

PCAS K220 (2017/2018)

**Supervised Project Report
(ANTA604)**

Unenthusiastic about Plastic

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Abstract/executive summary:

Plastics are a growing environmental problem that many nations are only just beginning to wake up to. While it is clear plastics can last for a very long time in the environment, causing harm to wildlife, it is unclear how to best reduce the amount we use. In Antarctica, 'the last wilderness on Earth', we'd like to think that plastics have not reached there, however human activity in Antarctica brings plastic along with it. This report investigated how plastics were used in relation to food at Scott Base and in a field camp, with the aim of finding some solutions to the plastic problem. Management and planning of how food was used was the best way of reducing plastic waste in the field, while at Scott Base a better understanding of what is recyclable was needed. Ultimately, the solution comes all the way back to New Zealand where better recycling and packaging systems need to be put in place to reduce plastics in the first place. Innovative food packaging is the ultimate solution to reducing plastic on food in Antarctica.

Introduction:

Reducing our footprint and preserving the natural environment are key aims for many of the National Antarctic Programs living and working in Antarctica. To maintain the idea that Antarctica is the last pristine wilderness, many efforts are taken to erase or minimise the human presence. For Antarctica New Zealand, minimization of waste and interference with the environment are at the top of the priority list and a specific focus is reducing the amount of plastic taken to and used in Antarctica. The environmental impacts of plastic have only recently been recognized, and there is an emerging body of literature detailing and highlighting the need to seriously reduce the amount of plastic we are producing and polluting into the environment. While on a global scale, plastic pollution in Antarctica may seem insignificant, the presence of plastics in Antarctica highlights how serious the issue has become, and provides an excellent case

study for how plastics are used and what the alternatives might be. This report aims to address the global environmental problem of plastics and use an Antarctic setting to address where practices need to change to reduce the amount of plastics we use.

Background:

Plastics are a huge environmental problem. Their inability to break down naturally means they remain in the environment for a long time. Ever since mass production began in the 1950's, over 9 billion ton of plastic has been produced. Plastics are made from synthetic polymers, which do not naturally biodegrade; "None of the commonly used plastics are biodegradable.... They accumulate, rather than decompose, in landfills or the natural environment"(Geyer et al. 2017, p.1)". Over very long periods of time, plastics can start to degrade due to heat and UV radiation, but this process is lengthy and results in a wide range of environmental issues in itself. Micro-plastics are produced when large plastic items slowly break down into smaller and smaller pieces, and these can cause health issues to many organisms that come into contact with, or ingest them. While this is an issue, it does show that the environment will wear down large plastic items. In Antarctica however, where the temperatures are rarely greater than freezing and there is no UV exposure for almost half the year, the longevity of plastics is hugely increased. Kerhsaw et al discuss how plastic debris break down in the ocean and describe how plastics at depth "will take much longer to fragment due to lack of ultraviolet penetration and much colder water temperatures" (Kerhsaw et al. 2011, p.23). Reducing the amount of plastics in Antarctica is therefore a high priority, so that there is less risk of plastics being released to the environment.

It has been estimated that only 30% of all plastic ever produced is still in use (Geyer et al. 2017, p.2), highlighting the issue of our habits when it comes to disposing of plastics. "Plastic has become so cheap and ubiquitous in our daily activities that it is seen as disposable, even after single-use (Ivar do Sul et al. 2011, p.151). Single-use plastics are the key to reducing our plastic waste, as they drive our habits of greater consumption and disposal, when there are alternatives that can be reused and recycled.

For Antarctica, reducing the amount of waste produced not only comes with huge logistical benefits (saving on amounts returned to home countries and costs involved), it also has a clear environmental advantage. Minimizing waste before it even goes south is one of Antarctica New Zealand's key aims and is noted in section three of the 2015/2016 Waste Management Strategy: "the less waste Antarctic activities generate, the less waste there is to dispose of...for waste minimization to be effective, effort must be made in each of these three areas (reduce waste volume, reuse materials, recycling materials)"(Antarctica New Zealand, 2015, section 3.1). Finding out where plastics are used and where they can be reduced is therefore a key step to the overall reduction in plastic use.

This report will focus on plastics used in food related activities and personal items carried by people travelling to and from Antarctica. Other areas that need

to be addressed but aren't within the scope of this report are science equipment, medical equipment and operational equipment (running of the base etc.). Food is often an area where a lot of plastic is used, for hygiene, packaging and transporting, so it is also an area where reducing plastic is highly possible. It has been identified that the largest market for plastic use is packaging, a growth accelerated by the shift from reusable to single-use containers (Geyer et al. 2017, p.1) and keeping food sealed and safe to transport to Antarctica relies on good packaging so to minimise food waste. This has been identified by Antarctica New Zealand as an area that needs to be improved and this report aims to identify where packaging on food can be reduced so to minimise this waste.

Methods:

To analyse how and where plastics are used in Antarctica, I carried out two case studies. The first was based on information supplied to me by Pauline Sitter, Environmental Advisor for Antarctica New Zealand. Two data sets were supplied, the first being weight data on waste returned to New Zealand at the end of the 2016/2017 summer season, and the second was the food order information for the 2017/2018 summer season. Both data sets were given as excel spreadsheets. I then supplemented these data sheets with the waste audit information provided by past PCAS students, as well as visited the Antarctic Centre to take photos of an example Field Food Box to get an idea for what plastics are used in the field. For the waste spreadsheet, the only data identifying plastic waste was with recycling, so that is the only area that has been analysed. It is likely that general waste and food waste had components of plastic waste, but as this was not explicitly identified, I could not use it. For the recycled plastic waste data, I worked out the % of plastic waste vs. all the rest of the recycling waste, and created a pie graph to represent this information.

The food order was analysed by identifying all the items ordered with single-use plastics and discussing alternate options. Photographs taken at the Antarctic Centre, of an example field food box, help to visualize the plastic packaging on some of these food items.

The second case study was conducted whilst in Antarctica on PCAS trip K220. Both photographs and notes were taken of food items taken into the field as well as the groups' personal items such as toiletries and own snacks (for any group member willing to share the contents of their bag). This was then analysed in a similar way to the food order in case study one.

While in Antarctica, a waste audit and viewing of the waste station was also done to get an idea of what types of plastics were going into the waste stream and whether any could be replaced with other materials or minimized in New Zealand before going South.

Results

Case study one: Food at Scott Base 17/18 Summer and Waste returned to New Zealand after 16/17 Summer Season

Antarctica New Zealand has shared their food order details and waste shipping data sheets for analysis.

Part one of this case study is an analysis of the data provided on waste returned to New Zealand after the summer season of 2016/2017. Within this spreadsheet, the only waste stream where exact figures were given for plastics was recyclables, so this is the only aspect of the data that has been analysed. Within this, I worked out the total percentage of plastic wastes within the recycled waste stream and then compared this to other types of recyclables.

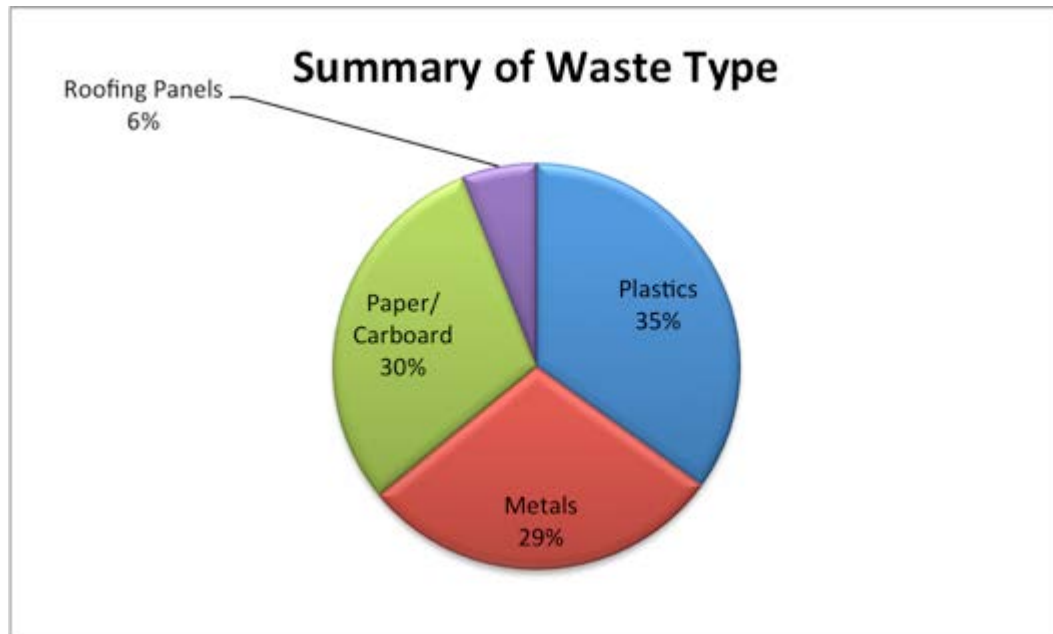


Figure 1. Pie chart of waste type from 2016/17 summer season waste data

As you can see in figure 1, plastics make up the largest % of waste within the recycled waste stream. While it is great that these plastics are being recycled, this result highlights the reliance on plastics in Antarctic activities and raises the question of whether any of these plastics could be re-used first, or swapped for other items that can be reused instead?

For part two of this case study, I analysed the information given in the food order spreadsheet, as well as visited the Antarctic Centre to photograph examples of the food boxes to get a visual understanding of what is in their that has plastic. Photographs 1-3 are examples of a field food box, where the majority of food within is wrapped in plastic packaging.





Photographs 1-3: Examples of a food box taken at the Antarctic Centre in Christchurch – shows clearly a number of items with plastic packaging, but also shows items in recyclable tins or cardboard boxes.



The food order spreadsheet gave an extensive list of all the food needed for a summer season. While the spreadsheet must be kept out of the report (a request from Antarctica New Zealand), Appendix 1 gives some examples of the spreadsheet as screenshots.

The majority of items in the food order list are wrapped in single use plastics, however due to hygiene and storage reasons, they would not be able to be taken out of these wrappers before sending down to the ice. Nor are there really any alternate products that provide the same food with a more environmentally friendly packaging option. Table one shows a rough calculation of the fraction of items in the food order that contain single-use plastics, with comments on whether these could be reduced or swapped for alternate foods.

Table 1. (Excludes dessert, meal extras such as spices and special diet items such as gluten or dairy free etc.)

Meal type	Number of plastic wrapped items	Comments
Breakfast	8/18	Cereals in boxes but also in plastic bags – option to put in a reusable

		container instead Sugar and dried fruits could also be sent in reusable containers – leave empty packets in New Zealand for direct disposal
Lunch	20/27	Things such as bread, salami or cheese would not be able to be taken out of plastic. Crackers often come in a box and then a plastic wrap – take out of plastic wrap and send in box alone, or in a reusable container.
Dinner	11/22	Meats could possibly be sent in their own containers, however plastic often spoils meat and glass is too fragile to send in cargo containers. Flavor sachets and instant veg also would need to remain in plastic.
Snacks	28/28	All single use plastics, as most snacks are single serve or non-sealable packaging. Difficult to reduce plastic as taking snacks out of wrappers and into a large container may seem unhygienic or more difficult pack and send down (in terms of space).

Case study two: PCAS Field Camp 2017/2018

The PCAS 2017/2018 group spent 4 days in the field. We had 5 kitchen groups who each had their own food box to share. We then also had a shared food box of snacks in the main tent and this contained items such as muesli bars and chocolate – items wrapped in single use plastics. The majority of snack items that students brought with them were also items wrapped in single use plastics such as – lollies, chocolate, muesli bars, nuts and dried fruit.

As we were only in the field for 3 nights, many of the food packets were opened but unfinished such as milk powder or dried instant vegetables (onions, peas,

potatoes). These then had to be disposed of back at Scott Base, with the plastic packaging thrown in general waste.

Images 4-8: Examples of the field kitchens, food boxes in the field, backcountry meals, the food storage area at Scott Base and the communal kitchen in the meeting tent at camp. The environmental conditions in the field make it harder to think about reducing plastics, as when you are there you want things that are easy to use, durable and as little fuss as possible.



Image 4



Image 5



Image 6



Image 7

Image 8



Discussion and Recommendations

Plastics are a common material used in Antarctica when it comes to packaging, preparing or storing foods, and it is easy to understand why. The cold and extreme environment requires durable and reliable materials to help food survive in the field, and plastics are used widely across the globe for this feature. When it comes to ordering food for the field, the focus is understandably on long-lasting and nutritious foods, most of which come in long lasting packaging – usually plastic based. One possible solution to reduce the amount of waste coming back due to packaging, would be to re-package suitable items (such as muesli bars or cereals) into re-useable containers instead. This is an option that is being discussed by Antarctica New Zealand currently. Another option would be to reduce the amount of packets used each trip. Due to the shorter time period we had in Antarctica, the food boxes were already packed before we left for the field. While this was of huge help to us getting to the field and getting to spend as much time there as we did, I do believe it lead to a greater amount of waste than had we packed the food boxes ourselves. Upon returning to camp and unpacking the food boxes, we found there were 6 milk powder packets all only partially used opened and in need of disposal. The dried vegetables, muesli and a few other food items also met the same fate. While some of the food could be re-used by the Scott Base kitchen, excess packaging was thrown out. To minimise this waste, a group kitchen box or being able to pack the kitchen boxes as a group may have meant we didn't all open the same things only to use a small amount of them.

We also found there were some issues with how waste was streamed at camp where many recyclable plastics were being discarded as general waste. Having taken part in the waste audit project at Scott Base, most waste was well streamed, but it was clear many people were still unaware about which plastics could be recycled or not. A greater awareness of this step would decrease the amount of plastics going to landfill. Or if any of the plastics could be reused for other purposes instead of being discarded, waste might be reduced further. An example might be re-using food containers, such as Pringles tubes.

Another observation I made while in camp and at Scott Base was the use of cable ties. While they were necessary for securing things such as poo bags from the field, they were also one of the only single-use plastic items that I saw other than those related to foods. Finding an alternative to cable ties would be a good way to reduce a large amount of single-use plastic, as I can imagine there are a large number ordered each season. I found many that had been dropped both around Scott Base and in the field, meaning these plastics were easily lost to the environment.

Ultimately, the focus for reducing plastic use is back in New Zealand. Better infrastructure for recycling plastics and new products that use fewer plastics but that are still suitable for use in extreme conditions are the best way to reduce plastics when it comes to food. More investigations would need to be done in other areas such as medical, science, personal and cleaning equipment, but a similar result is likely to occur. Both scholars and companies alike have highlighted improving infrastructure as a key step in the fight against plastic pollution. Not only will it mean less plastic waste ending up in landfill, it also provides new job opportunities and a possible new source of income (Kershaw et al, 2011). McDonald's in one such company that has awakened to the plastic problem and have expressed their plans of moving to more compostable packaging while also providing the infrastructure for their packaging to be disposed correctly. McDonald's New Zealand is a signatory to the New Zealand Packaging Accord (2004) and have committed to having 100% recyclable or renewable packaging by 2025. Packaging Forum spokeswoman, Lyn Mayes stated "there needed to be more investment in building recycling bins here to ensure consumers could dispose of McDonald's packaging, otherwise it just became litter" in an interview with Stuff in January, 2018. This move to recyclable, non-plastic materials for packaging can also be seen in the growing numbers of small businesses who are making alternate packaging option such as:

- Ecoware NZ
- Biopak NZ
- Eco-express
- Friendly Pak NZ

One possibility could be for Antarctic organisations, such as Antarctica NZ, to form a partnership with a sustainable packaging business and have suitable and sustainable packaging for food designed specifically for them. More research may need to be done to determine what materials will work in the conditions down in Antarctica, but it could be a way to move forward and get rid of plastic packaging altogether on the ice.

Conclusion

Plastics are widely used in Antarctica when it comes to storing, using and transporting food. Not only is it difficult to get food to the base, travelling out to the field to carry out research proves an even greater challenge for transporting and storing foods. Packaging and storage therefore need to be able to withstand the cold and rough environment so food does not perish. This investigation found the biggest uses of plastics when it came to food were on things such as muesli bars or chocolate, food items that were consumed the most at our own

field camp. While it may be difficult to reduce plastic waste from items such as these, there is room for improvement with other, more communal foods such as milk powder, instant veg or cereals. Better planning and management of the food boxes at camp would have definitely reduced our plastic waste while in the field. Overall however, plastic in use (when it comes to food) is actually well managed in Antarctica and it is the way we dispose of it back in New Zealand that needs to be improved. Until new, sustainable products are available to use instead, and food companies start packaging their foods in more sustainable materials, it will be difficult to reduce the plastic use in this area by much. More research would need to be done on other activities use of plastic, such as scientific or field equipment to get a holistic view of how plastics are used. To accompany this, more research could also be done on what materials are best suited to store and package food in the Antarctic environment so that plastic use can be minimized.

References

- Geyer, R., Jambeck, J, and Lavender Law, K, (2017), Production, use, and fate of all plastics ever made, *Science Advances*, (1-5)
- Kerhsaw, P., Katsuhiko, S., Lee, S., Samseth, J. and Wooding, D., (2011) , Plastic Debris in the Ocean, UNEP Year Book, (21-33)
- Ivar do Sul, J., Barnes, D., Costa, M., Convey, P., Costa E. and Campos, L., (2011), Plastics in the Antarctic Environment: Are we looking only at the tip of the iceberg?, *Oecologia Australis* 15, (150-170)
- Antarctica New Zealand, (2015-16) Waste Management, Antarctica New Zealand

Links to sustainable and re-usable packaging initiatives:

- <http://www.biopakshopnz.com/categories/Plates-Bowls-Trays>
- <http://www.wholefoodsmarket.com/mission-values/environmental-stewardship/green-mission>
- <http://www.ecoware.co.nz/custom-packaging/>
- <http://www.friendlypak.co.nz/Products/Food-Prep/Cling-Film>
- <https://www.eco-express.co.nz/bin-linersbags>