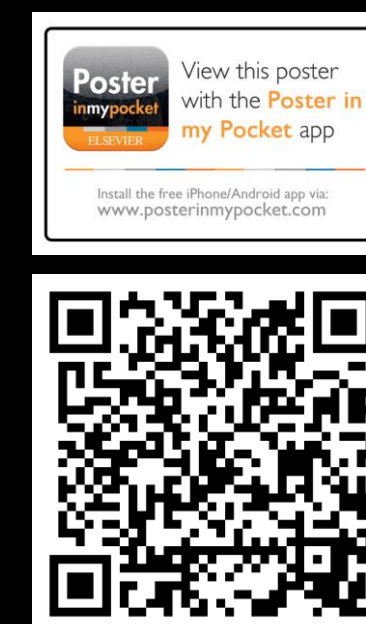


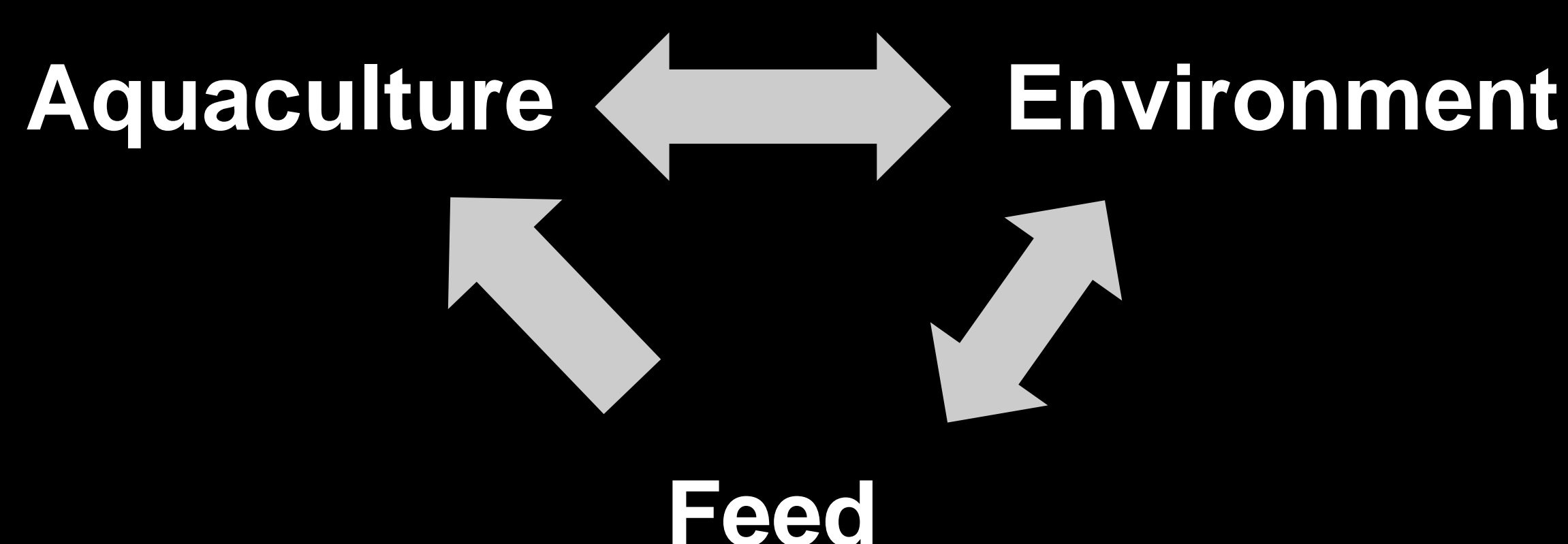
Overview of nuclear applications to study aquaculture-environment interactions and aquaculture nutrition

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Context

Fluxes of Contaminants & essential elements



Impact of contaminants and role of essential elements

Contaminants

- ↑ Risk for consumers
- ↑ Death = ↑ Cost
- ↓ Growth = ↑ Cost

Nutrients (Assimilation efficiencies) = ↓ Cost

Nuclear techniques

Radiotracers

- Gamma emitters:**
 ^{51}Cr , ^{54}Mn , ^{57}Co , ^{65}Zn , $^{110\text{m}}\text{Ag}$, ^{109}Cd
- Beta emitters:**
 ^{14}C , ^3H , ^{45}Ca , ^{63}Ni

Measurements

- Spectrometry:**
Germanium or NaI counters
- Liquid scintillation counters

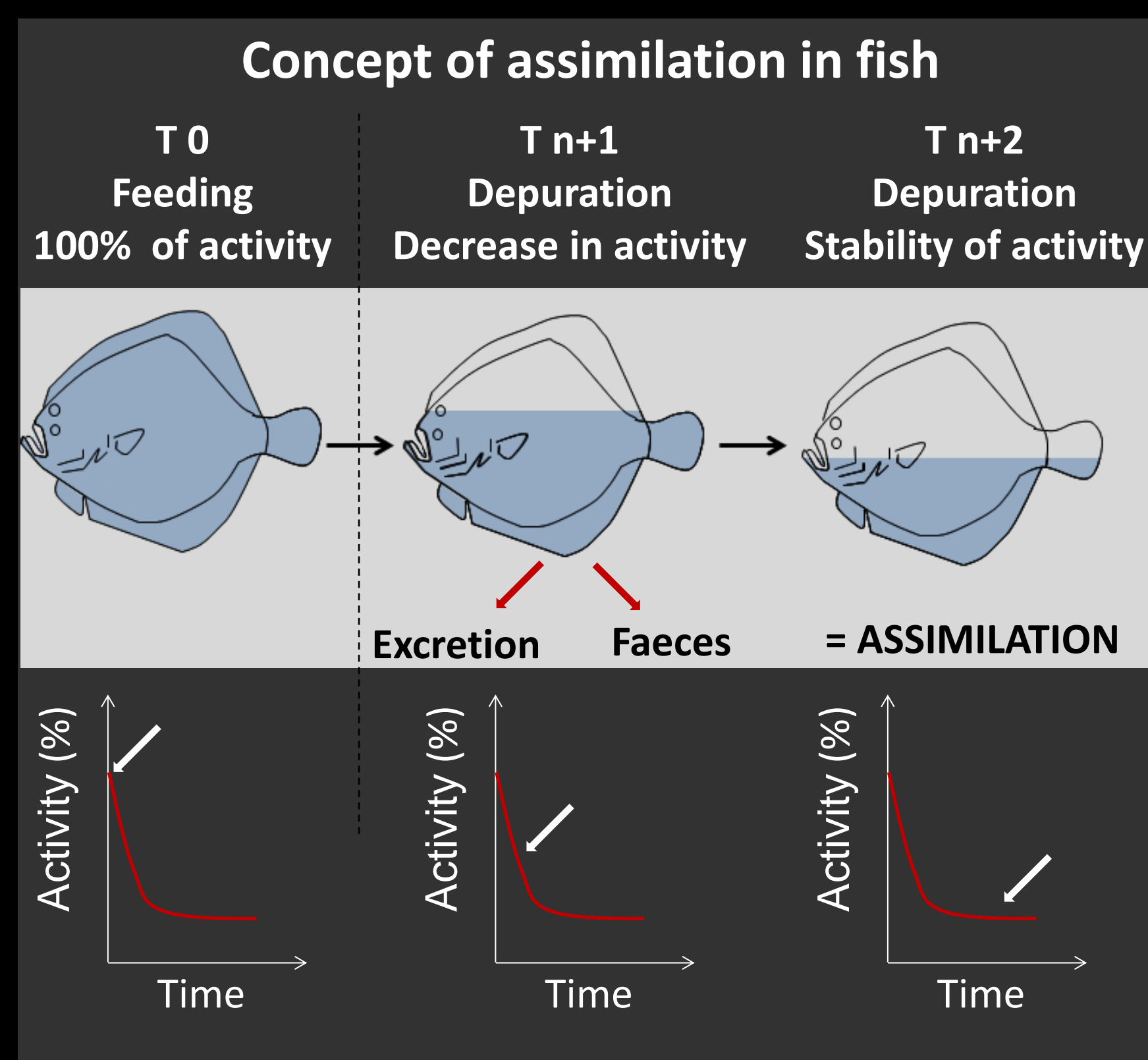
Advantages

- Cost effective**
- Low levels of elements used**
(closed to background levels)
- High sensitivity & specificity**
- Easy handling**
- Individual counting & Live organisms**
(over long period of time for Gamma emitters)

Applications

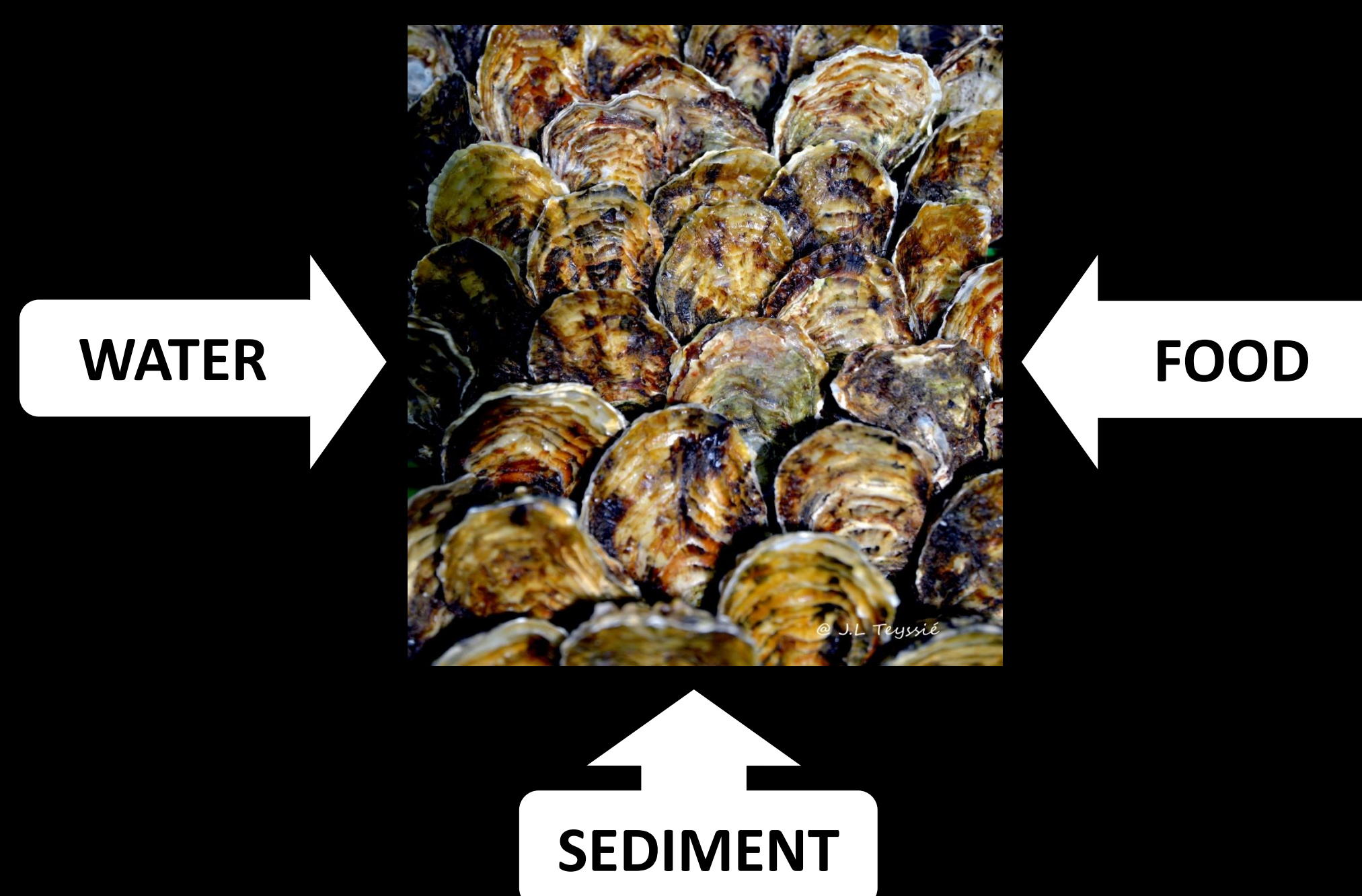
Feeds

- Assimilation efficiencies**
(contaminants & essential elements)



Environment

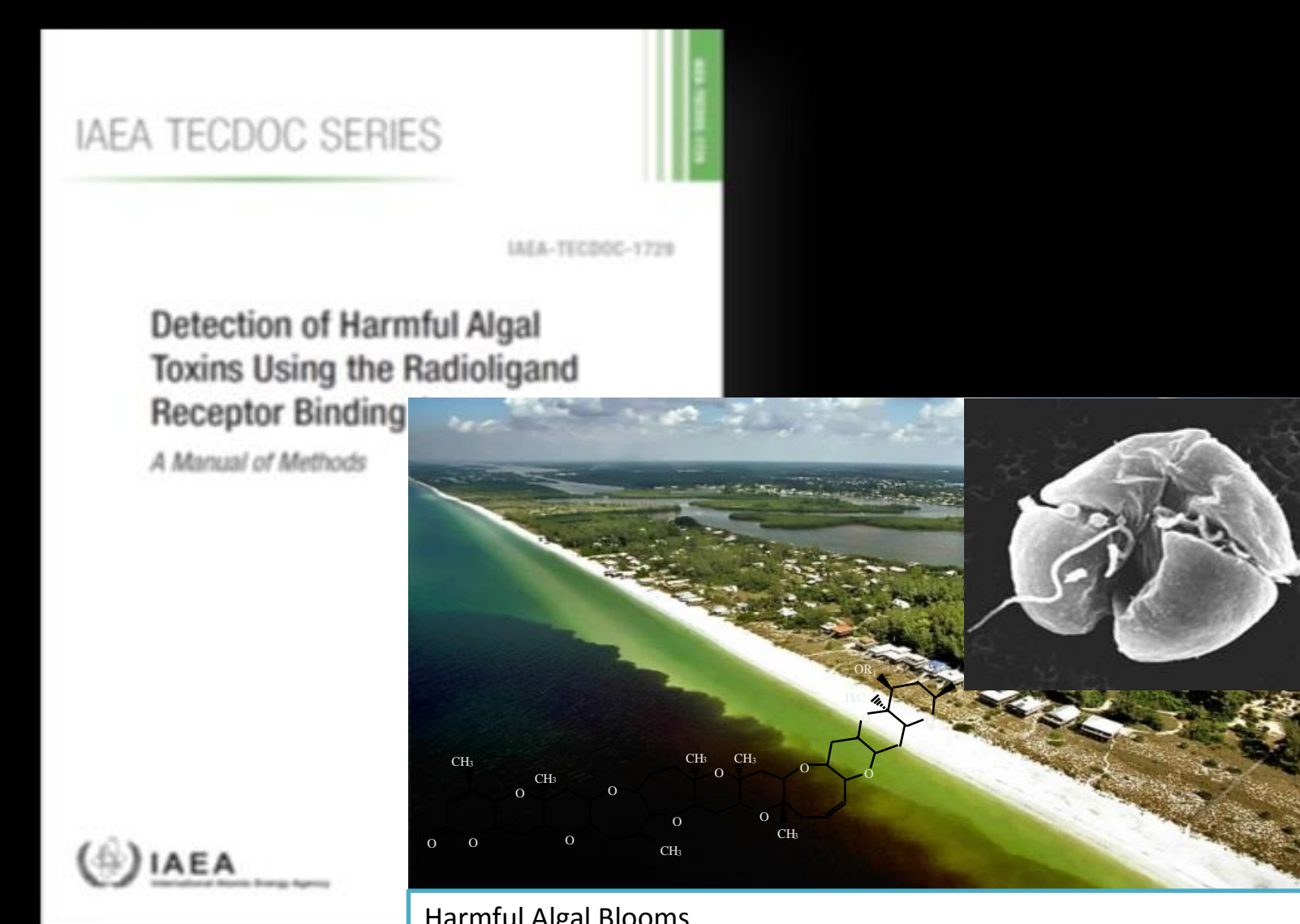
- Effect of abiotic factors** (temperature, pH or salinity) on **essential element** (e.g. calcium) **uptake capacities**
- Contamination processes** (metals, organics or biotoxins)



- Risk for consumers**
Digestion in vitro
- Diseases and Viruses**
e.g. Use of radiovaccine, characterized a vaccine candidate
See HEIDARIEH et al. (2015) Gene expression analysis in rainbow trout (*Oncorhynchus mykiss*) skin: immunological responses to radiovaccine against *Ichthyophthirius multifiliis*

Detection

- Marine biotoxins**
Receptor binding assays (RBAs)
Radioimmunoassays (RIAs)



Toxicokinetics and dynamics of biotoxins
Regulation tools – seafood safety
Rapid detection of occurrence

- Hormones**
Radioimmunoassays (RIAs)
Stress measurement
(e.g. cortisol levels in water/seafood)
Physiology understanding (aquaculture related)

- Diseases**
Quantitative polymerase chain reaction
Starting to apply this with EUS, KHV, WSSV being the main target
(contact: Hermann UNGER - H.Unger@iaea.org)