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Oyster larval rearing trials in New Caledonia

Workshop Tropical Oyster Darwin 28 May 2023



Oyster in New Caledonia

All the work done has been possible thanks to the direct and indirect collaboration of several organisms. Whether it is by the organization of exchanges of experiences, advice and technical accompaniments but also by the financial supports.

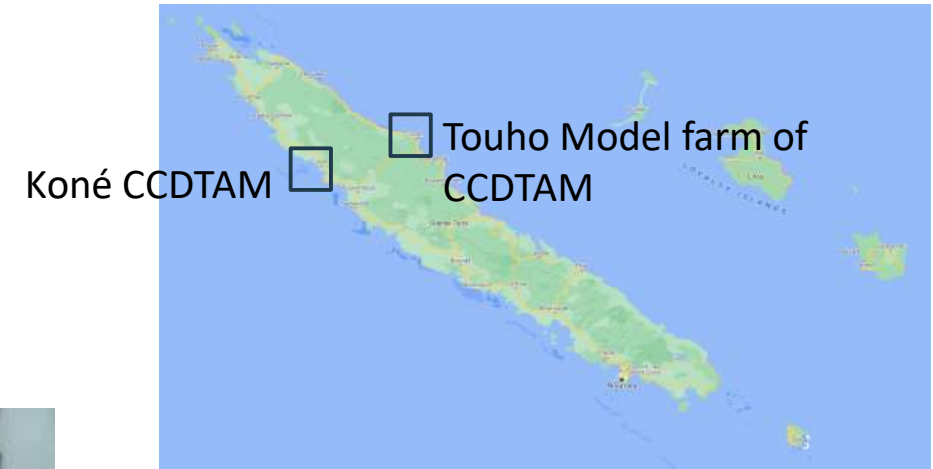


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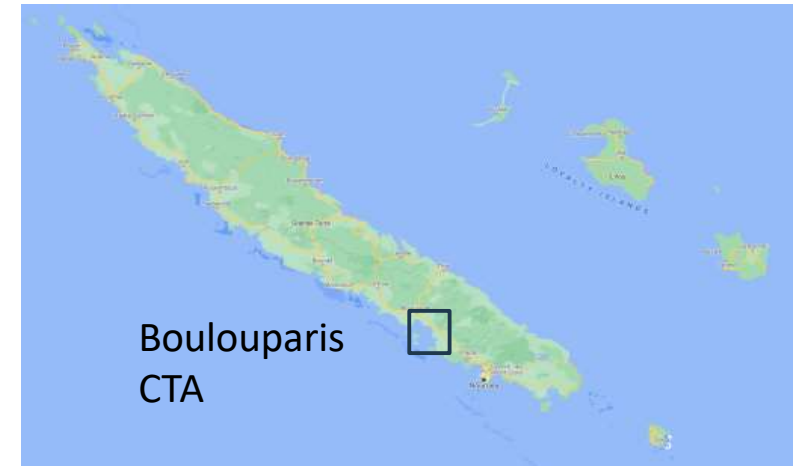
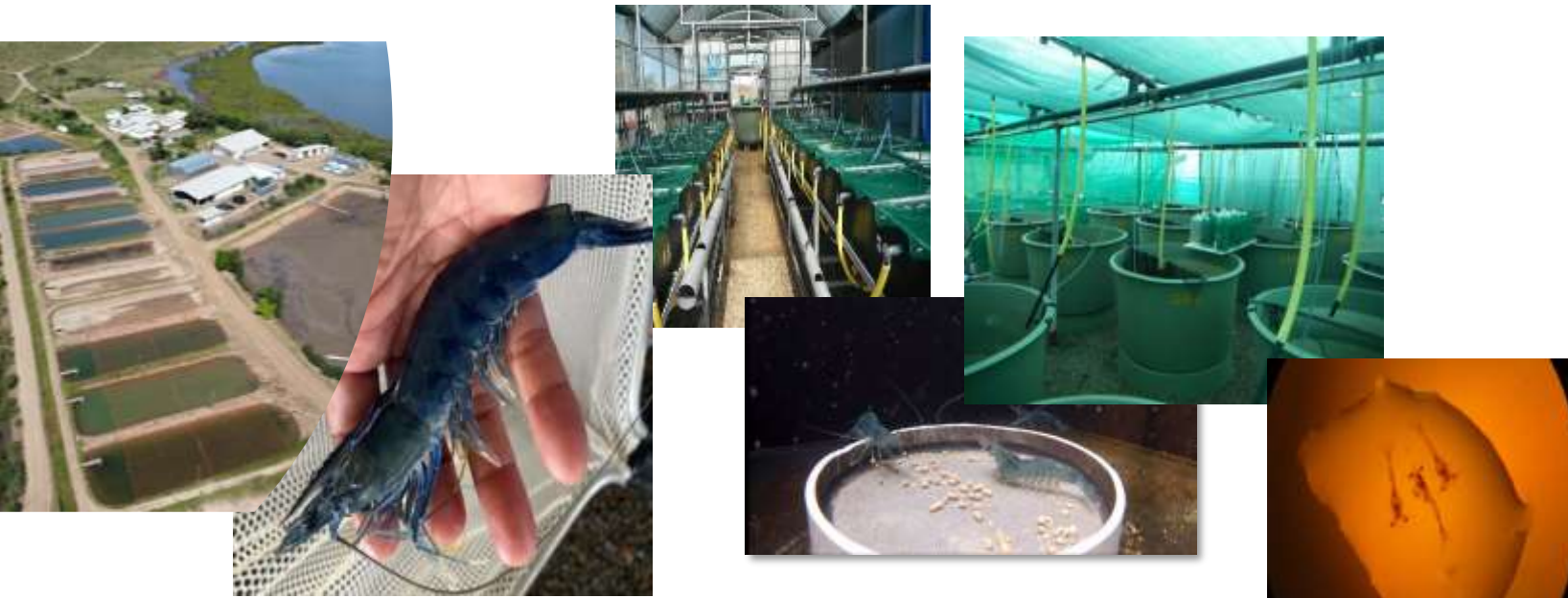
CCDTAM: Caledonia Marine Aquaculture Development and Transfer Center (Koné)

The CCDTAM was created in 2012 to develop fish farming in New Caledonia. The work is accessed on *Lutjanus sebae*, *Siganus lineatus* et *Siganus canaliculatus*.



CTA: Aquaculture Technical Center (Boulouparis)

The CTA works mainly on the blue shrimp *Litopenaeus stylirostris*. We carry out experiments in ponds, hatchery but also on nutrition and on aquaculture diversification. We cohabit and collaborate with Ifremer on the same site.



Oyster in New Caledonia

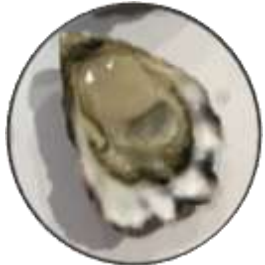
Between 6 and 7 species of oysters have been recorded in New Caledonia (Bourret 1979), 3 of which are reported to be abundant on the shores and in estuaries:

Identification according to morphological criteria only



- **Mangrove oyster- *Saccostrea cucullata***

- Lives on mangrove roots along rivers and estuary channels
- Mainly along the La Foa, Témala and Diahot rivers



- **Huître de roche - *Saccostrea echinata***

- More marine and deeper
- Mainly found in the bay of Prony, Népoui and Saint-Vincent



- **Huître rose - *Saccostrea amusa***

- Found on the rocks of beaten shores



Historical—First larval rearing test at CCDTAM (2016-2020)

The **Arembo oyster farm** producing rock oysters from natural catchment and **Michel Bermudes** of the Pacific Community are at the origin of the hatchery spat production project at Adecap Technpole.

Principle results:

- 14 trials were conducted
- 1 trial has a 13% survival before fixation and a 30% fixation rate

Production:

- **2019** – 10 000 spats => 5000 Arembo, 1500 CTA, 1500 CCDTAM

Main difficulties encountered:

- Large volume and limited number of tanks => does not allow for replicate tests
- Variable quality of fresh and sea water
- Limiting fish hatchery planning
- Lack of dedicated staff



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Historical – Spats growth CCDTAM

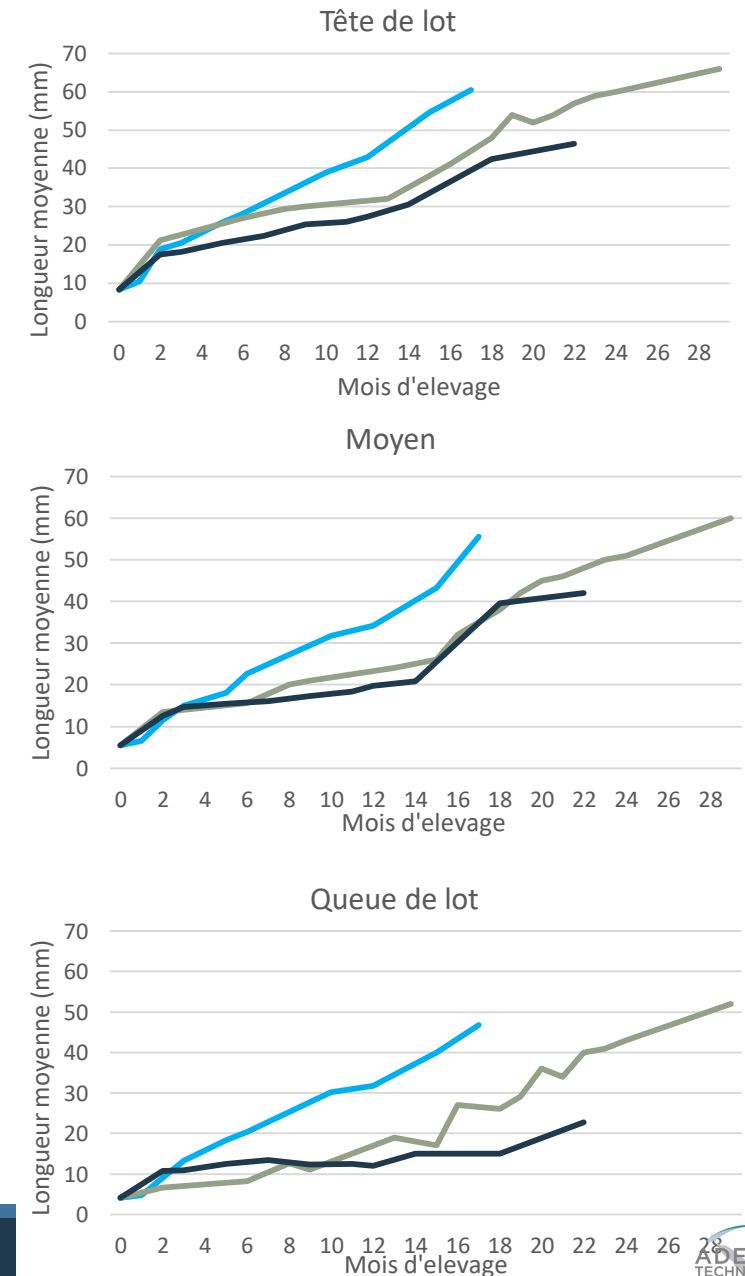
The spat produced in 2019 were divided into three batches on 3 different sites :

- **Arembo** : Breeding in the tidal zone – Bouraké
- **CTA**: In a shrimp pond – Boulouparis
- **CCDTAM**: In a tank fed with the excess of algae production - Koné

Résultats:

- For all three sizes, the trends show greater growth in shrimp farm type ponds
- Overall survival rate is 30%

- Interest in carrying out a pre-growth/growth in a pond where phytoplankton develops in a more important way, even more so in the presence of a farm (shrimp/fish)
- Warning: mortality observed in ponds during algae blooms



Location of the St-Vincent Aquaculture Station



Location of the St-Vincent Aquaculture Station



Water pumping and filtration



Pumping at sea:

- Pumping area about 2 meters deep
- Floating strainer 50cm below the surface
- Stop pumping below 0.8m tidal range

Water pumping and filtration



Primary Reserve:

- 500m³ liner
- Partial settling of water

Water pumping and filtration



Technical area:

- Sand filter 1500L
- Bag filter 25 μ m, 10 μ m
- Cold unit boiler
- Diesel boiler

Pompage et traitement de l'eau



Hatchery reserve:

- 50m³ resin concrete tank
- Continuous recirculation on 5µm, 1µm, UV and a heat exchanger at 29°C
- Recirculation of the water from the reserve on the skimmer

Tests conducted at CTA– PROTEGE Program

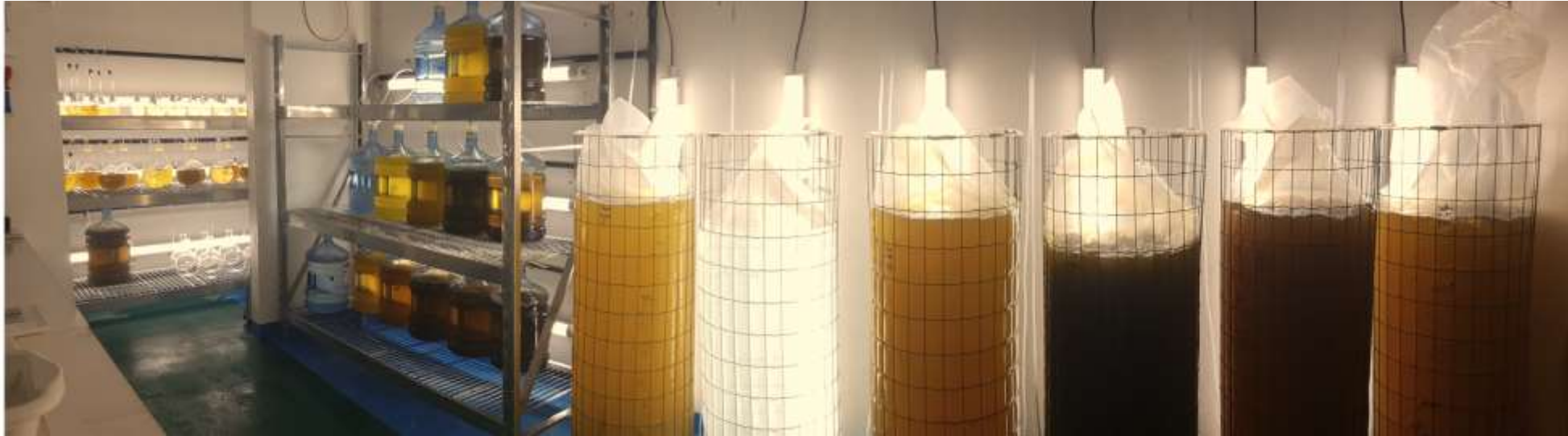
- Work done under the PROTEGE program (11^{ème} FED)
- Two components constitute the oyster action carried out in this program
 - ❖ **Component 1: Hatchery Spat Production:**
 - Control of reproduction and the larval cycle
 - Validation of the technical and financial feasibility of setting up an oyster hatchery on the territory
 - ❖ **Component 2: Spat collection in the natural environment:**
 - To know the favorable conditions for spawning => gonadal monitoring
 - Collection method and potential => installation of collectors

❖ **Component 1: Hatchery spat production**

- Need to adapt the existing structures to the SASV with the equipment of:
 - Algae room
 - Larvae rearing room
 - Micro-nursery
 - Nursery
 - Broodstock tanks

Tests conducted at CTA - PROTEGE Program

- **Creation of an algae room**



3 strains in culture:

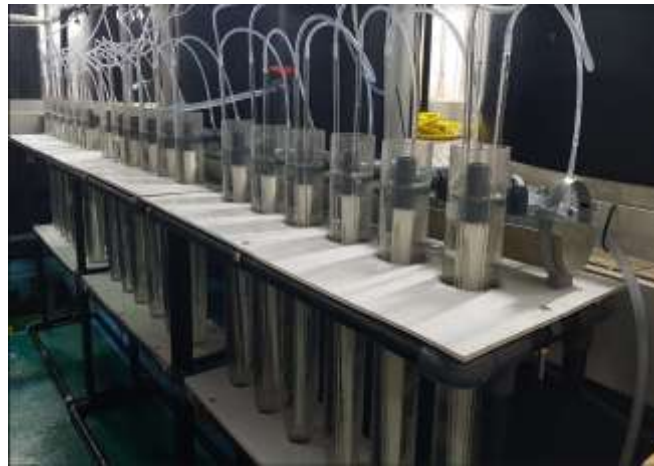
- *T.isochoyris lutea*
- *Chaetoceros calcitrans*
- *Chaetoceros muelleri*
- Maximum production capacity (theoretical): 100 litres/day

Tests conducted at CTA - PROTEGE Program

- **Installation of 2 larval production systems.**

18 CUDLS 2,5L(designed by the Cawthron institute):

- Continuous renewalsans
- Rearing density of 50 to 400 larvae/ml



Static tank of 150L:

- Complete emptying of the tank daily with the addition of antibiotics..
- Rearing density 8 larvae/ml



Tests conducted at CTA - PROTEGE Program

- **Micro-nursery**

Downweller:

- Downward flow of water on a bed of microbrisures (200-300 μ m) to optimize larvae attachment



Upweller:

- Upward flow of water to promote feeding and evacuation of faeces



Tests conducted at CTA - PROTEGE Program

- **Outdoor nursery**

Upweller:

- Optimization of growth through natural productivity of shrimp ponds



Tests conducted at CTA - PROTEGE Program

- **Broodstock Storage**

Pond:

- Installation of a floating pontoon to accommodate the storage baskets
- Algae provided by natural productivity



Thermoregulated maturation tanks:

- 2 heated and/or cooled tanks
- Daily distribution of 30 liters of algae/thank



- **Two larval rearing trials at CTA in March 2022**

- No fertilization performed with broodstock stored at CTA - Poor gonadal observation index.
- Use of broodstock taken from the natural environment:
 - **Test n°1 10/03/22**, origin: Baie St Vincent, hatching rate:**70%**, harvested larvae : **1,2** millions
 - **Test n°2 29/03/22**, origin: Touho, hatching rate:**55%**, harvested larvae: **2,3** millions
- For each trial, 1.2 million larvae were reared in static tanks at a density of 8 larvae/ml, in 150 liters.

Tests conducted at CTA - PROTEGE Program

- **larval protocol**
- **Salinity: 32 ppt**
- **Temperature: 30°C**
- **Erythromycine: 2,5ppm**
- **EDTA: 5ppm**

jour	Concentration d'algue	Distribution		
		Calci	Tiso	Mu
1	40 000	40 000		
2	40 000	40 000		
3	45 000	45 000		
4	50 000	40 000	10 000	
5	55 000	38 500	16 500	
6	60 000	42 000	18 000	
7	65 000	32 500	26 000	6 500
8	70 000	35 000	28 000	7 000
9	75 000	30 000	30 000	15 000
10	75 000	22 500	30 000	22 500
11	75 000	22 500	30 000	22 500
12	75 000	22 500	30 000	22 500
13	75 000	15 000	30 000	30 000
14	80 000	16 000	32 000	32 000
15	80 000	16 000	32 000	32 000
16	80 000	8 000	32 000	40 000
17	85 000		34 000	51 000
18	85 000		34 000	51 000
19	90 000		36 000	54 000
20	90 000		36 000	54 000
21	90 000		36 000	54 000

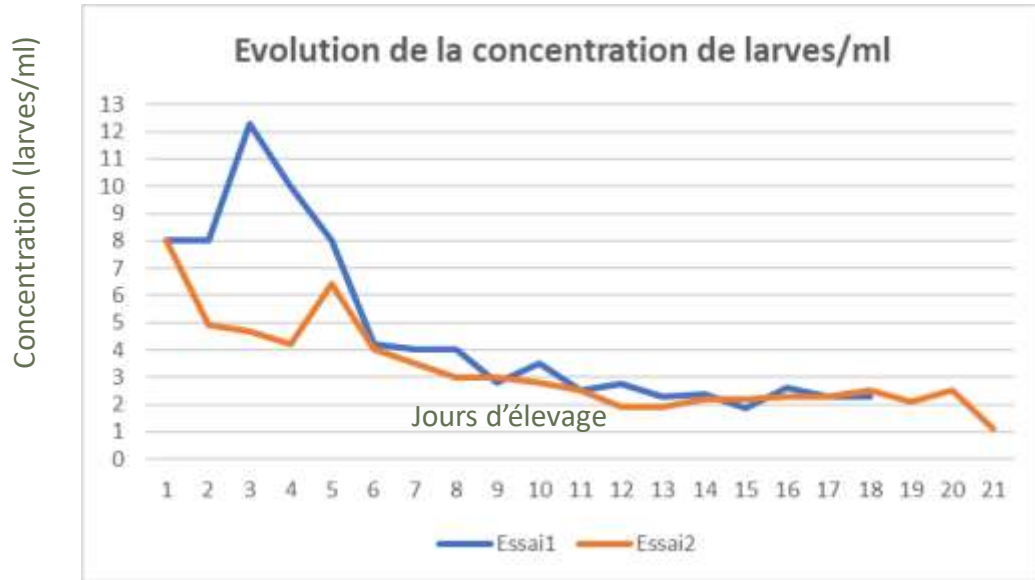


PROTEGE

Tests conducted at CTA - PROTEGE Program

❖ Results of larval rearing

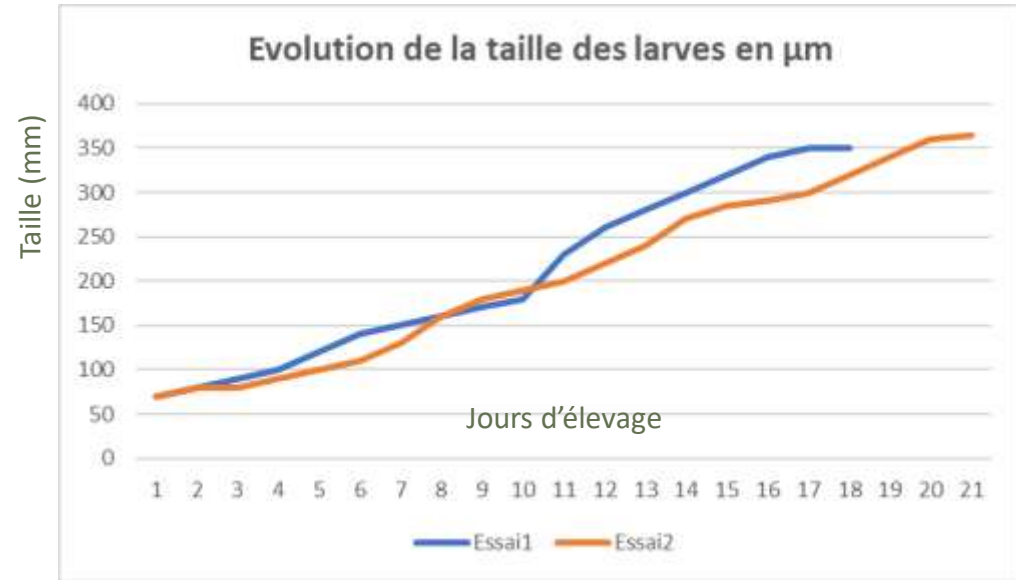
Survivale



Essai 1: 319 500 larves
Survivale: **26,6%**

Essai 2: 169 500 larves
Survivale: **14,12%**

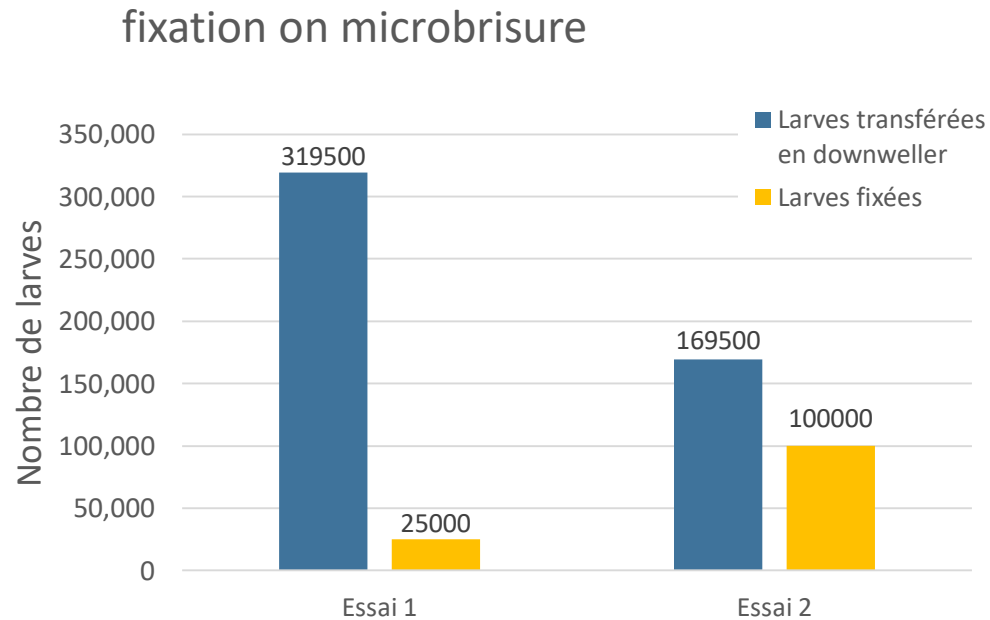
Growth



Essai 1: 350µm à J18
- Larvae kept on **180µ**

Essai 2: 360µm à J21
- Larvae kept on **236µ**

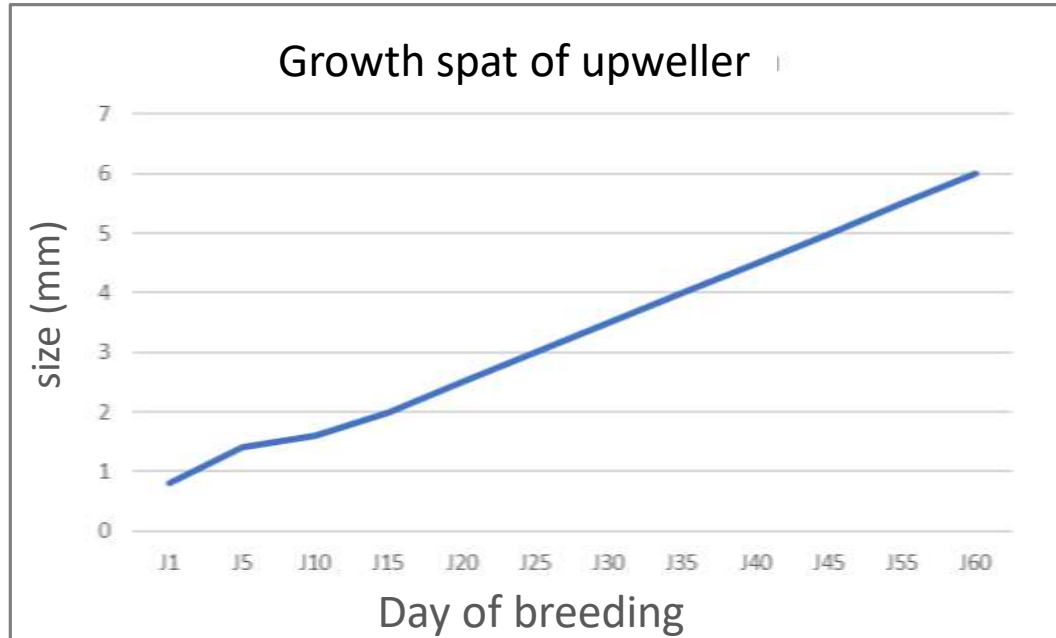
❖ Downweller Results



Essai 1: 25 000 spats
 - Percentage of fixation: **7,82%**

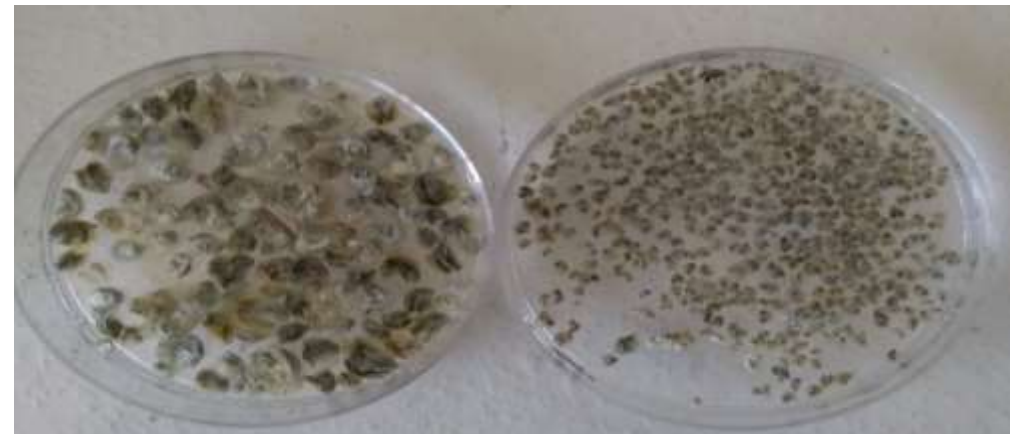
Essai 2: 100 000 spats
 -Percentage of fixation: **59%**

❖ Upweller Results



Test 1: 82 days of upweller
 -11900 spats > 4mm
 -14540 spats < 4mm

Test 2: 60 days of upweller
 - 13650 spats > 4mm
 - 90460 spats < 4mm
 - 2650 spats < 1mm jetés



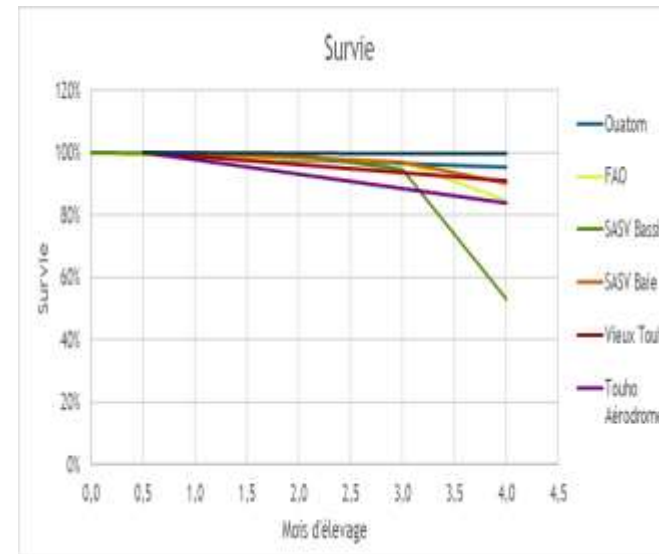
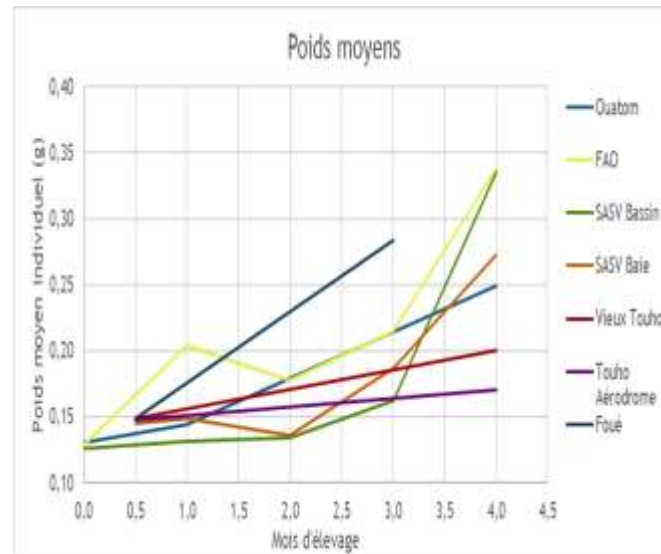
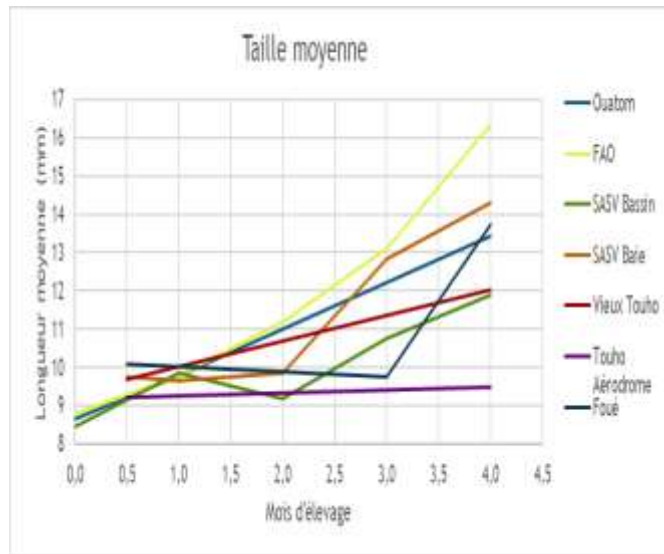
❖ Upweller extérieur:



Transfert des naissains le 23 Juin 2022, total Essai 1 et 2 :130 550

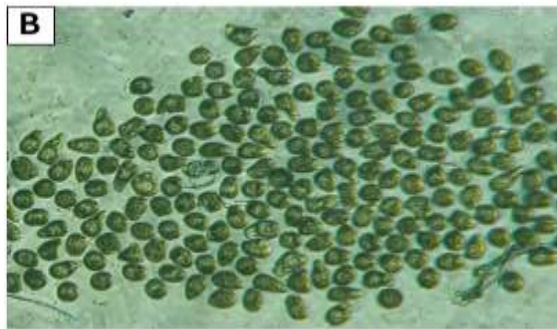
Tests conducted at CTA - PROTEGE Program

- ❖ Transfer of 70,000 spat to the Arembo oyster farm and 2,500 to 3,000 spat to 9 small oyster farm project holders to collect data. All holders have been equipped with growth materials financed by the PROTEGE project.



❖ Component 2: Spat collector in the natural environment

- Need to know the favorable conditions for spawning => gonadal monitoring:
 - Observation of the percentage of gonad/chair
 - Observation of gametes, shape, mobility and attribution of a gonadal index



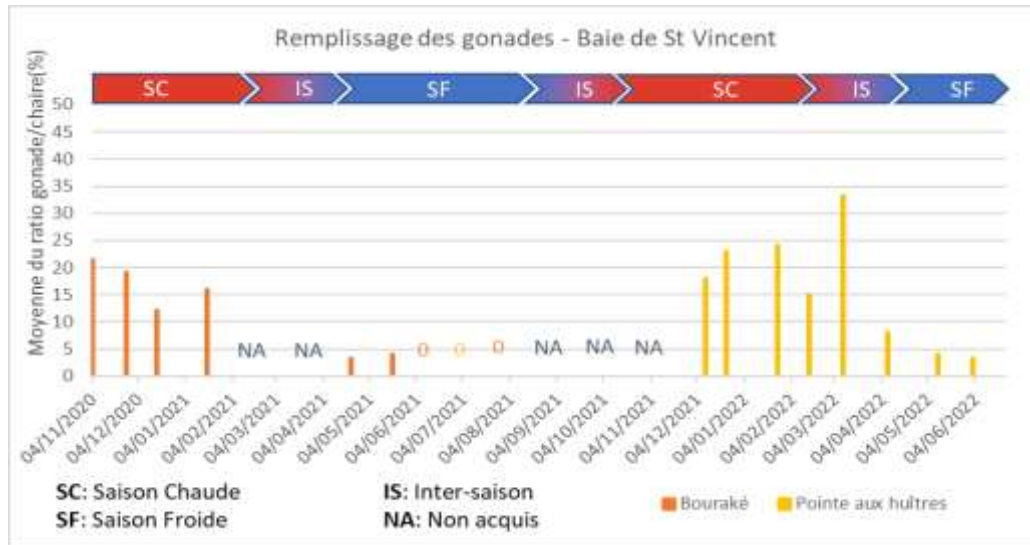


PROTEGE

Tests conducted at CTA - PROTEGE Program

❖ Gonadal monitoring

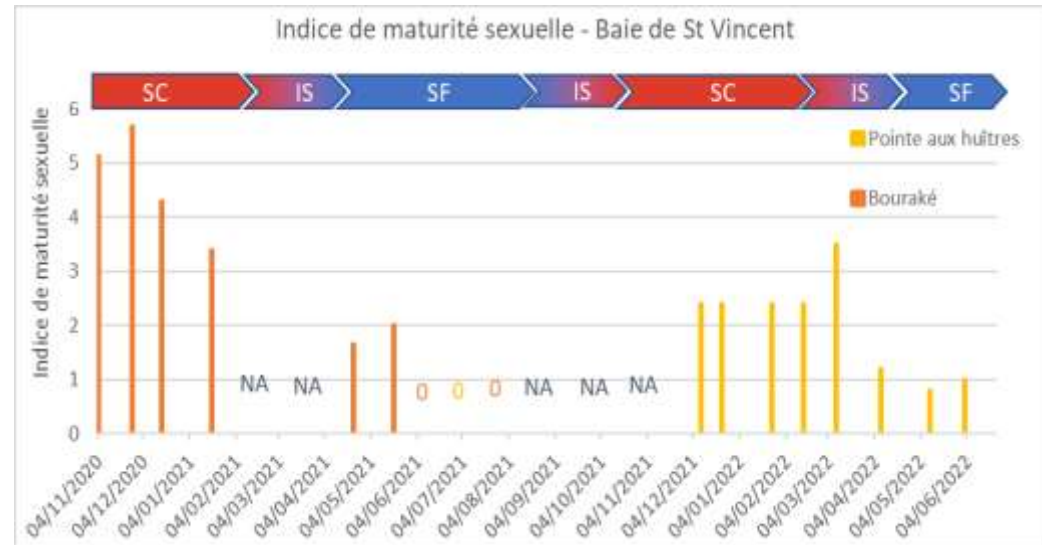
Observation of the percentage of gonad/chaire of a gonadal index



Difficulties encountered:

- Obtaining off-season fishing permits
- Containment COVID19
- El nina period

Observation of gametes, shape, mobility and attribution



Usable results:

- Oviposition period favored in warm season
- Laying triggered during heavy rains
- Many partial layings during the season exacerbated by El nina
- Percentage of gonad rarely above 50%.

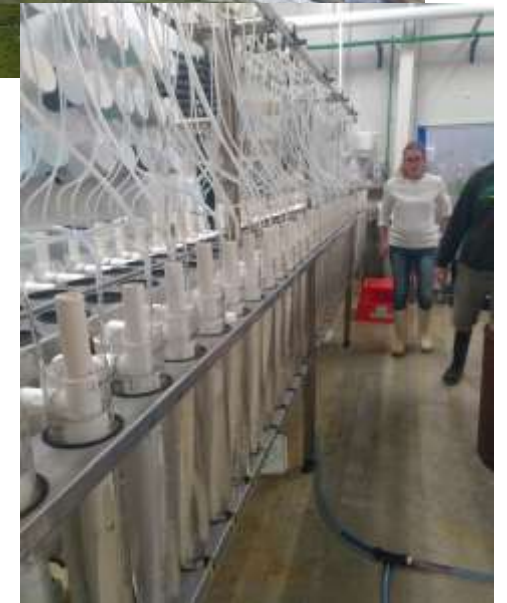
❖ Collection method and potential => installation of collectors

- 15 spat collector spread over 5 sites.
- 1000 to 3500 spat collected by unit
- Many spats died due to predation (*Ocenebra* sp)
- Experimentation in progress and search for ways to improve

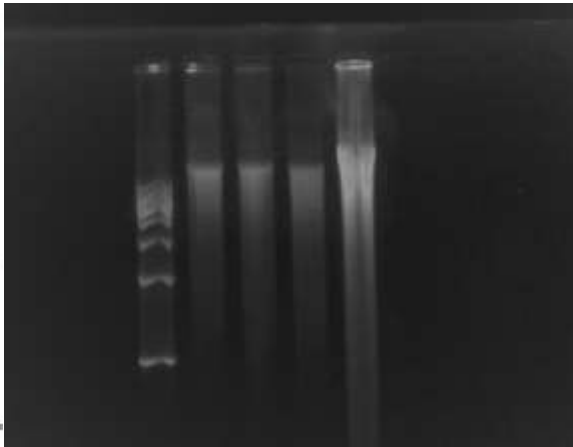
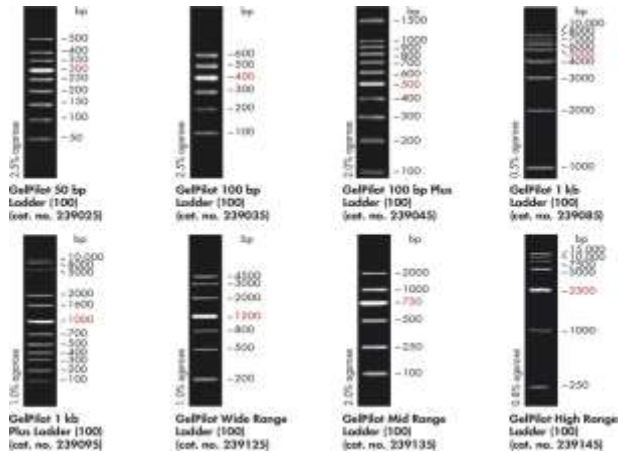


Collaboration and exchange with the Cawthron Institute

- Exchanges with the Cawthron Institute were initiated at the end of 2020 with Julien Vignier (Aquaculture scientist) and financed by the specific fund.
- They were concretized by a training of 3 weeks at the Cawthron Aquaculture Park of Nelson in October 2022 of the person in charge of hatchery of the CTA (me) and of a carrier of project of private oyster hatchery.
- Julien Vignier came 3 weeks in April to the Aquaculture Station of St Vincent to accompany us on a cycle of reproduction and larval rearing.
- Other collaborations should follow...



- A genetic identification campaign of the different species present in New Caledonia has been launched in collaboration with IFREMER.
- Explorations will be carried out on at least 5 sites from North to South and on the East and West coast.
- 6 different morphotypes were found only on the site of the Aquaculture Station of St Vincent.
- First results expected in June





Thanks for your attention