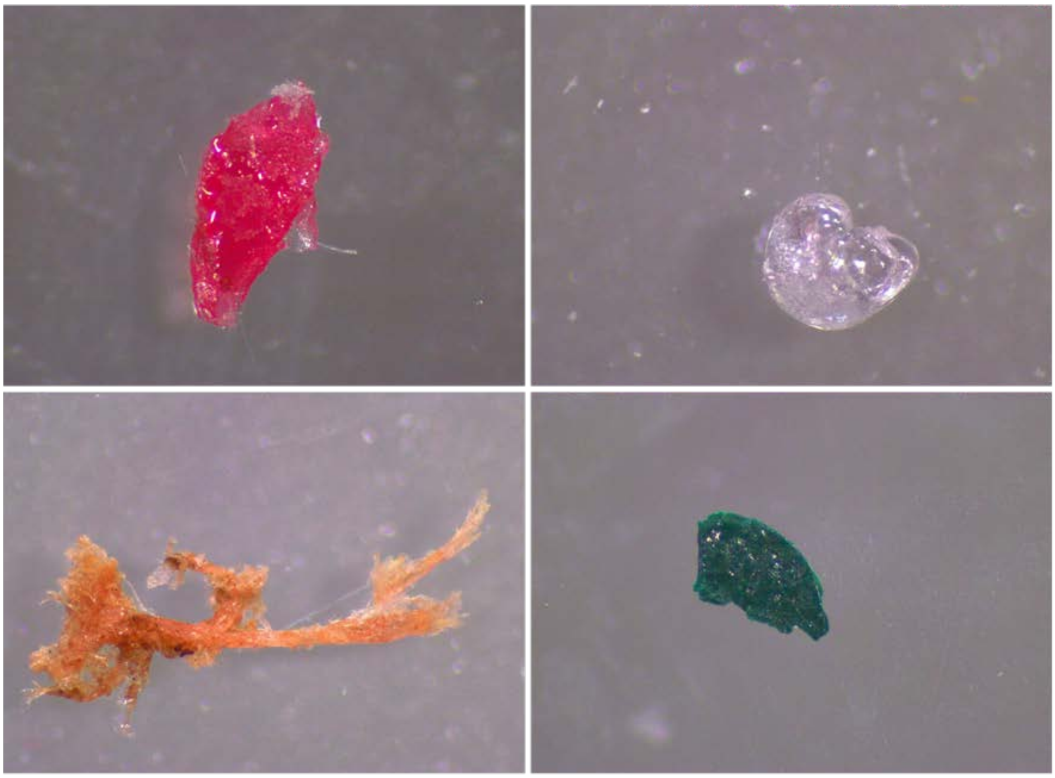

Microplastic ingestion in North Sea prey fish

And implications of fibre contamination

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Abstract

Plastic pollution abounds in our oceans, resulting in a number of deleterious consequences for marine organisms. The transfer of microplastics (plastic particles measuring < 5 mm) between trophic levels through predator-prey interactions has become an important aspect of marine pollution research. This study aims to investigate microplastic ingestion in prey fish species, in order to provide further understanding of the potential for microplastic transfer between trophic levels. Sprat (*Sprattus sprattus*) and sandeel (*Ammodytidae*), together with a small number of other prey species, were analysed for ingested microplastics. The fish were collected from a number of locations in the North Sea. 291 sprat and 297 sandeels were analysed using both dissection and KOH dissolution to extract potential plastic. 12 and 5 microplastic particles were retrieved from the sprat and sandeels respectively. According to FT-IR analysis these were composed of a range of polymers including polyethylene (PE), polymethyl methacrylate (PMMA) and polypropylene (PP). Furthermore, sprat from both the winter and summer seasons were compared. Results show that summer sprat contained more plastic than the winter sprat, suggesting seasonal variation in microplastic ingestion by sprat in the North Sea. Microplastic characterisation by colleagues revealed that FT-IR is essential for determining whether a sample is ultimately plastic or not. One problem that occurs from analysing microplastic ingestion in a laboratory environment is the potential for atmospheric fallout of microfibres. The variation in the methods used by researchers to minimise or avoid air-borne contamination makes it difficult to compare microplastic results. This emphasises the need for studies to report fibrous and non-fibrous microplastics separately so as to allow proper comparison between studies. Although fibres were recovered from the samples during analysis, they were not taken into account in the ingestion results as their origin remains unclear. However, to determine the potential impact of air-borne fibres, the average number of fibres per fish, fibre colour and fibre contamination in the laboratory were all considered.

Contents

1. Introduction

The oceans are of significant socio-economic importance, providing jobs, food and recreation for much of the world's population (Costanza, 1999). Yet anthropogenic pollution abounds in our oceans, with marine litter threating wildlife, hindering human activities and reducing the recreational value of our coasts (Fleet *et al.*, 2009). Plastics represent the major portion of marine pollution (Galgani *et al.*, 2015), with this trend likely to continue into the future. Worldwide plastic production increased steadily over the period 2005-2015, reaching 335 million tonnes in 2016 (Plastics Europe, 2017). Land-based sources are thought to contribute 80% of all marine debris (Andrady, 2011). While this figure has yet to be verified in studies, Jambeck *et al.* (2015) estimate that between 5 and 13 million tonnes of plastic waste entered the oceans solely from land-based sources in 2010. This has had, and continues to have, devastating impacts on marine fauna through effects such as entanglement and ingestion (Kühn *et al.*, 2015). The former may restrict an animal's movement and cause injury, reducing their ability to avoid predators and acquire food, as well as increasing the potential for drowning. Consumption of marine debris (both intentional and accidental) may cause a suppressed appetite or blockage of the gastrointestinal tract leading to malnutrition and in some cases may even be lethal (Kühn *et al.*, 2015). Litter in the ocean can also have a negative effect on marine flora, through smothering and crushing, leading to reduced sunlight and inducing anoxic conditions on the seabed (Kühn *et al.*, 2015). Plastics can also either adsorb pollutants present in the ocean or can leach out organic compounds added during their manufacturing (Teuten *et al.*, 2007). Moreover, it has been hypothesised that once ingested, these potentially toxic substances can bioaccumulate and be transferred between trophic levels (Teuten *et al.*, 2009).

Marine plastics are comprised of both macro- and microplastics. The latter are defined as plastic particles measuring < 5 mm (Arthur *et al.*, 2009). Microplastics can be further subdivided into two categories: primary microplastics are those that already measure < 5 mm, such as pre-production pellets, microbeads used in cosmetic products (Cole *et al.*, 2011) and fibres from synthetic clothing (Dris *et al.*, 2016). These enter the marine environment through a number of pathways, including wastewater (Browne *et al.*, 2011), accidental spillage during transport (Andrady, 2011) and even through atmospheric fallout (Dris *et al.*, 2016). Secondary microplastics are those that originated as macroplastics but through various degradation and fragmentation processes are broken down into smaller particles (Andrady, 2011). Abiotic factors such as UV degradation and wind/wave action (Andrady, 2011), as well as animal digestion (van Franeker *et al.*, 2011) can cause plastic fragmentation.

Microplastics are found throughout the water column, from the surface down to sediments due to their density differences and the effect of ocean currents (Lusher, 2015). Furthermore, they are found in all marine zones, from coastal waters to the deep ocean (Lusher, 2015). Once microplastics have entered the marine environment, they can interact in a number of ways. Microplastics can be ingested (either intentionally or accidentally) by marine organisms and therefore can be transferred between trophic levels through subsequent predator-prey interactions (Lusher, 2015).

The transfer of marine microplastics between trophic levels has become an important aspect of marine pollution research (Cole *et al.*, 2011). An early study on the diet of two fur seal species (*Arctocephalus gazella* and *A. tropicalis*) at Macquarie Island reported the presence of microplastics in the seals' scats (Goldsworthy *et al*., 1997). The authors also found that 92% of all otoliths recovered from the scats belonged to the pelagic fish species (*Electrona subaspera*), confirming it as a major food source for the seals. This was followed by a similar study on the diet on Hooker's sea lions (*Phocarctos hookeri*) at the same location, in which both microplastics and the otoliths of *E. subspera* were also extracted from the scats of the research species (McMahon *et al.*, 1999). A further study on the diet of *A. gazella* and *A. tropicalis* found 164 microplastic particles in the scats of the fur seals (Eriksson *et al.*, 2003). Analysis of these particles revealed that they had been broken down by either UV or through abrasion. The researchers reasoned that because of their small size, they were most likely ingested by *E. subspera*, thus supporting that trophic transfer of microplastics in marine organisms does occur (Eriksson *et al.*, 2003). However, direct trophic transfer between prey and predator has not been recorded often in the wild. Welden *et al.* (2018) examined plaice (*Pleuronectes platessa*) for microplastic uptake and found that microplastics were present not only in *P. platessa* themselves, but also in four of the nine intact sandeels (*Ammodytes tobianus*) retrieved from the foregut of *P. platessa*, thus indicating trophic transfer of microplastics between *A. tobianus* and *P. platessa* (Welden *et al.,* 2018). Although not observed in the wild in *sensu stricto*, Nelms *et al.* (2018) analysed scat sub-samples of captive grey seals (*Halichoerus grypus*) and the whole gastrointestinal tracts (GIT) of wild-caught Atlantic mackerel (*Scomber scombrus*), which were subsequently fed to *H. grypus*. This study found microplastics in 32% of the fish and 48% of the scat sub-samples, reinforcing the evidence for trophic transfer of microplastics between marine organisms.

Trophic transfer has been observed in marine organisms under controlled exposure in the laboratory from mussels (*Mytilus edulis* (L.)) to crabs (*Carcinus maenas* (L.)) (Farrell & Nelson, 2016) and amongst six zooplankton taxa (Setälä *et al.*, 2014). Despite these observations, Santana *et al.* (2017) argue that the feeding of organisms with a high load of microplastics during trophic transfer studies does not necessarily reflect events *in natura*. The authors carried out a study on the transfer of microplastics from the mussel *Perna perna* to two predators: the crab *Callinectes ornatus* and the puffer fish *Spheoeroides greeleyi*. *P. perna* were exposed to levels of microplastics less extreme than used in previous studies. Moreover, they were treated in such a way that the microplastics were only present in the hemolymph, as opposed to both the digestive tract and the hemolymph. The authors confirmed that trophic transfer did indeed occur between *P. perna* and the two predator species but that the latter did not retain the microplastics (Santana *et al.,* 2017).

One problem that occurs from analysing microplastic ingestion in a laboratory environment is the potential for atmospheric fallout. Atmospheric fallout or air-borne fibre contamination has become a widespread topic for discussion within microplastic research in recent years (Hermsen *et al.*, 2017; Wesch *et al.*, 2017). Fibres from clothing are abundant, and those that originate from the washing of synthetic fibres are known to contribute towards marine microplastic pollution (Browne *et al.*, 2011). However, the sources, pathways and quantification of fibres from atmospheric fallout are still poorly reported (Dris *et al.*, 2016). Yet Dris *et al.* (2016) showed that atmospheric fallout does provide a pathway for microplastic pollution. In busy and enclosed environments such as laboratories, atmospheric fallout from fibres and general air circulation may lead to air-borne contamination and thus may pose a threat to the correct reporting of microplastics in samples. Indeed, some microplastic studies have reported fibres as composing 100% of the ingested plastics in fish (*Platichtys flesus* (European flounder)*; Osmerus eperlanus* (European smelt); *Boops boops* (Bogue)) (McGoran *et al.*, 2017; Nadal *et al.*, 2016). However, not all microplastic ingestion studies have taken fibres into consideration. For instance, Budimir *et al*. (2018), Kühn *et al.* (2018) and Foekema *et al*. (2013) disregarded fibres altogether to avoid over-estimation, while Ramos *et al*. (2012) Romeo *et al.* (2015) both did not describe their procedure at all. The aforementioned studies that did not include fibres in their analysis reported low numbers of ingested plastic. Conversely, studies that did take fibres into account reported higher plastic occurrence, and in most studies, most of the recorded plastics were reported as fibres (Mizraji *et al*., 2017; Devriese *et al.*, 2015; Zoeter Vanpoucke, 2015; Lusher *et al.*, 2013). Moreover, in some studies, even when scientists have corrected for fibres, the proportion of fibre to plastic remained high (Halstead *et al.*, 2018; Lusher *et al.*, 2018). Wesch *et al.* (2017) argue that is it impossible to exclude contamination of air-borne fibres in samples using common lab facilities. The authors tested a number of laboratory environments and showed that only when using a clean bench could microplastics and fibres be accurately determined. Indeed, although Hermsen *et al.* (2017) did use a clean air device in their analysis of North Sea fish and no fibres were found in these samples, air-borne fibre contamination was still detected in their controls.

1.2 Previous research

Previous research carried out by Bernike van Werven at Wageningen Marine Research (WMR) for her Bachelor thesis (van Werven, 2016) provides the framework for this project. Van Werven (2016) analysed 960 sprat (*Sprattus sprattus*) individuals for microplastic ingestion and found that none of them contained any plastics. She proposed a number of potential reasons for this, including seasonal variation.

The samples she analysed were caught during the winter season. Unpublished data by Leopold *et al.* indicate a difference in the length and weight of summer sprat compared to winter individuals, with the former being longer and heavier on average. Thus, van Werven (2016) hypothesised that sprat may eat more during summer, justifying the lack of ingested plastic in the winter samples.

Van Werven (2016) also looked at secondary fibre contamination. She used receptacles (Petri dish or Bogorov counting chamber) filled with tap water as controls and recorded any secondary fibre contamination after analysis of every sample. Van Werven (2016) also took a number of precautionary measures: she prepared the samples in a laminary flow laboratory in order to minimise the risk of potential air-borne contamination and wore a blue 100% cotton laboratory coat.

1.3 Research questions

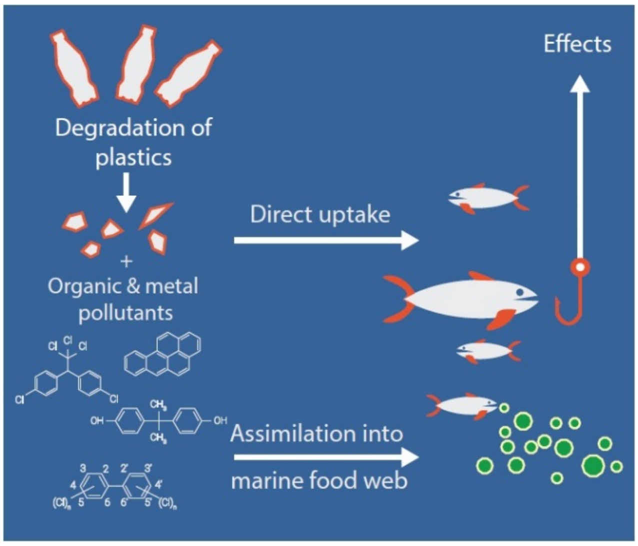

Figure 1.3. *Schematic of the PLASTOX framework (Booth, n.d.)*

With this in mind, this project aims to investigate microplastic ingestion in prey fish species from the North Sea, in order to provide further understanding of the potential for microplastic transfer between trophic levels. Since prey fish are target of predation by various organisms (such as bigger fish, marine mammals, seabirds), they provide a suitable basis for the investigation of the trophic transfer of marine (micro)plastic. Furthermore, despite them being relatively low in the foodweb, they are physically large enough to carry out ingestion analysis.

This research will contribute to the Joint Programming Initiative (JPI) Oceans PLASTOX project, which aims to investigate the direct and indirect ecotoxicological impacts of microplastics on marine organisms (Figure 1.3). The project combines a number of European organisations, among them WMR, which has been tasked with investigating the ingestion of plastic by organisms at the higher end of the foodweb.

Based on the aforementioned previous research, the following research questions are proposed:

- “Is there seasonal variation in microplastic ingestion by sprat in the North Sea?”
- “Do other North Sea prey fish species contain ingested microplastics?”
- “Can particles be visually identified correctly as being microplastics?”
- “What factors contribute most to air-borne fibre contamination in the laboratory?”

In order to answer the first question, sprat from both the summer and winter seasons will be analysed (hereinafter referred to as “summer sprat” and “winter sprat”). Based upon van Werven’s work (2016), it is expected that the summer sprat will have little-to-no ingested plastic. Sandeel (*Ammodytidae marinus)*, horse mackerel (*Trachurus trachurus)*, three-spined stickleback (*Gasterosteus aculeatus)* and whiting (*Merlangius merlangus)* from both winter and summer will also be analysed for plastic ingestion in order to determine whether there exists any species variability.

As previously mentioned, atmospheric fallout of fibres does provide a pathway for microplastic pollution (Dris *et al.*, 2016). Thus, it is expected that there will be contamination in the laboratory from air-borne sources from both clothing and general air circulation. Specifically, it is expected that an increase in the number of persons present in the laboratory will lead to an increase in the number of fibres from atmospheric fallout (from both clothing and a general increase in air circulation), which will ultimately be reflected by an increase in the number of fibres recorded.

1.4 Research species

European sprat (*Sprattus sprattus)*

Sprat are a pelagic schooling species, commonly found in relatively shallow marine waters, particularly in shelf and inshore waters. Of the three sub-species, *S. sprattus sprattus* is found in the North Sea and Northeast Atlantic, where it is one of the most abundant pelagic fish species. Within the North Sea Ecoregion (NSER), sprat are found between 0 and 100 m depth, although they are most abundant between 30 and 50 m depth (Dickey-Collas *et al*., 2015). Moreover, they are most abundant in the southeast of the North Sea (specifically, to the south and east of the Dogger Bank). Sprat spawn in spring and summer seasons and in their juvenile stage, they enter shallow waters (such as estuaries and marshes) for feeding proposes (Dickey-Collas *et al*., 2015; Camphuysen & Henderson, 2017).

Sprat are obligate particular feeders: they snatch their prey, which include larger planktonic organisms. They specialise in crustaceans, such as copepods, amphipods and mysids. Sprat are a key food source for commercially-important fish, such as whiting and cod (*Gadus morhua*), the latter being its main fish predator. They are also preyed upon by diving seabirds (such as the Sandwich, Common and Arctic terns, *Thalasseus sandvicensis, Sterna hirundo, S. paradisaea*) and marine mammals (Dickey-Collas *et al*., 2015; Camphuysen & Henderson, 2017).

Sandeel (*Ammodytidae)*

There are six species of sandeel (*Ammodytidae)* in European waters, but they commonly difficult to identify to genus or species level (Sparholt, 2015). Indeed, the sandeel specimen used in this survey were not identified further than "sandeel". Sandeels are partly pelagic and partly benthic, although most of their life is spent buried in the sand. Given their preference for sandy sediments (in particular medium to coarse grain size), catches are usually high in these areas. Depth and spatial distribution are mostly dictated by their substrate preference (Sparholt, 2015; Camphuysen & Henderson, 2017).
Sandeels undertake a diel vertical migration, meaning they move up the water column to feed. They feed in the pelagic zone during daylight and their prey include zooplankton, polychaetes and fish (larvae). Sandeels are a major food source for a range of marine predators, such as predatory fish (e.g. mackerel, whiting and gurnard), rays (Starry ray), seabirds (e.g. European shag (*Phalacrocorax aristotelis*), black-legged kittiwake (*Rissa tridactyla*) and common guillemot (*Uria aalge*)) and marine mammals (such as baleen whales) (Wanless *et al.*, 1998; Sparholt, 2015; Camphuysen & Henderson, 2017).

Other species

In addition to the two focal species, a small number of other species was also analysed for microplastic ingestion. These include horse mackerel (*Trachurus trachurus)*, three-spined stickleback (*Gasterosteus aculeatus)*, whiting (*Merlangius merlangus)* and anchovy *larvae (Engraulis encrasicolus)*. Table 1.4 presents an overview of each species with information pertaining specifically to the North Sea.

Table 1.4. Overview on the distribution, diet and predators of the small number of other species used in this study.

Species	**Zone**	**Depth**	**Diet**	**Predators**	**References**
Atlantic horse mackerel (*Trachurus trachurus)*	Pelagic Pelagic-neritic	20-50 m	Fish, crustacean and squid	Large fish; marine mammals	Ellis, 2015 Neves *et al.*, 2015
Three-spined stickleback (*Gasterosteus aculeatus)*	Pelagic	10-20 m	Invertebrates (insects; crustaceans; copepods)	Sea- and estuarine birds; marine mammals	Daan, 2015
Whiting (*Merlangius merlangus)*	Demersal	30-150 m	Crustaceans; small fish	Seabirds; marine mammals	Hislop *et al.*, 2015
Anchovy *larvae (Engraulis encrasicolus)*	Pelagic	15-30 m	Larvae (invertebrates and fish)	Predatory fish	Heessen *et al.*, 2015

2. Methodology

2.2 Sampling strategy

The fish used in this study were caught in the North Sea as part of both statutory task fish surveys and net tests between 2007 and 2016. Information pertaining to each cruise is presented in Table 2.2.1. Sample provenience is shown in Figure 2.2.1.

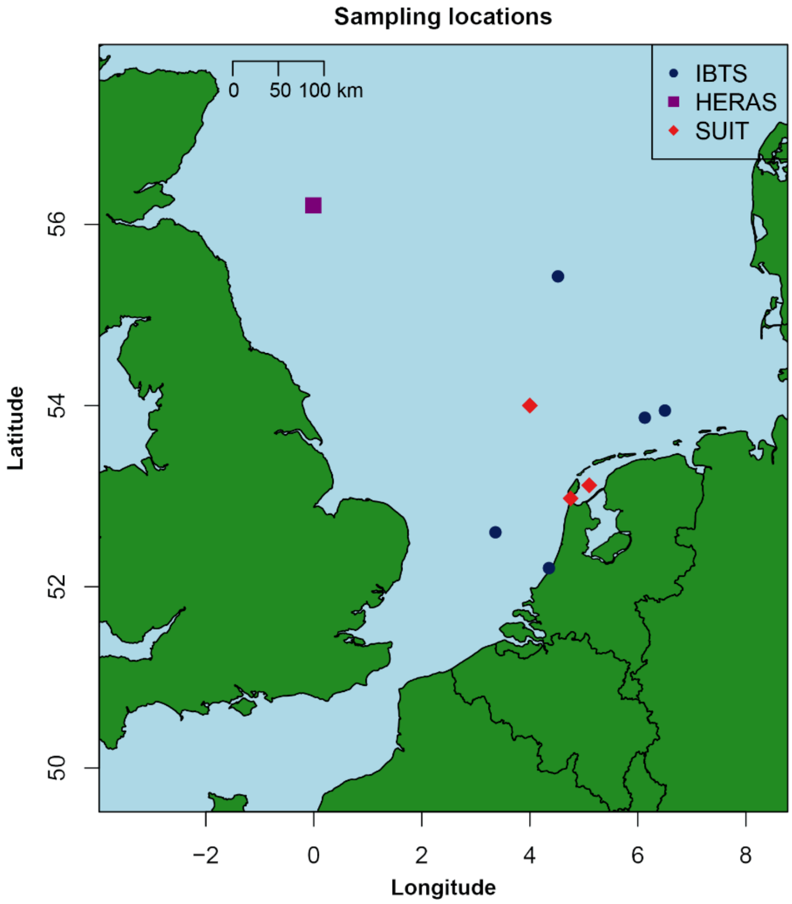

Figure 2.2.1. Overview of the provenance of the samples used in this study: *samples were caught in various locations in the North Sea during the IBTS (5 locations), HERAS (1 location) and the SUIT tests (3 locations).*

IBTS

The International Bottom Trawl Survey (IBTS) is carried out yearly in January and February in the North Sea (ICES, 2015a). Samples are caught using a Grande Ouverture Verticale (GOV), a (semi-pelagic) bottom trawl. The net consists of a mesh size measuring 100 mm and 10 mm at the codend. The headline of the net sits approximately 5 m above the seafloor, and as such the depth at which the samples are caught is dependent on the depth of the seafloor. The standard haul duration of the IBTS is 30 minutes, with a fishing speed of 4 knots. Trawling is only carried out during daylight (ICES, 2015a). The samples used in this study were caught during the 2013 IBTS between 10.0 and 38.4 m water depth.

HERAS

The Herring Acoustic Survey (HERAS) is carried out annually in June/July. It is an international survey aimed at providing an estimate of herring and sprat abundance and distribution in the North Sea, west of Scotland and Malin Shelf (ICES, 2015b). Fishing only occurs when shoals are detected acoustically in the water column using a Simrad EK60 scientific echosounder. A sub-sample from the school is obtained in order to collect biological data. No specific trawling gear is used for catching the sample, as long as the one chosen is deemed suitable for obtaining the sub-sample required. Depth, fishing speed and duration are dependent on the shoals and are thus adjusted to accommodate the recording of the shoals (ICES, 2015b).

SUIT test

Surface and Under Ice Trawl (SUIT) was developed to facilitate the sampling of the ice-water interface in polar environments. SUIT is able to sample the upper two meters of the water column, whether it be open water or directly under the sea ice (van Franeker *et al.*, 2009; Kühn *et al.*, 2018). The steel frame of the SUIT is shaped similar to a sledge with a 2 x 2 m opening. Sitting on top of the frame is a row of tyres to enable gliding under the ice, as well as floaters to ensure the correct orientation of the SUIT either under the ice or at the surface in open water. The nets used are 7 mm half-mesh shrimp net and a 0.3 mm plankton net at the codend (van Franeker *et al.*, 2009). The fish used in this study were caught during the testing of SUIT in the general Wadden Sea area (2007), Friese Front (2009) and the Marsdiep (2010) (Figures 2.2.1 and 2.2.2).

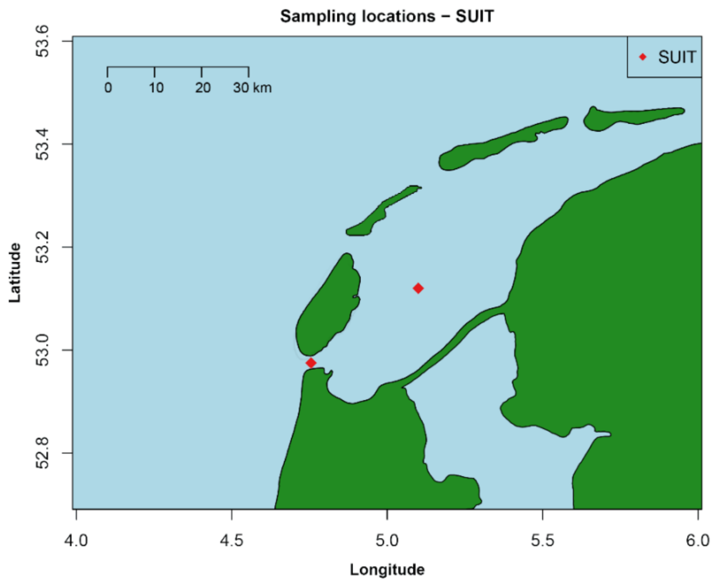

Figure 2.2.2. Locations of two of the SUIT tests: *the SUIT tests were carried out in Marsdiep (between the mainland of the Netherlands and the island of Texel), and the general Wadden Sea area. The third location (Friese Front) is shown in Figure 2.2.1.*

Table 2.2.1. Overview of the provenance of the samples used in this study: *for each expedition, information such as the vessel, the fishing gear used, location, date and number of stations is presented. The number of stations fished at for the SUIT test in August 2010 was not available.*

Expedition	**Research Vessel**	**Fishing Gear**	**Area**	**Date**	**Number of stations**
Herring Acoustic Survey	Tridens II	Pelagic Trawl 2000 m	Scottish East Coast	August 2016	1
International Bottom Trawl Survey	Tridens II	GOV	Southern North Sea	January-February 2013	5
SUIT test	SC41 – Osterems	SUIT	Marsdiep, Wadden Sea	August 2010	NA
SUIT test	SC41 – Osterems	SUIT	Friese Front	July-August 2009	2
SUIT test	Navicula	SUIT	Wadden Sea	June-July 2007	1

The samples were stored in a deep freezer in plastic bags based on the respective surveys/tests. Within each bag, samples were sorted per station number (i.e. location of each catch), which had both haul/trek numbers and dates associated with them. An inventory of every sample was taken in August 2017 [Appendix 1]. The samples were cross-referenced with the original paperwork, and all fish were counted. Each sample was assigned a sample number so that each fish could be given its own code (sample number-year-abbreviated species name). Moreover, this ensured that the samples could be kept in the freezer and be retrieved quickly and efficiently at the time of analysis. Due to long-term storage complications such as the freezer breaking down multiple times, many of the fish were in an advanced state of decomposition. As such, these could not be used for analysis and thus were discarded. An overview of the samples used in this study is presented in Table 2.2.2.

Table 2.2.2. Overview of the focal species used in this study: *Sprat and sandeel used in this study are presented along with their provenance, and seasonal information. The small number of other fish species used in this study are presented in table 2.2.1.*

Species	Number of fish	Expedition	Year	Season
Sprat	118	HERAS	2016	Summer
Sprat	173	SUIT test	2010	Summer
Sprat	129	IBTS	2013	Winter
Sandeel	287	SUIT test	2010	Summer
Sandeel	9	SUIT test	2009	Summer
Sandeel	1	SUIT test	2007	Summer

2.3 Sample analysis

Of the many methods that exist for the extraction of ingested microplastics in fish, the two used in this study are amongst the most widely used: individual dissection and dissolution by potassium hydroxide (KOH). Although dissection is an inexpensive and relatively straightforward method, it is time-consuming and the probability for overlooking potential plastics is somewhat larger, particularly to the inexperienced eye. Both time constraint and the number of individuals needing to be analysed meant that a combination of individual dissection and KOH dissolution was used.

Dissection was the primary method of analysis used in this study. This was done in order to obtain a frequency of occurrence in the event of finding any microplastic during batch KOH analysis. Each individual was weighed on a Sartorius electronic scale (to 4 decimals) and measured (to a millimetre, total fish length (TL)) prior to dissection [Appendix 2]. Following this, each fish was cut open from anus to throat using small scissors and its gastrointestinal tract was extracted using tweezers. The stomach was isolated and placed onto a clean petri dish, which was covered with parafilm for transportation to the microscope. The stomach was then cut open under the microscope and its contents analysed. Each stomach was photographed using a Zeiss Achromat S 0.63x microscope with integrated AxioCam MRc camera.

KOH dissolution is a recent development in plastic ingestion analysis. It was first put forward by Foekema *et al.* (2013), tested in a number of studies (e.g. Dehaut *et al.*, 2016), and confirmed and supported as an effective method by Kühn *et al.* (2017) and Karami *et al.* (2017), respectively. It is a very efficient and rapid method, which allows organic matter to dissolve while leaving any potential plastic intact. In the current study, all dissolutions were analysed using the same method: once (mostly) dissolved, the solution was sieved using a 30 µm sieve, and the contents poured into a Bogorov counting chamber, which was then covered with parafilm for transportation to the microscope for analysis. Samples that were processed in batches were sometimes sieved in stages if the batches were copious. Any suspected microplastics and/or fibres were recorded, and transferred onto a clean microscope slide which was covered with a glass slip and secured with sellotape to prevent loss of the sample.

2.3.1 Fish species

Summer Sprat

For this study, 297 summer sprat were available. Sample 3.01 (36 individuals) was dissected first. Due to the low number of microplastics found in sample 3.01, it was decided to process the next sample (sample 3.03, n=37) in batches using KOH dissolution. The fish were dissolved whole in order to save time. This sample was divided into four batches (3 x 9 larger fish; 1 x 10 smaller fish). Each batch was placed in a clean glass bottle, covered with 1 M KOH and placed in the oven at 35^{O}C for approximately 24 h. All four batches were taken out the following day and batch 1 was sieved first using a 30 µm sieve. However, due to the fish bones not dissolving completely in KOH, the sieve quickly became blocked. As such, it was decided to use a bigger mesh size (500 µm) and re-sieve the batch. This proved equally unsuccessful and thus the content was re-bottled and filled with KOH again. It was then left to dissolve further (at room temperature) until it was considered ready for analysis by means of visual inspection.

Winter Sprat

The winter sprat (n=129) were analysed using both dissection and KOH dissolution in order to minimise both dissolution time and avoid the sieving incident that occurred with the summer sprat. The samples were analysed per location. Being so close in both location and collection date, samples 1.02 and 1.05 (Figure 2.3.1) were processed together. The gastrointestinal tract was separated into two jars, one containing the stomachs and the other the intestines. This was done to determine whether there was any difference in the presence of microplastics between stomachs and intestines. Each jar was covered with 1 M KOH and left to dissolve. Once the contents were dissolved (this was inspected visually), the solutions were analysed as described above.

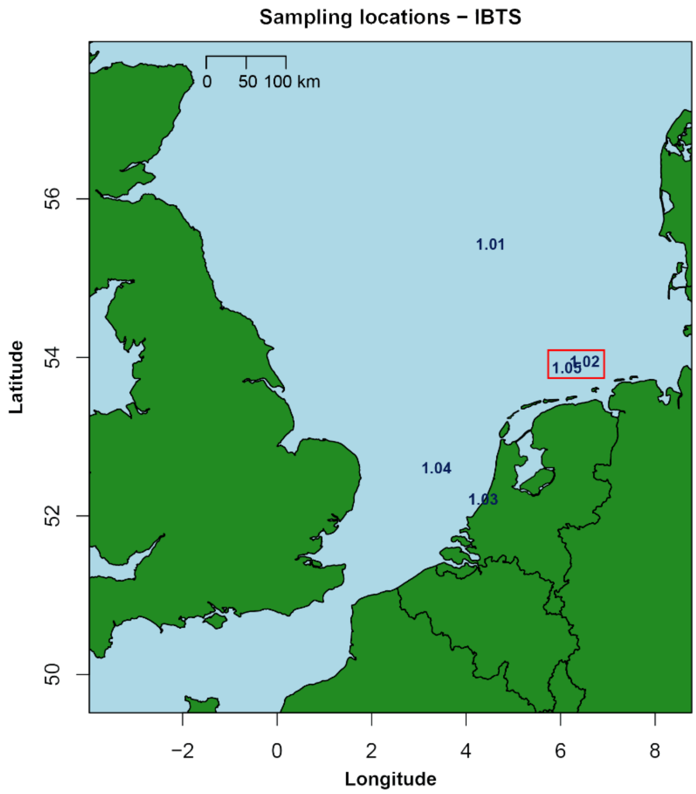

Figure 2.3.1. Locations of the IBTS samples: *due to their proximity, samples 1.02 and 1.05 were processed together.*

Sandeel

A group of 297 sandeels from the summer season were analysed. Due to their small size (most measured <5 cm) and their delicate nature, the sandeels were all processed whole using KOH. Initially, the sandeels were placed in clean glass bottles straight from the weighing scales. However, after a few batches, it was thought that the potential for air-borne contamination through excessive handling was too high. In order to eliminate this problem, each individual was rinsed with Milli-Q prior to placing it in the bottle.

Other species

A small number of other species were also analysed (Table 2.3.1). These were generally found in the same freezer bag as either the sprat or sandeel samples and as such were frozen together. In order not to discard these species once they had thawed, they were processed with KOH. The unknown species and the anchovy larvae were used in the preliminary experiment. They were processed in two batches of two and four individuals respectively. One batch for each sample was placed in a 35^{O}C oven for 24 h and the other was left at room temperature. This was done to determine whether samples dissolved quicker at a slightly higher temperature. As this appeared not to be the case, all further KOH dissolutions were dissolved at room temperature. The three-spined stickleback, whiting, horse mackerel and juvenile fish species were all processed individually as there was only one specimen per species.

Table 2.3.1. Overview of the other species analysed: *the small number of other species used in this study are presented along with their sample number, their provenance, and seasonal information.*

Species	Number of fish	Expedition	Year	Season
Three-spined stickleback	1	IBTS	2013	Winter
Whiting	1	IBTS	2013	Winter
Unknown	4	SUIT test	2010	Summer
Horse mackerel	1	SUIT test	2010	Summer
Anchovy larvae	8	SUIT test	2010	Summer
Juvenile fish sp.	1	SUIT test	2010	Summer

2.3.2 Control and air-borne fibre contamination analysis

In order to minimise the risk of air-borne fibre contamination, a number of precautionary steps were carried out. For instance, all apparatus was rinsed with Milli-Q prior to and after use, and parafilm was used to cover up any apparatus exposed to air, such petri dishes. Furthermore, a white 100% cotton lab coat was worn at all times in order to be able to differentiate between different sources of fibres.

A Bogorov counting chamber was used as both a control and for the air-borne fibre contamination analysis (henceforth referred to as control Bogorov). The control Bogorov was rinsed and filled with Milli-Q and placed at location A (Figure 2.3.2) at the beginning of each laboratory session. Fibres were counted under the microscope at the end of every laboratory session. Information such as time (start and end), and number of people in the lab were recorded [Appendix 3]. Location A produced underwhelming results and as such, it was moved to location B where there was more foot traffic. However, this did not work as planned either and finally, the control Bogorov was moved to location C.

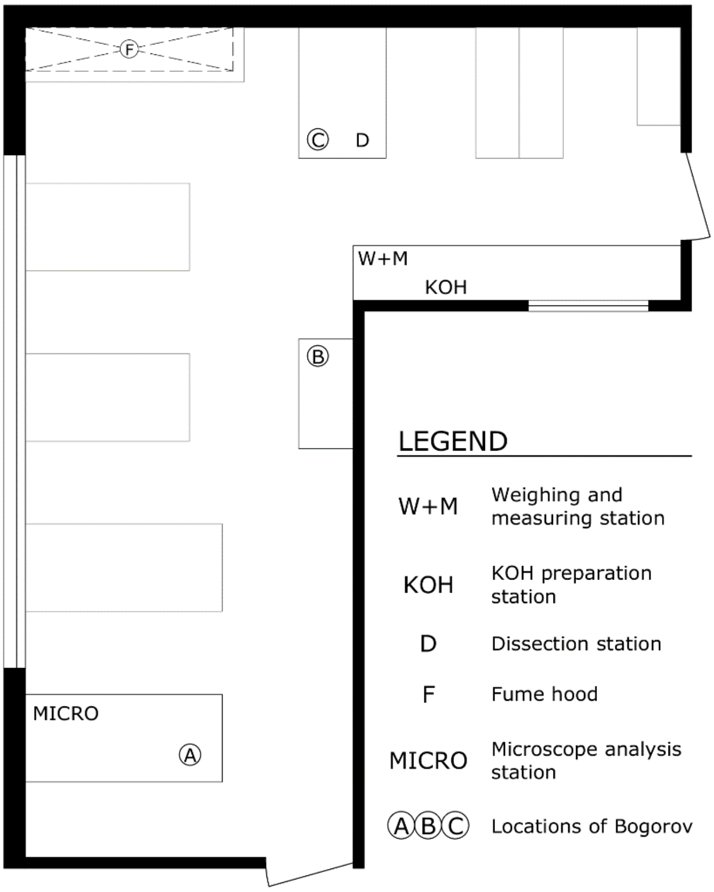

Figure 2.3.2. Layout of laboratory in bird-eye view: *the control Bogorov used for control and air-borne fibres contamination analysis was placed in location A first, location B second, and location C last; weighing and measuring were done at location "W + M"; KOH preparation and sieving were done at location "KOH"; Dissection was carried out at location "D" and microscopy analysis was done at location "MICRO". "F" is the location of the fume hood.*

2.4 Data Analysis

2.4.1 Suspected plastics

Following analysis, all suspect samples (including fibres) underwent Fourier Transform Infrared Spectroscopy (FT-IR) analysis at Shimadzu in Germany. The samples were photographed using a Leica EZ4 W Microscope [Appendix 4]. Smaller particles (fibres and particles smaller than approximately 1 mm; sizes were estimated visually) were placed on and compressed with a DC-3 Diamond Compression Cell, and analysed using Shimadzu Micro Infrared Microscope AIM-9000. Larger particles (> 1 mm; sizes were estimated visually) were analysed using a Shimadzu FT-IR IRSpirit. The software used were LabSolutions IR and AIMSolutions. Only scores above 750 (out of 1000; 75% confidence) were taken into account. Any scores below 800 underwent expert judgment by a member of the Shimadzu team and any uncertainties were classified as “unknown”. Natural materials were grouped together. Fibres and non-fibrous samples (both plastic and non-plastic) are presented separately in the results.

2.4.2 Sample characterisation

Once sample analysis was completed, all suspect microplastics and fibres underwent judgement by Susanne Kühn, Jan Andries van Franeker, André Meijboom and myself (henceforth referred to as judges) [Appendix 5]. Each judgement was done separately in order to minimise influence. The judges were presented with each sample and given two questions:

- Is the sample potentially air-borne?
- Is the sample plastic?

Scores were given for each answer (no=0; yes=1; unsure=0.5) and a tally was made in order to obtain a frequency of occurrence.

2.4.3 Fibres

The collected data were analysed using Microsoft Excel and RStudio version 1.1.423 (RStudio Team, 2016). Average number of fibres per fish, fibre colour and fibre contamination in the laboratory were all considered during this study. Average number of fibres per fish was calculated by dividing the number of fibres by the number of fish. This was done to compare whether analysing or handling the samples differently affected the number of fibres found in the samples. The differences in the average number of fibres per fish were used to compare: 1. Individual dissections and individual KOH methods for summer sprat; 2. Individual KOH and batch KOH for both summer sprat and sandeels; and 3. Batch KOH dissolution of whole fish vs. the gastrointestinal tracts for all sprat. Additionally, this was done to compare rinsed vs. un-rinsed sandeels prior to both batch and individual KOH dissolution.
Fibre colours were used as a comparison for sample and control fibres. Additionally, a comparison was done for sample and control fibres for sprat only. Two sub-comparisons were made: the first comparing sample and control fibre colours for sprat processed in KOH and the second comparing sprat analysed through dissection.

2.5 Statistical analysis

Statistical analysis was performed with RStudio version 1.1.423 (RStudio Team, 2016). A generalised linear model (GLM) was used to examine the variation in fibre contamination in the laboratory in relation to location, average number of people and duration. Both duration and average number of people were checked for collinearity using Variance Inflation Factor (VIF).

3. Results

The results from individual dissection and KOH dissolution are presented in this chapter. Results from FT-IR analysis on synthetic polymers and fibres, and Sample Characterisation are presented first, followed by results from the fibre analyses.

3.2 FT-IR analysis

A total of 69 non-fibrous samples and 33 fibres were available for analysis [Appendix 6]. 11 items were lost when handling prior to FT-IR (5 non-fibrous samples and 6 fibres). Figures 3.2.1 and 3.2.1 show results from FT-IR (from both Shimadzu IR Microscope AIM-9000 and FT-IR IRSpirit combined) for non-fibrous samples and fibres respectively. There were two unknowns for non-fibrous samples and one for fibres. Natural materials were grouped together and include protein, cotton, cellulose and sand/silica dioxide (n=43) for non-fibrous samples and protein and cotton (n=12) for fibres. Synthetic polymers that appeared only once were grouped together as “other”. These include a polyvinyl chloride (PVC) and acrylic adhesive compound, polybutyl methacrylate, low-density polyethylene (LDPE) and polystyrene (PS) for non-fibrous samples, and an amyl acetate and polyacrylonitrile (PAN) compound, a cupra and acetate compound and polyethylene terephthalate (PET) for fibres.

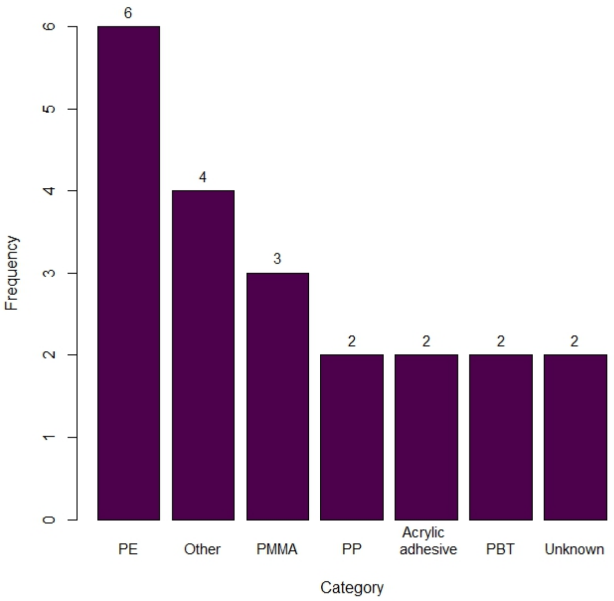

Figure 3.2.1. Overview of non-fibrous samples analysed with FT-IR: *a total of 64 samples were available for analysis but 43 samples were revealed to be of natural origin (protein, cotton, cellulose and sand/silica dioxide) and thus were excluded from further analysis. Polyvinyl chloride (PVC) and acrylic adhesive compound, polybutyl methacrylate, low-density polyethylene (LDPE) and polystyrene (PS) are grouped together under “Other”.*

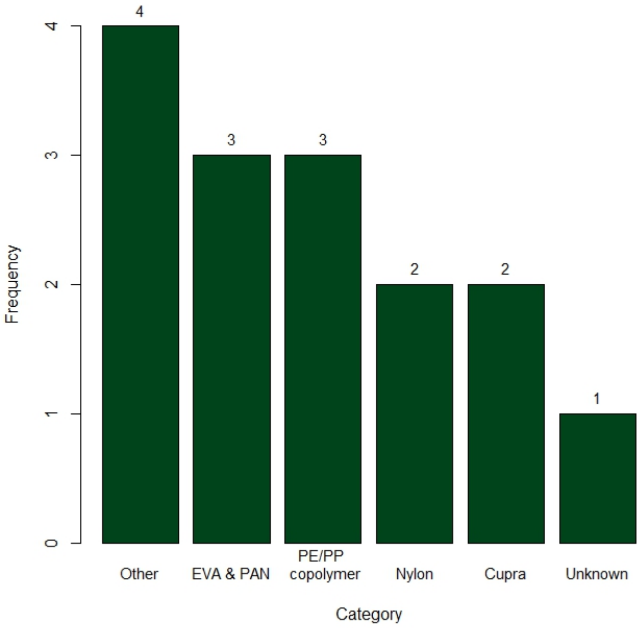

Figure 3.2.2. Overview of fibres analysed with FT-IR: *a total of 27 samples were available for analysis but 12 samples were revealed to be of natural origin (protein and cotton) and thus were excluded from further analysis. Amyl acetate and polyacrylonitrile (PAN) compound, a cupra and acetate compound, polyethylene (PE) and polyethylene terephthalate (PET) are grouped together under "Other".*

3.3 Synthetic polymers in fish species

Table 3.3.1 shows the frequency of occurrence of microplastics in both focal species. One microplastic particle was recovered from one of the individually analysed summer sprat (total n=55). Assuming a mean of one microplastic per affected fish, the frequency of occurrence was estimated for batch samples, as a frequency of occurrence could not be calculated. The remaining 11 microplastics were recovered from the summer sprat processed in batches (n=236). However, two microplastics were found in a batch of 27 winter sprat (total n=129). Van Werven's (2016) results (0 microplastics in 960 winter sprat) were taken into account. The same calculations were done for the sandeels as well. One microplastic was retrieved from one of the individually analysed fish (total n=62) and the remaining four microplastics were recovered from the samples processed in batches (n=235). A total frequency of occurrence for summer sprat, winter sprat, sprat from both seasons and sandeel was also calculated.

Table 3.3.1. Frequency of occurrence (%) of microplastics recovered in the focal species: *total occurrence for summer and winter sprat are presented both separately and together. * Data from van Werven (2016).*

Species	Treatment	Season	Number of fish analysed	Frequency of occurrence (%)
Sprat	Individual	Summer	55	1.8
Sprat	Batch	Summer	236	4.6
Total		Summer	291	4.1
Sprat	Batch	Winter	129	1.6
Sprat	Individual/Batch	Winter	960	0*
Total		Winter	1089	0.18
Total Sprat			1380	0.14
Sandeel	Individual	Summer	62	1.6
Sandeel	Batch	Summer	235	1.7
Total		Summer	297	1.7

Summer vs. Winter sprat

According to FT-IR analysis, winter sprat (n=27; 1 batch) contained two synthetic polymers compared to 12 in the summer sprat (n=124; 1 individual and 7 batches). The synthetic polymers from the winter sprat were polyethylene (PE) and polypropylene (PP). The fish that contained these polymers were from the same batch (1.03-2013-SPR-B001) caught during the IBTS just off the Dutch coast (Figure 3.3.1).

A wider range of synthetic polymers were found in the summer sprat. These included PE, polymethyl methacrylate (PMMA), acrylic adhesive, low-density polyethylene (LDPE), polybutyl methacrylate and a combination of polyvinyl chloride (PVC) and acrylic adhesive. These polymers were mostly found in the summer sprat caught during the SUIT test in the Marsdiep in 2010 and during HERAS 2016 at a station off the Scottish East Coast (Figure 3.3.1).

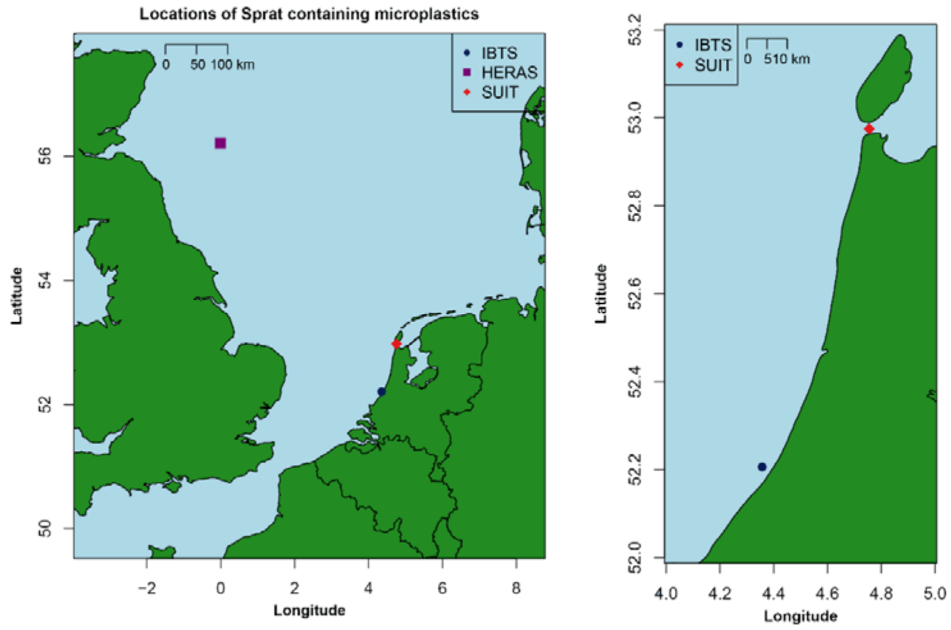

Figure 3.3.1. Locations of sprat containing microplastics (with magnification of locations on the right): *Scottish East Coast (HERAS); Dutch Coast (IBTS); Marsdiep (SUIT).*

Sandeel

FT-IR revealed five synthetic polymers originating from five different sandeel samples (1 individual and 4 batch samples): one acrylic adhesive particle, two polybutylene terephthalate (PBT) particles, one PMMA particle and one polystyrene (PS) particle. All synthetic polymers were found in sandeels caught either during the SUIT tests of 2009 in the Friese Front or in 2010 in the Marsdiep (Figure 3.3.2).

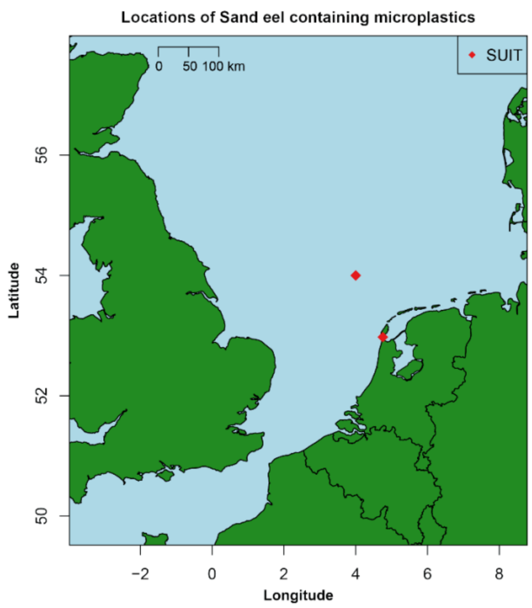

Figure 3.3.2. Locations of sandeels containing microplastics: *Friese Front (top) and Marsdiep.*

Other species

Table 3.3.2. presents the results from the analysis of the other species processed in KOH. No suspected plastics were found. However, fibres were found in half of the samples. The horse mackerel had the most fibres found compared to any other sample in the entire study. Out of the 13 fibres found, 12 were blue and one was red.

Table 3.3.2. Results from KOH dissolution of other species: *no suspected plastics were found, but fibres were found in half of the samples. The horse mackerel had the most fibres found out of any other sample in the entire study. Almost all fibres were blue (n=12) and one was red.*

Sample	Species	Number of fish	Number of microplastics	Number of fibres	Fibre colour
1.1	Three-spined stickleback	1	0	4	Blue
1.1	Whiting	1	0	2	Blue
5.09	Unknown	2	0	0	
5.09	Unknown	2	0	0	
5.13	Horse Mackerel	1	0	6	Blue (5) Red (1)
7.11	Anchovy Larvae	4	0	1	Blue
7.11	Anchovy Larvae	4	0	0	
7.16	Juvenile fish sp.	1	0	0	

3.4 Sample characterisation

Figures 3.4.1 and 3.4.2 show the frequency of occurrence for opinions provided by the four judges on whether samples were air-borne and plastic respectively. The fibres are excluded from the plastic data. There appears to be a general agreement among all judges about whether samples were air-borne. However, there was less harmony regarding opinions on whether samples were composed of plastic or not: frequency of occurrence shows more variation amongst the scores.

Of the 62 samples that were collected for sample characterisation, 36 were suspected of being plastic (i.e. non-fibrous) particles by the judges. Of these, 17 [1] were confirmed as synthetic polymers by FT-IR (Figure 3.2.1). 29% (n=5) was correctly judged as microplastics by all four judges, 18% (n=3) was correctly judged by three of the judges, 24% (n=4) was judged correctly by half the judges and 6% (n=1) was correctly identified by only one of the judges. Another 6% (n=1) was judged as “unsure” by one judge and non-plastic by the remaining judges. Finally, 18% (n=3) was identified as non-plastic by all four judges.

[1] This figure excludes four of the samples: the two “unknowns” in Figure 3.2.1 and another two samples that were confirmed as plastic by FT-IR but were not available for judgement.

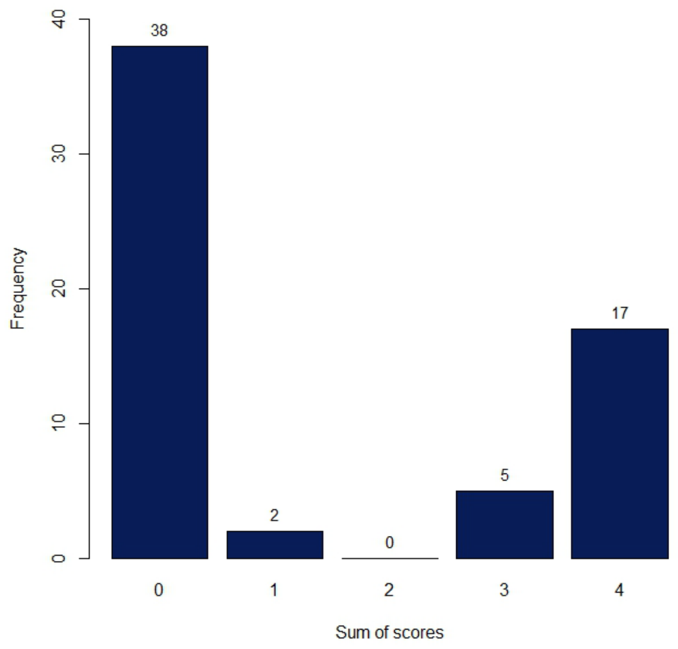

Figure 3.4.1. Frequency of occurrence for samples thought to be air-borne. *Three choices were given during sample characterisation: no (score 0); yes (score 1); maybe (score 0.5).*

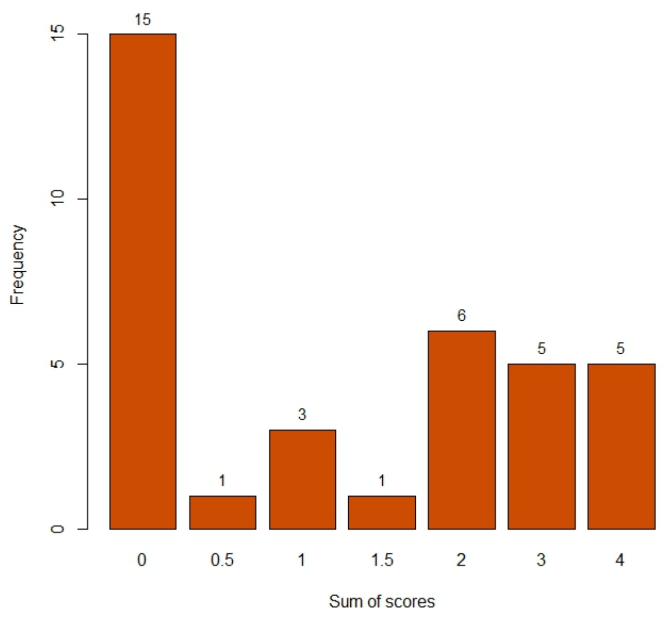

Figure 3.4.2. Frequency of occurrence for opinions for suspected plastics. *Three choices were given during sample characterisation: no (score 0); yes (score 1); maybe (score 0.5). Note that the fibre data are excluded from these results.*

3.5 Fibres

3.5.1 Average number of fibres per fish

Tables 3.5.1.a-f show the results from the average number of fibres per fish, which were calculated by dividing the number of fibres by the total number of fish. This was done to compare whether analysing or handling the samples differently affected the number of fibres found in the samples. Samples that were analysed individually and in batches were compared separately.

Sprat

Table 3.5.1.a compares the average number of fibres per sprat between the two analysis methods: individual dissection and individual KOH dissolution. Individual KOH had three times more fibres per fish than individual dissection. Individual KOH had twenty times more fibres per fish than batch KOH (Table 3.5.1.b). Comparing batch KOH dissolution of whole sprat and just gastrointestinal tracts (GIT) revealed no great difference in the average number of fibres per fish: on average whole fish had 1.4 times more fibres per fish compared to batches in which just the GIT were dissolved (Table 3.5.1.c).

Table 3.5.1.a. *Difference in the average number of fibres per summer sprat (± standard deviation) when comparing individual dissection vs. individual KOH methods.*

Summer Sprat	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Individual dissection	36	8	0.222 (± 0.485)
Individual KOH	19	13	0.684 (± 1.565)

Table 3.5.1.b. *Difference in the average number of fibres per summer sprat (± standard deviation) when comparing individual KOH vs. batch KOH.*

Summer Sprat	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Individual KOH	19	13	0.684 (± 1.565)
Batch KOH	236	8	0.034 (± 0.242)

Table 3.5.1.c. *Difference in the average number of fibres per sprat (± standard deviation) found when comparing batch KOH dissolution of whole fish vs. the gastrointestinal tracts.*

Sprat (all seasons)	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Whole KOH	244	9	0.037 (± 0.246)
GIT KOH	117	3	0.026 (± 0.159)

Sandeel

Table 3.5.1.d compared the average number of fibres per sandeel between individual and batch KOH dissolution. Individual KOH showed on average 8 times more fibres per fish than batch KOH dissolution. Sandeels not rinsed prior to batch KOH dissolution (Table 3.5.1.e) had 6 times more fibres per fish compared to those that had been rinsed with Milli-Q. Conversely, those rinsed prior to individual KOH had five times more fibres per fish than those that were dissolved without prior rinsing (Table 3.5.1.f).

Table 3.5.1.d. *Difference in the average number of fibres per sandeel (± standard deviation) when comparing individual KOH vs. batch KOH.*

Sandeel	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Individual KOH	62	21	0.339 (± 0.788)
Batch KOH	235	10	0.043 (± 0.317)

Table 3.5.1.e. *Difference in the average number of fibres per sandeel (± standard deviation) when comparing rinsed vs. un-rinsed sandeel prior to batch KOH dissolution.*

Sandeel (Batch KOH)	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Rinsed	219	7	0.032 (± 0.293)
Not rinsed	16	3	0.188 (± 0.544)

Table 3.5.1.f. *Difference in the average number of fibres per sandeel (± standard deviation) when comparing rinsed vs. un-rinsed sandeel prior to individual KOH dissolution.*

Sandeel (Individual KOH)	Number of fish	Number of fibres	Av. no. of fibres per fish (± SD)
Rinsed	49	20	0.408 (± 0.864)
Not rinsed	13	1	0.077 (± 0.277)

3.5.2 Fibre colours

The following section presents a comparison of the fibre colours of samples and controls for all species, followed by a comparison of sample and control fibre colours for sprat only.

Samples vs. Control for all species

Sample and control fibre colours are not comparable. Figures 3.5.2.a and 3.5.2.b show the colour distribution of fibres found in samples (for both species and analysis methods) and controls respectively. A total of 77 fibres were found during sample analysis. Blue dominated the sample fibres (71%; n=55), with white being the second most present colour (17%; n=13). However, the reverse was found in the control fibres: the predominant colour was white, accounting for 71% (n=368) of the 533 fibres found, followed by blue (16%; n=83). In general, control fibres displayed a wider range of colours compared to those found in samples.

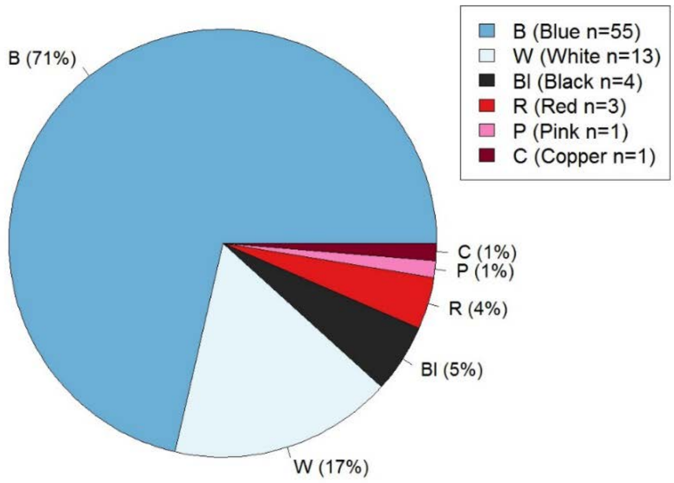

Figure 3.5.2.a. Colours of sample fibres and their respective percentages found during analysis of all species and for both analysis methods (KOH and dissection): *A total of 77 fibres were found, the majority of which were blue. White was the second most common colour. The remaining fibres were black, red, pink and copper.*

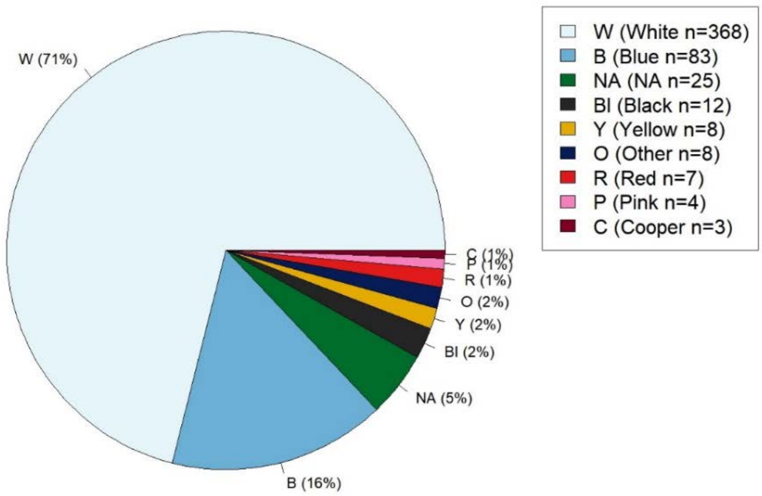

Figure 3.5.2.b. Colours of control fibres and their respective percentages found during analysis: *A total of 533 fibres were found, the majority of which were white. Blue was the second most common colour. The colour of 25 fibres were not recorded (NA); The remaining fibres were black, yellow, red, pink and copper. Category "other" represents those colours for which only 1 or 2 fibres were found. These include green, purple, beige, and grey.*

Comparison of sample and control fibre colours for sprat

Comparison of sample and control fibre colours between the two analysis methods could only be done with sample 3 (summer sprat), as this was the only sample for which both methods were used. Dissection was done in one day, thus only the control fibres done during those days were accounted for. However, KOH was performed over two days (one day for preparation, and another for analysis), and as such, colours of control fibres from both days were incorporated in the results.

a. Comparison of sample and control fibre colours for sprat processed in KOH

Figures 3.5.2.c. and 3.5.2.d. show the colour distribution of fibres found in samples (n=8) processed in KOH and their controls (n=71) respectively. Blue dominated the sample fibres (50%; n=4), with black being the second most present colour (38%; n=3). However, white was the predominant colour in control fibres, accounting for 92% of the 71 fibres found. In general, control fibres displayed a wider range of colours compared to those found in samples.

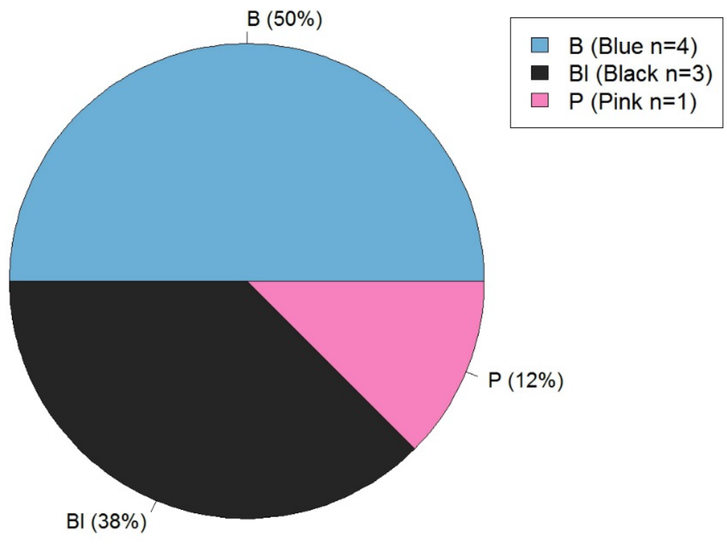

Figure 3.5.2.c. Colours of fibres found during analysis of sprat samples (sample 3) in KOH: *A total of 8 fibres were found, half of which were blue. The remaining were black and pink.*

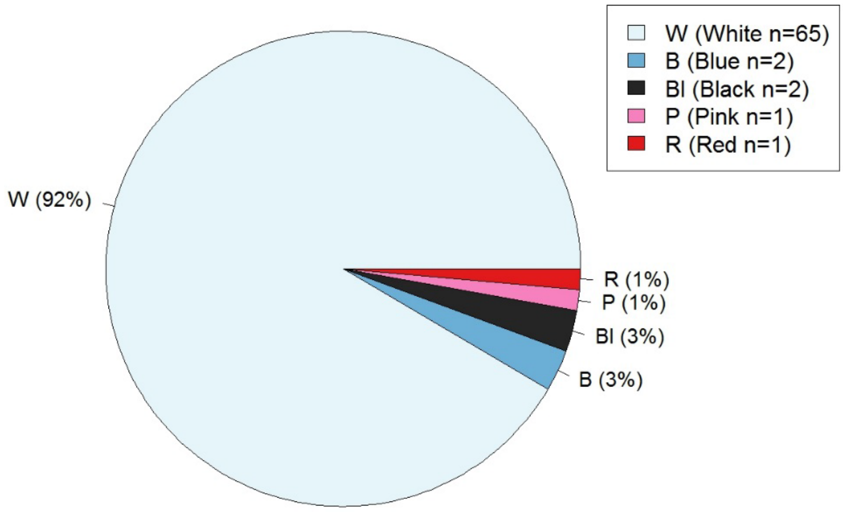

Figure 3.5.2.d. Colours of control fibres and their respective percentages found during analysis of sprat samples (sample 3) in KOH: *A total of 71 fibres were found, the majority of which were white. The remaining fibres were blue, black, pink and red.*

b. Comparison of sample and control fibre colours for sprat analysed through dissection

The colour distribution of fibres found in samples analysed through dissection and their controls were composed of 100% blue (n = 8) and 100% white (n = 15) respectively.

3.5.3 Fibre contamination

A GLM was carried out to determine whether location, duration and average number of people were explanatory variables for fibre contamination in the laboratory. Duration and average number of people showed no collinearity (VIF = 1). Results show that each variable (all three locations, average number of people and duration) was significant ($p < 0.05$). A further GLM was done to determine whether an interaction existed between duration and number of people (the longer the duration in the laboratory, the greater the number of people) and between duration and location. Results showed that both were significant ($p < 0.05$).

4. Discussion

Microplastic research is both highly topical and warranted. Its significance is reflected not only in the increasing attention within the scientific community (Thompson, 2015), but also by the growing awareness of the environmental impact of (micro)plastics by the general public. Research seems particularly relevant and necessary in light of recent reports and studies that have found microplastics in even the most remote, uninhabited and pristine environments including the Arctic (Kühn *et al.*, 2018; Obbard *et al.*, 2014) and Antarctic (Waller *et al.*, 2017), in deep-sea sediments (Bergmann *et* al., 2017; van Cauwenberghe *et al.*, 2013) and on deserted islands (Lavers and Bond, 2017). One of the ways to determine and understand how microplastics affect the environment is through trophic transfer in marine organisms. This study has strived to add to this branch of microplastic research through the analysis of ingested microplastics in North Sea prey fish.

Previous work on approximately 1000 winter sprat revealed no ingested plastic (van Werven, 2016). As such, this study sought to analyse summer sprat to determine whether seasonality may provide an explanation for the lack of plastic in winter sprat. Moreover, sandeel and a small number of other prey species (e.g. horse mackerel, whiting and anchovy) were also analysed for ingested microplastics to examine whether species other than sprat also contained microplastics. Sandeel was of particular interest as, to date, little research has examined microplastic ingestion in this species. Moreover, *Ammodytes* sp. is a highly important prey species for a number of fish, seabird species and marine mammals (Welden *et* al., 2018; Camphuysen & Henderson, 2017).

The second part of this study focused on fibre contamination. This particular topic is a relatively new aspect within microplastic research and there is increasing interest in its significance within the literature (Kühn *et al.*, 2018; Wesch *et al.*, 2017). It is clear that the issue of fibre contamination during analysis and within the laboratory is complex. Indeed, the discussion on fibres analysis and their implication on microplastic research took increasing precedence as this study evolved.

4.2 Synthetic polymers in fish species

FT-IR spectroscopy revealed a mixture of plastics, the majority of which are among the most commonly manufactured (Miller *et al.*, 2017). These include polyethylene (PE), polypropylene (PP), polystyrene (PS) polyethylene terephthalate (PET) and polyvinyl chloride (PVC) (Miller *et al.*, 2017). Unlike previous work by van Werven (2016), winter sprat did contain microplastics: one PE particle and PP particle. Summer sprat contained both a wider range and a greater number of microplastics (n=12), suggesting seasonal variation. However, frequency of occurrence of ingested microplastic was similar for individually-dissected summer sprat and batch KOH winter sprat (1.8% and 1.6% respectively). Despite this, the difference in the frequency of occurrence between summer and winter sprat was greater when grouping all summer sprat together (n=291) and taking into account the winter sprat (n=1089) from van Werven (2016), indicating possible seasonal variation (occurrence of 4.1% and 0.14% for summer and winter sprat respectively). There appears to be large variation in the degree of uptake of microplastics in sprat within the literature (Table 4.2.1). Interestingly, Budimir *et al*. (2018) and Hermsen *et al.* (2017) sampled sprat from the autumn and winter seasons respectively, and found a microplastic occurrence of 0.9% and 0.25% in their respective studies (Table 4.2.1). Conversely, Beer *et al*. (2018) analysed sprat from spring and summer in a long-term study and found that 18.8% of sprat had ingested microplastics. Moreover, the authors found that the summer specimen [2] contained a significantly higher amount of microplastics than those collected in the spring (p=0.04). Beer *et al*. (2018) explained this variation through potential increased feeding in the summer months. Indeed, they found a positive correlation between fish size and microplastic uptake. Increased size in summer sprat does seem to be supported by unpublished work by Leopold *et al.* that indicates a difference in the length and weight of summer sprat compared to winter individuals, with the former being longer and heavier on average. Sprat analysed by Zoeter Vanpoucke (2015) were collected in the autumn and spring, but she found no significant temporal variation (p=0.887).

Taking into account the aforementioned studies, it would be reasonable to deduce that seasonal variation of ingested microplastics in sprat does indeed occur. However, further dedicated studies on this topic are needed to confirm this.

Microplastics found in the sandeels in this study confirms that other North Sea prey fish do contain ingested microplastics. Frequency of occurrence in the sandeels analysed in this study (1.7%) approximates that of Hipfner *et al.* (2018). However, unlike the sandeels in this study, only microfibres were recovered by Hipfner *et al.* (2018). The authors took precautionary methods to avoid sample contamination and could thus confirm that the fibres were not from secondary contamination. They proposed that the occurrence of microfibres in part of their samples could in part be explained by the proximity of one of their sampling sites to a vast urban catchment and thus to the increased likelihood of fibres offshore due to the wastewater discharge (Hipfner *et al.*, 2018). Microplastic occurrence in the sandeels recovered from the foregut of plaice by Welden *et al.* (2018) was considerably higher than both this study and Hipfner *et al.* (2018). However, their sample size was small (n=9) and without comparison to other studies, is not possible to draw a conclusive argument. Considering that there is a very limited

[2] Beer *et al*. (2018) analysed both sprat and Atlantic herring (*Clupea harengus*). They found no significant difference in the amount or size of the plastic recovered between both species, leading the authors to pool all data for further analysis.

number of studies dedicated to microplastic ingestion in sandeels, further research is needed to establish occurrence of microplastic in this ecologically-important species.

Other species

No suspected plastics were found in the other species analysed, but this is contrary to previous studies (Table 4.2.1). As with both focal species, previous studies shown great variation in the degree of uptake of microplastics in other prey species within the literature. The very small sample size should be taken into account when considering the results of this study and further analysis is needed to obtain a better indication on whether these species ingest microplastics.

Table 4.2.1. Summary of previous studies reporting the occurrence of microplastics in the species used in this study. *The percentage of fibres found is also presented.*

Fish	Species	Region	Frequency of occurrence (%)	Fibres (% of plastic found)	Reference
Sprat	*Sprattus sprattus*	Baltic Sea	18.8 [3]	93 [3]	Beer *et al.* (2018)
		Northern Baltic Sea	0.9	Excluded	Budimir *et al*. (2018)
		North Sea (Southern Bight)	0.25	0	Hermsen *et al.* (2017)
		North Sea (Belgium)	38.7	78	Zoeter Vanpoucke (2015)
Sandeel	*Ammodytes personatus*	Northeastern Pacific Ocean	1.5	100	Hipfner *et al.* (2018)
	Ammodytes tobianus	Celtic Sea	44.4	Not described	Welden *et al.* (2018)
Horse mackerel	*Trachurus trachurus*	Portugal	7.0	59	Neves *et al*. (2015)
		North Sea	1.0	Excluded	Foekema *et al*. (2013)
		English Channel	28.6	68	Lusher *et al.* (2013)
Three-spined stickleback	*Gasterosteus aculeatus*	Northern Baltic Sea	0	Excluded	Budimir *et al*. (2018)
Anchovy	*Engraulis encrasicolus*	western Mediterranean Sea	14.3	83 [4]	Compa *et al.* (2018)
		Gulf of Lion (Mediterranean Sea)	40	48	Collard *et al.* (2017)
Whiting	*Merlangius merlangus*	western English Channel	1.4	83 [4]	Steer *et al.* (2017)
		North Sea (Southern Bight)	0	0	Hermsen *et al.* (2017)
		North Sea	5.7	Excluded	Foekema *et al*. (2013)
		English Channel	32	68	Lusher *et al.* (2013)

[3] This figure is for both study species (sprat and herring).

[4] This figure takes into account all species in the studies. The authors did not state separate figures for each species.

4.3 Sample characterisation

In order to answer whether particles can be correctly identified as being microplastics by visual means, a sub-sample of suspected plastics collected in this study underwent judgement. Frequency of occurrence given by the judges showed greater agreement regarding the air-borne samples compared to the suspected plastics. This clearly implies that whilst microscopic analysis is a necessary and useful first step in microplastic analysis, FT-IR is essential for determining whether a sample is ultimately plastic or not. Although the majority of judges have many years of experience with plastics and synthetic materials, the usual techniques for inspecting suspected plastics (such touching, squeezing, scraping, burning and even listening) were not available to them due to the small size of the samples. The only method possible (bar a very few cases) was visual inspection. This made judging troublesome and this is reflected in the results: 29% (n=5) of all samples available for sample characterisation were unanimously judged as microplastic by all four judges. This only confirms the need for FT-IR to determine the composition of microplastics.

4.4 Fibres

4.4.1 Average number of fibres per fish

The average number of fibres per fish was calculated to compare whether analysing or handling the samples differently affected the number of fibres found. The results revealed that fish analysed individually in KOH had more fibres on average than both those that underwent dissection (by threefold) and those analysed in batch KOH (x20 and x8 in sprat and sandeel respectively). This implies that should time not be an issue, individual dissection may be less susceptible to fibres contamination, and should KOH be the preferred method of analysis, analysing samples in batches would be both time-efficient and reduce the risk of secondary contamination. However, this then poses a problem for calculating a frequency of occurrence if microplastics are recovered in the fish processed in batches.

The comparison of batch KOH dissolution of whole fish and the gastrointestinal tracts (GIT) showed no great difference: on average whole fish had 1.4 time more fibres per fish compared to batches in which just the GIT were dissolved. This indicates that dissolving the whole fish or part of the fish does not appear to influence the number of fibres in a sample. Finally, rinsing fish with Milli-Q does not seem to have a difference on the number of fibres per fish: sandeels that were not rinsed prior to batch KOH dissolution had 6 times more fibres than those that had been rinsed, whilst the opposite was found for sandeels analysed individually with KOH: those that were rinsed had five times more fibres than those that were not rinsed.

4.4.2 Fibre colours

Fibres collected in the control Bogorov allowed for another type of analysis: the comparison of colours from the control fibres and those retrieved from the samples. For all three groups for which fibre colour comparison was done (sample vs. control for: 1. all species; 2. sprat processed in KOH; 3. sprat analysed with dissection), blue was the most common colour found in the samples and white the colour more commonly found in the control Bogorov. This implies a certain consistency in the source of contamination for both the control Bogorov and the samples. However, it is not clear what exactly these sources could be. A white 100% cotton lab coat was worn at all times during analysis, so it would be reasonable to deduce that the white fibres (which comprised the majority of those found in the control Bogorov) came from the lab coat. However, once the control Bogorov was placed in a location, it was left untouched and at a certain distance from the location of analysis until the end of the analysis session, when it was carried to the microscope and handled for only a short period of time under the microscope (the time needed for counting and recording fibres). The blue fibres found in the samples may reflect the type of clothes worn under the lab coast during analysis. However, this then raises the question as to why not more white fibres were found in the samples. One explanation could be that "ordinary" clothing may shed fibres more easily than a lab coat, or that different materials (e.g. wool) may moult more easily. Finally, the fibres found in the control Bogorov displayed a wider range of colours compared to those in the samples. A possible explanation for this is that the control Bogorov was exposed to multiple persons passing by, most of whom were seldom wearing a lab coat. However, there are too many variables to be able to provide a straightforward explanation for the differences in fibre colours.

4.4.3 Fibre contamination

The original plan of using the fibres collected in the Bogorov for the purpose of the control during stomach analysis failed. As explained in the methods chapter, the control Bogorov was placed in a certain location in the laboratory at the start of the analysis and the fibres collected were counted after an analysis session had been completed. This particular method resulted in it not being possible to use the fibres collected in the Bogorov as a control, given that crucial information (such as number of fish analysed and time for each analysis) was not recorded. Undoubtedly, this was an oversight in the study design and could have been avoided with better planning. Despite this, comparison of the fibres collected in the control Bogorov could still be carried out to determine fibre contamination in the laboratory. Fibre contamination was shown to be a factor of location, duration and the average number of people present in the laboratory. However, further analyses should be done to determine which factor (if any) influences fibre contamination the most.

Table 4.2.1 includes the percentage of fibres that constitute the microplastics found in each study. The majority of studies that reported higher microplastic occurrence also reported that most of the microplastics were composed of fibres. For instance, Zoeter Vanpoucke (2015) reported that 38.7% of sprat had ingested microplastics, but most of these were fibres (78%). Fibres also represented the overwhelming majority of microplastics (93%) found by Beer *et al*. (2018). Budimir *et al*. (2018) excluded fibres from their results and Hermsen *et al.* (2017) carried out sampling in a laminar flow cabinet and performed a twofold control analysis to ensure no fibre contamination of the samples, resulting in low ingested microplastic occurrence in sprat in both studies. However, both Zoeter Vanpoucke (2015) and Beer *et al*. (2018) also took steps to avoid or account for any potential contamination (e.g. sample preparation took place in a fume hood, minimal handling of samples and filters and controls/procedure blanks). The variation in the methods used by researchers to minimise or avoid air-borne contamination makes it difficult to compare microplastic results. This only reinforces the need for studies to report fibrous and non-fibrous microplastics separately so as to allow proper comparison between studies.

4.5 General remarks on analysis procedure and recommendations for future work

Although WMR does have a clean bench, it was not practically feasible to carry out the entire procedure (from dissection/KOH dissolution to microscopy analysis) at that location, and as such many of the steps were carried out at various locations around the laboratory. Thus, air-borne contamination could have occurred in a number of ways during analysis. This is particularly true for analysis of whole fish with KOH dissolution. Although care was taken to minimise contamination (such as the covering of receptacles with parafilm and the washing of utensils with Milli-Q), there were a number of times when the fish were exposed to air and thus to the potential of fibre contamination. Instances include during the taking of the inventory at the start of the study, and during the weighing and measuring of the fish prior to KOH dissolution. As such, future work should use controls and describe these in detail so as to be able to account for any secondary contamination effectively.

During KOH analysis, it was observed that larger fish dissolved less well and more specifically, that bones were left undissolved. This created issues during sieving as it took a longer time to sieve and it made it difficult to sieve without spillage and loss of solution. The undissolved bones also created issues during analysis as it was challenging and time-consuming to sort through the samples, and may have led to an oversight of potential plastic particles in the samples. It is therefore highly recommended to avoid dissolving whole fish, particularly bony fish larger than ~7 cm. However, it should be noted that a 1 M solution was used in this study, and thus perhaps using a stronger concentration would solve this particular issue. One disadvantage of KOH dissolution is that it strips organic material from any potential microplastic particles and as such the origin cannot be determined with FT-IR (M. Egelkraut-Holtus, personal communication, 20 April 2018). For instance, if a particle were to be analysed by FT-IR without having been analysed by KOH, and FT-IR revealed a composition of PET and fat, it may suggest that the particle was ingested. However, since KOH dissolves the majority of fat and protein, the origin of the particle cannot be determined with any certainty. Microparticles also pose a problem for FT-IR, as their size makes them vulnerable to breaking during processing. As a result, there is only one (maximum two) chance(s) to analyse such samples and if FT-IR cannot determine the composition, the sample is likely to be destroyed without the payoff of a result.

Another limitation of this study is the placement of the control Bogorov. The Bogorov was moved from location to location as the latter was thought to have more foot traffic. Ideally, a Bogorov would have been placed in three different laboratories and the number of people recorded at each location in order to determine how many people there were at each location. In this study, there is no way of knowing this, as the Bogorov was placed in the same laboratory over three separate time periods and the average number of people present was recorded.

5. Conclusion

This study sought to answer four questions. Firstly, seasonal variation in ingested microplastics in sprat in the North Sea was examined. According to the results from this study and those from a previous long-term study in the Baltic Sea, there appears to be seasonal variation in microplastic ingestion by sprat in the North Sea. Results showed that summer spat ingested more microplastics compared to winter specimen. However, further research is needed to confirm this. Secondly, species variation in ingested microplastics was also analysed. Microplastics found in the sandeels in this study confirms that other North Sea prey fish do contain ingested microplastics. However, no microplastics were found in all other species, but the sample size was too small to draw a conclusion. Considering that there is a very limited number of studies dedicated to microplastic ingestion in sandeels, further research is needed to establish occurrence of microplastic in this ecologically-important species. Thirdly, microplastic characterisation by colleagues revealed that FT-IR is indispensable for determining whether a sample is ultimately plastic or not. Finally, results showed that air-borne fibre contamination in the laboratory was the results of several factors (number of people present, duration and location of control Bogorov) but it was not possible to determine which had the greater effect. Although this study provides some interesting results, future research is needed to provide clearer conclusion to some of the questions. This is particularly true for the determination of factors that contribute the most to air-borne fibre contamination in the laboratory, as it is commonly stated as one of the main problems affecting microplastic analysis and results.

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Prepping a sample for FT-IR analysis at Shimadzu in Germany

(Photo: J.A. van Franeker)

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Appendix 1: Fish species inventory

Table A1. *Inventory of fish species used in this study. Information includes provenance (survey/test and information pertaining to these), the code attributed to each sample and the number of fish in each sample.*

Sample	Expedition	RV	Fishing gear	Year	Season	Location	Station	Haul/ Trek	Date	Species	Latin name	Abbr.	Code	n.
1.01	IBTS	Tridens II	Bottom trawl	2013	Winter	55.43N-4.52E	3400058	58	20/Feb/13	Sprat	*Sprattus sprattus*	SPR	1.01-2013-SPR	9
1.01	IBTS	Tridens II	Bottom trawl	2013	Winter	55.43N-4.52E	3400058	58	20/Feb/13	Three-spined stickleback	*Gasterosteus aculeatus*	GAS	1.1-2013-GAS	1
1.01	IBTS	Tridens II	Bottom trawl	2013	Winter	55.43N-4.52E	3400058	58	20/Feb/13	Whiting	*Merlangius merlangus*	MER	1.1-2013-MER	1
1.02	IBTS	Tridens II	Bottom trawl	2013	Winter	53.95N-6.51E	3400007	07	23/Jan/13	Sprat	*Sprattus sprattus*	SPR	1.02-2013-SPR	34
1.03	IBTS	Tridens II	Bottom trawl	2013	Winter	52.21N-4.36E	3400049	49	15/Feb/13	Sprat	*Sprattus sprattus*	SPR	1.03-2013-SPR	27
1.04	IBTS	Tridens II	Bottom trawl	2013	Winter	52.61N-3.37E	3400015	15	28/Jan/13	Sprat	*Sprattus sprattus*	SPR	1.04-2013-SPR	26
1.05	IBTS	Tridens II	Bottom trawl	2013	Winter	53.87N-6.13E	3400006	06	23/Jan/13	Sprat	*Sprattus sprattus*	SPR	1.05-2013-SPR	33
2	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea			17/Aug/10	Sprat	*Sprattus sprattus*	SPR	2-2010-SPR	118
3.01	HERAS	Tridens II	Pelagic Trawl 2000M	2016	Summer	Scottish East Coast 56.21N-0.01E	5400397		17/Jul/16	Sprat	*Sprattus sprattus*	SPR	3.01-2016-SPR	41
3.02	HERAS	Tridens II	Pelagic Trawl 2000M	2016	Summer	Scottish East Coast 56.21N-0.01E	5400397		17/Jul/16	Sprat	*Sprattus sprattus*	SPR	3.02-2016-SPR	43
3.03	HERAS	Tridens II	Pelagic Trawl 2000M	2016	Summer	Scottish East Coast 56.21N-0.01E	5400397		17/Jul/16	Sprat	*Sprattus sprattus*	SPR	3.03-2016-SPR	38
4.03	SUIT test	SC41 - Osterems	SUIT	2009	Summer	Friese Front	FF05	02	28/Jul/09	Sandeel sp.	Ammodytidae	AMM	4.03-2009-AMM	7
4.24	SUIT test	SC41 - Osterems	SUIT	2009	Summer	Friese Front	FF15		3/Aug/09	Sandeel sp.	Ammodytidae	AMM	4.03-2009-AMM	2
5.01	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	10	17A	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.01-2010-SPR	6
5.02	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	20A	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	5.02-2010-AMM	4
5.02	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	20A	18/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.02-2010-SPR	3
5.06	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	10	16A	16/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.06-2010-SPR	3
5.09	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	21A	18/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.09-2010-SPR	3
5.09	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	21A	18/Aug/10	Juvenile fish sp.		UNK	5.9-2010-UNK	4

5.10	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	19A	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	5.10-2010-AMM	13
5.11	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	10	17B	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.11-2010-SPR	19
5.12	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	20B	18/Aug/10	Sprat	*Sprattus sprattus*	SPR	5.12-2010-SPR	3
5.13	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	9	16A/B	17/Aug/10	Sandeel sp.	Ammodytidae	AMM	5.13-2010-AMM	1
5.13	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	9	16A/B	17/Aug/10	Horse mackerel	*Trachurus trachurus*	TRA	5.13-2010-TRA	1
6.02	SUIT test	Navicula	SUIT	2007	Summer	Wadden Sea			June/July 2007	Sandeel sp.	Ammodytidae	AMM	6.02-2007-AMM	1
7.02	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	7	13	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.02-2010-SPR	2
7.03	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea		6A	16/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.03-2010-SPR	1
7.05	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	19B	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.05-2010-AMM	9
7.06	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	10	16A	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.06-2010-SPR	5
7.07	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	9	15B	17/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.07-2010-AMM	1
7.08	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	2	7	16/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.08-2010-AMM	11
7.09	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea		6B	16/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.09-2010-AMM	221
7.10	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	10	17B	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.10-2010-SPR	1
7.11	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	21B	18/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.11-2010-SPR	3
7.11	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	21B	18/Aug/10	Anchovy larvae	*Engraulis encrasicolus*	LARA	7.11-2010-LARA	8
7.12	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	11	18B	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.12-2010-AMM	2

7.14	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	22A	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.14-2010-AMM	8
7.14	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	22A	18/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.14-2010-SPR	2
7.15	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	8	14B	17/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.15-2010-AMM	11
7.15	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	8	14B	17/Aug/10	Sprat	*Sprattus sprattus*	SPR	7.15-2010-SPR	6
7.16	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	22B	18/Aug/10	Juvenile sprat	*Sprattus sprattus*	JUVS	7.16-2010-JUVS	1
7.16	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	22B	18/Aug/10	Sandeel sp.	Ammodytidae	AMM	7.16-2010-AMM	11
7.16	SUIT test	SC41 - Osterems	SUIT	2010	Summer	Marsdiep; Wadden Sea; North Sea	12	22B	18/Aug/10	Juvenile sprat	*Sprattus sprattus*	JUVS	7.16-2010-JUVS	1

Appendix 2: Fish data

Table A2. *Complete dataset for all species used in this study, including total length (cm) and weight (g), and information pertaining to each analysis (treatment and dates).*

Code	Batch Code	Season	Ind. or batch	N	Length (cm)	Weight (g)	Method	KOH M	KOH temp	KOH content	Notes (condition of fish etc.)	Prep Date	Analysis date (KOH)
1.01-2013-SPR-001	1.01-2013-SPR-B001	Winter	Batch	1	10.4	7.1981	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-002	1.01-2013-SPR-B001	Winter	Batch	1	9.2	5.7921	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-003	1.01-2013-SPR-B001	Winter	Batch	1	11.2	8.5221	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-004	1.01-2013-SPR-B001	Winter	Batch	1	10.6	8.4570	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-005	1.01-2013-SPR-B001	Winter	Batch	1	8.8	3.3838	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-006	1.01-2013-SPR-B001	Winter	Batch	1	9.5	4.5773	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-007	1.01-2013-SPR-B001	Winter	Batch	1	10.4	7.8754	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-008	1.01-2013-SPR-B001	Winter	Batch	1	10.5	8.9744	KOH	1	room	guts		9/Nov	24/Nov
1.01-2013-SPR-009	1.01-2013-SPR-B001	Winter	Batch	1	11.2	8.0854	KOH	1	room	guts		9/Nov	24/Nov
1.02-2013-SPR-004	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.6	2.3652	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-006	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.4	1.8898	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-007	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.5	2.1216	KOH	1	room	guts	Missing stomach?	27/Nov	5/Dec
1.02-2013-SPR-010	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.8	2.8773	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-011	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.6	2.3689	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-012	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.1	1.9338	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-016	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.7	2.2883	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-017	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.8	2.5049	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-019	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.0	2.4775	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-020	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.9	2.7199	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-021	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.0	2.8021	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-022	1.02_1.05-2013-SPR-B001	Winter	Batch	1	9.5	4.7068	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-023	1.02_1.05-2013-SPR-B001	Winter	Batch	1	9.8	6.5740	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-024	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.2	8.2430	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-025	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.5	5.7367	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-026	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.7	7.5003	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-027	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.9	8.8549	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-028	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.5	9.9448	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-029	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.4	7.2115	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-030	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.1	8.9021	KOH	1	room	guts		27/Nov	5/Dec

1.02-2013-SPR-031	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.8	10.0059	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-032	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.4	8.8053	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-033	1.02_1.05-2013-SPR-B001	Winter	Batch	1	12.0	13.6386	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-034	1.02_1.05-2013-SPR-B001	Winter	Batch	1	12.5	13.2410	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-001	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.2	1.9521	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-002	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.0	1.8282	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-003	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.0	1.6287	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-004	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.7	2.5937	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-005	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.5	2.4466	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-007	1.02_1.05-2013-SPR-B001	Winter	Batch	1	6.6	1.7444	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-008	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.8	2.2045	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-009	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.0	2.8562	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-010	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.3	1.9587	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-011	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.3	2.4721	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-012	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.4	2.0737	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-013	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.3	1.7117	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-014	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.0	1.7105	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-015	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.4	2.0218	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-016	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.2	2.4198	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-017	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.5	2.2208	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-019	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.8	2.5893	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-020	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.7	2.5798	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-021	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.5	2.1194	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-022	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.1	2.3741	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-023	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.9	2.4240	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-024	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.0	2.9986	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-025	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.4	2.7868	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-026	1.02_1.05-2013-SPR-B001	Winter	Batch	1	7.5	2.7089	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-027	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.2	3.3482	KOH	1	room	guts		27/Nov	5/Dec

1.05-2013-SPR-028	1.02_1.05-2013-SPR-B001	Winter	Batch	1	8.4	3.2112	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-029	1.02_1.05-2013-SPR-B001	Winter	Batch	1	9.3	5.0121	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-030	1.02_1.05-2013-SPR-B001	Winter	Batch	1	10.5	7.3155	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-031	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.1	9.2843	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-032	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.2	9.8797	KOH	1	room	guts		27/Nov	5/Dec
1.05-2013-SPR-033	1.02_1.05-2013-SPR-B001	Winter	Batch	1	11.7	11.9069	KOH	1	room	guts		27/Nov	5/Dec
1.02-2013-SPR-005	1.02-2013-SPR-005	Winter	Individual	1	6.9	1.5456	KOH	1	room	-	Destroyed in the process so discarded	-	-
1.02-2013-SPR-018	1.02-2013-SPR-018	Winter	Individual	1	7.8	2.3770	KOH	1	room	whole	Too delicate	27/Nov	5/Dec
1.02-2013-SPR-001	1.02-2013-SPR-B001	Winter	Batch	1	6.5	1.3425	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-002	1.02-2013-SPR-B001	Winter	Batch	1	7.2	1.8059	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-003	1.02-2013-SPR-B001	Winter	Batch	1	7.1	2.1673	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-008	1.02-2013-SPR-B001	Winter	Batch	1	7.8	2.3940	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-009	1.02-2013-SPR-B001	Winter	Batch	1	7.7	2.5205	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-013	1.02-2013-SPR-B001	Winter	Batch	1	6.9	1.7001	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-014	1.02-2013-SPR-B001	Winter	Batch	1	7.3	1.9832	KOH	1	room	whole		27/Nov	5/Dec
1.02-2013-SPR-015	1.02-2013-SPR-B001	Winter	Batch	1	7.8	2.2285	KOH	1	room	whole		27/Nov	5/Dec
1.03-2013-SPR-001	1.03-2013-SPR-B001	Winter	Batch	1	10.1	6.3027	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-002	1.03-2013-SPR-B001	Winter	Batch	1	9.0	4.6561	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-003	1.03-2013-SPR-B001	Winter	Batch	1	9.9	6.1182	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-004	1.03-2013-SPR-B001	Winter	Batch	1	10.3	7.4627	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-005	1.03-2013-SPR-B001	Winter	Batch	1	10.7	8.5304	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-006	1.03-2013-SPR-B001	Winter	Batch	1	10.4	7.0262	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-007	1.03-2013-SPR-B001	Winter	Batch	1	10.2	6.6559	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-008	1.03-2013-SPR-B001	Winter	Batch	1	10.6	6.7329	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-009	1.03-2013-SPR-B001	Winter	Batch	1	10.6	7.4186	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-010	1.03-2013-SPR-B001	Winter	Batch	1	10.2	9.4800	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-011	1.03-2013-SPR-B001	Winter	Batch	1	10.3	6.4960	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-012	1.03-2013-SPR-B001	Winter	Batch	1	10.5	6.6535	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-013	1.03-2013-SPR-B001	Winter	Batch	1	10.5	7.7188	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-014	1.03-2013-SPR-B001	Winter	Batch	1	10.8	7.8336	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-015	1.03-2013-SPR-B001	Winter	Batch	1	10.5	10.4577	KOH	1	room	guts		29/Nov	5/Dec

1.03-2013-SPR-016	1.03-2013-SPR-B001	Winter	Batch	1	10.3	6.8032	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-017	1.03-2013-SPR-B001	Winter	Batch	1	12.0	5.4239	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-018	1.03-2013-SPR-B001	Winter	Batch	1	11.8	10.3012	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-019	1.03-2013-SPR-B001	Winter	Batch	1	8.5	3.2451	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-020	1.03-2013-SPR-B001	Winter	Batch	1	-	-	KOH	1	room	guts	Tail broken off	29/Nov	5/Dec
1.03-2013-SPR-021	1.03-2013-SPR-B001	Winter	Batch	1	11.8	11.4077	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-022	1.03-2013-SPR-B001	Winter	Batch	1	11.4	8.7118	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-023	1.03-2013-SPR-B001	Winter	Batch	1	11.8	12.5805	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-024	1.03-2013-SPR-B001	Winter	Batch	1	12.5	11.7742	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-025	1.03-2013-SPR-B001	Winter	Batch	1	12.5	10.6198	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-026	1.03-2013-SPR-B001	Winter	Batch	1	12.7	14.9848	KOH	1	room	guts		29/Nov	5/Dec
1.03-2013-SPR-027	1.03-2013-SPR-B001	Winter	Batch	1	12.5	15.8713	KOH	1	room	guts		29/Nov	5/Dec
1.04-2013-SPR-001	1.04-2013-SPR-B001	Winter	Batch	1	7.5	1.6217	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-002	1.04-2013-SPR-B001	Winter	Batch	1	8.3	2.8574	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-003	1.04-2013-SPR-B001	Winter	Batch	1	9.2	3.8714	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-004	1.04-2013-SPR-B001	Winter	Batch	1	9.9	4.7824	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-005	1.04-2013-SPR-B001	Winter	Batch	1	9.3	4.6123	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-006	1.04-2013-SPR-B001	Winter	Batch	1	10.1	5.4804	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-007	1.04-2013-SPR-B001	Winter	Batch	1	10.0	5.3108	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-008	1.04-2013-SPR-B001	Winter	Batch	1	10.4	5.9471	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-009	1.04-2013-SPR-B001	Winter	Batch	1	11.0	8.6762	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-010	1.04-2013-SPR-B001	Winter	Batch	1	11.9	10.2334	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-011	1.04-2013-SPR-B001	Winter	Batch	1	11.6	10.3791	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-012	1.04-2013-SPR-B001	Winter	Batch	1	11.4	7.1973	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-013	1.04-2013-SPR-B001	Winter	Batch	1	11.5	9.6654	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-014	1.04-2013-SPR-B001	Winter	Batch	1	11.4	7.8589	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-015	1.04-2013-SPR-B001	Winter	Batch	1	10.5	5.9558	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-016	1.04-2013-SPR-B001	Winter	Batch	1	10.9	6.2773	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-017	1.04-2013-SPR-B001	Winter	Batch	1	10.4	5.9793	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-018	1.04-2013-SPR-B001	Winter	Batch	1	10.9	7.5134	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-019	1.04-2013-SPR-B001	Winter	Batch	1	11.4	6.7504	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-020	1.04-2013-SPR-B001	Winter	Batch	1	10.9	9.5572	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-021	1.04-2013-SPR-B001	Winter	Batch	1	11.1	8.2397	KOH	1	room	guts		28/Nov	5/Dec

1.04-2013-SPR-022	1.04-2013-SPR-B001	Winter	Batch	1	12.1	11.3706	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-023	1.04-2013-SPR-B001	Winter	Batch	1	12.6	13.7068	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-024	1.04-2013-SPR-B001	Winter	Batch	1	11.8	9.9291	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-025	1.04-2013-SPR-B001	Winter	Batch	1	12.0	11.4880	KOH	1	room	guts		28/Nov	5/Dec
1.04-2013-SPR-026	1.04-2013-SPR-B001	Winter	Batch	1	13.5	17.1745	KOH	1	room	guts		28/Nov	5/Dec
1.05-2013-SPR-006	1.05-2013-SPR-006	Winter	Individual	1	7.5	2.4892	KOH	1	room	guts	Indistinguishable entrails --> solo	27/Nov	5/Dec
1.05-2013-SPR-018	1.05-2013-SPR-018	Winter	Individual	1	7.5	2.2990	KOH	1	room	whole		27/Nov	5/Dec
2-2010-SPR-061	2-2010-SPR-061	Summer	Individual	1	6.0	0.7698	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-062	2-2010-SPR-062	Summer	Individual	1	6.1	0.9811	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-063	2-2010-SPR-063	Summer	Individual	1	7.1	1.1445	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-064	2-2010-SPR-064	Summer	Individual	1	9.4	2.6827	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-065	2-2010-SPR-065	Summer	Individual	1	7.4	1.6286	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-066	2-2010-SPR-066	Summer	Individual	1	7.8	2.1015	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-067	2-2010-SPR-067	Summer	Individual	1	7.0	1.3879	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-068	2-2010-SPR-068	Summer	Individual	1	7.7	1.4568	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-069	2-2010-SPR-069	Summer	Individual	1	7.7	1.5000	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-070	2-2010-SPR-070	Summer	Individual	1	7.2	1.4276	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-071	2-2010-SPR-071	Summer	Individual	1	6.8	1.2358	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-072	2-2010-SPR-072	Summer	Individual	1	6.9	1.4147	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-001	2-2010-SPR-B001	Summer	Batch	1	7.3	1.3661	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-002	2-2010-SPR-B001	Summer	Batch	1	7.5	1.5262	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-003	2-2010-SPR-B001	Summer	Batch	1	7.2	1.2705	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-004	2-2010-SPR-B001	Summer	Batch	1	7.1	1.4490	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-005	2-2010-SPR-B001	Summer	Batch	1	7.1	1.3560	KOH	1	room	whole		18/Oct	20/Oct
2-2010-SPR-006	2-2010-SPR-B002	Summer	Batch	1	7.0	1.2550	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-007	2-2010-SPR-B002	Summer	Batch	1	6.8	1.0901	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-008	2-2010-SPR-B002	Summer	Batch	1	7.2	1.4139	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-009	2-2010-SPR-B002	Summer	Batch	1	6.6	0.8939	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-010	2-2010-SPR-B002	Summer	Batch	1	6.8	1.0228	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-011	2-2010-SPR-B003	Summer	Batch	1	7.5	1.6882	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-012	2-2010-SPR-B003	Summer	Batch	1	7.6	1.5257	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-013	2-2010-SPR-B003	Summer	Batch	1	7.2	1.3139	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-014	2-2010-SPR-B003	Summer	Batch	1	7.3	1.4696	KOH	1	room	whole		18/Oct	6/Nov

2-2010-SPR-015	2-2010-SPR-B003	Summer	Batch	1	7.5	1.3122	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-016	2-2010-SPR-B004	Summer	Batch	1	8.0	1.6405	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-017	2-2010-SPR-B004	Summer	Batch	1	7.3	1.5467	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-018	2-2010-SPR-B004	Summer	Batch	1	8.0	1.7161	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-019	2-2010-SPR-B004	Summer	Batch	1	8.3	2.4885	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-020	2-2010-SPR-B004	Summer	Batch	1	8.3	1.7474	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-021	2-2010-SPR-B005	Summer	Batch	1	8.6	3.0611	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-022	2-2010-SPR-B005	Summer	Batch	1	7.0	1.6334	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-023	2-2010-SPR-B005	Summer	Batch	1	7.4	1.4532	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-024	2-2010-SPR-B005	Summer	Batch	1	7.2	1.1936	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-025	2-2010-SPR-B005	Summer	Batch	1	7.4	1.1425	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-026	2-2010-SPR-B005	Summer	Batch	1	7.6	1.7252	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-027	2-2010-SPR-B005	Summer	Batch	1	7.8	1.2693	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-028	2-2010-SPR-B005	Summer	Batch	1	7.9	1.7512	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-029	2-2010-SPR-B005	Summer	Batch	1	7.3	1.2963	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-030	2-2010-SPR-B005	Summer	Batch	1	7.5	1.3526	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-031	2-2010-SPR-B006	Summer	Batch	1	7.1	1.2928	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-032	2-2010-SPR-B006	Summer	Batch	1	6.5	1.0146	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-033	2-2010-SPR-B006	Summer	Batch	1	6.9	1.2462	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-034	2-2010-SPR-B006	Summer	Batch	1	7.3	1.1229	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-035	2-2010-SPR-B006	Summer	Batch	1	6.9	1.4933	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-036	2-2010-SPR-B006	Summer	Batch	1	7.0	1.3289	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-037	2-2010-SPR-B006	Summer	Batch	1	7.4	1.5163	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-038	2-2010-SPR-B006	Summer	Batch	1	7.3	1.3615	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-039	2-2010-SPR-B006	Summer	Batch	1	7.3	1.4375	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-040	2-2010-SPR-B006	Summer	Batch	1	7.2	1.3670	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-041	2-2010-SPR-B007	Summer	Batch	1	7.6	1.5081	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-042	2-2010-SPR-B007	Summer	Batch	1	7.0	1.2917	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-043	2-2010-SPR-B007	Summer	Batch	1	7.3	1.4998	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-044	2-2010-SPR-B007	Summer	Batch	1	7.4	1.6661	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-045	2-2010-SPR-B007	Summer	Batch	1	7.3	1.4178	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-046	2-2010-SPR-B007	Summer	Batch	1	7.7	1.6885	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-047	2-2010-SPR-B007	Summer	Batch	1	7.5	1.5277	KOH	1	room	whole		18/Oct	6/Nov

2-2010-SPR-048	2-2010-SPR-B007	Summer	Batch	1	7.2	1.1182	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-049	2-2010-SPR-B007	Summer	Batch	1	7.2	1.0487	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-050	2-2010-SPR-B007	Summer	Batch	1	7.5	1.3039	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-051	2-2010-SPR-B008	Summer	Batch	1	7.3	1.3732	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-052	2-2010-SPR-B008	Summer	Batch	1	7.0	1.3022	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-053	2-2010-SPR-B008	Summer	Batch	1	7.5	1.6284	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-054	2-2010-SPR-B008	Summer	Batch	1	7.5	1.5338	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-055	2-2010-SPR-B008	Summer	Batch	1	7.4	1.5061	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-056	2-2010-SPR-B008	Summer	Batch	1	7.5	1.7263	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-057	2-2010-SPR-B008	Summer	Batch	1	7.5	1.5551	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-058	2-2010-SPR-B008	Summer	Batch	1	7.3	1.3884	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-059	2-2010-SPR-B008	Summer	Batch	1	7.4	1.5777	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-060	2-2010-SPR-B008	Summer	Batch	1	7.7	1.6899	KOH	1	room	whole		18/Oct	6/Nov
2-2010-SPR-DIS	2-2010-SPR-DIS	Summer	Batch	46	-	-	KOH	1	room	whole	See notebook for explanation	18/Oct	7/Nov
3.01-2016-SPR-001	3.01-2016-SPR-001	Summer	Individual	1	12.8	15.1239	Dissection					5/Sep	5/Sep
3.01-2016-SPR-002	3.01-2016-SPR-002	Summer	Individual	1	12.3	15.5660	Dissection					5/Sep	5/Sep
3.01-2016-SPR-003	3.01-2016-SPR-003	Summer	Individual	1	12.1	13.3929	KOH	5	50	whole		5/Sep	7/Sep
3.01-2016-SPR-004	3.01-2016-SPR-004	Summer	Individual	1	9.1	4.2900	KOH	1	room	stomach	Stomach incomplete/rotten	5/Sep	7/Sep
3.01-2016-SPR-005	3.01-2016-SPR-005	Summer	Individual	1	12.4	16.9288	Dissection					5/Sep	5/Sep
3.01-2016-SPR-006	3.01-2016-SPR-006	Summer	Individual	1	10.4	7.8281	Dissection					5/Sep	5/Sep
3.01-2016-SPR-007	3.01-2016-SPR-007	Summer	Individual	1	11.6	10.8331	Dissection					3/Oct	3/Oct
3.01-2016-SPR-008	3.01-2016-SPR-008	Summer	Individual	1	9.0	4.1093	Dissection				Very rotten/black insides	3/Oct	3/Oct
3.01-2016-SPR-009	3.01-2016-SPR-009	Summer	Individual	1	10.6	6.9888	Dissection					3/Oct	3/Oct
3.01-2016-SPR-010	3.01-2016-SPR-010	Summer	Individual	1	13.3	17.0237	Dissection				Very disintegrated	4/Oct	4/Oct
3.01-2016-SPR-011	3.01-2016-SPR-011	Summer	Individual	1	12.8	16.6701	Dissection					4/Oct	4/Oct
3.01-2016-SPR-012	3.01-2016-SPR-012	Summer	Individual	1	10.3	6.3514	Dissection					4/Oct	4/Oct
3.01-2016-SPR-013	3.01-2016-SPR-013	Summer	Individual	1	12.0	11.4761	Dissection					6/Oct	6/Oct
3.01-2016-SPR-014	3.01-2016-SPR-014	Summer	Individual	1	13.4	12.1881	Dissection					6/Oct	6/Oct
3.01-2016-SPR-015	3.01-2016-SPR-015	Summer	Individual	1	13.1	14.7848	Dissection					6/Oct	6/Oct
3.01-2016-SPR-016	3.01-2016-SPR-016	Summer	Individual	1	13.0	15.2968	Dissection					6/Oct	6/Oct
3.01-2016-SPR-017	3.01-2016-SPR-017	Summer	Individual	1	12.9	14.7427	Dissection					6/Oct	6/Oct
3.01-2016-SPR-018	3.01-2016-SPR-018	Summer	Individual	1	12.8	13.3179	Dissection				Fibres possibly from me: wearing "happy jumper"	10/Oct	10/Oct

3.01-2016-SPR-019	3.01-2016-SPR-019	Summer	Individual	1	9.4	4.6797	Dissection					10/Oct	10/Oct
3.01-2016-SPR-020	3.01-2016-SPR-020	Summer	Individual	1	12.9	14.9709	Dissection					10/Oct	10/Oct
3.01-2016-SPR-021	3.01-2016-SPR-021	Summer	Individual	1	11.1	8.3830	Dissection					10/Oct	10/Oct
3.01-2016-SPR-022	3.01-2016-SPR-022	Summer	Individual	1	13.2	15.8573	Dissection					10/Oct	10/Oct
3.01-2016-SPR-023	3.01-2016-SPR-023	Summer	Individual	1	14.0	18.5592	Dissection					10/Oct	10/Oct
3.01-2016-SPR-024	3.01-2016-SPR-024	Summer	Individual	1	12.5	12.3406	Dissection					10/Oct	10/Oct
3.01-2016-SPR-025	3.01-2016-SPR-025	Summer	Individual	1	14.9	20.0464	Dissection					10/Oct	10/Oct
3.01-2016-SPR-026	3.01-2016-SPR-026	Summer	Individual	1	13.8	16.2046	Dissection					10/Oct	10/Oct
3.01-2016-SPR-027	3.01-2016-SPR-027	Summer	Individual	1	12.5	14.0542	Dissection				Accidentally snipped the stomach in two	10/Oct	10/Oct
3.01-2016-SPR-028	3.01-2016-SPR-028	Summer	Individual	1	11.3	8.8660	Dissection					10/Oct	10/Oct
3.01-2016-SPR-029	3.01-2016-SPR-029	Summer	Individual	1	11.2	9.1972	Dissection					10/Oct	10/Oct
3.01-2016-SPR-030	3.01-2016-SPR-030	Summer	Individual	1	12.2	11.9669	Dissection					10/Oct	10/Oct
3.01-2016-SPR-031	3.01-2016-SPR-031	Summer	Individual	1	13.3	16.9758	Dissection					10/Oct	10/Oct
3.01-2016-SPR-032	3.01-2016-SPR-032	Summer	Individual	1	11.3	10.2019	Dissection					10/Oct	10/Oct
3.01-2016-SPR-033	3.01-2016-SPR-033	Summer	Individual	1	12.9	13.0754	Dissection					10/Oct	10/Oct
3.01-2016-SPR-034	3.01-2016-SPR-034	Summer	Individual	1	9.7	3.9526	Dissection					10/Oct	10/Oct
3.01-2016-SPR-035	3.01-2016-SPR-035	Summer	-	1	-	-					Too disintegrated	10/Oct	
3.01-2016-SPR-036	3.01-2016-SPR-036	Summer	-	1	-	-					Too disintegrated	10/Oct	
3.01-2016-SPR-037	3.01-2016-SPR-037	Summer	Individual	1	11.0	6.2859	Dissection					10/Oct	10/Oct
3.01-2016-SPR-038	3.01-2016-SPR-038	Summer	Individual	1	9.3	3.8377	Dissection					10/Oct	10/Oct
3.01-2016-SPR-039	3.01-2016-SPR-039	Summer	Individual	1	11.0	6.9053	Dissection					10/Oct	10/Oct
3.01-2016-SPR-040	3.01-2016-SPR-040	Summer	-	1	-	-					Too disintegrated	10/Oct	
3.01-2016-SPR-041	3.01-2016-SPR-041	Summer	Individual	1	11.1	7.9105	Dissection					10/Oct	10/Oct
3.02-2016-SPR-001	3.02-2016-SPR-B001	Summer	Batch	1	13.7	15.8515	KOH	1	room	whole	Biggest specs of sample 3.2 (sorted them by size by eye first)	17/Oct	7/Nov
3.02-2016-SPR-002	3.02-2016-SPR-B001	Summer	Batch	1	13.3	15.3130	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-003	3.02-2016-SPR-B001	Summer	Batch	1	13.3	15.8229	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-004	3.02-2016-SPR-B001	Summer	Batch	1	13.2	15.7830	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-005	3.02-2016-SPR-B001	Summer	Batch	1	14.1	17.7916	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-006	3.02-2016-SPR-B001	Summer	Batch	1	12.8	16.3759	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-007	3.02-2016-SPR-B001	Summer	Batch	1	13.2	15.4237	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-008	3.02-2016-SPR-B001	Summer	Batch	1	14.0	20.2435	KOH	1	room	whole		17/Oct	7/Nov

3.02-2016-SPR-009	3.02-2016-SPR-B001	Summer	Batch	1	14.0	18.4578	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-010	3.02-2016-SPR-B001	Summer	Batch	1	13.3	15.2218	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-011	3.02-2016-SPR-B002	Summer	Batch	1	12.5	14.7926	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-012	3.02-2016-SPR-B002	Summer	Batch	1	12.2	12.0806	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-013	3.02-2016-SPR-B002	Summer	Batch	1	12.0	12.1923	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-014	3.02-2016-SPR-B002	Summer	Batch	1	11.9	12.5022	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-015	3.02-2016-SPR-B002	Summer	Batch	1	12.6	13.4319	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-016	3.02-2016-SPR-B002	Summer	Batch	1	12.7	14.4303	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-017	3.02-2016-SPR-B002	Summer	Batch	1	12.5	14.1826	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-018	3.02-2016-SPR-B002	Summer	Batch	1	11.5	8.9722	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-019	3.02-2016-SPR-B002	Summer	Batch	1	11.6	9.9256	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-020	3.02-2016-SPR-B002	Summer	Batch	1	12.0	10.8712	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-021	3.02-2016-SPR-B002	Summer	Batch	1	11.3	9.3860	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-022	3.02-2016-SPR-B003	Summer	Batch	1	10.5	6.6469	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-023	3.02-2016-SPR-B003	Summer	Batch	1	11.3	10.0640	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-024	3.02-2016-SPR-B003	Summer	Batch	1	11.3	8.9450	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-025	3.02-2016-SPR-B003	Summer	Batch	1	11.7	10.3992	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-026	3.02-2016-SPR-B003	Summer	Batch	1	12.0	11.1881	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-027	3.02-2016-SPR-B003	Summer	Batch	1	12.1	12.3745	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-028	3.02-2016-SPR-B003	Summer	Batch	1	11.9	12.9998	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-029	3.02-2016-SPR-B003	Summer	Batch	1	11.6	9.6434	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-030	3.02-2016-SPR-B003	Summer	Batch	1	12.6	14.2470	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-031	3.02-2016-SPR-B003	Summer	Batch	1	11.5	12.3411	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-032	3.02-2016-SPR-B003	Summer	Batch	1	11.5	9.6211	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-033	3.02-2016-SPR-B004	Summer	Batch	1	11.1	8.8612	KOH	1	room	whole	Smallest specs of sample 3.2	17/Oct	7/Nov
3.02-2016-SPR-034	3.02-2016-SPR-B004	Summer	Batch	1	9.8	4.6348	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-035	3.02-2016-SPR-B004	Summer	Batch	1	9.5	5.3934	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-036	3.02-2016-SPR-B004	Summer	Batch	1	9.7	5.1463	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-037	3.02-2016-SPR-B004	Summer	Batch	1	11.1	9.7207	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-038	3.02-2016-SPR-B004	Summer	Batch	1	11.0	8.1367	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-039	3.02-2016-SPR-B004	Summer	Batch	1	9.8	5.4274	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-040	3.02-2016-SPR-B004	Summer	Batch	1	8.9	3.7406	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-041	3.02-2016-SPR-B004	Summer	Batch	1	9.5	4.7287	KOH	1	room	whole		17/Oct	7/Nov

3.02-2016-SPR-042	3.02-2016-SPR-B004	Summer	Batch	1	9.5	5.2806	KOH	1	room	whole		17/Oct	7/Nov
3.02-2016-SPR-043	3.02-2016-SPR-B004	Summer	Batch	1	9.4	4.7084	KOH	1	room	whole		17/Oct	7/Nov
3.03-2016-SPR-038	3.03-2016-SPR-038	Summer	-	1	-	-					Stomach/belly too open	11/Oct	
3.03-2016-SPR-001	3.03-2016-SPR-B001	Summer	Batch	1	13.0	17.6494	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-002	3.03-2016-SPR-B001	Summer	Batch	1	13.0	15.5371	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-003	3.03-2016-SPR-B001	Summer	Batch	1	12.5	13.4464	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-004	3.03-2016-SPR-B001	Summer	Batch	1	12.9	16.2075	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-005	3.03-2016-SPR-B001	Summer	Batch	1	12.6	13.2122	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-006	3.03-2016-SPR-B001	Summer	Batch	1	13.2	16.3780	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-007	3.03-2016-SPR-B001	Summer	Batch	1	14.2	16.3918	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-008	3.03-2016-SPR-B001	Summer	Batch	1	13.2	16.8734	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-009	3.03-2016-SPR-B001	Summer	Batch	1	14.2	20.9792	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-010	3.03-2016-SPR-B002	Summer	Batch	1	13.0	14.8302	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-011	3.03-2016-SPR-B002	Summer	Batch	1	13.2	17.6979	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-012	3.03-2016-SPR-B002	Summer	Batch	1	14.3	20.0576	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-013	3.03-2016-SPR-B002	Summer	Batch	1	13.2	14.6265	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-014	3.03-2016-SPR-B002	Summer	Batch	1	13.5	18.4932	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-015	3.03-2016-SPR-B002	Summer	Batch	1	13.2	14.7532	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-016	3.03-2016-SPR-B002	Summer	Batch	1	14.1	18.9011	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-017	3.03-2016-SPR-B002	Summer	Batch	1	13.3	17.4801	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov
3.03-2016-SPR-018	3.03-2016-SPR-B002	Summer	Batch	1	13.5	17.0068	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	6/Nov

3.03-2016-SPR-019	3.03-2016-SPR-B003	Summer	Batch	1	13.4	17.2557	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-020	3.03-2016-SPR-B003	Summer	Batch	1	12.4	12.9973	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-021	3.03-2016-SPR-B003	Summer	Batch	1	12.5	12.6564	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-022	3.03-2016-SPR-B003	Summer	Batch	1	13.5	17.4622	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-023	3.03-2016-SPR-B003	Summer	Batch	1	13.0	14.0689	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-024	3.03-2016-SPR-B003	Summer	Batch	1	13.4	16.2179	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-025	3.03-2016-SPR-B003	Summer	Batch	1	12.5	13.6834	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-026	3.03-2016-SPR-B003	Summer	Batch	1	12.2	13.0826	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-027	3.03-2016-SPR-B003	Summer	Batch	1	11.9	10.7831	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-028	3.03-2016-SPR-B004	Summer	Batch	1	11.5	10.1121	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-029	3.03-2016-SPR-B004	Summer	Batch	1	11.1	9.4910	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-030	3.03-2016-SPR-B004	Summer	Batch	1	11.3	9.4676	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-031	3.03-2016-SPR-B004	Summer	Batch	1	11.0	7.9553	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-032	3.03-2016-SPR-B004	Summer	Batch	1	10.2	5.8593	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-033	3.03-2016-SPR-B004	Summer	Batch	1	10.8	7.0742	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-034	3.03-2016-SPR-B004	Summer	Batch	1	8.9	3.6159	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-035	3.03-2016-SPR-B004	Summer	Batch	1	10.9	8.3136	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-036	3.03-2016-SPR-B004	Summer	Batch	1	10.1	5.9879	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov
3.03-2016-SPR-037	3.03-2016-SPR-B004	Summer	Batch	1	11.0	8.5174	KOH	1	35°C for ~24 hours and then room temp until processing	whole		11/Oct	7/Nov

5.01-2010-SPR-001	5.01-2010-SPR-B001	Summer	Batch	1	6.4	0.8211	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.01-2010-SPR-002	5.01-2010-SPR-B001	Summer	Batch	1	5.9	0.8090	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.01-2010-SPR-003	5.01-2010-SPR-B001	Summer	Batch	1	6.0	0.9851	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.01-2010-SPR-004	5.01-2010-SPR-B001	Summer	Batch	1	7.6	1.6565	KOH	1	35oC (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.01-2010-SPR-005	5.01-2010-SPR-B001	Summer	Batch	1	7.2	1.5832	KOH	1	35oC (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.01-2010-SPR-006	5.01-2010-SPR-B001	Summer	Batch	1	6.9	1.3741	KOH	1	35oC (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
5.02-2010-SPR-001	5.02-2010-SPR-B001	Summer	Batch	1	5.8	1.0782	KOH	1	room	whole	Too delicate to dissect	17/Oct	20/Oct
5.02-2010-SPR-002	5.02-2010-SPR-B001	Summer	Batch	1	6.1	1.2812	KOH	1	room	whole	Too delicate to dissect	17/Oct	20/Oct
5.02-2010-SPR-003	5.02-2010-SPR-B001	Summer	Batch	1	6.8	1.4095	KOH	1	room	whole	Too delicate to dissect	17/Oct	20/Oct
5.06-2010-SPR-001	5.06-2010-SPR-B001	Summer	Batch	1	7.0	1.7893	KOH	1	35°C (3hrs)	whole	Too delicate to dissect	12/Oct	12/Oct
5.06-2010-SPR-002	5.06-2010-SPR-B001	Summer	Batch	1	6.9	1.3744	KOH	1	35°C (3hrs)	whole	Too delicate to dissect	12/Oct	12/Oct
5.06-2010-SPR-003	5.06-2010-SPR-B001	Summer	Batch	1	6.0	1.3026	KOH	1	35°C (3hrs)	whole	Too delicate to dissect	12/Oct	12/Oct
5.09-2010-SPR-001	5.09-2010-SPR-B001	Summer	Batch	1	6.3	1.2361	KOH	1	room	whole	Too small and delicate to handle	17/Oct	20/Oct
5.09-2010-SPR-002	5.09-2010-SPR-B001	Summer	Batch	1	5.5	0.8357	KOH	1	room	whole	Too small and delicate to handle	17/Oct	20/Oct
5.09-2010-SPR-003	5.09-2010-SPR-B001	Summer	Batch	1	6.7	1.7946	KOH	1	room	whole	Too small and delicate to handle	17/Oct	20/Oct
5.11-2010-SPR-018	5.11-2010-SPR-018	Summer	-	1	-	-					Too disintegrated		
5.11-2010-SPR-019	5.11-2010-SPR-019	Summer	-	1	-	-					Too disintegrated		
5.11-2010-SPR-001	5.11-2010-SPR-B001	Summer	Batch	1	6.7	1.5479	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct

5.11-2010-SPR-002	5.11-2010-SPR-B001	Summer	Batch	1	6.7	1.6066	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-003	5.11-2010-SPR-B001	Summer	Batch	1	6.3	1.2868	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-004	5.11-2010-SPR-B001	Summer	Batch	1	6.9	1.6349	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-005	5.11-2010-SPR-B001	Summer	Batch	1	6.5	1.5002	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-006	5.11-2010-SPR-B001	Summer	Batch	1	6.8	1.6842	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-007	5.11-2010-SPR-B001	Summer	Batch	1	6.4	0.9952	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-008	5.11-2010-SPR-B001	Summer	Batch	1	6.3	1.1540	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-009	5.11-2010-SPR-B002	Summer	Batch	1	5.5	0.6477	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-010	5.11-2010-SPR-B002	Summer	Batch	1	6.2	1.1212	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-011	5.11-2010-SPR-B002	Summer	Batch	1	5.2	0.6932	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-012	5.11-2010-SPR-B002	Summer	Batch	1	6.1	1.0694	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct

5.11-2010-SPR-013	5.11-2010-SPR-B002	Summer	Batch	1	5.5	0.6946	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-014	5.11-2010-SPR-B002	Summer	Batch	1	6.1	1.1896	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-015	5.11-2010-SPR-B002	Summer	Batch	1	5.6	0.8724	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-016	5.11-2010-SPR-B002	Summer	Batch	1	6.4	1.3054	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.11-2010-SPR-017	5.11-2010-SPR-B002	Summer	Batch	1	4.9	0.5262	KOH	1	room	whole	Very bad shape; very delicate: need to handle with tweezers very carefully!	17/Oct	19/Oct
5.12-2010-SPR-001	5.12-2010-SPR-B001	Summer	Batch	1	6.3	1.0685	KOH	1	room	whole	Too small and delicate to handle	17/Oct	19/Oct
5.12-2010-SPR-002	5.12-2010-SPR-B001	Summer	Batch	1	6.1	1.0489	KOH	1	room	whole	Too small and delicate to handle	17/Oct	19/Oct
5.12-2010-SPR-003	5.12-2010-SPR-B001	Summer	Batch	1	6.2	1.1845	KOH	1	room	whole	Too small and delicate to handle	17/Oct	19/Oct
7.02-2010-SPR-001	7.02-2010-SPR-B001	Summer	Batch	1	6.8	1.6131	KOH	1	35°C (3hrs)	whole	Too small and delicate to extract stomach --> KOH	12/Oct	12/Oct
7.02-2010-SPR-002	7.02-2010-SPR-B001	Summer	Batch	1	6.6	1.3105	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.03-2010-SPR-001	7.03-2010-SPR-001	Summer	Individual	1	9.5	5.1794	KOH	1	35°C (3hrs)	stomach	See notebook for explanation	12/Oct	12/Oct
7.06-2010-SPR-001	7.06-2010-SPR-B001	Summer	Batch	1	6.1	1.1784	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.06-2010-SPR-002	7.06-2010-SPR-B001	Summer	Batch	1	6.8	1.7072	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.06-2010-SPR-003	7.06-2010-SPR-B001	Summer	Batch	1	6.4	1.3435	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.06-2010-SPR-004	7.06-2010-SPR-B001	Summer	Batch	1	6.6	1.2792	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.06-2010-SPR-005	7.06-2010-SPR-B001	Summer	Batch	1	6.7	-	KOH	1	35°C (3hrs)	whole		12/Oct	12/Oct
7.10-2010-SPR-001	7.10-2010-SPR-001	Summer	Individual	1	5.5	0.4773	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.11-2010-SPR-001	7.11-2010-SPR-001	Summer	Individual	1	6.3	1.1190	KOH	1	room	whole		5/Sep	7/Sep
7.11-2010-SPR-002	7.11-2010-SPR-002	Summer	Individual	1	5.6	0.7150	KOH	1	50	whole		5/Sep	7/Sep

7.11-2010-SPR-003	7.11-2010-SPR-003	Summer	Individual	1	7.0	1.5835	KOH	1	room	whole	Too disintegrated for dissection	17/Oct	20/Oct
7.14-2010-SPR-001	7.14-2010-SPR-B001	Summer	Batch	1	5.6	0.5659	KOH	1	room	whole	Too small and delicate to handle, let alone dissect	17/Oct	20/Oct
7.14-2010-SPR-002	7.14-2010-SPR-B001	Summer	Batch	1	6.0	1.0104	KOH	1	room	whole	Too small and delicate to handle, let alone dissect	17/Oct	20/Oct
7.15-2010-SPR-001	7.15-2010-SPR-B001	Summer	Batch	1	6.3	1.1437	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.15-2010-SPR-002	7.15-2010-SPR-B001	Summer	Batch	1	5.5	0.6041	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.15-2010-SPR-003	7.15-2010-SPR-B001	Summer	Batch	1	6.0	0.9750	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.15-2010-SPR-004	7.15-2010-SPR-B001	Summer	Batch	1	5.8	0.7575	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.15-2010-SPR-005	7.15-2010-SPR-B001	Summer	Batch	1	5.5	0.8474	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
7.15-2010-SPR-006	7.15-2010-SPR-B001	Summer	Batch	1	5.5	0.8495	KOH	1	35°C (3hrs)	whole	Too delicate to dissect and extract stomach without damaging/opening it	12/Oct	12/Oct
4.03-2009-AMM-001	4.03-2009-AMM-001	Summer	Individual	1	3.8	0.0395	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-002	4.03-2009-AMM-002	Summer	Individual	1	3.7	0.0225	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-005	4.03-2009-AMM-005	Summer	Individual	1	3.9	0.0511	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-006	4.03-2009-AMM-006	Summer	Individual	1	3.8	0.0284	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-003	4.03-2009-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken; Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-004	4.03-2009-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken; Not rinsed	9/Nov	21/Nov
4.03-2009-AMM-007	4.03-2009-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken; Not rinsed	9/Nov	21/Nov
4.24-2009-AMM-001	4.24-2009-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Too small/fragile to determine length and weight; Not rinsed	9/Nov	21/Nov
4.24-2009-AMM-002	4.24-2009-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
5.02-2010-AMM-001	5.02-2010-AMM-001	Summer	Individual	1	5.7	0.3241	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
5.02-2010-AMM-002	5.02-2010-AMM-002	Summer	Individual	1	6.0	0.4314	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov

5.02-2010-AMM-003	5.02-2010-AMM-003	Summer	Individual	1	5.9	0.3302	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
5.02-2010-AMM-004	5.02-2010-AMM-004	Summer	Individual	1	-	-	KOH	1	room	whole	Broke in two when too out of bag; Not rinsed	9/Nov	21/Nov
5.10-2010-AMM-001	5.10-2010-AMM-001	Summer	Individual	1	5.5	0.2047	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-002	5.10-2010-AMM-002	Summer	Individual	1	5.0	0.1494	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-003	5.10-2010-AMM-003	Summer	Individual	1	4.8	0.1185	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-004	5.10-2010-AMM-004	Summer	Individual	1	4.8	0.1343	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-005	5.10-2010-AMM-005	Summer	Individual	1	4.6	0.0904	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-006	5.10-2010-AMM-006	Summer	Individual	1	5.2	0.1439	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-007	5.10-2010-AMM-007	Summer	Individual	1	5.4	0.1839	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-008	5.10-2010-AMM-008	Summer	Individual	1	4.9	0.1305	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-009	5.10-2010-AMM-009	Summer	Individual	1	4.3	0.0933	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-010	5.10-2010-AMM-010	Summer	Individual	1	-	-	KOH	1	room	whole	Broken; rinsed	22/Nov	23/Nov
5.10-2010-AMM-011	5.10-2010-AMM-011	Summer	Individual	1	5.4	0.1957	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-012	5.10-2010-AMM-012	Summer	Individual	1	5.3	0.2039	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.10-2010-AMM-013	5.10-2010-AMM-013	Summer	Individual	1	5.8	0.2871	KOH	1	room	whole	Rinsed	22/Nov	23/Nov
5.13-2010-AMM-001	5.13-2010-AMM-001	Summer	Individual	1	7.6	0.4947	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
6.02-2007-AMM-001	6.02-2007-AMM-001	Summer	Individual	1	9.0	1.2752	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
7.05-2010-AMM-001	7.05-2010-AMM-B001	Summer	Batch	1	6.1	0.3906	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-002	7.05-2010-AMM-B001	Summer	Batch	1	4.9	0.1542	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-003	7.05-2010-AMM-B001	Summer	Batch	1	6.5	0.4500	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-004	7.05-2010-AMM-B001	Summer	Batch	1	5.0	0.1394	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-005	7.05-2010-AMM-B001	Summer	Batch	1	5.2	0.1684	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-006	7.05-2010-AMM-B001	Summer	Batch	1	5.6	0.2134	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-007	7.05-2010-AMM-B001	Summer	Batch	1	5.4	0.1970	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-008	7.05-2010-AMM-B001	Summer	Batch	1	4.8	0.1563	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.05-2010-AMM-009	7.05-2010-AMM-B001	Summer	Batch	1	4.5	0.0874	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.07-2010-AMM-001	7.07-2010-AMM-001	Summer	Individual	1	4.1	0.0396	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
7.08-2010-AMM-001	7.08-2010-AMM-B001	Summer	Batch	1	4.7	0.1422	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-002	7.08-2010-AMM-B001	Summer	Batch	1	4.8	0.1324	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-003	7.08-2010-AMM-B001	Summer	Batch	1	5.4	0.2252	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-004	7.08-2010-AMM-B001	Summer	Batch	1	5.8	0.2981	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-005	7.08-2010-AMM-B001	Summer	Batch	1	5.0	0.1842	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-006	7.08-2010-AMM-B001	Summer	Batch	1	5.1	0.1786	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov

7.08-2010-AMM-007	7.08-2010-AMM-B001	Summer	Batch	1	5.8	0.2450	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-008	7.08-2010-AMM-B001	Summer	Batch	1	5.2	0.2053	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-009	7.08-2010-AMM-B001	Summer	Batch	1	4.8	0.1404	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-010	7.08-2010-AMM-B001	Summer	Batch	1	5.7	0.2470	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.08-2010-AMM-011	7.08-2010-AMM-B001	Summer	Batch	1	6.0	0.4063	KOH	1	room	whole	Not rinsed	22/Nov	24/Nov
7.09-2010-AMM-102	7.09-2010-AMM-102	Summer	Individual	1	6.3	0.2924	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-103	7.09-2010-AMM-103	Summer	Individual	1	5.6	0.1787	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-104	7.09-2010-AMM-104	Summer	Individual	1	7.2	0.4158	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-105	7.09-2010-AMM-105	Summer	Individual	1	6.0	0.1818	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-106	7.09-2010-AMM-106	Summer	Individual	1	6.8	0.3772	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-107	7.09-2010-AMM-107	Summer	Individual	1	6.4	0.3347	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-108	7.09-2010-AMM-108	Summer	Individual	1	5.0	0.1418	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-109	7.09-2010-AMM-109	Summer	Individual	1	5.5	0.1560	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-110	7.09-2010-AMM-110	Summer	Individual	1	6.5	0.2877	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-111	7.09-2010-AMM-111	Summer	Individual	1	6.8	0.3844	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-202	7.09-2010-AMM-202	Summer	Individual	1	7.3	0.4513	KOH	1	room	whole	Rinsed	5/Dec	8/Dec
7.09-2010-AMM-203	7.09-2010-AMM-203	Summer	Individual	1	7.0	0.3614	KOH	1	room	whole	Rinsed	5/Dec	8/Dec
7.09-2010-AMM-204	7.09-2010-AMM-204	Summer	Individual	1	5.6	0.2036	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-205	7.09-2010-AMM-205	Summer	Individual	1	7.9	0.5184	KOH	1	room	whole	Rinsed	5/Dec	8/Dec
7.09-2010-AMM-206	7.09-2010-AMM-206	Summer	Individual	1	7.6	0.5568	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-207	7.09-2010-AMM-207	Summer	Individual	1	5.5	0.1801	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-208	7.09-2010-AMM-208	Summer	Individual	1	5.6	0.2057	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-209	7.09-2010-AMM-209	Summer	Individual	1	6.1	0.2113	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-210	7.09-2010-AMM-210	Summer	Individual	1	6.2	0.2888	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-211	7.09-2010-AMM-211	Summer	Individual	1	4.8	0.0985	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-212	7.09-2010-AMM-212	Summer	Individual	1	6.3	0.2434	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-213	7.09-2010-AMM-213	Summer	Individual	1	5.8	0.3526	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-214	7.09-2010-AMM-214	Summer	Individual	1	6.2	0.2356	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-215	7.09-2010-AMM-215	Summer	Individual	1	6.2	0.3424	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-216	7.09-2010-AMM-216	Summer	Individual	1	5.8	?	KOH	1	room	whole	Rinsed	5/Dec	11/Dec
7.09-2010-AMM-001	7.09-2010-AMM-B001	Summer	Batch	1	5.1	0.1404	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-002	7.09-2010-AMM-B001	Summer	Batch	1	4.3	0.0680	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-003	7.09-2010-AMM-B001	Summer	Batch	1	5.0	0.1214	KOH	1	room	whole	Rinsed	30/Nov	7/Dec

7.09-2010-AMM-004	7.09-2010-AMM-B001	Summer	Batch	1	4.7	0.1095	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-005	7.09-2010-AMM-B001	Summer	Batch	1	7.0	0.4069	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-006	7.09-2010-AMM-B001	Summer	Batch	1	6.6	0.4701	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-007	7.09-2010-AMM-B001	Summer	Batch	1	5.1	0.1622	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-008	7.09-2010-AMM-B001	Summer	Batch	1	4.7	0.1056	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-009	7.09-2010-AMM-B001	Summer	Batch	1	5.0	0.1194	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-010	7.09-2010-AMM-B001	Summer	Batch	1	5.4	0.1831	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-011	7.09-2010-AMM-B001	Summer	Batch	1	5.3	0.1606	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-012	7.09-2010-AMM-B001	Summer	Batch	1	5.9	0.2789	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-013	7.09-2010-AMM-B001	Summer	Batch	1	6.5	0.3854	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-014	7.09-2010-AMM-B001	Summer	Batch	1	5.9	0.3497	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-015	7.09-2010-AMM-B001	Summer	Batch	1	6.3	0.3913	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-016	7.09-2010-AMM-B001	Summer	Batch	1	6.2	0.3199	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-017	7.09-2010-AMM-B001	Summer	Batch	1	5.3	0.1857	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-018	7.09-2010-AMM-B001	Summer	Batch	1	5.4	0.1790	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-019	7.09-2010-AMM-B001	Summer	Batch	1	4.9	0.1209	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-020	7.09-2010-AMM-B001	Summer	Batch	1	5.0	0.1456	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-021	7.09-2010-AMM-B002	Summer	Batch	1	5.8	0.2027	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-022	7.09-2010-AMM-B002	Summer	Batch	1	5.7	0.2067	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-023	7.09-2010-AMM-B002	Summer	Batch	1	5.4	0.1949	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-024	7.09-2010-AMM-B002	Summer	Batch	1	4.8	0.1204	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-025	7.09-2010-AMM-B002	Summer	Batch	1	4.9	0.1955	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-026	7.09-2010-AMM-B002	Summer	Batch	1	5.5	0.2115	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-027	7.09-2010-AMM-B002	Summer	Batch	1	4.9	0.1444	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-028	7.09-2010-AMM-B002	Summer	Batch	1	5.1	0.1696	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-029	7.09-2010-AMM-B002	Summer	Batch	1	5.6	0.2163	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-030	7.09-2010-AMM-B002	Summer	Batch	1	5.0	0.1728	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-031	7.09-2010-AMM-B002	Summer	Batch	1	5.0	0.1174	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-032	7.09-2010-AMM-B002	Summer	Batch	1	5.0	0.1435	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-033	7.09-2010-AMM-B002	Summer	Batch	1	5.1	0.1556	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-034	7.09-2010-AMM-B002	Summer	Batch	1	5.7	0.1942	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-035	7.09-2010-AMM-B002	Summer	Batch	1	5.7	0.2445	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-036	7.09-2010-AMM-B002	Summer	Batch	1	5.0	0.1317	KOH	1	room	whole	Rinsed	30/Nov	7/Dec

7.09-2010-AMM-037	7.09-2010-AMM-B002	Summer	Batch	1	4.9	0.1315	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-038	7.09-2010-AMM-B002	Summer	Batch	1	5.4	0.1912	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-039	7.09-2010-AMM-B002	Summer	Batch	1	5.5	0.1979	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-040	7.09-2010-AMM-B002	Summer	Batch	1	4.9	0.1412	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-041	7.09-2010-AMM-B002	Summer	Batch	1	5.3	0.1807	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-042	7.09-2010-AMM-B003	Summer	Batch	1	5.8	0.1886	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-043	7.09-2010-AMM-B003	Summer	Batch	1	5.8	0.2429	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-044	7.09-2010-AMM-B003	Summer	Batch	1	6.0	0.2578	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-045	7.09-2010-AMM-B003	Summer	Batch	1	6.1	0.3376	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-046	7.09-2010-AMM-B003	Summer	Batch	1	5.5	0.2425	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-047	7.09-2010-AMM-B003	Summer	Batch	1	5.6	0.2365	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-048	7.09-2010-AMM-B003	Summer	Batch	1	5.3	0.1768	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-049	7.09-2010-AMM-B003	Summer	Batch	1	4.7	0.1122	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-050	7.09-2010-AMM-B003	Summer	Batch	1	5.3	0.1667	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-051	7.09-2010-AMM-B003	Summer	Batch	1	5.5	0.1759	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-052	7.09-2010-AMM-B003	Summer	Batch	1	5.0	0.1546	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-053	7.09-2010-AMM-B003	Summer	Batch	1	5.5	0.2006	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-054	7.09-2010-AMM-B003	Summer	Batch	1	5.5	0.1918	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-055	7.09-2010-AMM-B003	Summer	Batch	1	5.7	0.2002	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-056	7.09-2010-AMM-B003	Summer	Batch	1	4.9	0.1194	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-057	7.09-2010-AMM-B003	Summer	Batch	1	5.3	0.1710	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-058	7.09-2010-AMM-B003	Summer	Batch	1	5.5	0.1717	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-059	7.09-2010-AMM-B003	Summer	Batch	1	5.3	0.1832	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-060	7.09-2010-AMM-B003	Summer	Batch	1	5.7	0.1966	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-061	7.09-2010-AMM-B003	Summer	Batch	1	4.8	0.1149	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-062	7.09-2010-AMM-B004	Summer	Batch	1	7.1	0.5115	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-063	7.09-2010-AMM-B004	Summer	Batch	1	6.2	0.2252	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-064	7.09-2010-AMM-B004	Summer	Batch	1	6.0	0.2784	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-065	7.09-2010-AMM-B004	Summer	Batch	1	6.9	0.5245	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-066	7.09-2010-AMM-B004	Summer	Batch	1	6.1	0.3261	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-067	7.09-2010-AMM-B004	Summer	Batch	1	6.8	0.3719	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-068	7.09-2010-AMM-B004	Summer	Batch	1	7.0	0.3633	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-069	7.09-2010-AMM-B004	Summer	Batch	1	6.3	0.2206	KOH	1	room	whole	Rinsed	30/Nov	7/Dec

7.09-2010-AMM-070	7.09-2010-AMM-B004	Summer	Batch	1	7.2	0.3906	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-071	7.09-2010-AMM-B004	Summer	Batch	1	7.5	0.4634	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-072	7.09-2010-AMM-B004	Summer	Batch	1	6.7	0.3456	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-073	7.09-2010-AMM-B004	Summer	Batch	1	6.6	0.2978	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-074	7.09-2010-AMM-B004	Summer	Batch	1	6.1	0.2222	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-075	7.09-2010-AMM-B004	Summer	Batch	1	6.0	0.3335	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-076	7.09-2010-AMM-B004	Summer	Batch	1	6.5	0.3699	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-077	7.09-2010-AMM-B004	Summer	Batch	1	7.0	0.4343	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-078	7.09-2010-AMM-B004	Summer	Batch	1	7.0	0.3866	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-079	7.09-2010-AMM-B004	Summer	Batch	1	6.1	0.2684	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-080	7.09-2010-AMM-B004	Summer	Batch	1	7.2	0.4329	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-081	7.09-2010-AMM-B004	Summer	Batch	1	5.9	0.2835	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-082	7.09-2010-AMM-B005	Summer	Batch	1	4.8	0.0934	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-083	7.09-2010-AMM-B005	Summer	Batch	1	5.1	0.1440	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-084	7.09-2010-AMM-B005	Summer	Batch	1	5.0	0.1495	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-085	7.09-2010-AMM-B005	Summer	Batch	1	4.7	0.0773	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-086	7.09-2010-AMM-B005	Summer	Batch	1	5.0	0.2080	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-087	7.09-2010-AMM-B005	Summer	Batch	1	5.2	0.1683	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-088	7.09-2010-AMM-B005	Summer	Batch	1	5.4	0.1912	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-089	7.09-2010-AMM-B005	Summer	Batch	1	5.4	0.1449	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-090	7.09-2010-AMM-B005	Summer	Batch	1	5.2	0.1717	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-091	7.09-2010-AMM-B005	Summer	Batch	1	5.6	0.2006	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-092	7.09-2010-AMM-B005	Summer	Batch	1	5.7	0.1969	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-093	7.09-2010-AMM-B005	Summer	Batch	1	4.7	0.1254	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-094	7.09-2010-AMM-B005	Summer	Batch	1	5.0	0.1357	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-095	7.09-2010-AMM-B005	Summer	Batch	1	4.3	0.0724	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-096	7.09-2010-AMM-B005	Summer	Batch	1	4.8	0.1069	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-097	7.09-2010-AMM-B005	Summer	Batch	1	5.0	0.1150	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-098	7.09-2010-AMM-B005	Summer	Batch	1	4.8	0.1002	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-099	7.09-2010-AMM-B005	Summer	Batch	1	5.2	0.1630	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-100	7.09-2010-AMM-B005	Summer	Batch	1	5.2	0.1561	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-101	7.09-2010-AMM-B005	Summer	Batch	1	4.8	0.1066	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-112	7.09-2010-AMM-B006	Summer	Batch	1	5.3	0.1011	KOH	1	room	whole	Rinsed	30/Nov	7/Dec

7.09-2010-AMM-113	7.09-2010-AMM-B006	Summer	Batch	1	5.3	0.1286	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-114	7.09-2010-AMM-B006	Summer	Batch	1	5.0	0.0871	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-115	7.09-2010-AMM-B006	Summer	Batch	1	5.0	0.1151	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-116	7.09-2010-AMM-B006	Summer	Batch	1	5.3	0.1085	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-117	7.09-2010-AMM-B007	Summer	Batch	1	6.0	0.2391	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-118	7.09-2010-AMM-B007	Summer	Batch	1	6.0	0.1683	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-119	7.09-2010-AMM-B007	Summer	Batch	1	5.5	0.1594	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-120	7.09-2010-AMM-B007	Summer	Batch	1	5.3	0.1337	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-121	7.09-2010-AMM-B007	Summer	Batch	1	5.7	0.1948	KOH	1	room	whole	Rinsed	30/Nov	7/Dec
7.09-2010-AMM-122	7.09-2010-AMM-B008	Summer	Batch	1	5.3	0.1410	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-123	7.09-2010-AMM-B008	Summer	Batch	1	6.4	0.2921	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-124	7.09-2010-AMM-B008	Summer	Batch	1	5.3	0.1494	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-125	7.09-2010-AMM-B008	Summer	Batch	1	5.2	0.1744	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-126	7.09-2010-AMM-B008	Summer	Batch	1	5.3	0.1522	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-127	7.09-2010-AMM-B009	Summer	Batch	1	4.5	0.0893	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-128	7.09-2010-AMM-B009	Summer	Batch	1	5.8	0.2028	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-129	7.09-2010-AMM-B009	Summer	Batch	1	6.8	0.3627	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-130	7.09-2010-AMM-B009	Summer	Batch	1	5.1	0.1371	KOH	1	room	whole	Rinsed	30/Nov	8/Dec
7.09-2010-AMM-131	7.09-2010-AMM-B009	Summer	Batch	1	6.2	0.2450	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-132	7.09-2010-AMM-B010	Summer	Batch	1	4.6	0.0955	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-133	7.09-2010-AMM-B010	Summer	Batch	1	4.7	0.0964	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-134	7.09-2010-AMM-B010	Summer	Batch	1	5.3	0.1299	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-135	7.09-2010-AMM-B010	Summer	Batch	1	5.2	0.1526	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-136	7.09-2010-AMM-B010	Summer	Batch	1	5.2	0.1340	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-137	7.09-2010-AMM-B010	Summer	Batch	1	5.3	0.1403	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-138	7.09-2010-AMM-B010	Summer	Batch	1	5.9	0.2522	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-139	7.09-2010-AMM-B010	Summer	Batch	1	5.8	0.2217	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-140	7.09-2010-AMM-B010	Summer	Batch	1	4.4	0.0672	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-141	7.09-2010-AMM-B010	Summer	Batch	1	4.6	0.1224	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-142	7.09-2010-AMM-B011	Summer	Batch	1	5.3	0.1708	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-143	7.09-2010-AMM-B011	Summer	Batch	1	5.7	0.1808	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-144	7.09-2010-AMM-B011	Summer	Batch	1	5.3	0.1524	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-145	7.09-2010-AMM-B011	Summer	Batch	1	5.6	0.1639	KOH	1	room	whole	Rinsed	4/Dec	8/Dec

7.09-2010-AMM-146	7.09-2010-AMM-B011	Summer	Batch	1	5.1	0.1608	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-147	7.09-2010-AMM-B011	Summer	Batch	1	5.4	0.1892	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-148	7.09-2010-AMM-B011	Summer	Batch	1	6.5	0.3482	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-149	7.09-2010-AMM-B011	Summer	Batch	1	5.8	0.1739	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-150	7.09-2010-AMM-B011	Summer	Batch	1	5.8	0.2449	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-151	7.09-2010-AMM-B011	Summer	Batch	1	4.7	0.1134	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-152	7.09-2010-AMM-B012	Summer	Batch	1	5.1	0.1253	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-153	7.09-2010-AMM-B012	Summer	Batch	1	5.6	0.2011	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-154	7.09-2010-AMM-B012	Summer	Batch	1	5.9	0.2821	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-155	7.09-2010-AMM-B012	Summer	Batch	1	6.7	0.3362	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-156	7.09-2010-AMM-B012	Summer	Batch	1	4.5	0.0801	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-157	7.09-2010-AMM-B012	Summer	Batch	1	5.0	0.1387	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-158	7.09-2010-AMM-B012	Summer	Batch	1	4.8	0.1215	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-159	7.09-2010-AMM-B012	Summer	Batch	1	4.9	0.1322	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-160	7.09-2010-AMM-B012	Summer	Batch	1	5.1	0.1402	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-161	7.09-2010-AMM-B012	Summer	Batch	1	4.6	0.0909	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-162	7.09-2010-AMM-B013	Summer	Batch	1	4.6	0.1123	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-163	7.09-2010-AMM-B013	Summer	Batch	1	4.9	0.1367	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-164	7.09-2010-AMM-B013	Summer	Batch	1	5.3	0.1915	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-165	7.09-2010-AMM-B013	Summer	Batch	1	5.0	0.1454	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-166	7.09-2010-AMM-B013	Summer	Batch	1	5.9	0.2767	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-167	7.09-2010-AMM-B013	Summer	Batch	1	5.8	0.2098	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-168	7.09-2010-AMM-B013	Summer	Batch	1	5.5	0.2023	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-169	7.09-2010-AMM-B013	Summer	Batch	1	4.6	0.1002	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-170	7.09-2010-AMM-B013	Summer	Batch	1	5.0	0.1258	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-171	7.09-2010-AMM-B013	Summer	Batch	1	5.3	0.1520	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-172	7.09-2010-AMM-B014	Summer	Batch	1	6.0	0.2128	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-173	7.09-2010-AMM-B014	Summer	Batch	1	7.9	0.5955	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-174	7.09-2010-AMM-B014	Summer	Batch	1	7.5	0.5035	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-175	7.09-2010-AMM-B014	Summer	Batch	1	6.8	0.4039	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-176	7.09-2010-AMM-B014	Summer	Batch	1	7.0	0.4638	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-177	7.09-2010-AMM-B014	Summer	Batch	1	7.3	0.5765	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-178	7.09-2010-AMM-B014	Summer	Batch	1	6.2	0.2930	KOH	1	room	whole	Rinsed	4/Dec	8/Dec

7.09-2010-AMM-179	7.09-2010-AMM-B014	Summer	Batch	1	7.2	0.5951	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-180	7.09-2010-AMM-B014	Summer	Batch	1	6.5	0.3362	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-181	7.09-2010-AMM-B014	Summer	Batch	1	5.4	0.1643	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-182	7.09-2010-AMM-B015	Summer	Batch	1	7.1	0.4178	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-183	7.09-2010-AMM-B015	Summer	Batch	1	5.9	0.2297	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-184	7.09-2010-AMM-B015	Summer	Batch	1	5.6	0.1725	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-185	7.09-2010-AMM-B015	Summer	Batch	1	5.7	0.1941	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-186	7.09-2010-AMM-B015	Summer	Batch	1	5.0	0.1481	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-187	7.09-2010-AMM-B015	Summer	Batch	1	5.5	0.2029	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-188	7.09-2010-AMM-B015	Summer	Batch	1	6.1	0.2544	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-189	7.09-2010-AMM-B015	Summer	Batch	1	6.9	0.3573	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-190	7.09-2010-AMM-B015	Summer	Batch	1	5.8	0.1934	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-191	7.09-2010-AMM-B015	Summer	Batch	1	5.0	0.1110	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-192	7.09-2010-AMM-B016	Summer	Batch	1	5.5	0.1337	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-193	7.09-2010-AMM-B016	Summer	Batch	1	5.0	0.1195	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-194	7.09-2010-AMM-B016	Summer	Batch	1	5.4	0.1694	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-195	7.09-2010-AMM-B016	Summer	Batch	1	4.5	0.0942	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-196	7.09-2010-AMM-B016	Summer	Batch	1	5.0	0.1878	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-197	7.09-2010-AMM-B016	Summer	Batch	1	5.0	0.1339	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-198	7.09-2010-AMM-B016	Summer	Batch	1	4.9	0.1268	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-199	7.09-2010-AMM-B016	Summer	Batch	1	4.8	0.1041	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-200	7.09-2010-AMM-B016	Summer	Batch	1	4.9	0.1217	KOH	1	room	whole	Rinsed	4/Dec	8/Dec
7.09-2010-AMM-201	7.09-2010-AMM-B016	Summer	Batch	1	4.5	0.0915	KOH	1	room	whole	Rinsed	5/Dec	8/Dec
7.12-2010-AMM-001	7.12-2010-AMM-001	Summer	Individual	1	5.1	0.1656	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
7.12-2010-AMM-002	7.12-2010-AMM-002	Summer	Individual	1	5.3	0.1684	KOH	1	room	whole	Not rinsed	9/Nov	21/Nov
7.14-2010-AMM-001	7.14-2010-AMM-B001	Summer	Batch	1	7.0	0.4439	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.14-2010-AMM-002	7.14-2010-AMM-B001	Summer	Batch	1	6.2	0.2907	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.14-2010-AMM-003	7.14-2010-AMM-B001	Summer	Batch	1	5.6	0.2334	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.14-2010-AMM-004	7.14-2010-AMM-B001	Summer	Batch	1	5.8	0.2343	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.14-2010-AMM-005	7.14-2010-AMM-B001	Summer	Batch	1	6.4	0.3672	KOH	1	room	whole	Broken around abdomen; rinsed	22/Nov	24/Nov
7.14-2010-AMM-006	7.14-2010-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken in two; rinsed	22/Nov	24/Nov
7.14-2010-AMM-007	7.14-2010-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken; rinsed	22/Nov	24/Nov
7.14-2010-AMM-008	7.14-2010-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Broken; rinsed	22/Nov	24/Nov

7.15-2010-AMM-001	7.15-2010-AMM-001	Summer	Individual	1	6.2	0.3990	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-002	7.15-2010-AMM-002	Summer	Individual	1	5.2	0.1598	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-003	7.15-2010-AMM-003	Summer	Individual	1	4.7	0.1154	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-004	7.15-2010-AMM-004	Summer	Individual	1	5.8	0.2353	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-005	7.15-2010-AMM-005	Summer	Individual	1	8.3	1.1801	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-006	7.15-2010-AMM-006	Summer	Individual	1	5.2	0.1335	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-007	7.15-2010-AMM-007	Summer	Individual	1	6.2	0.2838	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-008	7.15-2010-AMM-008	Summer	Individual	1	4.9	0.1260	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-009	7.15-2010-AMM-009	Summer	Individual	1	6.5	0.4232	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-010	7.15-2010-AMM-010	Summer	Individual	1	5.6	0.1813	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.15-2010-AMM-011	7.15-2010-AMM-011	Summer	Individual	1	5.3	0.1449	KOH	1	room	whole	Rinsed	27/Nov	5/Dec
7.16-2010-AMM-001	7.16-2010-AMM-B001	Summer	Batch	1	5.7	0.2901	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-002	7.16-2010-AMM-B001	Summer	Batch	1	5.9	0.2904	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-003	7.16-2010-AMM-B001	Summer	Batch	1	6.5	0.4167	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-004	7.16-2010-AMM-B001	Summer	Batch	1	5.9	0.3500	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-005	7.16-2010-AMM-B001	Summer	Batch	1	5.2	0.1979	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-006	7.16-2010-AMM-B001	Summer	Batch	1	5.0	0.1968	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-007	7.16-2010-AMM-B001	Summer	Batch	1	5.7	0.3047	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-008	7.16-2010-AMM-B001	Summer	Batch	1	6.1	0.3595	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-009	7.16-2010-AMM-B001	Summer	Batch	1	5.0	0.1471	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-010	7.16-2010-AMM-B001	Summer	Batch	1	4.8	0.1407	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
7.16-2010-AMM-011	7.16-2010-AMM-B001	Summer	Batch	1	-	-	KOH	1	room	whole	Rinsed	22/Nov	24/Nov
1.01-2013-GAS-001	1.01-2013-GAS-001	Winter	Individual	1	5.9	1.4724	KOH	1	room	whole	Had to process - in same bag as 1.1-2013-SPR	9/Nov	21/Nov
1.01-2013-MER-001	1.01-2013-MER-001	Winter	Individual	1	6.5	1.6014	KOH	1	room	whole	Had to process - in same bag as 1.1-2013-SPR	9/Nov	21/Nov
5.09-2010-UNK-001	5.09-2010-UNK-001	Summer	Batch	2	-	-	KOH	1	room	whole	Quite disintegrated ("mushy")	5/Sep	7/Sep
5.09-2010-UNK-002	5.09-2010-UNK-002	Summer	Batch	2	-	-	KOH	1	50	whole	1 fish intact; the other is disintegrated	5/Sep	7/Sep
5.13-2010-TRA-001	5.13-2010-TRA-001	Summer	Individual	1	4.6	0.2398	KOH	1	room	whole	Had to process - in same bag as 5.13-2010-AMM-001	9/Nov	21/Nov
7.11-2010-LARA-001	7.11-2010-LARA-001	Summer	Batch	4	-	-	KOH	1	room	whole	Quite disintegrated ("mushy")	5/Sep	7/Sep

7.11-2010-LARA-002	7.11-2010-LARA-002	Summer	Batch	4	-	-	KOH	1	50	whole	Quite disintegrated ("mushy")	5/Sep	7/Sep
7.16-2010-JUVS-001	7.16-2010-JUVS-001	Summer	Individual	1	5.6	0.4258	KOH	1	room	whole	Rinsed	30/Nov	11/Dec

Appendix 3: Fibre contamination data

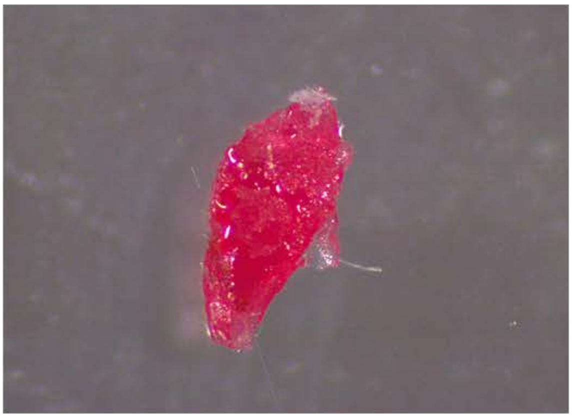
Table A3. *Complete dataset for fibre contamination recorded during laboratory sessions including start and end time, number of people at the start and end of each session and number of fibres recorded in the control Bogorov. These data were used to determine whether location, duration and average number of people could explain fibre contamination in the laboratory.*

A	B	C	D	E	F	G	H	I	J	K	L	M
Location	Date	Start time	End time	Duration (mins)	Fibre count	N persons in lab START	N of persons in lab END	Avg n of persons in the lab	Person minutes (I x E)	Fibre contamination per minute (F/E)	Fibre/person (F/I)	Fibres/person minute (F/J)
A	7/Sep	11.09	15.21	252	25	3	4	3.5	882	0.10	7.14	0.03
A	3/Oct	13.43	16.30	167	3	5	5	5	835	0.02	0.60	0.00
A	3/Oct	10.00	10.30	30	2	4	4	4	120	0.07	0.50	0.02
B	3/Oct	10.00	10.30	30	2	4	4	4	120	0.07	0.50	0.02
C	3/Oct	10.00	10.30	30	4	4	4	4	120	0.13	1.00	0.03
A	3/Oct	11.30	11.45	15	5	24	4	14	210	0.33	0.36	0.02
B	3/Oct	11.30	11.45	15	5	24	4	14	210	0.33	0.36	0.02
C	3/Oct	11.30	11.45	15	3	24	4	14	210	0.20	0.21	0.01
A	4/Oct	10.42	12.08	86	1	2	2	2	172	0.01	0.50	0.01
A	4/Oct	13.33	14.16	43	2	5	6	5.5	236.5	0.05	0.36	0.01
A	4/Oct	14.34	15.11	37	0	4	4	4	148	0.00	0.00	0.00
A	4/Oct	15.58	17.32	94	2	3	4	3.5	329	0.02	0.57	0.01
A	5/Oct	13.24	15.28	124	1	3	3	3	372	0.01	0.33	0.00
A	6/Oct	11.58	12.06	8	1	6	5	5.5	44	0.13	0.18	0.02
A	6/Oct	13.53	14.33	40	1	7	6	6.5	260	0.03	0.15	0.00
A	6/Oct	14.52	16.34	102	1	6	2	4	408	0.01	0.25	0.00
A	10/Oct	9.14	10.09	55	2	3	5	4	220	0.04	0.50	0.01
A	10/Oct	10.39	12.27	108	1	5	2	3.5	378	0.01	0.29	0.00
A	10/Oct	13.27	15.14	107	2	8	3	5.5	588.5	0.02	0.36	0.00
A	10/Oct	15.32	17.23	111	2	6	3	4.5	499.5	0.02	0.44	0.00
A	11/Oct	10.46	11.58	72	1	2	4	3	216	0.01	0.33	0.00
A	11/Oct	13.18	14.56	98	0	3	3	3	294	0.00	0.00	0.00
B	12/Oct	9.03	10.12	69	5	2	3	2.5	172.5	0.07	2.00	0.03
B	12/Oct	10.40	12.13	93	19	2	4	3	279	0.20	6.33	0.07
B	12/Oct	13.11	15.39	148	15	7	4	5.5	814	0.10	2.73	0.02
B	12/Oct	16.24	17.30	66	8	3	1	2	132	0.12	4.00	0.06
C	17/Oct	9.55	10.25	30	3	5	2	3.5	105	0.10	0.86	0.03
C	17/Oct	10.56	12.13	77	12	5	3	4	308	0.16	3.00	0.04
C	17/Oct	13.17	16.04	167	28	5	8	6.5	1085.5	0.17	4.31	0.03
C	19/Oct	10.25	11.59	94	7	1	7	4	376	0.07	1.75	0.02
C	19/Oct	12.51	15.10	139	2	1	6	3.5	486.5	0.01	0.57	0.00
C	20/Oct	11.14	12.11	57	3	5	1	3	171	0.05	1.00	0.02
C	20/Oct	12.39	15.50	191	10	2	2	2	382	0.05	5.00	0.03
C	6/Nov	11.04	12.13	69	2	9	7	8	552	0.03	0.25	0.00
C	6/Nov	13.21	15.21	120	10	7	3	5	600	0.08	2.00	0.02
C	7/Nov	11.07	12.17	70	12	6	10	8	560	0.17	1.50	0.02
C	7/Nov	13.24	15.16	112	15	10	8	9	1008	0.13	1.67	0.01
C	9/Nov	11.04	12.21	77	4	6	3	4.5	346.5	0.05	0.89	0.01

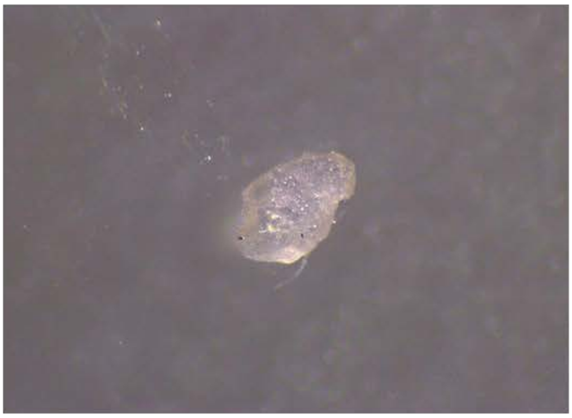
C	9/Nov	13.49	15.22	93	8	7	1	4	372	0.09	2.00	0.02
C	10/Nov	10.45	12.11	86	5	5	3	4	344	0.06	1.25	0.01
C	21/Nov	11.20	12.25	65	6	10	5	7.5	487.5	0.09	0.80	0.01
C	21/Nov	13.40	15.15	95	13	6	5	5.5	522.5	0.14	2.36	0.02
C	21/Nov	16.15	17.12	57	7	7	4	5.5	313.5	0.12	1.27	0.02
C	22/Nov	10.57	12.21	84	4	4	1	2.5	210	0.05	1.60	0.02
C	22/Nov	13.38	15.35	117	23	4	4	4	468	0.20	5.75	0.05
C	23/Nov	13.24	15.07	103	12	5	4	4.5	463.5	0.12	2.67	0.03
C	24/Nov	16.46	18.00	74	4	5	1	3	222	0.05	1.33	0.02
C	24/Nov	11.10	12.07	57	2	6	6	6	342	0.04	0.33	0.01
C	24/Nov	15.35	16.08	33	4	2	1	1.5	49.5	0.12	2.67	0.08
C	27/Nov	9.06	10.06	60	6	8	9	8.5	510	0.10	0.71	0.01
C	27/Nov	10.56	12.41	105	6	8	1	4.5	472.5	0.06	1.33	0.01
C	27/Nov	13.17	16.59	222	25	10	5	7.5	1665	0.11	3.33	0.02
C	28/Nov	10.14	12.00	106	3	3	7	5	530	0.03	0.60	0.01
C	28/Nov	14.46	18.05	199	14	5	4	4.5	895.5	0.07	3.11	0.02
C	29/Nov	13.08	15.00	112	22	8	9	8.5	952	0.20	2.59	0.02
C	30/Nov	9.08	10.15	67	12	7	2	4.5	301.5	0.18	2.67	0.04
C	30/Nov	10.50	12.13	83	3	6	1	3.5	290.5	0.04	0.86	0.01
C	30/Nov	13.05	14.44	99	5	2	7	4.5	445.5	0.05	1.11	0.01
C	30/Nov	15.15	15.56	41	9	1	6	3.5	143.5	0.22	2.57	0.06
C	4/Dec	13.28	15.10	102	25	5	6	5.5	561	0.25	4.55	0.04
C	5/Dec	9.50	12.17	147	13	6	3	4.5	661.5	0.09	2.89	0.02
C	5/Dec	14.00	17.16	196	18	6	1	3.5	686	0.09	5.14	0.03
C	7/Dec	13.28	17.24	236	14	2	1	1.5	354	0.06	9.33	0.04
C	8/Dec	10.42	11.58	76	5	2	2	2	152	0.07	2.50	0.03
C	8/Dec	14.45	16.49	124	2	2	2	2	248	0.02	1.00	0.01
C	11/Dec	11.05	12.14	69	5	7	1	4	276	0.07	1.25	0.02
C	11/Dec	13.37	15.10	93	22	6	2	4	372	0.24	5.50	0.06

Appendix 4: Sample photos

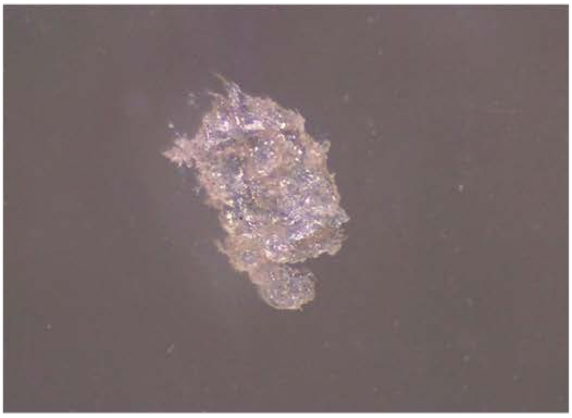
Note: *Photos were taken at Shimadzu in Germany with a Leica EZ4 W Microscope. Not all samples were photographed and scale was not recorded. Composition according to FT-IR for each sample stated below each photo. Microplastics are presented first followed by fibres.*



Sample: 1-03-2013-SPR-B001_a
Composition: Polypropylene

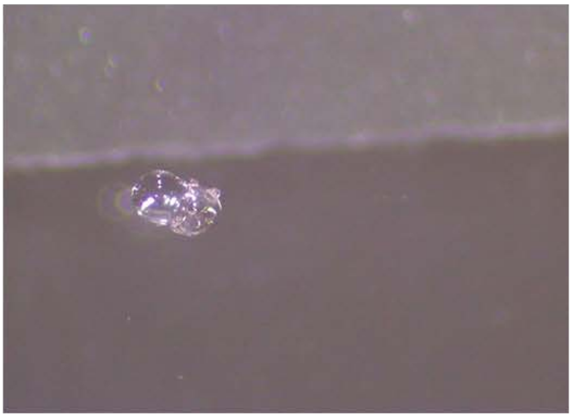


Sample: 1-03-2013-SPR-B001_b
Composition: Polyethylene

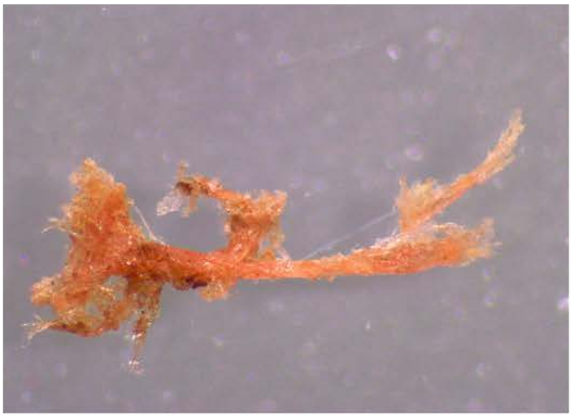


Sample: 2-2010-SPR-B007_a
Composition: Polyethylene

Sample: 2-2010-SPR-B008_a
Composition: Polymethyl methacrylate

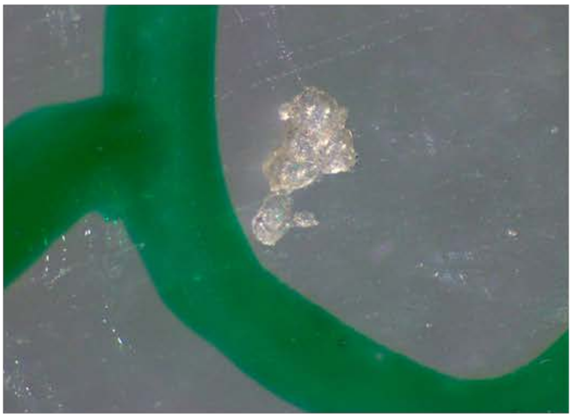


Sample: 2-2010-SPR-B008_b
Composition: Polymethyl methacrylate

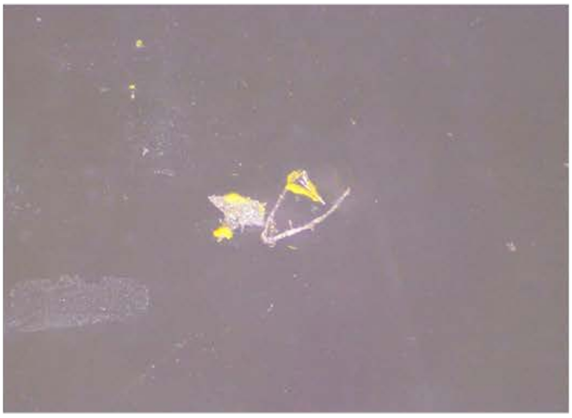


Sample: 2-2010-SPR-B008_c
Composition: Polyethylene

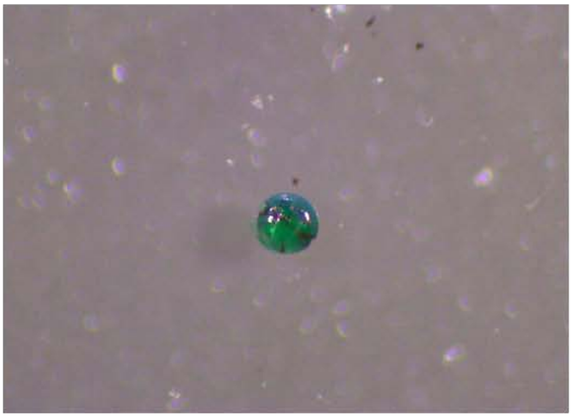

Sample: 2-2010-SPR-B008_e
Composition: LDPE

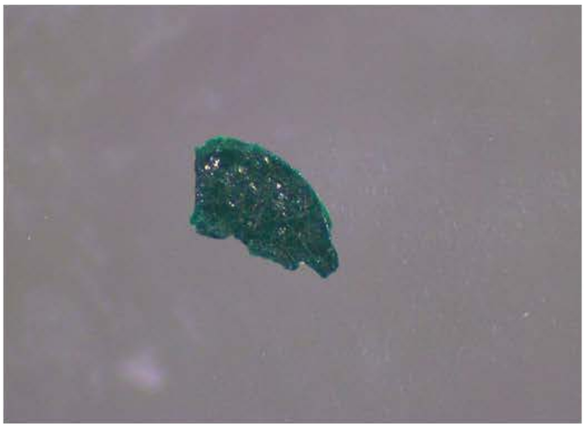

Sample: 2_2010_SPR_DIS_d2
Composition: Polyethylene


Sample: 3-02-2016-SPR-B003_a
Composition: Unknown


Sample: 4-03-2009-AMM-005_1
Composition: (yellow) Acrylic adhesive

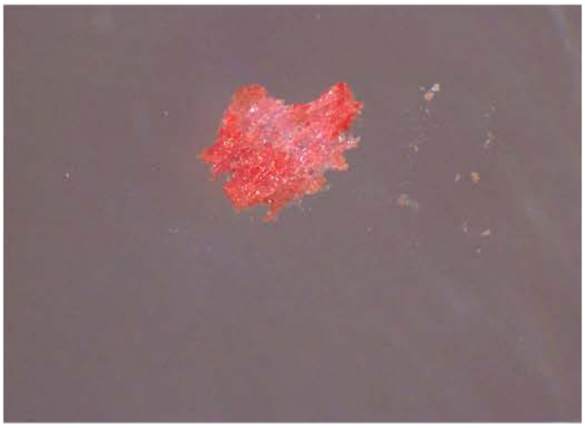

Sample: 5-09-2010-SPR-B001_b
Composition: PVC + Acrylic adhesive


Sample: 5-10-2010-AMM-005_b
Composition: Polystyrene (dyed green by pen)



Sample: 5-11-2010-SPR-B001_a
Composition: Polybutyl methacrylate

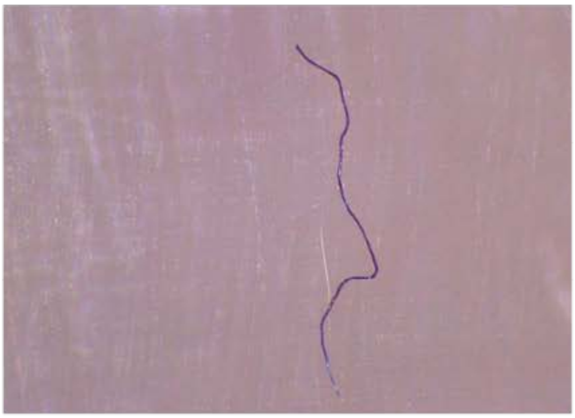
Sample: 5-11-2010-SPR-B001_b
Composition: Polyethylene



Sample: 7-09-2010-AMM_B003
Composition: Polybutylene terephthalate

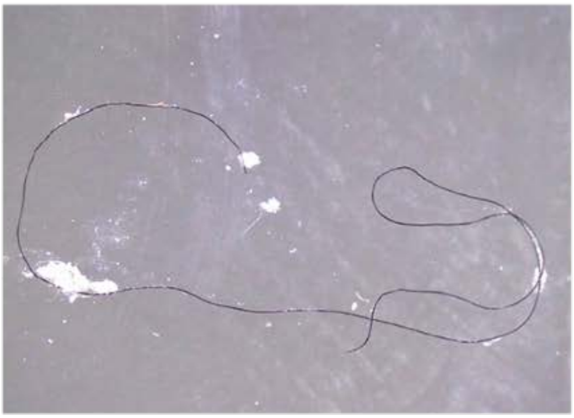
Sample: 7-09-2010-AMM_B004
Composition: Polybutylene terephthalate

Sample: 7-09-2010-AMM-B007_a
Composition: Polymethyl methacrylate



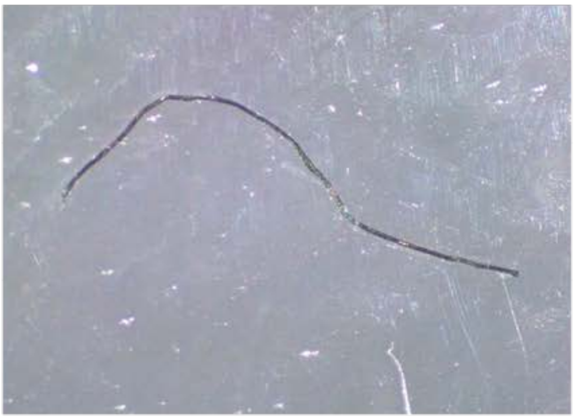
Sample: 1-01-2010-GAS_001
Composition: CUPRA

Sample: 2-2010-SPR-070_b
Composition: Amyl acetate and PAN



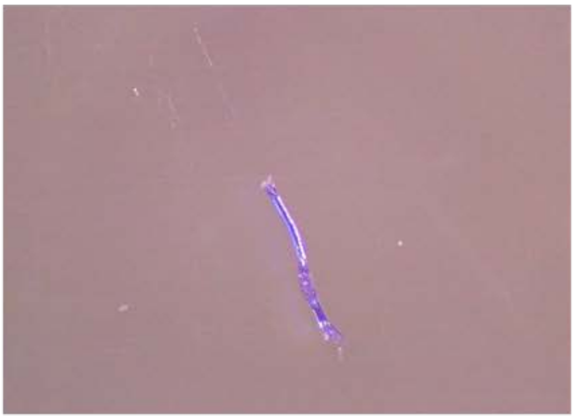
Sample: 2-2010-SPR-DIS_a
Composition: EVA + PAN

Sample: 3-02-2016-SPR-B002_b
Composition: Polyethylene/Polypropylene copolymer

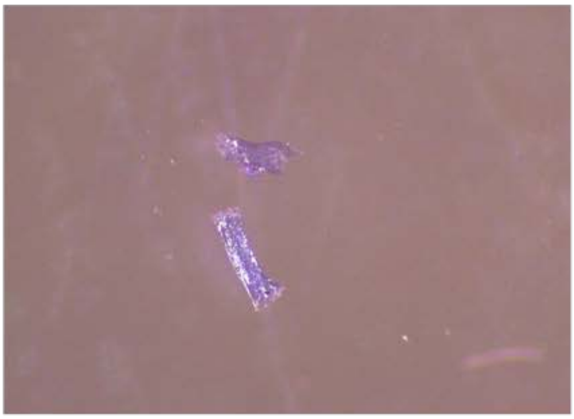


Sample: 3-03-2016-SPR-B004_a
Composition: EVA + PAN

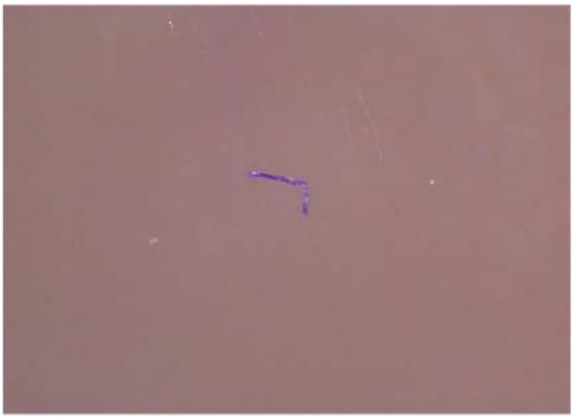
Sample: 3-03-2016-SPR-B004_b
Composition: Polyethylene/Polypropylene copolymer



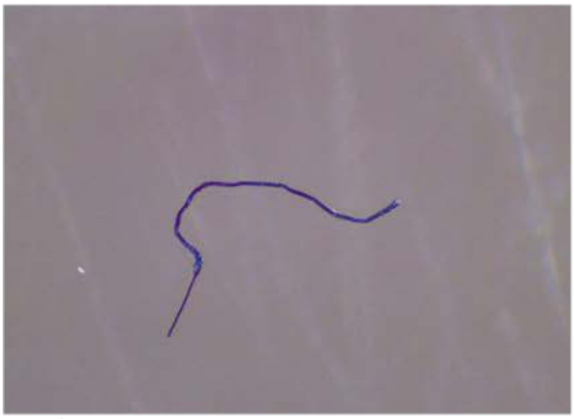
Sample: 5-10-2010-AMM_003
Composition: Polyethylene / Polyethylene terephthalate



Sample: 5-10-2010-AMM-003_postFTIR
Composition: Polyethylene / Polyethylene terephthalate



Sample: 5-10-2010-AMM_006
Composition: CUPRA and acetate



Sample: 5-13-2010-TRA-001_a
Composition: Unknown

Sample: 5-13-2010-TRA-001_c
Composition: CUPRA

Sample: 7-09-2010-AMM-B007_b
Composition: Polyethylene terephthalate

Table A5.a. Results from the scores given by each judge during sample characterisation for samples thought to be air-borne. *Total scores were used for Figure 3.4.1.*

Batch Code	AOD	SKU	JAF	AM	Total Score
	Aerial (0=n; 1=y; 0.5=?)	Aerial (0=n; 1=y; 0.5=?)	Aerial (0=n; 1=y; 0.5=?)	Aerial (0=n; 1=y; 0.5=?)	
1.01-2013-GAS-001	1	1	1	1	4
1.02_1.05-2013-SPR-B001-a	1	1	1	1	4
1.02_1.05-2013-SPR-B001-b	0	0	0	0	0
1.03-2013-SPR-B001-a	0	0	0	0	0
1.03-2013-SPR-B001-b	0	0	0	0	0
2-2010-SPR-061	1	1	1	0	3
2-2010-SPR-063	0	0	0	0	0
2-2010-SPR-064	0	0	0	0	0
2-2010-SPR-068	0	0	0	0	0
2-2010-SPR-070-a	0	0	0	0	0
2-2010-SPR-070-b	1	1	1	0	3
2-2010-SPR-071	1	1	1	1	4
2-2010-SPR-B007-a	0	0	0	0	0
2-2010-SPR-B007-b	0	0	0	0	0
2-2010-SPR-B008-a	0	0	0	0	0
2-2010-SPR-B008-b	0	0	0	0	0
2-2010-SPR-B008-c	0	0	0	0	0
2-2010-SPR-B008-e	0	0	0	0	0
2-2010-SPR-DIS-a	1	1	1	1	4
2-2010-SPR-DIS-b	0	0	0	0	0
2-2010-SPR-DIS-c	0	0	0	0	0
2-2010-SPR-DIS-d	0	0	0	0	0
3.01-2016-SPR-009	0	0	0	0	0
3.01-2016-SPR-012	1	1	1	1	4
3.02-2016-SPR-B002-a	0	0	0	0	0
3.02-2016-SPR-B002-b	0	0	0	0	0
3.02-2016-SPR-B003-a	0	0	0	0	0
3.02-2016-SPR-B003-b	0	0	0	0	0
3.03-2016-SPR-B004-a	1	1	1	1	4
3.03-2016-SPR-B004-b	0	0	0	0	0
4.03-2009-AMM-005	0	0	0	0	0
4.03-2009-AMM-B001	1	1	1	1	4
5.01-2010-SPR-B001	0	0	0	0	0
5.09-2010-SPR-B001-a	0	0	0	0	0
5.09-2010-SPR-B001-b	0	0	0	0	0
5.10-2010-AMM-002	1	1	1	0	3
5.10-2010-AMM-003	1	1	1	1	4
5.10-2010-AMM-004	0	0	0	0	0
5.10-2010-AMM-005-a	0	0	0	0	0
5.10-2010-AMM-006	1	1	1	1	4
5.11-2010-SPR-B001-a	0	0	0	0	0
5.11-2010-SPR-B001-b	0	0	0	0	0
5.11-2010-SPR-B001-c	0	0	0	0	0
5.11-2010-SPR-B001-d	0	0	0	0	0
5.11-2010-SPR-B002	0	0	0	0	0
5.11-2010-SPR-EXTRA	0	0	1	0	1

5.13-2010-TRA-001-a	1	1	1	1	4
5.13-2010-TRA-001-b	1	1	1	1	4
5.13-2010-TRA-001-c	1	1	1	1	4
6.02-2007-AMM-001	1	1	1	1	4
7.08-2010-AMM-B001	0	0	1	0	1
7.09-2010-AMM-205-a	0	1	1	1	3
7.09-2010-AMM-206	1	1	1	1	4
7.09-2010-AMM-210-b	1	1	1	0	3
7.09-2010-AMM-B002	1	1	1	1	4
7.09-2010-AMM-B003	0	0	0	0	0
7.09-2010-AMM-B004	0	0	0	0	0
7.09-2010-AMM-B007-a	0	0	0	0	0
7.09-2010-AMM-B007-b	1	1	1	1	4
7.11-2010-SPR-001	0	0	0	0	0
7.16-2010-AMM-B001-a	0	0	0	0	0
7.16-2010-AMM-B001-b	1	1	1	1	4

Table A5.b. Results from the scores given by each judge during sample characterisation for suspected plastics. *Total scores were used for Figure 3.4.2. Note that fibre samples are excluded from the table. FT-IR results are included for comparison between judgement (denoted by scores) and conclusive composition.*

** sample composed of two elements but this was unclear at time of judgement, hence only one score was given during sample characterisation. During FT-IR preparation, sub-samples were prepared. FT-IR analysis revealed a different composition for each sub-sample, leading to multiple scores.*

Batch Code	AOD	SKU	JAF	AM	Total Score	FT-IR result (0=n; 1=y; 0.5=?)
	Plastic (0=n; 1=y; 0.5=?)	Plastic (0=n; 1=y; 0.5=?)	Plastic (0=n; 1=y; 0.5=?)	Plastic (0=n; 1=y; 0.5=?)		
1.02_1.05-2013-SPR-B001-b	0	0	0	0	0	NM
1.03-2013-SPR-B001-a	1	1	1	1	4	1
1.03-2013-SPR-B001-b	0	1	1	1	3	1
2-2010-SPR-063	0	0	0	0	0	NM
2-2010-SPR-064	0	0	0	0	0	NM
2-2010-SPR-068	0	0	0	0	0	NM
2-2010-SPR-070-a	1	0	0	1	2	1
2-2010-SPR-B007-a	0	0	0	1	1	1
2-2010-SPR-B007-b	0	0	0,5	1	1,5	0
2-2010-SPR-B008-a	1	1	1	1	4	1
2-2010-SPR-B008-b	1	1	1	1	4	1
2-2010-SPR-B008-c	0	0	1	1	2	1
2-2010-SPR-B008-e	0	1	1	1	3	1
2-2010-SPR-DIS-b	0	0	0	0	0	0
2-2010-SPR-DIS-c	0	0	0	0	0	0
2-2010-SPR-DIS-d*	0	0	1	1	2	0/0/1
3.01-2016-SPR-009	0	0	1	0	1	0
3.02-2016-SPR-B002-a	0	0	0	0	0	0
3.02-2016-SPR-B003-a	1	0,5	0,5	1	3	Unknown
4.03-2009-AMM-005*	0,5	0	0	0	0,5	0/1
5.01-2010-SPR-B001	1	1	1	1	4	1
5.09-2010-SPR-B001-a	0	0	0	0	0	Lost
5.09-2010-SPR-B001-b	0	0	0	0	0	1

5.10-2010-AMM-004	0	1	1	0	2	0
5.10-2010-AMM-005-a	0	0	0	0	0	0
5.11-2010-SPR-B001-a	1	1	1	1	4	1
5.11-2010-SPR-B001-b	0,5	0	0,5	1	2	1
5.11-2010-SPR-B001-c	0	0	0	0	0	0
5.11-2010-SPR-B001-d	0	0	0	1	1	Lost
5.11-2010-SPR-B002	0	0	0	0	0	0
5.11-2010-SPR-EXTRA	1	0	1	1	3	Lost
7.09-2010-AMM-B003	0	0	0	0	0	1
7.09-2010-AMM-B004	0	0	0	0	0	1
7.09-2010-AMM-B007-a	1	1	1	0	3	1
7.11-2010-SPR-001	0	0	0	0	0	Unknown
7.16-2010-AMM-B001-a	0	1	1	0	2	0

Appendix 6: FT-IR results

Table A6.a. *FT-IR results for non-fibrous samples, including subcategories used for Figure 3.2.1 (NM = not measured)*

Batch Code	No of pieces	Standard or Mirco FTIR	Result	Subcategory	Score
1.02_1.05-2013-SPR-B001-b	1	-	Protein	Natural	NM
1.03-2013-SPR-B001-a	1	FT-IR IRSpirit	PP	PP	909
1.03-2013-SPR-B001-b	2	FT-IR IRSpirit	PE	PE	914
2-2010-SPR-063	7	-	Protein	Natural	NM
2-2010-SPR-064	2	-	Protein	Natural	NM
2-2010-SPR-068	10	-	Protein	Natural	NM
2-2010-SPR-070-a	1	Micro IR AIM-9000	Acrylic adhesive	Acrylic adhesive	795
2-2010-SPR-B007-a	1	FT-IR IRSpirit	PE	PE	918
2-2010-SPR-B007-b	1	Micro IR AIM-9000	Protein	Natural	897
2-2010-SPR-B008-a	1	FT-IR IRSpirit	PMMA	PMMA	951
2-2010-SPR-B008-b	1	FT-IR IRSpirit	PMMA	PMMA	930
2-2010-SPR-B008-c	1	FT-IR IRSpirit	PE	PE	907
2-2010-SPR-B008-e	1	Micro IR AIM-9000	Low Density Polyethylene	Other	876
2-2010-SPR-DIS-b	1	FT-IR IRSpirit	Protein	Natural	866
2-2010-SPR-DIS-c	1	-	Protein	Natural	NM
2-2010-SPR-DIS-d1	1	FT-IR IRSpirit	PE	PE	919
2-2010-SPR-DIS-d2	1	FT-IR IRSpirit	PE	PE	909
2-2010-SPR-DIS-d3	1	FT-IR IRSpirit	Protein	Natural	852
3.01-2016-SPR-009	1	Micro IR AIM-9000	Cotton/cellulose	Natural	TBC
3.02-2016-SPR-B002-a	1	FT-IR IRSpirit	Protein	Natural	760
3.02-2016-SPR-B003-a	1	Both	Unkown	Unknown	Unkown
4.03-2009-AMM-005	1	Micro IR AIM-9000	Acrylic adhesive	Acrylic adhesive	862
4.03-2009-AMM-005	1	Micro IR AIM-9000	Cotton	Natural	943
5.01-2010-SPR-B001	1	FT-IR IRSpirit	PP	PP	929
5.09-2010-SPR-B001-a	1	-	-	Lost	Lost
5.09-2010-SPR-B001-b	1	Micro IR AIM-9000	PVC + acrylic adhesive	Other	TBC
5.10-2010-AMM-004	1	Micro IR AIM-9000	Protein	Natural	776
5.10-2010-AMM-005-a	3	FT-IR IRSpirit	Cellulose	Natural	924
5.10-2010-AMM-005-b	1	FT-IR IRSpirit	PS	Other	864
5.11-2010-SPR-B001-a	1	FT-IR IRSpirit	Polybutyl Methacrylate	Other	864
5.11-2010-SPR-B001-b	1	FT-IR IRSpirit	PE	PE	930
5.11-2010-SPR-B001-c	7	Both	Protein	Natural	797 (st); 824 (micro)
5.11-2010-SPR-B001-d	1	-	-	Lost	Lost
5.11-2010-SPR-B002	3	FT-IR IRSpirit	Protein	Natural	758
5.11-2010-SPR-EXTRA	1	-	-	Lost	Lost
7.09-2010-AMM-B003	1	FT-IR IRSpirit	PBT	PBT	939
7.09-2010-AMM-B004	1	Micro IR AIM-9000	PBT	PBT	907
7.09-2010-AMM-B007-a	1	FT-IR IRSpirit	PMMA	PMMA	905
7.11-2010-SPR-001	1	Both	Unkown	Unknown	Unkown
7.16-2010-AMM-B001-a_1	1	FT-IR IRSpirit	Silicone dioxide (Sand)	Natural	756
7.16-2010-AMM-B001-a_2	1	Micro IR AIM-9000	Silica gel	Natural	809
Bottle cap control	1	FT-IR IRSpirit	PP	Control	944

Table A6.b. *FT-IR results for fibres, including subcategories used for Figure 3.2.2 (NM = not measured)*

Batch Code	No of pieces	Standard or Mirco FTIR	Result	Subcategory	Score
1.01-2013-GAS-001	1	-	Lost	Lost	Lost
1.01-2013-GAS-001	1	Micro IR AIM-9000	Cupra	Cupra	847
1.01-2013-GAS-001	1	Micro IR AIM-9000	Cotton	Natural	920
1.02_1.05-2013-SPR-B001-a	1	Micro IR AIM-9000	Protein	Natural	892
2-2010-SPR-061	1	Micro IR AIM-9000	Protein	Natural	906
2-2010-SPR-070-b	1	Micro IR AIM-9000	Amyl acetate and PAN	Other	799 (acetate); 790 (PAN)
2-2010-SPR-071	1	Micro IR AIM-9000	Cotton	Natural	802
2-2010-SPR-DIS-a	1	Micro IR AIM-9000	EVA + PAN	EVA + PAN	EVA (773); PAN (770)
3.01-2016-SPR-012	1	Micro IR AIM-9000	Cotton "RAMIE"	Natural	829
3.02-2016-SPR-B002-b	1	FT-IR IRSpirit	PE/PP copolymer	PE/PP copolymer	880
3.02-2016-SPR-B003-b	1	Micro IR AIM-9000	PE/PP copolymer	PE/PP copolymer	821
3.03-2016-SPR-B004-a	1	Micro IR AIM-9000	EVA + PAN	EVA + PAN	Look up
3.03-2016-SPR-B004-b	1	FT-IR IRSpirit	PE/PP copolymer	PE/PP copolymer	890
4.03-2009-AMM-B001	1	-	Lost	Lost	Lost
5.10-2010-AMM-002	1	Micro IR AIM-9000	Cotton	Natural	932
5.10-2010-AMM-003	1	Micro IR AIM-9000	PE/PET	Other	929 (PE); 920 (PET)
5.10-2010-AMM-006	1	Micro IR AIM-9000	Cupra + Acetate	Other	833
5.10-2010-AMM-012-a	1	-	Lost	Lost	Lost
5.13-2010-TRA-001-a_1	1	Micro IR AIM-9000	Unkown	Unkown	Unkown
5.13-2010-TRA-001-a 2	1	-	Lost	Lost	Lost
5.13-2010-TRA-001-b	1	-	Lost	Lost	Lost
5.13-2010-TRA-001-cI	1	Micro IR AIM-9000	Cupra	Cupra	845
5.13-2010-TRA-001-cII	1	Micro IR AIM-9000	Cotton	Natural	863
6.02-2007-AMM-001	1	Micro IR AIM-9000	Cotton	Natural	856
7.08-2010-AMM-B001	2	Micro IR AIM-9000	Nylon	Nylon	862
7.09-2010-AMM-205-a	1	-	Lost	Lost	Lost
7.09-2010-AMM-206	1	Micro IR AIM-9000	Cotton	Natural	865
7.09-2010-AMM-210-a	1	Micro IR AIM-9000	EVA + PAN	EVA + PAN	EVA (793); PAN (789)
7.09-2010-AMM-210-b	1	Micro IR AIM-9000	Protein	Natural	860
7.09-2010-AMM-B002	1	Micro IR AIM-9000	Protein	Natural	943
7.09-2010-AMM-B007-b	1	Micro IR AIM-9000	PET	Other	935
7.16-2010-AMM-B001-b	1	Micro IR AIM-9000	Protein	Natural	840