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IS BLUE GROWTH A DRIVER OR A CONSTRAINT TO THE SUSTAINABILITY OF MARINE AQUACULTURE DEVELOPMENTS? REVIEWS OF BOTTLENECKS AND LESSONS FROM PAST DEVELOPMENTS.

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Abstract

After an initial rapid and strong growth, the development of marine aquaculture in Europe (EU) has shown signs of stagnation, even regression in some Member States. The explanatory factors of this stagnation have often taken the form of technical constraints, disease control and environmental management, constraints on production factors (access to capital, access to space, access to knowledge...). In addition to these constraints, there are significant conflicts of use with other activities, both for access to resources and for environmental impacts suffered or emitted. However, the explanatory factors have paid little attention to socio-economic forcing, whether it be the adequacy between production systems and markets, or even the consumption modes, or the adequacy of aquaculture developments with the territories where they take place. In addition, the growth of production has often been accompanied by increasing difficulties in terms of farms' profitability.

Notwithstanding these issues and following the financial crisis of 2008, Blue Growth has been perceived as a development opportunity through a series of key sectors that are expected to boost the economy and provide jobs and welfare (EC, 2017). Among these sectors, marine aquaculture raises high expectations through Blue Growth and its declination into the European Union's integrated maritime policy and its marine spatial planning tool (MSP). Seen as a tool for integration, and even integrated management, the MSP is also put forward as a factor for improving the social acceptability of aquaculture developments, especially through the approach of Allocated Zones to Aquaculture (AZAs), reinforced by communication actions aimed at mitigating the misperceptions that consumers and citizens might express about aquaculture and its products. The stagnation of catches from fisheries, the increasing demand per capita in seafood products supported by an ever increasing world demography and confirmed by the various models reinforce the role henceforth devolved to aquaculture to provide for this growth.

A review of issues and bottlenecks to the development of marine aquaculture in Europe and in the world nevertheless makes it possible to underline an important number of constraints which can break and question the desired or planned development, but also a certain number of contradictions between the stated objectives and the reality of developments. This long-standing dynamic linked to the first developments related to the Blue Revolution still seems to be at work. The same causes leading to the same effects, the adequacy of the objectives assigned to aquaculture developments with a sustainability approach is questionable. A review of development experiences within the H2020 MedAID project reinforces an initial statement related to the lack of attention paid to the adequacy of aquaculture

objectives with the territories that support them, with markets and their evolution and with consumer expectations. If technological solutions and innovations remain at the heart of aquaculture developments, these constraints underline their necessary but not sufficient property and the needs for more holistic approach centred on governance.

Keywords: Sustainable aquaculture, Bottlenecks to development, European Blue Growth, Holistic approaches, Aquaculture development policies

EC (2017). Report on the Blue Growth Strategy, Towards more sustainable growth and jobs in the blue economy. Commission Staff working document on Blue Growth 2013-2016, SWD(2017) 128 final, 61p.

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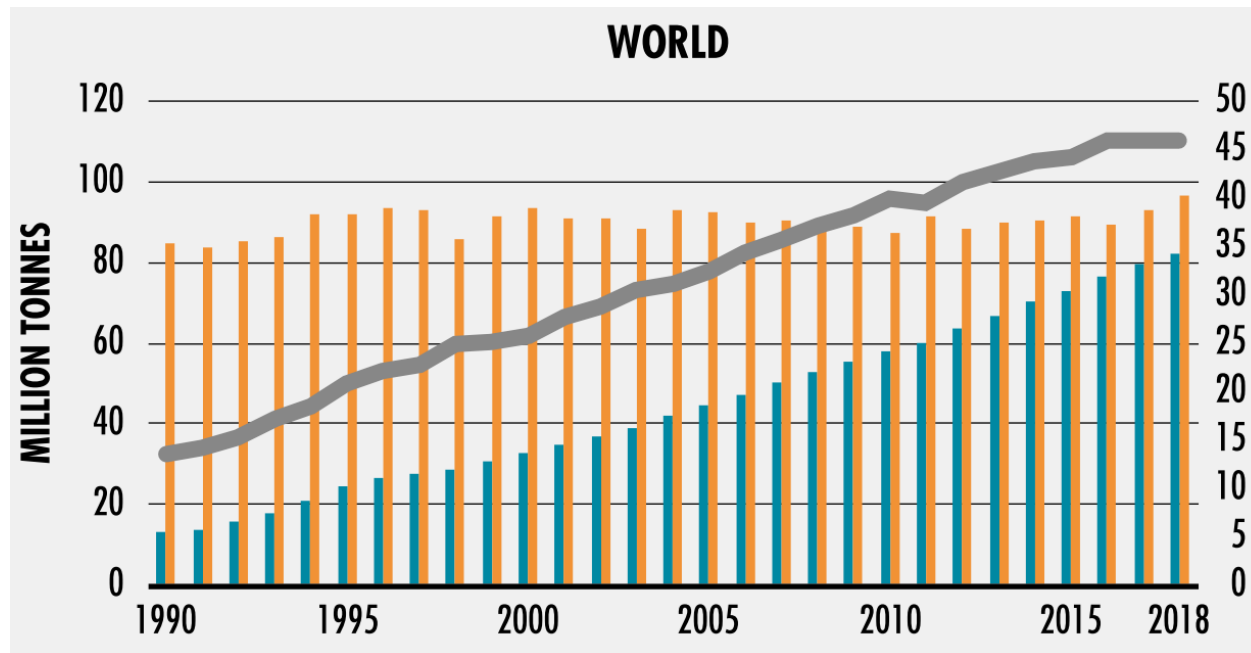
- 1. Aquaculture development within the Blue Revolution period**
- 2. Aquaculture development and the Blue Growth Strategy**
- 3. Lessons learned from aquaculture development: toward the Social Acceptability of aquaculture developments**

Marine Aquaculture Development: Challenges?

From where we came to where we go...

Step 1. Blue Revolution

The rapid expansion of intensive commercial aquaculture, the development of the so-called "new aquaculture" (marine) in the 80s. Salmon, Shrimps (penaeid), Seabass and Seabream as the main species developed.

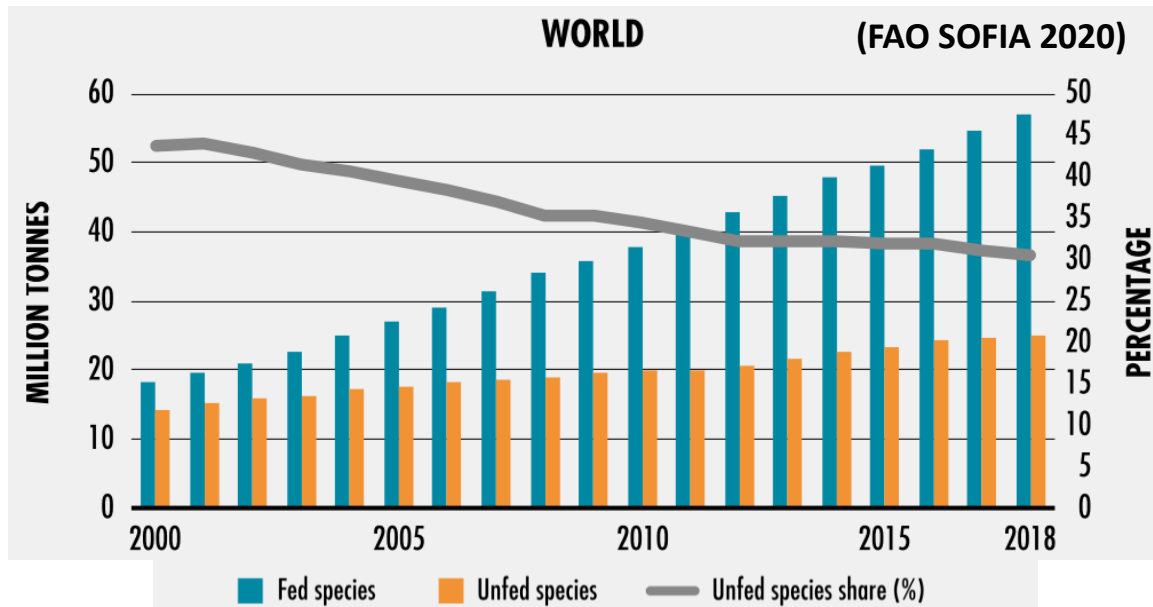


Over the last three decades (1980-2010), world production of farmed fish for human consumption has increased almost 12-fold, with an average annual growth rate of 8.8%. Despite decreasing growth, aquaculture has been the engine of growth in total fish production since the 90s. In 2014 and for the first time, the supply of fish for human consumption from aquaculture was higher than that from catches.

Contribution of aquaculture in total production of aquatic animals (FAO SOFIA 2020)

1. Blue Revolution

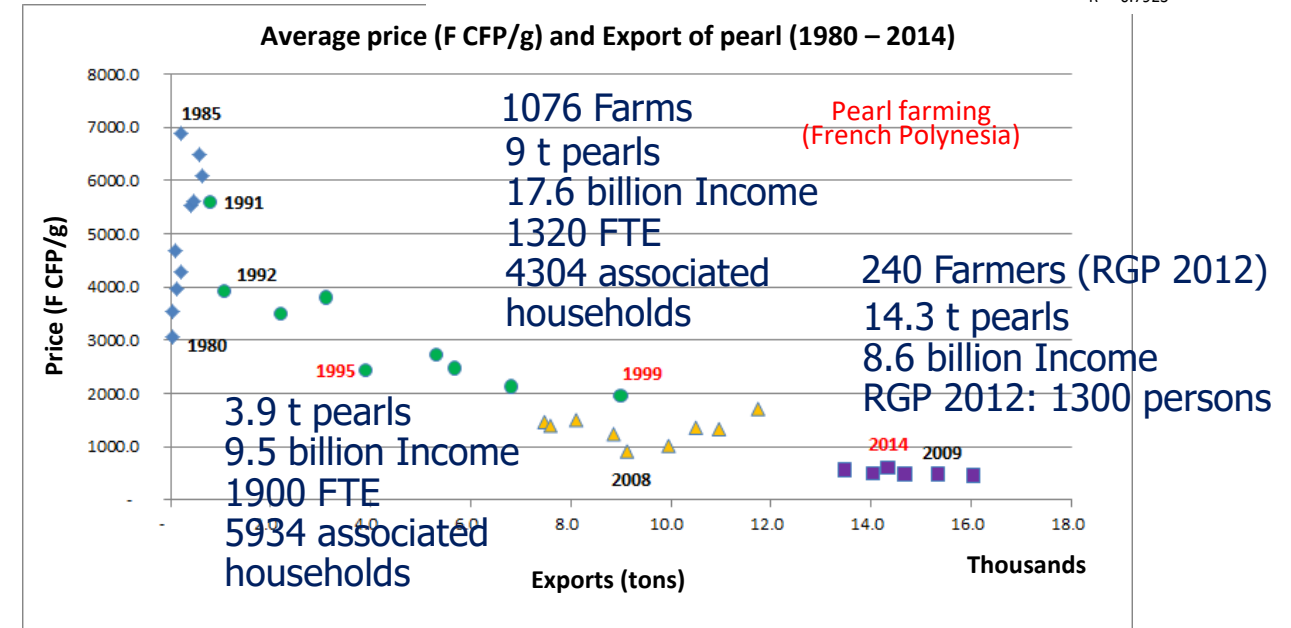
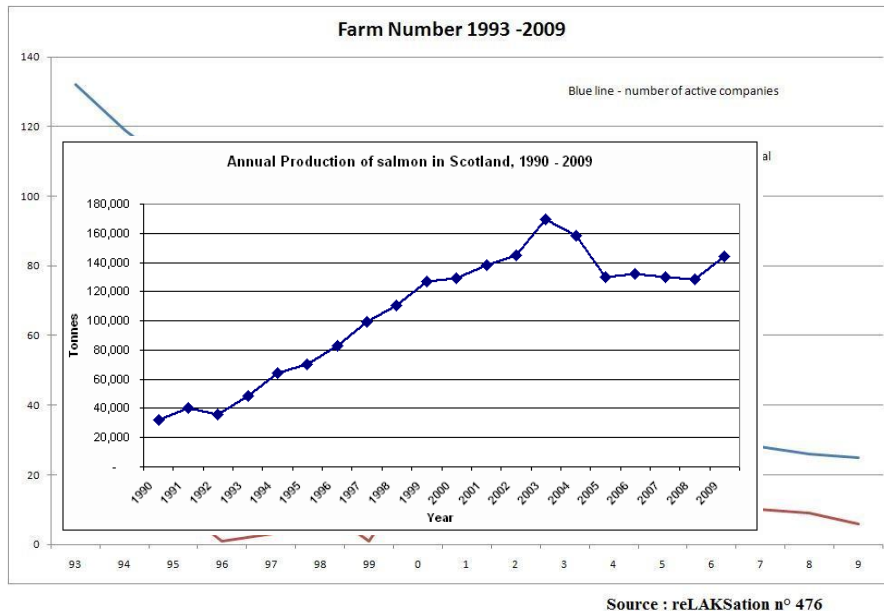
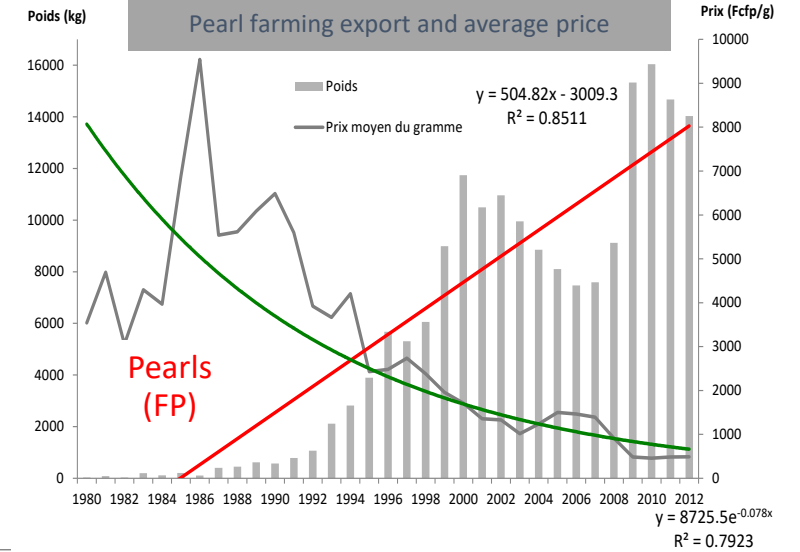
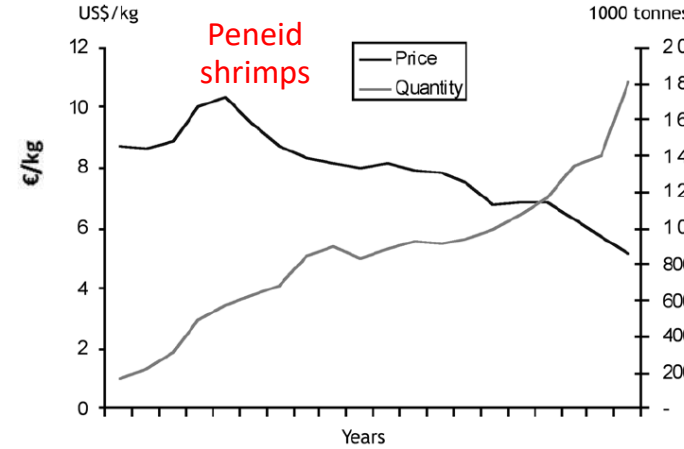
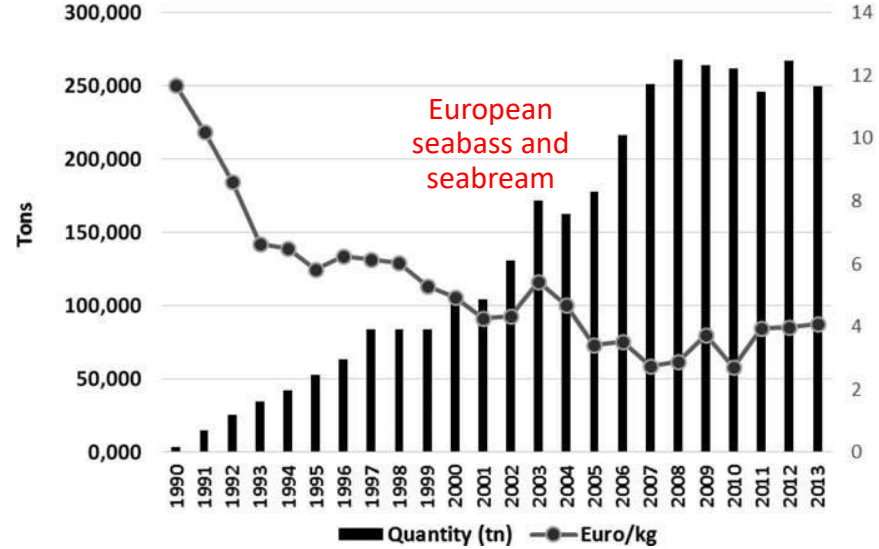
Its implementation has raised many concerns: production becoming energy-intensive, nutrient pollution, vector of invasive species, habitat destruction, ecosystem integrity, spread of diseases... and an aquaculture becoming a consumer of resources via fishmeal and fish oil instead of being a net producer of animal proteins (Pullin et al. 1993; Folke et al. 1998; Goldberg and Triplett 1997...).



To maintain its production and continue to grow, aquaculture must overcome a number of growing constraints.

An approach rather in terms of technological and engineering responses (species, genetics, disease, domestication, nutrition, CoC, BMPs, simplification of administrative procedures...). But little or no institutional and organisational innovation and a development **too often disconnected from the characteristics of demand and preferences.**

Farm gate prices impacted by the dramatic increase of supply. A classic price mechanism part of the Demand and Supply market mechanism.



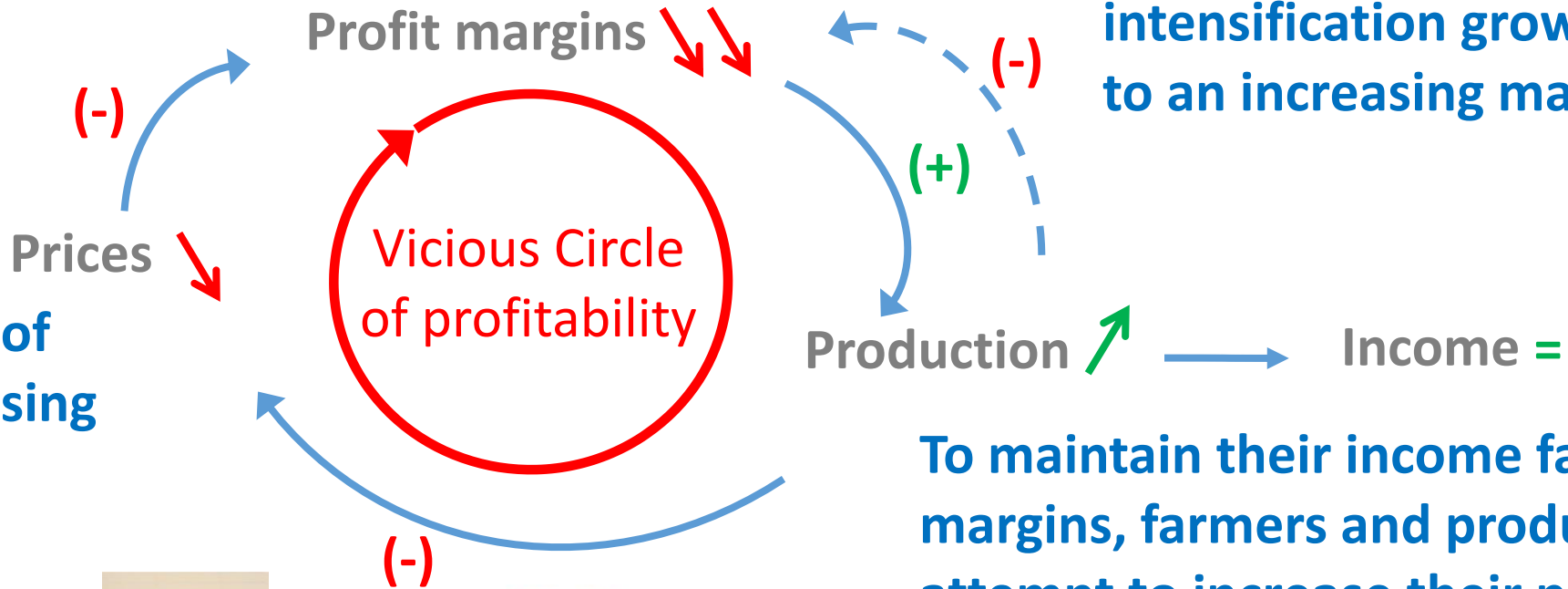
Lower economic efficiency in the use of resources, and fewer induced effects (jobs), but greater technical efficiency to maintain and increase production volumes. Collective result at the industry level of the sum of individual and rationale choices at farm level.

Economic vicious circle of aquaculture development at farm level

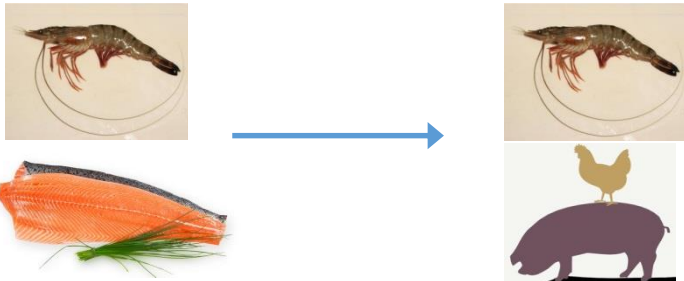
For the same level of production, a decrease in prices induces a decrease in profit margins and then in income

A first negative feedback due to difficulties in mastering the intensification growth leading to an increasing marginal costs

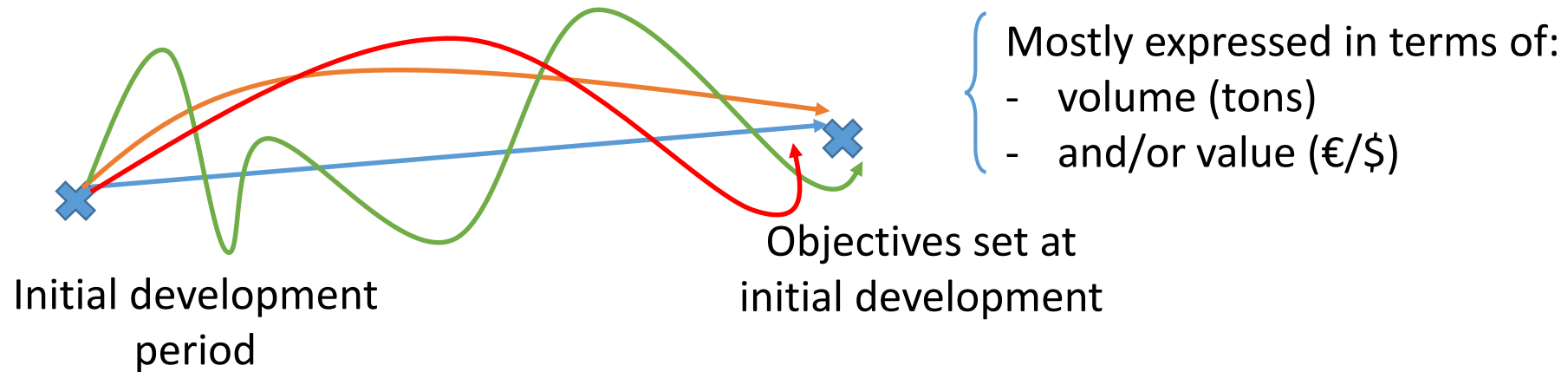
In a context of price decreasing



To maintain their income facing lower margins, farmers and producers attempt to increase their production



A development too disconnected from markets AND, more importantly, from market evolutions.



Objectives set in terms of volumes, but how is the transition being made?

- Technology, while obviously necessary and the basis for aquaculture, is not sufficient itself to ensure the sustainability.
- From technical and environmental ones, the main bottlenecks to development moved to socio-economic ones.
- The question of the transition between the present situation and the objectives set: path to sustainability, transition shocks, vulnerability and adaptation of farms, relevance of the objectives and means of achieving them.

The industry is then trapped in a single cost reduction strategy, when other potential strategies (e.g. better segmentation) are pushed at the back of the stage.

2. Blue Growth (2012) and Aquaculture

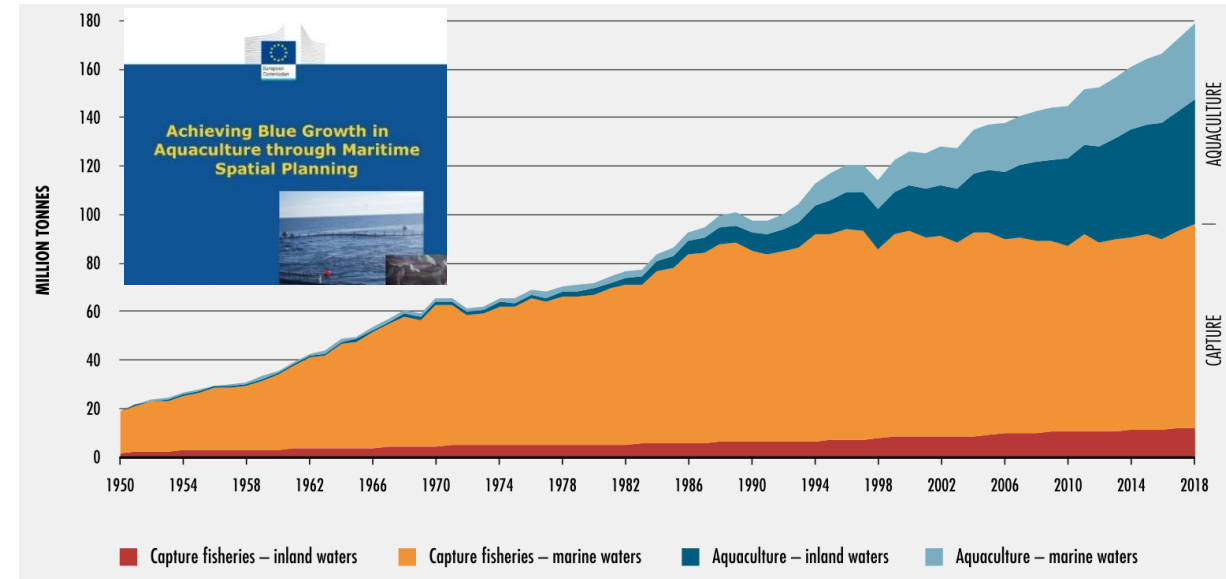
There are new drivers to aquaculture development:

- Fastest-growing food production sector
- Increasing demand for seafood products (population growth, urbanization, rising living standards, international trade offering greater choices...)
- Stagnating catches from the 90s' (about 90 million t.)

Aquaculture is therefore required to meet these needs by increasing its production by 50% from 2008 to 2022 and doubling it by 2030 (IFPRI's IMPACT model).

European aquaculture, a pillar of Blue Growth.
A quantitative and spatial expansion vision to be implemented through:

- Integrated Maritime Policy
- Strategic guidelines for the sustainable development of aquaculture in the EU
- National and Regional Strategic Aquaculture Plans
- MSP Maritime Spatial Planning



**World Fisheries and Aquaculture Production
1950 – 2018 (FAO 2020)**

A trend to move to offshore to break free from environmental constraints and conflicts of use: IMTA, Multi-uses Offshore Platforms.

Still a rather technical and technological response to aquaculture sustainability through an approach in terms of environmental sustainability. Issues from the Blue Revolution are still not yet addressed through the BG strategy.

2. Blue Growth and Aquaculture

Call for proposals regarding "Aquaculture" from the H2020 Framework Programme



SFS-11-2014/2015: Implementation of an Ecosystem-based approach for European aquaculture:

- A. [2014] Optimizing space availability for European Aquaculture 1 **Where?**
- B. [2015] Consolidating the environmental sustainability of European aquaculture 2 **How much?**

SFS-32-2017-[2016-2017]: Promoting and supporting innovation in aquaculture production systems: eco-intensification inland (including fresh water), coastal zone and offshore

3 **How far?**



Aquaculture development within the BG and MSP remains thought out and translated according to:

- sites selection (**Where?**)
 - carrying capacity (**How much?**)
 - ecological intensification (**How far?**)
- ➔
- **Allocated Zones to Aquaculture (AZA)**
 - **Regional development schemes for aquaculture**
 - ...

Integration displayed, but rather absent in practice (segmentation, exclusion more than real integration).

A MSP closer to a 80s' zoning 2.0 ?

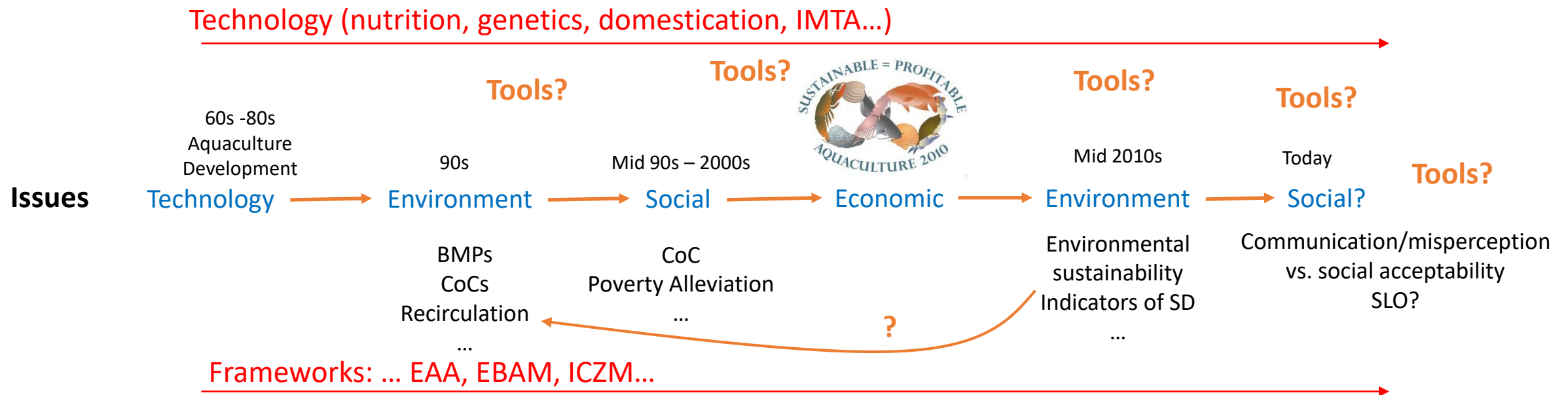
3. Lessons from Aquaculture Development...

There are new drivers to aquaculture development, but main bottlenecks remain unchanged (less technological or environmental and more and more social and economic). Aquaculture development in support to Blue Growth remains thought in a similar way than the blue revolution period, although knowledge about its development dynamics has progressed a lot.

Concepts and tools succeed to each other...

Questioning aquaculture development is also asking the question of **which aquaculture and for whom? In what context and what territorial framework before asking the question Where? How much? How ?**

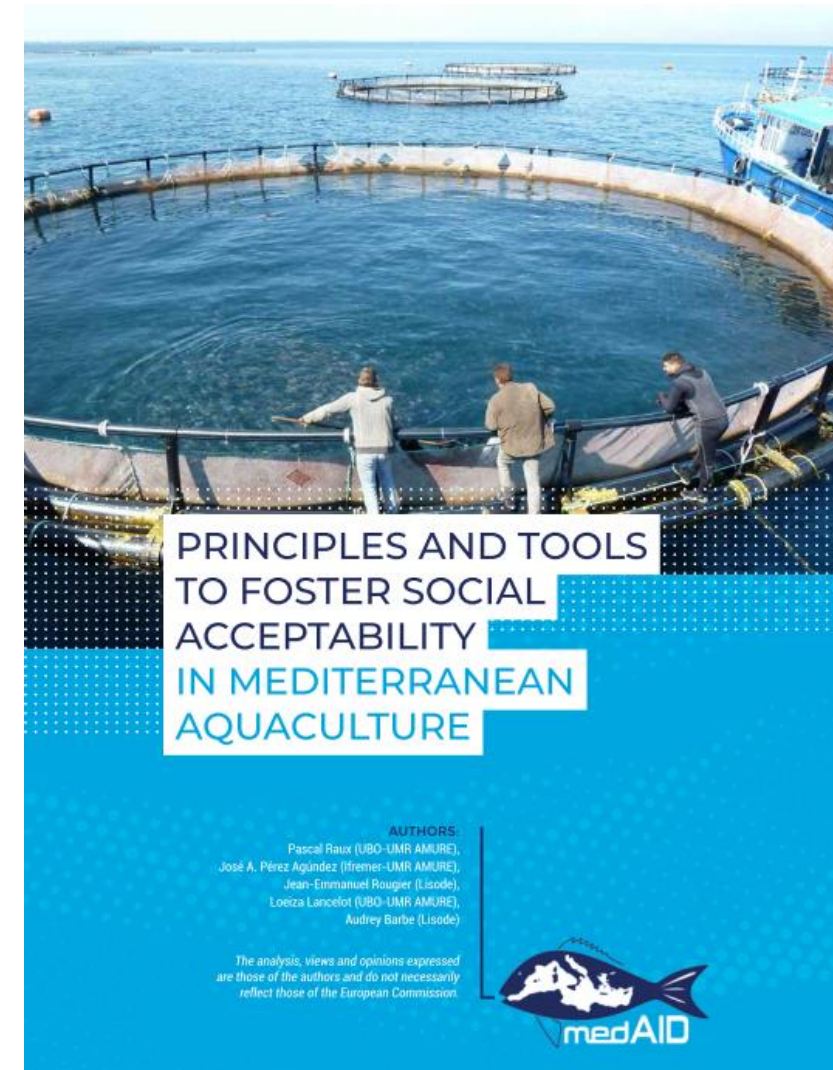
If integration is declared and stated (Marine Spatial Planning), it is rather missing in practice (exclusion vs. integration). Faced with the difficulty of implementing integration, tools come before questions and concepts follow concepts.



3. Lessons from Aquaculture Development...

The issue of integration for sustainability again and again...

- Needs to reverse the way of thinking aquaculture development. e.g. development plan of marine fish farming through regional development schemes) in France: no new creation of aquaculture sites from 1996. Objective: triple marine fish farming production to reach 20,000 t (2014-2020). Reality: from 4,400 t in 2012 to 4,000 t in 2017...
- Aquaculture is not only decreed, it has to be co-constructed in a territorial approach
- Needs to move from sites selection first
- Social Acceptability as an integrated approach seems to be promising, by:
 - Repositioning governance at the core of sustainability
 - Escaping from the dichotomous approach of Pro vs. Anti aquaculture development
 - Moving from top-down to bottom-up approach in a territorial dimension to co-construct the aquaculture vision of a territory
- A more integrated approach of Carrying Capacity through an integrated CC



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4 main recommendations to address sustainability of aquaculture developments through a Social Acceptability approach

1. SUPPORT CONCERTATION

FROM INTERVIEWS AND WORKSHOPS:

” Various stakeholders expressed their interest to participate in the process and advocate the interests of the stakeholders.

” Do not start the process on the premise as to whether certain stakeholders will participate in the process. Implement a separate workshop.

2. GIVE IMPORTANCE TO THE ADEQUACY BETWEEN THE TERRITORY AND THE PROJECT

TO ADDRESS ISSUES RELATED TO WORKSHOP PARTICIPANTS PROPOSED:

” Check that the territory is adequate for the project. Assess the impact of aquaculture on the environment.

” Anticipate needs: Extension of ports, reservation of space at port level for aquaculture farms, increase the capacity of training centres, etc.

3. VALUE THE BENEFITS OF THE PROJECT AND PROMOTE TRANSPARENCY

TO ADDRESS ISSUES RELATED TO WORKSHOP PARTICIPANTS PROPOSED:

” The benefits of the project must be well distributed:

- Help fishermen who wish to convert to aquaculture.
- Allow fishermen to enter concessions.
- Review laws regarding taxes paid by fishermen.
- Compensate inshore fishermen for impacts they suffer either directly from aquaculture farms (a percentage of farm's profits could be dedicated to fishermen) or from the government.
- Replace off-shore farms with on-shore farms.
- Distribute aquaculture companies along the coast in order to reduce their concentration in a single place.

4. ESTABLISH A FRAMEWORK THAT SUPPORTS AQUACULTURE DEVELOPMENT AND COMPLIANCE TO THE DEVELOPMENT PROCESS

TO ADDRESS ISSUES RELATED TO AQUACULTURE DEVELOPMENT, WORKSHOP PARTICIPANTS PROPOSED:

- ”
- More control and monitoring of operators' practices (licences limits, home ports, etc.).
 - Scientific monitoring of the state of the ecosystem at least twice a year (or every season) under and around the cages with qualified personnel.

- ”
- Political will (more human and financial resources allocated).
 - Create a Ministry of the Sea.

- ”
- More stringent regulations.
 - A normative framework for the disposal of cages at sea.
 - Sound and proven impact studies.
 - Allocation of licence subject to the absence of *Posidonia* beds and sufficient depth.