Developing land based multитrophic recirculating aquaculture concepts

S. Borchartd, L. Christiansen, R. Marquardt

Former studies showed that Integrated Multi Trophic Aquaculture (IMTA) concepts can be suitable alternatives to conventional indoor land based Recirculating Aquaculture Systems (RAS). Main advantages are improvement of waste water management, optimal exploitation of feed input and minimization of water and energy resources, while still providing constant and suitable rearing conditions for the cultured organisms (e.g. Wecker et al, 2005). In Germany high near- or offshore productions are not possible or profitable, e.g. due to the small, highly employed sea areas, unstable conditions or legal framework, only land-based systems are feasible. There is a need for advance land-based aquaculture systems. Here we demonstrate how we develop an IMTA – system consisting of three trophic levels: fish, oysters and algae, with a direct comparison to a RAS.

IMTA

Preliminary tests in a 1250 L system indicated that in closed IMTA systems without seawater inflow, in which the organisms only rely on the input of feedstuff, the ratio fish : oysters needs to be lower to enable growth and survival for the latter. The ratio will therefore be set to 1:2 to 6 units algae. As all water parameters including nutrients were well below RAS recommended minimum values (Timmons & Ebeling, 2010), we will also double the stock density to 16 kg turbot, 32 kg Japanese oyster and 96 kg Ulva lactuca in the larger 6000 L experiment. The two systems (IMTA and RAS) will be set up at 18°C, 25 psu salinity with a flow rate of about 6000 L per hour, enabling at least one water exchange per hour for the whole system and three in the fish tanks. Water parameters will be monitored online automatically, including temperature, salinity, CO2, pH, dissolved oxygen, turbidity, nutrients (ammonium, nitrite, nitrate, phosphate) in all tanks and PAR (light intensity) in the algae tank. Final conclusions will be used to adopt the IMTA design to industrial scales, create new products from aquaculture, optimize nutrient flows, feeding output and test new species for land based recirculating aquaculture systems.