Feeding seabream in susbstituting fishmeal and fish oil by fresh mussel and feed based on vegetal resources

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INTRODUCTION

- **SIMTAP objectives :**

  Based on IMTA approach

  1. **To reduce the waste emissions**
  2. **To reduce the use of resources (energy, water, fishmeal, fish oil, soybean) => to develop sustainable feed based on local resources**

  - **Experiments carried out in Charente-Maritime = oyster and mussel production area**
  - **Gilthead seabream (*Sparus aurata*) target species**

⇒ **Keeping growth performances similar to delivery of commercial feed with FM and FO?**

⇒ **Consequences on body composition? for fry and for marketable fish?**

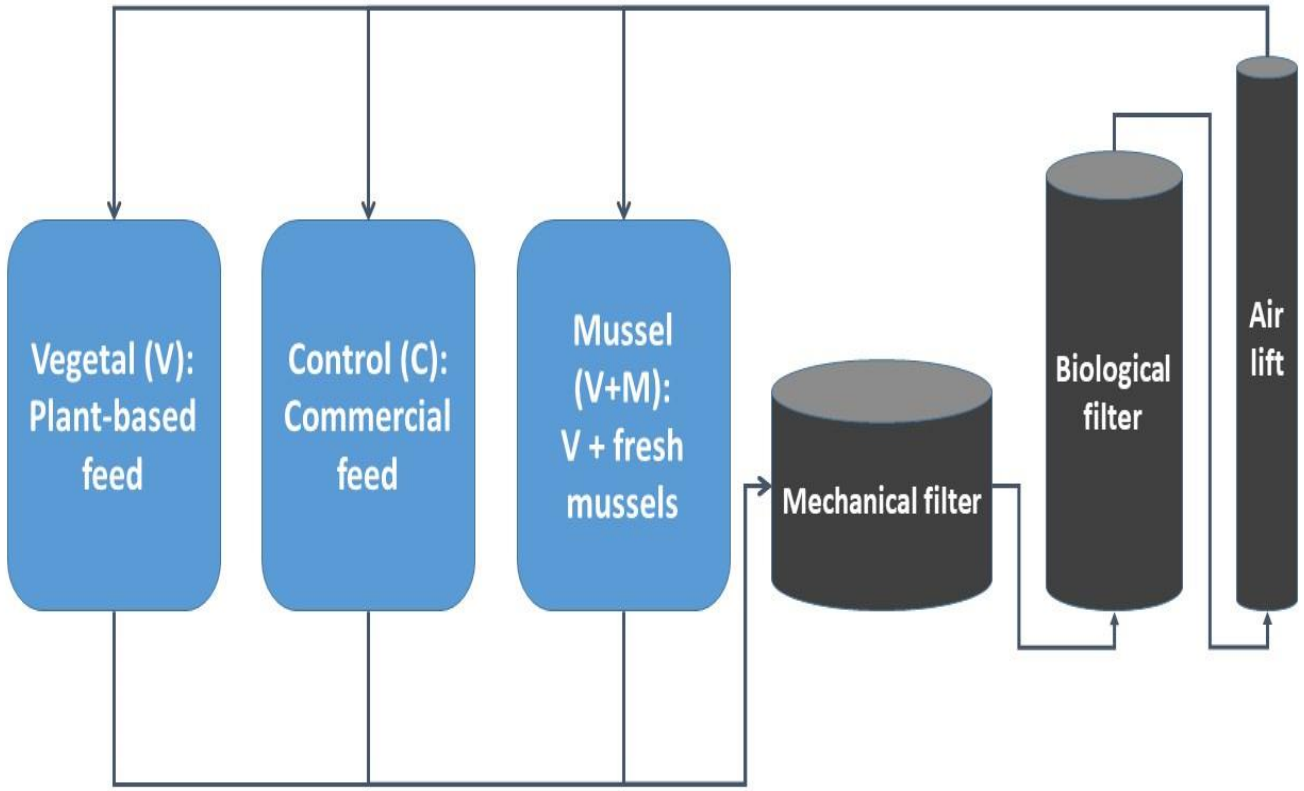
FEED STRATEGY

- **Experimental feed formulated based on:**
  1. **Absence of marine ingredients**
  2. **Use of plant ingredients only from European area**
  3. **Limited use of synthetic amino acids**
  4. **Protein/fat rate similar to the commercial feed of reference**
  5. **Use of an attractive compound to foster fish consumption**

- **Mussel as source of protein (11%) and LC-PUFA (Fat = 3.7%) and available for free with the use of discarded mussels**

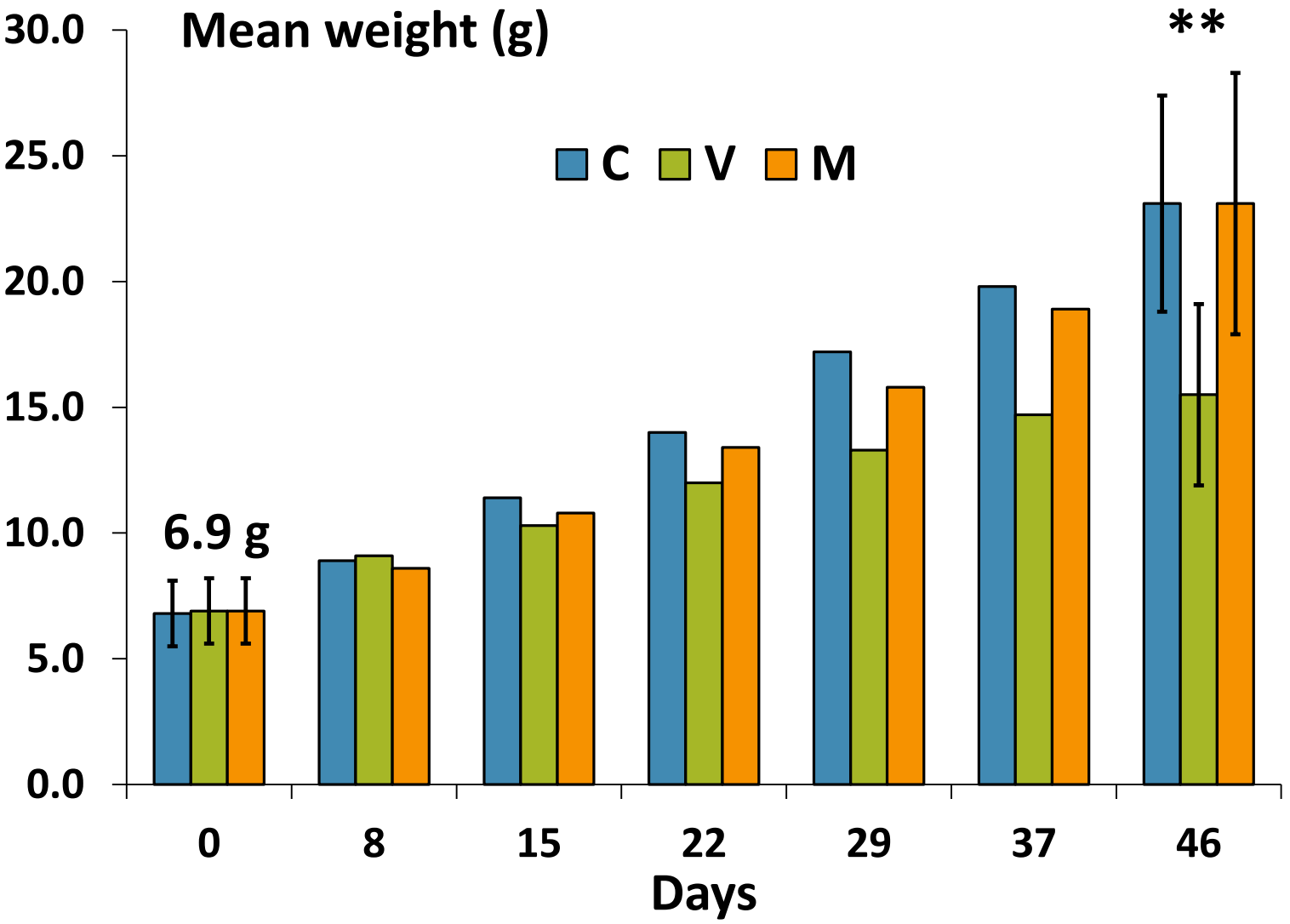
- **Plant-based pelleted feed delivered 5/6 days and mussel 1/6 day**

Fry: Experimental design



- RAS with 3 tanks of 1.6 m^3
- 3 treatments:
  - (C) Commercial feed
  - (V) Plant-based feed
  - (M) Plant-based feed + flesh of mussel (delivered without the shell)
  - Feeding rate: 3% BW/day
- Initial body weight: 6.9 g
  Initial Stock density = 1.5 kg/m^3
- Experimentation lasted 6 weeks
- Constant temperature = 21 ± 1°C

Fry: growth performances



	C	V	M
Final weight (g)	23.1^{a}	15.5^{b}	23.1^{a}
Survival rate (%)	99	98	99
FCR (eq. Form. Feed)	1.00	2.35	1.26

Fry: body composition

	stocking	harvesting		
treatment		C	V	M
DM (%)	24.3	27.8	28.9	30.7
Crude protein (%)	15.5	15.8	15.4	16.0
Crude fat (%)	6.1	9.4	11.9	12.2
Protein retention (%)		30	16	29
Fat retention (%)		69	45	70

- Protein content similar among treatments
- Fat content ↗, more in V and M due to use of plant oil
- Protein and fat retention similar between C and M, > V

Fry: Fatty acids composition

Fatty acids (%)	stocking	harvesting		
		C	V	M
Saturated				
16:0	16.6	18.0	11.2	11.4
Monounsaturated				
18:1	17.5	17.2	29.4	28.8
n-3 polyunsaturated				
18:3 n-3	1.3	1.1	19.0	19.4
20:5 n-3 (EPA)	7.9	9.2	1.3	1.8
22:6 n-3 (DHA)	10.7	10.8	2.1	2.2
EPA + DHA (g/100 g fish)	1.05	1.74	0.38	0.46
n-6 polyunsaturated				
18:2 n-6	7.7	5.9	20.0	19.0
Total n-3	25.3	26.8	24.9	26.0
Total n-6	10.0	7.8	21.6	20.7
n-3/n-6	2.5	3.4	1.1	1.3

❑ **Effect of the plant-based feed:**

- **EPA, DHA, 16:0: M and V < C**

⇒↘ **at harvesting**

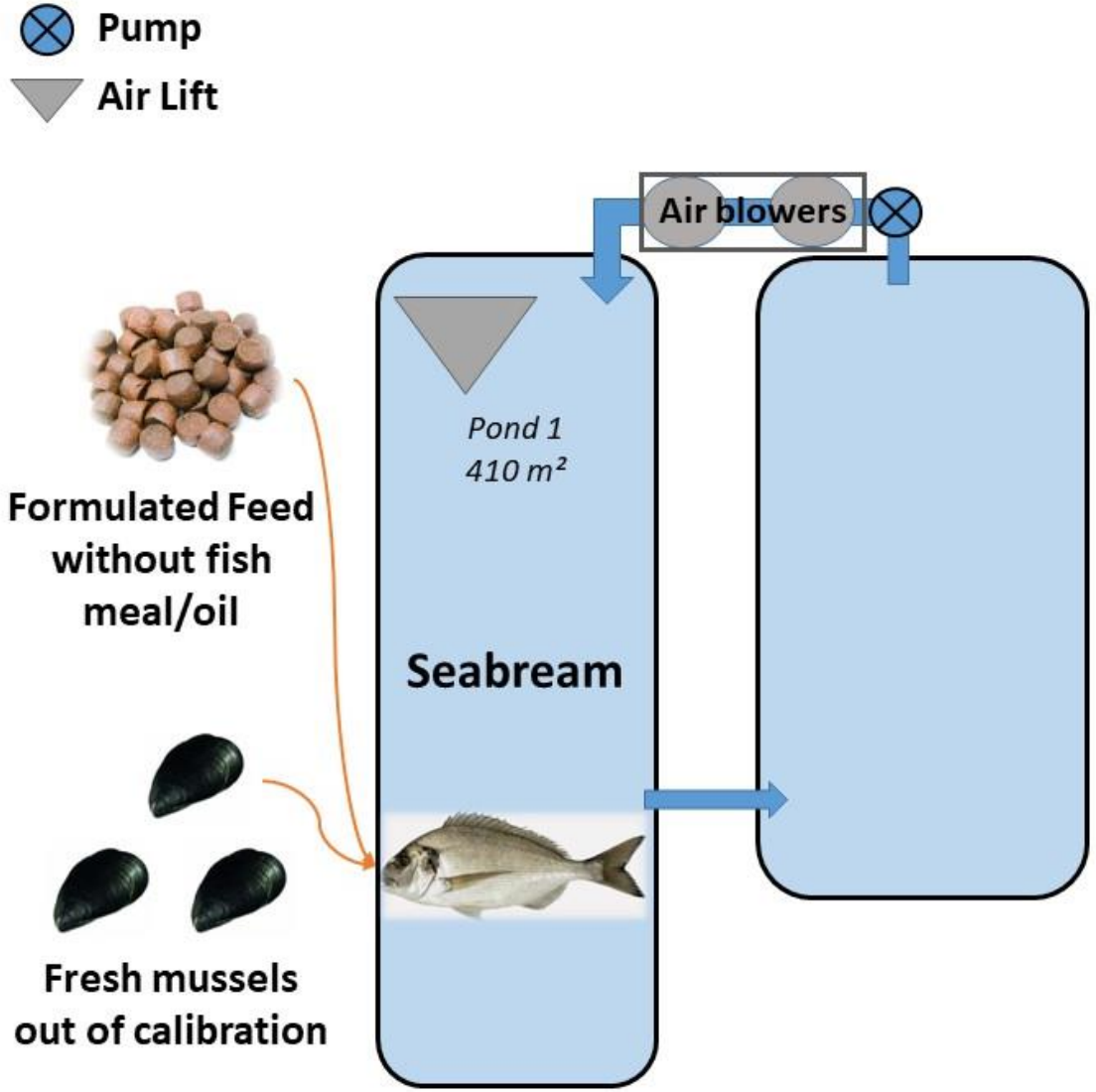
- **18:1, 18:3 n-3, 18:2 n-6: M and V > C**

⇒↗ **at harvesting**

- **n-3/n-6: Total n-6 ↗ => ↘ for V and M**

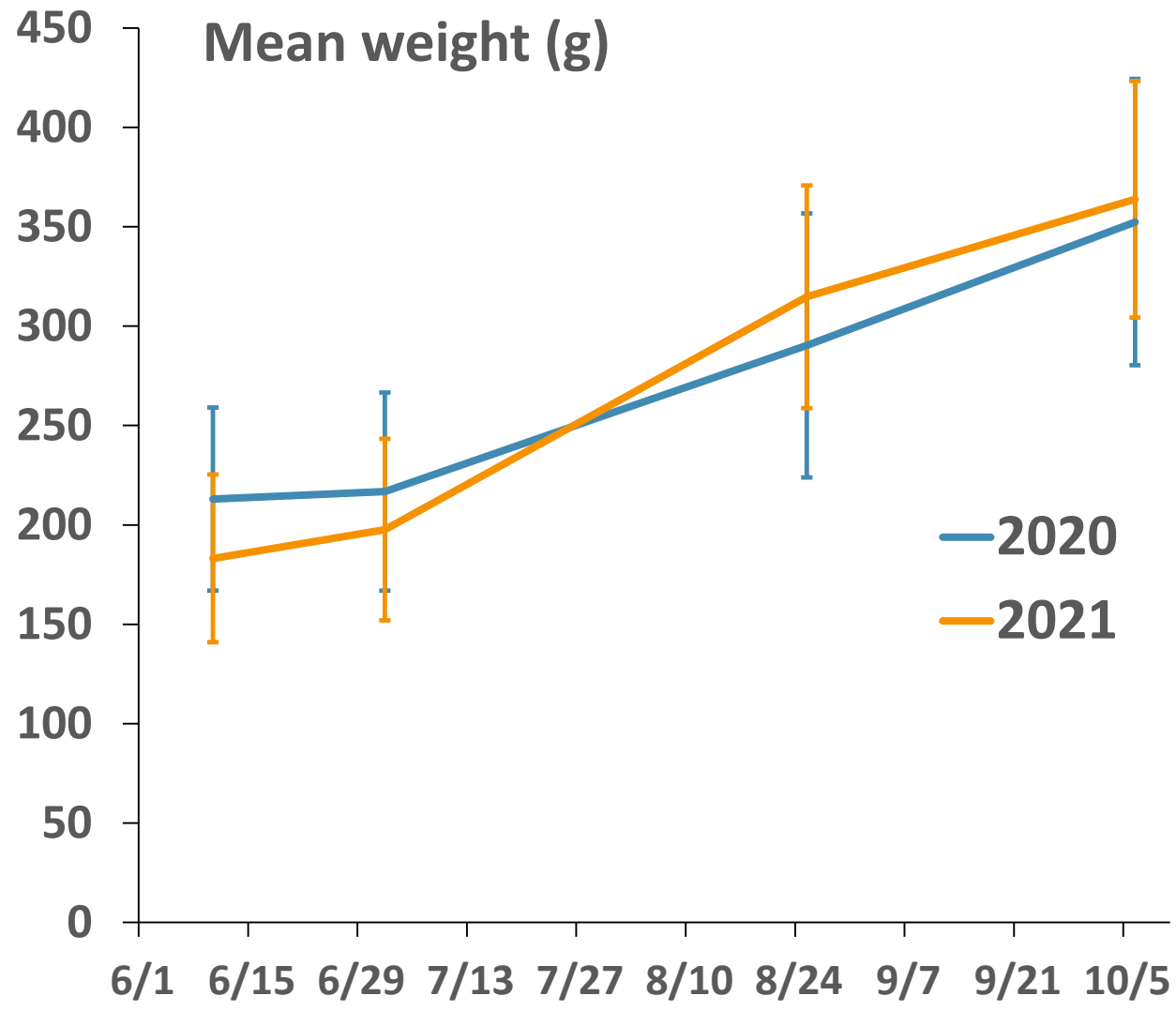
❑ **EPA+DHA (g/100g fish) => +17% in M vs V**

Marketable fish: Experimental design



- Fish reared in an outside pond
- Fish from RAS
- Full mussels delivered (with shell)
- Initial mean body weight: 200 g
- Initial fish stock density = 0.65 kg/m²
- Experimentation carried out in 2020 and in 2021, from June to October

Marketable fish growth performances



- Mean weight increased less than 2-fold
- Good growth except during the first month due to the adaptation of fish to feed and their new environment
- Survival rate : 90-95%
- FCR : 2.0-2.3 (in eq. form. feed)

Marketable fish: body composition

	stocking	harvesting
DM (%)	35.1	37.3
Crude protein (%)	17.6	17.3
Crude fat (%)	14.9	17.3
Protein retention (%)		16
Fat retention (%)		56

- between the beginning and the end:
  - ❑ Protein similar
  - ❑ Fat ↗, as observed for fry

Marketable fish: fatty acids composition

Fatty acids (%)	stocking	harvesting
Saturated		
16:0	12.4	12.0
Monounsaturated		
18:1	32.4	36.2
n-3 polyunsaturated		
18:3 n-3	4.0	12.3
20:5 n-3 (EPA)	3.4	1.3
22:6 n-3 (DHA)	6.8	2.8
n-6 polyunsaturated		
18:2 n-6	15.5	18.9
Total n-3	18.4	12.9
Total n-6	17.0	20.2
n-3/n-6	1.1	0.9

Effect of the plant-based feed less pronounced:

- **16:0 => harvesting ≈ stocking**
- **EPA and DHA: harvesting < stocking**
- **18:1, 18:3 n-3, 18:2 n-6: harvesting > stocking**
- **Total n-3 ↘ and total n-6 ↗ => n-3/n-6 ↘**

Conclusion

- Body lipid content increased due to plant-based feed
- Addition of mussel to the plant-based diet:
  - Maintain growth performances similar to usual fish feed
  - Improved protein retention
  - Improved FA profile of fish, especially ↗ EPA and DHA
- Differences in FA composition between stocking and harvesting are less pronounced for marketable fish than for fry

Conclusion

- The use of a plant-based feed and local discarded mussels seems promising on growth and FA aspects

⇒ to insure supply in protein and promote this kind of feeding, need to explore additional available resources on the area

⇒ use of discarded oysters?


Thank you