ArcBlue

Enhanced Blue Economy Collaboration across Alaska, Greenland and North Norway

Report by Apostolos Tsiouvalas, Elise Nyborg & Andreas Raspotnik

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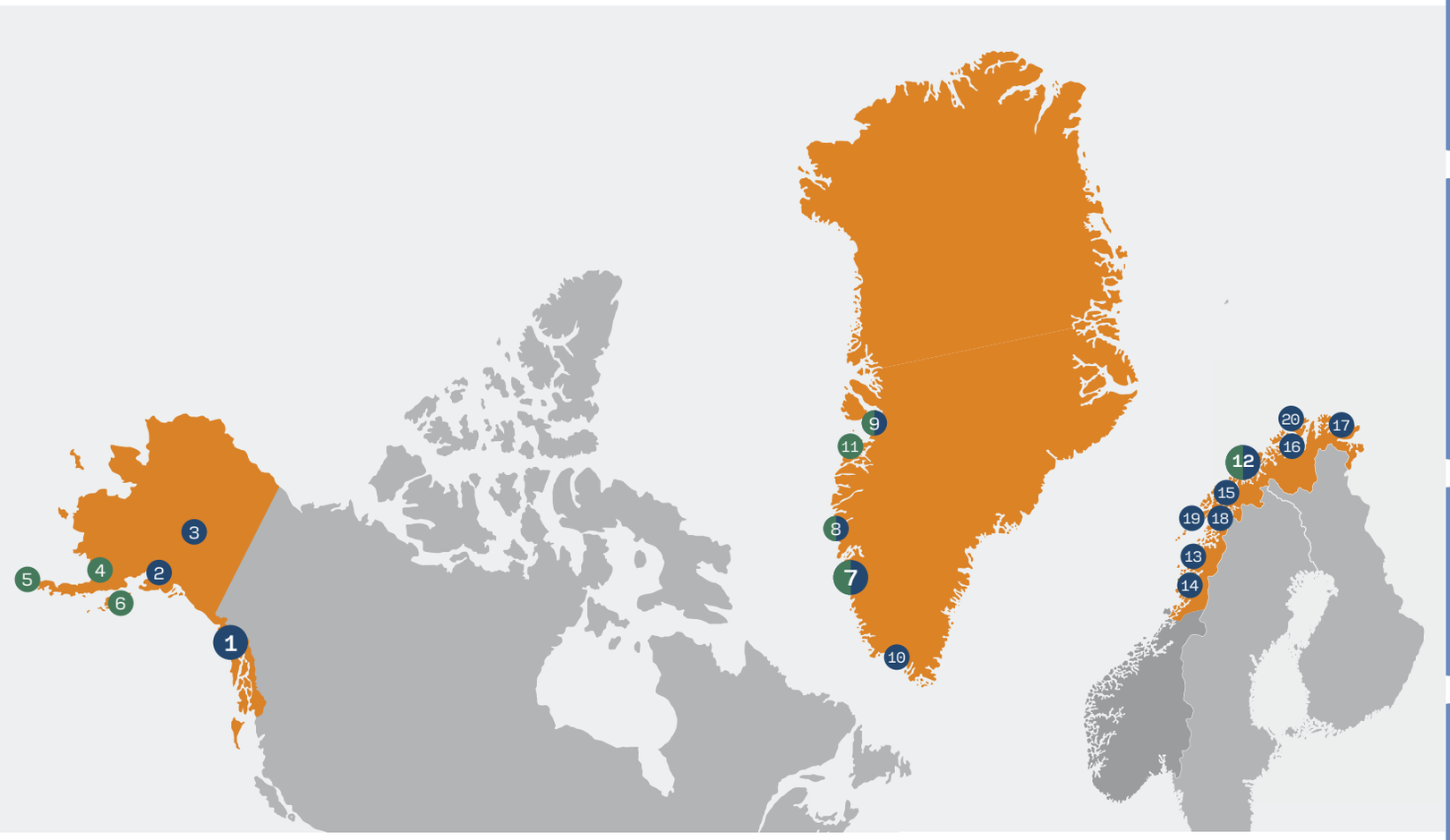
ArcBlue

Arctic Regions under Analysis

(Map not to proportionate scale)



Alaska

Largest Cities

1. Juneau (Capital city)
2. Anchorage
3. Fairbanks

Biggest Harbors

4. Naknek
5. Dutch Harbor/Unalaska
6. Kodiak

Greenland

Largest Cities

7. Nuuk (Capital city)
8. Sisiumiut
9. Ilulissat
10. Qaqortoq
11. Aasiaat

Biggest Harbors

7. Nuuk
8. Sisiumiut
11. Aasiaat
9. Ilulissat

North Norway

Largest Cities

12. Tromsø (Capital city)
13. Bodø
14. Mo i Rana
15. Harstad
16. Alta

Biggest Harbors

12. Tromsø
17. Båtsfjord
18. Lødingen
19. Sortland
20. Hammerfest

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Apostolos Tsiouvalas, Elise Nyborg & Andreas Raspotnik

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Today, Arctic communities are finding novel ways of balancing food security, economic growth, social inclusion and the protection of the aquatic environment through product development and improved utilization methods. However, the strength, focus and progress being made in the Arctic blue economy is uneven, with regions making important progress while others lag behind.

As such, the development of the Arctic blue economy faces diverse and variable challenges that vary from region to region. These include social, economic, logistical, and political obstacles. And yet, the blue economy has great potential to transform Arctic societies, strengthen local value creation and increase employment in regions that are most often sparsely populated with populations decreasing at a worrisome pace. Moreover, positive spin-off effects do not only have the potential to encourage cooperation at various stages of the value chain within the region but essentially also to foster Arctic cooperation by the increased collaboration of regional stakeholders from different Arctic states.[1]

ArcBlue - Enhanced Blue Economy Collaboration across Alaska, Greenland and North Norway aims to contribute to blue value creation and competence development, and further promote knowledge exchange and cooperation in the *blue* sectors of fisheries and aqua-/mariculture between the Arctic regions of Alaska, Greenland and North Norway.

This report provides for a first comparative assessment of the blue economy in Alaska, Greenland and North Norway, with a focus on fisheries and marine-related aquaculture, also known as 'mariculture.' The comparison of a country (Greenland) with regions (Alaska and North Norway) brings certain challenges due to differences in data availability and resolution. While we aimed to select metrics with reliable and comparable data for all three regions, this was not always possible. In some cases, we had to use higher-level metrics or incorporate qualitative data to fill gaps

[1] Björnsdóttir, B., Reykdal, Ó. et al. (2021). Blue Bioeconomy in the Arctic Region. Retrieved 1 January 2024 from https://oaarchive.arctic-council.org/items/4b2a1247-a8ef-4a7f-8853-bf00a12128eb.

in quantitative data. Although some metrics are directly comparable, others, such as Gross Value Added (GVA) and Gross Domestic Product (GDP), may not perfectly align. Where significant differences exist, we have noted these discrepancies. For consistency and comparability across the regions, we use 'metric tonnes' as our standard unit of measurement and 'USD' as the common currency value. While USD is our primary currency of reference for comparative analysis, we consistently provide the equivalent amounts in Danish Krone (DKK) and Norwegian Krone (NOK). Where data permits, we have included trend indicators (arrows) to denote upward or downward movements over a ten-year period.

We have adopted a SWOT (Strengths, Weaknesses, Opportunities, Threats) approach to structure our comparison across these regions. To complement the data, we have further spotlighted relevant success stories for each region, offering a short stand-alone exploration of the themes discussed. These case studies serve as practical examples for those seeking to familiarize themselves with a particular region.

A note on terminology: In discussions that encompass the overall seafood supply chain, 'fisheries' includes both wild-caught and farmed seafood, thus incorporating marine aquaculture. However, when focusing specifically on the management and conservation of wild fish populations, 'fisheries' refers exclusively to wild-catch sectors. Due to the prohibition of finfish farming in Alaska, a clear distinction is also made between aquaculture and mariculture throughout the report. The term 'mariculture' is employed when discussing non-finfish farming activities in Alaska, while 'aquaculture' is used when addressing developments in the farming sector in North Norway.

ARCBLUE: ENHANCED BLUE ECONOMY COLLABORATION ACROSS ALASKA, GREENLAND AND NORTH NORWAY

ArcBlue is a three-year program (2022-2025), financed by the Norwegian Ministry of Foreign Affairs within the framework of the Arctic 2030 program. It is led by the High North Center for Business and Governance, Nord University in Bodø (Norway). Key partners include the Fridtjof Nansen Institute (Lysaker, Norway), the Institute of the North (Anchorage, Alaska) and The Arctic Institute - Center for Circumpolar Security Studies (Washington, DC). For more information, please check out the project's webpage: https://www.nord.no/en/about/faculties-and-centres/nord-university-business-school/centres-and-collaboration/high-north-center/projects/arcblue.

ArcBlue builds on the following on the successful cooperation efforts of the AlaskaNor project: www.alaskanor.com, the broad economic expertise provided by the Arctic Economic Council's Blue Economy Working Group and the 2023 established UArctic Thematic Network 'Blue Economy and the Arctic': https://www.uarctic.org/activities/thematic-networks/blue-economy-and-the-arctic-bluearctic/.

2. An Introduction to Three Arctic Regions Under Analysis

With over 3 million lakes, 3,000 rivers and 25,148 km of coastline expanding around a vast area of 1,717,856 km² bordering three different seas (Arctic Ocean, Pacific Ocean and Bering Sea), the **State of Alaska** is one of the most productive fishing regions in the world, producing a wide variety of seafood.[2] With all five species of Pacific salmon, four species of crab, many kinds of groundfish, shrimp, herring, sablefish, pollock, and Pacific halibut, Alaska is one of the world's leading stakeholders in seafood industry, nowadays predominantly driven by salmon, white-fish and mariculture production. The practice of harvesting seafood in Alaska, can be traced back to time immemorial, since Alaska Native communities, such as the Aleuts, the Athabascans, Alutiiqs, Haidas, Inupiat and Yup'ik, Tlingits, Tsimshians and many other indigenous groups have relied on subsistence activities such as sealing, whaling, fishing, and gathering for centuries.[3] Today, the State has about 731,000 residents (2022), with over half of them being concentrated in the three biggest cities, Anchorage (289,810), Fairbanks (95,356), Juneau (31,685), working in different sectors such oil and gas production, mining, fisheries (including aquaculture), logging industry, tourism, agriculture, and public services. Currently, about 8.5% of the total population are employed in fisheries and aquaculture. Today, nearly 40% of Alaska's more than 31,000 fishermen live in the Southcentral towns of Anchorage, Kenai, Cordova, Seward, Homer, Valdez and Whittier.[4]

The evolution of **Greenland** from a nation reliant on traditional subsistence fishing to a leading, industrialized player in the global fisheries sector marks a significant transformation. Despite its relatively short history in commercial fishing, Greenland's industry now forms the basis of its export-based economy. Spanning over 23 latitudinal degrees (60-83°N), Greenland, the world's largest island, boasts a vast and nutrient-rich marine environment that is home to over 1,100 marine species, including more than 250 species of fish, mussels, and shellfish.[5] An absence of inland fishing, due to Greenland's extensive ice cap, contrasts with the robustness of its marine and recreational fisheries, which feature commercially significant species

[2] Resource Development Council for Alaska. Alaska's Fishing Industry. Retrieved 6 May 2023 from https://www.akrdc.org/fisheries

[3] Alaska Department of Fish and Game. Subsistence in Alaska. Overview: Definition, Responsibilities and Management. Retrieved 6 May 2023 from https://www.adfg.alaska.gov/index.cfm?adfg=subsistence.definition

[4] Welch, L. (2022). Economic report for Alaska fishing industry economic offers some surprising numbers. Anchorage Daily News, 25 January 2022. Retrieved 6 May 2023 from https://www.adn.com/business-economy/2022/01/24/economic-report-for-alaska-fishing-industry-economic-offers-some-surprising-numbers/

[5] ICES. (2023). Greenland Sea ecoregion – Ecosystem overview [Report]. ICES Advice: Ecosystem Overviews. https://doi.org/10.17895/ices.advice.22664881.v1

such as shrimp, halibut, cod, crab, and lumpfish.[6] Fishing in Greenland is an integral nationwide endeavor, occurring along most of Greenland's extensive 44,087 km² coastline and extending offshore, encompassing a wide range of activities from small- and large-scale marine capture to locally significant land-based, post-harvest processing. As the most sparsely-populated country in the world, artisanal fisheries represent an important livelihood for Greenland's many coastal towns and small settlements, helping to ensure food security, reduce poverty, and support cultural cohesion. However, Greenland's fisheries are not just nationally vital but bear a significant global presence. Over just a few decades, the country has become the world's leading producer of northern shrimp as well as the foremost contributor to the global Greenland halibut catch.[7] Looking ahead, environmental changes and climate dynamics are expected to increase productive stocks and open up new opportunities in aquaculture, positioning Greenland at a crossroads of potential growth and increased influence in the global seafood sector.

Throughout history, the local populations of **North Norway** have revered and depended on the bountiful sea, with the earliest evidence of fishing activities in North Norway dating back some 6000 years. Bordered by the Barents Sea, often referred to as a 'global food chamber'[8] in the North, and influenced by the warming Gulf Stream from the South, the region enjoys immediate access to highly productive coastal and offshore waters, creating ideal conditions for a thriving marine ecosystem. These nutrient-rich waters, combined with the rugged shelter of the coastline, support a diverse range of commercially valuable fish species, including cod, pollock, saithe, halibut, as well as pelagic species like mackerel and herring. Of utmost importance, the Barents Sea hosts the largest population of Northeast Atlantic cod. This cod stock has played a pivotal role in the development of northern communities, continuing to provide economic benefits to this day. Traditionally, cod fisheries created ideal conditions for the region's first major and long-standing export industry, known as stockfish. Comprising the northernmost counties of Nordland and Troms and Finnmark (Troms and Finnmark constituted a single county from 1 January 2020 until 1 January 2024), North Norway today plays a significant role in Norway's broader fisheries and aquaculture sector. With about half a million people living in the two northernmost counties - predominantly concentrated in the four biggest cities, Tromsø (78,303), Bodø (53,522), Mo i Rana (25,965) and Harstad (24,917), the region contributes to a substantial part of the seafood produced in Norway.[9] In 2020, a remarkable 889,648 tons of wild fish were landed in North Norway (Nor-

[6] FAO 2023. Fishery and Aquaculture Country Profiles. Greenland, 2016. Country Profile Fact Sheets. Fisheries and Aquaculture Division [online]. Rome. Updated Feb 22, 2017. Retrieved 31 July 2023 from https://www.fao.org/fishery/en/facp/grl?lang=en

[7] Prisanalyse og prognoser for de vigtigste fiskearter fra Grønland. (2021). GEMBA Seafood Consulting A/S. Retrieved 24 December 2023 from https://knapk.gl/wp-content/uploads/2022/01/Prisanalyse-KNAPK-2021-09-11-2021-final-final.pdf

[8] Sunnanå, K. (2015). Barentshavet – et globalt spiskammer. Tidsskriftet Ottar 304(1), pp. 3–8.

[9] Statistic Norway (2023). Befolkning. 01222: Endringar i befolkninga i løpet av kvartalet, for kommunar, fylke og heile landet (K) 1997K4 - 2023K3. Retrieved 27 September 2023 from https://www.ssb.no/statbank/table/01222/

dland, Finnmark and Troms), representing approximately 32% of Norway's total fish landings.[10] Concurrently, the aquaculture sector has experienced exponential growth since the 1970s, with farmed salmon accounting for one-third of the seafood produced in the region by 2018, resulting in increased employment opportunities. 2022 was the best year ever for Norwegian seafood exports, with the state exporting 2.9 million tonnes of seafood to a value of NOK 151.4 billion.[11] With the potential for growth in traditional seafood production, along with promising developments in utilizing other raw materials and resources lower in the food chain, North Norway's fisheries and aquaculture sector hold the promise of even further expansion in the future.

2.1 Key Facts

		Alaska	Greenland	North Norway
GEOGRAPHY	**Coastline**	6,640 miles (10,686 km)	27,394 miles (44,087 km)	7,468 miles (12,020 km)
	Area	1,717,856 km²	2,166,086 km²	112,975 km²
GOVERNMENT	**Organization**	State (19 boroughs and 1 unorganized region)	Self-governing territory within the Kingdom of Denmark	3 counties (Nordland, Troms and Finnmark) and 87 municipalities
	Capital	Juneau	Nuuk	Bodø (Nordland) Tromsø (Troms) Vadsø (Finnmark)
	Largest cities (2022)	Anchorage (289,810) Fairbanks (95,356) Juneau (31,685)	Nuuk (19,261) Sisimiut (5,520) Ilulissat (4,737) Qaqortoq (3,008) Aasiaat (2,977)	Tromsø (78,303) Bodø (53,522) Mo i Rana (25,965) Harstad (24,917) Alta (21,317)

[10] Statistic Norway (2020). Fisheries. Retrieved 27 September 2023 from https://www.ssb.no/en/fiskeri

[11] Norwegian Seafood Council (2023). Norway's seafood exports worth NOK 151.4 billion in 2022. Retrieved 27 September 2023 from https://en.seafood.no/news-and-media/news-archive/norways-seafood-exports-worth-nok-151.4-billion-in-2022/

PEOPLE	**Population (2022)**	731,011 (2021)	56,562	Total: 486,696 Nordland: 243,385 Troms and Finnmark: 243,311
	Indigenous Groups	Unangax and Sugpiaq, Athabascan, Eyak, Tlingit, Haida, Tsimshian, Inupiaq, Yup'ik, Cup'ik (15,6% of the population)	Inuit (89%)	Sámi (50,000-100,000)
ECONOMY	**GDP**	USD 49.63 billion ALASKA (2022) USD 25.46 trillion UNITED STATES (2022)	DKK 20,124 million (2020) (USD 3.076 billion)	NOK 119.5 billion NORTH NORWAY (2021) (USD 13,88 billion) NOK 2940.96 billion NORWAY (2021) (USD 341.8 billion)
	GDP/capita	USD 68,919 ALASKA (2022) USD 76,348 UNITED STATES (2022)	DKK 358,000 (2020) (USD 54,571.21)	NOK 495,000 NORTH NORWAY (2021) (USD 57,520) NOK 540,000 NORWAY (2021) (USD 62,758)
	Major industries	Oil and gas production, mining, fisheries (incl. mariculture), timber, tourism, agriculture	Fisheries and fish processing, hunting and whaling, animal husbandry, tourism, mining, renewable energy, handicrafts, small shipyards	Oil and gas production, fisheries (incl. aquaculture), shipping (incl. ship building), pulp & paper products, metal, chemical, timber, mining
	Natural resources	Petroleum, natural gas, timber, zinc, gold, silver, fish, shellfish	Fish, crustaceans, minerals (e.g. rare earth elements, iron, zinc, gold, diamonds), hydropower, oil	Petroleum, natural gas, iron ore, copper, lead, zinc, titanium, nickel, fish, timber, hydropower
	Unemployment rate (2022)	4,3% ALASKA 3,7% U.S.	3,7%	1,4% NORDLAND 2,4% TROMS & FINNMARK 2,7% NORWAY
	Main export commodities	Petroleum, zinc, seafood, lead, gold	Seafood and fish products, animal products and livestock	Petroleum, zinc, seafood, lead, gold
	Total export value	USD 5.58 billion (2022)	DKK 5.93 billion (2022) (USD 889.15 million)	NOK 47.609 billion (2020) (USD 4.76 billion)

Information relevant to Alaska has been, inter alia, sourced from the OECD, the Alaska State Department of Labor and Workforce Development, Business Index North, U.S. Census Bureau, U.S. Department of Commerce Bureau of Economic Analysis. Analysis of data relevant to Greenland has been conducted using the latest information available from Statistics Greenland. Information relevant to North Norway has been, inter alia, sourced from Norwegian Seafood Council; the Norwegian Labour and Welfare Administration and Statistics Norway.

3. Economic Profile

The geo-hydrological formation of the waters in Alaska, Greenland, and North Norway provides rich marine ecosystems, rendering fisheries and aqua-/mariculture crucial for the economies and food security of these three regions.

While there is a long history of relying on marine living resources, over the last few years, the fisheries of these regions have increasingly maintained a crucial role in their respective regional and national economies, largely driven by technological advancements and government reforms that have been important for shaping and modernizing the industries over the last three decades. Yet, due to their geographical location, environmental and climatic conditions, and economic capacities and incentives, each region has developed distinct seafood industries. Mirroring models found in most Nordic regions, Alaska, Greenland, and North Norway's fishing industry currently focus on a few key commercially viable species, with pollock being predominantly harvested in Alaska, northern shrimp in Greenland, and Atlantic cod in North Norway. Indeed, Greenland is far more dependent on the fishing industry than Alaska or (North) Norway, with the country having created an almost monocultural economy. In turn, salmon aquaculture currently constitutes one of the main export commodities for Norway, contributing substantially to the state's economy. Although finfish farming is not allowed in Alaska, salmon also has the greatest economic impact (jobs, income, and total value) among all species in the Alaskan seafood industry, mainly thanks to the development of hatcheries and the sustainable management of wild salmon stocks. Currently, the contribution of such fisheries is important to the global economies, with all three regions gradually expanding towards new markets. Yet, all three regions encounter both small-scale traditional and large-scale industrial fishing, with conflicts of interest between stakeholders being pertinent at times.

3.1 Economic Status Quo

	Alaska	Greenland	North Norway
Main Seafood Industries	salmon, pollock and other groundfish, and crab, oysters (mariculture)	Northern shrimp (offshore and inshore), greenland halibut (inshore), atlantic cod (offshore and inshore), lumpfish (inshore), queen crab (inshore)	salmonids (aquaculture), North-East Atlantic cod haddock, saithe, Norwegian spring spawning herring (NSS-herring), capelin, shrimp, red king crab
Total Economic Value Added[12]	~ USD 5.7 billion (2019) ↑	~DKK 3.68 billion (2021) ↑	~18.6 billion NOK (2021) ↑ (USD 2.1 billion)
Commercial seafood production (tonnes)	~ 2.4 billion ↑	204,600.30 (2022)[13] ↑	~ 0.7 billion↑
Capture (wild-caught)	100% (2022)	100% (2022)	n/a
Mari-/ Aquaculture (farmed)	0% (2022)	0%[14] (2022)	n/a
Top exports of fisheries products	pollock, surimi, fillets, frozen sockeye salmon	Shrimp: peeled and whole; halibut: whole and fillet; cod: whole and fillet	salmon, cod, mackerel and herring
Total Export Value (USD)	USD 3.3 billion	5.84 billion DKK (2022) ↑ (USD 875 million)	~ 70 billion NOK (2022) ↑ (USD 7 billion)[15]

[12] Economic metrics differ. Greenland and North Norway's data are derived from sector-specific Gross Value Added (GVA), while Alaska's figure refers to total economic output.

[13] While landing metrics are generally considered indicative of total production, this assumption does not hold as strongly for Greenland due to unique local regulation allowing a significant portion of offshore catches in select fisheries to be processed at sea. Therefore, this analysis employs total catch figures to more accurately assess Greenland's fishery production. For comparability with metrics from Alaska and North Norway, this exclusively considers catches made by Greenlandic vessels in territorial waters.

[14] Despite the presence of several aqua/mariculture initiatives in Greenland, including for Atlantic cod, blue mussel, and seaweed farming, these activities remain undifferentiated in national commercial seafood production statistics. This is due to their experimental status and minor scale, which do not yet impact overall commercial production figures significantly.

[15] The seafood export value appears to surpass the total export value in the key facts table. The last total export value available in the previous table refers to 2020, while for the seafood industry, it pertains to 2022 and has been experiencing exponential growth every year.

	Alaska	Greenland	North Norway
Export Type	n/a	Unprocessed (68%), Processed (32%)	n/a
Percentage of Total Exports	77% (2022) ↑	98.5% (2022) ↑	n/a
Main markets	United States, China, Japan, EU, South Korea and Canada	EU (Denmark, Sweden, Germany, Spain), China, UK, Japan, Taiwan, USA	Norway, Poland, USA, Japan, France, Netherlands, Germany
Fishing Fleet	8,900	279 ↓	3,257
Non-registered vessels	-	1606 ↑	-
Largest Harbors	Naknek (in terms of value), Dutch Harbor/ Unalaska and Kodiak (in terms of volume)	Nuuk, Sisimiut, Aasiaat, Ilulissat (in terms of volume) 13 towns have ports and most settlements on the coast have reception facilities with processing capabilities (50 in total). Not all are accessible year round.	Tromsø, Båtsfjord, Lødingen, Sortland Hammerfest (in terms of volume)

Information relevant to Alaska has been, inter alia, sourced from NOAA Fisheries, the Resource Development Council for Alaska, the U.S. Department of Commerce Bureau of Economic Analysis, McDowell Group, the Alaska Mariculture Task Force, the Alaska Seafood Marketing Institute. Analysis of data relevant to Greenland has been conducted using the latest information available from Statistics Greenland and Greenland Fisheries License Control Authority. Information relevant to North Norway has been, inter alia, sourced from Statistics Norway, SINTEF, NOFIMA, the MARPART Project Report, Nærings- og fiskeridepartementet, Klima- og miljødepartementet; Fiskeridirektoratet, and Norges Fiskarlag.

3.2 Comparative SWOT Analysis

Alaska

Strengths	Weaknesses	Opportunities	External Threats
• Overall performativity, resilience and adaptability of Alaska's fisheries and mariculture • Regionalized Alaska fisheries management that best reflects the state's economic needs • Fast recovery of fisheries and mariculture from the COVID-19 pandemic's impacts • Gradually developing new industries • The Alaska Mariculture Task Force (AMTF) enhances the economic viability and ecological sustainability of the state's mariculture industry	• Lower production and investment priority mainly on specialty products and low value species • Lack of stable funding for fisheries and especially mariculture • Underdeveloped industries (e.g. arrowtooth flounder, skates) • Limited local processing	• Process more seafood domestically • Foster mariculture initiatives • Increase focus/ funding on underdeveloped (e.g. crab industries, recovering their previous role in global economies) • Promote full utilization of fish by-products • Expand market targets	• Harsh and changing climatic conditions • Economic impact by the COVID-19 pandemic

Greenland

Strengths	Weaknesses	Opportunities	External Threats
• High efficiency of offshore sector, with highly modernized fleet • Front runner in Nordics in taxing resource rent in fisheries, with an effective and straightforward system • Adaptive and shock-resilient, exemplified by rapid recovery from global pandemic and Ukraine crisis • Strong geographic diversification in terms of market reach and resource supply base • Strength in innovative market strategies to further market reach and diversify products • Embrace of resource utilization • Successful pursuit of MSC certification in core fisheries for broader market access and ability to set premium prices	• Lack of experience with aquaculture • Highly concentrated economic and export portfolio • Import-dependent with low domestic production of goods and energy • Logistically challenging landscape and climate • Overcapitalization of small-scale inshore fisheries • Relatively low competitive innovation and entrepreneurial activity • Trade growth is limited by mandatory use of the government-owned Royal Arctic Line for all imports and exports	• Increased accessibility of new ice-free fishing areas, including more suitable conditions for mariculture • New, economically promising pelagic fisheries more viable with climate change • Market potential for diversification into previously uncapitalized 'low-value' non-fish species • Leveraging traditional knowledge for product and value-add innovation • Maximizing seafood by-product utilization • Building distinct geographic specific brand identity • Investment in fisheries economics research	• Climate-induced investment uncertainty in future fisheries • Particularly vulnerable to changes in global consumer seafood demand and consumption patterns • Particularly exposed to global market price volatility • Threat of growth in global aquaculture production to current business model • Particularly vulnerable to any supply chain issues or bottlenecking arising as a result of global uncertainty (pandemic, war in Europe) • Particularly vulnerable to global fluctuations in energy and oil prices

North Norway

Strengths	Weaknesses	Opportunities	External Threats
• Important collaboration between stakeholders, researchers and the industry • Resilience of supply chains during COVID-19 • Technological innovations and marketing strategies that emphasize a 'local Arctic product' label • The 'Traffic light system' allows for increased production capacity in most regions • Norwegian salmon has gained world-wide recognition as a prized sushi product • With nearly half of this production occurring in the north of the country, Norway exported 2.9 million tonnes of seafood to a value of NOK 151.4 billion in 2022 (USD 15 billion)	• Lack of stable investments	• Develop underdeveloped species/industries, including low-trophic species • Draw lessons from successful algaculture cases abroad • Increase focus/ funding on smaller industries • Innovations in waste utilization and full utilization of fish by-products • Expand market targets	• Changing climatic conditions • Biological fluctuations and shifts in migration patterns (especially with respect to cod) • Short-term Economic impact by the COVID-19 pandemic

3.3 Successful Case Studies

A SUCCESS STORY FROM ALASKA: PROMISING MARICULTURE OPERATIONS

Although fish farming in Alaska is prohibited by law, many species have been produced and sold from Alaskan mariculture operators over the last three decades. Since 1990, mariculture production has included several species, the most important being Pacific oyster, geoduck, blue mussel, green sea urchin, littleneck clam, and pink scallop. Today, mariculture in Alaskan waters primarily revolves around oyster farming and consists of 58 aquatic farms, 8 nurseries, and 4 hatcheries for a total of 70 permitted operations. The overall sales of shellfish and aquatic plants for all permitted operations reached USD 1.2 million in 2016 constituting, in addition to fisheries, a promising source of income. In this context, the Alaska Mariculture Task Force was developed to further identify areas for making mariculture more viable and sustainable, arguing that, in just 20 years, Alaska's mariculture industry could grow by USD 100 million through workforce development, improved state policies and regulations, education, and market development. The Task Force has further highlighted the need for increasing Alaska Native participation and inclusion of traditional knowledge in mariculture development, which remains minimal.

Visit https://seagrovealaska.com/ to explore the US's largest kelp farm in Doyle Bay, Alaska and https://www.saltyladyseafood.co/ to learn more about Salty Lady Seafood, a woman-owned and managed oyster farm in Juneau, Alaska!

A SUCCESS STORY FROM GREENLAND: FROM FISH WASTE TO PROFIT

Historically, a significant portion of fish by-products in Greenland were either discarded or ineffectively used. With a utilization rate as low as 20%, residues were either dumped into the ocean or landfilled, with an estimated 52,025 tons of biodegradable waste generated each year. In 2019, the Greenlandic company Royal Greenland initiated several projects aimed at decreasing this waste, setting an ambitious goal of reaching a 80% utilization rate across all factories and trawlers. Recognizing the economic potential hidden in these by-products, this goal was backed by the development of new methods for innovative resource utilization. In 2018, Royal Greenland began producing cod liver oil from a unit in Maniitsoq approved for human and animal consumption. The processing and marketing of rest raw materials has proven successful as well as sustainable, opening new markets and revenue streams for the company in the feed and ingredients industry. Since 2021, cod heads from Maniitsoq have been effectively sold for drying and as bait in fisheries, while experiments in Newfoundland with dried fish skins for pet food have showcased a new potential

product line. A particular achievement is the long-standing production of shrimp meal in Ilulissat from shrimp shells, which is resold as a consumable product for the broth and soup industry. In order to build on this potential, a dedicated innovation department was established in 2022 to expand the development of raw materials into new products.

Despite not reaching the targeted 80% utilization rate, Royal Greenland's efforts have resulted in an impressive 70% utilization rate in just a few years, including the challenging processing of parts like offal and fractions otherwise difficult to utilize. Closer analysis shows that for around 40% of fisheries, the utilization ratio exceeds 90%, with Greenland halibut standing out as a particular success. In collaboration with the EU-funded WaSeaBi project, Royal Greenland continues to explore the potential of side streams from fisheries for producing high-value products like proteins and minerals, aiming now to reach 100% utilization by 2030.

Learn more about Royal Greenland's maximum utilization efforts here, and visit https://www.waseabi.eu/ to explore WaSeaBi's initiatives.

A SUCCESS STORY FROM NORTH NORWAY: AQUACULTURE – THE FUTURE OF SEAFOOD INDUSTRIES

Among all industries of Norwegian fisheries, the most exponentially growing has been aquaculture. Aquaculture in North Norway, focusing primarily on Atlantic salmon, has grown significantly, benefiting from the region's cold seawater temperatures that limit salmon lice and diseases. In 2019, the three northernmost counties produced 606,463 tons (550,173 metric tons) of farmed fish, primarily salmon. Nordland led with over 50% of production, while Troms and Finnmark contributed 29% and 20%, respectively.[16] Overall, the future of Norway's seafood industry holds promising prospects, with projections indicating a potential five- to six-fold growth in revenue by 2050. The most substantial expansion is anticipated in aquaculture, with estimates suggesting production levels could reach up to 5 million tons.[17] This growth aligns with global expectations, foreseeing that by 2030, two-thirds of the world's seafood will be sourced from marine farming, both near the coast and farther out at sea.

Visit https://www.salmar.no/en/about-salmar/salmars-operating-areas/ and https://novasea.no/en/ to learn more about successful aquaculture operations in North Norway!

[16] Statistics Norway. Aquaculture (discontinued). Sales of slaughtered fish for food. Quantity, by fish species and county. Retrieved 23 October 2023 from https://www.ssb.no/en/jord-skog-jakt-og-fiskeri/statistikker/fiskeoppdrett/aar-forelopige

[17] Olafsen, T. et al. (2012). Value created from productive oceans in 2050. A report prepared by a working group appointed by the Royal Norwegian Society of Sciences and Letters (DKNVS) and the Norwegian Academy of Technological Sciences (NTVA). Retrieved 28 October 2023 from https://www.sintef.no/en/latest-news/2012/value-created-from-productive-oceans-in-2050/

3.4 Main Takeaways and Opportunities for Collaboration - Economies

The comparative SWOT analysis of the economic status quo of Alaska, Greenland, and North Norway reveals intriguing insights into the fisheries and aqua-/mariculture industries in these regions. Despite their geographical disparities and their roles as competing regions in global seafood markets, they share a common characteristic of large dependence on oceanic ecosystems and resources, developing similar industries, in particular in relation to groundfish fisheries.

In all three regions, the fisheries sector plays a crucial role in the local economy, providing employment and livelihoods to coastal communities while navigating challenges posed by environmental changes and market demands. Moreover, all three regions also face similar external threats, such as climate change, which may further impact the profitability and harvest of such stocks. Furthermore, both Alaska and North Norway emerge as global players in the salmon industry, with salmon production serving as a highly profitable source of income and employment. However, their approaches to salmon farming differ fundamentally, presenting opportunities for mutual learning and collaboration: Alaska's successful development of hatcheries and sustainable management of salmon stocks fundamentally contrasts with North Norway's highly profitable aquaculture sector. While salmon products emerge as vital export commodities for both Alaska and North Norway, Greenland, on the other hand, heavily relies on the fishing industry, facing exceptionally high and increasing operating costs that have not yet allowed the systematized development of aquaculture. Despite facing infrastructural limitations, Greenland could benefit from adopting successful practices from both Alaska and Norway to diversify its economy, develop aquaculture, and reduce reliance on subsidies. Exchange of information, best practices, and technological advancements among Alaska, Greenland, and North Norway hold the key to ensuring the resilience and prosperity of their fisheries and aqua-/mariculture industries.

To strengthen collaboration efforts between the three regions, the following questions need to be addressed by stakeholders from the respective region:

Comparative Advantages: Given the unique strengths of Alaska, Greenland and North Norway, what comparative advantages does each region hold for the development of fisheries and aqua-/mariculture? How can these advantages be leveraged to boost the blue economy across the Arctic regions? What challenges have been encountered in scaling up solutions in the fisheries and aquaculture sectors, and how have these challenges been overcome?

Investment and Infrastructure: What types of investments and infrastructure developments are needed to enhance the sustainable growth of fisheries and aqua-/mariculture? Can cross-regional collaboration facilitate access to funding?

Innovation and Technology Transfer: Considering the varying levels of technological adoption in fisheries and aquaculture across the regions, what strategies can be employed to foster knowledge exchange and technological transfer? In what ways has technology and innovation played a role in advancing the economic aspects of fisheries and aquaculture in your region? Can you identify any specific policies or technologies that have been particularly effective in modernizing these industries?

Adapting to Market Changes and Consumer Trends: How has your region adapted to changing market demands and consumer trends? Can you share examples of how these adaptations have opened new opportunities or strengthened the economic resilience of the sectors? Could joint strategies be adopted to enhance the competitiveness of Arctic products in the global seafood market or attract international investment?

Economic Impact Assessment and Forecasting: Can economic impact assessments and forecasting tools be utilized to understand the potential impacts of climate change on fisheries and aquaculture and adapt to changing environmental conditions?

Policy Support and Economic Incentives: Can you discuss the role of policy support and economic incentives in the development of the fisheries and aquaculture sectors in your region? What types of policies or incentives have been most effective, and what can other regions learn from your experiences?

Economic Diversification and Value Addition: How have other different sectors within the blue economy (e.g., tourism, renewable energy, shipping) collaborated with the fisheries and aquaculture sector in your region to drive economic growth? Have there been successful examples in your region of cross-sectoral innovation, where collaboration with other industries has led to new opportunities or solutions for fisheries and aquaculture? Can you share examples of successful collaborations and the benefits they brought?

4. Environmental Profile

In the Arctic regions of Alaska, Greenland and North Norway, the environmental context for fisheries and aquaculture is defined by a unique combination of limited species diversity and high productivity. These areas, thriving with cold-water species adapted to Arctic conditions, underscore their ecological and economic significance, yet also reveal their vulnerability to environmental changes. While all three regions prioritize sustainability and conservation in managing their marine resources, their approaches and levels of development vary. North Norway leads with advanced sustainable practices in fisheries and aquaculture, underpinned by strict regulations and a commitment to the precautionary principle. Significant investment in research and technology has enabled Norway to substantially mitigate aquaculture pollution and enhance fish health management, although interactions with wild fish populations remain a concern. In contrast, Alaska's blue sector is distinguished by its sustainable management of wild fisheries, particularly salmon. Less focused on mariculture, Alaska sets a global standard in sustainable wild-catch practices and ecosystem-based management, also supported by a robust regulatory framework. Greenland, meanwhile, is still in the process of developing its fisheries sector and emerging aquaculture sector sustainably, drawing lessons from its Arctic counterparts to adopt environmentally conscious practices and elements of ecosystem-based ocean management. However, the long-term outlook for all three regions remains uncertain due to global warming effects like ocean acidification and shifting sea ice patterns, posing unpredictable challenges to marine ecosystems, as well as new economic opportunities. Ensuring the long-term sustainability of these critical sectors will require adaptive management underpinned by robust collaboration.

4.1 Environmental Status Quo

	Alaska	Greenland	North Norway
Key Marine Ecosystem Characteristics	Five distinct large marine ecosystems include the Gulf of Alaska, Eastern Bering Sea, Aleutian Islands, Beaufort Sea, and Chukchi Sea. Their geomorphology varies along the coast	Arctic and sub-Arctic marine environment, encompassing coastal and fjord systems. Polynyas and deep-sea ecosystems are ecologically important but vulnerable habitats	North Atlantic ecosystem, encompassing extensive coastal and fjord systems. Deep-sea and cold-water coral habitats are ecologically important features
Management approach	Ecosystem-based fisheries management (EBFM)	Science-based adaptive fisheries management: primarily a single-species approach, but with elements of ecosystem-based fisheries management (EBFM)	Ecosystem-based fisheries management (EBFM)
Biodiversity status	Rich and diverse and mostly healthy, with few species facing certain pressures	Unique and relatively pristine, but vulnerable due to limited species diversity, increasing human activity, and changing climate	Generally healthy, but some areas experiencing stress due to environmental changes and human activities
Commercial stock status	Relatively stable (few stocks overfished)	Mixed (some healthy stocks, others overfished)	Mostly stable (very few stocks overfished)
Primary environmental concerns	Bycatch, overfished stocks, challenges from hatcheries, disease outbreaks, rising temperatures, ocean acidification, "The Blob"	Bycatch (seabirds), bottom trawling impact on seabed, overfishing in inshore fisheries, climate change, ocean acidification, rising temperatures	Bycatch, overfished stocks, pollution from aquaculture, straying salmon, disease outbreaks, rising temperatures, ocean acidification
Data Availability and Quality	High, with comprehensive monitoring programs	Moderate, with challenges due to the remote and harsh environment	High, with a strong tradition of marine research and data collection
Key conservation/ technical management measures	Catch Limits through Quota allocation underpinned by total allowable catch (TAC), Selectivity Controls (gear and vessel standards), Marine Spatial Closures, Temporal Closures, Effort Limits	Catch Limits through Quota allocation underpinned by total allowable catch (TAC): *with exceptions for certain fisheries, including quota-free zones, Selectivity Controls (gear and vessel standards), Marine Spatial Closures,Temporal Closures, Effort Limits	Catch Limits through Quota allocation underpinned by total allowable catch (TAC), Selectivity Controls (gear and vessel standards), Marine Spatial Closures, Temporal Closures, Effort Limits

Information relevant to Alaska has been, inter alia, sourced from McDowell Group and NCOOS Research Project. Analysis of data relevant to Greenland has been conducted using the latest information available from Statistics Greenland, the International Council for the Exploration of the Sea (ICES), the Northwest Atlantic Fisheries Organization (NAFO), Conservation of Arctic Flora and Fauna (CAFF), the Greenlandic Government. Information relevant to North Norway has been, inter alia, sourced from the Nordic Council of Ministers, SINTEF, NOFIMA, and the Klima og miljødepartementet.

4.2 Comparative SWOT Analysis

Alaska

Strengths	Weaknesses	Opportunities	External Threats
• Electronic monitoring system in catch estimation in the fisheries sector • Shellfish monitoring industry in collaboration with State authorities and NOAA's weather service focusing on HAB • Environmental commitment from private companies (e.g. Alaskan Leader Seafood, Westward Seafoods, and Salty Lady Seafood Company)	• Chance for adult hatched salmons to stray and affect genetic diversity of salmon stocks • Harmful algal blooms (HABs) and their associated toxins affecting mariculture production	• Increase research and collaboration between Alaska's major research institutions and the industry • Draw lessons from sustainable aquaculture/mariculture and fishing operations abroad • Introduce an early warning system for algae blooms • Embrace modern technologies and modernize the fleet • Conduct comprehensive environmental impact assessments (EIA) prior to all operations	• Climate change-induced challenges such as fish migrating northwards, or invasive alien species creating ecosystem disturbances • Ocean acidification, changes in water • Abnormally warm body of water that has been circulating the coast of Southeast Alaska (Blob)

Greenland

Strengths	Weaknesses	Opportunities	External Threats
• Commitment to sustainable use of marine resources • Industry-driven use of MSC certification as a market mechanism to improve sustainability in fisheries • User participation in fisheries management: mandatory community consultation in quota determination and policy-making process • Multiple Evidence Base (MEB) approach to mitigating scientific information gaps using international research expertise and local user observations, including community-based monitoring • Investment in research capacity • Identifying areas of heightened ecological significance, carrying out impact assessments of petroleum and maritime activities, and taking action on (some) aspects of oil spill prevention • Successful reduction of bycatch using multiple-tiered technical and regulatory approach • Domestic ban on fish discards	• Lack of sufficient scientific knowledge available to inform management, particularly regarding future stock sustainability and dynamics • Deficiency in comprehensive biological references for multiple target species. • Inadequate monitoring of wider ecosystem indicators, such as non-target fish, bycatch, and trawling impacts • Inadequate habitat mapping leaves large marine areas, particularly deep-sea zones, uncharted and poorly understood. • Public tension between local and scientific knowledge recommendations. • Political influence on scientific advisories, leading to discrepancies in TAC adherence. • Absence of management and recovery plans across all fisheries • Adaptive capacity of coastal inshore sector in comparison to offshore sector • Limited waste treatment options giving rise to local origin marine litter and plastic pollution • Reliance on trawling as the primary fishing method	• Enforcing quotas on the basis of recognized scientific advice across all commercial fisheries • Increasing proportion of MSC-certified inshore fisherie • Enhancing local Indigenous participation in conservation and fisheries management • Developing climate change adaptation strategies across the fisheries value chain • Strengthening coastal sector resilience • Leveraging low-tech solutions to boost scientific monitoring • Establishing a monitoring and improvement plan for reducing emissions from sizable small-scale fleet • Strengthening waste management through circular principles • Implementing spatial management measures to protect vulnerable benthic habitats • Expanding sustainably (precautionary approach to new regions, rigorous monitoring for mariculture) • Considering commercial harvest of marine non-native species, such as blue mussels	• Atlantification' of marine ecosystems with climate change • Climate change impacts intensified by geography and fisheries traits: rising temperatures, acidification, hypoxia, and sea-ice loss particularly affect coastal fisheries • Climate-enhanced coastal erosion endangers critical fisheries supply chain infrastructure, heightening logistical obstacles • Erratic weather patterns generate bottlenecks in transport logistics, encompassing both aerial and maritime channels • The region's geography acts as a global "sink" for long-range pollutants transported by ocean and atmospheric currents • International agreements on migratory species limit decentralized management, with the integration of local and indigenous knowledge into advisory boards limited

North Norway

Strengths	Weaknesses	Opportunities	External Threats
• In response to the Red King Crab's invasion in the Barents Sea, the state established a two-fold scheme for its management • The adoption of the 2020 'traffic light system,' has contributed to the achievement of sustainable and predictable growth of Norwegian aquaculture by dividing the Norwegian coast into 13 production regions • Private Norwegian fisheries and aquaculture operations have obtained certifications from organizations like the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC)	• Risk of overfishing due to fluctuating stock dynamics (e.g cod) • Discharges from farming facilities and spread of parasites • Genetic contamination of wild salmon and trout populations due to escapes • Harmful algal blooms (HABs) and their associated toxins	• Increase research and collaboration between Norway's major research institutions and the industry • Draw lessons from sustainable aquaculture/ mariculture and fishing operations abroad • Introduce an early warning system for algae blooms • Conduct comprehensive environmental impact assessments (EIA) • Promote full utilization of fish by-products	• Rapid reduction in the extent and thickness of multiyear sea ice in the Arctic, rising water temperatures, and alterations in water salinity • Climate change-induced challenges such as fish migrating northwards, or invasive alien species creating ecosystem disturbances (e.g. pink salmon invasion)

4.3 Successful Case Studies

A SUCCESS STUDY FROM ALASKA: INNOVATIONS IN THE PRIVATE SECTOR

Innovative technologies towards a sustainable fisheries transition have not only been adopted by State authorities, but also from private fishing corporations. For instance, Westward Seafoods uses innovative technology methods in order to reduce energy costs, meet strict environmental legislation and create value from waste. Aiming at minimizing its eco-footprint, Westward Seafoods is focusing its attention on a factory by-product known as 'stick water'. This is a liquid mix of water and suspended fish oil and residue that is left over from seafood processing at the company's Westward Seafoods' plant in Dutch Harbor, Alaska. By separating the fish oil from the stick water, Westward Seafoods manages to clean the water and get valuable fish oil to use for omega-3 supplements as well as an alternative to diesel.

Find out more on Westward Seafoods's policy here: https://westwardseafoods.com/

A SUCCESS STUDY FROM GREENLAND: PISUNA – COMMUNITY-BASED MONITORING TO MANAGEMENT

PISUNA (Piniakkanik Sumiiffinni Nalunaarsuineq) in Greenland is a pioneering community-based program integrating traditional knowledge into fisheries management. Initiated in 2009, it involves collaboration between the Greenland Ministry of Fisheries and Hunting, local fishers, and hunters. The program engages local fishermen and hunters in monitoring living resources, turning their observations into actionable data for sustainable fisheries management. This participatory approach has engaged over 90 community members in 15 communities, who actively document and analyze local living resources through Natural Resource Councils. Their insights have led to a substantial database of observations, as well as over 494 community-led proposals for natural resource management actions, including adjustments in fishing seasons for species like the common eider and quota changes for Atlantic cod. Multiple projects in the Arctic have taken inspiration from PISUNA, demonstrating the impact of the project's work.

Visit the PISUNA observations database here: https://eloka-arctic.org/pisuna-net/en.

A SUCCESS STUDY FROM NORTH NORWAY: THE 'TRAFFIC LIGHT SYSTEM'

To better ensure the profitability along with sustainability of Norwegian aquaculture, Norway introduced the 'Traffic light system'. According to the strategy, based on scientific recommendations, the coast is divided into 13 production regions, in which environmental indicators will regulate the production capacity. The current environmental factor is the impact of salmon lice on wild salmon and trout population and it determines if a production increase may be granted. According to the 'Traffic light system' management strategy of the government, six of the seven production regions (numbers 7-13) designated in North Norway, have been granted 'Green light' for increase of production, and 'Yellow' in one, for maintaining the same production capacity.

Learn more about the 'Traffic Light System' here: https://www.forskningsradet.no/siteassets/publikasjoner/2021/an-evaluation-of-the-scientific-basis-of-the-traffic-light-system-for-norwegian-salmonid-aquaculture.pdf

4.4 Main Takeaways and Opportunities for Collaboration - Environment

Alaska, Greenland and North Norway exhibit diverse environmental profiles concerning fisheries and aqua-/mariculture. Despite their geographical disparities, these regions face amplified climate change impacts that increasingly affect their seafood industries, including rising temperatures, ocean acidification, changes in species migrations, invasive alien species disturbances, and coastal erosion. Collaborative research efforts and environmental impact assessments are crucial in addressing these challenges, and the three regions could learn from each other by sharing best practices and experiences. For example, Greenland's commitment to sustainable marine resource management, such as the use of industry-driven MSC certification and the 'trawl bycatch-program', offers valuable insights into reducing bycatch and improving stock assessment surveys. However, challenges persist, including insufficient scientific knowledge for informed management decisions, deficiencies in comprehensive biological references, inadequate monitoring of wider ecosystem indicators, incomplete habitat mapping, and tensions between local and scientific knowledge. In Alaska, on the other hand, a notable commitment to sustainability is demonstrated through collaborative research efforts with institutions like the National Center for Coastal Ocean Science and environmental initiatives by private companies. The adoption of modern technologies and comprehensive environmental impact assessments aims to address climate change-induced challenges, including fish migration and alterations in water salinity. Notably, Alaska implements an electronic monitoring system and initiatives promoting full utilization of fish by-products to enhance sustainable fisheries practices. Similarly, North Norway showcases a sustainable approach to fisheries and aquaculture e.g. through initiatives like the 2020 'traffic light system' and private sector certifications from organizations like MSC and ASC. Persistent challenges include overfishing, discharges from farming facilities, and genetic contamination of wild populations.

Overall, collaboration, knowledge exchange, and international partnerships among Greenland, Alaska, and North Norway are essential for addressing environmental challenges and promoting future sustainable fisheries and aqua-/mariculture practices across the regions. For instance, Greenland could benefit from Alaska's advanced electronic monitoring system and initiatives promoting the full utilization of fish by-products. Alaska, on the other hand, could learn from North Norway's sustainable aquaculture approach and private sector certifications, enhancing its own salmon industries. In turn, Norway could gain lessons from Alaska's hatcheries, which are considered among the world's most sustainable seafood industries. Additionally, North Norway could gain insights from Greenland's community-driven fisheries management and initiatives like the 'trawl bycatch-program' to improve its own management strategies.

Some questions to be considered to enhance regional - environmental - collaboration are:

Sustainable Practices: Considering the fragile Arctic environment, what specific practices or initiatives have been successful in your region in promoting environmental sustainability within the fisheries and aquaculture sectors? What sustainable aquaculture practices have been developed or are being experimented with? How can these practices be shared and adapted across the regions to minimize environmental impact and enhance overall environmental health?

By-Product Utilization: How can the regions of Alaska, Greenland and North Norway further innovate in the full utilization of fish by-products to minimize waste and create additional value streams? Could collaborative projects be established to share technologies and practices that contribute to a zero-waste blue economy?

Climate Change Adaptation: How are fisheries and aqua-/mariculture sectors in each region adapting to the challenges posed by climate change? What innovative approaches or technologies are being explored or have been implemented in your area to increase the resilience of fisheries and aquaculture to climate change? How can stakeholders across the Arctic regions collaborate to scale up such innovations?

Research, Monitoring, and Data Sharing: Can improved research, monitoring, and data-sharing initiatives between Alaska, Greenland, and North Norway enhance the understanding and management of fish stocks and the health of marine ecosystems? Could you discuss a case where cross-regional or international collaboration has played a role in environmental monitoring and management in your region? What made this collaboration effective, and how can we replicate such models? What platforms or mechanisms could support real-time data exchange and joint research initiatives?

Sustainable Resource Management: What management approaches or measures regarding the conservation and sustainable use of marine resources have been effective in Alaska, Greenland and North Norway? How can these be adapted and shared among the regions to address shared environmental challenges?

5. Socio-Cultural Profile

The fisheries and aqua-/mariculture industries in Alaska, Greenland, and North Norway hold significant societal implications, influencing various facets of community life and contributing to overall societal well-being.

Fishing is historically deeply ingrained in the cultural identity of all three Arctic regions, and these industries today provide jobs and livelihoods, particularly in coastal areas, while also contributing to tax revenues that fund local services and infrastructure development. The modernization of seafood industries, aimed at enhancing economic profitability, has, however, led to complex social dynamics that can be encountered throughout the Arctic. The decline in employment, concentration of rights, privatization of commons, and the introduction of advanced technologies have altered traditional social patterns. The tension between large-scale and small-scale or coastal fisheries remains a persistent issue in all three regions, impacting the once deep integration of fishing activities with coastal communities. The ever-changing relationship between the fishing sector, state, and society has thus become a common theme, as technology tends to replace labor and reshapes required skills. Thus, while fisheries continue to be a vital contributor to national economies and a source of employment and subsistence (primarily in Greenland), their decisive impact on coastal communities is diminishing. The decline in community-based fishing is noticeable across all three regions, affecting the cultural identity of local communities. While a significant portion of the male rural population continues to be involved in the industries, women remain limited to processing work or family-driven businesses. Severe challenges also persist in implementing indigenous rights in marine areas. Notably, Greenland's labor market exhibits a unique skill stratification, reflecting colonial history and employing foreign workers for higher qualified roles. Despite these complexities, fishing, both commercial, recreational and subsistence, remains essential for food security in Greenland, more so than in Alaska and North Norway.

5.1 Socio-Cultural Status Quo

	Alaska	Greenland	North Norway
Total Sector Employment	62,200 (2019) ↑	4343 (2022)[18] ↓	~9,000 ↑
Harvesting	34,900 (2019) ↑	n/a	8086 (2019) ↑
Commercial Fishing	31,300 (2019) ↑	n/a	4,824 (2019)
Management/ Hatcheries/Aqua-Mariculture	3,800 (2019) ↑	n/a	3,262 (2019) ↑
Processing	27,100 (2019)	n/a	~880
Total Labor Income from Seafood Industries	USD 1,75 billion	DKK 1.61 billion (2021) ↓ (USD 237 million)	n/a
Average worker age in sector	50 (2017) ↑	55-59 (2022) ↑	50-59 (2021) ↑
Foreign workers[19]	~17270 or 78% (2020) ↑	351 or 25% (2022) ↑	n/a
Gender Inequality in Seafood Industries	n/a	15.4 % (2022) ↑	4% women (double compared to the national average)
Indigenous Groups Employed in Seafood Industries	Aleut, Alutiiq, Athabascan, Eyak, Tlingit, Haida, Tsimshian, Inupiaq, Yup'ik, Cup'ik	Inuit	Sami (Sea Sami)

Information relevant to Alaska has been, inter alia, sourced from Resource Development Council; Alaska Seafood Marketing Institute; NOAA Fisheries; North Pacific Research Board; NOAA Economic; Laborstats Alaska and Social Sciences Research Program; Information relevant to North Norway has been, inter alia, sourced from Fiskeridirektoratet; Klima og miljødepartementet; SINTEF; NOFIMA; Nærings- og fiskeridepartementet; Fiskeridir. Analysis of data relevant to Greenland has been conducted using the latest information available from Statistics Greenland.

[18] Data reflects primary employment figures only. Including secondary employment, figures rose by 1,075 to 5,418.

[19] Regional methodologies for measuring the proportion of foreign workers in the fisheries sector vary significantly. In Alaska, available labor statistics are confined to the post-harvest processing sector and distinguish between Alaskan residents and non-residents, the latter not necessarily being non-U.S. workers. Greenland's approach considers workers who are 'foreign-born.' Conversely, Norway does not maintain data specific to this demographic within the sector.

5.2 Comparative SWOT analysis - Socio-Cultural Profile

Alaska

Strengths	Weaknesses	Opportunities	External Threats
• Privatization of access through various initiatives, such as the Individual Transferable Quota (ITQ) program in federal fisheries and the Limited Entry Program in state managed fisheries • As of 2023, the Western Alaska Community Development Quota (CDQ) Program benefits 65 communities, with 80% being Alaskan Natives • Fishing has deep cultural significance for Alaska Native communities • The Tamgas Creek Hatchery in Metlakatla, AK, is exclusively driven by Alaska Native communities • The NOAA Alaska Fisheries Center (AFSC) provides economic and sociocultural information that assist the National Marine Fisheries Service (NMFS), and as of 2019, has profiled 196 communities • Educational institutions play a significant role in research and public engagement • The Department of Labor and Workforce Development oversees seafood industry employment, training programs, and initiatives supporting fishing-related individuals	• Lack of full implementation of indigenous rights in marine areas - not adopted UNDRIP or ratified ILO C169 • Male-dominant sector, with women engagement remaining highly relevant only to family-based operations • Depopulation due to urbanization • Gradual loss of Traditional Knowledge due to technological advancements, which may have profound implications for biodiversity conservation, cultural identity, and community resilience	• Maintain the regionalization of fisheries and mariculture, placing emphasis on the employment of Alaska residents • Ensure gender equality and increase the participation of women in the workforce • Push the US government to sign and ratify international legal developments pertinent to indigenous rights and consider Traditional Ecological Knowledge (TEK) along with modern technologies • Carry out full-consultations with local communities and incorporate the Free Prior and Informed Consent (FPIC) principle in each of the planning phases of new industries • Conduct comprehensive societal impact assessments (SIA)	• Increased competition in light of globalization and changes in trade policies, such as tariffs and quotas, can affect the competitive landscape by influencing the flow of seafood imports and exports • Environmental factors such as temperature variations, pollution levels, habitat degradation, and ocean acidification can influence the abundance and distribution of fish populations • Consumer trends, dietary choices, health considerations, and cultural factors all play a role in shaping the demand for seafood products • Market dynamics such as globalization, technological advancements, trade policies, and sustainability certifications influence market demands for seafood

Greenland

Strengths	Weaknesses	Opportunities	External Threats
• High labor resilience to harsh conditions and environmental change. • Retention and integration of traditional practices and techniques into modern fisheries, such as the coastal halibut catch • Use of offshore sector policies to stimulate growth in the coastal post-harvest sector. • Use of private-public partnerships to drive business development and employment, such as new fish processing plants in remote areas in East Greenland • Strong tradition of international exchanges, like NORDJOBB and Northern Periphery and Arctic Programme, to address gaps in skills development and labor availability. • Job satisfaction remains high even amidst challenges.	• Wage and occupational standards inequality between offshore and inshore sectors • Few job prospects or choices outside of fisheries in rural settlements • Overcapacity and hidden unemployment coastal fisheries • Struggle to balance wage work with subsistence practices. • Colonial perceptions and tendencies in managerial hiring processes • Gender stereotypes and inequality within fisheries and post-harvest sector	• Implementing Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines) • Synergies between tourism and fisheries • Celebrating traditional knowledge and practices • Upskilling of coastal fishers • Cultural integration and skill exchange • Youth engagement and sector rejuvenation (intergenerational knowledge transfer) • Encouraging gender inclusivity • Diversifying coastal sector opportunities • Expanding digital and remote training solutions	• Post-industrialization leading to increasing absorption by the public sector • High national unemployment • Rural depopulation threatens post-harvest sector stability and future climate-driven expansion of fisheries into northern Greenland • "Brain drain" phenomenon resulting in loss of skilled, young workers • Loss of traditional knowledge transfer to younger generations • Negative impact of climate change on traditional practices and wellbeing • Public health challenges including mental health, increasing obesity, and lifestyle diseases • Vulnerability to market price fluctuations leading to volatile employment, particularly in the post-harvest sector

North Norway

Strengths	Weaknesses	Opportunities	External Threats
• Fisheries and aquaculture, like shrimp fisheries in North Troms, boost local welfare by sustaining settlements and employment in sparsely populated regions • Local vessels from East Finnmark, Porsanger, and Nordkapp are exclusively permitted in the red king crab fishery, ensuring local economic growth and community involvement • Lofoten Seaweed, a small company, sustainably harvested wild seaweed to create food, nutritional, and cosmetic products. It has earned multiple awards • Certain Sámi areas embrace aquaculture as a way to bolster the local economy and preserve cultural heritage • North Norway still accounts for over twice as much female representation in fisheries compared to the national average • Under the 2005 Finnmark Act a process has been initiated towards the evaluation of Sámi customary rights in marine areas and traditional fisheries	• Conflicts between state and local small-scale/Sami fisheries • Conflicts with Sami due to aquaculture developments in traditional areas • Greater risk of injuries and fatalities for small-scale fishermen • Male-dominated industries (less than 5% women) • Depopulation due to urbanization • The gradual loss of Traditional Knowledge due to technological advancements is a significant concern, especially for indigenous and local communities. As modern technologies replace traditional practices, there's a risk of eroding invaluable knowledge passed down through generations	• Regionalize fisheries and aquaculture • Increase resident employment • Increase participation of women in the workforce • Carry out full-consultations with local communities and incorporate the Free Prior and Informed Consent (FPIC) principle in each of the planning phases of new industries in traditional areas • Consider TEK along with scientific knowledge • Conduct comprehensive societal impact assessments (SIA)and Assess Sami rights in marine areas in accordance with the scope of the Finnmark Act	• Increased competition in light of globalization and changes in trade policies, such as tariffs and quotas, can affect the competitive landscape by influencing the flow of seafood imports and exports • Environmental factors such as temperature variations, pollution levels, habitat degradation, and ocean acidification can influence the abundance and distribution of fish populations • Consumer trends, dietary choices, health considerations, and cultural factors all play a role in shaping the demand for seafood products • Market dynamics such as globalization, technological advancements, trade policies, and sustainability certifications influence market demands for seafood

5.3 Successful Case Studies

A SUCCESS STORY FROM ALASKA: THE WESTERN ALASKA COMMUNITY DEVELOPMENT QUOTA PROGRAM

Local participation serves as a crucial measure of sustainability and the blue economy in Alaska fisheries, and it manifests itself in various forms. One notable initiative is the Western Alaska Community Development Quota (CDQ) Program, which has been established with the goal of enabling eligible villages to engage in fisheries activities, promote economic development, reduce poverty, and provide economic and social advantages for local residents. By fostering sustainable and diversified local economies, the CDQ Program seeks to support long-term prosperity and the well-being of Alaskan communities. Non-profit CDQ groups are allocated 10% of the annual quotas for Alaska Pollock, groundfish, crab and halibut fisheries of the Bering Sea and Aleutian Islands, in order to fund docks, seafood processing facilities and other projects. As of 2023, 65 communities are associated with the CDQ program, 80% of whom are Alaskan Natives. Revenues achieved through the CDQ program totals in the hundreds of millions annually distributed among the eligible communities.

Learn more about the Western Alaska Community Development Quota (CDQ) Program here: https://www.fisheries.noaa.gov/alaska/sustainable-fisheries/community-development-quota-cdq-program

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A SUCCESS STORY FROM NORTH NORWAY: THE RED KING CRAB MANAGEMENT REGIME IN FINNMARK

Given that seafood industries have historically represented North Norway's primary economic pillar, numerous instances illustrate the government’s commitment to fostering social inclusion and community advancement in the region. An interesting such initiative constitutes the development of Red King crab fisheries in Finnmark. The Red King crab, originally introduced to the Barents Sea by Soviet scientists in the 1960s, has become an invasive species in the Northeast coast of Norway with significant ecological and economic repercussions, particularly on important species like cod. As mentioned above, in response to the spread of the Red King crab, a management plan was devised with dual objectives. While it aimed to curtail the crab’s westward expansion into Norwegian marine areas, it also sought to sustain a long-term commercial fishery for the Red King crab, contributing to socioeconomic

growth in the region and compensating fishermen for potential losses due to the crab's impact on crucial ground fish species. Against this background, participation in the Red King crab fishery is restricted to local vessels registered in East Finnmark or the municipalities of Porsanger and Nordkapp. These restrictions ensure local economic development, aligning with the plan's initial objective. Currently, approximately 600 vessels are licensed for Red King crab catches in Finnmark, contributing to both economic growth and the preservation of local fisheries and traditional knowledge.

Find out more about the Red King crab story here: https://nordnorge.com/en/artikkel/king-crabs-from-finnmark-have-their-own-luxury-hotel/

A CASE STUDY FROM GREENLAND: NUTAAQ® COD – REVITALIZING GREENLAND'S COD INDUSTRY

The Nutaaq® cod project, launched by Royal Greenland in 2015, represents a successful fusion of traditional fishing practices with modern processing techniques. This initiative has not only revitalized a crucial segment of Greenland's local economy but also set new standards in the seafood industry for quality and sustainability. Historically, Atlantic cod was vital to Greenland's economy, but a late 20th-century shift saw local processing decline in favor of exporting unprocessed cod to China, a move driven by cheaper labor costs but impacting local employment and product quality. The introduction of Nutaaq cod, translating to 'the new' in Greenlandic, marks a return to and modernization of traditional fishing practices. Best described as a form of short-term capture-based aquaculture, this initiative collaborates with local fishermen, using a traditional method to capture and contain cod in net traps along Greenland's rocky coastlines. This is followed by a period of containment without feeding, ranging from two to four weeks. Taking a novel approach to processing, this is then followed by rapid freezing within two hours of capture, ensuring superior freshness and nutritional quality.This approach not only ensures minimal environmental impact and by-catch but also enhances the quality of the fish. Starting with just 25 fishermen, the project has grown to engage around 120 fishermen. The approach has effectively tackled the challenge of seasonal quality fluctuations in cod, stabilizing marketability and prices. The higher quality of Nutaaq cod has moreover captured demand as a premium product, particularly in European markets like the UK. This demand has led to better pricing, benefiting both fishermen and processors. With 4500 tons of Nutaaq cod processed in 2020, investments are currently in place to expand production capacity.

Read more about Nutaaq® cod here: https://www.royalgreenland.co.uk/foodservice/Concepts/nutaaq-cod/

5.4 Main Takeaways and Opportunities for Collaboration - Societies

The SWOT analysis demonstrates that Greenland, Alaska, and North Norway can learn valuable lessons from each other's approaches to fisheries and aquaculture in addressing socio-cultural challenges and promoting community well-being. For instance, Alaska's Individual Transferable Quota (ITQ) program and the Western Alaska Community Development Quota (CDQ) Program demonstrate effective strategies for prioritizing community engagement and economic development, especially in rural areas. Greenland and North Norway could benefit from similar initiatives to increase resident employment and maintain settlement in sparsely populated regions. Furthermore, North Norway's emphasis on local vessel eligibility for certain fisheries, as seen in the red king crab fishery, highlights the importance of securing local economic development and societal engagement. This approach could further inspire Greenland and Alaska to implement similar schemes to bolster community welfare and involvement in the seafood industry, thereby addressing challenges related to depopulation and maintaining cultural survival. Additionally, the successful integration of traditional practices and sustainable industry practices in North Norway, such as the small company Lofoten Seaweed employing women in local communities, presents an opportunity for knowledge exchange. Greenland and Alaska could learn from these initiatives to further promote gender inclusivity and cultural preservation within their own seafood industries. Furthermore, North Norway's efforts to assess Sámi customary rights in marine areas and traditional fisheries under the 2005 Finnmark Act demonstrate a commitment to gradually incorporating indigenous perspectives into seafood industry planning processes. Greenland and Alaska could adopt similar approaches by considering Traditional Ecological Knowledge (TEK) alongside scientific knowledge and conducting comprehensive societal impact assessments to address conflicts with indigenous communities and promote cultural resilience. By sharing best practices and experiences in decentralizing and regionalizing fisheries, increasing women's participation in the workforce, and conducting thorough societal impact assessments, Greenland, Alaska, and North Norway can collectively address common challenges and foster sustainable socio-cultural development within their seafood industries. Related questions are:

Community and Indigenous Engagement: In what ways have local and Indigenous communities been engaged in the development and management of fisheries and aqua-/mariculture in Alaska, Greenland and North Norway? How can stakeholder collaboration be improved to ensure the socio-cultural sustainability of these sectors? What models of community-based management or engagement have proven most effective, and what can other regions learn from your experience?

Traditional Knowledge: How can traditional knowledge and practices be integrated with modern aquaculture and fisheries management to enhance socio-cultural and environmental outcomes? What are some examples of successful integration in these regions?

Inclusive Development: How can the blue economy sectors in Alaska, Greenland and North Norway be developed to better include and benefit women? What barriers currently exist to women's full participation, and what successful models of inclusion can be shared and adapted across these regions to empower women economically and socially?

Youth and Education: What initiatives are in place or could be developed to engage the youth in the blue economy sectors, ensuring knowledge transfer and the sustainability of these industries? Could educational institutions or exchanges be involved in this process? What role does engaging with youth and incorporating their perspectives play in fisheries management?

6. Governance Profile

In the realm of governance, the fisheries and aquaculture sectors of Alaska, Greenland and North Norway exhibit distinct approaches, reflecting the regions' unique historical, political and cultural contexts.

North Norway operates under a highly centralized governance model, where decision-making is largely driven by national regulations and policies. This approach facilitates comprehensive management but can sometimes overlook local nuances. The region has seen increasing stakeholder involvement, particularly from environmental groups, influencing policy shifts toward more sustainable practices. In contrast, Alaska has adopted a more decentralized governance system, allowing for significant local and regional input, particularly from Indigenous communities. Alaska's system incorporates elements of co-management, where state and federal agencies collaborate with local stakeholders, balancing economic interests with traditional and cultural considerations. However, challenges in balancing economic interests with conservation goals persist. In contrast, Greenland, at a developmental crossroads, employs a more hybrid model. This approach aims to leverage the strengths of centralized policy-making, ensuring national-level objectives, while also embracing local knowledge and needs with elements of stakeholder involvement. Such diverse governance frameworks across these regions highlight the importance of context-specific strategies in fisheries and aquaculture management. Despite their differences, a common thread in all three regions is the evolving recognition of the need for more inclusive, adaptable governance structures that can respond to dynamic environmental, social, and economic pressures. All three regions increasingly participate in regional and international collaborations, recognizing the transboundary nature of marine resources and the need for shared governance approaches to address global challenges like climate change.

5.1 Governance Status Quo

	Alaska	Greenland	North Norway
Main Legislation	1976 Magnuson Stevens Act (MSA) 1995 Fish Stocks Agreement 1998 American Fisheries Act (AFA) Species-based legislations	1979 Home Rule Act 1996 Fisheries Act	1982 UNCLOS 1995 Fish Stocks Agreement 2008 Act relating to the management of wild living marine resources (Marine Resources Act)
Jurisdiction	State holds jurisdiction to 3 nm Federal government holds jurisdiction to 3-200 nm	Sovereign rights to 200 nm EEZ	Sovereign rights to 200 nm EEZ

	Alaska	Greenland	North Norway
Management	Federal level (beyond 3 nm): The Secretary of Commerce holds authority for managing resources in the EEZ NOAA is responsible for managing and conserving marine resources in federal waters throughout the US The North-Pacific Fisheries Management Council (NPFMC) develops offshore fishery management plans (FMPs) and regulatory measures for federal fisheries in the North Pacific FMPs outline the status of the fisheries and encompass regulations on the allocation of TACs, gear, bycatch and discard regulations, and limitations on access to resources in terms of space and time State level (within 3 nm): The Alaska Department of Fish and Game (ADF&G) is responsible for managing the state's fisheries and mariculture activities Board of Fisheries (BOF) establishes regulations and policies for fisheries management in Alaska, including subsistence, commercial, sport, and personal use fisheries	Management is broken into inshore and small-scale fisheries and offshore, large-scale sectors. This categorization is based on distance from the coast—3 nautical miles beyond the baseline of the fishing territory—and vessel size, distinguished as over or under 75 GRT/120 GTt The basis of Greenland's fisheries for both small and large sectors is the total allowable catch (TAC) as recommended through the biological advice of the Greenland Institute of Natural Resources (GINR) and mandated by the Ministry of Hunting, Fisheries and Agriculture (MFHA) of the Government of Greenland in consultation with the Fisheries Council (Fiskerirådet) At the regional level, Greenland is a contracting party to conventions set out by the Northwest Atlantic Fisheries Organisation (NAFO) and North-East Atlantic Fisheries Commission (NEAFC) to manage transboundary fish stocks beyond its national jurisdiction	North-East Atlantic Fisheries Commission (NEAFC) The Directorate of Fisheries plays a key role in overseeing fisheries Scientific research for management is conducted by the Institute of Marine Research The Ministry of Climate and Environment and the Norwegian Environmental Agency contribute to integrated marine area management

	Alaska	Greenland	North Norway
Enforcement	Alaska Department of Public Safety, through its Division of Alaska Wildlife Troopers	Greenland Fisheries License Control (GFLK) handles enforcement and surveillance of Greenland's inshore and offshore fisheries Additional offshore enforcement and prevention of illegal, unreported and unregulated (IUU) fishing is carried out by the Danish Navy	The Coast Guard, part of the Royal Norwegian Navy, handles enforcement at sea
Legislation for Mari-/ Aquaculture/ Management/ Hatcheries	The Alaska Department of Fish and Game (ADF&G) is responsible for managing the state's fisheries and mariculture activities	No specific act as of yet	Aquaculture Act of 2005 The Ministry of Trade, Industry, and Fisheries (MTIF) holds responsibility for overseeing the administration and implementation of the Aquaculture Act The Directorate of Fisheries is the designated authority tasked with enforcing the regulations and provisions outlined in the Act Through the Planning and Building Act of 2008, marine spatial planning is delegated to local municipalities for areas up to one nautical mile, ensuring a high degree of discretion for municipal authorities to decide the development of aquaculture. The Sámi Parliament has the right to object to the establishment of an aquaculture project during the coastal zone planning process

	Alaska	Greenland	North Norway
Relevant RFMOs	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (CCBSB) Western and Central Pacific Fisheries Commission (WCPFC) International Pacific Halibut Commission (IPHC)	North-East Atlantic Fisheries Commission (NEAFC) North-East Atlantic Fisheries Commission (NAFO) North Atlantic Salmon Conservation Organization (NASCO) North Atlantic Marine Mammal Commission (NAMMCO) Via Denmark, Greenland is also a member of the International Council for the Exploration of the Sea, ICES, which coordinates and promotes marine research in the North Atlantic	North-East Atlantic Fisheries Commission (NEAFC) North Atlantic Salmon Conservation Organization (NASCO) International Commission for the Conservation of Atlantic Tunas (ICCAT)
Other species-centered regimes	Crab fisheries are jointly managed by both federal and state authorities Salmon fisheries are managed exclusively by state authorities	Internal-use fishery for salmon	King crab regime in Finnmark
International treaties	International Pacific Halibut Commission US-Canada Pacific Salmon Treaty	Bilateral Sustainable Fisheries Partnership Agreement (SFPA) with EU Bilateral Norway-Greenland fisheries agreement Bilateral UK-Greenland fisheries dialogue Bilateral Faroe-Greenland fisheries agreements Tripartite negotiations with Greenland, Iceland, and the Faroe Islands on the allocation of redfish quotas in the North Atlantic Multilateral agreement between the EU, Faroe Islands, Greenland, Iceland, Norway, and the United Kingdom on Mackerel in the North-East Atlantic	Trilateral EU-UK-Norway fisheries agreement Bilateral EU-Norway fisheries agreement Bilateral UK-Norway fisheries agreement Agreement between the Government of Norway, the Government of Iceland, and the Government of the Russian Federation concerning certain aspects of cooperation in the area of fisheries

6.2 Comparative SWOT analysis - Governance Profile

Alaska

Strengths	Weaknesses	Opportunities	External Threats
• In 2023, the bill S.1227 was introduced to combat foreign illegal, unreported, and unregulated (IUU) fishing practices • The Commercial Fisheries Entry Commission is vital in enforcing Alaska's limited entry law by issuing fishing permits and meticulously recording harvest volume and value for state fisheries • The Department of Commerce, Community, and Economic Development is increasingly focusing on the seafood industries • The Alaska Seafood Marketing Institute aims to enhance the economic value of Alaska seafood through marketing efforts and other initiatives • The State of Alaska offers training opportunities and extension services through institutions	• The complexity of the governance structure of Alaska fisheries and mariculture governance may lead to potential fragmentation • Monitoring and enforcing fishing regulations and mariculture operations across Alaska's vast and remote coastal areas characterized by severe climatic conditions present significant logistical challenges • Balancing competing interests and fostering collaboration among different stakeholders is challenging	• Increase coordination among different stakeholders and collaboration between state and federal authorities • Enhance data collection and scientific research and promote adaptive management approaches • Incorporate climate change considerations into management strategies in light of a changing Arctic environment • Ensure transparent and inclusive decision-making processes • Strengthen collaboration with local and indigenous communities to support co-management efforts	• Possible changes in distribution and migration patterns of stocks caused by climate change could test existing governance structures • The increasing frequency and severity of extreme weather events can disrupt fishing operations, damage hatcheries or mariculture infrastructure, and affect the distribution and abundance of fish stocks • Tensions, arising from competing territorial claims, resource exploitation interests, and strategic considerations among Arctic nations, have the potential to disrupt cooperative efforts and agreements regarding the management and regulation of shared stocks

Greenland

Strengths	Weaknesses	Opportunities	External Threats
• Strong government support for fisheries and associated research and development • Close relationship between government and major industry stakeholders • High voluntary compliance with regulation, including in small-scale fisheries • Use of low-cost digital solutions to improve monitoring, including electronic logbooks and SMS 'nudge' deterrence strategies against underreporting • Incorporation of MSC certification into fisheries governance for improved accountability, predictability, and transparency • Effectiveness of Greenland's Fisheries Observer Program as a model to improve catch reporting, with a discard rate several times lower than the global average	• Lack of integration of Indigenous and user knowledge into formal fisheries management and decision-making at the national level • Substantial stakeholder disagreement impedes fisheries management reform • Strained relationship between scientific advisories and government resulting in public distrust • Gaps in cooperation with adjacent coastal states in transboundary resource management, particularly with. Iceland and Canada • Remote geography and lack of resource challenges conventional command-and-control enforcement • Poor oversight of large, mostly unregistered coastal fleet falling below regulatory thresholds for international safety and environmental standards	• Improve data transparency and disclosure in fisheries management and supply chains • Support development of Community-Based Fisheries Management (CBFM) and co-management approaches • Formal structure for public engagement and inclusion in the scientific process • Proactively ensure robust aquaculture governance structures (scientific monitoring, management, control) • Strengthening management of inshore fisheries. • Committing to Global Dialogue on Seafood Traceability standard	• Possible changes in distribution and migration patterns of stocks caused by climate change could test existing governance structures • High ministerial and political turnover

North Norway

Strengths	Weaknesses	Opportunities	External Threats
• Local schemes, like the Red King Crab management in Finnmark, sustainably prioritize community interests in quota-regulated zones • Norwegian-Russian collaboration on shared stock quotas under the Joint Norwegian-Russian Fisheries Commission remains intact despite Russia's strained relations with the West following the Ukraine invasion • Norwegian aquaculture's multi-level approach ensures effective coordination in regulating, managing, and promoting sustainability	• Lack of regionalization of fisheries and aquaculture with most decision-making currently occurring in the south • Existing aquaculture governance structures frequently affect both small-scale fisheries and Sami fisheries	• Promote regional fisheries and decentralization policies to shift decision-making away from actors in Southern Norway • Enhance stakeholder coordination and ensure transparent, inclusive decision-making in fisheries management • Incorporate climate change considerations into management strategies • Address Sami rights in the sea and collaborate with local communities to support co-management	• Possible changes in distribution and migration patterns of stocks caused by climate change will test governance structures • Studies warn that the Gulf Stream system of warm ocean currents could collapse in the future, potentially impacting biodiversity distribution along the coast • Tensions, arising from competing territorial claims, resource exploitation interests, and strategic considerations among Arctic nations, have the potential to disrupt cooperative efforts and agreements regarding the management and regulation of shared stocks

6.3 Successful Case Studies

A SUCCESS STORY FROM ALASKA: THE 2023 FISH ACT

In 2023, the senator from Alaska, in collaboration with a bipartisan coalition of senators from Hawaii, Rhode Island, and Mississippi, introduced the bill S.1227. Referred to as the Fighting Foreign Illegal Seafood Harvest (FISH) Act, this legislation aims to combat foreign illegal, unreported, and unregulated (IUU) fishing practices. The bill proposes several measures, including the blacklisting of offending vessels from U.S. ports and waters, strengthening the enforcement capabilities of the U.S. Coast Guard, and advancing negotiations at international and bilateral levels to establish enforceable agreements and treaties. The FISH Act builds upon previous significant efforts against IUU fishing, such as the Maritime SAFE Act, which was enacted in December 2019 as part of the National Defense Authorization Act. By introducing this new legislation, the senator seeks to further address the issue of IUU fishing in Alaska and enhance the regulatory framework to ensure the future sustainability and legality of seafood harvesting practices throughout the United States.

You can access the Foreign Illegal Seafood Harvest (FISH) Act here: https://www.govinfo.gov/app/details/BILLS-118s1227is/summary

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A SUCCESS STORY FROM GREENLAND: ENHANCING COMPLIANCE IN ATLANTIC SALMON FISHERIES

Faced with the challenges of enforcing regulation in remote and expansive areas, Greenlandic authorities adopted a subtle yet effective approach to improve compliance among fishers using low-tech behavioral nudges. This strategy involved the targeted use of SMS reminders, a low-cost intervention that proved to be remarkably successful. Fishers receiving these reminders showed a 6% increase in compliance rates in reporting their salmon catch, highlighting the efficacy of this simple behavioral intervention. This case exemplifies how understanding and leveraging fishers' behaviors and attitudes can lead to effective management outcomes, even in challenging environments where traditional enforcement is less practical.

Read the full academic study here: https://academic.oup.com/icesjms/article/78/8/2809/6364351

A SUCCESS STORY FROM NORTH NORWAY: ROBUST AQUACULTURE GOVERNANCE

While the governance of the fisheries sector is often characterized as centralized, the multifaceted approach of Norwegian aquaculture dispersed across three levels of administration: national, county and municipal, has managed to ensure a robust coordinated effort in regulating and managing the aquaculture industry, addressing various dimensions of environmental and societal impact, and promoting sustainable practices within the sector. Under this apparatus, North Norway has implemented a robust regulatory framework that balances environmental sustainability with economic considerations, allowing for the responsible management of aquaculture. With nearly half of this production occurring in North Norway, Norway managed to export 2.9 million tonnes of seafood to a value of NOK 151.4 billion in 2022.

Visit the Norwegian government's department of aquaculture here: https://www.regjeringen.no/en/dep/nfd/organisation/Departments/havbruksavdelingen/id2696730/

6.4 Main Takeaways and Opportunities for Collaboration - Governance

Disregarding their commitment to international law of the sea instruments that in general provide the framework for sovereign states to organize their living resource management, Greenland, Alaska, and North Norway exhibit distinct governance profiles in managing their fisheries and aqua-/mariculture sectors. Greenland's governance structure emphasizes strong government support for the industry, yet faces challenges regarding regulatory frameworks, cooperation with adjacent coastal states, and integration of Indigenous/local knowledge into formal management. To enhance its governance, Greenland could benefit from enhancing regional collaboration, promoting community-based fisheries management, and strengthening aquaculture governance structures. On the other hand, in Alaska, the largely regionalized governance structure involves multiple agencies and stakeholders, leading to potential fragmentation. Logistical challenges in monitoring and enforcing regulations across remote coastal areas further complicate governance efforts. Alaska could improve the governance of its seafood industries by increasing coordination among stakeholders, enhancing data collection and scientific research, and incorporating climate change considerations into management strategies and thus draw on Norway's coordinated approach to aquaculture regulation and Greenland's initiatives in promoting community-based management. North Norway's governance approach encompasses local schemes and international collaborations, demonstrating successful management of shared stocks and robust coordination in regulating aquaculture. However, challenges such as the lack of regionalization and impact on small-scale and Sami fisheries persist. To improve its current governance structure, North Norway could promote regionalization of fisheries, incorporate climate change considerations into strategies, and strengthen collaboration with local and Sami communities for co-management efforts. North Norway could thus draw lessons from Alaska's inclusive decision-making processes and Greenland's emphasis on sustainable practices. By sharing experiences and best practices, these regions can strengthen their governance frameworks and promote sustainable and robust future fisheries and aqua-/mariculture practices.

Key questions to be addressed are:

Regulatory Frameworks: What are the key similarities and differences in the regulatory frameworks governing fisheries and aqua-/mariculture in Alaska, Greenland and North Norway? Is there value in aligning regulations or standards across regions?

Best Practices in Policy Making: What are some of the best practices in policy making and governance that have led to successful development of the blue economy in each of the three regions? How can these practices be shared and adapted across the regions?

Conflict Resolution and Cooperation: How have conflicts over resource use been managed in these regions? What mechanisms or bodies can be established to promote cooperation and resolve disputes, both within and between the Arctic regions?

Climate Change Mitigation and Adaptation Policies: How are current governance structures in your region equipped to integrate climate change mitigation and adaptation strategies within the fisheries and aqua-/mariculture sectors? What policy adjustments or innovations could better support these sectors in adapting to climate change while promoting economic growth?

Policy Inclusion for Traditional Knowledge: How can policies be adapted or created to better include traditional ecological knowledge in the management of fisheries and aqua-/mariculture? Are there examples of policies from Alaska, Greenland or North Norway that have successfully integrated such knowledge?

Indigenous Participation: How are Indigenous communities currently involved in the governance of fisheries and aqua-/mariculture in Alaska, Greenland and North Norway? What are the best practices for enhancing their participation and ensuring their rights and knowledge are integrated into policymaking and management practices? Have co-management models involving Indigenous communities, government agencies, and industry stakeholders been successful in your region?

Cross-border Environmental Governance: Given the transboundary nature of marine ecosystems and the migratory patterns of many fish species, what are the challenges and opportunities for enhancing cross-border environmental governance among Alaska, Greenland and North Norway? Should these regions work together more effectively to address shared environmental challenges?

International Cooperation: What role can international cooperation play in addressing transboundary challenges such as illegal fishing, biodiversity conservation, and climate change impacts on the blue economy? How can the Arctic regions lead by example?

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ABSTRACT

Despite regional disparities, Alaska, Greenland, and North Norway are three Arctic coastal regions that share common challenges and opportunities in harnessing marine resources sustainably. This report presents a comprehensive analysis of the blue economy - in fisheries and aqua-/mariculture - initiatives within these regions, focusing on economic diversification, environmental conservation, social inclusion, and governance frameworks. The report explores efforts to foster innovation and entrepreneurship, alongside placing emphasis on the better utilization of traditional industries. It evaluates strategies for balancing economic development with conservation imperatives, including climate change mitigation and sustainable resource management. Paramount considerations encompass community engagement, Indigenous rights, and the preservation of cultural heritage. Lastly, governance structures are critically examined, highlighting evolving frameworks that accommodate local, national, and international interests. By addressing the current lack of systematized comparative studies, this report offers valuable insights for policymakers and stakeholders to foster transregional exchanges and enhance cooperation in blue economy development across Arctic coastal regions.

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