575235-EPP-1-2016-1-NO-EPPKA2-SSA-N
Agreement number 2016 – 3452
Erasmus Plus Sector Skills Alliance LOT 1 project
www.blueedu.eu

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

D4.2 Occupational standards for European cage farmed salmon, correlated to cage based production in the Mediterranean area

WP 4 Occupational definitions

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Version: Final

Date: 13.12.2018

Funded by the Erasmus+ Programme of the European Union

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.

Summary

An agreed framework of 'shared learning outcomes' that reflect the competences common to finfish aquaculture companies at the husbandry operative and site manager level is needed to enable the Aquaculture VET community to collaborate more effectively with the main producer companies. This will lead to collaborative VET developments that improve the accessibility and relevance of aquaculture VET provision and improved pathways for 'unqualified' work-based learners, who currently struggle to complete a respected National Qualification.

An analysis of the existing learning outcomes (LOs) within selected units of National Qualifications for aquaculture in Norway, Scotland and Ireland, reveals a high degree of commonality, despite differences in the way LOs are expressed. However, a correlation between these NQ units and industry standards, as expressed by their Standard Operating Procedures (SOPs), training manuals and Codes of Good Practice (CoGP), varies considerably according to the subject. The lowest correlation was found for fish biology and the highest for fish health. This is not an indication of the relative importance of each subject in the eyes of the industry, but a reflection of which subjects are most readily operationalized by aquaculture businesses and reflected within their Standard Operating Procedures (SOPs)

A comparison between the inhouse staff development practices of two Norwegian owned companies, one based in Norway and the other Scotland, revealed that there are sophisticated systems in place for the assessment of competence that reflects company SOPs. However, room for improvement in the consistency of the judgements made was also cited, indicating that further formalization, assisted by a better alignment and harmonization with VET providers and their NQs, would be beneficial.

Recommendations include the establishment of an active Aquaculture Skills Foresight Forum for northern Europe to develop agreed definitions of occupational competence, but with communication links to southern European countries dependent on cage-based aquaculture. Membership will include aquaculture producer and technology supply companies as well as VET providers and ESCO, in order to ensure that the common competences defined inform the development of a shared framework of learning outcomes to underpin future collaborative VET developments, and ESCO revision.

Funded by the Erasmus+ Programme of the European Union

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Chapter 1: Establishing common standards

1.1 Framework of common standards

The BlueEDU Lot 1 project has established the skills gaps and future VET needs of the aquaculture cage farming sector in 12 European countries, corelated to the existing VET supply. This research will inform recommendations for the development of more accessible aquaculture VET pathways to National Qualifications (NQs). Typically, mature learners from a range of backgrounds throughout the European aquaculture industry cannot readily access a suitable NQ in aquaculture. Many of the well-established VET pathways are based on a full-time course attendance model, designed to suit young entrants who have recently left school. This delivery mode is impractical for those already in work, but unqualified. Therefore, more flexible and innovative VET delivery systems are required, and in most countries, they need to be developed or improved.

It is anticipated that most future aquaculture VET development activity will be collaborative and undertaken by 'clusters' of VET providers working closely together with their industry stakeholders. By sharing their ideas on teaching and learning, and developing resources together, work-loads will become more manageable. However, for collaborative development to become possible, the 'common ground' in terms of aquaculture knowledge, understanding and competences, must be defined at the outset to reflect industry needs. Once completed and agreed by all parties, this will provide a well understood and navigable structure to support future aquaculture VET collaboration.

1.2 Learning outcomes approach to standardisation

In the UK National Occupational Standards (NOS) are developed by industry representatives, acting under the auspices of the appropriate Sector Skills Council, and provide the bedrock of the national VET system. All new National Qualifications (NQs) must demonstrate how the NOS appropriate to the occupation and target audience have been addressed. Failure to do so leads to further development work and remediation, before validation can be reconsidered by the Scottish Qualifications Authority (SQA) acting as the Awarding Body. The Lantra Sector Skills-Council are the organisation responsible for recruiting aquaculture industry representatives to join a subcommittee to inform the initial creation of the NOS and subsequent updating, previously undertaken on a 5-year cycle.

Although the UK's adherence to NOS development and application is not integral to the VET development systems of other European countries, effective alternative mechanisms for industry involvement in VET design and development do exist. This allows industry representatives to ensure that formal VET and NQs will meet their current and future VET and skills needs.

Following an exhaustive investigation of existing occupational standards and their equivalent, and the processes underlying their development, a previous BlueEDU 'desk study', 'The derivation and

application of occupational standards to VET design', concluded that a framework of 'common Learning Outcomes' (LOs) should be defined and then used to guide subsequent collaborative developments. Most European VET systems have adopted a 'Learning Outcome' (LO) based approach to VET, and although LOs can vary in their style, presentation and comprehensiveness, the term is widely understood and provides a sound basis and methodology for the creation of a shared framework.

1.3 Corelating learning outcomes and industry standards

The initial focus was an analysis of the learning outcomes (LOs) and standards for north European aquaculture. As Iceland and the Faroes have no aquaculture occupational standards or VET system to refer to, the work has been focused on Norway, Ireland and Scotland, who all have NQs described through a system of well-organised learning outcomes. The mechanism for their derivation, including industry involvement in their definition, ratification, review and revision, varies in each country, but nevertheless provides a basis for comparison, through an examination of the existing documented curriculum.

Selected learning outcomes in aquaculture NQs at EQF levels 3/4 have been corelated for Norway, Ireland and Scotland to determine the common ground and variances. There have been constraints, as some learning outcomes, such as those used by Norway and Ireland are more broadly defined, as compared with the detailed Scottish Qualifications Authority (SQA) definitions in Scotland which are more prescriptive, due to the inclusion of performance criteria which further define each learning outcome. As the Scottish system is the only one of the three founded on National Occupational Standards, it has been used as the benchmark for this exercise, aligning the equivalent LOs from the Irish and Norwegian VET systems.

1.3.1 Salmon farming industry standards

Subsequently, salmon farming industry standards have been corelated to each learning outcome, with reference to Standard Operating Procedures (SOPs) from a typical Scottish salmon farming company, the Scottish Codes of Good Practice (CoGP) and a leading Norwegian company training manual. Each of these go further than the NQs specify, providing an industry perspective on each learning outcome and a greater depth of information. However, the Norwegian company refer to additional information held in specific documents and company manuals that describe key tasks and procedures that staff are expected to know. Whilst translation of these has not been possible for the purposes of this exercise, it will be possible in the future, assisted by the emerging BlueEDU Aquaculture Skills Foresight Forum (See 3.2).

Ultimately, for VET providers to engage, company knowledge and skills requirements in the participating partners countries will need to be openly compared and analysed in fine detail in order to inform the

development of shared learning outcomes that VET providers can apply to a collaborative learning resource development process.

1.3.2 Presentation of the correlation of the documented learning outcomes and competences

The result of the above two-phase correlation activity is fully tabulated in text form and provided as appendices.

Learning Outcomes have been corelated to Industry standards using a coding system. The reader can navigate and explore the detailed outcome of each correlation at subject level, through reference to the appended documents describing the NQs, SOPs, Training manual and Code of Good Practice (CoGP) which all provide a coding definition used in Appendices 1-3.

The information in Appendices 1 and 3 is presented as illustrated in the table below

National Qualifications (Learning Outcomes)				Industry standards			
Scotland		Ireland	Norway	Scottish Company SOPs		Norwegian Company	Scotland
SQA NQ	MA/NOS	QQI	Journeyman	General	Specifics	Training Manual	Scottish CoGP

Table 1 Summary of north European NQ correlation with industry standards

The information in Appendices 2 (Fish Biology) is presented more simply.

National Qualifications (Learning Outcomes)			
Scotland		Ireland	Norway
SQA NQ	MA/NOS	QQI	Journeyman

Table 2 Summary of north European NQ correlation for Fish Biology

1.3.3 Developing competences from an industry perspective

The main purpose of creating a framework of learning outcomes based on shared occupational competences is to support the harmonization of aquaculture VET in Europe, including the assessment of competence. This will allow VET providers to more readily develop a shared-resources to support the delivery of European NQs and help the Norwegian owned companies to converge their currently disparate staff development practices. This will create an environment within which the management of learner mobility, including long duration (6 months plus) is eased, due to higher levels of commonality, and can thrive.

Therefore, the staff development practices of two large farm businesses under the same Norwegian ownership, one based in Norway and the other in Scotland, have been compared. An in-depth analysis has revealed how industry currently assess staff competence and take account of the range of competences held by individual staff members when planning and conducting farm operations. Both companies insist that staff complete their company training schemes composed of external courses, as well as inhouse training. They also encourage them to undergo and complete an appropriate NQ. Many of the young recruits to the Norwegian company have completed the first two years of an NQ before they start a 2-year apprenticeship program with the company, which leads to the Journeyman Certificate, a nationally recognised trade qualification, and full-time employment. Consequently, by the time they have completed the apprenticeship, the Norwegian company has a detailed knowledge of their performance and competence. Conversely, in Scotland, many staff recruited at the husbandry operative level lack a suitable qualification at the outset. Although they must all complete the company training schemes, it is not mandatory for them to complete a National Qualification. However, many entrants with serious career aspirations do complete the Modern Apprenticeship in Aquaculture during their first few years in the industry.

Both companies have ‘mature’ Standard Operating Procedures (SOPs) in place that are driven by quality assurance (QA) requirements to satisfy their buyers and fish consumers. They also clearly reflect any Codes of Good Practice, which are particularly influential in Scotland and comply with Health and Safety and other regulations.

In both cases staff development programs are well designed and well-structured and provide a logical career development pathway. In Scotland the HR Manager has championed their development, whist in Norway the development was initially driven by a senior fish production quality assurance manager, before being passed over to the HR department to operationalize.

1.3.4 Southern Europe

There was limited success in the location and translation of relevant occupational standards and qualifications for comparison to the north European findings. However, Norwegian aquaculture technology is being adapted and deployed in the south of Europe to support the growth of their cage farming sector, implying that despite the differences in the species farmed and the aquatic environment, there will be a lot of common ground. This may be most pronounced in the core subjects of fish biology, aquatic environment, fish feeding and nutrition and fish health and welfare. But it will also include the operation of cage farming equipment now being adopted in Spain, Turkey and Greece and the associated large-scale cage farming equipment and technology.

An interview with one major Norwegian technology supply company was very revealing. They asserted that whilst a lot of cage farming technology is now being adapted and transferred to southern Europe, there are some distinct differences between salmon production in northern Europe and the production of Sea Bass and Bream in the south. The salmon industry is a lot more advanced regarding fish stock genetic improvement, as there are no managed breeding programs at this stage for Sea Bass and Bream to help improve the species on farm performance.

In addition, as many of the larger companies are vertically integrated, they make their own feed using locally captured industrial fish meal species, but this leads to variable feed quality. Food conversion ratios have been relatively poor at 2:1 as compared to 1.1:1 achieved now by the best salmon farms, and the market value of the farmed product is lower, leading to a different fish production business model. Although recognising the value of salmon farming technology, such as cameras to control feed wastage, the sophisticated systems used in northern Europe must be adapted, lowering their functionality and cost, so as they can be introduced to help improve the efficiency of feeding in a cost-effective way.

There are definite moves towards scaling up both in Turkey, Spain, through the introduction of larger 120 metre cages, centralized feeding systems with camera technology, larger feed boats (barges) and net washing equipment. The farm labour in the south is relatively cheap and generally not knowledgeable and low skilled. They are instructed informally on farm but bearing in mind the advent of technology the low skills base of the workforce is likely to become an increasing issue over time.

Based on the interview it is apparent that salmon farming technology will become increasingly influential in the south, implying that cage farming competences may converge between the north and south of Europe, despite the need to adapt some technologies to the realities of the fish species, warmer aquatic environment and different business models.

Chapter 2: Key findings

The detailed correlations have provided an insight to the degree of commonality between the three NQs examined. In addition, the relevance of equivalent learning outcomes from the NQS has been determined by mapping them to industry standards in the form of company SPOs, training manuals and Codes of Good Practice. This has provided a revealing analysis that is presented in full detail within Appendices 1-4.

In addition, the detailed examination and comparison of staff development practices by two large but typical Norwegian owned companies in Norway and Scotland, has revealed how the companies develop staff competence within their respective inhouse systems.

2.1 The common ground and significant differences

The degree of commonality between selected subject information sources has been evaluated using SQA Units as a baseline for comparison to other qualifications and industry recognized standards, as illustrated by Table 1.

2.1.2 Fish Health

The SQA Fish Health unit has been used as a comparison baseline for all other units/qualifications, training programmes, SOPs and industry CoGP. It has been designed to provide the learner, inexperienced and experienced farm staff, with the relevant knowledge and skills required to monitor fin fish health and identify the common causes of fish diseases. The unit emphasizes the importance of prevention through good husbandry and fish welfare practices, as well as requiring the learner to carry out disease treatments whilst complying with current legislation and maintaining appropriate records.

Learning Outcome 1 is a knowledge-based outcome which requires the learner to describe common diseases, modes of transfer and preventative measures which can be taken to prevent or reduce the impact of disease transmission. This outcome compares well with equivalents in Norway, Ireland and those operating procedures and codes of practice that relate to Scotland. This is as expected, as a knowledge of disease symptoms and preventative measures and procedures should be a fundamental to any animal husbandry environment. In Scotland the aquaculture sector uses Veterinary Health Plans (VHPs), with their focus being always on prevention rather than cure. Preventative measures include good husbandry, bio security awareness and minimising stress, which are all key themes of any aquaculture VHP. In Scotland VHP's are emphasized in the industry CoGP and are in place across most of the aquaculture sector as a key requirement of any certification or Quality Assurance scheme.

Learning Outcome 2 is a performance-based outcome which requires the learner to monitor fish stocks for physical and behavioural abnormalities, prepare samples for disease diagnosis and record the results. The ability to recognise the difference between normal and abnormal behaviour can only be gained through experience and observation. This can be difficult for new entrants to the industry and learners who may be college based. There are several aspects to this outcome that are reflected in other qualifications in Norway and Ireland, and in the aquaculture industry. However, the aquaculture companies generally have inhouse biologists or employ the services of specialist fish veterinarians. Aquaculture staff will need a good knowledge of the signs and symptoms that would indicate a potential disease/health problem, but generally they will then follow the company SOP for dealing with an incident. The company SOP generally reflects the VHP, which can be site specific. The VHP will advise site staff on what the symptoms may indicate, steps they should take, how to take samples and who they should inform to start the reporting procedure. In Scotland the CoGP encourages the aquaculture industry to include a training programme in the VHP they create, which can be provided as part of the fish veterinarian service.

Learning Outcome 3 is a knowledge-based outcome which requires a learner to describe disease prevention and treatment techniques, equipment required for effective treatments and demonstrate an awareness of the current legislation in relation to fish disease control. This outcome compares well across all other qualifications, SOPs and CoGP. As referred to in Learning Outcome 1, prevention is always better than cure and it is vital that those employed in the aquaculture industry are aware of the importance of preventative measures and steps that should be taken and adhered to. Disease prevention methods can include disinfection, vaccination and buying stock from disease free certified sources. In the aquaculture industry staff will carry out disease prevention procedures and treatments as part of the VHP, and will include chemicals/medicines required, treatment methods and dose rates. The VHP will detail the steps that should be taken once a disease has been identified, reporting and recording procedures, and what should happen if a notifiable disease is suspected. As described in the other Learning Outcomes the VHP is normally created in consultation with the specialist fish veterinarian.

Learning Outcome 4 is performance-based, requiring the learner to maintain written records of the fish health treatments carried out and the observations of fish stocks after the treatments. This outcome compares well across all qualifications, as expected, because it requires the learner to demonstrate competence in the practical application of fish health management regimes. There were no qualifications, SOPs or CoGP available at this time relating to Southern Europe, which could have been used for comparison. However, even though the samples compared for the Fish Health unit all come from Scotland, Norway and Ireland the basic principles of fish disease treatments still apply whether the fish being treated are in the colder waters of northern Europe or the warmer seas of Southern Europe. All fish health treatments will require the stock to be prepared, equipment to be prepared, treatments calculated and prepared accurately, treatment carried out correctly, stocks observed, and accurate records of all activities maintained. The practical application of fish health treatments is as important to the aquaculture sector as being able to identify when there may be a health-related problem within the fish stocks.

This is reflected heavily in the Scottish aquaculture sector CoGP and the generic Scottish SOPs. Prevention will always be better than cure, however there will be occasions where treating health problems is required and having staff who are trained, knowledgeable and able to respond quickly and appropriately is of high importance. The interviews carried out for WP5&6 identified that staff training in fish health will become even more of an issue as the industry continues to expand and becomes more reliant on technology to increase production output. The SQA Fish Health unit and its equivalent in Norway and Ireland, could be adapted for delivery in the workplace and in other countries irrespective of geographic location or species as the basic concepts are still the same.

See Appendix 1 for a tabulation of the detailed correlation between alternative National Qualifications and industry standards for Fish Health.

2.1.2 Fish Biology

A knowledge of fish biology and the aquatic environment has underpinned the development of aquaculture practices globally, as both are of fundamental importance. However, although a knowledge of the internal and internal anatomy and the function of organs is referred to in all three National Qualifications examined, there are no direct references made to fish biology in any of the industry standards. The importance of a knowledge of fish biology is implicit as opposed to explicit. For example, it is difficult to recognize the unhealthy diseased state of a fish and abnormal behavior, unless the healthy state and behavioral norms are not first well understood. Fish biology is a foundation subject, the importance of which the industry takes for granted.

See Appendix 2 for a tabulation of the detailed correlation between National Qualifications for Fish Biology

2.1.3 Aquatic Environment

The quality of the aquatic environment and suitability as an aquaculture site is normally established as part of the application process for any new aquaculture venture. If an application is accepted, it will be the responsibility of the fish farmers to ensure the quality of the environment is maintained at a level prescribed by the licensing authorities. Maintaining a high-quality aquatic environment is paramount on any aquaculture site to ensure the health and welfare of the fish stocks is maintained at an optimal level. There is also a responsibility on fish farmers to ensure that they maintain the aquatic environment not only for their stocks but also the wider environment and all flora and fauna.

The SQA Aquatic Environment for Aquaculture units is designed to enable learners to develop an understanding of aquatic environments and to be able to relate the conditions to the environmental requirements of an aquaculture system. Learners will develop the skills required to measure water quality characteristics and perform basic identification of aquatic flora and fauna. With those skills a learner will then be required to evaluate an aquatic environment as suitable for an aquaculture enterprise.

The Aquatic Environments for Aquaculture unit compares well with other qualifications in Ireland and Norway, but this is not the case when comparing learning outcomes in National Qualifications to the aquaculture industry standards e.g. SOPs, Salmar Training, Scottish aquaculture CoGP. This is due to the requirements of the unit which asks a candidate to assess the suitability of a water source for an aquaculture enterprise. In the working environment this is not necessarily applicable as the candidates will be working on a site that is already in use for commercial production and so do not normally have to assess the suitability of the site.

The SQA Aquatic Environments for Aquaculture unit has been used as a baseline for comparison between qualifications /units in other countries and industry related standards such as the Salmar training programme, Scottish Aquaculture CoGP and a generic SOP relating to salmon farming in Scotland which has been derived from a range of SOPs in the Scottish Aquaculture industry. It would not be possible to use a specific companies SOPs at this time due to confidentiality agreements, so a generic SOP was created by the BlueEDU team by bringing together the relevant parts from all SOPs available.

Learning Outcome 1 of the Aquatic Environments for Aquaculture unit is a knowledge-based outcome which requires the learner to describe the main stages of the hydrological cycle and the main water quality characteristics with most relevance to aquaculture. This outcome compares well with the other qualifications in Norway and Ireland and is well suited for use in a college or school-based VET delivery system. There is less relevance however when compared against SOPs and CoGP, which focus on the industry and the practices carried out in a real working environment. This outcome does provide an opportunity for learners to improve their knowledge and understanding of the aquatic environment and its relevance to the species being farmed. Staff working in aquaculture facilities will have some awareness of the main water quality characteristics as they will be measured and recorded routinely but may not necessarily have a full understanding of the impact of environmental influences on water quality.

Learning Outcome 2 of the Aquatic Environments for Aquaculture unit is a knowledge and performance-based outcome which requires the learner to use maps and charts to interpret and record site characteristics, measure and record water quality parameters and identify aquatic flora and fauna. As in LO1 this outcome compares well with other awards/qualifications in Norway and Ireland, with some comparisons with industry SOPs and CoGP. This outcome allows learners the opportunity to expand on their knowledge and understanding of the aquatic environment and put into practice the skills required to take water samples and interpret results. This relates well to the industry practices for measuring water quality parameters. In an aquaculture environment there will be some water quality parameters measured and recorded daily (sometimes multiple times in a day), and a degree of interpretation will be required as all staff need to know the optimal and safe range is for each parameter. This does not necessarily mean the staff member has to have an in-depth knowledge of the relationships between water quality parameters and the environment, but they must be aware of the safe and unsafe readings for the fish species being farmed. There is a difference in emphasis.

Learning Outcome 3 of the Aquatic Environments for Aquaculture unit is a knowledge-based outcome which requires the learner to evaluate a potential aquaculture site. The learner must interpret data related to water quality, site characteristics, seasonal information and the potential impact on local flora and fauna. This outcome allows the learner to demonstrate they can interpret and report on given information to assess the suitability of a site. As for LO1 & LO2 this outcome compares well with the awards/qualifications in Norway and Ireland. There is very little relevance or comparison with the

industry SOPs or CoGP. This is expected however as staff working on an aquaculture site would not normally be expected to evaluate the suitability of the site they work on as this site will have already completed a highly technical and in-depth Environmental Impact assessment (EIA), which is required before any license application is granted.

See Appendix 3 for a tabulation of the detailed correlation between alternative National Qualifications and industry standards for Aquatic Environment.

2.1.4 Conclusions

The three National Qualifications examined (Scotland, Ireland and Norway) express learning outcomes (LOs) in different ways. The SQA system is the most detailed and prescriptive. Conversely, the Norwegian system has broadly defined learning outcomes at national level, which are interpreted locally by each Upper Secondary School to suit the priorities of the industry in their region. The Irish system sits somewhere between the two but is more like the Scottish system.

However, the subjects examined demonstrated that there is a close correlation between all the National Qualifications within the three core subject areas examined. The degree of correlation to the industry standards (SOPs, Norwegian company training manuals and CoGP) varied, as there is often no practical necessity for industry to consider and reflect all the academic subject knowledge underpinning some operations. A lack of correlation between operations and fish biology was the most marked, as the inclusion of this subject and its importance will be taken for granted. Ironically, earlier BlueEDU research into VET demand revealed that some of the larger companies are concerned about the lack of fish biology knowledge of some of their more specialist operatives, as they feel that the increased use of technology has ‘distanced them’ from the fish stocks. They also wish to see more of their staff develop a deeper knowledge of fish biology, health and welfare so as they can take the lead when it comes to important fish husbandry decisions on site. So, the lack of correlation is not an indication of a lack of importance. BlueEDU research has revealed the reverse to be true.

This limited work package study has not revealed the degree to which aquaculture technology and operating procedures vary between the main companies in the countries involved, as this requires an in-depth discussion with industry which has not been possible to date. This work will be an important early activity within any subsequent VET development projects, to establish the common ground regarding the technical competences of the operative and site manager, leading to a shared framework of learning outcomes that can underpin collaborative VET resource developments.

The correlation activity undertaken within this work package demonstrates that it is possible to derive common learning outcomes by referring to existing qualifications and a select group of industry standards. However, the process would be much improved with the inclusion of industry within the process, including both fish producer and technology supply companies, particularly when addressing some technologically driven subjects, such as rearing systems, fish feeding and stock control.

2.2 Competence from an industry perspective

From an industry perspective, practical competence has been the holy grail driving most staff development. There is however a growing realisation that this extends well beyond 'technical competence'. The importance of transversal skills such as team work, communication, problem-solving and analytical skills are increasingly coming to the fore. Management skills, particularly team-leading and collaboration have also been recognized as very important by industry, and in need of development in Norway, Scotland and other European countries subject to the BlueEDU study.

The way competence is judged by industry is of paramount importance, in terms of the process, the standards applied and the consistency of such judgements at company and industry level. Without doubt the existence of legislation, much of which is driven by European directives, acts as a unifying force. The same can be said of the QA requirements of the multinational food retailers that buy most farmed fish.

However, despite these unifying factors driving standards, an examination of company level practices reveals some significant differences. It also reveals the potential to increase the sharing of staff development good practice between companies, converge processes and further develop linkages with the VET system as part of the overall drive for increased harmonization. It is not clear at this stage how the judgements made by VET practitioners assessing their students compare with those made by site mangers and team leaders judging the competence of their staff in the real place of work. There may be a gap between the expectations of those who are judging competence, including VET practitioners and industry team leaders that needs to be further investigated and defined.

2.2.1 The management of staff competence by a Norwegian Company

The Norwegian company have set up a system that ensures staff competence is well defined and held on an accessible data base that site managers can routinely refer to when planning operations. This enables them to plan a farm task selecting only those team members who show on the data base as being competent. This system is intuitive to use, based on matrices and a visual 'traffic light' data base system.

Consequently, each member of staff must undergo the company training required, which when completed, and following assessment by the site manager, demonstrates they have the knowledge, understanding and practical competence required to undertake specified tasks for the company.

The company have a training manual that refers to a range of staff development activities that that must be completed by site managers and husbandry operatives. It is assumed that all site managers have completed all aspects of operative training, before they are eligible for promotion.

The types of staff development deployed are:

a) Internal training (no certification)
b) Internal Training Program for Technical Equipment
c) Internal training program for knowledge of standards
d) Internal training (leading to certification)

e) External Training courses
f) National Qualifications recognised

Some aspects of company training lead to certification where as others do not, but all form part of the matrix of requirements to qualify the staff (at company level) for undertaking specific tasks. There-fore, collectively, they constitute a company level definition of competence for husbandry operative and site managers.

Four of the above staff development requirements (a,b,d and e) derived from an analysis of the training manual are summarized and categorized below. (See Appendix 4 for the training manual details)

i) Husbandry operative

Internal training (no certification)	Internal Training Program	Internal courses (Certificated)	External Training Courses
Health and Safety			Use of defibrillator
Walk around the cage			2-day safety course for farmers
			Basic safety course “STCW imo 50” or higher
			HES course for leaders
			Safety and hazards - gas under pressure
			Safety Representative Course
Boats moorings and cages			
Operation of IMM barges	Operation of Fleet	Certificate for boats	

	workability and use areas, operation, maintenance and control of this fleet. Equipment Specific Use of Boat practical training to drive and operate the site's boats	License to drive a boat (higher class than in point 2.) Costal skipper certificate (Class D5) ROC-VHF course (Valid for 5 years) VHF course	
Receiving external boats			
Large scale mooring work (internal for service boats)	Introductory courses “Nokk/Capstan” maintenance and control of “Nokk” and practical training in use Practical course “Nokk and Capstan” 5 working days with practical use of “Nokk” under supervision	Crane and stropping course – a documented courses Crane and course G20/G8 Course in applying a lift Course in stropping	
Limited scale mooring work	Use of technical equipment structure, operation, application, maintenance and control		
			Electrical security for instructed personnel
Deploying and uptake of fishing net			Preventing escapes
Raising and lowering the bottom ring			
Husbandry			Fish welfare course biology

Use of “orkast” (method to catch and crowd fish)			
Fish Sampling			
Individual registration and counting sea lice			
Handling the Sea lice tarpaulin			Handling chemicals and medicine
Handling dead fish			
Feeding			
Technical operation and use of feeding facilities and monitoring			
		Warm working operations	
Driving			
		Driving licence for a car	
		Truck driving	

Table 3 Summary of task training requirements (Norwegian company)

ii) Site Manager

In addition to satisfying all the operative requirements in Table 3 above, the site manager should be able to plan, lead and execute large operations on the farm.

Including:

- Mastering executive management of the operation
- Develop operation plan.
- Conduct start up meeting
- Delegation of tasks to competent personnel
- Assess equipment requirements
- Ensure adequate crew and competence (including externals) are available at the appropriate time
- Distribution of work tasks to those who participate in the operation
- Time Management

Assessment of competence

Throughout the training manual, there are statements implying that some form of internal assessment process is being applied. (See the full details of the Norwegian company's training manual are provided in Appendix 4)

However, assessment processes are not described explicitly, as exemplified by the abstracts below.

- *"Participated and trained in the use of full tarpaulin"*
- *"Read and understood the Sea Lice treatment manual"*
- *"The competence should be sufficient to safeguarding your own and other personnel safety"*
- *"Shall be familiar with user manuals for different rings and nets in use at the farm"*
- *"Shall know how to build-up of equipment, the usage properties and characteristics and user areas of equipment"*

Taken at face value, this implies that participation in training, supported by knowledge which has been demonstrated by reading and becoming aware of manuals so as the learner 'knows how to do' various tasks, leads to competence. However, how the judgements of competence are made and by whom, is not documented.

On interviewing the senor quality manager responsible for devising the QA driven staff development system, it was ascertained that site managers are making judgements regarding the competence of operatives based on informal questioning of the operative and observation of their task performance. Once the site manager is satisfied that they are competent at a specific task, their status in the data base is updated and the task specific traffic light turned to green.

Self-assessment by the candidate is also applied, followed by validation by the site manager who will ask questions orally and informally, with no recording of the responses required. There are company level checks on site managers by senior managers acting with the HR department through the internal audit process and the random sampling of operatives who have been deemed competent, to check their knowledge and understanding.

Each time an operative changes sites they must demonstrate their competence to their new site manager in order to 'regain a green light'. There is no assumption that the judgements of their previous site manager, carry forward. This policy has been formed in order to allow for the adjustment that is sometimes required to the conditions that prevail on a new site, implying that some of the competences are not transferable but are 'site specific' in nature, and/or vary due to the differences between 'site specific SOPs' for valid reasons. There are no statistics to demonstrate how often an operative deemed competent at their previous site is judged to be incompetent at the new site. The system does allow site managers a high degree of control over their SOPs and compliance by their operatives.

At times external service providers have experienced difficulties that imply the need for a problem-solving approach and better collaboration between farms and their teams.

There are perceptions amongst senior managers that the current system may have some shortcomings to address in the future, namely:

- The need to standardize the way that site managers make their judgement of the competence of operatives.
- The need for coordination of the implementation of staff development at farm level and better-linkage between site managers and the HR administrative function.
- Changes to SOPs to arise from management team meetings leading to better harmonisation across farm sites, to counter unjustified variance that results from differences in team culture.
- The implementation of an upgraded system for HR data management

It was also noted that there was a need for more emphasis on a centralised, 'top down prescription' regarding the application of technology and new working methods, in order to harness the best solutions that arise from farm-based problem solving.

2.2.2 The management of staff competence by a Scottish Company

The Scottish company interviewed has a well structured and presented staff development program and a very clear vision of its staff development strategy. They have a stated belief in the "creation, sharing and application of knowledge" and use training to enhance motivation. They operate a system of rigorously recorded personal development planning to realise the full potential of all staff and use a range of approaches to support the development of competence, including;

- high quality and closely monitored induction,
- assigned personal work mentor (close personal supervisor),
- managers creating the right environment for continuous learning
- Internal training (non-certificated)
- Internal training (certificated)
- External training (certificated and non-certificated)

- Complimentary National Qualifications (non- mandatory)

There is no insistence on qualifications when recruiting husbandry operatives, but competency-based interviews are held to establish an impression of the individual's competence, based largely on self-declaration and their answers to questions during the interview process.

During the first 6 months of employment this will be validated, or not, to inform their personal development plan. A 'close personal supervisor' is assigned to each trainee and judges their competence, which ultimately gets signed off according to company protocols.

The induction and appraisal systems are central tools within staff development and support a two-way communication process as well as a mechanism for establishing personal development priorities. After 6 months, the training becomes very site specific and more driven by SOPs.

2.3 Conclusions from analysis

2.3.1 Mapping learning outcomes

The mapping of the learning outcomes of different National Qualifications is a manageable task when three or four countries are involved, and it is possible for VET practitioners to build up a useful picture of the 'common ground' between different National Qualifications when they have adopted a learning outcomes approach. At times, mapping to industry standards is more problematic, as some of the technical details are not available or are held in other documents that were not available. However, bearing in mind companies mostly use the same technology and adopt many of the same farming techniques, with the producer and supply companies' active cooperation, it should be possible to define 'shared competences' that can inform a shared framework of 'learning outcomes' within NQs. The company CEOs recognize that some matters are not to be shared with other companies by their managers, but these tend to be financial and not technical. Generally, there is a growing will to share and transfer knowledge in order to solve aquaculture problems collectively in the future and this will be a far more significant influence than secrecy and covetousness.

2.3.2 Industry's assessment of competence

In both the Norwegian and Scottish company, the development of husbandry operatives is dependent on the assessment of knowledge, understanding and practical competence 'in company', supported to varying degrees by the company HR department. The company's assessment of practical competence is important to both, with one relying on judgements made by the 'close personal supervisors' and the appraisal process latterly, and the other on the site managers judgement of the competence of operatives which is recorded on a central database. The same systems support the development of site managers.

The Norwegian company has noted areas for improvement within its inhouse system which focus on the need for better coordination, an improved process for discussing and approving changes to SOPs and the

standardization of site managers as 'in company' assessors, judging staff competence. A closer alignment between inhouse company staff development systems and assessment processes with the National Qualification Frameworks in the future, will be of great benefit to the companies and the industry, leading to greater consistency and harmonization.

Chapter 3: Recommendations

3.1 Blue EDU Aquaculture Skills Foresight Forum (ASFF)

Although the industry has been unable to commit the staff resource required to establishing the ASFF during BlueEDU Lot 1, as originally intended, they have indicated their future commitment to this initiative. The proposed remit of the ASFF is for the industry and VET providers from the main north European finfish producing companies to work together to develop a framework of common competences for the finfish farming husbandry operative and site manager level.

The largest Norwegian led companies have agreed to work together and under the ownership structure, subsidiary companies from Scotland, Ireland and Iceland will join them.

It is recommended that the ASSF should is constituted as follows:

- Norwegian parent producer company (ASSF lead and chair)
- Other producer companies drawn from Scotland, Ireland and Iceland and under Norwegian ownership
- Technology Supply (single company or a collective)
- VET producers (Representing Norway, Scotland, Ireland and Iceland)
- ESCO representative

To increase industry attendance, it is recommended that any 'face to face' ASFF meetings are held at convenient Aquaculture conferences in Europe that are commonly attended by the company senior managers. Some virtual meetings could also be held, and sub-groups could be established for the development of fully documented standards for industry approval, following their initial input and guidance. The ESCO representative may not need to attend every meeting in person but should be copied in on all correspondence. They should be invited to attend key meetings to ensure that the standards were developed in a form that can be used to upgrade the ESCO Aquaculture competence definitions.

The work of the ASFF should be carefully coordinated with any national level initiatives addressing aquaculture occupational definitions and competences. For example, the Scottish Industry Lead group (ILG 2030) have committed to a revision of the 'occupational map' for Scottish aquaculture, and it will be

important to form a connection between this national level initiative and the work of the ASFF at European level.

3.2 Developing a framework of shared of learning outcomes

This framework of common competences for the finfish farming referred to in 3.1 above should be interpreted by VET providers from the ASFF to create a framework of 'shared learning outcomes' which should be EQF leveled

Once levelling is complete and following ASFF approval, the framework of shared Learning outcomes should;

- support any future collaborative development of shared resources for aquaculture VET by north European VET partners, that targets the finfish husbandry operative level,
- inform the updating of national qualifications to ensure that they fully meet industry needs in terms of the technology and aquaculture techniques
- inform the development of aquaculture higher VET requested by industry as a secondary priority,
- be shared with southern European VET providers and industry representatives in countries that are adopting north European aquaculture technology and systems, and
- inform the updating of ESCO standards for aquaculture.

ESCO should be consulted to ensure that the same frameworks of competences and/or learning outcomes can be translated into their terms and used to update ESCO definitions of aquaculture competences. {1}

It is recommended that representatives of those countries with significant cage farmed production of finfish are informed of ASFF progress within any subsequent VET development projects, and have a facility for comment and communication, via a European representative body, such as the Federation of European Aquaculture Producers (FEAP)

References

1) ESCO web site reference - https://ec.europa.eu/esco/portal/skill

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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 Fish Health

Appendix	1	2	3	4	5	6	7	8
LO	H039 11	HC0H 04	HC0J 04	5N5286 (QQI)	NJ(Sect 1, 2,3)	SOP	Sal	CoGP
1	H039(1a)	HC0H(K8)		QQI(31)	NJ(3.7 a,b,c)	SOP (1 a)		CoGP(1 a), CoGP(2 a, b,c,d,e)
	H039(1b)	HC0H(K8)		QQI(31)	NJ(3.7 a,b,c)	SOP(2 a)	Sal(12)	CoGP(1 a), CoGP(2 a,b,c,d,e)
	H039(1c)	HC0H(K3)		QQI(6)	NJ(1.9 b,c), NJ(2.3 a), NJ(3.4 a,b), NJ(3.8 a,b)	SOP(3 a)	Sal(11)	CoGP(3 a,b,c,d,e,f,g,h,I,j,k) CoGP(4 a,b,c,d,e,f,g) CoGP(5 a,b,c,d,e,f)
2	H039(2a)	HC0H(P2)(P3)(P1)(P6)(P8)(K1)(K4)(K5)(K6)		QQI(32)	NJ(1.5 c,d),NJ(2.6 a),NJ(3.7 a,b,c)	SOP(4 a)	Sal(14)	CoGP(1 a,c) CoGP(6 a,b,c,d,e,f,g,h,I,j)
	H039(2b)	HC0H(P4)(P8)(K2)		QQI(32)	NJ(2.6 a),NJ(3.1 a)	SOP(5 a)	Sal(14)	CoGP(1 a,c) CoGP(6 a,b,c,d,e,f,g,h,I,j)
	H039(2c)	HC0H(P5)				SOP(6 a)	Sal(9)	CoGP(1 b)
	H039(2d)	HC0H(K7)						
3	H039(3a)	HC0H(P7)(K9)		QQI(6)	NJ(1.9 b,c),NJ(2.3 a),NJ(3.4 a,b),NJ(3.8 a,b)	SOP(7 a)	Sal(11)	CoGP(3 a,b,c,d,e,f,g,h,I,j,k) CoGP(4 a,b,c,d,e,f,g) CoGP(5 a,b,c,d,e,f)
	H039(3b)		HC0J(K1)(K2)(K3)(K4)	QQI(25)	NJ(1.1 a,b),NJ(1.10 a,b,c,d),NJ(3.4 a,b)	SOP(8 a,b,c,d)		CoGP(1 a,b,c,d,e,f,g) CoGP(7 a,b,c,d,e,f,g,h,i)
	H039(3c)		HC0J(K5)		NJ(1.8 a,b,c,d),NJ(3.8 b,c)	SOP(9 a)		CoGP(1 a,b,c,d,e,f,g)

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	H039(3d)	**HC0H(K10)**			**NJ(1.1 a,b), NJ(1.10 a,b,c,d),NJ(3.4 b),NJ(3.8 b)**	**SOP(10 a)**		
4	**H039(4a)**		**HC0J(K9)(K10)(P1)(P2)(P3)**	**QQI(26)(25)(32)**	**NJ(1.8 a,b,c,d),NJ(3.8 b,c)**	**SOP(11 a)**		**CoGP(1 a,b,c,d)**
	H039(4b)		**HC0J(K6)(K7)(K8)(K9)(K10)(P1)(P2)(P3)(P4)**	**QQI(6)(27)(32)**	**NJ(1.8 a,b,c,d),NJ(2.3 a),NJ(2.6),NJ(3.1 a),NJ(3.8 a,b,c)**	**SOP(12 a)**	**Sal(2)(4)**	**CoGP(1 a,b,c,d,e,f,g)**
	H039(4c)		**HC0J(K11)(K12)(K13)(K16)(K19)(P1)(P5)(P6)**	**QQI(27)(32)**	**NJ(1.8 a,b,c,d), NJ(1.9 a,b,c), NJ(3.8 b,c)**	**SOP(13 a,b,c)**		**CoGP(1 d)**
	H039(4d)		**HC0J(K14)(K15)(K18)(P1)(P7)(P8)**	**QQI(32)**	**NJ(2.6 a)**	**SOP(14 a,b)**		**CoGP(1 c,d)**
	H039(4e)		**HC0J(K17)(K20)**	**QQI(27)**	**NJ(2.6 a)**	**SOP(15 a)**		**CoGP(1 a,b,c,d) CoGP(6 a,b,c,d,e,f,g,h,l,j)**

Table 4 Comparison of Fish Health related units, qualifications, company SOPs and industry best practice guides from Norway, Scotland and Ireland. Full definitions of the codes used are shown in Table 5

Code	Title	Award/Qual/Comp	Appendix
H039	H039 11 Aquaculture: Fish Health	SQA	1
HC0H	HC0H 04 Monitor fish/shellfish health and welfare	NOS	2
HC0J	HC0J 04 Prepare and treat health problems in fish	NOS	3
5N5286	5N5286 Finfish Ongrowing Operations	QQI	4
NJ	Section 1,2,3	Journeyman	5
SOP	Generic Scottish Aquaculture SOPs	Generic company	6
Sal	Salmar(Norway)	Salmar Training	7
CoGP	Scottish Finfish Aquaculture	Industry Code of Good Practice	8

Table 5 The full titles and codes of each of the Fish Health related units, qualifications, company SOPs and industry best practice compared in Table 4

Appendix 1

SQA National units (Scotland)

Learning Outcome H039 11 Aquaculture: Fish Health

1. Describe the common causes of fish disease in farmed fin fish (written and/or recorded oral evidence. Closed book)

H039 (1a) Describe common non-transmissible fin fish diseases and associated symptoms. (Min of two)

H039 (1b) Describe common transmissible fin fish diseases including associated symptoms and mechanisms of disease transfer. (Min of two)

H039(1c) Describe methods of fish disease prevention including reference to Standard Operating Procedures (SOP) and site health plan. (Min of two)

2. Conduct fin fish health monitoring operations. (written and/or recorded oral evidence and performance evidence. Supervised open book)

H039(2a) Monitor and record fin fish behaviour including any abnormalities.

H039(2b) Monitor and record fin fish anatomy including any abnormalities.

H039(2c) Carry out recognised procedures for preparing laboratory samples for fin fish disease diagnosis. (Min of two; prep, dissect, observe, record)

H039(2d) Examine prepared samples and accurately record observations. (examine and accurately record)

3. Describe the procedures for fin fish disease control. (written and/or recorded oral evidence. Closed book)

H039(3a) Describe fin fish disease prevention measures according to SOP and site health plan and in compliance with current legislation.(Min of two)

H039(3b) Describe fin fish disease treatment techniques conducted according to SOP and site health plan and in compliance with current legislation.(Min of two)

H039(3c) Identify equipment appropriate to disease treatment techniques and operator safety.(Min of two both cases)

H039(3d) Outline the role of legislative authorities in the control of fin fish disease and current legislation.(Min of two both cases)

4. Conduct fin fish disease treatment operations. (written and/or recorded oral evidence and performance evidence. Supervised open book)

Funded by the Erasmus+ Programme of the European Union

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H039(4a) Calculate and measure the correct treatment dose appropriate to the fin fish disease being treated.(Min of four)

H039(4b) Prepare equipment and fin fish stocks for a disease treatment.(Min of four for both)

H039(4c) Carry out the application of the treatment dose according to SOP for the disease treatment technique.(Min of four)

H039(4d) Observe and record the immediate response of the fin fish stocks to the treatment.(Min of four)

H039(4e) Record the fin fish disease treatment accurately.(Min of four)

NOS/MA units

HC0H 04 Monitor fish/shellfish health and welfare (Scotland)

HC0H (P1) carry out work safely in line with relevant health and safety requirements

HC0H (P2) monitor stocking densities within holding units

HC0H (P3) monitor fish/shellfish for any signs of stress or disorder

HC0H (P4) monitor fish/shellfish for the presence of disease or parasites in accordance with industry standards

HC0H (P5) remove and record mortalities from holding units minimising disturbance to remaining fish/shellfish

HC0H (P6) report any unusual variations in mortality promptly to the appropriate person

HC0H (P7) maintain appropriate levels of hygiene and bio-security
HC0H (P8) provide information to maintain records of monitoring in accordance with legal and site requirements

HC0H (K1) the relevant health and safety requirements associated with monitoring the health and welfare of fish/shellfish

HC0H (K2) the anatomy of a healthy fish/shellfish

HC0H (K3) welfare requirements for fish/shellfish and how these are maintained within holding units

HC0H (K4) the signs that indicate stress or disorder in fish/shellfish
HC0H (K5) why accurate mortality records are essential to the management of a fish/shellfish farm
HC0H (K6) how variations in mortality can be used to indicate the condition of farm stock

HC0H (K7) how to recognise common parasites including their different life cycles

HC0H (K8) how to recognise common diseases

HC0H (K9) site procedures for maintaining effective hygiene and bio-security

HC0H (K10) the legal and site requirements for maintaining records of the health and welfare of fish/shellfish

HC0J 04 Prepare and treat health problems in fish (Scotland)

HC0J (K1) the relevant health and safety requirements when treating health problems in fish

HC0J (K2) the hazards associated with treatments and the precautions that are used to control them

HC0J (K3) how fish are conditioned ready for treatment

HC0J (K4) how husbandry risk assessments are used to ensure successful treatments and maintain fish welfare

HC0J (K5) the equipment and methods used to treat fish

HC0J (K6) how to prepare the equipment used to treat fish

HC0J (K7) the importance of fully preparing fish before administering treatments

HC0J (K8) how to identify when fish are not fully prepared and ready for treatment

HC0J (K9) why it is important to prepare treatment according to legal requirements

HC0J (K10) how dosages for treatments are calculated

HC0J (K11) why it is important to administer treatment according to veterinary instructions and the requirements of the site Fish Health Plan

HC0J (K12) why it is important to control treatments to protect other stock and the environment

HC0J (K13) why treated fish need to be isolated and controlled

HC0J (K14) how to recognise signs of stress during treatment

HC0J (K15) the emergency actions to take in response to any adverse effects caused by treatments

HC0J (K16) the purpose of withdrawal periods and how to calculate withdrawal periods

HC0J (K17) why it is important to maintain accurate records of treatments administered to fish

HC0J (K18) the importance of monitoring and evaluating treated fish

HC0J (K19) site procedures for the disposal of chemicals and treatments

HC0J (K20) the legal and site requirements for maintaining records of treatments administered to fish

HC0J (P1) carry out work safely in line with relevant health and safety requirements
HC0J (P2) identify and condition fish ready for the safe administration of treatments
HC0J (P3) prepare treatments and equipment to meet specified requirements, in accordance with the site Fish Health Plan

HC0J (P4) prepare treatment facilities to effectively isolate target stock during treatment, and avoid the contamination of non-target stock and the environment

HC0J (P5) administer treatments to fish accurately according to veterinary instructions while continually monitoring fish for signs of stress

HC0J (P6) use treatment facilities to control the administration of treatments to avoid contaminating other stock and the environment (i.e. holding units and containers)

HC0J (P7) take emergency action, within the limits of your own authority, in response to any adverse effect caused by treatments

HC0J (P8) monitor treated fish to evaluate recovery and the effectiveness of treatments

QQI (BIM; Ireland)

5N5286 Finfish Ongrowing Operations

QQI (6) Discuss the importance of the disinfection routine prior to and post handling of Finfish

QQI (25) Recommend the correct sea-lice treatment

QQI (26) Calculate stocking density, feed rate, food conversion ratio and treatment dosages

QQI (27) Handle chemicals correctly and safely and fill in a chemical log

QQI (31) Identify the major threats to fish health

QQI (32) Exercise initiative in maintaining fish health.

Norway Journeyman (Norway) Section 1, 2 & 3

NJ (1.1) carry out work at a fish farm in line with current regulations and ethical guidelines

Learners need to:

(a)know which regulations apply to salmon production (FW & M);

(b)understand the significance and purpose of each regulation

NJ (1.5) observe organisms and environments and evaluate changes in relation to the species' normal appearance and behaviour

Learners need to:

(a) know which environmental parameters are measured in M&FW;

(b) understand why each environmental parameter is measured and how the data is interpreted and applied;

(c) recognise normal appearance and behaviour of aquatic organisms;

(d) understand how changes in the aquatic environment can impact on the behaviour of aquatic organisms, including farmed finfish;

Context: Behaviour of all aquatic organisms relevant to fish farming, including algae, zooplankton, epiphytes growing on cage surfaces and M&FW fish species (Salmon and Lumpfish)

NJ (1.8) assess risk in work operations and implement measures to reduce the risk of injury or damage to personnel, farmed organisms and equipment

Learners need to:

(a)Be aware of the hazards a fish farmer can face and where they will be encountered;

(b)Know what personal protective equipment they need to use in each hazardous work situation;
(c)Understand how to conduct and document a risk assessment;

(d)Understand how to undertake a 'job analysis' before each task in undertaken on the farm to ensure their safety and the safety of others;

Context: Marine on-growing and FW hatchery phase in relation to Norwegian regulations

NJ (1.9) prepare routines for safeguarding the quality of processes and products in the fish farming industry

Learners need to:

(a)Understand the importance of complying with chemical withdrawal periods;

(b)Understand the importance of farm biosecurity;

(c)Know and comply with the biosecurity procedures on the farms that they are working on

NJ (1.10) carry out work at a fish farm in accordance with relevant environment, health and safety regulations

Learners need to:

(a)Be aware of all regulations that influence the working environment and management of farm operations;

(b)Understand how employment regulations influence farm operations;

(c)Know the company rules and regulations governing safety;

(d)Understand the link between national statute and regulation and company policy and procedure governing health and safety;

Context: Marine on-growing and FW hatchery phase

NJ (2.3) clean, inspect and maintain a facility and equipment based on the materials' properties and application

Learners need to:

(a)Understand the importance of routine maintenance and hygiene on fish farms

NJ (2.6) use digital tools in production control, environmental monitoring and documentation

Learners need to:

(a)Know how to the operate digitally enabled equipment on a fish farm

NJ (3.1) plan, implement, document and evaluate optimal operations based on the biology of the farmed species

Learners need to:

(a)Understand how the biology of the farmed species influences farm production technology and regimes

NJ (3.4) carry out work in line with relevant regulations for preventive health work, animal welfare and hygiene

Learners need to:

(a)Understand the need for disinfection within hatchery hygiene and biosecurity regimes;

(b)Understand fish health and welfare and the influence of national and European animal welfare regulations on husbandry practices

NJ (3.7) recognise normal behaviour and appearance in fish farm organisms and elaborate on common diseases and parasites

Learners need to:

(a)Be able to recognise normal and abnormal fish behaviour indicative of disease;

(b)Know the common pathogens and parasites infecting farmed species;

(c)Understand the nature of common fish diseases and their control and management;

Context: Farmed fish species - salmon and lumpfish; Pathogens and parasites - Sea lice, Amoebic Gill disease, Pancreas Disease, CMS (Cardiopathy)

NJ (3.8) handle and use chemicals correctly in accordance with information in an EHS data sheet

Learners need to:

(a)know how to prevent common diseases and treat fish when necessary;

(b)Know how to interpret and follow Environmental Health and Security regulations;

(c)Know how to store, handle and apply chemicals to the treatment of fish diseases;

Context: FW&M fish diseases and chemical treatment regimes

Generic Aquaculture SOPs (Scotland)

SOP1 Company SOPs and VHP contains information on common non-transmissible diseases and associated symptoms.

(a) The main non-transmissible diseases that can affect Atlantic salmon in the marine phase are detailed on the VHP and in company SOPs e.g. some gill disorders.

SOP2 Company SOPs and VHP contains information on common transmissible diseases and associated symptoms.

(a)The main transmissible diseases that can affect Atlantic salmon in the marine phase are detailed on the VHP and in company SOPs and in particular notifiable diseases.

SOP3 If disease suspected

Company investigation, follow company VHP for diagnosis process;
Procedures which can impact on fish health and welfare (routinely review and update where necessary)

(a)Report any health concerns (symptoms, mortality) immediately to the appropriate company person; Handling and crowding(follow company SOP), grading(follow company SOP), stocking and stocking densities(SEPA consent and CoGP), equipment inspection(routine checks and repair as SOP), net fouling(check and maintain clear water flow), water quality(daily checks of quality and follow SOP if outside parameters),predator control(follow company SOP for predator control), bio-security (Human disinfection SOP, incoming fish stock SOP),stock separation (year classes kept separate), fallowing(fallow site as per SEPA consent),wellboat and vessel control(disinfect as per CoGP)

SOP4 Monitoring – recognition of disease, personnel involved – procedure for monitoring of disease

(a)Daily monitoring of fish behaviour & feeding activity. Any of the following observations should alert site supervisor to the possibility of a problem with fish health/welfare: Changes in water quality/turbidity.Change in appetite. Changes in swimming behaviour. Evidence of irritation, Respiratory distress.The presence of lethargic/moribund/dead fish. Colour changes. Lesions/fin or skin haemorrhage/ eye damage.

SOP5 Monitoring, recording and control

Record keeping – health monitoring including monitoring of e.g. mortalities, physical damage, deformities, use of medicines/vaccines

(a)All fish behaviour, abnormalities, water quality and feeding activity are recorded daily. Veterinary and pathology reports;Reporting Structure & Responsibilities (who to report to e.g. site manager, production manager, company biologist)

SOP6 Taking and preparing samples for diagnosis

(a)It is not possible to confirm diagnosis of some diseases without further veterinary investigation. Samples should be collected, in consultation with Company Biology Dept. Samples should include formalin fixed tissues for histology and sterile fresh samples. The site manager should arrange to have samples chilled and stored prior to submission for analysis.

SOP7 Disease Control procedures

(a)Disease Control procedures aim to prevent disease outbreaks and minimise losses. Disease Control procedures include: removal and culling sick fish; removal of mortalities; disposal of dead fish; emergency culling in cases of notifiable disease; chemical and medicine use (includes anaesthesia). Vaccination policies are put in place where appropriate. The company procedures are based on current knowledge relating to the development of known diseases and any processes which may help to mitigate their incidence. The company VHP will routinely review and update the effectiveness of the company disease control procedures and include control of specific diseases.

SOP8 Treatment protocols for bath and infeed treatments

(a)All medicines used must be used as per manufacturer's instructions, authorised for use on fish and permitted on the relevant authority discharge consent for that site. All fish harvested will have exceeded the manufacturer's withdrawal period. Relevant authorities must receive notification of treatment intention. Essential equipment to be prepared e.g. treatment chemical/medicines, tarpaulins, oxygenation, oxygen meter.

Appropriate PPE to be worn by staff/operatives.

(b)Fish must be starved for a minimum of 24 hours before treatment, but not more than 72 hours unless for fish welfare reasons. Treatment should not be started if there is evidence of excessive organic material present in the water or if the net is overgrown.

Fish are crowded in nets as per SOP for crowding and net lifting.

Oxygen diffusers should be placed into the pen and oxygen levels measured before a treatment starts. Treatments should not start until the oxygen level in the water is above a minimum threshold e.g. 7

mg/l. Oxygen levels and fish behaviour are monitored throughout the treatment. Treatment will cease if oxygen levels drop below a minimum level e.g. 6 mg/l.

(c)The net containing fish is surrounded by a tarpaulin.

All medicines are administered as per Veterinary instructions and can vary due to site location, stocking density, cage size, discharge consents.

When treatment period is over the tarpaulin is removed and the net is lowered.

Treated fish are monitored post treatment.

All treatment details are recorded, and any withdrawal periods observed.

(d)In Feed treatment; Relevant authorities must receive notification of treatment intention. All medicines used must be used as per manufacturer's instructions, authorised for use on fish and permitted on the relevant authority discharge consent for that site.

A medicine request must be submitted to the veterinary supplier in good time, before the treatment start date e.g. a minimum of 10 days in advance. The request must include the following details: number of fish, biomass, feed type, feed manufacturer, feed rate, feed quantity, inclusion rate and drug quantity

The veterinary supplier will send the medicine to the feed manufacturer for preparation.

Treated fish are monitored post treatment.

All treatment details are recorded, and any withdrawal periods observed.

SOP9 Equipment identification, preparation and operation are integrated throughout all SOPs and defined as only being carried out by competent staff/operators.

PPE prepared and used as per company safe working practices. COSHH protocols followed at all times.

(a)Equipment to prepare includes: PPE, medicines, tarpaulins, oxygen diffusers and supply systems, oxygen meters, feeding systems. Operator safety and H&S protocols are always followed as per company safe working practices.

SOP10 The role of legislative authorities is integrated throughout all Fish Health and VHP SOPs as reference for staff and includes procedures to follow if a disease outbreak occurs.

(a)The main pieces of legislation affecting disease control in Scotland is the Aquatic Animal Health (Scotland) Regulations 2009 and several EU council directives. In Scotland any symptoms or suspect of a notifiable disease must be reported to the Fish Health Inspectorate. Particular attention on Notifiable

diseases and Movement restrictions, which include Confirmed Designation Notices (CDNs), Initial Designation Notices (IDNs), Staff Prohibition Notices (SPNs), veterinary medicine use and withdrawal periods, COSHH, H&S legislation and discharge consents.

SOP11 The practical application of treating fish is integrated throughout the VHP and company SOPs. The focus is on bath treatments and infeed treatments.

(a)In feed treatments are normally prepared by the feed manufacturers with medicines as prescribed on veterinary advice. Bath treatments are prepared on site as required. All medicines used must be used as per manufacturers' instructions, authorised for use on fish and permitted on the relevant authority discharge consent for that site. All fish harvested will have exceeded the manufacturer's withdrawal period. Relevant authorities must receive notification of treatment intention.

SOP12 The practical application of preparing equipment to treat fish (bath and infeed) is integrated throughout the VHP and company SOPs for fish treatment.

(a)Essential equipment to be prepared e.g. treatment chemical/medicines, tarpaulins, oxygenation, oxygen meter and PPE. Appropriate PPE to be worn by staff/operatives at all times during treatment. Fish must be starved for a minimum of 24 hours before treatment, but not more than 72 hours unless for fish welfare reasons. Treatment should not be started if there is evidence of excessive organic material present in the water or if the net is overgrown.

SOP13 The practical application of fish treatments is integrated throughout the VHP and company SOPs for a number of diseases using bath or infeed treatments.

(a)Bath treatments: Fish are crowded in nets as per SOP for crowding and net lifting.

Oxygen diffusers are placed into the pen and oxygen levels measured before a treatment starts. Treatments should not start until the oxygen level in the water is above a minimum threshold e.g. 7 mg/l. Oxygen levels and fish behaviour are monitored throughout the treatment. Treatment will cease if oxygen levels drop below a minimum level e.g. 6 mg/l.

(b)The net containing fish is surrounded by a tarpaulin.

All medicines are administered as per Veterinary instructions and can vary due to site location, stocking density, cage size, discharge consents.

When treatment period is over the tarpaulin is removed and the net is lowered.

(c)Infeed treatments: Feed on a cage by cage basis

It is important that affected fish are fed at a steady rate and do not get too hungry as frantic feeding behaviour and increased stress can lead to increased mortalities with some diseases.

Fish must be carefully observed during feeding for any change in behaviour. If any changes are observed this must be reported to the relevant person on site.

Enriched diets (functional feeds) could be fed, once a disease has been identified, to help boost the immune response.

Treated fish in all cases are monitored post treatment.

All treatment details are recorded and any withdrawal periods observed."

SOP14 The observation and recording of stock behaviour and responses is carried out every day as routine and is integrated throughout the VHP and company SOPs for fish treatments.

(a)Bath treatments: Oxygen levels and fish behaviour are monitored throughout the treatment. Treatment will cease if oxygen levels drop below a minimum level e.g. 6 mg/l. Infeed treatments:Fish must be carefully observed during feeding for any change in behaviour.

Treated fish in all cases are monitored post treatment.

If any changes in behaviour are observed post any treatment this must be reported to the relevant person on site. "

SOP15 The recording of fish disease treatments is integrated throughout the VHP and company SOPs for fish treatments.

(a)All treatment details are recorded in the company medicine records and farm management software. Any withdrawal periods must be observed.

Norwegian Salmon Company

Sal(2) Handling the Sea lice tarpaulin, consisting of the following description of the work operations:

Participated and been trained in the use of full tarpaulin, and safe work practices and the use of equipment of protection around this.

Read and understood the Sea Lice treatment manual.

- Reviewed relevant risk assessments. The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation, as well as leading the operation.

Sal(4) Use of "orkast" (method to catch fish) and the congestion of fish, consisting of the following description of the work operations:

Have participated and been trained in the use of "Orkast" and congestion of fish. Know safe working practices and use of relevant protective equipment.

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Sal(9) Sampling on fish, consisting of the following description of the work operations: Completed training in relevant sample sampling on fish.

Sal(11) To receive external boats, consisting of the following description of the work operations:

Completed training in routines around reception of external boats (feed boats, ensilage boats, diesel boats and service boats).

This implies:

- The danger of fish escaping by placing a boat up to the fishing net.

- The risk of getting an infection when receiving boats that has been on other farms.

- Checkout routines, hygiene when the boat arrives to the farm/cage.

- Safety of persons when receiving the boat to the farm/cage. Reviewed relevant risk assessments and user guides"

Sal(12) Individual registration and counting sea lice, consisting of the following description of the work operations:

Completed training by supervisory veterinarian and participant in individual registration and counting of sea lice.

This implies:

- Familiar with fish welfare methodology used to catch fish and anaesthetize fish before weighing and counting.

- Known with all stages of the sea lice.

- Known with gonad control

- Reviewed relevant risk assessments and user guides

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation."

Sal(14) Handling dead fish, consisting of the following description of the work operations:

Completed training in the correct uptake of dead fish.

This implies:

- Training in categorization of dead fish and knowledge of the most known diseases and symptoms on these. Parts of this training will be done together with the supervising veterinarian at the site and through fish welfare courses.

- Reviewed relevant risk assessments

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation."

Scottish Finfish Aquaculture (CoGP; Scotland)

CoGP1 Training

A documented training programme must be in place to include areas specifically related to the

VHP/BP. Examples of what the training programme must include are as follows:

(a)Recognition of fish diseases;

(b)Investigation of disease including correct sample submission and recording procedures;

(c)Sea lice monitoring, recording and control procedures;

(d)Safe and effective use of medicines and chemicals;

(e)Fish handling;

(f)Fish crowding/grading for management purposes;

(g)Humane slaughter and culling of fish.

CoGP2 Disease Surveillance

Procedures must be in place to carry out regular observation of fish by personnel trained in the recognition of fish diseases.

(a)On farm monitoring for the presence of disease.

(b)Actions on suspicion of disease – in house investigation, chain of responsibility and communication with diagnostic services.

(c)Veterinary and laboratory support in disease detection and diagnosis.

(d)Sampling procedures for disease detection/monitoring.

(e)Actions on suspicion of notifiable disease."

CoGP3 General management procedures

This should cover the principal management procedures which may have a direct impact on fish health and welfare; it should address the objective of minimising stress, damage and detrimental effects on health and welfare status of the fish:

(a)Transport of fish, transfer of smolts and fish handling;

(b)Stocking procedures and stocking density;

(c)Routine inspection of fish, nets and equipment including recording systems;

(d)Monitoring of smoltification in relevant species;

(e)Water quality parameters, monitoring systems and recording procedures, emergency back-up arrangements and alarms;

(f)Monitoring algae/jellyfish, prevention and contingency planning;

(g)Predator control systems, procedures and licensing requirements;

(h)Fish grading systems;

(i)Fish crowding procedures for management purposes;

(j)Slaughter, including emergency slaughter arrangements;

(k)Disposal of mortalities.

CoGP4 Biosecurity

This section should deal with the following:

(a)Health checks and certification of all incoming stocks including cleaner fish;

(b)Visitor and vehicle control;

(c)Sanitation and movements of personnel including third party contractors;

(d)Sanitation of equipment – moveable and fixed structures and buildings;

(e)Stock separation and fallowing policies;

(f)Duties of person responsible for monitoring and recording biosecurity procedures;

(g)Biosecurity procedures review protocol.

CoGP5 Disease Control Measures

Disease control measures are aimed at prevention of disease outbreaks and minimising fish losses. Appropriate vaccination policies must be in place, based on risk assessment and the available products. Procedures must be in place to minimise the incidence of specific diseases. These procedures must be based on current knowledge of the disease and means of preventing or minimising its incidence. This section needs to cover the following:

(a)Removal and culling of sick fish from pens or tanks;

(b)Removal and disposal of dead fish using legally permissible methods; diver biosecurity;

(c)Emergency slaughter procedures;

(d)Vaccination and prophylaxis policies, including vaccination procedures, documentation and auditing (in-house and third-party); vaccination biosecurity;

(e)Use of chemicals and medicines; data sheet and COSSH information; stock control; recording

usage; storage and safe handling of products;

(f)Anaesthesia procedures."

CoGP6 Monitoring, recording and control

This section needs to cover the following:

(a)Record keeping – health monitoring including monitoring of, for example, mortalities (separated into categories), sea lice numbers, gill disease, physical damage to fish, predation, deformities, occurrence of cataracts, vaccine responses, feeding behaviour and diver observations;

(b)Occurrence of regular veterinary visits; recording observations and agreed actions;

(c)Environmental monitoring (oxygen, temperature, algae/secchi, etc.);

(d)Stock performance (sample weights, FCRs, feeding rates, etc.);

(e)Veterinary and pathology reports;

(f)On farm and company reporting structures and responsibilities relevant to the VHP/BP;

(g)Health meetings and mechanisms for VHP/BP review, to include assessment of effectiveness of control measures in place; use of chemicals/medicines, mortality rates, incidence of specific disease;

(h)Use of Animal Remedies Record Book, detailing all treatments and vaccinations undertaken;

(i)Feed medicines details (brand, type, batch number, dates of use, quantity, etc.);

(j)Use of Chemical Store log book."

CoGP7 Procedures for the control of specific diseases based on past history and risk assessments

These procedures must include risk assessment, prevention, identification and diagnosis, control and treatment. Examples are as follows:

(a)Freshwater parasites;

(b)Bacterial diseases;

(c)Saprolegnia;

(d)Infectious pancreatic necrosis;

(e)Pancreas disease and associated pathologies;

(f)Sea lice;

(g)Gill disease;

(h)Algae/Jellyfish;

(i)Deformities.

Appendix 2 Fish Biology

Learning Outcome	SQA	NOS/MA		QQI (BIM)	Norway Journeyman	
	Fin Fish Biology H038 12 (SCQF 6)	**K2 Aqua 13**	**Aqua 12 K3;Aqua 1 K2;Aqua 19 K6**	Aquaculture Hatchery Production 5N5206	**Section 3 Aquaculture & Environment**	**Section 1 Operation & Production**
1	Describe the natural life cycle of at least one species of farmed fish.		The environmental conditions required by the fish/shellfish being farmed and the actions that can be taken to maintain conditions within holding units	Examine the lifecycle of an identified aquaculture species	3.1 plan, implement, document and evaluate optimal operations based on the biology of the farmed species	1.5 observe organisms and environments and evaluate changes in relation to the species' normal appearance and behaviour
2	Identify internal and external features of fish anatomy.	The anatomy of a healthy fish/shellfish		Identify the main external features and internal organs of a fish and shellfish		
3	Describe the main functions of internal and external anatomical structures of a fish.	The anatomy of a healthy fish/shellfish				

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 3 Aquatic Environment

Appendix	1	2	3	4	5	6
LO	F6TG 11	HC0G 04	5N5286 & 5N5287(QQI)	NJ(Sect 1, 2,3)	SOP	CoGP
1	F6TG(1a)		QQI(SO16)	NJ(3.2 a)		
	F6TG(1b)	HC0G (K3)	QQI(SO 10,15,17)	NJ(1.5 a,b), NJ(3.2 a)		
2	F6TG(2a)		QQI(SO 9,10,15)			
	F6TG(2b)	HC0G(K1)(K5)(K6)(P1)(P5)	QQI(SO 9,10,17)	NJ(1.1 a,b),NJ(2.6 a,b),NJ(3.3 a,b,c)	SOP(1 a)	CoGP(3) CoGP(5)
	F6TG(2c)	HC0G(K19)(P13)	QQI(SO 17)	NJ(1.1 a,b),NJ(1.2 d),NJ(2.6 a,b),NJ(3.2 a),NJ(3.3 a,b)	SOP(1 a)	CoGP(3) CoGP(5)
	F6TG(2d)	HC0G(K14)	QQI(SO 10)	NJ(1.12 a), NJ(3.5 a,b)		
3	F6TG(3a)		QQI(SO 10,12,15) QQI(FOO 20,23)	NJ(3.2 a,b,c)		
	F6TG(3b)	HC0G(K4)(K6)	QQI(SO 16) QQI(FOO 20,24)			
	F6TG(3c)		QQI(SO 10) QQI(FOO 20)	NJ(1.2 d),NJ(1.5 a,b),NJ(2.6 a,b),NJ(3.2 a,b),NJ(3.3 a,b)	SOP(1 a)	
	F6TG(3d)	HC0G(K7)(K14)(K15)	QQI (SO 10,12) QQI (FOO 20)	NJ(1.5 a,b,c,d), NJ(1.12 a,d),NJ(3.2 a,b),NJ(3.5a,b)		

	F6TG(e)		**QQI(SO 10,12,15,16) QQI(FOO 7,20,23,24,28)**	**NJ(1.5 a,b,c,d),NJ(1.11 a),NJ(1.12 a,d),NJ(3.2 a,b,c),NJ(3.3 a,c),NJ(3.5 a,b)**		

Table 6 Comparison of Aquatic Environment related units, qualifications, company SOPs and industry best practice guides from Norway, Scotland and Ireland. Full definitions of the codes used are shown in Table 7

Code	**Title**	**Award/Qual/Comp**	**Appendix**
F6TG	F6TG 11 Aquatic Environments for Aquaculture	SQA	1
HC0G	HC0G 04 Monitor the aquatic production environment for farmed fish/shellfish	NOS	2
5N5286 (FOO) & 5N5287 (SO)	5N5286 Finfish Ongrowing Operations(FOO) &5N5287 Seaweed Ongrowing(SO)	QQI	3
NJ	Section 1,2,3	Journeyman	4
SOP	Generic Scottish Aquaculture SOPs	Generic company	5
CoGP	Scottish Finfish Aquaculture	Industry Code of Good Practice	6

Table 7 The full titles and codes of each of the Aquatic Environment related units, qualifications, company SOPs and industry best practice compared in Table 6

SQA National units (Scotland)

Learning Outcome F6TG 11 Aquatic Environments for Aquaculture

1.Describe water sources suitable for aquaculture (written and/or recorded oral evidence. Closed book)

F6TG (1a) The hydrological cycle is described accurately.

F6TG (1b) The water quality characteristics relevant to aquaculture are described accurately.

2.Gather information on a local aquatic environment with aquaculture potential (written and/or recorded oral evidence and performance evidence. Open book records and performance evidence

F6TG (2a) The information abstracted from maps is accurate.

F6TG (2b) The key water parameters are measured accurately.

F6TG (2c) The measured water parameters are recorded accurately in the appropriate units.

F6TG (2d) The local aquatic flora and fauna are identified and recorded accurately using common names.

3.Evaluate the suitability of an aquatic environment for a specified aquaculture enterprise (written and/or recorded oral evidence)

(3a) The description of the topography and physical characteristics of the aquatic environment and its immediate surrounds is accurate.

(3b) The graphical representation of the seasonal variations in the condition of the aquatic environment is accurate.

(3c) The range of values for specified water characteristics is derived and recorded accurately.

(3d) The implications of the recorded flora and fauna are considered.

(3e) Produce a report on a local aquatic environment with aquaculture potential.

NOS/MA units

HC0G 04 Monitor the aquatic production environment for farmed fish/shellfish

P1 carry out work safely in line with relevant health and safety requirements

P5 carry out procedures to maintain oxygen levels within holding units

P13 provide information to maintain records of monitoring in accordance with legal and site requirements

K1 the relevant health and safety requirements associated with monitoring the aquatic production environment

K3 the environmental conditions required by the fish/shellfish being farmed and the actions that can be taken to maintain conditions within holding units

K4 why it is important to maintain environmental conditions within holding units and how changes in environmental conditions can affect fish/shellfish

K5 the equipment and methods used to sample and assess environmental conditions

K6 the relationship between water temperature and dissolved oxygen

K7 how legislation affects water usage and discharge

K14 types of commercially damaging species, why they need to be controlled and the action to take if their presence is suspected

K15 how the loss of fish/shellfish can affect the environment and farm production and how the legal implications of escapes can impact on the farm

K19 the legal and site requirements for maintaining records of monitoring the aquatic production environment

QQI (BIM; Ireland)

5N5286 Finfish Ongrowing Operations

QQI (7) Review the relevant monitoring regulations and their enforcement bodies

QQI (20) Plan a potential finfish farm to include preparation for licence application

QQI (23) Interpret charts

QQI (24) Apply the principles of meteorology

QQI (28) Plan the procedure to deploy and adjust sea cage moorings

5N5287 Seaweed Ongrowing

QQI (9) Outline the main provisions of the Health, Safety and Welfare at Work Act

QQI (10) Explore the features of a good ongrowing site and the use of seaweeds

QQI (12) Review the relevant monitoring regulations and their enforcement bodies

QQI (15) Interpret tide timetables and charts

QQI (16) Record weather conditions

QQI (17) Perform a sample for the oxygen, water temperature, salinity, water depth and visibility

Norway Journeyman (Norway) Section 1, 2 & 3

NJ (1.1) carry out work at a fish farm in line with current regulations and ethical guidelines

Learners need to:

(a)know which regulations apply to salmon production (FW & M);

(b)understand the significance and purpose of each regulation

NJ (1.2) register feed amounts, mortality, average weight, density and environmental parameters

Learners need to:

(d)maintain routine records for feed, mortality, average weight and environmental parameters

Context: Salmon and trout M&FW

NJ (1.5) observe organisms and environments and evaluate changes in relation to the species' normal appearance and behaviour

Learners need to:

(a) know which environmental parameters are measured in M&FW;

(b) understand why each environmental parameter is measured and how the data is interpreted and applied;

(c) recognise normal appearance and behaviour of aquatic organisms;

(d) understand how changes in the aquatic environment can impact on the behaviour of aquatic organisms, including farmed finfish;

Context: Behaviour of all aquatic organisms relevant to fish farming, including algae, zooplankton, epiphytes growing on cage surfaces and M&FW fish species (Salmon and Lumpfish)

NJ (1.11) plan, implement and evaluate a production schedule with numbers, growth rate, biomass, density, water and oxygen requirements and feed consumption

Learners need to:

(a)Understand how to plan production taking account of the environmental and fish production parameters influencing fish growth

Context: Marine on-growing and FW hatchery phase

NJ (1.12) elaborate on regulations that regulate the fish farming industry, and retrieve essential information related to the establishment of a new fish farm business in a specific area

Learners need to:

(a)Understand the importance of fish containment and the impact escapees can have

(d)Understand the 'route map' to a site licence, for a new fish farm business, including environmental analysis and biomass limits

Context: Marine phase only

NJ (2.6) use digital tools in production control, environmental monitoring and documentation

Learners need to:

(a)Know how to the operate digitally enabled equipment on a fish farm

(b)Know how to sample the aquatic environment, including the water column and sediments

Context: Norwegian marine cage farms, including, feed control systems, cameras, environmental monitoring, fish stock monitoring and record keeping systems.

Environmental monitoring- sechi-disc and core sampling

NJ (3.2) describe chemical and physical properties in water and elaborate on the most important environmental factors in the aquatic environment

Learners need to:

(a)Know which physical and chemical properties are relevant to fish farming and why

(b)Understand how changes in key water parameters can impact on the aquatic environment and organisms

(c)Understand how changes in key water parameters can influence the farm operation

Context: M&FW environments

NJ (3.3) carry out routine measurements of relevant environmental parameters and assess the results based on the species' environmental requirements and tolerance limits

Learners need to:

(a)know which environmental parameters are measured on a farm and why?

(b)know how selected environmental parameters are measured?

(c)understand how environmental conditions can be controlled to optimise conditions

Context: Salmon, lumpfish and rainbow trout, FW&M

NJ (3.5) identify environmental problems linked to aquaculture and discuss how they can be prevented locally and globally

Learners need to:

(a)Understand the impact aquaculture can have on the environment, including water quality sediments and aquatic flora and fauna

(b)Understand the mitigating measures fish farms can undertake to minimise environmental impact

Context: Regulation and mitigation of the environmental impact of fish farming, locally and globally, including sea lice on wild stocks, escapees, solid and soluble wastes.

Generic Aquaculture SOPs (Scotland)

SOP1 Where weather and safety considerations permit, fish farm staff must make daily inspections of all sites to minimise the risk of water quality issues compromising the health of the fish.

(a) The following parameters must be measured: Oxygen (twice daily with a minimum threshhold e.g.7mg/l), Water temperature (daily with a maximum threshhold e.g.170C), Water clarity (visibility threshhold e.g. not below 3 metres) If any of the parameters shown drop below the levels given the relevant SOP for that parameter should be used to address the situation.

Scottish Finfish Aquaculture (CoGP; Scotland)

CoGP 3 Monitoring recording and control

3. Environmental monitoring (oxygen, temperature, algae/secchi, etc.)

CoGP 5 General management procedures

5. Water quality parameters, monitoring systems and recording procedures, emergency back-up arrangements and alarms

Appendix 4 Norwegian company training manual

1. Operations Management consisting of the following description of the work operations:

Should be able to plan, lead and execute large operations on the farm.

Including:

- Mastering executive management of the operation
- Develop SJA and operation plan.
- Conduct start up meeting
- Delegation of tasks to competent personnel
- Assess Equipment requirements
- Ensuring adequate crew and competence (including externals) are available at the appropriate time
- Distribution of work tasks to those who participate in the operation
- Time Management (AML)
- Relevant Law

Have read and understand the relevant procedures and risk assessments for the specific operation.

Example of operations considered to be larger work operations are:

Sea Lice treatment operations, delivering fish, moving/sorting of fish, to receive smolt.

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

2. Handling the Sea lice tarpaulin, consisting of the following description of the work operations:

Participated and been trained in the use of full tarpaulin, and safe work practices and the use of equipment of protection around this.

Read and understood the Sea Lice treatment manual.

- Reviewed relevant risk assessments

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

3. Operation of IMM barges, consisting of the following descriptions of work operations

Have participated and received training in removing sea lice with non-medical methods, safe working practices and use of protective equipment around these methods.

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

4. Use of "orkast" (method to catch fish) and the congestion of fish, consisting of the following description of the work operations:

Have participated and been trained in the use of "Orkast" and congestion of fish. Know safe working practices and use of relevant protective equipment.

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

5. Walk around the cage, consisting of the following description of the work operations:

Should have received practical training in the implementation of walking around the cage, and read and understood the documentation "walking around the cage".

Should have gone through relevant risk assessments and manuals.

Documentation:

Confirmation of undergone internal training.

6. Raising and lowering the bottom ring, consisting of the following description of the work operations:

Shall be familiar with user manuals for different rings and nets in use at the farm, and have been given practical training in:

- raising and lowering of bottom ring

- use of proper protective equipment during the operation

- read and understand the manual for operation of nets, rings and moorings.

- reviewed relevant risk assessments

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

7. Limited scale mooring work, consisting of the following description of the work operations:

Gone through training in safe handling of moorings.

Shall know how to build-up of equipment, the usage properties and characteristics and user areas of equipment, as well as maintenance and control of the equipment to be used.

This implies:

- Work with anchoring and mooring of light objects, such as a light floating pier or similar objects
- Withdrawal and insertion of cages (connecting and inserting chicken feet's)
- Removal and assembly of buoys
- Periodic control of moorings
- Opening and closing of stretch in the frame mooring (for internal movement of cages)
- Raising of "koblingsskive" and work at these.
- Use of protective equipment and safe zones during handling of moorings in the given operations.
- Knowledge of documentation requirements embodied in "NYTEK"
- Reviewed relevant risk assessments

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

8. Large scale mooring work (internal for service boats), consisting of the following description of the work operations:

Gone through training in safe handling of moorings.

Shall know how to build-up of equipment, the usage properties and characteristics and user areas of equipment, as well as maintenance and control of the equipment to be used.

This implies:

- Understanding of mooring analyses.
- Firming of moorings.
- Changing components in mooring lines.
- Use of protective equipment and safe zones during handling of moorings in the given operations.
- Use of protective equipment and secure zones when handling moorings in the given operations.
- Knowledge of documentation requirements embodied in "NYTEK"
- Reviewed relevant risk assessments

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Documentation:

Revised internal training confirmation.

9. Sampling on fish, consisting of the following description of the work operations:

Completed training in relevant sample sampling on fish.

Completed practical training in PCR sample withdrawal.

Documentation:

Confirmation of undergone internal training.

10. Deploying and uptake of fishing net, consisting of the following description of the work operations:

Completed training in deployment and uptake of fishing nets, safe working practices and the use of protective equipment around this.

This implies:

- Reviewed relevant risk assessments and user guides

The competence should be sufficient to be able to safeguard your own and others´ personnel safety, escapes of fish during operations at the farm, as well as leading the operation.

Documentation:

Confirmation of undergone internal training.

11. To receive external boats, consisting of the following description of the work operations:

Completed training in routines around reception of external boats (feed boats, ensilage boats, diesel boats and service boats).

This implies:

- The danger of fish escaping by placing a boat up to the fishing net.
- The risk of getting an infection when receiving boats that has been on other farms.
- Checkout routines, hygiene when the boat arrives to the farm/cage.
- Safety of persons when receiving the boat to the farm/cage. Reviewed relevant risk assessments and user guides

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation.

Documentation:

Confirmation of undergone internal training.

12. Individual registration and counting sea lice, consisting of the following description of the work operations:

Completed training by supervisory veterinarian and participant in individual registration and counting of sea lice.

This implies:

- Familiar with fish welfare methodology used to catch fish and anaesthetize fish before weighing and counting.
- Known with all stages of the sea lice.
- Known with gonad control
- Reviewed relevant risk assessments and user guides

Documentation:

Upload course certificate or copy of supervisory report where training is described.

Confirmation of undergone internal training.

13. Feeding, consisting of the following description of the work operations:

Completed training in feed and feeding strategies.

This implies:

- Feeding strategies (basic principles)
- Introduction to concepts describing conditions for fish growth and understanding of the production tool "Fishtalk"

Documentation:

Confirmation of undergone internal training.

14. Handling dead fish, consisting of the following description of the work operations:

Completed training in the correct uptake of dead fish.

This implies:

- Training in categorization of dead fish and knowledge of the most known diseases and symptoms on these. Parts of this training will be done together with the supervising veterinarian at the site and through fish welfare courses.
- Reviewed relevant risk assessments

The competence should be sufficient to safeguarding your own and other personnel safety, escape of fish from the farm and fish health during the operation.

Documentation:

Confirmation of undergone internal training.

15. Technical operation and use of feeding facilities and monitoring, consisting of the following description of the work operations:

Conducted training in the fleet's feeding facilities, structure, workability/user properties and areas, operation, maintenance and control of the fleet.

This implies:

- Cleaning of feeding facilities
- Calibration of feeding facilities
- Software for feeding systems as well as the camera system on the site
- Know the system for shutdown of components for safe maintenance.

- Operator's Manual must be available, and staff shall be inserted into maintenance routines according to this manual.
- The location's flushing system for feeding pipes

Documentation:

Confirmation of internal (possibly external) training, specifying which feeding facility and surveillance training has been given.

An internal training program for technical equipment, consisting of 5 modules is offered:

1. Operation of fleet, consisting of the following description of the work operations:

Completed training in the fleet at the site and similar type of fleet's structure, workability and use areas, operation, maintenance and control of this fleet.

This implies:

- Going through the control list for carrying out controls and how to sign out these control points

Documentation:

Confirmation of internal training and completed control list for each single person shall be included.

2. Equipment specific use of boat, consisting of the following description of the work operations:

Conducted adequate training and practical training to drive and operate the site's boats. Have got training in structure, operation, use and application, as well as maintenance and control of the boats that are in use at the site. Must know the areas and surrounding in which the boats are driving and operating in. Must be familiar with and undergone the necessary training provided in paragraph 7 of the "Regulations on qualifications and certificates for seafarers".

Documentation:

Confirmation of internal training and completed control list for each single person shall be included.

3. Introductory courses "Nokk/Capstan", consisting of the following description of the work operations:

Going through before practical usage of "Nokk" under supervision.

Undergone general training in structure, operation, workability/use and application, as well as maintenance and control of “Nokk” and practical training in use of “Nokk”, and 2 working days with observation.

This implies:

- Read and understand the procedure “Capstan/Nokk and winch”
- Use the “Nokk and Capstan” at the boat
- Use of protective equipment
- Being illuminated and trained in risk zones and hazard elements using “Nokk and Capstan”. 20 hours with observations are required before using “Nokk”.

Documentation:

Confirmation of internal training. Enter the type of equipment that has been completed.

4. Practical course “Nokk and Capstan”, consisting of the following description of the work operations:

Completed before independent work with “Nokk”:

- Must have got approved the introductory course in using “Nokk” in the competence module.
- 5 working days with practical use of “Nokk” under supervision. During the start up phase there shall be done easier work related to “Nokk” as dragging dead fish.

The person who approves the course signs on the following: "The person has undergone practical training and has sufficient training to independently consider using “Nokk and/or Capstan”

Documentation:

Confirmation of internal training. Enter the type of equipment that has been completed.

5. Use of technical equipment, consisting of the following description of the work operations:

Shall have received training in structure, operation, workability/use and application, as well as maintenance and control of the equipment or similar equipment, at the site.

This includes training in the use of relevant protective equipment, and review of relevant instruction manual and practical training.

Applies to equipment that comes under requirements in paragraph 10-4 “Regulation on work performance”.

Example of equipment under the category of technical equipment:

- Truck (Equipment specific training)
- Crane and lifting equipment (equipment-specific training)
- Tipping containers
- Angle grinder (Also requires approved training in hot working environments)
- Chainsaw
- High pressure cleaner / steamer below 250 bar
- High pressure cleaner over 250 bar
- Column drilling machine
- Machine for pressing bags
- Battery charger

Documentation:

Confirmation of internal training. Enter the type of equipment that has been completed.

An internal training program for knowledge of standards, consisting of 3 modules is offered:

1. Global gap, consisting of the following description of the work operations:

Training according to requirement in the standard.

Documentation:

Confirmation of undergoing internal training.

2. SalMar standard, consisting of the following description of the work operations:

Vision, postulates and Salmar school.

Documentation:

Confirmation of undergoing internal training.

3. ASC, consisting of the following description of the work operations:

Training according to requirement in the standard.

Documentation:

Confirmation of undergoing internal training.

The following external training courses are offered:

1. Course in preventing escapes
2. Fish welfare course biology
3. Defibrillator course
4. 2-day long safety course for farmers
5. Basic safety course “STCW imo 50” or higher

6. HES course for leaders
7. Handling chemicals and medicine
8. Safety and hazards in conjunction with gas under pressure (Oxygen batteries) and use of these
9. Safety Representative Course (for safety representative, 40hours)

Detailed description of the course content is not included in this version.

The following certificates are offered:

1. Driving licence for cars – Class B (ordinary car)
2. Certificate for boats
3. Licence to drive a boat (higher class than in point 2.)
4. Costal skipper certificate (Class D5)
5. ROC-VHF course (Valid for 5 years)
6. VHF course
7. Electrical security for instructed personnel
8. Hunting course (National required certificate)
9. Crane and stropping course – a documented courses
10. Crane and course – G20/G8
11. Course in applying a lift
12. Course in stropping – G11
13. Truck
14. Warm working operations

Two types of national qualifications approved:

1. Fagbrev (Journeymann certificate)
2. Higher degrees from university