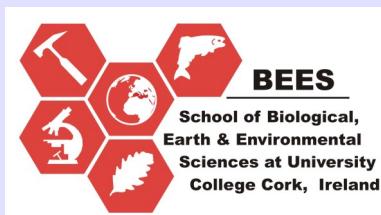


Aquaculture & Fisheries Development Centre
School of Biological, Earth & Environmental Sciences
University College Cork
Annual Report 2014





AFDC Strategic Vision

“To support, stimulate and promote the development of aquaculture and fisheries, thereby enabling these sectors to achieve their full socio-economic potential by utilising sustainable natural resources”



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EXECUTIVE SUMMARY

During 2014 the personnel profile of the centre included a Director, Dr Sarah Culloty, a Manager, Dr Maria O'Mahoney, five Principal Investigators in each of the four thematic research areas; Prof. Tom Cross/ Dr Phil McGinnity (Molecular Genetics of Aquatic Animals), Dr Sarah Culloty (Shellfish Health), Prof. Gavin Burnell (Aquaculture) and Dr Emer Rogan (Marine Mammals & Fisheries), 2 Senior Researchers, 1 Research Fellow, 5 Post-doctoral Researchers, 10 PhD students, 3 MSc student and 2 Research Assistants. During 2014, 6 PhD's were awarded to PhD students conducting research at the AFDC and a research MSc was awarded to 1 AFDC/School of BEES student. Two 4th year research dissertation projects and 1 MSc Marine Biology theses were conducted at the AFDC. A total of 29 publications in peer-reviewed journals were produced in addition to 1 book chapter and 1 published report. These included articles in journals such as Molecular Ecology, PLoS One, Aquaculture, Journal of the Marine Biological Association of the United Kingdom and Diseases of Aquatic Organisms. Two oral presentations were given at international conferences.

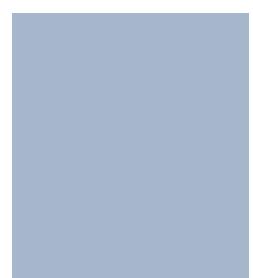
Four new research projects with a combined funding value of over €475,183 started in 2014. Sixteen research projects with a combined value of €6.7m were on-going during 2014. The profile of research funding at the AFDC is an amalgamation of 92.8% Exchequer funding and 7.1% EU funding. The research capacity, diversity and strengths continue to grow through new projects involving national and international collaborations and activities which expand the profile of expertise at the centre. One of the main priorities of the AFDC is to provide continued support to industry and to enhance industry. The AFDC also continues to play an important role in the education of undergraduate and postgraduate students within the School of BEES.



Dr Sarah Culloty
Director



Dr Maria O'Mahoney
Manager



FACILITIES & SPECIFICATIONS

The Aquaculture & Fisheries Development Centre (AFDC) is a 1200m² research facility embedded within the School of Biological, Earth & Environmental Sciences (BEES). The facility includes recirculating fish and shellfish systems, laboratories (Wet and Dry) and offices. The tank rooms are equipped with marine and freshwater tropical marine system recirculation units, broodstock conditioning units, shellfish on-growing units, filter-feeder broodstock conditioning units, a larval culture system and live food culture facilities. Seawater (Grade A) is delivered to on-site and stored. The AFDC has facilities seawater filtration and UV treatment if required.

The AFDC is authorised to operate under the European Communities Health of Aquaculture Animals and Products Regulations 2008 (Authorisation number: 006 / FHA).

The indoor recirculation units consist of mechanical and biological water filtration, water treatment systems involving UV sterilisation and ozonation, and temperature control conditioning units to enable full control of environmental parameters/variables. Light intensity and photoperiod are available in some areas and may be locally controlled on a number of discrete systems. A range of tank designs and sizes are incorporated which allow fish to be held at each life cycle stage, and also for the production of research specific systems/units to suit almost any form of aquatic research with experimental-scale trial replication. The infrastructure at the AFDC also allows for Algal culture and live feed production areas are available to support the culture of many species through their larval stages. A recirculating shellfish nursery system, broodstock holding/conditioning unit, thermally controlled hatchery and live feed production units are custom designed to provide a series of systems suitable to the needs of a number of shellfish species. The two tank rooms of the AFDC are fully backed-up with a 50KVA Generator fitted with an Automatic transfer Switch (ATS) and Digi-dialler. The dedicated AFDC Laboratory houses water quality analysis equipment, a Beckman Z2 coulter counter (particle size analyser) and drying oven as well as the standard laboratory equipment. On site laboratories provide dedicated research facilities and technical support essential to research at the AFDC.

Additional laboratory facilities available at the AFDC include:

- Molecular genetics laboratory
- Water quality testing
- Wet lab/post mortem room
- Tissue culture laboratory
- Histology and Immunology laboratory

Focus On Aquaculture Research

Sea Urchin Immunology (PI Prof. Gavin Burnell, PhD Student Ashlie Cipriano)

Although the initial purpose of the Crawford Hayes funded sea urchin immunology research project was to examine the effects of prebiotics and probiotics on the purple sea urchin, *Paracentrotus lividus*, as the project evolved it became much more about working with *P. lividus* as a species and the difficulties faced studying its immune response to various factors. While it is important to understand the necessity of aquaculture and its role in our global culture, it is also important to understand the processes involved in culturing an organism for mass production and developing innovative techniques for mitigating the consequences of high population densities. Upon commencement of the research, the difficulties of sampling individuals became clear and placing lone urchins in individual tanks was impractical. Therefore a tagging experiment was deemed necessary, and Passive Integrated Transponder (PIT) tagging of individuals was the most successful of the methods employed in both the laboratory and the field. More specifically, once an initial adaptation period is allowed, tagging shows to cause limited mortality. The immune system of sea urchins was then investigated, and several immunostimulants were utilised in pilot studies. These results were presented at the Asia-Pacific Aquaculture in 2013 conference in Vietnam. At the end of the presentation, an audience discussion highlighted the possibility that feeding sea urchins *Laminaria* sp. during the experiment may have an immunostimulatory effect on the urchins which may mask the results of the immunostimulants

we were using experimentally. As such the basis of the next study had been established. Two experimental diet treatments, *Laminaria digitata* and *Mytilus edulis*, were tested on *P. lividus* and compared to a starvation treatment. It was found that *Laminaria* did in fact have an effect on host response, as did *M. edulis*, although to a lesser degree. The results highlighted that animals should not be fed *Laminaria* sp. during short-term experiments. Further studies are looking at the impact of transport and pathogens on immune parameters and how immunostimulants may mitigate these impacts.

Integrated Multi-Trophic Aquaculture (PI Prof. Gavin Burnell, PhD student Daryl Gunning)

PhD student, Daryl Gunning, completed his first year of an Irish Research Council Employment-Based PhD with the Daithi O'Murchu Research Centre (DOMMRC) and University College Cork in 2014.

At the beginning of 2014, the anaesthesia of *Holothuria forskali* (cotton-spinner sea cucumber) was trialled. One might wonder why would you anaesthetize a sea cucumber?

First of all, the assessment of a sea cucumber's growth rate is hampered by the manner in which they distort their body shape and intake/pass water. This results in a fluctuation in body weight and length, making



PhD student Ashlie Cipriano at work in the AFDC laboratory



***P. lividus* and the PIT Tag Reader**

growth measurements difficult. Secondly, anaesthesia is often used as a method for reducing stress when tagging animals. I wanted to assess the applicability of this procedure to sea cucumbers.

Three anaesthetizing agents were trialled, MgSO₄, MgCl₂, and KCl. The weight and length of sea cucumbers were measured a number of times prior and post anaesthesia. It was found that when treated with 1%, 1.5%, and 2% MgCl₂, the variation in mean weight measurements was significantly reduced. There were no significant reductions in weight variation for all concentrations of MgSO₄ and KCl. There was no significant reduction in length variations for any of the anaesthesia agents trialled.

A tagging trial was also performed on *H. forskali*. The tag used, was a novel PIT tag, designed for use on fish, that is only 1.4mm x 8mm in size. Unfortunately, these trials were not successful, with all tags being lost within 2 months. The hunt for a successful sea cucumber tagging method continues.

During the summer of 2014, a very successful method of growing March Samphire (*Salicornia europaea*) was trialled. This growing system is known as aeroponics; the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. Plants grown in this unit grew significantly more than those receiving a hand-watering regime.



The sea cucumber, Holothuria forskali



An aeroponics unit



March Samphire (*Salicornia europaea*) cultures in an aeroponics unit

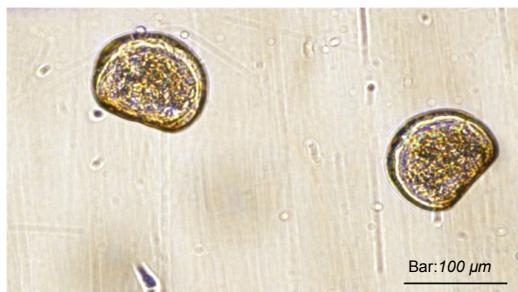
Cost Action FA1305: The EU-Aquaponics Hub- Realising Sustainable Integrated Fish and Vegetable Production for the EU (Prof. Gavin Burnell)

Prof. Gavin Burnell is one of the two Irish delegates selected by Enterprise Ireland to be on the Management Committee of this COST network which started in January 2014. Prof. Burnell is also a member of WG4 "Aquaponics Knowledge Transfer, Outreach and Training: The EU Aquaponics resource from the present into the future".

The main objective of the Action is to create a unique pan-European platform to facilitate the foundation of a competitive aquaponics sector in Europe. The EU Aquaponics Hub will act as a forum to assemble EU and world-renowned expertise in the new field of aquaponics drawing on the EUs excellent expertise in aquaculture and hydroponics. By combining the skills and expertise of its members, the EU Aquaponics hub network will significantly promote and build aquaponics capacity and facilitate the expansion of aquaponics science and technology in the EU. For further information see http://www.cost.eu/COST_Actions/fa/Actions/FA1305.

Focus On Shellfish Health Research

Herpes Virus in Irish Oysters and Identification of Resistant Stocks - HERPISH (PI Dr Sarah Culloty, Marie Curie Intra-European Fellow Dr Maria Prado-Alvarez)



D-larvae at 48 h post fertilization cultured in the AFDC facilities

Herpes virus is the main pathogen affecting production of the Pacific oyster worldwide. During 2014 the research activity related to the EU Marie Curie funded HERPISH project was mainly focused on the susceptibility of different stocks of oysters around the Irish coast to the ostreid herpes virus OsHV-1 and the selection of oysters with any sign of resistance to the viral disease for further genetic analysis.

The analysis of virus prevalence on oysters collected during summer 2013 in three locations differently affected by the ostreid herpes virus OsHV-1 consisted on the extraction of DNA and the

virus amplification by PCR. A collection of specific primers and sequencing technology was applied to oyster samples to identify the prevalence of the different virus variants. The relationship between environmental parameters, prevalence of virus infection and oyster mortality was established using statistical tools.

In order to identify resistant oysters, two experimental infections under controlled conditions were carried out in spat oysters and larvae, which are the most susceptible stages in the life history of the oysters. After the summer mortality event on 2013, a collection of spat oyster was transferred to the facilities at the AFDC where the experimental infection with purified virus was carried out. The system and requirements for oyster larvae production were settled up and a protocol for oyster larvae production was developed. Once the pure bred families were produced, larvae were also exposed to the viral suspension. Survivors from both experimental trials were used for RNA extraction and next generation sequencing (RNA-seq) to identify any differently expressed genes related to less susceptibility to OsHV-1.



Oyster trestles in Carlingford Lough

Opinion Piece: Experiences of a PhD Student with the Shellfish Productivity in the Irish Sea - Working Towards a Sustainable Future (SUSFISH) Project - (PI Dr Sarah Culloty, PhD Student (Dr) Maud Cross)

I graduated in 2014, having successfully defended my PhD thesis "Aspects of the biology of *Mya arenaria* and *Ensis* spp. (Mollusca; Bivalvia) in the Irish Sea and adjacent areas" in December 2013. This PhD was part of a 3 year INTERREG 4A Ireland-Wales "SUSFISH", project which aimed to assess the impacts of climate change on aquaculture and fisheries in the Irish Sea. I investigated aspects of the biology, health status and population genetics of two clam groups in the Irish Sea and neighbouring areas. Outputs during the 3 years included three peer-reviewed publications, and the opportunity to present results at a number of international conferences, including the European Marine Biological Symposium Conference, Edinburgh, Scotland (08/2010), where I won a prize for the Best Student Poster and the National Shellfisheries Association Conference, Baltimore, USA (03/2011), where I won a prize for the Best Student Presentation. I

relished the opportunity for networking and the opportunity to learn more about the field of marine biology.

One of the main positive factors of the PhD was the relationship with my supervisors and co-workers, in an encouraging research environment. During the PhD my colleagues in the AFDC were an excellent source of information and support. Communication with my principal supervisors (Dr Sarah Culloty and Dr Ruth Ramsay) was critical, and the direction of the project and the relevant investigation needed was continuously helped by a thorough and detailed research plan, regular updates and meetings, and indispensable feedback during the thesis write up. I thoroughly enjoyed every aspect of the PhD, from initial planning and field work, to laboratory research, attendance of conferences and writing, culminating in a successful viva and a joyful graduation day. A further publications is currently being prepared from the thesis.



Graduation Day: Dr Maud Cross (centre) with PhD supervisors Drs Sarah Culloty (left) and Ruth Ramsay (right)

Cost Action FA1301: CephsInAction (Dr Sarah Culloty and Dr Sharon Lynch)

On 1 January 2013, research the use of any of the about 700 extant species of “live cephalopods” became regulated within the European Union by Directive 2010/63/EU. The Directive establishes measures for the “protection of animals used for scientific or educational purposes”. Cephalopods are the sole invertebrate taxon to be included in this Directive. This marks a paradigm shift for invertebrates in EU, by covering the use of an entire class of Molluscs, namely “live cephalopods” (i.e. hatched juveniles and adults) in the legislation covering experimental procedures likely to cause pain, suffering, distress, or lasting harm. This means that, under the Directive and transposed national laws, cephalopods have the same legal status as vertebrates, in relation to their experimental use in research and testing. CephsInAction promotes training, dissemination, sharing of tools and knowledge to improve best practice in care and management of cephalopods utilized for scientific and/or educational purposes. It is aimed to foster multi-disciplinary and inter-species scientific exchanges to integrate knowledge on welfare practices.

Dr Sarah Culloty is vice-leader of working group 2 (WG2) "Stress and Disease" in the most common cephalopods *Sepia officinalis* and *Octopus vulgaris*. This working group will evaluate signs of stress, pain and suffering in those cephalopod species. In addition, the WG will investigate non-invasive diagnostic techniques and collate an atlas of disease and parasites in cephalopods. Dr Sharon Lynch is a participant in this action. For further information see <http://www.cephsinaction.org/>.

Partnership with the Sea Fisheries Protection Authority in Association with UCC (Dr Sarah Culloty)

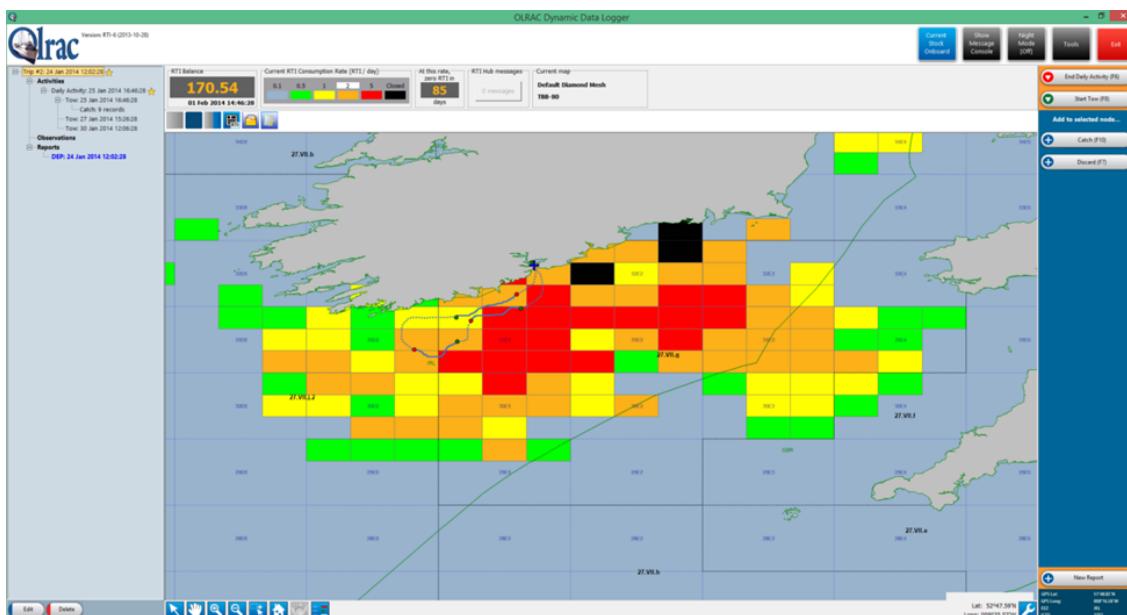
In 2014 an important new partnership commenced with the introduction of the Sea Fisheries Protection Authority Programme in Association with UCC. Within the AFDC and the School of BEES two Graduates Ms Tanya Slattery and Mr Paul Coleman were recruited to the programme. Both Tanya and Paul are based at the SFPA offices in Clonakilty and their role is to inform the conduct of shore line surveys, produce Sanitary Surveys and associated sampling plans for shellfish production areas in Ireland. Paul and Tanya are currently undertaking MSc's as part of this work.

Focus On Marine Mammals & Fisheries Research

Develop & Test a Suite of Measures to Contribute to Rebuilding Depleted Fish Stocks (PI Dr Emer Rogan, Postdoctoral Researcher Dr Sarah Kraak)

Dr Sarah Kraak, Postdoctoral Researcher with the Marine Institute Sea Change funded project “Develop and test a suite of measures to contribute to rebuilding depleted fish stocks” provides an overview of the main activities of the project and progress achieved.

The biggest part of the project has been devoted to the development, simulation testing, and discussing with the fishing industry and other stakeholders of a novel system for fisheries management called RTI – short for Real-Time Incentives. RTI is designed to incorporate a variety of biological and ecological targets and objectives in one spatially-based management measure. Fishermen no longer have to comply with a myriad of regulations that prescribe and prohibit. Instead, they have one account of fishing-impact credits of which the spending rate is determined by the time they spend in different “spending-rate areas”. In some areas (ecologically or biologically sensitive areas) they may pay 2 to 5 credits (RTI units) a day, and in other, less sensitive, areas they may only pay 1, 0.5 or even 0.1 RTI units a day. The RTI tariffs are shown on a tariff map and reflect the distribution of the fish and other features of the marine ecosystem that need protection. The tariffs can be updated within-year, at any chosen time scale, e.g. weekly (‘real-time’), to reflect changes in the relevant distributions. Users of different fishing gear get allocated different tariff maps, reflecting the differences in impact of the gears on the commercial resources and the ecosystem. This way, fishermen can run their business based on their own preferences and at the same time automatically avoid too high an impact on the commercial fish resources or the marine ecosystem.



Collaborator Olrac SPS, a South-African fisheries-software company, has produced the picture in their mock-up version of their implementation of RTI in their on-board software for fishers.

Focus On Molecular Genetics of Aquatic Animals Research

Beaufort Marine Research Award in Fish Population Genetics (*Prof Tom Cross - Grantee/ Dr Phil McGinnity - Principal Investigator, Senior Researcher Dr Jamie Coughlan, Senior Researcher Dr Tom Reed, Research Support Officer Dr Eileen Dillane, PhD Student Ciar O'Toole*)

New insights into the family biology of farm escaped salmon in the wild

This research was conducted under the Beaufort Marine Research Award in Fish Population Genetics funded by the Irish Government under the Sea Change Programme.

The farming of finfish in offshore aquaculture facilities poses a genetic threat to wild populations when escapes from such facilities occur. In Atlantic salmon farming operations, farm fish are often highly genetically divergent from local wild stocks and successful spawning of farm escapees in the wild has been demonstrated. Salmon populations are typically locally adapted to the unique conditions of the rivers in which they are born and themselves spawn as adults. Thus, one way gene-flow from farm to wild gene pools thus has the potential to dilute this local adaptation and may homogenise wild salmon populations. Moreover, outbreeding depression is predicted to result from hybridisation between farm and wild salmon, which may threaten the productivity of wild populations and their ability to cope with climate change and other anthropogenic threats.

In a new paper to be published in the prestigious journal *Heredity*, Reed et al. (*in press*) reanalyse data from (originally ground-breaking) experiments conducted jointly by Queen's University, Marine Institute and University College Cork in the west of Ireland (McGinnity et al. 1998; 2003), where pure farm, pure wild and hybrid Atlantic salmon families were artificially produced in a hatchery and then 'planted' as eggs in the wild. DNA fingerprinting techniques were used to subsequently assign sampled offspring back to their parents and hence group of origin, and farm-origin fish were found to have much lower survival rates in the wild than fish of wild parentage (with hybrids intermediate), suggesting a genetic basis to performance differences. However, kin structure was never accounted for in these original analyses, while variation in performance at the family level was never explored.

The new analysis shows that (a) the original results are robust to re-analysis using modern mixed-modelling techniques that account for this kin structure, and (b) that families vary enormously in their survival and growth in the wild, with some evidence that the variation in performance of farm families is lower than that of wild families. We also use these data to estimate crucial quantitative genetic parameters (heritability and genetic correlations) in a wild setting, using a recently developed Bayesian framework. The vast majority of heritability and genetic correlation estimates from salmonids derive from aquaculture or hatchery settings, which may be a poor surrogate for estimates of quantitative genetic variability in natural ecological settings. Thus, in addition to confirming previous results using modern, robust statistical techniques, we provide fresh



The trapping facility on the Srahrevagh River, Co. Mayo, Ireland

information that is vital for modelling the impacts of introgression by escaped farm salmon into wild populations. Our study is also one of the first to characterise evolutionarily-relevant quantitative variation in a wild fish population.

POSTGRADUATE STUDENTS GRADUATED IN 2014

4th Year Research Dissertations

1. Keaveny E. 2014. To determine the optimum method of processing scat samples while examining the diet composition of the Grey seal (*Halichoerus grypus*). Supervisor: Dr Sarah Culloty.
2. McKeown P. 2014. A comparison of methods to distinguish the blue and Mediterranean mussels. Supervisor: Dr Sarah Culloty.

MSc Marine Biology Theses

1. Laide C. 2014. The role of potential reservoirs in the transmission of herpes virus to oysters. Supervisor: Dr Sarah Culloty.

MSc Theses

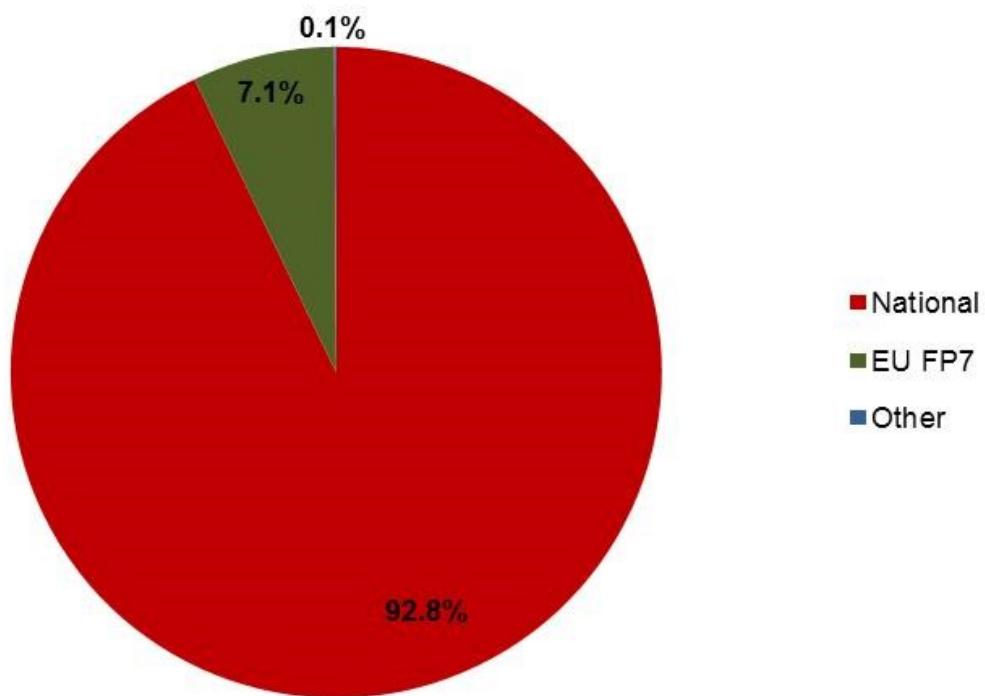
1. Luck C. 2014. A comparative study of the feeding ecology of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) in Ireland. Supervisor: Dr Emer Rogan.

PhD Theses

1. Cross M.E. 2014. Aspects of the biology of *Mya arenaria* and *Ensis* spp. (Mollusca; Bivalvia) in the Irish Sea and adjacent areas. Supervisors: Dr Sarah Culloty, Dr Ruth Ramsay (School of BEES).
2. Englund A.M. 2014. Acoustic behaviour, ecology and social structure of bottlenose dolphins (*Tursiops truncatus*, Montagu 1821) in the North Atlantic. Supervisors: Dr Emer Rogan and Dr Simon Ingram (University of Plymouth, U.K.).
3. Flannery G. 2014. Aspects of the biology of the parasite *Bonamia ostreae* with a view to gaining a greater understanding of how to alleviate its impact on the European flat oyster, *Ostrea edulis*. Supervisors: Dr Sarah Culloty and Dr Sharon Lynch.
4. Hernandez-Milian G. 2014. Trophic role of small cetaceans and seals in Irish waters. Supervisor: Dr Emer Rogan.
5. Pazhayamadom D.G. 2014. Application of signal detection methods to fisheries management system. Supervisor: Dr Emer Rogan.
6. O'Toole C. 2014. A study of the molecular variation of Atlantic salmon (*Salmo salar*) and Brown trout (*Salmo trutta*). Supervisors: Prof. Tom Cross & Dr Phil McGinnity.

RESEARCH FUNDING

During 2014, sixteen research projects to the value of €6.7m were on-going at the AFDC. New projects to the value of €475,183 started in 2014. National funding sources, primarily through the Government of Ireland but also including Inland Fisheries Ireland, Irish Research Council, National Parks and Wildlife Service and UCC's Crawford Hayes Fellowship accounted for 92.8% of the total research funding for 2014. European Union funding, through the Framework 7 funding programme, accounted for 7.1% of funding at the AFDC reflecting the lag in funding available during the transition from the FP7 funding programme to the Horizon 2020 Research and Innovation funding programme. During this time, the AFDC has endeavoured to secure additional funding for research from available sources, hence the notable increase in national funding in recent years. A further 0.1% of funding was received from Invest Northern Ireland.



Allocation of research funding (%) on-going during 2014 from different funding bodies.

ON-GOING & NEW RESEARCH GRANTS DURING 2014

2014 Funding

Burnell G.B. Cost Action FA1305: The EU-Aquaponics Hub- Realising Sustainable Integrated Fish and Vegetable Production for the EU. European Cooperation in Science and Technology (COST), 2014-2018.

Culloty S.C. Reducing the impact of pathogens and disease in the Irish oyster industry to support the sustainability and growth of the sector (REPOSUS). Irish Government Department of Agriculture, Food and the Marine, 2014-2017. €291,157.

Culloty S.C. Address the Periwinkle culture issue. Invest Northern Ireland, €6,500.

Culloty S.C. Provision of sanitary survey reports and associated sampling plans for shellfish production areas in Ireland. Sea Fisheries Protection Authority, €63,763.

Culloty S.C. SFPA Secondment Programme. Sea Fisheries Protection Authority, €63,763.

McGinnity P. Assessment of the provenance of salmon from the River Shannon. ESB, 2014. €50,000.

2013 Funding

Burnell G.B. The ecological and economic contribution of the detritivore component to novel marine Integrated Multi-trophic Aquaculture (IMTA) systems. Irish Research Council, 2013-2017. €32,000.

Culloty S.C. Herpes virus in Irish oysters and identification of resistant stocks (HERPISH). FP7 Marie Curie Intra-European Fellowship, 2013-2015. €191,360.

Culloty S.C. Cost Action FA1301: CephSInAction. European Cooperation in Science and Technology (COST), 2013-2017.

2012 Funding

Culloty S.C. Bridging the gap between science and producers to support the European marine mollusc production sector (EUROSHELL). EU FP7 Funding, 2012-2014. €18,168.

Burnell G.B. & Culloty S.C. The effect of pre- and probiotics on marine invertebrates in aquaculture. School of BEES Crawford Hayes Scholarship, 2012-2015. €72,000.

2011 Funding

Burnell G.B. Aqua-tnet3: European thematic network in the field of aquaculture, fisheries and aquatic resources management. European Commission Lifelong Learning Programme, 2011-2014. €10,400.

Culloty S.C. Management of infectious diseases in oysters and mussels in Europe (BIVALIFE). EU FP7 Funding, 2011-2014. €256,410.

Rogan E. The genetic structure, foraging ecology, movement patterns and habitat choices of bottlenose dolphins (*Tursiops truncatus*) along the west coast of Ireland. National Parks and Wildlife Service, 2011-2015. €45,000.

Rogan E. The genetic structure, foraging ecology, movement patterns and habitat choices of bottlenose dolphins (*Tursiops truncatus*) along the west coast of Ireland. School of BEES Crawford Hayes Scholarship, 2011-2015. €72,000.

2010 Funding

McGinnity P. & Cross T.F. IFI Strategic Partnership Project – Setting Conservation Limits. National Salmon Conservation Stamp. IFI Research Partnership Project, Inland Fisheries Ireland. €80,000.

2008 Funding

Burnell G. & Cummins V. Beaufort Marine Research Award: Ecosystem Approach to Fisheries

Management. Irish Government NDP administered by the Marine Institute, 2008-2015, €1,860,004.

Cross T.F. & McGinnity P. Irish cod breeding programme. Marine Institute, 2008-2015, €213,088.

Cross T.F. & McGinnity P. Beaufort Marine Research Award: Fish population genetics. Irish Government NDP administered by the Marine Institute, 2008-2015. €2,710,236.

Rogan E. & Codling E. Develop and test through simulation a suite of measures that will contribute to rebuilding depleted fish stocks in waters around Ireland. Marine Institute, 2008-2014. €627,633.

PUBLICATIONS

Peer-Reviewed Publications

1. Aykanat T., Johnston S.E., Cotter D., **Cross T.F.**, Poole W.R., Prodöhl P.A., Reed T.E., Rogan G., **McGinnity P.** & Primmer C.R. 2014. Molecular pedigree reconstruction and estimation of evolutionary parameters in a wild Atlantic salmon river system with incomplete sampling: a power analysis. *BMC Evolutionary Biology*, 14: 68, doi:10.1186/1471-2148-14-68.
2. Banguera-Hinestrosa E., Evans P.G.H., Mirimin L., Reid R.J., Mikkelsen B., Couperus A.S., Deaville R., **Rogan E.**, Hoelzel A.R. 2014. Phylogeography and population dynamics of the white-sided dolphin (*Lagenorhynchus acutus*) in the North Atlantic. *Conservation Genetics*, 15 :789-802.
3. **Brown S.**, Reid D. & **Rogan E.** 2014. Characteristics of Fishing Operations, Environment and Life History Contributing to Small Cetacean Bycatch in the Northeast Atlantic. *Plos One*, DOI: 10.1371/journal.pone.0104468.
4. **Cross M., Lynch S.A.**, O' Riordan R.M. & **Culloty S.C.** 2014. A health status of clams, *Mya arenaria* and *Ensis siliqua*, in the Irish Sea. *Journal of Invertebrate Pathology*, doi: 10.1016/j.jip.2014.11.001.
5. **Cross M.E.**, O'Riordan R.M., & **Culloty S.C.** 2014. The reproductive biology of the exploited razor clam, *Ensis siliqua*, in the Irish Sea. *Fisheries Research*, 150, 11-17.
6. Cronin M., Gregory S. & **Rogan E.** 2014. Moulting phenology of the harbour seal in south-west Ireland. *Journal of The Marine Biological Association of The United Kingdom*, 94 :1079-1086.
7. Dalton C., O'Dwyer B., Taylor D., de Eyto E., Jennings E., Chen G., Poole R., **Dillane M. & McGinnity P.** 2014. Anthropocene environmental change in an internationally important oligotrophic catchment on the Atlantic seaboard of western Europe. *Anthropocene*, 5: 9-21.
8. **Darmody G., Maloy A.P., Lynch S. A., Prado-Alvarez M.**, Cotterill J., Wontner-Smith T. & **Culloty S.C.** 2014. Tissue targeting of the European flat oyster, *Ostrea edulis*, using microencapsulated microbeads as a biological proxy. *Aquaculture International*, DOI 10.1007/s10499-014-9842-y.
9. de Eyto E., White J., Boylan P., Clarke B., Cotter D., Doherty D., Gargan P. , Kennedy R., **McGinnity P.**, O'Maoiléidigh N. & O'Higgins K. 2014. The fecundity of wild Irish Atlantic salmon *Salmo salar* L. and its application for stock assessment purposes. *Fisheries Research*, 164: 159-169.
10. Engelsma M.Y., **Culloty S.C., Lynch S.A.**, Arzul I. Carnegie R.B. 2014. Bonamia parasites: a rapidly changing perspective on a genus of important mollusc pathogens. *Diseases of Aquatic Organisms*, 110 (1-2): 5-23.
11. Fernández R., Pierce G.J. MacLeoda C.D. Brownlow A., Reid R.J., **Rogan E.**, Addinka M., Robert Deaville R., Jepson P.D. & Begoña Santos M. 2014. Strandings of northern bottlenose whales, *Hyperoodon ampullatus*, in the north-east Atlantic: seasonality and diet. *Journal of the Marine*

- Biological Association of the United Kingdom, 94 (06): 1109-1116.
- 12. **Flannery G., Lynch S.A., Carlsson J., Cross T.F. & Culloty S.C.** 2014. Assessment of the impact of a pathogen, *Bonamia ostreae*, on *Ostrea edulis* oyster stocks with different histories of exposure to the parasite in Ireland. *Aquaculture*, 432 :243-251.
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Book Chapters

1. Carlsson J., Cross T.F., McGinnity P., Prodöhl P. & McDevitt A. 2014. The use of genetics to infer the origins of the terrestrial and freshwater elements of the Irish fauna. In: Sleeman P., Carlsson J. & Carlsson J.E.L. (eds). Mind the Gap II: new insights into the Irish postglacial. Irish Naturalists' Journal, Belfast, 150 pp.

Non-Peer Reviewed Publications

Published Reports

1. Cronin M., Gosch M., Jessopp M., Luck C., Rogan E. & Reid D. 2014. A pilot study of seal predation on salmon in selected Irish rivers and estuaries. IFI/2014/1-4178. Inland Fisheries Ireland, Dublin.

CONFERENCE PRESENTATIONS

Oral Presentations

1. Gunning, D., Hughes A., Loucaidis A., Rebours C., Israel D., Attwood D., Kletou D., Angel D., Johansen J., Brunner L., Chiantore M., Co R., Atack T. & Speirs, W. 2014. Implementation of IMTA systems for different habitats in Europe. Session: Beyond Monoculture (The EU IDREEM Project). Aquaculture Europe 2014, 14-17th October 2014, Donostia - San Sebastian, Spain.
2. Gunning D., Harman L., Kiely M., Nunan R., Jones P., Horgan B. & Burnell G. 2014. Designing a marine aquaponics (maraponics) system to model IMTA. Aquaculture Europe 2014, 14-17th October 2014, Donostia - San Sebastian, Spain.

AFDC PERSONNEL

Principal Investigators



Dr Sarah Culloty, Director of the AFDC is PI with the Shellfish Health research group and Lecturer with the School of BEES.



Prof. Gavin Burnell is PI with the Aquaculture Research Group. Gavin is also Acting Head of the School of BEES and Acting Head of Zoology.



Professor Tom Cross, is PI with the Molecular Genetics research group and Professor Emeritus with the School of BEES.

Dr Emer Rogan is PI with the Marine Mammals and Fisheries Research Group and Lecturer with the School of BEES.



Dr Phil McGinnity is the Beaufort Marine Research Award Principal Investigator with the Molecular Genetics research group.



Prof. John Davenport is Professor Emeritus with the School of BEES and has a particular interest in aquaculture and the environment.

Manager



Dr Maria O'Mahoney is Manager of the AFDC. Maria's research background is in the application of novel technologies to the aquaculture of sea urchins and abalone.

Researchers



Dr Jamie Coughlan is Senior Researcher with the Beaufort Fish Population Genetics project with the Molecular Genetics of Aquatic Animals.



Dr Thomas Reed is Senior Researcher with the Beaufort Fish Population Genetics project with the Molecular Genetics of Aquatic Animals.



Dr Sharon Lynch is Research Fellow with the Shellfish Health Research Group working on a range of projects within the group.



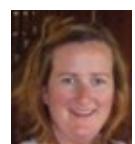
Dr Patricia Breen is Postdoctoral Researcher with the Beaufort Ecosystem Approach to Fisheries Management project with the Marine Mammals & Fisheries Research Group.



Dr Susie Brown is Postdoctoral Researcher with the Marine Mammals and Fisheries Research Group working on the Beaufort EAFM project.



Dr Sarah Kraak, Postdoctoral Researcher with the Marine Mammals and Fisheries Research Group, working on the SeaChange project.



Dr Eileen Dillane is Postdoctoral Researcher with the Molecular Genetics of Aquatic Animals Research Group.



Dr Maria Prado Alvarez, is the Marie Curie Intra-European Fellow with the Shellfish Health Research Group working on oyster herpes virus.



Deepak George Pazhayamadom is a PhD student with the Marine Mammals and Fisheries Research Group working on the application of Signal Detection Methods to the Fisheries Management.



Anneli Englund is a PhD student with the Marine Mammals and Fisheries Research Group working on vocalisations in marine mammals.



Gema Hernandez-Milian is the Beaufort EAFM PhD student with the Marine Mammals and Fisheries Research Group.



Grace Flannery is a PhD student with the Shellfish Health Research Group. Grace's research is part of the EU FP7 OYSTERECOVER project.



Maud Cross is a PhD student with the Shellfish Health Research Group. Maud's research is part of the EU FP7 SUSFISH project.



Amy Geraghty is a PhD student with the Shellfish Health Research Group. Amy is researching the health status of Irish waters in marine reserve and non-marine reserve areas.



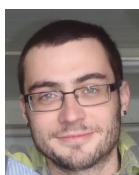
Ashlie Cipriano is a PhD student with the Aquaculture Research Group. Ashlie's research investigates the effect of prebiotics and probiotics on marine invertebrates in aquaculture.



Milaja Nykanen is a PhD student with the Marine Mammals and Fisheries Research Group. Milaja's research investigates coastal bottlenose dolphins in Western Ireland.



Amy O'Reilly is a PhD student with the Shellfish Health Research Group. Amy's research is part of the EU FP7 funded BIVALIFE project.



Daryl Gunning is a PhD student with the Aquaculture Research Group. Daryl's research is based on IMTA.



Elaine Brennan is conducting an MSc by research with the Shellfish Health Research Group.

Paul Coleman is conducting an MSc as part of the secondment programme in partnership with the SFPA in Clonakilty.



Tanya Slattery is conducting an MSc as part of the secondment programme in partnership with the SFPA in Clonakilty.

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