Biodiversity of freshwater autotrophs in selected wet places in northern coastal ecosystems of James Ross Island

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Abstract

Freshwater algae and cyanobacteria, their biodiversity in particular, have been studied at the James Ross Island (Antarctica) since 2004. The main aim of presented study was to contribute to species list of a particular seepage that has been monitored repeatedly on the northern deglaciated part of the Island. The seepage is located on north-facing slopes of Berry Hill and supplied by melt water from annual snow depositions and frozen ground. Microclimate conditions have been monitored by an automatic weather station since 2012. For the purpose of this study, samples of microbiological mats were collected from bottom of three streams passing through the seepage dominated by several moss species. Algal and cyanobacterial taxa were determined according to morphological characteristics. Species richness differences between sampling sites were found and evaluated. Dominating taxa differed between sampling sites as well. The species reported in our study were compared with existing literature sources related to James Ross Island. Altogether, 44 algal and cyanobacterial taxa were found. Biodiversity of the seepage is discussed and related to microclimate characteristics of the site.

Key words: James Ross Island, Antarctica, microclimate, algae, cyanobacteria, diatoms

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Introduction

Seepages are waterlogged areas. They are fed by water from the surrounding areas, as well as ground water. The moisture content depends on the amount of groundwater, surface inflow and total water retention in the landscape. Other important factors are the composition of rocks and soil permeability. Seepages are one of the most characteristic habitats at Maritime Antarctica (Elster 2002) and their biodiversity is rich of cyanobacteria, algae and diatoms as reported *e.g.* by Komárek et Elster 2008 for James Ross Island. In the deglaciated northern part of James Ross Island, there are a high number of seepages, shallow lakes and streams (Nedbalová et al. 2013). In this study, we focused on seepages and streams located on the northern slopes of Berry Hill. The site has been studied within last decade with a special emphasis to biodiversity of cyanobacteria and diatoms (Elster et al. 2008, Komárek et al. 2008, Kopalová et al. 2012). The seepages reported in our study are supplied by water primarily from frozen ground and melting snow fields covering hill tops and northern slopes below Berry Hill.

In our study, we focused on the biodiversity of autotrophs from samples collected from transition habitat between seepage and stream. Studied samples are from a small-area vegetation spot formed on slopes fed by melting water coming from snow accumulation and frozen ground and flowing through seepage and providing a steady state flow of water through seepages.

Material and Methods

Site description

The studied area is a part of a deglaciated northern part of James Ross Island (Fig. 1). The deglaciated area belongs geographically to the Ulu Peninsula and represents one of the largest deglaciated regions in Antarctica. Generally, the deglaciated part of James Ross Island is rich in different types of Antarctic coastal ecosystems with seasonal liquid water availability and persistent vegetation cover (see *e.g.* Láska et al. 2011a for a review). In the study area, precipitation predominated in solid form with annual rate estimation between 300 and 500 mm water equivalent per year only (Dethloff et al. 2010). The orographic effect of nearby Antarctic Peninsula can be also seen in the global solar radiation exceeding mean daily intensity of 250 W m^{-2} during summer months (Láska et al. 2011b). Thanks to microrelief, a patchy snow field accumulation, size and location of which is season-dependent according to prevailing wind direction, are typical feature of terrestrial habitats at the altitude from 0 to 200 m a.s.l. (Zvěřina et al. 2014). In such places, small-area vegetation oases are formed thanks to melt water availability. In majority of them lichens and mosses can be found. Some of them, however, are dominated only by microbiological mats, their algal, cyanobacterial, bacterial and fungal components, respectively.

The site of sample collections (63° 48' 15" S, 57° 51' 00" W) is referred as Komarek slopes and is characterized by inclined, north-facing stony slopes on a foothill of Berry Hill mesa. The area is wet throughout austral summer season because of availability of melt water from short-term snowfields accumulated during a preceding winter season (*see* Fig. 2A) and/or water running from the active layer of permafrost appearing on the surface on warm days. Due to microrelief, the study area is distinguished into three parallel separate streams running from a snowfield to seashore. Along the streams margins, moisture is available forming a seepage and small area moss-dominated vegetation cover (for more details *see* Barták et Váczi 2015). The bottom of the three streams is covered by a rich microbial community, development of which is season-dependent. Main components of communities, especially cyanobacteria found in the three streams were reported in earlier studies (Komárek et al. 2008). Recently, biodiversity of soil diatoms found in this particular area is analysed (Chattová, MS in prep.)

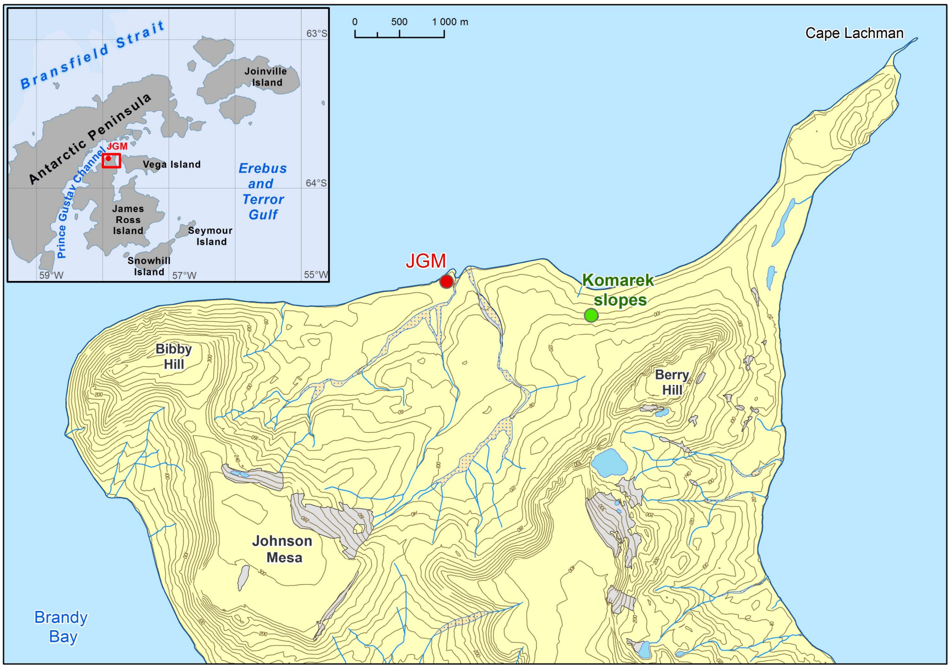

Fig. 1. Northern part of James Ross Island with indication of sampling site (Komarek slopes) and Johann Gregor Mendel Station (JGM). Modified map of James Ross Island-Northern part (Czech Geological Survey 2009).

Instrumentation

Automatic weather station is located at 56 m a.s.l. (63° 48' 09.5" S, 57° 50' 19.4" W) on a northern slope with an inclination of 7°. The data of air temperature and relative humidity at 2 metres above ground were measured with a Minikin TH (EMS Brno, Czech Republic). Ground temperature at 5 cm depth was obtained using a Pt100/Class A resistance thermometer connected to EdgeBox V12 data logger (EMS Brno, Czech Republic). The measurements were carried out at 1 hour intervals in the period from January 1st, 2012 to February 8th, 2015. Raw data were used for determining daily maximum and minimum temperatures and calculating the mean daily and monthly averages. Thawing days and freeze-thawing days, which indicated presence of liquid water in the ground, were defined according to minimum temperature > 0.5°C and at least one maximum temperature > 0.5°C, respectively (Guglielmin et al. 2008). Photosynthetically active radiation (PAR) was measured in the interval 400-700 nm with an EMS12 radiometer (EMS Brno, Czech Republic), which was installed at J. G. Mendel Station located 3 km east of the study site (Fig. 1). PAR was monitored at 10 s intervals and stored as 10 min average values used for further calculation of daily and monthly mean intensities of PAR.

Collection of samples

Samples of stream bottom microbiological mats were collected from the three sampling sites on January 21st, 2015. The sampling spots where located in two streams, coordinates of which are summarizes in Table 1. Photographs of sampling sites are presented at Figs. 2B, C, D. Individual sampling sites exhibited differently coloured mats covering stream bottom. Thus, we hypothesized that species composition and proportion between algae, cyanobacteria and diatoms numbers would differ between the sampling sites. The samples were collected to a 25 ml plastic tubes and preliminary microscopic observation made at J. G. Mendel Station using a Meopta microscope (DN 816, Přerov, CZ). Then, the samples were delivered to a laboratory (Masaryk University, Brno), where stored in a refrigerator at 5ºC for 2 weeks.

Sample 1	*Stream No. 1*	*(63°48'13" S, 57°50'51" W)*
Sample 2	*Stream No. 2*	*(63°48'10" S, 57°51'01" W)*
Sample 3	*Stream No. 2*	*(63°48'16" S, 57°51'03" W)*

Table 1. Characteristics of sampling sites and geographic co-ordinates for particular sampling sites.

Optical microscopy and morphology-based determination

Samples were transferred to the Czech Republic and then analysed by optical microscopy (Olympus BX50, Japan). Algal, cyanobacteria and diatoms were determined using a morphological approach. Diatom samples were prepared following the method described in Van der Werff (1955). Small quantities of the samples were cleaned by adding 37% H_2O_2 and heating to 80°C for about 1 h. The reaction was completed by addition of $KMnO_4$. Following digestion and centrifugation, the resulting clean material was diluted with distilled water to avoid excessive concentrations of diatom valves that may hinder reliable observations. Cleaned diatom valves were mounted in Naphrax®. Diatoms were observed at 1000x magnification using an Olympus BX50 microscope equipped with Differential Interference Contrast (Nomarski) optics.

Fig. 2. General view on Komarek slopes (A), sampling site No. 1 (B), sampling site No. 2 (C), and sampling site No. 3 (D).

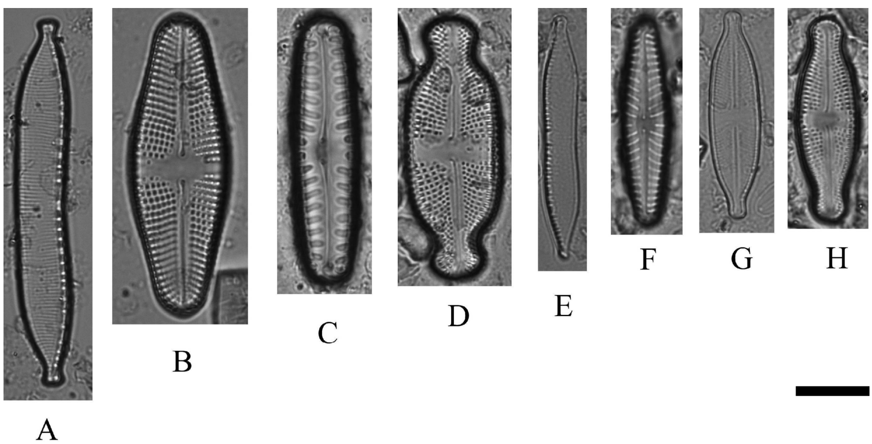

Fig. 3. A - *Hantzschia amphioxys* f. *muelleri,* B - *Achnanthes muelleri,* C - *Pinnularia borealis,* D - *Luticola gigamuticopsis,* E - *Nitzschia homburgiensis,* F - *Navicula* cf. *seibigeana,* G - *Stauroneis latistauros,* H - *Luticola austroatlantica.*

Results

Microclimate conditions

At the study site, air temperature records show large annual and day-to-day variations. The slight increasing of mean annual air temperature (MAAT) was observed in 2012–2014 (Fig. 4A). The MAAT varied between -7.6°C (2012) and -6.6°C (2014). The absolute maximum temperature reached 13.0°C on February 24th, 2013, while the minimum temperature decreased to -31.1°C on August 21st, 2014. The mean monthly temperature reached its maximum in January 2012 (1.1°C), while the minimum was observed in July 2013 (-17.7°C). Mean annual relative humidity was fairly stable during the observed period and varied between 86.6% (2013) and 87.4% (2014). The maximum relative humidity of 100% occurred during short-term period (2-4 days) from November to April mainly (Fig. 4A). The minimum relative humidity decreased to less than 60% typically during winter months (May–September). Large day-to-day changes of relative humidity were found in the seasonal variation for all months. The mean monthly relative humidity slowly decreased from January (90%) to August (83%) and started increasing again in October. The variability of monthly PAR intensity at J. G. Mendel Station shows a simple annual course with symmetric pattern around summer solstice (Fig. 4B). The maximum PAR was 592.8 µmol m^{-2} s^{-1} in December 2012 and 536.6 µmol m^{-2} s^{-1} in December 2014, respectively. On the other hand, the minimum irradiance was found in June with monthly averages below 60 µmol m^{-2} s^{-1}. The mean annual PAR for 2012–2014 was 223.6 µmol m^{-2} s^{-1}. The highest annual irradiance was 227.0 µmol m^{-2} s^{-1} in 2013.

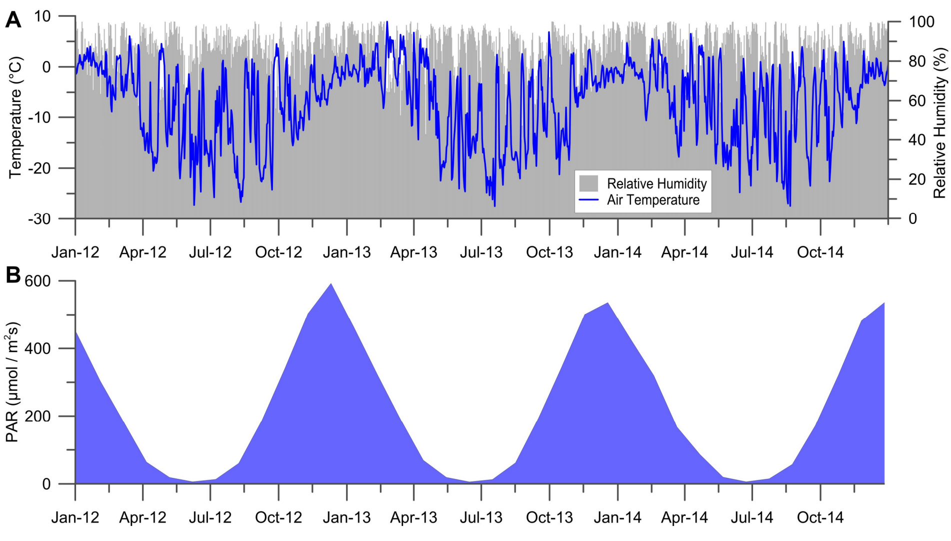

Fig. 4. Variation in (A) mean daily air temperature, relative humidity and (B) mean monthly PAR on the north-facing slope of Berry Hill mesa and J. G. Mendel Station (in case of PAR) in the period from January 2012 to December 2014.

The Fig. 5 shows mean daily air temperature, ground temperature at 5 cm and PAR intensity in two seasons (October to April 2012/13 and October to April 2013/14, respectively). Significant differences were found for air (Fig. 5A) and ground (Fig. 5B) temperature regimes. The beginning of summer season (October–December 2013) was warmer then the end of summer (February–April 2014). The overall mean seasonal air temperature (October–April) was higher in 2012/13 (-2.6°C) comparing to period 2013/14 (-3.9°C). Smaller seasonal differences were observed at 5 cm ground temperatures which varied between -0.8°C (2012/13) and -1.0°C (2013/14). The number of thawing days with the minimum ground temperature higher than 0.5°C indicating presence of liquid water during whole day, which was also higher in 2012/13 (44 days) than 2013/14 (33 days). The total number of freeze-thaw days during which water freeze at least for several hours reached 46 days (2012/13) and 76 days (2013/14), respectively.

The seasonal variation in mean daily PAR follows the changes in solar elevation through the year (Fig. 5C). The mean seasonal PAR from October to April was 248.5 μmol m^{-2} s^{-1}. The maximum daily PAR reached 736.5 μmol m^{-2} s^{-1} on December 17th, 2012 and 713.2 μmol m^{-2} s^{-1} on December 18th, 2013, respectively. However, there is a strictly difference in the incident PAR ranging between 300 and 730 μmol m^{-2} s^{-1} around solstice. Large day-to-day variation in PAR reflects the significant role of cloudiness and occurrence of optically thicker clouds along the Antarctic coast.

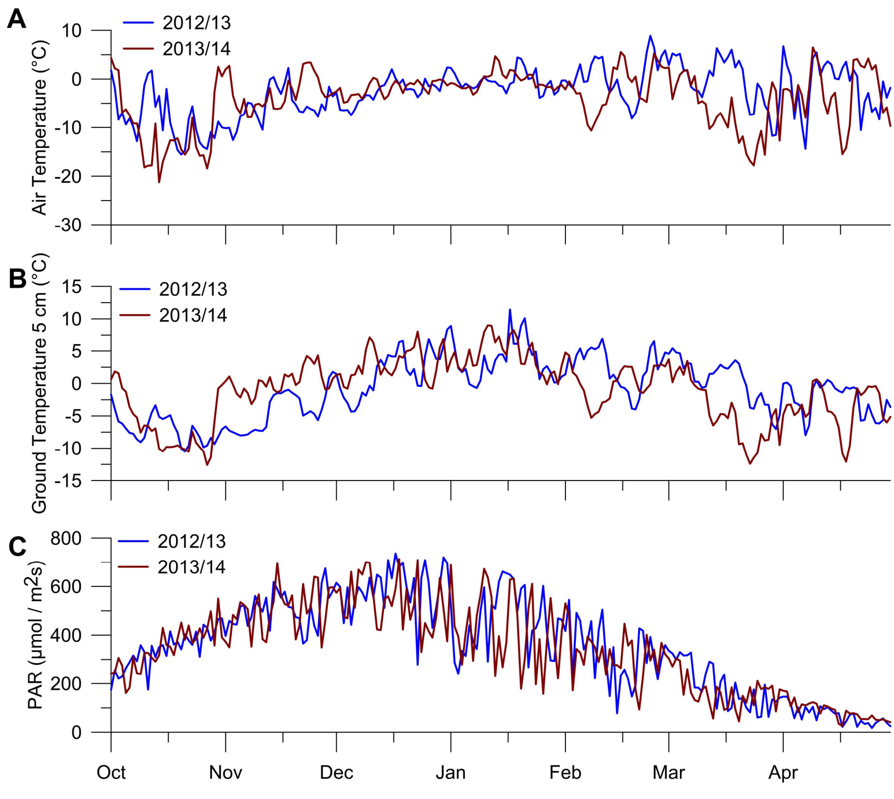

Fig. 5. Seasonal variation in (A) mean daily air temperature, (B) ground temperature at 5 cm and (C) PAR for the period from October 1st to April 30th in 2012/13 and 2013/14, respectively.

	Sample 1	Sample 2	Sample 3
CYANOBACTERIA			
Gloeocapsa sp.	+	+	0
Leptolyngbya sp.	+	+	0
Oscillatoria sp.	0	0	+
Phormidium sp.	0	+	0
CHLOROPHYTA			
Actinotaenium sp.	+	0	+
Klebsormidium sp.	0	0	+
Zygnema sp.	0	0	+
BACILLARIOPHYCEAE			
Achnanthes coarctata (Brébisson ex W.Smith) Grunow	+	0	+
Achnanthes muelleri Carlson	+	+	0
Achnanthes taylorensis D.E.Kellogg, Stuiver, T.B.Kellogg & G.H.D.Denton	0	+	0
Hantzschia abundans Lange-Bertalot	+	+	+
Hantzschia acuticapitata Zidarova & Van de Vijver	+	+	+
Hantzschia amphioxys (Ehrenb.) Grunow *f. muelleri* Ts. Kobay.	+	+	+
Hantzschia hyperaustralis Van de Vijver & Zidarova	+	+	+
Humidophila aff. *perpusilla*	+	0	0
Humidophila arcuata (Lange-Bertalot) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová	+	+	+
Humidophila inconspicua (Kopalová & Van de Vijver) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová	+	+	+
Humidophila sceppacuerciae Kopalová	+	+	+
Chamaepinnularia krookiformis (K.Krammer) Lange-Bertalot & K.Krammer	+	0	0
Luticola australomutica Van de Vijver in Van de Vijver & Mataloni	+	+	0
Luticola austroatlantica Van de Vijver, Kopalová Spaulding et Esposito	+	+	+
Luticola doliiformis Kopalová & Van de Vijver	0	0	+
Luticola gigamuticopsis Van de Vijver	+	+	+
Luticola muticopsis (Van Heurck) D.G.Mann	+	+	+
Luticola sp. 1	+	0	+
Luticola sp. 2	+	+	+
Luticola truncata Kopalová & Van de Vijver	+	+	+
Muelleria aequistriata Van de Vijver & Spaulding	0	+	0

Muelleria luculenta S.A.Spaulding & J.P.Kociolek	+	0	0
Muelleria regigeorgiensis Van de Vijver & Spaulding	0	+	0
Navicula cf. *seibigiana*	0	0	+
Nitzschia commutata Grunow	0	+	+
Nitzschia homburgiensis Lange-Bertalot	+	+	+
Orthoseira roeseana (Rabenhorst) O'Meara	+	0	+
Pinnularia borealis var. *pseudolanceolata* B. Van de Vijver & R.Zidarova	+	+	+
Pinnularia borealis var. *scalaris* (Ehrenberg) Rabenhorst	+	+	+
Pinnularia intermedia (Lagerstedt) Cleve	0	+	0
Pinnularia subaltiplanensis Zidarova, Kopalová & Van de Vijver	+	0	+
Stauroneis latistauros Van de Vijver & Lange-Bertalot	+	+	+
Stauroneis pseudoschimanskii Van de Vijver & Lange-Bertalot	0	0	+
OTHER AUTOTROPHS			
coccal green algae	+	+	0
undetermined coccal cells (orange colour)	+	0	0
undetermined coccal cells (red colour)	+	0	0
undetermined thin cyanobacteria	+	+	0

Table 2. List of species of freshwater autotrophs found in Komarek slopes sampling sites, James Ross Island.

The Fig. 6A presents local climatic conditions in the mid-austral summer (January 1st to February 8th, 2015), when the biological samples were collected. The air temperature was 1.3°C, while the ground temperature at 5 cm reached 5.2°C in this period. The positive mean daily air temperature occurred in the period from January 17th to February 6th, while the mean daily ground temperature was positive during whole observed period. The longest warm period was recorded between January 25th and 31st, when the maximum air temperature was 10.5°C and the maximum ground temperature reached 16.3°C, respectively (*see* Fig. 6A). In total, 32 thawing days were observed in the study site.

The mean daily PAR shows a gradual decrease in the PAR intensity toward the beginning of February 2015 (Fig. 6B). Nevertheless, higher mean monthly PAR was observed in January 2015 (477.9 µmol m^{-2} s^{-1}) than in the previous January. The maximum PAR was recorded on January 1st, 2015 (696.8 µmol m^{-2} s^{-1}) during clear sky conditions over James Ross Island.

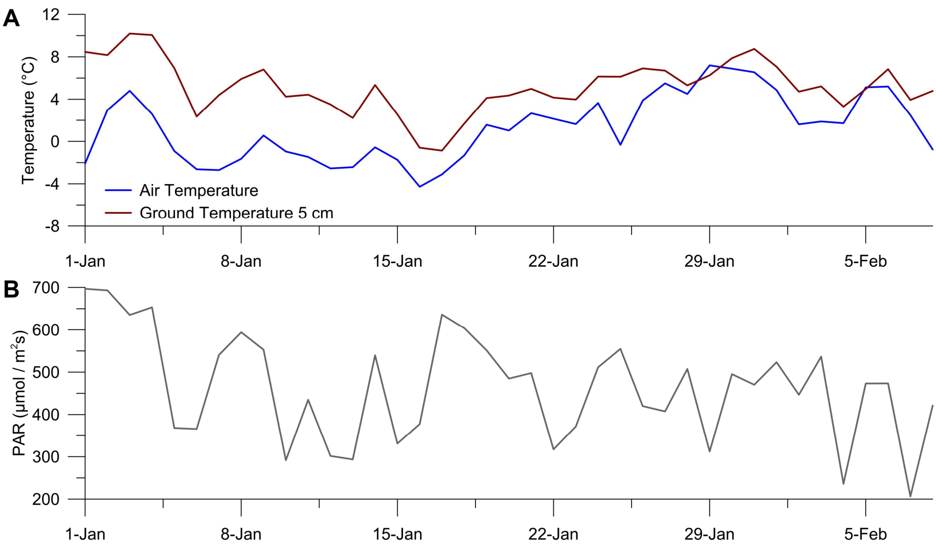

Fig. 6. Variation in (A) mean daily air temperature, ground temperature at 5 cm and (B) PAR for the period from January 1st to February 8th, 2015.

Biodiversity of autotrophs

The samples were collected from the three different colour sampling sites (Fig. 2) from two streams (Table 1). Compared to previous expectations in our samples strongly dominated diatoms. Other taxonomic groups were found very rarely. The second most abundant group was filamentous (*Oscillatoria* sp., *Pseudanabaena* sp.) and coccal (*Gloeocapsa* sp.) forms of cyanobacteria. Green algae were represented by *Klebsormidium* sp. that dominated in Sample 3. Other present green algae belong to genus *Actinotaenium* and *Zygnema*.

Altogether, 44 taxa (*see* Table 2) were identified in all samples. Sample 1 (Fig. 2B, from stream 1) had a ginger-like colour and contained altogether 32 taxa. As well as brown colour at Sample 2 (Fig. 2C, from stream 2) here dominate diatoms. In Sample 2, 28 taxa were determined. Contrastingly to the above samples, Sample 3 had a green colour (Fig. 2D, from stream 2) and different taxonomic composition. Altogether there were found 28 taxa. It was dominated by green algae *Klebsormidium* sp. with rarely co-occuring *Actinotaenium* sp. A great number of co-occurring diatoms was identified similarly to other two samples (for diatom taxa specification see the below text). Green algae *Klebsormidium* sp. and *Zygnema* sp. were found and determined only at Sample 3. At Sample 1 and 2, a higher diversity of cyanobacteria (*Leptolyngbya* sp., *Phormidium* sp., *Gloeocapsa* sp.) was found than in Sample 3 (only *Oscillatoria* sp.).

A total of 33 diatom taxa belonging to 11 genera have been found during the analysis of 3 microbial mats of samples. For selected species *see* Fig. 3. Table 2 provides a full list of all species observed in this study. Species richness per sample ranged from 23 to 25 with an average number of taxa per sample of 24. The most species rich genera included *Luticola* D.G.Mann (8 species), *Hantzschia* Grunow (4 species), *Humidophila* (Lange-Bertalot & Werum) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová (4 species), *Pinnularia* Ehrenberg (4 species) and *Achnanthes* Bory de Saint-Vincent (3 species).

Sample 1 was dominated by *Luticola gigamuticopsis* Van de Vijver, *Nitzschia homburgiensis* Lange-Bertalot, *Luticola austroatlantica* Van de Vijver, Kopalová Spaulding et Esposito and *Orthoseira roeseana* (Rabenhorst) O'Meara, altogether with another typical limno-terrestrial diatoms such as *Achnanthes coarctata* (Brébisson ex W.Smith) Grunow. Sample 2 shared some of the dominant taxa with the first sample such as *Luticola gigamuticopsis* and *Luticola austroatlantica*, with a co-occuring *Muelleria regigeorgiensis* Van de Vijver & Spaulding*, Achnanthes taylorensis* D.E.Kellogg, M.Stuiver, T.B. Kellogg & G.H.D.Denton, *Pinnularia intermedia* (Lagerstedt) Cleve and *Muelleria aequistriata* Van de Vijver & Spaulding. Sample 3 exhibited different dominant taxa with *Luticola truncata* Kopalová & Van de Vijver and *Humidophila arcuata* (Lange-Bertalot) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová being most abundant species, accompanied with *Luticola doliiformis* Kopalová & Van de Vijver, *Stauroneis pseudoschimanskii* Van de Vijver & Lange-Bertalot and *Navicula* cf. *seibigiana*. These differences might be attributed to a high biodiversity of green algal and cyanobacterial species of the third sampling site.

Discussion

The mean daily air temperatures and ground temperatures at 5 cm on the north-facing slope of Berry Hill mesa (Komarek slopes) indicate that there were only small temperature differences compared to lower-lying site near to J. G. Mendel Station (Hrbáček et al., in review). Although Komarek slopes have a higher elevation than J. G. Mendel Station (52 m of altitude difference), the MAAT at Komarek slopes was about 0.5°C higher than MAAT observed at J. G. Mendel Station in the same period. Generally higher air temperatures recorded at Komarek slopes are related to the influence of terrain (slope angle and aspect) on solar radiation and temperature regimes. On the other hand, significant cooling effect of the ocean and sea-ice can be seen at the low-lying coastal sites, J. G. Mendel Station in particular.

Our samples reported in this study, *i.e.* those collected from streams and seepages fed by melting snow at Komarek slopes showed lower taxonomical diversity than the earlier samples from lakes (Skácelová et al. 2013) and soil crusts (Skácelová et Barták 2014) from James Ross Island (Hawes et Brazier 1991, Kopalová et al. 2012, Komárek et al. 2008). Komárek et Elster 2008 in their study determined relatively broad spectrum of cyanobacterial species in seepages at Komarek slopes. They found numerous species of cyanobacteria and concluded that seepages are the richest locality in this area. Contrastingly, our study did not support such conclusion since number of cyanobacterial species was rather low (*see* Table 1) and the samples were dominated by diatoms (*c.f.* data presented by Fernández-Valiente et al. 2007 for similar ecosystems at Livingston Island). A low diversity of algae and cyanobacteria found in this study is probably due to the seasonality of the studied localities. In austral summer, streams are supplied with melting water from the snowfield and later in season they are drying up. Kopalová et al. 2013 notes that sites with a similar ecology are dominated by only a few species of diatoms and overall species diversity is relatively low. An irregular water regime also influences the chemical and physical properties of the streams (Vincent et James 1996) which also affects the diversity and species composition because every taxon has a certain ecological valence.

Our study revealed a high biodiversity of diatoms. The dominant taxa are typical limno-terrestrial species reported to be frequent also in streams and seepages of James Ross Island where Kopalová et al. (2012) reported 69 taxa. When compared with diatom communities reported for lake ecosystems by Kopalová et al. (2013) for James Ross Island streams, samples from seepages and those analysed in our study (microbial mats) showed somewhat lower species richness. The three samples shared many species with the soil samples taken from the same locality during January–February 2015 (Chattová et al. unpublished results). Shared species where *e.g. Hantzschia amphioxys* (Ehrenb.) Grunow *f. muelleri* Ts. Kobay., *Hantzschia abundans* Lange-Bertalot, *Hantzschia hyperaustralis* Van de Vijver & Zidarova, *Luticola truncata*, *Humidophila inconspicua* (Kopalová & Van de Vijver) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová, *Luticola muticopsis* (Van Heurck) D.G.Mann and *Nitzschia homburgiensis*. Such a relatively high number of typical terrestrial species of diatoms found in our samples is not surprising, considering the fact that the microbial mats can be characterized by extreme environmental conditions, mainly by unstable moisture regime (Kopalová et al. 2013, Souffreau et al. 2010).

Although the three samples shared more than 60 percent of taxa and were in general dominated by species of the genus *Luticola*, some remarkable differences in the species composition could be observed. The differences between the species composition are most likely associated with different microrelief, spatial patchiness in the stream, and different colour of the upper surface of a mat.

The effect of microclimate on development of biodiversity of stream bottom autotrophs can be generalized as dependent on liquid water availability and surface/water temperature. In spite of the fact that yearly maxima of daily total of photosynthetically active radition are found in the second half of December (*see* Fig. 6), maxima in ground temperature are found several weeks later, *i.e.* in the middle of January. Such microclimate conditions may lead to development of species-rich microbiological mats covering stream bottom in this particular period of austral summer. Direct effect of microclimate on biodiversity differences between individual seasons (*see* above), however, could not be proven from our data. Many earlier studies from different Antarctic regions, however, report seasonality in biodiversity of freshwater autotrophs (*e.g.* McKnight et Tate, 1995). Our data indicate rather microtopographic differences in biodiversity since the individual streams differed in the species found even when sampled on the same day. It might be concluded that the sampled locality Komarek slopes has a microclima suitable for development of species-rich microbial mats. Together with water and nutrient availability, it represents a driving factor for sustainability autotrophic species forming communities on stream bottom, seepages and neighbouring moss-dominated wet places.

Concluding remarks

In spite of the fact that biodiversity of freshwater microbiological mats is well documented in continental Antarctica, it is less well described for maritime Antarctica regions (*e.g.* De los Ríos et al. 2004). They are characterized by a less extreme climatic conditions than other Antarctic areas, with higher mean temperatures and precipitation amount (Camacho 2006). Such climatic conditions accompanied with complex geology causes great variety ice-free freshwater ecosystems available for microautotrophs during summer months (Ellis-Evans 1996). A broad range of physical and chemical conditions found in streams, lakes and ponds in maritime Antarctica terrestrial ecosystems may lead to a richer species composition than in continental Antarctica.

In this study, the community structure of microbial mats forming a cover of stream bottoms at James Ross Island is presented. Similarly to the study done at the Byers Peninsula (Livingston Island, South Shetland Islands) – Fernández-Valiente et al. (2007), we found that stream bottom and stream edge microecosystems were dominated by diatoms. Moreover, earlier study from Livingston Island reported dominance of diatoms combined with an absence of heterocystous cyanobacteria (Davey et al. 1993). Such community structure might be attributed to a relatively high concentration of nitrogen-containing compounds supplied to a stream (Torro et al. 2007). In other freshwater ecosystems at James Ross Island such as *e.g.* bottom of ponds, moist soil and soil crusts, however, relative share of cyanobacterial species increases (Skácelová et al. 2013).

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