SmartChain
Blue Bioeconomy Solutions

# BlueBio SMARTCHAIN Project

# Barriers to higher resource utilization in demersal fish supply chains in Norway and Iceland

Research Findings Brief
September 2024

## Drivers and causes of FLW

***The aim is to identify drivers and causes for FLW in different stages of the fisheries supply chain and identify opportunities to increase the use of RRM.***

## RRM challenges

***The main challenges in full utilization of marine resources are access to RRM considering large exports of whole fish, uncertain profitability in RRM value chains, technology and storage on board insufficient and lack of full traceability.***

## FLW in seafood supply chains

***The majority of FLW in the whitefish industry comes from the sea-going fleet because of discards.***

Both Norway and Iceland are important global exporters of demersal fish. Even though most of the harvested fish are from sustainable fish stocks they are fully exploited. It it therefore not a feasible option to increase the harvest, to meet the future global demand of seafood. Simultaneously, there are significant amounts of under-utilised rest raw materials (RRM) during harvesting, such as heads, skins, viscera, as well as prevalent food loss and waste (FLW) in the demersal fish supply chains. To identity barriers and opportunities to increase use of RRM and identify drivers and causes for FLW, we have reviewed literature and conducted interviews with industry representatives, as well as mapping information on data capturing and current regulations in Norway and Iceland governing demersal fisheries.

## Defining FLW and RRM

FAO[1] (n.d.) defines 'food loss' as the decrease in the quantity or quality of food resulting from decision and action by the food industry, while 'food waste' is defined as a decrease in quality and/or quantity in the retail, service, and/or consumption stage. While food loss originates from volume of the main product, like the filet, originally intended for human consumption, RRM originates from the process of producing the main product, separating out other fractions not commonly used for human consumption. Figure 1 shows the stages in the seafood supply chain and gives a schematic overview of how losses or residual fractions are defined as either "food loss", "rest raw materials" or "food waste".

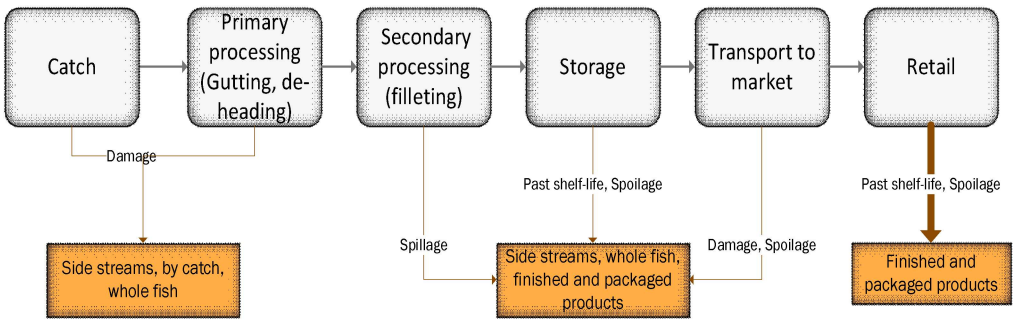


*Figure 1 The generic whitefish supply chain with critical points where losses occur.*

Currently, national level data on FLW is not generated on a regular basis which is identified as an important knowledge gap in mapping amounts of FLW. Our findings show that regulatory interventions during catch and improved RRM traceability could

[1] FAO. (n.d.). Food Loss and Waste (FLW) in Fish Value Chains. Food Loss and Waste in Fish Value Chains. https://www.fao.org/flw-in-fish-value-chains/overview/food-loss-and-waste-in-fish-value-chains/en/

## RRM utilization and export

***Currently, Iceland has a higher rate of utilization in the demersal fish sector than Norway due to certain regulatory, economic, and institutional aspects***

enhance the utilization of RRM in demersal fish supply chains. Information sharing and collaboration between the fishing fleet, seafood processors and the marine ingredient sector would allow improved resource utilization through better management of supply and demand. Furthermore, development of technology for on-board processing and storage is a potential area of improvement. The majority of FLW in the whitefish industry comes from the sea-going fleet because of discards. The main reason for this is the lack of technological solutions on board of the fleet and financial incentives to bring the raw material ashore.

# Differences between Norway and Iceland

Iceland has been leading in exporting prepared products, in particular fresh fish/fillets by air due to a larger investment in technology for filleting and portioning, which have been enabled by an increasing share of vertical integrated companies having control of both the fisheries and the processing stage. Norway on the other hand, with less vertical integrated companies, mainly export whole, gutted fish due to high custom duties on prepared products to important markets (i.e. the EU) and high salaries, making it less profitable to process domestically. Both countries have been trending towards higher utilization, and value-added production of the RRM in recent years. For example, the RRM utilization from Norwegian demersal fish industry have in the last years increased from less than 40% to about 60%, while Iceland has reached around 80% as shown in Figure 2.

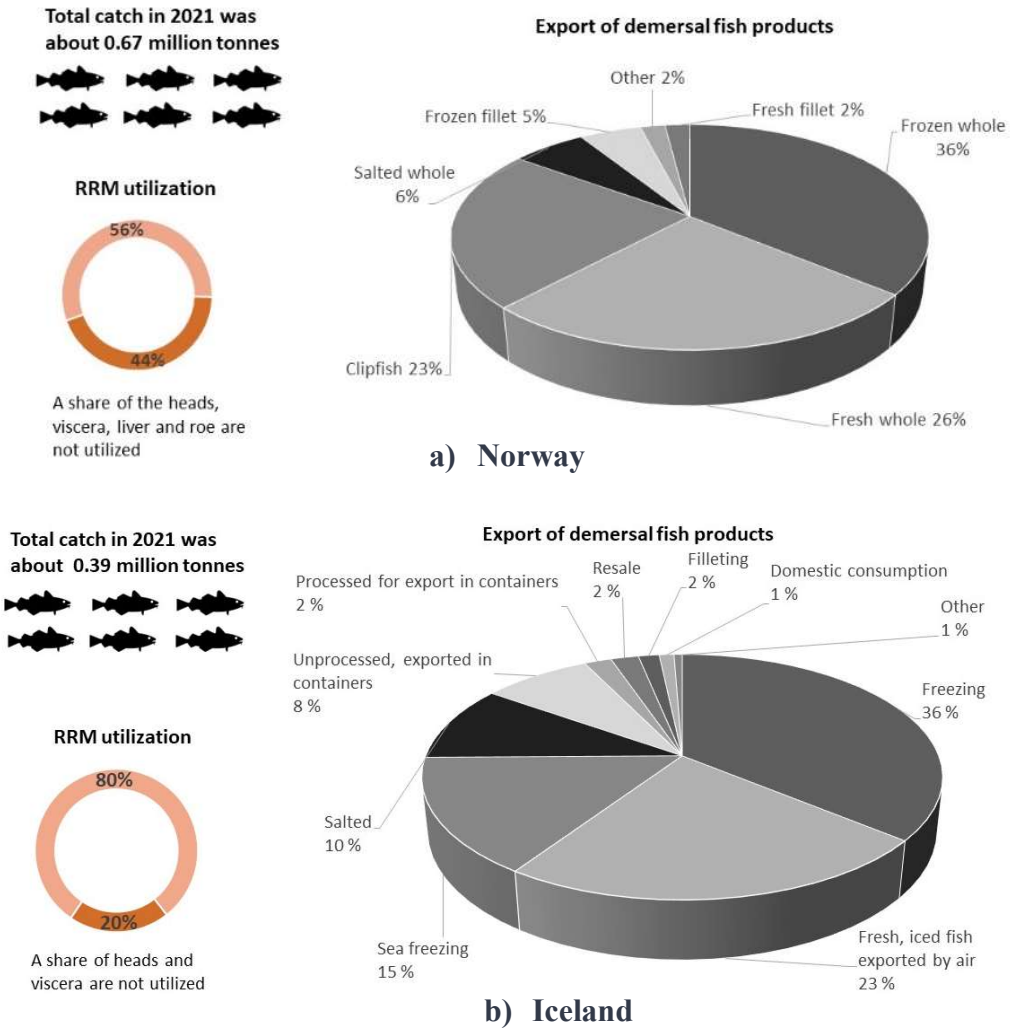


*Figure 2: Total catch, approximate resource utilization and categories of exported demersal fish products (cod, haddock and saithe in 2021 for a) Norway and b) Iceland (Source: Strand et al., 2024)*

## Leverage points for enhanced sustainability

***To enhance the sustainability of the seafood supply chain, it is necessary to increase the use of RRM, improve decision making, and establish relevant sustainability indicators to assess performance.***

For Iceland, only viscera and a share of the fish heads are discarded at sea and is currently not being utilized while most of the catch and the RRM in cod processing on land is utilized[2]. Norway has been producing fish oil and silage from the fractions that are accepted for human consumption by regulation, because of low consumer acceptance and economics which influence further processing into lower value feed ingredients today.

Overall, there are many similarities in terms of information flows and regulatory environment in the seafood supply chains in Norway and Iceland. However, the vertical integration of fishing vessels and processors which is more common in Iceland show a higher degree of information sharing and better production planning.

# Key findings on reducing FLW and increasing the utilization of RRM in demersal fish supply chains

To enhance the sustainability of the supply chain, it is necessary to increase the use of RRM, improve decision making in the supply chain, and establish relevant sustainability indicators. Additionally, increasing transparency within the supply chain is a key element in achieving these goals. Various efficient and advanced technologies are readily available to enhance traceability in the seafood sector. However, current regulations do not mandate companies to utilize these technologies, and the existing economic incentives are not sufficiently enticing for companies to adopt them. The following points were identified as key barriers towards increasing the utilization of RRM in the fisheries supply chain.

## Transparency, communication, and information sharing

***Companies interviewed state that lack of information on available raw materials and quality is a major barrier towards optimization of production and production planning.***

- There is currently no information available on volumes of losses/discards of by-catch during catch operations, and there is a need for national level data on FLW generated on a regular basis to map amounts of FLW.
- The development of technology for on-board processing and storage is a potential area of improvement to reduce discards at sea
- Iceland has stricter regulations and economic incentives to facilitate total utilization of the catch, Norwegian fisheries management do have incentives for landing of by catch.
- The industry structure of the whitefish sectors differs in terms of communication and production planning where the Norwegian whitefish sector faces some challenges to enhance the utilization of RRM in comparison to the Icelandic vertically integrated whitefish sector.
- Lack of monitoring and documenting temperature and quality of RRM is a barrier towards further utilization.

[2] Viðarsson, J. R., Guðjónsson, Þ., & Sigurðardóttir, S. (2015). Report On Current Practices In The Handling Of Unavoidable, Unwanted Catches. Zenodo. https://doi.org/10.5281/ZENODO.1204294

## Key sources for further information

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*Scientific publication:*

Strand, A. V., Mehta, S., Myhre, M. S., Ólafsdóttir, G., & Saviolidis, N. M. (2024). Can higher resource utilization be achieved in demersal fish supply chains? Status and challenges from Iceland and Norway. *Resources, Environment and Sustainability*, 100157.

*Deliverables:*

Mehta, S., Myhre, M., Olafsdottir, G., Iordan, C.M. and Thakur, M. (2022). Resource utilization in seafood supply chains: Food loss, food waste and rest raw materials. The SMARTCHAIN project co-funded by ERA-NET, EU Horizon 2020 G.A. No 817992, and Norges forskningsråd (RCN), Innovation Fund Denmark (IDF), The Icelandic Centre for Research (RANNIS) / Technical Development Fund (TDF), and UEFISCDI Romania. *Deliverable: D1.1 &D1.2*, SINTEF Ocean, Trondheim, 48 pages.

Strand A. V., Olafsdóttir, G., Saviolidis, N. M., Myhre, M. S. and Thakur, M. (2023) Data capture and information flows in seafood supply chains in Norway and Iceland. The SMARTCHAIN project co-funded by ERA-NET, EU Horizon 2020 G.A. No 817992, and the Norwegian Research Council (RCN), Innovation Fund Denmark (IDF), and The Icelandic Centre for Research (RANNIS) / Technical Development Fund (TDF). *Deliverable: D1.3*, SINTEF Ocean, Trondheim, 62 pages.

*Conference presentations:*

Strand, A.V, Mehta, S*., Myhre, M.S., Ólafsdóttir, G., Saviolidis, N. M., Magnus S. Myhre and Shraddha Mehta (2023). Can higher resource utilization be achieved in seafood supply chains? Status and challenges from Iceland and Norway. International Conference on Resource Sustainability (icRS 2023) August 7-9th 2023, University of Surrey, UK.

Strand, A.V. (2022) Blockchain technology for improving decision making in seafood supply chains. Symposium on Catch Identification technologies. November 2-3 rd 2022, Bergen, Norway

Strand, A. V, and Thakur, M. (2022) Smart solutions for advancing supply systems in blue bioeconomy value chains. ICCC 2022 - 7th IIR International Conference on Sustainability and the Cold Chain. April 11-13th 2022. Online.

*Posters*

Mehta, S., Myhre, M., Olafsdottir, G., Carvajal, A. K., Jafarzadeh, S. and Thakur, M. (2022). Food loss and waste in seafood value chains: causes, volumes and environmental cost. 36th EFFoST International Conference 2022.

*Webinars:*

Myhre, M. S. and Mehta, S. (2022) Can higher resource utilization be achieved in seafood supply chains? Status and challenges from Iceland and Norway. SmartChain Stakeholder Webinar. August 31st 2022.

Strand, A. V.(2022) Current data capturing practices in seafood supply chains in Norway and Iceland - a basis for a blockchain based traceability system. SmartChain Stakeholder Webinar. August 31st Aug 2022.



## SMARTCHAIN – Smart solutions for advancing supply systems in blue bioeconomy value chains

https://bluebioeconomy.eu/smart-solutions-for-advancing-supply-systems-in-blue-bioeconomy-value-chains/
https://www.sintef.no/en/projects/2021/smartchain/

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