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## Designing a miniature electronic tag for jellyfish tracking

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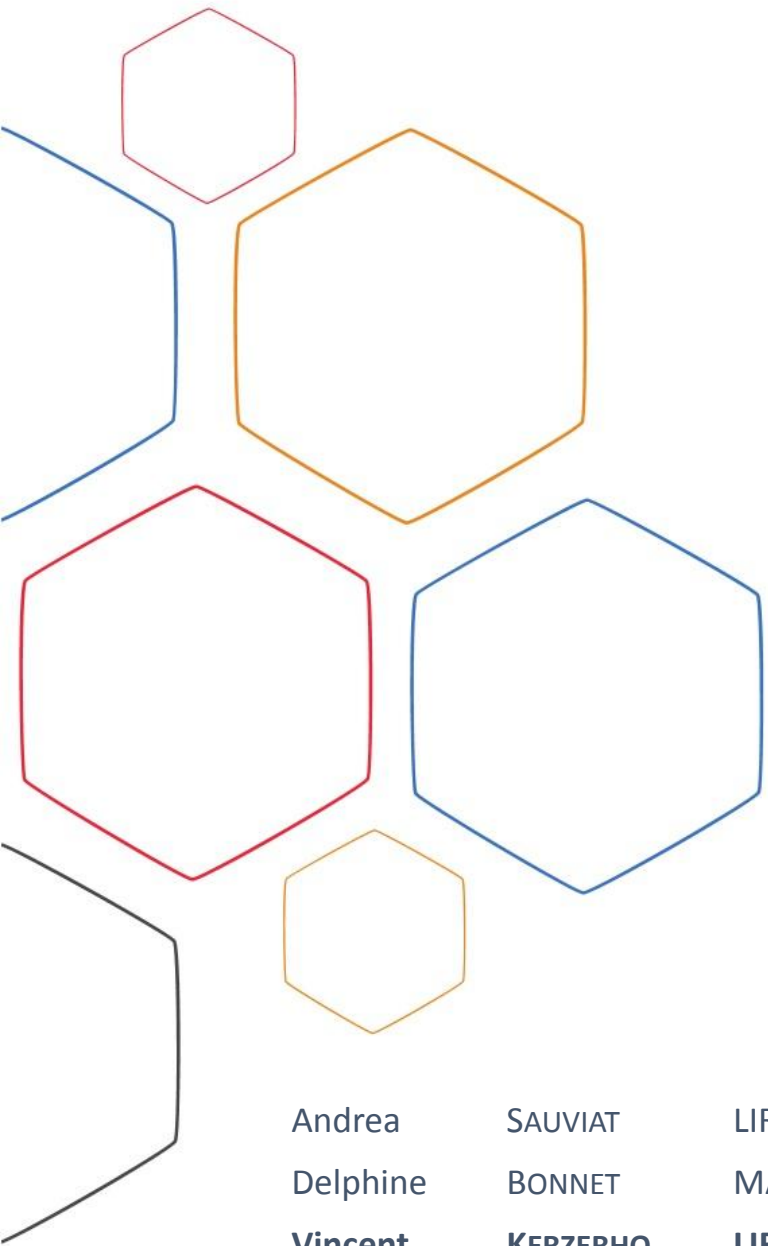
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**LIRMM**

# Designing a miniature electronic tag for jellyfish tracking

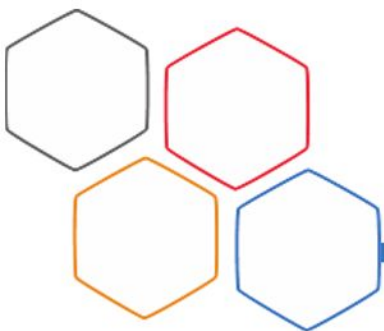
*ICFT 2023 - International Conference on Fish Telemetry  
11 - 16 June 2023, Sète, FRANCE*

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Delphine	BONNET	MARBEC	/	UM
<u>Vincent</u>	<u>KERZERHO</u>	<u>LIRMM</u>	<u>/</u>	<u>CNRS</u>

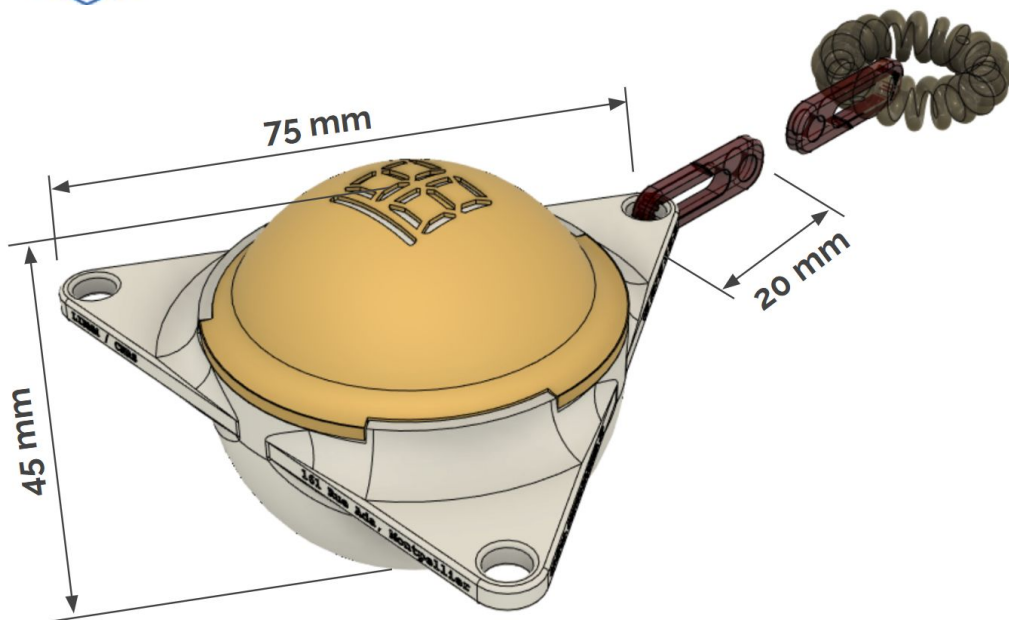


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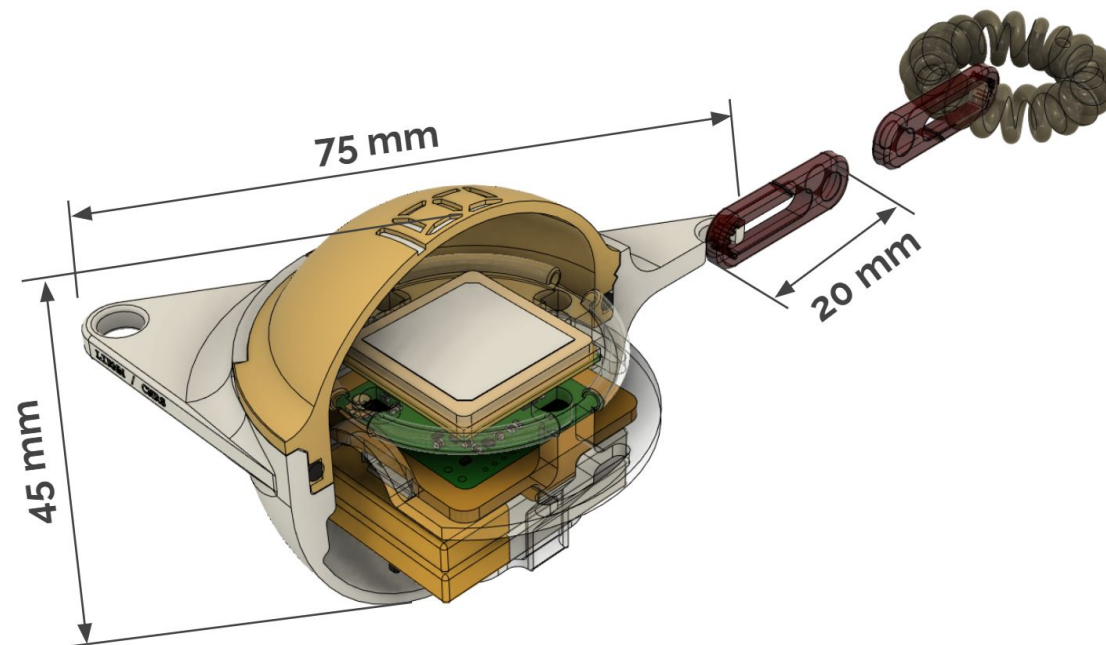




# Floating electronic tag for jellyfish tracking (v3 May 2023)



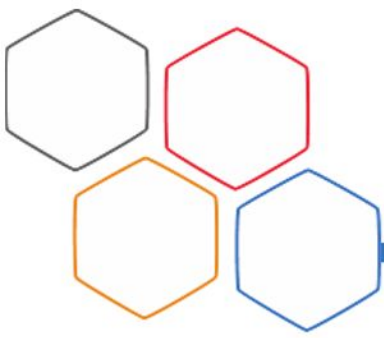
3D model (external view)



3D model (internal view)

## Technical information:

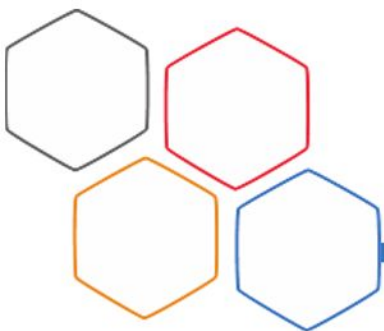
- 41 g
- 7 h to 12 days autonomy
- GPS for positioning
- Wireless communication for data transmission during deployment
- Sensors: temperature, accelerometer
- 30 tags available



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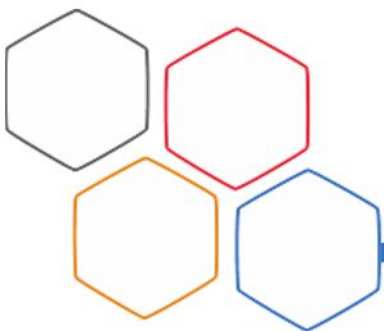
- 1. Why ?**
- 2. How ?**
- 3. First deployments**
- 4. June to October 2023 tagging campaign**



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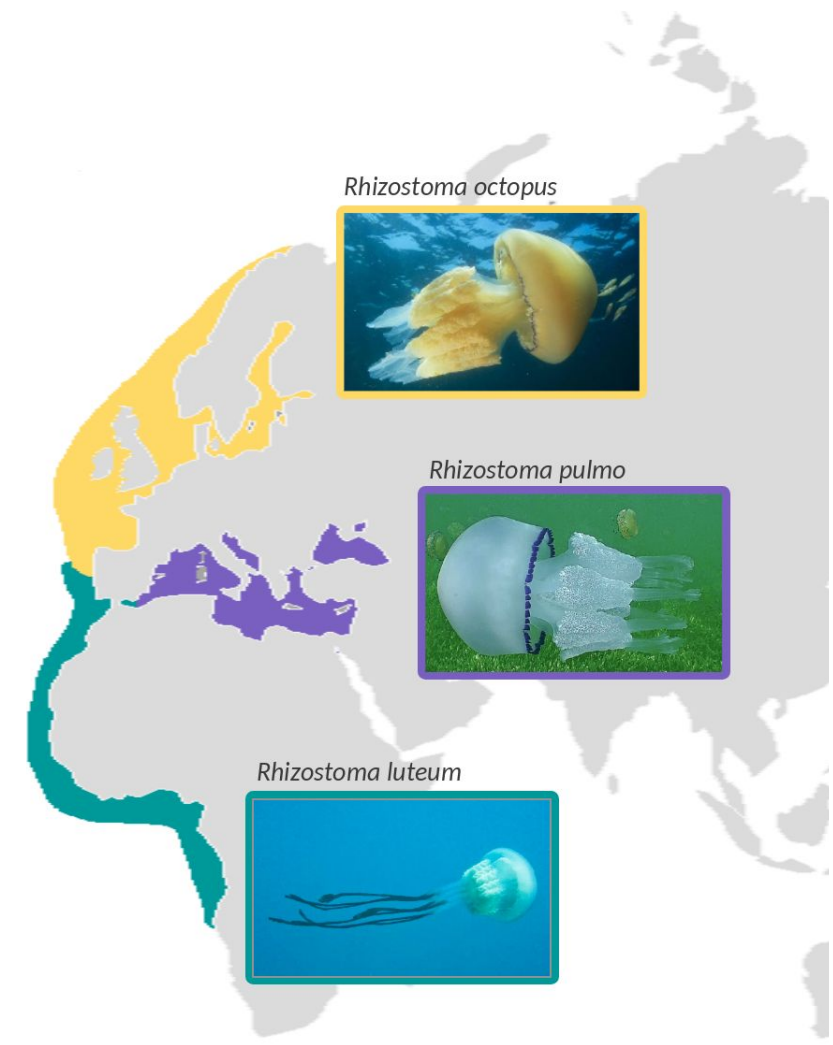


- 1. Why ?**
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Why ? 1/3

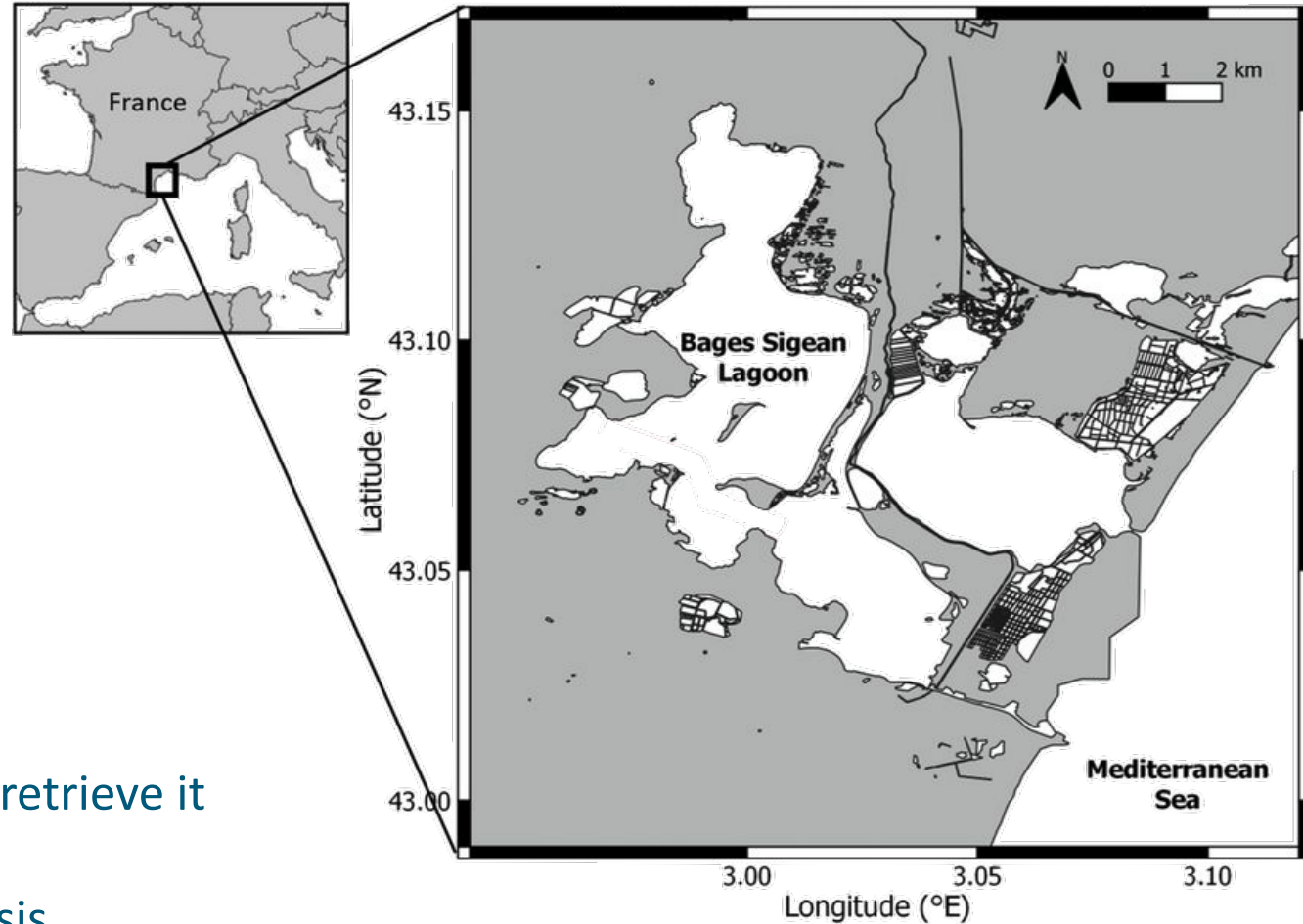
The object of study: *Rhizostoma pulmo*

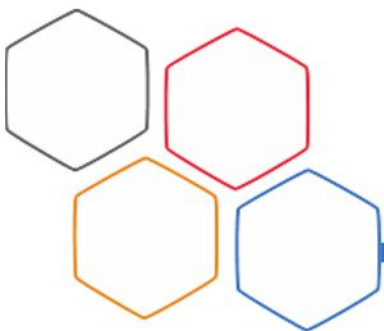


# Why ? 2/3

## Objectives

- Increase knowledge of the ecology of *R. Pulmo* by monitoring individual growth and sexual differentiation processes in the wild
  - Since 2014, the Bages-Sigean lagoon, a natural laboratory host a permanent population
- ↓
- Use electronic tag to geolocate the jellyfish and retrieve it occasionally for individual growth monitoring
  - individual position tracking for movement analysis

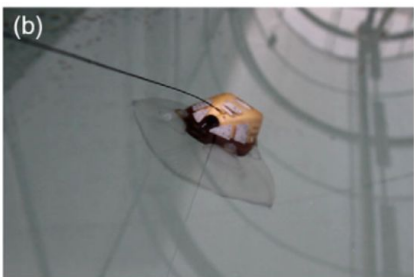




# Why ? 3/3

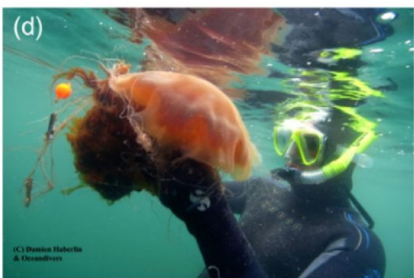
## State of the art in jellyfish tagging

Glue



Suction cup

Tie cable



Tie cable

Glue



Suction cup

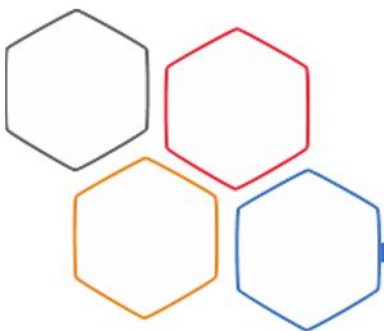
- Several tagging techniques, rarely reliable
- Short time (minutes to hours) deployments in majority, one of 28 days using tie cable
- No tag for repeated geolocation



**Need to develop a new tag**

- reliable attachment
- long battery life
- geolocation technique
- as small as possible to limit impact on the animal

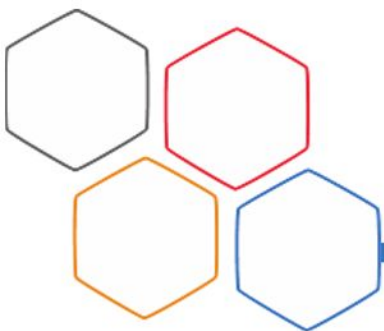




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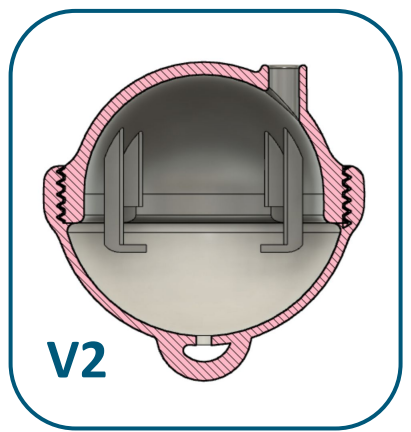
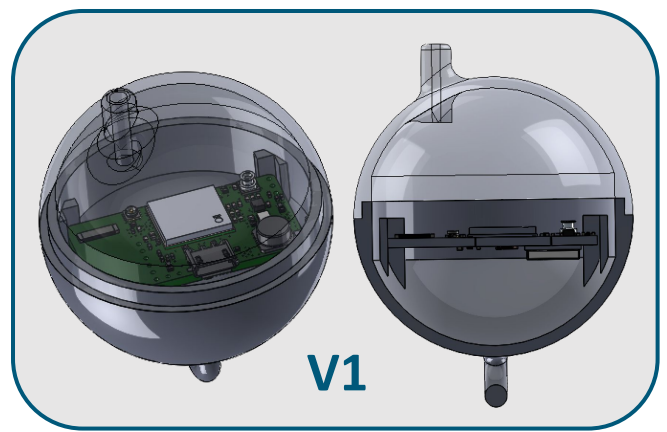
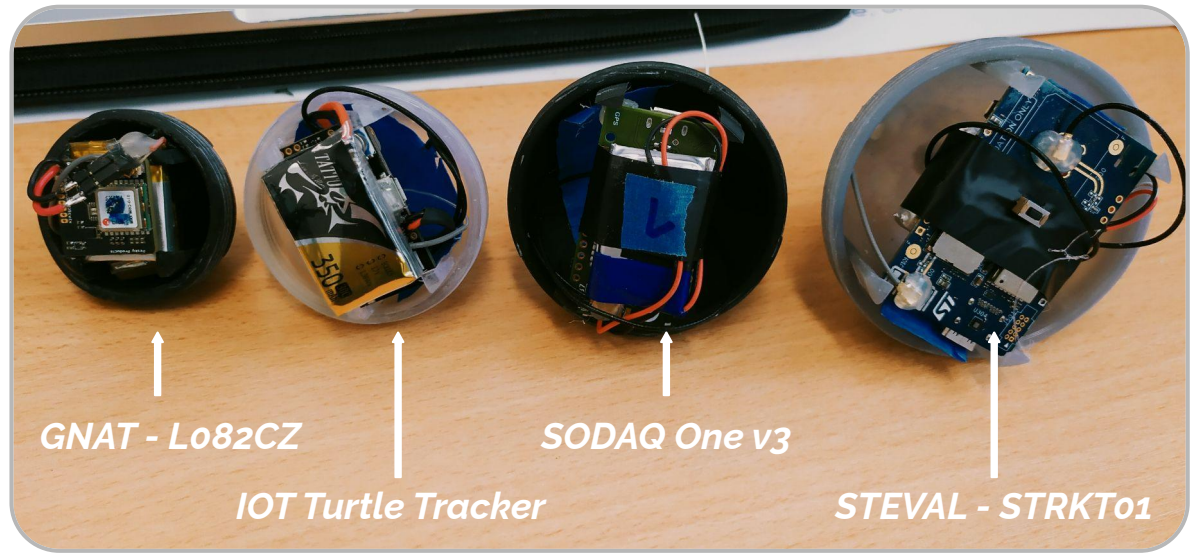


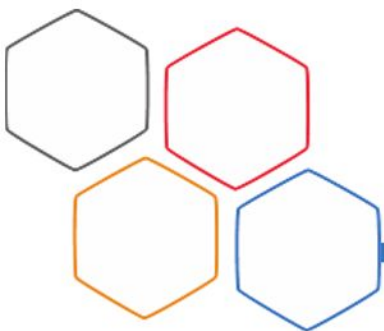
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# Tag development 1/2

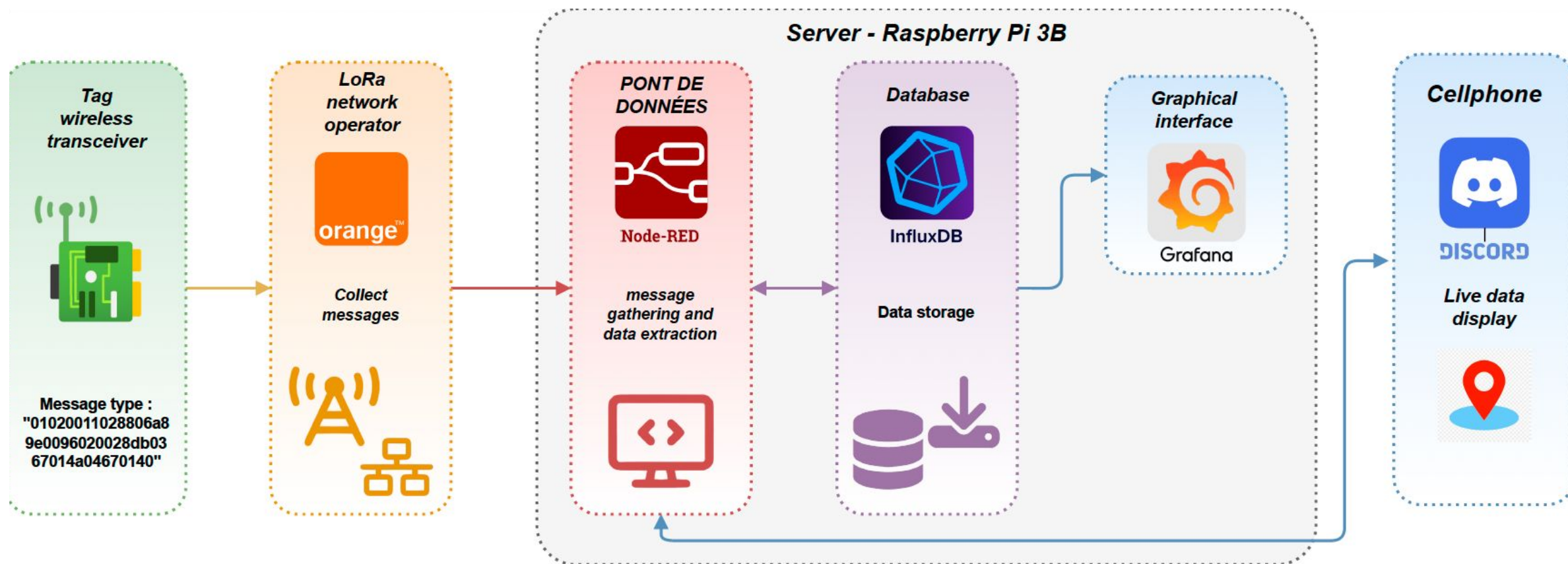
## Benchmarking and *in-situ* tests

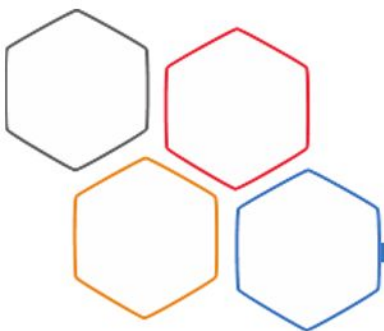




# Tag development 2/2

## Information system

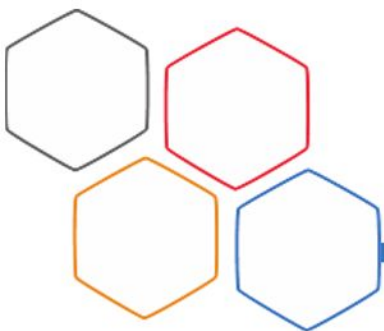




# Table of contents



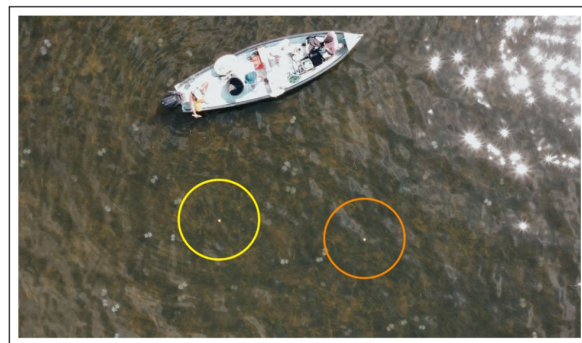
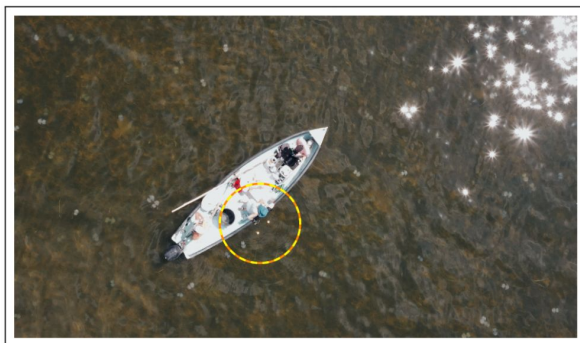
1. Why ?
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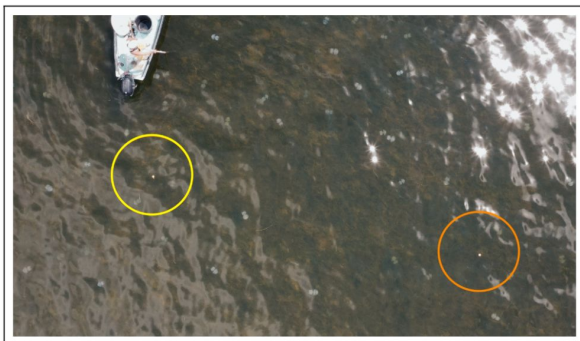
# First deployments 1/2

## Objectives: validation of the system and the tagging technique

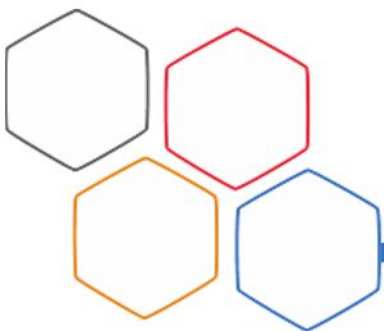
- 3 tagging operations (07 and 08/2022)
- 15 tagged jellyfishes
- Deployment duration: 10 min to 1 hour.



Tagged jellyfish ( July 28th 2022)



- Orange circle: tagged jellyfish
- Yellow circle: free moving tag
- No wind/ no swell



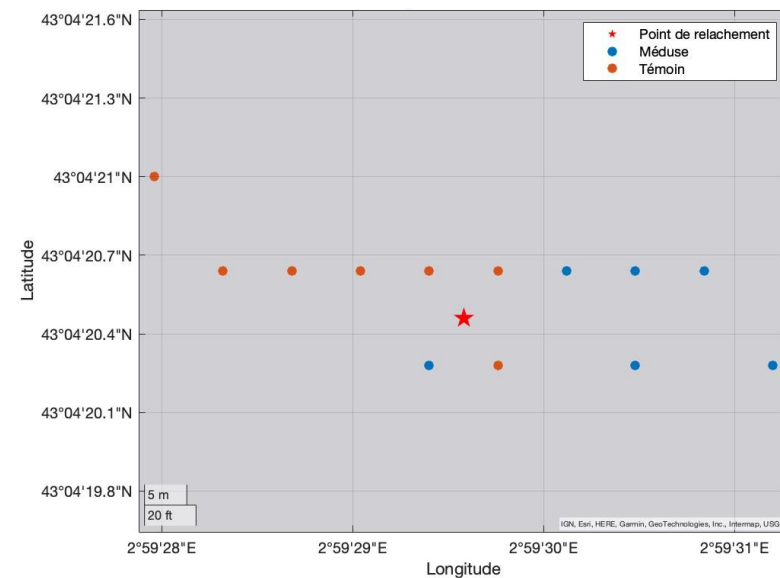
# First deployments 2/2

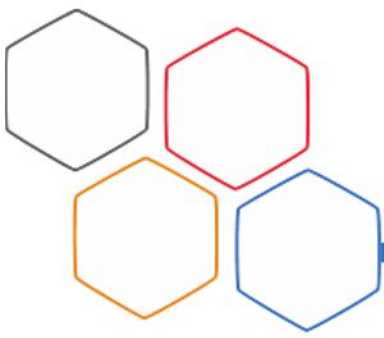
## Results:

- Global system validated (GPS/sensor + wireless data transmission + database enhancing)
- Jellyfish retrieval using live GPS transmission
- Tagging technique
- Jellyfishes keep swimming after tagging



Extended experiments

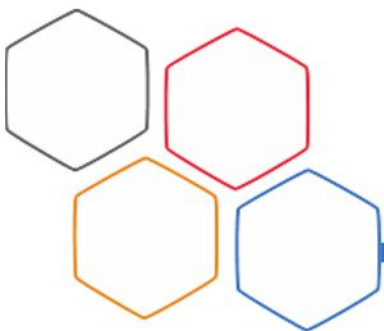




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1. Why ?
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3. First deployments
4. **June to October 2023 tagging campaign**



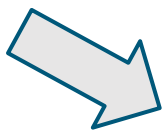
# June to October 2023 tagging campaign

5 experiments

4 size classes :

- L<15cm
- 15<L<25cm
- 25<L<35cm
- L>35cm

10 jellyfishes / class

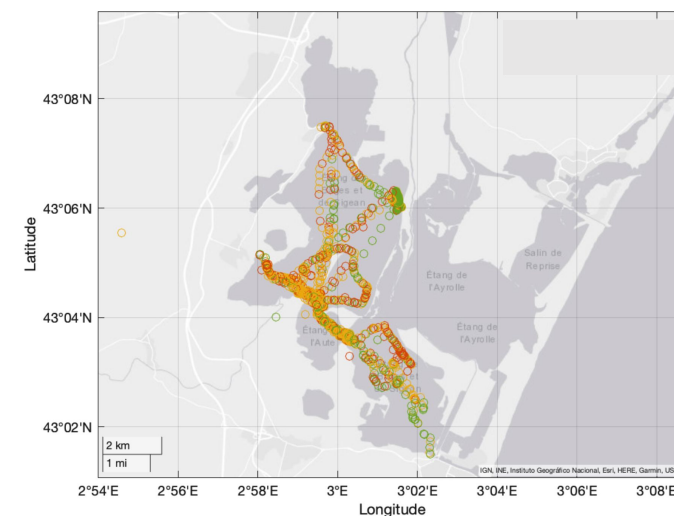
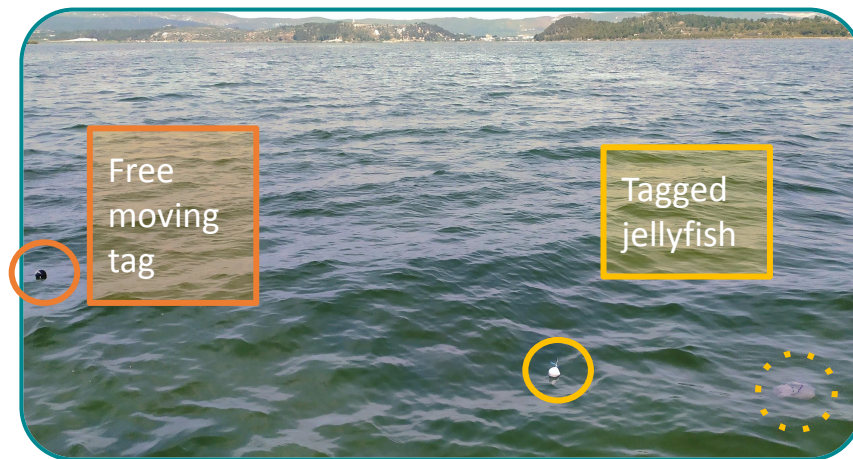


3 experiments to study tag impact on jellyfish:

- study recovery after tagging operation
- characterize tag impact on jellyfish movement
- jellyfish natural movement analysis using a drone

2 experiments to study jellyfish development and behavior:

- repeated fishing for repeated biometries to study individual development (growing and sexual maturation) over several weeks
- GPS for precise position tracking to study movement over the lagoon

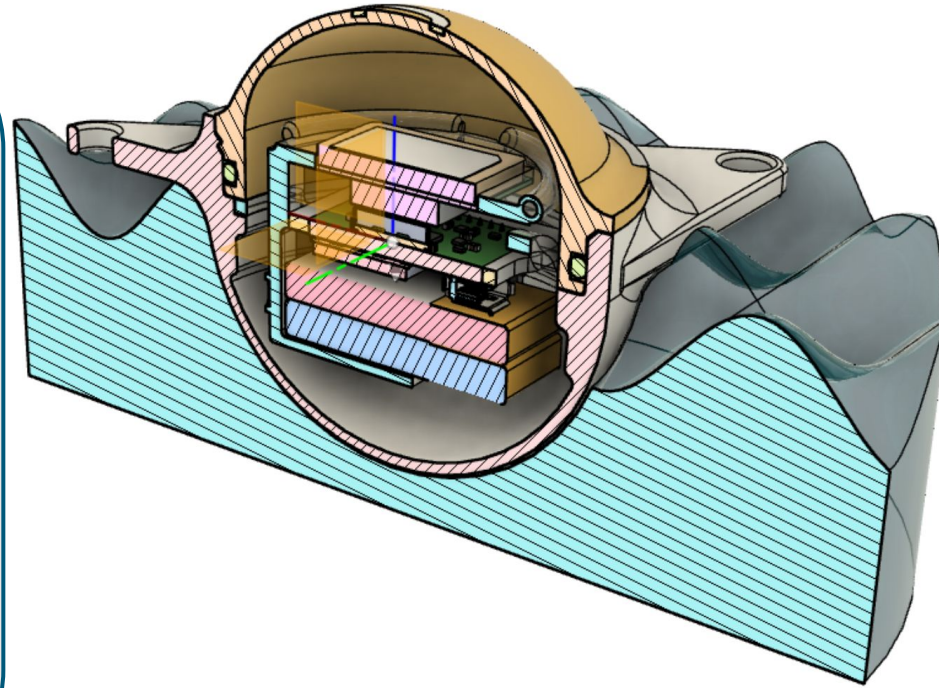




# Conclusions/Perspectives

## Results:

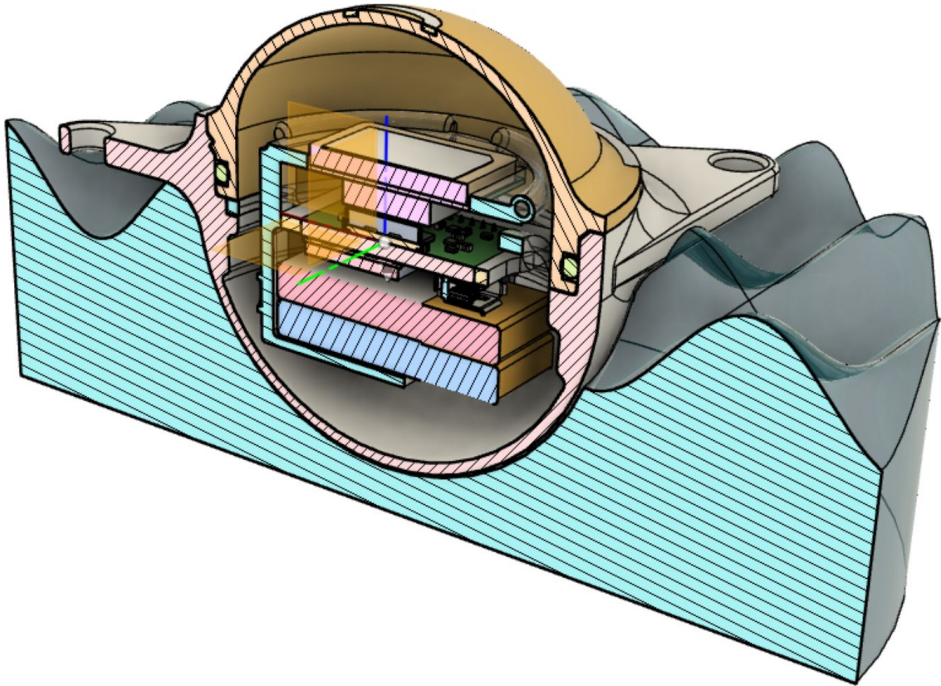
- Small floating tag with GPS and LoRa communication system
- Long battery life tag (up to 12 days)
- Tagging technique validated *in-situ*
- Tag functioning validated *in-situ*
- data information system validated
- Retrieve technique using GPS validated
- 15 jellyfishes tagged during 10 to 60 min



## Next steps:

- Extended deployments to monitor individual growth and sexual differentiation
  - Extended deployments to quantify the impacts of tag on jellyfish
  - 200 tagged jellyfish
- 
- Study jellyfish in the sea
  - Develop new tag

Thank you for your attention



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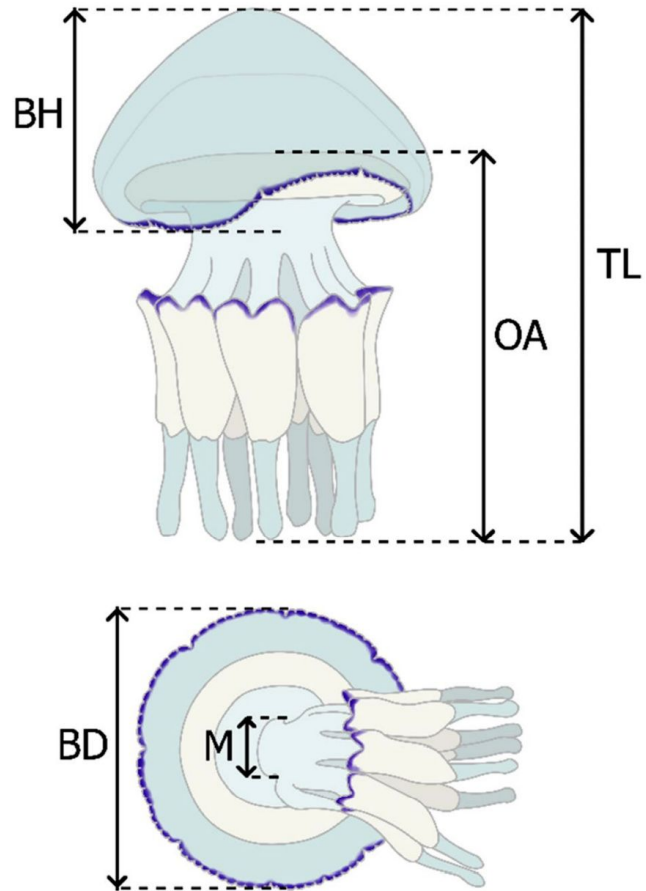


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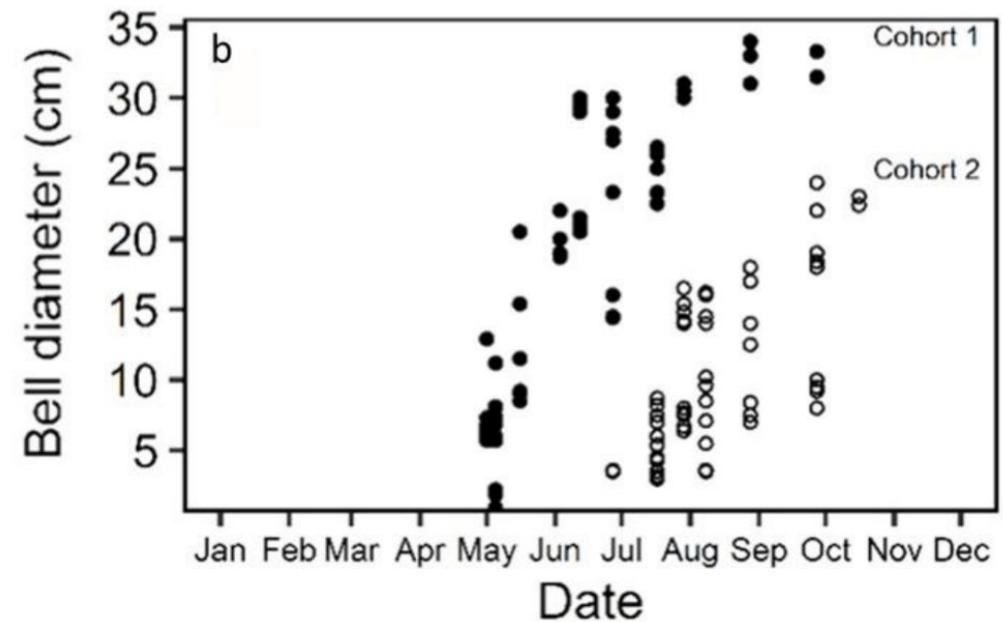
# L'objet d'étude: la rhizostoma pulmo



Morphological measurement:

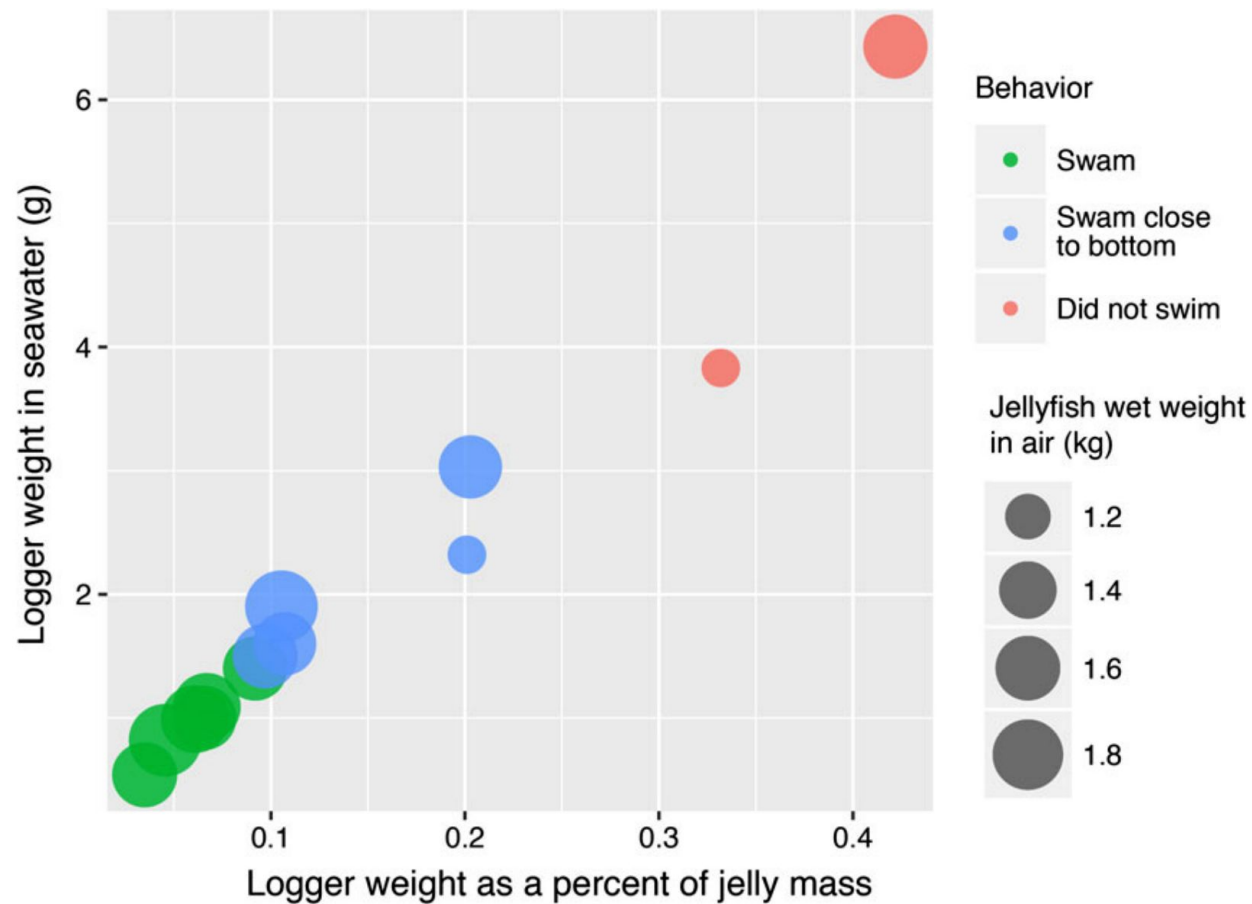
Bell Diameter (BD): 1mm to 40cm

Wet Weight (WW): up to 2kg



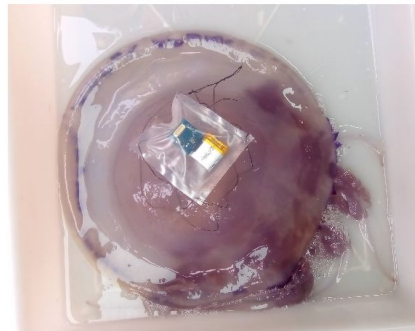
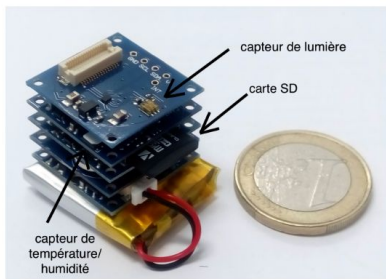
Source: Variability of growth rates and thermohaline niches of *Rhizostoma pulmo*'s pelagic stages

# L'influence d'une marque électronique



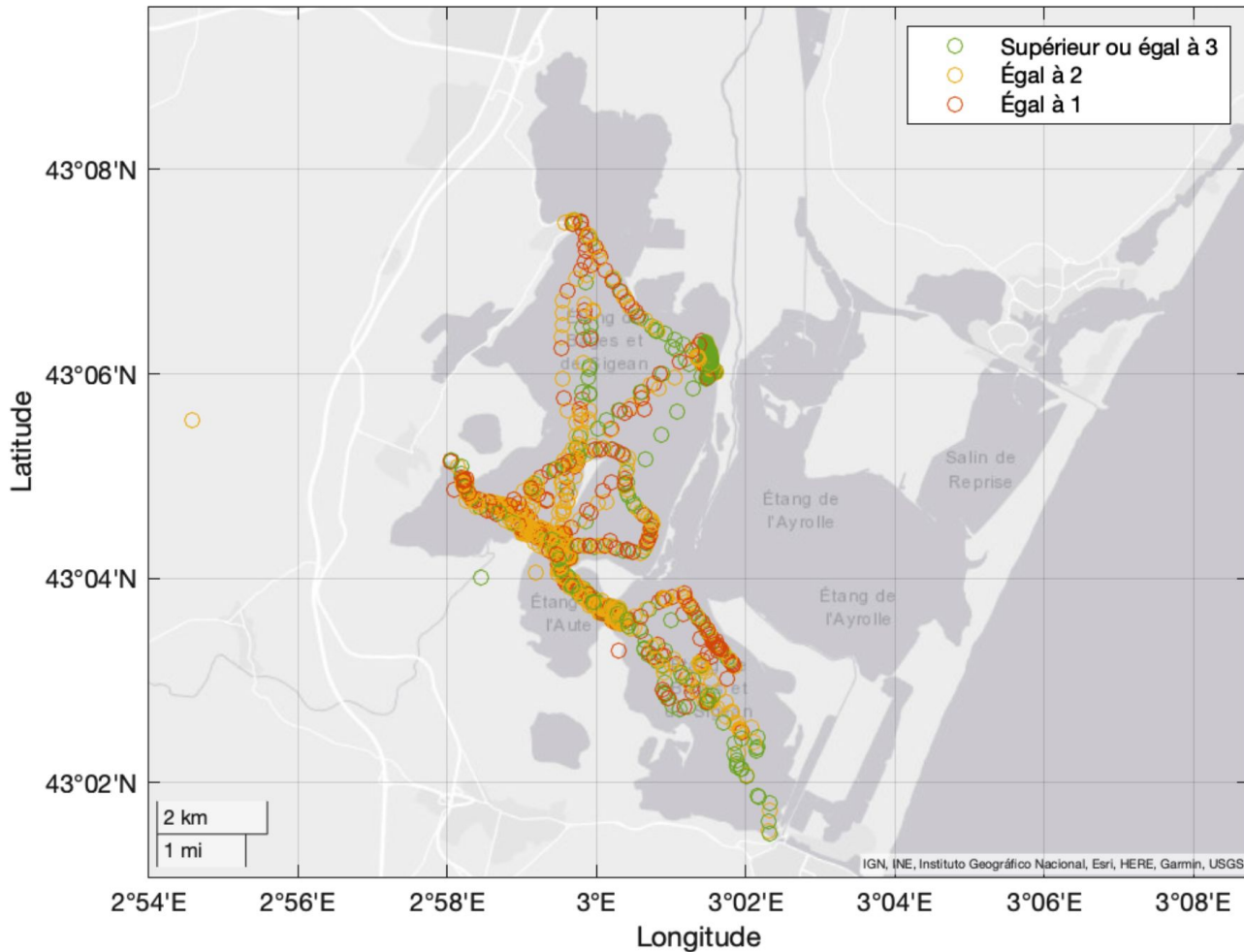
Source: How to tag a jellyfish? (2016)

# Première expérimentation - 2018



Source: Projet marquage méduses (2018)

# Couverture LoRa - 2022



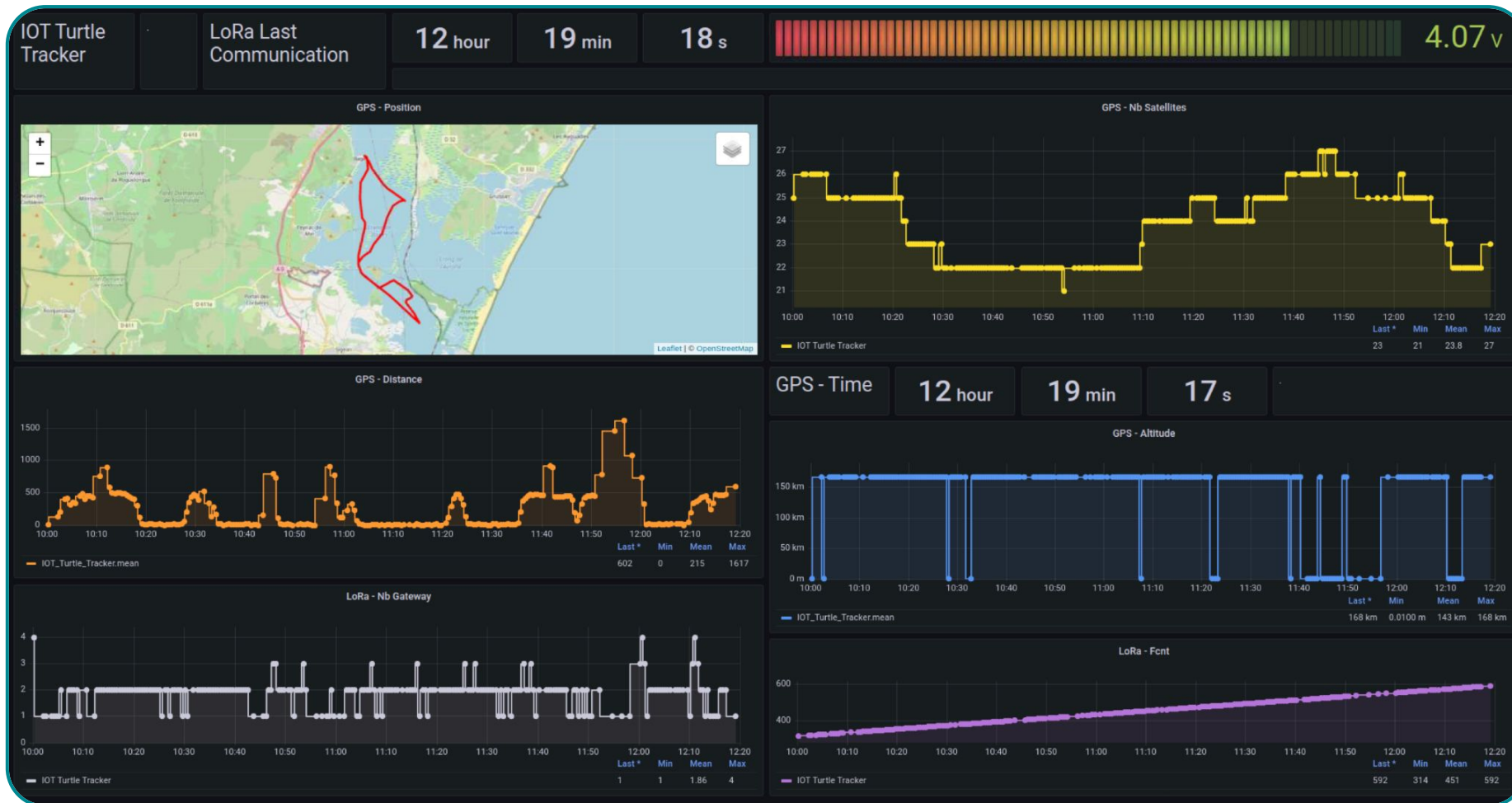
Nombre de gateways captés sur la lagune de Bages-Sigean

Nombre de message émis	4177	100 %
Nombre de message reçu	3826	91.6 %
3 gateways ou plus	943	24.6472 %
2 gateways	1889	49.3727 %
1 gateway	994	25.9801 %


## Analyse des données


- Faible couverture LoRa
- Présence de zones "blanche"
- Taux de réception variable selon météo

# Exemple de Dashboard - Grafana




# Exemple de messages - Discord


 JellyBot BOT 26/05/2023 10:50

 From: GNAT L082CZ - 02 @ 23.05.26 - 10h50 | 56

Position	43.061964, 2.999179
EHPE	22
LoRa NbGateways	2
Battery Level	3.93%
Temperature	30°C

 From: GNAT L082CZ - 02 @ 23.05.26 - 10h53 | 58

Position	43.061832, 2.998623
EHPE	23
LoRa NbGateways	2
Battery Level	3.93%
Temperature	29°C

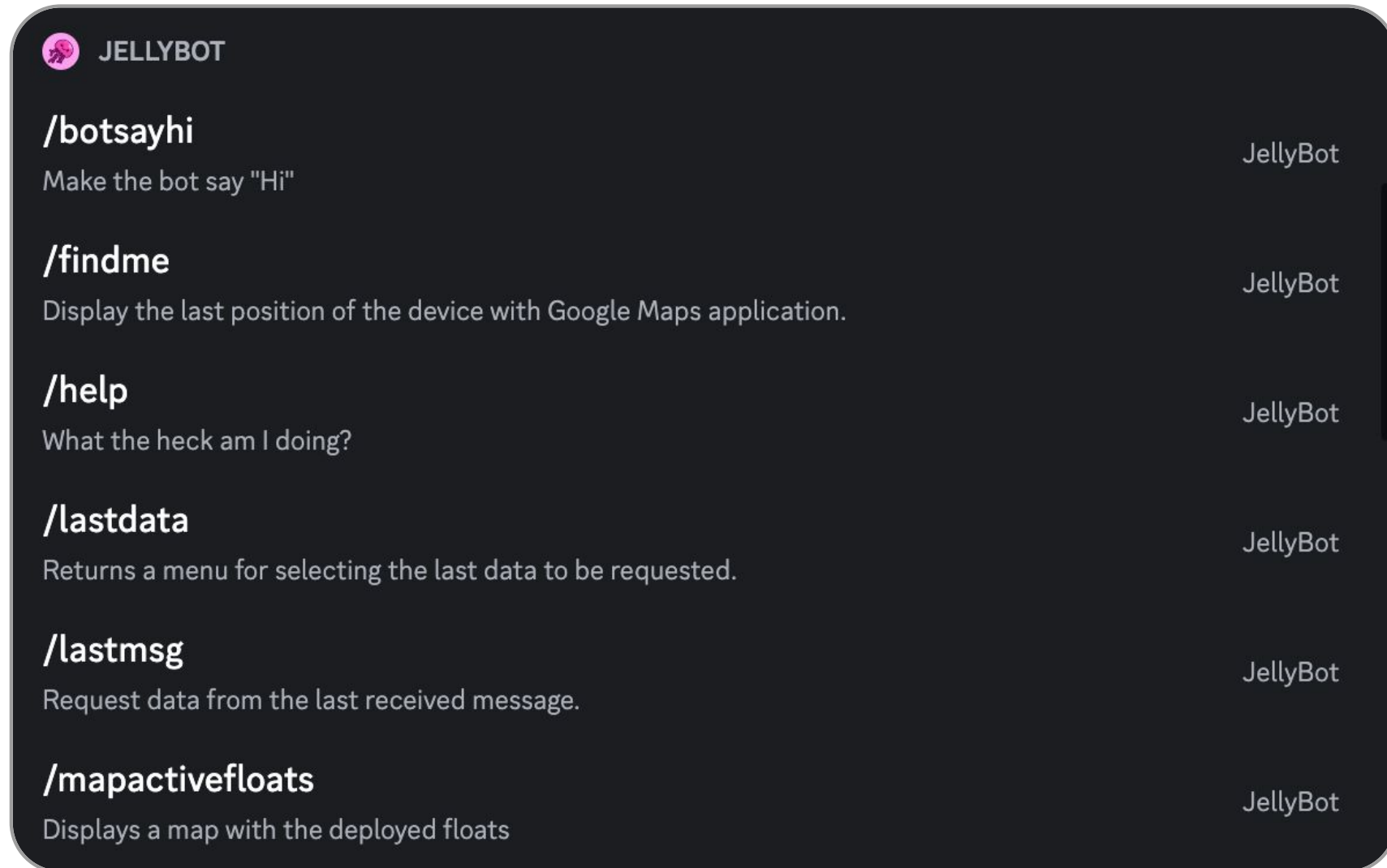
 From: GNAT L082CZ - 02 @ 23.05.26 - 10h55 | 59

Position	43.068144, 2.991886
EHPE	23
LoRa NbGateways	1
Battery Level	3.93%
Temperature	29°C





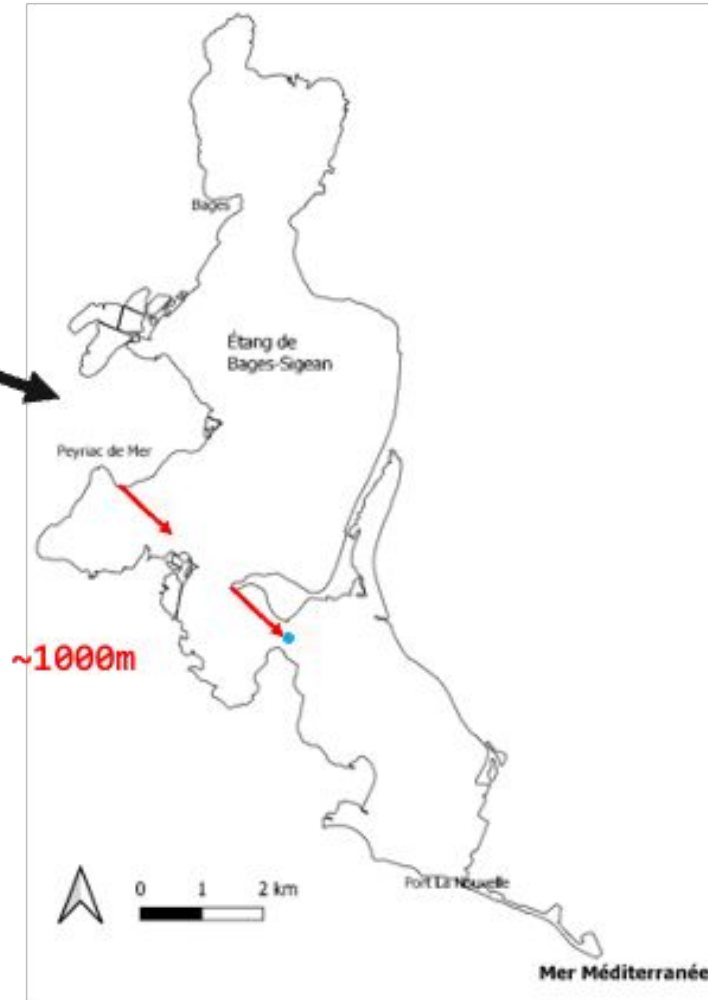
# Exemple de Dashboard - Grafana



**JELLYBOT**

<b>/botsayhi</b> Make the bot say "Hi"	JellyBot
<b>/findme</b> Display the last position of the device with Google Maps application.	JellyBot
<b>/help</b> What the heck am I doing?	JellyBot
<b>/lastdata</b> Returns a menu for selecting the last data to be requested.	JellyBot
<b>/lastmsg</b> Request data from the last received message.	JellyBot
<b>/mapactivefloats</b> Displays a map with the deployed floats	JellyBot

# Bages Sigean lagoon: a natural mesocosm



- Small surface 38km<sup>2</sup>
- Shallow lagoon 1.3m
- Natural reserve park
- Artisanal fishing activities

