

# **Aquaculture and Marine Resource Management**

**Faculty of Agricultural and Environmental Sciences,  
Wageningen University**

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This report was finalised on 26 June 2016



# **Report on the master's programme Aquaculture and Marine Resource Management of Wageningen University**

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point (19 December 2014).

## **Administrative data regarding the programme**

### **Master's programme Aquaculture and Marine Resource Management**

Name of the programme:	Aquaculture and Marine Resource Management
CROHO number:	60804
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specialisations or tracks:	- Aquaculture - Marine Resources and Ecology - Marine Governance
Location:	Wageningen
Mode of study:	full time
Language of instruction:	English
Expiration of accreditation:	12 April 2017

The visit of the assessment panel Aquaculture and Marine Resource Management to the Faculty of Agricultural and Environmental Sciences of Wageningen University took place on 9-10 May 2016.

## **Administrative data regarding the institution**

Name of the institution:	Wageningen University
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

## **Composition of the assessment panel**

The NVAO has approved the composition of the panel on 8 February 2016. The panel that assessed the master's programme Aquaculture and Marine Resource Management consisted of:

- Prof. Michel Kaiser (chair), professor of Marine Conservation Ecology at Bangor University, United Kingdom;
- Prof. Maarten Bavinck, associate professor in the Department of Geography, Planning and International Development Studies (GPIO) of the University of Amsterdam and professor of Coastal Resource Governance at the Norwegian College of Fishery Science, University of Tromsø, Norway.

- Eldin Honingh, student of the master's programme Marine Sciences at Utrecht University, the Netherlands;
- Prof. Svein Jentoft, professor at Norwegian College of Fisheries Science, University of Tromsø, Norway;
- Prof. Marco Saroglia, professor emeritus at the University of Insubria in Varese, Italy;
- Prof. Patrick Sorgeloos, professor emeritus at Ghent University, Belgium.

The panel was supported by dr. Floor Meijer, who acted as secretary.

Appendix 1 contains the curricula vitae of the panel members.

## **Working method of the assessment panel**

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### *Preparation*

Before the assessment panel's site visit to Wageningen University, the secretary received the programme's critical reflection. She sent it to the panel after checking it for completeness of information. Upon reading the critical reflection, the panel members formulated questions and preliminary findings. The panel also studied fifteen master's theses and the accompanying assessment forms. The panel chair and secretary selected the theses from a list of graduates of the past two academic years, thereby ensuring that the selection covered all three specialisations of the programme and a variety of grades and supervisors. Appendix 6 contains information regarding the documents and theses that the panel studied.

Prior to the site visit, the secretary composed a schedule. Interviews were planned with students, teaching staff, management, alumni, the Programme Committee and the Board of Examiners. The programme selected representative partners for the various interviews. The schedule of the site visit is included as appendix 5. A preparatory skype call was held between the chair, the secretary and the student member to discuss the aims and objectives of the review and the format of the site visit.

In the week before the site visit, panel member Svein Jentoft informed the secretary that he would not be able to attend the site visit due to unforeseen circumstances. Although he could not be present during the site visit, professor Jentoft agreed to stay involved with the assessment. Prior to the site visit, he shared his findings regarding the documentation and the theses that he had studied with the secretary and panel. His colleague professor Maarten Bavinck was prepared to replace professor Jentoft during the site visit.

### *Site visit*

At the start of the site visit, the panel held a preparatory meeting during which the panel was given instructions regarding the assessment framework. The panel also discussed its working method and its preliminary findings.

During the site visit, the panel examined materials from five core courses of the programme and the underlying specialisations (cf. appendix 6). The availability of some of the materials was limited due to malfunction in the Blackboard software used as the main teaching resource in the university. The panel provided students and lecturers with the opportunity to speak informally with the panel outside the set interviews. There were no applications for this open office hour.

The panel used the final part of the visit to discuss its findings in an internal meeting. The visit was concluded with a public presentation by the panel's chair, in which he expressed the panel's preliminary impressions and general observations.

#### *Report*

After the site visit, the secretary wrote a draft report based on the assessment panel's findings. Subsequently, she sent it to the assessment panel for feedback. After processing the panel members' feedback, the secretary sent the draft report to the university with the request to report any factual inaccuracies. The secretary discussed the ensuing comments with the panel's chair and adapted the report accordingly before finalising it.

#### *Decision rules*

In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of both the standards and the programme as a whole.

#### **Generic quality**

The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

#### **Unsatisfactory**

The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

#### **Satisfactory**

The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

#### **Good**

The programme systematically surpasses the current generic quality standard.

#### **Excellent**

The programme systematically well surpasses the current generic quality standard and is regarded as an international example.

## **Summary judgement**

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The master's programme Aquaculture and Marine Resource Management aims to train academic professionals in the field of the sustainable use, conservation and restoration of marine and aquatic ecosystems and resources. Compared to its predecessor, the Aquaculture and Fisheries programme (assessed in 2010), the current programme is much broader, as it combines ecological, technological, socio-economic and governance perspectives.

The panel has established that the intended learning outcomes of the master's programme match the international requirements for an academic programme at the master's level. While the intended learning outcomes reflect the different perspectives on the field, the panel feels that the goal of interdisciplinarity could be given more emphasis in order to do justice to the integrated profile of the programme. The panel appreciates that the programme has submitted the intended learning outcomes to academic peers and representatives of the professional field. It does, however, conclude that the advisory board that consists of potential employers of graduates could be used to much greater effect to enhance the programme. The panel advises the programme to formalise its relations with the professional field by way of a structural feedback mechanism between the programme and the advisory board which is a powerful resource for academics and students alike.

The two-years master's programme is taught in the English language and starts with three compulsory common courses (18 EC in total) that introduce students to the latest developments in the field and familiarise them with the integration of beta and gamma perspectives on aquaculture and marine resource management. After this common phase, students specialise in (1) Aquaculture, (2) Marine Resources and Ecology, or (3) Marine Governance. The first two specialisations are primarily beta-oriented, while the third is essentially gamma-oriented. Besides following specialisation courses, first-year students also choose electives and follow an academic consultancy training. The second year of the programme consists of an academic internship or minor thesis (24 EC) and a major thesis project (36 EC) that is conducted in one of the chair groups that contribute to the programme. Individual study paths throughout the course are discussed with the study advisor and submitted to the Board of Examiners for approval. This model was noted as a particularly point of strength in the programme as it provides each student with bespoke advice on which skills they need to achieve the intended learning outcomes.

The panel concludes that the content of the curriculum is driven by the marine research lines of the Wageningen chair groups. Therefore, the programme is not exhaustive: students are made aware of the different systems in existence (land-based aquaculture, marine-based aquaculture, etc.), but do not necessarily come into contact with all of them during the programme. The panel received evidence that led to the conclusion that this approach ensures that the research strengths of the chair groups are optimally exploited. Students are sufficiently prepared to independently fill in any remaining knowledge gaps, for example through the choice of their internship.

The panel notes that the curriculum is regularly adapted to meet the demands of students, ongoing research of staff and trends in the domain at large. Recent and foreseen changes include the introduction of the new common course *Trends in Aquaculture* and a restructuring of the Marine Governance specialisation, which was taken by fewer students than the other two specialisations. The panel is positive about these changes, which were partly motivated by student feedback and which testify to the on-going dynamic and flexible nature of the programme. With respect to the intention to increase the 'marine' character in the currently

rather generic Marine Governance specialisation, the panel warns against overspecialisation. Career-wise, students will benefit from being exposed to case studies from other fields. To give the specialisation a more rounded social sciences profile, the panel suggests involving sociologists (and possibly also political scientists, anthropologists and geographers) from the Wageningen chair groups alongside the economists and environmental scientists that currently contribute to the specialisation. The panel applauds the role of the Programme Committee that monitors the quality of the programme and has instigated recent curriculum changes. This element of internal quality insurance is clearly taken seriously, with evidence of active and positive reaction to suggestions and requests for modifications to the programme.

The teaching methods that are used are suitable and sufficiently diverse. Furthermore, they reflect the small-scale nature of the programme. The panel is positive about the use of so-called thesis circles in some thesis tracks, which allow students to peer review each other's work on the final research project. The panel would welcome the introduction of thesis circles in all (seven) thesis tracks.

Staff members from at least five different Wageningen chair groups are involved in the programme. The academic quality of the staff is very good. The panel notes that several staff members are internationally leading in their fields. In terms of didactics, the panel concludes that steps have been taken to increase the (currently rather low) number of staff members with a teaching qualification (*Basiskwalificatie Onderwijs*, BKO). BKO-training is mandatory for tenure-tracks and other junior staff. According to the panel, senior staff members with ample teaching experience could also benefit from didactic training, as long as its content is sufficiently challenging. The student-staff ratio of the programme (6:1) is favourably low compared to most other academic institutions in Europe

The panel is satisfied with the quality of the programme's assessment system and the role of the Board of Examiners, but concludes that safeguarding the consistency of assessment across the different chair groups that contribute to the programme is a point that requires attention. While assessing a sample of recently completed theses, the panel came across considerable variations in the level of feedback that was provided to students, and it also noticed that not all chair groups adhere to the weighting of different thesis components that is prescribed by the Board of Examiners. Furthermore, the panel did not always agree with the grade that was given, which it sometimes considered too high and sometimes too low. Consistency issues aside, the panel concluded that all sample theses were of at least sufficient academic quality. Some of the best theses were even of a publishable standard. The panel has also established that most graduates find jobs quickly after graduation, both in and outside of academia. While the Dutch labour market is currently rather tight, international career prospects are favourable and many of the graduates from this programme find careers overseas.

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	good
Standard 3: Assessment	satisfactory
Standard 4: Achieved learning outcomes	satisfactory
General conclusion	satisfactory

The chair and the secretary of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment was conducted in accordance with the demands relating to independence.

Date: 26 June 2016



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Prof. Michel Kaiser



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dr. Floor Meijer

## Description of the standards from the Assessment framework for limited programme assessments

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### *Organisation of the degree programme*

Wageningen University (WU) is a matrix organisation that consists of a single faculty: the Faculty of Agricultural and Environmental Sciences. As a result, the university's rector magnificus is also dean of the faculty. The faculty houses approximately 90 chair groups, organised in five departments or 'science groups'. The Education Institute (*Onderwijsinstituut*, OWI) is responsible for the content, quality and finances of all degree programmes (19 bachelor's and 26 master's programmes). The OWI Board consists of four professors and four students and is the governing body of all degree programmes.

Each WU programme has a programme director (PD) and a programme committee (PC). The PC of the Aquaculture and Marine Resource Management programme consists of three student members and three staff members who represent each specialisation. The Programme Committee plays a prominent role in the organisational structure of WU. It is responsible for the content and quality of the programme and it advises the Board of the Education Institute. The programme director is responsible for the execution of the programme. The PD of the Aquaculture and Marine Resource Management programme functions as a liaison between the programme committee and education institute ('demand side'), and the chair groups who provide the courses ('supply side').

Several chair groups from different departments contribute to the Aquaculture and Marine Resource Management programme. The main contributors are: Aquaculture & Fisheries (AFI), Marine Animal Ecology (MAE, founded July 2015), Aquatic Ecology and Water Quality Management (AEW), Environmental Economics and Natural Resource group (ENR), Environmental Policy Group (ENP), Bioprocess Engineering (BPE) and Toxicology (TOX). The programme director is in close contact with these chair groups on design, content and quality of the courses provided.

### **Standard 1: Intended learning outcomes**

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

#### **Explanation:**

As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme. Insofar as is applicable, the intended learning outcomes are in accordance with relevant legislation and regulations.

### **Findings**

The master's programme Aquaculture and Marine Resource Management (MAM) is the successor of the master's programme in Aquaculture and Fisheries (assessed in 2010). Its aim is to train academic professionals in the field of the sustainable use, conservation and restoration of marine and aquatic ecosystems and resources. In order to do so, it combines ecological, technological, socio-economic and governance perspectives, most notably in the common part of the programme but to a lesser extent also in the three specialisations. This broad approach matches the faculty-wide ambition of 'beta-gamma integration' and is considered as a defining characteristic of the current programme which provides graduates

with a holistic perspective of the subject area while allowing them to specialise in specific aspects.

The panel supports the reorientation of the programme that has taken place since the last assessment. The inclusion of socio-economic and governance perspectives fits recent trends within the field and has increased the societal relevance of the programme. The panel does note that establishing the desired level of integration of beta and gamma perspectives has not been an easy or straightforward process. Over the assessment period, it has required continuous monitoring and fine-tuning by the programme committee. In that sense, the profile of the programme is currently somewhat unsettled. This will most likely change in the coming period, as there are signs that the programme is now moving into a consolidating phase.

The programme has translated its aims to ten intended learning outcomes. The majority (nine) of these are the same for all students, but each specialisation has also added a specific intended learning outcome that reflects the intentions of that particular specialisation. The panel concludes that the intended learning outcomes match the domain-specific framework of reference of the programme (cf. appendix 2) as well as the international standards for an academic master's programme. A table that relates the learning outcomes to the Dublin Descriptors at the master's level is included in appendix 3. The panel notes that the integrated character of the programme could receive more emphasis in the intended learning outcomes. While the intended learning outcomes undeniably refer to the different approaches that are represented within the programme, the overall sense of interdisciplinarity could resound more clearly in the full set of intended learning outcomes.

The programme aims to equip students with the research skills that are a prerequisite for entering a PhD programme, but also with the consultancy and communication skills that are necessary for a career in the public or private sector. The panel has established that the intended learning outcomes adequately reflect the dual aim to prepare students for academic as well as for professional careers.

The critical reflection mentions that the intended learning outcomes have been reviewed by international academic peers, in order to ensure that they cover the relevant aspects and that they are phrased at the right level. These international experts have confirmed that the learning outcomes reflect what can be expected of a master's graduate working in the field of Aquaculture and Marine Resource Management. The intended learning outcomes have also been submitted to Advisory Board consisting of representatives of potential future employers of graduates. In spite of the advice of the previous assessment panel to ensure regular meetings, this board has not convened in the current assessment period. According to the programme management this is due to the high-ranking position of the board members, which puts constraints on their ability to attend periodic meetings. Interaction with the professional field currently takes place through the personal networks of staff members, internships of students and guest lectures. The panel stresses the importance of regular and formal consultation of the field on course content and expectations with regard to graduates. It suggests that the programme could explore new ways of shaping the existing interaction into a formalised and continuous feedback structure. The programme may consider targeting a broader audience of employers to ensure regular feedback and/or to use events (such as a student thesis presentation conference) as a means of attracting the advisory board to attend and potentially find new employees of the future.

## **Considerations**

The panel has established that the intended learning outcomes of the programme are in line with the domain-specific reference framework that was developed by the programme and match the international requirements, as laid down in the Dublin Descriptors. It appreciates the broad profile of the programme, which fits recent developments in the field, but feels that interdisciplinarity could receive more emphasis in the intended learning outcomes that were defined. The panel is also positive about the programme's intention to equip graduates with the communication and consultancy skills required by the professional field as well as with the academic skills that are a prerequisite for entering a PhD programme.

## **Conclusion**

*Master's programme Aquaculture and Marine Resource Management:* the panel assesses Standard 1 as 'satisfactory'.

## **Standard 2: Teaching-learning environment**

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

### **Explanation:**

The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

## **Findings**

### *Design and coherence of the curriculum*

The fulltime English-taught master's programme consists of 120 EC, spread evenly over two years. Each academic year is divided into six periods, running from September to July. Following an interdisciplinary common part (period 1 and 2), students specialise in one of three fields: (1) *Aquaculture*, (2) *Marine Resources and Ecology*, or (3) *Marine Governance*. The general philosophy of the programme is to start from a broad and general basis and gradually move towards specialisation, culminating in the thesis. This set-up reflects the T-shaped model that is in use for all master's programmes at Wageningen University. The horizontal part of the "T" represents knowledge of the broader domain, while the vertical part of the "T" represents in-depth specialisation in one discipline. Beta-gamma integration mostly takes place within the common part of the programme, but also in some of the specialisation courses.

The first year of the programme starts with a common part of three compulsory, multidisciplinary courses that provide the ecological, technological and socio-economic knowledge base for the three specialisations. These are: (1) *Life History of Aquatic Organisms*, (2) *Marine Systems*, and (3) *Trends in Aquaculture* (6 EC each). As the programme has to deal with a rather diverse inflow of students (cf. below, *Study load and feasibility*) the common courses are designed to level the playing field and prepare students for the specialisations. Natural and social science aspects are integrated in this compulsory part of the programme.

Quickly after the start of the programme, students choose a specialisation that starts in period 2 and also covers period 3, 4 and 5. Each specialisation offers one specific course (*Aquaculture Production Systems*; *Marine Resources Management*; *Advanced Environmental Economics and Policy*). In addition, the students select a subject-specific thesis preparation course. The programme as a whole offers seven subject-specific thesis tracks (2-3 per specialisation) and each thesis track is preceded by its own preparatory course in year 1.

At the end of the first year, the students of different specialisations are reunited in an academic consultancy project commissioned by an external party. A maximum of 30 students – not just from MAM but also from other WU master's programmes – can take part in a marine-themed *European Workshop Environmental Sciences and Management*. During a two-week stay in a foreign country (previous workshops have been held in Norway, this year's workshop takes place in Malta), students work in project groups on assignments that address real-life problems. A selection procedure applies to the *European Workshop Environmental Sciences and Management* as only a limited number of places are available. Alternatively, students can participate in a similar, but terrestrially themed *European Workshop*, or in a more general, faculty-wide *Academic Consultancy Training*. During the site visit, the programme management described the *European Workshops* and *Academic Consultancy Training* as key assets of the programme, because they enable students to have an actual impact on real-life issues.

In the first year of the programme, students select optional courses amounting to 18 EC. These courses can be chosen from any programme or specialisation at Wageningen University. During the site visit, the panel learned that an obvious option is to pick courses that can help with getting rid of any deficiencies that a student may have. Such deficiencies are identified at the start of the programme, when the study advisor helps the student to plan an individual study path. It is within the power of the study advisor to make binding suggestions. Students that lack a background in statistics are, for example, directed towards the *Advanced Statistics* course. The panel was somewhat surprised to learn that this applies only to students who opt for the two beta-oriented specialisations, *Aquaculture* and *Marine Resources and Ecology*. For the *Marine Governance* specialisation statistics is seen as less relevant, because its research methods are either qualitative (Environmental Policy Group) or based on mathematical modelling (Environmental Economics and Natural Resource Group). The panel, however, believes that advanced statistical knowledge could also prove valuable for Governance students, especially when considering analysis of quantitative and qualitative questionnaire study data, or when undertaking contingent valuation or choice experiment type methodologies.

The second year of the programme focuses entirely on the thesis (36 EC) and the academic internship (24 EC). The thesis, in which students work independently on a research project that is part of the ongoing research of a chair group, is considered the core of scientific learning in the master's programme. During the project, students have regular meetings with their supervisor and participate in chair group activities such as literature discussions, work discussions, seminars and social gatherings. Through the academic internship students experience the reality of the working environment in a company, public institution, consultancy firm, research organisation, other university or NGO. Potential internship projects include the development of policy documents, communication plans, evaluation reports, education or communication materials, or performing a research project. Students conclude their projects with an internship report, a reflection report and an oral presentation/defence. During the site visit the panel learned that there is no fixed list of internships for students to choose from. They themselves are responsible for finding a suitable project, for which they can rely on the networks of the chair groups. The panel concludes that this rather informal system has not proved problematic in the past – all students manage to find internships quite easily. It does, however, point out that the current system makes it harder for students to find internships in subjects outside of the core expertise of staff members. Students can also opt to do a second thesis project (of at least 24 EC) instead of an internship. The panel was informed that this option is commonly chosen by students who want to pursue a career in research and also by non-Dutch students who have to finish their study within the scholarship period and cannot afford internship-related delays. With respect to the latter, the panel feels that time restrictions should not limit the opportunity of students to do an internship, as this is an important element of the programme.

During the site visit the panel studied course material from five core courses. It was generally very pleased with the content, level and cohesion of these relatively short-running (three to eight week) courses. Especially the specialisation courses were found to be suitably challenging, as they tie in with cutting-edge research. By nature the common courses are more introductory; they are designed to bridge knowledge gaps and quickly bring students from different backgrounds to the same level. The panel is aware that for some students, especially for those that graduated from a Wageningen bachelor's programme, this means that there is (considerable) overlap with their previous training. On the other hand, it was clear that international students value the common courses and that they are a necessary requirement in

a programme which aims to be international in its appeal and interdisciplinary in its content design.

The panel concluded that the programme has made clear choices in terms of content: only subjects that fit the Wageningen research profile are taught within the master's programmes. Although this means that the programme is not comprehensive – for example: the programme does not cover crustaceans or diseases in aquaculture – it does ensure that there is a strong link between the teaching efforts and the underlying research lines. Moreover, the panel agrees with the programme management that providing students with a strong 'toolbox' is more important than detailed coverage of every single aspect of the domain of the programme. By using the academic skills that they were taught, graduates should be able to fill any remaining gaps in their knowledge of the domain, thereby engaging in lifelong learning. The panel adds that, if the programme at any time feels that developments in the domain would require teaching in subjects that the Wageningen research does not cover, it could consider hiring (guest) lecturers from other universities for this purpose.

The panel learned that a number of major curriculum changes have been made in recent years, mainly in response to student feedback. The programme committee that is responsible for the quality of the curriculum as a whole and of its individual components was the driving force behind these modifications. Two of the most important changes are (1) the introduction of the new *Trends in Aquaculture* course in the current academic year (2015-2016) and (2) the adjustment of the Marine Governance specialisation that is currently taking shape. The panel is generally impressed by the dynamic character of the programme, as evidenced by these modifications, and the adequate response to student evaluations. The one-year 'education modification cycle' that is in use at Wageningen University to signal problems and make adjustments is clearly effective. The panel is also positive about the role of the programme committee, which proactively puts issues of concern on the agenda and makes sure that solutions are found.

The panel established that the main reason for introducing the new *Trends in Aquaculture* course in the second period was that students experienced a lack of aquaculture topics in the common part of the curriculum. The new course, which is a collaboration of three different chair groups, aims to correct that by exploring challenges and opportunities for aquaculture in maintaining fish supplies for a growing world population. During the course, students work in small groups of 4-5 students on a particular species (such as tilapia, mussels). Throughout the course they write group reports. To conclude the course they produce an individual paper. During the site visit, students described the new course as intensive and relevant for all students, as none of them have a background in aquaculture.

Student feedback also prompted a restructuring of the *Marine Governance* specialisation. The general impression is that students are less attracted to the (unfamiliar) social sciences perspective than to the more technical and ecological approaches, which means that student numbers in the *Marine Governance* specialisation have lagged behind in recent years. Students that did opt for this specialisation perceived the courses offered by the Environmental Economics and Natural Resource chair group and the Environmental Policy chair group as too general. As of 2016-2017 these courses will be substituted by the specialisation course *Marine Resource Management* and the thesis preparing courses *Marine Governance and Globalization* and *Sustainability of Food Production and Consumption*, which will specifically deal with marine-subjects.

With regard to the proposed adjustment of the *Marine Governance* specialisation, the panel would like to warn against overspecialisation. Adjusting the core course of the programme is probably sensible, but the panel suggests keeping the generic approach in other courses. Although it is understandable that (some) students do not see the relevance of including non-marine topics in a marine programme, the panel feels that acquiring a more generic perspective will in fact help them in their later careers. Furthermore, it notes that the interviewed students and alumni seemed quite well aware that a broad outlook on environmental governance issues improves their position on the labour market. Something that could be considered with regard to the Governance specialisation is to involve the WU Sociology chair group. The programme management explained to the panel that this chair group does not contribute to the courses because it lacks a research line on marine topics. The panel, however, feels that the *Marine Governance* specialisation would attain a more rounded social sciences profile if sociologists (and possibly also political scientists, anthropologists and geographers) were involved alongside economists and environmental scientists. Graduates of the specialisation told the panel that they would have liked a greater focus on processors and retailers in terms of social responsibility (sourcing, ethics, life cycle analysis) and the panel agrees that this is a good suggestion.

#### *Teaching methods*

The master's programme uses a variety of teaching methods, such as practicals (29%) and field practicals (11%), individual supervision (21%), tutorials (14%), lectures (17%), and group work (8%). In the first year of the programme, practicals are considered especially important, as they help students acquire specific skills and familiarise them with lab work. During field practicals students are physically confronted with ecosystems. Lectures are often combined with tutorials. During the latter, students work on (computer-supported) assignments that are based on theoretical concepts, which were introduced in the lectures. A tutor supervises the work that is undertaken in tutorials. Students also do group work. In the second year of the programme, the dominant teaching method is individual supervision, during the internship and thesis research project).

After studying the course overviews, the panel concludes that the programme's learning methods are appropriate and in line with what may be expected of a master's programme in Aquaculture and Marine Resource Management. The specific profile of Wageningen University resonates especially in the *European Workshop* and *Academic Consultancy Training*, in which groups of students do consultancy work on real-life projects. A particularly strong aspect of this exercise is the mixture of students from other master's programmes outside the discipline considered here. The panel was also pleased to learn about the introduction of 'thesis circles' in the thesis tracks of the Marine Resources and Ecology specialisation. This new work form connects students that work on similar thesis research projects within a certain chair group. In frequent meetings, students present their work to each other and perform peer-reviews of draft versions of thesis chapters. The panel established that the first experiences with thesis circles are positive. Students stressed that frequently scheduled sessions help to keep everyone on track and prevent delays by keeping students focused on short-term deadlines. Furthermore, peer review is a valuable addition to the skills set of master's students. The panel would welcome the implementation of thesis circles in all seven thesis tracks of the programme.

#### *Study load and feasibility*

The average number of contact hours throughout the curriculum of the master's programme is estimated at 21 hours per week during the first year of the programme and 6 hours per week during the second year, most of which are thesis contact hours. Not included in those

numbers is the fulltime presence of students at their internship location during internships and at the chair group during their thesis research project. According to the panel these numbers are adequate and similar to other higher education institutions in Europe.

Cohort size has steadily increased, from just 3 students in 2005 to (an unusual peak of) 46 in 2015. The average amount of students per year during the review period was 34. Drop-out rates can be as low as 0% (as was the case in 2013), but in 2011 there was a peak of 13%. According to an evaluation done by the programme, drop-outs are usually the result of personal circumstances, not of programme-related problems. During the site visit, the students confirmed that the programme is feasible and they did not report any particular stumbling blocks. Switching between specialisations is allowed and will not necessarily lead to delays. Even so, many students take more than two years to complete, mostly because they exceed thesis deadlines. The panel established that this applies especially to students from the Netherlands and other Western-European countries, who can more easily afford to take the extra time to perfect their thesis or internship project than their counterparts from other parts of the world. Non-European students are usually on scholarships that run out after two years, so they feel the urgency to complete on time and choose not to take the internship opportunity, which is a regrettable. To deal with thesis delays, the programme has introduced thesis contracts, in which supervisor and student set strict deadlines for different phases of the project. The programme aims for a success rate of 90% after three years, but has not yet managed to achieve that target. Throughout the assessment period, the success rates after three years showed some fluctuations. Again, the 2011 cohort stands out as somewhat less successful (65% success rate after 3 years), while in other years the success rate was well above 80%. A factor that could also explain why so many students take more than two years to complete is that quite a few of them simultaneously do a second master's programme. Commonly, it takes them three years to complete both programmes. The panel was informed that the statistics have not been corrected for this practice.

For the inflow of students the programme is reliant on a number of WU bachelor programmes and side-inflow from students outside of WU. The latter are invited to participate in the 'general introduction days', during which they are familiarised with the structure, opportunities and constraints of the programme. Currently there is no bachelor's programme in the field of aquaculture/marine resource management. Growing numbers of students enrol in the BSc Marine Living Resources minor in order to prepare for the MSc programme. For students from universities of applied science (*bbo*) this minor functions as a premaster's programme.

The panel has established that the programme is increasingly realising its aim of an 'international classroom'. In 2015, out of a total of 46 students, 28 were from the Netherlands, 9 from the rest of Europe (Italy, Germany, Greece, Switzerland, Norway) and 9 from outside of Europe (Indonesia, Bangladesh, China, Colombia, Libanon, Turkey). Whereas the previous assessment panel noted that the student members of the programme committee were all Dutch, the current panel met with a completely non-Dutch student delegation. This indicates a high level of involvement of foreign students, which should be applauded. The programme management mentioned that it sees foreign students as the key to future growth. The labour market for graduates in the Netherlands is perceived as too small to accommodate more Dutch students, whereas career opportunities outside the Netherlands are quite favourable. The panel agrees that targeting the international student market is a sensible approach. It has picked up on some discussions regarding the level of foreign, especially non-European, students, whose prior education is usually more applied and less theoretical than that of Dutch students. There are also reports of language issues and the

panel has established that the admission requirements with respect to proficiency in English are rather low (IELTS score of at least 6.0). Nonetheless, both students and staff members indicated that most of the differences in level are rather quickly resolved, both by the common courses and by optional courses that specifically deal with deficiencies. As part of the individual study path that is set at the start of the programme, the study advisor can direct students who are less proficient in English to the University's language centre.

### *Staff*

The programme reports a very favourable student-staff ratio's of 6:1, although it concedes that the university's matrix model, in which several chair groups contribute to a single programme, makes it rather difficult to calculate a 'hard figure'.

The majority of staff members who teach in the master's programme have obtained a PhD degree (85%). 21% of these staff members with a PhD are (full) professors. The panel has established that staff members are actively involved in research in their respective fields. Some of them are internationally leading experts. Furthermore, it notes that the interviewed students and alumni were positive about the quality of the lecturers. The good score that the programme's staff received in the 2014 National Student Questionnaire (4.1 on a five point scale) confirms this positive evaluation.

The number of lecturers that has acquired a teaching qualification ('BKO', *Basiskwalificatie Onderwijs*, or its predecessor, the 'OWK', *Onderwijskwalificatie*) is rather low. Just 9% has a BKO and 36% has the OWK or other form of qualification. Almost 30% of the staff is still in training for the BKO. Obtaining a BKO is a requirement for new permanent staff and staff in tenure track, whereas experienced staff members whose teaching is evaluated positively are exempted from BKO-training. Senior teaching qualifications are absent at the moment. The panel advises the programme to revise its exemption policy for senior lecturers. Assuming that the BKO-training is sufficiently demanding, more experienced lecturers could also benefit from further professionalization.

As was mentioned earlier, the master's programme is fed by a substantial number of chair groups from different departments of Wageningen University. As a result its teaching staff is rather loosely fitted. Contacts between staff members from different chair groups with respect to the teaching are incidental rather than structural. Each chair group typically offers its own courses, many of which are not restricted to MAM-students but also serve other Wageningen MSc programmes. Although there are some examples of chair groups offering joint courses, staff members are not always fully aware of what happens in other courses, especially when these courses are part of another specialisation. This issue could be resolved by the organisation of an annual teaching review group for all academics that contribute to the programme where they could share up-coming proposed changes and teaching needs. On the other hand, contacts between staff members and students of the programme are very close. The education is sufficiently small scale for students and staff members to interact on a personal level. This especially holds true for the second year of the programme, when students are fully immersed in the research environment of the chair groups in which they conduct their thesis projects. Staff-student cooperation is encouraged by the university's organisational structure, in which the faculty-wide OWI-Board that consists of both staff and students plays an important role, as do the programme committees of the degree programmes. The programme in Aquaculture and Marine Resource Management furthermore has an (informal) 'Education Committee' that acts as a link between students and staff.

### *Programme-specific facilities*

During the site visit, the panel took a tour along the lab facilities used in the master's programme, most notably the Carus facility which houses experimental aquaria and basins. Both fresh and salt water, and warm and cold water, experiments can be performed there. The aquatic respiration chambers are a unique feature, providing the opportunity to perform continuous measurements and determine the metabolism of an organism. The panel was impressed with the quality of the lab facilities, and also with the overall high standard of teaching facilities. The classrooms that it visited on its tour were well equipped and suitable for maintaining small scale education even in classes with large cohorts.

### **Considerations**

The panel has established that the curriculum matches the broad profile of the master's programme and is appropriately structured: after a common phase that consists of three introductory courses that combine technological, ecological and socio-economic aspects, students specialise in one of three tracks: either they choose one of the more beta-oriented specialisations (Aquaculture or Marine Resources and Ecology) or they follow the gamma-oriented specialisation (Marine Governance). The panel concludes that this setup reflects the 'T-shaped' Wageningen model and allows the programme to deal with the rather diverse inflow of students. The trade-off of having a truly international student population is that the common introductory courses are not equally challenging for all students. The panel recognises this problem, but feels that the programme is handling it in the best possible way. The flexibility of the curriculum, which can be customised into individual study paths, is a strength of the programme and the panel appreciates the role of the study advisor in dealing with deficiencies. The panel also particularly liked the academic consultancy training that concludes the first year and temporarily reunites students from different specialisations.

The panel has established that the master's programme is essentially 'supply-driven'. It is fed by the marine research lines of various Wageningen chair groups and as a result it ties in with cutting-edge performed at the university. A possible downside of this set-up is that important topics that are not part of the university's research portfolio (i.e. crustaceans, diseases in aquaculture) are not extensively covered. The courses provide students with an overview of all aspects relevant for the domain, but in-depth attention is reserved for Wageningen research topics. The programme management has made it sufficiently plausible that this does not hamper students in their later careers. Students are given an academic toolbox that they can use to fill any knowledge gaps that they might experience in their later working environment.

The panel is positive about the (intended) changes to the curriculum, most notably the introduction of the new *Trends in Aquaculture* course and the reconsideration of the Marine Governance specialisation. With respect to the latter, the panel advises to keep some broad content for wider context, as students may not end up in marine careers. The recently conceived changes are an indication that student feedback is taken seriously. The panel was impressed by the role of the programme committee, which was described as the 'conscience' of the programme during the site visit. The programme committee actively monitors the quality of the individual courses and the programme as a whole, and is very effective and influential in directing the course content. The programme director, who 'buys in' teaching from the respective chair groups at the request of the programme committee, is the linking pin in the organisation. All in all, the panel believes that the particular organisational set-up increases flexibility and dynamism, as it allows the programme to respond rapidly to any curriculum problems that occur.

The panel praises the excellent (laboratory) facilities of the programme and the enthusiastic teaching staff, amongst which are many researchers that are internationally leading in their respective fields. The panel encourages the management to continue their efforts to increase the number of lecturers holding a teaching qualification, which it considers not just valuable for junior, but also for senior staff members. The student-staff ratio of the programme is quite favourable, which allows the programme to hold on to small-scale teaching methods.

### **Conclusion**

*Master's programme Aquaculture and Marine Resource Management:* the panel assesses Standard 2 as 'good'.

### **Standard 3: Assessment**

The programme has an adequate assessment system in place.

#### **Explanation:**

The tests and assessments are valid, reliable and transparent to the students. The programme's examining board safeguards the quality of the interim and final tests administered.

### **Findings**

#### *System of assessment*

In an appendix to the critical reflection, the programme has presented a matrix that gives an overview of learning outcomes per course and the method and level of assessment for each of those learning outcomes. As all courses contribute to a number of learning outcomes, most include more than one type of assessment. In total, the matrix distinguishes between eight assessment methods, ranging from written tests (open, multiple choice) to papers, and from oral presentations to scientific reports. The matrix also shows how learning outcomes relate to the intended learning outcomes of the programme as a whole. Assessment at course level is described in the 'assessment strategy', which is included in the course guide. This strategy clarifies how and when course-specific learning outcomes are assessed, which examiners are involved, and how they establish the final grade.

To enhance the quality and transparency of grading, examiners have developed a number of tools such as answer keys for multiple choice exams, and model answers, assessment criteria and rubrics for written assignments. In some cases the 4-eyes principle is used to improve the reliability of exams. Over the review period the programme has promoted the transparency and validity of its assessment system by actively instructing course examiners on good practices with regards to assessment. The programme has also sought the opinion of international peers on the level of the assessment of individual courses. From 2012 onwards, all chair groups are obliged to have (the assessment in use within) their courses assessed by peers every six years.

The panel has studied examination materials from five core courses of the programme (cf. appendix 6) and concludes that the learning objectives of these courses are assessed in an adequate way. The panel is generally pleased with the level of the tests. It did observe that multiple-choice tests are commonly used, especially in the common courses. As multiple-choice tests tend to focus on lower level learning objectives (i.e. the recall of facts rather than the application of knowledge) the panel wonders whether this assessment method is suitable for a programme at the master's level. Multiple-choice tests are fine as revision tools, but not as a summative assessment method.

The 2014-2015 course evaluations show that students are generally pleased with the level and content of assessments, and that the assessment system is considered sufficiently transparent. The students that the panel spoke with confirmed this. The level of feedback varies from course to course and from lecturer to lecturer, but students were not dissatisfied in this respect. The panel, however, came across some tests that contained hardly any written feedback from the examiner.

#### *Thesis assessment*

The final assessment of the programme is a thesis of 36 EC. Students join a chair group and conduct a research project that contributes to its ongoing research. At the start of the thesis project, the supervisor and student sign a contract that contains detailed information about the planning of the project, the arrangements concerning supervision and necessary facilities, and the weighting for each part of assessment. In the opinion of the panel, this contract adds

to the transparency of the process. The students that the panel spoke to stated that the thesis assessment procedures are sufficiently clear to them. During the site visit the panel was told that the thesis supervisor is by default not the main examiner of the thesis. Generally, the Board of Examiners has appointed one examiner within each chair group, so that he/she can safeguard the quality and consistency of all thesis assessments. Together, the examiner and supervisor determine the final grade for the thesis, which is filled out on an assessment form. In doing so, the examiner and supervisor make use of a rubric for the assessment of master's theses that was developed in 2010 by the Board of Examiners in order to enhance transparency, validity and reliability of grading. The final grade consists of four components: research competence (30-60%), thesis report (30-60%), colloquium (5-10%), and oral defence (5-10%). Within the margins provided above, and on the condition that the sum total of percentages is 100, examiners are allowed to determine the relative weight of each of those components.

The panel established that the chair groups are in favour of this flexibility because it enables them to take account of the proportion of practical and theoretical work in the thesis research, which is typically different for the life sciences and the social sciences. While the panel does not object to the variable weight given to the four thesis components, it does feel that examiners should stick to the range of weights prescribed by the Board of Examiners. This is currently not the case. The sample theses show that the Aquaculture and Fisheries chair group, which is responsible for a substantial part of the theses, uses a weighting of the assessment criteria that substantially differs from the weighting prescribed by the Board of Examiners. It has set the weight of the oral defence at 25% of the final grade, while the Board of Examiners prescribes a range of 5-10% for this criterion. The panel points out that this practice could have serious consequences, as it makes it much harder to guarantee that all thesis projects completed within the programme result in the achievement of the same intended learning outcomes. The consistency of marking across chair groups is another specific concern. With regard to the 15 sample theses, the panel concluded that its own assessment of the theses was not always in line with the grades given by the supervisor and examiner. In some cases the panel would have raised or lowered the grade by as much as a point.

Furthermore, the panel wonders whether, in general, enough weight is given to the thesis report. In the beta-oriented chair groups the grade for the report only amounts to 30 or 40% of the final grade (whereas in the gamma-groups this is typically 60%), which is a problem in terms of the comparability of the overall assessment. The external reviewers lacked information on the other thesis components (research competence, colloquium, oral defence) so they typically had to rely on the thesis report and the feedback of the supervisors to determine whether the overall grade is justifiable. In this respect the current thesis assessment form is not of much help. The level of commentary that is supplied in the textbox at the bottom of the thesis form varies greatly and in many cases, there is no or hardly any substantiation of the grades for the different components. In several cases, the examiner or supervisor only provided comments in Dutch. In the opinion of the panel it would be much better to replace the textbox at the end of the form by four separate textboxes for the four thesis components, so that the markers have to justify all of the grades given. Also, the panel would recommend providing clear guidelines on the amount of commentary that is expected. With respect to leaving a proper audit trail, it would also be a good idea to document the feedback that was given in relation to the draft version of the thesis. This not only enables external reviewers to gain insight into the thesis process, but also offers the programme legal protection against potential complaints by dissatisfied students should they occur.

### *Board of Examiners*

The Aquaculture and Marine Resource Management programme falls under the responsibility of the Board of Examiners for the Life Sciences (EBLS), which is one of the four Boards at the Faculty. In total the Board is responsible for six master's and three bachelor's programmes. The tasks of the Board include dealing with (suspected) cases of fraud and plagiarism, checking whether the individual study paths of students cover all intended learning outcomes and granting exemptions. The Board of Examiners is also responsible for safeguarding that the quality of tests, interim examinations and final assessments enables the achievement of the intended learning outcomes. It does so by appointing examiners for each course and thesis. The Board has developed documents to support examiners in their task to develop valid, reliable and transparent assessments.

In 2011 and 2012, the Board of Examiners has held meetings with chair groups involved in the programme in order to verify the quality of assessment in 'their' courses and in the theses written within the group. Because the two chair groups that are involved in the Marine Governance specialisation fall under the responsibility of the Board of Examiners for the Social Sciences (EBSS), these groups were jointly visited by both boards. Even so, EBLS is ultimately responsible for the Aquaculture and Marine Resources master's programme as a whole. After the 2011-2012 visits, the Board has stayed in regular contact with the chair groups about the implementation of the recommendations that were made during the chair group visits. In many chair groups the visits have led to an intensive discussion about the reliability, transparency and validity of interim examinations. Since all parties felt the positive effect of the visits, they have become a permanent component of the activities of the Board of Examiners. At least once in five years a new round of visits will be organised. Additional meetings take place if concerns are raised for a specific course.

The panel met with the Board of Examiners during the site visit, and was pleased by its proactive approach to its new legal responsibilities concerning the safeguarding of assessment quality and the level of achieved learning outcomes. The panel realises that the mandate of the Board of Examiners is not a particularly easy one, as it has to deal with many chair groups from quite distinct fields, each with their own research cultures. It is therefore understandable that the homogenisation of assessment practices is still work in progress. As yet, the panel feels that the consistency of marking has not been given sufficient attention. During the site visit, it got the impression that neither the Board of Examiners nor the chair groups have taken much responsibility for this issue. Its recommendation would be to make this an important topic for the next round of chair group visits. Maintaining a close dialogue with the chair groups is essential to ensure the comparability of assessment procedures across the programme.

### **Considerations**

The panel has established that a system of assessment that covers all the intended learning outcomes is in place. The programme makes use of an appropriate variety of assessment methods, although the panel suggests abandoning multiple-choice tests as a summative assessment method. To enhance the quality and transparency of assessment, the programme has developed tools, such as answer keys, model answers, assessment criteria and rubrics. The tests that the panel studied were generally at the right level.

Although the introduction of the thesis assessment form and the thesis rubric are valuable steps towards ensuring the comparability of thesis assessment across all chair groups, the panel notes that further improvements are necessary. Thesis practices vary from chair group to chair group and not all chair groups adhere to the instructions of the Board of Examiners

regarding the weight that should be given to the different components that together make up the final grade for the thesis project. Furthermore, there is currently very little by way of an audit trail of the contact between supervisor and student during the thesis project. Assessment forms are used in such a way that they provide very little insight into why a certain grade was given, which is not just a problem for external reviewers who have to verify the assessment, but could also have a legal backlash. The panel advises to provide examiners with guidance on the level of detail that is expected with regard to the qualitative feedback that substantiates the grades. Furthermore, the panel recommends keeping a formal record of the comments made on a draft of the thesis (not marked) to be able to assess to which extent the student has adopted the advice. In the opinion of the panel this could be done in such a way that it doesn't add to the overall bureaucracy or workload of staff members.

Although the Board of Examiners is generally proactive in fulfilling its legal duties, the consistency of marking and assessment approaches seems not to have received the attention it needed. The panel feels that this issue should be dealt with properly in the next round of visits to the chair groups, which the panel considers a valuable way of informing examiners of existing and new rules and regulations.

## **Conclusion**

*Master's programme Aquaculture and Marine Resource Management:* the panel assesses Standard 3 as 'satisfactory'.

#### **Standard 4: Achieved learning outcomes**

The programme demonstrates that the intended learning outcomes are achieved.

##### **Explanation:**

The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes.

#### **Findings**

Although second year's students of the programme also complete an academic internship (24 EC), the programme considers the thesis project (36 EC) as the culmination of their master's training. Prior to the site visit, the assessment panel has studied fifteen recently completed master theses in order to establish the level achieved by graduates. The panel was generally pleased with these sample theses, which proved sufficiently academic in content. All theses were found to be of at least satisfactory quality. Some were extremely detailed pieces of research of high scientific quality, which could result in ISI publications.

In the weaker theses the panel found particular problems with regard to referencing, experimental design and statistics, such as graphs and figures that were not properly formatted, axes that were not labelled etc. As these are basic skills that are usually taught at the undergraduate level, this could be taken as a sign that students receive insufficient training in this area. During the site visit it was mentioned several times that (non-Dutch) students who lack a background in statistics have to take the (optional) *Advanced Statistics* course, but the students that the panel spoke to mentioned that this course covers basic rather than advanced statistics. In the opinion of the panel, the programme should reconsider whether students are sufficiently prepared for this part of the thesis research.

The performance of alumni is also indicative of the level achieved by graduates. During the site visit the panel met with a number of recent graduates, who represented a wide range of different careers across the different specialisations. According to the panel, the programme produces graduates that meet the requirements of the labour market. The WO-monitor 2013 points out that MAM graduates ( $n=10$ ) generally had a job within 1-1,5 years after graduation. According to graduation questionnaires held by the programme itself, up to 50% of the graduates had found a job at the moment of graduation. Despite these promising figures the panel established that the national labour market is quite competitive and career options may be better outside of the Netherlands. Alumni indicated that, especially for graduates of the Marine Governance and Marine Resources and Ecology specialisations, finding a job in the Netherlands can prove quite difficult. The programme management confirmed that the financial crisis and ensuing recession have had an effect on the labour market. Potential employers, such as Wageningen's own Imares company, suffered from budget cuts.

During the site visit the panel also dwelled upon the issue of whether the programme gives sufficient attention to preparing students for the labour market. Evaluations held amongst alumni have pointed out that many of them, especially graduates of the Aquaculture specialisation, found that the programme was lacking in this respect. The alumni that the panel spoke with indicated that they would have liked to receive more information on potential employers. However, the panel also notes that the programme contains several components that specifically deal with the connection to the professional field, such as the academic consultancy training at the end of year 1, and the academic internship in year 2. Generally, students seem very appreciative of these programme components.

## **Considerations**

The panel concludes that graduates of the master's programme have demonstrated a satisfactory overall level of achieved learning outcomes. All of the sample theses were of at least sufficient academic quality and some were very good. Opportunities for further improvement lie mostly in enhancing the at times rather crude statistical skills of students. The performance of alumni confirms that graduates meet the requirements of both the academic and the professional labour market. While professional career options in the Netherlands may be limited, partly as a result of cyclical changes, the skills of graduates are sufficiently transferable for them to pursue international careers – as many in fact do.

## **Conclusion**

*Master's programme Aquaculture and Marine Resource Management:* the panel assesses Standard 4 as 'satisfactory'

## **General conclusion**

The master's programme in Aquaculture and Marine Resource Management is an ambitious programme that addresses societally relevant topics and fits very well within the distinctive profile of Wageningen University. Within this report the panel has highlighted some challenges that appear to arise from the particular matrix structure of the university, in which rather autonomous chair groups feed the degree programmes. Undoubtedly, however, the organisational set-up results in just as many strengths and opportunities. The programme has strong links to cutting edge-research performed in the chair groups and is dynamic and flexible in character. The latter was compellingly demonstrated by the programme's recent transformation from a rather straightforward programme in aquaculture and fisheries into a much broader, more interdisciplinary programme that also considers trends in the field from a governance perspective. The panel is confident that recently implemented changes will bear fruit in the coming period and that the programme will continue to adequately respond to developments in the field and feedback given by its students.

## **Conclusion**

The panel assesses the *Master's programme Aquaculture and Marine Resource Management* as 'satisfactory'.



## **Appendices**



## **Appendix 1: Curricula Vitae of the members of the assessment panel**

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**Michel Kaiser (chair)** is professor of Marine Conservation Ecology at the School of Ocean Sciences, Bangor University. He is an independent Member of the Joint Nature Conservation Committee, the UK Marine Science Coordination Committee, and he chairs the Seafish Industry Authority's Science Advisory Group. He co-convened the 6<sup>th</sup> World Fisheries Congress in 2012. After gaining his PhD in 1991, he joined CEFAS to lead research on the effects of human activities (fishing and aquaculture) on the marine environment. He joined Bangor University in 1998 where he has expanded these interests to encompass social and economic consequences of different approaches of managing fishing activities. Michel was awarded a D.Sc. in 2003 in Marine Biology, and was awarded the Fisheries Society of the British Isles (FSBI) medal in 2004 for his contribution to fish and fisheries research. He was awarded a personal Chair in Marine Conservation Ecology in 2006. He has authored over 180 peer reviewed publications and has written or edited 5 books. His current research focuses on techniques to achieve sustainable use of the marine environment, with a particular emphasis on developing techniques to minimize ecological impacts of fisheries and aquaculture, and research to underpin the appropriate use of marine protected areas. The latter focuses on recovery and dispersal dynamics in seabed communities and integration of spatial social and economic valuation of marine biodiversity. His research group provides scientific advice to the Welsh Government and the Isle of Man Government.

**Maarten Bavinck** is associate professor in the Department of Geography, Planning and International Development Studies (GPIO) of the University of Amsterdam and a member of the Governance and Inclusive Development programme group. He also holds a chair in coastal resource governance at the Norwegian Fisheries College of the Norges Arktisk Universitet in Norway. Maarten Bavinck is specialized in the governance of capture fisheries, particularly in the South, and is especially interested in the fate of small-scale fisher peoples. His fieldwork is concentrated in South Asia (India and Sri Lanka). His theoretical perspectives are interactive governance, legal pluralism, and political ecology. He has authored two monographs and several edited volumes, as well as a large number of peer-reviewed articles and book chapters. Maarten Bavinck is founder and co-director of the social-science Centre for Maritime Studies (MARE), and founding associate editor of the journal Maritime Studies. He also co-edits (with Svein Jentoft) the MARE Publication Series, published by Springer. He has recently served as president of the International Commission on Legal Pluralism (2008-2015). Among other research activities, he was the principal investigator of the REINCORPFISH project (NWO/WOTRO 2010-2016) that focused on the resolution of fisheries conflicts in South Asia and South Africa. He is now leading the Fish4Food project (NWO/WOTRO 2016-2020) that investigates opportunities for improving low-price fish chains in facilitating urban food security (Ghana and India). He has played leading roles in many other projects funded by the European Commission, NWO/WOTRO, ESRC (UK), ICSSR (India), and SSHRC (Canada). His teaching activities (undergraduate/graduate/PhD) are concentrated in the International Development Studies programme of the University of Amsterdam, in which he takes responsibility for courses on environmental and marine geography, governance, and South Asia studies.

**Eldin Honingh** is currently enrolled in the Marine Sciences master at the University of Utrecht. He finished his bachelor's degree at the University of Utrecht with a focus on ecology in 2014 after a Study Abroad program at the James Cook University in Cairns. This Study Abroad program (2009-2010) of six months contained courses on among others: engineering and biological chemistry. During his bachelor's degree he mainly focussed on ecology and this specialization also took place during the master's. The Master thesis title is:

The spatial variation in Cockle growth on the Dutch Wadden Sea, and the minor research title: The influence of bioturbators on the biogeochemical cycles of the Markerwadden. He aims to graduate his Master's degree in August 2016. During his student life Eldin Honingh worked as a student assistant for the Ecology and Biodiversity subject in the first year of the biology bachelor's. During his Masters, he promoted and represented the master Marine Sciences at several Master Information Events.

**Prof. Svein Jentoft** has degrees in business economics and sociology. As of 1998 he is professor of fisheries and coastal resource governance and organization studies at the Norwegian College of Fishery Science, at University of Fisheries, UiT – The Arctic University of Norway. He has forty years of experience within fisheries social science research and education, including as PhD and master thesis supervisor, and has published (written, edited and co-edited) twenty six books, most recently on *Interactive governance for small-scale fisheries: Global reflections* (2015 – edited with Ratana Chuenpagdee). Jentoft is moreover editor in Chief of *Maritime Studies* and co-editor of the *Mare Series*. He has published close to 200 journal articles and book chapters and has broad international experience, studying and working at universities in many countries in Europe, North- and Central America. He was a member of the Norwegian delegation during the FAO Technical Consultations FAO on the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (2014) and is one of the founding members of 'Too Big to Ignore', a Global Partnership for Small-Scale Fisheries Research. Jentoft was also principle investigator of the Povfish project, financed by the Norwegian Research Council, and has been part of two major EU funded projects. He has served on many boards and committees throughout his career. For many years Jentoft was board member of the Innovate Fisheries Management at Ålborg University in Denmark, and has been guest lecturer at universities around the world, key note speaker at many international conferences. He currently shares his time between the Norwegian College of Fisheries Science and the Centre for Sami Studies at UiT- The Artic University of Norway.

**Prof. Marco Saroglia** is retired collaborator at the University of Insubria, Varese, Italy. He obtained a Master in biology at the University of Turin (1973), and a PhD in general pathology at the University of Pavia (1982). From 1970 to 1989, he was scientist and chair (from 1976) of the research group of the 'Biology and Biological Technologies Office', at the Studies and Researches Department of the National Electricity Board of Italy (ENEL), Centre for Thermal and Nuclear Researches, in Milan. Subsequently he was appointed associate professor of Animal Physiology, and later on full professor of Aquaculture, at the Agriculture Faculty, University of Basilicata, Potenza, Italy. He fulfilled a number of managerial activities, such as acting dean of the Faculty of Agriculture, rector's delegate for the organization of the new library, president of the PhD School on Animal Production. In 2001 he moved to the University of Insubria in Varese, where he was appointed full professor of Aquaculture and of Marine Biotechnologies. He covered a number of responsible positions, such as acting president of the course on Natural Sciences, president of the PhD School on Assessment, Protection and Exploitation of Biodiversity and later of the PhD School in Molecular, Agro Industrial and Food Biotechnologies. After that he was appointed as member of the Scientific Committee of the Insubria Center for International Security (ICIS). At the University of Insubria prof. Saroglia taught Aquaculture, Hydrobiology, Etology and Animal Welfare, Animal Biotechnology, Halieutic Biotechnologies. He also collaborated in teaching Aquaculture with Ghent University (Belgium), CNAM Montpellier (FR), Ecole Agronomic de Poisy (FR).

**Prof. Patrick Sorgeloos** has been involved in fish and shellfish larviculture R&D in Europe, Asia, Latin America and Africa since the mid seventies. In 1978 he established the Artemia

Reference Center and in 1986 he became the first professor of aquaculture at Ghent University. Until his retirement as emeritus professor in October 2013 over 250 Master (from > 50 countries) and 70 PhD alumni (from > 20 countries) graduated at Ghent University in the field of aquaculture under his guidance. Prof. Sorgeloos is a strong promoter of international networking in aquaculture and was/is involved with the World Aquaculture Society (1999-2000 President), the European Commission (chairman Thematic Network Aquaculture – AquaTnet; member Advisory Group DG Research FP7 theme 2 “food, agriculture and biotechnology; chairman ASEM Aquaculture Platform) and the European Aquaculture Technology & Innovation Platform (founding member).



## **Appendix 2: Domain-specific framework of reference**

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### **Introduction**

Fish has always been part of the human diet and at present fish is an important food commodity. In 2010, 16.7% of the global population's animal protein intake consisted of fish. Fish provided 2.9 billion people with almost 20% of their average animal protein intake and 4.3 billion people with about 15%. In addition, approximately 40% of fish and fish products is traded internationally, making seafood a major source of income for most fish-exporting developing countries. Consequently the aquaculture and fisheries sectors play a significant role in the livelihood of half a billion people (ca. 8% of the world population) who are directly or indirectly dependent on the production of seafood (FAO, 2010; 2014).

Global fish production has grown steadily in the last five decades, with food fish supply increasing at an average annual rate of 3.2 percent, outpacing world population growth at 1.6 percent. World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 19.2 kg in 2012, in a preliminary estimate. A further 38.4 million tons will be requested by a 9 billion population, just to ensure the novadays per caput consumption.

Although wild-caught seafood has dominated total supply during most of history, in the past 30 years, thanks to improved knowledge of the biology of aquatic organisms and the development of new farming techniques, modern aquaculture has gradually become an equally important way of producing seafood. Currently it has even bypassed capture fisheries as the primary source of seafood. The development of aquaculture fits in a new trend of offshoring economic development where space on land becomes scarce. Also other economic activities are developing in many marine regions of the world, such as tourism, biotechnology, energy production, and seabed mining. The potential of these marine resources and activities has to be further developed to provide the growing population with the necessary food and resources.

This 'blue growth' should be sustainable to also provide future generations with valuable resources. The growing human demands for fish and fish products, energy and other marine resources can lead to over-exploitation of marine ecosystems, pollution, and competing claims on marine space and resources. Ensuring the sustainability of blue growth calls for an integrative approach to development and management. Such an approach needs input on the dynamics and components of marine ecosystems and on the impact of different kinds of activities and uses. It also needs to consider the role of stakeholders to allow for decision making at the ecosystem level. Biological and ecological knowledge in combination with technological and socio-economic innovations are needed to make most efficient use of the untapped potential of the marine environment, while safeguarding the sustainable development of marine uses, in particular of fisheries and aquaculture.

The aim of this reference framework is to position the domains of both Aquaculture and Marine Resource Management and their interactions in the context of the increasing human pressure on natural resources.

### **Aquaculture and Marine Resource Management**

Sustainable aquaculture and use of marine resources require detailed understanding of ecological aspects, technical possibilities, socio-economic demands and constraints, people's wellbeing and preferences, and of policy options and scenarios. Therefore, academic education in aquaculture and marine resource management should focus on: (i) educating a

solid disciplinary base in the biological and technical aspects of aquaculture; (ii) understanding of ecosystem functioning, including relationships with the effects of exploitation, resilience and persistence; (iii) analysing management options, including interventions for transformation towards sustainable aquaculture and use of natural marine and aquatic ecosystems; and (iv) understanding of social, economic and governance aspects related to the optimal use by society of marine and aquatic environments as renewable natural resources. Three subfields underpin these foci within aquaculture and marine resource management: aquaculture, sustainable resource management and marine governance.

#### *Aquaculture*

Modern aquaculture is a relatively new sector that plays an important and increasing role in providing humans with proteins. The sector is not only increasing in size, but also the number of cultured species is still increasing. For realizing its large potential, the aquaculture sector requires fundamental and basic biological and technical knowledge in various domains, such as nutrition, breeding, reproduction, health, water quality management, and production system design. One of the main challenges is to solve biological and technological bottle necks, such as maintaining good health, being able to reproduce new species (e.g., tuna and eel), and how and what to feed (nutritional requirements). The current relevance and future potential of aquaculture to feed the world is indisputable, but the sector should also solve a number of sustainability and image issues. Such issues include the use of alternative feed ingredients (reducing fishmeal and fish-oil use), water scarcity (e.g. using less water by novel system developments), avoiding escapees and reducing the associated risk of impact on biodiversity, the optimal embedding of culture locations in the environment, and the reduction of nutrient emissions. For utilizing the huge and important potential of aquaculture in the coming years, biological and ecological knowledge is required to enable both technological and socio-economic innovations in a sustainable manner.

#### *Sustainable resource management*

The supplies of fish from wild resources have reached a maximum. According to recent estimates from FAO (2014) marine capture production is generally decreasing, from a peak of 86.4 million tonnes in 1996, to 79.7 million tonnes in 2012. Moreover, 28.8% of the stocks were estimated to be fished at an unsustainable level, which can lead to considerable ecological and societal effects. Marine biodiversity is reduced, and fragile marine ecosystems such as coral reefs and sea grass field are impacted. Global climate change and increased land-based pollution complicate the effective utilization and management even more. The urgency of these developments has led to new societal measures, such as a discard ban within the European Community, and to new scientific concepts about sustainably exploiting stocks, such as integrated ecosystem assessment and the theory of balanced harvesting. Many knowledge uncertainties still exist about the effects of new measures and how new scientific concepts can deal with these uncertainties. It is the role of sustainable resource management to contribute to provide the required knowledge and positively influence marine ecosystems and the cumulated effect of activities and natural changes they are exposed to.

#### *Marine governance*

The current governance system for marine uses and biodiversity is centred around sectoral decision-making structures for fisheries, aquaculture, shipping, wind energy, tourism etc. Given the present challenges of marine conservation and sustainable use this system needs to shift towards the ecosystem-level. This means that policies, activities and stakeholder structures need to become more integrated, e.g. through the establishment of new policy tools, such as marine spatial planning, and new decision-making procedures. In addition, governance innovations that go beyond traditional governmental policies are emerging as a

response to the increasing demands of society for sustainable products and the protection of marine life and areas. Retailers, and environmental organizations such as WWF and IUCN for example request sustainability audits and certification for the seafood value chain. The increased transparency about the social and environmental impact and the emergence of market-based incentives for more sustainable fish products lead to changes in the market for fish products. Knowledge and insight into the changing roles of governments, NGOs, companies and citizen-consumers that accompany new policy tools and governance innovations is needed to design effective governance strategies that contribute to sustainable blue growth. .

## **What can be expected from a MSc Aquaculture and Marine Resource Management graduate?**

### *Requirements for future professionals*

Future professionals will require a multidisciplinary mind-set. They will need to be aware of the trade-offs between the human needs, the state of the marine and aquatic environment and possible technological and socio-economic responses. The marine and aquatic resources need to be developed effectively and managed to ensure that their impacts on aquatic ecosystems, including biodiversity and ecosystem services are sustainable. Achieving this balance, and understanding and accounting for the trade-offs involved, requires knowledge of aquaculture production, human activities, the ecology of the aquatic environment, and the governance systems that are used to manage marine resources and biodiversity.

The learning outcomes of a master's degree programme should communicate the fact that graduates have developed academic, research and communicative skills to an advanced level, and that these learning outcomes have a bearing on the professional sphere.

### *Knowledge and research skills*

The graduate:

- can systematically solve scientific problems within the context of aquaculture and marine resource management;
- is able to make use of the conceptual framework of the discipline in which he/she has specialized in order to explain the state of the art of developing theories and to identify the most important research issues;
- can develop, apply and optimize research techniques;
- can independently formulate, initiate and execute a research project and analyse and interpret the results.

### *Academic and learning skills*

The graduate:

- can report orally and in writing on the field of study for a specialist and a general audience;
- is able to critically reflect on the performance of him/herself and others in the professional context and to evaluate the societal and ethical consequences of research;
- can communicate effectively within the chosen field of specialisation;
- is able to work both independently and as part of a multidisciplinary team.

## **Reference**

Crawford, M.A., M. Bloom, C.L. Broadhurst, W.F. Schmidt, S.C. Cunnane, C. Galli, K. Gehbremeskel, F. Linseisen, J. Lloyd-Smith and J. Parkington. 1999. Evidence for the unique function of docosahexaenoic acid during the evolution of the modern hominid brain, *Lipids* 34, supp 1, 39-47.

FAO. 2010. The State of World Fisheries and Aquaculture 2010. Rome. 197 pp.

FAO. 2014. The State of World Fisheries and Aquaculture 2014. Rome. 223 pp.

## Appendix 3: Intended learning outcomes

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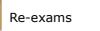
After successful completion of this MSc programme graduates are expected to be able to:		Dublin descriptors				
		Have knowledge and understanding	Apply knowledge and understanding	Making judgements	Communication	Learning skills
<b>For all specialisations:</b>						
1	analyse the physiology, ecology and management of aquatic organisms and marine ecosystems	X	X	X		
2	analyse critically the social dynamics of the utilisation of marine resources, and the conservation and restoration of marine ecosystems	X	X	X		
3	evaluate different stakeholder positions, including the role of the expert, and reflect upon cross-disciplinary views on marine ecosystem and aquatic production issues	X	X	X		
<b>For specialization Aquaculture:</b>						
4a	to design optimal and sustainable production of fish and other marine organisms in a global perspective	X	X	X		
<b>For specialization Marine Resources and Ecology:</b>						
4b	to evaluate limiting factors in order to be able to contribute to an improved biodiversity, environmental quality and sustainability of marine ecosystems.	X	X	X		
<b>For specialization Marine Governance:</b>						
4c	to evaluate existing arrangements in order to design strategies for the governance and management of sustainable marine ecosystems and aquatic resources	X	X	X		
<b>For all specialisations:</b>						
5	design a research plan in which the problem definition, hypothesis, research objectives and research questions are described in relation to relevant literature	X	X	X		
6	apply appropriate research methods and techniques, including gathering new information and integrating this in existing theories in order to test the scientific hypotheses by gathering new information and by integrating this in existing theories	X	X	X		
7	analyse critically the ethical and societal consequences of production of aquatic organisms and use of marine ecosystems, define dilemmas and design possible solutions	X		X		
8	co-operate in an interdisciplinary and international team to perform project-based work	X	X		X	
9	communicate clearly (verbally and in writing) about the results of project and research work with specialists and non-specialists, considering the nature of the target group				X	
10	reflect upon personal knowledge, skills, attitudes and functioning, both individually and in discussions with others and design and plan their own study path				X	X



## Appendix 4: Overview of the curriculum

		Period 1 September/October	Period 2 November/December	Period 3 January	Period 4 February	Period 5 March/April	Period 6 May/June	
<b>Year 1</b>								
	<b>Specialisation A: Aquaculture</b>							
Morning	Life History of Aquatic Organisms	Aquaculture Production Systems	Holidays	Microalgae biotechnology	Re-exams	Optional	European Workshop Environmental Sciences and Management or Academic Consultancy Training	Holidays
Afternoon	Marine Systems	Trends in Aquaculture		Building with nature		Nutrition, welfare and reproduction in aquaculture		Re-exams
	<b>Specialisation B: Marine Resources and Ecology</b>							
Morning	Life History of Aquatic Organisms	Ecology: classics and trends	Holidays	Marine Resources Management	Re-exams	Fisheries Ecology or Water Quality	Environmental Toxicology	European Workshop Environmental Sciences and Management or Academic Consultancy Training
Afternoon	Marine Systems	Trends in Aquaculture				Optional		Holidays Re-exams
	<b>Specialisation C: Marine Governance</b>							
Morning	Life History of Aquatic Organisms	Environmental Policy: Analysis and Evaluation	Holidays	Optional	Re-exams	Economics and Management of Natural Resources	Optional	European Workshop Environmental Sciences and Management or Academic Consultancy Training
Afternoon	Marine Systems	Trends in Aquaculture				Advanced Environmental Economics and Policy		Holidays Re-exams
<b>Year 2</b>	<b>Whole day</b>	<b>Major Thesis (36 ECTS)</b>			Holidays	Re-exams	<b>Internship or Minor Thesis (24 ECTS)</b>	

Legend:

 Compulsory Subject (CS)	 Holidays
 Specialisation (CS)	 Re-exams
 Thesis preparation course + Major thesis (Restricted Optional RO)	



## Appendix 5: Programme of the site visit

Visiting timetable Aquaculture and Marine Resource Management		
<b>Day 1: 9 May</b>		
12.30	15.30	Preparatory meeting (including critical reflection + theses) Reading additional documentation Lunch
15.30	15.45	Break
15.45	16.45	<b>Tour</b> <ul style="list-style-type: none"> <li>• Ing. Ep Eding</li> <li>• Ir. Marjolijn Coppens</li> </ul>
16.45	17.45	<b>Interview with the programme management</b> <ul style="list-style-type: none"> <li>• Ir. Marjolijn Coppens, education manager MAM</li> <li>• Dr. ir. Leo Nagelkerke, chair programme committee MAM</li> <li>• Prof. dr. ir. Tiny van Boekel, director Education Institute, dean of education</li> <li>• Prof. dr. Bas Zwaan, board member Education Institute</li> </ul>
17.45	18.00	Break
18.00	18.45	<b>Interview with alumni</b> <ul style="list-style-type: none"> <li>• Jochem Hop MSc, Projectleader ATKB (concultancy in soil, water and ecology)</li> <li>• Nicky Stringer MSc, Animal Care technician Cobb Europe</li> <li>• Floor Hulskens MSc, Policy Officer Visfederatie</li> <li>• Alwin Hylkema MSc, Lecturer Researcher Aquaculture and Fisheries</li> </ul>
<b>Day 2: 10 May</b>		
09.00	09.15	Internal meeting panel
09.15	10.00	<b>Interview with students</b> <ul style="list-style-type: none"> <li>• Job van Mil, specialisation Aquaculture</li> <li>• Michel van Spankeren, specialisation Aquaculture</li> <li>• Jolien Leliveld, specialisation Aquaculture</li> <li>• Jimmy van Rijn, specialisation Marine Resources and Ecology</li> <li>• Sarine Versteeg, specialisation Marine Resources and Ecology</li> <li>• Rosalie Tukker, specialisation Marine Governance</li> <li>• Amanda Putri, specialisation Marine Governance</li> </ul>
10.00	10.45	<b>Interview with lecturers</b> <ul style="list-style-type: none"> <li>• Dr. Simon Bush, Chair group Environmental Policy</li> <li>• Dr. ir. Rolf Groeneveld, Chair group Environmental Economics and Natural Resources</li> <li>• Dr. ir. Johan Schrama, Chair group Aquaculture and Fisheries</li> <li>• Prof. dr. Johan Verreth, Chair group Aquaculture and Fisheries</li> <li>• Ir. Paul van Zwieten, Chair group Aquaculture and Fisheries</li> <li>• Prof. dr. Tinka Murk, Chair group Marine Animal Ecology</li> </ul>
10.45	11.00	Break

11.00	11.45	<b>Interview with Programme Committee (students + teaching staff)</b> <ul style="list-style-type: none"> <li>• Prof. dr. Leo Nagelkerke, chair Programme Committee</li> <li>• Prof. dr. Geert Wiegertjes, staff member Programme Committee</li> <li>• Michele Gallo, student member Programme Committee</li> <li>• Agustin Capriati, student member Programme Committee</li> <li>• Francisco Xosé Presas Basalo, student member Programme Committee</li> </ul>
11.45	12.30	<b>Board of Examiners, Study Advisor</b> <ul style="list-style-type: none"> <li>• Prof. dr. ir. Mart de Jong, chair Board of Examiners</li> <li>• Dr. ir. Klaas Swart, former secretary Board of Examiners</li> <li>• Dr. Peter de Jong, secretary Board of Examiners</li> <li>• Ir. Marjolijn Coppens, stand-in for study advisor</li> </ul>
12.30	13.30	Open office hour Lunch Internal meeting panel
13.30	14.15	<b>Interview with programme management</b> <ul style="list-style-type: none"> <li>• Ir. Marjolijn Coppens, education manager MAM</li> <li>• Dr. ir. Leo Nagelkerke, chair programme committee MAM</li> <li>• Prof. dr. ir. Tiny van Boekel, director Education Institute, dean of education</li> <li>• Prof. dr. Bas Zwaan, board member Education Institute</li> </ul>
14.15	16.00	Internal meeting panel
16.00	16.15	Presentation of preliminary findings

## **Appendix 6: Theses and documents studied by the panel**

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Prior to the site visit, the panel studied the theses of the students with the following student numbers:

880511453120	900303496040	891010090100
890325990060	820405626040	900212496040
900822295100	910313771120	840225543040
821106576030	910424716110	900406419120
870714559130	871216798010	890724243110

During the site visit, the panel studied materials from the following courses (partly as hard copies, partly via the institute's electronic learning environment):

Common courses:

- Lifehistory of Aquatic Organisms (AFI-31306)
- Marine Systems (AEW-22806)

Specialisation courses:

- Aquaculture Production Systems (AFI-31806)
- Marine Resource Management (AFI-32806)

Thesis preparation course:

- Economics and Management of Natural Resources (ENR-31306)

In addition the panel studied:

- Annual reports Board of Examiners (2012-2013 and 2013-2014)
- Minutes Programme Committee (2014-present)