AQUA EXCEL 2020

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

D4.4d Face-to-face training course 4

University of Stirling, INRA, AquaTT, WUR

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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] contributes. 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 AQUAEXCEL[2020] 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 "Introductory Bioinformatic Course to Sequencing Data Processing" was the fourth face-to-face course in the AQUAEXCEL[2020] training course series and was provided by University of Stirling (UoS) (UK), with the expertise of INRA (France). The objective of this course was to facilitate researchers in gaining a better understanding of their data, gain more insights or to plan experiments better and maximise the analytics output. The key learning objectives were for participants to understand the utility of NGS for a range of aquaculture-related objectives and bioinformatics pipelines for NGS data, and to gain knowledge of specific pipelines for RADseq and RNAseq protocols.

This AQUAEXCEL[2020] training course took place in August 2019 with 24 participants attending, who were selected based on their submitted applications. The course included lectures, practical exercises, a field trip and a mini industry seminar. The mini industry seminar focused on data management and shared environment and gave the participants the opportunity to exchange with an industry professional in the bioinformatics field.

Authors/Teams involved: Rebecca Doyle (AquaTT), Marieke Reuver (AquaTT), Peadar O' Raifeartaigh (AquaTT), Michaël Bekaert (UoS), Christophe Klopp (INRA), Chris Hollenbeck (Xelect), Geertje Schlaman (WU).

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Introduction

AQUAEXCEL^{2020} 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 AQUAEXCEL^{2020}'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 AQUAEXCEL^{2020} has a dedicated task focused on training a new generation of aquaculture researchers and industry stakeholders.

Nine technical training courses in total are organised by different AQUAEXCEL^{2020} partners offered to people within and outside the partnership. The courses focus on different aspects of aquaculture experimentation to foster a culture of cooperation between all parties involved. These training sessions aim to transfer new knowledge and insights originating from the research and services carried out and created by AQUAEXCEL^{2020}.

This AQUAEXCEL^{2020} training course, which was titled "Introductory Bioinformatic Course to Sequencing Data", was a five-day face-to-face course. Key learning objectives were facilitating participants' understanding of the utility of NGS for a range of aquaculture-related objectives and bioinformatics pipelines for NGS data, and to gain knowledge of specific pipelines for RADseq and RNAseq protocols.

As an interdisciplinary field of science, bioinformatics combines biology, computer science, information engineering, mathematics and statistics to analyse and interpret biological data. Aquaculture researchers require the ability to accurately interpret the data from their studies in order to provide scientifically solid recommendations to industry. The course provided an overview of the current methodology and software used in the disciplines as well as hands-on applications introducing the participants to real-world examples.

Two tutors and one guest speaker contributed to this training course (see Annex 4). One tutor (Michaël Bekaert) is from the Institute of Aquaculture, University of Stirling (Scotland, UK) and the other (Christophe Klopp) is from the Department of Applied Mathematics and Informatics, INRA (France). These leading experts in bioinformatics presented on i) Unix/Linux command system and basic scripting, ii) sequence alignment (genomic and transcriptomic), iii) variation calling (SNP), iv) RNA-Seq expression measurement, v) 16S metagenomics, vi) genome assembly with short and long reads, vii) marker development (GBS/RAD-Seq). The course included lectures and practical design exercises, along with a field trip and a mini industry seminar. This mini seminar, featuring guest speaker Chris Hollenbeck (Xelect) focused on data management and shared environment and gave the course participants an opportunity to exchange with an industry professional.

1. Face-to-face course 4

1.1 Pre-course activities

AquaTT developed a promotional leaflet to promote the Training Course "Introductory Bioinformatic Course To Sequencing Data Processing" and the course announcement was 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 2a and b), the project Twitter account and the partners' channels. Annex I shows the promotional leaflet.

Figure 1: Promotional leaflet for AQUAEXCEL2020 Bioinformatics training course

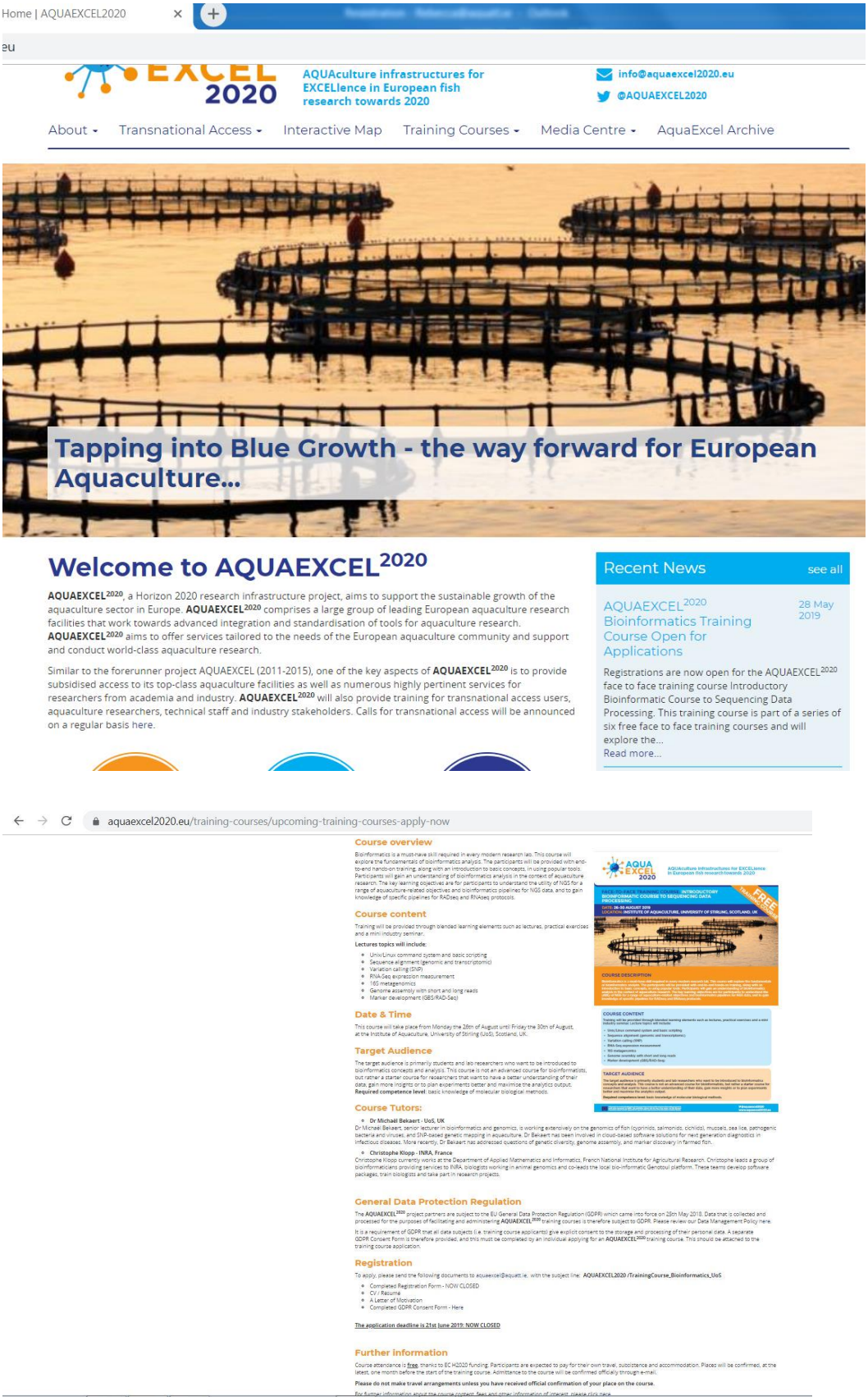

Figure 2a and b: Screenshots of website promotion and application details for Bioinformatics course- https://aquaexcel2020.eu/training-courses/upcoming-training-courses-apply-now

The application period of the course was open from 28 May 2019 until 21 June 2019 and applicants were required to complete a registration form (Annex 2) and a letter of motivation and email both together with their CV to aquaexcel@aquatt.ie.

The target audience was primarily students and lab researchers who wanted to be introduced to bioinformatics concepts and analysis. This course was not designed to be an advanced course for bioinformatists, but rather a starter course for researchers that want to have a better understanding of their data, gain more insights or to plan experiments better and maximise the analytics output. Participants were required to have a basic knowledge of molecular biological methods.

37 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 University of Stirling 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 with the option of including a few non-EU candidates where increased collaborations could be of benefit to Europe, and professionals and scientists working in the bioinformatics field with the ability to contribute to improving bioinformatics analyses across Europe. The course organiser (Michaël Bekaert) decided not to give preference to many applicants from the University of Stirling, and instead repeat this training course for these students on another occasion in the university, to maximise the number of people who would benefit from this training.

1.2 Course activities

24 participants attended the bioinformatics training course. 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 practical assignments and a technical field trip. 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, who had innovative examples and are active in the field of bioinformatics (from the UK and France) (see participant list of industry seminar in Annex 6).

Training material was shared with the participants by the course tutors on GitHub (see Figure 3 for a print-screen of the site).

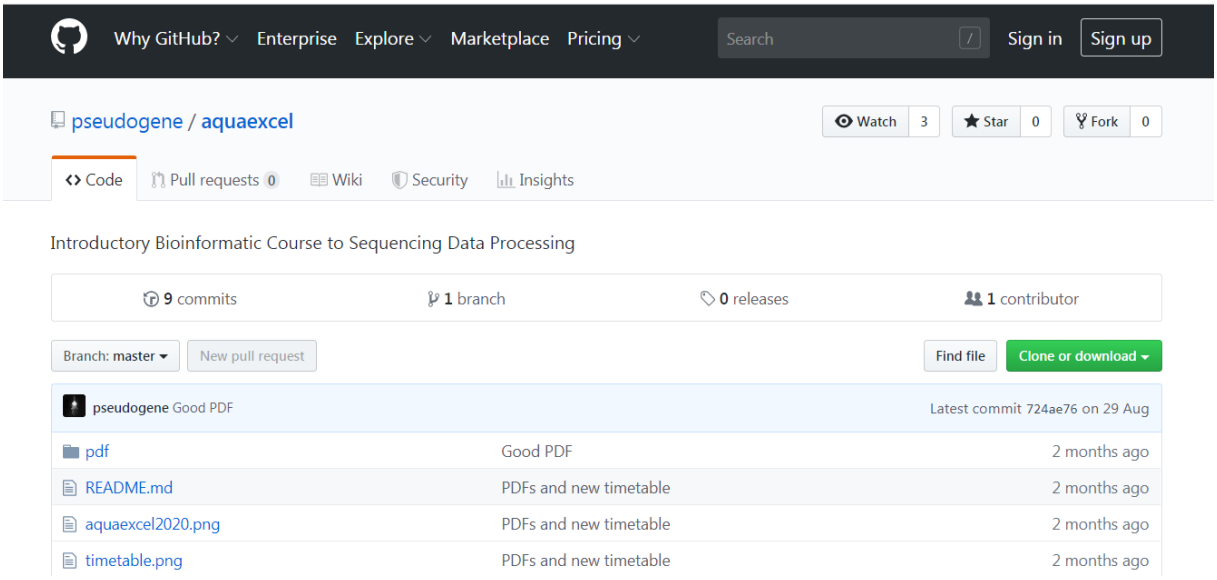

Figure 3: Screenshot of GitHub page.

The training course was designed so that the participants would have the opportunity to carry out practical bioinformatics exercises while the course tutors were present to guide the participants.

After a short introduction explaining the context of the training course each participant could introduce him/herself briefly. Following this, there were a number of sessions focused on Linux command system, basic scripting, remote computing and cloud computing. The participants carried out practical exercises in each of these sessions in order to "learn by doing."

The second and third day followed the same format with lectures and practical exercises. The topics focused on were sequence formats, sequence quality, sequence alignment (genomic), sequence alignment (transcriptomic), 16S metagenomics, variation calling (SNP), RNA-Seq expression and Marker development (GBS/RAD-Seq).

The fourth day began with an open discussion on the research typically carried out by the participants and the types of data and analysis they were handling/planning. In the afternoon, a mini industry seminar took place. Xelect presented a bioinformatics case study at this seminar. Following the seminar, there had been a visit planned to the Xelect facilities. Unfortunately, this trip was cancelled with short notice. Instead, the tutors and participants took a cultural trip to the Wallace Monument. This social session allowed the participants some important time to network and discuss the course.

The final day of the training course consisted of practical sessions focusing on genome assembly.

Figure 4: Participants of the AQUAEXCEL2020 Bioinformatics training course.

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 future AQUAEXCEL2020 training courses, and evaluate the need for future bioinformatics 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.

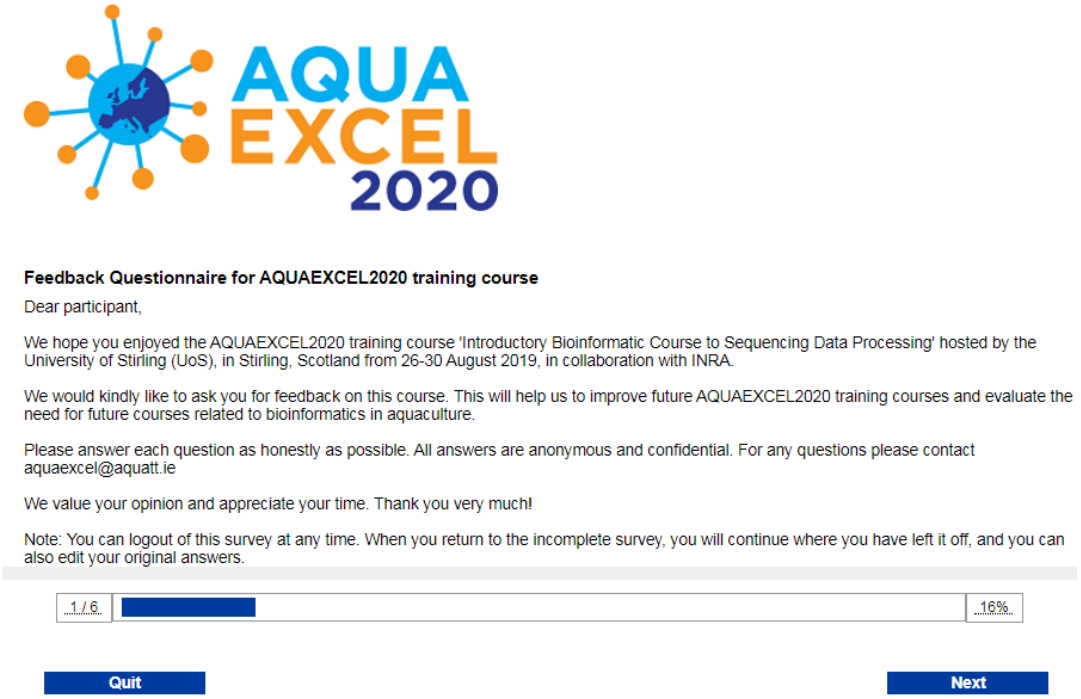

Figure 6: Print screen of welcome page of the online evaluation survey.

Participants were given a certificate of participation if requested upon completion of the course (Annex 8). Training material was also made available to participants after the course through GitHub.

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. AquaTT also developed the deliverable report.

2. Conclusions

Most respondents heard about the course from colleagues (42%) and from the AQUAEXCEL2020 website (32%). 21% of respondents heard about the course through the AQUAEXCEL2020 Twitter and 5% found the course through an internet search. The online feedback survey had 19 respondents, and all results are included in Annex 7.

Almost half (47%) of the respondents received travel and subsistence funding to attend this course through project grants/funding, while 37% were funded through their employer and 16% were either fully or partially self-funded. The fact that quite a number of the participants of this bioinformatics course were willing to self-fund their expenses emphasises that it is an important and timely training course.

The training course achieved the desired objectives of training participants to understand the utility of NGS for a range of aquaculture-related objectives and bioinformatics pipelines for NGS data, and to gain knowledge of specific pipelines for RADseq and RNAseq protocols. This is evident as the percentage of participants with moderate knowledge of bioinformatics increased from 11% before the course to 47% after the course. No participants had detailed knowledge of bioinformatics before the course, but this increased to about 16% after the course. Before the training course 42% of respondents had no knowledge of bioinformatics. After the training course, no respondents selected the "no knowledge" option.

The respondents' feedback showed very positive results of the course. 89% agreed or strongly agreed that the duration of the course was good, that the procedure for registration was clear and simple, and that the information leaflet about the course was informative and visually attractive. 94% agreed or strongly agreed that the communication of the course (programme, announcements) was good and that the information at the start of the course was clear. The main conclusion from this feedback is that the following AQUAEXCEL2020 face-to-face training courses should follow the steps taken for the bioinformatics course in terms of registration, course duration, promotional leaflet and communication.

The training course achieved a very successful grade from the respondents, with 47% awarding it the highest grade (excellent) and 53% awarding it a grade of good; totalling 100%. No participants rated the course poor or below average.

Some examples of reasons for the excellent grades were:

- *"Good overview of multiple analyses you can do in bioinformatics."*
- *"In total course was excellent, we learned a lot and had a great time."*
- *"It was well organized, the mentors were too good in and had expertise in the subjects. They were very clear and tried their best to introduce us to the subjects. They literally gave their best. For instance, they encouraged us and stayed with us, helping us with the command lines after the completion of the lecture hours too."*
- *"The course was excellent and fulfilled my expectations"*

- *"The structure of the course was well planned, combined with theoretical and practical inputs. The number of participants were optimal for two lecturers."*

Respondents were also very positive about the mini industry seminar. 62% 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 AQUAEXCEL[2020] training courses and the value participants place on this aspect of the course.

When deciding to enrol for the training course, 100% respondents valued course content as a very or extremely important factor. 73% valued the course trainers as a very or extremely important factor, 58% valued the course as free to enrol as a very or extremely important factor and, 37% 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 subjects and content
- The hands-on exercises
- The tutors
- The clear introduction
- Good teaching methods
- Opportunity to collaborate with other participants

Areas were there were suggestions for improvement for future AQUAEXCEL[2020] training courses included:

- Connection to internet EDUROAM network
- Food provider

For future bioinformatics courses participants suggested the following topics:

- Genome-wide association study
- Statistics and final data presentation
- *"I would like to go deeper in the data analysis after obtaining the processed sequencing data. But I believe this should be separately in another course for data analysis using programming languages like R or python."*

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 bioinformatics. 100% of respondents indicated that they would be interested in attending a follow-up course. 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 bioinformatics knowledge in the aquaculture industry.

Glossary

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

UoS: University of Stirling

INRA: French National Institute for Agricultural Research

EAS: European Aquaculture Society

FEAP: Federation of European Aquaculture Producers

EATiP: European Aquaculture Technology and Innovation Platform

Document information

EU Project N°	652831	**Acronym**	AQUAEXCEL[2020]
Full Title	AQUAculture Infrastructures for EXCELlence in European Fish Research towards 2020		
Project website	www.aquaexcel.eu		

Deliverable	**N°**	D4.4d	**Title**	**Face-to-face training course 4**
Work Package	**N°**	**4**	**Title**	**Integration, training, dissemination and cooperation**

Date of delivery	**Contractual**	09/2019 (Month 48)	**Actual**	08/2019 (Month 47)
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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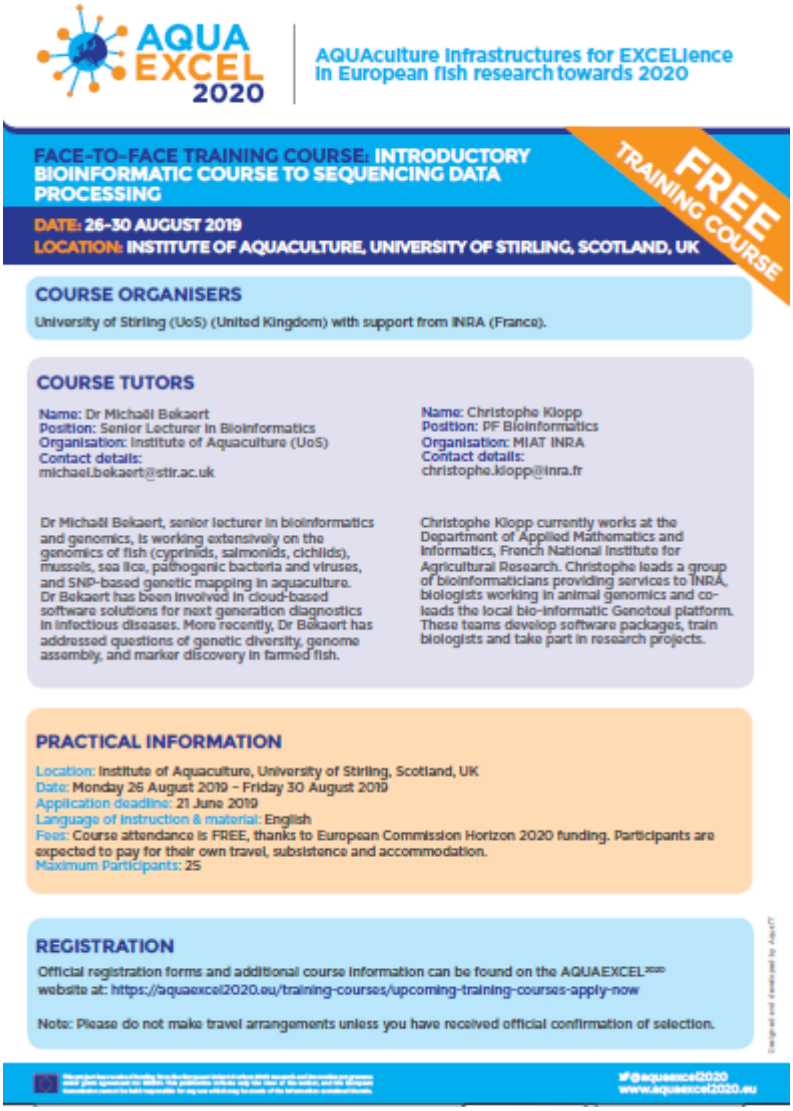
Version log			
Issue Date	**Revision N°**	**Author**	**Change**

Annex 1: Promotional Leaflet



AQUA EXCEL 2020

AQUAculture Infrastructures for EXCELlence in European fish research towards 2020

FACE-TO-FACE TRAINING COURSE: INTRODUCTORY BIOINFORMATIC COURSE TO SEQUENCING DATA PROCESSING

FREE TRAINING COURSE

DATE: 26-30 AUGUST 2019

LOCATION: INSTITUTE OF AQUACULTURE, UNIVERSITY OF STIRLING, SCOTLAND, UK

COURSE ORGANISERS

University of Stirling (UoS) (United Kingdom) with support from INRA (France).

COURSE TUTORS

Name: Dr Michaël Bekaert
Position: Senior Lecturer in Bioinformatics
Organisation: Institute of Aquaculture (UoS)
Contact details:
michael.bekaert@stir.ac.uk

Dr Michaël Bekaert, senior lecturer in bioinformatics and genomics, is working extensively on the genomics of fish (cyprinids, salmonids, cichlids), mussels, sea lice, pathogenic bacteria and viruses, and SNP-based genetic mapping in aquaculture. Dr Bekaert has been involved in cloud-based software solutions for next generation diagnostics in infectious diseases. More recently, Dr Bekaert has addressed questions of genetic diversity, genome assembly, and marker discovery in farmed fish.

Name: Christophe Klopp
Position: PF Bioinformatics
Organisation: MIAT INRA
Contact details:
christophe.klopp@inra.fr

Christophe Klopp currently works at the Department of Applied Mathematics and Informatics, French National Institute for Agricultural Research. Christophe leads a group of bioinformaticians providing services to INRA, biologists working in animal genomics and co-leads the local bio-informatic Genotoul platform. These teams develop software packages, train biologists and take part in research projects.

PRACTICAL INFORMATION

Location: Institute of Aquaculture, University of Stirling, Scotland, UK
Date: Monday 26 August 2019 – Friday 30 August 2019
Application deadline: 21 June 2019
Language of instruction & material: English
Fees: Course attendance is FREE, thanks to European Commission Horizon 2020 funding. Participants are expected to pay for their own travel, subsistence and accommodation.
Maximum Participants: 25

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 AquaIT

@aquaexcel2020
www.aquaexcel2020.eu

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: INTRODUCTORY BIOINFORMATIC COURSE TO SEQUENCING DATA PROCESSING

Organiser(s): University of Stirling, Scotland with support from INRA (France).
Dates: 26 – 30 August 2019
Location: Institute of Aquaculture, University of Stirling, Scotland, UK

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, two months 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_Bioinformatics_UoS** by the **21st of June 2019.**

- **Completed Registration Form**
- **CV / Résumé**
- **Letter of Motivation**
- **Completed and signed 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 completed and signed GDPR form, indicating in subject: AQUAEXCEL2020 /TrainingCourse_Bioinformatics_UoS

Annex 3: Course Agenda

Introductory Bioinformatic Course to Sequencing Data Processing

Time	Sun 25th	Mon 26th	Tue 27th	Wed 28th	Thu 29th	Fri 30th
07:30:00		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
08:00:00						
08:30:00		Get togeather	Sequence formats Pathfoot, A96	16S metagenomics Pathfoot, A96	Open discussion Pathfoot, C21	Genome assembly Pathfoot, A96
09:00:00		Unix/Linux command system Pathfoot, A96				
09:30:00						
10:00:00						
10:30:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00:00		Basic scripting Pathfoot, A96	Sequence quality Pathfoot, A96	Variation calling (SNP) Pathfoot, A96		Genome assembly Pathfoot, A96
11:30:00						
12:00:00						
12:30:00						
13:00:00		Lunch	Lunch	Lunch	Lunch	Lunch
13:30:00						
14:00:00		Remote computing Pathfoot, A96	Sequence alignment (genomic) Pathfoot, A96	RNA-Seq expression Pathfoot, A96	Xelect Industry seminar Pathfoot, C21	
14:30:00						
15:00:00						
15:30:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break	
16:00:00		Cloud computing Pathfoot, A96	Sequence alignment (transcriptomic) Pathfoot, A96	Marker development (GBS/RAD-Seq) Pathfoot, A96	Trip	
16:30:00						
17:00:00						
17:30:00						
18:00:00						
18:30:00						
19:00:00	Dinner	Dinner	Dinner	Dinner	Dinner	
19:30:00						

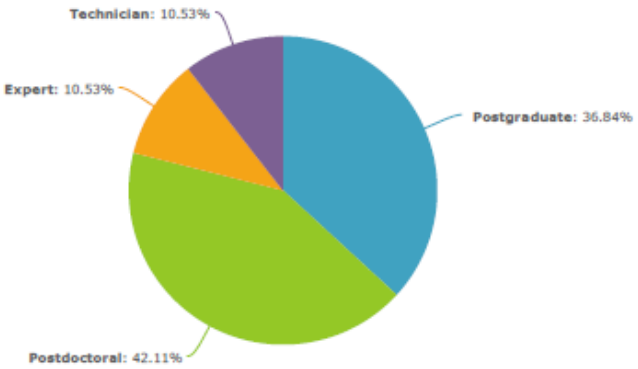
Annex 4: Course Tutors

Annex 5: Participant List: Training Course

Annex 6. Participant list: Industry seminar

Annex 7. Survey results

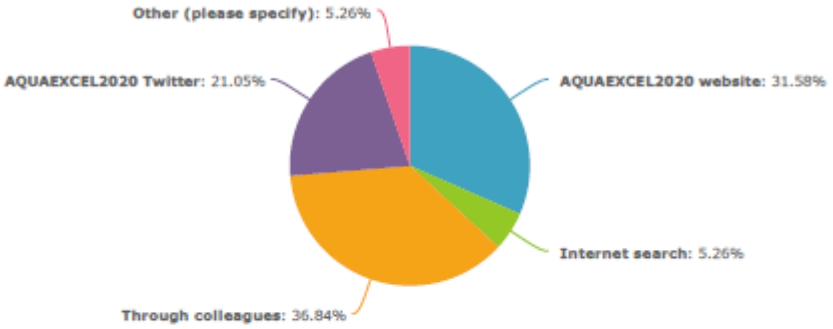
1. **1. What is your current research category?**



Postgraduate	36.84%		7
Postdoctoral	42.11%		8
Expert	10.53%		2
Technician	10.53%		2
		Total Responses	19
		Skipped	1

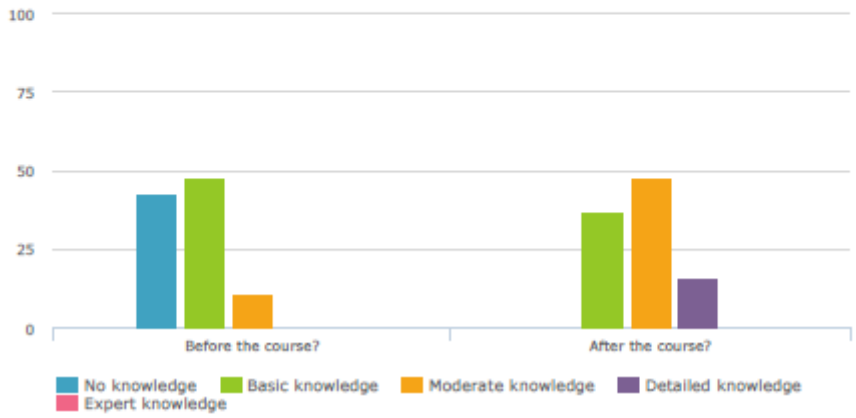
siencist	3.85%		1
		Total Responses	26
		Skipped	5

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



AQUAEXCEL2020 website	31.58%		6
Internet search	5.26%		1
Through colleagues	36.84%		7
AQUAEXCEL2020 Twitter	21.05%		4
by receiving the email from the project manager at our faculty	5.26%		1
		Total Responses	19
		Skipped	1

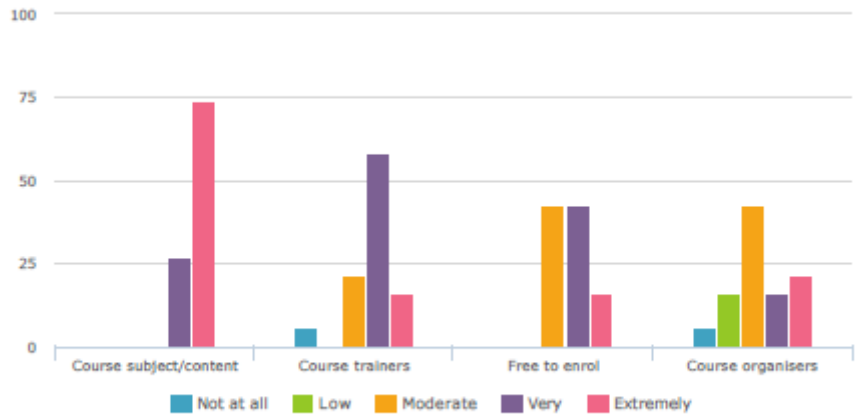
3. 3. How would you rate your knowledge of bioinformatics:



	No knowledge	Basic knowledge	Moderate knowledge	Detailed knowledge	Expert knowledge	Responses
Before the course?	8 42.11%	9 47.37%	2 10.53%	0 0.00%	0 0.00%	19
After the course?	0 0.00%	7 36.84%	9 47.37%	3 15.79%	0 0.00%	19

Total Responses	19
Skipped	1

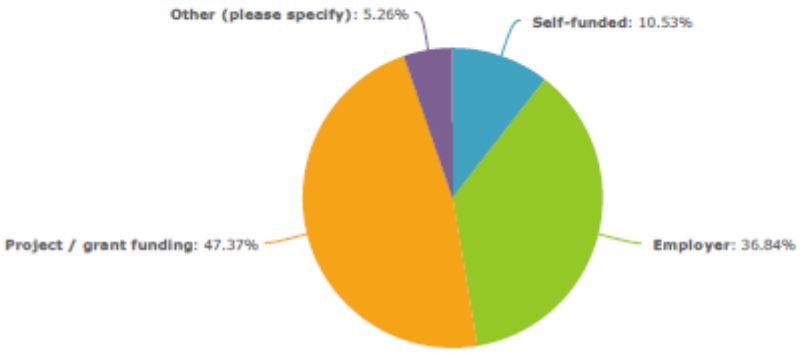
4. 4. How important were the following factors for you when deciding to enrol into this training course?



	Not at all	Low	Moderate	Very	Extremely	Responses
Course subject/content	0 0.00%	0 0.00%	0 0.00%	5 26.32%	14 73.68%	19
Course trainers	1 5.26%	0 0.00%	4 21.05%	11 57.89%	3 15.79%	19
Free to enrol	0 0.00%	0 0.00%	8 42.11%	8 42.11%	3 15.79%	19
Course organisers	1 5.26%	3 15.79%	8 42.11%	3 15.79%	4 21.05%	19

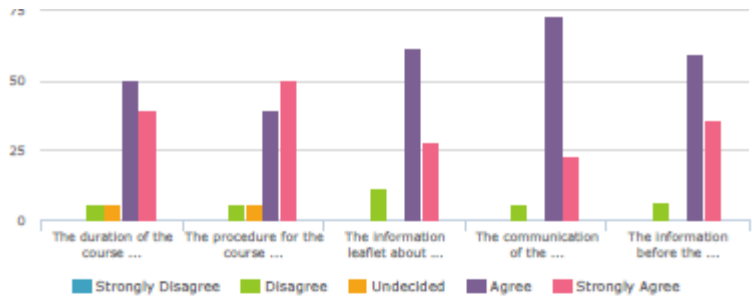
Total Responses	19
Skipped	1

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



Self-funded	10.53%		2
Employer	36.84%		7
Project / grant funding	47.37%		9
Self funding in addition to employer funding	5.26%		1
		Total Responses	19
		Skipped	1

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%	1 5.56%	1 5.56%	9 50.00%	7 38.89%	18
The procedure for the course registration was clear and simple.	0 0.00%	1 5.56%	1 5.56%	7 38.89%	9 50.00%	18
The information leaflet about the course was informative and visually attractive.	0 0.00%	2 11.11%	0 0.00%	11 61.11%	5 27.78%	18
The communication of the course (announcements, programme, etc.) was good.	0 0.00%	1 5.56%	0 0.00%	13 72.22%	4 22.22%	18
The information before the start of the course was clear.	0 0.00%	1 5.88%	0 0.00%	10 58.82%	6 35.29%	17

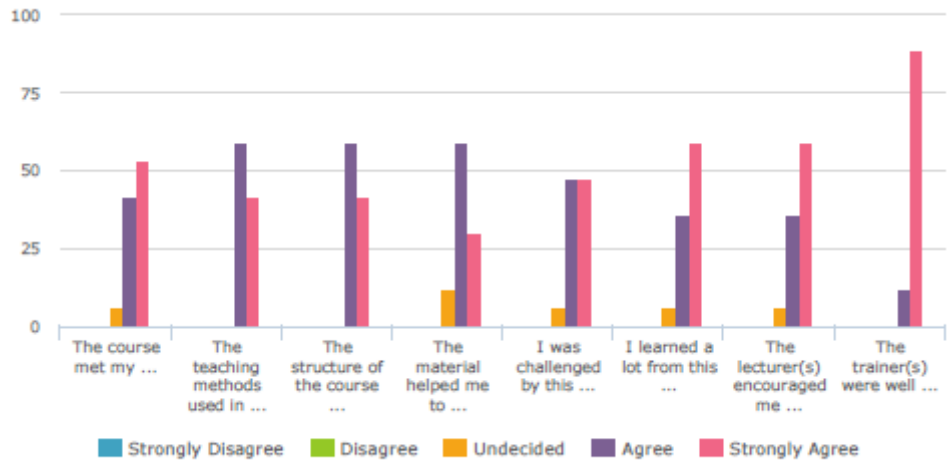
Total Responses	18
Skipped	2

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

Count	Response
1	Extremely expensive accomodation offered by University of Stirling Venues, initially offering a 4star hotel when comparing prices and finally booking with them, and a week before indicating accommodation was in student rooms very near course venue which was convenient but expensive. Problems with internet connection to EDUROAM.
1	In my opinion, the accomodation offer from the University of Stirling was illogical, unfavourable and rather tardy. Accomodation with lunch and coffee breaks was more expensive or similar in price to all inclusive offer which leaves little room for flexibility.
1	It was very well organised course.
1	The organization was overall good, as it provided good details on the programme and the plan of the day. Moreover, it was feasible to follow the programme schedule, it was a bit intense but it offer lots of knowledge in short time. Thus, I believe that the tutors were quite efficient and very helpful!
1	Very nicely organised by Michaël except few small technical issues. The food was extremely salty.

Total Responses	5
Skipped	15

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

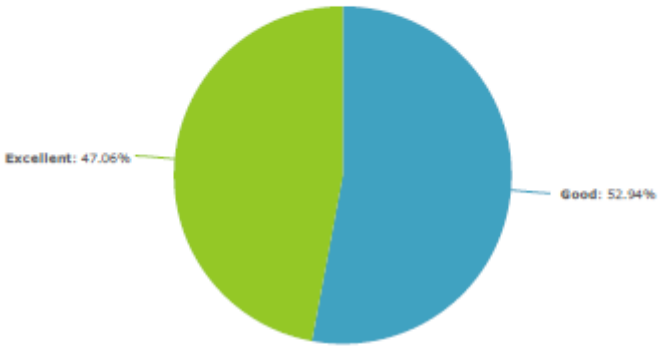


	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Responses
The course met my expectations.	0 0.00%	0 0.00%	1 5.88%	7 41.18%	9 52.94%	17
The teaching methods used in this course helped me achieve the course's learning outcomes.	0 0.00%	0 0.00%	0 0.00%	10 58.82%	7 41.18%	17
The structure of the course was logical.	0 0.00%	0 0.00%	0 0.00%	10 58.82%	7 41.18%	17
The material helped me to master the content.	0 0.00%	0 0.00%	2 11.76%	10 58.82%	5 29.41%	17
I was challenged by this course.	0 0.00%	0 0.00%	1 5.88%	8 47.06%	8 47.06%	17
I learned a lot from this course.	0 0.00%	0 0.00%	1 5.88%	6 35.29%	10 58.82%	17
The lecturer(s) encouraged me to think about the subject matter.	0 0.00%	0 0.00%	1 5.88%	6 35.29%	10 58.82%	17
The trainer(s)	0	0	0	2	15	17

were well prepared and knowledgeable.	0.00%	0.00%	0.00%	11.76%	88.24%

Total Responses	17
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	0.00%		0
Good	52.94%		9
Excellent	47.06%		8
		Total Responses	17
		Skipped	3

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

Count	Response
1	Basically the course arrangement is in line with my expectations.
1	Good overview of multiple analyse you can do in bioinformatics.
1	If I had been able to connect to EDUROAM and do exercises on my own computer I would grade the course as Excellent.
1	In total course was excellent, we learned a lot and had a great time.
1	It was well organized, the mentors were too good in and had expertise in the subjects. They were very clear and tried their best to introduce us to the subjects. They literally gave their best. For instance, they encouraged us and stayed with us, helping us with the command lines after the completion of the lecture hours too.
1	No comments, brilliant course!
1	Overall, the course met my expectations with plenty of gathered material for future use, interesting discussions and insight form top experts in the field. There are always things to improve, so my grade is good.
1	Please see my comment on the overall feedback.
1	The course was excellent and fulfil my expectations
1	The course was very well-organized and perfectly presented by the lecturers. I was somehow missing at some sections due to the lack of my knowledge in the field.
1	The structure of the course was well planned, combined with theoretical and practical inputs. The number of participants were optimal for two lecturer.
1	Very useful

Total Responses	12
Skipped	8

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

Count	Response
1	Contents were very well structured, good instructors, hands-on practice.
1	Exercises after clear introduction
1	Good structure of the course and very good lecturers.
1	Good teaching method. Practising on real data what we learn
1	how approachable, friendly and helpful the teachers were.
1	Learning that this is an introduction and that more practice is required, that trial and error help with learning scripts.
1	Michaël and Christophe teaching
1	The concept of the course, very logical to introduce the field Structure of practical sessions-not all scripts were prepared in advance, students were enouraged to find the solutions themselves, but solutions were also provided after reasonable amount of time Short and clear lectures, immediately followed by practical sessions Short meditations, unusual but efective approach Contact with the trainers Technical issues arose during the course, but were swiftly addressed
1	The hands on the bioinformatics and opportunity to collaborate with the trainees of the course
1	The lecturar Dr. Christophe Kloppe was extremely presented the lectures so that I was understanding the issues clearly.
1	The mentors had an extreme level of patience and teaching skills
1	The trainer tracked each student's progress and patiently explain.
1	The tutors tried to give us feedback on the exercises and they helped us to understand the way of thinking in order to approach each exercise.

Total Responses	13
Skipped	7

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

Count	Response
1	According to the progress of the students to appropriately change teaching speed.
1	Better visual aid and power supply
1	Connection to internet EDUROAM, some of us had problems that may have been able to be solved previously if knowing exact requirements of computers to be able to connect.
1	Connection to the network - eduroam doesn't seem to be a realiable way to connect; It might be useful to send some introductory material to students before the first lecture, with all the starting web links included, to avoid confusion, especially if issues with connection arise.
1	FOOD PROVIDER
1	just some technical aspects like cable plugs and wifi access.
1	not really
1	Problem with the connection to Eduroam. It make us loose some time to more relevant practice things
1	The course should be given in 2 weeks instead of one week. It was a lot of information which is really good but somehow we were time-bounded and not every student could get enough time to perform the exercises.
1	The court should be longer and specific e.g. RNASeq
1	The main reason I participated at the course was that in the announcement was written that this course is organized for the beginners, but at the course I rarely found a beginner such as myself. Therefore, it was not easy for me to catch the lectures in some sections! I propose for the next time, considering the real level of the participants at the field, so that the professionals will not be bored and on the other hand the beginners such as me will not be lost.
1	The server access was quite limited, so the data processing was slow. And more plugs were required for the computers.

Total Responses	12
Skipped	8

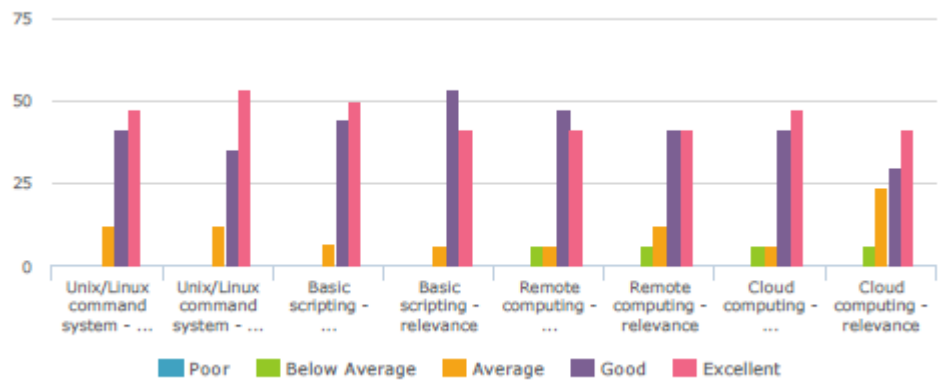
13. **13. Did you miss any subjects/topics?**

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

Count	Response
1	Genome-wide association studies could have been introduced too.
1	Genome-wide association study
1	I skipped last days due to my travel arrangement. No additional topics are needed, in my opinion.
1	I would like to go deeped in the data analysis after obtaining the processed sequencing data. But I believe this should be separately in another course for data analysis using programming languages like R or python.
1	no
1	No
1	NO
1	No, I think all basics of data processing were included.
1	None
1	Presentation of the results eg graphs etc
1	Statistics and final data presentation
1	Yes, but this was due to the lack of my knowledge and experience in this field and not related to the lecturers at all. Therefore, I do not want to complain about it!

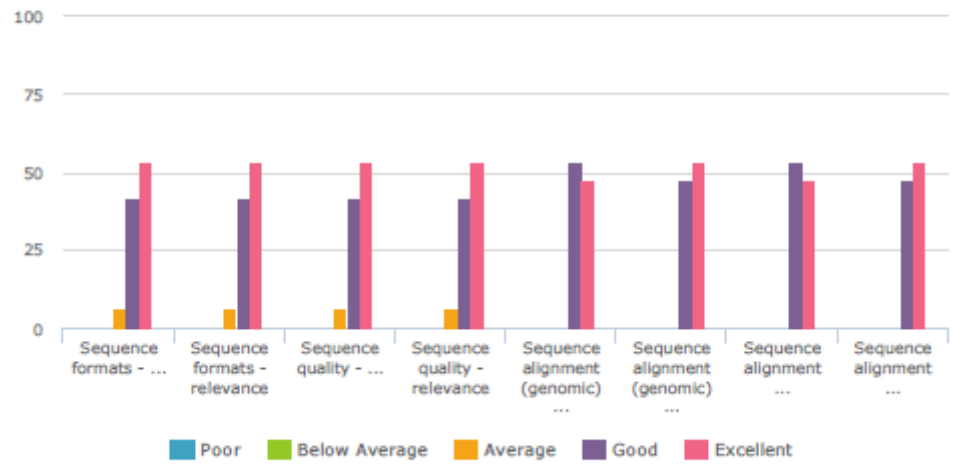
Total Responses	12
Skipped	8

14. **14. How would you rate the quality of the following parts from Day 1?**



	Poor	Below Average	Average	Good	Excellent	Responses
Unix/Linux command system - **presentation and materials**	0 0.00%	0 0.00%	2 11.76%	7 41.18%	8 47.06%	17
Unix/Linux command system - **relevance**	0 0.00%	0 0.00%	2 11.76%	6 35.29%	9 52.94%	17
Basic scripting - **presentation and materials**	0 0.00%	0 0.00%	1 6.25%	7 43.75%	8 50.00%	16
Basic scripting - **relevance**	0 0.00%	0 0.00%	1 5.88%	9 52.94%	7 41.18%	17
Remote computing - **presentation and materials**	0 0.00%	1 5.88%	1 5.88%	8 47.06%	7 41.18%	17
Remote computing - **relevance**	0 0.00%	1 5.88%	2 11.76%	7 41.18%	7 41.18%	17
Cloud computing - **presentation and materials**	0 0.00%	1 5.88%	1 5.88%	7 41.18%	8 47.06%	17
Cloud computing - **relevance**	0 0.00%	1 5.88%	4 23.53%	5 29.41%	7 41.18%	17

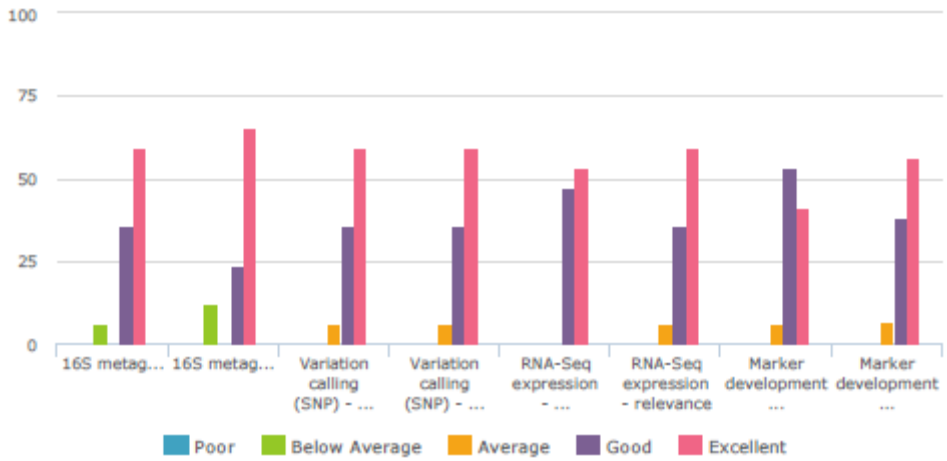
15. **15. How would you rate the quality of the following parts from Day 2?**



	Poor	Below Average	Average	Good	Excellent	Responses
Sequence formats - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**7** 41.18%	**9** 52.94%	17
Sequence formats - **relevance**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**7** 41.18%	**9** 52.94%	17
Sequence quality - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**7** 41.18%	**9** 52.94%	17
Sequence quality - **relevance**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**7** 41.18%	**9** 52.94%	17

Sequence alignment (genomic) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**9** 52.94%	**8** 47.06%	17
Sequence alignment (genomic) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 47.06%	**9** 52.94%	17
Sequence alignment (transcriptomic) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**9** 52.94%	**8** 47.06%	17
Sequence alignment (transcriptomic) - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 47.06%	**9** 52.94%	17

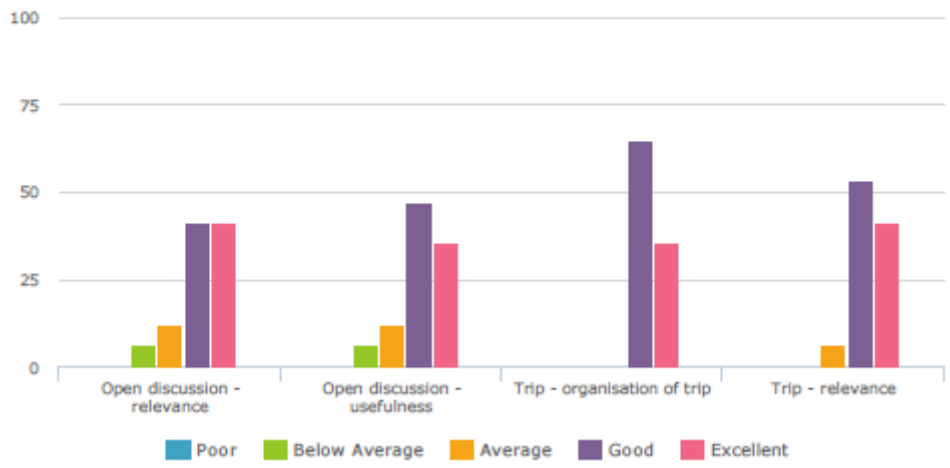
16. **16. How would you rate the quality of the following parts from Day 3?**



	Poor	Below Average	Average	Good	Excellent	Responses
16S metagenomics - **presentation and materials**	**0** 0.00%	**1** 5.88%	**0** 0.00%	**6** 35.29%	**10** 58.82%	17
16S metagenomics - **relevance**	**0** 0.00%	**2** 11.76%	**0** 0.00%	**4** 23.53%	**11** 64.71%	17
Variation calling (SNP) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**6** 35.29%	**10** 58.82%	17
Variation calling (SNP) - **relevance**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**6** 35.29%	**10** 58.82%	17
RNA-Seq expression - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 47.06%	**9** 52.94%	17
RNA-Seq expression - **relevance**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**6** 35.29%	**10** 58.82%	17
Marker development (GBS/RAD-Seq) - **presentation and materials**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**9** 52.94%	**7** 41.18%	17
Marker development (GBS/RAD-Seq) - **relevance**	**0** 0.00%	**0** 0.00%	**1** 6.25%	**6** 37.50%	**9** 56.25%	16

Total Responses	17
Skipped	3

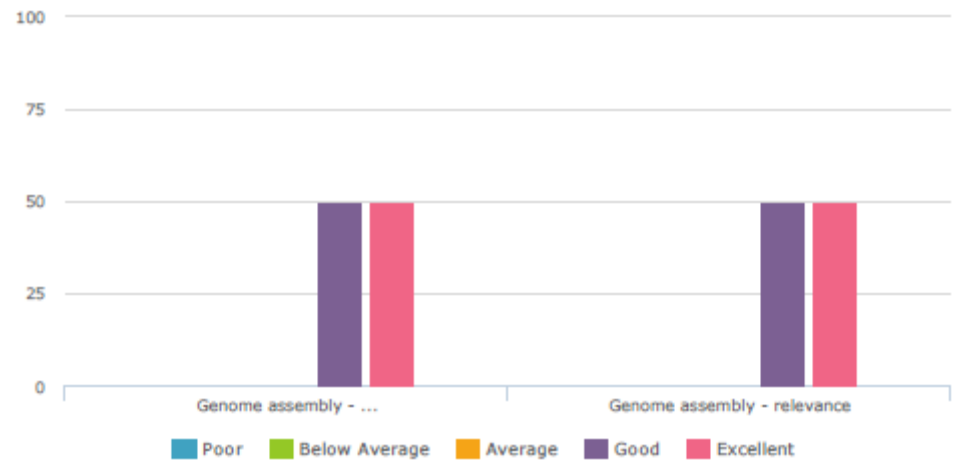
17. **17. How would you rate the quality of the following parts from Day 4?**



	Poor	Below Average	Average	Good	Excellent	Responses
Open discussion - **relevance**	**0** 0.00%	**1** 5.88%	**2** 11.76%	**7** 41.18%	**7** 41.18%	17
Open discussion - **usefulness**	**0** 0.00%	**1** 5.88%	**2** 11.76%	**8** 47.06%	**6** 35.29%	17
Trip - **organisation of trip**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**11** 64.71%	**6** 35.29%	17
Trip - **relevance**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**9** 52.94%	**7** 41.18%	17

Total Responses	17
Skipped	3

18. **18. How would you rate the quality of the following parts from Day 5?**



	Poor	Below Average	Average	Good	Excellent	Responses
Genome assembly - **presentation and materials**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 50.00%	**8** 50.00%	16
Genome assembly - **relevance**	**0** 0.00%	**0** 0.00%	**0** 0.00%	**8** 50.00%	**8** 50.00%	16

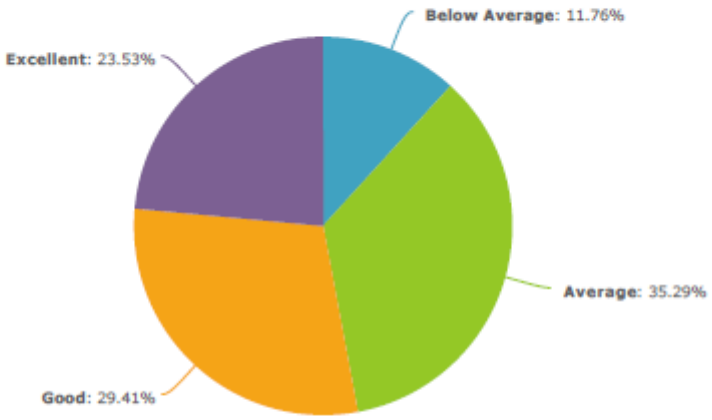
Total Responses	16
Skipped	4

19. **19. How would you rate the quality of the Industry Mini Seminar on Day 4?**

	Poor	Below Average	Average	Good	Excellent	Responses
Mini seminar with industry partners - **opportunities for exchange**	**0** 0.00%	**0** 0.00%	**3** 17.65%	**8** 47.06%	**6** 35.29%	17
Mini seminar with industry partners - **representation of industry experts**	**0** 0.00%	**0** 0.00%	**1** 5.88%	**10** 58.82%	**6** 35.29%	17
Mini seminar with industry partners - **concept**	**0** 0.00%	**0** 0.00%	**2** 11.76%	**10** 58.82%	**5** 29.41%	17

Total Responses	17
Skipped	3

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



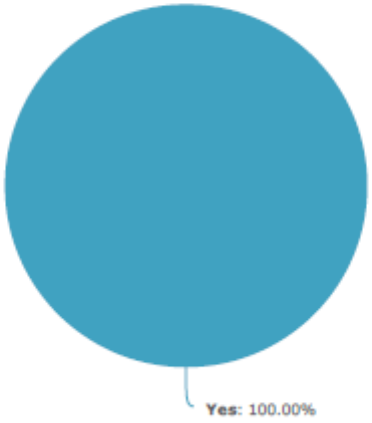
Poor	0.00%		0
Below Average	11.76%		2
Average	35.29%		6
Good	29.41%		5
Excellent	23.53%		4
		Total Responses	17

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

Count	Response
1	Before the course begins, you can send students some basic information to give students a basic understanding.
1	Dr. Christophe Klopp was excellent! I wish I will have another opportunities to listen his talks again!
1	I have no suggestion. The subject is very complex and diverse, and I think the lecturers handled the topics well and were well prepared and organized.
1	In certain occasions we were lost with the command lines, may be have a separate notepad with commands could help.
1	More focus on particular subject rather than broad view of everything.
1	Provide course material prior to the course
1	Seeing that there are always participants with different background, maybe it could be useful to pair students of different background to facilitate the learning process. Or suggest students to try a small introductory course in unix prior to arriving as it might speed things later (exemple: ee.surrey.ac.uk/Teaching/Unix/index.html).
1	spending less time on the keygen part
1	Trainers were really clear and highly professional, but somehow I felt they could have been a bit slow when they introduced us to the command lines. Since it's an introductory course, not everyone will be having enough knowledge/ no knowledge about the topics taught in training course. Also, they started with the command lines directly, instead they could somehow explain to us about the relevance of Unix with the biological data which they explained to us on the later days (2nd day onwards).

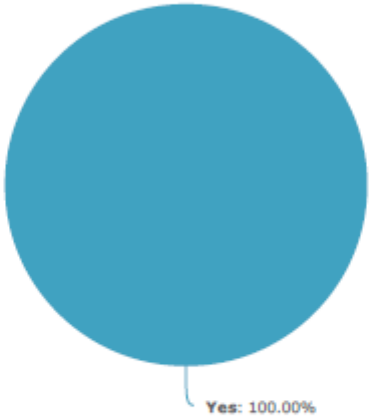
Total Responses 9

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



Yes	100.00%		17
No	0.00%		0
Maybe	0.00%		0
		Total Responses	17
		Skipped	3

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



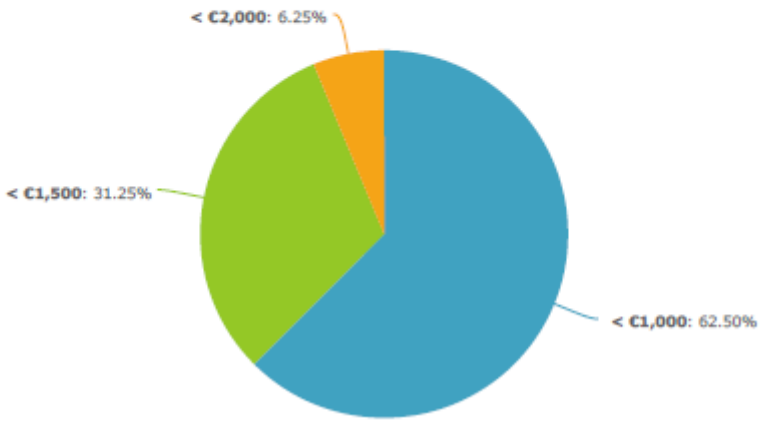
Yes	100.00%		17
No	0.00%		0
Maybe	0.00%		0
		Total Responses	17
		Skipped	3

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

Count	Response
1	#very helful course that take me into the first steps of analysing genome and RNA sequences. Finally know how to prepare the data for further analysis
1	Excellent hands on experience at Bioinformatics course by Aquaexcel2020 for any experience level, highly recommended! Thank you Mickael and Christophe!
1	Great and mind-blowing course!
1	Great experience, had to process a lot of data and use all my brain "cores"
1	Great overview of bioinformatics analysis for genomic study
1	I don't know how Twitter style look likes. Sorry!
1	It was exciting to deal with Unix commands since I never had any application of bioinformatics in my Ph.D. studies. I would learn more if we had 2-3 more days of training. Overall, the training was very well-structured and I learned quite a lot.
1	mkdir command thinking to cd in my brain with bioinformatics
1	Not yet applicable!

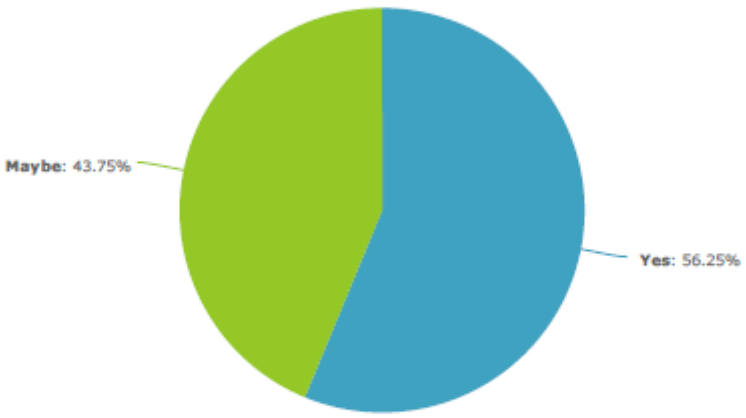
Total Responses	9
Skipped	11

25. 25. The Introductory Bioinformatic Course to Sequencing Data Processing was subsidised. What would be the maximum amount you/your company could afford to pay for a similar course?



< €1,000	62.50%	10
< €1,500	31.25%	5
< €2,000	6.25%	1
< €3,000	0.00%	0
> €3,000	0.00%	0
	Total Responses	16
	Skipped	4

26. **26. Would you or your institute be interested in future Introductory Bioinformatic Courses to Sequencing Data Processing organised by UoS and INRA at the cost indicated by you above?**



Yes	56.25%	9
No	0.00%	0
Maybe	43.75%	7
	Total Responses	16
	Skipped	4

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

Count	Response
1	enjoyed the aquarium tour
1	I understand that it is not easy to choose the participants who are at almost the same level of knowledge and experience in topic, however, this may increase the efficiency of the course for the all participants.
1	If there is any possibility, this course should be for 2 weeks so that we can include GWAS in the syllabus (since it's close to the other topics in the course) and try to interpret the data after analysis by using different software.
2	No.
1	Please organise follow-up courses
1	The accommodation offered by University of Striling was too expensive and not clearly offered, I have not jet received an invoice. Good job done by the course organisers but unfortunaly University of Stirling Venues I would not recommend as the information provided by them was not transparent and misleading to believe we were paying for hotel when we finally accomodated in student romms and did not have room service etc

Total Responses	7
Skipped	13

Annex 8: Certificate of Participation

AQUAculture Infrastructures for EXCELlence in European fish research towards 2020

Training Course: Introductory Bioinformatic Course to Sequencing Data Processing

CERTIFICATE OF PARTICIPATION

This certificate confirms that the following candidate participated in the AQUAEXCEL2020 Training Course: **"Introductory Bioinformatic Course to Sequencing Data Processing"**, provided by the University of Stirling (UoS) (United Kingdom), with the assistance and expertise of INRA (France), from 26 – 30 August 2019.

NAME HERE

Training Course Details

- The objectives of this course were to help participants gain an understanding of bioinformatics in the context of aquaculture research.
- The course contained training on Unix/Linux command system and basic scripting, sequence alignment, variation calling (SNP), RNA-Seq expression measurement, 16S metagenomics, genome assembly with short and long reads and marker development (GBS/RAD-Seq).
- A half day industry mini seminar on bioinformatics gave the course participants an opportunity to exchange with industry professionals.
- The 5 day-course was taught by tutors from UoS and INRA.
- For more details, see www.aquaexcel2020.eu and / or contact the UoS contact person below.

Michaël Bekaert,
University of Stirling (UoS)
michael.bekaert@stir.ac.uk

UNIVERSITY OF STIRLING

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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.*