

Pilot 3: The FishGlassHouse

Tasks under WP 5.1, 5.2 and 5.3

Modern aquaponics in Mecklenburg-Western-
Pommern, Germany

University of Rostock, Germany
Aquaculture & Sea-Ranching

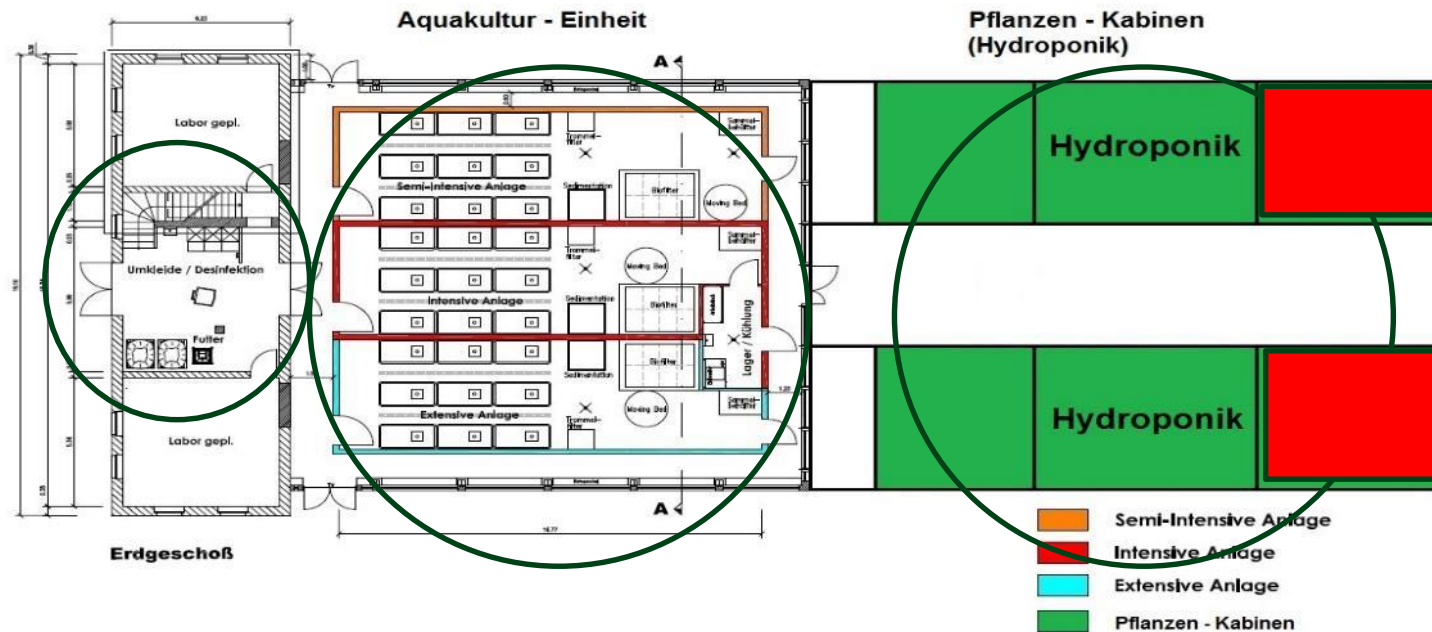
- *Prof. Dr. rer. Nat. Harry W. Palm*
- *Dr. Adrian Bischoff-Lang*
- *M.Sc. Jan Eike Krämer*
- *M.Sc. Jan Klein*
- *M.Sc. Troung Van Thuong*

The “FishGlassHouse“



- Three different aquaculture units – different stocking density of African catfish (*Clarias gariepinus*)
 - extensive (35 individuals per m³)
 - semi-intensive (70 individuals per m³)
 - intensive (140 individuals per m³)
 - **1:1 copy of a commercial production unit**
- Six different cabins for plant cultivation

The FishGlassHouse (Aquaculture & Hydroponics)



- Two main units:
 - Aquaculture unit
 - Hydroponic unit
- Construction as closed recirculation aquaculture systems
- Laboratories



The Aquaculture units

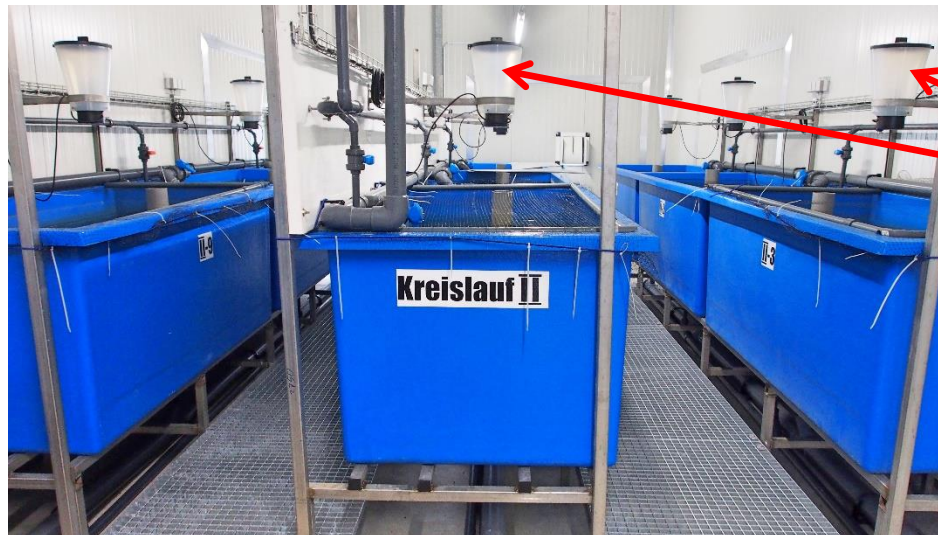
- extensive RAS
- semi-intensive RAS
- intensive RAS

Automatic control

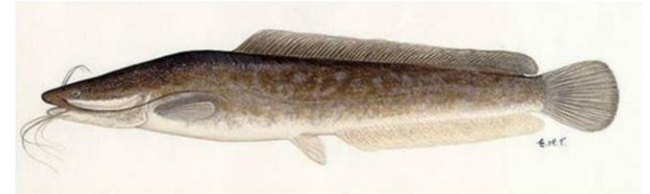


→ 9 fish tanks per unit (triplicate – staggered)

Intensive RAS



African catfish (*Clarias gariepinus*)



<http://www.fao.org/typo3temp/pics/7b7e489048.jpg>

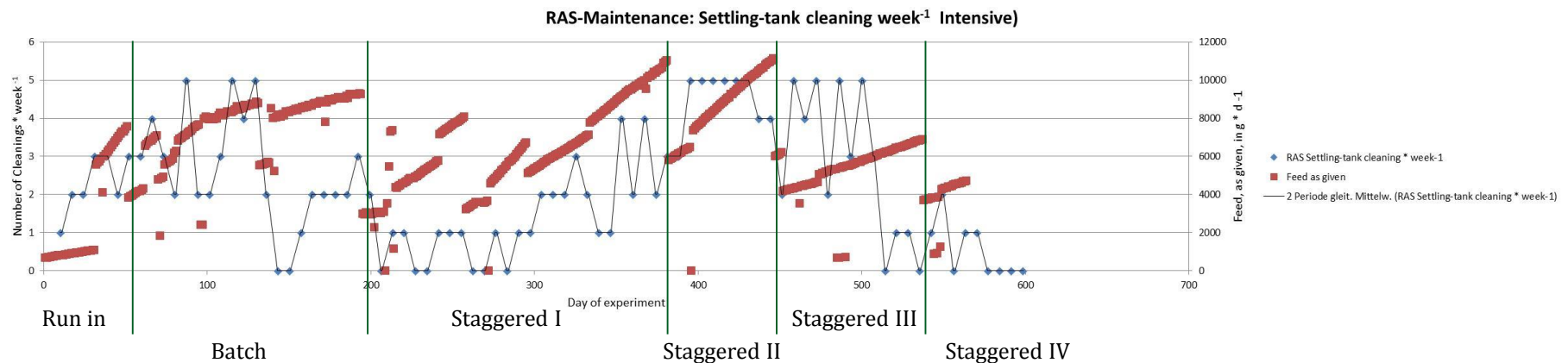
Automatic feeders



RAS = Recirculating Aquaculture System

Activity 5.1 => Input for WP3: comparison of different water sources for hydroponic units

- Production of African catfish: Feed use and maintenance
 - daily feed intake: 0 – 11 kg



Nutrient water transfer tanks (water exchange between production units)

Aquaculture units



Hydroponic cabins



The Hydroponic unit - automatic control of environmental parameters



- Light intensity
→ Automatic shading
- Temperature
→ Automatic ventilation
- System controle
→ Automatic sensors
(conductivity, pH,
temperature and
oxygen)

→ Local network



Hydroponic unit- cabines 1_01-1_05

Cabine:

- **1_01** Polyculture: *Clarias gariepinus* & *Oreochromis niloticus*
→ Evaluate growth effects on different herbs
- **1_02** Fish Welfare
→ Evaluate effects of aquaponics on fish welfare
- **1_04** Commercial aquaponic plant production
→ Ebb-and-flood-system (cooperation with local retailer “Grönfingers GmbH”,
→ → Evaluate effects of different fish stocking densities on plant growth
- **1_05** Cooperation with professorship plant-cultivation,
→ Evaluate different hydroponic sub-systems on plant growth (e.g. NFT, Ebb-and-flood , RAFT)

Hydroponic cabins



Cabin 1_01: Polyculture

Cabin 1_02: Fish welfare

Hydroponic cabins:



Cabin 1_04: Commercial aquaponic plant production



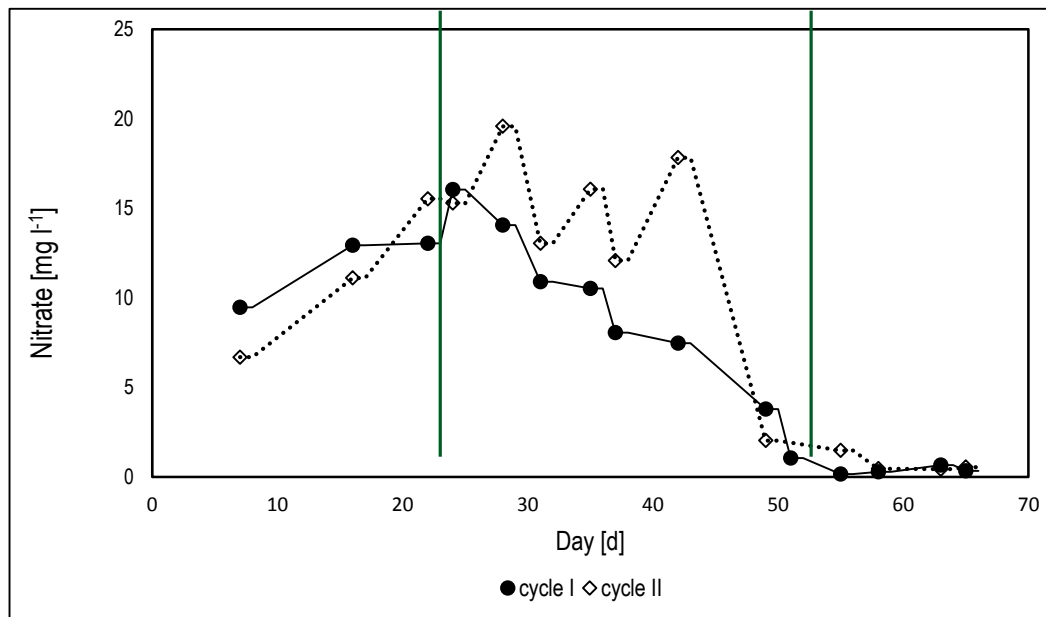
Cabin 1_05: Different hydroponic subsystems

O. niloticus – *C. carpio*



Spring - Summer

Cucumber, Tomato, Salat



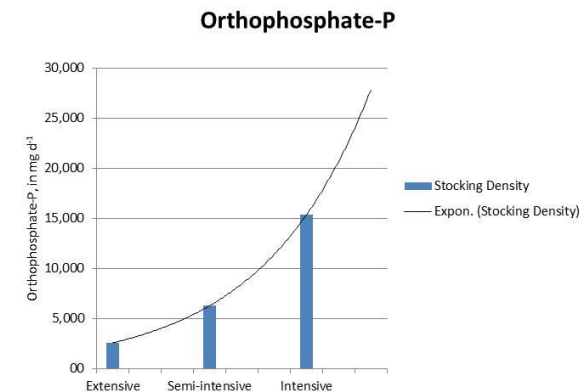
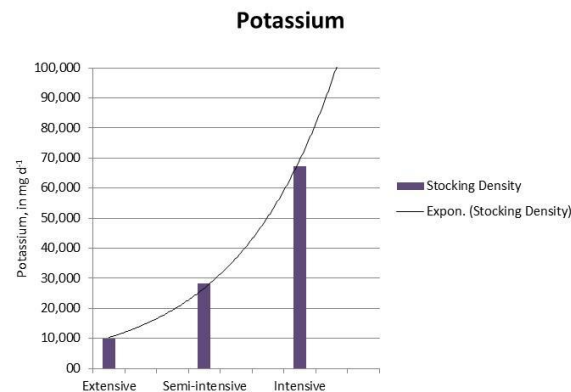
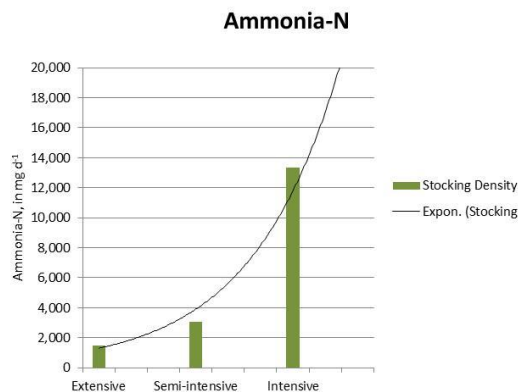
Effects:

- Consumption of nitrate in both cycles
- Cleaning the process water in both species

Knaus, U. & Palm, H.W. (Aquaculture, 2017): Effects of the fish biology on aquaponical cultured vegetables under optimal conditions.

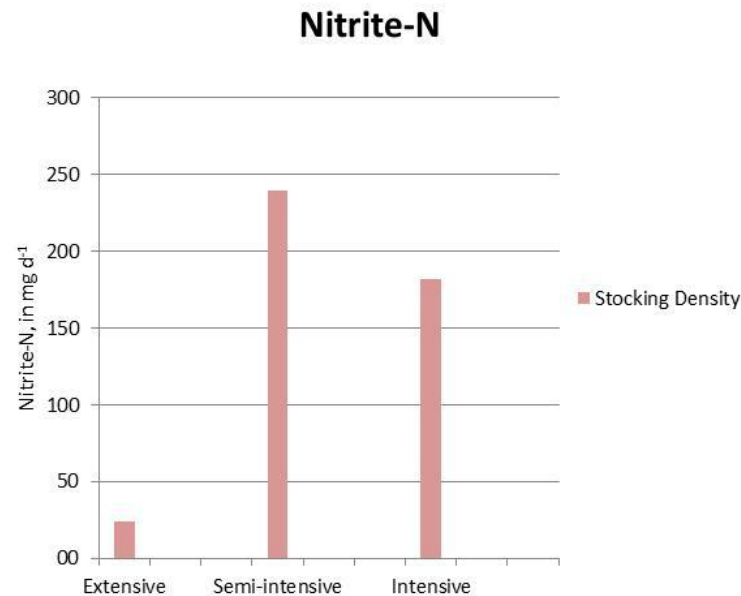
Activity 5.1 => Input for WP3: comparison of different water sources for hydroponic units

- Results: Stocking density proportionally affects nutrient dynamics (NH_4 , K, $\sim$ P)



Activity 5.1 => Input for WP3: comparison of different water sources for hydroponic units

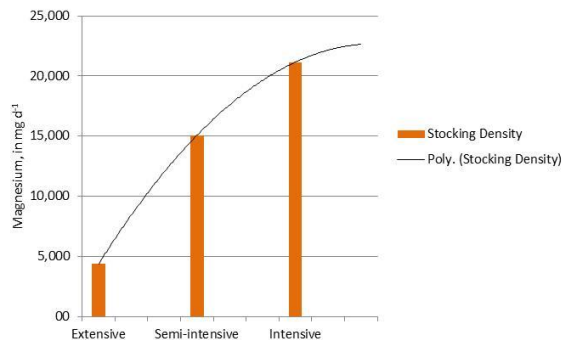
- Results: Biofilter size and pH affect nutrient dynamics (NO_2)



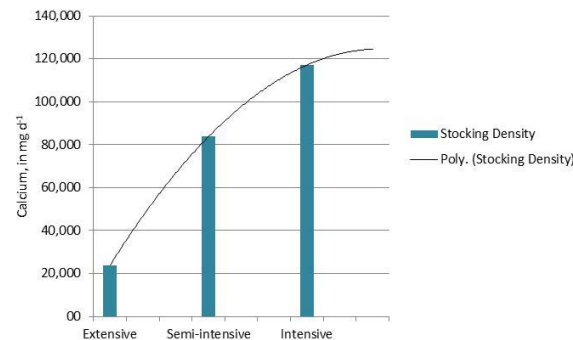
Activity 5.1 => Input for WP3: comparison of different water sources for hydroponic units

- Results: Stocking density disproportionately affects nutrient dynamics (Mg, Ca, NO_3)

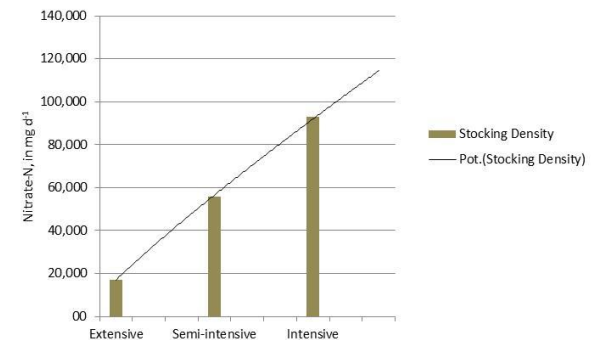
Magnesium



Calcium



Nitrate-N



Activity 5.1 => Input for WP3: comparison of different water sources for hydroponic units

- Planned experiments: Identification of components inside the sedimenters (nutrients, solids or particulate matters)
- Shift of water input source from the sedimenter into the sump
- Mineralisation tank to re-utilize nutrients from particulate matters
- Possibility to incorporate mineralisation tank into commercial production units

Expected outcome (5.1, 5.2, to be used in 5.3 - workshops):

- Different plant performances under combination with catfish => **ongoing**
- Nutrient dynamics and availability for plant production ✓
- Nutrient data to be used by pilot 4 => **delivered and ongoing**
- Effects of nutrient additives (P, K) on fish welfare in aquaponics => **ongoing**
- Effects of polyponics on plant production (basil) => **ongoing**
- Sedimentation and mineralisation in aquaponics => **starting**
- Decision support choosing the right dimension for fish & plant production
- Decision support for the most suitable hydroponic sub-systems
- Effects of feed manipulation on growth and quality of fish & plant