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Cruising in Uncharted Waters: A Systematic Analysis of the Sustainability of Cruise Tourism in Flåm, Norway

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Declaration

I, Kenisha Wallace Johnson, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature.....

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Abstract

When the coronavirus pandemic broke out in 2020, global cruise tourism came to a halt. After two years with little international tourism, cruise ships began to come back to Norway as normal in 2022. At the same time, the years of 2020 and 2021 were marked by increasingly noticeable climate change effects. This two-year period without cruise tourism combined with the increasing urgency of the climate crisis makes the question of cruise tourism's sustainability incredibly relevant in 2022.

This thesis investigates the economic, social, and environmental sustainability of cruise tourism in Flåm Norway using the Global Sustainable Tourism Council's Destination Criteria as an analytical approach. To do so, it uses secondary air quality data, surveys, and interviews.

This thesis finds that there are both positive and negative impacts of cruise tourism in Flåm. While the industry contributes a lot financially to the village and increases the activities available for residents, there is also the fact that many residents feel overwhelmed by the large numbers of guests. When it comes to environmental issues, the industry and local actors seem willing to address these problems, but there is little monitoring of the environment. This means that problems are not being identified and, therefore, cannot be addressed.

As cruise tourism does not seem likely to end in the near future, it is important to make the industry as sustainable as possible. For Flåm, this means that, first and foremost, monitoring of the economic, social, and environmental impacts of cruise tourism must improve.

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Abbreviations

AIS……...Automatic Identification System

EPI…….…….…….Environmental Port Index

EU……..European Union

GSTC……..…….Global Sustainable Tourism Council

IPCC…….…….Intergovernmental Panel on Climate Change

MARPOL…….. International Convention for the Prevention of Pollution from Ships

NSD……...…….…….Norwegian Center for Research Data

SDGs…..……...……..……..Sustainable Development Goals

TBT……...……...…Tributyltin

UN……...……United Nations

WTO……..World Tourism Organization

Chemical Symbols

CO…….……..……...Carbon Monoxide

CO_2……..……...……..……..Carbon Dioxide

NO……..……...……..…… Nitric Oxide

NO_X……..……..…….……Nitrous Oxides

NO_2…….…….……...…….……Nitrogen Dioxide

N_2O…….…….……...……Nitrous Oxide

O_3……...……...…….……..Ozone

PM2.5…….....……Particulate Matter 2.5

PM10…….……...……Particulate Matter 10

SO_X……Sulfur Oxides

SO_2……...……Sulfur Dioxide

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1 Introduction

The SARS-Cov-2 (hereafter referred to as coronavirus) pandemic brought global cruise tourism to a halt in 2020 after highly publicized outbreaks on cruise ships, border closures, and the introduction of travel restrictions. This abrupt change had an enormous impact on cruise destinations, and Norway has not been immune. However, after two years of travel restrictions, the 2022 travel season is poised to be an active one. Flåm Norway, which is used as a case study in this thesis, is expecting 120 cruise ship calls in 2022 (Flåm Port, 2022). This is only a little bit less than 2019 which had 151 cruise ships call according to the call list I obtained from Flåm Port.

2020 and 2021 were also plagued with climate change related extreme weather events. Additionally, the most recent Intergovernmental Panel on Climate Change (IPCC) report on climate change impacts, adaptation, and vulnerability tells us that unless we take drastic action, we are facing increasingly extreme climate change which will threaten natural and human systems (IPCC, 2022).

This threat means that humanity needs to reconsider many aspects of society and the two years with little or no cruise tourism provide the perfect opportunity to evaluate the sustainability of the industry in Flåm and the impacts it has had on the local community and environment.

This thesis aims to contribute to this work and investigate the sustainability of cruise tourism in Flåm. The research question is as follows:

To what extent is cruise tourism in Flåm, Norway sustainable?

With the sub-questions of:

Is cruise tourism in Flåm economically sustainable?,

Is cruise tourism in Flåm socially sustainable? And,

Is cruise tourism in Flåm environmentally sustainable?

1.1 Research Contribution and Originality

While there has been some limited research on the impacts of cruise tourism in Norway and several Master´s theses addressing Flåm specifically, this thesis contributes to filling a research gap by systematically addressing the question of the sustainability of cruise tourism in Flåm. Furthermore, there has been very little work done looking into the environmental impacts of cruise tourism in Flåm or even in Norway as a whole, and this thesis also begins to address that gap.

1.2 Structure

To address these questions, I use secondary data, surveys, and semi-structured interviews. The results of this research are then discussed through the lens of the Global Sustainable Tourism Council (GSTC) destination criteria. This thesis is broken down into a total of seven sections, followed by references and appendices. In section two I present the relevant background information to this study. In section three I discuss my analytical approach and positionality. In section four I present my methods and discuss ethics and limitations. Section five contains the results of my work, and section six is an analysis and discussion of these results. Finally, section seven is the conclusion.

2 Background

This section presents the relevant background to this thesis. This includes the concept of sustainability, the economic, social, and environmental impacts of cruise tourism, a brief history of cruise tourism in Norway and Flåm and the research that has been done, an explanation of relevant governing bodies and regulations, and, finally, the GSTC´s destination criteria.

2.1 Sustainability

Sustainability has been defined by the United Nations (UN) Brundtland Commission as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). This is the most widely used definition of sustainability and it is closely linked with the Sustainable Development Goals (SDGs). The SDGs are, in turn, integrated into the GSTC´s Destination Criteria for sustainable tourism. Therefore, this is the definition of sustainability that I use in this thesis.

2.2 The Economic, Social, and Environmental Impacts of Cruise Tourism

In order to discuss the economic, social, and environmental sustainability of cruise tourism, it is first necessary to establish what the economic, social, and environmental impacts of cruise tourism are. Therefore, this section discusses the known impacts of cruise tourism generally, without focusing on Flåm or Norway yet.

Cruise ships bring (largely foreign) tourists to destination ports where they book activities and buy souvenirs. Naturally, they are seen as a source of income and jobs for these destination communities. Despite the size of the cruise tourism industry and the fact that it is the most profitable type of tourism globally (Honey, 2019), there has been little research done on the economic impacts of cruise tourism. The research that has been done is mainly in the form of case studies of particular locations. In their study on the spending distribution of cruise tourists in Uruguay, Brida, Lanzilotta, Moreno, & Santiñaque. (2018) pointed out that this makes it impossible to make generalized statements. While it is certain that cruise tourism makes some positive economic contributions to destination communities, the industry can also be problematic – both locally and globally. Locally speaking, there is the risk that the economic benefits of cruise tourism are not distributed equally or fairly. Globally, there is the issue of exploitation. Cruise ships tend to be registered in countries with weak labor and tax laws, allowing them to

pay their employees, who often come from poorer countries, very low wages – especially when compared to wages in the countries they visit and the countries that the tourists come from (Honey, 2019). This issue is made worse by the fact that cruise employees are frequently subject to discrimination, with white employees taking the higher paying, passenger facing jobs while employees of color are paid less and sometimes even segregated from guests (Honey, 2019). This exploitation and discrimination of employees does not directly impact the destination communities, but it is an important issue to keep in mind when considering the sustainability of the industry.

Cruise tourism also has social impacts on destination communities. These can be negative impacts such as the crowding and annoyance of the local population, or positive impacts such as increased employment opportunities and activity offerings. Generally, the power imbalance between the cruise companies and the local communities means that residents and local stakeholders do not have a lot of say in the development of cruise destinations (James, Olsen, & Karlsdóttir, 2020). This means that residents may suffer negative social impacts. In some cases, there is also the risk of exploitation of and discrimination against local populations. There is, furthermore, the risk that cruise ship pollution can harm the local populations´ health, although there is no systematic monitoring of this (Lloret, Carreño, Carić, San & Fleming, 2021). Unfortunately, research on the impacts of cruise tourism on destination communities is very limited in terms of accuracy and transparency (Wozniak and MacNiell, 2018). It is also limited in that it is typically only done after cruise tourism in the location has begun, so there is no baseline to compare with (Wozniak and MacNiell, 2018).

Finally, cruise tourism is known to harm the environment. Originally, most of the attention on these negative impacts was on waste dumping at sea, which led to the creation of the International Convention for the Prevention of Pollution from Ships, also known as MARPOL, in 1973 (Honey & Bray, 2019). Unfortunately, the creation of MARPOL did not completely solve the issue, and cruise ships still damage the environment by dumping sewage, greywater, water containing cleaning chemicals, bilge water, and ballast water into the ocean (Carić & Mackelworth, 2014). This dumping can cause a myriad of problems such as eutrophication and dead zones, the bioaccumulation of toxic substances in animals, and the spreading of invasive species to new environments (Carić & Mackelworth, 2014). Cruise ships also harm the

environment with their emissions to the air. These emissions include greenhouse gases and toxic pollutants such as nitrogen oxides (NO_X), sulfur oxides (SO_X), carbon monoxide (CO), ozone (O_3), and particulate matter (PM2.5 and PM10) (Carić & Mackelworth, 2014). All fuel burning pollutes the air, but the issue is exacerbated by the fact that cruise ships typically burn bunker fuel, which is what is leftover once other fuels are extracted from crude oil (Honey & Bray, 2019). Cruise ships also emit air pollutants from the burning of solid waste and are responsible for marine debris (Carić & Mackelworth, 2014). Some additional potential environmental impacts are noise and light pollution, and collisions with animals (Carić & Mackelworth, 2014), as well as the environmental hazards created by cruise ship accidents such as oil spills (Lloret et al., 2021). Recently, cruise companies have put in a great deal of effort to shape a positive image regarding environmental responsibility, but a literature review of recent studies by Lloret et al. (2021) have found that this image is inaccurate.

2.3 Cruise Tourism in Norway

Cruise tourism to Norway has risen rapidly, increasing by nearly eight-fold since 1995 with around 800,000 cruise tourists visiting Norway in 2018 (Dybedal, 2018). Most of them visited western Norway, and at the time the report by the Norwegian Transport Economics Institute was written, their numbers were expected to increase (Dybedal, 2018). In 2019, another report by the Transport Economics Institute predicted that by 2040 there will be an annual 1,000,000 cruise tourists visiting south-western Norway alone (Dybedal & Jacobsen, 2019). This projection assumes that the growth continues as normal, and the same report acknowledges that different factors could change the trajectory of cruise tourism in Norway (Dybedal and Jacobsen, 2019). These factors include environmental concerns and regulations, as well as tourists or cruise companies deciding to focus on different locations (Dybedal & Jacobsen, 2019).

This rapid growth in cruise tourism has led to increased interest in the industry in the media and in academia. A Western Norway Research Institute report, referencing a 2018 analysis of media reporting written by Iversen and Hem, describes this attention as being of two main types: pro-cruise and skeptical of cruise with calls for stronger restrictions (Walnum, Gössling, Simonsen, Iversen, Hem, Dybedal, & Jacobsen, 2019). However, they reference the same analysis by Iversen and Hem as finding that much of the media attention is based on undocumented claims and subjective experiences (Walnum et al., 2019).

When it comes to cruise tourism in Norway, there has been some limited academic research – including several masters theses – as well as some professional reports written by private industry actors and public agencies. Much of this research, however, is based on modelling. For example, in their paper addressing cruise emissions in Norway, Simonsen, Gössling, and Walnum (2019) used Automatic Identification System (AIS) data to track the ships´ locations and calculate their estimated carbon dioxide (CO_2), NO_X, and PM2.5 emissions in Norwegian ports and Norwegian waters. They acknowledge that this probably underestimates the emissions because they assume that all the cruise ships burn the legally required fuel while in port, which may not be the case (Simonsen et al., 2019). However, they also point out that this is the first time anyone has even attempted to model this data and that the lack of emissions data is a large barrier to the regulation of cruise ships in Norway (Simonsen et al., 2019). Another report from the same project estimated that the lack of cruise tourism in 2020 saved western Norway from 60,000 tons of CO_2, 766 tons of NO_X, and 49 tons of SO_X (Simonsen, 2021).

The Norwegian Maritime Authority (2017) has also looked into air pollution as part of a more comprehensive report on cruise ship emissions to the atmosphere and the ocean in heavily trafficked fjords. Their findings include claims that Flåm's NO_X levels are sometimes over the boundary set by the Norwegian government and that emissions to the sea come mostly from local ship traffic rather than cruise ships (Norwegian Maritime Authority, 2017). Once again, these claims are based on modelling rather than monitoring, and the data put into the models comes largely from voluntary surveys given to the ships, with the surveys and the modelling being carried out by Ramboll Consulting (Norwegian Maritime Authority, 2017).

There has also been some research into the societal impacts of cruise tourism, with a case study of the Geiranger area finding that farming, although important in maintaining the landscape and culture that draw the tourists, is neglected at the expense of catering to them (Vik, Benjaminsen, & Daugstad, 2010). The same paper identified a divide in the way the issue is framed, with the two main narratives being one of synergy promoted by those in the tourism sector and government officials involved in its management, and one of the marginalization of farmers put forth by the farmers (Vik et al., 2010). Both groups agree, however, that rural Norway is marginalized (Vik et al., 2010).

2.3.1 Cruise tourism in Flåm

Figure 1: Map of Aurlandsfjord
A map showing the Aurlandsfjord retrieved from norgeskart.no (Norwegian Mapping Authority, 2022) and edited to show Flåm, Aurland, Aurlandsfjord and Nærøyfjord

Flåm is small village in western Norway and is a part of Aurland Municipality, which has a population of 1766 (Statistics Norway, 2022). The village is located at the end of the Aurlandsfjord. The neighboring fjord branch, Nærøyfjord, has been designated as a UNESCO World Heritage Site. Both are branches of the Sognefjord, Norway´s longest and deepest fjord. Aurlandsfjord is deep and narrow and is surrounded by high cliffs. The village of Flåm is a popular tourist destination due to its picturesque location and the draw of the famous Flåm Railway. Tourists come from all over the world by car, train, and boat. Aurland Municipality and the village of Flåm are therefore reliant on tourism as a source of income.

Figure 2: Sognefjord A map showing the Sognefjord, retrieved from norgeskart.no (Norwegian Mapping Authority, 2022) and edited to show Flåm

Many of these tourists come on cruise ships. Flåm Port received 151 cruise ships in 2019 according to the list I obtained from the Aurland Port Authority, and they are expecting 120 in the 2022 season (Flåm Port, 2022). These cruise ships have the potential to impact Flåm in a variety of ways, with the industry bringing in income for the community, the large volume of tourists having numerous social effects, and the tourism operations and the ships themselves affecting the local environment.

Simonsen et al.´s, (2019) modelling work suggests that emissions are high in Flåm, and that there is a need for more air quality monitoring. This need for more monitoring was also identified in 2010, when Manzetti and Stenersen (2010) studied the environmental condition of the Sognefjord. They found that there has been very little research done on the subject, despite the fact that the fjord´s ecological condition seems to have declined drastically, and despite their identification of several threats to the fjord (Manzetti & Stenersen, 2010). These threats include local industry, hydroelectric plants, sewage dumping, and shipping (Manzetti & Stenersen, 2010). They also noted that there has been no investigation into the environmental impacts of the building of the cruise ship ports or the dumping of rock into the fjord when they built the tunnels (Manzetti & Stenersen, 2010). Some of these findings were confirmed by Opdal, Aksnes, Rosland, and Fiksen (2013) who found that there has been very little systematic research into the Sognefjord. The same study found that most quantitative studies were conducted after 1980, meaning that it would be difficult to monitor any changes to the condition of the fjord (Opdal et al., 2013).

Research into cruise tourism in Flåm has generally found that the community is split in their opinions of the industry. A report written in the wake of the coronavirus pandemic´s halting of cruise tourism in 2020 found that many residents feel that Flåm is invaded by tourists in the summer, and some even leave the area to avoid the stress (Urbaniak-Brekke, Simonsen & Engeset, 2021). This applied especially to young adults and those with small children, who were also more concerned with the environmental and climate aspects of cruise tourism than older study participants (Urbaniak-Brekke et al., 2021). On the other hand, the same study found that the oldest residents have a sentimental attachment to the cruise ships and missed them in 2020 (Urbaniak-Brekke et al., 2021). These divided feelings have also been found by master´s students researching cruise tourism in Flåm. Dybwik (2020) wrote about this phenomenon, pointing out

that the tourism industry is aware of their responsibility for the local environment and has been focusing more on sustainability, while at the same time one can see in newspapers and Facebook comment sections that some residents feel that cruise tourism destroys the natural environment. The same thesis referenced the Norwegian Farmers´ "Hay Bale Action" [Høyballaksjon] against cruise tourism in 2014 and listed some of the concerns at that time as being that smoke from the cruise ships reaches the farms and that the cruise ships block the views (Dybwik, 2020). Additionally, residents complained that cruise tourists used their gardens as bathrooms, although the Port Authority thought this was more likely to be campers than cruise tourists, since cruise tourists have bathrooms on the boat (Dybwik, 2020).

In her master´s thesis on Flåm as a tourist village, Nicolaisen (2020) identified positive and negative effects of cruise tourism and tourism in general. On one hand, cruise tourism has increased the offerings available to residents when it comes to activities, restaurants, and jobs (Nicolaisen, 2020). On the other hand, many residents feel that they have lost their town to tourism (Nicolaisen, 2020). Some examples of this include a local football field becoming a parking lot in the summer, residents travelling to other towns to go grocery shopping because the local stores are full of tourists, and residents feeling like foreigners because there are so many foreign workers and guests that they are unable to speak Norwegian around town (Nicolaisen, 2020). The high number of tourists also impacts farming, with farmers having to schedule their movement of animals around when there will be lots of visitors and the town ending the practice of using the Flåm Railway to transport sheep because the space was needed for tourists (Nicolaisen, 2020). Finally, Nicolaisen (2020) found that tourism and related issues have also created tension among residents. One participant described the foreign workers who come to Flåm in the summer as forming a ghetto and complained that they don´t contribute to the local society (Nicolaisen, 2020). Other participants said that they do not state their opinions on tourism publicly for fear of losing business from the companies involved in the industry (Nicolaisen, 2020). On the other hand, Nicolaisen's (2020) informants said that those who have moved to Flåm on a year-round basis have a hard time integrating into society, and that society is split into three different groups of those who were born and grew up in Flåm, those who moved to Flåm permanently, and seasonal workers. When it comes to environmental impacts, Nicolaisen (2020) heard from multiple informants that there have not been any fish in Aurlandsfjord since 2006. These informants blamed the cruise ships, although Nicolaisen (2020) points to reports that other

activities may be responsible for this and Manzetti and Stenersen (2010) have identified some of those potential causes. Finally, informants expressed concern over the air pollution from cruise ships and the fact that the children were growing up with the smell of oil and particulate matter in the air (Nicolaisen, 2020).

These same environmental impacts were identified in Standstå's (2019) Master´s thesis, with her participants also disclosing that there are no fish in the fjord and discussing the smell coming from the boats. Additionally, they also expressed a discomfort from knowing how much the boats pollute even when they can´t see or smell the smoke (Standstå, 2019). Participants in the study also complained about the noise coming from the cruise ships, and one noted that there seems to be a large distance between the sustainability marketing of Flåm as a cruise destination and the reality of the situation (Standstå, 2019). This thesis identified the same economic impacts as the others discussed in this section, with some participants saying that cruise tourism is incredibly important to Flåm´s economy, while others pointed to the unequal distribution of the money the cruise tourists spend (Standstå, 2019).

2.4 Governance, Rules, and Regulations

There are a variety of rules governing cruise ships and their emissions in Norway. First and foremost, they must always follow the rules set forth by MARPOL. Within Norway, there is some difference in authority depending on where the ships are. While they are in Norwegian waters, they are under the authority of the Norwegian Maritime Authority (Sjøfartsdirektoratet) and the Norwegian Coastal Administration (Kystverket).

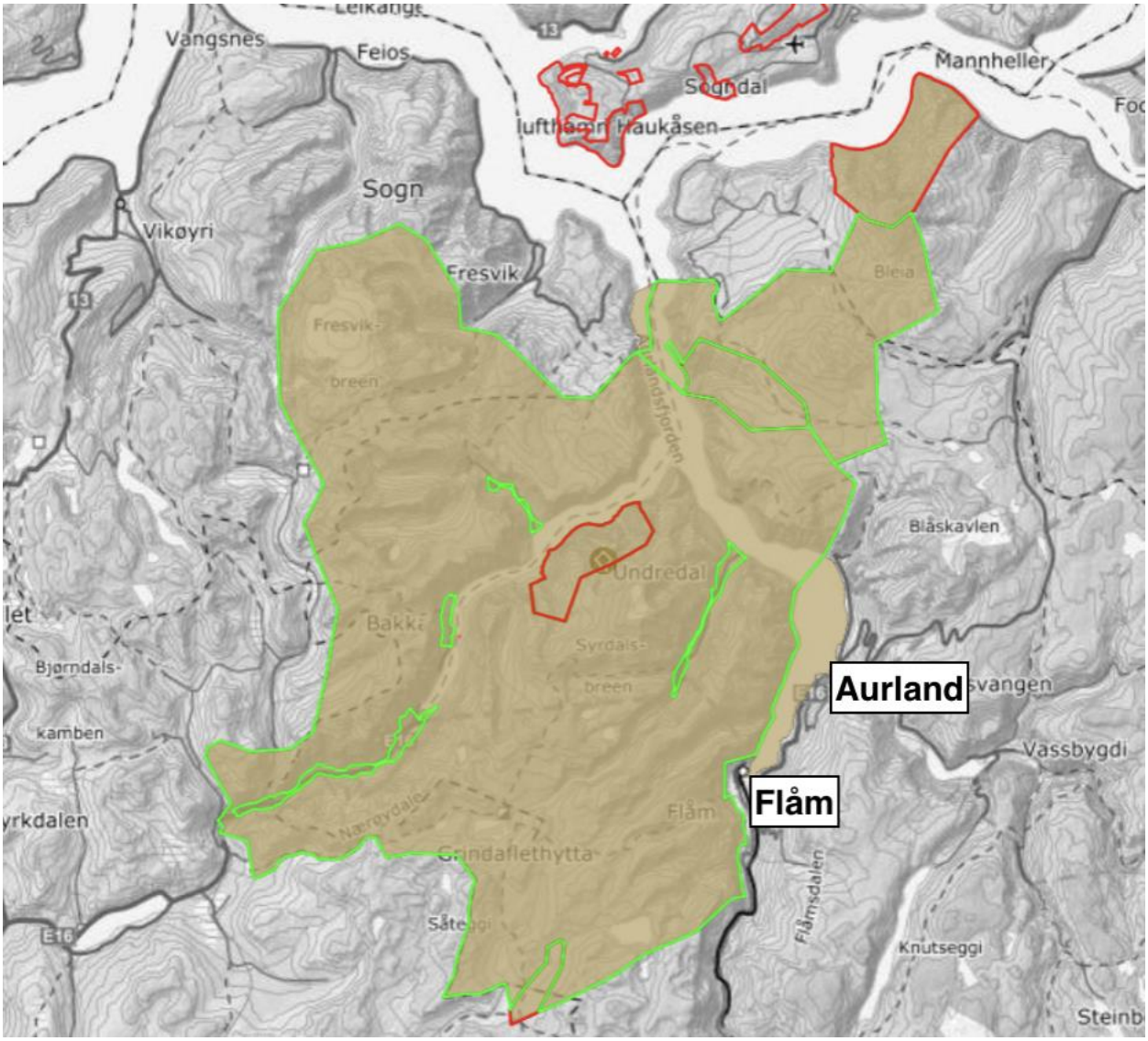

Figure 3: Map of the World Heritage Area and the Protected Area

This map is retrieved from fylkesatlas.no and shows the Nærøyfjord World Heritage Area shaded in brown, with the Protected Area outlined in green. The areas outlined in red are nature reservations. I have edited the map to show the locations of Flåm and Aurland (Fylkes Atlas Vestland, 2022).

Within the World Heritage Park, which the Aurlandsfjord is a part of, there are additional rules. In 2017 the Norwegian Parliament passed a resolution requiring that cruise ships in the World Heritage Fjords be emission free as soon as technologically possible, and by 2026 at the latest (Norwegian Parliament, 2018). This rule has been implemented in different tiers in order to reduce the emissions of harmful pollutants in the area, with Tier One being implemented in 2020 and Tier Two in 2022. Some cruise ships are already not allowed to come to Flåm because of their emissions. In addition to having additional national regulations, the World Heritage Park is

governed by a council made up of the mayors and deputy mayors of the four bordering municipalities, county politicians, and representatives of other interest groups (Stokke, Haukeland, and Clemetsen, 2016).

The regulatory situation is further complicated by the fact that 96% of the Nærøyfjord World Heritage Area is also a protected area (Stokke et al., 2016). In this respect, the Norwegian Environment Agency has authority through the Norwegian Nature Surveillance (Stokke et al., 2016). The protected area is managed by an inter-municipality protected area board, where employees are employed by the county (Stokke et al., 2016). The cruise ships must sail through the protected area in order to reach Flåm, but Aurland Municipality and the Aurlandsfjord are not part of the protected area. Here, the Aurland Port Authority has responsibility for managing the fjord in line with the Norwegian Harbors and Waters Law (Stokke et al., 2016). One challenge, specifically in terms of the regulation of emissions and other environmental impacts of ships, is that under this law the port is required to accept any ship which wishes to stop there (Stokke et al., 2016). Finally, Flåm itself is a part of Aurland Municipality which is governed according to the Planning and Building Act.

2.5 Global Sustainable Tourism Council Destination Criteria

Sustainable tourism is defined by the World Tourism Organization (WTO) as "tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities" (UN, 2022). This is the definition which has been adopted by the UN. For tourism destinations, this can be assessed using the GSTC´s Destination Criteria. These criteria were designed as guidelines for tourism destinations that want to be sustainable, and to help sustainability minded tourists identify suitable destinations, among other things (GSTC, 2019).

In this thesis, I use the GSTC's destination criteria to assess the sustainability of cruise tourism in Flåm. The thesis addresses each of the criteria but focuses on the environmental aspects as this is where the biggest information gaps are. I selected these criteria to use as a framework because they break sustainability into different aspects, which is useful for this discussion.

The GSTC sustainable destination criteria are broken down into four main criteria, each of which has its own sub-criteria. The criteria are presented in below:

Criteria	Sub-Criteria
A. Sustainable Management	a. Management structure and framework
	b. Stakeholder engagement
	c. Managing pressure and change
B. Socio-economic sustainability	a. Delivering local economic benefits
	b. Social wellbeing and impacts
C. Cultural sustainability	a. Protecting cultural heritage
	b. Visiting cultural sites
D. Environmental sustainability	a. Conservation of natural heritage
	b. Resource management
	c. Management of waste and emissions

Table 1; Global Sustainable Tourism Council Destination Criteria

These sub-criteria are then further broken down into several different aspects of consideration, and each has its own corresponding indicators and is paired with specific sustainable development goals (GSTC, 2019). Some of these sub-criteria and their indicators are aimed at developing or historically disadvantaged locations and are not as relevant for a destination such as Flåm. This is discussed where relevant.

3 Analytical Approach

This section discusses the approach I have taken to analyzing and discussing my results. First, I explain my use of the GSTC Destination Criteria as a framework for the discussion. Finally, I discuss my positionality and its significance to the thesis.

3.1 Global Sustainable Tourism Council Destination Criteria

Selecting an analytical approach and framework for discussion for this topic was difficult. As a part of their work, Alfaro Navarro, Andrés Martínez, & Mondéjar Jiménez (2018) carried out a literature review of different sustainable tourism indicators and found that there is no single widely accepted indicator. Additionally, most of the scientific literature around sustainable tourism indicators and assessments focuses on the development of new indicators, rather than the application of existing ones (Kristjánsdóttir, Ólafsdóttir, & Ragnarsdóttir, 2018). Environmental impact assessments were not feasible for this case study, as they require a lot of data which does not exist for Flåm. Furthermore, this was meant to be a mixed methods study, not a purely quantitative one.

I chose to frame my discussion around the Global Sustainable Tourism Council´s Destination Criteria because these criteria covered all three aspects of sustainability that I planned to investigate, allowed for qualitative assessment, are user friendly, and are internationally recognized. It was important to me to select a method of analysis that was accessible to people outside of academia, as I want my research to contribute something of value to the case study region, rather than just benefiting me. In this way, the GSTC Destination Criteria are very helpful, as they are designed for among other uses, educational and commercial use (GSTC, 2019).

3.2 Approach and Positionality

Although this thesis makes use of mainstream and even commercial concepts in its conceptualization and theory, I take a critical approach in my analysis. Specifically, I take a political ecology approach in that I consider power dynamics throughout my research (Benjaminsen and Svarstad, 2021). I also do not take for granted that the criteria and indicators listed are correct and necessarily indicative of sustainability.

It is possible that my own beliefs and biases have impacted my interpretations and findings despite my efforts to prevent this. First, I must disclose that I am in general critical of the concept of sustainability as defined by the UN, and of the SDGs. Additionally, I have an environmental science background and have spent the past two years in an environmental studies program and am therefore predisposed to be more concerned about the environmental aspects of sustainability and skeptical of sustainability claims made by industry actors.

4 Methods

This section discusses the methods used in this thesis. It begins with a presentation of Flåm as a case study area, before moving on to an explanation of my mixed-methods, interdisciplinary approach. I then discuss the different data collection methods I used for this thesis, as well as my methods of analysis. Finally, I delve into the relevant ethical considerations and limitations of this study.

4.1 Case Study Flåm

I chose to use a case study approach to my investigation of the sustainability of cruise tourism because it is a complex topic, and the sustainability of tourism is dependent on many industry and location specific factors. I chose to use the village of Flåm and corresponding Aurlandsfjord (and, to a certain extent, Nærøyfjord) because it is one of Norway´s most famous tourism destinations, and I anticipated that the small size would mean residents would notice cruise tourism's local impacts. Due to Flåm's small size and inclusion in Aurland Municipality, residents of the entire municipality, rather than just Flåm, were included in the surveys and interviews. Additionally, while Flåm sits on the edge of the Aurlandsfjord, I also included the Nærøyfjord because they are connected and impact each other.

4.2 A Mixed-Methods Interdisciplinary Approach

This thesis is a mixed methods study, making use of secondary data, surveys, and interviews. I used these methods with the aim of increasing the completeness of my study, meaning that by combining multiple methods, I hoped to gain a more comprehensive understanding of the sustainability of cruise tourism in Flåm (Bryman, 2012).

This thesis is also interdisciplinary, meaning that I have used and integrated multiple disciplines, although they are still distinguishable from each other (Sumner & Tribe, 2008). These include a natural science-based environmental science approach to the environmental aspects of sustainability and a political ecology approach to the social and economic aspects.

4.3 Data Collection

4.3.1 Secondary Data

This thesis makes use of air quality data which has been collected by the Flåm Port, under the Aurland Port Authority, since June of 2019. The Flåm Port displays the previous seven days´ air

quality measurements on their website (https://www.flamport.no/environment-), and I obtained access to the historical data by contacting the Port Authority. I also used the cruise ship call lists for 2019, 2020, and 2021, all of which are available on their website.

When I retrieved the historical air quality data, there were several options. I downloaded the data as one-hour averages in order to preserve as much of the variation as possible without having an overwhelming number of data points. This was not possible for carbon monoxide, however, which I downloaded as eight-hour averages. This data was collected for two different air quality monitoring stations, Sentrum and Utkant, which were downloaded and analyzed separately.

4.3.2 Surveys

This study also uses surveys in order to include resident opinions and insights. By posting Norwegian and English versions of the survey in the Facebook group "Kva skjer i Aurland kommune?", [What's happening is Aurland Municipality?] I used convenience sampling to find participants. I used this method of sampling because I was not able to travel to Flåm due to the pandemic, and it limits the sampling bias in that people with a variety of opinions are likely to be in the Facebook group. This method resulted in a total of 55 responses, with 51 coming from the Norwegian version of the survey and 4 from the English version.

I wrote the survey in English first, and then translated to Norwegian. Before publishing the survey, I had it looked over by a native Norwegian speaker to ensure the questions and answer options were clear. I then distributed both the Norwegian and English versions of the survey to make it as accessible to as many people as possible and get the largest number of responses possible. Both versions are in Appendix A.

4.3.3 Semi-Structured Interviews

I used semi-structured interviews with open-ended questions to give interviewees the chance to talk about what they felt was important, and to avoid influencing the results as much as possible. It is difficult to ensure that all biases are removed however, and I have kept in mind the possibility that my questions or behavior during the interviews may have biased the results. I used different interview guides for different participants to get the most relevant information from participants, as they had different areas of expertise and relationships to cruise tourism. The process was also iterative, meaning I updated the interview questions as I learned new information, which resulted in slightly different interview guides even among the same

categories of participants. Additionally, two interviews were conducted in Norwegian. All of the interview guides are available in Appendix B, although many of the interviews included follow-up questions which are not listed in the interview guides.

I found some people to contact on websites for Aurland Municipality and Flåm Port, although not all of them responded to my requests. I also attempted to get into contact with people who were studying cruise tourism or working on nearby environmental projects or with tourism in the area, with limited success. Finally, I invited survey participants who indicated that they were interested in following-up to be interviewed, which resulted in two additional interviews.

The interviews were conducted online, via zoom or teams depending on the preference of the participant. I audio recorded and transcribed all interviews for analysis. One I was done with the transcriptions, I deleted the audio recordings.

The interviews conducted in Norwegian were somewhat limited by my Norwegian skills, as I was less able to ask follow-up questions. Despite knowing this would be a problem, I offered to use Norwegian if the participant preferred it in order to make it a more comfortable experience for them.

4.4 Data Analysis

This section describes the methods I used to analyze the secondary, survey, and interview data.

4.4.1 Secondary Data

Before I could analyze the air quality data from the Aurland Port Authority, I had to clean it. There were both large and small gaps in the measurements and in order to graph the measurements and analyze the data I needed to have x-values for each hour of each year. This meant adding the missing times to the data, even though no air quality measurements would be associated with those times. I did some of this by hand, but much of it was coded by a Data Science Masters student who wishes to remain anonymous. I then carefully checked the data before doing any analysis. Additionally, there were some outliers which had to be removed. For some pollutants, the first measurement after a period of no measurement was almost always drastically higher than any of the measurements afterwards. I deleted these values before doing any analysis.

I also needed to combine the cruise ship and air pollution data. To do this, I added the hourly cruise ship call data to the hourly air pollution data, keeping a count of the total number of cruise ships in Flåm at any given time. When recording the times that a cruise ship was in Flåm I chose to be inclusive. This means that if a cruise ship was listed as being in Flåm from 11:00 to 17:00, I listed it as present in Flåm for the hour beginning at 17:00. I did not make a distinction in the data if a ship left partway through the hour, meaning that a ship leaving at 17:00 would look the same as a ship leaving at 17:30 in the data.

For the analysis, I graphed the one-hour averages of each pollutant at each air quality monitoring station as a function of time. I also calculated the average annual and high season concentrations for each pollutant at each monitoring station. Finally, I looked for patterns in the pollution levels and cross-checked any spikes in pollutant concentrations with the cruise ship data.

4.4.2 Surveys

To analyze the survey results I exported the responses to excel and categorized the responses. When asking for gender, for example, I had used an open-ended short answer question to allow for as much freedom as possible for participants. I coded responses of “kvinne”, “dame”, and “hokjønn” as F, and responses of “mann” became M. I also coded the responses to the questions regarding cruise tourism´s impacts so that they could be averaged and analyzed. The most negative responses, (“very bad”, “very negative”, “no influence” and “no cruise tourism”) received a point value of one, while the most positive responses received the highest point values.

After coding the data, I divided it into multiple sets to look for patterns. The data were divided by gender, age, amount of time with a close connection to Flåm, and highest level of education. I then averaged the responses to each question for each group and compared.

Finally, in order to analyze the answers provided by the respondents in the “anything you would like to add” section of the survey, I coded them to look for common themes.

4.4.3 Semi-Structured Interviews

I audio recorded and transcribed each interview to use for analysis. Once transcription was complete, I deleted the recordings. I had to transcribe some of the interviews by hand due to background noise, but some were transcribed by word before I checked them for accuracy.

Where I transcribed by hand, I did not transcribe word for word, but rather with the goal of maintaining the meaning of the statement.

After the interviews were transcribed, I coded each one for the main ideas to find common themes.

4.5 Ethical Considerations

All participants for both the surveys and the interviews were provided with information so that the requirements for informed consent have been met. I met the Norwegian Center for Research Data (NSD) requirements and received approval for this project. All participants were informed that they could withdraw their consent at any time without consequences. Since the survey was distributed online by me and I reached out to all interview participants individually and independently, there is very little risk of participants feeling obligated to be a part of this study.

All survey participants are anonymous, and data from the surveys is discussed in an aggregate manner, meaning it is not possible to know what an individual participant answered for the different questions.

Two of the interview participants who were contacted in connection with their professions and spoke about their jobs are referred to by name and have consented to this. The other interview participants are referred to anonymously. I have also taken care to avoid divulging any potentially identifying information in my discussion of these interviews. The interviews were audio-recorded for the sake of transcription and analysis. I was the only person who had access to these recordings, and they were deleted immediately after I finished transcribing them. Additionally, once this thesis is complete, the transcriptions will also be deleted.

4.6 Limitations

This study has been limited by practical and ethical considerations, which I discuss in this section.

First and foremost, this study has been limited by the coronavirus pandemic. This thesis is built on a case study, but I did not travel to Flåm to carry out fieldwork for both ethical and practical reasons. I was very concerned about the ethical implications of travelling to a small, somewhat remote community in the middle of a pandemic to conduct interviews and surveys and did not want to risk bringing coronavirus from the Oslo area to Flåm. This was a large part of the reason

I did not conduct physical fieldwork. Coronavirus was also a practical challenge, as I myself caught it two times during the writing of this thesis. Additionally, I conducted my fieldwork in the midst of a wave of coronavirus infections, which made scheduling interviews difficult. This difficulty with planning also contributed to my decision to conduct my fieldwork virtually. I am confident that this was the right decision, but aware that this is a serious limitation for this study.

This study has also been limited by data availability. When I conceived of this thesis, I planned to combine physical science data on air and water quality with interview and survey results, but this has not been entirely possible. For one, there is no time series water quality data available for the Aurlandsfjord or the Nærøyfjord. Additionally, the air quality data from the Flåm Port is limited. They only began measuring the air quality partway through 2019, meaning this data does not include a full cruise season. Additionally, there are several large data gaps, so the data I did have was not complete.

There have also been limitations to my primary data collection. I used convenience sampling for the surveys, and carried this out by posting in the Facebook group "Kva skjer I Aurland kommune?" There are some disadvantages to this method: not everyone is on Facebook, and people with a strong opinion or vested interest are more likely to reply (although this would probably be a problem no matter how the survey had been distributed). The results might also be skewed by the demographic make-up of Facebook users.

There were also limitations to my interview methods, both in the sampling and in the interviews themselves. When it comes to sampling, I was limited by a low response rate to my interview requests, which I suspect would have been less of a problem if I had been able to travel to Flåm. I was also limited by my own knowledge of the governance system in Norway and the relevant research fields. While I do speak Norwegian, it takes longer and my lack of familiarity with Norwegian academic and governance institutions meant that it took me longer to find and identify relevant people to contact. It is also possible that I missed some entirely. Finally, the two interview that took place in Norwegian were limited by my Norwegian skills as I was less able to ask follow-up questions.

My analysis of all the results presented below is also limited by my own biases, which have been disclosed in the positionality section of this thesis.

5 Results

In this section I present the results of my research broken down into three sections. First, I present my findings from the secondary data, then the survey findings, and finally the findings from the interviews. The average values in the tables have been rounded to three decimal points.

5.1 Secondary Data

Figure 4: Air Quality Monitoring Stations
A map obtained from Flåm Port showing the locations of the air quality monitoring stations

Flåm Port has collected historical air quality data stretching from mid-2019, when they began monitoring, to the present day. There are two different monitoring stations, one in downtown Flåm (hereafter referred to as Sentrum, which is what they named it) near the port, and one further up the valley (hereafter referred to as Utkant, which is also what they named it). The location of each sampling station is shown on the left. The Sentrum data starts on June 20, 2019, and the Utkant data begins on July 8, 2019 – both of which are pre-pandemic. I chose to cut the data off on December 31, 2021 because this data was downloaded in January of 2022, and it made for a natural stopping point.

In 2019 158 cruise ships called at Flåm Port, according to the call list they shared with me. The vast majority (136) came between May and September. Unfortunately, Flåm Port did not begin collecting air quality data until mid-June of 2019, and there is a gap from late-June to early July. For this reason, this analysis will focus on the months of July and August when comparing cruise tourism high season air quality across the years. These are the only two months which had 30 or more cruise ship calls in 2019 and consistent data collection. In some cases, I have not calculated the July to August summer season averages because there were too few or no measurements

taken during this period. Additionally, it is important to note that the annual averages are based on the available data, which had large gaps.

Previous research has established that the smoke coming from cruise ships is generally made up of NO_X, SO_X, CO_X, O_3, and suspended particles (Carić & Mackelworth, 2014). Heavy oil use is known to cause a lot of pollution, although the Norwegian Maritime Authority (2017) found that only 12% of cruise ships who responded to their survey said that they use heavy oil in the World Heritage fjords. The Norwegian government has also established specific emissions requirements for the World Heritage fjords, with a goal of zero emissions by 2026 (Norwegian Parliament, 2018). Additionally, two interviewees claimed that the visible smoke coming from the cruise ships is mainly carbon dioxide and water vapor. According to the Norwegian Maritime Authority (2017), current knowledge suggests that it consists of mainly particulate matter, NO_X, and water vapor. It is difficult to know, however, exactly what the cruise ships are emitting because there is very little monitoring of their fuel use or emissions (Simonsen et al., 2019). Therefore, this study looks at all pollutants which are known to come from ships and for which Flåm Port has collected measurements. These include NO_2, SO_2, O_3, PM 2.5, PM 10, and CO. The data for CO was only available in eight-hour averages, but all the others are one-hour averages.

5.1.1 Nitrogen Dioxide

Nitrous oxides (NO_X) have been identified by the Norwegian Maritime Authority (2017) as one of the main components of smoke emitted by cruise ships in the World Heritage Fjords, which include the Nærøyfjord. NO_X generally refers to nitric oxide (NO) and nitrogen dioxide (NO_2). Flåm Port's air quality measuring has only collected data for NO_2, which is presented below. The vertical axes are set at 250 micrograms (μg) per cubic meter, even though some values are off the chart. This is because setting 250 $\mu g/m^3$ as the maximum value includes most of the data points and allows us to see the general trends in the average NO_2 concentration throughout the years.

It is important to keep in mind when looking at the annual averages that they are based only on the available data, and there are some large gaps in data collection.

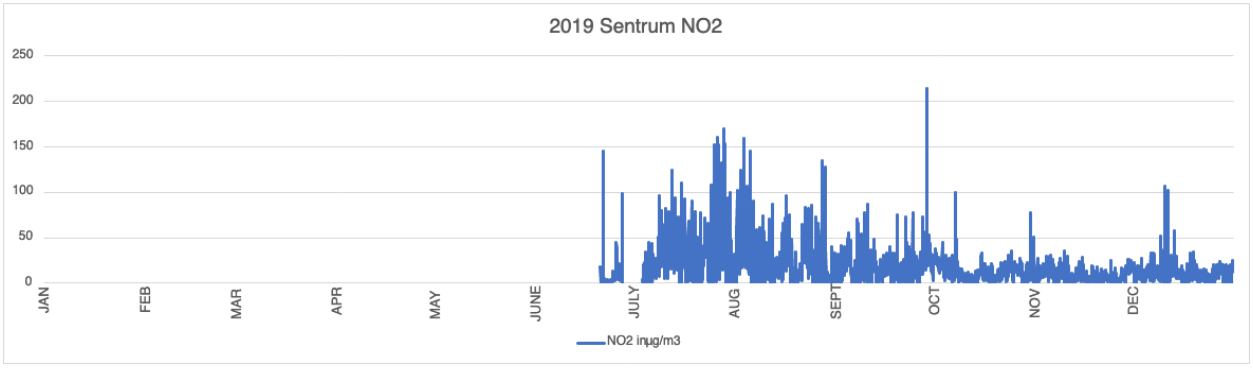

Figure 5: 2019 Sentrum NO_2

This figure shows the one-hour average NO_2 concentrations at the Flåm Sentrum air quality monitoring station over the year 2019.

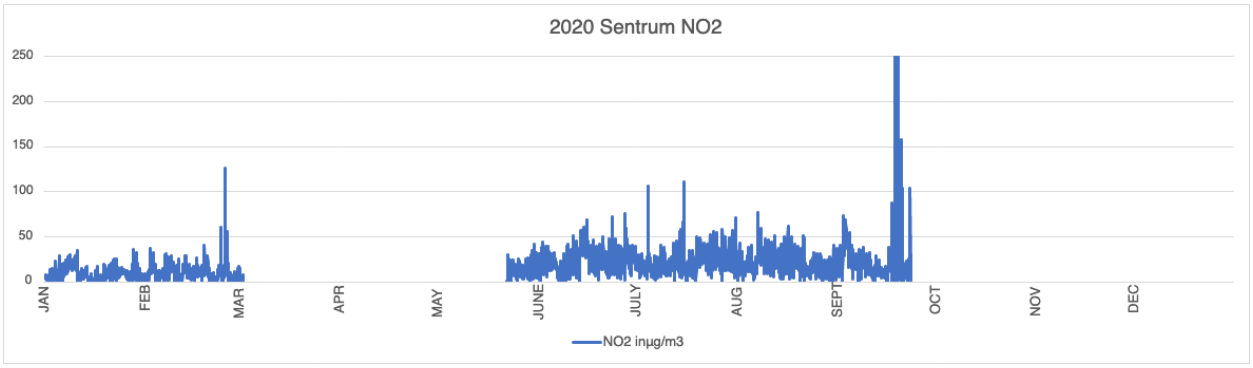

Figure 6: 2020 Sentrum NO_2

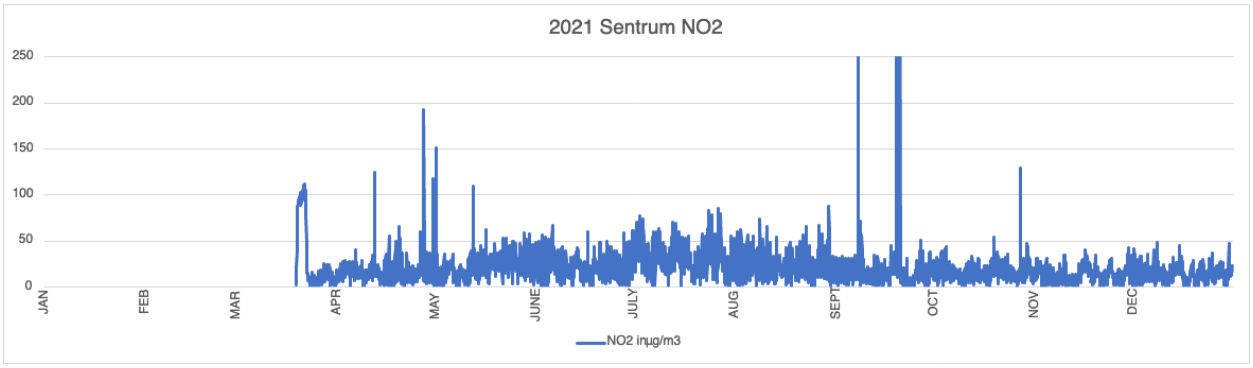

Figure 7: 2021. Sentrum NO_2

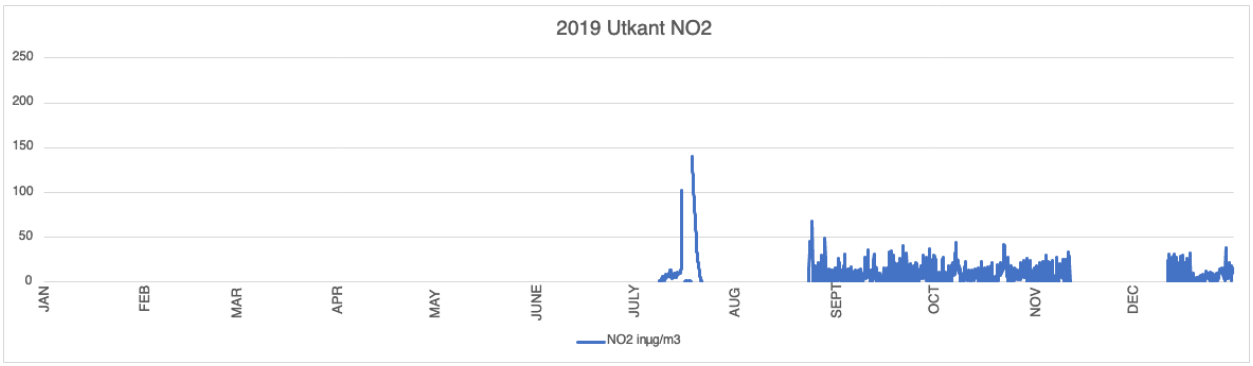

Figure 8: 2019 Utkant NO_2

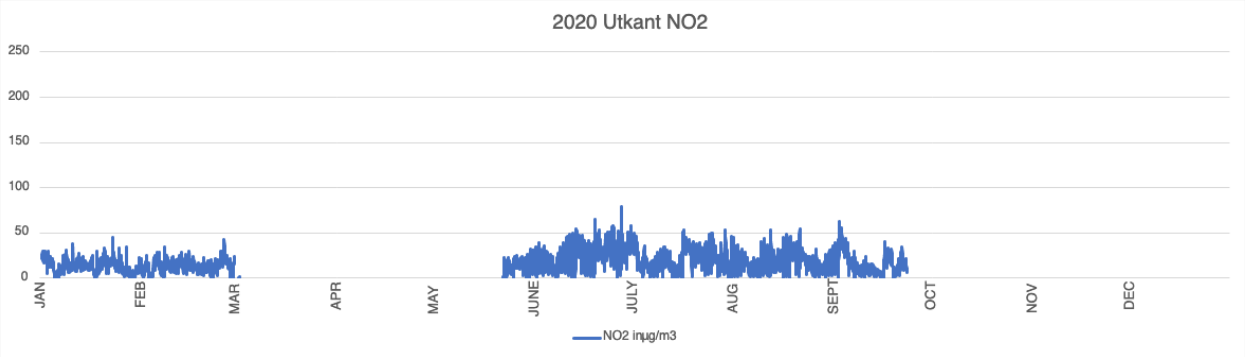

Figure 9: 2020 Utkant NO_2

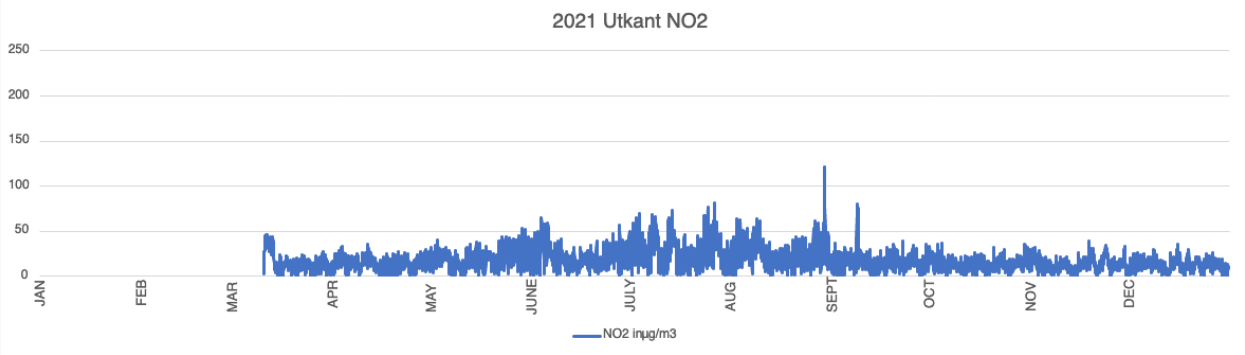

Figure 10: 2021 Utkant NO_2

Monitoring Station	2019	2020	2021
Sentrum	28.142	21.556	26.983
Utkant	N/A	20.417	25.767

Table 2: July-August Average NO_2 Concentration

Monitoring Station	2019	2020	2021
Sentrum	17.023	17.743	20.151
Utkant	8.689	18.542	17.714

Table 3: Annual Average NO_2 Concentrations

We can see from Figures 5, 6 and 7 and Tables 2 and 3 above that, for the months of July and August, the NO_2 concentration at the Sentrum air quality monitoring station was higher in 2019 and 2021 than in 2020. In fact, the average NO_2 concentration at Sentrum was 28.14 $\mu g/m^3$ for July and August of 2019 and 26.98 $\mu g/m^3$ in 2021, while it was 21.56 $\mu g/m^3$ in 2020.

Unfortunately, it is not possible to make the same observations or comparisons about the Utkant station, because no NO_2 data was collected during the "high season" of June to August in 2019.

However, we can compare the 2020 and 2021 average concentrations with the corresponding Sentrum average concentrations. In 2020 Utkant measured an average NO_2 concentration of 20.42 µg/m^3 for the months of July and August, and in 2021 that value was 25.77 µg/m^3. These are slightly lower than the corresponding Sentrum values, which were 21.56 µg/m^3 and 26.98 µg/m^3 respectively. The Utkant measuring station is further from the cruise ships than the Sentrum station is, but the difference between these average concentrations is not very big and it is very possible that there are other factors which contribute to the difference.

In Figures 6 and 7 there are some dramatic spikes in the recorded NO_2 concentration. These are not associated with any data gaps but could still be an equipment malfunction. On the other hand, it is entirely possible that there was a pollution event which spiked the actual NO_2 concentration in the air.

Interestingly, there is also a notable variation in the data. The NO_2 concentration goes up and down fairly regularly rather than staying high or low for a while. This variation is present throughout the year, including at times when there were no cruise ships in Flåm and the year 2020 which had no cruise ships at all. It is also interesting to note that the NO_2 concentration tends to be slightly higher in the summer months than in the winter months. This is true even in 2020 which did not have any cruise ships.

5.1.2 Sulfur Dioxide (SO_2)

SO_X is another known component of cruise ship smoke (Carić & Mackelworth, 2014) and is mainly made up of sulfur dioxide (SO_2). The Flåm Port measurements only include SO_2, so that is what is discussed in this section. The vertical axis maximum for these graphs has been set at 450 µg/m^3, because it includes most of the values and still shows the variation in the data. There are some individual concentrations that are above 450 µg/m^3 which are therefore not visible on the graphs.

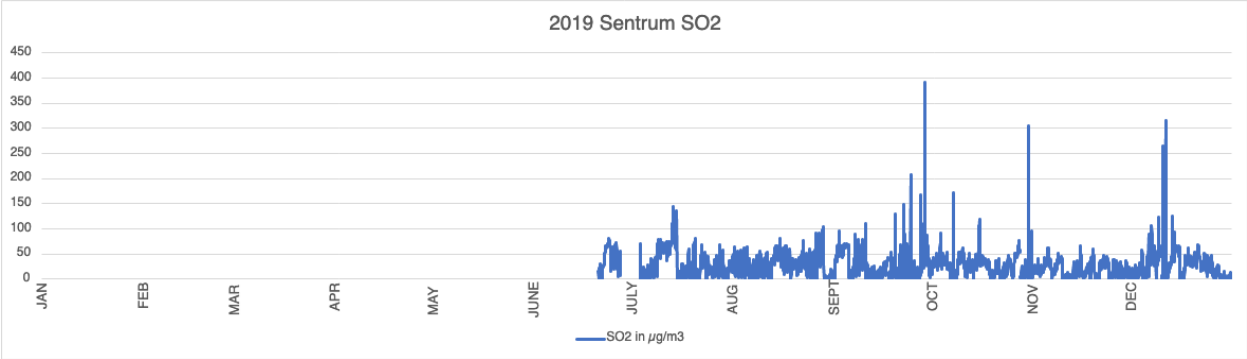

Figure 11: 2019 Sentrum SO_2

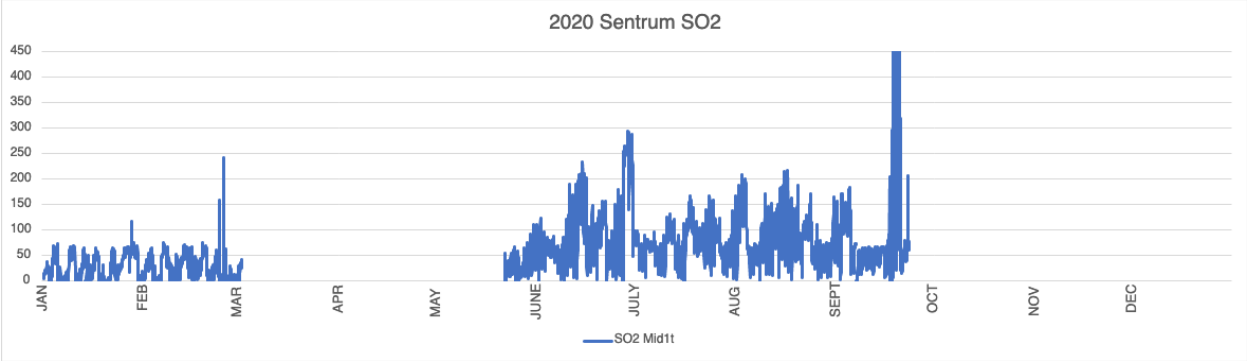

Figure 12: 2020 Sentrum SO_2

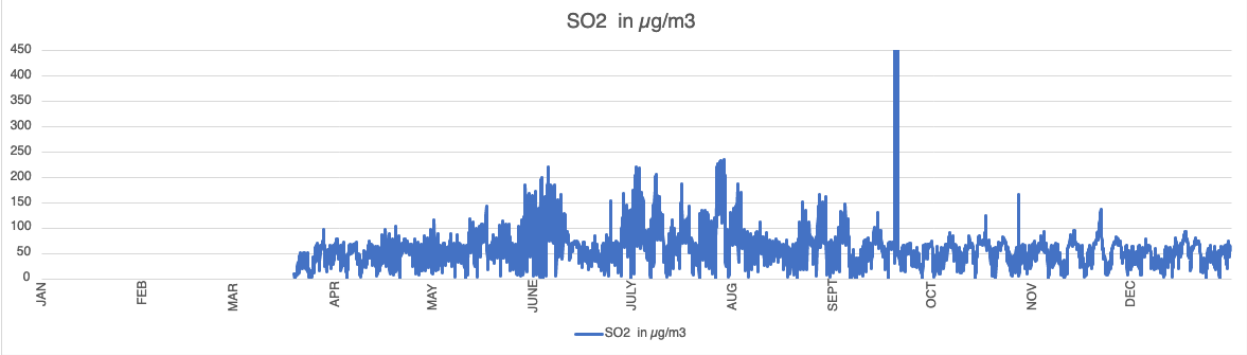

Figure 13: 2021 Sentrum SO_2

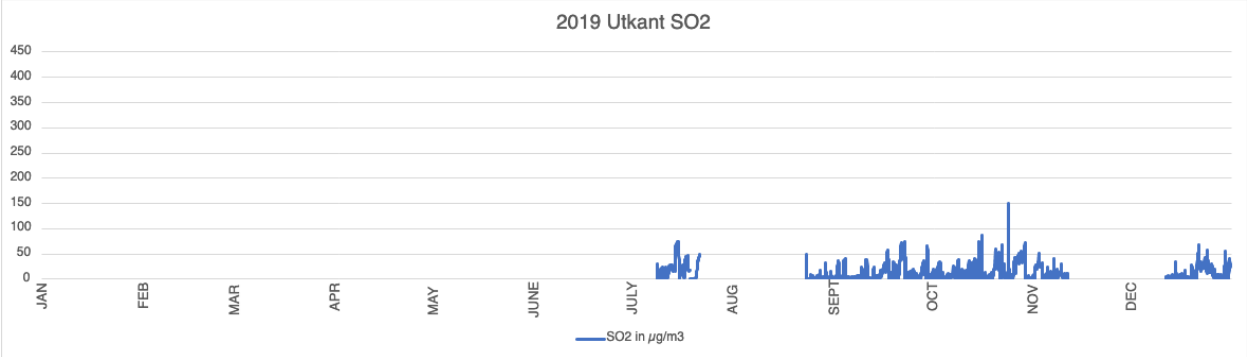

Figure 14: 2019 Utkant SO_2

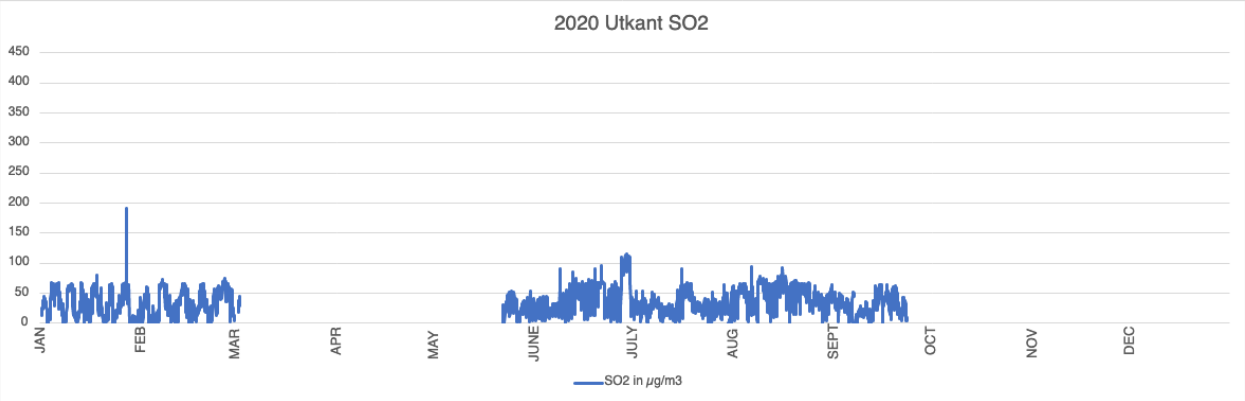

Figure 15: 2020 Utkant SO_2

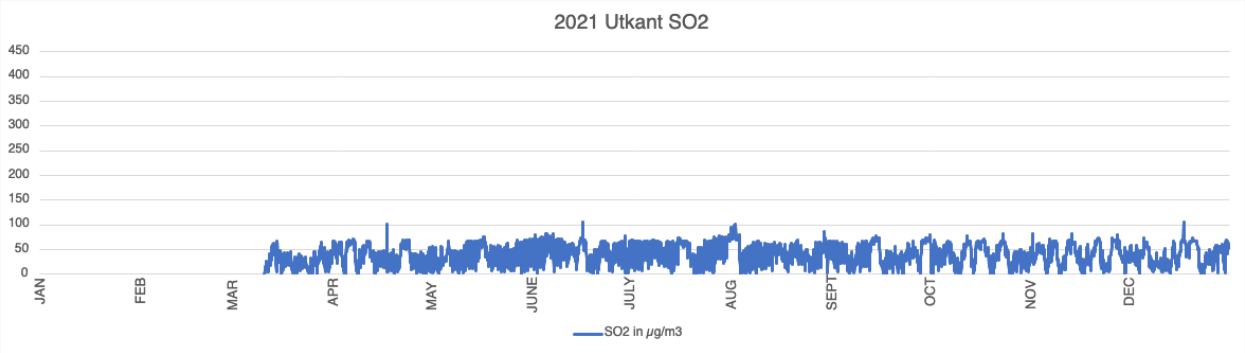

Figure 16: 2021 Utkant SO_2

Monitoring Station	2019	2020	2021
Sentrum	30.702	81.107	83.505
Utkant	N/A	38.544	46.683

Table 4: July-August Average SO_2 Concentrations

Monitoring Station	2019	2020	2021
Sentrum	27.066	63.288	62.186
Utkant	12.130	35.473	40.622

Table 5: Annual Average SO_2 Concentrations

Looking at Figures 11 to 16 and Tables 4 and 5, we can see that the average measured SO_2 concentration is higher at the Sentrum monitoring station than the Utkant station. We can also see that the average SO_2 concentration for July and August is higher than the average for the entire year at both stations in all years (with the exception of Sentrum 2019, where we do not have enough data to measure). This difference is much more noticeable at the Sentrum monitoring station, where the July and August averages for 2020 and 2021 are about 20 $\mu g/m^3$ higher than the annual averages. The same difference is not seen in 2019, which has much less data.

Figures 12 and 13 each show one instance where the SO_2 concentration spikes above 450 µg/m^3. It is possible that this is an equipment malfunction, but the spikes are sustained, meaning there is more than one hour in a row where a high SO_2 concentration is reported. It is also possible that there were pollution events at these times, which drove up the SO_2 concentration.

Like with NO_2, there is also significant variation in SO_2 concentration visible in Figures 11 to 16.

5.1.3 Ozone (O_3)

O_3 has been identified as an emission coming from ships (Carić & Mackelworth, 2014), and can also be formed photochemically when there is NO_X in the air. Although it is beneficial high in the atmosphere, it can be harmful to human health if it is near the ground. This section will consider the O_3 concentrations in Flåm. The following figures show the one-hour O_3 concentration averages, with the upper boundary of 400 µg/m^3. This allows all the data points to be on the graph and shows the variation at the lower concentrations.

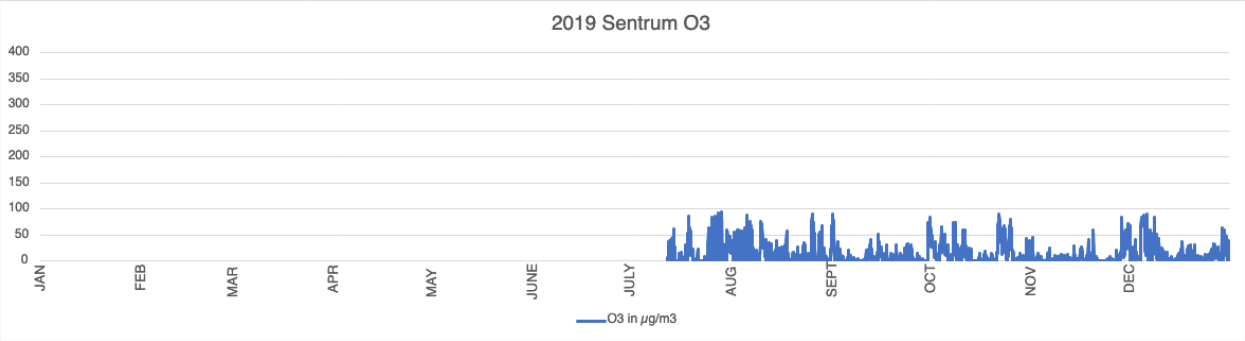

Figure 17: 2019 Sentrum O_3

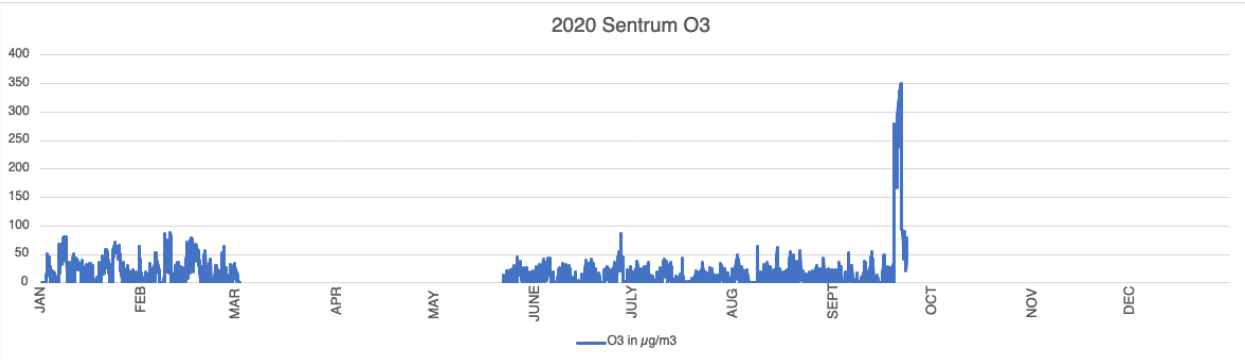

Figure 18: 2020 Sentrum O_3

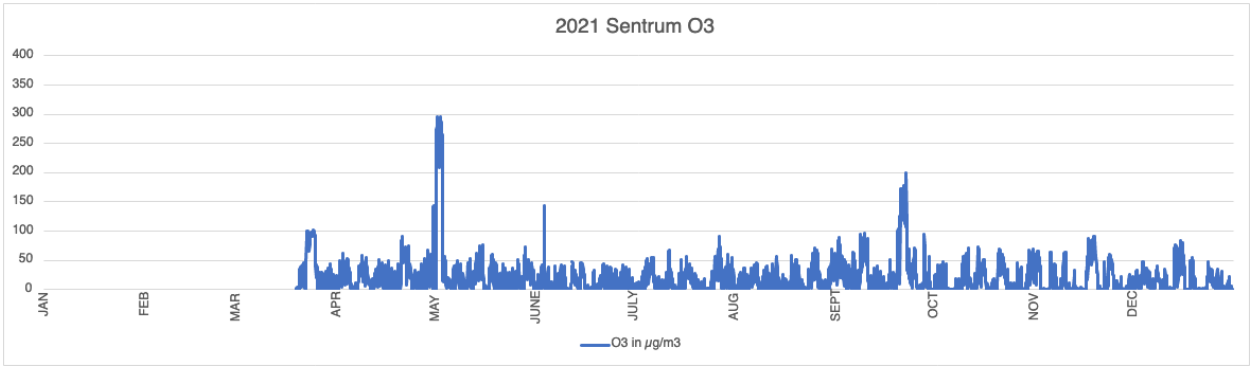

Figure 19: 2021 Sentrum O_3

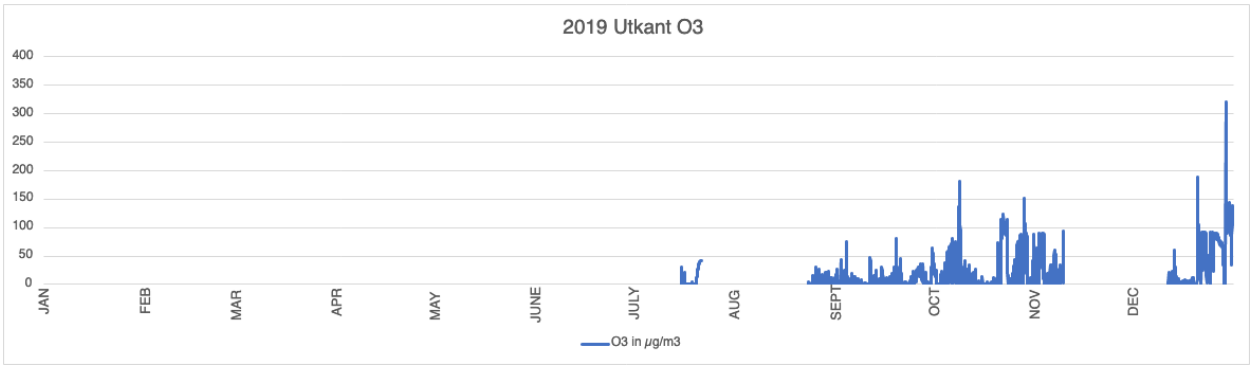

Figure 20: 2019 Utkant O_3

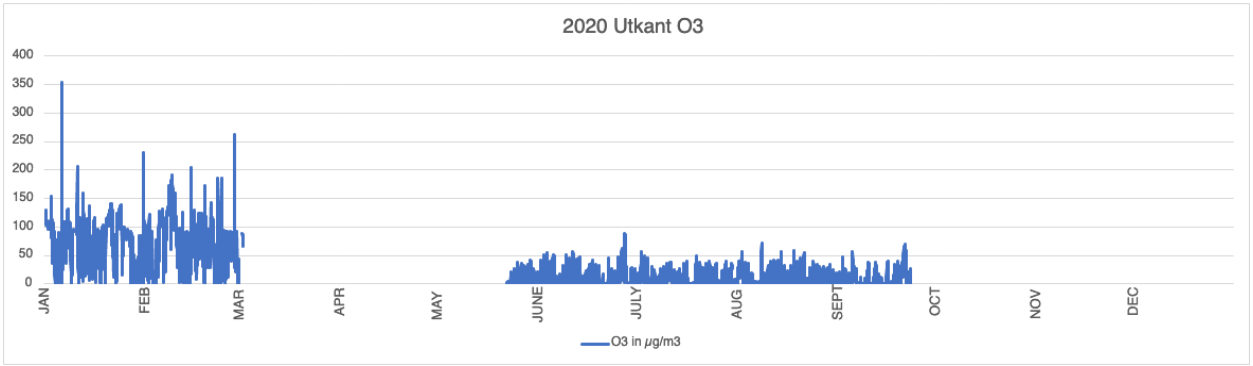

Figure 21: 2020 Utkant O_3

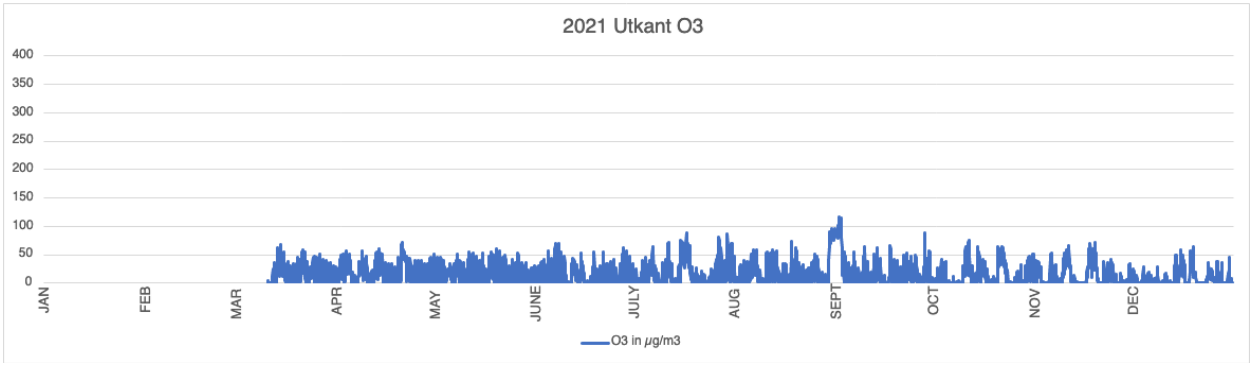

Figure 22: 2021 Utkant O_3

Monitoring Station	2019	2020	2021
Sentrum	17.610	8.336	14.804
Utkant	N/A	9.565	17.998

Table 6: July-August Average O_3 Concentrations

Note, there is no average for July-August Utkant 2019 due to a lack of data in that time period.

Monitoring Station	2019	2020	2021
Sentrum	13.585	16.816	20.604
Utkant	20.154	30.700	15.638

Table 7: Annual Average O_3 Concentrations

Figures 17 to 22 and Tables 6 and 7 show the opposite pattern of NO_2 and SO_2. With the exception of the Sentrum monitoring station in 2019 and the Utkant station in 2021, both stations in all years recorded a higher annual average concentration of O_3 than the corresponding July to August average concentration. This difference is particularly strong in 2020. This is clear from the average values in Tables 6 and 7 and is also visible in Figures 17 to 22. It is important to remember, however, that there are large gaps in the data. Tables 6 and 7 also show that, in general, there is a higher average concentration of O_3 at Utkant than at Sentrum. This is also the opposite pattern from NO_2 and SO_2.

In Table 6 we can see that the summer O_3 concentration at the Sentrum monitoring station was significantly lower in 2020 than it was in 2019 and 2021. Table 7 on the other hand, shows that 2019 had the lowest annual O_3 concentration of all three of the years – though it only has data for the second half of the year.

Figures 18 and 19 each show high O_3 concentration events, and Figures 20 and 21 show that there was a lot of variation, along with some noticeably high concentrations, in the measured O_3 concentration in late 2019 and early 2020.

5.1.4 PM2.5

Particulate matter with a diameter of 2.5 micrometers or smaller (commonly known as PM2.5) is one of the most well-known products of combustion and is a major component of cruise ship emissions. This section analyzes the PM2.5 data collected by Flåm Port from 2019 to 2021. The y-axis boundary of the following figures is set at 12 $\mu g/m^3$, which preserves the visibility of the data variability and contains most of the concentration values. There are two pollution events each in Figures 25 and 27 where the concentration exceeds 12 $\mu g/m^3$.

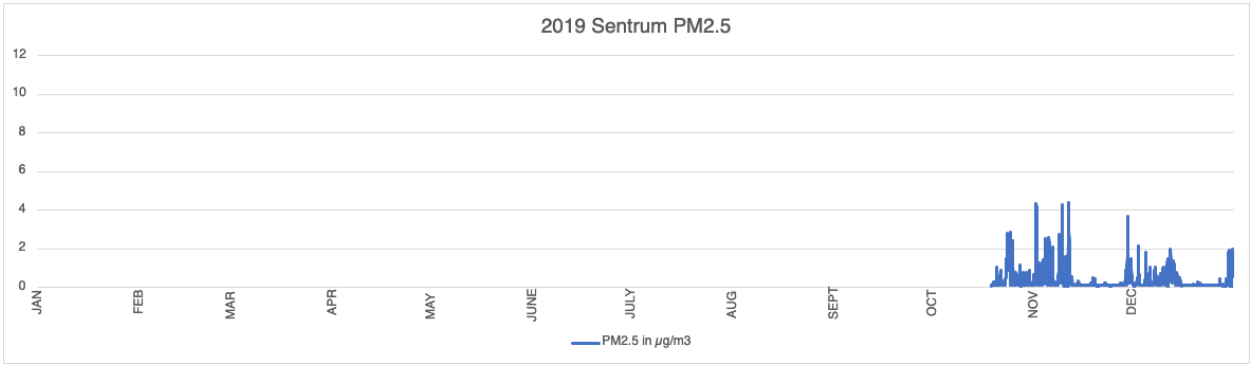

Figure 23: 2019 Sentrum PM2.5

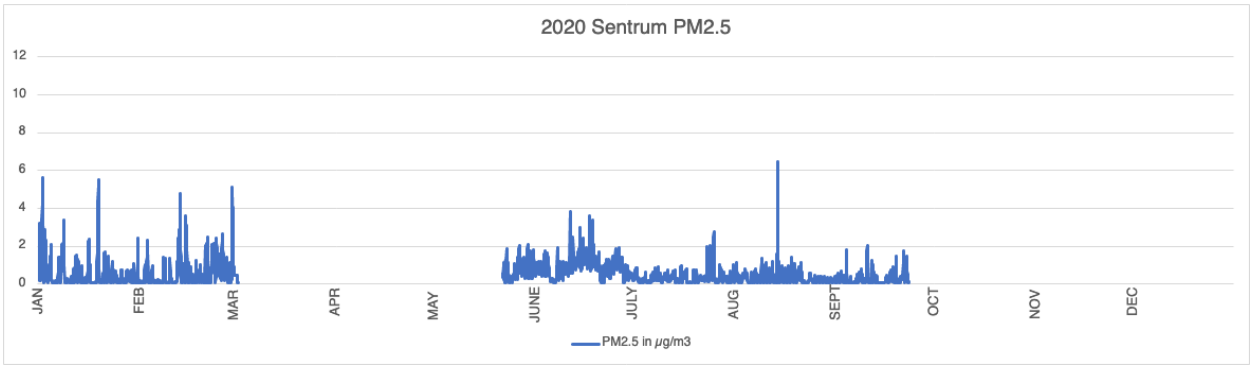

Figure 24: 2020 Sentrum PM2.5

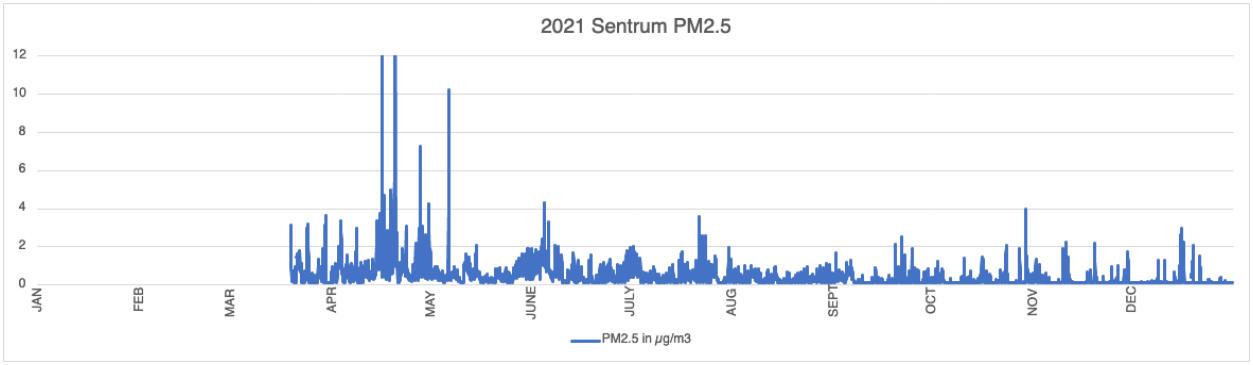

Figure 25: 2021 Sentrum PM2.5

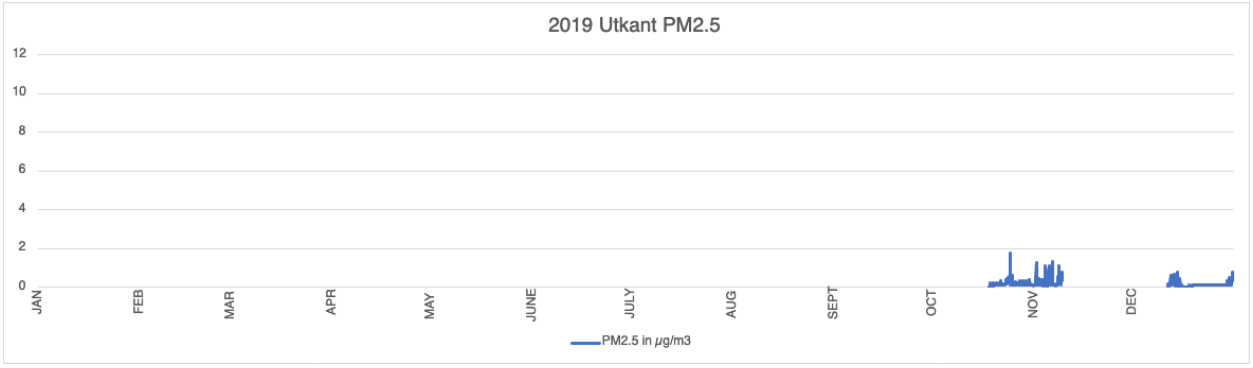

Figure 26: 2019 Utkant PM2.5

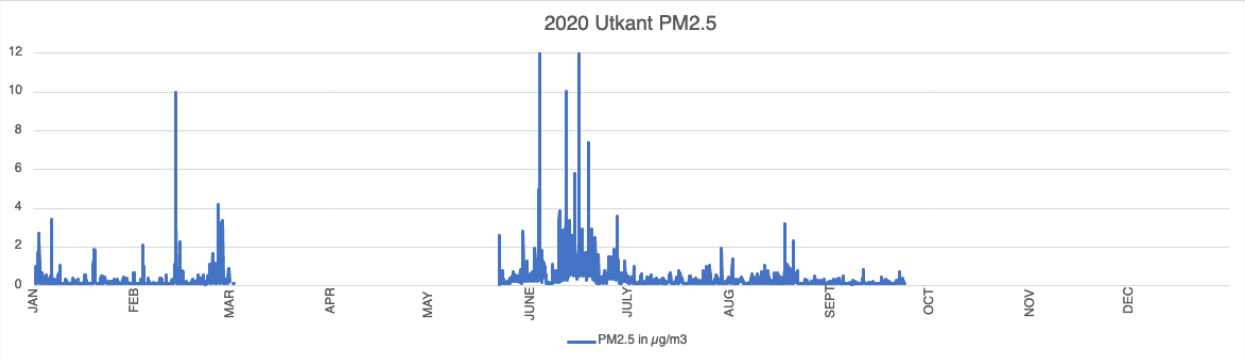

Figure 27: 2020 Utkant PM2.5

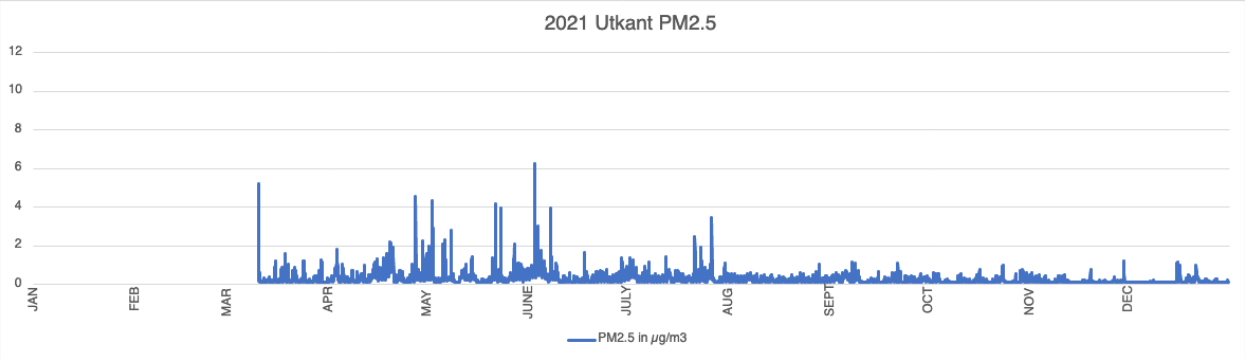

Figure 28: 2021 Utkant PM2.5

Monitoring Station	2019	2020	2021
Sentrum	N/A	0.331	0.402
Utkant	N/A	0.219	0.288

Table 8: July-August Average PM2.5 Concentrations

Monitoring Station	2019	2020	2021
Sentrum	0.321	0.493	0.444
Utkant	0.161	0.322	0.272

Table 9: Annual Average PM2.5 Concentrations

It is difficult to make any comparisons of the PM2.5 data over time and come to any conclusions, as it is limited by large data gaps. What we can see from Tables 8 and 9, is that the PM2.5 concentration at Utkant is generally lower than the PM2.5 concentration at Sentrum. This is the case in the summer months as well as annually. It is difficult to tell because of the gaps in the data, but the spikes in PM2.5 concentration do not seem to be confined to any particular time of year, nor do they tend to happen at a certain time of day. There does seem to be a general trend of higher PM2.5 concentrations in the daytime and evening and the concentration falling over night, although there are many exceptions.

Table 8 shows that for the months of July and August, there was a higher PM2.5 concentration at both air quality monitoring stations in 2021 than in 2020. The opposite trend can be observed

with the annual concentrations in Table 9, the averages for 2020 were higher than those in 2021. This table also shows that the 2019 averages were quite a bit lower than those of both 2020 and 2021, but there was very little data for 2019 compared to 2020 and 2021.

5.1.5 PM10

Particulate matter with a diameter of less than 10 micrometers, commonly called PM10, is inclusive of PM2.5 as well as the larger particles. Like PM2.5, it is suspected to be a component of cruise ship emissions. This section contains an analysis of the PM10 concentration data collected by Flåm Port. The graphs in this section have an upper concentration boundary of 250 µg/m^3, because this allowed for most of the data to be shown. It does, however, make it difficult to see the variation at the lower concentrations.

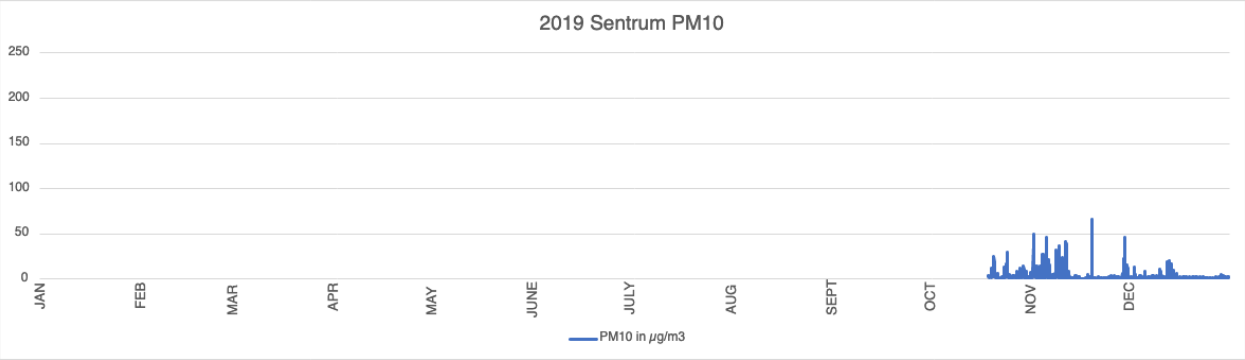

Figure 29: 2019 Sentrum PM10

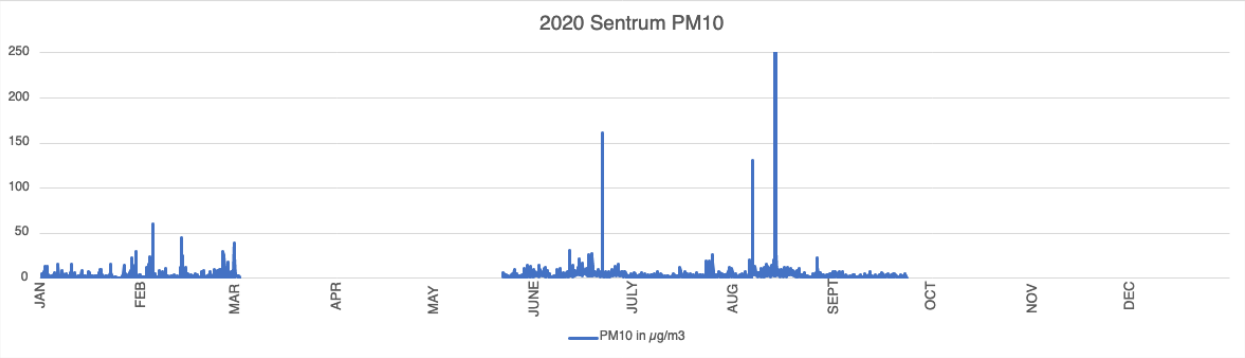

Figure 30: 2020 Sentrum PM10

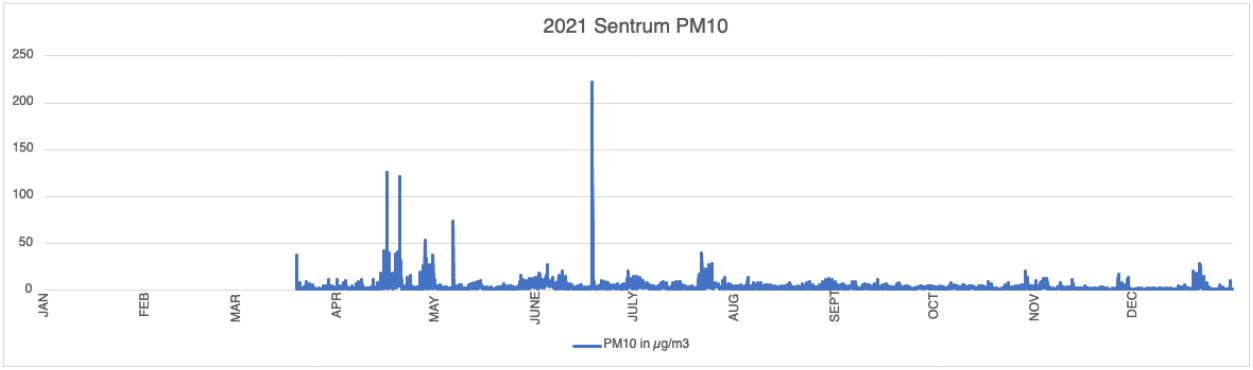

Figure 31: 2021 Sentrum PM10

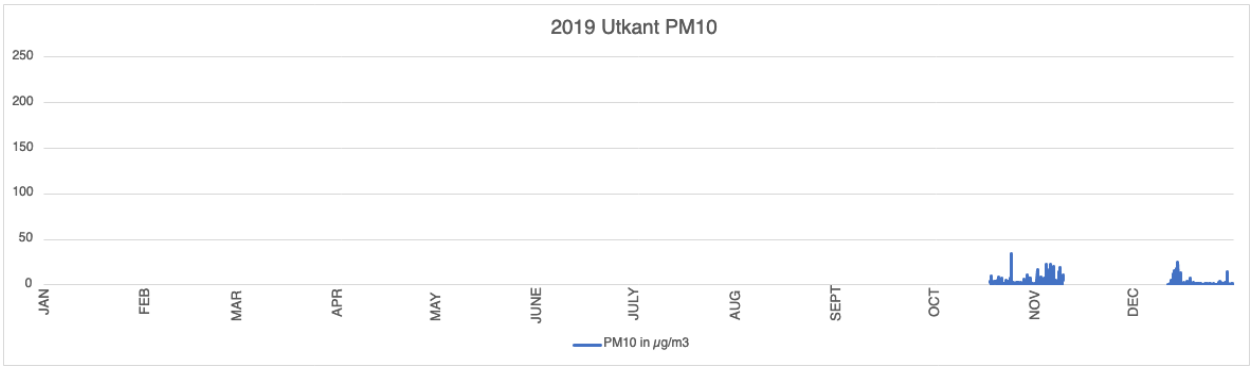

Figure 32: 2019 Utkant PM10

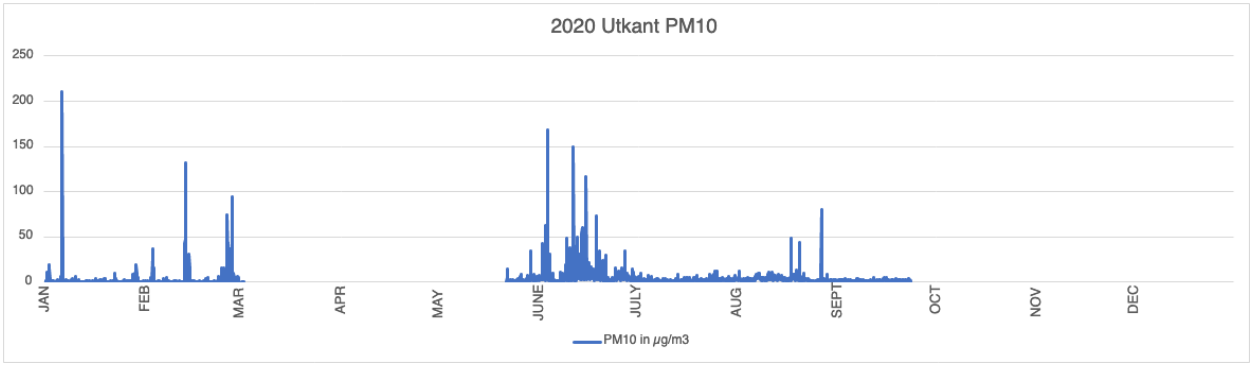

Figure 33: 2020 Utkant PM10

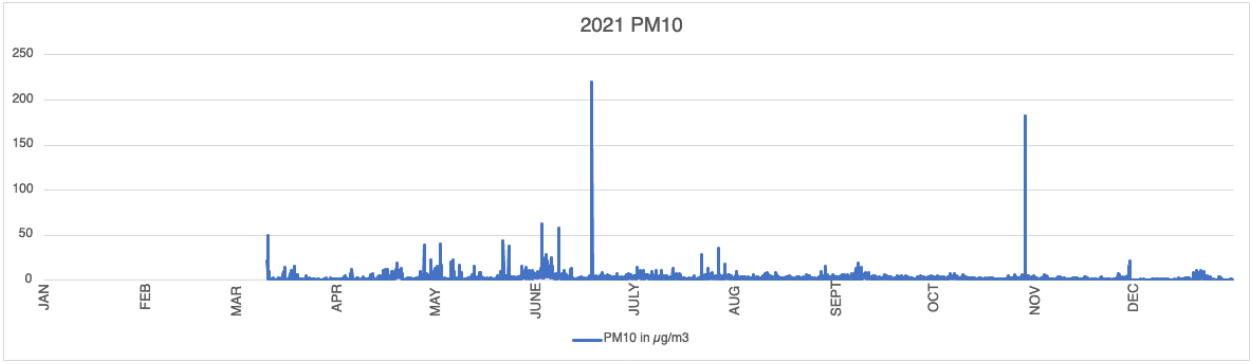

Figure 34: 2021 Utkant PM10

Monitoring Station	2019	2020	2021
Sentrum	N/A	3.999	3.187
Utkant	N/A	2.727	2.635

Table 10: July-August Average PM10 Concentrations

Monitoring Station	2019	2020	2021
Sentrum	3.243	3.440	3.038
Utkant	2.425	3.065	2.372

Table 11: Annual Average PM10 Concentrations

Tables 10 and 11 show that the average PM10 concentrations were higher at Sentrum than at Utkant for all three years represented by the data, for both the July to August averages and for the annual averages. We can also see that the 2021 averages were lower than the 2020 averages. As with many of the other pollutants, it is difficult to make any observations about the 2019 data because it starts so late in the year.

Figures 29 to 34 show that, for the most part, the PM10 concentrations stay well below 50 μg/m^3, although there are some concentration spikes to well above 50 μg/m^3. These pollution spikes are distributed throughout the calendar year and occur at least a couple of times in both 2020 and 2021. There are no recorded spikes above 50 μg/m^3 in 2019, although the data for 2019 is very limited.

5.1.6 Carbon Monoxide (CO)

CO is the final pollutant that is analyzed in this section. The CO data was only available as eight-hour averages, so there are less data points available for analysis. The upper boundary for Figures 35 to 40 has been set at 0.4 μg/m^3, which allows all data points to be included in the graph.

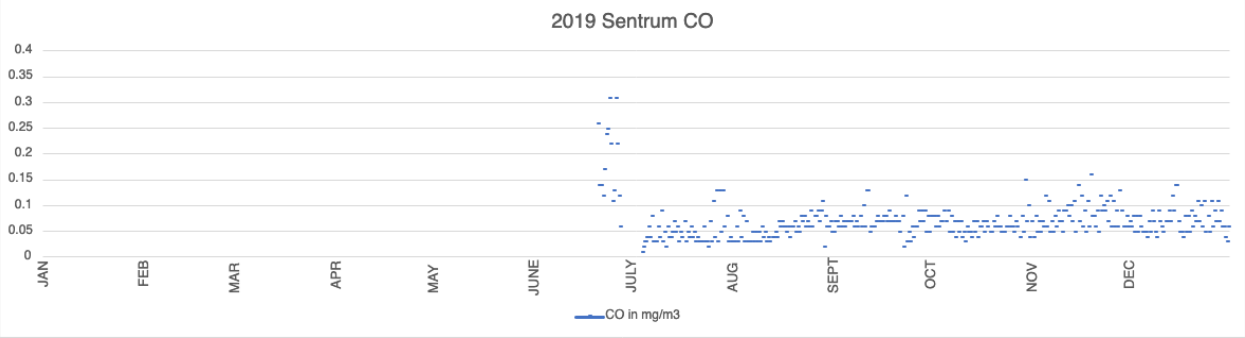

Figure 35: 2019 Sentrum CO

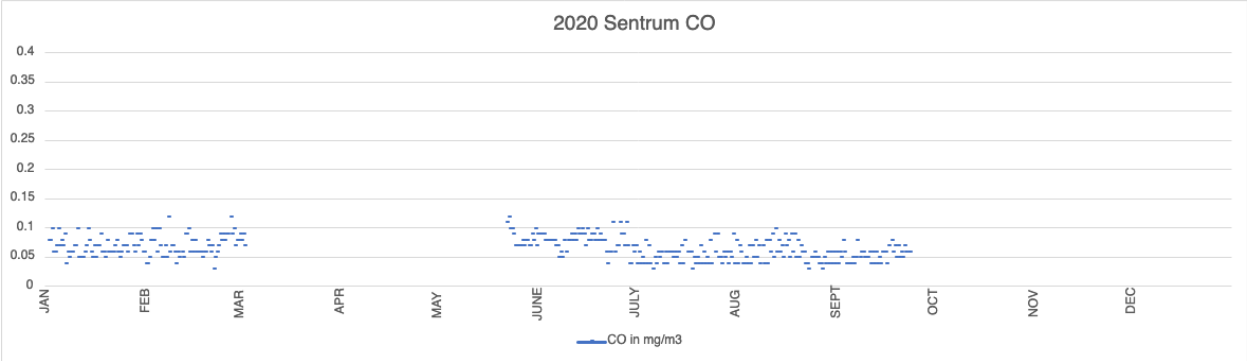

Figure 36: 2020 Sentrum CO

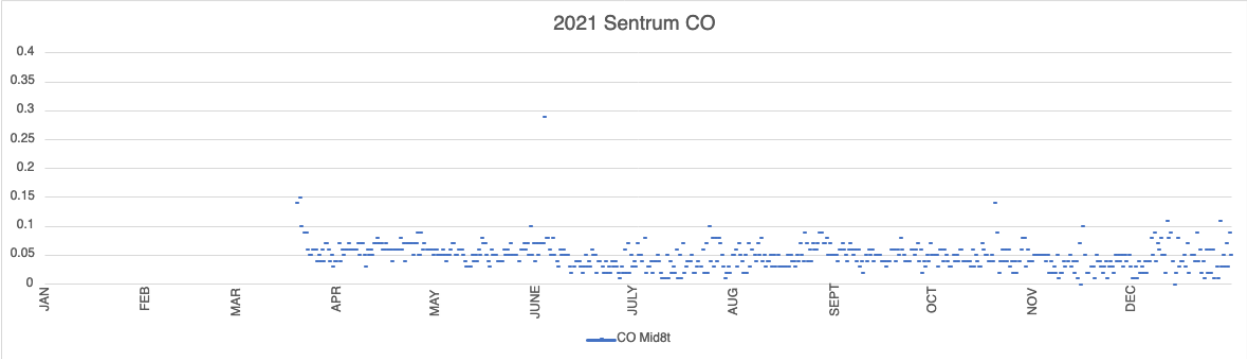

Figure 37: 2021 Sentrum CO

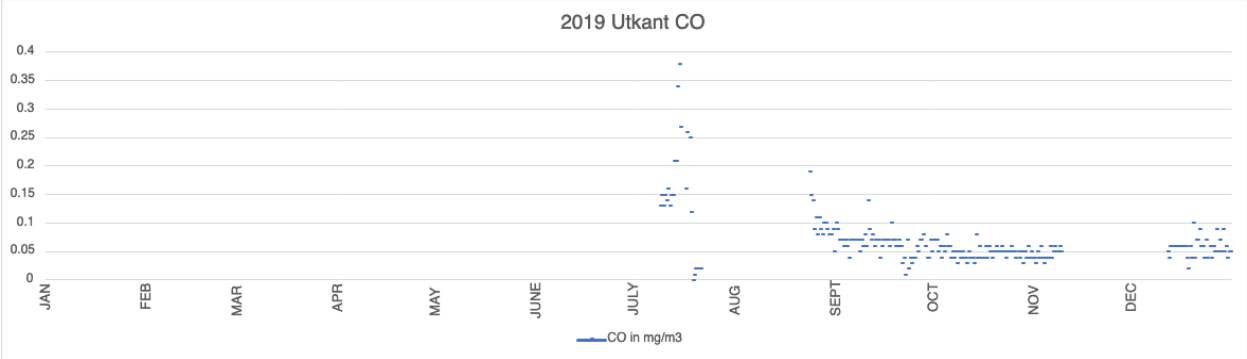

Figure 38: 2019 Utkant CO

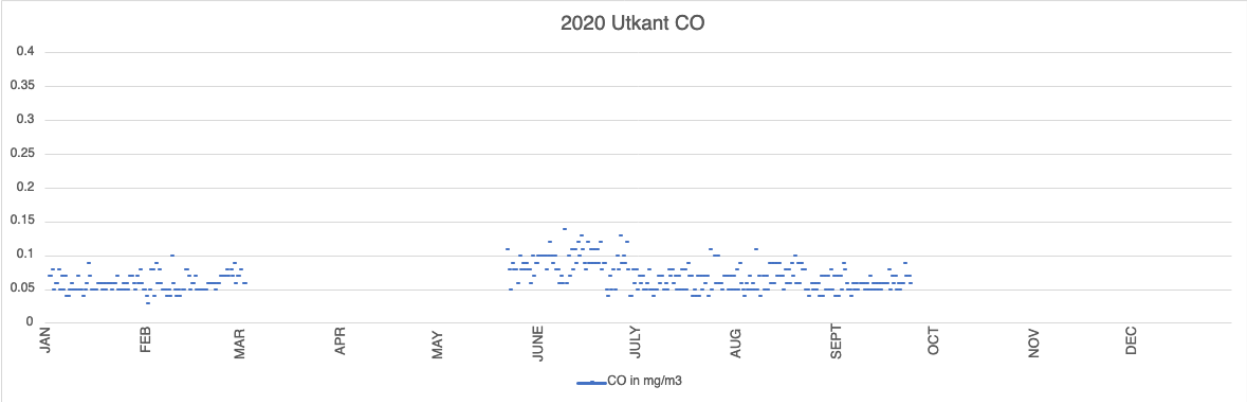

Figure 39: 2020 Utkant CO

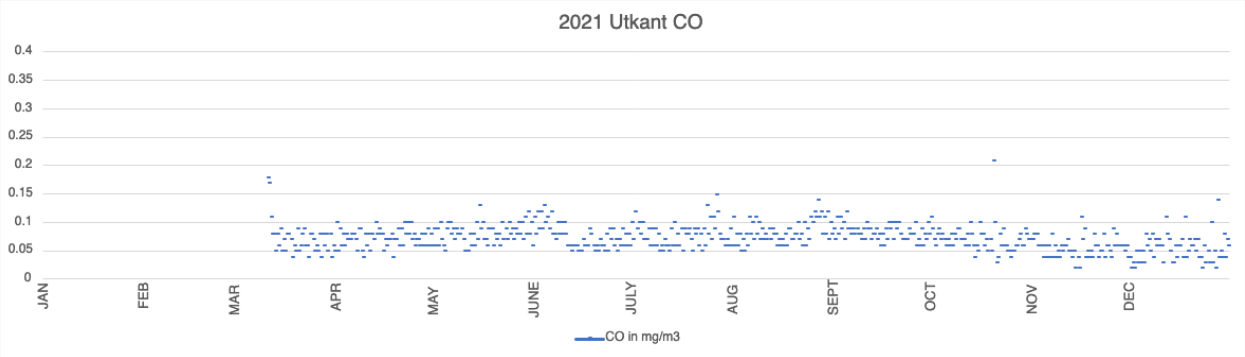

Figure 40: 2021 Utkant CO

Monitoring Station	2019	2020	2021
Sentrum	0.053	0.056	0.041
Utkant	N/A	0.064	0.081

Table 12: July-August Average CO Concentrations

Monitoring Station	2019	2020	2021
Sentrum	0.070	0.066	0.048
Utkant	0.068	0.067	0.073

Table 13: Annual Average CO Concentrations

Tables 12 and 13 show that the CO concentration at the Utkant station tends to be higher than the concentration at the Sentrum station. This could not be assessed for the cruise tourism "high-season" months of 2019, however, because there were not enough measurements during that time from the Utkant monitoring station.

Figures 35 to 40 show that the CO concentration goes up and down and sometimes spikes. This variation is not exclusive to any one part of year, and occurs across all three years included in the study. It is also visible at both monitoring stations.

It is interesting that the CO concentrations for 2019 are about the same as those in 2020, while the concentrations at the Sentrum monitoring station in 2021 are lower than previous years, and those at the Utkant station are higher than in previous years.

5.2 Survey Results

Posting the surveys in the "Kva skjer I Aurland Kommune" Facebook group resulted in a total of 55 responses, out of a total of 1766 residents in Aurland Municipality (Statistics Norway, 2022). Due to the limited number of responses, the results in this section are not statistically significant.

The survey questions were posed as fill in the blank questions and designed so that the responses could be converted to numbers for analysis. The averages used in the analysis have been rounded to two decimal places, and the full surveys are in Appendix A.

The first two questions ("Overall, I think cruise tourism is ____ for Flåm/Aurland", and "Overall, I think cruise tourism is ____ for Norway") each had five answer options of: very good, good, neither good nor bad, bad, and very bad. These questions will be referenced in the data tables as "cruise tourism in Flåm" and "cruise tourism in Norway". For the analysis, these answers were assigned an integer value, with very good being five and very bad being one.

The next three questions ("Cruise tourism has had an overall ____ economic effect on Flåm/Aurland", "cruise tourism has had an overall _____ social effect on Flåm", and "cruise tourism has had an overall ____ environmental effect on Flåm/Aurland") also had five answer options, which were: very positive, positive, neither positive nor negative, negative, and very negative. These questions will be referenced in the data tables as "economic impact Flåm", "social impact Flåm", and "environmental impact Flåm". These answers were also assigned integer values, with very positive being five and very negative being one.

The next question ("I believe residents have ____ influence on decision-making about cruise tourism in Flåm/Aurland") had three answer options: a lot of, a little, and no. "A lot of" was assigned a value of three, with "no" getting a value of one. This question will be referenced as "resident influence" in the tables.

Finally, the last question ("I would like ____ cruise tourism in Flåm/Aurland in the future" had six answer options: A lot more, a little more, the same, a little less, a lot less, and no. "A lot more" received a value of six, and "no" received a value of one. This question will be referred to as "future cruise tourism" in the data tables on the next page.

Question	Average for all respondents
Cruise tourism Flåm	3.87
Cruise tourism Norway	3.75
Economic impact Flåm	4.56
Social impact Flåm	3.55
Environmental impact Flåm	2.73
Resident influence	2.02
Future cruise tourism	3.72
# of participants	55

Table 14: Entire Sample Average Responses

This table shows the average of all participant responses. For the first five questions, the most favorable opinion about cruise tourism is assigned a numerical value of five, while the least favorable gets a numerical value of one. A value of three is neutral. For "Resident influence" a value of three would indicate a belief that residents have a lot of influence, a value of two a little influence, and a value of one no influence. Finally, for future cruise tourism the answers are in relation to pre-pandemic levels of cruise tourism and a value of six represents a desire for much more cruise tourism in the future, five a little more, four the same as before, three a little less, two much less, and one no cruise tourism at all.

Question	Women	Men
Cruise tourism Flåm	3.76	4
Cruise tourism Norway	3.62	3.92
Economic impact Flåm	4.39	4.72
Social impact Flåm	3.44	3.6
Environmental impact Flåm	2.79	2.68
Resident influence	2.07	1.96
Future cruise tourism	3.52	3.96
# of participants	29	25

Table 15: Average Responses by Gender

Question	Under 25	25-39	40-54	55 and over
Cruise tourism Flåm	4	3.83	3.78	4
Cruise tourism Norway	3.57	3.56	3.78	4.08
Economic impact Flåm	4.86	4.61	4.5	4.36
Social impact Flåm	4	3.28	3.67	3.5
Environmental impact Flåm	3	2.5	2.61	3.08
Resident influence	1.71	1.94	2.18	2.08
Future cruise tourism	4.67	3.56	3.56	3.75
# of participants	7	18	18	12

Table 16: Average Responses by Age

Question	15 or fewer years	16 to 30 years	31 to 45 years	Over 45 years
Cruise tourism Flåm	3.11	3.82	4.17	4.12
Cruise tourism Norway	2.78	3.59	4	4.24
Economic impact Flåm	4.22	4.71	4.45	4.63
Social impact Flåm	2.78	3.71	3.58	3.76
Environmental impact Flåm	2	2.65	2.67	3.24
Resident influence	2	1.82	1.92	2.29
Future cruise tourism	3	3.69	3.75	4.12
# of participants	9	17	12	17

Table 17: Average Responses by time in Flåm

Question	Primary school	High school	Bachelor	Master or more
Cruise tourism Flåm	4	4.11	4.14	3.09
Cruise tourism Norway	3	4.11	3.90	3.09
Economic impact Flåm	5	4.53	4.67	4.4
Social impact Flåm	4.67	3.58	3.57	3.27
Environmental impact Flåm	3	2.89	3.04	1.91
Resident influence	2	2	2.1	1.91
Future cruise tourism	5	3.72	4	3
# of participants	3	19	21	11

Table 18: Average Responses by Highest Level of Education

Note that the participants for this table add up to 54, because one participant did not indicate their highest level of education.

Table 14 shows that, on average, survey participants viewed cruise tourism as having a positive impact on Flåm and on Norway. This is especially true when it comes to the economic impact of cruise tourism on Flåm, where the average response of 4.56 lies just above halfway between "positive" and "very positive". The exception to this positivity is environmental impact, where the average of 2.73 is below the neutral value of three. A total of 22 participants said cruise tourism had a "negative" or "very negative" impact on the environment, while 16 said it was "positive" or "very positive". We can also see that survey participants believed the population only has "a little" influence on the cruise tourism decision-making process in Flåm. 27 participants, or 49%, selected this option. Finally, Table 14 shows that, on average, survey participants wanted a little less cruise tourism than before the pandemic. It is important to note, however, that a plurality of respondents – 22 of them, or 40% – indicated that they would like to

have the same level of tourism as before the pandemic. The next most popular answer was “much less” which was selected by 12 participants. In total, almost as many participants (20) indicated that they would like to have less tourism in the future as those who said they wanted the same amount. On the other side, a total of 12 indicated that they would like to have more cruise tourism than before the pandemic.

Table 15 shows the response averages divided by gender. Because there was one participant who did not identify as male or female, the number of participants in this section adds up to 54. For the sake of anonymity, this participant´s answers are not discussed in this breakdown.

The data does not show a large difference in the opinions of women and men, although women are slightly less favorable towards cruise tourism than men. The one exception to this is regarding the environmental impact, where the women in the sample have a slightly less negative average than the men. It is also notable that, on average, women want slightly less cruise tourism in the future than men, despite rating it more positively in all the previous questions.

Table 16 shows that there are no major differences in the opinions of the different age groups of survey participants. The younger participants in the survey had a very high opinion of the economic impact of cruise tourism on Flåm, with all but one participant under 25 saying it is “very positive”. It is noteworthy however, that there are only seven participants in this category. Interestingly, participants in the “under 25” and “55 and over” groups both viewed cruise tourism as having “neither positive nor negative” environmental impact, while the two middle groups viewed it as somewhat negative. In terms of influence on decision-making, the two oldest groups indicated that they felt they had “a little influence”, while the younger groups were between “no influence”, and “a little influence”. The youngest age group had the lowest average for this question. Finally, it is notable that the average for those under 25 indicates a desire for more cruise tourism in the future, while all the higher age groups had an average between “a little less” and “the same as before” [the pandemic].

Table 17 shows the average responses based on how long the participants have lived in or had a close connection to Flåm. This method of participant division showed the clearest trends in opinion of all the divisions discussed in this paper. I originally wanted to have a group of those who had been in Flåm for less than three years, to see if there was a different opinion among those who have not experienced a tourist season, but there were not enough participants in that

category. I used 15-year blocks because interview participants noted that cruise tourism in Flåm has grown and changed a lot over the past 15 years.

Table 17 shows a clear trend in opinion correlated with amount of time being closely connected to Flåm. Those who had been in Flåm for 15 years or less had a much less positive view of cruise tourism's effect on the area than all other groups, with an average of 3.18 which is just above "neither good nor bad". Those who had lived in Flåm between 16 and 30 years had an average of 3.82 which is closer to good, and the groups of 31 to 45 years and over 45 years in Flåm had averages above four, meaning they were between "good" and "very good". This trend is stronger for cruise tourism's impact on Norway. Those who had lived in Flåm for less than 15 years viewed cruise tourism as slightly negative, with an average of 2.78 which is between "bad" and "neither good nor bad", while those who had lived there for more than 45 years rated cruise tourism's impact on Norway at 4.24.

Looking at the specific impacts of cruise tourism on Flåm, Table 17 shows that all four groups indicated that cruise tourism has had a positive economic impact. This was rated lowest (but still above "good" at 4.22) by those who had lived in Flåm for 15 or fewer years and highest by those who had been in Flåm between 16 and 30 years, at 4.71. Participants were not as positive about social impact, where there is an upward trend correlated with the amount of time connected to Flåm. The 15 years or less group had an average of 2.78, which is between "negative" and "neither positive nor negative". All the other groups, on the other hand, had an average above 3.5, meaning they were closer to "positive" than to "neither positive nor negative". The average for participants connected to Flåm for over 45 years was highest, at 3.76. Finally, there is an upward trend in opinion on the environmental impact of cruise tourism on Flåm. Those who had been in the area for the least amount of time rated the impact at an average of two, which is "negative". There is very little difference between those who have been in Flåm for 16 to 30 years and those who have been there for 31 to 45 years, with averages of 2.65 and 2.67 respectively. Those who had been in Flåm the longest (45 or more years) rated the environmental impact of cruise tourism most positively, with an average value of 3.24, which is, in contrast to the other groups, between "neither positive nor negative" and "positive".

Interestingly, Table 17 shows that those who had been in Flåm the least amount of time and those who had been there the most amount of time thought the population had more influence on

the decision-making process than the two groups in the middle, with those who have been there over 45 years rating the population as having the highest influence.

Finally, Table 17 shows the same increasing trend in opinion on how much cruise tourism Flåm should have in the future. Those who had been in Flåm for less than 15 years gave an average answer of three, meaning they would like to have a "little less" cruise tourism than before the pandemic. The groups who had been in Flåm 16 to 30 years and 31 to 45 years had respective averages of 3.69 and 3.75, which are between "a little less" and "the same". The only demographic to have an average above four was people who have been connected to Flåm for more than 45 years, with an average of 4.12 which is between "the same" and "a little more".

Table 18 shows the averages for the participant opinions divided into groups based on highest level of education. This section does not discuss the primary school group, as it only had three participants. In general, the group with a bachelor's degree as their highest level of education viewed tourism slightly more favorably and wanted slightly more in the future than the group with high school as their highest level of education. The most notable difference, however, was the group with a master's degree or higher. These participants indicated a markedly worse view of cruise tourism than the other groups, rating cruise tourism in Flåm and in Norway at 3.09 or, "neither good nor bad". They also rated cruise tourism's social impacts in Flåm at 3.27, which, in contrast to those with a bachelor's degree or high school education, is closer to "neither positive nor negative" than it is to "positive". The biggest difference, however, was in environmental impact. The group with a master's degree or higher rated cruise tourism's environmental impacts on Flåm, on average, at 1.91 which is between "very negative" and "negative". This is not only lower than the groups with high school or bachelor's level education (2.89 and 3.04 respectively), but it is the lowest rating in this category by any grouping in this analysis. The next lowest group was residents between 25 and 39 years of age who rated it on average at 2.5.

5.2.1 Additional information from surveys

At the end of the survey, there was an optional long answer section with the question "Is there anything you would like to add about cruise tourism?". This question got 23 responses (out of the 55 total survey responses) and elicited a variety of opinions – although there were a few common (and contradictory) themes which emerged.

One example of this is the economic impact of cruise tourism. On the one hand, five respondents had something positive to say. One participant pointed out that:

> *Cruiseturisme skaper arbeidsplasser og inntekt til Aurland kommune*
>
> *[cruise tourism creates jobs and income for Aurland Municipality]*

While another went further and said:

> *Lokalt næringsliv treng cruise*
>
> *[local business needs cruises].*

On the other hand, there were three respondents who were less positive about the economic contributions of cruise tourism, with one pointing out that

> *Corona har vist at kommunen ikke går under uten cruise turisme. Det er veldig få bosatte I kommunen som tjener seg rik på cruise, mens de fleste av oss lever jo ikke av dette*
>
> *[corona has shown that the municipality doesn't go under without cruise tourism. There are very few who live in the municipality who make themselves rich from cruises, while most of us don't live off of it]*

And another noting the same thing, saying

> *Cruiseturismen legg igjen store summar til dei store aktørane I Flåm. Dei mindre bedriftene, samt turismen I Aurland nyt ikkje godt av dette*
>
> *[Cruise tourism gives large sums of money to the major actors in Flåm. The smaller companies, including tourism in Aurland do not earn good money from it].*

Several respondents brought up sustainability and environmental regulations. These comments came from both sides, with some expressing favorability towards regulations and concern over environmental impacts, and others expressing concern about the economic implications of the new regulations and doubt about their effectiveness.

Participants expressed concerns about cruise tourism polluting the fjords and the industry´s lack of sustainability. This included some specific concern about cruise ship paint ending up on the

bottom of the fjord. One the other hand, some were concerned about the environment, but optimistic about the possibility of more environmental development saying

> *med landstraum til Flåm kan me bli eit av verdas fremste grøne reisemål. Ved å legge landstraum i Flåm opnar ein moglegheita for at me kan drive alt anne på straum også. Me kan då få ein energi-hub i Flåm for lading av bussar, båtar, bilar og skip.*
>
> *[with shore power to Flåm we can be one of the world's foremost green travel destinations. By setting up shore power in Flåm we create an opportunity to run everything else on electricity also. Then we can be an energy hub in Flåm for charging busses, boats, cars, and ships].*

Some participants were concerned that the new environmental regulations would mean that many cruise ships would not be allowed to travel to Flåm, and that the local economy and society would suffer. One participant pointed out that the regulations might not even stop the emissions, only move them and maybe even increase them, saying:

> *Det er vel bedre at cruise shipa selgar til Flåm enn at dei skal selge til Vik, for så å klare å sende gjestene med buss til Flåm?*
>
> *[It is better that cruise ships sail to Flåm than for them to sail to Vik and send the guests to Flåm by bus].*

Finally, the respondents had generally positive opinions about the impacts cruise tourism had on the local community, citing benefits such as having more activities and opportunities for residents and the creation of a more diverse community than such a small town would otherwise have had.

5.3 Interviews

This section is based on the results of seven interviews conducted with people living and working in and around the Flåm area. Two of the participants, who were contacted and interviewed because of their jobs, are referred to by name, while the others are referred to anonymously. In my analysis of these interviews, I found several major themes which I discuss in this section. These are: the economic importance of tourism to Flåm, the new regulations in the World Heritage Fjords, the environmental impacts of cruise tourism, a trend towards

sustainability, cruise tourism´s development over time and social impact on Flåm, and the need for more monitoring and information. Additionally, an interview with an employee of the County Governor [Statsforvalteren] provided insight into the governance of the area, which is also discussed in this section.

All interviewees emphasized the economic importance cruise tourism has for Flåm and expressed a desire for continued cruise tourism in the future. According to the Port Director, Tor Mikkel Tokvam, about 25% of Flåm´s tourists come on cruise ships in a normal year, and they spend around 250 million kroner in the municipality. Multiple interviewees stated that businesses in the community rely on this money, and that residents rely on the jobs. This reliance was also evident in the discussion of the pandemic, Participant Four said that unemployment went from 0.4 percent to seven or eight percent and Ingrid Lydvo of Norway´s Best noted that the pandemic was especially hard for small businesses on the harbor. This sentiment was echoed by Participant Five (employed in the tourism industry) who said that 2020 and 2021 were terrible. Participant Five added that while having Norwegian tourists was nice and they spent a lot of money, the tourism industry cannot rely on them because they do not book in advance and only come when the weather is nice. Additionally, Participant Five felt that the economic importance of cruise tourism to the districts is under-represented in the discussion of cruises, saying “cruisenæringen er ekstremt viktig for distriktet spesielt, og det er beklagelig at det ikke kommer fram” [the cruise industry is extremely important, especially for the district and it is regrettable that this doesn’t come forward]. Lydvo raised this concern as well, stating that the economic importance of cruise tourism in Flåm is “under-communicated in many channels”. There was also some discussion of the fact that not everyone benefits from cruise tourism. Participant Four said that, except for where people in Aurland are employed in the tourism sector in Flåm, the cruise money only benefits Flåm and mainly stays with the larger tourism companies. The cruise companies themselves also try to keep as much money as possible. While Lydvo said that cruise tourists leave a lot of money locally in Flåm compared to other destinations, Participant Four pointed out that they have everything they need on the ship and Participant Six (an employee of the County Governor) told me that the cruise companies have started bringing their own bikes in an effort to keep more of the money for themselves. Despite these concerns, all the participants said they wanted cruise tourism to continue in the future. It is notable, however, that they were satisfied with the level of cruise tourism before the pandemic and expressed a desire to spread the ships

over a longer season rather than having more ships. Several participants also emphasized that this future cruise development should be sustainable or "green."

Another major, recurring theme was that of the new emissions regulations for the World Heritage Fjords. There are two main points that came up in connection with these regulations: their negative impact on Flåm, and their ineffectiveness. Tokvam explained that the regulations are meant to reduce the nitrous oxide (NO_X) emissions in the World Heritage Fjords and are implemented in tiers, with Tier One having been implemented in 2020 under the pandemic, Tier Two taking effect in 2022, and Tier Three, a zero emissions rule, coming in 2026. He explained that they can already see the impact of these regulations and that the Tier Two restrictions on ships built before 2013 have meant they have had to reject some ships. Further, he said that this set the cruise season development back by 20 years. Participant Four expressed the concern that this loss of business could turn into unemployment. These regulations were also largely regarded as failing to accomplish their main goal of protecting the area from emissions. Lydvo explained that the ships which don't meet the requirements simply go to ports outside of the World Heritage Area, namely Vik, and bus the tourists to Flåm. Participant Five expressed the view that they are now emitting the same pollutants into what is essentially the same air, while the Flåm area loses out on business. Additionally, the buses themselves pose a problem. Participant Six explained that not only do they pollute, but the local infrastructure is not equipped to handle so many buses. They said that they expect this to become a bigger problem now that the cruises are coming back after the pandemic. Both Participant Six and Participant Seven, a researcher at the Western Norway University of Applied Sciences [Høgskulen på Vestlandet], said they believed that the restrictions should be applied to the whole of Norway.

The interviewees identified several environmental concerns associated with cruise tourism, with the most common being air pollution. Participant Four said that many of the residents who live near the harbor worry about the air quality when they see the smoke from the cruise ships. Lydvo also acknowledged that people worry about the smoke, but claimed it is mainly water vapor. Participant Three, who works on climate issues for local municipalities, said that carbon dioxide (CO_2) emissions decreased 34% during the years with coronavirus restrictions. Tokvam listed sulfur oxides (SO_X), NO_X, particulate matter, and black carbon as pollutants, but clarified that none of these go over the legal limits and said that the air quality is often impacted by the

weather. Additionally, he explained that the closed-loop systems, which are required when ships use high sulfur fuel, keep sulfur out of the air but create a lot of white smoke. Further, he pointed out that the Port had gotten some very high sulfur dioxide (SO_2) readings which they couldn't account for and speculated that it might be because of nearby industry. Participant Five acknowledged that air pollution was a problem with cruise ships but took an optimistic view and said that the worst ships are being phased out and the cruise companies are working hard on new, cleaner technology. There was also some discussion of water quality. Participant Three explained that cruise ships cannot dump sewage in the inner Nærøyfjord, and that Sognefjord is considered to have medium ecological quality but that the problem is mainly factories. Participant Seven thought cruise ships could be a problem ecologically and pointed out that the noise from the ships impact any fish and mammals in the fjord. This participant also pointed out that cruise tourism is already responsible for the destruction of some local habitat, namely the Flåm River Delta which was destroyed when they built the harbor. Finally, Participant Six identified waves from fast moving ships as being the cause of beach erosion but clarified that they have set speed limits to deal with this.

While they acknowledged the environmental challenges of cruise tourism, many interviewees also identified an increasing trend towards sustainability in the industry. Tokvam and Lydvo both referenced the Port's adoption of the Environmental Port Index (EPI) as a good mechanism to make cruise tourism in Flåm more sustainable by rewarding ships for reduced emissions. Participant Six said that the environment is becoming more and more of a focus in local planning. Participant Three noticed the same tendency with the cruise companies themselves, saying that they had read their plans and that the companies have ambitious sustainability goals. Participant Four had also noticed the sustainability trend and was positive towards continued cruise tourism in the future because of it, although they qualified this statement saying that there must be a limit to it. This sustainability trend doesn't apply to just the cruise companies themselves. Lydvo also described Norway's Best's previous investment in hybrid and electric fjord safari boats and future wishes to electrify their buses.

In addition to economic and environmental impacts, several participants described the social impacts cruise tourism has had on Flåm, as well as how the industry has changed over time. The main social impact identified by interviewees was the crowds. Tokvam, Lydvo, and Participant

Five all claimed that the tourism industry's good planning and management of the tourists have prevented problems with crowding in Flåm. Participant Four, on the other hand, described the town center of Flåm as being "a place for tourism" and said that "There's hardly any room for other people. That's why we don't use [the center] as much in the summer". Cruise tourism has also physically changed Flåm, with the center becoming cruise tourism oriented and the harbor being built. Participant Four observed that the tourism industry has become noticeably more industrial over time and felt that this was a negative change.

Finally, several of the interviewees identified a need for more information and environmental monitoring. This applies especially to the fjord itself and the water quality, although it is also a relevant issue with the air quality monitoring since it started so recently. Participant Six said that, in general, there is not much monitoring of the fjords in Norway, and they do not have an overview of the state of the ecosystem. Participant Seven identified the same problem and provided more detail, explaining that they do not know which species are in the fjord and when, including how many invasive species are already in the fjord, how often the water masses in the fjord are renewed, or what the pre-industrial conditions in the fjord were. Additionally, they said that while there is some recent data on water quality in Aurlandsfjord, it is mainly related to the EU Framework requirements, and they have even less data on the inner-Nærøyfjord.

5.3.1 Local Governance

Although it was not a common theme throughout the interviews, the interview with Participant Six provided me with insight into how the area is governed. They explained that the directory board for the protection area is a political body, made up of local politicians and that their (Participant Six) job is to inform these politicians of the environmental impacts and threats of different activities so that they can make the best decisions. Participant Six also said that it can be confusing for people working outside of the agency to know how it works and who is responsible for what. Additionally, the different municipalities have significant responsibility and authority, which can make it difficult to make decisions with the bigger picture in mind. Finally, Participant Six clarified that the protection area does not extend below the surface of the water.

6 Analysis and Discussion

In order to address the research question *To what extent is cruise tourism in Flåm socially, economically, and environmentally sustainable?,* I make use of the GSTC´s destination criteria. The bulk of my research falls under sections B (Socio-economic sustainability) and D (Environmental sustainability), but I will also discuss sections A (Sustainable management) and C (Cultural sustainability). This discussion addresses each in turn, in order to assess the overall sustainability of Flåm as a destination.

6.1 Sustainable Management

Sustainable management, the first criterion set out in the GSTC destination criteria, is further divided into three sub-criteria: management structure and framework, stakeholder engagement, and managing pressure and change (GSTC, 2019).

6.1.1 Management structure and framework

The sub-criterion of management structure and framework includes three aspects: destination management responsibility, destination management strategy and action plan, and monitoring and reporting (GSTC, 2019).

Destination management responsibility refers to the destination having an effectively managed body which is responsible for ensuring sustainable tourism with coordination and the involvement of a range of actors including business interests, the public sector, and public interests (GSTC, 2019). The cruise tourism governance situation in Flåm is complicated and involves a lot of coordination of different interests and groups. Flåm is part of the Aurland Municipality, which has an economic plan and budget for 2022 to 2025 available online and has an informative website which details the responsibilities of different employees (Aurland Municipality, 2021). Another relevant governing body is the Nærøyfjord Protected Area Board, which is composed of the mayors and deputy mayors of the four bordering municipalities as well as community representatives and other interest representatives. There is also the Norwegian Maritime Authority which has significant authority over the fjord itself. My interview with Participant Six revealed that it is often difficult for these groups to make comprehensive, big picture decisions because there are so many competing interests involved, such as the potentially competing interests of each municipality, and competing interests within the municipalities.

These could include, for example, the need to protect the local environment and the need to grow the economy.

The next area of consideration under management structure and framework is the destination management strategy and action plan. Participant Six said that the Governor´s Office is currently creating a Visitor Strategy for the Nærøyfjord Protected Area. This strategy will be an addition to the Management Strategy for the Nærøyfjord Protected Area, which was created in 2008. Unfortunately, it is not published yet and it is therefore not possible to fully assess this aspect of the management structure and framework criterion. However, the 2019 hearing regarding the plan can provide some insight into its priorities and considerations. The hearing document implies that the final visitor strategy will have been created with input from a variety of actors and will consider sustainability and nature protection (Nornes, Vallestand, & Johansen, 2019). There are some potential limitations to this plan however, in that Flåm and Aurlandsfjord are not part of the protected area. Additionally, it is unclear how involved stakeholders outside of the local governments are in the creation of the plan.

The final aspect of management structure and framework is monitoring and reporting. This refers to the setting of specific, measurable targets and goals for socioeconomic, cultural, and environmental indicators (GSTC, 2019). This was not a focus of my research, apart from environmental monitoring which is discussed later, and no specific socioeconomic or cultural goals or indicators came up in the surveys or interviews.

6.1.2 Stakeholder engagement

This sub-criterion is divided into four: enterprise engagement and sustainability standards, resident engagement and feedback, visitor engagement and feedback, and promotion and information (GSTC, 2019). This section focuses on enterprise engagement and sustainability standards and on resident engagement and feedback.

With regard to enterprise engagement and sustainability standards, Flåm seems to be doing fairly well. My interview with Tokvam revealed that Flåm Port has adopted the EPI to reward the cleaner cruise ships and that this has been successful. Additionally, they are working towards getting shore power installed, to eliminate emissions from cruise ships in port. Tokvam also explained that the cruise companies are receptive to requests from the community, such as the request that they not use the speakers while in port except in the case of an emergency and the

request that they not use HFO in the area even if they have a scrubber system, because of the visual pollution created by the resultant white smoke. Norway´s Best also contributes in this area, as Lydvo explained in her interview that they have a hybrid boat and two entirely electric ones, and that they are hoping to electrify the buses.

I did not investigate resident engagement and feedback specifically in relation to sustainability, but perceived resident influence on the cruise tourism decision-making process was included in the surveys. Overall, residents felt that they had "little" influence on the cruise tourism decision making process. There was some variation in the average for different demographic groups, but all of them were close to "little" influence, with the lowest value being 1.71 (where one is "no influence" and two is "little influence") for residents under 25 years old, and the highest being 2.29 for residents who have lived in Flåm for over 45 years. It makes sense that residents who have been in the area the longest, and therefore are the most familiar with the governance system and likely to have held positions of power or influence over time, felt they had more influence than other groups. There is some evidence that resident feedback is taken seriously, as the noise complaints and visual pollution complaints to the cruise companies discussed above were both made as a result of resident feedback. There is potentially additional evidence of this in the fact that both of these issues were identified in previous master´s theses, while the participants in this thesis did not name this as a problem. That being said, there were still problems raised by participants in this thesis that have not been addressed, and this seems to be an issue where there is room for improvement in the sustainability of cruise tourism in Flåm.

Visitor engagement and feedback was not an area of focus in my research, and the topic did not come up in the surveys or interviews. The same is true of promotion and information.

6.1.3 Managing pressure and change

The sub-criterion of managing pressure and change is further divided into four aspects of consideration, which are: managing visitor volumes and activities, planning regulations and development control, climate change adaptation, and risk and crisis management.

Managing cruise tourism visitor volumes and activities came up several times during the interviews. The interviewees who are involved in the tourism industry expressed the opinion that Flåm is very good at handling large volumes of cruise tourists. They specifically referenced the buses and the railway, and the fact that the harbor is downtown so the cruise tourists don't have

to go through residential areas or areas designed for local use to get to their destinations. They also stated that the industry was concerned about avoiding negatively impacting residents. This is an issue that was brought up by participants in previous master´s thesis, with informants complaining of tourists using their gardens as toilets (Dybwik, 2020). The interviewees also acknowledged that some of the community does not like the crowds. Participant Four, who does not work in the cruise tourism industry, was less positive about cruise guest management and stated that many residents, including themself, did not use Flåm on days when there were cruise ships. This opinion is also evident in the survey results, which imply the existence of a decently large portion of Flåm´s population that wants less cruise tourism in the future. Additionally, this was an issue raised in previous theses as well, with some participants saying that they could not use their own grocery stores because they were so crowded, or that they avoided town on cruise days because of the stress (Nicolaisen, 2020). It is clear that there is some disagreement among the local population over whether or not the cruise industry successfully handles large numbers of cruise tourists. Additionally, several interviewees pointed to the emerging bus problem in connection with the new emissions rules. The Tier Two emissions regulations came into effect in 2022 and disqualify some cruise ships from visiting Flåm. Some of these ships go to Vik instead and then bus their passengers to Flåm. There is concern among the local tourism industry and the residents that the roads are not equipped to handle all the buses, and furthermore, figuring out where to put the buses once they get to Flåm is a challenge as there is limited space. My interviews also revealed a desire within the tourism industry to spread the cruises out over a larger part of the year, which they indicated would reduce the negative impact on the local community and spread the benefits longer. According to several interviewees, this goal is also impeded by the new emissions restrictions, as the cruise ships which would be able to sail in the fjords in the winter are no longer allowed.

Planning regulations and development control seems to be an area with potential for improvement. The hearing document for the destination plan creation, discussed above, seems to indicate a good amount of collaboration between different actors and some consultation of the public. However, there is still the fact that, on average, survey respondents felt they had “little” impact on decision-making. Additionally, although some interviewees said environmental considerations have become more of a focus over time, it does not seem to be a formal consideration in many decision-making processes, except where it is required by law. There is

also the added challenge of there being many different regulations which apply in the area, with Aurland Municipality having significant authority over their land and regulations, The Norwegian Maritime Authority and the Norwegian Coastal Authority having authority over the fjord, and the protected area being governed by the Norwegian Environment Agency.

Climate change adaptation is a difficult area to assess, as Aurland Municipality is in the process of creating a new climate plan. The old one is available online, but it is for the years 2011 to 2020 and is therefore out of date. Participant Three, who I interviewed, works on climate for Aurland and several other municipalities. As Aurland is a small community, I do not think the fact that they only have one person working on climate issues – and working with other municipalities as well – is a sign that they do not take climate seriously. There is also evidence of climate change concern in Flåm in particular, as Lydvo described Norway´s Best´s acquisition of hybrid and electric boats and desire to reduce emissions by electrifying buses, and Tokvam stated that they are hoping to get shore power so the cruise ships can turn their engines off in port. Despite all of this, there is still the fact that cruise tourism is inherently bad for the climate. Even if Flåm did everything in their power to reduce cruise tourism´s emissions and climate impact, the industry´s global contribution to climate change would still be a problem. When it comes to local adaptation to climate change, the only impacts listed by interviewees were increased precipitation and the flooding of the Flåm river, and increased vegetation growth. No interviewees expressed concern for any climate change related threats to cruise tourism, although I did not ask about it. This is an area with potential for improvement through the adoption of a more systematic approach.

Although not a focus area of my research, I believe risk and crisis management is also a potential area for improvement. I did not find any emergency plans on the Aurland Municipality website. It is possible that such considerations will be included in the visitor management plan that is currently being written, but currently available information points to this being an area for improvement.

Overall, sustainable management of cruise tourism in Flåm seems to be lacking a systematic approach. Some specific areas that could benefit from such an approach are the incorporation of resident feedback, the development of emergency and crisis response plans, the incorporation of

climate change into local institutions, and goal setting for environmental, social, and cultural targets.

6.2 Socio-economic sustainability

The second criterion set out by the GSTC, socio-economic sustainability, is broken down into the two sub-categories of delivering local economic benefits and social well-being and impacts (GSTC, 2019). This section is directly related to my research question and is where the bulk of pervious research on cruise tourism in Norway has been focused.

6.2.1 Delivering local economic benefits

The goal of delivering local economic benefits is further divided into the following aspects: measuring the economic contribution of tourism, decent work and career opportunities, and supporting local entrepreneurs and fair trade.

The economic contribution of cruise tourism in Flåm seems to be high and well-known. All the interviewees stressed the economic importance of cruise tourism for the area. Tokvam stated that cruise tourists leave about 250 million kroner in Flåm in a normal year. Lydvo also indicated that they are proud of the amount of money that cruise tourists spend locally. The survey results showed that most people are aware of the impact cruise tourism has on Flåm economically and view it positively. Cruise visitor numbers are publicly accessible, as the call list is published on the Flåm Port´s website showing when the ships will come and how many visitors each will bring. The data regarding visitor expenditure is clearly collected somewhere since the Flåm Port and Norway´s Best have the information, but I was not able to find it online. This contributes to an emerging pattern of a lack of systematic data collection and reporting. While my work indicates that cruise tourism is economically important to Flåm, the evidence of this should be more readily available. This lack of data availability could also contribute to the problem identified by Participant Five, who felt that the economic importance of cruise tourism to the district is not emphasized enough in the wider discussion about cruises in Norway. On the other hand, cruise tourism has the potential to cost money as well, when local services must respond to any emergencies that occur.

When it comes to providing decent work and career opportunities, the situation is more complicated. It is clear from the increase in unemployment in 2020 when there was no cruise tourism that the industry is important for local employment. This topic was raised in both the

surveys and the interviews. Given Norway´s labor laws, it seems safe to assume that this employment provides decent work in a secure environment with living wages. It is, however, unclear how this work is divided up among the different population demographics. The unequal division of the benefits of cruise tourism was also a topic that came up in both the surveys and the interviews. One survey respondent pointed out that the pandemic has proven that Flåm can survive without cruise tourism and stated that there are a few people who have become rich off of the cruises, but most people do not rely on it. This was echoed by another survey respondent who claimed that the small businesses in Flåm do not make much money from cruises. This topic also came up in my interviews, with Participant Four noting that the economic benefits don´t spread very much geographically either, except for those who live in Aurland and work in Flåm. Of course, one must also consider that those in Flåm who do make a living from cruise tourism probably spend some of that money in the local community. An additional challenge was revealed in Nicolaisen´s (2020) thesis – some businesses have trouble making enough money in the summer to provide year-round employment. On the other side of the issue, Lydvo pointed out that Norway´s Best is proud to be locally based and has no plans to move the main office out of the area, which provides local jobs. Still, not everyone benefits equally from cruise tourism, and it would be worth looking into which groups do and which groups do not.

Cruise tourism is known for being bad when it comes to supporting local entrepreneurs and fair trade. As was pointed out to me during the interviews, the cruise tourists have everything they need on the boat. That being said, Tokvam and Lydvo claimed that cruise tourists leave more money in Flåm that in other locations. One of the biggest attractions in Flåm is the railway, which is owned by Norway´s Best. Lydvo explained that they make an effort to get the cruise tourists to book with them directly, which results in all the money spent being kept in the community. On the other hand, the cruise tourists typically do not eat in local restaurants or venture beyond the tourist shops at the harbor. I have not seen any evidence of the tourism industry in Flåm actively supporting small businesses or emphasizing fair trade, although this was not a focus area for my research, so that does not mean it was not there. Additionally, this criterion seems to be more aimed at tourism destinations in less developed areas, rather than wealthy countries such as Norway.

6.2.2 Social well-being and impacts

The social well-being and impacts sub-criterion is divided into five aspects. These are: support for community, preventing exploitation and discrimination, property and user rights, safety and security, and access for all.

In their guidelines, the GSTC describes support for community as the existence of a system which allows and encourages businesses, residents, and tourists alike "to contribute to community and sustainability initiatives in a responsible manner" (GSTC, 2019, p.10). This was not something I explicitly asked about, but the survey and interview results seem to imply that no such system exists when it comes to cruise tourism in Flåm. Cruise tourists have been described as having highly scheduled time in Flåm. The cruise ship call list shows that the ships are usually in the harbor for less than a day, which does not leave much time for the guests to partake in community or sustainability initiatives. It is worth noting however, that although it is not a formal contribution system, some participants felt that cruise tourism contributes to the community anyway, with survey respondents noting that the existence of cruise tourism in Flåm improved the availability of activities and opportunities for residents and another stating that cruise tourism gives the town a more diverse community than a small Norwegian town would have otherwise.

Neither the prevention of exploitation and discrimination nor property and user rights were the focus of this research, nor was either issue raised by survey or interview participants. Exploitation and discrimination did, however, come up in one of the previous theses. Norway has strong rights for workers and citizens, so the risk of cruise tourism causing the exploitation of workers in Flåm seems low. In Nicolaisen´s (2020) interviews, however, some informants discussed the fact that it is difficult for outsiders to become a part of the local society. Additionally, one of Nicolaisen´s (2020) interviewees referred to the group of foreign seasonal workers as a "ghetto" and complained that they do not contribute to society, which raises some concerns about discrimination against this group. There is also the issue of discrimination and exploitation on board the ships themselves. Cruise ships are typically registered in countries with relaxed labor laws, meaning there is the potential that, by Norwegian standards, the workers on board are being exploited. This is something that cruise destinations may want to take into consideration when claiming sustainability. When it comes to property and user rights,

Indigenous rights are not an issue in Flåm. Communal access rights could be a problem in terms of coastal access, but no participants raised this issue.

Safety and security is not an area of concern in Flåm. Norway has well established emergency response systems and is known to be a very safe country. This applies to both issues of crime and issues of health and hygiene. No participants in either the surveys or the interviews expressed any concerns about their personal health or safety, or the health or safety of others.

The final aspect of social well-being and impacts laid out by the GSTC is access for all, which refers to disability access to practical, natural, and cultural sites. This was not a focus area for my research and did not come up in the surveys or interviews. The website for the Flåm railway, the most popular activity, does not indicate accessibility, although forums dedicated to accessible travel suggest that it is wheelchair accessible. This is an important area where there is room for improvement.

This section has addressed the social and economic sustainability of cruise tourism in Flåm. My research results indicate that cruise tourism is important for Flåm economically, and those involved in the local tourism industry seem concerned about the social impacts of cruise tourism. The survey respondents were, on average, positive about cruise tourism´s social impact on Flåm and even more positive about its economic impact. There is also some evidence of resilience in times of crisis, in that the community has not fallen apart under the coronavirus pandemic, which is an important aspect of sustainability. There does, however, seem to be a need for a more coordinated systematic effort in Flåm to address sustainability. Some specific areas of improvement include formal goal setting for economic, social, and environmental targets, a more systematic data collection method, and better communication of emergency planning and accessibility information.

6.3 Cultural sustainability

The third criterion put forward by the GSTC is cultural sustainability, which is broken down into the sub-criteria of protecting cultural heritage and visiting cultural sites. Many of the topics in this section are outside the scope of my research, but I address them to the extent that it is possible.

6.3.1 Protecting cultural heritage

The sub-criterion of protecting cultural heritage is further divided into the protection of cultural assets, cultural artifacts, intangible heritage, traditional access, and intellectual property. These topics did not come up in my research, although they were discussed in the papers I read when doing my background reading and they are relevant because of Nærøyfjord's World Heritage status. It is important that the entire area be governed in a way that protects the cultural value in order to keep the World Heritage Status. Additionally, a large part of the draw of Flåm is the cultural landscape, and the physical landscape which is looks the way it does largely because of the traditional farming and land use. There has been some acknowledgement of the importance of traditional land maintenance, which seems to be a challenge as there is more economically rewarding work to be done and some farmers have expressed a concern that they do not have time to continue farming as they should while making money to support their families (Vik et al., 2010). There is also the issue of language use, which could fall under intangible heritage. Participants in Nicolaisen´s (2020) thesis expressed feeling that they have become foreigners in their own home because during the tourism season it is often necessary for them to speak English instead of Norwegian. It is important for Flåm as a sustainable cruise tourism destination that the residents do not feel they are losing their culture because of the tourists, although this issue is likely caused by all the different kinds of tourism. This is another area for improvement and would be a good area for future research.

6.3.2 Visiting cultural sites

The sub-criterion of visiting cultural sites is broken down into two aspects: visitor management at cultural sites, and site interpretation. I have not researched this area, and it did not come up in interviews or surveys. However, based on my findings regarding visitor management, it seems likely that this is not an area of concern as the tourism companies in the area seem concerned about the social impacts of cruise tourism.

6.4 Environmental sustainability

Environmental sustainability was the focus of my research, as this was where I identified the biggest research gap relating to cruise tourism in Flåm. This criterion is broken down into three separate criteria by the GSTC: conservation of natural heritage, resource management, and management of waste and emissions (GSTC, 2019).

6.4.1 Conservation of natural heritage

Conservation of natural heritage is further divided into four separate criteria. These are: protection of sensitive environments, visitor management at natural sites, wildlife interaction, and species exploitation and animal welfare (GSTC, 2019).

The protection of sensitive environments requires monitoring of those environments, as well as specific efforts to conserve these environments and their biodiversity. This is perhaps the area with the biggest need for improvement in Flåm. My initial background reading for this thesis revealed that there has been very little research into the environmental impacts of cruise tourism in Flåm and, indeed, in Norway as a whole. The academic research which has been done is mainly focused on cruise ship emissions. There have also been some reports published by government agencies or at the request of government agencies, but the work for these has been done by consulting companies and is not scientifically reviewed. In my interviews with people working in relevant fields, I inquired about monitoring systems, and discovered that there is almost no systematic monitoring of the environment in Flåm. Additionally, in my background reading for this project I discovered that the institute which had been monitoring the condition of Sognefjord was shut down in 2007 (Manzetti & Stenersen, 2010). There is some environmental monitoring in the protected area which borders Flåm, but my interview with Participant Six revealed that cruise tourism is not really something they are worried about, the bigger threat is hikers. This fits with what the other interview participants said about the cruise tourists, that they are typically only in the area for a few highly scheduled hours, with the main activity being the railroad. My interview with Participant Seven revealed that, especially when it comes to the fjord, very little is known about the environment. This statement is corroborated by Opdal et al., (2013) who point out that this lack of knowledge makes it impossible to keep track of any change over time. Earlier research found that there are no fish in the Aurlandsfjord anymore, a claim which is supported by informant statements in other Master´s theses, although there are many possible reasons for this (Manzetti & Stenersen, 2010). Participant Seven said that there has been some regular monitoring of the Aurlandsfjord recently, but there is only sporadic data on the inner-Nærøyfjord. Additionally, they do not have an overview of the ecosystems in the fjord or of which animal species are there and when. This means that they do not know which invasive species are already present. Cruise ships are not allowed to discharge wastewater in the World Heritage Fjords which is good for preventing the introduction of alien species, but there is

still some risk in this area. This risk is hard to mitigate since there is no overview of which species are already there. There have been some efforts in this area with tracking where cruise ships have been before coming to Norwegian ports, and the monitoring of specific species, but it is not systematic (Husa, Agnalt, Berntsen, Falkenhaug, Fossøy, Forsgren, Grefsrud, Hjelset, Hanssen, Husby, et al., 2022). The more active indicators associated with this criterion – such as controlling invasive species, conserving biodiversity, and mitigating the impact cruise tourism has on the environment – are all dependent on monitoring the ecosystems and the state of the environment.

In order to meet the visitor management at natural sites criterion, the GSTC recommends monitoring visitor impact on these natural sites, as well as taking steps to minimize this impact and educating visitors on their behavior (2019). My interviews with Lydvo and Tokvam revealed that cruise tourists tend to go on arranged activities, with the most popular being taking the Flåm railway. However, they also do things like going to the Viking Village, taking bike trips, and going on fjord excursions. Participant Six indicated that cruise tourists are not a big threat to natural areas, as they generally visit them with guides who tell them how they should behave. That being said, Participant Six also expressed a desire to have visitors better educated about the responsibilities that come with the Norwegian right of public access [allemannsretten]. Namely, the responsibility to leave no trace. I did not investigate what the cruise tourists have been told about their responsibilities when visiting natural sites in Flåm, but when I asked about any threats cruise tourism poses to the environment, no interview participants raised the issue of their behavior in natural areas. This was also not raised in the extra information section of the surveys. On the other hand, informants in previous theses complained of cruise tourists using their gardens as bathrooms, feeding their animals chocolate, and picnicking on farmland – although there is some debate over which tourists are responsible for this (Dybwik, 2020). While there is not any indication that this is a big problem in Flåm, there should be a systematic approach to monitoring it, especially since the natural areas are one of the biggest draws for tourists.

Since cruise tourists mainly stick to the central areas in Flåm, they are not likely to be where most wildlife is, and wildlife interaction is not likely to be a big problem. It should, however, be monitored to ensure that it does not become a problem. This is especially relevant when the tourists engage in activities such as bike rides or fjord cruises. When it comes to the fjord

activities, this monitoring is extra difficult because, as Participant Seven pointed out, we have a poor overview of which species are in the fjord. In order to ensure that cruise tourists are not having adverse impacts on the local wildlife, two steps need to be taken: a survey of the local ecosystem should be taken to get an idea of which species are present, and a monitoring system of the tourist activities should be established.

The main activities for cruise tourists in Flåm have been identified by the interviewees in the industry as the Flåm Railway, bike rides, and fjord cruises, none of which involve captive animals. Therefore, species exploitation and animal welfare is not an area of concern. The purchase of products derived from threatened or endangered wildlife is also not likely to be an issue.

6.4.2 Resource management

Resource management is divided into the three sub-categories of energy conservation, water stewardship, and water quality (GSTC, 2019).

The first aspect of resource management is energy conservation, which involves encouraging energy use reduction as well as using as much renewable energy as possible. Flåm has taken steps to address both issues in relation to cruise tourism. Tokvam described Flåm´s adoption of the EPI, which rewards more environmentally friendly ships. Additionally, Lydvo explained that Norway´s Best is switching to electric power wherever possible, having purchased hybrid and electric boats and having hopes to electrify their busses. This also applies to the harbor itself, where they are hoping to install electric shore power for the cruise ships to use in port.

The second part of resource management is water stewardship. This is not a main area of concern for cruise tourism in Flåm, as Norway has an established system for monitoring water supply which complies with the European Union (EU) Directive. This system includes regular monitoring and reporting. Additionally, western Norway is known for having high precipitation and water supply is not typically a problem. However, cruise tourism´s use of and impact on the water could be better monitored, so while it is not a main priority, it is an area for improvement.

The final aspect of resource management is water quality, which is an area that needs to be improved. My interviews revealed that there is no long-term systematic monitoring of the water quality in the Aurlandsfjord or the Nærøyfjord. There has been some sporadic monitoring of

various water quality parameters in the fjords, but nothing that creates the time series data needed to monitor the effects of specific activities such as cruise tourism. Participant Seven stated that current information indicates that the ecological condition of Aurlandsfjord is okay, but it is not known how often the water masses are renewed or what the natural condition of the fjord was in pre-industrial times. It is therefore impossible to truly monitor the impact cruise tourism has on the fjord. This is perhaps one of the most important gaps when it comes to cruise tourism sustainability in Flåm. One thing we do know, according to Participant Seven, is that the top level of sediment in the Nærøyfjord has high levels of tributyltin (TBT). TBT is highly toxic and has been banned in the EU and Norway since 2003, although there are a few exceptions. The fact that it is in the top layer of sediment means that there is a current source of TBT in the Nærøyfjord, although the source has not been identified. It is also important to know the sedimentation rate of the fjord to determine the best way to mitigate the TBT, but this is also unknown. This lack of knowledge about the water quality and processes in the fjord is one of the more urgent problems with the sustainability of cruise tourism in Flåm and is something that the authorities should take immediate action to address in order to avoid unknowingly damaging the ecosystem.

6.4.3 Management of waste and emissions

The final sub-criterion set forth by the GSTC is management of waste and emissions, which is broken down into five categories: wastewater, solid waste, GHG emissions and climate change mitigation, low-impact transport, and light and noise pollution.

A study from the Norwegian Maritime Authority (2017) found that cruise ships do not pose a threat when it comes to wastewater emission in Flåm, as 91% of the ships do not release treated or untreated wastewater into the World Heritage Fjords. Furthermore, the report found that local boat traffic is a bigger problem where this is concerned (Norwegian Maritime Authority, 2017). Of course, this is based on information collected from the cruise ships themselves. Some of the information was, however, confirmed Participant Three who said that the inner-Nærøyfjord is not available for the release of sewage. Additionally, no survey participants or interview participants brought this up. This is a concern, however, when it comes to water quality monitoring. As discussed above, little is known about the Aurlandsfjord and the Nærøyfjord. This makes it difficult to know how much wastewater, including treated wastewater, can be safely released into the water. There is also the matter of other wastewater, such as ballast water

and water used in scrubber systems. The Norwegian Maritime Authority (2017) found that some cruise ships admit to releasing treated scrubber system wastewater into the fjords. The release of any water containing oil is not allowed, and in accordance with the Ballast Water Convention [Ballastvannsforskriften], ballast water is required to be treated before release in order to prevent the introduction of invasive species (Ballast Water Convention, 2017). This means that technically this should not be a concern, but once again the lack of monitoring makes it one.

Solid waste is not an area of concern when it comes to cruise tourism sustainability in Flåm because, as Tokvam explained, cruise ships do not leave waste in Flåm. This is due to the town´s remote location, which makes waste collection difficult and expensive. Therefore, cruise ships dispose of solid waste in other locations. This is also not an issue with regard to the waste the tourists undoubtedly produce while they are visiting Flåm, as Norway has a well-established waste collection system which includes recycling and the composting of organic waste. Additionally, no interviewees or survey participants brought solid waste up as an issue, which seems to imply that it is not a problem.

Greenhouse gas emissions and climate change mitigation is perhaps the single most problematic topic associated with cruise tourism sustainability. However, in the division set forth by the GSTC, travel emissions are discussed in the next category of low-impact transportation. Therefore, this paragraph only discusses emissions and climate change mitigation as they related to the time the cruise ships are in port in Flåm. In this regard, Flåm does rather well. Flåm center is right next to the harbor, so the cruise tourists do not need to take buses or cars to get to it. The fjord cruise boats owned by Norway´s Best, on which many cruise tourists take fjord excursions, are hybrid and electric. This is especially good because the electricity in Norway comes largely from renewable sources, so electrification probably does mean a reduction in greenhouse gas emissions. One problem area is the use of buses related to the Flåm Railway. Typically, half of the passengers will take buses to the station at Myrdal and take the railway down, while the other half take the train to the top and the buses back. Lydvo claimed that Norway´s Best wants to electrify the buses, but as of yet this has not occurred. On the other hand, some of the popular activities, such as cycling, do not involve any greenhouse gas emissions. There is also the issue of the ships´ emissions while they are in port. Currently they must keep some engines running to provide electricity on board, but Tokvam said Flåm is hoping to get shore power so they can turn

the engines off. Once again, since Flåm is in a country with heavy reliance on renewable energy, this electrification would likely reduce greenhouse gas emissions and the overall impact on climate change. As it stands now, however, the buses and the ships themselves while in port are a source of greenhouse gas emissions and, therefore, contribute to climate change. When it comes to mitigation and emissions reductions planning, Aurland Municipality does have a climate plan, although it is published every ten years and not annually (Strand & Rosenvold, 2010). They are currently creating a new one, and the most recently available plan online is for 2011 to 2020. It seems that Flåm is making an effort to reduce the greenhouse gas emissions and climate change contribution of cruise tourism as much as possible, although the climate change impact of cruises will be a problem no matter what they do due to the high greenhouse gas emissions that cruise tourism is responsible for.

The next criterion is low-impact transportation, which includes transportation within the tourist destination and to and from it. This area is highly problematic for cruises, which are known to contribute enormously to global greenhouse gas emissions, as well as emitting other pollutants which worsen the air quality. Some specific pollutants of concern are nitrous oxides (NO_X), sulfur oxides (SO_X), ozone (O_3), PM2.5, PM10, and carbon monoxide (CO). In relation to this sub-criterion, I discuss each of these pollutants with reference to the findings presented in the secondary data results section before moving on to discuss congestion, which is also a part of low-impact transportation. For this reason, this sub-criterion is discussed over several paragraphs rather than in one, as has been the case for the previous ones.

Nitrogen dioxide (NO_2) is one of the more problematic air pollutants emitted by cruise ships. This discussion only considers NO_2 instead of all nitrous oxides because the air quality monitoring conducted by the Flåm Port only includes NO_2.

The fact that the July-August average NO_2 concentrations at the Sentrum station for 2019 and 2021 were so close, while the 2020 concentration was lower is interesting because NO_X is assumed to be a major component of the smoke emitted by cruise ships in the Nærøyfjord, and one would therefore expect the 2019 concentration to be significantly higher than the concentrations in 2020 and 2021. The average NO_2 concentrations in 2020 and 2021 are indeed lower than the average “high season” concentration in 2019, but the values for 2019 and 2021 are quite close. 2021 did have some cruise tourism, but this added up to a total of six ships in

July and August, so it is not likely to be the reason that the concentrations for 2019 and 2021 are so close to each other and the one for 2020 is not. The NO_2 concentration was lower in 2020 than the other years, but there was only a small difference between 2019 and 2021 which seems to indicate that cruise tourism is not a large contributor to NO_2 in Flåm, as there as hardly any cruise tourism in 2021. Additionally, newer ships are known to emit less NO_X and research has found that there is a tendency for newer ships to visit the western fjords (Simonsen, 2021). The Norwegian Maritime Authority (2017) wrote in a report that the NO_X level in Flåm was sometimes above the boundary prescribed in the Norwegian Pollution Control Regulations [Forurensnings forskriften] to protect human health. The Norwegian Pollution Control Regulations (2004) 7-5 set the one-hour boundary for NO_X concentration to protect human health at 200 $\mu g/m^3$. The data collected by Flåm Port shows that the NO_2 level in the Sentrum passed this level a handful of times over the course of the data collection period. from 2019 to 2021. These exceedances do not seem to be caused by cruise tourism however, since they occurred outside of the cruise tourism high season of May to August and occurred in 2020 which had no cruise tourism. It is, however, possible that cruise ships are a contributing factor to the higher NO_2 concentration, and it is notable that the NO_2 concentration at Utkant did not exceed the Norwegian Pollution Control Regulations boundary during the study period. This indicates that something near Sentrum caused these exceedances. The NO_2 annual concentrations do not exceed the Norwegian Pollution Control Regulations (2004) annual boundary of 30 $\mu g/m^3$for the protection of vegetation. However, once again, I must note that NO and N_2O were not measured.

Next, I discuss the SO_2 results presented in the secondary data results section. The Norwegian Pollution Control Regulations (2004) set the one-hour SO_2 limit for the protection of human health at 350 $\mu g/m^3$. For ecosystem protection, the boundary is set at an annual average of 20 $\mu g/m^3$. The air quality data from Flåm Port indicate that the one-hour boundary was crossed several times in the measurement period of 2019 to 2021. Additionally, the annual average for both the Sentrum and Utkant stations in 2020 and 2021 were well above 20 $\mu g/m^3$, indicating that the SO_2 levels in Flåm could be a problem for ecosystem health. However, these high levels cannot be ascribed to cruise tourism because there was none in 2020 and very little in 2021. In fact, the only year that had a normal amount of cruise tourism is also the only year in this study which did not record an average annual SO_2 concentration above the boundary set – although this is also the year that is missing the most data. Due in part to the lack of data from 2019, it is

impossible to check if there really is a correlation between cruise tourism and high SO_2 levels in Flåm. What is clear, however, is that high SO_2 levels are a problem in Flåm, and that the concentration is higher at the Sentrum monitoring station than at the Utkant station.

O_3 is another pollutant of concern, as it is dangerous to human health at high concentrations. The July-August average and annual average ground level O_3 concentrations in Flåm from 2019 to 2021 were all well below the goal set in The Norwegian Pollution Control Regulations (2004), which is 125 $\mu g/m^3$. There were a few occasions where this boundary, which specifies that there may not be more than 25 eight-hour averages above it in a calendar year, was exceeded. These exceedances are only visible in the data a few times over the two and a half year monitoring period, although there are long periods where no data was collected which could contain exceedances. It is difficult to draw any conclusions about the O_3 levels in Flåm, because the data is very limited and there are no clear patterns. Additionally, the averages seem to be influenced by a few high pollution events. It is notable, however, that most of the summer of 2020 had markedly lower O_3 concentrations than the summers of 2019 and 2021 or any of the years overall.

The lack of summer 2019 data makes it impossible to draw any conclusions or even speculate about cruise tourism's impact on the PM2.5 levels in Flåm. There were a few cruise ships in 2021, but it was far from a normal year for cruise tourism. Additionally, while these cruise ships visits do correspond with elevated PM2.5 concentrations, this also fits the general pattern of higher PM2.5 concentrations in the daytime, a pattern which is visible even in 2020 when there was no cruise tourism. It is difficult to say if this indicates that cruise ships do not drive up the PM2.5 concentration however, as cars are also known to produce PM2.5 and 2020 had an increase in domestic tourism in Norway, which increased car traffic in tourist destinations in Norway. The average PM 2.5 concentration at the Sentrum monitoring station was higher than the average at the Utkant monitoring station for all three years and in both time periods of consideration (tourism high season and annual). This cannot be attributed to cruise tourism however, as the measurements are from years in which there as little or no cruise tourism. Additionally, there could be any number of additional contributing factors, such as cars or bonfires. The Norwegian Pollution Control Regulations (2004) prescribe 10 $\mu g/m^3$of PM2.5 as the limit for the annual average to protect human health. The annual averages for Sentrum and

Utkant from 2019 to 2021 were all significantly below this barrier. However, none of this data includes a time period with normal cruise tourism, so the only conclusion that can be drawn is that without cruise tourism, PM2.5 is not a concern in Flåm.

PM10 is another potentially harmful pollutant known to come from combustion. The PM10 concentration spikes much more dramatically than the other pollutants discussed in this study. These spikes occurred throughout the year, including the winter when there were no cruise ships, and were observed in 2020 which had no cruise tourism at all. Unfortunately, due to the PM10 concentration data starting in late 2019, it is impossible to look for the impact of cruise ships. The Norwegian Pollution Control Regulations (2004) set the annual average PM10 concentration boundary at 20 $\mu g/m^3$, and the daily average limit at 50 $\mu g/m^3$. This data indicates that Flåm does not have to worry about crossing these boundaries. It seems unlikely that cruise tourism would bring the averages up over this boundary, but it is still worth noting that there is no data on PM10 concentration during a normal cruise season.

Finally, this section addresses CO. CO is mainly thought of as an indoor air pollutant which, if the concentration is too high, can cause CO poisoning. However, it can also cause problems as an outdoor air pollutant. The Norwegian Pollution Control Regulations (2004) set the boundary to protect human health at 10 $\mu g/m^3$ for eight-hour averages. There was no point throughout this three-year data where the CO concentration in Flåm was anywhere near this boundary. It is true that there were data gaps, but the data covers the summer and fall of 2019, which had normal activities and also spans almost the entirety of 2021, so it is unlikely that the CO concentration would have reached the boundary in those data gaps. This means that CO is not something Flåm needs to worry about, and the data indicates that cruise ships, while they may emit CO, do not cause problems in this area.

The data collected and analyzed in this thesis do not show any obvious correlations between cruise ships and bad air quality. This does not mean, however, that cruise ships do not pollute the air. This data only covers part of one normal cruise tourism season, and for some of the pollutants there is no data until after the end of the 2019 cruise season. There is evidence that some activity near the Sentrum monitoring station was worsening the air quality, particularly for NO_2, SO_2, and PM 2.5. It is also true that these are the main pollutants associated with cruise tourism in the World Heritage Fjords by the Norwegian Maritime Authority (Norwegian

Maritime Authority, 2017). However, they are also the main pollutants associated with combustion in general. It is possible that these elevated concentrations are caused, at least in part, by local boat traffic which is known to emit the same pollutants as cruise ships. We also know from Simonsen, Gössling, and Walnum's (2019) analysis that cruise ships do contribute significantly to Norway´s air pollution.

This section also discusses transportation congestion. This has not previously been an issue in Flåm. When asked if cruise tourism impacted their use of the fjord, no interview participants said that it did, nor had they heard complaints about this from anyone else. Participant Four clarified that the cruise ships typically arrive early in the morning, a time when they are not likely to bother anyone. When it comes to transport around Flåm, the arrival and departure times of the cruise ships are published online and are easily accessible to the public so it would be possible to plan around them. Additionally, Flåm center is right next to the port, so there is no need for transportation to the shopping areas. The only complaints regarding congestion in Flåm were aimed at the presence of the tourists themselves and were not issues with transportation.

Finally, this section discusses the last aspect of management of waste and emissions – noise and light pollution. No interview or survey participants raised this issue themselves, and when asked about it the interviewees did not think it was an issue. Tokvam explained that they can regulate this, and that they have had problems with noise in the past and asked the cruise companies to keep it down, which was successful. When it comes to the impact of noise and light pollution on wildlife, it is not possible to make an assessment because of a lack of knowledge about the animals in the Aurlandsfjord. Participant Seven explained that it was very possible that noise pollution from the ships disturbed the animals but, as is a theme with this research, we need more information in order to be sure.

There are several problematic areas where the environmental sustainability of cruise tourism in Flåm is concerned. These include emissions to the air, emissions to the sea, contribution to climate change, and, potentially, impact on wildlife. A common theme throughout these threats – and, in fact, a problematic category on its own – is the lack of systematic monitoring of the natural environment in Flåm and cruise tourism's impacts on it. Additionally, the damage that cruise tourism in general does to the climate cannot be overstated and should be considered when evaluating the environmental sustainability of Flåm as a cruise destination.

7 Conclusion

Whether or not cruise tourism is sustainable is dependent on one´s definition of sustainability and, even then, there is the question of who it is sustainable for. This thesis has used the United Nations Brundtland Commission´s definition of sustainability which is: "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987), and the World Tourism Organization´s definition of sustainable as "tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities" (UN, 2022) in an effort to address the research question: *To what extent is cruise tourism in Flåm, Norway sustainable?* This question has further been broken down into the three sub-questions of: *Is cruise tourism in Flåm economically sustainable?*, *Is cruise tourism in Flåm socially sustainable?*, and *Is cruise tourism in Flåm environmentally sustainable?*

7.1 Economic Sustainability

My results indicate that cruise tourism is economically very important for Flåm. Cruise tourism contributes to meeting the town´s economic needs, although there seems to be some danger in relying on it as a source of income, as disasters such as the coronavirus pandemic can disrupt the industry. Additionally, environmental regulations will likely only get stricter, and there is already some concern in Flåm over the economic implications of the 2026 zero emissions requirement. This research indicates that, while Flåm survived 2020 and 2021 with no and little cruise tourism respectively, there is a need for economic planning in case there is another disruptive event. Additionally, the money is not spread equally and much of the money spent by the tourists ends up in the hands of the cruise companies themselves, rather than the destination communities. These issues should be considered carefully in planning processes if cruise tourism is to be truly economically sustainable in Flåm in the long term.

7.2 Social Sustainability

Cruise tourism has a complicated social impact on Flåm. On the one hand, the money coming in from the industry combined with the need to serve the tourists (from all tourism sectors) has led to the existence of many restaurants and activities that would otherwise not have been available in such a small village. It also means that the residents of Flåm are exposed to much more

diversity than they otherwise would be. On the other hand, some residents feel that Flåm is overwhelmed with tourists, that they cannot use their own town in the summer and find that they are not able to use Norwegian in their home in Norway. There are also the issues of the seasonal workers, who may face discrimination, and the cruise ship workers, who are vulnerable to exploitation and discrimination. All of these aspects are important to consider when evaluating the social sustainability of cruise tourism in Flåm.

7.3 Environmental Sustainability

The main finding of my investigation into the environmental sustainability of cruise tourism in Flåm is a need for greater and more consistent monitoring. This applies in all areas, but especially when it comes to the monitoring of the state of the Aurlandsfjord and the Nærøyfjord. There are many potential negative environmental impacts of cruise tourism, such as air pollution, water pollution, litter, noise pollution, and beach erosion, among others. It is impossible, however, to say how much of a problem any of these impacts are without monitoring. When compared to other cruise destinations, Flåm seems to be doing very well at limiting the environmental damage. My results indicate that this is because the industry in Flåm seems to be doing the best they can at addressing environmental issues where they can – even when this means limiting the number of ships that can visit – with the institution of the Environmental Port Index, the push for shore power for the cruise ships, and the use of electric and hybrid charter vehicles for fjord cruises. It is, therefore, especially important to monitor and identify environmental issues so that they can be addressed.

7.4 Is cruise tourism in Flåm sustainable?

Cruise tourism in Flåm has both positive and negative impacts. The industry contributes to the local economy through tourist spending and job creation, which further contributes when those who work in those jobs spend money in the community. It also contributes socially by allowing for more activities and restaurants which are available to residents as well as tourists. There are also some negative impacts however, such as the local population feeling that their town is too crowded for them to use and the largely unmonitored environmental consequences of cruise tourism. According to the World Tourism Organization, sustainable tourism “takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities”. Flåm seems to have been fairly successful as a destination in addressing the economic and social needs of host communities, and

the needs of visitors and the industry are outside the scope of this study. The challenge is the needs of the environment, where there is a need for more monitoring to fully address this question.

It is also necessary to consider the future needs and to account for the definition of sustainability itself. A sustainable activity cannot "[compromise] the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987), which is where the biggest issue is when it comes to cruise tourism's sustainability. Without better monitoring of the environmental impacts of cruise tourism in Flåm, there is the possibility that it could be damaging to the environment in ways that make Flåm a less attractive destination in the future, as well as limiting other opportunities for self-sufficiency, such as fishing. There is also the question of sustainable for whom? When discussing sustainability, it is impossible to ignore the fact that cruise tourism contributes huge amounts of greenhouse gas emissions, both overall and compared to other forms of tourism. Flåm will likely face the impacts of climate change in the future and will need to adapt, although this may not be to the level that it threatens the abilities of future generations to meet their needs. We do know, however, that globally, climate change threatens the ability of many people, future and present, to meet their own needs and this is also an important consideration when discussing sustainability.

A need for more monitoring and a more systematic approach

Given the comeback that cruise tourism is already making for the 2022 season and its importance to Flåm´s economy, it seems unlikely that it will stop anytime soon. This means it is important to make the industry as sustainable as possible, and my work indicates that tourism actors in Flåm are willing to do what they can to address and mitigate any issues brought about by cruise tourism. Therefore, it is essential that a more systematic and comprehensive approach is taken to monitoring the economic, social, and impacts of the industry on Flåm, the Aurlandsfjord, and the Nærøyfjord.

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Appendices

Appendix A: Surveys

Norwegian Version

Cruiseturismes påvirkninger på Flåm og Aurland

Informasjonen:

Som del av min masteroppgave undersøker jeg påvirkningene av cruiseturisme i Flåm og Aurland. Denne spørreundersøkelsen er ute etter dine erfaringer med cruiseturisme i ditt lokalsamfunn. Svarene er anonyme og skal ikke diskuteres enkeltvis. Den ferdige oppgaven vil bli gjort offentlig tilgjengelig. Ved å fortsette samtykker du i at svarene dine kan brukes.

Du har rett til å ta tilbake samtykket ditt eller ta kontakt med meg og stille spørsmål om prosjektet når som helst.

Takk på forhånd,

Masterstudent: kenisha.johnson@nmbu.no

Veileder: ian.bryceson@nmbu.no

Den første seksjonen består av noen demografiske spørsmål.

1. Hvor gammel er du?
2. Hvilke kjønn identifiserer du deg med?
3. Hva arbeider du med?
4. Hva er din høyeste utdanning?
5. Hvor lenge har du bodd i eller hatt nær tilknytting til Flåm/Aurland?

De neste spørsmålene handler om din erfaring med cruiseturisme.

6. Stort sett mener jeg at cruiseturisme er _____ for Flåm.
    a. Veldig bra
    b. Bra
    c. Verken bra eller dårlig
    d. Dårlig
    e. Veldig dårlig
7. Stort sett mener jeg at cruiseturisme er _____ for Norge.
    a. Veldig bra
    b. Bra
    c. Verken bra eller dårlig

   d. Dårlig
   e. Veldig dårlig
8. Cruiseturisme har for det meste hatt en _____ økonomisk påvirkning på Flåm/Aurland.
   a. Veldig positiv
   b. Positiv
   c. Verken positiv eller negativ
   d. Negativ
   e. Veldig negativ
9. Cruiseturisme har for det meste hatt en _____ sosial påvirkning på Flåm/Aurland.
   a. Veldig positiv
   b. Positiv
   c. Verken positiv eller negativ
   d. Negativ
   e. Veldig negativ
10. Cruiseturisme har for det meste hatt en _____ miljøpåvirkning på Flåm/Aurland.
   a. Veldig positiv
   b. Positiv
   c. Verken positiv eller negativ
   d. Negativ
   e. Veldig negativ
11. Jeg mener at befolkningen har _____ innflytelse på den beslutningstakende prosessen om cruiseturisme i Flåm/Aurland.
   a. Stor
   b. Liten
   c. Ingen
12. Jeg vil ha _____ cruiseturisme i Flåm/Aurland i framtida. (Sammenlignet med før pandemien.)
   a. Mye mer
   b. Litt mer
   c. Samme
   d. Litt mindre
   e. Mye mindre
   f. Ingen
13. Noe du vil legge til om cruiseturisme i Flåm/Aurland?
14. Hvis har interesse i å delta i et oppfølgingsintervju, skriv e-posten din her.

English Version

Cruise tourism's impacts on Flåm and Aurland

Information:

As a part of my master's thesis I am investigating the impact cruise tourism has on the Flåm and Aurland area. This survey will ask some questions about your experience with cruise tourism in your community. Your answers are anonymous and will not be discussed individually in the finished thesis, which will be available to the public. By continuing with this survey you are consenting to having the information you provide used in this manner.

You have the right to withdraw this consent or contact me at any time with questions about the project.

Thank you!

Master's student/primary researcher: kenisha.johnson@nmbu.no

Thesis supervisor: Ian.bryceson@nmbu.no

The first section consists of some demographic questions.

1) How old are you?
2) Which gender do you identify with?
3) What is your main occupation?
4) What is your highest level of education?
5) How long have you lived in or had a close connection with Flåm/Aurland?

The next sections will ask about your experience with cruise tourism.

6) Overall, I think cruise tourism is _____ for Flåm/Aurland.
    a. Very good
    b. Good
    c. Neither good nor bad
    d. Bad
    e. Very bad
7) Overall, I think cruise tourism is _____ for Norway.
    a. Very good
    b. Good
    c. Neither good nor bad
    d. Bad
    e. Very bad
8) Cruise tourism has had an overall _____ economic effect on Flåm/Aurland.
    a. Very positive
    b. Positive
    c. Neither positive nor negative
    d. Negative
    e. Very negative
9) Cruise tourism has had an overall _____ social effect on Flåm/Aurland.
    a. Very positive

b. Positive
c. Neither positive nor negative
d. Negative
e. Very negative

10) Cruise tourism has had an overall _____ environmental effect on Flåm/Aurland.
    a. Very positive
    b. Positive
    c. Neither positive nor negative
    d. Negative
    e. Very negative
11) I believe residents have _____ influence on decision-making about cruise tourism in Flåm/Aurland.
    a. A lot of
    b. A little
    c. No
12) I would like _____ cruise tourism in Flåm/Aurland in the future.
    a. Much more
    b. A little more
    c. The same amount of
    d. A little less
    e. A lot less
    f. No

13) Any additional comments about cruise tourism in your community?
14) If you would be interested in participating in a follow up interview, please put your email here.

Appendix B: Interview Guides

Interview Guide 1

(Used for Tor Mikkel Tokvam and Participant Three)

Questions:

1) Can you tell me a little bit about your background? What education and work experience do you have?

2) To your knowledge, has cruise tourism had any impact on the local environment? If so, what are they?

3) Do you have or know of any long-term data monitoring local air or water quality?

4) In 2020 there was a large reduction in cruise tourism, do you believe this caused any changes in the local environment?

5) Have there been any other changes to the cruise tourism industry that have caused changes in the local environment? Regulations or environmental initiatives for example?

6) Recently the Norwegian government and the cruise companies themselves have been more concerned with making the industry sustainable, with one major concern being the different fuel types used by ships, do you have any thoughts about this?

6) In general, what are your thoughts on cruise tourism – considering environmental, social, and economic factors?

7) Would you like to see continued cruise tourism in the future? To what extent?

8) Is there anything else you would like to mention?

Interview Guide 2

(Used for Ingrid Lydvo)

Questions:

1) Can you tell me a little bit about your background? What education and work experience do you have? And how long have you been living or working in the area?

2) Can you tell me what your company does with cruise tourism? With all tourism if that's applicable?

3) Do you notice cruise tourism outside of work?

4) To your knowledge has cruise tourism had an impact on the local environment? If so, what?

5) In 2020 there was a large reduction in cruise tourism, do you believe this caused any changes in the local environment?

6) The Norwegian government and the cruise industry itself have been more concerned about the environment lately, have you noticed any impacts of that? Like any policies?

7) In general, what are your thoughts on cruise tourism – considering environmental, social, and economic factors?

8) Would you like to see continued cruise tourism in the future? To what extent?

9) Is there anything else you would like to mention?

Interview Guide 3

(Used for Participant Four)

Questions:

1) Can you tell me a little bit about your background? What experience do you have?

2) How long have you been living here and what do you do in the area?

3) Has cruise tourism impacted your business? Your daily life? If so, how?

4) To your knowledge, has cruise tourism had any impact on the local environment? If so, what are they?

5) How does this compare to non-cruise tourism in the area?

6) In 2020 there was much less cruise tourism because of the pandemic, did you notice any changes in the area that you correlate with this?

7) The Norwegian government and the cruise industry have become more concerned about the environment recently, have you noticed any changes in this area?

8) In general, what are your thoughts on cruise tourism – considering environmental, social, and economic factors?

9) Would you like to see continued cruise tourism in the future? To what extent? 10) Is there anything else you would like to mention?

Interview Guide 4

(Used for Participant Five)

1) Kan du forklare litt om bakgrunnen din? Hva driver du med i området og hvor lenge har du bodd der?

2) Har cruiseturisme påvirket dagliglivet ditt? Eller jobben din? Hvordan?

3) Har du merket eller hørte om noen påvirkninger av cruiseturisme på det lokale miljøet?

4) Hva med andre former av turisme?

5) I 2020 var det ingen cruiseturisme, hva merket du om det?

6) Regjeringen og cruiseindustrien har blitt mer opptatt av miljøet i det siste, har du merket noen endringer på grunn av det?

7) Hvor mye bruker du fjorden, og hvordan?

8) Hvordan påvirker cruiseturisme din bruk av fjorden?

9) Generelt, hva mener du om cruise turisme? Med hensyn til miljø, sosiale, og økonomiske faktorer?

10) Hvordan ønsker du at cruiseturisme skal utvikles i framtida?

11) Er de noe annet du vil si? Noe jeg ikke har spurt om som du synes er viktig?

Interview Guide 5

(Used for Participant Six)

1) Kan du fortelle litt om bakgrunnen din? Hvilke type utdanning du har og hvor lenge du har bodd eller jobbet i område?
2) Og kan du snakke litt om jobben din? Hva jobber du med?
3) Hva tror du er den største trusselen mot naturen i området?
4) Hva merker du om forskjellen mellom cruiseturister og andre turister, hvis du merker noe?
5) Hvor mye vurdere de som har ansvar for miljøet og naturen i området cruiseturismen?
6) Vet du om noen overvåkningsprogrammer når det gjelder fjordens miljøpåstand eller cruiseturisme?
7) Hvordan opplever du personlig cruiseturisme i dagliglivet ditt?
8) Har du merket manglet av cruiseturisme i de siste to årene?
9) Hva tenker du om cruiseturisme i framtida? Bør det være mer eller mindre enn før pandemien?

Interview Guide 6

(Used for Participant Seven)

1) First can you just tell me a little bit about your education and what you are working with now?
2) I got your name from Participant at insitution, and she said you and some students have been doing some research on Nærøyfjorden, can you tell me about that?

3) I have been looking into the environmental impacts of cruise tourism and as far as I can tell there is no regular monitoring of the water quality in Nærøyfjorden, do you know of any?
4) Do you think cruise ships in Nærøyfjorden impact the natural environment? If yes, what do you think the most important impacts are?
5) Do you think cruise ships are a risk when it comes to invasive species?
6) Do you think cruise ships are a risk when it comes to eutrophication?
7) So looking at the bigger picture, considering environmental, social, and economic factors, in the Flåm area (or any of the fjord communities that get a lot of course tourism) how do you think cruise tourism should develop in the future?

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