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Blue Degrowth and the Politics of the Sea: Rethinking the Blue Economy

Blue Growth and its discontents in the Faroe Islands: an island perspective on Blue (De)Growth, sustainability, and environmental justice

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Abstract
Blue Growth is promoted as an important strategy for future food security, and sustainable harvesting of marine resources. This paper aims to identify dominating ideologies and strategies of Blue Growth in the Faroe Islands, mainly regarding salmon farming and industrial capture fisheries, and to investigate how these ideologies materialize in the social metabolism of Faroese society. The analysis approaches the Faroese Blue Economy from a holistic perspective using analytical concepts and frameworks of social (island) metabolism, environmental justice and degrowth to assess how current Blue Growth strategies pertain to long-term sustainability and human well-being. It offers a critical analysis of aquaculture in the Faroe Islands and shows that although the rhetoric around Blue Growth is framed within mainstreamed sustainability discourse, the ideologies and visions underpinning current Blue Growth strategies result in a continuation of conventional growth through the exploitation of new commodity frontiers. Finally, the negative consequences of Blue Growth are assessed and discussed through a mapping of recent and ongoing social and ecological distribution conflicts in the Faroes.

Keywords Blue degrowth · Environmental justice · Fisheries · Aquaculture · Faroe Islands · Social metabolism · Island metabolism

Introduction

The term and phenomenon of Blue Growth, and its various synonyms, have become increasingly influential in ocean and marine resource governance in recent years, gaining impetus especially in the wake of Rio + 20 (Silver et al. 2015). It is used by major intergovernmental organizations such as the UN, the EU and the World Bank, by governments and the corporate sector, and it is gaining importance and influence in research and in research funding.

Although there is variation and differences in how programs and initiatives of Blue Growth are framed, they allude to the overarching idea of sustainable development and human well-being through continued economic growth. Blue Growth is also framed as a future necessity in the effort of securing adequate nutrition for a growing world population. Fish provides essential nutrition to the world population, but as capture fisheries seem to have reached limits for further growth (FAO 2018; Pauly et al. 2002), aquaculture, and other forms of marine economic activities, are commonly promoted as viable strategies for securing the continuation of "sustainable development". This belief that ecological, social and economic goals can be reached through (Blue) Growth strategies can and has been questioned and challenged on the same grounds that belief in conventional or green growth has been questioned (Barbesgaard 2018; Hadjimichael 2018; Hadjimichael et al. 2014). It rests on the mounting evidence and documentation that growth, i.e., the increasing throughput of materials and energy in human economies, is on a trajectory to catastrophic ecological crisis

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(Steffen et al. 2015; Krausmann et al. 2018).[1] Degrowth has emerged as a research agenda, questioning growth on these grounds, and it poses questions that sustainability sciences "can no longer afford to ignore" (Kallis et al. 2018).

This analysis departs from such a critical premise on Blue Growth, using the Faroe Islands as a case. The Faroe Islands, or the Faroes,[2] are a small island nation in the North Atlantic, where salmon farming has expanded rapidly during the past three decades. Faroese salmon farming is promoted as ecological modernization of the Blue Economy, and as a successful case of Blue Growth in action. The production process is promoted as clean, controlled, efficient, as well as environmentally sustainable. The legitimacy of the salmon farming industry also gains strength from the presupposition implicitly and explicitly visible in much Faroese policy discourse that fisheries alone cannot in the long run secure prosperity and growth. This presupposition, however, largely avoids the question of how capture and coastal fisheries and aquaculture are interconnected. This is not just the case in the Faroes. As Boonstra et al. (2018, p. 341) point out, many policy initiatives and strategies on Blue Growth tend to leave capture fisheries out of the equation, this being the case for both the EU and the FAO Blue Growth initiatives. However, a better understanding of the interactions between fisheries and aquaculture is crucial to evaluate how these two sectors contribute to food security goals, as well as to environmental sustainability and resource use efficiency (Natale et al. 2013; Naylor et al. 2000; Campbell and Pauly 2013).

As a small island nation, the Faroes are a relatively closed and bounded system well suited for a case study of industrial (Blue) Growth processes and the sustainability challenges inherent in such processes. Islands are manageable units of study, they are "good to think with" (Gillis 2004; Baldacchino and Clark 2013), and islands provide excellent opportunity for the study of material and energy flows through industrial systems (Deschenes and Chertow 2004; Krausmann et al. 2014). These characteristics make the Faroes a good case to explore the interrelations between fisheries, aquaculture environmental justice and long-term sustainability in both local and global context.

The argument pursued in this paper is that the ideologies currently dominating marine resource policy and governance, and guiding strategies of Blue Growth in the Faroes are not contributing to ecological sustainability nor to long-term human well-being. This argument is supported by a schematic assessment of the material and energy flows currently comprising Faroese aquaculture and fisheries, and a mapping of social conflicts arising from Blue Growth.

Investigating the phenomenon and concept of Blue Growth in the Faroes, the paper aims to contribute an alternative narrative to the "conventional mainstream 'success stories' of capitalism, innovation and efficiency", as an element in the effort of rewriting the history of [blue] growth in the affluent Global North (Scheidel and Schaffartzik 2019). Another aim is to identify social forces in Faroese society that may potentially challenge and replace growth ideologies and contribute to processes towards sustainability transitions and degrowth (Kallis et al. 2012; Temper et al. 2018a; b). Because the Faroes are a society both at the frontier of resource extraction, while at the same time, most members of society have the opportunity at least to the imperial mode of living (Brand and Wissen 2012), the Faroese case also provides insights on the tensions and analogies between environmental justice and degrowth movements and perspectives in the Global North.

Social metabolism, ecological distribution conflicts, and sustainability transformations

The analysis builds on the conceptual framework presented by Scheidel et al. (2018) that "maps out the linkages between (a) patterns of (unsustainable) social metabolism, (b) the emergence of ecological distribution conflicts, (c) the rise of environmental justice movements, and (d) their potential contributions for sustainability transitions." Social metabolism relates to ecological distribution conflicts in the way that "changes in socio-metabolic configurations redefine the distribution of environmental benefits and burdens across different actors" (Scheidel et al. 2018). The concept and approach of social metabolism are mainly used in sustainability science to study the biophysical aspects of nature-society relations by looking at society's economy in terms of biophysical stocks (humans, durable infrastructure and artefacts, animal livestock) and the flows of matter and energy required to either produce new stocks or maintain and reproduce existing stocks. In this sense, social metabolism is a metric for biophysical growth or degrowth (Fischer-Kowalski and Haberl 2015). Social metabolism thus refers to the material and energy flows required to maintain social systems at various scales and levels, and these flows can be studied using a variety of more and less formalized and standardized methods and tools. Examples include MuSIASEM (Multi-scale integrated analysis of societal and ecosystem metabolism) (Giampietro et al. 2009), MEFA (Material and Energy Flow Accounting) (Krausmann et al. 2004; Haberl et al. 2004), MFA (Material Flow Analysis) (Fischer-Kowalski and Hüttler 1998), Ecological Footprint Analysis (Wackernagel and Rees 1996), and HANPP (Human Appropriation of Net Primary Production)

[1] See also reports by IPCC (Intergovernmental Panel on Climate Change) and IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services).

[2] The Faroe Islands or the Faroes are English terms for *Føroyar* and are used interchangeably in this text.

(Vitousek et al. 1986). More specifically, in the study of material flows in marine contexts, concepts such as FIFO (Fish In Fish Out) (Tacon and Metian 2008; Jackson 2009; Kaushik and Troell 2010) have been developed to measure metabolic flows in fish farming.

The *social* in social metabolism refers to the fact that in human society the flows of material and energy, which constitute social systems, are always culturally and ideologically organized. In other words, these flows, and the stocks they produce, may be conceptualized as materializations of certain ideologies. A proper understanding of social metabolism therefore includes an understanding of the power relations organizing it, that is, its social, political and economic dimensions. Social metabolism shapes and maintains the physical landscape (and seascape), and the social structures within which people maintain themselves and their livelihoods, as well as humans themselves, as social and biological beings (Paulson 2015, 2017). Capital investments in aquaculture and associated infrastructure are thus materializations and tangible manifestations of certain ideological visions and imaginaries that need to be critically investigated, rather than simply accepted as matter of factual aspects of economic progression or development (Escobar 2015).

The hypothesis proposed by Scheidel et al. (2018) is that increases in social metabolism will lead to an increase in social conflicts or ecological distribution conflicts. And that such conflicts in turn may result in environmental justice groups or movements arising. As environmental justice movements are powerful forces for sustainability, in challenging and politicizing unsustainabilities, and sometimes even in transforming them, ecological distribution conflicts are an important area of study for sustainability science (Temper et al 2015; Temper et al. 2018a, b; Scheidel et al. 2018).

The term Environmental Justice became widely used in the 1970s, mainly in the United States. The focus of the first environmental justice struggles was on pollution and human health issues, and the term was also employed to describe the uneven, racialized and class-based, distribution of environmental risks and benefits between communities and groups of people (Bullard 1990). Since then a large body of literature has evolved around the term, which has been expanded to encompass uneven distribution of environmental risks and benefits on a global scale, and how risks in certain places can be causally related to benefits elsewhere in the world system, and vice versa, through processes of ecologically unequal exchange and environmental load displacement (Hornborg 1998). One recent definition by Anguelovski (2015, p. 33) states that environmental justice is "the right to remain in one's place and environment and be protected from uncontrolled investment and growth, pollution, land grabbing, speculation, disinvestment, and decay and abandonment". In a recent paper, Scheidel and Schaffartzik (2019) make a distinction between environmental justice movements and movements of degrowth, arguing that the former are often located at the frontiers of resource extraction, and operating in low resource use contexts, while degrowth movements tend to operate in high resource use contexts. The tensions and analogies between these two perspectives have also been analyzed by Rodríguez-Labajos et al. (2019), in a global South-North perspective. From an island perspective, these tensions and analogies are, however, also identifiable at the local scale.

Materials and methods

The methodological approach of this paper is to combine the analysis of how Blue Growth in the Faroes is discursively framed and articulated, with an analysis of how it is materializing in biophysical terms. The consequences for sustainability, environmental justice, and human well-being are assessed through a mapping of social conflicts arising from Blue Growth.

Ideologies and strategies of Blue Growth dominating the political and corporate sphere in the Faroes are identified through a review of gray literature on Blue Growth in ocean governance, as well as information available on the official websites of government ministries and the aquaculture companies. Although there are differences between governmental and corporate approaches to ocean governance and Blue Economy, neither the political nor the corporate sectors question the viability of pursuing strategies of Blue Growth.

The schematic assessment of the material and energy requirements of Faroese capture fisheries and aquaculture is based on peer-reviewed literature, gray literature, statistical material available from the national statistical authority Statistics Faroe Islands (SFI), and other information and data available on aquaculture company websites. It should be stressed that data quality and statistics on Faroese fisheries are fraught with some of the same uncertainties that characterizes capture fisheries statistics generally. When it comes to aquaculture, the information and figures on production are in some cases contradictory. It is evident that the companies have become more aware of the ecological and sustainability aspects of their production in recent years, at least in their branding and reporting strategies. The production of Faroese salmon requires significant material and energy inputs. Part of this input is wild fish, and this analysis focuses on the requirements of pelagic fish biomass and calculates a FIFO (fish in fish out) ratio. Likewise, the flows of fossil energy required in the salmon production process are estimated for the year 2017, based on information from the largest salmon farming producer in the Faroes, Bakkafrost. The reason for choosing to base calculations on Bakkafrost's production is

simply that they have made such data publically available, and the other companies have not.

The mapping of environmental justice or ecological distribution conflicts[3] in the Faroes related to the Blue Economy, and the discussion of these conflicts, is based on data gathered through media searches, participatory observation, and semi-structured interviews with people involved in the conflicts.

Being Faroese, born and raised in the Faroes, having been marginally involved in some of the conflicts that are described, and experiencing the rapid changes in social metabolism of Faroese society during the past decades, the research presented here can also be seen as auto-ethnography or "insider ethnography" (Hayano 1979; Anderson 2006); as an attempt of understanding the forces, ideological and material, currently at play in shaping and reshaping this small island society and their implications for long-term ecological and human well-being.

Islands of Blue Growth: the trajectory of the Faroese blue economy

The Faroe Islands are an autonomous self-governing nation within the Danish kingdom, with legislative and administrative responsibility of most areas, including the conservation and management of marine resources. Population is approximately 51,000 and the Faroes consist of 18 islands, 17 of which are inhabited. Land area is 1,399 square kilometers and the exclusive economic zone (EEZ) is 274,000 square kilometers, meaning sea area is almost 200 times the land area.

The Faroes were initially settled almost two millennia ago, and during the first centuries after settlement developed a distinct and ecologically sustainable social ecology (Lawson et al. 2005), distinct cultural traditions and own language. During the twentieth century, the Faroes became increasingly integrated into the world system and the global market economy, mainly through the export of fish products together with the industrialization of the fisheries sector. The Faroese export economy has relied almost exclusively on fish products, and political and public debates and struggles over fisheries policy and marine governance has been ongoing throughout the century. In recent years, the pressure of foreign capital and interests has been mounting, and political controversies over a proposed fisheries reform to introduce a TAC-based system in place of the former effort based, and to curb foreign capital interests are raging. Access and control over marine resources are thus a central element of Faroese politics, which was also the main reason why the Faroes did not join the European Union together with Denmark in 1973. Fisheries management is therefore the responsibility of the Faroese Government, and the Faroes are not subject to the EU's Common Fisheries Policy.

To give a sense of scale of the Faroese capture fisheries, the total marine catches have varied between around 350,000 tons and more than 700,000 tons for the past decade (SFI 2019a). This corresponds to roughly 0.5% of the global capture fisheries of around 91 million tons (FAO 2018). In comparison, the Faroese population constitutes only 0.0006% of the world population, and the Faroese capture fisheries are among the highest per capita in the world. Fish products currently represent somewhere between 90 and 98% of total export value, but since the 1970s aquaculture has increased dramatically, and in 2017 salmon farming made out 46% of export value. Historically, demersal fish species have been the prime target of the Faroese fishing fleet, particularly cod, haddock and saithe, but demersal catches have either stabilized or declined, and some stocks are close to collapse (Havstovan 2019). Although the Faroese trajectory needs to be understood in its own ecological, historical, management and governance context, the state of Faroese fisheries follows the global trends, in the sense that limits for further growth in demersal fisheries seem to have been reached or transgressed. Global capture fisheries yields, in spite of increasing fishing efforts, peaked in the late 1980s (Pauly et al. 2002). Seen in a longer historical perspective, during the twentieth century, total catch figures in the Faroes rose from 1,200 tons in 1903 to approximately 700,000 tons in 2003 (Jákupstovu 2004; SFI 2019a). Calculating with a constant annual growth rate, this would be equivalent to an annual growth rate of 6.6% for twentieth century Faroese fisheries. Since the 1980s, however, growth has mainly been maintained through the exploitation of pelagic fish stocks. This shift in trophic level harvesting, from demersal to pelagic fisheries, is a case of what Pauly et al. (1998) have referred to as "fishing down marine food webs". It has been identified by environmental historians as part of a greater trend of biodiversity loss caused by human activities which can be traced far back in time (Roberts 2007). Total catch of the four most significant pelagic fish species in Faroese fisheries, i.e., capelin, mackerel, herring, and blue whiting, grew more than seven fold between 1990 and 2017, from 81,029 tons in 1990 to 583,370 tons in 2017 (SFI 2019a), which is equivalent to an annual growth rate of 7.6%. In other words, Blue Growth in the Faroes has entailed a tremendous growth in annual biomass extraction from the sea during the past century. If calculated on a per capita basis, catches grew almost 180-fold, from 0.079 tons (or 79 kg) in 1903 to more than 14 tons for every Faroese inhabitant in 2003. It is clear that the extraction of marine biomass from the oceans has

[3] The conflicts described here are chosen based on their relation to fisheries and aquaculture. The EU policy program for Blue Growth also involves other sectors for instance coastal tourism. Although rapid growth in tourism in the Faroes is currently stirring social conflicts, they are not included here.

increased at a growth rate, which cannot be sustained far into the future.[4] The Faroese fishing fleet is also a major contributor to the Faroese greenhouse gas emissions, which is currently around 20 tons per capita (EA 2018).

The period of growth in pelagic fisheries corresponds to the period in which aquaculture established itself in the Faroes. There is little to no critical research on Faroese aquaculture (but see Young et al. 2019). Hovgaard (2015) has described aquaculture as an example of a "small island innovation system", and divided its development into three periods, each period dominated by a certain entrepreneurial mode. If we look at the growth in biophysical terms, the production of farmed salmon grew from 14,484 tons in 1996 to 71,172 tons in 2017. The large farmed salmon biomass requires large feed inputs and produces equally large amounts of waste, but regulation of the industry is to a significant degree left to the operators themselves. Such large production also requires space, and practically all Faroese fjords and sounds are licensed out to salmon farming and allocated between the operating companies. While production has increased, the number of business operators has decreased from more than 50 license holders in 1985 (Hovgaard 2015, p. 103) to only three operators in 2018, who control the whole production chain. The biggest salmon producer in the Faroes is the company Bakkafrost, a Faroese company listed on the Oslo Stock Exchange since 2010, and said to be the eight-largest salmon farming company in the world. Bakkafrost (2018b) harvested 54,615 tons of gutted salmon in 2017, which corresponds to 77% of the total Faroese production that year. Mowi (previously Marine Harvest), is one of the largest fish farming companies in the world and also operates salmon farms in the Faroes. Mowi is likewise listed on the Oslo Stock Exchange. Luna is a Faroese owned and controlled joint-stock company, farming salmon under the trademark of Hiddenfjord.

Blue Growth ideologies in the Faroes

Blue Growth and its associated terms are by no means unequivocal, but its roots can be traced back to the idea of sustainable development (Eikeset et al. 2018). As put by Boonstra et al. (2018, p. 340), this means that "Blue Growth is underpinned by a discourse that frames a trajectory of development that can realize greater revenues from marine resources while at the same time preventing their degradation, overuse, and pollution ". This underpinning discourse is also visible in the Faroese context. The Faroese Ministry of Fisheries frames Blue Growth mainly in terms of Blue Bio-economy, a concept that has been promoted by the Nordic Council.[5] Bio-economy[6] signifies production of renewable resources, and making waste flows from such production processes into value added products, particularly in the biotechnology and chemical industry (NMTT 2015).

Governmental visions of Blue Growth: exploiting "underutilized" marine resources

The concept of Blue Growth has thus entered into Faroese policy discourse, and in 2015 the Faroese Ministry of Fisheries hosted an international conference on "Growth in the Blue Bio-economy" stressing the "huge growth potential in marine bio-economy" (Faroese Government 2015). More recently, the ministry has launched an initiative on international co-operation on Blue Growth between what they are referring to as Large Ocean Nations.[7] In 2017, the Faroese Ministry of Fisheries hosted a Large Ocean Nations Forum in Malta with delegates from 10 Large Ocean Nations "to discuss the potential of sustainable Blue Growth" (NORA 2017).[8] Again, the overarching theme revolves around realizing greater revenues from renewable resources, adding value to residuals or waste from already existing production processes. Although the necessity of sustainable and local management, control and ownership of marine resources is stressed, there is little to no articulation of the need to reduce resource use in absolute terms or any questioning of the viability of pursuing growth per se. The themes around sustainable Blue Growth at the forum can be aligned with the discourse on Blue Bio-economy, the focus being on how to develop new industries around "underutilized" marine resources. As is the case with other concepts such as Green Economy, and Circular Economy, the mainstreamed version of Bio-economy remains limited in strong sustainability

[4] If Faroese pelagic fish catches were to continue to grow at this rate of 7.6% annually from the year 2017 onwards, they would reach the total global catch of 91 billion tons within 70 years.

[5] The Nordic Council of Ministers is the official body for formal inter-parliamentary co-operation among the Nordic countries, and has members from Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland.

[6] This framing of bio-economy should not be confused with Georgescu-Roegen's writings on bioeconomics (e.g. Bonaiuti 2011).

[7] The term Large Ocean Nation denotes small island states with large ocean territories. It is promoted by the Faroese Government who is urging for instance the FAO and COFI (Committee on Fisheries) members to embrace the concept. In contrast to the commonly used concept Small Island Developing States (SIDS), this concept would include small island nations in both the Global North and the Global South, helping, according to the Faroese Minister, to focus on the "strengths, responsibilities and the huge potential" of Large Ocean Nations.

[8] The forum was organized in close co-operation with FAO, and with participants from the Faroe Islands, Iceland, Greenland, Cabo Verde, Grenada, Malta, Mauritius, Norway, Papua New Guinea, Sao Tome and Principe, the Seychelles and Vanuatu (NORA 2017).

visions and in questioning economic growth (D'Amato et al. 2017).

Corporate visions of Blue Growth: feeding the world with sustainable salmon

Discursive framings of the concepts of growth and sustainability on the official websites of the salmon farming companies currently operating in the Faroes fit nicely with the observation made by Tomlinson (2013), that discursive devices such as the problem of global food security are often used as conceptual tools by dominant institutions with prior ideological commitments that have little to do with solving actual problems of food security. The "food security" discursive device is immediately identifiable on the websites of Mowi and Bakkafrost. On the official Faroese Mowi website we are informed that:

> Approximately 70% of our planet is covered by water, yet only around 2% of the world's food supply comes from the ocean. With wild-capture fisheries under increasing pressure, it is important that aquaculture bridges this gap, assuming an increasingly greater role in providing food security for the planet. At Mowi, we believe that by farming the ocean, we can sustainably produce healthy, nutritious and affordable food for society at large (Mowi 2019)

Bakkafrost likewise, on their official website and in their sustainability reports use this food security device. In their sustainability report for 2018, a "sustainable and responsible approach to aquaculture" is presented as part of their growth strategy. It is a "plan designed around a vision to enable healthy living for millions of people through the provision of healthy and nutritious salmon" (Bakkafrost 2019, p. 6). The plan aims to support strategies for creating "sustainable organic growth" for example through the construction of a biogas plant, which is prospected to process the waste from salmon production.

In the case of Luna, there is less focus on global issues such as Blue Growth and food security, and they stress instead the quality of their product, the clean and pristine production environment, and the professionalism of their production methods, which are, in their own words "beyond sustainable" (Hiddenfjord 2019).

Corporate and government visions coming together in "sustainable" Blue Growth strategies

On the FaroeseSeafood.com website, which is a collaboration between government ministries and the aquaculture and fisheries corporate sectors, run by the Ministry of Foreign Affairs and Trade, the Ministry of Fisheries, The Faroese Fish Producers Association, The Association of Faroese shipowners and The Faroese Fish Sellers Association, it is likewise stated that:

> Aquaculture currently represents over 50% of fish products for human consumption. According to reports from the UN's Food and Agriculture Organization (FAO) aquaculture will become vital in meeting the rapidly increasing demand for seafood, with Faroese aquaculture contributing to global food security (FaroeseSeafood 2019)

In short, salmon farming is aligned with conventional sustainability discourse and Blue Growth as a strategy for "sustainable development", contributing to the Sustainable Development Goals (Bakkafrost 2019), and securing an adequate protein supply for a growing world population. Salmon is promoted as a healthy and environmentally friendly food item, and growth in production as sustainable and desirable. On the Mowi website their growth strategy is framed as a "Blue Revolution" referring to the growth potential in "farming the ocean". The association in terms with The Green Revolution is apt, since modern fish farming is in many ways an expansion of Green Revolution strategies into marine and coastal ecosystems. The Green Revolution entailed a transformation of agriculture and food production, from local recycling of biomass to highly specialized throughput systems of matter, energy and chemical substances, resulting in increased social metabolism and devastating socio-ecological consequences in many regions of the world (Shiva 2016; Evenson and Gollin 2000). One characteristic of such specialized throughput systems is that ecological feedback is externalized, through processes of resource appropriation, also in the form of ocean grab (Bennett et al. 2015), and environmental load displacement, often in distant regions, meaning that the socio-ecological consequences of unsustainable resource use is easily ignored. This principle is also applicable in fish farming, and it is increasingly the case in aquaculture with fish feed production becoming demand-driven rather than supply driven (Merino et al. 2010), and the supply in fish feed often originate in distant waters and territories (Deutsch et al. 2007; FIVH and RFN 2017).

The discursive framings of growth and sustainability used by the corporate and government sectors in the Faroes combine to a narrative serving to legitimize the expansion of aquaculture and (blue) growth generally. Problematization and questioning of the size and sustainability of material resource and waste flows is avoided through a focus on how waste flows may be utilized for further growth. For instance through the construction of the prospected biogas plant, which will process the waste products from the salmon farming industry, but without questioning the viability of using pelagic fish as a raw material in biofuel production. The construction of a biogas plant is a pertinent example of a so-called "biofuel delusion" (Giampietro and Mayumi

2009), and of Blue Growth ideology materializing in durable infrastructure, that serves to facilitate the continuation of unsustainable resource flows. In short, Blue Growth, as a term and as a phenomenon, is not about fundamental changes and transition towards sustainability, but simply about framing conventional growth strategies in sustainable development rhetoric—rhetoric that has been referred to as "sustainababble" (Engelman 2013).

Measuring material and energy flows in Faroese salmon farming: FIFO and carbon footprint

As we have seen in the previous section, Blue Growth in the Faroes is presented as sustainable, and as a viable way of increasing global food production and enhancing global food security. Using methodological tools developed to measure social metabolism it is possible to study the biophysical reality behind this claim. As is the case with terrestrial farm animals, industrially farmed salmon in the Faroes is dependent upon direct external feed input. Aquatic organisms generally have a more efficient metabolism relative to terrestrial organisms, which means that aquaculture has a real potential to contribute to global food security (Froehlich et al. 2018). However, aquaculture is not sustainable per se, neither does it necessarily contribute to global food security, particularly not aquaculture based on high trophic level aquatic species. While aquaculture in some regions of the world is based to a large degree on low trophic level aquatic species, aquaculture in so-called developed countries has been based on high trophic level species such as salmon (Tacon et al. 2010), which is the case in the Faroes. One of the companies operating in the Faroes, Mowi (Marine Harvest) imports its fish feed from Skretting in Norway, but 75% of the fish feed used in Faroese salmon production is supplied by the only local fish feed producer Havsbrún, which is owned by Bakkafrost. Havsbrún is reported to supply all fish feed used in Bakkafrost's salmon production (Seafood Watch 2018, p. 46). The raw material for fish feed production is supplied mainly by the Faroese pelagic fishing fleet. Of the roughly 342,000 tons of raw material, mainly blue whiting, landed to Havsbrún in 2017, 87% was landed by Faroese fishing vessels (KVF 2018). Bakkafrost produced 54,615 tons of salmon in 2017, which was 77% of the total domestic salmon production of 71,172 tons that year (SFI 2019b). FIFO calculations are based on Bakkafrost's production figures in the year 2017.

FIFO calculations of Faroese salmon production

The information stated on Havsbrún's website and other website material from Bakkafrost reporting the content of fish meal and oil in their fish feed products, varies between approximately 40% and 80%. The figures reported to Seafood Watch (2018, p. 46) are 25% fish meal inclusion and 16.5% fish oil inclusion, or 41.5% in total. In their sustainability report for 2017, a figure of 29% fish meal level and 15% fish oil level is reported, or 44% in total.[9] A quarter of the fish meal and almost half of the fish oil is reported to derive from trimmings and cutoffs (Bakkafrost 2018a, p. 20). In the same report, the feed conversion ratio (FCR) is reported to be 1.2:1 (Bakkafrost 2018a, p. 22). This feed conversion ratio means that every increase in body weight of farmed salmon requires 1.2 kg of feed. Calculating with the highest and lowest fish content in the feed, would result in FIFO ratios between 5:1 and 1.7:1. If the calculation is based only on figures and information reported by Bakkafrost in their 2017 sustainability report, the FIFO can be calculated for fish meal and fish oil separately as suggested by Kaushik and Troell (2010).

$$\text{FIFO} = \frac{\text{Fish oil in the feed}}{\text{Yield of fish oil from wild fish}} \times \text{Feed conversion ratio}$$

Using this equation, and calculating with the reported level of fish oil in the feed,[10] the production of 1 kg of salmon requires an input of 3.6 kg of wild fish. As Bakkafrost reports that almost half their fish oil comes from trimmings and cut-offs, the figure can be reduced by half to 1.8 kg. This means that for every kg of salmon produced, at least 1.8 kg of wild fish is required. From a global food supply perspective, as well as from a human health perspective, direct consumption of wild pelagic fish species should be encouraged instead of their reduction into feed (Tacon and Metian 2013). From an ecological perspective, every kilo of salmon produced in this way will exact a pressure at least twice as high on wild pelagic fish stocks. The conception that aquaculture lessens pressure on wild fish stocks is, in this case, an illusion. While the efficiency ratios in salmon farming have been improved significantly, the growth in production is still based on a growth or increase in the use of natural resources, in this case pelagic fish. In addition to pelagic fish, the feed consists of imported ingredients such as for instance soy meal, rapeseed oil and chemical substances.[11]

[9] Production figures available on Havsbrún's website show that the reduction ratio for raw material into fish meal is on average approximately 5:1 and 23:1 for fish oil. This means that the production of one kg of fish meal requires 5 kg of fish, and 1 kg of fish oil requires 23 kg of fish. These figures correspond well with the estimation of fishmeal yields from forage fisheries of 22.5% and 5% oil yields suggested by Tacon and Metian (2008).

[10] As fish oil is an essential ingredient in salmon production, more so than fish meal, calculations are based on fish oil requirements rather than fish meal requirements.

[11] The Faroese salmon industry brands Faroese salmon as especially "clean" and healthy, but import statistics show that very large quantities of highly problematic chemicals such as hydrogen peroxide (Bechmann et al. 2019) have been used in Faroese salmon production along with many other chemicals.

The main fish species used in Faroese fish feed production is blue whiting, a pelagic species that is well suited for direct consumption. It is caught in large volumes almost exclusively to be used in fish feed production. Other species reported to be used in salmon feed in the Faroes are anchovy, capelin, menhaden, sand eel, herring, boarfish, sprat and krill (Seafood Watch 2018, p. 47). The raw material intake, that is pelagic fish, by Havsbrún was 342,456 tons in 2017 (Bakkafrost 2018b, p. 7), corresponding to almost half of the total Faroese catch which was 700,364 tons in 2017 (SFI 2019a). In other words, an amount almost half the size of total fisheries catch in the Faroes was reduced to fish meal and oil instead of being used for direct human consumption, resulting in an overall loss of available fish protein.

Fossil energy requirements of salmon farming

When it comes to the fossil energy required to sustain Faroese salmon production some figures and accounting have been reported by Bakkafrost (2018a, p. 23). The figures include energy consumption in hatcheries, farming, harvesting, processing, packaging and feed production.[12] The company reports that their energy consumption deriving from sources owned or controlled by the company was 265 GWh in 2017, and 48 GWh derived from electricity (roughly half of which was produced with fossil fuel) purchased and consumed by the company. Total energy consumption was 313 GWh. The CO_2 emission from this (85 thousand tons) was roughly 8% of the total Faroese greenhouse gas emission in 2017. These figures only include Bakkafrost and not the other two operators Mowi (Marine Harvest) and Luna/Hiddenfjord. Since Bakkafrost stood for 77% of total salmon production in 2017 a rough extrapolation can be made to include total domestic salmon production in 2017. In this case it can be estimated that salmon farming contributed 10% of total Faroese greenhouse gas emissions. It should also be stressed that the emissions accounted for in this example do not include so-called scope 3 emissions, that is the indirect emissions deriving for instance from extraction, transportation and production of materials used in production (GGP 2004, p. 25). If these requirements were taken into account they would add significantly to the ecological footprint of Faroese seafood. Together, the Faroese fisheries and aquaculture sectors contributed more than 50% of the total Faroese greenhouse gas emissions in 2017. Also, as a significant proportion of the Faroese total fish catch goes into fish feed, aquaculture production in the Faroes is highly dependent upon industrial fisheries.

It is clear that growth in the blue economy of the Faroes has entailed large increases in the social metabolism of Faroese society. Increases in aquaculture and pelagic fisheries are only the latest phase in this trajectory, and growth has been rapid; salmon production more than doubled in the decade between 2007 and 2017 (SFI 2019b). Because fish meal and fish oil are essential ingredients in salmon production, especially fish oil, the pelagic zones become a commodity frontier for salmon and other finfish aquaculture, and pelagic fish species that could be used for direct human consumption, are increasingly used to produce fish meal and fish oil[13] resulting in overall protein loss.

Blue Growth, environmental justice, and ecological distribution conflicts in the Faroes

As has been demonstrated above, from a strong sustainability perspective, industrial fisheries and industrial salmon farming in the Faroes as they are currently organized must be considered cases of ecologically unsustainable (blue) growth. According to the hypothesis put forth by Scheidel et al. (2018) of "more metabolism, more conflicts" the growth in metabolism will lead to the emergence of ecological distribution conflicts, and potentially to the rise of environmental justice movements, a pattern that is discernible in the Faroese context. The issues of concern in the Faroes relating to aquaculture are very similar to the issues and arguments related to fish farming that have been identified elsewhere in Europe by Ertör and Ortega-Cerdà (2015, p. 206–207). They list issues such as: "nutrition load; chemical use; escapees facilitating disease transmission and genetic interaction with wild species; high amount of fish protein used for the production of carnivorous fish; negative physical impacts of infrastructure; animal welfare and species' preservation; inappropriate selection of the location of fish farms; competition over the use of space; lack of a clear and participatory decision-making procedure; the absence of transparent information; the protection of local culture, social cohesion and tradition; and equitable access to natural resources and livelihood. All of these issues and arguments are present and relevant in the Faroese case, but conflicts often receive little attention, and are dismissed by government agencies and the corporate sector as expressions of

[12] The methodology used is The Greenhouse Gas Protocol (2004).

[13] Replacing fish with other feed sources would relieve pressure on pelagic fish stocks, but would simultaneously add to the pressure on other ecosystems and lead to other environmental justice issues and conflicts. The demand for agroindustrial products, such as soy, in aquaculture is already problematic from an ecological perspective (FIVH and RFN 2017:23; Seas at Risk 2015). Additionally agroindustrial expansion in areas such as Mato Grosso in Brazil has been linked to severe human rights abuses and violations, including the displacement and murder of indigenous Guaraní-Kaiowá people (EJAtlas 2019).

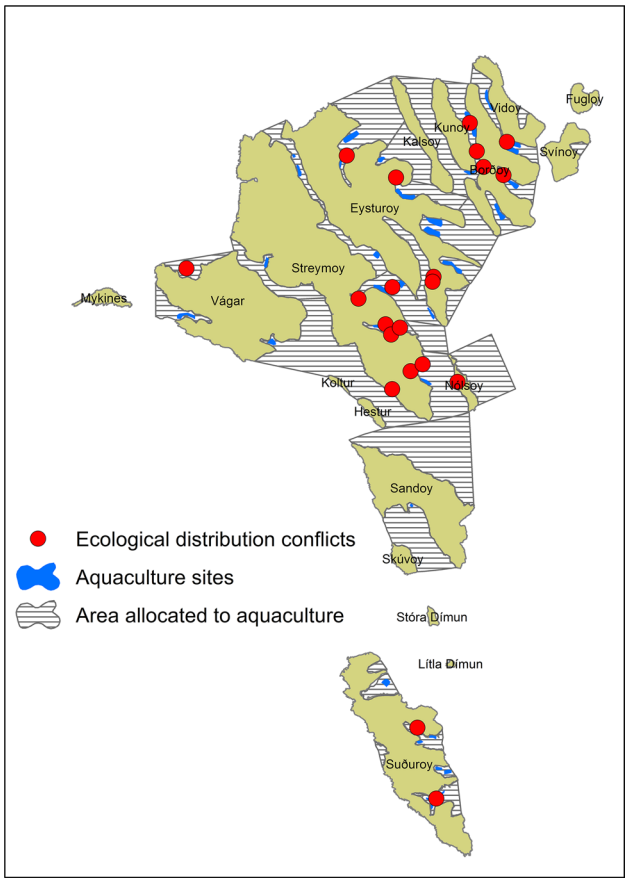

Fig. 1 Map of the Faroe Islands showing ecological distribution conflicts related to Blue Growth, aquaculture sites, and areas allocated to aquaculture

isolated and sporadic cases of NIMBY[14] conflicts. When considered together, however, a pattern of ecological distribution conflicts arising in the wake of Blue Growth emerges.

A number of ecological distribution conflicts have received public and media attention in the Faroes during the past 5 years (Fig. 1). The groups involved in the protests and conflicts are coastal fishers, landowners, NGOs, local communities, and citizen groups. The issues that have caused the conflicts have been the placement of fish farms, the expansion of fish farms into areas considered worthy of protection and conservation, the appropriation of land and water resources from local communities by the aquaculture industry, the construction of inappropriate industrial infrastructure in or in (the vicinity of) residential areas, pollution, lack of participatory decision-making, displacement of alternative economic practices, and privatization and enclosure of for instance harbors that were previously common areas. All protests are based in claims that activities related to fisheries and aquaculture are negatively affecting local environments, livelihoods and well-being.

Among the most vocal protestors of the Faroese aquaculture industry have been the lobster fishers. Analysis of aquaculture conflicts in Europe has shown that small-scale commercial fishers are the group most frequently reporting negative effects on their livelihoods from fish farming activities (Ertör and Ortega-Cerdà 2015, p. 205, Table 2), and this is also the case in the Faroes. The small-scale lobster fishers operate in the same coastal areas that are increasingly used for fish farming, and have reported diminished catches and various negative effects on the coastal ecosystems. The Faroese public has been made aware of the conflict through media coverage during some years, and the association of lobster fishers has a website,[15] where they write about their situation and conflicts with the salmon farming industry and the regulating authorities. According to the lobster fishers, they are being illegally displaced by the salmon farming industry, and the lobster fisheries are diminishing because of pollution and disturbance from the salmon farms. One post on the website referring to a graph of lobster catches going down and a graph of salmon production going up correspondingly, says:

> Never before have our fjords been so polluted with medicinal residues […] Why is no one warning of the danger? Are we so hypnotized by money that we are ready to destroy our nature and everything living in it just to get jobs? (Originally in Faroese, author's translation)[16]

The conflict around the lobster fisheries has been reported by the Faroese national media, and by the lobster fishers association through their website, but so far the lobster fishers have not been successful in their claims to having the primary right to the fjords. Most recently this conflict is playing out in Haraldssund, where the lobster fishers have been evicted to allow salmon farming pens in the area. The only success the lobster fishers have had has been some monetary compensation from the salmon farming companies. In most cases, however, the lobster fishers have been reluctant to accept the compensation because, as is stated

[14] NIMBY is an acronym for Not In My Back Yard and refers to opposition of local residents to development in their area. The term carries a connotation that such protests are fueled by a selfish concern for one's own area, while similar development in other areas would not be opposed.

[15] See https://www.hummarafelagid.com/

[16] URL: https://www.hummarafelagid.com/433454562. The original text on the website in Faroese is: *Ongantíð áður hava okkara firðir verið so dálkaðir við medisinrestum sum í dag. Og hendan medisindálking økist við einari óhugnaligt stórari nøgd hvørt ár. Hví rópar eingin varskó? Eru vit so hypnotisera av pengum at vit vilja oyðileggja okkara náttúru og tað sum í henni livur, bara fyri at fáa arbeiðspláss?*

by a lobster fisher in 2013, accepting compensation would be equivalent to selling the right to harvest lobsters in the fjords (KVF 2013).

The increase in (blue) social metabolism and its negative consequences, has recently led to the formation of a new organized protest group. The cause of conflict is the expansion of (blue) industrial infrastructure and industrial activity negatively affecting local livelihoods. In the Faroes, these conflicts often center on harbor areas. From a social, and island, metabolism perspective this is not surprising since harbors are the very place through which the growing material and energy flows are channeled. It is where fish is landed, processed, and exported, and it is where the growing volumes of imports and exports are shipped through.[17] It is also very often where increased material flows accumulate as capital stocks, i.e., as enduring industrial infrastructure. As material flows have increased, new harbors have been built, and old harbors have been expanded, usually under heavy and sometimes organized protests from individuals and community groups. Whereas harbors were previously integral parts of local communities, the past century of blue growth has transformed them into industrial areas. Harbors have been enclosed from the public, and most recently, harbor areas are being privatized. Local protests are often related to noise and air pollution in connection with bunkering and landing activities, from fishing and shipping vessels and other industrial activities taking place in harbors located near residential areas. Protests have occurred sporadically in different geographic locations, but recently, in 2018, people in different areas of the Faroes affected by these activities have set up an organization called *Heimafriður,* which can be translated as "Peace at home" or Home-peace. The stated purpose of the organization is to work towards a healthier living environment where "unendurable noise, shakings, smoke or lights from ships or other industrial activity shall not be allowed to affect residential areas negatively in the future".[18] Although not adhering to any articulated degrowth agenda, this organized group of people from a number of Faroese communities all negatively affected by unsustainable social metabolism is arguably turning into an environmental justice group/movement.

Conclusions

This paper has investigated how Blue Growth ideologies and strategies materialize in the Faroes as unsustainable social metabolism, and has mapped and discussed the ecological distribution conflicts arising as a consequence thereof. Because of the limited size, the well defined borders, and the relative simplicity of the Faroese economy, the consequences of Blue Growth become more clearly discernible, making the Faroes "good to think with" when it comes to the prospects of growth in the Blue Economy and how it pertains to long-term sustainability and human well-being.

Blue Growth, or growth in the Faroese Blue Economy is not a new phenomenon, but has been ongoing for more than a century, and is now framed in terms of "sustainable development". The increases in Faroese social or island metabolism, that is, the increases in the quantities of matter and energy transformed in processes of Blue Growth in the Faroes, are a transforming force in Faroese society, both biophysically and culturally. This analysis has only focused on estimating the material flows required in the production of salmon, but the increasing social metabolism is also materializing in rapid build-up of material stocks and supporting infrastructure, such as very large smolt plants,[19] expansion of energy infrastructure, and more. While governance visions and strategies of Blue Bioeconomy focus on making revenues of waste, they ignore the negative socio-ecological consequences of continued growth on Faroese society. In summary, the discourses of Blue Bioeconomy and Blue Growth and their underlying ideologies combine to create a landscape with expanding production facilities and expanding infrastructure, powered and fueled through increasing resource extraction and use. Rather than leading to a reduction in energy and material throughput, these ideologies are maintaining and forging new resource-intensive dependency paths for Faroese society. It is also noteworthy that this growth in social metabolism is co-occurring with a trend of increased income inequality (Joensen 2019).

A point of departure for the present analysis is the premise that ecological distribution conflicts are a crucial force in sustainability transformations, and also, that progression towards global environmental justice will require a reduction of social metabolism in absolute terms. This premise entails the recognition that (blue) growth beyond a certain point is not sustainable in a zero-sum world (Hornborg 2003; 2009), and moreover, that once basic and fundamental material standards have been achieved, further growth, i.e., increasing social metabolism, will lead to the erosion of welfare and

[17] Air traffic to and from the Faroes is also increasing, but most material flows are channeled through marine harbors.

[18] Author's translation from Faroese. The original text in Faroese is: *Endamál felagsins er at virka til frama fyri heimafriði og heilsubetri umhvørvi hjá íbúgvum í Føroyum. Ótolandi larmur, ristingar, roykur og ljós frá skipum ella øðrum havnavirksemi skal ikki sleppa at hava negativ árin á bústaðarøki framyvir.*

[19] For example, the largest smolt plant in the world has been under construction on the small Faroese island of Borðoy since 2016.

human well-being rather than enhancing it (Max-Neef 1995; Kubiszewski et al. 2013).

Groups such as the lobster fishers and *Heimafriður*, which have been briefly discussed here, arise in protest to specific problems experienced locally as threats to local livelihoods, and are not necessarily linked to overarching critiques of growth. These, and various other groups protesting what they perceive to be unjust distribution of environmental benefits and burdens within Faroese society may appear isolated, but together they are an important voice in contesting and politicizing the expansion of Blue Growth, questioning its viability and legitimacy. Local environmental justice groups also often reach out and join forces with other groups in society with an articulated degrowth agenda, such as local Faroese NGOs for example. In this sense, the conflicts become simultaneously environmental justice and degrowth conflicts. The Faroese context is, however, special since the Faroes are both a resource extraction frontier and an affluent welfare society in the Global North. This context, of unsustainable resource extraction, and material affluence, has developed through the twentieth century. It is, however, built on, and has developed alongside an alternative and sustainable traditional economic base, which continues to make out a significant proportion of the informal Faroese economy (Bogadóttir and Olsen 2017; Bogadóttir forthcoming). This informal economy, and alternative social metabolism to the industrial one, also continues to provide meaning, social cohesion, and well-being to people in the Faroes. This supports the assertion that the reasons for why people, or groups of people, oppose or protest against socio-metabolic changes or transformations taking place in their local environments, although not always articulated in such terms, are not simply expressions of NIMBY protests or modern environmentalism, but are existentially rooted in specific cultural-environmental context. This argument has long been put forward in a context of poor and marginalized people (Martinez-Alier 2002; Guha and Martinez-Alier 1997), while protests by "modern" people in "developed" regions tend to be easily categorized as NIMBY conflicts and dismissed. Albeit not necessarily articulated in terms of environmental justice or degrowth the struggles to protect local livelihoods and places in the Faroes all fall under the definition of environmental justice proposed by Anguelovski (2015, p. 33). Moreover, they represent alternative social imaginaries that prioritize human and ecological well-being over growth. These imaginaries are based in the not so distant, but ecologically sustainable, past, and in alternative and diverse visions of the future. Without involving a necessity of reverting to traditionalism, the alternatives to Blue Growth are already present in Faroese society.

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