



Case study

Integrated Multi-Trophic Aquaculture

Zero Waste Scotland is supporting the development of a circular economy by sharing the learnings of projects to stimulate ideas and collaboration in Scotland.

The by-products of one aquatic species provides food for another in an innovative trial taking place in Loch Fyne. The process, known as Integrated Multi-Trophic Aquaculture (IMTA) is a form of polyculture which mimics the nutrient flows in natural systems to produce multiple outputs from a food production system.

Background

The IMTA trial in Loch Fyne is being progressed by the Scottish Salmon Company and the Loch Fyne Oyster Company in conjunction with the Scottish Association for Marine Sciences (SAMS). The four-year trial is part of IDREEM, a wider European level research programme. IMTA is common in small scale aquaculture in China as a traditional technique. However, it is a new approach for salmon farming, the dominant aquaculture in Scotland.

Process

In conventional salmon farming, around 60% of the nitrogen in the salmon feed is lost to the wider loch ecosystem and can have negative ecological impacts if present in high concentrations. Making use of the waste as a resource is at the heart of the IMTA approach. In the IMTA trial, seaweed and shellfish are grown close to the salmon in order to maximise uptake of the nutrients. The shellfish benefit from the organic particulates and the seaweed from the soluble nutrients,



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including nitrogen. The trial also includes growing sea urchins on some of the seaweed.

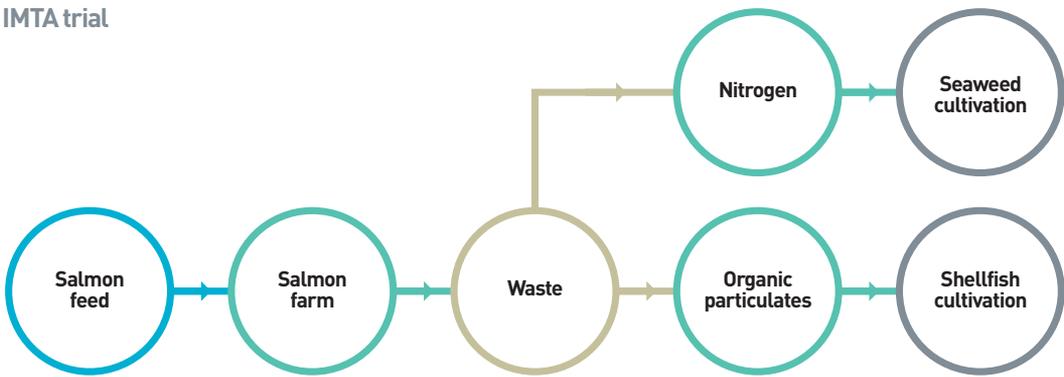
The products and results

A range of shellfish have been used in the Scottish Salmon Company trial including: mussels, oysters and queen scallops, each of which have established markets, as well as sea urchins which are less established. The main seaweed species being grown in the trials is edible kelp.

“The basic premise of IMTA is turning waste nutrients into useful products. By using waste products from fin-fish aquaculture as food for other organisms then we can reap the dual benefits of reduced pollution and increased productivity. The art of IMTA is in balancing nutrient flows across the whole managed ecosystem and not just its individual elements.”

Dr Adam Hughes, SAMS

IMTA trial



Other types of seaweed are also cultivated, either as a food product or as a future source of marine proteins and oils for healthcare, pharmaceutical and fish feed products. The early results of the pilot are positive, with significantly higher growth rates shown in the seaweed and shellfish. As a result, the Scottish Salmon Company plan to extend IMTA techniques to other sites in Scotland.

Circular economy benefits

Shellfish cultivation in Scotland is still a relatively small industry but is considered to have potential for growth. The IMTA trials demonstrate a productive and sustainable cultivation method that embraces the principles of a circular economy by making use of the nutrients present in otherwise wasted resources.

Polyculture, the process of growing multiple crops in the same space, can also provide a more resilient production system; both in a commercial sense from having a wider product range to sell and in an ecological sense from being based on a managed ecosystem.

IMTA and polyculture more widely, can give a higher total productivity than monoculture techniques where only a single type of

crop is present. There is also potential for some of the seaweed and shellfish outputs from the system to be processed into ingredients for salmon feeds.

Nitrogen recycling in IMTA is especially important as nitrogen in the form of plant nutrients or protein is a valuable resource usually requiring high energy inputs to manufacture as fertiliser or convert to protein. IMTA makes use of a free source of nitrogen otherwise wasted. IMTA offers an innovative business model for future aquaculture in Scotland.

The economic and environmental benefits of nutrient recycling can be used as the basis for a more resilient salmon farming industry and a wider renewable marine bio-resource sector.

Zero Waste Scotland supports the development of circular economy systems, models and products. For information on the support available, contact the Circular Economy team on circulareconomy@zerowastescotland.org.uk.

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