

## Output 4 - Unitization of aquaculture curriculum VET courses

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### TASK 1: Comparison of Norwegian and Scottish Aquaculture VET systems

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## Table of contents

Summary .....	4
Comparison of the Norwegian and Scottish Aquaculture VET systems .....	5
Comparative analysis of the Norwegian Aquaculture National Qualification (“fagbrev”) .....	8
APPENDIX 1: Comparative analysis of Norwegian NQ competence aims .....	11
Section1: Operation and production.....	11
Section 2: Constructions and technology .....	14
Section 3: Aquaculture and the environment (10 goals).....	15
Appendix 2: Scottish Aquaculture MA Analysis - Level 2 (EQF 4).....	18

Task 1: Investigate and describe how the Scottish Quality Authority levels within aquaculture VET in Scotland may be compared to the levels within aquaculture VET in Norway. For husbandry staff, as an example, it is foreseen that there may be a gap of 2-3 levels up to the Norwegian aquaculture VET levels. These gaps arise as a consequence of how the aquaculture VET systems are set up and organised

## Summary

On analysis, the Norwegian NQ developed for husbandry level operatives was found to have a wide range of EQF levels within its 'competence aims'. (See Appendix 1). Some aims are very supervisory or managerial in nature, as compared with the equivalent Scottish MA at operative level 2. Many are general and in need of interpretation and elaboration by the Norwegian VET teachers within each region. The true EQF level based on the analysis ranges from EQF 4-7. Conversely, the Scottish MA Level 2 which is based on the Scottish industry National Occupational Standard (NOS) for husbandry operatives is set at a EQF 4 and do not deviate significantly from that level. The MA reflects the NOS and is prescribed nationally and its assessment (as opposed to delivery) is not intended to be open to interpretation.

Considering that the aquaculture systems in both countries, are predominantly salmonid and Atlantic salmon based, deploying similar technology, the difference in EQF levels when comparing the two qualifications targeting husbandry operative, is at first sight, surprising. There are several possible reasons offered for this disparity between the EQF levels of the Norwegian and Scottish NQs:

- The salmon husbandry role in Norway is more demanding than in Scotland.
- The absence of a Norwegian Higher VET programme to date has led the VET system to cater for occupational levels above the operative level.
- The Scottish NOS and therefore MA are out of date in comparison to the Norwegian NQ

The group drew no firm conclusion as to which of these explanations were the most likely. However, the analysis is being used to help the Norwegian and Icelandic partners to Unitise their programme, taking care to level their NQs competences (aims) carefully.

This has helped partners to think more deeply about how to formulate more effective and appropriate learning outcomes that can inform programme design and guide the delivery and assessment of NQ level programmes targeting mature learners from industry.

## Comparison of the Norwegian and Scottish Aquaculture VET systems

The Norwegian and Scottish VET systems governing NQs in aquaculture in each country differ considerably and provide a different regulatory environment for the aquaculture VET providers in each country to comply with, despite both describing themselves as ‘competence based’.

The SQA system is unitised, and continual assessment of nationally prescribed learning outcomes with no final examination is the norm. Whereas, the Norwegian system is more syllabus based and includes a final theory and practical examinations, as well as some continual assessment by the schools which can influence the learners’ results.

Without doubt, preparing young school-based learners and mature-learners from industry for their final exam is the main underlying driver and priority of the delivery system in Norway.

By comparison, the current Aquaculture NQ in Scotland (The Modern Apprenticeship in Aquaculture) relies entirely on ‘evidence of competence’ gathered in the workplace and held within a ‘portfolio of evidence’. There is no requirement for group work or college attendance and learning is individualised from the outset, by virtue of the choice offered within the mandatory and optional unit structure within the awards. However, customisation to suit the learner, their employer, and opportunities available on their farm, also limits the subject content and range of competences gained, which could present issues when they change their employment and move farms.

The main similarities and differences between the two NQ systems in Norway and Scotland are summarised in the table below.

<b>Aquaculture VET Characteristics</b>	Norway	Scotland
Established National Qualification (NQ) in Aquaculture	Yes, “fagbrev i akvakultur”, awarded by the Ministry of education	Yes, the Modern Apprenticeship (MA) in Aquaculture, awarded by the Scottish Qualifications Authority (SQA)
EQF levelled Aquaculture NQ	Yes, NQ claimed to be set at EQF level 5 for the operatives. (In reality, the analysis of the Norwegian NQ reveals a wide range of levels (see Appendix 1).	Yes, several levels for MA from Operative, Supervisory and Managerial (EQF 3-6)
NQ containing National Standards set by industry	Yes, industry representatives develop the National Exam questions in the theoretical exam and industry representatives are directly involved to assess the practical exam for young learners and mature learners.	Yes, developed by Lantra Sector Skills Council Aquaculture Committee – National Occupational Standards (NOS) and incorporated in MA Learning Outcomes
Fixed syllabus NQ	Yes, all aspects of the syllabus must be taught and assessed for fresh-water hatchery and marine on-growing. The emphasis is on the	No, there is a flexible core and options NQ structure, allowing for customisation, so as the MA can be achieved by any employee, whether

	salmon and trout farming relevant to Norwegian production.	working on a freshwater, marine, finfish or shellfish farm
Learning Outcomes (LO) based NQ	Yes, but broadly defined LOs that amount to a 3-page summary syllabus, presented in three sections and adjusted to the regional needs at local level by each VET school in close cooperation with the farming companies in this region.	Yes, very detailed LOs, with performance criteria and assessment evidence requirements prescribed to a fine degree of detail and nationally standardised by the SQA QA system
Continuous assessment	Yes, there is a lot of continuous assessment for young learners from school, but <b>not</b> for mature learners from industry with 5 years-experience.	Yes, for all learners based on portfolio of evidence to meet set standards. There is 100% reliance on continuous assessment of performance and underpinning knowledge.
Final examination	Yes, there is a final theory and practical exam for both young learners and mature learners. The receive their NQ after passing both. They evidence their practical competence in the 2 day long practical exam. .	No, although the MA system does not prohibit the inclusion of a final examination within an assessment strategy. This option is not applied by providers currently who rely on 'portfolios of assessment evidence'.
Work based learning delivery system	It is integrated into the training practices. Young learners access farms local to their college several days a week as well as in longer periods during a period of 2 years, for training and a lot of their learning occurs in a real place of work under supervision. The <b>mature learners learn from their employment</b> experience.	Yes, a total reliance on work-based learning and assessment on the job whilst in employment under contract and often supported by instruction within company training schemes.
Work based assessment of performance	Yes, for young learners, through continuous assessment and the apprenticeship system, but not for mature learners who are deemed competent following 5-years-experience.	Yes, with a strong reliance on formal 'witness testimony' processes on farm under the direction of a qualified assessor very familiar with the MA standards. The evidence is held in a carefully managed portfolio.
College classroom-based delivery	Yes, with a <b>lot of group work</b> as the norm for both the young and mature learners in classroom, laboratory settings and out at the cages.	No class-room attendance for any learners and remote group learning activity is not currently facilitated.
Individual Learning Plans	Generally, no, although there is some customisation of assessment	The MA is based on a system of <b>individualised learning</b> and

	approaches encouraged to accommodate the individual needs of young learners. This does not apply to the mature learners.	assessment planning, according to learner progress, farm needs and training opportunities.
Application of on-line learning and learning technologies	The young students apply VLEs in all their courses, including aquaculture. There is limited usage of on-line learning applications for the mature learners. What dominates are reliance on class-room based delivery in combination with frequent practice at the farms, for the theory-based learning.	Some reliance on on-line learning by some VET providers, but most rely on informal learning and employer instruction, as the portfolio assessment process reflects farm practices.

**Table 1:** Summary comparison of Aquaculture VET systems in Norway and Scotland (UK)

The Norwegian NQ in Aquaculture is delivered by the public sector, but with vitally important assistance from local fish farming companies which provides the VET schools access to commercial farm sites, technology and training opportunities daily. Regular communication between farms and their local VET Schools has led to a strong working partnership and industry confidence in the public sector NQ provision.

In Scotland, public sector VET providers (generally colleges) can apply for a contract from Skills Development Scotland (SDS) to deliver the MA in Aquaculture, as well as private sector training providers, within a competitive marketplace.

# Comparative analysis of the Norwegian Aquaculture National Qualification (“fagbrev”)

## 2.1 Norwegian NQ

The Norwegian Aquaculture NQ curriculum contains a series of ‘goals’ which are defined in broad terms and interpreted by teaching staff in each of the country’s 14 VET schools in consultation with industry. This enables each school to place the correct emphasis within the delivery of the curriculum and specific learning outcomes to suit their local employers. All component parts of the curriculum are compulsory and subject to final national examination, including a theory paper for all learners (young and experienced) and a practical examination for young learners with no prior experience.

The Norwegian NQ - Journeyman Certificate in Aquaculture is composed of three sections, each with stated competence aims (goals):

- Operation and Production (17 goals)
- Construction and Technology (9 goals)
- Aquaculture and the Environment (10 goals)

The Norwegian Qualification Framework and definitions has been examined by a project working party to analyse its structure and content. The aim was to develop a shared understanding of the learning outcomes within each of the stated goals and EQF levels, with reference to the Scottish Modern Apprenticeship for comparison.

### **See Appendix 1 - Comparative analysis of Norwegian NQ competence aims**

## 1.2 Scottish Modern Apprenticeship in Aquaculture

The Scottish Modern Apprenticeship in Aquaculture is a work-based qualification available at three levels

- |                                  |                    |
|----------------------------------|--------------------|
| • Level 2 Operative              | SCQF 5 and EQF 4   |
| • Level 3 Supervisory Management | SCQF 6/7 and EQF 5 |
| • Level 4 Management             | SCQF 8/9 and EQF 7 |

At each level, the Modern Apprenticeship award structure (composition of Units) includes mandatory and optional Units offering a large choice to ensure it can be achieved by any employee on any finfish or shellfish farm.

The level 2 Modern Apprenticeship referred to above is the closest equivalent award to the Norwegian NQ and has been subjected to an in-depth analysis of its knowledge requirement. The tabulation in Appendix 2 provides a salmon farming interpretation of generic units which can be used for any farmed species of finfish or shellfish, making the award more comparable to the Norwegian NQ, which is delivered almost entirely in the context of salmon farming.

### **See Appendix 2 – Modern Apprenticeship in Aquaculture**

The MA analysis concluded that each unit is comprehensive and prescriptive. However, some of the knowledge statements are short, specific, and unambiguous, whereas others are longer, broader in scope and much more open to interpretations by different teachers/assessors.



Although the Scottish VET system is unitised, prescriptive and generally believed to be well-regulated, some Units and knowledge statements require attention during the next MA Aquaculture revision to ensure the standards are tightly defined and can be applied consistently by different Scottish providers. This is an important Scottish Qualifications Authority (SQA) tenet, as poorly written Unit 'knowledge statements can lead to standardisation problems to the detriment of learners and the industry.

### **3 Analysis and conclusions**

The analysis has two aspects, the micro analysis of the EQF levels with the Norwegian NQ and a macro level comparison with the Scottish level 2 (EQF 4) MA in Aquaculture.

#### **3.1 The Micro level analysis**

The detailed analysis of the Norwegian NQ focussed on the content of the aim statements and the active verbs which are indicative of the EQF level taken literally as written. The analysis commentary provided used the Scottish MA level 2 as a benchmark for comparative purposes only. (See Appendix1)

Note: Appendix 1 has used coloured font highlights to notify the need for scope statements and Aims which partially or entirely exceed the operative level (using the MA level 2 Aquaculture as a comparative benchmark)

If the opportunity arises to collaborate with the Aquaculture Higher VET developments now underway in Norway, this work can be used to ensure an appropriate differentiation of levels between VET and higher VET and more effective progression for learners moving from Aquaculture VET to Higher VET in the future.

The issues detailed in Appendix 1 for each aim statement can be categorised as follows:

- a) Aims that are too broad and lack scope statements, leaving them, wide open to different interpretation by different teachers. The lack of scope statements is highlighted in blue font in Appendix 1
- b) Aims which have more than one level signified by several verbs within the statement and need to be broken up into several smaller aims.
- c) Aims which reflect high level managerial competencies and/or knowledge that are unlikely to be relevant to the operative role and appear more appropriate to Higher VET. Aims which partially or entirely exceed the operative level, using the Scottish MA as a benchmark are highlighted in Appendix 1.

#### **3.2 Macro level comparison**

A comparison between the Norwegian and Scottish Aquaculture NQs analysis revealed that the EQF level of the Scottish MA level 2 kept consistently close to EQF level 4, whereas the level of the Norwegian NQ ranged from EQF 4-7.

Several possible explanations for this variance were offered:

- a) The fish husbandry role within the Norwegian industry is more demanding and requires a higher level of competence, knowledge and understanding than their counterparts in Scotland.

There has been evidence from previous research (BlueEDU Sector Skills) to demonstrate that the team culture in Norway does differ compared to Scotland, with a higher expectation placed on husbandry level staff to be able to cover the duties of the supervisory level if required in the event of their absence.

- b) To date, there has been no Higher VET programme in Norway, and therefore the NQ level has been developed to serve the needs of both the husbandry and supervisory level.

Following the introduction of Aquaculture Higher VET, the NQ may need to be revised as there could be a danger of too much overlap between the VET and Higher VET programmes to the detriment of career progression via this pathway.

- c) The Scottish NOS and therefore MA level 2, may be out of date and in need of upgrading to better reflect advances in techniques and technology that impact on the competences required by today's salmon husbandry operatives

## APPENDIX 1: Comparative analysis of Norwegian NQ competence aims

### Section1: Operation and production

Program area description	Competence aims: The aims of the training are to enable the apprentice to	Comparative analysis of the Norwegian NQ in Aquaculture
<p>The programme subject covers work processes and vocational practice related to the operation and maintenance of an aquaculture facility. It involves hygiene, health, environment and safety, equipment selection, economics and the farmed organisms' optimal weight and welfare. The programme subject deals with the use of freshwater and seawater for growing fish, algae and animals in different stages of life, annual cycles and environments. It also deals with the quality assurance of work processes and products. Regulations and framework conditions that regulate the industry nationally and internationally are included in this programme subject.</p>	<p>1.1 carry out work at a fish farm in line with current regulations and ethical guidelines</p>	<p>Operational EQF level 4</p> <p>A very broad aim. The terms work and regulations need a scope statement</p>
	<p>1.2 register feed amounts, mortality, average weight, density and environmental parameters</p>	<p>Operational EQF level 4</p> <p>Register presumably means record? On this assumption the aim is more specific as it does have an embedded scope statement</p>
	<p>1.3 calculate feed amounts and feed farmed organisms</p>	<p>Operational and supervisory EQF level 5</p> <p>Farmed organisms need a scope statement</p>
	<p>1.4 explain the importance of optimal feeding</p>	<p>Supervisory/Management level EQF level 5/7</p> <p>A very 'open ended aim'. Could be improved with a qualifying statement....." with reference to a,b and c"</p> <p>This is a large and centrally important concept to the design and management of a feeding regime and is not something operatives would need to be able to explain in Scotland</p>

	1.5 observe organisms and environments and evaluate changes in relation to the species' normal appearance and behaviour	Operational EQF level 4  Very broad aim: The terms in blue font need a scope statement
	1.6 plan, implement, evaluate and document the cleaning and maintenance of boats, engines and equipment in the aquaculture industry	Operational EQF Level 4 and supervisory EQF level 5 Planning and evaluation are competencies above Scottish operative level
	1.7 carry out sorting, weighing and transport of farmed organisms	Operational EQF level 4  The terms in blue font need a scope statement
	1.8 assess risk in work operations and implement measures to reduce the risk of injury or damage to personnel, farmed organisms and equipment	Supervisory EQF level 5 Assessing risk and implementing measures are competencies above Scottish operative level
	1.9 prepare routines for safeguarding the quality of processes and products in the fish farming industry	Supervisory EQF level 5 Preparing routines are competencies above Scottish operative level and would be undertaken by supervisors. Operatives would comply with the routines.
	1.10 carry out work at a fish farm in accordance with relevant environment, health and safety regulations	Operational EQF level 4  The terms in blue font need a scope statement
	1.11 plan, implement and evaluate a production schedule with numbers, growth rate, biomass, density, water	Supervisory/ Management EQF level 5/7 Planning, evaluation and assessing growth rates and oxygen requirements are competencies above Scottish operative level.

	and oxygen requirements and feed consumption	This aim has a very wide scope and may benefit from being be disaggregated
	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	Management EQF level 7 Addressing regulations for farm establishment is above Scottish operative level and would be a management level responsibility
	1.13 describe the organization of an aquaculture company, starting with type of organization and an organizational chart	Management EQF level 7 Organisational structures do not concern the Scottish operative level and are a supervisory/management consideration.
	1.14 explain the difference between a budget and a financial statement for operation and investment in an aquaculture business, and highlight any disparities and the possible reasons for these disparities	Management EQF level 7 This entire aim is a management level consideration within the Scottish system, and of no concern to operatives.
	1.15 explain connections between input factors and finance in an aquaculture firm, with particular emphasis on the significance of their own work	Supervisory/Management EQF level 5/7 This entire aim is a supervisory/management level consideration within the Scottish system, and of limited concern to operatives, beyond a superficial awareness.
	1.16 describe how the market for fish-farmed products has changed, and discuss possible future prospects	Supervisory/ Management EQF level 5/7 This entire aim is a supervisory/management level consideration within the Scottish system. The final element is managerial level thinking.

	1.17 give examples of the market's demand for quality and choice of fish-farmed products	Operational EQF level 4  This could be tackled at operative level but is not part of EQF level 3 requirements in Scotland. The terms in blue font need a scope statement
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## Section 2: Constructions and technology

Program area description	Competence aims: The aims of the training are to enable the apprentice to	Specific topics for (concrete) questions
The programme subject covers the construction, mode of operation and operation of facilities, tools and equipment. This includes the use and maintenance of equipment, tools, means of access, and instruments related to work at a fish farm. It also deals with knowledge of materials and the security and maintenance of facilities. It involves the use of trucks, cranes and limited radiotelephony.	2.1 describe the construction and function of facilities for egg, brood, table fish, algae and shellfish production	Operational EQF level 4  Not part of EQF level 3 requirements in Scotland. It has a very wide scope already, but those items in blue font need further species scope statements.
	2.2. use the correct tools and equipment based on the situation, the equipment's construction and mode of operation	Operational EQF level 4  The terms in blue font need a scope statement
	2.3 clean, inspect and maintain a facility and equipment based on the materials' properties and application.	Operational EQF level 4  The terms in blue font need a scope statement
	2.4 choose ropes and chains according to purpose and connect them together using appropriate methods	Operational EQF level 4  The terms in blue font need a scope statement
	2.5 operate modern fish-farm boats in line with relevant regulations	Operational EQF level 4

		The terms in blue font need a scope statement
	2.6 use digital tools in production control, environmental monitoring, and documentation	Supervisory/Management EQF level 5/7 Production control is a supervisory/management level consideration within the Scottish system.
	2.7 use a truck in accordance with relevant regulations	Not included in the course
	2.8 carry out stropping, hooking, rigging and signalling in accordance with relevant regulations with the use of a quayside crane or boat derrick	Operational EQF level 4  Operational, clear, concise and with a suitable scope
	2.9 use modern radio communication equipment and follow emergency procedures	Operational EQF level 4  Operational, clear, concise and with a suitable scope

### Section 3: Aquaculture and the environment (10 goals)

Program area description	Competence aims: The aims of the training are to enable the apprentice to	Specific topics for (concrete) questions
The programme subject covers actual farmed species and the surrounding environment. It also involves the measurement and	3.1 plan, implement, document and evaluate optimal operations based on the biology of the farmed species	Supervisory/Management EQF level 5/7 Planning and evaluating is a supervisory/management level competence within the Scottish system.

<p>evaluation of chemical and physical environmental parameters, the fish's health and practice hygiene work. Feed and feeding of farmed organisms and species-specific dietary requirements are central elements in the programme subject. It also deals with ecology and the mutual effect between the fish farming facility and the environment.</p>		<p>This aim is too broad to be very meaningful and needs to be disaggregated and elaborated.</p>
	<p>3.2 describe chemical and physical properties in water and elaborate on the most important environmental factors in the aquatic environment</p>	<p>Operational EQF Level 4/Supervisory EQF level 5</p> <p>To be able to elaborate on important environmental factors is a supervisory level competence within the Scottish system.</p> <p>The terms in blue font need a scope statement</p>
	<p>3.3 carry out routine measurements of relevant environmental parameters and assess the results based on the species' environmental requirements and tolerance limits</p>	<p>Operational EQF level 4/Supervisory EQF level 5</p> <p>To be able to elaborate on important environmental factors is a supervisory level competence within the Scottish system.</p> <p>The terms in blue font need a scope statement</p>
	<p>3.4 carry out work in line with relevant regulations for preventive health work, animal welfare and hygiene</p>	<p>Operational EQF level 4</p> <p>Poorly written, but if interpreted, it appears to be a horizontal theme that must always be applied by operatives, which is valid and also covered in the Scottish system at operative level</p>
	<p>3.5 identify environmental problems linked to aquaculture and discuss how they can be prevented locally and globally</p>	<p>Operational EQF level 4 and Management EQF level 7</p> <p>Awareness of environmental problems may be valid at operative level in the Scottish system. However, to be able to discuss solutions would be considered managerial.</p>
	<p>3.6 propose damage limitation measures for an incident at a fish farm</p>	<p>Supervisory/Management EQF level 5/7</p> <p>Proposing how to address containment is a supervisory/management level responsibility within the Scottish system.</p>
	<p>3.7 recognise normal behaviour and appearance in fish farm organisms</p>	<p>Operational EQF level 4 and Supervisory EQF level 5</p>



	and elaborate on common diseases and parasites	<p>The elaboration would not be required at operative level within the Scottish system.</p> <p>The terms in blue font need a scope statement</p>
	3.8 handle and use chemicals correctly in accordance with information in an EHS data sheet	<p>Operational EQF level 4</p> <p>The terms in blue font need a scope statement</p>
	3.9 elaborate on breeding targets for actual fish-farm organisms	<p>Supervision/Management EQF level 5/7</p> <p>The elaboration would not be required at operative level within the Scottish system and operatives would not be dealing with targets but conducting operations. Poorly written aim that lacks a scope statement and should be reviewed.</p>
	3.10 discuss how an aquaculture business can be run in co-existence with other commercial interests, preservation and leisure activities	<p>Management EQF level 7</p> <p>To discuss is not a suitable operative level competence within the Scottish system. This is a chief executive and governance issue.</p>

## Appendix 2: Scottish Aquaculture MA Analysis - Level 2 (EQF 4)

<b>Monitor the aquatic production environment for farmed fish/shellfish</b>			
<b>Aqua 12</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with monitoring the aquatic production environment	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	how to inspect and test holding units	Procedural knowledge of cage operations - inspection	Cage farming of salmon including containment
K3	the environmental conditions required by the fish/shellfish being farmed and the actions that can be taken to maintain conditions within holding units	Factual knowledge of salmon environmental requirements and control of the rearing environment	Salmon biology
K4	why it is important to maintain environmental conditions within holding units and how changes in environmental conditions can affect fish/shellfish	Understanding the interaction between salmon and its aquatic environment	
K5	the equipment and methods used to sample and assess environmental conditions	Factual knowledge of equipment and procedure for use	Farm water monitoring routines
K6	the relationship between water temperature and dissolved oxygen	Knowledge and understanding of the dynamics of the temperature DO relationship	Anticipation of changing environmental conditions and impact on operations
K7	how legislation affects water usage and discharge	Knowledge and understanding	Licensing abstraction and discharge
K8	why waste must be disposed of according to site procedures	Knowledge and Understanding	Disposal of common organic and inorganic farm waste

K9	how the design and construction of holding units and handling equipment supports containment	Knowledge and understanding	Containment
K10	potential causes of stock escapes and the actions to follow if an escape is suspected or identified	Knowledge	
K11	common pests and predators and how they are likely to affect farm stock	Knowledge and understanding	Predator ID, behaviour and deterrence/controls
K12	signs that can indicate potential predator activity	Knowledge	
K13	relevant legal pest and predator preventative measures and devices	Knowledge	
K14	types of commercially damaging species, why they need to be controlled and the action to take if their presence is suspected	Knowledge and understanding	What examples are there in the context of salmon cage farming? Jelly fish may be?
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	Knowledge and understanding	Containment
K16	emergency procedures and why they must be followed when dealing with an incident	Knowledge and understanding	<b>Site specific knowledge</b>
K17	the site back-up systems, including when and how they are used to maintain environmental conditions and deal with emergencies	Knowledge and understanding	How is this interpreted in the context of a cage farm?
K18	site procedures for maintaining effective hygiene and biosecurity	Knowledge	
K19	the legal and site requirements for maintaining records of monitoring the aquatic production environment	Knowledge	

<b>Monitor fish/shellfish health and welfare</b>			
<b>Aqua 13</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with monitoring the health and welfare of fish/shellfish	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the anatomy of a healthy fish/shellfish	Knowledge	Salmon biology
K3	welfare requirements for fish/shellfish and how these are maintained within holding units	Knowledge	Legislative requirements and codes of practice
K4	the signs that indicate stress or disorder in fish/shellfish	Knowledge	Salmon health
K5	why accurate mortality records are essential to the management of a fish/shellfish farm	Knowledge and understanding	
K6	how variations in mortality can be used to indicate the condition of farm stock	Knowledge	
K7	how to recognise common parasites including their different life cycles	Knowledge	
K8	how to recognise common diseases	Knowledge	

K9	site procedures for maintaining effective hygiene and biosecurity	Knowledge	<b>Site specific knowledge</b>
K10	the legal and site requirements for maintaining records of the health and welfare of fish/shellfish	Knowledge	<b>Site specific knowledge</b> (related to legal)

<b>Prepare and gather live fish/shellfish</b>			
<b>Aqua 3</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with gathering live fish/shellfish	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	why it is important to modify gathering processes to reflect changes in environmental conditions	Knowledge and understanding	Pre harvest, pre- grading, sampling (non-passive), moving stock, changing nets (sometimes)
K3	why it is important to prepare equipment correctly before gathering live fish/shellfish	Knowledge and understanding	Equipment operation and maintenance. (nets, fish pumps, bio scanners)
K4	when and how to gather fish/shellfish to minimise stress levels during the gathering process, and why this is important	Knowledge and understanding	Production cycle determining fish movement, crowding and capture. Observation of fish behaviour
K5	the importance of monitoring the health and welfare of fish/shellfish during gathering	Knowledge and understanding	Fish biology and aquatic environment
K6	signs that indicate stress or disorder in fish/shellfish	Knowledge	Health

K7	why and how fish/shellfish are conditioned before movement and handling	Knowledge and understanding	<b>Site specific knowledge</b> (and generic salmon farming knowledge)
K8	why it is important to monitor environmental conditions during gathering	Knowledge and understanding	Fish biology and aquatic environment
K9	the potential impact of adverse environmental conditions on gathering	Knowledge and understanding	
K10	the equipment and methods used to gather live fish/shellfish on site	Knowledge	
K11	the site procedure for maintaining hygiene and bio-security	Knowledge	<b>Site specific knowledge</b>
K12	how to deal with factors that can disrupt the gathering process within the limits of your own authority.	Knowledge and understanding	<b>Site specific knowledge</b>

<b>Work safely in an aquatic environment</b>			
<b>Aqua 37</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the health and safety responsibilities of employer and employees	Knowledge	UK legislation for H&S
K2	common hazards associated with working in an aquatic environment	Knowledge	Water and land based hazards associated with cage farms
K3	when risk assessments should be conducted, including the role of dynamic risk assessment	Knowledge and understanding	<b>Company policy</b> (Linked to legislative requirement)

K4	how hazards and risks relevant to the work site are documented	Knowledge	Recording procedure ( <b>Site or company specific</b> )
K5	the principles of accident and incident prevention and reporting	Knowledge	UK legislation for H&S
K6	health and safety legislation and organisational policies and procedures	Knowledge	<b>Company policy</b> (Linked to legislative requirement)
K7	the importance of protective equipment in maintaining site safety	Knowledge	
K8	the use and correct application of protective equipment	Knowledge	
K9	the risks associated with weather and environmental conditions	Knowledge	Water and land based hazards associated with cage farms
K10	personal coldwater survival techniques	Knowledge	Personal operator safety (water)
K11	safe lifting and manual handling techniques and their importance in avoiding injury	Knowledge and understanding	Personal operator safety (land)
K12	why permissions are required for equipment usage	Knowledge and understanding	
K13	the importance of equipment maintenance	Knowledge and understanding	
K14	the communication devices that are required at the work site	Knowledge	

K15	site emergency plans	Knowledge	Site specific knowledge
K16	the dangers associated with lone working and how they can be minimised	Knowledge and understanding	
K17	the hazards associated with the handling of bottled gases	Knowledge	Personal operator safety (handling dangerous substances)

<b>Prepare holding units to receive fish</b>			
<b>Aqua 1</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with the preparation of holding units	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the environmental conditions (water temperature, quality, and quantity) required by the fish species being farmed	Knowledge	Fish biology, environmental requirements, fish tolerance and production plan (including biomass/densities)
K3	how adverse environmental conditions can affect the preparation of holding units	Knowledge	The effect of heavy weather and tidal constraints on cage farm operations
K4	the importance of ensuring the security and integrity of holding units	Knowledge and understanding	Containment (Links directly with Aqua 12 knowledge)



K5)	common pests and predators and the impact of their presence on farm stock	Knowledge and understanding	Predator ID, behaviour and deterrence/controls
K6	the relevant legal pest and predator preventative measures and devices	Knowledge	
K7	the importance of hygiene and bio-security for farmed fish		Generic biosecurity knowledge preceding A13 K9
K8	the different types of holding units used		Difference cages (Scope could be extended to land based Units?)
K9	the importance of measuring the carrying capacity of the holding units in order to ensure that the welfare requirements of the fish to be stocked are met		Volume, stock density and water/oxygen supply
K10	how the carrying capacity of holding units is calculated		
K11	how production plans control the stocking process		Market driven production planning and cycles
K12	the different types of feeding systems used in holding units		Cage feeding systems available commercially (Scope could be extended to land based systems)

<b>Carry out routine maintenance and repairs on aquaculture facilities</b>			
<b>Aqua 11</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>

K1	the relevant health and safety requirements associated with maintenance and repair of aquaculture facilities	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the importance of routine maintenance and repair to aquaculture facilities	Knowledge and understanding	Materials degradation, cause, and remediation. Farm vulnerabilities
K3	what a maintenance schedule is and why it important	Knowledge and understanding	Manufacturers equipment schedules.
K4	the signs that indicate the need for maintenance and repair	Knowledge	Land based infrastructure, water-based cage infrastructure. Equipment
K5	the importance of assessing risks before commencing work		Principles of and reasons for risk assessment. Precedes A37 K3)
K6	why it is important to minimise environmental impact during routine maintenance and repair activities	Knowledge and understanding	
K7	the difficulties that may occur and how these should be dealt with	Knowledge and understanding	<b>Site specific knowledge</b>
K8	the importance of disposing of waste according to site waste management procedures	Knowledge and understanding	
K9	the importance of biosecurity	Knowledge and understanding	
K10	the equipment, methods and expertise used to maintain and repair aquaculture facilities	Knowledge	<b>Site specific knowledge</b>

K11	the legal and site requirements for maintaining records of maintenance and repair	Knowledge	.... Related to legal requirements
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<b>Prepare and treat health problems in fish</b>			Whole Unit in the context of sea lice
<b>Aqua 14</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements when treating health problems in fish	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the hazards associated with treatments and the precautions that are used to control them		Handling, storage and administration of chemicals
K3	how fish are conditioned ready for treatment		Starvation regimes
K4	how husbandry risk assessments are used to ensure successful treatments and maintain fish welfare		husbandry risk assessments?
K5	the equipment and methods used to treat fish	Knowledge	Methods and equipment for each disease treatment in scope
K6	how to prepare the equipment used to treat fish	Knowledge	Preparation procedures for all equipment in scope
K7	the importance of fully preparing fish before administering treatments	Knowledge and understanding	Pre -disease treatment procedures for all treatment scenarios in scope
K8	how to identify when fish are not fully prepared and ready for treatment	Knowledge and understanding	

K9	why it is important to prepare treatment according to legal requirements	Knowledge and understanding	Legislative requirements and welfare codes
K10	how dosages for treatments are calculated	Knowledge	Disease dose calculations according to FHP
K11	why it is important to administer treatment according to veterinary instructions and the requirements of the site Fish Health Plan	Knowledge and understanding	Disease treatment procedure for all treatment scenarios in scope
K12	why it is important to control treatments to protect other stock and the environment	Knowledge and understanding	
K13	why treated fish need to be isolated and controlled	Knowledge and understanding	
K14	how to recognise signs of stress during treatment	Knowledge	
K15	the emergency actions to take in response to any adverse effects caused by treatments	Knowledge	
K16	the purpose of withdrawal periods and how to calculate withdrawal periods	Knowledge	
K17	why it is important to maintain accurate records of treatments administered to fish	Knowledge and understanding	
K18	the importance of monitoring and evaluating treated fish	Knowledge and understanding	

K19	site procedures for the disposal of chemicals and treatments	<b>Site specific knowledge</b>	Waste disposal regulations and H&S
K20	the legal and site requirements for maintaining records of treatments		

<b>Prepare for the transport of live fish/shellfish</b>			
<b>Aqua 19</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with the transport of live fish	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	legislation controlling the transport of live fish/shellfish	Knowledge	Legislation and welfare codes of practice
K3	methods used to transport live fish/shellfish	Knowledge	Methods for live transportation of salmon, well boat
K4	why only healthy fish/shellfish should be transported and when they need to be conditioned	Knowledge and understanding	Salmon biology and health
K5	the behaviour that indicates when fish/shellfish are stressed or have a disorder	Knowledge	
K6	how to establish the environmental conditions required by fish/shellfish	Knowledge	Salmon biology, tolerance, and optimal conditions

K7	the importance of hygiene and bio-security when transporting live fish/shellfish	Knowledge and understanding	Biosecurity and implementation of company/site biosecurity procedures
K8	the precautions that are followed to reduce the danger of transporting non-target species with live fish/shellfish	Knowledge	
K9	the equipment needed and how to prepare it	Knowledge	Procedure recommended by manufacturer for equipment in scope
K10	the importance of minimising the risk of escapes	Knowledge and understanding	Containment
K11	the need to carry out a husbandry risk assessment and how this controls the transport of live fish/shellfish		Husbandry risk assessment?
K12	the legal and site requirements for maintaining records of transport		<b>Site specific knowledge</b> in response to legislation

<b>Stock fish/shellfish into holding units</b>			
<b>Aqua 2</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with the stocking of holding units	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	how to maintain the health and welfare of fish/shellfish during the stocking process	Knowledge	Salmon biology, equipment operation and site procedure

K3	how adverse environmental conditions (weather, water conditions) can affect the stocking operation	Knowledge	Site procedures and contingency
K4	the importance of stocking density in maintaining health and welfare standards	Knowledge and understanding	Salmon biology, equipment operation and site procedure
K5	causes of fish/shellfish loss during stocking activities and how this can affect the environment	Knowledge	Containment
K6	how the legal implications of fish/shellfish loss can impact on the farm	Knowledge and understanding	
K7	how legal requirements control the movement and receipt of fish/shellfish	Knowledge and understanding	Legislative controls and codes of conduct
K8	the importance of observing newly stocked fish/shellfish for signs that indicate stress or disorder	Knowledge and understanding	Salmon biology and health
K9	the importance of observing and recording mortality rates in fish/shellfish	Knowledge and understanding	Salmon Health
K10	the site standard operating procedures that control the stocking process	Knowledge	<b>Site specific knowledge</b>
K11	the site stocking plan and the relationship between stocking density and carrying capacity	Knowledge and understanding	Fish production planning influence on daily operations. Farm capacity

K12	how to deal with factors that can disrupt the stocking process within the limits of your own authority	Knowledge	<b>Site specific knowledge</b>
K13	the equipment and methods used to transfer fish/shellfish to the site		Procedures for each item of equipment in scope
K14	site procedures for maintaining effective hygiene and bio-security		<b>Site specific knowledge</b>
K15	the legal and site requirements for maintaining records of stocking		<b>Site specific knowledge</b> and legal obligations

<b>Grade Live fish/shellfish</b>			
<b>Aqua 4</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	how grading equipment can damage fish/shellfish if it is not in a serviceable condition	Knowledge	Maintenance of grading equipment in scope
K2	how live fish/shellfish are graded according to their different characteristics (specification, size, quality, condition)	Knowledge	Grading purpose and criteria for all types of grading in scope
K3	how to deal with factors that can disrupt the grading process within the limits of your own authority	Knowledge	<b>Site specific knowledge</b>
K4	site procedures for maintaining effective hygiene and bio-security during grading of live fish/shellfish	Knowledge	<b>Site specific knowledge</b>



K5	the advantages and disadvantages of different grading methods	Knowledge	Pros and cons for all methods in scope
K6	the equipment and methods used to grade live fish/shellfish on site	Knowledge	Grading equipment and methodology for all grading scenarios in scope
K7	the importance of accurate grading to the management of healthy fish/shellfish	Knowledge and understanding	The impact grading on stock management and production performance
K8	the legal and site requirements for maintaining records of grading	Knowledge	Legislative requirements
K9	the potential impact of adverse environmental conditions on the grading operation	Knowledge	<b>Site specific knowledge</b> in relation to each type of grading operation in scope
K10	the signs which indicate stress or disorder in fish/shellfish during grading	Knowledge	Salmon biology, health and behaviour
K11	what are the grading requirements for the fish/shellfish to be graded	Knowledge	<b>Site and task specific...</b> Market specification and production plan influences
K12	what are the relevant health and safety requirements associated with the grading process	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K13	why fish/shellfish are graded as part of husbandry programmes	Knowledge and understanding	Knowledge of market requirements and production cycles/regimes

<b>Harvest fish</b>		
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<b>Aqua 5</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with harvesting fish	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	how relevant food safety legislation controls the production of fish for human consumption	Knowledge	Influence of food safety legislation
K3	legal requirements that control the dispatch of fish	Knowledge	Welfare legislation and codes of practice
K4	your own responsibilities under relevant food hygiene legislation	Knowledge	
K5	the requirements of humane dispatch of fish, including the different methods and techniques used	Knowledge	Methods and techniques for each harvest method in scope
K6	how relevant environmental legislation controls the disposal of waste	Knowledge	Organic waste disposal methods in scope
K7	how and why harvested fish are stored to maintain flesh quality including the use of ice to suit prevailing environmental conditions	Knowledge and understanding	Fish storage practices and procedures in scope
K8	why it is important to minimise fish stress during harvest	Knowledge and understanding	Impact of stress on flesh quality and welfare considerations
K9	why it is essential for harvested fish to meet customer and quality requirements	Knowledge and understanding	The impact of buyer/customer requirements on harvesting operation and timing
K10	how and why fish are conditioned in preparation for harvest	Knowledge and understanding	The influence of fish starvation on stress and flesh quality

K11	the equipment and methods used to harvest fish	Knowledge	Harvesting equipment and methods for harvest scenarios in scope
K12	K12 how to deal with factors that can disrupt the harvesting process, within the limits of your own authority	Knowledge	<b>Site specific knowledge</b>
K13	the legal and site requirements for maintaining records of harvesting	Knowledge	<b>Site specific knowledge</b> and response to legislation

<b>Feed fish</b>			Whole Unit
<b>Aqua 6</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with feeding activities	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the characteristics and types of feed suitable for feeding fish at different stages of development	Knowledge	Fish feeding and nutrition for the stages of the lifecycle in scope
K3	the storage requirements of fish feed including the importance of effective pest control	Knowledge	Feed storage design, maintenance, and stock control
K4	the importance of following specified feeding schedules and minimising waste	Knowledge and understanding	Feeding regimes and their implementation
K5	how to recognise poor quality feed and the problems that can be caused if it is given to fish	Knowledge and understanding	Feed quality
K6	the different types of feeder or feeding systems used on site	Knowledge	Feeding systems in scope including digital control

K7	why feeding is modified in response to environmental conditions	Knowledge and understanding	Feeding practices interaction with environment (temperature & O2)
K8	normal feeding behaviour including signs that indicate when fish are full	Knowledge and understanding	Feeding to satiation whilst avoiding waste
K9	how water quality and suspended solid discharge can be affected by feeding activities	Knowledge and understanding	Impact of feeding on the environment and mitigation
K10	how feeding rates are calculated	Knowledge	Calculation from charts and automation
K11	why and how feeders are set, calibrated and maintained	Knowledge and understanding	Procedures for feeding systems in scope
K12	the systems used to monitor feed intake and wastage (including considering poor quality feed, uneaten feed and packaging)	Knowledge	Waste feed disposal
K13	the component of foodstuffs and their role in the development of fish	Knowledge and understanding	Fish Nutrition
K14	how customer and quality requirements influence the content of the feed used	Knowledge and understanding	Engineering diets and feed regimes
K15	how food conversion rates are calculated for fish stock, the factors that affect it and its importance to the production process	Knowledge and understanding	Fish production efficiency
K16	the financial significance of feed costs in the production of farmed fish	Knowledge and understanding	

K17	the importance of good hygiene when feeding fish	Knowledge and understanding	Hygiene
K18	the legal and site requirements for maintaining records of feeding	Knowledge	<b>Site specific knowledge</b> and response to legislation

<b>Collect information on fish growth and development</b>			Whole Unit
<b>Aqua 7</b>	<b>Knowledge and Understanding to be demonstrated</b>	<b>Nature of assessment</b>	<b>Subject context</b>
K1	the relevant health and safety requirements associated with the sampling process	Knowledge of the relevant aspects of H&S Legs	<b>Site specific knowledge</b>
K2	the importance of collecting accurate information on fish growth and development to fish farm production	Knowledge and understanding	Fish stock control
K3	how anaesthetics can be used to assist the collection of accurate data and to minimise the stress caused to fish, and how to ensure that the correct amount of anaesthetic is administered	Knowledge and understanding	Use of anaesthetics
K4	the standard measurements that are commonly used to specify the size of individual fish	Knowledge	Fork length, weight, and condition factors
K5	the importance of maintaining measuring equipment in a serviceable condition, including keeping calibration correct	Knowledge and understanding	Maintenance requirements for equipment in scope
K6	the importance of hygiene and biosecurity	Knowledge and understanding	Biosecurity

K7	how to collect representative samples of fish	Knowledge	Passive (automated) and active sampling regimes
K8	how assessments are used to determine performance to meet production targets	Knowledge	Fish performance monitoring
K9	the equipment and methods used to sample and assess fish	Knowledge	Procedures for the sampling methods in scope
K10	the legal and site requirements for maintaining records of fish growth and development	Knowledge	<b>Site specific knowledge</b> and response to legislation