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Capture based aquaculture and sustainability

The social and economic perspective

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Acknowledgements

Finally, the day has come. I have submitted my thesis and my time as a student has come to an end. I have learned too much to repeat here and I have developed more than words can describe. It has been a long and demanding journey. There have been up's and down's but the support and understanding I have been given from everyone have been both priceless and amazing. I hope that I one day can repay some of it. There are probably hundreds of people that I should thank for their support, guidance, help and understanding. But the most important one is my mother; I owe her the world and without her unconditional support and love this thesis would never have seen the light of day. Thank you.

Før i verden så va det trebåta og jærnmeinn, i dag e det jernbåta og tremeinn.

– Birger Eilertsen

Abstract

The seasonal fisheries in Norway is both a blessing and a curse. The fisheries management have for decades tried to find a way to move some of the seasonal pressure from the traditional season to other parts of the year. This have been done with different levels of success. The duty system is an example of one of the tools that have been tried to secure the supply of fresh fish for the land industry in periods of the year when the supply traditionally is low. The newest tool is capture based aquaculture. This tool aims to move some of the fish to the off season by catching it alive, storing it and producing it when the market prices are higher. To get this system going the fisheries management set aside a quota bonus for the vessel participating in the CBA system This bonus works as a strong incentive for the fishing vessels. This thesis aims to explore if CBA can contribute to social and economic sustainability in coastal societies. This is done by interviewing owners of fishing vessels, representatives from the industry, representatives from research and management and representatives from the society. The thesis shows that the main factor for succeeding with creating social and economic sustainability in coastal societies through CBA is to offer a way for fishing vessels to increase their profits. Either by getting a higher price from the market or by using incentives, such as the quota bonus. This is described in more detail throughout the thesis.

Table of contents

Chapter 1 – Introduction	7
1.1 Introduction	7
1.2 Research question	10
1.3 Thesis structure	11
Chapter 2 - Theory	12
2.1 Theory – Concept, opportunities and challenges related to CBA	12
2.2 Analytical framework	13
2.3 Factors to consider related to economical sustainability in CBA	15
2.4 Factors to consider in relation to social sustainability in CBA	16
Chapter 3 – Method	18
3.1 Research interview	18
3.2 Interview guide	19
3.3 Selection of informants and material	20
3.4 Sampling method	21
3.5 Coding	21
3.6 Document analysis	21
3.7 Assessment of method	22
3.8 Reliability	23
3.9 Validity	25
3.10 Data analysis	26
3.11 Source criticism	26
3.12 Ethical challenges	26
3.13 Limitations in the data collection	27
Chapter 4 - Seasonality	28
4.1 Coping with seasonality and uncertainty- some central historical aspects related to sustainability	28
4.2 The historic perspective on how to escape from the curse of the season: Trawlers and the duty system	30
4.3 The duty system	33
4.4 A short history of the sales organizations in Norwegian fisheries	34
Chapter 5 - Results and findings	34
5.1 The practice of CBA	34

5.2 CBA - from capture to production	36
5.3 Other managerial tools used to extend the season	37
5.4 Results from the interviews	37
Chapter 6 - Discussion	39
6.1 Economic sustainability	39
6.2 Social sustainability	43
Chapter 7 – Conclusion	46
7.1 Economic sustainability	46
7.2 Social Sustainability	47
Chapter 8 - Further research	48
8.1 Further research	48

Abbreviations

CBA – Capture based aquaculture

TAC – Total allowable catches

List of figures, models and tables

Figure 1: Illustration of the seasonal variations in the Norwegian cod, saithe and haddock fisher

Model 1: Sustainability index for process industry (Husgafvel et al., 2014).

Chapter 1 – Introduction

1.1 Introduction

In this chapter there will be given an introduction to Norwegian fisheries and capture based aquaculture. The main research question is then presented along with two sub-research questions. The final part of this chapter is a short description of how this thesis is structured.

Capture based aquaculture is an ancient way of capturing live fish and storing it. The goal of CBA is to store the fish for periods when the access is limited. In storage the fish can be fed to gain weight and to improve its quality and price. Capture based aquaculture (CBA) is defined as wild caught fish that is being kept alive in the sea for more than 12 weeks and is fed before production (Lovdata, 2014). Capture based aquaculture (CBA) has long and old roots in Norway. As early as the 1880's Norwegian fishing vessels sold their live fish in Grimsby (UK) (Nofima, 2012a). The price for the live fish was as much as 100x as high as the price for the salted cod. Keeping the fish alive in cages after it has been caught goes back a little under 30 years (Nofima, 2012a). On a global basis as much as 20% of the world's aquaculture comes from CBA. Hence, CBA is an important part of the world's fisheries sector. The motivations for storing the fish alive might vary (Nofima, 2012a). It might be stored for quality improvement, growth or market prices (Nofima, 2012a). In Norway, with its huge seasonal fishery after North East Arctic cod (*Gadus morhua*) also called "skrei", the main motivation for storing it is to be able to provide the industry with fresh cod in the off-season and in turn creating jobs in periods of the year when the workers are typically laid off.

The rich resources harvested from the sea in Norway is not only a blessing. The short and intense seasons make it challenging to handle the fish. Large quantities of fish demand a large capacity to catch, produce, transport, consume and sell the fish. To be able to turn the fish into actual economic value the industry has been depending on capital, infrastructure and knowledge beyond the coastal communities. The coastal societies needed help to handle the curse of the market and the power of capital forces (Johnsen&Finstad, 2020). The highly cost-efficient winter fishery for cod, that in addition harvests the most valuable part of the stock, makes seasonal fishery very rational (Henriksen, 2013). Even if we consider the market and year-round employment would be preferable to move the peak to other parts of the year, it is highly likely that the Norwegian fisheries always will be a seasonal fishery (Henriksen, 2013).

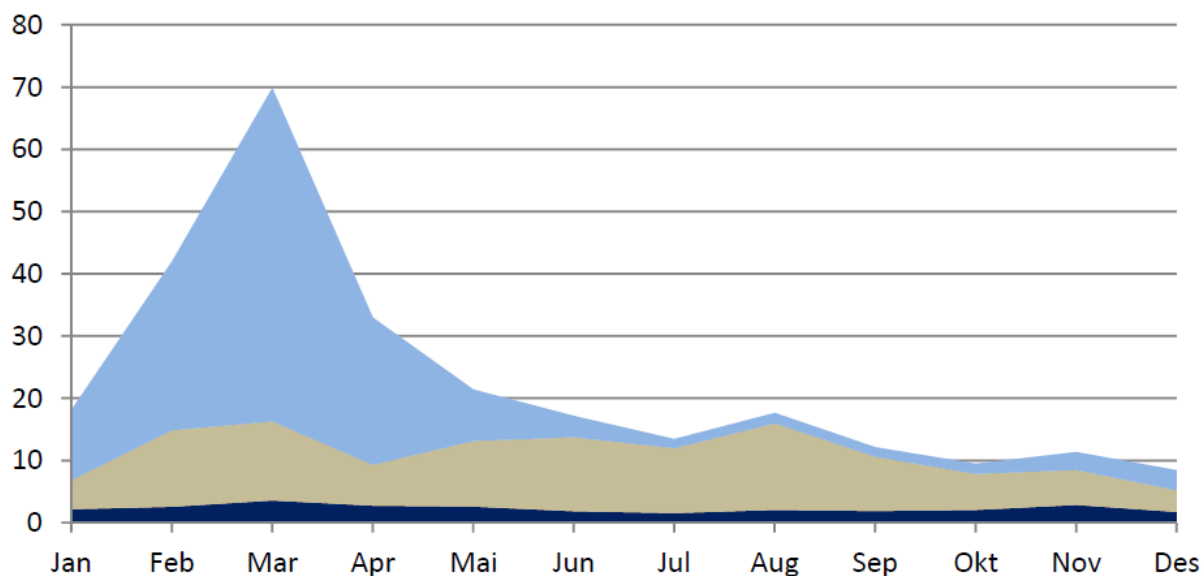


Figure 1: Seasonal profile for the landings from the coastal fleet in the saithe, cod and haddock fisheries. It is the average monthly landings for the years 2006-2010 in 1000 tons. Cod is light blue, saithe is brown, and haddock is dark blue (Henriksen, 2011)

As shown by the diagram above the Arctic cod fisheries in northern Norway has a strong seasonal profile (Henriksen, 2011). This profile shows that most of the cod (light blue) that is landed by the coastal fleet is landed in a short period that stretches from the start of the new year to Easter. It also shows that for long periods of the year the landings of cod are limited, and if the number of buyers is considered it becomes apparent that there is not a lot of fresh cod that is being produced on each factory in the off-season.

The Marine resource act sets the guidelines for how the Norwegian fisheries are supposed to be managed. The act says the following about its purpose; *The purpose of the law is to secure a sustainable socioeconomic profitable management of the wild living resources and its genetic material and to contribute to securing employment and settlement in the coastal societies* (N.-o. Fiskeridepartementet, 2008). The management of the fisheries are in other words divided into three parts biological, economic and social. In this thesis the focus will be on the social and economic management of the Norwegian fisheries. Some of the tools used to stimulate the landings of fresh fish are the quota bonus for CBA, district quotas and the fresh fish arrangement. These tools have to some degree been successful in the aspect of increasing the landing and the production of fish in periods of the year with traditionally small or no landings and little or no production (Henriksen, 2013). Capture based aquaculture is one of several tools designed to increase the value of the fish through moving the production of some of the fish to a period of the year where the supply of fresh fish to the markets is traditionally limited. This has a direct impact on the market price.

In this thesis CBA will be explored with a focus on social sustainability and economic sustainability. The political goal of CBA has been to extend the period of the year where fresh cod is available for the industry and the market as well as reducing the amount of fish that is available in the season. To motivate the fishermen to do CBA a quota bonus for CBA capture was established as an incentive for the fishing vessel owner to shift their efforts toward this type of fishery (NOU, 2014).

Based on research conducted by Nofima, cod is a species that is well suited for live storage. Therefore, it can be a perfect resource for development of CBA. Thus, the option to extend the season exists. Live storage means that the fish is caught gently with the purpose of being stored alive in cages until it is produced and sold on the market. This makes strategic market adaptations possible; this does in turn mean that the industry in a greater degree than before can have fresh fish for production in periods where it is traditionally hard to get, especially in the summer months after the summer fisheries (N.-o. Fiskeridepartementet, 2014).

Cod Town is an old traditional fishing town in a municipality in Northern Norway, with roots being traced back to the stone age. The short distance to the rich fishing grounds with plenty of fish, seal, whales and birds, is the main reason for settling there. Over the years Cod Town has been the base for an extensive fishery industry and the whole society was built around capture and processing of cod and other species. With a shrimp processing plant, several white fish processing plants and a diverse fishing fleet of considerable size. One of the processing plants was producing fillet of cod, saithe and haddock. The activity in the small town was for many years centered around the different fisheries, the winter fishery for Arctic cod (skrei) being the most important both in economic terms and in volume. Cod Town was also one of the communities where the industry got a dispensation from the participation act and could own a white fish trawler that had to land the catch in the town. The trawlers fish off-shore and are not dependent of the seasonal abundance of fish, henceforth the control of trawlers gave the local processing industry better opportunity to control the supply and in turn production of fish and made the processing industry less controlled by the seasonal variations. The dispensation was given so that the industry would have a stable supply of fish, in turn avoiding a shortage of resources and not having to lay off workers for long periods of time. As the years went by the fishing industry changed and both the fishing and the processing industry in Cod Town is only a fraction of what it was back in the 1980-90's.

The participation act states that only active fishermen can own quotas. This means that the industry can't own fishing vessels and in this makes the industry dependent on the good grace

of the local fleet and the trawlers for fish. The dispensation from the participation act allowed the industry full control of the quotas. This meant that the industry was in control of the supply of fish. This made it possible for the industry to have the trawlers supply them with fish in periods of the year when the coastal fleet was not capable.

Today the local fish industry in Cod Town is owned by a vertically integrated company, which has its main processing facility in another fishing town in the same municipality. While the company still holds quotas linked to the dispensation from the participation act and the duty system, the main supplier of fish is now the coastal fleet and the main activity at the local industry is from the new year and until Easter, in the peak season of the cod fishery. This is when the coastal fleet is on the fishing grounds to catch their cod quota. There is no fillet production in Cod Town any longer. The processing activity is limited to heading and gutting of the fish, packing, icing and shipping it out to different countries in Europe. Most of the fish is then being processed further in these countries, while some of it goes to the stores and in turn the consumers. When the trawlers no longer supply the industry with fresh fish, the stable supply of fresh fish that is needed to run a successful fillet industry is gone. However, stable fish supply is only one of the conditions needed for fillet production, the main reason for the decrease in the fish fillet production in Norway is related to economy, it has been difficult to produce fillet with profit in Norway, even with huge subsidies from the state (Johnsen&Finstad, 2020). Today there is no more fillet industry in Cod Town, and the focus is mainly on the seasonal fisheries. While revitalization of fillet production is not a feasible option, as I describe below, CBA can be the future for GoodCod in Cod Town. In this thesis I will explore the impact CBA has on the economic sustainability for the fishing vessels and the local industry. Second, I will explore how CBA may impact the industry, and the social stability of the Cod Town society.

1.2 Research question

Capture based aquaculture is potentially the future for the rural communities of coastal Norway. It has the potential to stretch the season for months and keep people at work and businesses profitable. But what about the sustainability of CBA today, where are we and where do we need/want to go. This thesis aims to shed some light on the sustainability of CBA. Cod Town and the CBA facility in Cod Town will be used as an example of CBA and its contribution to social and economic sustainability. It is a highly relevant topic because it is up for debate every year if the incentives should continue or if the trial period is over and if

the quota bonus should be increased, decreased or removed. In the attempt of answering this the following research question has been formulated:

Can capture based aquaculture contribute to social sustainability and economic sustainability in Norway's coastal societies?

The question will be addressed through one exploratory case study in a local society that has a CBA facility. Where the strength and weaknesses of the CBA in relation to impacts for the local society and the local industry is explored. The results cannot be generalized, but the impacts may be possible to explore through similar case studies. The main research question is formulated into the following two sub-research questions. The first one being; *How does capture based aquaculture (CBA) influence the social sustainability of the local industry and the fishing vessels?*

The second sub-research question is; *How does capture based aquaculture (CBA) influence the economic sustainability of the local industry and the fishing vessels?* This question has the same goal as the previous one. It will try to show how CBA impacts the economic sustainability of the local industry and the fishing vessels. Through answering these questions one and one the goal is to be able to combine them and draw a conclusion to the main research question.

1.3 Thesis structure

Before the introduction there is a list of figures and a list of abbreviations, there is also a table of content early in the thesis. One of the main goals in the process of writing the thesis have been to keep a red line running through it. The thesis starts by introducing CBA, the research question and the sub-research questions. In the following chapter the theory basis for the thesis is described. The framework used and the theoretical background through which the data will be presented and analyzed. The theory chapter is followed by the method chapter. In this chapter the method used by the researcher to gather data and arrive at the conclusion is explained in detail. After the method chapter comes the result/data chapter, this is where the data and the analysis of the data is presented and sorted. The discussion follows the result/data chapter. In the discussion chapter the analyzed data is presented through the theory and discussed. Different views are brought forward and debated. In the conclusion all the strings are pulled together and cumulates in a short and effective conclusion where the results from the discussion are presented. The final chapter presents some ideas for further research. Appendixes follow the text and can be found in the pages after the last chapter.

Chapter 2 - Theory

2.1 Theory – Concept, opportunities and challenges related to CBA

In this part of the thesis the theoretical framework used in the thesis is presented and explained. The aim of this chapter is to ensure a common understanding of theoretical background through which the collected data is analyzed and discussed.

Some of the main concepts of the research question and the sub-research question, how they are used in the text and how they should be understood

In this thesis a general understanding of terms like capture-based aquaculture (CBA), economic sustainability, social sustainability is important. In addition to this it is important to define some terms that is central for the understanding of the thesis. All of these will be explained in such a way that a common understanding is reached. The definitions given below represents how each of the concepts is to be understood throughout the thesis

- Stakeholders

Freeman (1984) defines stakeholders as any group or individual who can affect or is affected by the achievement of the organization's objectives (Charles Fontaine, 2006). In this thesis the stakeholders are the local communities, the fishing vessel owners and the local industry.

- Sustainability

Sustainability is commonly defined as a way to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs (Brundtland, 1987). The United nations adopted the same definition in its Agenda for Development: Development is a multidimensional undertaking to achieve a higher quality of life for all people. Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development. (Kuhlman & Farrington, 2010). With these definitions of sustainability in mind I will present the definitions of economic sustainability and social sustainability.

- Economic sustainability

Economic sustainability was by Bayramoglu (2018) defined as 'Achievement by an agribusiness of an income that will meet the subsistence needs of the people dependent on the agribusiness, depreciation and interest against the fixed capital used in production'

(Bayramoglu, Oguz, Karakayaci, & Arisoy, 2018). To find the economic sustainability of CBA we must look at both the economics for the fishing vessels and the industry.

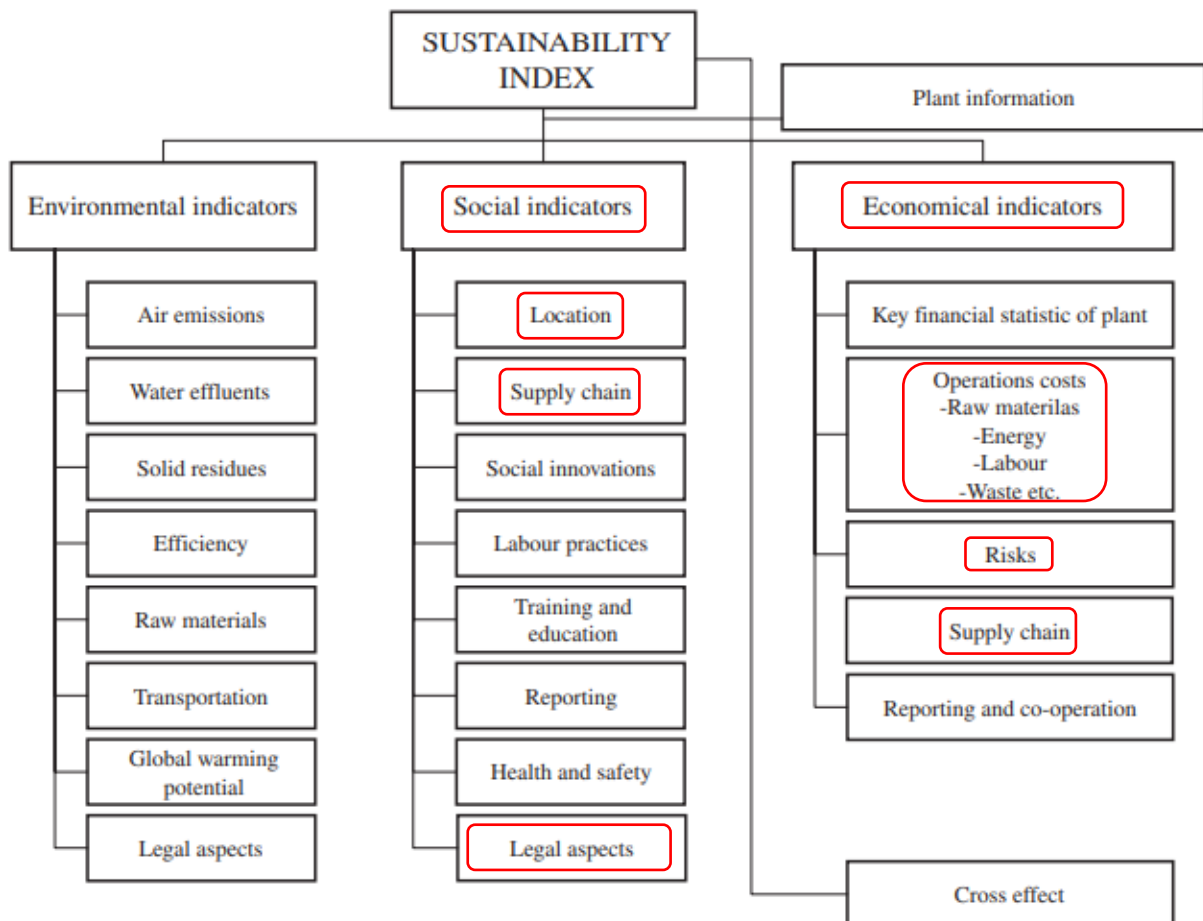
- Social sustainability

Social sustainability is by the university of Alberta defined as universal human rights and necessities are attainable by all people, who have access to enough resources in order to keep their families and communities healthy and secure. Healthy communities have just leaders who ensure personal, labor and cultural rights are respected and all people are protected from discrimination (Alberta, 2012). In the thesis the focus will be directed to the part of the definition that is relevant for CBA, and how CBA contributes to social sustainability in coastal communities. Examples of this could be how much extra work is generated as a result of CBA and how CBA interacts with the culture and the people, and in turn how it can effect the social sustainability.

2.2 Analytical framework

In the following model from Husgafvel et.al., (2014) we can see a sustainability index. This index was based on the idea that sustainable industrial development requires comprehensive approach towards sustainability, encompassing all its intertwined dimensions and elements(Husgafvel et al., 2014). The three dimensions of sustainability makes up the indicators in the model. The three sustainability dimensions are environmental sustainability, social sustainability and economical sustainability. In this thesis environmental sustainability is not included. This thesis will instead focus on the social sustainability, economical sustainability and the different indicators that belong under each of the two indicators. In the work with the thesis some of the indicators will be excluded while the focus will be on some others. The indicators chosen among the social indicators are location, supply chain and legal aspects. In addition to this comes the indicators chosen among the economical indicators that are operations cost, risks and supply chain. Under the social indicators we find the location indicator, the main use for this indicator will be to look closer on government effectiveness and regulatory quality. The supply chain indicator will also be used in the thesis and the main purpose in the use of this will be to investigate things related to the company's social responsibility. The indicator named legal aspects will be used to analyze how legal aspects can influence social sustainability. As an indicator within the economical sustainability we can find operations cost that includes raw materials, energy, labour, waste etc. This will mainly be used to explain the price the fishing vessels get for their fish and the price the

industry gets from the market. The last indicator that will be used to describe economic indicators are risks. Risks talks about the quota bonus and how the bonus system impact the economical sustainability of the vessel and the local industry. Lastly the thesis will look at the supply chain for the local industry to see how it effects the economical sustainability. In the discussion part of the theory we will find that the discussion is centered around the social indicators and the economical indicators.



Model 1. Sustainability index for process industry (Husgafvel et al., 2014).

Både for fartøy og bedrift (og dermed) lokalsamfunn er tilgang på råvarer og arbeidskraft viktig. Bonusene reduserer dessuten risiko. For fartøyet er også kontroll over verdikjeden gjennom salgslagssystemet viktig. Dette var jo det en prøvde kontrollere gjennom pliktene I sin tid. Du behøver ikke å benytte alle bokser ifiguren, men du trenger den til å argumentere for at de faktorer eller indikatorer som du plukker ut er relevante. I ditt tilfelle er legal aspekts viktig der kommer pliktene inn. Pliktsystemet fungerte ikke, så derfor må en utvikle andre redskap.

Her er også en relevant artikkel:

<https://www.tandfonline.com/doi/full/10.1080/08941920903305674?src=recsys>

2.3 Factors to consider related to economical sustainability in CBA

For the fishing vessels the focus will be on how CBA effects their operations. What are the pros and cons of doing CBA? The main things to be considered is the effectiveness of catching the fish alive instead of catching it in the traditional way. Some points that are relevant to consider when the effectiveness is being considered is the time it takes to do CBA and the effects of this, is the distance between the production facilities relevant and how does CBA effect the workload of the crew? The effectiveness of the quota bonus as an incentive for doing CBA is also important to explore. Is the quota bonus the decisive factor for the fishing vessels to continue with CBA or can CBA survive without the bonus?

For the industry the focus will be on how CBA effects their daily operations. What are the pros and cons for the industry? One of the main things to consider is if CBA generates extra work in periods of the year where it normally is little to no production.

The local industry and the fishing vessels are considered the primary stakeholders in this part of the thesis. This is because they are the ones that is directly connected to CBA. This clarification is done because it could be argued that the local coastal society and the national government are stakeholders when it comes to the economic sustainability of CBA. The local society, that provides food and housing for the employees and to some degree provides the employees, is a stakeholder. The national government, through passing laws and facilitating CBA, is also a stakeholder. But since neither the local coastal society nor the national government take a direct part in the daily operations connected to CBA, they are not included.

Fishing vessels

When trying to find CBA's impact on the social and economic sustainability for the fishing vessels, there are some factors that will be focused on. Time is one of the factors. How does CBA effect the time spent on fisheries and is this of importance for the fishing vessels? The distance between the CBA facilities is also of importance. If the fishing vessels must spend

much more time transporting the fish from the fishing ground to the CBA facility than to a traditional landing site how would it effect the fishing vessel in the consideration on whether to do CBA or not. The quota bonus is also important to consider. What role does it play as an incentive to for the fishing vessels to do CBA, and would CBA be viable without the quota bonus?

Industry

Finding CBA's impact on the social and economic sustainability will in this thesis be described by finding out if it creates extra work, and if it does how much extra work does it create. The thesis will also try to shed some light on how the seasonal variations impacts the production cycle in the industry. The thesis will also try to find out how the seasonal variations impact the industry and how does the industry adapt to the seasonal variations. Within this we will discuss work immigration, workload, investment, seasonal variations, the market all considering CBA and the impact is has on the economic sustainability of the industry.

2.4 Factors to consider in relation to social sustainability in CBA

The main stakeholders for social sustainability are the fishing vessels, the industry and the local coastal society. In this thesis we will explore how CBA can contribute to creating social sustainability in the coastal communities. Below is some of the main factors that will be discussed and considered in relation to CBA's ability to contribute to social sustainability.

In this thesis the fishing vessels role in creating social sustainability will be connected with their reflections on their role in creating social sustainability in coastal societies. Some of the themes that will be discussed is if they can create social sustainability in cooperation with CBA and how the social sustainability can be maintained. In addition, the thesis will try to show the fishing vessels motivation for why the fishing vessels are doing CBA and how the fishing vessels doing CBA contribute to social sustainability

The local coastal society Cod Town have had fish and fisheries as their way of life for millenniums. The future of Cod Town and similar towns are connected to the social sustainability. The social sustainability is effected by how the local industry is managed.

Local industry

To create a coastal society jobs are an important factor. One of the goals of CBA is to secure production of fresh fish in the off-season. This in turn mean that there will be work for the

employees at GoodCod. CBA can contribute to create jobs and the thesis will talk about the extra work the CBA industry generates. It does not necessarily mean that the local industry employs extra people, but maybe the local industry can have production for an extended period of the year or in periods when there is traditional little or no production. Job growth also contributes in creating a local culture and identity in the local coastal society.

This thesis will base its definition of identity on the following definition. Society identities are important as the driving forces to create pride, self-respect, unity, sense of belonging, and social responsibility for people, groups and organizations in society (Ratanakosol, Pathumcharoenwattana, & Kimpee, 2016). In this thesis this definition will be used to discuss the importance of CBA for the society identity. The identity will be presented as a factor for the fishing vessels, the local society and the industry. The thesis will discuss the impact CBA can have on the identity of all three of the main stakeholders and how CBA can impact the identity of the coastal society.

In the Oxford dictionary culture is defined as the customs and beliefs, art, way of life and social organization of a particular country or group. In this thesis the focus will be on the part of the definition that talks about culture as a way of life for a group. Culture is closely linked to identity and this thesis will discuss the impact CBA has on the culture in the coastal communities that has a CBA facility. Identity and culture are important parts of creating living coastal communities. The thesis will also look at how CBA can contribute to create and maintain a living coastal society. By living coastal society, it is meant the coastal societies that throughout history has had fisheries as their main source of life and societies that with an identity and culture that is strongly connected to fisheries. Cod Town being an example of such a society.

What part does the fishing vessels play in order to create socially sustainable coastal communities? With this the thesis aims to shed some light on the ability the fishing vessels have to create jobs in the coastal communities and the fishing vessel owner's perspective of their role as contributors to the social sustainability in coastal communities.

This thesis also tries to describe the role the industry has in the maintenance of social sustainability. This will be described by the jobs created and various other efforts the local industry does to help the coastal societies to maintain their identity, culture and the social sustainability.

In the following chapter the methodological choices will be explained in addition the reliability and the validity of the thesis is accounted for. Along with coding description of how the data was gathered and analyzed.

Chapter 3 – Method

This thesis is mainly based on primary data that has been gathered through interview. Within qualitative methods the interview is considered the most common method for data gathering (Thagaard, 2013).

The purpose of the thesis is to map out some of the impacts CBA has on economic and social sustainability. This chapter will cover the methodology which includes design, validity, reliability as well as methodical and ethical challenges. This chapter will also describe the analysis of the data gathered from the methods used.

The principles for selection of informants is of significance for conclusions about its transferability. The researchers interpretations of social patterns in the collected data gives the basis for the conclusions the research leads to (Thagaard, 2013, pp. 60-61).

3.1 Research interview

It was early on decided that interview would be the most efficient and best way to collect the data. It was decided that we wanted to have some freedom in the interview, so we chose to arrange the interview as a semi-structured interview. The semi structured interview is designed to ascertain subjective responses from persons regarding a particular situation or phenomenon they have experienced (McIntosh & Morse, 2015). The semi structured interview can be described as a middle ground between an open conversation and predetermined questions, which in turn mean that the interview can move away from the interview guide when/if the informant takes a different direction or of the researcher makes new discoveries in the responses (Brinkmann, Tanggaard, & Hansen, 2012).

The workload of conducting an interview is not to be underestimated. It is a long and time-consuming process. The preparations before the interviews, the interview itself and the analysis of the responses took time. This is because of the type of data that was needed to answer the research questions. Because of the Covid-19 situation in Norway, several of the informants was unwilling to meet and conduct the interview face to face. Instead the interviews were distributed by email and done over phone. The informants were contacted

before the distribution of the interviews and was informed of their nature and that if there were any questions to the interview and its question it should be reported. A short document with information about the interview was sent along with the interview.

In the following text I will describe the process I went through in the work with preparing, conducting and analyzing the interview.

Thagaard (2018) describes the interview as an especially well-suited method to bring forward information on how the informants experiences and understands themselves and their surroundings. Thagaard (2018) also says that the purpose of an interview is to collect rich and comprehensive information about how other people experiences their life situation and their perspectives and view on the themes that is presented in the interview. The experiences and perspectives the participant tells reflect happenings in their lives and is colored by the understanding the participant has of the given subject (Thagaard, 2013, p. 95). Since most of the informants was asked different questions, and the questions was adapted to shed light on different parts of the research question their skills, opinions, knowledge and perspective naturally colored their answers. Each participant is also colored by their understanding of the subject.

When the data collection involves direct contact between the researcher and the participant, as with an interview, the relation between the researcher and the participant is crucial for the quality of the material(Thagaard, 2013, p. 14). In this thesis most of the interviews was done by email and involved minimal contact between the researcher and the participant. The interviews conducted by telephone had more dialogue and there was in a higher degree conversation instead of a list of questions the participant had to answer. The difference between the interview done by email and by telephone is mainly that the telephone interview is more fluent, and interactive, it is also possible to ask follow-up questions at the end of each answer. By using the semi-structured interview, the informants could continue talking beyond the main questions that was prepared. If the informants did not answer the questions sufficiently, extra questions would be asked to get a clear answer. Although, in several cases, the informants showed their passion, knowledge and insight in such a way that questions that was to be asked later in the interview was answered earlier. Even though the number of informants was relatively low, a saturation point was reached in some of the questions, especially to the fishermen and the industry this happened.

3.2 Interview guide

After analyzing the theoretical basis for the thesis and comparing it to our research question the interview guide was put together. All the questions in the interview guide had a connection to the research questions. The interview guide had sustainability and CBA as the overall and main topic. Underlying was the sub-research questions that was about the two chosen dimensions of sustainability (social and economic).

3.3 Selection of informants and material

Where the researcher should get the information involves defining the relevant selection for the research. One way of conducting a qualitative study is with strategic selection, this means that the selection of informants has skills, knowledge or other various qualifications that is strategic in relation to the research questions and the researches theoretical perspectives (Thagaard, 2013, p. 60). In addition to strategic selection this thesis also has an availability selection. This means that the informants are available in our period of research, and that they willingly participate. All the informants in the interviews participated because of their own interest in the research question and wanted to help to shed some light where they could.

The selection was made through narrowing down the most relevant sources of information. The main goal was to find a wide range of informants that when combined could give a broad description of the CBA and its social and economic sustainability. Informants from research, industry, fishermen and local society was chosen. All of them having knowledge and/or experiences relevant to the research question. At Nofima the participant is an expert in his field and has done many publications regarding CBA. At Norges Råfisklag the participant handles the fish transactions between the fishing vessels and the industry. The informant has a good insight in how the fishing vessels and the industry responds to the CBA and its surrounding system. The informant from the industry is responsible for the largest CBA-facility in the region and is the manager of a local factory. The informant has through the job a good insight into what the CBA means for the local industry, the fishing vessels and the local society. When talking about fishing vessels in the thesis it is important to mention that interview was only done with the owner of each fishing vessel. All the informants from the fishing vessels was either the sole owner or majority owner of the fishing vessel. Informants from the crew was not interviewed. This is because they are not directly responsible for the economy or the time management of the fishing vessel. Only owners of fishing vessels that has delivered their catch for CBA was interviewed. They were chosen because they have experience and first-hand knowledge on the impact CBA has on their operations and how the CBA system effects their business. In addition, they are directly effected by the CBA system.

Two mayors from fishery dependent municipalities was interviewed. Both with considerable knowledge of present and past importance of the fisheries for their municipalities.

3.4 Sampling method

All the informants in the interview was contacted by email or telephone. The interview was set up and distributed by email. The informants answered the questions, and some had questions regarding the questions in the interview. All of them was very cooperative and answered the questions and follow up questions without hesitation.

Collection of data material was mainly done from January-May 2020. Most of this period is in the main period of the cod season and this proved to be a challenge. The challenge was that for long periods of time the industry and the fishing vessels did not have time for an interview or even a call back. As a researcher I had to remind the industry and the fishing vessels of the interview, and that I would like a response. This was done several times with some of the informants. In some cases, the responses came after the fishing vessels had caught their quota and had time to spare for an interview. On the other hand, the informants who were not employed by the industry or the fishing vessels was quick to respond.

3.5 Coding

The table below was used to code the results. The informants from fishing vessels, the informants from industry, the informants from research and management and the informants from society have all been given a code. The letter represents the group of informants the informant belongs to and the number shows which of the informants in any given group that said what. An example of this could be V1, this representative belongs in the fishing vessel group and it is representative 1. By doing it this way we can follow the answers of each informant and from that get a view of the bigger picture

Informant	Code
Fishing vessel	V1, V2, V3. V4
Industry	I1, I2
Research and Management	RM1, RM2
Society	S1, S2

3.6 Document analysis

Document analysis was the other research method used in the thesis. In this thesis the word document includes all written sources that will be relevant for the research questions. This includes laws, reports, news articles, magazines and books. The main bulk of the research used in the thesis comes from Nofima and research done by them. In addition to this, documents published by the government and directorates have been used in the work with the thesis. All the publications below are relevant in connection to the social sustainability and the economic sustainability of CBA.

Document	Organization
Levendelagring: En framtidig næring?	Sintef
Et kvotesystem for økt verdiskaping	Nofima
Evaluering av ferskfiskordningen og kvotebonus for levendefangst	Nærings- og fiskeridepartementet
Fangstbasert akvakultur	Nofima
Høstfiske og restkvoter i kystflåten	
Riksrevisjonens undersøkelse av kvotesystemet i kyst- og havfisket	Nofima
Levende fram til slakting – et stort framskritt for hysa	Riksrevisjonen
Lønnsom foredling av hvitfisk i Norge – hva skal til?	Nofima
Levende levert hyse som er kontrollert slaktet gir store fortrinn under prosessering og kjølelagring	Nofima
Vurdering av leverings-plikten, bearbeidingsplikten og aktivitetsplikten	Nofima
Økt lønnsomhet i torskesektoren	Ekspertgruppe nedsatt av Nærings- og fiskeridepartementet
Bruk av permitteringer og utenlandsk arbeidskraft i fiskeforedling	Nofima

3.7 Assessment of method

In this thesis we used qualitative method because the data collected could only be uncovered by contacting specific people and having them tell their story. Interpretation of the interviews proved to be a challenge. Analyzing the answers and interpreting them in such a way that they are representable for the answers the informants gave. The researcher had knowledge of some of the informants and they had knowledge of the researcher. But it was made clear at the start of every interview was that the participation was on a voluntary basis and honest answers was preferred. The thesis does not uncover any compromising information about the informants and therefore it is unlikely that their answers is not honest and frank.

3.8 Reliability

Reliability can be connected to the following question; will a critical assessment of the project give the impression of the research being conducted in a trustworthy and credible manner(Thagaard, 2013, pp. 201-203)? In this project all the informants participated voluntarily, and their experiences and knowledge were shared to the researcher without hesitation. The term reliability is referring to the question; could another researcher, using the same methods reach the same conclusion(Thagaard, 2013, pp. 201-203). It is more likely than not that a different researcher could get the same answers by conducting the same interview and asking the same informants. The principle that says that the researcher should be independent in the relation to the informants, is not relevant in studies where people interacts with each other. The researcher will have to argue the case of reliability by clarifying how the data has been developed through the research process. The argumentation for the quality of the collected data is supposed to convince the critical reader of the research quality, and in turn the value of the results(Thagaard, 2013, pp. 201-203). In terms of the reliability of the data, the questions were not loaded nor were they leading the participant to give the wanted or preferred answer. Regarding my personal relationship to the informants it is not unthinkable that our relationship might have played a role in how some of the informants chose to answer the questions in the interview. However, I find it unlikely that the informants gave a different answer than the one they wanted to give. The reason for answering something different is not present and as a researcher I want their true and honest opinion and their subjective view on the topic in the interview. Thagaard (2013) also says that the cooperation between researchers can contribute to strengthening the reliability of the research. To be specific she writes; The reliability can also be strengthened by having several researchers cooperating and discussing important decisions in the research process, or by including another researcher to do a critical evaluation of the of the different approached in the projects. The reliability can also be

connected to the quality of the information basis of the project and to assessments of how the researcher uses and develops information from the field (Thagaard, 2013, pp. 201-203). Throughout the thesis there has been cooperation with other researchers and people of knowledge within the subject. They have at several occasions given feedback on the project and suggested changes or corrected misunderstandings and errors. Thagaard(2018) also writes that reliability has to be connected to the researcher explaining his approach to the data gathering (Thagaard, 2013, pp. 201-203). This is done in the part of the thesis where data collection is described in detail. In that the data collection is described in a step-by-step process. Thagaard(2018) also point out that the argumentation for reliability involves the researcher reflecting over the context for the gathering of data, and how the relation to the informants in the projects can have an effect on the information gathered by the researcher (Thagaard, 2013, pp. 201-203). The data collection for the thesis was mostly done by email and by telephone. It is possible to imagine that the participant is more relaxed in a setting chosen by the participant. There were given no guidelines for where or when the participant should answer the questions. This may have helped the participant in feeling more comfortable and in turn this might have given more honest answers, on the other hand the participant might have reflected more around the meaning of the answers that was given. It is also possible to imagine that the participant talked to someone not included in the research to get confirmation on the answers. Another option is that because of the removal of the face to face situation of a normal interview the stress is removed from the situation and the participant avoid saying things the wrong way and gets time to respond exactly as intended. It is also worth to consider that the option for immediate follow-up questions is not present and that this has an impact on the data collected. Some nuances might have been lost due to the format of the interview. As shown above there are many ways the email-format of an interview can impact the reliability of a research project. In addition to email a couple of interviews was done by phone. There were several reasons for this two of them being covid-19 and geographic distance between researcher and participant. The phone interviews were in most cases set up some time before they took place. In other cases, especially with the fishermen I was told to contact them during a period of time, and if they had time, they would answer, if they did not have time I would have to make the call sometime later, hoping that they had the time. This being an expected part of the data collection. The phone interviews are different in the form that they are “live”, the participant answers the question when it is asked and the time for reflection and thought is greatly reduced in comparison to the interviews conducted by email. This might give more honest and direct answers, but it can also lead to

the participant feeling stressed and forgetting relevant information. The option of asking follow-up questions is also present when the interview is conducted by telephone.

Thagaard (2018) also presents a few questions for the researcher to think about during the research process. She says that the following questions can have a positive effect on the reliability of the project; How has the research process developed? Has the relation to the informants been open or have the researcher been given limited and superficial information? How can the relation between the researcher and the informants be described, and how does this relation impact the data that is collected (Thagaard, 2013, pp. 201-203)? As a researcher I have asked myself these questions throughout the project and used the as a guideline for the data collection and the data analysis.

3.9 Validity

Validity is connected to interpretation of data and is about the validity of the interpretations the researcher finds out. We can pinpoint the term by asking questions about the validity of the interpretations with the following question; are these results representable for the reality we have studied? (Thagaard, 2013, pp. 204-205). In the work with the thesis there are several stories that is being told and each of the informants presents their individual view of the reality. But when put together and create an image that fits with the reality. The map fits the landscape, and the results of the thesis shows us the complexity of the theme that has been studied.

How can we strengthen the validity of the research? Thagaard (2013) Uses the term transparency. Transparency includes that the researcher clarifies the grounds of the interpretations made by explaining how the analysis is relevant for the conclusions that is made. The strength of the interpretation is depends on how thorough the researcher explains the interpretations (Thagaard, 2013, pp. 204-205).

Throughout the research process other researchers has been involved. Both to give their opinion and feedback, but also to critique the work and the methods that has been used. During the process fellow students has also been included to give their feedback. Thagaard (2018) says that the researcher strengthens the validity by critically revising the analysis process. One can even have a colleague playing to be the devil's advocate and critique the researcher's analysis. The researcher can test if alternative perspectives can give a relevant understanding. The value of the interpretations is strengthened by proving that alternative interpretations is less relevant(Thagaard, 2013, pp. 204-205).

The researcher should specify how he reached the understanding that the project concludes with. This means to explain the methods used and how field work was conducted and relations in the field. It is of great importance that the researcher describes how experiences from the project and relations to the informants in the field can be linked to the relation and positioning in relation to the informants(Thagaard, 2013, p. 206).

3.10 Data analysis

The data gathered from the interviews was sorted into different categories, the categories was predetermined by the research question and the sub- research questions. The data was sorted into two main categories that were economic sustainability and social sustainability. Then the data was analyzed to get the essence of what the information gathered.

3.11 Source criticism

The sources used in this thesis are mainly research and management institutions in addition to the informants. Norges råfisklag and Nofima are highly respected institutions in the Norwegian fisheries. They represent knowledge and thorough research. There is no reason to think that the information gathered from these two is incorrect. The informant is the primary source of information and as mentioned earlier in this chapter there are some factors that could influence the answers of the informants, but there is no reason to suspect that the answers are faulty or misleading,

3.12 Ethical challenges

All research projects should reflect around the ethics of the project- the researcher should stay in line with the research ethical principles, but also take ethical considerations connected to the relation between society and research (Tjora, 2010). It is especially considerations regarding the informants free and informed consent, confidentiality and anonymity that will be considered.

In this thesis all the informants were informed of the purpose of the study, and what rights they had. All the informants were taking part in the research on a voluntary basis, and that they could withdraw whenever they wanted and without giving any reason for their withdrawal.

One of the main ethical challenges in this research project is the connection between the researcher and some of the informants. This is especially true for the relation between the informants for Norges Råfisklag and the participant from GoodCod. This is because the

researcher has a relation to them that reaches beyond the thesis and the research. It is not unthinkable that the relation between the researcher and the informants influences the results, however it is unlikely that they told anything, but the truth and the researcher had no reason to suspect that the informants told anything but the truth. On the other hand, this personal connection between researcher and some of the participant would most likely have made it easier for the researcher to meet the informants and to conduct the interviews. This thesis will not use any data that, in any way, can be traced back to a person.

The researchers have answered the questionnaire that decides if the thesis has a duty to report. The result of the questionnaire was that the thesis does not fall under such a duty because it does not use any personal information that can be used to identify any of the informants in the research (appendix 1).

In addition to this it is important to point out that ant qualitative research project need a reflecting researcher. This project is based on my interpretation and understanding, and it cannot be excluded that my background, from a small coastal society that previously had trawlers landing fresh fish for production, has influenced my perspective and my role as a researcher. At the same time, I have been aware of this and I have strived to be as neutral as possible and observed the phenomena from the outside.

Observation and personal experience from my time as an employee in the industry have also been a part of developing this thesis. Things I did not understand and reflect around at the time, have in the work with the thesis made more sense. It is hard to say that my personal experiences and observations have not played any role at all in the work with the thesis. However, I have been aware of this and I have tried my best to keep my integrity and objectivity as a researcher in the forefront of the work and in the contact with the informants. I do not believe that my personal views and opinions have significantly influenced the thesis or its conclusions.

3.13 Limitations in the data collection

Through the previous chapter the choices in connection to the chosen method have been explained. One of the main limitations is the number of informants in the interviews. It is imaginable that with more informants there would be more information gathered and a broader spectrum of opinions could have been presented giving the thesis a higher relevance and e stronger scientific foundation. However, the informants in this thesis provided the thesis with good answers and the data gathered from the informants was sufficient to answer the research

question. It was proved difficult to get more informants, but not for a lack of trying. Another point that could be improved is the number of other documents analyzed through the thesis. It can be argued that with more scientific material and documents the thesis would have a more solid foundation. But considering the timeframe and the delays, the documents that were used have proven to be sufficient. It is also possible to argue that another scientific method, like a combination between qualitative and quantitative could have been an advantage for this thesis. For example, could a questionnaire, sent to the informants, given a deeper scientific understanding of the topics. Observation and personal experience from my time as an employee in the industry have also been a part of developing this thesis. Things I did not understand and reflect around at the time have in the work with the thesis made more sense. It is hard to say that my personal experiences and observations have not played any role at all in the work with the thesis. However, I have been aware of this and I have tried my best to keep objective and I do not believe that my personal view and opinion have significantly influenced the thesis or its conclusions.

Chapter 4 - Seasonality

4.1 Coping with seasonality and uncertainty- some central historical aspects related to sustainability

In this chapter the seasonality of the Norwegian fisheries will be explained and there will be a historic description of some of the main aspects in the historic development of Norwegian fisheries. Trawlers and the duty system will be used as an example on how the management tried to overcome some of the challenges related to the seasonality of the cod fisheries.

Since the stone age and the first people settled in Cod Town fishery and the other natural resources that comes from the ocean has been the basis for life. There has been fishing activity in the town for thousands of years(Riksantikvaren, 2018). The seasonal fishery also forced the fishers to find ways to conserve the fish for periods of the year where the access was in less abundance. The fishers also wanted to sell the fish and to be able to transport it over long distances they had to find a way to preserve the fish. Sources from the 11th and 12th century shows that stock fish was a highly regarded product for export in in the stone age, and maybe even earlier(StoreNorskeLeksikon, 2018). The fish was a main source of income in the north and was traded for goods all over the world. In the 13th century the stock fish made up for more than 80% of Norway's total export(StoreNorskeLeksikon, 2018). Today the cods export value is a little above 7,1 billion kroner (sentralbyrå, 2020) and stands for 60% of

export value of white fish (E24, 2020). However there has happened a lot in the years between the stone age fishers and the modernized and highly efficient fleet in the industry of today. But some things have not changed and one of these is the nature given condition that brings the skrei down along the Norwegian coast every winter. **FYLL UT MER OVER HER**

Cod Town was one of the communities where the industry got a dispensation from the participation act and could own a white fish trawler that had to land the catch in the town. The trawlers fish off-shore and are not dependent of the seasonal abundance of fish, henceforth the control of trawlers gave the local processing industry better opportunity to control the supply and in turn production of fish and made the processing industry less controlled by the seasonal variations. The dispensation was given so that the industry would have a stable supply of fish, in turn avoiding a shortage of resources and not having to lay off workers for long periods of time. As the years went by the fishing industry changed and both the fishing and the processing industry in Cod Town is only a fraction of what it was back in the 1980-90's.

The participation act states that only active fishermen can own quotas. This means that the industry can't own fishing vessels and in this makes the industry dependent on the good grace of the local fleet and the trawlers for fish. The dispensation from the participation act allowed the industry full control of the quotas. This meant that the industry was in control of the supply of fish. This made it possible for the industry to have the trawlers supply them with fish in periods of the year when the coastal fleet was not capable.

Today the local fish industry in Cod Town is owned by a vertically integrated company, which has its main processing facility in another fishing town in the same municipality. While the company still holds quotas linked to the dispensation from the participation act and the duty system, the main supplier of fish is now the coastal fleet and the main activity at the local industry is from the new year and until Easter, in the peak season of the cod fishery. This is when the coastal fleet is on the fishing grounds to catch their cod quota. There is no filet production in Cod Town any longer. The processing activity is limited to heading and gutting of the fish, packing, icing and shipping it out to different countries in Europe. Most of the fish is then being processed further in these countries, while some of it goes to the stores and in turn the consumers. When the trawlers no longer supply the industry with fresh fish, the stable supply of fresh fish that is needed to run a successful fillet industry is gone. However, stable fish supply is only one of the conditions needed for fillet production, the main reason for the decrease in the fish fillet production in Norway is related to economy, it has been difficult to

produce filets with profit in Norway, even with huge subsidies from the state (Johnsen&Finstad, 2020).

4.2 The historic perspective on how to escape from the curse of the season: Trawlers and the duty system

In the start of the 1900's the British fishery expanded further north and into the Barents Sea (Mathiesen et al., 2016). On their way north the foreign trawlers destroyed the fishing gear of Norwegian fishermen. The complaints regarding the trawlers destruction of fishing gear resulted in the Norwegian government passing the first trawler law, this law forbid fishing inside the Norwegian territorial boarder (Mathiesen et al., 2016). In the interwar period the international trawler fishery expanded in the north. This happened alongside some expansion in the Norwegian trawler fishery and a strong growth in the Norwegian coastal fishery (Mathiesen et al., 2016). This growth led to a further aggravation of the difficulties. Amongst the Norwegian coastal fishers, the resistance towards trawlers was strong and it became clear that a new trawler law was needed (Mathiesen et al., 2016). The fear that an entire coastal fleet would be redundant by an efficient and capital strong trawler fleet, owned by people without and connection to the trait became an important issue for the Norwegian fishermen organization (Norges Fiskarlag) (Mathiesen et al., 2016). Even if the fleet was in poor economic shape, it was mainly owned by the coastal people (Mathiesen et al., 2016). The fear was that the fishers would be proletarianized paycheck workers (Mathiesen et al., 2016). The answer to this was a new set of trawler laws in 1936 and 1939. The main purpose of the law was to protect, conserve and strengthen the economic and social structure in the fisheries, with a coastal fleet owned by the fishers. This has been one of the main principles in the politics throughout the 1900's (Mathiesen et al., 2016).

In the post-war period, there was a broad consensus of the need of modernization and industrialization in Northern Norway (Holm, Finstad, & Henriksen, 2012). This was however challenged in the years after 1945 when there was built an extensive frozen fish industry in Norway (Mathiesen et al., 2016). Specially in Finnmark which suffered from the destructions from the near total destructions of war, the industry establishment was significant. In the 1950's there was two dominating frozen fish companies in the county (Mathiesen et al., 2016). One of these was the privately owned Findus in Hammerfest. They got their fish from a fleet of their own offshore trawlers. The ownership of these was made possible by the new trawler law that made it possible for other interests than active fishermen to own trawl quotas (Mathiesen et al., 2016). In the Norwegian fisherman organization, the resistance against

trawlers was still great and the leaders of the organization was critical to the growth in the trawler fishery (Mathiesen et al., 2016). After a long discussion a new law came in place. This law stated that companies where fishermen together with municipalities and fish producers has the main bulk of the interests can buy fishing vessels. The softening of the law needs to be seen in the context of the growing fillet industry (Mathiesen et al., 2016). A growth that continued throughout the 1960's. the expansion of the fillet industry was politically motivated and continued despite getting better prices for the conventional products, saltfish and stock fish (Mathiesen et al., 2016). But the frozen fish industry met other objectives. In Finnmark alone there was 39 fillet freezing factories in 1968, this mean that the competition for the fish was very hard. When the fillet industry did not have fish, the workers was laid off (Mathiesen et al., 2016). The union for the workers that was laid off, meant that, in periods where the coastal fleet could not supply the industry with enough fish, the trawlers should supply the industry (Mathiesen et al., 2016). To make the supply of fish as stable as possible the industry should own and control the trawler fleet. This in turn challenged the participation act and the question about who could own fishing rights (Mathiesen et al., 2016). The outcome was that the government made an exception from the participation act a that made it possible for the industry to own trawlers (Mathiesen et al., 2016). There was no need to formalize a duty for the trawlers to deliver their fish at a certain fish factory, because the factories already owned the trawlers (Mathiesen et al., 2016). The new trawlers that was owned by the industry from the 1960's, made it possible to supply the frozen fish industry with fresh fish for production (Mathiesen et al., 2016). As a result, the layoffs were fewer. However, it was a short-lived joy. The new trawler brought with them significant expenses for an industry that was not very profitable before the arrival of the trawlers. One important thing to mention here is that using trawler for fishery was not a goal on its own, it was only supposed to be a supplement in periods of the year when the coastal fleet could not supply the industry with fish (Mathiesen et al., 2016). At the same time, it was a broad agreement that to keep people working, in a region with few options, had a high priority. Through different forms of support from the government the level of employment in the industry was maintained. The fleet also received large subsidies through the main agreement (Hovedavtalen) (Mathiesen et al., 2016). As the years went by the coastal states wanted increasingly better control of the natural resources in the ocean and under the seabed (Mathiesen et al., 2016). In 1977 the 200 nautical mile economic zone, was in effect. Up until 1977 the reigning management regime was open fisheries on an open ocean. The coastal states could only regulate the fishery in the 12 nautical mile zone from land (Johnsen&Finstad, 2020). Most of the species had an expansion well

beyond the individual country's twelve-mile-zone (Johnsen&Finstad, 2020). The United Nations Convention on Law of the Sea (UNCLOS) and the coastal states establishment of a 200 nautical mile economic zone brought most of the world commercially exploited fishing resources under the control of the coastal state, and the coastal states was to cooperate in line with UNCLOS (Johnsen&Finstad, 2020). With these tools in hand it was possible to regulate the fishery with stricter means, and so the fisheries was made manageable (Johnsen&Finstad, 2020).

Before this the trawl fishery was regulated with individual fishing vessel quotas. The system worked such that when the quota of the trawlers was caught the fishery was stopped for the trawlers. The coastal fleet could however continue to catch fish after this (Mathiesen et al., 2016). From 1990 the individual fishing vessel quotas has also been in place for the coastal fleet. The divide between the trawlers part of the total quota and the coastal fleets part is called the trawl ladder. It implies that the share of the coastal fleet increases when the total quota is reduced, when it is high, like it has been the latest year, the coastal fleet gets around 67% of the yearly quota, while the rest is for the trawler fleet (Mathiesen et al., 2016).

During the 1980's and 1990's the frozen fish industry came into great economic troubles (Mathiesen et al., 2016). Quota reductions, stricter resources control and a turn toward a market-oriented fishery political regime without economic support from the government led to bankruptcy of most of the frozen fillet industry (Mathiesen et al., 2016). This is where the duty system is introduced. In connection with new owners in the factories, the government changed the terms for letting the industry own quotas (Mathiesen et al., 2016). The industry owned quotas and the trawlers had to deliver their fish to the predetermined factory or town (Mathiesen et al., 2016). The duty system was introduced one by one for each quota owner, and there were variations in the rules from one factory to the other. The background for the duty system was to ensure work at the local factories and to make sure that social interests was taken care of in a time where owning a fishing vessel and quotas had become valuable. Simultaneously as the value of quotas has increased, the land industry has had great economic challenges (Mathiesen et al., 2016).

In the 1980's the law was changed so that the trawlers could freeze fish onboard the fishing vessels, this meant that several salt fish trawlers and fresh fish trawlers was refitted to freezer trawlers (Mathiesen et al., 2016). A few years later the Russians started delivering fish in northern Norway, putting a temporary change in the structure and adaptation regarding the over dimensioned fillet freezing industry on hold (Mathiesen et al., 2016).

In 1994 the company Norway Seafoods was established. They started buying bankrupt factories, many of the factories owning trawlers. In 2000 the owner of the companies was considered savior's; they were to secure the industry in fishing town in deep crisis. Det northern Norwegian company Nergård did also buy old bankrupt factories and became a considerable owner of trawl quotas. As earlier the ownership was made possible by making exceptions in the participation act. Allowing non-active fishermen to own fishing rights. With the new owners, new rules followed (Mathiesen et al., 2016).

During the 1990's the support for fisheries through the main agreement was reduced and in time removed. One of the main reasons for the removal of the main agreement was the EEC-agreement that demanded that governmental subsidies for the fisheries had to be removed (Mathiesen et al., 2016). Since than Norwegian fish industry has been subject to global market terms, which in turn has had a great impact for the employment (Mathiesen et al., 2016). In the 1970's it was around 100 fillet factories in Norway while there in 2010 only was ten left. Secondly the number of foreign workers has increased greatly. The EEC-agreement opened for foreign workers in a greater scale than before to be able to come to Norway to work in the fish industry (Mathiesen et al., 2016).

4.3 The duty system

The duty system was created to ensure that the trawler quotas owned by the industry fulfilled its intention of securing the fillet industry fish in periods of the year when the coastal fleet did not. There are three main duties in the duty system. Those are the duty to uphold activity, the duty to use the fish in production and the duty to offer the fish to the respective factory that was given the original right to own the quota (Mathiesen et al., 2016).

The duty to uphold activity at a factory links the factory and the fishing vessel together. In ensures that activity at the factory and the fishing vessel remains one connected unit that cannot be altered without the approval of the government. It also prevents the owner to shut down the factory so that the owner is left with a fishing right and no factory (Mathiesen et al., 2016).

The duty to use the fish in production says that the industry must use 70% of the cod bought under the duty to offer. This duty came in place because it was shown that the favored factories bought the fish and resold it with profits without using the fish in any form of production (Mathiesen et al., 2016).

The duty to offer was originally made so that it said that the trawlers had to deliver their fish to a given factory or a town. In 2003 this changed, now it was enough to offer the fish to the factory, and if the buyer says it don't want to buy the fish, the fish has to be offered to someone in the region. If no one in the region wants to buy the fish it can be sold outside the duty system (Mathiesen et al., 2016).

The decisive factor in the industry is the resource- the fish in the sea. Traditionally the sea and the fish were a common, meaning that it was open for all to harvest what they needed. It is a tendency that if a common is not regulated the profits will be eaten up by the costs for participation (Mathiesen et al., 2016). If it is not regulated the existence of the species is also in danger, so it is regulated. This is what happened in the cod fishery in 1989 and as a result the coastal fleets access to the common was regulated, and the common closed (Mathiesen et al., 2016). The government decided to implement the regulation through individual fishing vessel quotas and split the value of the resource between the owners of fishing vessels that had qualified for a quota, while others was excluded (Mathiesen et al., 2016).

4.4 A short history of the sales organizations in Norwegian fisheries

In the inter-war period, the fishers organized in sales organizations to achieve higher and more stable prices for their catches, in turn improving their income. The organized trade started during the winter fisheries in 1940

Chapter 5 - Results and findings

This chapter aims to present the results from the interviews, observation and the literature used in the work with the thesis. The CBA system is explained in detail and the results from the interviews are sorted and arranged.

5.1 The practice of CBA

Capture based aquaculture in Norway is mostly done by catching the fish with a Danish seine. This is a gentle way of catching the fish, and it prevents the fish from being exhausted and let's it recuperate quickly once in the fishing vessel. The Danish seine is in its simplest form a net shaped as a bag, and it's being hauled along the bottom. The ropes of the seine guide the fish inside the bag. Once the bag has caught enough fish the bag is hauled towards the fishing vessel. When the net is on the side of the fishing vessel the fish is pumped from the ocean and onboard the fishing vessel. In the case of traditional capture all the fish must be bled before it is moved to the storage tanks inside the fishing vessel. When the fish is caught for CBA they are pumped directly into the tanks without being bled. In the fishing vessel there are big tanks

designed to keep the fish alive during transport. When the fishing vessel reaches the storage facility the fish is pumped from the fishing vessel and into large floating cages (Nofima, 2012b). During the process of transferring the fish from the fishing vessel to the storage facility the buyer weighs samples of the fish, this is done to estimate the total amount of fish that is delivered for live storage. When the fish is transferred to the facility for storage the fishing vessel still owns the fish. Four weeks into the storage the industry buys the fish and it is now on their hands to keep it alive and to maximize the profits and minimize the mortality. The fish that is dead before it is transferred or dies within the four weeks is registered as a traditional landing, meaning that the fish is dead upon arrival at the local industry. This fish is not considered as a part of the CBA-system.

In 2020 2500 tons of cod is set aside to the CBA system. If a fishing vessel lands 100 tons of live cod that is meant for CBA, only part of catch is deducted from the fishing vessel quota, while the rest is deducted from a so called quota bonus of 2500 tons cod that is allocated to the purpose of stimulate to CBA. All fishing vessels that land under the CBA arrangement fishery get only 70% of the catch deducted from their quota if there is fish left in the quota bonus. The 100 tons of fish only gives a 70-ton reduction of the quota. As mentioned, these 2500 tons are set aside for the sole purpose of covering the quota bonus of 30% (N. o. fiskeridepartementet, 2019). This means that the fishing vessel having a catch of 100 tons only get a reduction on the quota of 70 tons. The 2500 tons of fish that is put into the CBA-system is meant as an incentive for the owners of the fishing vessels to invest in the needed equipment, to use the extra time for catching the fish alive and delivering it alive. In addition, the 2500 tons came from the total quota that Norway has.

Economic models indicate that the quota bonus is the single most important motivational incentive for the fishing vessels to do CBA (Nofima, 2016). For an incentive such as the quota bonus to affect the landing pattern of a fishing vessel it has to be very lucrative (Nofima, 2016). It is well illustrated by the development in the landings of live cod (Nofima, 2016). The quota bonus has been a positive incentive to increase the landings of live cod (Nofima, 2016). However, it is noted that the bonus is very high, and the analysis indicates that CBA is dependent on a lucrative quota bonus (Nofima, 2016).

The advantages with CBA are many. Availability, quality, increased shelf-time because it is fresh, less wastage because all the fish is of good quality, streamlined production because of the availability (Nofima, 2017). Kjell Midling (2010) makes a good point when saying *“When we harvest from natural stocks such as the wild cod, there is a limit to how much we can*

harvest and at the same time maintaining the sustainability of the ocean. If we want to increase the profit, we have to increase the value of what we are already catching”(Nofima, 2010).

5.2 CBA - from capture to production

Capture

The Cod is mostly caught using proper gear and a fishing vessel with custom designed tanks for transportation of live fish. The most common used method is the Danish seine. The Danish seine is efficient, has a high selectivity and does not inflict lethal damage to the fish if the size of the catches is kept manageable. The fish is then moved from the Danish seine into the fishing vessel using a pump. The fish is kept alive inside the tanks during transport.

Delivery

At arrival the fish is pumped into cages similar to those used in aquaculture. During the pumping the fish is counted, and a random selection of fish is weighed to get an estimate of the total volume delivered. Somewhere between 5-6% of the total catch is weighed (I1).

Storage

The first days of storage the fish gets to rest for 2 days, and after this all the dead fish is removed. This fish is counted as traditional capture and is produced in the traditional way. After four weeks of storage the feeding of the fish starts. The storage has a demand of two workers, and it is a continuous job to feed the fish and remove dead fish, this job runs all the way up to production

Production

When the fish is ready for production it is moved into a waiting cage which is placed right next to the local industry. Then the fish is moved from the cage to a big tank using a large landing net attached to a crane. The tank is used for short time storage. The next step is the sedation, then it is bled in a separate tank. When the fish is completely bled it is gutted and the head is removed. It is then packed with ice into Styrofoam boxes and shipped out to the European market by truck. The products the local industry is left with is the heads which is hung for drying and later sold for consumption. The guts are frozen and sold for animal feed. The blood water is rinsed, and the clean water let back into the ocean.

The main reasons for doing CBA is improved quality, production in a part of the year when the coastal fleet cant supply the industry with fresh fish, growing the fish bigger before production and selling more of the fish to a higher price in a part of the season where it traditionally has been less fresh cod in the market.

5.3 Other managerial tools used to extend the season

The fresh cod agreement

This was set in place so that fishing vessel that delivers fresh cod outside the main season gets to fish more than their quota allows them to. A predetermined amount of fish is reserved from the total quota of the coastal fleet. In the same way as CBA the aim is to extend the season and to move some of the seasonal pressure to periods of the year when it is landed less fish.

The district quota agreement

The district quota agreement was set in place to give the ministry the legal basis to facilitate production in districts with little or no other business. This is done by fixing a portion of the national quota to production at a factory in the district.

5.4 Results from the interviews

The following two tables show the results from the interviews, sorted by the different findings that will be discussed later in the thesis. Under each of the tables there is also a written explanation for the findings. In the table there are three categories No., Findings and Informant. No. gives the finding a number so that it can be easily identified later in the text. The category named Findings is where the findings are placed, and the category Informants is where the different informants and their code is found.

Economical sustainability		
No.	Findings	Informant
1.	Limited impact for the industry as a whole	RM1, RM2
2.	Important for the local industry	RM1, RM2, I1, I2
3.	Increased profitability for the fishing vessels	RM1, RM2, V1, V2, V3, V4
4.	To invest in CBA-facilities is costly, for both the fishing vessel and the industry	RM1, RM2, I1

5.	It is important to get markets that are have a strong will and ability to pay for fresh cod year-round	RM2
6.	The production demands a larger workforce in a time of the year when most workers has been laid-off	RM1, RM2, I1, I2, V1, V2, V3, V4
7.	The demand for a larger workforce is 2-3x than what it would be without CBA	I1, I2
8.	It is a more time-consuming fishery	V1, V2, V3, V4
9.	The quota bonus/price is the main reason why we/they do CBA	V1, V2, V3, V4, I1, I2
10.	The extra time spent is taken from other fisheries	V2, V3, V4
11.	Without quota bonus or higher price from the industry we will not partake in CBA	V1, V2, V3, V4

Social sustainability		
No.	Findings	Informant
1.	Catching and producing fish is an important part of our identity	I1, I2, S1, S2, V1, V2, V3, V4
2.	Catching and producing fish is an important part of the local culture	I1, I2, S1, S2
3.	CBA increases the employment in the coastal societies	I1, I2, RM1, RM2
4.	The local industry has to a wide extent contributed in building coastal societies	I1, I2, S1, S2

5.	Reflects on the importance of CBA for job creation and coastal societies	I1, I2, V1, V3, V4
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In the following chapter the results presented above is discussed. Economic sustainability and social sustainability will be the man topics and along with the model found in chapter 2.2 the results will be discussed.

Chapter 6 - Discussion

Through analyzing the interviews, we discovered ten connected to economic sustainability and five findings related to social sustainability. These sixteen findings along with research papers and observations will be presented and discussed in the following text. The findings are divided by category and the first category is Economic sustainability and the second category is Social sustainability.

6.1 Economic sustainability

The model in chapter 2.2 give some indicator for measuring the economical sustainability in the following text the indicators; operational costs, risks and supply chain will be discussed together with the results from the interviews.

The informants from Research and management (RM1 and RM2) says that CBA has a limited impact for the industry on a national level. The Norwegian total quota for cod is 324 091 tons in 2020(Fiskeridirektoratet, 2020). At the same time the total quota for the CBA quota bonus is 2500 ton(Fiskeridirektoratet, 2020). This means that the quota reserved for CBA is 0,77% of the total quota. Not enough to make a difference on a national level. However, several of the informants pointed out that it made a difference for them. The informants from RM1 and RM2 said that although it didn't make a difference for the industry on a national level it is significant for the local industry. This was also confirmed by the informants from the industry (I1 and I2).

Both the Research and management (RM1 and RM2), the industry (I1 and I2) and the fishing vessels (V1, V2, V3 and V4) points out that the work with CBA requires extra personnel and that it takes more time. This falls under the economical indicators and in turn under operations cost. For the local industry this means that the workforce is expanded from the period the first fish is in the cages and until the last fish is shipped away. The industry (I1 and I2), Research and management (RM1 and RM2) and the fishing vessels (V1, V2, V3 and V4) also

mentioned that CBA contributes to work in a period of the year when the industrial workers is normally laid-off.

If we look closer at the indicator, operations cost we see that energy and labor are some of the subcategories. The Norwegian coastal fleet is dependent on the traditional cod season. As a result of their mobility it is not an option for the to catch their fish in the Barents Sea or too far off the Norwegian coast. This makes them highly dependent on the traditional cod fisheries. This is the periods of the year where they make 80% of their income. A fishing vessel that is fitted to catch several different species of fish, the amount of time spent on the different fisheries becomes one of the variables that must be considered. When the fishing vessel is fishing almost every day throughout the year and since time is limited, some time priorities must be done.. The fishing vessels (V1, V2, V3) mention that catching and transporting live fish is more time consuming than traditional capture. For the fishing vessels that fish year-round time is, as mentioned, an important variable. Research done by Sintef shows that 30% of the respondents mentions the CBA collides with other fisheries (Sintef, 2017). It follows that if the fishing vessels must spend more time catching the fish alive instead of the traditional way, that there is less time for the other fisheries. When the time-consuming fishery is of less value than the extra profit the fishing vessel makes from the fisheries the time is taken from it is difficult to find an economic argument for why the fishing vessels should continue to do this fishery. This is directly linked to operations costs and belongs under the economic branch of the sustainability index.

Another factor that effects the deliveries of live cod is the distance between the factories that has facilities for CBA. In 2018 there were 192 landing sites for cod but only 17 CBA facilities (råfisklag, 2019). This tells us that the distance from where the cod is caught and to the nearest CBA facility is also of importance. In appendix 2 we can see that the distance from 9 - 10, 2 - 3 and 7 - 8 is significant. If we look at appendix 3 we can see the distance between traditional landing sites. This means that if the fish is caught in the middle of the examples given above the distance to the nearest CBA facility is much further than the distance the fish has to be transported is much further to a CBA facility than to a traditional landing site. This also means that it takes more time to transport the fish and that the fuel costs are higher. This is where the quota bonus comes in as an incentive for the fishers to partake in the CBA system. However, the quota bonus is not supposed to be a permanent incentive, it was started as a temporary incentive for the industry and the fleet so that they could get started with CBA. The department of fisheries established the quota bonus in 2008 and further strengthened it in

2013(Riksrevisjonen, 2019-2020). As we can understand this belongs on the economical branch of the sustainability index and falls under the operations cost indicator.

When the fishing vessels (V1, V2, V3 and V4) and the industry (I1 and I2) also point out that the reason the fishing vessels partake in the CBA is the quota bonus it is clear that it belongs in the economical branch of the sustainability index and under operations cost. This is because of the extra cost that follow the CBA. The fishing vessels must catch less fish than normal between each time they must deliver the fish and the transport capacity for live fish is reduced. Both takes extra time, time that could be used for other fisheries. The industry needs to compensate the fishing vessels for their extra efforts, and this can only be done by getting a higher price for the product that is sold. The main reasons for the fishing vessels to partake in CBA is, as mentioned, the quota bonus. In addition to the quota bonus price is a main reason. However, if the quota bonus and the price does not make up for the extra efforts the fishing vessels have to put in, there is no reason for the fishing vessels to partake in the CBA system. One of the informants from research and management (RM2) also points this out when saying that it is important to get markets that have a strong will and ability to pay for fresh cod year-round. In this sentence one of the industry's main challenges can be found. If the industry can't get the extra profits for their and the fishing vessels extra efforts the motivation for the industry to partake in CBA is not present. The quota bonus is, as mentioned, an incentive for the industry and the fishing vessels to do CBA. But if CBA proves not to be profitable it is not viable. Research done by Sintef tells the same story when it comes to the importance of the quota bonus. It has to be maintained as an incentive if the fishers are to put more effort into capturing the fish alive and partake in the CBA system (Sintef, 2017). All of the factors mentioned above places the previous paragraph in the economical branch of the sustainability index and in turn under cost of operations. When the work is more demanding, time consuming or work intensive the fishing vessels need to be compensated for their extra efforts.

There are investments that needs to be done by both the fishing vessels and the industry and according to the informants from research and management (RM1 and RM2) the investments are costly. These costs will come on top of the extra cost during capture, storage, and the extra time sent by the fishing vessels. For CBA to become a viable option all these expenses must be earned back by the industry through higher market prices. These investments are directly connected to the economical banc of the sustainability index and in tur belongs under

operations cost. When the cost of the operation rises the fishing vessels need to be compensated in order to achieve economic sustainability.

The informants from the fishing vessels (V1, V2, V3 and V4) and research and management (RM1 and RM2) all point out that the profitability for the fishing vessels has increased after they decided to partake in the CBA system. The fishing vessels (V1, V2, V3 and V4) mentions the quota bonus as the main reason that they partake in CBA. The office of the auditor general pointed out that the profitability in the land industry is low (Riksrevisjonen, 2019-2020). As mentioned earlier in the thesis the price for the fish and the quota bonus is of great importance for the fishing vessels. The operations cost is of great importance for the fishing vessel to partake in the CBA system. Without the extra profit, to compensate for the extra work and time spent, there are currently no incentive in place that can make the fishing vessels participate in the CBA system. The fishing vessels have expenses that needs to be covered and neither the owner of the fishing vessel nor the crew has any interest in taking part in an economic inefficient fishery.

Placed in the sustainability index and under economical indicators we find operations cost. The rise in quality and availability provided by CBA makes it effect the economic indicator, operations cost. CBA makes it possible to facilitate the availability of cod after relatively short season, CBA makes it possible to take advantage of rising market prices when the supply of fresh fish in in decline(Hermansen, 2016). Quality improvements that is achieved through the storage process also lead to a bigger portion of the fish can be sold in the best paying markets(Hermansen, 2016). When the local industry increases the profitability of a product, it becomes more attractive.

The catch-based cod industry is affected by great differences between the landed volume in the season compared to the off-season (Nofima, 2014). The unpredictability of both volume and quality contributes to low exploitation of a very important natural resource (Nofima, 2014). This obviously has an impact on the operations cost and within this the raw materials. Meaning that the quality of the fish declines as a result of a narrow focus on volume. Price competition makes the potential when it comes to quality, differentiating and profitability untapped (Nofima, 2014). CBA is one of the tools that can be used to reduce some of the seasonal pressure. If a larger portion of the fish were caught for CBA it would reduce the seasonal pressure and the fish produced could reach a higher quality and in that way in could be possible for the industry to get higher market prices for the fish. Unleashing some of the potential related to quality, differentiating and profitability through CBA could help the

economic sustainability of CBA. This place the previous paragraph in the sustainability index, directly under economical indicators and in turn under operations cost.

6.2 Social sustainability

The office of the auditor general recently delivered a report on the management of the fisheries. Several things in relevance with the thesis was pointed out. Some of the that was pointed out was that there had been a reduction in the number of landing and production sites for fish through the years, the fishing vessels have higher mobility, the connection with the local society is weaker, an increasingly lower portion of the fish is processed in Norway, fewer municipalities have landing sites and factories for processing fish (Riksrevisjonen, 2019-2020).

In the interviews there were five main findings.

The first one being that the informants from the industry (I1, I2), the society (S1, S2) and the fishing vessels (V1, V2, V3, V4) says that catching and producing fish is an important part of their identity.

The informants from the industry (I1, I2) and society (S1, S2) says that catching and producing fish is an important part of the local culture.

The informants from the industry (I1, I2) and research and management (RM1, RM2) says that CBA increases employment in the coastal communities.

The informants from the industry (I1, I2) and society (S1, S2) says that the local industry has to a wide extent contributed in building coastal communities.

Both the industry (I1, I2) and the fishing vessels (V1, V2, V3) reflects on the importance of CBA for job creation and local communities.

In the rest of the chapter the three circled indicators from the table in chapter 2.2 will be presented and used. The three indicators being location, supply chain and legal aspects.

In the model in chapter 2.2 we find that both location and legal indicators are used to measure the social sustainability. Location mainly focuses on government effectiveness and regulatory quality it is also closely linked to the legal indicator. In the marine resource act §1 describes the following regarding the purpose of the law; *The purpose of the law is to secure a sustainable socioeconomic profitable management of the wild living resources and its genetic material and to contribute to securing employment and settlement in the coastal societies(N.-*

o. Fiskeridepartementet, 2008). In this part of the thesis the focus will be on trying to show CBA's ability to contribute to securing employment and settlement in the coastal societies. Along with the industry owned trawlers, the main agreement, the duty system one of the main goals for doing CBA, is to secure employment and settlement in coastal societies. One of the things the informants from the industry (I1, I2) and research and management (RM1, RM2) says is that CBA increases employment in the coastal communities. This is a strong indicator towards the important role CBA can have for small coastal societies. In addition to these informants from the industry (I1, I2), the society (S1, S2) and the fishing vessels (V1, V2, V3, V4) says that catching and producing fish is an important part of their identity. Along with this the informants from the industry (I1, I2) and society (S1, S2) says that catching and producing fish is an important part of the local culture. This implies that in addition to moving some of the seasonal pressure to periods of the year when the availability of fresh fish is limited and creating jobs in coastal societies, CBA helps to preserve local culture and identity. Several coastal societies along the Norwegian coast was established because of the short distance to the life essential resources in the ocean. And through thousands of years a fishing culture has developed. From capture and production to the dinner table in many Norwegian homes the resources from the ocean has played an important part in creating and shaping a culture and an identity in the coastal societies. For the culture and the identity to live on it is important to secure employment in the coastal communities and this is where CBA can play an important part if it is allowed to grow and get the assistance needed to grow. This can also be found if we have a closer look at the marine resource act §7d where it is stated that the ministry, in the management of the resource, should emphasize an expedient distribution of the resources, which can partake in securing employment and settlement in the coastal societies (N.-o. Fiskeridepartementet, 2009). The quota bonus can be considered as a tool for securing employment and settlement in the coastal societies. Since CBA generates extra work and quota bonus is an incentive for the fishing vessels to do CBA the quota bonus can help in creating social sustainability in coastal communities.

The model presented in chapter 2.2 talks about the supply chain. The local industry is dependent on a local society to house, feed and to some degree provide workers. Therefore society identities are important as the driving forces to create pride, self-respect, unity, sense of belonging, and social responsibility for people, groups and organizations in the society (Ratanakosol et al., 2016). And in turn produce an available and willing workforce to take part in the creation or maintenance of social sustainability and the local industry. In Cod

Town capture and production of fish has always been an important part of the society identity. CBA is in many ways helping to preserve the society identity by stretching the season and making capture and production possible in the off-season and in turn it helps making the society identity stronger. In extent CBA also makes the social sustainability stronger and it contributes to securing settlement and employment in coastal communities. As shown by Gamst and Jenssen (2019) the fishermen want to deliver the fish in their home port, not only for the reduced distance but also for contribute in the building of coastal communities (Gamst & Jenssen, 2019). The findings done by Gamst and Jenssen (2019) is also found in this thesis. The local fishermen contribute to building the society identity by landing the fish in their home port and creating jobs and making the local industry viable. CBA will also contribute in job creation and in making the local industry viable.

The auditor general (Riksrevisjonen, 2019-2020) also points out that activity in the fishing industry has positive effects in local communities. One of the effect is the development of the supply industry that is needed for the fishing vessels and the factories, other positive effect is that fishery create activity in other business and in the society as a whole (Riksrevisjonen, 2019-2020). All of the things mentioned in this paragraph is a direct part of the supply chain indicator. This is important to consider when making regulations and practices such as the quota bonus for CBA. The quota bonus works as an incentive for the fishing vessel to do CBA, CBA generates extra work for the local industry which in turn results in more work for the supply industry. It is an important consideration to make, the amount of work that is generated by CBA outside the local industry and how CBA contributes in creating social sustainability in coastal societies.

The effects of having developed CBA reaches beyond moving the seasonal peak to the off-season. In addition to the initial goal which was to provide the industry and the market with fresh fish in the off-season, there has been a technological development that can benefit other fisheries than the traditional cod fishery. There have been some improvement of the haddock quality and in turn the market price have risen significantly (Nofima, 2020). The knowledge from CBA is also used in the building of new trawlers. Several of the new trawlers have tanks onboard the fishing vessel so that the fish can be rested and the trawlers can get higher quality on a larger portion of their catch (Erlandsen, 2019). This signals that there are unintended positive side effects and that there might be opportunities in CBA that is not yet discovered. Either way the haddock and the potential to get a higher market price for it is good news for the fresh fish producers and their employees.

Chapter 7 – Conclusion

This chapter aims to pull all the strings together and provide an answer to the main research question.

The this has discussed social sustainability, economic sustainability and if CBA can contribute to this. The thesis has the research question, *Can capture based aquaculture contribute to social sustainability and economic sustainability in Norway's coastal societies?* To answer this question, two sub-research questions was formulated. The first one being; *How does capture based aquaculture (CBA) influence the social sustainability in the coastal societies?* The second one is *How does capture based aquaculture (CBA) influence the economic sustainability in the coastal societies?* In the conclusion each of the sub-research questions will be answered and together they will answer the main research question.

7.1 Economic sustainability

Through the discussion part of the thesis there has been a few central topics related to the economic sustainability of CBA. In the coming text the first sub-research question will be answered. *How does capture based aquaculture (CBA) influence the economic sustainability in the coastal societies?* The first one is the one that says that CBA has a limited impact on a national level but a big impact on the local industry. This means that even though the quota bonus is 0,77% of the total quota, the impact it has on the local industry is significant. The impact is also seen in the second topic, this topic says that CBA generates extra work for the local industry, and it generates work in periods of the year when most of the workers traditionally are laid-off. This tells us that the industry finds it economically sustainable to partake in the CBA system. The investments done are considerable and for CBA to be a good option for both the fishing vessels and the industry extra profit will have to be gathered through getting a higher price from the market. The fishing vessels pointed out that catching and transporting the fish alive was more time-consuming than traditional capture. There are several reasons for this. The fishing vessel cannot catch as much fish at the time and must repeat the catch process several times to catch the same volume for CBA in comparison to traditional capture. The transport capacity for live fish is also reduced when the fishing vessel does CBA in comparison to traditional capture. The distance between the CBA facilities is also longer than the distance between the traditional landing sites. This means that the transport of fish for CBA takes longer time than the transport of fish for traditional capture. All the factors mentioned above are considered by the fishing vessel when it is deciding whether to partake in CBA or to deliver the catch traditionally. The extra time spent

for CBA will have to be taken from other fisheries, and this must be compensated for it to be economic sustainable for the fishing vessel. The fishing vessels also say that the quota bonus is the main reason why they partake in CBA. It is mentioned that if the price of live cod was sufficiently high, CBA would be a viable option. The last one that is mentioned is the potential CBA have to rise the quality of the fish and moving some of the seasonal pressure to periods of the year when the market price is traditionally higher.

7.2 Social Sustainability

To explore the social sustainability, we asked; *How does capture based aquaculture (CBA) influence the social sustainability in the coastal societies?* Through this question the theoretical background (chapter 2.2) was selected, and the interview guide was developed. Through the analysis of the responses some main findings were selected. The first one being that the informants from the industry (I1, I2), the society (S1, S2) and the fishing vessels (V1, V2, V3, V4) say that catching and producing fish is an important part of their identity. This tell us that fisheries are important for these informants and as we can read earlier in the thesis identity is important for the social sustainability. In the discussion part of the thesis we can also read that the informants from the industry (I1, I2) and society (S1, S2) say that catching and producing fish is an important part of the local culture. This also points to their identity and in turn the social sustainability. The informants from the industry (I1, I2) and research and management (RM1, RM2) says that CBA increases employment in the coastal communities. By increasing the employment, the social sustainability is also increased, this goes especially for a coastal society with few/no other industries or private employers than the local fish industry. In this way CBA influences the social sustainability in coastal societies. The informants from the industry (I1, I2) and society (S1, S2) says that the local industry has to a wide extent contributed in building coastal communities. This means that the local industry knows its importance in and for the coastal societies. This is also acknowledged by the government when prioritizing the building of an extensive frozen fish industry in the years following the second world war. We can also read from the marine resource act that one on the main goals of the act is to contribute in *securing employment and settlement in the coastal societies*. This is one of the lines that can be found in Norwegian fisheries policy. CBA is one of the tools trying to secure settlement and employment on coastal societies. When the local industry decides to invest in CBA, even if the main motivation is increasing their profits, they take part in securing settlement and employment in coastal societies. As shown earlier both the industry (I1, I2) and the fishing vessels (V1, V2, V3) reflects on the importance of CBA

for job creation and coastal societies. This acknowledgement shows us that the fishing vessels (V1, V2, V3) and the industry (I1, I2) understand the potential impact social sustainability can have on coastal societies and the social sustainability.

This leaves us with the big question, the main research question; *Can capture based aquaculture (CBA) contribute to social sustainability and economic sustainability in Norway's coastal societies?*

The answer to this question is more complex than a yes or no answer. CBA can contribute to both social sustainability and economic sustainability in coastal societies. But as we see the CBA system today it cannot do it on its own. All the time the industry fails to get a sufficiently high price from the market, the fishing vessels are pointing to the quota bonus as the main motivation for doing CBA. This makes both the social sustainability and the economic sustainability dependent on the quota bonus. CBA can contribute to both economic sustainability and social sustainability in Norway's coastal societies if the extra efforts of the fishing vessels is compensated. The social sustainability includes both identity and culture and without local industry both will wither, and the coastal society suffer the faith of several other coastal communities.

As we have read throughout the thesis the quota bonus is of great importance, and CBA in its current form and shape in the current market is depending on managerial facilitation from the government, this means that the quota bonus is very important for the social sustainability and the economic sustainability. It is also important that the tools used are the best ones to achieve the preferred goals. The quota bonus as a tool is necessary, but it is not sufficient to secure settlement and employment in coastal societies. It contributes to social sustainability and to economic sustainability, but without the quota bonus or other tools, both economic sustainability and social sustainability are weakened.

Chapter 8 - Further research

8.1 Further research

This thesis has talked about seasonal variations in relation to the availability of cod and how CBA can contribute to make fresh cod available for longer parts of the year. It is however possible to see that there are some unintended advantages in the development of the CBA technology. One of the side-effects for CBA is that the fishing vessels has started to deliver live haddock to the factories. One of the advantages that comes from delivering live haddock

is that the quality of the fish is higher, and the loin yield was 48% compared to 16% for the traditionally delivered haddock. There is also a significant increase in value per day, when compared to traditionally delivered haddock (Nofima, 2019). The industry says that that this concept is a good foundation for how catch and production should be done in the future (Nofima, 2020). The report also concluded that pre-rigor processing av live delivered haddock and cod can secure more local employment and value creation (Nofima, 2020). This is obviously something with a huge potential and something worth exploring further

As we have read above both the industry and the fishing vessels mentions the quota bonus/the price as the main reason why they do CBA. It could be interesting to find what price range the fishing vessels would need to do CBA without the quota bonus. In addition to this it could be interesting to find out at what percentage the quota bonus loses its efficiency. Today the quota bonus is at 30%, and some would claim that this is the low point where it is still efficient. But where is it really?

Tools like the fresh cod agreement, the quota bonus, the duty system and the district quota agreement were set in place to try to spread the seasonal pressure over the year and to secure production in periods of the year when it traditionally is less fresh fish landed. Are these methods the solution to this or are there other tools that can solve the challenges the follow the highly seasonal cod fishery?

Seasonal workers from other countries than Norway has increased the last decade. In a report from Nofima it is said that it is a paradox that the industry has troubles recruiting workers even when the unemployment rate is relatively high(Henriksen, Pettersen, & Zhang, 2017). It is also said that there are examples of 150 unemployed people in a municipality, while the fish industry has 300 seasonal workers from other countries (Henriksen et al., 2017). There are naturally several reasons for why the industry has problems with hiring enough workers locally, but one of the reasons might be that the unemployed people are not interested in seasonal work. This is a challenge for both the industry and Norway. CBA can help with employing people in periods of the year when it normally is less work. But will it make the work more attractive for Norwegian workers?

Appendix 1 - Print screen from NSD web page for check if the project had to be registered with NSD.

Hvilke personopplysninger skal du behandle?

Hva er personopplysninger?

Hva er behandling?

Navn (også ved signatur/samtykke) ?

Ja Nei

Fødselsnummer eller andre nasjonale identifikasjonsnumre ?

Ja Nei

Fødselsdato

Ja Nei

Adresse eller telefonnummer

Ja Nei

E-postadresse, IP-adresse eller annen nettidetifikator ?

Ja Nei

Bilder eller videoopptak av personer ?

Ja Nei

Lydopptak av personer ?

Ja Nei

Gps eller andre lokaliseringsdata (elektroniske spor) ?

Ja Nei

Bakgrunnsopplysninger som vil kunne identifisere en person ?

Ja Nei

Genetiske opplysninger ?

Ja Nei

Biometriske opplysninger ?

Ja Nei

Andre opplysninger som vil kunne identifisere en fysisk person ?

Ja Nei

Du har oppgitt at ingen personopplysninger skal behandles i prosjektet.

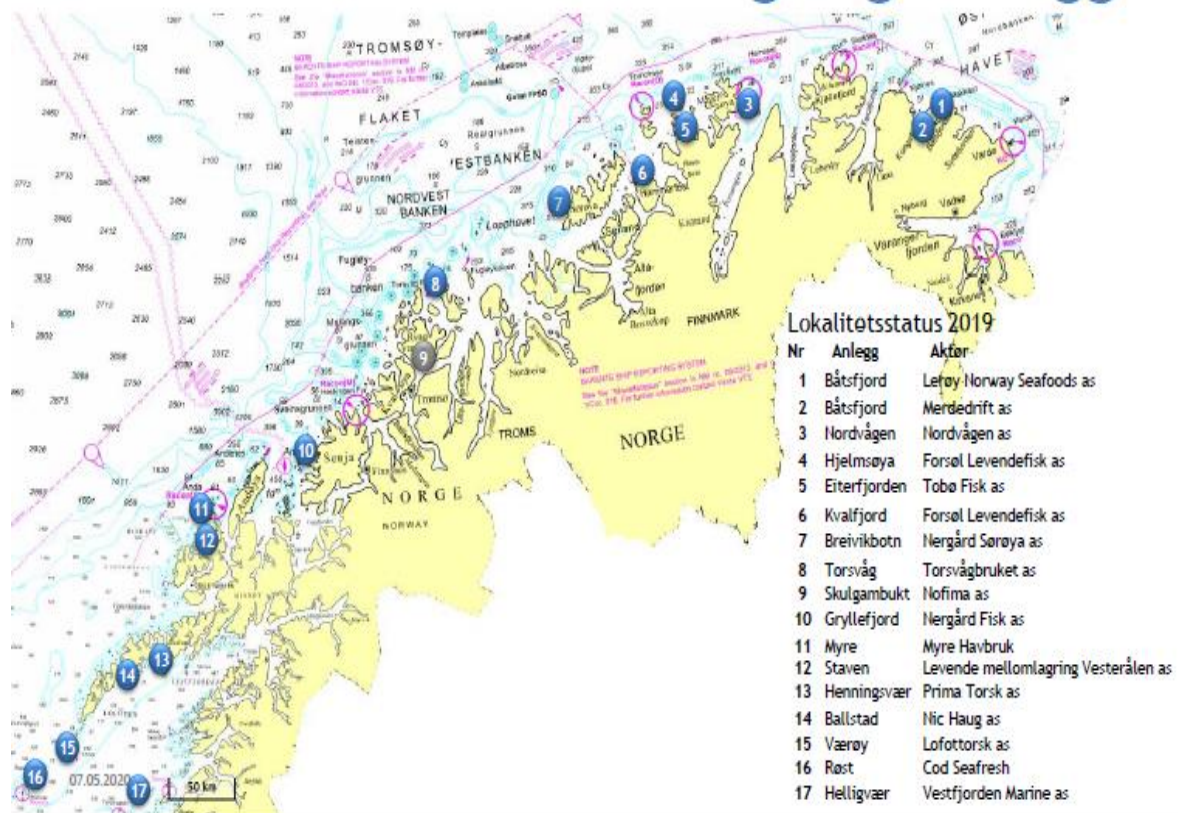
Dersom du kun skal behandle anonyme opplysninger, skal du ikke melde prosjektet. Et anonymt datamateriale består av opplysninger som ikke på noe vis kan identifisere enkeltpersoner, hverken direkte, indirekte eller via e-post/IP-adresse eller koblingsnøkkel.

Vi gjør oppmerksom på at dette ikke er en formell vurdering, men en veiledning basert på svarene du har gitt over.

[Gå til innlogging](#)

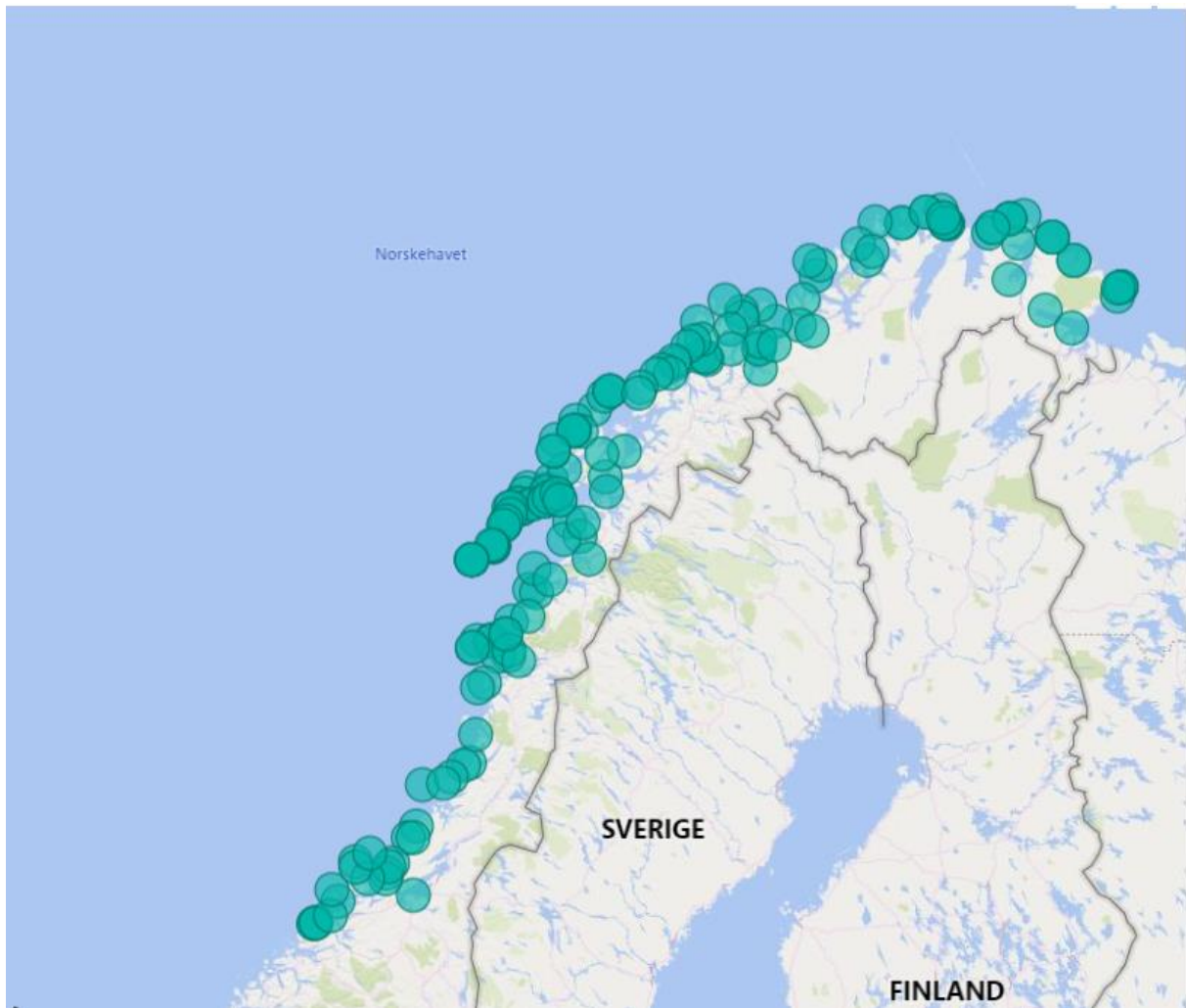
Appendix 2

Levendelagringsanlegg 2019



Map provided by Norges Råfisklag, A. Reiertsen (2020)

Appendix 3



Map provided by Norges Råfisklag, A. Reiertsen (2020)

Appendix 4

Vil du delta i forskningsprosjektet *Capture based aquaculture and sustainability*?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å belyse den sosiale og økonomiske bærekraften til levendelagring. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Denne masteroppgaven tar sikte på å belyse den sosiale og økonomiske bærekraften for levendelagring. Dataene som innsamles skal kun brukes i dette prosjektet. Du er valgt som informant på bakgrunn av din stilling og den kunnskapen du sitter med i tilknytning til bærekraft, levendelagring og fiskeri.

Hva innebærer det for deg å delta?

For deg innebærer deltakelse at du deltar på et kort intervju hvor svarene dine vil analyseres og brukes som data i oppgaven. Svarene dine registreres skriftlig og vil ikke være tilgjengelig for noen andre enn intervjuer i forskningsprosessen. All data som brukes i oppgaven vil anonymiseres slik at det ikke vil være mulig å bruke data gjengitt i oppgaven til å komme i kontakt med deg. All data som blir samlet inn vil også bli slettet etter forskningsoppgavens ferdigstilling. Ingen sensitive personopplysninger vil lagres.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Det vil være u.t. og veileder ved UiT som vil ha tilgang på innsamlet data. Du vil ikke bli navngitt i oppgaven og svarene som avgis vil kodes og anonymiseres slik at de ikke kan spores tilbake til deg.

Med vennlig hilsen

Remy A. Eilertsen

Appendix 5

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Capture based aquaculture and sustainability*, og har fått anledning til å stille spørsmål tilknyttet prosjektet.

Jeg samtykker til:

- å delta i *intervju* forutsatt at sensitive personopplysninger ikke skal komme frem i intervjuet og det ikke gjøres opptak.
- Jeg samtykker til at innsamlet data oppbevares og behandles frem til prosjektet er avsluttet.
- Jeg samtykker til at det kan gjøres notater, men at disse ikke inneholder navn, personnummer eller ander opplysninger som kan brukes til å identifisere meg.

(Signert av prosjektdeltaker, dato)

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