



40 YEARS ANNIVERSARY

# Industry 4.0 solution for fish farming

Tom Heintjes

November 8, 2017



# CONFERENCE AGENDA

PENKO Engineering B.V. - Schutterweg 35 - 6718 XC EDE



12:30

Registration

13:15

Welcome and Introductions

SMART Industry

Prof. Dr. Ir. Egbert-Jan Sol  
*Chief Technical Officer*  
*TNO*

Industry 4.0 – a practical example

Tom Heintjes  
*Development Manager*  
*PENKO Engineering B.V.*

Mega Trends in Society

Ralph Wessels  
*Investment Strategist*  
*ABN Amro Bank*

Special Tribute

15:30

Mini Exhibition - Discussion Forums - Networking





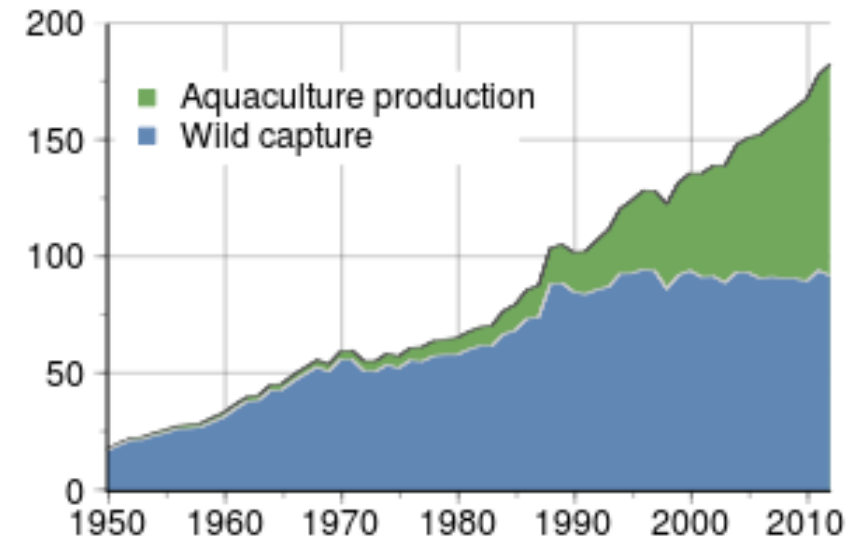
# Agenda



1. Fish farming
2. The opportunity
3. Available, in-house technologies
4. A complete solution:
  - a) *Phase 1 – a system for measuring DO*
  - b) *An even more complete system*
  - c) *(Future) phase 2 – a system for feeding*
  - d) *(Future) phase 3 – a system for harvesting*
  - e) *The ideal, total solution*
5. Conclusion
6. Questions?



# Fish farming



Fish farming is increasingly important to protect wild fish stocks, and to feed a growing global population







# Fish farming – the importance of DO

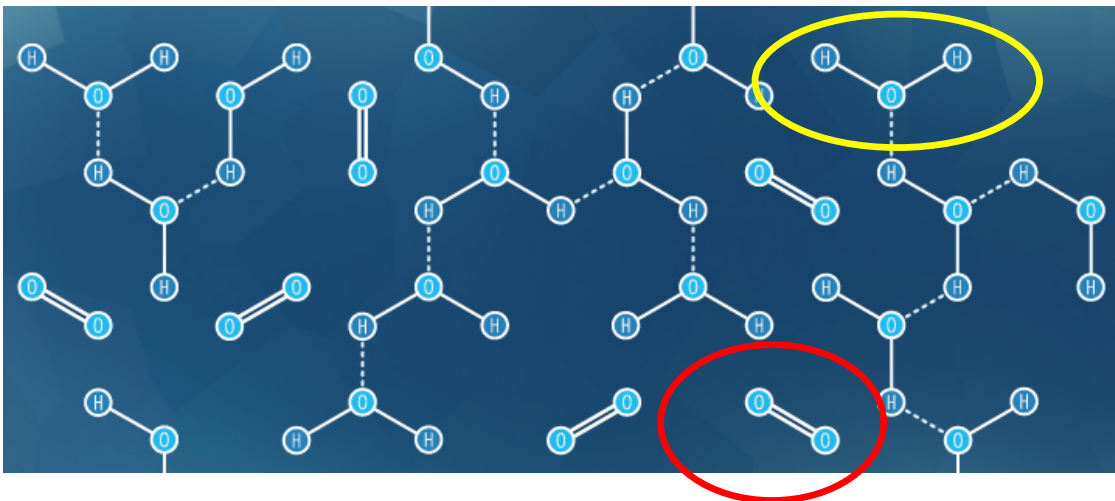


Dissolved Oxygen (DO) is essential for the fish to live!



$\text{H}_2\text{O}$  molecule

DO molecule



Higher water temperature leads to higher fish body temperatures

Higher fish body temperatures lead to increased metabolism, and higher food intake

During food intake, fish use more DO

The required amount of DO varies significantly in a 24-hour period

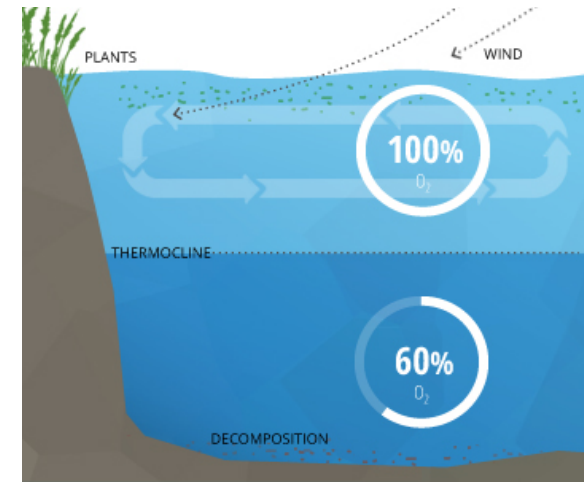
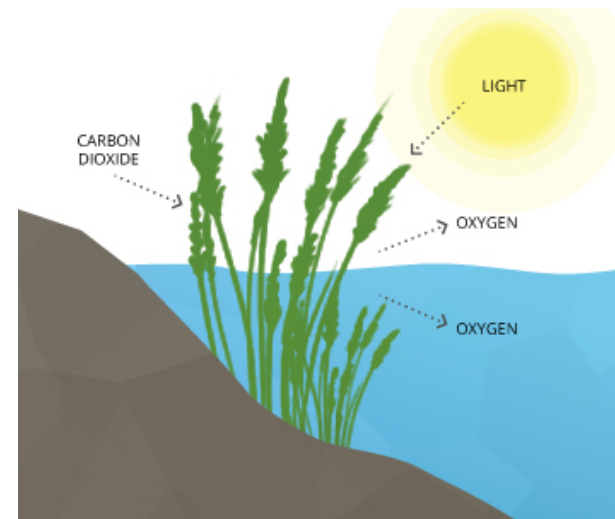
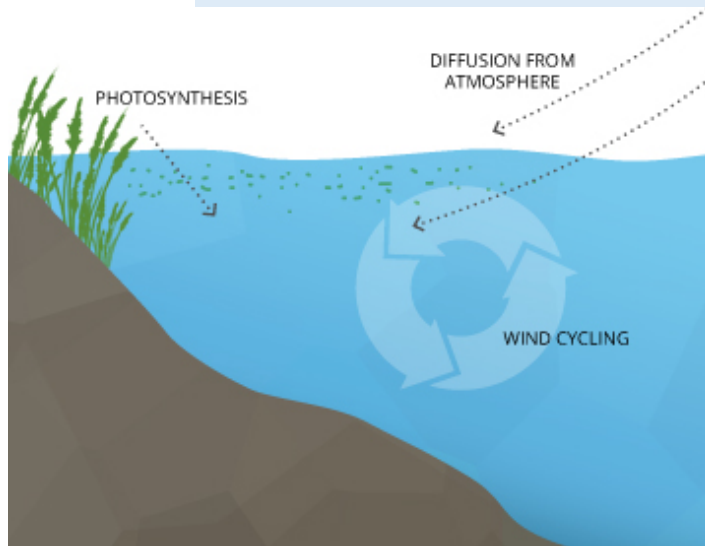
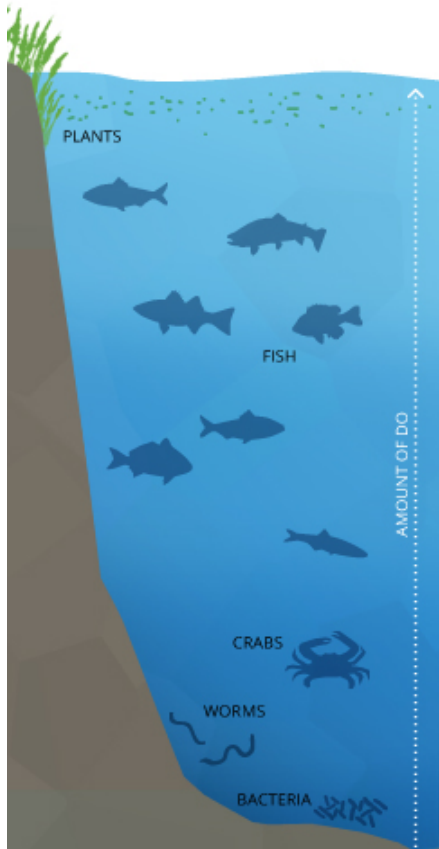
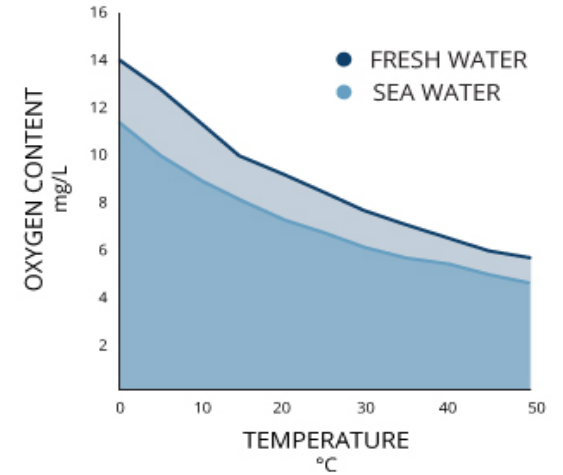


# Fish farming – a complex process



The DO-level in water depends on:

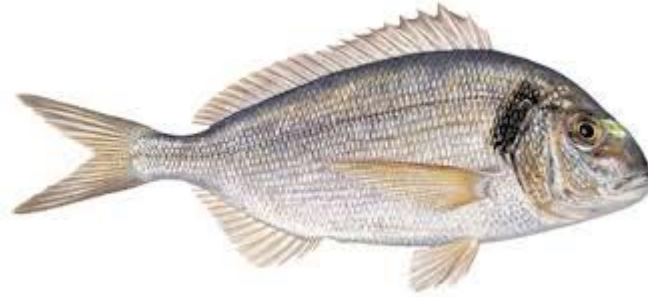
- *Water temperature*
- *Photosynthesis*
- *Depth, currents*
- *Presence of fish and other species*
- *Water salinity*
- *Interaction with air at the water surface*







# Fish farming – a complex process



Fish feed pellets are the most expensive cost item

Juveniles: feeding 6 – 8 times per day \* Mature fish: feeding 1 – 4 times per day \*



During feeding, fish use a lot of DO



(Daily) variable market demands

\* During growth season (May – October), less frequent in winter period



# The opportunity



- Knowing the **real-time DO-levels** in the fish farm\* allows for an optimal feeding schedule
- An optimized feeding schedule will **save on expensive fish feed**, and lead to **optimized operator capacity**
- Fine-tuning the daily market demand with the kg's of captured fish allows for **less give-away**

So...

- Fish farms can benefit from an overall data management system!

\* The natural level at open sea, in between the fish cages and inside the fish cages

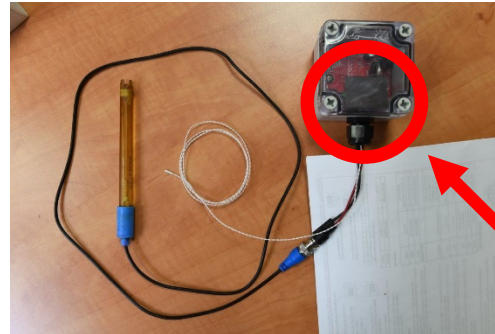




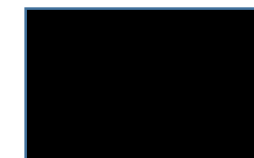
# Available, in-house technologies



- Penko controlling solutions
- Penko cloud solutions
- Echoflex sensor technology



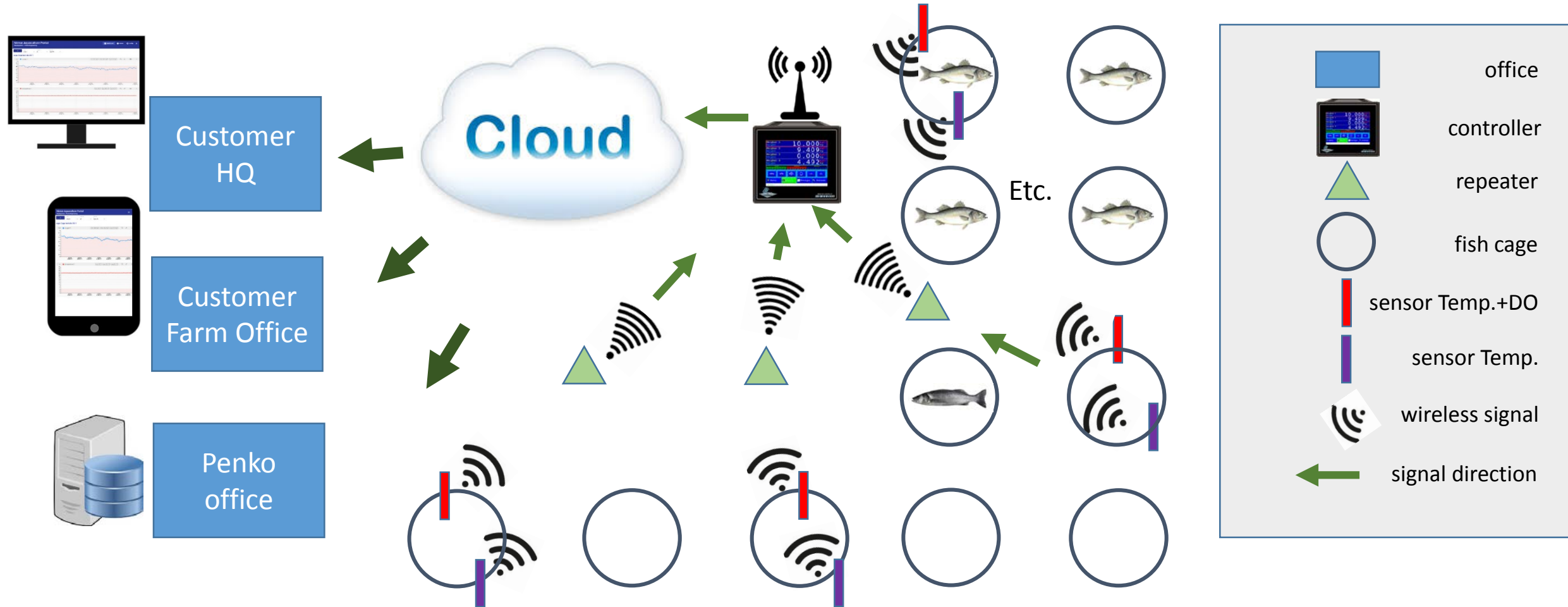
Mini-solar panel 2 x 3 cm



- Echoflex low-energy harvesting technology

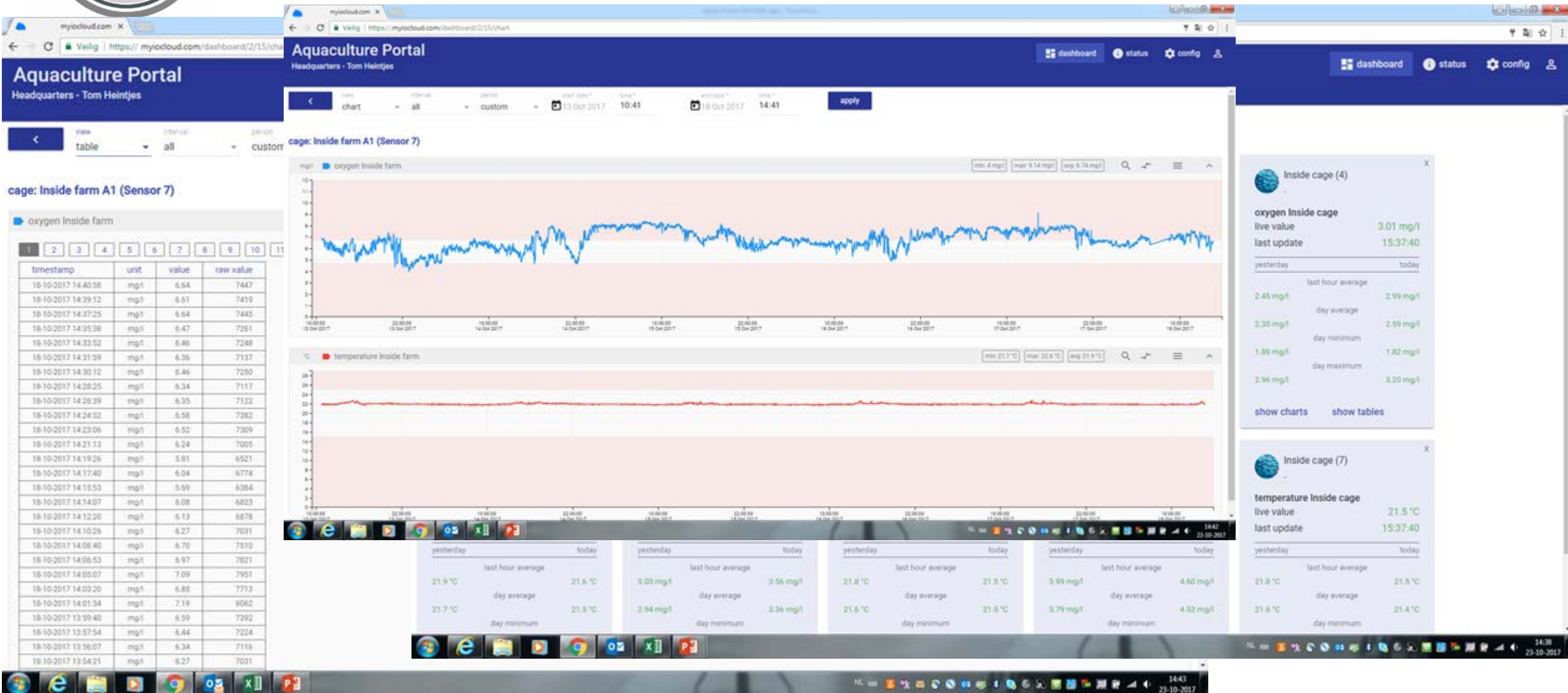


# Phase 1 – solution for measuring DO





# Phase 1 – results







# An even more complete solution



(example)

Scientific research, analysis of historical data

The DO-level in water depends on:

- *Temperature*
- *Photosynthesis*
- *Depth, currents*
- *Presence of fish and other species*
- *Salinity*
- *Interaction with air at water surface*



(example)

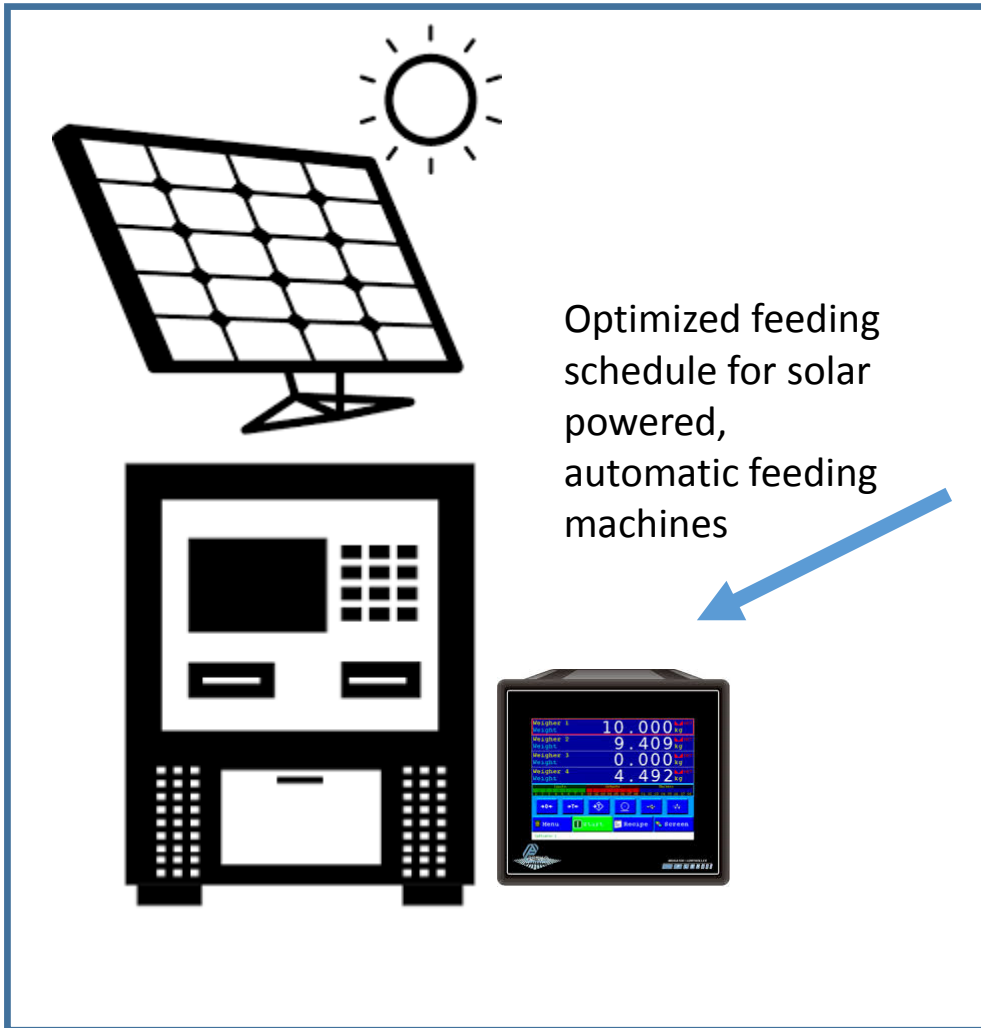
Weather forecasting, real time data



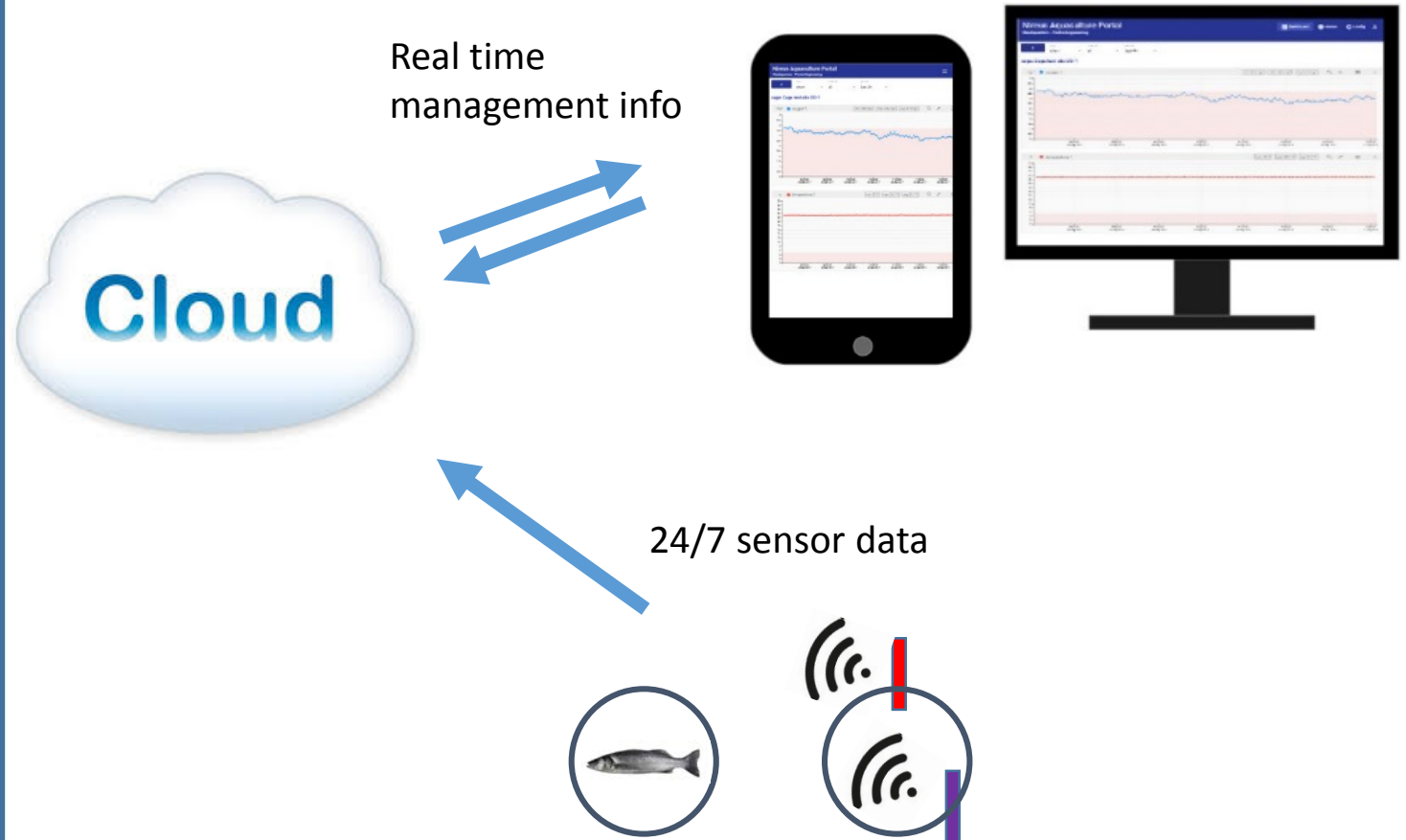
(example)



# Phase 2 – a system for feeding



Optimized feeding schedule for solar powered, automatic feeding machines

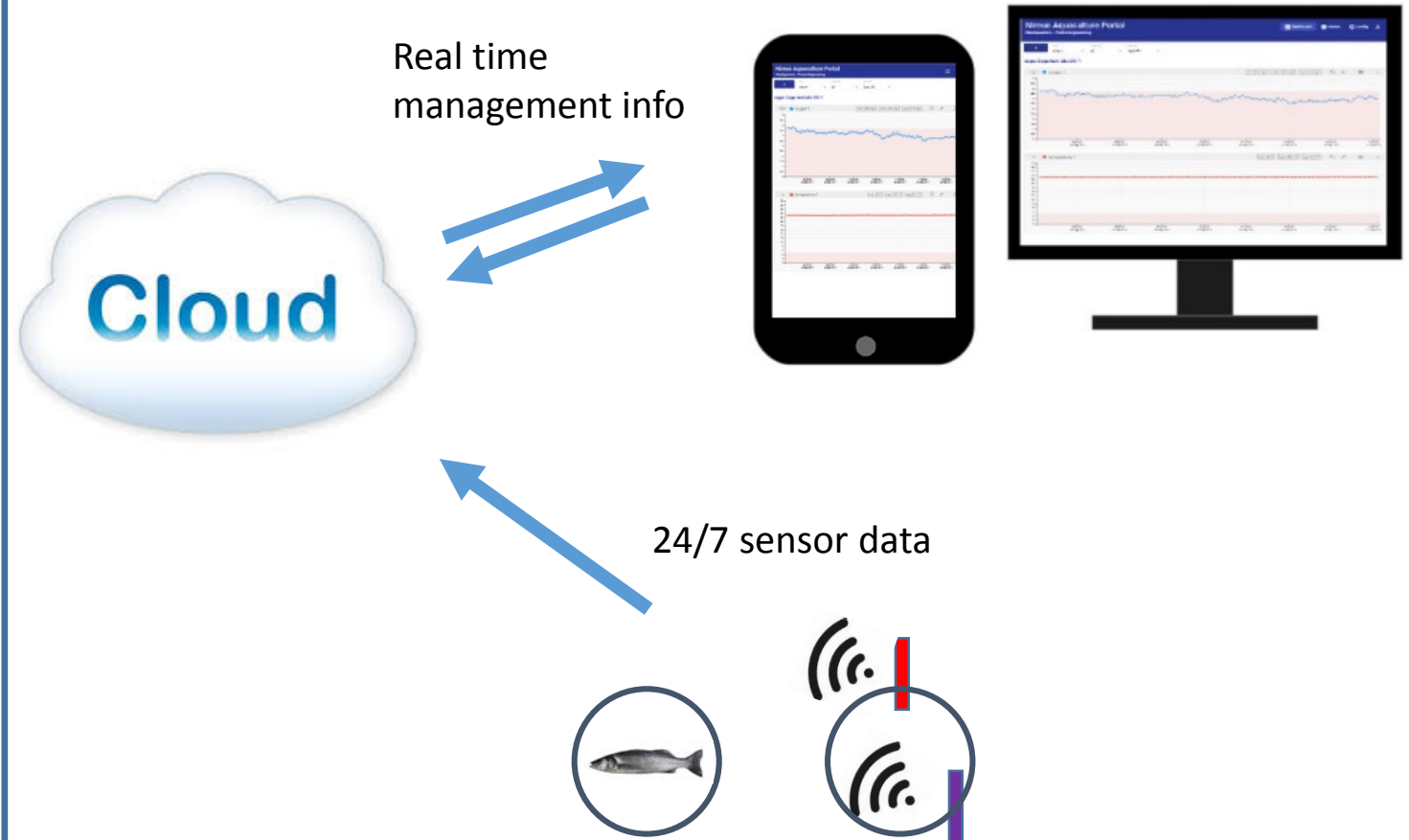
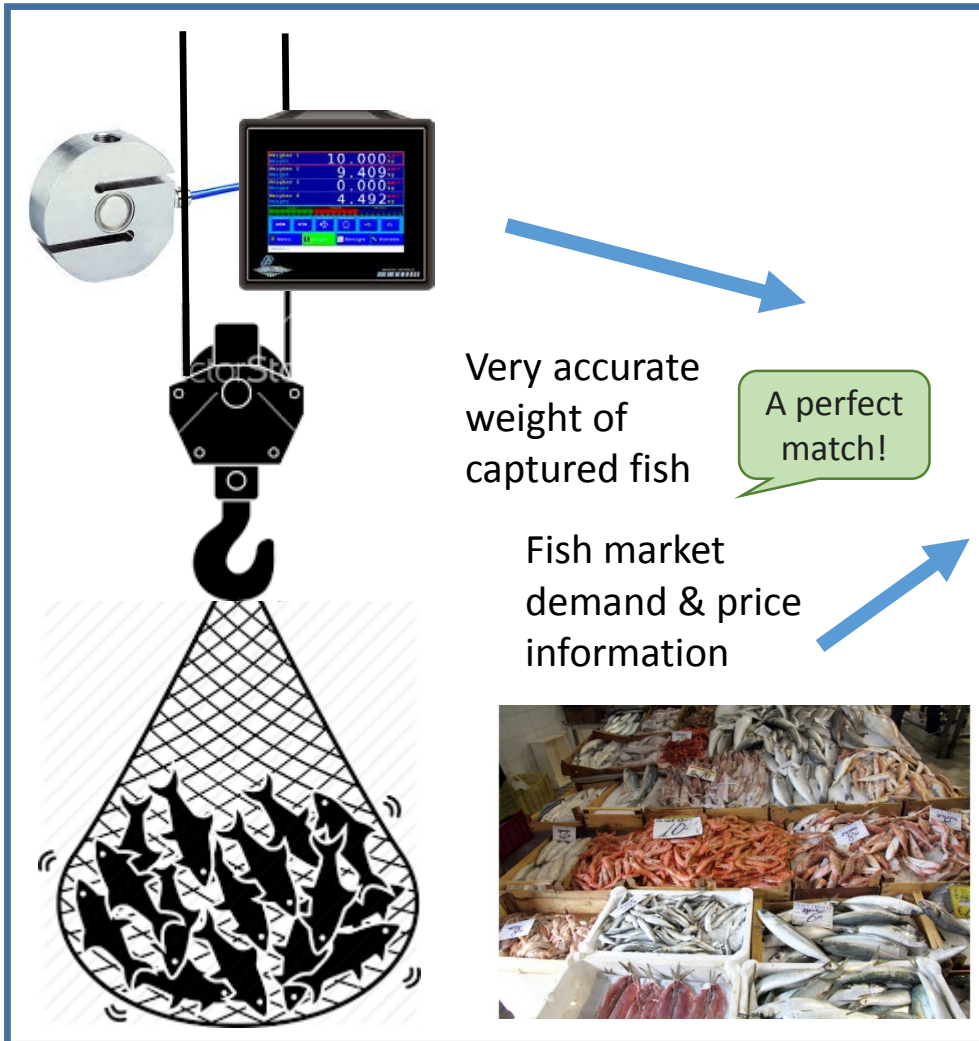


Real time management info

24/7 sensor data



# Phase 3 – a system for harvesting







# The ideal, total solution



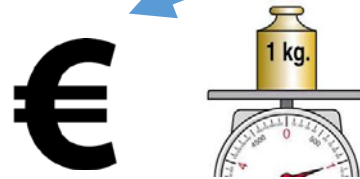
Solar powered, lean,  
optimized feeding  
solution



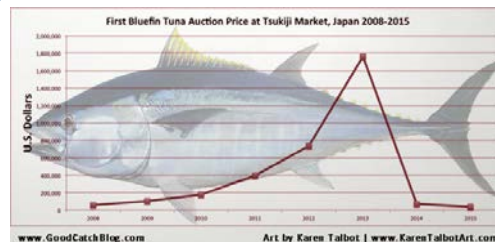
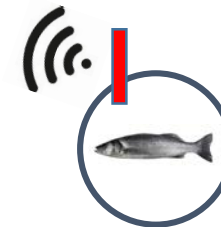
Real time management  
information



Fish demand market  
information, capture  
management



24/7 sensor information





# Conclusion



- Industry 4.0 applications provide countless opportunities
- Each customer can benefit from intelligent, (highly) customized solutions
- Penko is available to consult and help you to capture the benefits of:





Thank you for your attention!







PENKO

*an ETC Company*