

1S4: Towards circular marine food production | Sustainable mariculture

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Global agricultural production has been increasing steadily during the last two centuries. Growing awareness of the drawbacks of modern agriculture, such as deteriorating soils, decreasing biodiversity and nutrient imbalance, has stimulated to look at alternative and more sustainable approaches, as for example nature-inclusive or circular agriculture.

Circular agriculture not just emphasizes the need for nutrient security by keeping nutrients as much as possible in the human consumption-agro-ecosystem, but also advocates a much more efficient production system.

The question is whether the practice of circular agriculture will enable feeding the still rapidly increasing world population, which is expected to reach the 10 billion around 2050, particularly when the expected negative impacts of climate change on important issues like fresh water supply and soil quality are considered. Attention has therefore turned towards the seas and oceans as well. At present only a meager 1.4% of human food comes from the seas, whereas our planet is for more than 70% covered with water.

High expectations were recently raised about the possibilities to increase marine yields. The fast growth of marine aquaculture over the last decades is seen as a promising signal. A blue paper by the High Level Panel for a Sustainable Ocean Economy predicts a six-fold increase. The Food and Land Use coalition even claimed that the step from fishing, basically primitive hunting, to other forms of harvesting can increase marine yields by orders of magnitude. However, these optimistic views have recently been challenged, and the future role of finfish marine aquaculture in global food production is seriously questioned. Van der Meer (2020) also warns that large-scale low-trophic aquaculture of, for example, multi-cellular seaweed may result in serious nutrient shortages, competition with natural phytoplankton and negative impacts on the marine ecosystem.

In this scientific session and workshop we will explore the transferability of the ideas developed in circular agriculture towards the seas and oceans: nutrient security, food above feed, the use of waste streams and the role of animals, to ensure high efficiency, but at low costs for the natural environment and avoiding the same mistakes as have been made on land. Mariculture, and particularly low-trophic culture, often consists of

open cultures depending on nutrient supply from the environment and we expect that the associated differences in temporal and spatial scales of the marine environment compared to for example the scale of a single farm on land, ask for a rather different approach of the ideas developed for the situation on land about, for example, nutrient security and the treatment of waste products. We will pay attention to various forms of mariculture: seaweed, shellfish, and other invertebrates. In the exploration major knowledge gaps should be defined and steps should be taken towards a road map for a research program.

The following topics could be included:

- Nutrient cycles in coastal marine systems
- Nutrient security in future low-trophic mariculture
- Processing for food system inclusion
- Marine by-products utilisation
- Food production and natural value trade-offs
- Land-sea interactions