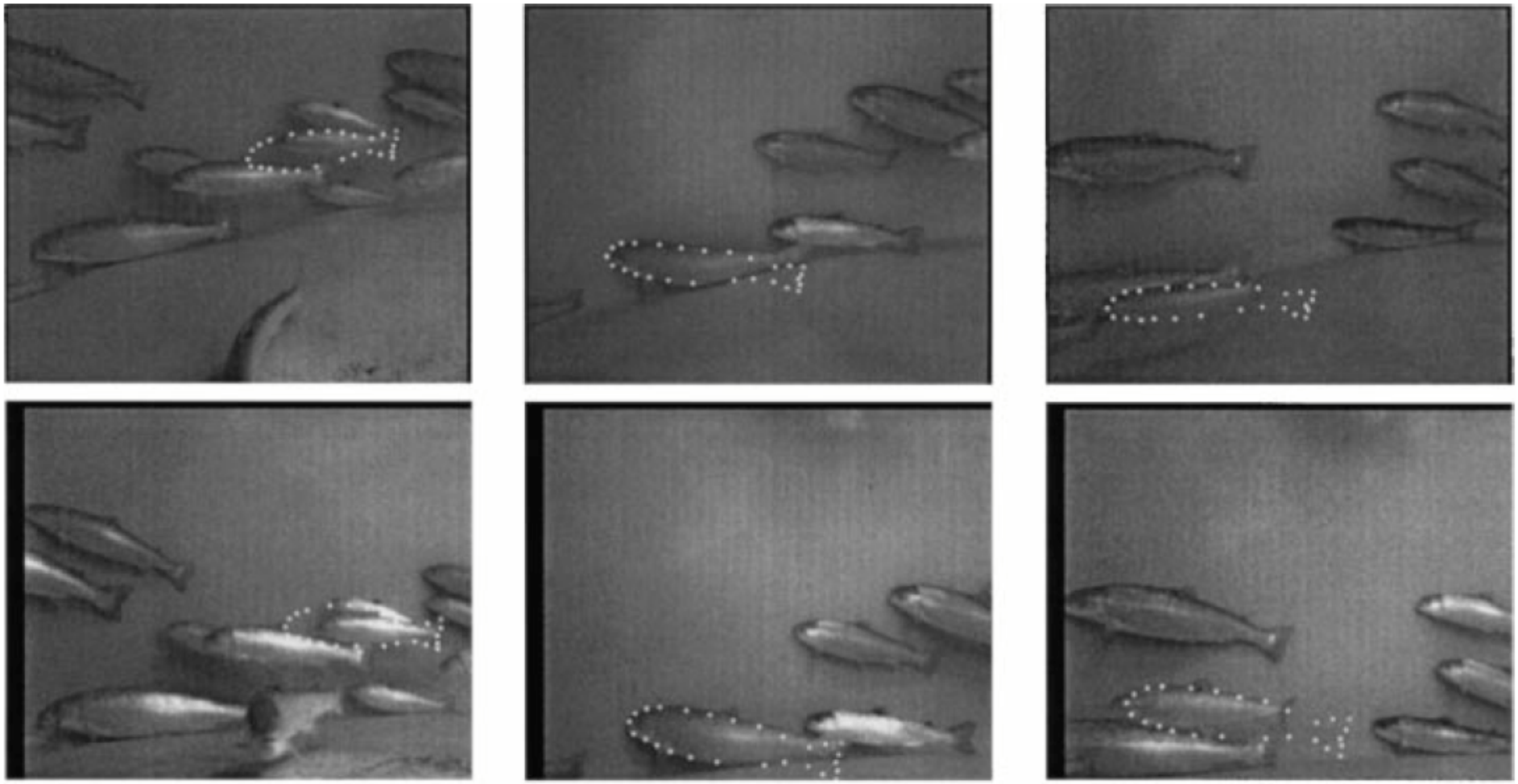
(Aquaculture, Fishery) ⊆ Agriculture
Livestock farming 1000 B.C. → Aquaculture today



Edges of other fish distorting model

Fish orientation too different

Model too large for fish

Tillet et al, 2000

Institute of Agricultural Engineering

C | A | U

Christian-Albrechts-Universität zu Kiel

Dipl.-Ing. Christoph Appel,
Prof. Dr. Eberhard Hartung and Dr. Eiko Thiessen

Supported by
“Innovationsstiftung Schleswig-Holstein”:

Fish In Vivo Online Monitoring (FIVOM) for Flatfish-Aquaculture

In co-operation with bbe Moldaenke, Kiel.

AquaLife 2006

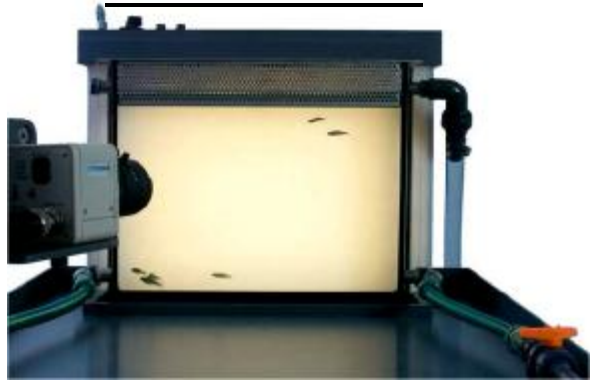
Kiel Center of Innovation
and Technology, Germany
September 12-14, 2006

Business Partner: bbe Moldaenke

Products for Biomonitoring of Water

Behaviour Analysis with Daphnia and Zebra Fish by means of Image Analysis

Fish Toximeter

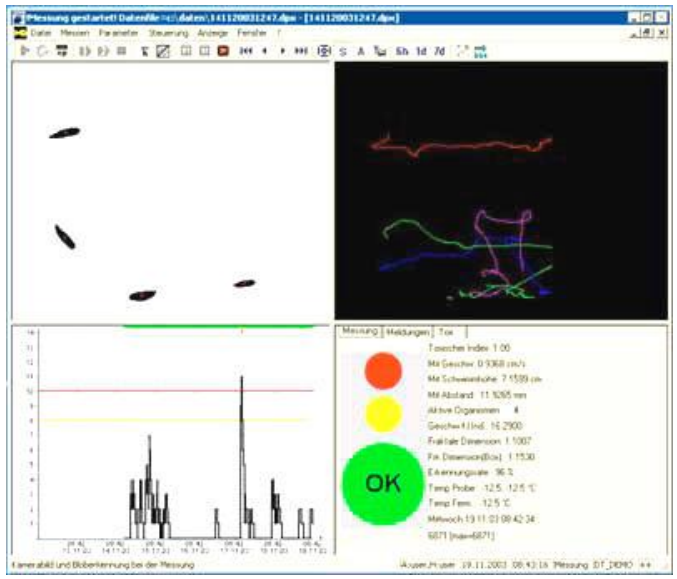


Daphnia Toximeter

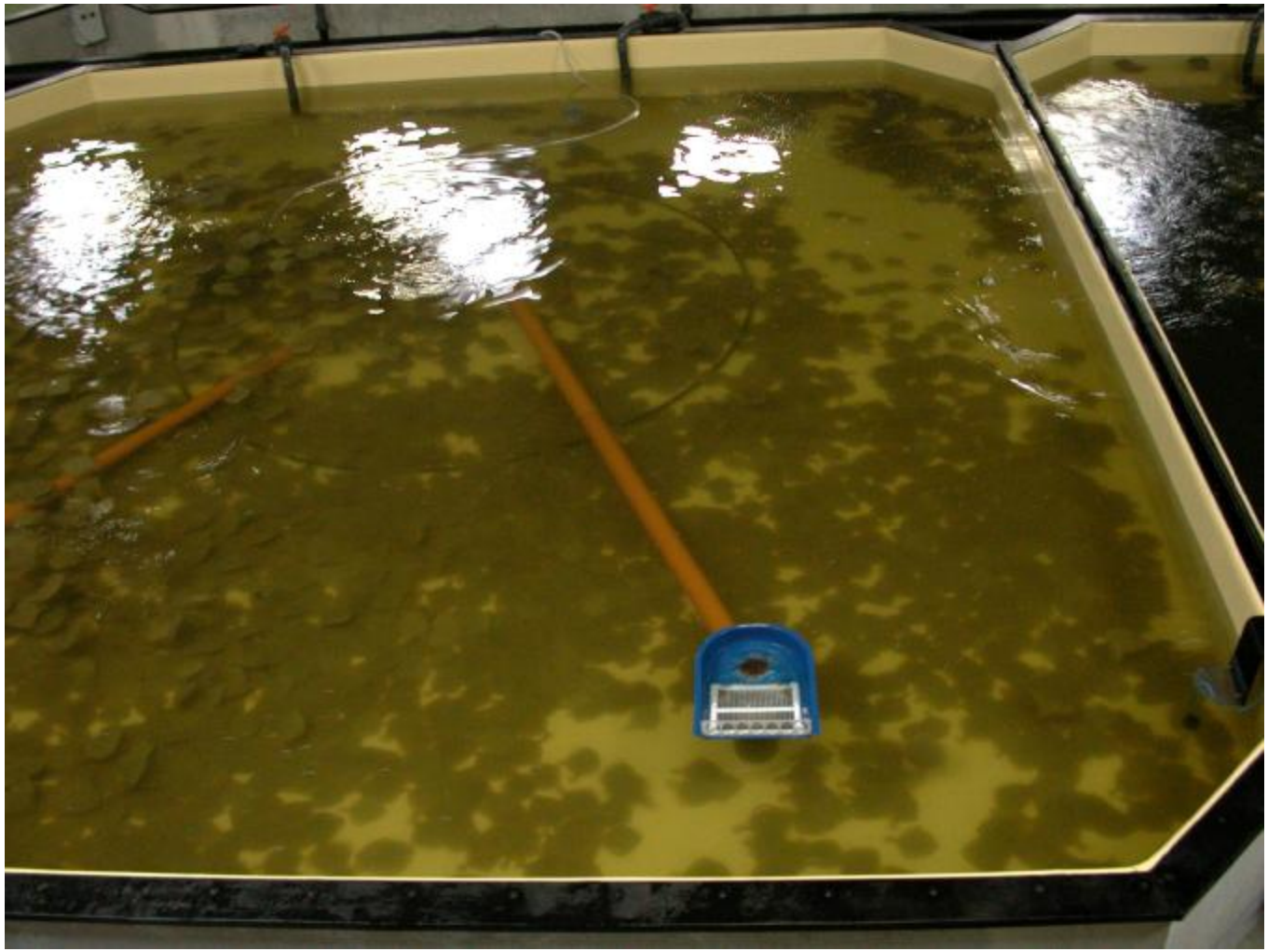
Hardware

Algorithm

Software



Turbot Production (Ecomares, Büsum)



Aims/Objectives of Project

Integration and adaption of an Image Acquisition System for detection of area and length and deduced parameters (weight, growth, body condition, …) of flatfish at a defined distance:

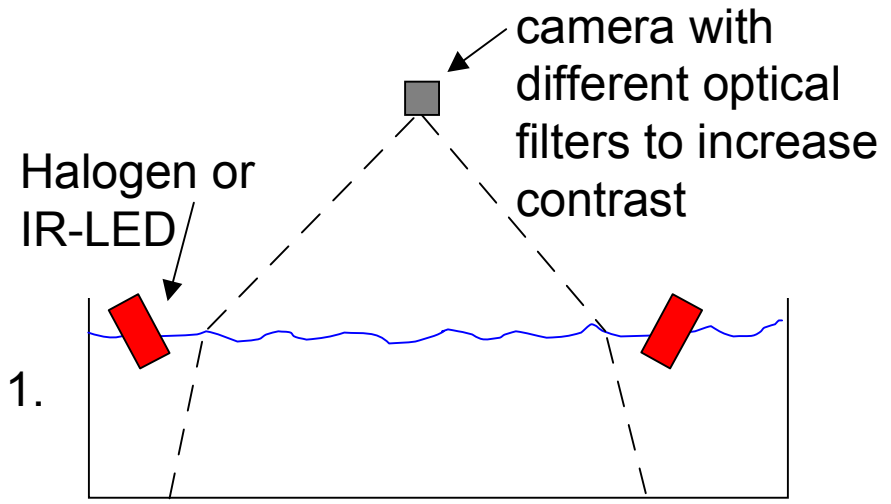
- Hardware:
  - camera system optimized for recirculation plants

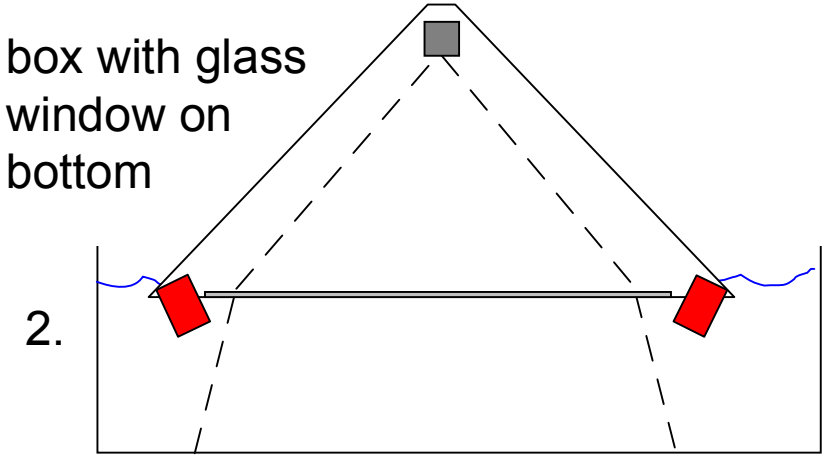
- Software:
  - database with geometric parameters/weight
  - algorithms for cognition and determination of fish

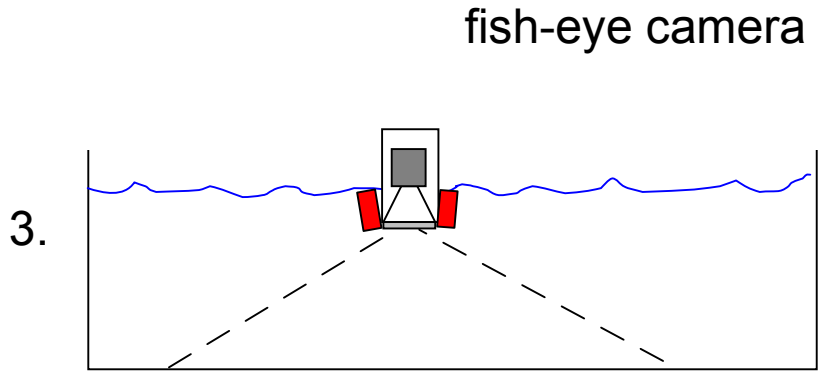
Camera Set-Ups to Examinate (ILV)

Three different mounting options:

- camera top on surface
- camera housed in shielded box
- camera housed in dived box

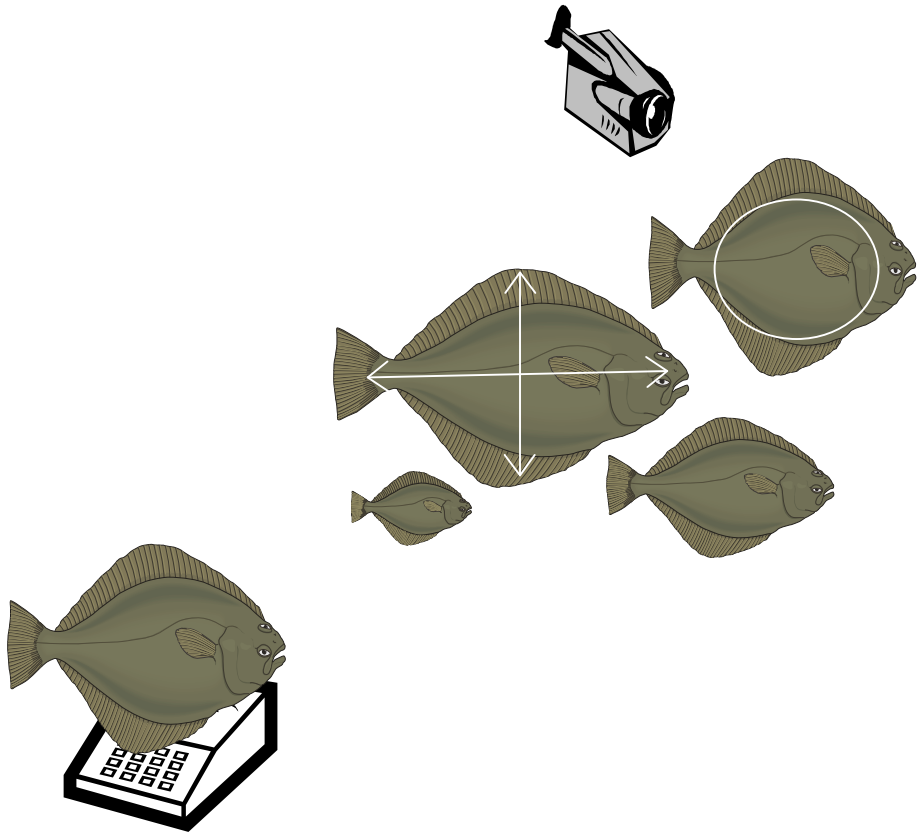






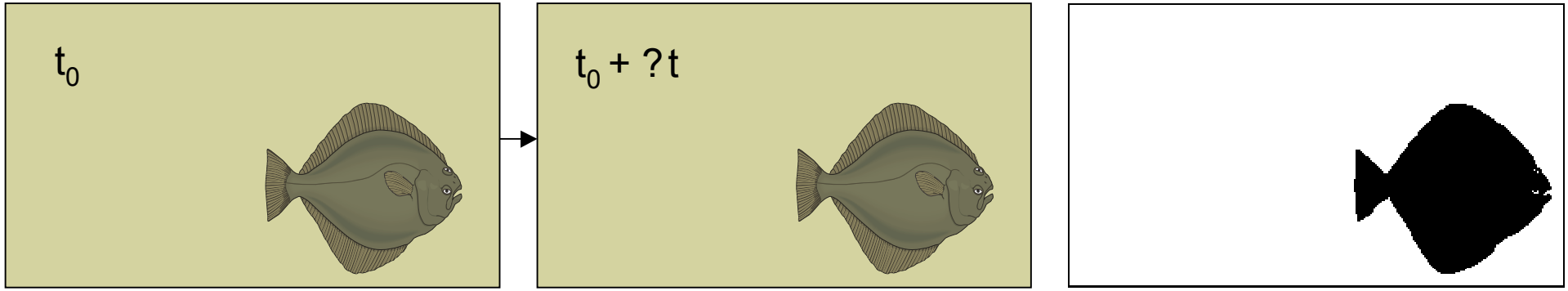
Database (ECOMARES)

- data acquisition of single fish
- determination of typical geometry (length-width ratio, roundness, …)
- no individual recognition

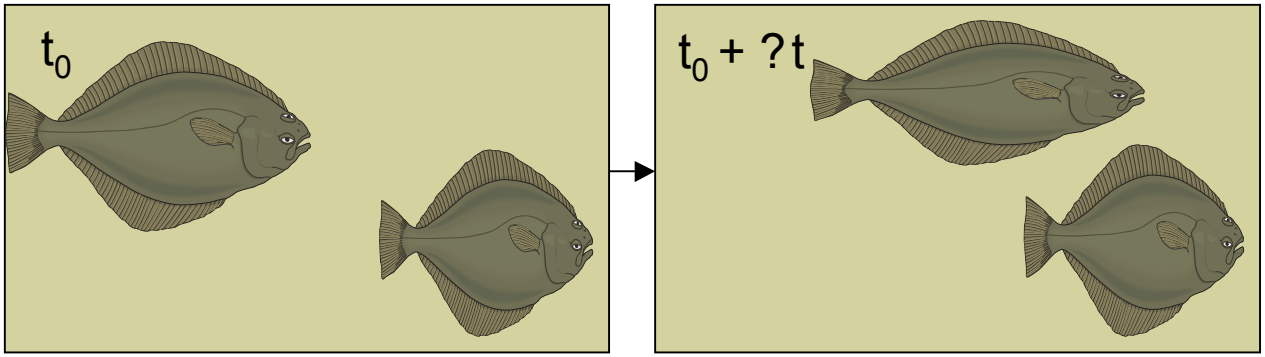


Laboratory Set-Up (ILV)

Eventualities of Image Look-Out I

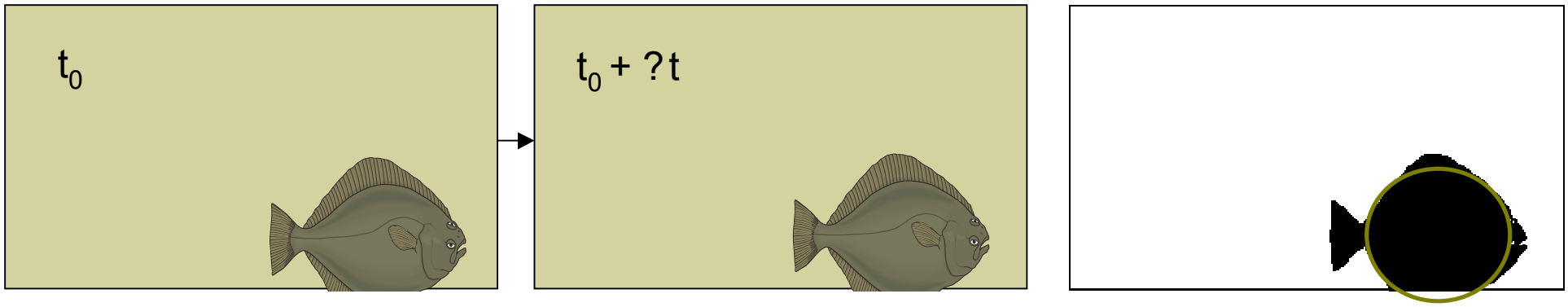


No pixel-change ? Object on bottom, not moving

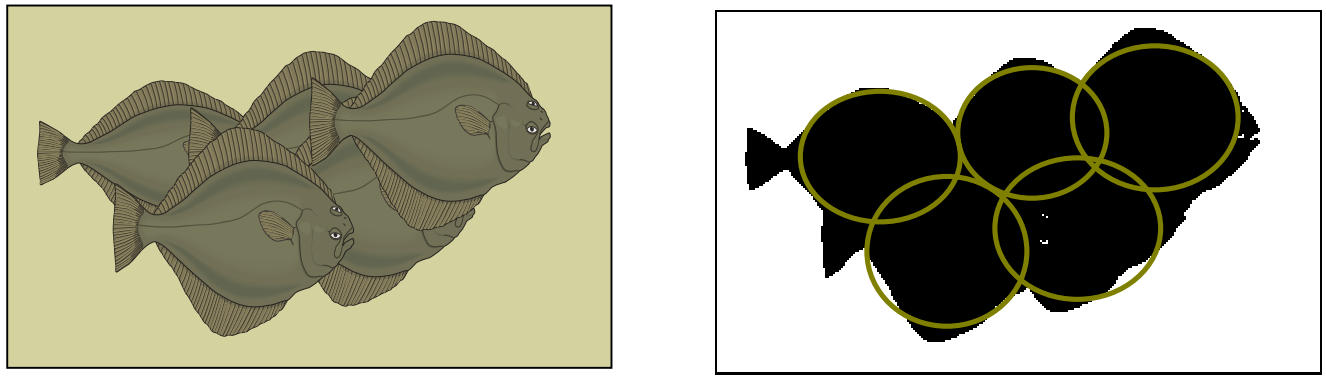


Pixel-change □ Object moving, not on bottom and distortion

Eventualities of Image Look-Out II



No pixel-change ? Object on bottom
Roundness=Circumference^2/Area ˜ 4π, but object cut by edge



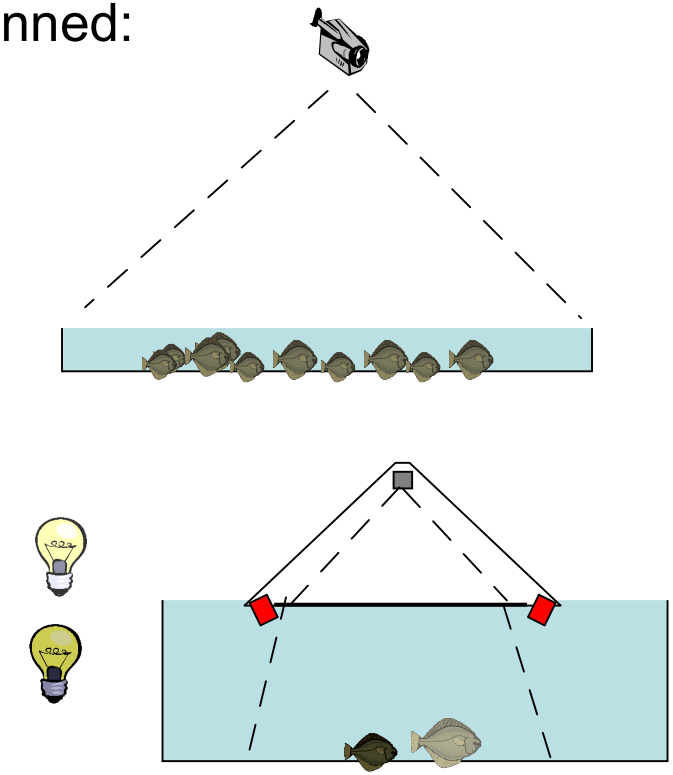
Roundness >> 4p □ not a single fish

Data Acquisition

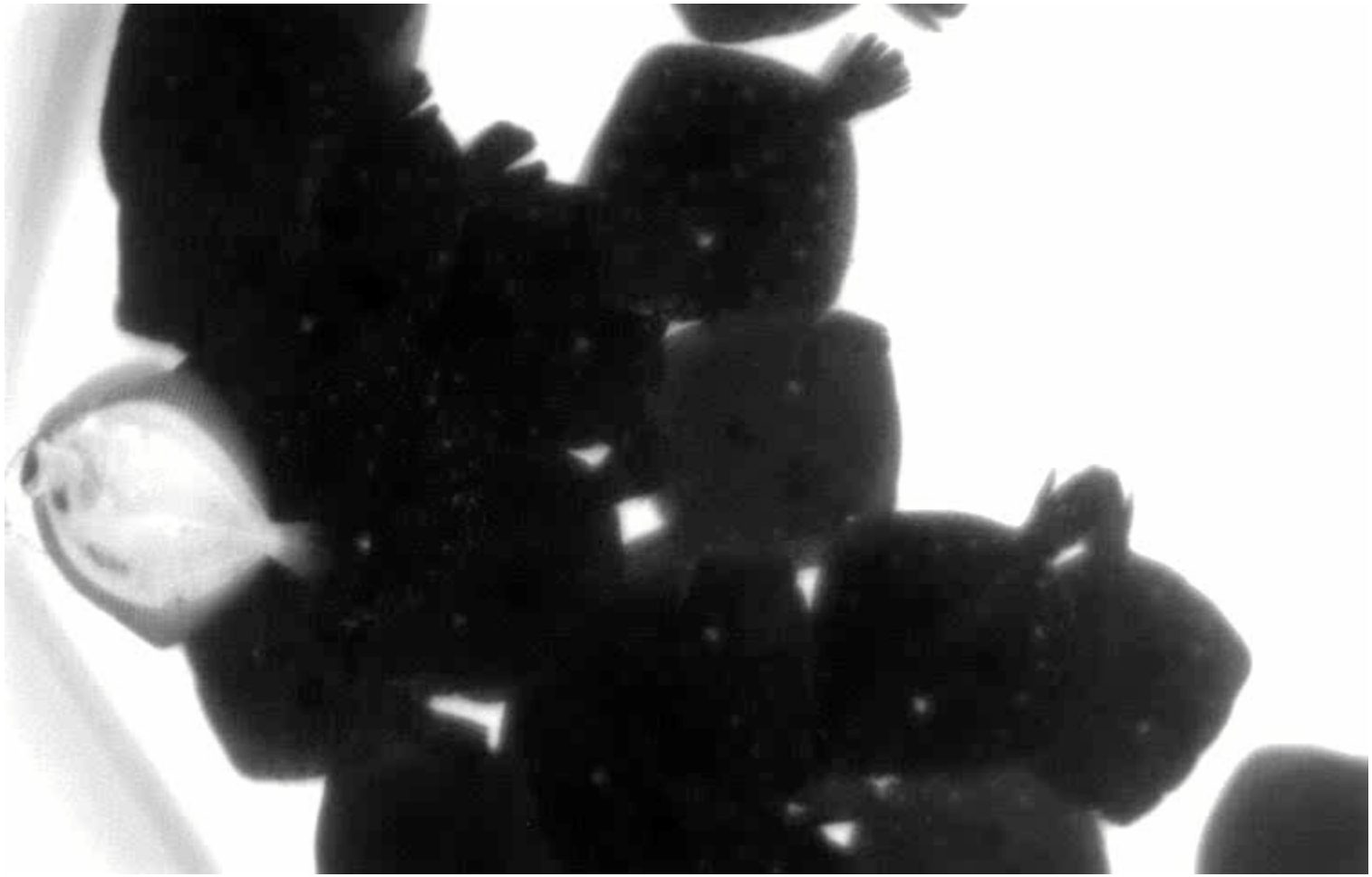
First Trial:

1/3” CMOS monochrome 752x480
Lens f=6mm, window in roof!

Planned:

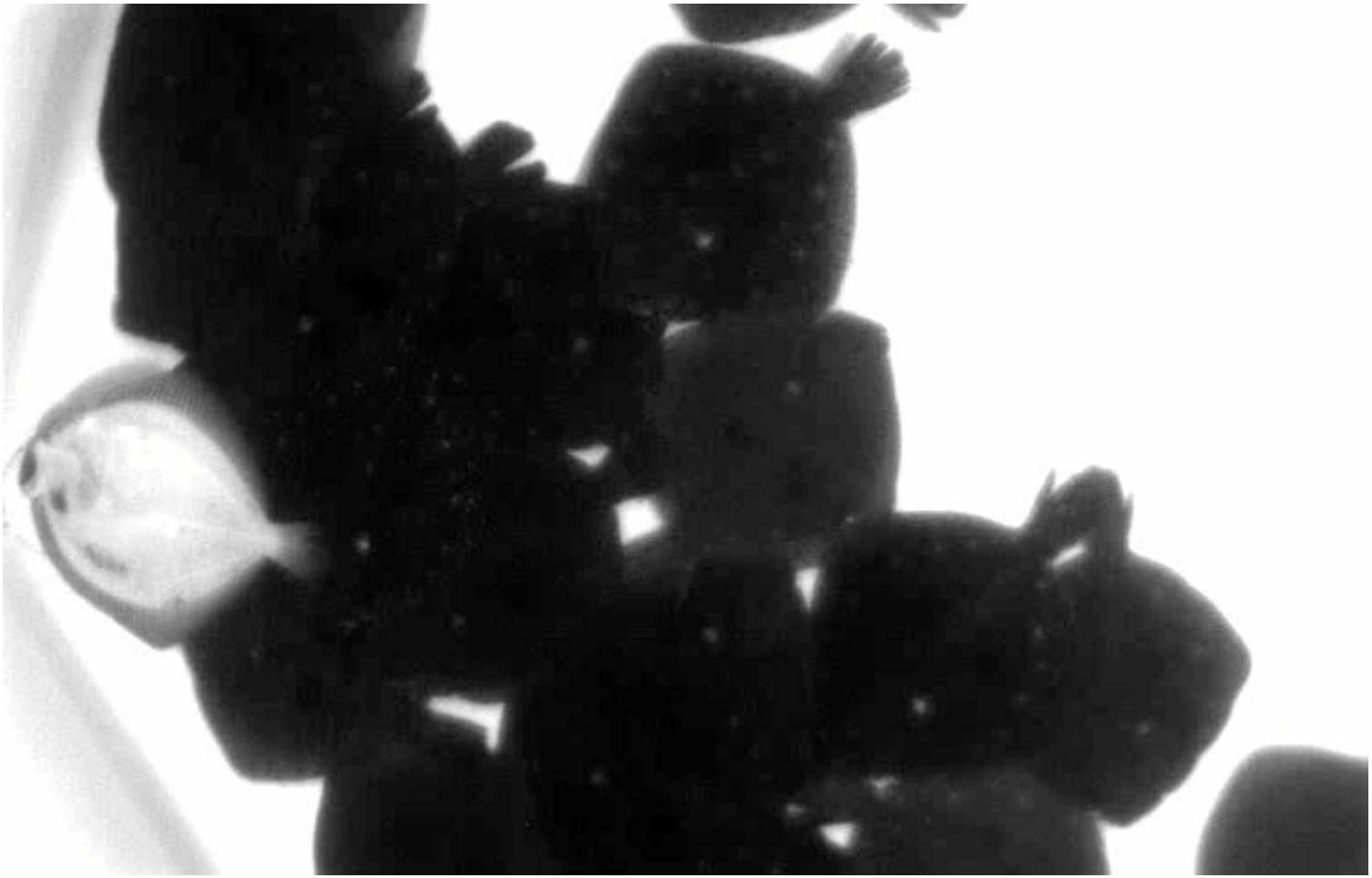


First Image Acquisition: First Problems



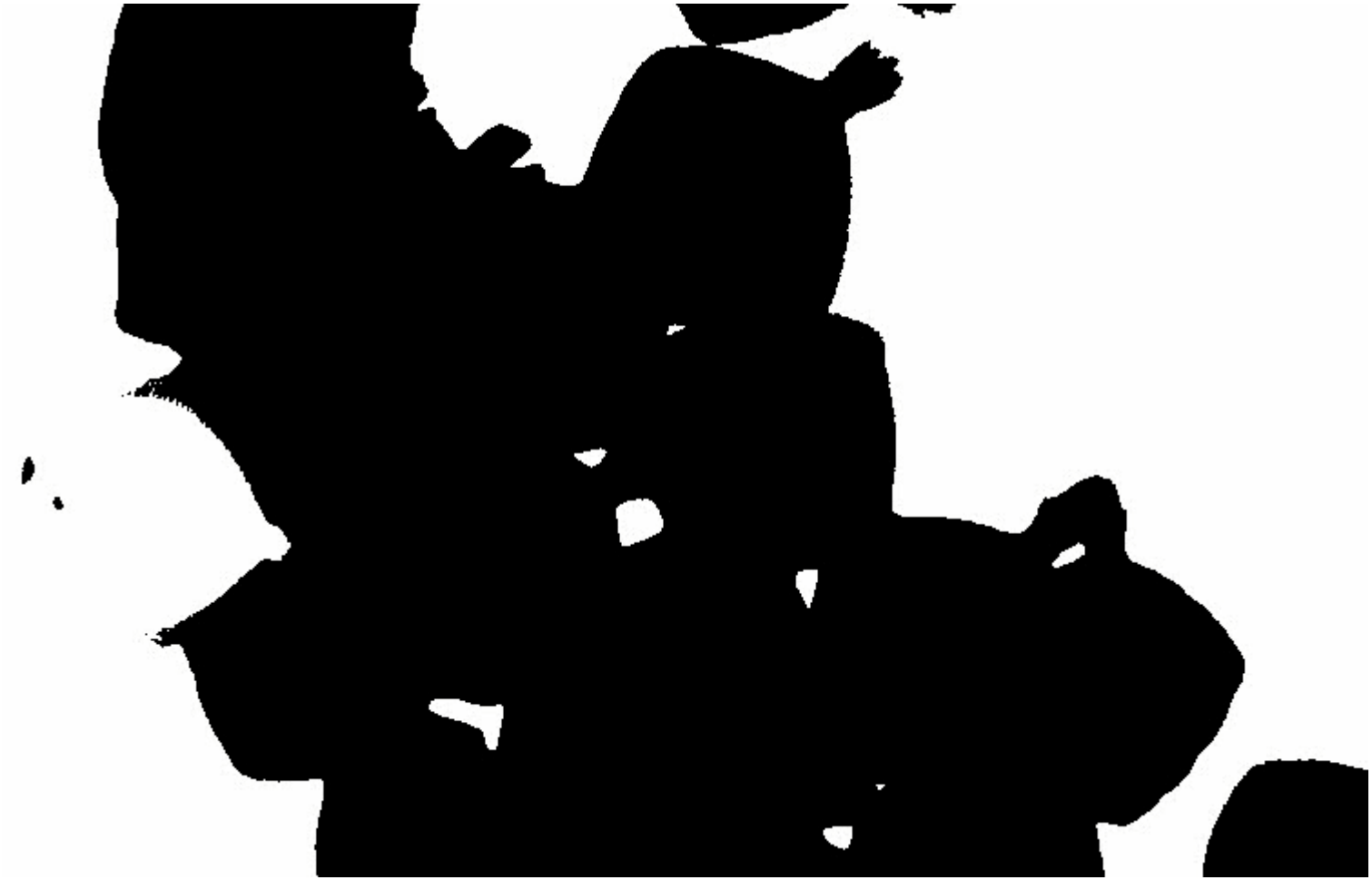
fps=25, f=6mm, d=1.7m, 3xfwd

First Image Acquisition: First Problems



fps=25, f=6mm, d=1.7m

First Image Acquisition: First Problems



fps=25, f=6mm, d=1.7m, thr=128, 3xfwd

First Image Acquisition: First Problems

fps=25, f=6mm, d=1.7m, thr=128

Resumé

- **Monitor weight, growth and variation etc.**
- **Determine geometric parameters of flatfish**
  - image analysis
  - problems - motion, clipping, overlap, light
  - solution - robust algorithms, statistics, no individual recognition
- **Set up database with geometric parameters and weight**
  - “training data” (ECOMARES)
  - range of geometric parameters
- **Adapt bbe’s fish toximeter**
- **More information on growth process**
  - optimize nutrition
  - improve management by continuous monitoring
- **Outlook**
  - behaviour
  - welfare