Whose Ocean Genome?

Unveiling the Imaginaries at Play in the Exploration and Use of Marine Genetics in Norway

Tuva Saltermark

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Abstract

Simultaneously as we venture into UN's Decade of Ocean Science for Sustainable Development and pressing concerns are voiced due to the declining state of the oceans, motivating visions are crafted by global and Norwegian actors who envision prosperous and resilient ocean futures by merging cutting-edge ocean sciences and technology with blue growth. Part of this vision is the exploration of marine genetics for scientific and commercial purposes. In 2020, a paper was published by The Ocean Panel encompassing what they present as the *Ocean Genome.* The panel defines the ocean genome as the "genetic material present in all marine biodiversity, including both the physical genes as the information they encode" (Blasiak et al., 2020, p. 2). By exploring the ocean genome, the panel envisions a future where the utilization of marine genetics will facilitate new and innovative approaches to marine conservation and management. Further, other affiliated actors such as the Centre for the Ocean and the Arctic and the Norwegian Earth BioGenome project together with the Ocean Panel suggest that the exploration of marine genetics can initiate a golden age for the marine bioeconomy and biotechnology in Norway. Building on Science and Technology Studies and Political Ecology, this thesis argues that the ways nature is studied, used, and modified by society is an inherently normative and ideological practice.

This thesis suggests that the conceptualization and exploration of the ocean genome includes a distinct sociotechnical imaginary built on state interests, win-win rationales and a particular set of solutions to our planetary predicaments that rely on techno-optimistic and decoupling premises. Applying a Sociotechnical Imaginary's framework, the thesis examines how this imaginary has originated, been embedded in society, extended through new rationales, and how it is now being met by resistance from movements such as Transformative Biodiversity Governance and Blue Degrowth. These movements present alternative onto-epistemological approaches to and understandings of what constitutes as sustainable and equitable uses of (marine) organisms and nature at large. There are plural ways of understanding both how ocean issues emerge, how communities seek to solve them, and what ocean futures actors insist we should aim for. However, as the findings of this thesis demonstrates, deliberative and inclusive approaches to ocean governance have been sidestepped in the ocean genome imaginary due to strong science-industry interlinks in marine sciences facilitated by state interests and furthermore the visions of scientific vanguards.

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To Iver, thank you for everything.

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Abbreviations

ABS: Access and benefit sharing

BBNJ: Biodiversity Beyond National Jurisdiction

COA: Centre for the Ocean and the Arctic

CBD: Convention on Biological Diversity

DSI: Digital Sequence Information

IPCC: Intergovernmental Panel on Climate Change

NMRA: Norwegian Marine Resource Act

NRC: Norwegian Research Council

PE: Political Ecology

STS: Science and Technology Studies

TBG: Transformative Biodiversity Governance

MGR: Marine Genetic Resources

STI: Sociotechnical Imaginaries

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1. Introduction

At both global and national levels, the ocean is becoming a prevalent topic due to multiple interests as well as problems. The aquatic realms, which cover about 70% of the Earth's surface, are at the centre of both geopolitical, environmental, business-related and, to some, deeply personal and emotional affairs (Brent et al, 2020; Ertör & Hadjimichael, 2020; WWF, n.d.). This is evident in the emergence of global initiatives pertaining to the oceans, such as The United Nations Decade of Ocean Science and the Sustainable Development Goal 14: Life Below Water. Furthermore, building on the idea of 'green growth', the Rio+20 conference introduced the idea of a 'blue growth'. Through the blue economy and growth, states, industry and science is accentuating what they present as unfulfilled economic opportunities associated with the oceans (Brent et al., 2020). This notion has been incorporated into both global and Norwegian policies (Brent et al, 2020; Barbesgaard, 2018).

Life in the ocean and life on land are interconnected through multiple intricate cycles and systems. Approximately half of Earth's oxygen is produced by marine plankton, and the ocean serves as one of Earths most important climate buffers in the face of climate change (UiB, n.d.). It is estimated that about 4/5 of the increased heat associated with greenhouse gas emissions from the second half of the 20th century has been absorbed by the world's oceans (UiB, n.d.). Simultaneously, the ocean is experiencing species decline and extinction at a much faster rate than terrestrial species (Blasiak et al., 2020). This has intricate and detrimental consequences not only for marine species, ecosystems and coastal communities, but for all humans and non-human species due to the ocean's interconnectedness to the rest of the planet (IPCC, 2019). Forceful statements have been made in the wake of these threats. The UN Secretary General's Special Envoy for the Ocean insisted in 2021 that the state of the ocean will "ultimately determine the survival of humankind on Earth" (UN, 2021).

At the outset of these predicaments and the complex issues they subsume, are various perspectives on what are the primary drivers causing marine degradation and decline, as well as on how these issues ought to be solved. These matters lie at the heart of debates on the governance and regulation of human-nature interactions related to marine environments (Evans et al., 2023). A deeply ingrained conception that has gained significant prominence in both global and Norwegian policies regarding ocean governance and sustainable development is triple-benefit or win-win solutions (Barbesgaard, 2018; UNDP, 2012; Louey, 2022; Ertör & Hadjimichael, 2020). Rooted in mainstream green growth rationales, the win-win premise views economic growth and sustainability not as opposing or contradictory interests but, instead, builds on the belief that sustained economic growth can be achieved within sustainable parameters by decoupling economic growth from material and energy throughput, thereby reducing carbon emissions (Hickel, 2020). Proponents of green growth maintain that this decoupling is attainable by developing technological innovations that can make production more efficient using less material and energy throughput, as well as the implementation of managerial solutions (Asafu-Adjaye et al., 2015).

Based on the premises of green growth and win-win solutions, the blue growth paradigm envisions a similar future where blue economies can coexist and furthermore significantly expand whilst preserving and restoring marine ecosystems. Barbesgaard suggests that in this scenario, "everybody supposedly wins: coastal communities, the environment and investors" (2018, p. 130). This discourse, according to Barbesgaard, has become a widespread discourse that is driven both by environmental NGOs, the financial sector, and military companies (2018). In Norway, the government has adopted a similar discourse and narrative in their Ocean Strategies for the blue economy in their ocean strategies published from 2017 and 2019. Norway also co-chairs the High Level Panel for A Sustainable Ocean Economy. In 2021 on behalf of the Norwegian government, the Norwegian prime minister Jonas Gahr Støre announced at the COP26 in Glasgow that:

> Sustainable ocean investments could create 12 million new jobs. According to economic forecasts this could yield more than 15 trillion dollars in benefits over the next three decades (…). Benefits in the form of renewable energy, decarbonisation of shipping, and sustainable tourism. In short: If we act in the right way, the oceans will provide the solution to some of the world's most pressing challenges, from climate change to food security (Regjeringen, 2021).

The concept of the blue economy is evolving as the oceans become more accessible to humans through technology and new scientific knowledge. These technological and scientific advancements are further coupled with prospects crafted by states and industry, who envision and narratively present the ocean as a new commodity frontier that will forge novel and sustainable industries at sea, such as offshore wind energy, seabed mining and new forms of aquaculture (Brent et al., 2020). Havice and Zalik (2018) argue that these trends not only forge ideas of new industries, but also transform the oceans into extended sites for commodification and represent a new epistemological frontier. As the limits and edges separating humans and oceans are becoming more and more diffused as technology and science progress, Havice and Zalik (2018) argue that the ocean is becoming a new knowledge frontier in and of itself, which does “not only shape what is known about the oceans, but also how they are governed and valued, and by whom” (p. 6).

Joining in on both the blue growth rationale and as a solution to ocean-related issues, is a holistic discourse and strategy of wielding marine genomics for creating novel marine-derived resources, whilst also utilizing marine genomics for ocean governance and conservation (Blasiak et al., 2020; Stenseth et al., 2021; Jakobsen et al., 2020). In 2020, the Ocean Panel epitomized this prospect through what they conceptualized as the ocean genome in their paper *The Ocean Genome: Conservation and the Fair, Equitable and Sustainable Use of Marine Genetic Resources.* In this paper, the panel suggests that the exploration of the ocean genome will not only enrich our knowledge about life and evolution, but will further enrich opportunities within the marine bioeconomy, that could in the future expand ocean-bound industries such as aquaculture. Further, they suggest that exploration of the ocean genome will be pivotal for better and more efficient approaches to marine conservation and governance (Blasiak et al., 2020). This, the panel states, is because marine genomic knowledge can help scientists better understand the functionality and resilience of marine species. This could again help illuminate how marine species respond and adapt to external pressures such as climate change and over-exploitation (Blasiak et al., 2020). The Panel stresses that the loss of genetic diversity amongst marine species can reduce population viability and resilience, and in worst-case scenarios lead to extinction. Therefore, they claim that mapping and exploring the ocean genome is now more important than ever, to understand how marine life responds to external pressure, and to find the best measures to hinder marine decline and population extinction.

By fusing economic interests with conservation goals, the Ocean Panel seeks to develop “innovative ocean solutions in the technology, policy, governance and finance realms that can help accelerate a move into a more sustainable and prosperous relationship with the ocean” (Blasiak et al., 2020, preface). In 2021, The Centre for Ocean and The Arctic (COA), an institution founded on behalf of the Norwegian government, published an equivalent paper based on the ocean genome document by the Ocean Panel titled *The Ocean Genome – Preservation and sustainable use of marine genetic resources in Norway* [1]. The COA created this paper at the request of the Norwegian government, seeking an equivalent document tailored to a Norwegian context. In the document, the COA accentuates the Norwegian Earth

[1] Authors translation. Original title “Havgenomet – bevaring og bærekraftig bruk av marine genetiske ressurser i Norge»

BioGenome Project (EBP-Nor) as a central contributor to the exploration and further utilization of the ocean genome in Norway (Stenseth et al., 2021). EBP-Nor is a subordinate level of the global scientific research project Earth BioGenome Project, which aims to sequence all of Earth's eukaryotic species within a 10-year timeframe (Jakobsen et al., 2020). EBP-Nor shares a similar national objective, seeking to sequence all Norwegian eukaryotic species, which is estimated to be about 45 000 species, within the same period (Stenseth et al., 2021).

The term genome has commonly been used to describe the complete set of genetic information in an organism (individual or species), such as the human genome. In discussions concerning the ocean genome by the Ocean Panel however, the Ocean panel extends the term genome to entail not just the genetic information of a specific organism; but all life below water. The Ocean Panel defines the ocean genome as "the foundation upon which all marine ecosystems rest and is defined here as the ensemble of genetic material present in all marine biodiversity, including both the physical gene and the information they encode" (Blasiak et al., 2020, p. 3).

The exploration of marine genomics also leads to greater opportunities for marine bioprospecting. Marine bioprospecting can be defined as a commercial activity that aims at exploring and collecting biological components that can be commodified into new marketable products (Benjaminsen & Svarstad, 2021). Further, innately entwined with the exploration and quest for marine derived products, is the biotechnology industry. Biotechnology can be defined as "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use" (CBD, Article 2). Historically, bioprospecting and biotechnology are activities that have been most commonly conducted by countries and companies in the Global North due to their resource and capital-intensive demands (Benjaminsen & Svarstad, 2021). Due to the disparities between countries and communities' capacities to indulge in these high-cost activities, the fair benefit sharing of genetic resources have become contentious topics, but several juridical principles and obligations have therefore been developed to guide and regulate the sharing of benefits arriving from genetic resources. These principles are often associated with the Convention on Biological Diversity (CBD). The CBD is an international treaty aimed at promoting the conservation and sustainable use of biodiversity, as well as the fair and equitable sharing of benefits arising from genetic resources. Some of the fundamental principles related to the convention are sovereign rights of nations over their own genetic resources, as well as access and benefit-sharing principles (ABS), pertaining to the access to genetic resources and how benefits derived from their utilisation are shared between providers and users. The convention has two supplementary treaties. These are the Cartagena Protocol on Biosafety, which concerns biosafety and issues related to genetically modified organisms due to biotechnology, and the Nagoya Protocol which tends to the fair and equitable sharing of benefits arising from the use of biodiversity. The Norwegian state is obliged to follow these conventions and their principles. Furthermore, the Norwegian state has its own set of principles relating to the utilization of marine resources and genetics. These are constituted in the Norwegian Marine Resource Act and the Nature Diversity Act.

Norway has a long-standing tradition of harvesting and utilizing marine resources, which has played a significant role in coastal settlement and activity. These traditions and their history have firmly established Norway as an ocean state, a notion that has been deeply ingrained in the national psyche (Liu et al., 2011; Movik & Stokke, 2015). Furthermore, Norway aspires to be a global leader in marine sciences, technology, and the blue economy (Nærings- og fiskeridepartementet, 2019). Norway's dedication to advancing marine research and innovation is evident through substantial financial investments in both marine research and marine bioprospecting. The state allocates significant resources to projects aimed at sampling marine species and bioprospecting. Moreover, the Norwegian Government has publicly funded a new polar research vessel, the RV Kronprins Haakon, with an investment of approximately 175 million euros (Havforskningsinstituttet, 2023). This vessel is intended, amongst several purposes, for marine research and bioprospecting. It is equipped with a submarine capable of diving to depths of up to 6000 meters (UiT, 2018). Further, the EBP-Nor has received 30 million NOK in funding from the Norwegian Research Council to carry out the sequencing of Norwegian eukaryotic species (The Norwegian Research Council, n.d.).

The publication of documents such as the COA's ocean genome paper, EBP-Nor's White Paper, and the Norwegian government's National Strategy for Marine Bioprospecting from 2009, as well as their ocean strategies published in 2017 and 2019, demonstrates Norway's commitment to taking a lead role in ocean sciences, genomic research and marine bioprospecting. Currently, the most important ocean-based industries in Norway encompass oil and gas, shipping, fish and seafood, the supply industry and ocean research (Nærings- og fiskeridepartementet, 2019). These ocean industries contribute to approximately 70% of Norway's export earnings (Nærings- og fiskeridepartementet, 2019).

Whose Ocean Genome for What Purposes?

This thesis contends that the conceptualization of the ocean genome and Norway's interests in its usage epitomizes a particular sociotechnical imaginary. Sociotechnical imaginaries (STI) are according to Science and Technology scholar Sheila Jasanoff (2015) "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (p. 4). In the sociotechnical imaginary of the ocean genome, the state, industry and scientific communities expect the usage of marine genomics to foster sustainable and equitable blue growth that will simultaneously ensure the preservation and restoration of marine life. Moreover, these actors also suggest that the blue economy will have the potential to solve some of the greatest issues faced by humanity today, like poverty, climate change, and ocean degradation (UN, 2021). Within this imaginary, it is envisioned that emerging approaches such as environmental DNA (eDNA), advancements in sequencing technologies and bioinformatics, and new biotechnologies such as CRISPR will play a part in shaping the future of ocean governance, as well as economic prosperity and sustainability (Blasiak et al., 2020; Jakobsen et al., 2020; Stenseth, et al., 2021).

However, visions of sustainability and prosperity are not universally shared, nor can they be impartially quantified (Robbins, 2020a; Ginsberg, 2017). Similar claims of subjectivity in natural sciences can be made for the collection of nature, claims Bronwyn Parry (2004). Parry therefore argues that when examining new nature collecting projects and bioeconomies, it is crucial to scrutinize who participates in these projects, where and how these materials are being re-deployed, and to whose advantages and interests.

This thesis departs from theoretical groundings within Political Ecology (PE) and Science and Technology Studies (STS) scholarship. It does so to explore how the conceptualization, collection, utilization, and modification of the ocean genome intersects with broader cultural and normative beliefs as well as power dynamics (Ginsberg, 2017; Parry, 2004; Robbins, 2020a). Moreover, as scholars within political ecology stress, the way actors choose to frame socioenvironmental issues as well as the way society decides to solve them, is rooted in various norms and conceptions of nature-human relations (Goldman et al., 2018). It should therefore be examined how normativity, power and interests shape and endorse these imaginaries, problem framings, solutions and their effects on society and non-human species.

Resting on Science and Technology Studies and Sheila Jasanoff's (2004) co-production idiom, this thesis sees the scientific exploration of nature and the making of novel sociotechnical artifacts such as genetically modified species as a joint exercise between political, scientific, and technical efforts. By rejecting portrayals of science and technology as linear processes, it seeks to deconstruct understandings of sciences and technology as accumulative and objective 'truth'-making (Goldman et al., 2011). Instead, with the help of Science and Technology and political ecology, this thesis examines the cognitive, institutional, material, and normative dimensions that are at interplay as novel scientific and technological inventions, such as the ocean genome project, evolve (Jasanoff, 2004). Furthermore, as Jasanoff (2004) suggests, sociotechnical imaginaries and their materialised artifacts do not only echo interests and objectives. These imaginaries and their materialisation also act upon the world they were created. Technology and novel innovations are not just deployed by society; they also play a part in shaping it. Therefore, it is necessary to examine whose conceptions of nature, sustainability and fair benefit sharing take part in shaping sociotechnical imaginaries such as the ocean genome as these are not only mere ideas, but also potential ocean futures.

Furthermore, amid blue growth initiatives and ongoing explorations of ocean genomics for commercial and conservation purposes, some scholars and social movements argue that a shift in mainstream biodiversity and ocean governance is necessary in the face of the ongoing planetary crisis. This thesis illuminates how movements within academia such as Transformative Biodiversity Governance and Blue Degrowth are challenging the (blue) growth agenda by suggesting that deep-rooted and structural changes are needed in the face of growing socioenvironmental issues. They challenge the current dominance of technical and economic 'fixes' to socioenvironmental issues as proposed by blue growth strategies and rationales, encouraging alternative solutions that recognize multiple worldviews and solutions, and a critical approach to economic growth (Brent et al., 2020; Visseren-Hamakers & Kok, 2022).

Rationale and Research Questions

On the international stage, Norway embodies an identity as a world-leading ocean state at the forefront of ocean research and sustainable marine resource management (Movik & Stokke, 2014; Rosendal & Skjærseth, 2022). Through governmental strategies and national projects, Norway now also seeks to take on a leading role in the global blue growth discourse and genomic science (Jakobsen et al., 2020; Stenseth et al., 2021). The conceptualization, exploration and utilization of the ocean genome is an emerging facet of Norwegian interest in the blue economy, something that is crystallized through state funding of marine research projects aimed at exploring marine genetics such as EBP-Nor and the FF Kronprins Haakon.

In this thesis, I explore how these developments are part of the collection and utilization of marine genetics in Norway, and how the marine genomic prospects made by the state, industry and scientific community together form a shared sociotechnical imaginary. Sociotechnical imaginaries have real effects on the world, as the visions they create have the power to influence policy and enable particular scientific and technological innovations. They furthermore reimagine and prescribe futures which they claim that society should to realise, makes sociotechnical imaginaries intrinsically normative (Ginsberg, 2017; Jasanoff, 2015). Therefore, this thesis is interested in examining who participates in creating these oceanic imaginaries, and what interests, values, and motives they hold. It investigates how these actors frame current socioenvironmental issues, and how they suggest that ocean genomics and blue growth can play part in solving these issues. The thesis also investigates different ways in which the state, science, industry, and other parts of society conceptualize sustainable ocean futures. In this regard, it also investigates how these actors frame current socioenvironmental issues and what solutions they propose to address these challenges. Additionally, the thesis investigates who may see the benefits of the imagined futures facilitated by the use of ocean genomics, but also who might see the unwanted consequences of it.

On this basis, this thesis poses the following research questions:

- How are issues related to sustainable and equitable use and benefit sharing of marine genetics understood, imagined, and enacted in the ocean genome imaginary?
- Who contributes to shaping such understanding and enacting, and who are potentially left out of future ocean imaginaries?

The thesis follows the sociotechnical imaginary (STI) framework, which entails a four-step approach to looking at how imaginaries originate, are embedded, extended and encounter resistance in society (Jasanoff, 2015). STI looks at the purpose, action and aspiration that exists among particular imaginaries and their intentions to enact certain futures based on science and technology (Beck et al., 2021). As such, the STI-framework looks at how ideas and imaginaries originate, how they become enacted in society, how they gain traction and extend, and furthermore how they encounter resistance. To explore these elements, the thesis engages in a set of sub-questions which are echoed in each of the thesis analytical chapters. All four chapters are a joined engagement of the thesis' findings, as well as discussions linked to the elements of the Sociotechnical Imaginary framework.

Thesis Outline

Chapter 2 provides the theoretical framework that I apply to investigate the thesis' research question. I engage primarily in Science and Technology studies and political ecology, as well as debates on the limits to growth. The chapter gives space to philosophies of science and environmental study, discussing the normative and cultural dimensions of research on nature and the environment.

Chapter 3 outlines the methodological groundings of this thesis and explicates my own onto-epistemological groundings. Further, the chapter presents the thesis' methodological design which includes a practice-oriented approach to document analysis, expert interviews, and abductive data processing methods.

After explaining the theoretical and methodological groundings of this thesis, I move on to discuss the findings by going through Sheila Jasanoff's Sociotechnical Imaginary framework. In chapter 4 on how novel sociotechnical imaginaries originate, I explore from which cultural contexts and political objectives the ocean genome-imaginary has derived. I question how the producers of the ocean genome imaginary perceive sustainable and equitable uses of marine genetic information and material. By doing so, I also examine who the primary contributors to this imaginary are.

Chapter 5 examines whether and to what extent ideas and plans for collecting and utilising the ocean genome are embedded into institutions and material forms in Norway. By investigating current state-funded projects and political initiatives, this chapter suggests that there is a considerate indication of the ocean genome projects embedding into institutional and infrastructural arrangements in Norway.

In chapter 6, I discuss Jasanoff's (2015) argument that for sociotechnical imaginaries to persevere, they must reinvent themselves in order to achieve support and grounding in new contexts and parts of society. Looking at current global demands for solutions in the face of climate and planetary crisis, and furthermore the urge for more sustainable industries, this thesis suggests that blue growth and the ocean genome imaginary can be understood as an economy of repair which seeks to further couple economic growth with sustainability policies.

Chapter 7 looks at the final step in the STI framework. As Jasanoff (2015) suggests, emerging sociotechnical imaginaries may encounter resistance from alternative movements. These movements of resistance often argue that prevailing imaginaries may not be adequately equipped to deal with societal issues, stressing the necessity of alternative imaginaries and solutions. This chapter illuminates two emerging academic movements, Transformative Biodiversity Governance (TBG) and blue degrowth. Both movements share the similarity of forming resistance to current mainstream socioeconomic governance and structures, urging for transformative change.

Chapter 8 expands on the philosophies and principles of blue growth and Transformative Biodiversity Governance, asking whether these theories are transferrable to issues surrounding the sustainable use and fair benefit sharing of resources deriving from marine genetic material and information. Further, it asks what potential impediments may exists if the principles of these movements were to be transferred to the ocean genome project.

Finally, the conclusion summarizes the sociotechnical imaginary's framework step by step and reflects on the findings and the most central themes of the thesis.

2. Theoretical Framework

This thesis is interested in investigating different perceptions of nature-society relations, sustainability, and socioenvironmental equality. As such, this thesis develops from the idea that there exists a "plurality of values and worldviews connected to different definitions of nature" (Keune et al., 2022, p. 25). The thesis seeks to explore how different nature-society perceptions, such as green growth and sustainable development, are part of forming new sociotechnical imaginaries. Furthermore, this thesis is also interested in investigating how particular perceptions acquire influence over governance and policy making. To investigate these issues, I will start by providing some theoretical grounding that looks at how the conceptualization of nature and society relate to and influence the making of science and its sociotechnical futures. This chapter begins with an outline of Science and Technology Studies (STS), as well as the co-production idiom by Sheila Jasanoff. I thereafter introduce an analytical framework that is built on STS theory, the Sociotechnical imaginary. The latter part of this chapter will attend to the field of Political Ecology, and its relation to the emerging degrowth-movement. I end the chapter by discussing ways in which STS and political ecology intersect.

Science and Technology Studies

Science and Technology Studies (STS) is a cross-disciplinary field that emerged during the 1960s and 1970s which holds a constructivist approach to analysing science and technology by exploring its fundamental embeddedness with societal contexts (Goldman et al., 2018; Jasanoff, n.d.). Goldman and Turner (2011) explain how STS studies examine how science and technology are entangled processes which are "shaped by particular historical, socioeconomic, political, and cultural contexts" (p. 11). Understood this way, science and technology are not domains that evolve in vacuum, separated from the rest of society and its culture and politics. Instead, they exist as processes inherently embedded with the rest of the world, unruly and resultant from situated contexts and practices. Science and technology hence "participate in the social world, being shaped by it, and simultaneously shaping it" (Goldman & Turner, 2011, p. 11).

Thomas Kuhn's book the *Structure of Scientific Revolutions* from 1962 has commonly been regarded as a starting point for the STS field. In his book, Khun (1962) argued against the prevailing notion of science as cumulative, meaning a process of linear progress. According to John Law (2015), the work of Khun and others in the early sociology of scientific knowledge shows how science “are disciplinary cultures and that scientific knowledge is shaped in interaction between the world on one hand and the culture of science, including its methods, on the other” (p. 33). Later, the work of Kuhn became an essential contribution in what was be coined the science wars which unfolded in the 1990s. This was a debate amongst scholars on the legitimacy and authoritative role of science, and furthermore a debate surrounding different philosophies and epistemologies of science (Baber, 1998). Gieryn (1999) describes it as a clash between warriors of “reason, empiricism, and truth of science” on one hand, and advocates of “postmodernism, relativism, and radical social constructivism” on the other (p. 336).

This debate remains within fields such as political sciences and other disciplines that investigate social structures. Nevertheless, Jasanoff (2004) argue that STS literature makes a clear statement on resisting the temptation to construe sciences and technology as deterministic. Further, it goes against uses of ‘evolutionary economist’s languages of strict path dependency to explain scientific and technological progress (Jasanoff, 2015). In this thesis I follow a similar rational, building on a view that sees scientific progress and technological innovations not as accumulative or ‘naturally’ given. Instead, the thesis seeks to interpret science and technology as being in interplay with other cognitive, institutional, material, and normative dimensions of society, like suggested by Jasanoff (2004). I do so by bridging STS’s co-production idiom and the Sociotechnical Imaginary’s framework.

The Co-production Idiom

Keune et al. (2022) argue that modern, Western worldviews have been part of creating a separation between society and nature, a dichotomy that they claim has fostered a belief that “nature as a separate and discrete object can be known, conquered and used at will for humankind’s benefit” (p. 25). Sheila Jasanoff (2004) counters these beliefs in her book States of Knowledge, where she introduces us to STS’s co-production idiom. She explains it as an interpretive idiom that investigates “how scientific ideas and beliefs, and (often) associated technological artifacts, evolve together with representations, identities, discourses and institutions that give practical effect and meaning to ideas and objects” (Jasanoff, n.d.). Going against the nature/culture divide, Jasanoff (2004) issues through the co-production idiom how nature, facts, reason, and policy are shaped together with society’s values, subjectivities and politics. Science and technology and the innovative artifacts that accompanies them, are as such understood as processes that “both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions” (Jasanoff, 2004, p. 2-

3). Furthermore, the co-production idiom undertakes normative analysis of novel sociotechnical projects and objectives. It does this by investigating how values, ethics and power is constituted within science and technology's epistemic, material, and social formations (Jasanoff, 2004).

Sociotechnical Imaginaries

The works of Jasanoff and other STS scholars have investigated how normative dimensions within the co-productions of science and society can influence scientific and technological projects. By funding, initiating, and facilitating specific scientific interests and research projects, nations can take part in both describing and realising particular sociotechnical futures which they claim we 'ought to realise' (Ginsberg, 2017; Jasanoff & Kim, 2009). As such, nations can be part of creating what Jasanoff and Kim (2009) define as sociotechnical imaginaries. They define these imaginaries as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" (Jasanoff & Kim, 2009, p. 120). Jasanoff (2015) furthermore describes sociotechnical imaginaries as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures" that become attainable through and is supported by advances in science and technology (p. 4). Sociotechnical imaginaries are as such not mere ideas. They can serve as powerful triggers of action as Delina (2018) argues, as these "visions are embedded into decisions affecting the sociotechnical fabric of society" (p. 49). As such, they can have profound influence on society and nature as they contribute to shaping national policy agendas and scientific projects. The co-production idiom is used to examine how particular "states of knowledge" is arrived at and acquire strength and stability in society (Jasanoff, 2004, p. 4).

To investigate this co-production, Sheila Jasanoff has created a sociotechnical imaginary-framework (STI) which includes four steps to analyse how ideas may flourish or perish. The first step of this framework looks at how new scientific ideas and technologies originate. New imaginaries must latch onto prior ideas since they never fully evolve on bare ground. Therefore, work on the origin of imaginaries must examine which social arrangements or rearrangements these emerging ideas help sustain, Jasanoff (2015) suggests. The social arrangements that ideas emerge from can for example be sustainable development and green growth. The second step of the framework looks at when ideas depart from only existing within restricted circles and communities such as scientific institutes, to becoming embedded into institutions, practices, and materiality (Jasanoff, 2015). The third step looks at how some ideas extend by acquiring strength and influence across national and global levels, thereby influencing policy, governance, and society's imaginations (Jasanoff, 2015). Lastly, the fourth step looks at how imaginaries may encounter resisting ideas that involve other alternative and desired sociotechnical futures (Beck et al., 2021). Jointly, these steps help examining the various worldviews, political interests, power structures, and material groundings that novel sociotechnical imaginaries arrive from.

Furthermore, this also relates to Ginsberg's (2017) notion that "technologies or futures are not inevitable; they are made" (p. 23). In Ginsberg's work, she examines how synthetic biology for the "better" of society has arisen as a sociotechnical imaginary across many nations. She examines this imaginary by using the STI-framework and argues that "other worlds are always there for the making", claiming that the same material can spawn multiple imaginaries (2017, p. 23). As follows, multiple imaginaries issuing similar topics can evolve in the same society, whilst coexisting either in tension or in a productive dialectic relationship. Throughout the thesis, I will go more into depth of the particularities of each step of the STI-framework as I employ it to examine the thesis' findings.

Science and Technology Studies and Genomics

Much work has been done in the STS field throughout the last decades surrounding genomic science. However, most of these analyses have centred around the Human Genome Project. This project was initiated in the 1990s, and was finalised in 2003, and revolved around mapping a whole human reference genome. The Human Genome Project received global recognition, catalysing debates and the investigation of ethical, legal, and societal questions relating to genetics and genomic sciences, and furthermore their normative dimensions and implications (Jasanoff et al., 2001).

According to Hedgecoe and Martin (2007), in the STS realm of research done surrounding genomics there has been paid less attention to the commodification and commercial exploitation of new genetic and genomic knowledge. They claim that instead, the main focus of STS scholars has been towards "changes in the knowledge production system associated with the development of the life sciences in general and the rise of genomics and 'big biology' in particular" (2007, p. 824).

Like Bronwyn Parry in her book *Trading the Genome: Investigating the Commodification of Bio-Information* from 2004, Hedgecoe and Martin (2007) also support the claim that there has been a change in genomic sciences in relation to commodification practices. They claim that with new arenas such as the life sciences and the development of biotechnology and genomics, a more profound change concerning the commodification of knowledge is occurring (Hedgecoe & Martin, 2007). Among these changes are the patenting of genes and life forms and the increasing linkages between science and industry (Hilgartner, 2015). According to Hedgecoe and Martin (2007), these shifts are "seen as having a number of important consequences, including the shifting of public-private boundaries and a corrosion of the norms of 'good science', leading to major conflicts of interests" (p. 824). Further they contemplate that the Human Genome Project can be seen as a publicly funded project "working within the bounds and interests of international pharmaceutical research" (Hedgecoe & Martin, 2007, p. 824). Kaushik Sunder Rajan (2005) has argued that the new value creation within genomics represents a new form of biocapitalism. Furthermore, Rajan suggests that this economic organisation depend on speculating in genomic futures, questioning and seeking which genomics are of financial value and which are not.

Based upon their literature review of STS research on genomics, genetic knowledge and biotechnology, Hedgecoe and Martin (2007) found that the literature within these realms follow two different strands of thought: The transformational and the contextual. They emphasise that such a classification is not an attempt to dichotomise the STS work on genomics, and that there are fluctuating dynamics between the strands of thought. However, they claim that these differing approaches to analysing genomics are important to distinguish as they make up different ways of "describing and analysing technological developments" (Hedgecoe & Martin, 2007, p. 819). In their analysis, they claim that the "transformational" approaches to such STS studies of genomics, tend to portray scientific and technological developments as revolutionary and as something separate from what has been done before. Hedgecoe and Martin largely critique this approach, as they claim there is doubt whether such transformations are occurring, and to what extent. They also stress the risks of framing these changes as revolutionary, as they claim it might make researchers pay less attention to how new developments in science and genomics retain to wider social contexts. They highlight the historical roots that underpin modern scientific techniques and their relation to historical atrocities such as eugenics and racism, which they claim "still lurk in the discourse and actions of modern genomics" (Hedgecoe & Martin, 2007, p. 820).

Hedgecoe and Martin do not scorn revolutionary progress within genomics all together but insists that contextual priorities are pivotal. Jasanoff's emphasis that the co-production idiom can be a tool to avoid such over-simplifications of genomic sciences and technologies, as it stresses the pivotal part of history within STS inquiry (Jasanoff, n.d.). Moreover, the STI-framework is also a reliable approach to analysing novel sociotechnical developments as it pays attention to the historical context of emerging imaginaries.

Although Jasanoff and Kim (2009) has looked to nations as central creators of novel sociotechnical imaginaries, STS scholars have also studied other significant spaces which foster new imaginaries and artifacts, such as STS-approached laboratory ethnography, looking at scientists and their petri dishes. Sismondo (2007) explains how in the 1970s, several researchers set foot in laboratories to study the culture of science (2007). The researchers observed scientists as they collected and analysed data, and examined how they conducted their experiments and their refinement of claims (Sismondo, 2007). Through these studies, Sismondo (2007) claims it was demonstrated how "not only data but phenomena themselves are constructed in laboratories – *laboratories* are places of work, and what is found in them is not nature but rather the product of much human effort" (p. 15). He goes on to claim that phenomena's stemming from laboratories are not naturally given, as they are "extracted and refined, or are invented for particular purposes, shielded from outside influences, and placed in innovative contexts" (Sismondo, 2007, p. 15). In the methodological chapter of this thesis, I will go more into depth of these topics as I explain the ontological and epistemological approaches applied in this thesis. Having now introduced the STS and sociotechnical imaginary-framework that I will later apply when discussing my findings, I now move onto the second theoretical framework of this thesis.

The Political Ecology Hatchet

Political ecology (PE) is an interdisciplinary field that emerged in the 1970s and 80s. In its essence, political ecology deals with "the use and control of natural resources" and environmental change and the representation of these (Goldman & Turner, 2011, p. 6). The field emerged as the coalescing of two movements. The first a growing influence of Marxist political economy and thinking, and its escalading critique against Malthusian theories concerned with population growth and resource scarcity (Goldman & Turner, 2011). Proponents of these critiques urged for a more social and politically oriented analysis of environmental knowledge and management. The second movement was the expansion of environmental and societal research such as "human ecology, cultural ecology, and environment and development research" (Benjaminsen & Robbins, 2015, p. 191). This ultimately made political ecology into an interdisciplinary field. According to Goldman and Turner (2011), political ecology has expanded significantly since the 1990s because of its ability to connect "social and ecological change; the environment and social justice and global and local change" (p. 6).

Predominantly, political ecology has been used in research and field studies in the Global South, dealing with rural socio-environmental issues. However, there has been an effort during the last decades to expand this geographical use. Hence, political ecology research has also reached the Nordic region the past years (Benjaminsen & Robbins, 2015). The Nordic context presents some unique aspects for political ecology-approaches. Benjaminsen and Robbins (2015) claim that especially the Arctic testifies to this, as it is considered an emerging "resource frontier and geopolitical target" due to, amongst others, climate change (p. 191).

Robbins (2020a) describe political ecology not as a theory or a methodology, but rather as a *hatchet* for "cutting and pruning away the stories, methods, and policies that create pernicious social and environmental outcomes" (p. 97). Researchers within these realms act as the employers of the hatchet and seek to politicize the 'apolitical ecology'. This approach stands as a critique against the notion of "objective" and "apolitical" approaches to ecology, claiming that "presumed neutrality of ecology as a science is illusory (Benjaminsen & Robbins, 2015, p. 191). Thus, political ecology follows similar terrains as STS, with a more constructivist approach to both knowledge production and management of social and environmental domains. Through a political ecologist lens, nature and resources are constructed rather than given (Robbins, 2020a). This means that there is a multitude of ways of perceiving and experiencing environmental elements. As such, land and resource management and the like, are inherently "guided by our norms, interests, and values" which vary among both individuals and societies (Benjaminsen & Robbins, 2015, p. 191).

Keune et al. (2022) argue that how we define nature is a deeply subjective and normative activity, and that it is crucial to be conscious of the plural ways of defining nature. As such, one can also argue that there exist several onto-epistemological approaches to the natural world. Keune et al. emphasise the culture/nature divide that has been dominant in Western thinking, pointing to Carolyn Merchant's book *The Death of Nature: Women, Ecology and the Scientific Revolution* from 1990. Based upon Merchant's book, Keune et al. issue how nature had historically been illustrated as a nurturer and caretaker during the sixteenth and seventeenth century. Since then however, nature was 're-constructed' and conceptualized as wild, chaotic and uncontrollable (Keune, et al., 2022). Today, concepts of nature such as 'mother nature' and 'wilderness' are still being used, and terms and discourses like these can be used to serve particular political and economic interests (Visseren-Hamakers & Kok, 2022).

Similar to STS studies, political ecology has also recognised knowledge production as a locus and determining factor in environmental governance and policy. It is by political ecologists understood as a tool which can endorse or transform skewed power relations through both the control and access to natural resources, but also just as much influence the very understanding and representation of nature and environmental change (Goldman & Turner, 2011, p. 6). Environmental and biodiversity governance has also been a locus within political ecology studies, seeking to explore how natural environments are managed by societies, across both local and globalized levels. Benjaminsen and Svarstad (2021) divides environmental governance into three aspects: use, conservation, and distribution. How these formations come into being, are determined by the agency of actors, social structures and power dynamics, that themselves are subject to perceptions and goals, manifested through institutions, policy and the like (Benjaminsen & Svarstad, 2021). Such aspects can by the help of the political ecology-hatchet be scrutinized for further examination through normative analyses. By dissecting what actors claim to be the causes of problems, their representation of these, and their goals and problem-solving strategies, normative analyses can investigate the specific goals and norms that set the underlying understanding stemming from the actors at hand, similarly to STS and the co-production idiom. Critical investigation of science can thereby reveal ways that research is being based on particular norms and values, which furthermore have significant implications and impact on research conclusions. This is according to Benjaminsen and Svarstad (2021), particularly troubling when such "assumed 'neutral' research forms the basis for decision-making on environmental governance" (p. 11). Thus, by examining the normative premises of science and research, one can also investigate how particular problem framings and problem solutions are made by various actors, and the social structures that have been part of "shaping a particular way of thinking" (Benjaminsen & Svarstad, 2021, p. 11).

Discourse and Narrative Analysis in Political Ecology

In political ecology studies, normative dimensions and value perceptions can be endeavoured by examining discourses and narratives. Benjaminsen and Svarstad (2021) defines discourse as «an established knowledge regime linked to a particular phenomenon or theme" (p. 41). Each of these discourses Benjaminsen and Svarstad claim, holds on to particular assumptions, arguments and claims regarding an issue. Discourses can be hegemonic and be part of exercising power, as they can be part of shaping how particular cases are being interpreted. Furthermore, they can dominate policymaking if there are no other discourses in the same field that can challenge or effect their point of view (Benjaminsen & Svarstad, 2021). As such, dominant discourses can at worst shape both policy, jurisdiction, and societal practices alone, thereby overshadowing other perspectives and values. Critical discourse analysis must thereby seek to examine how powerful actors shape, create, and communicate particular issues in ways that support and empower their interests.

The French psychiatrist, later turned historian-philosopher Michel Foucault, stands prominently as a reference point in discussions on discourse analysis. Foucault's works are often affiliated with works of post-structuralism, an intellectual movement dedicated to questioning the instability of fundamental concepts we often take for granted – such as "self, truth, and knowledge (Robbins, 2020a, p. 71). Based on one of Foucault's notable theses, Robbins underscores the profound notion that "truth is an effect of power", shaped by language and upheld by its seemingly intuitive or unquestioned nature (Robbins, 2020a, p. 71). Robbins (2020a) suggest that delving into discourses – compromising language, narratives, imaginary, and terminology – offers a lens to comprehending society and immanent and taken-for-granted notions of the world.

The examination of apparent truths is what Foucault does by using an archaeological analysis of discourse, the nexus of his *The Archaeology of Knowledge* from 1969. In this context, the term "archaeology" can be perceived as an endeavour to unearth the concealed narrative behind the meanings of concepts and objects, along with their socio-political histories (Foucault, 1969). Archaeology in this way can reveal the veiled history of these 'truths', rendering them less inevitable and exposing their role in perpetuating the power dynamics of certain individuals or groups (Foucault, 1969; Robbins, 2020a). In his book, Robbins (2020a) proceeds on poststructuralist approaches in political ecology by elucidating Derrida's works on deconstruction as a methodological approach to examining how "specific ideas about nature and society limit and direct what is taken to be true and possible" (p. 71). By deconstructing discourses through close analysis and inspection, truth claims and hegemonic discourses can be identified. The significance of analysing discourse in matters concerning the environment goes thusly to the emphasis on how environments themselves are subject to diverse discursive forms and representations. These involve narratives, concepts, ideologies and the like.

Limits to Growth and the Degrowth Movement

A central discussion within political ecology has been the debate on limits to growth. Historically, issues surrounding nature degradation and human-environmental interactions have been influenced by Malthusian notions of limits to growth (Benjaminsen & Svarstad 2021; Robbins 2020a). Deriving from ideas of Thomas Robert Malthus, Malthusianism and limits to growth is based on a hypothesis that as populations grow, pressure on natural resources will lead to collapse due to misalignment between population growth and access to resources (Malthus, 1798). This 'population law' has been largely used in discourses surrounding socioenvironmental issues. However, one of the core essences of political ecology has been to deconstruct this narrative, arguing that resources are constructed rather than given (Robbins, 2020a). Furthermore, Robbins (2020a) claims that political ecology "have always pointed to the way scarcity is a construct that is allied with elite power, not emancipatory process" (p. 3).

During recent years, another movement under the term degrowth has challenged political ecology's notions of natural limits as constructed. The movement is based upon a critique of prevailing discourses and policies established on green growth and decoupling rationales. These rationales derive from ecomodernist notions of growth and techno-positivism that believe that economic growth can be decoupled from energy and material throughput (Hickel & Kallis, 2020). As such, proponents of green growth assert that "continued economic growth expansion is compatible with our planet's ecology, as technological change and substitution will allow us to absolutely decouple GBP growth from resource use and carbon emission" (Hickel & Kallis, 2020, p. 469). Decoupling is understood as socioeconomic and technological processes which through modernization and increased efficiency, able the decoupling of economic growth from environmental impacts, whilst also preserving nature and reducing global poverty (Asafu-Adjaye et al., 2015). Ecomodernists distinguish decoupling into relative and absolute alternatives, suggesting relative decoupling as when "human environmental impact rise at a slower rate than overall economic growth", whereas absolute decupling is when "total environmental impacts (…) peak and begin to decline, even as the economy continues to grow" (Asafu-Adjaye et al., 2015, p. 11).

This socioeconomic and technological premise has been widely agreed upon and become a hegemonial discourse in socioenvironmental policies both globally and in Norway since the Brundtland Commission which was released in the 80s and the related Sustainable Development Goals (Hickel & Kallis, 2020). It has furthermore been a part of shaping a global win-win discourse premised on the idea that green growth and environmental issues can be resolved hand in hand by leveraging technological and managerial solutions (Brent et al, 2020). The degrowth movement as well as ecology economists, however, argue that there is no adequate empirical reliance over long periods which can attest that absolute decoupling has actually occurred (Hickel, 2020; Vatn, 2021).

Political ecologist Paul Robbins (2020b) has critiqued degrowth of endorsing an unwarranted critique of "scaled, intensive, and technical innovations" and relying too strongly on uncritical utopias (p. 4). Acknowledging the negative associations with the term degrowth, Hickel argues that degrowth is not inevitably utopian. It is rather the planned reduction of energy and resource use "designed to bring the economy back into balance with the living world in a way that reduces inequality and improves human well-being" (Hickel, 2020, p. 1105). As such, degrowth has a 'discriminatory' approach to growth. This means that it seeks to "scale down ecologically destructive and socially less necessary production" such as SUVs, advertisement, and private transportation, while expanding socially important sectors like "healthcare, education, care and conviviality" (Hickel, 2020, p. 1108).

A central debate between political ecologists and degrowth proponents is also about whether limits to growth are constructed or not. Degrowth proponents Gómez-Baggethun (2020) and Albert (2020) acknowledge that resources can be flexible constructed. Albert (2020) furthermore claims that biotechnology and synthetic biology could potentially be part of achieving some scale of decoupling, like prior technological progression such as the Agricultural Revolution have done. However, Both Gómez-Baggethun and Albert argue that we should not rely on notions of decoupling as this may furthermore legitimise unsustainable policies and practices. When discussing the findings of this thesis, I will continue these discussions as I introduce another subsection of degrowth, the so-called 'blue degrowth'.

Science and Technology Studies and Political Ecology

As the final section of this thesis' theoretical framework, I look to the intersection of STS and political ecology. Since the 1990s, there has been an increased attention towards bridging works from the fields Science and Technology Studies and Political Ecology together (Lave, 2012). This has led to an increased interflow between the two fields where works from each field has begun to "merge, overlap and borrow from each other" (Goldman & Turner, 2011, p. 5). Goldman and Turner explain this development due to political ecologists seeking to better implement political aspects of environmental knowledge to their research by employing methods from STS and its emphasis on knowledge production. Accordingly, scholars from Science and Technology Studies have turned to political ecology to more extensively take part in the political analysis of knowledge production and "by blurring the assumed boundaries between environmental practice (production) and management (application)" (Goldman & Turner, 2011, p. 5). In their book, Goldman and Turner investigate the synthesis of the two fields by moving beyond the conventional comprehension of environmental science as production, application and circulation of knowledge. This division, Goldman and Turner claim falsely divide the three spheres and hence science and knowledge "as a disembodied product that circulated in certain networks and then is applied" (2011, p. 4). Rather, they understand this trichotomy of environmental science as a dynamic domain of politics and actors who cannot be understood without acknowledging and seeking out their interconnectedness.

Goldman and Turner insist we must move beyond this conventional way of treating policy, management, and environmental science as "loosely articulated spheres of activity and discourse" (Goldman & Turner, 2011, p. 3). In this, they claim one must explore the much more complex reality of 'knowledge politics', where production of scientific knowledge is bound together with environmental and resource management and policy. Through such analysis, it makes it possible to identify how knowledge claims about the environment are "generated, packed, promoted, and accepted by the diversity of actors in environmental management, conservation, and development" (Goldman & Turner, 2011, p. 4).

As such, both management goals and directives, as well as environmental scientific knowledge, are shaped by socioenvironmental ideas and discourses. Policy decisions on environmental and biodiversity governance is understood like this "not simply the playing out of material interests" (Goldman & Turner, 2011, p. 3). Political decisions and governance are rather a competition between various socioenvironmental perceptions, methodologies, values, and knowledge claims. Like the STI-framework emphasises that sociotechnical futures are shaped by particular imaginaries, so too does political ecology emphasise that the environments that are 'produced' depend on what interests and discourses acquire influence and dominance over public decision making.

The foundational premise of these lines of thought and the merge between STS and PE can thusly be understood as the premise that there are different ways of perceiving nature, which may lead to different ways of governing it. Such differences may be competing ontologies and epistemological approaches to environmental knowledge. Political ecology has been critiqued for looking to much at the application of knowledge (Lave, 2012), whereas scholars from Science and Technology Studies employing the co-production idiom has been critiqued for not addressing power adequately (Jasanoff, 2004). As such, by merging the two fields, one acquires analytical tools that can make present the normative aspects of policy governance and scientific knowledge.

Concluding Remarks

This chapter has introduced the theoretical framework that builds the foundation of this thesis. Grounded in theory from Science and Technology Studies and Political Ecology, it has argued that scientific knowledge and the governance of nature and biodiversity is an interconnected process influenced by values and perceptions of nature. Further, the chapter has presented the degrowth movement as an additional academic discussion on the construction and limits to growth. In the later part of this thesis, the degrowth movement will be further elaborated on as I present it as an example of a movement of resistance towards current blue growth and ocean genome imaginaries.

3. Methodological Chapter

The phenomena and term the 'ocean genome' is a novel concept and it is just throughout the recent years that it has begun to be applied as a concept in national and international policy papers, projects, and strategies. There are significant limitations to studies with a conceptual approach to the ocean genome. Additionally, some of the documents that I have included as the empirical basis of this thesis points themselves to the ambiguity of the concept (Blasiak et al., 2020). As a result, I have chosen an explorative and abductive approach to investigate the research questions of this thesis.

This chapter outlines and explains the research design and the onto-epistemological rationale that makes up this thesis. This thesis is a qualitative research project engaged in a project and imaginary coalesced by both the natural and social sciences. Thus, I will first begin by delineating the ontological and epistemological underpinnings of my research. I will also elucidate and reflect upon my own positionality. After doing so, I will explain my data collection methods and abductive approach led through practice-oriented document analysis and discourse analysis. Here, I will present the documents and interviews that make up the data material of the thesis. Furthermore, I elaborate on the semi-structures expert interviews that were conducted.

Onto-epistemological Underpinnings

Social Science and Technology Studies (STS) and Political Ecology (PE) have both been part of and contributing to what has been regarded as an 'ontological turn' in social science and the humanities (Goldman et al., 2018). According to Goldman et al., (2018) the ontological turn marks a shift from dealing primarily with epistemologies (how to know what reality is) within social sciences and humanities, to more increasingly incorporating and grappling with ontologies (what is reality). This ontological turn which has influenced both STS and PE, has emblemed a change from a deep-rooted doctrine within social sciences. Priorly, social sciences had been influenced by notions of truthmaking as a stable 'entity' which could be uncovered by applying the appropriate and objective metrics (Law, 2015). This worldview echoes the culture-nature binary as priorly mentioned in the theoretical chapter, as it reflects a philosophy where the natural world and the social world are viewed as two distinguished parts that can be understood and measured separately. As John Law (2015) writes, this dichotomized way of viewing nature and society has been widely embedded and institutionalised in society, and as such, they influence environmental and biodiversity governance. Furthermore, due to the scope and power of this worldview and its capacity to shape policy making, problem framing and solutions, it has consequently been part of organizing nature-society relations in particular ways (Law, 2015; Robbins, 2020a).

Through their scholar contributions, STS and PE scholars have been attempting to deconstruct this binary. As examples, Stephen Hilgartner, Bronwyn Parry, Bruno Latour and Steve Woolgar have been researching natural scientists and their practices in laboratories, investigating and suggesting that how nature, sociotechnical artifacts and property is created, is not just a discovery of an external 'truth' (Hilgartner, 2015; Latour & Woolgar, 1979; Parry, 2004). Rather, they suggest, that what we constitute as nature, value, property and furthermore what later becomes created as novel sociotechnical artifacts, is deeply rooted in how society perceive reality. Furthermore, Parry (2004) suggests that instruments that are being used to examine nature constitute social tools, as they are tools created by society interests aimed to uncover and utilize nature in specific ways, such as applying genetic sequencing methods for biotechnology purposes. Lastly, STS scholars lay emphasis on scientists' capability of forming new realities as they can modify and alter nature through creating new medicines, species, foods and so on (Fujimura, 2019).

On these notions, the line I thereby walk in this thesis rests on Donna Haraway's (1988) dissection of the "God trick". Haraway explains the "God trick" as when scientists place try to position themselves objectively and separate from the sciences they execute. Haraway however argues that science and knowledge making is a situated practice which reflect particular locations and social interests and agendas. As such, scientists are intrinsically linked to social and its ideologies and power structures. The same can also be said for the development of technology and innovation. For research to be reliable, it must therefore strive to be transparent by reflecting on how it is being influenced by its own particular situatedness (Haraway, 1988). As such, this thesis moves away from any notion of research as objective. Instead, it relies on the notion that ontology and epistemology is inherently interlinked, and that what we perceive as reality depends on the tools and values we apply when trying to understand it. Accordingly, it acknowledges that there exists a plurality of ways of enacting upon and thereby understanding the world (Goldman et al., 2018, Law & Lien, 2012). In this thesis, I will refer to the interrelatedness between ontology and epistemology as onto-epistemologies.

It is important to emphasise that it is not my intent to disregard research done within and by natural scientists and the measurements they use, nor proclaim mistrust towards their intentions to finding sustainable and equitable solutions in face of climate and biodiversity issues. Most of the informants expressed what I perceived as strong commitments to these issues. What this thesis seeks to investigate however, is how the ways which sustainability and social equity is understood by those who take part in the ocean genome imaginary, relate to broader societal normative, cultural, and ideological factors. The aim of this thesis is to illuminate these and to examine what this encompasses for the future utilization of marine genetics.

As a last notion on these reflections, I will elucidate my own situatedness and positionality as a researcher. My engagement in marine biodiversity policy and governance issues are strongly connected to my upbringing on a Northern Norwegian fish farm. Throughout generations, the local community I come from have relied on harvesting from wild living marine species, crossing coasts and fjords from the Norwegian Westcoast to Murmansk. Due to my background, I am therefore familiar with the social, political, and economic landscape of coastal and rural Norway, particularly the North. Furthermore, I come from a municipality who has been frequently listed on the Norwegian ROBEK-list, a register for municipalities who are obliged to receive financial directions by the state due to economic imbalances (Regjeringen, 2022). Moreover, many of these regions are experiencing depopulation and are thereby striving to find ways to keep their communities going. These are aspects I aspire to be mindful and considerate of when later reflecting on alternatives such as the blue degrowth.

Finally, I would also like to disclose that whilst writing this thesis, I have been part of an interdisciplinary art project made up by three biologists, an artist and myself. Together, we received the Arctic Arts Festivals youth grand and as part of the project we journeyed across five coastal communities in Northern Norway. Here, we had conversations with locals about their traditional and coastal practices, as well as giving ear to their social and environmental concerns. Some of them had lived their whole lives by the sea, becoming life witnesses to the alternations of the ocean surrounding them. These impressions have inevitably influenced this research project in some parts. Moreover, it has also strengthened my own notion on the importance of stakeholder involvement in projects and imaginaries relating to ocean governance and the futures which science, industry and the Norwegian state wishes to enact.

Practice-oriented Approach to Document Analysis

Asdal and Reinertsen encourages us through their practice-oriented approach to document analysis to transcend the ‘flatness of documents’ (Asdal & Reinertsen, 2020). According to

Asdal and Reinertsen, transcending the 'flatness' of documents implies an analytical undertake where one approaches documents not just as mere written material. Instead, one looks at documents more as a dimensional space constituted by and capable of configuring *tools, cases, and movements,* which holds the capacity of shaping material consequences (Asdal & Reinertsen, 2020). This perception also embraces the belief that documents are never fully neutral, as documents always "come from somewhere, and compromise of the very themes and controversies which they unfold" [2] (Asdal & Reinertsen, 2020, p. 14). As such, documents connect to the wider world as they are being created due to specific objectives, as well as being able to initiate and shape material consequences and practices, either calculated for or not. Examples of this can be political strategies which become part of shaping political agendas, which furthermore may influence and enact specific policies. Thereby, one can see documents as always entail an acting out of something, documenting something and working relationally (Asdal & Reinertsen, 2020).

Asdal and Reinertsen (2020) exemplify documents capacity to shape discourses and furthermore the material world by looking at documents that deal with nature and natural resource extraction issues. When addressing the material consequences of documents, they limelight how documents can choose to leave space for (or not) to certain natural phenomena or environmental issues. Documents can furthermore decide how issues should be addressed and what aspects should be prioritized. These notions are similar to political ecology which seeks to scrutinize how discourses and narratives are part of shaping nature conceptions. As such, documents can ultimately have determining outcomes for ecosystems and species, Asdal and Reinertsen claim. It is thereby imperative to investigate the objectives and motives behind documents, and furthermore seek to understand how these documents are interpreted and later applied for decision making.

Asdal and Reinertsen (2020) write about looking at documents as entailing tools, cases, and movement, which they establish as a set of apparatuses and methodological approach for applying a practice-oriented document analysis. This involves looking at documents as encompassing instruments which are part of realising, establishing, and creating something in society. By using different techniques such as narrative persuasion, framing issues to fit specific interests, and prioritizing certain worldviews, stakeholders and interests over others, documents are also capable of exercising power (Asdal & Reinertsen, 2020). Furthermore,

[2] Authors translation

Asdal and Reinertsen claim that documents are capable of constructing novel sociotechnical artifacts, such as a gene edited salmon or an artificial bay, as documents can influence public debate, management, and sometimes law making- or changing. They also suggest that documents can be understood as technologies which enact political, knowledge or market interests. By referring to political technologies, they talk about documents that seek to form policy, such as administrative and governmental documents. Documents like these can be part of suggesting and forming how nature should be 'organised' and utilized. Knowledge documents are documents interested in making something visible and open for analytical contributions and discussions, such as novel knowledge production. These documents make specific artifacts such as new technology or scientific discoveries visible and are often part of political cases and decisions. Asdal and Reinertsen mention similarly to other scholars such as Bronwyn Parry (2004) and Sheila Jasanoff (2004) that methods, values, and intentions set various premises for the development of knowledge technologies, and that these elements should also be considered when analysing documents. Lastly, their third category involves market technologies, documents which are connected to marked forces, trade and business (Asdal & Reinertsen, 2020). They underline that these documents are not neutral but rather *performative* tools, who enact potential realities by signifying how things should take place, such as business strategies which advocate certain market interests and objectives. As such, both political, knowledge and marked technologies may "grips into the 'reality' it describes" by suggesting what realities should be enacted (Asdal & Reinertsen, 2020, p. 56). As will later be discussed in this thesis, the documents which tend to the ocean genome project merge both political, knowledge and market interests.

Strategic Literature Search

This thesis began with my exploration document *The Ocean Genome – Preservation and Sustainable Use of Marine Genetic Resources in Norway* published by the Centre for the ocean and the Arctic. Pursuing a practice-oriented approach to document analysis, I began to search for and collect more relevant data by delving into the document to discover it as a *place* with its own cases and vested interests, as suggested by Asdal and Reinertsen (2020).

I examined who had been the and authors of the Centre for the Ocean and the Arctic's (COA) paper, what their field of expert was, and what institutions they represented outside the COA. By reading through the COA's document, I explored how the paper was linked to a similar paper published by the Ocean Panel. This paper became part of my data collection too. Furthermore, the CAO's ocean genome document accentuated the Norwegian EBP-Nor as pivotal for the exploration of the ocean genome in Norway. Thereby, this research initiative and its White Paper would become a central part of this thesis and its empirical data.

After having carried out a practice-oriented document analysis, discovering the CAO's document interrelatedness to other documents and institutions, I conducted a strategic literature search. I did this to see if there was other data that was relevant that I had not discovered through the practice-oriented document analysis approach. For this, I explored literature from 68 different databases through Oria. I attempted to use the term 'ocean genome' as a search word. However, the using this search terminology left me with very few results. Overall, there was just about a handful of relevant sources that applied the term 'ocean genome', and all of these have been applied either as part of the empirical data of this thesis, or as relevant literature.

Main documents

Author	Institution	Title	Year	Pages
Blasiak, R., R. et al., 2020	Ocean Panel	The Ocean Genome: Conservation and the Fair, Equitable and Sustainable Use of Marine Genetic Resources	2020	68
Stenseth, N. C. et al., 2021	Centre for the Ocean and the Arctic	The Ocean Genome – Conservation and Sustainable Use of Marine Genetic Resources in Norway [3]	2021	10
Jakobsen, K. et al., 2020	The EBP-Nor Working group	White Paper – Establishing a national initiative for Earth BioGenome Norway (EBP-Nor)	2020	16

Table 1: Main documents

As part of the data collection, I also included three Norwegian governmental strategies. These were included both because they contribute to give insight to Norwegian political contexts, as

[3] Original title: Havgenomet – bevaring og bærekraftig bruk av marine genetiske ressurser i Norge

well as national priorities and ocean-bound strategies. Further, they are also important for when analysing national discourses.

Supplementary documents

Author	Title	Year	Pages
Published by following Norwegian Ministries: Fisheries and Coastal Affairs, Education and Research, Trade and Industry, Foreign Affairs	Marine bioprospecting – a source to new and sustainable economic growth	2009	34
Norwegian Ministry of Trade, Industry and Fisheries & Ministry of Petroleum and Energy	New Growth, Proud History - The Governments Ocean Strategy [4]	2017	106
Norwegian Ministry of Trade, Industry and Fisheries	Blue Opportunities – The Norwegian Government's Updated Ocean Strategy [5]	2019	50

Table 2: Supplementary documents

Since there was a limited number of documents that referred to marine genetics as an 'ocean genome', it became important to expand my data material by also conducting interviews with experts in the field.

Expert Interviews

Conducting interviews played a crucial role in this thesis, considering the scarce literature addressing marine genetics that relate to the 'ocean genome' and blue growth framework, particularly in a Norwegian context. Through expert interviews, my aim was to delve deeper into the contextual underpinnings of these documents and initiatives, and how they had been initiated. I chose to do qualitative semi-structured interviews, as this would make room for the informants to speak their minds on themes and topics they considered particularly important and relevant. The semi-structure was furthermore beneficial due to the explorative and abductive approach of this thesis.

I began with a targeted sampling approach, reaching out to people who had been involved in the documents that formed my data material. Later, I also applied a snowball technique, as

[4] Original title: Ny vekst, stolt historie. Regjeringens havstrategi
[5] Original title: Blå muligheter – Regjeringens oppdaterte havstrategi

some informants recommended that I could reach out to other scientists who had been part of relevant projects or documents. Eventually, I conducted interviews with six different scientists who had all been involved with either the document published by CAO, the Ocean Panel, or EBP-Nor.

Name	**Involved in the following institutions:**
Anne	Centre for the Ocean and the Arctic (COA)
Pål	EBP-Nor and the CAO
Clara	Biodiversity Genomics Europe and EBP-Nor
Thomas	Biodiversity Genomics Europe and EBP-Nor
Ivan	The Ocean Panel and Rev Ocean
Peter	UiO:Life Science

Table 3: List of informants

I reached out to the informants directly by mail whilst asserting that I had registered their contributions to documents and projects I was going to use in my thesis. Before conducting the interviews, I sent each person an informational letter and consent form which included a descriptive overview of the thesis, including research questions and aims, and the estimated time for each interview and what participation entailed. The first two people I talked had a lot of administrative overview which was beneficial at the beginning of the project as it helped creating an overview of relevant national research initiatives, and well as who were part of these. The consent form registered and approved by the Norwegian Centre for Research Data (NSD). The consent from all informants was recoded, either written or oral. Since there is a limited number of contributing authors who have been part of writing the documents that I analyse, I clarified to informants that full anonymity was not attainable, even as I was using pseudonyms. However, none of the informants viewed this as an issue.

Before conducting the interviews, I was trying to be mindful of potential challenges that could occur from executing expert interviews with researchers from disciplines different from my own as I was coming from social sciences and had no prior education in natural sciences. Power relations can significantly influence the dynamics of expert interviews. In these settings, the informants are presenting their field of expertise, while I was coming into this theme as an outsider, meaning I had less information about internal debates, disagreements, and concerns. Therefore, I strived to have as much overview of the topic and field in advance as I could in the time frame that I had. Further, I had my interview guides reviewed by fellow biologist colleagues and friends. This was helpful as I got to reflect and discussing the topics at hand with others from natural sciences. Furthermore, most of the informants I interviewed were very mindful when communicating their field of expertise as they tried to make it as comprehensive and clear as possible, generally expressing an eagerness and positive attitude to sharing their knowledge and work to someone coming from outside the natural sciences.

Abductive Approach and Data Processing

As this is a qualitative explorative study, I chose an abductive approach when doing data processing and analysing. Abductive research is a merge between inductive and deductive analysis. Whereas inductive approaches are often more exploratory, deductive usually approach their research and studies with a prior theoretical framework in mind (Thompson, 2022). As such, Thompson (2022) states that an abductive approach will facilitate a "parallel and equal engagement with empirical data and extant theoretical understandings" (p. 1411).

My data analysis began with Asdal and Reinertsen's practice-oriented approach to document analysis. As such, I began my research set on the premises that documents constitute power and have the influence to shape political agendas and social artifacts (Asdal & Reinertsen, 2020). However, it was not before after I had coded and categorized the documents and transcribed interviews in NVivo, that I settled on the Science and Technology Studies and Political Ecology frameworks. This was due to the novelty of the research field, and I therefore wanted to acquire a broader overview of the field before locking into theoretical frameworks. The abductive approach thereby allowed the research to be informed by both theory and empirical. This approach was however at times demanding due to the amount of data and theory I ended up reviewing in order to land on the proper conceptual framework. However, it allowed me to revise my coding system and to become deeply familiar with the data material. This was beneficial both for when I was conducting interviews with informants, as well as when I was writing the analytical chapters.

4. Imaginaries Originate – A Sustainable and Abundant Ocean

A core premise to Science and Technology Studies (STS) is that science, technology, and innovation is not deterministically developed through a linear path. Science, technology, and its innovation evolve and change with the rest of society (Jasanoff, 2004). The rationale behind applying a sociotechnical imaginary-framework (STI) in this thesis derives from what I explain as a both a vision and simultaneously an enactment of a particular sociotechnical imaginary. This is the sociotechnical imaginary vested by vanguards who envision a sustainable blue growth paradigm using marine genetic resources, whilst simultaneously ensuring the preservation of marine life the equitable share of the benefits that derive from the ocean. This chapter, which forms the first part of the STI-framework, seeks to investigate who is part of shaping this imaginary, how these imaginaries have emerged, and how they understand and conceptualize sustainable and equitable uses of marine genetics.

The chapter begins by examining authors and knowledge producers from The Ocean Panel and The Centre of the Arctic and the Ocean, and their respective papers which both conceptualize all of oceans marine genetic information and material as an 'ocean genome'. Drawing on Asdal and Reinertsen's practice-oriented document analysis, the chapter proceeds by elucidating how these strategies relate current blue-green growth discourses, as well as to ongoing projects such as the Earth BioGenome project. Lastly, this chapter looks to how utilization of the ocean genome as well as the EBP-Nor project is aimed to be enacted in practice.

Scientists, State, and Industry Initiating Genomic Futures

The origin of this thesis derives as explained from an identification and exploration of *The Ocean Genome – Conservation and Sustainable Use of Marine Genetic Resources in Norway,* published by the Centre for the Arctic and the Ocean (CAO)[6]. Published in 2021, this publication attends to the exploration and conservation of the ocean genome, issuing how this will "lead to secure the marine biological diversity and thereby a sustainable ocean economy, food security and human prosperity and survival" (Stenseth, et al.). Carrying out a practice-oriented document analysis as constituted by Asdal and Reinertsen, I identified this documents relation to two other works which has together with the document by CAO become the locus of this thesis. These are the Ocean Panels Blue Paper on the Ocean Genome, and EBP-Nor's White Paper. EBP-Nor deviates somewhat from the works of CAO

[6] Abbreviation created by author.

and the Ocean Panel as EBP-Nor is a project embedded in a more finite and concentrated goal set at mapping all eukaryotic species on Earth. As such, it does not only refer to marine genomics. Yet, all three documents share multiple similarities through their objectives and goals, as they all seek to apply genomic sciences to preserve genetic diversity as well as creating more value within the bioeconomy. This chapter will therefore focus on these three documents, whilst the other documents listed in the data collection will be examined so to create a better comprehension of the scientific and national context of the genomic imaginaries.

The Centre for the Ocean and the Arctic (COA) was established in 2017 by the Norwegian government, with the objective that the centre would work on knowledge production and communication surrounding the blue economy and UN sustainable goals, with specific regards to Norway and the High North (Centre for the Ocean and the Arctic, 2019). According to the centre, enhancing the understanding of a blue economy in the High North is to actively contribute to fulfil the SDG goals. Furthermore, the centre seeks to be a knowledge producer which can inform and educate decision makers, businesses, and the Norwegian people, and to furthermore catalyse the potential for growth in ocean businesses in the northern areas (Centre for the Ocean and the Arctic, 2019). The centre seeks to integrate expertise across disciplines, both nationally and internationally, and to collaborate with both governmental decision makers as well as businesses. Another part of their objectives is to strengthen the collaboration between public and private businesses, whilst "aiming to develop the ocean industries with the biggest possible growth value within sustainable frames"[7] (Centre for the Ocean and the Arctic, 2019). The centre also seeks to raise awareness on technological developments, climate and environmental change and green business competitive power pertinent to the High North (Centre for the Ocean and the Arctic, 2019).

These interests of the centre coalesce with objectives issued in the Norwegian Ocean Strategies published in 2017 and 2019. In these, the Norwegian government seeks to expand already established ocean industries in Norway whilst also facilitating the growth of new ones, like offshore wind power, seabed mining (Nærings- og fiskeridepartementet, 2019; Nærings- og fiskeridepartementet & Olje- og energidepartementet, 2017). Norwegian scientists and innovators are also anticipating technological progress within genomic sciences and biotechnology such as better gene sequencing machines making genetic sequencing

[7] Authors translation.

cheaper and faster. In 2015, the Partnerskap Bioverdi published a paper titled *Biovalue: The bioeconomy can become the new oil*[8], anticipating that the bioeconomy will become a key part in Norway's future economy (Partnerskap Bioverdi, 2014). As this thesis and research is being conducted, about 10 years after Partnerskap Bioverdi's suggestions, the technological development amid genetic science is according to informants moving at record speed.

The ocean genome document published by COA is a paper based on a Blue Paper published by the Ocean Panel in 2020, titled *The Ocean Genome: Conservation and the Fair, Equitable and Sustainable Use of Marine Genetic Resources.* The COA document was written subsequent to this publication. One of the informants, Anne, had been part of making COA's ocean genome document. She informed that the centre had been commissioned by the Norwegian Ministry of Foreign Affairs to produce a document on the ocean genome equivalent to the one by the Ocean Panel but written in relation to a Norwegian context. The centre thereby assembled an expert group made up by Norwegian specialists, which resulted in a group of experts working within genetics, ecology, bioprospecting and biotechnology, environmental fields such as toxicology and microbiology. Together, these were tasked to write a paper on the ocean genome which was relevant to Norway. Anne stated that what was written in this document, was the statements and reflections by the individual authors and not the centre itself. The ocean genome document published by the COA was part of their *Blue Compass*, a project launched by the centre in 2021. This project was aimed at creating an overview of opportunities for the growth of the blue economy in Norway.

COA's ocean genome document was as explained inspired by one of the Ocean Panel's Blue Paper documents. The Ocean Panel was established in 2018 and is today made up by 17 countries dispersed over 6 continents and is co-chaired by Norway and Palau (Ocean Panel, n.d.-c). Each nation is represented by their head of state and government representatives. The Panel, which also goes under the name High Level Panel for a Sustainable Ocean Economy (HLP) describes itself as "unique global initiative by serving world leaders that is in working to build momentum towards a sustainable ocean economy in which effective protection, sustainable production and equitable prosperity go hand-in-hand" (Ocean Panel, n.d.-c). The panel has a network of what they define as advisory participants made up by businesses (e.g. MOWI, Odfjell, Kongsberg and Hurtigruten AS, Rev Ocean), NGOs (WWF International) and IGOs (e.g. the Norwegian Seafood Council, WTO and the World Bank) (Ocean Panel,

[8] Authors translation

n.d.-a). According to the panel, the ocean is a solution for some of the world's grand challenges. Therefore, they claim it is time to "shift from thinking of the ocean as a victim to seeing it as an essential part of solving global challenges" (Ocean Panel, n.d.-c).

Through their strategies and public announcements, the panel expresses that the blue economy can be part of solving global issues relating to climate change and poverty. In relation to these visions, the panel has created a transformative 'framework for change' in relation to ocean governance and the blue economy. These include objectives to secure ocean protection, production, and prosperity (Ocean Panel, 2022). As such, the panel seeks to transform ocean conservation and utilization, and to thereby "ultimately managing humanity's impacts on it" (Ocean Panel, n.d.-b).

The Ocean Panel first published their ocean genome document in 2020. The document echoes the panels interest in coupling marine economics with the exploration and preservation of marine genetic diversity. The document was written by 4 lead authors and 8 contributing authors, and the these represent various disciplines within natural sciences, whilst also including one author from law. Furthermore, Kjell Inge Røkke-owned Rev Ocean has been part of writing the document. Rev Ocean, represented by Nina Jensen, was also part of writing the ocean genome document published by COA. The Ocean Panel states that nations and furthermore sciences and industry must pay more attention to marine genetics, thereby the ocean genome, as to illuminate the "the existing and potential benefits associated with the ocean genome, the threats it is facing, and the crucial importance of conservation to maintain the ocean's genetic diversity" (Blasiak et al., 2020, p. 3). Connecting the objectives of the COA and the Ocean Panel, it is evident that the two institutions share similar visions set both at growing marine sciences as well boosting ocean-bound industries and economic growth. Before examining what these visions entail in more detail, I will introduce another institution which is part of forming national projects aimed at mapping marine genetic information and material in Norway.

With Asdal and Reinertsens practice-oriented document analyse and their attention to documents ability for instituting movement and work in mind, the EBP-Nor became an essential extension of this thesis. This project was by the COA ocean genome-publication asserted as elementary to the Norwegian exploration and utilisation of the ocean genome (Stenseth et al., 2021). In their publication, COA look to the Earth BioGenome Project (EBP) and recognise it as pivotal for the exploration of marine genetic diversity, hence the 'Norwegian ocean genome', as it will play part in mapping the genetic information derived from the national waters (Stenseth et al., 2021). The Earth BioGenome Project has been referred to as a moonshot for biology. The EBP is a global venture "which aims to sequence, catalog and characterize the genomes of all Earth's eukaryotic biodiversity over a period of ten years" (Earth Biogenome Project, 2022). As such, the project seeks to "create a new foundation for biology to drive solutions for preserving biodiversity and sustaining human societies" (Earth Biogenome Project, 2022).

The global EBP constitutes of subordinate regional and local levels. These are, amongst several, the European Reference Genome Atlas (ERGA). ERGA is a pan-European initiative which seeks to sequence reference-quality genomes for all European species. They furthermore present this as a response to the threats towards biodiversity decline, envisaging it as "a powerful resource in understanding how biodiversity functions" (European Reference Genome Atlas, n.d.). ERGA forms as a part of the Biodiversity Genomics Europe (BGE), which is a consortium that unitizes both ERGA and Bioscan Europe. BGE is a European project specialising in "the production of biodiversity genomic data" for the "biomonitoring, conservation and species recovery across the continents" (Biodiversity Genomics Europe, n.d.). When talking to Thomas, an informant who had been part of both the EBP-Nor and BGE, he defined ERGA as a society which supports the BGE, elaborating:

> ERGA is a bottom-up approach, where a lot of researchers came together from different working groups, now we call them committees. But it is more like a society. One of the first goals of ERGA was to establish BGE, and one of the first things ERGA did, was lobby work, so we lobbied that EBP got into the new European Framework for horizon 27.

This thesis focuses on the subordinate Norwegian level, EBP-Nor. This is a Norwegian-initiated project following the same aforesaid visions as the global EBP, only the national project is aimed at sequencing all eukaryotic species in Norway, which they estimate at 45 000 species (Jakobsen et al., 2020). As mentioned, the COA present EBP-Nor as elementary when it comes to mapping Norway's ocean genome. COA and EBP-Nor furthermore also addresses Norway's technological advantages, economic interests, and access to diverse marine biodiversity (Jakobsen et al., 2020; Stenseth et al., 2021). EBP-Nor defines themselves as a non-profit, bottom-up initiative led by seven major Norwegian universities (Jakobsen et al., 2020). Moreover, informants from the EBP-Nor explained that the project has extensive collaborations with industrial partners and is looking to expand and get more collaborators on board. In 2020, EBP-Nor published a White Paper titled

Establishing a national initiative for Earth BioGenome Project Norway (EBP-Nor). This document was produced by a EBP-Nor working group consisting primarily of natural sciences researches. As explained by representatives from the EBP-Nor, the paper also was written in collaboration with the Norwegian Environment Agency and the Norwegian Research Council.

Having introduced the knowledge producers who partake in shaping imaginaries of the sustainable and equitable use of marine genetics, this thesis now moves onto examining these imaginaries and their enactment more extensively.

Win-win Solutions for Marine Genetics and the Blue Bioeconomy

When processing and coding the documents by EBP-Nor, CAO and the Ocean Panel, to the surface came matching visions, objectives, and discourses between the papers. The knowledge producers envision a moreover similar future in which genomic science is used to improve marine management and conservation, whilst also facilitating the expansion of the bioeconomy, as stated by the EBP-Nor's White Paper from 2020:

> Having an atlas of all DNA sequences (i.e. reference genomes) of all species of life on Earth will ultimately provide fundamental insights into biology, transform our ability to tailor conservation of life, and deliver a comprehensive view of nature's toolkit for future biotechnology to provide humanity with food, medical treatment, drugs, vaccines, biofuels and biomaterials. It will produce a complete catalogue of life on the planet and thus be a historic mission to acquire fundamental knowledge about the natural world – in the same spirit as particle physics, and exploration of the universe – and represent a gold-mine of data to be utilized for the benefit of mankind directly and in follow-up projects (e.g. medicine, blue-green economy) (Jakobsen et al., p. 3).

As such, biodiversity conservation and economic growth is seen as mutual interests that can develop simultaneously. This rationale connects to discourses that have been dominant in sustainable development and green growth discourses that promise win-win solutions to socioenvironmental challenges. The depiction of economic expansion and growth coupled with sustainable strategies is a well-recognized premise originating back to the Brundtland Commission and report, where sustainable development was defined as a development "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Comission, 1987). This premise has later been developed through green growth, an economic proposition seeking to expand economic growth whilst detaching it from material and energy throughput (Hickel & Kallis, 2020).

Daisy Ginsberg (2017) writes about sustainable abundance as a socioeconomic utopian mode where actors imagine that coupling ventures of the bioeconomy with technological innovations, can facilitate global prosperity and "unprecedented abundance" (p. 74). Similar prospects are made for the blue economy and blue growth. Sissel Rogne, administrative director of the Norwegian Marine Research Institute stated in Vårt Land in 2021 that:

> The ocean is a part of the solution to a lot: the climate, good nutrition, and health.

Rogne further defined the ocean as an infinity machine "in the shape of raw materials for the bioeconomy which is increasingly growing"[9] (Sylte, 2021). The blue growth paradigm promises a triple-win situation where both ecological, social, and economic aspect foster from expanding blue economies (Brent et al., 2020; Ertör & Hadjimichael, 2020). Barbegaard (2018) looks at how under the 'blue growth' banner, economic growth and conservation is seen not as opposing interests, nor contradictory dynamics in expanding the economic potential and profit from ocean-based industries. When asking informants why marine science and genomics are important, Clara who had been working with EBP-Nor expressed similar ideas:

> I think the ocean is just holding the potential for solutions to climate and biodiversity crisis. And it's been the most overlooked and understudied biome, if you can call it that, superbiome maybe, because it is many different biomes within it. So, I think it is time to look there for solutions. (…) I think there is many different solutions in terms of for example developing further and prioritizing sustainable food production. Both wild populations and aquaculture, as opposed to things like beef. I think there is a lot of potential with things like carbon capture technologies, and just in general, improving the health of the ocean, will improve the health of the planet. It just has such an outsized impact. (…) Those go hand in hand too. If we recover wild fish populations, they will both sustain the food, and improve the carbon cycle. There is just so much potential for improvement there, and we've just sort of let the state of the ocean decline for so long, without really paying too much attention, thinking you know, its big, its resilient, and now we're like 'oh wait', it's kind of messed up now.

Both the CAO, the Ocean Panel and the EBP-Nor claim that this win-win situation can happen by expanding three particular fields. These are commercial utilization of marine genetics, building further knowledge about life and evolution, and finding novel solutions and

[9] Authors translation

tools for biodiversity conservation and governance. The following sections elaborate on how the knowledge producers envision that genomic sciences will contribute to supporting and expanding these interests.

Commercial Aspects of the Ocean Genome

The interest in ocean genomics and its economic potentials can be understood as the extension of foregoing transformations in the study of the natural world. As Bronwyn Parry (2004) elucidates, there was a profound transformation taking place at the turn of the 20th century in the way sciences study nature, as novel sciences such as genetics allowed organisms and living material to be opened up for further investigation, making its constituent parts such as cells, genes and biochemical compounds available both for scientific research, as well as for economic applications. By extracting genetic or biochemical information from living organisms, biotechnology enabled organisms and their constituent parts to be replicated, modified and transformed in ways that made them "commodifiable and marketable" (Parry, 2004, p. 50).

This shift, which presented opportunities for rendering biological materials into more 'information-based' forms, Parry explains was followed by several economic, technical, and societal changes. Some of these, Parry (2004) illuminates, was the introduction of "advances biotechnologies, the rise of an information economy, and the extension of systems of regulation – particularly systems of intellectual property rights – to new geographies and epistemological domains" (p. 43). These changes have enabled scientists to extract genetic and biochemical information from organisms. As a consequence, by extracting these assets, they can furthermore be replicated, modified, and transformed into new combinations which can be made profitable and marketable (Parry, 2004).

Both the Ocean Panel, the CAO and EBP-Nor stress that the bioeconomy and the blue economy can benefit from the exploration and utilization of marine genomics. In their document, the Ocean Panel emphasis specific industries whom they claim will have great potentials for commercial pursuits. These are marine drug discovery, nutraceuticals, cosmetics, aquaculture and new food products, and bulk chemicals (Blasiak et al., 2020). The Ocean Panel claims that marine species may potentially hold much greater attributes than terrestrial species:

> Marine plants, animals, fungi and microorganisms have evolved to occupy a variety of niches, being able to thrive in the extremes of heat, cold, water chemistry and darkness

> found in the ocean. The resulting adaptations are recorded in their genetic codes, enabling them to produce a wide variety of primary and secondary metabolites with significant biological activities that have attracted growing commercial interest from a range of industries (Blasiak et al., 2020, p. 7).

In the Norwegian Bioprospecting Strategy from 2009, they state that the government will seek to prioritize collecting genetic resources from Arctic aquatic biodiversity and extreme habitats, furthermore issuing that:

> Norway manages large oceanic areas, where there are probably more than 10,000 species, of which few have been studied. Some of these live in extreme environments, in Arctic waters where temperatures are low, and light conditions vary, or in oil reservoirs under high pressure and in high temperatures, while others live along the coast and fjords where there are high concentrations of species. It is reasonable to assume that several of these marine organisms have properties that can be used as basis for different products and processes within a number of industries (Norwegian Ministries of Fisheries and Coastal Affairs, p. 3).

The Ocean Panel assert that it is difficult to quantify the monetary benefits associated with the ocean genome and related biotechnological innovations (Blasiak et al., 2020). However, the EBP-Nor's White Paper acclaims that the return investment from the EBP project will likely exceed the capital which was created from the Human Genome project (Jakobsen et al., 2020). Furthermore, the authors of the EBP-Nor White Paper suggest that "given that EBP will sequence 1.5 million species for a cost similar to or lower than that of sequencing 'just' the human genome (by 2018), a conservative estimate is a return on investment for EBP-Nor ten times that of the Human Genome Project (in 2010), i.e., 1400:1, within the first two decades of completion" (Jakobsen et al., 2020, p. 13).

Life and Evolution

By both documents and the informants that I conducted interviews with, species decline, and global environmental issues were rendered as core motives for improving our knowledge about genomics and genetic diversity (Blasiak et al., 2020; Jakobsen et al., 2020; Stenseth et al., 2021). Ivan, and informant from Rev Ocean who had also been contributing to Ocean Panel's ocean genome document, claimed that bettering our comprehension of species genomes, will not only increase our knowledge about life itself and fundamental mechanisms of evolution. It will also increase our comprehension of how species respond to climate change, whilst also uncovering how they may or may not show resilience and adaptive capacities in face of environmental change (Blasiak et al., 2020). As of such, sequencing the genomes of species will be elementary, knowledge producers claim. Moreover, the exploration of genetic diversity in the ocean was underscored by several informants as an elementary endeavour as there are branches of the tree of life which exist in the ocean and not in any other ecosystems. Ivan accentuated the high phyletic diversity in oceans compared to terrestrial landscape. The Ocean Panel writes what whereas 32 out of 33 phyla occur in the ocean, whilst only 17 occur on land and in fresh water (Blasiak et al., 2020).

Ivan, a representative of the Ocean Panel and Rev Ocean, further stressed the importance of recording the genetic information of species before they go extinct, whilst also emphasising how this genetic information could be applied for genetic biotechnologies and engineering:

> (the ocean genome and marine genetics) is part of the 4 billion legacy of how evolution has worked on earth, and they are the answers to many basic questions, and indeed a lot of marine genetic resources associated with those species. Ultimately this may form a pool of genetic information that becomes important in terms of genetic engineering in the future, so I think it’s of critical importance to record the genomes of those organisms.

Marine Management and Conservation

In their White Paper, EBP-Nor states the following:

> Biodiversity is increasingly threatened by human-related activities, directly by habitat destruction and species exploitation, and indirectly by climate change, spread of invasive species and pests as a result of globalization. We are in the midst of the sixth great extinction event of life on our planet, with the risk of losing up to 50% of existing species by 2050, which not only threatens wildlife species, but also imperils the global food supply. Therefore, conservation of species and ecosystems, and increasing our understanding of their ecological interactions, are global imperatives for human survival and prosperity (Jakobsen et al., 2020, p. 2).

Novel knowledge about marine genomics is encouraged to take greater place in marine management and conservation plans by the Ocean Panel, the COA and EBP-Nor. The main stressors and threats to marine biodiversity are according to the Ocean Panel “overexploitation, habitat destruction, pollution, invasive species and, increasingly, the degradation of marine species, all of which are additionally impacted by a changing climate" (Blasiak et al., 2020, p. 7). The Ocean Panel stresses that it is important to preserve genetic diversity, as genetic variability leads to greater population fitness, and that this furthermore increases organisms' capability to adapt and recover from environmental and climate changes (Blasiak et al., 2020). The Ocean Panel further argues that researching genetic diversity is important for "understanding long-term climate resilience, such as the ability of some corals to be heat resistant in the face of mass bleaching events" (Blasiak et al., 2020, p. 4).

Clara and Ivan accentuated how using genetic information for marine management and conservation is not a new method, as genetic information has been used both for the identification and monitoring of organisms, and in genetic sciences relating to wildlife for a long time. Ivan also pointed out that when sampling in the deep sea, which they often do, "we'll often be dealing with new taxa and new species. And genetics are a tool that helps us in classification and identification of that biodiversity".

Collecting the ocean genome involves sampling and identifying marine organisms, which later has their DNA sequenced in laboratories or increasingly so *in locus,* for instance on research vessels that can do both sampling and sequencing on board. Methodological approaches vary between traditional sampling techniques, to more recent technologies such as eDNA. eDNA is a 'passive' sampling technique which can acquire DNA from either specific or entire community assemblages (Blasiak et al., 2020). This is done by collecting samples from surroundings where species have been present, such as soil, sediment, or water where they leave faeces, saliva, urine, and skin cells (Blasiak et al., 2020). As such, genetic information can be acquired from species without having observed them with the naked eye.

Furthermore, these sampling techniques do not require whole body extractions which can be harmful to individual species, and detrimental to those who are in danger of getting extinct (Blasiak et al., 2020). Environmental DNA (eDNA) is a method which is increasingly being used for screening biodiversity in various ecosystems and biodiversity analysis (Blasiak et al., 2020). However, Ivan claimed that there is an issue with eDNA libraries being too thin and limited, so that only about 20% to 30% of the sequences generated by eDNA screens to actual species. Therefore, Ivan claims, part of their job is to try to fill out those libraries with more genetic information from different taxa. The Ocean Panel and the CAO also suggest leveraging biotechnological tools such as CRISPR for marine management and conservation. They suggest that these techniques can be used for example for species monitoring and disease control. In chapter 6 on ideas extending, I will write about how they envisage applying these techniques in marine management and for novel ocean-based food industries.

Chapter conclusion

Jasanoff (2015) and Hilgartner (2015) suggests that for new and emerging imaginaries and innovations to gain traction, it is feasible for their creators to attach these visions to already existing social, economic structures and the wider narratives and national identities of states and society. Through critical discourse analysis, this chapter has illustrated how blue growth's win-win narrative is built on existing narratives such as green growth and sustainable development. Furthermore, it has illustrated how imaginaries surrounding the ocean genome and blue growth latches onto national narratives and identities such as Norway being a leading ocean nation. Objectives surrounding the imaginary's bioeconomic aspirations furthermore attaches to national hopes of finding a 'new oil' that can prolong the economic growth that the Norwegian state has experienced the last decades after building out the national gas and oil industry. As such, new visions of genomic futures are validated and furthermore create new anticipations as their visionary vanguards connect them to already established histories and narratives of Norway as a leading ocean state awaiting new industry adventures. Ultimately, this chapter also elucidates how the knowledge producers are creating a figurative and metaphorical idea of a boundless ocean genome that can contribute to solving global issues such as poverty, climate change and species extinction. In the following chapter, I explore how these visions are being embedded and materialised in Norwegian society.

5. Embedding Imaginaries into Practice and Materiality

Following Science and Technology Studies attention to the power of the imagination, this chapter issues how imaginaries are not just mere ideas. Rather, they can have real effects on the world as they become part of shaping national strategies, scientific visions, and technological aspirations (Jasanoff, 2015). As such, when imaginaries are embedded into society, they do not only shape the institutions they represent, but also society and culture at large (Jasanoff, 2015). Furthermore, as some imaginaries transform from ideas to practice, they are often shaped and facilitated by the help of values and politics in society, for example through national interests and obligations. This chapter seeks to investigate how visions of a complete collection of all of earths eukaryotic species genomes, including marine ones, are embedded through research initiatives, institutions, and practices in Norway, and what interests and objectives impact these engagements.

Genomic science, Fujimura (2019) argues, is both a national and transnational "flow of ideas, information, materials, protocols and practices" (p. 177). As this chapter illuminates, global ideas such as the Earth BioGenome are initiated and expand across transnational levels. These ideas and the embedment of them are shaped and configured to fit specific objectives made by nations, industry or rest of society. Comparing the project structure and funding requirements between EBP-Nor and the European BGE and ERGA, this chapter explores how the Norwegian genome project differs in terms of stakeholder inclusion and principles compared to the European levels, and how this can be viewed in relation to state interests and funding requirements explicated by the Norwegian Research Council (NRC).

Embedding Genomic Imaginaries in Norway Through the EBP-Nor Project

The prior chapter 4 on imaginaries originating highlighted how CAO initially wrote their ocean genome-paper based on a request by the Norwegian Ministry of Foreign Affairs. Through a practice-oriented document analysis approach, it became evident that the paper published by the CAO was made up by authors who had also contributed to the Ocean Panel and the EBP-Nor's documents. As such, it was clear that the marine genetic projects were formed and proposed by a correlating network of scientists, mostly representing countries and institutions from the Global North.

In Norway, there is currently a growing initiative aimed at mapping and sequencing marine genetics. As assessed in the introductory chapter, Norway invests in marine sciences and marine bioprospecting, through the national research vessel FF Kronprins Haakon, among other projects. Furthermore, as this chapter will discuss, Norway, through the Norwegian Research Council, is the main funder of the EBP-Nor initiative. I will now focus on the EBP-Nor project, as this is a recently initiated project, and as such, it is an interesting case to study through explorative research. In addition, out of Norwegian marine research initiatives, it is the national project which is most attentive to conducting whole-genome sequencing.

According to Clara, EBP-Nor first came into being after the founder of the global EBP initiative Harris Lewin had been visiting Norway. He had been touring around various countries on behalf of the initiative and came to Oslo to present the project and try to get other researchers on board. Furthermore, Clara explains that this was when Harrison and the present EBP-Nor project leader met and started putting in motion the plans for a national initiative. Norway thereby became one of the first national initiatives of the global EBP.

Similar to the global EBP, EBP-Nor seeks to follow a similar timeframe aimed at sequencing all Norwegian eukaryotic species within 10 years. EBP-Nor estimates that the amount of Norwegian eukaryotic species is around 45 000 species (Jakobsen et al., 2020). In their White Paper, EBP-Nor also launched a three-stage project plan. The first stage set at sequencing approximately 20-50 species has a “particular interest to Norway, such as ‘iconic’ species selected in interaction with the interested public, such as industry, funding bodies, and school classes” (Jakobsen et al., 2020, p. 9). In the second phase, which begins two years into the project, the aim is to sequence 200-500 species, in addition to “denser sampling of specimens, establishing biobanks and scaling up of sequencing, sequence analyses, storage and coupling sequence data and metadata” (Jakobsen et al., 2020, p. 9). Phase three, which includes the last 6-7 years of the projects 10-year plan, seeks to sequence the remaining species left, which will be several thousand species. Additionally, they will also select particular ‘complete ecosystems’ which will be studied more comprehensively (Jakobsen et al., 2020). In their project description, they claim that this phase will lay the foundation for an extended collaboration with Nordic countries, the UK, Canada, the US and the European level, in addition to the global EBP (Jakobsen et al., 2020). The paper accentuates that the information accumulated by the project will be released in open-access databases.

Technological Progress Fuelling Genomic Research in Norway

Jasanoff (2015) claims that for novel developments and imaginaries within science and technology to be embedded into society and its institutions, they must build on already established economic, material, and social infrastructures. When asking informants what they believed was the main reason that genomic sciences and its related industrial pursuits and innovations were expanding, the most reoccurring answers revolved around technology. Technology and methods, according to many of the informants, are currently moving and transforming at record speed, almost revolutionary. One of the reasons of this is because sequencing genomes has become increasingly faster and cheaper, which has overall made it easier to sequence large amounts of information (Blasiak et al., 2020). This was echoed in the replies by informants. Ivan explains:

> We are now working with third generation DNA-sequences. Things like Oxford Nanopore MinION technology, which we can even take so sea and undertake low coverage genome sequencing with, actually on board of the ship. So sequencing is much easier, it is much cheaper, and we can do it in the field.

According to Clara, at the time of time interview in spring 2023, EBP-Nor had not conducted any big genome sequencing yet. She explained that all the genomes EBP-Nor sequenced so far had been about 2 gigs or less. However, she informed that during summer 2023 EBP-Nor was to get a new sequencing machine:

> It's going to change the whole industry. PacBio is the main sequencing company for what we call long read sequencing, and they have just come up with a new machine which basically cut the cost by about 15 times, which makes it 15 times more efficient. It is going to cut things by 15 times, so if you think about that, we have 15 times the capacity to do, say larger genomes, or more genomes.

As stressed by the Ocean Panel, sequencing large amounts of species demands massive datacentres and capacity (Blasiak et al., 2020). The Ocean Panel states that it needs to build improve such technological infrastructures if genomic science and research is to fulfil its goals (Blasiak et al., 2020). Furthermore, Pål, an informant who had been involved in the CAO paper and EBP-Nor, emphasised that throughout the EBP-Nor project, several 'disruptive technologies' had entered the scientific field. He explained disruptive technologies novel technologies that 'change the game' in scientific research. In addition, Pål stressed that such technologies demand more funding, and he claimed that the funding which EBP-Nor had received from the Norwegian Research Council (NRC) was far from enough if they were to achieve their 10-year plan. At the time of the interview, Pål also stressed that the project was bringing to use new disruptive technologies which alone required that they had 10 million NOK.

Hedgecoe and Martin (2017) alert researchers from framing technological and scientific progress as evolutionary. They suggest that this risks oversimplifying science and technology developments and their interlinkages to prior societal and scientific structures and projects (Hedgecoe & Martin, 2007). As this thesis has illuminated, the current genomic projects should be seen in relation to changes that have been happening within the way nature is studied. As Parry (2004) argues, genomic science projects and the bioeconomy is a continuation of not only using non-human organisms for their whole body parts, but moving onto dissecting living organisms into constituent parts to utilize their various properties such as genes. As such, similar developments have been ongoing throughout several decades. However, as suggested by the documents and informants, these activities are now accelerating at record speed due to fast progressions in technology and innovation. It is thereby worth noting and asking whether stakeholders outside science and industry are being adequately included in these projects and their underlying imaginaries. I will attend to these questions later in this chapter, after having made clear the economic foundations of the EBP-Nor.

Funding Requirements Steering Organizational Structures, Genomic Collections and Stakeholder Inclusion

The Norwegian Earth BioGenome project (EBP-Nor) has received 30 million NOK from the Norwegian Research Council (NRC) to carry out their genome sequencing project (Titain, 2021). Clara from EBP-Nor could inform that as they were establishing the project, one of the requirements from the NRC to receive funding was that they had to include two industry collaborators. According to Clara, this was premised on the idea that:

> That would make the project generate knowledge that would be more readily taken up in biotech and industry applications.

Similar arguments are made in the Norwegian national strategy *Marine Bioprospecting – a source of new and sustainable wealth growth* published in 2009, as they emphasise that for Norwegian wealth growth within the bioeconomy to expand, it is necessary to establish strategic alliances between companies and knowledge clusters. Furthermore, when the strategy was launched in 2009, industry-focused research received an increase of 165 million NOK through national funding (Norwegian Ministries of Fisheries and Coastal Affairs et al., 2009).

In addition to the funding from NRC, EBP-Nor has also received some funding from UiO:Life Sciences, Pål informed. However, informants from the EBP-Nor stressed that they needed more financial support in order to fulfil their project aim. As a result, they explained that they were looking for more industry partners, both for tasks such as sequencing but also for funding the project. Further, informants told that members of the initiative would reach out to various institutions they considered to be relevant for the project and try to get them on board. In the EBP-Nor White Paper, they write that they are "currently in an ongoing dialogue with several large private enterprises with interests in the marine environments, biodiversity research, bio economy/blue-green shift and bioprospecting" (Jakobsen et al., 2020, p. 7). They also state in their document that EBP-Nor has received huge interest from private companies such as the biotech field, pharmaceutical businesses, and overall industries that are working with bioproducts, biomaterials, aquaculture, bioproduction and marine technology (Jakobsen et al., 2020). Furthermore, Clara explained that the project is also being contacted by industries and companies that want to become part of the project, such as Ervik Havfiske, a fishing company specialising on Patagonian Toothfish. Furthermore, Clara highlighted how getting more industry partners on board is important as the project is preparing to go from the first to the second stage of their 10-year plan, stating:

> We cannot do this alone, the bigger the better, really.

At the initial phase of the project, Clara claims that EBP-Nor was organised more exclusively, as this was one of the requirements when they were forming the first proposal submitted to the NRC. However, going forward, Pål issued that they wanted to invite more collaboration partners on board such as the Norwegian Institute of Marine Research. However, he claimed that they did not have enough financial founding to do so yet. On the account of this, it is evident that the initial phase of the EBP-Nor project was mostly made up by science-industry collaborations. I asked informants if any environmental organisations or non-industry stakeholders had been included, as was suggested by the EBP-Nor themselves in their White Paper. There was however no representation of such organisations or public groups.

Drawing on political ecology, Maestre-Andrés et al. (2018) issues how stakeholder inclusion and participation in biodiversity governance is meant to "contribute to environmental justice by giving all relevant stakeholders the right to influence the management of their area" (p. 1300). Stakeholder inclusion and participation can contribute to the redistribution of power by decision makers "informing or seeking advice on their proposals" from public communities and groups (Maestre-Andrés et al., 2018, p. 1303). Farida Saleem et al. (2020) writes about normative approaches to stakeholder involvement as an approach where decision makers should "deal with stakeholders, based on a moral commitment rather than using stakeholders to maximize profit”, furthermore issuing how “decisions that are made without considering whether their impact on others is unethical” (p. 4). Paul Robbins (2020a) points out in his book *Political Ecology: A Critical Introduction* that employing a ‘stakeholder’ terminology in biodiversity governance issues is common. Yet, he highlights that this is a somewhat problematic term to use in research on resource and environmental conflicts due to its origin in business management theory that proposes that all stakeholders carry their value in monetary forms. In chapter 6 on ideas extend and chapter 7 on how ideas encounter resistance, I further elaborate on biodiversity value that goes beyond monetary definitions. Although I acknowledge Robbin’s remarks on how stakeholders’ interests do not only involve monetary priorities, I will be using the term as it is commonly known. In the EBP-Nor White Paper, the authors claim that at a wider stakeholder scale composed by interested communities such as naturalists, students, and schoolchildren, along with public engagement entities and farming bodies will be engaged (Jakobsen et al., 2020). Furthermore, the paper also includes a list made up potential stakeholders and interested parties they suggest could be included, such the Norwegian environmental organisations Naturvernforbundet and Sabima (Jakobsen et al., 2020). Although this reveals their awareness of the significance in involving stakeholders, neither environmental organisations nor local communities have been included in the project.

Clara and Thomas, who had been part of both the ERGA/BGE network and EBP-Nor, claimed that there are considerate differences between stakeholder inclusion in EBP-Nor and the European BGE. According to Clara, these differences had been evident from the very beginning of each research project, stressing the difference between their institutional organisation and funding requirements:

> ERGA is funded by the EU, which required that it was inclusive from the beginning. There were made justice and inclusion committees, and the project was formed in a way where everyone, even private individuals, could participate. Work was also done to have ‘poorer nations’ and such be part of the project.

In contrast, the NRC only required that EBP-Nor brought on board two industry partners when they initiated their project. Hence, EBP-Nor were not obliged arrange any committees or strategies aimed at securing that the project was conducted through just and inclusive research. Consequently, Clara could inform that at the time of the interview, EBP-Nor had no inclusion or equity committee, and that there has been little engagement with these issues so far in the project. However, Clara stressed that it was pivotal that the EBP-Nor incorporated this, and that she herself was working hard for EBP-Nor to become more inclusive, issuing how the EBP is supposed to embody both a scientific *and* a social mission. Clara claimed that the differences between the European and Norwegian initiatives was a result of principles made by the EU and their funding, which she claims set the terms for a more open and inclusive organisational structure. She furthermore claimed that the difference between the Norwegian and the European level goes not just for the EBP-Nor, but how this was a common trait for all national EBP levels. Clara issues that:

> these principles permeate in everything you do.

Comparing the EU to Norway, Clara states that the EU as a funding body wants Europe to be brought together, which she claims:

> requires really focusing on these principles of justice, equity, diversity, and inclusion for example, to make sure that all countries, for example many countries in Eastern Europe with less financial resources for biodiversity genomics can be involved, and that they can benefit, build capacity and distribute this knowledge across Europe.

This was what the EU as a funder mandates, she states. Comparing this to the interests of the Norwegian state, she asserts:

> The research council of Norway, they're just thinking within Norway, so they are not that concerned about distribution, they want, you know, some different universities to participate, but they are more like 'however you need to organize it to get it done'. So, they would be fine if just a few universities kind of went out and sequences everything, even though they did not involve all the local institutions and local communities. And that comes down to what funders mandate, and what do funders value in that project. And that is different at a level like the EU, and a level like Norway.

So even though EBP-Nor and the European ERGA/BGE network share a similar overarching goal to sequence all eukaryotic genomes in Europe and Norway, informants suggest that there are consequential disparities between the two in terms of organisational structure and research and stakeholder inclusion. Clara furthermore emphasised that the bottom-up approach had been key in the organisation and forming of ERGA. The institution she claimed, had been open for all institutions, as well as individuals from the beginning:

> This really opened it up to a broader and more diverse and more inclusive group of people, because you didn't have to have come from rich institutions and have the

> power to make big projects, so therefore also PHD student could join. Like people that are early career, diverse careers, people from countries with and without a lot of financial resources for this kind of work. Everybody could join and participate. And from there, it is sort of self-organized into structures with leadership and different committees, and it's a really open grassroot effort. And I think it's interesting some of the tensions that kind of get created, because you have this very different philosophical approach.

In the European genome project, she says, everyone can join from the start of a project and join together to apply for funding from the EU, which, she argues, fosters more inclusiveness according to her. Elaborating further on why she considered stakeholder involvement as important, Clara explained:

> Cause otherwise you take something from a country that is rich in biodiversity and low in research money for example, and then you take that biodiversity, you make it open to everyone, but who can capitalize on that? It's the countries with money to do so already, and that's not fair. So, its different strategies being developed to make sure that the countries where biodiversity comes from, see the benefits of research on the biodiversity.

Access and benefit sharing (ABS) is a central issue in matters pertaining to the exploration of genetic material and bioprospecting (Benjaminsen & Svarstad, 2021). The Convention on Biological Diversity (CBD) and the Nagoya Protocol are supposed to ensure that "users of genetic resources share (commercial and other) benefits that arise from utilization" (Rabitz et al., 2022, p. 146). These issues are pivotal as nations, scientists and industry as mentioned are expecting large capital returns for projects such as the EBP-Nor. I will elaborate on this further in chapter 7 when I discuss benefit sharing of genetic resources in Norwegian settings. Having discussed organisational disparities between the Norwegian EBP-Nor and the European Earth BioGenome project, this thesis will now illuminate how there are also differences between these two levels in terms of mapping and sequencing criterions.

"The Collection of Nature and the Nature of Collecting"

As illuminated in the chapter 4 on how sociotechnical imaginaries originate, Parry (2004) suggests in her chapter "The Collection of Nature and the Nature of Collecting" (p. 12) that the way sciences study nature has changed the recent decades due to novel technologies and methods such as genetic sequencing and biotechnology. She furthermore argues that due to interests in biological materials for industry purposes, this also changes how and what is being collected from nature. The collection of nature becomes subjective and normative, as it is being enacted by certain sets of interests. In the case of the ocean genome, these interests relate not only to the discovery and conservation of biodiversity, but also to both national and industry objectives set at promoting bioeconomic growth.

When discussing industry involvement and their role in the EBP-Nor project, Clara highlighted that industry partners are involved in both conducting the sampling of species whilst also being able to suggest which species should be collected and sequenced. Clara stated that this is because industry partners may have ideas of how organisms could have interesting attributes that could potentially lead to bioeconomic resources. One of the industry partners who have been part of the project from the start, ArcticZymes, does exactly this according to Clara. Other industry partners such as Rev Ocean and Ervik Harvest are also on board to help with sampling, as they have big ships that can explore vast areas of the oceans and do deep sea sampling.

Thomas stressed how there was a difference between the selection criterions made for genome sequencing between EBP-Nor and BGE. He explained that the BGE has a type of 'sorting algorithm' which was applied by using computer programs. As such, he suggested, the sorting algorithm made by the BGE seek to avert any personal favouring when selecting which genomes the project should sequence. Thomas explained that the criteria were developed by ERGA and were further applied by BGE. He informed that the sorting algorithm consisted of four steps. The first and thereby top priority, according to Thomas, is to cover the tree of life, hence if "there is nothing in that phyla, you will get a very big score" in the sorting algorithm. The second criteria focus on researchers' capacity of verifying that they have the species that they said they would sequence, meaning that researchers must verify that they can acquire the samples they said they would get. As a third criteria, the selection criteria considers which country in Europe the suggestions come from. Thomas links this to the BGE's goal of sequencing genomes which are equally distributed across Europe so that all countries are included, also those countries that don't have resources necessary to do genome sequencing. As such, those countries will be prioritized over countries that do have these resources. Thomas informed that through these sorting algorithms, Norway, for example, would not do well in terms of scoring, as it is an economically strong country that has a well-established scientific background within these sciences. Thomas claimed that the same would go for countries like the UK, Germany France, which are countries that should be able to raise money out of their own resources. The fourth and last criteria relates to the BGE's JEDI-criteria (justice, equality, diversity, and inclusiveness). This entails that minority groups are favoured before majority groups. Thomas mention that these would for example be groups like women, Romani, and refugees. When asked what this comprises, he replied:

> The inclusion has not that much to do with genomic science per say, it has more about that we raise their strengths in the scientific community. So, if everything is equal when groups apply to research and sequence genomes, then we favour minority groups such as women. In Norway it would be relevant for example, if a Norwegian and a Sami would suggest sequencing a reindeer. Then the Sami would get the bit, if all the other criteria was equal. They would get to deliver the sample, they would be the genome-team leader, and the first one on the publication. But usually, we would want the two groups to cooperate, and that everyone that is interested in the species would collaborate. So, the main idea is that those with disadvantages will be prioritized.

In terms of both sequencing and the storing of genetic material and information, Clara highlighted that there were different philosophies of nature and the different ways of doing this. She explains how in New Zealand, inclusion of indigenous groups had been more central than in Norway. In New Zealand, the Māori had been included in their genome initiatives from the beginning. One effect of this was an agreement that all genetic information belonging to Māori communities biodiversity was to be stored on their grounds, so that their nature as such would remain on their land.

According to Thomas, the EBP-Nor does not apply similar research criterions like the BGE does. He states that EBP-Nor had an initial list of genomes which the project planned to sequence. But since then, Thomas claimed that what genomes are being sequenced by EBP-Nor rather depends on availability and "who knows who". He continued:

> Not everybody who said they could deliver samples, actually could deliver samples. They also want to get more engagement, and at some time there might be an open call, but that is still under debate. While the European one, it is open for everyone.

What Thomas referd to here is BGE's open calls, which means that they launch open calls where anyone who is interested can suggest and partake in sequencing genomes. EBP-Nor and the British Darwin Tree of Life has no open-selection calls as such, he claims, however he issues that one:

> Can always send in, and then they have a committee, and they can say “oh this sounds interesting to us, we do that”.

Thomas furthermore remarked:

> They (EBP-Nor) seem to have a lot of money up until now, and my impression is that the ones who wanted to have species sequenced got them, but with BGE we have limited funding, and therefore we decided to have a process that is to some degree objective. This is different from other projects, and we hope that it can be a model for others. And that is the major difference between EBP-Nor and BGE, its selection criteria.

Communicating Genomic Projects to the World Outside Science and Industry

When asking informants what ways they communicated the objectives and work of EBP-Nor to people outside their sciences and discipline, informants responded that they primarily communicated through the projects popular science blog. I was also informed that they had hosted a public lecture at the Climate House (NHM). However, Clara expressed that the lecture was “mostly obviously for people within the field”. Additionally, they have had some interactions with Titan, a natural sciences and technology paper linked to the University of Oslo. In 2019, Aftenposten published an article relating to EBP-Nor, titled “International research projects wants to map species DNA before it is to late – Norwegian scientists are ready to take responsibility for animals, plants, fish, mushrooms and birds with special significance to Norway”[10]. On communication with the public, Clara furthermore declared:

> This has all been sort of like the launch stage of the project, so it’s really when we start putting genomes out, and publishing genomes, that we will do more of this dissemination, because then we will be able to connect with journalists and do stories about that we have done the reindeer genome, and we can do some popular science communications about this. But it is difficult to do so much about that before you have the results, because that’s what everyone cares about.

When asking what benefits arrive from the exploration of marine genetics, Ivan from Rec Ocean claimed that the most “obvious benefit to the public, was the economic benefits”, thereby presuming the interests of the public. Thomas from expressed that the foremost challenge in terms of communicating with the public was to get people interested and engaged

[10]Original title: “Internasjonalt forskningsprosjekt vil kartlegge arters DNA før det er for sent»

in topics concerning biodiversity and climate change to begin with. He issued that this was a necessary first step, and a struggle, before being able to communicate the significance of preserving genetic diversity. Based on the informants' perspectives, it was evident that they found communication and promoting their research objectives as challenging, particularly the issues pertaining species and genetic diversity decline.

Chapter conclusion

When doing interviews with people who had been part of EBP-Nor, it was made clear that neither local communities, indigenous groups, nor environmental organisations or public engagement entities had been brought on board of the Norwegian EBP project. This is despite EBP-Nor emphasising their commitments to engage wider stakeholder scales in their project. This suggests that there is a significant gap between their stated motives, and the actual embedment of these plans. As Clara suggests, this could be due to the funding principles made by the NRC that prioritise industrial partners over other non-commercial stakeholders. These differ from the funding requirements made by the EU for the European level of EBP, who have created a JEDI-strategy to ensure justice, equity, diversity and inclusion in their scientific project. Consequently, national interests and objectives have permeated the whole structure and practice of the EBP-Nor, making it less inclusive than the European level. The chapter also illustrated the difference between the sequencing requirements of the EBP-Nor and the European level, whereas the latter level has created a more transparent sequencing strategy than the Norwegian EBP-Nor. The thesis will further discuss whether this can cause spillover effects that lead to more partial industry-vested collection practices, and to less stakeholder participation.

6. Extending Imaginaries of Growth – Blue Economies and An Economy of Repair

In chapter 4 on how sociotechnical ideas originate, it was discussed how the ocean genome imaginary and the blue growth discourse is a continuation of green growth rationales which seek to combine continuous economic growth with environmental and biodiversity governance and policy making. Additionally, it suggested that these imaginaries are further engraved into national discourses by attaching these imaginaries to a Norwegian state identity as a leading nation on both ocean governance, marine sciences, and the blue economy. Further, it was discussed how these engagements connect to Norwegian state commitments to finding an industry that can be a replicant as 'new oil', as there grows more attention and urgency around finding industries with lower-carbon energy use. Examining chapter 4 on ideas originate and chapter 5 on ideas embedding, this thesis further displays how these imaginaries are being embedded through national policy strategies and research initiatives such as the research vessel Kronprins Haakon, Centre for the Ocean and the Arctic's ocean genome document, as well as the Norwegian EBP-Nor initiative.

Jasanoff (2015) suggests that for sociotechnical imaginaries to persist and furthermore continue influencing and moulding society, it is important that they re-invent themselves in ways that make them suited for their current societal contexts. In this chapter, I argue that blue growth is a reshaping the green growth-paradigm which discursively presents blue economies as an 'economy of repair'. It proposes that the blue economy and growth is a response to global concerns and demands for sustainable policy making and industry infrastructure. Amid this, nations and industry are discursively shaping the oceans as a new, sustainable resource frontier. As such, this discourse plays part in legitimising further resource exploitation of ecosystems that are currently facing detrimental crisis and species decline. Furthermore, based on scholarly discussions on 'technical fixes' and the 'economy of repair', the chapter looks at how genetic sciences and engineering tools such as CRISPR is being considered as technical fixes to issues internal of ocean-bound industries like aquaculture. I suggest that these are solutionist and promissory scientific projects that hold particular representations of sustainability. Moreover, I question whether these representations have become so ingrained in biodiversity and marine governance that they can be regarded as epistemic selecivities.

Extending (Blue) Growth and the Bioeconomy Through Triple-Wins

By referring to extension, the STI-framework is interested in investigating how certain ideas and imaginaries manage to persist through time and gain traction, so that they can persevere both global and national dominance (Jasanoff, 2015). To examine how imaginaries extend, Jasanoff (2015) suggests that analytical research must pay attention to and intersect the "descriptive and normative, structure and agency, material and mental, and local and translocal" dynamics that are at interplay when science, technology and society make up or strengthen sociotechnical imaginaries (p. 323). Jasanoff asserts that for ideas, ideologies, and imaginaries to thrive and extend, they must be re-invented into "new soil". The blue growth imaginary is as elaborated in chapter 4 on ideas originating a prolongment of the green growth and sustainable development-paradigm. As aforementioned, the conceptualization of the ocean genome embodies a sociotechnical imaginary which epitomize blue bioeconomic growth that both ameliorate the declining state of the ocean whilst simultaneously increasing industry markets and activities from the ocean. Such industries can be bioprospecting and aquaculture, as mostly written about in this thesis. Furthermore, this trajectory also focuses on the equitable benefit sharing of marine resources. The influence of this imaginary is palpable across national policies, strategic frameworks, and resonates with statements and values shared by the informants. It is through this discourse that the blue growth paradigm takes shape, painting a picture of a concerted effort to rejuvenate 'ocean health' while fostering economic opportunities, all in harmony with environmental sustainability.

A number of scholars claim that global attention towards blue economies marks the making of the ocean as a novel resource frontier (Brent et al., 2020; Ertör & Hadjimichael, 2020). The emergence of the blue economy-concept first appeared during the Rio+20 negotiations and has since been gaining momentum through intergovernmental endeavours like the UN Decade for Ocean Research and the SDGs 14 (Barbesgaard, 2018; Brent et al., 2020). Ertör and Ortega-Cerdà (2019) explain frontiers as 'commodity widening' and 'commodity' deepening-strategies'. Furthermore, they claim that these strategies possess the ability of steadily shifting "places of production towards ecologically less exploited areas and use advanced technology to intensify production and increase profits" (Ertör & Ortega-Cerdà, 2019, p. 338).

Both governmental aims and strategies and the news media is part of shaping discourses surrounding natural resource issues. Moreover, they also contribute to setting the tone and expectations in terms of how we perceive what causes environmental issues, as well as what solutions must be pursued in order to evade them (Davies et al, 2017; Reinertsen & Asdal, 2018). As by suggested by Anna Tsing (2003), resource frontiers are not just something which nations and industries discover accidently at the end of 'geographical boundaries' that suddenly become accessible due to technological innovations. Instead, they are projects in the making, enacted through political interests, technological progress and formed by the current societal contexts (Tsing, 2003; Jasanoff, 2015).

Noticing a change in Norwegian governmental discourses devoted to ocean-issues, Asdal and Reinertsen (2018) claim there has been a shift in national governmental documents and policies whereas the ocean has been changed from being framed as unpredictable and unruly, to calculable, productive and sustainable. These discursive reconstructions have taken place at the same time as Norwegian governments have been shaping new national strategies for the blue economy that seek to expand ocean-based industries throughout the Norwegian coast (Nærings- og fiskeridepartementet & Olje- og energidepartementet, 2017; Nærings- og fiskeridepartementet, 2019). The reconstructed discourses of oceans as stable and abundant align with Tsing's (2003) argument that actors reshape frontiers narrative persuasion by making them appear "appear inert, ready to be dismembered and packaged for export" (p. 5100). As such, it becomes easier to imagine these landscapes and ecosystems as novel resource frontiers, ready be implemented into markets.

Furthermore, discursive tools such as applying national identities, norms and collective narratives are part of constructing novel frontiers which help make novel landscapes and resources interesting to the markets and the public (Barney, 2009). In the case of projects surrounding blue growth and bioprospecting in Norway, documents and national strategies have leaned onto narratives of Norway as a 'world-leading ocean state' at the forefront of marine science and management has been elementary (Nærings- og fiskeridepartementet, 2019). Furthermore, as public and scientific pressure urges nations to transition to lower-carbon economies as a response to the global climate crisis, the it is suggested that ocean-based industries can become the nations 'new oil' (Partnerskap Bioverdi, 2014).

In 2020, former prime minister of Norway, Erna Solberg stated the following:

> The earth is first and foremost an ocean planet, and the oceans resources are both over-taxed and underestimated. This is not sustainable, and the world's nations must collaborate better to secure clean and productive oceans [11] (Solberg, 2020).

[11] Authors translation.

Similar statements are repeated throughout the blue growth discourse, both in Norway and internationally. This illustrates a paradox in the blue growth discourses as it depicts oceans as being overexploited and in decline, whilst simultaneously being insufficiently used and underestimated economically. Furthermore, such statements propose that further industry pursuit at sea can be repair and fix ocean degradation by introducing cleaner and more efficient means of production.

These discourses and rationales share similarities to what Fairhead et al., (2012) describe as 'green grabbing'. They claim that green grabbing is becoming increasingly common as nations and industry seeks to widen resource frontiers and exploitation by appropriating land and resources whilst claiming that this is to fulfil socioenvironmental agendas and needs. Green grabbing is thusly the "appropriation of nature for green ends" (Fairhead et al., 2012, p. 255). Huff and Brock (2023) argue that such rationales have become further extended by what they call accumulation by restoration, also referred to as an 'economy of repair'. These modes promise reparation of degraded nature that simultaneously acquires monetary benefits from these processes (Huff & Brock, 2023). These economic rationales align with neoliberal and marked-based understandings of environmental and biodiversity issues, where degradation of nature and ecosystems are the consequences of governance and market failures that not adequately incorporates nature and biodiversity into market systems (Huff & Brock, 2023). By making nature 'visible' to capital, it can thus be made stronger incentives to bring nature and biodiversity into economic decision making, by merging biodiversity preservation with economic growth. The Ocean Panel for example, claim that by acknowledging the potential commercial value of biodiversity by using it for pharmaceuticals, cosmetics, nutraceuticals, and novel foods, this will motivate nations to better preserve the species and ecosystems that sustain making of these commercial products (Blasiak et al., 2020).

By coupling marine biodiversity with human needs, marine biodiversity thereby is understood primarily as a set of ecosystem services, rather than intrinsically valuable in and of themselves. Moreover, environmental and biodiversity issues are not seen as caused by unsustainable practices or socioeconomical structures such as overconsumption, they are rather understood as the economy's failure to include the value of biodiversity into 'sustainable' economic structures. Huff (2021) claims that the suggested solution to these 'market failures' is the furthermore expansion of markets through creating "new markets, financial instruments and commodities that will bring unpriced and thus neglected aspects of nature and social life into the market gaze" (p. 3).

Based on these arguments, the ocean genome imaginary can be understood as constituting a re-flourishment of the already prevailing green growth-premises, just shipped and equipped in new packaging. The ocean genome imaginary pledges that by no longer 'neglecting' potential value from the marine genetics, the blue bioeconomy can flourish whilst also preserving marine biodiversity. Moreover, both documents and informants claim that the blue economy will create more sustainable food production than prior land-based industries such as the beef industry. All of which will be made possible by coupling novel technology and innovation with efficient marine management and conservation. However, Huff (2021) claims that this approach depoliticises environmental and biodiversity issues, and that the 'economy of repair' neutralises and preservers extractive-industrial practices that do not serve in sustainable ways. The 'economy of repair' does thereby not sufficiently assess the root causes of environmental issues. They also critique these rationales for not challenging the continued growth dependencies, but rather thriving amidst them (Huff & Brock, 2023). In chapter 7 on movements of resistance, I will discuss similar critiques of the green-blue growth paradigm as I introduce alternative perspectives of sustainability and economics. However, before I tend to these critiques, I will elucidate another facet of sustainability-thinking existing within the ocean genome imaginary and project.

Leveraging Biotechnology in the Name of Sustainability

As a furthermore extension of blue growth and blue genomic imaginaries, genetic engineering has been considered as a feasible next step in marine management and industry (Blasiak et al., 2020; Stenseth et al., 2021). Through her work, Joan H. Fujimura (2019) frame genome scientists as sociocultural entrepreneurs, highlighting how "genome scientists are imagining the future and sometimes transfiguring nature and culture through their work. They are building roads to our future and choosing where and how to build them" (p. 177). Science and researchers' opportunities to imagine specific alternatives and sociotechnical artifacts, and furthermore their influence the making of these imaginaries into material beings, bear testimony to their to power and influence. It should be noted that out of the informants that I interviewed, none of them were working with genetic engineering applications of marine genetics, as far as I was informed. I tried to reach out to scientists working who had been part of the ocean genome documents and were working with marine genetic engineering. However, I failed to get an interview with any of these as they were too busy for interviews. Nevertheless, both the ocean genome documents and some of the informants had a lot to say about these topics.

By both the Ocean Panel and the CAO, applying novel gene-editing tools such CRISPR is anticipated to both become part of future marine food production, as playing part in marine conservation and biodiversity management (Blasiak et al., 2020; Stenseth et al., 2021). The CAO highlight how Norwegian marine research been seminal in prior developments of genome-based breeding, methods which they state makes for more efficient and flexible breeding approaches than prior traditional breeding methods (Stenseth et al., 2021). Widening the knowledge about marine genomics, the CAO and Ocean Panel documents proclaim will enhance genome-breeding capacities (Blasiak et al., 2020; Stenseth et al., 2021). On using marine genomic sciences to expand the aquacultural industry, Clara states:

> You can understand which species and even populations within the species are more suited to captive breeding. Like they will thrive, they will grow faster, they will have low incidents of diseases, these kinds of traits. And it could be certain species, but it could also be like finding the best population within the species, and to use that genetic pool. And not just thinking about fish or whatever, but you could also think of seaweeds, and different things that can provide for example fatty acids that can go into aquaculture feed, and these other kinds of parts of the food chain.

In Norway, there has already been attempts to develop commercial aquaculture utilizing cod, halibut, catfish, blue mussels, and various types of kelp (Stenseth et al., 2021).

As part of their envisaged ocean genome futures, the COA proclaim that "in the future aquaculture, CRISPR-Cas technology will be used and will have great significance for the prevention of diseases"[12] in commercial aquaculture (Stenseth et al., 2021). Furthermore, they emphasise that CRISPR-Cas is already being used in scientific research in Norway, and that it poses great potentials for the marine bioindustry (Stenseth et al., 2021).

In June 2023, the Norwegian Official Report "Gene technology in a sustainable future" [13] (NOU 2023: 18, 2023) was put forward by a committee on genetic technology to the Norwegian Ministry of Climate and Environment. The NOU was brought about by a commission appointed by the Solberg-government in 2020. Due to the rapid development of genetic technology, the decreasing costs of its uses, and due to the technologies becoming more available, the commission was set to revise and update information surrounding the development and potential applications of biotechnology in Norway and globally (NOU 2023:

[12] Authors translation from Norwegian.
[13] Authors translation from Norwegian. Original title: *Genteknologi I en bærekraftig fremtid.*

18). These revisions were furthermore meant to advice future policy making and regulations regarding biotechnology application and GMOs in Norway.

The Norwegian Biotechnology Advisory Board has claimed that current legislation on biotechnology lags the further development of such technology. It has advocated that the Gene Technology Act should be made more flexible, by for example suggesting that genetically modified organisms (GMO) should be categorised into distinguished levels with separate regulation and jurisdiction (Havforsknintsinstituttet, 2019).

The suggestion, and simultaneously the expectations advocated by supporters such methods is that CRISPR-technology will both make breeding marine species more efficient, and furthermore that it will be more controllable than prior traditional breeding methods (Havforsknintsinstituttet, 2019). Although genetic engineering is strictly regulated in Norway and the EU today, CRISPR has been applied by the Norwegian Marine Research Institute as they have created a farmed salmon without gender cells (Havforsknintsinstituttet, 2019). Salmon is today by far the most important species within commercial aquaculture in Norway (Stenseth et al., 2021). Movik and Stokke (2014) elaborates how since the 1970s, there has been a dramatic expansion of commercial fish farming in Norway, and throughout only a few decades it has become a major and important industry for Norway and coastal communities. Aquaculture and fish farming however face extensive challenges such as animal welfare issues, escapees and the spread of salmon lice or sea lice, as well as chemical waste (Movik & Stokke, 2014; Oelsen et al, 2011). As such, these problems can pose serious issues to local marine environments and fish stocks (Blasiak et al., 2020).

By inactivating the salmon's germ cells, scientists from the Norwegian Institute of Marine Research (IMR) have produced a sterile Atlantic salmon (Havforsknintsinstituttet, 2019). The IMR suggests that by applying genetic engineering tools, more 'sustainably' farmed salmons can be created. They claim farmed fish can be made more sustainable by editing salmon without active germ cells. This is seen as a preventative measure, as farmed salmon without active germ cells will not be able to breed with wild species if they escape from fish farms, thereby evading potential genetic erosion (Havforsknintsinstituttet, 2019). Moreover, the IMR suggests that this could also fix the issue of early sexual maturation among farmed fish (Havforsknintsinstituttet, 2019).

Additionally, the Ocean Panel also suggests that genetic engineering can be leveraged for marine conservation and biodiversity management (Blasiak et al., 2020). The authors state that CRISPR can be used to monitor near threatened or vulnerable species (Blasiak et al., 2020). For species that are furthermore at the risk of going extinct, they claim that genetic engineering can be used to enhance "the adaptive capabilities of the species within its environment (…) making genetic modifications in the form of targeted beneficial mutations and gene replacements as potential tools for species survival" (Blasiak et al., 2020, p. 35).

Ivan from Rev Ocean suggested that despite a lot of talk, these methods have not become commonly applied in marine governance and management so far:

> We have seen quite a bit of talk about assisted evolution and use of GMO's, particularly in the context of saving coral reefs in the context of a warming ocean. I'm yet to see any real significant advances in that area to be honest. There is a lot of talk, and not a lot of action as yet. Any release of genetically modified organisms has to be scrutinized very carefully, because obviously there can be issues with that type of activity.

Both the Ocean Panel and the CAO acknowledge that CRISPR is still very disputed, and that it has to undergo adequate risk assessment (Blasiak et al., 2020; Stenseth et al., 2021).

Pål, who is affiliated with both the COA document and the EBP-Nor project, stated the following on regulations of genetic engineering in Norway:

> We have very strict biotechnology regulations in Norway, pointlessly strict after my opinion. And that goes to the definition of GMO's, where in a way CRISPR-Cas is defined as GMO. Which I mean is wrong (…). With CRISPR-Cas, you can do completely clean editing, in principle. But that is important to add, in principle. Because there can occur things.

Although CRISPR and other genetic engineering methods have not yet been formalised and utilized in commercial aquaculture, Pål stated that he was certain that we would see more of synthetic biology in Norway in the future, for example in food production. This was also stated in COA's document (Stenseth et al., 2021). As such, genetic engineering and methods like CRISPR for marine biodiversity governance and food production can be understood as being somewhere amid imaginaries and materialisation in a Norwegian context. However, the expectations of technologies should be taken cognizance of, as they have the power of being performative by their ability to mobilise and thereby enact certain visions for the future (Hedgecoe & Martin, 2007). Furthermore, scientists are also central figures in the making of sociotechnical futures, as their conceptions of viable futures influence policy making and how society perceive sociotechnical futures (Fujimura, 2019).

We have seen in this chapter how the both the IMR, COA and the Ocean Panel suggest that biotechnology can be leveraged for more 'sustainable' ocean futures. However, what is considered as sustainable is an inherently political and normative debate as it can differ considerably between actors (Ginsberg, 2017). As we have seen in the blue growth discourse and the 'economy of repair', sustainability is comprehended as a merge between economic growth and technical-managerial policy making. Leveraging biotechnology for novel food production and marine biodiversity management and conservation can also be seen as pursuing similar sustainability perceptions. As was illuminated, the IMR are suggesting that the fish farmed salmon without germ cells can lead to a more sustainable aquaculture industry. As such, by applying gene editing tools, nature and marine organisms can be 'fixed' so to fit into industrial food production such as aquaculture. As such, the sociotechnical inventions such as CRISPR are part of extending the use of technical fixes to solve environmental and biodiversity issues.

In the Norwegian Government Ocean Strategy from 2019, the continued expansion of aquaculture industry was accentuated as a core facet of blue economic expansion in Norway. As aforementioned, the Ocean Panel also envisages that "there is a significant potential to domesticate all 3,000 species harvested from the ocean as human food" (Blasiak et al., 2020, p. 18). Marine sciences are working close with Norwegian state goals of industry expansion (Havforsknintsinstituttet, 2019). With novel methods such as CRISPR being explored in the IMR, I concludingly suggest that researchers are trying to overcome interior challenges of the aquaculture industry by attending to technical and managerial fixes. In the following section, I explore how these particular sustainability-perceptions are forming the blue growth paradigm. Furthermore, I discuss how it can be understood as reinforcing epistemic selectivities in marine biodiversity governance.

Blue Growth and Technical fixes – An Epistemic Selectivity?

More and more scholars are questioning whether approaches to socioenvironmental issues that base their rationale on the monetary value of nature is a suitable and equipped framework set at resolving current planetary crisis (Visseren-Hamakers & Kok, 2022). Furthermore, it is questioned if these approaches are instead being contributory to the continuation of unsustainable practices and futures. Brand and Vadrot (2013) reflect on this as they argue that the broad use of marked-based approaches in environmental and biodiversity policies have led to epistemic selectivities in biodiversity policy. They define epistemic selectivities as "those mechanisms inscribed within political institutions which privilege particular forms of knowledge, problem perceptions, and narratives over others" (Brand & Vadrot, 2013, p. 207).

This thesis has suggested that the ocean genome imaginary builds on blue growth's techno- and growth positivism which sees economic expansion and the preservation of marine biodiversity and ecosystems as compatible. When explicating where current biodiversity issues stem from, both the Ocean Panel and EBP-Nor claim that these derive from anthropogenic activity (Blasiak et al., 2020; Stenseth et al., 2021). By doing so, the authors discursively present humanity as a whole as the primary causes of biodiversity loss and environmental degradation. What problem perceptions and framings like these fail to assert, is how wealthier countries largely located in the Global North have historically been inducing far greater greenhouse gas emissions than the Global South (Hickel, 2020). It furthermore suggests that these issues should be resolved by better knowledge about marine genomics, creating more sustainable ocean-bound industries, as well evolving species monitoring and marine conservation, instead of looking at larger socioeconomic structures that are driving climate change and environmental degradation. Brand and Vadrot emphasise the power and hegemonial structures that exists among epistemic selectivities. They illuminate this by revealing how states privilege certain strategies, problem perceptions and solutions over others, which furthermore may lead to that only a certain set of interests, policies and strategies are implemented. Other less 'powerful and influential' value perceptions and problem framings and solutions may thereby end up being overlooked (Brand & Vadrot, 2013).

Chapter conclusion

By illuminating the global growth-paradigm capacity to re-embed into 'new soil', this chapter has illustrated how the blue growth imaginary extends these trajectories by framing oceans as the new abundant resource frontier. Further, the chapter suggests that industry expansion at sea is legitimised by making blue growth seem as a mode of 'ocean repair'. This involves a narrative and storytelling that claims that new ocean-bound industries will rupture from prior unsustainable land-based industries. The blue growth and ocean genome imaginary thusly promises a blue, sustainable and abundant ocean future. The imaginary is furthermore extended by suggestions of leveraging novel biotechnical tools such as CRISPR to tackle marine industrial issues. Current debates on biotechnology legislation in Norway and the EU suggest that biotechnological imaginaries and pursuits are being re-evaluated, as it is considered to open up on jurisdiction relating to biotechnology, gene editing and bioengineering. Although these are still very contested topics, they are suggested by scientists as plausible solutions for sustainability issues. Due to scientific institutions and researchers' power to influence and shape sociotechnical futures, these developments should be taken serious and furthermore critically examined. In chapter 8 on alternative imaginaries, this thesis will discuss these issues further. Lastly, this chapter has illuminated how scholars are questioning whether valuing nature in monetary terms can adequately address and solve socioenvironmental issues currently taking place. The use of marked-based approaches in environmental and biodiversity policies is critiqued for favouring specific narratives and problem solutions, something Brand and Vadrot (2013) term as epistemic selectivities. In the following chapter, I will introduce movements of resistance who suggest that there is a need to move beyond these rationales in face of our shared planetary crisis.

7. Emerging Movements of Resistance Against Dominant Imaginaries

Arriving at the sociotechnical imaginary's (STI) final step, resistance, this chapter asks whether sociotechnical ideas and projects relating to the utilization of marine genetic material and information has encountered resistance and what alternatives such movements of resistance might reveal. Resistance can take multiple forms. However, this chapter focuses primarily on academic ones. Investigating resistance towards sociotechnical imaginaries is important because, as Jasanoff (2015) argues, they can crystallise dissatisfaction with dominant structures, ideologies, norms, and practices. Furthermore, by challenging prevailing systems and sociotechnical ideas, resisting movements can unveil alternative approaches to how society and the future ought to be shaped (Ginsberg, 2017). In this way, resistance can expose diverse ideas on how to organise society and nature that deviate from dominant perspectives.

This chapter explores two movements that challenge mainstream biodiversity and marine governance. These are Transformative Biodiversity Governance (TBG) and blue degrowth. Although the movements focus on distinctive themes, both intersect in multiple ways. The first part of the chapter examines rising demands for transformational change of governance that deal with ocean and biodiversity policy. Because of pressing concerns about the accelerating environmental and biodiversity decline, as well as the socioenvironmental issues it entails, these movements are advocating for profound changes that disrupt or transform current mainstream governance. In the first part of this chapter, I bring attention to the scholarly movement of TBG and discuss whether the ocean genome imaginary and relating projects correlate with these perspectives. I ask whether the ocean genome imaginary inspires and facilitates transformative and disruptive changes in ocean and biodiversity governance, or if it maintains business-as-usual by supporting the continuation of unsustainable practices. In line with TBG's that value pluralism in biodiversity governance and critical perspectives on economic growth is of importance, I present blue degrowth as an alternative approach to marine and biodiversity governance, and furthermore as an alternative blue economy. The blue degrowth compromises both a critique of the current blue growth paradigm, while at the same time presenting alternative perspectives on ocean-bound sustainability. In the final part of this chapter, I reflect on whether and how blue degrowth and TBG perspectives could be applied to the ocean genome imaginary in a Norwegian context.

Calls for Transformation in Ocean and Biodiversity Governance

Despite decades of global engagement and ambitions set at turning the planetary trajectories leading to environmental and biodiversity decline, socioenvironmental crisis and species decline keeps further intensifying (Evans et al., 2023; Visseren-Hamakers & Kok, 2022). Moreover, efforts made to tackle these issues such as the Aichi Biodiversity Targets and the SDG 14 have yet to meet their end goals. Thereby, some scholars are arguing that initiatives like these have played part in elongating the current socioenvironmental crisis (Brent et al., 2020; Evans et al., 2023; Visseren-Hamakers & Kok, 2022). In face of these socioenvironmental detriments, calls for transformation is becoming increasingly prominent amidst both scholars and social movements working on global governance issues relating to environmental and biodiversity politics (Evans et al., 2023; Visseren-Hamakers & Kok, 2022). Where these conversations and movements resemble, is in their call for a transformative change that is critical towards practices and systems that carry on unjust and unsustainable practices.

Ideas of what transformation entails, however, differs both in relation to what worldviews and norms actors advocating change possess, as well as the breadth, scale, and scope of transformational ideas (Evans et al., 2023). When discussing calls for change, it is therefore rudimentary to be attentive to the plurality of perspectives and the inherently subjective nature of transformational ideas (Evans et al., 2023). In 2023, Evans et al. published an article examining different theories of transformation relating to ocean governance. Global ocean governance has been critiqued for being too fragmented, not adequately inclusive and falling short when it comes to just distribution of resources stemming from marine biodiversity (Barbesgaard, 2018; Evans et al., 2023). Evans et al. suggests that perspectives on transformation in ocean governance literacy can be seen as belonging to two different movements, which are the socio-ecological perspectives and the socio-technical perspectives. Socio-ecological perspectives on transformation view the world as a dynamic, complex and multi-level system where transformation must occur at all levels leading to deep rooted and systemic change. Socio-technical system approaches on the other hand, focus predominantly on technological, managerial, and innovative approaches to change, such as leveraging novel technologies for efficient biodiversity governance and the like. Such perspectives are akin to the ecomodernist movement discussed in chapter 2 of this thesis. Evans et al. claim that although socio-technical perspectives have primarily been applied in energy governance and policies, they have also made their way into debates and policies relating to transformation of ocean governance in recent years.

Similar to political ecology scholars' focus on socioenvironmental problem framings, Evans et al. (2023) argue that perspectives on transformation depend on how actors choose to frame problems. They distinguish between those perspectives that view socioenvironmental problems as narrow and thereby resolvable by expertise, technology and innovation and managerial solutions. Other perspectives however, like those similar to socio-ecological perspectives, may see problems as rooted in broader challenges and unsustainable structures, such as socioeconomic systems, worldviews, and norms. These perspectives may thereby advocate for more systemic and deep-rooted change that look to both societal as well as personal levels of transformation (Evans et al., 2023). Evans et al. stresses that these two categories can intersect, and furthermore that it can be feasible to intermix them in face of socioenvironmental issues. Moreover, their literature review on perspectives on transformation echo the onto-epistemological plurality which this thesis accentuated in the methodological chapter. There, I argued that there exist plural perceptions of 'reality', and based on STS and political ecology theory, these differentiated perspectives of the world enable different ways of enacting the world. However, only certain perspectives achieve hegemonic positions in society, and thereby manage to dominantly influence policy making, as suggested by Benjaminsen and Svarstad (2021).

In chapter 4 and 5 on how the ocean genome imaginary has originated and been embedded, I argue that the blue-green growth paradigm resting on decoupling ideas have gained such widespread traction it can be considered a hegemonic discourse and perspective in biodiversity and sustainability governance (Brand & Vadrot, 2013; Brent et al., 2020). In chapter 5 on imaginaries extending, I also argued that these ideas have extended by creating the narrative of the 'economy of repair'. This is the idea that biodiversity issues can be resolved by expanding industry and economic activity whilst simultaneously 'fixing' biodiversity in pressured ecosystems such as the ocean and marine environments. By doing so, marine life is incorporated as market value, something that has become an epistemic selectivity in biodiversity governance according to Brand and Vadrot (2013). These rationales overlap extensively with what Evans et al. (2023) describe as socio-technical attitudes and approaches to transformation. However, Evans et al. and Brand and Vadrot alert that such approaches to ocean and biodiversity governance may contribute to prolong unsustainable practices and lead to blue/green-washing if they rely too much on quick fixes without attention to underlying unsustainable and unjust societal and economic structures. Yet, Evans et al. also argue that calls for transformation that advocate ‘radical’ alternatives or shifts to sustainability may also fall short if they are not sensitive enough to contexts and local considerations, and that these radical approaches to change must therefore stay away from the temptation of creating ‘blueprints’ for change.

Conclusively, as Evans et al. (2023) stress, there is a significant difference between those movements calling for comprehensive and radical change and those suggesting smaller alterations to established structures. In the following section I will discuss calls for transformation made by the Ocean Panel and the Transformative Biodiversity Governance movement. Both call for a transformation in ocean and biodiversity governance and politics. However, what these institutions and movements perceive as transformative vary in terms of worldviews, problem framings and scope. I will discuss the ocean genome imaginary and project in a Norwegian context and how it pertains to calls for transformation. Doing so, I will pay particular attention to issues relating to benefit sharing from marine genetic resources as well as perspectives on ocean sustainability.

Diverging Perspectives on Transformation: Business-as-usual or Radical Shifts?

When analysing demands for transformative change, it is important to be attentive to the diverse actors who are forwarding these incentives. Moreover, it is imperative to be conscious of the fact that these actors might differ in how they define transformational change, and what levels of power and influence over policy making they possess. Attention to these differences can reveal underlying norms and cultural variations between actors and institutions, as well as power and equity imbalances. As in the context of the ocean genome imaginary, the Ocean Panel has itself stressed what they claim is a need to transform both ocean governance and economy. The panel stresses that all their Blue Papers published in 2020 reflect the views of each individual working group and authors related to each respective paper, stating that the Blue Papers are “an independent input to the HCP process and does not represent the thinking of the HLP (…)” (Blasiak et al., 2020, preface). However, the overarching goal of the panel and the Blue Papers have been to bring together ideas aimed at transforming ocean governance and the ocean economy, the panel suggests (Ocean Panel, 2022). As discussed in chapter 4 on how the sociotechnical imaginary of the ocean genome originated, it was noted that these ideas of transformation have been crystalized in the panels paper *Transformations for a Sustainable Ocean Economy: A vision for Protection, Production and Prosperity* of 2022. In this paper, the panel suggests that transformation must occur in fields of ocean wealth, ocean health, ocean equity and ocean finance for there to build a foundation for ocean-based "economic recovery and resilience" (2022, p. 5). In essence, the panels perspective on transforming ocean governance and economy rests strongly on leveraging innovation and technology to create new ways of preserving marine biodiversity as well as creating new or intensifying already existing ocean and marine industries.

While the Ocean Panel speaks directly of the need for transformative change, the Centre for the Ocean and the Arctic (COA) and the EBP-Nor project do not explicitly refer to transformative change in this way. Instead, these actors bring attention to transformations that occur within life sciences due to scientific and technological developments. Simultaneously, the changes the CAO and the EBP-Nor speak of within the life and ocean sciences, and furthermore the bioeconomy, are alterations and change that surpass scientific and economic domains. As this thesis has argued particularly in chapter 6 on imaginaries extending, the ocean genome sociotechnical imaginary and the prospects it entails are part of forming imaginations, goals, and furthermore creating futures set at solving socioenvironmental and sustainability issues. How institutions and actors aim to do so, is highly political. This thesis thereby argue that changes that take place within science and the bioeconomy are not just transformative to science and finance, but will also be transformative to society at large. Ocean and genome imaginaries are transformed into practice by for example mainstreaming biotechnological tools such as CRISPR, expanding the use of genomic breeding techniques, and developing new managerial approaches to ocean governance and conservation.

As the prior chapters have discussed, particularly the prior chapter 6 on ideas extending, the ocean genome and blue growth imaginary tends to rely primarily on what Evans et al. (2023) define as socio-technical perspectives on transformation. These ideas, as discussed, focus primarily on technical and managerial changes set at making industrial pursuit and governance more efficient and technologically advanced. In chapter 6, I discussed the ways blue economies are extending by discursively presenting blue growth as an 'economy of repair' that merges the restoration of oceans with economic growth. The blue growth discourse has gained traction in global governance through initiatives such as the Rio+20, SDG goal 14: Life Below Water, and the objectives of the Ocean Panel. These rationales permeate global ocean governance so greatly that they can be conceived as a hegemonial discourse and an epistemic selectivity (Barbesgaard, 2018; Brand & Vadrot, 2013; Brent et al., 2020). This thesis illustrates how this discourse is also widespread in Norwegian ocean governance and ocean strategies.

As (blue) growth initiatives expand, some scholars are questioning whether such growth and triple-win strategies are adequate for tackling the socioenvironmental crisis at hand (Barbesgaard, 2018; Brent et al., 2020; Otsuki, 2015; Visseren-Hamakers & Kok, 2022). These critiques emerge from the notion that current mainstream environmental and biodiversity governance, which rests strongly on green growth, ecosystem services and decoupling rationales, have failed at bending the curve of the current devastating planetary trajectory (Otsuki, 2015; Visseren-Hamakers & Kok, 2022). Ginsberg (2017) and Jasanoff (2015) argue that movements that resist deep rooted norms and structures in society can reveal alternative ways of organising the future. Some of the current movements resisting mainstream sustainability governance are doing just this by calling that alternative, deep rooted, and structural changes are needed in order to create legitimate sustainable policies and solutions. One of these movements is Transformative Biodiversity Governance (TBG). Visseren-Hamakers and Kok (2022) argue that TBG can be regarded as a new era in global biodiversity governance. They define transformative change as "a fundamental, society-wide reorganization across technological, economic and social factors and structures, including paradigms, goals and values" (Visseren-Hamakers & Kok, 2022, p. 8). This new era, they claim, marks a shift from focusing primarily on technocratic and regulatory fixes to socioenvironmental issues to increasingly recommending transformative and structural changes that re-evaluate socio-economic structures and value perceptions (Otsuki, 2015; Visseren-Hamakers & Kok, 2022).

Three areas permeate the field of Transformative Biodiversity Governance. The first dimension focuses on the need to make structural and systemic changes towards sustainability and equality. According to Visseren-Hamakers and Kok (2022), global biodiversity governance has been too focused on trying to fix direct drivers of ecological harm such as overfishing and pollution, thereby inadequately addressing the indirect drivers of unsustainability. As a result, Smallwood et al. argue that global biodiversity governance has failed to face the indirect drivers of species decline, and is therefore "unable to confront the economic, political and social paradigms that drive the destruction of biodiversity globally" (Smallwood et al., 2022, p. 60). By addressing underlying societal causes of unsustainability, TBG seeks to confront the indirect drivers that are underpinned by societal values and norms as well as socioeconomic dynamics (Visseren-Hamakers & Kok, 2022). This relates to a second dimension in one of the core interests of TBG literature, which is the attention to definitions and perceptions of nature. Defining nature, Keune et al. (2022) suggest is a highly "context-specific, subjective, normative and dynamic" endeavour which encompasses diverging worldviews, norms, and values (p. 25). Keune et al. (2022) along with other scholars of TBG acknowledges onto-epistemological multiplicity and that there exist multiple ways of both perceiving and enacting human-nature relations. They argue that it is crucial to be attentive to this pluralism as relying on 'objective' definitions of nature may disregard and marginalize certain groups and their values and practices attached to the management and use of nature.

Thereby, TBG scholars argue that biodiversity governance should be inclusive and deliberative, embracing a plurality of values, nature perceptions and epistemologies, and furthermore focus on sustainable "types of knowledge that are currently underrepresented", such as local and indigenous knowledges (Visseren-Hamakers & Kok, 2022, p. 12). Kok et al., argue (2022) that this is crucial not only because this opens for the democratic inclusion of values and perceptions, hindering uneven power distribution, but also because different ways of perceiving and valuing nature often entail "different views on what the problem of biodiversity loss is and [on what are] the most appropriate and effective solutions to that problem" (p. 344). Similar to political ecology theory and Brand and Vadrot's (2013) notions on epistemic selectivities, Kok et al. (2022) thereby stress that societal values and perceptions of human-nature relations shape how problems and solutions to socioenvironmental issues are framed. Being attentive to this plurality helps to avoid that certain powerful and influential knowledge producers and agenda-setters reach hegemonic influence over policymaking and ocean and biodiversity governance.

A third important feature of TBG is its engagement in questions surrounding financial systems and economic growth. Büscher et al. (2022) argue that one of the most pivotal facets of creating sustainable pathways going forwards is creating new financial and economic systems that steer away from "the current limited paradigm of economic growth" (p. 244). They also argue that economic growth must not be pursued at the expense of the environment, and that an increase of societal movements and groups are stressing the socioenvironmental issues and conflicts originated by or made worse by "unfettered economic growth and consumption" (Büscher, et al., 2022, p. 244). Therefore, TBG scholars argue that there is a need to promote alternatives to paradigms such as economic growth and neoliberalism, whereby some suggest new economic models and structures such as degrowth and ecological economics (Keune, et al., 2022; Visseren-Hamakers & Kok, 2022). As such, TBG literature engages more with questions of the limit to growth than prior mainstream biodiversity and sustainability governance has done, which has primarily relied on the growth paradigm and decoupling rationales. I will go more into depth of this discussion in the latter part of this chapter, as I discuss blue degrowth approaches within ocean biodiversity governance.

Büscher et al., (2022) note that transformative change is "an extremely complex proposition", referring to the practical implications of implementing such large-scale structural changes, as well as the multiple layers and understandings of the concept of transformation (p. 244). However, the core argument in the TBG literature is that legitimate change towards sustainability cannot be achieved by furthering the status quo. Büscher et al. (2020) argue that current mainstream biodiversity governance is not equipped nor sufficient at making the appropriate changes needed amidst the ongoing planetary predicament. Keune et al. (2022) also acknowledge that the inclusion of plural ways of perceiving and valuing nature is a challenging endeavour, as the "plurality of values means a plurality of ontologies, epistemologies, interests and needs", which can be challenging to adequately and efficiently include when trying to form sustainable and equitable solutions (p. 26). The inclusion of plurality is however essential, they argue, as it may hinder exclusive and uneven power balances.

Both the Ocean Panel and Transformative Biodiversity Governance scholars are thereby making calls for transformative change, arguing that the current state is not satisfactory. Both argue that inclusivity will be essential to transformative change, meaning that a variety of relevant stakeholders must be included in changing governance and policy. However, the most considerable difference between the two movements is TBG's emphasis on structural and economic change as opposed to the Ocean Panel's and the genome projects focus on technical and managerial solutions as primary mechanisms for sustainable change, such as creating novel species monitoring, leveraging biotechnology for marine conservation and novel foods. Thus, TBG claim that deep rooted change is needed to reorient society's and individuals' norms, expectations, values and worldviews. I will now look at two facets that permeate the ocean genome imaginary, the fair benefit sharing of resources arriving from the utilization of marine genetics and the use of marine genomics for sustainability solutions. By doing so, I will examine whether the ocean genome imaginary engages in notions of transformative change or if it is part of prolonging mainstream biodiversity and ocean governance. By discussing these topics and uncovering who is part of shaping discourses and decision making, I seek to further unveil who is part of shaping marine and genomic futures and how they do this through jurisdiction and governmental strategies. Furthermore, I seek to examine whether there are voices that are not incorporated, thereby overlooking onto-epistemological multiplicity.

Social Constructions of Ownership and Benefit Sharing of Marine Genetic Resources

Particular perceptions of nature do not only have the capacity to shape and sometimes dominate discourses and narratives that influence policy making and governance. They also impact more rigid societal fabrics such as jurisdiction (Jasanoff, 2015). A central aspect of the governance of marine genetic diversity is the discussion of fair benefit sharing of its resources. In their ocean genome document, the Ocean Panel dedicates a considerable segment of the paper to questions surrounding how marine genetic resources (MGR) can be fairly and equitably shared amongst stakeholders. They focus primarily on the traceability of MGR, challenges to regulating marine resources deriving from areas outside national jurisdiction, and patent rights (Blasiak et al., 2020). Out of the three main documents of this thesis (papers published by the CAO, Ocean Panel and EBP-Nor), it is only the Ocean Panel that elaborates on issues relating to the fair sharing of MGR. The CAO briefly mentions benefit sharing once in their document, stating that Norway must "include conservation of the ocean genome in scientific research and commercialisation, as well as agreements on the sharing of benefits" (Stenseth et al., 2021). The EBP-Nor however, fails to address these topics in their White Paper. Their main focus is however set at state interests and the benefits the Norwegian society can acquire from the utilization of marine genetic resources, such as medicine and aquaculture. The document and its authors do not contemplate how these benefits could be shared equitably or what mechanisms could be used to avoid having monetary and other benefits accumulate onto a few businesses, countries, or societal groups.

This is despite the fact that Norwegian utilization and commercialisation of marine genetic resources are required to abide to a set of obligations pertaining to The Nagoya Protocol, The Norwegian Marine Resource Act (NMRA) and The Convention on Biodiversity (CBD). The Norwegian Marine Resource Act (Havressurslova 2008) relating to the management of wild living marine resources states that "The wild marine living resources belong to Norwegian society as a whole"[14] (§ 2). Furthermore, the Act is meant to "ensure sustainable and economically profitable management of wild living marine resources and genetic material derived from them, and to promote employment and settlement in coastal communities" [15] (§

[14] Translated from: «Dei viltlevande marine ressursane ligg til felleskapet i Noreg.

[15] Translated from: «Formålet med lova er å sikre ei berekraftig og samfunnsøkonomisk lønsam forvaltning av dei viltlevande marine ressursane og det tilhørande genetiske materialet og å medverke til å sikre sysselsetjing og busetjing i kystsamfunna.

1). Hence, the act does not only address property rights and benefit sharing of resources derived from wild living marine organisms. It also articulates principles focused on societal and economic organizations purposed at guaranteeing prosperity and settlement across coastal Norway. The Act rests upon a premise and furthermore a traditional Norwegian narrative of the oceans as 'åpen allmenning' – meaning that it is a common communal resource and property (NOU 2006: 16). However, the commons principle is contested both globally and nationally. This has been evident in recent Biodiversity Beyond National Jurisdiction (BBNJ) negotiations, as well as in current Norwegian disputes over fishery politics and governance.

The Nagoya Protocol is a legally binding international instrument which includes a set of obligations for its contracting parties. The protocol was established to secure that benefits arising from the utilization of genetic resources are fairly and equitably distributed and shared (Morgera et al., 2014). In The Norwegian Marine Resource Act, it is cognized that the wild living marine resources belong to the Sámi and Norwegian people. It furthermore recognizes the historical presence and importance of both groups with regards to coastal settlement, traditional local marine economies, and value creation, as well as culture and identity (Havressurslova, 2008). By intersecting tenets from international human rights, international environmental law, the CBD and the NMRA act, the Norwegian state is obliged to include local and indigenous communities in the governance of nature protection, as well as the fair benefit sharing of resources deriving from the ocean.

There was an overall consensus between both the ocean genome and EBP-Nor documents and the informants that genomes should not be owned in and of themselves. They all stressed that information deriving from genomic research and industry initiatives should be uploaded onto public databases, thereby becoming available to everyone (Blasiak et al., 2020; Jakobsen et al., 2020; Stenseth et al., 2021). Pål particularly emphasised that EBP-Nor is a community science project waged by Norwegian taxpayers, and that it was therefore imperative that all the genetic information they acquire must be made public. However, despite this, the EBP-Nor White Paper and web page lacks information about and engagement in topics on stakeholder inclusion and equitable benefit sharing. Moreover, open-access policies are contested amongst stakeholders concerned about the ownership and benefit sharing of genetic resources (Bond & Scott, 2020). In principle, open-access policies make genetic information available to everyone by placing it in public databases. As such, the genetic information is not being privatised by business who collected the material and information. However, to use and capitalize on genetic information deriving from marine species, countries and companies must be in possession of the finance and technology needed to create monetary value from this information (Blasiak et al., 2020; Rosendal & Skjærseth, 2022). Therefore, it has predominantly been rich countries and biotech companies from the Global North that have been able to monetize on genetic information and material (Blasiak et al., 2020; Bond & Scott, 2020).

Moreover, the boundary making between material and informational genetic resources, and furthermore the distinctions between traditional knowledge, non-commercial and commercial research and the like have proven to be slippery, with what Bond and Scott (2020) calls "indistinct boundaries" (p. 30). This has made some scholars like Bond and Scott question whether digital sequence information deriving from genetic resources can create a "new wave of digital biopiracy or the start of a new open-source revolution in the engineering of life", something they issue is still under fierce debate (2020, p. 31). These debates were emphasised by Clara from EBP-Nor. She stated that research initiatives like the EBP-Nor must engage in the debates surrounding the application of juridical mechanisms that can ensure the fair benefit sharing of genetic resources:

> Yes, cause otherwise you take something from a country that is rich in biodiversity and low in research money for example, and then you take that biodiversity, you make it open to everyone, but who can capitalize on that? It's the countries with money to do so already, and that's not fair. So, it's different strategies being developed to make sure that the countries where biodiversity comes from, see the benefits of research on the biodiversity. And it's an interesting tension, the whole like 'open science thing'. I am generally an open science person, but it's always like, as open as possible, and as closed as necessary.

She furthermore talked about how these issues were applicable in a Norwegian context, emphasising issues of ownership both between countries and within, referring to different stakeholders such as local and indigenous communities:

> I would say the Sámi and any local community should be at the table at these discussions when you are talking about basically using biodiversity. I think you need to involve the people that that biodiversity really belongs to. And so that's were Sámi indigenous peoples in general, but also other types of local communities, should be at the table. It's to avoid this kind of helicopter science right, where you just go in and extract what you want, and then you leave the community in the dust. And then maybe

> someone goes on and makes a bunch of money from developing some kind of drug from that genome, and the community where it comes from sees none of it. Like that's what you want to avoid. And that's been a problem in biodiversity research, and I don't know, every other field, colonialism… like forever.

Clara also stressed the contrast between EBP-Nor and global Earth BioGenome project, claiming that EBP-Nor had not engaged enough with social and ethical issues:

> I think with this Earth BioGenome project in general, there is much more awareness of the issues there, and so it's a big priority, it just hasn't happened at the Norwegian level yet. But that's one of my missions as, to get this in place for phase two, because it should be in place from the beginning of a project (…). But like, how do we make sure the benefits are going back to where the biodiversity came from, and the local communities? And there are suggestions for example, some percent of any profits made from these genomes will go into a fund, that will then be redistributed back to local communities.

Clara's statements touch upon issues relating to the so-called derivative debate. The Nagoya Protocol defines derivatives as "a naturally occurring biochemical compound resulting from the genetic expression or metabolism of biological or genetic resources, even if it does not contain functional units of heredity" (Nagoya Protocol, § 2). Under Norwegian jurisdiction, derivatives can be patented if they have undergone a form of processing, for example if biological materials have been isolated and used for a technical function, for example for pharmaceutical applications (Patentloven, 1967, § 1). As such, it is not the whole-body organisms which biotech companies are interested in patenting. Instead, it may be the material or information derived from species, which can be "biochemical compounds or information about the structure of those compounds" (Parry, 2004, p. 239). The real monetary value of genetic resources lies in derivatives and their information, and not whole-body organisms (Parry, 2004; Rosendal & Skjærseth, 2022). As genomes and whole-body organisms are not patented, but derivatives are, Norwegian patent laws separate the genetic information from its bodily organisms. It depicts one of the facets, the informational, as dissected and dichotomized from the organism, even when the information originally stems from the natural world (Rosendal & Skjærseth, 2022). As such, an information/organism binary is constructed along the lines of the broader culture/nature binary which has been dominant in socioenvironmental and biodiversity governance (Keune et al., 2022). Information and codes are made to be analysed, used, and owned as separated from the natural world, instead of understanding it as intrinsically connected. This reflects the subjectivity of ownership and benefit sharing, and as such it also presents a particular onto-epistemological approach to both the definition of biodiversity, and who it is that has the right to own it. Moreover, local resource autonomy could be further restricted by these patent laws. Marine whole-body organisms are still principally a common resource under these patent laws. However, if local or indigenous groups were to later develop science and technology which could make use of intricate biochemical compounds and information, they could experience that these processes have already been patented by biotech companies (Parry, 2004).

Jurisdictions which favour the separation of information and material are, according to Parry (2004), supported by bioprospecting and biotech companies who validate these laws by stressing how whole-body organisms won't be patented and privatized, only their derivatives. Furthermore, bioprospecting and biotech companies' right to patent derivatives is often defended by the cost-intensive activity of collecting biomaterial (Blasiak et al., 2020). If derivatives are not included in benefit sharing modalities, the "CBD's third objective on equitable sharing may become increasingly undermined" (Rosendal & Skjærseth 2022, p. 204). However, case studies focused on genetic resources from polar regions have illustrated that industry actors would strongly oppose suggestions on including derivatives in benefit sharing (Rosendal & Skjærseth, 2022).

The derivative debate reflects how property rights is a process which involves the construction and boundary making between the "economic and the noneconomic" (Goven & Pavone 2015, p. 306). It also shows different ways of perceiving both nature and value. Bridging this debate to the ocean genome imaginary in Norway, it is evident that issues relating to benefit sharing from MGR is a highly political, philosophical, and normative issue in need of an open and transparent debate. Through the NMRA and the commons principle, benefits arriving from the uses of wild living marine resources are meant to secure coastal settlement and sustainable economic activity throughout coastal Norway. However, due to the current regulatory mechanisms that dichotomize whole body organisms from derivatives, this can, as Clara issues, lead to a situation where local communities that 'own the biodiversity' see none of its monetary benefits. The Norwegian state and the ongoing genomic research projects, however, have not yet engaged adequately with the principles made by the NMRA, the Ocean Panel itself and TBG in regards to inclusion and fair distribution of benefits arriving from marine resources. This is evident both when analysing documents interlinked with Norwegian genome strategies, and when interviewing experts working with relevant genomic research projects. Instead, the EBP-Nor has been part of deepening science-industry interlinks by only bringing in industry partners as collaborators, whilst leaving out other stakeholders like local and indigenous communities.

Ideas of Sustainability in the Ocean Genome Imaginary, Transformative or Prolongments of the Status Quo?

Turning to the second key aspect within the sociotechnical imaginary of the ocean genome, we find its emphasis on sustainable ways of employing marine genetics. Definitions of sustainability are, as highlighted by Evans et al. (2023) and Ginsberg (2017), subjective and can vary significantly among different groups and cultures. Consequently, what one level of governance or sector might regard as sustainable may differ significantly from the perspective of i.e. a local community or other cultural group. For this reason, scholars in Transformative Biodiversity Governance (TBG) like Visseren-Hamakers and Kok (2022), emphasise the importance of embracing value pluralism and diverse ways of comprehending and utilizing nature. This is to prevent so-called objective and apolitical approaches to socioenvironmental issues and governance that overlook the inherently manifold and normative approaches to the uses and comprehension of nature. For example, how a biologist, marine biotech company and local fisher value and utilize a marine ecosystem and its species may vary greatly. Scientists, biotech companies, and fisheries could also be affected by conservation and management measures in diverse ways. To evade skewed power dynamics and policy influence where only a few, powerful actors and discourses are able to influence and shape sustainability policy and governance, the TBG field therefore considers it paramount to include plural values and to be considerate of diverse ways of knowing and using nature (Keune, et al., 2022). This involves the inclusion of diverse stakeholders and their perspectives, including indigenous communities, local populations, governments, scientists, and non-governmental organisations in decision-making processes. This ‘transformative’ approach furthermore recognises the value of traditional and local knowledge and the need for collaboration among various knowledge institutions and groups (Evans et al., 2023). TBG scholars underscore how inclusion and participation is rudimentary for the protection of human rights, property rights, and sovereignty of land and natural resources (Visseren-Hamakers & Kok, 2022; Smallwood et al., 2022). This includes the recognition of the rights and needs of local and marginalized communities that depend on biodiversity for their livelihoods, and the variety of ways which these communities make use of natural resources (Keune, et al., 2022; Smallwood et al., 2022).

As illustrated in both chapter 4 on imaginaries originating and chapter 5 on how these imaginaries are embedded into society, there is a considerable lack of stakeholder inclusion and participation in both the Centre of the Ocean and the Arctic (COA) and EBP-Nor's documents, as well as the EBP-Nor project itself. Not only does the lack of inclusion and participation fall short in terms of the objectives set by Ocean Panel and Transformative Biodiversity Governance when it comes to transformative sustainability and ocean governance. It furthermore conflicts with the Norwegian states obligations when it comes to inclusion of local and Sámi communities in the governance of resource utilisation and conservation, as well as issues on access and benefit sharing of marine resources through agreements such as the NMRA and the Convention on Biological Diversity. As chapter 5 illuminated, only industry actors had been included in the EBP-Nor project, which informants claimed was a consequence of the requirements made by the Norwegian Resource Institute. Moreover, the COA had not been attentive to how the utilization and governance of marine genetics and the benefit sharing of its resources could be distributed in equitable ways. This is despite the fact that the COA is an institution constituted by the Norwegian state set at addressing topics relating to ocean economies that will facilitate for and secure costal settlement and prosperity (Centre for the Ocean and the Arctic, 2019). In the EBP-Nor and the document published by the COA, attention is thereby drawn primarily to science and industrial and commercial actors and how they may benefit from genomic knowledges and resources. Non-industrial actors such as local and indigenous communities and groups working on smaller scales like fisheries, are on the other hand forgotten or left out of the imaginary. These are groups who might have other ways of using and valuing marine life than biotech companies and genomic scientists.

This strong science-industry interlink can help explain why a specific narrative and rationale dominate the documents, projects and overall discourse related to the use of (marine) genomics in Norway. These are narratives and rationales that proclaim that technical and managerial solutions are the best way of solving ocean-bound socioenvironmental and biodiversity issues. The rationale and imaginary leans on blue growth thinking and win-win approaches to ocean issues. Rather than seeing economic (blue) growth as naturally given and evolutionary, Transformative Biodiversity Governance scholars, however, emphasise how capitalistic models set at unlimited growth such as blue growth are economic structures laden with normative and ideological beliefs (Büscher et al., 2022; Visseren-Hamakers & Kok, 2022). The blue growth and ocean genome imaginary is based on the idea and belief that economic growth can be decoupled from material and energy throughput. This decoupling has not been grounded in empirical evidence (Gómez-Baggethun, 2020). Nevertheless, the belief that species can be sustained and even flourish whilst natural resource use and capitalist production modes expand, is a rationale and narrative that has become so dominant in biodiversity and sustainability governance the last decades to such an extent that it can be considered a hegemonic discourse as well as an epistemic selectivity (Brand & Vadrot, 2013). As Barbesgaard (2018) and Ertör and Hadjimichael (2020) suggest, this rationale is now also making its way into ocean economics and governance through the blue growth discourse and the understanding of the ocean as the next big resource frontier.

Even though the ocean faces multiple stressors and challenges, chapter 6 on imaginaries extending illustrated how the ocean is constructed as a new resource frontier in spite of declining populations and ecosystems at sea. This happens as states, institutions, scientists, and businesses create discourses and embrace rationales that claim that the ocean can be 'repaired' whilst intensifying material use and throughput in the ocean further. As such, ocean marine ecosystems can be 'repaired' whilst industries simultaneously intensify resource extraction and industrial activity through technical and managerial solutions seeking to make ocean governance and the blue economy more efficient (Huff & Brock, 2023). Resource extraction in declining marine ecosystems thereby become discursively legitimized despite widespread ocean-bound concerns. Furthermore, science and technology through novel methods and inventions such as biotechnical tools are part of further extending this imaginary and potential remedies in face of species and ocean decline.

Looking at similar narratives in the poultry industry, political ecologists Rebeccah Leigh Rutt and Jostein Jakobsen (2022) research the industry's use of genetic engineering tools such as fetus sexing other genome editing tools in food production. Rutt and Jakobsen argue that these biotechnical applications can be understood as a response to increased public demands for the industry to resolve its internal sustainability and animal welfare issues. By employing biotechnology to resolve issues such as the 'brother layer problem', the poultry industry tries both to meet public demands for ethical and sustainable animal agriculture, whilst also meeting the demands of modern capitalist agro-industry that urges capitalist growth (Rutt & Jakobsen, 2022). Similarly, the blue growth discourse claims that blue economics will be more sustainable than prior land-based industries such as beef production. These arguments are repeated both in documents as well as by informants. This argument is thereby widespread amongst blue growth proponents despite aquaculture being an industry already faced with many environmental and animal welfare concerns (Ertör & Ortega-Cerdà, 2019; Oelsen et al., 2011). Similar to the poultry industry, as exemplified by Rutt and Jakobsen, the ocean genome imaginary suggests leveraging biotechnology for marine conservation and management as well for aquaculture. One current science-industry collaboration is as previously mentioned facilitated by the Norwegian Institute of Marine Research where they are trying to create what they refer to as a 'sustainable salmon' that cannot reproduce with wild salmon if escaped from fish farm as this has been a central issue in the aquaculture industry (Havforsknintsinstituttet, 2019).

Responding to similar demands from the public and industry like for instance the poultry industry, blue growth and the ocean genome imaginary can also be understood as a response to demands for more sustainable and ethical food production. By 'seemingly solving' sustainability concerns by finding new technical fixes and more sustainable industries, blue growth helps stabilise demands for ethical and sustainable food production together with resource exploitation (Rutt & Jakobsen, 2022). Like Transformative Biodiversity Governance scholars, Rutt and Jakobsen also argue that relying too much on solutions based on technical fixes coupled with unregulated economic growth are insufficient as these solutions do not pay adequate attention to underlying sustainability issues within the capitalist food industry. According to Rutt and Jakobsen (2022) and Besky and Blanchette (2019), leveraging biotechnology to remake species creates "different kins of biological and capitalist creatures" (Rutt & Jakobsen, 2022, p. 5). Such as genderless salmon in commercial aquaculture, these novel modified species and so-called 'sustainability solutions' may further intensify and legitimize the capitalization and unsustainable exploitation of nature and living organisms (Rutt & Jakobsen, 2022).

Chapter conclusion

The empirical analysis in this thesis has illustrated how plans for the commercial use and conservation of marine species is a sociotechnical ocean genome imaginary created by a confined network of science-industry collaborations and national interests. Neither the COA nor the EBP-Nor have ensured participation of non-industrial stakeholders in their documents or project initiatives at the time when this research project conducted. Consequently, what one observes throughout the documents and science projects is a constrained rationale and imaginary in regard to potential futures for the ocean. This imaginary is firmly based on techno-optimistic and growth-driven rationales that pay inadequate attention to the more challenging sides of these blue growth prospects, such as planetary boundaries and overconsumption. Consequently, there is a substantial lack of attention to other ways of resolving socioenvironmental issues and critical voices that could challenge the growth reliance that permeates the ocean genome imaginary, such as Transformative Biodiversity Governance. Who participates in and influences knowledge production and (marine) biodiversity governance matters as this is part of shaping socioeconomic decisions and solutions to environmental issues (Goldman et al., 2011). Therefore, as argued by political ecology and TBG scholars, attention to stakeholder participation and value pluralism is pivotal (Goldman et al., 2018; Evans et al., 2023). By relying on single solutions that may lead to epistemic selectivities, other alternative ocean futures may be foreclosed, which further risks the intensification of unsustainable industrialisations of the sea (Brand & Vadrot, 2013; Rutt & Jakobsen, 2022). As the last final chapter before the thesis' conclusion, I will now elaborate on how blue degrowth could lead as an example of alternative principles for an ocean future that sustainably preserves marine genetic diversity and coastal communities.

8. Emergence of Alternatives: Blue Degrowth as Counter-Narrative

Through Sheila Jasanoff's (2015) Sociotechnical Imaginary's framework (STI), this thesis has examined how imaginaries of ocean futures intertwined with technological progress relating to genomic knowledge have emerged, both globally and in Norway. It has also investigated how these imaginaries have become embedded in institutions and scientific research initiatives through Norwegian ocean research and projects such as Norwegian EBP-Nor. Furthermore, the thesis has elucidated how the ocean genome imaginary and blue growth has been an extension of prior dominating sociotechnical narratives such as green growth and decoupling. As the latter chapter illuminated however, movements of resistance may emerge when "new conceptions of how to change the world bump up against the old", argues Jasanoff (2015, p. 323). As exemplified, Transformative Biodiversity Governance (TBG) has emerged as a movement of resistance towards mainstream sustainability and biodiversity governance, and furthermore uncritical approaches to 'green' growth (Visseren-Hamakers & Kok, 2022). Whilst exploring literature on blue growth, another movement of resistance emerged that revealed opposition towards proposals of augmenting the blue economy to solve ocean issues. This is called the blue degrowth movement.

Blue degrowth is a movement merged by scholars and civil society originating from the larger degrowth movement. Jasanoff (2015) claims that by looking at movements of resistance, one can reveal dissatisfaction of prevalent imaginaries that opponents claim are no longer satisfactory or sufficient to solve present-day challenges, like the global socioecological crisis and ocean degradation. These movements may furthermore reveal new imaginaries that presents alternative solutions to solve the challenges faced by human and non-humans. Blue degrowth is a movement that does exactly this. It expresses dissatisfaction of the current (blue) growth paradigm and can be understood as an antithesis and counter-narrative to such growth philosophies (Ertör & Ortega-Cerdà, 2019). Blue growth proponents argue that a new storyline and framework is in need as blue growth in many ways has failed at "providing just and fair grounds for local communities to benefit from the ocean economy pillars" by prioritizing profit over sustainability and local justice (Cavallo et al., 2023, p. 2). This chapter will illuminate how both TBG and blue growth can pose as critical and fruitful perspectives when discussing future challenges and opportunities for the utilizations of marine genetics in Norway. The clash between new and settled imaginaries such as (blue) green growth and blue degrowth can furthermore expose deep-rooted dynamics of power in society by examining which imaginaries gain traction and influence in policy making whilst others do not (Jasanoff, 2015). It is these questions that this chapter seeks to explore.

Dissimilarities Between Blue Growth and Degrowth

Blue degrowth is as disclosed part of the larger degrowth movement. As articulated in the theoretical chapter of this thesis, the degrowth movement has emerged from a debate surrounding the limits to growth (Benjaminsen & Svarstad, 2021). Based on Earth System sciences, degrowth scholar Jason Hickel (2019) argues that there exist several planetary boundaries that must be respected if to avoid further socioecological and environmental crisis. He argues that there are five planetary boundaries that have already been overshoot, which are climate change, biodiversity loss, land-system change, phosphorous loading, and nitrogen loading. Furthermore, ocean acidification is presumed “two-thirds of the way to the boundary” in terms of what ocean ecosystems are capable of enduring (Hickel, 2019, p. 18).

Central to the degrowth movement is also its critiques of decoupling rationales. This thesis has, similarly to degrowth scholars Erik Gómez-Baggethun (2020) and Michael J. Albert (2020), acknowledged that resource making can be somewhat flexibly constructed and that some level of decoupling can occur. The question has been raised whether biotechnology and the bioeconomic industry can succeed at decoupling economic growth from production, as some have argued that these technologies can lead to revolutions in food production such as the green revolution priorly has done (Hessen, 2020; Albert, 2020). However, with the intensification of production and efficiency lead by the green revolution, several ecological and animal welfare implications have followed (Rutt & Jakobsen, 2022). As Gómez-Baggethun (2020) points out, industrial agriculture and farming may “use less resources and pollute less per unit of product, but they produce more, use more resources, and create more pollution overall” which has furthermore “increased resource use and pollution in absolute terms”, making industrialization lead to “*more* efficiency and *less* sustainability” (p. 4). On the note of this, it is uncertain whether biotechnology can achieve the sustainable growth and animal welfare as suggested by some of the documents and informants, and furthermore succeed where similar ‘revolutions’ have priorly failed. Further, Gómez-Baggethun (2020) argues there is “no empirical evidence supporting a decoupling of economic growth from environmental pressures on anywhere near the scale needed to deal with environmental breakdown” and that this is not likely to occur in the time to come either, making blue growth a barren proposition for solving the socioenvironmental ocean-bound issues currently unfolding (p. 4).

The degrowth movement is however more than just a discussion on the limits to growth. It is a multifaceted movement that calls for the reimagining of societal priorities and values in society at large, promoting more holistic, just, convivial, and sustainable ways of organising society (Ertör & Hadjimichael, 2020; Hickel, 2020). Core principles of the degrowth movement include strengthening local governance and production, redistribution of wealth, equality, and alternative economic modes that diverge from current growth dependencies (Ertör & Hadjimichael, 2020). However, one of the main critiques of the degrowth movement is that it primarily originates from western countries in the Global North (Ertör & Hadjimichael, 2020; Hickel, 2020). Therefore, concerns have been raised about how the term degrowth may not be very well-suited for communities and ways of life outside Euro-western cultures and knowledge systems (Ertör & Hadjimichael, 2020). For this reason, it has been suggested that degrowth should not aim to create blueprints to fit all cultures, nations, and communities. Instead, it should be understood as a movement composed of alternatives that challenge current mainstream growth-dependent and neoliberal governance. Furthermore, whenever referred to or pursued, degrowth should always be sensitive to the particular context, community, and environment which it finds itself (Cavallo et al., 2023).

Moving on to the blue segment of degrowth, the blue degrowth movement strives to find better alternatives to what it regards as blue growth's "narrow vision of monetary-valued growth" (Cavallo et al., 2023, p. 2). The blue degrowth movement represents a collaborative effort involving small-scale fishers, local communities, non-governmental organizations (NGOs), Environmental Justice Organizations (EJOs) and scholars (Ertör & Hadjimichael, 2020). At its core, the movement shares a common goal to strengthen the rights of "local coastal communities, small-scale production, local consumption, and fishing as well as consumption cooperatives, and (participative) common management of marine areas" (Ertör & Hadjimichael, 2020, p. 5).

The blue growth discourse and the blue degrowth movement have different views on how they perceive socioenvironmental issues and their proposed solutions for addressing them. This is something that reflects their contrasting onto-epistemological approaches to ocean governance and blue economy. The blue growth rationale suggests that decline in ocean ecosystems and species is mainly due to inefficient ocean governance, and that these issues can be resolved by improving efficiency and increasing technical and scientific investments to address management challenges (Blasiak et al., 2020). It also claims that financial incentives for previously neglected ecosystems and species can lead to more sustainable governance and blue economies. On the other hand, the blue degrowth movement takes a different stance. It emphasizes the need to respect planetary boundaries and, where possible and socially fair, degrow certain sectors of the ocean industry whilst supporting small-scale and autonomous food production from the sea (Ertör & Hadjimichael, 2020). According to this perspective, the primary driver of ocean degradation is not technical issues or efficiency. Rather, it is capitalist modes of extraction and production, overconsumption, and distribution conflicts (Cavallo et al., 2023; Ertör & Hadjimichael, 2020; Hickel, 2020).

These debates raise questions about responsibility and problem framing when dealing with socioenvironmental challenges. Throughout this thesis, it has been emphasised how this is a central focus in both political ecology, science, and technology studies as well as Transformative Biodiversity Governance (TBG). As these field argue, the ways we frame problems, and furthermore how society attempts to fix these issues are both political and normative processes (Goldman et al., 2011; Jasanoff, 2004; Robbins, 2020b).

Political ecology and TBG scholars argue that how actors frame problems and their preferred solutions depend on their perceptions of human-nature (Goldman et al., 2011; Keune et al., 2022). In the context of the ocean genome imaginary and blue growth discourse, responsibility is attributed to all of humanity when explaining the global environmental challenges. This perspective does not distinguish between high-income or low-income countries, nor high-emission and low-emission communities and industries. As accentuated by Hickel, the "vast majority of ecological breakdown is being driven by excess consumption in the global North, and yet has consequences that disproportionately damage the South" (Hickel, 2020, p. 1109). Despite this difference, both the Ocean Panel's document and the EBP-Nor's leave out underlying and indirect drivers of ocean degradation, such as socioeconomic structures and unsustainable consumption cultures.

The blue growth and parts of the genome imaginary thereby rests on a particular narrative that steers attention towards managerial and techno-positive fixes, rather than evaluating underlying unsustainable socioeconomic structures like consumption patterns in the Global North that overshoot planetary thresholds. Jason Moore (2017) argues that attributing the current planetary crisis to humanity as an "undifferentiated whole" such as the Anthropocene, is both apolitical and misleading (p. 2). Moore challenges the prevailing narratives in (blue) growth and mainstream sustainability governance. Like degrowth, he suggests that the socioenvironmental crisis is due mainly to current global capitalist mode of extraction and production that depends on continuous growth despite its harmful effects on both human and the environment (Moore, 2017). Similar to blue degrowth, responsibility is thereby shifted away from all of humanity, and rather placed on economic modes of production such as capitalism and its underlying ideologies. Based on these discussions and Jasanoff's (2015) notion that movements of resistance can reveal alternative ways of organizing and imagining the future, the forthcoming section will now apply ideas from blue degrowth and TBG to discuss alternative ways of envisaging the utilization of marine genetics.

Blue Prosperities for Coastal Norway – Reorienting Ideas of Purpose, Power, Narratives, and Wealth

As Ginsberg (2017) underscores, "no future is inevitable, they are made" (p. 153). The same genetic material and information from marine species can be used to build vastly different sociotechnical imaginaries and futures, which makes the collection and utilization of marine genetics far from an apolitical and objective endeavour. Both are activities guided by goals and expectations of what the future should look like and how nature ought to be used by society (Parry, 2004). Thusly, current explorations of marine genomics do not only advance our knowledge about marine life and evolution, as well as species capacities to respond to or go extinct in face of climate change and ocean degradation. The collection and exploration of marine genomics also open up for new biotic futures. These futures are fleeting as the innovations and artifacts developed by science grow in relation to larger societal norms, cultures, and expectations. Marine genomics in Norway are currently collected and explored for the further growth of blue economies. However, with emerging movements urging for a paradigm shift that step away from growth-dependency and look towards other forms of governance and socioeconomic solutions, it should be asked whether principles from these movements could be applicable to build different sociotechnical imaginaries. In these sections, I discuss this in relation to how marine genetics are collected, how their benefits are shared and furthermore the novel artifacts that innovators anticipate that they can produce.

Collecting Marine Genetic Diversity with Value Pluralism in Mind

New technologies are making it easier to collect and alienate genetic materials and information from organisms than ever before through tools such as eDNA and advanced computational resources (Blasiak et al., 2020; Parry, 2004). Now executing out what is considered to become the largest project in the history of biology, the global and national levels of the Earth BioGenome project are seeking to collect all genomic information stemming eukaryotic life across the globe in a ten-year time frame. But as meticulously revealed by Bronwyn Parry (2004), what is being gathered under collection projects like these mirror larger societal objectives. This thesis has therefore attempted to investigate what is ultimately being prioritized and collected in contemporary collecting projects related to marine diversity in Norway today.

The Earth BioGenome project, as outlined in Chapter 4, states its mission as collecting, cataloguing, and characterizing all of Earth's eukaryotic species with the aim of growing bioeconomies as well as developing better ways to monitor and preserve nature's biodiversity (Earth BioGenome Project, u.d.). The same goals are shared by the EBP-Nor, who also suggest that "Knowing the complete DNA sequences (genomes) of all species of life on Earth will (…) present an unpresented gold-mine of scientific data for biotechnology, medicine and drug development bioprospecting, new biomaterials, biofuels and bioproduction (including aquaculture, horticulture and livestock production)" (Jakobsen et al., 2020, p. 2). The projects hence present their objectives as collecting genetic material and information for strengthening knowledge and sustainable management of nature and biodiversity, as well as collecting Earth's eukaryotic species in hope of finding genetics that could be utilized for novel bioeconomic products. However, the empirical findings of this thesis indicate that due to funding principles set by the Norwegian Research Council (NRC), Norwegian collection projects risk favouring the latter objective. This is based on how the NRC has facilitated stronger science-industry collaborations by requiring EBP-Nor to partner with entities from the beginning of the project. These requirements are in line with objectives made in Norwegian governmental strategies on bioprospecting, the *Marine bioprospecting – a source of new and sustainable wealth growth* published in 2009. In this strategy, it is suggested that management systems must be strengthened that aim at the "commercialisation of [marine genetic] research results" (Norwegian Ministries of Fisheries and Coastal Affairs, 2009, p. 7). As Clara from EBP-Nor informed, the inclusion of other non-commercial stakeholders had been undermined in the national project, something she suggested has permeated the overall organisational structure of the research initiative. Clara and Thomas contrasted EBP-Nor to the EU-funded European level of BGE, where requirements of justice, equity, diversity, and inclusion have prompted the establishment of committees to ensure these principles. Further, the European level had also established specific sequencing requirements designed to ensure the scientific inclusion of countries and groups with fewer financial resources.

While research in the natural sciences often presents itself as objective and free from normative objectives, this thesis illustrates the continuous co-production of scientific endeavours and its sociotechnical artifacts with the rest of society's politics and norms

(Jasanoff, 2004). In the context of the collection of marine genetics through the EBP-Nor initiative, it is apparent that commercial interests take precedence through the funding mechanisms established by the NRC. This may also be true when it comes to the actual collection of marine genetics, as Clara informs that industry partners have the ability to influence the selection of species which are to be collected by the research project, based on which species these industry partners anticipate to bring about commercial products for the bioeconomy. Thomas also claimed that the collection requirements within the EBP-Nor project were much looser than those of the European level, as they were more personally influenced by project members. Another indication of the widespread influence of commercial interests permeating the collection projects came from a representative of Rev Ocean, who asserted that collecting marine genetics is crucial to do before species go extinct, as these materials and information will become vital for future industrial bioengineering. As such, it is evident that commercial values and objectives wield significant influence over the data collection process in the EBP-Nor project.

Monetary valuations of nature have become common practice in biodiversity governance as ecosystem service perspectives gain momentum in the international governance on biodiversity (Keune et al., 2022). Ecosystem services can be defined as the "direct or indirect contribution to sustainable human well-being", which Keune et al., (2022) suggest can create an "anthropocentric and instrumental perspective on nature while acknowledging the intrinsic value of species and ecosystems" (p. 30). However, concerns have been raised about ecosystem services potentially favouring monetary aspects of nature over other value perceptions (Brand & Vadrot, 2013). This thesis supports the notion that there exists a myriad of onto-epistemological approaches to nature that vary among social groups, geographical regions, and cultures, and that this influence how nature is valued (Goldman et al., 2011; Keune et al., 2022). The values of nature can furthermore be defined as "sets of beliefs/concepts upheld by people about the meanings of different dimensions of nature, influencing one's behaviour towards the natural world (Brondízio et al., 2021, p. 486). As suggested by Keune et al., (2022), some nature perceptions that deviate from commercial valuations of nature are nonmaterial values such as culture and identity, Rights of Nature (an emerging framework advocating knowledge and values of Indigenous and local communities) and non-economic values such as harvesting nature for food sovereignty.

As of now, EBP-Nor lacks the necessary parameters to secure social and environmental objectives they are bound to oblige to through juridical commitments Norway is part of. One of these is the Convention on Biological Diversity, which underscores states obligations to

> "(…) respect, preserve and maintain knowledge, innovation and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices (..)" (§ 8-j).

Indigenous and local communities can have vested interests in the conservation and use of biological and genetic diversity. However, Sámi people and local coastal communities have not been included or engaged in the Norwegian EBP-Nor project, whom are actors who may hold different perspectives and ways of using nature that go beyond commercial interests, such as for example biocultural values and food sovereignty. Excluding such groups from biodiversity governance and collection projects, and failing to respect their rights or interests, could, at worst, result in ethical and juridical violations (Ministry of Local Government and Regional Development, 2018). Furthermore, this can undermine the integrity of scientific research projects, such as genomic collection projects and their future applications, like conservation and industrial pursuits.

To align with tenets such as those from the CBD, it is imperative that EBP-Nor and other ongoing genomic collection projects in Norway actively facilitate inclusive participation and furthermore secure the rights of non-commercial stakeholders such as coastal and Sámi communities. By proactively involving groups and individuals who possess traditional knowledge and practices related to the ocean, a more inclusive and equitable approach can be achieved in these research projects. This becomes particularly crucial at the outsets of the UN Decade of Ocean Science, where local expertise and indigenous knowledge are being undervalued in favour of more generalisable knowledge systems (UiO, 2022). Furthermore, by expanding the scope of their research collaborations and implementing more deliberative procedures, EBP-Nor and similar initiatives can enhance transparency, ensuring that the collection of genetic materials and information serves the broader public interest rather than primarily benefiting industry partners.

Bridging Blue Degrowth and The Ocean Commons Principle Seeking Alternative Ocean Futures

As we transition from collection to regulation of marine genetic resources, I will now bridge principles from blue degrowth, TBG and the Norwegian Marine Resource Act to explore the possibility of alternative blue economies. To start, I will share an anecdote to shed light on past ambiguities regarding the ownership of wild living marine resources and their association with the Norwegian Marine Resource Act.

For centuries, the utilization of wild living marine resources, particularly in the context of fisheries, has been one of Norway's most crucial export industries. Just like resources obtained from marine genetics, Norwegian fisheries are subject to the Norwegian Marine Resource Act (NMRA), which aims to ensure ocean-bound economies are done sustainably, as well as prosperity for coastal communities and the ongoing settlement in these regions. As such, the NMRA addresses not only property rights and benefit sharing, but also encompasses socioeconomic policies designed to keep coastal communities alive and prosperous, whilst also ensuring resource sovereignty and autonomy.

The NMRA is built upon the premise, and moreover traditional Norwegian understanding of the oceans as 'åpen allmenning', which translates to the ocean as common resource and property (NOU 2006: 13). However, the act has raised debate recent years as fishery policies in Norway has led to capital and resource accumulation upon a few, large businesses instead of generating local jobs and sovereignty in coastal Norway. This issue has been highlighted by Ottar Brox, a Norwegian social science researcher, renowned for his analytical work on Norwegian fishery politics. Through his work, Brox (1966) illuminated how the Norwegian state has enabled the transfer of wild living marine resources from local and small-scale fisheries to industrial, large-scale companies through the accumulation of fishing quotas. The initial idea behind this policy was that as fishing quotas were transferred to large-scale fisheries, these companies would be obliged to a delivery policy. This delivery policy entailed that fish was to be processed and manufactured in local facilities before exported out of the region, thereby stimulating economic activity, and ensuring jobs in coastal communities close to where fishery had been executed. These obligations were however not followed, as these companies exported the fish and had it processed and manufactured in lower-cost countries instead (Therkelsen, 2014). This led to a concentration and accumulation of common wealth resources derived from the sea and fisheries instead. Consequently, it has also made it harder for younger generations to establish themselves as fishers, given the exorbitantly high prices of fish quotas. This is particularly evident in Northern Norway. One of the peoples and companies that accumulated the most wealth and fishing quotas from these policies was and continues to be Kjell Inge Røkke and his large-scale trawling company (Voktor, 2022). Røkke has ultimately become one of Norway's wealthiest individuals due to fishery industry. In 2022, he relocated to Switzerland. Consequently, he became the one taking out the largest fortune from Norway to Switzerland, paying far less taxes than he would have in Norway, thereby transferring furthermore wealth from the regions where his companies have accumulated wealth from marine organisms and common resources (Alnes et al., 2022). In response to these regulations and the soaring prices on fishery quotas, which has made it challenging for local residents to establish themselves as small-scale fisheries, various civil resistance movements have emerged in Norway opposing the ways Norwegian policies have facilitated the accumulation and transfer of resources and sovereignty, such as the Coastal Revolt and the initiative 'Take the Oceans Back and Put the Soil to Use' [16].

Due to its terminology, degrowth has been affiliated with negative connotations such as economic regression as critics have raised concerns about whether scaling down the economy might jeopardize essential needs required to for living good lives (Hickel, 2020). However, degrowth is not the same as regression. Rather, it represents a deliberate reduction of sectors that are unsustainable or unnecessary to ensure high quality of life where basic needs are met (Hickel, 2020). Furthermore, it emphasizes the equitable distribution of resources and wealth derived generated from economic activities that adhere to sustainable parameters (Hickel, 2020). When considering the practical application of degrowth in a Norwegian context, it is howbeit crucial to be mindful of the regional and socioeconomic disparities amid this wide-reaching country. Despite Norway being one of the world's wealthiest nations, significant differences exist in terms of access to public services. For instance, the northern regions of Norway, which are expected to possess most of the marine species of interest for the marine bioeconomy in Norway, grapple with depopulation and inadequate access to public services such as health care and education (SSB 2023; Yildiz et al., 2016). It is thereby reasonable to assume that proposals for descaling the economy could invoke resistance in these regions, as they are already struggling in face of socioeconomic challenges. However, as fishery exports from coastal Norway testify, Northern Norway is far away from being scarce in terms of access to natural resources and value creation. The primary issue, though, has been that the

[16] Authors translation. Original names "Kystopprøret" and "Ta havet tilbake og jorda i bruk».

monetary value generated in these regions through fisheries have been transferred from local communities to larger companies so that locals see none of its benefits.

Anticipations surrounding marine bioeconomy in Norway is growing, driven by progress in within genomic sciences and collection and outlooks for novel resource frontiers. However, the strong connections between the scientific and industrial sectors in marine genomic projects, supported by the Norwegian government and the Norwegian Research Council, raise concerns that similar transfers of monetary value from wild living marine resources in coastal regions could be further accumulated in the future of Norwegian marine bioeconomy. Both the Centre of the Ocean and the Arctic and the EBP-Nor White Paper fail to address how the utilization of wild living marine resources through the blue bioeconomy could bring value back to coastal regions where these species and resources originate from. They also neglect to address ownership rights of biodiversity of local and Sámi communities, which the Norwegian state is obliged to abide to through the NMRA and the Convention on Biological Diversity. The Røkke-owned company however, Rev Ocean, has been included and become a permeating influence and contributor in both the COA's document and the EBP-Nor project (as well as being part of authoring the Ocean Panel's ocean genome document). Rev Ocean's yacht, which is meant to serve both as a research vessel and as a luxurious yacht for tourism and voyages in polar regions, is still under construction. However, EBP-Nor made a collaboration with the company at the outset of the research initiative and intends to work together when the vessel is completed, as confirmed by project informants. Additionally, an informant from Rev Ocean revealed that the company has participated in research expeditions conducted by OceanSenses on the Norwegian research vessel FF Kronprins Håkon. Furthermore, he informed that Rev Ocean has engaged in lobby work during the international BBJN negotiations. Rev Ocean is thereby given the chance to do both policy influence and research work. In a documentary titled "The Struggle for the Coast" [17] released in 2022, directed by Hans Eirik Voktor, Ottar Brox stated the following:

> It is not Røkke that stole it [the wild fishery stocks]. It was the state that stole it and gave it to Røkke" [18].

Given the significant influence of Rev Ocean in national and international documents and research projects surrounding the collection of marine genetics and Røkke's further use of

[17] Authors translation. Original title «Kampen om Kysten".
[18] Authors translation.

MGR in his biotech company, it raises questions about how Kjell Inge Røkke and his industry-science pursuits may benefit from these endeavours. Furthermore, it prompts one to ponder whether the Norwegian state once again is facilitating the transfer of value derived from wild living marine resources away from their original regions to privately owned companies.

As genomic sequencing projects evolve and accelerate, a more extensive and deliberative debate is therefore sorely needed to discuss the regulatory framework for genetic resources in Norway. Through this, it must be explored what mechanisms could be applied to ensure that marine genetic resources (MGR) are employed in a way that benefits not only businesses but also the regions from which these resources originate. As has been discussed, it is important to note that fair access and benefit sharing from MGR extends beyond the implementation of open-source solutions. It also involves decisions between what is constituted as economic and non-economic, and who benefit from diverse jurisdiction (Goven & Pavone, 2015). As the latter chapter argued, existing patent laws differentiate the informational values and their applications from the organisms which they are derived. This makes companies less obliged to share benefits from genetic resources with the regions from which these compounds originated. Furthermore, a more thorough inquiry is needed to investigate the interests, power, and influence held by industry collaborators such as Rev Ocean and ArcticZymes as they are given central roles in these science-industry endeavours. Such knowledge is critical to prevent scenarios in which control and benefits associated with MGR are shifted from the state and local communities to the industries, akin to what has happened in the case of Norwegian fisheries. Similar to the core principles of the NMRA, the fundamental objectives of blue degrowth are as we've seen to ensure sustainable blue economies and thriving coastal communities with resource sovereignty at their core. This involves building economies that prioritize resource sovereignty, self-sufficiency, and the well-being of people (Hickel, 2020). Instead of perceiving blue degrowth as regression, it can be aspired to as a guiding principle set at reorienting power and accumulative wealth away from few, powerful industry actors to the benefits of the people, based on the Norwegian oceans commons principle.

However, (blue) degrowth goes several steps further than only proposing fairer benefit sharing from natural resources. The movement furthermore advocates for a "different economy altogether", one that does not rely on growth in the first place (Hickel, 2020, p. 1108). Similar to Transformative Biodiversity Governance (TBG), it argues that growth that jeopardizes environments and biodiversity must be replaced with economic models that respect ecological thresholds whilst simultaneously meeting social needs (Gómez-Baggethun 2020; Visseren-Hamakers & Kok, 2022). As such, it is not enough asking how to equitably distribute benefits derived from natural resources. It should furthermore be asked what (blue) economies should grow and which should not, and what role science and technology should play in these developments.

The UN's slogan for the Decade of Ocean Science for Sustainable Development 2021-2030 has been "The science we need for the ocean we want". Ellen Marie Krefting, professor in the history of ideas at the University of Oslo, remarks that this slogan is interesting because it implicitly suggests "that the ocean we want, is something we can create"[19] (UiO, 2022). Likewise, the ocean genome imaginary propose that the future ocean is something we can both control and create through the help of technology and science. However, as argued in this thesis, connections between scientific discovery and innovation are far from a linear deterministic path. Instead, technology and innovation interact with a wide range of enterprises far beyond labs, machines, and tech hubs. They are intrinsically interlinked to and influences by political interests and norms (Jasanoff, 2004). This thesis has therefore attempted to answer who exactly takes part in envisaging, thereby potentially creating novel ocean futures. Are some voices and values left out of these equations? And moreover, who are the interests of these technologies and innovations serving, and who sees the benefits and furthermore the negative consequences of these innovations and prescribed futures?

As critical discourse analysis and empirical investigations has illuminated throughout this thesis, the sociotechnical imaginary of a prosperous, sustainable, and equitable ocean through genomic science and biotech is an imaginary co-produced by a disclosed network of science, industry, and state interests. Through holistic approaches, these actors claim these ocean futures will help solve global socioenvironmental issues such as food sovereignty and climate change. Stilgoe (2013) elucidates how science and innovation the recent decades have sought to tackle so-called 'grand-challenges' like these. However, they've deemed yet to fulfil many of these endeavours, despite science and technology having never been as productive as now (Stilgoe, 2013). Stilgoe further argues that "There are reasons why the world's combined innovative capacity has spewed forth iPhones and space shuttles but not yet managed to produce clean energy or universal access to clean water" but that also argues that "This sort of imbalance is not inevitable" (2013, p. xii). These trends can be explained due to science and

[19] Authors translation.

innovations lack of engagement in the fears, hopes, concerns, and needs of the public. Instead, the common trend in Europe has been that science and researchers are expected to “demonstrate that [their science and innovations] are having ever-greater economic impact” to public funders (Stilgoe, 2013, p. xiii). Beck (1995) argues that without adequate public engagement and regulations that guide science and innovation in a just and sustainable direction, innovation can become a form of organized irresponsibility. This happens when the potential of science, innovation, and technology are left to be dealt with by regulators and the future, rather than being carefully considered and assessed during their developments (Beck, 1995). Currently, the regulatory system for science and technology is designed in a way that regulators have to predict the emergence of new technologies and respond accordingly. Whether these innovations are “controlled in the public interest is largely a question of luck” (Stilgoe, 2013, p. xiv).

This trend is also observed in blue growth and ocean genome imaginaries, as these initiatives as these initiatives are primarily funded, ordered, and envisioned by the government and institutions constituted for the sake of growing the blue economy, such as the Ocean Panel and the Centre for the Ocean and the Arctic. As a result, there is a noticeable absence of more impartial, non-commercial, and alternative sustainability perspectives among these initiatives and the envisioned ocean futures that could critically examine the sustainability claims put forward by these actors. Many of the innovative developments surrounding marine genetics now find themselves somewhere amid imaginaries, research projects and suggested industry ventures. Many of these are aimed at expanding the aquaculture, pharmaceutical, nutraceuticals and food industry. These industries, driven by biotechnologies and new harvesting techniques, are broadening the scope of how one can extract and utilize marine ecosystems. However, as this thesis has highlighted, coastal stakeholders outside the realms of science and industry have not played a significant role in shaping these imaginaries.

An example of such extension in marine bioeconomics is krill harvesting. In addition to being involved in collecting samples for genetic sequencing through Rev Ocean, Kjell Inge Røkke is also owner of Aker BioMarine, a biotechnology and krill harvesting company focused on developing krill-based products for “aquaculture, pet food and human consumption” (Aker, n.d.). Concerns have been raised about krill harvesting by small-scale fisheries throughout coastal Norway, with demands for a complete halt to such harvesting practices. This is due to the degrading impacts krill harvest can bring on the rest of marine ecosystems, as krill serves as the primary food source for herring and mackerel, and furthermore the high chances of catching cod and other fish broods when krill trawling (Trygstad & Thonhaugen, 2021). This serves as an example of the marine bioeconomies that the Norwegian state aims to expand by growing scientific knowledge about ocean genomics and its commercial opportunities.

The Ocean Panel and the COA also aspire to use marine genomic knowledge for finding new opportunities within genomic breeding, so to domesticate more marine species for industrial aquaculture. Currently, about ten new marine species are introduced into aquaculture every year, but the Ocean Panel suggests that there is "significant potential to domesticate all 3,000 species harvested from the ocean as human food" (Blasiak et al., 2020, p. 18). In Norway, research is already underway on the domestication of cod, halibut, catfish, mussels, and seaweeds (Stenseth et al., 2021). However, there have been long-standing concerns raised by local communities, NGO's, and scientists regarding the impacts of aquaculture, included issues relating to animal welfare and escapees (Movik & Stokke, 2014). Recent reports by NRK have revealed mass deaths in Norwegian aquaculture facilities and violations of guidelines made by some of the largest aquacultural companies in Norway (Tomter et al., 2023). The Norwegian Fishermen's Association in Nordland has expressed intentions to sue the government for insufficient governance and research of the consequences of aquaculture, as they argue this has led to the destruction of fishing grounds due to pollution, resulting in the loss of future income and rural development (Trana & Sea-Khow, 2018). Despite widespread concerns and the implications that aquaculture pose on small-scale fisheries and food sovereignty through coastal Norway, Norwegian governments continues to pursue plans to expand aquaculture, something also further envisioned in the ocean genome imaginary (Nærings- og fiskeridepartementet, 2019).

According to documents and informants, the issues within aquaculture could potentially be addressed through genomic breeding that could find species better suited for domestication (Stenseth et al., 2021). Further, the national Institute of Marine Research now finds itself at the forefront of another sociotechnical experiment. For ten years the institute has researched genetically modified salmon without germ cells, an experiment aimed at mitigating the problem of genetic erosion that can occur at fish escapees (Løland, 2023). The institute has now applied for permission to release these salmons into aquaculture farms at sea to see how they respond to these environments. After conducting a risk assessment, The Norwegian Scientific Committee for Food and Environment expressed concerns that the experiment poses significant risks. Representatives of the committee claim that it cannot be verified that all the genetically modified salmons are sterile. It these salmons escape fish farms, they could thereby at worst reproduce and furthermore transmit hidden sterility to wild salmon. This could be detrimental to the wild salmon, representatives from the committee argue. Further, they expresses concerns that sterile salmon that escapees fish farms may consume a significant number of small salmons, which ultimately could threaten the wild population (Løland, 2023). When asking informants about the future of genetic editing and engineering in Norway, some seemed hesitant to talk about it. Others, in contrast, expressed positive attitudes, claiming that genetic editing and engineering does not deviate greatly from previous genomic and mutation techniques in industrial agriculture. These diverging attitudes show well how controversial and widespread opinions on genetic engineering is also within scientific communities. With science and industry going as far as genetically modifying species to continue economic expansions, it should be asked how far society, with the help of science and technology, is willing to go for the sake of growth? And to whose benefits are these growth imaginaries serve?

There is a growing demand in Europe for greater acknowledgement of public interests and interdisciplinary collaboration in the making of science and innovation. This is expected to become even more important in the future as technologies will pose larger interventions and changes to society (Stilgoe, 2013). When asking what "futures we want science and innovation to bring into the World" (Owen et al., 2013), it is hence rudimentary to involve civil society and researchers from outside just science, technology, and innovation so to explore what society desires and needs, and furthermore what motivations lay behind sociotechnical creations. Embracing diverse perspectives and promoting transparency can ensure that science and innovation serve in the interests of the public, not just the industry and state, as suggested by Sykes and Macnaghten (2013), whilst also illuminating the public's fears, concerns and hopes regarding the application of science and innovation.

This thesis does not condemn the exploration and mapping of marine genetics as inherently bad or solely executed for exploitative and commodifying purposes. On the contrary, these ocean knowledges may provide crucial information about species priorly unfamiliar and unapproachable to humans and presenting novel scientific tools to address the crisis faced by marine ecologies. However, it underscores widespread public concerns regarding industries like aquaculture and other bioeconomies and the complications they can cause local resource sovereignty and small-scale local economic activities such as fisheries. It also illuminates the evident overshadowing of non-commercial stakeholders in the sociotechnical ocean imaginaries. Within a blue degrowth framework, small-scale industries, food sovereignty and local production is prioritized before quick-fixes and (uncritical) growth for the sake of growth (Ertör & Hadjimichael, 2020). As this thesis chapter has illustrated, small-scale fisheries and the growth of bioeconomies such as aquaculture and krill trawling are difficult to merge without detrimental consequences for fisheries and local food production and sovereignity. Further so, small-scale fisheries have shown to cause far less ecological impacts than trawling as well as aquaculture (Ta havet tilbake og jorda i bruk, 2021). Overlooking the interests and concerns voiced by fisheries is as such counterintuitive if the end goal of the ocean (genome) imaginary and the blue economy is to ensure sustainable blue economies and food security. As such, this thesis argues that if not socially and politically attuned and transparent, science and industry dealing with and employing marine genetics may risk jeopardizing the marine genetic diversity and the best of coastal societies, which they proclaim to advocate in their win-win discourses.

The ocean genome imaginary is fundamentally technocratic, composed of strategies and futures shaped by expertise that involves and demands that participators hold on to intricate knowledges. This complexity can pose challenges to the idea of creating deliberative debates because public engagement requires that civil actors attain sufficient levels of knowledge and understanding of the technologies and innovations that are proposed (Sykes & Macnaghten, 2013). Furthermore, this knowledge-sharing process must occur as transparent and impartial as possible, something which this thesis has shown to be difficult due to the political and normative dimensions existing among sustainability and human-nature perspectives. However, democratic engagement and the right of civil society to take part in shaping their own futures should not be deviated due to complexity. As STS scholars point out, science and technology are world-making activities, as the imaginaries visioned and crafted by current pioneers may become the (oceanic) realities of civil society and local communities in the future. Therefore, in the midst of technological progress and national negotiations regarding genetic engineering and the creation of modified species, it is timely to put more emphasis on critical perspectives on science and innovation that are not solely driven by the interest of growth. To inform the public about such alternative perspectives, TBG and degrowth principles can serve as valuable critiques and forms of engagement.

However, there are several challenges and obstacles to the potential incorporation of TBG and blue degrowth principles in the future utilization of marine species and their genetics in Norway. One initial barrier is related to the interests of the Norwegian state, as it has, through funding requirements, promoted stronger science-industry collaboration while neglecting national obligations meant to ensure representation for other non-commercial stakeholders, such as local coastal communities and Sámi people. Another obstacle is the prevailing dominance of growth discourses and rationales in both state interests and scientific imagination. Despite scientists often claiming their work to be objective and following a linear path (Stilgoe, 2013), this thesis has demonstrated the opposite. Growth rationales and techno-positivism can, as this thesis has argued, lead to epistemic selectivities and rationales like the economy of repair (Brand & Vadrot, 2013, Huff & Brock, 2023). Relying too much on technological fixes risks overshadowing other critical alternatives to sustainable futures, such as degrowth or ecological economics (Rutt & Jakobsen, 2022). It is worth noting that degrowth has also been critiqued for being too vague and of lacking the necessary planning systems and regulations so to transition from idea to practice (Foster, 2023). In addition to its Blue Papers, the Ocean Panel published an independent article featuring suggestions made by independent authors on opportunities for stronger ocean equity. In this paper, a small section is contributed to debates on the limits to growth. It furthermore suggests scaling back over exploitative ocean industries, suggesting that "a sustainable ocean economy should be aware of environmental and social limits on growth and consider degrowth where appropriate" (Österblom et al., 2020, p. 2). As a counter issues of vagueness and lack of planning in degrowth, these authors suggest practical suggestions such as "constructive and science-based conversations, scenarios and piloting of approaches" (Österblom et al., 2020, p. 39).

Due to its far-reaching proposals and its encouragement for deep-rooted and radical shifts in the ways we organise the economy and the rest of society, degrowth been dismissed as an utopian project, and one that could lead to economic regression and social injustice at worst (Hickel, 2020). In response to these claims, Gómez-Baggethun (2020) draws a comparison between the utopia of degrowth to the utopia of modernism. According to Gómez-Baggethun, a vast majority of the world today finds itself within the technological utopia of modernism, which he, like TBG scholars, claims can reinforce environmental degradation and social injustice by "offering false solutions to the environmental challenges of our time" (2020, p. 2). Further, he argues that "science is pointing out that humanity has never been moving faster nor further from sustainability than now" (2020, p. 4). As such, ecomodernism supported by its techno-optimism and green growth paradigm is a leading example of utopias, as it entails a vision of conceivable sustainable futures not yet achieved. What distinguishes the degrowth utopia from the ecomodernist utopia, Gómez-Baggethun argues (2020), is its attempt to challenge the belief that capitalist modernization and technological innovations will bring the world out of its planetary crisis.

Chapter conclusion

This chapter has argued the relevance of movements of resistance and their imaginary forces that can foster alternatives. In the case of Transformative Biodiversity Governance and blue degrowth, these movements of resistance critically re-evaluate current mainstream biodiversity and ocean governance, advocating deep-rooted changes instead that reorient our notions on human-nature relations, sustainability, justice, and sovereignty. In the case of the ocean genome, this has been done by discussing the importance of stakeholder inclusion during the collection of nature, and the current necessity to include groups outside science-industry realms into the collection of marine genomics. Further, it has taken a historical look at prior contentions surrounding the ownership and benefit sharing of wild living marine resources in Norway, asking whether the Norwegian state is once again facilitating the transfer of value from coastal areas to big companies. Lastly, it has discussed potential implications which the ocean genome imaginary may pose on local coastal communities if further enacted. By doing so, the chapter also contemplated on Norwegian expectations of continued blue growth and how this can jeopardize important facets of the blue economy such as such as small-scale fisheries and local food sovereignty.

As such, this thesis ends on a normative note, suggesting a change from dominant imaginaries such as decoupling and blue-green growth in face of the widespread socioenvironmental challenges. However, as STS and political ecology scholars proclaim, all knowledge making is shaped by its own norms and onto-epistemologies. As such, this thesis illustrates how win-win and blue growth rationales permeate marine sciences in Norway and become their own normative foundations.

9.

10. Conclusion

In this thesis, I have explored the ocean genome imaginary, focusing on how issues related to sustainable and equitable use and benefit sharing from marine genetic resources are understood, imagined, and enacted. Further, I have sought to answer who contributes to shaping this understanding and enacting, and who are potentially left out of the making of these ocean imaginaries and potential futures.

Chapter 2 provided the theoretical foundations of this thesis. Rooted in Science and Technology Studies and political ecology, this thesis resists beliefs of linear causality and objectivity within the realms of science, technology, and innovation (Jasanoff, 2004). Instead, based on Jasanoff's (2015) co-production idiom, this thesis argues that science and technology are world-making enterprises that have the power to shape and enact specific sociotechnical futures. Furthermore, these futures are constructed in tandem with the rest of society and its politics, norms, and ideologies. As political ecology also underscores, people's understandings of human-nature relations and what constitutes as sustainable reflects the myriad of different onto-epistemologies existing in society (Goldman et al., 2018). To explore whose visions gain prominence and bring about certain politics and futures, this thesis has applied Science and Technology Studies and political ecology to examine who participates in and holds power and influence in shaping policymaking and creating ocean futures through science and technology. The Sociotechnical Imaginary framework (STI) has throughout this thesis provided a suitable framework for such endeavours as its four-step approach made up by the origins of imaginaries, their embedment and extension and encountered resistance can illuminate how sociotechnical imaginaries "take shape in varied social and cultural contexts and how they in turn help reorient the evolution of those contexts" (Jasanoff, 2015, p. 322).

Before applying STI's four-step framework, chapter 3 clarified and discussed the methods employed in this thesis. Critical discourse analysis and a practice-oriented document analysis were applied to scrutinize the conceptualizations and discourses presented in various documents related to the ocean genome as well as emerging research initiatives. Given the novelty of these topics, semi-structured interviews were conducted with experts in the field to elucidate more about the collection and uses of marine genetics in a Norwegian context. The entire thesis project was carried out using an abductive approach, interlinking findings and theoretical frameworks together along the way.

Chapter 4 discussed the origins of emerging sociotechnical imaginaries and how they need to align with pre-established notions of how to organize nature and society to gain acceptance and traction in society (Jasanoff, 2015). It shed light on genomic and ocean imaginaries emerging through institutions such as the Ocean Panel, the centre for the Arctic and the Ocean and EBP-Nor, whereas the latter two have been established or funded by the Norwegian government. Moreover, it elucidated how these institutions convey genomic imaginaries and bioeconomic prospects through the discourse of blue growth which has its roots in green growth and decoupling rationales, which have strongly influenced sustainability and biodiversity politics in recent years. Scientists and industry have further extended this rationale as they present win-win solutions to ongoing socioenvironmental issues such as ocean decline. In these ocean imaginaries, genomic sciences can be utilized to catalyse bioeconomies such as aquaculture, novel foods, nutraceuticals, and pharmaceuticals, whilst claiming that this can simultaneously align with the preservation and protection of marine life.

Whether imaginaries transition from mere ideas to practices and tangible artifacts, hinges on whether they are embedded into society's structures and institutions (Jasanoff, 2015). Chapter 5 discussed how the ocean genome imaginary and blue growth rationale is embedded into the fabrics of society through governmental strategies and ongoing research projects such as EBP-Nor and FF Kronprins Haakon. This happens simultaneously with genomic sciences and biotechnology progressing and novel innovations making genetic sequencing remarkably cheaper and faster. Further, this chapter also reveals how sociotechnical fabrications forged by science and technology in Norway are co-produced in alignment with the aspirations of the Norwegian state regarding the expansion of ocean and bio-economies. This became evident when comparing requirements made by the NRC funded EBP-Nor and the EU funded European level of EBP. Whilst the EU funded ERGA and BGE were obliged to follow principles of justice, equity, diversity, and inclusion (their JEDI-strategy), the only requirement NRC made to the Norwegian EBP-Nor was that they had to bring on two industry collaborators from the start of the project. According to informants who had contributed in both levels, the funding requirements had in consequence permeated the whole organisational structure of the Norwegian level of EBP, arguing that EBP-Nor lacks mechanisms set at securing inclusive and equitable genomic research. The requirements made by the NRC align with the Norwegian governments' interest in fostering stronger collaboration between science and industry to make scientific discovery and innovation easier transferrable for industry purposes (Norwegian Ministries of Fisheries and Coastal Affairs et al., 2009). Furthermore, the chapter revealed that whilst the European level has developed a sorting algorithm and system set at averting that any personal favouring can occur when selecting which genomes should be sequenced, the Norwegian EBP-Nor has developed no such regulations. Instead, informants stated that genomes sequenced by the EBP-Nor was influenced more by what was available to the project as well as proposals from project members and suggestions made by industry collaborators looking for genetics useful to the biotech industry. Lastly, the chapter revealed how central stakeholders such as local coastal communities and coastal Sámi people have not been included in the Norwegian level of EBP, who are groups that the Norwegian state is obliged to include in matters of ocean and biodiversity governance through principles from the Convention on Biological Diversity and the Norwegian Marine Resource Act.

Chapter 6 discussed how the blue growth rationale and the ocean genome imaginary are part of extending green growth, decoupling and win-win rationales by presenting oceans as an emerging resource frontier (Brent et al., 2020; Tsing, 2003). By applying metaphors and narratives, the blue growth discourse and ocean genome imaginary attempt to legitimize further resource expansion in marine ecosystems already under pressure by claiming that blue growth can serve as a restorative economic approach (Huff and Brock, 2023). This assertion is built upon beliefs suggesting that novel technical tools and emerging marine sciences and industries can ameliorate and extend blue economies while simultaneously restoring degraded ocean ecosystems. This assertion is further extended by scientists and industries proposing that biotechnologies and genetic engineering can be leveraged for sustainability solution in for example the aquaculture industry (Blasiak et al., 2020; Stenseth et al., 2021). These proposals hold particular relevance in Norway today, as a the Norwegian Gene technology committee released a report on the regulation and use of genetic engineering and technology for a "sustainable future" June 2023 (NOU 2023: 18).

What constitutes as sustainable, however, is inherently political and subjective (Ginsberg, 2017). Chapter 7 elucidated this as it delved into current movements of resistance that challenge mainstream sustainability policies and biodiversity governance. Movements of resistance can unveil dissatisfaction with prevailing imaginaries and social structures (Jasanoff, 2015). Furthermore, they can unveil the existence of alternative ideas on how to organize society and the future (Ginsberg, 2017). Transformative Biodiversity Governance (TBG) is a movement that does exactly this by contending that current policies and governance are inadequate at tackling and addressing the pressing issues at hand (Visseren-

Hamakers & Kok, 2020). Therefore, the movement argue that a deep-rooted transformation is needed, one that steps away from solely relying on technical and managerial fixes, to a shift in socioeconomic structures and fundamental values that steps away from growth-dependencies (Visseren-Hamakers & Kok, 2020). The chapter also discusses how particular nature-culture perceptions can set the premises not just for sustainability and biodiversity governance, but also other societal fabrications such as jurisdiction and the ownership of marine genetics resources. Consequently, TBG suggests the exploration of alternative ways of organizing the economy and society in ways that respect planetary and ecological boundaries.

Chapter 8 brought movements of resistance one step further by illuminating the blue degrowth movement as counter-narrative to the prevailing green-blue growth rationales. Serving as an alternative to dominant blue growth discourses, blue degrowth is a movement advocating small-scale economies for the benefits of local resource sovereignty and food security. The chapter highlighted aligning principles between the Norwegian Marine Resource Act (NMRA) and the blue degrowth movement, as both underscore the importance of preserving local, sustainable ocean economies whilst securing prosperous and active local communities. However, the chapter revealed that the Norwegian state has previously failed to ensure that wild living marine resources, stemming from what is considered by Norwegian society and state as a commons resource, has benefitted coastal communities. On the basis the Norwegian states' interests in tighter science-industry collaborations in the sequencing and utilization of marine genetics, the chapter asks whether similar proceeding can occur through the use of the ocean genome.

In *Trading the Genome,* Parry (2004) asks the following about genetic collecting projects:

> Who is involved in underwriting or organizing these contemporary collecting projects? Where are these new materials being transferred to, how are they being concentrated and "disciplined", where and how are they being re-deployed, and, most important of all, to whose advantage? (Parry, p. 40).

Twenty years after Perry's publication, these questions are more relevant than ever as novel technologies and enhanced machine capacities are making genetic information and material more accessible and re-deployable than ever. This thesis has argued that what is collected from nature depends on the interests and objectives of the collector (Parry, 2004). Furthermore, the way these collections are utilized depend on what is considered desirable and achievable by society and its innovators. As this thesis has demonstrated, the collection of marine genetics in Norway today and the aspirations of its use, together forms a particular sociotechnical imaginary. This imaginary is constructed by a confined network of scientists, industry actors and state interests seeking win-win solutions that merge further exploitation of marine species and ecosystems under pressure, while also seeking to preserve marine life and diversity through species monitoring and conservation. However, what this thesis has underscored is that science and technology is a world-making endeavour that often strengthens and prolong taken-for granted notions of society. In the case of the ocean genome, this notion has been that (blue) economies can pursue infinite growth whilst also preserving the environment and non-huma life through decoupling economy growth from energy and material throughput. However, as degrowth and Transformative Biodiversity scholars have asserted, the decoupling of growth and resource flows at the scale needed to resolve our current planetary crisis has not yet happened, nor does it have grounding in empirical evidence (Gómez-Baggethun, 2020; Visseren-Hamakers & Kok, 2022). As the planetary crisis amplifies, resistance towards continuous economic growth for the sake of growth and mainstream biodiversity and ocean governance has occurred with movements such as Transformative Biodiversity Governance and blue degrowth, asking for deep-rooted change as against to the of continuation of the status quo.

In the wake of global attention surrounding the ocean, its state, and its resources, and furthermore with a focus on the collection of marine genomics and its potential usages, this thesis has provided an insight into the ways imaginaries can set the premise for the future, but furthermore how they also are subject to power-relations. In the case of the ocean genome imaginary, oceanic futures are created by the imagination and interests of the state, industry, and scientists. In its embedment and institutionalising, the project excludes stakeholders who may potentially live in these futures subject to aquacultural expansion and genetically modified marine species. While doing so, it overlooks the concerns voiced by civil society as they are expressing fears that their environments, livelihoods, and food sovereignty will be demolished with marine innovations and activities extending. This prioritization of science-industry collaboration and commercial interests over the consideration of the needs and concerns of civil society echoes a larger trend in genomic sciences and innovation (Hedgecoe & Martin, 2007; Stilgoe, 2013).

With concerns voiced due to the detrimental consequences of uncritical economic growth and the speed and progress of science and innovation, it is timely for the ocean genome imaginary and its innovators to make a jump out of their labs and offices and take a deep dive into the very environments and social contexts they are proposing their futures upon, to thoroughly consider the consequences that their inventions may ultimately have on both coastal communities and marine species if not sustainably, socially and locally attuned.

As projects focused on the collection and utilization of (marine) genetics unfold and progress in Norway and globally through “moon-shot” endeavours such as the Earth BioGenome project, a broader public debate is imperative to address the equitable distribution of benefits arising from the use of marine genetic resources. Concurrently, a necessity arises for deliberative debates and regulatory frameworks to assert how the valuation of marine genetic resources can be aligned with the principles of the Norwegian Marine Resource Act. Furthermore, research should be done to investigate whether commercial interests supersede the collection and sequencing of ecologically important organisms and environmental concerns, as EBP-Nor lacks organised sequencing requirements that can ensure the projects transparency and impartiality. As marine genomic research advances and expands in Norway supported by public funding, further research is imperative to investigate whether the ocean genome imaginary and its enactment is developing in the favour of industry or for civil society and the marine life it proclaims protect.

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Appendices

Appendix I

Consent form

Vil du delta i masterprosjektet "Unveiling the Ocean Genome: from conceptualization to utilization of marine genetics in Norway"

Dette er et spørsmål til deg om å delta i mitt masterprosjekt ved Senter for Utvikling og Miljø (UiO) som handler om havgenomet. Jeg ønsker å gjennomføre et intervju med deg da jeg tror du kan bidra med nyttig informasjon til mitt prosjekt.

Bakgrunn og formål

Formålet med prosjektet er å studere begrepet havgenomet. Ved bruk av diskursanalyse ønsker jeg å se nærmere på hvordan marine arter og deres genetiske informasjon forstås og fremstilles som havgenomet, samt hvordan dette samhandler i prosesser om marin ressursutvinning og vern. Prosjektets geografiske kontekst er Norge, med et særlig fokus på Arktisk.

I prosjektet vil jeg analysere internasjonale og nasjonale dokumenter som omhandler havgenomet, marint vern og marin bioprospektering og genteknologi. Jeg vil se nærmere på innsamling, kategorisering og de rettslige prosedyrene som omfatter havgenomet i Norge i dag.

Forskningsspørsmål per dags dato (masteroppgaven skrives på engelsk, men intervju kan foregå på engelsk eller norsk, alt etter hva som er ønskelig):

(1) How is the ocean genome conceptualized in Norway?
(2) What connections are made between the importance of exploring the ocean genome, commodification of marine genetic information and marine conservation?

Hvorfor får du spørsmål om å delta?

Det er et ønske at prosjektets utvalg skal ha en tverrfaglig representasjon av folk som har erfaring innen marin forvaltning og næringsliv, og/eller genetisk biomangfold og forskning. Ytterligere er utvalget basert på folk som har jobbet enten direkte eller indirekte med havgenomet i Norge, eller andre som jeg er blitt anbefalt å ta kontakt med av veileder og andre forskere på Senter for Utvikling og miljø.

Hva innebærer det for deg å delta?

Om du velger å bli med i prosjektet vil du bli spurt om å delta i et intervju på 45-60 min. Jeg har utarbeidet en intervjuguide, og det vil gis rom til personen som blir intervjuet å komme med ting ut fra egne interesser og erfaring. Intervjuene vil forekomme enten ved fysisk møte eller over video/telefon. Spørsmålene vil variere mellom de som intervjues, alt etter hvilken yrkes- og fagbakgrunn de ulike har. Et gjennomgående fokus vil imidlertid være kunnskapsinnhenting om marine arter og genetisk informasjon og marin bioprospektering og vern i Norge.

Når vi møtes vil jeg be om godkjenning til å ta lydopptak. Jeg vil også ta notater under intervjuet. Lydopptak vil senere bli transkribert og opplysningene fra intervju vil registreres elektronisk, for senere å bli slettet. Det er Tuva Saltermark (masterstudent, SUM, UiO) som vil gjennomføre intervjuene. Alle forskningsresultater vil publiseres anonymiserte med mindre noe annet er avtalt. I disse tilfellene vil personen som intervjues bli spurt om sitatsjekk og godkjenning før publisering.

Frivillig deltakelse

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.

- All data vil lagres på en sikker universitetsserver og beskyttes med et passord. Navn og kontaktinformasjon vil erstattes med en kode som lagres på en egen navneliste adskilt fra øvrige data.
- Personlig data vil kun være tilgjengelig for godkjente prosjektdeltakere: masterstudent Tuva Saltermark og veileder og professor Mariel Cristina Støen ved Universitetet i Oslo.

Deltakerne i denne studien vil ikke kunne gjenkjennes i denne publiserte masteroppgaven.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Etter prosjektslutt/når oppgaven er godkjent, vil datamaterialet med dine personopplysninger anonymiseres.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Universitetet i Oslo har Personverntjenester vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- Senter for Utvikling og Miljø ved Universitetet i Oslo, va Tuva Saltermark (tuvasaltermark@gmail.com) eller veileder og professor Mariel Cristina Støen (m.c.stoen@sum.uio.no)
- Vårt personvernombud: Roger Markgraf-Bye (personvernombud@uio.no)

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost (personverntjenester@nsd.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen
Tuva Saltermark
Masterstudent
Senter for Utvikling og miljø, Universitetet i Oslo

Jeg har mottatt og forstått informasjon om prosjektet [sett inn tittel], og har fått anledning til å stille spørsmål. Jeg samtykker til:

□ Å delta i intervju for denne masteroppgaven

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)

Appendix II

General sample of interview guide

- How would you define the ocean genome?
- Why is exploration of the ocean genome important?
- How is marine genetics currently being collected in Norway?
- Why is it important to explore and sequence marine genetics?
- Who selects the chooses which species are collected in your research project, and on what principles are these decisions made?
- Who has the ownership of genetic material and information acquired from marine genetic species in Norwegian waters?
- Which stakeholders are included in the knowledge production and research project surrounding the collection and utilization of the ocean genome?
- In what ways do included stakeholders engage in the research projects?
- Are there stakeholders outside science and industry who are included in the knowledge production surrounding the ocean genome, such as NGO's and local communities?

Additional questions for informants apart of EBP-Nor

- What is EBP-Nor, and what is its overall objective?
- At what stage is EBP-Nor currently today?
- Who are apart of the EBP-Nor in Norway today?
- Why do EBP-Nor collect and sequence genetics from eukaryotic species?
- How are the genetic information and material collected by EBP-Nor owned?
- How is the project financed?
- What will the data and information be utilized for?
- How is the work of EBP-Nor communicated to the public, and how do you work to get relevant stakeholders to become a part of the project?