Methodology for behavioral study of early fishes on the Corsican coastline, Mediterranean Sea

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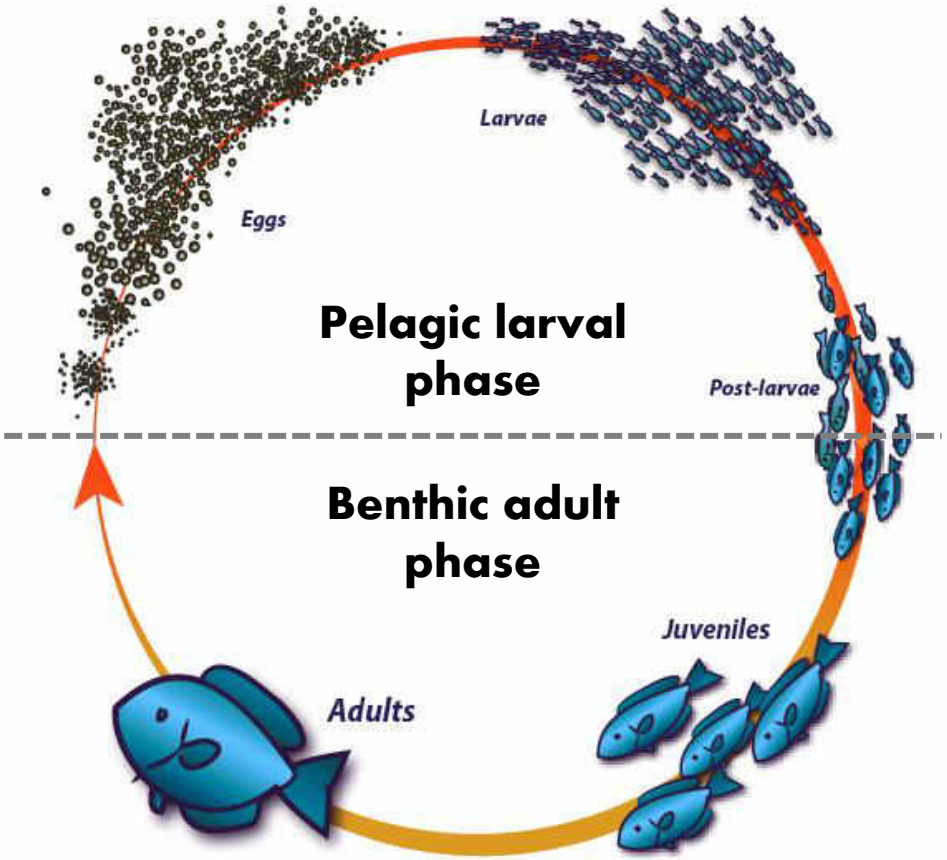
Context

Why study young stages of coastal fishes ?

- Coastal fishes are a major part of marine biodiversity and biomass

- Early stages : Larval and Post-Larval stages are crucial for the recruitment and settlement of future stocks

Life cycle of demersal coastal fishes



(Crec'hriou et al., 2015)

- ❑ Dispersal potential
- ❑ Recruitment period
- ❑ Drastic mortality

→ key element for stock constituting

- ❑ Sedentarity
- ❑ Low mortality
- ❑ Low density variation

Early stages have a real interest for stock management and protection

It is important to …

- Improve knowledge on early stages
  - ➔ Especially on Mediterranean species

What we know today :

- Early stages are "competant"
  - ➔ They have real physical and behavioral abilities
- Influence on settlement rates of individuals

Context and objectives of my PhD research

- ❑ Improve knowledge on physical and behavioral abilities of early life stages
  - ➔ Mediterranean species
- ❑ Show the early life stages importance for management of fish stocks

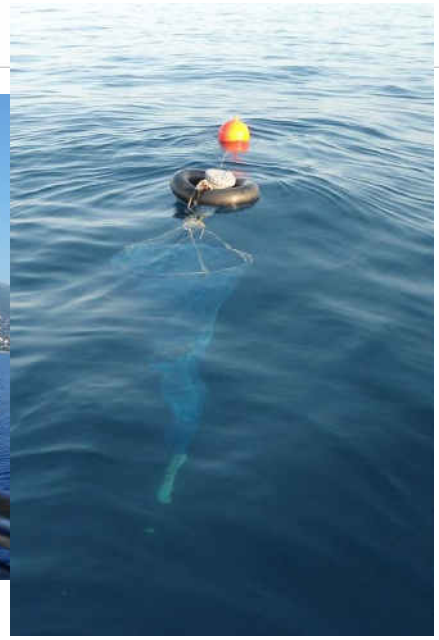
Study site

North-eastern Corsican coast

- Urban area of Bastia (<50 000 inhabitants)
- Natural reserve site
- Natura 2000 zone

Sampling method :

- ➔ Monthly fishing since June 2016
- ➔ Light traps
- ➔ Catch of individuals at post-larval stage
- ➔ 30 individuals per species



Study of physical abilities in relation to morphology

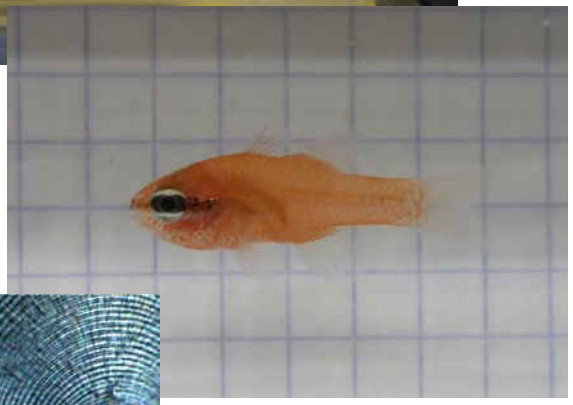
Objectives :

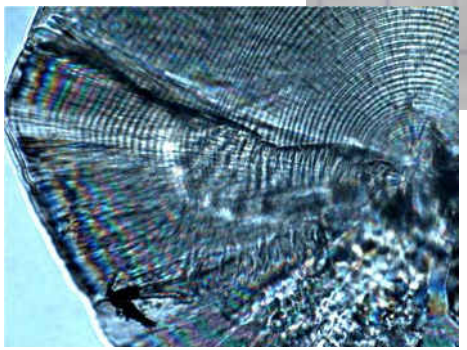
- Estimate PL swimming capacity (critical swimming speed : Ucrit)
- Evaluate morphological characteristics (morphometric index)
- Age determination (otolithometry)

Can physical characteristics influence recruitment and settlement of individuals?

Methods

- ❑ **Ucrit determination**
  - ➔ **Swimming chamber**
    Generates an adjustable stream
- ❑ **Photos and measurements**
  - ➔ **Morphological index**
- ❑ **Otoliths extraction**
  - ➔ **Age determination**





First results

- 274 PL tested
- 14 species
- 4 families
- 5 species < 10 individuals

Table of species collected

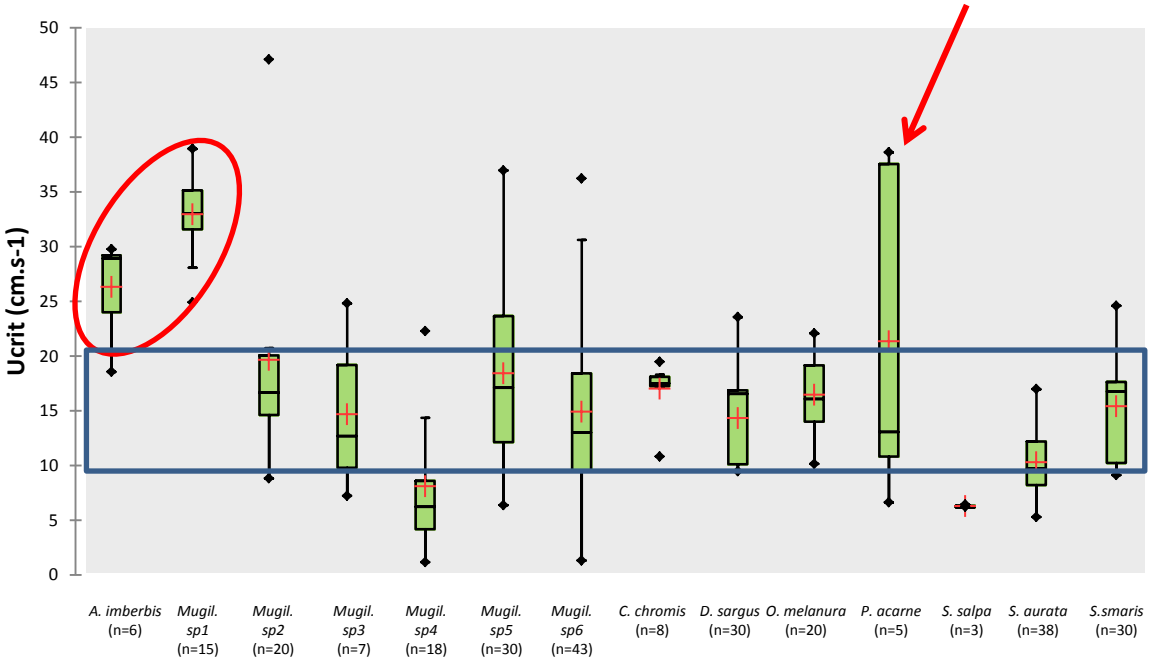
Family Species	Month of fishing	n	Total Length
Apogonidae			
Apogon imberbis	october	6	3,05 [0,38]
Mugilidae			
Mugilidae sp. 1	july	15	2,30 [0,22]
Mugilidae sp. 2	november	20	3,16 [0,22]
Mugilidae sp. 3	november	7	2,84 [0,25]
Mugilidae sp. 4	december	18	1,83 [0,17]
Mugilidae sp. 6	december	30	2,45 [0,37]
Mugilidae sp. 7	january	43	2,70 [0,41]
Pomacentridae			
Chromis chromis	july	8	1,93 [0,23]
Sparidae			
Diplodus sargus	june	30	2,10 [0,25]
Oblada melanura	july	20	2,08 [0,20]
Pagellus acarne	november	5	3,07 [0,12]
Sarpa salpa	december	3	2,25 [0,06]
Sparus aurata	february	38	2,06 [0,17]
Spicara smaris	june	30	1,87 [0,24]

First results

Pagellus spreading box
- ➔ 5 individuals
- ➔ big speed differences

Ucrit significantly faster

Ucrit average aroud 15cm.s-1



Critical swimming speed (Ucrit) Boxplot by species

First results

Several variables determinates for each species :

Ucrit, Total Length, Standard Length, Body Depth, Body Area, Muscle Area, and two ratio calculations, Fitness ratio and Muscle ratio.

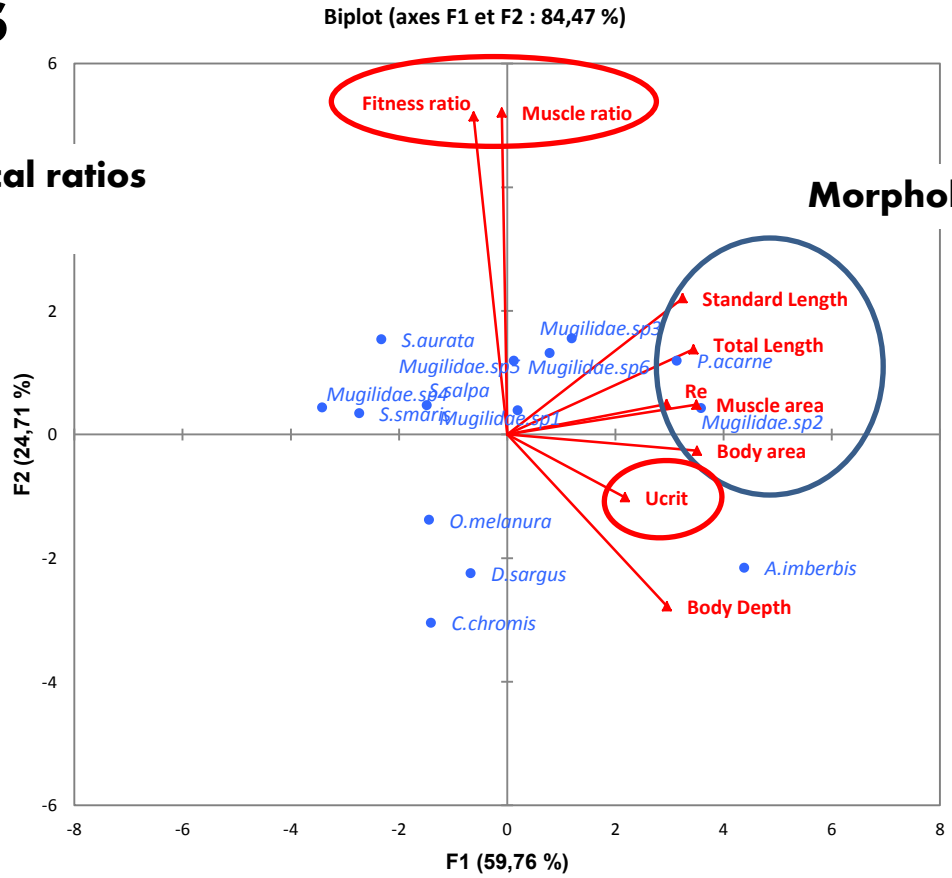
➔ Interaction between variables tested

Examples : Positive correlations founded between Ucrit and Total Length
Most observed for Mugilidae sp1, O. melanura, S. smaris

First results

Ucrit and Morphological ratios not linked

Morphological variables

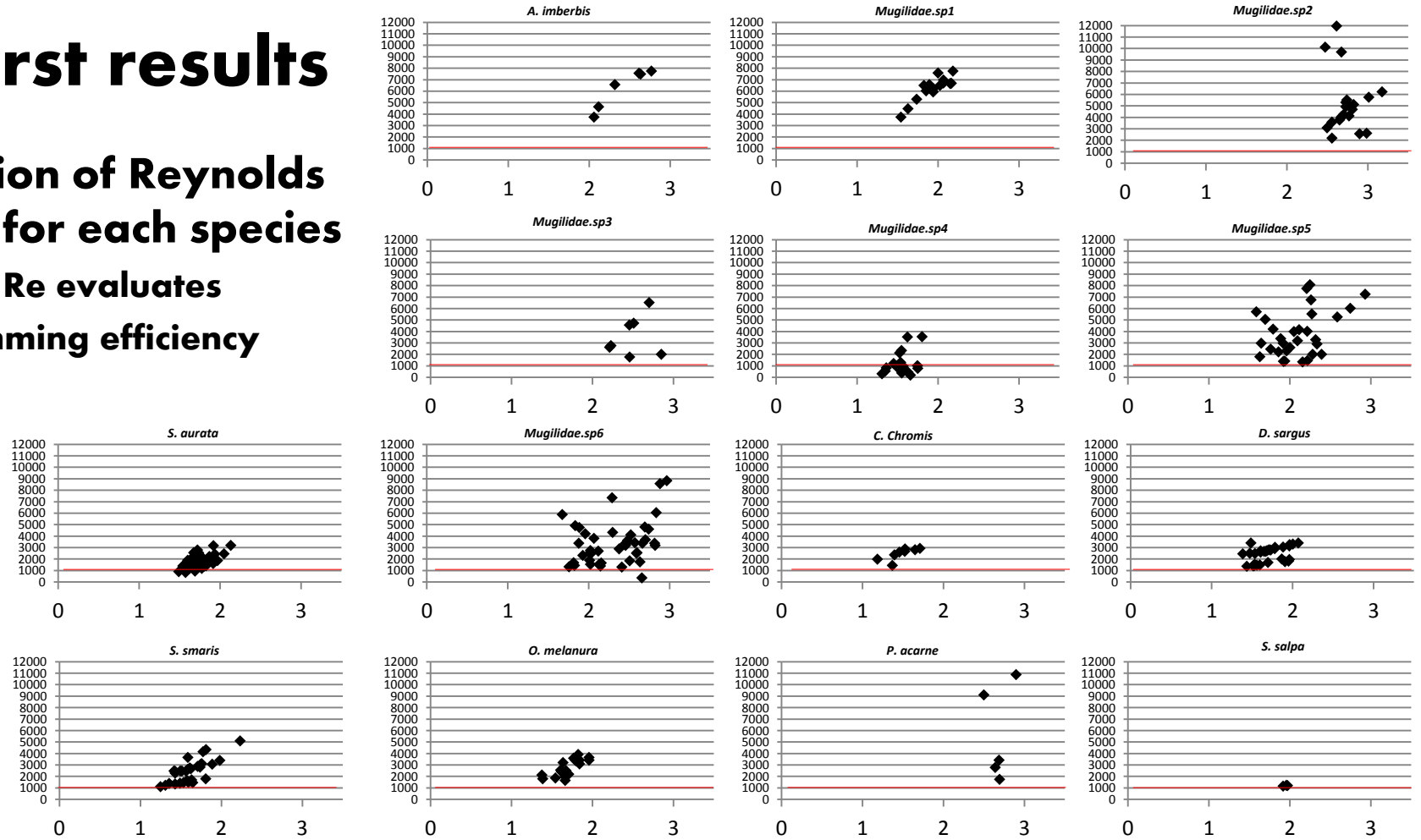


Principal Component Analysis Biplot

First results

Calculation of Reynolds number for each species

➔ Re evaluates swimming efficiency



Reynolds number graphs by species

Preliminary conclusions

- Interaction between variables studied by species
- Physical characteristics do not explain swimming capacities for each species
- Mediterranean species have efficient swimming capacities
- Ucrit database has been improved for Mediterranean species

Study of *in situ* orientation behavior

Objectives :

- Observe orientation in the field
- Test two coastal attraction : rocky bottom / sandy bottom

Do post-larvae have a significant orientation in the natural environment?

Have they a different orientation depending on the kind of coast?

Methods

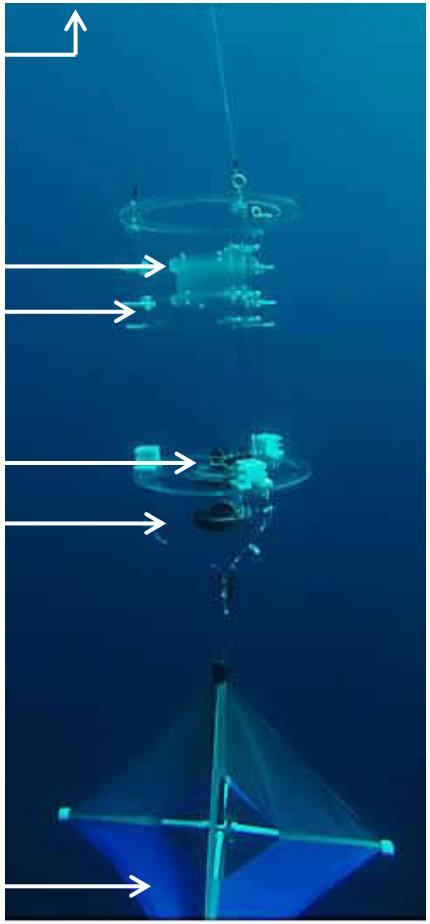
Drifting *In Situ* Chamber (Paris et al., 2013)

In situ observation instrument

➔ Evaluate the orientation

(ability of PL to keep a bearing)

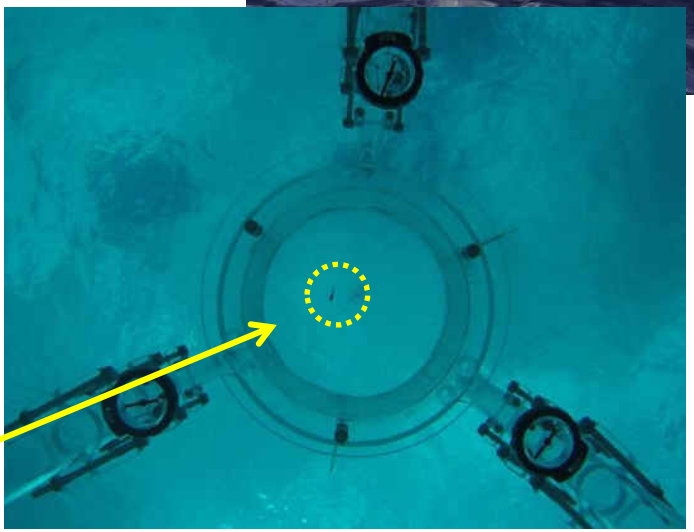
- Without human disturbance
- Without apparent reference frame
- With known parameters (depth, temperature…)



Methods

❑ Field Protocol

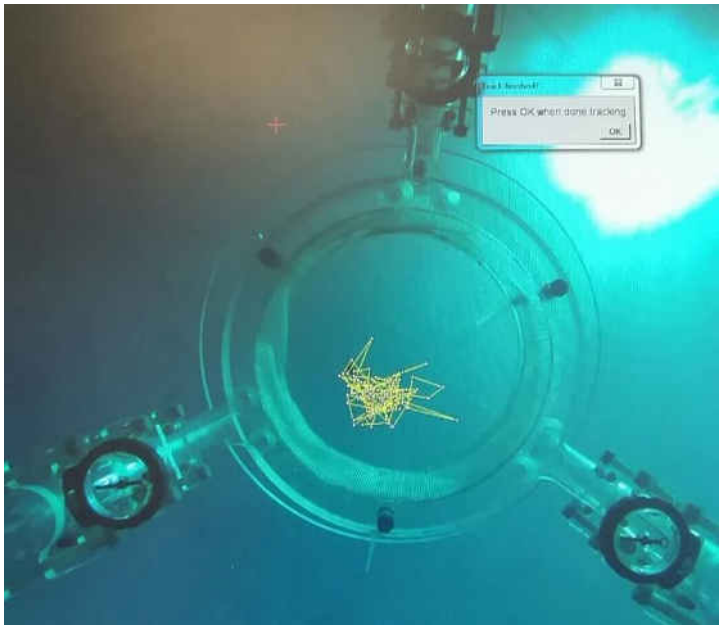
- PL placed in the chamber (one by one)
- Device drifts during15 min
- Photos / 1 second
- Measurement of parameters



PL position in the arena

Sample image taken by the camera

Methods

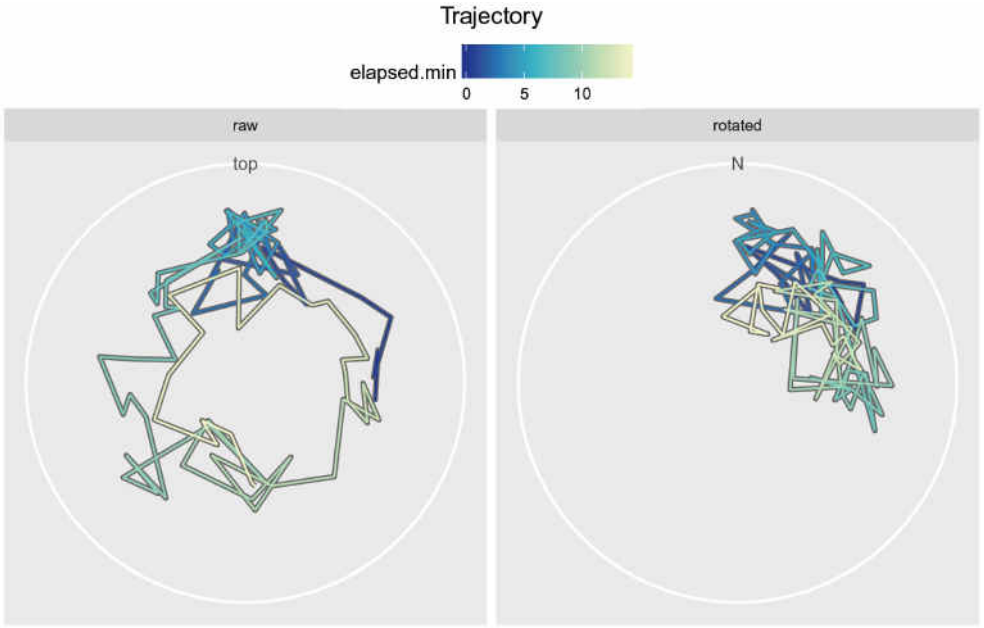


Position tracking

❑ Lab Protocol

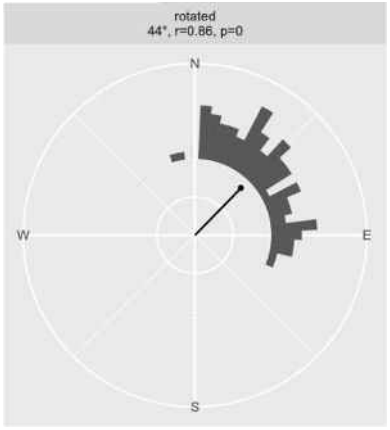
- Data collection (images, gps, compass)
- Image analysis
- Determination of tracking position
- Statistics Calculation
  (Position, Directionality)

First results

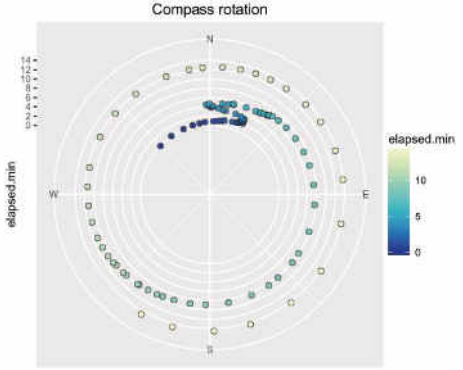


Tracking position in the arena

Tracking position corrected by cardinal points



Significant orientation in the arena



DISC rotation

Statistic graphs example
➔ to evaluate orientation in the field

First results

Example table by species

Species	Coasts	Directionnality tests		Cardinal	Stream
C. chromis	Sandy	r=0.604	p>0.05	NO	N
	Rocky	r=0.788	**p<0.05**		N
O. melanura	Sandy	r=0.157	p>0.05	NW-N-SE	SE
	Rocky	r=0.474	**p<0.05**		N
S. smaris	Sandy	r=0.371	p>0.05	SSE	SE
	Rocky	r=0.614	**p<0.05**		N

➔ **Majority of PL have a significant orientation in rocky environment**

Preliminary conclusions

- Mediterranean species have a significant orientation
- Different directionality according to species
- Rocky environment is clearly preferential

To conclude …

- The tested Mediterranean species are “competent”
- PL tested have real swimming and orientation capacities
- Additional tests must be performed to explain the orientation results
- These results represent a new knowledge for Mediterranean region

Perspectives

- An acoustic experiment is planned to try to explain the significant orientation of PL in rocky environments
- Test new Mediterranean species
- Integrate these results into models of dispersion

This type of data could represent undeniable tools for management and conservation measures

Thank you for your attention