A density separation method for microplastics implemented to varved sediments of Lake Kallavesi, eastern Finland

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Abstrakti

Mikromuovit ovat ympäristöön rikastuvia saasteita, joiden tutkimus on yleistynyt vasta 2000-luvulla. Mikromuovitutkimus keskittynyt lähinnä merialueille, ja tutkimus järvissä on pitkään ollut toissijaista, vaikka järvet ovat yleisesti herkempiä vesistöjen pilaantumiselle. Tässä pro gradu -tutkielmassa tutkittiin mikromuovien määrää sekä trendejä suomalaisessa järviympäristössä vuosina 2009–2016 ja kehitettiin uusi tiheyseroihin pohjautuva mikromuovien erottelumenetelmä, jonka avulla muovipartikkelit erotetaan sedimentistä. Mikromuovien tunnistamisessa käytettiin kuvantavaa FTIR-laitteistoa sekä MPHunter-ohjelmaa. Näytteet otettiin jääsormimenetelmällä Kuopion Kallavedestä, Maljalahden pohjasedimentistä. Jääsormen avulla mikromuovipartikkelit kytkettiin sedimenttiprofiiliin, joka ajoitettiin lustokronologiaa käyttäen. Tämän tutkielman tulokset osoittavat, että Maljalahden järvisedimentin mikromuovipartikkelien määrä ja partikkelien muovilaadut kasvoivat Maljalahden alueen rakentamisen aloitettua vuonna 2011.

Avainsanat: *Mikromuovi, Järvisedimentti, Kallavesi, Esiintyminen, Lustokronologia, Raskasneste-erottelu, FTIR*

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Abstract

Microplastics are environmentally persistent pollutants ubiquitous in the aquatic environment. Compared to marine environments, the abundance of microplastics in freshwater environments is less studied. The thesis introduces an improved density separation method to isolate microplastics from loose sediment samples. Identification of the found particles was performed by imaging FTIR microspectroscopy combined with MPHunter software. In this study, the method was tested and linked to field results. A freeze core was taken from Maljalahti Bay, Lake Kallavesi, Eastern Finland. Freeze core captures microplastics in an *in-situ* sediment profile, and the core was dated with varve chronology. Microplastics analysed from the sediment of Maljalahti reflected the anthropogenic changes in the lake catchment. According to this study, the amount and variability of microplastics are positively connected to human activities such as the construction work started in the immediate catchment of Maljalahti Bay.

Keywords: *Freshwater, Microplastics, Plastic pollution, Lake sediments, Lake Kallavesi, Occurrence, Varve chronology, Microplastic accumulation, Density separation, Fourier-transform infrared*

Content

Glossary and abbreviations

AD	Anno domini, calendar years
ATR	Attenuated total reflectance
ABS	Acrylonitrile butadiene styrene
BP	Before present i.e. years before the calendar year 1950
CA	Cellulose acetate
DDE	Dichlorodiphenyldichloroethylene
ECHA	European Chemical Agency
FPA	Focal plane array
FTIR	Fourier transform infrared (imaging device)
HDPE	High density polyethylene
LDPE	Low density polyethylene
LOI	Weight loss on ignition
LST	Lithium heteropolytungstate
m a.s.l.	Meters above the present-day sea level
MP	Microplastic
MPHunter	Software which identifies plastics from imaging FTIR data. Developed in Aalborg University, Denmark.
MS	Magnetic susceptibility
PA	Polyamide
PAH	Polycyclic aromatic hydrocarbons
PAN	Polyacrylonitrile
PC	Polycarbonate
PCB	Polychlorinated biphenyl
PE	Polyethylene
PET	Polyethylene terephthalate
PLA	Polylactic acid

Plastic	Modified from the Latin "plasticus" and the Greek "plastikos" which means a material which can be moulded. Plastic in this thesis refers to a whole class of very different synthetic polymers, no matter the size
PMMA	Polymethyl methacrylate, also known as acrylic or acrylic glass
POM	Polyoxymethylene
POP	Persistent organic pollutant
PP	Polypropylene
PS	Polystyrene
PU	Polyurethane
PVC	Polyvinylchloride
PVC-U	Unplasticized polyvinylchloride (rigid polyvinylchloride)
SPT	Sodium polytungstate
micro-XRF	Micro X-ray fluorescence

Figures and tables

1. Introduction

Microplastics are plastic particles smaller than 5 mm at their widest. Plastics and microplastics have been present in the environment for almost a century but the problem was only truly realised about two decades ago (Lambert and Wagner, 2018). Therefore, microplastic pollution is still considered a relatively new environmental hazard and 'contaminant of emerging concern' as highlighted in Lambert and Wagner (2018). Microplastic research is still a work in progress – although rapid advancements are made due to scientific, public and political interests. Most of the studies made to date focus on marine environments but microplastics have also been found in different freshwater systems worldwide (*e.g.* Eriksen *et al.*, 2013; Free *et al.*, 2014; Obbard *et al.*, 2014). The advantage of studying freshwater systems compared to marine environments is that especially lakes near populated areas are exposed to large amount of plastic pollution and shallow water bodies are in general vulnerable to pollution. Not only lakes have an important role in transportation of microplastics but also as microplastic sinks when plastic material accumulates in lake bottoms. In addition, freshwater systems have typically more distinct catchment areas which makes it easier to recognise sources of plastic pollution.

However, there is still only a limited understanding of the long-term effects of microplastic exposure on the environment and the residence time of microplastics in freshwater systems. Furthermore, there is no commonly accepted sampling protocol for sediment samples. To achieve better understanding of the effects of microplastics on terrestrial environment, microplastic distribution and their sedimentation rate need to be investigated.

The aim of this study is to create a new, precise, and sensitive method to separate microplastics from sediment material. The sample material is treated as little as possible: method steps are simple, only one chemical is added and no destructive methods, such as ultrasonic wash, is applied. New methods are urgently needed because current analytical techniques are time-consuming and therefore impractical. This density separation-based method is suitable for all kinds of loose sediments regardless of the sampling method used. In this study, sediment samples were taken with the freeze core method, but the microplastic separation method was also tested with sediment trap samples and Kajak retriever samples. With this method, reliable results are obtained, and the detection of plastic contamination is simple. Microplastics were analysed with imaging Fourier transform infrared (FTIRi), a sophisticated, non-destructive spectroscopic identification method. The obtained spectra were identified with MPHunter software. By identifying microplastics (type of the polymer, particle morphology etc.) assumptions of their origin can be made. The method can later be used in various new microplastic studies and it allows spatiotemporal comparison across aquatic environments and direct comparison between studies.

In addition, a microplastic depth profile from a freshwater environment with high temporal resolution is determined. Lacustrine sediment samples were taken from the lakebed of Maljalahti Bay, Lake Kallavesi, Eastern Finland. Maljalahti Bay was chosen as the study site because its bottom sediments were already known to contain microplastics (Uurasjärvi *et al.*, 2020), and it can be considered as a hotspot area for microplastic accumulation. In addition, possible sources of microplastic pollution are easily recognisable. Only a few studies made to date include data on the vertical distribution of plastics with temporal resolution within lacustrine sediments (*e.g.* Corcoran *et al.*, 2015; Brandon *et al.* 2019; Dong *et al.*, 2020).

Overall, the importance of temporal control in microplastic research is still underestimated. Without it, no change in microplastic accumulation can be detected. Microplastics are not regularly monitored and no background information is available (Galgani *et al.*, 2010, 2013) because there are no standard procedures or sampling techniques (Hidalgo-Ruz *et al.*, 2012). In addition, sedimentation rates can vary even within a single basin and thus the temporal aspect must be taken into consideration. High temporal resolution allows comparison of microplastic-time series in different environments globally. In this study, the temporal variation of microplastic accumulation is determined with varve chronology.

The main research questions to be answered in this thesis are:

1. How to develop a method to extract microplastics from clastic sediments?
2. What are the driving factors in microplastic accumulation?
3. Is there a temporal (annual or seasonal) variation in microplastic accumulation?

2. Background

2.1 Microplastics

Freshwater is globally important natural resource and the fragile state of freshwaters is realised. Lakes, ponds, and rivers, in general, are more sensitive to changes in environmental and climate conditions than seas. Microplastics are widely considered as emerging contaminants in the aquatic environment, but their research in freshwaters is still insufficient. The ocean basins are often considered as "microplastic sinks" but not all plastics reach the seas. Like other terrigenous material, also plastic accumulates in freshwater environments (Horton *et al.*, 2017). The volume of freshwaters is considerably smaller than the volume of the oceans, and therefore it's suggested that concentrations in lakes etc. close to human habitats are more significant than in the seas (*e.g.* Free *et al.*, 2014). Since it is not yet possible to determine the impact of long-term exposure of microplastic accumulation on the environment or changes in microplastic concentrations over time, study of microplastics in freshwaters is crucial.

2.1.1 Terminology

Microplastics are a large group of synthetic polymers which vary in their physical and chemical properties. Although, no universally accepted definition exists, generally, microplastic particles are defined to be less than 5 mm in their longest diameter (Arthur *et al.* 2009). According to more precise definition, microplastics are polymers within the size range 5 000–1 µm (Horton *et al.*, 2017). Particles smaller than this are called nanoplastics (<1 µm), particles bigger than 5 000 µm *i.e.* 5 mm are called mesoplastics (20–5 mm) and plastic particles even bigger than 20 mm are called macroplastics (Horton *et al.*, 2017; Lambert and Wagner, 2018). The small size of microplastics makes their study complicated (Klein *et al.*, 2018). In this study, only microplastic particles, whose size is 5 mm to 20 µm, are examined. The lower limit is defined by the lower limit of analysing device, imaging FTIR.

2.1.2 A brief history of plastics

Development of plastic materials started from the development of natural rubber in the 1800's and the first (actually functional) fully synthetic polymer *Bakelite* was produced in 1907 (Brydson, 1995; Lambert and Wagner, 2018). In the 1930's polyvinyl chloride (PVC), polyethylene terephthalate (PET), polyurethane (PUR) and polystyrene (PS) were developed, in the 1950's high-density polyethylene (HDPE) and polypropylene (PP) were invented and finally, in the 1960's synthetic plastic materials were made from other than natural sources (Brydson, 1995; Lambert and Wagner, 2018).

Plastic industry and plastic consumption have been growing exponentially since 1950's; the production of plastics has multiplied from 0,5 million tonnes per year (1960's) to over 300 million tonnes per year worldwide in 2000's (Thompson *et al.*, 2009). According to PlasticsEurope's latest annual report 2018, 64,4 million tonnes of plastic materials (not including PET-, PA- and polyacryl-fibers) were produced in Europe and 348 million tonnes of plastic in the whole world in 2017. The production of primary plastics is estimated to increase by +1,5 % in 2019 compared to previous year (PlasticsEurope, 2018).

Plastics are very useful because they are versatile, lightweight, strong, relatively low-cost and resistant to wear and biodegradation (Andrady, 2011). Admittedly, plastics are involved in almost all aspects of daily life: in medicines, packaging materials, clothing, transportation and telecommunication (Thompson *et al.*, 2009). About 4 % world's oil production is used for the production of plastics in the 2000's (Thompson *et al.*, 2009).

The term "microplastic" was first introduced by Thompson *et al.* in 2004, and in 2009 Arthur *et al.* suggested that microplastics should include all fragments under 5 mm. However, the first documentations of microscale plastic particles in marine ecosystems were made already in the early 1970s by Carpenter and Smith (1972), Colton *et al.* (1974) and Gregory (1977) just to mention few. This emphasizes the fact that microplastics have been present in the environment since their manufactory increased exponentially in the 1960s (Eerkes-Medrano *et al.* 2015; Lambert and Wagner, 2018). The abundance of microscale plastics has increased with the production of plastic (Thompson *et al.*, 2004; Barnes *et al.*, 2009). Microplastics have been seen a subject of research only since the beginning of 21st century (Eerkes-Medrano *et al.* 2015; Lambert and Wagner, 2018).

2.1.3 Physical and chemical properties

Because microplastics contain various types of different polycarbonates, they have different physical properties. These properties are for example density of the plastic, shape of the particle and plasticity (Table 1) (Horton *et al.*, 2017).

Table 1. Densities of common plastic polymers. Additives and resins are usually added to plastic products which alters their specific density. Because of additives, these plastics are widely used in multiple different consumer products, for medical purposes and for technology. Density values taken from Lambert and Wagner (2018).

Polymer type	**Abbreviation**	**Density**	**Use**
Low-density polyethylene	LDPE	0.91–0.93	“Soft” plastic *e.g.* plastic bags and wraps
High-density polyethylene	HDPE	0.94–0.97	Elastic plastic, *e.g.* in plastic bottles
Polypropylene	PP	0.85–0.94	Widely used in “hard” plastic items *e.g.* tableware
Polystyrene	PS	0.96–1.05	Solid or foamed, used in *e.g.* food packaging but also as *e.g.* building insulation foam
Polyamide	PA	1.12–1.14	Fibres such as nylon
Polycarbonate	PC	1.20	Strong, used *e.g.* in computer cases, transparent PC used as “glass”
Cellulose acetate	CA	1.28	Fibre or solid, used in *e.g.* ribbons, diapers, and frames of eyeglasses
Polyvinyl chloride	PVC	1.38	Solid, used *e.g.* in building pipes
Polylactic acid	PLA	1.21–1.43	Used as a decomposable packaging material *e.g.* in compost bags
Polyethylene terephthalate	PET	1.34–1.39	Fibre or solid, widely used in *e.g.* clothing and packaging
Polyoxymethylene	POM	1.41	Solid, *e.g.* zippers and knife handles

Plastics denser than water will eventually settle and accumulate in bottom sediments. On the other hand, also floating particles (lighter than water) have been observed in bottom sediments (Ye and Andrady, 1991). Density of plastic polymers can alter due to biodegradation, weathering (Ye and Andrady, 1991) or chemical additives (Andrady, 2011; Hidalgo-Ruz *et al.*, 2012; Klein *et al.*, 2018). Weathered surface of plastic particle is more prone to absorb new substances which alters the density of a particle (Hidalgo-Ruz et al., 2012). Moreover, many plastics are hydrophobic in nature and thus, sink only if they are attached to *e.g.* organic material or other plastics which have higher density (Ye and Andrady, 1991). However, microplastic behaviour in the environment is still not fully understood since the results of experimental laboratory studies don't necessarily apply directly to the natural conditions (Horton *et al.*, 2017).

Plastic materials are rarely produced as primary plastic polymers (Thompson *et al.*, 2009). Usually, chemical additives and/or polymer resins are added to improve the performance of the plastic (Thompson *et al.*, 2009; Klein *et al.*, 2018). The additives include colourings, flame retardants, UV stabilizers, reinforcing carbon or silica (Thompson *et al.*, 2009).

2.1.4 *Primary and secondary microplastics and degradation of plastics*

Microplastics can be divided to primary and secondary microplastics. Primary microplastics are man-made plastic particles in the micrometre size range. Primary sources are for example cosmetic products, cleaning scrubbers, manufactured pellets and powders etc. (Eerkes-Medrano *et al.* 2015; Horton *et al.*, 2017; Klein *et al.*, 2018; Lambert and Wagner, 2018). Secondary microplastics are fragmented from larger plastic items (meso and macroplastics) or released from synthetic textiles as microfibers (Horton *et al.*, 2017; Lambert and Wagner, 2018). Signs of degradation, such as cracking, pits and loosing of little pieces, can be observed also in microplastic particles (Eerkes-Medrano *et al.* 2015.

Degradation is a chemical process which changes the molecular weight of the plastic polymer. As stated in Andrady (2011), all plastics degrade eventually. Degradation of microplastics can be caused by photodegradation (exposure to solar UV light) (Andrady, 2011; Free *et al.*, 2014), mechanical abrasion or physical degradation (*e.g.* wave action and sand friction) (Andrady, 2011), chemical degradation (*e.g.* oxidation and hydrolysis) and biological degradation (*e.g.* degradation by microbes) (Barnes *et al.*, 2009; Cole *et al.*, 2011). When plastic particle is extensively degraded, it becomes brittle and breaks into fragments. If degradation process continues, plastic fragments break into even smaller pieces, until theoretically the polymer breaks down completely (mineralisation) (Andrady, 2011; Klein *et al.*, 2018). On the other hand, plastics are produced to resist challenging conditions and thus, degradation rates and residence time of plastics in the environment are long (Klein *et al.*, 2018).

Exact degradation rates are not known yet but the rate varies with different plastic types and environments (Andrady, 2011; Eerkes-Medrano *et al.* 2015). In this case, lack of data from freshwater environments compels the use of marine research to understand the basics of plastic degradation. Andrady (2011) describes how microplastics degrade in marine environments and presumably, same physical and chemical processes can be applied to freshwater environments. In marine environment degradation is several orders of magnitude faster in the top of pelagic zone than in benthic bottom sediments due to exposure to sunlight (Andrady, 2011). Photodegradation, and especially UV-B light, is a big contributor in plastic degradation (Andrady, 2011). UV-B light degrades common polymers such as LDPE, HDPE, PP and nylons (Andrady, 2011). In addition, higher temperature and availability of oxygen are observed to accelerate degradation rate (Andrady, 2011). In water, temperatures are usually lower and plastic material is not in direct contact with air which reduces the degradation rate. Notwithstanding, as mentioned in Andrady (2011), plastic material which has not been subjected to prior degradation, usually does not degrade in water via photodegradation but rather via other degradation processes.

2.1.5 The amount of microplastic in the environment

The amount of globally produced plastic debris can only be estimated. Lack of data and variations in plastic production and disposal complicate the approximates. It is even more demanding to estimate how much plastic debris ends up in the environment and how much of it is microplastics (Horton *et al.*, 2017).

If it was possible to stop the input of plastic debris to the environment (which is unlikely), the amount of microplastics would still increase because of degradation of previously released plastic debris (Eerkes-Medrano *et al.* 2015; Horton *et al.*, 2017). Nevertheless, plastic production continues to increase in nearby future and therefore, plastic release to the environment is expected to continue as well.

Release of bulk plastic items into the environment is regulated by national and international waste legislation but microplastic debris is not yet under regulation (Eerkes-Medrano *et al.* 2015). However, improvements are under way. European Chemical Agency, ECHA, proposed banning of intentionally added microplastics to EU Member States (ECHA, 2019). In some countries, such as in the United Kingdom, plastic microbeads in cosmetics are already banned (Department for Environment Food & Rural Affairs and MP Thérèse Coffey, 2018).

2.1.6 *Sources of microplastics*

Microplastics enter the environment and freshwater systems from various sources. Sources are for example littering, waste management (personal care products, textile fibres) and effluents applied on fields, industrial products and processes, incidental release (*e.g.* from tires), atmospheric deposition of fibres, storm water overflow events (Eerkes-Medrano *et al.* 2015). Nonetheless, wastewater treatment plants are considered the most significant point source of microplastics to enter the freshwater environments in urban areas (Talvitie *et al.*, 2015; Mason *et al.*, 2016).

Microplastics have been observed in various freshwater systems in every continent: lakes (Faure *et al.*, 2012; Eriksen *et al.*, 2013; Free *et al.*, 2014), rivers (Morritt *et al.*, 2013; Mani *et al.*, 2015), stormwater ponds (Liu *et al.*, 2019) and sea ice (Obbard *et al.*, 2014; Geilfus *et al.*, 2019). These studies show a correlation between the amount and the type of microplastics found and the proximity and the type of human activities in the area. For example, proximity of urban centre areas, human population density near the waterbody, waste management and possible sewage overflow affect microplastic abundance (Eerkes-Medrano *et al.* 2015; Horton *et al.*, 2017).

Horton *et al.* (2017) notes that terrestrial land and water areas have been seen only as a transportation path for microplastic before particles reach the oceans. In reality, almost all plastic is produced on terrestrial areas and plastic accumulates first in continental environments *e.g.* inland water systems (Horton *et al.*, 2017). It’s suggested that soil and freshwater are acting as long-term sinks for microplastics before their release to the ocean (Eerkes-Medrano *et al.* 2015). Horton *et al.* (2017) assume that there are more microplastics in freshwater systems than in the oceans. Also, it’s crucial to understand that plastic debris is not only transported by rivers from land to sea but also back from sea to land via *e.g.* tides and flooding (Horton *et al.*, 2017).

2.1.7 *Impacts on the environment*

Microplastics contain chemical additives which can be carcinogenic and acutely toxic. When microplastics degrade, chemical additive can leach and degradation products become bioavailable for biota (Klein *et al.*, 2018). Microplastics can also absorb toxic compounds such as persistent organic pollutants (POPs) *e.g.* polychlorinated biphenyls (PCBs), dichlorodiphenyldichloroethylene (DDE), and polycyclic aromatic hydrocarbons (PAHs) (Hirai *et al.*, 2011). When aquatic species misidentify plastics as food and ingest plastics, bioaccumulating POPs enter the food web (Andrady, 2011; Eerkes-Medrano *et al.* 2015). Moreover, the ingestion of microplastics may physically fill digestion system of an organism and cause starvation (Wright *et al.* 2013). Long-terms effects of continuous exposure to microplastics are not known yet (Klein *et al.*, 2018) but microplastics have been observed to affect not only individual organism but also populations (Wright *et al.* 2013). Potential risk for human health is yet to be studied as well (Thompson *et al.*, 2009; Klein *et al.*, 2018).

2.2 Varves

Climatic regime and seasonal changes are reflected in the lake sediments. In boreal climate zone, such as in Eastern Finland, sedimentation is rhythmic – controlled by seasonal changes in climate – and sedimentary structures can be preserved in anoxic lake bottoms (Saarnisto, 1986). If regularly laminated sediments reflect the annual cycle of deposition, they are called varves.

2.2.1 Formation of varves

Probably, the most studied varved sediment type is clastic-biogenic varves (Bonar, 2005). Snow melt in the spring (*i.e.* spring flood event) brings eroded material to the lake from the catchment area resulting a spring minerogenic (*i.e.* clastic) lamina (Fig. 1) (O’Sullivan, 1983; Saarnisto, 1986). During summer, autumn and winter allochthonous and autochthonous organic matter settles to the lake bottom forming an organic rich lamina (*i.e.* growing season lamina) (O’Sullivan, 1983; Saarnisto, 1986). These annual layers, varves, are preserved if sediment mixing by e.g. wave action or bioturbation is prevented (Zolitschka *et al.*, 2015).

In boreal climate regime, lakes are usually thermally stratified. The lake water turns over bringing the oxygen rich surface water to the bottom of the lake during the spring and the autumn, when the water heats up or cools down radically resulting in a change in water density. However, in deeper basins of the lake the water column does not necessarily completely mix, or oxygen rich surface water is quickly depleted in the bottom after the overturn. Under hypoxic to anoxic bottom water conditions benthic fauna cannot destroy the structures formed (O’Sullivan, 1983; Saarnisto, 1986). Also, a high sedimentation rate can prevent bioturbation which causes the preservation of forming layers, varves.

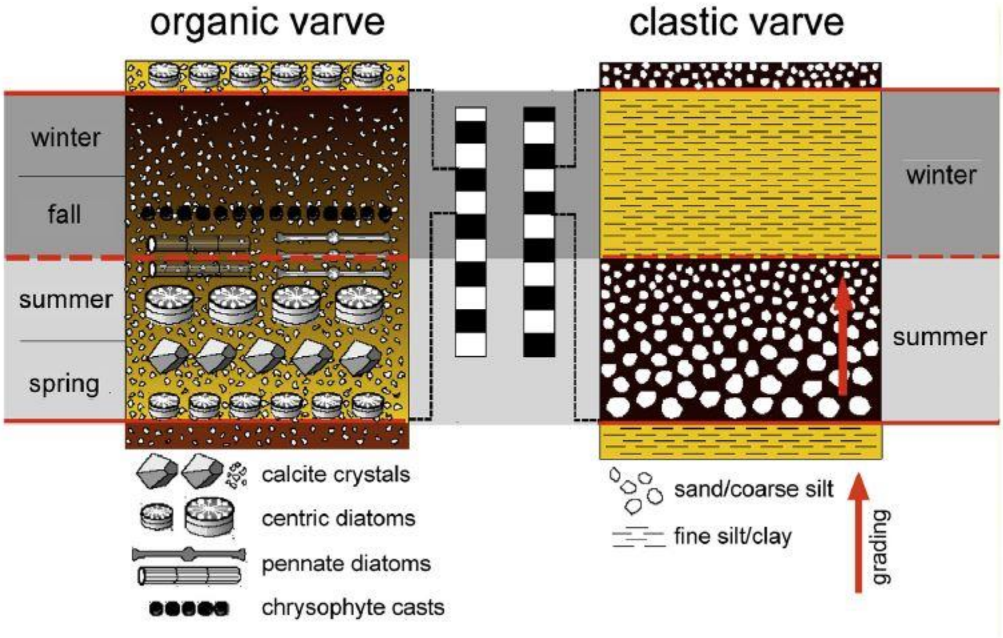


Figure 1. A typical a. organic and b. clastic varve structure presented by Zolitschka *et al*. (2015). Boreal climate regime favours the formation of clastic-biogenic varves.

In addition to clastic-biogenic varves, other varve types, such as biogenic varves, calcareous varves, diatom-rich varves and iron-rich varves, are found in freshwater and marine environments across the world (Bonar, 2005).

2.2.2 *Varves in microplastic research*

Varves have not been widely used in microplastic research yet, but their potential as a direct dating method to track changes in microplastic concentrations have been acknowledged (*e.g.* in MICRO2018 conference in Lanzarote in 19th–23rd November 2018). Brandon *et al.* (2019) used varve chronology to form microplastic abundance-time curve from 1834 to 2009 of coastal sediments of the Santa Barbara Basin, California, United States. Using varves Brandon *et al.* (2019) correlated the exponential increase in plastic production with plastic deposition rates in the sediment record. No other studies have used varves in addition to Brandon *et al.* (2019) to my knowing.

3. Regional setting

3.1 Study site

Lake Kallavesi is located in the Eastern Finland, in the county of Pohjois-Savo, in the area of the city of Kuopio and the municipalities of Siilinjärvi and Leppävirta (Fig. 2). Lake Kallavesi is an inland freshwater lake which includes several basins connected as one big water body. It is the 10th largest lake in Finland with an area of 478 km^2. It's a part of Vuoksi water course (HERTTA Database, 2017). The medium depth of Lake Kallavesi is 9,7 m and the maximum depth is 75 m (HERTTA Database, 2017). Water level in Lake Kallavesi is regulated between 81,1 and 82,2 m a.s.l. (Kejonen, 2005).

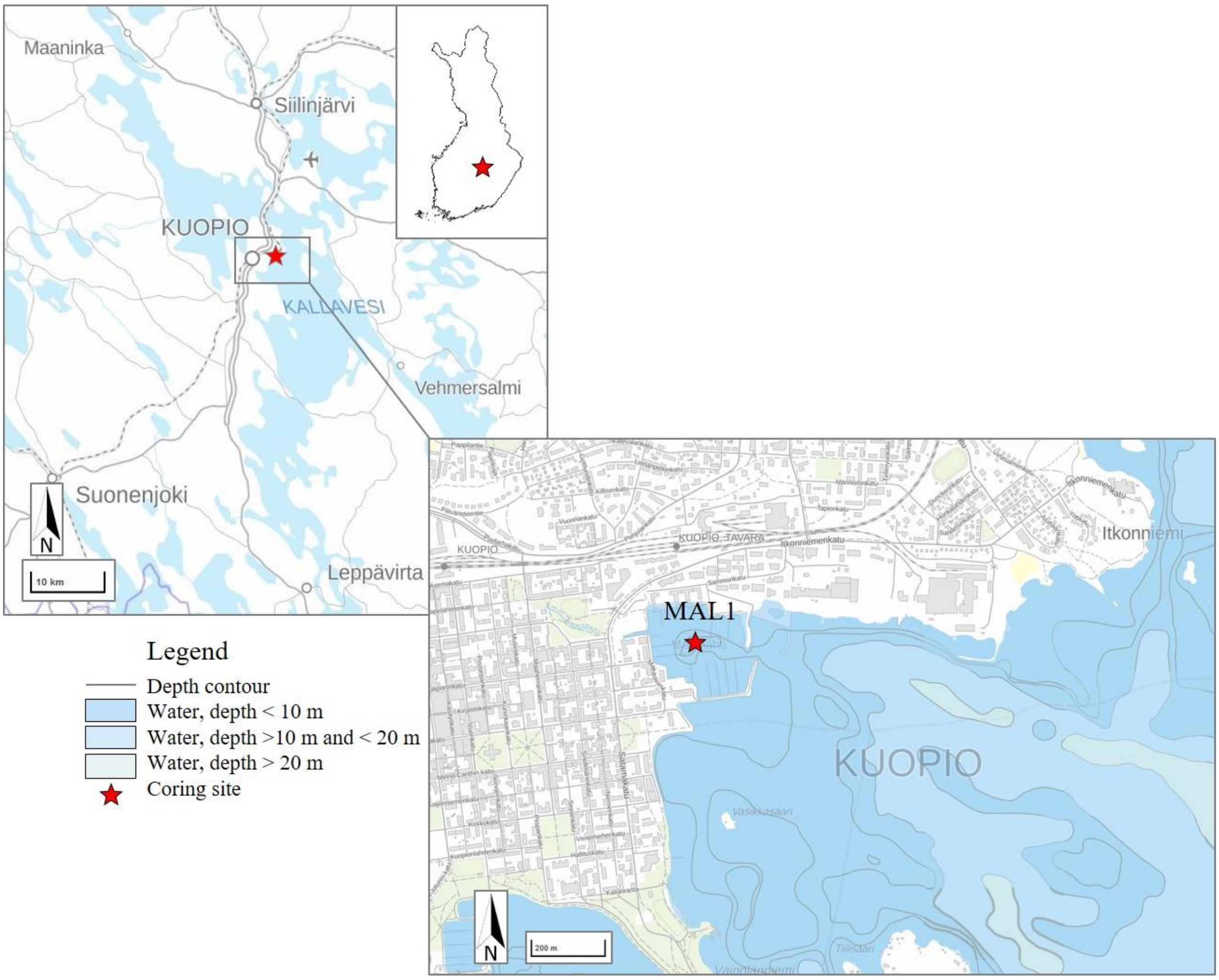


Figure 2. Study area (open data map from National Map Survey of Finland 2018).

Water quality and the ecological state of Lake Kallavesi is good according to Vuoksi water management program 2016–2021 (Manninen and Kotanen, 2012). Lake Kallavesi is a typical dimictic brown-watered, humus rich lake. The state of eutrophication varies within different parts of Lake Kallavesi (Hartikainen, 2018). The deeper parts of the lake experience oxygen depletion during the winter stratification, and thus some areas are mechanically oxidized to prevent bottom anoxia (Hartikainen, 2018).

3.2 Climate of the study region

The Kuopio district belongs to the southern boreal climate zone and it is characterized by four distinctive seasons. The annual average temperature in the Kuopio district is 2–3 °C and the average annual precipitation is 550–650 mm (30 years average 1971–2000) (Kersalo and Pirinen, 2009). Average temperature in July is 16,1–18 °C and in January -10,0 – -8,1 °C (Kersalo and Pirinen, 2009).

The wettest month of the year is August (80–90 mm) and the driest are March, April and May (30–35 mm per month) (Kersalo and Pirinen, 2009). Approximately 40–50 % of the annual precipitation precipitates as snow, and the snow depth in the area is approximately 50 cm. Stable snow cover develops at the Kuopio district usually in the end of November and the snow melts completely in the end of April (Kersalo and Pirinen, 2009). Lake Kallavesi is ice covered about 4–5 months per year (Kersalo and Pirinen, 2009). Strong seasonal variations affect the availability, sources, transportation and deposition of the sediment (Johansson *et al.*2019).

3.3 Varves in Lake Kallavesi

The climatic setting of Eastern Finland favours the formation of (clastic-biogenic) varves in the sediment record (e.g O’Sullivan, 1983; Saarnisto, 1986). Varves have been studied extensively in Finland from the 1970’s onwards (*e.g.* Saarnisto, 1975, 1986; Saarnisto, Huttunen and Tolonen, 1977; Ojala and Alenius, 2005; Tiljander, 2005; Haltia-Hovi, Saarinen and Kukkonen, 2007 just to mention few). Varves have been studied also in the same regions as Lake Kallavesi, *e.g.* Lake Kuninkaisenlampi in Juankoski (Saarni, 2017) and Lake Lehmilampi (Haltia-Hovi, Saarinen and Kukkonen, 2007; Salminen *et al.*, 2019) in Nurmes, Eastern Finland. However, no varves have been reported from Maljalahti Bay or Lake Kallavesi before. On the other hand, as mentioned already in Saarnisto (1986), varves can be formed also in the deep basins of large lakes, not only in isolated, small and deep lakes and ponds. Therefore, hypothetically varves can be found as well from Lake Kallavesi.

3.4 Geological history of Lake Kallavesi and Kuopio district

The bedrock in the Kuopio district is mainly 2,5 Ga old granite gneiss and the main soil type in the catchment area of Kallavesi is coarse, sandy Quaternary ground moraine (Kejonen, 2005; Maankamara DigiKP200, 2019). The sedimentation of lake sediments in the area of Lake Kallavesi started after the deglaciation (Kejonen, 2005).

The deglaciation of the Kuopio district occurred in the early Holocene, approximately between 9000 and 10 000 BP (Saarnisto, 1970). First, the deglaciated area was covered by the Yoldia Sea stage which then was replaced by the Ancylus Lake 9 500 BP (Saarnisto, 1970). Because of the postglacial crustal rebound, the eastern Finland was soon separated from the Ancylus Lake and the Lake Suursaimaa was formed due to transgression. The ancient Lake Suursaimaa was at its full extent approximately between 6 000 to 6 700 BP, and it also included the area of present Lake Kallavesi (Saarnisto, 1970). Highest shoreline was approximately 80 m above current lake level of Lake Kallavesi (Saarnisto, 1970). Approximately 5 700 BP, the water level in the Lake Suursaimaa started to drop due to new outlets in the south (Saarnisto, 1970). The outlet of present Vuoksi was formed 5 000 BP owing to continuous isostatic rebound effect, and Lake Kallavesi became isolated due to regression (Saarnisto, 1970).

3.5 Anthropogenic influence around Lake Kallavesi

The area around Lake Kallavesi was soon inhabited after deglaciation. Slash-and-burn cultivation was practised from 16th to 18th century, which eventually turned forest into farmlands (Soininen, 1961). Modern agriculture and forestry started in the 19th century (Soininen, 1961). Before industrialization, lake pollution and nutrient release to lakes was minimal.

The city of Kuopio was established already in 1775, but the modern building of the city centre started after the Continuation War (City of Kuopio website, read 5.6.2019). In 1960's and 1970's pavement was built in city centre and runoff water was directed into ditches which eventually flowed into Lake Kallavesi. Moreover, sewage waters from both households and industry were released untreated to Lake Kallavesi until the 1980's. Around the same time, extensive use of plastics started in Finland (Halonen, 2011).

3.6 Sample site

Samples were taken from Maljalahti Bay, a part of Lake Kallavesi, that is surrounded by the city of Kuopio. Previous results show that microplastics are present in both the water column and the lake sediments of Lake Kallavesi (Uurasjärvi *et al.*, 2020). In addition, the catchment area of the bay and its sources of pollution are well-known, which makes it easier to analyze the possible results.

Maljalahti Bay was selected as a study site because it is a hot spot area collecting urban runoff from the city. Urban areas are acknowledged as important contributors of microplastics into the environment (Free *et al.*, 2014). Maljalahti Bay is rather closed freshwater basin. A stream is flowing through the centrum of the city of Kuopio into the bay. The western and southern shores of the bay are residential areas and new housing is built on the northern shores of Maljalahti Bay.

Building of the new residential area of Maljalahti started in 2011 (Regional State Administrative Agencies Eastern Finland, 2011). Passenger harbour is situated in Maljalahti, and therefore the bottom of the dock area is sporadically dredged. Last dredging was carried out during winter 2018–2019 (ruling 8/2018 ELY) and previous one in the late spring of 2011 (Regional State Administrative Agencies Eastern Finland, 2011). New boat moorings and a part of breakwater were built in 2011 (Regional State Administrative Agencies Eastern Finland, 2011).

Quality of bottom sediments up to 1 m depth was tested in Maljalahti Bay in 2016 and 2017, and concentrations of some hazardous substances were above permitted (Ramboll Finland Oy, 2016). Quality of bottom sediments have been tested also in 2004 and 2006 and the reports show slight contamination with oil and heavy metals (Savo-Karjalan Ympäristötutkimus Oy, 2004 and 2006). However, the contamination didn't require remediation of contaminated soil (Regional State Administrative Agencies Eastern Finland, 2011).

In total, three samples were taken from Maljalahti Bay but only one of them is assessed in this study. The selected sample (MAL1) were taken closest to the shore, in the dock, only tens of meters from the stream. The dock is isolated from open water by two breakwaters. At the narrowest point, breakwaters are less than 50 m from each other. The coordinates for this site are 62° 53.685' N and 27° 41.897' E. The coring site was at the deepest basin inside the dock area.

Microplastic concentrations are studied to decrease with the distance from central areas (Wang *et al.*, 2017). The other samples were taken further away from the harbour to get an idea of dispersion gradient: MAL2 about 300 m away and MAL3 about 1 km away from the shore (Fig. 3). However, these samples (MAL2 and MAL3) were not analysed during this project because the amount of workload was not suitable for a master's thesis.

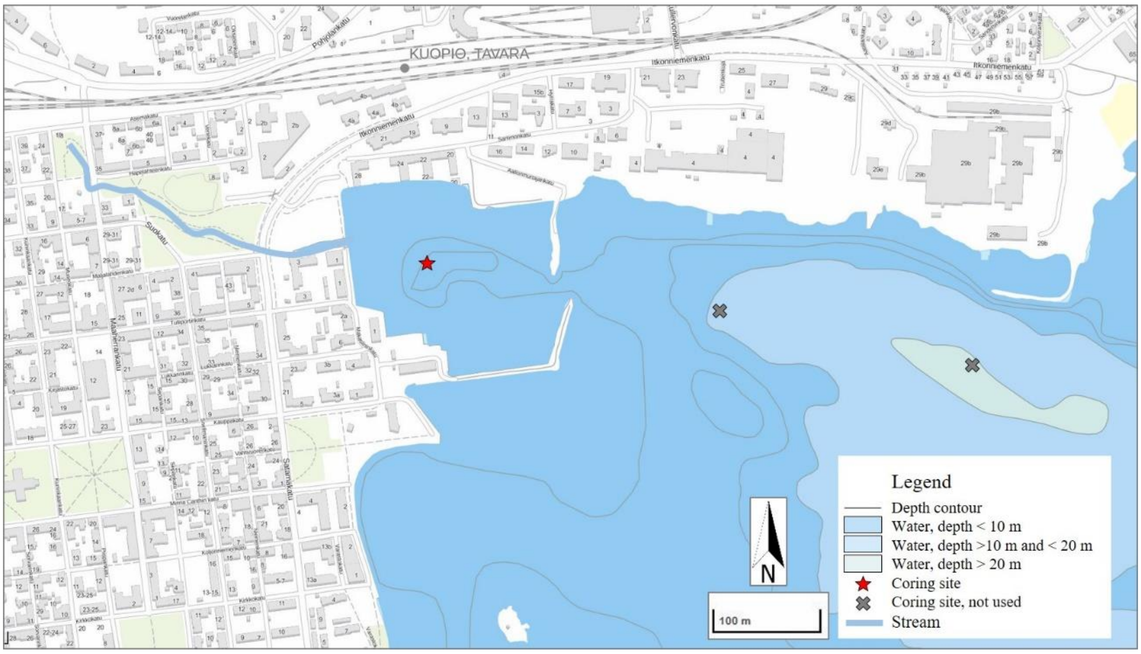


Figure 3. Sample sites in Maljalahti Bay in Lake Kallavesi. The study site, MAL1, is in the harbour of Kuopio, only tens of meters from the shore (Open data map from National Map Survey of Finland 2018). Stream flowing through the city centre is highlighted.

4. Materials and methods

4.1 Sampling of sediments

Samples were taken on top of the lake ice in 8th March 2017 from Maljalahti Bay, Lake Kallavesi. Precise sample site is presented above in figure 3. In the study site, the depth of the water was measured, and two sets of samples were taken: a surface sediment sample with Kajak sample retriever and a freeze core. The samples were taken each from their own hole in the ice to make sure samples were undisturbed. The water depth at MAL1 site was approximately 9 m.

A Kajak sampler with a 60-cm-long cylinder was used to obtain undisturbed surface sediment samples from the water-sediment interface. The Kajak sample was 23,0 cm long and it was divided into 1-cm-thick subsamples on the study site, and the subsamples were stored in 0,5 l sealed plastic bags until laboratory treatment. Subsamples were put in a freezer right after retrieving them and transported to University of Turku in frozen form. Kajak samples were used to determine water content, organic content (LOI *i.e. loss in ignition*) and magnetic susceptibility (MS).

Grain size and microplastic analysis were made from freeze core samples. Freeze core is a simple, inexpensive technique where loose sediment is frozen in-situ (Saarnisto, 1986). The technique was first introduced by Shapiro (1958) and then developed by *e.g.* Wright in 1960's (1980) and later Saarnisto (1975) and Saarnisto *et al.* (1977). The freeze core was a one meter long wedge shaped aluminium tube which was filled with dry ice (-79 °C) and alcohol (to accelerate freezing).The core was let to penetrate loose sediment, and then was held in place for 20 minutes by attaching the core to the lake ice with rope. Approximately 1–3 cm thick layer of sediments froze on the surface of metallic wedge. The top part of the wedge is wider than the bottom part, and thus more sediment material is attached on the top part of the freeze core. The core was pulled out of the sediment and unfrozen, soft sediments on top of frozen layer was removed immediately with a saw. The tube was detached from the sediment crust by taking out the extra dry ice and pouring warm water inside the tube. The freeze core was kept frozen all time because melting would destroy the fine structures.

Freeze core was chosen for microplastic sampling because of its ability to capture plastic particles in an in-situ sediment profile. Compared to other lake coring methods, such as piston cores, a relatively large amount of sediment can be obtained with freeze core with minimal contamination. Moreover, freeze core sample enables high-resolution dating with varve chronology. The downside with the freeze core method is that standardized volume of the obtained samples cannot be determined due to the irregular shape of the core and differences in the freezing time.

The freeze core was 38,5 cm long and it was wrapped in a thin plastic wrap (PET) and aluminium foil to prevent freeze drying during the storing. The freeze core was transported in frozen form with dry ice (−78 °C) to University of Turku. The samples were stored in a cold room at the temperature of −22 °C at Geohouse, Department of Geography and Geology. Later, the freeze core was photographed and divided into subsamples according to possible, visible varves or laminae. The subsamples were cut with a small saw blade from the frozen freeze core. Approximately the topmost 11 cm of the freeze core was used in this thesis. Subsamples were used for microplastic analysis.

4.2 Magnetic susceptibility

Magnetic susceptibility of sediments expresses the concentration of magnetic minerals and demonstrates the variation of the sedimentation rate of a lake. Magnetic susceptibility is used as a standard method for correlation between sediment samples (Nowaczyk, 2001). The samples from Maljalahti Bay were taken from the water-sediment interface and thus, the samples were characterized by a very high water content. Therefore, magnetic susceptibility was measured from discrete subsamples as recommended by Nowaczyk (2001).

Magnetic susceptibility was measured from fresh Kajak subsamples. The subsamples were let to melt for 24 h and were then filled into standard paleomagnetic sample boxes (polystyrene, external dimensions 2.2 × 2.2 × 1.8 cm, volume 6.2 cm^3). Magnetic susceptibility was measured non-destructively through the boxes in SI-form with a Bartington MS2 meter with a MS2E1 sensor. A calibration sample was measured before the first sample and in between every five samples to get the corrected magnetic susceptibility. Moreover, readings against air was measured before and after the samples and the average air reading was subtracted from the initial susceptibility measurement to get corrected susceptibility. This procedure is explained in more detail in Nowaczyk (2001).

4.3 Water content and LOI

Measuring water content and LOI are easy and relatively rapid basic methods to describe the characteristics of sediment (Zolitschka *et al.*, 2001). Kajak subsamples were taken off from the polystyrene cubes and placed into crucibles. Water content was measured by heating the Kajak subsamples overnight in 100 °C. Loss in ignition was measured by heating the samples 2 hours in 550 °C (*e.g.* Heiri *et al.* 2001). The samples were weighted before and after the heating and cooled down in a desiccator. These procedures are explained in more detail in *e.g.* Dean (1974)

4.4 Grain size analysis

Grain size was determined from each subsample taken from the freeze core. Material for the analysis was first treated with heavy liquid. After microplastic separation, minerogenic residue left in the centrifuge tubes was treated with hydrogen peroxide (H_2O_2) in 80 °C for 5 days to remove the organic material.

Grain size analysis was made with Coulter LS™ 200 Particle Size Analyzer. Distilled water was added to the samples. Before adding the diluted sample into Coulter, the samples were placed in an ultrasonic diffuser for 3 minutes to break up any coagulated particles.

4.5 Varve chronology

In this study, a layer was counted as a varve if both a clastic spring lamina and an organic growing season lamina with clear differences in colour were identified. According to law of superposition, older layers underlay the younger ones and therefore, varve years can be counted downcore according to varves.

As mentioned in Saarnisto (1986), counting of varves from the surface of a frozen sample is usually the most practical counting technique. Approximately 10-cm-long and 2,5-cm-wide subsamples with 2 cm overlap were cut with a small circular saw from the frozen freeze core. Saarnisto (1986) suggested counting in a cold room but since it was not possible in Geohouse, counting was made in a room temperature but extra carefully to prevent melting. The sample was taken out from the freezer, the surface was cleaned with a knife and varves where counted using a Nikon SMZ800 microscope with a 1.5 × magnification. Counting was made only couple of minutes at the time and then, the sample was taken back to the freezer for minimum 10 minutes before continuing. The procedure was repeated until the sample was completely counted.

Since layers in MAL1 freeze core had recognisable colour differences, varve count was revised from photographs taken of fresh freeze core. As mentioned by Saarnisto (1977), photographs are the simplest way to document and count varves.

Annually laminated (*i.e.* varved) lake sediments reflect past environmental and climatic conditions and can be used as a direct dating method (*e.g.* O'Sullivan, 1983; Saarnisto, 1986). Varve series can be linked to calendar years by *e.g.* radiocarbon (Bonar, 2005) or ^{137}Cs dating (Ojala *et al.* 2017). However, radiometric dating was not made in this study since the anticipated timescale was less than a decade. Instead, calendar years were counted directly from the varves observed. Thickness of annual laminations was counted three times in total. Counting error in varve count was calculated as following:

$$\frac{Minimum\ varve\ count}{Average\ of\ varve\ count} \times 100$$

$$\frac{Maximum\ varve\ count}{Average\ of\ varve\ count} \times 100 - 100$$

4.6 Meteorological and hydrological data

Meteorological and hydrological observations were applied to understand the forces driving sediment and microplastic fluxes. The meteorological and hydrological data included local air temperature (°C), precipitation (mm), snow depth (cm) and snow equivalent (mm), water discharge data (m^3/s) and timing of seasonal freezing and melting (date). As studied by Johansson *et al.* (2019), air temperature, precipitation and snow accumulation have the biggest impact on sediment accumulation rate in Kallavesi on a seasonal scale. Other driving parameters are *e.g.* wind speed and ice coverage.

Air temperature, precipitation and snow depth were measured from Savilahti, Kuopio, by the Finnish Meteorological Institute (The Finnish Meteorological Institute's Open Data, 2020). Savilahti is located approximately 3 km west from the study site, Maljalahti Bay.

Snow equivalent and discharge data were measured from Viannankoski, Onkijärvi, Kuopio by Finnish Environmental Institute (HERTTA Database, 2017). Viannankoski is located approximately 45 km north-west from Maljalahti Bay. River discharge and snow equivalent data was not available closer to the study site. Nevertheless, the changes in the maximum river discharge and snow equivalent data represent the hydrological conditions and its variations in the study site.

Ice-cover information was based on visual observations assessed from Itkonniemi, Kuopio, which is less than 2 km from Maljalahti Bay. Ice-cover data was also obtained from Finnish Environmental Institute.

The measuring period, from the 1st of November 2008 to the end of June 2016, was selected to match the timescale achieved with varve chronology. In this study, winter is considered to be the timespan from the 1st of November to the 30th of April of the following year, and the growing season is considered to be the timespan between the 1st of May and the 31st of October.

4.7 Microplastic analysis

Since most of microplastic fragments are mixed with sediment particles in the lake bottom and thus, not visible for naked eye, microplastics were studied from bulk sediment samples. Microplastic particles were separated from lake sediment and from each other using differences in densities. Density separation is the most common way to separate plastic particles from sediment particles (Hidalgo-Ruz *et al.*, 2012; Klein *et al.*, 2018). Different density separation methods have been used by *e.g.* Imhof *et al.* 2012 and Dong *et al.* 2020. Basically, lighter plastic particles are separated from heavier sediment particles by mixing a sediment sample with a saturated solution (*e.g.* heavy liquid, NaCl solution, seawater or freshwater) (Hidalgo-Ruz *et al.*, 2012). After mixing, heavier sediment settles and lighter plastic particles are left floating (Hidalgo-Ruz *et al.*, 2012). The float can either be sieved or filtrated, or floating microplastics can be picked up straight from the supernatant (Hidalgo-Ruz *et al.*, 2012).

For instance, Imhof *et al.* (2012) describes their improved density separation. In their method, sediment (and other) samples are first divided into different size classes and organic material is removed either with hydrogen peroxide (H_2O_2) or with enzymes (Imhof *et al.*, 2012). The density separation itself is done in a specific apparatus built for microplastic separation. Extraction efficacy with this method is high – up to 100 % with particles in 1-5 mm size range and 95,5 % with smaller microplastic particles (Imhof *et al.*, 2012). Same method is also applied now in other studies and universities (*e.g.* Aalborg, Denmark). Downsides with this separation method is that it requires time-consuming sample preparations and large amounts of sediments (a litre or more), utilizes toxic chemicals (*e.g.* zinc chloride $ZnCl_2$ or sodium polytungstate SPT as heavy liquid), and requires multiple ultrasound washes which can destroy or break up microplastic particles.

Froth flotation is another method used, especially in plastic recycling industry (Imhof *et al.*, 2012). However, it’s rather complex method and the recovery rate is only 55 % (Imhof *et al.*, 2012). In addition, froth flotation favours certain types of plastic particles and thus, it is not reliable method for an equal separation of all plastic polymers.

The method used in this thesis was created in University of Turku together with University of Eastern Finland. The sample volumes in this study were small and the hypothesis was that only small amounts of microplastics were found in each sample. The method is basically a modified cryptotephra method which was first introduced by Turney (1998) and then modified by Kalliokoski *et al.* (2019). Cryptotephra particles are in many ways similar to microplastic particles: they are in the same size range as the smallest microplastics (approximately 10 µm) and they are scarcely abundant in the samples. The advantage of this method is that it does not require large amount of sediment material and the protocol is gentle for the possible microplastics in the sample.

4.7.1 *Development of microplastic separation*

The method was tested by adding a well-known plastic into approximately a 1000-year-old lake sediment. The test sediment did not contain any plastic because of its age, and the sediment was otherwise carefully handled to prevent any microplastic pollution.

A hundred red polyethylene terephthalate (PET) microplastic particles were added to the test sediment. The PET particles were produced from used red ketchup bottles. Particles' density was 1.3−1.4 g/ml and the size ranged between 250−500 µm. The method was tested 3 times, and the average of 96 out of 100 PET-particles were separated from the test samples with the heavy liquid separation protocol. Furthermore, hundred high-density polyethylene (HDPE) particles were added to the test sediment. The HDPE particles were white, their density was less than 1.0 g/ml and their size was approximately 250 µm. Separation of the known HDPE particles was tested two times. Average of 89 out of 100 HDPE particles were separated from the sediment with the method. Overall, the method has high extraction efficiency among these types of plastics. Besides the added test microplastics, no other plastic-like particles were observed when the test samples were examined under a microscope.

As mentioned by R.C. Thompson (in Hidalgo *et al*. 2012,), all microplastic fragments are not necessarily extracted from sediment samples in the first separation phase. In this study, three treatments with heavy liquid were tested to be the most efficient with the test samples. First phase, water flotation, worked with lighter HDPE particles: approximately 10 % of the HDPE particles were detected floating on distilled water but the PET particles were not found in the water fraction. Most of the particles were separated in the first phase of heavy liquid separation: approximately 85 % of the PET particles were found after one treatment, 10−15 % after the second treatment and 0−5 % after the third treatment. Most of the HDPE particles, approximately 85−90 %, were found after the first phase of heavy liquid separation, and rest after the second phase. No HDPE particles were detected in the third phase. Heavy liquid separation protocol is explained in more detail later in this chapter.

During the development of the method, sieving the test sample was also tested. The test sample (*i.e.* sediment + added particles) was sieved into 500 µm, 212 µm, 106 µm and 36 µm sizes to extract finer sediment material. For example, Hidalgo-Ruz *et al.* (2012) highly recommend sieving before density separation to make comparison with other studies easier. However, Horton *et al.* (2017) notes that sampling equipment and methodology affects the size of the particles observed and therefore, has an impact to the results in most studies. Consequently, sieving complicated the extraction and counting of microfibers. In the end, it was decided that some microfibers could have been lost during this phase (*e.g.* overflow over the edges of the sieve or particles getting stuck on the mesh) and sieving was cut out from the protocol. Hence, the method used in this study is as simple as possible and all unnecessary steps are cut out of the protocol to prevent contamination and loosing of particles. Although sieving was cut out, finer sediment material (<15 µm), was extracted by filtration in the procedure.

Heavy liquid separation is used to separate crushed rock or sediment material into different specific gravity fractions. The separation solution used was non-toxic lithium heteropolytungstate (LST) which contains lithium, sodium and tungsten. LST is thermally stable, recyclable and proven to be safe and efficient alternative in heavy liquid separation (Mounteney, 2011). The density of LST is 2,85 g/ml in room temperature but LST can be diluted with deionised, distilled water into desired densities. Different densities of LST were tested as well. Firstly, the test sample was treated with heavy liquid which density was 1,2 g/ml, secondly with heavy liquid which density was 1.3 g/ml and finally with heavy liquid which density was 1.4 g/ml. The idea behind was to separate different kind of microplastics from each other. However, the outcome from these tests were not as good as wanted: only half of the test particles were able to be recovered. Hence, the density of the heavy liquid was set to 2.0 g/ml which separates most microplastic particles from sediment particles. Quinn *et al.* (2017) compared several microplastic density separation techniques, and likewise, they concluded that the recovery rate of microplastics was better when the used solution was denser. Usually, density of microplastic particles ranges between 0.8 to 1.43 g/ml but because density can alter depending on additives etc, density of heavy liquid was set just a bit lighter than inorganic material (>2.5 g/ml).

The problem with the heavier density (2.0 g/ml) is that not only microplastic particles but also lots of organic material was separated from the sediment particles. As stated in Lambert and Wagner (2018) and Klein *et al.* (2018) microplastic particles are difficult to distinguish from organic matter because of hydrophobic nature of many plastics. Removal of natural debris with hydrogen peroxide was tested. H_2O_2 (35 w-%) was added to density separated material and let to react for 2 days in 40 °C as described in *e.g.* Nuelle *et al.* (2014) and Liu *et al.* (2019). Typically, organic material is removed with H_2O_2 in 80 °C. Though, 80 °C could alter plastic materials and therefore, lower temperatures must be used. Procedure with H_2O_2 did not extract enough organic material with these samples and removal of natural debris was cut out of the protocol.

Enzymatic digestion of organic debris could have been another option to remove organic material from samples, as described *e.g.* in Enders *et al.* (2015) and Liu *et al.* (2019). However, use of enzymes is rather expensive and requires precise conditions for enzymes to function.

The developed heavy liquid protocol was successfully applied for various sediment types such as coarse and fine lacustrine sediments and marine sediments. In addition to the freeze core, Kajak sediment retriever and sediment traps were used to collect sediment samples for microplastic analysis.

4.7.2 *Sample preparation*

Freeze core from MAL1 site was cut into subsamples for microplastic analysis. In total, 14 subsamples of MAL1 freeze core were analysed. The surface of the freeze core was scraped off with a knife to ensure clean sample without plastic contamination from the sampling. The topmost six varves of the freeze core sample were cut and divided further according to physical properties of the sediment into smaller subsamples, representing either clastic or organic lamina of a varve. Subsamples were let to melt in beakers for approximately 4 hours, and then moved to 100-ml-measuring cylinders were the samples were let to settle before measuring the volume. By this procedure, the volume of the subsamples is not dependent on the water content or the compacting of the sediment. Both beakers and cylinders were covered with aluminium foil to prevent contamination.

Subsamples were divided further into 50 ml polypropylene (PP) centrifuge tubes, about 5 ml of material in each tube. Material was moved from measuring cylinder with the help of distilled water to make sure no particles were lost during this phase. The centrifuge tubes were then filled up with distilled water, and sample material and water were mixed by shaking the tube.

Samples were centrifuged on a VWR Mega Star 1.6 centrifuge at 3000 rpm for 9 minutes with a brake rate of 6. Material denser than water (over 1.0 g/ml) sunk into the bottom of the centrifuge tube and less dense material (less than 1.0 g/ml) floated on the top of the centrifuge tube. Distilled water was used as the first step in density separation for practical reasons, but also all floating particles were collected before the heavy liquid separation. The floating material and water on the top of the centrifuge tube, *i.e.* the float, was poured out to a beaker and then through a paper filter (Munktell Ahlstrom, general purpose paper, size 90 mm, grade 1003) which particle retention was 12–15 µm. Filtration was aided by a vacuum. To prevent losing any particles, walls of the filtration funnel was rinsed with distilled water as recommended in Hidalgo-Ruz *et al.* (2012).

Used paper filter was placed on a petri dish (made of PP) and the petri dish was sealed with masking tape to avoid airborne contamination. Filters were later examined under a microscope. Water and the fine material, which went through the filter, were flushed away.

4.7.3 *Heavy liquid separation protocol*

Material heavier than water in the bottom of a centrifuge tube was treated with heavy liquid separation. In this case, LST heavy liquid with density of 2.0 g/ml, was used to separate inorganic material from plastic particles and other material with the same density.

The centrifuge tubes with the samples inside were filled with LST and mixed carefully. Samples were centrifuged and the float (density less than 2.0 g/ml) was decanted. The material which was left in the bottom of the first centrifuge tube (density more than 2.0 g/ml) was treated with LST three times in total. Multiple density separations were necessary to make sure that all plastic material was separated from minerogenic material, as determined when developing the protocol.

The float, which was decanted, was divided evenly into three new 50-ml-centrifuge tubes (approximately 12.5 to 15 ml per centrifuge tube). Walls of the beaker used for dividing the sample material were rinsed with deionised and micro-filtrated water to prevent losing any particles in the procedure. Rinsing water was put to the centrifuge tubes with the float.

Hidalgo-Ruz *et al*. (2012) noticed in their review that some fraction of the microplastics stick easily to container walls. Therefore, container/centrifuge tube/filtration funnel walls were rinsed, and particles saved in every part of the process. In addition, sample was moved as little as possible between different containers.

The new centrifuge tubes with the float inside were filled with deionised micro-filtrated water, mixed, centrifuged and the float decanted and poured through a paper filter. Paper filters were examined later. Dividing the float into three is based on changing the density radically in a centrifuge tube. When distilled water (1.0 g/ml) is applied to the float (2.0 g/ml) for the first time, density changed to 1.2–1.3 g/ml depending on the amount of the float (which was 12.5–15 ml/centrifuge tube). When samples are centrifuged, heavier plastic particles sink down to the bottom of the centrifuge tube and lighter particles with organic material float on the top. Distilled water was applied three times to the centrifuge tubes to wash away LST. When distilled water was applied second time, density was closer to 1.0 g/ml. Used LST was recycled by evaporating the excess water away.

The protocol for separating microplastics from sediment material is presented in figure 4.

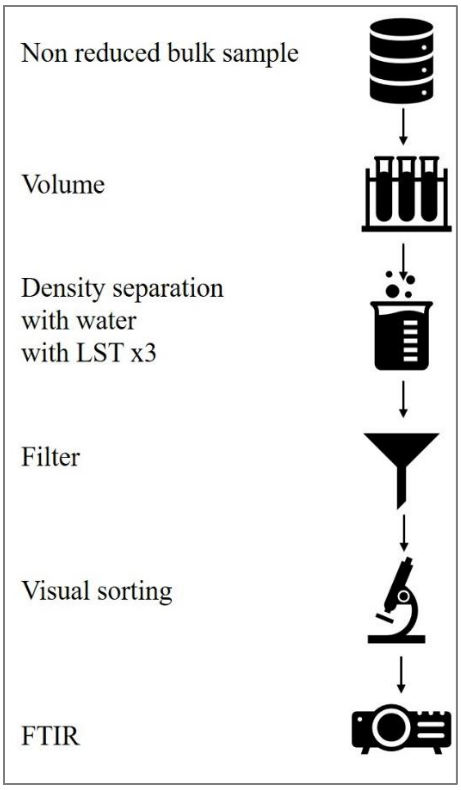


Figure 4. Sample processing steps simplified.

4.7.4 *Visual sorting of microplastics*

Both visual identification with a microscope and imaging FTIR analysis was applied to minimise misidentifications of microplastics. Because of the analysis device, imaging FTIR, particles outside the scope of the study needed to be removed before the imaging. Thus, possible microplastic particles were manually selected from the paper filters with micro tweezers to be analysed further with imaging FTIR.

Not only the paper filters with the sample material but also the residue material, which was treated with heavy liquid three times, was examined under the microscope and possible microplastics were extracted from other particles. Particles were chosen visually: particles which did not have a cellular or organic structure, fibres which were equally thick and particles which had even colour throughout and were otherwise homogenous. The criteria for microplastic selection was made after Norén (2008).

This part of the process was acknowledged as the biggest issue in this method, since particles were chosen subjectively. Eriksen *et al.* (2013) tested the accuracy of visually identifying microplastics and the results indicate that up to 20 % of particles were aluminium silicates instead of plastics. In this study, aluminium silicates were extracted by heavy liquid separation but instead, chitin crusts can be misidentified as clear plastic particles. However, using imaging FTIR plastics are identified among all picked particles. Therefore, the real problem with this method were the particles which were not identified or found visually during the first step of sorting and therefore not picked. These particles are *e.g.* small and clear particles which have been acknowledged to be the hardest ones to identify even with microscope (Hidalgo-Ruz *et al.*, 2012). As the test samples had only plastic particles, which were red or white and the size was >100 μm, the method was not tested with these challenging particles.

Paper filters and/or the residues of treated samples were placed on a clean petri dish and examined under a Nikon SMZ800 stereomicroscope with a 6.3 × magnification. Each particle picked was photographed with a Nikon DS-Fi2 microscopic camera. Particles were picked with a pair of micro tweezers and put into a clean centrifuge tube. Centrifuge tube was filled with AAA quality ethanol (C_2H_5OH) to make it easier to handle microscopic particles. Ethanol was used because it evaporates quickly, and it does not interfere microplastic imaging with imaging FTIR.

4.7.5 *Identification of microplastics with imaging FTIR*

As stated in Imhof *et al.* (2012): "identification of the recovered plastic particles is a crucial step in the quantification process". Most reliable way to identify different types of microplastics is to use infrared spectroscopy which analyses the chemical composition of the material (Hidalgo-Ruz *et al.*, 2012). *E.g.* Borg Olesen *et al.* (2018), Klein *et al.* (2018), Lambert and Wagner (2018) recommend imaging FTIR or Raman as sophisticated devices for microplastic identification since both devices have been used for polymer identification for a long time. Thus, samples were analysed with imaging FTIR spectrometer in Kuopio, in SIB Labs, University of Eastern Finland. Imaging FTIR imaging is used for identifying and quantifying the types of microplastics. The device used was Agilent Cary 670 spectrometer with Cary 620 microscope and it was based on 128×128 focal plane array (FPA) detector.

Possible microplastic particles were transported in centrifuge tubes from University of Turku to SIB Labs, University of Eastern Finland. Particles and ethanol were poured on a polycarbonate gold-coated membrane filter (Sterlitech Co), which particle retention was 0.8 µm, or on a silver membrane filter, which particle retention was 5.0 µm (Sterlitech Co), with the help of some extra ethanol. Most of the samples were filtered onto silver filter since gold filter was easily clogged. Diameter of the filters were 25 mm, but samples were filtrated to a smaller area to make analysis faster – diameter of the area analysed was 13 mm. The filters were placed on a glass slide with a piece of two-sided tape. The glass slide with the filter was placed on a petri-dish (PP) to avoid contamination and the filter was let dry for a 15–30 min before imaging with imaging FTIR. After the calibration and background check of imaging FTIR, the glass slide and the filter were placed under the device.

The imaging FTIR spectra was recorded with a resolution of 8 cm^{-1}, with 4 scans. Scan range was 3800 – 800 cm^{-1}. The analysed area was divided into 18×18 FPA tiles. The whole filtrated area of 13 mm diameter was scanned.

Imaging FTIR was used in reflectance mode instead of transmission (*i.e.* absorbance, TRS) mode since reflectance is easier to use and cheaper than transmission (*e.g.* filter costs and preparation of the sample). Although transmission is claimed to result better quality spectra (Borg Olesen *et al.*, 2018), no difference in previous results has been noticed between transmission and reflection mode when analysing microplastics (personal communication with E. Uurasjärvi 4.6.2019).

Minimum particle size of imaging FTIR is 20 µm which is defined by the physical diffraction of light used in the device (Klein *et al.*, 2018). The problem with identifying microplastics with imaging FTIR or other spectroscopy based device is that high pigment particles (black/dark colours) absorb all the light used in the device and no reflection for identification is formed (Lambert and Wagner, 2018). Therefore, for example particles from car tires are hard to recognise even with high-quality devices. Another challenge is the degradation of plastics which can change the characteristics of the plastics and thus complicate the identification (Lambert and Wagner, 2018).

4.7.6 Data processing

The imaging FTIR imaging data was analysed using MPHunter software which is developed in Aalborg University, Denmark, together with Alfred Wegener Institute, Germany. MPHunter sofware was written by Jes Vollertsen and it is based on the work of Primpke *et al.* (2017). MPHunter software correlates spectra obtained with imaging FTIR with reference spectra and recognises polymer types and measures the sizes of the particles (Liu *et al.*, 2019). MPHunter is relatively fast and precise way to automatically identify and quantify microplastics from imaging FTIR imaging spectra (Liu *et al.*, 2019). The basics of the MPHunter microplastic analysis procedure is explained in more detail by Liu *et al.* (2019).

Reference database contained 41 spectrums including plastics but also natural organic materials which could be misidentified as plastics. Spectra was analysed with PA, PET, HDPE, PS, ABS, PU, PVC, PP, PMMA, polyacrylic fibre, silk, skin, cotton and wool. All the other reference materials had three different reference spectra excluding polyacryl fibre which has only one reference spectrum. Reference PP also included one oxidised spectrum. Reference database was made in Aalborg University and was modified to fit with imaging FTIR of SIB Labs by Emilia Uurasjärvi.

4.7.7 Reporting microplastic results

It is difficult to estimate, how older microplastics in *e.g.* older sediment samples react and decay in the sediments and during the sample processing. In this study, sampling protocol was rather gentle for the sample material. For instance, no ultrasound or other destructive methods were used. However, evaluation of the results is problematic due to degradation of microplastics during sampling protocol. Thus, Liu *et al.* (2019) suggest that mass of the microplastic particles should be quantified to present reliable results instead of presenting numerical abundance of microplastics. However, MPHunter only estimates particle mass based on the area and transparency of the particle. Thus, number of particles was also reported in addition to mass in this thesis.

Hidalgo-Ruz et al. (2012) suggested reporting results with convertible units if possible. The most common unit used in literature recently is particles/kg (dry weight of sediment) (e.g. Dong *et al.* 2020). The imaging FTIR together with MPHunter calculates the number and mass of the natural and microplastic particles. Since the volume of the samples was measured, microplastic concentration was calculated with the formula:

$$MP\ concentration = \frac{MPs\ (pc\ or\ mg)}{Sample\ volume\ (ml)} \times 1000$$

The amount of microplastics found was presented as mg/l and pc/l. Moreover, microplastic concentrations were linked to time instead of an area. The control samples were presented as number of particles accumulated per time unit per area (MPs/h/cm$^{2)}$.

Morphological characteristics of microplastics were briefly estimated with help of imaging FTIR and charts made in MPHunter. Particle dimension ratio was calculated to estimate particle shape. MPHunter measures major and minor dimensions (µm) of the particle and dividing major dimension by minor dimension, a ratio is calculated:

$$Particle\ dimension\ ratio = \frac{Major\ dimension\ (\mu m)}{Minor\ dimension\ (\mu m)}$$

If ratio is more than 10, particle is most probably a fibre (Uurasjärvi *et al.*, 2020).

4.7.8 Plastic contamination

The risk of contamination in microplastic research is significant, since plastic materials are widely used everywhere: in sampling, clothing, laboratory premises and equipment *etc*., and detached particles can contaminate the samples. Thus, the contamination was considered in every step of the process. Contamination was minimized by using different kind of protective equipment and microplastic contamination was monitored the whole time.

All the equipment (glassware, samples etc.) was covered with tin foil or stored upside down to prevent contamination by airborne microplastics. Glassware and other tools used were rinsed with high-purity distilled water before use but also after use to prevent losing any particles in the process.

Heavy liquid separation was made in a pressurised separate clean room and all the stages of heavy liquid separation in a laminar flow cabinet or a fume hood. Fume hood is not recommended since it draws air in and thus, can collect airborne microplastics into the workspace. However, a fume hood is essential to protect lab users from inhaling possible toxic gases. A fume hood was mainly used when preparing the heavy liquid and laminar flow cabinet in other stages of the process. The workplace for stereo-microscope inspection was cleaned before sample on the petri-dish were treated.

Unfortunately, the faucet to distilled water was made of plastic (unknown, probably clear LDPE), and distilled water was stored in clear LDPE bottles (Fig. 5). Moreover, syringe, which was used in sample preparation to take out excess water, was made of PP. In future, non-plastic alternatives should be considered.

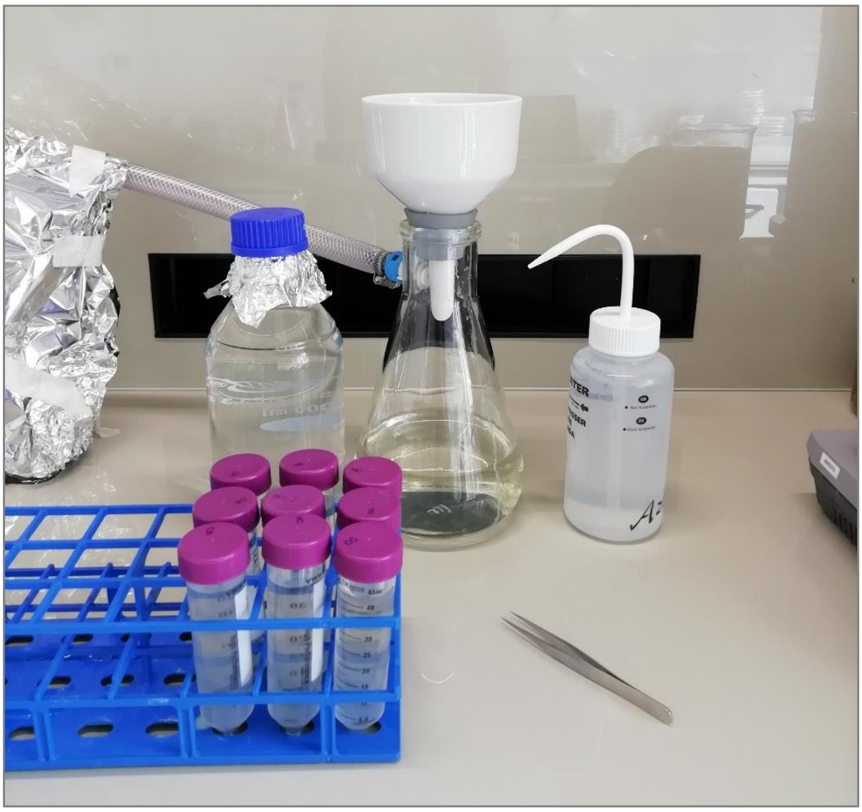


Figure 5. Sources of contamination during the lab work: LDPE plastic bottles, syringe, PP centrifuge tubes and blue corks. Other sources of contamination are e.g. nitrile gloves and plastic tap.

Distilled water was not filtered before the use. A study made in the University of Eastern Finland proved that distilled water taken from a laboratory water distillation machine (with purification equipment) did not contain microplastics (Uurasjärvi *et al.*, 2020).

People working in the microplastic lab were using violet, 100 % cotton lab coats so that detached fibres from the coat were easily detected as a part of contamination. The violet fibres were found later in the samples, but their abundance was not calculated. In addition, no make-up or nail polish was allowed to use during lab work. Only blue nitrile cloves were used during heavy liquid separation.

When sampling the freeze core, only metallic items were used. Subsamples were divided into either glass or porcelain containers which were rinsed with distilled water before use. During heavy liquid separation, samples were in hard plastic, clear polypropylene (PP) centrifuge tubes which had violet corks. The tubes were new and were used only once to minimize microplastic release. Old plastic items are prone to wear and are brittle (Andrady, 2011).

Reused heavy liquid was filtered before the new analysis because of airborne microplastic contamination. However, heavy liquid was stored in a glass bottle which had a blue plastic cork (PP). Metallic and glass tools are suggested when studying microplastics (Hidalgo-Ruz *et al.*, 2012) but the use of LST in the process limits the amount of metallic items. No metal items (*e.g.* aluminium foil instead of plastic cork) can be used with LST because metal can precipitate LST.

Furthermore, an open petri dish was placed in direct proximity to the work area to monitor volatile microplastic pollution during the laboratory work. These control bowls were also analysed in imaging FTIR.

5. Results

5.1 Magnetic susceptibility

The low field magnetic susceptibility (MS) of the samples varied from 8.5 * 10^{-6} to 33.0 * 10^{-6} κ (Fig. 6). The values were lowest at the top of the sediment at depth 0–1 cm, and the general trend was an increase in values with depth. MS was peaking at 6–7 cm depth, MS being 33.0 * 10^{-6} κ. Low field magnetic susceptibility can be used later for fine-scale correlation between other recovered cores MAL2 and MAL3.

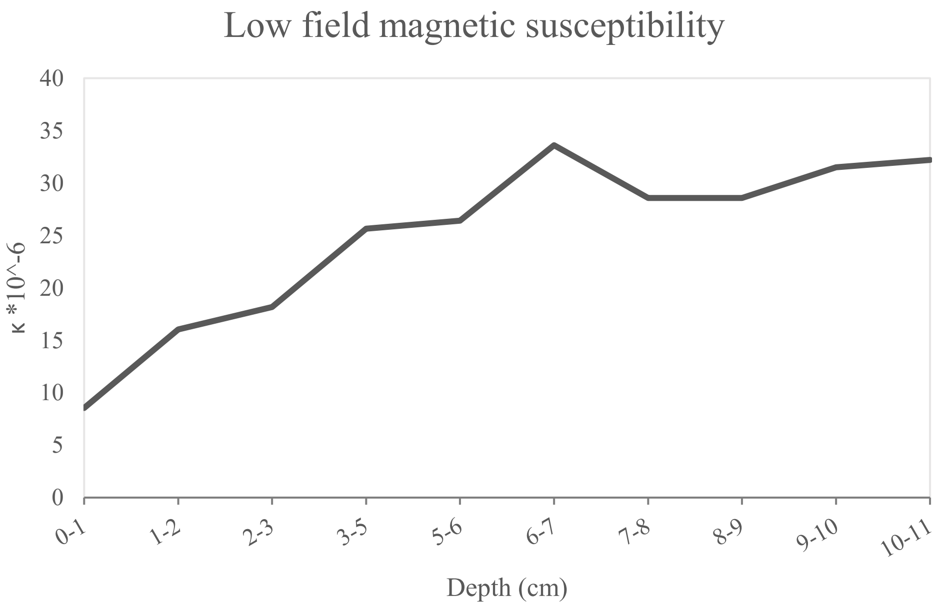


Figure 6. Low field magnetic susceptibility (MS) from the discrete MAL1 samples.

5.2 Water content and LOI

Water content of the sediment varied from 78.8 % to 52.2 % (Fig. 7). Water content was highest, 78.8 %, at the top of the sediment and decreased with depth. From 8–9 cm downcore the water content increased again slightly.

LOI of the samples varied from 3.2 % to 11.1 % (Fig. 7). LOI decreased steadily from the top of the sediment until 7–8 cm. LOI was lowest, 3.21 %, at 7–8 cm depth. From 8 to 11 cm depth, LOI increased rapidly, peaking at 9–10 cm, being 11.1 %.

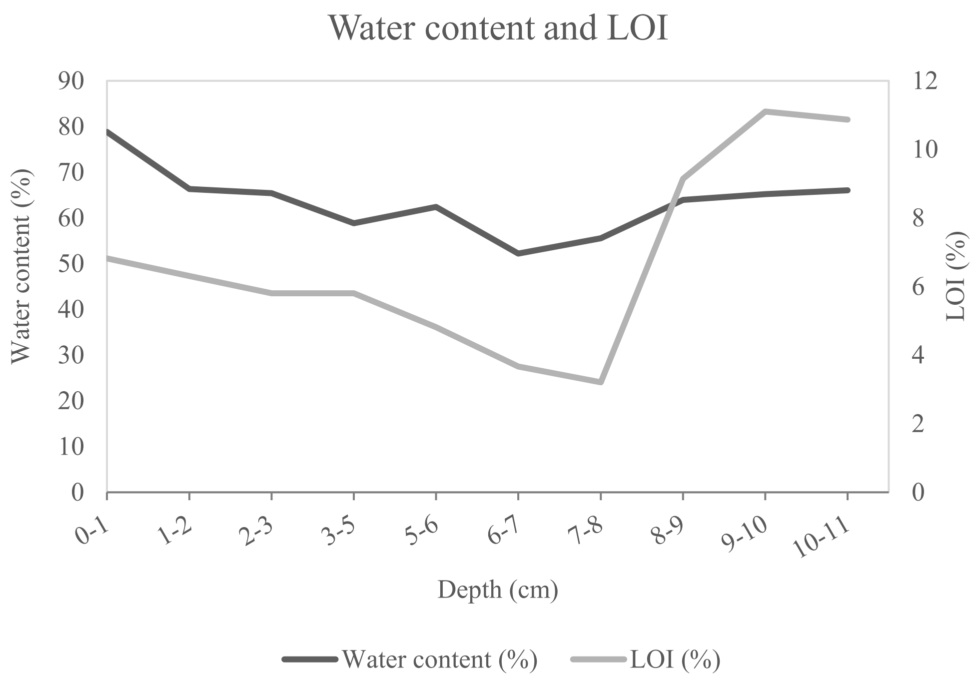


Figure 7. Water content and LOI (%) of the MAL1 Kajak samples.

5.3 Grain size analysis

Grain sizes in MAL1 varied between 2.2 µm and 4.6 µm (median values) (Fig. 8). Average grain size of light, spring lamina was 3.45 µm and average grain size of dark coloured, growing season lamina was 3.64 µm.

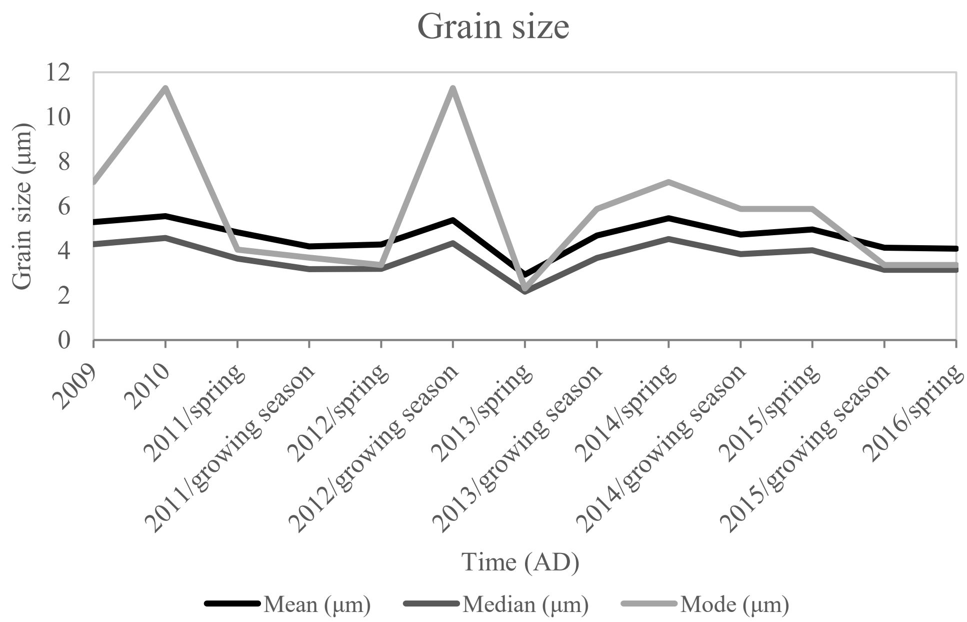


Figure 8. Grain size mean, medium and mode values (µm) of the MAL1 sediment core.

No clear seasonal variation in grain sizes was detected. The spring lamina was coarser than the growing seasons of the years 2011, 2014 and 2015, and the growing season lamina was coarser than the spring lamina of the years 2012 and 2013. The comparison of seasonal grain size data could not be done neither from 2016 since only one of the two seasons was analysed nor from the years 2009 and 2010.

The mode values showed two distinctly coarser samples: the growing season of the year 2012 and the year 2010. The mean and median values of these two samples, however, were in line with other samples.

5.4 Varve chronology

The sediment of Maljalahti Bay was visibly laminated (Fig. 9). Physical properties such as colour and layer thickness varied throughout the core, representing the different seasons of a year. According to changes in physical properties, laminations in the sediment of Maljalahti Bay were interpreted as annual.

Figure 9. The topmost 13 cm of the varved sediment of Maljalahti Bay, MAL1. The photograph was taken of the fresh freeze core sample.

Varves are usually thicker in the top part of the sediment and the varve thickness decreases with depth due to compaction and consequently decreasing water content. However, no decreasing trend was seen in the first 13.5 cm of MAL1 freeze core. Layers in the topmost 9 cm were twisted and the layer thickness varied significantly. Especially layers were bended between 3.5–8 cm. From 9 cm downcore, layers were clear and horizontal.

Since the core was taken in early spring 2017 before the spring flood, the first lamina should have been growing season lamina 2016. However, no dark lamina was recognised on the top part of the sediment, and the suggestion was that the most recent lamina was lost during the sampling. Thus, the first lamina observed was a light lamina from spring 2016. The last varve (i.e. subsample), at 9.8–10.6 cm, taken to microplastic analysis represents the year AD 2009.

The thickest layer was 2.4 cm, representing the AD 2011, and the thinnest layer was 0.8 cm, from the AD 2010 (Fig. 10). The average layer thickness was 1.3 cm. The light lamina was thicker than the following dark lamina. Counting error was +6,4 %.

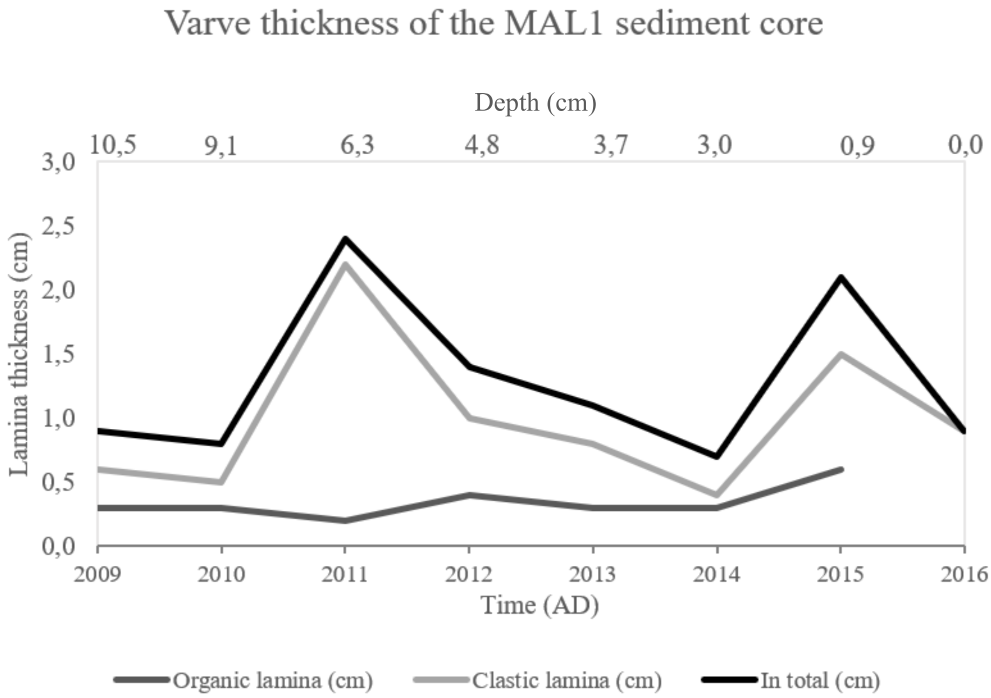


Figure 10. Varve thickness of the first 11 cm of the MAL1 sediment represented in calendar years (AD).

5.5 Meteorological and hydrological observations

Stable snow cover was developed approximately in the end of November or the beginning of December in Kuopio district during the measuring period. Around the same time lake ice was established in Lake Kallavesi. Timing of maximum snow depth was usually between mid-March and early-April. Melting of snow occurred normally in April and lake ice was completely melted in early-/mid-May. Maximum spring discharge occurred usually few weeks after snow melt in May.

Overall, a small change in the length of the winters was observed (Fig. 11). From 2008 to 2011 the temperature stayed under zero degrees for a longer time compared to the winters from 2012 to 2016. Shorter winters are reflected in the maximum snow depth. The maximum snow depth varied between 19 and 82 cm and the snow equivalent between 28 mm and 163 mm during the measuring period, from November 2008 to June 2016 (Table 2). Maximum spring water discharge in Viannonkoski, Kuopio, varied between 205.11 m^3/s and 385.88 m^3/s. Maximum snow depth, snow equivalent and the following maximum spring water discharge were directly linked to each other (Fig. 12).

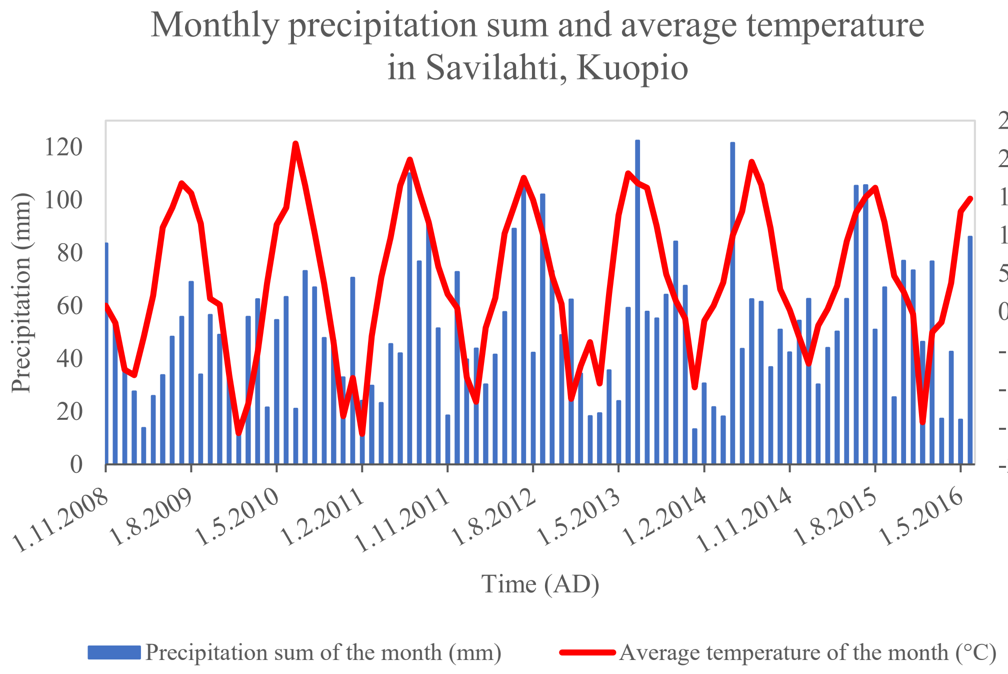


Figure 11. Monthly air temperature and the precipitation sum in Savilahti, Kuopio, during the measuring period 1st of November 2008 to 1st of June 2016.

Table 2. Meteorological and hydrological data from the 1st November 2008 to the 1st June 2016.

Year	Maximum snow depth (cm)	Maximum snow equivalent (mm)	Maximum discharge (m^3/s)	Average air temperature of growing season (°C)	Precipitation during growing season (mm)
2016	52	84	219.28		
2015	49	106	307.1	11.6	416.7
2014	19	28	260.85	12.2	376.9
2013	70	118	264.4	13.3	382.6
2012	62	128	385.88	11.8	471.1
2011	82	163	343.68	13.2	417.4
2010	76	157	205.11	12.9	326.7
2009	41	107	272.58	11.7	297.4

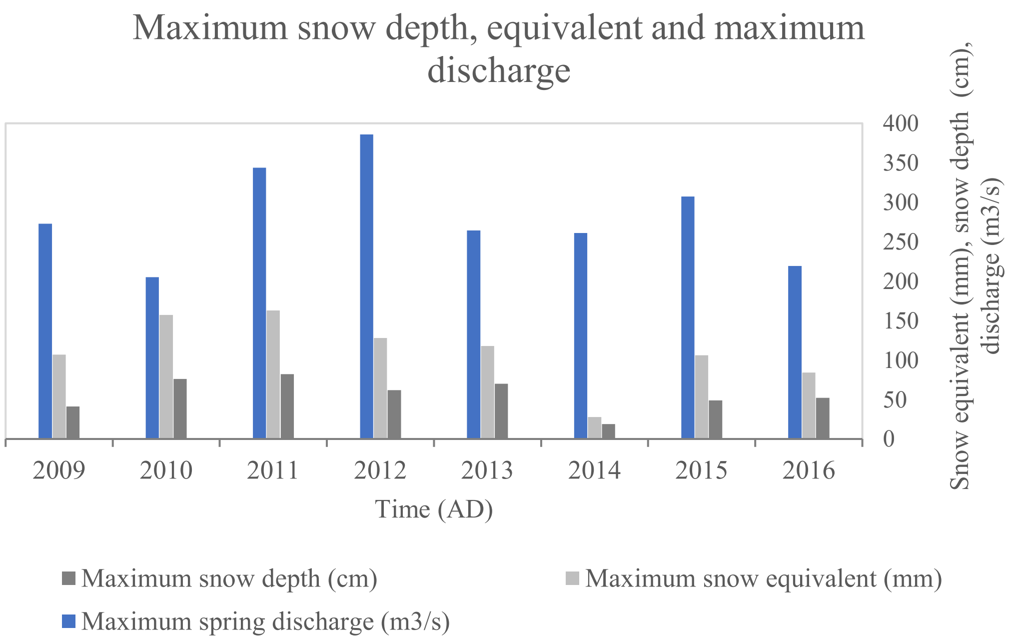


Figure 12. The maximum snow depth, snow equivalent and spring discharge of the years 2016–2009.

Precipitation of the growing season varied between 297.4 mm and 471.1 mm. Average air temperature of growing season (1st of May to 31st of October) varied between 11.6 °C and 13.3 °C. No prolonged summers nor long heat waves occurred during the measuring period. The only time air temperature exceeded 25 °C for more than a day was in July 2010. First, the temperature was over 25 °C for three days and later, for four days consecutively.

Winter 2013–2014 was the mildest during the measuring period. Snow covered the area of Kuopio in the end of November 2013, but it melted a month later, in end of December

2013 causing maximum water discharge of 2014 (260.85 m^3/s) in Viannankoski, just in the beginning January. Stable snow cover was developed again in mid-January. Maximum snow depth reached it maximum, 19 cm, in February. Melting of snow occurred in mid-March, and the actual spring discharge in Viannankoski was slowest spring discharge of the measuring period, 116.36 m^3/s. Lake ice in Lake Kallavesi was completely melted in the mid-April.

5.6 Microplastic analysis

5.6.1 Sample volume

Sample volume was measured from subsamples of the freeze core. Volumes of subsamples vary from minimum 2.0 ml (in MAL1.3.1) to maximum 78.0 ml (in MAL1.6.2) (Fig. 13). The thickest flood layers correlated with the spring 2011 and 2015 resulted the biggest sample volumes.

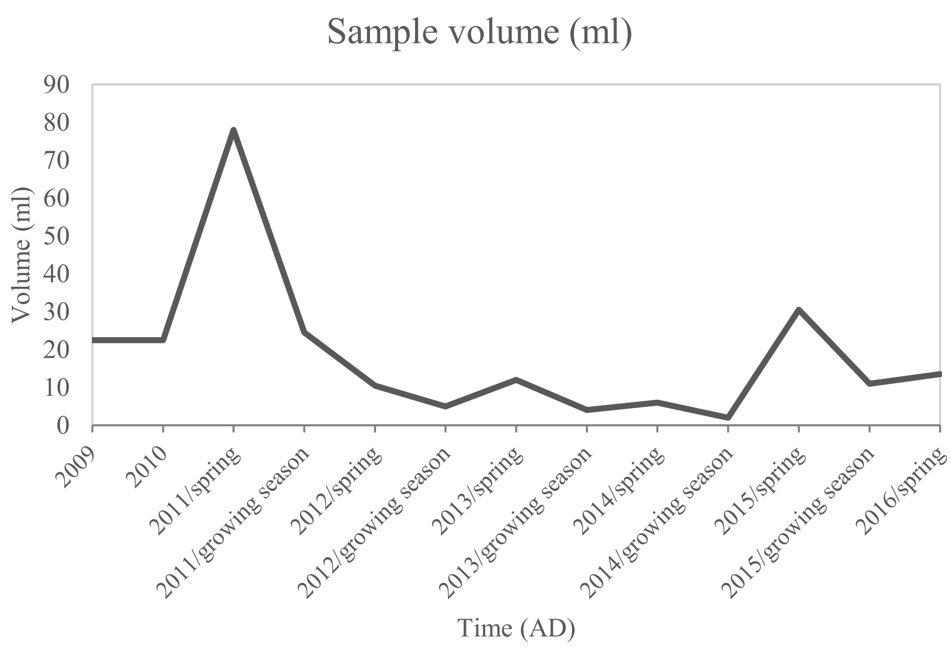


Figure 13. Sample volume (ml) of the MAL1. Samples are represented in calendar years.

5.6.2 *Naming of the samples*

MAL1 is the name of the sample site, the second number represents counted varve year and additional third number is either 1=dark lamina, which represents summer, autumn and winter or 2=light lamina, which represents spring. Varve year starts from spring flood (light lamina) but the samples are named conversely. Samples were named from top downcore by following: MAL1.1.2 (light lamina), MAL1.2.1 (dark lamina), MAL1.2.2 (light lamina), MAL1.3.1 (dark lamina), MAL1.3.2 (light lamina), MAL1.4.1 (dark lamina), MAL1.4.2 (light lamina), MAL1.5.1 (dark lamina), MAL1.5.2 (light lamina), MAL1.6.1 (dark lamina), MAL1.6.2 (light lamina).

The topmost layer had only lighter lamina to be seen (MAL1.1.2) and summer/autumn layer was supposedly destroyed in sampling. In addition, two more layers were cut: MAL1.7 and MAL1.8 which represented 7^{th} and 8^{th} layer (or a possible varve) from top down. These two layers were too thin to be cut according to seasonal lamina.

5.6.3 *Particle identification with MPHunter*

All the particles, which were picked from the samples, were analysed and thus, results represent the actual amount of microplastics found. In this study, both mass and numerical abundance of microplastics are reported in this study. A total of 8 different plastic types with different chemical components were found from the samples: polyamide (PA), polyacrylonitrile (PAN), polyethylene (PE), polyethylene terephthalate (PET), polymethyl methacrylate (PMMA), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC).

No data was obtained from sample MAL1.3.2, which represented the spring 2014, nor from MAL1.5.1, which represented growing season 2012 (see 5.5.8). In addition, no microplastics were found with MPHunter from the topmost sample MAL1.1.2.

PP was the most abundant polymer type followed by PE, PS, PET and PAN. PP was the highest portion of all polymer types in almost all the samples. Exceptions were MAL1.2.1, which represented the growing season of the 2015, and MAL1.5.2, which represented the spring 2012. PE was the most common type of microplastic in these two samples. Particles found with MPHunter are presented in Table 3.

Table 3. The amount of natural and microplastic particles found from the samples. Individual microplastics are presented as percentage of particles and as percentage of total mass of all microplastics analysed. *Sample volume is the volume of analysed freeze core subsample used in microplastic analysis.

Sample	**Year**	**Season**	**Sample volume ***	**Particles found in total**	**Natural particles**	**MPs**	**PA**	**PAN**	**PE**	**PET**	**PMMA**	**PP**	**PS**	**PVC-U**	**Notes**
	AD		ml	pc	pc	pc (mass mg)	pc, (m) %	pc, (mass) %	pc, (mass) %	pc, (m) %	pc, (m) %	pc, (m) %	pc, (m) %	pc, (m) %	
MAL1.1.2	2016	Spring	13.5	7	7	0 (0)									Plastic wrap
MAL1.2.1	2015	Summer and autumn	11.0	136	106	30 (2.37)		7 (2)	93 (98)						Plastic wrap
MAL1.2.2	2015	Spring	30.5	231	151	80 (1 178.69)			6 (0)	6 (0)		76 (0,3)		7 (99.6)	Plastic wrap
MAL1.3.1	2014	Summer and autumn	2.0	71	56	15 (0.50)	7 (8)		47 (8)			47 (84)			
MAL1.3.2	2014	Spring	6.0												No data
MAL1.4.1	2013	Summer and autumn	4.0	287	249	38 (2.66)	3 (2)	3 (0.2)	39 (28)	11 (5)	3 (2)	39 (62)	3 (0.2)		
MAL1.4.2	2013	Spring	12.0	99	29	70 (2.66)	1 (1)		20 (2)			79 (97)			
MAL1.5.1	2012	Summer and autumn	5.0												Plastic wrap, no data
MAL1.5.2	2012	Spring	10.5	114	26	88 (26.27)			72 (97)	5 (0.4)		21 (2)	1 (0.4)	1 (0)	

Sample	Year	Season	Sample volume	Particles found in total	Natural particles	MPs	PA	PAN	PE	PET	PMMA	PP	PS	PVC-U	Notes
MAL1.6.1	2011	Summer and autumn	24.5	134	49	85 (10.21)		15 (6)	9 (2)	1 (0.01)		73 (93)	1 (0.1)		
MAL1.6.2	2011	Spring	78.0	101	29	72 (3.99)		1 (7)	11 (8)	1 (0.4)		82 (84)	3 (2)		
MAL1.7	2010	-	22.5	108	45	63 (3.57)			22 (9.9)			76 (90)	1 (0.1)		
MAL1.8	2009	-	22.5	78	29	49 (7.78)		12 (1)	22 (8)			65 (91)			

The results differed from each other depending on whether they were presented in terms of number of particles analysed or as mass of particles. The number of particles (in total) varied from 71 to 287 (Fig. 14). The number of microplastic particles varied between 15 and 88, and the number of natural particles between 26 and 151.

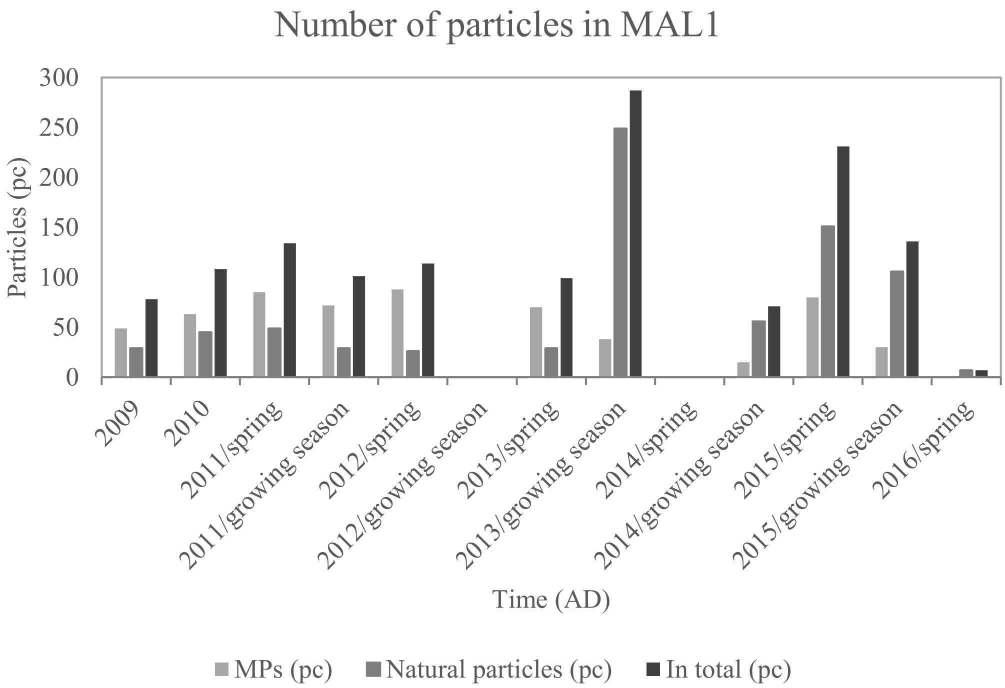


Figure 14. Number of particles (pc) per sample analysed from the MAL1 freeze core. Note that no results were achieved from the samples correlating with the growing season 2012 and the spring 2014.

More microplastic particles were analysed in the samples correlating with spring than with the growing season. However, due to failed samples, microplastic data was available from both spring and growing season only from the years of 2011, 2013 and 2015. The other years, the microplastics data was available of only one season (2012, 2014, 2016; Fig. 11) or the sample represented the whole year (2009 and 2010).

Total mass of MAL1 microplastic particles varied immensely throughout the sediment core (Fig. 15). The minimum mass of microplastic particles was 0.016 mg (the growing season 2015) and the maximum 1.178 mg (the spring 2015). The maximum mass, nevertheless, was not realistic, and it was acknowledged as a failure in the microplastic identification (see chapter 5.4.7). The maximum mass was mainly composed of seven misidentified PVC particles. In addition, the sample representing the spring 2012, was also acknowledged unrealistically big (26.2 mg), since a mass of one PE particle was overestimated (see chapter 5.4.7).

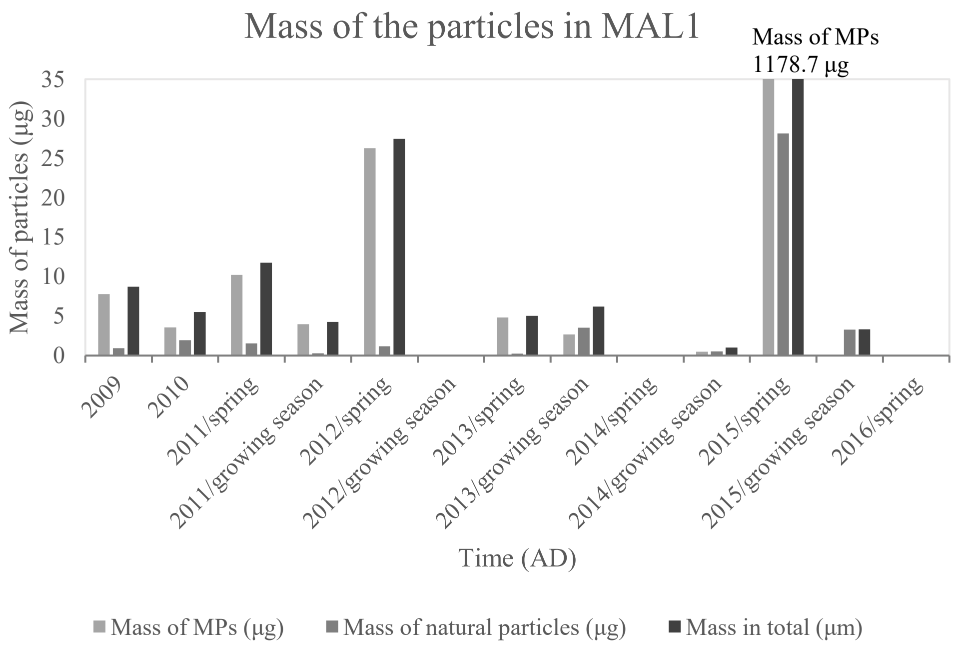
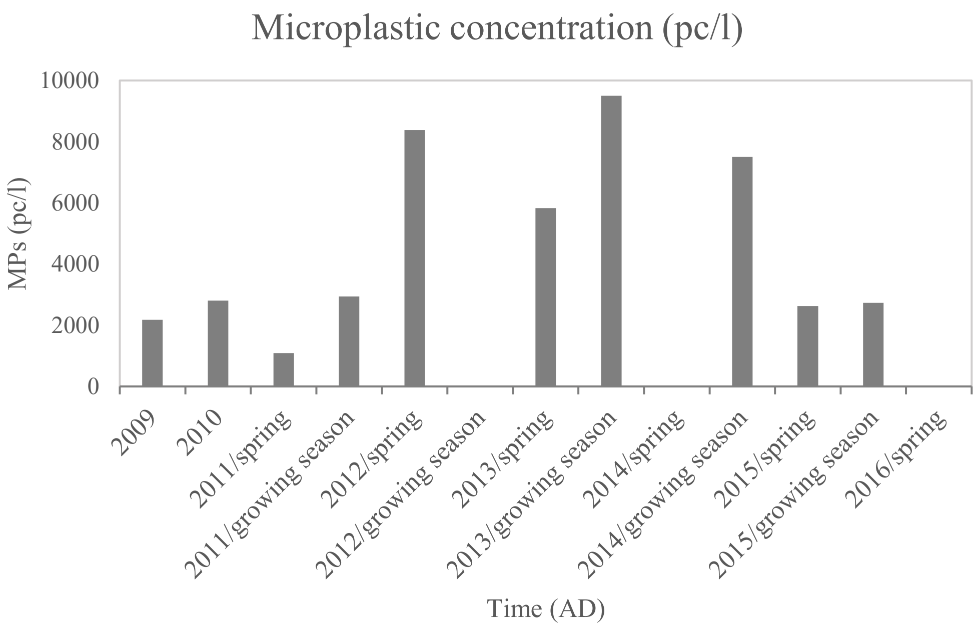


Figure 15. Mass of particles (µg) analysed from the MAL1 freeze core. The mass of the samples representing the spring of 2012 and the spring of 2015 were acknowledged as misanalysed. These two masses are not presented in figures later in this thesis.

The concentration of microplastics in MAL1 sediment record were ranging between 1 090 and 9 500 particles/l of sediment (Fig. 16). The microplastic concentration (pc/l) was slightly lower in the samples representing the spring than in the samples representing the following growing season. The microplastic concentration represented in terms of mass was varying between 1.5 and 664.8 mg/l, the average concentration being around 200 mg/l of sediment. The results did not show any correlation with the depth or on a seasonal level. No concentration was available of the growing season of the year 2012 and the spring of the year 2014 and no plastics were analysed in the sample representing the spring 2016.



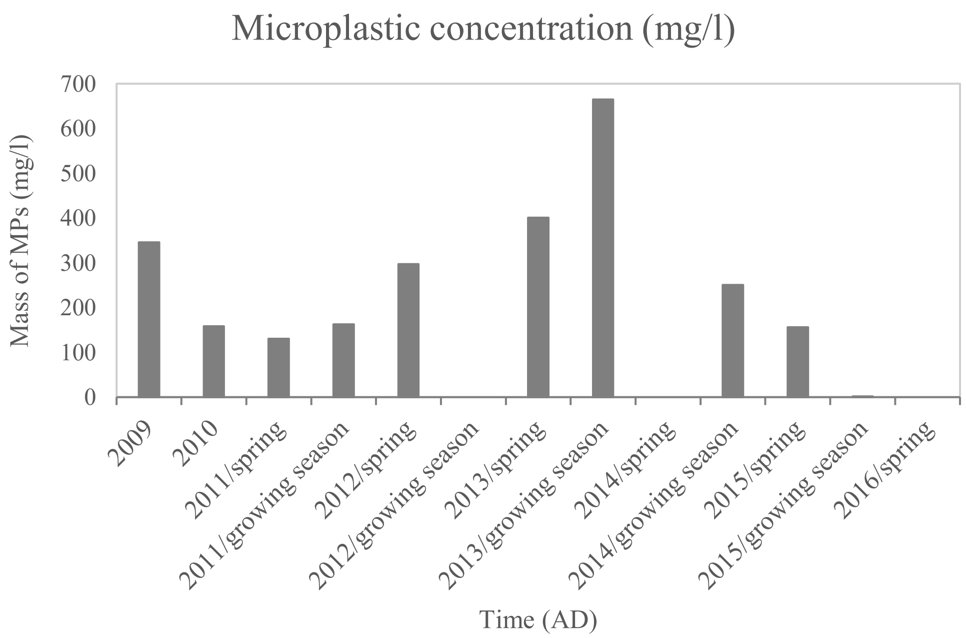


Figure 16. Microplastic concentrations in the MAL1 sediment.

<u>2010 and 2009</u>

In both the years of 2010 and 2009, PP was the most dominant polymer type, PE coming in second (Fig. 17). In 2010, also one PS particle was analysed but the mass was so small, 0.09 % of the total mass, that it did not show on the total mass chart. In 2009, 11 PAN particles were analysed in addition to PP and PE particles. Their mass comprised of 1.5 % of the total mass.

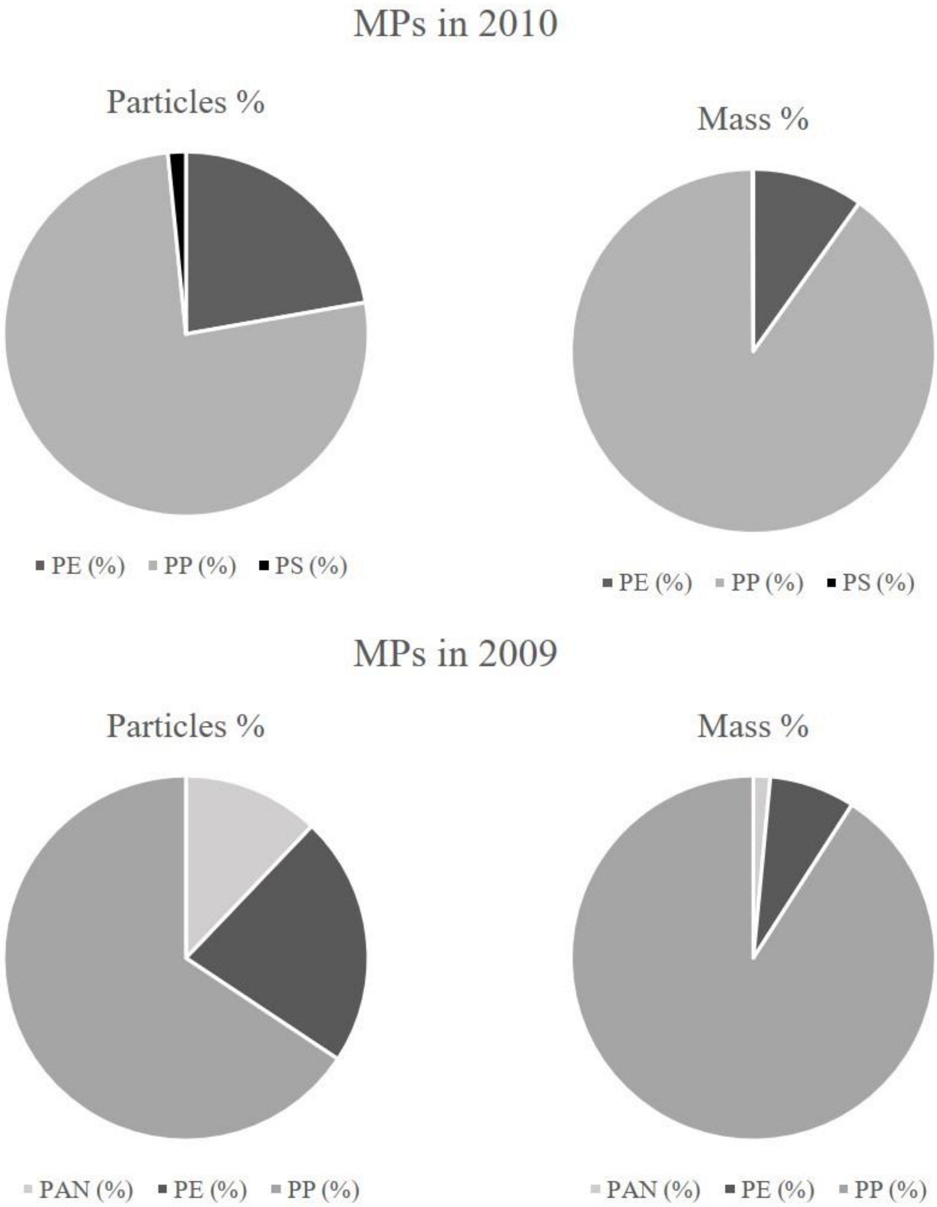


Figure 17. The number and the mass of microplastic particles analysed from the samples representing the years of 2010 and 2009.

<u>2011</u>

PP was the most abundant polymer type by number and by mass in both samples representing the year of 2011 (Fig. 18). 59 PP particles were analysed from the sample representing the spring of 2011 and 62 PPs from the growing season sample of 2011. In both samples PAN, PE, PET and PS particles were analysed as well. In the spring sample, PE was the second most abundant polymer type (8 pc, 6.8 % of the mass of microplastics), and PAN in the growing season sample (13 pc, 5.7 % of the mass of microplastics). Only a couple PET and PS particles were analysed in both samples.

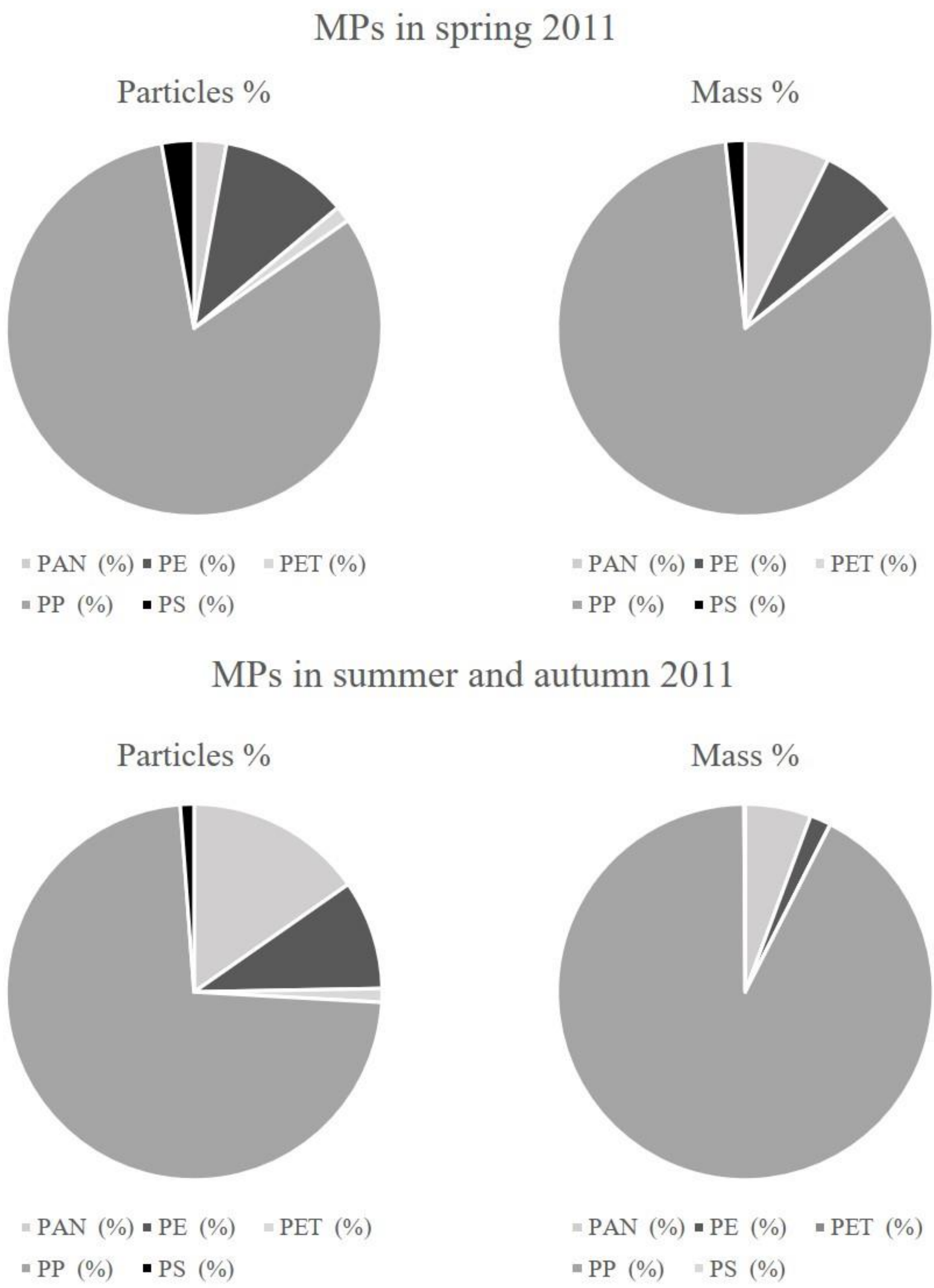


Figure 18. The number and mass of the microplastic particles analysed from the samples representing the spring and the growing season of 2011.

<u>2012</u>

PE was the most abundant polymer type in the sample representing the spring of 2012 (Fig. 19). Also, 19 PP, 4 PET, 1 PS and 1 PVC particle were analysed. PE comprised most of the mass (73.4 %) of microplastics in this sample. No data was available from growing season 2012.

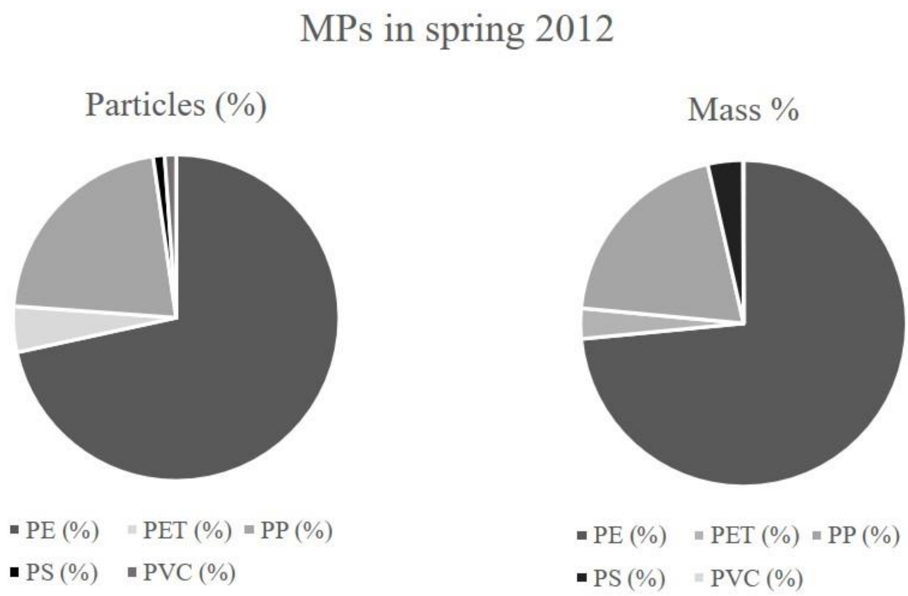


Figure 19. The number and mass of the microplastic particles analysed from the sample representing the spring of 2012.

<u>2013</u>

PP was the most abundant polymer type in both the spring and the growing season samples of 2013 (Fig. 20). In the sample representing the spring of 2013, PP, PE and PA particles were analysed, PP being the most dominant microplastic type in both by number (55 pc) and by mass (96.5 %). Spring sample had almost twice as much microplastic particles analysed as the growing season sample 2013.

In the growing season sample, also PAN, PET, PMMA and PS were analysed in addition to the polymer types analysed from the spring sample. 39 particles of both PE and PP were found, but the mass of PP was 62.1 % of the total mass of microplastics analysed from the sample. Mass of PE was 28.3 %.

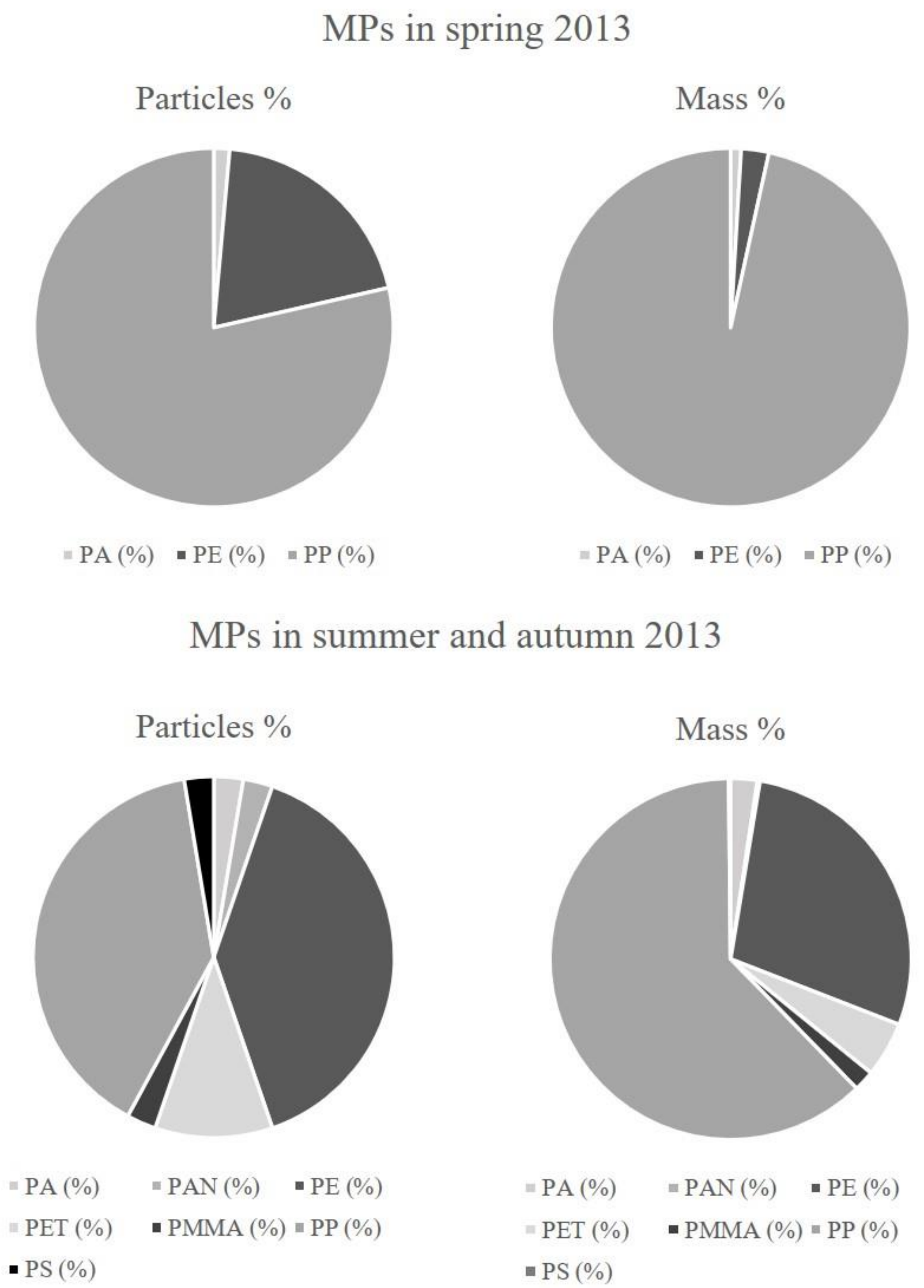


Figure 20. The number and mass of the microplastic particles analysed from the samples representing the spring and the growing season of 2013.

<u>2014</u>

7 PP particles, 7 PE particles and 1 PA particle were analysed from the sample representing the growing season of 2014 (Fig. 21). Although, the equal amount of PEs and PPs were analysed, the mass of the PP particles was 84.1 % of the total mass of all microplastics, making PP the most abundant polymer type in 2014. No data was available from the spring of 2014.

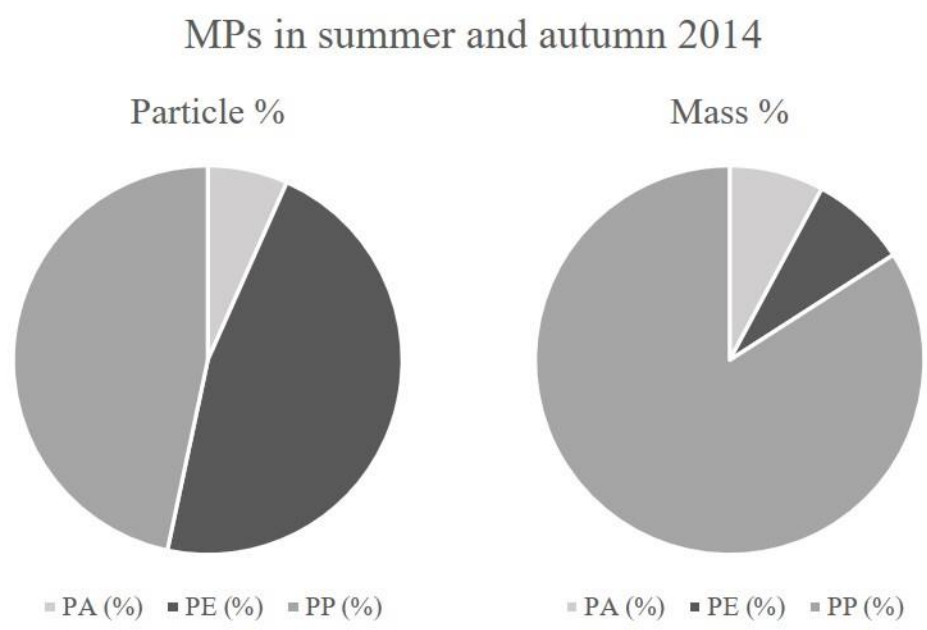


Figure 21. The number and mass of the microplastic particles analysed from the sample representing the growing season of 2014.

2015

Most of the particles analysed from the sample representing the spring of 2015 were PP particles (61 pc, 76.3 % of all particles) (Fig. 22). 7 PE, 5 PET and 7 PVC-U particles were analysed as well. As mentioned, PVC-U particles were acknowledged as misidentification and therefore, the mass of PVC-U particles was excluded from this sample.

The sample representing the growing season of 2015 was the only sample of MAL1 freeze core, which did not contain PP particles. The most abundant polymer type was PE (28 pc and 98.4 % of the total mass of microplastics), in addition to 2 PAN particles analysed (1.6 % of the mass).

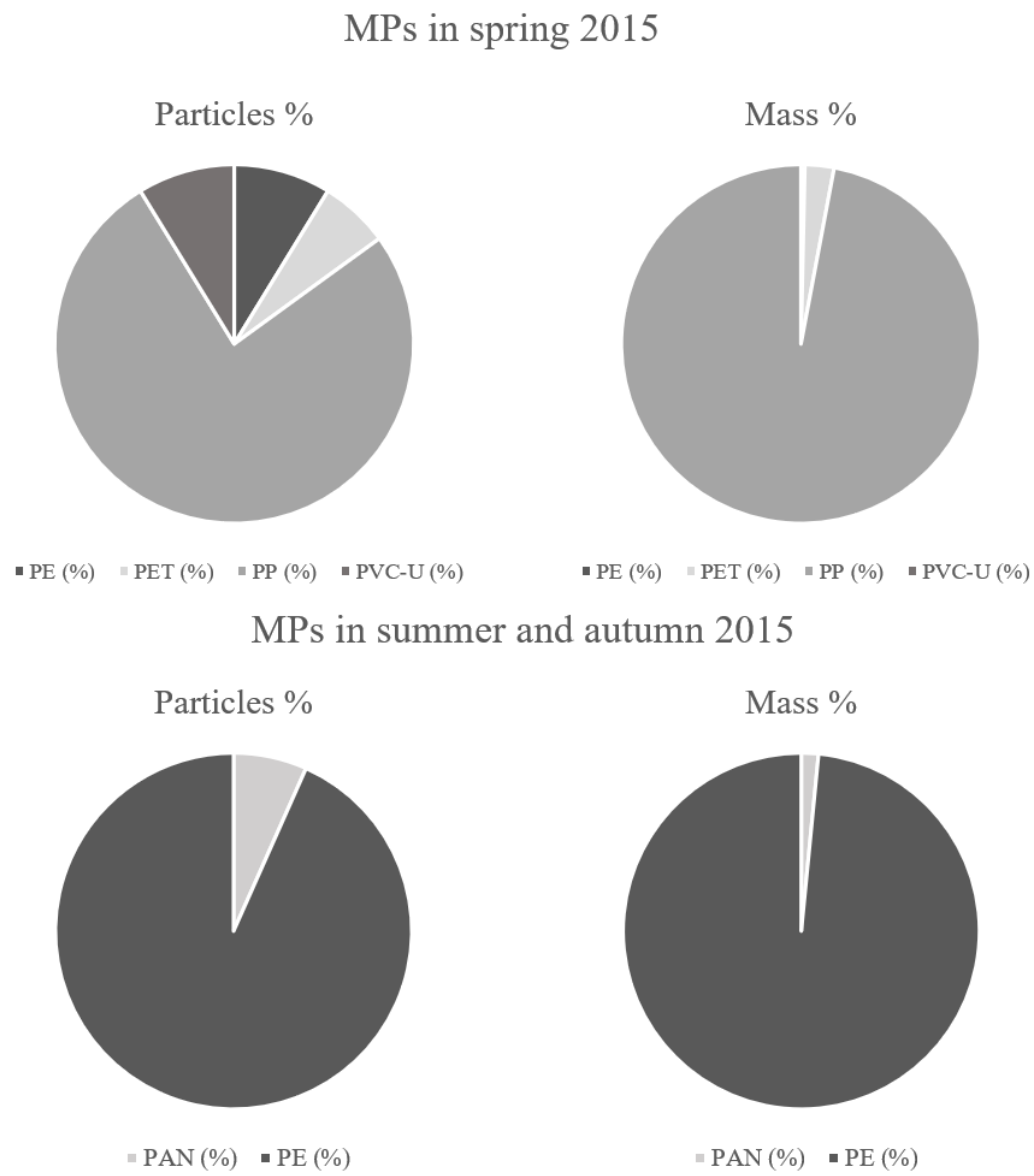


Figure 22. The number and mass of the microplastic particles analysed from the samples representing the spring and growing season of 2015.

5.6.4 *Morphological characteristics of microplastics*

Microplastics were comprised mainly of fragments, flakes, and fibres (Fig. 23). Particles seemed weathered when they were selected to imaging FTIR analysis. Pellets or beads were not detected. Microplastics were not sorted by colour in this study.

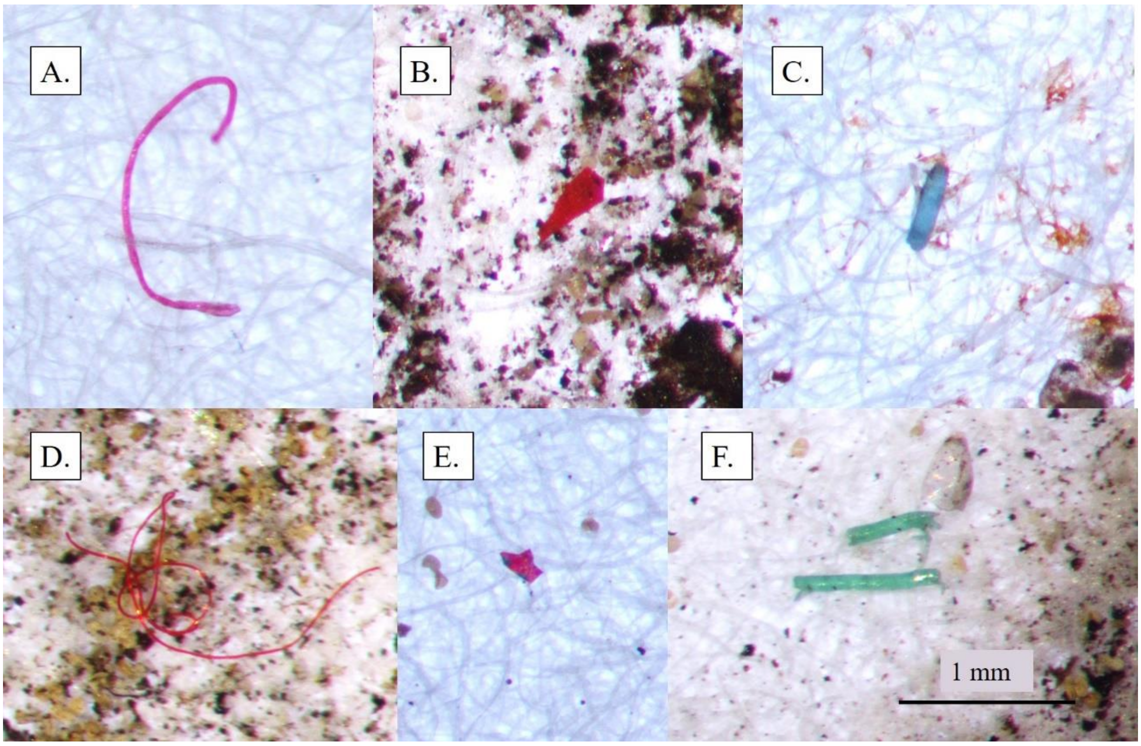


Figure 23. Different shapes of microplastics found in the MAL1. A. Red fibre in MAL1.8, B. A red fragment in MAL1.7, C. A blue fragment in MAL1.7, D. A red fibre in MAL1.6.2, E. A red flake in MAL1.5.1, F. A green fibre/fragment in MAL1.6.1. All particles are colourful and easily recognisable from the background.

The ratio of particle dimensions was calculated to estimate whether a particle is a fibre or other type of a particle (fragment, flake, pellet or bead) (Appendix 7−16). According to the dimension ratio (>10) synthetic fibres were few (Table 4), although when selecting particles for analysis with the microscope, fibre was the most dominant shape.

Table 4. The proportion of fibres of all microplastics in the MAL1 sediment.

Sample	Fibres (pc)	Polymer type	Fibres (%)	Other shapes (pc)	Other shapes (%)
MAL1.2.1	7	PE	23.3	23	76.7
MAL1.2.2	0	-	0	80	100.0
MAL1.3.1	0	-	0	15	100.0
MAL1.3.2	-	-	-	-	-
MAL1.4.1	0	-	0	0	0
MAL1.4.2	1	PA		69	
MAL1.5.1	-	-	-	-	-
MAL1.5.2	3	PP	3.4	85	96,6
MAL1.6.1	3	1 PP, 2 PAN	3.4	85	96,6
MAL1.6.2	2	PAN	2.8	70	97.2
MAL1.7	0	-	0	63	100.0
MAL1.8	3	PP	6,1	46	93.9

5.6.5 *Natural particles*

Natural particles were among analysed particles from all samples. Natural particles were smaller in size and mass compared to microplastic particles found from the samples (Appendix 7−16). Natural particles were either protein or cellulose particles, protein being the most common type of natural materials. Cellulose was detected from all but MAL1.5.2 (spring 2012), MAL1.6.1 (summer and autumn 2011) or MAL1.6.2 (spring 2011) samples.

5.6.6 *Background contamination*

The control samples collected airborne contamination during the laboratory work. However, contamination from the sample collection and protocol itself was not controlled with this method.

A control petri dish was held open in the direct proximity of the samples but was open a longer time than the samples. The control samples collected contamination for hours (Table 5), but a single centrifuge tube was open only minutes (not precisely measured in this study) during the protocol. Moreover, the surface area of petri dish is 63.6 cm^2 but the surface area of mouth of centrifuge tube is only 7.1 cm^2, and thus more particles can accumulate on a petri dish than in centrifuge tubes.

Table 5. The accumulation time and contaminants accumulated in the control samples.

Name	Samples	Accumulation time	MPs (pc)	Other particles (pc)	MPs/h/cm^2
Control 1	MAL1.2.1 MAL1.2.2.	33 h 15 min	1 PET, 7 PE, 3 PS, 1 PVC, 3 PP, 2 PAN	38 proteins	0.008
Control 2	MAL1.1.2 MAL1.3.1 MAL1.3.2.	10 h 10min	4 PET, 2 PS, 1 PP	0	0.010
Control 3	MAL1.4.1 MAL1.4.2 MAL1.5.1 MAL1.5.2.	24 h 50 min	1 PE	0	0.001
Control 4	MAL1.6.2 MAL1.7.	24 h	93* PE, 4 PS, 2 PP	5 proteins	0.005*
Control 5	MAL1.6.1 MAL1.8.	10 h 10 min	4 PE	5 proteins	0.006

* A big piece of PE was analysed as multiple particles because of its position on the filter resulting that 93 of analysed PET particles were one big particle. 93 Pes is therefore counted as one and the result (MP/h/cm2) is corrected.

Same polymer types were analysed in the control samples than in the actual samples. PE particles were found in all the control samples, and fibre was the most dominant shape. Although, some polymers were analysed in the control samples, same polymers were not necessarily found in the actual samples.

5.6.7 *Sources of error*

Visual identification of microplastics, when picking the possible microplastics from paper filters, contained a risk of misidentification of particles and thus, over or underestimation of certain types of plastics (Eriksen *et al.*, 2013). As, mentioned in Hidalgo-Ruz *et al.* (2012) particles with eye-catching colours have higher probability of being picked from samples and in contrary, dull colours are more likely to be overlooked.

When preparing the samples for the imaging FTIR, the gold and silver filters were placed on a glass slide and in a petri dish (made of PP). However, some fibres detached from the filter when it dried and attached to the lid of the petri dish. Thus, some fibres were lost before the analysis and therefore, cause interference with the results.

Plastic wrap, which was added around ice finger core to prevent freeze drying, was found from 5 samples even though it was supposed to be extracted when the surface of the freeze core was scraped off with a knife. For example, a big piece of plastic wrap was found from MAL1.1.2 when selecting particles for analysis. Plastic wrap did not show in MPHunter because of its size and position on the filter (Fig. 24). The particle was approximately 3 mm long and moulded in a way that it was almost 1 mm above the filter surface which interfered the analysis with imaging FTIR. Imaging FTIR was focused just above the surface of the gold filter and consequently, particle did not get analysed. However, plastic particle was acknowledged as part of contamination from the sample preparation.

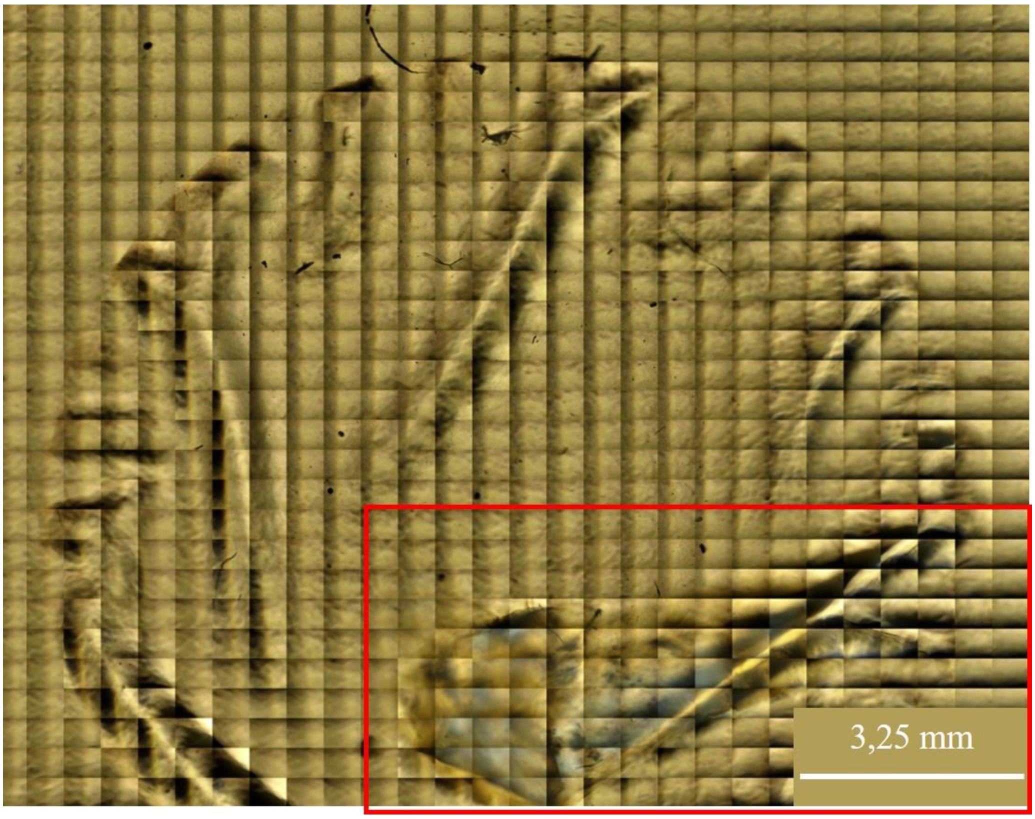


Figure 24. Picked particles of MAL1.1.2 on a polycarbonate gold-coated membrane filter. A piece of plastic wrap is highlighted with a red square. Plastic wrap is hardly seen in the photograph since the focus of the microscope is on the surface of the gold filter where other partices are. Photographt was taken with Agilent Cary 670 spectrometer's Cary 620 microscope.

Pieces of plastic wrap were also found from other samples: MAL1.2.1, MAL1.2.2 and MAL1.5.1. These pieces of plastic wrap from the samples MAL1.2.2 and MAL1.5.1 were picked for microplastic analysis but the wrap in MAL1.2.1 was excluded. The piece of plastic wrap in MAL1.2.1 was over 5 mm long, and therefore not a microplastic (Fig. 25). Imaging FTIR cannot analyse particles which overlay one another. Therefore, a big piece of plastic wrap in MAL1.2.1 was excluded from the analysis to ensure correct results from smaller particles.

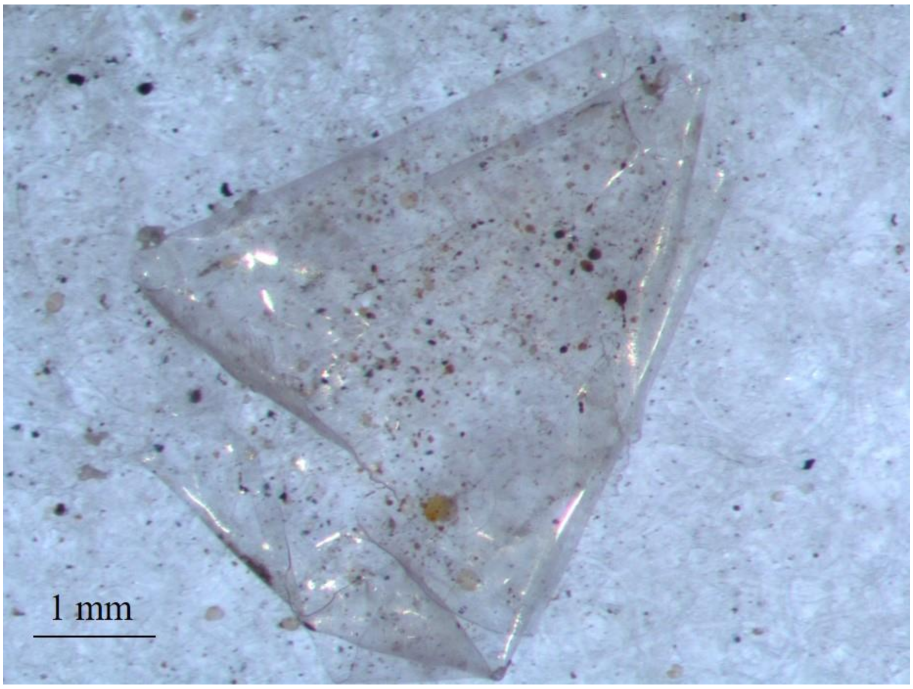


Figure 25. A piece of plastic wrap in the sample MAL1.2.1. Piece was acknowledged as a contaminant and it was not picked for imaging FTIR analysis.

A clear error in microplastic identification in MPHunter analysis was detected in the sample MAL1.2.2. 7 PVC particles were analysed but in reality, the PVCs were a piece of plastic wrap (PE) which MPHunter misidentified. Similar identification errors were not detected in other samples. However, MPHunter overestimated the mass of a single PE particle in the sample MAL1.5.2. The mass of the particle was 2.3 μg which was nearly hundred times bigger than the masses of other analysed particles.

Two samples were incorrectly analysed with imaging FTIR and their results were not reliable. First sample was MAL1.3.2, representing the spring of 2014. When analysing MAL1.3.2, scan type settings in the software running imaging FTIR (Resolution Pro) were incorrect. As mentioned before, analysing beam in imaging FTIR was used in reflectance mode. However, scan type settings in Resolution Pro were set to absorbance mode. In MAL1.3.2 scan was set to “reflectance”, instead of “absorbance”. The wrong settings were noticed right after the analysis, but the imaging was not revised. It was suggested to convert the data in MPHunter back to accustomed and/or convert reference spectra to fit the incorrectly analysed data. However, neither of these worked as anticipated and the microplastic results of MAL1.3.2 were unreliable. Data of MAL1.3.2 is presented in MPHunter microplastic probability map in figure 26.

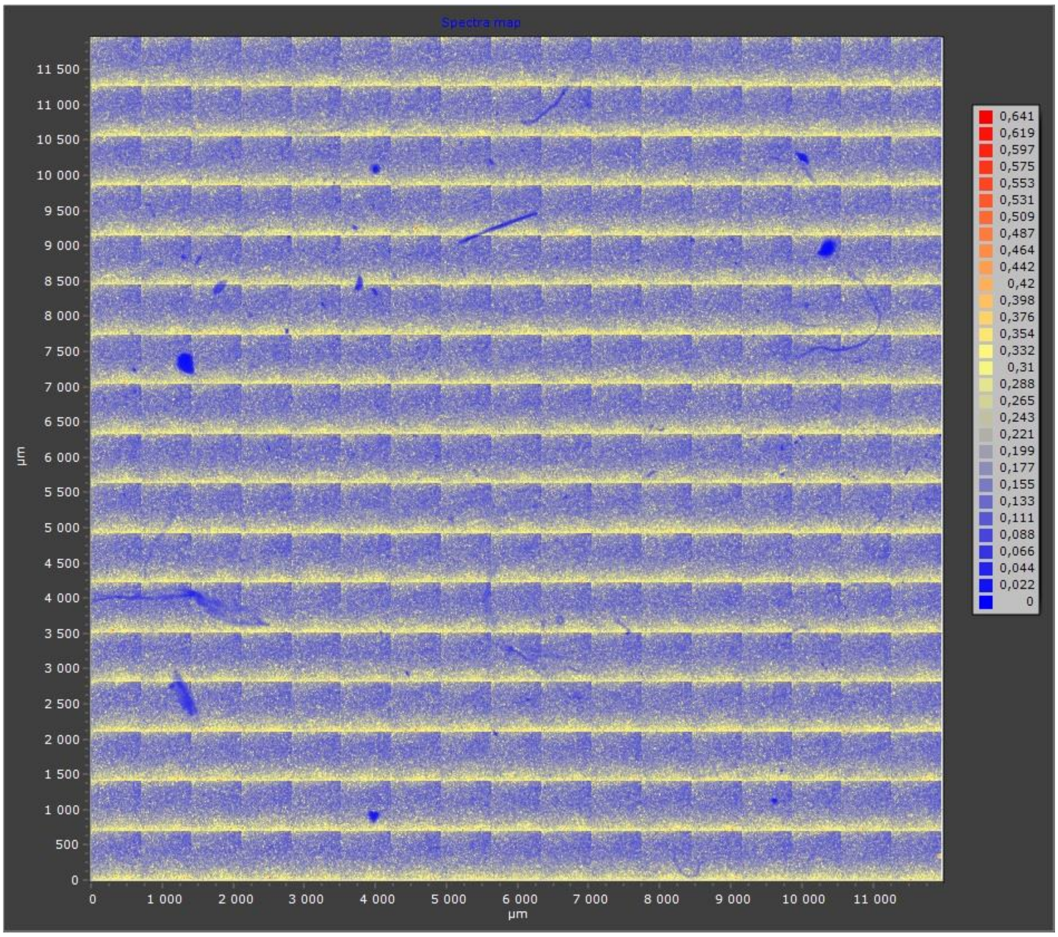


Figure 26. Microplastic probability map of MAL1.3.2 (MPHunter). Normally, MPHunter shows the most probable microplastics with red colour. Wrong settings when imaging with imaging FTIR changed the probabilities to the opposite. In this sample, the dark blue colour (probability 0) is most likely to be a microplastic or a natural particle. However, MPHunter could not analyse these particles when the raw data from imaging FTIR was corrupted.

The second incorrectly analysed sample was MAL1.5.1. Accidentally, the sample data was deformed in FTIR imaging. The data was twisted or packed into smaller area than it should have been (Fig. 27). The data was unreadable for MPHunter and no results were achieved from MAL1.5.1.

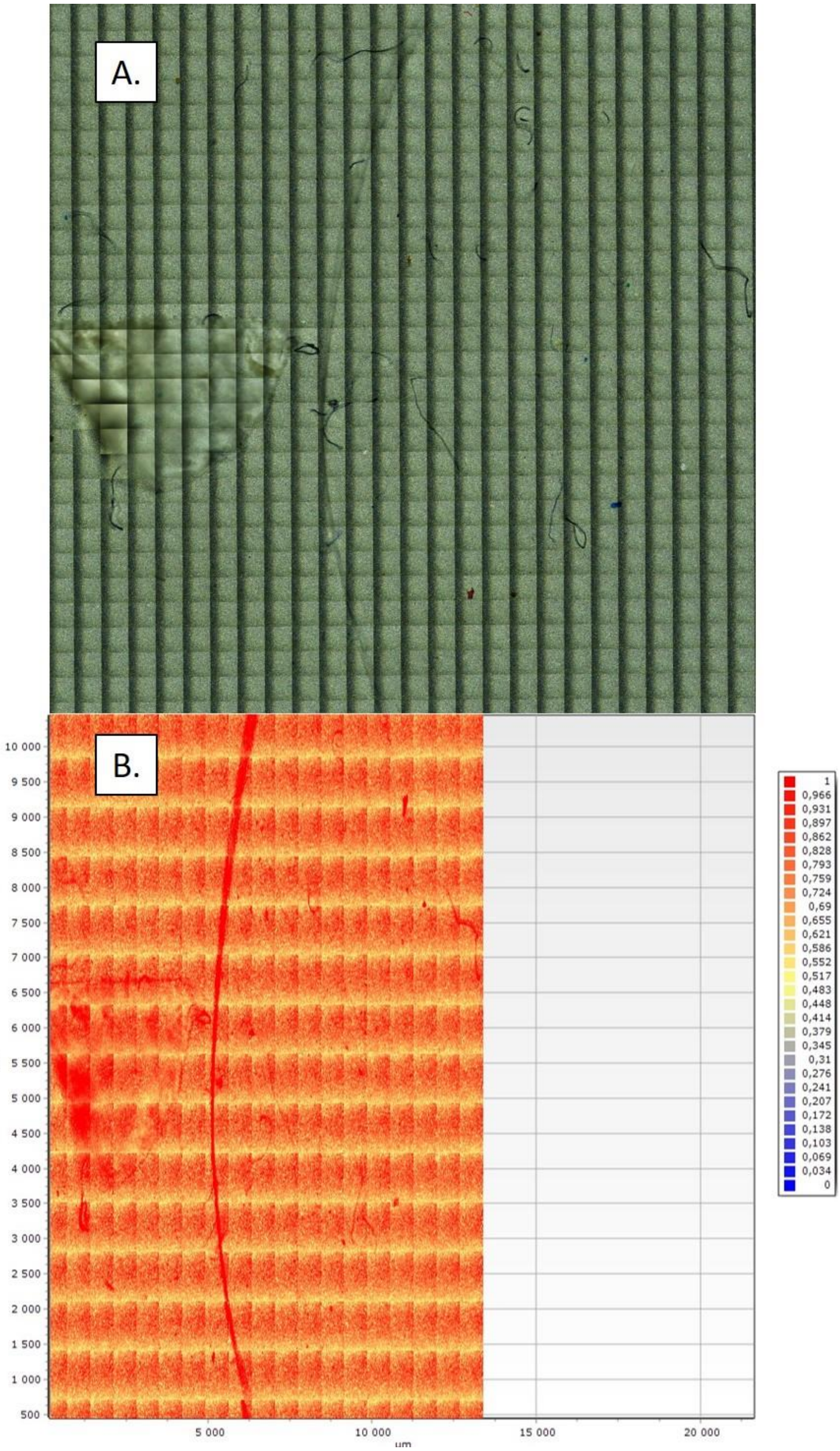


Figure 27. MAL1.5.1 filter deformed in FTIR imaging which prevents correct identification of microplastic with MPHunter. A. Particles on a silver membrane filter, B. The same filter twisted after imaging on FTIR.

6. Discussion

6.1 Sedimentation in Maljalahti Bay

Maljalahti Bay is highly affected by anthropogenic factors: Maljalahti Bay is located in the immediate proximity of the city centre of Kuopio and the shoreline surrounding the bay is a residential area. The runoff from the city is directed to Maljalahti Bay via a stream. Moreover, there is a passenger harbour in Maljalahti, hence boat moorings and docks are built, the boat traffic is more extensive than in the other areas of Lake Kallavesi, and the lake bottom near the shore is regularly dredged. Considering this, disturbance leading to resuspension of sediment material is likely in Maljalahti Bay. The coring site was relatively sheltered due to its location in the deepest basin of the dock in Maljalahti Bay. The main source of sediment was likely the stream ending on the west side of the dock. Some suspended material might have entered through the narrow gap between two breakwaters on the east side of the dock if winds have been favourable. However, the gap was only noted as a secondary route for sediment.

The sediment core of Maljalahti Bay was characterised by a decreasing trend in water content (Fig. 7) and an increasing trend in MS (Fig. 6) implying compaction of sediment material downcore (Haltia-Hovi *et al.* 2007). A decreasing trend downcore in LOI (Fig. 7) suggested either an increasing influx of minerogenic material into the lake or decomposition of the organic material of the sediment with time (Saarni *et al.* 2015). A distinct change was observed between the years of 2011 and 2010: LOI increased rapidly indicating an increase in organic matter ratio of the sediment and the MS was peaking at 2011, which implied higher concentration of magnetic minerals. The clastic spring lamina was coarser than the organic growing season lamina in three years out of five. The growing season lamina was coarser than the spring lamina in two consecutive years, 2012 and 2013. According to these three sediment parameters, water content, LOI and MS, the flux of different components to the sedimentary record had changed in Maljalahti during the study period reflecting increasing anthropogenic land use in the catchment area. Nevertheless, the indications of seasonally varying sediment flux enable the preconditions for the formation of annually laminated sediments. High sedimentation rate might have prevented bioturbation which enables varve preservation in the basin.

The MAL1 freeze core was characterized by distinct colour differences between laminations. The rhythmic colour variation reflects regular change in the source material, which can be linked to seasonal changes (Saarnisto, 1986). Generally, spring lamina is defined by higher mineral composition than growing season lamina in clastic-biogenic varves (Saarnisto, 1986). Composition change is detected *e.g.* as a change in colour and composition: minerogenic material forms a lighter coloured lamina and organic material forms a darker coloured lamina in sediment core. Consequently, lighter laminae in the MAL1 sediment were likely formed following spring floods transported large numbers of mineral particles which were then deposited. Darker, organic laminae were formed during growing season. As studied by Johansson *et al*., (2019), sedimentation is marginal in Lake Kallavesi during the winter season, especially during periods of ice cover, and hence the role of winter accumulation is considered negligible in Maljalahti Bay.

The amount of snow accumulating during the winter was connected to the sediment flux. The maximum snow equivalent is positively correlated with spring floods in Finland (Kuusisto, 1984), and spring floods generate the biggest peaks in the annual sediment flux in Lake Kallavesi (Johansson *et al.* 2019). The maximum discharge of the year of Viannankoski, Onkijärvi, occurred during the spring flood and showed coeval changes with spring clastic lamina thickness in the sediment of Maljalahti Bay (Fig. 28).

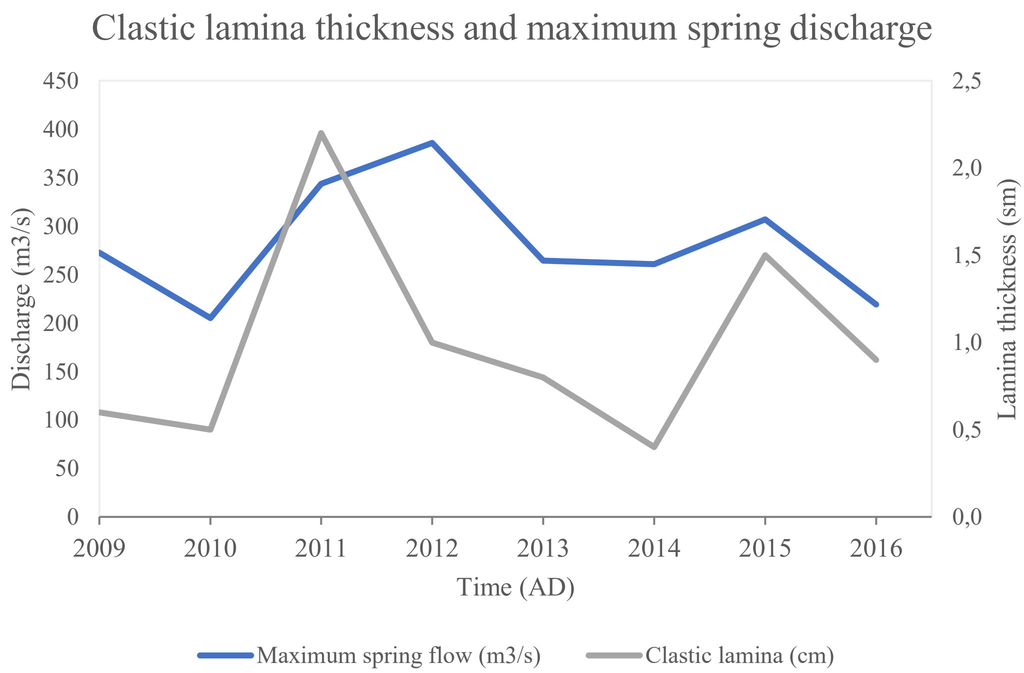


Figure 28. Clastic lamina thickness and the maximum spring discharge in 2009−2016.

Another prominent feature in the sediment of MAL1 was thicker clastic lamina compared to organic lamina. Clastic lamina thickness is controlled by the duration and strength of the spring flood (Tikkanen, 1990). The varve representing the year of 2011 was the thickest − clastic lamina being over 2 cm thick while the thickness of the biogenic lamina was similar to other biogenic laminae analysed in this study. At the same depth LOI was the smallest indicating low organic content, water content relatively small pointing to dense, clastic material and the MS the highest of all MAL1 subsamples suggesting to high minerogenic composition. All the variables supported the visually identified clastic lamina. Meteorological and hydrological factors were favourable for sediment accumulation in 2011. The winter of 2010−2011 was snowy: maximum snow depth and maximum snow equivalent were the largest and the following spring flood the second biggest of the measuring period. Although the laminations were continuous throughout the freeze core, the layers at the top part of the sediment were bent, which may be a result of anthropogenic disturbance.

Dredging in the dock area of Maljalahti Bay was carried out in the late spring/early summer of 2011 and the construction of new housing on the northern shore of Maljalahti Bay started also in 2011 (Regional State Administrative Agencies Eastern Finland, 2011). The beginning of the construction work in the catchment area of Maljalahti Bay coincide with twisted layers but also with increased layer thickness in the varve representing the year of 2011. Construction sites can increase soil erosion, causing disturbance in the natural sedimentation rate (Pitt *et al.* 2007). Bending of sediment structure can also originate from the freeze core sampling technique (Saarnisto, 1975). However, by the looks of the sediment, bending from sampling is unlikely, and the start of the construction work is the most probable cause of the erosion pulse seen in the sediment core.

The thickness of organic lamina, on the other hand, is related to the primary production during the open water season (Tiljander *et al.*, 2003), erosion of terrigenic material, decomposition of materials in the water column and the bottom of a lake (Zolitschka *et al.*, 2015) and remineralization (Saarni *et al.* 2015). The thickness of organic lamina comprises of autochthonous and allochthonous material formed and derived to the lake during growing season (Tikkanen, 1990). In the study of Johansson *et al.* (2019), the sedimentation rate was at its highest during summer months (June−August). Likewise, precipitation is positively correlated to sedimentation rate (Itkonen and Salonen, 1994; Saarni *et al.* 2015) and a similar trend was detected between growing season precipitation and organic layer thickness in the sediment of Maljalahti (Fig. 29). Only exceptions were the year 2011 which was dominated by the start of the construction work and dredging, and the topmost sample correlated with the year 2015 which was affected by low compaction of the surface sediments and high water content.

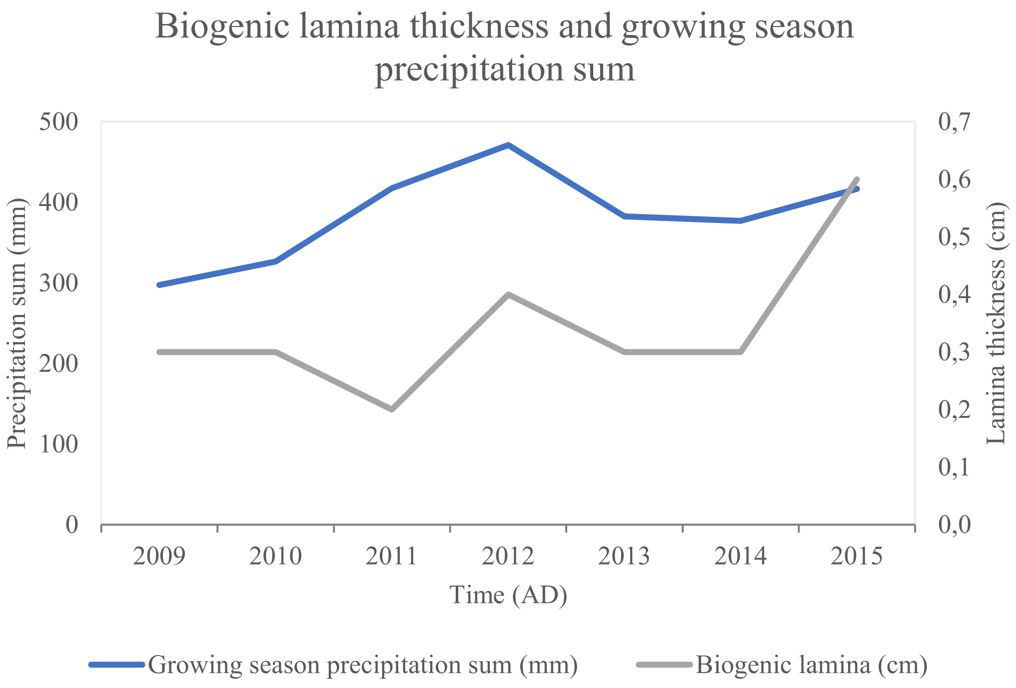


Figure 29. Biogenic lamina thickness and the growing season precipitation sum in 2009−2015.

Overall, the layer thickness varied a lot in the top 11 cm of the MAL1 sediment reflecting changes in the sediment availability, transport and accumulation rate. In the samples representing 2009 and 2010, varve thickness was more constant than between the years 2011 and 2016. The elevated minerogenic matter deposition from 2011 to 2016 results from intensified anthropogenic activities in the lake catchment.

The availability of sediment material is a restricting factor in sediment transportation and deposition. The intensified land use most probably increased the amount of available sediment matter in the bay catchment which amplified the natural processes (river discharge, precipitation) driving sedimentation.

High energy spring floods have the ability of transporting larger particles (Tikkanen, 1990). Thus, the clastic lamina can comprise of coarser particles than the organic lamina. However, a distinct difference in grain sizes was not observed in the MAL1 freeze core (Fig. 8).

The coarse summer lamina of 2012 can be explained by growing season precipitation. The construction work in Maljalahti Bay in 2012 and 2013 likely increased the availability of sediment material. Anthropogenic induced sediment together with high precipitation rates were reflected in the sediment core of Maljalahti.

Precipitation is directly linked to sediment accumulation rate in boreal climate zones (Itkonen and Salonen, 1994; Saarni *et al.*, 2015). The growing season of 2012 was the wettest of the measuring period. The growing season of 2013 was not especially wet, but it was warmest of the measuring period. Due to a relatively warm autumn, the ground did not freeze early, and late autumn rains could have eroded soil material. The eroded material was probably also reflected in the sample representing the spring of 2014.

As mentioned earlier, snow melted two times during the winter of 2013–2014. The first melting period occurred in the end of December 2013, causing maximum discharge in Viannankoski already in early January 2014. A high energy event in the middle of winter could have transported mineral particles to sedimentation areas if the ground was not yet frozen. Also, Johansson *et al.* (2019) noted that minor sediment accumulation during winter occurred during increased air temperatures, which supports the observation of the accumulation of minerogenic particles during the winter of 2013–2014. Snow was established again in mid-January and the actual spring flood occurred in March 2014. In the photograph taken of the freeze core, at the depth 3,0−3,7 cm representing the year of 2014 (Fig. 9), a dim double clastic lamina was observed. Recurrent periods of snowmelt can develop sub-laminations or irregularities in the internal structure of varves (Lamoureux *et al.*, 2001). Additionally, sub-laminations can also develop after severe rainfall events and local wind-driven currents (Tiljander *et al.*, 2003; Bonar, 2005). The detailed microfacies analysis, however, was out of scope of this study.

The sample representing 2010 was also a clearly coarser sample than others if looking at the grain size mode. However, coarser material was not the result of spring discharge or precipitation. The winter of 2010 was snowy and the enhanced runoff following the snow melt lasted longer than during the other winters of the measuring period (Fig. 11). The maximum discharge in Viannankoski was the slowest of the measuring period. The long spring discharge, nevertheless, was not reflected in the thickness of the spring lamina. The growing season of 2010 was also not wet. Nevertheless, the reason for the coarsest grain size mode of the 2010 cannot be explained by the existing results.

The sedimentation history of Maljalahti Bay was examined to understand the basic circumstances for microplastic transportation and accumulation. The MAL1 sediment was considered as a varved sediment because of a strong seasonal contrast in the physical properties of the sediment. The correlation between the thick minerogenic layer and the start of the construction work and dredging in 2011 confirms the accuracy of the varve chronology.

6.2 Microplastics in Maljalahti Bay

The hypothesis was that mostly non-floating microplastics would be found in the bottom sediments of Maljalahti Bay. However, the most abundant polymer types were PP and PE which have a lower density than freshwater. They are typically found in surface waters (*e.g.* Wang *et al.*, 2017) but have also been detected in lake and marine sediments (*e.g.* Vianello *et al.*, 2013; Brandon *et al.* 2019). The degradation of microplastics and biofouling alters the original density of polymers (Andrady, 2011) and therefore, low-density particles are detected in the bottom sediments (Ye and Andrady, 1991). Denser microplastics than water, such as PA, PAN, PET, PMMA, PS and PVC, were also found in the bottom sediments of Maljalahti Bay.

The polymer types found in Maljalahti Bay were all commonly used in consumer products. Our results of the polymer types are in line with Uurasjärvi *et al.* (2020) who studied microplastics in the surface waters of Maljalahti Bay. Same polymers were identified both in the surface waters (Uurasjärvi *et al.* 2020) and in the bottom sediments.

A large variety of polymer types and particle morphologies indicate multiple different microplastic sources (Uurasjärvi *et al.* 2020). Polymer types found in the topmost 11 cm of the MAL1 sediment were quite heterogenous which implied to changes in microplastic sources during the last decade (Fig. 17−22). In 2009 and 2010, only three different polymer types (PP, PE and 2009 PS/2010 PAN) were analysed. From 2011 until 2013 multiple different polymer types were detected, which correlates with the timing of the construction work in Maljalahti. From 2014 onwards variation in polymer types decreased again. This suggest that the construction work had an impact on the microplastic availability, transport, and sources.

Approximately 50 % of the microplastic particles found in the surface water of Maljalahti Bay were fibres and the other half fragments (Uurasjärvi *et al.*, 2020). On the contrary, mostly fragments were analysed in the bottom sediments of Maljalahti Bay. No beads, pellets or other primary microplastic forms were detected in Maljalahti, which supports *e.g.* Hidalgo-Ruz *et al.* (2012) who suggested that at present, most microplastics originate from secondary rather than primary sources. Although the morphology and surface textures of the analysed particles were not investigated in detail in this study, microplastic particles were rough and slightly weathered, which indicated that they originate from secondary sources. Nonetheless, classification of microplastic particles to primary or secondary was not done.

In previous studies, microplastics found from deeper in sediment cores (correlated with the 1950's to 1990's) were more worn than in the upper part of the sediment (the 1990's to 2010s) (Brandon *et al.*, 2019; Dong *et al.*, 2020). No change in microplastic textures with depth was observed. This was expected, because the samples were taken from the top part of the sediment that represents last ten years.

In this study, the microplastic concentrations in the vertical sediment profile of MAL1 were highly heterogenic. Microplastic concentrations varied between 1 090 and 9 500 pc/L of sediment which is a higher concentration in many sediments (Thompson *et al.*, 2004; Norén, 2007). On a seasonal scale, more plastics were detected from the spring samples than from the growing season samples. The exception was the year 2011, when more microplastic particles were analysed from growing season sample (85 pc) than from spring sample (72 pc). This can be an result of dredging done in the spring 2011.

Maljalahti Bay is surrounded by populous residential areas which makes it a hot spot area regarding to microplastic abundance. Microplastic release to the environment is considerable bigger in urban areas than in less densely populated areas which highlights the important role of anthropogenic factors in microplastic distribution (Hidalgo-Ruz *et al.*, 2012; Eriksen *et al.*, 2013; Free *et al.*, 2014). Also in Lake Kallavesi, the location near human activities was connected to high microplastic concentration (Uurasjärvi *et al.*, 2020). The surface water of Maljalahti harbour contained one of the highest microplastic concentration (0.66 MPs/m^3) achieved with manta trawl sampling method (Uurasjärvi *et al.*, 2020). On the other hand, pump filtration method resulted the lowest microplastic concentration. Uurasjärvi *et al.* (2020) explained the difference with possible seasonal variation: the pump filtration was made in the spring and the manta samples were taken in the autumn. No seasonal variation in microplastic concentrations was detected from the sediments in this study.

The stream transporting storm waters from the city of Kuopio to Maljalahti was identified as a possible transportation route for microplastics. The hypothesis was that microplastics accumulate in the snow on the streets during winter and are transported by runoff during the spring melt. However, the maximum spring discharge or maximum snow equivalent did not correspond with the amount of microplastics found at the study site (Fig. 30).

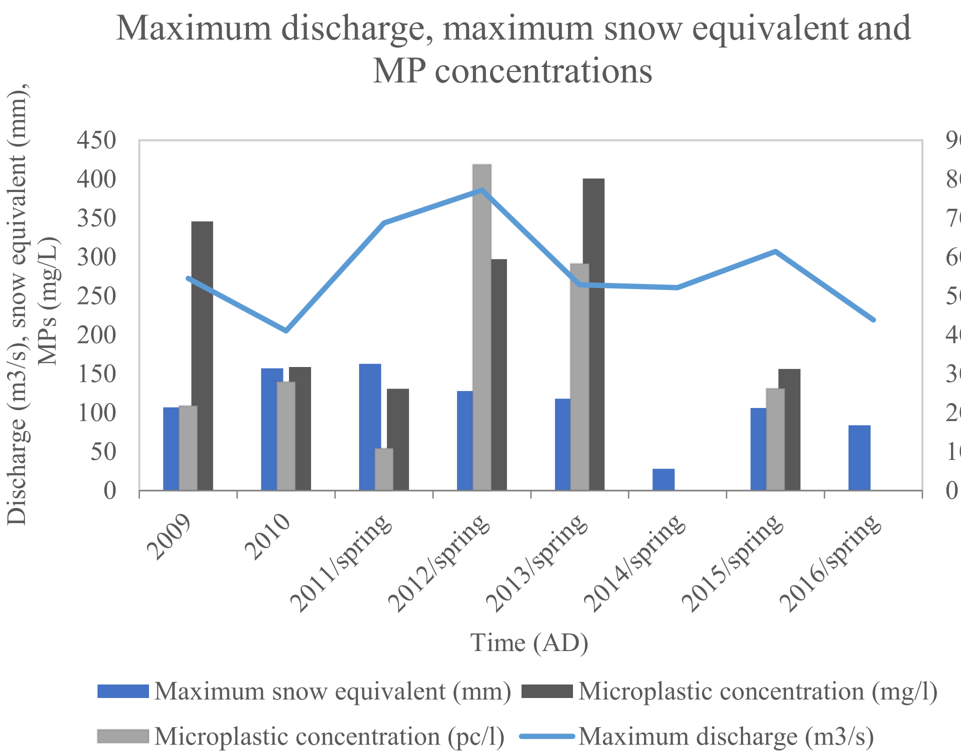


Figure 30. The concentrations of microplastics (mg/l and pc/l) with respect to the maximum discharge of Viannankoski (m3/s) and maximum snow equivalent (mm) in Kuopio area in spring seasons 2009–2009. No microplastic data was available from the springs of the years 2014 and 2016.

Microplastic concentration was related to precipitation and temperature to determine if precipitation and the following runoff were able to increase the amount of microplastic particles transported from the catchment into the basin. However, no clear trend was observed in the occurrence of microplastics accumulated during the growing season and the average temperature and the precipitation sum of growing season (Fig. 31).

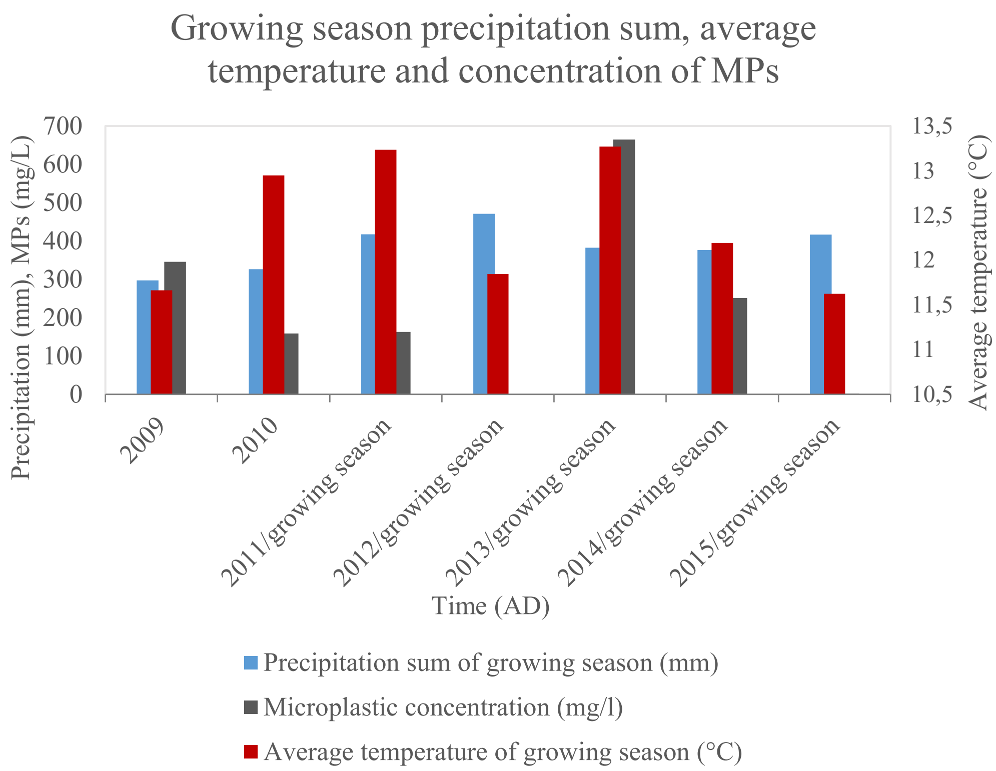


Figure 31. The amount of microplastics (mg/L) with respect to the average air temperature (°C) and the precipitation (mm) of the growing season in 2009−2015. The microplastic data of the growing season 2015 is not seen in the figure since the concentration was 1,5 mg/L.

No relationship between microplastic abundance, grain size and lamina thickness were detected either (Fig. 32). In literature, there are studies both in favour (*e.g.* Vianello *et al.*, 2013) and against (Browne *et al.* 2010; Peng *et al.*, 2017) the connection of microplastic abundance with grain size variation. However, these studies have not considered the sedimentation rate which is crucial to understand the relationship between microplastic accumulation and sedimentation. Contradicting conclusions emphasize the need for more detailed investigations into microplastic-sediment relatedness.

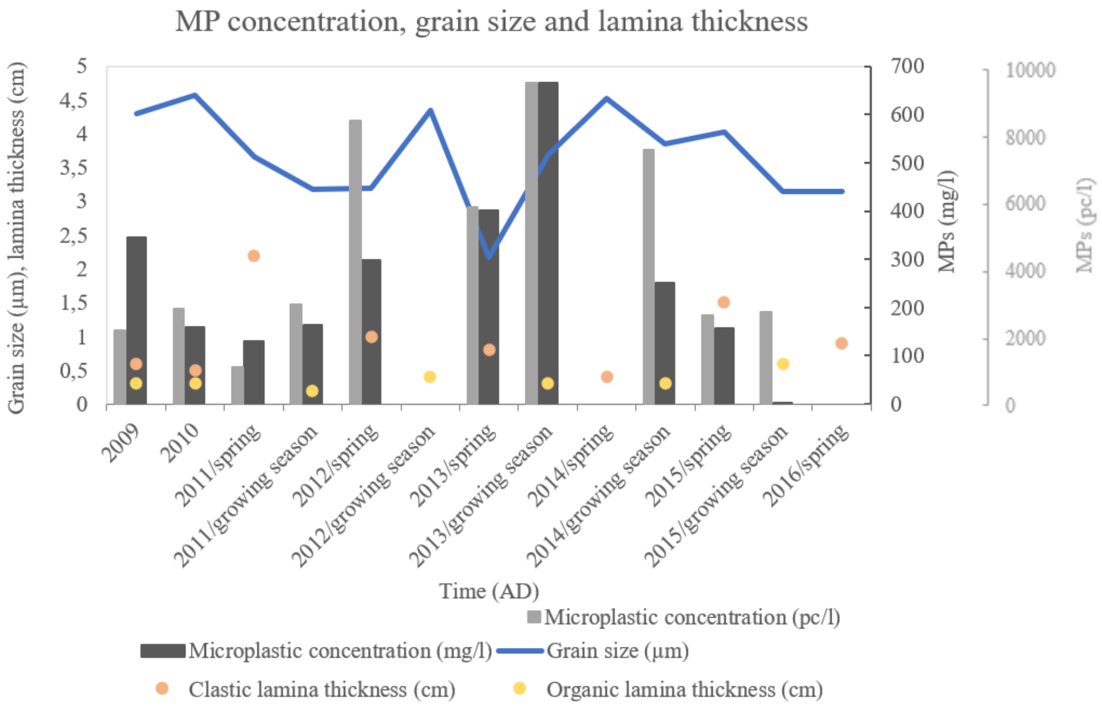


Figure 32. Amount of microplastics (mg/l and pc/l) in respect to lamina thickness (cm) and grain size (µm) in 2009−2016. Grey columns present microplastic concentrations (light grey is pc/l and dark grey (mg/l), blue line represents grain size values and yellow (biogenic) and orange (clastic) dots lamina thickness.

Hydrological and meteorological conditions, plastic particle properties and surroundings of the sedimentation basin all have an impact on microplastic distribution patterns (Andrady, 2011; Eerkes-Medrano *et al.* 2015; Ballent *et al.*, 2016). Microplastic particles are suggested to behave like small sediment particles: in low-energy environments small particles stay suspended for a longer time and in high-energy environment the particles are transported by water discharge (Browne *et al.* 2010).

The stream was hypothesized to be the primary source of microplastics in Maljalahti Bay, such as other rivers near densely populated areas (e.g. Morritt *et al.*, 2013). In addition to the stream, microplastics among other particles are probably transported into the bay by surface runoff from the shore and from the lake basin of Lake Kallavesi by wind driven currents. Microplastics may have originated also inside the dock area by littering etc.

No direct relation (negative nor positive) was observed with microplastic abundance and the factors driving sedimentation in Maljalahti, nor with quantity of microplastics and sediment grain size or lamina thickness. The background levels of microplastic in the environment, and in this case in the catchment of Maljalahti Bay, are presumably quite constant during the last ten years. The coring site of Maljalahti Bay was only tens of meters from the inlet of the stream and therefore, a strong discharge had most probably transported particles further away from the shore. The heaviest particles, *i.e.* mineral particles, deposited closest to the output of the stream and lighter particles stayed suspended for a longer time in the water column. The freeze core method does not allow for the determination of sediment accumulation rate (SAR) in terms of g/m^2/year but as linear sediment accumulation rate (LSAR), mm/year. Therefore, the concentration of microplastics in the freeze core samples is diluted when the rate of sedimentation increases.

Brandon *et al.* (2019) and Dong *et al.* (2020) detected that the amount of microplastics accumulated in sediments correlated closely with the international plastic production and consumption, and changes in the local population near the sstudy site. Considering the changes recorded of the microplastic deposition in Maljalahti Bay, the most significant factor affecting the microplastics concentration was the construction work in the direct proximity of the study area. The construction presumably increased both the number of microplastic particles and the variability of polymer types in the area. According to this result, it seems that microplastics are transported from the catchment area to the water systems quite rapidly, without a high-energy event such as a specifically strong spring flood. However, to detect continuous temporal trends in microplastic accumulation, longer timescale than a decade is needed.

To summarize, microplastic abundance or distribution did not show any correlation with the meteorological or hydrological parametres studied in this thesis. However, a clear connection with the start of the construction work in the study area was detected. Low microplastic concentrations in the spring samples can result from dilution of microplastics in the enhanced sedimentation rate. Microplastic accumulation in Maljalahti is most likely driven by a complex combination of factors, involving natural and anthropogenic forcing mechanisms. The role of meteorological and hydrological factors however were acknowledged as important influence in the transport and dispersal of microplastics although the results did not show a clear correlation. The suggestion is to investigate the features of microplastic particles in more detail and over a longer timespan obtained with varve chronology. Additional statistical analysis could be applied to detect more discreet correlations in a seasonal scale.

6.3 Potential and reliability of microplastic analysis

The new improved separation method for microplastics resolves to a lot of uncertainties that previous methods have had before. Hidalgo-Ruz *et al.* (2012), Galgani *et al.* (2013)

and others have listed problems in past studies such as ability to capture plastic particles, separation of low-density materials from plastics, identification plastic type, minimization of contamination and affordable method to enable method accessibility. The new method answers almost all the questions. Sampling with ice-finger captures plastic particles effectively and heavy liquid separates microplastic particles from other material with a recovery rate of 96 % with PET particles and 85 % with HDPE particles (test samples). Furthermore, the combination of imaging FTIR and MPHunter is the most precise method for imaging and identifying different types of plastic materials and contamination can be minimized with further improvements (*e.g.* use of blank samples). Most of all, the method is simple enough to be replicated in future studies.

The disadvantage of the method is that it is time consuming and therefore indirect expenses such as labour costs and laboratory fees are high, although the method itself is inexpensive. Another downside is the subjective selection of particles into imaging FTIR. Particles with distinct, unnatural colour were more likely to be selected visually for the analysis than clear/transparent and dark particles, as also studied by Eriksen *et al.* (2013).

The reliability of microplastic analysis with MPHunter would have been even better had there been an opportunity to check the results manually. Unfortunately, due to insufficient computer hardware, manual revision with MPHunter was not possible. However, revision of microplastic identification results was conducted by comparing the imaging FTIR images, MPHunter probability maps and the microscopic photos of picked particles.

The most distinctive error in MPHunter was that it identified bigger particles as multiple smaller ones, as mentioned before. Better manual revision would have resolved this problem. However, this issue was acknowledged and resolved by presenting results not only in terms of the number of microplastics but also in terms of mass of microplastics. In general, representing results in terms of number of particles (pc/l) is nonspecific since microplastic, especially older ones, degrade into multiple pieces. However, also representing the results in terms of mass (g/l) is problematic in a way that denser polymer types override the lighter ones although the amounts can be the same. The results are therefore more unilateral since the most common or heavier polymers dominate. Presenting the results by microplastic particle concentration (pc/l) allows for more variation in the results, as noticed in this thesis. Marginal polymer types can be essential for the study, and it is better to present them in terms of particles (pc/l) than in mass (g/l). Ultimately, the most common way in literature is still to represent the results in terms of particles due to the lack of standardized units.

Microplastic concentrations presented in terms of items (pc/l) or weight (mg/l) do not display the actual microplastic abundance in a sedimentary environment, as noticed when considering the dilution of microplastics in the chapter 6.2. All in all, every presentation style has its disadvantages. There is no commonly accepted system to present the results which would enhance the comparability of the reported microplastic abundances across different studies.

The sample volumes in this study were small. Extrapolation easily leads to overestimations, and the results should be judged critically. Also, the timespan of this study is relatively short, only 7 years, compared to *e.g.* the studies of Brandon *et al.* (2019) and Dong *et al.* (2020) which investigated the entire period of plastic use and even beyond.

The control samples collecting airborne contamination were analysed with the same polymer types as the sediment samples. Background contamination levels could not be constructed with these control samples since contamination control differentiated from the used sample protocol. Overall, the numbers of microplastic particles accumulated in the control samples were very small. The use of blank samples in microplastic contamination control has become more common only recently, and airborne control samples were up to date when this study began in 2017. Nevertheless, airborne control samples are unable to capture directly accumulated contamination from sampling, equipment and reagents.

7. Summary

The present study illustrated several opportunities and limitations of the new method created in this study. The method was suitable for different types of loose sediment, as proven when developing the method protocol, but the identification of microplastics included errors. Widely acknowledged suggestion for standardized sampling procedures which favour spatiotemporal comparison of microplastic abundance, is suggested also in this study.

The sediment in Maljalahti was varved, controlled by seasonal runoff from the stream flowing through the city centre of Kuopio. Additionally, sedimentation was highly affected by anthropogenic factors, such as the construction of the harbour of Maljalahti Bay which started in 2011. Microplastic accumulation in Maljalahti Bay was also most probably regulated by a complex combination of natural and anthropogenic factors, the stream identified as the main transport source of microplastics into the bay. However, due to dilution of microplastics, a direct relation with microplastic abundance and the studied meteorological and hydrological parameter was not acknowledged.

The majority of microplastics identified in this study were fragments. Polypropylene (PP) was the dominant polymer type, polyethylene (PE) coming in second. The variation in polymer types reflected the changes in the lake catchment: more diverse polymer types connected with the start of the construction work in Maljalahti Bay. In addition, the amount microplastics increased as well, indicating a positive relation between human activities and microplastics.

It is suggested to continue with the studies of lacustrine bottoms sediments with high temporal resolution to examine the historical occurrence of microplastic abundance and sedimentary processes controlling the microplastic accumulation.

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Appendix 1

MAL1 Low field magnetic susceptibility*

Depth (cm)	Results x10^-6 (SI)	Calibration coefficient	Corrected susceptibility
0-1	8,8	0,97	8,5
1-2	16,5	0,97	16,0
2-3	18,7	0,97	18,2
3-5	26,4	0,97	25,6
5-6	27,2	0,97	26,4
6-7	34,6	0,97	33,6
7-8	29,3	0,98	28,6
8-9	29,3	0,98	28,6
9-10	32,3	0,98	31,5
10-11	33,0	0,98	32,2

*0,1 LF, SI

Appendix 2

MAL1 Water content and LOI

Depth (cm)	Wet weight (g)	Dry weight (g)	Water content (g)	Water content (%)	LOI (g)	Organic content from wet weight (%)	LOI (%)
0-1	35,1	7,4	27,7	78,8	0,5	1,4	6,8
1-2	58,5	18,4	40,1	66,3	1,2	2,1	6,3
2-3	37,0	12,8	24,2	65,4	0,7	2,0	5,8
3-5	42,3	17,4	24,9	58,9	1,0	2,4	5,8
5-6	40,6	15,3	25,3	62,4	0,7	1,8	4,8
6-7	46,3	22,1	24,2	52,2	0,8	1,8	3,7
7-8	40,8	18,1	22,6	55,6	0,6	1,4	3,2
8-9	43,5	15,7	27,8	64,0	1,4	3,3	9,1
9-10	45,5	15,8	29,7	65,2	1,8	3,9	11,1
10-11	46,1	15,6	30,4	66,0	1,7	3,7	10,9

Appendix 3

MAL1 Grain size

Sample	Year/Season	Mean	Median	Mode
MAL1.1.2	2016/spring	4,093	3,142	3,359
MAL1.2.1	2015/growing season	4,144	3,146	3,359
MAL1.2.2	2015/spring	4,952	4,022	5,878
MAL1.3.1	2014/growing season	4,731	3,857	5,878
MAL1.3.2	2014/spring	5,456	4,526	7,083
MAL1.4.1	2013/growing season	4,676	3,684	5,878
MAL1.4.2	2013/spring	2,931	2,167	2,312
MAL1.5.1	2012/growing season	5,374	4,341	11,29
MAL1.5.2	2012/spring	4,286	3,193	3,359
MAL1.6.1	2011/growing season	4,194	3,18	3,687
MAL1.6.2	2011/spring	4,821	3,651	4,047
MAL1.7	2010	5,551	4,573	11,29
MAL1.8	2009	5,289	4,302	7,083

Appendix 4

MAL1 Varve chronology

Year	Organic lamina (cm)	Clastic lamina (cm)	In total (cm)
2016		0,9	0,9
2015	0,6	1,5	2,1
2014	0,3	0,4	0,7
2013	0,3	0,8	1,1
2012	0,4	1	1,4
2011	0,2	2,2	2,4
2010	0,3	0,5	0,8
2009	0,3	0,6	0,9
Average of three counts			

Appendix 5

Meteorological and hydrological data

Date	Precipitation (mm)	Snow depth (cm)	Air temperature (°C)	Water flow (m3/s)
1.11.2008	2,6	0	2,9	151,99
2.11.2008	0	0	0,8	159,47
3.11.2008	0,1	0	2,6	135,32
4.11.2008	0,2	0	4,3	101,79
5.11.2008	0	0	3,4	87,17
6.11.2008	0	0	0,7	86,61
7.11.2008	0	0	0,2	98,16
8.11.2008	1,1	0	0,8	110,9
9.11.2008	6,9	0	3,6	137,77
10.11.2008	7,5	0	6,1	137,99
11.11.2008	7,2	0	4,2	137,21
12.11.2008	1,3	0	3,6	152,57
13.11.2008	6,4	0	4,6	166,09
14.11.2008	5,4	0	2,2	158,29
15.11.2008	11,8	0	3,8	152,53
16.11.2008	0,2	0	0,7	152,45
17.11.2008	1,5	0	-2,7	145,34
18.11.2008	7,1	3	1,3	143,53
19.11.2008	1,6	1	0,2	145,85
20.11.2008	0	2	-3,3	146,56
21.11.2008	0	2	-4	147,32
22.11.2008	0	2	-4,4	146,42
23.11.2008	9,2	3	-2,8	119,34
24.11.2008	0,5	13	-0,7	99,38
25.11.2008	0	12	-0,5	100,14
26.11.2008	4	12	0,9	100,8
27.11.2008	6,6	16	-3,2	101,25
28.11.2008	0,3	17	2,7	101,2
29.11.2008	0,1	13	1	100,96
30.11.2008	1,9	10	1,3	101,12
1.12.2008	9,5	8	1,9	101,39
2.12.2008	2,2	8	1,7	120,34
3.12.2008	5,2	5	2,9	132,73
4.12.2008	3,9	2	1	121,1
5.12.2008	0	4	0,3	120,7
6.12.2008	0	4	-2,7	120,29
7.12.2008	0	4	-4,1	113,99
8.12.2008	2,8	4	-3,1	110,57
9.12.2008	3,3	7	0,8	110,68

10.12.2008	0	11	-4	110,58
11.12.2008	0,2	10	-5,8	99,39
12.12.2008	0,2	9	-0,3	69,88
13.12.2008	0,5	9	0,9	81,24
14.12.2008	0	6	1,2	101,25
15.12.2008	0	5	0,7	101,25
16.12.2008	0	5	-4	101,24
17.12.2008	0,4	5	-4,2	100,89
18.12.2008	0,9	6	0,8	83,18
19.12.2008	2,9	6	1,9	69,78
20.12.2008	4,5	5	0,4	69,9
21.12.2008	2,9	8	0,4	69,68
22.12.2008	12,8	8	-0,5	69,67
23.12.2008	0,3	24	-2,8	70,2
24.12.2008	0	22	-6,9	70,65
25.12.2008	0	21	-6,7	70,94
26.12.2008	0	19	0,5	71,1
27.12.2008	0	15	-0,3	94,75
28.12.2008	0	14	-4,6	89
29.12.2008	0	12	-2,1	70,25
30.12.2008	0	15	-0,9	70,23
31.12.2008	0,4	15	-0,3	69,93
1.1.2009	0,1	15	-8,3	65,39
2.1.2009	0,6	15	1,9	47,49
3.1.2009	2,3	16	2,5	47,49
4.1.2009	0	17	5,6	47,49
5.1.2009	1,3	17	1,9	47,49
6.1.2009	2,9	18	-4,2	47,49
7.1.2009	0,7	22	4,2	47,61
8.1.2009	1,2	22	4,1	47,69
9.1.2009	0,2	23	-8,1	47,69
10.1.2009	0,1	23	-5,1	47,69
11.1.2009	0,7	22	0,6	49,27
12.1.2009	1	20	2,9	57,18
13.1.2009	3,1	14	4	69,67
14.1.2009	0,4	8	0,4	78,51
15.1.2009	0	9	1	75,68
16.1.2009	0	9	4,6	59,33
17.1.2009	0	9	4,1	53,04
18.1.2009	0	9	-7,2	58,71
19.1.2009	0,8	9	-7,1	58,58
20.1.2009	0,4	10	-5,4	56,21
21.1.2009	3,8	10	-4,4	52,83
22.1.2009	8	13	-3,2	52,77
23.1.2009	3,9	17	-6,2	52,78
24.1.2009	0	20	-8,8	52,73

25.1.2009	0,7	20	-7,5	52,73
26.1.2009	3,7	20	-5,3	52,67
27.1.2009	0	22	-4,4	52,63
28.1.2009	0	22	-5,3	52,63
29.1.2009	0,1	22	-5,9	52,63
30.1.2009	0	21	0,3	52,53
31.1.2009	0,5	21	7,6	52,53
1.2.2009	0	22	-7,2	52,44
2.2.2009	0	22	-8,4	52,33
3.2.2009	0	21	-7,7	52,33
4.2.2009	1,4	22	-4	52,25
5.2.2009	7,4	23	-8,7	52,22
6.2.2009	2,4	32	4,2	52,19
7.2.2009	2,2	33	0,1	52,12
8.2.2009	6,2	34	-3,6	52,05
9.2.2009	0,7	33	0,7	54,74
10.2.2009	0	32	-6,9	57,04
11.2.2009	0	32	-5,8	56,87
12.2.2009	0	31	-5,7	55,37
13.2.2009	0	31	-9,2	53,31
14.2.2009	0	31	0	49,27
15.2.2009	0	30	2,3	40,65
16.2.2009	0	30	7,5	36,85
17.2.2009	0,6	30	6,3	36,85
18.2.2009	1,8	33	5,3	36,85
19.2.2009	0,7	34	-8,8	36,83
20.2.2009	0	34	-5,8	36,79
21.2.2009	0	34	-6,6	36,72
22.2.2009	0,1	33	-5,5	36,71
23.2.2009	1	34	-8,8	36,63
24.2.2009	1,4	35	-5,1	36,61
25.2.2009	0	33	-4,6	36,61
26.2.2009	0,8	36	-7,7	36,59
27.2.2009	0,8	36	-5,3	36,59
28.2.2009	0,1	40	-8,6	36,57
1.3.2009	0	39	-7,3	36,49
2.3.2009	0,2	38	-5,2	36,44
3.3.2009	1,7	38	-4,7	36,39
4.3.2009	0	38	0,9	36,39
5.3.2009	0	37	0,1	36,39
6.3.2009	0	37	0	36,32
7.3.2009	0	36	-2	36,28
8.3.2009	0	36	-4,9	36,19
9.3.2009	0	34	-4,4	36,16
10.3.2009	3,4	35	-3,9	36,07
11.3.2009	0	38	-4,3	35,99

12.3.2009	0	38	-8,6	35,95
13.3.2009	0	38	0,4	32,97
14.3.2009	0	37	0,2	31,07
15.3.2009	0	37	-0,9	31,07
16.3.2009	1,6	37	1,1	29,38
17.3.2009	0,2	37	-0,1	28,62
18.3.2009	0	35	0,5	26,46
19.3.2009	0	35	-4	25,33
20.3.2009	0	35	0,1	25,33
21.3.2009	0	34	-2,2	25,33
22.3.2009	0	34	-4,9	25,33
23.3.2009	0	34	-5,7	23,26
24.3.2009	0	34	-9,2	22,13
25.3.2009	0,1	34	-9,1	20,6
26.3.2009	0	34	-8,3	18,93
27.3.2009	0	34	-7,5	18,93
28.3.2009	0,1	34	-5,3	18,93
29.3.2009	0,9	34	-0,3	18,93
30.3.2009	5,4	34	0,5	18,93
31.3.2009	0,2	37	2,4	18,93
1.4.2009	0	32	1,1	18,93
2.4.2009	2,2	30	1,4	18,93
3.4.2009	0	31	0	18,93
4.4.2009	0,9	31	-2,4	18,93
5.4.2009	0,6	31	0,3	18,93
6.4.2009	0,1	32	1,1	18,93
7.4.2009	2	31	-2,2	18,93
8.4.2009	0,1	32	0,1	18,93
9.4.2009	0,3	32	-0,6	18,93
10.4.2009	12,4	31	0,4	18,93
11.4.2009	0	41	1,4	18,93
12.4.2009	0	34	2,2	18,93
13.4.2009	0,5	31	1,5	18,93
14.4.2009	0	31	2	18,93
15.4.2009	0	28	0,4	18,93
16.4.2009	0,2	28	0,1	18,93
17.4.2009	2,9	27	0,2	21,21
18.4.2009	0	27	-2,3	24,72
19.4.2009	0,6	27	-0,4	24,69
20.4.2009	0	27	0,8	28,41
21.4.2009	0	27	0,5	44,53
22.4.2009	0	25	4,5	44,53
23.4.2009	0	22	3,5	44,53
24.4.2009	0	18	6,6	49,2
25.4.2009	0	12	10	93,9
26.4.2009	0	5	12	122,45

27.4.2009	0	0	9,8	144,74
28.4.2009	3,1	0	9,5	169,57
29.4.2009	0	0	3,7	145,08
30.4.2009	0	0	4,1	169,22
1.5.2009	0	0	8,2	172,16
2.5.2009	0	0	10,4	175,13
3.5.2009	0,1	0	11,3	178,35
4.5.2009	4	0	8,5	184,78
5.5.2009	0,3	0	8	214,99
6.5.2009	10,8	0	6	221,47
7.5.2009	0,6	0	8,3	228,12
8.5.2009	0	0	10,5	240,14
9.5.2009	4,4	0	9,9	252,19
10.5.2009	0	0	10,9	258,95
11.5.2009	0,3	0	9,3	262,72
12.5.2009	4,5	0	6,5	254,53
13.5.2009	0,6	0	8	249,07
14.5.2009	0	0	7,5	248,04
15.5.2009	0	0	8,6	249,45
16.5.2009	0	0	8,6	248,73
17.5.2009	0	0	9,4	247,16
18.5.2009	0	0	10,6	244,4
19.5.2009	0	0	12,5	239,57
20.5.2009	0	0	11	232,48
21.5.2009	0,3	0	12,4	225,78
22.5.2009	0	0	12,2	218,96
23.5.2009	0	0	13,9	250,42
24.5.2009	0,3	0	12,4	272,58
25.5.2009	0	0	12,3	208,06
26.5.2009	2	0	13,9	140,47
27.5.2009	3,4	0	15	108,03
28.5.2009	2,2	0	12,4	96,23
29.5.2009	0	0	12,9	84,53
30.5.2009	0	0	17,2	75,61
31.5.2009	0	0	21	75,84
1.6.2009	0	0	16,2	75,86
2.6.2009	0,1	0	11,7	75,74
3.6.2009	0,3	0	9,7	82,2
4.6.2009	4,7	0	8,2	85,49
5.6.2009	2,1	0	4,5	85,36
6.6.2009	1,8	0	4,8	85,39
7.6.2009	0	0	7	73,13
8.6.2009	0	0	8,7	44,41
9.6.2009	0	0	11,4	19,29
10.6.2009	0	0	13,6	19,29
11.6.2009	0,1	0	16,1	19,29

12.6.2009	0,2	0	16,7	19,29
13.6.2009	12,6	0	17,5	19,29
14.6.2009	0,2	0	18,4	22,36
15.6.2009	8,3	0	13,3	23,53
16.6.2009	2,1	0	10,6	26,15
17.6.2009	1,9	0	10,6	25,98
18.6.2009	3,6	0	8,7	19,13
19.6.2009	1,8	0	10,8	14,35
20.6.2009	6,6	0	11,4	9,92
21.6.2009	0	0	13,2	8,69
22.6.2009	0	0	16,4	7,57
23.6.2009	1,5	0	17,4	6,95
24.6.2009	0	0	17,1	6,95
25.6.2009	0	0	19	6,95
26.6.2009	0	0	21,1	6,94
27.6.2009	0	0	22,9	6,93
28.6.2009	0,4	0	20,2	6,93
29.6.2009	0	0	13,5	6,94
30.6.2009	0	0	16,6	6,95
1.7.2009	0	0	22,3	6,95
2.7.2009	0	0	18,9	6,93
3.7.2009	0	0	13	6,93
4.7.2009	0,4	0	9,2	6,93
5.7.2009	0	0	9,2	6,93
6.7.2009	0,1	0	11,8	6,93
7.7.2009	7,3	0	14,5	6,93
8.7.2009	4,2	0	13,5	6,93
9.7.2009	7,3	0	16	6,93
10.7.2009	3	0	17,3	6,94
11.7.2009	0,2	0	17,8	6,93
12.7.2009	3,2	0	16,2	6,93
13.7.2009	11,7	0	15,7	6,93
14.7.2009	0,1	0	16,2	6,94
15.7.2009	0	0	18,9	6,95
16.7.2009	9,8	0	19,5	6,93
17.7.2009	0	0	17,5	6,95
18.7.2009	0	0	16,2	11,25
19.7.2009	0	0	15,7	20,79
20.7.2009	2	0	15,1	20,79
21.7.2009	0	0	17,3	20,85
22.7.2009	0	0	16,6	20,82
23.7.2009	0	0	18,2	20,78
24.7.2009	0	0	19,6	18,88
25.7.2009	5,7	0	17,8	12,48
26.7.2009	0	0	18,4	6,93
27.7.2009	0	0	19,8	6,93

28.7.2009	0	0	19,1	6,92
29.7.2009	0,8	0	18,9	6,91
30.7.2009	0	0	18,7	6,91
31.7.2009	0	0	20,4	6,91
1.8.2009	2,1	0	18	6,91
2.8.2009	5,5	0	16,8	6,91
3.8.2009	0	0	17,9	6,9
4.8.2009	0	0	15,6	6,89
5.8.2009	0	0	14,8	6,89
6.8.2009	0,1	0	18	6,89
7.8.2009	2,6	0	18,1	6,89
8.8.2009	0	0	19,7	6,89
9.8.2009	0	0	20,7	6,89
10.8.2009	1,3	0	18,9	6,64
11.8.2009	6,1	0	18,2	6,55
12.8.2009	16,7	0	15,5	6,55
13.8.2009	0	0	15,1	6,55
14.8.2009	0	0	14,2	6,55
15.8.2009	0	0	14,8	6,55
16.8.2009	7,7	0	11,9	6,55
17.8.2009	1,1	0	12,6	4,37
18.8.2009	0	0	11,5	3,38
19.8.2009	0,7	0	12,5	3,37
20.8.2009	0	0	11,5	1,65
21.8.2009	0	0	14,7	0,87
22.8.2009	0	0	15,9	0,87
23.8.2009	0	0	14,5	0,87
24.8.2009	0	0	14,4	0,87
25.8.2009	0	0	14,2	0,87
26.8.2009	1	0	15,1	0,87
27.8.2009	0,2	0	14,8	0,87
28.8.2009	0	0	15,7	0,87
29.8.2009	16,1	0	17,5	0,87
30.8.2009	0,1	0	13,7	0,88
31.8.2009	7,7	0	12,7	0,88
1.9.2009	0,3	0	14,7	1,12
2.9.2009	0	0	18,6	1,55
3.9.2009	0,9	0	16,3	1,55
4.9.2009	4,3	0	15,7	1,55
5.9.2009	0	0	14,3	1,56
6.9.2009	13,3	0	11,9	1,56
7.9.2009	0,1	0	13,3	3,19
8.9.2009	0,1	0	14,3	5,39
9.9.2009	0,9	0	18,3	6,59
10.9.2009	0	0	13,5	6,59
11.9.2009	0,1	0	11,1	6,59

12.9.2009	0	0	11,1	6,59
13.9.2009	0	0	10,3	6,59
14.9.2009	0	0	10,6	6,59
15.9.2009	0	0	11,1	6,59
16.9.2009	0,9	0	11,4	6,59
17.9.2009	1,2	0	8,2	6,59
18.9.2009	0,1	0	7,5	6,59
19.9.2009	1,2	0	11,4	6,59
20.9.2009	0	0	11,7	6,59
21.9.2009	0	0	11,3	6,59
22.9.2009	3,3	0	10,2	6,59
23.9.2009	0	0	11,8	6,59
24.9.2009	0	0	8,5	6,58
25.9.2009	1,7	0	6,6	6,57
26.9.2009	0	0	12	6,58
27.9.2009	0	0	13,8	6,58
28.9.2009	0,3	0	8,7	6,57
29.9.2009	0,5	0	4,1	6,57
30.9.2009	4,8	0	3	6,57
1.10.2009	0	0	1,8	6,57
2.10.2009	0	0	2,3	6,57
3.10.2009	1,2	0	3,2	6,57
4.10.2009	21,3	0	5,9	6,57
5.10.2009	6,9	0	4,8	6,59
6.10.2009	1	0	2,5	6,59
7.10.2009	10,3	0	4,7	6,6
8.10.2009	0	0	3,6	11,82
9.10.2009	0	0	2,3	12,08
10.10.2009	0	0	1,9	10,43
11.10.2009	0	0	0,4	10,43
12.10.2009	0,2	0	0,7	10,43
13.10.2009	0	0	0,2	10,44
14.10.2009	0	0	-2,1	11,88
15.10.2009	0	0	0,3	25,89
16.10.2009	3,4	0	0,8	32,33
17.10.2009	0,2	0	1,7	32,28
18.10.2009	0,8	0	2,7	27,97
19.10.2009	4,2	0	2,2	22,62
20.10.2009	0	0	2,3	22,78
21.10.2009	0	0	2,5	23,77
22.10.2009	0,1	0	2,9	23,55
23.10.2009	0	0	1,2	20,87
24.10.2009	0	0	0,9	20,87
25.10.2009	2,8	0	1,3	20,87
26.10.2009	4,1	0	4,4	20,87
27.10.2009	0	0	4	19,96

28.10.2009	0	0	0,9	15,98
29.10.2009	0	0	0,2	13,91
30.10.2009	0	0	-2,1	15,01
31.10.2009	0	0	-3,5	15,86
1.11.2009	0	0	0	15,86
2.11.2009	0	0	0,6	15,86
3.11.2009	0	0	0,2	15,86
4.11.2009	0	0	-0,7	15,86
5.11.2009	0,1	0	-0,1	15,86
6.11.2009	1,7	0	-0,2	15,86
7.11.2009	0,9	3	0,3	15,86
8.11.2009	0,1	2	0,5	15,86
9.11.2009	0,1	0	0,6	15,86
10.11.2009	12,5	0	0,1	15,86
11.11.2009	0,2	9	-0,4	15,88
12.11.2009	0	8	-2,5	15,88
13.11.2009	0	8	-4,8	16,31
14.11.2009	0,1	8	-4	16,59
15.11.2009	0	8	0,8	16,59
16.11.2009	0,5	8	0	16,59
17.11.2009	0,8	7	0,5	14,4
18.11.2009	1,9	6	1,4	11,59
19.11.2009	0,1	2	1,9	11,59
20.11.2009	9,1	0	1,7	11,59
21.11.2009	1,4	0	4,9	11,62
22.11.2009	6,2	0	1,6	11,62
23.11.2009	1	0	3,7	31,09
24.11.2009	1,5	0	4,7	42,76
25.11.2009	5,5	0	3	45
26.11.2009	1,8	0	3,7	78,3
27.11.2009	0,8	0	4,8	144,06
28.11.2009	0	0	3,7	143,26
29.11.2009	0,2	0	3,3	118,96
30.11.2009	2,5	0	3	107,64
1.12.2009	3,6	0	3,2	160,09
2.12.2009	0	0	-0,7	158,64
3.12.2009	0,1	0	-3,2	123,87
4.12.2009	0	0	-4,4	108,47
5.12.2009	0	0	-3,7	111,84
6.12.2009	0	0	-2,1	112,17
7.12.2009	0	0	-0,7	94,14
8.12.2009	0	0	-0,5	80,66
9.12.2009	0	0	0,1	80,68
10.12.2009	0	0	-2,2	76,52
11.12.2009	0	2	-3,1	69,74
12.12.2009	1,1	2	-2,9	69,72

13.12.2009	0	4	-8,2	69,63
14.12.2009	0,1	4	3,4	69,62
15.12.2009	0,7	4	4,2	66,97
16.12.2009	0	6	5,1	62,89
17.12.2009	0	6	7,8	62,72
18.12.2009	0	6	1,6	62,7
19.12.2009	0	6	1	50,8
20.12.2009	0,7	6	2,8	44,38
21.12.2009	6,7	9	1,2	39,46
22.12.2009	1,6	15	1,1	31,92
23.12.2009	10,1	16	-7,3	30,21
24.12.2009	1	24	1	28,36
25.12.2009	0	22	-22,2	28,36
26.12.2009	2,7	21	3,6	28,36
27.12.2009	1,6	21	5,9	28,36
28.12.2009	2,2	21	5,3	28,36
29.12.2009	1,2	21	-4	28,36
30.12.2009	1,4	21	1,6	28,36
31.12.2009	0,3	24	1,9	28,36
1.1.2010	0	24	5,8	28,36
2.1.2010	0	23	9,7	28,36
3.1.2010	1,7	23	-22,8	28,36
4.1.2010	2,9	26	4,7	28,36
5.1.2010	0,7	30	3	28,36
6.1.2010	0,7	33	9,9	28,36
7.1.2010	0,4	31	-21,9	28,36
8.1.2010	0,5	31	-22,2	28,36
9.1.2010	0,4	31	-21,5	28,36
10.1.2010	0,3	30	6	28,36
11.1.2010	0	29	-7,9	28,36
12.1.2010	0	29	-4,7	28,35
13.1.2010	0	28	-8,9	23,45
14.1.2010	0,1	28	1,4	21,24
15.1.2010	0	28	-8,8	21,24
16.1.2010	0	27	-7,2	21,18
17.1.2010	0	28	-7,3	21,16
18.1.2010	0	26	-9	19,84
19.1.2010	0	28	4,8	17,64
20.1.2010	0	27	7,7	17,64
21.1.2010	0	27	-20,4	17,64
22.1.2010	0	27	-22,4	17,64
23.1.2010	0	27	-23,9	17,64
24.1.2010	0	27	-20,3	17,64
25.1.2010	0	28	6,2	17,63
26.1.2010	0	28	-22,3	17,6
27.1.2010	0,1	28	-22,4	17,6

28.1.2010	1,7	29	-22	17,6
29.1.2010	1,9	30	6,8	17,6
30.1.2010	1,9	34	2,9	17,6
31.1.2010	3,3	37	-8,5	17,6
1.2.2010	14,9	40	-7,1	17,6
2.2.2010	2,4	50	-5,6	18,4
3.2.2010	1,6	49	0,4	21,3
4.2.2010	7,3	50	-6	28,04
5.2.2010	0,4	53	-3,7	31,9
6.2.2010	0,1	52	-4,8	38,25
7.2.2010	0,2	51	-5,2	40,02
8.2.2010	3	50	-5,1	34,95
9.2.2010	0,6	52	0,2	27,31
10.2.2010	0	51	7,2	24,44
11.2.2010	0,4	50	6,9	24,42
12.2.2010	0	51	3,3	24,4
13.2.2010	0	50	6,7	24,32
14.2.2010	0	49	4	24,32
15.2.2010	0	50	0,1	24,32
16.2.2010	0	49	2,3	24,31
17.2.2010	0	49	-23,5	24,28
18.2.2010	0	48	-21,8	24,2
19.2.2010	0	48	-24,4	24,2
20.2.2010	0	48	-24,3	24,2
21.2.2010	6,5	48	9,1	24,19
22.2.2010	0,3	54	5,1	21,1
23.2.2010	11,6	54	3,9	18,49
24.2.2010	0	66	4,6	20,45
25.2.2010	0	65	2,8	25,18
26.2.2010	0,8	63	-8,9	26,18
27.2.2010	2,2	62	-2,4	26,18
28.2.2010	3,5	62	0,5	26,17
1.3.2010	8,1	60	0,4	26,06
2.3.2010	4,1	62	0	32,68
3.3.2010	7	65	-2	42,37
4.3.2010	2,2	72	-4,9	42,06
5.3.2010	4	73	1,8	42,06
6.3.2010	0	76	-9,7	42
7.3.2010	0,3	74	4,9	41,85
8.3.2010	0,5	72	-3,4	37,29
9.3.2010	2,3	71	-5,6	35,38
10.3.2010	3,3	71	-5,4	30,09
11.3.2010	3,9	75	-0,3	26,92
12.3.2010	0	69	-6	26,88
13.3.2010	0	68	-7,3	26,76
14.3.2010	0,6	66	1,8	26,76

15.3.2010	0	68	2,8	26,76
16.3.2010	0	68	6	26,17
17.3.2010	0	68	2,8	23,2
18.3.2010	5,3	67	-9,4	23,2
19.3.2010	4,3	74	-3,6	23,2
20.3.2010	1,9	75	-0,9	23,2
21.3.2010	0	73	-3,7	23,2
22.3.2010	0	73	-8,2	23,2
23.3.2010	0	72	-3,9	26,03
24.3.2010	0	72	-6,9	30
25.3.2010	1,3	71	-8	30
26.3.2010	0,1	71	1,2	28,54
27.3.2010	3,9	70	1,6	29,83
28.3.2010	2,2	66	1,6	29,8
29.3.2010	4,7	63	1	30
30.3.2010	1,9	60	1,4	30,12
31.3.2010	0,5	56	2	30,12
1.4.2010	0	51	5,2	30,12
2.4.2010	0,1	43	4,3	30,12
3.4.2010	0,9	40	3,8	30,12
4.4.2010	0,7	36	4,5	30,12
5.4.2010	0	31	2,8	30,12
6.4.2010	1	28	4,3	41,64
7.4.2010	0	25	2,8	61,77
8.4.2010	0,5	23	2,8	71,93
9.4.2010	0,7	21	4,3	80,48
10.4.2010	0,1	17	4,8	92,89
11.4.2010	0	13	3,9	104,68
12.4.2010	0	8	5,6	125,91
13.4.2010	0	0	6,2	153
14.4.2010	0	0	2,7	154,65
15.4.2010	2,1	0	4,4	158,95
16.4.2010	0,1	0	3,5	165,91
17.4.2010	2,6	0	2,7	170,71
18.4.2010	1,6	0	1,9	175,96
19.4.2010	0	0	2,3	178,81
20.4.2010	0,1	0	2,9	181,46
21.4.2010	0	0	4,1	184,85
22.4.2010	0,1	0	3,4	187,72
23.4.2010	0,8	0	0,9	191,86
24.4.2010	2,1	0	0,5	195,58
25.4.2010	0	0	2,3	198,3
26.4.2010	0	0	6,8	191,6
27.4.2010	3,5	0	6,7	175,18
28.4.2010	0	0	2,8	173,94
29.4.2010	1,2	0	2,4	177,22

30.4.2010	3,3	0	4,5	163,34
1.5.2010	11	0	7,3	158,07
2.5.2010	4,2	0	4,9	178,61
3.5.2010	0	0	4,3	194,74
4.5.2010	0	0	2,8	190,53
5.5.2010	0	0	4,8	176,03
6.5.2010	0	0	4,9	168,2
7.5.2010	0,5	0	5,1	169,7
8.5.2010	3,1	0	3,9	171,02
9.5.2010	0	0	6,4	173,81
10.5.2010	0,7	0	8,2	175,64
11.5.2010	0	0	10	186,56
12.5.2010	0	0	12,7	205,11
13.5.2010	0,8	0	15,5	187,46
14.5.2010	0	0	19,8	175,64
15.5.2010	0	0	19,5	174,66
16.5.2010	1	0	19,8	173,86
17.5.2010	4	0	18,3	165,71
18.5.2010	0,1	0	18,4	158,58
19.5.2010	0	0	17,8	156,64
20.5.2010	0	0	18	156,19
21.5.2010	0	0	18,2	156,03
22.5.2010	0	0	13,9	155,94
23.5.2010	0,3	0	12,4	155,93
24.5.2010	3,3	0	12,9	155,26
25.5.2010	7,2	0	10,3	154,31
26.5.2010	4,3	0	10,2	152,74
27.5.2010	0	0	10,5	152,19
28.5.2010	4,6	0	9,8	151,49
29.5.2010	5,3	0	9,9	150,53
30.5.2010	4,2	0	9,5	148,85
31.5.2010	0	0	13,3	122,87
1.6.2010	0	0	14	109,73
2.6.2010	0	0	15,1	144,44
3.6.2010	5,6	0	12,8	161,09
4.6.2010	0,3	0	10,9	120,48
5.6.2010	3,4	0	7,1	69,22
6.6.2010	0	0	9,9	69,27
7.6.2010	0	0	9,5	78,14
8.6.2010	0,1	0	10,5	84,47
9.6.2010	4,5	0	11,5	84,47
10.6.2010	0	0	13,1	84,37
11.6.2010	17,3	0	15,2	84,19
12.6.2010	20	0	11,8	86,25
13.6.2010	0	0	10,6	110,58
14.6.2010	0	0	11,2	118,63

15.6.2010	1,2	0	11,9	110,22
16.6.2010	0	0	10,7	110,37
17.6.2010	0,5	0	12,5	110,82
18.6.2010	0,2	0	14,5	110,95
19.6.2010	3,5	0	17	112,77
20.6.2010	3,2	0	16,3	114,52
21.6.2010	0	0	13,2	101,34
22.6.2010	0	0	14,2	93,64
23.6.2010	0	0	15,3	93,75
24.6.2010	0	0	17	93,79
25.6.2010	3,5	0	19,3	93,72
26.6.2010	0	0	18	87,94
27.6.2010	0	0	14,5	83,51
28.6.2010	0	0	14,4	83,31
29.6.2010	0	0	16,5	36,36
30.6.2010	0	0	20,9	22,07
1.7.2010	1,8	0	19,3	22,07
2.7.2010	0	0	14,6	28,67
3.7.2010	0	0	17,1	30,58
4.7.2010	0	0	23,6	29,11
5.7.2010	0	0	23,3	17,45
6.7.2010	0	0	23	10,45
7.7.2010	0,1	0	22,4	10,06
8.7.2010	10,6	0	21,4	9,4
9.7.2010	0,1	0	21,4	9,4
10.7.2010	0	0	21,6	9,4
11.7.2010	0	0	22,4	9,4
12.7.2010	0	0	25,6	9,4
13.7.2010	0	0	27,1	9,4
14.7.2010	0	0	26,1	9,4
15.7.2010	0,1	0	23,6	8,81
16.7.2010	0	0	23,9	9,11
17.7.2010	0	0	19,9	11,16
18.7.2010	1,7	0	20,9	11,16
19.7.2010	0	0	20,2	11,15
20.7.2010	0,3	0	19,1	9,37
21.7.2010	0,1	0	20,8	7,61
22.7.2010	0,1	0	24,1	7,59
23.7.2010	0	0	17,8	7,59
24.7.2010	0,3	0	15,7	7,58
25.7.2010	0	0	19	7,58
26.7.2010	0,1	0	26	7,58
27.7.2010	0	0	26	7,59
28.7.2010	0	0	26,2	7,58
29.7.2010	0	0	28,9	7,58
30.7.2010	1	0	22,5	7,58

31.7.2010	4,7	0	20	7,58
1.8.2010	0	0	20,1	7,58
2.8.2010	0,4	0	20,8	7,57
3.8.2010	0,1	0	21	7,54
4.8.2010	0	0	23,9	7,53
5.8.2010	0	0	19,4	7,56
6.8.2010	0	0	20,6	7,53
7.8.2010	0	0	23,6	7,53
8.8.2010	0,4	0	27,3	7,53
9.8.2010	4,3	0	22,7	7,53
10.8.2010	6,1	0	19,5	6,96
11.8.2010	4,2	0	18,6	5,81
12.8.2010	0	0	19	5,81
13.8.2010	0	0	20,7	5,81
14.8.2010	0,1	0	23	5,81
15.8.2010	0	0	19,8	5,81
16.8.2010	0	0	13,7	5,81
17.8.2010	0	0	14,1	5,81
18.8.2010	0	0	13,8	5,8
19.8.2010	0	0	13,2	5,81
20.8.2010	0	0	12,9	5,81
21.8.2010	12,3	0	15,8	5,81
22.8.2010	18,3	0	15,9	5,81
23.8.2010	5	0	14,2	5,81
24.8.2010	8,9	0	10,4	5,81
25.8.2010	8,2	0	12,1	5,81
26.8.2010	1,8	0	9,5	5,81
27.8.2010	0	0	8,7	5,81
28.8.2010	1,8	0	9,3	5,81
29.8.2010	0,1	0	9,6	5,81
30.8.2010	0	0	9,2	5,81
31.8.2010	1,1	0	10,4	5,81
1.9.2010	6,2	0	9,7	5,81
2.9.2010	3	0	8,6	5,81
3.9.2010	1	0	7,5	5,78
4.9.2010	0,7	0	7,4	5,81
5.9.2010	0	0	10	5,81
6.9.2010	0,1	0	11	5,81
7.9.2010	0	0	13,3	5,81
8.9.2010	0	0	12,5	5,81
9.9.2010	0	0	12,8	5,81
10.9.2010	0	0	12,2	5,81
11.9.2010	0	0	12,8	5,81
12.9.2010	1,1	0	14,1	5,81
13.9.2010	19,8	0	14,7	5,81
14.9.2010	0,2	0	12,5	5,81

15.9.2010	4,7	0	13,4	5,82
16.9.2010	0	0	11,1	5,83
17.9.2010	1	0	10,8	5,81
18.9.2010	4,7	0	10,9	5,81
19.9.2010	1,1	0	9,7	5,82
20.9.2010	0,3	0	9,8	5,84
21.9.2010	15,3	0	9,4	5,84
22.9.2010	2,4	0	10,1	25,63
23.9.2010	0,7	0	10	27,36
24.9.2010	0,1	0	12,5	20,11
25.9.2010	4,5	0	10,7	20,11
26.9.2010	0	0	6,2	20,11
27.9.2010	0	0	4,9	18,08
28.9.2010	0	0	4,7	32,46
29.9.2010	0	0	6,7	40,44
30.9.2010	0	0	7,1	55,22
1.10.2010	0	0	4,6	68,87
2.10.2010	0	0	7	68,87
3.10.2010	0	0	5,1	68,84
4.10.2010	0	0	7,8	68,69
5.10.2010	0	0	6,8	44,58
6.10.2010	0	0	6,3	25,55
7.10.2010	0	0	7,8	25,57
8.10.2010	0	0	8,1	25,58
9.10.2010	0,1	0	8,7	33,18
10.10.2010	3,4	0	5,5	38,57
11.10.2010	1,9	0	4,1	38,53
12.10.2010	0	0	1,7	47,87
13.10.2010	0,2	0	2,4	71,08
14.10.2010	15,2	0	0,7	73,97
15.10.2010	0,5	2	0,3	47,07
16.10.2010	2	0	0,5	27,07
17.10.2010	0,3	0	1,4	27,07
18.10.2010	0	0	5	27,17
19.10.2010	0	0	5	27,16
20.10.2010	8,4	0	4,6	20,55
21.10.2010	2,8	0	1,3	16,63
22.10.2010	2,1	0	0,5	16,78
23.10.2010	1,4	2	0,5	16,79
24.10.2010	0	0	1,8	16,79
25.10.2010	0	0	0,1	16,79
26.10.2010	0	0	0,3	16,79
27.10.2010	2,4	0	-0,8	20,78
28.10.2010	2,5	0	3	36,41
29.10.2010	0,3	0	5,7	43,68
30.10.2010	1,9	0	3	43,65

31.10.2010	2,4	0	7,3	43,7
1.11.2010	0,1	0	7,2	43,6
2.11.2010	2,8	0	1,3	40,32
3.11.2010	7,4	0	5,4	30,89
4.11.2010	2,3	0	4,2	30,98
5.11.2010	0,1	0	-0,1	33,01
6.11.2010	1,8	0	-2,6	36,21
7.11.2010	4,3	0	-0,6	36,26
8.11.2010	0	7	-2,5	44,29
9.11.2010	10,9	5	-4	49,59
10.11.2010	0,5	12	0,6	49,58
11.11.2010	0,4	11	-0,9	49,8
12.11.2010	1,1	9	-0,4	53,16
13.11.2010	4	9	0,5	55,88
14.11.2010	0,5	11	-2	55,95
15.11.2010	2,1	10	0,8	55,93
16.11.2010	0,1	7	0,2	55,89
17.11.2010	0	7	-5,1	55,87
18.11.2010	5,2	7	-5,8	52,11
19.11.2010	0	12	-7,4	49,54
20.11.2010	0	11	-5,7	44,48
21.11.2010	0	11	-8,1	29,42
22.11.2010	0,2	10	-4,7	29,42
23.11.2010	0	11	-9	24,7
24.11.2010	0,2	11	-6,8	18,91
25.11.2010	2,3	6	-9,9	16,3
26.11.2010	0,1	10	-9,3	13,99
27.11.2010	0	9	0,9	12,96
28.11.2010	0,3	9	4,7	12,99
29.11.2010	0	8	7,8	12,85
30.11.2010	0,2	8	2,5	13,36
1.12.2010	1,4	10	-7,8	20,31
2.12.2010	0	11	-6,2	22,76
3.12.2010	0,2	11	-8,1	17,02
4.12.2010	0	12	1,5	11,13
5.12.2010	0,6	11	-8,9	11,13
6.12.2010	5,9	13	-5,6	11,16
7.12.2010	0	20	-8,6	11,17
8.12.2010	0,1	19	-4,6	11,17
9.12.2010	0,1	18	-5,4	12,16
10.12.2010	0	18	1,1	12,99
11.12.2010	0	17	5,9	12,99
12.12.2010	0,4	17	3	12,99
13.12.2010	0	17	4,4	12,98
14.12.2010	0	18	9,6	10,48
15.12.2010	2,1	18	7,7	8,26

16.12.2010	0	18	4,6	8,26
17.12.2010	0	18	4,5	9,64
18.12.2010	0	19	7,9	10,81
19.12.2010	1,6	19	6,7	10,8
20.12.2010	6,3	21	3,9	10,8
21.12.2010	0,9	27	3,1	10,81
22.12.2010	0	26	-21,4	10,81
23.12.2010	0	27	-27,4	10,81
24.12.2010	0	26	-26,8	10,81
25.12.2010	1,5	26	-20,3	10,79
26.12.2010	0	26	1,4	10,77
27.12.2010	0	25	1,7	10,77
28.12.2010	0	25	4,4	10,77
29.12.2010	0	25	6,1	10,77
30.12.2010	10,3	24	6,1	10,77
31.12.2010	1,5	35	0,4	10,79
1.1.2011	0,2	36	0,4	10,77
2.1.2011	1,6	34	3,1	10,77
3.1.2011	0,7	36	4,3	10,77
4.1.2011	0,4	36	9,1	10,77
5.1.2011	0	38	3,9	14,22
6.1.2011	0,9	38	0,1	19,05
7.1.2011	5,3	39	-7,3	19,8
8.1.2011	5,9	42	-5,6	24,45
9.1.2011	7	46	0,6	28,81
10.1.2011	1	46	0,5	32,33
11.1.2011	2,9	45	-0,2	38,47
12.1.2011	1,3	49	-2,1	37,89
13.1.2011	4,9	49	-4,5	37,79
14.1.2011	0,8	51	1,6	37,73
15.1.2011	0	51	-20,3	37,66
16.1.2011	10,5	50	-21,4	37,54
17.1.2011	1,7	60	-7,9	37,53
18.1.2011	3,1	60	-5,5	37,47
19.1.2011	1,4	62	-4,1	38,2
20.1.2011	0	61	-7,9	38,48
21.1.2011	0,8	61	-9,7	38,44
22.1.2011	2,1	60	-5,5	38,39
23.1.2011	0,2	61	-9,6	38,24
24.1.2011	8,6	60	-6,2	38,23
25.1.2011	0,1	68	2,4	38,18
26.1.2011	0,2	67	9,5	38,05
27.1.2011	0,3	66	2,2	38,01
28.1.2011	0,6	65	0,1	31,12
29.1.2011	2,4	63	0,6	25,35
30.1.2011	3,2	61	-8,6	25,33

31.1.2011	2,5	62	-6,5	25,32
1.2.2011	2,9	62	-4,8	25,21
2.2.2011	3	64	-3,2	18,15
3.2.2011	11,6	65	-2,3	18,52
4.2.2011	0,9	78	-2,9	18,53
5.2.2011	0,4	77	-8,4	18,52
6.2.2011	1,6	75	4,5	18,41
7.2.2011	0	77	5,6	18,16
8.2.2011	1,8	76	-6,4	17,73
9.2.2011	0,2	76	-9,2	17,73
10.2.2011	0	76	6,7	17,73
11.2.2011	0,8	74	9,2	17,73
12.2.2011	0	75	9,5	17,73
13.2.2011	0	74	-22,8	17,73
14.2.2011	0	74	-25,1	17,73
15.2.2011	0	73	-21,8	17,73
16.2.2011	0	73	-26,9	17,72
17.2.2011	0	73	-30,4	17,71
18.2.2011	0	72	-27,9	17,71
19.2.2011	0	72	-26,9	17,71
20.2.2011	0	72	-22,6	17,71
21.2.2011	0	72	-25,8	17,71
22.2.2011	0	72	-22,4	19,11
23.2.2011	0	72	8,2	21,07
24.2.2011	0	72	-22,7	22,19
25.2.2011	0,8	72	7,7	24,43
26.2.2011	0,1	73	-5,9	24,38
27.2.2011	0	73	-2,7	24,33
28.2.2011	0	72	-4,6	25,93
1.3.2011	0	72	-5,9	30,89
2.3.2011	0	71	0	42,24
3.3.2011	0	71	0,9	47,61
4.3.2011	0	70	0,5	44,86
5.3.2011	1,3	68	0,9	37,21
6.3.2011	0	69	-6,7	37,05
7.3.2011	0	69	-5,5	31,1
8.3.2011	0,4	69	0	26,13
9.3.2011	0	69	0	24,14
10.3.2011	2,2	68	1,5	18,55
11.3.2011	7,6	69	-0,6	18,55
12.3.2011	0	78	-2,4	20,98
13.3.2011	0	76	-4,5	25,03
14.3.2011	5,1	75	-2,5	25,03
15.3.2011	0	79	-6	22,87
16.3.2011	0	78	-9	16,94
17.3.2011	0	78	-5,9	13,04

18.3.2011	0	77	0,5	13,04
19.3.2011	1,7	76	0,2	13,04
20.3.2011	0,3	78	0	13,04
21.3.2011	0,9	76	-0,8	11,81
22.3.2011	1,5	75	3,8	10,76
23.3.2011	2,6	75	-0,2	10,74
24.3.2011	1	79	-5,2	10,77
25.3.2011	0	78	-7,7	10,77
26.3.2011	0	77	-8,1	10,77
27.3.2011	2,3	76	-4,3	10,77
28.3.2011	2,8	79	-3	15,82
29.3.2011	0	82	-8	25,03
30.3.2011	0	81	-9,8	35,5
31.3.2011	0	81	-3,3	39,58
1.4.2011	0	80	0,5	39,53
2.4.2011	0	79	2,4	41,19
3.4.2011	4,9	68	4,5	45,31
4.4.2011	10,7	62	3,5	32,73
5.4.2011	0,1	57	5,2	38,52
6.4.2011	3,5	53	2,4	64,57
7.4.2011	0	49	2,2	74,34
8.4.2011	0	46	2,2	73,78
9.4.2011	0	42	2,3	73,7
10.4.2011	0	40	3,3	73,66
11.4.2011	0	37	2	78,07
12.4.2011	0	35	3	85,23
13.4.2011	0	32	4,6	85,34
14.4.2011	0	27	3,1	98,18
15.4.2011	0	25	6	124,02
16.4.2011	0	21	8,1	130,66
17.4.2011	1,6	14	7,9	132,1
18.4.2011	0	0	4,6	203,18
19.4.2011	0	0	2,9	264,13
20.4.2011	2,2	0	1,7	289,43
21.4.2011	0,1	0	2,5	312,19
22.4.2011	0,1	0	4,1	318,89
23.4.2011	0	0	7,1	325,82
24.4.2011	0	0	8,8	332,78
25.4.2011	0	0	8,5	339,69
26.4.2011	0	0	9,9	343,68
27.4.2011	0	0	7,6	264,65
28.4.2011	0	0	5,9	217,36
29.4.2011	0	0	6,3	193,57
30.4.2011	0	0	3,5	171,93
1.5.2011	0	0	3,1	175,84
2.5.2011	0	0	1,8	191,26

3.5.2011	0	0	3,2	199,15
4.5.2011	0	0	4,6	194,83
5.5.2011	0	0	4	182,41
6.5.2011	0	0	6,9	182,96
7.5.2011	0	0	8,8	182,71
8.5.2011	0	0	10,3	181,4
9.5.2011	0	0	15,1	175,9
10.5.2011	0	0	12,4	146,69
11.5.2011	0,1	0	11,5	118,2
12.5.2011	0,1	0	11,1	119,86
13.5.2011	0	0	7,9	120,51
14.5.2011	0	0	7,5	107,55
15.5.2011	0	0	11	107,76
16.5.2011	9,1	0	8,8	111,78
17.5.2011	9,8	0	8,9	124,68
18.5.2011	3,6	0	7,9	111,34
19.5.2011	3,4	0	9,3	111,55
20.5.2011	0	0	12,8	111,28
21.5.2011	3,4	0	12,4	111,33
22.5.2011	0	0	14,3	111,33
23.5.2011	3,5	0	14,4	111,32
24.5.2011	3,2	0	13,6	111,01
25.5.2011	0,5	0	11,2	110,76
26.5.2011	0	0	9,4	110,23
27.5.2011	1,5	0	10,2	97,91
28.5.2011	5,8	0	11,1	92,06
29.5.2011	0,9	0	11,4	92,07
30.5.2011	0,6	0	10,7	92,01
31.5.2011	0	0	16,6	103,05
1.6.2011	2,8	0	21	109,71
2.6.2011	0,5	0	14,8	108,77
3.6.2011	0	0	13,6	94,81
4.6.2011	0,6	0	16,7	92,29
5.6.2011	0	0	12,2	111,35
6.6.2011	0	0	16	110,87
7.6.2011	0	0	19,5	65,7
8.6.2011	0	0	20,2	24,57
9.6.2011	0	0	21,5	14,13
10.6.2011	0	0	23,1	14,13
11.6.2011	0	0	21,7	12,07
12.6.2011	6,4	0	15,8	10,74
13.6.2011	0	0	10	13,19
14.6.2011	6,6	0	9,8	17,16
15.6.2011	0	0	13,7	52,23
16.6.2011	0,2	0	14,9	59,87
17.6.2011	0,4	0	15,4	31,66

18.6.2011	1,9	0	14,7	17,61
19.6.2011	4,6	0	15,7	17,61
20.6.2011	5,8	0	14,1	17,61
21.6.2011	4,1	0	13,5	33,02
22.6.2011	2,6	0	15,7	40,3
23.6.2011	3,6	0	16,2	34,05
24.6.2011	0	0	15,6	30,79
25.6.2011	1,2	0	15,3	28,83
26.6.2011	0,3	0	16,4	28,87
27.6.2011	0,4	0	17,1	26,55
28.6.2011	0	0	19	18,35
29.6.2011	0	0	21,8	14,28
30.6.2011	0	0	21	14,29
1.7.2011	0	0	24,6	14,29
2.7.2011	0	0	23,9	14,29
3.7.2011	4,4	0	15,9	14,29
4.7.2011	0	0	13,2	16,28
5.7.2011	0	0	15,9	20,27
6.7.2011	0	0	18,8	15,8
7.7.2011	0	0	20,7	13,52
8.7.2011	0	0	23	13,43
9.7.2011	0	0	24,6	13,44
10.7.2011	1	0	21,7	13,43
11.7.2011	1,5	0	22,5	13,43
12.7.2011	24,1	0	18,6	13,48
13.7.2011	3,3	0	15,5	13,59
14.7.2011	0	0	15,6	13,59
15.7.2011	7,7	0	17	13,53
16.7.2011	1,4	0	17,1	13,54
17.7.2011	0	0	16,3	13,59
18.7.2011	0	0	19,8	13,57
19.7.2011	48,6	0	20,7	13,5
20.7.2011	1,1	0	19,8	13,59
21.7.2011	15,1	0	21,8	13,59
22.7.2011	0	0	23,9	13,59
23.7.2011	0	0	24,5	13,59
24.7.2011	1,8	0	21,8	13,59
25.7.2011	0	0	19,8	13,67
26.7.2011	0	0	20,7	13,63
27.7.2011	0	0	21,5	13,59
28.7.2011	0	0	22,2	13,58
29.7.2011	0	0	20,9	13,44
30.7.2011	0	0	18,2	13,43
31.7.2011	0	0	16,2	13,57
1.8.2011	0	0	12,6	13,59
2.8.2011	0	0	15,5	13,59

3.8.2011	0	0	17,5	13,59
4.8.2011	0	0	19,3	13,59
5.8.2011	14,1	0	14	13,59
6.8.2011	2,9	0	15,9	13,59
7.8.2011	7,8	0	18	13,59
8.8.2011	0,3	0	17,6	54,37
9.8.2011	1,5	0	15,1	63,42
10.8.2011	3,3	0	14,1	59,49
11.8.2011	0	0	12,7	59,69
12.8.2011	0	0	13	59,65
13.8.2011	0	0	13,8	59,71
14.8.2011	0	0	16,3	59,61
15.8.2011	0	0	16,5	54,68
16.8.2011	0	0	15,8	38,36
17.8.2011	4,2	0	14,8	35,07
18.8.2011	29,5	0	13,5	37,42
19.8.2011	0	0	14,6	62,79
20.8.2011	0	0	14,5	81,94
21.8.2011	0	0	16	81,92
22.8.2011	0	0	16,8	94,71
23.8.2011	0	0	16,8	101,4
24.8.2011	0,1	0	15,6	85,3
25.8.2011	0	0	15,5	58,35
26.8.2011	0	0	18,9	35,12
27.8.2011	0	0	20,2	22,04
28.8.2011	0	0	20,1	25,86
29.8.2011	1,2	0	15,1	47,16
30.8.2011	1,3	0	13,4	51,59
31.8.2011	10,6	0	13,3	56,4
1.9.2011	0,7	0	13,7	70,86
2.9.2011	1,2	0	13,7	71,7
3.9.2011	0	0	12	51,27
4.9.2011	0	0	9,3	31,95
5.9.2011	0	0	13,7	12,39
6.9.2011	0,1	0	15,8	12,39
7.9.2011	0	0	15,4	11,74
8.9.2011	5,1	0	14,6	10,65
9.9.2011	0	0	14	8,48
10.9.2011	0	0	13,5	7,98
11.9.2011	0	0	11	8,22
12.9.2011	2,1	0	12,3	8,3
13.9.2011	12,4	0	14,2	14,24
14.9.2011	18,9	0	13,2	40,6
15.9.2011	1,5	0	13,3	56,85
16.9.2011	0,5	0	12,5	56,85
17.9.2011	0,2	0	10,1	56,85

18.9.2011	0	0	7,8	56,85
19.9.2011	6,2	0	9,6	46,58
20.9.2011	6,9	0	11,2	43,65
21.9.2011	11,8	0	11,7	68,44
22.9.2011	8,6	0	10,3	95,01
23.9.2011	5,3	0	9,5	105,99
24.9.2011	2,4	0	8,5	109,55
25.9.2011	0	0	7,9	109,3
26.9.2011	4,8	0	8,9	109,04
27.9.2011	2,5	0	11	109,66
28.9.2011	0,5	0	9,8	110
29.9.2011	0	0	9,4	110,05
30.9.2011	0	0	12,8	110,05
1.10.2011	0	0	7,7	110,05
2.10.2011	0	0	7,4	110,05
3.10.2011	0	0	7,1	140,81
4.10.2011	13,9	0	8,6	165,93
5.10.2011	0,1	0	9,2	132,21
6.10.2011	4,9	0	9,3	90,72
7.10.2011	1,1	0	9,8	74,32
8.10.2011	0	0	7,4	88,53
9.10.2011	0,8	0	3,5	88,53
10.10.2011	14,4	0	6,6	125,17
11.10.2011	0,6	0	6,3	161,81
12.10.2011	1	0	4,6	161,81
13.10.2011	1,2	0	4,5	150,03
14.10.2011	0	0	3,3	142,69
15.10.2011	0	0	4,3	127,99
16.10.2011	0	0	5,4	98,19
17.10.2011	0	0	6	93,61
18.10.2011	4,3	0	7,8	93,61
19.10.2011	1,8	0	5,9	105,91
20.10.2011	0,3	0	6,7	148,29
21.10.2011	0	0	4,5	166,81
22.10.2011	2,3	0	3,5	166,81
23.10.2011	0	0	2,4	165,35
24.10.2011	0	0	5,1	155,98
25.10.2011	0	0	4,1	144,31
26.10.2011	0	0	2,7	144,31
27.10.2011	0	0	3,4	144,31
28.10.2011	2,2	0	5,7	122,87
29.10.2011	0	0	6,2	52,05
30.10.2011	2,5	0	6,5	38,65
31.10.2011	0	0	7,1	38,65
1.11.2011	0,1	0	6	47,82
2.11.2011	0	0	10,1	55,57

3.11.2011	0	0	5,1	55,57
4.11.2011	0	0	5	51,37
5.11.2011	0	0	5,1	48,37
6.11.2011	0	0	3,5	48,37
7.11.2011	0	0	6	49,2
8.11.2011	0	0	5,9	50,87
9.11.2011	0	0	0,2	50,87
10.11.2011	0	0	0,2	50,87
11.11.2011	0	0	3,7	50,87
12.11.2011	0	0	1,7	50,87
13.11.2011	0	0	3	50,87
14.11.2011	0	0	2,5	50,87
15.11.2011	0	0	0	50,87
16.11.2011	0,3	0	2,1	55,64
17.11.2011	0	0	2,5	61,27
18.11.2011	1,9	0	1	61,27
19.11.2011	0,3	0	0,7	61,27
20.11.2011	0,1	0	-5,5	61,27
21.11.2011	1	0	0,4	61,27
22.11.2011	0	0	0,6	53,79
23.11.2011	0,8	0	1,1	46,15
24.11.2011	1,7	0	4,6	38,55
25.11.2011	2,8	0	3	38,55
26.11.2011	0	0	3,6	38,55
27.11.2011	5,7	0	1	38,55
28.11.2011	0	5	-0,6	34,22
29.11.2011	2,9	5	0,4	27,53
30.11.2011	0,9	4	2,8	27,69
1.12.2011	1,4	0	2,5	30,13
2.12.2011	0	0	3,3	32,63
3.12.2011	0,3	0	-0,1	32,52
4.12.2011	2,3	0	1,6	32,56
5.12.2011	0,2	0	0,8	25,29
6.12.2011	2,4	0	-0,6	20,14
7.12.2011	0	3	0,5	23,03
8.12.2011	0,8	3	0,9	29,17
9.12.2011	2,8	3	0,2	34,3
10.12.2011	4,1	9	0,2	37,07
11.12.2011	0,2	8	0,3	39,26
12.12.2011	3,6	6	-2,8	42,91
13.12.2011	2,6	9	0,9	42,91
14.12.2011	1,7	7	1,9	42,91
15.12.2011	5,7	5	1,6	42,86
16.12.2011	0,4	5	2,2	42,82
17.12.2011	4,7	4	0,7	42,81
18.12.2011	3,3	3	1,6	42,9

19.12.2011	1,4	2	1,2	43,07
20.12.2011	0,3	2	1,1	40,91
21.12.2011	0	0	0,3	25,53
22.12.2011	0,2	0	-0,5	25,58
23.12.2011	8,2	2	-0,4	25,73
24.12.2011	0	7	0,7	25,92
25.12.2011	8	5	0	25,96
26.12.2011	3,9	4	2,5	44,88
27.12.2011	0	3	1,8	78,64
28.12.2011	6,4	3	0,2	89,38
29.12.2011	3,6	11	0,9	93,2
30.12.2011	4	5	0,9	105,34
31.12.2011	0,2	8	-4,6	113,99
1.1.2012	0	8	-5,8	112,35
2.1.2012	2,9	8	-3,4	92,88
3.1.2012	0,4	11	0,7	81,55
4.1.2012	7	11	-0,1	80,75
5.1.2012	0,7	16	0,6	80,35
6.1.2012	0,1	15	-0,9	80,35
7.1.2012	0	15	-8,2	80,35
8.1.2012	0	15	-6,2	80,29
9.1.2012	1,1	14	-7,2	72,82
10.1.2012	0,1	16	3,1	60,1
11.1.2012	0	15	-7,1	46,27
12.1.2012	8	15	-2,8	35,56
13.1.2012	4,5	25	-3,4	29,69
14.1.2012	0,4	25	-6,9	29,73
15.1.2012	0	24	1,2	31,29
16.1.2012	0,8	24	-7,3	40,29
17.1.2012	4,7	24	-5,4	58,35
18.1.2012	0,2	29	-5,7	93,69
19.1.2012	1,8	29	-6,3	97,68
20.1.2012	0,6	31	-5,7	85
21.1.2012	2,1	30	-6,7	65,18
22.1.2012	1	33	-8,1	43,35
23.1.2012	3,2	33	-8,8	38,54
24.1.2012	0	35	4	35,17
25.1.2012	0,1	34	2,2	35,07
26.1.2012	0	34	1,9	35,18
27.1.2012	0	34	0,9	35,27
28.1.2012	0	33	3,5	35,27
29.1.2012	0	33	-20,7	35,27
30.1.2012	0	33	-27,4	35,27
31.1.2012	0	33	-24,6	35,27
1.2.2012	0	34	-22,8	29,36
2.2.2012	0	34	-23,6	25,78

3.2.2012	0	34	-23,7	25,69
4.2.2012	0	33	-28,5	25,69
5.2.2012	0,1	34	-27,1	25,69
6.2.2012	4	35	-9,7	25,69
7.2.2012	0,7	39	4	25,68
8.2.2012	0	41	-23,7	25,54
9.2.2012	0	40	-24,9	25,42
10.2.2012	0	40	-20,2	25,33
11.2.2012	0,1	39	-9,1	25,33
12.2.2012	1,2	38	-7,6	25,33
13.2.2012	0,4	41	3,9	25,88
14.2.2012	6,4	43	3,3	27,33
15.2.2012	0,8	46	-7,1	35,32
16.2.2012	1,1	45	-7,3	41,91
17.2.2012	4,8	47	-4,2	43,56
18.2.2012	0,2	50	-6,7	45,84
19.2.2012	7	49	-8,1	45,71
20.2.2012	2,4	53	-3,8	45,6
21.2.2012	5	55	-2,9	45,49
22.2.2012	6,3	56	-3,3	45,41
23.2.2012	0,1	62	0,1	45,35
24.2.2012	0	59	-4,9	45,2
25.2.2012	0,2	58	-5,2	45,02
26.2.2012	0	57	-8,2	44,85
27.2.2012	0	56	-8	44,63
28.2.2012	3	56	-7,2	44,34
29.2.2012	0	59	-3,6	32,89
1.3.2012	1,6	57	0,9	16,92
2.3.2012	0	52	2,2	15,77
3.3.2012	0	51	-2,8	14,95
4.3.2012	0	51	-8	14,95
5.3.2012	0	50	-9,5	14,06
6.3.2012	0	50	1,7	13,31
7.3.2012	0	50	0,9	13,31
8.3.2012	0	50	-8,9	12,66
9.3.2012	4	50	-6,2	12
10.3.2012	0	53	0,5	12
11.3.2012	2,7	52	-0,5	12
12.3.2012	0	54	2	15,08
13.3.2012	0,7	54	-0,8	16,73
14.3.2012	0	54	0,4	18,23
15.3.2012	0	54	0,9	34,63
16.3.2012	0	53	1,7	42,83
17.3.2012	0,2	52	1,8	42,64
18.3.2012	0	51	-0,4	42,58
19.3.2012	7,8	50	-2,8	42,43

20.3.2012	0	59	0,6	42,43
21.3.2012	0	58	-2,4	42,26
22.3.2012	4,4	57	1,7	39,83
23.3.2012	0,5	53	1,2	35,65
24.3.2012	0	51	-0,4	35,58
25.3.2012	0,3	51	0,2	30,36
26.3.2012	6,7	50	-0,5	21,76
27.3.2012	1,3	53	0,2	19,68
28.3.2012	0	53	3,1	19,63
29.3.2012	0,1	51	0,8	19,63
30.3.2012	0	49	-3,3	20,29
31.3.2012	0	48	-5,4	21,23
1.4.2012	0	48	-5,5	21,23
2.4.2012	0	48	-3,4	19,23
3.4.2012	0	47	-4,1	17,9
4.4.2012	0,1	47	-3,2	14,7
5.4.2012	3	47	-0,1	13,23
6.4.2012	0,3	48	0,9	13,23
7.4.2012	0	51	-6,3	13,23
8.4.2012	0	50	-5,5	13,23
9.4.2012	0	50	-2,4	13,23
10.4.2012	0	50	1,7	13,23
11.4.2012	0	48	3,2	13,23
12.4.2012	0	45	5,7	13,23
13.4.2012	5,5	36	3,8	13,23
14.4.2012	2,7	33	3,7	13,23
15.4.2012	0,3	29	1,9	26,14
16.4.2012	2,3	28	2,2	45,43
17.4.2012	6,9	26	0,5	60,07
18.4.2012	0,7	28	1,3	85,14
19.4.2012	0	25	0,5	102,33
20.4.2012	2,9	24	2,6	106,11
21.4.2012	0	19	4,4	110,93
22.4.2012	0	14	5,1	110,93
23.4.2012	3,4	8	5,8	111,15
24.4.2012	5,1	0	5,8	156,96
25.4.2012	0	0	5,4	279,49
26.4.2012	7,2	0	4,2	237,71
27.4.2012	0	0	8,7	182,7
28.4.2012	1,1	0	9	195,56
29.4.2012	0	0	5,9	210,79
30.4.2012	0	0	6,4	222,56
1.5.2012	0	0	4,5	236,16
2.5.2012	0	0	5,6	243,45
3.5.2012	0,5	0	3,8	257,91
4.5.2012	0	0	3,7	327,02

5.5.2012	7,1	0	3,8	362,92
6.5.2012	1,6	0	7,1	375,33
7.5.2012	0	0	7,4	379,93
8.5.2012	0	0	8,8	382,69
9.5.2012	0	0	11	385,23
10.5.2012	9,6	0	12,6	385,88
11.5.2012	22,2	0	13,2	385,44
12.5.2012	3,1	0	6,9	382,98
13.5.2012	0	0	6,2	380,68
14.5.2012	0	0	9,5	381,98
15.5.2012	0	0	12,5	379,15
16.5.2012	0,7	0	13,8	376,69
17.5.2012	3,3	0	17,2	374,59
18.5.2012	4,3	0	11,2	373,87
19.5.2012	0	0	12,2	360,65
20.5.2012	0	0	13,6	346,98
21.5.2012	0	0	13,2	342,67
22.5.2012	0	0	11,6	322,54
23.5.2012	0	0	11	308,5
24.5.2012	0	0	12,6	302,75
25.5.2012	2,4	0	15,2	285,35
26.5.2012	0	0	14,2	256,94
27.5.2012	0	0	15,6	250,62
28.5.2012	2,8	0	12,5	242,69
29.5.2012	0	0	8,1	211,69
30.5.2012	0	0	8,8	173,2
31.5.2012	0	0	9	172,15
1.6.2012	0	0	11,1	174,37
2.6.2012	21,1	0	10,3	164,59
3.6.2012	1,6	0	10,2	153,99
4.6.2012	7	0	9,3	131,31
5.6.2012	0,1	0	11,6	119,07
6.6.2012	6,3	0	11,9	112,81
7.6.2012	1,1	0	12,3	109,77
8.6.2012	0	0	14,9	110,11
9.6.2012	0,1	0	13,6	110,11
10.6.2012	0	0	13,8	110,39
11.6.2012	0	0	15,6	86,89
12.6.2012	1	0	14,6	65,54
13.6.2012	0	0	17,1	75,6
14.6.2012	0,9	0	16,6	70,82
15.6.2012	0	0	17,6	64,69
16.6.2012	2,3	0	18,8	62,54
17.6.2012	22,6	0	16,2	65,8
18.6.2012	0,6	0	15,4	99,28
19.6.2012	5,9	0	14,8	120,98

20.6.2012	2,2	0	13,4	140,38
21.6.2012	0,5	0	12	146,03
22.6.2012	0	0	14	109,14
23.6.2012	0	0	15	106,49
24.6.2012	7,7	0	12,3	124,87
25.6.2012	4,6	0	14,2	128,75
26.6.2012	0	0	15,7	77,87
27.6.2012	0,4	0	14,1	48,43
28.6.2012	0	0	9,8	46,34
29.6.2012	0	0	12,3	59,86
30.6.2012	3,1	0	15,8	74,27
1.7.2012	14,4	0	16,2	81,65
2.7.2012	0	0	18,2	80,22
3.7.2012	0	0	17,6	59,53
4.7.2012	0	0	17,9	35,04
5.7.2012	0	0	19,4	31,31
6.7.2012	0	0	19,9	31,49
7.7.2012	1,5	0	20,6	31,55
8.7.2012	4,2	0	20,4	31,59
9.7.2012	0,7	0	18,4	77,85
10.7.2012	0,7	0	14,9	139,11
11.7.2012	2,8	0	16,4	137,22
12.7.2012	7	0	18,1	114,04
13.7.2012	18,2	0	17,1	58,08
14.7.2012	0	0	16,6	130,23
15.7.2012	8,9	0	16	153,02
16.7.2012	3,2	0	16,7	138,06
17.7.2012	0,4	0	16,6	130,03
18.7.2012	13,6	0	14,8	120,84
19.7.2012	3,7	0	15	110,85
20.7.2012	0	0	14,9	118,67
21.7.2012	0,3	0	15	131,68
22.7.2012	12,3	0	13,4	134,31
23.7.2012	3,7	0	14,3	133,34
24.7.2012	0	0	17,8	116,62
25.7.2012	4,5	0	18,8	86,67
26.7.2012	0	0	17,9	87
27.7.2012	0	0	16,7	87,16
28.7.2012	2	0	20	87,11
29.7.2012	4,9	0	21	86,76
30.7.2012	0	0	23,9	71,63
31.7.2012	0	0	19,5	56,62
1.8.2012	0,1	0	16,3	51,44
2.8.2012	0,1	0	16,7	51,64
3.8.2012	0,1	0	19,1	67,92
4.8.2012	0,6	0	18,1	86,13

5.8.2012	0,4	0	17,8	85,88
6.8.2012	7,2	0	17,7	86,2
7.8.2012	9,1	0	17,6	107,85
8.8.2012	9,7	0	11,5	133,89
9.8.2012	0,4	0	9,2	146,54
10.8.2012	0	0	10,4	178,97
11.8.2012	0	0	11,9	218,66
12.8.2012	0	0	13,9	226,54
13.8.2012	0	0	16,6	235,1
14.8.2012	0	0	17,1	234,16
15.8.2012	0,4	0	18,1	232,64
16.8.2012	0	0	17,7	218,29
17.8.2012	0	0	17,7	182,31
18.8.2012	0	0	18,1	154,66
19.8.2012	1	0	14,1	146,92
20.8.2012	0	0	10	146,88
21.8.2012	0,1	0	11,6	117,03
22.8.2012	3,1	0	13,3	84,19
23.8.2012	9,9	0	14,3	76,31
24.8.2012	0	0	12,2	76,41
25.8.2012	0	0	13,3	76,48
26.8.2012	0	0	14,4	76,62
27.8.2012	0	0	14,7	94,3
28.8.2012	0	0	14,1	101,58
29.8.2012	0	0	13	89,62
30.8.2012	0	0	11,6	40,09
31.8.2012	0	0	10	21,59
1.9.2012	4,6	0	10,6	16,47
2.9.2012	3,6	0	11,4	16,48
3.9.2012	4	0	12,8	17,75
4.9.2012	2,5	0	12,1	25,84
5.9.2012	0	0	14,3	41,04
6.9.2012	0,2	0	10,5	47,8
7.9.2012	2,7	0	8,9	47,63
8.9.2012	11,2	0	7	47,63
9.9.2012	0	0	7,7	47,62
10.9.2012	0	0	8,1	43,16
11.9.2012	0	0	14,6	39,99
12.9.2012	14,8	0	13,9	39,86
13.9.2012	0	0	11,4	39,89
14.9.2012	2,7	0	10,4	36,53
15.9.2012	0,9	0	12	31,87
16.9.2012	0	0	11,6	31,72
17.9.2012	1,9	0	13	31,82
18.9.2012	2,8	0	12,1	31,87
19.9.2012	8,8	0	13,1	31,84

20.9.2012	1,4	0	9,3	41,79
21.9.2012	0,8	0	7	56,77
22.9.2012	2,2	0	7,8	62,53
23.9.2012	8,8	0	9,4	62,53
24.9.2012	7,1	0	7,3	74,77
25.9.2012	0	0	6,7	76,86
26.9.2012	9,6	0	5,4	47,45
27.9.2012	8,1	0	10,5	31,17
28.9.2012	0	0	8	35,08
29.9.2012	1,1	0	7,5	38,27
30.9.2012	2,3	0	10,2	38,31
1.10.2012	0,6	0	9	41,82
2.10.2012	1,3	0	11,6	56,21
3.10.2012	0,2	0	11,3	67,52
4.10.2012	0	0	11,1	82,6
5.10.2012	15,9	0	10,9	92,35
6.10.2012	0,2	0	7,7	94,58
7.10.2012	0,3	0	7,7	93,79
8.10.2012	0,1	0	7	93,89
9.10.2012	1,1	0	7,1	99,73
10.10.2012	0	0	6,9	99,97
11.10.2012	0	0	5,7	99,97
12.10.2012	0,5	0	4,2	100
13.10.2012	1,1	0	4,5	99,9
14.10.2012	0	0	4,1	99,43
15.10.2012	7,3	0	3,7	99,37
16.10.2012	5,8	0	6,9	106,64
17.10.2012	17	0	5,6	127
18.10.2012	8,5	0	6,9	155,19
19.10.2012	0,4	0	9,9	156,19
20.10.2012	0	0	3,1	156,42
21.10.2012	0	0	2,6	156,4
22.10.2012	0,9	0	-0,1	156,4
23.10.2012	1	0	1,9	162,95
24.10.2012	2,9	0	3	193,7
25.10.2012	0	0	-0,7	208,36
26.10.2012	0	0	-2,6	201,55
27.10.2012	0	0	-2,9	196,18
28.10.2012	0,9	0	0,5	196,06
29.10.2012	1	4	0	171,33
30.10.2012	4,5	3	1,4	142,54
31.10.2012	1,6	7	0,3	104,47
1.11.2012	0	8	1,9	102,89
2.11.2012	4,3	4	2,3	112,97
3.11.2012	10,6	0	2,7	115,82
4.11.2012	0,2	0	2,4	125,02

5.11.2012	0	0	2,3	142,62
6.11.2012	6,7	0	0,5	152,43
7.11.2012	0,9	8	0	148,75
8.11.2012	0,1	5	-0,6	140,97
9.11.2012	0	5	-2,7	135,41
10.11.2012	2,2	5	0	135,35
11.11.2012	4,4	3	1,5	135,08
12.11.2012	2,5	0	4	135,33
13.11.2012	0	0	-0,3	129,7
14.11.2012	0,6	0	1,9	125,97
15.11.2012	0	0	3,2	126,43
16.11.2012	0	0	1,5	126,64
17.11.2012	0,1	0	3,3	126,43
18.11.2012	2,5	0	4,4	126,34
19.11.2012	0,4	0	3,3	119,4
20.11.2012	5,7	0	4,1	114,61
21.11.2012	0,1	0	6,4	114,75
22.11.2012	0,3	0	5,3	113,46
23.11.2012	0,9	0	4,1	112,72
24.11.2012	5,1	0	4,6	112,72
25.11.2012	0,2	0	3,1	113
26.11.2012	0	0	1,1	113,22
27.11.2012	0,1	0	0,8	98,31
28.11.2012	0	0	-6	88,38
29.11.2012	0	2	-9,6	88,61
30.11.2012	1	3	0,1	88,61
1.12.2012	0,7	3	0,8	88,54
2.12.2012	3,8	4	1,2	88,28
3.12.2012	0	9	8,1	86,82
4.12.2012	2,6	7	8,1	61,08
5.12.2012	1	12	3,6	50,29
6.12.2012	0,2	11	7,8	44,16
7.12.2012	5	10	-8,8	44,16
8.12.2012	7	15	-5,7	44,16
9.12.2012	1,3	21	-7,1	44,16
10.12.2012	0,5	20	-7,2	39,93
11.12.2012	9,1	20	-7,3	35,63
12.12.2012	1,4	28	-2,1	35,69
13.12.2012	2,4	28	-6	35,69
14.12.2012	2,7	28	-5,2	35,69
15.12.2012	0,3	29	-8,9	35,69
16.12.2012	4,1	29	0,1	35,69
17.12.2012	0,6	32	0,6	35,7
18.12.2012	0	31	3,8	34,94
19.12.2012	0	30	7,1	33,25
20.12.2012	0	29	5,8	33,17

21.12.2012	0	31	9,9	33,17
22.12.2012	0,2	29	-23	33,17
23.12.2012	0	29	9,9	33,17
24.12.2012	0,9	29	6,1	33,17
25.12.2012	0	32	4,2	33,17
26.12.2012	1,4	31	6,4	33,16
27.12.2012	1,9	33	-7	33,15
28.12.2012	0	34	-5	30,68
29.12.2012	0,1	33	0,1	27,35
30.12.2012	10,4	32	-5,7	27,05
31.12.2012	4,7	40	-0,6	27,05
1.1.2013	6,4	38	1	27,05
2.1.2013	0,6	35	1	27,05
3.1.2013	0	33	-0,7	27,05
4.1.2013	1,1	33	-2,3	27,05
5.1.2013	0,1	33	-8,8	27,05
6.1.2013	0	34	-8,9	27,05
7.1.2013	0,4	35	2,4	27,05
8.1.2013	2,3	36	-4,4	26,98
9.1.2013	1,2	38	-2,4	27,91
10.1.2013	0,1	41	-5,1	28,71
11.1.2013	0	39	-7,7	28,71
12.1.2013	0	39	2,3	28,71
13.1.2013	0	38	0,4	28,71
14.1.2013	0	37	-5,6	30,49
15.1.2013	0	38	-6,9	32,27
16.1.2013	0	38	2,2	32,27
17.1.2013	0	38	-20,1	32,27
18.1.2013	0	37	9,9	32,27
19.1.2013	1,9	38	-7,4	32,27
20.1.2013	0,1	40	-9,5	32,25
21.1.2013	0	40	1,2	32,25
22.1.2013	0,3	39	-6,1	32,12
23.1.2013	0	39	1,7	32,1
24.1.2013	0	40	0,3	32,1
25.1.2013	1,7	40	-8,2	32,1
26.1.2013	2,5	42	-5,1	32,08
27.1.2013	0,3	45	-3,7	32,08
28.1.2013	1,1	44	-6,7	32,08
29.1.2013	0,3	46	-0,4	32,08
30.1.2013	10,3	45	0,4	32,08
31.1.2013	3,7	51	0,2	32,08
1.2.2013	0	52	0,9	31,14
2.2.2013	0,1	51	-3,7	30,34
3.2.2013	0,3	50	-5	30,34
4.2.2013	0,2	50	-5,8	30,34

5.2.2013	0	49	-6,7	30,34
6.2.2013	0	49	1,4	30,34
7.2.2013	0,2	49	-9,8	34,11
8.2.2013	1,9	49	0,3	37,3
9.2.2013	2,5	50	-3,8	39,45
10.2.2013	3,6	51	-3,2	41,6
11.2.2013	1,2	54	-2,5	42,13
12.2.2013	1,8	55	-2,8	43,7
13.2.2013	0	57	0,8	43,59
14.2.2013	0	56	-3,1	43,55
15.2.2013	0	55	-4,1	43,44
16.2.2013	0,1	54	-3,4	43,33
17.2.2013	0	53	-2	43,25
18.2.2013	0,3	53	0,9	40,45
19.2.2013	0	52	-3,2	38,03
20.2.2013	0	52	-9,9	38,03
21.2.2013	0,6	52	-8,5	31,68
22.2.2013	0	53	-5,7	26,26
23.2.2013	0	53	-4,1	26,26
24.2.2013	0	52	-0,6	26,26
25.2.2013	0	52	0,2	23,77
26.2.2013	0,1	51	0,7	21,28
27.2.2013	0	50	-0,1	21,28
28.2.2013	5,3	50	1,4	21,27
1.3.2013	0	50	-8	21,28
2.3.2013	0	50	2,8	21,28
3.3.2013	0	50	1,2	21,28
4.3.2013	0	49	3	21,28
5.3.2013	2,8	49	-8,3	21,28
6.3.2013	2	52	-3,1	21,27
7.3.2013	0,2	56	0,2	21,23
8.3.2013	0	55	-9,6	21,23
9.3.2013	0	55	4,2	21,23
10.3.2013	1,9	54	2,1	21,23
11.3.2013	0,4	57	-9,1	21,23
12.3.2013	5,3	57	2	21,23
13.3.2013	5	63	-8,1	21,23
14.3.2013	1	70	3,8	21,23
15.3.2013	0	69	3	21,23
16.3.2013	0	67	4,8	21,23
17.3.2013	0	66	5,6	21,18
18.3.2013	0	65	3,8	23,21
19.3.2013	0	64	-8,5	24,42
20.3.2013	0	62	-6,6	25,5
21.3.2013	0,2	58	1	27,66
22.3.2013	0,4	58	0,9	31,47

23.3.2013	0	58	-5,8	35,91
24.3.2013	0	59	-4,4	35,83
25.3.2013	0,1	59	-6	35,83
26.3.2013	0	58	-8,1	35,79
27.3.2013	0	58	-6	35,63
28.3.2013	0	58	-3,1	35,63
29.3.2013	0	58	-5,9	35,52
30.3.2013	0	58	-5,5	35,51
31.3.2013	0	58	-6,5	35,51
1.4.2013	0	58	-3,2	32,86
2.4.2013	0	58	-4,1	19,63
3.4.2013	0	58	0,4	19,63
4.4.2013	0	58	1,5	18,56
5.4.2013	0	55	0,3	15,9
6.4.2013	0	53	-3,9	14,83
7.4.2013	0	53	-3	14,83
8.4.2013	0	53	0,4	14,83
9.4.2013	0	53	-2,7	14,78
10.4.2013	0	52	0,3	14,77
11.4.2013	1,8	53	0,8	14,77
12.4.2013	0,6	52	2,1	31,35
13.4.2013	6,4	49	2,3	41,22
14.4.2013	0,3	43	2,7	41,13
15.4.2013	1,8	39	4,6	41,07
16.4.2013	3,9	30	7,2	49,65
17.4.2013	0,6	22	5	61,62
18.4.2013	7,6	17	6,3	78,55
19.4.2013	0,4	9	6,3	99,24
20.4.2013	0	2	4,1	141,76
21.4.2013	0	0	4,9	161,12
22.4.2013	0	0	7,6	177,35
23.4.2013	1,8	0	5,8	206,71
24.4.2013	1,5	0	5,7	202,11
25.4.2013	0,1	0	5,1	198,81
26.4.2013	0	0	4,9	205,18
27.4.2013	3,8	0	3,8	211,76
28.4.2013	0	0	3,3	219,37
29.4.2013	3,9	0	5,6	226,25
30.4.2013	1,1	0	5,3	230,54
1.5.2013	0	0	5,2	235,13
2.5.2013	0,1	0	5,3	234,25
3.5.2013	0	0	5,8	234,56
4.5.2013	3,6	0	8,4	239,44
5.5.2013	2,8	0	5,1	244,11
6.5.2013	0	0	8	250,13
7.5.2013	2,7	0	11,1	254,31

8.5.2013	0	0	9	257,21
9.5.2013	13,4	0	6,8	259,13
10.5.2013	0,4	0	7,4	259,46
11.5.2013	0,3	0	10,2	260,19
12.5.2013	0	0	10,3	262,38
13.5.2013	0,2	0	12,8	263,99
14.5.2013	0	0	11,3	264,06
15.5.2013	0	0	11,9	264,4
16.5.2013	0	0	14,5	263,86
17.5.2013	0	0	17,9	262,32
18.5.2013	0,4	0	15,3	260,13
19.5.2013	0	0	17	256,62
20.5.2013	0	0	15,1	251,89
21.5.2013	0	0	13,6	246,43
22.5.2013	0	0	14,7	237,98
23.5.2013	0	0	14,1	206,85
24.5.2013	0	0	11,9	170,06
25.5.2013	0	0	14,4	178,47
26.5.2013	0	0	17,3	183,76
27.5.2013	0	0	17,2	141,64
28.5.2013	0	0	19,6	121,2
29.5.2013	0	0	18,5	121,2
30.5.2013	0	0	20,6	121,69
31.5.2013	0	0	19	96,91
1.6.2013	0	0	20,1	69,91
2.6.2013	0	0	21,2	54,33
3.6.2013	0	0	22,7	53,97
4.6.2013	0	0	21,8	53,78
5.6.2013	0	0	21,2	54,1
6.6.2013	0	0	17,5	54,21
7.6.2013	1	0	16,1	53,98
8.6.2013	4,2	0	17,4	32,19
9.6.2013	0,6	0	15,5	16,82
10.6.2013	1,2	0	15,8	19,01
11.6.2013	0,2	0	12,7	20,31
12.6.2013	0,2	0	11,6	21,48
13.6.2013	8,6	0	13,4	23,81
14.6.2013	4,9	0	14,5	23,83
15.6.2013	1,8	0	13,8	32,6
16.6.2013	3,8	0	15,6	36,53
17.6.2013	4,5	0	12,4	13,95
18.6.2013	1,4	0	13,8	13,88
19.6.2013	0	0	14,1	13,96
20.6.2013	0,6	0	14,8	15,56
21.6.2013	0	0	17,7	18,2
22.6.2013	0	0	20	18,22

23.6.2013	0	0	19,8	18,21
24.6.2013	0	0	21	18,2
25.6.2013	0	0	23,1	30,75
26.6.2013	0	0	24,6	44,23
27.6.2013	18,7	0	23,7	50,15
28.6.2013	0	0	21,2	54,47
29.6.2013	0,1	0	22,5	55,55
30.6.2013	7,4	0	22	55,32
1.7.2013	45,6	0	18,9	36,36
2.7.2013	0,3	0	17,2	31,64
3.7.2013	15,1	0	17,2	39,25
4.7.2013	0	0	18,1	43,12
5.7.2013	6,3	0	20,6	75,84
6.7.2013	0	0	17,9	102,14
7.7.2013	0	0	19,4	121,26
8.7.2013	0	0	16,4	142,89
9.7.2013	0,5	0	16,1	116,78
10.7.2013	2	0	15,6	96,38
11.7.2013	0	0	15,8	80,16
12.7.2013	0	0	16,6	69,35
13.7.2013	0,1	0	17,4	59,82
14.7.2013	21,1	0	18,6	44,21
15.7.2013	0,3	0	16	44,43
16.7.2013	13,5	0	12,3	51,06
17.7.2013	1,2	0	11,4	71,43
18.7.2013	6,7	0	12,7	79,67
19.7.2013	1,9	0	12,5	69,35
20.7.2013	0	0	14,2	56,79
21.7.2013	0,2	0	13,3	56,79
22.7.2013	0,7	0	14,9	40,74
23.7.2013	0	0	17,9	30,27
24.7.2013	0	0	17,2	21,71
25.7.2013	0	0	17,9	17,64
26.7.2013	0	0	18,2	21,09
27.7.2013	0	0	18,7	21,75
28.7.2013	0	0	18,9	21,75
29.7.2013	0,3	0	20,5	21,75
30.7.2013	0,2	0	19,7	30,9
31.7.2013	6,4	0	19	38,65
1.8.2013	2,2	0	17,3	59,55
2.8.2013	0	0	18,5	72,09
3.8.2013	0	0	19,2	58,57
4.8.2013	0	0	20,8	39,6
5.8.2013	0,1	0	19,5	28,31
6.8.2013	0	0	19	26,36
7.8.2013	4,5	0	21,2	22,81

8.8.2013	4,3	0	18,8	22,79
9.8.2013	12,9	0	17,9	22,72
10.8.2013	1,3	0	15	26,75
11.8.2013	3	0	15,5	44,9
12.8.2013	2,8	0	15,2	50,5
13.8.2013	0,1	0	15,5	48,81
14.8.2013	12,3	0	14,3	42,23
15.8.2013	4,3	0	14,2	38,71
16.8.2013	1,5	0	14,8	40,96
17.8.2013	5,8	0	15,4	47,14
18.8.2013	0	0	18	59,57
19.8.2013	1,7	0	17,5	75,49
20.8.2013	0	0	16,6	75,29
21.8.2013	0	0	15,7	63
22.8.2013	0,9	0	14,3	33,76
23.8.2013	0	0	12,2	33,94
24.8.2013	0	0	12,3	34,07
25.8.2013	0	0	15,1	34,07
26.8.2013	0	0	15,3	34,44
27.8.2013	0	0	16,8	38,68
28.8.2013	0	0	17	44,29
29.8.2013	0	0	13,5	38,11
30.8.2013	0	0	12,2	22,46
31.8.2013	0	0	12,6	17,04
1.9.2013	20	0	13,6	17,03
2.9.2013	5	0	12,7	16,17
3.9.2013	0	0	13,4	15,3
4.9.2013	0	0	14,4	14,67
5.9.2013	0	0	13,9	13,94
6.9.2013	0	0	14,1	13,99
7.9.2013	0	0	14,9	14,01
8.9.2013	0	0	15	13,95
9.9.2013	0	0	13,9	13,99
10.9.2013	0	0	11,6	13,94
11.9.2013	3,8	0	13,1	13,91
12.9.2013	0	0	13,6	12,9
13.9.2013	0	0	13,4	12,17
14.9.2013	0	0	14,1	12,17
15.9.2013	0	0	13	12,17
16.9.2013	0	0	12,6	11,04
17.9.2013	0,4	0	12,7	10,37
18.9.2013	0,4	0	14,1	10,37
19.9.2013	0	0	14,3	10,37
20.9.2013	0	0	13,6	9,8
21.9.2013	12,8	0	11,7	8,65
22.9.2013	6,3	0	10,5	8,65

23.9.2013	0	0	8,6	8,68
24.9.2013	0	0	5,6	8,69
25.9.2013	2,1	0	3	10,87
26.9.2013	3,9	0	5,3	21,48
27.9.2013	0,2	0	7	29,85
28.9.2013	0,1	0	6,5	31,61
29.9.2013	0	0	3,7	31,61
30.9.2013	0,2	0	3,4	27,48
1.10.2013	0	0	3,9	20,61
2.10.2013	2,1	0	3,9	19,57
3.10.2013	0	0	6,9	19,57
4.10.2013	0	0	6,4	15
5.10.2013	0,8	0	8,6	10,51
6.10.2013	0	0	9,9	8,91
7.10.2013	0	0	10	8,91
8.10.2013	1,1	0	8,5	8,91
9.10.2013	1,7	0	11,5	9,01
10.10.2013	0	0	8,2	9,01
11.10.2013	0	0	5,8	9,01
12.10.2013	0	0	6,3	9,01
13.10.2013	0	0	5	9,01
14.10.2013	0	0	2,2	9,01
15.10.2013	0,9	0	5,3	15,57
16.10.2013	0	0	-0,1	19,29
17.10.2013	18,5	0	0,2	19,29
18.10.2013	3,4	3	0,4	35,72
19.10.2013	0,2	3	-0,9	47,45
20.10.2013	0	3	-0,5	47,45
21.10.2013	0	3	-0,7	41,32
22.10.2013	11,9	3	-0,9	36,53
23.10.2013	3,6	7	4	49,62
24.10.2013	2,4	0	9,6	60,69
25.10.2013	0,8	0	5,3	60,69
26.10.2013	6,2	0	3,5	80,42
27.10.2013	0,1	0	6,5	120
28.10.2013	9,5	0	9	140
29.10.2013	0	0	7,3	140
30.10.2013	0	0	4,3	140
31.10.2013	1	0	1,6	140
1.11.2013	5,4	0	4,7	132
2.11.2013	0,5	0	4,5	128
3.11.2013	0	0	2,8	125
4.11.2013	11,5	0	1,8	121
5.11.2013	5,7	0	3,4	122
6.11.2013	0,9	0	3,7	134
7.11.2013	0	0	1,6	138

8.11.2013	2,4	0	2,6	142
9.11.2013	2	0	4,2	148
10.11.2013	1,5	0	3,6	149
11.11.2013	0	0	0,7	140
12.11.2013	4,7	0	2,5	125
13.11.2013	4,7	0	4	125
14.11.2013	0,3	0	1,6	126
15.11.2013	7,4	0	1,4	126
16.11.2013	0,1	0	4,4	128
17.11.2013	0,2	0	3,4	129
18.11.2013	2,8	0	1,8	130
19.11.2013	4	0	2,6	132
20.11.2013	0	0	1,4	132
21.11.2013	10,6	0	0,7	133
22.11.2013	0,5	2	1,7	115
23.11.2013	0,6	0	-0,9	105
24.11.2013	0,1	0	0,6	104
25.11.2013	0	0	-2,8	104
26.11.2013	5,6	0	-3,9	100
27.11.2013	1,9	6	2	98,21
28.11.2013	0,3	4	1	94,1
29.11.2013	0	4	-5,3	94,1
30.11.2013	10,6	4	-4,4	93,88
1.12.2013	1,8	15	-3,3	94,03
2.12.2013	0,5	17	-7,4	87,41
3.12.2013	0	16	1,6	74,01
4.12.2013	0	14	-3,1	68,34
5.12.2013	0,9	14	-2,6	68,34
6.12.2013	3,6	14	0	68,34
7.12.2013	2,1	20	-4,2	68,34
8.12.2013	0	21	-6,3	68,34
9.12.2013	0	20	1,4	64,77
10.12.2013	4,1	20	2	61,74
11.12.2013	0	21	3,2	61,74
12.12.2013	3,4	17	3,9	61,74
13.12.2013	0	12	0,5	61,74
14.12.2013	0	11	-8,1	61,74
15.12.2013	1,7	12	-4,2	61,74
16.12.2013	2,2	13	1,3	61,74
17.12.2013	0,6	9	2,4	61,74
18.12.2013	0	8	0,5	74,98
19.12.2013	0,2	8	0,5	84,44
20.12.2013	5,5	8	0,3	100,39
21.12.2013	5,5	12	0,9	122,72
22.12.2013	4,5	13	2,9	122,72
23.12.2013	3,7	8	2,2	147,11

24.12.2013	9,5	7	0,6	169,6
25.12.2013	4,6	6	3,5	178,91
26.12.2013	0	0	3,5	191,59
27.12.2013	5,6	0	2	225,53
28.12.2013	3,9	0	4,4	238,99
29.12.2013	0	0	4	242,75
30.12.2013	0,1	0	2,5	245,44
31.12.2013	3,5	0	0,8	248,41
1.1.2014	1,3	0	2,6	251,59
2.1.2014	0,1	0	0,1	255,31
3.1.2014	0	0	0,8	257,22
4.1.2014	0,1	0	-0,6	258,67
5.1.2014	0,2	0	0	260,32
6.1.2014	1,2	0	-0,2	260,85
7.1.2014	0,5	0	0,6	260,85
8.1.2014	1,2	0	0,7	259,59
9.1.2014	0,4	0	1,1	259
10.1.2014	0,2	0	-3,9	256,89
11.1.2014	0	0	0,4	253,68
12.1.2014	2	0	1,3	247,05
13.1.2014	2	5	3,5	240,71
14.1.2014	0	4	2,2	234,13
15.1.2014	0,2	5	3,9	226,91
16.1.2014	0,7	5	5,7	218,96
17.1.2014	0	5	4,1	206,65
18.1.2014	0,4	5	6,2	113,39
19.1.2014	0	5	7,6	42,05
20.1.2014	0	6	8,6	42,23
21.1.2014	0,5	6	5,5	42,46
22.1.2014	0	9	9,7	42,59
23.1.2014	0	8	-22,8	42,6
24.1.2014	0,1	8	4,7	42,6
25.1.2014	0	8	-6,6	42,6
26.1.2014	0	8	-7,5	42,6
27.1.2014	0	6	0	43,56
28.1.2014	0	9	2,2	57,77
29.1.2014	0	9	5,7	66,87
30.1.2014	0	9	9,4	53,88
31.1.2014	2,2	9	7,9	44,94
1.2.2014	2,6	11	-9,1	44,94
2.2.2014	1,8	14	-6	44,85
3.2.2014	0	15	-2,5	44,74
4.2.2014	0	14	0,3	44,64
5.2.2014	0	13	-3,2	40,18
6.2.2014	0	13	-5,1	33,86
7.2.2014	0,1	12	-4,9	28,72

8.2.2014	4,9	13	-0,6	28,72
9.2.2014	0	14	1,2	28,75
10.2.2014	3,7	13	0,7	28,72
11.2.2014	1,4	13	0,5	30,18
12.2.2014	1	13	0,1	31,38
13.2.2014	0,9	13	0,5	31,38
14.2.2014	0	12	-0,1	35,91
15.2.2014	0,7	12	-0,5	41,15
16.2.2014	2,9	12	-0,4	41,02
17.2.2014	0,4	15	0,7	40,98
18.2.2014	1,7	13	0,4	40,9
19.2.2014	0	14	-3,6	39
20.2.2014	0,3	13	-5,6	33,51
21.2.2014	3,8	14	-4,8	33,46
22.2.2014	3,9	19	-0,9	33,44
23.2.2014	0,4	18	2,1	33,4
24.2.2014	0	14	4	33,36
25.2.2014	0	12	2,5	33,31
26.2.2014	0	11	-0,6	33,24
27.2.2014	0,1	11	-0,1	33,22
28.2.2014	0	11	0,4	31,22
1.3.2014	0,1	11	-0,2	28,02
2.3.2014	0,2	10	0,1	28,02
3.3.2014	5,1	12	0,2	28,07
4.3.2014	0	13	0,8	28,12
5.3.2014	0	13	0,4	28,12
6.3.2014	0	12	1,1	51,35
7.3.2014	4,5	11	2,3	64,1
8.3.2014	3,5	10	2,4	64,13
9.3.2014	0	8	3,3	64,12
10.3.2014	0	8	4,5	64,1
11.3.2014	0	7	3,5	64,1
12.3.2014	0	6	5,1	64,1
13.3.2014	0,1	0	5,6	64,1
14.3.2014	0	0	3,2	64,1
15.3.2014	0	0	-0,1	64,1
16.3.2014	0	0	-3,2	64,1
17.3.2014	0	0	-5,9	88,63
18.3.2014	1,2	0	-5,6	116,36
19.3.2014	0,9	4	-3,8	115,36
20.3.2014	3,7	4	-2,9	114,66
21.3.2014	0,4	7	1,6	114,29
22.3.2014	0	0	3,9	113,67
23.3.2014	1,9	0	2,1	112,63
24.3.2014	0	0	3,3	87,94
25.3.2014	0	0	-0,3	75,62

26.3.2014	0	0	0,2	75,62
27.3.2014	0	0	2,7	75,87
28.3.2014	0	0	0,5	76,02
29.3.2014	0	0	4	64,79
30.3.2014	0	0	0,2	56,82
31.3.2014	0	0	0,5	41,95
1.4.2014	0	0	0,4	37,54
2.4.2014	0	0	-0,5	29,98
3.4.2014	0	0	0	24,58
4.4.2014	0	0	0,7	21,07
5.4.2014	0	0	2,2	18,11
6.4.2014	0	0	1,8	18,18
7.4.2014	0	0	-0,8	18,18
8.4.2014	0	0	0,2	18,18
9.4.2014	0	0	0,6	18,18
10.4.2014	0	0	-0,4	18,18
11.4.2014	5,2	0	2,4	18,18
12.4.2014	2,9	0	4,5	18,18
13.4.2014	2,3	0	4,1	18,18
14.4.2014	5,8	0	4,8	17,23
15.4.2014	0,5	0	2,9	16,6
16.4.2014	0	0	2,5	16,6
17.4.2014	0	0	6,8	16,62
18.4.2014	0,7	0	7,2	16,66
19.4.2014	0	0	8,6	16,66
20.4.2014	0	0	8,5	16,66
21.4.2014	0	0	9,3	16,75
22.4.2014	0	0	7,1	45,26
23.4.2014	0	0	2,8	70,03
24.4.2014	0	0	4,8	71,04
25.4.2014	0	0	6,8	81,47
26.4.2014	0	0	7,8	90,01
27.4.2014	0	0	8,3	90,44
28.4.2014	0	0	10,1	118,11
29.4.2014	0,6	0	5,9	129,21
30.4.2014	0,1	0	1,6	127,51
1.5.2014	0,1	0	2,1	123,23
2.5.2014	0	0	2,8	115,94
3.5.2014	0,2	0	2,9	107,46
4.5.2014	0,9	0	3,8	107,39
5.5.2014	0	0	3,5	107,36
6.5.2014	0	0	2,6	77,46
7.5.2014	0	0	2,8	62,58
8.5.2014	0,1	0	5,8	62,72
9.5.2014	4,4	0	6,1	62,62
10.5.2014	4,2	0	10	62,78

11.5.2014	4,1	0	7	68,21
12.5.2014	0,9	0	8,5	79,77
13.5.2014	44,5	0	8,6	123,35
14.5.2014	1,1	0	4,4	181,75
15.5.2014	0	0	5,5	187,2
16.5.2014	0,5	0	6,7	184,72
17.5.2014	0	0	13,6	148,19
18.5.2014	0	0	17,3	128,93
19.5.2014	0	0	20,6	141,15
20.5.2014	1,8	0	20	147,71
21.5.2014	0,1	0	16,2	152,34
22.5.2014	0	0	19,2	154,14
23.5.2014	0	0	23,2	154,16
24.5.2014	0	0	24,4	156,09
25.5.2014	21,2	0	20,2	161,85
26.5.2014	4,1	0	6,3	170,87
27.5.2014	0	0	5,9	165,47
28.5.2014	0	0	8,4	168,89
29.5.2014	28,1	0	8,4	165,1
30.5.2014	5,2	0	11,2	160,67
31.5.2014	0	0	12,5	161,3
1.6.2014	0	0	12	166,49
2.6.2014	0	0	12,2	172,83
3.6.2014	4,7	0	15	170,61
4.6.2014	0,9	0	17,5	168,16
5.6.2014	0,1	0	22,1	165,01
6.6.2014	0	0	22,3	163,89
7.6.2014	6,4	0	20,2	163,07
8.6.2014	4,1	0	17,1	160,17
9.6.2014	0	0	13,9	153,05
10.6.2014	0	0	11,9	136,84
11.6.2014	0	0	15,4	111,04
12.6.2014	6,1	0	15,4	94
13.6.2014	1,5	0	15,4	93,33
14.6.2014	0	0	9,6	88,12
15.6.2014	0	0	12,1	80,71
16.6.2014	3,2	0	10,1	70,32
17.6.2014	1,9	0	5,5	45,91
18.6.2014	1,8	0	8,7	38,11
19.6.2014	0	0	10,6	36,17
20.6.2014	0,2	0	8,8	36,28
21.6.2014	0,1	0	9,7	36,42
22.6.2014	0,3	0	9,9	36,46
23.6.2014	0,1	0	13,7	35,21
24.6.2014	0	0	12,6	26,95
25.6.2014	0	0	11,1	17,33

26.6.2014	0	0	11,2	16,88
27.6.2014	0	0	11,6	15,65
28.6.2014	2,8	0	12,1	13,41
29.6.2014	0,4	0	14,1	10,31
30.6.2014	9,1	0	11,7	8,65
1.7.2014	12,6	0	11,5	8,65
2.7.2014	1,4	0	12,9	16,43
3.7.2014	9,1	0	12,9	26,11
4.7.2014	6,5	0	14,6	30,73
5.7.2014	0	0	16,5	36,89
6.7.2014	0	0	18,6	33,81
7.7.2014	0	0	20,8	28,59
8.7.2014	0	0	21,7	20,65
9.7.2014	6,9	0	20,9	12,82
10.7.2014	0	0	13,5	10,29
11.7.2014	0	0	16,7	8,69
12.7.2014	0	0	19,5	8,28
13.7.2014	0,3	0	19,6	7,99
14.7.2014	1,4	0	21,4	7,99
15.7.2014	0,4	0	21,2	7,99
16.7.2014	1,7	0	19,1	8,03
17.7.2014	0	0	19,6	8,03
18.7.2014	0	0	20,7	8,03
19.7.2014	0,1	0	21,3	8,03
20.7.2014	0	0	20,9	8,03
21.7.2014	0	0	19,7	8,03
22.7.2014	0	0	21,8	8,03
23.7.2014	0	0	22,4	8,03
24.7.2014	0	0	22,2	8,03
25.7.2014	0	0	23,6	7,99
26.7.2014	0	0	24,3	7,99
27.7.2014	0,2	0	24,1	7,99
28.7.2014	1,9	0	22	7,99
29.7.2014	3,5	0	20,2	7,99
30.7.2014	10,5	0	20	7,99
31.7.2014	6	0	21,9	8,02
1.8.2014	0	0	20,9	8,02
2.8.2014	0	0	20,5	7,99
3.8.2014	0	0	21,2	7,99
4.8.2014	0	0	23	7,99
5.8.2014	0	0	22,9	7,99
6.8.2014	0	0	23,5	7,99
7.8.2014	0,2	0	23,3	7,99
8.8.2014	0	0	21,4	7,99
9.8.2014	0	0	20,8	7,99
10.8.2014	0	0	19,9	7,99

11.8.2014	1,3	0	22	7,99
12.8.2014	9,2	0	18,6	7,99
13.8.2014	6,1	0	15,4	7,99
14.8.2014	2,8	0	16,1	7,99
15.8.2014	0	0	16,3	7,99
16.8.2014	0	0	15,5	7,99
17.8.2014	0	0	13,5	7,99
18.8.2014	4,4	0	15,1	7,99
19.8.2014	1,1	0	14,8	7,99
20.8.2014	5,6	0	13,8	7,99
21.8.2014	1,1	0	13,7	7,94
22.8.2014	0	0	13,9	7,9
23.8.2014	5,3	0	12,9	7,9
24.8.2014	3,5	0	13,1	7,9
25.8.2014	8,5	0	12,8	7,9
26.8.2014	2,9	0	13,8	7,9
27.8.2014	5,9	0	13,5	7,9
28.8.2014	3,5	0	13,1	7,9
29.8.2014	0,1	0	11,1	7,9
30.8.2014	0	0	9,4	7,9
31.8.2014	0	0	9,8	7,9
1.9.2014	0	0	10,1	7,93
2.9.2014	0	0	12,5	7,93
3.9.2014	0	0	14	7,93
4.9.2014	0	0	16,1	7,93
5.9.2014	0,6	0	15	7,93
6.9.2014	0	0	13,1	7,93
7.9.2014	0	0	13,3	7,93
8.9.2014	0	0	14,2	7,93
9.9.2014	0	0	15,1	7,93
10.9.2014	0	0	15	7,67
11.9.2014	0	0	14,5	7,27
12.9.2014	1,4	0	11,9	7,26
13.9.2014	0	0	10,3	7,25
14.9.2014	0	0	12,4	7,26
15.9.2014	0	0	9,3	6,94
16.9.2014	0	0	9,5	6,57
17.9.2014	0	0	10,4	6,57
18.9.2014	0	0	12,6	6,57
19.9.2014	0	0	12,6	6,57
20.9.2014	0	0	13,1	6,57
21.9.2014	1,8	0	12,2	6,57
22.9.2014	8,3	0	5,5	6,56
23.9.2014	12,6	0	1,3	6,55
24.9.2014	4,2	0	1,7	6,57
25.9.2014	0,2	0	5,9	6,57

26.9.2014	4,3	0	9,7	6,57
27.9.2014	0,1	0	9,6	6,57
28.9.2014	1,4	0	9,4	6,57
29.9.2014	1,9	0	9,5	6,57
30.9.2014	0	0	7	6,55
1.10.2014	0	0	3,2	6,56
2.10.2014	0	0	7,1	6,57
3.10.2014	0	0	6,1	6,55
4.10.2014	0	0	6,4	6,56
5.10.2014	0	0	4	6,57
6.10.2014	0	0	4,2	6,57
7.10.2014	0	0	4,5	6,57
8.10.2014	8,6	0	5,7	6,57
9.10.2014	9,3	0	8,3	6,57
10.10.2014	4,1	0	6,1	7,16
11.10.2014	0,9	0	5,6	9,03
12.10.2014	0	0	4,3	12,52
13.10.2014	0	0	2,6	12,52
14.10.2014	0,3	0	2,4	12,52
15.10.2014	0	0	-0,1	12,52
16.10.2014	0	0	-0,8	12,52
17.10.2014	0	0	-3	12,52
18.10.2014	1		-2,1	12,52
19.10.2014	11,4		1,7	12,57
20.10.2014	0,9	0	0,7	12,75
21.10.2014	0	0	-2,9	14,36
22.10.2014	0		-5,6	14,43
23.10.2014	0		-5,2	16,19
24.10.2014	0,5		-0,3	29,92
25.10.2014	4,4	0	1	40,63
26.10.2014	1,1	0	4,5	43,38
27.10.2014	3,1	0	8,4	56,41
28.10.2014	2,3	0	9,3	68,05
29.10.2014	2,9	0	9,1	82,3
30.10.2014	0,1	0	4,6	102,85
31.10.2014	0	0	1,4	107,5
1.11.2014	2,9	0	-3,7	107,23
2.11.2014	7,1	2	0,9	107,23
3.11.2014	1,6	0	8,5	110,63
4.11.2014	13,7	0	8,8	116,82
5.11.2014	0	0	-0,9	146,81
6.11.2014	2,8	0	-2,8	171,06
7.11.2014	2,4	2	-2,5	168,55
8.11.2014	0,2	2	-2,5	166,46
9.11.2014	0,4	2	1,5	162,27
10.11.2014	3	0	5,1	144,47

11.11.2014	3,4	0	5,8	157,71
12.11.2014	0,2	0	2,1	170,38
13.11.2014	0,1	0	0,3	172,4
14.11.2014	0	0	-2,4	173,82
15.11.2014	0,1	0	-3,7	173,82
16.11.2014	0,1	0	0,5	173,39
17.11.2014	0	0	-2,6	172,4
18.11.2014	0	0	0,3	170,42
19.11.2014	0	0	0,1	168,03
20.11.2014	0	0	0	167,65
21.11.2014	0,7	0	-3,6	167,45
22.11.2014	0,1	0	-2,3	159,77
23.11.2014	0,1	0	-0,8	129,29
24.11.2014	0	0	0,2	92,88
25.11.2014	0,5	0	0,8	69,28
26.11.2014	0,3	0	1,9	69,67
27.11.2014	2,4	0	1,6	84,16
28.11.2014	0	0	1,8	110,63
29.11.2014	0	0	1,2	118,04
30.11.2014	0,2	0	-0,4	111,03
1.12.2014	0	0	0,9	78,64
2.12.2014	3,1	0	0,7	65,52
3.12.2014	0	5	1,9	59,86
4.12.2014	0	3	2	59,92
5.12.2014	1,5	3	0,5	59,92
6.12.2014	4,2	2	0,7	59,92
7.12.2014	3,2	3	0,3	64,45
8.12.2014	1,9	2	2,1	69,17
9.12.2014	0,2	0	1,2	68,85
10.12.2014	3	0	1,7	68,79
11.12.2014	0,1	5	1,2	68,98
12.12.2014	1,9	2	0,2	68,98
13.12.2014	2,8	3	-0,4	68,98
14.12.2014	0,1	6	-0,4	68,98
15.12.2014	3,9	6	0,8	68,98
16.12.2014	0,9	6	0	68,98
17.12.2014	5,6	7	0,4	68,98
18.12.2014	1,2	7	-2,6	79,42
19.12.2014	4	9	-0,2	87,82
20.12.2014	4,7	10	0	87,72
21.12.2014	2,7	16	-3,2	87,04
22.12.2014	0,2	18	-5,9	77,51
23.12.2014	0	18	2,1	65,37
24.12.2014	0	17	6	54,12
25.12.2014	0,1	17	4,1	54,12
26.12.2014	2,1	16	-5,9	44,67

27.12.2014	0	21	-9,3	37,02
28.12.2014	0	20	6	37,08
29.12.2014	0,4	20	7,2	37,08
30.12.2014	6,5	20	-7,2	37,15
31.12.2014	0	22	0,8	37,18
1.1.2015	0,6	20	2,7	39,05
2.1.2015	14,9	18	0,8	43,57
3.1.2015	2	25	0,5	46,23
4.1.2015	0	26	-8,8	49,74
5.1.2015	0	25	5,2	48,09
6.1.2015	0,7	25	8,4	47,98
7.1.2015	7,4	26	-6,2	48,92
8.1.2015	7,6	32	-2,5	49,44
9.1.2015	2,4	39	0,6	49,41
10.1.2015	0,8	41	-9,6	49,29
11.1.2015	1	40	6,2	50,25
12.1.2015	1,6	41	5,6	50,11
13.1.2015	2	42	3,3	48,98
14.1.2015	1,4	44	-7,1	42,38
15.1.2015	0,4	43	-0,5	37,8
16.1.2015	5,6	43	-0,1	33,39
17.1.2015	0	40	1,5	30,28
18.1.2015	0,6	39	-0,6	26,84
19.1.2015	0	38	-8,5	23,4
20.1.2015	0	38	-20,1	22
21.1.2015	0	38	5,4	22,06
22.1.2015	0	39	-20,1	23,62
23.1.2015	1,4	39	6,4	23,62
24.1.2015	0,5	41	-8,5	23,64
25.1.2015	0,3	41	-2,3	24,66
26.1.2015	1,1	41	0,6	24,66
27.1.2015	2,2	41	0	24,63
28.1.2015	4,2	44	0,3	24,57
29.1.2015	0,7	47	-0,6	24,66
30.1.2015	0,3	46	0,1	24,66
31.1.2015	2,9	46	0,7	24,66
1.2.2015	1,9	46	-2,7	27,21
2.2.2015	0,6	47	-4,6	32,04
3.2.2015	1,5	46	-2,1	37,83
4.2.2015	0	48	-2,9	43,94
5.2.2015	1,7	46	-4,7	46,33
6.2.2015	0,9	49	-2,3	48,26
7.2.2015	0,8	48	0,3	48,14
8.2.2015	0,2	49	-6,9	48,04
9.2.2015	0,2	48	-9,2	46,83
10.2.2015	0	47	2,6	45,27

11.2.2015	0	47	4,9	45,15
12.2.2015	0	44	0,7	41,39
13.2.2015	0,3	43	-2,7	37,58
14.2.2015	2,8	43	-2,7	33,09
15.2.2015	0	46	3,3	29,88
16.2.2015	0	46	-8,4	29,98
17.2.2015	1	46	-5	26,83
18.2.2015	0,5	46	0	24,84
19.2.2015	0,3	47	1,2	24,84
20.2.2015	0,2	43	2,9	24,84
21.2.2015	3,4	40	1,6	24,84
22.2.2015	6,4	39	0,5	24,84
23.2.2015	3,3	42	0,3	24,84
24.2.2015	4,3	44	0,7	29,81
25.2.2015	0	42	1,6	41,13
26.2.2015	0	40	1,4	51,33
27.2.2015	0	39	0,8	57,78
28.2.2015	0	38	-0,5	62,77
1.3.2015	0,1	37	1,1	62,96
2.3.2015	1,8	37	1,3	63,05
3.3.2015	3,7	36	0,9	64,51
4.3.2015	3,8	35	0,9	62,77
5.3.2015	0,2	34	0,8	62,77
6.3.2015	1,3	33	0,6	62,77
7.3.2015	2,9	32	0,8	62,77
8.3.2015	0,1	28	3,9	62,77
9.3.2015	0	24	3,7	62,77
10.3.2015	3,3	24	2,2	57,29
11.3.2015	0	22	1	64,03
12.3.2015	0	22	0,3	58,9
13.3.2015	0	21	0,4	59,14
14.3.2015	0	21	0,3	60,47
15.3.2015	0	22	-0,6	59,65
16.3.2015	0	22	1,3	59,76
17.3.2015	0	22	1,9	59,83
18.3.2015	0	21	2,9	59,83
19.3.2015	0	21	4,4	59,77
20.3.2015	0	19	-0,4	59,54
21.3.2015	0	19	-6,3	59,27
22.3.2015	1,8	19	-6,5	58,97
23.3.2015	8,2	20	-0,1	58,79
24.3.2015	1,2	22	0	58,87
25.3.2015	0	21	-6	58,28
26.3.2015	0	21	-4,1	58,52
27.3.2015	1,2	21	-0,8	58,31
28.3.2015	5,1	21	2,2	58,23

29.3.2015	1,7	19	1,2	58,06
30.3.2015	4,4	17	0,3	58,7
31.3.2015	3,2	19	1	58,86
1.4.2015	0,2	19	2,1	59,27
2.4.2015	3,5	17	0,8	62,2
3.4.2015	0,1	17	1,3	68,71
4.4.2015	0	15	2,8	71,47
5.4.2015	0	12	1,7	75,9
6.4.2015	0,1	11	2,4	75,9
7.4.2015	0	8	4,1	82,14
8.4.2015	0	5	4,1	94,63
9.4.2015	0	0	5,1	95,77
10.4.2015	0	0	5,2	104,69
11.4.2015	0	0	4,7	135,26
12.4.2015	1,3	0	5,8	145,9
13.4.2015	0,9	0	4,9	140,7
14.4.2015	2,7	0	3,4	151,31
15.4.2015	6,9	0	1,1	161,79
16.4.2015	1,1	2	0,8	167,4
17.4.2015	0,4	0	3,3	172,86
18.4.2015	0	0	2,1	178,08
19.4.2015	0,6	0	3,6	183,37
20.4.2015	0	0	3,8	188,19
21.4.2015	0	0	5,2	193,31
22.4.2015	9,1	0	4,4	200,05
23.4.2015	3	3	2,1	205,52
24.4.2015	0	0	2,7	211,82
25.4.2015	0	0	2,5	215,88
26.4.2015	2,6	0	3,8	220,84
27.4.2015	1,1	0	5,7	225,42
28.4.2015	0	0	7,1	241,51
29.4.2015	16,6	0	2,9	278,66
30.4.2015	0	7	2,2	286,61
1.5.2015	0,2	0	6,8	291,71
2.5.2015	8,8	0	4	294,17
3.5.2015	1,2	0	3,2	300,41
4.5.2015	0	0	4,9	304,08
5.5.2015	0	0	7,9	306,31
6.5.2015	0,1	0	11,5	307,1
7.5.2015	10,6	0	10,7	306,81
8.5.2015	0	0	10,2	306,88
9.5.2015	1,6	0	7,6	306,88
10.5.2015	0,3	0	10,7	306,88
11.5.2015	0,2	0	8,7	292,7
12.5.2015	10	0	9,6	269,93
13.5.2015	11,3	0	8,7	250,75

14.5.2015	2,9	0	6,2	251,81
15.5.2015	0	0	6,6	250,57
16.5.2015	1,6	0	7,4	248,1
17.5.2015	0,5	0	7,9	246,75
18.5.2015	9,4	0	4,9	244,51
19.5.2015	0	0	7,4	244
20.5.2015	1,4	0	9,8	243,02
21.5.2015	0	0	10,3	240,58
22.5.2015	0	0	13,3	237,18
23.5.2015	0,2	0	10,1	236,32
24.5.2015	0,2	0	7,8	229,58
25.5.2015	0	0	10,4	226,07
26.5.2015	0,4	0	14,9	198,81
27.5.2015	0,3	0	12,9	184,07
28.5.2015	0	0	12,4	180,12
29.5.2015	0,9	0	12,8	176,18
30.5.2015	0	0	12,7	176,49
31.5.2015	0,5	0	12,8	161,19
1.6.2015	0	0	12,6	128,05
2.6.2015	1,2	0	14	97,81
3.6.2015	8,9	0	11,2	69,69
4.6.2015	1,8	0	10,4	60,69
5.6.2015	0,4	0	11,1	60,78
6.6.2015	1	0	13,1	61,09
7.6.2015	0,5	0	12,4	61,59
8.6.2015	1,7	0	9,8	61,16
9.6.2015	0	0	11,3	61,27
10.6.2015	1,1	0	11,2	61,38
11.6.2015	0	0	11,4	61,26
12.6.2015	0	0	13	60,6
13.6.2015	1	0	14	60,18
14.6.2015	6,7	0	10,6	59,57
15.6.2015	2	0	10,1	50,25
16.6.2015	0,6	0	9,8	44,52
17.6.2015	1,8	0	9,7	34,75
18.6.2015	3,6	0	12,1	24,77
19.6.2015	6,8	0	13,1	19,44
20.6.2015	1	0	15,2	17,41
21.6.2015	0	0	17	15,96
22.6.2015	20,1	0	17,8	11,37
23.6.2015	33	0	14,1	55,51
24.6.2015	3,4	0	15,1	124,54
25.6.2015	0	0	15	95,51
26.6.2015	0	0	12,9	102
27.6.2015	0,9	0	13,8	109,84
28.6.2015	6,9	0	14,5	109,38

29.6.2015	0	0	17,7	108,72
30.6.2015	0,9	0	16,5	127,33
1.7.2015	0	0	13,6	158,34
2.7.2015	2,3	0	14,9	168,83
3.7.2015	0	0	21,7	167,7
4.7.2015	0	0	17,9	165,99
5.7.2015	0	0	13,1	163,73
6.7.2015	0	0	13,1	148,64
7.7.2015	14,9	0	12,5	116,6
8.7.2015	20,4	0	14,1	107,09
9.7.2015	10,9	0	15,6	127,36
10.7.2015	0	0	15,7	148,61
11.7.2015	0,1	0	14,5	169,59
12.7.2015	1,6	0	12,4	167,97
13.7.2015	0	0	11,9	138,55
14.7.2015	0,8	0	13	107,53
15.7.2015	0	0	12,2	99,08
16.7.2015	1,4	0	14,6	88,16
17.7.2015	0	0	15,3	88,42
18.7.2015	2	0	17	89,78
19.7.2015	1,3	0	14,7	89,82
20.7.2015	1,8	0	15,8	88,89
21.7.2015	2,1	0	15,2	88,13
22.7.2015	0,5	0	15,5	69,45
23.7.2015	7	0	15,6	45,28
24.7.2015	2,5	0	15,6	37,4
25.7.2015	0	0	16,5	37,55
26.7.2015	19,4	0	15,2	52,09
27.7.2015	0	0	16,2	61,54
28.7.2015	0	0	15,7	61,3
29.7.2015	10,8	0	14,7	73,08
30.7.2015	0	0	15,2	98,41
31.7.2015	5,8	0	14,9	101,4
1.8.2015	6,5	0	14,7	101,39
2.8.2015	0	0	15,3	101,6
3.8.2015	0	0	15,1	101,73
4.8.2015	2,4	0	15,5	101,52
5.8.2015	0,1	0	16,7	101,52
6.8.2015	3,5	0	16,2	101,44
7.8.2015	0,5	0	18,2	101,42
8.8.2015	0	0	19,1	101,47
9.8.2015	0	0	17,2	101,42
10.8.2015	0	0	16,3	100,32
11.8.2015	0,4	0	19,8	101,82
12.8.2015	1,4	0	17,8	108,44
13.8.2015	0,2	0	14,5	129,44

14.8.2015	0,1	0	14,2	140,06
15.8.2015	0	0	14,4	135,03
16.8.2015	0	0	14	134,71
17.8.2015	0	0	14,3	104,81
18.8.2015	0	0	15,5	85,57
19.8.2015	0	0	16,3	82,07
20.8.2015	0	0	16,9	77,8
21.8.2015	0	0	16,8	37,24
22.8.2015	0	0	16,7	7,75
23.8.2015	0	0	17,5	7,75
24.8.2015	0	0	18,6	7,64
25.8.2015	0	0	18,7	5,06
26.8.2015	14,7	0	18,1	5,06
27.8.2015	5,8	0	16,1	5,06
28.8.2015	15,3	0	14,7	7,29
29.8.2015	0	0	14,1	6,15
30.8.2015	0	0	14,1	6,17
31.8.2015	0	0	13,8	8,84
1.9.2015	3,6	0	12,7	12,21
2.9.2015	0	0	9,6	20,84
3.9.2015	2,3	0	10,1	20,84
4.9.2015	0,1	0	12	17,79
5.9.2015	11	0	12,9	12,17
6.9.2015	0	0	12,4	12,17
7.9.2015	0,1	0	12	11,02
8.9.2015	0	0	12,1	10,45
9.9.2015	0	0	11,7	8,36
10.9.2015	0	0	11,5	6,72
11.9.2015	0	0	12,4	6,34
12.9.2015	0	0	12,5	7,37
13.9.2015	5,2	0	12,3	7,37
14.9.2015	0	0	12,9	7,37
15.9.2015	0	0	12,3	6,4
16.9.2015	1	0	12,7	5,57
17.9.2015	2,3	0	13,3	7,09
18.9.2015	17,1	0	15	11,43
19.9.2015	1,5	0	13,9	11,9
20.9.2015	0	0	11,8	11,9
21.9.2015	11,4	0	10,3	30,01
22.9.2015	7,8	0	11,1	60,48
23.9.2015	0	0	11,9	78,9
24.9.2015	1,4	0	13,2	87,82
25.9.2015	0	0	12,8	102,93
26.9.2015	0,6	0	10,1	97,75
27.9.2015	1,3	0	8,7	97,75
28.9.2015	0,2	0	8,9	97,75

29.9.2015	0	0	7,8	97,75
30.9.2015	0	0	10,5	97,75
1.10.2015	0,3	0	9,9	84,75
2.10.2015	1,8	0	10,3	56,14
3.10.2015	0	0	6,9	45,79
4.10.2015	0,9	0	7,5	45,35
5.10.2015	0	0	4,1	45,82
6.10.2015	0	0	1,8	47,02
7.10.2015	0	0	1,3	47,13
8.10.2015	0	0	0,8	47,04
9.10.2015	0	0	2	46,93
10.10.2015	0	0	2,6	46,18
11.10.2015	0	0	2,4	38,05
12.10.2015	0	0	4	30,07
13.10.2015	0	0	5,5	24,74
14.10.2015	0	0	5,6	22,61
15.10.2015	0	0	5,5	22,68
16.10.2015	0	0	7,4	22,71
17.10.2015	0	0	8,2	22,72
18.10.2015	0	0	7,2	22,71
19.10.2015	0	0	5,8	22,71
20.10.2015	0	0	4,7	22,72
21.10.2015	1,1	0	4,8	22,71
22.10.2015	4,7	0	7,2	22,77
23.10.2015	4,1	0	8	30,16
24.10.2015	0	0	4,5	35,41
25.10.2015	10,8	0	6,7	29,15
26.10.2015	0,6	0	5,7	31,76
27.10.2015	0	0	1,7	46,17
28.10.2015	0,1	0	0,8	61,5
29.10.2015	0,7	0	2,1	61,74
30.10.2015	0	0	-2,1	61,88
31.10.2015	0,3	0	3,5	62,07
1.11.2015	0	0	7,8	62,07
2.11.2015	0	0	8,7	62,09
3.11.2015	0	0	7,7	70,01
4.11.2015	0	0	6,1	75,25
5.11.2015	0	0	1,9	74,68
6.11.2015	2,4	0	3	67,51
7.11.2015	1,9	0	6,2	53,61
8.11.2015	4,3	0	4,1	43,9
9.11.2015	2,5	0	3,7	40,36
10.11.2015	8,8	0	4	40,42
11.11.2015	7,4	0	1,9	40,42
12.11.2015	2	0	1,5	40,84
13.11.2015	1	0	1,2	49,87

14.11.2015	2,5	0	3	50,03
15.11.2015	3,2	0	1,2	92,39
16.11.2015	5,8	0	0,7	137,17
17.11.2015	5,6	0	0,8	148,17
18.11.2015	3,3	0	2	144,73
19.11.2015	0,5	0	2,1	143,33
20.11.2015	10	0	0,1	141,97
21.11.2015	5,9	6	-0,9	134,09
22.11.2015	0,3	12	0,9	112,11
23.11.2015	0	11	-2,8	108,79
24.11.2015	0	9	-2,4	106,95
25.11.2015	2,8	7	2,1	107,22
26.11.2015	1,4	0	1,4	107,95
27.11.2015	0,4		4,6	108,58
28.11.2015	0,9	0	6,2	113,24
29.11.2015	1,8	0	2,5	118
30.11.2015	2,3	0	1,6	118,68
1.12.2015	1,6	0	0,8	137,93
2.12.2015	1,1	0	-0,4	147,43
3.12.2015	2,1	0	0,3	146,96
4.12.2015	13,5	0	0,2	145,62
5.12.2015	7,8	2	1,7	149,68
6.12.2015	1,5	0	3,9	178,74
7.12.2015	0,1	0	1,8	174,17
8.12.2015	0,6	0	0,6	168,67
9.12.2015	1,9	0	5	167,73
10.12.2015	5,8	0	3,9	167,73
11.12.2015	0,2	0	2,3	167,35
12.12.2015	0,5	0	0,6	166,71
13.12.2015	0,3	0	0	167,18
14.12.2015	0	0	-3,3	168,76
15.12.2015	0,5	0	-3,5	168,76
16.12.2015	2,6	2	-4,5	168,76
17.12.2015	2,1	5	-6,5	168,93
18.12.2015	13,5	7	0,5	168,88
19.12.2015	1,1	13	1,4	169,36
20.12.2015	0,5	9	4	168,07
21.12.2015	2,2	0	6	168,71
22.12.2015	0,2	0	3,8	168,76
23.12.2015	7,1	0	0,2	169,7
24.12.2015	0,1	5	-0,1	172,88
25.12.2015	6,2	0	3,1	172,88
26.12.2015	0,2	0	0,3	172,88
27.12.2015	0,1	0	-5,1	172,88
28.12.2015	0	0	-4,4	173,27
29.12.2015	0	0	-9,5	173,36

30.12.2015	0	0	-4,4	170,16
31.12.2015	0	2	-2,3	170,28
1.1.2016	0	2	-7	169,25
2.1.2016	0	2	1,5	166,06
3.1.2016	0,4	2	1,1	157,88
4.1.2016	0	3	6,8	124,78
5.1.2016	0	3	9,2	115,59
6.1.2016	0	3	-24,5	114,86
7.1.2016	0	3	-25,8	106,38
8.1.2016	0	3	9,7	67,69
9.1.2016	0	4	6,4	54,68
10.1.2016	0	4	9,5	38,2
11.1.2016	0	4	6,2	34,08
12.1.2016	3,3	4	1,4	34,08
13.1.2016	11,2	7	1,3	34,14
14.1.2016	3,8	19	2,1	34,25
15.1.2016	0,1	27	-24	54,91
16.1.2016	0,4	25	-24,8	34,28
17.1.2016	0	24	-26,5	34,28
18.1.2016	0	23	-28,5	34,28
19.1.2016	0	22	-27,6	34,28
20.1.2016	0,3	22	-26,7	32,61
21.1.2016	0	23	-26,3	32,61
22.1.2016	0,2	23	-22,3	32,61
23.1.2016	0	23	-8,2	34,38
24.1.2016	1,9	22	-5,2	34,38
25.1.2016	0,9	26	-4,8	39,38
26.1.2016	7,2	27	-2,6	42,09
27.1.2016	1,1	28	0,4	50,47
28.1.2016	10,1	26	0,2	58,94
29.1.2016	4,5	33	-2,6	53,45
30.1.2016	0,7	34	1,6	41,66
31.1.2016	0,3	33	-0,2	41,47
1.2.2016	0,4	33	-3,3	36,54
2.2.2016	3,3	32	-2	21,7
3.2.2016	0,3	35	-3,5	17,6
4.2.2016	4	36	-4,1	16,82
5.2.2016	0,5	41	-7,2	16,82
6.2.2016	4,6	40	-5,8	16,82
7.2.2016	0,4	43	1,3	16,82
8.2.2016	3,3	36	1,5	16,82
9.2.2016	2,9	33	1,3	16,82
10.2.2016	5,9	28	2,3	16,83
11.2.2016	8,2	24	1,5	27,68
12.2.2016	3,9	23	0,2	49,12
13.2.2016	3	21	-0,4	59,84

14.2.2016	8	28	0,1	61,29
15.2.2016	1,2	35	0,4	55,63
16.2.2016	0	34	-5,3	55,51
17.2.2016	0	34	-4,2	51,74
18.2.2016	3,5	33	-3,5	49,23
19.2.2016	0,1	37	-0,7	45,07
20.2.2016	7	36	0	43,12
21.2.2016	8,1	43	0,9	42,02
22.2.2016	3,2	47	-4,3	42,08
23.2.2016	0,5	48	-6	41,18
24.2.2016	1,5	49	-2,3	39,48
25.2.2016	0,8	50	0,9	37,29
26.2.2016	1,7	49	-4,6	37,26
27.2.2016	0,3	51	0,2	37,19
28.2.2016	0,1	50	-5,6	37,13
29.2.2016	0	50	-7	37,05
1.3.2016	0	49	-3,8	37,04
2.3.2016	0	49	-5,7	35,65
3.3.2016	0	48	-9,1	36,52
4.3.2016	1,4	47	-4,7	36,5
5.3.2016	2,4	49	0,9	36,43
6.3.2016	0,5	52	-0,7	36,42
7.3.2016	4	50	0	36,42
8.3.2016	1,5	50	0,7	36,42
9.3.2016	1,4	46	0,3	39,92
10.3.2016	0	45	-0,8	41,52
11.3.2016	0,5	44	0	41,36
12.3.2016	0	44	0,1	41,24
13.3.2016	1,9	44	-3,2	41,1
14.3.2016	0	45	-0,1	40,98
15.3.2016	0	45	1,5	40,54
16.3.2016	0	45	3	40,31
17.3.2016	0	45	0,5	36,8
18.3.2016	0	44	-6,2	28,47
19.3.2016	0	44	-7,6	24,31
20.3.2016	0	44	-7,1	21,26
21.3.2016	0	44	-7,9	19,27
22.3.2016	0	44	-8,2	19,48
23.3.2016	0,7	44	-5	18,96
24.3.2016	0	45	0,4	18,96
25.3.2016	1,8	45	0,2	18,96
26.3.2016	0,8	45	1,9	18,96
27.3.2016	0	42	4,5	18,96
28.3.2016	0	38	5,8	18,96
29.3.2016	0	34	4,7	18,96
30.3.2016	0	33	4,7	22,52

31.3.2016	0,4	32	3,1	35,12
1.4.2016	0,7	31	1,7	52,29
2.4.2016	0	29	1,1	67,44
3.4.2016	0	28	1,5	91,06
4.4.2016	0	27	0,4	95,12
5.4.2016	0,6	27	3,2	93,72
6.4.2016	3,1	24	2,8	94,03
7.4.2016	0,8	21	6,2	94,4
8.4.2016	1,2	15	4,6	107,41
9.4.2016	0,2	12	4,8	128,3
10.4.2016	0	7	3	131,58
11.4.2016	0	6	3,6	152,96
12.4.2016	0,2	4	4,6	172,66
13.4.2016	0	2	2,5	171,1
14.4.2016	0	0	0,3	171,93
15.4.2016	0	0	-0,3	174,35
16.4.2016	0	0	4,3	177,07
17.4.2016	6,1	0	6,4	178,65
18.4.2016	0,2	0	4,9	173,34
19.4.2016	12,9		3,4	171,71
20.4.2016	4,6	2	2,2	176,29
21.4.2016	0,2	0	1,7	181,41
22.4.2016	0,1	0	1,7	185,23
23.4.2016	0	0	1,3	188,66
24.4.2016	0,6	0	2,4	191,66
25.4.2016	1,7	0	3,9	194,03
26.4.2016	3,8	0	7	197,28
27.4.2016	1,7	0	8,3	201,63
28.4.2016	0,1	0	8,4	207,5
29.4.2016	3,8	0	8	213,42
30.4.2016	0	0	8,2	216,34
1.5.2016	0	0	8,9	219,28
2.5.2016	0	0	10,1	213,2
3.5.2016	0	0	11,3	206,24
4.5.2016	0	0	12,6	207
5.5.2016	0	0	13,8	207,95
6.5.2016	0	0	14,7	208,41
7.5.2016	0	0	13,7	206,59
8.5.2016	0	0	15,8	205,99
9.5.2016	0	0	13,5	201,84
10.5.2016	2,4	0	11	188,52
11.5.2016	0,6	0	7,1	168,92
12.5.2016	0	0	10,2	157,43
13.5.2016	0	0	11,3	155,84
14.5.2016	0,6	0	12,4	157,87
15.5.2016	0	0	13,2	122,24

16.5.2016	0	0	13,2	122,57
17.5.2016	2,9	0	10,8	122,03
18.5.2016	0	0	10,6	119,83
19.5.2016	0	0	12,7	119,53
20.5.2016	0	0	13,3	117,81
21.5.2016	10,4	0	10,8	116,61
22.5.2016	0	0	12,4	116,12
23.5.2016	0	0	17,3	115,18
24.5.2016	0	0	18,8	111,12
25.5.2016	0	0	16,9	83,95
26.5.2016	0	0	11,2	57,65
27.5.2016	0	0	9,3	52,69
28.5.2016	0	0	12,9	53,03
29.5.2016	0	0	16,5	53,1
30.5.2016	0	0	19,4	52,6
31.5.2016	0	0	19,4	51,82
1.6.2016	0	0	19,7	51,78

Appendix 6

Snow equivalent data

Date	Snow equivalent (mm)
1.1.2008	9
16.1.2008	29
1.2.2008	55
16.2.2008	73
1.3.2008	98
16.3.2008	109
1.4.2008	123
16.4.2008	107
1.5.2008	12
16.5.2008	0
1.6.2008	0
1.10.2008	0
16.10.2008	0
1.11.2008	1
16.11.2008	3
1.12.2008	30
16.12.2008	32
1.1.2009	45
16.1.2009	51
1.2.2009	67
16.2.2009	85
1.3.2009	91
16.3.2009	96
1.4.2009	106
16.4.2009	107
1.5.2009	10
16.5.2009	0
1.6.2009	0
16.6.2009	0
1.10.2009	0
16.10.2009	0
1.11.2009	1
16.11.2009	9
1.12.2009	0
16.12.2009	3
1.1.2010	21
16.1.2010	31
1.2.2010	40
16.2.2010	71
1.3.2010	94
16.3.2010	126
1.4.2010	157
16.4.2010	45
1.5.2010	23
16.5.2010	0
1.6.2010	0

16.6.2010	0
1.10.2010	0
16.10.2010	1
1.11.2010	0
16.11.2010	17
1.12.2010	21
16.12.2010	29
1.1.2011	40
16.1.2011	65
1.2.2011	105
16.2.2011	131
1.3.2011	133
16.3.2011	148
1.4.2011	163
16.4.2011	73
1.5.2011	1
16.5.2011	0
1.6.2011	0
16.6.2011	0
1.10.2011	0
16.10.2011	0
1.11.2011	0
16.11.2011	0
1.12.2011	0
16.12.2011	16
1.1.2012	36
16.1.2012	59
1.2.2012	67
16.2.2012	78
1.3.2012	110
16.3.2012	117
1.4.2012	128
16.4.2012	99
1.5.2012	10
16.5.2012	0
1.6.2012	0
16.6.2012	0
1.10.2012	0
16.10.2012	0
1.11.2012	8
16.11.2012	0
1.12.2012	0
16.12.2012	21
1.1.2013	47
16.1.2013	59
1.2.2013	79
16.2.2013	88
1.3.2013	96
16.3.2013	113
1.4.2013	118
16.4.2013	105
1.5.2013	3

16.5.2013	0
1.6.2013	0
16.6.2013	0
1.1.2014	12
16.1.2014	14
1.2.2014	16
16.2.2014	28
1.3.2014	25
16.3.2014	15
1.4.2014	12
16.4.2014	4
1.5.2014	0
16.5.2014	0
1.6.2014	0
16.6.2014	0
1.10.2014	0
16.10.2014	0
1.11.2014	0
16.11.2014	1
1.12.2014	0
16.12.2014	7
1.1.2015	37
16.1.2015	61
1.2.2015	93
16.2.2015	99
1.3.2015	106
16.3.2015	93
1.4.2015	99
16.4.2015	29
1.5.2015	6
16.5.2015	0
1.6.2015	0
16.6.2015	0
1.10.2015	0
16.10.2015	0
1.11.2015	0
16.11.2015	2
1.12.2015	0
16.12.2015	5
1.1.2016	7
16.1.2016	21
1.2.2016	42
16.2.2016	57
1.3.2016	80
16.3.2016	84
1.4.2016	45
16.4.2016	18
1.5.2016	0
16.5.2016	0
1.6.2016	0
16.6.2016	0
1.10.2016	0

16.10.2016	0
1.11.2016	0
16.11.2016	10
1.12.2016	27
16.12.2016	50

Appendix 7

MAL1.2.1

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	1300,8	45,5	36,4	1,3	18922	18,92
Natural_2	protein	514,3	33	19,8	1,7	4081	4,08
Natural_3	protein	1058,8	50,3	26,8	1,9	11339	11,34
Natural_4	protein	726	35,1	26,3	1,3	7644	7,64
Natural_5	protein	1058,8	41,6	32,4	1,3	13738	13,74
Natural_6	protein	756,3	47,4	20,3	2,3	6147	6,15
Natural_7	protein	3297,3	101,5	41,4	2,5	54562	54,56
Natural_8	protein	695,8	39	22,7	1,7	6329	6,33
Natural_9	protein	544,5	33,5	20,7	1,6	4501	4,50
Natural_10	protein	302,5	22,9	16,8	1,4	2036	2,04
Natural_11	protein	2026,8	68,9	37,4	1,8	30352	30,35
Natural_12	protein	726	42,4	21,8	1,9	6332	6,33
Natural_13	protein	786,5	41,6	24,1	1,7	7581	7,58
Natural_14	protein	1270,5	50,3	32,1	1,6	16328	16,33
Natural_15	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_16	protein	816,8	44,8	23,2	1,9	7588	7,59
Natural_17	protein	635,3	35,1	23	1,5	5852	5,85
Natural_18	protein	1058,8	46,5	29	1,6	12287	12,29
Natural_19	protein	1663,8	60,5	35	1,7	23302	23,30
Natural_20	protein	1936	56,9	43,3	1,3	33523	33,52
Natural_21	protein	514,3	30,1	21,8	1,4	4475	4,48
Natural_22	protein	998,3	39,6	32,1	1,2	12810	12,81
Natural_23	protein	1058,8	52,5	25,7	2,0	10876	10,88
Natural_24	protein	3236,8	80,9	50,9	1,6	65948	65,95
Natural_25	protein	665,5	44,4	19,1	2,3	5081	5,08
Natural_26	protein	1210	51,7	29,8	1,7	14430	14,43
Natural_27	protein	847	40,5	26,6	1,5	9021	9,02
Natural_28	protein	907,5	40,3	28,7	1,4	10412	10,41
Natural_29	protein	1028,5	42,4	30,9	1,4	12708	12,71
Natural_30	protein	665,5	33,5	25,3	1,3	6724	6,72
Natural_31	protein	695,8	37,6	23,6	1,6	6562	6,56
Natural_32	protein	907,5	46,8	24,7	1,9	8961	8,96
Natural_33	protein	574,8	33	22,2	1,5	5098	5,10
Natural_34	protein	816,8	45	23,1	1,9	7556	7,56
Natural_35	protein	998,3	41,6	30,6	1,4	12213	12,21
Natural_36	protein	2662	78,3	43,3	1,8	46121	46,12

Natural_37	protein	1089	62,7	22,1	2,8	9626	9,63
Natural_38	protein	907,5	39,1	29,5	1,3	10715	10,72
Natural_39	protein	998,3	41,6	30,6	1,4	12213	12,21
Natural_40	protein	937,8	45	26,6	1,7	9960	9,96
Natural_41	protein	998,3	45,2	28,1	1,6	11238	11,24
Natural_42	protein	2480,5	83,2	38	2,2	37674	37,67
Natural_43	protein	695,8	39	22,7	1,7	6329	6,33
Natural_44	protein	695,8	42,4	20,9	2,0	5815	5,82
Natural_45	protein	1300,8	49,8	33,2	1,5	17289	17,29
Natural_46	protein	1119,3	52,5	27,1	1,9	12155	12,16
Natural_47	protein	877,3	40,3	27,7	1,5	9729	9,73
Natural_48	protein	877,3	37,6	29,7	1,3	10432	10,43
Natural_49	protein	1482,3	52,5	36	1,5	21317	21,32
Natural_50	protein	1905,8	66	36,8	1,8	28029	28,03
Natural_51	protein	877,3	39,6	28,2	1,4	9892	9,89
Natural_52	protein	302,5	28,2	13,7	2,1	1654	1,65
Natural_53	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_54	protein	453,8	30,1	19,2	1,6	3484	3,48
Natural_55	protein	1240,3	53,6	29,5	1,8	14618	14,62
Natural_56	protein	302,5	22,9	16,8	1,4	2036	2,04
Natural_57	protein	635,3	35,1	23	1,5	5852	5,85
Natural_58	protein	393,3	28,2	17,8	1,6	2795	2,80
Natural_59	protein	363	30,1	15,4	2,0	2230	2,23
Natural_60	protein	574,8	35,1	20,8	1,7	4791	4,79
Natural_61	protein	544,5	33,5	20,7	1,6	4501	4,50
Natural_62	protein	423,5	30,1	17,9	1,7	3035	3,04
Natural_63	protein	484	37,6	16,4	2,3	3176	3,18
Natural_64	protein	786,5	39,6	25,3	1,6	7952	7,95
Natural_65	protein	484	39	15,8	2,5	3063	3,06
Natural_66	protein	695,8	36,6	24,2	1,5	6734	6,73
Natural_67	protein	423,5	33	16,3	2,0	2768	2,77
Natural_68	protein	302,5	22,9	16,8	1,4	2036	2,04
Natural_69	protein	423,5	30,1	17,9	1,7	3035	3,04
Natural_70	protein	211,8	22,9	11,8	1,9	998	1,00
Natural_71	protein	363	28,2	16,4	1,7	2382	2,38
Natural_72	protein	605	35,1	21,9	1,6	5308	5,31
Natural_73	protein	363	28,2	16,4	1,7	2382	2,38
Natural_74	protein	484	30,1	20,5	1,5	3964	3,96
Natural_75	protein	393,3	30,1	16,6	1,8	2617	2,62
Natural_76	protein	484	35,1	17,5	2,0	3397	3,40
Natural_77	protein	544,5	33,5	20,7	1,6	4501	4,50
Natural_78	protein	907,5	39,6	29,2	1,4	10586	10,59
Natural_79	protein	665,5	39	21,8	1,8	5790	5,79
Natural_80	protein	695,8	35,1	25,2	1,4	7020	7,02
Natural_81	protein	937,8	41,3	28,9	1,4	10834	10,83
MP_1	pe	4053,5	134,4	38,4	3,5	62278	59,16
MP_2	pe	1542,8	99,4	19,8	5,0	12194	11,59
MP_3	pe	3115,8	154,5	25,7	6,0	32007	30,41
MP_4	pe	4235	191,2	28,2	6,8	47762	45,37
MP_5	pe	8681,8	377,1	29,3	12,9	101795	96,71

MP_6	pe	7411,3	254,3	37,1	6,9	110023	104,52
MP_7	pe	8772,5	359,9	31	11,6	108910	103,47
MP_8	pe	6473,5	219,9	37,5	5,9	97067	92,21
MP_9	pe	6019,8	292,8	26,2	11,2	63027	59,88
MP_10	pe	3176,3	166,4	24,3	6,8	30876	29,33
MP_11	pe	7804,5	305,3	32,6	9,4	101615	96,53
MP_12	pe	1996,5	107,4	23,7	4,5	18909	17,96
MP_13	pe	1905,8	115,1	21,1	5,5	16072	15,27
MP_14	pe	10103,5	478,2	26,9	17,8	108720	103,28
MP_15	pe	12614,3	438,3	36,6	12,0	184910	175,66
MP_16	pe	1452	98,6	18,8	5,2	10892	10,35
MP_17	pe	25773	830,4	39,5	21,0	407389	387,02
MP_18	pe	1210	54,5	28,3	1,9	13679	13,00
MP_19	pe	10890	390,8	35,5	11,0	154550	146,82
MP_20	pe	7229,8	229,3	40,1	5,7	116098	110,29
MP_21	pe	13370,5	392,5	43,4	9,0	231992	220,39
MP_22	pe	7592,8	256,6	37,7	6,8	114409	108,69
MP_23	pe	4174,5	155,2	34,2	4,5	57179	54,32
MP_24	pe	877,3	58,7	19	3,1	6680	6,35
MP_25	pe	4840	215,2	28,6	7,5	55429	52,66
MP_26	pe	7139	221,7	41	5,4	117097	111,24
MP_27	pe	4386,3	172,5	32,4	5,3	56797	53,96
MP_28	pe	1875,5	106,4	22,4	4,8	16838	16,00
MP_29	pan	2208,3	133,5	21,1	6,3	18605	21,95
MP_30	pan	1724,3	120,7	18,2	6,6	12549	14,81
Natural_82	cellulose	12221	368,5	42,2	8,7	206445	317,93
Natural_83	cellulose	5717,3	264,2	27,6	9,6	63007	97,03
Natural_84	cellulose	2631,8	127,1	26,4	4,8	27764	42,76
Natural_85	cellulose	8923,8	400,4	28,4	14,1	101283	155,98
Natural_86	cellulose	11253	304	47,1	6,5	212131	326,68
Natural_87	cellulose	4779,5	167,7	36,3	4,6	69355	106,81
Natural_88	cellulose	11434,5	533,8	27,3	19,6	124749	192,11
Natural_89	cellulose	6110,5	239,7	32,5	7,4	79323	122,16
Natural_90	cellulose	1028,5	74,3	17,6	4,2	7251	11,17
Natural_91	cellulose	726	61,6	15	4,1	4359	6,71
Natural_92	cellulose	6110,5	138,7	56,1	2,5	137140	211,20
Natural_93	cellulose	2601,5	115,6	28,6	4,0	29807	45,90
Natural_94	cellulose	1996,5	100,3	25,4	3,9	20245	31,18
Natural_95	cellulose	1210	50,3	30,6	1,6	14810	22,81
Natural_96	cellulose	7078,5	256,9	35,1	7,3	99349	153,00
Natural_97	cellulose	1240,3	76,6	20,6	3,7	10231	15,76
Natural_98	cellulose	2631,8	159,4	21	7,6	22130	34,08
Natural_99	cellulose	4053,5	192,1	26,9	7,1	43566	67,09
Natural_100	cellulose	4386,3	206,5	27	7,6	47446	73,07
Natural_101	cellulose	3962,8	177,7	28,4	6,3	45012	69,32
Natural_102	cellulose	1240,3	71,7	22	3,3	10922	16,82
Natural_103	cellulose	1724,3	84,2	26,1	3,2	17973	27,68
Natural_104	cellulose	2631,8	184,8	18,1	10,2	19086	29,39
Natural_105	protein	8742,3	170,4	65,3	2,6	228461	228,46
Natural_106	protein	1966,3	58,7	42,7	1,4	33559	33,56

Appendix 8

MAL1.2.2

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	363	25,3	18,2	1,4	2649	2,649
Natural_2	protein	605	33,5	23	1,5	5557	5,557
Natural_3	protein	1784,8	64,5	35,3	1,8	25167	25,167
Natural_4	protein	1149,5	66	22,2	3,0	10198	10,198
Natural_5	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_6	protein	484	40,7	15,1	2,7	2930	2,93
Natural_7	protein	242	22,9	13,5	1,7	1303	1,303
Natural_8	protein	7139	199,9	45,5	4,4	129851	129,851
Natural_9	protein	756,3	39	24,7	1,6	7477	7,477
Natural_10	protein	968	49,8	24,7	2,0	9575	9,575
Natural_11	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_12	protein	393,3	28,8	17,4	1,7	2731	2,731
Natural_13	protein	574,8	39	18,8	2,1	4319	4,319
Natural_14	protein	1089	58,7	23,6	2,5	10294	10,294
Natural_15	protein	1361,3	63,8	27,2	2,3	14785	14,785
Natural_16	protein	635,3	40,3	20,1	2,0	5102	5,102
Natural_17	protein	907,5	53,6	21,6	2,5	7826	7,826
Natural_18	protein	8500,3	137,8	78,6	1,8	267131	267,131
Natural_19	protein	272,3	21,1	16,5	1,3	1793	1,793
Natural_20	protein	8288,5	148,4	71,1	2,1	235750	235,75
Natural_21	protein	35634,5	263,9	171,9	1,5	2450686	2450,686
Natural_22	protein	453,8	33	17,5	1,9	3178	3,178
Natural_23	protein	1542,8	64,5	30,5	2,1	18799	18,799
Natural_24	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_25	protein	1089	67,6	20,5	3,3	8935	8,935
Natural_26	protein	1452	58,7	31,5	1,9	18301	18,301
Natural_27	protein	635,3	40,3	20,1	2,0	5102	5,102
Natural_28	protein	2692,3	72,1	47,6	1,5	51221	51,221
Natural_29	protein	8318,8	148,3	71,4	2,1	237684	237,684
Natural_30	protein	2117,5	86,4	31,2	2,8	26427	26,427
Natural_31	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_32	protein	544,5	33	21	1,6	4576	4,576
Natural_33	protein	1210	56,9	27,1	2,1	13095	13,095
Natural_34	protein	1149,5	49,1	29,8	1,6	13692	13,692
Natural_35	protein	1361,3	53,8	32,2	1,7	17557	17,557
Natural_36	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_37	protein	363	33	14	2,4	2034	2,034
Natural_38	protein	8833	165,9	67,8	2,4	239531	239,531
Natural_39	protein	1089	49,1	28,2	1,7	12289	12,289
Natural_40	protein	16183,8	245,1	84,1	2,9	544136	544,136
Natural_41	protein	160113,3	631,6	322,7	2,0	20670480	20670,48
Natural_42	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_43	protein	1361,3	53,8	32,2	1,7	17557	17,557
Natural_44	protein	1633,5	56,2	37	1,5	24178	24,178

Natural_45	protein	544,5	40,3	17,2	2,3	3748	3,748
Natural_46	protein	1361,3	65,9	26,3	2,5	14328	14,328
Natural_47	protein	2087,3	104,9	25,3	4,1	21144	21,144
Natural_48	protein	302,5	22,9	16,8	1,4	2036	2,036
Natural_49	protein	574,8	33,5	21,8	1,5	5015	5,015
Natural_50	protein	242	25,3	12,2	2,1	1177	1,177
Natural_51	protein	695,8	37,6	23,6	1,6	6562	6,562
Natural_52	protein	484	30,1	20,5	1,5	3964	3,964
Natural_53	protein	1240,3	56,9	27,7	2,1	13758	13,758
Natural_54	protein	8409,5	136	78,7	1,7	264895	264,895
Natural_55	protein	484	30,1	20,5	1,5	3964	3,964
Natural_56	protein	1603,3	61,3	33,3	1,8	21351	21,351
Natural_57	protein	181,5	17,8	13	1,4	943	0,943
Natural_58	protein	484	30,1	20,5	1,5	3964	3,964
Natural_59	protein	332,8	30,1	14,1	2,1	1874	1,874
Natural_60	protein	635,3	33,5	24,1	1,4	6127	6,127
Natural_61	protein	726	42,4	21,8	1,9	6332	6,332
Natural_62	protein	211,8	21,1	12,8	1,6	1085	1,085
Natural_63	protein	332,8	30,1	14,1	2,1	1874	1,874
Natural_64	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_65	protein	15336,8	244,1	80	3,1	490777	490,777
Natural_66	protein	453,8	39	14,8	2,6	2692	2,692
Natural_67	protein	514,3	33	19,8	1,7	4081	4,081
Natural_68	protein	363	28,2	16,4	1,7	2382	2,382
Natural_69	protein	4386,3	157,4	35,5	4,4	62271	62,271
Natural_70	protein	272,3	30,1	11,5	2,6	1254	1,254
Natural_71	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_72	protein	393,3	28,2	17,8	1,6	2795	2,795
Natural_73	protein	1240,3	54,5	29	1,9	14372	14,372
Natural_74	protein	514,3	37,6	17,4	2,2	3585	3,585
Natural_75	protein	1361,3	58,7	29,5	2,0	16086	16,086
Natural_76	protein	514,3	33,5	19,5	1,7	4015	4,015
Natural_77	protein	363	33,5	13,8	2,4	2001	2,001
Natural_78	protein	1936	87,2	28,3	3,1	21902	21,902
Natural_79	protein	363	25,3	18,2	1,4	2649	2,649
Natural_80	protein	756,3	40,3	23,9	1,7	7230	7,23
Natural_81	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_82	protein	2087,3	72,2	36,8	2,0	30739	30,739
Natural_83	protein	605	36,6	21	1,7	5092	5,092
Natural_84	protein	726	37,6	24,6	1,5	7145	7,145
Natural_85	protein	1119,3	51,3	27,8	1,8	12430	12,43
Natural_86	protein	937,8	54,5	21,9	2,5	8216	8,216
Natural_87	protein	332,8	22,9	18,5	1,2	2463	2,463
Natural_88	protein	877,3	39,8	28	1,4	9839	9,839
Natural_89	protein	5717,3	142	51,2	2,8	117200	117,2
Natural_90	protein	605	35,1	21,9	1,6	5308	5,308
Natural_91	protein	393,3	28,8	17,4	1,7	2731	2,731
Natural_92	protein	302,5	22,9	16,8	1,4	2036	2,036
Natural_93	protein	6594,5	127,5	65,9	1,9	173724	173,724
Natural_94	protein	332,8	28,8	14,7	2,0	1956	1,956
Natural_95	protein	423,5	33,5	16,1	2,1	2723	2,723
Natural_96	protein	272,3	22,9	15,1	1,5	1649	1,649

Natural_97	protein	332,8	27,5	15,4	1,8	2051	2,051
Natural_98	protein	363	28,2	16,4	1,7	2382	2,382
Natural_99	protein	1724,3	88,7	24,7	3,6	17065	17,065
Natural_100	protein	1058,8	44	30,7	1,4	12984	12,984
Natural_101	protein	514,3	33,5	19,5	1,7	4015	4,015
Natural_102	protein	3993	118,4	42,9	2,8	68568	68,568
Natural_103	protein	726	42,4	21,8	1,9	6332	6,332
Natural_104	protein	756,3	35,1	27,4	1,3	8294	8,294
Natural_105	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_106	protein	7683,5	161,2	60,7	2,7	186566	186,566
Natural_107	protein	635,3	37,6	21,5	1,7	5470	5,47
Natural_108	protein	1875,5	60,8	39,3	1,5	29477	29,477
Natural_109	protein	937,8	44,8	26,7	1,7	10002	10,002
Natural_110	protein	484	33,5	18,4	1,8	3557	3,557
Natural_111	protein	877,3	49,1	22,7	2,2	7974	7,974
Natural_112	protein	1119,3	44,8	31,8	1,4	14249	14,249
Natural_113	protein	786,5	39,6	25,3	1,6	7952	7,952
Natural_114	protein	484	30,1	20,5	1,5	3964	3,964
Natural_115	protein	605	35,1	21,9	1,6	5308	5,308
Natural_116	protein	635,3	42,4	19,1	2,2	4848	4,848
Natural_117	protein	484	30,1	20,5	1,5	3964	3,964
Natural_118	protein	2299	83,8	34,9	2,4	32136	32,136
Natural_119	protein	423,5	37,6	14,4	2,6	2431	2,431
Natural_120	protein	2934,3	77,5	48,2	1,6	56561	56,561
Natural_121	protein	544,5	30,1	23	1,3	5017	5,017
Natural_122	protein	1028,5	51	25,7	2,0	10562	10,562
Natural_123	protein	484	40,7	15,1	2,7	2930	2,93
Natural_124	protein	4295,5	117	46,7	2,5	80286	80,286
Natural_125	protein	635,3	39	20,8	1,9	5276	5,276
Natural_126	protein	514,3	33,5	19,5	1,7	4015	4,015
MP_1	pet	605	49,8	15,5	3,2	3740	5,161
MP_2	pet	1119,3	55	25,9	2,1	11600	16,008
MP_3	pet	1754,5	83,5	26,8	3,1	18781	25,918
MP_4	pet	1936	88,7	27,8	3,2	21514	29,69
MP_5	pet	2359,5	81,2	37	2,2	34915	48,183
MP_6	pe	272,3	33,5	10,3	3,3	1125	1,069
MP_7	pe	363	30,1	15,4	2,0	2230	2,118
MP_8	pe	544,5	40,3	17,2	2,3	3748	3,561
MP_9	pe	181,5	17,8	13	1,4	943	0,896
MP_10	pe	756,3	56,2	17,1	3,3	5182	4,923
MP_11	pe	332,8	49,8	8,5	5,9	1131	1,075
MP_12	pe	453,8	33	17,5	1,9	3178	3,019
Natural_127	protein	393,3	25,3	19,8	1,3	3109	3,109
Natural_128	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_129	protein	363	25,3	18,2	1,4	2649	2,649
Natural_130	protein	2904	88,7	41,7	2,1	48407	48,407
Natural_131	protein	968	61,2	20,1	3,0	7800	7,8
Natural_132	protein	393,3	33	15,2	2,2	2387	2,387
Natural_133	protein	2208,3	135,6	20,7	6,6	18316	18,316
Natural_134	protein	363	28,2	16,4	1,7	2382	2,382
Natural_135	protein	484	40,7	15,1	2,7	2930	2,93
Natural_136	protein	363	28,8	16	1,8	2327	2,327

Natural_137	protein	242	22,9	13,5	1,7	1303	1,303
Natural_138	cellulose	1542,8	82,6	23,8	3,5	14675	22,6
Natural_139	cellulose	1361,3	82	21,1	3,9	11508	17,722
Natural_140	cellulose	4144,3	224,9	23,5	9,6	38901	59,907
Natural_141	cellulose	1542,8	73	26,9	2,7	16612	25,582
Natural_142	cellulose	1694	76,6	28,2	2,7	19086	29,393
Natural_143	cellulose	4416,5	134,4	41,8	3,2	73932	113,855
Natural_144	cellulose	1694	93,4	23,1	4,0	15646	24,095
Natural_145	cellulose	2571,3	121,8	26,9	4,5	27634	42,556
Natural_146	cellulose	272,3	33,5	10,3	3,3	1125	1,733
Natural_147	cellulose	12160,5	299,8	51,6	5,8	251191	386,834
Natural_148	cellulose	3751	157,5	30,3	5,2	45510	70,086
Natural_149	cellulose	151,3	22,9	8,4	2,7	509	0,784
Natural_150	cellulose	3751	171,5	27,8	6,2	41774	64,333
Natural_151	cellulose	1603,3	102,6	19,9	5,2	12763	19,655
MP_13	pvc-u	145139,5	955,6	193,4	4,9	11226823	15493,016
MP_14	pvc-u	2252203,3	3716,8	771,5	4,8	695050496	959169,664
MP_15	pvc-u	602459	1456,4	526,7	2,8	126920984	175150,96
MP_16	pvc-u	66459,3	594,6	142,3	4,2	3783190	5220,802
MP_17	pvc-u	49005	492,8	126,6	3,9	2481887	3425,003
MP_18	pvc-u	15730	302,3	66,2	4,6	416797	575,18
MP_19	pvc-u	128623	780,7	209,8	3,7	10792770	14894,023
MP_20	pp	8772,5	196,9	56,7	3,5	199021	189,07
MP_21	pp	9105,3	148,3	78,2	1,9	284645	270,413
MP_22	pp	3357,8	100,9	42,4	2,4	56885	54,041
MP_23	pp	6050	122,7	62,8	2,0	151941	144,344
MP_24	pp	2208,3	74,3	37,8	2,0	33425	31,754
MP_25	pp	28979,5	305,3	120,9	2,5	1401043	1330,991
MP_26	pp	181,5	21,1	11	1,9	797	0,757
MP_27	pp	1482,3	63	29,9	2,1	17748	16,861
MP_28	pp	211,8	22	12,3	1,8	1038	0,986
MP_29	pp	695,8	42,4	20,9	2,0	5815	5,524
MP_30	pp	1815	60,2	38,4	1,6	27859	26,466
MP_31	pp	695,8	37,6	23,6	1,6	6562	6,234
MP_32	pp	968	47	26,2	1,8	10154	9,646
MP_33	pp	2843,5	83,8	43,2	1,9	49160	46,702
MP_34	pp	544,5	30,1	23	1,3	5017	4,766
MP_35	pp	2601,5	77,5	42,7	1,8	44460	42,237
MP_36	pp	2117,5	70,7	38,1	1,9	32307	30,691
MP_37	pp	6806,3	228,5	37,9	6,0	103254	98,091
MP_38	pp	9256,5	132	89,3	1,5	330603	314,072
MP_39	pp	4356	106,5	52,1	2,0	90769	86,23
MP_40	pp	453,8	30,1	19,2	1,6	3484	3,31
MP_41	pp	877,3	48,6	23	2,1	8062	7,659
MP_42	pp	786,5	39,6	25,3	1,6	7952	7,554
MP_43	pp	121	16,5	9,3	1,8	452	0,429
MP_44	pp	14520	187,4	98,7	1,9	573051	544,398
MP_45	pp	605	35,1	21,9	1,6	5308	5,043
MP_46	pp	877,3	49,1	22,7	2,2	7974	7,576
MP_47	pp	1452	66	28	2,4	16271	15,457
MP_48	pp	544,5	37,6	18,5	2,0	4019	3,818
MP_49	pp	1996,5	112,9	22,5	5,0	17977	17,078

MP_50	pp	1210	72	21,4	3,4	10352	9,835
MP_51	pp	937,8	46,5	25,7	1,8	9639	9,157
MP_52	pp	877,3	57,5	19,4	3,0	6812	6,472
MP_53	pp	1845,3	77,5	30,3	2,6	22368	21,25
MP_54	pp	6050	219,5	35,1	6,3	84934	80,688
MP_55	pp	17575,3	202,5	110,5	1,8	777000	738,15
MP_56	pp	7411,3	131,4	71,8	1,8	212827	202,185
MP_57	pp	1028,5	79,8	16,4	4,9	6751	6,414
MP_58	pp	363	40,3	11,5	3,5	1666	1,583
MP_59	pp	181,5	17,8	13	1,4	943	0,896
MP_60	pp	484	42,4	14,5	2,9	2814	2,673
MP_61	pp	2541	70,7	45,8	1,5	46519	44,193
MP_62	pp	695,8	68,2	13	5,2	3614	3,434
MP_63	pp	514,3	35,1	18,6	1,9	3835	3,643
MP_64	pp	665,5	40,7	20,8	2,0	5540	5,263
MP_65	pp	665,5	33,5	25,3	1,3	6724	6,388
MP_66	pp	423,5	37,6	14,4	2,6	2431	2,31
MP_67	pp	514,3	40,7	16,1	2,5	3308	3,142
MP_68	pp	181,5	17,8	13	1,4	943	0,896
MP_69	pp	2238,5	72,2	39,5	1,8	35355	33,587
MP_70	pp	1905,8	88,3	27,5	3,2	20955	19,908
MP_71	pp	877,3	65,9	17	3,9	5951	5,653
MP_72	pp	544,5	42,4	16,4	2,6	3562	3,384
MP_73	pp	302,5	27,5	14	2,0	1695	1,61
MP_74	pp	786,5	47,7	21	2,3	6606	6,276
MP_75	pp	2389,8	73,2	41,6	1,8	39742	37,755
MP_76	pp	332,8	40,3	10,5	3,8	1400	1,33
MP_77	pp	272,3	30,1	11,5	2,6	1254	1,192
MP_78	pp	786,5	97,3	10,3	9,4	3237	3,075
MP_79	pp	2208,3	72,2	39	1,9	34406	32,685
MP_80	pp	998,3	44,2	28,8	1,5	11483	10,909

Appendix 9

MAL1.3.1

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
MP_1	pa	2722,5	109,1	31,8	3,4	34615	39,461
Natural_1	protein	2843,5	82	44,2	1,9	50225	50,225
Natural_2	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_3	protein	907,5	45	25,7	1,8	9328	9,328
Natural_4	protein	1331	66	25,7	2,6	13672	13,672
Natural_5	protein	2299	98,4	29,7	3,3	27348	27,348
Natural_6	protein	211,8	21,1	12,8	1,6	1085	1,085
Natural_7	protein	332,8	28,8	14,7	2,0	1956	1,956
Natural_8	protein	605	33,5	23	1,5	5557	5,557
Natural_9	protein	3509	114,1	39,1	2,9	54939	54,939
Natural_10	protein	453,8	33,5	17,2	1,9	3126	3,126
Natural_11	protein	635,3	36,6	22,1	1,7	5613	5,613
Natural_12	protein	3811,5	113,6	42,7	2,7	65105	65,105
Natural_13	protein	423,5	28,8	18,7	1,5	3168	3,168
Natural_14	protein	423,5	25,3	21,3	1,2	3606	3,606
Natural_15	protein	211,8	21,1	12,8	1,6	1085	1,085
Natural_16	protein	302,5	28,2	13,7	2,1	1654	1,654
Natural_17	protein	1119,3	49,1	29	1,7	12981	12,981
Natural_18	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_19	protein	423,5	33,5	16,1	2,1	2723	2,723
Natural_20	protein	1573	60,2	33,3	1,8	20925	20,925
Natural_21	protein	665,5	45,2	18,8	2,4	4995	4,995
Natural_22	protein	665,5	37,6	22,6	1,7	6004	6,004
Natural_23	protein	484	30,1	20,5	1,5	3964	3,964
Natural_24	protein	635,3	39	20,8	1,9	5276	5,276
Natural_25	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_26	protein	1028,5	58,7	22,3	2,6	9182	9,182
Natural_27	protein	1058,8	44,8	30,1	1,5	12750	12,75
Natural_28	protein	665,5	36,6	23,1	1,6	6161	6,161
Natural_29	protein	1663,8	78,1	27,1	2,9	18040	18,04
Natural_30	protein	363	25,3	18,2	1,4	2649	2,649
Natural_31	protein	665,5	35,1	24,1	1,5	6423	6,423
Natural_32	protein	877,3	43,8	25,5	1,7	8953	8,953
Natural_33	protein	514,3	33	19,8	1,7	4081	4,081
Natural_34	protein	1149,5	49,8	29,4	1,7	13502	13,502
Natural_35	protein	726	40,7	22,7	1,8	6593	6,593
Natural_36	protein	665,5	49,8	17	2,9	4526	4,526
Natural_37	protein	665,5	39	21,8	1,8	5790	5,79
Natural_38	protein	574,8	33,5	21,8	1,5	5015	5,015
Natural_39	protein	937,8	44,8	26,7	1,7	10002	10,002
Natural_40	protein	1724,3	56,8	38,7	1,5	26659	26,659
Natural_41	protein	665,5	37,6	22,6	1,7	6004	6,004
MP_2	pe	302,5	28,2	13,7	2,1	1654	1,571
MP_3	pe	393,3	40,7	12,3	3,3	1934	1,838

MP_4	pe	1573	69,4	28,9	2,4	18168	17,26
MP_5	pe	242	22,9	13,5	1,7	1303	1,238
MP_6	pe	605	44,4	17,4	2,6	4199	3,989
MP_7	pe	332,8	42,4	10	4,2	1330	1,264
MP_8	pe	1240,3	55,8	28,3	2,0	14051	13,348
Natural_42	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_43	protein	453,8	33	17,5	1,9	3178	3,178
Natural_44	protein	272,3	22,9	15,1	1,5	1649	1,649
Natural_45	protein	393,3	39	12,9	3,0	2022	2,022
Natural_46	protein	816,8	40,7	25,5	1,6	8344	8,344
Natural_47	protein	695,8	40,3	22	1,8	6120	6,12
Natural_48	protein	1603,3	67,6	30,2	2,2	19365	19,365
Natural_49	protein	635,3	33,5	24,1	1,4	6127	6,127
Natural_50	protein	302,5	22,9	16,8	1,4	2036	2,036
Natural_51	protein	393,3	28,8	17,4	1,7	2731	2,731
Natural_52	protein	363	30,1	15,4	2,0	2230	2,23
Natural_53	protein	635,3	40,7	19,9	2,0	5048	5,048
Natural_54	protein	423,5	37,6	14,4	2,6	2431	2,431
Natural_55	protein	423,5	36,6	14,7	2,5	2495	2,495
Natural_56	cellulose	907,5	66,1	17,5	3,8	6343	9,768
MP_9	pp	695,8	47,4	18,7	2,5	5203	4,942
MP_10	pp	332,8	25,3	16,7	1,5	2226	2,115
MP_11	pp	8833	254,2	44,2	5,8	156311	148,495
MP_12	pp	8742,3	143,9	77,3	1,9	270399	256,879
MP_13	pp	453,8	33,5	17,2	1,9	3126	2,97
MP_14	pp	423,5	28,2	19,1	1,5	3242	3,08
MP_15	pp	544,5	33	21	1,6	4576	4,347

Appendix 10

MAL1.4.1

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm^3]	Mass [ng]
MP_1	pa	4174,5	160,1	33,2	4,8	55451	63,214
Natural_1	protein	272,3	28,2	12,3	2,3	1340	1,34
Natural_2	protein	272,3	22,9	15,1	1,5	1649	1,649
Natural_3	protein	816,8	49,7	20,9	2,4	6840	6,84
Natural_4	protein	544,5	37,6	18,5	2,0	4019	4,019
Natural_5	protein	544,5	33	21	1,6	4576	4,576
Natural_6	protein	363	25,3	18,2	1,4	2649	2,649
Natural_7	protein	9619,5	146,3	83,7	1,7	322053	322,053
Natural_8	protein	605	37,6	20,5	1,8	4962	4,962
Natural_9	protein	484	33	18,7	1,8	3615	3,615
Natural_10	protein	877,3	45	24,8	1,8	8716	8,716
Natural_11	protein	1119,3	49,1	29	1,7	12981	12,981
Natural_12	protein	665,5	37,6	22,6	1,7	6004	6,004
Natural_13	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_14	protein	937,8	44,2	27	1,6	10134	10,134
Natural_15	protein	453,8	28,8	20	1,4	3637	3,637
Natural_16	protein	242	22,9	13,5	1,7	1303	1,303
Natural_17	protein	1028,5	50,3	26	1,9	10700	10,7
Natural_18	protein	211,8	17,8	15,1	1,2	1283	1,283
Natural_19	protein	605	42,4	18,2	2,3	4397	4,397
Natural_20	protein	1210	60,6	25,4	2,4	12297	12,297
Natural_21	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_22	protein	726	40,3	22,9	1,8	6663	6,663
Natural_23	protein	514,3	33	19,8	1,7	4081	4,081
Natural_24	protein	3751	97,7	48,9	2,0	73321	73,321
Natural_25	protein	937,8	66,6	17,9	3,7	6725	6,725
Natural_26	protein	695,8	39	22,7	1,7	6329	6,329
Natural_27	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_28	protein	786,5	46,5	21,6	2,2	6780	6,78
Natural_29	protein	393,3	33	15,2	2,2	2387	2,387
Natural_30	protein	786,5	41,6	24,1	1,7	7581	7,581
Natural_31	protein	484	28,8	21,4	1,3	4138	4,138
Natural_32	protein	242	22,9	13,5	1,7	1303	1,303
Natural_33	protein	1421,8	55,8	32,5	1,7	18464	18,464
Natural_34	protein	3872	97,9	50,4	1,9	77992	77,992
Natural_35	protein	121	16,5	9,3	1,8	452	0,452
Natural_36	protein	816,8	37,6	27,7	1,4	9043	9,043
Natural_37	protein	393,3	25,3	19,8	1,3	3109	3,109
Natural_38	protein	544,5	33,5	20,7	1,6	4501	4,501
Natural_39	protein	816,8	43,8	23,8	1,8	7761	7,761
Natural_40	protein	302,5	30,1	12,8	2,4	1548	1,548
Natural_41	protein	574,8	39	18,8	2,1	4319	4,319
Natural_42	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_43	protein	1240,3	56,8	27,8	2,0	13793	13,793

Natural_44	protein	847	41,6	26	1,6	8792	8,792
Natural_45	protein	907,5	51,2	22,6	2,3	8197	8,197
Natural_46	protein	302,5	33,5	11,5	2,9	1389	1,389
Natural_47	protein	574,8	30,1	24,3	1,2	5590	5,59
Natural_48	protein	484	35,1	17,5	2,0	3397	3,397
Natural_49	protein	1149,5	61,2	23,9	2,6	10999	10,999
Natural_50	protein	635,3	35,1	23	1,5	5852	5,852
Natural_51	protein	544,5	33	21	1,6	4576	4,576
Natural_52	protein	181,5	17,8	13	1,4	943	0,943
Natural_53	protein	1179,8	53,8	27,9	1,9	13187	13,187
Natural_54	protein	1179,8	46,5	32,3	1,4	15256	15,256
Natural_55	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_56	protein	7804,5	149,9	66,3	2,3	206925	206,925
Natural_57	protein	695,8	37,6	23,6	1,6	6562	6,562
Natural_58	protein	1058,8	50,3	26,8	1,9	11339	11,339
Natural_59	protein	453,8	28,8	20	1,4	3637	3,637
Natural_60	protein	181,5	17,8	13	1,4	943	0,943
Natural_61	protein	1119,3	49,1	29	1,7	12981	12,981
Natural_62	protein	1210	56,2	27,4	2,1	13266	13,266
Natural_63	protein	453,8	33	17,5	1,9	3178	3,178
Natural_64	protein	695,8	40,7	21,8	1,9	6055	6,055
Natural_65	protein	514,3	40,3	16,3	2,5	3343	3,343
Natural_66	protein	363	28,8	16	1,8	2327	2,327
Natural_67	protein	7350,8	110	85,1	1,3	250286	250,286
Natural_68	protein	726	47,4	19,5	2,4	5665	5,665
Natural_69	protein	1694	61,2	35,3	1,7	23888	23,888
Natural_70	protein	332,8	33,5	12,6	2,7	1681	1,681
Natural_71	protein	907,5	45,4	25,5	1,8	9249	9,249
Natural_72	protein	605	37,6	20,5	1,8	4962	4,962
Natural_73	protein	665,5	40,3	21	1,9	5599	5,599
Natural_74	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_75	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_76	protein	695,8	37,6	23,6	1,6	6562	6,562
Natural_77	protein	514,3	30,1	21,8	1,4	4475	4,475
Natural_78	protein	4567,8	105,2	55,3	1,9	101055	101,055
Natural_79	protein	907,5	45	25,7	1,8	9328	9,328
Natural_80	protein	544,5	30,1	23	1,3	5017	5,017
Natural_81	protein	453,8	33,5	17,2	1,9	3126	3,126
Natural_82	protein	907,5	46,8	24,7	1,9	8961	8,961
Natural_83	protein	605	37,6	20,5	1,8	4962	4,962
Natural_84	protein	181,5	21,1	11	1,9	797	0,797
Natural_85	protein	1573	56,9	35,2	1,6	22130	22,13
Natural_86	protein	816,8	41,6	25	1,7	8175	8,175
Natural_87	protein	363	33,5	13,8	2,4	2001	2,001
Natural_88	protein	181,5	17,8	13	1,4	943	0,943
Natural_89	protein	363	33,5	13,8	2,4	2001	2,001
Natural_90	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_91	protein	1512,5	60,6	31,8	1,9	19214	19,214
Natural_92	protein	242	22,9	13,5	1,7	1303	1,303
Natural_93	protein	665,5	40,7	20,8	2,0	5540	5,54
Natural_94	protein	242	22,9	13,5	1,7	1303	1,303
Natural_95	protein	363	27,5	16,8	1,6	2440	2,44

Natural_96	protein	907,5	40,5	28,5	1,4	10356	10,356
Natural_97	protein	514,3	35,1	18,6	1,9	3835	3,835
Natural_98	protein	1452	63,8	29	2,2	16822	16,822
Natural_99	protein	423,5	28,2	19,1	1,5	3242	3,242
Natural_100	protein	1028,5	49,1	26,6	1,8	10961	10,961
Natural_101	protein	998,3	51,3	24,8	2,1	9888	9,888
Natural_102	protein	2450,3	110,4	28,3	3,9	27706	27,706
Natural_103	protein	363	28,2	16,4	1,7	2382	2,382
Natural_104	protein	635,3	39	20,8	1,9	5276	5,276
Natural_105	protein	2057	66,5	39,4	1,7	32407	32,407
Natural_106	protein	121	16,5	9,3	1,8	452	0,452
Natural_107	protein	877,3	51,3	21,8	2,4	7636	7,636
Natural_108	protein	484	33,5	18,4	1,8	3557	3,557
Natural_109	protein	544,5	33,5	20,7	1,6	4501	4,501
Natural_110	protein	695,8	47,4	18,7	2,5	5203	5,203
Natural_111	protein	2238,5	70	40,7	1,7	36473	36,473
Natural_112	protein	453,8	39	14,8	2,6	2692	2,692
Natural_113	protein	1331	55,2	30,7	1,8	16359	16,359
Natural_114	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_115	protein	423,5	40,3	13,4	3,0	2267	2,267
Natural_116	protein	2420	81,8	37,7	2,2	36465	36,465
Natural_117	protein	423,5	28,2	19,1	1,5	3242	3,242
Natural_118	protein	635,3	39	20,8	1,9	5276	5,276
Natural_119	protein	968	51,2	24,1	2,1	9327	9,327
Natural_120	protein	1936	81,2	30,4	2,7	23506	23,506
Natural_121	protein	242	25,3	12,2	2,1	1177	1,177
Natural_122	protein	393,3	25,3	19,8	1,3	3109	3,109
Natural_123	protein	1149,5	55,6	26,3	2,1	12103	12,103
Natural_124	protein	605	37,6	20,5	1,8	4962	4,962
Natural_125	protein	484	35,1	17,5	2,0	3397	3,397
Natural_126	protein	1421,8	58,5	30,9	1,9	17590	17,59
Natural_127	protein	544,5	33,5	20,7	1,6	4501	4,501
Natural_128	protein	1421,8	56,9	31,8	1,8	18079	18,079
Natural_129	protein	484	30,1	20,5	1,5	3964	3,964
Natural_130	protein	695,8	35,1	25,2	1,4	7020	7,02
Natural_131	protein	2631,8	88,7	37,8	2,3	39756	39,756
Natural_132	protein	574,8	45,2	16,2	2,8	3725	3,725
Natural_133	protein	1482,3	58,5	32,2	1,8	19118	19,118
Natural_134	protein	2964,5	91,7	41,2	2,2	48824	48,824
Natural_135	protein	5172,8	161,4	40,8	4,0	84459	84,459
Natural_136	protein	1089	55	25,2	2,2	10982	10,982
Natural_137	protein	332,8	33	12,8	2,6	1709	1,709
Natural_138	protein	363	25,3	18,2	1,4	2649	2,649
Natural_139	protein	181,5	17,8	13	1,4	943	0,943
Natural_140	protein	1210	56,2	27,4	2,1	13271	13,271
Natural_141	protein	423,5	33,5	16,1	2,1	2723	2,723
Natural_142	protein	453,8	33	17,5	1,9	3178	3,178
Natural_143	protein	453,8	44,4	13	3,4	2362	2,362
Natural_144	protein	665,5	33,5	25,3	1,3	6724	6,724
Natural_145	protein	242	22,9	13,5	1,7	1303	1,303
Natural_146	protein	2934,3	96,4	38,8	2,5	45500	45,5
Natural_147	protein	363	30,1	15,4	2,0	2230	2,23

Natural_148	protein	9559	154	79	1,9	302242	302,242
Natural_149	protein	605	35,1	21,9	1,6	5308	5,308
Natural_150	protein	605	40,3	19,1	2,1	4627	4,627
Natural_151	protein	2662	88,5	38,3	2,3	40800	40,8
Natural_152	protein	332,8	22,9	18,5	1,2	2463	2,463
Natural_153	protein	1210	71,6	21,5	3,3	10412	10,412
Natural_154	protein	2329,3	80,3	36,9	2,2	34407	34,407
Natural_155	protein	3509	84,4	53	1,6	74327	74,327
Natural_156	protein	1361,3	68,3	25,4	2,7	13814	13,814
Natural_157	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_158	protein	998,3	56	22,7	2,5	9056	9,056
Natural_159	protein	453,8	33	17,5	1,9	3178	3,178
Natural_160	protein	756,3	52,2	18,5	2,8	5583	5,583
Natural_161	protein	1724,3	63,8	34,4	1,9	23722	23,722
Natural_162	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_163	protein	363	28,8	16	1,8	2327	2,327
Natural_164	protein	726	40,7	22,7	1,8	6593	6,593
Natural_165	protein	1089	50,3	27,5	1,8	11996	11,996
Natural_166	protein	393,3	28,2	17,8	1,6	2795	2,795
Natural_167	protein	998,3	51,3	24,8	2,1	9888	9,888
Natural_168	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_169	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_170	protein	635,3	40,7	19,9	2,0	5048	5,048
Natural_171	protein	786,5	40,3	24,9	1,6	7820	7,82
Natural_172	protein	514,3	40,3	16,3	2,5	3343	3,343
Natural_173	protein	1300,8	53,5	30,9	1,7	16097	16,097
Natural_174	protein	786,5	37,1	27	1,4	8494	8,494
Natural_175	protein	1875,5	71,7	33,3	2,2	24984	24,984
Natural_176	protein	363	22,9	20,2	1,1	2931	2,931
Natural_177	protein	2087,3	72,1	36,9	2,0	30787	30,787
Natural_178	protein	3297,3	93,8	44,7	2,1	59013	59,013
Natural_179	protein	1210	69	22,3	3,1	10800	10,8
Natural_180	protein	756,3	48,5	19,9	2,4	6011	6,011
Natural_181	protein	1694	56,8	38	1,5	25732	25,732
Natural_182	protein	272,3	22,9	15,1	1,5	1649	1,649
Natural_183	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_184	protein	363	30,1	15,4	2,0	2230	2,23
Natural_185	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_186	protein	605	48,5	15,9	3,1	3847	3,847
Natural_187	protein	363	27,5	16,8	1,6	2440	2,44
Natural_188	protein	1028,5	55,8	23,5	2,4	9662	9,662
Natural_189	protein	1875,5	64,5	37	1,7	27784	27,784
Natural_190	protein	605	33,5	23	1,5	5557	5,557
Natural_191	protein	665,5	35,1	24,1	1,5	6423	6,423
Natural_192	protein	1119,3	60,2	23,7	2,5	10594	10,594
Natural_193	protein	665,5	33,5	25,3	1,3	6724	6,724
Natural_194	protein	453,8	33,5	17,2	1,9	3126	3,126
Natural_195	protein	635,3	35,1	23	1,5	5852	5,852
Natural_196	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_197	protein	2994,8	78,7	48,5	1,6	58062	58,062
Natural_198	protein	332,8	35,1	12,1	2,9	1606	1,606
Natural_199	protein	665,5	37,6	22,6	1,7	6004	6,004

Natural_200	protein	1179,8	51,7	29,1	1,8	13718	13,718
Natural_201	protein	968	48,5	25,4	1,9	9848	9,848
Natural_202	protein	514,3	42,4	15,4	2,8	3177	3,177
Natural_203	protein	1452	62,9	29,4	2,1	17065	17,065
Natural_204	protein	786,5	41,6	24,1	1,7	7581	7,581
Natural_205	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_206	protein	242	25,3	12,2	2,1	1177	1,177
Natural_207	protein	514,3	37,6	17,4	2,2	3585	3,585
Natural_208	protein	302,5	22,9	16,8	1,4	2036	2,036
Natural_209	protein	453,8	33	17,5	1,9	3178	3,178
Natural_210	protein	514,3	30,1	21,8	1,4	4475	4,475
Natural_211	protein	181,5	17,8	13	1,4	943	0,943
Natural_212	protein	1058,8	49,7	27,1	1,8	11493	11,493
Natural_213	protein	332,8	30,1	14,1	2,1	1874	1,874
Natural_214	protein	1421,8	59,1	30,6	1,9	17423	17,423
Natural_215	protein	786,5	44,4	22,6	2,0	7097	7,097
Natural_216	protein	363	30,1	15,4	2,0	2230	2,23
Natural_217	protein	484	37,6	16,4	2,3	3176	3,176
MP_2	pet	4840	186	33,1	5,6	64148	88,525
MP_3	pet	1058,8	51,3	26,3	2,0	11123	15,349
MP_4	pet	211,8	22,9	11,8	1,9	998	1,377
MP_5	pet	1875,5	93,7	25,5	3,7	19109	26,371
MP_6	pe	272,3	28,2	12,3	2,3	1340	1,273
MP_7	pe	786,5	51,2	19,6	2,6	6157	5,849
MP_8	pe	1270,5	61,2	26,4	2,3	13437	12,765
MP_9	pe	1300,8	55,3	29,9	1,8	15581	14,802
MP_10	pe	574,8	33,5	21,8	1,5	5015	4,765
MP_11	pe	14852,8	276,4	68,4	4,0	406559	386,231
MP_12	pe	393,3	28,2	17,8	1,6	2795	2,655
MP_13	pe	847	67,6	16	4,2	5405	5,135
MP_14	pe	514,3	40,3	16,3	2,5	3343	3,176
MP_15	pe	726	52,2	17,7	2,9	5146	4,888
MP_16	pe	10769	182,3	75,2	2,4	323979	307,78
MP_17	pe	151,3	28,8	6,7	4,3	404	0,384
MP_18	pe	302,5	33,5	11,5	2,9	1389	1,32
MP_19	pe	151,3	17,8	10,8	1,6	655	0,622
MP_20	pe	242	30,1	10,2	3,0	991	0,941
MP_21	ps	544,5	35,1	19,7	1,8	4300	4,472
Natural_218	protein	1179,8	70,9	21,2	3,3	9995	9,995
Natural_219	protein	695,8	40,7	21,8	1,9	6055	6,055
Natural_220	protein	756,3	48,5	19,9	2,4	6011	6,011
Natural_221	protein	272,3	22,9	15,1	1,5	1649	1,649
Natural_222	protein	544,5	38,5	18	2,1	3922	3,922
Natural_223	protein	574,8	35,1	20,8	1,7	4791	4,791
Natural_224	protein	423,5	30,1	17,9	1,7	3035	3,035
Natural_225	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_226	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_227	protein	423,5	28,2	19,1	1,5	3242	3,242
Natural_228	protein	998,3	50,3	25,2	2,0	10080	10,08
Natural_229	protein	1240,3	66,2	23,8	2,8	11825	11,825
Natural_230	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_231	protein	211,8	22	12,3	1,8	1038	1,038

Natural_232	protein	968	53,9	22,9	2,4	8854	8,854
Natural_233	protein	1936	72,1	34,2	2,1	26487	26,487
Natural_234	protein	393,3	25,3	19,8	1,3	3109	3,109
Natural_235	protein	363	27,5	16,8	1,6	2440	2,44
Natural_236	protein	1179,8	53,8	27,9	1,9	13187	13,187
Natural_237	protein	1421,8	72,2	25,1	2,9	14262	14,262
Natural_238	protein	635,3	35,1	23	1,5	5852	5,852
Natural_239	protein	363	33	14	2,4	2034	2,034
Natural_240	protein	363	28,2	16,4	1,7	2382	2,382
Natural_241	protein	484	30,1	20,5	1,5	3964	3,964
Natural_242	protein	847	41,6	26	1,6	8792	8,792
Natural_243	protein	423,5	33,5	16,1	2,1	2723	2,723
Natural_244	protein	605	37,6	20,5	1,8	4962	4,962
Natural_245	protein	786,5	55,3	18,1	3,1	5696	5,696
Natural_246	cellulose	1936	137,8	17,9	7,7	13849	21,328
Natural_247	cellulose	574,8	56,2	13	4,3	2993	4,61
Natural_248	cellulose	2510,8	113	28,3	4,0	28402	43,739
Natural_249	cellulose	3055,3	152,2	25,6	5,9	31233	48,098
MP_22	pp	7108,8	153,2	59,1	2,6	168031	159,629
MP_23	pp	1028,5	40,7	32,2	1,3	13231	12,57
MP_24	pp	8167,5	195,2	53,3	3,7	174060	165,357
MP_25	pp	3055,3	75,3	51,6	1,5	63095	59,941
MP_26	pp	211,8	22,9	11,8	1,9	998	0,948
MP_27	pp	937,8	39,1	30,5	1,3	11441	10,869
MP_28	pp	181,5	17,8	13	1,4	943	0,896
MP_29	pp	726	44,4	20,8	2,1	6047	5,745
MP_30	pp	28616,5	328,6	110,9	3,0	1269097	1205,643
MP_31	pp	574,8	35,1	20,8	1,7	4791	4,551
MP_32	pp	574,8	38,5	19	2,0	4370	4,151
MP_33	pp	1391,5	56,9	31,1	1,8	17318	16,452
MP_34	pp	121	22	7	3,1	339	0,322
MP_35	pp	302,5	25,3	15,2	1,7	1840	1,748
MP_36	pp	453,8	30,1	19,2	1,6	3484	3,31
MP_37	pmma	2420	71,1	43,3	1,6	41925	49,471
MP_38	pan	665,5	42,4	20	2,1	5320	6,278

Appendix 11

MAL1.4.2.

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
MP_1	pa	4446,8	252,8	22,4	11,3	39841	45,418
Natural_1	protein	90,8	13,3	8,7	1,5	316	0,316
Natural_2	protein	242	21,1	14,6	1,4	1417	1,417
Natural_3	protein	242	21,1	14,6	1,4	1417	1,417
Natural_4	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_5	protein	2783	88,1	40,2	2,2	44778	44,778
Natural_6	protein	242	25,3	12,2	2,1	1177	1,177
Natural_7	protein	3599,8	130,3	35,2	3,7	50653	50,653
Natural_8	protein	786,5	49,7	20,2	2,5	6343	6,343
Natural_9	protein	90,8	13,3	8,7	1,5	316	0,316
Natural_10	protein	393,3	37,6	13,3	2,8	2096	2,096
Natural_11	protein	2268,8	90,3	32	2,8	29044	29,044
Natural_12	protein	907,5	57,9	19,9	2,9	7239	7,239
Natural_13	protein	363	33,5	13,8	2,4	2001	2,001
Natural_14	protein	272,3	30,1	11,5	2,6	1254	1,254
Natural_15	protein	544,5	35,1	19,7	1,8	4300	4,3
Natural_16	protein	302,5	28,8	13,4	2,1	1616	1,616
Natural_17	protein	151,3	17,8	10,8	1,6	655	0,655
MP_2	pe	1996,5	74,1	34,3	2,2	27407	26,037
MP_3	pe	363	30,1	15,4	2,0	2230	2,118
MP_4	pe	605	40,3	19,1	2,1	4627	4,396
MP_5	pe	514,3	33,5	19,5	1,7	4015	3,814
MP_6	pe	151,3	17,8	10,8	1,6	655	0,622
MP_7	pe	211,8	22	12,3	1,8	1038	0,986
MP_8	pe	484	30,1	20,5	1,5	3964	3,766
MP_9	pe	2208,3	79,6	35,3	2,3	31202	29,642
MP_10	pe	574,8	39	18,8	2,1	4319	4,103
MP_11	pe	2238,5	85,2	33,5	2,5	29953	28,455
MP_12	pe	1179,8	70,7	21,3	3,3	10028	9,527
MP_13	pe	423,5	37,6	14,4	2,6	2431	2,31
MP_14	pe	665,5	61,6	13,8	4,5	3662	3,479
MP_15	pe	151,3	21,1	9,1	2,3	553	0,526
Natural_18	protein	302,5	30,1	12,8	2,4	1548	1,548
Natural_19	protein	121	16,5	9,3	1,8	452	0,452
Natural_20	protein	3146	93,5	42,8	2,2	53885	53,885
Natural_21	protein	574,8	40,3	18,2	2,2	4176	4,176
Natural_22	protein	121	13,3	11,6	1,1	562	0,562
Natural_23	protein	181,5	17,8	13	1,4	943	0,943
Natural_24	protein	453,8	33,5	17,2	1,9	3126	3,126
Natural_25	protein	211,8	17,8	15,1	1,2	1283	1,283
Natural_26	protein	181,5	21,1	11	1,9	797	0,797
Natural_27	protein	151,3	17,8	10,8	1,6	655	0,655
Natural_28	protein	544,5	45,5	15,2	3,0	3316	3,316
Natural_29	cellulose	181,5	35,1	6,6	5,3	478	0,736

MP_16	pp	393,3	35,1	14,3	2,5	2243	2,131
MP_17	pp	3751	103,2	46,3	2,2	69424	65,953
MP_18	pp	3569,5	105,3	43,2	2,4	61621	58,54
MP_19	pp	726	47,4	19,5	2,4	5665	5,382
MP_20	pp	1482,3	61,2	30,8	2,0	18289	17,375
MP_21	pp	453,8	33	17,5	1,9	3178	3,019
MP_22	pp	514,3	40,3	16,3	2,5	3343	3,176
MP_23	pp	574,8	40,7	18	2,3	4132	3,925
MP_24	pp	484	35,1	17,5	2,0	3397	3,227
MP_25	pp	1452	76,9	24,1	3,2	13972	13,273
MP_26	pp	90,8	16,5	7	2,4	254	0,241
MP_27	pp	302,5	28,8	13,4	2,1	1616	1,535
MP_28	pp	937,8	54,5	21,9	2,5	8216	7,805
MP_29	pp	302,5	25,3	15,2	1,7	1840	1,748
MP_30	pp	1361,3	56	30,9	1,8	16840	15,998
MP_31	pp	3085,5	111,4	35,3	3,2	43530	41,353
MP_32	pp	1058,8	51,7	26,1	2,0	11048	10,496
MP_33	pp	1482,3	68	27,8	2,4	16463	15,64
MP_34	pp	514,3	37,6	17,4	2,2	3585	3,406
MP_35	pp	2510,8	85,8	37,3	2,3	37434	35,563
MP_36	pp	2238,5	66,4	43	1,5	38458	36,535
MP_37	pp	10073,3	186	69	2,7	277823	263,932
MP_38	pp	665,5	49,8	17	2,9	4526	4,299
MP_39	pp	30038,3	275,1	139	2,0	1670528	1587,002
MP_40	pp	1482,3	55,8	33,8	1,7	20069	19,065
MP_41	pp	211,8	28,2	9,6	2,9	810	0,77
MP_42	pp	1028,5	43,4	30,2	1,4	12415	11,795
MP_43	pp	90,8	13,3	8,7	1,5	316	0,3
MP_44	pp	363	25,3	18,2	1,4	2649	2,517
MP_45	pp	3236,8	114,4	36	3,2	46625	44,294
MP_46	pp	2783	99,3	35,7	2,8	39714	37,729
MP_47	pp	1058,8	44,8	30,1	1,5	12750	12,113
MP_48	pp	393,3	30,1	16,6	1,8	2617	2,486
MP_49	pp	12160,5	156,2	99,1	1,6	482096	457,991
MP_50	pp	211,8	21,1	12,8	1,6	1085	1,03
MP_51	pp	4991,3	139	45,7	3,0	91268	86,704
MP_52	pp	968	46,5	26,5	1,8	10271	9,757
MP_53	pp	10285	144,1	90,9	1,6	373809	355,119
MP_54	pp	423,5	40,3	13,4	3,0	2267	2,154
MP_55	pp	998,3	55,8	22,8	2,4	9102	8,647
MP_56	pp	665,5	37,6	22,6	1,7	6004	5,704
MP_57	pp	20479,3	198,7	131,2	1,5	1074958	1021,21
MP_58	pp	242	22,9	13,5	1,7	1303	1,238
MP_59	pp	2722,5	78,3	44,3	1,8	48241	45,829
MP_60	pp	726	42,4	21,8	1,9	6332	6,015
MP_61	pp	2268,8	85,8	33,7	2,5	30566	29,038
MP_62	pp	544,5	35,1	19,7	1,8	4300	4,085
MP_63	pp	877,3	51,7	21,6	2,4	7585	7,206
MP_64	pp	1028,5	62,3	21	3,0	8654	8,221
MP_65	pp	211,8	21,1	12,8	1,6	1085	1,03
MP_66	pp	2662	128,4	26,4	4,9	28105	26,7
MP_67	pp	1149,5	47,9	30,5	1,6	14043	13,341

MP_68	pp	4053,5	125,5	41,1	3,1	66665	63,332
MP_69	pp	453,8	33,5	17,2	1,9	3126	2,97
MP_70	pp	7018	153,9	58,1	2,6	163032	154,88

Appendix 12

MAL1.5.2

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	937,8	40,5	29,5	1,4	11058	11,058
Natural_2	protein	1936	85,8	28,7	3,0	22257	22,257
Natural_3	protein	393,3	28,8	17,4	1,7	2731	2,731
Natural_4	protein	574,8	33	22,2	1,5	5098	5,098
Natural_5	protein	2238,5	62,5	45,6	1,4	40817	40,817
Natural_6	protein	574,8	35,1	20,8	1,7	4791	4,791
Natural_7	protein	907,5	46,8	24,7	1,9	8961	8,961
Natural_8	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_9	protein	1694	61,2	35,3	1,7	23888	23,888
Natural_10	protein	998,3	46,5	27,4	1,7	10923	10,923
Natural_11	protein	816,8	60,6	17,1	3,5	5603	5,603
Natural_12	protein	1058,8	49,1	27,4	1,8	11616	11,616
Natural_13	protein	363	33,5	13,8	2,4	2001	2,001
Natural_14	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_15	protein	786,5	37,1	27	1,4	8494	8,494
Natural_16	protein	2813,3	76	47,1	1,6	53012	53,012
Natural_17	protein	15760,3	200	100,3	2,0	632483	632,483
Natural_18	protein	4991,3	145	43,8	3,3	87486	87,486
Natural_19	protein	3448,5	110,3	39,8	2,8	54921	54,921
Natural_20	protein	332,8	28,2	15	1,9	2001	2,001
Natural_21	protein	665,5	44,4	19,1	2,3	5081	5,081
Natural_22	protein	5293,8	104,6	64,4	1,6	136445	136,445
Natural_23	protein	272,3	25,3	13,7	1,8	1490	1,49
Natural_24	protein	514,3	35,1	18,6	1,9	3835	3,835
Natural_25	protein	1754,5	65,9	33,9	1,9	23803	23,803
MP_1	pet	453,8	35,1	16,5	2,1	2986	4,12
MP_2	pet	847	44,8	24,1	1,9	8160	11,261
MP_3	pet	2964,5	128,3	29,4	4,4	34889	48,147
MP_4	pet	2359,5	128,8	23,3	5,5	22015	30,381
MP_5	pe	3811,5	131,9	36,8	3,6	56076	53,272
MP_6	pe	242	33,5	9,2	3,6	889	0,845
MP_7	pe	665,5	40,3	21	1,9	5599	5,319
MP_8	pe	1089	70	19,8	3,5	8632	8,201
MP_9	pe	726	45,5	20,3	2,2	5894	5,6
MP_10	pe	2904	104,3	35,5	2,9	41191	39,132
MP_11	pe	198833,3	826,2	306,4	2,7	24369810	23151,32*
MP_12	pe	3206,5	94,4	43,3	2,2	55473	52,699
MP_13	pe	423,5	40,3	13,4	3,0	2267	2,154
MP_14	pe	332,8	28,8	14,7	2,0	1956	1,858
MP_15	pe	1391,5	74,3	23,8	3,1	13272	12,609
MP_16	pe	423,5	40,3	13,4	3,0	2267	2,154
MP_17	pe	423,5	37,6	14,4	2,6	2431	2,31
MP_18	pe	3085,5	105,4	37,3	2,8	46019	43,718
MP_19	pe	211,8	25,3	10,6	2,4	902	0,856

MP_20	pe	4961	243,1	26	9,4	51552	48,974
MP_21	pe	605	47,4	16,3	2,9	3934	3,737
MP_22	pe	907,5	44,2	26,1	1,7	9490	9,016
MP_23	pe	4144,3	152	34,7	4,4	57555	54,677
MP_24	pe	605	45,5	16,9	2,7	4093	3,889
MP_25	pe	4961	152,8	41,3	3,7	82048	77,946
MP_26	pe	907,5	46,5	24,9	1,9	9027	8,576
MP_27	pe	1058,8	58,7	23	2,6	9730	9,244
MP_28	pe	1391,5	53,6	33,1	1,6	18401	17,481
MP_29	pe	605	36,6	21	1,7	5092	4,837
MP_30	pe	151,3	25,3	7,6	3,3	460	0,437
MP_31	pe	907,5	58,1	19,9	2,9	7222	6,861
MP_32	pe	574,8	44	16,6	2,7	3824	3,632
MP_33	pe	2601,5	109,1	30,4	3,6	31607	30,027
MP_34	pe	60,5	13,3	5,8	2,3	140	0,133
MP_35	pe	6745,8	125,2	68,6	1,8	185049	175,797
MP_36	pe	5566	185,7	38,2	4,9	84965	80,716
MP_37	pe	1179,8	83,4	18	4,6	8503	8,078
MP_38	pe	272,3	25,3	13,7	1,8	1490	1,416
MP_39	pe	24321	320,4	96,6	3,3	940152	893,144
MP_40	pe	1694	75,7	28,5	2,7	19305	18,339
MP_41	pe	605	37,6	20,5	1,8	4962	4,714
MP_42	pe	2722,5	95,4	36,3	2,6	39582	37,603
MP_43	pe	2450,3	83,3	37,5	2,2	36715	34,879
MP_44	pe	1149,5	77,1	19	4,1	8728	8,291
MP_45	pe	302,5	28,2	13,7	2,1	1654	1,571
MP_46	pe	2420	88,5	34,8	2,5	33719	32,033
MP_47	pe	1542,8	76	25,8	2,9	15942	15,145
MP_48	pe	393,3	30,1	16,6	1,8	2617	2,486
MP_49	pe	2662	170,5	19,9	8,6	21161	20,103
MP_50	pe	605	45,5	16,9	2,7	4093	3,889
MP_51	pe	5172,8	139,3	47,3	2,9	97843	92,95
MP_52	pe	1573	69	29	2,4	18252	17,339
MP_53	pe	302,5	33	11,7	2,8	1412	1,342
MP_54	pe	363	30,1	15,4	2,0	2230	2,118
MP_55	pe	1966,3	76,6	32,7	2,3	25714	24,428
MP_56	pe	3236,8	113,4	36,4	3,1	47065	44,712
MP_57	pe	1361,3	57,5	30,1	1,9	16403	15,583
MP_58	pe	1028,5	72,1	18,2	4,0	7475	7,102
MP_59	pe	121	17,8	8,7	2,0	419	0,398
MP_60	pe	423,5	37,6	14,4	2,6	2431	2,31
MP_61	pe	4658,5	111,2	53,3	2,1	99355	94,387
MP_62	pe	907,5	58,7	19,7	3,0	7149	6,791
MP_63	pe	726	45,2	20,5	2,2	5944	5,647
MP_64	pe	1936	76,6	32,2	2,4	24929	23,683
MP_65	pe	726	57,4	16,1	3,6	4678	4,444
MP_66	pe	4507,3	98,3	58,4	1,7	105262	99,999
MP_67	pe	181,5	22,9	10,1	2,3	733	0,696
MP_68	ps	5263,5	134,6	49,8	2,7	104797	108,988
Natural_26	protein	272,3	25,3	13,7	1,8	1490	1,49
MP_69	pvc-u	211,8	21,1	12,8	1,6	1085	1,497
MP_70	pp	2087,3	79,6	33,4	2,4	27877	26,483

MP_71	pp	242	22,9	13,5	1,7	1303	1,238
MP_72	pp	3085,5	94,5	41,6	2,3	51326	48,76
MP_73	pp	1270,5	66,6	24,3	2,7	12344	11,726
MP_74	pp	2752,8	110,4	31,8	3,5	34969	33,221
MP_75	pp	3267	85,3	48,8	1,7	63757	60,569
MP_76	pp	211,8	17,8	15,1	1,2	1283	1,219
MP_77	pp	756,3	69,6	13,8	5,0	4183	3,973
MP_78	pp	2541	86,4	37,4	2,3	38055	36,152
MP_79	pp	4507,3	178,7	32,1	5,6	57910	55,014
MP_80	pp	605	40,3	19,1	2,1	4627	4,396
MP_81	pp	1754,5	104,2	21,4	4,9	15051	14,298
MP_82	pp	9165,8	348,3	33,5	10,4	122840	116,698
MP_83	pp	2178	101,5	27,3	3,7	23811	22,62
MP_84	pp	3902,3	169,6	29,3	5,8	45725	43,439
MP_85	pp	816,8	46,5	22,4	2,1	7312	6,946
MP_86	pp	4477	306	18,6	16,5	33364	31,696
MP_87	pp	9014,5	435,8	26,3	16,6	94969	90,22
MP_88	pp	1331	58,9	28,8	2,0	15307	14,542

*Error

Appendix 13

MAL1.6.1

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	574,8	33	22,2	1,5	5098	5,098
Natural_2	protein	5233,3	134,3	49,6	2,7	103841	103,841
Natural_3	protein	635,3	39	20,8	1,9	5276	5,276
Natural_4	protein	1089	45,4	30,6	1,5	13318	13,318
Natural_5	protein	4295,5	127,6	42,8	3,0	73618	73,618
Natural_6	protein	1633,5	63	33	1,9	21555	21,555
Natural_7	protein	2299	85,5	34,2	2,5	31496	31,496
Natural_8	protein	786,5	46,5	21,6	2,2	6780	6,78
Natural_9	protein	1361,3	70	24,8	2,8	13488	13,488
Natural_10	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_11	protein	2420	77,5	39,7	2,0	38473	38,473
Natural_12	protein	2299	100,4	29,2	3,4	26823	26,823
Natural_13	protein	1905,8	83,2	29,2	2,8	22238	22,238
Natural_14	protein	726	40,7	22,7	1,8	6593	6,593
Natural_15	protein	726	44,4	20,8	2,1	6047	6,047
Natural_16	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_17	protein	211,8	21,1	12,8	1,6	1085	1,085
Natural_18	protein	1028,5	65,9	19,9	3,3	8180	8,18
Natural_19	protein	665,5	35,1	24,1	1,5	6423	6,423
Natural_20	protein	2571,3	91,5	35,8	2,6	36799	36,799
Natural_21	protein	726	45,2	20,5	2,2	5944	5,944
Natural_22	protein	1663,8	60,5	35	1,7	23302	23,302
Natural_23	protein	10164	226,7	57,1	4,0	232054	232,054
Natural_24	protein	1361,3	71,1	24,4	2,9	13266	13,266

Natural_25	protein	6110,5	192,6	40,4	4,8	98716	98,716
Natural_26	protein	605	36,6	21	1,7	5092	5,092
Natural_27	protein	363	25,3	18,2	1,4	2649	2,649
Natural_28	protein	2631,8	79,9	41,9	1,9	44147	44,147
Natural_29	protein	1421,8	69	26,2	2,6	14911	14,911
Natural_30	protein	937,8	41,3	28,9	1,4	10834	10,834
Natural_31	protein	1603,3	73	28	2,6	17940	17,94
Natural_32	protein	393,3	35,1	14,3	2,5	2243	2,243
Natural_33	protein	5505,5	152,1	46,1	3,3	101482	101,482
Natural_34	protein	786,5	41,6	24,1	1,7	7581	7,581
Natural_35	protein	1119,3	55,8	25,6	2,2	11443	11,443
Natural_36	protein	484	33,5	18,4	1,8	3557	3,557
Natural_37	protein	1996,5	66,4	38,3	1,7	30592	30,592
Natural_38	protein	1119,3	66,4	21,5	3,1	9615	9,615
Natural_39	protein	514,3	33,5	19,5	1,7	4015	4,015
Natural_40	protein	272,3	30,1	11,5	2,6	1254	1,254
Natural_41	protein	786,5	51	19,6	2,6	6177	6,177
Natural_42	protein	5989,5	203,1	37,6	5,4	89963	89,963
Natural_43	protein	363	33	14	2,4	2034	2,034
Natural_44	protein	2873,8	106,4	34,4	3,1	39534	39,534
Natural_45	protein	1089	45,4	30,6	1,5	13318	13,318
Natural_46	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_47	protein	1663,8	61,3	34,6	1,8	23000	23
Natural_48	protein	3841,8	103,7	47,2	2,2	72478	72,478
Natural_49	protein	8833	170,3	66	2,6	233345	233,345
MP_1	pet	181,5	17,8	13	1,4	943	1,301
MP_2	pe	3720,8	100,3	47,2	2,1	70273	66,759
MP_3	pe	1089	56	24,7	2,3	10778	10,239
MP_4	pe	4114	102,1	51,3	2,0	84410	80,19
MP_5	pe	605	40,3	19,1	2,1	4627	4,396
MP_6	pe	1058,8	47	28,7	1,6	12147	11,54
MP_7	pe	574,8	49,8	14,7	3,4	3375	3,207
MP_8	pe	695,8	49,8	17,8	2,8	4946	4,699
MP_9	pe	484	37,6	16,4	2,3	3176	3,017
MP_10	ps	1028,5	51,7	25,3	2,0	10426	10,843
MP_11	pp	242	22,9	13,5	1,7	1303	1,238
MP_12	pp	4870,3	117,5	52,8	2,2	102814	97,674
MP_13	pp	16304,8	239	86,9	2,8	566526	538,2
MP_14	pp	1482,3	67,6	27,9	2,4	16552	15,725
MP_15	pp	211,8	21,1	12,8	1,6	1085	1,03
MP_16	pp	2662	88,3	38,4	2,3	40887	38,842
MP_17	pp	2934,3	99,6	37,5	2,7	44006	41,806
MP_18	pp	816,8	41,6	25	1,7	8175	7,767
MP_19	pp	4870,3	108,1	57,3	1,9	111713	106,127
MP_20	pp	544,5	40,7	17	2,4	3708	3,523
MP_21	pp	393,3	30,1	16,6	1,8	2617	2,486
MP_22	pp	28677	297,2	122,8	2,4	1409042	1338,59
MP_23	pp	7018	168,3	53,1	3,2	149008	141,558
MP_24	pp	3267	91,2	45,6	2,0	59585	56,606
MP_25	pp	6382,8	120,1	67,7	1,8	172733	164,097
MP_26	pp	151,3	17,8	10,8	1,6	655	0,622
MP_27	pp	514,3	30,1	21,8	1,4	4475	4,251

MP_28	pp	514,3	39	16,8	2,3	3457	3,285
MP_29	pp	272,3	28,2	12,3	2,3	1340	1,273
MP_30	pp	7986	196,5	51,7	3,8	165300	157,035
MP_31	pp	423,5	30,1	17,9	1,7	3035	2,883
MP_32	pp	3630	104,2	44,3	2,4	64378	61,159
MP_33	pp	211,8	22,9	11,8	1,9	998	0,948
MP_34	pp	2450,3	66,5	46,9	1,4	45983	43,684
MP_35	pp	5293,8	100,2	67,3	1,5	142470	135,347
MP_36	pp	2238,5	79,1	36	2,2	32269	30,656
MP_37	pp	4567,8	127,9	45,5	2,8	83105	78,95
MP_38	pp	24774,8	518,4	60,8	8,5	602952	572,804
MP_39	pp	393,3	35,1	14,3	2,5	2243	2,131
MP_40	pp	1573	60,1	33,3	1,8	20973	19,925
MP_41	pp	1603,3	58,7	34,8	1,7	22312	21,196
MP_42	pp	211,8	22,9	11,8	1,9	998	0,948
MP_43	pp	786,5	45	22,3	2,0	7006	6,656
MP_44	pp	1149,5	49,1	29,8	1,6	13692	13,007
MP_45	pp	2147,8	78,4	34,9	2,2	29981	28,482
MP_46	pp	393,3	40,7	12,3	3,3	1934	1,838
MP_47	pp	25803,3	390,2	84,2	4,6	869060	825,607
MP_48	pp	4416,5	118,1	47,6	2,5	84129	79,923
MP_49	pp	998,3	49,7	25,6	1,9	10217	9,707
MP_50	pp	998,3	42,6	29,9	1,4	11926	11,33
MP_51	pp	877,3	40,7	27,4	1,5	9626	9,145
MP_52	pp	302,5	33	11,7	2,8	1412	1,342
MP_53	pp	14550,3	311,5	59,5	5,2	346164	328,856
MP_54	pp	635,3	33,5	24,1	1,4	6127	5,821
MP_55	pp	1149,5	58,7	24,9	2,4	11470	10,896
MP_56	pp	3509	79,8	56	1,4	78553	74,625
MP_57	pp	1542,8	76	25,8	2,9	15942	15,145
MP_58	pp	302,5	25,3	15,2	1,7	1840	1,748
MP_59	pp	998,3	55,8	22,8	2,4	9102	8,647
MP_60	pp	3176,3	88,5	45,7	1,9	58026	55,125
MP_61	pp	242	28,8	10,7	2,7	1034	0,983
MP_62	pp	393,3	30,1	16,6	1,8	2617	2,486
MP_63	pp	605	40,3	19,1	2,1	4627	4,396
MP_64	pp	544,5	36,6	18,9	1,9	4124	3,918
MP_65	pp	28798	353,4	103,7	3,4	1195084	1135,329
MP_66	pp	48339,5	585,2	105,2	5,6	2033478	1931,804
MP_67	pp	1875,5	77,7	30,7	2,5	23052	21,899
MP_68	pp	15155,3	306,1	63	4,9	382178	363,069
MP_69	pp	1754,5	56,9	39,2	1,5	27532	26,156
MP_70	pp	816,8	46,8	22,2	2,1	7258	6,895
MP_71	pp	32125,5	663,5	61,6	10,8	792173	752,564
MP_72	pp	211,8	22,9	11,8	1,9	998	0,948
MP_73	pan	1845,3	124,3	18,9	6,6	13954	16,465
MP_74	pan	5354,3	288,1	23,7	12,2	50684	59,807
MP_75	pan	1784,8	72,1	31,5	2,3	22510	26,562
MP_76	pan	17303	571,9	38,5	14,9	266609	314,598
MP_77	pan	1694	79,9	27	3,0	18291	21,584
MP_78	pan	4870,3	205,2	30,2	6,8	58873	69,47
MP_79	pan	1754,5	88,1	25,4	3,5	17799	21,003

MP_80	pan	605	48,5	15,9	3,1	3847	4,54
MP_81	pan	423,5	40,7	13,2	3,1	2243	2,647
MP_82	pan	635,3	50,9	15,9	3,2	4041	4,769
MP_83	pan	1452	101,8	18,2	5,6	10545	12,443
MP_84	pan	1028,5	71,7	18,3	3,9	7511	8,863
MP_85	pan	1633,5	102,7	20,2	5,1	13230	15,611

Appendix 14

MAL1.6.2

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	877,3	46,5	24	1,9	8435	8,435
Natural_2	protein	1361,3	63,8	27,2	2,3	14785	14,785
Natural_3	protein	574,8	40,3	18,2	2,2	4176	4,176
Natural_4	protein	363	28,2	16,4	1,7	2382	2,382
Natural_5	protein	1210	62,5	24,6	2,5	11926	11,926
Natural_6	protein	423,5	28,2	19,1	1,5	3242	3,242
Natural_7	protein	1300,8	56,9	29,1	2,0	15133	15,133
Natural_8	protein	1119,3	58,7	24,3	2,4	10874	10,874
Natural_9	protein	332,8	33	12,8	2,6	1709	1,709
Natural_10	protein	393,3	30,1	16,6	1,8	2617	2,617
Natural_11	protein	453,8	28,2	20,5	1,4	3721	3,721
Natural_12	protein	907,5	46,5	24,9	1,9	9027	9,027
Natural_13	protein	998,3	47,5	26,7	1,8	10680	10,68
Natural_14	protein	453,8	33	17,5	1,9	3178	3,178
Natural_15	protein	544,5	35,1	19,7	1,8	4300	4,3
Natural_16	protein	453,8	33	17,5	1,9	3178	3,178
Natural_17	protein	4144,3	129,3	40,8	3,2	67675	67,675
Natural_18	protein	453,8	30,1	19,2	1,6	3484	3,484
Natural_19	protein	302,5	22,9	16,8	1,4	2036	2,036
Natural_20	protein	484	33	18,7	1,8	3615	3,615
Natural_21	protein	514,3	35,1	18,6	1,9	3835	3,835
Natural_22	protein	3055,3	95,9	40,6	2,4	49559	49,559
Natural_23	protein	1421,8	61	29,7	2,1	16864	16,864
Natural_24	protein	695,8	39	22,7	1,7	6329	6,329
Natural_25	protein	332,8	30,1	14,1	2,1	1874	1,874
Natural_26	protein	393,3	25,3	19,8	1,3	3109	3,109
Natural_27	protein	453,8	28,2	20,5	1,4	3721	3,721
MP_1	pet	1633,5	110,8	18,8	5,9	12266	16,927
MP_2	pe	3025	133,6	28,8	4,6	34889	33,145
MP_3	pe	1421,8	77	23,5	3,3	13374	12,706
MP_4	pe	60,5	13,3	5,8	2,3	140	0,133
MP_5	pe	2359,5	159,7	18,8	8,5	17750	16,862
MP_6	pe	8500,3	176,6	61,3	2,9	208418	197,997
MP_7	pe	605	35,1	21,9	1,6	5308	5,043
MP_8	pe	514,3	37,6	17,4	2,2	3585	3,406
MP_9	pe	514,3	49,8	13,1	3,8	2702	2,567
MP_10	ps	2057	98,6	26,6	3,7	21860	22,734
MP_11	ps	2601,5	80,6	41,1	2,0	42765	44,475
Natural_28	protein	574,8	30,1	24,3	1,2	5590	5,59
Natural_29	protein	484	33,5	18,4	1,8	3557	3,557
MP_12	pp	847	44,8	24,1	1,9	8160	7,752
MP_13	pp	393,3	40,3	12,4	3,3	1955	1,857
MP_14	pp	6564,3	116,1	72	1,6	188957	179,509
MP_15	pp	211,8	22,9	11,8	1,9	998	0,948

MP_16	pp	1391,5	84,2	21	4,0	11705	11,12
MP_17	pp	847	44,4	24,3	1,8	8231	7,819
MP_18	pp	7986	165,7	61,4	2,7	196040	186,238
MP_19	pp	13007,5	227	73	3,1	379653	360,671
MP_20	pp	302,5	22,9	16,8	1,4	2036	1,934
MP_21	pp	151,3	17,8	10,8	1,6	655	0,622
MP_22	pp	1512,5	53,6	35,9	1,5	21740	20,653
MP_23	pp	635,3	40,3	20,1	2,0	5102	4,847
MP_24	pp	847	43,4	24,9	1,7	8420	7,999
MP_25	pp	877,3	45	24,8	1,8	8716	8,281
MP_26	pp	544,5	35,1	19,7	1,8	4300	4,085
MP_27	pp	30703,8	514,8	75,9	6,8	932664	886,031
MP_28	pp	998,3	51,7	24,6	2,1	9822	9,331
MP_29	pp	2813,3	92,9	38,6	2,4	43394	41,225
MP_30	pp	7562,5	142,3	67,7	2,1	204742	194,505
MP_31	pp	1149,5	56	26,1	2,1	12008	11,408
MP_32	pp	2964,5	113,1	33,4	3,4	39562	37,584
MP_33	pp	695,8	40,7	21,8	1,9	6055	5,752
MP_34	pp	1633,5	68	30,6	2,2	19994	18,995
MP_35	pp	1210	57,5	26,8	2,1	12961	12,313
MP_36	pp	211,8	21,1	12,8	1,6	1085	1,03
MP_37	pp	181,5	21,1	11	1,9	797	0,757
MP_38	pp	9165,8	149,9	77,8	1,9	285407	271,137
MP_39	pp	332,8	30,1	14,1	2,1	1874	1,78
MP_40	pp	1058,8	55,2	24,4	2,3	10351	9,834
MP_41	pp	211,8	17,8	15,1	1,2	1283	1,219
MP_42	pp	998,3	53,8	23,6	2,3	9442	8,97
MP_43	pp	1270,5	61,3	26,4	2,3	13408	12,738
MP_44	pp	4265,3	102,1	53,2	1,9	90731	86,194
MP_45	pp	12009,3	176,9	86,4	2,0	415252	394,49
MP_46	pp	151,3	17,8	10,8	1,6	655	0,622
MP_47	pp	12463	314,7	50,4	6,2	251333	238,767
MP_48	pp	332,8	28,8	14,7	2,0	1956	1,858
MP_49	pp	181,5	21,1	11	1,9	797	0,757
MP_50	pp	272,3	22,9	15,1	1,5	1649	1,567
MP_51	pp	1149,5	56,8	25,8	2,2	11848	11,256
MP_52	pp	605	42,4	18,2	2,3	4397	4,177
MP_53	pp	695,8	52,5	16,9	3,1	4697	4,462
MP_54	pp	393,3	33,5	14,9	2,2	2348	2,231
MP_55	pp	484	30,1	20,5	1,5	3964	3,766
MP_56	pp	453,8	28,2	20,5	1,4	3721	3,535
MP_57	pp	5051,8	143,9	44,7	3,2	90337	85,82
MP_58	pp	453,8	44,4	13	3,4	2362	2,244
MP_59	pp	3751	121,6	39,3	3,1	58925	55,979
MP_60	pp	1240,3	67	23,6	2,8	11694	11,109
MP_61	pp	453,8	35,1	16,5	2,1	2986	2,837
MP_62	pp	393,3	30,1	16,6	1,8	2617	2,486
MP_63	pp	2510,8	71,7	44,6	1,6	44759	42,521
MP_64	pp	1875,5	78,4	30,5	2,6	22862	21,719
MP_65	pp	605	35,1	21,9	1,6	5308	5,043
MP_66	pp	302,5	22,9	16,8	1,4	2036	1,934
MP_67	pp	242	22,9	13,5	1,7	1303	1,238

MP_68	pp	695,8	47,4	18,7	2,5	5203	4,942
MP_69	pp	181,5	17,8	13	1,4	943	0,896
MP_70	pp	2087,3	112,8	23,6	4,8	19674	18,69
MP_71	pan	7955,8	320,6	31,6	10,1	100560	118,661
MP_72	pan	12009,3	504,2	30,3	16,6	145670	171,891

Appendix 15

MAL1.7

MP identifier	Polymer group	Area on map [µm²]	Major dimension [µm]	Minor dimension [µm]	Dimention ratio	Volume [µm³]	Mass [ng]
Natural_1	protein	605	33,5	23	1,5	5557	5,557
Natural_2	protein	242	21,1	14,6	1,4	1417	1,417
Natural_3	protein	4477	119,1	47,9	2,5	85738	85,738
Natural_4	protein	453,8	39	14,8	2,6	2692	2,692
Natural_5	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_6	protein	605	33,5	23	1,5	5557	5,557
Natural_7	protein	514,3	33,5	19,5	1,7	4015	4,015
Natural_8	protein	211,8	21,1	12,8	1,6	1085	1,085
Natural_9	protein	786,5	46,5	21,6	2,2	6780	6,78
Natural_10	protein	514,3	33,5	19,5	1,7	4015	4,015
Natural_11	protein	332,8	25,3	16,7	1,5	2226	2,226
Natural_12	protein	544,5	35,1	19,7	1,8	4300	4,3
Natural_13	protein	484	33,5	18,4	1,8	3557	3,557
Natural_14	protein	1815	69	33,5	2,1	24300	24,3
Natural_15	protein	1542,8	64,5	30,5	2,1	18799	18,799
Natural_16	protein	1361,3	74,5	23,3	3,2	12665	12,665
Natural_17	protein	1028,5	69	19	3,6	7803	7,803
Natural_18	protein	937,8	55,8	21,4	2,6	8033	8,033
Natural_19	protein	272,3	28,2	12,3	2,3	1340	1,34
Natural_20	protein	1361,3	67,6	25,6	2,6	13960	13,96
Natural_21	protein	363	30,1	15,4	2,0	2230	2,23
Natural_22	protein	393,3	35,1	14,3	2,5	2243	2,243
Natural_23	protein	484	44,4	13,9	3,2	2688	2,688
Natural_24	protein	181,5	21,1	11	1,9	797	0,797
Natural_25	protein	3993	87,8	57,9	1,5	92469	92,469
Natural_26	protein	574,8	33,5	21,8	1,5	5015	5,015
Natural_27	protein	1240,3	57,9	27,3	2,1	13521	13,521
Natural_28	protein	756,3	49,5	19,5	2,5	5884	5,884
Natural_29	protein	1815	66	35	1,9	25423	25,423
Natural_30	protein	12523,5	172,6	92,4	1,9	462741	462,741
Natural_31	protein	1119,3	47,9	29,7	1,6	13314	13,314
Natural_32	protein	2873,8	115,1	31,8	3,6	36547	36,547
Natural_33	protein	847	48,6	22,2	2,2	7516	7,516
Natural_34	protein	3902,3	95,3	52,1	1,8	81370	81,37
Natural_35	protein	937,8	44,8	26,7	1,7	10002	10,002
Natural_36	protein	665,5	37,6	22,6	1,7	6004	6,004
Natural_37	protein	8742,3	159,3	69,9	2,3	244270	244,27
Natural_38	protein	1512,5	66	29,2	2,3	17655	17,655
Natural_39	protein	2843,5	71,1	50,9	1,4	57886	57,886
Natural_40	protein	2631,8	75,7	44,3	1,7	46586	46,586
Natural_41	protein	13279,8	176,1	96	1,8	510070	510,07
MP_1	pe	393,3	36,6	13,7	2,7	2151	2,044
MP_2	pe	423,5	28,2	19,1	1,5	3242	3,08
MP_3	pe	1573	52,7	38	1,4	23934	22,737

MP_4	pe	1058,8	53,6	25,2	2,1	10652	10,12
MP_5	pe	1724,3	86,2	25,5	3,4	17562	16,684
MP_6	pe	181,5	22,9	10,1	2,3	733	0,696
MP_7	pe	8863,3	265	42,6	6,2	150988	143,438
MP_8	pe	1119,3	63,8	22,3	2,9	9996	9,496
MP_9	pe	695,8	52,2	17	3,1	4726	4,489
MP_10	pe	5051,8	119,3	53,9	2,2	108979	103,53
MP_11	pe	211,8	22,9	11,8	1,9	998	0,948
MP_12	pe	453,8	28,2	20,5	1,4	3721	3,535
MP_13	pe	3236,8	177,4	23,2	7,6	30081	28,577
MP_14	pe	423,5	33,5	16,1	2,1	2723	2,587
MP_15	ps	423,5	28,2	19,1	1,5	3242	3,371
Natural_42	protein	907,5	63,6	18,2	3,5	6599	6,599
Natural_43	cellulose	121	22,9	6,7	3,4	326	0,502
Natural_44	cellulose	332,8	33,5	12,6	2,7	1681	2,589
Natural_45	cellulose	5051,8	228,9	28,1	8,1	56785	87,449
MP_16	pp	2783	90,1	39,3	2,3	43790	41,601
MP_17	pp	272,3	27,5	12,6	2,2	1373	1,304
MP_18	pp	211,8	21,1	12,8	1,6	1085	1,03
MP_19	pp	1119,3	42,4	33,6	1,3	15049	14,297
MP_20	pp	19390,3	399,2	61,8	6,5	479662	455,679
MP_21	pp	756,3	54,7	17,6	3,1	5326	5,059
MP_22	pp	1421,8	57,7	31,4	1,8	17849	16,956
MP_23	pp	5535,8	117,3	60,1	2,0	133039	126,387
MP_24	pp	2147,8	101	27,1	3,7	23264	22,101
MP_25	pp	6534	146,1	57	2,6	148865	141,422
MP_26	pp	11797,5	263	57,1	4,6	269522	256,046
MP_27	pp	635,3	40,7	19,9	2,0	5048	4,795
MP_28	pp	3690,5	102,8	45,7	2,2	67476	64,102
MP_29	pp	1875,5	110,8	21,6	5,1	16170	15,361
MP_30	pp	1724,3	83	26,5	3,1	18245	17,333
MP_31	pp	695,8	45,5	19,5	2,3	5413	5,143
MP_32	pp	1089	54,5	25,4	2,1	11080	10,526
MP_33	pp	363	28,8	16	1,8	2327	2,211
MP_34	pp	181,5	21,1	11	1,9	797	0,757
MP_35	pp	514,3	35,1	18,6	1,9	3835	3,643
MP_36	pp	605	62,9	12,2	5,2	2963	2,815
MP_37	pp	15457,8	350,8	56,1	6,3	346917	329,572
MP_38	pp	4991,3	124,8	50,9	2,5	101684	96,599
MP_39	pp	665,5	39	21,8	1,8	5790	5,501
MP_40	pp	756,3	56,2	17,1	3,3	5182	4,923
MP_41	pp	635,3	49,5	16,3	3,0	4152	3,944
MP_42	pp	1512,5	59,6	32,3	1,8	19538	18,561
MP_43	pp	14338,5	215	84,9	2,5	487084	462,73
MP_44	pp	816,8	44,2	23,5	1,9	7687	7,303
MP_45	pp	23474	509,6	58,7	8,7	550716	523,181
MP_46	pp	1058,8	56,9	23,7	2,4	10026	9,525
MP_47	pp	363	25,3	18,2	1,4	2649	2,517
MP_48	pp	847	62,2	17,3	3,6	5871	5,578
MP_49	pp	544,5	52,5	13,2	4,0	2877	2,733
MP_50	pp	272,3	22,9	15,1	1,5	1649	1,567
MP_51	pp	9952,3	184,3	68,8	2,7	273709	260,024

MP_52	pp	2722,5	85,8	40,4	2,1	44015	41,814
MP_53	pp	1210	53,8	28,7	1,9	13872	13,178
MP_54	pp	2752,8	99,5	35,2	2,8	38794	36,854
MP_55	pp	635,3	47,4	17,1	2,8	4337	4,12
MP_56	pp	907,5	39,6	29,2	1,4	10586	10,057
MP_57	pp	211,8	22,9	11,8	1,9	998	0,948
MP_58	pp	574,8	30,1	24,3	1,2	5590	5,31
MP_59	pp	665,5	44,4	19,1	2,3	5081	4,827
MP_60	pp	574,8	37,6	19,5	1,9	4478	4,254
MP_61	pp	3115,8	101,1	39,2	2,6	48890	46,445
MP_62	pp	181,5	22,9	10,1	2,3	733	0,696
MP_63	pp	4779,5	109,7	55,5	2,0	106099	100,794

Appendix 16

MAL1.8

MP identifier	Polymer group	Area on map [µm^2]	Major dimension [µm]	Minor dimension [µm]	Dimension ratio	Volume [µm^3]	Mass [ng]
Natural_1	protein	695,8	40,3	22	1,8	6120	6,12
Natural_2	protein	11706,8	156,5	95,2	1,6	446017	446,017
Natural_3	protein	211,8	22,9	11,8	1,9	998	0,998
Natural_4	protein	302,5	36,6	10,5	3,5	1273	1,273
Natural_5	protein	423,5	28,2	19,1	1,5	3242	3,242
Natural_6	protein	4295,5	98,6	55,5	1,8	95287	95,287
Natural_7	protein	605	33	23,3	1,4	5649	5,649
Natural_8	protein	2541	73	44,3	1,6	45064	45,064
Natural_9	protein	726	45,5	20,3	2,2	5894	5,894
Natural_10	protein	1270,5	73,2	22,1	3,3	11233	11,233
Natural_11	protein	998,3	43,4	29,3	1,5	11696	11,696
Natural_12	protein	665,5	37,6	22,6	1,7	6004	6,004
Natural_13	protein	665,5	39	21,8	1,8	5790	5,79
Natural_14	protein	1179,8	58,5	25,7	2,3	12111	12,111
Natural_15	protein	3811,5	91,3	53,2	1,7	81043	81,043
Natural_16	protein	6776	170,2	50,7	3,4	137400	137,4
Natural_17	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_18	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_19	protein	937,8	48,2	24,8	1,9	9292	9,292
Natural_20	protein	695,8	40,7	21,8	1,9	6055	6,055
Natural_21	protein	302,5	25,3	15,2	1,7	1840	1,84
Natural_22	protein	1058,8	51,2	26,3	1,9	11157	11,157
Natural_23	protein	574,8	39	18,8	2,1	4319	4,319
MP_1	pe	635,3	37,6	21,5	1,7	5470	5,197
MP_2	pe	1210	47,9	32,1	1,5	15560	14,782
MP_3	pe	484	39	15,8	2,5	3063	2,91
MP_4	pe	1391,5	60,1	29,5	2,0	16413	15,592
MP_5	pe	5142,5	129,8	50,4	2,6	103775	98,587
MP_6	pe	242	22,9	13,5	1,7	1303	1,238
MP_7	pe	13400,8	212,1	80,5	2,6	431246	409,684
MP_8	pe	1421,8	62,7	28,9	2,2	16407	15,587
MP_9	pe	847	51,3	21	2,4	7118	6,763
MP_10	pe	786,5	48,6	20,6	2,4	6480	6,156
MP_11	pe	1694	99,1	21,8	4,5	14751	14,013
Natural_24	protein	363	28,8	16	1,8	2327	2,327
Natural_25	protein	332,8	28,8	14,7	2,0	1956	1,956
Natural_26	protein	211,8	22	12,3	1,8	1038	1,038
Natural_27	cellulose	423,5	42,4	12,7	3,3	2155	3,318
Natural_28	cellulose	544,5	33,5	20,7	1,6	4501	6,932
Natural_29	cellulose	181,5	17,8	13	1,4	943	1,452
MP_12	pp	151,3	17,8	10,8	1,6	655	0,622
MP_13	pp	302,5	22,9	16,8	1,4	2036	1,934
MP_14	pp	2541	110,8	29,2	3,8	29681	28,197
MP_15	pp	2087,3	93,4	28,5	3,3	23754	22,566

MP_16	pp	756,3	39	24,7	1,6	7477	7,103
MP_17	pp	2087,3	102,7	25,9	4,0	21600	20,52
MP_18	pp	2450,3	78,3	39,9	2,0	39075	37,122
MP_19	pp	2117,5	79,6	33,9	2,3	28691	27,256
MP_20	pp	1210	51,7	29,8	1,7	14430	13,709
MP_21	pp	2299	62,5	46,8	1,3	43053	40,9
MP_22	pp	22687,5	394,3	73,3	5,4	664837	631,595
MP_23	pp	786,5	37,1	27	1,4	8494	8,069
MP_24	pp	2843,5	94,3	38,4	2,5	43682	41,498
MP_25	pp	6140,8	139,1	56,2	2,5	138038	131,136
MP_26	pp	1028,5	56,9	23	2,5	9461	8,988
MP_27	pp	4930,8	174,8	35,9	4,9	70820	67,279
MP_28	pp	53119	888,9	76,1	11,7	1616692	1535,857
MP_29	pp	393,3	45,5	11	4,1	1729	1,643
MP_30	pp	5082	130,1	49,7	2,6	101126	96,07
MP_31	pp	998,3	50,3	25,2	2,0	10080	9,576
MP_32	pp	18029	339,2	67,7	5,0	488056	463,653
MP_33	pp	1179,8	63,6	23,6	2,7	11153	10,595
MP_34	pp	332,8	25,3	16,7	1,5	2226	2,115
MP_35	pp	64523,3	1120,4	73,3	15,3	1892440	1797,818
MP_36	pp	1421,8	58,7	30,9	1,9	17546	16,669
MP_37	pp	13310	372,6	45,5	8,2	242177	230,068
MP_38	pp	47704,3	787,6	77,1	10,2	1471538	1397,961
MP_39	pp	332,8	30,1	14,1	2,1	1874	1,78
MP_40	pp	8197,8	274,7	38	7,2	124600	118,37
MP_41	pp	6019,8	140,9	54,4	2,6	131006	124,455
MP_42	pp	786,5	49,8	20,1	2,5	6321	6,005
MP_43	pp	10012,8	284,8	44,8	6,4	179296	170,331
MP_44	pan	1421,8	86,8	20,9	4,2	11866	14,002
MP_45	pan	968	58,7	21	2,8	8134	9,598
MP_46	pan	2057	116,4	22,5	5,2	18519	21,852
MP_47	pan	786,5	53,6	18,7	2,9	5878	6,937
MP_48	pan	544,5	37,6	18,5	2,0	4019	4,742
MP_49	pan	4598	214,6	27,3	7,9	50164	59,193