University of Glasgow | College of Medical, Veterinary & Life Sciences

Head of College Scholars List Scheme

Summer Studentship

Report Form

1. **Student**

Surname: Kosová **Forename:** Eliška

E-mail address: 2248875k@student.gla.ac.uk

2. **Supervisor**

Surname: Spatharis **Forename:** Sofie

E-mail address: sofie.spatharis@gla.ac.uk

3. **Research Project Report**

3.1 Project Title:

The effect of microplastics on the ecosystem services provided by mussels

3.2 Project Lay Summary:

Microfibers are currently a main issue for the health of marine ecosystems. This research project aimed to determine their potential effects on microalgae growth and on mussels. The project was a part of a broader study of a PhD student in Dr. Spatharis's lab that investigates the effects of microfibers on the ecosystem services provided by mussels, and specifically their ability to mediate nuisance microalgae.

The original aim of the project was to investigate only the changes in algal growth due to microfibers in the absence of mussels. However, I also took part in an experiment testing the effect of microplastics on mussel filtering ability. Six vessels containing live mussels were set up. Each treatment contained one of 3 different concentrations of phytoplankton in the presence and absence of microfibers. To test the potential effect of microfibers on microalgae, the same set up was used with only empty shells. The filtration ability was measured by taking water samples and analysing the microalgae and chlorophyll concentrations.

Start Date: 16/5/2018 **Finish Date**: 18/6/2018

3.3 Original project aims and objectives:

The scientific research on the effect of microplastics has focused mainly on the physiology of mussels. The most dominant form of microplastics in marine environment are microfibers from nylon fishing nets and from clothing, hence, microfibers were used in this project. This experiment aimed at identifying the effects of microfibers on the ecosystem services provided my mussels using filtration rates as a proxy. The experiment also aimed to test whether microfibers affect microalgae growth too.

3.4 Methodology: Summarise and include reference to training received in research methods etc. (250 words max):

Mussels were collected during low tide in intertidal zone in Arrochar, Scotland. In the lab I was shown how to safely remove symbionts like barnacles from the mussel shells, as other filter feeding organisms could affect the results. I also experienced a dissection of a mussel and was taught about its physiology.

The experimental approach was aiming at investigating both, the effect of microfibers on microalgae growth and on mussel filtering capacity. Each treatment consisted of 3 microalgal concentrations, with or without microfibers and in the presence of a live mussel or an empty shell (see Fig. 1). The duration of each of 5 replicates was 24 hours and 25 ml samples were taken at 0h, 1h and 24h phytoplankton concentration analysis. In addition, 100ml samples for chlorophyll-α analysis were taken at 0h and 24h. Before each replicate mussels were acclimatised in vessel, fed 2 days and starved on the 3rd.

I was informed of and followed lab safety regulations and learned how to et up the experiment, collect samples, clearly label the sampling tubes and different techniques of sample preparation for analysis depending whether it was for chlorophyll-α analysis or cell count. This involved filtration techniques, pipetting, working with centrifuge and spectrophotometer. Also, the correct way of handling samples was important as chlorophyll-α samples had to be kept away from the light.

Lastly, I was trained on cell counting technique using a microscope and microscope camera and was taught the consistent systematic way to get accurate results.

3.5 Results: Figures included in the appendix

The results were inserted in Excel and the concentrations were transformed into percentage (%) change and standard deviations was calculated. There were two ways of seeing the results shown in the graphs; the change in chlorophyll-a (ch-a) concentration (Fig. 2) and in phytoplankton cell concentration per ml over 24hrs (Fig. 3).

First, the effect of microfibers on phytoplankton growth was investigated. For the lowest phytoplankton concentration (C) the mean chl-a concentration change was lower with microfibers (MF) present (190% increase) than without microfibers (708% increase). However, the standard variation for non-microfiber results was much higher, meaning that the results varied. The cell concentration decreased in both vessels but more significantly in CMPF. The medium concentration (E), like in C concentration, showed lower increase in chl-a with MF. The microalgae concentration increased in vessel without MF (8%) and decreased with MF (8%). The highest concentration showed

reverse result for chl-a concentration; higher increase in GSPF (22%) than in non-MF GSP (5%). There was an increase in non-MF GSP (21%) and decrease (1%) in GSPF in cell concentration.

Next, the effect of microfibers on mussel filtrating ability was looked at. The lowest concentration (C) showed higher increase in chl-a concentration without MF (167%) than without (124%). In the medium concentration EMPF, containing MF, decreased by 12% in chl-a compared to EMP, which increased by 15%. In the highest concentration (G) both vessels decreased in chl-a but GMP more significantly. Overall, all vessels with mussels showed decrease in phytoplankton cell concentration, and all not containing MF showed higher decrease.

3.6 Discussion:

The aim of the experiment was to test whether microfibers present in marine environment affect A) microalgae growth and B) the ecosystem service of mussels through their filtering ability. Twelve different vessels, each with different treatments, and 5 repeats of the experiment were used to find out any patterns and draw conclusions.

Looking at the effect of microfibers on microalgae growth, the results show that the microfibers lower the rate of growth in chl-a concentration at low or medium phytoplankton concentration and they cause increase in rate of growth at high concentration. At all phytoplankton concentrations, the vessels containing microfibers always showed decrease in cell concentration, unlike less of decrease in vessels without MF. This suggests that generally microfibers negatively impact the microalgae growth and even cause the cell decrease. However, the results between experiments varied a lot, and therefore, the standard deviation is high making the results less accurate.

The results also show the effects of microfibers on the filtering ability of mussels. At low phytoplankton concentration, the chl-a increase suggests phytoplankton growth, but is lowered with presence of microfibers. At medium concentration, the non-MF increased in chl-a compared to decrease in presence of MF. This suggests that microfibers increased the filtering capacity of mussels, however, looking at the previous experiment this was more likely due to the lowered microalgae growth. At high concentration, the microfibers lowered the filtration rate of mussels, as there was more decrease in chl-a without microfibers.

The microalgae concentration change shows decrease in all vessels containing mussels, which is due to their filtering ability that acts as an important ecosystem service in managing microalgae blooms. The results show that the mussel filtering rate was lowered at all concentrations, when the vessels contained microfibers. Hence, the results suggest that the microfibers negatively affect the mussel filtering ability.

When looking at the reliability of the results, the error bars showing standard deviation shows high variation between the results of the repeated experiments with the same treatments. The chlorophyll-a analysis seems to be more accurate when the phytoplankton concentration is high, as very low concentrations show great variation. This was also the case with cell counting for vessels with mussels that were more accurate with high concentrations. There was no clear pattern in standard deviation for cell concentration in vessels containing shells.

The results did not show very strong pattern but suggested a general one that microfibers do not enhance the organisms' functions and rather impair them. In conclusion, generally the microfibers A) negatively affected the microalgae growth and B) lowered the mussel filtering capacity and hence its ecosystem services.

4. **Reflection by the student on the experience and value of the studentship:**

The studentship was a very valuable experience for me. First of all, I have never had a full-time job before, so working every day for 8 hours was something new. I realised that working in a laboratory setting requires organisation and focus to details at all times, as carelessness can result in physical danger or messing up with the results. I learned to label everything carefully because a little mistake on a label can mean that the entire sample is worthless. Even though, there is a lot of repetitiveness during the sample analysis, each sample needs to be considered individually and cannot be expected to act like the others, so it requires patience. In addition, practice helped me to become comfortable in carrying out the different methods.

An everyday task that might seem unimportant showed up to be crucial for the experiments. This was the case of making enough saltwater for the mussels. Without the saltwater we were unable to conduct the experiment. Therefore, organisation is important, and an established order simplifies all the everyday tasks, with each apparatus having its own place and processes are conducted in a systematic way. This was sometimes tricky when there were three of us working together, and hence, communication was a key in order to prevent any confusion.

Finally, working with a PhD student allowed me to familiarise myself with the degree. I have considered doing PhD at some point and this was helpful in understanding what it takes. I realised that it is a lot of work being in the lab all the time, as we had to collect the samples even on the weekends at times. It does not depend only on the person but also on others; the lab is shared, there is a lot of paperwork, and safety and organisational measures.

I appreciate how much responsibility I was given, because I was allowed to make mistakes, which were crucial for improvement on my learning journey.

5. **Dissemination: (note any presentations/publications submitted/planned from the work):**

There are not any presentations planned. I might continue working part-time voluntarily in the lab next semester.

6. **Signatures:**

Supervisor Date: 20/7/2018

Student: Date: 1/6/2018

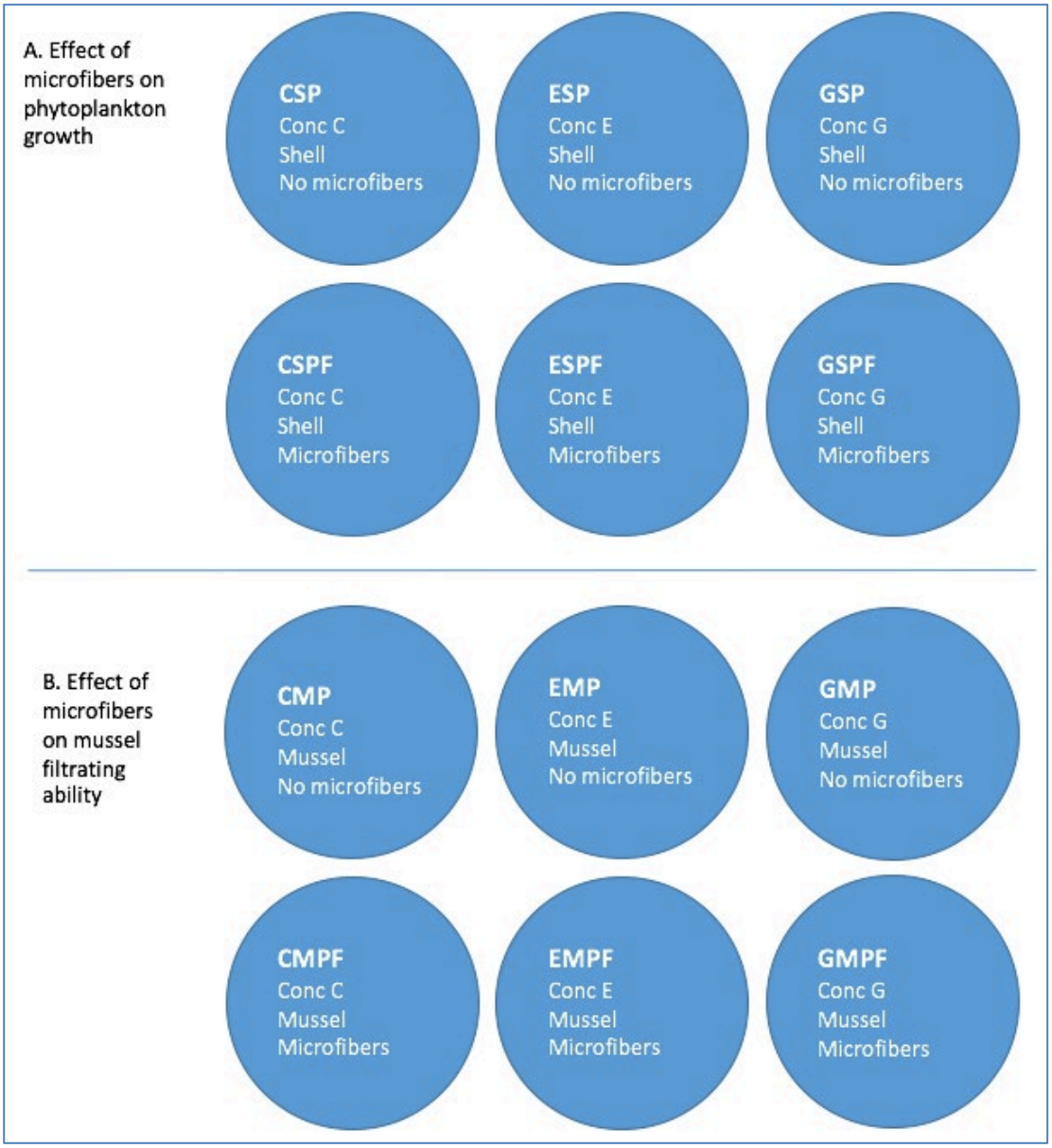

Figure 1. showing the experimental treatment. A. investigated effect of microfibers on microalgae growth B.investigated the effect of microfibers on mussel filtrating ability.

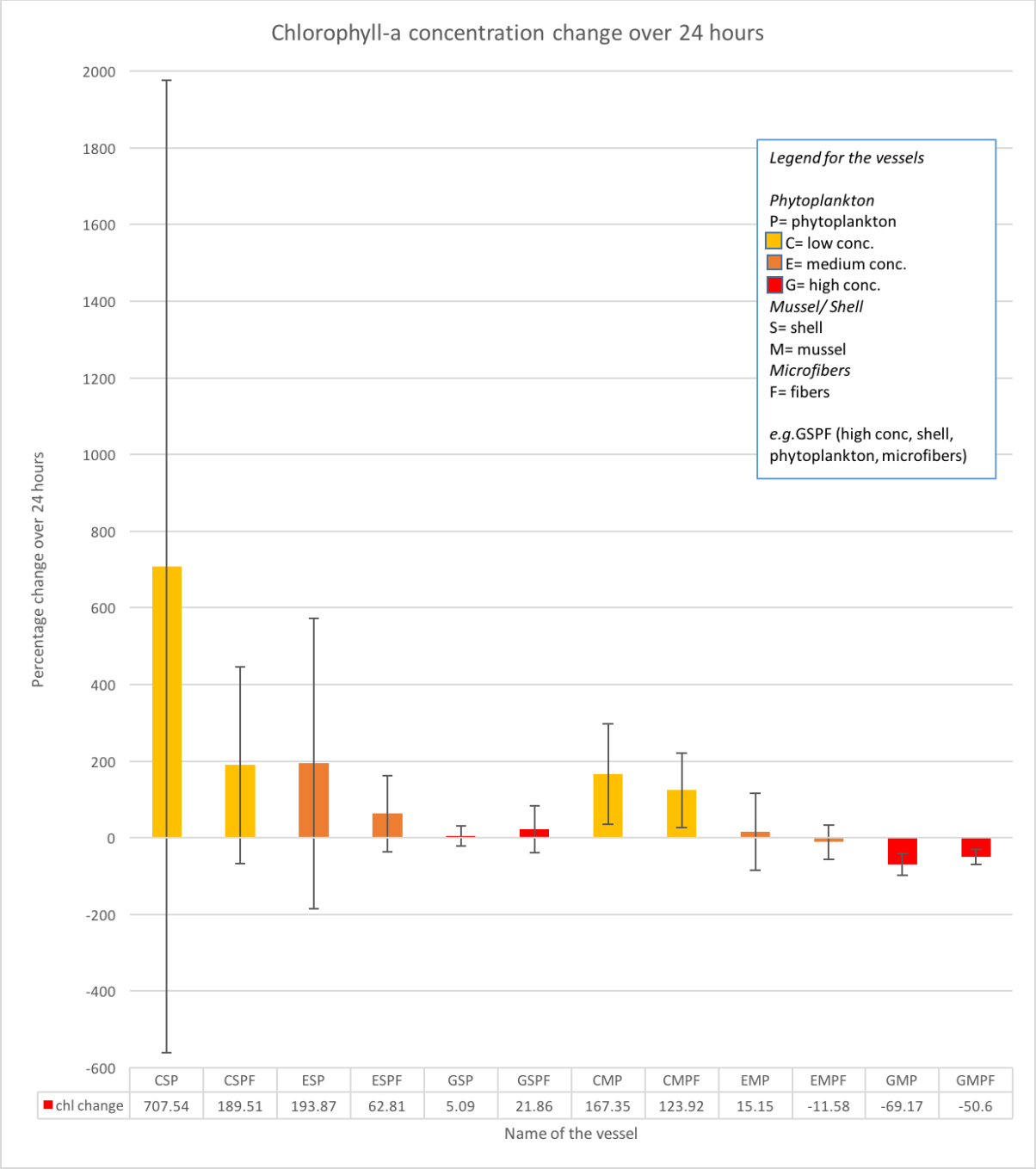

Fig. 2. showing the mean average of chlorophyll-a concentration percentage change over 24 hours. The error bars show the standard deviation of the repeated experiments.

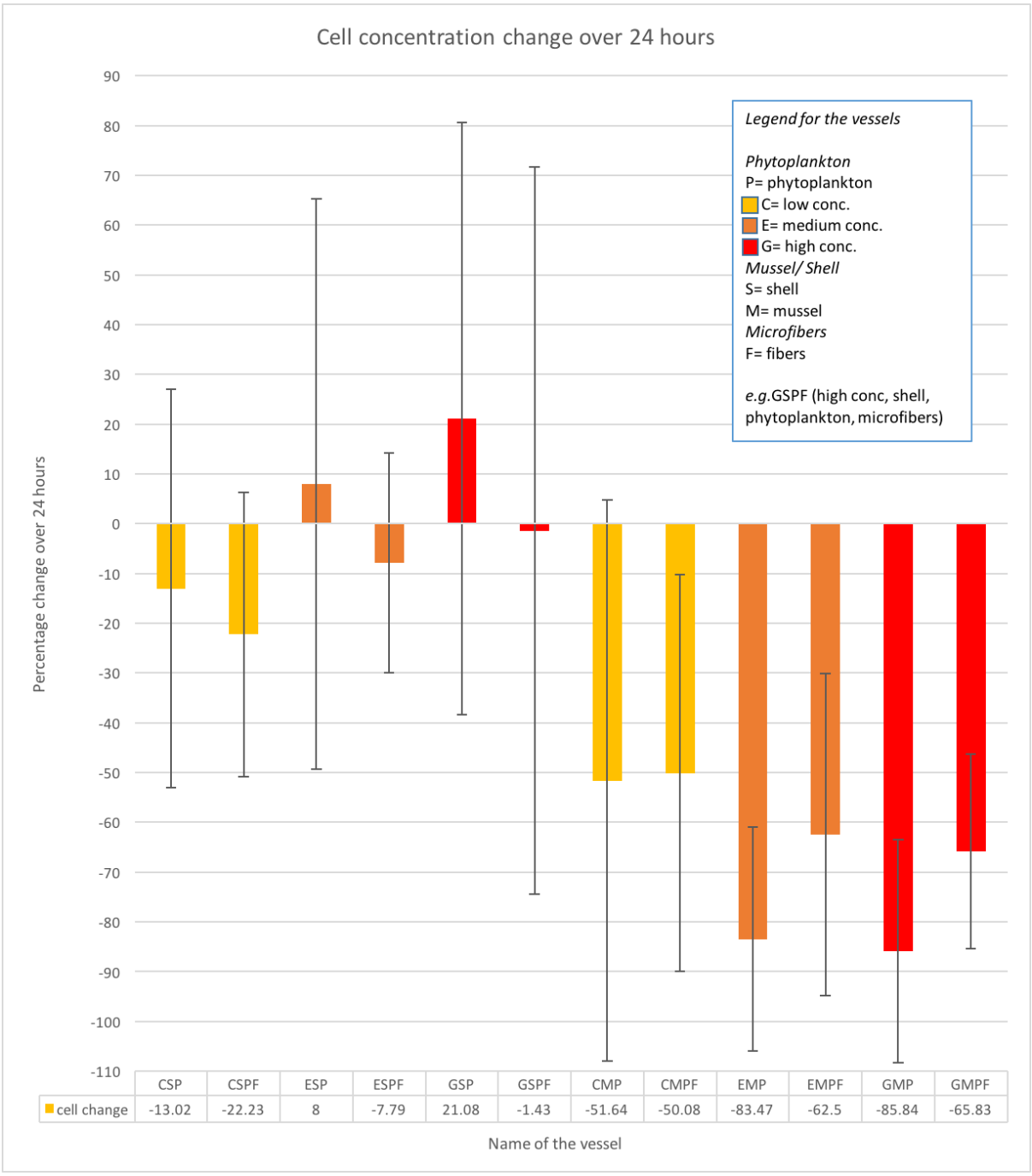

Fig. 3. showing the mean average cell concentration percentage change over 24 hours. The error bars show the standard deviation of the 5 experimental repeats.