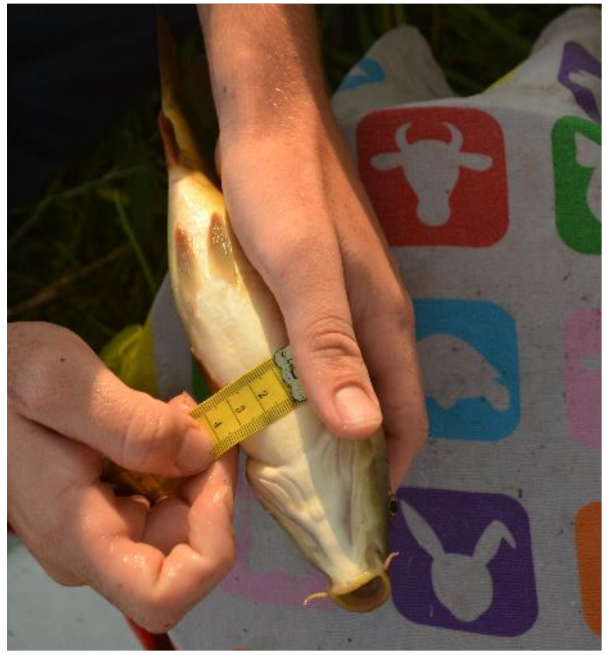
MONITORFISH
PIONEERING FISH FARM MANAGEMENT

# FISH FARMER'S PROBLEM

Fish farming companies on average lose 40% of their revenue because the fish are not kept in optimum growing conditions. Every 7th batch is lost 100% catastrophically.

**High stress on fish are mainly caused due to:**

- Daily manual handling of fish to estimate fish weight
- Over/under feeding of fish
- Cannibalistic nature of fish

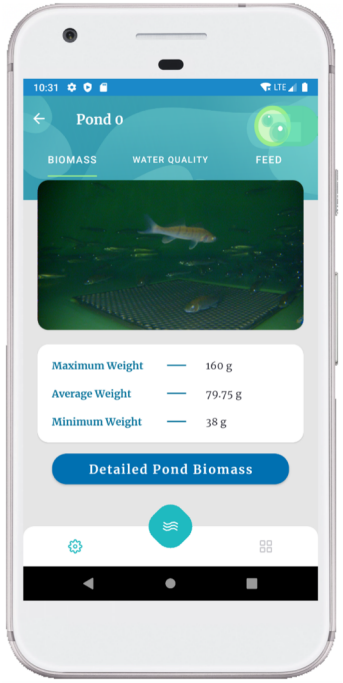


MONITORFISH

Weighing 50-1000 fish per tank everyday...

# OUR SOLUTION: AnFish©

## AI-based fish health diagnoses




### BIOMASS ESTIMATOR

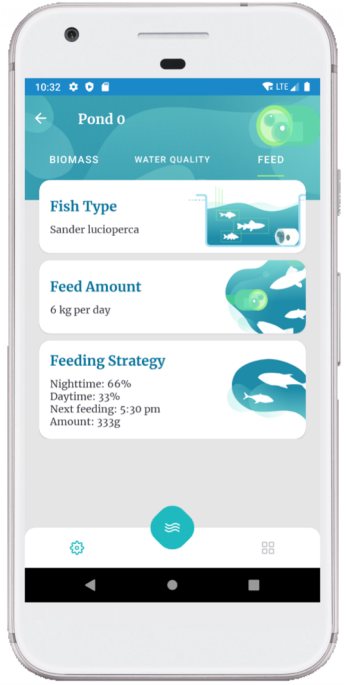
Save time and efforts to measure fish weight. Get live fish weight measurement within seconds

### FISH SORTING

Get alerted to sort your fish based on the weight to avoid cannibalism

### FISH GROWTH

Understand and take control of the fish production to achieve your target-output




### FISH HUNGER

Feed effectively at the right time and in precise quantity to save on feeding costs

# Key Steps

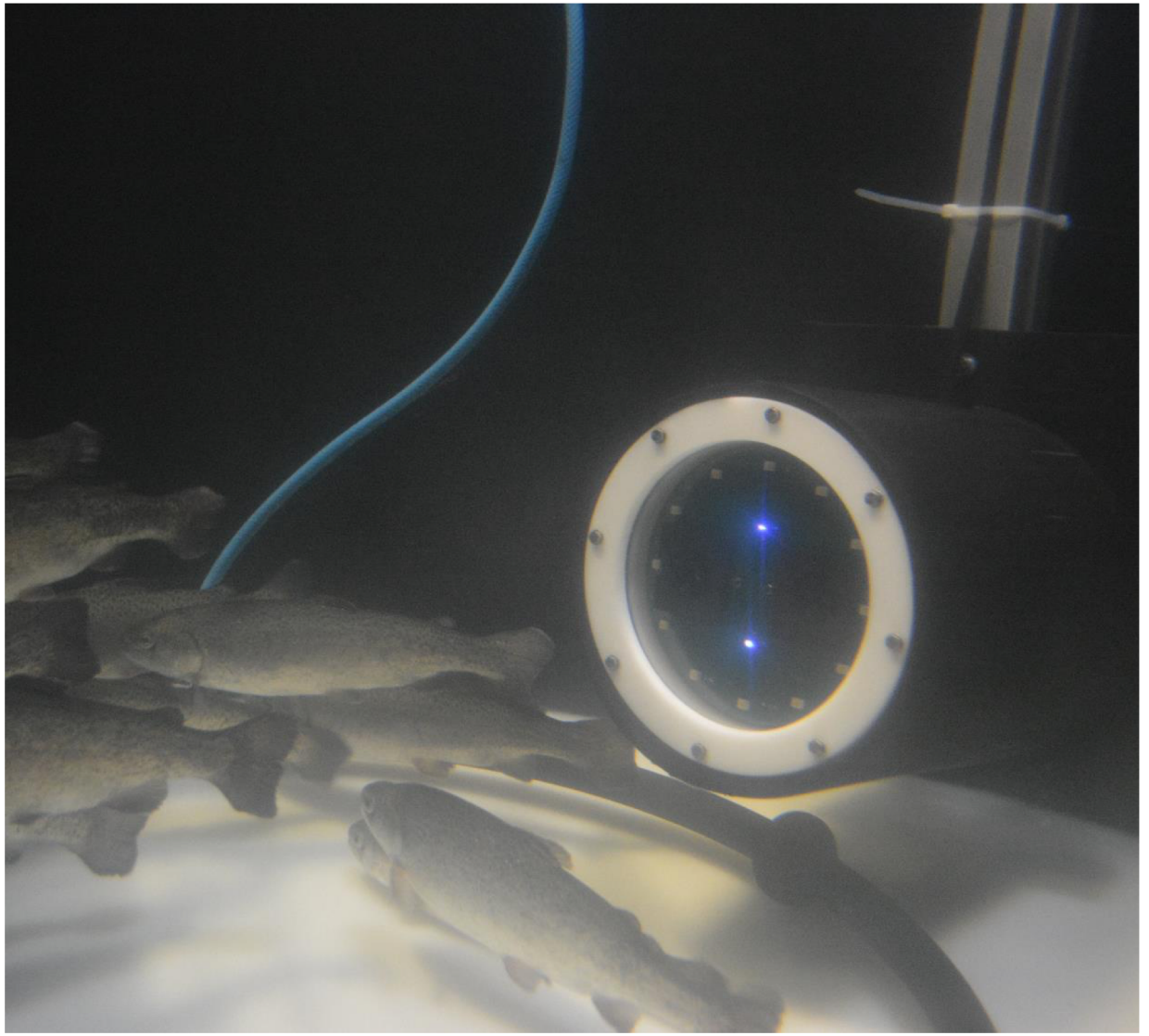
01 Installation

02 All Powered Analytics

03 Digital Twin

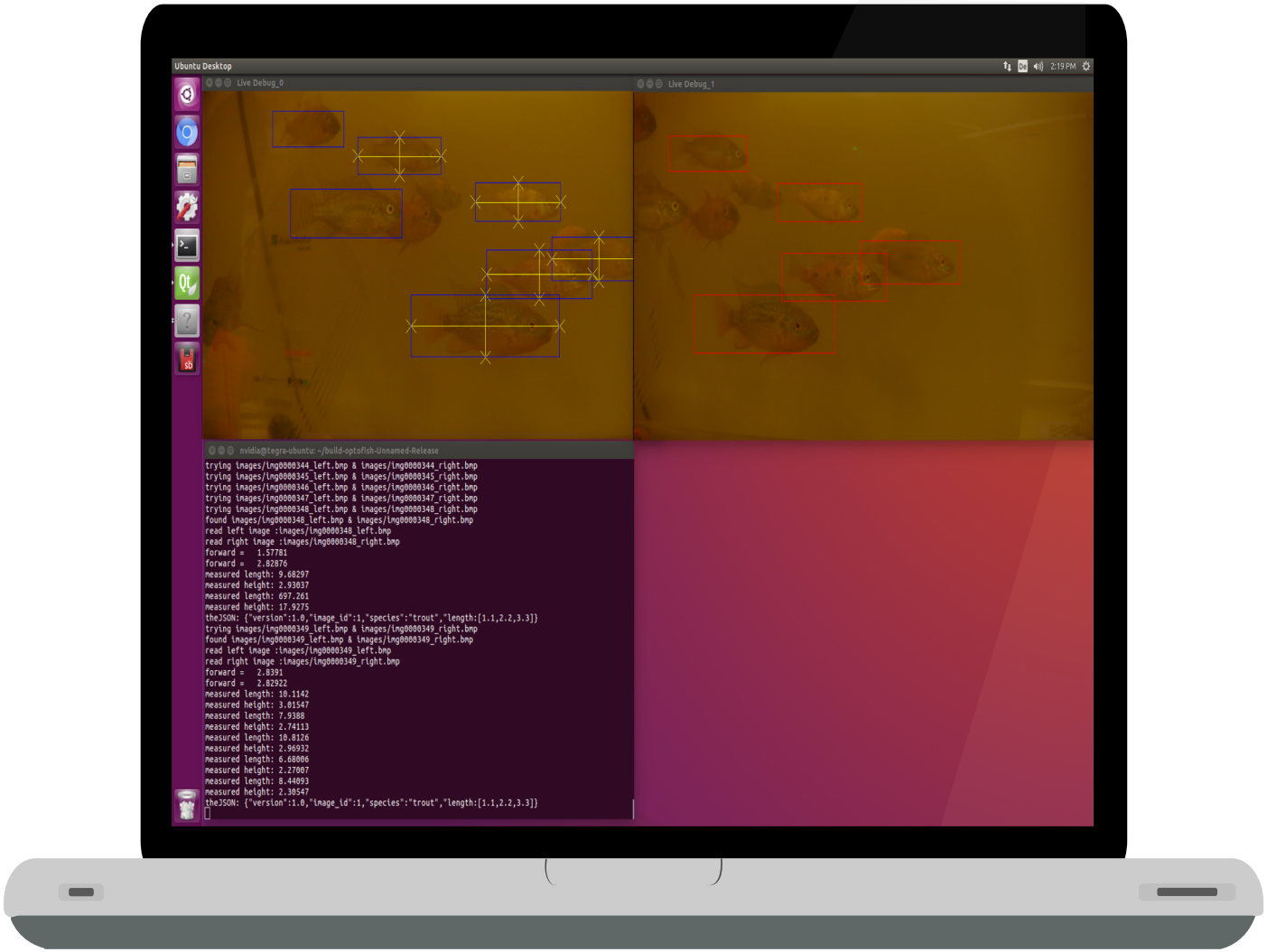
# Installation

Our proprietary software AnFish© is enabled by a stereo camera system installed within the fish tank along with water quality sensors measuring pH, temperature and dissolved oxygen.



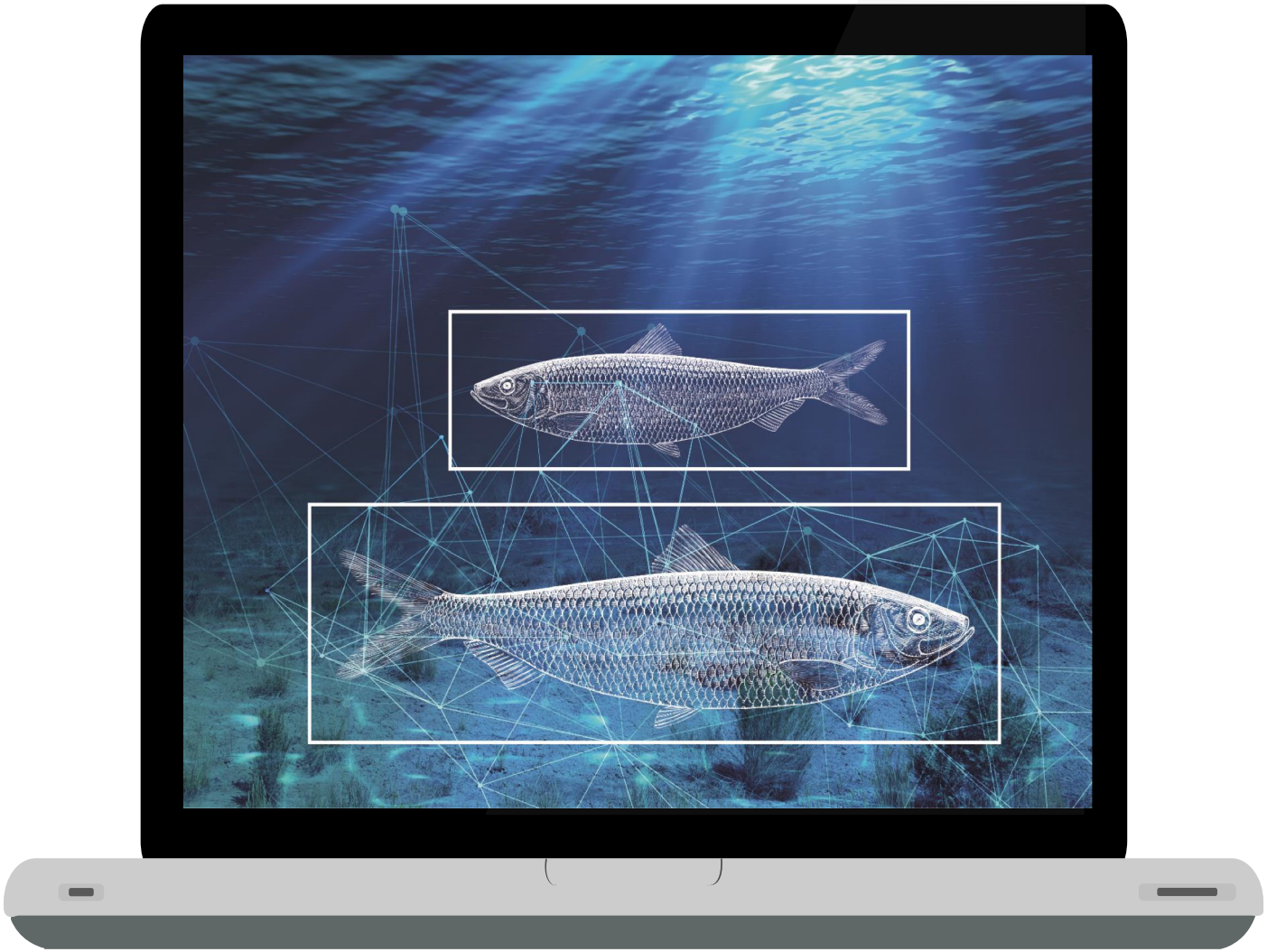
# AI Powered Analytics

Our unique data architecture aided by advanced underwater image recognition technology allows automatic simulation of key parameters like fish weight, feeding effectiveness, early signs of stress and water quality.



# Digital Twin

We create a digital manual for the fish farm that creates recommended actions on feeding, increasing output, expanding the fish farm, predicting upcoming problems, and predicting overall cost of the fish farm.



**PILOT PROJECT**

*„We can use the images and software to monitor the condition of the scales and the development of the fish - and intervene if something is wrong. That means fewer losses. And the quality of the fish is better when it is less stressed."*

# Fish welfare detection parameters

**AI-based fish health diagnoses**

Measured values:

- Optical parameters:
  - Fish size and weight
  - Movement and patterns of movement
  - Skin properties, colour, infections
  - Behavioural changes e.g. due to stress

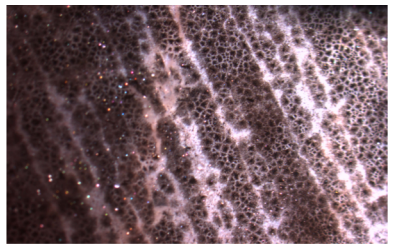
Water quality parameters:

- Temperature, pH value, oxygen, ammonium concentration
- Nitrite concentration, turbidity, water level
- Carbon dioxide, redox potential

# Validation objectives

## AI-based fish health diagnoses

| Fish welfare parameters | Validation method |
| --- | --- |
| Biometric feature:<br>Size, weight, (number) results in population density | Biometric feature:<br>Size, weight, (number) results in population density<br>manual measuring, weighing, counting |
| Textures and anomalies:<br>skin characteristics (fins, scales), eyes, gills | You can simply impress your audience and add a unique zing and appeal to your Presentations. |
| Behavioral changes:<br>Stress-related (physical, chemical, human-related influences; diseases), species-specific stress factors | Tissue/blood sample to determine the cortisol/sugar level, eating behaviour<br>Evaluation by experts (e.g. stocking density) |
| Movements/deformation:<br>Global movement (individual movement / swarming movement), local movements (gills, fins) | Tracking and plotting the trajectories, counting the gill movements, escape, hectic; observation of fin movement |



# Fish activity detection

**movement activity = m / day / fish**

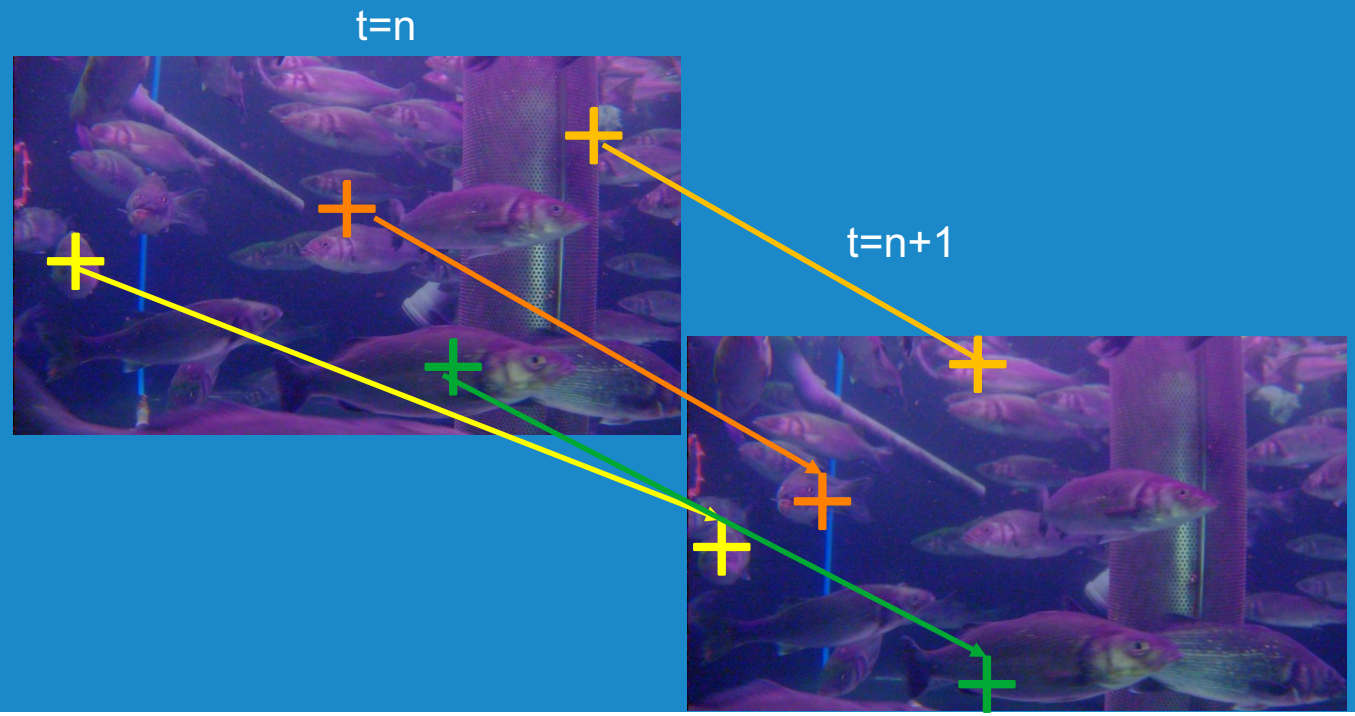
Task:

- Tracking of all objects (fish)
- Analysis of the image sequence
- Accumulation of relative movement

Technology:

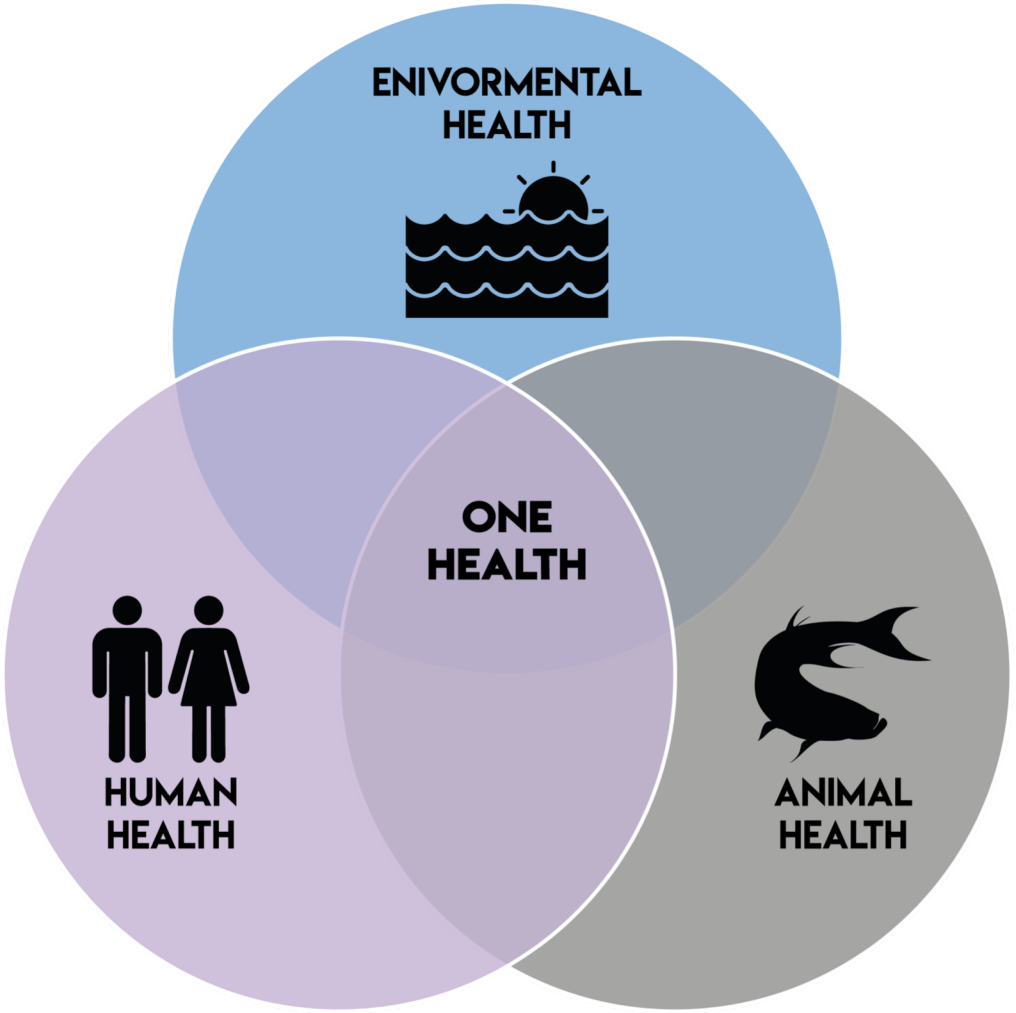
- Recurrent Neural Networks
  Combination of RNN and CNN
- feed forward neuron
- recurrent neurons

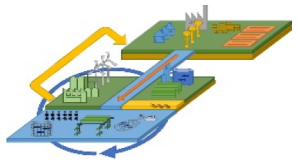
Spatial differences of all animals of an image capture out of a sequence of two images



# One Health

## AI-based fish health diagnoses

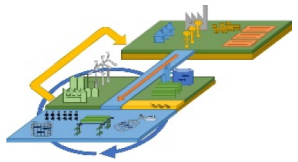




BioFiA

# Bio-indicators for the Evaluation of the Welfare, Health and Product Quality of Fish in different Aquaculture Systems

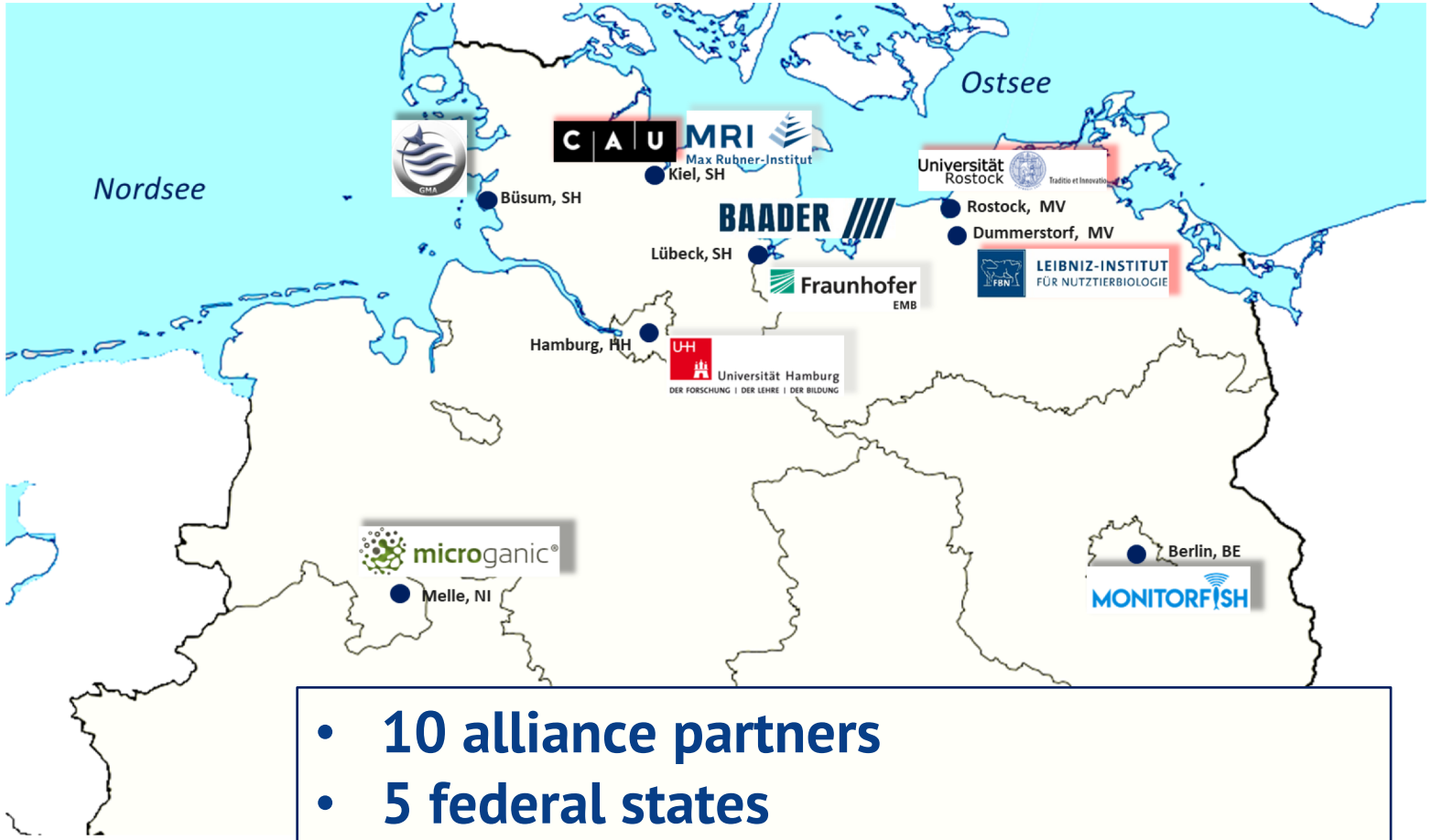
https://www.bams.uni-kiel.de/de/unsere-konsortien/biofia-innovative-bioindikatoren-fuer-die-evaluierung-der-haltung-gesundheit-und-produktqualitaet-von-fischen-in-differenten-aquakultursystemen



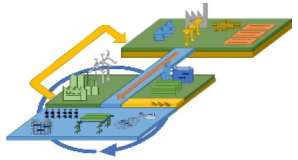
# Project partners

| Unternehmen | | |
|---|---|---|
| MONITORFISH | MonitorFish - Hochschule für Technik und Wirtschaft Berlin | Dominik Ewald |
| BAADER | Nordischer Maschinenbau Rudolf Baader GmbH & Co. KG - Lübeck | Bodo Hensen |
| microganic® | Microganic GmbH, Melle | Svenja Starke |
| Gesellschaft für Marine Aquakultur | Gesellschaft für Marine Aquakultur mbH, Büsum | Michael Schlachter |
| **Forschungspartner** | | |
| Fraunhofer EMB | Fraunhofer-Einrichtung für Marine Biotechnologie (EMB), Lübeck | Sebastian Rakers |
| LEIBNIZ-INSTITUT FÜR NUTZTIERBIOLOGIE | Leibniz-Institut für Nutztierbiologie (FBN), Dummerstorf | Tom Goldammer |
| MRI Max Rubner-Institut | Max Rubner-Institut (MRI) - BFI Ernährung-Lebensmittel, Kiel | Joachim Molkentin |
| Universität Hamburg | Universität Hamburg | Eva Spieck |
| C A U Christian-Albrechts-Universität zu Kiel | Christian-Albrechts-Universität zu Kiel | Carsten Schulz |
| Universität Rostock | Universität Rostock | Patrick Unger |

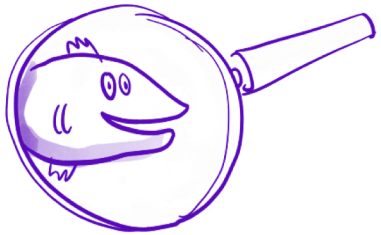
# Location of the BioFiA network partners



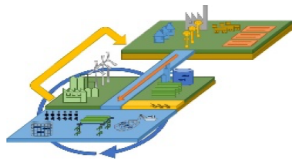

- 10 alliance partners
- 5 federal states
- wide use of the BaMS region



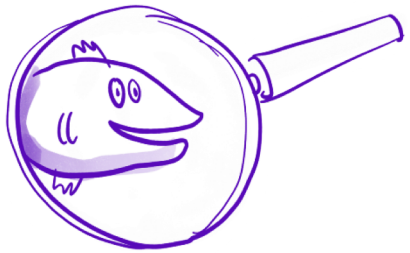
# Project goals



- Development of molecular and cellular **bio-indicators** and use and evaluation of AI-based **monitoring mechanisms** to assess stress, animal welfare and health in aquaculture facilities and optimize fish production at key stages of animal production
- Based on this contributions are made to:
  - Stress reduction in machine processing - stress-free harvesting and slaughtering of salmonids to improve fillet quality
  - Understanding the influence of different microbial communities on nitrification efficiency (in RAS) and on fish
  - Identification of positive effects of micro-algae feeding on animal health and evaluation of micro-algae as feed additive and as complete feed for fish
- Implementation strategies - **recommended actions** for companies



# Working plan



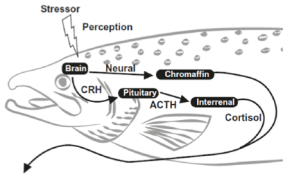
## Work package 1: Scientific data acquisition and experimental research

### M1.2: Controlled environmental impact of fish farming

Fish production on-farm

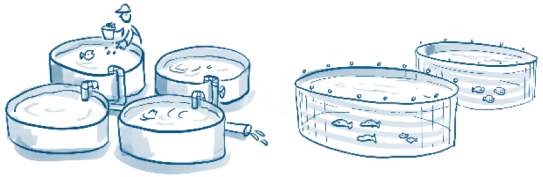
RAS-Rearing of young fish

| | 1 | | 2 | |
|---|---|---|---|---|
| Kontrolle | A | $A_1$ | D | $D_1$ |
| Stressor 2 | B | $B_1$ | E | $E_1$ |
| Stressor 3 | C | $C_1$ | F | $F_1$ |




Micro-algae diet

| | 1 | | 2 | | 3 | |
|---|---|---|---|---|---|---|
| Kontrolle | A | $A_1$ | D | $D_1$ | G | $G_1$ |
| Dosis 1 | B | $B_1$ | E | $E_1$ | H | $H_1$ |
| Dosis 2 | C | $C_1$ | F | $F_1$ | I | $I_1$ |

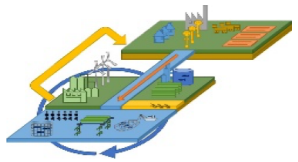


### M1.5: Non-invasive cloud-based real-time fish monitoring

- Mobile, 24/7, video
- complete physical chemistry,
- Adaptation, validation and further development of the software

### M1.6: Parasitological studies of experimental fish

- Parasite detection
- Evaluation of fish farming



# Interfaces

MONITORFISH

BAADER ////

microganic®

Gesellschaft für Marine Aquakultur

Fraunhofer EMB

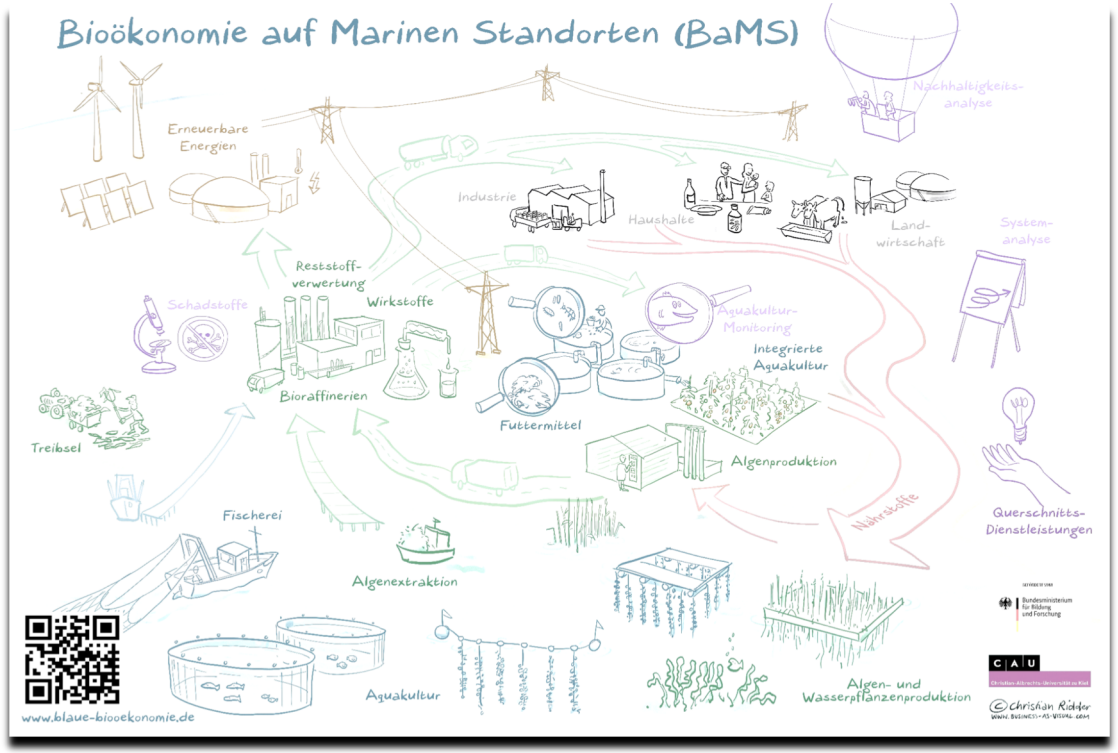
LEIBNIZ-INSTITUT FÜR NUTZTIERBIOLOGIE

MRI Max Rubner-Institut

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

C | A | U Christian-Albrechts-Universität zu Kiel

Universität Rostock Traditio et Innovatio

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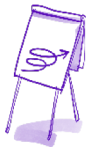

MONITORFISH

## CEO & CO-FOUNDER

**Chaitanya Dhumasker**

M.Sc. Manufacturing engineering
Business administration

**Experience**

First employee of a water filtration tech startup in Germany. Has led the startup to enter and scale up in the market

## CSO & CO-FOUNDER

**Dominik Ewald**

M.Sc. Biotechnology

**Experience**

Strong network with agricultural association and aquaculture farmers in Europe

## CTO

**Jan Apel**

B.Sc. Computer science

**Experience**

10+ years experience in developing software architecture

## SENIOR FISH EXPERT

**Ralf Fisch**

Dipl. in Biology and Bionics

**Experience**

20+ years experience designing fish farms and improving fish farming output in Europe

MONITORFISH

# SUMMARY

## MonitorFish at glance

ewald@monitorfish.com

www.monitorfish.com