SEAFOOD TOMORROW

Nutritious, safe and sustainable seafood for consumers of tomorrow

Grant Agreement No: 773400

Deliverable D6.5

eLearning module

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Start date of the project: 01/11/2017 **Duration: 42 months**

Organisation name of lead contractor: EuroFIR AISBL

Revision: v1

Project co-funded by the European Commission within the H2020 Programme	
Dissemination Level	
PU Public	X
PP Restricted to other programme participants (including the Commission Services)	
RE Restricted to a group specified by the consortium (including the Commission Services)	
CO Confidential, only for members of the consortium (including the Commission Services)	

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1. Summary

Within Work Package 6 Communication, Dissemination and Exploitation, Task 6.4 Stakeholder Engagement developed elearning to improve the professional skills and competences of those working, or being trained to work, in the seafood industry, considering resources that were available.

For this purpose, three preliminary interconnected activities were performed, namely an online survey, interviews with industry representatives, and an education resources mapping exercise. The outcomes of these activities were used to identify areas of need and gaps that SEAFOOD[TOMORROW] might reasonably address utilising knowledge within the consortium in the timeframe available (2017-2020).

The elearning aims to provide continuing professional development (CPD) for those working in the seafood sector and training materials for those entering the blue economy. Topics include innovative solutions for improving socioeconomic and environmental sustainability of seafood production and processing, as well as product quality and safety. The content was developed by the beneficiaries and the modules made available using OpenTEA (www.opentea.eu), an open source elearning platform developed by BROWSE (FP7, Grant agreement ID 265307, 2011-2014).

After being tested by the consortium, the SEAFOOD[TOMORROW] elearning was launched in March 2021 (https://bit.ly/31Tro9o) and is free-of-charge for users. AEIFORIA (IT; Beneficiary No. 24) will maintain the site and provide certificates of attendance for the next three years (i.e., until the end of 2023).

2. Objectives

The SEAFOOD[TOMORROW] Description of Action (2017) stated:

> *The overall objective of WP6 is to ensure effective external communication, dissemination, and optimal knowledge transfer of SEAFOOD[TOMORROW] results, leading to effective exploitation of its innovation outputs. Specific objectives are to: …*
>
> *6.4. Improve the professional skills and competences of those working or being trained to work within the seafood industry through the development of an e-learning module.*

Thus, the objective of Task 6.4 Stakeholder Engagement was to develop and publish elearning content that could be used independently or in conjunction with existing resources facilitating continuing professional development for those working in the seafood sector and/ or training materials for those entering the blue economy.

Following initial investigations, it was clear the needs and gaps for appropriate Blue Economy training, and educational resources were vast and diverse for SEAFOOD[TOMORROW] to address alone.

Instead, it was agreed that the SEAFOOD[TOMORROW] elearning content would focus on topics relevant to the project, specifically improved socioeconomic and environmental sustainability of seafood production, quality and safety of seafood products, and consumer acceptability of existing and emerging products.

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3. Background

Whilst sufficient food for the 7.2 billion people on the planet is a requirement, it is expected that by 2050 at least 2 billion more people will need to be fed, with ca. a 1% increase in demand annual (EC, 2015). The EU population is projected to peak around 2050, reaching 526 million, an increase of ca. 19 million (3.7 %) compared with 2014 (EC, 2017). This means that food production will need to increase, putting more pressure on existing resources.

Ensuring that food production, distribution, and consumption are socially, economically, and environmentally sustainable, secure, and fair is one of the main challenges of the 21st century (EC, 2017). According to OECD-FAO (2017), ocean resources (fisheries and aquaculture) will be indispensable in this challenge.

World fish production is projected to reach 194 million tonnes in 2026, with an overall increase of 26 million tonnes, or 15% (average 2014-2026). At the same time, world food fish consumption is projected to increase by ca. 20% (ca. 29 million tonnes). However, complex risks need to be addressed within the seafood sector to achieve this because of pressures on natural resources and impacts on the environment (e.g., over-exploitation, pollution, declining biodiversity, and climate change) demanding responsible and sustainable approaches (OECD, 2016).

To achieve sustainable use of marine resources, the EU has developed policies, among which is the European Marine Strategy Framework Directive (2008/56/EC), where Member States (MS) must formulate appropriate strategies to protect and preserve marine environments. In this context, renewal and strengthening of technical skills is required to support improved technology progresses and management practices. The gap between existing blue economy workers' skills and needs of the labour market are one of the key challenges to future development (EC, 2014) and vital to ensure the sustainability of production and supply (Camia et al. 2018).

There is growing appreciation within the aquaculture sector of the need for more responsive, flexible, and collaborative approaches to education, learning, and training, including continuing professional development that respond to the needs of the industry and individuals (Seixas, 2012). eLearning solutions offer effective instructional methods (i.e., practice with feedback) and collaboration with personalised learning paths and pace (FAO, 2011). More widespread deployment of elearning solutions is offering greater flexibility, increased on-the-job training, better quality customisation resources, wider access, and significant cost savings for individuals and the industry.

4. eLearning design

SEAFOOD[TOMORROW] opted to use an established elearning platform (OpenTEA, www.opentea.eu) that was developed by BROWSE (FP7, Grant agreement ID 265307, 2011-2014), allowing the consortium to focus on content (Calliera et al., 2015; Remoundou et al., 2015; Sacchettini et al., 2012, 2017).

According to FAO (FAO 2011), needs analysis is crucial to validate elearning intervention and provide information about gaps that need to be addressed, ensuring the content is appropriate for the audience. For this reason, development of SEAFOOD[TOMORROW] elearning was preceded by stakeholder consultation, which took the form of: (1) online survey amongst potential users to identify needs; (2) mapping exercise to identify gaps in educational provision; and (3) interviews with seafood industry representatives to outline suitable approaches/ solutions.

For more information about each for these activities see Appendix 1-3.

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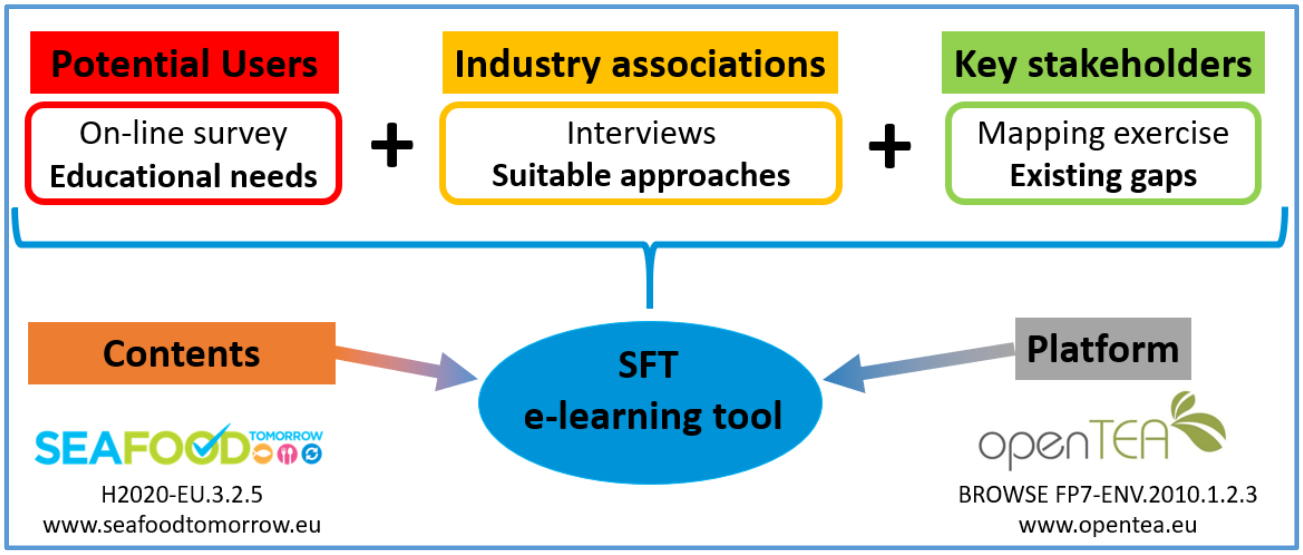

Figure 1: The framework used to develop the SEAFOOD[TOMORROW] elearning tool

4.1. Mapping exercise

See Appendix 1: Mapping exercise layout (AEIFORIA)

For the mapping exercise, respondents were asked to list existing Blue Economy learning and training resources that would be useful for development of the SEAFOOD[TOMORROW] elearning, including a short description and covering key information (i.e., language, topic(s), format, links, and contact details).

The mapping exercise was run from April 2018 to March 2019.

Each offering was verified by AEIFORIA and any missing or incorrect information resolved. The table was included in the survey (Section 4.2) and shared with interviewees (Section 4.3).

Contributors (54) from 16 countries provided inputs regarding existing learning initiatives and resources.

Results showed that, whilst a significant volume of online resources is available and in a variety of formats, there are gaps in provisions, particularly with respect to language, as most are only available in English. Also, most of the content focuses on safety and quality rather than sustainability and development of new technologies.

4.2. Survey amongst potential users

See Appendix 2: Online survey (AEIFORIA, EuroFIR, IRTA, QUB, and IPMA)

The survey amongst potential users was undertaken in the form of an online questionnaire, consisting of four parts:

(i) Sociodemographic characteristics of participants

(ii) Attitudes towards training and elearning technologies

(iii) Perceptions of knowledge and interest about seafood related topics

(iv) Opinions of existing materials and preferable approaches for new resources.

Data were collected by means of statements, where respondents indicated the extent of agreement on a five-point Likert scale. For each question, respondents could answer, "*do not know*" or "*never heard about it*". Respondents were also given the opportunity to provide additional information (free-text field).

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The questionnaire was developed in English, but also translated into 11 languages by consortium Beneficiaries: French (translation by AQUIMER), Spanish (ANFACO), Portuguese (IPMA), Italian (AEIFORIA), Dutch (UGENT), Greek (SKALOMA), Polish (ZUT), Norwegian (MOREFORSKING), Czech (SPES), German (SPES), and Turkish (SPES), to ensure as wide a representation as possible of the international seafood industry.

Data collection took place between April and May 2018 using Survey Monkey, with the link to the questionnaire being sent to contacts across the seafood chain (i.e., producers, processors, retailers, professional schools/ universities, and other stakeholders, e.g., industry associations) identified by Beneficiaries and the project Industrial Advisory Committee (IAC). 218 questionnaires were completed (average age 46 years; 61% males).

Key outcomes were:

- Opportunities to obtained information about practical eco-innovative solutions for a sustainable seafood production and processing would be of interest and the content valuable.
- Preferred content format included materials that could be downloaded, simple resources (i.e., text, images) and/ or short, readily accessible audio-video content.
- Ca. 40% of participants can spend 15-30 minutes a day on learning activities
- eLearning was used already by ca. 40% of participants
- eLearning resources were already available for a range of activities in the Blue Economy, but their appearance and content were generally low/ not satisfactory
- Many expressed difficulties around meeting users' needs (i.e., contents, formats, language, accessibility)

4.3. Interviews amongst seafood industry representatives

See Appendix 3: Interview to seafood industry associations (AEIFORIA)

Interviews with the seafood industry were not foreseen in the DoA, but the decision to include them was driven by results from the survey (specifically difficulties around meeting users' needs and low perception of existing resources), which required further investigation of training needs, interests, barriers, etc., and better understanding of how to develop the SEAFOOD[TOMORROW] elearning and ensure it was fit-for-purpose.

Interviews were carried out with six associations, either Beneficiaries (ANFACO – ES, Aquimer – FR, SPES/SETBIR - TR and SPES/LVA – AT) or IAC members, (ASSOTTICA - IT, EMPA - pan-European). Together, they covered different sectors of the Blue Economy including producers, processors, and retailers.

Interviews were organised in two parts: (i) information about the associations (i.e., name, sector, profile) and (ii) key drivers/ benefits of SEAFOOD[TOMORROW] elearning (e.g., topics, formats, duration, language, participation). The interviews were conducted by AEIFORIA in English, as none highlighted this as a constraint for participation.

Data collection took place between January and March 2019 by telephone or email exchange.

Key outcomes were:

- Interest in SEAFOOD[TOMORROW] topics varied according to activity sector
- Preference for mixed formats (e.g., audio-video, text, and images) that could be downloaded for off-line use
- Need for local (native spoken) language

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- Consideration for needs of users (i.e., short, simple, intuitive, interactive) and organisations (i.e., solutions to real-world problems with practical examples)

4.4. Characteristics of the SEAFOOD[TOMORROW] elearning

These analyses (4.1-4.3) supported development of SEAFOOD[TOMORROW] elearning, specifically topics and structure.

The main audience was identified as ***seafood sector operators***, particularly managers and future managers since these individuals are more able (and willing) to access elearning and disseminate the knowledge and skills acquired. However, the elearning is open to any user who has an interest in the topics covered. Students and researchers might also find the content useful, as they describe developments in seafood safety, quality, and sustainability.

The main characteristics of the tool are:

- **Flexibility**: Self-paced learning course following a modular approach, comprised independent units, facilitating personalised learning paths.
- **Targeted**: Focuses on topics covered by SEAFOOD[TOMORROW], i.e., those areas where Beneficiaries have high levels of knowledge and experience, specifically safety, quality, and sustainability.
- **Accessible**: Mix of formats, the majority of which can be downloaded for off-line use
- **Relevant**: Short, easy, intuitive, and interactive modules considering solutions for real-world problems with practical examples
- **Moderated**: User can obtain a certificate of attendance based on 75% completion (tracked automatically)

Finally, the SEAFOOD[TOMORROW] e-learning is free-of-charge and, whilst it is in English, because it is open access, organisations can download the content and translate, as necessary.

5. eLearning content

Modules of the SEAFOOD[TOMORROW] elearning were created in collaboration with the Beneficiaries including some audio-visual content from SEAFOOD[TOMORROW] demonstration workshops (T4.4).

Beneficiaries who contributed were: SPAROS (PT), DTU (DK), Moreforsking (NO), University of Porto (PT), Tarelaks (NO), IRTA (ES), QUB (UK), AZTI (ES), CIIMAR (PT), RISE (SE), Aquimer (FR), ANFACO (ES), CEFAS (UK), ILVO (BE), LAQV-REQUIMTE (PT), PREDELL (FR), AquaTT (IE), and URV (ES).

All modules were reviewed and edited by EuroFIR (Siân Astley, native EN-speaker) and AEIFORIA (Alice Tediosi, OpenTEA developer) with the aim of ensuring the modules were fit-for-purpose, from a communication point-of-view, but also non-specialist perspective (sense-check) to ensure supporting text was provided, abbreviations were explained, outcomes elaborated, etc. All images were checked for copyright and royalty permissions and are, in fact, either royalty-free or owned by the consortium.

Any modifications were agreed with the authors before the materials were uploaded to OpenTEA. Each contributor was asked to check their module(s) prior to wider publication, firstly, by the consortium and then publicly. Testing within the consortium allowed errors to be corrected, and improved functionality.

In addition to the contributors, Beneficiaries took part in the testing phase were IPMA (PT) and CBHU (HU).

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5.1. SEAFOOD[TOMORROW] e-learning units and modules

The SEAFOOD[TOMORROW] elearning is composed of five units, each containing one or more modules:

Unit 1: Eco-Innovative solutions for sustainable seafood production

1. General overview
2. Biofortification of farmed fish
3. Iodine biofortification of rainbow trout with sugar kelp
4. Integrated Multitrophic Aquaculture (IMTA)
5. Magnetic bead-based colorimetric immunoassay for the detection of tetrodotoxins in shellfish
6. Fast screening method for the detection of multiple marine toxins in shellfish
7. Enzyme assay for the detection of xenobiotics
8. Neural networks and modelling of HAB

Unit 2: Development of new seafood products that protect the environment and benefit consumers

1. General overview
2. Sodium reduction in seafoods
3. Tailor made seafood recipes for seniors, youth and pregnant women
4. Reduction of toxins in bivalves
5. Listeria specific bacteriophages to improve the safety of seafood products
6. Enhanced purification tank strategies to reduce norovirus (NoV) contamination in live bivalve molluscs (LBMs)
7. Reduction of energy and water consumption in seafood processing

Unit 3: Benefit to risk assessment of solutions

1. General overview

Unit 4: Seafood authentication, traceability, labelling, and certification

1. General Overview
2. DNA sequence database
3. Fast DNA-based salmon species identification
4. Digital traceability system

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Unit 5: Communication

1. Communication in the seafood sector and FishChoice: a benefit-risk communication tool

5.2. SEAFOOD[TOMORROW] elearning access

http://www.opentea.eu/en/e-learning/courses-Creating-nutritious-safe-and-sustainable-seafood-for-consumers-of-tomorrow.29/

Figure 2: SEAFOOD[TOMORROW] elearning homepage

There are three orange buttons on the homepage providing access to (1) OpenTEA (ENTER; registration), (2) INSTRUCTIONS (how to guide for using the platform and elearning), and (3) a list of units and modules (LESSONS). Once in the platform, it is possible to access all resources, and navigation is achieved by clicking back/next; grey bars show progress for each module (Figure 3).

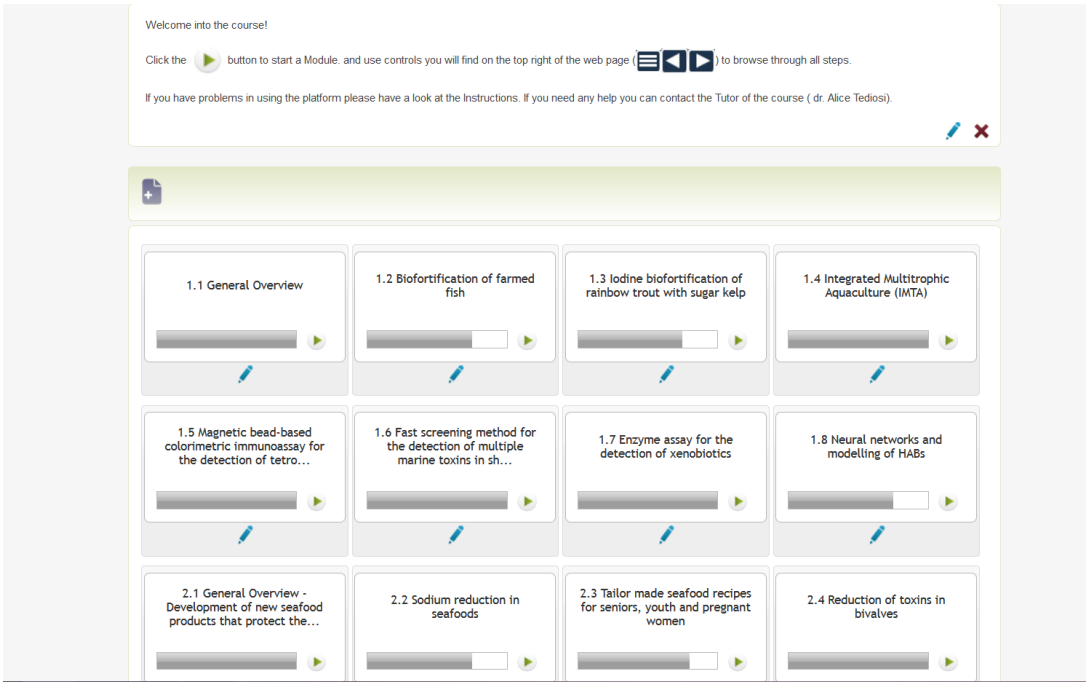

Figure 3: Virtual room with module list (detail)

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Each module is composed of:

- Short introduction (e.g., CV(s) of instructors and descriptions of the lectures)
- Preliminary materials (where applicable)
- PowerPoint-style presentation in a PDF file or video format
- Quiz for self-assessment
- Follow-up materials (where applicable)
- End page allowing navigation back to the module list

As the end of the course, users are asked to provide feedback (https://it.surveymonkey.com/r/5TB9SL3) and can request a certificate of completion (min. 75%). The feedback questionnaire aims to gather information for correcting errors and, thus, improving the elearning. A tracking system in the platform monitors users' activities and performance, facilitating measurement of completion and success.

See Appendix 4 for additional screenshots.

5.3. Dissemination and sustainability

In terms of dissemination activities, the aims were to promote the elearning via the project's website and social media accounts (Twitter, LinkedIn) – this has been achieved. In addition, an email describing the elearning was sent to the consortium and IAC members who were also encouraged to share the elearning.

A press release was published on 19th March 2021 (https://bit.ly/3apZtlT).

The elearning was presented at the Italian Demonstration workshop (4th March 2021, T4.4), advertised at the Spanish Demonstration workshop (3rd March 2021), and included at the final event (15th April 2021, EventInsight) as well as in the Policymakers' meeting (31st March 2021, GoToMeeting) for use by delegates.

It was also demonstrated in an interactive info session for EC staff on 23rd April 2021 and was included in the Innovation Radar, and a factsheet describing the elearning was published before 30th April 2021.

To increase visibility, and therefore uptake, the course will be included in the *Blue Academy for Professionals of Seafood Industry*, part of BAPSI (co-funded by the EASME, GA No. 863545; http://www.bapsi.eu/).

Finally, AEIFORIA is committed to maintaining SEAFOOD[TOMORROW] e-learning for up to three years, during which time access will be free-of-charge (until the end of 2023). After that, continued access will depend on numbers of users, relevance of the topics, and organisations' willingness to update or host the content.

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6. Conclusions

Results obtained from the survey highlighted a general interest about practical eco-innovative solutions for a sustainable seafood production and processing industry. In addition, online materials are being used periodically and some Blue Economy employees are willing and able to benefit from the elearning.

Despite existing elearning resources being available, potential users expressed difficulties with access and/ or use (content, formats, language, accessibility, appearance). SEAFOOD[TOMORROW] performed interviews with seafood industry representatives to better understand their needs. These interviews confirmed their interest in SEAFOOD[TOMORROW] topics, but also a strong preference for mixed formats that should be downloadable.

English language content is a barrier, especially in Southern European countries. The importance of having the content translated in native languages was stressed by interviewees as well as the need for short, easy to access, intuitive, and interactive modules that deal with simple solutions for real-world problems with practical examples. Likewise, the mapping exercise showed that there is a significant volume of online resources available, in a variety of formats, but there are gaps in provisions, particularly with respect to language as well as in sustainability and technology development.

These issues were considered in the development and delivery of content for SEAFOOD[TOMORROW] elearning (T6.4). Likewise, particular attention was given to the (technical) language, with the emphasis on inclusive, informative, and interesting contents that are – and will remain – relevant to non-scientific audiences. Involving researchers was challenging, and we believe that this might be the reason why existing resources are often poorly received and under-utilised by the industry.

Nevertheless, SEAFOOD[TOMORROW] has created a flexible format using simple tools (e.g., PDF, videos, PowerPoint-style lectures), which can be downloaded (most part) that are organised in short modules. Topics that were included are of interest to potential users and focus on sustainability and technology development, thus filling an existing gap. The content is in English because limited resources did not permit translation during the project. However, because the elearning is free-of-charge and can be downloaded, organisations can easily translate and/ or adapt the contents to suit the needs of their staff or members, as necessary. They also have access to lecturers, facilitating the discussion and/clarifying doubts, whenever appropriate.

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8. Appendix 1: Mapping exercise

8.1. Template

Please fill in the table below with any relevant training initiative related to the seafood sector that you are aware of. This information will help to identify educational gaps, which will be considered to develop the SEAFOOD[TOMORROW] e-learning tool.

Reference contact: Alice Tediosi (alice.tediosi@aeiforia.eu)

Title	Short description	Available languages	Main topic addressed	On-line (Y/N)	Reference contact (web link, email)

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8.2 Identified online resources

Title	Short description	Language	On-line (Y/N)	Reference contact (web link, email)
Seafood Training Academy	e-learning programmes on safety, hygiene, and fish smoking/free of charge (part of them - see terms)	English	Y	http://seafoodacademy.org/topics/1-topic-academy-seafish-courses.php
Marine Training.eu / Navigating the Marine Training and Education Landscape in Europe	Training catalogue, development of training packages, thesis/internship position advertisement, videos	English	Y	http://www.marinetraining.eu/
PEF / Life Cycle Thinking	Product Environmental Footprinting/free of charge	English	Y	https://www.lifecycleinitiative.org/resources-2/e-learning-modules/
Seafood Watch The Monterey Bay Aquarium	Seafood Watch® program helps consumers and businesses choose seafood that's fished or farmed in ways that support a healthy ocean, now and for future generations. Our recommendations indicate which seafood items are Best Choices or Good Alternatives, and which ones you should Avoid.	English	Y	http://www.seafoodwatch.org/
animal production, nutrition, and feed formulation in Aquaculture	expert's take about nutrition and feed formulation, productivity, and sanitary risk management	English	Y	https://www.aqua-techna.com/en/productivity
AQUATnet	education and teaching platform for the aquaculture, fisheries, and aquatic resource management sector in Europe	English	Y	http://www.aquatnet.com/
Healthy fish	Training Program standardized at European level for the aquaculture sector/free of charge	English, IT, ES, TU, HR	Y	http://apromar.es/healthyfishapp/ http://apromar.es/healthyfishapp/login/index.php
AQUEXCEL2020 elearning course: Experimental data management: from generating protocols to sharing data	AQUAEXCEL2020 is a research infrastructure project funded under the EU's Horizon 2020 programme which started in October 2015. AQUAEXCEL2020 training courses aim to educate a new generation of aquaculture researchers and industry stakeholders to use their new knowledge, skills and tools in order to advance an innovative, sustainable aquaculture sector./free of charge	English	Y	aquaexcel@aquatt.ie

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AQUEXCEL2020 elearning course: Training in the use of the Fish and Chips tool	AQUAEXCEL2020 is a research infrastructure project funded under the EU's Horizon 2020 programme which started in October 2015. AQUAEXCEL2020 training courses aim to educate a new generation of aquaculture researchers and industry stakeholders to use their new knowledge, skills and tools in order to advance an innovative, sustainable aquaculture sector./free of charge	English	Y	aquaexcel@aquatt.ie
AQUEXCEL2020 elearning course: Using modelling of scale effects as a tool for experimental design	AQUAEXCEL2020 is a research infrastructure project funded under the EU's Horizon 2020 programme which started in October 2015. AQUAEXCEL2020 training courses aim to educate a new generation of aquaculture researchers and industry stakeholders to use their new knowledge, skills and tools in order to advance an innovative, sustainable aquaculture sector./free of charge	English	Y	aquaexcel@aquatt.ie; https://aquaexcel2020.eu/training-courses/aquaexcel2020-training-courses
SDG Indicator 14.b.1 - Securing sustainable small-scale fisheries	FAO course (free)	English	Y	http://www.fao.org/elearning/#/elc/en/course/SDG14B1
Better Training for Safer Food	training courses organized by the commission (10 e-learning modules in 2 steps)	English	Y	https://ec.europa.eu/food/safety/btsf_en
Trafoon	ppt of the workshops, guidelines, webinars, information, downloadable materials / free of charge	English (but materials also in DE, FR, SL, PL, NL, ES and more)	Y	https://www.trafoon.eu/; Information Shop at https://www.trafoon.org/
Open LCA	open source Life Cycle Assessment software	English	Y	http://www.openlca.org/ LCA4ALL@icloud.com
Seafish	workbooks, DVDs, and downloadable content which can be studied from home and used as part of some of our training courses. Seafish has developed various online learning tools and open learning courses./free of charge	English	Y	http://www.seafish.org/training/onshore-training/training-materials ; http://www.seafish.org/training/onshore-training/e-learning-open-learning
Real time monitoring of sea contaminants by an	This course is designed to familiarise with the SEA-on-a-CHIP device, a remote, miniaturized, autonomous and flexible immuno-	English	Y	http://www.opentea.eu/en/e-learning/courses-Real-time-

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autonomous lab-on-a-chip biosensor	sensor platform for real-time analysis of marine waters in estuarine and coastal areas, in multi-stressor conditions.			monitoring-of-sea-contaminants-by-an-autonomous-lab-on-a-chip-biosensor.21/
Val FoU AS	Courses in seaweed farming / with fee	Norwegian	Y	http://val.vgs.no/val-fou-as/ ; https://val.vgs.no/2017/09/nettkurs-tar-nye-eventyret/
AlgaeBase	AlgaeBase is a global algal database of taxonomic, nomenclatural and distributional information.	English	Y	http://www.algaebase.org/
Salmon, Cod, Mackerel, Herring Academies	A lot of information about these seafood types in Norway. Possibility to download some documents	English (DE, FR, ES, SE, CN, IT, PT, JP, PL)	Y	https://academies.fromnorway.com/
Seafood from Norway / Norwegian Seafood Council	Information about seafood and aquaculture in Norway	English, Norwegian	Y	https://en.seafood.no/
FDA CFSAN Education Resource Library: Safe Food Handling: What You Need to Know	Seafood Safety	English	Y	https://www.healthypeople.gov/2020/tools-resources/evidence-based-resource/fda-cfsan-education-resource-library-safe-food-handling
Taredyrkerne (Norwegian seaweed farms)	Organization for seaweed farmers in Norway	Norwegian/ English	Y	http://www.norwegianseaweedfarms.com/
Surofi (Sunnmøre og Romsdal Fiskesalslag)	Catch handling	Norwegian/ English and Norwegian	Y	https://www.surofi.no/surofi/fangstbehandling/
Kunnskapsfilm	Teaching resources for primary- and lower secondary school and upper secondary education and training	Norwegian	Y	http://kunnskapsfilm.no/series/sjomat/
Sett Sjøbein Education	Information about career- and education opportunities in the field of seafood, fisheries and aquaculture	Norwegian	Y	https://settsjobein.no/yrker-og-utdanninger/

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Norges Vel - The Royal Norwegian Society for Development	Article about the establishment of Taredyrkerne	Norwegian	Y	https://norgesvel.no/arkiv/en-merkedag-for-taredyrkerne-article496-28.html
Fischbestände online (fish stocks online)	Info about fish stocks	German	Y	https://fischbestaende.thuenen.de/
Aquakulturinfo	Info about aquaculture	German	Y	www.aquakulturinfo.de
Biology and culture of Penaeid shrimp The culture of Brachionus plicatilis: a virtual practicum Analytical techniques in aquaculture research	Educational resources / free of charge	English	Y	https://www.ugent.be/bw/asae/en/research/aquaculture/education/educationresources
Quality control in the fish industry	Online manual: Quality control in the fish industry, objectives of quality control, and indicates where and how it can be used.	English	Y	http://www.fao.org/wairdocs/tan/x5934e/x5934e01.htm
Labelling	Labelling regulations and monitoring	English	Y	http://www.seafish.org/industry-support/legislation/traceability-and-labelling
Traceabilty	information on traceability, glossary, and seafood industry traceability toolkit	English	Y	http://futureoffish.org/content/traceability-101
Traceability	FAO document about Seafood Traceability	English	Y	http://www.fao.org/3/a-i8183e.pdf
FDA's Center for Food Safety and Applied Nutrition Education Resource Library	Educational Publications	English	Y	https://epublication.fda.gov/epub/
IDREEM (Increasing Industrial Resource Efficiency in European Mariculture)	European research project launched in 2012 to protect the long-term sustainability of European aquaculture by developing and demonstrating a new innovative production technology, Integrated Multi-Trophic Aquaculture or IMTA.	English	Y	www.idreem.eu
NOAA Fish Watch	Database on sustainable seafood	English	Y	https://www.fishwatch.gov/

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www.shelleye.org	Webinar	English	Y	www.shelleye.org
Prime Fish Science-based competitiveness and policymaking for the European seafood market	H2020 project: exchange of communications between different European countries between universities and the scientific world on issues of fisheries and aquaculture with a wide range of topics	English	Y but also face-to-face meetings (included)	http://www.primefish.eu/
formazione degli operatori in acquacultura (training of aquaculture operators)		Italian	Y	http://www.api-online.it/index.cfm/it/
Master Fishmonger Standard	Funded and developed by Fishmongers' Company, NFF and other industry experts	English	Y online application	https://www.masterfishmonger.co.uk/
Master di gestione della fascia costiera e delle risorse acquatiche (Master in management of the coastal area and of water resources)	Quality of the environment, of fisheries and of aquaculture	Italian	online lectures via UNICAM platform by acquisition of learning materials; teacher online with students on the same platform for a number of hours in proportion with the online lectures	http://masterrisorsemarinecostiere.unicam.it/
Deniz Ürünleri İşleme (Seafood Processing)		Turkish	Y	http://www.katalog.ktu.edu.tr/DersBilgiPaketi/generalinfo.aspx?pid=85&lang=1
Deniz Ürünleri Kalite Kontrol (Seafood Quality Control)		Turkish	Y	http://www.katalog.ktu.edu.tr/DersBilgiPaketi/generalinfo.aspx?pid=85&lang=1

Deniz ürünleri gıda güvenliği (Seafood safety)		Turkish	Y	http://www.ktu.edu.tr/fbebalikcilik
Le CNAM Intechmer	A number of training possibilities in the field of seafood and sea sciences and technology	English, French	N (or only partially)	http://www.intechmer.cnam.fr/
Fiske og fangst (fishing and catching) - Utdanning.no	Governmental webpage information of education programmes, careers, and career planner	Norwegian	Y	https://utdanning.no/studiebeskrivelse/fiske_og_fangst
Marine Advisory Service - Seafood Technology	Information about Sea food issues	English	Y	https://www.deseagrant.org/news-events/
Odisee - Cursussen AQUACULTUUR Basis & Specialisatie	aquaculture advanced training	Dutch	videos	https://www.odisee.be/en
Disease management	Bap course on basic bio security on farm	English	Y	Global aquaculture alliance
szkolenia z zakresu dostępności programów operacyjnych (training on the availability of operational programs)	Training conducted by regional technology transfer centers, for example, Horizon 2020	Polish	materials available on the website of the West Pomeranian University of Technology in Szczecin	https://www.zut.edu.pl/index.php?id=7237
It´s learning	The learning LMS solution allows academic institutions to personalise learning by putting curriculum resources, instructional strategies, objective-based lesson plans and assessments, all in one easy-to-access central location. The platform provides ways for teachers to create engaging lessons/resources, makes teacher collaboration and sharing of materials easy, and automates routine tasks	English and many more	Y	www.itslearning.no
Seafood spoilage predictor	user-friendly software to predict the effect of constant or fluctuating temperature storage conditions on product shelf-life.	English	Y	http://fssp.food.dtu.dk/

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@Risk software	Risk assessment tool	English	Y	http://www.palisade.com/trials.asp
Cristal ball software	Risk assessment tool	English	Y	https://www.oracle.com/technetwork/middleware/crystalball/downloads/index.html
Consumer benefit-risk communication tool	user-friendly online tool to guide and inform consumers and health professionals to select the most appropriate seafood to ensure a healthy and nutritional diet	English	Y	http://www.ecsafeseafood.eu
Safe seafood Guides	Seafood safety guidelines for policy makers, industry and consumers, including recommendations to help reduce possible risks of seafood contamination	English and Portuguese	Y	http://www.ecsafeseafood.eu; http://www.ecsafeseafood.eu/ecsafe seafood-media-centre/safe-seafood-guides
Training material and guidelines for live mussels transport and storage	Training material and guidelines for live mussels transport and storage in the framework of the EU-funded FP7 MuusselsAlive project	English	Y	https://musselsalive.wordpress.com
Training material and guidelines for live brown crab transport and storage	Training material and guidelines for live brown crab transport and storage in the framework of the EU-funded Interreg Acrunet project	English	Y	http://www.acrunet.eu/
Training material	Videos of solution to process seafood in developing countries	English	Y	http://www.securefish.net/
Material covering different topics related with seafood quality, innovation, new products, services and technologies	Material covering different topics related with seafood quality, innovation, new products, services and technologies in the framework of seafoodplus platform (FP6-funded)	English	Y	https://www.seafoodplus.org/project/rtd-pillar-projects.21.0.html
Web-based tool for assessing food safety and health benefits	Web-based tool for assessing food safety and health benefits in the framework of an FP6-funded project Qalibra	English	Y	http://www.qalibra.eu/
Composition and Nutritional Value of Most Consumed Seafood Products in Portugal	Nutrictional composition of the most relevant seafood species in Portugal from IPMA	English, Portuguese	Y	https://www.ipma.pt/resources.www/docs/publicacoes.site/pescado/inicio.htm

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Bognar tables - cooked food yield and retention factors	Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes) - Bognar tables	English	Y	www.fao.org/uploads/media/bognar_bfe-r-02-03.pdf
Software & Solutions for Risk & Decision Analysis	The complete risk and decision analysis toolkit, including @RISK, BigPicture, PrecisionTree, TopRank, NeuralTools, StatTools, Evolver, and RISKOptimizer.	English	Y (but it has a cost)	http://www.palisade.com
LanguaL™ - the International Framework for Food Description	It is an automated method for describing, capturing and retrieving data about food.	English	Y	http://www.langual.org
FoodRisk.org	FoodRisk.org is a metadatabase of tools and models for food safety professionals in industry, academia, and government	English	Y	http://foodrisk.org
Fishchoice	FISHCHOICE is part of the FP7 project ECsafeSEAFOOD, aimed at assessing food safety issues related to priority contaminants present in seafood as a result of environmental contamination and evaluating their impact on public health.	English	Y	http://www.fishchoice.eu
The Seafood School at Billingsgate	Learn how to buy, prepare, cook and enjoy fish with experts	English	Y	http://www.seafoodtraining.org/

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9. Appendix 2: Online survey

9.1 Questionnaire

SEAFOOD[TOMORROW] is funded by the European Union, and aims to validate and optimize commercial solutions for improving the socioeconomic and environmental sustainability of the seafood production and processing industry, while contributing to product quality and safety. To achieve these objectives, the project needs the stakeholders' support and input. For this reason, we would be most grateful if you could devote a few minutes to complete this web-based questionnaire, which investigates educational needs in the seafood sector. Your comments and feedback will help shape the progress and outcomes of the project, in this case the development of a free-of-charge e-learning tool for the seafood industry, ensuring it is fit-for-purpose.

Your answers are anonymous and will be kept confidential. Thank you very much for your cooperation.

For more information about SEAFOOD[TOMORROW], visit www.seafoodtomorrow.eu or contact Alice Tediosi (alice.tediosi@aeiforia.eu)

Part A – Personal Data

1) Please indicate which category you belong to:

- aquaculture companies/farms
- fisheries
- seafood processors
- seaweed producers
- fish feed producers
- supermarkets and seafood retailers
- professional schools/universities in the seafood sector
- other (please specify) ……

2) What is your role in the company/institution?

- manager
- employee
- external collaborator
- trainee
- student
- other (please specify) ……

3) What is the size of the enterprise you work for?

- fewer than 10 persons employed
- 10 to 49 persons employed
- 50 to 249 persons employed
- 250 or more persons employed
- I do not work in an enterprise

4) In which country are you located?

5) Which of the following categories best represents your level of education?

- none
- primary level
- secondary level
- technical or professional education
- undergraduate degree
- postgraduate degree

6) Please indicate your gender.

- male
- female

7) Please indicate your age

8) How did you obtain the majority of your work-related knowledge?

- Technical or professional schools
- Undergraduate studies
- Postgraduate studies
- On-the-job learning/training
- Day-release or other formal education supported by your employer
- I am still being trained/studying

9) Do you use online materials for learning purposes?

Yes / No

10) How often do you use these online materials?

- weekly
- monthly
- yearly
- never

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Part B – Perception

11) How would you define the level of information you gained - in your education or training at work - about the following topics? **(Please mark one answer in each row)**.

	Excellent (1)	Good (2)	Neutral (3)	Fair (4)	Poor (5)	Never heard about it
Seafood safety (e.g. chemical contamination in seafood/ environment, biological contamination)						
Seafood quality (e.g. chemical composition, nutritional benefits, sensory acceptability)						
Sustainability (e.g. certification schemes, labelling, traceability)						
Technology development (e.g. seafood handling in processing and production)						

12) How would you describe the following online formats to obtain information about seafood quality, safety and sustainability? (Please mark one answer in each row).

	Excellent (1)	Good (2)	Neutral (3)	Fair (4)	Poor (5)	I do not know
Simple learning resources (e.g. text, images and charts)						
Downloadable materials (e.g. manuals, checklists, guidelines)						
Audio-video materials						
Webinars (e.g. video-audio conferences, chat-based)						
Online software or simulation games						
Online help and expert systems (e.g. individual tutored activity)						
Online group activities (e.g. discussion forums, chat, shared applications)						
Other (please specify)						

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13) To what extent are you interested in, or do you consider relevant to receive more information about the topics listed below? **(Please mark one answer in each row)**.

	Very interested (1)	**(2)**	**Neutral (3)**	**(4)**	**Not interested (5)**	**I do not know**
Feed from sustainable sources for tailor-made fortified fish						
Integrated Multi Trophic Aquaculture (IMTA) for sustainable aquaculture production						
Reduction of risks from harmful algal blooms and human norovirus in shellfish production areas						
Energy and water savings in seafood processing						
Predictive modelling for microbiological hazard management						
Sodium reduction in seafood products						
Digestible tailor-made seafood products for specific population groups						
Integration of sensors for management of seafood production systems						
Strategies to remove contaminants from seafood products						
Automated traceability systems and labels of quality						
Certification schemes of seafood quality and safety						
Other (please specify)						

14) How much time would you be willing to spend in a day on e-learning programmes?

- less than 15 minutes
- 15 – 30 minutes
- 30 – 45 minutes
- 45 – 60 minutes
- more than 1 hour
- I am not willing to spend time on e-learning programmes

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Part C – Existing resources

15) Please indicate to what extent you agree or disagree with the following statements related to online educational provision and training in the seafood sector. **(Please mark one answer in each row)**.

	Totally agree (1)	**(2)**	**Neutral (3)**	**(4)**	**Totally disagree (5)**	**I do not know**
On-line training tools/materials are available						
On-line training tools/materials are available but not in my native language						
On-line training tools/materials are available but difficult to access or expensive						
On-line training tools/materials are available but the contents are not satisfactory for my specific needs						
On-line training tools/materials are available but the format is not satisfactory for my specific needs						
On-line training tools/materials are available but unappealing						

16) Please list any valuable training initiative(s) related to the seafood sector that you are aware of and that is (are) relevant for your activities.

Title	**Short description**	**On-line (Y/N)**	**Reference contact (web link, email)**

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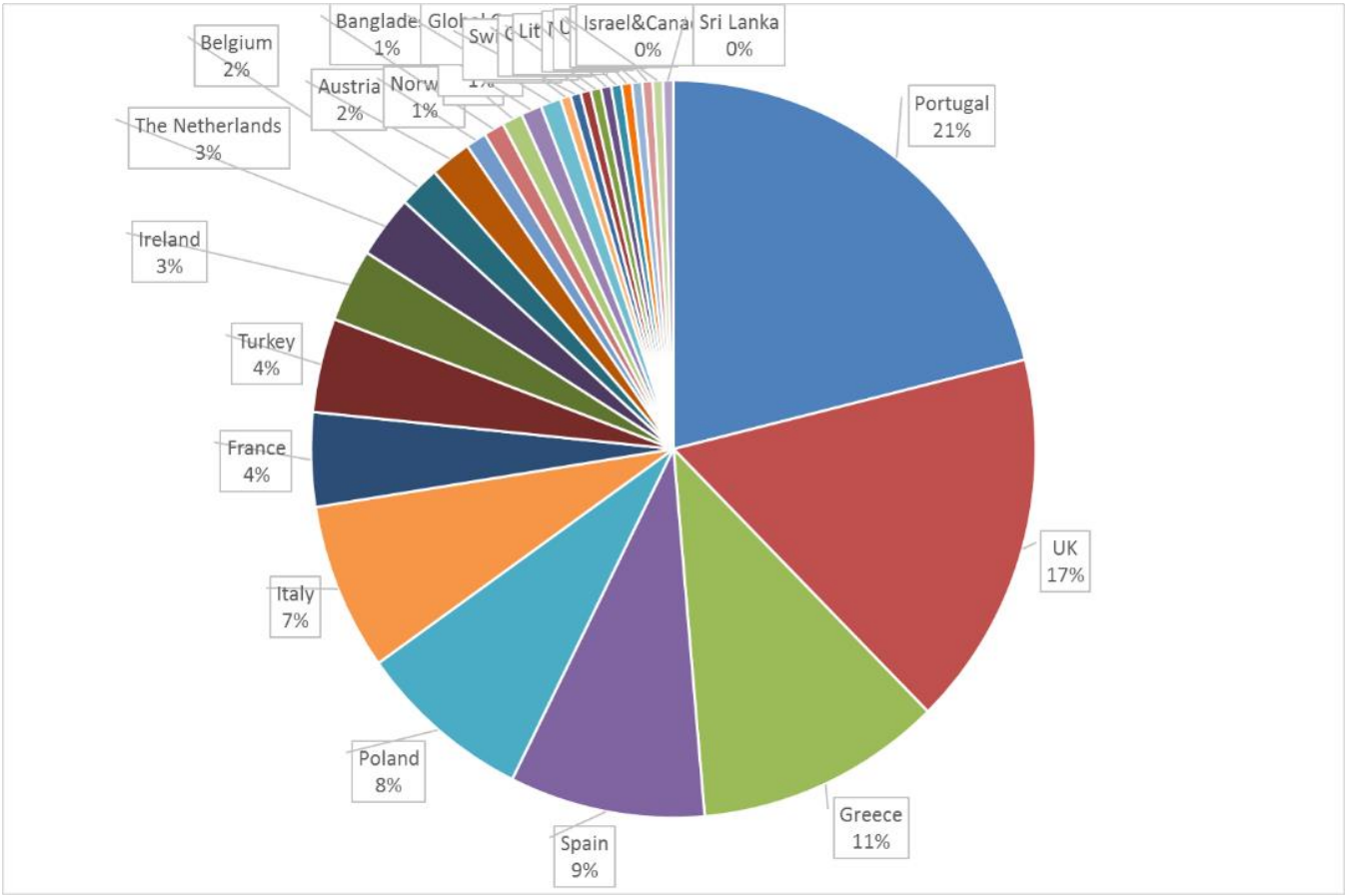
9.2 Questionnaire: Results - Summary

Sample description

Percentage of respondents per category.

Categories	Percentage (%)
professional schools and universities in the seafood sector	28
aquaculture companies/farms	26.1
fisheries	11.5
seafood processors	11
supermarkets and seafood retailers	7.3
seaweed and fish feed producers	1.9
other	14.2

Percentage of respondents per country



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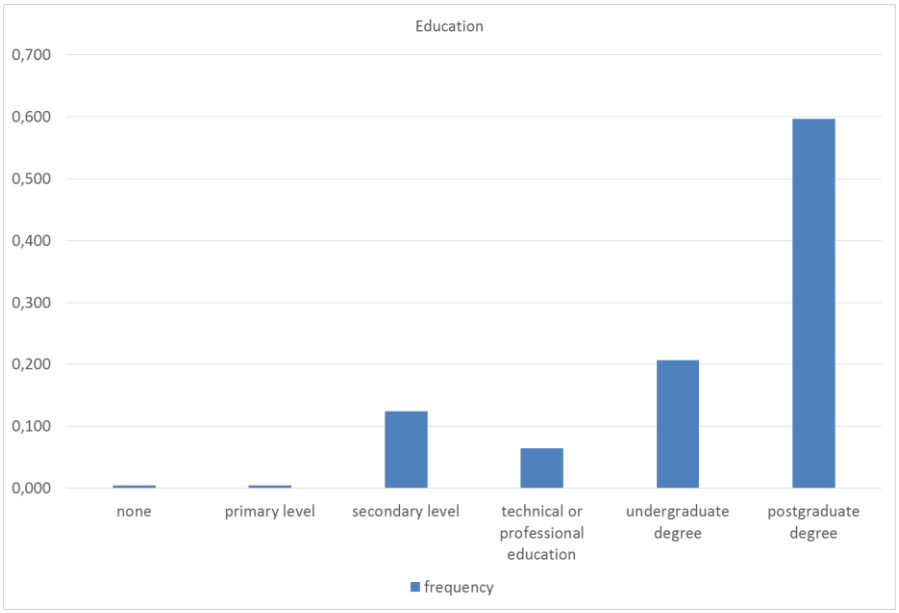
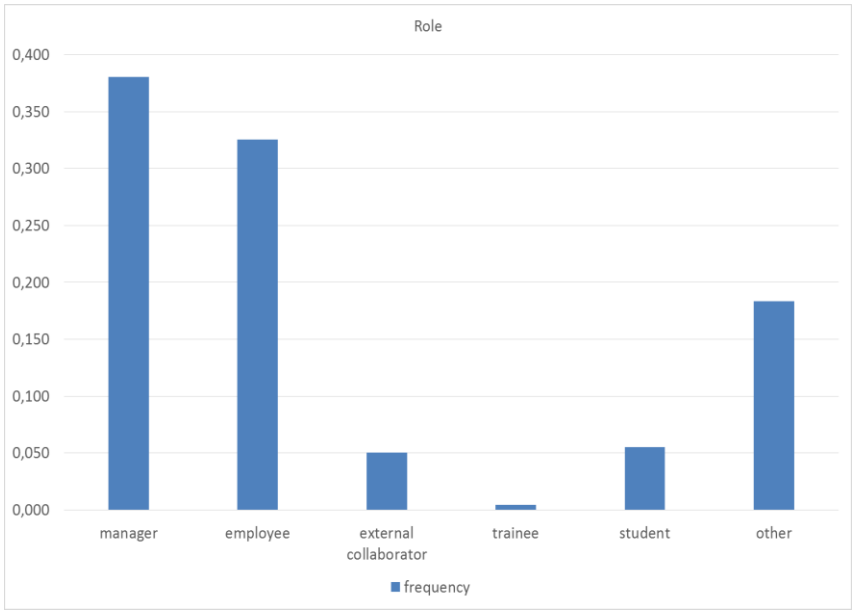
Educational level of respondents



Role of respondents



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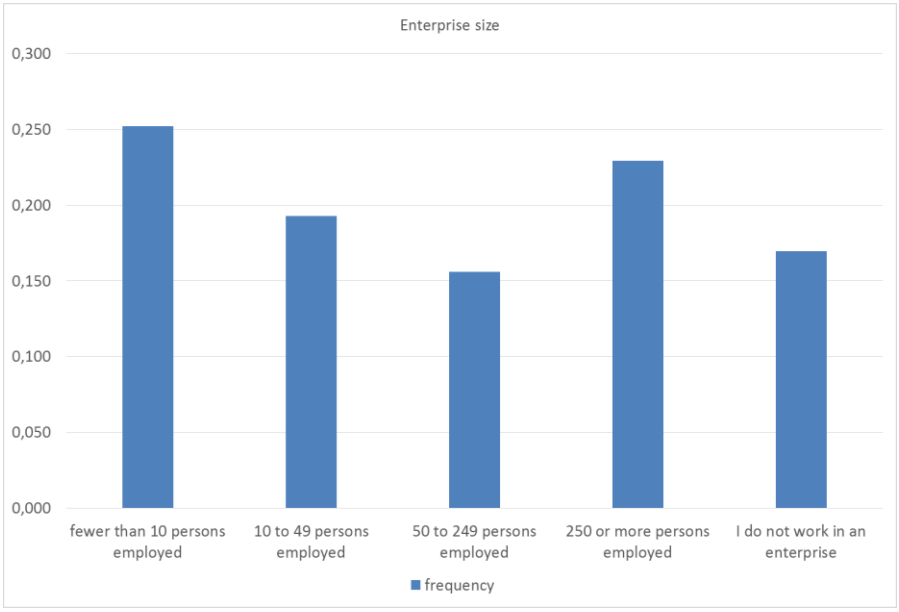
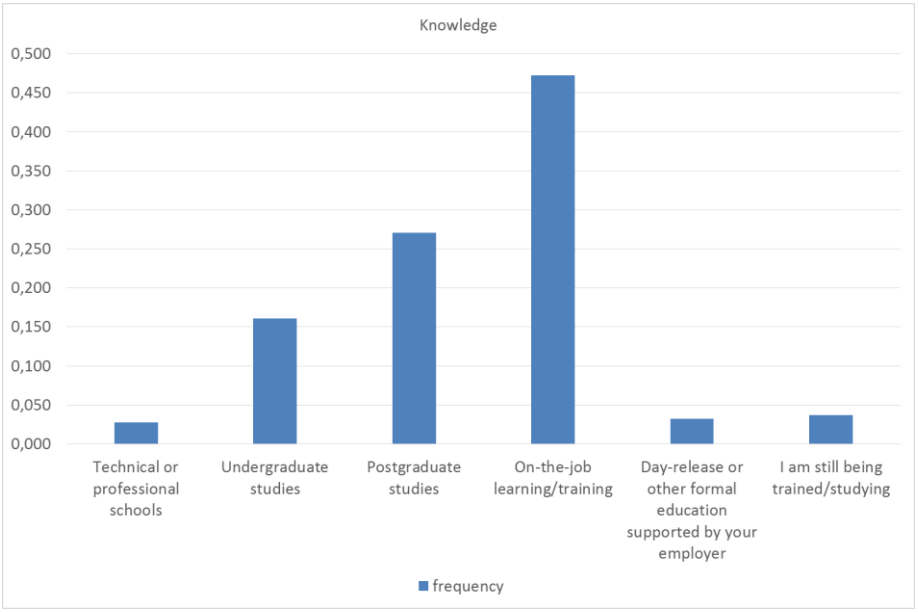
Enterprise size



Source of work-related knowledge



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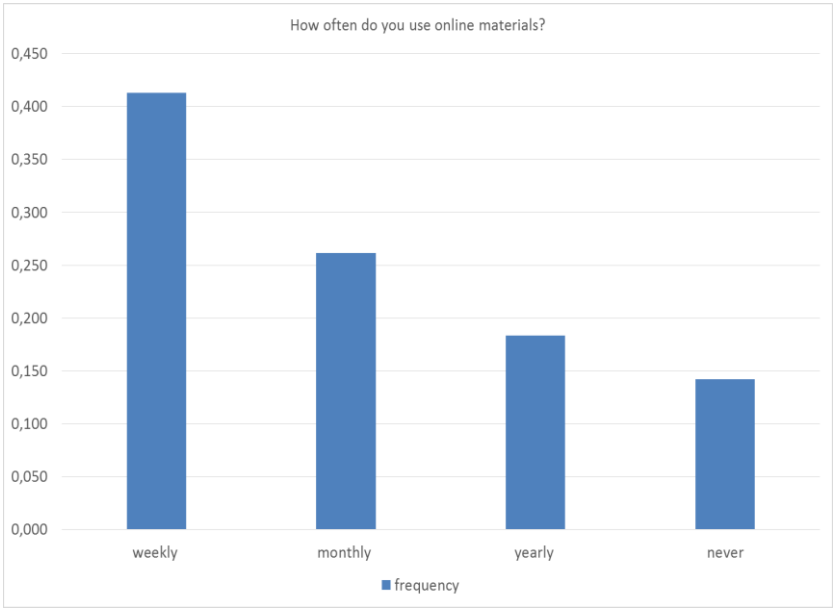
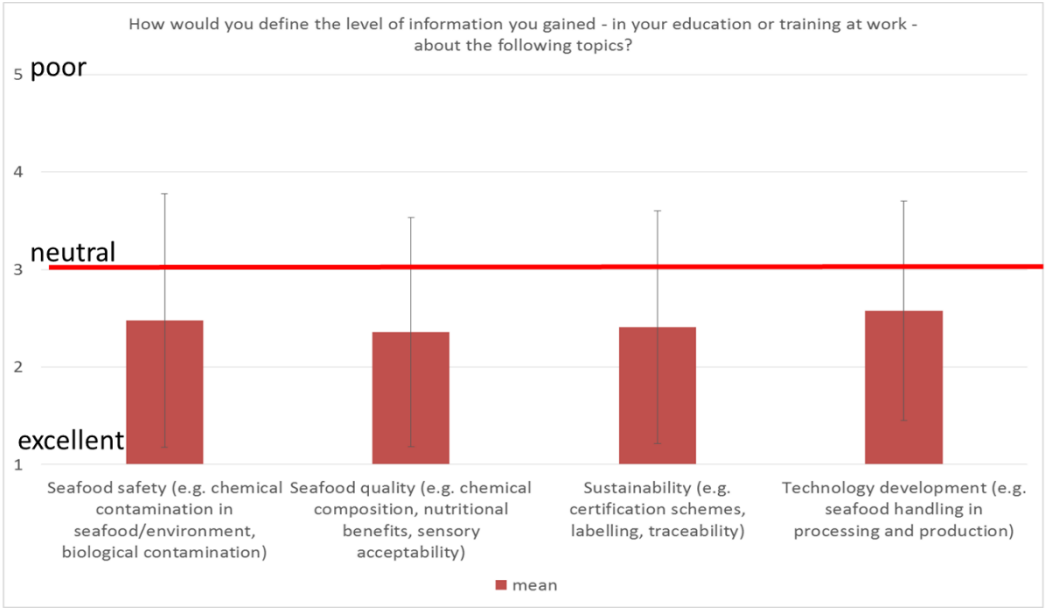
Frequency of use of online materials



Results (of using elearning previously)



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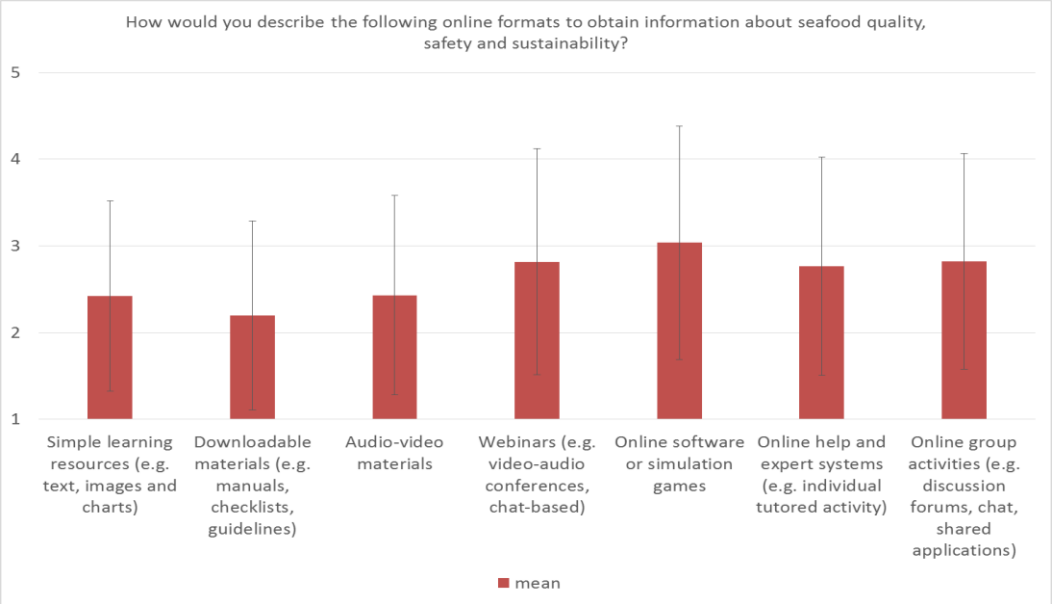

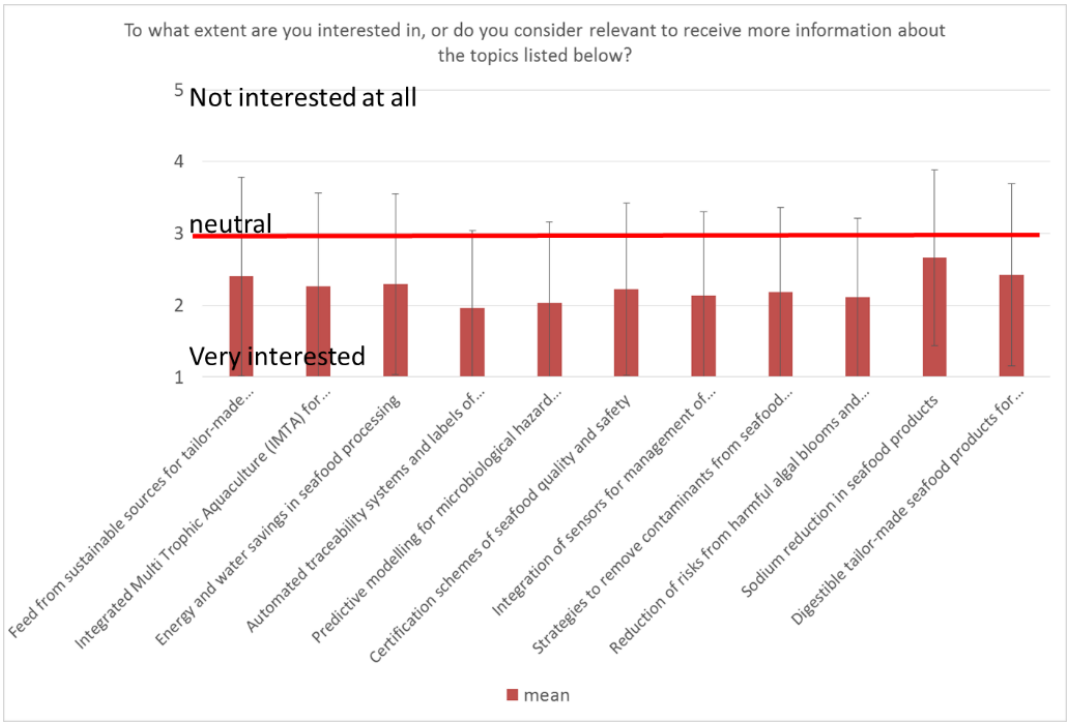

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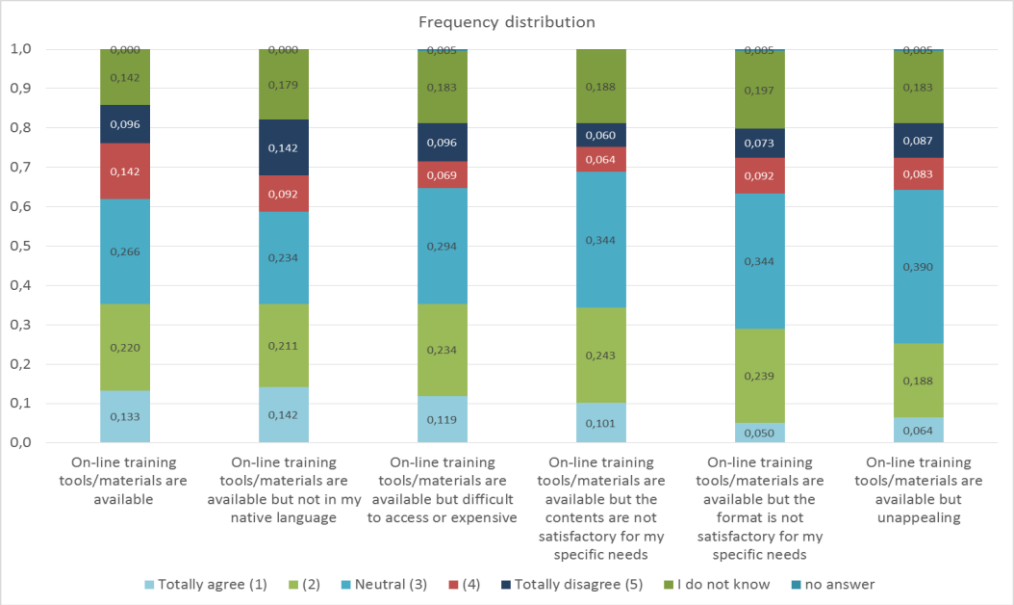
How much time would you be willing to spend in a day on elearning programmes?	Frequency
10-30 minutes	0.39
30-45 minutes	0.18
45-60 minutes	0.15
Less than 15 minutes	0.14
More than 1 hour	0.08
I am not willing to sped time on elearning programmes	0.06



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10. Appendix 3: Interview to seafood industry associations

10.1 Interview structure

SEAFOOD[TOMORROW] is a project funded by the European Union, to promote sustainability in the seafood production. Since we are developing an e-learning course within the project, we are keen to gather inputs from the seafood industry associations to identify educational needs in this sector. So we are most grateful for your cooperation.

Your answers will be kept confidential.

a) Name:

Affiliation:

Sector:

General profile of associates:

b) Could you please rate from 0 (no interest) to 10 (very interested) the following topics, for which your associates would like more information and training?

TOPICS	INTEREST (0 to 10; specify the 3 most interesting)
Feed from sustainable sources for tailor-made fortified fish	
Integrated Multi Trophic Aquaculture (IMTA) for sustainable aquaculture production	
Reduction of risks from harmful algal blooms and human norovirus in shellfish production areas	
Energy and water savings in seafood processing	
Predictive modelling for microbiological hazard management	
Sodium reduction in seafood products	
Digestible tailor-made seafood products for specific population groups	
Integration of sensors for management of seafood production systems	
Strategies to remove contaminants from seafood products	
Automated traceability systems and labels of quality	
Certification schemes of seafood quality and safety	

c) Are there other topics that would be very interesting for your associates and that you would like to be included in this e-learning course?

d) How do you think we should develop our e-learning course in order to be beneficial to your associates?

Please consider these aspects:

- length of each session (how many minutes a day, not necessarily every day, for how long/how many times)
- formats of the materials (text and charts, downloadable materials, audio-video, …)
- language (English, native language). The project will produce materials in English.

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For PROJECT BENEFICIARIES ONLY: Take into account whether the translation costs are eligible within your allocated project resources, would you have the possibility to translate the materials into your native language?

-other

e) Are you aware of any e-learning courses already covering the topics mentioned? If so, please provide the contacts of the owners of the course/materials.

f) Have you / your associates participated to these courses? If so, which were the weaknesses and strengths that could be useful for the e-learning course we are about to develop?

- Did the participants receive a certificate or diploma?

g) In your opinion, what is the key to maximise the participation of your associates in the SEAFOOD[TOMORROW] e-learning course?

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10.2 Interview responses

	Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Sector	food industry	Seafood and aquaculture industry cluster	food consulting	food industry	seafood	mollusc producers
General profile of associates	seafood producers, food processing industry, aquaculture companies, canning industry	engineers	industrial fish and seafood processors, retailers	non-profit organization which aims to develop dairy, meat, food industry and to support food processing industry	Industry and Trade of seafood products	mollusc producers

Could you please rate from 0 (no interest) to 10 (very interested) the following topics, for which your associates would like more information and training?

TOPICS	**INTEREST (0 to 10 ; specify the 3 most interesting)**						**Average score**	**Standard deviation**
	Association 1	**Association 2**	**Association 3**	**Association 4**	**Association 5**	**Association 6**		
Feed from sustainable sources for tailor-made fortified fish	1	10	8	10		0	**5.8**	**4.9**
Integrated Multi Trophic Aquaculture (IMTA) for sustainable aquaculture production	2	10	5	8		0	**5.0**	**4.1**
Reduction of risks from harmful algal blooms and human norovirus in shellfish production areas	8	10	2	1		10	**6.2**	**4.4**

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Energy and water savings in seafood processing	10	10	10	6		0	**7.2**	**4.4**
Predictive modelling for microbiological hazard management	4	9	9	10		9	**8.2**	**2.4**
Sodium reduction in seafood products	7	10	8	9		0	**6.8**	**4.0**
Digestible tailor-made seafood products for specific population groups	3	10	7	5		0	**5.0**	**3.8**
Integration of sensors for management of seafood production systems	4	10	3	4		0	**4.2**	**3.6**
Strategies to remove contaminants from seafood products	9	10	10	8	8	8	**8.8**	**1.0**
Automated traceability systems and labels of quality	5	10	6	7	9	7	**7.3**	**1.9**
Certification schemes of seafood quality and safety	6	10	7	3	10	6	**7.0**	**2.7**

Are there other topics that would be very interesting for your associates and that you would like to be included in this e-learning course?

Association 1	**Association 2**	**Association 3**	**Association 4**	**Association 5**	**Association 6**
Importations-exportations, regulations, requirements. Food waste valorisation methods	Robotic in seafood process	/	/	Strategies of communications to the consumer of nutrients contained in seafood products	market, environment

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How do you think we should develop our e-learning course in order to be beneficial to your associates?

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Free. Concepts to apply to the real world, practical lessons, good professionals. Real time part (ex. Forum) and flexibility	/	Not one long course unit, but a series of shorter units, so that it is more easy and uncomplicated to follow and "Consume" the course	interactive, livelier and more attractive	I believe that a direct involvement of the participants by means of specific "questions time" and above all through analysis, discussion and sharing of issues and problems is important. Participants must be actively involved in the lesson	interviews of experts (with knowledge, infographics, suggestions). small focused detailed topics

length of each session

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
During 2 months for example, each session 2hours per week. A session for one thematic.	1-2 hours a day and 3 days	max 45 minutes	30 – 45 min / per day	45-60 minutes	10 minutes

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formats of the materials

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Downloadable materials, because it's better to save the information	Downloadable , audio-video	Video lecture supported by downloadable data	Text and charts, presentations, Audio, video, F2F meetings, Scientific papers, interviews	text and charts, downloadable materials and questionnaires	Interviews, infographics to download, access to law/regulations (links)

language

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Spanish	Should be better in the native language (French)	Translation into national language would be appreciated (German)	both of them (English + Turkish)	English	native languages

availability for translation

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Yes, but depending on the time required	It depends of the size of the files, but we should be able to do it for some of them	/	/	/	/

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Are you aware of any e-learning courses already covering the topics mentioned? If so, please provide the contacts of the owners of the course/materials

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
No	not these topics	Sessions of former EU project FoodSTA and the ISEKI webinars	no	no	no

Have you / your associates participated to these courses? If so, which were the weaknesses and strengths that could be useful for the e-learning course we are about to develop?

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Web seminar (ASIS) on control of allergens for food intolerances (1 hour). Final part Q&A	no	+: good practical useability; -: quality of accompanied material (sometimes)	no	no	/

Did the participants receive a certificate or diploma?

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Certificate	/	No, just a confirmation of attendance by mail	/	/	/

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In your opinion, what is the key to maximise the participation of your associates in the SEAFOOD TOMORROW e-learning course?

Association 1	Association 2	Association 3	Association 4	Association 5	Association 6
Free, attractive topics, easy to access and intuitive, useful concepts to solve real problems	Short sessions, very specific (one topic per session), and the translation in the native language, because in France, unfortunately, many people don't speak well English	direct interesting lectures with a high degree of practical use and direct applicability in practice	If this e-learning course improves the commercial characteristics of the firm and increases its revenues, the company can take this course to its employees. Therefore, the subjects of the course should be chosen in such a way as to benefit the firm.	Transforming technical-scientific results into practical examples or best practices to be analyzed with operators working in that specific sector. Look for the operative difficulties with the help of the operators and identify practical, quick and easy solutions.	We should ask national organisations within our organisation to disseminate the tool among their associates.
					A short video or document or infographics to upload somewhere, giving an idea of what the tool is and what it would be helpful for (Skills they can get etc)
					Difficulties to deal with people who are not familiar with these technologies and not favourable to any training. Efficient with small enterprise is to give an advantage: convince national organisations to make it mandatory or give economic advantage (reduction of fees)… so they will come to us.

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11. Appendix 4: Screenshots of the elearning tool

Figure 1: Course homepage

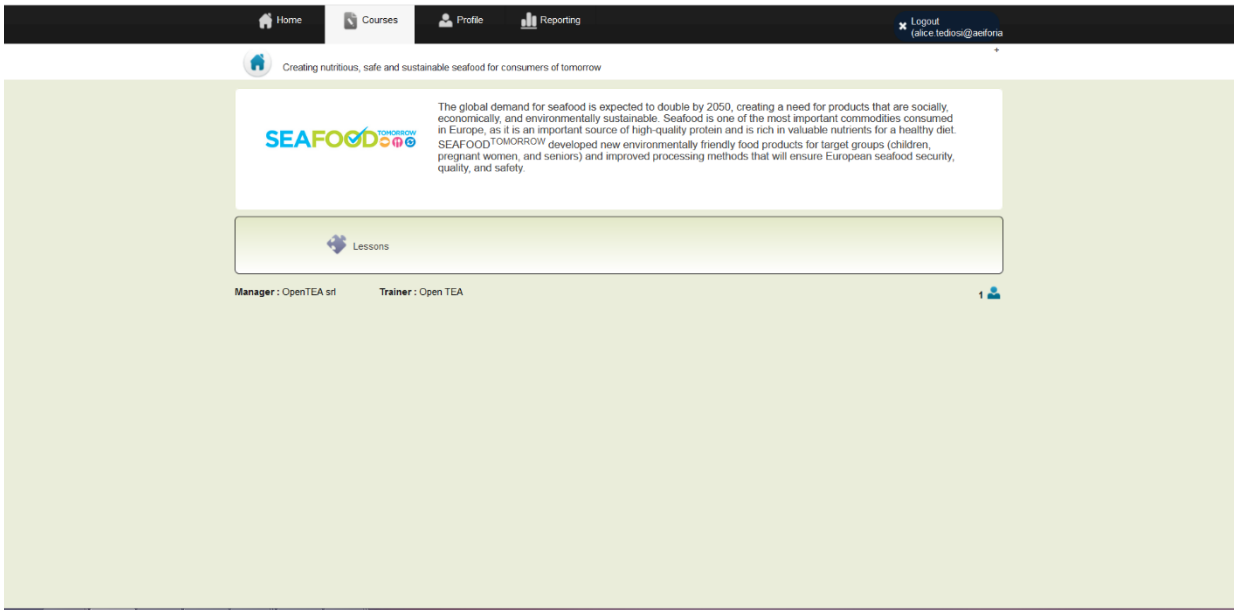

Figure 2: First step (Introduction) of the module: 1.2 Biofortification of farmed fish

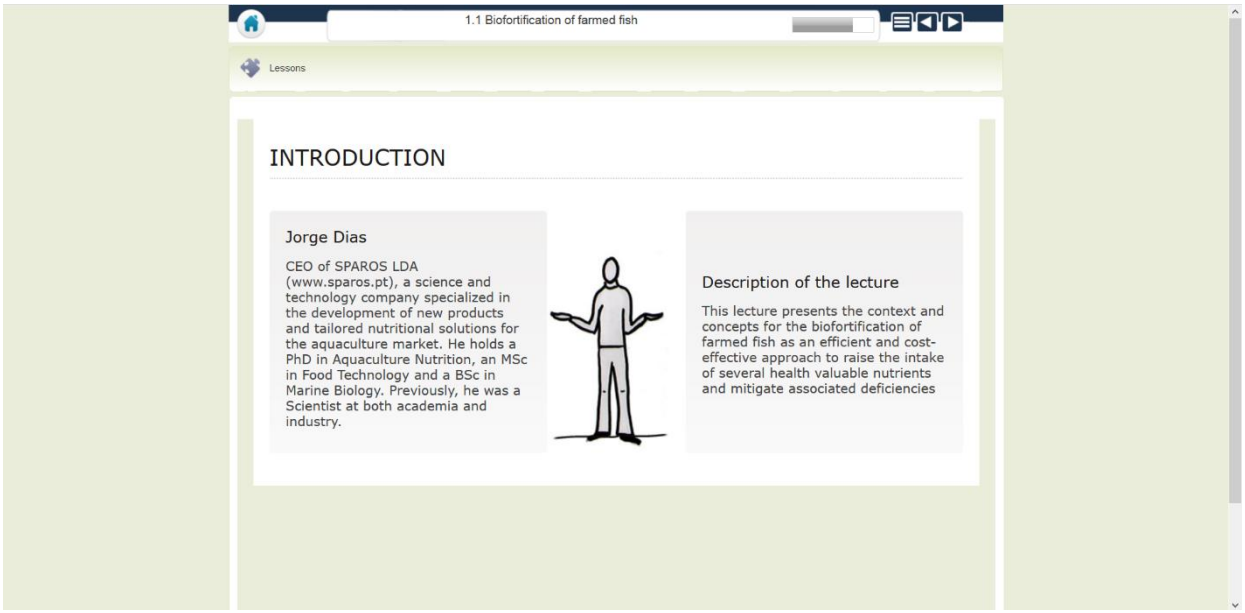

Figure 3: A (downloadable) Power Point presentation as the main learning content of Module 1.2

Figure 4: Follow-up materials (a video) included in the module 2.5 Listeria specific bacteriophages to improve the safety of seafood products

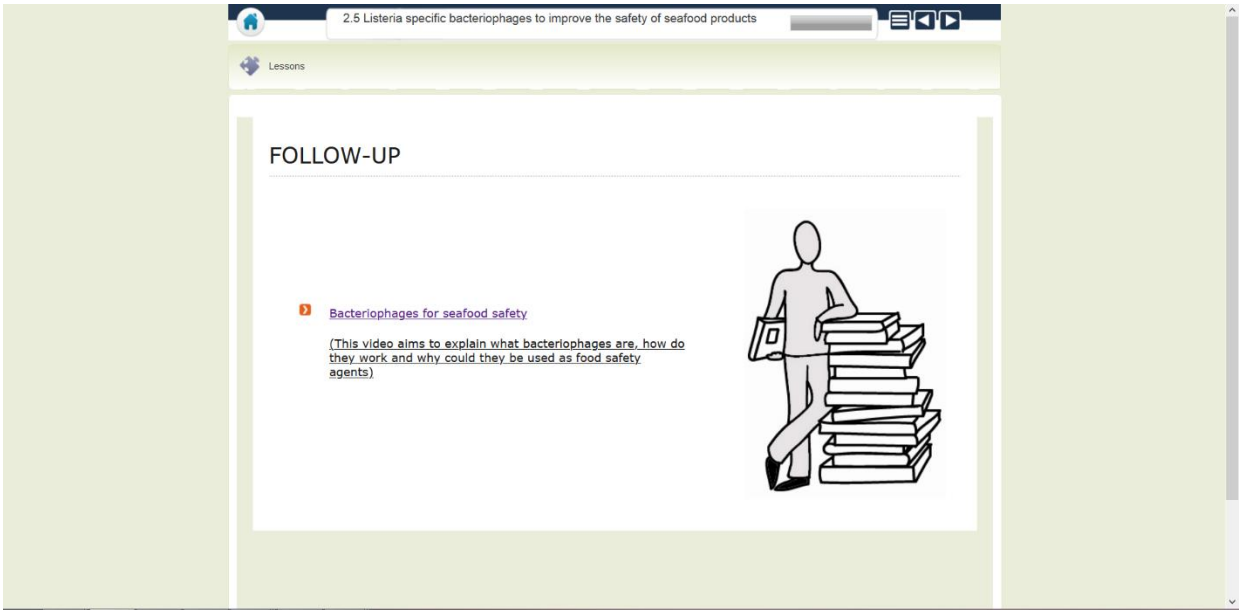

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Figure 5: Quiz with multiple-choice questions included for the user's self-assessment

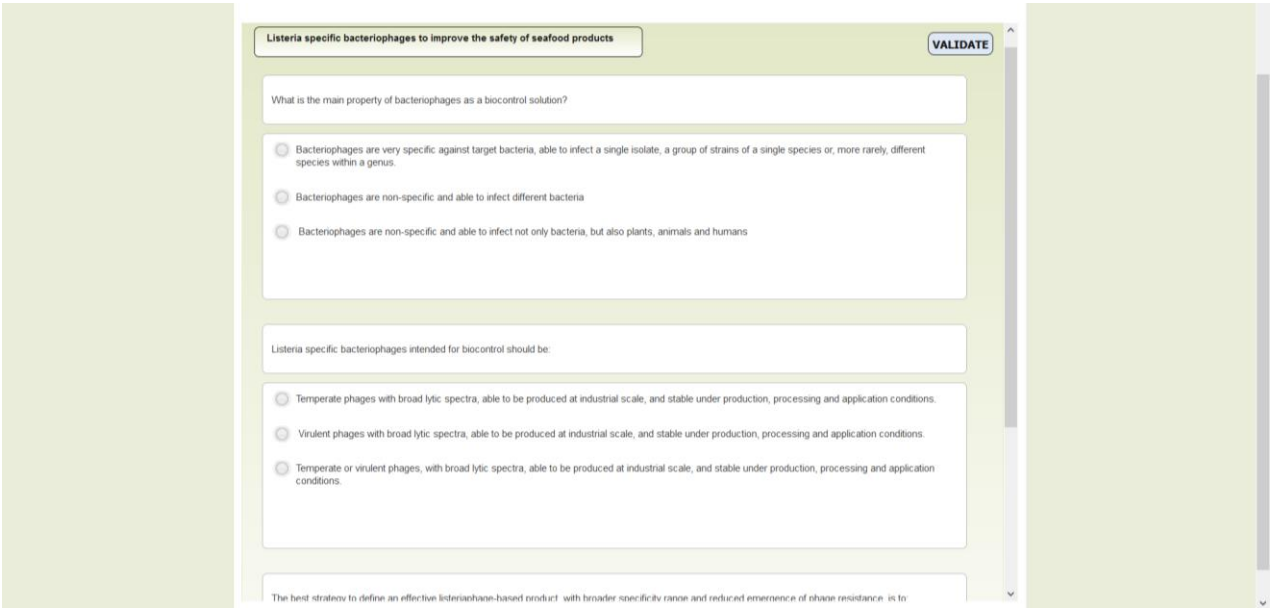
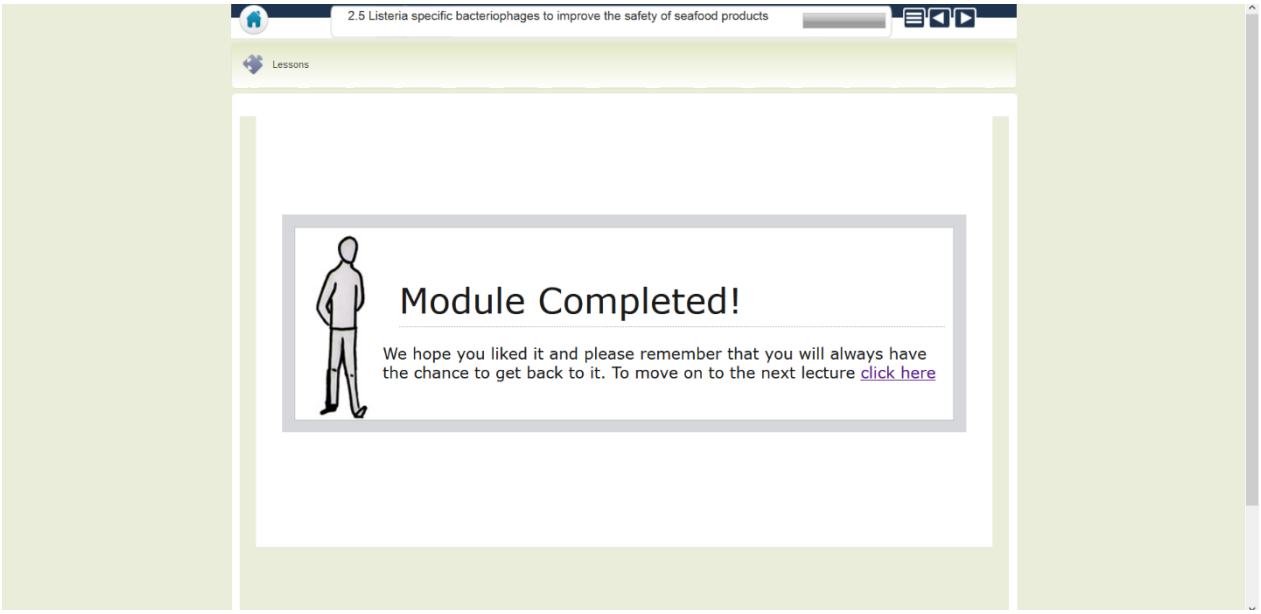


Figure 6: End page included in each module



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