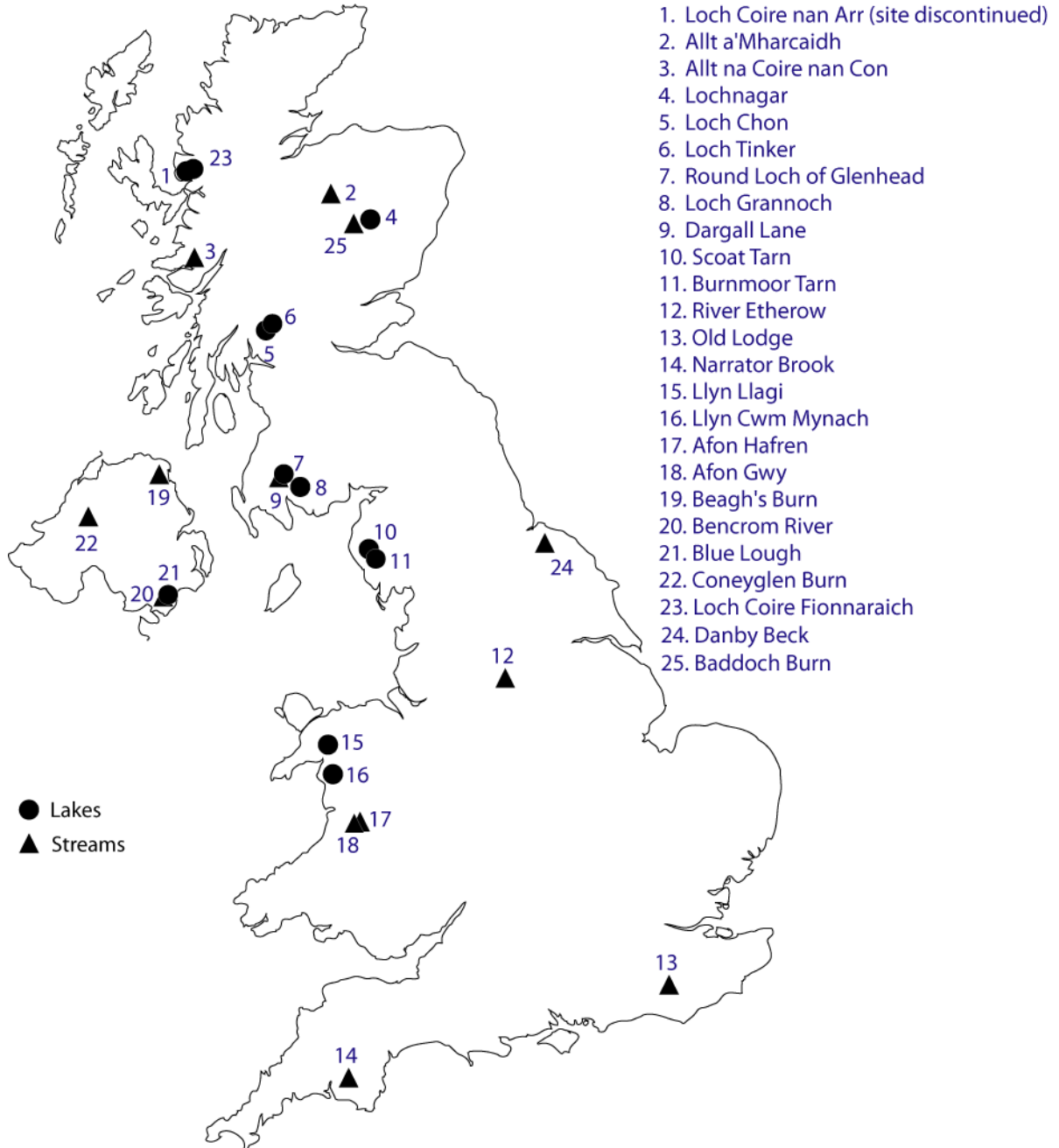
## 2 INTRODUCTION

Originally named the Acid Waters Monitoring Network, the UK Upland Waters Monitoring Network (UKUWMN) has been operating continuously since 1988. This report presents a summary of work undertaken in the contract year 2016-2017 at three Scottish forested sites currently supported in part by Forest Research: Allt na Coire nan Con, Loch Chon and Loch Grannoch. The UKUWMN gratefully acknowledges Forest Research for providing resources that contribute towards the continuation of monitoring at these sites, and especially recognises Pete Madden for sample collection at Allt na Coire nan Con. We would also like to thank Marine Scotland, Queen Mary University of London, the NERC Centre for Ecology and Hydrology (CEH), the Scottish Environmental Protection Agency (SEPA), Scottish Natural Heritage (SNH) and ENSIS Ltd. who have recently supported the rest of the programme at the three sites.

In order to present the Forest Research funded aspects of the UKUWMN in context, all sampling performed in 2016-17 is described and time series summary data are presented for the full suite of chemical and biological measurements taken from the start of monitoring up to March 2016.

Detailed analysis of data has been presented in four interpretative reports, Kernan *et al* (2010), Monteith and Shilland (2007), Monteith (2005) and Monteith and Evans (2000) dealing with 20, 18, 15 and 10 years of accumulated results respectively. All four can be found in the reports section of the [UKUWMN](#) web site. A special issue of the journal Ecological Indicators was produced in 2014, the majority of the papers in which feature interpretation of UKUWMN sites and data. The papers can be found online [here](#). A full description of sampling methods and analytical procedures, together with site descriptions, is also presented on the UKUWMN [methods](#) web page.

### 3 LOCATION OF UKUWMN SITES



## **4 SUMMARY OF WORK UNDERTAKEN 2016-2017**

### **4.1 Summary Overview**

During the period from April 2016 to March 2017 the funded chemical and biological sample collection, analysis and data collation, quality control and archiving proceeded with few problems at all three sites. The main change relative to previous years was the withdrawal of Marine Scotland Science from some aspects of the monitoring program. Unfortunately the 2016 macrophyte survey at Allt na Coire nan Con was impossible for the third year running due to spate conditions in the stream at the time of sampling.

### **4.2 Water Chemistry**

Both water chemistry analysis and sampling experienced changes during the reporting period. Resource reallocation at Marine Scotland Science (MSS) resulted in them no longer being able to collect or analyse most UKUWMN water chemistry samples after July 2016. All subsequent analysis has been performed by the laboratories at the Centre for Ecology and Hydrology.

MSS collected the June 2016 sample from Loch Grannoch, after which sampling switched to ENSIS staff, who sampled in September and December 2016 and March 2017. MSS sampled Loch Chon in early June, September and December 2016 and ENSIS collected a delayed sample in April 2017. Subsequently, sampling has changed over to Alex Fenton from the Forestry Commission who has already kindly been sampling nearby Loch Tinker. Monthly dip samples were collected from Allt na Coire nan Con by another local Forestry Commission operative, Pete Madden.

All samples were delivered to the analytical laboratories and have been analysed and archived in the UKUWMN central chemistry database at CEH Lancaster. Quality control is being performed on the data prior to it being presented online on the UKUWMN website.

### **4.3 Sediment Traps**

Sediment traps were recovered and replaced by a team from ENSIS on the on the 21<sup>st</sup> of August 2016 at Loch Chon and on the 8<sup>th</sup> of August 2016 at Loch Grannoch. Diatoms in the sediment retrieved from the traps were made into slides and have been archived pending funding becoming available for analysis. Spheroidal Carbonaceous Particles from the sediment have been counted by Prof N. Rose. Trap sediment samples for trace metals were collected and have been archived pending funding becoming available for analysis.

## **4.4 Thermistors**

Top and bottom thermistors and thermistor chains were removed and replaced on the 21<sup>st</sup> of August at Loch Chon and 8<sup>th</sup> of August 2016 at Loch Grannoch. All units had functioned well during the previous year and the data were added to the ENSIS/MSS thermistor water temperature database. The stream thermistor at Allt na Coire nan Con functioned well and data have been added to the MSS stream thermistor database.

## **4.5 Epilithic Diatoms**

Epilithic diatoms were retrieved from three sampling points around Loch Chon on the 21<sup>st</sup> of August 2018 and at four sampling points around Loch Grannoch on the 8<sup>th</sup> of August 2016. Three samples were retrieved from Allt na Coire nan Con on the 10<sup>th</sup> of July 2016. All samples were preserved in Ethanol to enable future eDNA work on the material if required. Sub-samples of each have been made into slides and will be archived pending funding becoming available for analysis.

## **4.6 Macroinvertebrates**

Aquatic macroinvertebrates were sampled by a joint QMuL/ENSIS team at Allt na Coire nan Con on the 7<sup>th</sup> of May 2016, at Loch Chon on the 5<sup>th</sup> May and Loch Grannoch on the 4<sup>th</sup> May. Five 1 minute kick samples were performed at the sites and all samples were preserved in Ethanol to enable future eDNA work on the material if required. The 2016 samples from all three sites have been archived, awaiting funding for analysis.

## **4.7 Fish**

Funding for fish surveying was unavailable and therefore it was not performed at the three sites in autumn 2016.

## **4.8 Macrophytes**

Aquatic macrophyte surveys were not performed at the loch sites in 2016. Unfortunately, for a third year running, Allt na Coire nan Con was not surveyed on the site visit of 10<sup>th</sup> of July 2016 due to spate conditions in the stream.

## **4.9 Data Management and Reporting**

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

The 2015-2016 annual summary data has been uploaded to the UWMN web site, and the sections on Allt na Coire nan Con, Loch Chon and Loch Grannoch appear in section 7 below.



## 5 DATA FORMAT

The chemical and biological data are presented in a series of sections, summarised below, on a site-by-site basis.

Section 1:	<p>Time series graphs of key spot sampled chemical determinands for individual samples.</p> <p>Summary table for key chemical determinands including: the mean over the 1988-1993 baseline period; the mean for the current year (2014-2015) and the standard deviation for the current year. The normal number of observations per year is 4 for lakes and 12 for streams.</p>
Section 2:	<p>Macroinvertebrates. Time series of macroinvertebrate taxon % abundance in annual aggregated samples (5 kick samples from lake littoral habitats or from riffle areas in streams), and annual total number of individual animals. Some species occurring at less than 1% relative abundance are omitted.</p> <p>Macroinvertebrate summary statistic time series:</p> <ol style="list-style-type: none"> <li>1) total number of individuals;</li> <li>2) number of individuals identified at Genus level only (excludes some ubiquitous groups such as the chironomids and oligochaetes);</li> <li>3) total number of taxa;</li> <li>4) Diversity Indices:             <ol style="list-style-type: none"> <li>a) Hill's <math>N_1</math>, the exponent of Shannon's Index and a measure of the number of abundant species in a sample (Hill, 1973).</li> <li>b) Hill's <math>N_2</math>, the reciprocal of Simpson's Index and a measure of the number of very abundant species in a sample (Hill, 1973).</li> <li>c) <math>E_5</math>, a measure of evenness based on the ratio <math>(N_2-1):(N_1-1)</math>. As a single species becomes more and more dominant, <math>E_5</math> tends to zero.</li> </ol> </li> </ol>
Section 3:	<p>Salmonids. Summary histogram of mean density of trout and salmon, if present, in three 50m reaches (number of individuals caught per <math>m^2</math> survey area) for each year of the monitoring period. (0+ = new recruits, "fry", &gt;0+ = all fish over one year of age, "parr"). The lower reach is coloured blue, middle reach pink and upper reach green.</p>
Section 4:	<p>Epilithic diatoms. Time series of annual mean percentage frequency (from 3-4 replicate samples) of taxa occurring at greater than 2 % abundance in any one sample.</p> <p>Epilithic diatom summary statistic time series. Mean, maximum and minimum for:</p> <ol style="list-style-type: none"> <li>a) Hill's <math>N_1</math> (see above)</li> <li>b) Hill's <math>N_2</math> (see above)</li> <li>c) <math>E_5</math> (see above)</li> <li>d) Diatom inferred pH (Di pH), reconstructed from the diatom data using C2 (Juggins, 2007) running the Weighted Averaging Partial Least Squares method and using pH training set data from the SWAP project (Stevenson et al. 1991). Bootstrapping was performed to choose the best Component to use for the reconstruction. Component 2 improved</li> </ol>

	<p>the model prediction by over 5% and was therefore chosen, and is shown here alongside the diatom percentage abundance stratigraphy. pH reconstructions are intended only for application to sedimentary diatoms but directional trends in inferred pH of epilithic assemblages should provide an indication of the direction of a response to changing acidity.</p>
Section 5:	<p>Aquatic macrophytes. For lakes relative species abundance determined on a five point scale (comparable to the DAFOR scoring system, Palmer <i>et al.</i> 1992) following shoreline survey, shore transects and deep water grapnel trawls, as follows:</p> <ol style="list-style-type: none"> <li>1. rare/infrequent</li> <li>2. occasional but not abundant</li> <li>3. widespread but not abundant</li> <li>4. locally abundant</li> <li>5. widespread and abundant</li> </ol> <p>For streams, total macrophyte cover estimated for 5m sections of a 50m survey stretch and each then partitioned into proportional species abundance to provide percentage cover for each species. Data analysed for this report are the mean species cover estimates for the 50m stretches.</p>
Section 6:	<p>For lake sites only. Histogram of diatom species composition from annually retrieved sediment traps. Species occurring at less than 1% abundance in all years are omitted.</p>
Section 7:	<p>For lake sites only. Time series graphs of annual data from thermistors attached to the sediment traps. Thermistor pairs are used, one 1.5m from the lake bottom and the other 1m from the water surface.</p>
Section 8:	<p>For lake sites only. Time series depth-temperature contour plot of data from a thermistor chain suspended near the deepest part of the site.</p>

## 6 REFERENCES

**Hill, M. O.** 1973 Diversity and evenness: a unifying notation and its consequences. *Ecology*, **54**, 427-31.

**Juggins, S.** 2007 C2 Version 1.5 User guide. Software for ecological and palaeoecological data analysis and visualisation. Newcastle University, Newcastle upon Tyne, UK. 73pp.

**Kernan, M., Battarbee, R. W., Curtis, C. J., Monteith, D. T. & Shilland, E. M.** 2010 *UK Acid Waters Monitoring Network 20 Year Interpretative Report*, 1-483, ENSIS Ltd, Environmental Change Research Centre, University College London, London.

**Monteith, D. T.** (Ed.) 2005 *UK Acid Waters Monitoring Network: 15 Year Report. Analysis and Interpretation of Results, April 1988-March 2003*. ENSIS Ltd, London.

**Monteith, D. T. & Evans, C. D.** (Eds.) 2000 *UK Acid Waters Monitoring Network: 10 Year Report. Analysis and Interpretation of Results, April 1988-March 1998*. ENSIS Ltd, London.

**Monteith, D. T. & Shilland, E. M.** (Eds.) 2007 *The United Kingdom Acid Waters Monitoring Network Assessment of the First 18 Years of Data. Data Summary Annex Accompanying Research Project Final Report. Report to the Department for Environment, Food and Rural Affairs (Contract EPG 1/3/160)*. ENSIS Ltd, London.

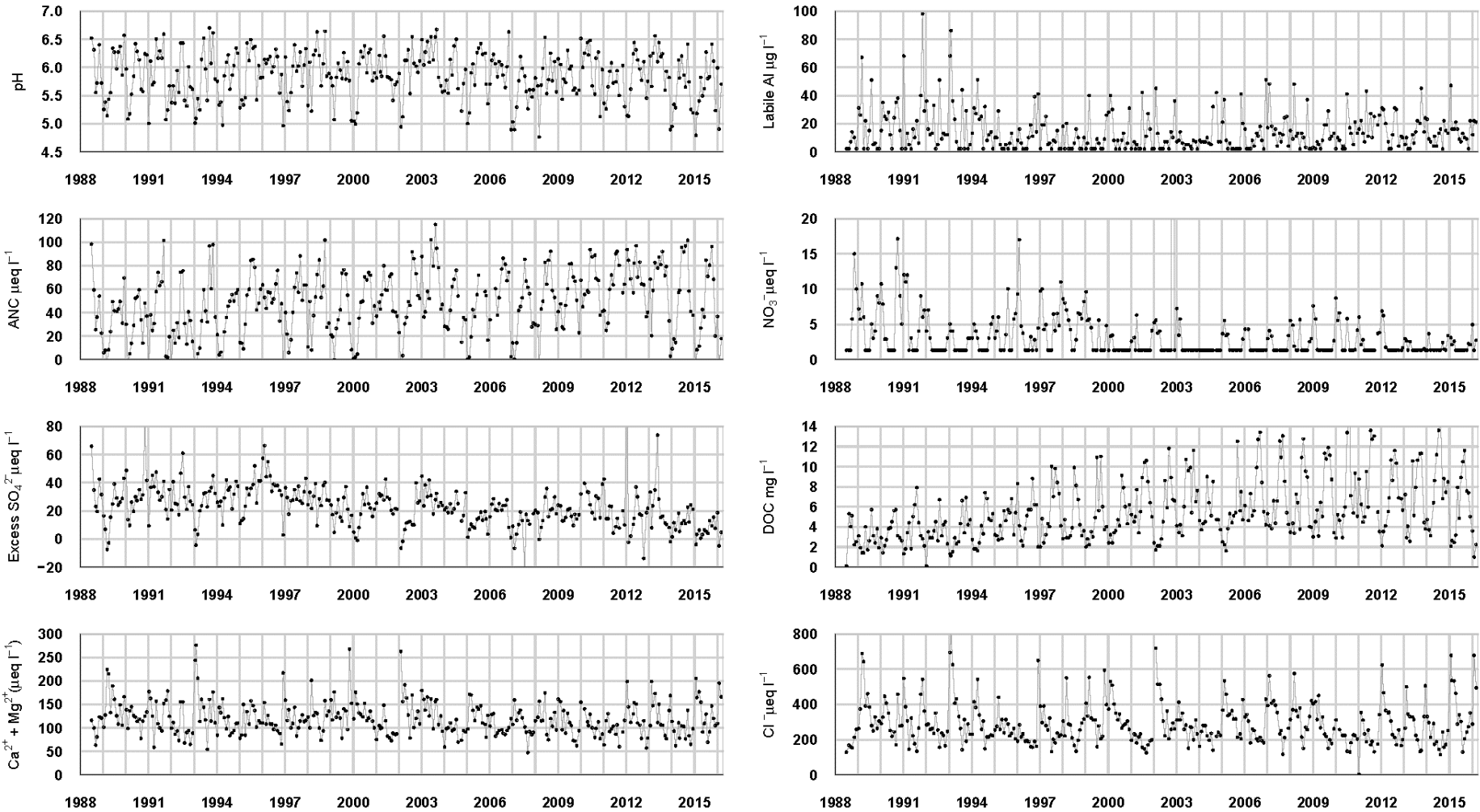
**Palmer, M. A., Bell, S. L. & Butterfield, I.** 1992 A botanical classification of standing waters in Britain: applications for conservation and monitoring. *Aquatic conservation: marine and freshwater ecosystems*, **2**, 125-143.

**Stevenson, A. C., Juggins, S., Birks, H. J. B., Anderson, N. J., Battarbee, R. W., Berge, F., Davis, R. B., Flower, R. J., Haworth, E. Y., Jones, V. J., Kingston, J. C., Kreiser, A. M., Line, J. M., Munro, M. A. R. & Renberg, I.** 1991 *The surface waters acidification project palaeolimnology programme: Modern diatom/lake-water chemistry data-set*. ENSIS Ltd, London.

# 7 SITE DATA

## 7.1 Allt na Coire nan Con

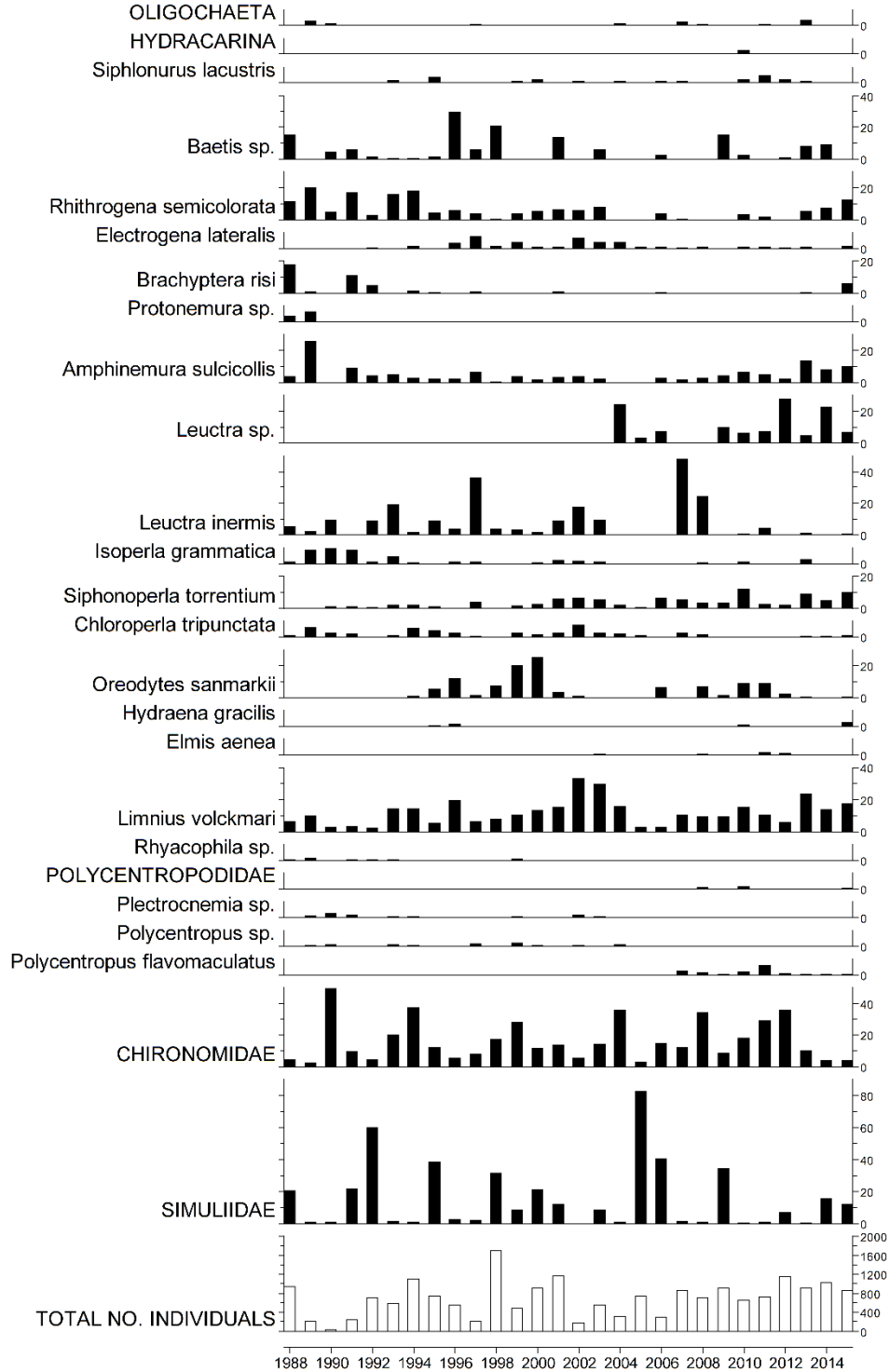
### 7.1.1 Spot sampled chemistry data



$\mu\text{eq l}^{-1}$ , * $\mu\text{g l}^{-1}$ , ** $\text{mg l}^{-1}$	pH	ANC	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	*Soluble Al	*Labile Al	Cl <sup>-</sup>	*SO <sub>4</sub> <sup>2-</sup>	xSO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	**DOC
Mean 1 <sup>st</sup> 5 yrs	5.81	32.14	58.91	70.20	274.34	9.14	64.76	21.47	325.23	62.07	27.96	4.79	3.18
15-16 mean	5.76	47.44	52.91	70.77	297.34	8.30	74.42	13.67	337.03	42.16	6.82	1.87	6.13
15-16 std dev	0.42	32.22	13.13	26.09	88.33	2.46	29.80	6.69	147.24	12.53	6.50	1.09	3.35

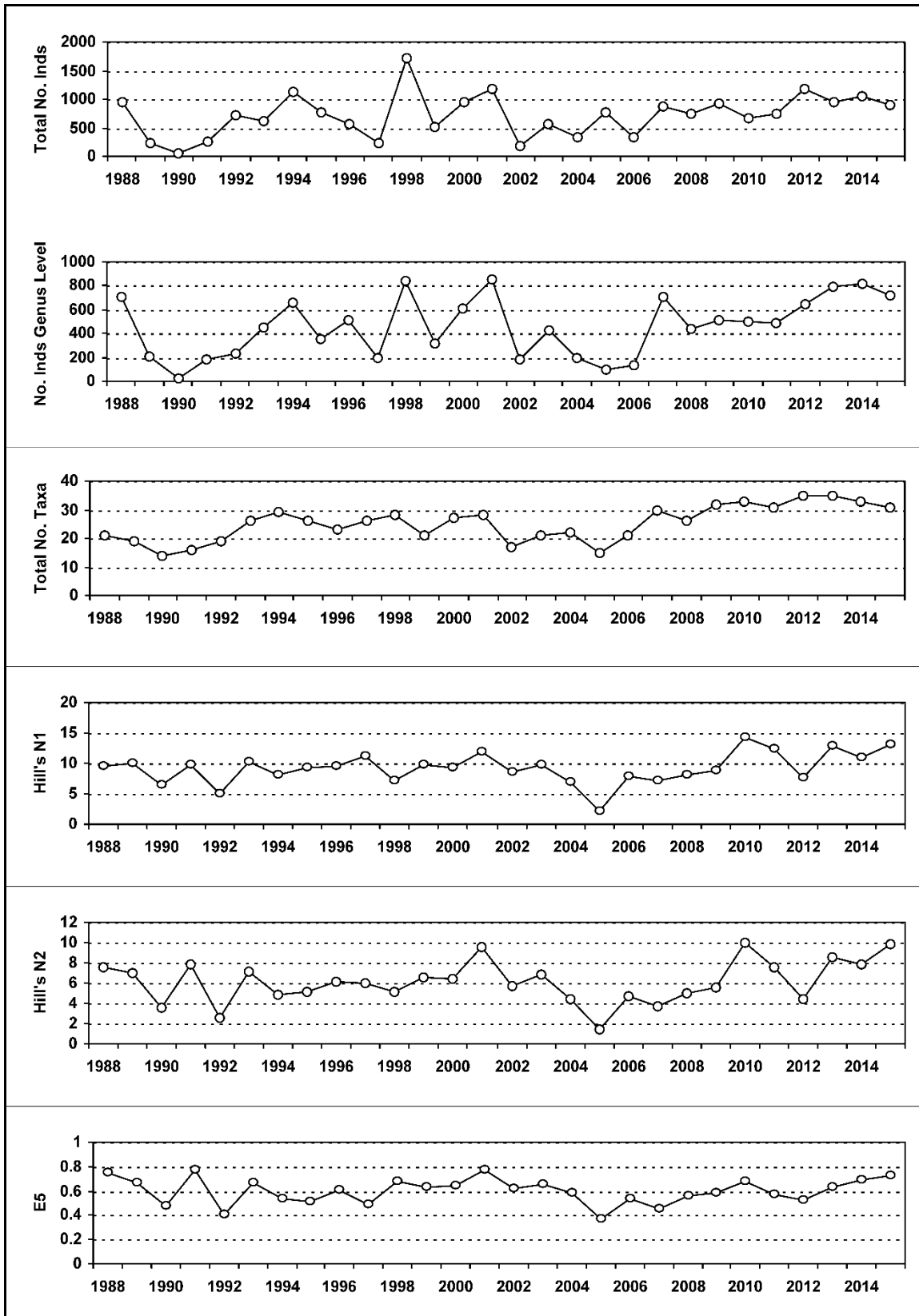
## 7.1.2 Macroinvertebrate data

### 7.1.2.1 Percentage abundance summary, Allt na Coire nan Con



2016 and 2017 samples archived awaiting funding for analysis

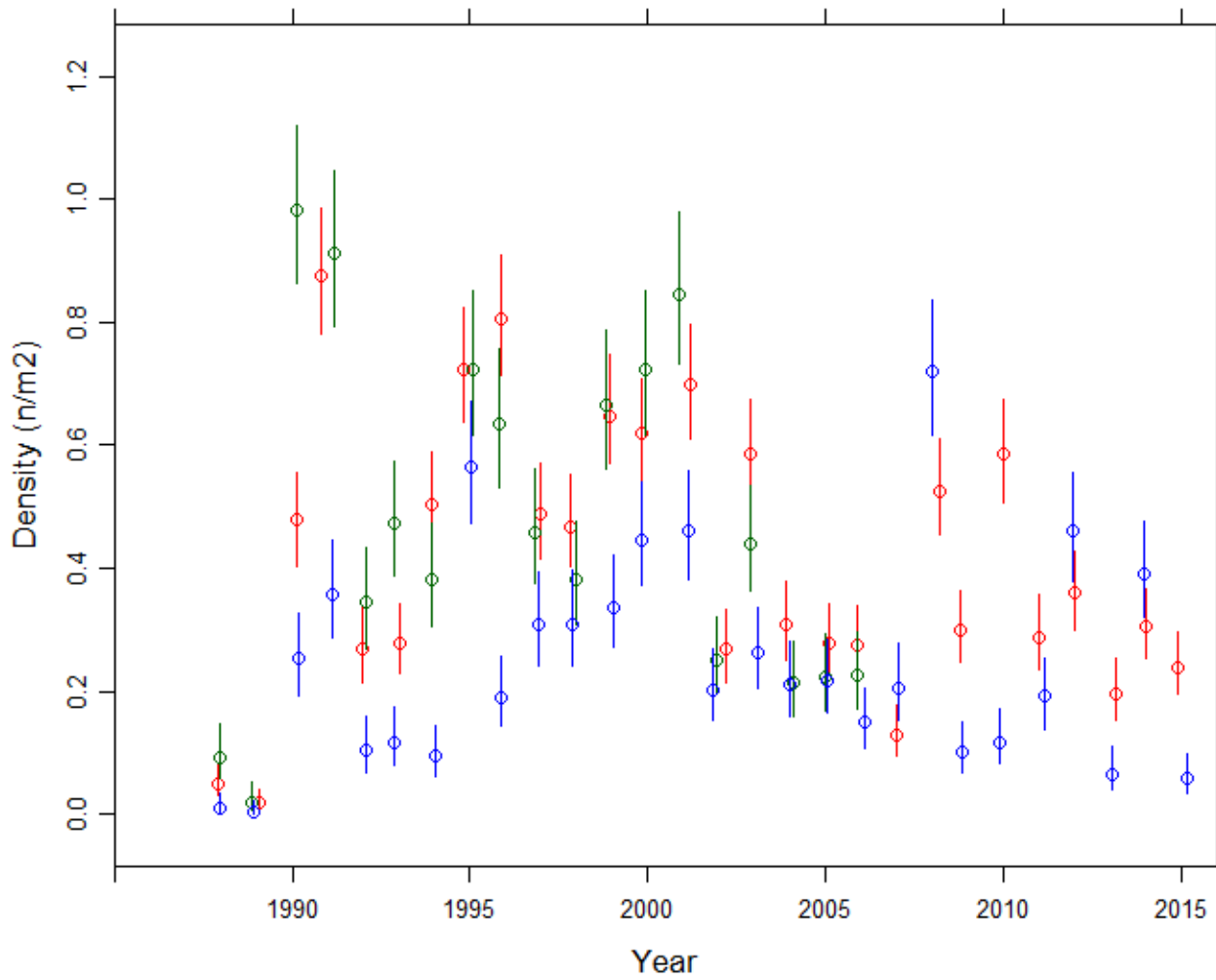
### 7.1.2.2 Summary statistics, Allt na Coire nan Con



2016 and 2017 samples archived awaiting funding for analysis

### 7.1.3 Fish data

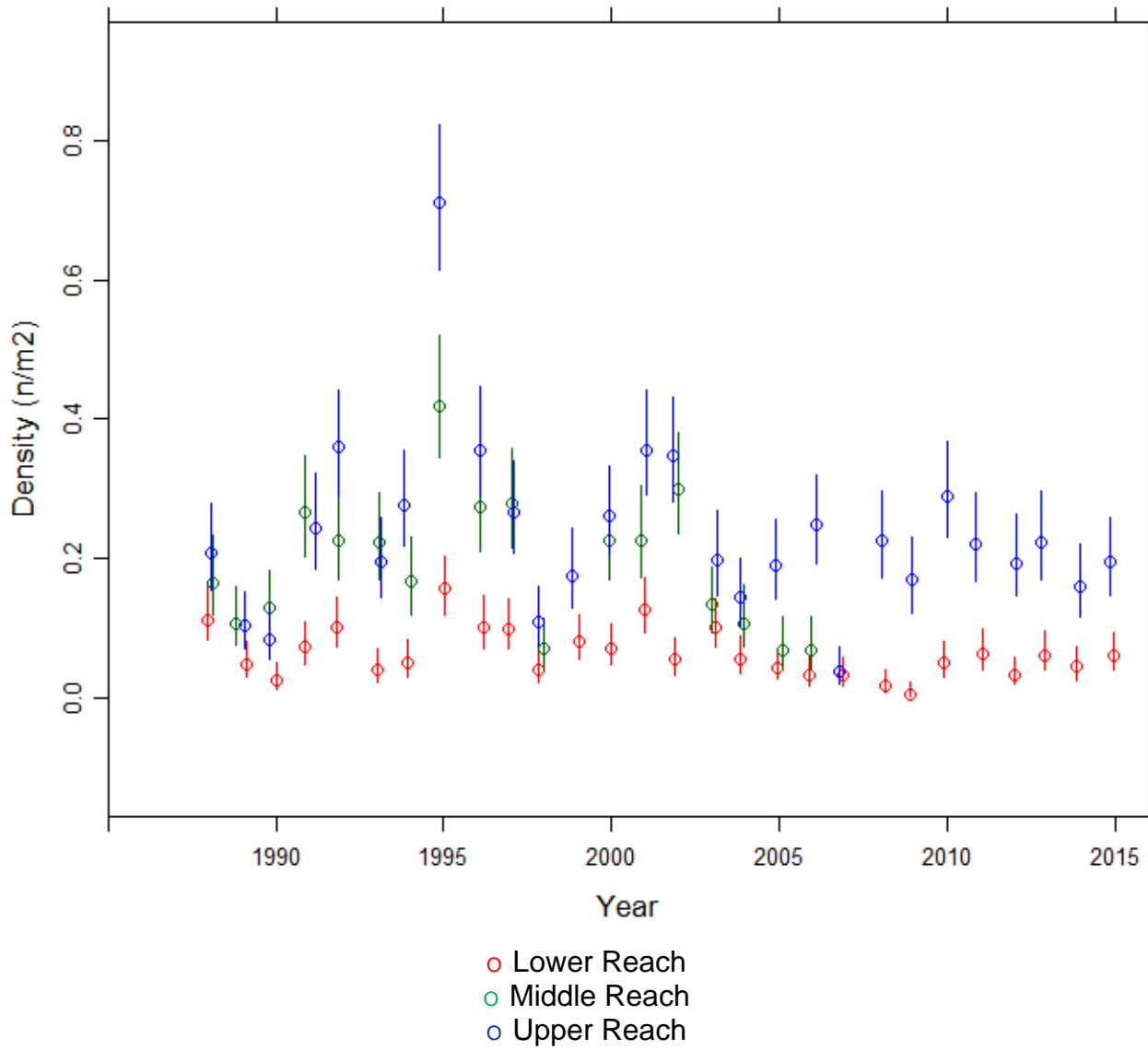
#### 7.1.3.1 Summary of Salmon fry densities (numbers m<sup>-2</sup>), Allt na Coire nan Con



- Lower Reach
- Middle Reach
- Upper Reach

Fishing no longer funded after 2015

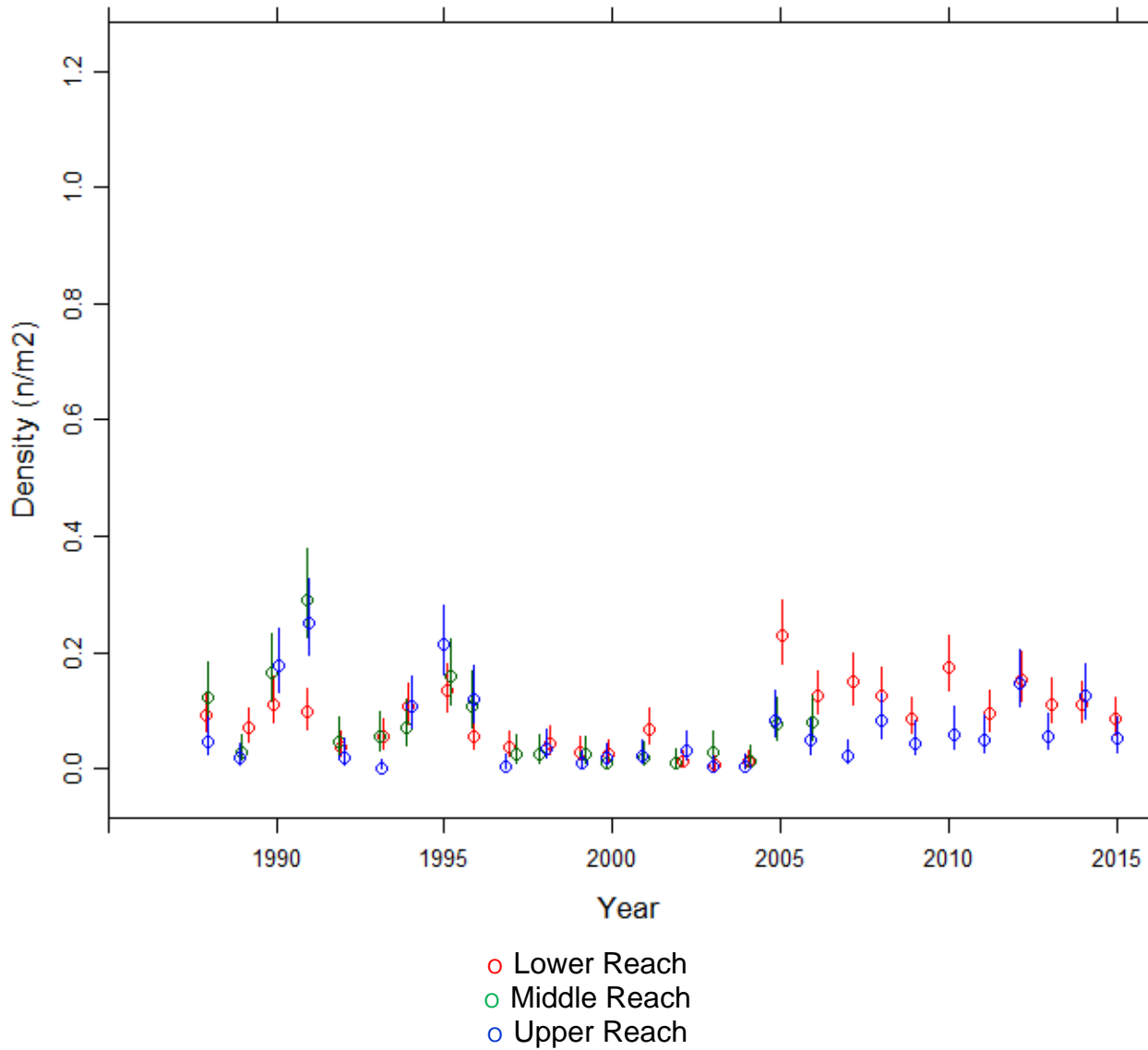
### 7.1.3.2 Summary of Salmon parr densities (numbers m<sup>-2</sup>), Allt na Coire nan Con



Fishing no longer funded after 2015

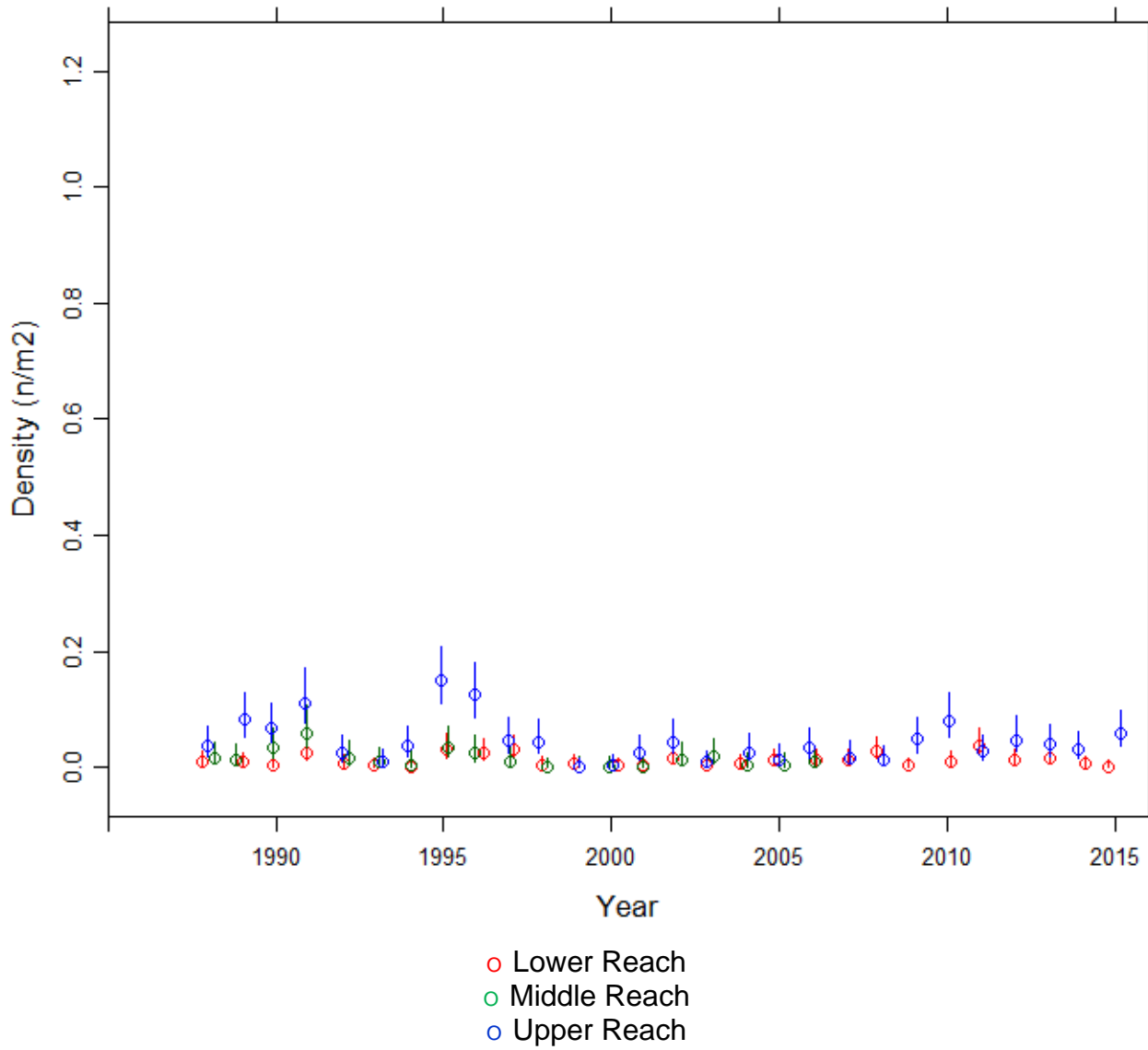


### 7.1.3.3 Summary of Trout fry densities (numbers m<sup>-2</sup>), Allt na Coire nan Con



Fishing no longer funded after 2015

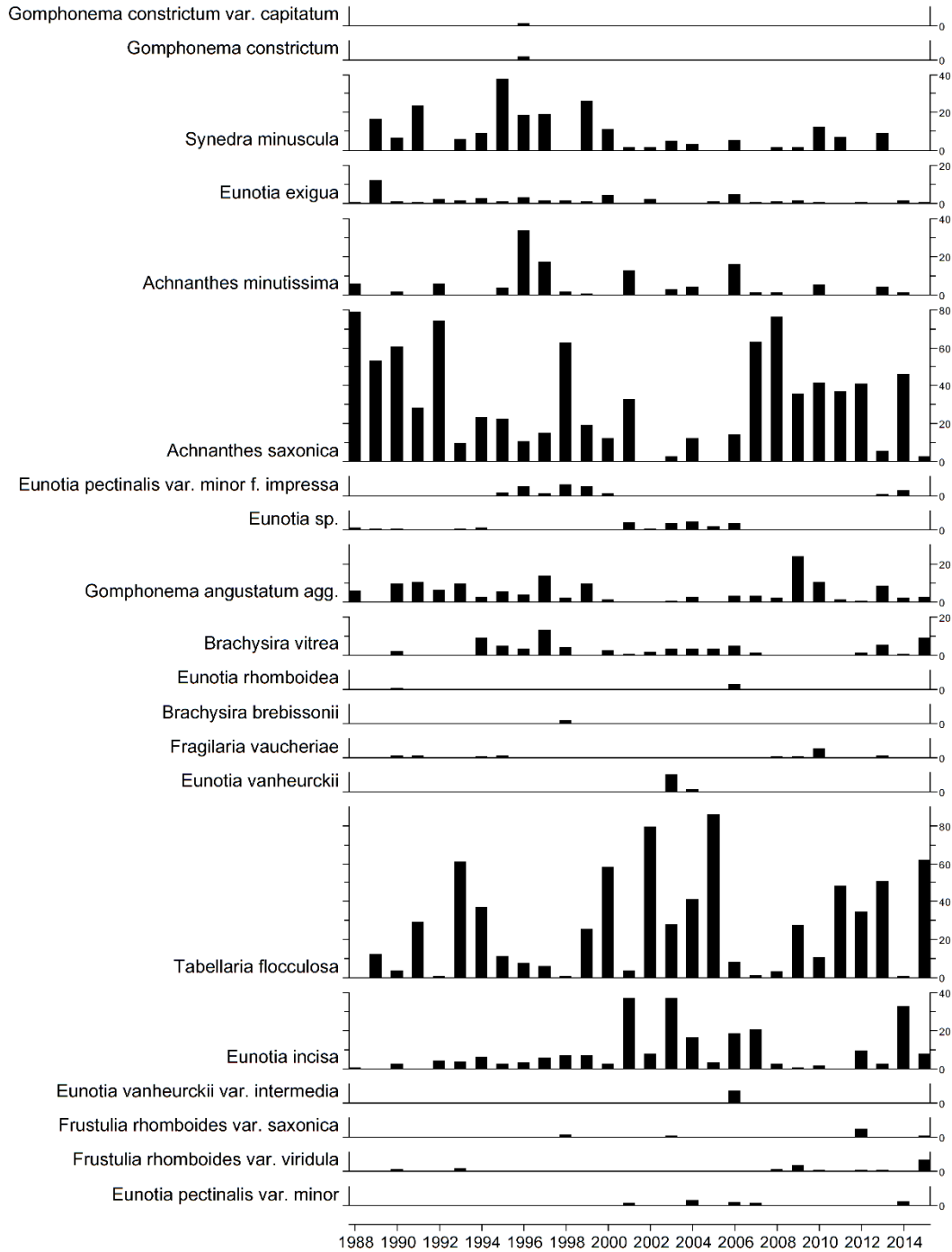
### 7.1.3.4 Summary of Trout parr densities (numbers m<sup>-2</sup>), Allt na Coire nan Con



Fishing no longer funded after 2015

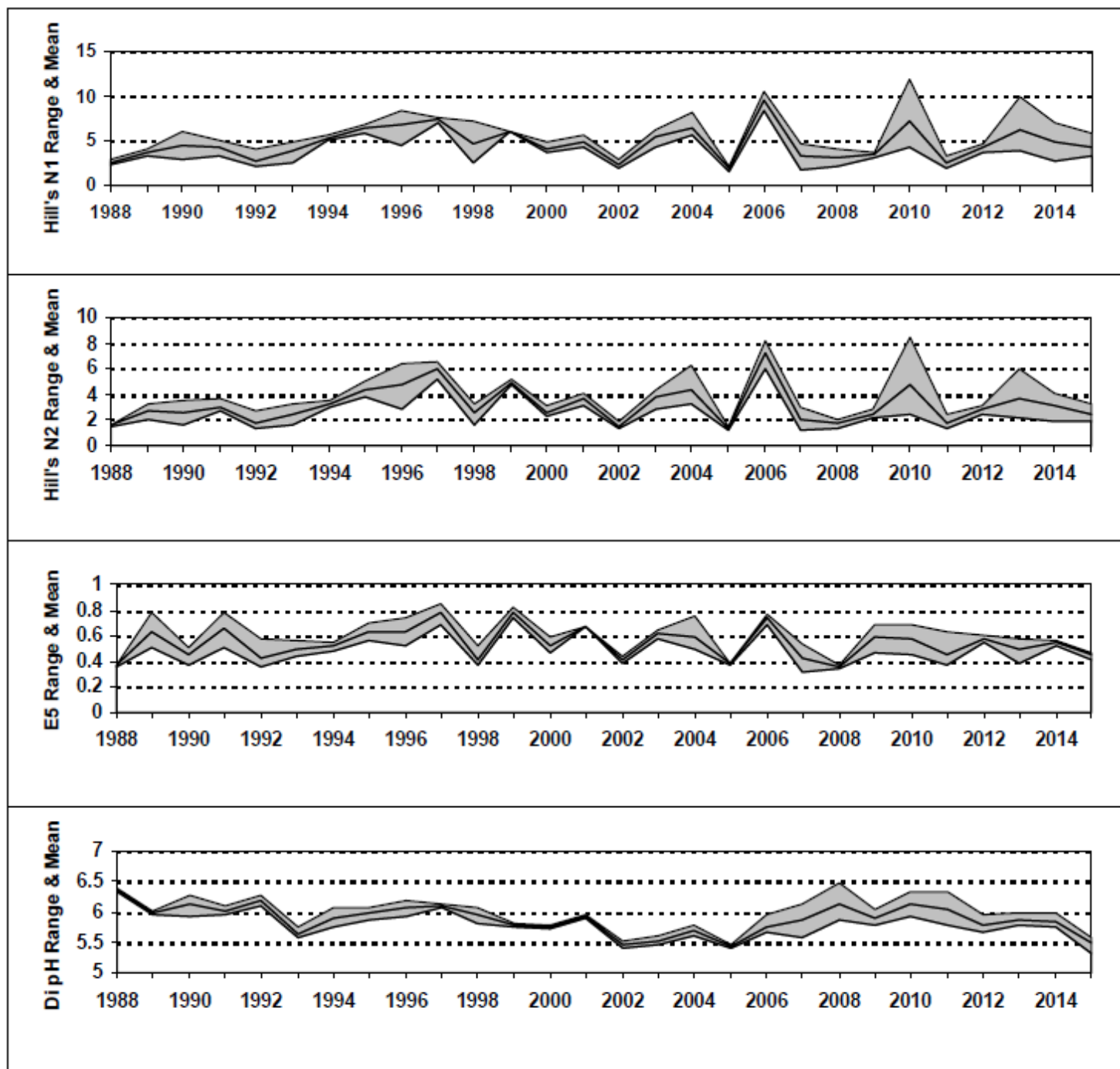
## 7.1.4 Epilithic diatom data

### 7.1.4.1 Percentage abundance summary, Allt na Coire nan Con



2016 and 2017 samples archived awaiting funding for analysis

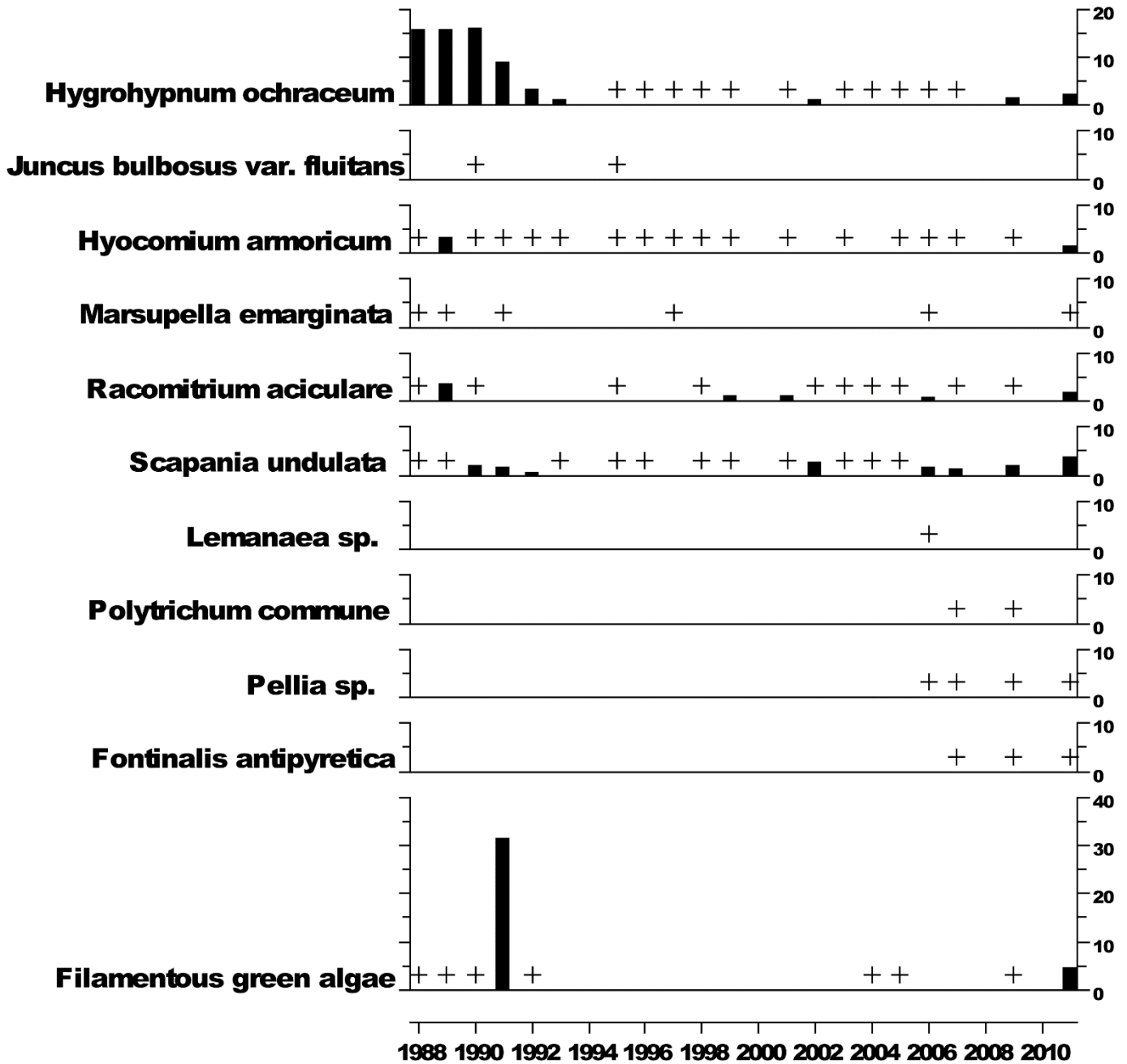
### 7.1.4.2 Summary statistics, Allt na Coire nan Con



2016 and 2017 samples archived awaiting funding for analysis

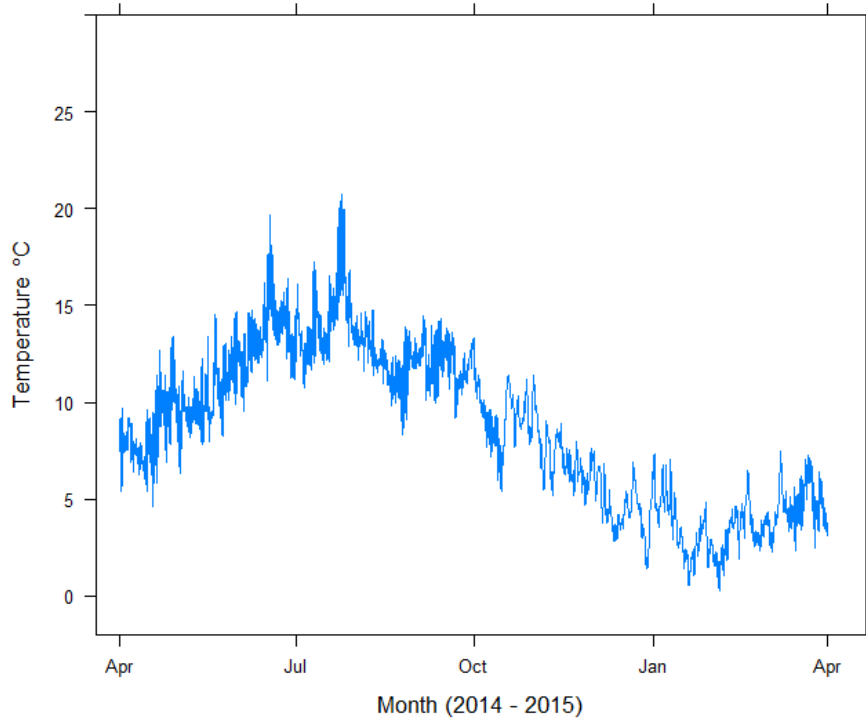
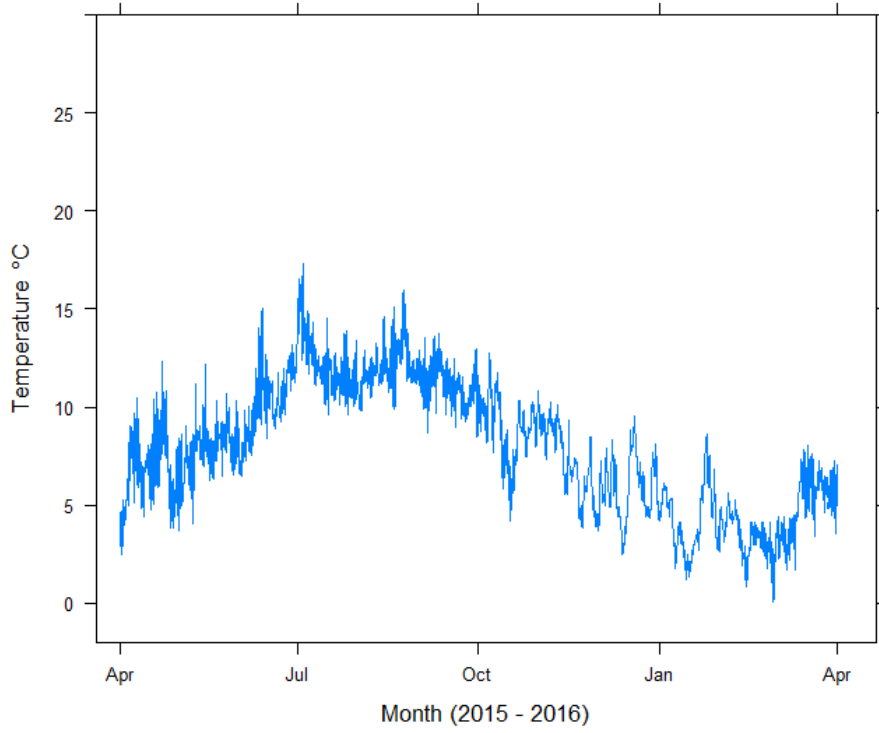
### 7.1.5 Aquatic macrophyte data, Allt na Coire nan Con

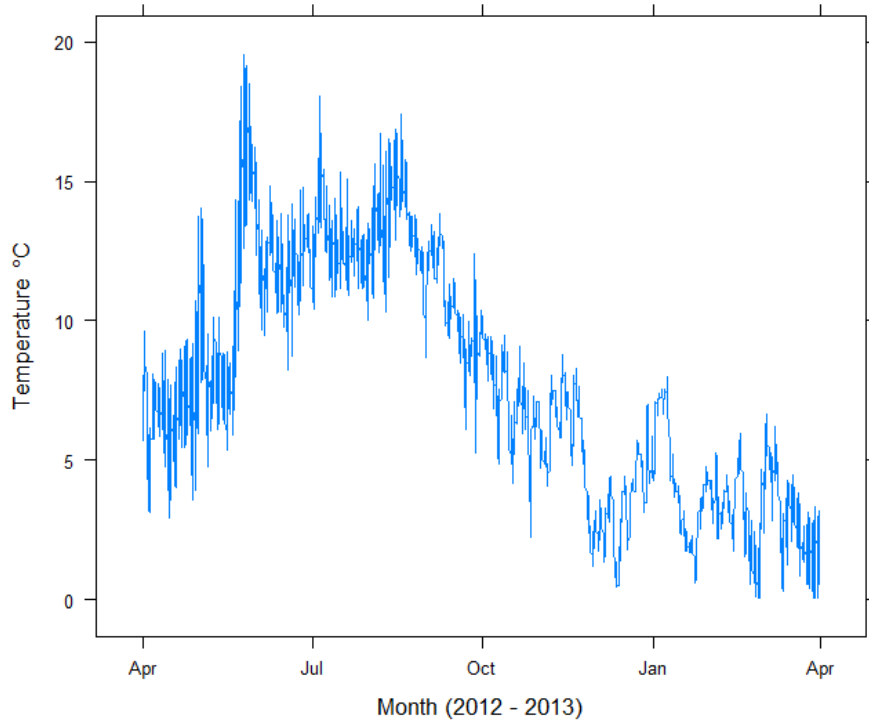
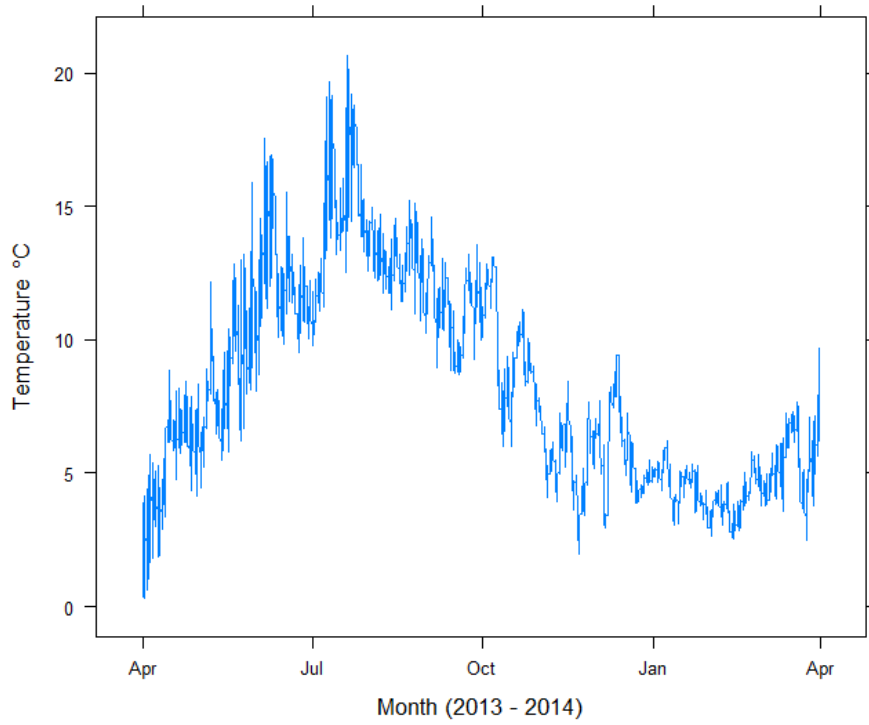
#### Percentage Species Cover

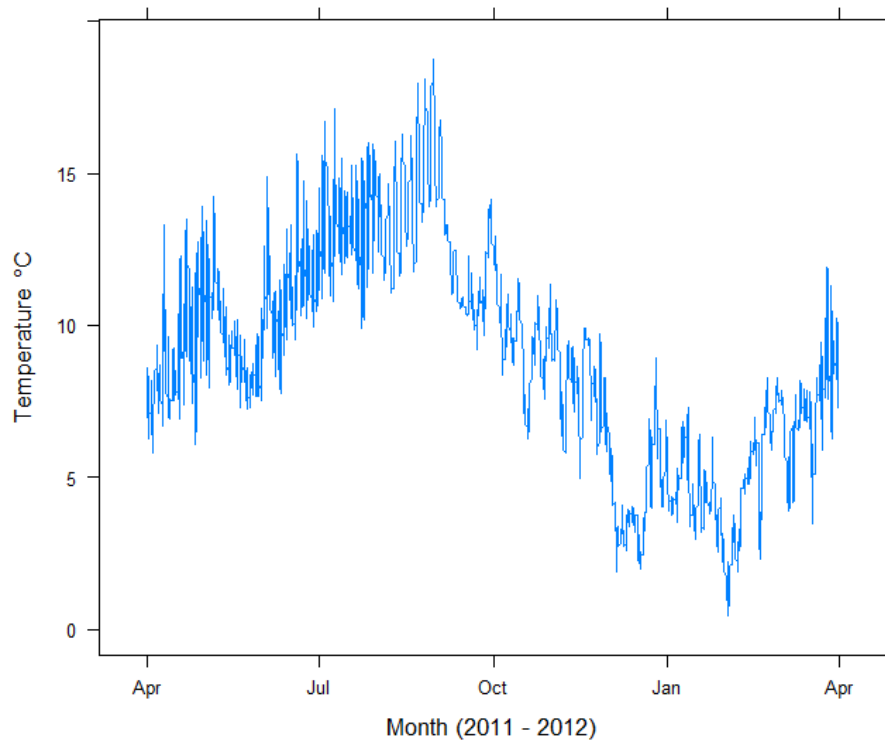


+ Represents <0.9% abundance  
 No surveys in 2008 and 2010 due to spate conditions

### 7.1.6 Thermistor data, Allt na Coire nan Con



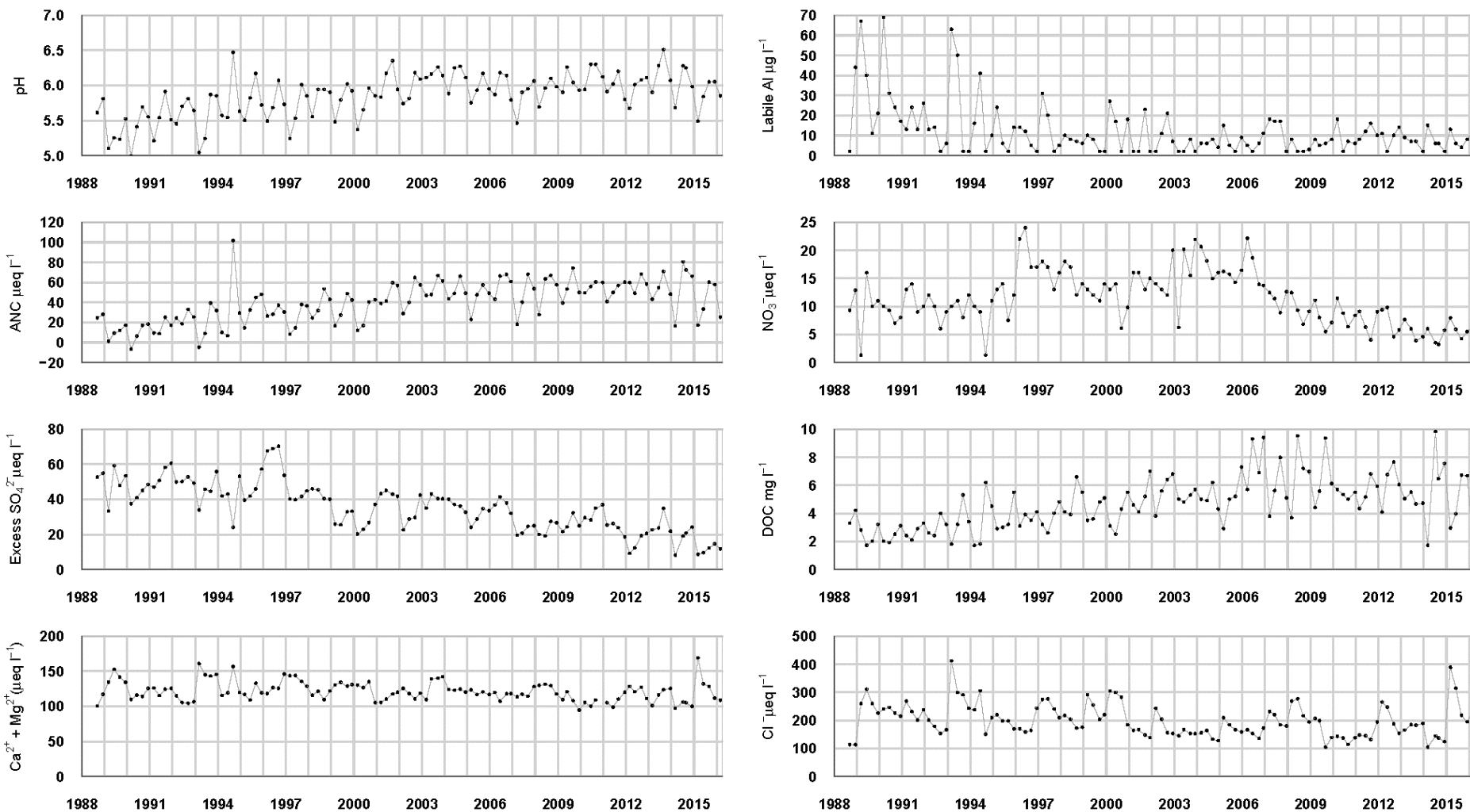






## 7.2 Loch Chon

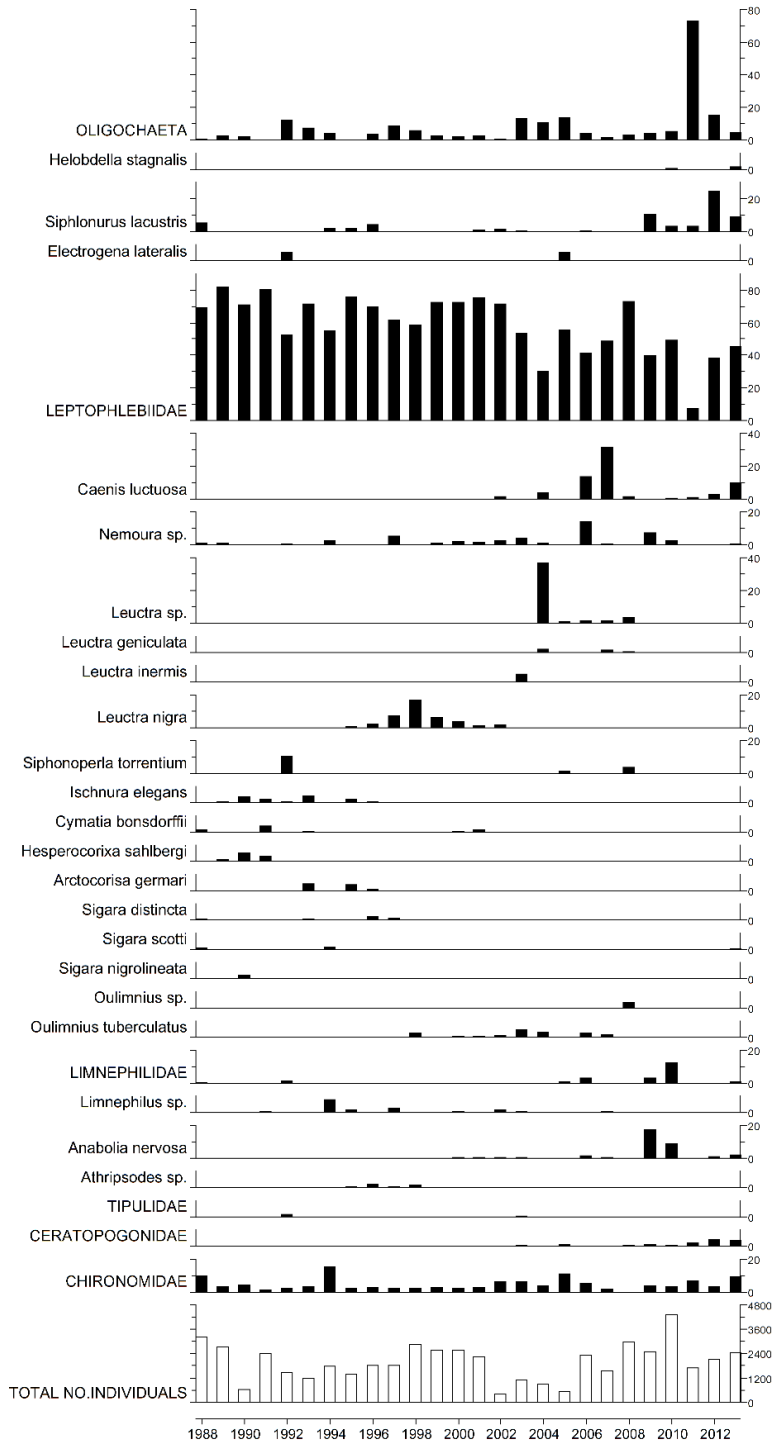
### 7.2.1 Spot sampled chemistry data



$\mu\text{eq l}^{-1}$ , * $\mu\text{g l}^{-1}$ , ** $\text{mg l}^{-1}$	pH	ANC	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	*Soluble Al	*Labile Al	Cl <sup>-</sup>	*SO <sub>4</sub> <sup>2-</sup>	xSO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	**DOC
Mean 1 <sup>st</sup> 5 yrs	5.46	14.54	76.17	47.42	189.44	5.79	66.65	27.50	227.51	72.38	48.53	9.94	2.73
15-16 mean	5.95	44.09	70.65	49.44	197.61	6.22	44.75	7.50	239.42	37.05	11.94	5.51	4.86
15-16 std dev	0.12	17.52	7.60	6.23	30.88	0.38	8.46	3.42	52.41	3.64	2.06	0.90	2.25

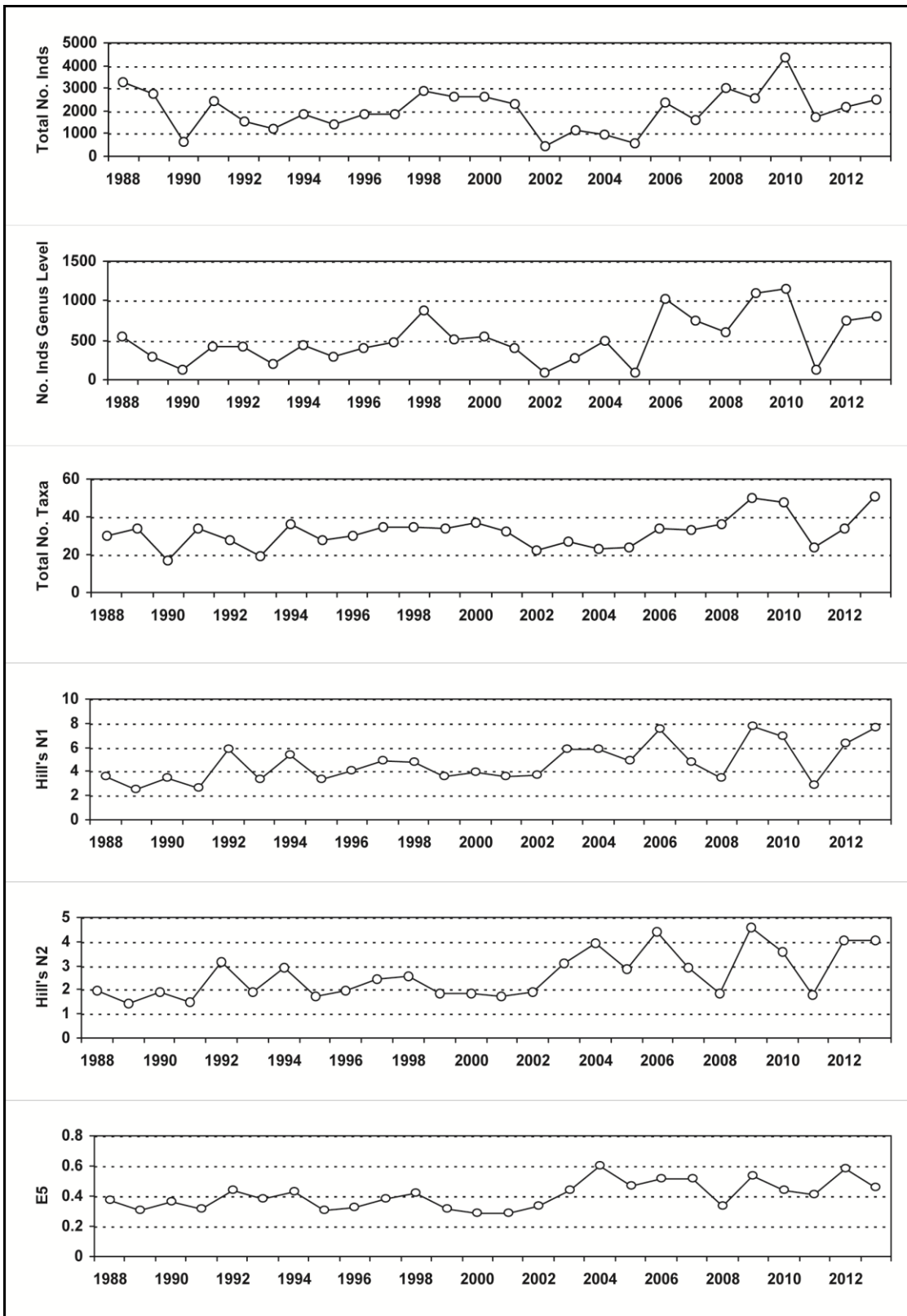
## 7.2.2 Macroinvertebrate data

### 7.2.2.1 Percentage abundance summary, Loch Chon



2014 - 2017 samples archived awaiting funding for analysis.

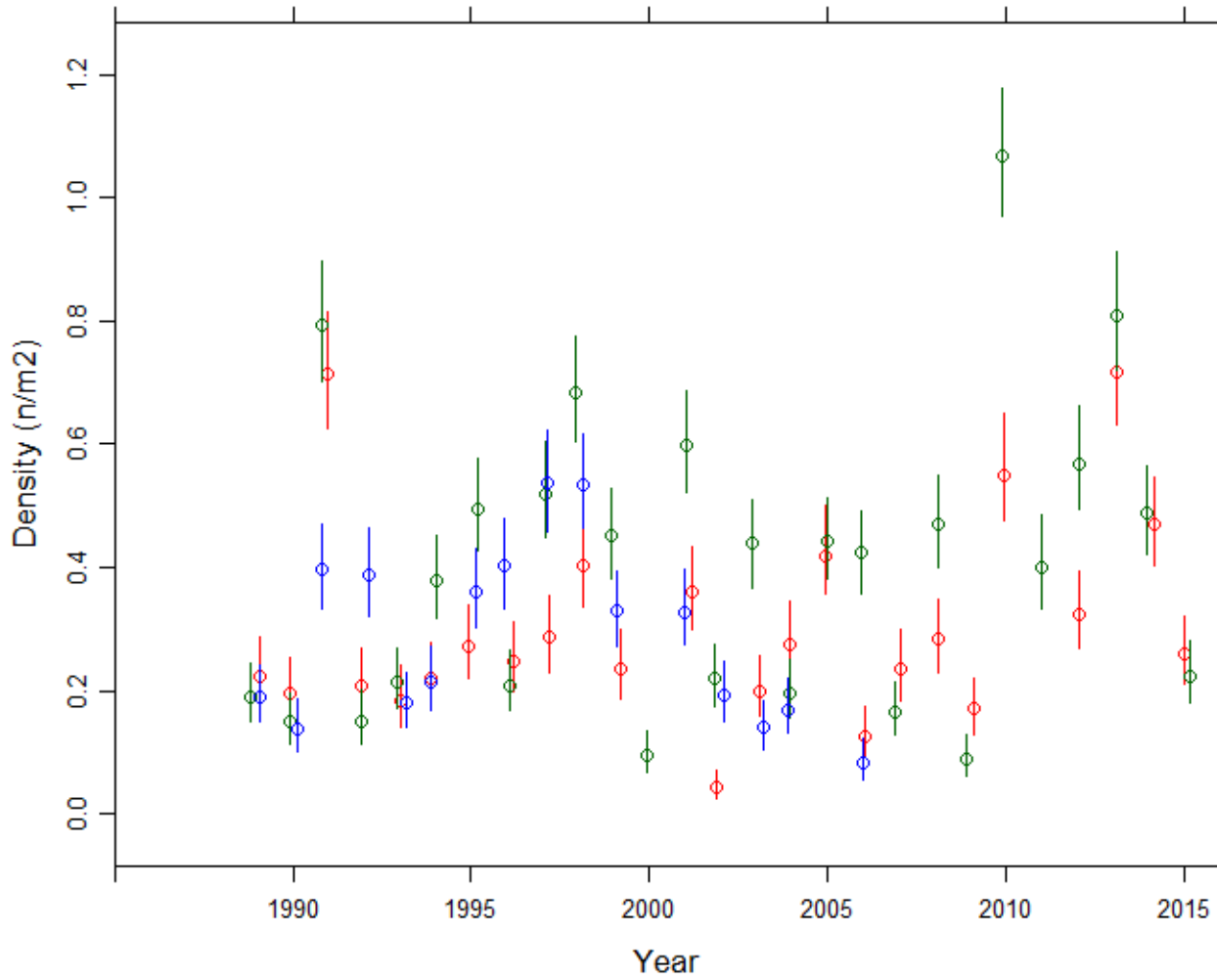
### 7.2.2.2 Summary statistics, Loch Chon



2014 - 2017 samples archived awaiting funding for analysis.

## 7.2.3 Fish data (for outflow stream)

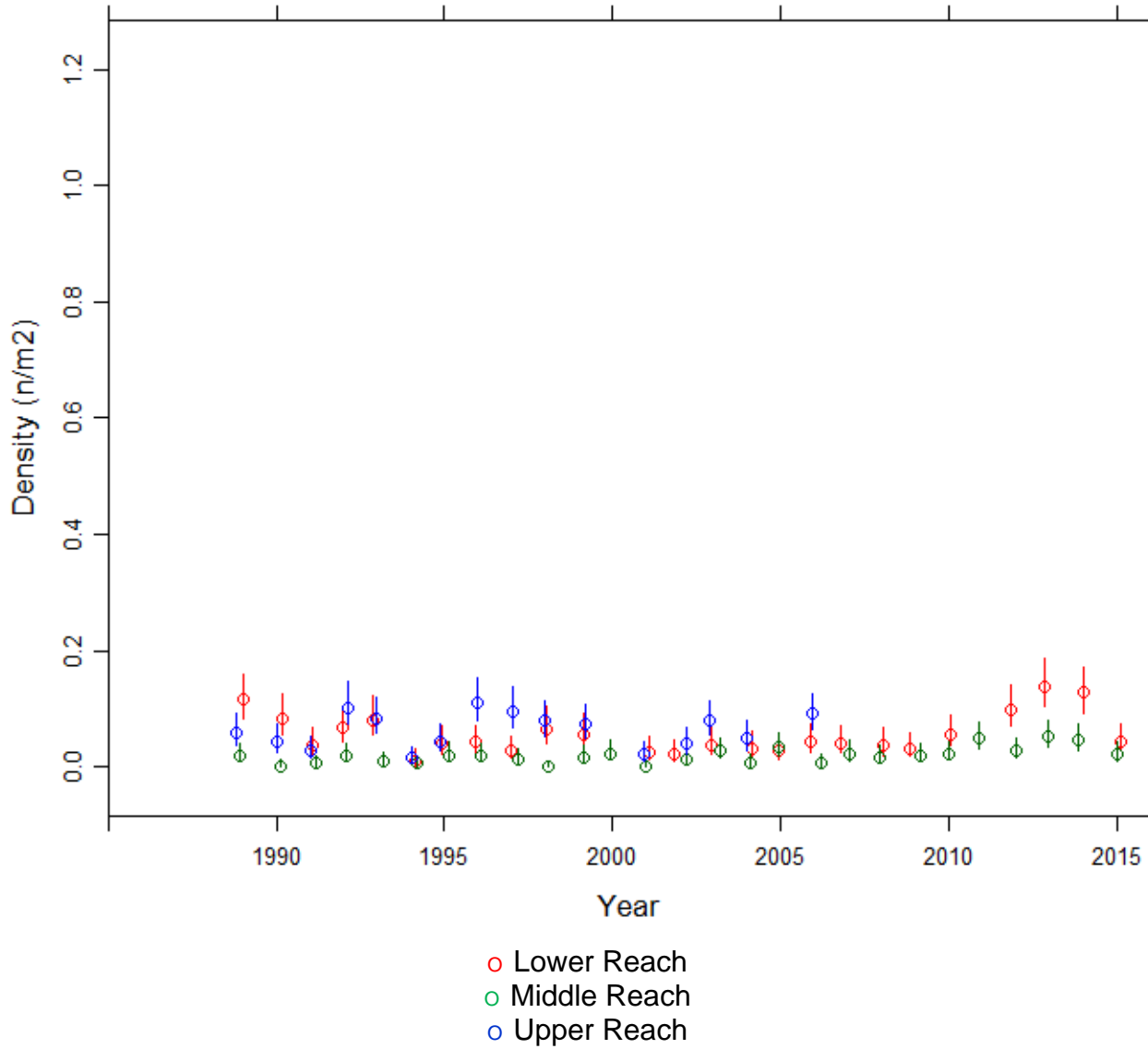
### 7.2.3.1 Summary of Trout fry densities (numbers m<sup>-2</sup>), Loch Chon



- Lower Reach
- Middle Reach
- Upper Reach

Fishing no longer funded after 2015

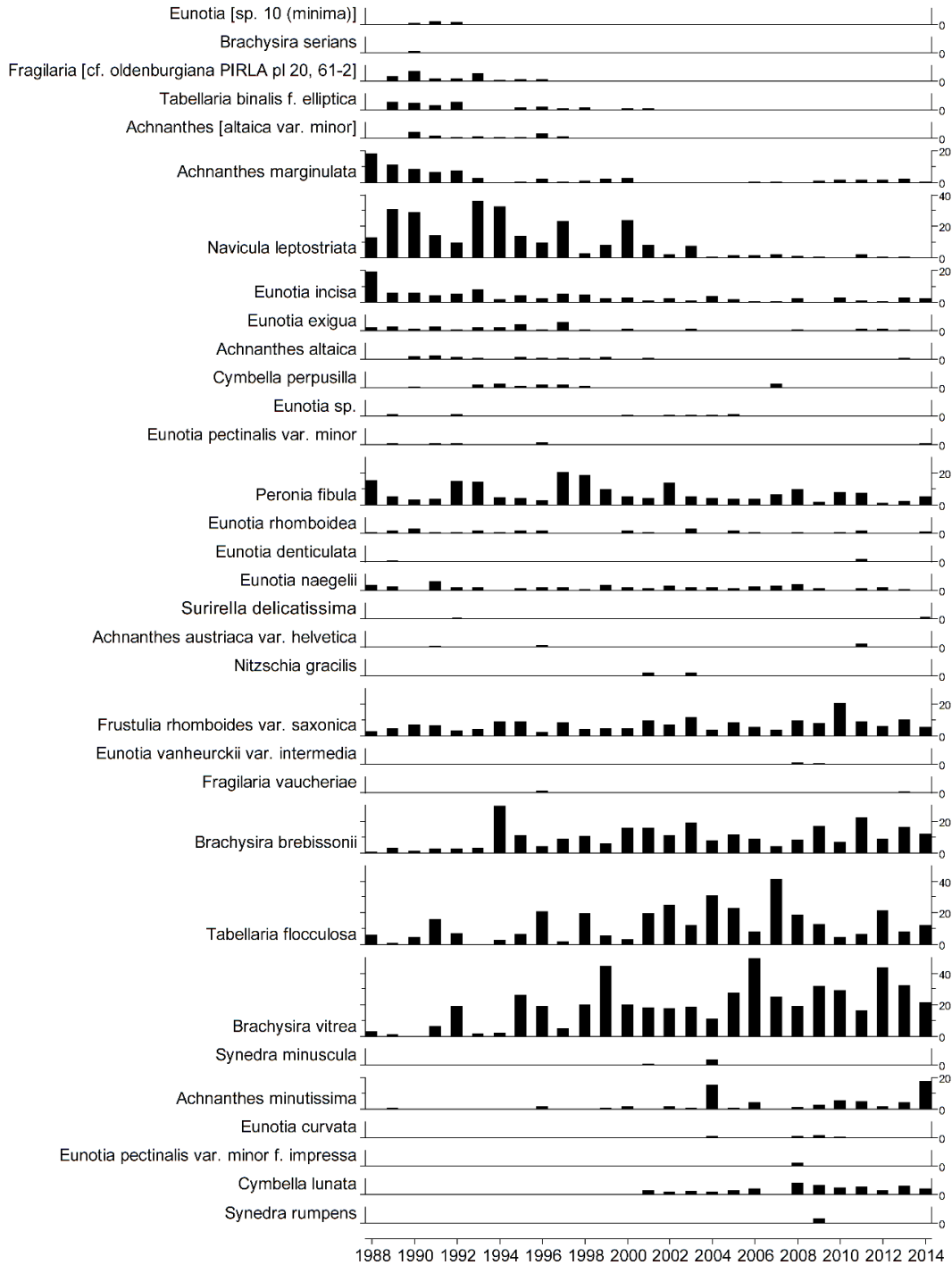
### 7.2.3.2 Summary of Trout parr densities (numbers m<sup>-2</sup>), Loch Chon



Fishing no longer funded after 2015

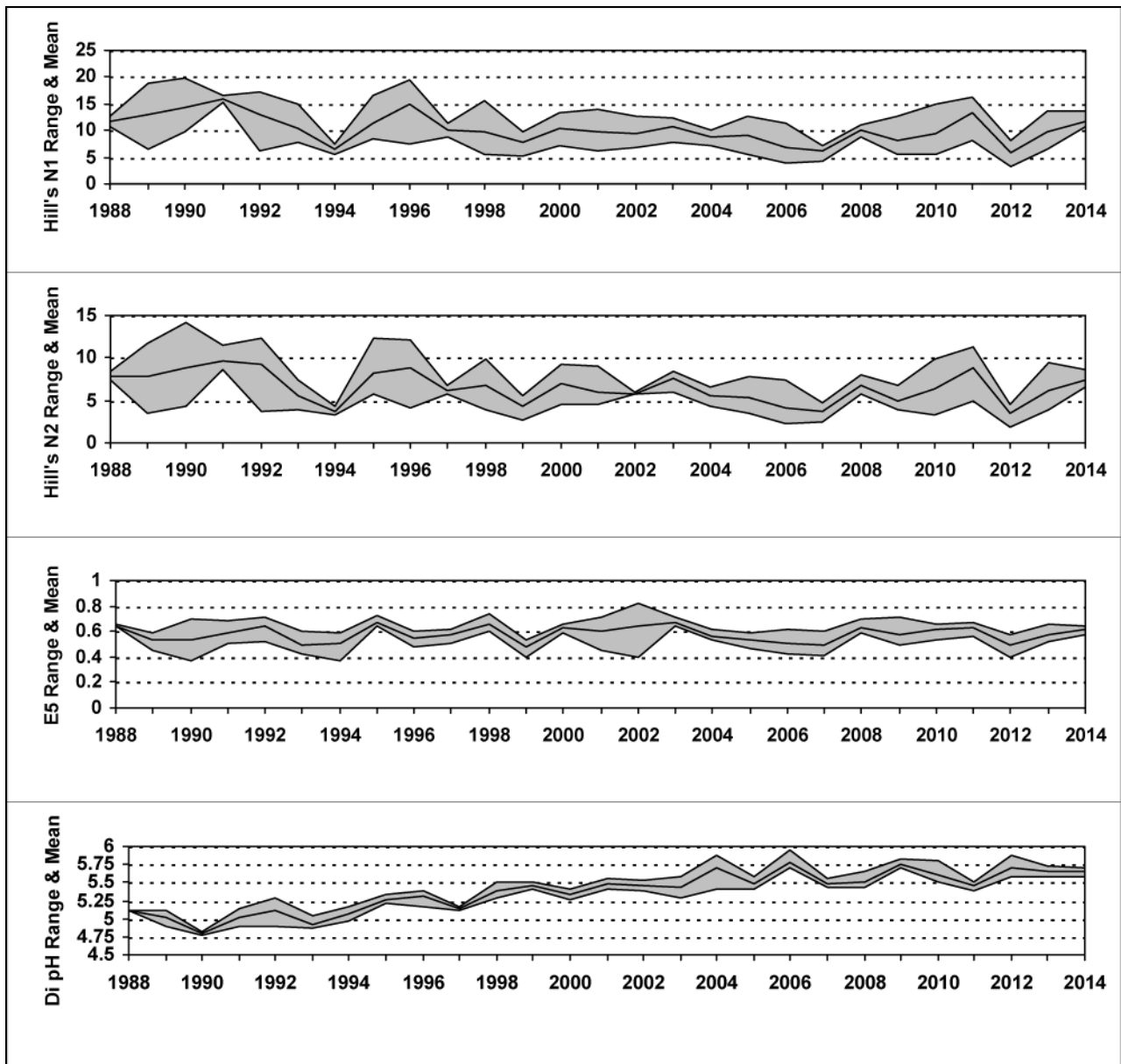
## 7.2.4 Epilithic diatom data

### 7.2.4.1 Percentage abundance summary, Loch Chon



2015 - 2017 samples archived awaiting funding for analysis

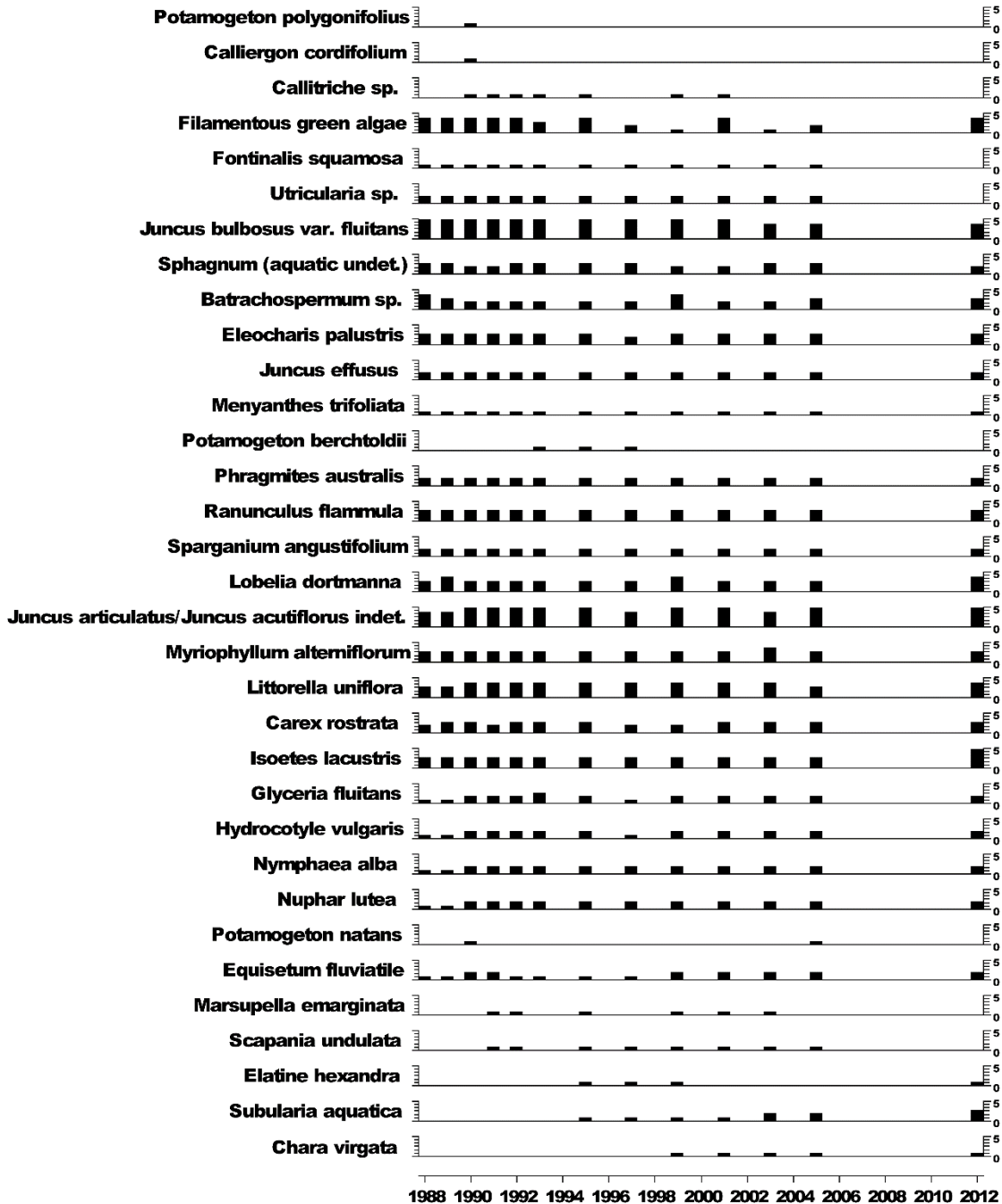
### 7.2.4.2 Summary statistics, Loch Chon



2015 - 2017 samples archived awaiting funding for analysis

## 7.2.5 Aquatic macrophyte data, Loch Chon

### Species Scores (1-5)

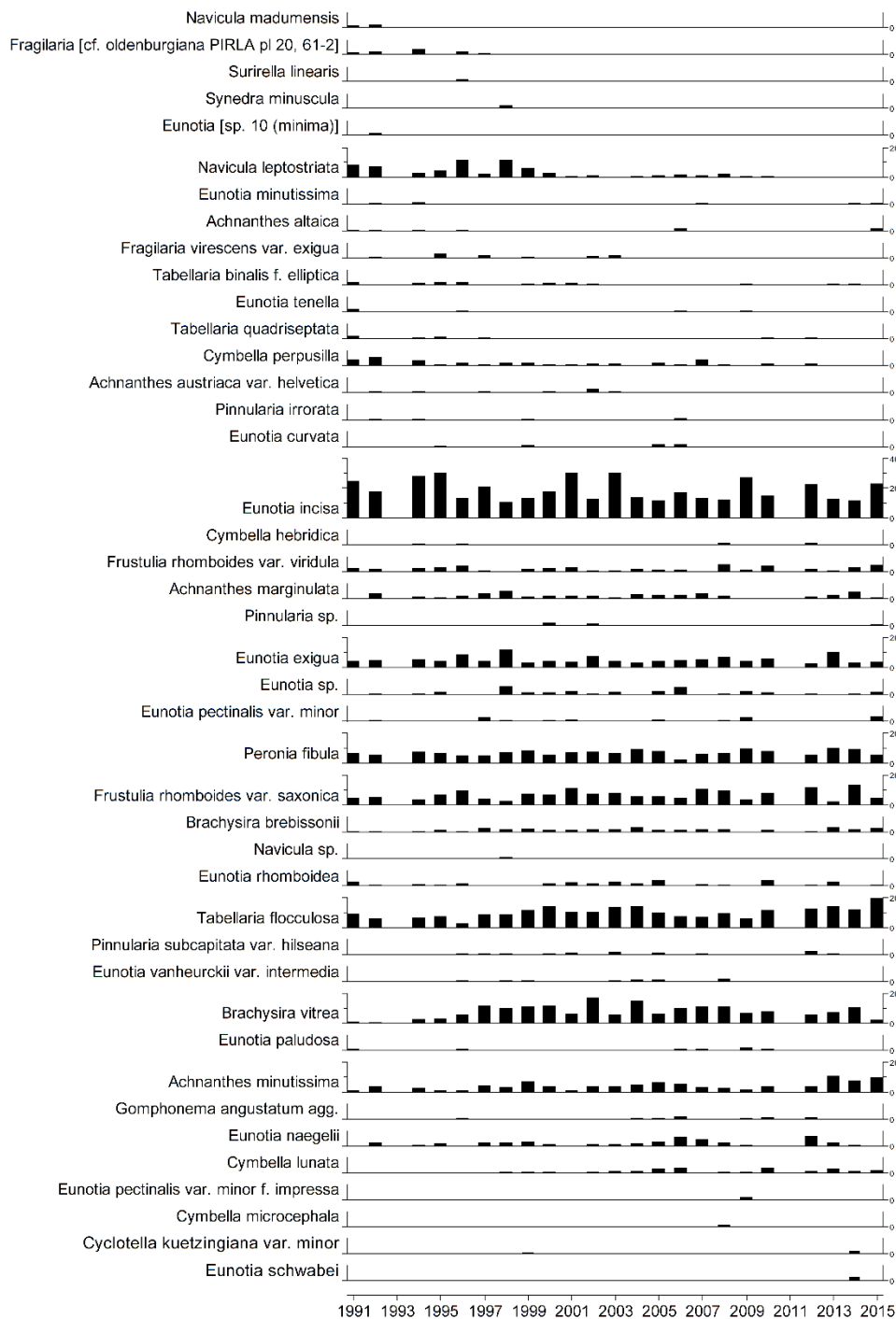


No surveys 2007-2012 and 2013-2017 due to funding cuts.  
2012 Bryophyte IDs pending

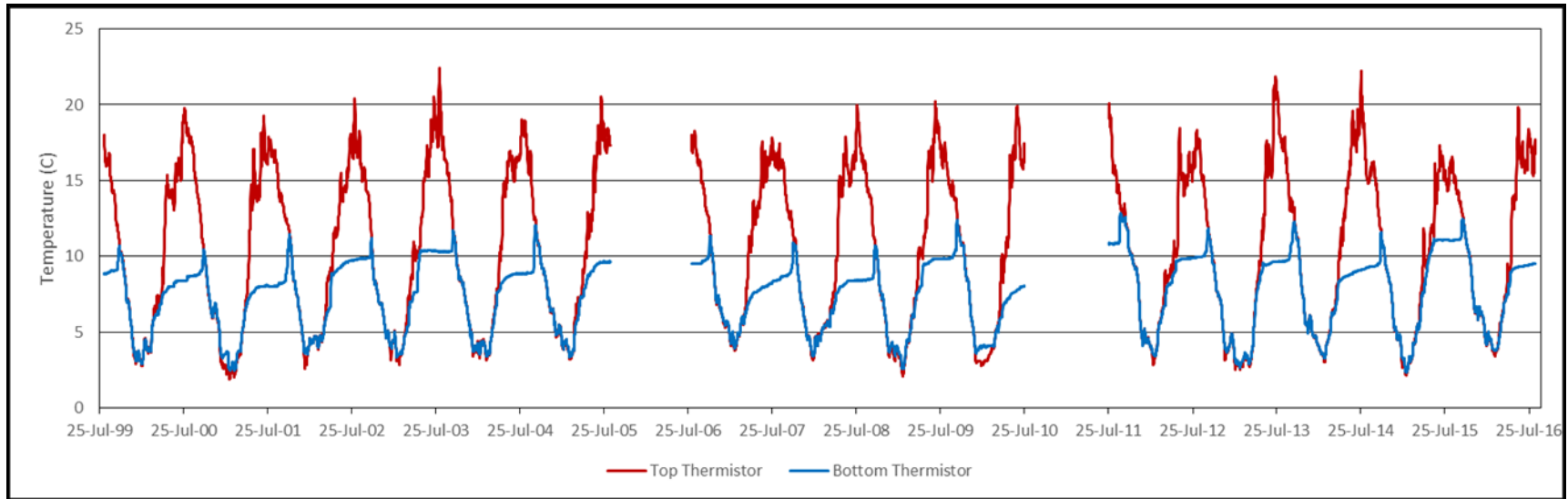


## 7.2.6 Sediment trap diatom data, Loch Chon

### Relative percentage frequency of diatom taxa

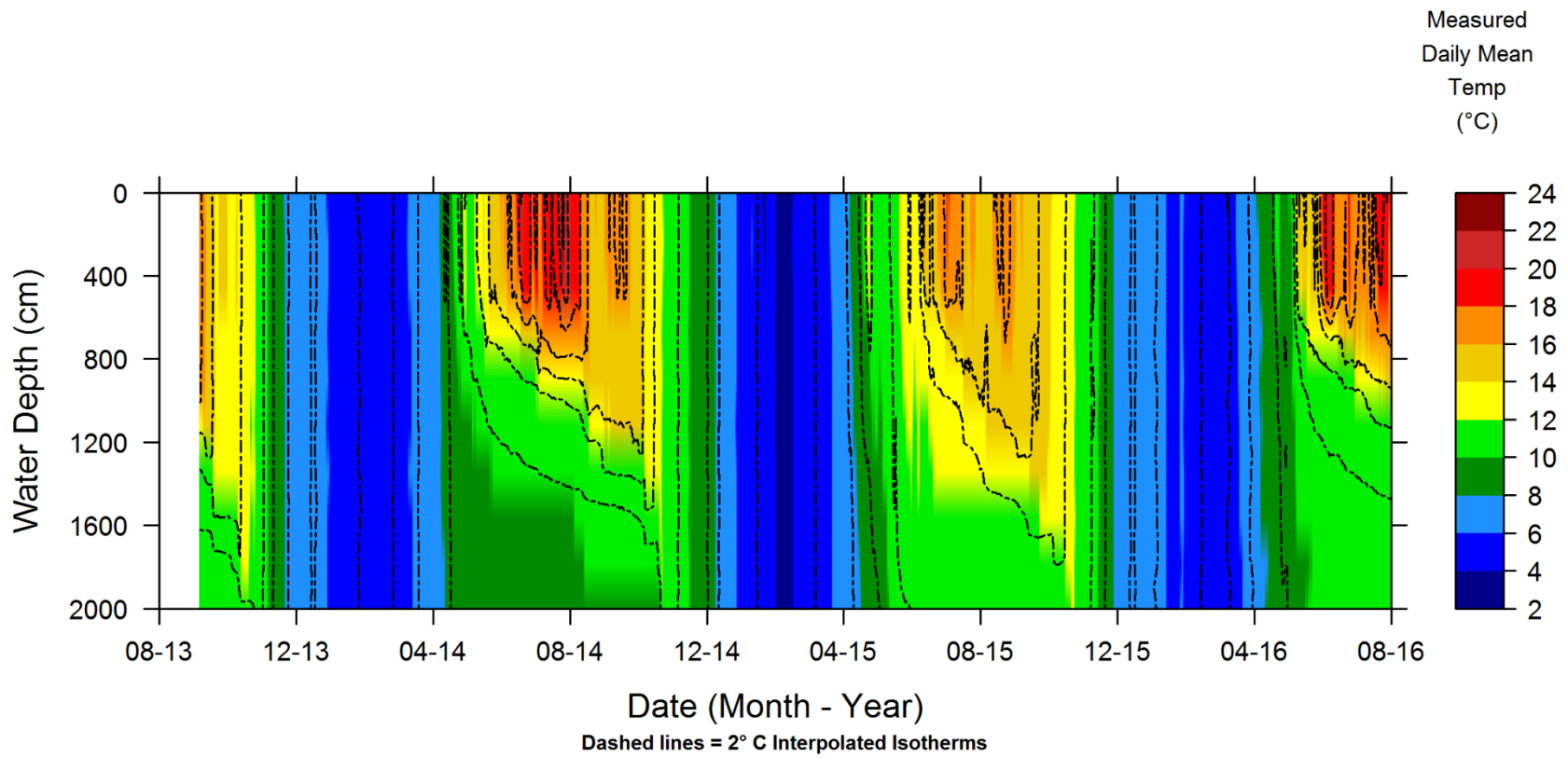


### 7.2.7 Sediment trap thermistor data, Loch Chon



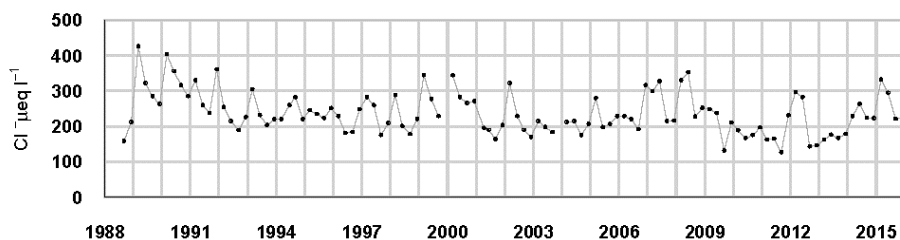
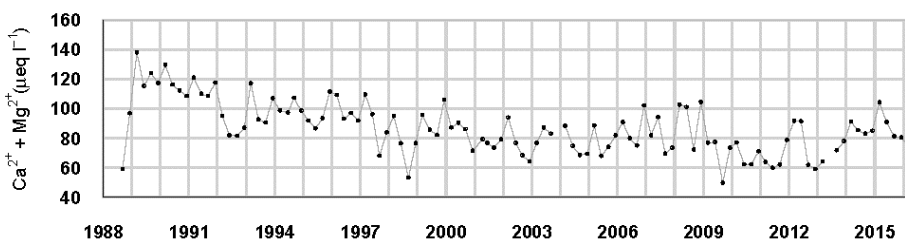
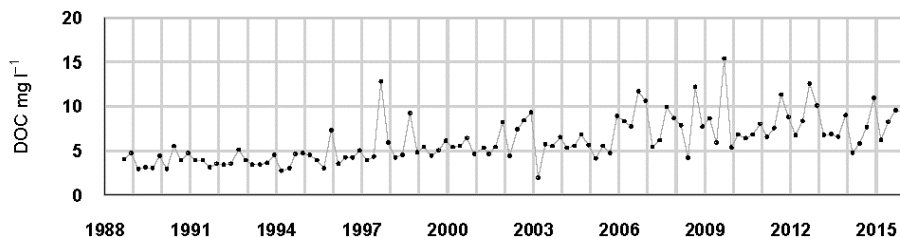
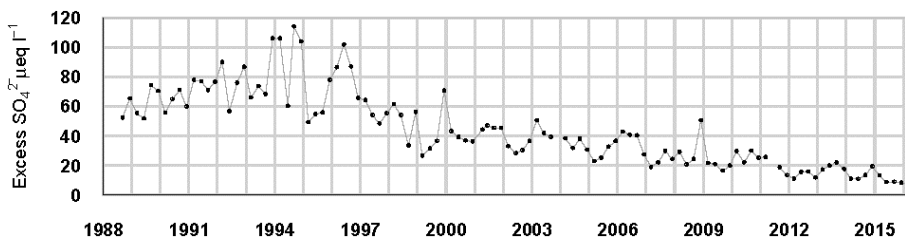
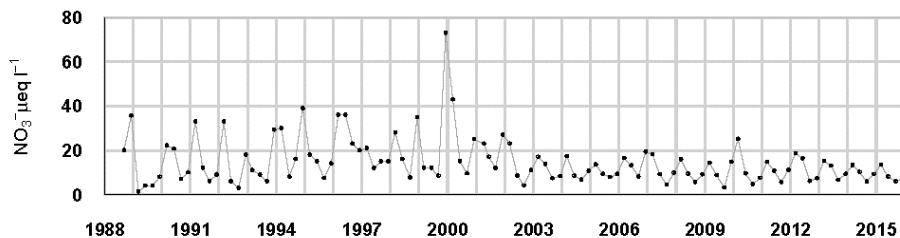
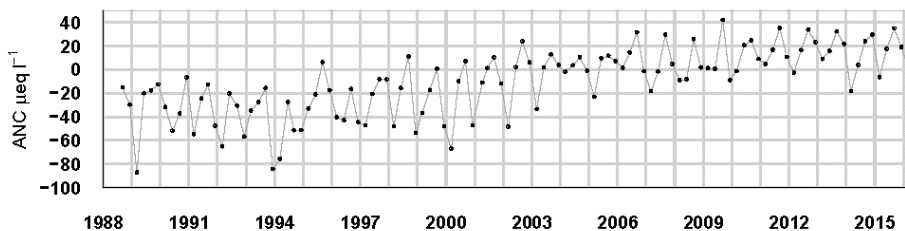
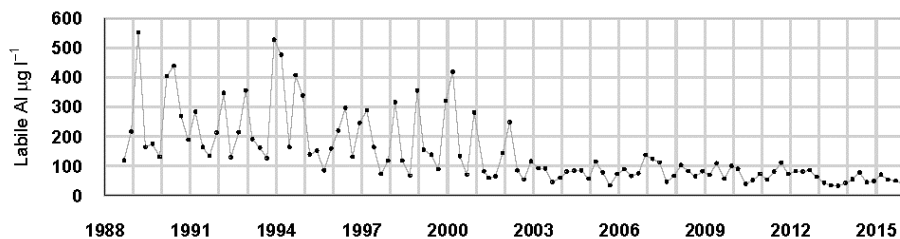
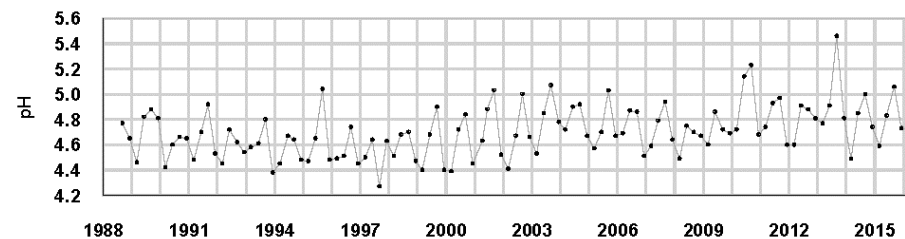
Thermistors not recovered in 2006 or 2011

### 7.2.8 Thermistor chain data, Loch Chon



## 7.3 Loch Grannoch

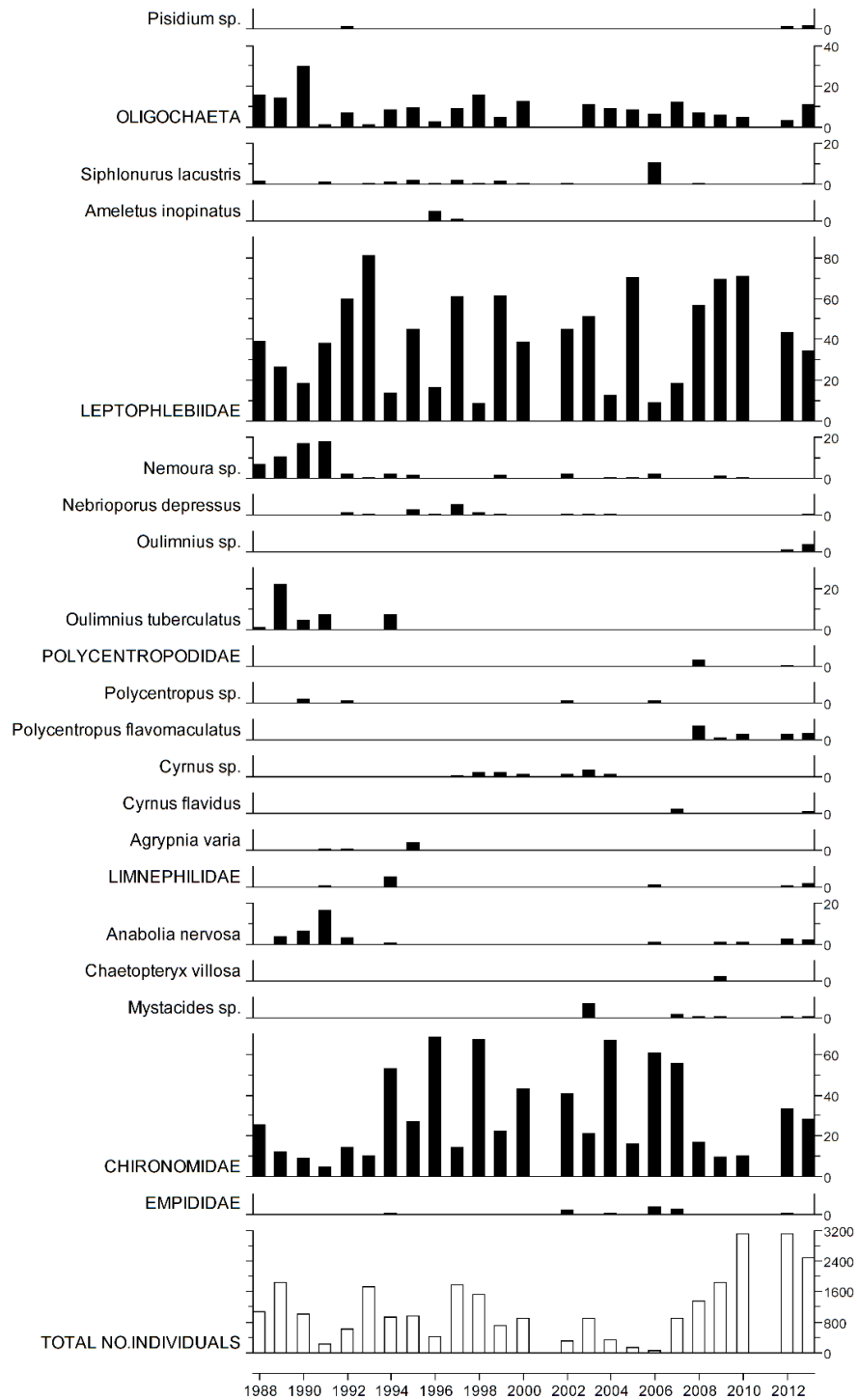
### 7.3.1 Spot sampled chemistry data



$\mu\text{eq l}^{-1}$ , $^*\mu\text{g l}^{-1}$ , $^{**}\text{mg l}^{-1}$	pH	ANC	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	*Soluble Al	*Labile Al	Cl <sup>-</sup>	*SO <sub>4</sub> <sup>2-</sup>	xSO <sub>4</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	**DOC
Mean 1 <sup>st</sup> 5 yrs	4.64	-34.33	50.92	55.53	237.51	4.82	310.95	241.85	281.54	98.11	68.59	13.64	3.81
15-16 mean	4.84	18.31	35.33	46.49	214.21	9.31	161.75	46.00	243.15	33.83	8.34	8.31	8.22
15-16 std dev	0.16	13.46	2.03	5.42	24.87	0.66	20.61	6.48	34.33	3.70	0.40	2.37	1.76

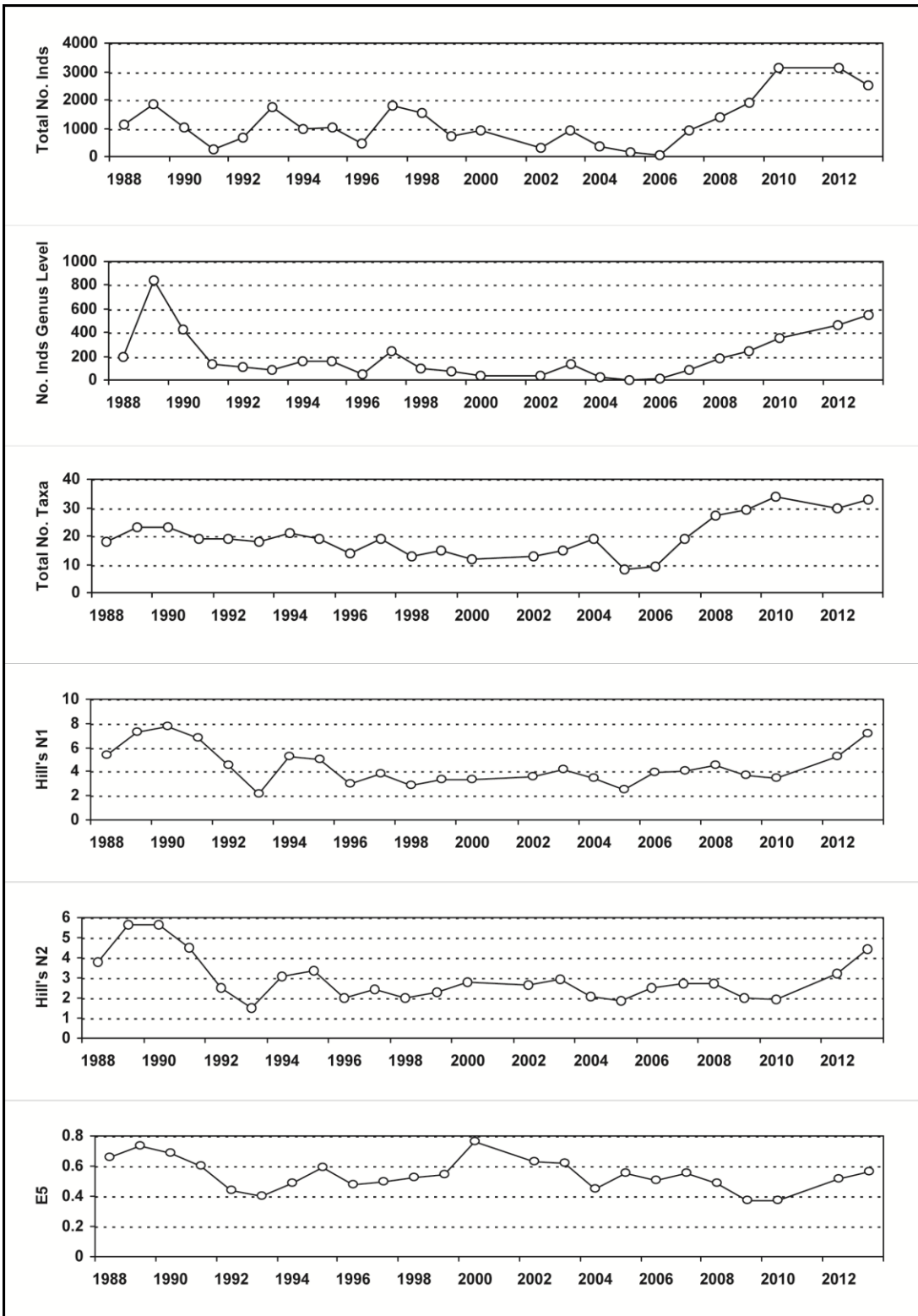
## 7.3.2 Macroinvertebrate data

### 7.3.2.1 Percentage abundance summary, Loch Grannoch



2014 - 2017 samples archived awaiting funding for analysis. Not sampled in 2011.  
 No sampling in 2001 due to Foot and Mouth restrictions.

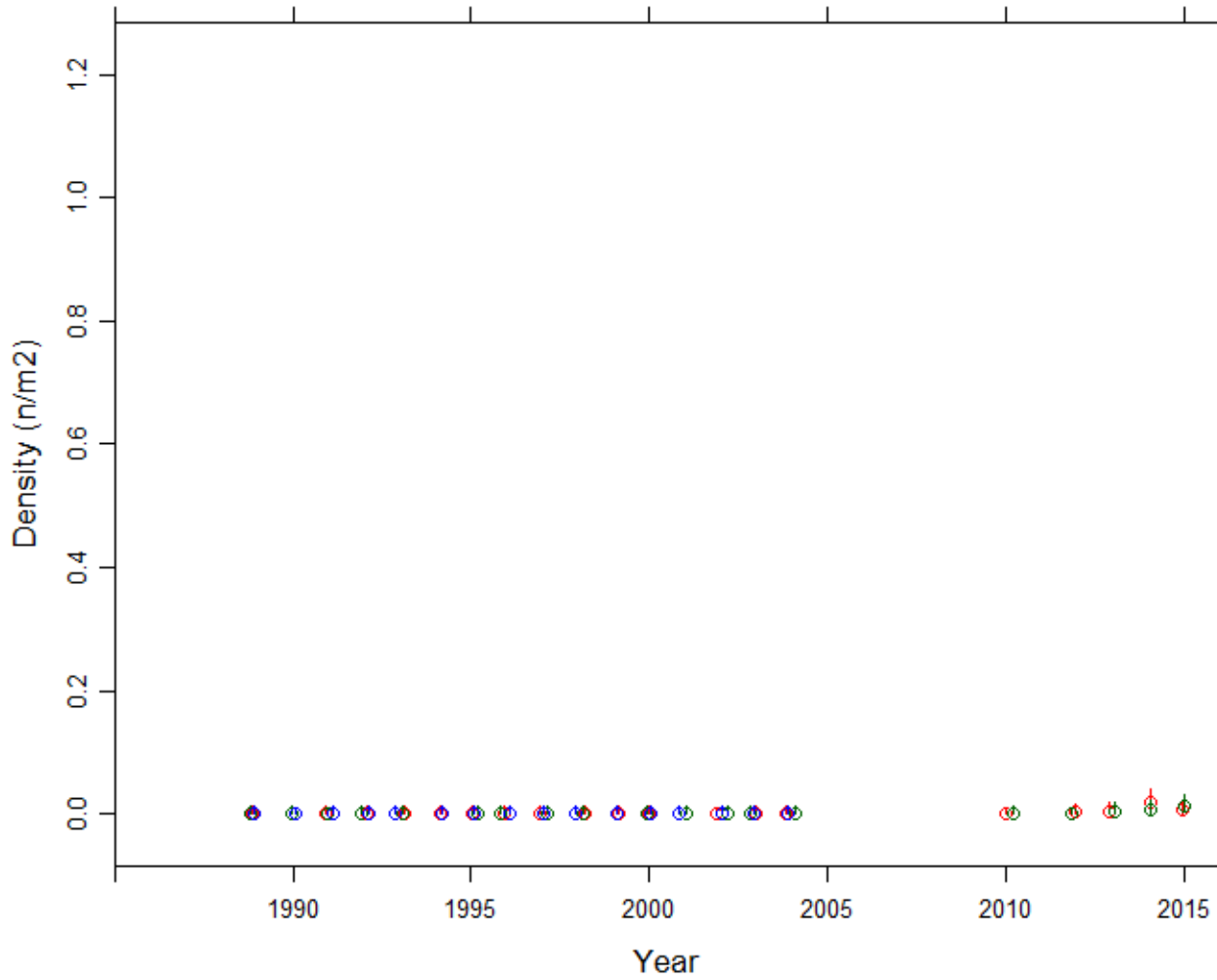
### 7.3.2.2 Summary statistics, Loch Grannoch



2014 - 2017 samples archived awaiting funding for analysis. Not sampled in 2011.  
 No sampling in 2001 due to Foot and Mouth restrictions.

### 7.3.3 Fish data (for outflow stream)

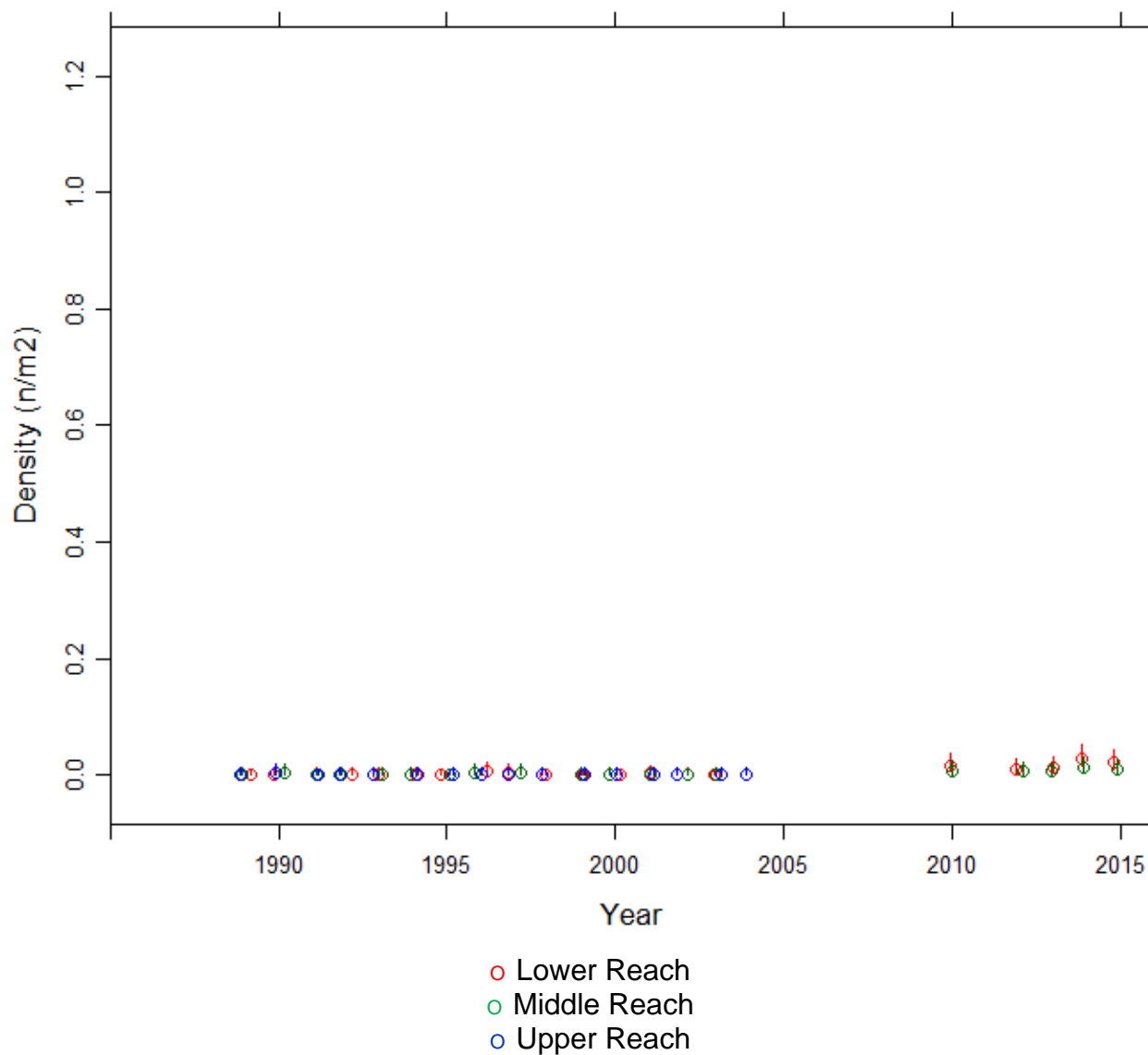
#### 7.3.3.1 Summary of Trout fry densities (numbers $m^{-2}$ ), Loch Grannoch



- Lower Reach
- Middle Reach
- Upper Reach

Fishing no longer funded after 2015

### 7.3.3.2 Summary of Trout parr densities (numbers m<sup>-2</sup>), Loch Grannoch

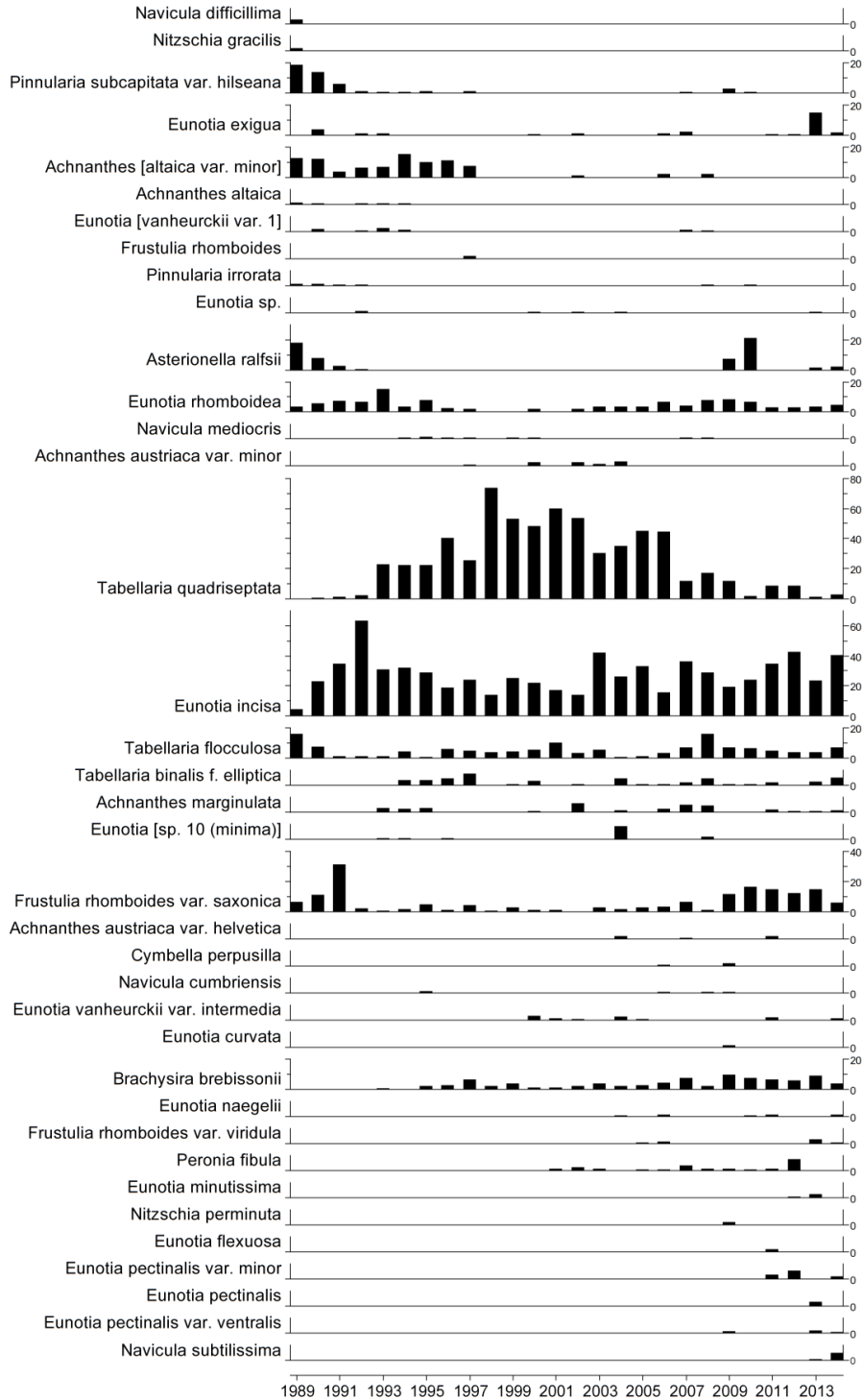


Fishing no longer funded after 2015



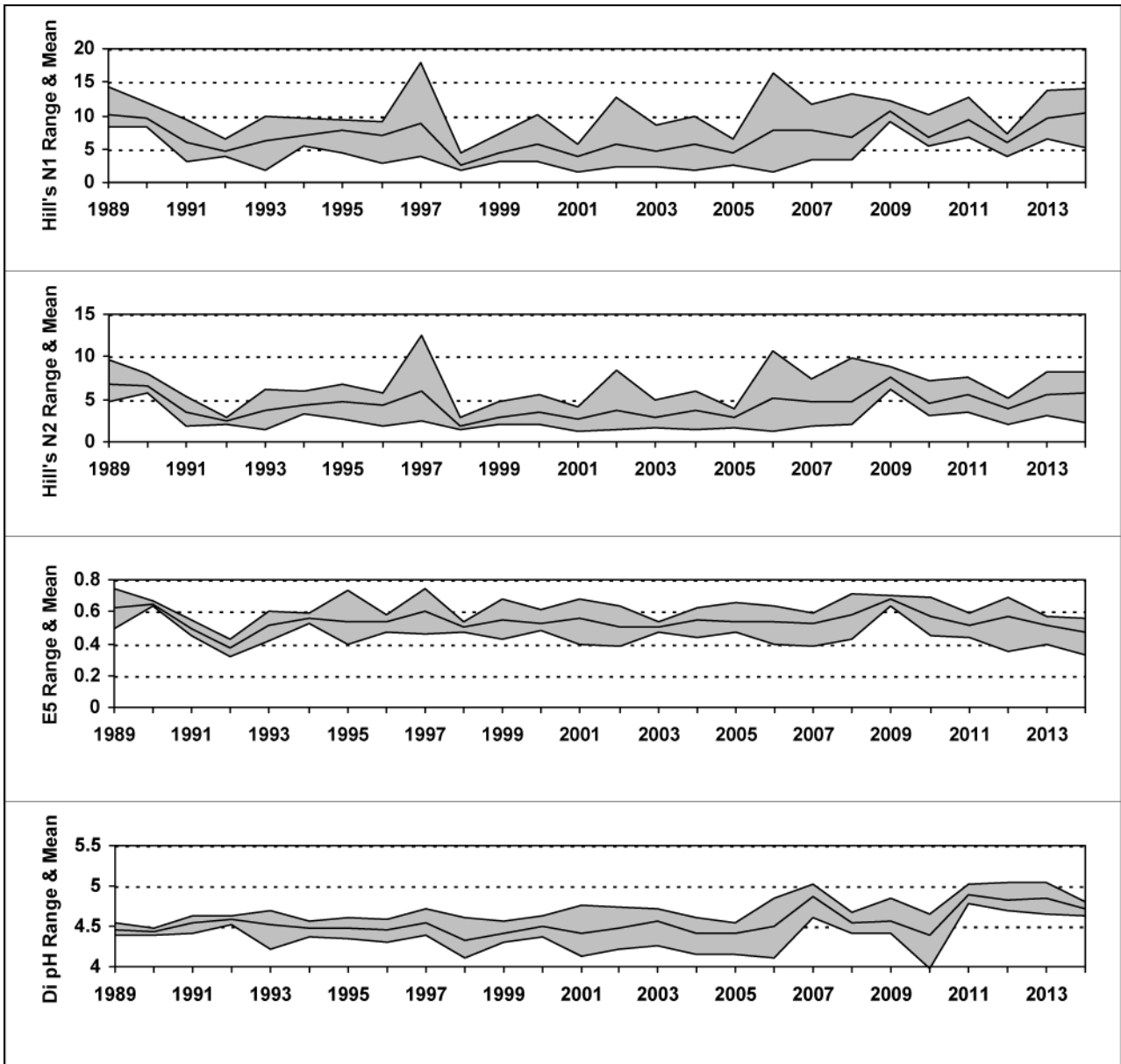
### 7.3.4 Epilithic diatom data

#### 7.3.4.1 Percentage abundance summary, Loch Grannoch



2015 - 2017 samples archived awaiting funding for analysis

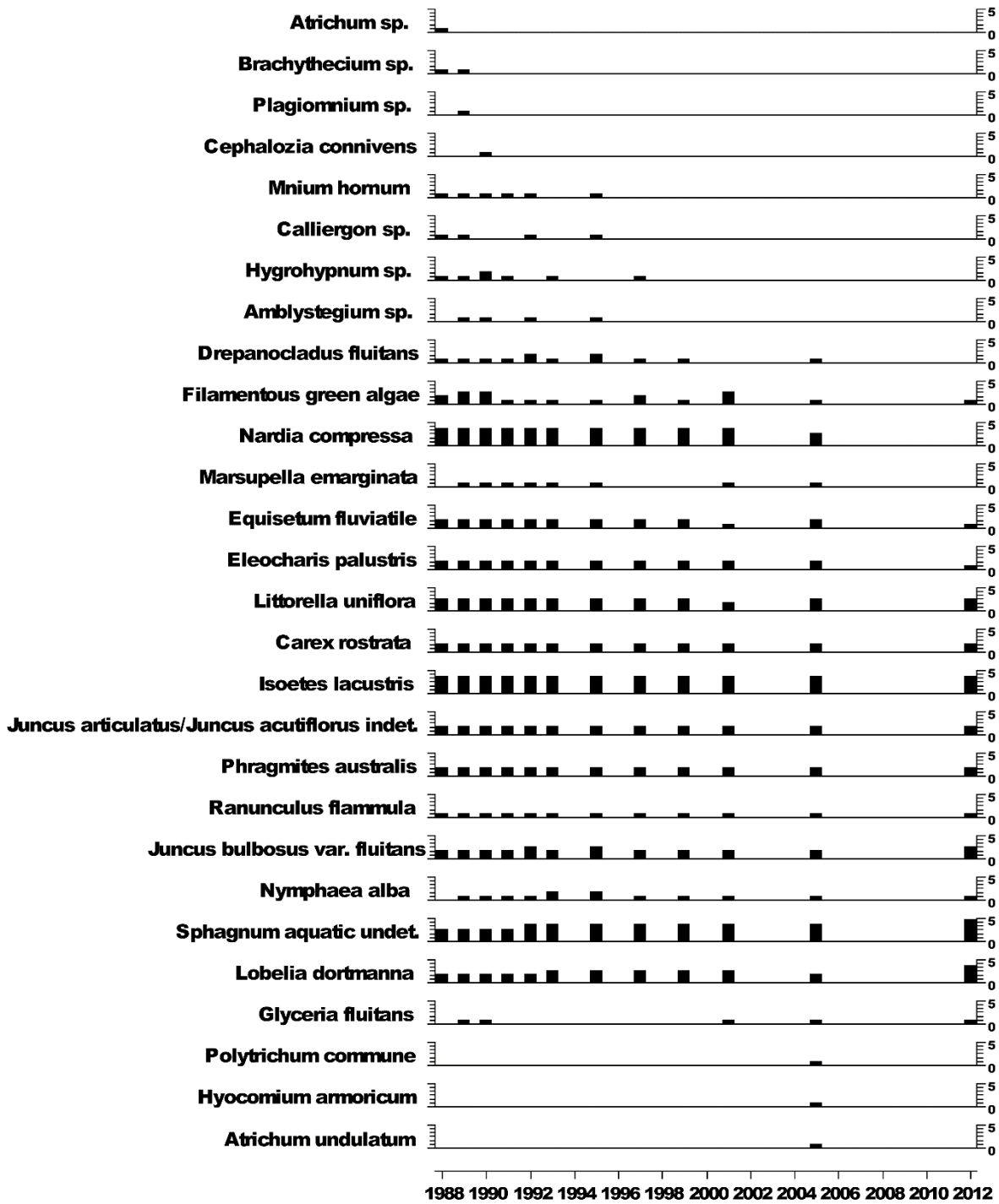
### 7.3.4.2 Summary statistics, Loch Grannoch



2015 - 2017 samples archived awaiting funding for analysis

### 7.3.5 Aquatic macrophyte data, Loch Grannoch

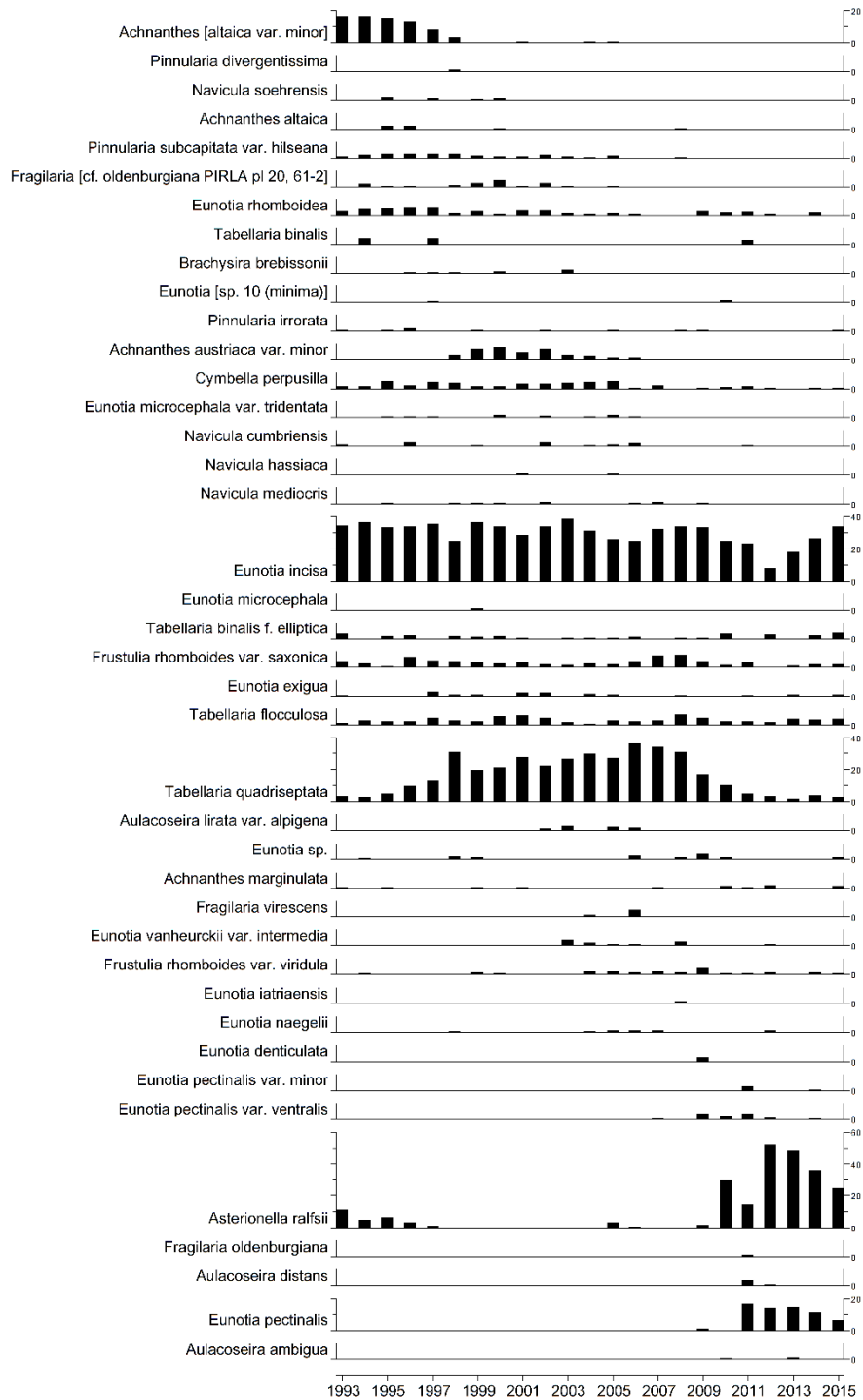
#### Species Scores (1-5)



No surveys 2007-2011 and 2013-2015 due to funding cuts  
2012 Bryophyte IDs pending

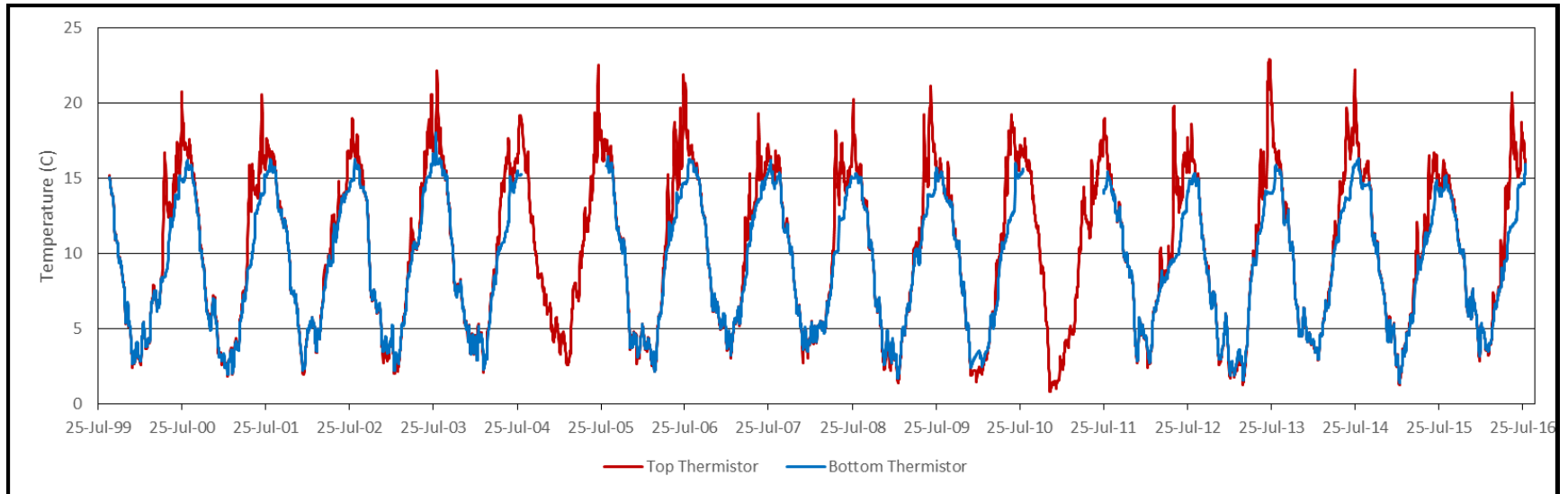
### 7.3.6 Sediment trap diatom data, Loch Grannoch

#### Relative percentage frequency of diatom taxa



2016 and 2017 samples archived awaiting funding for analysis

### 7.3.7 Sediment trap thermistor data, Loch Grannoch



### 7.3.8 Thermistor chain data, Loch Grannoch

