

*Fostering Growth in the Blue Economy by developing an
action plan for innovative European aquaculture VET and
harmonized qualifications*

D4.1 The derivation and application of occupational standards to VET design

WP 4 Occupational definitions

Author: Martyn H. Haines.

Contributors: Margaret Eleutherius ¹,

John Birger Stav ²

¹ AQUALEX Multimedia Consortium Ltd - Board Chair (Internal Evaluator)

² Norwegian University of Science and Technology NTNU (Norway)

Version: Final

Date: 30.11.2017



Summary

Overview

Occupational standards have a potentially important role to play within future European collaborative VET development and the harmonization of aquaculture qualifications and they can be presented in a range of formats.

They can provide a clear framework to guide non-formal and formal VET development at company, national and potentially European level. The methodology for developing occupational standards and competence profiles has evolved in some of the BlueEDU countries according to varying methodologies. Therefore, any attempt to develop 'shared' occupational standards for cage farming finfish at European level must start with an agreement regarding the methodology to be applied. The use of Learning Outcomes is prevalent throughout European VET systems, and may offer a 'common denominator', and a more direct basis for expressing and developing shared occupational standards for the cage farming of finfish.

Definitions of occupational standards and competence

Some European aquaculture leaders have recognized the need to 'professionalize' the aquaculture workforce, enabling the industry to adapt to evolving technologies and make better progress towards achieving challenging national growth targets. More recent evidence from the BlueEDU initial research, undertaken during the FEAP meeting in Venice in May 2017, has validated this view. The opinion of an audience, predominantly composed of aquaculture company chief executives and leaders of the producer organizations, was resounding, with 98% believing that "a competent workforce is essential for aquaculture to progress." [12]

Although to many, 'competence' is a non-technical term, various education authorities, agencies and academics have provided a range of definitions, some of which have evolved to become influential within European VET design. The simple assertion by industry leaders above gives rise to a series of questions to be addressed within this evaluation. More specifically;

- how have the different definitions of competence influenced the evolution of occupational profiles and standards,
- how are occupational standards used today to inform VET development in different BlueEDU countries, and
- how could occupational standards be used in the future to guide collaborative European VET development?

Most occupational standards refer to 'competence' as an important parameter. The published literature confirms that 'competence and professionalization' is inexorably linked, [4] and that definitions of competence have driven VET development in many well-established industry sectors.

Although an ancient activity, aquaculture is a relatively new industry, and published definitions of occupational standards, in the widest sense, are limited. Despite this, there are some examples of occupational standards and definitions of competence that have been applied to non-formal and formal aquaculture VET in the north and south of Europe. The European aquaculture industry has at times provided considerable assistance within previous projects addressing the development of occupational standards (See description of the WAVE project in Chapter 2,4). However, qualitative surveys undertaken within the BlueEDU Initial Opinion study have indicated that this cooperative spirit has not been so evident within those countries cage farming finfish. Allegedly, this has hampered the development and updating of occupational standards at national level at times. As many fish production companies are using similar technology and applying similar procedures under the guidance of the same technology supply companies, there could be an opportunity for a more collaborative approach to occupational standards development in the future.

There are some optimistic signs emerging. Some of the largest and most influential fish producing companies are developing 'technology specific' standards that could be more widely shared, potentially, and provide impetus to the collaborative development of occupational standards and Aquaculture VET at European level.

European aquaculture labour mobility

Facilitating labour mobility is of great political importance within Europe, for one simple reason. The economy in the relatively prosperous north is growing and this can provide employment opportunity to those living in the less prosperous south. This economic reality is reflected within the aquaculture sector. Consequently, companies can face practical difficulties when recruiting and developing an influx of immigrant staff lacking formally recognized qualifications. In some countries, because of the rapid expansion of their aquaculture sector, the percentage of the aquaculture workforce that are unqualified has increased. This is exemplified by Norway, where a survey by SINTEF undertaken in 2014 revealed that approximately 50% of the aquaculture workforce did not hold a recognized qualification appropriate to their role. In November 2017, initial BlueEDU research revealed that the percentage of 'unqualified' staff had risen further in some companies. Consequently, the development of VET solutions for mature entrants, some of whom are experienced but need to gain an aquaculture qualification relevant to their role, is a high priority.

Although some European countries do not have a suitable aquaculture VET provision, improved recognition of 'qualification equivalencies' could be beneficial to those that do. Consequently, the development of a more comprehensive inventory of aquaculture VET and qualifications available in Europe, with the equivalencies identified, is an important aim within BlueEDU. The European Qualifications Framework (EQF) provides a 'translation tool' that can support the recognition of equivalent qualifications between countries, and it includes competence as an important parameter. However, wherever the methodology for the development of occupational standards and competence profiles is deficient or absent within a country, the reliability of an EQF driven recognition process will diminish.

Evaluation process

Currently, the information on occupational standards and qualifications in aquaculture relevant to the cage farming of finfish in northern and southern Europe is sparse and fragmented. Once achieved, a definition of the ‘common ground’ within occupational standards and qualifications would be invaluable to informing future European collaborative VET development initiatives. This makes clarity regarding each country’s respective methodologies for occupational standards development and their application to VET design a pre-requisite.

The following process has been followed:

- Review of the methodology used to derive occupational standards and competence frameworks applied to VET development.
- Consideration of the influence of relevant European VET tools (including EQF and ECVET) and previous initiatives on the harmonization of qualifications and the future development of ‘shared’ occupational standards.
- Proposed action plan for the development of European Occupational Standards (EOS) for cage farmed production in northern Europe, correlated to southern Europe.

Recommendations

The evaluation of the derivation and application of occupational standards in different BlueEDU countries confirmed that there are significant variations in methodology and the influence of such processes on VET development. However, as the use of Learning Outcomes is prevalent across Europe, they can provide a common denominator to occupational standards development within BlueEDU. With limited explanation and facilitation, a common methodology can be established within a working group led by industry to develop cage farming standards. This will be restricted to simple definitions of the knowledge, understanding, skills and competence (degree of autonomy) required to undertake defined tasks.

As most large companies have some form of Standard Operating Procedures (SOPs), this will provide the basis for agreeing shared task definitions, which can then inform the development of a framework of shared Learning Outcomes for areas of commonality. This process can be initiated and completed in northern Europe led by large multinational fish producers and facilitated by BlueEDU partners. The output will then be correlated with cage farming in the south of Europe to define the common ground applying to both regions.

The final output can then be used to inform collaborative VET solutions for the education and training of unqualified mature entrants who are currently experiencing the greatest difficulty in becoming qualified.

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Chapter 1: Key concepts definitions and methodology

Occupational (job) profiles are a complete description of the knowledge, skills and competences required to undertake the tasks and responsibilities required to fulfil a role. Occupational profiles describing the same role can vary between countries due to differences in the methodology, aquaculture systems and underlying beliefs. Typically, ‘skills or attributes’ based competences are referred to, but more recently, ‘capability’ based competences are becoming more influential. Once a framework of occupational standards exists, it can be referred to by VET designers to create qualifications.

1.1 Competence

Competence has been broadly associated with what a person is able to do. Standards and frameworks addressing competence have been associated with signing off practitioners as ‘fit to practice’. Questions have been raised regarding how well the daily reality of work is represented by the ‘skills or attributes’ based models that prevail. Consequently, capability based models that take account of changing contexts, evolving practices and ethical demands have evolved more recently. The definitions of capability, although less tangible in nature, are beginning to have some influence on the evolution of competence profiles for many professions.

Within aquaculture, competence definitions have tended to be task orientated in nature. However, recent BlueEDU qualitative survey work in Mid-Norway indicates that less tangible capabilities, such as collaboration, problem- solving and the use of initiative, are coming to the forefront within some companies. They are harder to define, and more challenging when it comes to forming reliable assessment strategies within a VET system. Some aquaculture employers have already recognized this challenge, acknowledging that assessing a learners theoretical understanding of such capabilities using traditional examinations, will be of limited practical benefit. Effective work based assessment will be essential to gathering reliable evidence of capability based competences, as they are behavioral in nature, and can only be revealed by regular and astute observations of learners by experienced and well-trained managers. To ensure the judgements of different managers is consistent and fair, assessment standardization and quality assurance systems will need to be in place.

Some competence definitions refer to ‘degrees of autonomy’ as a major determinant of ‘skills based’ competence. This is registered in practice by the level of supervision required to apply a skill, or skill set, to carry out a task. This principle is reflected in the European Qualifications Framework (EQF) which refers to ‘responsibility and autonomy’. (See Chapter 3.2)

From a practical perspective, the evaluation of a person’s competence can be achieved by placing their ability to undertake a ‘specified task to a required standard’ on the following scale:

- The skill(s) required to complete the task need further development,
- the skill(s) can be applied to complete the task under supervision,
- the skill(s) can be applied to complete the task with limited supervision

- the skill(s) can be applied to complete the task without supervision, and
- can supervise others applying the skill(s) to complete the task.

The various philosophies and approaches that have been applied to defining competence have been evaluated in a study by Stan Lester [4] and are summarized below.

Table 1: Definitions of competence according to Stan Lester: Professional Standards, competence and capability.

Approach	Primary sources	Development methodologies	Format
Internal individual attribute based competence			
Technocratic		Derived from knowledge base or course syllabus	Tasks expressed as application of knowledge
Instructional design	Draws on blooms et al taxonomy	Job analysis, learning needs analysis	Table of knowledge skills and attitudes associated with the job
Behavioural	McBer organisation and associated authors eg. McLelland, Spencer and Spencer, Kemp	Behavioral event interviewing, Critical incident analysis, repertory grid technique	Behaviors approaches and dispositions, associated with effective job performance
External, social activity based competence			
Task based	Early UK Manpower Services Commission (MSC) Agency models	Task analysis	Descriptions of tasks and their component parts
Role based	Mansfield-Mathews job competence model and subsequent analysis	Functional Analysis	Descriptions of job functions and detailed activities within them
		Job analysis, analysis of roles across professions	Descriptions of broad functions and key activities within them

Europe has followed the UKs lead this century with the adoption of processes for the development of occupational analysis. [4] Latterly within the UK, functional analysis methodology within role based approaches has been the most influential, having superseded early task analysis approaches deployed in the 1980s. This methodology led to the development of National Occupational Standards (NOS) in Aquaculture underpinning the Modern Apprenticeship (MA) in Aquaculture, the only National

Qualification available in Scotland currently. The knowledge and skills associated with aquaculture at each occupational level are rigorously defined within the MA Units.

In summary, whilst skills based competence systems remain very relevant to aquaculture, due to their practical and applied nature, capability based definitions are gaining recognition and widening the scope. This is being reflected by some Quality and Human Resource Managers within larger aquaculture companies as they devise their own competence definitions, and start to recognize the importance of less tangible capabilities.

1.2 Standard Operating Procedures (SOPs)

Although there are smaller scale operators which are particularly prevalent within southern Europe, the production of fin-fish in cages for the high-volume export markets is dominated by large multinational companies, both in northern and southern Europe. Consequently, because the large companies employ hundreds of staff across multiple farm sites, most have devised Standard Operating Procedures (SOPs), designed to underpin and control the operational management of fish production and processing from 'egg to plate'. All activities are highly regulated, and quality assured to satisfy a multitude of criteria, largely driven by stringent food safety and animal welfare requirements imposed by legislation and the quality assurance (QA) requirements of a large and powerful food retail sector. Therefore, consistency in the way all tasks are conducted on the farm and in the fish processing facilities is paramount, alongside record-keeping to ensure the accountability and traceability of every step of the production process.

Informal communications with some companies during the BlueEDU Initial Opinion study qualitative surveys, indicates that the development of SOPs is more effective as a collective and consultative activity. This is to ensure that site managers and senior production managers reach agreement on how every task is to be conducted. Each task should be broken down into its components and defined in an unambiguous way to ensure consistent interpretation by all managers and husbandry operatives.

Many tasks involve the operation of increasingly sophisticated equipment and digital technologies. Therefore, as technology advances, SOPs need to be updated. The technology supply companies can support farms in the updating of SOPs when introducing new equipment. However, the process being undertaken is effectively a 'task based' analysis, as described in the table in Chapter 2.1. The SOP definitions, once developed, remain the intellectual property of the company.

Although a well-defined set of SOPs will define tasks that are often species, and/or technology specific, they will not always determine who is responsible for each component of the task. In the past some companies in Scotland have taken the next step in the continuum, allocating tasks to roles, thereby completing a competence/skills profile for each occupation that exists within their business. However, the BlueEDU Initial Opinion study revealed that subsequently some companies have had difficulty in getting their company SOPs implemented with consistency

1.3 National Occupational Standards (NOS) underpinning National Qualifications

Occupational/job profiles are a complete description of the knowledge, skills and competences required to undertake the tasks and responsibilities required to fulfil the role. Once every occupation within a sector has been defined in these terms, that sector then has a National Occupational Standard (NOS) covering all occupational levels, which can inform national level VET design.

In some, but not all countries, the national VET system demands that National Occupational Standards are produced for each sector to inform the development of National Qualifications. For the public-sector agencies organizing the standards development committees and task groups, effective employer representation is a real challenge. Ideally, all vested interests, including both small and large companies should have a voice in the process.

Aquaculture occupational standards and job profiles, could be meaningfully compared between countries, despite the challenges posed by differing methodology, so long as these differences are understood. Table 2 below provides an indication of the compatibility of different BlueEDU countries as VET development partners, and has been derived from a full analysis of their respective VET systems. (Appendix 3). It should be noted that NOS from different countries can vary in style, according to their specificity. Although Scotland experienced a phase of 'species specific' NOS in the 1990s, they have been superseded by a more generic NOS. Interestingly, informal communications with Aquark, a Greek 'knowledge transfer' company, indicate that Greece has developed species specific standards for the culture of Sea Bream and Bass more recently. However, generally, aquaculture standards have become increasingly generic to accommodate what is a technologically diverse sector, perhaps best exemplified by the ESCO standards, which are the most generic and 'broadly defined' of all, as required to accommodate a very 'broad church' of European aquaculture vested interests.

Hence, for the occupational standards development work of the proposed 'Labour Skills Foresight Committee' for cage farmed salmon to be influential an agreement should be reached regarding the methodology and terminology to be applied to standards development at the outset.

The status of Occupational Standards in the broadest sense, including; National Occupational Standards (NOS), Learning Outcomes (LOs) and Standard Operating Procedures (SOPs) that can influence non-formal and formal VET system in the BlueEDU countries, has been summarized in Table 2 below.

1.3.1 The UK (Scotland) Aquaculture NOS experience

Today, the UK (Scotland) has a well-defined, generic NOS underpinning its work based Modern Apprenticeship in Aquaculture. However, it has been a problematic evolution at times, and communication with Scottish stakeholders within the BlueEDU qualitative surveys indicate the following difficulties were encountered:

- *Expulsion of VET providers from the Aquaculture NOS development process.* This led to a committee with little understanding of the VET assessment process in the 1980s. In the absence of VET providers, an inoperable fish husbandry NRQ resulted. The negative experience of newly

trained work-based assessors within a large Scottish salmon farming company during initial delivery, damaged the reputation of work based NRQs in Scotland for many years.

However, remediation early this century rationalized the UK (Scottish) NOS, which are now much more generic. The NOS have been updated in 2016 and underpin the Modern Apprenticeship (MA) in Aquaculture which has a manageable assessment strategy. Consequently, recruitment to the MA has been growing.

- *Ineffective employer representation on the development committees during NOS development and updating.* There was little continuity between staff attending standards development committees, on behalf of each aquaculture company. Generally, the larger companies attended, whilst smaller farms were less well represented.
- *Infrequent NOS review on a set 5-year cycle.* This led to standards at risk of becoming outdated. Under revised regulations, the UK (Scottish) industry are now free to update their NOS as often as they feel is required. However, this problem has been moderated latterly through the development of more generic standards that do not date so quickly.

1.4 Learning Outcomes

Recognition of the inherent advantage of Learning Outcome (LO) based VET systems has swept Europe, despite reservations having been expressed by some leading education experts, including Declan Kennedy. [14] The use of LOs has now been incorporated within VET systems by most EU member states over the last decade. Many of those countries have also converted to a Unitized system, whereby each Unit is composed of defined LOs. In some systems, such as those in Scotland, Ireland and Finland, LOs are highly prescriptive and have mandatory associated performance criteria and assessment requirements. Proponents of such 'prescriptive' Unitized VET systems claim that whilst being nationally standardized and quality assured at provider level, they can and do remain responsive to local employer and individual learner needs, as NRQs can be customized through the selection of Optional Units. Conversely, in the Norwegian VET system, learners must satisfy all 36 LOs, equipping them for any role in the fish farming process. The aquaculture curriculum consists of 3 main modules: *operation and production (17 LOs)*, *farms and techniques (9 LOs)*, and *farming and environment (10 LOs)*. The LOs are broadly defined, aligning with the descriptions of the aquaculture curriculum. However, although all LOs are mandatory, the VET schools can give priority to some over others, by spending some additional time on them.

The LO defines the knowledge, understanding or skill that will be gained by the learner, as a direct result of the learning activity, whatever its nature. Therefore, LOs are a very direct reflection of the NOS, where they exist. In some VET systems, as exemplified by Ireland, there is no NOS development phase, but employers are involved with VET providers in developing a Unitized VET, which can serve a very similar purpose.

In summary, occupational standards can be expressed as NOS at national level, SOPs at company Level, and reflected within Learning Outcomes at national and/or local level. The availability of each in the BlueEDU countries is summarized below in Table 2, and elaborated further in Appendix 3.

Table 2 – Overview of the derivation and application of Aquaculture Occupational Standards

Country	Occupational Standards		
	Aquaculture NOS	Learning Outcomes	SOPs Company level
Norway	No. Companies may influence VET providers locally to prioritize some of the LOs, but all LOs must be delivered.	LOs are defined at national level	Yes, and linked to QA and company training
UK (Scotland)	Yes	Yes, within NRQs with options structures that offer flexibility	Yes
Ireland	No, but standards are set in VET	Yes, and industry are involved in development	Yes
Finland	No, but Industry is involved in VET design	Yes, a flexible LO based VET system.	Don't know
Faroes (Denmark)	No	No	Don't know
Iceland	No	LO's are used. It may not be a Unitized VET system	Limited industry footprint currently
Southern Europe			
Greece	Yes, for Sea Bream/Bass	No. The national VET system is allegedly disconnected from providers.	Yes
Spain	Yes	Unitized and may have equivalent to LOs	Yes
France	No, but industry involved in VET	Yes	Don't know

	design		
Italy	No	Yes, recently introduced	Don't know
Cyprus	No	No	Yes, for some large companies
Croatia	No	No	Yes, for some large companies

It should also be noted that the SOPs development work ongoing by large Norwegian companies is in effect creating technically current SOPs that could profoundly influence the development of national and European occupational standards and VET design, if shared with other companies nationally and more widely within northern Europe.

In addition, Greece has occupational standards for Sea Bream/Bass production that could help to anchor aquaculture VET development in southern Europe, if they are respected by most aquaculture companies in that region. Occupational Standards have been developed in other Southern European countries, including Spain. Future research aims to fully reveal the existence and status of any other standards that have been developed and are relevant to southern European cage farming.

In summary, there appears to be limited good practice regarding industry involvement in the derivation of Aquaculture NOS and VET design at national level in northern and southern Europe. Where industry led NOS exist in the UK (Scotland), despite their checkered history, ultimately, they have informed the development of credible work based NRQs which are growing in significance nationally. By comparison, in Ireland the VET development process does not include NOS development. However, the development of Unitized VET qualifications based on Learning Outcomes that state what the 'learners should know, understand and be able to do', achieves the same purpose in practical terms.

Chapter 2: The European dimension

European VET tools that could potentially support the harmonization of aquaculture qualifications and the development of aquaculture occupational standards and VET have been evaluated. Some, such as the European Skills, Competences and Qualifications (ESCO) and the European Qualifications Framework (EQF), will have an ongoing role within the BlueEDU project. In addition, the 'legacy' of work relevant to the development of aquaculture occupational standards funded under the previous Leonardo program has been reviewed, most notably, the WAVE and VALLA projects.

2.1 European Skills, Competences and Qualifications (ESCO)

ESCO is a multilingual classification presented in 25 European languages and founded on the three pillars of skills, occupations and qualifications, relevant to the European Union labour market and education and training. As such, ESCO serves a very broad range of vested interests, encompassing most significant industry sectors and their vocations.

A wide variety of existing sources were analyzed to first establish ESCO, including national, regional and sectoral classifications. The ESCO standards have emerged from the following 'melting pot' of industry linked and other sources which are referred to in the ESCO handbook. [7]

Industry sources:

- Sectoral classifications
- National classifications
- Sector Skills Councils publications
- Occupational Standards
- Job descriptions
- Job vacancies

Academic and other sources:

- Qualifications Standards
- Learning Outcomes
- National Observatories publications
- International classifications
- Scientific articles
- Regulations

This diverse range of information sources adds breadth and depth to the ESCO process. However, some sources may not be as well informed by labour market needs as others. There has been some analysis of aquaculture within the original ESCO development phase that is held under the Forestry, Agriculture and Fisheries Sectoral Reference Group, a very diverse category. The aquaculture industry was consulted during the development of the Aquaculture standards and have contributed, supported by the Federation of European Aquaculture Producers (FEAP). [Per. Comm. 15]

Inevitably, aquaculture competences are very broadly defined, as they reflect land and water based production systems for every commercially significant farmed species of fin and shellfish, in the hatchery and on-growing phase.

The ESCO Aquaculture Competences have been analyzed to produce the subset relevant to cage farming shown in Appendix 2. It is apparent from this abstract that the definitions are very generic to accommodate the above diversity. This limits the value of the standards as a guide to the future collaborative development of European Aquaculture VET relevant to cage farming.

Currently, ESCO 1.0 is being updated, and recently devised national occupational standards could potentially influence ESCO refinement. The BlueEDU project will inform ESCO of its work, providing them the opportunity to use their outputs within imminent updates.

2.2 European Qualifications Framework (EQF)

The EQF is an interpretation tool, allowing different qualifications to be compared by determining the level of knowledge, skills and competences required to satisfy the Learning Outcomes.

This is defined in the following terms by the EQF system:

- Knowledge is described as theoretical and/or factual
- Skills are described as cognitive (involving the use of logical, intuitive and creative thinking), and practical (involving manual dexterity and the use of methods, materials, tools and instruments)
- Competence is described in terms of responsibility and autonomy.

The EQF, as fully defined in Appendix 1, will be applied to the process of identifying qualification equivalencies, as required to complete the VET supply analysis. The inclusion of competences within the EQF that are defined according to levels of autonomy, reflect the reality of the aquaculture workplace. This helps to make the EQF a useful common denominator when deriving qualification equivalencies.

2.3 European aquaculture occupational standards project legacy

There has been some relevant work in Aquaculture following the creation of the European Qualifications Framework in 2008 in response to European policy directives. Two of the most significant projects most relevant to VET and occupational standards and funded under Leonardo, the predecessor to Erasmus+, are described below and their legacy evaluated.

2.1.1 WAVE (Working in Aquaculture-Validation of Experience, 2003-2006) [17]

The WAVE initiative targeted the entire aquaculture sector (freshwater and marine) throughout Europe including the workers and employers in SMEs, trade associations, colleges and training organizations and regulatory authorities. WAVE established a 'Master list of competencies' based on a wide range of

existing aquaculture industry activities and practices across Europe, including Norway, Spain and France. providing a large inventory referenced to EQF levels in the final report.

A robust methodology was devised to support dialogue with providers and employees on a trans-European scale. [Per. comm.15] There were 151 aquaculture employees working on 97 fish farms in 11 different European countries interviewed. This included 86 managerial level, 65 technicians/workers, and all commercial species, production techniques and technologies. This led to 248 competencies organized in to 16 groups, being presented in 10 EC languages. This "bottom-up' approach ensured that the list met the approval of all sectors of the European industry at the time. [Per. comm. 15]

Consequently, a 'European Master List of Competencies' was drawn up for the sector with the aim of identifying and defining skills, knowledge and competencies in a way that could be understood and accepted by both workers and managers.

The WAVE project has developed several tools with potential for other sectors [17]

- Guidelines in 10 EC languages for 5 different target audiences on how to use the Master List;
- The WAVE competency database, essential to managing the extended discussions concerning the draft competency lists;
- The WAVE surveying tool allowing interviewers in 11 countries to upload results to the database;
- The WAVE competency tool capable of providing a customized Master Competency List for each user.

The WAVE Master list of competences are comprehensive and are organized within the following broad categories; shell and finfish hatchery operations, shellfish on-growing and fish on-growing. However, they are not structured in a way that is navigable for specific functions/activities within aquaculture sub-sectors, limiting their application as a guide to the future development of cage farming competences at European level.

2.1.2 VALLA (Validation of all lifelong learning in Aquaculture [16])

The stated aims of the VALLA project were to “support the realization of a European area for lifelong learning, building transparency and trust” It was launched at the same time as the EQF in 2008.

VALLA aimed to contribute towards the EQF mission in several ways: “developing competence-based learning outcomes for the aquaculture sector; by providing a reference for the validation of non-formally acquired competences; by linking such reference points to established sectoral standards; and thus 'improve permeability' within education and training”

In more practical terms, these are VALLA's stated objectives [16]:

- showing how unaccredited learning activities in the aquaculture sector can be described as Learning Outcomes (what a learner knows, understands and is able to do) and according to best practice format,

- providing generic tools, methodology and supporting guidelines able to be used by all sectors,
- using existing networks covering Higher Education, Vocational Education and Training (VET) and non-formal learning to promote quality assurance and trust.

The VALLA aspiration as described has potential relevance to the BlueEDU Sector Skills Alliance mission, as an effective and reliable mechanism for the validation of non-formally acquired competences would be most valuable to unqualified aquaculture recruits. Many have gained relevant skills and knowledge that could be recognised and contribute towards their qualification. This process is sometimes referred to as the 'Recognition and Accreditation of Prior Learning' and supports the development of individual learning plans.

The VALLA project outputs, which were documented in an Excel workbook. The main occupations in the aquaculture industry were defined at four levels; semi-skilled/basic manual, skilled craft/semi-skilled craft, /technician, manager/specialist and owner/senior manager/professional.

However, the work appears incomplete, as in the sheet addressing on-growing, the specific performance criteria are referenced for some, but not all Learning Outcomes. They are not referenced for any of the hatchery or shellfish on-growing Learning Outcomes.

However, the matrix used by VALLA to illustrate at which occupational level each defined competence is presented within an effective format that a future collaborative occupational standards development group could adopt.

In summary, whilst the EQF will be helpful when determining equivalencies between different Aquaculture qualifications, the ESCO system is broadly defined, limiting its practical value as a guide to the development of occupational standards and VET relating to cage farming. However, the BlueEDU outputs may help to refine and complete some ESCO aquaculture definitions. Leonardo legacy projects do not present competences in a way that is easy to abstract those applicable to the cage farming husbandry operative and site manager roles, limiting their practical value to BlueEDU.

Chapter 3: Occupational standards driven VET development

Shared occupational standards to underpin the development of a more accessible and innovative work based VET system could accelerate European aquaculture VET development. Collaborative approaches between aquaculture companies and a dedicated ‘collectives’ of VET providers are therefore being encouraged by BlueEDU, to enable unqualified cage farm staff to access appropriate VET and NRQs in the future more readily. The rate of progress at national and European level will be limited, if aquaculture companies work in silos as they develop ‘in company’ training schemes (non-formal VET) independently from each other and their VET providers. Collaborative workforce development is advisable and indicative of a maturing industry. In some industries companies whole heartedly cooperate to define credible shared occupational standards that underpin their national VET and NRQs. Consequently, whenever they are judging job applicants, the NRQs held are understood, and can be relied on, wherever the applicant has gained their experience.

This is well exemplified by the land-based engineering sector in the UK, which works very closely with their VET providers and each other to develop NOS which they keep up to date, together, despite the very competitive environment within which they work. They recognize the real value of a fully cooperative workforce development strategy and benefit greatly from having trusted National Qualifications, when staff move from one company to another.

The more employers commit to the development of their national VET system, the greater the return. Some of the best examples are to be found within the much-vaunted German ‘Dual System’, which combines the best of college based knowledge development with high quality work based training, mentoring and assessment within well designed apprenticeships that can be customized. However, arguably, what really differentiates Germany from many others, is the proactive involvement of employer representatives in VET design and quality assurance as a function of their Chamber of Commerce. [10] As a result, apprenticeships have very high status with school leavers and their parents, as they provide a smooth pathway to the most attractive careers with the best employers, via the apprenticeship pathway. In Germany, VET has achieved parity of esteem with Higher Education, and some would argue, has even exceeded it.

Most VET systems have adopted the Learning Outcome approach as detailed in Appendix 3. However, scanning the European landscape, and with reference to informal communications with VET experts, there are some such as the UK (Scotland), Ireland and Finland, that have progressed further to offer NRQs that can be customized. Some allow Units to suit the specific work place and learners to be selected within an individual learning plan to satisfy both the learners’ and the employers’ priorities. However, there are potential drawbacks. The customization of NRQs can lead to an employee holding a qualification that does not comprise competences that reflect the entire production process, limiting the learners’ mobility. Following a national consultation. Finland will be one of the latest countries to implement this style of flexible Unitized VET following a national reformation being implemented in August 2018. [11].

The other potential advantage to the development of an agreed frame work of Learning Outcomes in aquaculture for the European industry is the extension of ECVET mobility which tends to be dominated by short term placements currently. The provision of 'long duration mobility' for apprentices would be much more readily facilitated, whereby apprentices could undertake a significant proportion of their training (3-12 months) in a partnership country, transferring those Learning Outcomes achieved to their home-based qualifications on return. In the absence of shared Learning Outcomes, the mechanism for ECVET, although available, is currently very bureaucratic, which can often deter VET providers and employers. This issue was widely recognized by a group of ECVET experts from 6 European member states within a peer learning activity in 2016 'ECVET Today and Tomorrow'.

Based on the revelations above, collaboration by the major fish producing companies to produce shared and respected European Occupational Standards (EOS) for cage farming that are regularly updated would be a major step forward for the cage farming sector of the industry. Their completion would be most welcomed by ESCO, as they recognize that well defined competences for this most important sector are currently lacking. Subsequently, VET development at national and European level could be informed by a respected EOS. This would provide workforce development a new impetus, based on standards developed collaboratively, with the 'common ground' between cage farmers in the north and south of Europe clearly identified. European aquaculture labour mobility would be facilitated, thereby satisfying an important political imperative for the European Commission.

3.1 Opportunities for collaboration

There are signs of an increased appetite for cooperation emerging. For example, in Norway a leading company has expressed a preference to work in partnership with their public-sector VET providers to build and secure capacity within the network of 14 Upper Secondary Schools providing their aquaculture VET nationally. They wish to ensure that their public-sector VET system can deliver more of the skills required by today's highly technological industry and target the growing number of unqualified mature entrants more effectively. [12] Norwegian companies already work closely with their local and regional VET providers, and the will to forge an even stronger working partnership to address the needs of mature unqualified entrants more effectively, is apparent.

Their aim is to reduce a growing dependency on 'in company training', recognizing the vital role played by their public-sector VET providers within future formal VET development and delivery. They acknowledge that by assisting their specialist VET providers to keep up to date with aquaculture technology and techniques, they can help to build the VET sector's capacity. This is a more cost effective and sustainable strategy longer term. Having recognized the value of collaboration and team work, they respect their VET providers expertise in producing a development and assessment strategy that can target these important wider capabilities.

Bearing in mind that many of the largest Norwegian companies have Scottish subsidiary companies, a newly formed group of Norwegian/Scottish industry pioneers may offer the best opportunity for redefining and future proofing Aquaculture VET. There are more similarities than differences between the biology of the farmed finfish, cage based equipment and technology, and production methods. Exploiting that high level of commonality to create a higher quality VET provision collaboratively at a lower cost, would appear to be an effective strategy.

The qualitative surveys within the BlueEDU Initial Opinion study also reveal that here have been some positive signs in Scotland. During 2015 the major cage farming companies collaborated effectively with the technology supply companies and Scottish government to develop a Scottish National Standard for 'Fish Containment' [18] This work underpinned equipment specifications, work place practices and the development of a Scottish Qualifications Authority (SQA) Unit in containment to support cage farming staff development.

The South of Europe also has some significant collaborative VET initiatives to build on. The Erasmus+ funded 'Healthy Fish' Strategic Partnership led by Spain (APROMAR) has led to a collaborative approach towards the development of knowledge based education for aquaculture operatives. An 'open source' Moodle Virtual Learning Environment (VLE) has been developed as a delivery platform for learning content relating to fish health management. [13] The learning resources have been designed with reference to some analysis of occupational standards, which will be evaluated in more depth during the development of shared occupational standards for cage farmers in year two of BlueEDU.

3.2 The role of occupational standards

As described in Chapter 2, occupational standards can be presented in different formats and informed in various ways. Their development tends to evolve along a continuum, starting with the farm and company level and in some countries culminating in agreed National Occupational Standard (NOS). However, the BlueEDU qualitative surveys within the Initial Opinion Study have revealed that even in countries such as the UK (Scotland), which has a mature NOS and national VET development process, it is common for large companies to provide in company training (non-formal VET) for their staff, in preference to national VET provision leading to NRQs. The major factors driving the development of in company training schemes could be;

- a lack of confidence in the national aquaculture VET supply,
- a belief that company training is more directly relevant as it targets their Standard Operating Procedures (SOPs),
- the ineligibility of those over 25 years old within UK (Scotland) for Modern Apprenticeship funding, and
- modern equipment required for specialized training is only affordable by the aquaculture companies.

The forthcoming in depth research into Scottish VET demand in year two will establish the significance of each of these factors.

Once occupational profiles and their constituent occupational standards describing the requisite knowledge, skills and competences have been defined, they can be used to inform VET design and development, whether the standards are defined at company and/or national level. A respected NOS can provide the ideal framework for cooperation between companies and their VET providers, guiding the development of VET provision and qualifications that are fit for purpose and kept up to date. Although ambitious, a shared framework of European Occupational Standards (EOS) would offer a major advantage to future European collaborative VET development. The existence of an EOS respected by industry would enable aquaculture qualifications, learning resources and VET pedagogy to be shared much more readily, and having industry at the heart of the development process is the only way for an EOS to gain real credibility.

3.1.1 Informing occupational standards

Some detractors claim that a NOS will always be of limited value, as it can quickly become outdated. This can be a real issue. For example, the UK (Scotland) Aquaculture NOS went through a phase of evolution in the late 90's that led to a 'species-specific' NOS for every UK species of farmed finfish.

This became unsustainable, and today the UK (Scottish) NOS have moved to the other end of the spectrum and are very generic, to the extent that shellfish and finfish are catered for within the same standards. Interestingly, there are 'species specific' occupational standards for the farming of Sea Bream and Bass in Greece. They will be fully evaluated within forthcoming research and standards development.

A NOS written in broad, generic terms, does not date so quickly, as specific details can be referred to in standards that are held in other documents that are more regularly updated.

It is typical for a generic NOS to be informed by the following:

- a) Industry Codes of Good Practice,
- b) Technical Certificates, offered by a recognized awarding body, and
- c) Company Standard Operating Procedures (SOPs)

Whilst (a) and (b) are consistent at national level, company SOPs' can and do vary, to some degree. They should reflect the Codes of Good Practice and Quality Assurance requirements (see 3.2.3). However, there are common denominators, as the cage farming industry across Europe is dependent on the same service sector companies, irrespective of the species farmed in many cases. For example, commercial feed companies provide balanced diets for a wide range of finfish commercially farmed in northern and southern Europe. Although fish feeding behaviors vary between species, the principles of feeding

regimes, feed distribution, growth and food conversion, do not. This is one amongst various examples implying that significant common ground exists and could be defined.

Consequently, the aquaculture service sector, which includes companies supplying consumables, such as health products and feeds, and others supplying equipment and technology, is well placed to provide a valuable input to the definition of occupational standards. Arguably, it is in their interests to ensure that their aquaculture clients get best value for money from their products. In the case of equipment and technology, customer support costs could be reduced by suppliers through well designed VET, which may provide them a sufficient incentive to get involved. If farm operators are well trained in the operational requirements of their equipment, this minimizes the risk of accidents, damage and sub optimal performance, to everyone's benefit.

3.1.2 Legislative compliance

By its very nature, fish farming is an activity with the potential to threaten human health and safety, the aquatic environment, including its flora and fauna, and animal (fish) welfare, to varying degrees. Europe is a sophisticated society and the public demand a wide range of reassurances, whether they consume fish or not. Consequently, the industry has become a highly regulated food producer. Therefore, by implication, the European and national legislative framework has a strong direct and indirect influence on occupational standards.

Aquaculture equipment is getting larger and more sophisticated, and requires specialized operators who have been trained, assessed and certified by a recognized awarding body, to prove their competence. This is exemplified by the operation of work boats, radio communications and land based vehicles, such as fork lift trucks, all of which require certificated operators. A full inventory of these requirements will be provided for a sample of BlueEDU countries within the VET supply analysis in year two of the project.

3.1.3 Codes of Good Practice (CoGP)

Some CoGP can be very comprehensive, specifying precisely what fish farms are legally obliged to comply with, as well as providing good practice guidelines across a wide range of core fish farming activities. As an example, the Scottish salmon farming CoGP made available for the Scottish Salmon Producers Organization include a chapter on Seawater farming, which runs to nearly 50 pages. [7&8]

The scope of this chapter includes sections on:

- i. Documents and training
- ii. Food safety and consumer assurance
- iii. Fish Health and biosecurity
- iv. Managing and protecting the environment
- v. Fish welfare and care
- vi. Feed and feeding

As all company SOPs must be compliant with all legally binding directives, well established Codes do provide a source of information that can be compared across countries. As many directives are driven by

the same European statutes which are reflected in national statute, before being specified in the Codes, one would expect a high level of commonality. To keep the industry compliant, it is common for CoGP to be kept up to date by the national producer organizations, making them a very useful source of information when comparing and defining standards. For this reason, many in industry will place a much higher significance on them than they do on the NOS. The most enlightened will understand that the CoGP can be referred to in a NOS, thereby keeping it up to date concurrently, whenever the CoGP is updated. Conversely, the salmon farming industry in Norway has not developed a CoGP.

3.1.4 Quality Assured fish production

The aquaculture industry is a producer of fish products for the powerful food retail sector, its main buyer. This necessitates a plethora of quality assurance (QA) standards. For example, in Scotland there are approximately 16 QA schemes that the salmon farming industry complies with, and many of these will have a direct influence on company SOPs. The aim of most food retail QA schemes is to provide reassurance to consumers, and this is achieved by imposing contractual demands on their fish suppliers QA system. This is one of the most important factors indirectly driving the design of company training (non-formal VET) and connects occupational standards to the real challenge industry faces when preparing documentation for multiple audits.

This is exemplified by the Salmar company in Norway, who will only deploy staff for a fish farming operation who have documented skills and competence derived from either; in company training, their NRQ, or certification from a provider of specialized technical training. All staff skills and competences are registered on their QA and HR systems.

Today, the fish-eating consumer wants to eat fish that is nutritious, tasty and safe to consume, necessitating accountability and traceability from 'egg to plate'. However, it does not stop there, as many consumers are also looking for reassurances regarding the responsibility producers demonstrate towards the environment and animal welfare, leading to the incursion of other schemes such as 'Freedom Foods' and Organic Food standards for certain 'niche' markets. Both in company training (non-formal VET) and National Qualifications (formal VET) informed by NOS or their equivalent, must be fully aligned to all QA requirements that companies have to comply with.

3.3 Learning Outcomes

During discussions with industry members it is apparent that fish producers have a lot of legislation to comply with and must be well prepared for multiple QA audits with the associated documentation always up to date. These requirements have driven the development of company SOPs and many in company training schemes (non-formal VET), designed to ensure all staff are trained operators, compliant with SOPs and therefore all the necessary regulations.

For any NRQ, or 'package' of formal qualifications in Aquaculture to be respected, there must be consistent linkage between the legislative and QA requirements, company SOPS, training delivery, and a quality assured assessment process that leads to the attainment of qualifications. Whenever industry members contribute to NOS and VET development, it is usually their own SOPs that are at the forefront of their minds, as this is what is most familiar to them.

This is the reality that needs to be recognized and accommodated within the future development of occupational standards at national or European level, once the opportunity arises. It will be impractical within the BlueEDU Lot 1 timescale for up to 10 BlueEDU countries currently lacking a credible and respected NOS, to develop one, even if they had the will and regulatory infrastructure to do so. This would require national VET systemic change in many cases, which is beyond the authority of the BlueEDU partnership. However, the development of Learning Outcomes, defining the knowledge, skills and competences the learners need to gain in subject areas applicable to all cage farmers, may offer a more practical way forward. This type of development would still be informed by QA, legislative requirements and Codes of Good Practice, as would NOS development, and achieves a similar endpoint without the need to reform VET systems at national level. In addition, a framework of Learning Outcomes recognized by industry, or a subset of companies, can then be referred to by VET development teams, leading to a VET resource that can be shared across many countries cage farming finfish. This is the methodology that the Irish have applied to their Aquaculture VET, effectively removing the NOS development stage which is obligatory within the UK VET system.

If this approach were adopted, the methodology and terminology would need to be standardized before Learning Outcomes could be created and shared. Learning Outcomes of all types and styles have evolved throughout Europe and the best are brief, unambiguous and accurately defined.

In summary, during any future European collaboration, it would be advantageous to adopt the Learning Outcomes approach to standards development, allowing each VET provider involved in the collaboration to share the LOs and take responsibility for getting them recognized at regional and/or national level in their own country, should they need to. In addition, any associated VET resource (learning, assessment or pedagogy) could also be developed with reference to a common LO based framework and shared. This approach offers major practical advantage with fewer constraints

Chapter 4: Recommendations

The development of European Aquaculture VET through the establishment of effective collaboration between industry and VET providers offers the following potential advantages:

- i. Greater commonality between aquaculture qualifications and improved transparency for industry and learners, leading to the harmonization of qualifications and labour mobility.
- ii. Provision of a framework of shared occupational standards and/or ‘Learning Outcomes’ compliant with legislative requirements and Codes of Good Practice.
- iii. The potential to develop shared VET resources (learning, assessment and pedagogy) based on shared occupational standards and/or Learning Outcomes.
- iv. The establishments of new, sustainable European collaborative groupings of aquaculture VET practitioners that routinely share VET resources and pedagogy.

Based on this evaluation of the ‘methodology for the derivation of occupational standards and their application to VET development’, there are two workstreams emerging within the subsequent ‘development of occupational standards for the European cage farmed salmon, correlated to cage based production in the Mediterranean area’, in year two of BlueEDU.

- A desk based study and comprehensive comparison of existing occupational standards (all forms) to establish the ‘common ground’ for cage farming.
- The establishment of a Labour Skills Foresight Committee to develop up to date standards for cage farming that reflect current technology and can be future proofed.

4.1 Comparative study of existing occupational standards

There are documented occupational standards held in the various formats indicated below and described more fully in Chapter 3 that can be analyzed. At this stage, it is likely that more information on occupational standards exists, and may will be revealed by the work ongoing.

Table 3 Source information for documented aquaculture Occupational Standards

Source information	Countries	Comments
Aquaculture National Occupational Standards (NOS)	UK (Scotland)	The UK (Scottish) NOS were revised in 2016. Industry were consulted, but some of the main producers did not actively participate.
Aquaculture NRQs Learning Outcomes	UK (Scotland), Ireland, Norway	Norway has defined 36 LOs at national level. The descriptions are ‘broad brush’, aligning with the descriptions of the national

		aquaculture curriculum adopted by 12 public and 2 private upper secondary schools at regional level. In addition, useful LOs may be revealed in other BlueEDU countries VET systems.
Codes of Good Practice (National CoGP)	UK (Scotland), Norway,	The CoGP are most comprehensive in Scotland, but probably don't exist in Norway and. There may be other CoGP, unrevealed within the BlueEDU countries at this stage.
Standard Operating Procedures (Company SOPs)	UK (Scotland), Norway, Ireland, Greece, Spain and to some extent, Cyprus and Croatia	SOPs are driven by QA requirements and the need for the safe, effective operation of equipment/technology. They may be more widespread within the Blue EDU countries than indicated
Quality Assurance Schemes	UK (Scotland), Norway, Ireland, Faroes	Many, but not all requirements, have been subsumed within CoGP where these exist. The QA schemes operating in Southern Europe may be revealed in year two.
Operator Certification	UK (Scotland), Norway, Ireland,	The certification of specified operations under legislative control, may be more widespread within the Blue EDU countries than indicated. This will be reviewed in year two

4.2 Labour Skills Foresight Committee

To be meaningful, credible and influential, the committee based approach to occupational standards development requires the active involvement of aquaculture producers and supply companies working with VET providers. It could start from a nucleus of the two-main salmon producing countries, Norway and Scotland and subsequently expand to include industry partners in Ireland and Iceland. The Faroes and Finland could at some stage join the process and/or be consulted as standards start to emerge.

The cooperation of the largest Salmon producing countries in Norway and Scotland would suffice to enable a meaningful start to be made on the development of European caged farmed salmon occupational standards. The recruitment of keen and willing committee members will be integral to future demand survey interviews with selected industry members who have a known interest in aquaculture workforce development.

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Contact person for this report:

Martyn Haines

- info@pisceslearning.com



Funded by the
Erasmus+ Programme
of the European Union

Disclaimer:

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use, which may be made of the information contained therein.

Appendix 1 - European Qualifications Framework (EQF)

The 8 levels of EQF

Defined by a set of descriptors indicating the **learning outcomes** relevant to qualifications at that level in any system of qualifications

EQF Level	Knowledge	Skills	Competence
	In the context of EQF, knowledge is described as <i>theoretical and/or factual</i> .	In the context of EQF, skills are described as <i>cognitive</i> (involving the use of logical, intuitive and creative thinking), and <i>practical</i> (involving manual dexterity and the use of methods, materials, tools and instruments)	In the context of EQF, competence is described in terms of <i>responsibility and autonomy</i> .
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behavior to circumstances in solving problems
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5 ^[1]	Comprehensive, Specialised, factual and	A comprehensive range of cognitive and practical skills	Exercise management and supervision in contexts of work or

EQF Level	Knowledge	Skills	Competence
	In the context of EQF, knowledge is described as <i>theoretical and/or factual</i> .	In the context of EQF, skills are described as <i>cognitive</i> (involving the use of logical, intuitive and creative thinking), and <i>practical</i> (involving manual dexterity and the use of methods, materials, tools and instruments)	In the context of EQF, competence is described in terms of <i>responsibility and autonomy</i> .
	theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	required to develop creative solutions to abstract problems	study activities where there is unpredictable change; review and develop performance of self and others
Level 6 ^[2]	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7 ^[3]	Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research Critical awareness of knowledge issues in a field and at the interface between different fields	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8 ^[4]	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study

EQF Level	Knowledge	Skills	Competence
	In the context of EQF, knowledge is described as <i>theoretical and/or factual</i> .	In the context of EQF, skills are described as <i>cognitive</i> (involving the use of logical, intuitive and creative thinking), and <i>practical</i> (involving manual dexterity and the use of methods, materials, tools and instruments)	In the context of EQF, competence is described in terms of <i>responsibility and autonomy</i> .
		or professional practice	contexts including research

Appendix 2 - ESCO standards relevant to Cage production

Description of water based Aquaculture (Cage farming) derived from ESCO definitions)	
Description in target language	Scope note
Water-based aquaculture encompasses the production of aquatic organisms involving water-based on-growing processes.	Water-based aquaculture includes: - cages placed on coastal waters, lakes or rivers, - floating rafts and longlines for culture on coastal waters, lakes or rivers; offshore cages for marine aquaculture. Cultured aquatic organisms includes: - finfish species such as seabream and seabass, carp, salmon, rainbow trout, turbot, catfish, halibut, tuna, cod, grouper, sturgeon, meagre, pike-perch, sole, eel, arctic char, mullet, - molluscs such as mussels, oysters, clams, scallops, octopus, abalone, cockles; - crustaceans such as prawns, shrimps and lobsters; - new aquatic resources such as sea urchins, sea cucumber, macroalgae, seahorses, sponges, amberjack, wreckfish and others.

<p>Water-based aquaculture managers plan, direct, coordinate and supervise production in large-scale aquaculture operations to culture and harvest fish and shellfish, or other forms of aquatic life, as cash crops or for release into fresh, brackish or salt water. They may specialise in certain species or groups of species.</p>	<p>Work can include supervision of grading, biological, environmental and ecological monitoring, depending on size of farm and species cultured. Cultured aquatic organisms may include finfish species such as seabream and seabass, salmon, turbot, catfish, halibut, tuna, cod, grouper, sturgeon, meagre, pike-perch, sole, arctic char, mullet; shellfish such as mussels, oysters, clams, scallops, octopus, prawns, shrimps and lobsters; new aquatic resources such as sea urchins, sea cucumber, sea-horses, sponges, amberjack, wreckfish.</p>
<p>Aquaculture mooring managers carry out and supervise the mooring of cages in stable stations, drifting cages or even self-propelled and semi-submerged cages. They safely operate and moor a variety of different types of large-scale cages, manage conditions such as currents, wave climate and seabed profile, in open or semi-open water areas.</p>	<p>Cage farming technology (especially offshore) has developed fast to meet the needs of the industry in respect of large species such as tuna. Mooring managers must be able to take into account conditions such as currents, wave climate and seabed profile, in open or semi-open water areas, where waves can attain heights of 14m.</p>
<p>Water-based aquaculture technicians operate in the production of aquatic organisms in water-based on-growing processes (freshwater, brackish water, salt water) in floating or submerged structures as cages, rafts or longlines.</p>	<p>Work includes feeding, using feeding equipment (semi-automatic and fully automated), grading, harvesting, maintenance work, health management treatments and water quality control. Work includes practical tasks such as operating marine engines, outboards, boats, cranes and winches.</p>
<p>Aquaculture husbandry technicians operate in the production of aquatic organisms, specialising in the husbandry of on-growing culture processes, especially in feeding and stock management.</p>	<p>Includes the operation and basic maintenance of auto feeders.</p>
<p>Aquaculture cage technicians operate in the production of aquatic organisms in water-based (freshwater, brackish water, salt water) on-growing processes in cages.</p>	<p>Work includes feeding, using feeding equipment (semi-automatic and fully automated), grading, harvesting, maintenance work, health management treatments and water quality control.</p>
<p>Water-based aquaculture technicians coordinate and supervise activities on fattening aquaculture organisms in suspended systems (floating or submerged structures). They participate in extraction operations and handling organisms for commercialisation. Water-based aquaculture technicians supervise maintenance of equipment</p>	<p>Work includes feeding, using feeding equipment (semi-automatic and fully automated), grading, harvesting, maintenance work, health management treatments and water quality control. Work includes practical skills such as operating marine engines, outboards, boats, cranes and winches.</p>

and facilities (cages, rafts, longlines, bouchot).	
Water-based aquaculture specialists apply knowledge gained from research about aquatic animals and plant life and their interactions with each other and the environment, to improve aquaculture production, to prevent animal health and environmental problems and to provide solutions where necessary.	Aquaculture specialists must be trained in specific fish biology and aquatic environment studies to acquire the requisite knowledge, skills and competences for efficient job performance.
Water-based aquaculture workers operate in the production of aquatic organisms in water-based on-growing processes (freshwater, brackish water, salt water) in floating or submerged structures as cages, rafts or longlines.	Work can include practical skills such as net cleaning, changing, repairing and storage, operating marine engines, outboards, boats, cranes and winches, as well as maintenance of facilities.
Aquaculture cage mooring workers operate highly-specialised equipment to moor cages in stable stations, drifting cages or even self-propelled and semi-submerged cages.	Cage mooring workers often work in harsh and dangerous conditions.
Water-based aquaculture workers carry out manual activities in the on-growing processes of cultured aquatic organisms in water-based suspended systems (floating or submerged structures). They participate in extraction operations and the handling of organisms for commercialisation. Water-based aquaculture workers maintain and clean facilities (nets, mooring ropes, cages)	Work includes practical tasks such as net cleaning, changing, repairing and storage, operating marine engines, outboards, boats, cranes and winches.

Appendix 3 – Derivation of VET in BlueEDU countries

The descriptions of national VET systems under the ‘derivation of processes’...referred to in the table below have been derived provided by CEDOFOP [6]

Country & Ref	Processes for the derivation of competence frameworks, occupational standards and their application to VET development (in general)	Commentary on the Aquaculture VET relevance and status
Northern Europe		
Norway Ref 5 & BlueEDU web site	The Ministry of Education has responsibility for continuous aquaculture training development, with expert groups from both school and companies providing upper secondary education instrumental. A tripartite group is formed to write and update vocational profiles for any new qualifications needed, providing the basis for developing the subject curricula.	Norwegian aquaculture VET system is provided by the Upper Secondary Schools that together with the industry lead the delivery of the apprenticeship program and Journeyman Certificate The assessment process for VET

	<p>There isn't any separate VET curriculum for staff working in industry, since there is only one national recognized certificate.</p> <p>The Directorate for Education (reports directly to the Minister for Education) appoints teams for curriculum development consisting of professionals (most often suggested by the employer and employee organizations) and VET teachers.</p> <p>The Directorate recently established a follow-up monitoring/review system, to gain a more holistic and systematic knowledge about curriculum implementation.</p> <p>A learning outcome based National Qualification Framework (NQF) has been adopted, but it is not Unitised. The Ministry defines the learning outcome descriptions at national level, in partnership with industry representatives. There are 12 out of 14 VET schools owned by the county but funded by the government. What the Ministry decide, is automatically implemented. Learners above 25 years of age, can also have their non-formal and informal learning validated at all levels of the education system, as of right.</p> <p>There has been no national decision regarding the implementation of ECVET to support credit transfer with other European countries.</p>	<p>students from industry, does not include continuous assessment. It depends on the final theory examination (offered by the VET school) and on the final practical exam to be offered by and assessed by the aquaculture industry itself.</p> <p>The young students, age 16 to 20/21, must pass the same two exams to get a NRQ "Journey Man certificate". In addition, continuous assessment is applied, consisting of teacher led tests (on-line as well as on paper), teacher led evaluation of student's performance during periods of practical experience, and industry led evaluation of performance during the last two years. At the end of each aquaculture course (1 or 2 years long), each student gets a score from 2-6 (from the teacher) based on continuous assessment. This score will be part of the diploma they receive after the first 2 years, and influences their progression to the apprenticeship system.</p> <p>In addition teachers must offer adapted assessment process for students that may have special needs, e.g. due to dyslexia.</p> <p>Although industry representatives are involved in updating, the mechanisms are allegedly too slow to keep pace with technological change. However, the broadly defined aquaculture VET curriculum framework is flexible enough to allow company priorities to be addressed. Hence, new aquaculture methods are introduced to the programme, despite being absent from the national curriculum.</p>
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<p>UK (Scotland)</p> <p>Ref: PLI</p>	<p>The UK has had a Unitized LO based VET system for over 3 decades. Comprehensive QA systems have evolved, whereby the SQA can devolve authority to their approved centres for the validation and approval to deliver new VET programs.</p> <p>In addition to local level devolution, the flexible qualifications structures allow programs to be customized to suit individual companies and learners. The recognition of prior learning is encouraged, and individual learning plans are developed in consultation between VET provider, the learners and their employer.</p> <p>Aquaculture falls under the auspices of LANTRA, the sector skills council for land and water based industries. Committees of employer representatives are formed to develop and review the NOS.</p> <p>ECVET has been used to support short term mobility programs within Europe.</p>	<p>In practice employer representation has been a weakness as it has been very difficult to get the most suitable staff development decision makers in companies to attend meetings.</p> <p>Those who make the decisions regarding their own in company staff training programs are not contributing towards NOS development. This leads to a disconnect between non-certificated company training driven by SOPs and the NOS. Consequently, the NOS are not as well respected by industry as they could be.</p> <p>The UK reality is described further in section 2.5.1 of the main document.</p>
<p>Ireland</p> <p>Ref 5</p>	<p>Ireland has avoided embarking on a process of standards development equivalent to the UK. The Irish National Framework for Qualifications (NQF) was introduced in 2003</p>	<p>There is a very high level of similarity between the Scottish SQA system and the NQF. The terminology and Unit content and</p>

	<p>and now forms the main organizational framework for VET development.</p> <p>Similar to the UK, qualifications are Unitized and based on Learning Outcomes that state what the learners should know, understand and be able to do.</p> <p>VET qualifications are based on research into sectoral needs by a standards development group for each occupational area and have industry and stakeholder representation.</p> <p>The process is over seen by the National Qualifications and Quality Assurance body and Quality Ireland (QQI)</p> <p>Research shows that self-governing professional bodies are common place in Ireland (like the UK) and their output is variable in quality.</p>	<p>structure and implied competence based pedagogy is identical in principle.</p> <p>Access can be gained to the Irish Aquaculture Qualifications through the BlueEDU partnership networks, allowing LOs to be fully compared.</p> <p>This will be undertaken within D4.2</p>
<p>Finland</p> <p>Ref: PLI Per Com SEDU Finnish VET Provider</p>	<p>The Finnish VET system is undergoing a major reform. This is because of a national level consultation with all industry sectors and those representing the labour market.</p> <p>The reformed system will be Unitized, Learning Outcome based, and very flexible. Through the development and offer of optional Units within National Qualification Frameworks that are devised at local provider level, companies can seek and get what they require to suit their own businesses</p> <p>From a learner perspective, individual learning plans will be formed, supported by the employer and VET provider, ensuring that VET targets the real priorities.</p> <p>This reformed VET system is currently in the planning phase and will be implemented by providers from August 2018.</p>	<p>The 'post reform' Finnish VET system will be identical down to the finest detail to the Scottish VET system, once implemented.</p> <p>This would enable Finland to share Aquaculture Occupational Standards and LOs, as they could be accommodated easily within their future more flexible VET system.</p> <p>Currently, there is no information available on aquaculture. The BLueEDU partnership will request support with gathering information on aquaculture VET through their ECVET networks</p>
<p>Faroes</p> <p>Ref 5</p>	<p>A National Qualification Framework is in place and operational in Denmark. A qualifications system and its design are adaptable to ECVET,</p>	<p>The Faroe Islands are a self-governing nation under the sovereignty of the Kingdom of</p>

	<p>as the same approach and terms are used. Partial qualifications are available in some programs.</p> <p>Validation is possible; each learner’s prior non-formal or informal learning is assessed on entry to all VET programs. Transfer of learning outcomes is possible case by case. No specific credit system at national level in VET is considered, as the current system is considered to work well.</p>	<p>Denmark. The legislature and govern marine resources independently. Faroe Islands remains outside the EU union. They are not currently member of FEAP</p> <p>There is believed to be some college based aquaculture activity, which needs to be more fully researched.</p> <p>The CEDOFOP description of Denmark makes no reference to LOs. It is possible that they do not have a LO based VET system. This will be confirmed by the BlueEDU partnership through the ECVET network.</p>
<p>Iceland Ref 5</p>	<p>A legislative shift to Learning Outcomes has already taken place and a comprehensive Life Long Learning strategy and legislation provide a framework for validation of prior learning.</p> <p>Mechanisms do not yet exist in some occupations, but there is gradual progress. The Upper secondary school act (2008) promotes credit units which are associated with credit points. Transfer of learning outcomes between education and training providers and qualifications can easily be included in any form of VET. Principals of upper secondary schools decide case by case which assessed learning outcomes are transferred.</p> <p>To acquire a qualification, learners in Initial VET may accumulate units/modules that are assessed and certified separately or, where a more holistic approach applies, based on a final exam.</p>	<p>Iceland has no history of Aquaculture VET provision and in the 1980s the fledgling industry SENT learners to the UK.</p> <p>Alignment with the Norwegian and/or Scottish VET system seems the most likely in the future, as Norwegian companies bought 4 out the 5 fish farming companies’ one year ago.</p> <p>Investigations carried out by Guri Kunna VET schools in the fall 2017, indicates that the government of Iceland is currently working together with one of the VET schools in Northern-Norway to prepare the development of an aquaculture VET program that may apply some of the NRQ applied in Norway.</p> <p>The move to a LO based VET system by Iceland at national level will be conducive to future collaboration and the sharing of</p>

		Aquaculture LOS, as described in Chapter 4
Southern Europe		
Greece Ref 2	<p>The state endorsed competence based approaches to VET originated within legislation in 2003. By 2010, Occupational Profiles (OPs) had been created for 202 occupations (41%), led by the National Qualifications Authority and with employer representation and experts from the field.</p> <p>The methodology applied was a combination of functional analysis and the 'Delphi' technique.</p> <p>Each OP consists of 'a definition of the occupation, including key tasks and processes, the knowledge skills and abilities needed for the occupation, associated education and training pathways and indicative methods of assessment'</p> <p>Due to their variable quality and nature, it has been reported by Stan Spencer (Ref2) that the OPs have not been accepted by the VET community in Greece. They have been more used for licensing or accreditation criteria.</p> <p>Greece does have a NOS for Sea Bream/Bass which is being interpreted. It is probably not a part of the State OP system.</p>	<p>Discussions during the Initial Opinion study indicate that the mechanism for standards development and the application of standards to VET development, are not effective at national level. [12] This may be attributed to a lack of staff development, prior to the OP development process commencing.</p> <p>Based on the description provided by Stan Spencer [2], the OP is overloaded and trying to perform to many functions. A systemic restructuring of OPs may be required, followed by development of the OP development teams before a productive renewal program is possible.</p>
Spain Ref 5	<p>Large scale Aquaculture companies have their own non-formal VET system. They have specific courses for their workers. There is no equivalence with the Public System.</p> <p>The autonomous communities have responsibilities for VET, consisting of developing and applying basic regulations and in regulating non-essential aspects of the VET system. Like-wise they have executive and administrative powers to manage the education system in their own territory.</p>	<p>Being Unitized, and based on learning units (possibly equivalent to outcomes), the Spanish VET system appears to be compatible with the UK, and Irish systems, despite the current lack of formal Aquaculture VET</p> <p>It is likely that the aquaculture companies are developing non-formal VET based on company SOPs. Personal communication</p>

	<p>All VET programs leading to certificates and diplomas are designed as learning units and modules. Learning units, acquired either in the mainstream VET system or through validation of non-formal learning, are individually assessed and certificated and may be accumulated towards a full National Qualification.</p>	<p>with a Spanish company is required to confirm the methodology and the nature and presentation of the SOPs produced.</p>
<p>France Ref 5</p>	<p>The industry contributes to the development of qualifications, provides work placements and contributes to the funding through taxes.</p> <p>Vocational qualifications (EQF levels 3 and 4) awarded by the Ministry of Education are based on units of LO and include professional units and general units.</p> <p>These qualifications can be obtained in Initial VET, Continuous VET or through the validation of non-formal and informal learning They are assigned a level of the NQF, which has been linked to the EQF since 2010.</p> <p>All the units in a VET qualification must be assessed to award the whole qualification; the assessment obtained for a unit is valid for five years.</p>	<p>Generally, France is recognized within the European Community as having a high quality and mature VET system.</p> <p>The current VET provision and its development requires further investigation.</p>
<p>Italy Ref 5</p>	<p>Most education reforms in Italy included designing learning outcomes-based curricula and units.</p> <p>The Ministry of Education, University and Research issued guidelines for VET providers that include learning outcomes. Higher technical education and training is organized in modules and units; training credits are recognized by HE institutions and are ECTS-compatible.</p> <p>In principle, the ET system enables switching between learning pathways. Legislation on certification and validation of competences was introduced in 2012 (Legge Fornero) and in 2013 the Decree 13/2013 defined the</p>	<p>A receptiveness towards the LO approach at National level is encouraging.</p> <p>This may be sufficient for Italian Aquaculture VET to partake in collaborative VET delivery.</p> <p>More research is needed to establish what, if any, Aquaculture formal and non-formal VET is provided in Italy.</p>

	<p>standards.</p> <p>Studies point to a growing interest in ECVET. A recent formal decision (the State-region agreement, January 2015) defines indicators and procedures to certify competences and to develop a credit system for Initial VET and Continuous VET, compatible with ECVET. This decision must be implemented regionally, including those seven regions, where certification and validation systems are already established.</p>	
<p>Cyprus</p> <p>Ref 5</p>	<p>The National Qualifications Framework has been designed but it is not yet operational.</p> <p>Common structures and elements, which will offer opportunities for combining and transferring credits, are being discussed. The Ministry of Education and Culture is investigating potential adaptation of a learning outcomes (LOs) approach in VET curricula. Education and training providers are being informed about ECVET and how to define units of LOs.</p>	<p>As there has been no commitment towards a LO based approach, the status of the national VET system may inhibit collaboration within the BlueEDU partnership, initially.</p> <p>However, this could potentially be overcome in Aquaculture, through a 'hub and spoke' delivery model, underpinned by a LO based National Awarding Body from one of the BlueEDU countries</p>
<p>Croatia</p>	<p>A learning outcomes approach was introduced in the context of national VET reform. The VET system development strategy (2008-13) introduced modularized Initial VET programs.</p> <p>The Agency for VET and Adult Education (AVETAE), the Ministry of Education, Science and Sports (MoSES) and the Education and Teacher Training Agency (ETTA) have developed new modularized VET curricula and 22 VET curricula have been piloted in VET schools since 2013.</p>	<p>Interviews with industry leader group representatives and NTNU, confirmed that there is no formal Aquaculture VET available in Croatia.</p> <p>Non-formal and informal VET arising from in company training activity is all that is currently available, and this may be restricted to the larger aquaculture companies only.</p>