AQUA EXCEL 2020

AQUAculture infrastructures for EXCELlence in European fish research towards 2020 – AQUAEXCEL2020

D4.4b Face-to-face training course 2

MODIFIED FOR PUBLIC WEBSITE

Wageningen University/AquaTT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652831. This publication reflects only the view of the author, and the European Commission cannot be held responsible for any use which may be made of the information contained therein

Executive Summary

Objectives
To educate a new generation of aquaculture researchers and industry stakeholders who focus on sustainable exploitation of their new knowledge, skills and tools to advance an innovative European aquaculture sector. The set-up of the training courses will centre on fostering a culture of cooperation between all parties involved.

Rationale:
To foster and build the human capital of the European aquaculture sector several goals are set by the Strategic Research and Innovation Agenda of EATiP to which AQUAEXCEL[2020] will contribute. All AQUAEXCEL[2020] training courses are multi-partner collaborations bringing together unique knowledge, tools and skills to create innovative modules that promote and enable peer-to-peer networking and collaboration. Participative training design ensures exchange and mutual learning between trainers and participants from both academia and industry. New models and partnerships for learning are explored for future recurrence, encouraging career development and innovation in the sector. Access to Research Infrastructures (knowledge, facilities and experience) will add value to the training. The training courses are state-of-the-art, transferring new knowledge and insights originating from the research and services carried out and created by AQUAEXCEL[2020], and building upon outputs, tools and achievements from FP7-AQUAEXCEL.

Main Results:
The AQUAEXCEL[2020] training course "Recirculating Aquaculture Systems (RAS) Technology" was the second face-to-face course in the AQUAEXCEL[2020] training course series and was provided by Wageningen University (WU) (the Netherlands), with the expertise of Ifremer (France), Nofima (Norway), Norges Teknisknaturvitenskapelige Universitet (NTNU) (Norway) and Danmarks Tekniske Universitet (DTU) (Denmark). The objective of this course was to facilitate participants in gaining an understanding of the principles of recirculation technology, the types of RAS and their specificities, capabilities and limitations, the advantages and necessary conditions for the optimal use/operation of RAS, and the ongoing research which can increase its efficiency and nutrient use.

This AQUAEXCEL[2020] training course took place in May 2019 with 27 participants attending, who were selected based on their submitted applications. The course included lectures, practical exercises, technical visits and an industry mini-seminar. The half day industry mini seminar focused on the state of RAS in the world, the requirements of Atlantic salmon smolts and post smolts in RAS, yellowtail kingfish and off flavour, and RAS in practice, organised with NGvA (the Dutch association for aquaculture) and Aquarius (aquaculture student organisation). The industry mini-seminar gave the course participants a unique opportunity to exchange with industry professionals in the field, with discussions focusing on the latest scientific advances in the RAS sector, and information on RAS development and needs for sustainable development in other countries within and outside the EU. The RAS Industry mini seminar was also open to industry stakeholders not enrolled in the entire course to facilitate their busy schedules.

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Contents

Introduction

AQUAEXCEL2020 aims to foster a culture of cooperation between European aquaculture Research Infrastructures (RIs), the associated research community, the aquaculture industry and other relevant stakeholders, which will help develop a more efficient and attractive European aquaculture Research Area leading to a sustainable and globally competitive European aquaculture sector. One of AQUAEXCEL2020's specific aims is to provide state-of-the-art unique training courses to educate a new generation of aquaculture researchers and industry stakeholders who focus on sustainable exploitation of their new knowledge, skills and tools to advance an innovative European aquaculture sector. Work package 4 of AQUAEXCEL2020 has a dedicated task focused on training a new generation of aquaculture researchers and industry stakeholders.

Nine technical training courses in total will be organised by different AQUAEXCEL2020 partners offered to people within and outside the partnership. The courses will focus on different aspects of aquaculture experimentation to foster a culture of cooperation between all parties involved. These training sessions will transfer new knowledge and insights originating from the research and services carried out and created by AQUAEXCEL2020.

This AQUAEXCEL2020 training course which was held on "Recirculating Aquaculture Systems (RAS) Technology" was a four-day face-to-face course with the objectives of reviewing the fundamentals of RAS and examining the different systems, designs, operations and applications.

RAS technology was developed in the 1980s, but its use in aquaculture remained quite limited until recently. However, the necessity to save freshwater in aquaculture practices, coupled with i) the necessity to increase fish health and safety in particular the salmon ongrowing industry by reducing the use of chemicals, and ii) the progressive enforcement of EU water quality regulations, has transformed RAS technology into a key method to develop and advance aquaculture production. This has led to increased training needs on RAS technology in the industry.

In total 11 tutors contributed to this training course (see Annex 4). Eight tutors are working in research institutes which are partners in the AQUAEXCEL2020 consortium (WU, NTNU, Nofima and DTU) and three were external contributors. These leading experts in RAS technology presented on the principles and concepts in RAS and discussed the operation of conventional and 'ecosystem approach' based RAS. Participants gained an understanding of the principles of recirculation technology, the types of RAS and their specificities, capabilities and limitations, the advantages and necessary conditions for the optimal use / operation of RAS and the ongoing research which can increase the efficiency and nutrient use of RAS.

This RAS training course included: i) aspects of recirculation technology relevant to research, ii) design, management, operation and evaluation of RAS iii) fish consumption and production: system mass balance and model iv) closing systems, v) minimising water and nutrient use, vi) different use of RAS, vii) technical visits. The course included lectures, practical design exercises and technical visits. Additionally, a half day industry mini seminar was organised which included topics such as the state of RAS in the world, the requirements

of Atlantic salmon smolts and post smolts in RAS, yellowtail kingfish and off flavour and RAS in practice. This mini seminar was organised with NGvA (the Dutch association for aquaculture) and Aquarius (aquaculture student organisation), and gave the course participants an opportunity to exchange with industry professionals. This RAS mini industry seminar was also open to industry stakeholders not enrolled in the entire course to hear about the latest discussions and scientific advances in the RAS sector, and exchange with the course participants to gain information on RAS development and needs for sustainable development in other countries within and outside the EU.

1. Face-to-face course 2

1.1 Pre-course activities

A promotional leaflet to promote the Training Course “Recirculating Aquaculture Systems (RAS) Technology” was developed (Figure 1) and distributed through several channels such as the AquaTT aquaculture mailing lists, the European Aquaculture Society (EAS) distribution channels, Federation of European Aquaculture Producers (FEAP) and European Aquaculture Technology and Innovation Platform (EATiP) distribution channels, EuroMarine (the European marine science network), the project website (Figure 2), social media and the partners’ channels. Annex I shows the promotional leaflet.

Figure 1: Promotional leaflet for RAS course

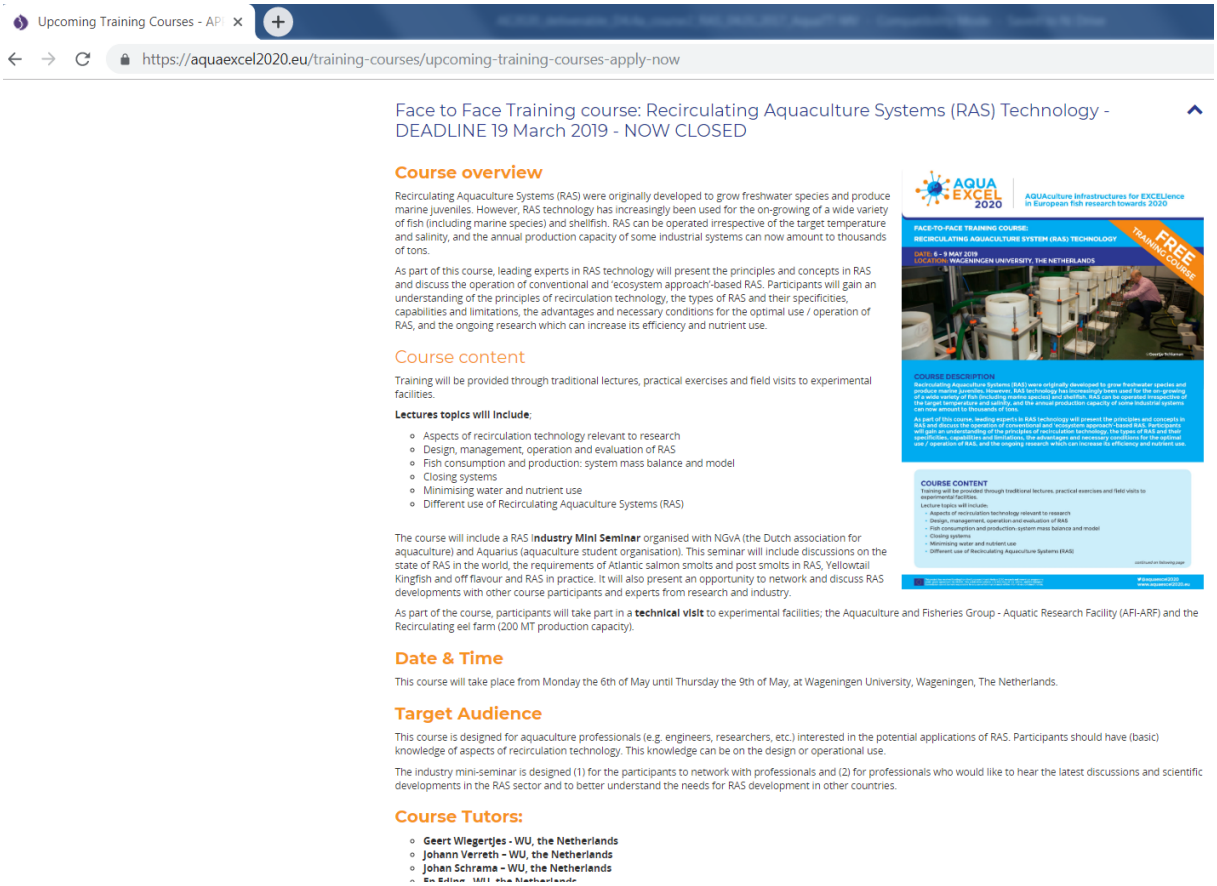

Figure 2: Screenshot of website promotion and application details for RAS course- https://aquaexcel2020.eu/training-courses/upcoming-training-courses-apply-now

The application period of the course was open from 26 February 2019 until 19 March 2019 and applicants were required to complete a registration form (Annex 2) and a statement of motivation and email both together with their CV to aquaexcel@aquatt.ie.

The target audience was aquaculture professionals (e.g. engineers, researchers, etc.) interested in the potential applications of RAS. Participants were required to have basic knowledge of aspects of recirculation technology, either on the design or operational use. Interested industry stakeholders not able to partake in the full course were welcome to take part in the industry mini seminar only.

110 individuals in total applied to participate in this training course, while the maximum number of participants possible was 25. A selection procedure to create a shortlist was put in place by Wageningen University to evaluate applicants based on their CVs and motivation letters.

The training programme from the AQUAEXCEL2020 project is set up to improve the research capacity across Europe. The programme is targeted at training a new generation of aquaculture researchers and industry representatives working in the field in one of the EU member states or new members and associated states of the enlarged EU, facilitating access with special focus on young researchers. Based on this, participants were selected based on the criteria: focus on candidates based in EU and new member states but including

a few non-EU candidates where increased collaborations could be of benefit to Europe, and professionals and scientists working in the 'RAS' field with the ability to contribute to improving RAS research capacity across Europe.

1.2 Course activities

Based on the overwhelming response and oversubscription, it was decided that an extra 2 applicants could be accommodated and so 27 aquaculture stakeholders from 14 different European countries and Africa, Iran and Turkey, were selected to attend the second AQUAEXCEL2020 face-to-face training course on RAS Technology (see final participant list in Annex 5). The activities during the training course are presented in detail in the course agenda in Annex 3 and course tutors and their contact details are listed in Annex 4. During the training course, theoretical lectures were interspersed with technical visits and practical assignments. In that way, scientific concepts could be verified by the course participants and put into a practical context enabling participants to "learn-by-doing". Higher cognitive levels of learning were gained in discussions throughout the course as well as during the industry mini seminar.

The training as well as the seminar provided good interaction with top specialists, lecturers and industry stakeholders, with innovative examples, active in the field of RAS (from Norway, the Netherlands, Denmark, USA) (see participant list of industry seminar in Annex 6).

The goal was to continuously have as many lecturers as possible present during the course and especially during the mini-seminar, as well as during lunches and social dinners to give participants the opportunity to interact with top specialists in the field. Throughout the course a minimum of three lecturers were present constantly. During the excursion, there was sufficient time for the participants to ask farmers questions.

A special (web-based) Blackboard learning environment was created, to which students and lecturers had access. All course training materials were placed on Blackboard, with an online module established specifically for this training course (see Figure 3 with print-screens of the site). The site contains links to the presentations and instructional material used during the course, as well as a discussion board and library of articles, informative literature and documents.

Figure 3: Screenshot of Blackboard page.

The training course was designed so that theoretical lectures were interspersed with technical visits and practical assignments. In this way, scientific concepts could be verified by the course participants and put into a practical context where participants were learning by doing. Higher cognitive levels of learning were gained in the discussions in between, and at, the seminar. The training at the seminar provided an interaction with top specialists, lecturers and industry stakeholders active in the field of RAS who provided innovative examples from the field of RAS.

After a short introduction explaining the context of the training course each participant could introduce him/herself briefly. Following this, a series of lectures took place on the state of RAS in the world, water quality requirements, and fish, consumptions and productions. A Nofima speaker discussed design, dimensioning and operational aspects of RAS research facilities. This lecture served as a starting point for the rest of the course, and gave an overview of all aspects that should be considered in a successful RAS design. After discussing this detailed overview, in the evening a technical visit took place to the Aquaculture and Fisheries Group- Aquatic Research Facility (AFI-ARF) experimental facilities. The theoretical aspects came to life as the technology discussed during the day was presented in a complete, working example.

The second day followed the same format with lectures followed by a technical visit. Lectures focused on tank hydraulics and removal processes for solids and suspended solids, gas control, biofiltration procedures, mass balance basics, nitrification kinetics and biofilter sizing. This was followed by a technical visit to a recirculating eel farm.

The third day began with lectures on biofiltration, bacterial control, biosecurity, and waste treatment and valorisation. The remainder of the day was dedicated to the mini industry seminar. A broad range of people participated in the seminar, which brought science and industry together. Scientific findings and best practices from industry were shared and this led to new discussions and insights. The seminar included expert talks on the state of RAS in the world, requirements of Atlantic salmon smolts and post smolts in RAS, off-flavour and a talk by King Fish Zeeland on RAS in practice. King Fish is a marine aquaculture company producing Yellowtail in land-based recirculation systems, and is the world's first RAS fish farm to be awarded a Best Aquaculture Practices certification from the Global Aquaculture Alliance, a non-profit organisation dedicated to advocacy, education and leadership in responsible aquaculture. The seminar finished with social drinks and a business market by Aquarius. This gave participants the valuable opportunity to network with industry experts and discuss common practices and practical solutions to real life challenges in RAS farms. As a result, the lectures and discussions from the RAS course were placed in perspective even more. 122 people attended the industry seminar (86 displayed on sign-in list, 25 participants and 11 teachers) and positive feedback was received.

The final day of the course began with lectures on environmental impact, IMTA and risk management, low energy RAS and energy control in RAS design. The participants then took part in two practical exercises which enabled them to use their new knowledge in practice. During the exercises participants were challenged to calculate the maximum carrying capacity for a theoretical system. A case study with relevant numbers was provided and all necessary calculations for the actual design were discussed. One practical exercise focussed on the technical requirements and aspects of water quality, TAN and the impact of feeding, whereas the other focussed on fish growth performance, body composition and harvesting.

Figure 4a: Participants at the mini industry seminar

Figure 4b: Participants at the mini industry seminar

Figure 4c: Participants during the RAS course

Figure 4d: Participants during the RAS course

Figure 4e: Participants during the RAS course

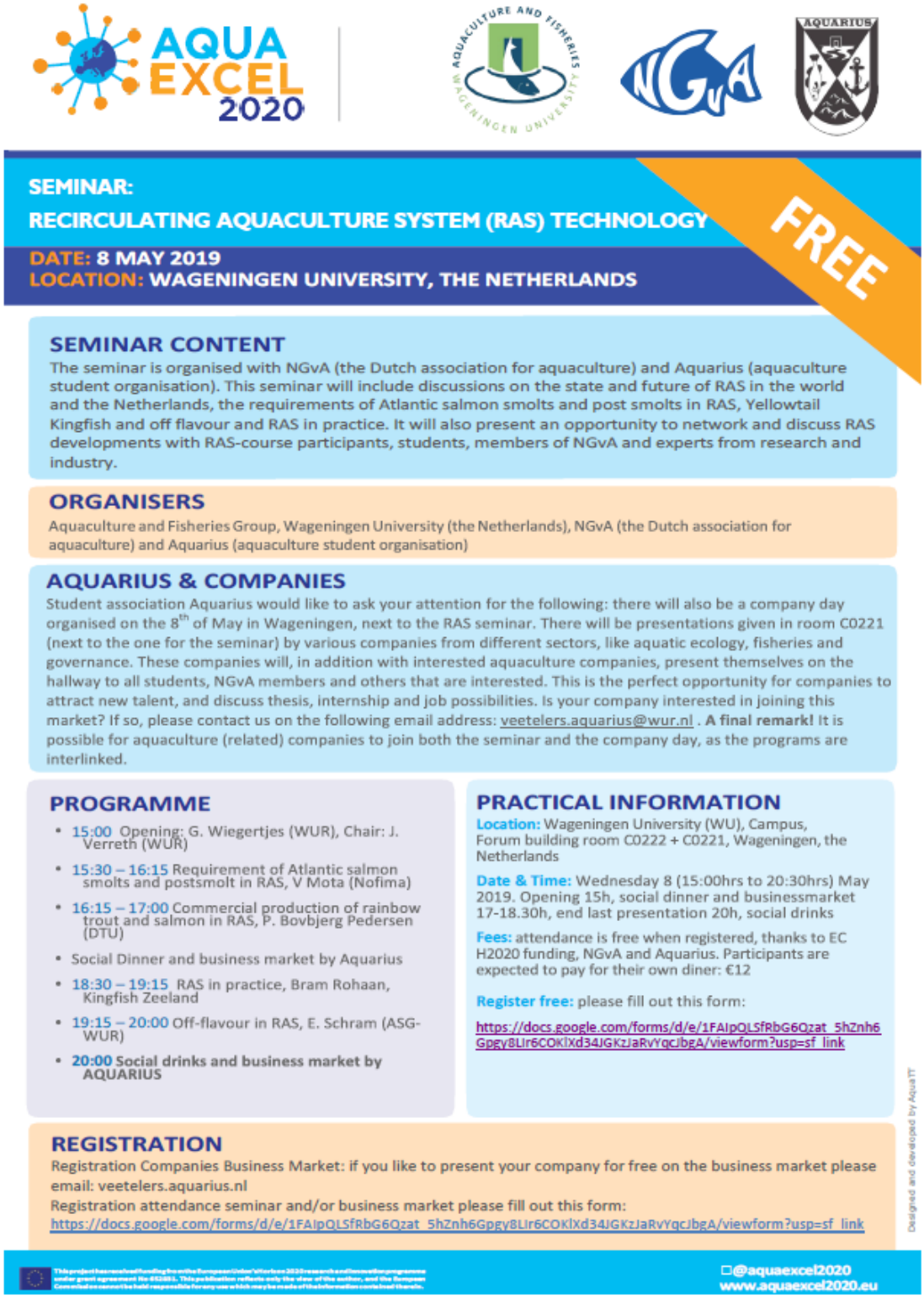

Figure 5: Promotional leaflet for industry seminar

1.3 Post-course activities

After completion of the course, participants were asked for feedback via an online survey (Figure 6), of which the results are given in Annex 7. These results will help the training

course organisers to improve the distance learning course and future AQUAEXCEL2020 face to face training courses, and evaluate the need for future RAS courses. The results of this evaluation exercise were confidential and anonymous so participants could be honest in their comments. The survey was online and took about 15 minutes to complete.

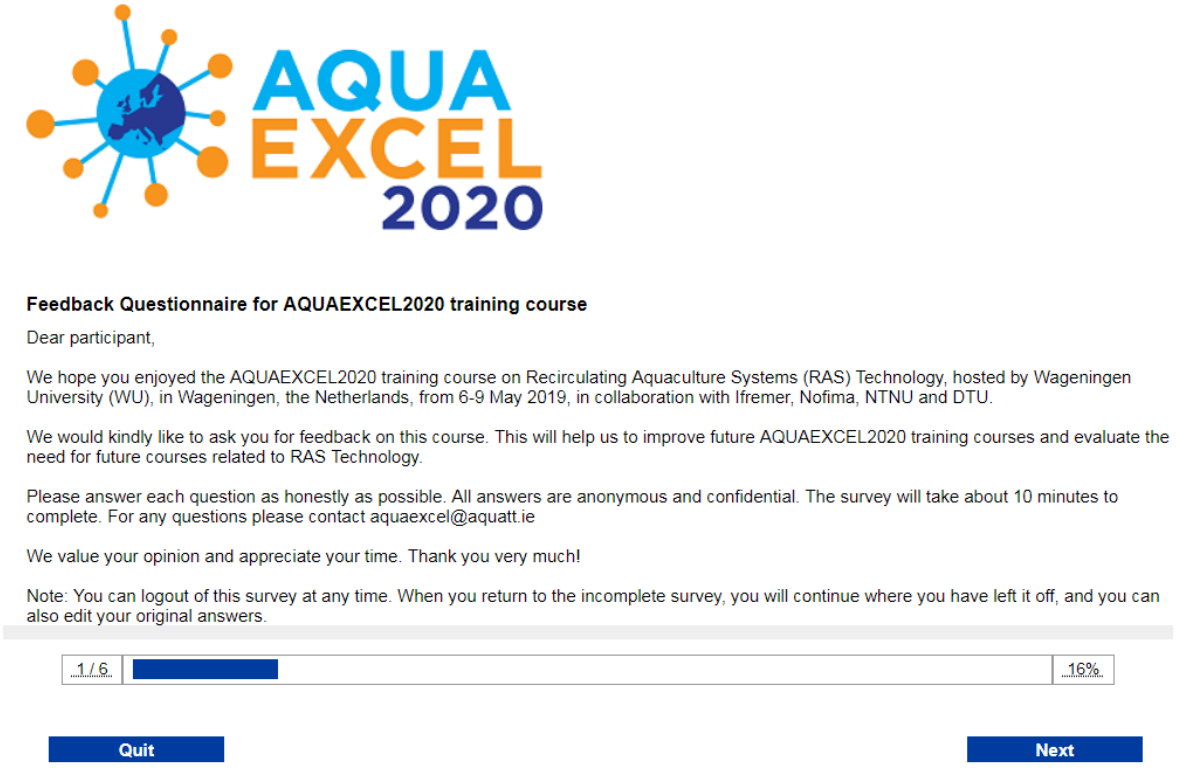

Figure 6: Print screen of welcome page of the online evaluation survey.

Participants were given a certificate of participation if requested upon completion of the course (Annex 8). All lectures were also made available to participants after the course through the BlackBoard system at Wageningen University.

AquaTT organised pre- and post-course activities, such as finalising course design, developing promotional leaflets and practical information documents, assisting in the organisation, managing the registrations, publishing and promoting the training courses, as well as carrying out and analysing the evaluations.

2. Conclusions

Most participants heard about the course from colleagues (46%) and from the AQUAEXCEL2020 website (46%). 4% of participants found the course through an internet search and 4% heard about it through another source. The online feedback survey was answered by 26 attendees, and all results are included in Annex 7. One participant had difficulty with submitting her survey report and tried to submit numerous times. We believe that this is the reason that for some of the answers there were over 27 total responses (but on further investigation it can be seen that the number of complete answers for each question is never more than 27).

Almost half (46%) of the participants received travel and subsistence funding to attend this course from their employers, while 25% were self-funded and 29% received project/grant funding. As with the first AQUAEXCEL2020 RAS course in France, the fact that quite a significant part of the participants of this RAS course were willing to self-fund their expenses emphasises that it is an important and timely training course.

The training course achieved the desired objective to inform and teach participants about the principles, concepts and operation of conventional and ecosystem approach-based RAS technology through a range of learning elements including traditional lectures, and practical forms of learning to apply knowledge. This is evident as the percentage of participants with detailed knowledge of RAS increased from 40% before the course to 78% after the course. No participants had expert knowledge of RAS before the course, but this increased to about 4% after the course.

The participants' feedback showed very positive results of the course. All participants agreed or strongly agreed that the duration of the course was good, that the procedure for registration was clear and simple, that the communication of the course (programmes, announcements) was good and that the information at the start of the course was clear. All participants bar one (who selected undecided- possibly due to not seeing the leaflet) agreed the informational leaflet was informative and visually attractive. The main conclusion from this feedback is that the following AQUAEXCEL2020 face-to-face training courses should follow the steps taken for the RAS course in terms of registration, course duration, promotional leaflet and communication.

The training course achieved a very successful grade from the participants, with 63% awarding it the highest grade -excellent- and 33% awarding it a grade of good; totalling 96%. No participants rated the course poor or below average.

Some examples of reasons for the excellent grades were:

- "The course gave all the detailed information from planning to design RAS and also to run RAS after the construction phase."
- "It was a very complete course where all aspects of RAS were touched upon. There was also enough time in between the lectures and visits to talk to the lecturers and other participants and discuss problems with regards to RAS."
- "The course is well organised, with clear topics and great trainers."
- "The course covered a wide range of topics concerning aquaculture and recirculation systems. The topics were well discussed from specialists in the field with very organised presentations."
- "Even though I consider myself knowledgeable, the content and discussion encouraged me to think about the material and learn from new information."
- "It was well organized, structured and conducted, focusing on important points and encouraging participants."

Participants were also very positive about the mini industry seminar. 81% reported that it was either a good or excellent opportunity to exchange with industry professionals. This emphasises the importance of including a mini industry seminar in all AQUAEXCEL2020 training courses and the value participants place on this aspect of the course.

When deciding to enrol for the training course, 93% participants valued course content as a very or extremely important factor. 64% valued the course trainers as a very or extremely important factor, 46% valued the course as free to enrol as a very or extremely important factor and, 75% valued the course organisers as very or extremely important.

The best things about the training course which were mentioned by participants in the survey included:

- The industry seminar
- The visits of several companies
- The trips to the RAS facilities
- The subjects/content
- Networking
- Practical sessions
- Combination of fieldtrips and lectures
- Knowledge of lecturers

Areas were there were suggestions for improvement for future AQUAEXCEL2020 training courses included:

- Better timing (farm visit ended very late and more time requested for practical exercises)
- Provide the presentations before the course to better follow the topics
- Less reading figures off PowerPoint, more discussion within the lectures
- To improve the subject of economic aspects
- A thorough work-through of the excel sheet at the end of the lectures
- Hands on sessions at WU
- Provision of lunch vouchers

For future RAS courses participants suggested the following topics:

- Probiotics
- Off-flavour focused on more
- Economics of RAS
- Welfare/behaviour/health of fish in RAS
- European regulation on effluent discharge
- Design of tanks and pipes
- Use of floculant for phosphorous removal
- Include more species of the marine environment and Mediterranean aquaculture.
- Biosecurity of RAS facilities.
- Saltwater RAS

The overall results from the online survey show that the vast majority of participants were very satisfied with their experience and increased their knowledge of RAS. 85% of participants indicated that they would be interested in attending a follow-up course, with the remaining 15% selecting maybe interested. An overwhelming 100% said that they would recommend this course to a fellow student/colleague. The survey results demonstrate how

worthwhile and beneficial the participants found the course and how it has successfully increased RAS knowledge in the industry.

Glossary

AQUAEXCEL^{2020}: AQUAculture Infrastructures for EXCELlence in European Fish Research towards 2020

RAS: Recirculating Aquaculture Systems

WU: Wageningen University

NTNU: Norges Teknisknaturvitenskapelige Universitet

DTU: Danmarks Tekniske Universitet

EAS: European Aquaculture Society

FEAP: Federation of European Aquaculture Producers

EATiP: European Aquaculture Technology and Innovation Platform

Document information

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Dissemination level	x	**PU Public, fully open, e.g. web**		
		CO Confidential, restricted under conditions set out in Model Grant Agreement		
		CI Classified, information as referred to in Commission Decision 2001/844/EC.		

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Annex 1: Promotional Leaflet

AQUA EXCEL 2020

AQUAculture Infrastructures for EXCELlence in European fish research towards 2020

FACE-TO-FACE TRAINING COURSE:

RECIRCULATING AQUACULTURE SYSTEM (RAS) TECHNOLOGY

FREE TRAINING COURSE

DATE: 6 – 9 MAY 2019
LOCATION: WAGENINGEN UNIVERSITY, THE NETHERLANDS

COURSE DESCRIPTION

Recirculating Aquaculture Systems (RAS) were originally developed to grow freshwater species and produce marine juveniles. However, RAS technology has increasingly been used for the on-growing of a wide variety of fish (including marine species) and shellfish. RAS can be operated irrespective of the target temperature and salinity, and the annual production capacity of some industrial systems can now amount to thousands of tons.

As part of this course, leading experts in RAS technology will present the principles and concepts in RAS and discuss the operation of conventional and 'ecosystem approach'-based RAS. Participants will gain an understanding of the principles of recirculation technology, the types of RAS and their specificities, capabilities and limitations, the advantages and necessary conditions for the optimal use / operation of RAS, and the ongoing research which can increase its efficiency and nutrient use.

COURSE CONTENT

Training will be provided through traditional lectures, practical exercises and field visits to experimental facilities.

Lecture topics will include:

- Aspects of recirculation technology relevant to research
- Design, management, operation and evaluation of RAS
- Fish consumption and production: system mass balance and model
- Closing systems
- Minimising water and nutrient use
- Different use of Recirculating Aquaculture Systems (RAS)

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AQUA EXCEL 2020

AQUAculture Infrastructures for EXCELlence in European fish research towards 2020

FACE-TO-FACE TRAINING COURSE: RECIRCULATING AQUACULTURE SYSTEM (RAS) TECHNOLOGY

FREE TRAINING COURSE

DATE: 6 – 9 MAY 2019
LOCATION: WAGENINGEN UNIVERSITY, THE NETHERLANDS

COURSE CONTENT

The course will include a RAS **industry mini seminar** organised with NGvA (the Dutch association for aquaculture) and Aquarius (aquaculture student organisation). This seminar will include discussions on the state of RAS in the world, the requirements of Atlantic salmon smolts and post smolts in RAS, Yellowtail Kingfish and off flavour and RAS in practice. It will also present an opportunity to network and discuss RAS developments with other course participants and experts from research and industry.

As part of the course, participants will take part in a **technical visit** to experimental facilities; the Aquaculture and Fisheries Group - Aquatic Research Facility (AFI-ARF) and the Recirculating eel farm (200 MT production capacity).

COURSE ORGANISERS

Aquaculture and Fisheries Group, Wageningen University (the Netherlands), with the expertise of Ifremer (France), Nofima (Norway), NTNU (Norway) and DTU (Denmark).

TARGET AUDIENCE

This course is designed for aquaculture professionals (e.g. engineers, researchers, etc.) interested in the potential applications of RAS. Participants should have (basic) knowledge of aspects of recirculation technology. This knowledge can be on the design or operational use.

The industry mini-seminar is designed (1) for the participants to network with professionals and (2) for professionals who would like to hear the latest discussions and scientific developments in the RAS sector and to better understand the needs for RAS development in other countries.

COURSE TUTORS

- **Geert Wiegertjes** – WU, the Netherlands
- **Johann Verreth** – WU, the Netherlands
- **Johan Schrama** – WU, the Netherlands
- **Ep Eding** – WU, the Netherlands
- **Vasco Mota** – Nofima, Norway
- **Raoul Piedrahita** – California, USA
- **Olav Vadstein** – NTNU, Norway
- **Per Bovbjerg Pedersen** – DTU, Denmark
- **Edward Schram** – ASG, the Netherlands
- **TBC** – Kingfish Zeeland, the Netherlands

PRACTICAL INFORMATION

Location: Wageningen University, Wageningen, the Netherlands

Date & Time: Monday 6 (09:00hrs) to Thursday 9 (17:30hrs) May 2019

Application deadline: 19 March 2019

Fees: Course attendance is free, thanks to EC H2020 funding. Participants are expected to pay for their own travel, subsistence and accommodation.

Maximum participants: 25 people

Language of instruction and material: English

REGISTRATION

Official registration forms and additional course information can be found on the AQUAEXCEL2020 website at **https://aquaexcel2020.eu/training-courses/upcoming-training-courses-apply-now.**

Note: Please do not make travel arrangements unless you have received official confirmation of selection.

Designed and developed by Aqua TT

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Annex 2: Application form for training course

AQUAculture infrastructures for EXCELlence in European fish research towards 2020

Registration Form for AQUAEXCEL2020 Face-to-Face Training Course

Title: Recirculating Aquaculture Systems (RAS) Technology

Organiser(s): Aquaculture and Fisheries Group, Wageningen University (the Netherlands)
Dates: 6-10 May 2019
Location: Wageningen University, the Netherlands

Course attendance is free, thanks to EC H2020 funding. Participants are expected to pay for their own travel, subsistence and accommodation. Places will be confirmed, at the latest, one month before the start of the training course. Admittance to the course will be confirmed officially through e-mail. **Please do not make travel arrangements unless you have received official confirmation.**

To submit your registration request, please send the following to aquaexcel@aquatt.ie, with the following subject line: **AQUAEXCEL2020 /TrainingCourse_ RAS2_WU** by the **19th of March 2019**

- **Completed Registration Form**
- **CV / Résumé**
- **Letter of Motivation**
- **Completed GDPR Consent From**

Any questions about the course or application process should be sent to aquaexcel@aquatt.ie

We look forward to welcoming you to the course.

Contact details

Title:	
Surname:	
First Name(s):	
Email:	
Telephone:	
Date of Birth:	
Gender:	

AQUAculture infrastructures for EXCELlence in European fish research towards 2020

Relevant information

Organisation Name:	
Organisation Type: • University • Research Institute • SME • Private Company • Other (please specify)	
Country:	
Position:	

Highest Qualification: • PhD • DVM or equivalent • MSc or equivalent • BSc or equivalent • Other (please specify)	
Research Category: • Postgraduate • Postdoctoral • Expert • Technician • Other (please specify)	
Previous Relevant Experience:	
Additional Support:	

Please complete all sections of this form and email it to: aquaexcel@aquatt.ie, with a CV, letter of motivation and GDPR form, indicating in subject: AQUAEXCEL2020 /TrainingCourse_ RAS2_WU

Annex 3: Course Agenda

2019	Monday May 6	Tuesday May 7	Wednesday may 8	Thursday may 9
9.00 - 10.00	Opening/ Introduction	Tank hydraulics and solids removal processes	Biofiltration and bacterial environment	Environmental impact, IMTA and risk management
	Geert Wiegertjes and Ep Eding	R. Piedrahita	O Valdstein (NTNU)	Ifremer
10.00 - 11.00	State of the art RAS in the world I	Suspended Solids characterisation and control/removal	Bacterial control and bio-security	Low energy RAS
		R. Piedrahita	O Valdstein (NTNU)	Per Bovbjerg Pedersen (DTU, Denmark)
11.00- 11.15	Coffee break			
11.15- 12.15	Water quality requirements	Gas control (oxygen, carbon dioxide and nitrogen gas)	Waste treatment and valorization	Energy control in RAS design
	V. Mota (Nofima)	R. Piedrahita	Ifremer	Per Bovbjerg Pedersen (DTU, Denmark)
12.15-13.30	Lunch break			
13.30 - 14.30	Fish, consumptions and productions: system mass bal	Biofiltration principles	?	Practical session I
	Ep Eding (Wageningen University, the Netherlands)	Ep Eding (Wageningen University, the Netherlands)		
14.30- 15.30	Design, dimensioning and operational of RAS research facilities	Mass balance basics nitrification kinetics Biofilter sizing	SEMINAR Opening: 15-15.30h	
	V. Mota (Nofima)		15.30-16.15 State of the art RAS in the world II	
15.30-15.45	Coffee break		Requirements of Atlantic salmon smots and postsmolts in RAS	Coffee break
15.45- 17.30	Technical visit 1:	Technical visit 2:	V. Mota (Nofima)	Practical session II
	Tour experimental facilities Aquaculture and Fisheries Group- Aquatic Research Facility (AFI-ARF)	Excursion Recirculating eel farm, 200 MT production capacity, Reijpel Aal in Helmond	Diner and business market by Aquarius	
	Diner		18.30-19.15h Off flavour E. Schram (ASG- WUR)	
			19.15- 20h RAS in practice King Fish Zeeland	
			20h Social drinks and business market by Aquarius	

Annex 4: Course Tutors

MODIFIED VERSION.

Annex 5: Participant List: Training Course

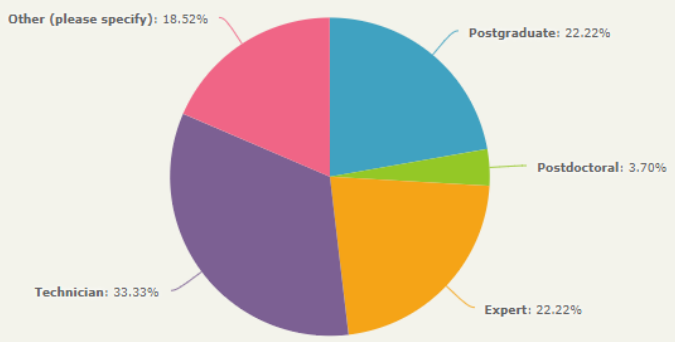
MODIFIED VERSION.

Annex 6. Participant list: Industry seminar

MODIFIED VERSION.

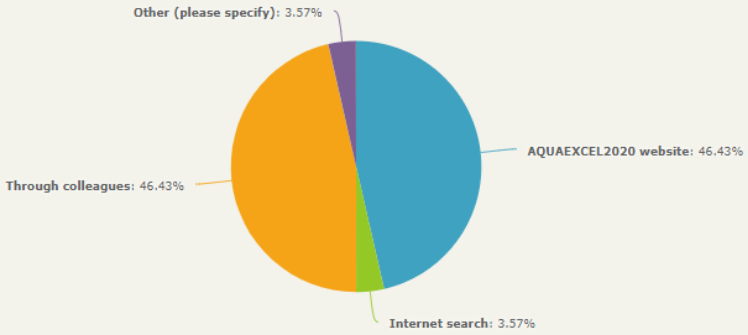
Annex 7. Survey results

1. **1. What is your current position?**



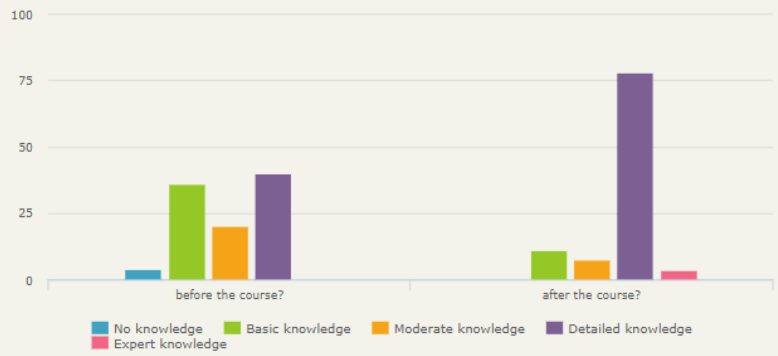
Postgraduate	22.22%	6
Postdoctoral	3.70%	1
Expert	22.22%	6
Technician	33.33%	9
Other (please specify)	18.52%	5
	Total Responses	27
	Skipped	3

2. **2. How did you hear about this course?**



AQUAEXCEL2020 website	46.43%	13
Internet search	3.57%	1
Through colleagues	46.43%	13
AQUAEXCEL2020 Twitter	0.00%	0
Other (please specify)	3.57%	1
	Total Responses	28
	Skipped	2

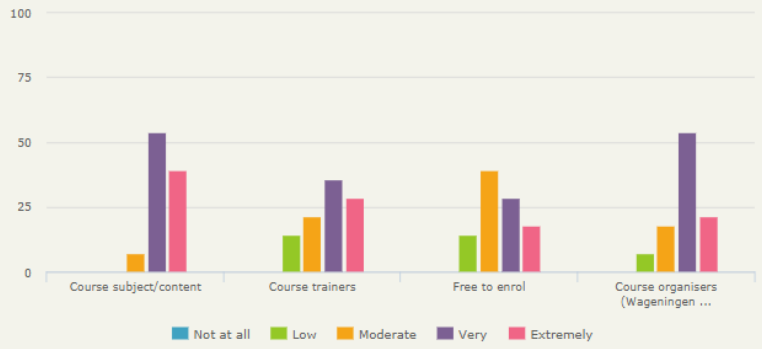
3. **3. How would you rate your knowledge of RAS:**



	No knowledge	Basic knowledge	Moderate knowledge	Detailed knowledge	Expert knowledge	Responses
before the course?	**1** 4.00%	**9** 36.00%	**5** 20.00%	**10** 40.00%	**0** 0.00%	25
after the course?	**0** 0.00%	**3** 11.11%	**2** 7.41%	**21** 77.78%	**1** 3.70%	27

Total Responses	28
Skipped	2

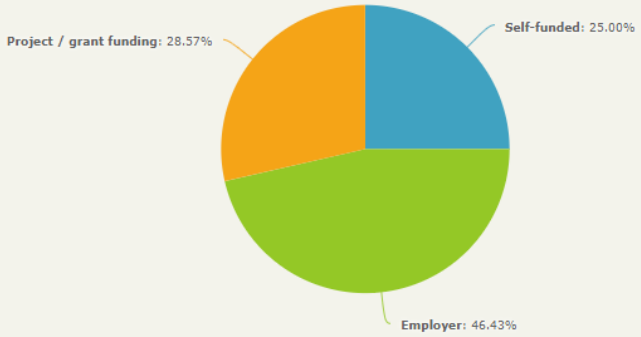
4. **4. How important were the following factors for you when deciding to enrol into this training course?**



	Not at all	Low	Moderate	Very	Extremely	Responses
Course subject/content	**0** 0.00%	**0** 0.00%	**2** 7.14%	**15** 53.57%	**11** 39.29%	28
Course trainers	**0** 0.00%	**4** 14.29%	**6** 21.43%	**10** 35.71%	**8** 28.57%	28
Free to enrol	**0** 0.00%	**4** 14.29%	**11** 39.29%	**8** 28.57%	**5** 17.86%	28
Course organisers (Wageningen University)	**0** 0.00%	**2** 7.14%	**5** 17.86%	**15** 53.57%	**6** 21.43%	28

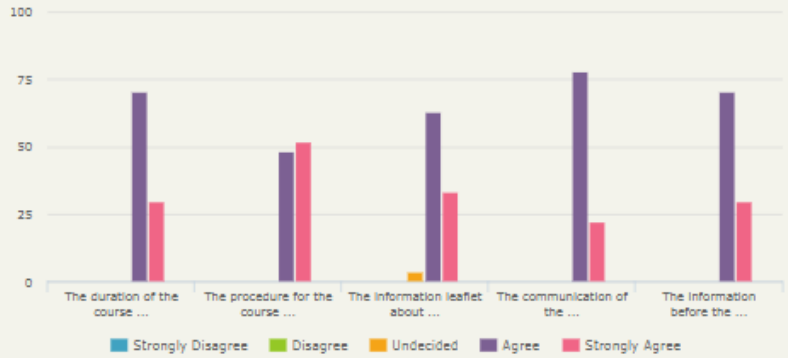
Total Responses	28
Skipped	2

5. **5. How were you funded/how did you fund the travel and subsistence expenses?**



Self-funded	25.00%		7
Employer	46.43%		13
Project / grant funding	28.57%		8
Other (please specify)	0.00%		0
		Total Responses	28
		Skipped	2

6. **6. Please read the following statements and indicate how they correspond to your experience of the course organisation.**



	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Responses
The duration of the course was good.	0 0.00%	0 0.00%	0 0.00%	19 70.37%	8 29.63%	27
The procedure for the course registration was clear and simple.	0 0.00%	0 0.00%	0 0.00%	13 48.15%	14 51.85%	27
The information leaflet about the course was informative and visually attractive.	0 0.00%	0 0.00%	1 3.70%	17 62.96%	9 33.33%	27
The communication of the course (announcements, programme, etc.) was good.	0 0.00%	0 0.00%	0 0.00%	21 77.78%	6 22.22%	27
The information before the start of the course was clear.	0 0.00%	0 0.00%	0 0.00%	19 70.37%	8 29.63%	27

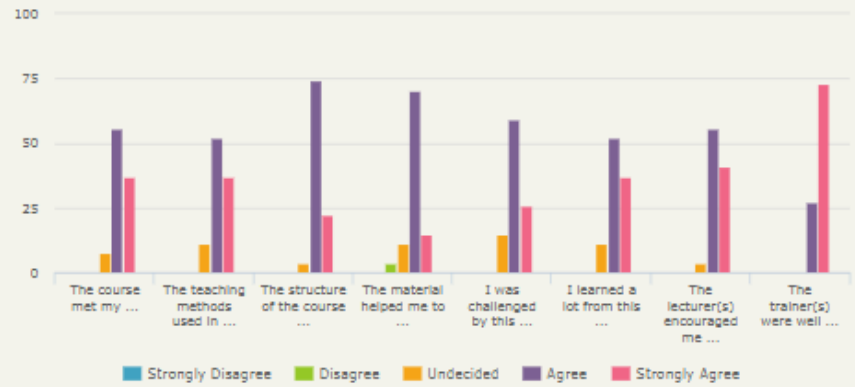
Total Responses	27
Skipped	3

7. **7. Do you have any more feedback on the organisation of the course?**

Count	Response
1	I would suggest providing presentations handouts before on the first day of the course.
1	If possible to send the plan of everyday earlier Send the responses to the applications earlier
1	no
1	Well organised and structured throughout the course

Total Responses	4
Skipped	26

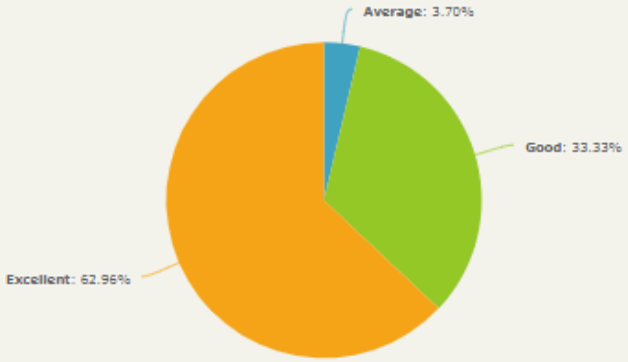
8. **8. Please read the following statements and indicate how they correspond to your experience of the course.**



	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Responses
The course met my expectations.	0 0.00%	0 0.00%	2 7.41%	15 55.56%	10 37.04%	27
The teaching methods used in this course helped me achieve the course's learning outcomes.	0 0.00%	0 0.00%	3 11.11%	14 51.85%	10 37.04%	27
The structure of the course was logical.	0 0.00%	0 0.00%	1 3.70%	20 74.07%	6 22.22%	27
The material helped me to master the content.	0 0.00%	1 3.70%	3 11.11%	19 70.37%	4 14.81%	27
I was challenged by this course.	0 0.00%	0 0.00%	4 14.81%	16 59.26%	7 25.93%	27
I learned a lot from this course.	0 0.00%	0 0.00%	3 11.11%	14 51.85%	10 37.04%	27
The lecturer(s) encouraged me to think about the subject matter.	0 0.00%	0 0.00%	1 3.70%	15 55.56%	11 40.74%	27
The trainer(s) were well prepared and knowledgeable.	0 0.00%	0 0.00%	0 0.00%	7 26.92%	19 73.08%	26

Total Responses	27
Skipped	3

9. **9. If you look at all aspects of the course, which grade would you award this course?**



Poor	0.00%		0
Below Average	0.00%		0
Average	3.70%		1
Good	33.33%		9
Excellent	62.96%		17
		Total Responses	27
		Skipped	3

10. **10. Please comment on the grade you gave the course (question number 9):**

Count	Response
1	Although I found that a lot of the information given regarding RAS systems was something I already knew, this lies within the job role I undertake on a day-to-day basis and not as a negative towards the course content. That being said, there was still alot to take home from the course content and it was interesting to see what other people have been working on. The practical sessions were a brilliant addition.
1	Even though I consider myself knowledgeable, the content and discussion encouraged me to think about the material and learn from new information.
1	Good lecturers and helpful trainer, flow of talks is logical, nice fieldtrips
1	Interesting and comprehensive training program. Quality speaker. Very nice training framework in Wageningen University
1	It was a very complete course where all aspects of RAS were touched upon. There was also enough time in between the lectures and visits to talk to the lectures and other participants and discuss problems with regards to RAS
1	it was almost perfect, but the freshwater systems were a little bit pushed back
1	It was well organized, structured and conducted, focusing on important points and encouraging participants.
1	its a good training course but to much center in fresh water
1	Its complete package both with theoretical and practical stuffs.
1	Many aspects of RAS were detailled and explained. The facility visits were of good quality
1	The classes were well structured and the lecturers and trainers helped me understand so much more about RAS.
1	The course covered a wide range of topics concerning aquaculture and recirculation systems. The topics were well discussed from specialists on the field with very organised presentations
1	the course gave a Multi disciplinary approach to most of the matters affecting ras in europe.
1	The course gave all the detailed information from planning to design RAS and also to run RAS after the construction phase.
1	The course is well organised, with clear topics and great trainers
1	The course was very detailed (lots of tables and figures which were species/ system/ goal specific). I found the content a little overwhelming, however, the networking helped me a lot.
1	The lecturers were highly skilled and highly accesible people> The material and topics were excellents and the social networking was really interesting
1	The topics coverd most general topic of RAS.
1	Very detailed talks and information provided.

11. 11. The best thing(s) about this course was/were:

Count	Response
1	combined fieldtrips and lectures
1	Its better to do some work on recirculatiing systems.we just to see but i need to practic in the factory
1	-Knowledge of lecturers -Organization of the schedule was really adapted to work in the best conditions
1	Logical course content with good lectures and discussions.
1	Meeting other people on the same subject.
1	More informative and got more opportunity to know about the aquaculture from different nations.
1	Networking
1	pick up some new information what I can use at home
1	Planning and design of RAS for different species.
1	practical hours exchanges facility visits courses on modelling
1	Some of the lectures presenting some new things. Calculation session
1	Talks and trip to the fish farms.
1	The combination ot theoretical and practical courses. the visits to the facilities and fish farms.
1	The interesting visit to de farms but also the lectures going deeper into water quality and bacterial environment
1	the knowledge of the speakers
1	The opportunity to have a hands on experience on ras visiting o the facilities of the university and the fish farms.
1	The practical sessions.
1	The seminar and the visits of several companies
1	The subjects, the Technical visits
1	visits
1	Visits to farms and the practical session.
1	Visits to Kingfish Zeeland and Seafarm

Total Responses	22
Skipped	8

12. **12. The thing(s) to be improved was/were:**

Count	Response
1	Addition of topics related with fish health in RAS systems and biosecurity of RAS facilities.
1	Hands on sessions at WU, maybe.
1	I think it should have been more time to do calculations excercises
1	If possible to give the presentations before the course to a better follow of the topics
1	include even more species of the marine environment and mediteranean aquaculture.
1	Less reading figures off powerpoint, more discussion within the lectures
1	maybe a theme with saltwater
1	Maybe some lunch vouchers
1	N/A
1	Perhaps a thorough workthrough of the excel sheet at the end during the lectures.
1	Practical calculation and design (more time and more details about designs of a small RAS)
1	Practical exercise was quite slow approach
1	The farm visit ended quite late which resulted in a short nights sleep and less concentration during the next day. Which was a shame because the presentations were very intesting.
1	to improve the economical aspects

Total Responses	14
Skipped	16

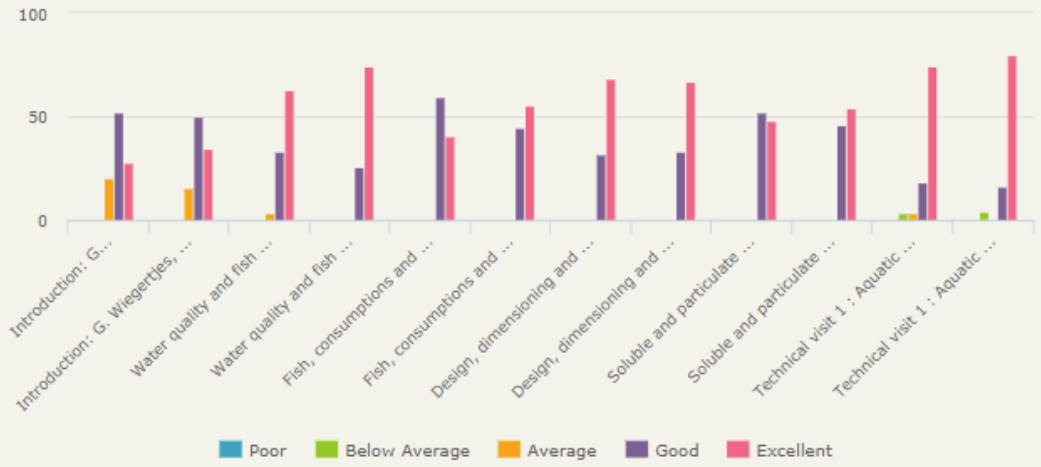
13. **13. Did you miss any subjects/topics?**

Please indicate any topics that, in your opinion, should have been included in the course:

Count	Response
1	economy, new possibilities in the RAS
1	european regulation on effluent discharge
1	I expected more about of flavor as is a very important topic in France RAS farmers
1	I think the course was pretty comprehensive
1	I was expecting more about off flavor and use of floculant for phosphorous removal
1	I would have liked to hear a bit more about use of probiotics. Now, the course focussed mostly on improving bacterial functioning through improving the biofilter but use of probiotics is definetely a hot topic and one that causes a lot of confusion. It would be nice is some light was shed on this topic.
1	Mediteranean aquaculture.
1	N/A
1	no
1	NO
1	None
1	Presentations about other Mediterranean species such as seabream and seabass, or even white shrimp.
1	saltwater RAS
1	See in Question 12.
1	Tanks and pipes design, quite complex but interesting.
1	Welfare/behaviour of the fish in RAS perhaps? But I understand this was a course mainly on technique so perhaps this doesn't really fit into the course.

Total Responses	16
Skipped	14

14. **14. How would you rate the quality of the following parts from Day1?**

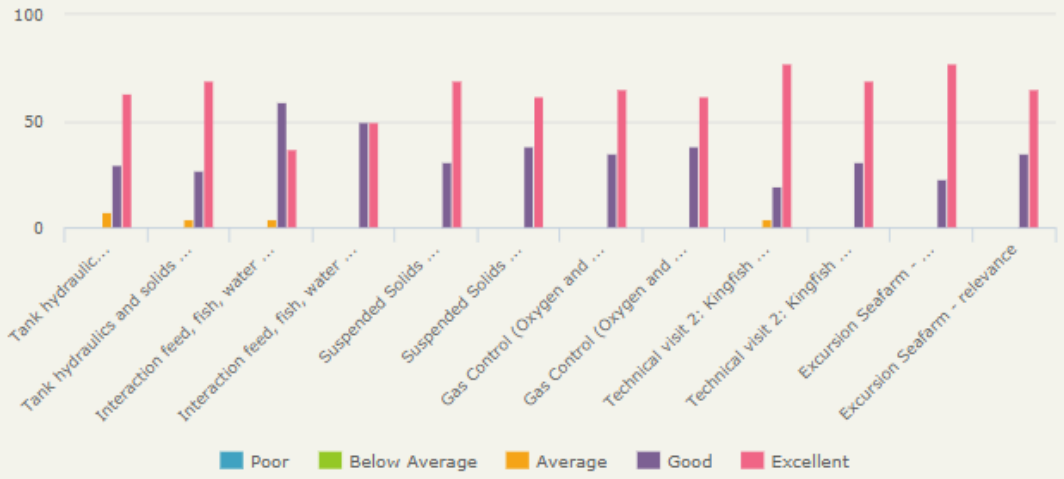


	Poor	Below Average	Average	Good	Excellent	Responses
Introduction: G. Wiegertjes, E. Eding (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**5** 20.00%	**13** 52.00%	**7** 28.00%	25
Introduction: G. Wiegertjes, E. Eding (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**4** 15.38%	**13** 50.00%	**9** 34.62%	26
Water quality and fish requirements / accumulating substances: V. Mota (Nofima) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 3.70%	**9** 33.33%	**17** 62.96%	27
Water quality and fish requirements / accumulating substances: V. Mota (Nofima) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**7** 25.93%	**20** 74.07%	27

Fish, consumptions and productions: nutrient balance and model: E. Eding (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**16** 59.26%	**11** 40.74%	27
Fish, consumptions and productions: nutrient balance and model: E. Eding (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**12** 44.44%	**15** 55.56%	27
Design, dimensioning and operation of RAS research facilities: V. Mota (Nofima) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 32.00%	**17** 68.00%	25
Design, dimensioning and operation of RAS research facilities: V. Mota (Nofima) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**9** 33.33%	**18** 66.67%	27
Soluble and particulate matter quantifications: E. Eding (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**13** 52.00%	**12** 48.00%	25
Soluble and particulate matter quantifications: E. Eding (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**12** 46.15%	**14** 53.85%	26
Technical visit 1 : Aquatic Research facilities (WU) - **organisation of visit**	**0** 0.00%	**1** 3.70%	**1** 3.70%	**5** 18.52%	**20** 74.07%	27
Technical visit 1 : Aquatic Research facilities (WU)- **relevance**	**0** 0.00%	**1** 4.00%	**0** 0.00%	**4** 16.00%	**20** 80.00%	25

Total Responses	27
Skipped	3

15. **15. How would you rate the quality of the following parts from Day2?**

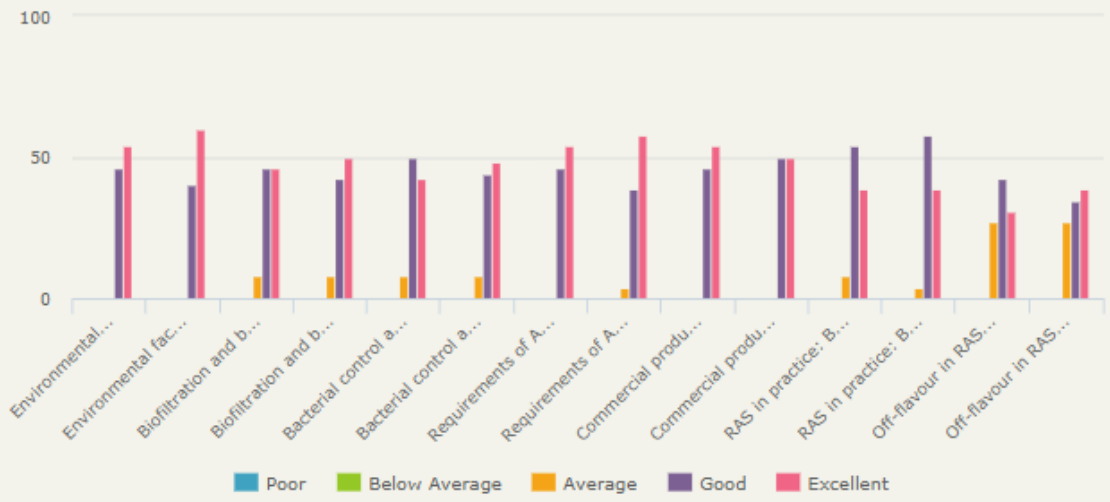


	Poor	Below Average	Average	Good	Excellent	Responses
Tank hydraulics and solids removal processes: R. Piedrahita (USA) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**2** 7.41%	**8** 29.63%	**17** 62.96%	27
Tank hydraulics and solids removal processes: R. Piedrahita (USA) - **relevance**	**0** 0.00%	**0** 0.00%	**1** 3.85%	**7** 26.92%	**18** 69.23%	26
Interaction feed, fish, water quality: J. Schrama (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 3.70%	**16** 59.26%	**10** 37.04%	27
Interaction feed, fish, water quality: J. Schrama (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**13** 50.00%	**13** 50.00%	26

Suspended Solids characterization and control/removal: R. Piedrahita (USA) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 30.77%	**18** 69.23%	26
Suspended Solids characterization and control/removal: R. Piedrahita (USA) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**10** 38.46%	**16** 61.54%	26
Gas Control (Oxygen and carbon dioxide): R. Piedrahita (USA) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**9** 34.62%	**17** 65.38%	26
Gas Control (Oxygen and carbon dioxide): R. Piedrahita (USA) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**10** 38.46%	**16** 61.54%	26
Technical visit 2: Kingfish Zeeland Yellowtail Kingfish RAS farm - **organisation of visit**	**0** 0.00%	**0** 0.00%	**1** 3.85%	**5** 19.23%	**20** 76.92%	26
Technical visit 2: Kingfish Zeeland Yellowtail Kingfish RAS farm - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 30.77%	**18** 69.23%	26
Excursion Seafarm - **organisation of visit**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**6** 23.08%	**20** 76.92%	26
Excursion Seafarm - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**9** 34.62%	**17** 65.38%	26

Total Responses	27
Skipped	3

16. **16. How would you rate the quality of the following parts from Day3?**

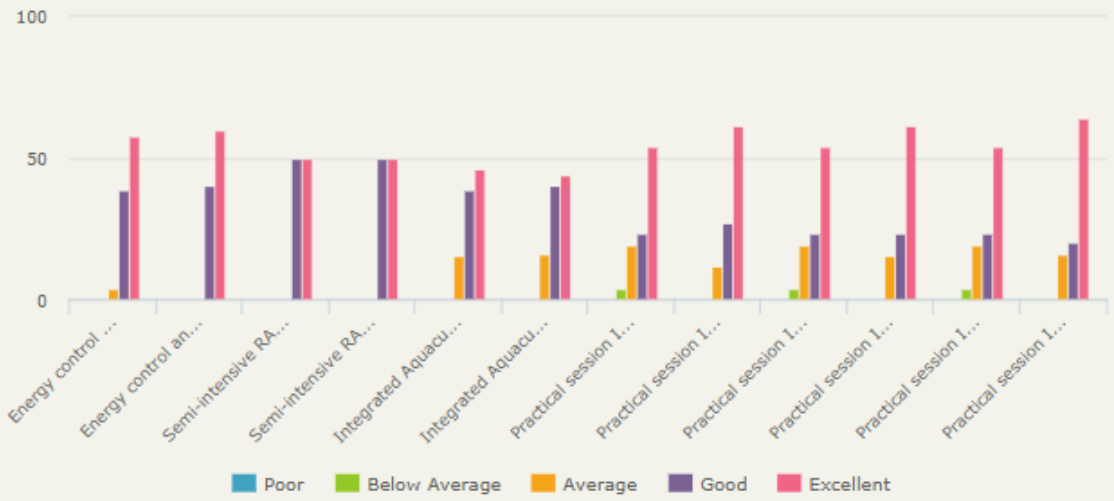


	Poor	Below Average	Average	Good	Excellent	Responses
Environmental factors affecting biofiltration: E. Eding (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**12** 46.15%	**14** 53.85%	26
Environmental factors affecting biofiltration: E. Eding (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**10** 40.00%	**15** 60.00%	25
Biofiltration and bacterial environment: O. Vadstein (NTNU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**2** 7.69%	**12** 46.15%	**12** 46.15%	26
Biofiltration and bacterial environment: O. Vadstein (NTNU) - **relevance**	**0** 0.00%	**0** 0.00%	**2** 7.69%	**11** 42.31%	**13** 50.00%	26
Bacterial control and bio-security: O. Vadstein (NTNU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**2** 7.69%	**13** 50.00%	**11** 42.31%	26

Bacterial control and bio-security: O. Vadstein (NTNU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**2** 7.69%	**13** 50.00%	**11** 42.31%	26
Bacterial control and bio-security: O. Vadstein (NTNU) - **relevance**	**0** 0.00%	**0** 0.00%	**2** 8.00%	**11** 44.00%	**12** 48.00%	25
Requirements of Atlantic salmon smolts and postsmolts in RAS: V. Mota (Nofima) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**12** 46.15%	**14** 53.85%	26
Requirements of Atlantic salmon smolts and postsmolts in RAS: V. Mota (Nofima) - **relevance**	**0** 0.00%	**0** 0.00%	**1** 3.85%	**10** 38.46%	**15** 57.69%	26
Commercial production of rainbow trout and salmon in RAS: P. Bovbjerg Pedersen (DTU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**12** 46.15%	**14** 53.85%	26
Commercial production of rainbow trout and salmon in RAS: P. Bovbjerg Pedersen (DTU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**13** 50.00%	**13** 50.00%	26
RAS in practice: B. Rohaan (KINGFISH Zeeland) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**2** 7.69%	**14** 53.85%	**10** 38.46%	26
RAS in practice: B. Rohaan (KINGFISH Zeeland) - **relevance**	**0** 0.00%	**0** 0.00%	**1** 3.85%	**15** 57.69%	**10** 38.46%	26
Off-flavour in RAS: E. Schram (WUR) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**7** 26.92%	**11** 42.31%	**8** 30.77%	26
Off-flavour in RAS: E. Schram (WUR) - **relevance**	**0** 0.00%	**0** 0.00%	**7** 26.92%	**9** 34.62%	**10** 38.46%	26

Total Responses	26
Skipped	4

17. **17. How would you rate the quality of the following parts from Day4?**

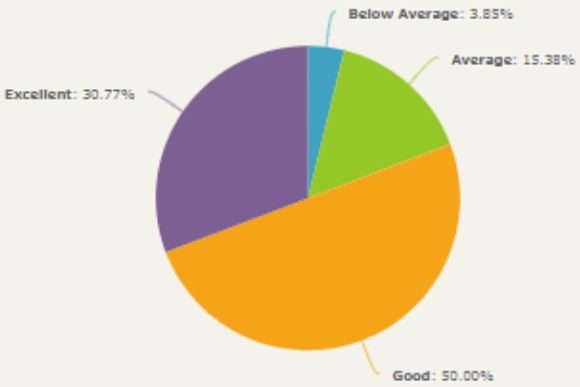


	Poor	Below Average	Average	Good	Excellent	Responses
Energy control and low energy: RAS: P. Bovbjerg Pedersen (DTU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 3.85%	**10** 38.46%	**15** 57.69%	26
Energy control and low energy: RAS: P. Bovbjerg Pedersen (DTU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**10** 40.00%	**15** 60.00%	25
Semi-intensive RAS and recent developments: P. Bovbjerg Pedersen (DTU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**13** 50.00%	**13** 50.00%	26
Semi-intensive RAS and recent developments: P. Bovbjerg Pedersen (DTU) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**13** 50.00%	**13** 50.00%	26

Integrated Aquaculture Systems - A way to treat and valorize waste?: IFREMER/ M. Nederlof (WU) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**4** 15.38%	**10** 38.46%	**12** 46.15%	26
Integrated Aquaculture Systems - A way to treat and valorize waste?: IFREMER/ M. Nederlof (WU) - **relevance**	**0** 0.00%	**0** 0.00%	**4** 16.00%	**10** 40.00%	**11** 44.00%	25
Practical session I - **instruction and materials**	**0** 0.00%	**1** 3.85%	**5** 19.23%	**6** 23.08%	**14** 53.85%	26
Practical session I - **relevance**	**0** 0.00%	**0** 0.00%	**3** 11.54%	**7** 26.92%	**16** 61.54%	26
Practical session II - **instruction and materials**	**0** 0.00%	**1** 3.85%	**5** 19.23%	**6** 23.08%	**14** 53.85%	26
Practical session II - **relevance**	**0** 0.00%	**0** 0.00%	**4** 15.38%	**6** 23.08%	**16** 61.54%	26
Practical session III - **instruction and materials**	**0** 0.00%	**1** 3.85%	**5** 19.23%	**6** 23.08%	**14** 53.85%	26
Practical session III - **relevance**	**0** 0.00%	**0** 0.00%	**4** 16.00%	**5** 20.00%	**16** 64.00%	25

Total Responses	26
Skipped	4

18. **18. How beneficial was the opportunity to exchange with industry professionals for you personally during the Industry Seminar on Day 4?**



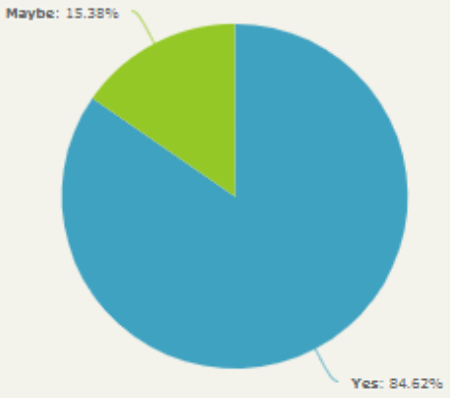
Poor	0.00%		0
Below Average	3.85%		1
Average	15.38%		4
Good	50.00%		13
Excellent	30.77%		8
		Total Responses	26
		Skipped	4

19. **19. Please suggest changes and/or improvements you would like to see made to the trainers' approach to teaching and facilitating:**

Count	Response
1	I woudl have liked it if there would have been a bit more attention for the effect of feed on RAS systems. Now it was only one presentation by Johan Schrama on fish nutrition but I think it would be relevant to go in more detail. Possibly by involving a fish feed manufactorer to let them explain what the difference is between RAS diets and diets for other systems. Feeding is a daily activity that had a huge impact on the RAS system. I think that not every RAS operator is aware of what to focus on when changing feed type or supplier for instance.
1	I would like to have a thorough follow through of the excel sheet.
1	More excercise with calculation
1	N/a
1	To meet the demands of the future and protect the environmenta more reasearch must be done on more marine fish species of the mediterranean
1	Use of handouts.

Total Responses	6
Skipped	24

20. **20. Would you like to attend a follow-up course in the future.**



Yes	84.62%		22
No	0.00%		0
Maybe	15.38%		4
		Total Responses	26
		Skipped	4

21. **21. Would you recommend this course to a fellow student/colleague?**

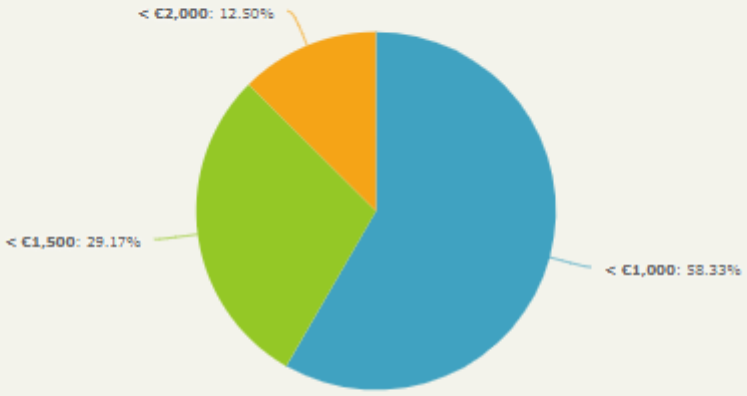
Yes	100.00%		23
No	0.00%		0
Maybe	0.00%		0
		Total Responses	23
		Skipped	7

22. **22. Please describe your learning experience in "Twitter" style (280 characters or less):**

Count	Response
1	"The practical sessions were invaluable"
1	A very intersting week with varying topics, keeping everyone interested throughout the course.
1	Excellent networking opportunites! Heavy content.
1	Great. Always room for new knowledge and apparently I had more room than I even realized!!
1	Hands-on, intensive and quality learning for any aquaculture researcher or fish farmer.
1	Highly interesting! Topics, hihly skilled lecturers and really useful networking!!
1	I am very glad to attend this amazing course!
1	I am working in the RAS farm since last two years. Actually i was not familier with so many things that´s going inside RAS, in short like "Fisk soup" with so many ingredients from one of the lectures from Vasco Mota. This course opened the way for me and i could think RAS from so many perspectives.
1	I enjoyed the course, that gave me a unique introduction to modern recirculating aquaculture systems. The systems and their challenges are matters that by ongrowing recearch and empirical data will get better and improve the quality of aquaculture fish species with respect to the natural envrinment.
1	I have had a great opportunity hearing from experts the matters of modern aquaculture. Matters of engineering and biology were analyzed as well as empirical methods were presented. The course helped me get an insight in RAS and FREA and i hope i ll be able to participate in the future
1	I learn a lot of new things about salt water RAS. The importance of the CO2 and the pH level
1	Very good, very professional staff.
1	Very well organized and industry oriented course.

Total Responses	13
Skipped	17

23. **23. The RAS course was subsidised. What would be the maximum amount you/your company could afford to pay for a similar course?**



< €1,000	58.33%		14
< €1,500	29.17%		7
< €2,000	12.50%		3
< €3,000	0.00%		0
> €3,000	0.00%		0
		Total Responses	24
		Skipped	6

24. **24. Would you or your institute be interested in future RAS courses organised by Wageningen University at the cost indicated by you above?**

Yes	54.17%		13
No	0.00%		0
Maybe	45.83%		11
		Total Responses	24
		Skipped	6

25. **25. Do you have any other suggestions or feedback?**

Count	Response
1	-
1	More talks related with fish health.
1	no
1	No
1	Practical calculation and design (more time and more details about designs of a small RAS)
1	RAS is the future aquaculture. Keep updating all the latest research going on RAS. I am very much impressed with the online measurements of TAN, nitrite, nitrate and pH of water samples from a visit of Wageningen fish lab.

Total Responses	6
Skipped	24

26. **This evaluation is processed anonymously.**

However, if you are open for questions please leave

your name and contact details:

Total Responses	8
Skipped	22

Annex 8: Certificate of Participation

AQUAEXCEL2020 – Training Course

CERTIFICATE OF PARTICIPATION

This certificate confirms that the following candidate participated in the AQUAEXCEL2020 Training Course

"RECIRCULATING AQUACULTURE SYSTEM (RAS) TECHNOLOGY"

provided by Wageningen University in the Netherlands

May 6-9, 2019

NAME

This Training Course was held as part of the AQUAEXCEL2020 project funded by the EU Horizon 2020 research and innovation programme under grant agreement no 652831.
http://www.aquaexcel2020.eu

Training Course Details

- The objectives of this course were to review the basics of RAS and examine the different systems, designs, operations and applications.
- A half day industry mini seminar on RAS evolution and new RAS uses, involving RAS farmers and engineering companies, gave the course participants an opportunity to exchange with industry professionals.
- The 4 days-course was taught by 12 tutors who are all experts in their field.

Ep Eding
Wageningen University

Geertje Schlaman
Wageningen University

Annex 9: Check list

Deliverable Check list (to be checked by the “Deliverable leader”)

	Check list		Comments
BEFORE	I have checked the due date and have planned completion in due time		*Please inform Management Team of any foreseen delays*
	The title corresponds to the title in the DOW		*If not please inform the Management Team with justification*
	The dissemination level corresponds to that indicated in the DOW		
	The contributors (authors) correspond to those indicated in the DOW		
	The Table of Contents has been validated with the Activity Leader		*Please validate the Table of Content with your Activity Leader before drafting the deliverable*
	I am using the AQUAEXCEL2020 deliverable template (title page, styles etc)		*Available in “Useful Documents” on the collaborative workspace*
The draft is ready			
AFTER	I have written a good summary at the beginning of the Deliverable		*A 1-2 pages maximum summary is mandatory (not formal but really informative on the content of the Deliverable)*
	The deliverable has been reviewed by all contributors (authors)		*Make sure all contributors have reviewed and approved the final version of the deliverable. You should leave sufficient time for this validation.*
	I have done a spell check and had the English verified		
	I have sent the final version to the WP Leader, to the 2nd Reviewer and to the Project coordinator (cc to the project manager) for approval		*Send the final draft to your WPLeader, the 2nd Reviewer and the coordinator with cc to the project manager on the 1st day of the due month and leave 2 weeks for feedback. Inform the reviewers of the changes (if any) you have made to address their comments. Once validated by the 2 reviewers and the coordinator, send the final version to the Project Manager who will then submit it to the EC.*