



SHELLFISH PRODUCTION

IN THE NETHERLANDS

(PART 2)

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HZ UNIVERSITY OF APPLIED SCIENCES



Creating the future of Delta Areas

GENERAL PROGRAM

Oyster cultivation in the Netherlands

Innovation in prevention of predation

System innovation

Product innovation

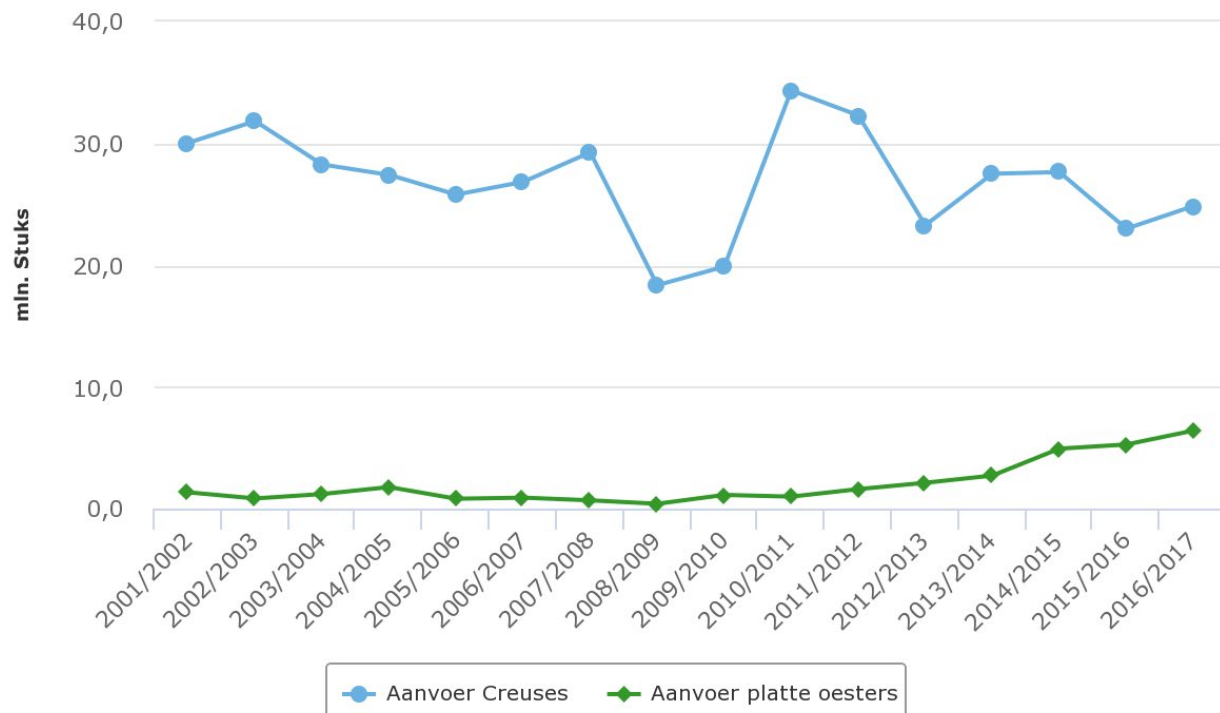
DUTCH OYSTER CULTIVATION

Oysters

Third European producer

Pacific cupped oyster (*Crassostrea gigas*): 2.900 tons (2017)

European flat oyster (*Ostrea edulis*): 350 tons (2017)



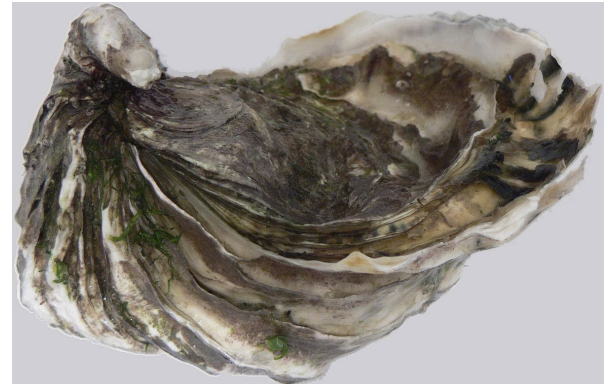
OYSTERS: BOTTOM CULTURE

European flat oyster: *Ostrea edulis*

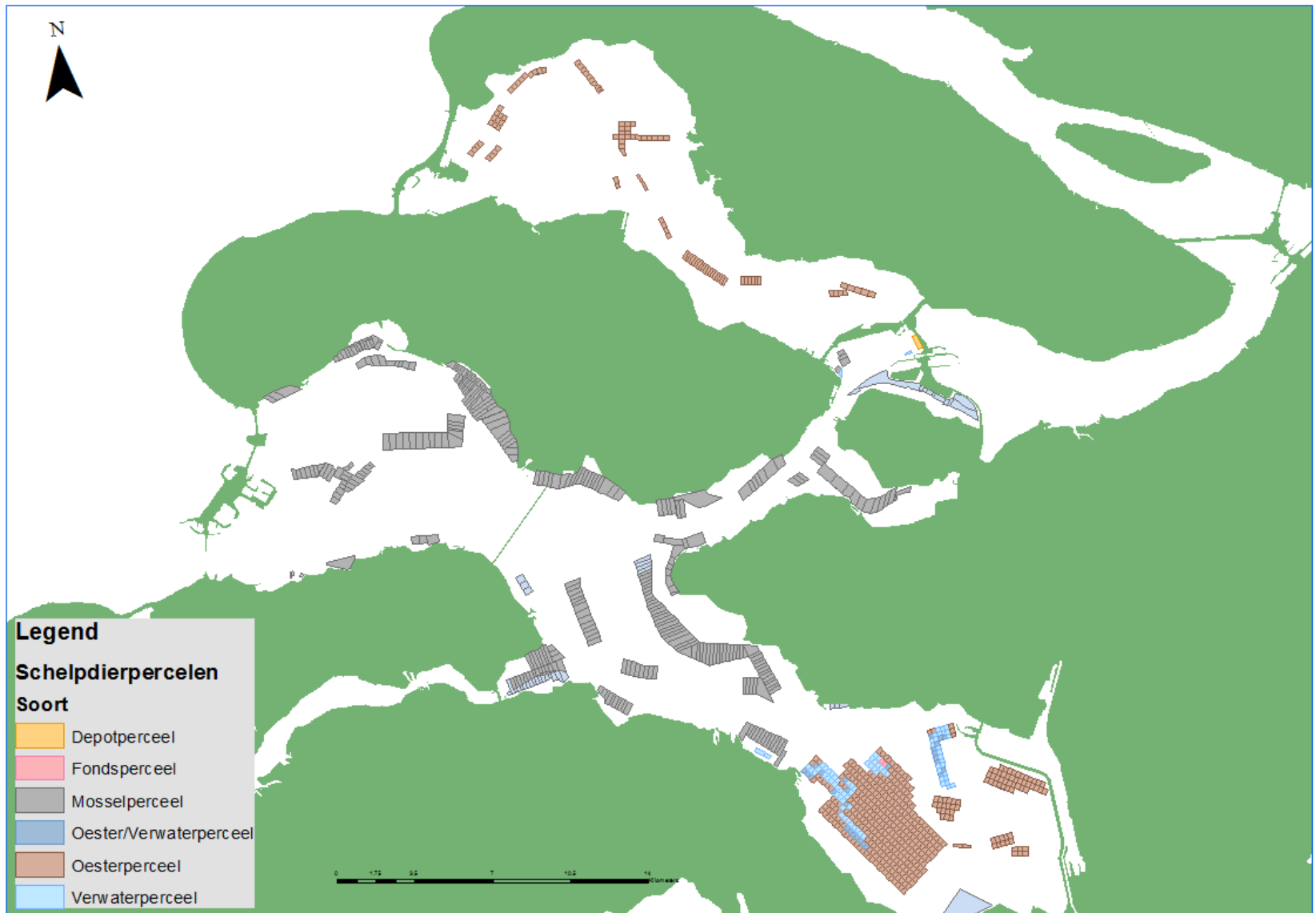
Pacific cupped oyster: *Crassostrea gigas*



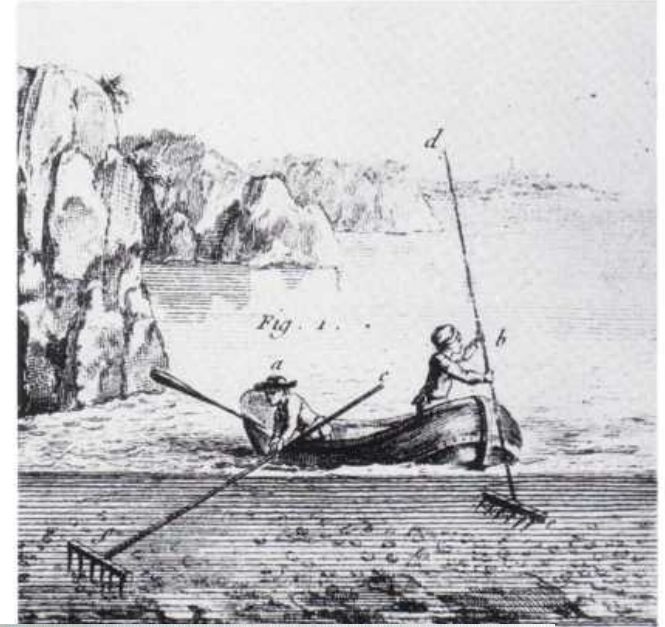
www.alamy.com - GDCBCR



CULTURE PLOTS



OYSTER CULTIVATION HISTORY





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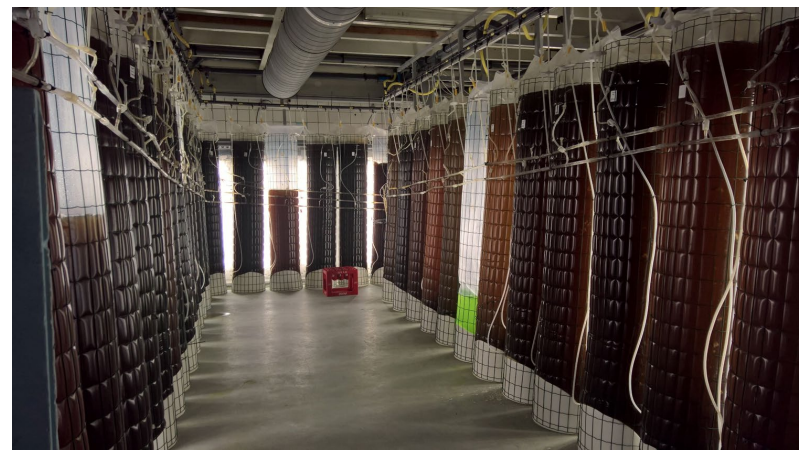
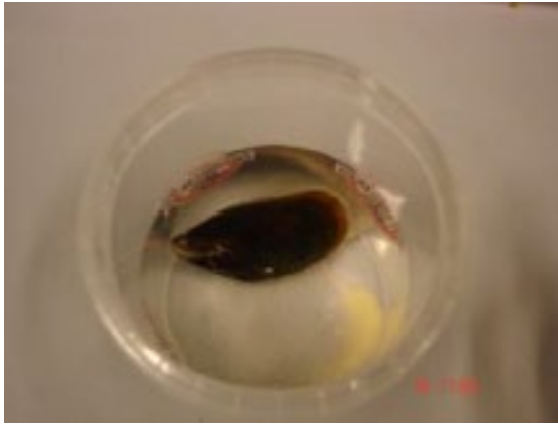
SHELLFISH SPAT PRODUCTION





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HATCHERY





stichting
Zeeschelp







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NURSERY





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GROW-OUT





RSITY
SCIENTES

HARVEST



STORAGE



20 NOVEMBER 2010



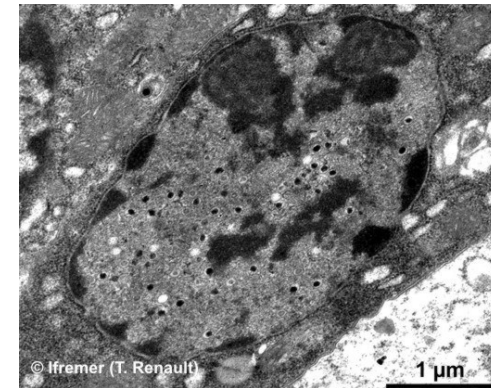


MAIN PRODUCTION CHALLENGES

Bonamia (*Bonamia ostreae*)



Oyster herpes virus (OsHV-1)



Oyster drill (*Ocenebrellus inornatus*)





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INNOVATION IN PREVENTION OF PREDATION





JAPANESE OYSTER DRILL (*OCINEBRELLUS INORNATUS*)

- Invasive species
- Predator
- Very high fecundity





PROJECT 'LEARNING TO COPE WITH THE JAPANESE OYSTER DRILL'

- **Gaining knowledge** - combination of monitoring and in situ manipulative experiments in enclosures
 - General mobility
 - speed
 - direction: current
 - direction: prey location
 - Predation behavior
 - predation prevention
 - preference





GENERAL MOBILITY - SPEED

- Experimental set-up
 - Goal: Determine “speed” of movement
 - Enclosure: 50 by 2 meter
 - Duration of the experiment: 2 weeks
 - Monitoring: every day at low tide

Average length Oyster drill	28.9 mm
0 meter	100 drills
10 meter	100 drills
20 meter	100 drills
30 meter	100 drills

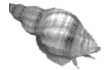


GENERAL MOBILITY - SPEED





GENERAL MOBILITY - SPEED



Results: movement “speed”

Number of observations	1686
Average movement of 400 Oyster drills	1.4 meter per day
Average movement <u>without</u> o-values of 400 Oyster drills	2.2 meter per day



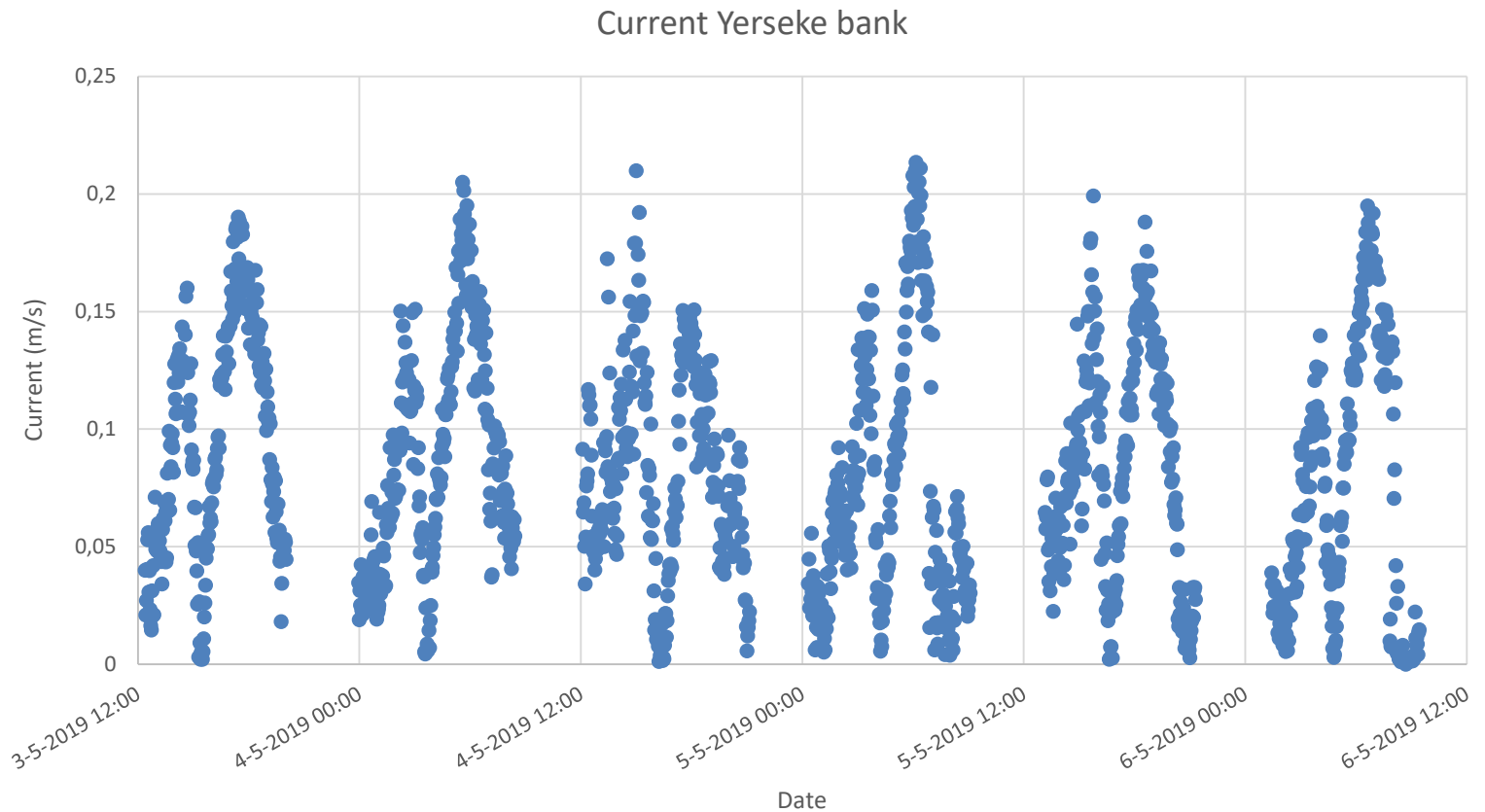
GENERAL MOBILITY - CURRENT

- **Experimental set-up**
 - Goal: Determine effect of current on oyster drill movement
 - Flow measurements field location
 - Duration: 7 days





GENERAL MOBILITY - CURRENT





GENERAL MOBILITY - CURRENT

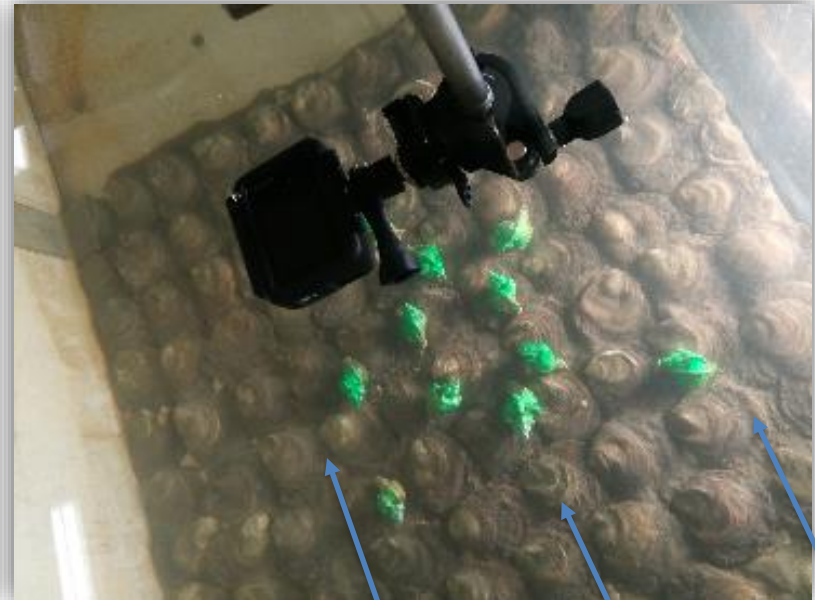
- Experimental set-up
 - Controlled Lab experiment – Flume NIOZ Yerseke





GENERAL MOBILITY - CURRENT

- Controlled Lab experiment

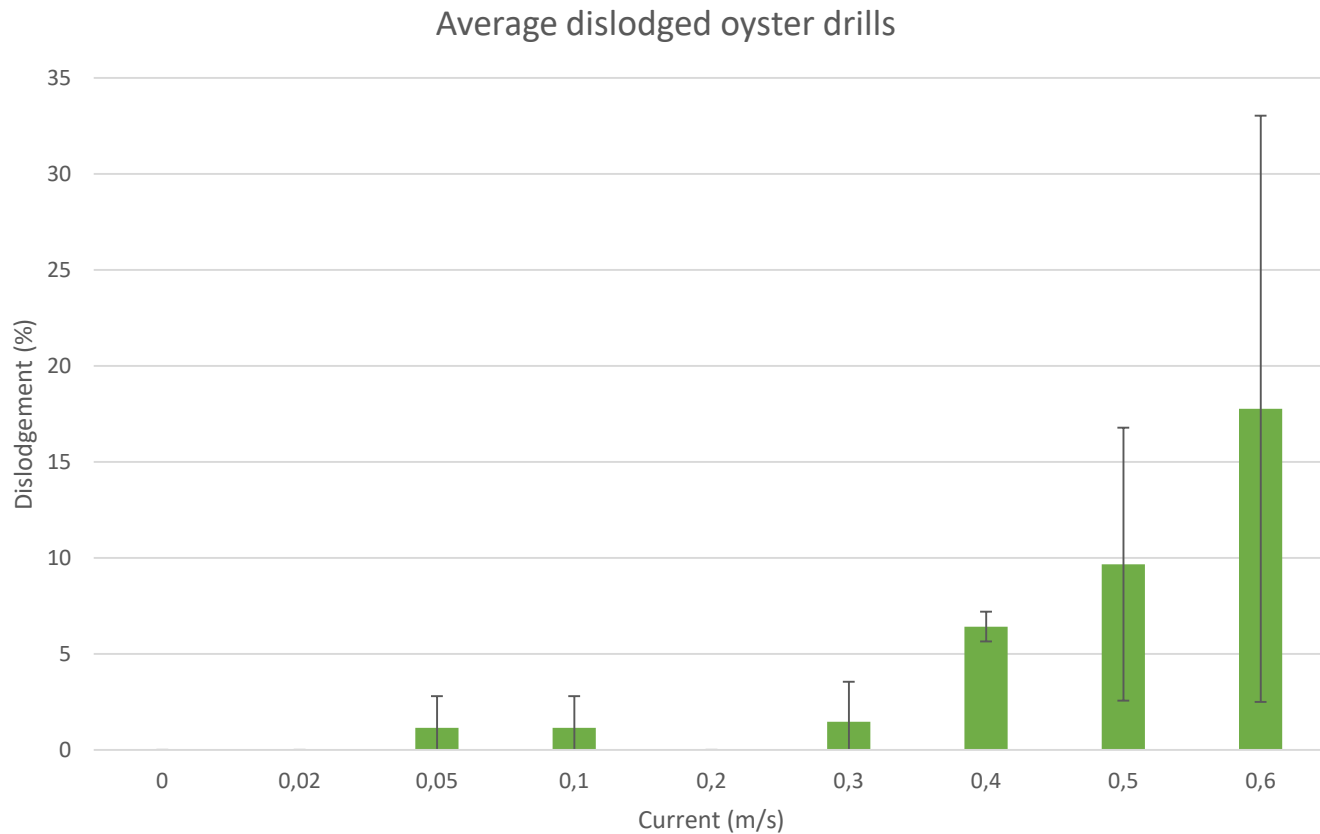




GENERAL MOBILITY - CURRENT



Results: movement due to current





GENERAL MOBILITY – PRAY LOCATION

- **Experimental set-up**
 - Goal: Determine effect of pray location on direction of movement
 - Enclosure: Hexagons (D= 4meter)
 - 60 drills, 2 size classes
 - Duration of the experiment: 3 days
 - Monitoring: end of experiment





GENERAL MOBILITY – PRAY LOCATION



Set up per hexagon	Size class	Amount
Green colored Oyster drills	28.0 to 34.9 mm	30
Orange colored Oyster drills	35.0 to 41.9 mm	30

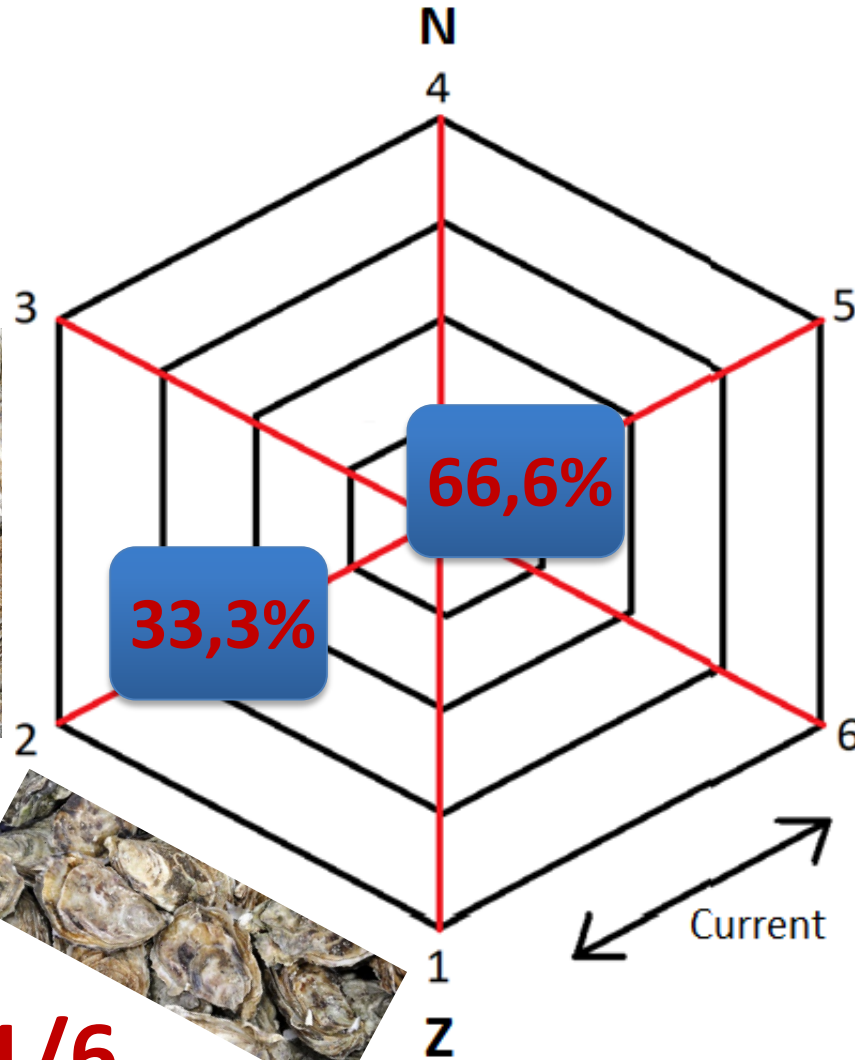


GENERAL MOBILITY – PRAY LOCATION

1/6



1/6



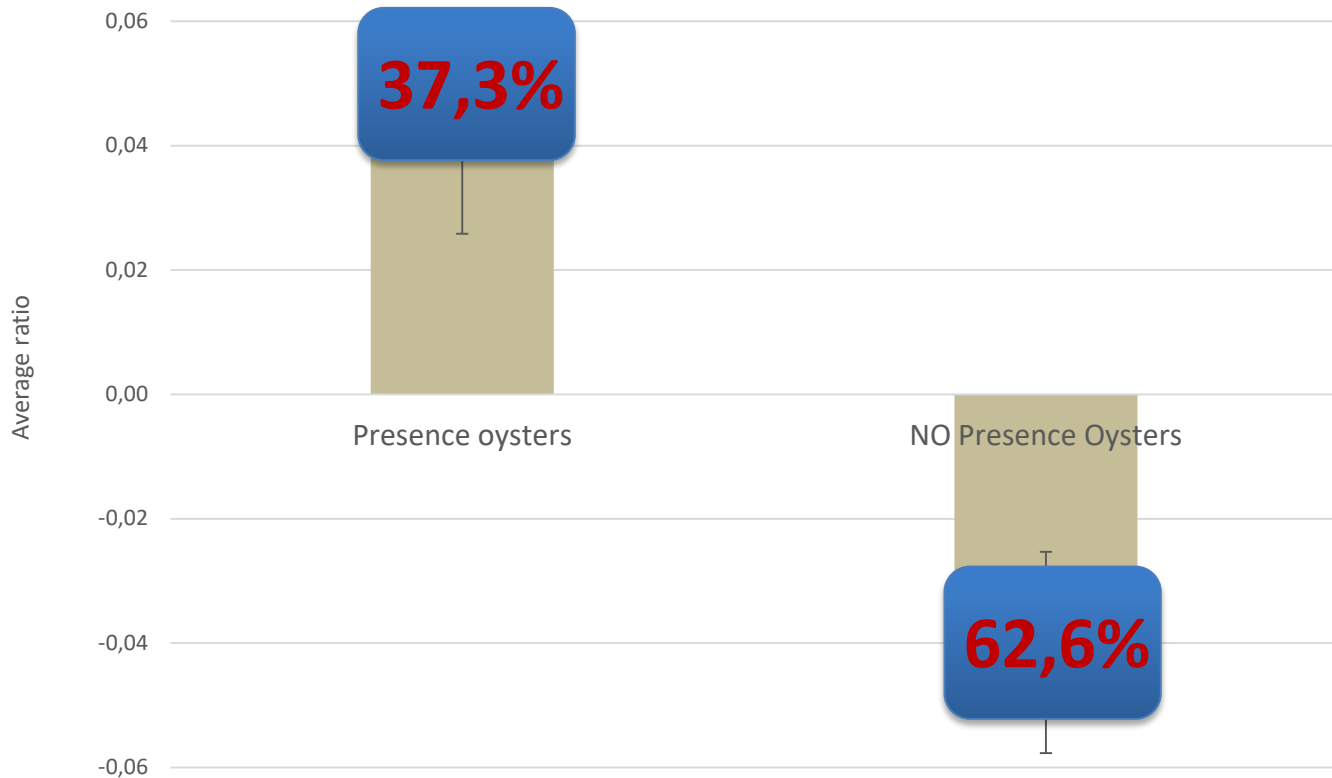


GENERAL MOBILITY – PRAY LOCATION



Results: movement due to pray location

Expected differences





PREDATION BEHAVIOR - PREDATION PREVENTION

- Experimental set-up

→ Goal: Determine if a mussel barrier “stops” oyster drill movement

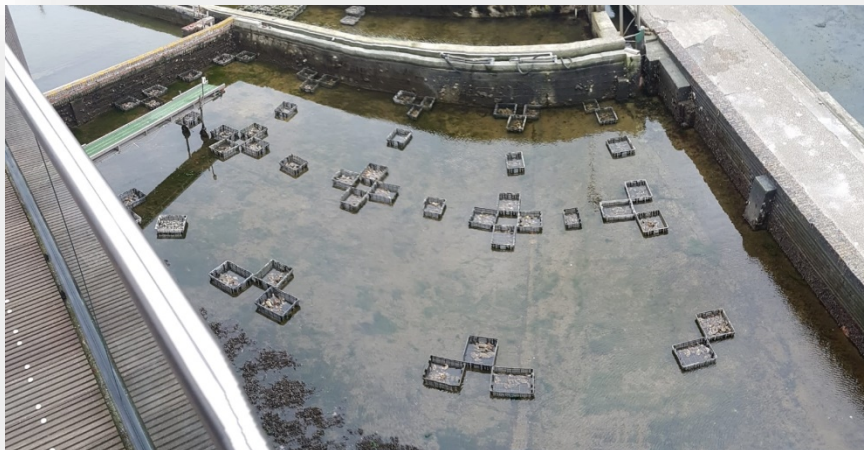
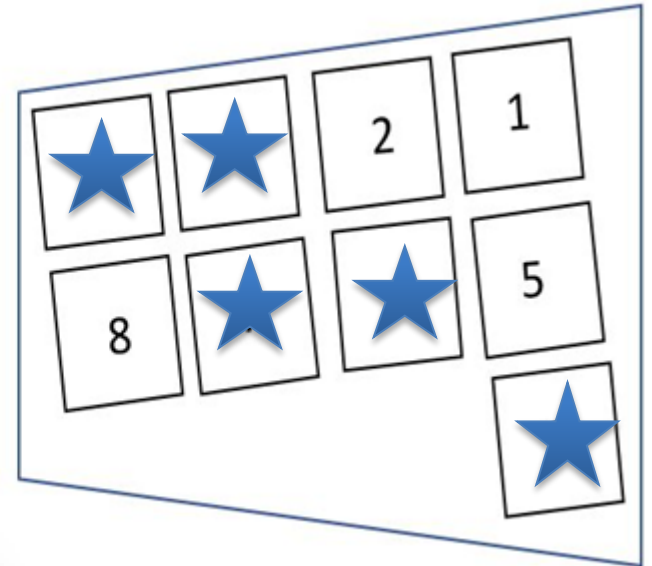
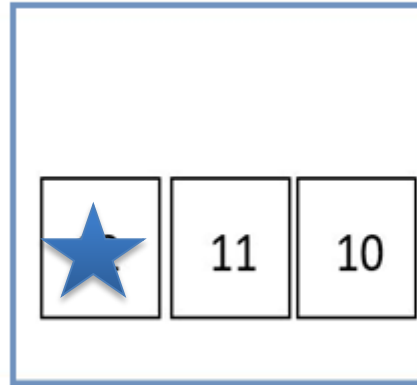
- Controlled experiment in oyster storage basins
- 3 Different mussel barrier widths
- Duration of the experiment: 3 months
- Monitoring: 2 times a week





PREDATION BEHAVIOR - PREDATION PREVENTION

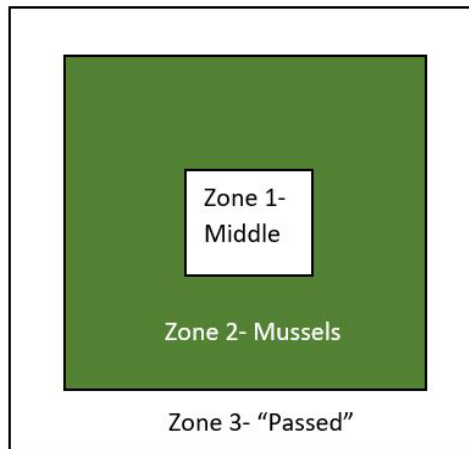
- Experimental set-up





PREDATION BEHAVIOR - PREDATION PREVENTION

- Monitoring



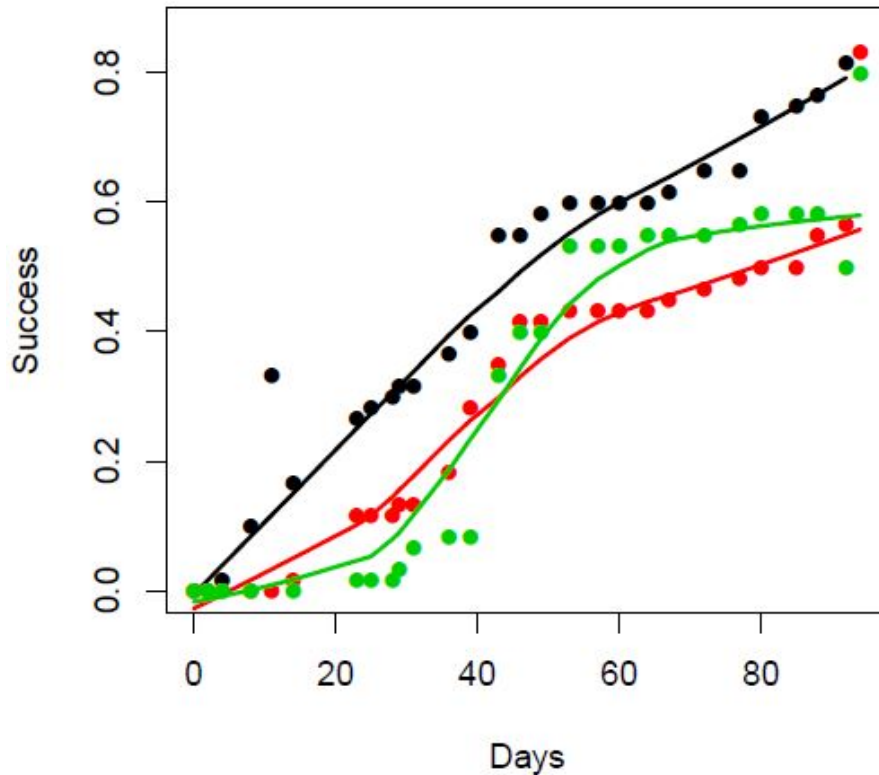


PREDATION BEHAVIOR - PREDATION PREVENTION

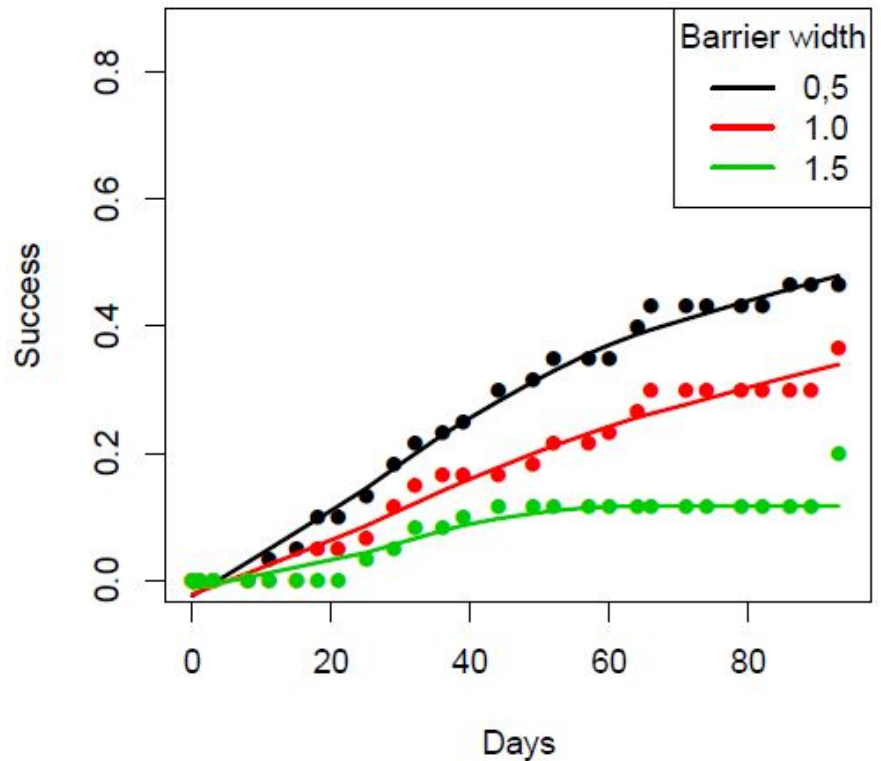


Results: Predation prevention

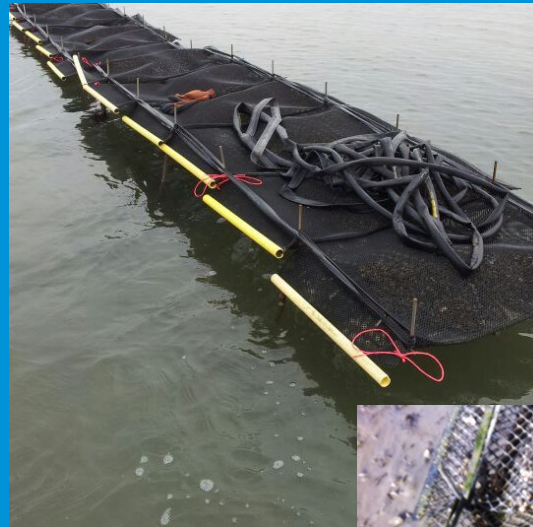
New mussel barrier



Existing mussel barrier



SYSTEM INNOVATION: OFF BOTTOM CULTIVATION



OYSTERS IN BAGS ON TABLES



20 NOVEMBER 2019



OYSTERS IN BASKETS



OYSTERS IN BASKETS



MANAGEMENT



EXPERIMENTAL FIELD SETUP

Average 4 hours
dry per tide: HIGH



Average 1,5 hours
dry per tide: MIDDLE

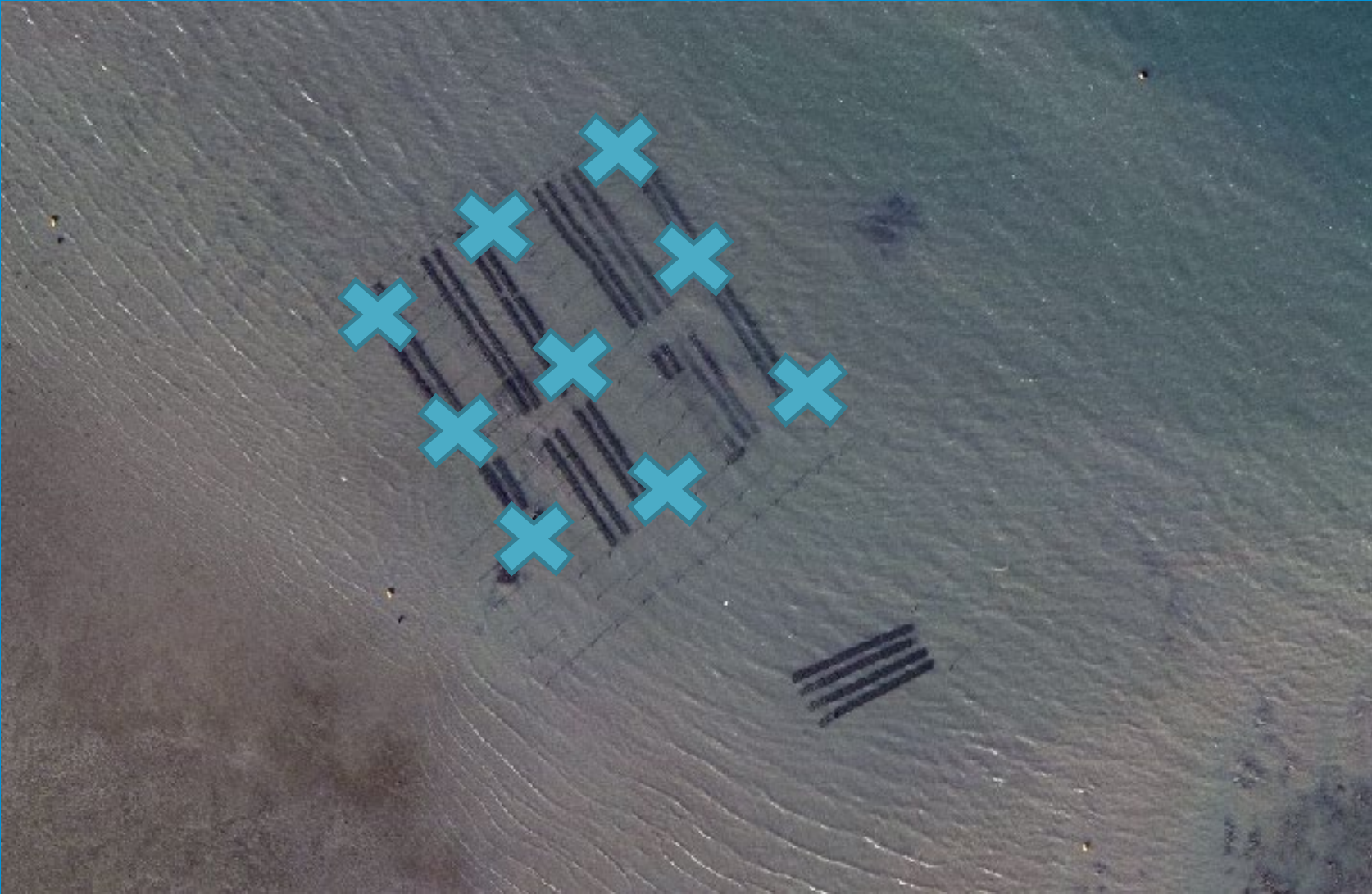


MONITORING

- * Term of 22 months
(June-2014 / April-2016)
- * 6 weekly monitoring
- * Continuous
Chlorophyll measurements
- * Follow business process
Thinning / maintenance







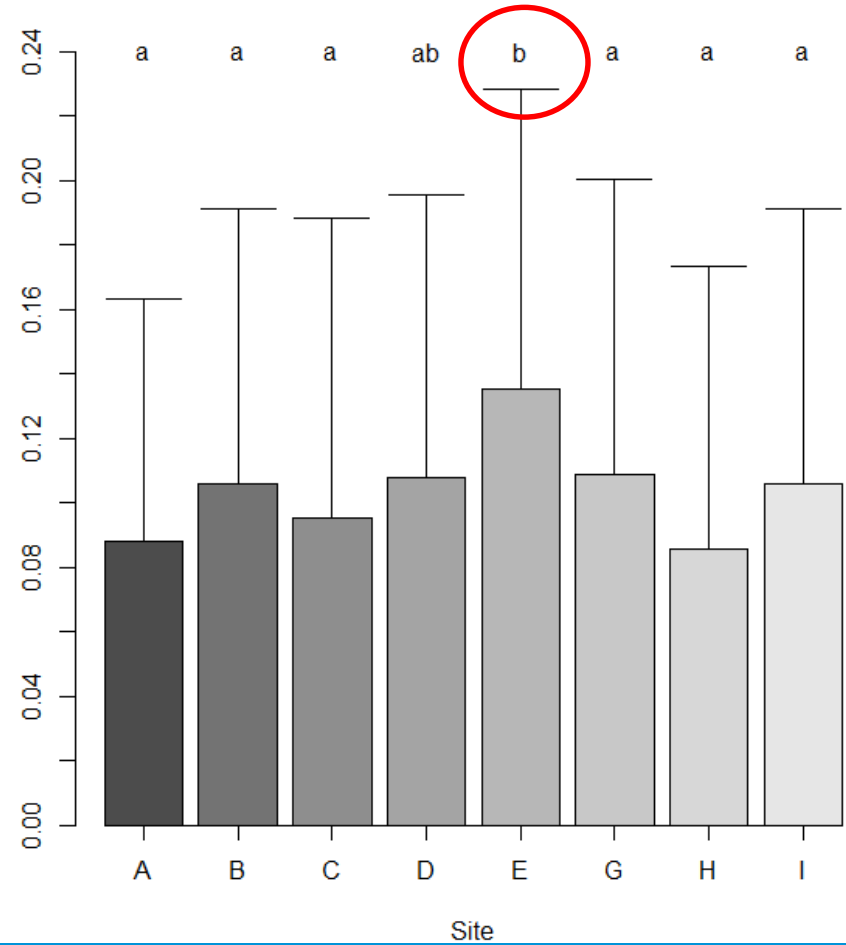
The image shows three rectangular traps made of green mesh, arranged in a row in a stream. Each trap is supported by a metal frame. The traps are filled with water and contain various aquatic organisms. The background shows the brownish water of the stream and some rocks.

4 kg

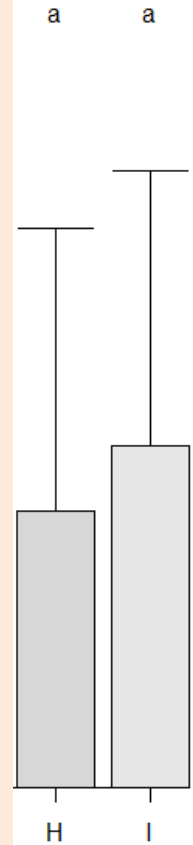
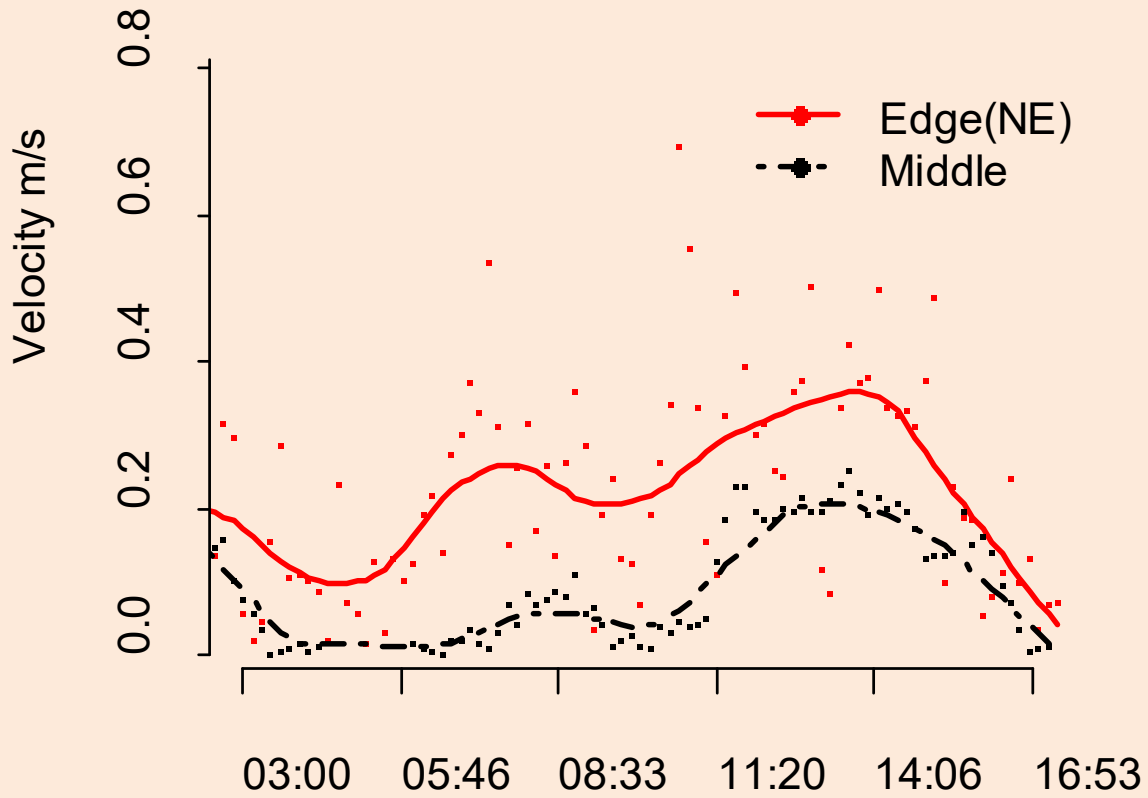
8 kg

12 kg

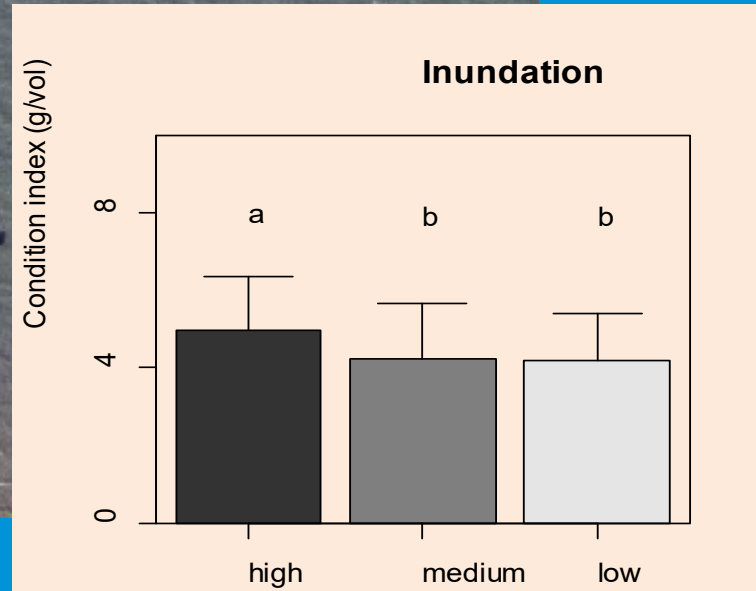
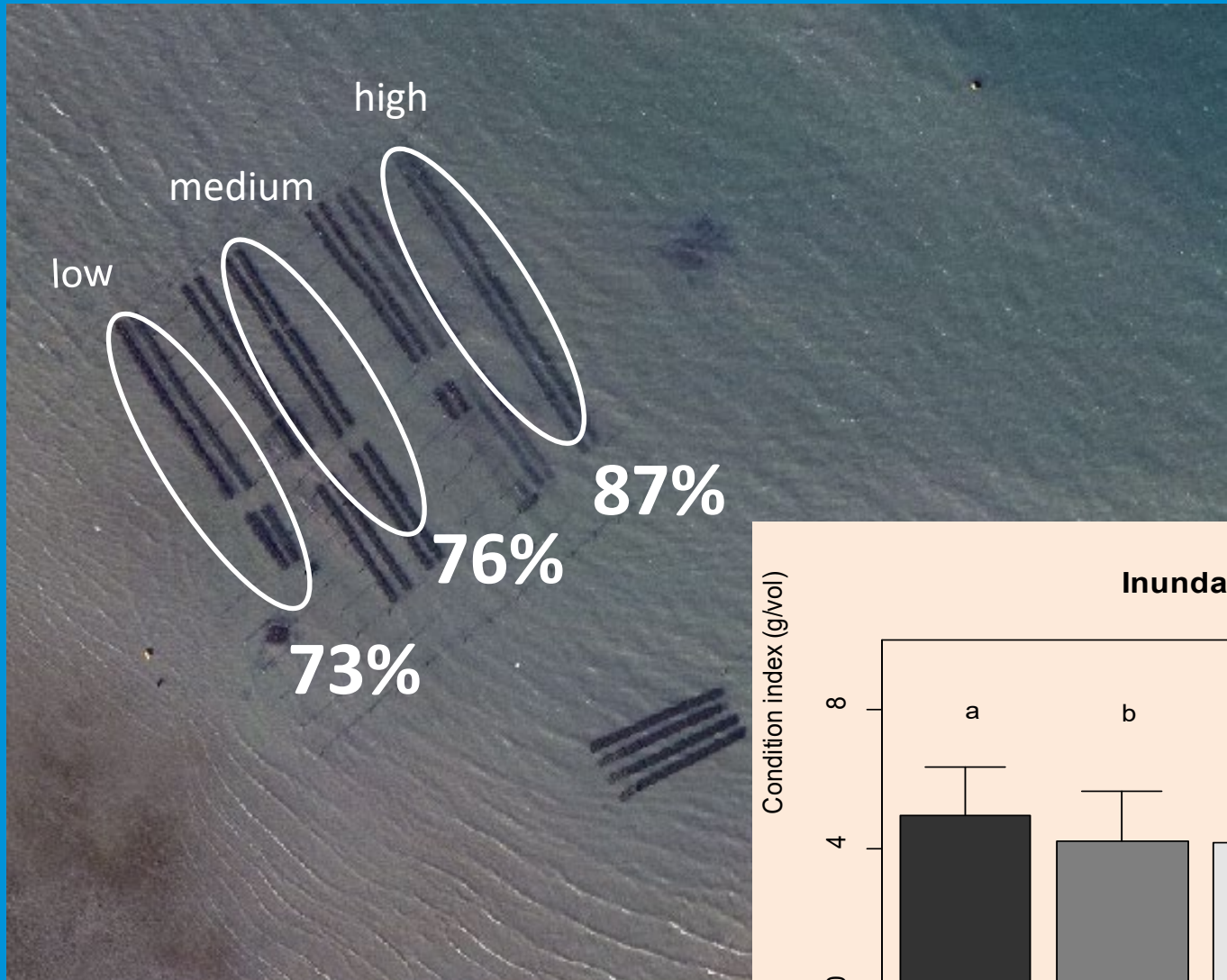
SPATIAL EFFECTS



SPATIAL EFFECTS



INNUNDATION



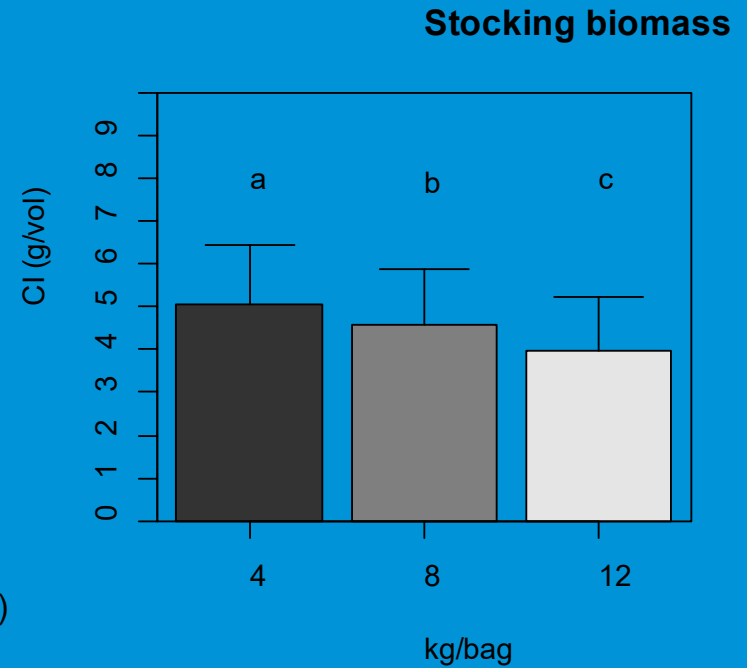
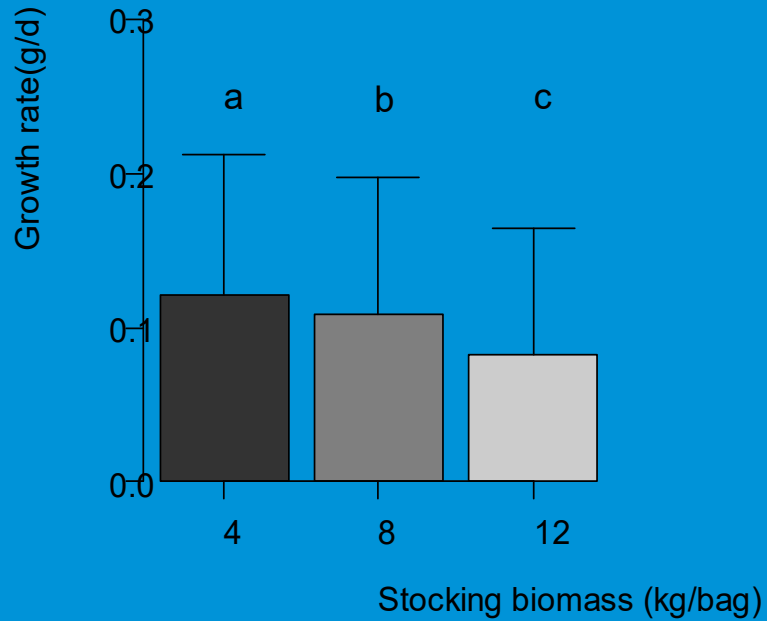
COMPARING PICTURES OVER TIME

HIGH (T15: 09-03-2016)
HIGH (T1: 23-07-2014)

MIDDLE (T15: 09-03-2016)
MIDDLE(T1: 23-07-2014)

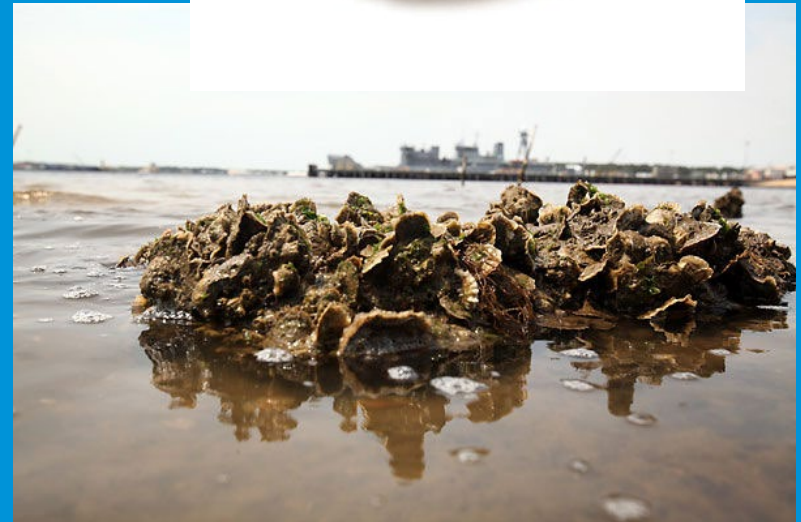


STOCKING BIOMASS





PRODUCT INNOVATION: TAILOR-MADE OYSTERS



TAILOR-MADE OYSTERS

- Consumer driven approach in in new product development.
 1. Consumer 'needs' and preferences
 2. Consumer barriers

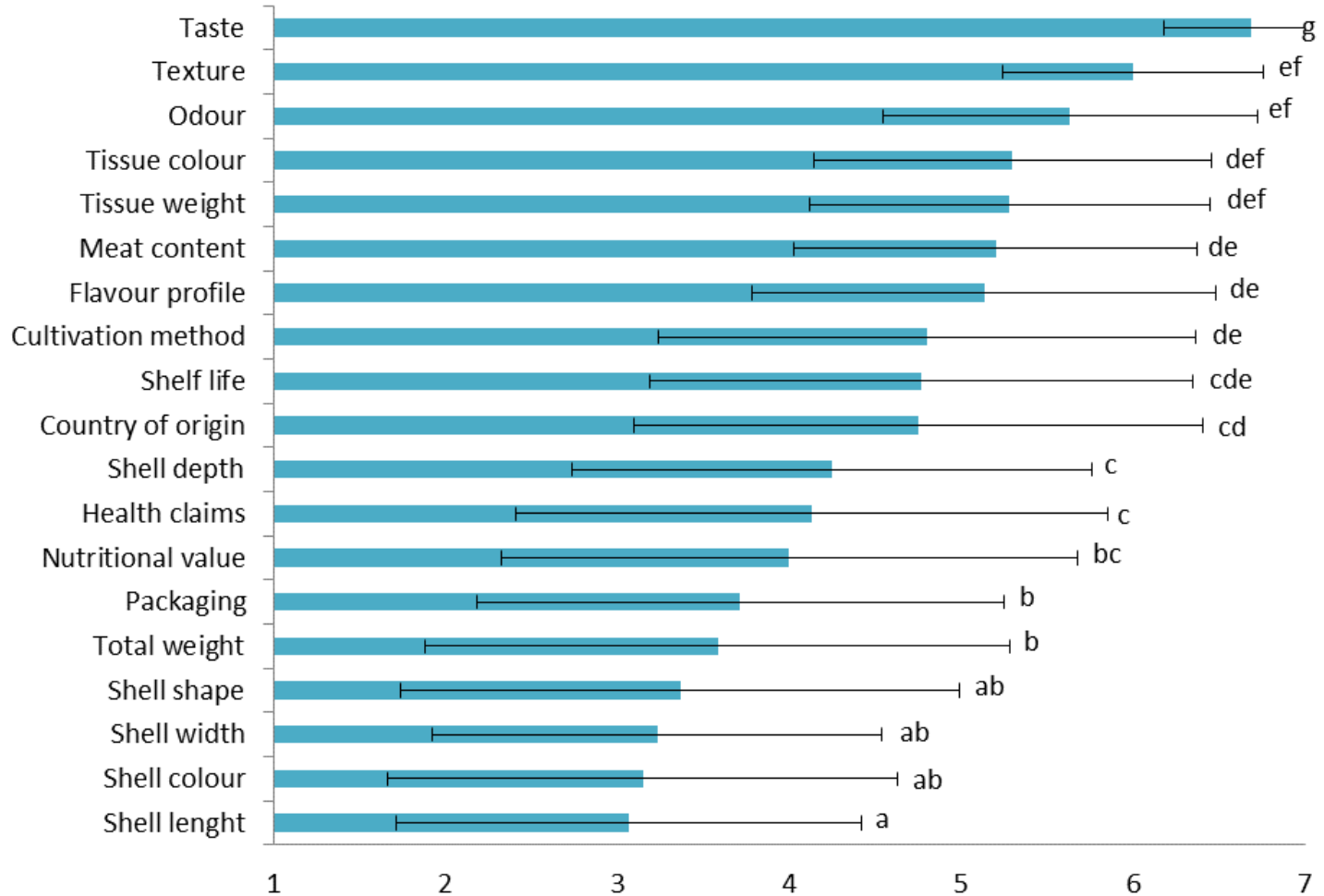
OYSTERS...



LOVERS



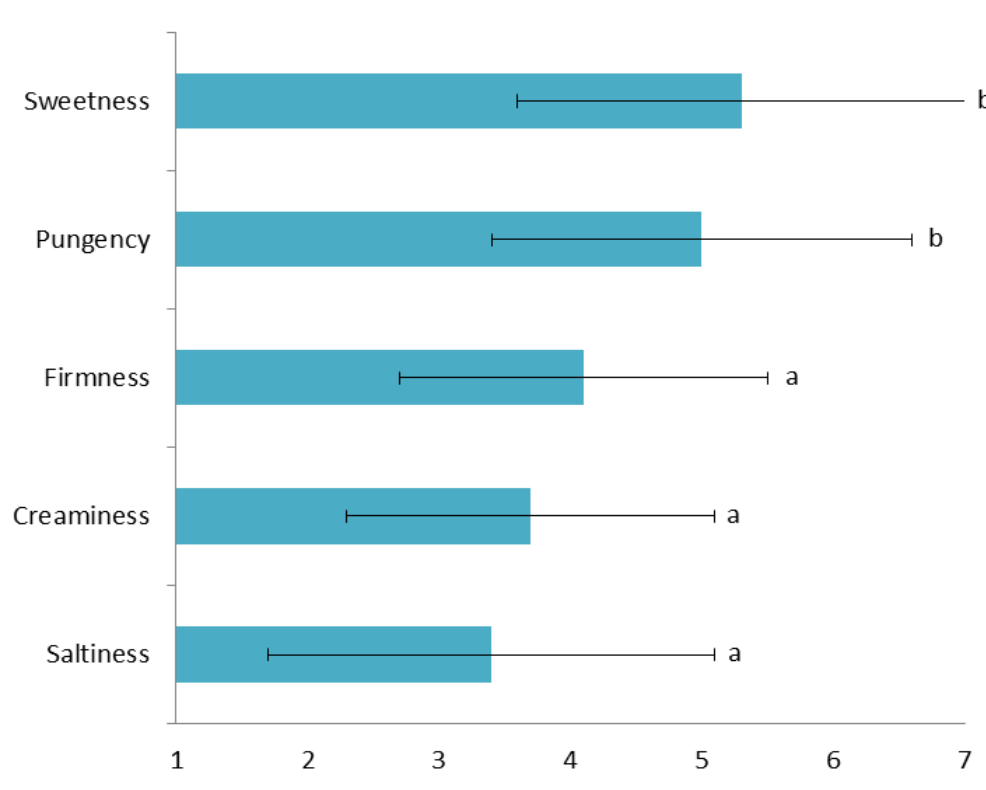
CONSUMER PREFERENCES (1)



'Not at all important to me'

'Very important to me'

CONSUMER PREFERENCES (2)



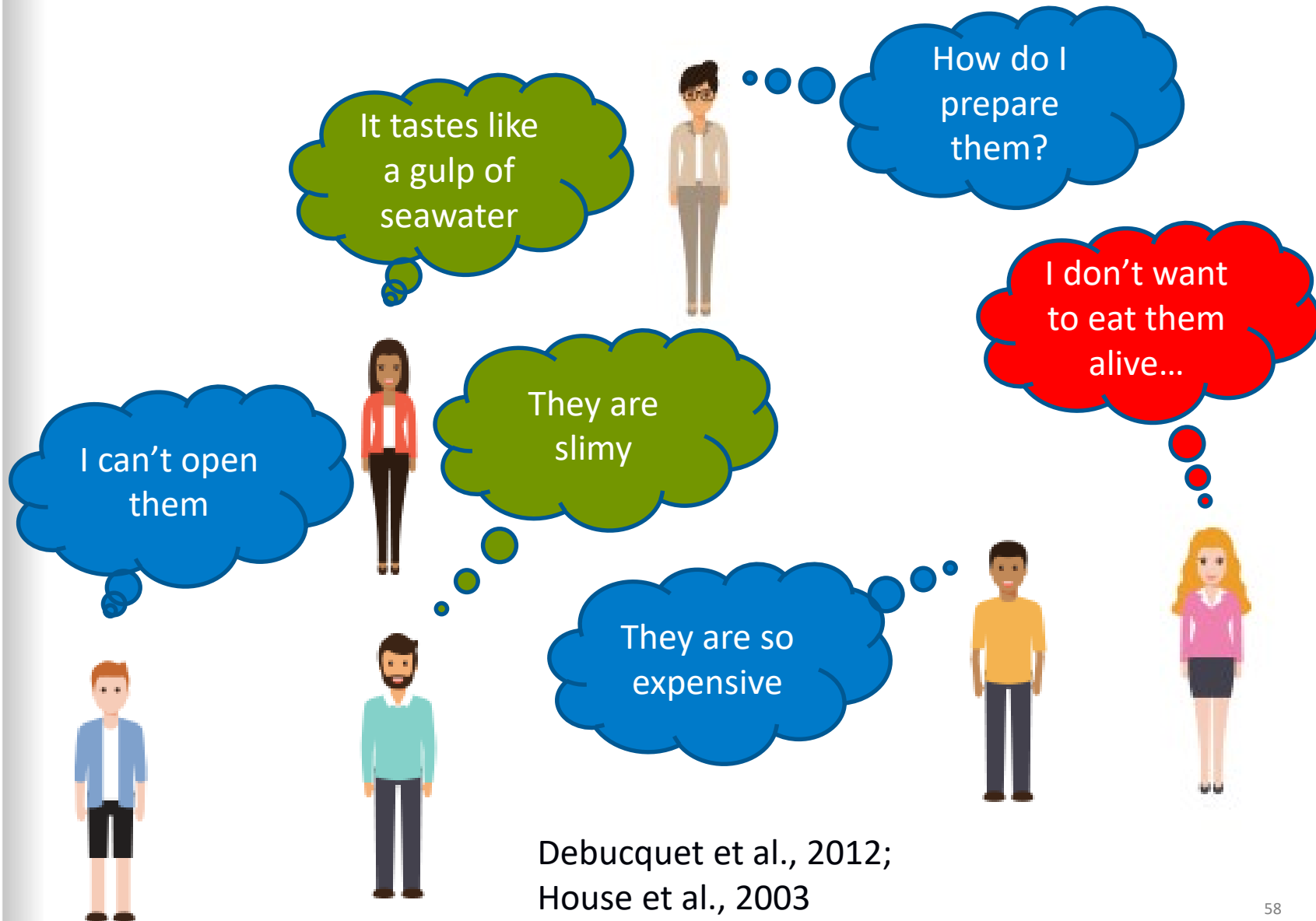
‘Not at all
important to me’

‘Very important
to me’

HATERS



BARRIERS



Debusquet et al., 2012;
House et al., 2003

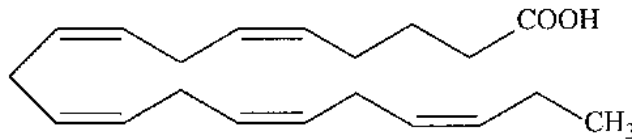


AIM IN THIS EXAMPLE

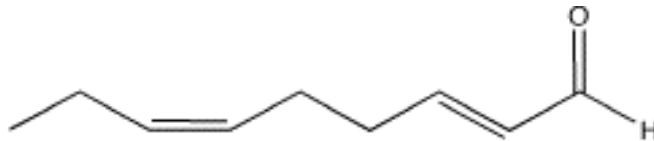
More favorable taste (Less salt, More sweet)

Where to start...?

ODOR & TASTE ACTIVE COMPOUNDS



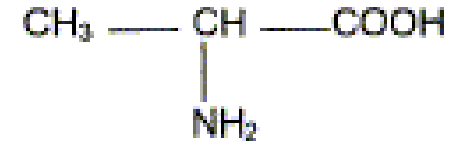
Eicosapentaenoic acid
(EPA)



E,Z)-2,6-Nonadienal



Cucumber odor +

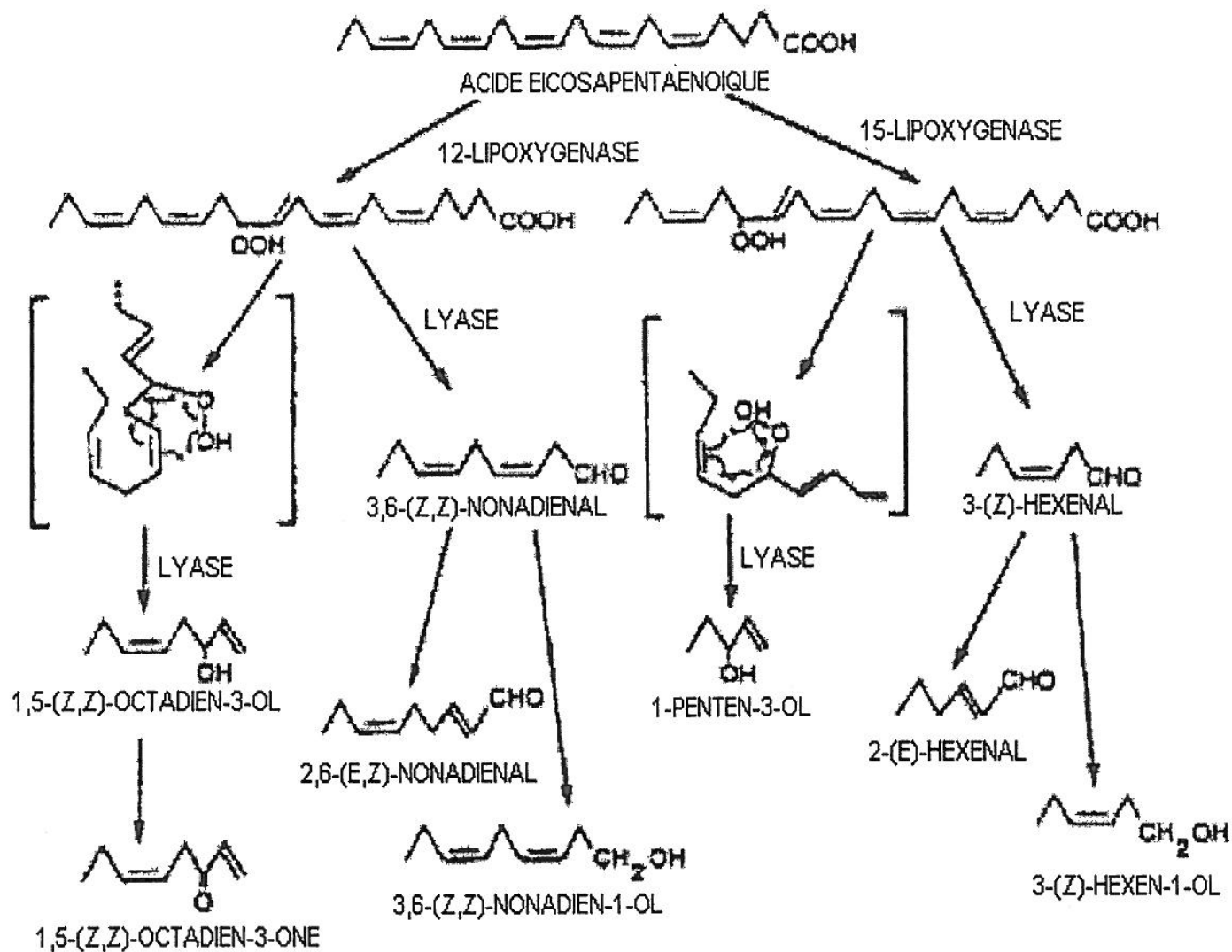


Alanine



Sweet flavor +

VOC PRECURSORS



FATTY ACIDS

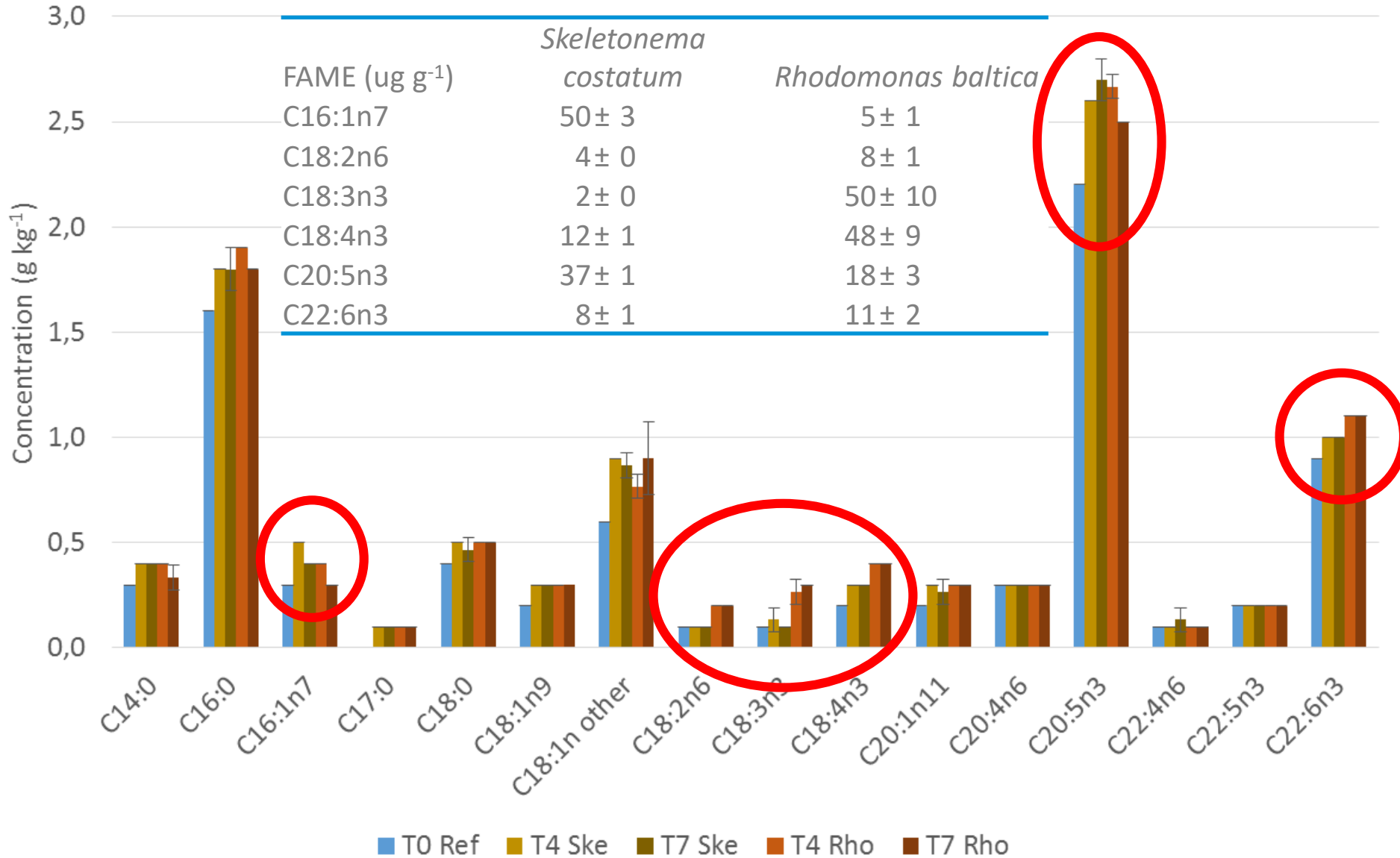


FAME ($\mu\text{g g}^{-1}$)	<i>Skeletonema</i>	
	<i>costatum</i>	<i>Rhodomonas baltica</i>
C16:1n7	50 ± 3	5 ± 1
C18:2n6	4 ± 0	8 ± 1
C18:3n3	2 ± 0	50 ± 10
C18:4n3	12 ± 1	48 ± 9
C20:5n3	37 ± 1	18 ± 3
C22:6n3	8 ± 1	11 ± 2

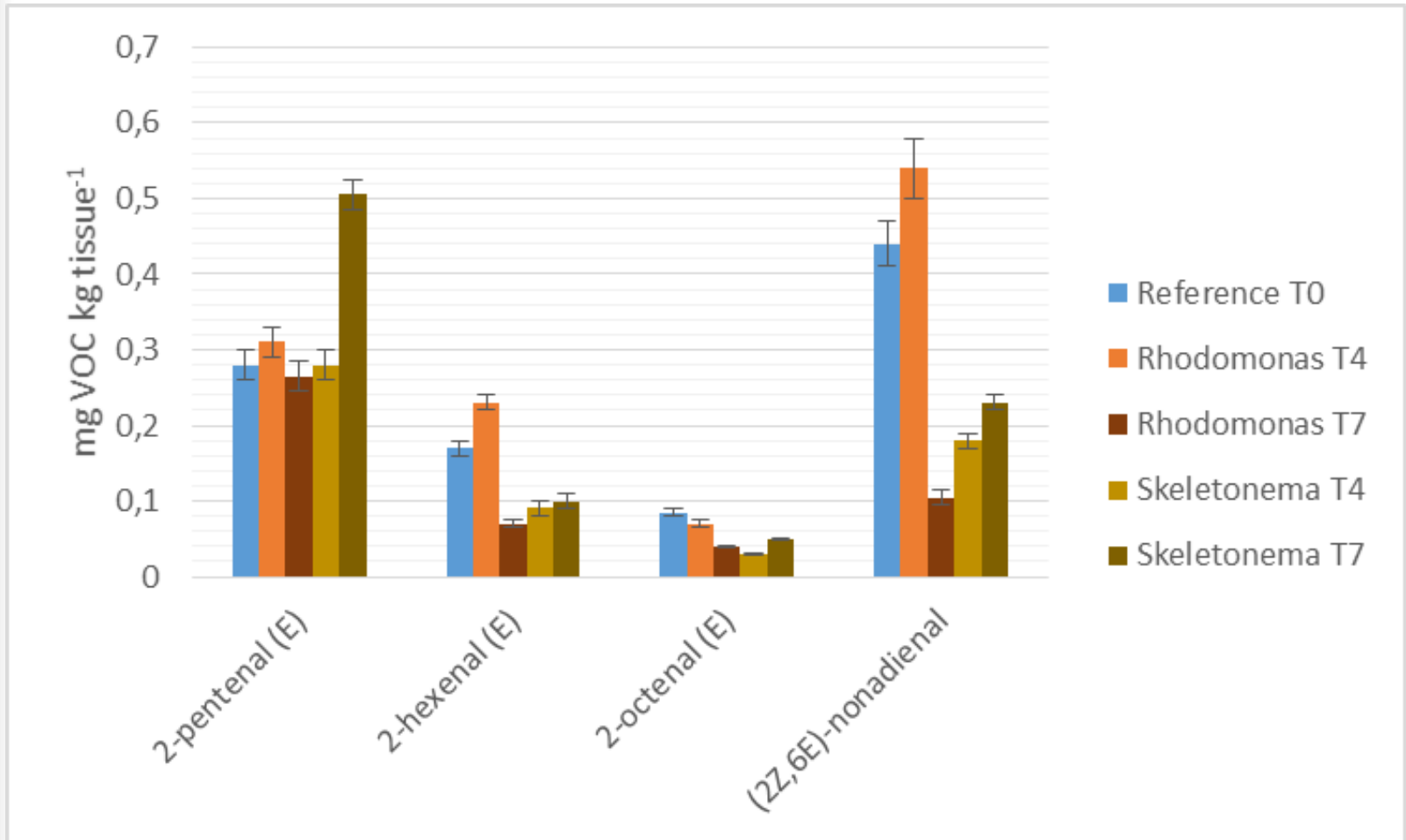




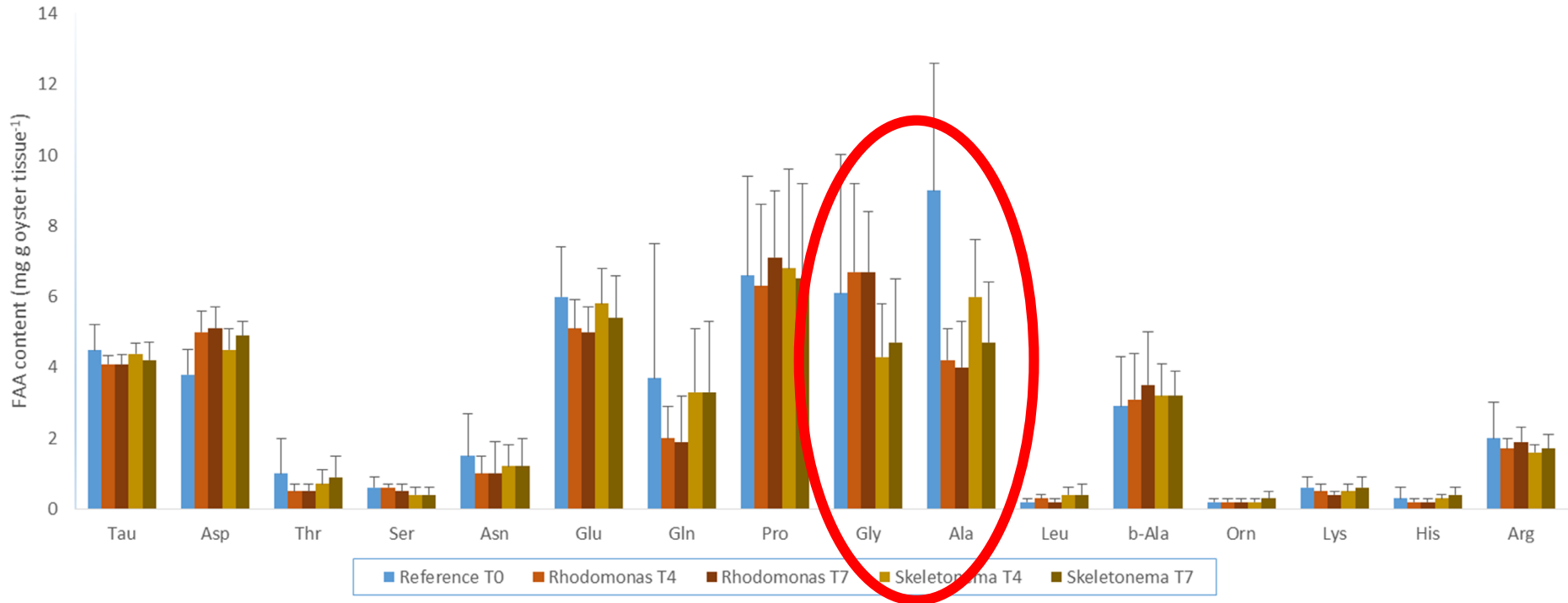
FATTY ACIDS



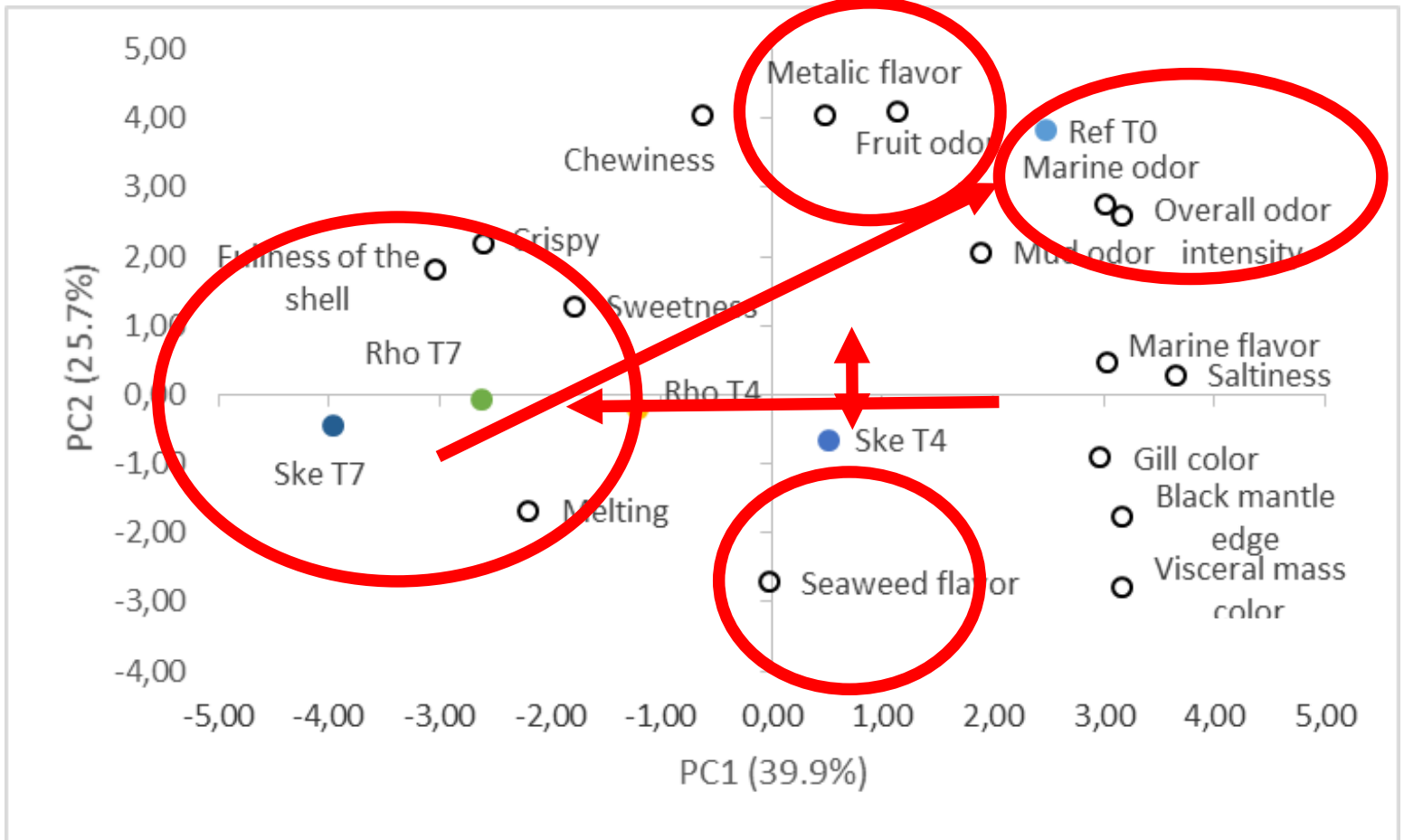
VOCs (ALDEHYDES)



FREE AMINO ACIDS



SENSORY EVALUATION



FUTURE CHALLENGES

License-to-produce

Land based farming (added value products)

Development of artificial diets for shellfish

Staple diet

Finishing diet

Reducing cost price of microalgae

Off shore farming (windmill parks)

HZ IS (CO)HOSTING:

The 6th edition of the international shellfish conference (<https://schelpdierconferentie.com/en/>) on 16 and 17 January 2020 at Neeltje Jans, The Netherlands

The 50th West-European Fish Technologist Association (WEFTA) meeting on 13-16 October 2020 in Rotterdam, The Netherlands



AND LASTLY: WE NEED YOUR HELP...

Options for:

Internships

Final thesis



Feel free to contact me: j.van.houcke@hz.nl

ACKNOWLEDGEMENTS



UNIVERSITÉ DE NANTES



AquaVlan²

Gefinancierd door



Met projectpartners

