

EMFF Operational Programme 2014-2020 Seafood Processing Development Measure

BIM Seafood Technical Services

Knowledge Gateway Scheme Work Programme Projects

Final Report 2021

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/DIS-BG020-BR016
NAME OF PROJECT: **Aquaculture Accelerator**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

1. To introduce and develop a comprehensive communication strategy outlining and encompassing a clear and progressive plan in respect of Ireland's ambition to be a global destination for aquaculture enterprises with international potential buoyed by our positive start-up environment and reputation.
2. Create a national focus bringing together and connecting all those who are involved in the nurturing of aquaculture innovation, e.g. universities, incubators, research centres, state bodies etc. This will involve introducing a comprehensive outreach program to an All-Ireland aquaculture community in the first instance providing a coordinated and clear strategy of engagement.
3. Find, develop, attract, support and nurture aquaculture talent in Ireland, seeking to develop the industry so it can compete globally. Develop and promote a significant and specific aquaculture investment program supporting projects with real commercial potential. This will provide them with the capital necessary to scale so as to deliver on this overall initiative. The development of an "Ireland Aquaculture Fund" of between €5-€10M will send a clear message to the Irish Aquaculture and global community of Ireland's clear intent and ambition to grow the industry in Ireland and for the global community to recognise Ireland as an attractive location to build a global aquaculture business.
4. Roadshow – This will start off with a series of regional stakeholder meetings, leveraging BIM's current network, outlining the purpose of the initiative, its ambition, its objectives and the introduction of a global development program for aquaculture talent and technology that will be based in Ireland. We will introduce a resource (Aquaculture Development Coordinator) dedicated to spending time supporting, educating, connecting and managing all contacts and relationships with potential Irish talent/start-ups, the community at large and key stakeholders. A very comprehensive and proactive engagement with students and universities will be key to the future success of this initiative. It is proposed that this will contribute to an Entrepreneurial module in the BIM Higher Diploma in Aquaculture Business running at Carlow Institute of Technology to help support and encourage students seeking roles within the industry.
5. Dealflow Development - Identifying, reviewing, nurturing and developing indigenous talent is an important strategic part of this Irish initiative. Additionally, we will seek to attract global entrepreneurs who are not necessarily ready for a full accelerator but are seeking opportunity globally to develop their business in locations where the right support is available. This cross pollination of ideas, culture and differing levels of experience is a healthy environment for developing talent and establishing opportunities for Irish aquaculture. BIM will work with other Irish government agencies to utilise all contacts and networks to identify, develop and engage innovative Irish aquaculture ideas, companies and start-up talent across the whole value chain.
6. Sector Investment (Ireland Aquaculture Fund) - Key to the success of this initiative will be access to capital and Ireland is long overdue a specific investment focus to support the potential of Irish Aquaculture. The creation of an Irish Aquaculture Fund of €5-€10M by the contracted company is essential, funded possibly by EI/Irish Strategic Investment Fund. BIM will drive this initiative from a policy/public body perspective to drive the development in the industry. A company will be recruited by BIM with experience on aquaculture accelerators programmes and investment experience this will dovetail the requirement of the fund to find and develop solid investment opportunities. This will also attract other potential investors to co-invest in projects growing the Irish reputation within the global aquaculture community. This "Ireland Fund" would be deployed over a 3-4-year period and would be restricted to Irish innovation / start-ups and also those international start-ups who set up in Ireland to

build their technology here given the availability of capital, support and infrastructure required to develop a globally focused company. A campaign to promote the availability of this “Ireland Fund” will be an important part of this overall initiative to attract talent to Ireland and into the industry.

7. Workshops and Development Initiatives - The long-term strategy here will be the development and fostering of local aquaculture talent and attracting other crucial disciplines e.g., engineering, data, coding and financial skills to the industry in order to build sustainable global businesses into the future. To speed up the development process there are many ways to develop dealflow and identify talent Company Building/Innovation Challenge/Aquaculture Hackathon.
8. To develop and bring a sense of national awareness and global interest in Irish Aquaculture and its strategic development the introduction of a one-day Irish National Aquaculture Event involving all stakeholders in the industry will be introduced to the Irish event calendar. This event will culminate in the presentation of several key awards similar to that of the UK Aquaculture Annual Event. It would be proposed that this similar type of event take place circa February/March 2021, to allow time to develop some momentum and progress in building a coordinated development initiative.
9. An Aquaculture workshop will be held over a 2-week period (target date October 2021) and will involve local and international mentors (panel to be selected based on types of people/technologies chosen for the workshop) who will provide subject matter expertise guidance and input to help further develop each entity/concept.

Objectives

The overall objective will be to create Ireland as a global centre for aquaculture innovation and provide an environment for companies to grow and develop in this sector. One critical area associated with this programme is the establishment of an ‘Ireland Aquaculture Fund’ of private investment for start-up companies in the aquaculture sector. It is planned that Hatch will begin development of this fund in 2021 and significant preparatory work has already been conducted. This will provide financial assistance for Irish companies in this sector in create less reliance in direct State supports. The workshop element of this programme is envisaged to continue if funding is available, but the overall objective is to support the establishment of a clear pipeline for Irish start up in the field of services to the National EU and global aquaculture industry. The successful establishment of the fund will generate an independent mechanism to support aquaculture start -ups.

Budget	€250,000
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Achievements/Spend

To date this programme has conducted three Innovation Studios and one full aquaculture accelerator programme with project contractors Hatch Ltd. A total of 32 companies have been brought through the process. This has generated a total of 105 new jobs and raised over c.€10m in funding. It has also created significant awareness of the potential of the aquatech opportunity in Ireland and is a now key recommendation of the Food Vision 2030 strategy. *‘Attract global investment in aquaculture technology. Promote Ireland as a knowledge base for aquaculture technology and research to attract investment to our knowledge base.’*

- In 2020 due to the demand from the increasing number of start-up aquatech companies, a full time Community Manager for Ireland was appointed with the contractor, Hatch Ltd. The Community Manager in 2021 already achieved over 50 new applications for the Innovation Studio (the highest number achieved since the programme started) and established links with State Agencies, universities and private investors.

- Members of the Hatch team contributed in terms of mentoring and lecturing to the Entrepreneurial module in the BIM Higher Diploma in Aquaculture Business. This is part of overall strategy to develop a community of enterprises dedicated to the growth of the aquatech sector in Ireland.
- A total of 54 applications were received for the 2021 Innovation Studio for the 10 available positions on the programme. The selected 10 companies attended the RDI Hub in Killorglin for the two-week intensive programme. Three of these companies have received positive feedback from potential investors.
- In addition to the Innovation Studios a significant amount of work has been put into the generation of an Irish Aquaculture Fund. Primarily through the Hatch Global Fund it is the intention to have an initial dedicated fund of c.€10m available to provide finance to support increasing demands from the aquatech sector in Ireland. In 2021 significant level of private and public investment was targeted at the companies engaged with the various Innovation Studios. At the end of 2021 this amounted to over €10m.

Summary of Spend	
Total Approved	€250,000
Total Eligible Expenditure	€250,000
Total Drawdown	€250,000
EU – 50%	€125,000
Exchequer – 50%	€125,000

Report by: Richard Donnelly

Date: 23rd March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/DIS-BG023-BR030
NAME OF PROJECT: **Aquaculture Remote Classroom (ARC)**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The Aquaculture Remote Classroom (ARC) is a mobile classroom which has been procured on a hire basis by BIM via an appropriate tender. The Farmed in the EU (ARC) project is operated, supported and managed by a private sector service provider which has been procured via an OJEU tender process. (Contract commenced 1st January 2020). The classroom is staffed by two highly competent and enthusiastic tutors with advanced and relevant academic specialisations in Marine Biology and Sport and Nutrition, they are supported by a Driver/Mechanic who accompanies them on deployment.

Objectives

The ARC has been designed to travel throughout Ireland and accommodate up to thirty young learners at a time and provide one full day of an interactive learning experience. The learning experience is focused on positively engaging young people about aquaculture and related topics with the express objective of fostering knowledge and understanding of aquaculture and how it relates to learners and their community. The content addresses strand of SESE Science, SESE Geography and SPHE Education curriculum as set down by the Department of Education and Skills, this ensures that the learning day contributes to knowledge of aquaculture while meeting some other requirements that have been set down by the Department of Education.

The programme has been planned with a target of delivering to approximately twenty-five learners per day for the bulk of the primary school year, the project operates to a target of no less than thirteen teaching days per month for the school year, but with the expectation that operational performance above this level in normal circumstances. It should be noted that there is a need to allow for travel between schools, set-up times, vehicle reconfiguration and occasional cancellations by schools, therefore twenty day per month deployments would be considered very ambitious.

A mobile classroom is absolutely necessary for the delivery of the project because many Irish primary schools operate at or close to capacity in terms of space and may not be able to facilitate activities like those provided by the ARC, therefore this project must provide the space by way of the mobile classroom, this ensures that no schools are disadvantaged, and that participation can be as widespread as possible. The successful delivery of any learning content is most effective where there are no more than thirty pupils in a single group being supported by two tutors. These factors have contributed to the design of the project in terms of the scale of engagement that is realistic and manageable in terms of logistics and costs.

There is also significant variation in the quality of technologies and resources that are available to schools, therefore, to enable effective and timely delivery, the mobile classroom must be fully equipped with all necessary learning tools, seating, tables, audio visual and computer equipment as relying on schools to provide these would be impractical and set up times would reduce the amount of time that could be utilised for learning activities. The mobile classroom has been developed with a view to providing all necessary space, learning tools and technologies for young learners while ensuring that each young participant has adequate opportunities for one-to-one interaction with the tutors.

The ARC visits schools on the basis of 'Expressions of Interest' submitted via the project website www.aquaculture.ie, operations are scheduled in a manner that seeks to minimise travel and specific areas that demonstrate high demand are timetabled to maximise impact and reduce cost.

The first year of the project 2019 was extremely successful with all school visits received extremely well and demand exceeding delivery capability. A total of nearly 5,000 visitors boarded the ARC in 2019. In 2020 due to the closure of schools in March due to the COVID-19 pandemic the delivery of the ARC programme was moved to an online format.

The content briefly covers the history of farming and food production before introducing aquaculture as a farming process, the content places aquaculture in a European and in an Irish context and frames the evolution of the practice over time and the emergence of the modern Irish aquaculture industry. The content also introduces the Food pyramid, discusses healthy eating and sustainability.

Budget	€350,000
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Achievements/Spend

The Aquaculture Remote Classroom is the Irish development of the EU Programme Farmed in the EU. Prior to 2020 the programme was delivered with one full day visit to an individual class of 30 pupils in 5th and 6th Class (11-12 year olds) onto the custom made ARC truck. Due to the Covid 19 crisis the programme had to adapt in order to continue to provide the service. In this respect a new and unique programme was developed to deliver the programme via online webinars. This involved both the development of course material that was suitable for online delivery but also work with regional educational centres around the country to ensure the programme could be delivered online directly to pupils.

In 2021 the online ARC programme achieved the following:

- 30 individual webinars delivered. Including one with the participation of the Minister of Agriculture, Food and the Marine.
- 250 individual schools participated in the webinars.
- 6,500 pupils participated against a target of 4,000 for 2021.
- During 2021 the four specially made online videos were updated and amended to provide a better online experience from students based on feedback. The subject of the four videos were:
 - What is Aquaculture?
 - The Nutrition of Seafood
 - Aquaculture and the Community
 - Sustainable Irish Seafood
- Presentations on the ARC were given following requests from the European Aquaculture Advisory Council and DG Mare in Brussels.
- An updated ARC (mobile classroom) was developed and fitted out.
- Enquiries and materials shared with seven other Member States who were interested in starting their own ARC programme.
- Wide range of media coverage from print, online and radio.

Summary of Spend	
Total Approved	€350,000.00
Total Eligible Expenditure	€329,405.27
Total Drawdown	€329,405.27
EU – 50%	€164,702.64
Exchequer – 50%	€164,702.64

Report by: Richard Donnelly

Date: 23rd March 2022



BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/DIS-BG023-BR031
NAME OF PROJECT: **Taste the Atlantic**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The TTA initiative will be critical to creating better understanding, acceptance, and public support of aquaculture along the western seaboard. The successful coexistence of aquaculture and tourism must be promoted to the public to ensure that the 'social licence' for aquaculture endures and that it is abundantly clear that aquaculture and leisure activities and tourism are not mutually exclusive. Failure to deliver positive public engagement about aquaculture and marine tourism could contribute to negative public perceptions, opposition to sustainable development and difficulties for the industry in applying through the aquaculture licencing process and the emergence of a narrative that aquaculture does not support coastal communities whereas, in fact, the opposite has been shown to be true.

BIM will work closely with the Irish aquaculture industry and Failte Ireland (FI) to develop new aquaculture related visitor experiences along the Wild Atlantic Way (WAW) that can contribute to much improved understanding of the aquaculture sector and that can contribute to wider public acceptance of aquaculture as a food producing sector. It is vital that visitor experiences about aquaculture and how it contributes to communities in numerous ways (direct/indirect employment, production of premium quality seafood, increased sales / consumption of locally produced seafood) are facilitated.

Objectives

BIM proposes to develop a number of aquaculture visitor experiences during 2021. BIM has identified eight potential projects which could be implemented during 2021.

1. Doagh Famine village – Aquaculture (oyster) information / interpretive materials (Co. Donegal)
2. Lissadell - Aquaculture (oyster) information / interpretive materials (Co. Sligo)
3. Keem Bay Seafoods– Aquaculture (salmon) interpretive centre on (Achill Island, Co. Mayo)
4. Croagh Patrick Seafoods, aquaculture information / interpretive materials (Co. Mayo)
5. Connemara Lady Tourism vessel – Aquaculture interpretive centre (Leenane, Co. Galway)
6. Mungo Murphy Abalone, aquaculture information / interpretive materials. (Co. Galway.)
7. Moyasta Oysters, aquaculture information / interpretive materials. (Co. Clare)
8. Roaringwater Bay Rope mussels, aquaculture information / interpretive materials. (Co. Cork)

In tandem with the development of the visitor experiences, FI will look to integrate the TTA into their regional development initiatives with the express aim of increasing the impact of TTA and increasing numbers of visitors to TTA seafood producers. FI see this as a more strategic option to increase cooperation amongst various regional offerings and to increase visitor numbers across the board in this region.

BIM will also facilitate a series of farm visits for key regional stakeholder groups to create better understanding of aquaculture amongst influential groups like chefs, journalists, NGOs and food/tourism industry interests. It is critical to foster better understanding of the aquaculture sector in order to ensure that support for the sector is obtained through creating a positive public perception and with it an enhanced 'social licence' for aquaculture.

BIM will engage a 'TTA aquaculture ambassador' to undertake a series of communications initiatives (media, social media, and 'live' outreach events) during 2021. The purpose of this will be to use a person of suitable public profile, who can be recognised as a sectoral influencer or leader in the Irish marine or food sector to facilitate an open and facts-based dialog on TTA and the aquaculture producers on the trail. These initiatives will include representatives of the aquaculture industry and other relevant stakeholders in order to allow the industry to be given a direct voice to discuss important national, European and global opportunities and challenges for the aquaculture industry. A wide range of topical issues can be covered over a limited series and this will create an opportunity for fair and objective discussion around aquaculture and tourism and the impact on communities around Ireland.

BIM will undertake a series of Communications and Promotional initiatives to raise the profile of the TTA trail during 2021. This will include the design, origination, production and widespread distribution of various materials including photographs and images, videography, animations, social media content and a range of tailored information materials like booklets, signs, posters and flyers. The potential of high impact mobile phone applications and similar options will be assessed and may be rolled out if deemed necessary.

Budget	€250,000
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Achievements/Spend

To date there are a total of 21 producers involved in the Taste the Atlantic programme. These are located along the whole of the Failte Ireland tourist trail, the Wild Atlantic Way. This project is run in partnership with Failte Ireland.

In 2021 the focus was upskilling the operators along the TTA route. Due to a large amount of uncertainty associated with Covid 19 and restrictions on travel, it was difficult for many operators to capitalise on the traditional international tourist market. This led many operators to develop both direct sales in the domestic market and also serve the domestic tourism market. For the majority of operators this allowed them to maintain their business. To provide support for these activities the following were conducted:

- Digital training was conducted with all 21 producers. This was run in partnership with Failte Ireland. The companies were provided with a full assessment and recommendations on how to use digital platforms for both direct sales and booking tours. This included a full audit of their websites, sales platforms and social media channels.
- A Young Chef Ambassador programme was also initiated in 2021. Five young chefs were selected by programme partners Chef Network from around Ireland. These chefs were provided with the opportunity to meet the producers directly and find out exactly how seafood products such as oysters, mussels and salmon are produced. In addition, each chef was asked to develop a recipe based on produce from the TTA producers following their visit.
- Due to Covid restrictions, group site visits were limited. An objective for 2021 was to have an outreach programme to the food service industry along the Taste the Atlantic route to visit certain producers. Only one such visit was conducted instead of three due to restrictions.
- In conjunction with the Galway Oyster Festival an event was held with the members of the TTA and the Young TTA Ambassador Chefs to present the recipes they developed as part of their site visits. This event achieved wide media coverage highlighting the aquaculture and tourism sectors working together.
- Development works were carried out on wide range of the facilities of the 21 producers along the TTA route. This was all done in consultation with Failte Ireland. One success was the initiation of farm tours and oyster tasting at Croagh Patrick Seafoods. With new tasting area on the farm and supporting

information material tours became fully booked for all of August and September. A target of 8 producers for the development of tours were set out in 2021. This target was met and developments were undertaken in eight of these locations during the year.

- A significant amount of media coverage was achieved from a range of activities associated with the TTA from the Young Chef Ambassadors to the launch of new tours. This has generated support from both Failte Ireland and local communities where these aquaculture activities take place. This is a significant support to the social license objective that this activity supports. Media (not including social media) coverage reach in 2021 was estimated at c.500,000 people throughout Ireland with a wide regional spread. In addition to this sentiment from this media analyses were exclusively positive.

Summary of Spend	
Total Approved	€250,000
Total Eligible Expenditure	€250,000
Total Drawdown	€250,000
EU – 50%	€125,000
Exchequer – 50%	€125,000

Report by: Richard Donnelly

Date: 23rd March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/DIS-BG038-BR015
NAME OF PROJECT: **Industry Working Groups**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

To continue to run and support the Irish Oyster Packers Group in terms of conducting meetings and workshops. There is also a need for development and networking within the next generation of oyster growers. To support this it is planned to hold a workshop within Ireland for these new entrants to see best practice within Ireland and create synergies among these operators.

As noted above the work of the Irish Oyster Packers Group has proven to be very beneficial for all members and based on this success it is planned to roll out similar type structures for the mussel and salmon sectors.

Objectives

BIM want to continue using a project-based model to drive this further collaboration within the aquaculture industry. The overall objective is to provide a forum for the oyster, salmon, and mussel farming sectors to harness the support of State organisations in an effective and efficient manner.

Budget	€5,000
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Achievements/Spend

- During 2021 the Irish Oyster Packers Group (IOPG) met on four occasions, three of these meetings were virtual and one was held in person when Covid 19 Government guidelines permitted.
- IOPG have been working with ZV Fish Auctions in Belgium to look at new and innovative ways of dealing with Brexit challenges to logistics and accessing the EU market. Several Team/Zoom calls were held with the IOPG and ZV Fish Auctions and a joint project is due to commence in early 2022. Unfortunately, a visit to the new logistics centre in Belgium in November 2021 was postponed due to the increased concerns over Covid 19.
- Norovirus results and analyses were presented by the Marine Institute at all four meetings in 2021. This norovirus study is part of another BIM EMFAF funded project and has proven to be extremely beneficial to the IOPG and their customers.
- A new working group of 'next generation' oyster farmers was established and will have first formal meeting in early 2022.
- The Salmon Industry Working Group was established, and six meetings were held (5 virtual, 1 in person). Initial target of two meetings was set in 2021.
- Mussel Working Group was established with one online webinar conducted in 2021.

Summary of Spend	
Total Approved	€5,000
Total Eligible Expenditure	€5,000
Total Drawdown	€5,000
EU – 50%	€2,500
Exchequer – 50%	€2,500

Report by: Richard Donnelly

Date: 23rd March 2022



BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/ESS-BG026-BR036
NAME OF PROJECT: Socio-Economic Effects of Aquaculture in Selected Bays
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

Following from a study carried out in 2019, where detailed economic data was collected from ten ports and their hinterlands to provide an analysis of the importance of the seafood industry to the rural economy, a similar study was planned for the aquaculture sector. This represents one of the actions under the National Plan for Strategic Aquaculture Development. This plan proposes that studies on how aquaculture contributes to communities in rural areas to inform decision-making and trade-off considerations are carried out. These studies would outline how aquaculture contributes to the societal benefits in the marine area, including the sustainable use of marine resources to address local social and economic issues; how properly planned aquaculture developments in the marine area can provide environmental and social benefits as well as drive economic development, provide opportunities for investment, employment and generate export and tax revenues and provide data and information and methodology to assess the economic and social influences and benefits of aquaculture activities to inform decision making and trade off decisions.

The annual socio-economic survey of the sector carried out by BIM provides insight into the performance of the sector in general and in comparison, to other EU Member States. However, the socio-economic importance of the sector locally is often alluded to, but a formal study of this assertion is required to highlight the sector's effect on the areas of operation and on the wider region and to provide metrics to the importance of the sector. This project seeks to establish the economic multiplier effects of the Irish aquaculture sector as a whole and of its major segments throughout local, regional and the national economies. It furthermore seeks to describe the underlying socio-demographic characteristics of the communities and stakeholders among whom the industry operates to provide context to those effects.

Detailed lists of businesses will be created, and data will be collected on turnover, costs, employment, the sources of inputs and outputs for the direct and indirect companies involved in the aquaculture sectors of these regions. Primary data will be collected via face-to-face interviews and/or telephone interviews with key seafood stakeholders in each study area and with ancillary businesses. Social statistics will be collated for each area describing key social indicators that characterise the demographic structure and labour force structure and insights into the decision-making process of firms in the sector. Multiplier estimates will be calculated for the indirect and the induced value added, and employment generated from the aquaculture sector. The flows of value added will be characterised from sea and farm to plate for each study area. All data collection, storage and data sharing processes must be compliant with recent GDPR legislation. Metadata for project datasets must also be compliant with the EU Inspire directive.

Objectives

The objective of this project is to measure the contribution of the Irish aquaculture sector to the local communities around the coastline of Ireland by describing the socio-economic contribution of aquaculture to its host communities for eleven representative bays by effects on employment, turnover GVA and other indicators and the multiplier effects of the sector up the value chain.

Budget	€90,750
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Achievements/Spend

The economic impact of the aquaculture sector at 11 of Ireland's most representative bay areas was the focus of this study. These ranged from Dingle, the largest of these bay economies, to Mulroy Bay in County Donegal, the smallest and most northerly of the bays assessed. As well as providing true insight on the impact of aquaculture upon the economies of the selected bays, the study also provided the secondary benefit of having both independently and professionally generated an alternative dataset and resultant estimates that can be used to compare with those in-house to ultimately improve BIM's measurement of the sectors performance. For each bay, the analysis considered:

- Finfish farming;
- Oyster farming; and
- Mussel and other shellfish farming.

Following on from a successful tendering process, economic consultants, Oxford Economics Limited, were engaged for the purposes of this project. The project was divided into several phases:

1. Planning, population and geographical framing, questionnaire design completed by April 2021.
2. Survey launch and data collection. Completed by June 2021.
3. Collation and analysis completed by August 2021.
4. First Drafting and editing of reports completed by October 2021.

The analysis carried out shows that the farming of finfish, oysters, mussels and other shellfish across the 11-bay area's bring substantial economic benefits to the Irish economy. When the direct, indirect, and induced impacts are combined, the bay-based aquaculture activity sustained a total of 1,385 jobs throughout Ireland in 2020, paying wages worth €34 million. This activity generated a total contribution to Ireland's Gross Domestic Product (GDP) (i.e. Gross Value Added, GVA) of €73 million and provided fiscal benefits estimated at €13 million.

In terms of GVA, employment, and wages, based on the analysis, BIM estimates that the bay areas' aquaculture sector makes an economic contribution in all eight regions of Ireland - even those with no direct bay presence. None of the 11 bays included within this study fell within the Midlands, Dublin or Mid-West, but these regions still receive some economic benefits from aquaculture via supply chain and subsequent consumer spending impacts. The South-West and Border regions benefit most from aquaculture. Between them, these regions are home to seven of the 11 bay areas analysed, including two of the largest bay areas in terms of aquaculture sector activity: Bantry Bay (South-West) and Donegal Bay (Border). As a result, the Border and South-West regions account for close to two thirds of the aquaculture related turnover generated across the 11 bay areas.

Aquaculture is a relatively large and resilient employer in the bay economies. It offers accessible jobs to local people, flexible employment opportunities, and has established access to external markets. Therefore, a vibrant and growing local aquaculture sector remains important for the economic and demographic health of these areas. This is particularly important given that employment opportunities in these areas is weak and relatively high rates of economic inactivity. Additionally, the outlook for the bay area economies is likely to be challenging given their sectoral structure, demographic trends, and stock of skills. However, breaking down the total impact of the aquaculture sector across the 11 bays into each of its sub-sectors, the analysis shows:

- The bays' finfish activity is estimated to have sustained 381 jobs, €16 million in earnings and €35 million in GVA in 2020.

- The bays' based oyster farming activity is estimated to have sustained 687 jobs, €13 million in earnings and €27 million in GVA.
- Mussel and other shellfish farming activity is estimated to have sustained 317 jobs, €5.9 million in earnings and €12 million in GVA.

Summary of Spend	
Total Approved	€90,750.00
Total Eligible Expenditure	€85,079.10
Total Drawdown	€85,079.10
EU – 50%	€42,539.55
Exchequer – 50%	€42,539.55

Report by: John Dennis

Date: 12th March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG020-BR073
NAME OF PROJECT: IATiP
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

BIM, with the support of ERINN Innovation, have been working with Irish aquaculture stakeholders to establish the Irish Aquaculture Technology Innovation Platform (IATiP) over the past three years as part of the BIM EMFF work programme. In January 2019, Intrigo Ltd (rebranded as ERINN Innovation) responded and successfully won a 24-month BIM tender contract to act as the secretariat for IATiP, which includes development of a brand, brand material, website and driving membership engagement for this new platform. This contract also includes identifying and assessing new Knowledge Outputs relevant to the Irish aquaculture sector. These will be transferred to BIM's technical experts and industry to drive development and innovation in the sector.

Objectives

The provision of the Secretariat function to the IATiP, to ensure the smooth and effective functioning of the platform, supporting growth in membership, ensuring good governance and also effective communication between members and other Mirror Innovation Platforms. The service will also include on-going mapping of innovative knowledge outputs to identify, appraise and transfer innovative relevant technologies from Irish and European research institutions to industry, this in turn will support the development of the sector and promote Irish aquaculture on an EU stage.

Budget	€126,620
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Achievements/Spend

Part A: IATiP Secretariat

- Business case outlining possible funding scenarios for IATiP prepared and delivered. The Business Case sets out two possible operational scenarios for the future evolution of IATiP. The first envisages a stand-alone independent multi stakeholder platform that would require funding, the second envisages the internalizing of the platform into a host institution whereby the secretariat would be provided as an in-kind contribution.
- Connections made with Mirror Innovation Platforms from around Europe. Four case studies prepared on their work (SAIC (Scotland), BaMS (Western Germany), Aquimer (France), Aquaculture Flanders (Belgium)).
- Quarterly knowledge sharing meetings with SAIC and open channels of communication with the other MiPs.
- Total of 40 interviews conducted with members of the aquaculture community from across Europe since October 2021 (published on IATiP website).
- Total of 234 followers on Twitter.
- Total views on website now 3,948.
- Total subscribers to mailing list now stands at 488.
- Collection of blogs due to be released in early 2022 covering range of topics from digitalisation to closed cage systems. Aim is to raise awareness about innovation taking place in other sectors around Europe and Norway in particular.

Part B : Aquaculture Knowledge Transfer update and next steps

New Finfish KOs collected (Norway)

- Over 300 businesses identified from four Norwegian Aquaculture Cluster Secretariats (NCE Seafood Innovation, Biotech North, NCE Aquatech, Stiim Aqua).
- Of these, 67 were identified as relevant/promising and presented to BIM technical and industry experts for assessment of suitability to Ireland, with 16 identified as being of high potential and requiring follow up.
- Two finfish brokerage events held in February 2022 with 30 Irish participants in attendance. Factsheets were prepared in advance, Norwegian companies individually presented their products/services followed by Q&A and discussion. Minutes were taken capturing outcomes and potential actions.
- A report containing all collected KOs and validated interview exchanges is currently being drafted for submission to BIM as an annex to the final report.

Summary of Spend	
Total Approved	€126,620.00
Total Eligible Expenditure	€122,616.21
Total Drawdown	€122,616.21
EU – 50%	€61,308.21
Exchequer – 50%	€61,308.21

Report by: Lucy Watson

Date: 22nd February 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG022-BR082-84
NAME OF PROJECT: Seaweed Development
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The Seaweed Development Services project included the continued development of culture techniques for brown and red seaweeds of commercial interest. Mentoring of industry was a key component of the work programme and was carried out subject to Public Health Guidelines. A work package to develop *Asparagopsis armata* cultivation techniques, both in the hatchery and at sea, was undertaken as part of the project. A seaweed strategy was commissioned to provide guidance to the farmed seaweed sector over the next EMFAF funding round.

Objectives

Field analysis, hatchery manipulation and pre-commercial growth of *Porphyra umbilicalis* on suitable substrates in the hatchery and later at sea was carried out in the spring when material was ripe. Growing wild harvested *Palmaria palmata* in tanks included sourcing wild product, setting up of the experimental protocol and growing out in ambient tank conditions was carried out during the spring and into summer when elevated temperatures and light intensity causes the crop to diminish. Seeded collector string (*Alaria esculenta* and *Saccharina latissima*) and culture for spraying on collectors for deployment at licensed sea sites was produced seasonally in the spring with autumn spraying associated with mentoring of industry. 10 kms seeded collector string plus culture to seed 7.5kms string was to be produced. Wild *Porphyra umbilicalis* plantlets were sourced and experimental methods investigated for culture with a view to seeding five nets. Up to 100 kgs *Palmaria palmata* was to be on-grown in tanks with 10 mentoring days provided to industry having regard to public health guidelines.

A further research project on the growth properties of *Asparagopsis armata*, the seaweed exhibiting anti-methanogenic properties in ruminants, was carried out by Bantry Marine Research Station, to include growth trials at their licensed facility, both in land-based tanks with additional growth trials and monitoring of *Asparagopsis armata* at sea sites. This required finding/collection of *Asparagopsis armata* from the wild, bulking up of the target species and establishment of fully monitored growth trials. The project aim was to produce a minimum of 200 Kgs wet weight *Asparagopsis armata* for processing. The strategy is to set out a roadmap for the development of the sector over the next funding round with a mid-term review.

Budget	€366,500
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Achievements/Spend

Multiple sporulations of *Alaria esculenta* were conducted in spring from both wild and farmed sources. However in 2021 sori on farm longlines were less developed and only available for a short period. Regional differences in availability were also noted. Ripe *Saccharina latissima* was collected at low spring tides up to May. Despite meticulous cleaning *Ectocarpus* contamination was discovered in at least three cultures and these were discarded. As ripe sporangia were not available in the wild during the summer it was decided to induce sorus production from non-fertile blades under controlled conditions. Four separate *Saccharina* sporulations were conducted from sori induced in the lab. Different density spraying experiments were also conducted. Findings confirmed that the density of culture sprayed on to collector string is indeed very important and that the stock held in the gametophyte culture chamber could be used to spray significantly

more collectors than hitherto considered. It was noted that there was an overall improvement in blade size and appearance compared to the lower density spray. Ectocarpus contamination proved to be a problem on the *Saccharina* crop in the winter and more research on *Saccharina* is required.

The deliverables were met in terms of required collector string and culture produced. A spring and autumn 2021 macroalgal training course was delivered at BMRS and was subject to public health guidelines. It was specifically designed for people interested in cultivating macroalgal gametophyte cultures and producing seeded collectors for deployment at sea. The feedback from the course was very positive.

A sample area stretching from South Donegal, Sligo, Mayo, Connemara, Galway, Clare, Kerry, Cork and Waterford was investigated for *Porphyra umbilicalis* in early 2021. Finding asexual plants proved as challenging as in previous years and only one site at Barley Cove in west Cork had putative asexual plants, some of which produced spores in the lab.

An intensive examination of all asexual *Porphyra* plants in the chill cabinets was done in late November 2020/early 2021 to prepare for the season. Poor quality blades were discarded, and densities reduced. No ripe margins were observed. Therefore 2021 started with poor quality material with epiphytic contamination. Shedding of margin sections from broodstock plants was observed mid-January and these pieces were retrieved and put in petri dishes for ongrowing and observation. Plants were removed to clean petri dishes after two weeks. This procedure was repeated after another two weeks and by mid-February small plants were transferred to 250 ml flasks containing sterile seawater and West Mc Bride Medium. Hairlike epiphytes were present on some petri dishes, so the protocol was amended so that petri dishes were replaced 24 hours after the first spore release and then subsequently every week. Seven of these "Petri dish" sporulations were conducted between January and April. The resulting asexual plants were maintained with weekly renewals and fortnightly gradings and cullings. Plants were gradually transferred to 1litre flasks. Overall, the growth rates were very slow.

Regarding the Barley Cove stock, by the end of May there were approximately 250 plants from 1-5 mm and significantly more below that size. As the plants grew CPS became aware of the presence of *Aoudinella sp* on the surface. Faced with this challenge CPS initiated a series of experiments to investigate ways of removing the *Aoudinella* without harming the *Porphyra* plant. These experiments investigated the impact of freezing, dehydration, freshwater treatment and temperature and light variation on the *Porphyra* blades.

Realistically a new source of epiphyte free asexual *Porphyra umbilicalis* is the real solution. A meeting with Professor Juliet Brodie (London Natural History Museum) in County Clare was held in August 2021. Prof. Brodie believes that asexual *Porphyra umbilicalis* is becoming more difficult to find in the Southern area of the British Isles. This is most likely due to the effects of global warming.

The best growth periods for *Palmaria* were from February to May and September to December. The use of black grow out tanks and partial shading lids helped keep bleaching at bay but also reduced growth rates. Density experiments indicated that the optimal density was 3 to 4 kgs/m². Daily percentage increases in volume of 4-10% were recorded. As temperatures increased issues with grazers and epiphytes were observed. However, the target deliverable of 100kgs was met.

Bantry Marine Research Station carried out research project to close the life cycle of *Asparagopsis armata* which is characterised by a gametophytic and a sporophytic life stage, which are morphologically and physiologically very different. The sporophytic stage, called the tetrasporophyte, produces tetraspores from which the gametophytic life stage develops. The induction of the tetrasporogenesis and the optimization of the growth conditions for the tetrasporophyte in laboratory conditions are fundamental steps to enable the

commercial production of this red seaweed. Ideally, a methodology for the nearshore deployment of lines seeded with the tetraspores produced in a hatchery, must be developed if this novel product can be produced in the quantities required for feeding to ruminants to mitigate green house gas emissions, which is the goal of the work in hand.

Experiments investigating the dynamic of nutrient uptake by the *A. armata* tetrasporophyte highlighted the potential of this species to be used as a biofilter near sources of pollution such as fish farms. The work indicated that nutrient depletion causes stress to this seaweed, as highlighted by chlorophyll a fluorescence analysis. The growth conditions for the tetrasporophyte were optimised through a series of experiments carried out at different environmental conditions. These experiments showed the optimal light saturation point, temperature and density at which plants grow best. Induction of sporogenesis in laboratory conditions was achieved by exposing the tetrasporophyte to nutrient-depleted medium and to a photoperiod dark:light of 16h:8h. The wild population of *A. armata* from the West Cork coast was monitored through the year and sites for collection are now documented. The tetrasporophyte was present from January to December. The gametophyte only appeared in the wild in June. From the end of August until December it was more abundant and with a bright-red coloration.

The gametophyte was harvested in different months and used for the development of a methodology for the nearshore cultivation of the seaweed. Several types of ropes and several sites for the deployment were tested. The vegetative growth of the *A. armata* gametophyte is favoured by rocky substrates, by the close proximity to a nutrient source (e.g., a fish farm) and by a rope that enables the attachment of the plant's harpoons. The project encountered challenges in terms of development of the methodology for spore release in the lab, and also the successful adherence of the harpoon to the grow rope at sea. Further work in these areas is required. The production did not meet the 200kg target.

The seaweed report sets out a strategy for the Irish farmed seaweed sector over 2021-2030 with a mid-term review. The report's summary findings are presented below.

Ireland's seaweed industry is dominated by companies that process seaweed harvested from the wild. The majority of this is from one species – *Ascophyllum nodosum*, which is processed to produce biostimulants and fertiliser. The other activity within the industry is seaweed cultivation.

The first significant cultivation activity started around 2010 and supported by various EMFF funded initiatives undertaken by BIM and the private sector, producing 12 tonnes in the first two years. Since then, the maximum annual production was 70 wet tonnes in 2015. Biomass output has fallen since then.

Some seaweed licences date back to 2011, however, the majority of the current 25 seaweed licences were granted between 2016 and 2020, and most include species other than seaweeds. In 2021 six production units operating the licenced area of 254 ha produced 50 wet tonnes.

Developing a cultivation sector demands a clear vision and targets for biomass production at a scale to allow Ireland to capture a share of the expanding markets. Compared to competing European regions such as Norway, where production has increased each year from 2015 to reach 336 tonnes in 2021, Ireland's output lacks scale.

Ambitions to develop high-value seaweed-based products will not be realised unless biomass production is increased. This increase can result from licence holders cultivating more of the current licenced area or attracting more growers.

Presently Ireland has little or no infrastructure which directly supports the development of a cultivated seaweed industry. A largely opportunistic research community responds to EU calls for research proposals and occasional national calls where macroalgae is included in the brief. Unlike leading countries, Ireland does not have a seaweed strategic research agenda, hence knowledge gaps concerning the cultivation of native species exist.

Access to juvenile seaweed for on-growing at sea is restricted by the limited capacity of a trial hatchery (under contract to BIM) to supply seeded lines, currently around 10.5 km per annum; sufficient to support a productive farm of around 4 ha. Such a facility cannot support the growth of an industry. Some growers have started to identify the need to develop their own hatcheries; however, little is known about their seeded string production capacity, other than it meets their requirements.

Growers generally struggle to obtain market information. Those producing seaweed for food products, typically have better insight to the national markets than international markets. Some growers just do not consider the need for such insight, claiming they sell all the seaweed they can produce – since it’s a seller’s market. Few realise they produce a commodity and that the increasing output of other European countries will lead to price reductions.

The strategic review defines multiple actions over the next 10 years relevant to an industry that wants to compete internationally. However, immediate action is needed to retain the current growers, attract new growers and to help them overcome the barriers they face. These priorities include:

- Stimulating non-productive licence holders to commence cultivating seaweed;
- Boosting the sector by attracting new growers;
- Obtaining relevant market information on seaweed for food use;
- Confirming and funding a national seaweed research agenda;
- Encouraging collaboration between growers to share information, know-how and equipment; and
- Establishing a hatchery facility capable of operating to international best practices, to reliably culture *Alaria esculenta*, *Saccharina latissima* and *Laminaria digitata* on behalf of growers and possessing the competences to develop methods to breed species in demand such as *Palmaria palmata* and other red seaweeds.

Summary of Spend	
Total Approved	€366,500
Total Eligible Expenditure	€366,500
Total Drawdown	€366,500
EU – 50%	€183,250
Exchequer – 50%	€183,250

Report by: Lucy Watson

Date: 22nd February 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG025-BR090
NAME OF PROJECT: **Brexit Seafood Industry Supports**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The Trade and Co-operation Agreement (TCA) has negatively impacted the Irish aquaculture sector, which is evident in increased costs and logistical impacts on trading relationships. There are now significant differences in the arrangements for trade between the UK and EU member states that affect businesses operating to and through Great Britain (using the landbridge). Although a deal has been agreed, a range of new rules in the form of customs paperwork, origin statements and health restrictions have been introduced.

With unique requirements for fish and fishery products, this sector must now adapt to the changes, brought about by Brexit, and seek out opportunities so that greater value can be derived from the market and shared throughout the supply chain. Notwithstanding the many adverse effects of Brexit, the sector is now at an inflection point by which those adverse effects must be mitigated while the opportunities presented by Brexit must be maximised.

Objectives

BIM sought to provide a suite of support services to assist Irish aquaculture producers to navigate the challenges of Brexit through this project.

This encompassed supports and guidance to understand new rules, documentation and studies to support DAFM to assess the longer-term impacts and opportunities of Brexit. The key goals are to assist industry to adapt, restructure and reposition post-Brexit.

The Seafood Industry Brexit Support consisted of individual aquaculture companies working with an approved BIM customs mentor to:

- Analyse the company's trading situation.
- Interpret and explain how the new custom requirements will impact the company's trading situation.
- Develop a tailored plan and support the company to implement actions to satisfy the new trade requirements.

Budget	€40,000
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Achievements/Spend

Under the EMFF, BIM has supported four aquaculture companies through the Brexit Seafood Industry Supports project. This support has consisted of individual aquaculture companies working with an approved BIM mentor, analysing the company's trading situation, interpreting and explaining how the new custom requirements will impact the company's trading situation and supporting the company to implement actions to satisfy the new requirements and allow for trade to continue to and through the UK.

Industry feedback on the support has been very positive, 88% of companies that engaged with the support were satisfied with the service and felt their business was better prepared for Brexit changes as a result.

Summary of Spend	
Total Approved	€40,000.00
Total Eligible Expenditure	€15,492.50
Total Drawdown	€15,492.50
EU – 50%	€7,746.25
Exchequer – 50%	€7,746.25

Report by: Gavin McGrath

Date: 21st March 2022



BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG038-BR061
NAME OF PROJECT: **Standards and Certification**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

Standards and certifications are now a key mechanism for businesses wishing to translate requirements, both product and process specifications, to other parts of the supply chain. There is an increasing global requirement for the use of accredited certification schemes in providing assurances of more sustainable practices in seafood production and more recently for the participation and assessment of accredited certification schemes to global benchmarking initiatives.

The production of organic aquaculture has been the success story of the organic movement in Ireland, with organic salmon production leading the way, and known as the world pioneer in the organic salmon sector.

The main goals of this project were:

- Continued alignment of accreditation, organic approval and GSSI status of BIM's current Certification Quality Aquaculture (CQA) certification schemes & prestigious certification to MSC Scheme.
- Maintained premium position in the marketplace.

Objectives

The principal objective of this project is to support the production of high-class farmed Irish seafood and to differentiate aquaculture products in the marketplace through quality, organic and eco certification, and labelling.

Budget	€187,602
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The maximum approved expenditure on the project totalled €187,602 corresponding to the following headings:

- A contracted Certification Body providing third-party certification services that undertook all audits to the CQA & CQA Organic and Eco subsopes of the CQA Scheme and maintained the ISO 17065 accreditation and EU Organic Approval
- A contracted accredited Certification Body providing assessment of compliance for rope and bottom grown mussels to MSC standards
- A contractor to develop CQA standards and provide independent review of contracted certification body (CB) in line with GSSI and other legislative requirements.

Achievements/Spend

Seafood certification is key to maintain market access both nationally and globally. The strategy of differentiating Irish seafood through the use of internationally recognised sustainability credentials has been a key objective for BIM in recent years.

BIM continued to undertake the governance and operation management of its ISO 17065 accredited Certified Quality Aquaculture (CQA) Assurance Programme, managed by service provider in line with Commission Organic Regulation 710/2009 & GSSI requirements, on behalf of the Irish aquaculture sector.

A total of 13 meetings were held relating to the management and operation of the CQA Programme including two Certification Body Review meetings, two CQA Internal Review meetings, and nine Certification Body monthly meetings - reports issued for CQA CB review, CQA Internal Audit, CQA Annual Management Review and minutes of monthly Certification Body meetings.

Certification audits were completed by the Certification Body for all 34 CQA certified companies to retain CQA, CQA Organic and Eco certification.

In 2021 BIM undertook a technical review of the CQA standards and procedures associated with the Scheme, a periodic requirement that owners of accredited certification schemes must undertake. This review was undertaken by the CQA TAC and ensures that certification remains relevant to industry best practice, market requirements and policy. A survey of certified CQA members was carried out in March 2021 to help inform the Standards review process regarding establishing the areas of interest from the various aquaculture sectors. The new versions of the CQA Standards finalised by the TAC in November 2021, underwent a 60 - day public consultation period between mid - July and mid - November as required by the GSSI approval process and good practice in standards development. The finalised versions of the CQA Standards were formerly submitted to INAB for accreditation review in early December 2021.

The Standard development process followed the CQA Procedures and minutes from meetings confirm that it has been actively reviewed via the committee process.

A total of six TAC meetings and one OC meeting were held in 2021 for the standards review process. In addition to this, in order to inform the review process, BIM gathered CQA member feedback undertaken through a structured questionnaire and follow up interview, with a 100% response rate. With regard to the 60-day public consultation process, press releases were published on BIM's website and in two marine media magazines.

The BIM CQA Farm Standard (Version 1.1) also continued to retain the Global Sustainable Seafood Initiative (GSSI) recognition during 2021, originally obtained in 2019 following a formal benchmarking exercise. In July 2020, GSSI's Monitoring of Continued Alignment (MOCA) procedure began which comprises a review of any changes in the Programme's ownership, management or the standard itself. In March 2021 GSSI recommended BIM for its continued recognition of Farm Standard (Issue 1, Revision 1, November 2018) following the completion of GSSI's MOCA process. This continued significant endorsement not only futureproofs CQA, it also places it, and by extension the Irish seafood products it covers, on a par with the very best competing standards around the world.

BIM holds MSC certification for both Rope and Bottom grown mussel sector in Ireland. This centralised certification represents an innovative approach to the certification process and provides best value for money for the whole industry. During 2021, Ireland's Bottom Grown Mussels & Ireland's Rope Grown Mussels continued to retain (MSC) Certification. There are currently 37 MSC Certified Rope Mussels Members and 47 Bottom Mussel Members (Combined ROI & NI).

For aquaculture products, organic certification has been a great success story and commands premium prices. 2021 saw increased competition in this market with several new entrants from the UK, Norway, and

Iceland. Organics remain a key market segment for Irish aquaculture with BIM assisting companies to achieve and retain accreditation to EU Organic Standards.

The use of organic certification has been a great success story for Irish farmed salmon and their products command premium prices within the farmed Atlantic salmon sector globally. Irish fish farming companies were assisted to achieve and retain accreditation to EU Organic Standards for salmon and mussels.

Summary of Spend	
Total Approved	€187,602.00
Total Eligible Expenditure	€181,513.56
Total Drawdown	€181,513.56
EU – 50%	€90,756.78
Exchequer – 50%	€90,756.78

Report by: Vera Flynn

Date: March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG038-BR063-72
NAME OF PROJECT: **Aquaculture Industry Services**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

This project sought to stimulate innovation in aquaculture by developing technical, scientific, and organisational knowledge in aquaculture farms, which, in particular, reduces the impact on the environment, improves animal welfare or facilitates new sustainable production methods across a number of work packages.

Objectives

CLAMS

- External contractor to update five existing CLAMS documents.
- Produce CLAMS documents for six new areas with active aquaculture groups.

Special Unified Marking Schemes (SUMS)

- Maintain and upgrade existing SUMS
- Renew and extend existing SUMS where required
- Install new SUMS where necessary

Archaeological Assessments

- Contract suitably qualified marine archaeologists to complete underwater archaeological assessments to support aquaculture licensing.

Depuration/Water Quality

- Facilitate industry verification of new depuration systems
- Undertake water quality projects in aquaculture areas as greatest risk due to deteriorating quality conditions

Husbandry technique assessment

- Refinement of native oyster spatting pond techniques to ensure repeatable results in terms of annual juvenile production.
- A comprehensive document based on a review of existing culture systems worldwide will be produced with particular reference to Irish oyster farming conditions. It is intended that the document can be used as a guide by both farmers and regulatory authorities.
- Development of a demonstration facility for aquaponics in Ireland.

Plastics/Waste

- This project includes undertaking and facilitating beach clean-up in aquaculture areas and recycling plastics.

Industry Workshops

- Hire of venue and equipment (outsourced) or Subject to COVID-19 safety requirements online webinar service supports

- Costs associated with speakers/service providers required to deliver workshops either in a group setting or online
- External service provider to update any Fish Welfare guidance and codes of practice
- Professional Printing Services of Folder Handout for workshops with Guidance Document and fish health monitoring guides

Budget	€378,000
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Achievements/Spend

- Six CLAMS addendums were completed for Trawbreaga, Killary, Lower Shannon, Castlemaine Harbour, Bantry Dunmanus and Dungarvan.
- SUMS have been designed and deployed for Roancarrig, while additional design and deployment work has progressed in Carlingford, Roaringwater, Poulasherry, Sligo, Trawbreaga alongside inspections and maintenance. Significant barriers finding suitably insured operators delayed the Ardbear deployment and Killary inspections until 2022.
- Marine Archaeology was confined to a preliminary geophysical survey for Kinsale Harbour with a number of pipeline projects identified for 2022.
- Water quality initiatives were supported regionally with two verification exercises carried out on depuration units and support testing provided to validate the systems. Due to the challenging situation with Covid-19 followed by Brexit issues around investment confidence and build logistics impeded the demand for further depuration units being commissioned. Water quality appeared as a recurring theme in the 12 CLAMS addendums both from those five completed in 2020 and six completed in 2021. Water quality issues were addressed including in Carlingford, Waterford estuary and Bannow Bay investigating the impact of marine traffic turbulence and investigation of water quality parameters for producers in the SE.
- Plastic and Marine Waste succeeded in successfully capturing 46.93 tonnes of marine litter, deploying twenty skips working with multiple communities in each region. The co-operation by industry with local community groups and NGOs such as Clean Coasts has increased awareness and profile for seafood producers in these Bays (Carlingford Lough; Co. Louth, Dungarvan, Co. Waterford; Roaringwater Bay, Bantry Bay, Ardroom and Kilmakilloge harbours Co. Cork; Castlemaine Harbour, Tralee Bay, Sneem, Co. Kerry; Poulasherry, Co. Clare; Achill, Clew Bay, Co. Mayo; Killary Harbour, Co. Galway; Sligo Bay and Trawbreaga Co. Donegal). Over 700 mussel barrels which were no longer functional were gathered from 10 rope mussel producing areas in Cork, S. Kerry, Galway and Mayo for recycling. Four former mussel rafts were removed from Killary Harbour and were upcycled or recycled while abandoned oyster sites on Achill, Co. Mayo and Bere Island, Co Cork were cleared of over 1,000 trestles which were also recycled.
- Spatting pond techniques: Four spatting ponds were commissioned for the duration of the native oyster spawning and growout season. Mechanical and passive methods of temperature control were employed to optimise returns from the pond and a report was provided discussing the relative

success of each technique. Overall, figures upward of 12 million settled spat were recorded in September 2021. However, survival post settlement can be as low as 15% when transferred to wild beds and inter-tidal nurseries so future work will focus on improving this stage of the growth cycle.

- Pacific Oyster Husbandry Techniques: A desktop review of oyster husbandry technology in use worldwide was commissioned during 2021. The purpose of this report was to seek out innovations which may address important sustainability issues for the sector such as the risk of generating marine litter, replacing single use plastics and maximising yield per hectare. Structural specifications, capital costs, impact on labour requirements and potential to improve quality were also considered. The results of the review were made available to industry and relevant partner Agencies and will assist in steering the sector towards more environmentally and financially sustainable practices in the future.
- Irish Mussel Producers Industry Webinar: It was planned to host a face-to-face Rope and Bottom mussel webinar in the final quarter of 2021, but industry representatives requested that we hold off until Spring 2022. This Webinar was a snapshot of topics to be discussed in more depth in Spring 2022. It was held on 9th December 2021 over Zoom. The recording of the presentations is available on the BIM website.

Summary of Spend	
Total Approved	€378,000.00
Total Eligible Expenditure	€308,171.89
Total Drawdown	€308,171.89
EU – 50%	€154,085.95
Exchequer – 50%	€154,085.95

Report by: Vera O'Donovan

Date: 11th March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG039-BR074 - BR038-BR065
NAME OF PROJECT: Shellfish Monitoring & Food Safety
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

Food Safety is an area where there is constantly evolving legislative and policy requirements. It is a principle of Irish and European Law that all Food Business Operators (FBO's): (producers, manufacturers, distributors, retailers and caterers) bear the primary responsibility for the safety and suitability for human consumption, of any food placed on the market by them. Furthermore, FBO's are required to take all reasonable steps to ensure the safety and hygienic standard of their products. These principles require the implementation of appropriate food safety management systems throughout the food chain.

In 2017, the European Food Safety Authority's (EFSA) Panel on Biological Hazards (BIOHAZ Panel) concluded in its Risk Assessment that the most effective public health measures to protect consumers from exposure to *Norovirus* in oysters was to produce oysters in areas which are not contaminated or to prevent contamination of mollusc production areas. According to the Panel, methods currently used to remove *Norovirus* in shellfish should be improved. Due to these initial findings, a 2-year (2017-2019) EU-wide Baseline Survey on *Norovirus* in oysters was commissioned by the EU to provide information on overall consumer exposure and the impact this would have on an oyster producer.

Upon completion of this 2-year EU Base-line survey, the Panel recommended establishing acceptable limits for the presence of *Norovirus* in oysters that are harvested and placed on the market in the European Union. The analyses of the substitution approach showed that selection of a potential limit within a microbiological criterion close to or lower than the LOQ (for example, less than 300 copies, given the current test used in this survey) would be difficult to apply.

The testing of oysters is critical to demonstrating compliance with quality control procedures and provide quality assurance to customers. The presence of *Norovirus* is a potential threat, particularly in the winter months and can lead to a negative impact by consumers and at times create a health risk.

The scope of this project was to ascertain best practices for *Norovirus* monitoring of Irish Oysters for export to protect public health risk and commercial markets and by investigating the correlation and ratio of infectious and non-infectious virus in oysters at different stages of oyster production. This was achieved by:

- Examining up to 1,000 samples per year
- Establishing levels of *Norovirus* in those samples
- Creating weekly reports on the profile of samples submitted
- Producing a project report that can be used by industry to establish national *Norovirus* trends, make recommendations on best practice, and thus ensure the maintenance of premium position in the marketplace.
- Preliminary development of a study that will ultimately help establish the ratio of infectious & non-infectious virus at key points in the oyster production chain (harvest area, pre-depuration & post-depuration) using FRNA bacteriophage.
- Knowledge exchange for all stakeholders.
- Provide materials which support food business operators in implementing food safety management systems incorporating HACCP that meets the highest regulatory and voluntary standards of food safety management.

- Develop & deliver a blended approach to food safety training via online workshops and via one-to-one tailored meetings.

Objectives

- Development of best practice for *Norovirus* monitoring of Irish Oysters for export to protect public health risk and commercial markets.
- Investigate the ratio of infectious and non-infectious virus in oysters at different stages of production.
- Development of best practice in food safety management systems.
- Aid Food Business Operators.

Budget	€180,000
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Achievements/Spend

A key element of quality assurance is demonstrating the absence of *Norovirus* in oysters at levels that may cause illness. Testing of oysters is critical to demonstrate compliance with quality control procedures and provide quality assurance to customers, thus protecting public health risk and commercial markets.

Although ISO 15216-1 is recognised by European Food Safety Authority (EFSA) and others as an important risk management tool for the detections of *Norovirus*, it cannot distinguish between infectious and non-infectious virus. Currently it is not possible to routinely culture *Norovirus* from shellfish matrix. F-specific RNA (FRNA) bacteriophage are commonly present in human wastewater and have been proposed as suitable surrogates of human enteric viruses. Infectious phage can be readily detected using a standard plaque assay and when coupled with in site hybridisation procedures, it is possible to differentiate between the genogroups of F-specific RNA FRNA bacteriophage. Preliminary work commenced to establish the ratio of infectious & non-infectious virus at key points in the oyster production chain (harvest area, pre-depuration & post-depuration) using F-specific RNA FRNA bacteriophage. This ongoing work is providing a useful indicator towards the extent of the estimation of infectious *Norovirus* provided by the use of RT-qPCR procedures.

In addition to the bacteriophage work conducted, the examination of up to 40 industry provided samples per week (Max 1,000 per year) with a higher frequency of samples over the winter months, the BIM funded *Norovirus* project has assisted in the development of best practice for *Norovirus* monitoring of Irish Oysters for export.

The implementation of this project has:

- Inaugurated frequency of testing
- Tailored this monitoring to incorporate seasonality
- Established a geographic distribution of norovirus in a given harvest area or end product (Post depuration)
- Enhanced sampling and transport storage condition procedures
- Forged excellent knowledge sharing opportunities with industry through forums such as the Irish Oyster Packers Group
- Informed the development & implementation of individually tailored producer *Norovirus* Risk Mitigation Management Plan procedures in the majority of production sites and assessed their fitness for purpose based on the *Norovirus* data obtained. In turn resulting in greater food safety procedures
- The deliverance of quality assurance to the consumer, which in turn has secured markets and the safeguarding of the Irish oyster industry

Development of Food Safety Management Systems Manual

The updated Integrated Food Safety Management System Manual provides the Food Business Operator (FBO) with the skills to identify and control any potential hazards that could pose a danger to the preparation of safe food. With the assistance of the BIM'S Food Safety Management System Manual, FBO's can identify what can go wrong, plan to prevent it from going wrong and reduce any potential risk to an acceptable level, thus ensuring public health.

Summary of Spend	
Total Approved	€180,000
Total Eligible Expenditure	€180,000
Total Drawdown	€180,000
EU – 50%	€90,000
Exchequer – 50%	€90,000

Report by: Vicky Lyons

Date: 2nd March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG039-BR075
NAME OF PROJECT: Shellfish Survey Programme
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The core part of this project involved carrying out subtidal seed mussel survey, using acoustic data, biological sampling and GIS following a robust and reliable methodology. In addition, further works on potential brood stock biomass estimation, increased bivalve larval monitoring, genetics of stocks, seed survival and condition/spawning stage of both seed mussel stocks and mature stocks is also included in the project scope. The survey vessel the M.V. T. Burke II is used to locate and survey seed mussel beds on the East Coast, in Dingle Bay and other areas of Ireland. Post fishery stock assessment will be carried out on the marked settlements. The vessel will also be used for work on bivalve larval monitoring and any other survey work as is required.

Additional scientific work is undertaken to provide transplanting solutions to the bottom grown mussel industry in relation to the lack of recruitment of "wild" seed. Further work is carried out on bivalve larvae species screening.

Objectives

The main objectives of the benthic mussel program are to identify and quantify sustainable seed mussel beds around the coast of Ireland and facilitate the search for seed mussel beds for the industry.

It also provides sound scientific information and data to DAFM to assist with resource management. It does so by producing survey reports that are made directly available to the industry and DAFM via the BIM website once an area of interest has been covered. Those reports detail the location of the seed mussel settlements, their estimated biomass, the nature of the seabed, the quality of the seed mussel. The survey information obtained is then used to determine if the beds are suitable for fishing or whether they should be closed for a certain period.

The objective of determining the genetic distribution of the mussel around the coast of Ireland was to access the locations with mixed or pure *Mytilus Edulis* (Me) *Mytilus galloprovincialis* (Mg) and hybrid populations. Testing the community ratio of relayed longline seed mussel on bottom mussel sites overtime will determine which species has a higher survivability rate. This will then feed essential information to Industry which in turn can then select certain seed mussel sources which may have a higher rate of survivability in a particular bottom mussel relay site over time.

Budget	€180,000
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Achievements/Spend

Maximum approved expenditure on the project totalled €180,000 corresponding to the following headings:

- Associated survey running costs of M.V. T. Burke such as fuel and berthing fees etc.
- Contractors to supply skipper (outsourced).
- DNA screening of bivalve and zooplankton larvae (outsourced).
- Larval/condition index sampling and boat hire (outsourced).
- Associated sampling consumables cost.

The project achievements for 2021 were as following:

- 46 days were spent at sea searching and assessing seed mussel beds.
- 4 settlements were found: all situated on the east coast of county Wexford, representing around 9,149 tonnes of seed mussel at the time of the surveys.
- The seed mussel fishery was therefore successfully opened in early September.
- Post fishery survey was carried out on the two east coast settlements.
- 66 plankton samples from 6 locations around the country were screened for species variations.
- 500 kg of seed mussels from 5 different locations were relayed in Cromane.
- 588 individual mussels from those 5 different locations were screened for species ratio.

All reports are available online at the following address: <http://www.bim.ie/our-publications/aquaculture/>

Summary of Spend	
Total Approved	€180,000.00
Total Eligible Expenditure	€179,254.52
Total Drawdown	€179,254.52
EU – 50%	€89,627.26
Exchequer – 50%	€89,627.26

Report by: Nicolas Chopin

Date: 22nd February 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG041-BR077
NAME OF PROJECT: **Marine Challenge**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The initial six months after transferring salmon smolts to sea is a key risk period in the production cycle with the young salmon being stressed not only by the process of smoltification but also being challenged by Amoebic Gill Disease, Sea lice, phytoplankton, and other environmental challenges. It has been observed that once the fish in the sea have reached an average weight of one kilo or more that they are much more resistant to these risk factors. Thus, if the 'young' fish can be further protected for the initial period at sea, volume and value can be maximised. This project follows successful trials initiated in 2019. We have now reached a stage where the equipment has been proven in the marine environment and is now ready to receive fish for a full 6-month period thus moving from trial towards commercial adoption.

Amoebic Gill Disease (AGD) is a recurring health issue for marine salmon farms. It is caused by a naturally occurring single celled planktonic organism and has no implications for human health or for interactions between farmed and wild fish. However, if left untreated in farmed conditions, high mortalities can occur. The preferred treatment method is bathing the affected salmon in fresh water. This project will help to improve this process and make it more efficient.

The increasing occurrence of phytoplankton and zooplankton challenges has been noted by the Irish aquaculture sector. Harmful plankton can result in symptoms ranging from suboptimal growth through to increased mortalities. In 2019 and 2020 elevated levels of mortality were recorded from the southwest to the northwest coast of Ireland however the specific causative environmental agents and the frequency of occurrence proved difficult to track and thus inhibited the capability of the sector to respond. In 2020 BIM developed a real time data logging system that was successfully deployed for a short period in the southwest, which yielded valuable data. A network of real time data loggers in conjunction with remediation strategies can alter the outcome of these naturally occurring events.

Objectives

- To test the efficacy of a flexible closed bag for closed containment growing.
- To run a closed containment system at sea using sea pen infrastructure.
- To develop a network of water quality sensors in order to assist with the early detection of harmful organisms.
- Increase knowledge of water quality around the coast particularly in relation to aquaculture sites
- To test bubble curtains particularly in relation to commercial effectiveness and running cost.
- To ascertain the effectiveness of a modular, transportable harvesting system.
- To establish the efficacy and efficiency of freshwater snorkel system in marine pen farming.

Budget

€400,000

Achievements/Spend

Closed Containment System

The closed containment system was deployed within a conventional salmon pen with a circumference of 50m. This pen was built using 2 x 315mm HDPE to ensure sufficient flotation of the closed containment system, the base was formed into a cone to permit fish waste to settle into a collection chamber. Water underwent mechanical filtration to 60 micron and received a UV dose of 100mjcm⁻¹. To power the system a 24kwh battery complete with 1kwh wind turbine and 3.2kwh of Photovoltaic cells was used 5000 salmon smolts with an average weigh of 90g were added to the pen. The closed containment system has been filled in the days prior and there was continuous input. This represents a starting density of 0.28kg/m³. With an estimated survival of 90% to 1kg this would represent a finishing density of 2.8kg/m³.

Fish in the closed containment system grew at the same rate as those found in traditional net pens until week 15. Fish in this system resumed feeding on the same day as input, whereas the fish in the traditional net pen took several days before feeding began. After week 15 the fish in the traditional net pen increased in size at a greater rate than those in the closed containment system. At this time, water quality within the closed containment system was compromised and due to a failure in the inlet water treatment AGD had become apparent within the closed system. This resulted in gill health in the closed bag deteriorating rapidly. There was no opportunity to recover this situation and so a biofilter was not added to the closed bag. Without an inlet water quality issue, it was modelled that the biofilter would maintain water quality and maintain sufficient oxygen for efficient growth. The use of the circulation pump within the closed bag increased oxygen availability by 15 -20% at 15oC.

The oxygen saturation was seen to drop steadily during May as a result of biomass increase and subsequent increased feed input. A Large drop in oxygen saturation was seen in June and was due to pump failure. The replacement pump rapidly returned oxygen saturation back to 60%. Oxygen saturation then plateaued at 50-55%, until the recirculation pump was added on the 22nd of June.

Survival was lower than anticipated at 75% and was a result of inlet water treatment failure and subsequent AGD occurrence. Biomass within the system at the end of the trial was 1,200kg.

For this trial to be successful, greater water input is required. It is estimated that 40l/s would be required. This will require a larger drumfilter or additional drumfilters. Additional inlet pumps would enable more consistent water quality in the event of single pump failure.

This additional equipment would require more power, estimated at 18kwh, representing 432kwh per day (an increase of threefold on the current usage) significantly increasing the carbon footprint of the closed containment system.

In respect of the power used to operate the closed containment system we found that by the end of the trial generator run time had been reduced by 60% and resulted in a total fuel saving of 2,432l, with a bowser capacity of 700l, this meant 4 less fills with a resulting reduction in the likelihood of a fuel spillage at sea. The use of renewable power in addition to maximisation of generator output reduced the carbon footprint of the closed containment system by 0.4kg of carbon for every kwh consumed.

Bubble Curtain

Two Atlantic salmon farm sites that had experienced elevated levels of mortality were selected for the deployment of bubble curtains. Conditions in Ireland differed greatly from the environments in which the bubble curtains are typically deployed. Traditional deployments have occurred in sites with low current

speeds in sheltered locations with a small wave climate, in locations in Chile. In Ireland, the locations are likely to experience increased wave exposure with five metre swells experienced and current speeds in excess of 1.5 knots.

The equipment manufacturers travelled to Ireland to visit site managers to ensure the equipment as supplied and deployed would facilitate the husbandry strategy on those sites. The real time data sensors were also deployed and baseline data was collected.

The bubble curtains require a very strict ISO standard for air quality. The two site plans and anchoring arrangements are in place. Some slight modifications were required to the manifolds and feed line supplies in order to better match the anticipated demands of the system. Ongoing monitoring of the system is underway and will continue into 2022.

Electrical Stunning System

A trial of the stunners was undertaken with four bleeders. The capacity of the system was calculated at 13 tonnes per hour but is dependent of the numbers of staff and the speed at which the fish can be brailed into the system. Care needed to be taken not to crowd the swimming pool area, as this can lead to fish being pushed down backward or doubling up in the stunner area which affects the efficacy of the system. Blood spotting was estimated to be less than 10% but further trials would need to be conducted in consultation with the manufacturer to assess if this can be further reduced.

The major advantage of this system was the ability to harvest in house with no contractors or vessels required. This had particular importance as covid on vessels often meant significant delays and backlogs from other operations. This level of flexibility gave the producer better planning for site harvests. The equipment can be operated by adequately trained farm personnel and costs can be saved by the farm as no outlay is required if harvesting cannot take place due to weather.

Downsides to the system are that the unit is difficult to transport and is probably not designed to be moved regularly. This could be improved by housing inside a container. In this case lighting would be required.

Overall, the system has many benefits including:

- All operation can take place in house – no contractors/vessels required
- Machine can easily be operated by farm staff
- Gives flexibility to the farm – no unnecessary waiting for availability of harvest boats
- Efficient operation
- Control for the farmer offering better planning and more efficient operation overall on sites
- No outlay if harvest does not proceed due to weather, malfunction of machinery, etc.

Freshwater Snorkel

It has been established that treatments using desalinated water are effective against AGD infection. This trial tested another method of creating freshwater availability on a site-specific basis using desalinated water to create a freshwater lens within a test cage. This concept exploits the fact that fresh water will 'float' on top of seawater in a discreet layer and not mix, if not disturbed by stirring agents such as wave action. It is hypothesised that the fish can then 'choose' to treat themselves by selectively occupying this layer until their gills have shed the amoeba. A flexible, strengthened, impermeable, bottomless structure was deployed within a salmon cage to test this approach.

The freshwater lens had an inflatable leading edge meaning that no additional solid flotation was required inside the pen. This eased deployment and recovery. The design of the tarpaulin included reinforcements

along its depth to maintain its cylindrical shape. The pen used was 50m circumference having a diameter of 16m.

Salinity at multiple depths was logged and it was established that the salinity was stable while reverse osmosis water was being added to the lens. When the system was shutdown, it took approximately 18 hours for salinity to increase above 25 parts per thousand.

Median Ct values in the snorkel cage show a significantly lower amoeba load compared to the control pen at the end of the trial. This observation is supported by lower AGD scores on histopathology at sampling point 3. Histology gill scores were significantly lower in the snorkel pen compared to the control pen, indicating a benefit of access to freshwater for gill health. Skin scores were also lower in the snorkel pen but the difference is minor and does not allow for statistically significant interpretation.

On a commercial scale, a freshwater supply in excess of what is required in the snorkel would be preferred, this would enable an element of redundancy. At a commercial scale the option to aerate or oxygenate the incoming freshwater is likely to be required.

Summary of Spend	
Total Approved	€400,000
Total Eligible Expenditure	€400,000
Total Drawdown	€400,000
EU – 50%	€200,000
Exchequer – 50%	€200,000

Report by: Geoff Robinson

Date: 11th March 2022

BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG041-BR078
NAME OF PROJECT: Oasis
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

The freshwater sector in Ireland is facing challenges relating to regulatory pressures on effluent discharge and water abstraction. The aim of this programme is to develop robust new culture and treatment systems for the sustainable development of the sector. Ireland's freshwater sector is restricted from expansion due to lack of suitable sites and competitiveness aligned with high production costs. The utilisation of non-agricultural lands for food production is a key aim of the European Union as it seeks to reduce the trade deficit in fish products. The OASIS project seeks to prove the viability of using RAMPS (Recirculating Aquaculture Multitrophic Pond Systems) on cutaway peatlands and address the challenges to the wider aquaculture sector posed by climate change. Developing a novel aquaculture production system capable of adhering to organic standards whilst minimising water abstraction and discharge is a significant step to closing the nutrient loop identified as a key component of the EU's farm to fork strategy. The project forms a key component in Ireland's ambition to align with the European Green Deal.

Following on from exploratory work in the 2000's, BIM identified significant swathes of land in Ireland which could be utilised for aquaculture. In particular, marginalised rural land and cutaway peatlands form a significant land holding which offers little in the way of commercial return at present. Some 80,000 hectares of cutaway peatland alone will exit peat production in the coming years and whilst some can be rehabilitated, the opportunity for job creation in these areas remains limited. The RAMPS project developed out of preliminary work in perch pond production and is based on a modified design of similar systems used for catfish in North America. The RAMPS project began in 2018 and has quickly established the potential of these systems. Based at two licensed sites in Keywater, Co. Sligo and Mount Lucas, Co. Offaly, work has concentrated on system design and modification, system efficiency, algae and duckweed management, water quality, fish health and all the necessary components of a viable aquaculture system.

OASIS is an innovative project aimed at expanding Ireland's freshwater aquaculture sector. As aquaculture faces increasing pressure from a legislative and licensing point of view. Measure to permit sustainable development within existing farm sites and innovative new methods of culture are required to address these constraints.

BIM is committed to helping industry assess its impact on the environment and implement innovative solutions to reducing discharges. The project seeks to get a better understanding of water quality of effluent and develop methods for remediating effluent. The project further seeks to explore the potential for developing multi trophic freshwater systems on marginalised agricultural land and cutaway peatlands. Using algae and duckweed to treat fish waste and recirculating water in pond systems thereby reducing discharges and abstraction. An ancillary benefit of such systems is that they have the potential to not only develop as circular economy projects but produce commercially viable protein which can be abstracted from the algae and duckweed. BIM is leading the way in opening up opportunities for the industry to expand in a sustainable manner.

The majority of Irish freshwater farms producing salmon and trout have been based on river systems, abstracting water, utilising it and discharging back into the system, in many cases with minimal treatment. BIM working with industry and academic partners will analyse and propose appropriate systems and

technology to reduce effluent discharge into the environment and develop alternative source of renewable energy products.

RAMPS is a novel production method developed by BIM. The system involves utilising cutaway peatlands and poor agricultural land for freshwater fish production. The system has the potential to significantly increase Irelands aquaculture production of organic produce in a sustainable and cost-effective way. The project involves cultivation of perch and trout in earthen ponds utilising duckweed and algae for bioremediation. Subsequently it is envisaged that the duckweed will be harvested and utilised in the cosmetic, animal protein and pharmaceutical sectors. The EU's Farm to Fork strategy sets targets of reducing nutrient losses by at least 50% to 2030 and reduce the use of nutrient losses by 20 %. The OASIS project is a practical model of how such reductions can be achieved in land-based aquaculture.

Objectives

- Documented inputs and outputs on trial sites.
- Trial of technological and management-based solutions.
- Utilisation of natural reedbed and wetland systems to treat effluent.
- Analysis of sludge generation and possible reduction solutions
- Assess the potential for duckweed cultivation as a protein source.
- Create a circular economy test model.
- Map the energy efficiency and Life cycle assessment (LCA) of the system.
- Production of out of season juveniles.
- Supply of niche organic product.
- Perch & trout culture expanded.
- Farms open to external visits from stakeholders to encourage dissemination.
- Development of sustainable IMTA system delivering both fish and plant products.
- Continued development of brood stock programme.

Budget	€300,000
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Achievements/Spend

The OASIS trial concluded in December of 2021 having reached its objectives. The project set out to assess the viability of aquaculture on cutaway peatlands and successfully culture rainbow trout, perch and duckweed in a RAMPS type system. The project showed the suitability of cutaway peatlands for aquaculture utilising novel technology. A number of key objectives were met during the trial period including:

- The suitability of cutaway peatlands for aquaculture.
- The use of a circular system with minimal water abstraction and discharge to culture fish.
- The potential of duckweed and algae to bioremediate fish waste.
- The commercial potential of duckweed as an alternative protein source.
- The potential for renewable energy usage in aquaculture.
- The low levels of sludge produced in oxygenated systems.
- The potential for aquaponic systems to uptake nutrients from aquaculture wastewater.

Potential obstacles to full commercial aquaculture production on peatlands include the need to better regulate pH levels and algal growth. Further work is required to manage spring algal blooms as water temperatures increase through global warming. Any commercial systems of this nature must include management control systems to be able to mitigate high pH levels from algal growth.

Summary of Spend	
Total Approved	€300,000
Total Eligible Expenditure	€300,000
Total Drawdown	€300,000
EU – 50%	€150,000
Exchequer – 50%	€150,000

Report by: Damien Toner

Date: 7th March 2022



BENEFICIARY: Bord Iascaigh Mhara
PROJECT REFERENCE NUMBER: 21/KGS/STS-BG043-BR088-89
NAME OF PROJECT: **Sustainability Programme**
IMPLEMENTATION PERIOD: 1st January to 31st December 2021

Project Scope

This sustainability project comprised two separate work packages with the common aim of understanding and improving environmental performance and impacts.

The first work package was designed to collect data on invasive alien species in aquaculture producing areas to establish prevalence, distribution and raise awareness and understanding of the spread of species through the Irish marine environment.

The Natural Capital work package tested the application of the UN SEEA to the seafood sector through the development of two demonstration case studies based in Clew Bay. More than ever seafood businesses and regulators need clear guidance to understand and manage their impacts and dependencies to deliver benefits across the natural, produced and social capitals and to better manage risks and opportunities for a nature positive, carbon neutral and equitable future.

Objectives

- To continue to establish baseline knowledge of the status of marine IAS in Ireland.
- To identify key risk areas and address them through development of appropriate biosecurity plans.
- To support DAFM in responding to areas of IAS need.
- To engage and build knowledge of IAS across the Aquaculture sector to improve understanding and encourage good practices.
- To test and demonstrate the application of Natural Capital Accounting for Irish Seafood sector, using the UN SEEA approach.
- To improve the understanding of the complex relationship between seafood sector activities and the natural environment.
- To contribute to the sustainable management of the seafood sector and the marine environment.

Budget	€123,000
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Achievements/Spend

Invasive Alien Species (IAS)

The BIM IAS project continues to deliver important baseline data for the Aquaculture sector. This helps to inform best practice in stock movements and ensure that the sector actively contributes to risk minimisation. At a wider level the project helps to ensure that biosecurity measures are proportionate to risk and manageable for the aquaculture businesses.

2021 was the fourth year of data collection on IAS from aquaculture sites linked to the SASI programme. SASI surveys were conducted in 11 bays in 2021. As with other years, additional survey work was commissioned to glean a wider picture of the distribution of IAS within marine environments in general and in 2021 a full survey of Donegal Bay was conducted. Seed mussel beds were also surveyed. A full 2021 survey report was produced.

One meeting of the IAS and Aquaculture Cross Departmental and Interagency working group was held in November 2021. This included a training session provided to the members and duplicated in another session provided directly to BIM staff. In 2021 industry awareness raising was conducted through direct client support and in the development of farm scale or stock movement linked Biosecurity Plans.

Chinese Mitten Crab: As a follow-up to the rapid response survey for Chinese Mitten Crab carried out in 2020 in response to a possible movement with mussel seed from Morecombe Bay, wider survey work and analysis was conducted along the east coast of Ireland at aquaculture areas and suitable CMC habitats. CMC was found in Waterford Harbour. A report was produced, and relevant authorities notified. It was concluded that aquaculture was unlikely to be the vector of introduction in this instance.

Natural Capital work package

This work package produced the following reports:

- Use case analysis
- Accounting Report – documents the accounting process, data and demonstration case studies.
- Synthesis Report – highlights opportunities and challenges for wider application of capitals accounting for the seafood sector and the marine environment.

The United Nations SEEA (System of Environmental and Economic Accounting) was used to test and demonstrate the application of Natural Capital Accounting for the Irish seafood sector. The UN SEEA is a well-developed and globally understood approach that can be applied at multiple scales. This is the first marine project in Ireland to adopt this approach. Two demonstration case studies were developed and included the consideration of a range of applications which could help to contribute to the sustainable management of the seafood sector and the marine environment:

Natural capital accounting adds value to current monitoring approaches by organising existing data into an integrated and coherent narrative across multiple dimensions (environmental, social, and economic). Historically bespoke data collection processes and missing information have impeded integration from occurring. This project provides a framework for future data collection including areas that should be targeted to generate value for money from investments in data and information.

This project has combined a wealth of information that can be used to provide a common natural capital narrative about Clew Bay. It is an important first step in framing the marine environment as a collection of ecosystem assets that provide services. However, more work is needed to improve current data so it can be used to support decision making and management of natural capital in Clew Bay. The project relied on existing readily available data and no new data was collected. 140 separate datasets for Clew Bay were added to the database used to inform the focus of the two case studies.

The first case study examined the native oyster habitat restoration work ongoing in Clew Bay. The project is actively increasing the extent and improving the condition of this important habitat and is receiving services from the aquaculture sector in the form of shell cultch to support the restoration. This is an example of the aquaculture and fishing sectors working together to actively manage the natural environment for the benefit of nature and business.

The second case study used a multiple approach to assess the value of the CLAMS group in Clew bay and the activities it carries out. The existence of the CLAMS group creates a multiplier effect delivering wider benefits across the capitals.

The outcomes from the project demonstrate how capitals accounting can be used in policy, management, and planning. The structured information set resulting from the project can be used by BIM, the local CLAMS groups, and statutory authorities, to inform ongoing management of Clew Bay and marine and bay areas in Ireland generally. The database will remain live and can continue to be used as a single repository for Clew Bay data for use by BIM and by extension the local seafood sector through CLAMS.

A key benefit of this project is the knowledge gained from trialling natural capital accounting in Clew Bay. The project provides experience through the use of Clew Bay as a study area, translating the theory of a capitals approach into practice. It also provides a foundation and structure to identify future information needs to support sustainable management of Irish marine environments by:

- Providing a systematic stocktake of the information available
- Identifying information that can underpin the seafood sector activities
- Identifying information gaps – contributing to the knowledge of ‘values’ across Irish waters
- Informing priorities for ongoing monitoring in Irish waters
- Providing methods for producing an information set that can be tested and improved
- Highlighting ways to present information on the Irish marine environment

The project has helped BIM build a knowledge base around the discipline of capitals accounting and the learnings and experience will be beneficial for seafood sector participation and representation in any future approaches adopted, either nationally, internationally or at a local level. Beyond the accounts, the language around capitals accounting can help the seafood sector to better understand dependencies on natural capital and communicate impacts and performance to other stakeholders. In many ways the real achievement of this project was insights and learning derived from participating in the process rather than the actual demonstration account outputs. It delivered experience and understanding of the application of Natural Capital Accounting, and the opportunities, challenges and data requirements for its successful utilisation.

It is clear and correct that Nature considerations become more prominent in future decision making. The capitals approach to decision making using the UN SEEA is an option. However, as seafood sector decisions do not take place in isolation, a national and co-ordinated approach using a single method would realise greater benefits.

Multiple Capitals Accounting is a data driven process that provides quantitative evidence for decision makers. The implementation of capitals accounting within business and government is in its infancy compared to the implementation of financial accounting and national accounting. For accounting to be successful, there is a need for the development of consistent national methods for the collection of marine environmental data, so the data can be integrated and readily incorporated into environmental-economic accounts for analysis and reporting. Further investment would be needed to gradually transition towards an embedded system of accounting. Done well there is scope for the process to support marine planning at a wider level and actively contribute to sustainable management of the seafood sector and the marine environment.

Summary of Spend	
Total Approved	€123,000
Total Eligible Expenditure	€123,000
Total Drawdown	€123,000
EU – 50%	€61,500
Exchequer – 50%	€61,500

Report by: Grainne Devine

Date: March 2022

