The background of the entire page is an underwater scene showing several salmon swimming in clear, blue water. The fish are captured in various positions, some swimming towards the camera and others away from it. The lighting is bright, creating a sense of depth and clarity.

**TOP-OF-THE-LINE
RAS SYSTEMS FROM
CLEWER
AQUACULTURE**

FISH IS SUPERFOOD – HEALTHY FATTY ACIDS AND MINERALS

RAS – SUSTAINABLE WAY TO PRODUCE FISH

With RAS systems by Clewer Aquaculture these two elements are combined in an excellent way. The production cycle can be optimised so that the fish will grow without disturbances in a desired time scale.

The biomass will be harvested as it grows meaning the most effective production scheme. With our modular way of thinking you can be sure to have a balanced production method and firm risk management.

**We also sell
equipment from
experienced producers**
- UV, ozone, drumfilters,
fish pumps,
graders etc.

RAS Modules and special options



MODULES FOR AQUACULTURE

modules include broodstock, hatchery and fingerling production if needed.



COLD WATER SPECIES

| 8-12 °C | F.ex. arctic char



MEDIUM TEMPERATURE SPECIES

| 12-18 °C | F.ex. rainbow trout



WARM WATER SPECIES

| 24-28 °C | F.ex. catfish



LABORATORY SCALE MODULES

RAS for research units and university laboratories
Different temperature options



TRAINING AND COURSES

tailored aquacultural education
practical "hands on" courses in fish farms



What is RAS?

The recirculating aquaculture system (RAS) is based on the fact that the water can be used several times when it is purified in the system. The ammonium fish excretes is very toxic and it accumulates in the system, but with biofilters it can be turned into less harmful forms. The process is called nitrification. The nitrifying bacteria transform ammonium into nitrites and further nitrate, which is not that toxic. This process is aerobic. To tolerate the accumulating nitrate levels the water can either be changed in appropriate flowrate or use another biological process, denitrification. In denitrification process the bacteria transform nitrate into nitrogen gas, which can be released in air. Thus the amount of water needed for production can be really small, only around 1% compared to the amount needed in traditional flow-through systems.

Sizing through modules

- minimize the risks
- maximize flexibility
- correct dimensioning
- perfectly running equipment
- timing possibilities
 - several yearly cycles
- precise calculations for production
- 3 temperature windows
- options also for laboratory scale
- training and course possibilities

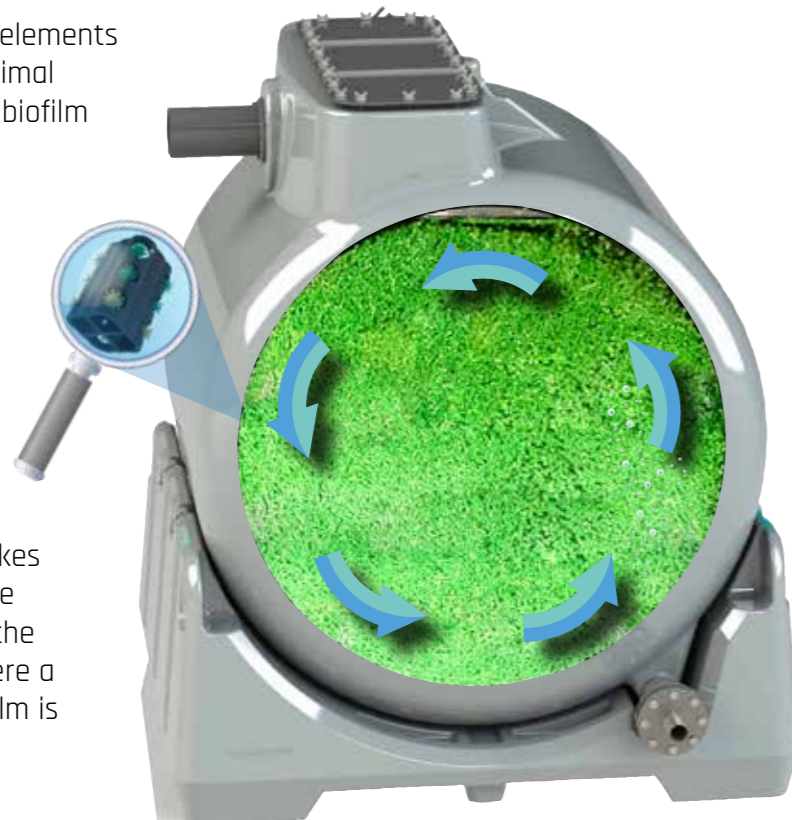


What is included in the systems?

Our systems are built in modules - all the equipment needed are organized into one functional system. The modules include both the tanks and water management systems with biofilters, drum filters, settlers, UV, oxygenating units, ozone etc. All the modules are tailor-made for certain fish species and unique production environment. The system is easily scalable with modules. Our principle is to emphasize the risk management and the flexibility - we rather make more separate units instead of few big ones to maintain these key elements.

The heart of every solution is the patented ROTATING BED BIOFILM REACTOR (RBBR)

The carrier elements provide optimal surface for biofilm growth.



The water cleaning takes place on the surface of the carrier, where a stable biofilm is formed.

Air is blown into the bioreactor to make the carrier rotate. The circular shape of the reactor ensures that the whole carrier mass is moving, leaving no dead zones or excess biomass inside the reactor.

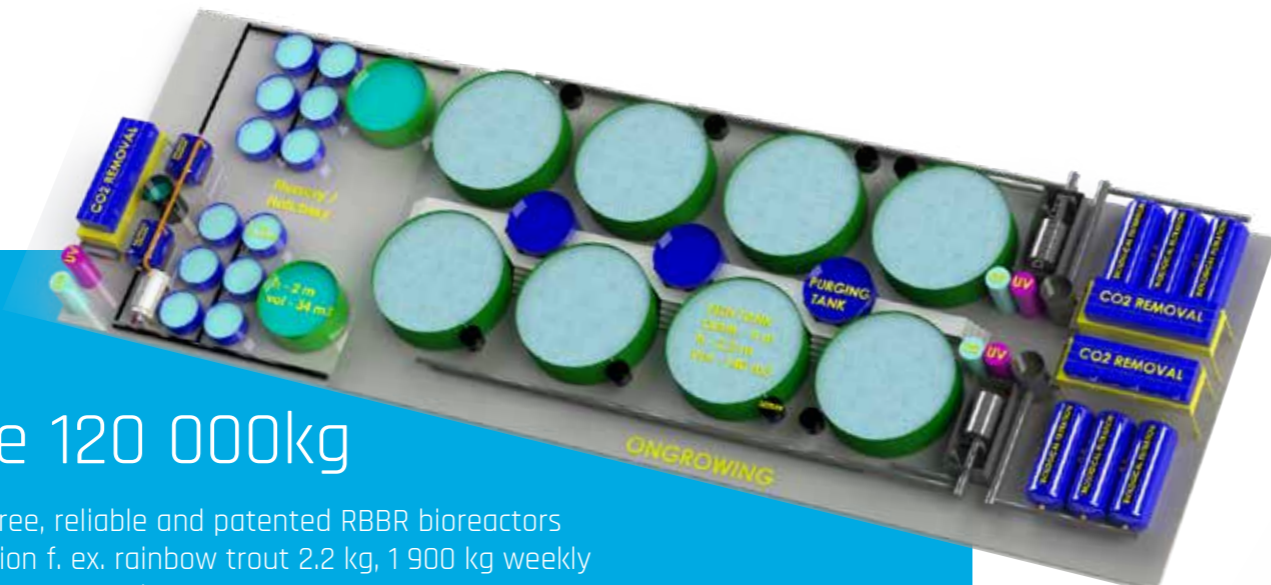
The round shape of the RBBR makes it easier to rotate the carrier mass, allowing carrier filling ratios up to 90% and reduced costs for air blowing

RBBR technology can be used in a wide range of water treatment systems. Currently the RBBR is utilized in municipal and industrial wastewater treatment, car washes and recirculating aquaculture systems (RAS).

RBBR provides many benefits:

- Self-cleaning and practically maintenance-free
- No dead zones or accumulation of excess biomass inside the reactor
- High carrier filling ratio (up to 90%)
- Different RBBR sizes (1, 4, 10, 20m³ are the standard sizes, up to 100m³ possible)
- Modular and scalable
- Easy to transport, no costs for oversized transport
- Easy to install, no need for underground piping
- Low head loss
- Closed process is hygienic, safe and odour-free
- Long life-cycle, up to 20 years





Module 120 000kg

Maintenance-free, reliable and patented RBBR bioreactors
 Yearly production f. ex. rainbow trout 2.2 kg, 1 900 kg weekly output (head-on & gutted).

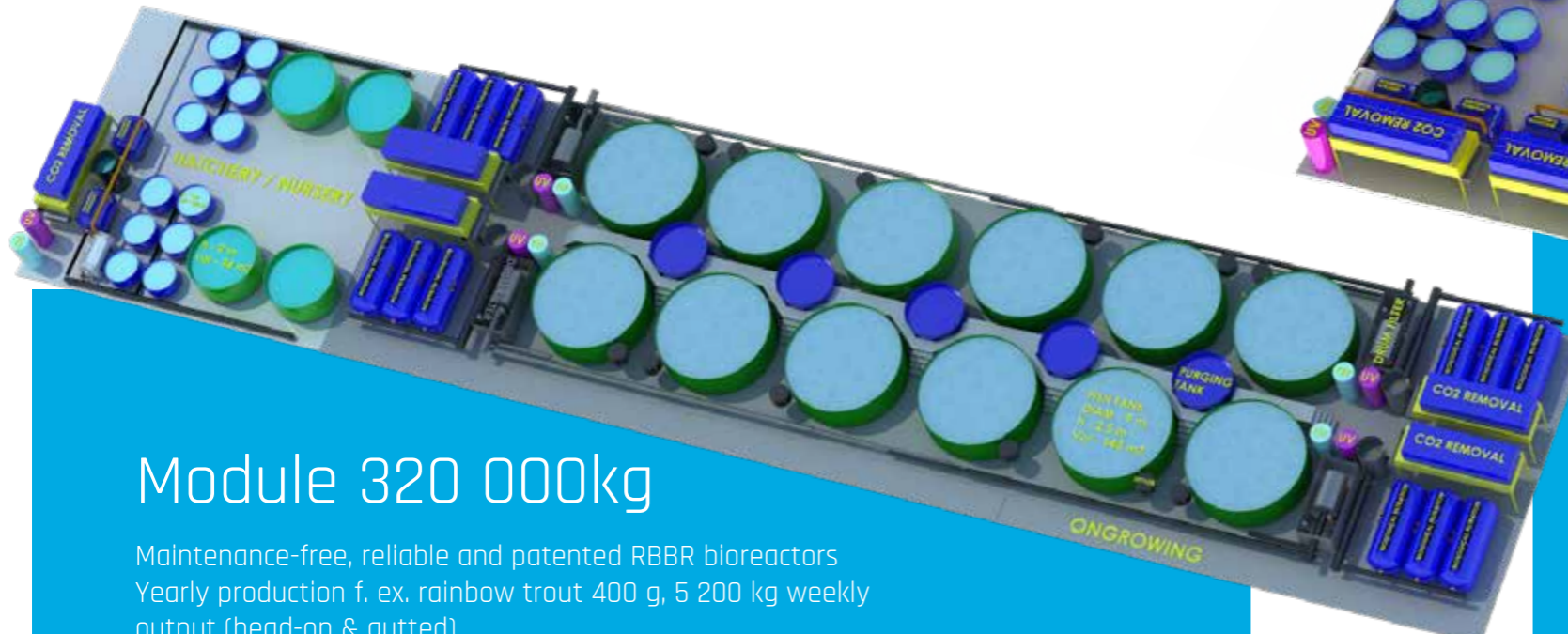
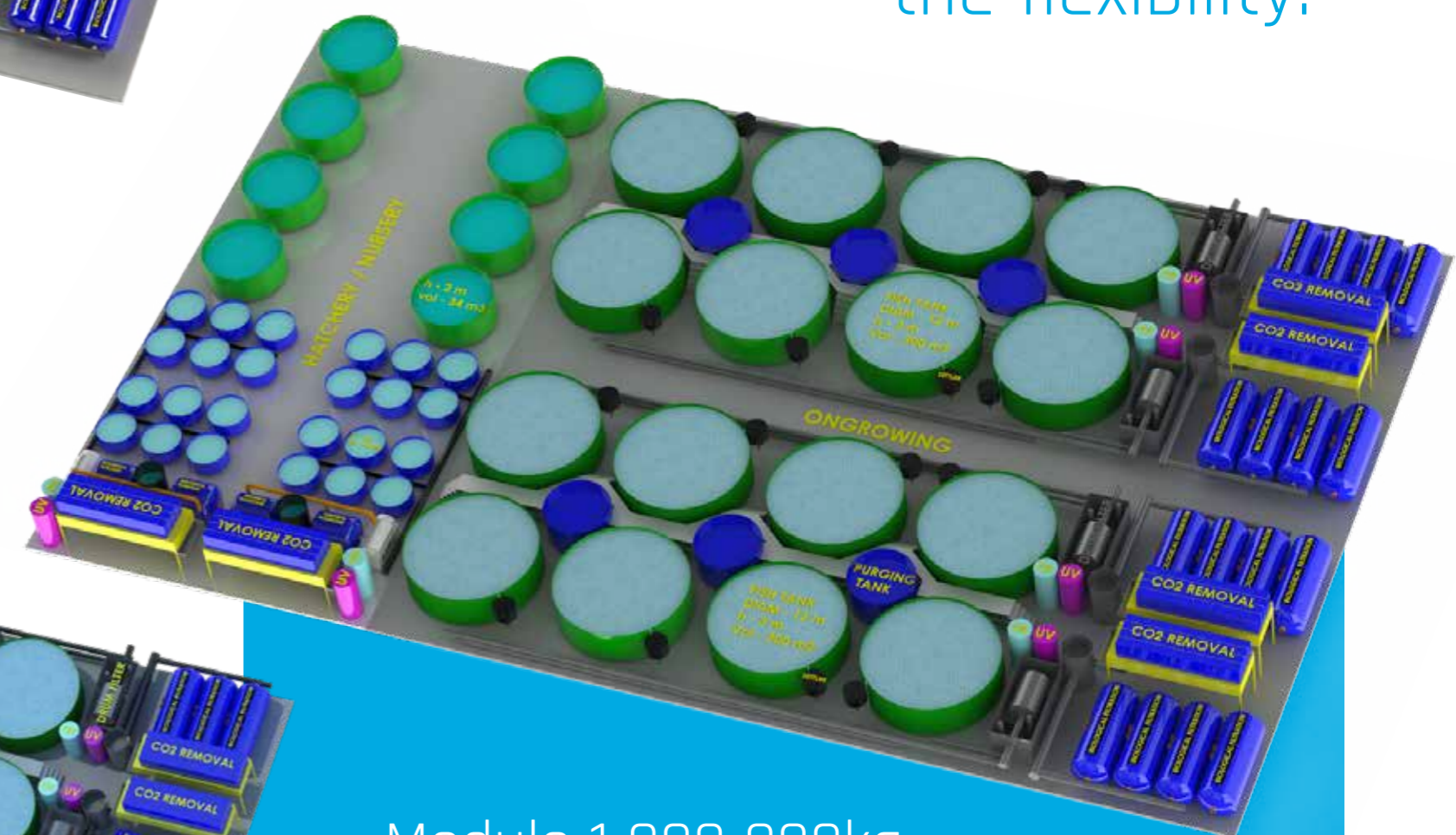
WATER

- fresh water
- new water needed 3-5 l/s

BUILDING

- area required for the building 1 540 m²
- rearing water volume 1 228 m³

Sizing through modules
 - minimize the risks, maximize the flexibility.



Module 320 000kg

Maintenance-free, reliable and patented RBBR bioreactors
 Yearly production f. ex. rainbow trout 400 g, 5 200 kg weekly output (head-on & gutted)

WATER

- fresh water
- new water needed 8-12 l/s

BUILDING

- area required for the building 2 354 m²
- rearing water volume 1 876 m³

Module 1 000 000kg

Maintenance-free, reliable and patented RBBR bioreactors
 Yearly production f. ex. rainbow trout 400 g, 16 000 kg weekly output (head-on & gutted)

WATER

- fresh water
- new water needed 26-35 l/s

BUILDING

- area required for the building 4 576 m²
- rearing water volume 5 192 m³

RESEARCH MODULES

Turn-key delivery, flexible design according to customer's needs.
 Whole piping system can be above ground.
 Scalable to different extents and levels of automation.
 Possibility to select watering for each tank in systems with several water qualities.



We provide training for the personnel

Modern RAS facilities are technical, high-investment systems that require well-educated and trained personnel to take care of the systems along with the fish. The module sales include the training as agreed with the customer.

practical training possibilities of fish husbandry, biosecurity and daily routines as well as the guidance to use, control and optimize the RAS system technology of the farm. The experience is gained during years and we offer the support as agreed.

Our aim is to be there along the way - from pre-training of the personnel to start-up phase and the whole production cycle. We will be giving

We have also organized several courses of aquaculture and fish processing for different kind of groups.

MODULES CAN BE EQUIPPED WITH:

- | | |
|--------------------------|--|
| Biofilters (Clewer RBBR) | Aeration and degassing units |
| Drumfilters (Faivre) | Feeding systems |
| Flotation units (Clewer) | Devices and tanks |
| UV-filters (UltraAqua) | Research equipment and meters |
| Ozone generators | Other equipment according to customer's need |
| Oxygenation units | |





OUR BACKGROUND

Our personnel have over 30 years of experience in aquaculture. We have made plans, equipment sales and turnkey projects in fish farms and research units. The list of references can be found on our website. Our expertise includes also aquaculture training and courses.

We all have also practical experience in fish farming.

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