Nutrients from farmed salmon waste can feed new marine industry

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The researchers at SINTEF have successfully managed year-round artificial cultivation of sugar kelp sporophytes. Credit: Silje Forbord

Waste from salmon production is currently being discharged into Norwegian coastal waters. Researchers say this is a resource – worth NOK 6 billion each year – that should be exploited for new biological production.

In 2009 Norwegian fish farms produced over a million tonnes of salmon and salmon trout; nearly 1.2 million tonnes of high-quality feed went into this production. But a considerable amount of feed administered is released to the surrounding waters as respiratory products, faeces and uneaten feed .

This means that a significant portion of the aquaculture industry's feed is actually wasted on fertilising the ocean with both organic and inorganic nutrients. The value of these nutrients is estimated at NOK 6 billion annually.

Higher economic yield, less pollution

In the project "Integrated open seawater aquaculture, technology for sustainable culture of high productive areas (INTEGRATE)", researchers have studied whether this waste can be put to use as nutrients for cultivating kelp and/or mussels. The project was headed by Associate Professor Kjell Inge Reitan of the Norwegian University of Science and Technology (NTNU) and received funding from the Research Council of Norway as part of the initiative to promote sustainable seafood production.

"The thinking is that integrated multi-trophic aquaculture (IMTA) will provide significant added value on investments in aquaculture," explains Dr Reitan, "while at the same time reducing potentially negative environmental impacts."

Environmental organisations are critical of aquaculture waste as ecologically detrimental.

Kelp can help: many application areas

Researchers carrying out experiments at the research institute SINTEF have documented good growth

of kelp cultivated near aquaculture facilities. Mussel cultivation under similar conditions also shows promise.

Kelp can bind large amounts of the inorganic nitrogen and phosphorous discharged by fish farms. One of Norway's most common macroalgae species, Laminaria saccharina – known as sea belt or sugar kelp – is particularly promising for industrial cultivation for use as a biofuel and feed additive and for extracting its chemicals. Dr Reitan is now collaborating with several companies looking to cultivate kelp for large-scale bioenergy production.

"Development in this area will need to be driven by players in bioenergy and feed production," asserts Dr Reitan. "I don't believe the salmon farming industry will get involved in commercially cultivating kelp in the near future, even though integrated production would give the industry a greener profile and enhance sustainability."

Kelp should grow all year
Based on industrial discharge figures from salmon production in Norway, the researchers estimate the annual potential for IMTA-method kelp at 0.6 to 1.7 million tonnes. The potential for mussels cultivated using IMTA methods is estimated at 7 200 to 21 500 tonnes. Cultivation on this scale would require 82 to 250 square kilometres of marine area. Worldwide, roughly 14 million tonnes of aquatic plants are cultivated annually.

Kelp cultivation needs to be a year-round endeavour in order to be efficient. The researchers at SINTEF have successfully managed year-round artificial cultivation of sugar kelp sporophytes (juvenile plants).

"This makes it possible to exploit the kelp's strong growth potential when conditions are favourable," says SINTEF Research Scientist Silje Forbord.

Quadrupling mussel cultivation

The researchers estimate that using IMTA methods to utilise Norway's salmon production waste nutrients, there is potential to achieve four times the current annual 3 000 to 5 000 tonne harvest of cultivated mussels.

The Research Council's research programme Aquaculture - An Industry in Growth (HAVBRUK) has launched the research project "Exploitation of nutrients from Salmon aquaculture (EXPLOIT)" to determine how to design and locate kelp and mussel cultivation facilities for optimal utilisation of the aquaculture industry's waste nutrients.

Provided by The Research Council of Norway

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