

## Consultation “Let’s Be Nice to the Ocean”

Paul Ricard Oceanographic Institute’s contributions: new models of aquaculture in sustainability science and circular economy approaches.

### **Addressing the challenges of climate change and oceanic ecosystems protection**

Aquaculture, as it is currently practiced, does not meet the triple imperative of feeding humanity by guaranteeing food security and sovereignty whilst preserving climate and ecosystems’ biodiversity. Changing the practices and accelerating research and innovation to develop alternative solutions are essential.

Therefore, the Paul Ricard Oceanographic Institute adopted an ecosystemic vision of aquaculture, fully integrating it into the overall framework of sustainability sciences, which simultaneously take into account several SDGs as well as their interactions. A fully integrated vision of aquaculture, that considers the Ocean -impacts and risks-, climate -adaptation and mitigation-, and biodiversity -halieutic resources and biodiversity conservation-, will be the basis for the land based multitrophic production model, placed as close as possible to consumption basins.

### **A flawed system on the verge of collapsing**

The acceleration of research, innovation and the lifting of bio-technological and regulatory obstacles are essential for this achievement. In order to make aquaculture sustainable, we must face head on the fact that it relies on a deeply flawed system, currently facing the dangers of overfishing, plummeting halieutic stocks, illegal fishing and climate change.

We are thus left facing a two fully intertwined threats:

- An economic downfall (and its social repercussions)
- An ecological collapse.

### **Fish meal: Aquaculture’s greatest vector of change for its sustainability**

As an answer to this assessment, the Paul Ricard Oceanographic Institute is developing alternative aquaculture feeds, made of insect proteins enriched with microalgae and marine organisms. The development of these alternative feeds and sustainable proteins are meant to effectively replace the traditionally used wild fish feed. A sustainable aquaculture feed based off insects’ flours is key to make aquaculture sustainable and to guarantee food security and sovereignty.

Moreover, the use of insect flours gives us the opportunity to place aquaculture even further in a sustainable food production through circular economy: insects, mainly the larvae of soldier flies, can through bioconversion be fed by agricultural and urban food waste.

In a world where food systems will be seriously disrupted, maintaining, and enhancing micronutrients (vitamins and proteins) in virtuous loops will be critical.

### **The carbon impact:**

In terms of carbon emissions, the carbon impact of the aquaculture sector should no longer be ignored. It is threefold:

1. Emissions from vessels fishing for long periods of times for pelagic fish, using onboard freezing.
2. The impacts of the cold chain for the preparation, transformation, conservation, and transport of the products.
3. Emissions from offshore aquaculture farms.

To address this triple carbon impact, production now must be land-based and placed as close as possible to consumption basins in order to drastically reduce the use of the cold chain.

### **Responses to a changing marine environment: Land based production, IMTA and positive impacts on communities.**

We must remember that whenever a fish is taken out of the water, it is being dug in ice. Ice is made of two of our future's scarcities: water and energy. We therefore urgently need to develop alternative practices to end that vicious process. Land based production sites, near consumption basins are one of them.

Considering global changes -extreme meteorological events, heatwaves, PH, deoxygenation, physical and biochemical changes-, science alerts us that the risks of disruptive events jeopardising offshore productions are increasing.

In addition, landbased production and its yield can be maximised through integrated multitrophic production, which allows, through re-creation of food chains, rearing of bivalves, molluscs, sea urchins and algae by only feeding the top predatory fish.

On a community-based level, there are great social benefits to bringing food protein production site back within community. This notably creates accessible jobs.

### **Transfer of competences, trainings, and replicability of models**

The need to accelerate towards sustainable, local and land-based fish production cannot be done without considering the issue of the producers' initial training as well as the dissemination of best practices and replicability of models.

It is essential to develop training programmes adapted to the territories' and communities' realities in order to allow the implementation of those technical solutions.

We believe the trainings must be tailored to the trainees' realities and needs as well as offer a wide array of programmes, ranging from the understanding of the activities' environmental impacts, to teaching of innovative breakthrough practices.

Considering the urgency of the situation, the need for competence transfers and trainings is dire, and the education must be scaled down and tailored to the participant's realities and adapted to low-tech, high-efficiency unit productions.

The Paul Ricard Oceanographic Institute is thus building a research and training platform in marine biology, aquaculture and sustainable innovations on the Embiez Island (Southern France), where flexible trainings in these techniques will be organised for students, farmers, entrepreneurs and stakeholders involved in those activities and transition models. This will be opened to both developed and developing countries.

This new model for aquaculture, placed as close as possible to consumer basins and linked to the local communities, will create inclusive jobs and allow us to address food security and sovereignty through sustainability sciences.

In the imminent prospect where we will be 9 billion human beings, we must act now. For either aquaculture will become the accelerator of our societies' disruptions, or the bedrock of our resilience.