



# Assesement of environmental Monitoring methods for Integrated Management of Aquaculture in open sea: A MASS BALANCE MODEL APPROACH

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# ASSESSMENT OF ENVIRONMENTAL MONITORING METHODS FOR INTEGRATED MANAGEMENT OF AQUACULTURE IN OPEN SEA

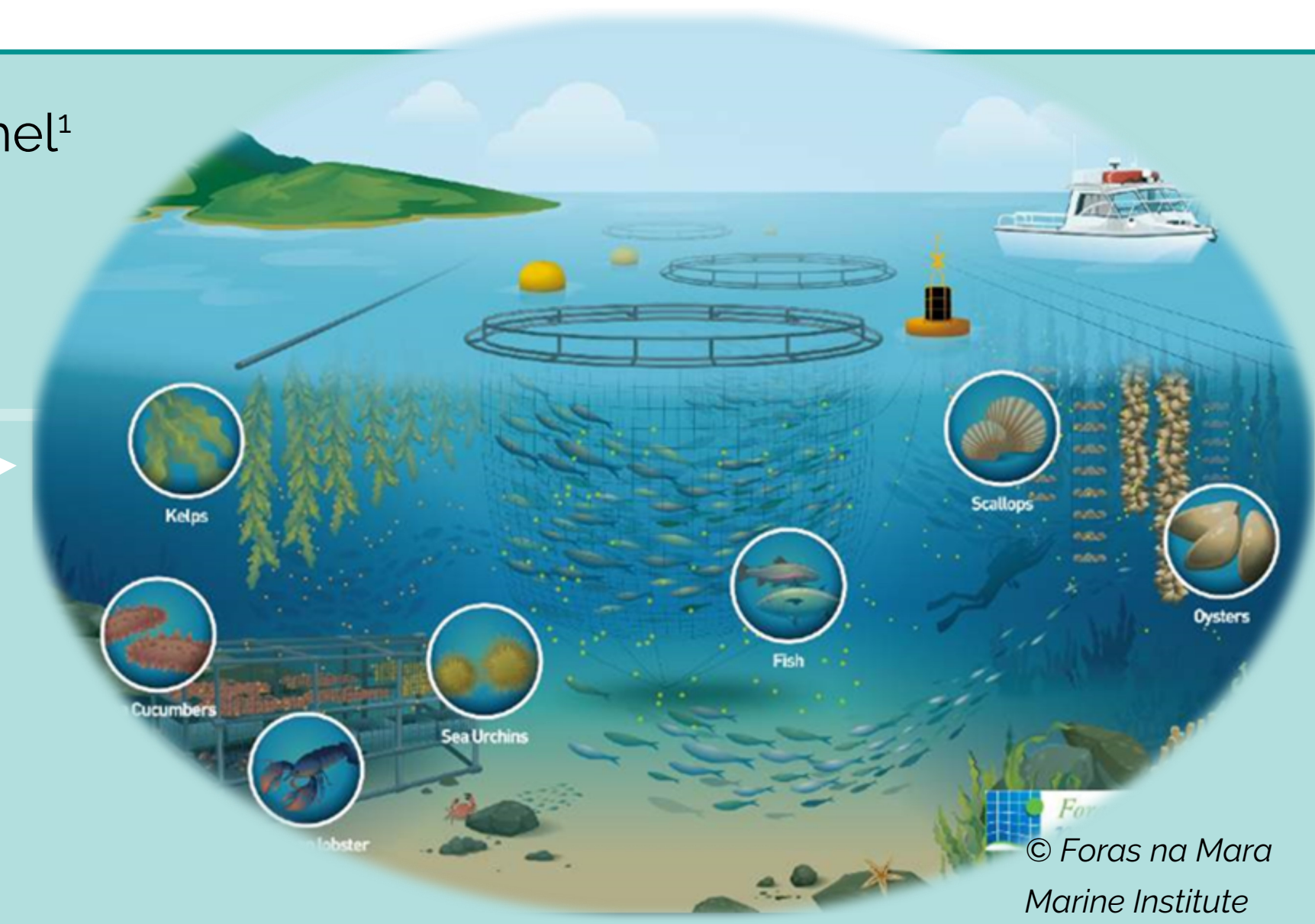
## A MASS BALANCE MODEL APPROACH

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### Integrated Multi-Trophic Aquaculture (IMTA)

⇒ Sustainable aquaculture

⇒ Trophic interactions : ensure (if possible) a mitigation of impacts of culture species  
(Chopin et al., 2012; Buck et al., 2018)

IMTA development at sea ⇒ **promising BUT** Requires **demonstration** of trophic interactions

### AMIMA Project

Proposal of a methodology to identify and characterize trophic interactions between aquaculture compartments and with the natural environment

Tools ?

Direct approach: identification of trophic links by tracking markers  
⚡ Analysis in progress ...

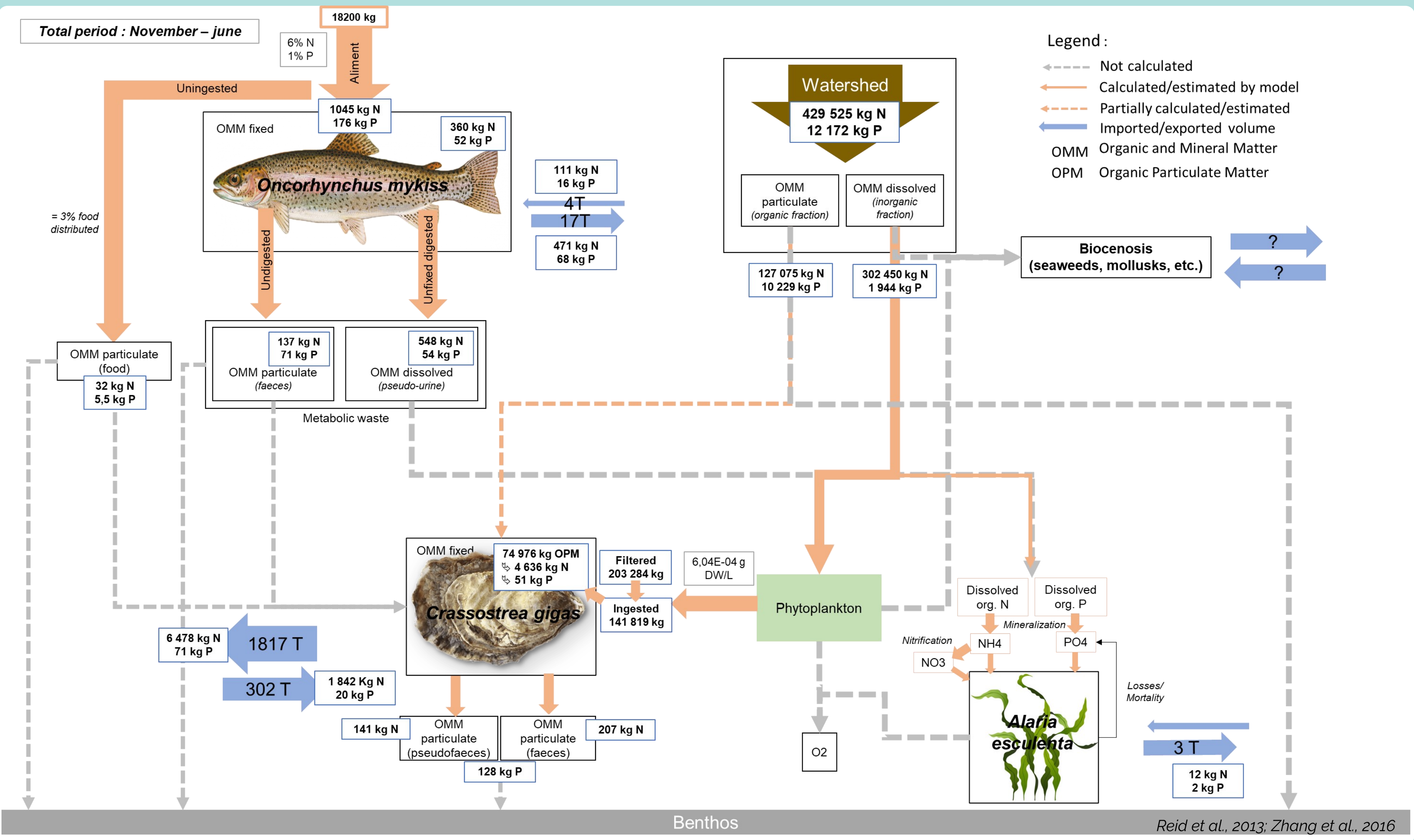
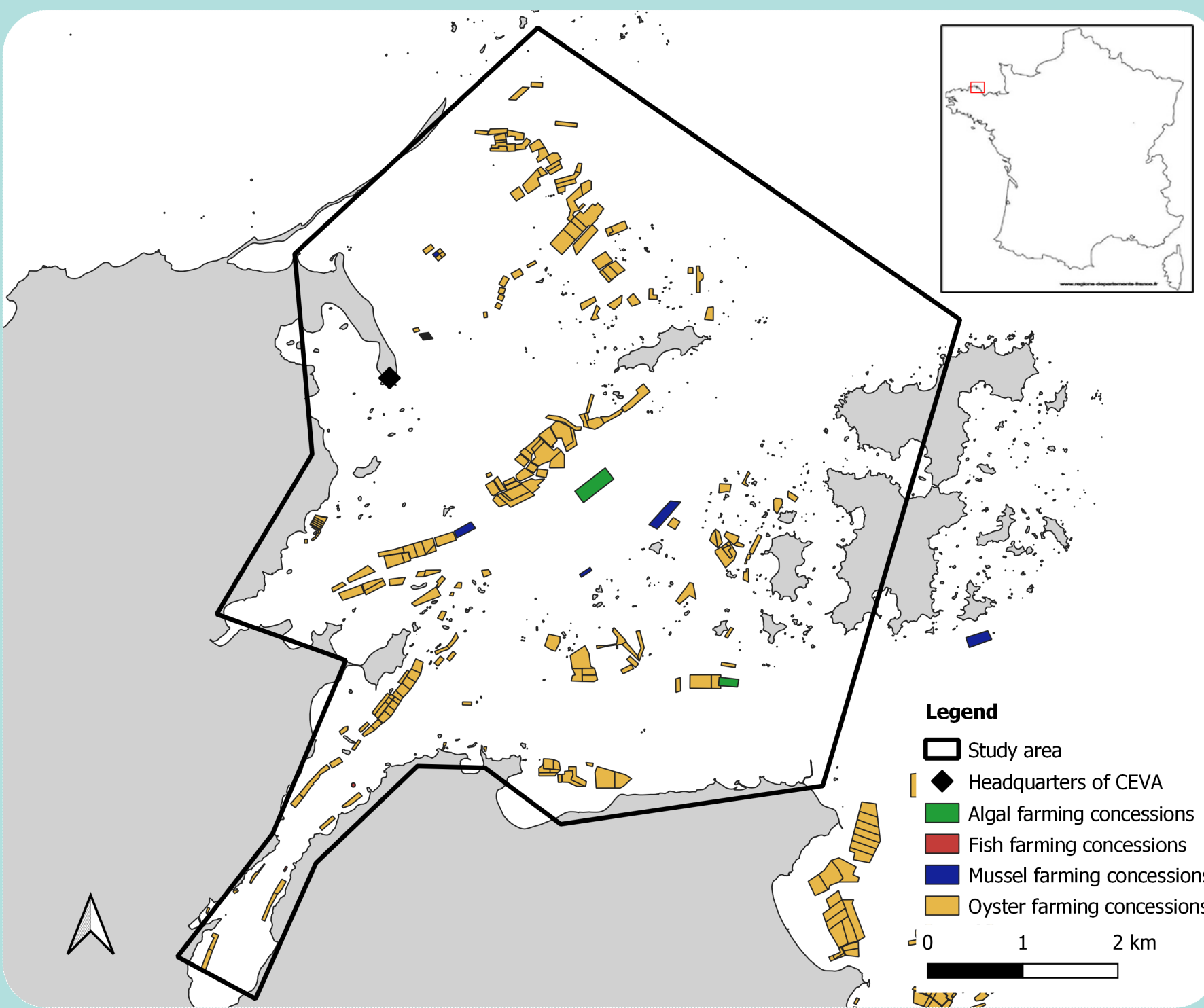
Indirect approach: application of mass balance (nitrogen (N) and phosphorus (P)) models for each aquaculture compartment

### Materials & methods of indirect approach

- Application of mass balances to aquaculture compartments in a specific period and study area: november to june in the Trieux estuary (Côtes d'Armor, France)
- Recovery of production data (oyster farmers, fish farmers, seaweed farmers)
- Use of growth models: evolution of biomass in each compartment

### Results of indirect approach

- Estimation of N, P flux quantities of the different aquaculture compartments
- Importance of material flows from the watershed



### Conclusion

#### Positive outcomes

Quantification of aquaculture biomass in the estuary, discharge and extraction  
Potential total remediation of fish emissions by oysters  
Meeting with interested producers

#### Negative outcomes

No trophic links between aquaculture species in a large estuary  
Missing data (production, environmental)

### Perspectives

- ⇒ Development of sustainable partnerships with local actors/producers: monitoring of breeding by periodic measurements (1 year or more)
- ⇒ Collection of environmental data at various spaces and times & use of others models (consideration of sedimentation and resuspension): better understanding of matter flow, the impacts and interactions of each aquaculture production on the environment and the potential interactions between them
- ⇒ Application of the method to another field with more aquaculture actors

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### References

CHOPIN et al., 2012, Rev Aquaculture 4: 209-220; Reid et al., 2013, Aquaculture 408: 34-46; Zhang et al., 2016, Journal of Environmental Sciences 126: 621-632; BUCK et al., 2018, Frontiers in Marine Science 5: 165.



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