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# ASSOCIATING SEA BREEM, OYSTER, CLAM AND SHRIMP IN AN EARTHEN-POND LOOP: TOWARD AN ENVIRONMENTALLY FRIENDLY SYSTEM

**Christophe Jaeger, Vincent Gayet, Joël Aubin**

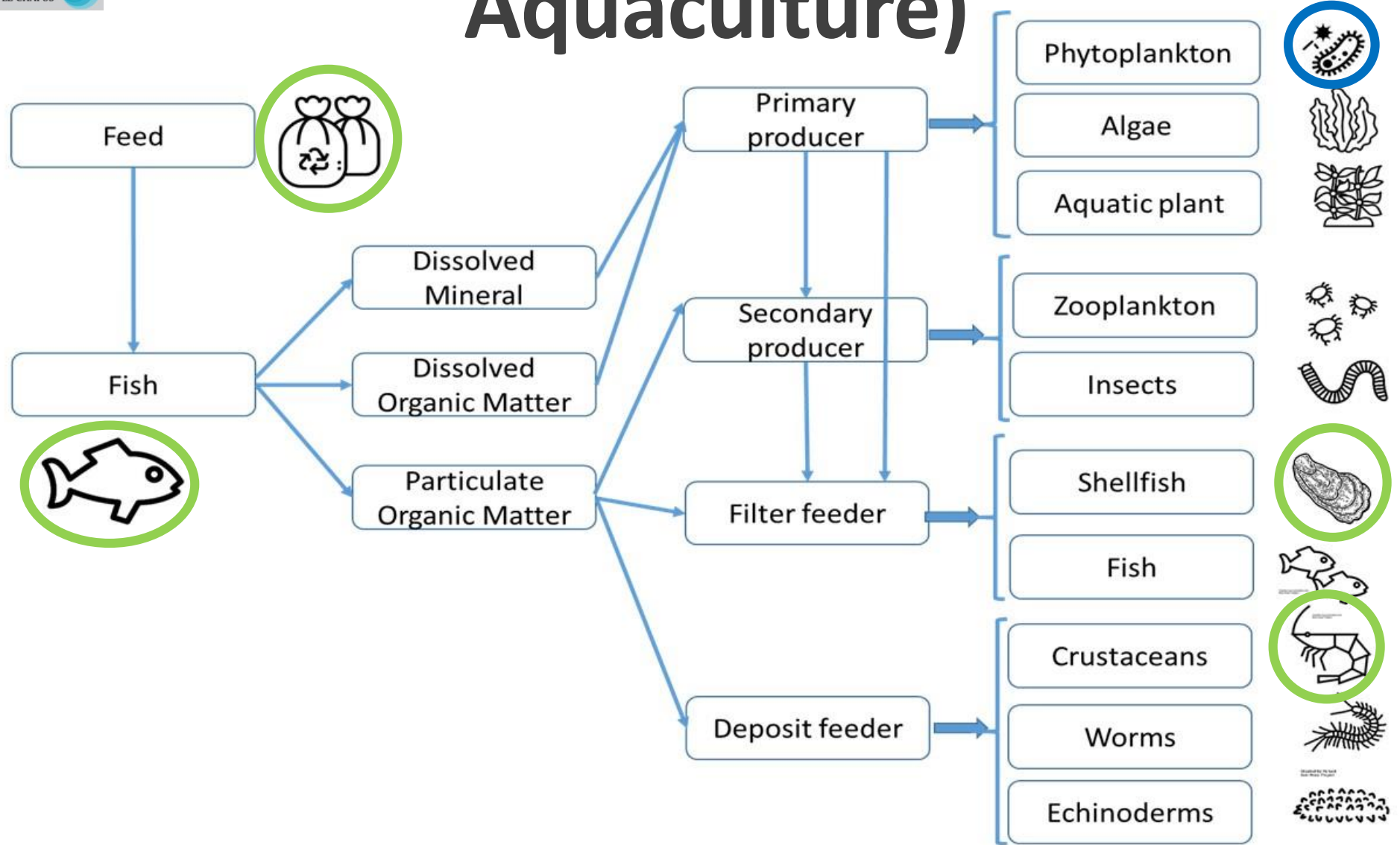
The PRIMA programme is supported under Horizon  
2020, the European Union's Framework Programme  
for Research and Innovation

# INTRODUCTION



- **SIMTAP project:**
  - ❖ **PRIMA grant**
  - ❖ **Based on IMTA approach**
  - ❖ **To reduce the waste emissions**
  - ❖ **To reduce the use of resources (energy, water, fishmeal, fish oil, soybean)**
- **System designed in ponds to meet the purposes of the project**
- **Assessed on:**
  - **water quality results**
  - **growth performances**
  - **nutrients use efficiency**

# IMTA (Integrated MultiTrophic Aquaculture)



# Description of the system



**Formulated feed: only composed of vegetal raw materials (without fish meal, fish oil, soybean), delivered 5 days/week**



**Mussels out of calibration, delivered 1 day/week, isoenergetic to formulated feed**



**Gilthead Seabream (*Sparus aurata*): from RAS, 1 387 pre-grown (stocked at 0.720 kg/m<sup>2</sup>), ability to eat mussels**



**Shrimp (*Penaeus japonicus*): 2.5 post-larva/m<sup>2</sup>**

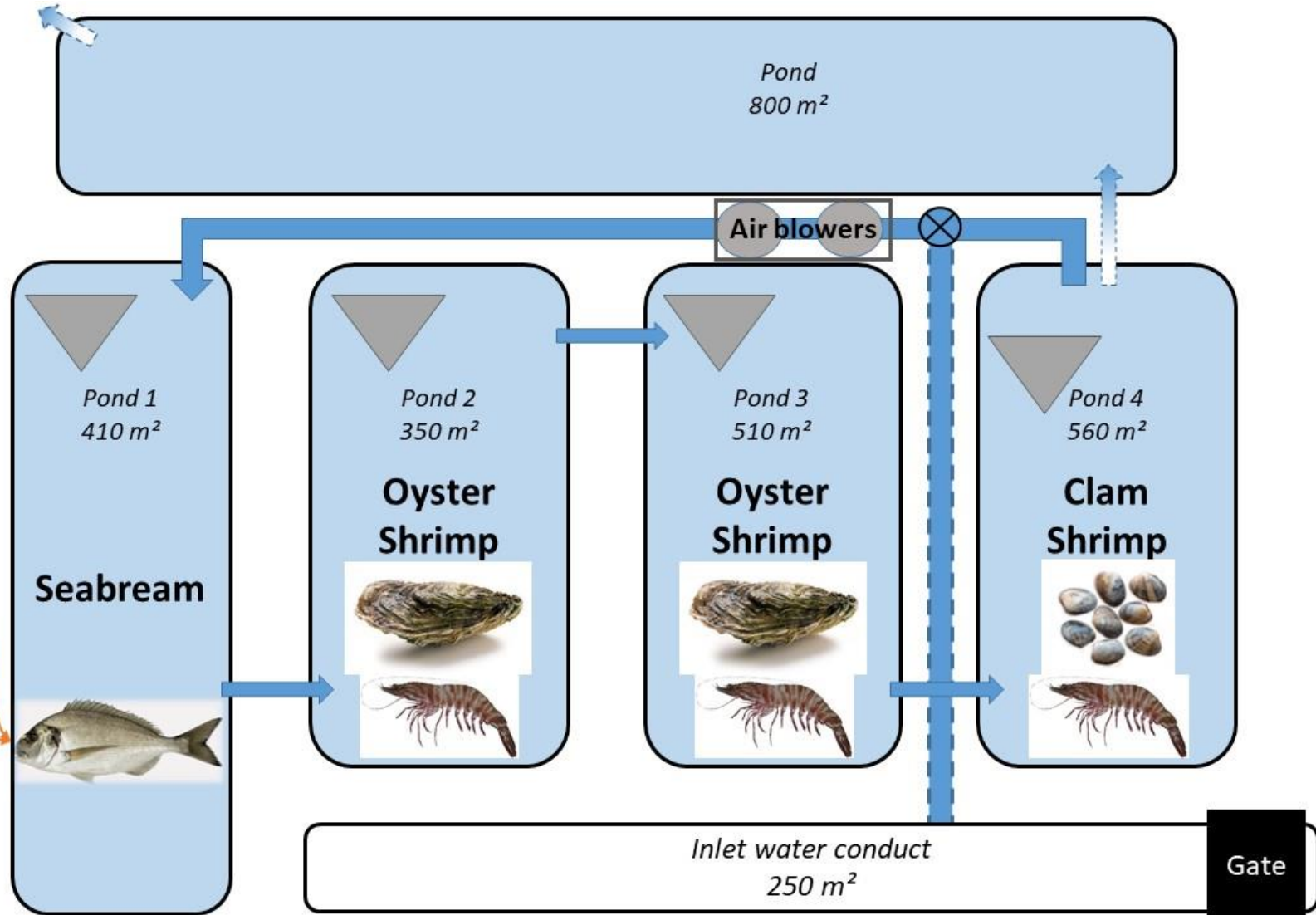


**Oyster (*Crassostrea gigas*): 2.5 individuals/m<sup>2</sup>**

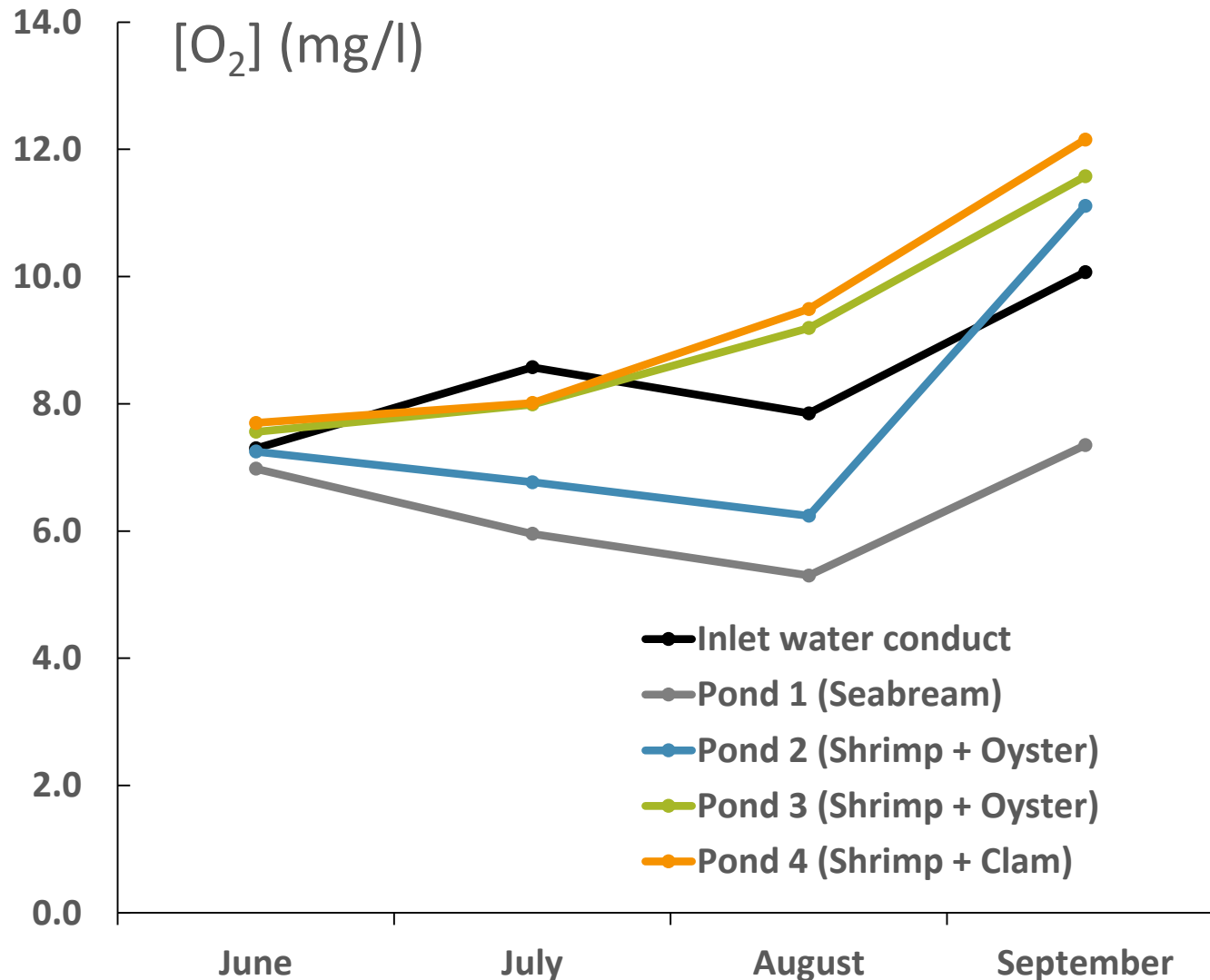


**Clam (*Ruditapes decussatus* / *philippinarum*): 21 individuals/m<sup>2</sup>**

# Pilot design



# Water quality



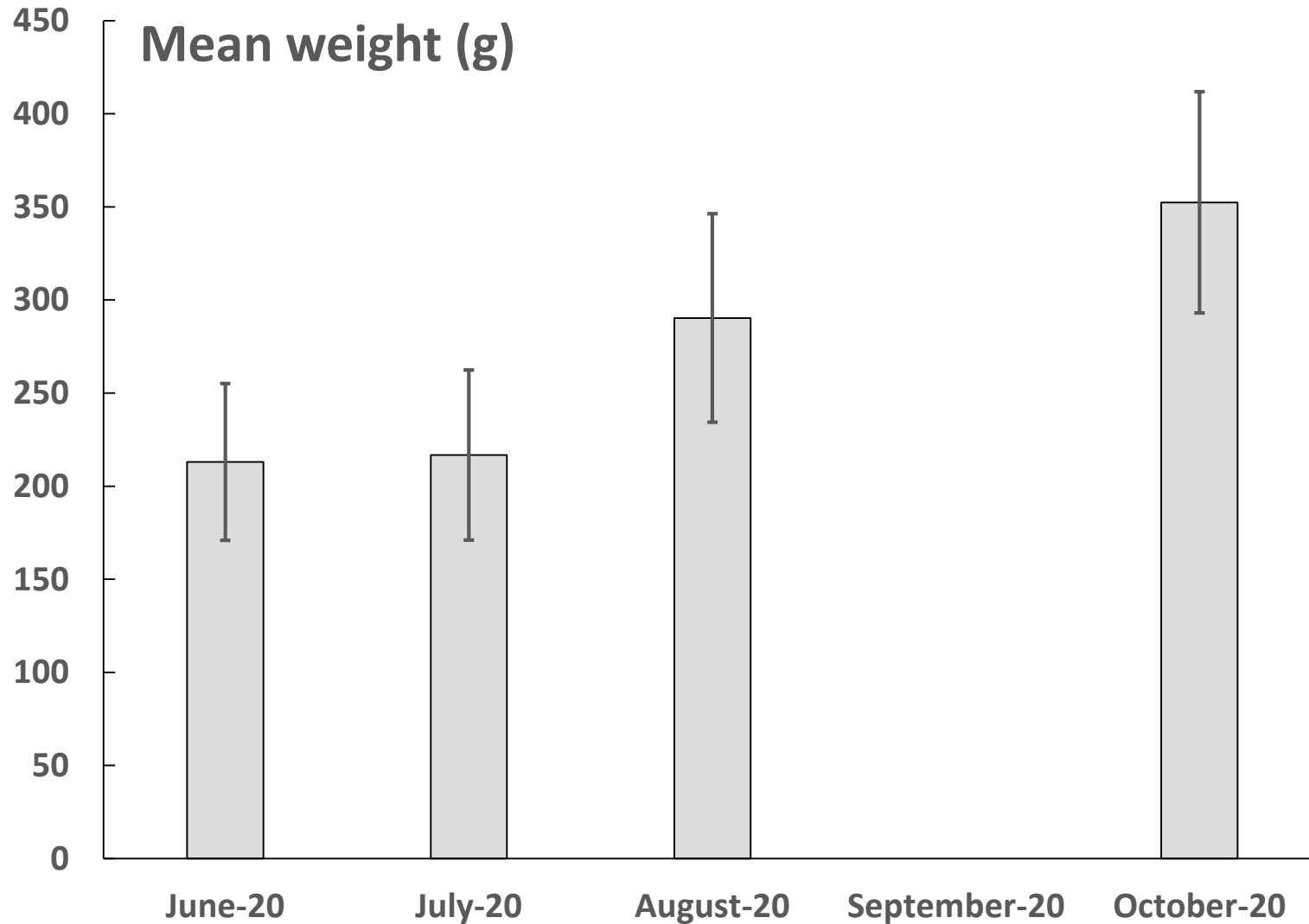
❖ No significant differences observed between ponds for [TN], [NH<sub>4</sub>], [NO<sub>2</sub>], [NO<sub>3</sub>], [TP] and [PO<sub>4</sub>] ( $p < 0.05$ )

❖ [O<sub>2</sub>] pond 1 < ponds 3 and 4 ( $p < 0.05$ )

❖ Strong variations between night and day

❖ ↗ [Total chloro] (2.5 → 61 µg/l) in the ponds, not in the conduct (5-11 µg/l)

# Gilthead seabream



- **Good growth except during the first month due to the adaptation of fish**
- **FCR : 1.9 (in eq. form. feed)**
- **Survival rate : 90%**

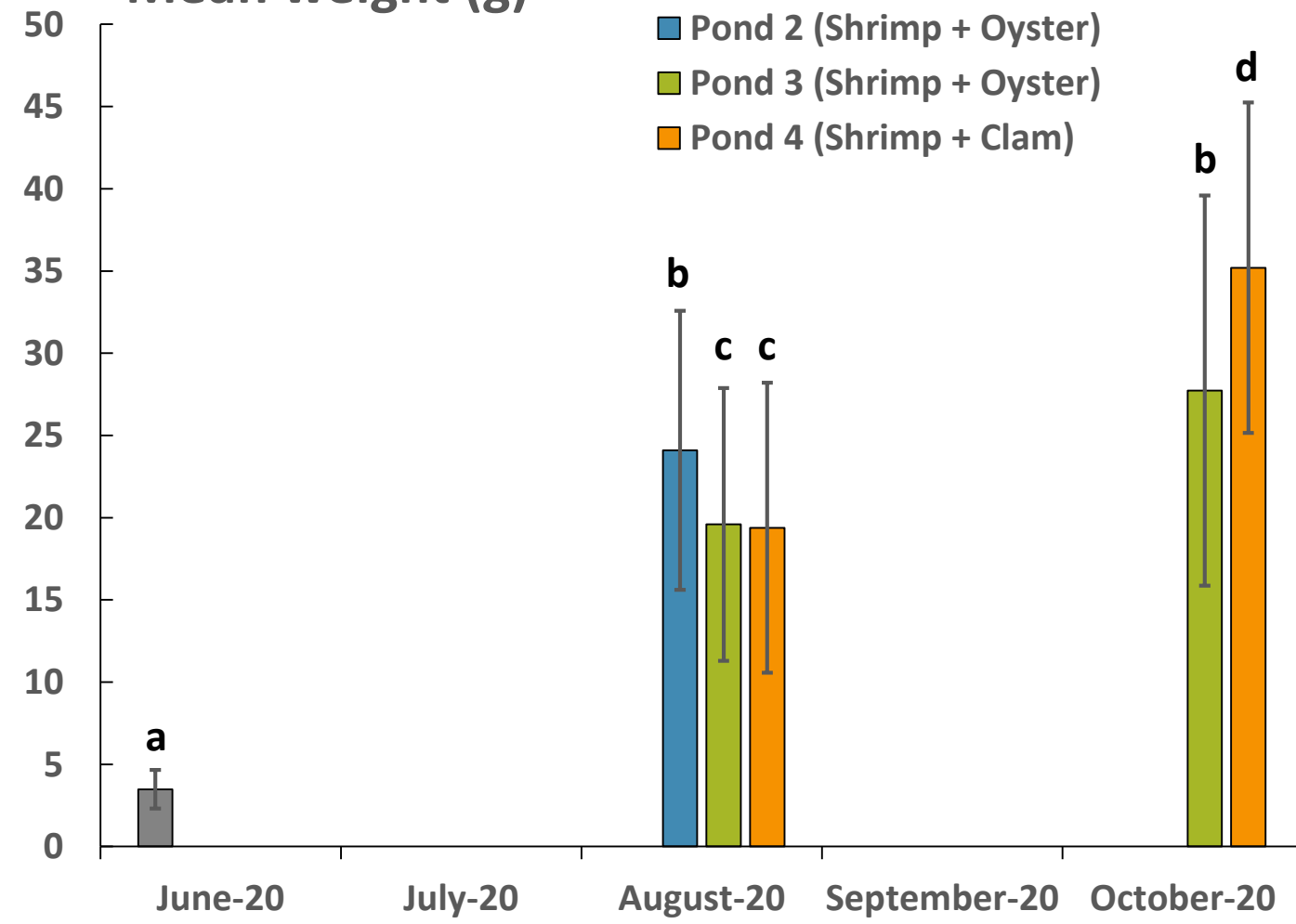


# Shrimp



Mean weight (g)

- initial stock
- Pond 2 (Shrimp + Oyster)
- Pond 3 (Shrimp + Oyster)
- Pond 4 (Shrimp + Clam)

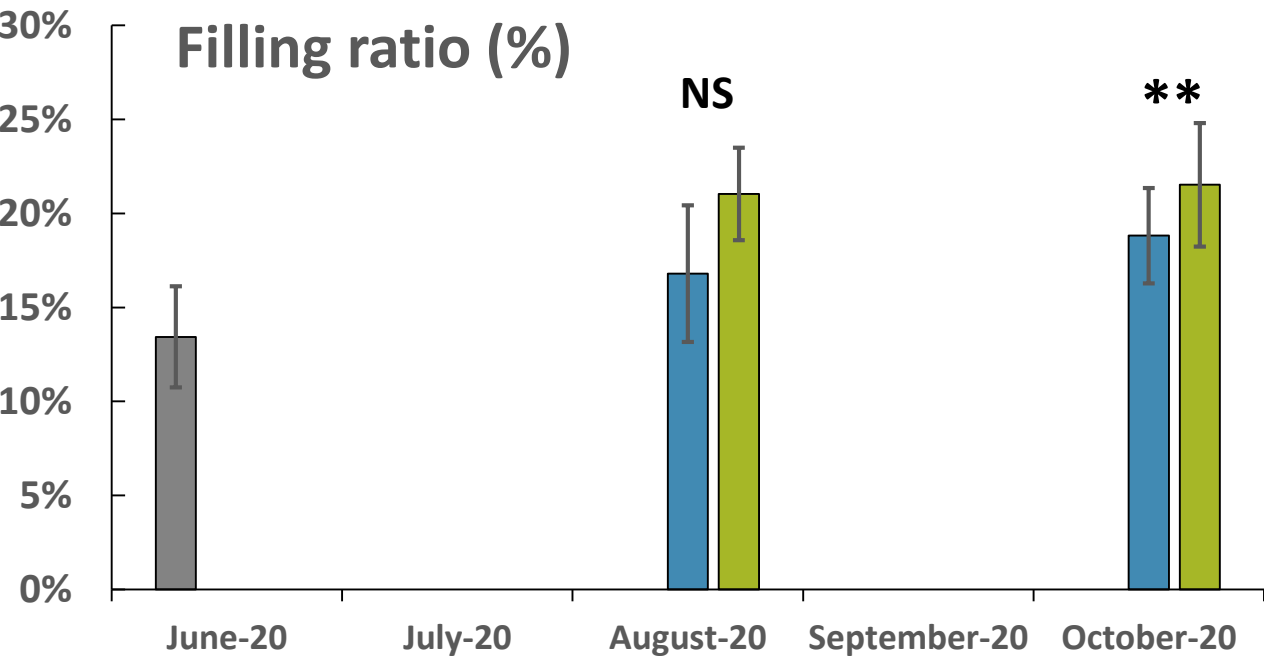
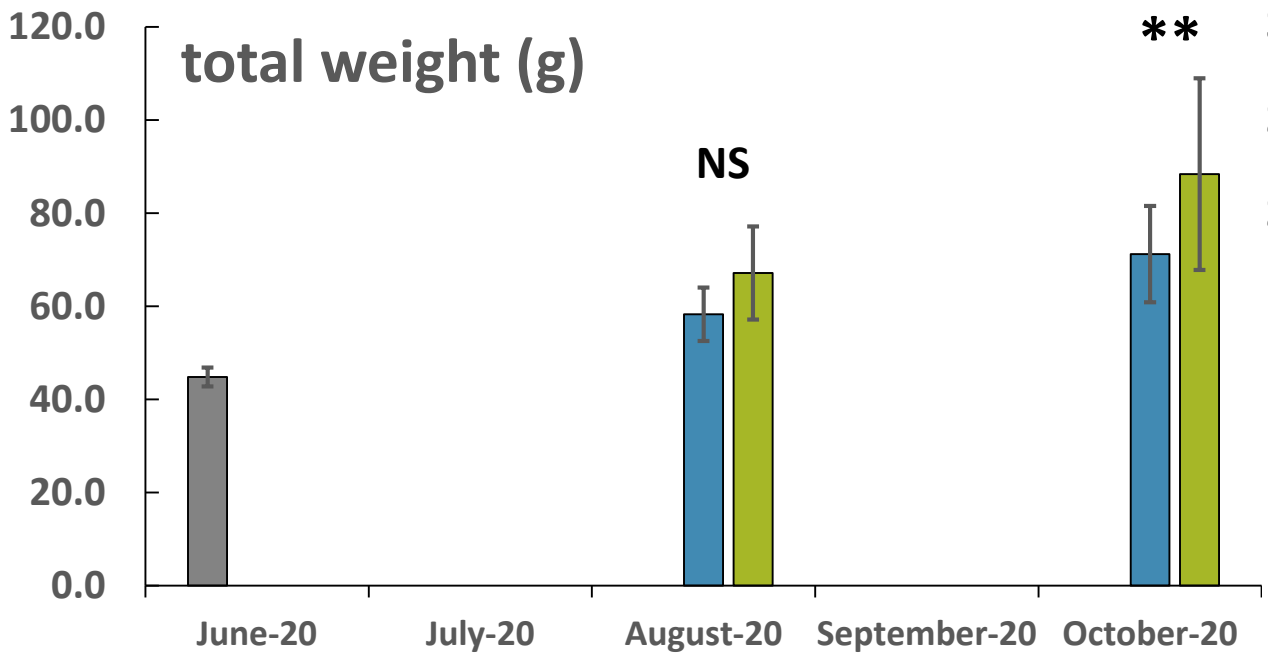


- Mean weight increased 9-fold
- Final weight similar to fed shrimps
- High variability due to sexual dimorphism
- All shrimps from the pond 2 died, just a few days before harvesting.
- survival rate : 38% pond 3, 58% pond 4 (predation by eels ?)

# Oyster



- Increase of the mean total weight (shell + flesh)
- Filling ratio over the standard quality (12%-15%)
- Survival rate = 90%

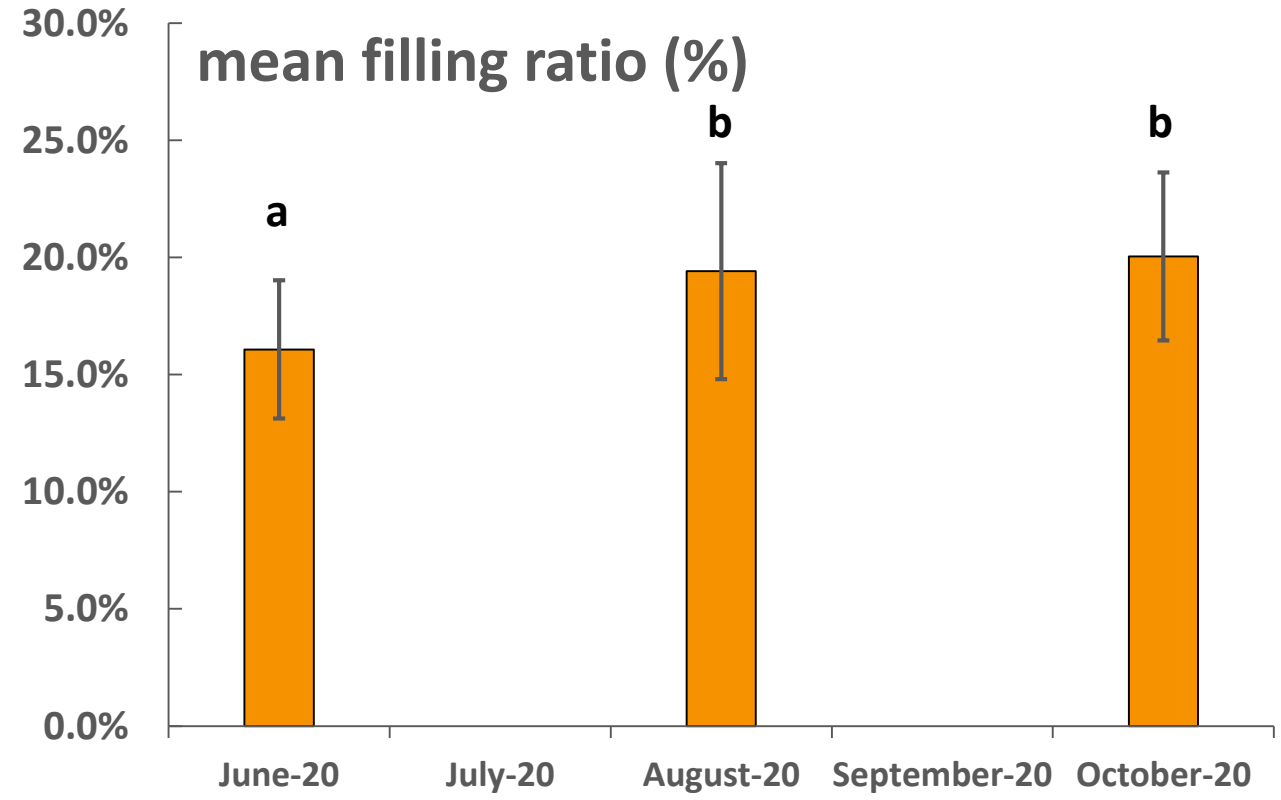
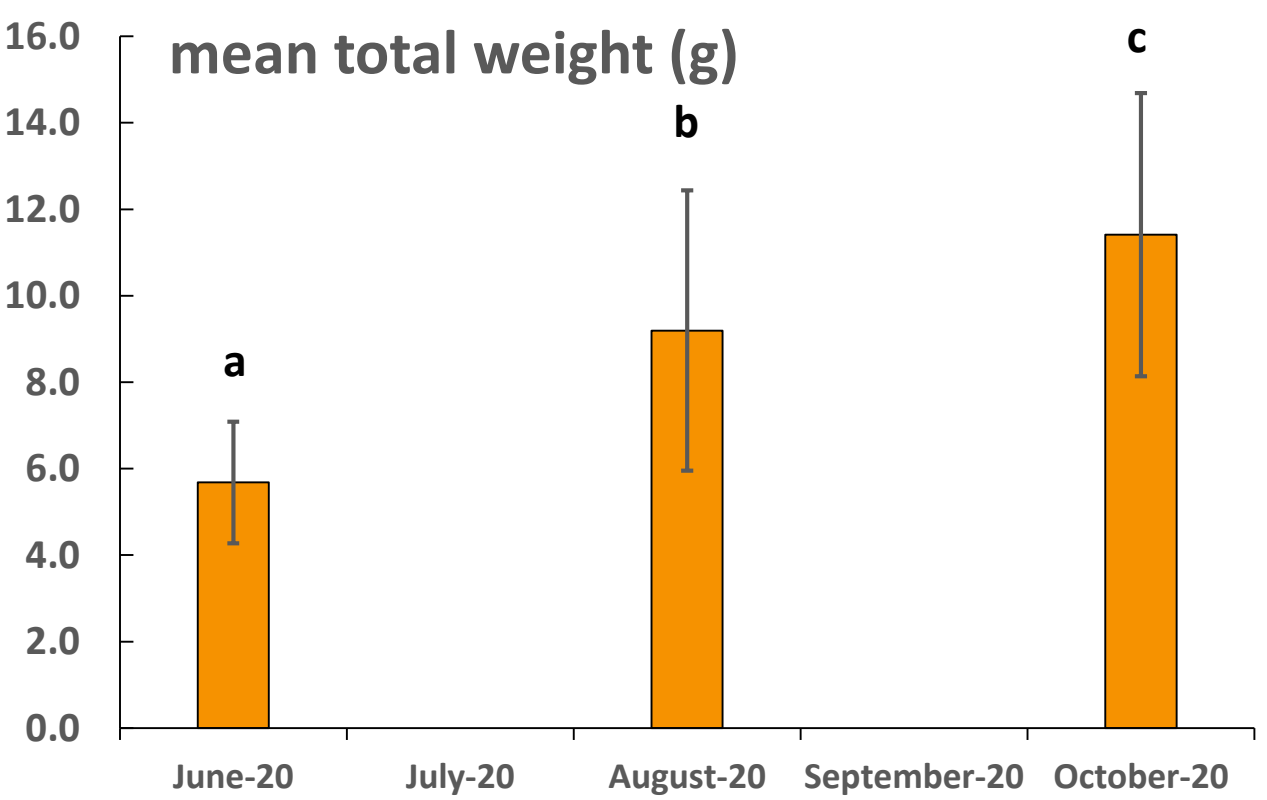


■ initial stock ■ Pond 2 (Shrimp + Oyster) ■ Pond 3 (Shrimp + Oyster) ■ initial stock ■ Pond 2 (Shrimp + Oyster) ■ Pond 3 (Shrimp + Oyster)

# Clam



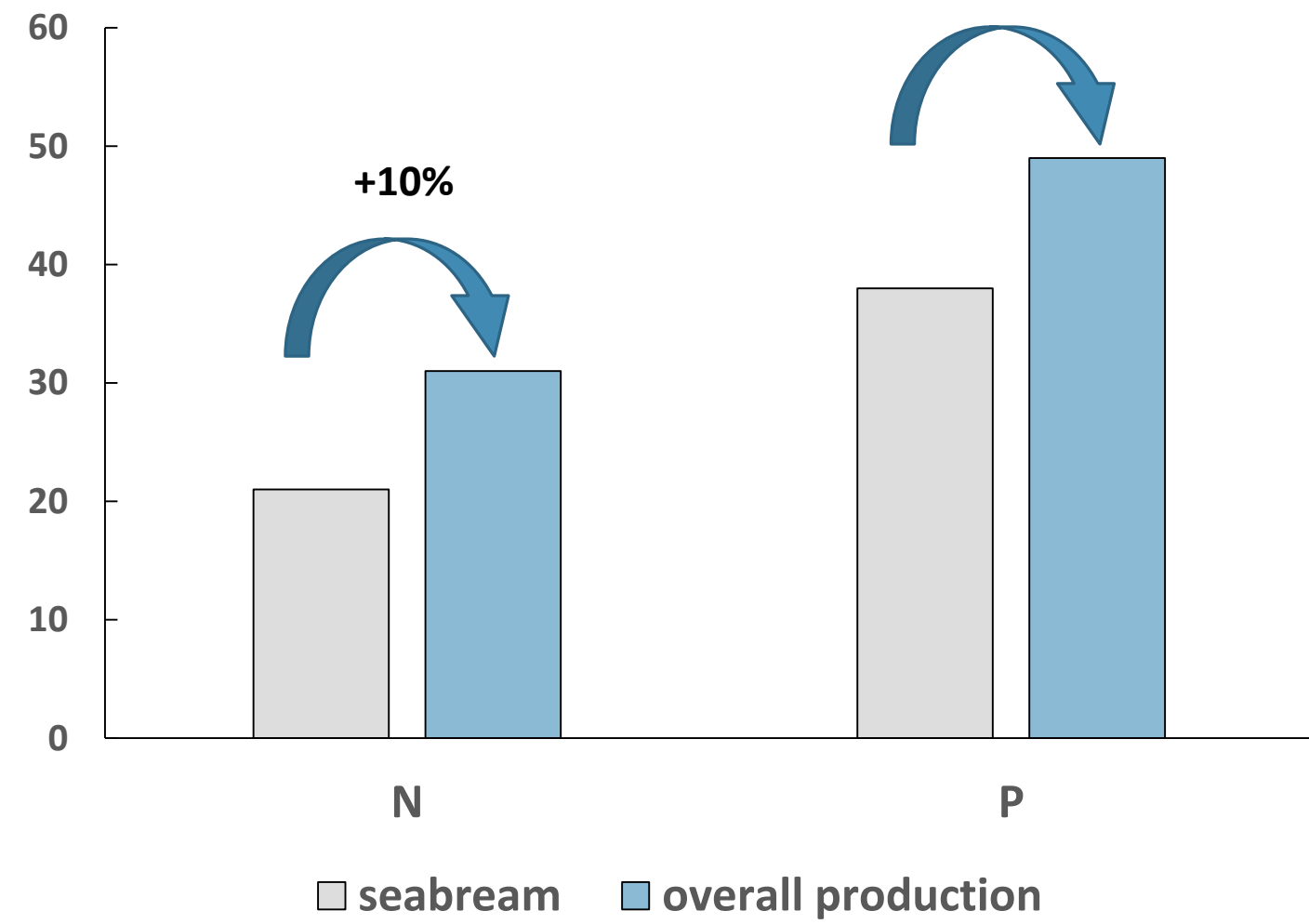
- Mean total weight doubled until a marketable size
- Mean filling ratio 20% at harvest (vs 16% at stocking)
- Survival rate estimated around 70%



# Nutrient use efficiency



## Nutrient Use Efficiency (%)



- Input = formulated feed + mussels
- Output = seabream + shrimp + oyster + clam
- Calculations based on body composition from literature
- Improvement of 10% of NUE and PUE



# Conclusion



- **The use of a plant based feed and local discarded mussels possible to growth seabream**
- **Shrimps grew up without additional feed, but survival has to be improved**
  - ⇒ **Air supply is necessary to support production**
- **Shellfish had good performances**
  - ⇒ **Possible to increase production of shellfish**



# Conclusion

- **The overall system improves use efficiency of the feed delivered**
  - ⇒ **limit use of ressources (feed ingredients and water)**
  - ⇒ **limit waste emissions**
  - ⇒ **increase number of marine products**





Thank you