Accelerating Innovation in Aquaculture

Ideas, investment and opportunity across the UK

Safe food, produced to a high standard, in a transparent and low carbon way, at CIEL we support and facilitate the delivery of efficient, sustainable and competitive livestock and aquatic food production.

- Challenges
- Priorities
- Solutions
- Innovation

Through emerging technology and processes we aim to reduce fragmentation and increase collaboration in the agrifood sector. Delivering results in the development of climate smart food systems and improved animal health, welfare and productivity.

Drawing on world-class research, industry and innovation, our goal is to successfully tackle key livestock and aquaculture farming challenges faced by the UK and around the world.

We can help you:

- Identify new ways to solve complex challenges
- Inform and influence industry priorities
- Speed up the translation of ideas into innovative supply chain solutions
- Position your organisation as a leading innovator

In May 2022, CIEL expanded its activity to include aquaculture with a remit to accelerate innovation.

Over the last 40 years, aquaculture has grown to become an important component of the UK seafood sector with a production value of over £1 billion to the UK economy.

Across the four nations, Northern Ireland, Wales, England and Scotland, the needs of UK aquaculture may be seen as similar, yet each face unique challenges. Complex and dynamic, the growth of Recirculating Aquaculture Systems (RAS), or RAS technology, complements a marine environment that is harder to monitor and control than land-based agriculture. All four nations need a greater understanding of the impacts on the marine and freshwater environments and how this will change as the climate warms.

To explore and better define these innovation challenges, CIEL ran a series of workshops throughout 2023, not simply to look at need, but also unlock a range of stakeholder-led ideas to address issues across:

- Aquaculture, climate change and the environment
- Husbandry, feed and technology
- Trade, supply chain and marketing
- Disease and public health

This resource offers a summary of the overarching themes and more specific challenges of each nation and we are grateful to everyone who participated and shared their experience and insight.

Working with our extensive academic and industry network, CIEL's dedicated resources will seek to drive the development of projects to meet each of the four nation's innovation priorities, ensuring tangible, deliverable actions for industry wide impact and progress.

Value of volume of farmed fish and shellfish in the UK (2021)

Top 5 species by value:	Top 5 species by volume:
1. Atlantic Salmon **£1.01bn**	1. Atlantic Salmon **205,393 tonnes**
2. Rainbow Trout **£51.3m**	2. Rainbow Trout **13,503 tonnes**
3. Mussels **£11.8m**	3. Mussels **12,223 tonnes**
4. Oysters **£9.7m**	4. Oysters **2,989 tonnes**
5. Carp* **£6.1m**	5. Other Salmonoids **605 tonnes**

Credit: www.seafish.org

*Carp production in the UK is largely for the ornamental trade

Northern Ireland

Main species:

Mussels, Oysters, Salmon, Trout

Sector Value (2021):

£13 million*

Dominated by marine shellfish production, the Northern Ireland aquaculture sector is a valuable, niche industry, consisting of a range of species-specific businesses which continue to develop.

Northern Ireland's trout aquaculture status as disease-free is an important promoting factor and underpins its competitive advantage. Workshop discussions identified several key challenges around environmental bioremediation; waste valorisation; climate change mitigation production efficiencies in labour, waste and energy, as well as the potential for co-location with offshore renewable energy projects.

Innovation opportunity roundup:

- **Multi-pond system kinetic energy** capture and conversion.
- **Bioremediation of coastal waters** to improve water quality.
- **Catchment characterisation of microbial pollution**, monitoring rainfall and pollution events for risk-based management of bivalve shellfish harvesting.
- **Waste valorisation for bivalve shellfish**.
- **Finfish waste for fly meal production**.
- **Insulation alternatives to polystyrene**.
- **Automation and LEAN manufacturing** opportunities.
- **Diagnostic technology** for antibiotic residue and disease diagnosis.

Image: Seaweed Generation Ltd

Wales

Main species:

Mussels, Oysters, Seaweed

Sector Value (2021):

£0.75 Million*

Home to one of the largest mussel farms in the UK, the Welsh Government has set an ambitious target of doubling aquaculture production, focussing on innovation and building sector capacity.

Highlighting South Wales's academic capability in marine and climate science, the adoption of emerging technology, fast transitioning and lessons learned from other nations is a key commercial advantage for a country viewed as a 'late mover' in aquaculture. The Welsh workshop focussed on identity and USPs, and what restricts and limits its development. Key challenges identified included: industry positioning; site availability and viability; co-location opportunities; waste minimisation and long-term development of algal toxin testing.

Innovation opportunity roundup:

- **Carbon and nitrogen sequestration models** for shellfish.
- **Development of shellfish seed production** for native oyster.
- **The role of bacteriophages** might play in reducing pathogenic bacteria issues and use of antibiotics.

England

Main species:

Trout, Mussels, Oysters, Seaweed

Sector Value (2021):

£41.5 million*

The English Aquaculture Strategy (Seafood 2040), sets out a delivery plan for the sustainable development of English aquaculture, supporting a ten-fold increase in production to approximately 90,000 tonnes by 2040[A].

With a recent decline in consumer demand and optics as an 'expensive protein', the focus of England's workshop was current species status, promotion, the impact of Brexit, regulatory, licencing and planning issues. The group also discussed England's marine water quality issues and how to best take advantage of emerging monitoring technology. Key challenges include alternative markets; allergen status of seaweed; sustainability messaging; waste valorisation; disease and epigenetics.

Innovation opportunity roundup:

- **Restoration of mussel stocks and bioremediation**.
- **RAS efficiency and optimisation**.
- **AI and wireless technology** innovation.
- **Co-location offshore renewable project submersible systems** and supply chains.
- **Seaweed aquaculture:** hatchery, farming, processing, supply and market development.
- **Addressing microbial risk to oysters**, including emergent Vibrio species bacteria.

[A] www.seafish.org/about-us/news-blogs/english-aquaculture-strategy-sets-out-plan-for-sustainable-growth/

Scotland

Main species:

Salmon, Mussels, Oysters, Trout, Seaweed

Sector Value (2021):

£1.1 Billion*

In 2020, close to 70% of UK economic output from the fishing and aquaculture industry was generated in Scotland. Aquaculture was worth £3.3bn to Scottish economy over the last decade, a contribution that has increased by 76%, from £206 million in 2011 to £362 million in 2020[A].

Home to the Sustainable Aquaculture Innovation Centre (SAIC) and current leader in UK aquaculture, Scotland's workshop discussions centred around the need for innovation and opportunities in novel feed ingredients, bivalve shellfish, environmental pressures and finfish disease diagnostics and control. Key challenges included reframing the sector 'story' particularly around pollutants; the impact of climate change on ecosystems; data; disease testing; diagnostics and sustainable sources of Omega 3 oils for feed.

Innovation opportunity roundup:

- **Environmental research** on pressures and cycles of bivalve shellfish.
- **Development of novel feed** ingredients for finfish.
- **Seaweed aquaculture** routes to market and circular bioeconomy.
- **On-site testing for marine algal biotoxins**.
- **Addressing Bonamia introduction** in native oyster broodstock.

[A]UK Fisheries Statistics 2022

Accelerating the development and advancement of the UK aquaculture industry

Join CIEL's Open Innovation Groups (OIGs)

Facilitated by CIEL, based on feedback from our four nation's workshops, our OIGs offer a unique opportunity for industry and academia to collaborate and innovate in a safe, precompetitive space.

- Fast-track your research, development and commercial success.
- Join one of our OIGs and let's get talking.
- Together we will find answers: join like-minded stakeholders, discover collaborators, attract investment and drive innovation through our Open Innovation Groups.
- Access world-leading aquaculture research capability and expertise in genetics and genome editing, disease resistance, health and welfare and environmental monitoring with CIEL.

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Scan the QR Code to download the Four Nations 2023 Report Summaries

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Innovate UK

*Value of national sectors collated under the UK's Data Collection Framework for fisheries and aquaculture, supplied by Cefas (contact fish.health.inspectorate@cefas.gov.uk).