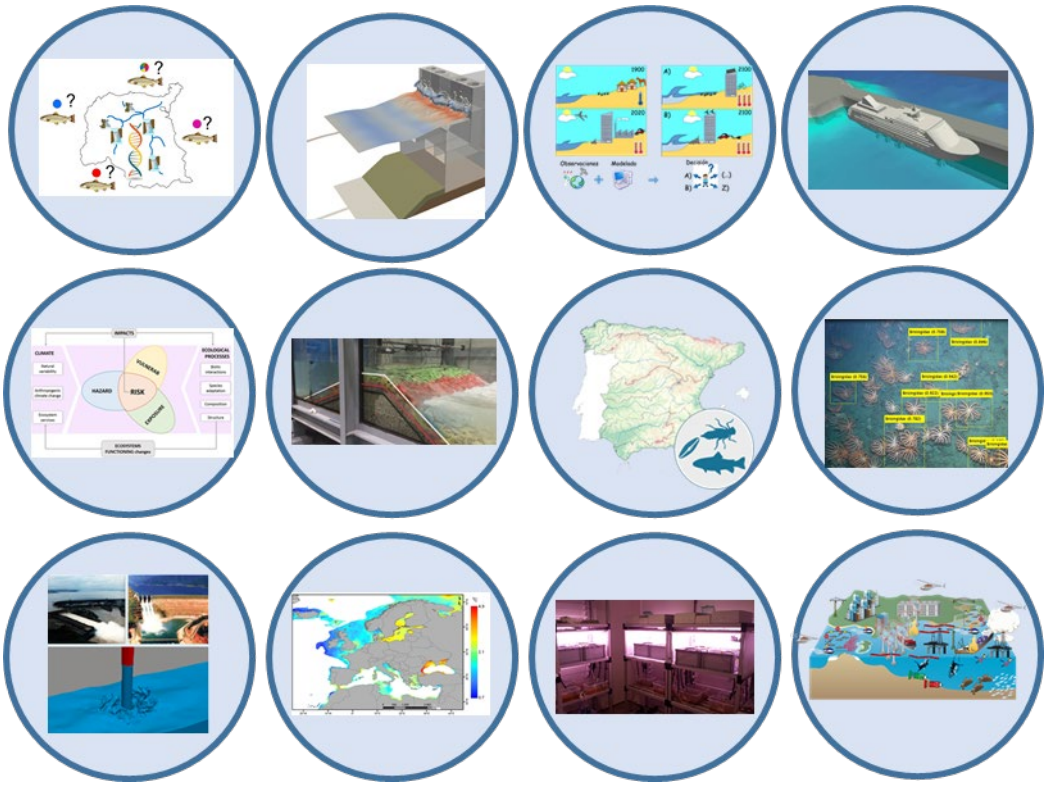
PhD PROGRAMME on COASTAL ENGINEERING, HYDROBIOLOGY AND MANAGEMENT OF WATER SYSTEMS

REPORT 2014-20



PhD Programme's Academic Commission

Santander, 9th February 2021

This report was approved by the Academic Commission of the PhD Program on Coastal Engineering, Hydrobiology and Management of Water Systems (IH2O) during its ordinary meeting held on 9th of February 2021.

CONTENTS

1. INTRODUCTION

1.1. Background

Following the completion of the first six-year term (academic years 2014/15-2019/20) since the approval and implementation of the ***PhD Programme in Coastal Engineering, Hydrobiology and Management of Water Systems*** *(*hereinafter*, the "**IH2O Programme**")*, the scientific management of which is associated to the Institute of Environmental Hydraulics of the Universidad de Cantabria (hereinafter, IHCantabria), this seems an appropriate time to carry out an assessment of the implementation process of this degree and of the results obtained. This exercise of internal assessment is an essential element associated with the completion of the first academic cycle, once the various administrative procedures have been completed (admissions, annual follow-ups, cross-training and specific training programs, quality assurance systems, etc.) and implemented under the new PhD regulations.

This analysis represents the continuation of the assessment process of the program carried out at the end of the fourth academic year, the results of which were summarised in the "***IH2O 2014-20 Program Initial Report***".

The Program's Academic Commission (hereinafter, the CAPD) approved the draft of this summary report of the program's implementation process which also served as 1) a reference for the preparation of future annual reports that will summarise the evolution of the activities and outcomes of each academic year, and 2) an essential document for the update of the programme's Verification Report.

1.2. Objective

The general objective of this report is to summarise the stage of development of the IH2O Program throughout the first six-year term (2014-20), focusing on the following:

- Description of the organisational structure of the programme, as well as the composition and accumulated experience of its research teams in this period of time.

- Draft of an academic report summarising the evolution in the number of PhD candidates, the list of specific training activities in the programme and the main outcomes of the training process.

- Development of an internal assessment of the main actors involved (Academic Commission, lecturers and PhD students) in order to confirm the suitability of the administrative procedures and the quality of the training processes.

1.3. Structure and scope of the document

This document has been structured in three separate sections that are associated with the three specific aforementioned objectives, which are supplemented with this first introductory chapter and a number of annexes:

- Section 2. This chapter deals with the organisational aspects of the programme, and updates the information on the **boards** responsible for its academic management. It also introduces the lecturers within the three **research teams**, particularly focusing on their significant experience accomplished during the last years, as well as the **international connections** established through agreements, projects, networks, etc.
- Section 3. This section includes all the information on the effective development of the programme, organised around three types of information: i) the **PhD students**; ii) the specific training **activities** of the Programme; iii) the **outcomes** of the training process, both in terms of the annual evolution of the PhD candidates and the thesis presented, as well as the quality of the scientific outcomes; and, iv) the **graduates** from the programme.
- Section 4: The last chapter of the report summarises the outcomes obtained, explains the internal **quality assessment** procedure and establishes the potential **proposals** for improvement for the new academic cycle 2021-2026.

2. ORGANISATION OF THE PROGRAMME

The IH2O PhD Programme is built on four key elements:

- Management Boards.
- Research Teams.
- External Partnerships.
- Internal Follow-up Procedures.

2.1. Management Boards

The programme is managed by the Academic Commission (CAPD) which, with the purpose of speeding up the required formalities for the development of the programme and promoting internal and external communications, relies on a number of delegate commissions (Figure 1), the composition and specific roles of which are described in the "IH2O Reference Document" (DdR, v2. 2018).

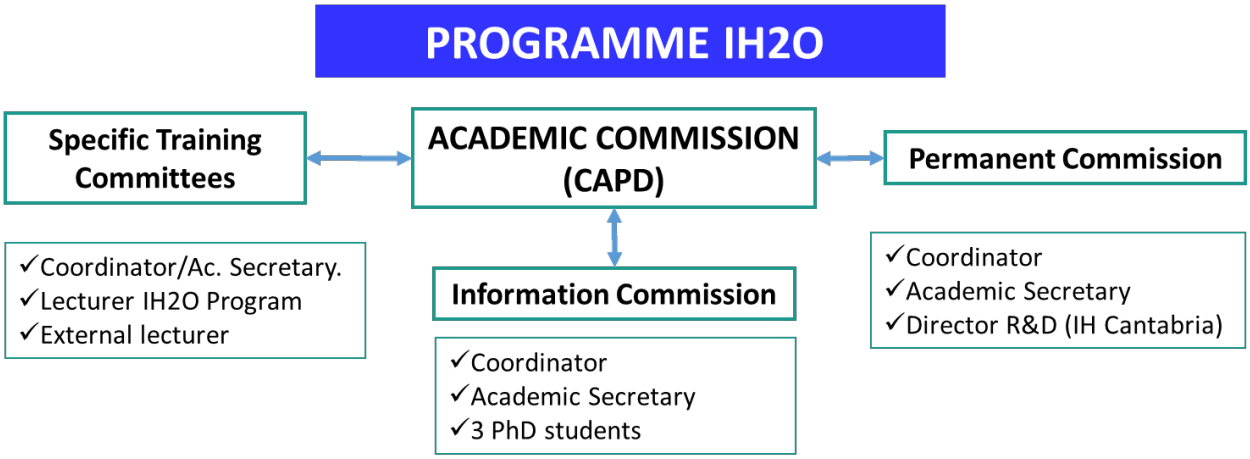


Figure 1. Diagram representing the bodies responsible for the administrative and scientific management of the programme.

The CAPD is chaired by the programme Coordinator and integrated by eight (8) further lecturers, who act on behalf of various sectors (Table 1). One of these lecturers acts as the Academic Secretary and additionally performs the roles of Deputy Coordinator, replacing the Coordinator in all the activities he is authorised to do. On the other hand, the ACDP delegates the management of the daily tasks to the **Permanent Commission**, integrated by the Coordinator, the Academic Secretary and the R&D Director of IHCantabria (Table 1). Nevertheless, the CAPD approved an online tool (via email) during its meeting on the 10th May 2017 to speed up the prior authorisation and subsequent ratification of some of these matters (e.g. approval of late admissions, application for extensions) at an ordinary meeting. This decision, which is only valid provided unanimous agreement of all the members, would

formally speed up compliance of the CAPD's responsibilities and would allocate a consultative role to the Permanent Commission.

This way, each of the lines of research of the programme (i.e. areas of IHCantabria= R&D groups of the UC) contributes a representative to the Commission, and so does the Spanish Institute of Oceanography (hereinafter. IEO), a partner institution of the Doctorate School of the Universidad de Cantabria (hereinafter. EDUC) and a research centre associated to one of the lines of the programme. These members act as a link between the lecturers, the PhD students of each team and the Commission.

	Sector	
Juanes, José A.*		**Coordinator**
López, Javier*	Climate, Energy and Infrastructures research team	**Academic Secretary**
Medina, Raúl	Board of Directors of IHCantabria	Member
Losada, Iñigo J.*	R&D Director of IHCantabria	Member
González, Mauricio	Master's and PhD Lecturers	Member
Álvarez, César	Civil Engineering School	Member
Puente, Araceli	Hydrobiology and Environmental Management research team	Member
García, Andrés	Hydraulic and Coastal Engineering research team	Member
Lavín, Alicia	Associates, Spanish Oceanographic Institute (IEO)	Member

*Members of the Programme's Permanent Commission

Table 1. Members of the programme's Academic Commission (CAPD).

In order to provide an adequate flow of information to the PhD students, an **Information Commission** was created consisting of the Coordinator, the Academic Secretary and a representative of the doctoral candidates of each of the three research teams. Nevertheless, at the request of the PhD students, at least two informative sessions have been provided in the last years to all the groups involved with the purpose of further improving the flow of information. This has almost replaced the responsibilities of the aforementioned Commission.

The following PhD students have performed this role during this time:

- Hydraulic and Coastal Engineering Team: **Íñigo Claramunt/ June Gainza/ Paula Núñez.**
- Climate, Energy and Infrastructures Team: **Javier Díez/ Eva Romano.**
- Hydrobiology and Environmental Management Team: **Camino Fernández/ Samuel Sainz.**

Finally, during the first six years of the programme, a group of lecturers related to this and other programmes of the Universidad de Cantabria were involved in the creation of **Specific Training Committees**, which were commissioned with the task of assessing the initial research Plan and the annual progress of the Doctoral candidates. The information regarding the lecturers can be found in Section 2.4.1.

2.2. Research Teams

Figure 2 summarises the structure of the Research Teams, identifying IHCantabria's Research Teams associated to each line, resulting in research sub-lines of the IH2O Programme.

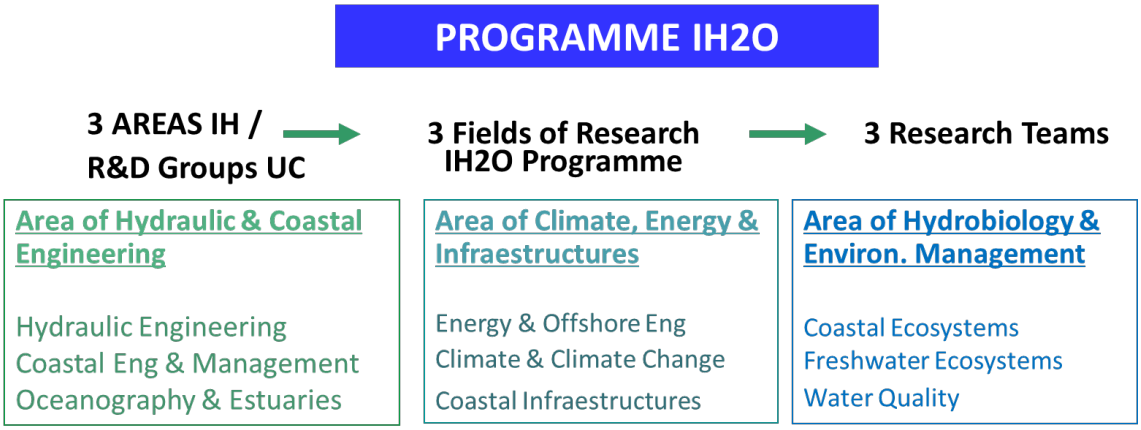


Figure 2. Programme's Research Teams.

Since the approval of the programme, which included 20 lecturers, 24 new lecturers were recruited either on a temporary (6) or a permanent basis, while 4 of the original researchers dropped out of the program due to changes in their employment situation or relationship with the Institute. Additionally, as the number of researchers increased and the lines of research had further developed, two of the lecturers included initially in the report were reallocated. Subsequently, at the end of the first cycle of the programme (2014-20), the teaching staff included 38 lecturers, of whom 36 are in active teaching and 2 are currently in voluntary leave of absence.

The following subsections show the updated composition of the three research teams of this programme, with summarised information on the expertise accumulated by the lecturers in the last six years (2014-20) through the analysis of their most relevant publications, competitive projects they have developed and, particularly, the PhD thesis which they have conducted and/ or are conducting.

Nevertheless, the "transdisciplinary" nature of IHCantabria and its R&D's structure which is the basis of the IH2O Programme, is reflected in the numerous interactions and partnerships between teams, and also in the PhD thesis co-directed by lecturers from the lines of research. It is therefore essential to carry out an overall analysis of the human team responsible for the IH20 Programme previous to the programme analysis.

As mentioned, a total of 40 lecturers were actively involved during the time under analysis (excluding the 4 lecturers referred above who left the programme at an early stage). Out of the total number of lecturers, 21 (52.5%) are lecturers and researchers from 5 different universities (UC, UPM, Univ Texas, Ecole Polytech. Fed. Laussanne and Lisbon University), 11 (27.5%) are staff lecturers at Foundation of the Institute of Environmental Hydraulics of Cantabria (hereinafter, FIHAC) and 8 (20%) are staff lecturers of the Spanish Institute of Oceanography and the Maritime Museum of the Cantabrian Sea (Cantabrian Government), with the UC being the one contributing the highest number of lecturers (27) through the IHCantabria (UC/FIHAC) (Figure 3).

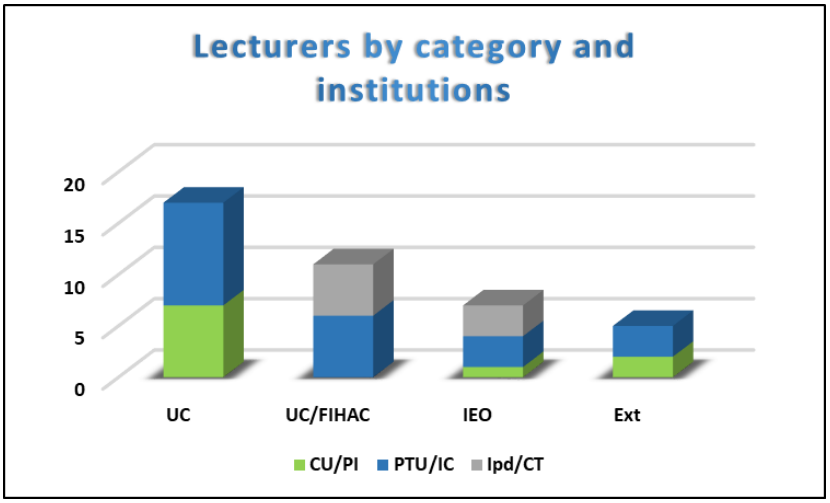


Figure 3. Breakdown of the lecturers by academic category (grouped by equivalent type) and institutions. Categories: 1) CU/ PI= Full Professor/ Research Professors; 2) PTU/ IC= Associated Professor/ Associated Lecturer/ Research Scientist/ Senior Postdoctoral Researcher; 3); IpD/ CT= Assistant Professor/ Staff Scientist/ Junior Postdoctoral Researcher.

The most numerous lecturer group is Associate professors, Research Scientists and Senior Postdoctoral Researchers (PTU/ IC, 55%), whereas Full Professors and Research Professors represent 25% of the lecturing staff. The youngest group of researchers involved in the programme (Assistant Professor/ Staff Scientist/ Junior Postdoctoral Researcher) represent 20% of the lecturers (Figure 3).

The distribution of the lecturers amongst the three research teams is slightly unbalanced (Figure 4), with a higher number of them (19) integrating the Hydrobiology team compared to the Climate team (14) or the Engineering team (7). The Hydrobiology group is the only one including lecturers from the three involved institutions (UC, FIHAC and IEO). In terms of the number of male lecturers (62.5%) compared to the number of female lecturers (37.5%), the ratio is slightly reduced (60/40) if we only take into account the permanent members of staff. These percentages vary amongst the various research teams, with greater unbalance being found in the Engineering group. Such distribution shows, to a certain extent, the existence of similar unbalance situations in the academic staff of the Civil Engineering School.

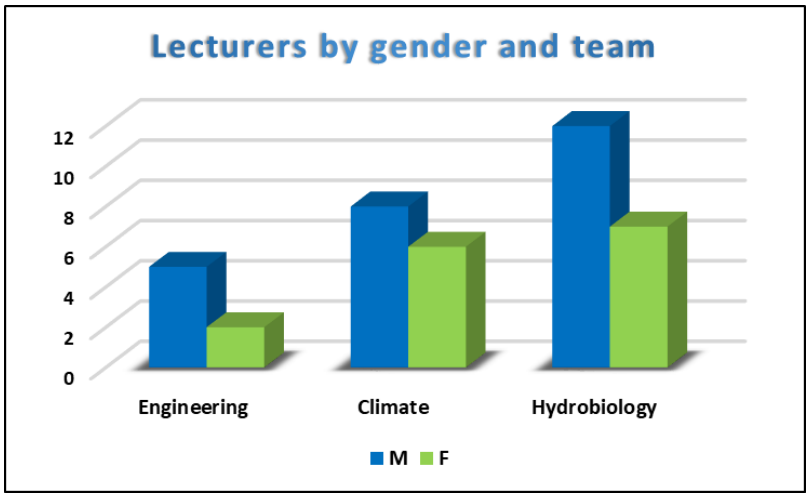


Figure 4. Breakdown of lecturers by research team and gender.

Nevertheless, this trend will revert in the medium term, due to the increasing number of young female researchers joining in as lecturers for the programme (Figure 5) and the natural renewal of the lecturing teams.

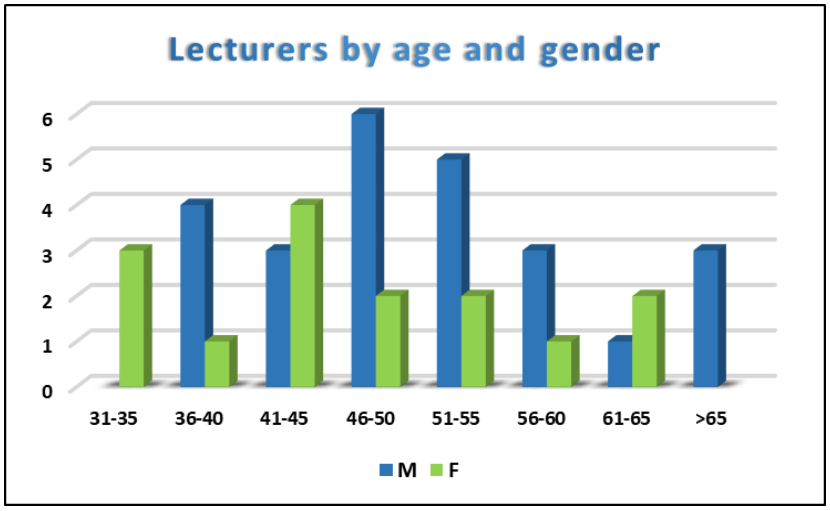


Figure 5. Breakdown of lecturers by age range, differentiating between male and female lecturers.

In terms of the research experience of the lecturers of the programme, Figure 6 summarises two major aspects of this activity: the number of papers published in JCR indexed scientific journals and the H Indexes (based on the information collected from SCOPUS, Nov. 2020). A percentage of 55% of the lecturers produced over 20 indexed papers in the last 6 years (2014-20) and 27% published over 10 articles, with the three research teams having representatives in both groups (Figure 6, left). This is portrayed in the H indexes that show the impact of the publications according to the number of cites they include (Figure 6, right).

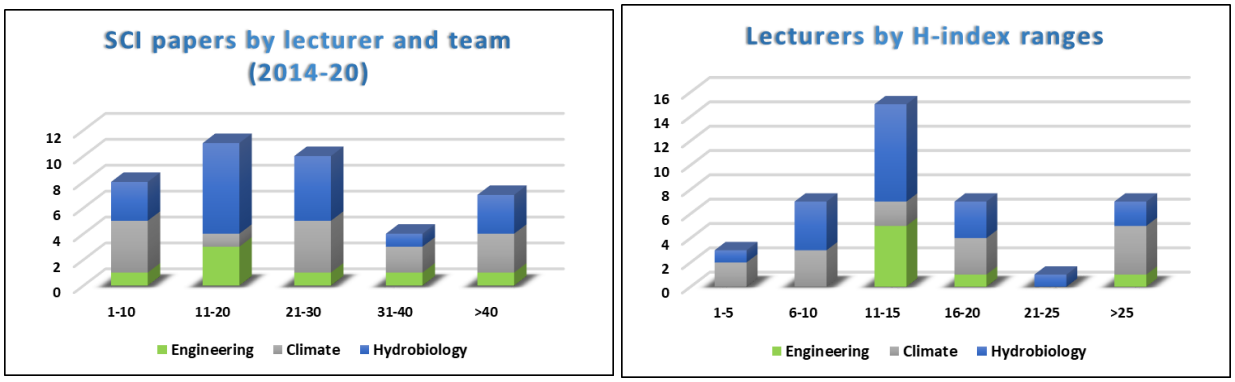


Figure 6. Breakdown of the number of indexed papers (JCR) published by lecturer within the 2014-20 period (left) and breakdown of lecturers by H-index ranges. In both cases the information is broken down also by research team.

And last, it is worth analysing the breakdown of thesis being supervised by the lecturers as an indication of the extent of distribution of the responsibilities of the lecturers of the programme. In this respect, 78% of the lecturers are involved in this activity (Figure 7). The large majority of the thesis are co-supervised with the purpose of increasing the multidisciplinary nature of the work, either within or between research teams. At the same time, there is an interest in promoting co-supervisions between senior and young researchers in order to incorporate new talent to the programme, in spite of the enormous limitations existing for them to effectively join the R&D staff.

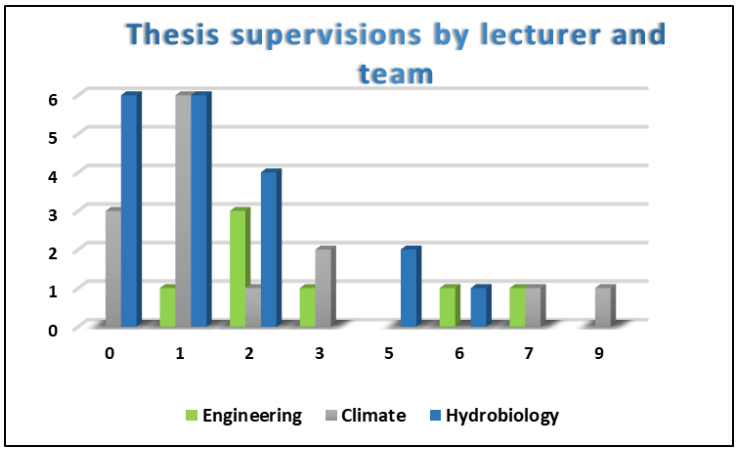


Figure 7. Breakdown of the involvement in the management of thesis by lecturers of the programme (nº of supervised thesis, in progress +presented), grouped by teams, during the 2014-20 period.

The following subsections provide detailed information on the composition and experience of each research team (most relevant publications and projects), as well as the number of thesis presented or in progress throughout the six academic years referred to (Oct/2014 – Nov/2020.

2.2.1. Hydraulic and Coastal Engineering

- Information on the team **lecturers**.

  This team is made up of 9 lecturers, with the large majority of them being permanent lecturers of the Universidad de Cantabria. The 7 lecturers named in the Table are currently actively working in the programme. Two of the lecturers (C. Álvarez and A. García) who were initially allocated to the Hydrobiology and Environmental Management team, were reallocated to this team. This was due to their research sublines being more in connection with those of their new team.

CURRENT SITUATION			EXPERIENCE			2014-2020					
LECTURER	POSITION	INSTITUTION	6-yr Research Periods	Last 6-yr Research Period	H-index	Total PhD Thesis	No SCI	Mentor IH2O	Supervisor IH2O	IH2O Thesis	IP Comp
Raúl Medina	CU	UC	6	2015	31	11	53	8	7	4	6
Mauricio González	PTU	UC	4	2019	19	4	37	2	6	5	3
Sonia Castanedo	PTU	UC	2	2013	15	6	24	0	2	1	0
César Álvarez	CU	UC	4	2019	14	3	14	2	2	0	0
Andrés García	CU	UC	2	2014	15	5	19	1	3	0	4
Ana J Abascal	Ipd-Sr	UC/FIHAC	na		11	2	15	0	1	1	4
Fco. Javier Bárcena	Ipd-Jr	UC/FIHAC	na		11	0	8	0	2	1	0

Table 2. Updated information (Nov. 2020) on the lecturers of the Hydraulic and Coastal Engineering team. (Mentor/Supervisor/ IH2O Thesis= Information relevant to the role developed and the thesis presented for the current programme; IP comp = Number of times the lecturer has acted as Principal Researcher of competitive projects in the period 2014-20).

- List of the **25 most relevant publications (SCI)** (2014-20)

  Out of the corpus of over 70 publications of the team during this term, 25 articles of JRC indexed journals have been selected, all of which belong to the first quartile (Q1) in any of the reference lists within the year of publication. This list attempts to show the scientific productivity of the research team, as well as the diversity of the thesis developed and the cooperative work. During the selection process, priority was given to work produced by PhD students of the IH2O Programme (**Author**), supplemented by other articles published by the various lecturers of the team in the last six years.

  1. **Chiri, H**., Abascal, A., Castanedo, S. 2020. Deep oil spill hazard assessment based on spatio-temporal met-ocean patterns. Marine Pollution Bulletin. 154: 111123. . IF: 4.049; Cat. JCR: Marine and Freshwater Biology; Rank: 4/107; D1.
  2. **Núñez, P**., Castanedo, S., Medina, R. 2020. A Global Classification of Astronomical Tide Asymmetry and Periodicity Using Statistical and Cluster Analysis, JGR Oceans. 125: 20. https://doi.org/10.1029/2020JC016143. IF: 3.819; Cat. JCR: Geosciences, Multidisciplinary; Rank; 28/200; Q1.
  3. **Jaramillo, C**., Martínez, J., González, M., Medina R. 2020. A shoreline evolution model considering the temporal variability of the beach profile sediment volume (sediment

gain/loss). Coastal Engineering, 156: 103612. https://doi.org/10.1016/j.coastaleng.2019.103612. IF: 4.119; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.

4. **Pellón E.**, Almeida, L.R., González, M., Medina, R. 2020. Relationship between foredune profile morphology and aeolian and marine dynamics: A conceptual model, Geomorphology, 351:106984; https://doi.org/10.1016/j.geomorph.2019.106984. IF: 3.819; Cat. JCR: Geosciences, Multidisciplinary; Rank: 28/200; Q1.
5. **Aniel-Quiroga, I.**, Vidal, C., López, J., González, M. 2019. Pressures on a rubble-mound breakwater crown-wall for tsunami impact, Coastal Engineering, 152:1-15. https://doi.org/10.1016/j.coastaleng.2019.103522. IF: 4.119; Cat. JCR: Engineering, Ocean; Rank: 1/14; Q1.
6. **Chiri, H.**, Abascal, A., Castanedo, S., Álvarez, J. A., Liu, Y., Weisberg, R., Medina, R. 2019. Statistical simulation of ocean current patterns using autoregressive logistic regression models: A case study in the Gulf of Mexico, Ocean Modelling, 136:1-12. https://doi.org/10.1016/j.ocemod.2019.02.010. IF: 3.215; Cat. JCR: Oceanography; Rank: 11/67; Q1.
7. **Chiri, H.**, Abascal, A., Castanedo, S., Medina, R. 2019. Mid-long term oil spill forecast based on logistic regression modelling of met-ocean forcings, Marine Pollution Bulletin. 146:962-976. https://doi.org/10.1016/j.marpolbul.2019.07.053. IF: 4.049; Cat. JCR: Marine and Freshwater Biology; Rank: 4/107; D1.
8. García-Alba J., Bárcena J.F., Ugarteburu C., García A. 2019. Artificial neural networks as emulators of process-based models to analyse bathing water quality in estuaries. Water Research, 150: 283-295. https://doi.org/10.1016/j.watres.2018.11.063. IF: 9.130; Cat JCR: Water Resources; Rank: 1/94; D1.
9. **Gomes, P.**, Medina R., González M., Garnier R. 2019. Wave reflection and saturation on natural beaches: The role of the morphodynamic beach state in incident swash, Coastal Engineering, 153:103540. https://doi.org/10.1016/j.coastaleng.2019.103540. IF: 4.119; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
10. de Almeida L.R., González M., Medina R. 2019. Morphometric characterization of foredunes along the coast of northern Spain. Geomorphology: 338: 68-78. https://doi.org/10.1016/j.geomorph. 2019.04.019. IF: 3.819; Cat JCR: Geography, Physical; Rank: 9/50; Q1.
11. **Núñez, P.**, Andrés García, Inés Mazarrasa, José A. Juanes, Ana J. Abascal, Fernando Méndez, Sonia Castanedo, Raúl Medina. 2019. A methodology to assess the probability of marine litter accumulation in estuaries, Marine Pollution Bulletin. 144:309-324. https://doi.org/10.1016/j.marpolbul.2019.04.077. IF: 4.049; Cat. JCR: Marine & Freshwater Biology; Rank: 4/107; D1.
12. Quetzalcóatl O., González M., Cánovas V., Medina R., Espejo A., Klein A., Tessler M.G., Almeida L.R., Jaramillo C., Garnier R., Kakeh N., González-Ondina J. 2019. SMCε, a coastal modeling system for assessing beach processes and coastal interventions: Application to the Brazilian coast. Environmental Modelling and Software, 116: 131-152. https://doi.org/10.1016/j.envsoft.2019.03.001. IF: 4.807; Cat JCR: Computer SCI, Interdiscip. Appl.; Rank: 14/109; Q1.

13. **Aniel-Quiroga, I**., Quetzalcoatl, O., González, M., Guillou, Louise. 2018. Tsunami run-up estimation based on a hybrid numerical flume and a parameterization of real topobathymetric profiles, Natural Hazards Earth System Sciences, 18:1469-1491. https://doi.org/10.5194/nhess-18-1469-2018. IF: 2.883; Cat. JCR: Water Resources; Rank: 21/91; Q1.
14. **Aniel-Quiroga, I**., Vidal, C., Lara, J.L., González, M., Sainz, A. 2018. Stability of rubble-mound breakwaters under tsunami first impact and overflow based on laboratory experiments, Coastal Engineering, 135: 39-54. https://doi.org/10.1016/j.coastaleng.2018.01.004. IF: 3.850; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
15. **Elshinnawy, A.I**., Medina, R., González, M. 2018. Dynamic equilibrium planform of embayed beaches: Part 1. A new model and its verification, Coastal Engineering, 135: 112-122. https://doi.org/10.1016/j.coastaleng.2018.01.010. IF: 3.850. Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
16. **Elshinnawy, A.I**., Medina, R., González, M. 2018. Dynamic equilibrium planform of embayed beaches: Part 2. Design procedure and engineering applications, Coastal Engineering, 135:123-137. https://doi.org/10.1016/j.coastaleng.2018.01.001. IF: 3.850; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
17. **Elshinnawy, A.I**., Medina, R., González, M. 2018. On the influence of wave directional spreading on the equilibrium planform, Coastal Engineering, 133:59-75. https://doi.org/10.1016/j.coastaleng.2017.12.009. IF: 3.850; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
18. **Gainza, J**., González, M., Medina, R. 2018. A process based shape equation for a static equilibrium beach planform, Coastal Engineering, 136:119-129. https://doi.org/10.1016/j.coastaleng.2018.02.006. IF: 3.850; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
19. **Gomes, P**., Medina R., González M., Garnier R. 2018. Infragravity swash parameterization on beaches: The role of the profile shape and the morphodynamic beach state, Coastal Engineering, 136: 41-55. https://doi.org/10.1016/j.coastaleng.2018.02.002. IF: 3.850; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.
20. Abascal, A.J., Castanedo, S., Núñez, P, Mellor, A., Clements, A., Pérez, B., Cárdenas, M., Chiri, H., Medina, R. 2017. A high-resolution operational forecast system for oil spill response in Belfast Lough. Marine Pollution Bulletin, 114: 302-314. http://dx.doi.org/10.1016/j.marpolbul.2016.09.042. IF: 3.241; Cat. JCR: Marine & Freshwater Biology; Rank: 9/106; D1.
21. Abascal, A.J., Sánchez, J., Chiri, H., Ferrer, M. I., Cárdenas, M., Gallego, A., Castanedo, S., Medina, R., Alonso, A., Berx, B., Turrell, W.R., Hughes, S.L. 2017. Operational oil spill trajectory modelling using HF radar currents: A northwest European continental shelf case study, Marine Pollution Bulletin, 119: 336-350. https://doi.org/10.1016/j.marpolbul.2017.04.010. IF: 3.241; Cat. JCR: Marine & Freshwater Biology; Rank: 9/106; D1.

22. Díez, J., Uriarte, A., Cánovas, V., Medina, R. 2017. A parametric model for dry beach equilibrium profiles, Coastal Engineering, 127: 134 144. http://dx.doi.org/10.1016/j.coastaleng.2017.06.012. IF: 2.674; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.

23. **Elshinnawy, A.I**., Medina, R., González, M. 2017. On the relation between the direction of the wave energy flux and the orientation of equilibrium beaches, Coastal Engineering, 127: 20-36. http://dx.doi.org/10.1016/j.coastaleng.2017.06.009. IF: 2.674; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.

24. Bárcena F.J., Camus P., García A., Álvarez C. 2015. Selecting model scenarios of real hydrodynamic forcings on mesotidal and macrotidal estuaries influenced by river discharges using K-means clustering. Environmental Modelling and Software, 68: 70-82. https://doi.org/10.1016/j.envsoft.2015.02.007. IF: 4.207; Cat JCR: Computer SCI, Interdisc. Appl.; Rank: 6/104; D1.

25. Jara M.S., González M., Medina R. 2015. Shoreline evolution model from a dynamic equilibrium beach profile. Coastal Engineering, 99: 1-14. https://doi.org/10.1016/j.coastaleng.2015.02.006. IF: 2.841; Cat JCR: Engineering, Ocean ; Rank: 1/14; D1.

- List of **5 competitive projects** (2014-20).

  During this period of time, funding was obtained from regional calls (e.g. SODERCAN, INNOVA), national calls (e.g. Plan Estatal, Retos Colaboración, Fundación Biodiversidad) or European calls (e.g. LIFE, INTERREG, H2020, Erasmus+) for the development of 8 competitive projects. The following are five representative examples which were conducted by various lecturers of the team (Table 3).

TITLE	PERIOD	PROJECT TYPE	IP	BUDGET
PLAN ESTRATEGICO NACIONAL PARA LA PROTECCIÓN DE LA COSTA (ESTRATEGIA NACIONAL)	2020/22	EUROPEAN COMMISSION	Raúl Medina	310.332,00 €
DINÁMICA DEL PERFIL DE PLAYA Y TÉCNICAS DE RECUPERACIÓN ASISTIDA: INVESTIGACIÓN NUMÉRICA Y EXPERIMENTAL EN LABORATORIO Y CAMPO (BEACH-ART)	2018/20	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Mauricio González	65.884,00 €
SISTEMA DE GESTIÓN DE LA CONTAMINACIÓN MARINA Y ATMOSFÉRICA DERIVADA DE DERRAMES (SICMA)	2018/21	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Ana Julia Abascal	303.443,00 €
PARAMETRIZACIÓN DE LOS EFECTOS FÍSICO-QUÍMICOS DEL MICROFITOBENTOS EN MODELOS DE TRANSPORTE ESTUARINO: BIOESTABILIZACIÓN DE SEDIMENTOS Y BIOMOVILIZACIÓN DE METALES (MORPEHUS)	2019/21	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Andrés García	104.000,00 €
SISTEMA RÁPIDO DE AYUDA A LA TOMA DE DECISIONES (BE-READY)	2020/21	EUROPEAN COMMISSION	Ana Julia Abascal	93.100,00 €

Table 3. List of 5 representative competitive projects developed by the Hydraulic and Coastal Engineering team.

- **Thesis presented and in progress** within the IH2O Programme (2014-20).

  During this period a total number of 9 students joined this line of the programme. Six of them have completed their PhDs (Table 4). Funding of the thesis was supported externally by other countries (2) or private companies (1), by the FPU National Training Programme (1) and by different projects of the research groups of IHCantabria itself (5).

ACCEPTANCE DATE	THESIS DATE	PhD STUDENT	SOURCE OF FUNDING	TITLE	SUPERVISOR/S	
21/11/2014	22/02/2018	**Elshinnawy, Ahmed Ibrahim A**	Ext	Improvements in coastal models of the plan form of beaches in long-term scales	**Raúl Medina**	**Mauricio González**
21/11/2014	04/09/2020	**Jaramillo Cardona, Camilo**	IH	Modelo de evolución de playas integrando planta y perfil, en escalas de medio a largo plazo	**Raúl Medina**	**Mauricio González**
30/01/2015	26/07/2018	**Gainza Thalamas, June**	FPU	Modelo de forma en planta de equilibrio basado en métodos numéricos	**Raúl Medina**	**Mauricio González**
20/11/2015	31/10/2018	**Aniel-Quiroga, Íñigo**	IH	Impacto de tsunamis en obras marítimas y zonas costeras	**Mauricio González**	**César Vidal**
20/11/2015	24/01/2020	**Chiri, Helios**	IH	Advances in statistical methodologies for mid-long term simulations od oil spills in the sea	**Ana J Abascal**	**Sonia Castanedo**
17/11/2016		**Núñez Pérez, Paula**	IH	Influencia de la asimetría de la marea en el intercambio de flujos de un estuario	**Raúl Medina**	**Sonia Castanedo**
17/11/2016		**Pellón De Pablo, Erica**	IH	Modelo de evolución costera en el muy largo plazo, incluyendo su interacción con la plataforma continental	**Raúl Medina**	**Mauricio González**
10/04/2017	28/09/2018	**Gomes Da Silva, Paula**	Ext	Wave runup en playas: el papel de la forma del espectro y de las condiciones morfodinámicas de la playa	**Mauricio González**	**Raúl Medina**
23/11/2017		**Lupiola Chamorro, Jagoba**	Ext	Influencia de los procesos de mezcla en el transporte de sustancias	**Andrés García**	**Francisco J Bárcena**

Table 4. Information on the thesis in progress and thesis presented from the Hydraulic and Coastal Engineering team during term 2014-20, with indication of the supervisors and the source of funding (Ext= external; FPU= National Training Programme; IH= own projects).

2.2.2. Climate, Energy and Infrastructures

- Information on the team **lecturers**.

  This team is made up of 16 lecturers, a large majority of whom are permanent lecturers at the Universidad de Cantabria or researches of FIHAC. Currently, this team is formed by 11 active lecturers who are included in Table 5.

CURRENT SITUATION			EXPERIENCE			2014-2020					
LECTURER	POSITION	INSTITUTION	6-yr Research Periods	Last 6-yr Research Period	H-index	Total PhD Thesis	No SCI	Mentor IH2O	Supervisor IH2O	IH2O Thesis	IP Comp
Íñigo Losada	CU	UC	6	2018	51	7	119	8	9	4	16
Javier López	PTU	UC	4	2017	30	3	44	4	7	0	8
César Vidal	CU	UC	5	2014	20	2	21	0	1	1	1
Pedro Díaz	PTU	UC	1	2014	11	1	23	0	1	1	1
Gabriel Díaz	PCD	UC	1	2017	5	2	9	0	1	0	2
Manuel del Jesus	PCD	UC	na		8	1	9	0	3	1	3
Raúl Guanche	RyC	UC/FIHAC	na		17	4	45	0	3	2	13
Melisa Menéndez	RyC	UC	na		29	2	33	0	2	0	3
María Maza	JdC	UC/FIHAC	na		12	0	21	3	1	0	1
Alexandra Toimil	Ipd-Jr	UC/FIHAC	na		6	0	11	0	1	0	0
M Teresa Viseu*	IC	Ext	na		4	0	7	0	1	0	0

*Temporary lecturers

Table 5. Updated information (Nov. 2020) on the lecturers of the Climate, Energy and Infrastructures team. (Mentor/Supervisor/ IH2O Thesis= Information relevant to the role developed and the thesis presented for the current programme; IP comp = Number of times the lecturer has acted as Principal Researcher of competitive projects in the period 2014-20).

- List of the **25 most relevant publications (SCI)** (2014-20).

  Out of the corpus of over 140 publications of the team during this term, 25 articles of JRC indexed journals have been selected, all of which are in the first quartile (Q1) of various reference lists within the year of publication. This list attempts to show the scientific productivity of the research team, as well as the diversity of the thesis developed and the cooperative work. During the selection process, priority was given to work produced by PhD syudents of the IH2O Programme (**Author**), supplemented by other articles published by the lecturers of the team in the last six years.

  1. **Barrera, C**., Battistella, T., Guanche, G., Losada, I.J. 2020. Mooring system fatigue analysis of a floating offshore wind turbine. Ocean Engineering, 195:106670. DOI: 10.1016/j.oceaneng.2019.106670. IF: 3.068; Cat. JCR: Engineering, Marine; Rank: 1/14; D1.
  2. **Barrera, C**., Guanche, R., Rodríguez, A., Armesto, J.A., Losada, I.J. 2020. On the importance of mooring system parametrisation for accurate floating structure designs. Marine Structures, 72:102765. DOI: 10.1016/j.marstruc.2020.102765 IF: 2.708; Cat. JCR: Engineering, Marine; Rank: 2/14; D1.
  3. **Toimil, A**., Camus, P., Losada, I.J., Le Cozannet G., Nicholls R.J., Idier D., Maspataud A. 2020. Climate change-driven coastal erosion modelling in sandy beaches: methods and uncertainty treatment. Earth-Science Reviews, 202:103110. https://doi.org/10.1016/j.earscirev.2020.103110. IF: 9.724; Cat. JCR: Geosciences, Multidisciplinary; Rank: 2/200; D1.

4. **Toimil, A**., Losada, I.J., Nicholls R.J., Dalrymple R.A., Stive M.J.F. 2020. Addressing the challenges of climate risks and adaptation in coastal areas: A review. Coastal Engineering, 156:103611. https://doi.org/10.1016/j.coastaleng.2019.103611. IF: 4.119; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.

5. **Barrera, C**., Guanche, R., Losada, I.J. 2019. Experimental modelling of mooring systems for floating marine energy concepts. Marine Structures, 63:153-180. DOI: 10.1016/j.marstruc.2018.08.003. IF: 2.708; Cat. JCR: Engineering, Marine; Rank: 2/14; D1.

6. **Barrera, C**., Losada, I.J., Guanche, R., Johanning, L. 2019. The influence of wave parameter definition over floating wind platform mooring systems under severe sea states. Ocean Engineering, 172:105-126. DOI: 10.1016/j.oceaneng.2018.11.018. IF: 3.068; Cat. JCR: Engineering, Marine; Rank: 1/14; D1.

7. Reguero B.G., Losada I.J., Méndez F.J. 2019. A recent increase in global wave power as a consequence of oceanic warming. Nature Communications, 10 (1): art 205. http://dx.doi.org/10.1038/s41467-018-08066-0. IF: 12.121; Cat. JCR: Multidisplinary Sciences; Rank: 6/71; D1.

8. Beck, M. W., Losada. I.J., **Menéndez, P**., Reguero, B.G, Diaz-Simal, P., Fernández, F. 2018. The global flood protection savings provided by coral reefs. Nature Communications, 9: article 2186. https://doi.org/10.1038/s41467-018-04568-z. IF: 11.878; Cat. JCR: Multidisciplinary Sciences; Rank: 5/69; D1.

9. **Menéndez, P**., Losada, I.J., Beck M.W., Torres-Ortega, S., Espejo, A., Narayan, S., Díaz-Simal, P., Lange, G. 2018. Valuing the protection services of mangroves at national scale: The Philippines. Ecosystem Services, 34:24-36. https://doi.org/10.1016/j.ecoser.2018.09.005. IF: 5.572; Cat. JCR: Environmental Studies; Rank: 10/116; D1.

10. **Toimil, A.**, Díaz-Simal, P., Losada, I.J., Camus, P. 2018. Estimating the loss of beach recreational value under climate change. Journal of Tourism Management, 68: 387-400. https://doi.org/10.1016/j.tourman.2018.03.024. IF: 6.012; Cat. JCR: Environmental Studies; Rank: 9/116; D1.

11. **Díez, J.**, Del Jesus, M. 2017. A rainfall analysis and forecasting tool. Environmental Modelling & Software, 97: 243-258. http://dx.doi.org/10.1016/j.envsoft.2017.08.011. IF: 4.177; Cat. JCR: Computer Sci., Interdisciplinary Applications; Rank: 9/105; D1.

12. **Martini, M**., Guanche, R., Losada-Campa, I., Losada, I.J. 2017. The impact of downtime over the long-term energy yield of a floating wind farm. Renewable Energy, 117: 1-11. https://doi.org/10.1016/j.renene.2017.10.032. IF: 4.900; Cat. JCR: Energy & Fuels; Rank: 20/97; Q1

13. Maza M., Adler K., Ramos D., Garcia A.M., Nepf H. 2017. Velocity and Drag Evolution from the Leading Edge of a Model Mangrove Forest. Journal of Geophysical Research: Oceans, 122: 9144-9159. http://dx.doi.org/10.1002/2017JC012945. IF: 2.711; Cat. JCR: Oceanography; Rank: 11/64; Q1.

14. **Toimil, A**., Losada, I.J., Camus, P., Díaz-Simal, P. 2017. Managing coastal erosion at the regional scale, Coastal Engineering, 128: 106-122. https://doi.org/10.1016/j.coastaleng.2017.08.004. IF: 2.674; Cat. JCR: Engineering, Ocean; Rank: 1/14; D1.

15. **Toimil, A**., Losada, I.J., Diaz-Simal, P., Izaguirre C., Camus, P. 2017. Multi-sectoral, high-resolution assessment of climate change consequences of coastal flooding. Climatic Change, 145:431-444. https://doi.org/10.1007/s10584-017-2104-z. IF: 3.537; Cat. JCR: Meteorology & Atmospheric Sci.; Rank: 17/86; Q1.

16. Guanche, R., **Martini, M**., Jurado, A., Losada, I.J., 2016. Walk-to-work accessibility assessment for floating offshore wind turbines. Ocean Engineering, 116:216-225. https://doi.org/10.1016/j.oceaneng.2016.03.013. IF: 1.894; Cat. JCR: Engineering, Marine; Rank: 2/14; D1.

17. Lara J.L., Maza M., Ondiviela B., Trinogga, J., Losada I.J., Bouma T.J., Gordejuela N. 2016. Large-scale 3-D experiments of wave and current interaction with real vegetation. Part 1: Guidelines for physical modeling. Coastal Engineering, 107: 70-83. http://dx.doi.org/10.1016/j.coastaleng.2015.09.012. IF: 3.221; Cat JCR: Engineering, Ocean; Rank: 1/14; D1.

18. Losada, I.J., Maza, E., Lara, J.L. 2016. A new formulation for vegetation-induced damping under combined waves and currents. Coastal Engineering, 107: 1-13. http://dx.doi.org/10.1016/j.coastaleng.2015.09.011. IF: 3.221; Cat JCR: Engineering, Ocean; Rank: 1/14; D1.

19. **Martini, M**., Guanche, R., Losada I.J., Vidal, C. 2016. Accessibility assessment for operation and maintenance of offshore wind farms in the North Sea. Wind Energy, 20:637-656. https://doi.org/10.1002/we.2028. IF: 2.725; Cat. JCR: Engineering, Mechanical; Rank: 23/130; Q1.

20. Maza M., Lara J.L., Losada I.J., Ondiviela B., Trinogga J., Bouma T.J. 2016. Large-scale 3-D experiments of wave and current interaction with real vegetation. Part 2: Experimental analysis. Coastal Engineering, 106: 73-86. http://dx.doi.org/10.1016/j.coastaleng.2015.09.012. IF: 3.221; Cat JCR: Engineering, Ocean; Rank: 1/14; D1.

21. Del Jesus, M., Rinaldo, A., Rodríguez-Iturbe, I. 2015. Point rainfall statistics for ecohydrological analyses derived from satellite integrated rainfall measurements. Water Resources Research, 51: 2974-2985. http://dx.doi.org/10.1002/2015WR016935. IF: 3.792; Cat JCR: Limnology; Rank: 1/20; D1.

22. Díaz, G., Méndez, F., Losada, I.J., Camus, P., Medina, R. 2015. A nearshore long-term infragravity wave analysis for open harbours. Coastal Engineering, 97: 78-90. http://dx.doi.org/10.1016/j.coastaleng.2014.12.009. IF: 2.841; Cat JCR: Engineering, Ocean; Rank: 1/14; D1.

23. Guanche R., De Andrés A., Losada I.J., Vidal C. 2015. A global analysis of the operation and maintenance role on the placing of wave energy farms. Energy Conversion and Management, 106: 440-456. http://dx.doi.org/10.1016/j.enconman.2015.09.022. IF: 4.801; Cat JCR: Thermodynamics; Rank: 2/58; D1.

24. **Martini, M**., Guanche, R., Armesto, J.A., Losada, I.J., Vidal, C. 2015. Met-ocean conditions influence on floating offshore wind farms power production. Wind Energy, 19:399-420. http://dx.doi.org/10.1002/we.1840. IF: 2.891; Cat. JCR: Engineering, Mechanical; Rank: 9/132; D1.

25. Maza M., Lara J.L., Losada I.J. 2015. Tsunami wave interaction with mangrove forests: A 3-D numerical approach. Coastal Engineering, 98: 33-54. http://dx.doi.org/10.1016/j.coastaleng.2015.01.002. IF: 2.841; Cat JCR: Engineering, Ocean; Rank: 1/14; D1.

- List of **5 competitive projects** (2014-20).

  During this period of time funding was obtained from regional calls (e.g. SODERCAN, INNOVA), national calls (e.g. Plan estatal, Retos Colaboración, Fundación Biodiversidad) or European calls (e.g. LIFE, INTERREG, H2020, Erasmus+) for the development of 16 competitive projects. The following are 5 representative examples which were conducted by various lecturers of the team (Table 6).

TITLE	PERIOD	PROJECT TYPE	IP	BUDGET
ANÁLISIS DE RIESGOS PARA LA IMPLEMENTACIÓN DE PROYECTOS DE ADAPTACIÓN AL CAMBIO CLIMÁTICO EN LA COSTA EN UN MARCO DE INCERTIDUMBRE (RISKOADAPT	2018/20	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Íñigo J Losada	82.800,00 €
EUROPEAN ADVANCES ON CLIMATE SERVICES FOR COASTS AND SEAS (ECLISEA)	2017/20	EUROPEAN COMMISSION	Melisa Menéndez	390.000,00 €
ANÁLISIS DEL COMPORTAMIENTO DINÁMICO DE PLATAFORMAS EÓLICAS FLOTANTES PARA LA OPTIMIZACIÓN DEL DISEÑO EN AGUAS PROFUNDAS (ACOPLE)	2018/21	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Raúl Guanche	121.000,00 €
SOLUCIONES HÍBRIDAS PARA LA ADAPTACIÓN COSTERA AL CAMBIO CLIMÁTICO (SHACC)	2019/21	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	María E Maza	85.000,00 €
PUERTOS HACIA LA AUTOSUFICIENCIA ENERGÉTICA (PORTOS)	2019/22	EUROPEAN COMMISSION	Javier López	204.525,00 €

Table 6. List of 5 representative competitive projects developed by the Climate, Energy and Infrastructures team.

- **Thesis presented and in progress** in the IH2O Programme (2014-20)

  During this period of time, a total of 18 students joined this line of the programme, with one of them leaving the programme. Five of them have completed their PhDs (Table 7). Funding of the thesis was externally supported by other R&D centres (3), by the EU (1 ITN), by National training programmes (6 FPU, 2 FPI) and projects of IHCantabria itself (5).

ACCEPTANCE DATE	THESIS DATE	PhD STUDENT	SOURCE OF FUNDING	TITLE	SUPERVISOR/S	
21/11/2014	10/10/2019	**Díez Sierra, Javier**	IH	Caracterización de patrones espacio-temporales de precipitación	**Manuel del Jesus**	
21/11/2014	07/04/2017	**Martini, Michele**	UE	Diseño y optimización de estrategias de O&M para parques de energías renovables marinas	**Raúl Guanche**	**Íñigo Losada**
21/11/2014	26/11/2018	**Menéndez Fernández, Pelayo**	FPI	Sistemas naturales para la defensa de la costa frente a la reducción de desastres y el cambio climático	**Íñigo Losada**	
21/11/2014	27/03/2018	**Toimil Silva, Alexandra**	IH	A framework for the multi-sectoral assessment of climate change risks in coastal areas	**Íñigo Losada**	**Pedro Díaz**
08/06/2015		**Mendes, Lourenço**	Ext	Computational fluid dynamics modelling of flows in spilway chutes	**Javier López**	**M Teresa Viseu**
20/11/2015	28/09/2020	**Barrera Sánchez, Carlos**	FPU	Diseño de líneas de fondeo para plataformas flotantes de energías renovables marinas	**Raúl Guanche**	**Íñigo Losada**
04/10/2016		**Lucio Fernández, David**	IH	Caracterización de la resiliencia de infraestructuras costeras	**Javier López**	**Íñigo Losada**
10/04/2017		**Di Paolo, Benedetto**	IH	Hybrib modelling for wave tanks with application to coastal engineering	**Javier López**	**Íñigo Losada**
23/11/2017		**Casado Rodríguez, Jesús**	FPU	Modelado conjunto de dinámicas hidrológicas y de vegetación bajo los efectos del cambio climático	**Manuel del Jesus**	**César Álvarez**
23/11/2017		**García-Maribona, Julio**	FPU	Modelado numérico del transporte de sedimentos con aplicación a la ingeniería de costas mediante técnica "CFD"	**Javier López**	**Íñigo Losada**
23/11/2017		**Lobeto Alonso, Héctor**	FPU	Avances metodológicos para el estudio climático de las dinámicas superficiales marinas (oleaje y nivel del mar)	**Melisa Menéndez**	**Raúl Medina**
23/11/2017		**Marina Ortiz, Dorleta**	Ext	Derisking methodology for offshore renewable technology field testing	**Raúl Guanche**	
27/11/2018		**Romano Moreno, Eva**	FPU	Desarrollo de metodologías para el estudio y cuantificación de la parada operativa en puertos, basado en la interacción barco atracado - estructura	**Javier López Lara**	**Gabriel Díaz**
11/03/2019		**Mattia Mazzaretto, Ottavio**	IH	Avances metodológicos para la caracterización del clima del oleaje	**Melisa Menéndez**	
23/07/2019		**Álvarez Cuesta, Moisés**	FPI	Análisis del riesgo y adaptación a los impactos de inundación y erosión inducidos por el cambio climático en la costa	**Íñigo Losada**	
08/11/2019		**Fernández Pérez, Alberto**	FPU	Diseño metodológico de adaptación de infraestructuras costeras por efecto del cambio climático	**Javier López**	**Íñigo Losada**
21/11/2019		**López Arias, Luis Fernando**	Ext	Modelado del servicio de protección costera brindado por comunidades de ecosistemas no continuos en zonas intermareales templadas y tropicales a partir de la interacción de ecosistemas-flujo-sedimento	**Javier López**	**María E Maza**

Table 7. Information on the thesis in progress and thesis presented in the Climate, Energy and Infrastructures team during term 2014-20, with indication of the supervisors and the source of funding (Ext= external; FPU= National Training programme; FPI= Researcher Training programme IH= own projects).

2.2.3. Hydrobiology and Environmental Management

- Information of the team **lecturers**.

  This team is made of 19 lecturers, a great majority of whom are permanent lecturers of the Universidad de Cantabria or researchers of the Spanish Institute of Oceanography. Out of them, 17 lecturers remain in active work. This team includes a significant number of temporary lecturers (4) associated to the programme as co-supervisors of some of the thesis. Additionally, 2 researchers who had been included in the initial proposal moved to the Hydraulic and Coastal Engineering team, as their sublines of research were more in connection with their new team (Table 8).

CURRENT SITUATION			EXPERIENCE			2014-2020					
LECTURER	POSITION	INSTITUTION	6-yr Research Periods	Last 6-yr Research Period	H-index	Total PhD Thesis	No SCI	Mentor IH2O	Supervisor IH2O	IH2O Thesis	IP Comp
José A Juanes	CU	UC	6	2019	21	7	57	6	6	1	14
Araceli Puente	PTU	UC	3	2019	17	4	43	4	5	3	5
Mª Luisa Pérez	PTU	UC	2	2016	5	0	4	0	0	0	0
José Barquín	PTU	UC	1	2015	16	4	34	2	5	2	16
Bárbara Ondiviela	Ipd-Sr	UC/FIHAC	na		11	2	29	2	2	2	3
Aina G Gómez	Ipd-Sr	UC/FIHAC	na		11	2	18	1	0	0	2
Inés Mazarrasa	Ipd-Jr	UC/FIHAC	na		10	0	12	0	0	0	0
Francisco Peñas	Ipd-Jr	UC/FIHAC	na		8	0	14	0	2	0	0
Francisco Sánchez	PI	IEO	3	2014	26	0	11	0	2	0	
Alicia Lavín	IC	IEO	5	2018	15	0	3	0	0	0	1
Alberto Serrano	IC	IEO	2	2014	22	0	21	0	1	0	
Antonio Punzón	IC	IEO	2	2019	13	0	25	0	2	0	
Jorge Landa	CT	IEO	3	2015	11	0	13	0	1	0	na
Rosario Domínguez*	CT	IEO	2	2018	13	0	11	0	1	0	na
José Manuel González	CT	IEO	na		9	0	20	0	1	0	
Gerardo García-Castrillo	IC	MMC	na		6	0	4	0	0	0	
Adolfo Cobo*	CU	UC	4	2013	15	0	26	0	1	0	2

*Temporary lecturers

Table 8. Updated information on the Hydrobiology and Environmental Management team lecturers. (Mentor/Supervisor/ IH2O Thesis= Information relevant to the role developed and the thesis presented for the current programme; IP comp = Number of times the lecturer has acted as Principal Researcher of competitive projects in the period 2014-20).

- List of the **25 most relevant publications (SCI)** (2014-20).

Out of the corpus of over 100 publications of the team during this term, 25 articles of JRC indexed journals have been selected, all of which are in the first quartile (Q1) of some of the reference lists within the year of publication. This list attempts to show the scientific productivity of the research team, as well as the diversity of the thesis developed and the cooperative work. During the selection process, priority was given to work produced by PhD students of the IH2O Programme (**Author**), supplemented by other articles published by the lecturers of the team in the last six years.

1. **Calleja, F**., Ondiviela, B., Puente, A., Juanes, J.A. 2020. Can seedlings' physiological information improve vegetation distribution predictions at local scales? Biological Invasions, 22:2509-2523. http://dx.doi.org/10.1007/s10530-020-02266-w. IF: 3.087; Cat. JCR: Biodiversity Conservation; Rank: 10/58; Q1.
2. Ramos E., Guinda X., Puente A., de la Hoz C.F., Juanes J.A. 2020. Changes in the distribution of intertidal macroalgae along a longitudinal gradient in the northern coast of Spain. Marine Environmental Research, 157: 104930. http://dx.doi.org/10.1016/j.marenvres.2020.104930. IF: 2.727; Cat. JCR: Marine & Freshwater Biology; Rank: 18/107; Q1.

3. Ríos, P., **Prado, E**., Carvalho, F., Sánchez, F., Rodríguez-Basalo, A., Xavier, J.R., Ibarrola, T.P., Cristobo, J. 2020. Community composition and Habitat characterization of a rock sponge aggregation (Porifera, Corallistidae) in the Cantabrian Sea, Frontiers in Marine Science. 7: art. 578. https://doi.org/10.3389/fmars.2020.00578. IF: 3,661. Cat JCR: Marine & Freshwater Biology; Rank: 8/107; D1.

4. **Weiss, C.V.,** Menéndez, M., Ondiviela, B., Guanche, R., Losada, I.J., Juanes, J.A. 2020. Climate change effects on marine renewable energy resources and environmental conditions for offshore aquaculture in Europe. ICES Journal of Marine Science, 00:1-15. https://doi.org/10.1093/icesjms/fsaa226. IF: 3.188; Cat. JCR: Marine and Freshwater Biology; Rank 12/107; Q1.

5. **Calleja, F**., Ondiviela B., Juanes, J. A. 2019. Invasive potential of Baccharis halimifolia: Experimental characterization of its establishment capacity. Environmental and Experimental Botany, 162:444-454. http://dx.doi.org/10.1016/j.envexpbot.2019.03.020. IF: 4.027; Cat. JCR: Plant Sciences; Rank: 26/234; Q1.

6. **Estévez E**., Alvarez-Martínez, J.M., Alvarez-Cabria, M., Robinson, C.T., Battin, T.J., Barquín, J. 2019. Catchment land cover influences macroinvertebrate food-web structure and energy flow pathways in mountain streams. Freshwater Biology, 64:1557-1571. http://dx.doi.org/10.1111/fwb.13327. IF: 3.835; Cat. JCR: Marine and Freshwater Biology; Rank: 5/107; D1.

7. **Fernández de la Hoz, C**., Ramos, E., Puente, A., Juanes, J.A. 2019. Temporal transferability of marine distribution models: The role of algorithm selection. Ecological Indicators, 106:105499. https://doi.org/10.1016/j.ecolind.2019.105499. IF: 4.229; Cat. JCR: Environmental Sciences; Rank: 61/265; Q1.

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14. **Fernández de la Hoz, C**., Ramos, E., Acevedo, A., Puente, A., Losada, I.J., Juanes, J.A. 2018. OCLE: A European open access database on climate change effects on littoral and oceanic ecosystems. Progress in Oceanography, 168:222-231. https://doi.org/10.1016/j.pocean.2018.09.021. IF: 3.245; Cat. JCR: Oceanography; Rank: 8/66; Q1.

15. **Fernández de la Hoz, C**., Ramos, E., Puente, A., Méndez, F., Menéndez, M., Juanes, J.A., Losada, I.J. 2018. Ecological typologies of large areas. An application in the Mediterranean Sea. Journal of Environmental Management, 205: 59-72. https://doi.org/10.1016/j.jenvman. 2017.09.058. IF: 4.865; Cat. JCR: Environmental Sciences; Rank: 33/265; Q1.

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17. **Weiss, C.V.**, Ondiviela, B., Guanche, R, Castellanos, O., Juanes, J.A. 2018. A global integrated analysis of open sea fish farming opportunities. Aquaculture, 497: 234-245. https://doi.org/10.1016/j.aquaculture.2018.07.054. IF: 3.022; Cat. JCR: Marine & Freshwater Biology; Rank: 14/108; Q1.

18. **Calleja, F.**, Galván, C., Silió, A., Juanes, J.A., Ondiviela, B. 2017. Long-term analysis of Zostera noltei: A retrospective approach for understanding seagrasses' dynamics. Marine Environmental Research, 130: 93-105. http://dx.doi.org/10.1016/j.marenvres.2017.07.017. IF: 3.159; Cat. JCR: Marine and Freshwater Biology; Rank: 11/106; Q1.

19. **Estévez, E**., Rodríguez, T, Álvarez-Cabria, M., Peñas, F.J., González, A.M., Lezcano M., Barquin, J. 2017. Analysis of structural and functional indicators for assessing the health state of mountain streams. Ecological Indicators, 72: 553-564. http://dx.doi.org/10.1016/j.ecolind. 2016.08.052. IF: 3.983; Cat. JCR: Environmental Sciences; Rank: 49/242; Q1.

20. Gómez A.G., Ondiviela B., Fernández M., Juanes J.A. 2017. Atlas of susceptibility to pollution in marinas. Application to the Spanish coast. Marine Pollution Bulletin, 114: 239-246. http://dx.doi.org/10.1016/j.marpolbul.2016.09.009. IF: 3.241; Cat. JCR: Marine & Freshwater Biology; Rank: 9/106; D1.

21. **González, A.M.**, Barquin, J. 2017. Mapping the temporary and perennial character of whole river networks. Water Resources Research, 53: 6709-6724. http://dx.doi.org/10.1002/2017WR020390. IF: 4.361; Cat. JCR: Limnology; Rank: 1/20; D1.

22. Galván, C., Puente, A., Castanedo, S., Juanes, J.A. 2016. Average vs. extreme salinity conditions: Do they equally affect the distribution of macroinvertebrates in estuarine environments? Limnology and Oceanography, 61: 984-1000. http://dx.doi.org/10.1002/lno.10267. IF: 3.383; Cat JCR: Limnology; Rank: 2/20; D1.

23. Mazarrasa I., Marbà N., Lovelock C.E., Serrano O., Lavery P.S., Fourqurean J.W., Kennedy H., Mateo M.A., Krause-Jensen D., Steven A.D.L., Duarte C.M. 2015. Seagrass meadows as a globally significant carbonate reservoir. Biogeosciences, 12: 4993-5003. http://dx.doi.org/10.5194/bg-12-4993-2015. IF: 3.700; Cat JCR: Geosciences, Multidiscip; Rank: 17/184; D1.

24. Ondiviela, B., Recio, M., Juanes, J.A. 2015. A management approach for the ecological integrity of NE Atlantic estuaries. Ecological Indicators, 52: 105-115. http://dx.doi.org/10.1016/j.ecolind.2014.12.003. IF: 3.190; Cat JCR: Environmental Sciences; Rank: 52/225; Q1.

25. Puente, A., Díaz, R.J. 2015. Response of benthos to ocean outfall discharges: does a general pattern exist? Marine Pollution Bulletin, 101: 174-181. http://dx.doi.org/10.1016/j.marpolbul.2015.11.002. IF: 3.099; Cat JCR: Marine & Freshwater Biology; Rank: 6/104; D1.

- List of **5 relevant competitive projects** (2014-20).

  During this period of time, fundingwas obtained from regional calls (e.g. SODERCAN, INNOVA), national calls (e.g. Plan Estatal, Retos Colaboración, Fundación Biodiversidad) or European calls (e.g. LIFE, INTERREG) for the development of 16 competitive projects. The following are five examples of projects which were conducted by various lecturers of the team (Table 9).

TITLE	PERIOD	PROJECT TYPE	IP	BUDGET
ASEGURANDO LA BIODIVERSIDAD, LA INTEGRIDAD FUNCIONAL Y LOS SERVICIOS ECOSISTÉMICOS EN REDES FLUVIALES EN SEQUÍA (ALICE)	2017/21	EUROPEAN COMMISSION	José Barquín	396.658,45 €
FORMACIÓN ESPECIALIZADA EN HERRAMIENTAS APLICADAS A ECOSISTEMAS MARINOS SOSTENIBLES (TRASMARES)	2019/22	EUROPEAN COMMISSION	José A Juanes	78.221,00 €
ADAPTACIÓN AL CAMBIO CLIMÁTICO MEDIANTE LA GESTIÓN Y RESTAURACIÓN DE ECOSISTEMAS ESTUARINOS EUROPEOS (LIFE ADAPTA BLUES)	2019/24	EUROPEAN COMMISSION	José A Juanes, Inés Mazarrasa	1.103.515,05 €
INTEGRACIÓN DE VARIABLES CLIMÁTICAS Y ANTRÓPICAS EN EL MODELADO ECOLÓGICO: UNA HERRAMIENTA DINÁMICA PARA LA GESTIÓN AMBIENTAL DE ZONAS ESTUARINAS (ECOTOPO)	2019/21	MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD	Araceli Puente, Cristina Galván	75.000,00 €
MODELADO HÍBRIDO DE LA DISTRIBUCIÓN DE MACROALGAS EN UN MEDIO CAMBIANTE: LA INTEGRACIÓN DE ESTRATEGIAS DE DISPERSIÓN COMO PREDICTORES BIÓTICOS (C3N-PRO)	2020/23	MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES	José A Juanes, Bárbara Ondiviela	104.000,00 €

Table 9. List of 5 representative competitive projects developed by the Hydrobiology and Environmental Management team.

- **Thesis presented and in progress** within the IH2O Programme (2014-20)

During this time, a total of 16 students joined this line of the programme with one drop-out. Five of them have completed their doctoral studies (Table 10) and 1 started its official registration (deposit), and will present it in the months following the closure of this report (January 2021). Funding of these thesis was supported externally by other countries (3) or other R&D centres (5, Spanish Oceanographic Institute) and National training programmes for both lecturers and researchers (2 FPU, 2 FPI).

ACCEPTANCE DATE	THESIS DATE	PhD STUDENT	SOURCE OF FUNDING	TITLE	SUPERVISOR/S	
21/11/2014	22/02/2019	**Estévez Caño, Edurne**	Pdoc	Los efectos del cambio en los usos del suelo en el metabolismo y flujos de energía en redes tróficas fluviales	**José Barquín**	
30/01/2015	04/07/2019	**Fernández de la Hoz, Camino**	FPI	Evaluación de los efectos del cambio climático sobre los ecosistemas litorales	**Araceli Puente**	**José A. Juanes**
20/11/2015	24/07/2019	**González Ferreras, Alexia**	FPI	Análisis de patrones espaciales de las características biofísicas en redes fluviales	**José Barquín**	**Carlos Alonso**
20/11/2015	12/01/2021*	**Zapata Cortez, Carlos**	Ext	Sistema de toma de decisiones basadas en los servicios ecosistémicos para un estuario estratificado o pobremente estratificado	**Araceli Puente**	**Andrés García**
02/06/2016	26/09/2019	**Calleja, Felipe**	Ext	Spatial and temporal analysis of estuarine vegetation: Tools for management and restoration of altered ecosystems	**José A Juanes**	**Bárbara Ondiviela**
04/10/2016		**Pérez Silos, Ignacio**	FPU	Efectos del cambio global sobre la biodiversidad, funcionamiento y servicios ecosistémicos de los bosques de ribera: implicaciones para la GIC	**José Barquín**	**César Álvarez**
17/11/2016	19/12/2018	**Da Cruz Weisz, Carlos V**	Ext	Methodologies applicable to marine spatial planning within the framework of current and future development of renewable energies and aquaculture	**José A Juanes**	**Bárbara Ondiviela**
05/02/2017		**Arronte Prieto, Juan C**	Ext	Ecología de las especies gadiformes de la plataforma Cantábrica	**Alberto Serrano**	
23/11/2017		**Navarro Rodríguez, Rosario**	Ext	Biología y ecología del estornino (Scomber colias, Gmelin 1798) en el norte y noroeste de la Península Ibérica. Impacto del aumento de la población en el ecosistema pelágico	**Rosario Domínguez**	**Jorge Landa**
23/11/2017		**Prado Ortega, Elena**	Ext	Modelado 3D de hábitats bentónicos profundos en el Cantábrico central a partir de técnicas de fotogrametría	**Adolfo Cobo**	**Francisco Sánchez**
27/11/2018		**Hoang, Minh**	UE	Effects of hydrological and water quality alteration on river ecosystem functioning	**José Barquín**	**Francisco Peñas**
27/11/2018		**Rocha Pompeu, Cassia**	UE	Basin-region hydromorphological alteration links to biodiversity and ecosystem functioning	**José Barquín**	**Francisco Peñas**
11/03/2019		**Polo Sainz. Julia**	Ext	Análisis de los efectos del cambio climático en el ecosistema demersal y pesquerís del mar Cantábrico	**Antonio Punzón**	
16/09/2019		**Sainz Villegas, Samuel**	FPU	Integración de umbrales fisiológicos y factores bióticos en el estudio de la vulnerabilidad de las comunidades de macroalgas frente al cambio climático	**José A Juanes**	**Araceli Puente**
07/02/2020		**Rodríguez Basalo, Augusto**	Ext	Procedimientos aplicables en el marco del proceso de creación y monitorización de áreas marinas protegidas del cantábrico central	**Francisco Sánchez**	**José A Juanes**

*Thesis deposited with date for presentation during academic year 2020-21

Table 10. Information on the thesis in progress and thesis presented by PhD students of the Hydrobiology and Environmental Management team during term 2014-20, with indication of the supervisors and the source of funding (Ext= external; FPU= National Training Programme; FPI= Researchers Training Programme; IH= own projects.

2.3. External partnerships

The development of the programme during these six years relied on various partnerships. In the first place, we should mention the agreements signed with the three regional institutions directly involved since the request of approval of the programme:

- Fundación Instituto de Hidráulica Ambiental de Cantabria (FIHAC) *(Foundation of Environmental Hydraulics Institute of Cantabria)*.
- Centro Oceanográfico de Santander del Instituto Español de Oceanografía (IEO) *(Santander Oceanographic Centre of the Spanish Oceanographic Institute)*.
- Museo Marítimo del Cantábrico del Gobierno de Cantabria (MMC) *(Maritime Museum of the Cantabrian Sea of the Cantabrian Government)*.

On the other hand, partnership agreements were exchanged with the following universities and research centres:

- Netherland Institute of Oceanography (NIOZ).
- The Nature Conservancy (TNC-USA).
- Instituto Dom Lluiz, Universidad de Lisboa.
- Institut de Recerca i Tecnologia Agroalimentàries (IRTA).
- Universidad Austral de Chile.
- Universidad de Boyacá, Colombia.
- Instituto Oceanográfico de la Armada de Ecuador (INOCAR).

These partnerships enabled the exchange of students and lecturers, as well as the development of specific research projects and the joint creation of new proposals.

In the same way, during this period the following research centres cooperated to enable PhD internships for programme students to be eligible to apply for an International Mention:

- Seymour Mar Discovery Center de Santa Cruz, CA (USA).
- University of South Florida (USA).
- University of Exeter (UK).
- Alice Holt Research Station - Forestry Commission, Farnham, Inglaterra (UK).
- Swiss Federal Inst of Aquatic Science & Technology (CH).
- École Polytechnique Fédérale de Laussanne (CH).
- Labòratorio Nacional de Engenharia de Lisboa (PT).
- Umbra Cuscinetti S.P.A. (IT).
- University of Gent (BE).
- Universidad de Costa Rica (CR).

2.4. Internal Follow-up Procedures

The programme's follow-up system was implemented, with two different scopes being covered: 1) the training of the Doctoral candidates and 2) the various procedures (i.e. administrative, training, selective, etc.) commencing at the time of admission and ending with the PhD graduation

Worth mentioning are the efforts made by the CAPD in the organisation and implementation of the various activities set out in the Verification Report, from a multidisciplinary perspective, and focusing at all times on the involvement of the students in the attempt to create a feel of belonging to a special and important group within IHCantabria. For this purpose, since the beginning, direct interaction between the Academic Commission and the PhD students was promoted through the creation of the Information Commission. In the latest years, regular informative meetings have also been held before the PhD Sessions.

In the same way, a "**Reference Document**" was drawn up to summarise the essential information about the programme, both from the viewpoint of its conception and the various procedures involved in its development. This Document was updated at the

beginning of academic year 2017-18 and translated into English with the purpose of adapting to the bilingual nature of the programme.

2.4.1. PhD student's follow-up

The current regulations establishes first, the initial approval of the research plan and, subsequently, an annual assessment of the training process of the PhD students and the stage of accomplishment of their thesis. For this purpose, the CAPD of the IH2O Programme delegates in the **Specific Training Committees** the task of assessing the Research Plans and their annual development follow-up, through biannual **PhD Sessions** (March-April/ September-October). The scope and procedure applied in these assessments (Figure 8) is detailed in the Reference Document.

C4. DOCUMENTO DE SEGUIMIENTO

PROGRAMA IH2O

NOMBRE			Línea I+D											F. Admisión
Tutor			Director(es)											
TÍTULO														
APROBACIÓN INICIAL			PLAN DE INVESTIGACIÓN*						PROGRAMA FORMACIÓN**							
			Ant	Obj	Mét	Cron	Res	NOTA	CUMPL	Art	Sem	Cursos	Congr	Proy	Est	FTr
Aprobac.		Evaluación	0,0					0,0								
SEGUIMIENTOS ANUALES			PLAN DE INVESTIGACIÓN*						PROGRAMA FORMACIÓN**							
			Progreso		Resultados		Dedic	NOTA	CUMPL	Art	Sem	Cursos	Congr	Proy	Est	FTr
Año 1		Evaluación	0,0					0,0								
Año 2		Evaluación	0,0					0,0								
Año 3		Evaluación	0,0					0,0								
Año 4		Evaluación	0,0					0,0								
COMITÉ			OBSERVACIONES													

CANTABRIA CAMPUS INTERNACIONAL

Figure 8. Data sheet for the assessment of Doctoral candidates.

Each Committee has one representative of the Academic Commission (Coordinator/ Academic Secretary) acting as President, a Lecturer of the programme and a PhD from the partner institutions or associated to other EDUC PhD programmes. These Committees meet during the Sessions and finally provide the assessment of the candidate

Each member of the Committee is provided with the PhD candidate's reports in advance and they are required to complete Form C.4 (Figure 8) with their assessment (1-10) on the aspects of the "Research Plan", whether it is for "initial approval" (first-year students), or for the annual follow-up of PhD candidates from previous periods. Additionally, they may include any observations to improve the training process and the progress of the doctoral thesis.

The assessment of the training programme, subject to compliance with the requirements of cross-training and specific training activities of the programme, is performed by the representative of the CAPD in the Committee.

During these six years, 11 PhD Sessions have been held. During the last academic year only one Session took place at the end of the year due to the pandemic situation. The following lecturers were involved in the Committees:

- Representing ACDP

    - José A Juanes (Coordinator).
    - Javier L Lara (Academic Secretary).

- Representing the group of lecturers of the programme

    - *Engineering Area*: César Vidal, Francisco Martín, Roland Garnier, Ana Julia Abascal.
    - *Climate/En/Infra Area*: Melisa Menéndez, Gabriel García, Manuel del Jesus, Paula Camus, Cristina Izaguirre, María Maza, Alexandra Toimil.
    - *Hydrobiology Area*: Luisa Pérez, Araceli Puente, Aina García, Bárbara Ondiviela, Inés Mazarrasa.

- Representing the partner institutions or other programmes

    - *MMC*: Gerardo García-Castrillo.
    - *IEO*: Alicia Lavín, Antonio Punzón, Francisco Sánchez, Jorge Landa.
    - *UC's Civil Engineering Programme*: José L Moura, Diego Ferreño, Jorge Castro, Luigi Dell'Olio, César Otero, Daniel Castro, Elena Blanco, Amaya Lobo.
    - *Nautical/Marine/Radioelec. Engineering Programme:* Carlos Pérez.
    - *Science and Technology Programme*: Jesús Fernández, Antonio Cofiño, Alberto González, Gema Fernández.

2.4.2. Procedure Follow-up.

As a way to supplement the assessment activities carried out by the Doctorate School through the Internal Quality Assurance System (hereinafter, SGIC) established by the current regulations, an internal satisfaction survey of the various groups involved in the IH2O Programme (PhD students, PhD graduates, lecturers) was established.

This survey focused on the aspects relating to the academic management of the programme by CAPD and IHCantabria's management boards, and with the Specific Training Programme. This additional information will allow for the improvement of certain aspects of the programme requiring a specific correction or, even, a request of amendment of the Verification Report at the end of the first cycle's assessment (6 years).

Mª Teresa de la Fuente Royano, the Quality Assurance Officer allocated by the UC, was involved for these purposes. Thanks to her support a specific supplementary survey for the IH2O Programme was agreed and applied through the current channels of the UC's SGIC. The contents and scope of the survey, which was anonymous and voluntary, were explained at an informative meeting with all the members of the programme.

The basic contents of the survey in its two versions (PhD students and lecturers) and the outcomes obtained are summarised in section 4.

The survey was arranged in 3 different blocks, relating to:

1. The **academic management** of the IH2O Programme, with a special focus on the work of the CAPD and the Administrator at the UC, as well as the information processes.
2. The **Specific Training Programme**, including the assessment of the various activities included in the programme's Verification Report and, therefore, implemented during this period.
3. The **overall satisfaction** with the programme.

The findings obtained from these surveys are summarised in section 4.2.

3. ACADEMIC REPORT

This section has been divided into three subsections, summarising the information relating to the PhD students, the training activities, the interactions with other programmes, both from EDUC and other universities, and the main outcomes obtained to date.

3.1. Admission of PhD students

The number of doctoral candidates joining the programme has increased considerably (Figure 9, left). This progress has allowed to reach the initially targeted number of d(25-35) who are simultaneously active during these first six years. A total of 43 PhD candidates have accessed the programme, two of whom left due to employment reasons. Five of them were PhD students being admitted to the programme during the first and second years who came from other extinct programmes. The maximum annual number of students set out in the report (12) was not exceeded during any one of the academic years.

An important appreciation was the decrease in the applications received for year 2019-2020, which was potentially due to the exceptional pandemic situation. Nevertheless, a comeback in the number of new PhD candidates is expected for year 2020-2021 to reach the average levels of previous years (6-8), which will allow to maintain the average number of active PhD candidates set out in the Verification Report.

As a whole, students came from various Spanish universities (27: 66%), out of which more than half had taken their initial studies at 8 universities other than the Universidad de Cantabria (Figure 9, right). This translates into a positive flow of students from other national and overseas universities of approximately 67%. Amongst the international students (34%), PhD students from two countries, i.e. Italy and Brazil, were predominant, contributing a total of 7 students who were from different universities. This proves the diversification of origin and teaching systems of the IH20 Programme.

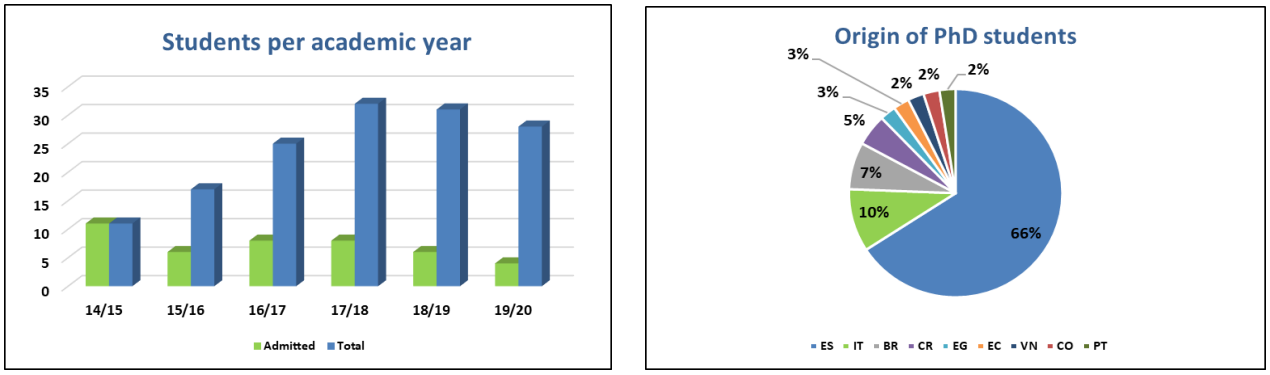

Figure 9. Evolution of the number of doctoral candidates admitted together with the total number of active students in the programme in each academic year (left) and distribution by country of origin (right).

The distribution of the active PhD students amongst the three research teams was unbalanced, which is generally due to the variations in the six generations. In general terms, the two areas with the largest number of Doctoral candidates are Climate, Energy and Infrastructures (41%) and Hydrobiology and Environmental management (37%). In any case, the most significant aspect is that the global number of PhD candidates associated to each of the areas, confirm viability and stability in the medium and long-terms (Figure 10, left).

The proportion of men and women in the group of PhD students is relatively balanced (54/46) with slight differences in their distribution, which evolves with the generations and the employment contract offerings (Figure 10, right).

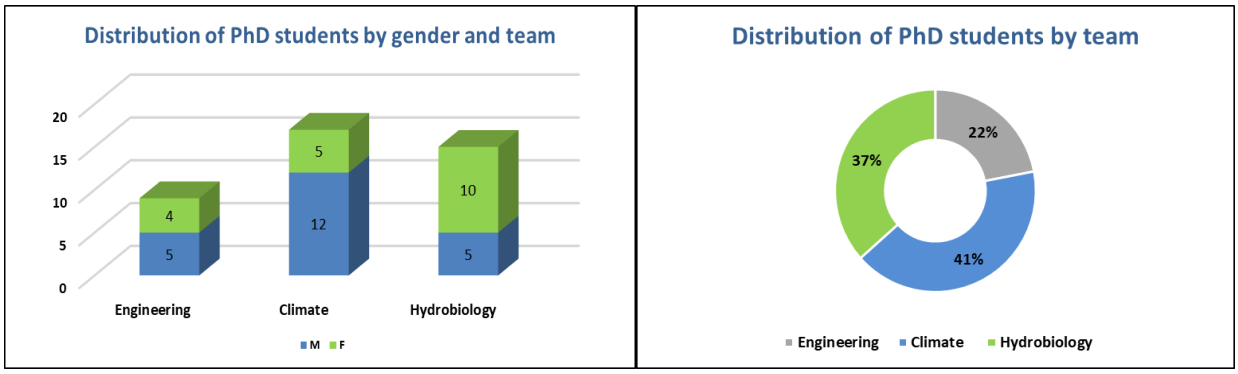

Figure 10. Percentage of PhD students included in each research team (left) and breakdown subject to gender (right).

The majority of the students (31: 76%) were selected through competitive selection processes funded by the EU (**ITN** Programme), the Spanish Ministry (**FPU, FPI**), the Universidad de Cantabria (**Predoc**) or equivalent institutions from other countries (**Ext**ernal funding), with the main selection criteria being student merits (Figure 11).

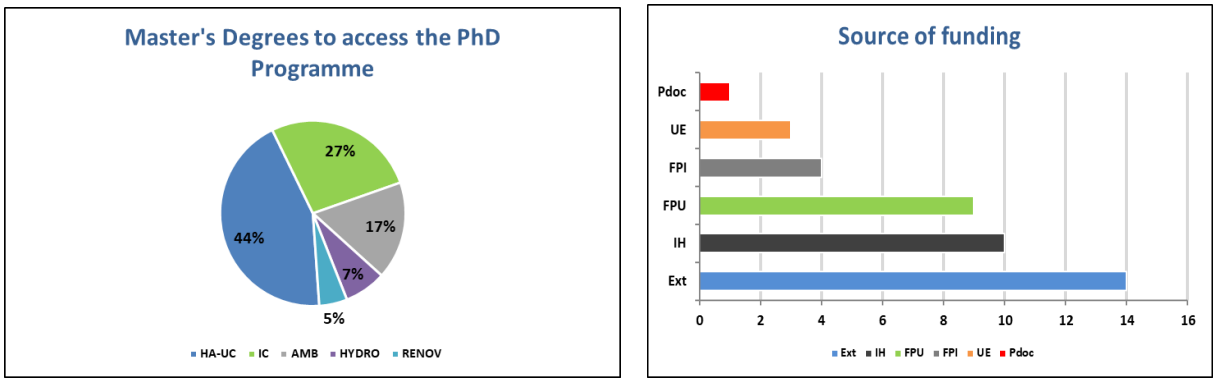

Figure 11. Distribution of the number of candidates according to the type of master's degree through which they accessed the Programme (HA-UC: Masters in Environmental Hydraulics; IC: Civil Engineering; AMB: Environmental Masters; HIDRO: Masters in Hydrology/Water resources; RENOV: Masters in renewable energies) (left) and the type of funding for their contracts (right). The external funding (EXT) includes PhD candidates funded with contracts from their countries of origin and the staff from IEO.

The latest of the groups selected (**Ext**) also includes some PhD students who accessed the programme following contracts to join the IEO's staff members. The remaining 24% were selected through public competitive selection processes associated to **IHCantabria's projects**, where, aside from student merits, the outcomes obtained by students in some of the master's degrees in Environmental Hydraulics or Civil Engineering of the UC (HA-UC) were taken into account. These degrees are the basis for the career path established by the IH2O Programme and they were the point of access of over half of the number of admitted PhD candidates (Figure 11).

It is also worth mentioning that at the end of year 2019-20, the IH2O Programme had 28 active PhD candidates, which represent 4.55% of the students enrolled in the Doctorate School (615); 14.89% of the students enrolled in Engineering programmes (188) and 28.57% of the students enrolled in programmes associated to the Civil Engineering School (98).

3.2. Training activities

Following is a detailed list of the programme's training activities grouped according to the categories set out in the Verification Report (cf. section 5.2. Follow-up of the PhD candidates), according to the objective assessment criteria associated to the various skills (Table 11). These activities were adapted during year 2019-2020, mainly in the second half, due to the pandemic situation, which caused a slight reduction in the offer of activities and the adaptation of many of them to an online format.

Category	Skills*	IH2O Activities	Requirement
Cross-training		EDUC's doctorate courses	80 hours
Specialised seminars	CB11, CB13, CB15	International seminars IH20+10 Seminars	18 hours
Courses on tools, models, statistics, etc.	CB11	Specialisation courses	2 Courses
Projects/ Contracts	CB12, CB16, CA01, CA02. CA03, CA04, CA05	Cooperation in competitive projects and particularly relevant contracts	1 Project
Congresses/ Workshops	CA06, CB13, CB14, CB15, CB16, CA02	Attendance to scientific congresses and meetings	2 oral papers
Research papers	CB13, CB14, CB16, CA02, CA04, CA05, CA06	Papers on JCR indexed journals	2 SCI (1Q1)
Internships/short stays	CB11, CB15, CB16, CA03, CA04, CA06	Scientific interaction with other researchers	1 week (min)

Table 11. Summary of requirements for the Doctoral candidates in terms of training activities of the programme and their related skills. (*See Verification Report)

The specific training activities organised by the programme during this period of time are summarised as follows:

- **104 Seminars** on various subjects.
- **22** Specialisation **Courses**.
- **10 Congresses and Technical Sessions.**

3.2.1.Seminars.

This training activity includes, first of all, the so called "Specialist International Seminars" and "IH 20+10 Seminars", which are all in-attendance seminars delivered at IHCantabria. The following is the full list of the seminars delivered in the 2014-20 period:

- 06/10/2014. Li Erikson (United States Geological Survey, Pacific Coastal & Marine Science Center, Santa Cruz, CA). Marine hazards in the US and Canadian Pacific Ocean Coasts.
- 12/02/2015. César Azorín-Molina (Instituto Pirenaico de Ecología, CSIC). "Global Stilling" y tendencias climáticas de la velocidad del viento en España y Portugal.
- 10/03/2015. Ioan Nistor (Universidad de Ottawa, Canadá). Tsunami Impacts on Structures - Engineering Lessons Learned from Tsunami Forensic Engineering Investigations.
- 11/03/2015. Ioan Nistor (Universidad de Ottawa, Canadá). Review of the State-of-the-Art Tsunami Design Procedures – Development of the new ASCE7 Tsunami Structural Design Guidelines.
- 17/04/2015. Sean Vitousek (United States Geological Survey, USGS). Part 1: Modeling internal waves. Part 2: Modeling long-term shoreline change.
- 17/04/2015. Pat Limber (Geological Sciences Department, Univ of Florida). Part 3: Sea cliff erosion and rocky coastline evolution over decadal to millennial time scales.
- 23/04/2015. Julio Candela (Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, México). The water exchange between Chinchorro bank and its surroundings.
- 23/04/2015. Julio Sheinbaum (Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, México). Plataformas de observación oceanográfica, línea base, modelos de simulación y escenarios de la capacidad natural de respuesta ante derrames de gran escala en el Golfo de México.
- 24/04/2015. Patrick Barnard (USGS Coastal and Marine Geology Program. Pacific Coastal and Marine Science Center, Santa Cruz, CA). Coastal change: past, present and future.
- 11/06/2015. Belén Benito (Universidad Politécnica de Madrid, UPM). Proyecto de Cooperación en Haití para la reducción del riesgo sísmico tras el terremoto de 2010.
- 28/10/2015. Antonio F Härter (Federal University of Santa Catarina, Brazil). The South Atlantic Ocean Response to Local and Remote Forcings.
- 28/10/2015. João Luiz Baptista (Federal University of Rio de Janeiro). Itajaí River's Floodings: Resilience and Development.

- 16/03/2016. Jetse J. Stoorvogel (Universidad de Wageningen, NH). How to obtain the proper soil information for environmental modelling?
- 28/03/2016. Virginia Carracedo (Departamento de Geografía, Urbanismo y Ordenación del Territorio, Universidad de Cantabria). Incendios forestales y gestión del fuego en Cantabria.
- 28/03/2016. Juan Busqué (Centro de Investigación y Formación Agrarias, Gob Cantabria). Integración de la ganadería extensiva y el pastoreo en los planes de gestión de espacios continentales de la Red Natura 2000 en Cantabria.
- 13/06/2016. Samantha J Hughes (Centro de Investigação e de Tecnologias Agro-Ambientais e Biológicas, Universidade de Trás-os-Montes e Alto Douro). The application of stochastic dynamic modelling in integrated aquatic resource management: visualising challenges for future WFD planning.
- 20/06/2016. Kelly A. Burks (US Army Engineer Research and Development Center, University of Florida). Using Nature-based Features and Risk-based Paradigms to Consider Climate Change and Promote Functional Resilience.
- 21/06/2016. Kelly A. Burks (US Army Engineer Research and Development Center, University of Florida) Developing Performance Metrics for Ecosystem Goods and Services Generated in the Post-Sandy Environment.
- 22/06/2016. Juan Luis Garzón (George Mason University, VI, USA). Numerical modeling and field observations in marsh areas to improve resilience and vulnerability in coastal communities.
- 20/09/2016. David Revell (Revell Coastal, LLC). Sea level rise adaptation and economics in Imperial beach, California.
- 17/10/2016. Zeng Zhou (Hohai University, China). Sediment and marsh dynamics on tidal flats: A modelling study.
- 24/01/2017. Rosa María Darbra (Universidad Politécnica de Cataluña, UPC). Herramientas de gestión ambiental en puertos europeos.
- 02/02/2017. Borja González (The Nature Conservancy and the University of California, Santa Cruz, UCSC). Highlights of the 4-year collaboration between IH, TNC and UCSC in Climate, Risk and Resilience.
- 27/06/2017. Dylan Anderson (College of Engineering, Coastal and Ocean Engineering, Oregon State University). Investigating the many timescale of wave-driven morphodynamics.
- 02/10/2017. Sebastian Solari (Universidad de la República de Uruguay, UdelaR). Ingeniería de costas en Uruguay: Presentación general y líneas de trabajo actuales en estadística aplicada.
- 06/02/2018. Mª José Polo (Universidad de Córdoba). Procesos hidrológicos en regiones mediterráneas. La escala de cuenca desde las ecuaciones de balance de agua y energía a escala local.
- 05/03/2018. Robert Nicholls (University of Southampton). Integrated assessment of coastal morphodynamics.
- 19/03/2018. Mar Marcos (Escuela de Doctorado, Universidad de Cantabria). Diluvios universales.

- 10/04/2018. Peter Mccomb (MetOcean Solutions). Spectral wave studies - New Zealand's Program in the Southern.
- 09/05/2018. Mark O´Malley (University College Dublin). Energy system integration and its role in integrating variable renewable energy.
- 31/10/2018. David R. Fuhrman (Technical University of Denmark). Simulation of Coastal CFD with stabilized turbulence closure models.
- 13/11/2018. Juan Arrisueño Gómez de la Torre (Empresa Portuaria Nacional de Perú). La modernización del sistema portuario peruano. Retos y oportunidades.
- 29/11/2018. Brecht Devolder (Department of Civil Engineering, KU Leuven, BE). Hydrodynamic modelling of wave-structure interaction processes using OpenFOAM.
- 28/01/2019. Imen Turki (Normandy University). Investigating of Coastal / Estuarine environments by the use of hybrid approaches.
- 06/02/2019. Alejandro Jacobo Cabrera Crespo (Departamento de Física Aplicada de la Universidad de Vigo y docente en la Facultad de Ciencias y la Escuela de Ingeniería Aeroespacial del Campus de Ourense). Aplicaciones del modelo Smoothed Particle Hydrodynamics en problemas de ingeniería costera.
- 18/02/2019. Robert Anthony Dalrymple (Department of Civil & Environmental Engineering. Northwestern University). Rip currents: a fifty-year history
- 19/02/2019. Robert Anthony Dalrymple (Department of Civil & Environmental Engineering. Northwestern University). Tsunamis and seaquakes.
- 11/03/2019. Andrea Saltelli (Centre for the Study of the Sciences and the Humanities (SVT) - University of Bergen (UIB)). Sensitivity analysis, an introduction.
- 22/03/2019. Antonio Cendreros (Universidad de Cantabria). Cambio Global e interacción entre agua y superficie terrestre.
- 26/03/2019. Alberto Ruiz Jimeno (Universidad de Cantabria). La industria de la Ciencia: de las partículas elementales a la web y la terapia hadrónica.
- 11/04/2019. Luis Otero Díaz (Universidad del Norte, Colombia). Ondas infragraviatorias y respuesta morfodinámica de playas en el caribe colombiano ante eventos extremos.
- 27/05/2019. Vincent Varamo (Universidad de Hawaii Manoa, Honolulu, HI, EEUU). 1) Reliable Acoustic Path (RAP) Tomography at the ALOHA Cabled Observatory. 2) Modeling Kelp Bed Dynamics in the Santa Barbara Channel.
- 05/07/2019. Tasman Crowe (UCD Earth Institute, University College Dublin). Combined effects of multiple stressors in marine ecosystems.
- 12/07/2019. Rodolfo Silva Casarín (Universidad Nacional Autónoma de México. UNAM). Experiencias en la implementación de infraestructura verde en América Latina y el Caribe.
- 26/07/2019. Mario Castro de Lera y Pablo Ruiz Sánchez (Deep Blue Globe). ONEWAVE, Tsunami Verification from Space.

- 26/09/2019. Edwin "Todd" Cowen (DeFrees Hydraulics Laboratory). Grand Challenges in Environmental Fluid Mechanics: Remote Sensing of Surface Flows as a Tool for Hydraulic, Hydrologic, and Ecosystem Science, Engineering and Management.
- 10/10/2019. Lukas Fröhling (Ludwig-Franzius Institute, Alemania). Physical model tests and simulations of offshore floating systems.
- 10/10/2019. Gabriel David (Ludwig-Franzius Institute, Alemania). Sea-level rise adaptation on the Maldives - contributions from a coastal engineer.
- 31/10/2019. Íñigo J. Losada Rodríguez (Instituto de Hidráulica Ambiental de la Universidad de Cantabria (IHCantabria), Universidad de Cantabria). SROCC-El informe especial del IPCC sobre Océanos, Criosfera y Cambio Climático.
- 05/11/2019. Marissa Yates (Saint-Venant Hydraulics Laboratory (Université Paris-Est, École des Ponts ParisTech, EDF R&D, Cerema).
- 23/06/2020. Felipe Maza (IHCantabria). Workshop 1 IH-IT: Librería de acceso a datos metocean alojados en IHCantabria "DataHub.Client (online).
- 03/07/2020. David del Prado (IHCantabria). Workshop 2 IH-IT: Introducción al uso de un clúster de supercomputación. Iniciación Clúster (online).
- 22/09/2020. Carlos Ciudad Trilla (Programa de Conservación de Espacios de SEO/BirdLife). Métodos de análisis de la conectividad ecológica en ecosistemas acuáticos continentales de la Cordillera Cantábrica. Parte 1. (presencial + online).
- 23/09/2020. Carlos Ciudad Trilla (Programa de Conservación de Espacios de SEO/BirdLife). Métodos de análisis de la conectividad ecológica en ecosistemas acuáticos continentales de la Cordillera Cantábrica. Parte 2. (presencial + online).
- 23/10/2020. Workshop 3 IH-IT. Sheila Abad (IHCantabria). Introducción a QGIS, un SIG (open source) para todos (online).
- 27/10/2020. Workshop 4 IH-IT. Felipe Maza (IHCantabria). Introducción a la gestión de código software e iniciación en Python (online).

On the other hand, we include under this heading the set of guest conferences delivered within the Technical Sessions associated to the communication activities of various projects, which were all opened to be attended by the IH20 Programme's PhD students:

- 20/04/2016. Bárbara Ondiviela (IHCantabria). El estado de conservación de los hábitats y especies de la Red Natura 2000 en la CC.AA. de Cantabria: perspectiva regional.
- 09/06/2016. Mogens Schou. (Aquamind, DK). Equilibrios entre la implementación de la Política Pesquera Común (PPC) y la creación de valor en las industrias.
- 19/07/2016. Bárbara Ondiviela (IHCantabria). Procedimiento metodológico para la localización y optimización de diseños de parques de acuicultura oceánica.
- 19/12/2017. Inés Mazarrasa (IHCantabria). Problemática de las basuras marinas: el proyecto CLEANLICs.

- 14/02/2018. José Luis González (Dir. Gral. de ordenación Pesquera y Acuicultura, MAPAMA). La acuicultura oceánica en el contexto del crecimiento azul.
- 29/05/2018. Miriam Jiménez (IHCantabria). Proyecto LIFE-CONVIVE: Actuaciones de restauración hidrodinámica.
- 29/05/2018. José A Juanes (Universidad de Cantabria, IHCantabria). Proyecto LIFE-CONVIVE: de las propuestas a los proyectos. Lecciones aprendidas.
- 29/05/2018. Raquel Sánchez (Dir. Gral. Medio Natural, Gobierno de Cantabria). Proyecto LIFE-CONVIVE: Actuaciones de control de Baccharis.
- 04/06/2018. Cristina Garmendia (Fundación COTEC). El papel de la innovación en un mundo en transición.
- 29/06/2018 Araceli Puente (Universidad de Cantabria, IHCantabria). Análisis del riesgo del cambio climático en los ecosistemas litorales. Proyecto FB-MARES.
- 29/06/2018. José A Juanes (Universidad de Cantabria, IHCantabria). Vulnerabilidad frente al cambio climático de los sistemas naturales en la costa española. Proyecto C3N.
- 29/06/2018. Elvira Ramos (IHCantabria). Cambios recientes en la distribución de las macroalgas intermareales en el Cantábrico. Proyecto FB-MARES.
- 29/06/2018. Antonio Punzón (Instituto Español de Oceanografía). Efecto del cambio climático en las comunidades de peces nectobentónicos del Mar Cantábrico. Proyecto CLIFISH. Proyecto FB-MARES.
- 15/10/2018. Ignacio Aguirre y María Merino. Día Internacional para la reducción de riesgos 2018. Proyecto CABARET.
- 27/06/2019. Melisa Menéndez y Adrián Acevedo. IHData. Datos Climáticos disponibles y servicios de acceso.
- 22-23/09/2020. José Barquín. Seminario aplicación práctica de análisis de conectividad en sistemas lenticos. Proyecto LIFE DIVAQUA.
- 24/09/2020. José A Juanes y Andrés García (Universidad de Cantabria, IHCantabria), Beatriz Echavarri, María Recio (IHCantabria), Raquel Sánchez (CGPYDR), Ramón Meneses (Ayto Anuero), Alejandro García (Aves Cantábricas) y Felipe González (SEO). Resultados y lecciones aprendidas en el desarrollo del Proyecto LIFE-CONVIVE.

In the same way, IHCantabria is actively involved in the *World Harbor Project* network and, more specifically, in its work group 4 on Capacity Building, which is in charge of organising the Program for the Specialist Online Seminars. Such seminars were delivered by various researchers and managers from all over the world and are open to the IH2O Programme's PhD candidates to participate. The following seminars were included:

- 07/09/2016. Peter Steinberg (Sidney Institute of Marine Sciences). Introduction to the World Harbor Project.
- 07/09/2016. Judith O'Neil (Center for Environmental Science, University of Maryland). WHP1: New York Harbour. Resilience in the face of 400 years of development.

- 07/09/2016. Bill Dennison (Center for Environmental Science, University of Maryland). WHP1: Chesapeake Bay and Baltimore Harbor.
- 26/10/2016. Louise Firth (University of Plymouth). WHP2: Eco-engineering of rock pools in coastal infraestructures: 3 case studies.
- 26/10/2016. Ido Sella / Shimrit Perfon-Finkel (ECOncrete. Concrete Ecological Solutions). WHP2: Re-designing coastal and marine construction in order to increase infraestructure ecological value.
- 29/11/2016. Paul Brooks (University College of Dublin). WHP3: Harbors ans Ports in different contexts. Potential influence of multiple stressors and climate change.
- 29/11/2016. José A Juanes (Universidad de Cantabria, IHCantabria). WHP3: Santander Bay: an overview.
- 23/02/2017. Aina García (IHCantabria). WHP4: Assessing the environmental risk to pollution in harbour areas.
- 23/02/2017. Anthony Chariton (Dept. Biological Sciences, Macquarie University, AU). WHP4: Metabarcoding of benthic eukaryote communities reflects the ecological condition of estuaries.
- 25/03/2017. David Aguirre (Massey University). WHP5: Auckland's Harbour.
- 25/03/2017. Catriona MacLeod (University of Tasmania). WHP5: Hobart Estuary.
- 25/03/2017. Paul Gribben (New South Wales Univ., Australia). WHP5: Sydney Harbour.
- 27/04/2017. Stuart Pearson (University of New South Wales). WHP6: Looking to the future. Conflict and the future in the World's Harbours.
- 27/04/2017. Rebecca Jarvis (Auckland University of Technology). WHP6: The social dimensions of marine spaces.
- 25/05/2017. Yunwei Dong (State Key Laboratory of Marine Environmental Science, Xiamen University). WHP7: The Xiamen Harbour.
- 25/05/2017. Kenny Leung (Swire Institute of Marine Science and School of Biological Sciences, University of Hong Kong). WHP7: On-going research projects in the marine environment of Hong Kong.
- 20/07/2017. Elisa Bone (Billion Oyster Project Curriculum and Community Enterprise for Restoration Science). WHP8: The Billion Oyster Project: a model for community participation in harbour restoration.
- 20/07/2017. Paolo Mancuso (Department of Biological Sciences and Environmental Geology, University of Bologna). WHP8: Understanding the drivers of community structure in artificial habitats to ecologically improve the design of harbour infrastructures.

And lastly, the PhD candidates delivered seminars previously to the presentation of their thesis, which were especially focused on considering potential ways for future transfer and interaction with other groups of the Institute.

- 15/02/2018. Ahmed I Elshinnawy. Static and Dynamic Equilibrium Planform of Embayed Beaches: New Advances and Influence of the Directional Wave Climate.
- 21/03/2018. Alexandra Toimil. Un marco para la evaluación multisectorial de los riesgos del cambio climático en zonas costeras.
- 23/10/2018. Íñigo Aniel-Quiroga. Tsunami coastal impacts: An alternative methodology to estimate run-up.
- 20/11/2018. Pelayo Menéndez. Servicios ecosistémicos de protección frente a inundación costera: metodología, valoraciones e integración.
- 17/12/2018. Carlos V. Weiss. Methodologies applicable to MSP within the framework of current and future development of renewable energies and aquaculture.
- 14/02/2019. Edurne Estévez Caño. Efectos de los cambios en la ocupación del suelo en ríos de montaña: Un enfoque multinivel.
- 18/07/2019. Alexia González Ferreras. Determinación y modelado de los patrones espaciales de la Trucha Común (Salmo Trutta Linnaeus, 1758) en la cuenca del río Deva-Cares: el rol de la conectividad y del nicho.
- 19/09/2019. Felipe Francisco Calleja Apéstegui. Vegetación en estuarios: ¿cómo cartografiarla (casi) sin salir del despacho?

3.2.2.Specialisation Courses

During the term 2014-20, various Specialisation Courses and Ongoing Training Courses were organised at IHCantabria. All of them were opened to the programme's PhD students to participate. Following are the dates in which such courses were delivered, the main lecturer and the number of lecturing hours:

- 06/10/2014. IH2VOF (presencial). Javier López. 12h.
- 07/10/2014. IHFOAM (presencial). Javier López. 24 h.
- 16/01/2015. ROM 5.1. Calidad de aguas portuarias (MOOC, 3ª ed). José A. Juanes y Aina García. 36h.
- 08/05/2015. ROM 5.1. Calidad de aguas portuarias (MOOC, 4ª ed). José A. Juanes y Aina García. 36h.
- 10/05/2015. La cordillera Cantábrica como centinela de los efectos del cambio global. José Barquín. 30h.
- 16/07/2015. Modelado avanzado de clima marítimo y propagación de oleaje. Melisa Menéndez. 15h.
- 29/01/2016. Infraestructura de Sistemas Operacionales de IHCantabria. Felipe Fernández. 2h.
- 24/02/2016. Sistema operacional de alta resolución para la construcción del Puerto de Açu (Brasil). Antonio Tomás. 1h.

- 08/04/2016. ROM 5.1. Calidad de aguas portuarias MOOC, 5ª ed). José A. Juanes y Aina García. 36h.
- 08/09/2016. ROM 5.1. Calidad de aguas portuarias (MOOC, 6ª ed). José A. Juanes y Aina García. 36h.
- 29/03/2017. IH2VOF (presencial). Javier López. 8h.
- 16/05/2017. Herramientas BRIHNE, modelado de vertidos de plantas desaladoras (on line). Andrés García. 7h.
- 06/11/2017. ROM 5.1. Calidad de aguas portuarias (MOOC, 7ª ed). José A. Juanes y Aina García. 36h.
- 21/11/2017. OCLE: Base de datos de amenazas históricas y futuras para los ecosistemas marinos en Europa. Camino Fernández. 2h.
- 16/04/2018. Hidrología para estudiantes de doctorado. César Álvarez. 40h.
- 16/05/2018. Teoría de la información y ciencias de la tierra. César Álvarez. 27h.
- 17/05/2018. IHPROPAGA (presencial). Gabriel Díaz. 12h.
- 21/05/2018. IH2VOF (presencial). María E. Maza. 8h.
- 26/11/2019. Curso básico IHFOAM. María E. Maza. 8h.
- 27/11/2019. Curso avanzado IHFOAM. María E. Maza. 8h.
- 06/02/2020. Curso "Métodos bayesianos con OpenBUGS". Enrique Castillo. 4h.
- 15/06/2020. ROM 5.1. Calidad de aguas portuarias (MOOC, 8ª ed). José A. Juanes, Bárbara Ondiviela y Aina García. 36h.

3.2.3. Congresses and Technical Sessions

PhD students also had access to various Workshops and Sessions organised by IHCantabria in the context of various projects, as well as to several international congresses, some of which were directly addressed to young researchers. All these activities enabled the active involvement of the PhD candidates of the programme in talks relating to their thesis projects.

Following are the references of the aforementioned scientific meetings, organised by type (congresses, technical sessions), with an indication of the dates, the programme lecturer in charge of organising them and their approximate length:

Congresses:

- 11/2014. International Conference on Advances in Extreme Value Analysis and Application to Natural Hazards (EVAN2015). Organizer: Melisa Menéndez. 5 days.
- 10/2017. International Short Course and Conference on Applied Coastal Research (SCACR2017). Organizer: Javier López. 4 days.
- 10/2017. Workshop on digital tools for designing Green Infrastructure Networks (GINS). Organizer: José Barquín. 2 days.

- 05/2018. Congress COASTLAB18. Organizer: Javier López. 5 days.

Technical Sessions:

- 11/2017. Technical meeting on "Energías marinas: oportunidades de desarrollo y estrategia de cooperación". Organizer: Francisco Royano. 6h.
- 12/2017. Closing session of the project on "Modelado de las zonas de acumulación de basura marina en lugares de importancia comunitaria (LIC) en el litoral de Cantabria (CLEANLICs)". Organizer: José A Juanes. 4h.
- 02/2018. Launching session of the project on "Atlas de viabilidad para el desarrollo de la acuicultura oceánica en España (ATLAS)". Organizer: José A. Juanes. 5h.
- 05/2018. Technical meeting on "COOPERA-NATURA". Proyecto LIFE-CONVIVE. Organizer: José A Juanes. 4h.
- 06/2018. Closing session of the project on "Elaboración de MApas de Riesgo de los sistemas naturales frente al cambio climático en los EStuarios cantábricos (MARES)". Organizer: Araceli Puente. 4h.
- 24/09/2020. Closing session of the project on "Integration of human activities in the conservation objectives of the Natura 2000 Network in the litoral of Cantabria (CONVIVE LIFE). Organizer: José A Juanes. 2h (Online).

3.2.4.Other Training Activities

Supplementary to the specific study activities, the IH2O programme's lecturers team worked with EDUC in various activities and actions organised by the latter, detailed as follows:

- *Cross-training activities.*

  Various lecturers of the programme have become involved from the first editions in the cross-training activities organised by EDUC. These are compulsory for all the PhD students of the UC. They prominently include the active involvement in the design and development of the course on "Preparation of a research project" delivered since 2013 by several lecturers from EDUC, within the Advanced Training.

- *Supervisor Courses.*

  Some of the younger lecturers of the programme have been involved in the Supervisor Training courses organised by EDUC. This activity has been supplementary to one of the activities proposed in the Verification Report of the programme with the same objective: to promote the exchange of experiences between the most experienced and the youngest lecturers.

- *Pre-doctoral internships at IHCantabria*

In the same way, IHCantabria, as an international R&D centre of reference, has received pre-doctoral and post-doctoral researchers from various universities who have interacted with the teams and the PhD students of the programme. A total of 20 PhD students from 8 different countries were received for internships of 4 months in average.

3.3. Outcomes

The most significant outcome from the first cycle of the new Doctoral Programme (the academic management of which was for the first time delegated to the Environmental Hydraulics Institute of the Universidad de Cantabria) is the ability to keep a trend of increasing progress of its three lines of research within a context of increasing scientific demand and excellence. Such generic outcomes are reflected in the specific outcomes obtained (articles, oral presentations, international mentions, etc.), as indicated in the following subsections.

3.3.1. In-progress and presented thesis.

Of the 41 doctoral thesis projects initiated in the 2014-20 period (the two dropouts have not been included), a total of **16 PhD students** have successfully completed their thesis, obtaining the highest mark (*cum laude* mentions). At the time of conclusion of this report, one further thesis is in the process of being deposited. The new graduates are, in their majority, PhD students from the first two generations of the programme (2014-15/2015-16), although there are also two from the third generation (2016-17) coming from previous programmes (Figure 12, left). The average time required for completion of the thesis was **3.7 years**, which includes part-time and full-time students.

In addition, as figure 12 (right) shows, years 2016 and 2017, the end of the cycle of the programmes regulated by the previous RD brought about, on the one hand, an unusual increase in the number of annual thesis presentations (with the average in the previous year's being approximately 6 to 7 thesis/ year) and, on the other hand, the stabilisation of the number of new thesis being presented under the new doctoral programme commencing in 2014-15 (IH20 Programme) from the fourth year onwards.

Therefore, the number of thesis presented (6 during years 2017-18 and 2018-19) remains within the range of annual thesis expected (5-8) from the analysis of the information on the various programmes associated to the research groups making up the IH2O Programme. An exception to this trend is the last year of the cycle (2019-20) which, similarly to what happens with other indicators (new candidates, research stays, training activities, etc.), reflects the impact of the pandemic situation affecting the said period of time.

Nevertheless, in terms of presentations of thesis, the information obtained through the progress follow-up of the various thesis provided during the PhD Sessions in October 2020, forecasts a resumption of the previous trend in year 2020-21.

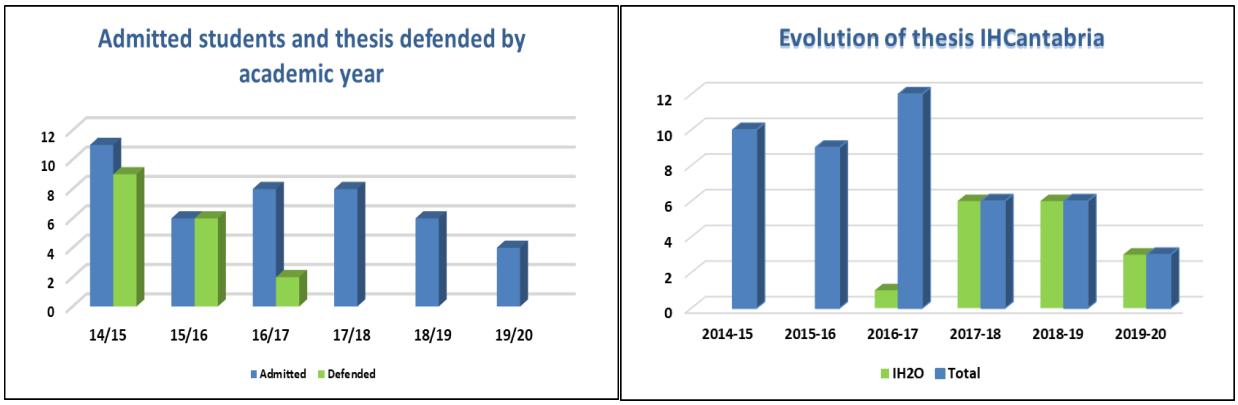

Figure 12. Representation of the number of admitted PhD candidates by academic year (left), together with the number of them who have presented their thesis and the evolution of the number of thesis relating to different programmes associated to IHCantabria that were presented in the 2014-20 period (right).

3.3.2.Publications

The outcome that is most directly related to the quality of the doctoral thesis is the number and the impact of the publications deriving from them. During the six years a total of **68 articles** have been published in indexed journals (JCR), out of which **55** are associated to the contents of the 16 thesis already presented (**x=3.4 SCI/thesis**). The PhD candidates are the leading authors of 61 of the articles published. Detailed information on the publications associated to the various thesis can be accessed on the IHCantabria webpage (https://ihcantabria.com/produccion-cientifica/tesis-doctorales-actuales/).

With regards to the indicators of quality of the articles on the presented thesis, **26** of the published articles were included in the first decile (**D1, 44%**), another **20** within the first quartile (**Q1, 33.9%**), **3** in the second quartile (**Q2, 1.7%**), and **6** of them in the third and fourth quartiles (**Q3/Q4, 10.2%**) (Figure 13). These data shows the importance of the requirement set out in the programme (2 SCI, at least 1 Q1, before the time of deposit) to help obtain outcomes that may qualify as excellent in terms of the studies completed and the competiveness of the researchers in future selective processes.

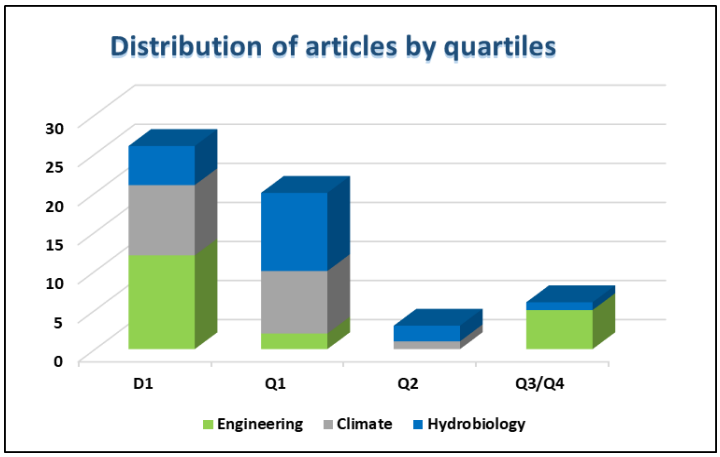

Figure 13. Representation of the total number of articles relating to the 16 presented thesis in 2014-2020 published in indexed journals (JCR), grouped according to indicators of quality (D1, first decile; Qn: quartiles 1-4) in their year of publication.

3.3.3. Congress presentations

Throughout these six academic years, the programme's PhD students have attended various national and international congresses, and delivered several oral presentations. These are also a requirement in the training process of the doctoral candidates and an indication of the direct outcomes of the thesis.

All the training activities admitted by Mentors and Supervisors receive the required funding for their development, either through travel grants associated to the pre-doctoral contracts, to public calls of the Universidad de Cantabria or to projects and especially relevant contracts developed by the research teams. The following is the list of the PhD students registered in the programme who have received some sort of support, whether from official bodies or projects of the research group in order to fund the costs of the courses and congresses (registration/travelling costs/accommodation costs) they are required to attend for their doctoral studies:

Iñigo **Aniel-Quiroga**.

- 2017. EGU. Viena.
- 2017. Jornadas de Puertos y Costas.
- 2018. ICCE 2018. Baltimore (USA).
- 2018. CoastLab 2018. Cantabria.

Carlos **Barrera**.

- 2017. II Jornada sobre el Estado Actual y Perspectivas de las Energías Renovables Marinas en España. España.
- 2017. Marine Energy Week. Bilbao.
- 2018. OMAE. Madrid.

Felipe **Calleja**.

- 2016. Congreso Ibérico Limnología. Tortosa.
- 2018. ISOBAY. Anglet (FR).
- 2018. International Meeting on Marine Research 2018. IMMR'18. Preconference day: Marine Invaders.

Jesús **Casado.**

- 2019. EGU General Assembly.
- 2019. Jornadas de Ingeniería del Agua. Castilla-La Mancha.

Helios **Chiri**.

- 2017. IOSC. Long Beach (USA).
- 2019. EGU General Assembly.
- 2019. XV Jornadas Españolas de Ingeniería de Costas y Puertos. Vizcaya.

Benedetto **Di Paolo.**

- 2018. Int. Conference on Ocean, Offshore & Arctic Engineering – OMAE. Madrid.
- 2019. SCARC 2019. Bari (Italia).
- 2019. MARINE 2019. Gotemburso (Suecia).
- 2020. OpenFOAM Workshop 2020. Virginia (USA).

Javier **Díez**.

- 2015. EGU. Viena.
- 2015. XIII Jornadas Españolas de Ingeniería de Costas y Puertos. Valencia.
- 2017. Jornadas de Puertos y Costas. Alicante.
- 2017. V Jornadas de Ingeniería del Agua. La Coruña.
- 2018. 11 Congreso de la Asociación Española de Climatología.
- 2019. EGU General Assembly.

Edurne **Estévez**.

- 2015. ASLO. Granada.
- 2016. Congreso Limnologia. Tortosa.
- 2018. Congreso Limnología. Coimbra (Portugal).

Camino **Fernández**.

- 2015. ECSA 55. Londres.
- 2016. ECSA 56. Bremen.
- 2017. CERF Biennial Conference. Providence (USA).

June **Gainza**.

- 2015. ISOBAY. Bilbao.
- 2017. Jornadas de Puertos y Costas. Alicante.

Julio **García-Maribona.**

- 2019. SCARC 2019. Bari (Italia).
- 2019. XV Jornadas Españolas de Ingeniería de Costas y Puertos.
- 2019. Congreso Bienal de Real Sociedad Matemática Española.
- 2020. European Geosciences Union Meeting 2020.

Paula **Gomes**.

- 2017. SCACR Int Short Course. Santander
- 2017. EGU. Viena
- 2017. Jornadas de Puertos y Costas. Alicante
- 2018. ICCE 2018. Baltimore
- 2018. Simposio Brasileiro de Praias Arenosas. Florianópolis (Brasil)

Alexia **González**.

- 2017. 10º Simposio Europeo Freshwater Sciences. Olomouc (Chequia).
- 2018. Congreso Limnología. Coimbra (Portugal).

Minh B. **Hoang.**

- 2019. 11th Symposium for European Freshwater Sciences – SEFS11. Croacia.

Camilo **Jaramillo**.

- 2015. Jornadas de Puertos y Costas. Cartagena.
- 2017. Jornadas de Puertos y Costas. Alicante.
- 2017. SCACR Int Short Course. Santander.

Héctor **Lobeto**.

- 2018. 25 years of progress in radar altimetry. Azores (Portugal).
- 2020. 12th Coastal Altimetry Workshop

David **Lucio**.

- 2017. Jornadas de Puertos y Costas. Alicante.
- 2017. SCACR Int Short Course. Santander.
- 2019. Congreso bienal de la Real Sociedad Matemática Española. Santander.
- 2019. Jornadas de Puertos y Costas. Málaga.
- 2019. Workshop on Correlated Extreme Events. Columbia.
- 2019. Coastal Structures Conference. Hannover.

Dorleta **Marina.**

- 2018. International Conference on Ocean Energy, ICOE 2018.
- 2018. Innovazul. Cádiz.

Michele **Martini**.

- 2015. EWEA Offshore. Copenhagen (DK).
- 2015. OMAE. St John's (Canada).
- 2015. Marine Energy Week. Bilbao.
- 2016. OMAE 2016. Busan (Corea).

Lourenço **Mendes.**

- 2017. International Short Course and Conference on Applied Coastal Research. Santander.

Pelayo **Menéndez**.

- 2017. Jornadas de Puertos y Costas. Alicante.
- 2017. SCACR Int Short Course. Santander.

María Rosario **Navarro.**

- 2018. 6th International Otolith Symposium. Keelung (Taiwan).
- 2018. Workshop on Age Estimation of Atlantic mackerel. San Sebastián.

Paula **Núñez**.

- 2017. Jornadas de Puertos y Costas. Alicante.
- 2017. SCACR Int Short Course. Santander.
- 2019. Jornadas de Puertos y Costas. Málaga.

Erica **Pellón**.

- 2017. SCACR Int Short Course. Santander.
- 2019. Jornadas de Puertos y Costas. Málaga.
- 2020. EGU General Assembly.

Ignacio **Pérez**.

- 2016. Limnología. España.
- 2017. 10º Simposio Europeo Freshwater Sciences. Olomouc (Chequia).
- 2018. II Workshop on information theory and the earth sciences. Santander.
- 2019. I Meeting of the Iberian Ecological Society & XIV AEET Meeting. Barcelona.

Julia **Polo.**

- 2020. ICYMARE. Bremen.

M Elena **Prado.**

- 2019. XX Simposio Ibérico de Estudios de Biología Marina. Braga (Portugal).
- 2019. 2nd Int. Workshop UNDERWATER 3D RECORDING & MODELLING. Chipre.

Cassia **Rocha.**

- 2020. SEFS11 – Symposium for European Freshwater Sciences.

Augusto **Rodríguez.**

- 2019. SIEBM XX. Braga (Portugal).

Eva **Romano.**

- 2019. XV Jornadas Españolas de Ingeniería de Costas y Puertos.

Alexandra **Toimil**.

- 2015. XIII Jornadas de Puertos y Costas. Cartagena.
- 2015. Summer School BC3: Climate change, on the road to Paris 2015. Bilbao.
- 2015. EVAN. Santander.
- 2016. Congreso Asoc. Esp de Climatología. Alicante.
- 2017. XIV. Jornadas de Puertos y Costas. Alicante.
- 2017. Int. Short Course & Conference on Applied Coastal Research. Santander.

Carlos **Zapata.**

- 2016. Determinación de la oferta y la demanda de los Servicios Ecosistémicos del Golfo de Guayaquil.
- Ciclo de conferencias del VI Informe nacional – Convenio de Diversidad Biológica.

3.3.4. Stays and Internships

An important aspect of the training of the doctoral candidates is the interaction with researchers from other centres with the purpose of promoting scientific debate and the building of new hypotheses. The programme established three requirements relating to the specific training program promoting such interactions. First of all, all the students are required to get involved in a project of the research team in relation with the subject matter of their thesis, so that they prove they can work within a team, doing tasks beyond the objectives of their thesis. Secondly, the PhD students are required to make two oral presentations at specialist congresses or seminars (Section 3.3.3), where they summarise, communicate and discuss the outcomes of their thesis with other colleagues. And, lastly, they are required to perform some research activity at other research centres, with a clear difference being made between 1) a compulsory (minimum) one week **stay**, where scientific debate is promoted (international courses, specialist field work programmes, short-term cooperative work, etc.), and 2) a voluntary **internship** at another centre in order to promote cooperation with leading research teams of their speciality. In the latter option, a minimum internship of 3 months is required, should they wish to apply for the "International mention".

In terms of stays, the involvement of the research teams in various international multidisciplinary projects has extensively helped the PhD students interact in scientific discussions associated to such projects (please see Section 2.2." n" and 3.2.3) and, therefore, to comply with this specific requirement. In terms of the internships, during the period under analysis (2014-20), 14 PhD students, mainly from the two first generations (2014-15: 50%; 2015-16: 66%), took on this training activity at various research centres at 7 different countries (Figure 14). The lengths of such internships varied between 1 and 12 months depending on the objectives that were set. Several internships that were scheduled for year 2019-20 have been put on hold due to the pandemic situation. Section 2.3 includes a list of the receiving centres.

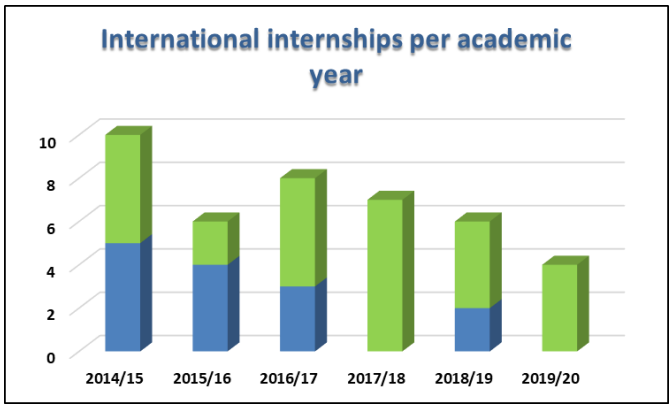

Figure 14. Representation of the number of students from each generation who have taken international internships for over 1 month (blue) during period 2014-20, compared to the total number of PhD candidates enrolled per academic year.

Some of these internships helped students comply with the requirements set up in the regulations leading to an international mention. Of the 16 programme thesis already completed, 5 (31%) obtained international mention. 30% of the mentions are registered to the two first generations (excepting one who is in the process of presentation of his thesis). The interest raised by this supplementary accreditation has seen limitations on account of various reasons. On the one hand, a portion of the new doctors (5) came from countries the funding of which required for them to take internships in a foreign country (e.g. Spain). On the other hand, the new PhD training model, which increases the academic requirements from students in shorter training periods (3 years), has led some supervisors and candidates to prioritise post-doctoral internships, thus helping at the same time with the frequent cooperation with colleagues from other countries in order to work on their international projects. Lastly, we must not forget the difficulties in obtaining funding to pay for the costs deriving from such internships. Nevertheless, it is expected that more than half the students of the programme enrolled in such period will obtain international mention of their PhDs.

3.3.5. Awards

Throughout these six years, the outcomes obtained as a group as well as individually, both by lecturers and PhD students, have been obtained various awards and recognitions. Such recognitions are a good indication of the quality of the research, which was in its majority carried out by the group of lecturers integrating the team of the IH2O programme. With the purpose of summarising some of the most relevant awards obtained in this time, they have been grouped up in three categories: collective awards, personal awards and awards to doctoral thesis of lecturers and their PhD students:

1) **<u>Collective awards</u>:**

- **IHCantabria:**
  - **2018, Proyecto Singular COHESION30 in Spain from the European Commission**. This award is a recognition granted to the best example of good practices in European cohesion policy nationally applied on celebration of its 30th anniversary as best example of the positive impact of these cohesion policies on the citizens of each country.
  - **2020, XIII Cantabria Digital Awards.** Prize being awarded to IHCantabria for the best website in the professional websites category.
- **Research teams:**
  - **2016, Premio al Mejor Trabajo del año del 55º Congreso de Ingeniería Naval e Industria Marítima, organised by AINE (Asociación de Ingenieros Navales y Oceánicos Españoles).** 1st Award to project TELWIND, presented by the Offshore Engineering and Renewable Energies group (Climate, Energy and Infrastructure team).

- **2016, Wind Energy Europe Award.** Award to the Offshore Engineering and Renewable Energies group at the posters contest, under category Turbine Technology, for the TELWIND platform concept.

- **2016, IX Cantabria Digital Awards.** Prize awarded to project IHTsusy, presented by the Coastal Engineering and Management group and the Information Technologies Team in the category best mobile app.

- **2019, Juan López Peñalver Award.** Prize awarded by the Royal Academy of Engineering to the Offshore Engineering and Renewable Energies group, for its outstanding professional contributions to Spanish engineering.

- **2019, EUDatathon (UE).** Second award to project "Blue Time Machine", presented by the Marine Climate and Climate Change and Coastal Engineering and Management groups in conjunction with the Information Technologies group, in category "Tackling Climate Change", which promotes the development of applications offering new services using data provided by the European Union institutions.

2) <u>Personal awards</u>:

- **Íñigo J Losada:**

  - **2014, Professional Recognition Award**. Colegio de Ingenieros de Caminos, Canales y Puertos de Madrid.

  - **2016, "Enrico Marchi" Award.** Distinguished Lecture. Gruppo Italiano di Idraulica. Societá sceintifica del settore "idraulica, idrologia, costruzioni idrauliche e marittime.

  - **2017, John G. Moffat-Frank E. Nichol Harbor and Coastal Engineering Award**. American Society of Civil Engineers (ASCE).

  - **2018**, **Jaume I Award** in the area of **Environmental Protection**.

3) <u>Awards to doctoral thesis</u>:

- **Extraordinary PhD Awards of the Universidad de Cantabria**, in the area of Technical Studies to the thesis of two researchers who belong to the group of lecturers of the programme:

  - **2017, María E Maza**, for her Doctoral Thesis "Modelado experimental y numérico de la interacción del oleaje con ecosistemas naturales para la protección costera", co-supervised by Dr Íñigo J Losada and Dr Javier López.

- **2018, Javier Bárcena,** for his Doctoral Thesis "Desarrollo de una metodología para delimitar zonas de mezcla de vertidos industriales en estuarios", co-supervised by Dr Andrés G. Gómez and Dr César Álvarez.

- **Award #PhDenlaUC**, awarded by the Doctorate School of the UC

  - **2018, Camino Fernández de la Hoz**, First award for the dissemination of research to a non-specialised audience carried out by the PhD candidates of the UC (https://www.youtube.com/watch?v=zZ6udj543YY).

- **Fundación ENDESA awards**

  - **2014, Javier Díez,** Young Researchers Award, A.E.C. Congress.

- **Modesto Vigueras Award** to young professionals, Technical Association for Harbours and Coasts *(Associación Técnica de Puertos y Costas)*:

  - **2019, Iñigo Aniel-Quiroga, 2nd Award,** for the Doctoral Thesis "Impacto de tsunamis en la costa: cálculo de la máxima inundación y análisis de la estabilidad de diques rompeolas de materiales sueltos", co-supervised by Dr Mauricio G. Rodríguez and r César Vidal.

  - **2020, Alexandra Toimil, 1st Award,** for her Doctoral Thesis "A framework for the multi-sectoral assessment of climate change risks in coastal areas", co-supervised by Dr Íñigo J. Losada and Dr Pedro Díaz.

4. IN-HOUSE QUALITY ASSESSMENT

This section includes an overall analysis of the two assessments made during the first cycle of the programme performed by the various groups involved: 1) the assessment made by EDUC of all the doctoral programmes and 2) the assessment made by CAPD on those aspects directly related to the IH20 Programme activities. The following subsections summarise these assessments (sections 4.1 and 4.2) and provide an integral insight from both assessments (section 4.3).

4.1. Overall Assessment of the Programme

The overall satisfaction outcomes of the PhD students were extracted from the UC's In-house Quality Assurance System (SGIC) reports, which are based on an anonymous questionnaire to be filled in on an annual basis, according to the following schedule:

1. One year following enrolment in the Doctoral programme: This survey deals with the various issues relating to the information available on the programme, the pre-registration and enrolment formalities, the allocation of the Mentor and thesis Director, the training supplementary activities, etc.
2. In the subsequent years, and until the PhD candidate presents their PhD thesis, a similar annual report needs to be drafted which does not include issues relating to the information on the PhD prior to enrolment, focusing only on the issues relating to the work of their Mentor, Director/s, the resources available for the preparation of their thesis, etc.

All the findings from the satisfaction surveys taken by the various sectors are available on the Quality Assurance Area website: http://web.unican.es/ unidades/area-calidad/informes-sgic. This report summarises part of the data from the reports drafted by the candidates collected since the implementation of the system (2016-17). Table 12 summarises the findings from the surveys taken by the students who have been in the programme for over 1 year.

ACADEMIC YEAR	Participation	Material means	Mentor's work	Supervisor's work	Overall satisfaction
2016-17	42%	3,40	3,1	2,90	3,50
2017-18	42%	4,22	3,7	3,80	4,00
2018-19	25%	4,67	2,6	3,00	5,00
Average	**36%**	**4,10**	**3,13**	**3,23**	**4,17**

Table 12. Summary of some assessments made by PhD candidates in various academic years on the IH2O programme, compared to the average value. Scale: 0 to 5.

The analysis points to 4 items of the SGIC that are more directly related to the academic management of the programme: material resources, the lecturers and the level of satisfaction with the training process. This information raises four general issues to reflect upon:

- As in the general scope of the UC, participation was not very high (<45%) and, therefore, representativeness of the findings is somehow limited. This aspect must be taken into account.
- The opinion of the PhD candidates on the means available to help develop the thesis has progressively improved throughout the three academic years under assessment, obtaining a very positive average value that stays above those obtained for the list of programmes delivered by the UC.
- On the other hand, the scores given to the work of Mentors and Directors are not as positive as would be expected (average scores are slightly above 3), in both cases remaining below the University's average.
- Such scores seem somewhat contradictory, especially those from the last academic year, in comparison to the assessment of the overall level of satisfaction with the programme, which obtained increasing scores throughout the three years to reach the highest value in the last year.

4.2. Assessment of the Specific Training Programme

In line with one of the actions for improvement proposed in the SGIC 2016-17 report, at the end of academic year 2018-19 a supplementary assessment exercise was performed which specifically referred to the management tasks and the specific study procedures of the IH2O Programme (See Section 2.4.2). The aspects assessed in these surveys and the average results obtained by each item in the 2 surveys taken by the PhD candidates, PhD graduates and lecturers (2017-18 and 2018-19) are included in Tables 13 to 15.

The results suggest a number of additional concerns to the ones mentioned in the previous section, which are detailed in the following subsections in relation with the three aspects under analysis: the academic management of the IH2O Programme, the Specific Study Plan and the overall satisfaction with its development.

4.2.1. Academic management of the Programme

Generally speaking, the assessments made of the various items are quite positive (90% > 3.5/5). There are tendencies by group:

- Lecturers are the ones providing the most positive opinions on the academic management, with scores above 4 and an average score of 4.56.
- On the opposite side, the PhD candidates, in spite of providing scores above 3.6 in their majority, they show a lesser level of satisfaction with aspects such as the responsiveness in the formalities with the EDUC".
- The PhD graduates were in agreement with some of the PhD candidates in certain aspects; however, this group provided a much more positive score to the work of the ACDP and, specially, the "degree of compliance of the study programme", which is a very relevant aspect given their global experience of the process.

SUMMARY OF THE SCORES AWARDED TO THE ACADEMIC MANAGEMENT AND THE SPECIFIC TRAINING PROGRAM		PhD students	PhD graduates	Lecturers
1. Academic management of the IH2O Programme	Work accomplished by the CAPD	4,04	4,71	4,77
	Compliance with the established work program	3,86	4,71	na
	Availability and dedication of supervisors throughout the development of the thesis	3,84	3,29	na
	Involvement of mentors in the follow-up of the training programme	3,60	3,50	na
	Work accomplished by the administrative staff of the IH20 programme	4,06	3,57	4,68
	Information provided by the management boards of the programme	3,46	4,40	4,50
	Information and Communication tools available (reference doc, SharePoint, web, etc…)	3,80	3,57	4,59
	Efficiency of administrative procedures carried out by the EDUC	3,44	3,29	4,27

Table 13. Summary of the average scores given by the PhD candidates, the PhD graduates and the lecturers to the academic management of the IH20 Programme. Bold font indicates the alternative questions posed to the lecturers.

On an analysis of each concept, other trends can be drawn as follows:

- The work of the Academic Commission and the Administrative staff are two elements receiving very positive scores by the three groups. It is important to highlight that since the academic management of the programme is performed by a mixed research institute where the research teams are the same as the programme teams, the administrative tasks are speedier and more unified (pre-doctoral contracts, tests and sampling, travel grants, publications, etc.).

- Other aspects that obtained positive scores, especially by the lecturers and partially by the PhD graduates, relate to the programme information. On the contrary, PhD candidates did not give positive scores to this aspect. In spite of the efforts made for the development of the "Reference Document" and the availability of a public access space to the programme's information (SharePoint), the fact is that PhD candidates tend to solve their queries directly with the coordinator. This fact raises the need to reconsider the role of Mentors, who are basic intermediaries but require internal rethinking.
- An aspect that received lower scores (3.3-3.5) from PhD candidates and PhD graduates relates to the formalities with EDUC, leading to the need to reconsider the reinforcement of the central services that ultimately manage the various formalities required from the Academic Commissions.

- Finally, the aspect that requires the highest level of attention of the ACDP and the lecturers is the scores given to dedication and availability of Mentors and Directors. This is the aspect with the lowest scores (3.3-3.9), especially given by the PhD graduates, which is in agreement with the scores provided in the general SGIC survey, where these were slightly lower. In any case, as section 4.1 explained, such scores are in opposition to the high level of satisfaction reported in the general survey (see Table 12) and in the programme-specific survey (see Table 13).

4.2.2. Specific Training Programme

The scores obtained for the various activities of the Specific Training Programme (Table 14) are very positive, generally speaking (mean overall score: 4.38; mean scores of 92% of the items >4). Nevertheless, the differences found between the scores given by each group encourage a detailed analysis with the purpose of proposing potential improvements for the design and development of these activities. The following are some of the most relevant findings deriving from the aforementioned analysis:

- With regards to seminars (see 3.2.1), the most interesting fact amongst the scores provided here is the opinion of a group of PhD candidates on the types of the topics of these study activities. This appears to be an aspect that would benefit from improvement and so it should be taken into account for future programmes.
- The assessment of specialised courses shows very positive scores, except in terms of their being suitable for the purposes of thesis. This aspect was given the lowest score by the PhD candidates (3.89). Nevertheless, as it is scored under the following item, the candidates can freely select the courses they prefer for each thesis, whether they are organised by the programme or any others, provided that they have been authorised by the Director and Mentor.
- PhD Sessions are a compulsory activity for all PhD candidates where an annual follow-up of their progress is carried out. These received very similar scores from PhD candidates and PhD graduates (ca. 4). This activity has been highly recognised by lecturers of other programmes of the UC who are involved in the Specific Training Committees, which is an aspect that grants a higher value to the follow-up of the training process.
- The requirement of delivering congress presentations was supported by all the groups, who scored them very positively on account of their being very beneficial for the PhD candidate training. An interesting point, however, is the fact that the lowest score given to interest and "suitability of the selected congresses" was that of the PhD candidates (4.11). This finding should be analysed by Mentors and Directors together.
- With regards to the candidates being required to have two indexed publications prior to the deposit of their thesis, all three groups provided the highest scores. On the other hand, the scores provided by PhD candidates (3.77) for the "Suitability of the requirement to the objectives of the doctoral studies" were striking. This is not the case of the PhD graduates, whose opinion is much more positive (4.67).

- And finally, all groups supported the involvement of PhD candidates in other competitive projects to help them supplement their training. However, in view of the lowest scores given by some PhD candidates (3.84), it is essential to come to an a priori agreement about the length of such involvement.

SUMMARY OF THE SCORES AWARDED TO THE ACADEMIC MANAGEMENT AND THE SPECIFIC TRAINING PROGRAM			PhD students	PhD graduates	Lecturers
2. SPECIFIC TRAINING PROGRAM	18 h Seminars	Interest of the activity for the PhD studies	3,94	4,14	4,64
		Coverage of subjects for the various lines of research	3,37	4,00	4,27
		Diversity of topics in relation to the lines of research	4,06	4,71	4,58
	2 Specialisation courses	Suitability of the courses in relation to the research/ **Compulsory attendance to at least 2 courses**	3,89	4,00	4,67
		Importance of the student's own selection of the preferred courses.	4,15	4,43	4,69
	PhD Sessions	Structure and objectives of the activity	4,00	4,00	4,69
		Interest for a follow-up of the study and research programme	3,90	4,00	4,75
	2 oral presentations in congresses	Suitability of the selected congresses / **2 Compulsory presentations in congresses**	4,11	4,83	4,79
		Importance of the participation of PhD students as speakers	4,62	5,00	4,90
	Publications 2 SCI (1Q1)	Importance of the requirement for the research career (e.g. postdoc.)	4,52	4,67	4,83
		Suitability of the requirement to the objectives of the doctoral studies	3,77	4,67	4,50
	Competitive Project	Interest of the activity for the scientific and technological qualification	4,23	4,50	4,54
		Adjustment of the duration of complementary works to the training programme that was initially established	3,84	4,29	4,68

Table 14. Summary of the average scores given by the PhD candidates, the PhD graduates and the lecturers to the Specific Training Programme. Bold font indicates the alternative questions posed to the lecturers.

4.2.3. Overall Satisfaction

Following the assessment of the various concepts, the last question of the survey was a general question targeting the opinion of the various groups as to their level of overall satisfaction with the programme, with the results being very positive (Table 15). The group that shows the highest level of satisfaction is the lecturer group. The PhD candidates gave an average score which was consistent with the score given for the SGIC survey (4.17), which is less positive than that of the lecturers and the PhD graduates, placed between them (Table 15).

In principle, these scores indicate that the outcomes for the first cycle, which was immersed in the process of implementation of the PhD School and the new third-cycle training system at the national level, have been quite positive. Nevertheless, there is still room for improvement given the initial objective set, i.e. excellence.

SUMMARY OF THE SCORES AWARDED TO THE ACADEMIC MANAGEMENT AND THE SPECIFIC TRAINING PROGRAM OF THE IH2O PROGRAMME	PhD Students	PhD Graduates	Lecturers
3. Overall satisfaction with the Doctorate Programme	4,01	4,43	4,71

Table 15. Summary of the average scores given by the PhD candidates, the PhD graduates and the lecturers to the overall satisfaction with the IH20 programme.

4.3. PhD graduates

The ultimate purpose of every training programme is to have all its PhD graduates acquire the competences set out in the programme to allow them to pursue their professional careers. The IH2O Programme attempts for the PhD students to be trained with the ultimate objective of their development of a professional career as Doctors through: research and transfer within public research agencies and public and private technology centres; specialised professional activities; administrative positions and university lecturing.

The outcomes of the first academic cycle (2014-20) confirm compliance with this objective, as the PhD graduates were **employed in 100% of the cases**. The activities being developed by the **16 PhD graduates** of the programme at the time of closing this report can be summarised in the following profiles:

- Researchers: This is the most prominent activity developed by the PhD graduates, with 10 of them being employed in this field (62.5%). The majority of them (6) is now working at the Universidad de Cantabria (5 in IHCantabria), whereas another 4 have joined prestigious research teams in their fields of specialisation in the United States (US Geologic Survey, Santa Cruz, CA), Austria (Innsbruck University), Ireland (University College of Dublin) and Brazil (Sta Catarina Federal University).

- Academic positions: Amongst the candidates who successfully completed their PhDs, there are now 2 new university lecturers (12.5%), one at the University of Costa Rica and another at Tanta University (Egypt). Both doctors received funding from their respective countries to support them in their doctoral studies at internationally-recognised centres.

- Professional activities: Three of the PhD graduates decided to pursue a business activity within the field of specialised consultancy (18.75%), all of them associated with overseas companies based in Germany (Deep Blue Globe), Australia (Bluecoast Consulting Engineers) and Italy (Angelantoni Test Technologies).

- Administrative positions: The other successful graduate of the programme chose the Spanish Central Administration (AGE) where he performs his functions as a member of the High Tech Staff of the Ministry of Transport.

4.4. Proposals for improvement

The assessments and comments received allowed for the creation of proposals that, on many occasions, have been discussed on a continued basis during the six years of existence of the programme, both during informative meetings with the Information Commission, and during the general meetings with PhD students and lecturers. These discussions were communicated to the CAPD and gave rise to specific solutions, which are recorded in its minutes or in the latest report of the SGIC (2018-19). The following points summarise them:

- A more precise definition of the roles of both the Mentor and the Supervisor, identifying their roles and the differences between both positions
- Consider potential exceptional situations for the application of the requirement of publishing two articles as main author in indexed journals (SCI) with one of them at least being issued during the first quartile (Q1).
- Ensure the use of the "Supervisory Commitment Agreement Document" and the "Training Program", which are documents exchanged between PhD candidates, Mentors and Supervisors as key elements for the management of the development of the various training activities (e.g. participation in projects) included in every thesis project.
- Propose training activities to cover the diversity of subjects and multidisciplinary approach of the programme in a more homogeneous way.

In view of the above findings, it seems clear that resuming some conversations on aspects such as the role of Mentors and Supervisors in the training process becomes necessary, with clarification of their responsibilities, or the adaptation of the training activities at times of change and emergence of new education formats (e.g. online). The impact of the current pandemic situation on some key training activities (e.g. congress involvement, stays and relocation training periods, etc.) also requires a deep analysis in order to improve the support to doctoral candidates who may find themselves in unexpected situations.

Following the conclusion of the first academic cycle (2014-20), it is time to introduce the relevant changes in order to continue to improve. This summary report is a basic instrument to support the formulation of potential amendments required in the Verification Report, which proves that there is room for improvement throughout the process of implementation of the new third-cycle studies at national level. For this adaptation process, we must take into consideration the change in the paradigm that is taking place in the field of access to research, also parallel to society in general.

The CAPD of the IH2O Programme chose to remain loyal to the initial proposal. This is the time to propose potential amendments. For this purpose, the Academic Commission created a work group that included young researchers and PhD graduates, whose proposals are a first approach to update the programme's Verification Report in preparation for the next academic cycle (2020-25).

5. CONTACT AND LINKS

5.1. Contacts

The following are the basic contacts:

PhD School (EDUC):

- Secretary: escueladoctorado@unican.es , +34 942 201296

IH2O Programme:

- Coordinator: José A. Juanes. juanesj@unican.es, +34 942 201616 ext 1405
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5.2. Programme Information

Please see below some links related to the units in charge of the doctoral programme's management, which provide all the information about it:

- General information on the IH2O programme. Page of the Universidad de Cantabria: https://web.unican.es/estudios/detalle-doctorado?p=185&a=2019
- Additional information. Page of the PhD School of the UC (EDUC): https://web.unican.es/centros/escuela-de-doctorado/Paginas/Doctorado-en-Ingenieria-de-Costas-Hidrobiologia-y-Gestion-de-Sistemas-Acuaticos.aspx
- Information on outcomes of the IH2O Programme. Page of IHCantabria: https://ihcantabria.com/formacion/ih2o-doctorado-en-ingenieria-de-costas-hidrobiologia-y-gestion-de-sistemas-acuaticos/

Additionally, a virtual space has been created to grant access to up-to-date information of the Programme by all the members and partners, through the IH2O folder on the *SharePoint* platform, which is accessible at the following link:

https://unican-my.sharepoint.com/:f:/g/personal/arriagaj_gestion_unican_es/EhWYe8PoztBCjL-6Qaix_BQBVJIeiEXH9OIeIngSH6MATg?e=BawjCT

The structure of files and sub files includes the following:

- **IH2O PROGRAMME**

  - **1. General Information**
    - Records of the ACDP
    - Documents
    - Templates
      - Student Forms
      - ACDP Forms
      - EDUC Forms
    - Presentations
    - ANECA follow-up

  - **2. PhD Sessions**
    - Scheduling

  - **3. Regulations**

With the support of:

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