

# MODULE 3. CONTENT

*Elaborated by NTNU – Norwegian University of Science and Technology, No*

<https://maripet.org/>

## MODULE 3. INNOVATIVE PROCESSING OF FISH DISCARDS TO BARF

### AUTHORS

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### STRUCTURE FOR MODULE CONTENT

*The content will be what the trainee/student will learn throughout the module after starting to take it.*

### TEACHING SPECIFICS

- SETTING (INDOOR/OUTDOOR/DISTANCE/BLENDED): Online (E-learning)
- DURATION (HOURS): 20h
- MATERIALS: Presentation, questions, case studies, self-study
- NO. OF LEARNERS/REPRESENTATIVES: Depending on the number of participants
- INDIVIDUAL OR GROUP WORK: Both, depending on the number and distribution of participants

### INFORMATION ABOUT THE TOPIC

The ability to utilize fish discards to produce Biologically Appropriate Raw Food (BARF) highly depends on the raw materials' quality, stability, safety, and nutritional profile. The present module gives an overview of handling procedures, strategies, and technologies to maintain or improve these parameters. The module is divided into five chapters following the raw material (discarded fish/bycatch) value chain from capture to valuable raw material for BARF production. Firstly, the raw materials' properties and stability are discussed briefly. This part discusses nutritional composition, spoilage, and safety issues. Secondly, matters related to catching technology and onboard handling and how to improve these parameters are presented. This section highlights the significance of proper chilling and chilling systems to maintain the quality of the raw materials. Chapters three and four deal with processing concepts increasing the raw materials and the quality and stability of the final product. In chapter three, novel concepts, including the implementation of hurdle principles, are discussed. Commercial potential technological applications of BARF production are presented in chapter four. Lastly, chapter five introduces packaging concepts for the whole value chain, both discussing bulk concepts potentially used for the distribution of the raw material (discarded fish), as well as consumer-friendly concepts for the distribution of the final BARF product.

Fish is a source of proteins and healthy lipids and a unique source of essential nutrients. The proximate composition differs among species, and fatty fish might have large seasonal variations due to the available nutrients and the spawning season. However, fish generally consist of 70-84 % water, 15-24 % protein, 0.1-22 % fat and 1-2 % minerals, and 0.1-1 % carbohydrate. Marine fish species contain a high share of polyunsaturated fatty acids (PUFAs), namely, EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), which are essential for animal health and for the proper growth of puppies. In addition to an excellent distribution of proteins and lipids, fish contains minerals such as iodine, calcium, iron, zinc, selenium, or phosphorus and vitamins B, D, A, and K. Fish protein is regarded as easily

digestible and contains all essential amino acids. Although fish consumption has many benefits, it is also a source of chemical and nutraceutical contaminants. Fatty species accumulate heavy metals, pollutants, and nutraceuticals that might be of concern. However, levels are often low, and only in polluted areas and under specific conditions are detected values higher than the limits set by the government. One risk factor highlighted in the Northeast Mediterranean is the content of Arsen (As) in wild captures. Despite some risks observed with fish consumption, they are widely outweighed by benefits.

Moreover, the MARIPET BARF raw material is regarded as perishable and loses quality throughout the value chain, from harvesting, processing, distribution, and during storage. The raw material is highly perishable due to a high post-mortem pH and a nutrient content supporting microbiological growth. Fish spoilage is based on three mechanisms post-mortem enzymatic autolysis, microbial growth and metabolism, and oxidation reactions. Mechanisms that will be discussed as a part of the module.

To avoid deterioration and spoilage, actions must be taken to maintain fish and seafood's initial properties and quality. A high-quality raw material will be essential to succeed in producing highly nutritious and attractive MARIPET BARF products. To ensure the MARIPET BARF raw materials quality, actions such as proper onboard handling, chilling, and preservation, as well as efficient cold chain and BARF processing technologies, must be implemented. As mentioned, the preset module will give an overview of handling strategies and potential technologies to valorize the MARIPET BARF raw material into BARF products.

## CAUSES AND DESCRIPTION OF HOW IT MANIFESTS

Module 3 provides essential knowledge to increase the utilization of today's discarded fish in novel side streams, including producing MARIPET BARF products. One of the most important success criteria is introducing strategies for improved handling of the MARIPET BARF raw materials while maintaining the raw material quality. Loss of raw material quality onboard fishing vessels or during transport and logistics reduces the raw materials' economic value as well as the potential of the raw material to be further processed into high-quality BARF products. Moreover, BARF processing strategies, including BARF product development, are important knowledge to consider in the overall MARIPET syllabus.

## PRINCIPLES, BASIC TERMS, AND MEASURES WITHIN THE SPECIFIC MODULE

As previously mentioned, the module consists of five essential sub-topics:

- Fish discards - properties and stability
- Catching technology and on-board handling
- Innovative processing concepts
- BARF processing technologies
- Packaging and distribution of BARF

The module will give an overview of the specific principles, basic terminologies, and measures related to each sub-topic.

## TRAINING MATERIAL FORMAT (TASKS, CASE STUDIES, EXERCISES) WITH A SHORT DESCRIPTION

The training material for module 3 consists of a written chapter (18 pages) supported by a presentation (35 slides) that includes questions to the five sub-topics presented, as well as two cases connected to sub-topics 2 and 4, respectively. Moreover, the detailed presentation of the two cases is given in a separate file (add link). In addition, a reading list is presented recommended for self-studying.

## INSTRUCTION FOR ASSESSMENT

IQQuiz assessment to be taken on Moodle

## LINK TO ONLINE RESOURCES AND SPECIFIC IMAGES

Speranza, B., et al., Innovative Preservation Methods Improving the Quality and Safety of Fish Products: Beneficial Effects and Limits. *Foods*, 2021. 10(11): p. 2854. <https://doi.org/10.3390/foods10112854>

Catchpole, T.L., C.L.J. Frid, and T.S. Gray, Discards in the North Sea fisheries: causes, consequences, and solutions. *Marine Policy*, 2005. 29(5): p. 421-430. <https://doi.org/10.1016/j.marpol.2004.07.001>

Feeckings, J., et al., Fishery Discards: Factors Affecting Their Variability within a Demersal Trawl Fishery. *PLOS ONE*, 2012. 7(4): p. e36409. <https://doi.org/10.1371/journal.pone.0036409>

Tsagarakis, K., A. Palialexis, and V. Vassilopoulou, Mediterranean fishery discards review of the existing knowledge. *ICES Journal of Marine Science*, 2014. 71(5): p. 1219-1234. <https://doi.org/10.1093/icesjms/fst074>

Shawyer, M. and A.F.M. Pizzali, The use of ice on small fishing vessels, in *FAO Fisheries technical papers*. 2003, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS: Rome. <https://www.fao.org/3/y5013e/y5013e00.htm>

Jessen, F., J. Nielsen, and E. Larsen, Chilling and freezing of fish, in *Seafood Processing: Technology, quality and safety*, I.S. Bozaris, Editor. 2014, Wiley-Blackwell. <https://doi.org/10.1002/9781118346174.ch3>

Koutsoumanis, K., et al., The use of the so-called 'super chilling' technique to transport fresh fishery products. *EFSA Journal*, 2021. 19(1): p. 06378. <https://doi.org/10.2903/j.efsa.2021.6378>

Abel, N., B.T. Rotabakk, and J. Lerfall, Mild processing of seafood—A review. *Comprehensive Reviews in Food Science and Food Safety*, 2022. 21(1): p. 340-370. <https://doi.org/10.1111/1541-4337.12876>

Ghanbari, M., et al., Seafood biopreservation by lactic acid bacteria – A review. *LWT - Food Science and Technology*, 2013. 54(2): p. 315-324. <https://doi.org/10.1016/j.lwt.2013.05.039>

## STEP-BY-STEP GUIDE

### INTRODUCTION – 1 SLIDE

The introduction consists of a short overview highlighting the significance of the presented module. It also highlights two essential factors: the significance of proper handling and strategies for preserving the MARI PET BARF raw material and MARI PET BARF processing and distribution.

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#### FIRST PART - FISH DISCARDS - PROPERTIES AND STABILITY – 4 SLIDES

The first part gives an overview of the MARIPET BARF raw materials' nutritional composition, contents of trace elements, and an introduction to mechanisms contributing to the loss of quality and spoilage.

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#### FIRST ACTIVITY - QUESTIONS – 1 SLIDE

Two questions for discussion related to the sub-topic presented in the first part of the module are presented.

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#### SECOND PART – CATCHING TECHNOLOGY AND ONBOARD HANDLING - 7 SLIDES

The second part gives an overview of the relevance of selecting a proper catching technology, onboard handling, and preservation of the MARIPET BARF raw material. In relation to onboard handling and preservation, strategies such as chilling, freezing, bulk storage and packaging concepts are discussed.

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#### SECOND ACTIVITY - QUESTIONS – 1 SLIDE

Two questions for discussion related to the sub-topic presented in the second part of the module are presented.

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#### THIRD ACTIVITY – CASE STUDY – 1 SLIDE

A case study is presented with a topic related to the module's second part. The complete case description can be found here: [\(link\)](#)

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#### THIRD PART - INNOVATIVE PROCESSING CONCEPTS – 3 SLIDES

The third part introduces the hurdle principle as well as gives an overview of available non-thermal and mild processing technologies.

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#### FORTH ACTIVITY - QUESTIONS – 1 SLIDE

Two questions for discussion related to the sub-topic presented in the third part of the module are presented.

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#### FOURTH PART - BARF PROCESSING TECHNOLOGIES – 7 SLIDES

The fourth part gives an overview of a set of potential technologies for BARF production. These technologies include thawing, the use of additives, fermentation, biopreservation, and drying.

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#### FIFTH ACTIVITY – QUESTIONS - 1 SLIDE

Two questions for discussion related to the sub-topic presented in the fourth part of the module are presented.

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#### SIXT ACTIVITY - CASE STUDY – 1 SLIDE

A case study is presented with a topic related to the module's fourth part. The complete case description can be found here: [\(link\)](#)

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#### FIFTH PART - PACKAGING AND DISTRIBUTION OF BARF – 3 SLIDES

The fifth part gives an overview of user-friendly packaging and distribution concepts for MARIPET BARF products. Moreover, it introduces the concept of active packaging solutions that have the potential to increase product shelf life and quality if implemented correctly.

## SEVENTH ACTIVITY – QUESTIONS - 1 SLIDE

Two questions for discussion related to the sub-topic presented in the fifth part of the module are presented.

### FACILITATOR'S NOTES

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TITLE	ESTIMATED TIMING	FACILITATOR NOTES	MATERIALS NEEDED
Questions - Part 1	15 min	<b>Individual</b> , followed by online class discussions.	Internet connection
Questions - Part 2	15 min	<b>Individual</b> , followed by online class discussions.	Internet connection
Case study 1	120 mins	<b>Individual</b> : Depending on the number of participants and distribution <b>Class</b> : Depending on the number of participants and distribution	Internet connection
Questions - Part 3	15 min	<b>Individual</b> , followed by online class discussions.	Internet connection
Questions - Part 4	15 min	<b>Individual</b> , followed by online class discussions.	Internet connection
Case study 2	120 mins	<b>Individual</b> : Depending on the number of participants and distribution <b>Class</b> : Depending on the number of participants and distribution	Internet connection
Questions - Part 5	15 min	<b>Individual</b> , followed by online class discussions.	Internet connection

### APPENDIX 1 - TITLE

Add here:

- N/A

### APPENDIX 1: REFERENCES

The following table summarizes the documents referenced in this document.

Location	Description
<URL or file path to where document is located>	<i>A detailed presentation of the Module's two case studies</i>
<URL or file path to where document is located>	<i>The module syllabus presented as a text file</i>
<URL or file path to where document is located>	<i>The module presentation, which also includes questions and cases studies</i>

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