Norwegian University
of Life Sciences

Master’s Thesis 2022 60 ECTS
Faculty of Environmental Sciences and Natural Resource Management
(MINA)

Ecological condition, alpha diversity, abundance, functional groups and species composition in macroinvertebrate communities of 15 tributaries in the Verdal watershed

Hannah Hoberg
Master of Science in Ecology (Tropical Ecology and Natural Resource
Management)

Aknowledgements

This master thesis marks the end of five years here at NMBU, Ås at the biology bachelor programme, and the ecology masters programme.

I would like to thank my supervisor Thrond Oddvar Haugen for all help regarding writing, motivation and statistics and my co-supervisor Stian Stensland for valuable feedback on my drafts. Thank you both for always being available for questions and help regarding this thesis!

Thanks to Trond Bremnes for valuable invertebrate identification guidance and expertise and Elina Lungrin for a valuable crash-course on taxation, and litterature suggestions for identification . Thanks to my fellow masterstudents Erland Båtnes Berntsen and Trygve Leigland Njaa for all contribution with macroinvertebrate collection, and for lots of fun times during the fieldwork. Thanks to Dina and Sunniva for company and collaboration on difficult taxa at the laboratory. Thanks to all the people who have helped during the fieldwork (electrofishing, habitat measurements): Louise Chavarie, Linda Eikaas Lemmens,Åsgeir R Almås, Arvid Husan, Anne-Gudrun Klæth Lyngsmo, Eva Helene Lyngsmo, Ola Lerfald and Terje Junge.

Lastly I would like to thank my friends, family (including pets) for all the emotional support and joy you give me every day. Your support has been especially appreciated during the course of my thesis. I would like to grant a special thanks to Snipp, my childhood cat who sadly passed away a week before this thesis was due for being a good part of my life me since I was ten. A special thanks to my significant other for always believing in me and for doing most of the daily household tasks, so that I could focus on the thesis without starving to death.

Norwegian university of life sciences
Ås, 16th of may 2022
____
Hannah Hoberg

Abstract

Streams and rivers are some of the most degraded and threatened ecosystems in a global perspective. There are several factors influencing declines in biodiversity globally, with the most driving agents being pollution, habitat degradation and destruction, climate change, flow modifications, harvesting and exploitation and invasive species. Invertebrates are often overlooked in conservation efforts, although they provide crucial ecosystem-services and contribute to a substantial amount of the freshwater biodiversity worldwide. The main aim of this master thesis was to determine what factors influence the macroinvertebrate community in the Verdal watershed in Trøndelag, Norway and to look into the following research questions: 1) Did the implemented measures have any impact on the macroinvertebrate community? Have the measures worked in terms of improving the ecological status? 2) How is the benthic community affected by the presence of fish? 3) How is the ecological condition of the streams, and what can be done to increase the ASPT-scores?
Macroinvertebrates were collected from 23rd of August – 3rd of September 2021 using the kick-net method and then identified at the laboratory. Two samples were taken from each station, from the upper and lower part. In total, 118 samples were taken from 59 stations and 15 different streams; Rossvoll, Yds, Broskit, Bjørk/Sundby, Karidals, Korsådals, Follo, Sems, Stub, Eklo, Hyll, Kvisla, Val, Skjørdal, and Kvellstad. Ordination was used to analyze the data looking at ASPT, alpha diversity, abundance, functional groups and benthic invertebrate composition. Restoration measures did not significantly affect the macroinvertebrate community. When looking at the lowest ASPT scores from each stream, only one stream; Karidalsbekken was in a good ecological condition. However, when looking at all ASPT scores, approximately 1/3 of all stations received an acceptable ecological score based on EU´s water directive. The main factors influencing ASPT were PC1* PC3 and a significant positive interaction with density of juvenile fish (0+). Alpha diversity scores were explained by the same factors as ASPT, including increasing distance to the fjord which was the most significant factor. Abundance was increasing with closer proximity to the fjord, and was lowest two years after measures were implemented, although unsignificant. Habitat variables were the factors describing the composition of functional groups. Further studies over a larger time frame are needed in terms of assessing effects of measures on the benthic community structure, but macroinvertebrate ASPT-scores and diversity increases with presence of 0+. In terms of improving the ecological state of the streams, focusing on

measures that increases amounts of 0+ will likely also have a positive effect on the macroinvertebrate community.

Sammendrag

Bekker og elver er noen av de mest påvirkede og truede økosystemene i verden. Det er flere ulike faktorer som fører til nedgang i biodiversitet globalt, blant annet forurensning, forfall og ødeleggelse av habitat, klimaforandringer, endringer av vannføring, overhøsting og utnyttelse av arter, samt invasive arter. Invertebrater blir ofte oversett i arbeid med bevaring av natur, selv om de gir viktige økosystem-tjenester og bidrar til en stor andel av biodiversiteten i ferskvann. Hovedformålet med denne masteroppgaven var å undersøke hvilke faktorer som påvirker bunndyrsamfunnet i Verdalselva i Trøndelag, Norge og prøve å finne ut av følgende spørsmål: 1) Blir bunndyrsamfunnet påvirket av restaurerings-tiltakene som har blitt gjort? Førte restaureringstiltakene til en bedring av den økologiske tilstanden i bekkene? 2) Hvordan påvirkes bunndyrsamfunnet av at årsyngel tar i bruk områdene? 3) Hvordan er den økologiske tilstanden i de ulike bekkene, og hva kan gjøres for å bedre ASPT-verdiene? Bunndyrprøvene ble utført i tidsperioden 23.august – 3.september 2021ved hjelp av sparkeprøver, og prøvene ble deretter nøklet på laboratoriet. Det ble tatt to prøver fra hver stasjon, i øvre og nedre del. Totalt ble det tatt 118 sparkeprøver fra 59 stasjoner og 15 ulike bekker. Disse bekkene var: Rossvoll, Yds, Broskit, Bjørk/Sundby, Karidals, Korsådals, Follo, Sems, Stub, Eklo, Hyll, Kvisla, Val, Skjørdal, og Kvellstad. Ordinasjon ble benyttet til analysene av datasettet for å se på økologisk tilstand (ASPT), alfa-diversitet, abundanse, funksjonelle grupper og bunndyrsammensetningen. Tiltakene som har blitt gjort hadde ingen signifikant påvirkning på bunndyrsamfunnene. Ved å se på de laveste ASPT-stasjonsverdiene per bekk, var det kun Karidalsbekken som hadde en god økologisk tilstand. Men, dersom man ser på ASPT-verdiene i alle stasjonene i bekkene, har omtrent 1/3 av stasjonene god økologisk tilstand i henhold til EUs vanndirektiv. Hovedfaktorene som påvirker ASPT-verdien er PC1 * PC3 og en signifikant positiv interaksjon med tettheten av årsyngel (0+). Alfa-diversiteten forklares av de samme faktorene som ASPT, men i tillegg var distansen fra fjorden inkludert som en positiv signifikant faktor. Abundansen økte med minkede avstand til fjorden, og var lavest to år etter restaureingstiltak ble utført, selv om dette ikke var signifikant. Habitatfaktorene PC1,PC2 og PC3 var viktigst for sammensetningen av de funksjonelle gruppene. Flere studier over en lengre tidsperiode trengs for å kunne se om tiltakene har en effekt på bunndyrsamfunnene over tid, men ASPT og diversitet økte med stigende tetthet av årsyngel. Derfor ser det ut til at tiltak med fokus å øke mengden av årsyngel vil også ha positiv effekt på bunndyrsamfunnet, slik at den økologiske tilstanden forbedres.

Innholdsfortegnelse

Introduction

Ecosystems worldwide are under increasing pressure from human influence and global warming (IPCC, 2022), with many being severely affected (Outlook, 2020). The same is true for streams and rivers, who are under increasing threat and in need of urgent measures (Dudgeon et al., 2006; Naiman & Turner, 2000). Freshwater streams and lakes provide vital refugees for biodiversity, and should be recognized for this in management decisions (Chester et al., 2015). The United Nations have declared the years 2021-2030 to be the «UN decade on ecosystem restoration» emphasizing the importance and urgency of restoration to reverse and slow down this trend of degradation to our ecosystems (UN general assembly, 2019). Adressing the drivers of decline in freshwater ecosystems is important so the appropriate measures and policies can be implemented (Baker et al., 2019).The main agents of decline in freshwater biodiversity is habitat degradation and destruction, climate change, harvesting and exploitation, flow modifications, invasive species and water pollution (Collier et al., 2016; Dudgeon et al., 2006; Heino et al., 2009; Outlook, 2020; Strayer, 2006). Although invertebrates are a vital part of freshwater ecosystems worldwide by providing crucial ecosystem-services, contributing to higher biodiversity and playing important roles in food-webs, they are often underprioritized in conservation efforts (Collier et al., 2016).

Verdalselva river is one of relatively few rivers protected under Norwegian law against the buildout of hydropower plants and has the status of a national wild-salmon watershed (Anonym, 2004). This provides an opportunity to look at ecosystem conditions, fish and macroinvertebrate communities in a watershed that is likely less disturbed than unprotected rivers. Previous studies from the area have looked into habitat loss and decrease in fish production, and found that the production of Brown trout (Salmo trutta) have decreased with 80% in Verdalsvassdraget compared to historical data (Hol, 2018).

Under Norwegian law declared in 2006, freshwater systems are required to have a good ecological condition based on EU´s water directive, where fish and macroinvertebrates can be used as a classification element (European Comission, 2000; Vannforskriften, 2019).
The use of macroinvertebrates as indicators have increased in recent years, likely due to the need of new tools to access habitat status (Dauvin et al., 2010). Macroinvertebrates can be used as indicators of pollutants, however other environmental stressors can be hard to separate from the effects of pollution (Johnson et al., 1993). Pollution influences the composition of

macroinvertebrates by Chironomidae and other tolerant taxa replacing the less-tolerant taxa such as Trichoptera and Plecoptera over time (Jenderedjian et al., 2007). Macroinvertebrates in freshwater streams and rivers are considered to be especially vulnerable to pollution, as pollutants are effectively spread downstream, with high potential of affecting larger parts of the ecosystem downstream from the toxic discharge (Collier et al., 2016).

Macroinvertebrate community structure may vary significantly between different streams as well as microhabitats within streams (Robson & Chester, 1999). Streams and rivers consisting of various channel types will generally be able to obtain a higher macroinvertebrate species diversity (Milner et al., 2015). Habitat variables affect benthic community structure over several scales (Townsend et al., 2003). Johnson et al. (2007)found that habitat differences on local scales describes most of the variation in macroinvertebrates between cites, while Li et al. (2012) found regional spatial scales to be slightly more important.

Benthic invertebrate quality assessment reliability depends on number of sites sampled and the background information that is accessible (Leonardsson et al., 2009). Stream restauration is more complex in urban locations with a larger human population, and are thus generally more expensive (Bernhardt & Palmer, 2007). This can be due to human infrastructure obstructing connectivity, agricultural run-off and other factors that negatively influence the habitat,and is harder to manage because it comes in conflict with human interest. Higher biodiversity is expected when there is good connectivity between streams, and with decreasing distance to nearest waterbody (Chester et al., 2015). UN emphasizes the need for measures

Objectives

The main aim of this study was to investigate the quality of the benthic invertebrate community in 15 sampled tributaries to the Verdalselva river system, specifically looking at ASPT-values, abundance, alpha diversity, species composition and composition of functional groups. These metrics were used to determine what factors influence the macroinvertebrate community. The following research questions were developed:

1) Have the implemented measures had any impact on the macroinvertebrate community, if so, in what way? Have the measures worked in terms of improving the ecological status?

2) How is the benthic community affected by the presence of fish?

3) How is the ecological condition of the streams, and what can be done to increase the ASPT-scores?

Materials and methods

Study site

In this study, macroinvertebrate samples have been collected from a total of 15 different tributaries located in Verdal municipality, Trøndelag (Figure 1). The 15 sampled tributaries where Rossvoll, Yds, Broskit, Bjørk/Sundby, Karidals, Korsådals, Follo, Sems, Stub, Eklo, Hyll, Kvisla, Val, Skjørdal, and Kvellstad. While most of the streams included in this study are tributaries of Verdalselva, two of the streams run directly into the Trondheimsfjord (Semsbekken and Ydsseelva) and one runs into Rinnelva river (Valbekken) before reaching the fjord. The location of the streams and tributaries are shown in Figure 1.

Description of tributaries

Descriptions of each tributary were determined using digital maps and in-field observations (Figure 1). Semsbekken flows directly into the fjord. The lower part of the stream flows through arable land with continuous riparian vegetation along the stream. There are three road crossings in this area. The surrounding areas of the upper part of the stream are composed of forest areas, however the this is beyond the stations used in this study. Rossvollbekken runs through arable land with continuous riparian vegetation. For the most part, Ydselva runs through agricultural land, with continuous riparian vegetation in the upper part. In the lower part there are more concentrated residential areas. Downstream of the railroad crossing there is less riparian vegetation.The upper part of Kvisla runs through agricultural areas with discontinuous riparian vegetation, with many areas lacking trees and bushes. The lower part of the tributary runs through partly agricultural, residential and industrial areas with little riparian vegetation, although some areas have dense vegetation. Broskitbekken runs through agricultural areas with some forest, residential houses and mostly continuous riparian vegetation. Skjørdalsbekken runs through agricultural areas. The middle part of the tributary has dense riparian vegetation, but the upper and the lower part has little to no riparian vegetation. The upper part of Skjørdalsbekken has some runoff from forests. Korsdalsbekken runs through an agricultural area with a small residential area close to the upper station. There is little riparian vegetation except for the part immediately before the outlet to Verdalselva. Stubbekken runs through arable land with dense, continuous riparian vegetation, and with one road crossing. Bjørkbekken runs through arable land with dense riparian vegetation. The upper part of the tributary has less vegetation than the lower part which runs through a small forest enclosed by fields. Follobekken runs through arable land with discontinuous riparian vegetation. Some areas along the upper and middle part of the tributary has dense riparian vegetation, while the upper part of Follobekken has little riparian vegetation. The most upper part of the tributary runs through a forest. Eklobekken runs through an agricultural landscape with continuous riparian vegetation. Karidalsbekken runs through both forest and agricultural landscapes, with the upper part of the tributary getting mostly runoff from the forest. There is continuous riparian vegetation on the lower part of the tributary, but on one side only a little riparian vegetation. The upper part of Kvellstadbekken (the largest part) runs through a forest, while the lower part runs through an agricultural landscape. The riparian vegetation is mostly continuous except for two parts with little riparian vegetation. In the transition between agricultural area and forest there is a quarry. Hyllbekken runs through arable land with little to no riparian vegetation in the lower part of the tributary. The upper part of the tributary has dense riparian vegetation. Valbekken runs through an agricultural landscape with some residential homes. The riparian vegetation is mostly sparse and discontinuous. There are some residential areas along the tributary.

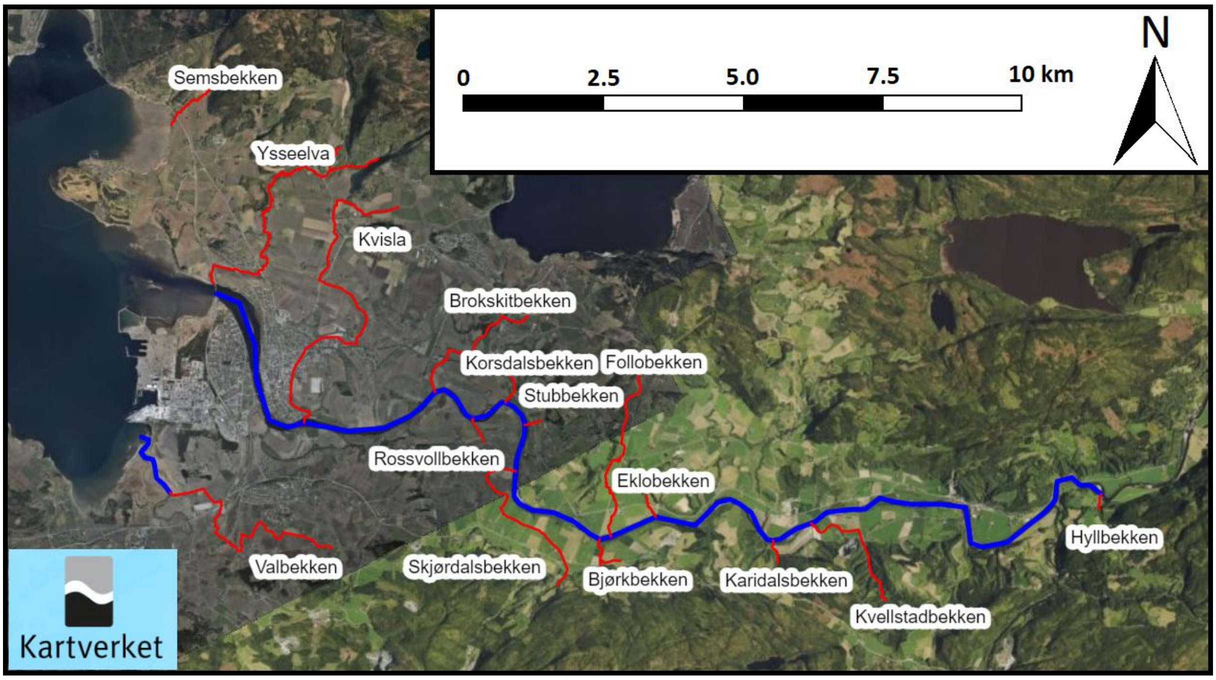


Figure 1: Map of Verdalselva watershed located in Verdal, Norway with the 14 chosen tributaries that the macroinvertebrate samples were taken from.

Data collection

The fieldwork was conducted from the 23rd of August to the 5th of September, and collection of benthic organisms took place in the time period 23rd of August – 3rd of September. In total, 118 samples were sampled and identified, from a total of 59 stations and 15 streams. Habitat measurements and electro-fishing was performed in the same time-frame, making sure that kick-sampling was always performed before electro-fishing to prevent macroinvertebrates from detaching and drifting downstream.

Habitat measurements and electrofishing

Habitat measurements were conducted in all stations. The stations length was measured, as well as number of pools and amount of driftwood. Each station was divided into 5 transects with an equal distance in between, based on the station's length. By each station several characteristics were measured: stream width, stream depth (at 10, 25, 50, 75 and 90 % of the width) and percentage of each substrate size fraction. The canopy was registered by coverage percentage to measure the shadow in water, and percentage of vegetation was registered in the floodzone and by the riverbank. Water velocity m/sec) was measured using a global waterflow probe (model FP111) and algae and moss coverage were visually determined. Number of hiding spots for juvenile fish were determined using a 13 mm diameter hose and classified by three size categories (2 –5 cm, 5-10 cm and >10 cm). The weighted shelter was calculated using the S1 + S2x2 + S3x3 formula (Forseth et al., 2014).The raw data from the habitat measurements can be found in the appendix (Appendix X).

The fishdata was obtained by 3- pass electric fishing (Berntsen, 2022; Njaa, (2022)).

Kick-sampling method

Benthic organisms were collected using the kick-sampling method (Hynes & Hynes, 1970). Kick-sampling has been deemed as a reliable method for disclosing differentiation of benthic invertebrate communities over time and between different sites, although not that successful at discovering rare taxa with fewer passes (Bradley & Ormerod, 2002). The samples were performed in three passes (3 x 20 seconds) to be as comparable as possible to previous studies, although Feeley et al. (2012) found that a shorter kick-time of 20 seconds was adequate and received similar results as 60 seconds, deeming this as a more time-effective method and energy-preserving method, both in the field and during sorting and identifying. Ultimately, the 3 x 20 second pass were chosen because this was the method used in previous years.

A hand-held 25 x 25 cm kick net with a mesh size of 250 µm were placed on the riverbed while the substrate was kicked vigorously upstream, resulting in macroinvertebrates detaching and flowing into the net placed downstream. The kick sampling was performed for 3 x 20 seconds along the same transect; the same area was kicked three times for a total of 60 seconds. Each transect was determined to be within 1-2 metres from the beginning and end of a station, resulting in two samples per station.

After each sampling, the contents of the mesh net were moved to a white plastic container for contrast. Larger objects such as stones, twigs and large vegetation material were removed. Although some benthic organisms might have been removed in this process, twigs etc. were removed to prevent the plastic bags around the samples from breaking before identification took place. The samples were then rinsed several times, by adding water to the container and pouring the organisms back into the net. After repeating the rinsing process several times, only abiotic material such as sand, gravel and clay were left in the container, while the organisms were left in the mesh net along with moss, leaves and vegetation debris. The rinsed sample was then transferred into a plastic bag, making sure the net was rinsed properly with no visible organisms left. The samples were then labelled with stream, station and subsample name and filled with 96 % ethanol before being stored in ~5 °C temperature before identification at the laboratory.

Identification of macroinvertebrates

The samples were in most instances divided into four equally sized subsamples. However, if the sample appeared particularly small or large, the sample might be divided into 1-8 equal subsamples. If a subsample was plucked and contained less than 35 individuals, another subsample was added.

The organisms were sorted out of the samples in good light using tweezers and a clear plastic tray with white contrast beneath. Larger objects such as leaves, and small twigs were flushed clean with water into the tray and removed for better visibility. When all organisms appeared to have been taken out of the sample, more liquid was added and the process was repeated, to ensure all visible individuals, including those floating on the surface were included. After identification, the benthic organisms were set in a diluted 96 % ethanol solution, so that the contents could be checked later.

Macroinvertebrates were identified as detailed as possible using a Leica MS 5 stereo microscope with 4x magnification. Additionally, a microscope was used, when necessary, for example to identify the mayfly *Baetis rhodani* by the spines present at the gills. The following literature was used for identification; Trichoptera larvae of Finland: A key to the Caddis Larvae of Finland and Nearby Countries(Rinne & Wiberg-Larsen, 2017), Stoneflies (Plecoptera) of Fennoscandia and Denmark (Lillehammer, 1988), Insektlære for fluefiskere (Krogvold & Sand, 2008), Aquatic Insects of North Europe volum 1 and 2 (Nilsson; Nilsson, 1997) and Guide to freshwater invertebrates(Dobson et al., 2013).

Diptera invertebrates were mostly identified to family, but the EPT-species were mostly identified to species, although some were too undeveloped, and were not keyed to species. In some instances, due to very small and undeveloped individuals, it was not possible to separate the families Capniidae and Leuctridae.

ASPT-index

In order to quantify the ecological status of the water bodies, I used the benthic invertebrate data to estimate the ASPT index - average score per taxon (Wright et al., 1989). This index consists of a total of 85 scoring taxa were each are given a score from 10-1 in accordance with their tolerance to organic pollution and eutrophication. The scoring taxa mainly consists of families, with some exceptions like the class Oligochaeta. Taxa given a low score has higher tolerance to pollution, whereas higher scores mean lower tolerance to pollution. The remaining taxa not included in the index are excluded and do not influence the score. The ASPT score per station was calculated using the following equation:

$$ASPT\ score = \frac{\sum taxa\ scores}{Numbers\ of\ scoring\ taxa}$$

The results from this calculation are used to determine the ecological state of the waterbody, and if measures need to be implemented in order to reach an acceptable ecological state (table 1). The ASPT scores is expected to have low levels of uncertainty, as it only goes down to the family level. However, due to undeveloped individuals, the family Capniidae and Leuctriidae were in many instances not possible to separate. This will not affect the ASPT scores, as these two families are equally scored in the index. Mean values of the upper and lower subsample were calculated to obtain one ASPT score per station. In streams with several stations, only the lowest-scoring station (“one out, all out” principle, 1OAO) was used to determine the ecological state of the stream in its entirety.

Table 1: Reference values and class limitations for classification of ecological state using the ASPT-index (Direktoratsgruppen Vanndirektivet, Veileder,02:2018)

		Acceptable ecological state (measures not necessary)		Unacceptable ecological state (Measures necessary)		
Watertype	Reference value	Very good	Good	Moderate	Poor	Very poor
All	6,9 >	6,8	6,8 - 6,0	6,0 - 5,2	5,2 – 4,4	< 4,4

Functional groups

To be able to investigate the distribution pattern of various groups of benthic organisms based on niche-use, functional groups were acquired using the freshwater ecology database (Schmidt-Kloiber & Hering, 2015) The data used in this thesis were from the following contributors (AQUEM expert consortium, 2002; Brabec, 2022; Bufagni, 2009; Dijikstra, 2022; Hoerren, 2022; Buffagni, 2022 and (Brojer et al., 2017; Graf, 2002; Graf et al., 2008; Graf et al., 2009; Kovács et al., 2002).The database used a ten-point assignment system giving each taxa a total of 10 points distributed amongst different functional feeding types. Most taxa were assigned to several different feeding types, and to be able to analyse the data I had to use a smaller data frame. Therefore, I used only the feeding type receiving the highest point for each taxon, resulting in only one functional group per taxa. The groups grazers/ scrapers and gatherers/collectors usually received the same or a very similar score and were therefore grouped together into grazers/gatherers, as they were not possible to separate. The data was collapsed into the following most common functional groups; Grazers/gatherers, predators, shredders, miners, active-filter feeders and passive-filter feeders. An overview of the functional group assigned to each taxon can be found in the appendix (Appendix table 4).

Alpha diversity: Shannon-Wiener Index

In order to determine species diversity within stations, the Shannon Wiener index were applied. The Shannon wiener index is a diversity index for alpha-diversity that can attain values from 0 and up, with the species diversity increasing with increased numbers. There is no upper limit to the index. The index is used to determine the species/taxa diversity in a given community. The Shannon-Wiener score will increase with increasing number of species and their abundance evenness. The following equation was used to calculate Shannon-Wiener diversity:

$$\mathit{Shannon} - \mathit{Wiener\ diversity\ index} = -\sum[\frac{\mathit{Individuals\ of\ a\ given\ type}}{\mathit{Total\ number\ of\ individuals\ in\ a\ community}} * \log(\frac{\mathit{Individuals\ of\ a\ given\ type}}{\mathit{Total\ number\ of\ individuals\ in\ a\ community}}$$

Statistical analysis and model selection

The statistical analyses were performed using the programme R version 4.1.3. (R Development Core Team, 2022). The statistical alpha level was 0.05 for all tests conducted. R was also used for all figures.

The choice of statistical models varied according to the type of response variable, but whenever feasible a mixed prediction structure was applied where station nested under tributaries were modelled as random intercepts (Zuur et al., 2009). The main response data used in this study were the macroinvertebrate data containing lowest taxa and number of individuals (abundance) from each site. Linear mixed effects candidate models, using the package lme4, were used to quantify various predictors' influence on Shannon Wiener diversity, ASPT-scores and abundance. For addressing effects on functional group composition candidate models were constructed using the mblogit procedure in package mclogit applying a multinomial logistic regression approach (Elff, 2020; MacKenzie et al., 2017).

Ordination was used to model effects on macroinvertebrate composition. Ordination consists of grouping datasets together into groups that are positively or negatively correlated with one another. Ordination was performed using the r data package vegan. An unconstrained decorana correspondence analysis (DCA) was performed to determine whether a linear ordination model would be suitable for the habitat measurement data (i.e., first axis length <

3). If the axis length is over 3, then a unimodal ordination is better suited. For the habitat variables, ordination was performed to obtain the PC scores that were later used to model habitat effects on the macroinvertebrate metrics including ASPT index, abundance, functional groups, Shannon Wiener index and in ordination. To look at patterns and correlation in the macroinvertebrate dataset, ordination was used to model how the habitat variables (PC1, PC2 & PC3) loaded onto the macroinvertebrate dataset.

Model selection was performed using an n-corrected version of Akaike's Information Criterion (AICc) and were used to perform the model selection (Akaike, 1974; Anderson, 2008) (Akaike, 2008) the R package AICcModavg was used to calculate AICc values.

Results

Ordination analyses of habitat measurements

DCA revealed a first axis length of 1.92, thus a linear ordination (i.e., PCA) was chosen for further analysis (Table 2). For importance of components from the linear ordination see Appendix.

Table 2: A decorana correspondence analysis was performed to determine model approach (linear or unimodal). The DCA1 values accounts for 38 % of variation within the habitat characteristics.

	DCA1	**DCA2**	**DCA3**	**DCA4**
Eigenvalues	0.38	0.20	0.079	0.076
Decorana values	0.38	0.89	0.065	0.044
Axis lengths	1.92	1.54	1.19	1.76

Negative PC1 values were associated with higher number of pools and dead wood, there was more surrounding vegetation casting shadow, and the stream was generally wider with more algae coverage (Figure 2). Habitat measurements that were positively associated with PC1 were: water velocity, depth, moss coverage as well as substrate grain size and hiding spaces (Figure 2 andFigure 3). Just number of pools showed some association, but weak, with negative PC2-values. All remaining habitat measurements such as water velocity, shadow, number of hiding spots and presence of moss and algae were more likely to have high values in the station when the PC2 value was positive.

Habitat measurements associated with negative PC3 values were depth and width of the stream, algae coverage and water velocity as well as increased shadow over riverbed. With positive PC3 values pools, dead wood, substrate, moss, hiding spots and surrounding vegetation is associated. Additionally, a higher PC3 is associated with a coarser substrate, more abundance of hiding spots and a higher moss coverage (Figure 1 and Figure 3)

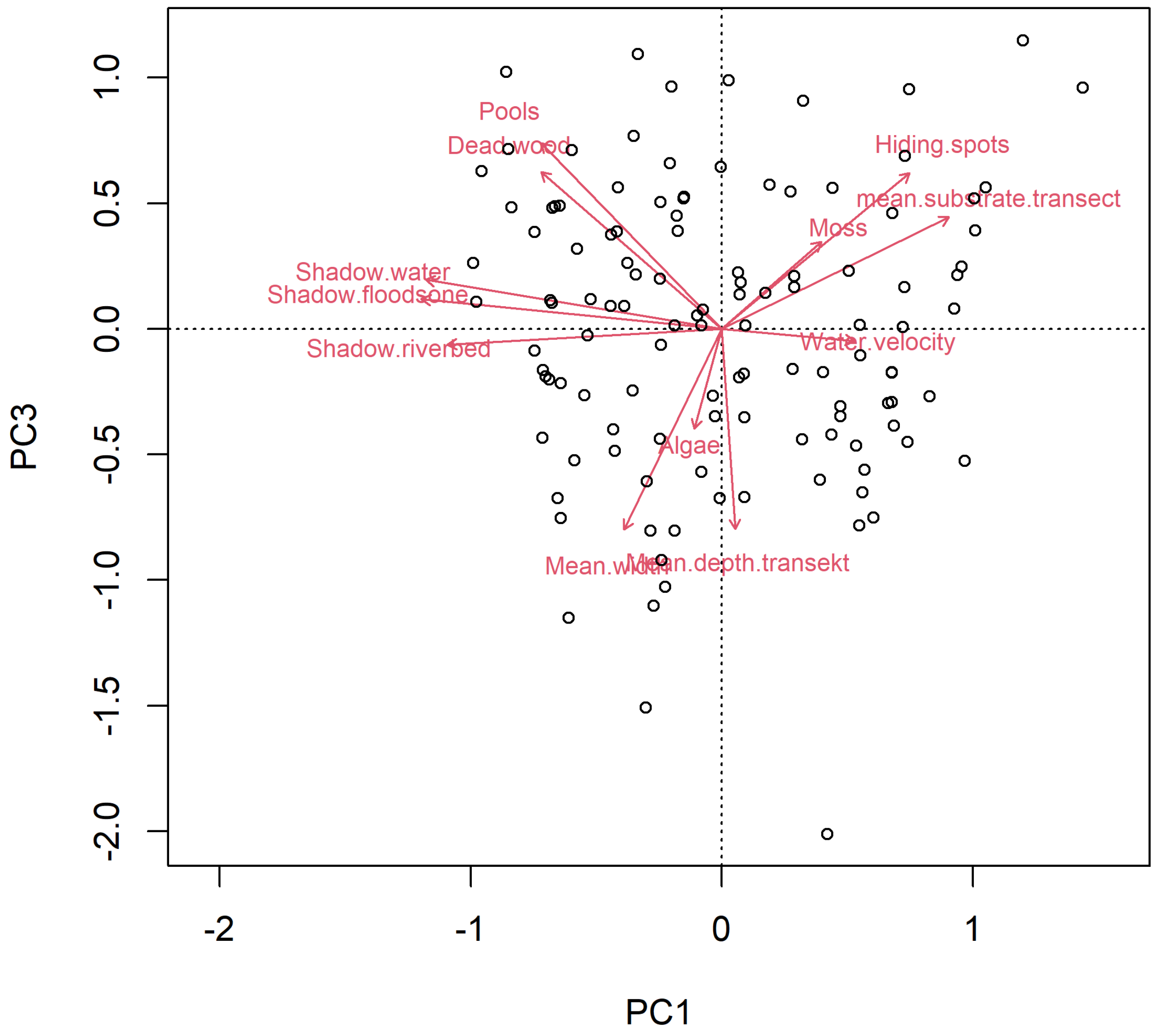
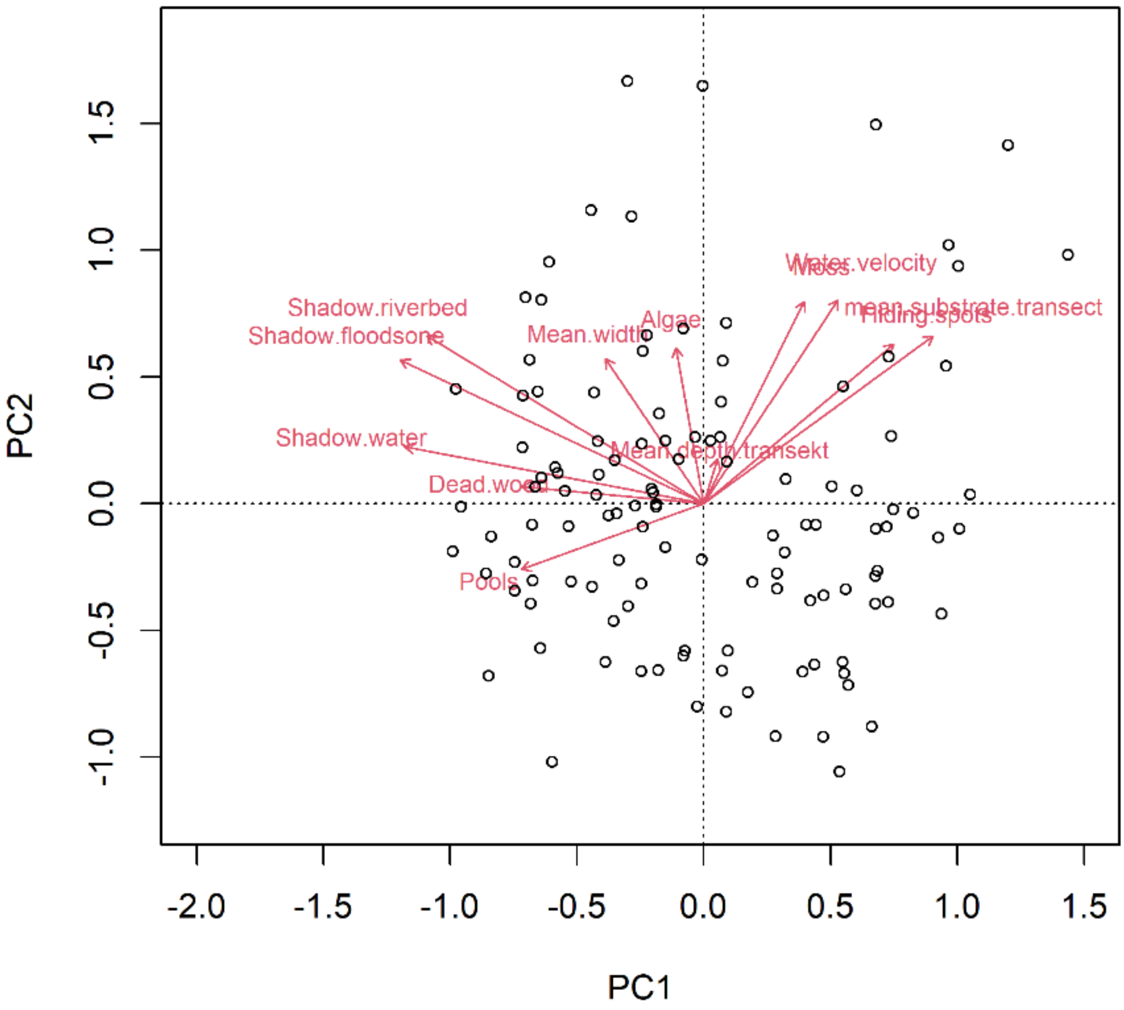


Figure 2:Biplot of the Principle Components Analysis (PCA) in the PC3 vs PC1 plane made using the habitat characteristics data.The biplot displays the interaction between different habitat characteristics, with characteristics that are closer together have a stronger interaction. PC1 and PC3 together explained 31 % of the proportion, with PC1 explaining 24% of the variation and PC3 explaining 7%.

Mean depth and mean width were both positively correlated with presence of algae (Figure 2). Water velocity was negatively correlated with the three habitat measurements concerning shadow. With increasing water velocity, there was more vegetation that casts shadow over the water. Water velocity was also negatively correlated with pools and dead wood, meaning dead wood and number of pools are lower when water velocity is high. Number of hiding spots, percent coverage of moss, water velocity and mean substrate is positively correlated. Increased coverage of moss, number of hiding spots and a coarser substrate is expected when water velocity is higher, as finer sand and sediments will be washed away.

There were more prominent positive among-habitat correlations in the PC2 vs PC3 plane than in the PC1 vs PC3 plane (figure 2 and figure 3). Mean depth was negatively correlated with number of pools and amounts of dead wood, meaning that the river is shallower when pools and dead wood is present. There is also less algae present with increasing amounts of pools. Water velocity and shadow riverbed have a strong positive correlation, meaning a faster water velocity is expected with increasing vegetation on the riverbed. The remaining factors are all positively correlated.



Figur 1: Biplot of the Principle Components Analysis (PCA) in the PC2 vs PC1 plane made using the habitat characteristics data..The biplot displays the interaction between different habitat characteristics. PC1 explained 24 % of the variation, PC2 explained 10%, resulting in the two PCA's describing a total proportion of 34 %.

In the PC2 vs PC1 plane, pools are negatively correlated with hiding spots, mean substrate, water velocity, moss and mean depth (figure 3). With a higher number of pools, the water velocity will decrease, there will be fewer hiding spots and lower moss coverage, the depth will decrease, and the substrate will consist of finer substrates such as fine sand. With coarser substrate there will be more hiding spots. With higher water velocity there is more presence of moss, and the depth is shallower. Shadow riverbed and shadow flood zone was positively correlated meaning that these two often occur at the same level of occurrence.

Species composition

In total, 62 539 individuals of benthic organisms were recorded in this study. The most abundant taxa were Chironomidae (27.96 %), Psychodidae (16.94 %), Baetis rhodani (14.98 %), Oligochaeta (9,62 %) and Alaites muticus (8.12 %) (Appendix table 2).The upper sample from Kvisla station 4 received the total lowest abundance, with only 23 individuals in the sample. The sample with the highest abundance of macroinvertebrates were the upper sample of Eklo station two with 2128 individuals in the sample (Appendix table 2)

ASPT-Index

The ASPT scores revealed that only one stream; Karidalsbekken received a good ecological score (ASPT = 6,3, Table 3). Semsbekken, Rossvollbekken, Eklobekken and Hyllbekken received a moderate score (RANGE), while the rest of the streams received a score of poor or very poor.

Comparisons of ASPT-scores from 2017, 2018 and 2021 revealed that four streams; Valbekken, Rossvollbekken, Karidalsbekken and Hyllbekken have increasing ASPT-values over this time span (Table 3). The four streams Ydselva, Skjørdalsbekken, Kvellstadbekken and Semsbekken have worsened, while the remaining streams received the same score or were not investigated in previous years.

Only stations with the lowest ASPT-scores were used to determine the ecological state of the stream as a whole. When looking at ASPT-scores from all stations, 18 out of 59 stations (lower + upper subsample) had a good ecological condition (received a score of good or very good) and the remaining stations received a score under what is acceptable; 21 stations received a moderate score, and 18 stations received a score of poor or very poor (Appendix table 6)

Table 3: A comparison of tributary-wise ASPT-scores from 2017 (Hol, 2018), 2018 (Esdar,2019) and 2021 (current study), Only stations with the lowest ASPT score were used to determine the ecological state of the entire stream. The ASPT scores for each individual station can be found in appendix (Appendix table 6).

Stream	2017 (Hol, 2018)	2018 (Esdar, 2019)	2021
Semsbekken	Good	-	Moderate
Valbekken	Very poor	-	Poor

Ydselva	Moderate	-	Very poor
Kvisla	-	-	Very poor
Broskitbekken	-	-	Very poor
Rossvollbekken	Poor	Very poor	Moderate
Korsådalsbekken	Very poor	Very poor	Very poor
Stubbekken	Poor	Poor	Poor
Skjørdalsbekken	Good	Moderate	Very poor
Bjørk/sundbybekken	-	-	Poor
Follobekken	-	-	Very poor
Eklobekken	-	-	Moderate
Karidalsbekken	Moderate	-	Good
Kvellstadbekken	Very poor	Good	Very poor
Hyllbekken	Moderate	Poor	Moderate

The candidate model for ASPT as a response variable had the following predictor structure: "PC1 * PC3 + Densitynullpluss". The top model attained 35 % of the AICc-support amongst all the candidate models. When years after measure was added to the top model, it was ranked as the second-most supported model (ΔAICc = 1.96), indicating that time after measure influences ASPT values in a given stream (attained 13 % of the AICcWt support). Type of measure did not have much influence on ASPT values, as the model got little support(Table 4).

Table 4: Model selection table for the top 10 candidate models fitted to predict ASPT index scores from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model. The entire model selection for the predicted ASPT scores can be found in appendix table 7.

	K	**AICc**	**ΔAICc**	**AICcWt**	**Cum.Wt**	**LL**
PC1 * PC3 + Densitynullpluss	8	391.0	0	0.35	0.35	-186.8
PC1 * PC3 + Densitynullpluss + years.after.measure	9	392.9	1.96	0.13	0.48	-186.6

PC1 * PC3 + Densitynullpluss * Distance.fjord	10	394.0	3.06	0.08	0.63	-186.0
PC1 * PC3 + Densitynullpluss * years.after.measure	10	394.2	3.22	0.07	0.7	-186.1
PC1 * PC3 + Distance.fjord + Densitynullpluss + years.after.measure	10	395.2	4.29	0.04	0.74	-186.6
Densitynullpluss	5	395.4	4.46	0.04	0.78	-192.4
PC1 * PC3	7	395.5	4.50	0.04	0.82	-190.2
PC1 + PC2 + PC3	7	395.9	4.92	0.03	0.85	-190.4
Densitynullpluss + years.after.measure	6	396.0	5.02	0.03	0.87	-191.6
PC1 + PC3	6	396.4	5.40	0.02	0.92	-191.8

*Table 5: Parameter estimates for the selected linear ASPT-model "PC1 * PC3 + Densitynullpluss" and corresponding ANOVA effect test (Table 4).*

	Parameter estimates					
	Estimate	**SE**				
intercept	5.18	0.16				
PC1	0.30	0.22				
PC3	0.31	0.21				
Densitynullpluss	0.0049	0.0018				
PC1*PC3	0.82	0.38				
ANOVA effect test						
npar	**Sum sq**	**Mean sq**	**F value**	**Chisq**	**Df**	**Pr(>Chisq)**
PC1	1 6.13	6.13	5.58	4.33	1	0.037
PC3	1 3.40	3.40	3.09	2.71	1	0.10
Densitynullpluss	1 7.29	7.29	6.64	7.25	1	0.0071

PC1*PC3	1 5.16	5.16	4.70	4.70	1	0.030

PC1 and PC3 values as well as a positive interaction between them (PC1*PC3) and increasing density of 0+ had a positive effect on ASPT-values (Table 4, Figure 2). The highest ASPT values was achieved when both PC3, PC1 and density of 0+ was high (Figure 4). The amount of fish present is the most significant factor for influencing ASPT-scores (p = 0.007).

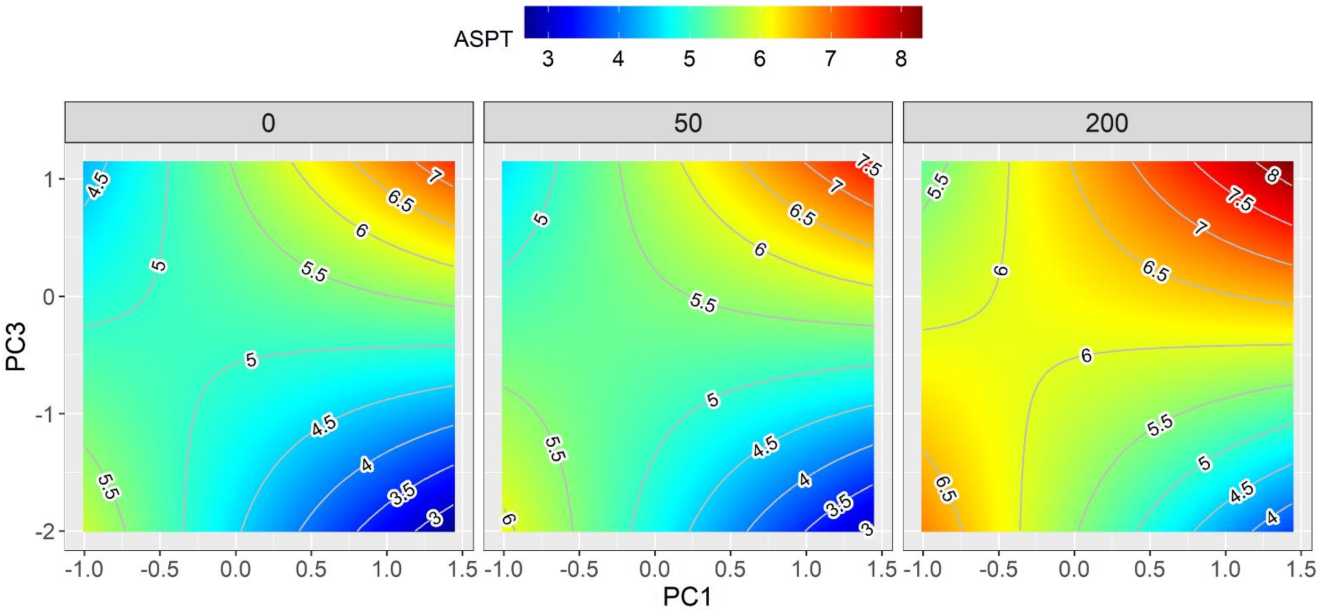


*Figure 4: ASPT prediction plot for the most supported model from the model prediction "PC1 * PC3 + densitynullpluss"(Table 4 andTable 5). The plot shows the ASPT values as a function of PC3 and PC1, with density of 0+ (0, 50 and 200) at the top panel border. The color gradient displays the range in ASPT values, with blue being the lowest, and red being the highest.*

Alpha diversity; Shannon - Wiener

The Shannon-Wiener candidate model with highest AICc-support was PC1 * PC3 + density.nullpluss + distance. fjord (Table 6). This model received 25% of the AICc support compared to the remaining models. The second- and third-most supported model received an AICc support of 11%. Years after measure and the type of measure that was implemented had little influence on the diversity (less than 1 % support).

The top model revealed that the highest SW diversity is expected when all explanatory variables are high, except for the PC1 values (Table 7). PC1*PC3, density of 0+ and distance from the fjord were the most important effects, with the interaction PC1*PC3 being significant (p = 0.009).

i

Table 6: Model selection table for the top 10 candidate models fitted to predict alpha diversity (Shannon-Wiener index scores) from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model. The full model selection of predicted alpha diversity is listed in appendix table 8.

Fixed effects model structure	**K**	**AICc**	**Delta_AICc**	**AICcWt**	**Cum.Wt**	**LL**
PC1 * PC3 + Densitynullpluss + Distance.fjord	9	118.6	0.00	0.25	0.25	-49.5
PC1 * PC3 + Distance.fjord	8	120.2	1.55	0.11	0.36	-51.4
PC1 * PC3 + Densitynullpluss * Distance.fjord	10	120.2	1.56	0.11	0.48	-49.1
Densitynullpluss + Distance.fjord	6	120.7	2.01	0.09	0.57	-54.0
Distance.fjord	5	120.7	2.08	0.09	0.66	-55.1
Densitynullpluss * Distance.fjord	7	121.7	3.09	0.05	0.71	-53.4
PC1 + Densitynullpluss + Distance.fjord	7	122.2	3.55	0.04	0.75	-53.6
PC1 + Densitynullpluss + Distance.fjord	7	122.2	3.55	0.04	0.79	-53.6
Densitynullpluss	5	122.6	3.91	0.04	0.83	-56.0
PC1*PC3	7	123.5	4.81	0.02	0.85	-54.2

*Table 7: Parameter estimates and effect test for the selected alpha diversity model: PC1 * PC3 + density.nullpluss + distance. Fjord (Table 6). Distance to fjord was modelled as scaled values with mean=0 and SD=1.*

Parameter estimates				**Anova effect test**				
Effect	**Estimate**	**SE**	**t value**	**Effect**	**Df**	**Df.res**	**F**	**Pr (>F)**
Intercept	1.54	0.057	26.9	**PC1**	1	80.7	0.49	0.49

PC1	-0.011	0.074	-0.15	**PC3**	1	76.9	0.25	0.62
PC3	0.019	0.070	0.28	**Densitynullpluss**	1	25.3	3.13	0.089
Densitynullpluss	0.0013	0.00067	1.89	**Distance.fjord**	1	13.8	2.93	0.11
Distance. Fjord	0.083	0.047	1.77	**PC1:PC3**	1	69.8	7.20	0.0091
PC1:PC3	0.36	0.13	2.84					

The selected model predicted Shannon-wiener diversity to increase with increasing 0+ density and increased distance from fjord (Figure 5). When both PC1 and PC3 are either low or high, a higher Shannon-Wiener diversity score was predicted.

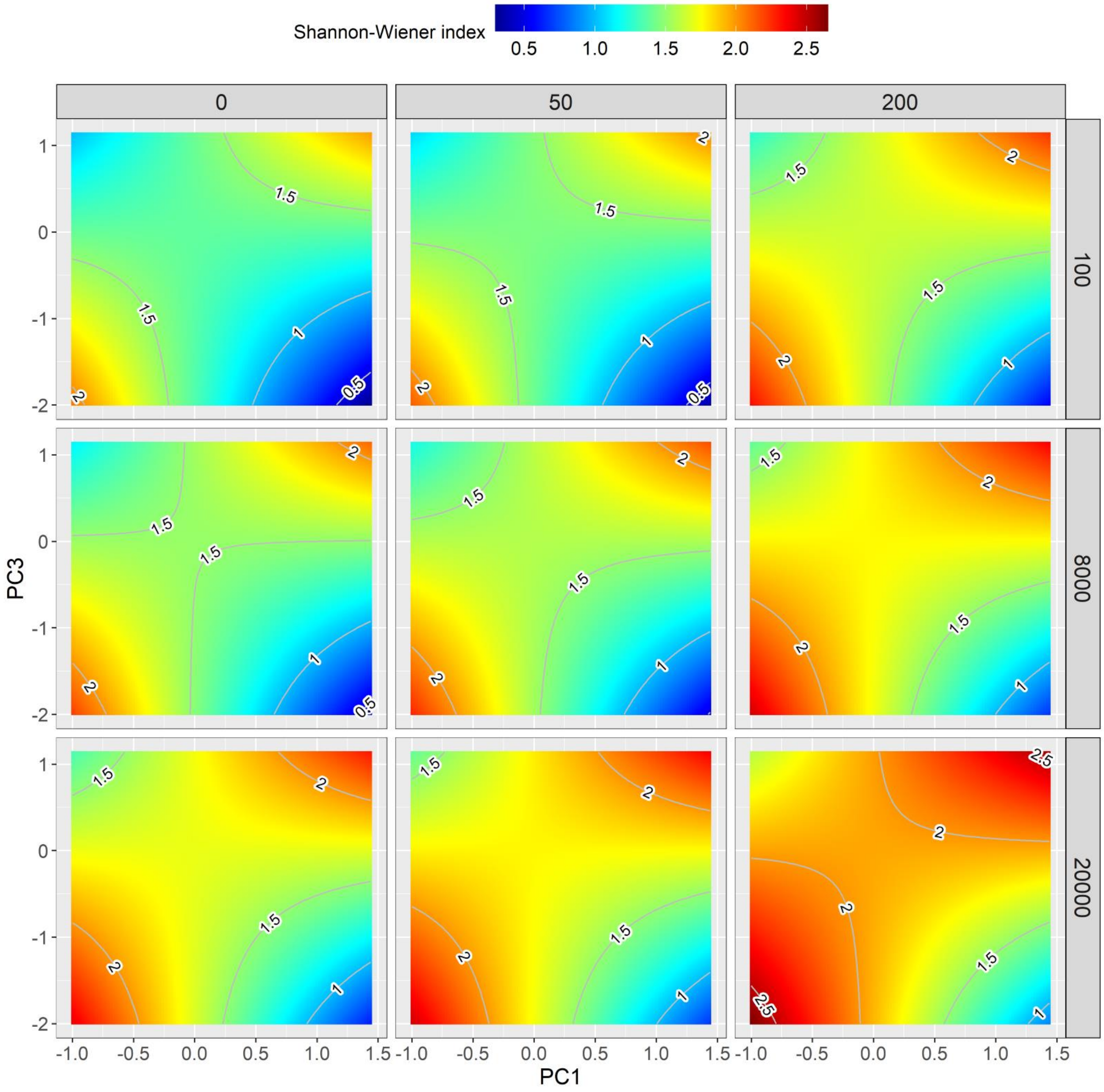


Figure 5:Prediction plot of alpha diversity using the Shannon-wiener diversity index, displaying the predictions for the top model chosen from the model selection as a function of PC1 and PC3(Table, 6 and Table 7). Density of 0+ (0, 50, 200) is

displayed in the top panel border and distance from the fjord is displayed in the right side border (100, 8000 and 20 000 meters from the fjord outlet). The colour gradients display the diversity with blue being the lowest scores, and red the highest.

Abundance

For the model selection among abundance candidate, a log-transformed linear model structure was used (Table 8). The most supported abundance model was a linear regression with distance to fjord as the only fixed predictor, that obtained 29 % of the AICc support. The second-most supported model; years.after.measure² + distance.fjord received a ΔAICc score of 1.8. This second model obtained 12 % of the AICcWt support compared to the other candidate models and was explored further in addition to the first one because to assess measures effect that had been implemented.

Table 8: Model selection table for the top 10 candidate models fitted to predict abundance from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model. The complete model selection for predicted abundance can be found in appendix Table 9.

Fixed effects model structure	**K**	**AICc**	**ΔAICc**	**AICcWt**	**Cum.Wt**	**LL**
Distance.fjord	5	308.0	0	0.29	0.29	-148.8
years.after.measure² + Distance.fjord	7	309.8	1.80	0.12	0.41	-147.4
Distance.fjord + PC1	6	309.9	1.88	0.11	0.53	-148.6
1	4	310.2	2.12	0.1	0.63	-150.9
years.after.measure² + Distance.fjord + PC1	8	311.6	3.57	0.05	0.68	-147.1
years.after.measure²	6	311.9	3.90	0.04	0.72	-149.6
years.after.measure	5	312.1	4.09	0.04	0.76	-150.8
PC2	5	312.2	4.15	0.04	0.8	-150.8
PC3	5	312.2	4.19	0.04	0.83	-150.8
PC1	5	312.2	4.20	0.04	0.87	-150.9

As shown in Table 9, the most supported model showed that the distance from the fjord had a significant negative effect on abundance (slope = -0.29, p = 0.017). With increasing distance to the fjord, there was lower abundance of benthic organisms (Figure 6).

Table 9: Parameter estimates and ANOVA effect test of the selected top abundance model “Distance.fjord” (table 8).Distance to fjord was modelled as scaled values with mean=0 and SD=1.

Parameter estimates

	Estimate	**SE**	**t value**
Intercept	5.87	0.13	46.4
Distance.fjord	-0.29	0.12	-2.39

ANOVA effect test

	npar	**Sum.Sq**	**Mean.sq**	**F**	**Chisq**	**Df**	**Pr(>Chisq)**
Distance.fjord	1	2.41	2.41	5.70	5.70	1	0.017

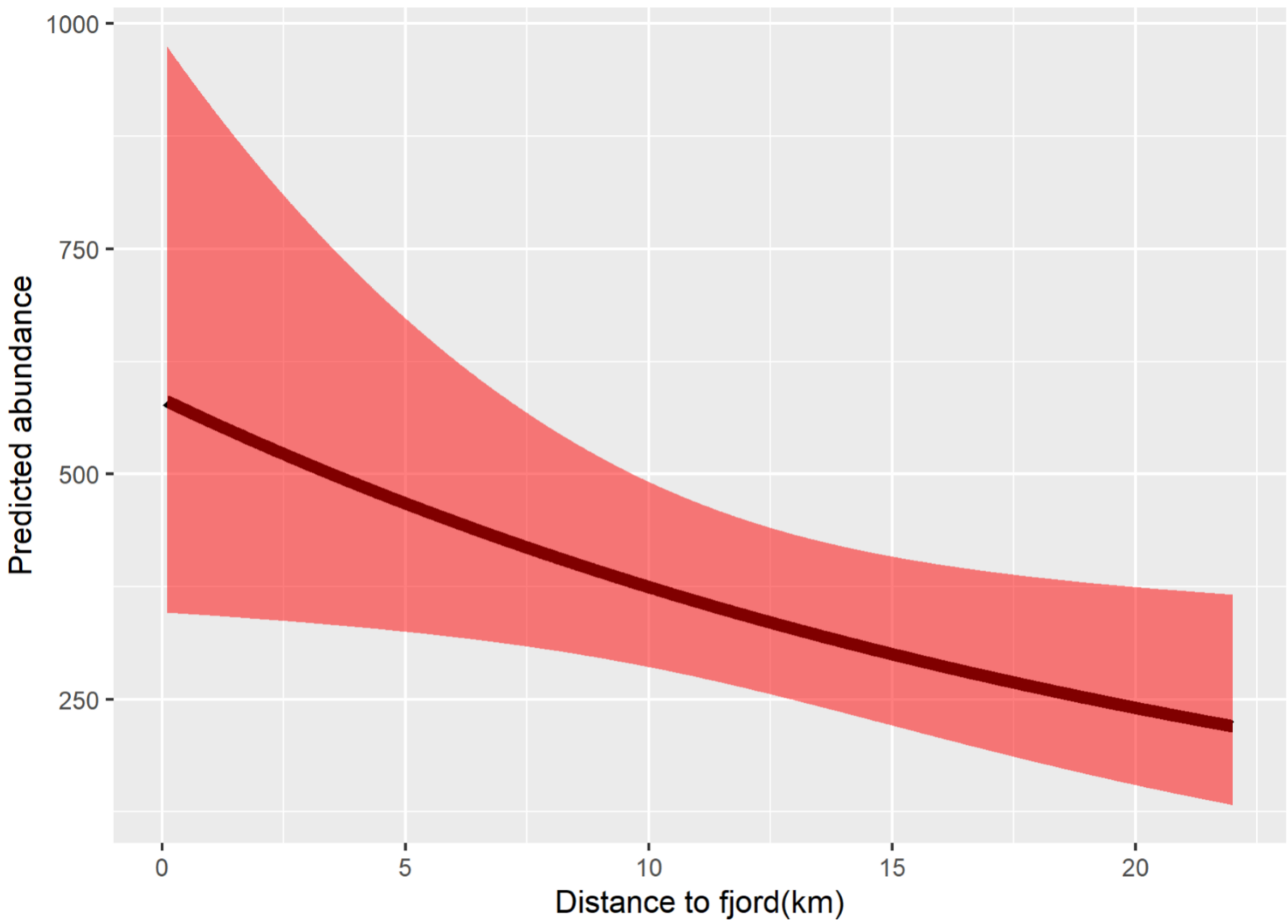


Figure 6: Prediction plot of the most supported abundance model «Distance.fjord» (Table 8 and Table 9)showing predicted development in abundance influenced by the distance to the fjord in kilometres. The red highlighted area defines the 95% confidence interval.

The second-most supported model that also included years after measure had the same negative load for distance from fjord, in addition to a negative relationship with 1 year after measure. There is a positive relationship between abundance and 2 years after measure (Table 9). Distance from fjord is significant ($p = 0.01489$). The abundance of macroinvertebrates decreased with the distance from the fjord and is lower between year 1 and year 3 after measures have been implemented, and at the lowest when two years have passed. In the first year since a measure has been placed or when no measure has been implemented, the abundance is expected to be higher. The same applies when the distance to the fjord is shorter and there is more than three years since a measure was implemented.

Table 10: The parameter estimates and Anova effect test for the second-most supported model predicting abundance "years.after measure² ,+ distance fjord"(Table 9). Distance to fjord was modelled as scaled values with mean=0 and SD=1.

Parameter estimates

Effect	**Estimate**	**Std.**	**Error**
Intercept	5.95	0.23	25.55
years.after.measure^2 1	-0.36	0.27	-1.32
years.after.measure^2 2	0.10	0.064	1.56
Distance.fjord	-0.28	0.12	-2.44

ANOVA effect test

Effect	**npar**	**Sum sq**	**Mean sq**	**F value**	**Chisq**	**Df**	**Pr(>Chisq)**
years.after.measure^2 2	2	1.48	0.74	1.75	2.79	2	0.25
Distance.fjord	1	2.51	2.51	5.93	5.93	1	0.015

s

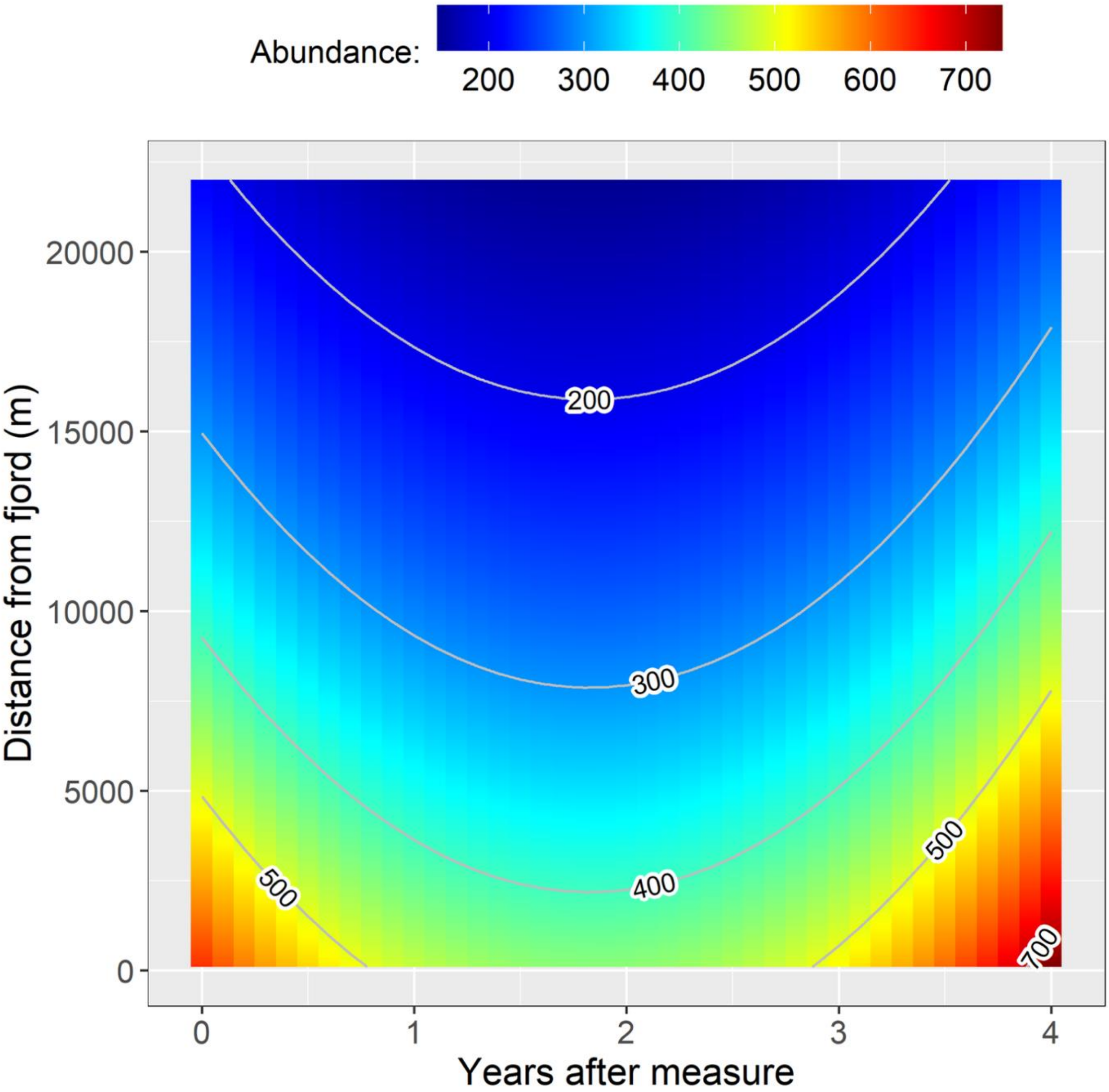


Figure 7: Prediction plot of the second-most supported abundance model "years.after measure² ,+ distance fjord"*(Table 9 and Table 10), showing predicted abundance influenced by years after measure and distance to the fjord in kilometres, with fitted polynoms reaching the lowest point two years after measure. The colour gradients display the abundance with blue being the lowest scores, and red the highest.*

Ordination analyses of benthic invertebrate data

The unconstrained decorana correspondence analysis (DCA) of the macroinvertebrate data yielded a first-axis length below 3 (axis length DCA1 = 2.686), thus, a linear ordination (Constrained Redundancy Analysis) was chosen in the following analyses (Table 11).

Table 11: Decorana correspondence analysis (DCA) of benthic invertebrate composition. DCA1 values explain 24% of the variation within the habitat characteristics.

	DCA1	**DCA2**	**DCA3**	**DCA4**
Eigenvalues	0.24	0.13	0.13	0.11
Decorana values	0.26	0.20	0.15	0.11
Axis length	2.69	3.22	2.14	2.01

The constrained RDA model selection favoured “PC1 + PC2 + PC3” as the candidate model with the highest AIC-support (Table 12, Appendix X). Indicating that the habitat parameters were the most influencing factors for determining the macroinvertebrate composition. Years after measure was included in the third-most supported model, whereas measure type was not as supported (table 12).

Table 12: Model selection table for the top 10 candidate models fitted to predict macroinvertebrate composition from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model. The model selection in its entiretu for macroinvertebrate coposition can be found in appendix Table 10.

Model structure	**npar**	**AIC**	**ΔAIC**
PC1+PC2+PC3	4	451.78	0
PC1+PC2	3	452.25	0.47
PC2+PC3 +years.after.measure	4	452.40	0.63
PC2+PC3	3	452.67	0.89
PC1+PC3 +Densitynullpluss	4	452.87	1.09
PC1+PC3 +Distance.fjord	4	453.06	1.28
PC2	2	453.08	1.30
PC1+PC3	3	453.34	1.56
PC1+PC3 +Measuretype	6	453.60	1.82
PC1	2	453.74	1.96

The selected constrained RDA showed that PC1 and PC3 were closely correlated and were associated with negative RDA1 and RDA2 values (Figure X). They were both associated with *Baetis rhodani* and *Nemoura cinera*. PC2 were strongly correlated with positive RDA2 values and negative RDA1 values, and were favouring *Alaintes muticus*, Psychodidae and Capniidae, and disfavouring Chironomidae. Rhyacophila sp. Is somewhere in the middle between PC2 and PC1. The taxa displayed were the most abundant taxa, and all but Chironomidae were associated with negative RDA1 values.

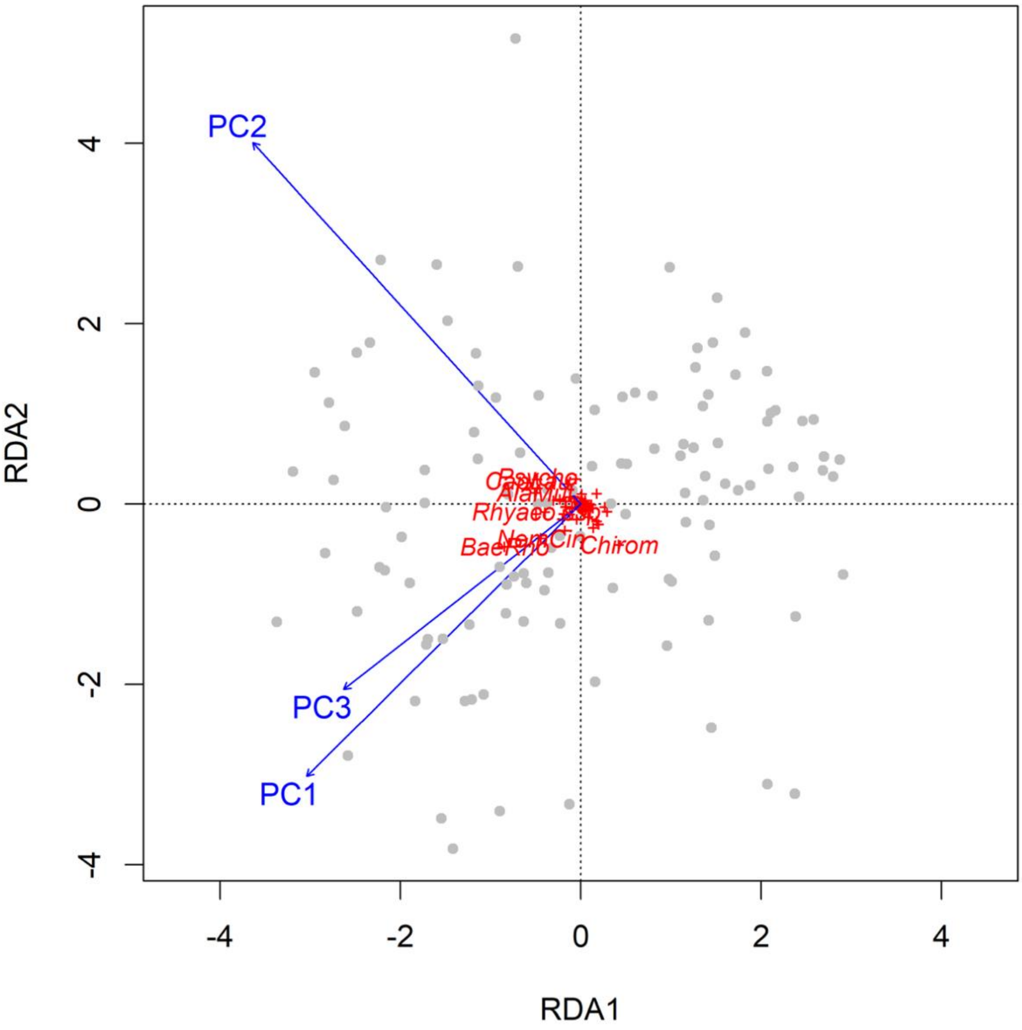


Figure 8: Biplot of the macroinvertebrate data predictions from the most supported Constrained Redundancy Analysis (RDA) model "PC1 + PC2 + PC3 (Table 11 and Table 12). The seven most common macroinvertebrate taxa are highlighted in red, and the loading of the PCA values (PCA1, PCA2 and PCA3) is displayed in the blue axis. The grey dots are station loading, and the red crosses are the loading of the remaining macroinvertebrates.

Functional groups

For the functional groups, model selection amongst multinomial candidate models revealed highest support for the interaction model "PC1 * PC2 * PC3" using logit parameter estimates (Table 13 and table 14) . When this model was combined with different additive effects, density of 0+ and distance to fjord where the most supported models

Table 13: Functional group model selection table for the top 10 candidate models fitted to predict the fraction of each functional group from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model. The full model selection for functional groups can be found in appendix Table 11.

Model structure	**df**	**AIC**	**ΔAICc**
PC1*PC2*PC3	40	44980.28	0
PC1*PC2*PC3+Densitynullpluss	45	44983.64	3.35
PC1*PC2*PC3+ Distance.fjord	45	44994.34	14.06
PC1*PC2*PC3+years.after.measure	45	44994.9	14.62
PC1*PC2*PC3+Measuretype	55	45001.44	21.16
PC1*PC3	20	45378.72	398.4
PC1*PC3+Densitynullpluss	25	45384.74	404.5
Distance.fjord +Densitynullpluss+PC1*PC3	30	45397.12	416.8
PC1	10	45446.77	466.5
PC1+Distance.fjord	15	45459.32	479.0

Table 14. Logit parameter estimates (est±SE) for the selected multinomial functional group model (Table 13). Each functional group has been modelled versus active filter feeders, so that the predicted fraction of a given functional group is relative to active filter feeders. ff = filter feeders

Functional group	**Grazers/gatherers**		**Miners**		**Passive ff**		**Predators**		**Shredders**	
Model terms	**est**	**SE**	**est**	**SE**	**est**	**SE**	**est**	**SE**	**est**	**SE**
Intercept	5.9	0.7	-5.1	1.5	0.92	0.69	3.0	0.67	-0.68	0.89
PC1	-1.8	0.41	0.04	2.1	-2.0	0.48	-1.3	0.43	-4.4	0.64
PC2	-0.65	0.24	-3.8	2.5	-1.5	0.29	-1.0	0.26	-0.76	0.39
PC3	2.1	0.52	4.8	2.4	1.2	0.60	2.1	0.53	1.7	0.68
PC1*PC2	-2.5	0.63	2.7	4.5	-1.5	0.72	-2.9	0.66	-3.7	0.95
PC1*PC3	3.1	0.64	3.0	4.1	2.4	0.80	3.9	0.67	2.9	1.1
PC2*PC3	-6.1	0.48	0.81	4.1	-7.1	0.57	-6.5	0.49	-6.1	0.69
PC1*PC2*PC3	1.5	1.1	-17.5	10.6	2.9	1.3	3.4	1.2	5.2	1.7

Active filter feeders had a higher predicted fraction of the macroinvertebrate community when PC3 and PC2 was negative and PC1 values were above 0 (Figure 9, Table 14). When PC2 is positive, the predicted fraction decreased drastically and it was most likely to find active filter feeders dominating when PC1 was high (i.e., 1 - 1.5) and PC3 is in the upper mid-range. Active filter feeders had a positive interaction with all functional groups except for miners (est =-5.130). Predicted fraction of grazers and gatherers were positively correlated with higher PC3 values (>-1) when PC2 values were-1, and negatively correlated with low PC3 values and high PC1 values when PC2 values were at 0 (Table 14).The same is true for grazers/gatherers with positive PC2 values, as well as a lower probability when both PC3 and PC1 was low. As seen in table 14 and Figure 9, grazers/gatherers have negative estimates PC1, PC2, PC1* PC2 and PC2*PC3. The probability of finding miners in a given sample was highest when both PC1 and PC3 were low or high with a negative PC2 value (PC2 est =-3761). With a positive PC2 value (1) the predicted fraction of miners was highest when PC1 was low and PC3 high or when PC1 was high and PC3 was low. Shredders were unlikely to be found when PC2 values were under 1, and if values were over 1 they were only present with low PC1 and PC3 values.

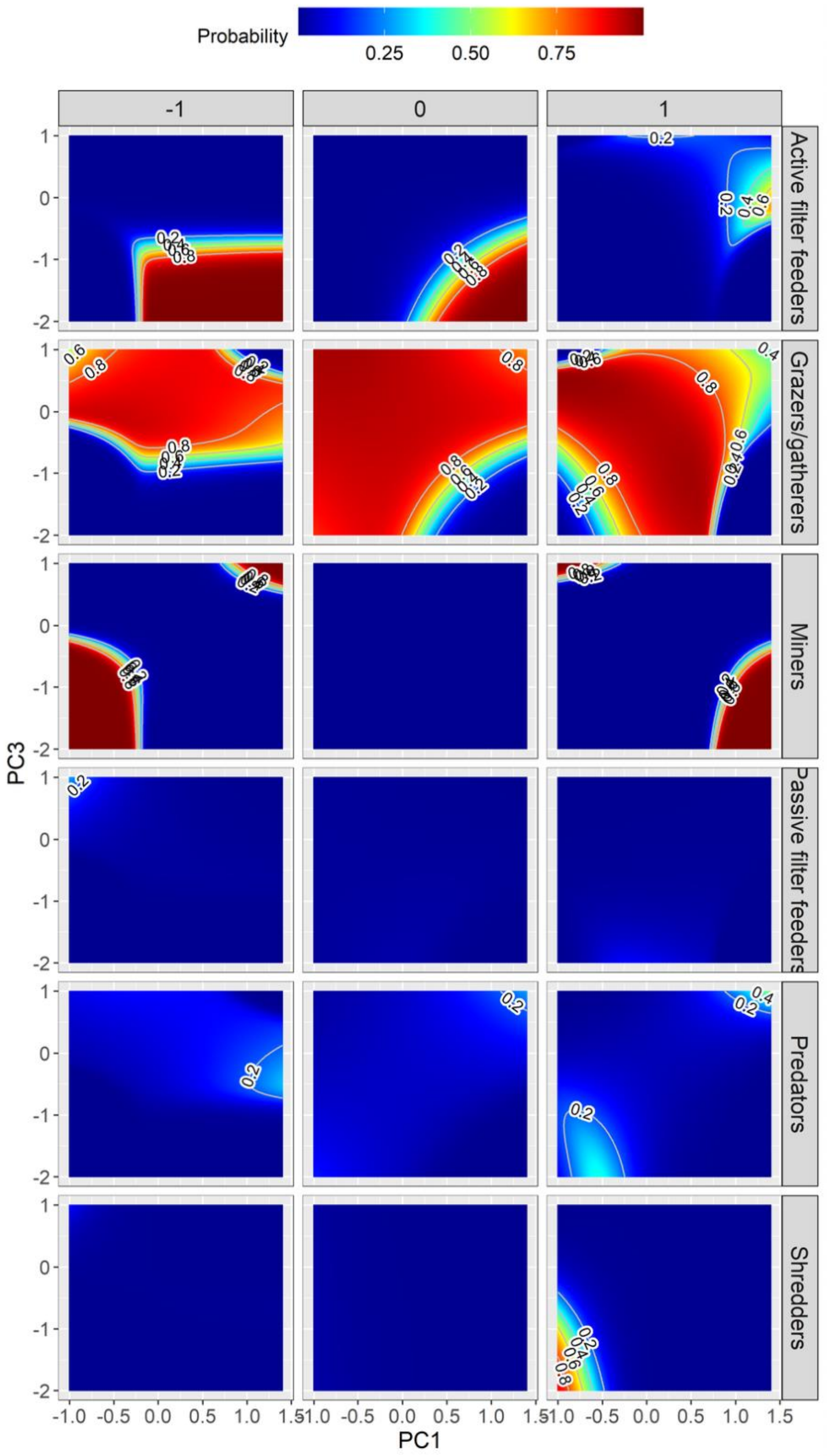


Figure 9: Prediction plot based on the selected multinomial model in Table 13 showing the predicted fraction of a given functional group as function of PC1-PC3. PC2 values (-1, 0, 1) are provided on the top panel border and functional groups (Active filter feeders, Grazers/gatherers, Miners, Passive filter feeders, Predators and Shredders) on the side in the panel borders.

Discussion

Years after measure paired with distance to fjord was the second most supported model regarding ASPT values and was slightly negatively correlated with abundance one year after measure. Two years after measures are implemented, abundance is expected to be at an all-time low, and then slowly increase again. The time after measures influence on abundance might indicate that effects of measures in terms of macroinvertebrates are not lasting. A decrease in abundance after two years could indicate that there might be some increase in fish density predating on dominating taxa after restoration, but previous studies did not find an increase in juvenile fish density (0+) with increasing years after measure (Pedersen, 2021). Another explanation could be that dispersal is easier in the two years after a measure is implemented, or less nutrient-tolerant species is able to successfully compete with dominating taxa, but other factors such as constant/seasonal supply of toxic nutrient loads and other habitat stressors prevents new colonizers of being able to successfully establish and procreate. Efforts to actively reintroduce macroinvertebrates to aquatic habitats have had approximately a 50% failure rate, likely due to complex invertebrate life cycles and negatively influencing habitat factors such as poor water quality(Jourdan et al., 2019). These same factors could be limiting benthic invertebrates that are trying to recolonize naturally after measure implementations, so that even with sufficient source-populations with high ASPT scores upstream have high ASPT-values, drifting individuals might not be able to properly recolonize poorer stations downstream even if connectivity is increased. Sundermann et al. (2011) found that source populations needed to be in a 0 - 5 km radius in order for recolonization to occur in restoring areas. In other words, if there is no pool to disperse from, the restoration outcome may be poor, even though the habitat is suitable. In Verdal watershed, the chosen tributaries are all approximately within 2 km distance or less from the adjacent tributaries, but there may still be longer distances between restored areas and stations or tributaries with high diversities and good ecological conditions. Invertebrates that are strong flyers such as dragonflies and damselflies are not as affected by geographical location (Townsend et al., 2003).

The abundance also decreases with increased distance to the fjord. The negative relationship between distance from the fjord and abundance might be explained by the areas in the lower parts of the watershed receiving more nutrient loads from surrounding agricultural activities, while the upper parts runs through forest and uncultivated landscape. In stream habitats with an increased organic load, certain benthic organism taxa such as Chironomidae and Oligochaeta tend to dominate as they are nutrient tolerant (*Direktoratsgruppen Vanndirektivet, Veileder,02:2018*) These two taxa dominated certain samples, and together accounted for ~ 38 % of the total macroinvertebrates found. Although abundance normally decreases with direct effects of toxicants, abundance may both decrease or increase with indirect effects of toxicants (Fleeger et al., 2003).

Type of measure did not get much support compared to other parametres in any of the analyses performed using the benthic dataset, however Pedersen (2021) found that measuretype was important in explaining the density of 0+, with all types of measure having a positive influence on density. Still, measuretype might have an indirect effect on the macroinvertebrates as higher density of 0+ increases ASPT and Shannon Wiener diversity.

Density of 0+

Increasing density of 0+ positively affects the ASPT and Shannon wiener index scores. It is unclear whether this is due to the fish only using habitats that are already in better ecological conditions, thus having higher diversity and ASPT scores, if density of 0+ is a result of cumulative effects such as habitat characteristics, implemented measures and distance to fjord or if the presence of 0+ have direct effects on the macroinvertebrate community (for example through predation of dominating abundant taxa). Results may indicate that if density of 0+ increase in the duration after measures were implemented, or if new measures favorable for fish density is implemented, these will also benefit the benthic community in terms of better ecological condition and increased diversity and might therefore accelerate this process. Although Pedersen (2021) did not find evidence for density increase of 0+ connected to years since measure, it might just be too early in the progress to tell yet.

Alpha diversity

The most supported Shannon Wiener diversity model was " PC1 * PC3 + density.nullpluss + distance. Fjord". The model predicted an increase in Shannon Wiener diversity when both PC1 and PC3 were either high or low, when there was a higher density of 0+ and when the station was further away from the fjord. Diversity decreases with lower numbers of fish and decreased distance from the fjord. The most significant factor predicting Shannon Wiener diversity scores where the distance from the fjord, meaning stations in the lower parts of the watershed generally have lower diversity. In terms of habitat characteristics, this means that we find the highest Shannon Wiener diversity scores when the stream is wider with more algae coverage and vegetation by riverbed (low PC1 and PC3) or when there is coarser substrate, more presence of moss and a higher number of hiding spots (high PC1 and PC3). Further, lower index numbers are expected with higher PC3 values and low PC1 values. When PC3 is low and PC1 is high, diversity is at its all-time low.

Ecological status

Valbekken, Rossvollbekken, Karidalsbekken and Hyllbekken achieved a better ASPT range than previous years, and Ydselva, Skjørdalsbekken, Semsbekken and Kvellstadbekken received a lesser category score (table 2). Only one stream, Karidalsbekken managed to receive a good ecological score based on the ASPT-results. This means that 14 out of 15 streams received scores under the treshold of what is considered an acceptable ecological state based on EU´s water framework directive, and will based on benthic ASPT values ("one out, all out principle"alone require further measures) (FOR 2006 12.14 nr 1446).

When looking at ASPT-scores from all stations, 18 out of 59 stations (lower + upper subsample) had a good ecological condition (received a score of good or very good) and the remaining stations received a score under what is acceptable; 21 stations received a moderate score, and 18 stations received a score of poor or very poor (Appendix 6). The 18 stations that received a good ecological condition were often in the upper parts of the stream, while the stations that received bad scores were more evenly distributed but often in the middle or low stations, or affecting entire streams like in the case with Korsådal-stream. There were not any clear patterns of ASPT scores increasing with higher stations and decreasing with lower stations within a stream, but when comparing only the lowest and highest station within each stream the majority of the streams (Yds, Kvisla, Broskit, Rossvol, Korsådal, Stub, Skjørdal, Follo, Karidals and Kvellstad) received a higher ecological condition in the upper vs the lower parts (Appendix 6).

When comparing the ASPT values to results from previous years (2017 and 2018) the four streams Valbekken, Rossvollbekken, Karidalsbekken and Hyllbekken achieved a better ASPT score and Ydselva, Skjørdalsbekken, Kvellstadbekken and Semsbakken received worse scores. There seemed to be no trend in ASPT values for worse or better, which correlates with the ASPT scores not being explained by measuretype or years after measure (Hol, 2018 ; Esdar, 2019, Table 4).

If using the one out, all out principle, one bad station can influence the assessment of the entire stream. To be able to increase the overall quality of the streams, the lowest-scoring stations must be targeted. The streams that may be more easily improved are Sems, with only one station, Sems 4 receiving a score close under the threshold (ASPT = 5,8). Similarly, Hyll has one station with a score of moderate (ASPT = 5,9). Yds has only one unacceptable station, though this station is classified as very poor.

The most supported ASPT model was "PC1 * PC3 + Densitynullpluss", and the highest ASPT values were achieved when both PC1, PC3 and density of 0+ was high (Figure 4). In other words, ASPT increases with habitat characteristics like coarser substrate, increased moss coverage and number of hiding spots (Figure 1). The lowest ASPT values were expected at low density of 0+ and when PC1 was high and PC3 was low. The habitat characteristics associated with high PC1 and low PC3 values slightly increased depth and water velocity (Figure 1) as well as a lack of pools and large woody debris. Presence of dead wood and pools are closely related, as well as vegetation by the river. With more surrounding vegetation, there is a higher chance that dead wood will accumulate in the stream, potentially creating smaller pools and a more diverse habitat.

Abundance

Regarding abundance results, the top model was "Distance.to.fjord" . There was a significant negative interaction with increasing distance from fjord, meaning that the highest abundance was expected in stations in the lower parts of the watershed. The second model, was "distance.to.fjord + years.after.measure(^2)". Where years after measure had a slight impact, causing abundance to be at its lowest two years after measures were implemented, and then gradually increasing again. The pattern seen with increased abundance in the lower parts of the watershed was likely due to increased agricultural run-off in these areas, which may be further emphasized by lack of riparian vegetation.(Kaase & Katz, 2012)found that differences in riparian vegetation structure significantly influenced canopy cover and species richness, and that restoring vegetation by the riverbed was effective in combating run-off from surrounding agriculture, as well as sedimentation, decreasing the organic load that gets in to the waterbody. Run-off from manure used as fertilizer may also contain residue from veterinary pharmaceuticals like parasite treatment such as ivermectin, which can have toxic effects on the macroinvertebrates for up to 4 months after being stored in the field(Sands & Noll, 2022). Stone and Wallace (1998) found abundance to be three times higher in a clear-cut affected stream, indicating high amounts of dominating nutrient-tolerant taxa such as Chironomidae and Oligochaeta (Direktoratsgruppen Vanndirektivet, Veileder,02:2018) .

Functional groups

Active filter feeders were predicted to have a higher fraction in the macroinvertebrate community when PC1 values was over 0 and both PC2 and PC3 was negative. When PC2 and PC3 are negative, there is a lack of hiding spots and moss and there is a finer substratum. There is also slightly less vegetation in the floodzone. There is no positive habitat characteristics associated with negative PC2 and PC3.

When it comes to grazers and gatherers, the predicted fraction was highest when PC3 values were high and PC2 values were above -1. These parameters are associated with presence of vegetation surrounding the stream casting shadow (Shadow over water, floodzone and riverbed). It was likely that grazers and gatherers were just a small fraction of the community when PC3 values were low and PC1 values high, in addition to PC2 values being at zero. This is weakly associated with increased water velocity and depth. There was also a higher fraction when PC2 was positive, and PC1 and PC3 were negative. In other words, grazers and gatherers are more likely to dominate when there is increasing shadow, and when the stream is slightly wider, with slightly increased algae coverage and some shadow over the riverbed. Miners were most likely to have a larger fraction in the community when PC1 and PC3 were either high or low, and with negative PC2 values. To put it differently, they were most likely to hold a higher fraction when there were more hiding spots, coarser substrate and higher moss coverage in a slightly more narrow stream with little algae coverage and Slightly less vegetation by the riverbed or when the exact opposite was true. Shredders was only probable with low PC1 and PC3 values, as have been explained previously. Predators and passive filter feeders were unlikely to hold a bigger fraction of the community regardless of differences in habitat.

Study limitations

The collection of the macroinvertebrates should ideally happen several times in the duration of the year to be able to find all macroinvertebrates as they may be present in the river at different seasons due to differing life cycles (Bergan, 2007; Bergan & Nystad, 2003). Additionally, samples taken in March and October usually contain a higher abundance of species, as well as more developed individuals, making this the recommended time for sampling (Bergan, 2007). However, sampling two rounds was not chosen for this study due to practical reasons and time constrains, and all benthic samples were taken in late august along with the electric fishing. Even though samples were taken relatively late, many individuals were quite undeveloped which made identification a more difficult and time-consuming process. This, along with general inexperience in identifying benthic invertebrates, may have resulted in some invertebrates being classified to the wrong taxa or not being keyed to species as expected. Mistakes, if any are likely at species level, and are therefore influencing diversity, ordination, abundance and functional groups, and not ecological condition scores (ASPT). However, there was two families; Capniidae and Leuctriidae, that were sometimes impossible to differentiate due to individuals being too undeveloped. However, this did not affect ASPT scores as these families are scored equally in the index. The likelihood of mistakes in identification were relatively low, because I received help from an expert on identification of macroinvertebrates.

Due to time-limitations most samples were divided into four subsamples, depending on the size of the sample. This means that some samples were fully identified, and others were subsampled, likely causing differences in total taxa found vs total taxa present in the full sample even though all results were multiplied by number of subsamples. However, this was done as some samples contained very few individuals if subsampled, and others were too big to sample fully. There was a large range of sample sizes, potentially affecting diversity comparisons between different stations (Cao et.al, 2002). Additionally some individuals might have been lost in the process of removing vegetation and small twigs to prevent the plastic sample bag from rupturing, or later in the process when the samples were sorted. Samples were taken over the span of several days, and differences in water flow might have occurred due to rainfall. Kick-sampling was performed by two different people which might have caused differences in kick-force, and fatigue in the last days might have affected the force (Feeley, 2011). Habitat measurements were performed by three different people, and some differences in estimation of percentages of various measurements based on observation and perception must be expected.

Conclusions

ASPT values were closely related to the density of juvenile fish (0+). In order to improve ecological conditions in the streams, further efforts to enhance connectivity and habitat suitability for juvenile fish is preferred. This could mean that we will continue to see improvements in the benthic ASPT scores as the fish starts to use the habitats again. Further, facilitating habitats with more hiding spots, more moss coverage (shadow?) and coarser substrate could enhance the ASPT-values in the streams. Stations higher up in the watershed had higher macroinvertebrate diversity, likely due to the habitats being less impacted and influenced by agricultural run-off.

Implications for management and future research

Both SW diversity index and ASPT received the lowest score when PC1 was high, and PC3 was low. This means that the streams that typically receives the lowest diversity and ASPT scores are lacking pools, dead wood as well as vegetation by the floodzone. These habitat characteristics are important for receiving a better ecological condition in the streams. Measures on a broad scale might be necessary, since surrounding sites need to have a good source population that individuals can disperse from (Sundermann, 2011). The best measures to implement for higher ASPT scores are thus creating pools, re-establishing vegetation in the floodzone as well as doing measures that results in a higher abundance of juvenile fish. Functional groups may increase in relation to increasing amounts of years since clear-cutting riparian vegetation and may slowly return to fractions similar to the reference value over time (Stone & Wallace, 1998).

Re-establishing riparian vegetation in areas where this is lacking plays an important role in freshwater conservation due for its ability to increase the water quality by providing buffers for nutrient run-off, binding nutrients in soil and plant parts and providing shade and thus cooler water temperatures (Dosskey et.al., 2010). Maintaining riparian vegetation is implemented in the Norwegian law vannressursloven § 11,and a width of at least two metres is required in agricultural areas. Otherwise, the width of the zone is determined by the municipalities. Vegetation zone should ideally consist of trees because trees have been shown to be more effective nutrient -binders than grass, likely due to a larger root system that is more effective in binding the soil(Søvik, 2007). For best effect the zone should ideally be 5-10 metres in width (Søvik et al., 2008). Landowners are responsible for maintaining riperian vegetation but is not required to establish vegetation if this has already been altered (Staubo et.al., 2019). According to Mürer (2019), these requirements should be made clearer to landowners, and the collaboration between landowners, Statsforvalter and Verdal municipality should be improved as the laws regarding this can be easily misunderstood. Allowing riparian vegetation to grow could have some benefits to the land owners, with larger root systems leading to increased erosion-control, preventing loss of valuable food soil (Monteiro et.al., 2016). Further assessment of riparian vegetation should be conducted, focusing on assessing the extent of the vegetation along the tributary stretches, and the general attitudes towards riparian vegetation management by landowners as proposed by Mürer (2019).

The lowest diversity scores were expected in the lower parts of the watershed, and ASPT scores were generally lower in the lower stations of a stream compared to the upper stations. In future studies water quality and nutrient load should be assessed in order to get a broader picture of the stressors that influence the macroinvertebrate communities in the lower parts of the watershed, and measures should be proposed to be able to specifically better the ecological conditions of the stations receiving the lowest scores. Due to the “one out, all out principle” streams with bad conditions will influence the scores of the stream in its entirety, even though other stations may be of good quality, so even if results were slightly discouraging (1 out of 15 streams classified as acceptable), many streams are close to the threshold if the worst stations are improved. Additionally, other factors such as climate change could have had an impact on the benthic communities although this is beyond the scope of this study, for example by negatively affecting taxa that prefer colder water temperatures (Heino et al., 2009). Future studies could look into this to see if there is any connection with the macroinvertebrate communities and climate change.

References

Anonym. (2004). St.prp. nr. 75 (2003-2004) – supplering av verneplan for vassdrag: Olje- og energidepartementet.

Akaike, H. (1974). A new look at the statistical model identification. *IEEE transactions on automatic control*, 19 (6): 716-723.

Anderson, D. R. (2008). *Model based inference in the life sciences: a primer on evidence*, vol. 31: Springer.

Baker, E., Crump, J. & Harris, P. (2019). Global environment outlook (GEO-6): Healthy planet, healthy people.

Bernhardt, E. S. & Palmer, M. A. (2007). Restoring streams in an urbanizing world. *Freshwater biology*, 52 (4): 738-751.

Bradley, D. C. & Ormerod, S. J. (2002). Evaluating the precision of kick-sampling in upland streams for assessments of long-term change: the effects of sampling effort, habitat and rarity. *Archiv fur Hydrobiologie*, 155 (2): 199-221.

Brojer, M., Jäch, M. & Kodada, J. (2017). *COLEOPTERA: Water Beetles sl In: Moog, O. & Hartmann, A.(eds.), Fauna Aquatica Austriaca, 2017. Wien: Federal Ministry of Agriculture, Forestry, Environment and Water Management, 49 pp*.

Chester, E. T., Miller, A. D., Valenzuela, I., Wickson, S. J. & Robson, B. J. (2015). Drought survival strategies, dispersal potential and persistence of invertebrate species in an intermittent stream landscape. *Freshwater Biology*, 60 (10): 2066-2083.

Collier, K. J., Probert, P. K. & Jeffries, M. (2016). Conservation of aquatic invertebrates: concerns, challenges and conundrums. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 26 (5): 817-837.

Dauvin, J.-C., Bellan, G. & Bellan-Santini, D. (2010). Benthic indicators: from subjectivity to objectivity–where is the line? *Marine Pollution Bulletin*, 60 (7): 947-953.

Dobson, M., Pawley, S., Fletcher, M. & Powell, A. (2013). *Guide to freshwater invertebrates*: Freshwater Biological Association.

Dudgeon, D., Arthington, A. H., Gessner, M. O., Kawabata, Z.-I., Knowler, D. J., Lévêque, C., Naiman, R. J., Prieur-Richard, A.-H., Soto, D. & Stiassny, M. L. (2006). Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological reviews*, 81 (2): 163-182.

Elff, M. (2020). Mclogit: Multinomial logit models, with or without random effects or overdispersion. *R package version 0.8*, 5.

Esdar, L. C. R. (2019). *Spatial variation in benthic macroincertebrate community structures in tributaries of Verdal river: Effects of biotic and abiotic environmental factors and restoration measrues.* Master thesis. Ås: Norwegian University of Life Sciences.

Feeley, H. B., Woods, M., Baars, J.-R. & Kelly-Quinn, M. (2012). Refining a kick sampling strategy for the bioassessment of benthic macroinvertebrates in headwater streams. *Hydrobiologia*, 683 (1): 53-68.

Fleeger, J. W., Carman, K. R. & Nisbet, R. M. (2003). Indirect effects of contaminants in aquatic ecosystems. *Science of the total environment*, 317 (1-3): 207-233.

Forseth, T., Harby, A., Ugedal, O., Pulg, U., Fjeldstad, H.-P., Robertsen, G., Barlaup, B. T., Alfredsen, K., Sundt, H. & Saltveit, S. J. (2014). *Handbook for environmental design in regulated salmon rivers*.

Graf, W. (2002). Trichoptera. In Moog, O.(ed.): Fauna Aquatica Austriaca, Edition 2002. Wasserwirtschaftskataster, Bundesministerium für Land und Forswirtschaft. *Umwelt und Wasserwirtschaft*.

Graf, W., Murphy, J., Dahl, J., Zamora-Munoz, C. & López-Rodríguez, M. J. (2008). *Distribution and ecological preferences of European freshwater organisms. Volume 1. Trichoptera*, vol. 1: Pensoft Publishing.

Graf, W., Lorenz, A., de Figueroa, J. M. T., Lücke, S., López-Rodríguez, M. J. & Davies, C. (2009). *Distribution and ecological preferences of European freshwater organisms: Volume 2 Plecoptera*: Pensoft Publishing.

Heino, J., Virkkala, R. & Toivonen, H. (2009). Climate change and freshwater biodiversity: detected patterns, future trends and adaptations in northern regions. *Biological Reviews*, 84 (1): 39-54.

Hol, E. (2018). *Tapt areal og redusert produksjonsevne i Verdalsvassdragets sjøørretbekker*. Master thesis. Ås: Norwegian University of Life Sciences.

Hynes, H. B. N. & Hynes, H. (1970). *The ecology of running waters*, vol. 543: Liverpool University Press Liverpool.

Jenderedjian, K., Hakobyan, S. & Jenderedjian, A. (2007). Use of benthic invertebrates as indicators of pollution origin in agricultural and urban areas. In *Air, water and soil quality modelling for risk and impact assessment*, pp. 217-220: Springer.

Johnson, R. K., Wiederholm, T. & Rosenberg, D. M. (1993). Freshwater biomonitoring using individual organisms, populations, and species assemblages of benthic macroinvertebrates. *Freshwater biomonitoring and benthic macroinvertebrates*, 40: 158.

Johnson, R. K., Furse, M. T., Hering, D. & Sandin, L. (2007). Ecological relationships between stream communities and spatial scale: implications for designing catchment-level monitoring programmes. *Freshwater Biology*, 52 (5): 939-958.

Jourdan, J., Plath, M., Tonkin, J. D., Ceylan, M., Dumeier, A. C., Gellert, G., Graf, W., Hawkins, C. P., Kiel, E. & Lorenz, A. W. (2019). Reintroduction of freshwater macroinvertebrates: challenges and opportunities. *Biological Reviews*, 94 (2): 368-387.

Kaase, C. T. & Katz, G. L. (2012). Effects of stream restoration on woody riparian vegetation of Southern Appalachian Mountain Streams, North Carolina, USA. *Restoration Ecology*, 20 (5): 647-655.

Kovács, T., Bauernfeind, E., Ambrus, A. & Reisinger, W. (2002). *New records of mayflies from Austria (Insecta: Ephemeroptera)*: na.

Krogvold, P. & Sand, K. (2008). *Insektlære for fluefiskere*: Tun.

Leonardsson, K., Blomqvist, M. & Rosenberg, R. (2009). Theoretical and practical aspects on benthic quality assessment according to the EU-Water Framework Directive–examples from Swedish waters. *Marine Pollution Bulletin*, 58 (9): 1286-1296.

Li, F., Chung, N., BAE, M. J., KWON, Y. S. & PARK, Y. S. (2012). Relationships between stream macroinvertebrates and environmental variables at multiple spatial scales. *Freshwater Biology*, 57 (10): 2107-2124.

Lillehammer, A. (1988). *Stoneflies (Plecoptera) of Fennoscandian and Denmark*, vol. 21: Brill.

MacKenzie, D. I., Nichols, J. D., Royle, J. A., Pollock, K. H., Bailey, L. L. & Hines, J. E. (2017). *Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence*: Elsevier.

Milner, V. S., Willby, N. J., Gilvear, D. J. & Perfect, C. (2015). Linkages between reach-scale physical habitat and invertebrate assemblages in upland streams. *Marine and Freshwater Research*, 66 (5): 438-448.

Mürer, V. (2019). *Forvaltningsansvar for bevaring og restaurering av kantvegetasjon langs vassdrag: med fokus på sjøørretbekker i Verdal kommune.* Master thesis. Ås: Norwegian University of Life Sciences.

Naiman, R. J. & Turner, M. G. (2000). A future perspective on North America's freshwater ecosystems. *Ecological applications*, 10 (4): 958-970.

Nilsson, A. *Aquatic Insects of North Europe. A taxonomic handbook. Volume 2: Odonata, Diptera. 2099 Abb., 440 S*: Apollo Books) Stenstrup.

Nilsson, A. (1997). *Aquatic insects of North Europe: a taxonomic handbook*, vol. 1: Apollo books.

Outlook, C. G. B. (2020). *5—Summary for Policy Makers*. Secretariat of the Convention on Biological Diversity: Montreal, QB, Canada.

Rinne, A. & Wiberg-Larsen, P. (2017). Trichoptera larvae of Finland: A key to the caddis larvae of Finland and nearby countries. *Helsinki, Finland: Trificon Books.[Google Scholar]*.

Robson, B. & Chester, E. (1999). Spatial patterns of invertebrate species richness in a river: the relationship between riffles and microhabitats. *Australian Journal of Ecology*, 24 (6): 599-607.

Sands, B. & Noll, M. (2022). Toxicity of ivermectin residues in aged farmyard manure to terrestrial and freshwater invertebrates. *Insect Conservation and Diversity*, 15 (1): 9-18.

Schmidt-Kloiber, A. & Hering, D. (2015). www. freshwaterecology. info–An online tool that unifies, standardises and codifies more than 20,000 European freshwater organisms and their ecological preferences. *Ecological Indicators*, 53: 271-282.

Søvik, A. K. (2007). Vegetasjonssoner bidrar til renere vann i vassdrag og innsjøer.

Søvik, A. K., Syversen, N. & Mæhlum, T. (2008). Vegetasjonssoner som rensefilter for overflateavrenning-effekt av ulik vegetasjon og variasjon i renseeffekt over tid. *Bioforsk FOKUS*.

Stone, M. K. & Wallace, J. B. (1998). Long-term recovery of a mountain stream from clear-cut logging: the effects of forest succession on benthic invertebrate community structure. *Freshwater Biology*, 39 (1): 151-169.

Strayer, D. L. (2006). Challenges for freshwater invertebrate conservation. *Journal of the North American Benthological Society*, 25 (2): 271-287.

Sundermann, A., Stoll, S. & Haase, P. (2011). River restoration success depends on the species pool of the immediate surroundings. *Ecological Applications*, 21 (6): 1962-1971.

Townsend, C. R., Dolédec, S., Norris, R., Peacock, K. & Arbuckle, C. (2003). The influence of scale and geography on relationships between stream community composition and landscape variables: description and prediction. *Freshwater biology*, 48 (5): 768-785.

Wright, J., Armitage, P., Furse, M. & Moss, D. (1989). Prediction of invertebrate communities using stream measurements. *Regulated Rivers: Research & Management*, 4 (2): 147-155.

Zuur, A. F., Ieno, E. N., Walker, N. J., Saveliev, A. A. & Smith, G. M. (2009). *Mixed effects models and extensions in ecology with R*, vol. 574: Springer.

UN general assembly. (2019). United Nations Decade on Ecosystem Restoration (2021 – 2030). UN.

Vanndirektivet, D. (2018). Veileder 02:2018 Klassifisering av miljøtilstand i vann: Direktoratsgruppen for gjennomføringen av vannforskriften

Vannforskriften. (2019). Forskrift om rammer for vannforvaltningen Accessible from: https://lovdata.no/dokument/SF/forskrift/2006-12-15-1446 (Accessed 13.05.2022)

Vannressursloven. (2000). Lov om vassdrag og grunnvann (LOV-2000-11-24-82). Retrieved from: https://lovdata.no/pro/NL/lov/2000-11-24-82

Appendix

Table 1: List of species/lowest taxation. The abbreviations used in the data analysis are listed next to the lowest taxation. The second part of this table is on the next page.

Class	Sub class	Order	Family	Subfamily	Genus	Species	Lowest taxation	Abbrevation
							nematoda	Nemato
		Araneae					*Araneae*	Aranea
							Acari	Acari
		Diptera	Chironomidae				*Chironomidae pupae*	
		Diptera	Simuliidae				*Simuliidae*	Simuli
		Diptera	Dixidae				*Dixidae*	Dixida
		Diptera	Tipulidae	Limoniidae			*Limoniidae sp*	Limoni
		Diptera	Psychodidae				*Psychodidae*	Psycho
		Diptera	Pediciidae		Pedicia		*Pedicia*	Pedici
		Diptera	Pediciidae		Dicranota		*Dicranota*	Dicran
		Diptera	Tipulidae	Limoniidae			*Eleophila*	Eleoph
		Diptera	Tipulidae	Limoniidae			*Helius sp.*	Helius
		Diptera (Adult)					*Diptera adult*	
		Diptera	Tipulidae	Limoniidae			*scleroprocta sp.*	Sclero
		Diptera (pupae)					*Diptera pupae*	Diptpup
		Diptera	Chironomidae				*Chironomidae*	Chirom
		Diptera	Ceratopogonidae	Ceratopogoninae			*Ceratopogoninae*	Cerato
		Diptera	Ceratopogonidae	Dasyheleinae			*Dasyhelea*	Dasyhe
		Diptera	ptychopteridae				*ptychopteridae*	Ptycho
		Megaloptera	Sialidae			Sialis fuliginosa	*Sialis fuliginosa*	SiaFul
		Diptera	Tipulidae				*Tipulidae*	Tipuli
		Trichoptera	Limnephilidae				*Limnephilidae*	Limnep
		Trichoptera	Limnephilidae		villosa		*Chaetopteryx spp.*	Chaero.ssp
		Trichoptera	Beraeidae			Beraeodes minutus	*Beraeodes minutus*	BerMin
		Trichoptera	Sericostomatidae			Sericostoma personatum	*Sericostoma personatum*	SerPer
		Trichoptera	Brachycentridae			Brachycentrus subnubilus	*Brachycentrus subnubilus*	BraSub
		Trichoptera	Rhyacophilidae				*rhyacophila indet.*	***Rhyaco.ssp***
		Trichoptera	Glossosomatidae			agapetus ochripes	*agapetus ochripes*	AgaOch
		Trichoptera	Goeridae			silo pallipes	*silo pallipes*	SilPal
		Trichoptera	Polycentropodidae			Plectronemia conspersa	*Plectrocnemia conspersa*	PleCon
		Trichoptera	Polycentropodidae			Polycentropus flavomaculatus	*Polycentropus flavomaculatus*	PolFla
		Trichoptera	Rhyacophilidae			Rhyacophila fasciata	*Rhyacophila fasciata*	RhyFas
		Trichoptera	Rhyacophilidae			Rhyacophila nubila	*Rhyacophila nubila*	RhyNub
		Ephemeroptera	Ephemeridae			Ephemera vulgata	*Ephemera vulgata*	EphVul
		Ephemeroptera	Baetidae			Centroptilum luteolum	*Centroptilum luteolum*	CenLut
		Ephemeroptera	Baetidae			Baetis niger	*Baetis niger*	BaeNig
		Ephemeroptera	Baetidae			Baetis macani	*Baetis macani*	BaeMac
		Ephemeroptera	Baetidae			Alainites muticus	*Alainites muticus*	AlaMut
		Ephemeroptera	Baetidae			Baetis rhodani	*Baetis rhodani*	BaeRho
		Plecoptera	Nemouridae			Nemoura cinerea	*Nemoura cinerea*	NemCin
		Plecoptera	Capnidae				*capnia sp.*	
		Ephemeroptera	Baetidae				*baetis indet.*	***Baetis.sp***

Table 1 part 2 of 2.

Class	Sub class	Order	Family	Subfamily	Genus	Species	Lowest taxation	
Clitellata	Oligochaeta						*Oligochaeta*	Oligoc
Clitellata	Hirudinea						*Hirudinea*	Hirudi
Gastropoda			Bithyniidae				*Bithyniidae*	Bithyn
Gastropoda			Lymnaeidae				*Lymnaeidae*	Lymnae
Gastropoda			Planorbidae				*Planorbidae*	Planor
		Megaloptera					*megaloptera sp*	Megalo
Gastropoda							*Gastropoda sp*	Gastro
		Hemiptera	Gerridae				*Gerridae*	Gerrid
		Landlevende tege						
		Coleoptera	Dryopidae				***Dryopidae larvae***	***Dryopi***
		Coleoptera	Haliplidae				***Haliplidae adult***	***Halipl***
		Coleoptera	Dysticidae		Agabus		***agabus type larvae***	***Agatyp***
		Plecoptera	Perlodidae				***Perlodidae indet.***	***Perlod***
		Plecoptera	Siphlonuridae				***Siphlonuridae indet.***	***Siphlo***
		Plecoptera	Leuctridae			Enten leuctra eller capnia	***Leuctridae indet.***	***CapLau***
		Plecoptera	Leuctridae			Leuctra digitata	*Leuctra digitata*	LeuDig
		Plecoptera	Leuctridae			Leuctra fusca	*Leuctra fusca*	LeuFus
		Plecoptera	Capnidae			capnia bifrons	*capnia bifrons*	CapBif
		Plecoptera	Capnidae			capnopsis schilleri	*capnopsis schilleri*	CapSch
		Plecoptera	Perlodidae			diura nanseni	*diura nanseni*	DiuNan
		Plecoptera	Perlodidae			isoperla grammatica	*isoperla grammatica*	IsoGra
		Plecoptera	Perlodidae				***Isoperla indet.***	***Isoper***
		Plecoptera	Leuctridae			Leuctra nigra	*Leuctra nigra*	LeuNig
		Plecoptera	Leuctridae			Leuctra hippopus	*Leuctra hippopus*	LeuHip
							butterfly larvae	
		Plecoptera	Nemouridae				***Protonemura indet.***	***Proton***
		Plecoptera	Nemouridae			Amphinemura borealis	*Amphinemura borealis*	AmpBor
		Plecoptera	Nemouridae			Amphinemura standfussi	*Amphinemura standfussi*	AmpSta
		Plecoptera	Nemouridae			Amphinemura sulcicollis	*Amphinemura sulcicollis*	AmpSul
Entognatha	Collembola						*Collembola*	Collem
		Plecoptera	Nemouridae			Nemurella pictetii	*Nemurella pictetii*	NemPic
		Diptera	Stratiomyidae			Beris clavipes	*Beris clavipes*	BerCla
							sommerfugllarve	
		Landlevende bille						
		Coleoptera	Curculionidae				*Curculionidae*	Curcul
		Coleoptera	Elmidae				*Elmidae adult*	
		Coleoptera	Dytiscidae				*Dytiscidae*	Dytisc
		Coleoptera	Elmidae				*Elmis type larvae*	***Elmtyp***
		Coleoptera	Hydrophilidae				*Hydrophilidae*	Hydrop
		Coleoptera	Scirtidae				*Elodes*	Elodes
		Coleoptera	Hydraenidae		Hydraena		*Hydraena*	Hydrae
		Coleoptera	Hydraenidae		Hydraena	Hydraena gracilis	*Hydraena gracilis*	HydGra
Bivalvia		Veneroida	Sphaeriidae				*Pisidium*	Pisidu
		Isopoda	Asellidae			Asellus aquaticus	*Asellus aquaticus*	AseAqu

Table 2: Results from the taxation in the laboratory. The results show number individuals of each species/lowest taxation for each sample taken from each station. The table also includes total number of individuals of each species found in all stations added together and the fraction relative to the total amount of individuals found. The table spans for 30 pages.

ID	Nemato	Acari	Simuli	Dixida	Limoni	Psycho	Pedici	Dicran
EKL-1-L	0	0	8	0	0	0	0	8
EKL-1-U	0	0	0	12	0	0	0	0
EKL-2-L	4	0	4	16	0	44	0	28
EKL-2-U	0	0	32	0	0	48	0	16
YDS-1-L	0	0	0	0	0	0	0	8
YDS-1-U	12	0	4	0	0	4	0	8
YDS-2-L	0	0	0	4	0	6	0	10
YDS-2-U	0	0	0	0	0	3	0	0
YDS-3-L	0	0	0	0	0	292	0	8
YDS-3-U	0	4	0	0	0	0	0	2
YDS-4-L	0	0	4	16	0	428	0	12
YDS-4-U	0	5	1	8	0	63	0	2
VAL-1-L	0	0	0	4	0	4	0	8
VAL-1-U	0	6	0	2	0	92	0	18
VAL-2-L	0	0	1	5	0	78	0	10
VAL-2-U	0	3	1	4	0	16	0	0
VAL-3-L	0	8	32	8	0	320	0	12
VAL-3-U	0	12	168	56	0	584	0	8
VAL-4-L	0	0	32	52	0	476	0	40
VAL-4-U	0	0	48	20	0	640	0	28
STU-1-L	0	0	56	0	0	128	0	88
STU-1-U	0	0	16	8	0	120	0	80
STU-2-L	0	0	2	0	0	0	0	12
STU-2-U	0	4	40	12	0	0	0	28
KVI-1-L	0	0	0	0	0	0	0	0
KVI-1-U	0	0	0	0	0	0	0	0
KVI-2-L	0	8	16	0	0	144	0	24
KVI-2-U	0	0	12	0	0	0	0	4
KVI-3-L	0	4	0	0	0	4	0	0
KVI-3-U	0	0	0	0	0	2	0	0
KVI-4-L	0	4	0	0	0	12	0	12
KVI-4-U	0	0	0	0	0	1	0	0
BRO-1-L	0	0	0	0	0	0	0	4
BRO-1-U	0	0	0	0	0	8	0	8
BRO-2-L	0	2	0	0	0	0	0	0
BRO-2-U	0	0	1	0	0	9	0	1
BRO-3-L	0	4	4	0	0	4	0	0
BRO-3-U	0	0	4	0	0	4	0	0
BRO-4-L	0	16	4	0	0	4	0	0
BRO-4-U	0	0	40	0	0	4	0	0

Table 2 part 2 of 30.

ID	Nemato	Acari	Simuli	Dixida	Limoni	Psycho	Pedici	Dicran
BRO-5-L	0	0	0	0	0	0	0	0
BRO-5-U	0	4	4	0	0	0	0	8
BRO-6-L	0	4	16	0	0	6	0	6
BRO-6-U	0	2	0	0	0	2	0	12
BRO-7-L	0	0	2	0	0	6	0	8
BRO-7-U	0	0	2	0	0	4	0	48
BRO-8-L	16	0	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	14	0	0	0	20	0	4
FOL-1-U	0	0	0	2	0	0	0	20
FOL-2-L	0	4	0	0	0	48	0	0
FOL-2-U	0	2	1	0	0	30	0	2
FOL-3-L	0	8	16	0	0	1452	0	140
FOL-3-U	0	4	0	0	0	316	0	16
FOL-4-L	0	4	104	4	0	184	0	52
FOL-4-U	0	8	20	0	0	48	0	4
FOL-5-L	0	16	0	0	0	84	0	8
FOL-5-U	0	0	12	16	0	64	0	16
BJO-1-L	0	0	0	0	0	20	0	16
BJO-1-U	0	2	1	0	0	0	0	1
BJO-2-L	0	0	1	0	0	6	0	1
BJO-2-U	0	2	0	2	0	10	0	3
BJO-3-L	0	0	0	2	0	13	0	6
BJO-3-U	0	2	2	2	0	12	0	0
BJO-4-L	0	8	4	4	0	140	0	20
BJO-4-U	0	0	4	0	0	232	0	16
BJO-5-L	0	8	0	4	0	28	0	4
BJO-5-U	0	0	0	0	0	124	0	24
SKJ-1-L	0	0	0	0	0	2	0	2
SKJ-1-U	0	0	0	0	0	6	0	14
SKJ-2-L	0	0	0	0	0	26	0	82
SKJ-2-U	0	0	2	0	0	67	0	47
SKJ-3-L	0	0	0	0	0	26	0	4
SKJ-3-U	0	0	0	0	0	32	0	16
SKJ-4-L	0	4	2	0	0	194	0	26
SKJ-4-U	0	1	1	0	0	132	0	15
SKJ-5-L	0	0	0	2	0	52	0	12
SKJ-5-U	0	0	4	0	0	260	0	0
SKJ-6-L	0	4	6	2	0	116	0	16
SKJ-6-U	0	8	8	0	0	264	0	4

Table 2 part 3 of 30.

ID	Nemato	Acari	Simuli	Dixida	Limoni	Psycho	Pedici	Dicran
ROS-1-L	0	0	8	0	0	24	0	8
ROS-1-U	0	0	0	0	0	20	0	32
ROS-2-L	0	0	4	0	0	10	0	166
ROS-2-U	0	0	0	0	0	4	0	0
KVE-1-L	0	2	2	2	2	112	0	0
KVE-1-U	0	0	2	4	0	58	0	8
KVE-2-L	0	0	6	2	0	8	0	4
KVE-2-U	0	0	0	0	0	14	2	2
KVE-3-L	0	0	0	0	0	16	0	10
KVE-3-U	0	0	2	2	0	2	0	0
KVE-4-L	0	0	6	0	0	6	2	10
KVE-4-U	0	0	4	0	0	4	0	8
KVE-5-L	0	0	0	0	0	0	0	3
KVE-5-U	0	0	0	0	0	0	0	2
SEM-1-L	0	8	0	0	0	232	0	0
SEM-1-U	0	0	4	4	0	100	0	0
SEM-2-L	0	8	0	0	0	132	0	8
SEM-2-U	0	0	4	8	0	332	0	0
SEM-3-L	0	4	4	8	0	692	0	68
SEM-3-U	0	4	28	4	0	144	0	0
SEM-4-L	0	52	0	0	0	208	0	12
SEM-4-U	0	8	12	0	0	160	0	4
HYL-1-L	0	4	5	1	0	4	0	1
HYL-1-U	0	22	9	12	0	4	0	2
HYL-2-L	0	10	28	24	0	16	0	2
HYL-2-U	0	0	32	12	0	14	0	0
KAR-1-L	0	4	4	4	0	32	0	0
KAR-1-U	0	8	12	20	0	448	0	20
KAR-2-L	0	4	32	8	0	112	0	0
KAR-2-U	0	0	8	0	0	32	0	0
KAR-3-L	0	0	0	8	0	32	0	0
KAR-3-U	0	0	4	4	0	24	0	0
KOR-1-L	0	0	0	0	0	12	0	12
KOR-1-U	0	0	0	0	0	0	0	8
KOR-2-L	0	0	0	0	0	12	0	4
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	88	4	0	0	0	0
KOR-3-U	0	0	36	0	0	4	0	16
SUM	32	327	1086	398	2	10592	4	1570
Fraction	0.05 %	0.52 %	1.74 %	0.64 %	0.00 %	16.94 %	0.01 %	2.51 %

Table 2 part 4 of 30.

ID	Eleoph	Helius	Sclero	Diptpup	Chirom	Cerato	Dasyhe	Ptycho
EKL-1-L	0	0	0	0	24	0	0	0
EKL-1-U	0	0	0	0	96	0	0	0
EKL-2-L	8	0	0	0	1156	12	0	16
EKL-2-U	0	0	0	16	1328	16	16	0
YDS-1-L	0	0	0	0	156	8	0	0
YDS-1-U	0	0	0	4	40	0	0	0
YDS-2-L	2	0	0	4	28	6	0	0
YDS-2-U	0	0	0	0	27	0	0	0
YDS-3-L	0	0	0	0	8	0	0	0
YDS-3-U	0	0	0	2	22	0	0	0
YDS-4-L	0	0	0	0	0	0	0	0
YDS-4-U	2	0	0	0	4	0	0	0
VAL-1-L	4	0	0	12	652	0	0	4
VAL-1-U	4	0	2	0	84	6	0	0
VAL-2-L	0	0	5	2	29	8	0	0
VAL-2-U	0	0	0	0	20	0	0	0
VAL-3-L	0	0	0	0	136	16	0	0
VAL-3-U	12	0	8	8	116	28	0	0
VAL-4-L	4	0	0	0	128	16	0	0
VAL-4-U	4	0	0	8	180	8	0	0
STU-1-L	0	0	0	0	112	0	0	0
STU-1-U	0	0	0	0	704	0	0	0
STU-2-L	2	0	0	2	60	0	0	0
STU-2-U	8	0	0	8	252	0	0	0
KVI-1-L	0	0	0	0	152	0	0	0
KVI-1-U	0	0	0	1	3	0	0	0
KVI-2-L	8	0	0	32	1120	8	0	0
KVI-2-U	12	0	0	0	276	4	0	0
KVI-3-L	12	0	0	0	148	56	0	0
KVI-3-U	0	0	0	2	182	36	0	0
KVI-4-L	0	0	0	4	144	8	0	0
KVI-4-U	1	0	0	0	15	0	0	0
BRO-1-L	0	0	0	0	120	0	0	0
BRO-1-U	0	4	0	12	284	0	0	0
BRO-2-L	0	0	0	0	76	0	0	0
BRO-2-U	8	0	0	5	155	1	0	0
BRO-3-L	4	0	0	0	128	16	0	0
BRO-3-U	4	0	0	4	228	4	0	0
BRO-4-L	4	0	0	16	376	0	0	0
BRO-4-U	0	0	0	4	852	4	0	0

Table 2 part 5 of 30.

ID	Eleoph	Helius	Sclero	Diptpup	Chirom	Cerato	Dasyhe	Ptycho
BRO-5-L	0	0	0	0	244	0	0	0
BRO-5-U	0	0	0	0	380	12	0	0
BRO-6-L	0	0	0	4	100	0	0	0
BRO-6-U	0	0	0	2	70	0	0	0
BRO-7-L	4	0	0	0	34	0	0	0
BRO-7-U	14	0	4	2	32	2	0	0
BRO-8-L	0	0	0	16	1168	0	0	0
BRO-8-U	0	0	0	0	712	0	0	0
FOL-1-L	6	0	4	2	62	0	0	0
FOL-1-U	8	6	2	0	62	0	0	0
FOL-2-L	0	0	0	0	156	0	0	0
FOL-2-U	1	0	0	0	54	0	0	0
FOL-3-L	0	0	0	4	76	12	0	0
FOL-3-U	32	0	0	0	100	4	0	52
FOL-4-L	12	0	0	4	88	0	0	0
FOL-4-U	0	0	0	4	56	4	0	0
FOL-5-L	0	0	0	0	40	0	0	8
FOL-5-U	4	0	0	4	28	4	0	4
BJO-1-L	0	0	0	0	56	0	0	0
BJO-1-U	4	0	0	0	58	0	0	0
BJO-2-L	1	0	0	0	13	5	0	0
BJO-2-U	0	4	0	1	23	2	0	0
BJO-3-L	1	0	0	1	16	11	0	0
BJO-3-U	0	0	0	2	42	4	0	0
BJO-4-L	0	0	0	0	4	4	0	0
BJO-4-U	0	0	0	4	12	0	0	0
BJO-5-L	0	0	0	4	32	4	0	0
BJO-5-U	6	0	2	6	32	20	0	0
SKJ-1-L	2	0	0	2	58	4	0	2
SKJ-1-U	4	0	0	0	460	8	0	0
SKJ-2-L	0	0	0	2	86	4	0	0
SKJ-2-U	2	0	0	1	153	12	0	0
SKJ-3-L	2	0	0	4	16	0	0	0
SKJ-3-U	16	0	0	0	464	0	0	24
SKJ-4-L	4	0	0	0	32	2	0	0
SKJ-4-U	0	0	0	2	19	2	0	0
SKJ-5-L	8	0	0	0	22	0	2	0
SKJ-5-U	0	0	0	0	12	8	0	0
SKJ-6-L	4	0	0	2	16	0	2	0
SKJ-6-U	0	0	0	0	36	0	0	0

Table 2 part 6 of 30.

ID	Eleoph	Helius	Sclero	Diptpup	Chirom	Cerato	Dasyhe	Ptycho
ROS-1-L	8	16	0	16	752	0	0	0
ROS-1-U	6	0	0	0	22	0	0	2
ROS-2-L	0	0	2	0	54	0	0	0
ROS-2-U	0	0	0	0	112	0	0	0
KVE-1-L	0	0	0	0	6	0	0	0
KVE-1-U	0	0	0	2	4	2	0	0
KVE-2-L	0	0	0	0	2	0	0	0
KVE-2-U	0	0	0	2	2	0	0	0
KVE-3-L	0	0	0	0	10	0	0	0
KVE-3-U	0	4	0	2	10	0	0	0
KVE-4-L	0	0	0	0	18	0	0	0
KVE-4-U	0	0	0	0	12	0	0	0
KVE-5-L	0	0	0	0	4	0	0	0
KVE-5-U	0	0	0	2	3	0	0	0
SEM-1-L	0	0	0	0	88	0	4	0
SEM-1-U	4	0	0	0	12	0	0	0
SEM-2-L	0	0	0	4	12	0	0	0
SEM-2-U	0	0	0	0	0	4	0	0
SEM-3-L	0	0	0	8	12	0	0	0
SEM-3-U	0	0	0	0	12	0	0	0
SEM-4-L	0	0	0	0	24	16	0	0
SEM-4-U	0	0	0	0	4	4	0	0
HYL-1-L	0	0	0	0	24	0	1	0
HYL-1-U	1	0	0	0	31	0	0	0
HYL-2-L	0	0	0	0	58	0	0	0
HYL-2-U	2	0	0	0	46	0	0	0
KAR-1-L	0	0	0	4	24	0	0	0
KAR-1-U	12	0	0	20	60	4	0	0
KAR-2-L	0	0	0	0	48	0	0	0
KAR-2-U	0	0	0	4	8	0	0	0
KAR-3-L	4	0	0	4	20	0	0	0
KAR-3-U	0	0	0	0	4	0	0	0
KOR-1-L	4	0	0	0	164	0	0	0
KOR-1-U	0	0	0	0	184	8	0	0
KOR-2-L	0	0	0	0	64	0	0	0
KOR-2-U	0	0	0	0	448	0	0	0
KOR-3-L	4	0	0	4	96	28	0	0
KOR-3-U	28	0	0	0	284	8	0	0
SUM	311	34	29	291	17483	463	25	112
Fraction	0.50 %	0.05 %	0.05 %	0.47 %	27.96 %	0.74 %	0.04 %	0.18 %

Table 2 part 7 of 30.

ID	SiaFul	Tipuli	Limnep	Chaero ssp	BerMin	SerPer	BraSub	Rhyaco ssp
EKL-1-L	4	0	0	0	0	0	0	8
EKL-1-U	0	0	0	0	0	0	0	0
EKL-2-L	8	0	0	8	0	4	0	0
EKL-2-U	0	0	0	0	0	0	0	8
YDS-1-L	0	4	0	0	0	0	0	4
YDS-1-U	0	4	0	0	0	0	0	0
YDS-2-L	0	0	0	0	0	0	0	0
YDS-2-U	0	0	0	0	0	0	0	1
YDS-3-L	0	0	0	0	0	0	0	0
YDS-3-U	0	0	0	0	0	2	0	0
YDS-4-L	0	0	0	0	0	0	0	4
YDS-4-U	0	1	0	1	0	0	0	1
VAL-1-L	0	0	0	0	0	0	0	0
VAL-1-U	0	0	0	0	0	0	0	0
VAL-2-L	0	0	0	3	0	0	0	3
VAL-2-U	0	0	0	0	0	0	0	1
VAL-3-L	0	0	0	0	0	0	0	12
VAL-3-U	0	0	4	0	0	0	0	0
VAL-4-L	0	0	0	0	0	0	0	0
VAL-4-U	0	0	0	0	0	0	0	4
STU-1-L	0	8	0	0	0	0	8	0
STU-1-U	0	0	0	0	0	0	0	24
STU-2-L	0	0	0	0	0	0	0	4
STU-2-U	0	0	0	0	0	0	0	16
KVI-1-L	0	0	0	0	0	0	0	0
KVI-1-U	0	0	0	0	0	0	0	0
KVI-2-L	0	8	0	0	0	0	0	48
KVI-2-U	0	4	0	0	0	0	0	4
KVI-3-L	0	0	0	0	0	4	0	0
KVI-3-U	0	0	0	0	0	2	0	0
KVI-4-L	0	4	4	0	0	0	0	4
KVI-4-U	0	0	0	0	0	0	0	0
BRO-1-L	0	0	0	4	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	0	0	4	0	0	0	0
BRO-2-U	0	5	0	2	0	0	0	0
BRO-3-L	0	0	0	0	0	0	0	0
BRO-3-U	0	0	0	0	0	0	0	0
BRO-4-L	0	36	0	0	0	0	0	0
BRO-4-U	0	8	0	0	0	0	0	0

Table 2 part 8 of 30.

ID	SiaFul	Tipuli	Limnep	Chaero ssp	BerMin	SerPer	BraSub	Rhyaco ssp
BRO-5-L	0	0	0	0	0	0	0	0
BRO-5-U	0	0	0	0	0	0	0	8
BRO-6-L	0	0	2	0	0	4	0	26
BRO-6-U	0	0	0	0	0	0	0	8
BRO-7-L	0	0	0	0	6	2	0	0
BRO-7-U	0	2	0	0	0	0	0	0
BRO-8-L	0	0	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	0	0	0	0	0	0	0
FOL-1-U	0	2	0	0	0	0	0	0
FOL-2-L	0	0	0	0	0	0	0	4
FOL-2-U	0	0	0	0	0	0	0	6
FOL-3-L	0	0	0	0	0	0	0	0
FOL-3-U	0	0	0	0	0	0	0	0
FOL-4-L	0	0	0	0	0	0	0	0
FOL-4-U	0	0	0	0	0	0	0	28
FOL-5-L	0	0	0	0	0	0	0	0
FOL-5-U	0	4	0	0	0	8	0	4
BJO-1-L	0	0	0	0	0	0	0	0
BJO-1-U	0	0	0	0	0	0	0	1
BJO-2-L	0	12	0	0	0	0	0	0
BJO-2-U	0	0	0	0	0	0	0	0
BJO-3-L	0	0	0	0	0	0	0	0
BJO-3-U	0	0	0	0	0	0	0	0
BJO-4-L	0	0	0	0	0	0	0	0
BJO-4-U	0	0	0	0	0	0	0	0
BJO-5-L	0	0	0	0	0	0	0	0
BJO-5-U	0	0	0	0	0	0	0	0
SKJ-1-L	0	14	0	0	0	2	0	2
SKJ-1-U	0	24	0	0	0	0	2	0
SKJ-2-L	0	4	0	0	0	0	0	0
SKJ-2-U	0	7	0	0	0	1	0	0
SKJ-3-L	0	0	0	0	0	2	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	0	2	0	0	0	0	0	2
SKJ-4-U	0	0	0	0	0	0	0	0
SKJ-5-L	0	0	0	0	0	0	0	0
SKJ-5-U	0	0	0	0	0	8	0	0
SKJ-6-L	0	0	0	0	0	0	0	4
SKJ-6-U	0	0	0	0	0	0	0	28

Table 2 part 9 of 30.

ID	SiaFul	Tipuli	Limnep	Chaero ssp	BerMin	SerPer	BraSub	Rhyaco ssp
ROS-1-L	0	0	8	0	0	0	0	0
ROS-1-U	0	6	0	0	0	0	0	2
ROS-2-L	0	8	0	0	0	0	0	0
ROS-2-U	0	0	0	0	0	0	0	0
KVE-1-L	0	0	0	0	0	0	0	4
KVE-1-U	0	0	0	0	0	0	0	0
KVE-2-L	0	0	0	0	0	0	0	0
KVE-2-U	0	0	0	0	0	0	0	2
KVE-3-L	0	0	0	0	0	0	0	2
KVE-3-U	0	0	0	0	0	0	0	2
KVE-4-L	0	0	0	0	0	0	0	2
KVE-4-U	0	0	0	0	0	0	0	0
KVE-5-L	0	0	0	0	0	0	0	1
KVE-5-U	0	0	0	0	0	0	0	3
SEM-1-L	0	0	0	0	0	0	0	0
SEM-1-U	0	0	0	0	0	0	0	0
SEM-2-L	0	0	0	0	0	8	0	0
SEM-2-U	0	0	0	0	0	0	0	4
SEM-3-L	0	0	0	0	0	0	0	4
SEM-3-U	0	0	0	0	0	4	0	4
SEM-4-L	0	0	0	0	0	0	0	0
SEM-4-U	0	0	0	0	0	0	0	0
HYL-1-L	0	0	0	0	0	0	0	0
HYL-1-U	0	0	0	0	0	0	0	0
HYL-2-L	0	0	0	0	0	0	0	6
HYL-2-U	0	0	0	0	0	0	0	12
KAR-1-L	0	0	0	0	0	0	0	0
KAR-1-U	0	0	0	0	0	0	0	0
KAR-2-L	0	0	0	0	0	0	0	12
KAR-2-U	0	0	0	0	0	0	0	4
KAR-3-L	0	0	0	0	0	0	0	8
KAR-3-U	0	0	0	0	0	0	0	0
KOR-1-L	0	4	4	0	0	0	0	0
KOR-1-U	0	0	0	0	0	0	0	0
KOR-2-L	0	0	0	0	0	0	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	0	0	0	0	0	0
KOR-3-U	0	0	0	0	0	0	0	0
SUM	12	171	22	22	6	51	10	339
Fraction	0.02 %	0.27 %	0.04 %	0.04 %	0.01 %	0.08 %	0.02 %	0.54 %

Table 2 part 10 of 30.

ID	AgaOch	SilPal	PleCon	PolFla	RhyFas	RhyNub	EphVul	CenLut
EKL-1-L	0	0	4	0	8	0	0	0
EKL-1-U	0	0	0	0	0	0	0	0
EKL-2-L	0	0	0	0	0	0	0	0
EKL-2-U	0	0	0	0	0	0	0	0
YDS-1-L	0	0	0	0	0	0	0	0
YDS-1-U	0	0	0	0	0	0	0	0
YDS-2-L	0	0	0	0	0	0	0	0
YDS-2-U	0	0	1	0	0	0	0	0
YDS-3-L	0	4	0	0	0	0	0	0
YDS-3-U	0	2	0	0	0	0	0	0
YDS-4-L	0	0	0	0	0	0	0	0
YDS-4-U	0	3	0	0	0	1	0	0
VAL-1-L	0	0	0	0	0	4	0	4
VAL-1-U	4	0	0	0	0	2	0	0
VAL-2-L	1	2	0	0	1	0	0	0
VAL-2-U	0	0	0	0	0	0	0	0
VAL-3-L	0	0	0	0	0	4	0	0
VAL-3-U	0	0	0	0	0	0	0	0
VAL-4-L	0	4	0	0	0	0	0	0
VAL-4-U	0	0	0	0	0	0	0	0
STU-1-L	0	0	0	0	0	0	0	0
STU-1-U	0	0	0	0	0	24	0	0
STU-2-L	0	0	0	0	0	0	0	0
STU-2-U	0	0	0	0	0	0	0	0
KVI-1-L	0	0	0	0	0	0	0	0
KVI-1-U	0	0	0	0	0	0	0	0
KVI-2-L	0	0	0	0	0	0	0	0
KVI-2-U	0	0	0	0	0	4	0	0
KVI-3-L	0	0	0	0	0	0	4	0
KVI-3-U	0	0	0	2	0	0	0	0
KVI-4-L	0	12	32	0	0	4	0	0
KVI-4-U	0	0	0	0	0	0	0	0
BRO-1-L	0	0	0	0	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	0	0	0	0	0	0	0
BRO-2-U	0	0	0	0	0	0	0	0
BRO-3-L	0	0	0	0	0	0	0	0
BRO-3-U	0	0	0	0	0	0	0	0
BRO-4-L	0	0	0	0	0	0	0	16
BRO-4-U	0	0	0	0	0	0	0	4

Table 2 part 11 of 30.

ID	AgaOch	SilPal	PleCon	PolFla	RhyFas	RhyNub	EphVul	CenLut
BRO-5-L	0	0	0	0	0	0	0	4
BRO-5-U	0	0	0	0	12	0	0	0
BRO-6-L	0	0	0	0	0	2	0	0
BRO-6-U	0	0	0	0	0	4	0	0
BRO-7-L	0	0	0	0	0	0	0	0
BRO-7-U	0	0	0	0	0	0	0	0
BRO-8-L	0	0	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	0	0	0	0	0	0	0
FOL-1-U	0	0	0	0	0	0	0	0
FOL-2-L	0	0	0	0	0	8	0	0
FOL-2-U	0	0	0	0	2	3	0	0
FOL-3-L	0	0	0	0	0	0	0	0
FOL-3-U	0	0	0	0	0	0	0	0
FOL-4-L	0	0	0	0	4	0	0	0
FOL-4-U	0	0	0	0	0	0	0	0
FOL-5-L	0	0	0	0	0	0	0	0
FOL-5-U	0	0	0	0	0	0	0	0
BJO-1-L	0	0	0	0	0	0	0	0
BJO-1-U	0	0	0	0	0	0	0	0
BJO-2-L	0	0	0	0	0	0	0	0
BJO-2-U	0	0	0	0	0	0	0	0
BJO-3-L	0	0	0	0	0	0	0	0
BJO-3-U	0	0	0	0	0	0	0	0
BJO-4-L	0	0	0	0	0	0	0	0
BJO-4-U	0	0	0	0	0	0	0	0
BJO-5-L	0	0	0	0	0	4	0	0
BJO-5-U	0	2	0	0	0	0	0	0
SKJ-1-L	0	0	0	0	0	0	0	0
SKJ-1-U	0	0	0	0	0	0	0	0
SKJ-2-L	0	0	0	0	0	0	0	0
SKJ-2-U	1	3	0	0	0	1	0	0
SKJ-3-L	0	0	0	0	0	0	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	0	0	0	0	0	2	0	0
SKJ-4-U	0	0	0	0	0	0	0	0
SKJ-5-L	0	2	0	0	0	0	0	0
SKJ-5-U	0	8	0	0	0	4	0	0
SKJ-6-L	0	0	0	0	0	14	0	0
SKJ-6-U	0	0	0	0	0	4	0	0

Table 2 part 12 of 30.

ID	**AgaOch**	**SilPal**	**PleCon**	**PolFla**	**RhyFas**	**RhyNub**	**EphVul**	**CenLut**
ROS-1-L	0	0	0	0	0	0	0	0
ROS-1-U	0	0	0	0	2	8	0	0
ROS-2-L	0	0	0	0	0	6	0	0
ROS-2-U	0	0	0	0	0	0	0	0
KVE-1-L	0	2	0	0	0	20	0	0
KVE-1-U	0	0	0	0	0	10	0	0
KVE-2-L	0	0	0	0	0	4	0	0
KVE-2-U	0	0	0	0	0	8	0	0
KVE-3-L	0	0	0	0	0	6	0	0
KVE-3-U	0	0	0	0	0	4	0	0
KVE-4-L	0	0	0	0	0	10	0	0
KVE-4-U	0	0	0	0	0	8	0	0
KVE-5-L	0	0	0	0	0	2	0	0
KVE-5-U	0	0	0	0	0	1	0	0
SEM-1-L	0	0	4	0	0	4	0	0
SEM-1-U	0	0	0	0	0	8	0	0
SEM-2-L	0	0	0	0	0	0	0	0
SEM-2-U	0	0	0	0	0	0	0	0
SEM-3-L	0	0	0	0	0	4	0	0
SEM-3-U	0	8	8	0	0	12	0	0
SEM-4-L	0	0	0	0	0	0	0	0
SEM-4-U	0	28	0	0	0	0	0	0
HYL-1-L	0	1	0	0	0	1	0	0
HYL-1-U	0	0	1	0	0	3	0	0
HYL-2-L	0	0	0	0	0	14	0	0
HYL-2-U	0	0	0	0	0	16	0	0
KAR-1-L	0	0	0	0	0	12	0	0
KAR-1-U	0	0	0	0	0	4	0	0
KAR-2-L	0	0	0	0	0	4	0	0
KAR-2-U	0	0	0	0	0	0	0	0
KAR-3-L	0	12	0	0	0	0	0	0
KAR-3-U	0	0	0	0	0	0	0	0
KOR-1-L	0	0	0	0	0	0	0	0
KOR-1-U	0	0	0	0	0	0	0	0
KOR-2-L	0	4	0	0	0	4	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	0	0	0	0	0	0
KOR-3-U	0	0	0	0	0	0	0	0
SUM	6	97	50	2	29	262	4	28
Fraction	0.01 %	0.16 %	0.08 %	0.00 %	0.05 %	0.42 %	0.01 %	0.04 %

Table 2 part 13 of 30.

ID	BaeNig	BaeMac	AlaMut	BaeRho	NemCin	Baetis	Oligoc	Hirudi
EKL-1-L	0	0	0	0	0	0	0	0
EKL-1-U	0	0	20	4	0	0	16	0
EKL-2-L	0	0	28	20	8	0	68	0
EKL-2-U	32	0	144	256	40	0	88	0
YDS-1-L	0	0	0	0	0	0	344	0
YDS-1-U	0	0	0	8	0	0	596	0
YDS-2-L	0	0	2	0	0	0	38	0
YDS-2-U	0	0	2	0	0	0	1	0
YDS-3-L	0	0	56	0	0	0	144	0
YDS-3-U	0	0	8	10	0	0	14	0
YDS-4-L	0	0	72	32	8	0	56	0
YDS-4-U	0	0	87	8	4	0	2	0
VAL-1-L	0	0	0	0	0	0	196	0
VAL-1-U	0	0	6	166	2	0	20	0
VAL-2-L	0	0	24	237	0	0	12	1
VAL-2-U	0	0	5	71	1	0	4	2
VAL-3-L	0	0	32	216	0	0	148	0
VAL-3-U	4	0	36	208	0	0	108	0
VAL-4-L	0	0	0	72	0	0	16	0
VAL-4-U	0	0	8	32	0	4	20	0
STU-1-L	0	0	0	32	0	0	64	0
STU-1-U	0	0	24	304	120	0	32	0
STU-2-L	0	0	0	20	24	0	6	0
STU-2-U	0	0	0	72	88	0	4	0
KVI-1-L	0	0	0	0	0	0	8	0
KVI-1-U	0	0	0	0	0	0	12	1
KVI-2-L	0	0	32	88	16	0	48	0
KVI-2-U	0	0	0	0	12	16	16	0
KVI-3-L	0	0	0	0	0	4	48	4
KVI-3-U	0	0	0	0	4	4	2	0
KVI-4-L	0	0	140	88	0	0	112	0
KVI-4-U	0	1	0	1	0	0	3	0
BRO-1-L	0	0	0	0	0	0	16	0
BRO-1-U	0	0	0	0	0	0	40	0
BRO-2-L	0	0	0	22	0	0	204	0
BRO-2-U	0	0	0	106	1	0	44	0
BRO-3-L	0	0	124	4	4	0	24	0
BRO-3-U	0	0	40	68	0	0	4	0
BRO-4-L	0	0	416	400	20	0	24	0
BRO-4-U	0	0	624	84	108	0	0	0

Table 2 part 14 of 30.

ID	BaeNig	BaeMac	AlaMut	BaeRho	NemCin	Baetis	Oligoc	Hirudi
BRO-5-L	0	0	16	4	0	0	24	0
BRO-5-U	0	0	20	236	28	0	28	0
BRO-6-L	0	0	0	110	10	0	6	0
BRO-6-U	0	0	0	22	8	0	0	0
BRO-7-L	0	0	2	6	8	0	132	0
BRO-7-U	0	0	0	8	8	0	172	0
BRO-8-L	0	0	0	0	0	0	224	0
BRO-8-U	0	0	0	0	8	0	560	0
FOL-1-L	0	0	4	0	0	0	6	0
FOL-1-U	0	0	0	0	0	0	4	0
FOL-2-L	0	0	12	8	4	0	4	0
FOL-2-U	11	0	0	68	0	0	4	0
FOL-3-L	0	0	200	384	8	0	12	0
FOL-3-U	0	0	20	32	0	0	92	0
FOL-4-L	0	0	88	156	20	0	92	0
FOL-4-U	0	0	76	104	4	0	24	0
FOL-5-L	0	0	44	40	0	0	0	0
FOL-5-U	0	0	64	144	4	0	4	0
BJO-1-L	0	0	0	4	0	0	32	0
BJO-1-U	0	0	1	2	0	0	3	0
BJO-2-L	0	0	0	8	0	0	10	0
BJO-2-U	0	0	1	9	0	0	14	1
BJO-3-L	0	0	0	4	0	0	21	0
BJO-3-U	0	0	4	4	0	0	36	0
BJO-4-L	0	0	20	40	0	0	28	0
BJO-4-U	0	0	32	124	0	0	60	0
BJO-5-L	0	0	28	28	0	0	20	0
BJO-5-U	0	0	0	4	0	0	40	0
SKJ-1-L	0	0	4	0	0	0	34	0
SKJ-1-U	0	0	2	4	0	0	58	0
SKJ-2-L	0	0	0	2	2	0	14	0
SKJ-2-U	0	0	0	5	5	0	27	0
SKJ-3-L	0	0	0	0	0	0	4	0
SKJ-3-U	0	0	0	0	0	0	16	0
SKJ-4-L	0	0	4	14	0	0	10	0
SKJ-4-U	0	0	1	0	0	0	7	0
SKJ-5-L	0	0	2	68	8	0	8	0
SKJ-5-U	0	0	4	64	0	4	8	0
SKJ-6-L	0	0	6	144	12	0	10	0
SKJ-6-U	0	0	24	168	52	0	20	0

Table 2 part 15 of 30.

ID	BaeNig	BaeMac	AlaMut	BaeRho	NemCin	Baetis	Oligoc	Hirudi
ROS-1-L	0	0	0	56	0	0	96	0
ROS-1-U	0	0	178	430	0	0	22	0
ROS-2-L	0	0	734	378	166	0	18	0
ROS-2-U	0	0	32	108	0	0	28	0
KVE-1-L	0	0	4	64	2	0	6	0
KVE-1-U	0	0	0	32	2	0	14	0
KVE-2-L	0	0	0	92	4	0	2	0
KVE-2-U	0	0	0	20	0	0	0	0
KVE-3-L	0	0	0	32	0	0	4	0
KVE-3-U	0	0	0	8	0	0	10	0
KVE-4-L	2	0	0	118	4	0	0	0
KVE-4-U	0	0	0	96	8	0	0	0
KVE-5-L	0	0	0	81	6	0	0	0
KVE-5-U	0	0	2	57	4	0	0	0
SEM-1-L	0	0	0	224	0	0	0	0
SEM-1-U	0	0	0	108	0	0	0	0
SEM-2-L	0	0	56	16	0	0	8	0
SEM-2-U	0	0	268	160	4	0	4	0
SEM-3-L	0	0	360	208	0	0	48	0
SEM-3-U	0	0	240	44	8	0	4	0
SEM-4-L	0	0	244	356	0	0	20	0
SEM-4-U	0	0	72	232	0	0	12	0
HYL-1-L	0	0	4	18	4	0	5	0
HYL-1-U	13	0	3	37	4	0	4	0
HYL-2-L	0	0	10	72	4	0	0	0
HYL-2-U	0	0	4	148	4	0	4	0
KAR-1-L	0	0	20	104	32	0	32	0
KAR-1-U	0	0	36	256	36	0	32	0
KAR-2-L	0	0	80	288	32	0	40	0
KAR-2-U	0	0	8	228	8	4	12	0
KAR-3-L	4	0	92	336	20	0	52	0
KAR-3-U	0	0	24	248	20	0	8	0
KOR-1-L	0	0	0	1	4	0	40	0
KOR-1-U	0	0	0	0	0	0	272	0
KOR-2-L	0	0	0	52	120	0	164	0
KOR-2-U	0	0	0	0	0	0	568	0
KOR-3-L	0	0	0	4	0	0	8	0
KOR-3-U	0	0	0	8	8	0	12	0
SUM	66	1	5080	9367	1153	36	6019	9
Fraction	0.11 %	0.00 %	8.12 %	14.98 %	1.84 %	0.06 %	9.62 %	0.01 %

Table 2 part 16 of 30.

ID	Bithyn	Lymnae	Planor	Megalo	Gastro	Gerrid	Dryopi	Halipl
EKL-1-L	0	0	0	0	4	0	0	0
EKL-1-U	0	8	0	0	0	0	0	0
EKL-2-L	0	0	0	0	0	0	0	0
EKL-2-U	0	0	0	0	0	0	0	0
YDS-1-L	0	44	0	0	0	0	0	0
YDS-1-U	0	228	0	0	0	0	0	0
YDS-2-L	0	0	0	0	0	0	0	0
YDS-2-U	0	0	0	0	0	0	0	0
YDS-3-L	0	0	0	0	0	0	0	0
YDS-3-U	0	0	0	0	0	0	0	0
YDS-4-L	0	0	0	0	0	0	0	0
YDS-4-U	0	0	1	0	0	0	0	0
VAL-1-L	0	0	0	0	0	0	0	0
VAL-1-U	0	0	0	0	0	0	0	0
VAL-2-L	0	2	0	0	0	0	0	0
VAL-2-U	0	1	0	0	1	0	0	1
VAL-3-L	0	0	0	0	0	0	0	0
VAL-3-U	0	0	0	0	0	0	0	0
VAL-4-L	0	4	4	0	0	0	0	0
VAL-4-U	0	0	0	0	0	0	0	0
STU-1-L	0	8	0	0	0	0	0	0
STU-1-U	0	0	0	0	0	0	0	0
STU-2-L	0	0	0	0	0	0	0	0
STU-2-U	0	0	0	0	0	0	0	0
KVI-1-L	0	32	8	0	0	0	0	0
KVI-1-U	0	52	72	0	0	0	0	0
KVI-2-L	0	24	0	0	0	0	0	0
KVI-2-U	0	20	0	0	0	0	0	0
KVI-3-L	0	0	0	0	0	0	0	0
KVI-3-U	0	0	0	2	0	0	0	0
KVI-4-L	0	0	0	0	0	0	0	0
KVI-4-U	0	0	0	0	0	0	0	0
BRO-1-L	0	0	0	0	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	2	0	0	0	0	0	0
BRO-2-U	0	0	0	0	0	0	0	0
BRO-3-L	0	0	0	0	0	0	0	0
BRO-3-U	0	0	0	0	0	0	0	0
BRO-4-L	0	0	0	0	0	0	0	0
BRO-4-U	0	0	0	0	0	0	0	0

Table 2 part 17 of 30.

ID	Bithyn	Lymnae	Planor	Megalo	Gastro	Gerrid	Dryopi	Halipl
BRO-5-L	0	12	0	0	0	0	0	0
BRO-5-U	0	0	0	0	0	0	0	0
BRO-6-L	0	0	0	0	0	0	0	0
BRO-6-U	0	0	0	0	0	0	0	0
BRO-7-L	0	0	2	0	0	0	0	0
BRO-7-U	0	0	0	0	0	0	0	0
BRO-8-L	16	0	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	6	0	0	0	0	0	0
FOL-1-U	0	0	0	0	4	0	0	0
FOL-2-L	0	0	0	0	0	0	0	0
FOL-2-U	0	1	0	0	0	0	0	0
FOL-3-L	0	4	0	0	0	0	4	0
FOL-3-U	0	0	0	0	0	0	0	0
FOL-4-L	0	4	0	0	0	0	0	0
FOL-4-U	0	0	0	0	0	0	8	4
FOL-5-L	0	0	0	0	4	0	0	0
FOL-5-U	0	0	0	0	0	0	0	0
BJO-1-L	0	0	0	0	0	0	0	0
BJO-1-U	0	0	0	0	0	0	0	0
BJO-2-L	0	0	0	0	0	0	0	0
BJO-2-U	0	0	0	0	0	0	0	0
BJO-3-L	0	0	1	0	0	0	0	0
BJO-3-U	0	0	0	0	0	0	0	0
BJO-4-L	0	0	4	0	0	0	4	0
BJO-4-U	0	0	0	0	0	0	0	0
BJO-5-L	0	0	0	0	4	0	0	0
BJO-5-U	0	0	0	0	0	0	0	2
SKJ-1-L	0	0	2	0	0	0	0	0
SKJ-1-U	0	0	0	0	0	0	0	0
SKJ-2-L	0	0	0	0	0	0	0	0
SKJ-2-U	0	0	0	0	0	2	1	0
SKJ-3-L	0	0	0	0	0	0	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	0	0	0	0	0	0	2	0
SKJ-4-U	0	0	0	0	0	0	0	0
SKJ-5-L	0	0	2	0	0	0	0	0
SKJ-5-U	0	0	0	0	0	0	0	0
SKJ-6-L	0	0	2	0	0	0	0	0
SKJ-6-U	0	0	0	0	0	0	0	0

Table 2 part 18 of 30.

ID	Bithyn	Lymnae	Planor	Megalo	Gastro	Gerrid	Dryopi	Halipl
ROS-1-L	0	0	0	0	0	0	0	0
ROS-1-U	0	2	0	0	0	0	0	0
ROS-2-L	0	0	0	0	0	0	0	0
ROS-2-U	0	0	0	0	0	0	0	0
KVE-1-L	0	0	0	0	0	0	0	0
KVE-1-U	0	0	0	0	0	0	2	0
KVE-2-L	0	0	0	0	0	0	0	0
KVE-2-U	0	0	0	0	0	0	0	0
KVE-3-L	0	0	0	0	2	0	0	0
KVE-3-U	0	0	0	0	0	0	0	0
KVE-4-L	0	0	0	0	2	0	0	0
KVE-4-U	0	0	0	0	0	0	0	0
KVE-5-L	0	0	0	0	0	0	0	0
KVE-5-U	0	0	1	0	0	0	0	0
SEM-1-L	0	0	0	0	4	0	0	0
SEM-1-U	0	0	0	0	0	0	0	0
SEM-2-L	0	0	0	0	0	0	0	0
SEM-2-U	0	0	0	0	0	0	0	0
SEM-3-L	0	0	0	0	0	0	0	0
SEM-3-U	0	0	0	0	0	0	0	0
SEM-4-L	0	8	0	0	0	0	0	0
SEM-4-U	0	0	0	0	0	0	0	0
HYL-1-L	0	0	0	0	1	0	0	0
HYL-1-U	0	0	0	0	0	0	0	0
HYL-2-L	0	0	0	0	2	0	0	0
HYL-2-U	0	0	0	0	2	0	0	0
KAR-1-L	0	0	0	0	0	0	0	0
KAR-1-U	0	16	0	0	0	0	0	0
KAR-2-L	0	0	0	0	0	0	0	0
KAR-2-U	0	0	0	0	0	0	0	0
KAR-3-L	0	0	4	0	0	0	0	0
KAR-3-U	0	0	0	0	0	0	0	0
KOR-1-L	0	4	4	0	4	0	0	0
KOR-1-U	0	80	0	0	0	0	0	0
KOR-2-L	0	0	0	0	0	0	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	0	0	60	0	0	0
KOR-3-U	0	0	0	0	8	0	0	0
SUM	16	562	107	2	102	2	21	7
Fraction	0.03 %	0.90 %	0.17 %	0.00 %	0.16 %	0.00 %	0.03 %	0.01 %

Table 2 part 19 of 30.

ID	Agatyp	Perlod	Siphlo	CapLau	LeuDig	LeuFus	CapBif	CapSch
EKL-1-L	0	4	4	8	0	0	0	0
EKL-1-U	0	0	0	0	0	0	0	0
EKL-2-L	0	0	0	0	0	0	0	0
EKL-2-U	0	0	0	0	0	0	0	0
YDS-1-L	0	0	0	0	0	8	0	0
YDS-1-U	0	0	0	0	0	20	0	0
YDS-2-L	0	0	0	0	0	0	0	0
YDS-2-U	0	0	0	0	0	0	0	0
YDS-3-L	0	0	0	16	0	44	0	0
YDS-3-U	2	0	0	6	0	0	0	0
YDS-4-L	0	0	0	4	0	0	0	0
YDS-4-U	0	0	0	7	0	0	0	0
VAL-1-L	0	0	0	0	0	0	0	0
VAL-1-U	0	0	0	0	0	0	0	0
VAL-2-L	0	0	0	0	0	0	1	0
VAL-2-U	0	0	0	1	0	0	0	0
VAL-3-L	0	0	0	0	0	0	0	0
VAL-3-U	4	0	0	0	0	0	0	0
VAL-4-L	0	0	0	8	0	0	0	4
VAL-4-U	0	0	0	0	0	0	0	0
STU-1-L	0	0	0	0	0	0	0	0
STU-1-U	0	0	0	64	0	0	0	0
STU-2-L	0	0	0	0	0	0	0	0
STU-2-U	0	0	0	8	0	0	0	0
KVI-1-L	0	0	0	0	0	0	0	0
KVI-1-U	0	0	0	0	0	0	0	0
KVI-2-L	0	0	0	64	0	0	0	0
KVI-2-U	8	0	0	4	0	0	0	0
KVI-3-L	0	0	0	0	0	0	0	0
KVI-3-U	14	0	0	4	0	0	0	0
KVI-4-L	0	0	0	0	0	0	0	0
KVI-4-U	1	0	0	0	0	0	0	0
BRO-1-L	0	0	0	0	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	0	0	0	0	0	0	0
BRO-2-U	0	0	0	0	0	0	0	0
BRO-3-L	0	0	0	0	0	0	0	0
BRO-3-U	16	0	0	0	0	0	0	0
BRO-4-L	4	0	0	0	0	0	0	0
BRO-4-U	8	0	0	0	0	0	0	0

Table 2 part 20 of 30.

ID	**Agatyp**	**Perlod**	**Siphlo**	**CapLau**	**LeuDig**	**LeuFus**	**CapBif**	**CapSch**
BRO-5-L	12	0	0	0	0	0	0	0
BRO-5-U	0	0	0	32	0	0	4	0
BRO-6-L	0	0	0	2	0	0	0	0
BRO-6-U	0	0	0	4	0	0	4	0
BRO-7-L	0	0	0	6	0	0	0	0
BRO-7-U	0	0	0	0	0	0	0	0
BRO-8-L	0	0	0	0	32	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	4	0	0	0	0	0	0	0
FOL-1-U	0	0	0	0	0	0	0	0
FOL-2-L	0	0	0	0	0	0	0	0
FOL-2-U	0	0	0	0	0	0	0	0
FOL-3-L	0	0	0	8	0	0	0	0
FOL-3-U	4	0	0	4	0	0	0	0
FOL-4-L	0	0	0	32	0	0	0	0
FOL-4-U	4	0	0	8	0	0	0	0
FOL-5-L	0	0	0	4	0	0	0	4
FOL-5-U	0	0	0	0	0	0	8	4
BJO-1-L	0	0	0	4	0	0	0	0
BJO-1-U	0	0	0	1	0	0	0	0
BJO-2-L	0	0	0	0	0	0	0	0
BJO-2-U	0	0	0	4	0	0	0	0
BJO-3-L	0	0	0	1	0	0	0	0
BJO-3-U	0	0	0	2	0	0	0	0
BJO-4-L	4	0	0	28	0	0	0	0
BJO-4-U	0	0	0	0	0	0	0	0
BJO-5-L	0	0	0	52	0	0	0	0
BJO-5-U	0	0	0	0	0	0	0	0
SKJ-1-L	2	0	0	0	0	0	6	2
SKJ-1-U	2	0	0	10	0	0	0	0
SKJ-2-L	0	0	0	0	0	0	0	0
SKJ-2-U	1	0	0	2	0	0	1	0
SKJ-3-L	0	0	0	0	0	0	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	4	0	0	12	0	2	0	0
SKJ-4-U	0	0	0	3	0	0	0	0
SKJ-5-L	0	0	0	24	0	0	0	0
SKJ-5-U	4	0	0	20	4	0	0	0
SKJ-6-L	0	0	0	0	4	0	6	0
SKJ-6-U	0	0	0	44	0	0	0	0

Table 2 part 21 of 30.

ID	Agatyp	Perlod	Siphlo	CapLau	LeuDig	LeuFus	CapBif	CapSch
ROS-1-L	104	0	0	0	0	0	0	0
ROS-1-U	0	0	0	42	0	0	0	0
ROS-2-L	2	0	0	2	0	0	0	0
ROS-2-U	0	0	0	0	0	0	0	0
KVE-1-L	0	0	0	0	0	0	0	0
KVE-1-U	0	0	0	0	0	0	0	0
KVE-2-L	0	0	0	0	0	0	0	0
KVE-2-U	0	0	0	0	0	0	0	0
KVE-3-L	0	0	0	0	0	0	0	0
KVE-3-U	0	0	0	0	0	0	0	0
KVE-4-L	0	0	0	6	0	0	0	0
KVE-4-U	0	0	0	0	0	0	0	0
KVE-5-L	0	0	0	1	1	0	0	0
KVE-5-U	0	0	0	1	0	0	0	0
SEM-1-L	0	0	0	0	0	8	0	0
SEM-1-U	0	0	0	4	0	0	4	0
SEM-2-L	0	0	0	12	0	0	0	0
SEM-2-U	0	0	0	0	0	0	0	0
SEM-3-L	0	0	0	4	0	0	0	0
SEM-3-U	0	0	0	8	0	0	0	0
SEM-4-L	0	0	0	40	0	0	0	0
SEM-4-U	0	0	0	8	0	0	0	0
HYL-1-L	0	0	0	4	0	0	0	0
HYL-1-U	0	0	0	9	0	0	0	0
HYL-2-L	0	0	0	4	0	0	0	0
HYL-2-U	0	0	0	0	0	0	0	0
KAR-1-L	0	0	0	12	0	0	0	0
KAR-1-U	4	0	0	44	0	0	0	0
KAR-2-L	0	0	0	8	0	0	0	0
KAR-2-U	0	0	0	8	0	0	0	0
KAR-3-L	0	0	0	8	0	0	0	0
KAR-3-U	0	0	0	12	0	0	0	0
KOR-1-L	0	0	0	0	0	0	0	0
KOR-1-U	0	0	0	0	0	0	0	0
KOR-2-L	0	0	0	4	0	0	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	0	0	0	0	0	0
KOR-3-U	4	0	0	0	0	0	0	0
SUM	212	4	4	742	41	82	34	14
Fraction	0.34 %	0.01 %	0.01 %	1.19 %	0.07 %	0.13 %	0.05 %	0.02 %

Table 2 part 22 of 30.

ID	DiuNan	IsoGra	Isoper	LeuNig	LeuHip	Proton	AmpBor	AmpSta
EKL-1-L	0	0	0	0	0	0	0	0
EKL-1-U	0	0	0	0	0	0	0	0
EKL-2-L	0	0	0	0	0	0	0	0
EKL-2-U	0	0	0	0	0	0	0	0
YDS-1-L	0	0	0	0	0	0	0	0
YDS-1-U	0	0	0	0	0	0	0	0
YDS-2-L	0	0	0	0	0	0	0	0
YDS-2-U	0	0	0	0	0	0	0	0
YDS-3-L	0	0	4	0	0	0	0	0
YDS-3-U	0	0	0	0	20	0	0	0
YDS-4-L	0	0	8	0	0	0	0	0
YDS-4-U	0	0	1	0	4	0	0	0
VAL-1-L	0	0	0	0	0	0	0	0
VAL-1-U	0	0	0	0	2	0	0	0
VAL-2-L	0	0	0	0	0	0	0	0
VAL-2-U	0	0	0	0	0	0	0	0
VAL-3-L	0	0	0	0	12	0	0	0
VAL-3-U	0	0	0	0	0	0	0	0
VAL-4-L	0	0	0	0	12	0	0	0
VAL-4-U	0	0	0	0	0	0	0	0
STU-1-L	0	0	0	0	0	0	0	0
STU-1-U	0	0	0	0	0	0	0	0
STU-2-L	0	0	0	0	0	0	0	2
STU-2-U	0	0	0	0	0	0	40	4
KVI-1-L	0	0	0	0	0	0	0	0
KVI-1-U	0	0	0	0	0	0	0	0
KVI-2-L	0	0	0	0	0	0	0	0
KVI-2-U	0	0	0	0	0	0	0	0
KVI-3-L	0	0	0	0	0	0	0	0
KVI-3-U	0	0	0	0	0	0	0	0
KVI-4-L	0	0	0	0	0	0	0	0
KVI-4-U	0	0	0	0	0	0	0	0
BRO-1-L	0	0	0	0	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	0	0	0	0	0	0	0
BRO-2-U	0	0	0	0	0	0	0	0
BRO-3-L	0	0	0	0	0	0	0	0
BRO-3-U	0	0	0	0	0	0	0	0
BRO-4-L	0	0	0	0	0	0	0	0
BRO-4-U	0	0	0	0	12	0	0	0

Table 2 part 23 of 30.

ID	DiuNan	IsoGra	Isoper	LeuNig	LeuHip	Proton	AmpBor	AmpSta
BRO-5-L	0	0	0	0	0	0	0	0
BRO-5-U	0	0	0	0	52	0	0	0
BRO-6-L	0	0	0	0	24	0	0	0
BRO-6-U	0	0	0	0	6	0	0	0
BRO-7-L	0	0	0	0	6	0	0	0
BRO-7-U	0	0	0	0	0	0	0	0
BRO-8-L	0	0	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	0	0	0	0	0	0	0
FOL-1-U	0	0	0	0	0	0	0	0
FOL-2-L	0	0	0	0	0	0	0	0
FOL-2-U	0	0	0	0	0	0	1	0
FOL-3-L	0	0	0	0	0	0	0	0
FOL-3-U	0	0	0	0	0	0	0	0
FOL-4-L	0	0	0	0	0	0	0	0
FOL-4-U	0	0	0	0	4	0	0	0
FOL-5-L	0	0	0	0	0	0	0	0
FOL-5-U	0	0	0	0	16	0	0	0
BJO-1-L	0	0	0	0	0	0	0	0
BJO-1-U	0	0	0	0	0	0	0	0
BJO-2-L	0	0	0	0	0	0	0	0
BJO-2-U	0	0	0	0	0	0	0	0
BJO-3-L	0	0	0	0	0	0	0	0
BJO-3-U	0	0	0	0	0	0	0	0
BJO-4-L	0	0	4	0	0	0	0	0
BJO-4-U	0	0	4	0	0	0	0	0
BJO-5-L	16	0	0	0	4	0	0	0
BJO-5-U	0	0	0	0	0	0	0	0
SKJ-1-L	0	0	0	0	0	0	0	0
SKJ-1-U	0	0	0	0	4	0	0	0
SKJ-2-L	0	0	0	0	6	0	2	0
SKJ-2-U	0	1	0	0	0	0	0	0
SKJ-3-L	0	0	0	0	0	0	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	0	0	0	0	0	0	0	0
SKJ-4-U	0	0	2	0	0	0	0	0
SKJ-5-L	0	0	0	0	0	0	0	0
SKJ-5-U	0	4	0	0	12	0	0	0
SKJ-6-L	0	4	0	0	14	0	0	0
SKJ-6-U	0	16	0	0	0	0	0	0

Table 2 part 24 of 30.

ID	DiuNan	IsoGra	Isoper	LeuNig	LeuHip	Proton	AmpBor	AmpSta
ROS-1-L	0	0	0	0	0	0	0	0
ROS-1-U	0	0	0	0	0	0	0	0
ROS-2-L	0	0	0	0	0	0	0	0
ROS-2-U	0	0	0	0	0	0	16	0
KVE-1-L	0	0	0	0	0	0	0	0
KVE-1-U	0	0	0	0	0	0	0	0
KVE-2-L	0	0	0	0	0	0	0	0
KVE-2-U	0	0	0	0	0	0	0	0
KVE-3-L	0	0	0	0	0	0	0	0
KVE-3-U	0	0	0	0	0	0	0	0
KVE-4-L	0	0	0	0	0	0	0	0
KVE-4-U	0	0	0	0	0	0	0	0
KVE-5-L	0	0	0	0	0	0	0	0
KVE-5-U	0	0	0	0	0	0	0	0
SEM-1-L	0	0	0	8	0	0	0	0
SEM-1-U	0	4	0	0	8	0	0	0
SEM-2-L	0	0	0	0	0	0	0	0
SEM-2-U	4	0	0	0	0	0	0	0
SEM-3-L	0	0	28	0	0	0	0	0
SEM-3-U	0	0	20	0	0	0	0	0
SEM-4-L	0	0	36	0	16	0	0	0
SEM-4-U	0	0	20	0	12	0	0	0
HYL-1-L	0	0	0	0	0	0	0	0
HYL-1-U	0	0	0	0	0	0	0	0
HYL-2-L	0	0	0	0	0	0	0	0
HYL-2-U	0	0	0	0	0	0	0	0
KAR-1-L	0	0	0	0	0	0	0	0
KAR-1-U	36	0	0	0	0	0	0	0
KAR-2-L	0	0	0	0	0	4	0	0
KAR-2-U	0	0	0	0	0	12	0	0
KAR-3-L	4	0	0	0	0	0	0	0
KAR-3-U	0	0	0	0	0	0	0	0
KOR-1-L	0	0	0	0	0	0	0	0
KOR-1-U	0	0	0	0	0	0	0	0
KOR-2-L	0	0	0	0	0	0	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	0	0	0	0	0	0	0
KOR-3-U	0	0	0	0	0	0	0	0
SUM	60	29	127	8	246	16	59	6
Fraction	0.10 %	0.05 %	0.20 %	0.01 %	0.39 %	0.03 %	0.09 %	0.01 %

Table 2 part 25 of 30.

ID	**AmpSul**	**Collem**	**NemPic**	**BerCla**	**Curcul**	**Dytisc**	**Elmtyp**	**Hydrop**
EKL-1-L	0	0	0	0	0	0	0	0
EKL-1-U	0	0	0	0	0	0	0	0
EKL-2-L	0	0	0	0	0	0	0	0
EKL-2-U	0	0	0	0	0	0	0	0
YDS-1-L	0	0	0	0	0	0	0	0
YDS-1-U	0	0	0	0	0	0	0	0
YDS-2-L	0	2	0	0	0	0	0	0
YDS-2-U	0	1	0	0	0	0	0	0
YDS-3-L	0	0	0	0	0	0	0	0
YDS-3-U	0	0	0	0	0	0	0	0
YDS-4-L	0	4	0	0	0	0	0	0
YDS-4-U	0	3	0	0	0	0	0	0
VAL-1-L	0	0	0	0	0	0	0	0
VAL-1-U	0	0	0	0	0	0	6	0
VAL-2-L	0	1	0	0	0	0	0	0
VAL-2-U	0	5	0	0	0	0	0	0
VAL-3-L	0	0	0	0	0	0	0	0
VAL-3-U	0	0	0	0	0	0	0	4
VAL-4-L	0	4	0	0	0	0	0	0
VAL-4-U	0	0	0	0	0	0	0	0
STU-1-L	0	8	0	0	0	0	0	0
STU-1-U	0	0	0	0	0	0	0	0
STU-2-L	0	2	0	0	0	0	0	0
STU-2-U	20	8	0	0	0	0	0	0
KVI-1-L	0	4	0	0	0	0	0	0
KVI-1-U	0	0	0	0	1	0	0	0
KVI-2-L	0	8	0	0	0	0	16	0
KVI-2-U	0	0	0	0	0	0	0	0
KVI-3-L	0	0	0	0	0	0	0	0
KVI-3-U	0	0	0	0	0	0	0	0
KVI-4-L	0	0	0	0	0	0	0	0
KVI-4-U	0	0	0	0	0	0	0	0
BRO-1-L	0	0	0	0	0	0	0	0
BRO-1-U	0	0	0	0	0	0	0	0
BRO-2-L	0	2	0	0	0	0	0	0
BRO-2-U	0	0	0	0	0	0	0	0
BRO-3-L	0	4	0	0	0	0	0	0
BRO-3-U	0	0	0	0	0	0	0	0
BRO-4-L	0	4	0	0	0	0	0	0
BRO-4-U	0	0	0	0	0	0	0	0

Table 2 part 26 of 30.

ID	AmpSul	Collem	NemPic	BerCla	Curcul	Dytisc	Elmtyp	Hydrop
BRO-5-L	0	0	0	0	0	0	0	0
BRO-5-U	0	0	0	0	0	0	0	0
BRO-6-L	0	0	0	0	0	0	0	0
BRO-6-U	0	0	0	0	0	0	0	0
BRO-7-L	0	0	0	0	0	0	0	0
BRO-7-U	0	0	0	0	0	0	0	0
BRO-8-L	0	32	0	0	0	0	0	0
BRO-8-U	0	0	0	0	0	0	0	0
FOL-1-L	0	0	0	0	0	0	0	0
FOL-1-U	0	0	0	0	0	0	0	0
FOL-2-L	0	0	0	0	0	0	0	0
FOL-2-U	0	1	0	0	0	2	0	0
FOL-3-L	0	4	0	0	0	0	48	0
FOL-3-U	0	0	0	0	0	0	0	0
FOL-4-L	0	0	0	0	0	0	0	0
FOL-4-U	0	0	0	0	0	0	4	0
FOL-5-L	0	0	0	0	0	0	0	0
FOL-5-U	0	4	0	0	0	0	0	0
BJO-1-L	0	0	0	0	0	0	0	0
BJO-1-U	0	2	0	1	0	0	0	0
BJO-2-L	0	0	0	0	0	0	0	0
BJO-2-U	0	5	0	0	0	0	0	0
BJO-3-L	0	1	0	0	1	0	0	0
BJO-3-U	0	2	0	0	0	0	0	0
BJO-4-L	0	4	0	0	0	0	8	0
BJO-4-U	0	0	0	0	0	0	0	0
BJO-5-L	8	0	0	0	0	0	0	0
BJO-5-U	0	0	0	0	0	0	0	0
SKJ-1-L	0	0	0	0	0	0	0	0
SKJ-1-U	0	0	0	0	0	0	0	0
SKJ-2-L	0	0	0	0	0	0	0	0
SKJ-2-U	0	0	0	0	0	0	0	0
SKJ-3-L	0	0	0	0	0	0	0	0
SKJ-3-U	0	0	0	0	0	0	0	0
SKJ-4-L	0	0	0	0	0	0	0	0
SKJ-4-U	0	0	0	0	0	0	0	0
SKJ-5-L	4	0	0	0	0	0	0	0
SKJ-5-U	0	0	0	0	0	0	0	0
SKJ-6-L	0	2	0	0	0	0	0	0
SKJ-6-U	0	0	0	0	0	0	0	0

Table 2 part 27 of 30.

ID	AmpSul	Collem	NemPic	BerCla	Curcul	Dytisc	Elmtyp	Hydrop
ROS-1-L	0	0	0	0	0	0	0	0
ROS-1-U	12	0	0	0	0	0	0	0
ROS-2-L	0	2	0	0	0	0	2	0
ROS-2-U	16	0	0	0	0	0	0	0
KVE-1-L	0	2	0	0	0	0	0	0
KVE-1-U	0	4	0	0	0	0	0	0
KVE-2-L	0	0	2	0	0	0	0	0
KVE-2-U	0	0	0	0	0	0	0	0
KVE-3-L	0	0	0	0	0	0	0	0
KVE-3-U	0	0	0	0	0	0	0	0
KVE-4-L	0	2	0	0	0	0	0	0
KVE-4-U	0	0	0	0	0	0	0	0
KVE-5-L	0	0	0	0	0	0	0	0
KVE-5-U	0	0	0	0	0	0	0	0
SEM-1-L	0	0	0	0	0	0	0	0
SEM-1-U	0	0	0	0	0	0	0	0
SEM-2-L	0	0	0	0	0	0	0	0
SEM-2-U	0	0	0	0	0	0	0	0
SEM-3-L	0	16	0	0	0	0	0	0
SEM-3-U	0	0	0	0	0	0	0	0
SEM-4-L	0	0	0	0	0	0	20	0
SEM-4-U	0	0	0	0	0	0	16	0
HYL-1-L	0	1	0	0	0	0	0	0
HYL-1-U	0	0	0	0	0	0	0	0
HYL-2-L	0	4	0	0	0	0	6	0
HYL-2-U	0	0	0	0	0	0	0	0
KAR-1-L	0	0	0	0	0	0	0	0
KAR-1-U	4	4	0	0	0	0	0	0
KAR-2-L	0	0	0	0	0	0	0	0
KAR-2-U	0	0	0	0	0	0	0	0
KAR-3-L	0	8	0	0	0	0	0	0
KAR-3-U	0	0	0	0	0	0	0	0
KOR-1-L	0	0	0	0	0	0	0	4
KOR-1-U	0	0	0	0	0	0	0	0
KOR-2-L	0	16	0	0	0	0	0	0
KOR-2-U	0	0	0	0	0	0	0	0
KOR-3-L	0	28	0	0	0	0	0	0
KOR-3-U	0	0	0	0	0	0	0	0
SUM	64	204	2	1	2	2	126	8
Fraction	0.10 %	0.33 %	0.00 %	0.00 %	0.00 %	0.00 %	0.20 %	0.01 %

Table 2 part 28 of 30.

ID	Elodes	Hydrae	HydGra	Pisidu	AseAqu	# individuals per station
EKL-1-L	0	0	8	8	0	100
EKL-1-U	0	0	0	0	0	156
EKL-2-L	0	0	0	548	0	1980
EKL-2-U	0	0	88	0	0	2128
YDS-1-L	0	0	16	0	0	592
YDS-1-U	0	0	8	0	0	936
YDS-2-L	0	0	0	0	0	102
YDS-2-U	1	0	2	0	0	39
YDS-3-L	16	4	96	0	0	692
YDS-3-U	14	0	20	0	0	128
YDS-4-L	8	0	16	0	0	672
YDS-4-U	1	0	4	0	0	214
VAL-1-L	0	0	0	0	0	892
VAL-1-U	0	0	16	0	0	438
VAL-2-L	0	0	18	3	0	447
VAL-2-U	0	1	7	0	0	145
VAL-3-L	0	0	8	0	0	964
VAL-3-U	4	0	0	0	0	1372
VAL-4-L	12	0	76	4	0	968
VAL-4-U	4	0	8	0	0	1016
STU-1-L	0	0	0	24	0	536
STU-1-U	0	0	8	0	0	1528
STU-2-L	0	0	0	2	0	138
STU-2-U	0	0	0	0	0	612
KVI-1-L	0	0	0	0	0	204
KVI-1-U	0	0	0	0	0	142
KVI-2-L	0	0	0	0	0	1712
KVI-2-U	0	0	4	0	0	400
KVI-3-L	0	0	4	4	0	296
KVI-3-U	0	0	0	0	0	256
KVI-4-L	0	0	116	8	0	708
KVI-4-U	0	0	0	0	0	23
BRO-1-L	0	0	0	0	0	144
BRO-1-U	0	0	4	0	0	360
BRO-2-L	0	0	0	0	0	312
BRO-2-U	0	0	0	0	0	338
BRO-3-L	0	0	4	0	0	324
BRO-3-U	0	0	4	0	0	380
BRO-4-L	0	0	4	0	0	1344
BRO-4-U	0	0	0	0	0	1752

Table 2 part 29 of 30.

ID	Elodes	Hydrae	HydGra	Pisidu	AseAqu	# individuals per station
BRO-5-L	0	0	4	4	0	324
BRO-5-U	0	0	68	4	0	900
BRO-6-L	2	0	28	0	0	352
BRO-6-U	4	0	10	0	0	158
BRO-7-L	2	0	6	6	0	238
BRO-7-U	2	0	8	0	0	308
BRO-8-L	0	0	0	0	0	1504
BRO-8-U	0	0	0	0	0	1280
FOL-1-L	0	0	0	0	0	132
FOL-1-U	0	0	0	0	0	110
FOL-2-L	0	0	4	0	0	252
FOL-2-U	0	0	14	0	0	203
FOL-3-L	0	4	80	0	0	2464
FOL-3-U	0	0	0	0	0	676
FOL-4-L	4	0	36	0	0	888
FOL-4-U	0	0	28	0	0	440
FOL-5-L	4	0	8	0	0	264
FOL-5-U	4	0	8	0	0	428
BJO-1-L	0	0	0	0	0	132
BJO-1-U	0	0	0	0	0	77
BJO-2-L	0	0	1	0	0	58
BJO-2-U	0	0	2	0	0	83
BJO-3-L	0	0	0	0	0	79
BJO-3-U	0	0	0	0	0	114
BJO-4-L	8	0	20	0	0	356
BJO-4-U	12	0	56	0	0	556
BJO-5-L	0	0	16	0	0	264
BJO-5-U	0	0	8	0	0	270
SKJ-1-L	0	0	0	0	0	140
SKJ-1-U	0	0	0	0	0	598
SKJ-2-L	0	0	2	0	0	232
SKJ-2-U	0	0	2	0	0	344
SKJ-3-L	0	0	0	6	0	64
SKJ-3-U	0	0	0	0	0	568
SKJ-4-L	0	0	22	0	0	340
SKJ-4-U	0	0	1	0	0	186
SKJ-5-L	0	0	4	0	0	220
SKJ-5-U	0	0	0	0	0	428
SKJ-6-L	4	4	22	0	0	420
SKJ-6-U	8	24	0	0	0	708

Table 2 part 30 of 30.

ID	**Elodes**	**Hydrae**	**HydGra**	**Pisidu**	**AseAqu**	**# individuals per station**
ROS-1-L	8	0	0	0	0	1104
ROS-1-U	2	0	16	0	0	804
ROS-2-L	0	0	14	0	0	1568
ROS-2-U	0	0	0	0	0	316
KVE-1-L	0	0	0	0	0	230
KVE-1-U	0	0	0	0	0	144
KVE-2-L	0	0	0	0	0	126
KVE-2-U	0	0	0	0	0	52
KVE-3-L	0	0	0	0	0	82
KVE-3-U	0	0	0	0	0	46
KVE-4-L	2	0	6	0	0	196
KVE-4-U	0	0	4	0	0	144
KVE-5-L	1	0	0	0	0	100
KVE-5-U	1	0	3	0	0	80
SEM-1-L	0	0	0	0	0	584
SEM-1-U	0	0	0	0	0	260
SEM-2-L	0	0	0	0	0	264
SEM-2-U	0	0	16	0	0	808
SEM-3-L	0	0	40	0	0	1508
SEM-3-U	0	0	12	0	0	564
SEM-4-L	4	0	68	0	8	1132
SEM-4-U	0	0	4	0	0	596
HYL-1-L	0	0	0	0	0	79
HYL-1-U	0	0	2	0	0	157
HYL-2-L	0	0	4	0	0	264
HYL-2-U	0	0	6	0	0	302
KAR-1-L	0	4	4	0	0	292
KAR-1-U	0	0	12	0	0	1088
KAR-2-L	0	8	36	0	0	716
KAR-2-U	0	0	0	0	0	336
KAR-3-L	12	4	28	0	0	660
KAR-3-U	0	0	16	0	0	364
KOR-1-L	0	0	0	20	256	537
KOR-1-U	0	0	0	0	584	1136
KOR-2-L	0	0	0	0	516	960
KOR-2-U	0	0	0	0	16	1032
KOR-3-L	0	0	0	8	352	684
KOR-3-U	0	0	0	0	160	576
SUM	144	53	1288	649	1892	
Fraction	0.23 %	0.08 %	2.06 %	1.04 %	3.03 %	

Table 3: The distance from each station to the Trondheimsfjord measured in meters along the tributaries, main rivers and streams. The distance.fjord column represents the distance from the station to the fjord, while the distance.confluence represents the distance from the station to the specified reference point (Verdal = Verdalselva, etc.) The table spans over 3 pages.

ID	Distance.confluence	Distance.fjord	Reference.point
BJO-1-L	8	11063	Verdal
BJO-1-U	63	11118	Verdal
BJO-2-L	226	11281	Verdal
BJO-2-U	269	11324	Verdal
BJO-3-L	357	11412	Verdal
BJO-3-U	407	11462	Verdal
BJO-4-L	474	11529	Verdal
BJO-4-U	538	11593	Verdal
BJO-5-L	851	11906	Verdal
BJO-5-U	900	11955	Verdal
BRO-1-L	14	5758	Verdal
BRO-1-U	65	5809	Verdal
BRO-2-L	115	5859	Verdal
BRO-2-U	160	5904	Verdal
BRO-3-L	595	6339	Verdal
BRO-3-U	653	6397	Verdal
BRO-4-L	685	6429	Verdal
BRO-4-U	737	6481	Verdal
BRO-5-L	1853	7597	Verdal
BRO-5-U	1898	7642	Verdal
BRO-6-L	2067	7811	Verdal
BRO-6-U	2113	7857	Verdal
BRO-7-L	2384	8128	Verdal
BRO-7-U	2430	8174	Verdal
BRO-8-L	2750	8494	Verdal
BRO-8-U	2795	8539	Verdal
EKL-1-L	172	12250	Verdal
EKL-1-U	209	12287	Verdal
EKL-2-L	346	12424	Verdal
EKL-2-U	408	12486	Verdal
FOL-1-L	307	11563	Verdal
FOL-1-U	347	11603	Verdal
FOL-2-L	469	11725	Verdal
FOL-2-U	520	11776	Verdal
FOL-3-L	2032	13288	Verdal
FOL-3-U	2072	13328	Verdal
FOL-4-L	2200	13456	Verdal
FOL-4-U	2241	13497	Verdal
FOL-5-L	3575	14831	Verdal
FOL-5-U	3630	14886	Verdal

Table 3 part 2 of 3.

ID	Distance.confluence	Distance.fjord	Reference.point
HYL-1-L	5	22074	Verdal
HYL-1-U	68	22137	Verdal
HYL-2-L	167	22236	Verdal
HYL-2-U	228	22297	Verdal
KAR-1-L	0	14718	Verdal
KAR-1-U	61	14779	Verdal
KAR-2-L	352	15070	Verdal
KAR-2-U	372	15090	Verdal
KAR-3-L	377	15095	Verdal
KAR-3-U	419	15137	Verdal
KOR-1-L	99	7490	Verdal
KOR-1-U	160	7551	Verdal
KOR-2-L	402	7793	Verdal
KOR-2-U	420	7811	Verdal
KOR-3-L	514	7905	Verdal
KOR-3-U	576	7967	Verdal
KVE-1-L	861	16359	Verdal
KVE-1-U	916	16414	Verdal
KVE-2-L	1192	16690	Verdal
KVE-2-U	1250	16748	Verdal
KVE-3-L	2282	17780	Verdal
KVE-3-U	2339	17837	Verdal
KVE-4-L	2397	17895	Verdal
KVE-4-U	2419	17917	Verdal
KVE-5-L	2397	17895	Verdal
KVE-5-U	2414	17912	Verdal
KVI-1-L	937	4217	Verdal
KVI-1-U	978	4258	Verdal
KVI-2-L	2745	6025	Verdal
KVI-2-U	2783	6063	Verdal
KVI-3-L	4407	7687	Verdal
KVI-3-U	4457	7737	Verdal
KVI-4-L	7081	10361	Verdal
KVI-4-U	7139	10419	Verdal
ROS-1-L	145	6810	Verdal
ROS-1-U	192	6857	Verdal
ROS-2-L	302	6967	Verdal
ROS-2-U	345	7010	Verdal

Table 3 part 3 of 3.

ID	Distance.confluence	Distance.fjord	Reference.point
SEM-1-L	109	109	Fjord
SEM-1-U	159	159	Fjord
SEM-2-L	345	345	Fjord
SEM-2-U	404	404	Fjord
SEM-3-L	795	795	Fjord
SEM-3-U	820	820	Fjord
SEM-4-L	940	940	Fjord
SEM-4-U	992	992	Fjord
SKJ-1-L	832	9658	Verdal
SKJ-1-U	872	9698	Verdal
SKJ-2-L	968	9794	Verdal
SKJ-2-U	1011	9837	Verdal
SKJ-3-L	1200	10026	Verdal
SKJ-3-U	1241	10067	Verdal
SKJ-4-L	1407	10233	Verdal
SKJ-4-U	1442	10268	Verdal
SKJ-5-L	3163	11989	Verdal
SKJ-5-U	3224	12050	Verdal
SKJ-6-L	3350	12176	Verdal
SKJ-6-U	3394	12220	Verdal
STU-1-L	52	8024	Verdal
STU-1-U	102	8074	Verdal
STU-2-L	195	8167	Verdal
STU-2-U	248	8220	Verdal
VAL-1-L	3489	4146	Rinn
VAL-1-U	3543	4200	Rinn
VAL-2-L	3953	4610	Rinn
VAL-2-U	3981	4638	Rinn
VAL-3-L	4696	5353	Rinn
VAL-3-U	4758	5415	Rinn
VAL-4-L	5020	5677	Rinn
VAL-4-U	5067	5724	Rinn
YDS-1-L	577	577	Fjord
YDS-1-U	612	612	Fjord
YDS-2-L	2274	2274	Fjord
YDS-2-U	2318	2318	Fjord
YDS-3-L	5638	5638	Fjord
YDS-3-U	5676	5676	Fjord
YDS-4-L	6022	6022	Fjord
YDS-4-U	6069	6069	Fjord

Table 4: The functional groups related to each species/lowest taxation. The table spans over two pages.

	Grazers/ gatherers	**Shredders**	**Passive filter feeders**	**Active filter feeders**	**Predators**	**Undeter-mined**	**Miners**
Nemato	X						
Aranea						X	
Acari						X	
Simuli			X				
Dixida				X			
Limoni	X						
Psycho	X						
Pedici					X		
Dicran					X		
Eleoph						X	
Helius	X						
Sclero						X	
Diptpup						X	
Chirom	X						
Cerato						X	
Dasyhe						X	
Ptycho	X						
SiaFul					X		
Tipuli		X					
Limnep		X					
Chaero.ssp		X					
BerMin	X						
SerPer		X					
BraSub			X				
Rhyaco.ssp					X		
AgaOch	X						
SilPal	X						
PleCon					X		
PolFla					X		
RhyFas					X		
RhyNub					X		
EphVul				X			
CenLut	X						
BaeNig	X						
BaeMac	X						
AlaMut	X						
BaeRho	X						
NemCin	X						
Baetis.sp	X						

Table 4 part 2 of 2.

	Grazers/ gatherers	**Shredders**	**Passive filter feeders**	**Active filter feeders**	**Predators**	**Undeter-mined**	**Miners**
Oligoc						X	
Hirudi	X						
Bithyn				X			
Lymnae	X						
Planor	X						
Megalo						X	
Gastro						X	
Gerrid					X		
Dryopi	X						
Halipl							X
Agatyp					X		
Perlod					X		
Siphlo	X						
CapLau						X	
LeuDig	X						
LeuFus	X						
CapBif		X					
CapSch	X						
DiuNan					X		
IsoGra					X		
Isoper					X		
LeuNig	X						
LeuHip	X						
Proton		X					
AmpBor	X						
AmpSta	X						
AmpSul	X						
Collem						X	
NemPic	X						
BerCla						X	
Curcul		X					
Dytisc					X		
Elmtyp	X						
Hydrop	X						
Elodes	X						
Hydrae	X						
HydGra					X		
Pisidu				X			
AseAqu	X						

Table 5: Habitat measurements (measured by using a digital map – norgeskart.no), electro fishing and measures implemented for each station. The table spans over 9 pages.

Tributary-ID	Length of station	Mean.width	Water.velocity	Algae coverage	Moss coverage	Shadow.water
BJO-1-L	52	2.74	0.9	0	16	80
BJO-1-U	52	2.74	0.6	0	0	90
BJO-2-L	50	3.89	0.5	0	0	100
BJO-2-U	50	3.89	0.5	0	0	70
BJO-3-L	44	3.4	0.6	0	0	70
BJO-3-U	44	3.4	0.3	0	0	70
BJO-4-L	50	3.76	0.7	16	0	100
BJO-4-U	50	3.76	0.6	50	16	60
BJO-5-L	50	1.94	0.3	0	0	80
BJO-5-U	50	1.94	0.4	0	0	90
BRO-1-L	47	2.1	0.6	0	0	90
BRO-1-U	47	2.1	0.2	0	0	10
BRO-2-L	38	2.1	0.2	0	0	60
BRO-2-U	38	2.1	0.6	0	0	60
BRO-3-L	50	2.27	0.4	0	0	80
BRO-3-U	50	2.27	0.6	0	0	60
BRO-4-L	80	2.32	0.1	16	0	10
BRO-4-U	80	2.32	0.1	16	0	0
BRO-5-L	55	2.36	0.3	0	0	0
BRO-5-U	55	2.36	0.2	0	0	0
BRO-6-L	50	1.82	0.3	16	0	20
BRO-6-U	50	1.82	0.4	0	0	0
BRO-7-L	50	1.8	0.2	0	0	60
BRO-7-U	50	1.8	0.2	0	0	80
BRO-8-L	44	2.04	0.3	0	0	60
BRO-8-U	44	2.04	0.1	0	0	40
EKL-1-L	50	2.12	0.4	0	0	90
EKL-1-U	50	2.12	0	0	0	30
EKL-2-L	66	2.14	0.1	0	0	90
EKL-2-U	66	2.14	0	0	0	100
FOL-1-L	36	2.6	0.1	0	0	60
FOL-1-U	36	2.6	0.4	16	0	90
FOL-2-L	50	2.46	0.4	0	0	30
FOL-2-U	50	2.46	0.2	0	0	10
FOL-3-L	40	2.14	0.4	0	0	50
FOL-3-U	40	2.14	0.1	0	0	90
FOL-4-L	40	2.14	0.6	0	0	90
FOL-4-U	40	2.14	0.3	0	0	80
FOL-5-L	35	1.5	0.8	0	0	40
FOL-5-U	35	1.5	0.26	0	0	20

Table 5 part 2 of 9.

Tributary-ID	**Length of station**	**Mean.width**	**Water.velocity**	**Algae coverage**	**Moss coverage**	**Shadow.water**
HYL-1-L	70	1.36	0.4	0	0	60
HYL-1-U	70	1.36	0.2	0	0	0
HYL-2-L	60	1.64	0.1	16	0	0
HYL-2-U	60	1.64	0.1	0	16	10
KAR-1-L	51	1.84	0.3	0	0	60
KAR-1-U	51	1.84	0.4	0	0	80
KAR-2-L	50	1.49	0.8	0	75	20
KAR-2-U	50	1.49	0.8	0	16	5
KAR-3-L	45	2.01	0.6	0	75	20
KAR-3-U	45	2.01	0.7	0	16	20
KOR-1-L	70	2.21	0.2	0	0	90
KOR-1-U	70	2.21	0.1	0	0	50
KOR-2-L	18.5	1.9	0.5	0	0	70
KOR-2-U	18.5	1.9	0	0	0	50
KOR-3-L	56	1.08	0.2	0	0	0
KOR-3-U	56	1.08	0.2	0	0	0
KVE-1-L	55	1.73	0.6	0	0	20
KVE-1-U	55	1.73	0.7	0	0	20
KVE-2-L	60	2.44	0.7	0	0	80
KVE-2-U	60	2.44	0.5	0	0	20
KVE-3-L	45	1.8	0.7	0	0	0
KVE-3-U	45	1.8	0.8	0	0	30
KVE-4-L	25	1.32	0.5	0	0	50
KVE-4-U	25	1.32	0.2	0	0	10
KVE-5-L	20	1.76	0.5	0	0	2
KVE-5-U	20	1.76	0.9	0	0	60
KVI-1-L	34	4.12	0.3	0	0	0
KVI-1-U	34	4.12	0.8	0	0	30
KVI-2-L	46	2.82	0.8	0	50	20
KVI-2-U	46	2.82	0.5	0	0	60
KVI-3-L	44	2.36	0.1	0	0	60
KVI-3-U	44	2.36	0.4	0	16	70
KVI-4-L	50	2.48	0.4	0	16	70
KVI-4-U	50	2.48	0.2	0	16	80
ROS-1-L	52	2.92	0.1	0	0	100
ROS-1-U	52	2.92	0.1	0	0	60
ROS-2-L	31	2.14	0.5	0	0	40
ROS-2-U	31	2.14	0.1	0	0	70

Table 5 part 3 of 9.

Tributary-ID	Length of station	Mean.width	Water.velocity	Algae coverage	Moss coverage	Shadow.water
SEM-1-L	50	2.9	0.2	0	0	40
SEM-1-U	50	2.9	0.1	16	0	90
SEM-2-L	52	2.16	0.9	16	0	70
SEM-2-U	52	2.16	0.2	0	0	80
SEM-3-L	47	3.33	0.3	0	0	80
SEM-3-U	47	3.33	0	16	16	100
SEM-4-L	63	2.12	1	0	0	30
SEM-4-U	63	2.12	0.7	16	16	70
SKJ-1-L	40	2.36	0.1	0	0	0
SKJ-1-U	40	2.36	0.5	0	0	0
SKJ-2-L	62	2.42	0.2	0	0	0
SKJ-2-U	62	2.42	0.5	0	0	0
SKJ-3-L	45	2.88	0.3	0	0	90
SKJ-3-U	45	2.88	0.1	0	0	60
SKJ-4-L	42.5	2.68	0.5	16	16	40
SKJ-4-U	42.5	2.68	0.5	0	0	70
SKJ-5-L	46	1.92	0.2	0	0	90
SKJ-5-U	46	1.92	0.2	0	0	95
SKJ-6-L	40	2.26	0.4	0	0	70
SKJ-6-U	40	2.26	0.5	16	75	50
STU-1-L	56	1.53	0.1	0	0	100
STU-1-U	56	1.53	0.3	0	0	30
STU-2-L	37	2.41	0.2	0	0	90
STU-2-U	37	2.41	0.3	0	0	60
VAL-1-L	50	1.64	0.3	0	0	80
VAL-1-U	50	1.64	0.2	0	0	90
VAL-2-L	29	1.3	0.4	0	0	70
VAL-2-U	29	1.3	0.3	0	16	0
VAL-3-L	52	1.08	0.7	0	0	10
VAL-3-U	52	1.08	0.3	0	0	10
VAL-4-L	53	1.55	0.6	0	0	50
VAL-4-U	53	1.55	0.6	0	0	80
YDS-1-L	30	4.42	0.6	0	0	0
YDS-1-U	30	4.42	0.6	0	0	0
YDS-2-L	44.3	5.06	0.2	0	0	50
YDS-2-U	44.3	5.06	0.3	0	0	70
YDS-3-L	32	5.16	0.2	0	0	80
YDS-3-U	32	5.16	0.6	0	0	40
YDS-4-L	55	3.02	0.5	0	0	90
YDS-4-U	55	3.02	0.1	16	16	90

Table 5 part 4 of 9.

Tributary-ID	Shadow. floodzone	Shadow. riverbed	Hiding. spots	Mean.depth. transekt	mean.substrate. transect	Dead. wood
BJO-1-L	63	12	0	0.242	388.5	7
BJO-1-U	63	33	0	0.22	10.9	7
BJO-2-L	63	33	0	0.162	30.6	10
BJO-2-U	33	12	1	0.274	65.8	10
BJO-3-L	83	83	0	0.186	7.9	9
BJO-3-U	12	12	3	0.246	98.5	9
BJO-4-L	63	92	0	0.149	45.3	3
BJO-4-U	63	63	0	0.124	128	3
BJO-5-L	63	63	6	0.054	74.4	4
BJO-5-U	12	12	0	0.06	32.55	4
BRO-1-L	63	63	2	0.09	51.9	15
BRO-1-U	33	33	1	0.048	68.3	15
BRO-2-L	83	83	7	0.083	247.3	8
BRO-2-U	83	63	4	0.582	250.6	8
BRO-3-L	63	63	0	0.054	15.9	10
BRO-3-U	83	63	4	0.582	250.6	10
BRO-4-L	0	0	3	0.102	225.3	0
BRO-4-U	0	0	8	0.068	445	0
BRO-5-L	0	0	6	0.048	388.5	1
BRO-5-U	0	0	3	0.078	236.2	1
BRO-6-L	0	0	5	0.076	377	0
BRO-6-U	0	0	14	0.068	427.6	0
BRO-7-L	63	33	2	0.088	461.1	11
BRO-7-U	83	63	6	0.052	10.9	11
BRO-8-L	92	33	0	0.062	18.4	19
BRO-8-U	92	63	1	0.29	1	19
EKL-1-L	33	33	1	0.056	123.8	4
EKL-1-U	63	63	5	0.014	338.3	4
EKL-2-L	83	12	0	0.094	5	12
EKL-2-U	12	12	0	0.078	15.8	12
FOL-1-L	92	92	0	0.074	1	9
FOL-1-U	83	92	0	0.064	80.8	9
FOL-2-L	33	12	9	0.08	320.5	2
FOL-2-U	12	0	15	0.066	625	2
FOL-3-L	33	12	0	0.054	34.5	5
FOL-3-U	63	63	0	0.068	18.8	5
FOL-4-L	63	33	3	0.036	28.6	7
FOL-4-U	63	63	6	0.046	355	7
FOL-5-L	12	0	1	0.064	68	17
FOL-5-U	33	12	1	0.074	43.7	17

Table 5 part 5 of 9.

Tributary -ID	**Shadow. floodzone**	**Shadow. riverbed**	**Hiding. spots**	**Mean.depth. transekt**	**mean.substrate. transect**	**Dead. wood**
HYL-1-L	63	83	7	0.082	152.7	0
HYL-1-U	0	0	8	0.072	445	0
HYL-2-L	0	12	3	0.098	377	0
HYL-2-U	12	12	2	0.16	19.7	0
KAR-1-L	12	0	1	0.06	422	24
KAR-1-U	12	0	10	0.068	478.5	24
KAR-2-L	12	12	13	0.06	512.35	8
KAR-2-U	0	0	33	0.186	400.7	8
KAR-3-L	0	12	10	0.078	213.5	2
KAR-3-U	12	12	13	0.122	422.2	2
KOR-1-L	33	33	0	0.092	5.95	20
KOR-1-U	83	83	0	0.122	149.1	20
KOR-2-L	33	0	6	0.051	461.6	1
KOR-2-U	33	0	0	0.216	32.2	1
KOR-3-L	0	0	1	0.14	173.4	0
KOR-3-U	0	0	0	0.146	1.5	0
KVE-1-L	0	12	2	0.114	270	0
KVE-1-U	33	33	0	0.104	94.2	0
KVE-2-L	63	12	2	0.084	70.9	7
KVE-2-U	83	33	6	0.09	315.6	7
KVE-3-L	12	12	7	0.076	223.6	5
KVE-3-U	63	12	3	0.158	562.6	5
KVE-4-L	33	12	3	0.054	220	7
KVE-4-U	12	12	0	0.074	1	7
KVE-5-L	33	12	2	0.106	146.8	2
KVE-5-U	12	12	4	0.072	63.4	2
KVI-1-L	0	0	0	0.47	1	0
KVI-1-U	12	12	15	0.248	625	0
KVI-2-L	63	33	13	0.134	433.5	4
KVI-2-U	33	63	8	0.16	275.5	4
KVI-3-L	63	33	0	0.256	63.4	1
KVI-3-U	33	33	0	0.258	313	1
KVI-4-L	63	33	3	0.078	247.6	13
KVI-4-U	63	0	7	0.086	310	13
ROS-1-L	12	0	0	0.166	1	10
ROS-1-U	0	0	0	0.098	1	10
ROS-2-L	0	12	0	0.092	37.1	13
ROS-2-U	33	33	0	0.092	19.4	13

Table 5 part 6 of 9.

Tributary-ID	**Shadow. floodzone**	**Shadow. riverbed**	**Hiding. spots**	**Mean.depth. transekt**	**mean.substrate. transect**	**Dead. wood**
SEM-1-L	83	92	0	0.066	67	15
SEM-1-U	63	92	5	0.07	146.8	15
SEM-2-L	83	92	5	0.142	276.9	11
SEM-2-U	63	33	5	0.088	437.8	11
SEM-3-L	83	83	0	0.068	35.5	9
SEM-3-U	33	63	0	0.052	220.8	9
SEM-4-L	12	12	11	0.094	535	13
SEM-4-U	12	33	4	0.078	196.7	13
SKJ-1-L	12	12	0	0.236	229	0
SKJ-1-U	0	0	2	0.098	308.7	0
SKJ-2-L	0	0	2	0.108	118.2	0
SKJ-2-U	0	0	0	0.134	8.8	0
SKJ-3-L	33	33	0	0.148	14.8	28
SKJ-3-U	92	63	6	0.128	12.9	28
SKJ-4-L	33	12	0	0.108	68.4	17
SKJ-4-U	33	33	0	0.116	124.1	17
SKJ-5-L	63	33	0	0.07	197.7	8
SKJ-5-U	83	63	10	0.194	73.1	8
SKJ-6-L	63	33	9	0.099	259.1	18
SKJ-6-U	63	63	1	0.062	354.85	18
STU-1-L	63	63	4	0.0792	2	4
STU-1-U	92	92	11	0.0712	197	4
STU-2-L	63	12	0	0.088	1	4
STU-2-U	83	83	2	0.094	7.9	4
VAL-1-L	83	83	1	0.092	18.4	6
VAL-1-U	63	33	20	0.058	252.6	6
VAL-2-L	12	0	2	0.048	32.5	0
VAL-2-U	0	0	20	0.19	302.8	0
VAL-3-L	12	0	2	0.094	502.2	0
VAL-3-U	0	12	0	0.102	11	0
VAL-4-L	0	0	7	0.118	326.8	23
VAL-4-U	83	33	5	0.054	45	23
YDS-1-L	0	0	13	0.138	259.1	1
YDS-1-U	0	0	4	0.152	287	1
YDS-2-L	63	12	0	0.144	63.4	7
YDS-2-U	63	33	8	0.128	377	7
YDS-3-L	92	92	9	0.094	106	3
YDS-3-U	92	92	3	0.083	388.5	3
YDS-4-L	92	92	1	0.05	108.4	2
YDS-4-U	92	92	4	0.067	169.8	2

Table 5 part 7 of 9.

ID	Pools	Density Nullpluss	Density.lt. nullplus	Years.after. measure	Before. after	Over. under	Measure type
BJO-1-L	2	18.62	11.97	Control	control	Control	Control
BJO-1-U	2	18.62	11.97	Control	control	Control	Control
BJO-2-L	2	22.78	12.68	Control	control	Control	Control
BJO-2-U	2	22.78	12.68	Control	control	Control	Control
BJO-3-L	1	51.92	10.34	Control	control	Control	Control
BJO-3-U	1	51.92	10.34	Control	control	Control	Control
BJO-4-L	0	55.65	7.37	Control	control	Control	Control
BJO-4-U	0	55.65	7.37	Control	control	Control	Control
BJO-5-L	2	76.95	2.06	Control	control	Control	Control
BJO-5-U	2	76.95	2.06	Control	control	Control	Control
BRO-1-L	4	68.17	46.27	2	After	Under	Connect
BRO-1-U	4	68.17	46.27	2	After	Under	Connect
BRO-2-L	2	6.54	7.34	2	After	Under	Connect
BRO-2-U	2	6.54	7.34	2	After	Under	Connect
BRO-3-L	1	16.79	20.65	2	After	Under	Connect
BRO-3-U	1	16.79	20.65	2	After	Under	Connect
BRO-4-L	0	10.62	10.95	2	After	In station	Connect
BRO-4-U	0	10.62	10.95	2	After	In station	Connect
BRO-5-L	2	2.31	0	2	After	In station	Connect
BRO-5-U	2	2.31	0	2	After	In station	Connect
BRO-6-L	1	3.29	0	2	After	Over	Connect
BRO-6-U	1	3.29	0	2	After	Over	Connect
BRO-7-L	7	0	0	2	After	Over	Connect
BRO-7-U	7	0	0	2	After	Over	Connect
BRO-8-L	3	0	0	2	After	Over	Connect
BRO-8-U	3	0	0	2	After	Over	Connect
EKL-1-L	3	4.25	0	4	After	Under	Connect
EKL-1-U	3	4.25	0	4	After	Under	Connect
EKL-2-L	7	0	0	4	After	Over	Connect
EKL-2-U	7	0	0	4	After	Over	Connect
FOL-1-L	5	10.2	6.98	4	After	Under	Connect
FOL-1-U	5	10.2	6.98	4	After	Under	Connect
FOL-2-L	5	54.7	3.29	4	After	Under	Connect
FOL-2-U	5	54.7	3.29	4	After	Under	Connect
FOL-3-L	3	118.06	1.17	4	After	Over	Connect
FOL-3-U	3	118.06	1.17	4	After	Over	Connect
FOL-4-L	2	94.64	5.87	4	After	Over	Connect
FOL-4-U	2	94.64	5.87	4	After	Over	Connect
FOL-5-L	0	4.15	0	4	After	Over	Connect
FOL-5-U	0	4.15	0	4	After	Over	Connect

Table 5 part 8 of 9.

ID	**Pools**	**Density Nullpluss**	**Density.lt. nullplus**	**Years.after. measure**	**Before. after**	**Over. under**	**Measure type**
HYL-1-L	0	342.38	7.75	2	After	Over	Connect
HYL-1-U	0	342.38	7.75	2	After	Over	Connect
HYL-2-L	0	195.89	6.25	2	After	Over	Connect
HYL-2-U	0	195.89	6.25	2	After	Over	Connect
KAR-1-L	0	76.01	2.32	0	After	Under	Connect
KAR-1-U	0	76.01	2.32	0	After	Under	Connect
KAR-2-L	0	69.12	12.9	0	After	Over	Connect
KAR-2-U	0	69.12	12.9	0	After	Over	Connect
KAR-3-L	0	0	0	0	After	Over	Connect
KAR-3-U	0	0	0	0	After	Over	Connect
KOR-1-L	4	20.49	7.21	4	After	Under	Connect
KOR-1-U	4	20.49	7.21	4	After	Under	Connect
KOR-2-L	0	23.71	0	4	After	Over	Connect
KOR-2-U	0	23.71	0	4	After	Over	Connect
KOR-3-L	0	44.26	13.25	4	After	Over	Connect
KOR-3-U	0	44.26	13.25	4	After	Over	Connect
KVE-1-L	0	71.64	3.15	2	After	Under	Connect
KVE-1-U	0	71.64	3.15	2	After	Under	Connect
KVE-2-L	2	47.71	7.85	2	After	Under	Connect
KVE-2-U	2	47.71	7.85	2	After	Under	Connect
KVE-3-L	0	10.76	8.66	2	After	Over	Connect
KVE-3-U	0	10.76	8.66	2	After	Over	Connect
KVE-4-L	0	12.12	6.06	2	After	Over	Connect
KVE-4-U	0	12.12	6.06	2	After	Over	Connect
KVE-5-L	0	0	2.89	2	After	Over	Connect
KVE-5-U	0	0	2.89	2	After	Over	Connect
KVI-1-L	0	2.14	0	4	After	Under	Sewage
KVI-1-U	0	2.14	0	4	After	Under	Sewage
KVI-2-L	1	0	3.47	4	After	Over	Sewage
KVI-2-U	1	0	3.47	4	After	Over	Sewage
KVI-3-L	2	0	0	4	After	Over	Sewage
KVI-3-U	2	0	0	4	After	Over	Sewage
KVI-4-L	5	0	3.85	4	After	Over	Sewage
KVI-4-U	5	0	3.85	4	After	Over	Sewage
ROS-1-L	1	0	6.4	Control	control	Control	Control
ROS-1-U	1	0	6.4	Control	control	Control	Control
ROS-2-L	2	0	7.68	Control	control	Control	Control
ROS-2-U	2	0	7.68	Control	control	Control	Control

Table 5 part 9 of 9.

ID	Pools	Density Nullpluss	Density.lt. nullplus	Years.after. measure	Before. after	Over. under	Measure type
SEM-1-L	0	87.41	6.63	3	After	Under	Connect
SEM-1-U	0	87.41	6.63	3	After	Under	Connect
SEM-2-L	3	143.82	22.02	3	After	Under	Connect
SEM-2-U	3	143.82	22.02	3	After	Under	Connect
SEM-3-L	0	12.33	8.55	3	After	Over	Connect
SEM-3-U	0	12.33	8.55	3	After	Over	Connect
SEM-4-L	2	0	14.68	3	After	Over	Connect
SEM-4-U	2	0	14.68	3	After	Over	Connect
SKJ-1-L	2	135.23	9.23	2	After	In station	Habitat
SKJ-1-U	2	135.23	9.23	2	After	In station	Habitat
SKJ-2-L	0	166.29	0	2	After	In station	Habitat
SKJ-2-U	0	166.29	0	2	After	In station	Habitat
SKJ-3-L	4	37.16	31.01	2	After	Over	Habitat
SKJ-3-U	4	37.16	31.01	2	After	Over	Habitat
SKJ-4-L	1	158.18	31.75	2	After	Over	Habitat
SKJ-4-U	1	158.18	31.75	2	After	Over	Habitat
SKJ-5-L	3	194.15	6.63	2	After	Over	Habitat
SKJ-5-U	3	194.15	6.63	2	After	Over	Habitat
SKJ-6-L	1	207.06	19.44	2	After	Over	Habitat
SKJ-6-U	1	207.06	19.44	2	After	Over	Habitat
STU-1-L	1	32.38	14.38	4	After	Under	Connect
STU-1-U	1	32.38	14.38	4	After	Under	Connect
STU-2-L	1	0	4.49	4	After	Over	Connect
STU-2-U	1	0	4.49	4	After	Over	Connect
VAL-1-L	2	52.01	12.39	0	After	Under	Connect
VAL-1-U	2	52.01	12.39	0	After	Under	Connect
VAL-2-L	2	52	0	0	After	Over	Connect
VAL-2-U	2	52	0	0	After	Over	Connect
VAL-3-L	0	70.24	3.56	0	After	Over	Connect
VAL-3-U	0	70.24	3.56	0	After	Over	Connect
VAL-4-L	0	84.15	7.96	0	After	Over	Connect
VAL-4-U	0	84.15	7.96	0	After	Over	Connect
YDS-1-L	2	84.96	2.26	1	After	In station	Habitat
YDS-1-U	2	84.96	2.26	1	After	In station	Habitat
YDS-2-L	0	8.87	0.45	1	After	Over	Habitat
YDS-2-U	0	8.87	0.45	1	After	Over	Habitat
YDS-3-L	0	17.7	2.45	1	After	Over	Habitat
YDS-3-U	0	17.7	2.45	1	After	Over	Habitat
YDS-4-L	2	81.58	3.52	1	After	Over	Habitat
YDS-4-U	2	81.58	3.52	1	After	Over	Habitat

Tabell 6: Overview of ASPT-values for all tributary stations.

Tributary-Station	ASPT-score	ASPT-score
SEM-1	6.946524064	Very good
SEM-2	6.273809524	Good
SEM-3	6.34422658	Good
SEM-4	5.78125	Moderate
YDS-1	6.229166667	Good
YDS-2	4.072115385	Very poor
YDS-3	6.294642857	Good
YDS-4	6.410714286	Good
VAL-1	5.333992095	Moderate
VAL-2	5.770526316	Moderate
VAL-3	5.183257919	Poor
VAL-4	5.233333333	Moderate
KVI-1	2.525	Very poor
KVI-2	6.076923077	Good
KVI-3	5.490118577	Moderate
KVI-4	4.388888889	Very poor
BRO-1	2.875	Very poor
BRO-2	4.583333333	Poor
BRO-3	4.316666667	Very poor
BRO-4	5.637254902	Moderate
BRO-5	4.958041958	Poor
BRO-6	6.706521739	Good
BRO-7	5.59375	Moderate
BRO-8	6.598214286	Good
ROS-1	5.208333333	Moderate
ROS-2	5.541208791	Moderate
KOR-1	3.511363636	Very poor
KOR-2	4.1875	Very poor
KOR-3	4.139037433	Very poor
STU-1	5.190635452	Poor
STU-2	5.731121281	Moderate
SKJ-1	5.707720588	Moderate
SKJ-2	6.629411765	Good
SKJ-3	2.75	Very poor
SKJ-4	5.902255639	Moderate
SKJ-5	6.642857143	Good
SKJ-6	6.892592593	Very good
BJO-1	5.990950226	Moderate
BJO-2	4.811538462	Poor
BJO-3	5.761904762	Moderate
BJO-4	4.571895425	Poor
BJO-5	5.561538462	Moderate
FOL-1	3.083333333	Very poor
FOL-2	5.222058824	Moderate
FOL-3	5.928571429	Moderate
FOL-4	6.16025641	Good
FOL-5	6.761904762	Good
EKL-1	5.587719298	Moderate
EKL-2	5.263888889	Moderate
KAR-1	6.47976012	Good
KAR-2	6.304347826	Good
KAR-3	6.546428571	Good
KVE-1	5.402046784	Moderate
KVE-2	4.988888889	Poor
KVE-3	4.390151515	Very poor
KVE-4	6.037433155	Good
KVE-5	6.536796537	Good
HYL-1	6.409166667	Good
HYL-2	5.878019324	Moderate

Table 7: Model selection table for the top 10 candidate models fitted to predict ASPT index scores from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model.

	K	AICc	ΔAICc	AICcWt	Cum.Wt	LL
PC1 * PC3 + Densitynullpluss	8	390.95	0	0.35	0.35	-186.81
PC1 * PC3 + Densitynullpluss + years.after.measure	9	392.9	1.96	0.13	0.48	-186.62
PC1 * PC3 + Densitynullpluss * scale(Distance.fjord)	10	394	3.06	0.08	0.63	-185.97
PC1 * PC3 + Densitynullpluss * years.after.measure	10	394.16	3.22	0.07	0.7	-186.05
PC1 * PC3 + scale(Distance.fjord) + Densitynullpluss + years.after.measure	10	395.23	4.29	0.04	0.74	-186.59
Densitynullpluss	5	395.4	4.46	0.04	0.78	-192.43
PC1 * PC3	7	395.45	4.5	0.04	0.82	-190.21
PC1 + PC2 + PC3	7	395.87	4.92	0.03	0.85	-190.42
Densitynullpluss + years.after.measure	6	395.97	5.02	0.03	0.87	-191.61
PC1 + PC3	6	396.35	5.4	0.02	0.92	-191.8
PC1	5	397.08	6.13	0.02	0.94	-193.27
PC1 * PC3 * scale(Distance.fjord) + Densitynullpluss	12	397.23	6.29	0.02	0.95	-185.13
scale(Distance.fjord) + Densitynullpluss	6	397.49	6.54	0.01	0.97	-192.37
scale(Distance.fjord) * Densitynullpluss	7	398.22	7.27	0.01	0.98	-191.6
PC1 * PC3 * years.after.measure	11	398.53	7.58	0.01	0.98	-187.02
PC1 * PC3 + Densitynullpluss + years.after.measure + Measuretype	12	398.79	7.85	0.01	0.99	-185.91
years.after.measure	5	399.88	8.93	0	0.99	-194.67
PC1 * PC2 * PC3	11	400.67	9.72	0	1	-188.09

Distance.fjord	5	400.82	9.88	0	1	-195.14
Measuretype	7	403.11	12.16	0	1	-194.05
Tributary	18	415.46	24.52	0	1	-186.28

Table 8: Model selection table for the top 10 candidate models fitted to predict alpha diversity (Shannon-Wiener index scores) from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model.

Fixed effects model structure	**K**	**AICc**	**Delta_AICc**	**AICcWt**	**Cum.Wt**	**LL**
PC1 * PC3 + Densitynullpluss + Distance.fjord	9	118.64	0.00	0.25	0.25	-49.49
PC1 * PC3 + Distance.fjord	8	120.19	1.55	0.11	0.36	-51.43
PC1 * PC3 + Densitynullpluss * Distance.fjord	10	120.20	1.56	0.11	0.48	-49.07
Densitynullpluss + Distance.fjord	6	120.65	2.01	0.09	0.57	-53.95
Distance.fjord	5	120.72	2.08	0.09	0.66	-55.09
Densitynullpluss * Distance.fjord	7	121.72	3.09	0.05	0.71	-53.35
PC1 + Densitynullpluss + Distance.fjord	7	122.18	3.55	0.04	0.75	-53.58
PC1 + Densitynullpluss + Distance.fjord	7	122.18	3.55	0.04	0.79	-53.58
Densitynullpluss	5	122.55	3.91	0.04	0.83	-56.01
PC1*PC3	7	123.45	4.81	0.02	0.85	-54.21
PC1 + Densitynullpluss	6	123.55	4.91	0.02	0.87	-55.40
PC1 + PC3 + Densitynullpluss + Distance.fjord	8	124.19	5.55	0.02	0.89	-53.43
Over.under+ Distance.fjord	7	124.28	5.64	0.01	0.90	-54.63
PC1 * PC3 * Densitynullpluss + Distance.fjord	12	124.57	5.93	0.01	0.92	-48.80
Distance.fjord *years.after.measure	7	124.67	6.03	0.01	0.93	-54.82
1	4	125.16	6.52	0.01	0.94	-58.40
PC1	5	125.47	6.83	0.01	0.94	-57.47
Measuretype + Distance.fjord	8	125.75	7.11	0.01	0.95	-54.21
PC1 * Densitynullpluss	7	125.80	7.17	0.01	0.96	-55.39
PC2	5	125.83	7.20	0.01	0.97	-57.65
PC3	5	126.53	7.89	0.00	0.97	-58.00
Over.under+PC1	7	126.71	8.07	0.00	0.97	-55.85

years.after.measure	5	126.91	8.27	0.00	0.98	-58.19
PC1 * PC3 * Densitynullpluss + Distance.fjord-+ years.after.measure	13	126.98	8.34	0.00	0.98	-48.74
PC1*PC2	7	127.36	8.72	0.00	0.99	-56.17
PC1+PC2+PC3	7	127.87	9.23	0.00	0.99	-56.43
poly(years.after.measure,2,raw=T)	6	128.37	9.73	0.00	0.99	-57.81
PC1*PC3 + Measuretype	10	128.49	9.85	0.00	0.99	-53.22
Over.under+Measuretype+PC1	9	128.56	9.92	0.00	0.99	-54.45
PC1*PC2*PC3	11	129.11	10.48	0.00	1.00	-52.31
Measuretype	7	129.49	10.85	0.00	1.00	-57.24
Measuretype+PC1	8	129.51	10.88	0.00	1.00	-56.10
Measuretype* Distance.fjord	11	129.67	11.03	0.00	1.00	-52.59
Over.under+years.after.measure	7	130.22	11.58	0.00	1.00	-57.60
Measuretype+PC1+PC2+PC3	10	131.40	12.76	0.00	1.00	-54.67
Measuretype+years.after.measure	8	131.78	13.14	0.00	1.00	-57.23
Tributary	18	135.00	16.36	0.00	1.00	-46.05

Table 9: Model selection table for the top 10 candidate models fitted to predict abundance from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model.

Fixed effects model structure	**K**	**AICc**	**Delta_AICc**	**AICcWt**	**Cum.Wt**	**LL**
Distance.fjord	5	308.04	0	0.29	0.29	-148.75
years.after.measure^2 + Distance.fjord	7	309.84	1.8	0.12	0.41	-147.41
Distance.fjord + PC1	6	309.92	1.88	0.11	0.53	-148.58
1	4	310.15	2.12	0.1	0.63	-150.9
years.after.measure^2 + Distance.fjord + PC1	8	311.6	3.57	0.05	0.68	-147.14
years.after.measure^2	6	311.93	3.9	0.04	0.72	-149.59
years.after.measure	5	312.12	4.09	0.04	0.76	-150.79
PC2	5	312.19	4.15	0.04	0.8	-150.83
PC3	5	312.22	4.19	0.04	0.83	-150.84
PC1	5	312.24	4.2	0.04	0.87	-150.85
Densitynullpluss	5	312.31	4.28	0.03	0.9	-150.89
Distance.fjord + PC1 * PC3	8	312.46	4.43	0.03	0.94	-147.57
years.after.measure + PC1	6	314.21	6.17	0.01	0.98	-150.73
Tributary	18	314.42	6.39	0.01	0.99	-135.76
Measuretype	7	315.49	7.45	0.01	1	-150.24

Table 10: Model selection table for the top 10 candidate models fitted to predict macroinvertebrate composition from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model.

Model structure	**npar**	**AIC**	**ΔAIC**
PC1+PC2+PC3	4	451.7778	0
PC1+PC2	3	452.2516	0.473873
PC2+PC3 +years.after.measure	4	452.4043	0.626564
PC2+PC3	3	452.6681	0.890298
PC1+PC3 +Densitynullpluss	4	452.865	1.087269
PC1+PC3 +Distance.fjord	4	453.0596	1.28185
PC2	2	453.0827	1.304921
PC1+PC3	3	453.3404	1.562678
PC1+PC3 +Measuretype	6	453.5991	1.82132
PC1	2	453.7415	1.963719
Densitynullpluss	2	453.9305	2.152715
Distance.fjord	2	453.9516	2.173831
years.after.measure	2	454.0828	2.305075
PC3	2	454.1458	2.36803
Measuretype	4	454.2782	2.50042
1	1	454.491	2.713218

Table 11: Functional group model selection table for the top 10 candidate models fitted to predict the fraction of each functional group from a given station. K = number of estimated parameters per model, AICc = Information criterion requested per model, ΔAICc = The appropriate delta component dependant on AICc selected, AICcWt = relative support (Akaike weights), Cum.Wt = Cumulative Akaike weights, LL = Log likelihood value per model.

	df	**AIC**	**deltaAIC**
PC1*PC2*PC3	40	44980.28	0
PC1*PC2*PC3+Densitynullpluss	45	44983.64	3.354689
PC1*PC2*PC3+ Distance.fjord	45	44994.34	14.06315
PC1*PC2*PC3+years.after.measure	45	44994.9	14.62257
PC1*PC2*PC3+Measuretype	55	45001.44	21.15879

PC1*PC3	20	45378.72	398.4405
PC1*PC3+Densitynullpluss	25	45384.74	404.4604
Distance.fjord **+Densitynullpluss+PC1*PC3**	30	45397.12	416.8414
PC1	10	45446.77	466.4889
PC1+Distance.fjord	15	45459.32	479.0439
Distance.fjord **+poly(years.after.measure**	20	45744.1	763.8201
Densitynullpluss	10	45749.36	769.0781
Distance.fjord	10	45750.47	770.194
Measuretype	20	45767.58	787.3034

Script Output 1: From R-script; Parameter estimates, species scores and site scores.

```
               DCA1    DCA2    DCA3
Eigenvalues     0.3751 0.19950 0.07916
Decorana values 0.3796 0.08882 0.06549
Axis lengths    1.9184 1.53546 1.19452
                DCA4
Eigenvalues     0.07624
Decorana values 0.04431
Axis lengths    1.76345



Call:
rda(X = scale(BenthicHab[, c(89:100)]))

Partitioning of variance:
              Inertia Proportion
Total              12          1
Unconstrained      12          1

Eigenvalues, and their contribution to the variance

Importance of components:
                        PC1    PC2    PC3
Eigenvalue           3.1169 1.6512 1.3867
Proportion Explained  0.2597 0.1376 0.1156
Cumulative Proportion 0.2597 0.3973 0.5129
                        PC4     PC5
Eigenvalue           1.1880 0.97580
Proportion Explained  0.0990 0.08132
Cumulative Proportion 0.6119 0.69322
                         PC6     PC7
Eigenvalue           0.79931 0.73304
Proportion Explained  0.06661 0.06109
Cumulative Proportion 0.75983 0.82092
                         PC8     PC9
Eigenvalue           0.62840 0.57834
Proportion Explained  0.05237 0.04819
Cumulative Proportion 0.87328 0.92148
                        PC10    PC11
Eigenvalue           0.42993 0.36488
Proportion Explained  0.03583 0.03041
Cumulative Proportion 0.95731 0.98771
                        PC12
Eigenvalue           0.14746
Proportion Explained  0.01229
Cumulative Proportion 1.00000
```

Scaling 2 for species and site scores
* Species are scaled proportional to eigenvalues
* Sites are unscaled: weighted dispersion equal on all dimensions
* General scaling constant of scores: 6.121273

Species scores:

	PC1	**PC2**
Mean.width	-0.45727	0.67231
Water.velocity	0.62162	0.94511
Algae	-0.12887	0.72195
Moss	0.46579	0.93695
Shadow.water	-1.38804	0.26410
Shadow.floodsone	-1.40821	0.66590
Shadow.riverbed	-1.28572	0.77802
Hiding.spots	0.87987	0.73891
Mean.depth.transekt	0.06401	0.20494
mean.substrate.transect	1.06304	0.77848
Dead.wood	-0.84721	0.07923
Pools	-0.84531	-0.30459
	PC3	**PC4**
Mean.width	-0.94061	0.31834
Water.velocity	-0.05611	0.39853
Algae	-0.46827	-1.23034
Moss	0.40650	-0.52219
Shadow.water	0.23094	0.05549
Shadow.floodsone	0.13988	0.27434
Shadow.riverbed	-0.07376	-0.10178
Hiding.spots	0.72862	0.47919
Mean.depth.transekt	-0.93707	1.06682
mean.substrate.transect	0.52213	0.24259
Dead.wood	0.73471	0.16399
Pools	0.87058	0.34761
	PC5	**PC6**
Mean.width	-0.31839	0.73955
Water.velocity	0.80326	-0.47454
Algae	-0.06914	0.47147
Moss	0.55197	0.26820
Shadow.water	0.25958	-0.01557
Shadow.floodsone	-0.28652	-0.39614
Shadow.riverbed	-0.43436	-0.55213
Hiding.spots	-0.58432	-0.05134
Mean.depth.transekt	0.33088	0.32093
mean.substrate.transect	-0.46235	0.29625
Dead.wood	0.94148	0.42337
Pools	-0.31883	0.77126

```
Site scores (weighted sums of species scores)
          PC1       PC2       PC3
sit1   0.087555  0.714438 -0.177361
sit2  -0.426092  0.035379 -0.484607
sit3  -0.587002  0.144610 -0.522913
sit4  -0.189360 -0.012759 -0.802416
sit5  -0.655096  0.442700 -0.673763
sit6  -0.008189 -0.220734 -0.673668
sit7  -0.610778  0.954748 -1.148683
sit8  -0.302893  1.668049 -1.507761
sit9  -0.376956 -0.046975  0.263376
sit10 -0.082252 -0.599295  0.014800
sit11 -0.665138  0.067494  0.489402
sit12 -0.180841 -0.657103  0.450687
sit13 -0.419099  0.247296  0.388689
sit14 -0.240768  0.601429 -0.919694
sit15 -0.534879 -0.089398 -0.025186
sit16 -0.225819  0.664825 -1.027168
sit17  0.558511 -0.337084 -0.649217
sit18  0.826224 -0.035685 -0.267015
sit19  0.726006 -0.388245  0.166595
sit20  0.551753 -0.669221 -0.104602
sit21  0.677269 -0.098233 -0.170746
sit22  1.007951 -0.099242  0.393065
sit23 -0.336058 -0.221181  1.094044
sit24 -0.860023 -0.275046  1.024441
sit25 -0.675674 -0.301834  0.481305
sit26 -0.746978 -0.229789 -0.086447
sit27 -0.246869 -0.315255  0.199789
sit28 -0.152653 -0.171223  0.520836
sit29 -0.850291 -0.678201  0.715557
sit30 -0.599151 -1.018379  0.712952
sit31 -0.990479 -0.188183  0.262380
sit32 -0.979398  0.453710  0.108022
sit33  0.272195 -0.124851  0.547243
sit34  0.745861 -0.021798  0.954056
sit35 -0.076068 -0.579829  0.075991
sit36 -0.683875 -0.393616  0.113470
sit37 -0.344210 -0.038538  0.217643
sit38 -0.245329  0.235857  0.505622
sit39  0.288590 -0.335454  0.167108
sit40  0.070932 -0.658172  0.137392
sit41 -0.098885  0.175706  0.054178
sit42  0.936745 -0.434837  0.215510
sit43  0.685010 -0.263545 -0.384475
```

sit44	0.435412	-0.634034	-0.421325
sit45	0.190394	-0.309654	0.574007
sit46	0.323352	0.097149	0.909436
sit47	1.199123	1.414740	1.149410
sit48	1.435953	0.982628	0.960568
sit49	1.003299	0.938172	0.519908
sit50	0.953906	0.544088	0.248409
sit51	-0.645889	-0.569881	0.491092
sit52	-0.838918	-0.129823	0.484380
sit53	0.504395	0.068294	0.231982
sit54	0.088358	-0.819768	-0.668104
sit55	0.661616	-0.879199	-0.295708
sit56	0.534178	-1.056802	-0.464377
sit57	0.675309	-0.284040	-0.290839
sit58	0.319257	-0.191149	-0.439806
sit59	-0.189096	-0.001047	0.014955
sit60	0.063846	0.262263	0.225763
sit61	0.721196	-0.090602	0.007187
sit62	0.548960	0.463418	0.015400
sit63	0.288639	-0.273984	0.210126
sit64	0.281352	-0.917248	-0.158268
sit65	0.472475	-0.362249	-0.308335
sit66	0.402946	-0.083307	-0.171366
sit67	0.420281	-0.381206	-2.010680
sit68	0.965791	1.020532	-0.525361
sit69	0.678659	1.495586	0.461728
sit70	0.068661	0.403226	-0.191628
sit71	-0.299517	-0.402982	-0.606893
sit72	0.089603	0.165933	-0.351471
sit73	-0.352043	0.172624	0.767616
sit74	-0.200360	0.043961	0.965417
sit75	-0.246624	-0.659778	-0.436324
sit76	-0.027267	-0.798879	-0.348154
sit77	0.093165	-0.578542	0.013838
sit78	-0.388348	-0.624604	0.092321
sit79	-0.641619	0.103296	-0.215704
sit80	-0.687544	0.567076	-0.200971
sit81	-0.444723	1.158554	0.090890
sit82	-0.207525	0.058478	0.659703
sit83	-0.716164	0.222520	-0.433667
sit84	-0.432301	0.438854	-0.398841
sit85	0.727702	0.579188	0.688635
sit86	0.074597	0.564002	0.186578
sit87	0.389258	-0.661485	-0.600527
sit88	0.675690	-0.394474	-0.174105
sit89	0.568570	-0.714460	-0.560257
sit90	0.546076	-0.624000	-0.781067

```
sit91  -0.745886 -0.342120  0.385360
sit92  -0.958363 -0.011644  0.629346
sit93  -0.036078  0.262813 -0.265836
sit94  -0.242073 -0.089737 -0.063806
sit95  -0.441565 -0.326732  0.374945
sit96  -0.576824  0.120595  0.318816
sit97  -0.151418  0.249313  0.525647
sit98  -0.005500  1.648213  0.644328
sit99  -0.523912 -0.305865  0.118362
sit100 -0.175913  0.355172  0.390447
sit101 -0.356500 -0.463002 -0.245091
sit102 -0.548879  0.050825 -0.262714
sit103 -0.677786 -0.081681  0.104705
sit104  0.026232  0.249022  0.989923
sit105  0.171930 -0.743188  0.144100
sit106  1.049261  0.037370  0.564128
sit107  0.925184 -0.132078  0.081671
sit108  0.470722 -0.917991 -0.347416
sit109  0.441155 -0.082884  0.562145
sit110 -0.414423  0.116401  0.564554
sit111  0.738839  0.266754 -0.449060
sit112  0.603092  0.052494 -0.751013
sit113 -0.272611 -0.006869 -1.101913
sit114 -0.081225  0.691590 -0.569199
sit115 -0.642123  0.804866 -0.752438
sit116 -0.285842  1.134220 -0.802845
sit117 -0.714074  0.425783 -0.163217
sit118 -0.703001  0.814436 -0.187932
             PC4       PC5        PC6
sit1    0.727624  0.876785  0.1760735
sit2    0.531649  0.568602 -0.1589408
sit3    0.445235  0.391258  0.3146298
sit4    0.779255  0.563847  0.7951124
sit5    0.438987  0.264032 -0.5563708
sit6    0.505612  0.340582  0.6653332
sit7   -0.506869  0.084566 -0.3833847
sit8   -2.443301  0.001588  1.0165389
sit9   -0.092584 -0.439042 -0.6913441
sit10  -0.258465  0.338775 -0.1635316
sit11   0.247806  0.480422 -0.2071764
sit12  -0.163214  0.026725  0.4390904
sit13   0.106725 -0.746061 -0.5347389
sit14   1.831817  0.497704  0.0159437
sit15  -0.199767  0.229847 -0.7046356
sit16   1.808212  0.625736 -0.0524208
sit17  -1.049154 -0.499031  0.5487342
sit18  -0.955111 -0.944631  0.6360371
```

sit19	-0.092244	-0.648795	0.3538852
sit20	-0.173575	-0.477482	0.3818636
sit21	-0.926404	-0.491561	0.4532262
sit22	0.115823	-0.761074	-0.0847171
sit23	0.335740	-0.591607	0.9375589
sit24	0.173206	-0.520813	0.2433292
sit25	0.005625	0.437893	-0.0458530
sit26	0.629094	0.284662	0.2173237
sit27	-0.111370	-0.020779	-0.1226720
sit28	-0.230494	-1.227733	-0.0748604
sit29	0.201942	-0.096181	0.8995911
sit30	-0.046770	-0.005628	1.3076288
sit31	-0.006531	-0.652144	0.0004137
sit32	-0.670637	-0.355186	0.2912833
sit33	0.356341	-0.766229	0.5941371
sit34	0.439934	-1.431906	1.1135630
sit35	-0.168063	0.128240	0.0022828
sit36	-0.223017	-0.388061	-0.2612165
sit37	-0.036870	0.292662	-0.6263460
sit38	0.028791	-0.590060	-0.3649743
sit39	-0.105757	1.395461	-0.5445666
sit40	-0.298397	0.665746	-0.2990818
sit41	-0.118331	-0.532686	-1.4627204
sit42	-0.200719	-0.659724	-0.2155400
sit43	-1.085506	-0.637837	0.3351057
sit44	-0.395432	0.056170	-0.2038086
sit45	-0.120449	0.842892	0.3797176
sit46	0.202147	0.635556	0.3119590
sit47	-0.523519	1.070948	0.0150109
sit48	0.929243	-0.158487	-0.2915494
sit49	-0.759088	0.952942	0.0917255
sit50	0.232433	-0.016880	-0.3254688
sit51	0.007861	0.586272	0.6072517
sit52	0.165946	-0.089001	0.2429061
sit53	-0.009637	-0.231626	-0.4309537
sit54	-0.028052	-0.033330	-0.0686522
sit55	-0.287004	-0.045526	-0.3760718
sit56	-0.358603	0.151981	-0.4838406
sit57	-0.065563	0.161429	-0.5356563
sit58	-0.112922	0.299909	-1.0531917
sit59	0.197252	0.493617	-0.3521798
sit60	0.319012	-0.391329	-0.2621173
sit61	0.019670	0.213945	-0.6304501
sit62	0.489151	0.196136	-0.5936419
sit63	-0.205237	0.329099	-0.7153013
sit64	-0.500087	0.284987	-0.4790444
sit65	-0.101344	0.095689	-0.6515839

```
sit66  -0.034573  0.707569 -0.9943977
sit67   1.024780  0.290251  0.9355912
sit68   1.177813 -0.542774  0.4479170
sit69   0.203826  0.251339 -0.0015227
sit70   0.420748 -0.353218 -0.2919365
sit71   0.352640 -0.286475  0.0578628
sit72   0.357800  0.154454  0.2692462
sit73   0.144963  0.141551  0.6677382
sit74   0.236004 -0.096726  1.0969571
sit75   0.030636  0.452285  0.5935545
sit76  -0.232516  0.302348  0.5619606
sit77  -0.081569  0.767983  0.1617441
sit78  -0.198797  0.227576  0.1547639
sit79  -0.188788 -0.107420 -0.6241071
sit80  -0.881520 -0.335678  0.0362787
sit81  -0.142541  0.144240 -0.3258115
sit82   0.232448 -0.435024  0.3276378
sit83  -0.119480 -0.142194 -0.6676663
sit84  -1.281942 -0.209785  0.6384241
sit85   0.633234  0.419364  0.0076011
sit86  -0.816455  0.796669  0.4394297
sit87   0.221745 -0.414539  0.5276272
sit88   0.022830 -0.194248  0.2012879
sit89  -0.254157 -0.232269 -0.0081846
sit90  -0.126831  0.301981 -0.2790618
sit91   0.352971  1.032856  1.0377680
sit92   0.439485  0.187540  0.6515316
sit93  -0.878126  1.000592  0.7323500
sit94   0.124514  0.778326  0.0497532
sit95  -0.078957 -0.138996 -0.0035925
sit96   0.537630 -0.422933 -0.2613184
sit97   0.331039  0.206596 -0.1000855
sit98  -1.521616  1.258251  0.7143553
sit99  -0.263609 -0.332481 -0.8569796
sit100  0.057128 -0.944447 -1.2508880
sit101 -0.162193  0.035432 -0.2491584
sit102 -0.076092 -0.381740 -0.9142080
sit103 -0.104112 -0.183703 -0.9476464
sit104  0.301586 -0.928244 -0.3800775
sit105 -0.334949  0.153208 -0.4162748
sit106  0.393748 -0.610332  0.1864600
sit107 -0.025990  0.112433 -0.6751500
sit108 -0.456880  0.172063 -0.7063028
sit109  0.244802  1.110709  0.0703952
sit110  0.054732  1.046133 -0.8521780
sit111  0.656795 -0.594793  0.8270048
sit112  0.491332 -0.274561  0.9018042
```

```
sit113  0.250781 -0.180022  0.6828403
sit114  0.552671 -0.705065  0.6168561
sit115  0.321829 -1.166538 -0.1671767
sit116  0.410496 -0.873322 -0.2735428
sit117  0.013760 -0.478879 -0.8413688
sit118 -0.975116 -0.901618  0.1132427

>
```

Script Output 2: From R-script; Estimates for functional groups.

```
Equation for Grazers/gatherers vs Active filter feeders:
            Estimate Std. Error z value
(Intercept)   5.9106     0.6993   8.452
PC1          -1.7912     0.4134  -4.333
PC2          -0.6464     0.2430  -2.660
PC3           2.0618     0.5171   3.988
PC1:PC2      -2.4502     0.6284  -3.899
PC1:PC3       3.0941     0.6405   4.831
PC2:PC3      -6.0790     0.4774 -12.733
PC1:PC2:PC3   1.4738     1.1434   1.289
            Pr(>|z|)
(Intercept)  < 2e-16 ***
PC1         1.47e-05 ***
PC2          0.00781 **
PC3         6.68e-05 ***
PC1:PC2     9.65e-05 ***
PC1:PC3     1.36e-06 ***
PC2:PC3      < 2e-16 ***
PC1:PC2:PC3  0.19741

Equation for Miners vs Active filter feeders:
             Estimate Std. Error z value
(Intercept)  -5.13029    1.45264  -3.532
PC1           0.03833    2.07713   0.018
PC2          -3.76123    2.47094  -1.522
PC3           4.76512    2.38600   1.997
PC1:PC2       2.68716    4.51918   0.595
PC1:PC3       3.01816    4.07130   0.741
PC2:PC3       0.81102    4.13137   0.196
PC1:PC2:PC3 -17.53916   10.56560  -1.660
            Pr(>|z|)
(Intercept) 0.000413 ***
PC1         0.985276
PC2         0.127963
PC3         0.045813 *
PC1:PC2     0.552103
PC1:PC3     0.458496
```

```
PC2:PC3     0.844369
PC1:PC2:PC3 0.096909 .

Equation for Passive filter feeders vs Active filter feeders:
            Estimate Std. Error z value
(Intercept)   0.9176     0.6934   1.323
PC1          -1.9822     0.4747  -4.176
PC2          -1.4985     0.2937  -5.102
PC3           1.2043     0.6028   1.998
PC1:PC2      -1.5470     0.7207  -2.146
PC1:PC3       2.3988     0.7965   3.012
PC2:PC3      -7.0832     0.5653 -12.530
PC1:PC2:PC3   2.8509     1.2774   2.232
            Pr(>|z|)
(Intercept)   0.1857
PC1         2.97e-05 ***
PC2         3.36e-07 ***
PC3           0.0457 *
PC1:PC2       0.0318 *
PC1:PC3       0.0026 **
PC2:PC3      < 2e-16 ***
PC1:PC2:PC3   0.0256 *

Equation for Predators vs Active filter feeders:
            Estimate Std. Error z value
(Intercept)   3.0381     0.6654   4.566
PC1          -1.3241     0.4263  -3.106
PC2          -0.9997     0.2548  -3.923
PC3           2.1373     0.5326   4.013
PC1:PC2      -2.8964     0.6574  -4.406
PC1:PC3       3.9210     0.6665   5.883
PC2:PC3      -6.4933     0.4885 -13.293
PC1:PC2:PC3   3.4043     1.1812   2.882
            Pr(>|z|)
(Intercept) 4.98e-06 ***
PC1          0.00190 **
PC2         8.75e-05 ***
PC3         5.99e-05 ***
PC1:PC2     1.05e-05 ***
PC1:PC3     4.03e-09 ***
PC2:PC3      < 2e-16 ***
PC1:PC2:PC3  0.00395 **

Equation for Shredders vs Active filter feeders:
            Estimate Std. Error z value
(Intercept)  -0.6778     0.8856  -0.765
PC1          -4.4135     0.6355  -6.945
```

```
PC2         -0.7636     0.3894  -1.961
PC3          1.7171     0.6805   2.523
PC1:PC2      -3.6955     0.9501  -3.890
PC1:PC3       2.9322     1.0692   2.742
PC2:PC3      -6.1484     0.6853  -8.971
PC1:PC2:PC3   5.2334     1.7375   3.012
            Pr(>|z|)
(Intercept)   0.4441
PC1        3.78e-12 ***
PC2          0.0499 *
PC3          0.0116 *
PC1:PC2       0.0001 ***
PC1:PC3       0.0061 **
PC2:PC3      < 2e-16 ***
PC1:PC2:PC3   0.0026 **
---
Signif. codes:
  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’
  0.1 ‘ ’ 1

(Co-)Variances:
Grouping level: TribStat
                        Estimate                        Std.Err.
Grazers/gatherers~1      25.68                          19.76
Miners~1                 15.73 12.89                    15.11 12.58
Passive filter feeders~1 21.67 15.42 24.39              27.01 24.59 44.37
Predators~1              20.81 14.26 20.33 22.83        30.17 19.89 32.50 30.09
Shredders~1              27.41 17.28 26.01 27.11 40.06   46.19 32.26 54.93 51.70 82.83
```

Script Output 3: From R-script; Importance of components. Results from the PCA analysis for the habitat characteristics.

```
Importance of components:
                         PC1     PC2
Eigenvalue              11.3006 4.57789
Proportion Explained   0.2421 0.09808
Cumulative Proportion  0.2421 0.34020
                        PC3     PC4
Eigenvalue              3.5470 2.72649
Proportion Explained  0.0760 0.05842
Cumulative Proportion 0.4162 0.47461
                         PC5     PC6
Eigenvalue              2.11987 1.82112
Proportion Explained  0.04542 0.03902
Cumulative Proportion 0.52003 0.55905
                         PC7     PC8
```

```
Eigenvalue           1.67938 1.53180
Proportion Explained  0.03598 0.03282
Cumulative Proportion 0.59503 0.62785
                       PC9    PC10
Eigenvalue           1.37468 1.29427
Proportion Explained  0.02945 0.02773
Cumulative Proportion 0.65730 0.68504
                      PC11    PC12
Eigenvalue           1.20504 1.08416
Proportion Explained  0.02582 0.02323
Cumulative Proportion 0.71085 0.73408
                      PC13    PC14
Eigenvalue           0.99051 0.96171
Proportion Explained  0.02122 0.02061
Cumulative Proportion 0.75530 0.77591
                      PC15    PC16
Eigenvalue           0.85226 0.79840
Proportion Explained  0.01826 0.01711
Cumulative Proportion 0.79417 0.81128
                     PC17    PC18
Eigenvalue           0.7143 0.66460
Proportion Explained  0.0153 0.01424
Cumulative Proportion 0.8266 0.84082
                      PC19    PC20
Eigenvalue           0.62720 0.59321
Proportion Explained  0.01344 0.01271
Cumulative Proportion 0.85426 0.86697
                      PC21    PC22
Eigenvalue           0.53994 0.48875
Proportion Explained  0.01157 0.01047
Cumulative Proportion 0.87854 0.88901
                       PC23     PC24
Eigenvalue           0.443726 0.397437
Proportion Explained  0.009507 0.008515
Cumulative Proportion 0.898514 0.907029
                       PC25     PC26
Eigenvalue           0.368629 0.309949
Proportion Explained  0.007898 0.006641
Cumulative Proportion 0.914927 0.921568
                       PC27     PC28
Eigenvalue           0.304402 0.285108
Proportion Explained  0.006522 0.006109
Cumulative Proportion 0.928090 0.934198
                       PC29     PC30
Eigenvalue           0.261967 0.231348
Proportion Explained  0.005613 0.004957
Cumulative Proportion 0.939811 0.944768
```

```
                    PC31     PC32
Eigenvalue           0.225016 0.205191
Proportion Explained  0.004821 0.004396
Cumulative Proportion 0.949589 0.953985
                    PC33     PC34
Eigenvalue           0.187117 0.170605
Proportion Explained  0.004009 0.003655
Cumulative Proportion 0.957994 0.961649
                    PC35     PC36
Eigenvalue           0.163717 0.151783
Proportion Explained  0.003508 0.003252
Cumulative Proportion 0.965157 0.968409
                    PC37     PC38
Eigenvalue           0.139435 0.123193
Proportion Explained  0.002987 0.002639
Cumulative Proportion 0.971396 0.974036
                    PC39     PC40
Eigenvalue           0.114148 0.107482
Proportion Explained  0.002446 0.002303
Cumulative Proportion 0.976482 0.978784
                    PC41     PC42
Eigenvalue           0.102820 0.089252
Proportion Explained  0.002203 0.001912
Cumulative Proportion 0.980987 0.982900
                    PC43     PC44
Eigenvalue           0.082343 0.072458
Proportion Explained  0.001764 0.001552
Cumulative Proportion 0.984664 0.986216
                    PC45     PC46
Eigenvalue           0.067594 0.056208
Proportion Explained  0.001448 0.001204
Cumulative Proportion 0.987665 0.988869
                    PC47     PC48
Eigenvalue           0.052509 0.050141
Proportion Explained  0.001125 0.001074
Cumulative Proportion 0.989994 0.991068
                    PC49     PC50
Eigenvalue           0.046933 0.041168
Proportion Explained  0.001006 0.000882
Cumulative Proportion 0.992074 0.992956
                     PC51      PC52
Eigenvalue           0.0351702 0.0327873
Proportion Explained  0.0007535 0.0007025
Cumulative Proportion 0.9937093 0.9944118
                     PC53      PC54
Eigenvalue           0.0307473 0.0274239
Proportion Explained  0.0006588 0.0005876
```

```
Cumulative Proportion 0.9950705 0.9956581
                      PC55      PC56
Eigenvalue            0.0223795 0.0207510
Proportion Explained  0.0004795 0.0004446
Cumulative Proportion 0.9961376 0.9965822
                      PC57      PC58
Eigenvalue            0.0195525 0.0180661
Proportion Explained  0.0004189 0.0003871
Cumulative Proportion 0.9970011 0.9973882
                      PC59      PC60
Eigenvalue            0.0159198 0.0139042
Proportion Explained  0.0003411 0.0002979
Cumulative Proportion 0.9977293 0.9980272
                      PC61      PC62
Eigenvalue            0.0128586 0.0109123
Proportion Explained  0.0002755 0.0002338
Cumulative Proportion 0.9983027 0.9985365
                      PC63      PC64
Eigenvalue            0.0092732 0.0083290
Proportion Explained  0.0001987 0.0001785
Cumulative Proportion 0.9987352 0.9989136
                      PC65      PC66
Eigenvalue            0.0082287 0.0075100
Proportion Explained  0.0001763 0.0001609
Cumulative Proportion 0.9990899 0.9992508
                      PC67      PC68
Eigenvalue            0.0065717 0.0050348
Proportion Explained  0.0001408 0.0001079
Cumulative Proportion 0.9993916 0.9994995
                     PC69      PC70
Eigenvalue            0.004855 4.036e-03
Proportion Explained  0.000104 8.648e-05
Cumulative Proportion 0.999604 9.997e-01
                      PC71      PC72
Eigenvalue            3.798e-03 3.415e-03
Proportion Explained  8.138e-05 7.316e-05
Cumulative Proportion 9.998e-01 9.998e-01
                      PC73      PC74
Eigenvalue            0.0030106 2.418e-03
Proportion Explained  0.0000645 5.181e-05
Cumulative Proportion 0.9999090 1.000e+00
                      PC75
Eigenvalue            1.827e-03
Proportion Explained  3.914e-05
Cumulative Proportion 1.000e+00

Scaling 2 for species and site scores
```

```
* Species are scaled proportional to eigenvalues
* Sites are unscaled: weighted dispersion equal on all dimensions
* General scaling constant of scores:  8.596357
```

Script Output 4: From R-script; Species scores and site scores.

Species scores

```
                 PC1        PC2       PC3
Nemato      0.070282  0.1118030 -0.003626
Acari      -0.613404 -0.0103222  0.054680
Simuli     -0.917858  0.3149317 -0.668303
Dixida     -0.569003 -0.0114284 -0.019740
Limoni     -0.003552 -0.0187467  0.002510
Psycho     -1.924442  0.2027592  1.195828
Pedici      0.005142 -0.0434880 -0.004297
Dicran     -0.556242  0.7963155  0.361800
Eleoph      0.035556  0.5322715 -0.062833
Helius      0.085209  0.0241692  0.012903
Sclero     -0.027152  0.0779427  0.051427
Diptpup    -0.176641  0.4145357 -0.148098
Chirom      0.378750  1.4180755 -0.818336
Cerato     -0.181844  0.7166696  0.202948
Dasyhe     -0.058979  0.0133582 -0.045332
Ptycho      0.004935  0.1533328  0.108505
SiaFul      0.013141  0.0346773 -0.013673
Tipuli      0.030169  0.3180302 -0.139181
Limnep     -0.011174  0.0978433 -0.013285
Chaero.ssp  0.032183  0.0476109 -0.002495
BerMin      0.006607  0.0109992  0.001766
SerPer     -0.012480  0.0027953  0.049279
BraSub      0.010103  0.0443206  0.012848
Rhyaco.ssp -0.484818 -0.1249680 -0.470253
AgaOch     -0.015647  0.0142789  0.019274
SilPal     -0.186254 -0.0433828  0.165621
PleCon     -0.040678 -0.0449828  0.010062
PolFla      0.014821 -0.0004152 -0.004263
RhyFas     -0.046796  0.0111908 -0.060833
RhyNub     -0.342611 -0.4885457 -0.236935
EphVul      0.020817  0.0157288  0.011707
CenLut      0.001412  0.0542840 -0.121670
BaeNig     -0.102669  0.0312234 -0.093213
```

```
BaeMac     0.010284 -0.0087878  0.001840
AlaMut    -1.953056  0.2488061 -0.055690
BaeRho    -2.124846 -0.4165248 -0.684559
NemCin    -0.740552  0.0614338 -1.222674
Baetis     0.041775  0.0307622 -0.019355
Oligoc     0.083069  1.5018466  0.329929
Hirudi     0.028840 -0.0065582  0.026072
Bithyn     0.051248  0.0365472 -0.016067
Lymnae     0.203886  0.4363433  0.077060
Planor     0.081687 -0.0371615  0.084064
Megalo     0.014821 -0.0004152 -0.004263
Gastro     0.100069 -0.0564734 -0.104260
Gerrid     0.003002  0.0120992  0.006254
Dryopi    -0.091012  0.0268656  0.058613
Halipl    -0.019508  0.0083030  0.012094
Agatyp     0.005465  0.2250004 -0.129057
Perlod     0.016956 -0.0167507 -0.005664
Siphlo     0.016956 -0.0167507 -0.005664
CapLau    -0.866464 -0.0563699  0.012056
LeuDig     0.041094  0.0053823 -0.013600
LeuFus     0.028604  0.0621740  0.178488
CapBif    -0.041836 -0.0277905 -0.040871
CapSch    -0.034322  0.0112865  0.037074
DiuNan    -0.135149  0.0081573  0.014347
IsoGra    -0.068582 -0.0647636 -0.002293
Isoper    -0.311295 -0.0479518  0.330243
LeuNig    -0.001520 -0.0363229  0.009293
LeuHip    -0.312138 -0.0113746 -0.039054
Proton    -0.041693 -0.0342554 -0.039121
AmpBor     0.012429 -0.0024402 -0.130601
AmpSta     0.007980 -0.0002238 -0.072981
AmpSul    -0.078414  0.0001793 -0.094657
Collem    -0.119995  0.0912953 -0.150871
NemPic     0.002346 -0.0209997 -0.003744
BerCla     0.008646 -0.0051884 -0.002870
Curcul     0.017936 -0.0080105  0.012444
Dytisc     0.000442 -0.0094284  0.000322
Elmtyp    -0.324790  0.0987511  0.092803
Hydrop    -0.001693  0.0500676  0.006084
Elodes    -0.322773  0.0177397  0.223042
Hydrae    -0.188390 -0.0310168 -0.014556
HydGra    -1.175223  0.2111888  0.259893
Pisidu     0.095305  0.3028046 -0.037539
AseAqu     0.341564  0.3866446 -0.214707
                PC4        PC5       PC6
Nemato     0.0330211 -0.0032763  0.045727
Acari      0.2081237  0.1691604 -0.080884
```

```
Simuli     -0.6534402  0.2484891  0.176683
Dixida     -0.4104957  0.2795279  0.333731
Limoni     -0.0081751  0.0100434  0.013798
Psycho     -0.7661515  0.3403232  0.108056
Pedici     -0.0233150 -0.0148829 -0.008731
Dicran     -0.6902635 -0.7974130 -0.487623
Eleoph     -0.4535856  0.2480282 -0.217498
Helius     -0.0462439  0.0387053 -0.056146
Sclero     -0.0567474  0.0659256 -0.041052
Diptpup    -0.0488290  0.2276045 -0.154167
Chirom      0.0161570  0.2795421 -0.449705
Cerato     -0.1261903  0.3794704 -0.149972
Dasyhe     -0.0184842  0.0080192 -0.029956
Ptycho     -0.0635662  0.1544076 -0.159849
SiaFul     -0.0265166  0.0131291 -0.035076
Tipuli      0.1123102 -0.0123815 -0.223193
Limnep     -0.0463808  0.0544935  0.001107
Chaero.ssp  0.0005265  0.0559976  0.001555
BerMin      0.0055120 -0.0310065 -0.001449
SerPer      0.0033093  0.0864554 -0.108882
BraSub     -0.0477962 -0.0094782 -0.004720
Rhyaco.ssp -0.0675721 -0.3065077 -0.165003
AgaOch     -0.0159890  0.0006794 -0.020714
SilPal      0.0968483 -0.0397187  0.118033
PleCon      0.0791671  0.0139247 -0.037215
PolFla      0.0029086  0.0119366 -0.015703
RhyFas      0.0385453 -0.1238071 -0.090612
RhyNub     -0.2845087 -0.1727253  0.070986
EphVul      0.0055375  0.0176651 -0.012400
CenLut      0.1246371  0.1262010 -0.042010
BaeNig     -0.0165814  0.0347654 -0.005847
BaeMac      0.0023933  0.0035656 -0.001850
AlaMut      1.2233422  0.5624410  0.049210
BaeRho     -0.2324291  0.0774109  0.152801
NemCin     -0.0730628 -0.4521815  0.141357
Baetis     -0.0375612  0.0495310 -0.057820
Oligoc      0.3885836 -0.2600033  0.636045
Hirudi      0.0184335  0.0206235  0.006441
Bithyn      0.0301171  0.0171711  0.018226
Lymnae      0.2102632 -0.3588635  0.329873
Planor      0.0380003 -0.1210876  0.114302
Megalo      0.0029086  0.0119366 -0.015703
Gastro     -0.1790578  0.0566431  0.151314
Gerrid     -0.0149769 -0.0060948 -0.013590
Dryopi     -0.0090670 -0.0315826 -0.029973
Halipl      0.0070291  0.0029246 -0.017444
Agatyp      0.0663541  0.3324514 -0.237222
```

```
Perlod   -0.0029874 -0.0254127 -0.025456
Siphlo   -0.0029874 -0.0254127 -0.025456
CapLau    0.1217663 -0.6277334 -0.049349
LeuDig    0.0077362  0.0172439  0.015574
LeuFus    0.0970590 -0.1486355  0.039739
CapBif   -0.0356405 -0.0380605 -0.122742
CapSch   -0.0297842  0.0161785 -0.051802
DiuNan    0.0330783  0.0007180  0.065238
IsoGra   -0.0801990 -0.0124809  0.002018
Isoper    0.1871271 -0.0633257  0.154497
LeuNig   -0.0270213  0.0324311 -0.005388
LeuHip    0.0716695 -0.1550279 -0.324326
Proton    0.0076162  0.0102686  0.044492
AmpBor   -0.0415572 -0.0155211 -0.032155
AmpSta   -0.0377826 -0.0266945 -0.014771
AmpSul    0.0115043 -0.0600242 -0.021363
Collem   -0.1064543  0.0072535  0.392255
NemPic   -0.0146036 -0.0009416  0.006918
BerCla    0.0025285  0.0027612 -0.003880
Curcul    0.0030108 -0.0033466  0.009468
Dytisc   -0.0061645 -0.0045977 -0.005620
Elmtyp    0.0792219 -0.0593167 -0.017490
Hydrop   -0.0473990  0.0437130  0.051549
Elodes    0.0147162 -0.2222956 -0.035614
Hydrae    0.0476204 -0.0897775  0.093645
HydGra    0.5330481 -0.7060240 -0.274764
Pisidu   -0.1504140  0.0210934  0.026004
AseAqu   -0.2063147 -0.1611111  0.986755


Site scores (weighted sums of species scores)

           PC1      PC2      PC3      PC4
sit1   0.60335 -0.01077  0.73350 -0.36265
sit2   0.92181 -0.55315 -0.30595  0.26956
sit3   0.66776 -0.40928  0.36965 -0.08447
sit4   0.37192 -0.33218  0.52883  0.05412
sit5   0.62498 -0.09426  0.79370 -0.48397
sit6   0.42310 -0.02743  0.35536  0.32207
sit7  -0.87158 -0.06254  1.41888  0.19552
sit8  -0.80823  0.11764  1.21657  0.34811
sit9  -0.52343 -0.13280  0.55767  0.77817
sit10  0.26196  0.65781  1.41057 -0.80097
sit11  1.25368 -0.10497  0.04972  0.35795
sit12  0.89503  0.55948  0.49360  0.10873
sit13  0.90083  0.04390 -0.22778  0.74829
sit14  0.40695  0.28527 -0.39280 -0.40872
```

sit15	0.06622	0.46512	-0.35192	1.35991
sit16	0.01087	0.08220	-0.61279	0.81040
sit17	-0.65702	0.58628	-1.72010	1.75524
sit18	-0.53161	0.13833	-2.37222	1.14014
sit19	0.75014	0.29056	-0.35257	1.72220
sit20	-0.60377	0.54127	-1.61888	1.19303
sit21	-0.31438	-0.30902	-1.13078	-0.41619
sit22	0.17411	-0.86579	-0.72049	-0.18699
sit23	0.25090	0.41770	0.06708	0.20932
sit24	0.40039	0.84941	0.10213	-0.45726
sit25	1.33668	0.95324	-0.41907	0.78553
sit26	1.26366	0.79778	-0.58467	0.89930
sit27	0.77853	-0.76911	-0.26007	-0.13716
sit28	0.71614	-0.19537	-0.22628	1.25353
sit29	-0.12830	1.72963	-0.26937	-0.79134
sit30	-1.12331	1.53036	-1.27383	0.52823
sit31	0.65011	0.09962	0.70582	0.20323
sit32	1.17456	-0.12555	0.09508	-0.39313
sit33	0.02794	-0.54194	-0.11538	0.50286
sit34	0.02973	-0.63419	0.02166	-0.41465
sit35	-1.76978	0.91542	0.60786	-0.03618
sit36	-0.29113	0.93541	1.10322	-0.35838
sit37	-1.37648	1.13035	-0.23674	-0.27106
sit38	-1.02775	0.30393	-0.39108	0.73600
sit39	-0.47985	-0.72036	0.75498	0.44360
sit40	-0.92001	0.10555	-0.18849	-0.44900
sit41	0.20535	-0.78014	-0.46499	0.09621
sit42	-0.12296	-0.71809	-0.63093	-0.19388
sit43	-0.58985	-0.97626	-0.95757	-0.61439
sit44	-0.35690	-0.83237	-1.08910	-0.74057
sit45	-0.63612	-0.49462	-0.65507	0.38389
sit46	-1.40577	0.85876	-0.26195	-0.68485
sit47	-1.29526	-0.23514	-0.89463	0.46112
sit48	-0.38844	-0.83937	-0.56572	-0.06991
sit49	-1.00741	-0.19252	-0.37977	1.10725
sit50	-0.69248	-1.00828	-0.36878	0.56377
sit51	0.96852	0.99905	-0.04637	-0.74211
sit52	1.40377	1.42906	0.08564	0.36056
sit53	0.27706	0.35640	-1.03939	-0.58321
sit54	1.39897	0.84274	-0.14639	0.80062
sit55	0.89780	0.59091	-1.13893	-1.25837
sit56	0.61355	0.99365	-1.07486	-1.57391
sit57	-0.23889	-1.26099	0.16880	-0.54989
sit58	0.07334	-0.69849	0.48952	-1.25389
sit59	0.15780	-1.41253	-0.25183	-0.98230
sit60	0.44004	-1.69208	0.38084	-0.65436
sit61	0.38897	-1.03198	0.36135	-0.76958

sit62	0.71387	-0.96047	-0.08308	-0.17005
sit63	-0.09414	-1.23311	-0.66990	-0.91390
sit64	0.13444	-1.30501	-0.65613	-0.75847
sit65	0.48894	-1.67646	-0.70396	-0.20383
sit66	0.31694	-1.58242	-0.57910	0.35650
sit67	1.34192	-0.15874	-0.08718	0.70869
sit68	1.28720	-0.75975	0.53299	0.80495
sit69	-0.92105	1.69695	-0.93959	-0.36700
sit70	0.80592	0.75946	-1.08757	-0.07522
sit71	0.95582	0.72219	0.53753	0.25425
sit72	0.99690	-0.02793	-0.28674	0.19565
sit73	-0.61730	0.85762	0.24073	1.60330
sit74	1.09639	-0.93688	0.19621	0.25515
sit75	0.29052	1.13311	-0.26237	-0.93206
sit76	-0.90979	-0.04742	0.19841	0.87792
sit77	-1.14562	0.31478	-1.22194	0.88843
sit78	0.17948	-0.30052	-0.38938	1.09584
sit79	-0.05114	-1.22162	0.31255	-0.90878
sit80	-0.11192	-1.45542	0.18416	-1.39188
sit81	-0.33843	-0.43662	1.03564	0.48520
sit82	-1.12254	-1.12586	0.64454	0.57819
sit83	-1.55712	0.19653	1.14304	0.29427
sit84	-1.15777	-0.90286	0.01450	0.74761
sit85	-1.43691	0.36076	1.31873	1.51557
sit86	-1.09974	-0.52682	1.03484	0.57564
sit87	0.90898	0.37233	0.25554	0.62879
sit88	0.57342	1.02068	0.15952	0.12790
sit89	0.49561	0.46219	0.60192	-0.62689
sit90	0.20195	0.81384	0.42066	-1.00741
sit91	0.84496	-0.40645	0.90823	-0.54530
sit92	0.87168	0.65627	0.70814	-0.79856
sit93	-0.39757	0.13480	1.00066	-0.42581
sit94	0.35825	-0.13279	1.41251	-0.51807
sit95	-0.26702	-0.37176	0.22239	-0.52889
sit96	-0.36982	-0.70728	0.74022	-0.45752
sit97	-0.85787	-0.39450	-0.15104	-0.80605
sit98	-1.07723	-0.43566	-0.60202	-0.33687
sit99	0.05308	0.98026	0.35235	-1.67144
sit100	-1.25100	0.50799	-1.37971	-0.86068
sit101	0.59801	-0.25290	-1.27016	-0.49022
sit102	-0.04178	0.16236	-2.48390	-1.40016
sit103	1.00291	1.03150	0.16632	-0.22951
sit104	-0.53335	0.26898	0.47539	-0.31083
sit105	-0.63173	0.08390	0.53039	0.02453
sit106	-0.10856	-0.86312	-0.03831	0.30995
sit107	-1.05032	0.76859	0.26104	-0.46970
sit108	-1.04627	1.29981	0.32572	-1.43421

```
sit109 -0.79652  0.87887  0.96134 -1.79136
sit110 -0.69510  0.92790  0.60054 -1.51467
sit111  1.04957  1.21444  0.38514  1.07284
sit112  0.62888  1.08286  0.52744  0.58021
sit113  0.77864  0.33223  0.74205 -0.10361
sit114  0.88120 -0.91947  0.32154  0.60507
sit115 -0.40924  0.30614  2.35157  1.44832
sit116  0.23226 -0.42089  0.17297  1.51368
sit117 -1.07028 -0.44477  1.19704  0.13062
sit118 -0.54639 -0.88509  0.56311  0.59475
              PC5      PC6
sit1   -0.5127245 -0.19014
sit2    0.2943729 -0.41364
sit3    0.3169132 -0.20167
sit4    0.0003252  0.15128
sit5    0.2054596  0.09227
sit6    0.9317229  0.54711
sit7   -0.5521445  0.35874
sit8   -0.3006559  0.20576
sit9   -0.2652688 -0.19956
sit10  -0.0174918 -0.62373
sit11  -0.1258596 -0.41788
sit12  -0.2124701 -0.69707
sit13   0.0385943  0.88453
sit14   0.6838840 -0.11399
sit15   1.3021696  0.08573
sit16   1.7320306 -0.74695
sit17   1.6872760 -0.24992
sit18   2.0418520 -1.04555
sit19   0.4823375 -0.11775
sit20  -1.5966980 -1.32261
sit21  -1.2295412 -1.09797
sit22  -1.4907161 -1.54612
sit23  -1.1774931 -0.05501
sit24  -1.0922968 -0.38957
sit25   0.4478644  0.47537
sit26  -0.1894898  0.45583
sit27  -1.1668244 -1.16882
sit28   0.7372497  0.57343
sit29   1.2962441 -0.32353
sit30   0.1536079 -0.60197
sit31   0.7778341 -0.58532
sit32  -0.1322259 -0.92230
sit33   0.4869593 -0.30869
sit34  -0.3092625 -0.37802
sit35  -0.4059272 -0.33441
sit36   1.1471402 -0.54226
```

sit37	-0.7760494	0.15075
sit38	0.0055922	-0.62256
sit39	0.4200012	-0.94864
sit40	0.6533998	-0.74894
sit41	0.2397643	0.36139
sit42	0.1057088	0.13425
sit43	0.3687732	0.15890
sit44	0.4714166	0.42747
sit45	-0.0019277	0.91861
sit46	-0.1064632	0.57174
sit47	-0.0569071	0.94326
sit48	0.3315501	0.68995
sit49	-0.3545722	1.12759
sit50	-0.2260846	0.79835
sit51	-0.6529869	1.81955
sit52	-0.9993566	2.59707
sit53	-1.3716691	3.32282
sit54	-0.0690836	1.39297
sit55	1.1816465	2.61296
sit56	0.2836983	1.04084
sit57	0.6755650	0.92811
sit58	0.0818614	0.74746
sit59	-0.0633371	0.46536
sit60	0.0812361	-0.18872
sit61	-0.2589554	-0.11389
sit62	0.3084863	0.37017
sit63	-1.0823256	-0.39857
sit64	-0.6184729	-0.38538
sit65	-0.5979501	-0.20940
sit66	-0.6148566	-0.35880
sit67	-0.1511659	0.38263
sit68	-0.5622466	0.91711
sit69	-0.1846363	-0.35092
sit70	-0.8092643	-0.78944
sit71	0.8110909	-0.56934
sit72	0.8029039	-1.05628
sit73	-0.0932126	-0.56831
sit74	0.3801315	-0.19724
sit75	1.0456186	-0.73120
sit76	-1.0471535	-0.53102
sit77	-0.9148922	-0.36017
sit78	0.9761491	0.29794
sit79	1.0907262	-0.18120
sit80	0.6718242	-0.12652
sit81	0.6065959	-0.18265
sit82	1.0933694	0.93636
sit83	-0.1079369	0.66986

```
sit84   0.5563010  0.72142
sit85  -0.6928750  0.43180
sit86   0.4298937  0.38770
sit87   0.5925764 -0.74201
sit88  -0.0417988 -1.16082
sit89  -0.7019769 -1.23729
sit90  -0.4099626 -0.91412
sit91   0.3436753 -0.45195
sit92   0.3806546 -1.09681
sit93  -0.5552177 -0.97736
sit94  -0.0494165 -0.42965
sit95  -0.8459327 -0.14390
sit96   0.8362505  0.05375
sit97  -0.7599591 -0.28123
sit98  -0.6502113  0.47738
sit99  -0.2978737  0.42167
sit100 -1.5172599 -0.20323
sit101 -0.6408917 -0.36275
sit102 -0.7882003 -0.43058
sit103  0.3000907 -0.32562
sit104  0.0528067 -0.57023
sit105  0.3597834  0.02983
sit106  0.3265352  0.57439
sit107  0.7328708  0.09473
sit108  2.6600699  0.54731
sit109 -0.7350628 -0.17441
sit110  0.9170281 -0.38316
sit111 -1.5086611 -0.02988
sit112 -1.4024556  0.99532
sit113  0.4048213  0.01116
sit114  0.2622838 -0.38724
sit115 -1.3622679  0.37929
sit116 -0.7810511 -0.82656
sit117 -0.6270225  1.37439
sit118  0.2601059  0.22877
```

Script Output 5: From R-script; Importance of components.

```
Importance of components:
                        RDA1    RDA2    RDA3
Eigenvalue            1.9558 0.81761 0.54884
Proportion Explained  0.0419 0.01752 0.01176
Cumulative Proportion 0.0419 0.05942 0.07118
                         PC1     PC2     PC3
Eigenvalue           10.0397 4.22220 3.09963
Proportion Explained  0.2151 0.09046 0.06641
```

```
Cumulative Proportion  0.2863 0.37675 0.44316
                    PC4     PC5     PC6
Eigenvalue          2.58753 2.05729 1.78368
Proportion Explained  0.05544 0.04408 0.03822
Cumulative Proportion 0.49860 0.54267 0.58089
                    PC7     PC8     PC9
Eigenvalue          1.64264 1.48090 1.23881
Proportion Explained  0.03519 0.03173 0.02654
Cumulative Proportion 0.61608 0.64781 0.67436
                   PC10    PC11   PC12
Eigenvalue          1.15991 1.12457 1.0689
Proportion Explained  0.02485 0.02409 0.0229
Cumulative Proportion 0.69921 0.72330 0.7462
                  PC13    PC14    PC15
Eigenvalue          0.9380 0.87076 0.84779
Proportion Explained  0.0201 0.01866 0.01816
Cumulative Proportion 0.7663 0.78496 0.80312
                   PC16    PC17    PC18
Eigenvalue          0.74867 0.69322 0.65081
Proportion Explained  0.01604 0.01485 0.01394
Cumulative Proportion 0.81916 0.83401 0.84796
                   PC19    PC20    PC21
Eigenvalue          0.61241 0.53558 0.52985
Proportion Explained  0.01312 0.01148 0.01135
Cumulative Proportion 0.86108 0.87255 0.88391
                    PC22     PC23    PC24
Eigenvalue          0.464591 0.437615 0.38924
Proportion Explained  0.009954 0.009376 0.00834
Cumulative Proportion 0.893861 0.903237 0.91158
                    PC25     PC26     PC27
Eigenvalue          0.345282 0.306467 0.293741
Proportion Explained  0.007398 0.006566 0.006294
Cumulative Proportion 0.918975 0.925541 0.931834
                    PC28     PC29     PC30
Eigenvalue          0.262495 0.251422 0.219224
Proportion Explained  0.005624 0.005387 0.004697
Cumulative Proportion 0.937458 0.942845 0.947542
                    PC31     PC32     PC33
Eigenvalue          0.215531 0.203324 0.182127
Proportion Explained  0.004618 0.004356 0.003902
Cumulative Proportion 0.952160 0.956516 0.960418
                    PC34     PC35     PC36
Eigenvalue          0.164212 0.159350 0.146319
Proportion Explained  0.003518 0.003414 0.003135
Cumulative Proportion 0.963937 0.967351 0.970486
                    PC37     PC38     PC39
Eigenvalue          0.129682 0.115831 0.107204
```

```
Proportion Explained  0.002778 0.002482 0.002297
Cumulative Proportion 0.973264 0.975746 0.978043
                         PC40     PC41     PC42
Eigenvalue            0.098308 0.091213 0.087925
Proportion Explained  0.002106 0.001954 0.001884
Cumulative Proportion 0.980149 0.982103 0.983987
                         PC43     PC44     PC45
Eigenvalue            0.078120 0.065850 0.061048
Proportion Explained  0.001674 0.001411 0.001308
Cumulative Proportion 0.985661 0.987072 0.988380
                         PC46    PC47     PC48
Eigenvalue            0.054031 0.05042 0.047643
Proportion Explained  0.001158 0.00108 0.001021
Cumulative Proportion 0.989537 0.99062 0.991639
                          PC49      PC50
Eigenvalue            0.0407166 0.0389155
Proportion Explained  0.0008724 0.0008338
Cumulative Proportion 0.9925110 0.9933447
                          PC51     PC52
Eigenvalue            0.0335950 0.030385
Proportion Explained  0.0007198 0.000651
Cumulative Proportion 0.9940645 0.994716
                          PC53      PC54
Eigenvalue            0.0271549 0.0255088
Proportion Explained  0.0005818 0.0005465
Cumulative Proportion 0.9952973 0.9958439
                          PC55      PC56
Eigenvalue            0.0218979 0.0204626
Proportion Explained  0.0004692 0.0004384
Cumulative Proportion 0.9963131 0.9967515
                          PC57     PC58
Eigenvalue            0.0182443 0.016524
Proportion Explained  0.0003909 0.000354
Cumulative Proportion 0.9971424 0.997496
                          PC59      PC60
Eigenvalue            0.0155228 0.0132488
Proportion Explained  0.0003326 0.0002839
Cumulative Proportion 0.9978290 0.9981128
                          PC61      PC62
Eigenvalue            0.0126107 0.0106733
Proportion Explained  0.0002702 0.0002287
Cumulative Proportion 0.9983830 0.9986117
                          PC63      PC64
Eigenvalue            0.0085553 0.0082228
Proportion Explained  0.0001833 0.0001762
Cumulative Proportion 0.9987950 0.9989712
                          PC65      PC66
```

```
Eigenvalue           0.0079640 0.0071343
Proportion Explained  0.0001706 0.0001529
Cumulative Proportion 0.9991418 0.9992947
                      PC67      PC68
Eigenvalue           0.006440 0.0048721
Proportion Explained  0.000138 0.0001044
Cumulative Proportion 0.999433 0.9995370
                      PC69      PC70
Eigenvalue           4.627e-03 3.904e-03
Proportion Explained  9.914e-05 8.364e-05
Cumulative Proportion 9.996e-01 9.997e-01
                      PC71      PC72
Eigenvalue           3.525e-03 3.225e-03
Proportion Explained  7.553e-05 6.911e-05
Cumulative Proportion 9.998e-01 9.999e-01
                      PC73     PC74
Eigenvalue           2.580e-03 2.39e-03
Proportion Explained  5.527e-05 5.12e-05
Cumulative Proportion 9.999e-01 1.00e+00
                      PC75
Eigenvalue           1.357e-03
Proportion Explained  2.908e-05
Cumulative Proportion 1.000e+00

Accumulated constrained eigenvalues
Importance of components:
                     RDA1   RDA2   RDA3
Eigenvalue           1.9558 0.8176 0.5488
Proportion Explained  0.5887 0.2461 0.1652
Cumulative Proportion 0.5887 0.8348 1.0000

Scaling 2 for species and site scores
* Species are scaled proportional to eigenvalues
* Sites are unscaled: weighted dispersion equal on all dimensions
* General scaling constant of scores:  8.596357
```

Script Output 6: From R-script; Species scores, site scores, site constraints and biplot scores for constraining variables.

```
Species scores

               RDA1      RDA2      RDA3
Nemato      0.0361783 -0.011347  0.031013
Acari      -0.3030658  0.045531  0.032884
Simuli     -0.1746513 -0.289854 -0.098018
Dixida     -0.1181183 -0.109471  0.072418
Limoni     -0.0009873 -0.009930 -0.013086
```

```
Psycho    -0.4824223  0.277223  0.455858
Pedici    -0.0083790 -0.007724  0.002677
Dicran     0.2919838 -0.078266  0.349912
Eleoph     0.2669199 -0.029766  0.239328
Helius     0.0559600  0.017256  0.004945
Sclero     0.0614799 -0.056808  0.078129
Diptpup    0.0188898  0.001517 -0.010206
Chirom     0.4237505 -0.446457  0.200458
Cerato     0.2023265 -0.222147 -0.067175
Dasyhe     0.0460927 -0.020647  0.083539
Ptycho     0.1379756 -0.043269  0.165827
SiaFul     0.0321629 -0.017748  0.056926
Tipuli     0.0861292 -0.067303 -0.200610
Limnep     0.0507769 -0.047106  0.016330
Chaero.ssp  0.0352056  0.017838  0.079543
BerMin    -0.0071654 -0.014462  0.039971
SerPer     0.0499708  0.044086  0.042696
BraSub     0.0178161 -0.011706  0.006996
Rhyaco.ssp -0.4940741 -0.105588 -0.011537
AgaOch    -0.0094019 -0.021687  0.011558
SilPal    -0.1028273  0.081511  0.021743
PleCon     0.0001038  0.040586  0.056633
PolFla     0.0001860  0.004301 -0.007128
RhyFas     0.0246146 -0.076879  0.009210
RhyNub    -0.2022027 -0.166067 -0.028129
EphVul     0.0224111  0.003017 -0.008309
CenLut     0.0075611 -0.043278 -0.060338
BaeNig    -0.0430898 -0.165504  0.037162
BaeMac    -0.0050761 -0.002922  0.011607
AlaMut    -0.5064340  0.130589  0.160265
BaeRho    -0.8457694 -0.466448 -0.043603
NemCin    -0.4445819 -0.375922  0.116748
Baetis    -0.0489580  0.025870  0.003581
Oligoc     0.1795952  0.122626  0.257445
Hirudi     0.0021003 -0.011526 -0.032640
Bithyn     0.0187422 -0.001592  0.043650
Lymnae    -0.1645870 -0.029123 -0.164005
Planor    -0.0636874  0.068160 -0.131170
Megalo     0.0001860  0.004301 -0.007128
Gastro     0.0847859 -0.139579 -0.034752
Gerrid     0.0102519 -0.009799 -0.019092
Dryopi     0.0182031  0.034800 -0.018654
Halipl    -0.0106132 -0.014906  0.015745
Agatyp     0.1191452 -0.002529 -0.152029
Perlod     0.0077401 -0.005244  0.009996
Siphlo     0.0077401 -0.005244  0.009996
CapLau    -0.5875353  0.238060  0.064794
```

```
LeuDig     0.0171886  0.003557  0.080486
LeuFus     0.0131280  0.115084 -0.103053
CapBif     0.0193327 -0.075073 -0.027678
CapSch     0.0062737 -0.058002 -0.006299
DiuNan    -0.0925901 -0.031686  0.070736
IsoGra    -0.0741939  0.084289  0.050795
Isoper    -0.0503294  0.281101 -0.032441
LeuNig     0.0165073  0.021511  0.009072
LeuHip    -0.1870899 -0.106905 -0.028569
Proton    -0.1607650 -0.023005 -0.005988
AmpBor     0.0578022 -0.007528  0.015842
AmpSta     0.0254159  0.012469  0.004949
AmpSul     0.0826902 -0.026058  0.067650
Collem     0.0314490  0.018693 -0.108228
NemPic     0.0020783  0.002062  0.002667
BerCla     0.0059328  0.005887 -0.001618
Curcul    -0.0075632  0.017960 -0.016062
Dytisc    -0.0180934 -0.016549  0.006182
Elmtyp    -0.1659836  0.033604  0.003514
Hydrop     0.0313994 -0.032334  0.009356
Elodes    -0.1462566  0.227149 -0.051118
Hydrae    -0.2314252  0.055796  0.041328
HydGra    -0.3980308 -0.085712  0.060276
Pisidu     0.1788094 -0.185264  0.279056
AseAqu     0.1388763 -0.261032  0.027172
              PC1       PC2       PC3
Nemato     0.061013 -0.1140005  0.002978
Acari     -0.542010 -0.0191923 -0.009199
Simuli    -0.926302 -0.2243183  0.501306
Dixida    -0.557927  0.1045886 -0.039824
Limoni    -0.003363  0.0191777 -0.007050
Psycho    -1.876646  0.0324243 -1.154016
Pedici     0.010617  0.0449972 -0.001767
Dicran    -0.704570 -0.5555429 -0.436892
Eleoph    -0.065049 -0.3948882  0.055339
Helius     0.068050 -0.0149536 -0.005171
Sclero    -0.048413 -0.0343443 -0.065008
Diptpup   -0.216541 -0.4027043  0.165429
Chirom     0.230616 -1.3398924  0.706885
Cerato    -0.306803 -0.6273031 -0.358168
Dasyhe    -0.069619  0.0182635  0.051701
Ptycho    -0.038573 -0.0703410 -0.083532
SiaFul     0.006165 -0.0124251  0.014797
Tipuli    -0.029887 -0.3385734  0.117431
Limnep    -0.031861 -0.0752932 -0.006166
Chaero.ssp  0.025581 -0.0283934  0.018099
BerMin     0.013300 -0.0085942 -0.002597
```

```
SerPer     -0.029326  0.0191189 -0.018524
BraSub      0.002577 -0.0359485 -0.024752
Rhyaco.ssp -0.323201  0.0407103  0.399358
AgaOch     -0.013325 -0.0079218 -0.032648
SilPal     -0.160893  0.0280642 -0.136948
PleCon     -0.037310  0.0528922  0.019679
PolFla      0.014811 -0.0027099  0.005119
RhyFas     -0.052754  0.0004020  0.042610
RhyNub     -0.261537  0.5122942  0.159344
EphVul      0.012781 -0.0138378 -0.011524
CenLut     -0.007531 -0.0671937  0.132821
BaeNig     -0.086472 -0.0128518  0.038130
BaeMac      0.013979  0.0084243 -0.001774
AlaMut     -1.896312 -0.2374112  0.387706
BaeRho     -1.925397  0.4926995  0.525565
NemCin     -0.587167 -0.0891986  1.168830
Baetis      0.059212 -0.0507431  0.011305
Oligoc     -0.015434 -1.5429991 -0.286661
Hirudi      0.027366 -0.0001280 -0.036553
Bithyn      0.050753 -0.0370351  0.026837
Lymnae      0.247794 -0.5928215 -0.193787
Planor      0.098100 -0.0215666 -0.095792
Megalo      0.014811 -0.0027099  0.005119
Gastro      0.078659  0.0934675  0.026361
Gerrid     -0.002583 -0.0101816 -0.012771
Dryopi     -0.106989 -0.0193035 -0.049792
Halipl     -0.015670 -0.0067411 -0.017536
Agatyp     -0.062636 -0.2249498  0.153560
Perlod      0.017256  0.0192149  0.005098
Siphlo      0.017256  0.0192149  0.005098
CapLau     -0.700791 -0.0561260  0.086174
LeuDig      0.045558  0.0004573  0.027325
LeuFus      0.011721 -0.1018373 -0.159676
CapBif     -0.049712  0.0440315  0.010053
CapSch     -0.040032  0.0038741 -0.062073
DiuNan     -0.103639 -0.0107970 -0.016161
IsoGra     -0.040443  0.0574991  0.022396
Isoper     -0.324330  0.0305172 -0.214138
LeuNig     -0.005561  0.0446381 -0.003670
LeuHip     -0.263976 -0.0071752 -0.033267
Proton      0.013120 -0.0020745  0.018205
AmpBor     -0.003365  0.0192471  0.145438
AmpSta      0.001007  0.0058615  0.081973
AmpSul     -0.101659  0.0346404  0.127096
Collem     -0.150259 -0.0942335  0.147300
NemPic      0.002820  0.0233036  0.003337
BerCla      0.007109  0.0049446  0.006250
```

```
Curcul      0.019916  0.0001165 -0.011192
Dytisc      0.008011  0.0080198 -0.009847
Elmtyp     -0.293086 -0.1217748 -0.096507
Hydrop     -0.013843 -0.0343285 -0.021983
Elodes     -0.305811 -0.0487465 -0.162434
Hydrae     -0.112620 -0.0179311  0.032666
HydGra     -1.106208 -0.2257362 -0.276604
Pisidu      0.052963 -0.1943961 -0.027516
AseAqu      0.313273 -0.3795896  0.028581


Site scores (weighted sums of species scores)

          RDA1      RDA2       RDA3     PC1
sit1   1.270910  1.518698  0.4162475  0.78305
sit2   1.519781  0.678694 -2.3153907  0.75789
sit3   1.249225  0.627321 -2.3905432  0.44828
sit4   0.601553  1.237933 -0.9694529  0.08826
sit5   1.410712  1.217515 -0.7428367  0.40087
sit6   0.791868  1.204458 -1.0135173  0.15389
sit7  -1.598990  2.656227  0.6701345 -1.19195
sit8  -1.164248  1.672310  1.7521059 -1.00622
sit9  -1.184503  0.800717  1.0444571 -0.53994
sit10  1.350209  1.088371  1.9018398  0.02888
sit11  2.457626  0.924380 -1.5884664  1.37176
sit12  2.158591  1.043035  0.2026686  0.84357
sit13  1.377260  0.313406 -2.0631083  1.08879
sit14  0.978467 -0.830335 -0.5519164  0.21775
sit15  0.492673 -0.111892 -0.3697786 -0.10593
sit16  0.354413 -0.926592 -1.5481643 -0.22990
sit17 -1.079525 -2.109870 -1.0072503 -0.91307
sit18 -0.899943 -3.401461 -1.9836814 -0.50229
sit19  1.355876  0.045203 -2.0812063  0.89056
sit20 -1.547635 -3.483713  0.2318118 -0.70910
sit21 -1.287645 -2.181271 -0.9103332 -0.21967
sit22 -0.404494 -0.952872 -1.5753744  0.56449
sit23  0.505498  0.450779  1.3185575  0.50507
sit24  1.423113 -0.228990  1.1031001  0.46446
sit25  2.870206  0.497042 -0.9969023  1.32377
sit26  2.417621  0.080941 -0.6436133  1.09020
sit27  1.154033  0.126395 -1.7511429  0.79233
sit28  1.105181  0.536621 -2.1550573  0.87337
sit29  1.445742 -2.477526  6.1777876 -0.37303
sit30 -1.419205 -3.818280  3.0376163 -1.40689
sit31  1.460869  1.791832 -0.1338731  0.50062
sit32  2.693451  0.528247 -1.1824725  1.17335
sit33 -0.369438  0.163748  0.0143699  0.27673
```

```
sit34 -0.364261 -0.756151 -0.7042984  0.53885
sit35 -2.834233 -0.539670  3.7880393 -2.07340
sit36  0.460934  1.192168  4.1215001 -0.59908
sit37 -2.173874 -0.733004  3.8566273 -1.50492
sit38 -2.233223 -0.700351  0.6334145 -0.89026
sit39 -0.942535  1.182299  0.8864097 -0.47504
sit40 -1.235348 -1.333103  0.9425489 -1.13309
sit41 -0.094843  0.153198 -1.5833916  0.30896
sit42 -0.744061 -0.798657 -0.8525430  0.06491
sit43 -1.712770 -1.555550 -1.1562728 -0.62852
sit44 -1.210383 -2.163467 -1.1947630 -0.54973
sit45 -1.986731 -0.362742  0.3718585 -0.45757
sit46 -2.482037 -1.188281  3.3629072 -1.10976
sit47 -3.371642 -1.303488  1.4154685 -0.27928
sit48 -1.733660  0.014034 -0.9360821  0.55323
sit49 -2.742391  0.269202  0.9849990 -0.36801
sit50 -2.160379 -0.032347 -0.5525201 -0.23194
sit51  2.379239 -1.246100  1.1677808  0.86343
sit52  2.909620 -0.777498 -1.3786597  1.40743
sit53  0.158632 -1.970319  0.5355328  0.53153
sit54  2.797683  0.308541 -0.9527088  1.03420
sit55  2.371586 -3.210573 -2.6069236  0.69108
sit56  2.070207 -3.105493  0.0440847  0.24548
sit57 -1.144146  0.504410 -0.8258312 -0.22620
sit58  0.124822  0.423848 -0.5492992 -0.04993
sit59 -0.234609 -0.350400 -2.1377911  0.18969
sit60  0.152414  1.045963 -2.4611166  0.69251
sit61  0.445883  0.454757 -1.1446869  0.57075
sit62  0.814429  0.616588 -2.7027151  1.04640
sit63 -0.833425 -1.208811 -1.9141737  0.02164
sit64 -0.231672 -1.322940 -2.0841783 -0.04708
sit65 -0.007803 -0.353187 -3.3294075  0.50205
sit66 -0.375967  0.014043 -3.4035876  0.42620
sit67  2.068105  0.918606 -3.7101909  0.75467
sit68  1.509175  2.290823 -4.6938226  1.72244
sit69 -1.695889 -1.495975  2.1909360 -0.29981
sit70  1.414554 -1.285959 -2.0681514  0.91122
sit71  2.353786  0.415975 -0.0847792  0.58684
sit72  1.875228  0.209603 -2.6130086  0.99625
sit73 -0.636069 -0.764597  2.0702801 -0.46613
sit74  1.714761  1.440040 -2.8715264  1.49035
sit75  1.485460 -0.571320  0.3622937 -0.15472
sit76 -1.730776  0.380014  1.6070775 -1.29965
sit77 -1.837691 -2.181352  1.6850683 -1.36325
sit78  0.333794  0.007151 -0.7154335 -0.02084
sit79 -0.478355  0.006756 -0.7176191 -0.18704
sit80 -0.805936  0.109052 -1.1368952 -0.11277
```

```
sit81  -0.700799  2.635748  1.3302665 -0.09765
sit82  -2.617038  0.866816  0.3705963 -0.95022
sit83  -2.487635  1.680494  3.2317431 -1.92118
sit84  -2.792333  1.125947  0.6816357 -1.27566
sit85  -2.951149  1.464530  1.7155518 -0.98377
sit86  -2.340917  1.791709  0.4757464 -0.92023
sit87   2.107704  1.010585 -1.6589366  0.61933
sit88   1.743920  0.154514 -0.0006932  0.51530
sit89   1.598920  0.226769  0.6271433  0.20422
sit90   1.163154 -0.197934  1.3067575 -0.17374
sit91   1.820927  1.904503  0.1404425  0.76781
sit92   2.581864  0.939962  2.2963773  0.86808
sit93  -0.471169  1.208468  1.4065682 -0.47286
sit94   0.985281  2.628035  0.7479595  0.25735
sit95  -0.674680  0.573200  1.5866229 -0.31171
sit96  -1.140471  1.314100 -0.2100928 -0.33642
sit97  -1.899698 -0.871455  1.4760186 -0.66388
sit98  -3.193271  0.362078  2.0620411 -0.38007
sit99   1.004236 -0.858143  1.5788694 -0.17099
sit100 -2.584800 -2.786792  3.6358002 -1.10247
sit101  0.956797 -1.567203 -1.1256012  0.37837
sit102 -0.126075 -3.326282 -0.2310152 -0.21205
sit103  2.680335  0.377836  1.1504781  0.87331
sit104 -0.607023 -0.872241  2.1213012 -0.18743
sit105 -0.899629 -0.694403  1.3014347 -0.81166
sit106 -0.823763  0.171127 -1.5374613  0.35074
sit107 -1.530783 -1.493222  2.3580850 -0.97586
sit108 -0.634671 -1.298227  2.9974309 -1.49904
sit109 -0.821933 -0.888758  2.3353675 -0.65272
sit110 -0.329426 -0.479667  2.8531549 -0.68527
sit111  2.079330  0.392094 -1.8924396  1.15396
sit112  1.137628  0.668252 -1.6750224  0.52965
sit113  2.064943  1.475857 -0.1478507  0.34503
sit114  1.290031  1.733350 -2.4405872  0.94707
sit115 -0.725849  5.164097  2.2291535 -0.61772
sit116 -0.057294  1.393833 -2.0425148  0.26031
sit117 -2.221512  2.709030  1.9299475 -1.20461
sit118 -1.478007  2.034585  0.1746565 -0.52536
            PC2       PC3
sit1   -0.244071 -0.667852
sit2    0.527145  0.666322
sit3    0.451484 -0.119431
sit4    0.327260 -0.343916
sit5    0.099009 -0.474454
sit6    0.005299 -0.237352
sit7   -0.064847 -0.772918
sit8   -0.481966 -0.515685
```

```
sit9    0.234823 -0.341755
sit10  -0.347150 -1.747926
sit11   0.113570  0.212326
sit12  -0.394602 -0.631236
sit13  -0.233861  0.411665
sit14  -0.443128  0.669430
sit15  -0.403873  0.816590
sit16  -0.263953  1.145215
sit17  -0.715600  1.971261
sit18  -0.336420  2.440274
sit19  -0.570425  0.118339
sit20  -0.592864  1.314299
sit21   0.157699  0.723153
sit22   0.651474  0.177403
sit23  -0.326372 -0.098638
sit24  -0.556392 -0.054017
sit25  -0.965970  0.699983
sit26  -0.841881  0.988825
sit27   0.882250  0.234096
sit28   0.112416  0.356035
sit29  -1.064119  0.326190
sit30  -1.013102  1.269482
sit31   0.135400 -0.293765
sit32   0.203390  0.351737
sit33   0.521178  0.029971
sit34   0.539444 -0.662318
sit35  -0.544101 -0.736709
sit36  -0.495542 -0.859089
sit37  -0.944161  0.427540
sit38  -0.337906  0.581332
sit39   0.896340 -0.819242
sit40   0.288772 -0.004478
sit41   0.719908  0.649484
sit42   0.667123  0.163855
sit43   1.001293  0.685246
sit44   1.015511  0.775604
sit45   0.532681  0.637510
sit46  -0.825571  0.005698
sit47  -0.438561  0.654095
sit48   0.215417  0.114067
sit49  -0.381940  0.339289
sit50   0.647231  0.211876
sit51  -0.724968 -0.181031
sit52  -1.513183 -0.205465
sit53  -0.585258  0.645243
sit54  -0.905284  0.035191
sit55  -0.484317  0.319656
```

```
sit56  -0.737842  0.376369
sit57   1.289972 -0.474200
sit58   0.815715 -0.779721
sit59   1.567500  0.224436
sit60   1.682949 -0.464255
sit61   0.986623 -0.819839
sit62   0.639652 -0.087205
sit63   1.343755  0.345384
sit64   1.620589  0.287978
sit65   1.665338  0.506627
sit66   1.465709  0.515483
sit67  -0.149069  0.110493
sit68  -0.086592 -0.718764
sit69  -2.385782  0.872488
sit70  -1.132053  1.074137
sit71  -0.635364 -0.529139
sit72  -0.182280  0.344353
sit73  -0.821523 -0.077295
sit74   0.898129 -0.189128
sit75  -0.854826  0.227026
sit76   0.336237 -0.070502
sit77  -0.071764  1.391784
sit78   0.536105  0.678625
sit79   1.501276 -0.123446
sit80   1.614303  0.079393
sit81   0.246059 -0.403785
sit82   1.325064 -0.492493
sit83   0.078219 -0.567042
sit84   0.933418  0.638783
sit85  -0.716480 -1.589832
sit86   0.428797 -0.899384
sit87  -0.399296 -0.382246
sit88  -1.141665 -0.534000
sit89  -0.333326 -1.079825
sit90  -0.684856 -0.859001
sit91   0.737197 -0.754319
sit92  -0.342404 -0.464014
sit93  -0.114147 -0.978624
sit94   0.273518 -1.371814
sit95   0.669029 -0.119244
sit96   0.883744 -0.578369
sit97   0.518603  0.094097
sit98  -0.046368  1.024288
sit99  -0.638193 -0.565458
sit100 -0.453939  1.501819
sit101  0.435414  1.383429
sit102 -0.028088  2.819442
```

```
sit103 -0.918629  0.069685
sit104 -0.174037 -0.744022
sit105  0.244406 -0.894051
sit106  0.616134 -0.448948
sit107 -0.783228 -0.898524
sit108 -0.851225 -0.828337
sit109 -0.734669 -1.765461
sit110 -0.618550 -0.722734
sit111 -1.816794 -0.779731
sit112 -1.549699 -0.892061
sit113 -0.315832 -0.491111
sit114  0.622633  0.042292
sit115 -0.522438 -1.582527
sit116 -0.057041  0.462228
sit117  0.578230 -0.624939
sit118  0.838951  0.173745


Site constraints (linear combinations of constraining variables)

          RDA1     RDA2      RDA3      PC1
sit1   -0.62116  0.76785 -0.329182  0.78305
sit2    0.63251  0.62758 -0.172515  0.75789
sit3    0.68249  0.88713 -0.085226  0.44828
sit4    0.70781  0.56169 -0.724129  0.08826
sit5    0.55810  1.33016 -0.217588  0.40087
sit6    0.67327  0.13564 -0.720803  0.15389
sit7    0.36435  2.07996 -0.822605 -1.19195
sit8   -0.30556  2.77114 -1.542441 -1.00622
sit9    0.16185  0.10566  0.619704 -0.53994
sit10   0.61925 -0.56593  0.135423  0.02888
sit11   0.12712  0.32946  1.108669  1.37176
sit12   0.45447 -0.78085  0.707369  0.84357
sit13  -0.16750  0.37749  0.770977  1.08879
sit14   0.24965  1.30207 -0.859145  0.21775
sit15   0.52281  0.33856  0.439648 -0.10593
sit16   0.25136  1.41340 -0.996068 -0.22990
sit17   0.31970 -0.44105 -1.172083 -0.91307
sit18  -0.43550 -0.54065 -1.003724 -0.50229
sit19  -0.31980 -1.05917 -0.409162  0.89056
sit20   0.26691 -1.07046 -0.536737 -0.70910
sit21  -0.32479 -0.54042 -0.763942 -0.21967
sit22  -0.96845 -1.09989 -0.424419  0.56449
sit23  -0.27211 -0.54920  1.517927  0.50507
sit24   0.23888 -0.15864  1.896158  0.46446
sit25   0.48884 -0.04152  1.138514  1.32377
sit26   0.86390  0.39112  0.565683  1.09020
```

sit27	0.35539	-0.24076	0.458972	0.79233
sit28	-0.07322	-0.33565	0.721629	0.87337
sit29	0.82139	-0.42054	1.578368	-0.37303
sit30	0.94573	-0.96866	1.386741	-1.40689
sit31	0.77896	0.43900	1.157980	0.50062
sit32	0.27072	1.17904	0.925914	1.17335
sit33	-0.46963	-0.63355	0.381492	0.27673
sit34	-1.21704	-1.11316	0.415815	0.53885
sit35	0.55436	-0.58311	0.196260	-2.07340
sit36	0.83233	0.06531	0.745836	-0.59908
sit37	0.15926	0.11316	0.540226	-1.50492
sit38	-0.37330	0.16760	0.751771	-0.89026
sit39	-0.02522	-0.66279	-0.036398	-0.47504
sit40	0.47051	-0.81201	0.144017	-1.13309
sit41	-0.12450	0.23091	0.130919	0.30896
sit42	-0.47527	-1.29826	-0.532636	0.06491
sit43	-0.02958	-0.60441	-0.993852	-0.62852
sit44	0.54118	-0.77448	-0.789998	-0.54973
sit45	-0.24933	-0.77577	0.496394	-0.45757
sit46	-0.96578	-0.63572	0.720470	-1.10976
sit47	-3.06044	-0.07956	0.126282	-0.27928
sit48	-2.71137	-0.61287	-0.251757	0.55323
sit49	-2.02842	-0.08646	-0.363555	-0.36801
sit50	-1.43334	-0.31263	-0.589814	-0.23194
sit51	0.71120	-0.34835	1.145294	0.86343
sit52	0.45334	0.26304	1.268557	1.40743
sit53	-0.61978	-0.44669	-0.182829	0.53153
sit54	1.15770	-0.56483	-0.749500	1.03420
sit55	0.50833	-1.27268	-0.825899	0.69108
sit56	0.89093	-1.26777	-0.888608	0.24548
sit57	-0.06641	-0.66794	-0.880215	-0.22620
sit58	0.22810	-0.21397	-0.746149	-0.04993
sit59	0.13979	0.13873	0.179376	0.18969
sit60	-0.45114	0.10232	0.173813	0.69251
sit61	-0.48779	-0.66150	-0.605423	0.57075
sit62	-0.87956	0.04404	-0.492713	1.04640
sit63	-0.11247	-0.62189	0.006222	0.02164
sit64	0.75016	-1.08816	-0.343454	-0.04708
sit65	0.17899	-0.58133	-0.718720	0.50205
sit66	-0.12228	-0.31022	-0.529743	0.42620
sit67	1.39759	0.34558	-2.556450	0.75467
sit68	-1.36443	0.58457	-1.494823	1.72244
sit69	-2.25808	0.77704	-0.193441	-0.29981
sit70	-0.30340	0.46703	-0.303655	0.91122
sit71	1.02901	0.13852	-0.381499	0.58684
sit72	0.01251	0.28931	-0.479487	0.99625
sit73	-0.40812	0.04592	1.138680	-0.46613

```
sit74  -0.54117 -0.31147  1.237428  1.49035
sit75   1.11304 -0.26024 -0.217556 -0.15472
sit76   1.01118 -0.62302 -0.297549 -1.29965
sit77   0.46215 -0.68095 -0.018280 -1.36325
sit78   0.83147 -0.39425  0.486693 -0.02084
sit79   0.55518  0.72345  0.305127 -0.18704
sit80   0.14445  1.23310  0.323615 -0.11277
sit81  -0.80285  1.50226  0.390049 -0.09765
sit82  -0.34095 -0.12813  0.904058 -0.95022
sit83   0.65008  1.02149  0.118439 -1.92118
sit84   0.19891  1.00578 -0.104732 -1.27566
sit85  -1.58805 -0.33365  0.089281 -0.98377
sit86  -0.71715  0.42811  0.096895 -0.92023
sit87   0.72548 -0.67156 -0.946410  0.61933
sit88  -0.04220 -0.84503 -0.742449  0.51530
sit89   0.60666 -0.88813 -1.051892  0.20422
sit90   0.68959 -0.65912 -1.284211 -0.17374
sit91   0.64747  0.02257  1.095990  0.76781
sit92   0.33738  0.40197  1.522288  0.86808
sit93  -0.03806  0.44256 -0.284342 -0.47286
sit94   0.31873  0.12994  0.144936  0.25735
sit95   0.40029 -0.19373  0.821320 -0.31171
sit96   0.12372  0.40636  0.839582 -0.33642
sit97  -0.47361  0.09753  0.692031 -0.66388
sit98  -1.98717  1.37302  0.585171 -0.38007
sit99   0.62030  0.02882  0.606519 -0.17099
sit100 -0.46193  0.29854  0.554946 -1.10247
sit101  0.88399 -0.07179  0.072821  0.37837
sit102  0.56355  0.62150  0.177507 -0.21205
sit103  0.53966  0.38913  0.705778  0.87331
sit104 -0.92957 -0.28864  1.053031 -0.18743
sit105  0.46645 -0.98279  0.071366 -0.81166
sit106 -1.24621 -1.08133 -0.281637  0.35074
sit107 -0.66019 -0.90362 -0.695199 -0.97586
sit108  0.73050 -1.13627 -0.715719 -1.49904
sit109 -0.65245 -0.72994  0.249197 -0.65272
sit110 -0.16768  0.14434  0.972141 -0.68527
sit111 -0.52753 -0.06143 -1.154360  1.15396
sit112 -0.01306 -0.01717 -1.354487  0.52965
sit113  0.97187  0.79223 -0.984443  0.34503
sit114 -0.19974  1.08452 -0.615777  0.94707
sit115  0.26032  1.73797 -0.344992 -0.61772
sit116 -0.29631  1.82838 -0.733924  0.26031
sit117  0.27273  1.08702  0.399610 -1.20461
sit118 -0.08526  1.49511  0.331431 -0.52536
            PC2       PC3
sit1   -0.244071 -0.667852
```

sit2	0.527145	0.666322
sit3	0.451484	-0.119431
sit4	0.327260	-0.343916
sit5	0.099009	-0.474454
sit6	0.005299	-0.237352
sit7	-0.064847	-0.772918
sit8	-0.481966	-0.515685
sit9	0.234823	-0.341755
sit10	-0.347150	-1.747926
sit11	0.113570	0.212326
sit12	-0.394602	-0.631236
sit13	-0.233861	0.411665
sit14	-0.443128	0.669430
sit15	-0.403873	0.816590
sit16	-0.263953	1.145215
sit17	-0.715600	1.971261
sit18	-0.336420	2.440274
sit19	-0.570425	0.118339
sit20	-0.592864	1.314299
sit21	0.157699	0.723153
sit22	0.651474	0.177403
sit23	-0.326372	-0.098638
sit24	-0.556392	-0.054017
sit25	-0.965970	0.699983
sit26	-0.841881	0.988825
sit27	0.882250	0.234096
sit28	0.112416	0.356035
sit29	-1.064119	0.326190
sit30	-1.013102	1.269482
sit31	0.135400	-0.293765
sit32	0.203390	0.351737
sit33	0.521178	0.029971
sit34	0.539444	-0.662318
sit35	-0.544101	-0.736709
sit36	-0.495542	-0.859089
sit37	-0.944161	0.427540
sit38	-0.337906	0.581332
sit39	0.896340	-0.819242
sit40	0.288772	-0.004478
sit41	0.719908	0.649484
sit42	0.667123	0.163855
sit43	1.001293	0.685246
sit44	1.015511	0.775604
sit45	0.532681	0.637510
sit46	-0.825571	0.005698
sit47	-0.438561	0.654095
sit48	0.215417	0.114067

sit49	-0.381940	0.339289
sit50	0.647231	0.211876
sit51	-0.724968	-0.181031
sit52	-1.513183	-0.205465
sit53	-0.585258	0.645243
sit54	-0.905284	0.035191
sit55	-0.484317	0.319656
sit56	-0.737842	0.376369
sit57	1.289972	-0.474200
sit58	0.815715	-0.779721
sit59	1.567500	0.224436
sit60	1.682949	-0.464255
sit61	0.986623	-0.819839
sit62	0.639652	-0.087205
sit63	1.343755	0.345384
sit64	1.620589	0.287978
sit65	1.665338	0.506627
sit66	1.465709	0.515483
sit67	-0.149069	0.110493
sit68	-0.086592	-0.718764
sit69	-2.385782	0.872488
sit70	-1.132053	1.074137
sit71	-0.635364	-0.529139
sit72	-0.182280	0.344353
sit73	-0.821523	-0.077295
sit74	0.898129	-0.189128
sit75	-0.854826	0.227026
sit76	0.336237	-0.070502
sit77	-0.071764	1.391784
sit78	0.536105	0.678625
sit79	1.501276	-0.123446
sit80	1.614303	0.079393
sit81	0.246059	-0.403785
sit82	1.325064	-0.492493
sit83	0.078219	-0.567042
sit84	0.933418	0.638783
sit85	-0.716480	-1.589832
sit86	0.428797	-0.899384
sit87	-0.399296	-0.382246
sit88	-1.141665	-0.534000
sit89	-0.333326	-1.079825
sit90	-0.684856	-0.859001
sit91	0.737197	-0.754319
sit92	-0.342404	-0.464014
sit93	-0.114147	-0.978624
sit94	0.273518	-1.371814
sit95	0.669029	-0.119244

```
sit96   0.883744 -0.578369
sit97   0.518603  0.094097
sit98  -0.046368  1.024288
sit99  -0.638193 -0.565458
sit100 -0.453939  1.501819
sit101  0.435414  1.383429
sit102 -0.028088  2.819442
sit103 -0.918629  0.069685
sit104 -0.174037 -0.744022
sit105  0.244406 -0.894051
sit106  0.616134 -0.448948
sit107 -0.783228 -0.898524
sit108 -0.851225 -0.828337
sit109 -0.734669 -1.765461
sit110 -0.618550 -0.722734
sit111 -1.816794 -0.779731
sit112 -1.549699 -0.892061
sit113 -0.315832 -0.491111
sit114  0.622633  0.042292
sit115 -0.522438 -1.582527
sit116 -0.057041  0.462228
sit117  0.578230 -0.624939
sit118  0.838951  0.173745


Biplot scores for constraining variables

       RDA1    RDA2     RDA3 PC1 PC2 PC3
PC1 -0.5611 -0.5565 -0.61283   0   0   0
PC2 -0.6708  0.7394 -0.05734   0   0   0
PC3 -0.4851 -0.3789  0.78814   0   0   0

>
```

Script Output 7: From R-script; Permutation test.

```
Permutation test for rda under reduced model
Permutation: free
Number of permutations: 999

Model: rda(formula = log(bunndyrOrdi + 1) ~ PC1 + PC2 + PC3, data = BenthicHab)
          Df Variance      F Pr(>F)
Model      3    3.322 2.9121  0.001
Residual 114   43.351

Model    ***
Residual
```

```
---
Signif. codes:
  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’
  0.05 ‘.’ 0.1 ‘ ’ 1
```

Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitskapelege universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway