

Challenges, opportunities and bottlenecks of a growing industry, a socioeconomic perspective of aquaculture development. The need for a better understanding of sustainability in the light of past developments and the frantic succession of concepts targeting sustainable aquaculture.

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As marine aquaculture continues to expand to meet the increasing demand for seafood products, it still faces many challenges, but also presents significant opportunities for coastal and marine developments. This presentation explores the evolution of marine aquaculture development, examining the key challenges, opportunities and bottlenecks faced by the industry from a socioeconomic perspective.

Integrated by its very nature, the concept of sustainability applied to aquaculture is still difficult to put into practice because of the limited capacity of operators to integrate its various dimensions in practice, and in particular its social dimension. This protean dimension remains difficult to grasp beyond over-simplistic translations, although it is one of the main bottlenecks in the sector today. As a legacy of the history of its development, this issue questions the objectives assigned to marine aquaculture and its development. It is therefore necessary to rethink the way in which the sustainability of aquaculture developments is addressed and the way in which these developments are thought and planned.

The growth of aquaculture has been accompanied by a strong quest of sustainability, driven by concerns over environmental impact, social equity, and economic viability. However, the rapid succession of concepts and frameworks aimed at achieving sustainable aquaculture has led to a fragmented understanding of what sustainability truly entails. There is then the necessity of a comprehensive and nuanced understanding of sustainability in the context of marine aquaculture development. By critically examining past approaches and experiences, we can identify lessons learned and opportunities for improvement. Moreover, there is a pressing need to bridge the gap between theory and practice, ensuring that sustainability initiatives are not only well-intentioned but also effectively implemented on the ground.

Drawing upon an illustration from South Africa, where marine aquaculture plays a significant role in coastal livelihoods and economic development, we will try to highlight the challenges and opportunities specific to this region and the complexity of achieving sustainability in diverse geographical and socio-cultural contexts.

While the Blue Economy approach in recent years has often been the framework for new aquaculture development and has gained popularity as a framework for sustainable ocean development, its implementation often fails to live up to its theoretical promise. In practice, the emphasis on economic growth and resource exploitation within the Blue Economy paradigm can perpetuate inequalities and environmental degradation, particularly in vulnerable coastal communities. It can also overlook the intrinsic value of marine ecosystems and fail to take sufficient account of issues of social equity and environmental justice as well as the diversity of production systems.

Redefining sustainability and innovation to better address the socio-economic bottlenecks of aquaculture may also require new forms of development through institutional innovations or a new approach to the Blue Economy, such as the Regenerative Blue Economy. Nature-based-Solutions and restorative aquaculture rooted in territorial needs are all examples of aquaculture development that could better meet the objective of sustainability through a holistic socioeconomic perspective. By addressing multifaceted challenges, seizing emerging opportunities and overcoming existing bottlenecks, it is possible to work towards a more sustainable and resilient future for the industry.

Défis, opportunités et goulets d'étranglement d'un secteur en pleine croissance, une perspective socio-économique du développement de l'aquaculture. La nécessité d'une meilleure compréhension de la durabilité à la lumière des développements passés et de la succession effrénée de concepts ciblant l'aquaculture durable.

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Alors que l'aquaculture marine continue de se développer pour répondre à la demande croissante de produits de la mer, elle est toujours confrontée à de nombreux défis, mais présente également des opportunités significatives pour les développements côtiers et marins. Cette présentation explore l'évolution du développement de l'aquaculture marine, en examinant les principaux défis, opportunités et goulets d'étranglement auxquels l'industrie est confrontée d'un point de vue socio-économique.

Intégré par nature, le concept de durabilité appliqué à l'aquaculture est encore difficile à mettre en pratique en raison de la capacité limitée des opérateurs à intégrer ses différentes dimensions dans la pratique, et en particulier sa dimension sociale. Cette dimension protéiforme reste difficile à appréhender au-delà de traductions trop simplistes, alors qu'elle constitue l'un des principaux goulets d'étranglement du secteur aujourd'hui. Héritage de l'histoire de son développement, cette problématique interroge les objectifs assignés à l'aquaculture marine et à son développement. Il est donc nécessaire de repenser la manière dont la durabilité des développements aquacoles est abordée et la manière dont ces développements sont pensés et planifiés.

La croissance de l'aquaculture s'est accompagnée d'une forte quête de durabilité, motivée par des préoccupations relatives à l'impact environnemental, à l'équité sociale et à la viabilité économique. Cependant, la succession rapide de concepts et de cadres visant à parvenir à une aquaculture durable a conduit à une compréhension fragmentaire de ce que la durabilité implique réellement. Il est donc nécessaire d'avoir une compréhension globale et nuancée de la durabilité dans le contexte du développement de l'aquaculture marine. En examinant de manière critique les approches et les expériences passées, nous pouvons identifier les leçons apprises et les possibilités d'amélioration. En outre, il est urgent de combler le fossé entre la théorie et la pratique, en veillant à ce que les initiatives de durabilité soient non seulement bien intentionnées, mais également mises en œuvre de manière efficace sur le terrain.

En nous appuyant sur l'exemple de l'Afrique du Sud, où l'aquaculture marine joue un rôle important dans les moyens de subsistance et le développement économique des zones côtières, nous tenterons de mettre en évidence les défis et les opportunités propres à cette région et la complexité de la réalisation de la durabilité dans des contextes géographiques et socioculturels diversifiés.

Si, ces dernières années, l'approche de l'économie bleue a souvent servi de cadre au nouveau développement de l'aquaculture et a gagné en popularité en tant que cadre pour le développement durable des océans, sa mise en œuvre n'est souvent pas à la hauteur de ses promesses théoriques. Dans la pratique, l'accent mis sur la croissance économique et l'exploitation des ressources dans le cadre du paradigme de l'économie bleue peut perpétuer les inégalités et la dégradation de

l'environnement, en particulier dans les communautés côtières vulnérables. Il peut également négliger la valeur intrinsèque des écosystèmes marins et ne pas tenir suffisamment compte des questions d'équité sociale et de justice environnementale, ainsi que de la diversité des systèmes de production.

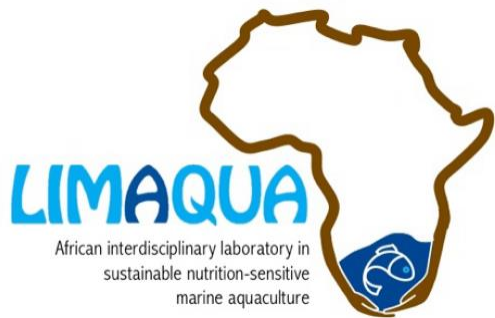
Redéfinir la durabilité et l'innovation pour mieux s'attaquer aux goulets d'étranglement socio-économiques de l'aquaculture peut également nécessiter de nouvelles formes de développement par le biais d'innovations institutionnelles ou d'une nouvelle approche de l'économie bleue, telle que l'économie bleue régénératrice. Les solutions fondées sur la nature et l'aquaculture réparatrice ancrée dans les besoins territoriaux sont autant d'exemples de développement de l'aquaculture qui pourraient mieux répondre à l'objectif de durabilité grâce à une perspective socioéconomique holistique. En relevant les défis à multiples facettes, en saisissant les opportunités émergentes et en surmontant les goulets d'étranglement existants, il est possible d'œuvrer pour un avenir plus durable et plus résilient pour le secteur.



**The 15th Aquaculture Association of Southern Africa (AASA) Conference
Redefining Innovation and Sustainability
Stellenbosch 9-13 Sept-24**

**CHALLENGES, OPPORTUNITIES AND BOTTLENECKS OF A GROWING INDUSTRY,
A SOCIOECONOMIC PERSPECTIVE OF AQUACULTURE DEVELOPMENT.**

**THE NEED FOR A BETTER UNDERSTANDING OF SUSTAINABILITY IN THE LIGHT OF PAST DEVELOPMENTS
AND THE FRANTIC SUCCESSION OF CONCEPTS TARGETING SUSTAINABLE AQUACULTURE.**



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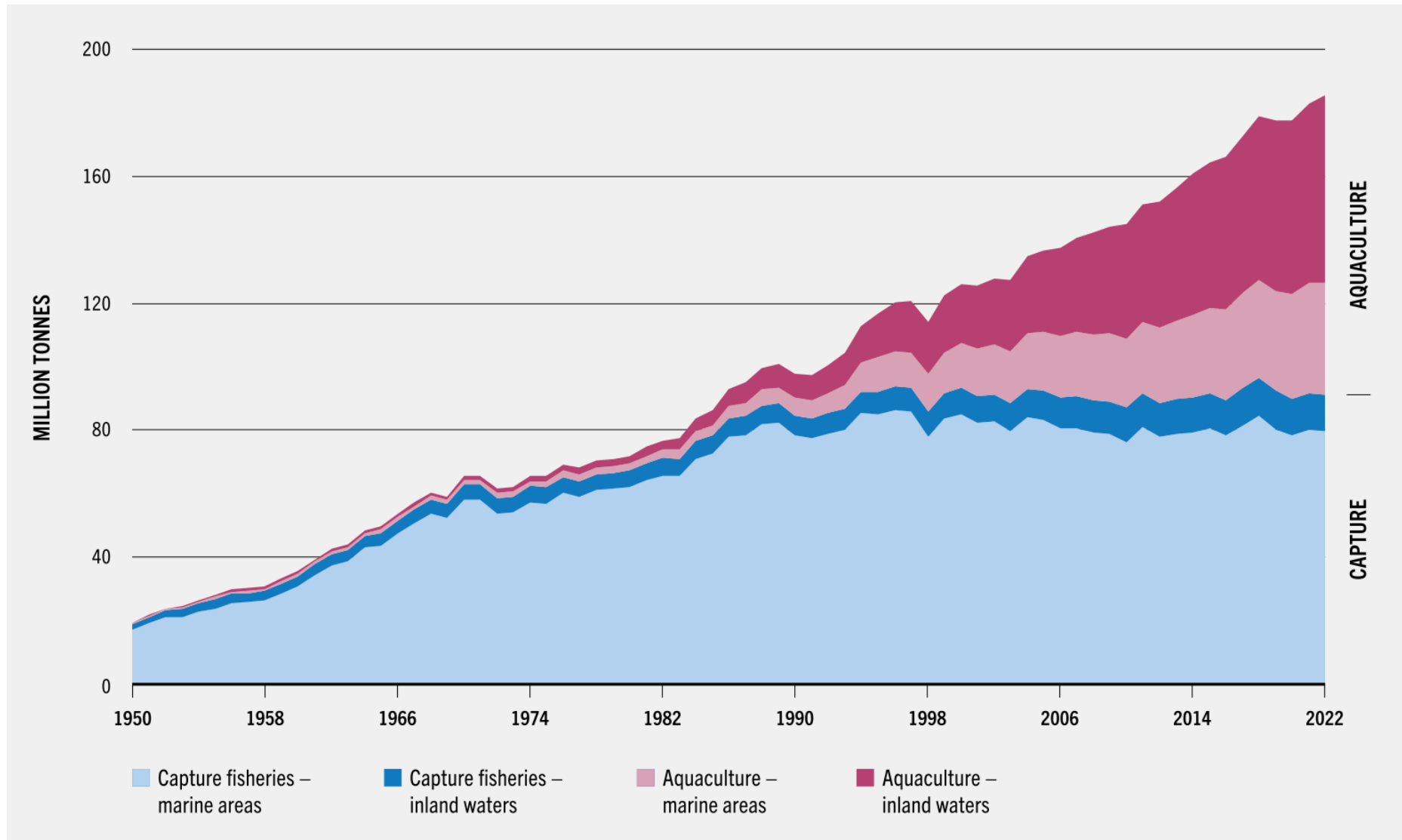
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When talking about Aquaculture Development (AD)...

always the following scheme

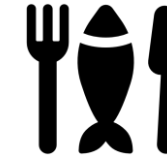
World fisheries and aquaculture production of aquatic animals 1950 – 2022 (SOFIA 2024)



Aquaculture growth vs. Fisheries decline or stagnation

Combined with a growing demand for aquatic animal foods and the world population growth

	1961	1990's	2000's	2010's	2020	2022	...2050
World population (billion)	3.1	5.7	6.5	7.3	7.8	7.95	9.7
Per capita apparent consumption of aquatic animal foods (kg)	9	14.3	16.8	19.5	20.2	20.7	+36M° tonnes



Demand for aquatic animal foods is rising steadily, with capita apparent consumption rising from 9 to 20.6 kg between 1961 and 2021. Average growth of 1.4% per year.

	1990s	2000s	2010s	2020	2021	2022
Average per year						
<i>(million tonnes, live weight equivalent)</i>						
Production						
Capture fisheries:						
Inland	7.1	9.3	11.3	11.5	11.4	11.3
Marine	81.9	81.6	79.8	78.3	80.3	79.7
Total capture fisheries	88.9	90.9	91.1	89.8	91.6	91.0
Aquaculture:						
Inland	12.6	25.6	44.8	54.5	56.4	59.1
Marine	9.2	17.9	26.7	33.2	34.7	35.3
Total aquaculture	21.8	43.4	71.5	87.7	91.1	94.4

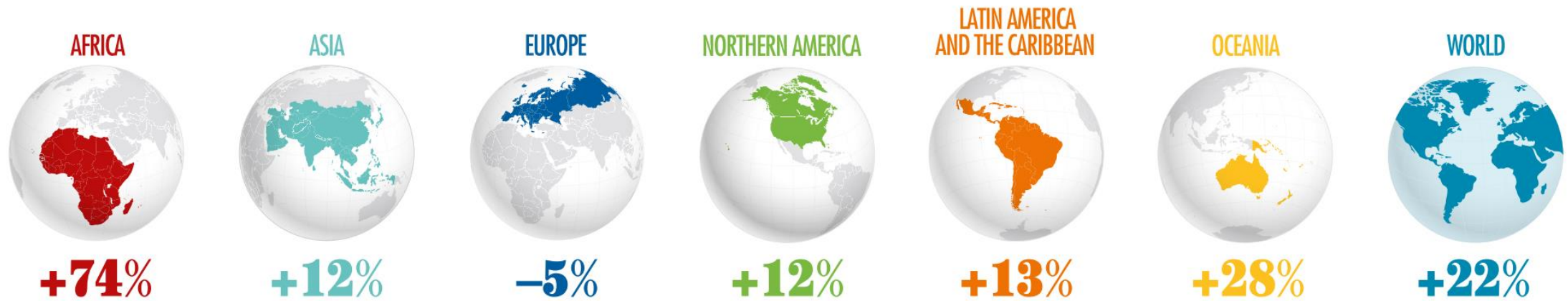
2014: 1 fish over 2 from aquaculture

2022: first time in history that global aquaculture production of animal species surpassed capture

FISH to 2030 (IMPACT model 2012): 2 fish over 3 will have to be farmed to face the world demand

As a substitute to catches Aquaculture has to feed the World!

Required growth in aquatic animal food supply to sustain 2022 per capita consumption levels through to 2050



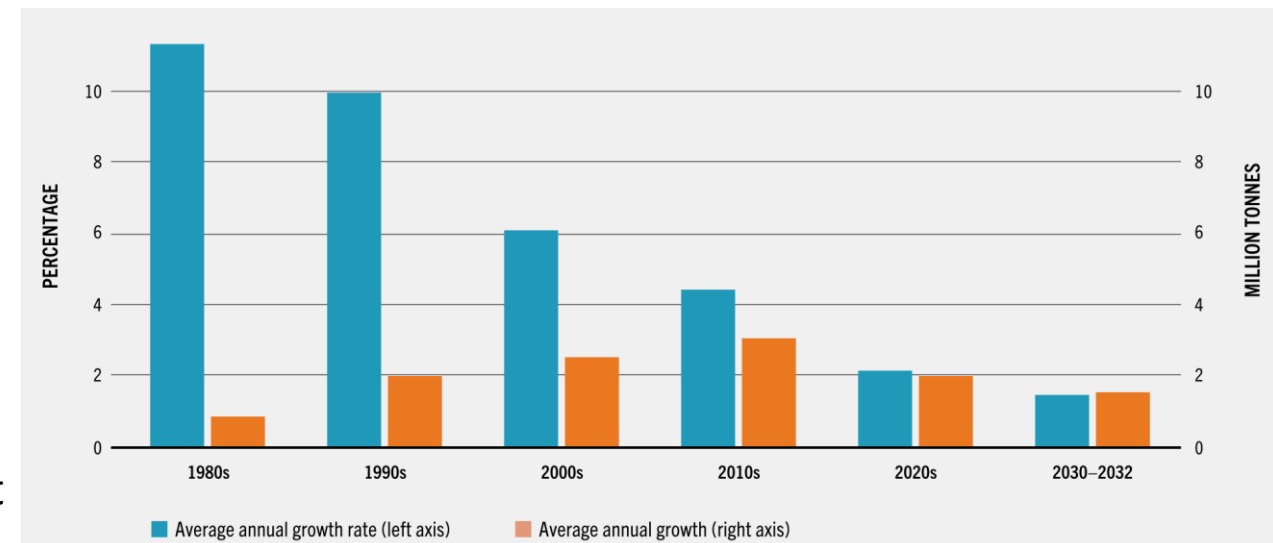
FAO SOFIA 2024

- World population up by 1.7 billion in 2050 compared with 2022
- An increase in the total aquatic animal food supply of 36 million tonnes for an apparent consumption of 20.7 kg per capita
- All things being equal (no changes in amount of non-food uses, CC...)

A still growing sector but at a reduced growth rate impacted by different factors:

- Enforcement of environmental regulations (China)
- Health of ecosystems
- Availability of suitable aquaculture sites
- Spread of diseases threats
- Reduced productivity gains...

The hype, fantasies and realities of aquaculture development globally and in its new geographies (Costa-Pierce, Chopin 2021)

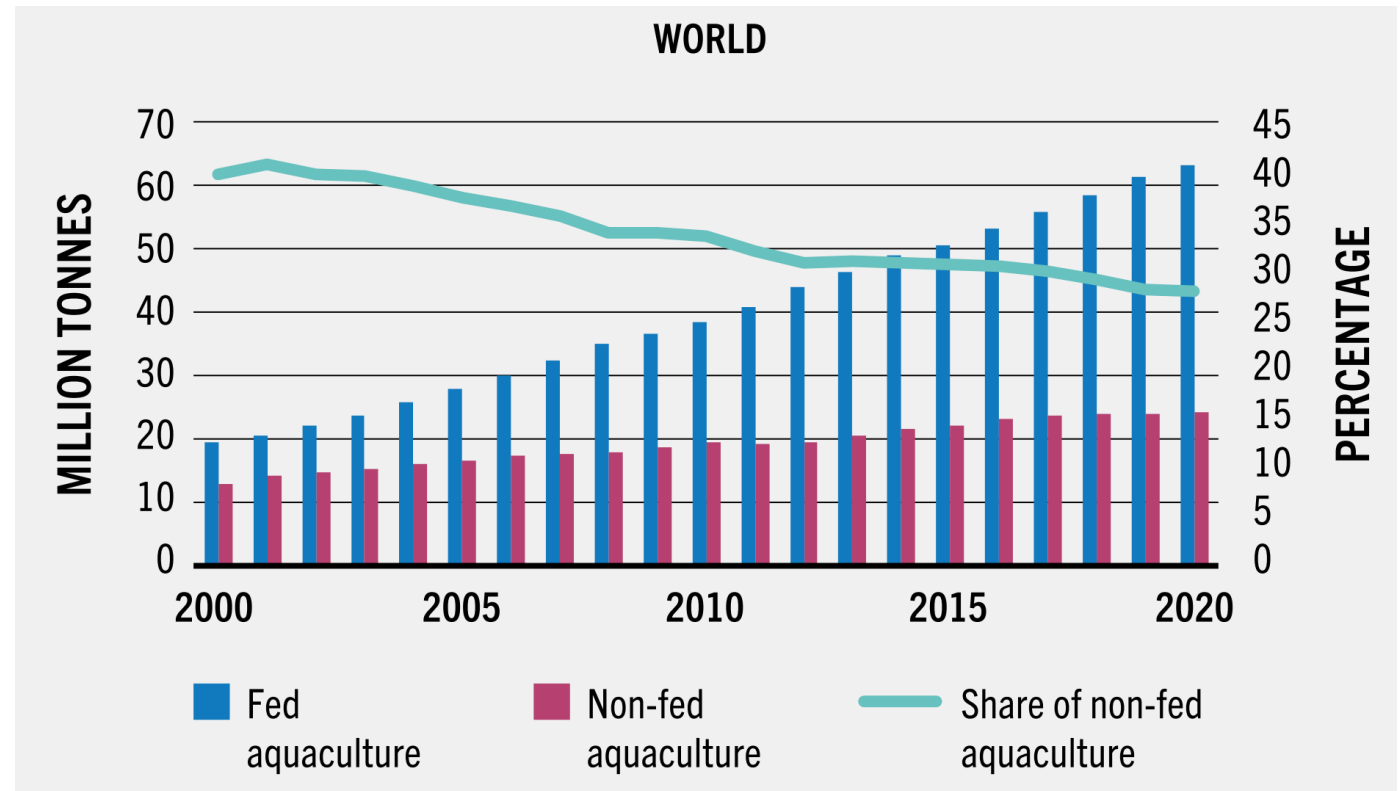


Annual growth of world aquaculture production by volume and rate, 1980–2032 (SOFIA 2024)

Nutrition (feed) is perceived as the most limiting factor to growth

Issues in terms of production becoming energy-intensive, nutrient pollution, invasive species, 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...)

Continuous decreasing share of non fed species, whatever continents. Non-fed aquaculture in total farmed animal species production fell from 39.7% in 2000 to 27.6% in 2020 and to 26.9% in 2022.



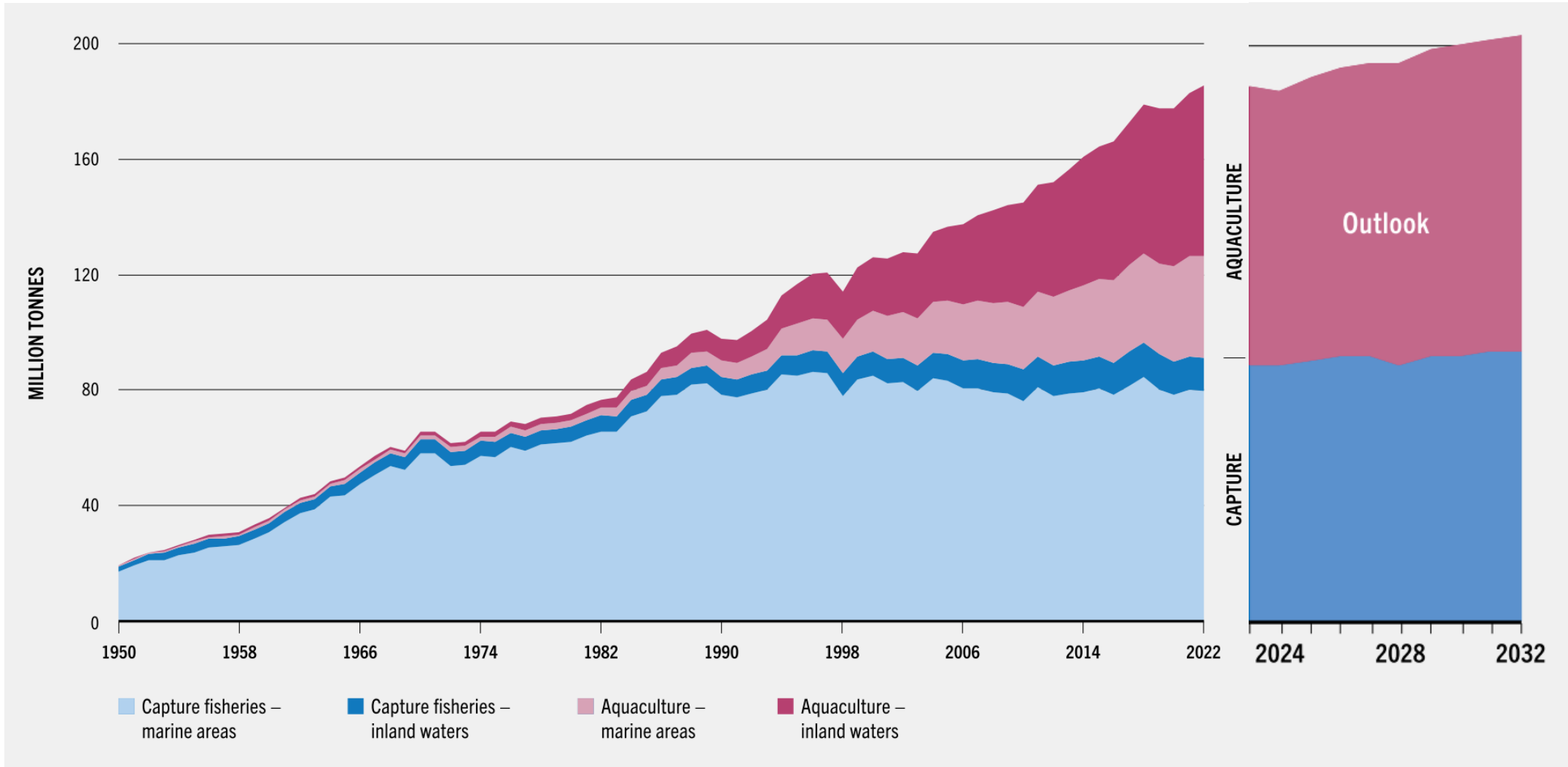
Fed and non-fed aquaculture production of animal species, 2000–2020 (FAO SOFIA 2022)

Additional issues... :

- Nutrition and fry supply
- Food safety
- Climate change
- Ability to invest
- A development too often disconnected from markets and their evolutions, from the characteristics of demand and preferences.
- Declining diversity in terms of species farmed, a concentration that is source of vulnerability for the industry
- Marine catches account for 87.3% of total catches, while aquaculture is mainly continental

Despite impacting factors over growth rate, the industry seems quite confident to cope with the requested growth...

World fisheries and aquaculture production of aquatic animals 1950 – 2032 (SOFIA 2024)



...but such development can be costly and different from the global picture at lower scale where developments occur

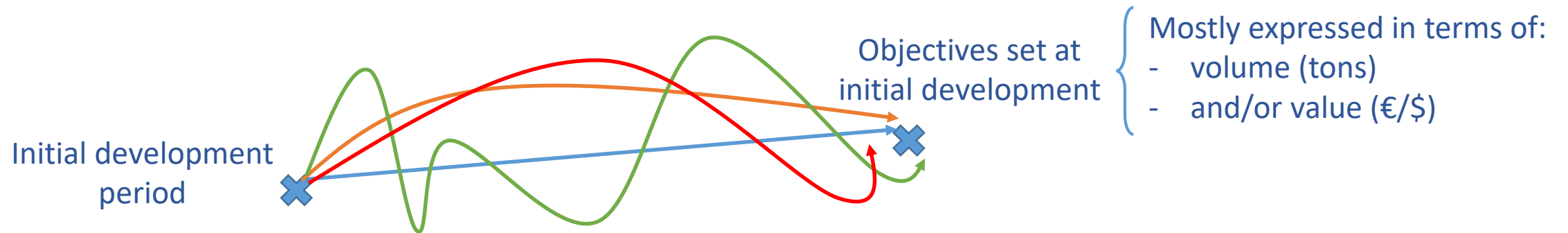
Is there any reason to doubt the ability of aquaculture to meet tomorrow's needs?

So why is sustainability of aquaculture systems so often discussed, what are its concerns and how is it addressed?

Behind that seemingly robust global development, it's a development mainly thought in terms of volume and space, supported by new drivers (Blue Growth, MSP, Blue Economy...):

- sites selection: **Where?** (MSP)
- carrying capacity: **How much?**
- ecological intensification: **How far?**

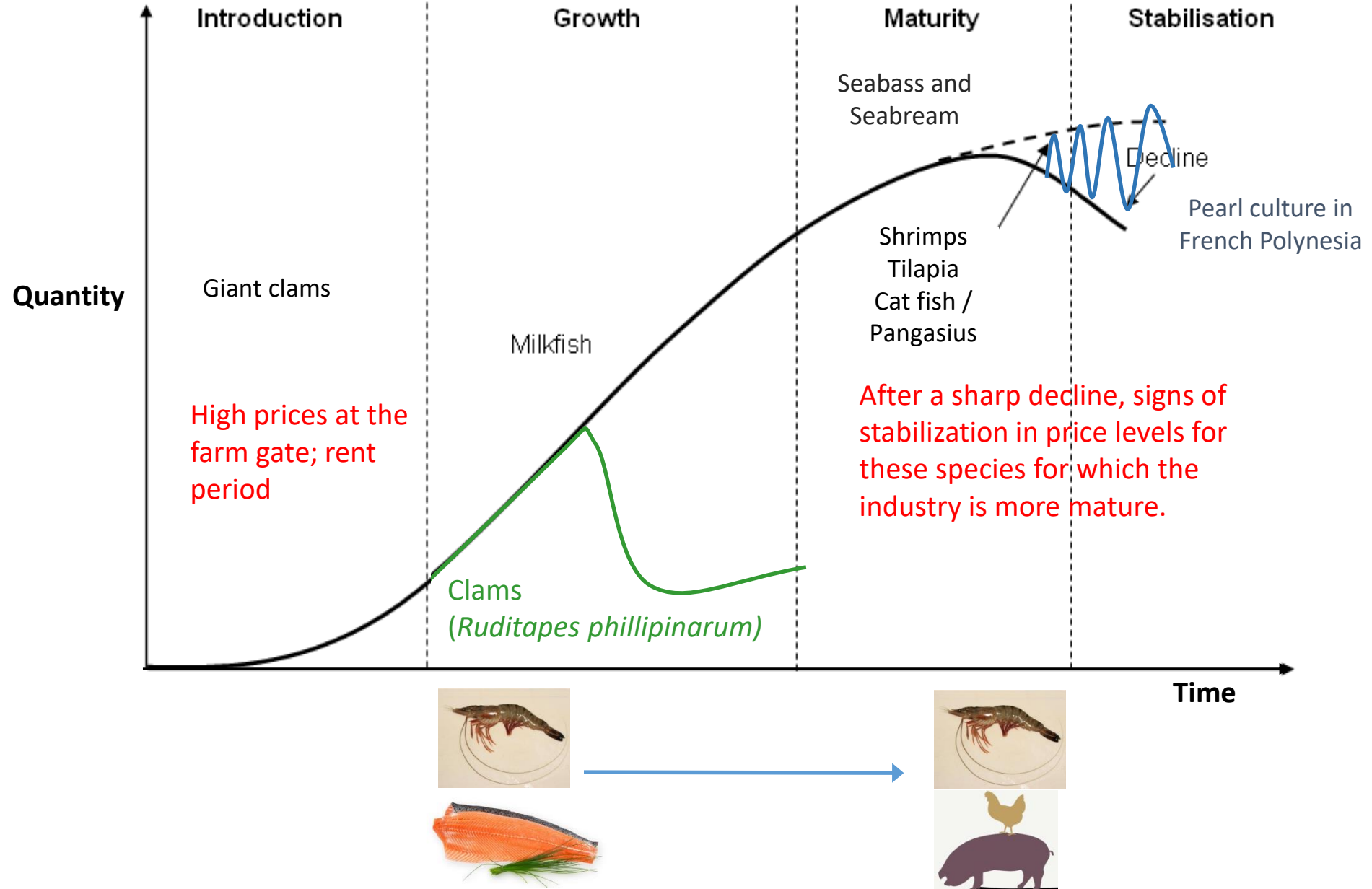
When at local level the issue is more related to which aquaculture and for whom? In what context and what territorial framework? The question is then **“How the transition between initial development and maturity is being made?”**



Technology, while obviously necessary and the basis for aquaculture, is not sufficient itself to ensure sustainability. The question of the transition between the present situation and the objectives set, raises a number of issues: path to sustainability, transition shocks, vulnerability and adaptation of farms, relevance of the objectives and means of achieving them.

“Remembering that in between periods of promising the Moon, there are painful “purgatory” periods of non-constructive regressions” (Costa Pierce, Chopin 2021)

The transition of aquaculture developments: between stabilisation and decline, a matter of vulnerability

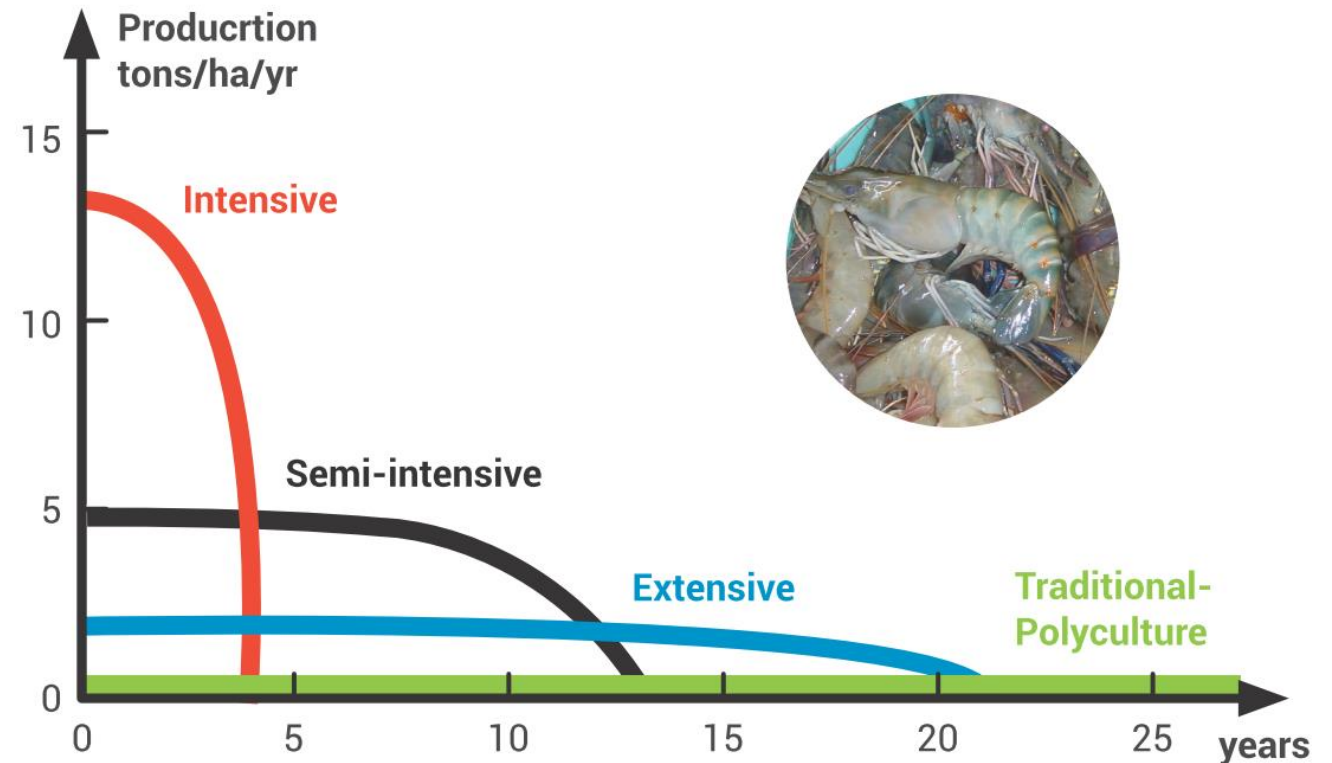


The case of penaeid shrimp farming development

Penaeid shrimps: part of the “new aquaculture” (marine) in the mid-80s. Together with Salmon, Seabass and Seabream...

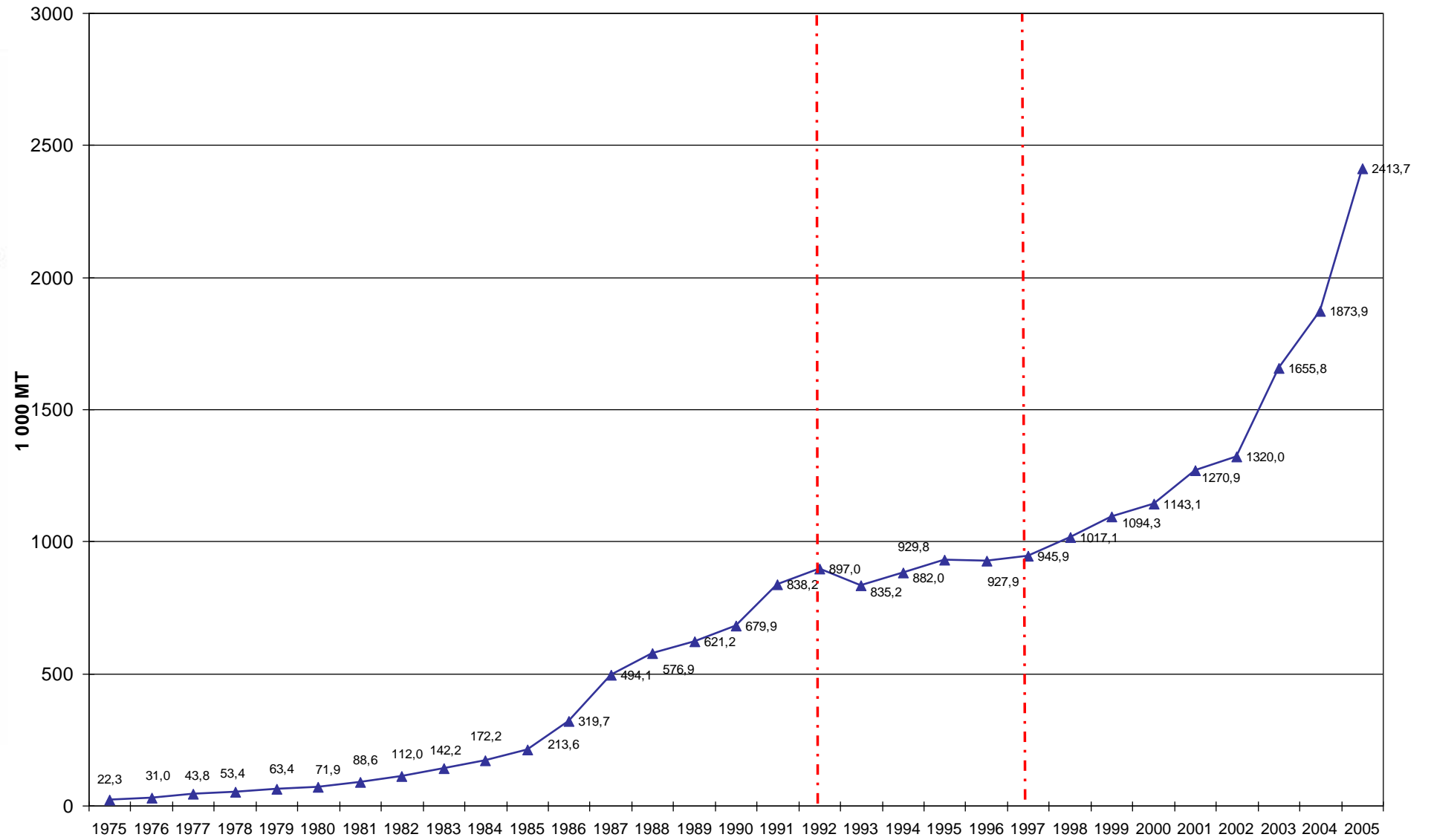
Production systems are perceived in terms of stocking density and its relationship to the environment as illustrated by the following figure depicting built-in unsustainability of industrial shrimp farming (Kautsky et al.)

It summarizes quite well the issues attached to development (maximise the profit/ha rather than the way to produce i.e. profit/kg). But it can also appear as too simplistic when the development issues in terms of sustainability are much complex and if more attention is paid to development profiles rather than technical systems

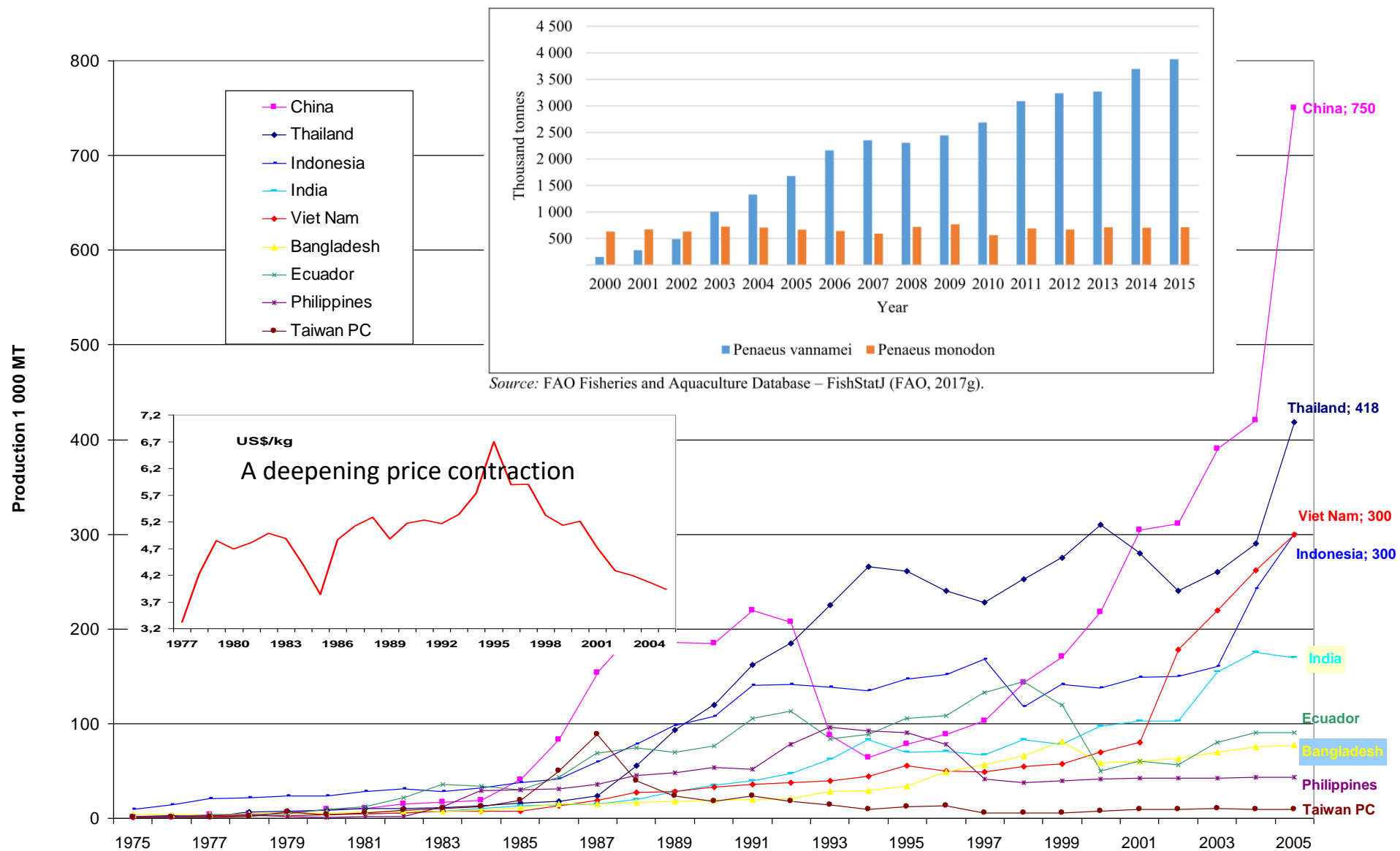


Graph depicting built-in unsustainability of Industrial Shrimp Farming by Nils Kautsky, as reproduced in Quarto (1998)

World shrimp farming production 1975 – 2005 (1 000 MT – Globefish FISHDAB 2006)

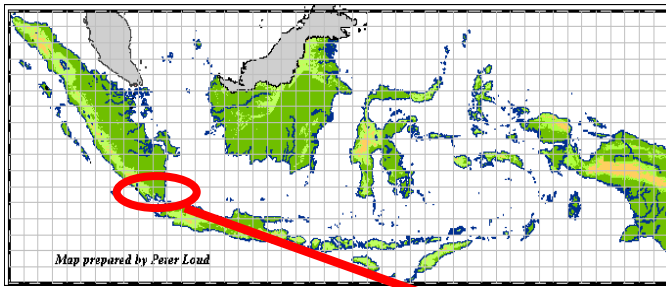


World shrimp farming production per country 1975 – 2005 (1 000 MT – Globefish)

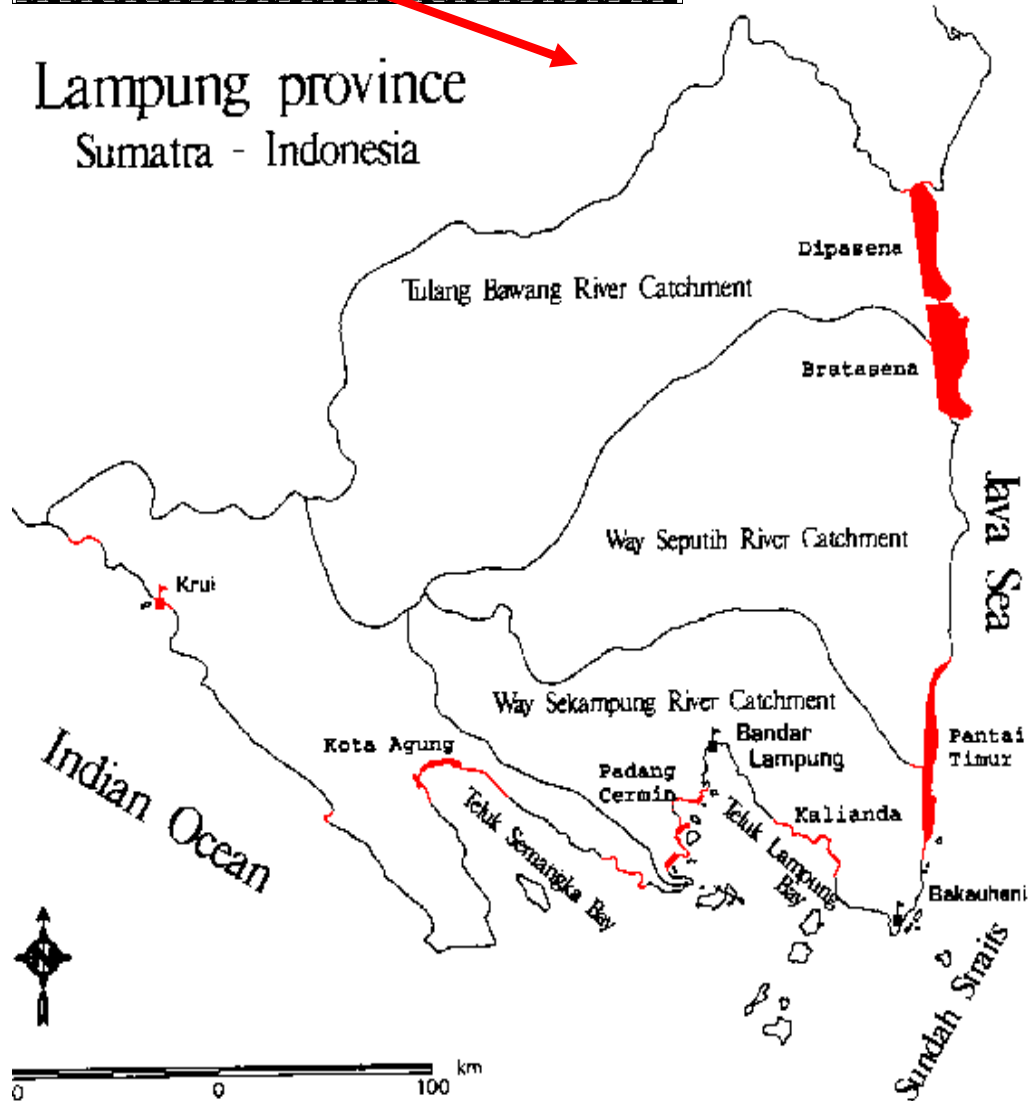


The Pink Gold Rush!

A local case study: Shrimp farming in Lampung province in the mid-90s



Lampung province
Sumatra - Indonesia



Shrimps exportations (head-less) - unit: tons.

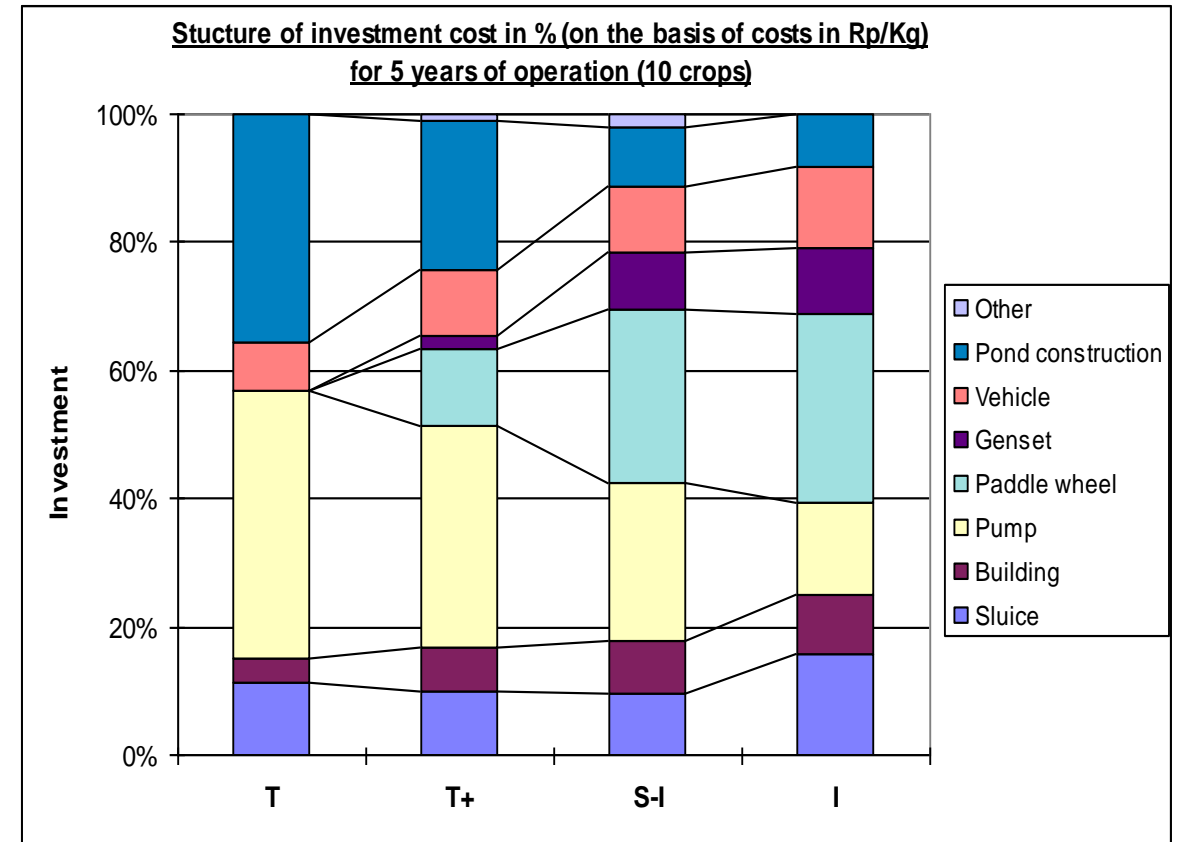
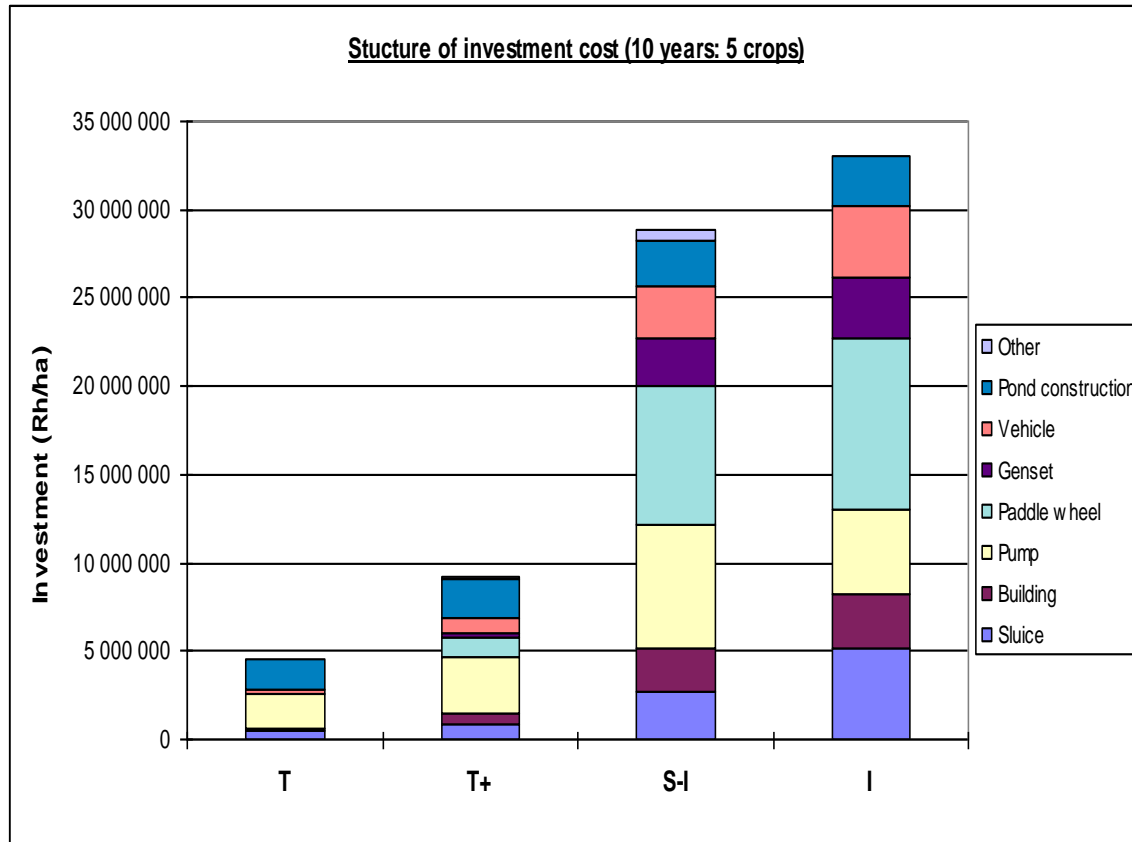
Province	1992	1995	% 94/95
JAKARTA	11 705	10 947	-19%
MEDAN	14 193	12 114	-15%
SURABAYA	25 992	18 164	-1%
BANDAR LAMPUNG	2 807	10 194	22%
Sub Total	54 697	51 419	-6%
Others	45 758	58 651	30%
Total INDONESIA	100 455	110 070	11%

Fisheries Statistics of Indonesia ; Jakarta March 1996

Lampung is a province :

- With a rapid economic development
- Shrimp culture developed rapidly in the 90's while other Indonesian regions were hit with disease and pollution problems
- A very high profitability induced a dynamic which reoriented completely the economy of many coastal villages
- After few years of rapid growth, a worry about the sustainability of this development. Environmental problems began in 1991 with the appearance of red tide and first disease outbreak in 1993. This puts Lampung Province on the path of many other regions where shrimp farming has completely collapsed.

Comparing the profitability of different levels of intensification



From surveys: Classification based on multivariate analysis, **4** technical systems identified and compared: traditional (T), traditional plus (T+), semi-intensive (S-I) and intensive (I).

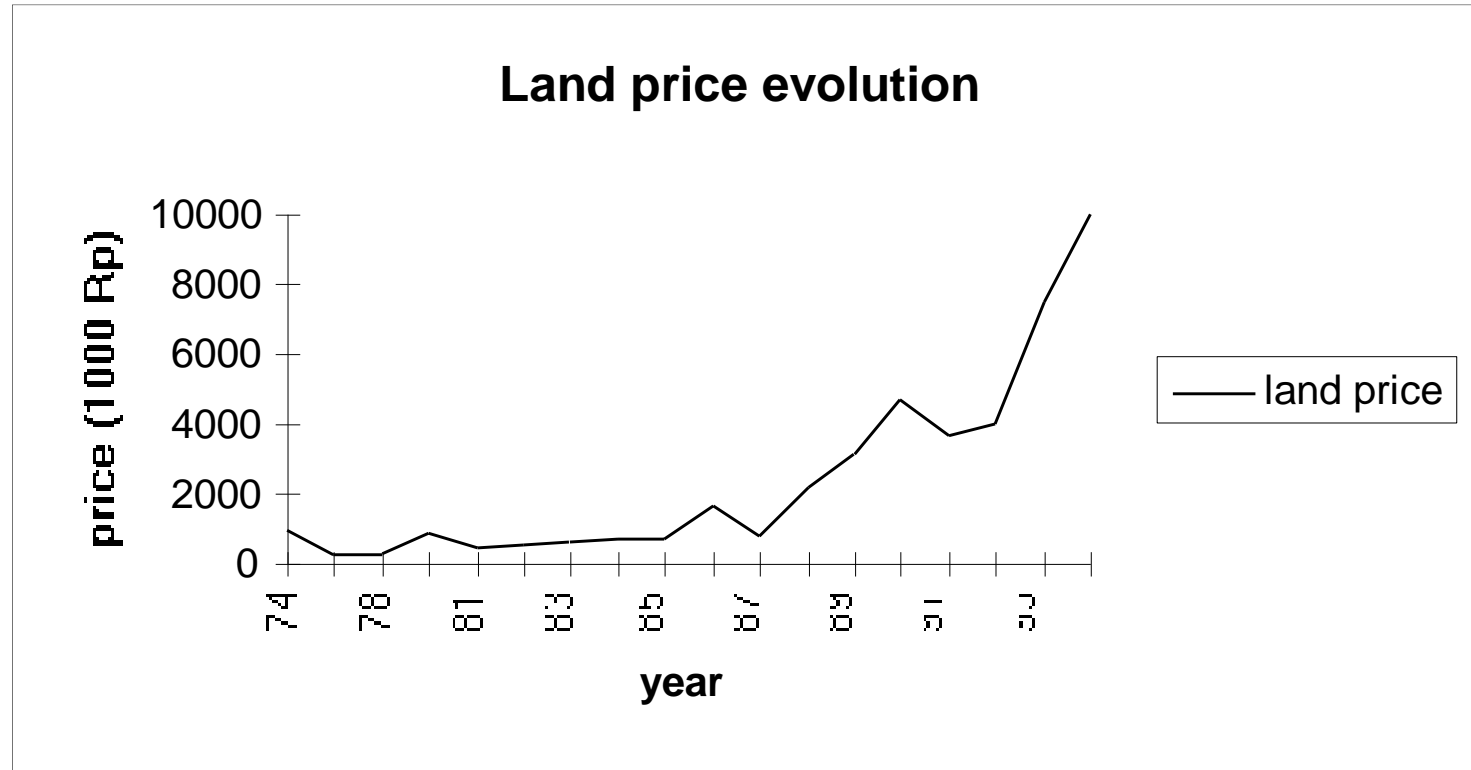
The results show that although there are differences in terms of investment levels and structures, the overall economic performance of the different systems is very good and comparable on average, with the exception of T+. Differences in terms of risk affect this performance (T+).

Comparing the profitability of different levels of intensification

	T	T+	S-I	I
Farm area (ha)	2,5	2,9	2,9	4,9
Stocking density (1.000 fry/ha)	26	45	115	239
Production per crop (Kg/ha)	312	514	1 569	2 335
Technical efficiency (Kg/1.000 fry)	12,4	11,5	13,8	10,1
Price (1.000Rp/kg)	16,6	16,7	17,2	17,1
Total cost (1.000Rp/kg)	7,2	11,2	8,2	7,8
Benefit (1.000Rp/kg)	9,4	5,5	9,0	9,3
Benefit/cost ratio	1,48	0,59	1,21	1,38
Added value ratio	0,73	0,55	0,66	0,67
Investment (1.000 Rp/ha)	5 543	8 542	17 791	20 979
IRR (2 crops, 1 year)	6%	-20%	41%	73%
IRR (6 crops, 3 years)	30%	26%	57%	69%
Profit rate	56,3%	33,1%	52,2%	54,1%
Return on investment (months)	11	17	7	5

1.000 Rp = 0,4 US\$ (1996)

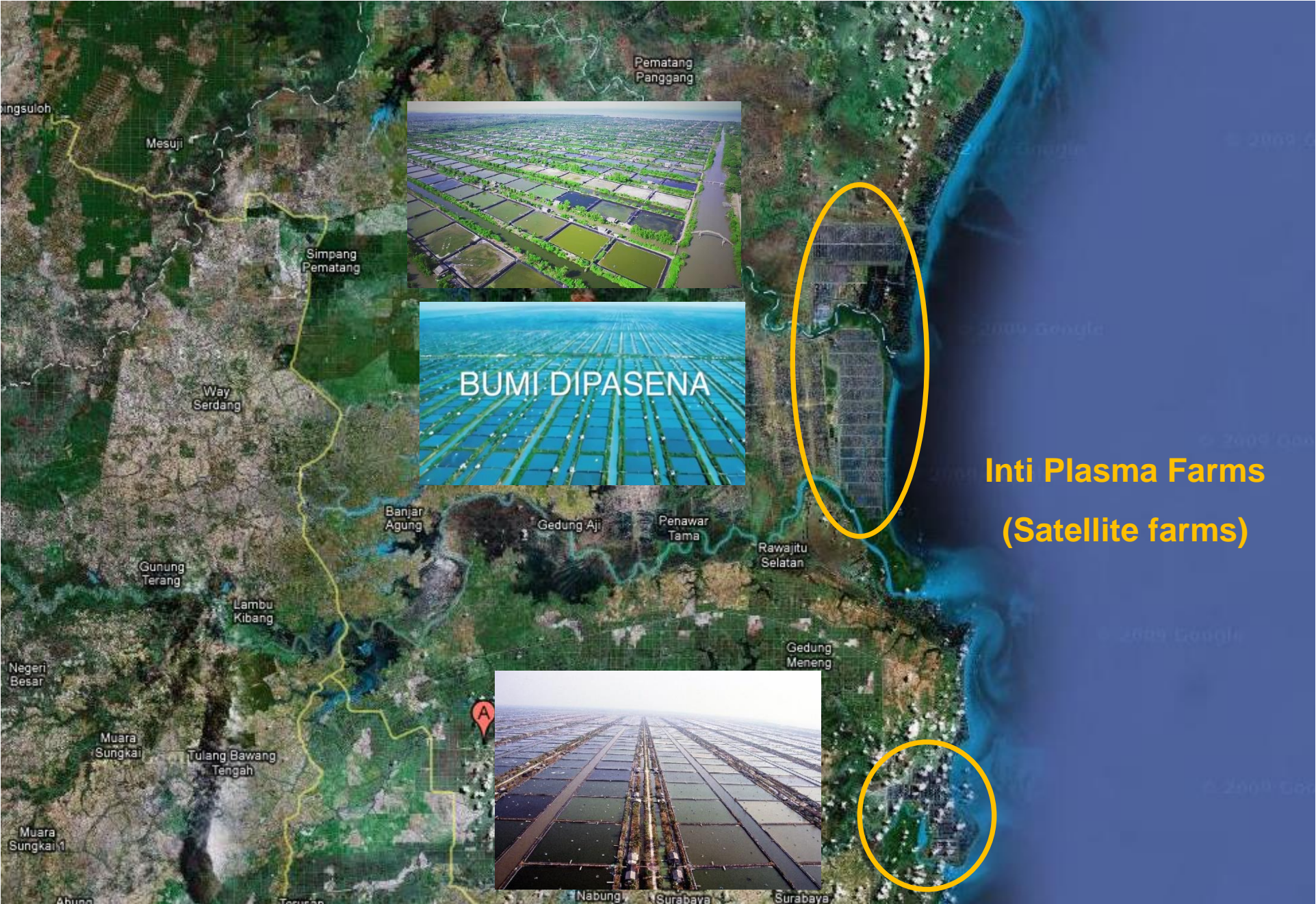
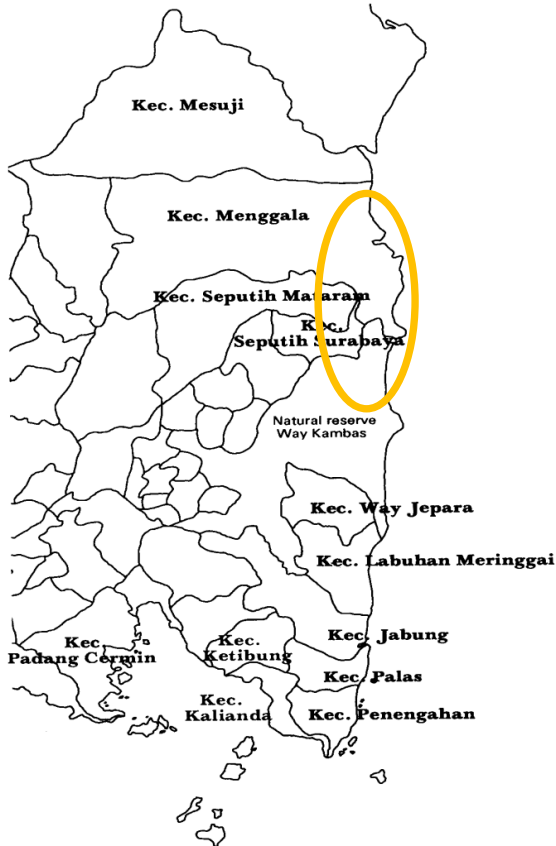
- Economic incentives are strong; but no significant difference among traditional, semi-intensive and intensive systems in terms of economic efficiency (profit rate above 50%) or wealth distribution (added value between 65 and 73%)
- Low results of traditional plus system
- No evidence of economic motives to support a technical system against another one (excepted at intermediate levels of intensification)



Added value and structure

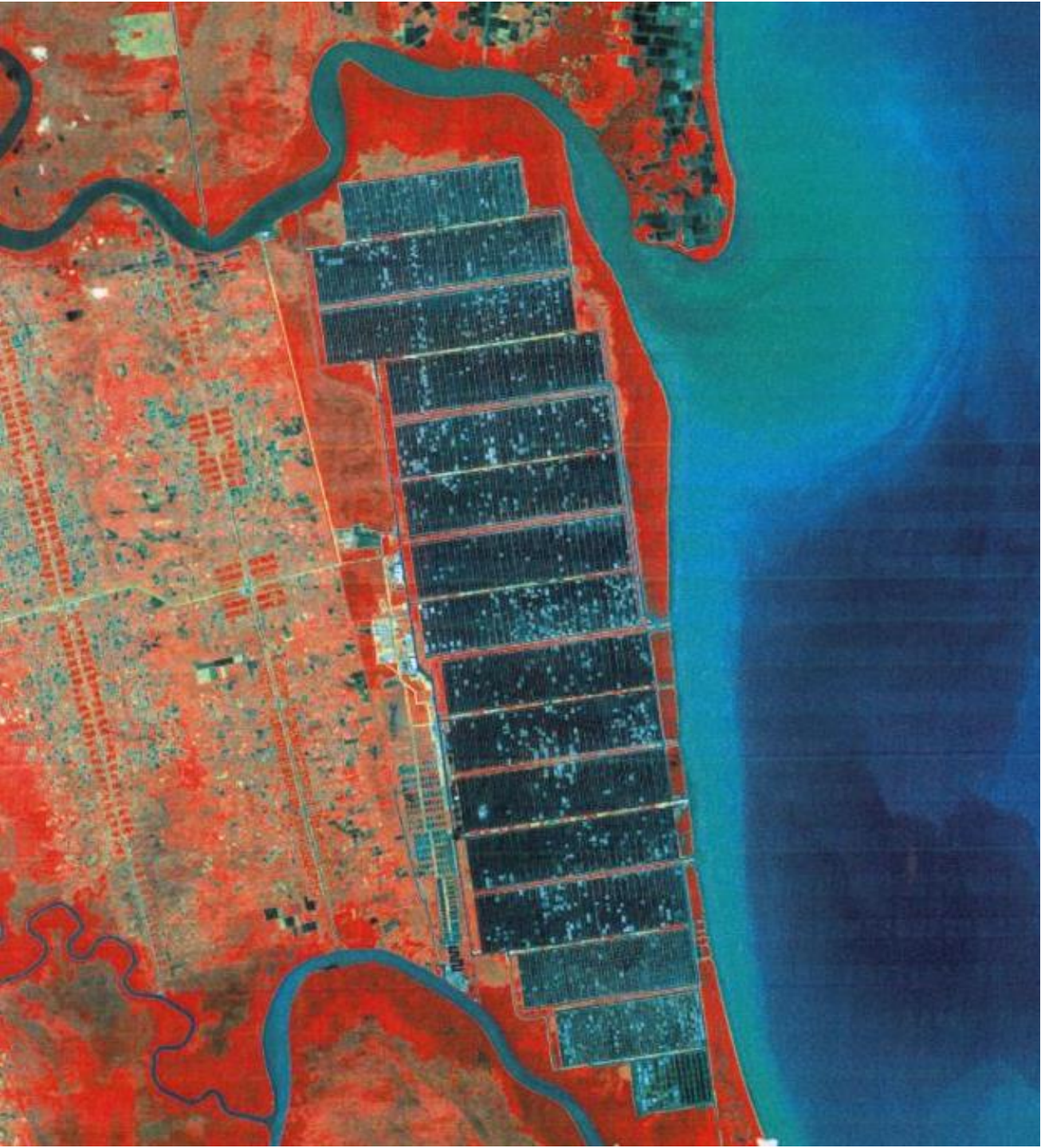
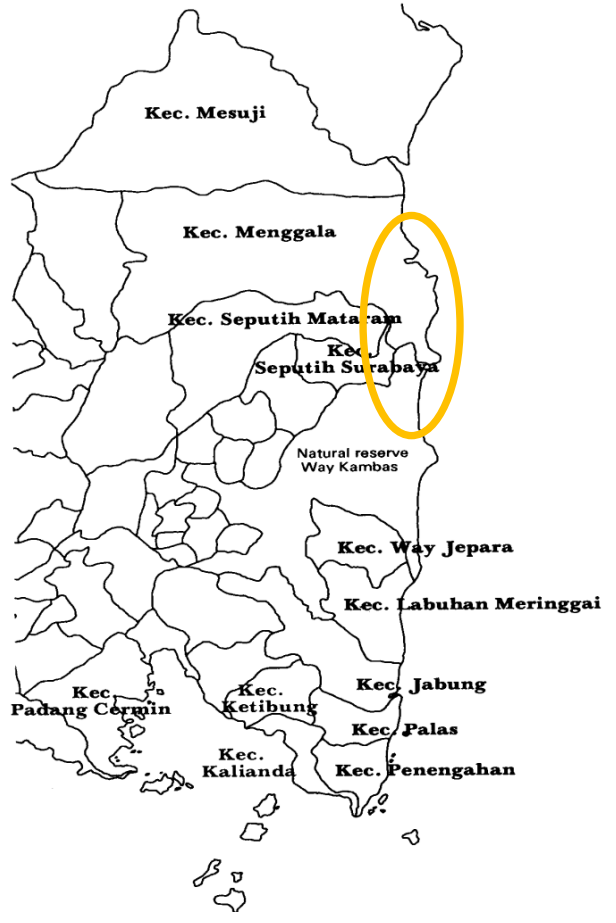
Share of added value/kg	T	T+	S-I	I
AVR	0,73	0,55	0,66	0,67
Added value/kg	12 200	9 222	11 288	11 476
Share of labour in added value	13,8%	18,0%	8,9%	9,0%
Valorisation (price Rph/kg)	16 621	16 707	17 190	17 050
Labour (Rp/kg)	2 271	2 989	1 527	1 521

East Lampung Est : Java Sea – Plasma Farms

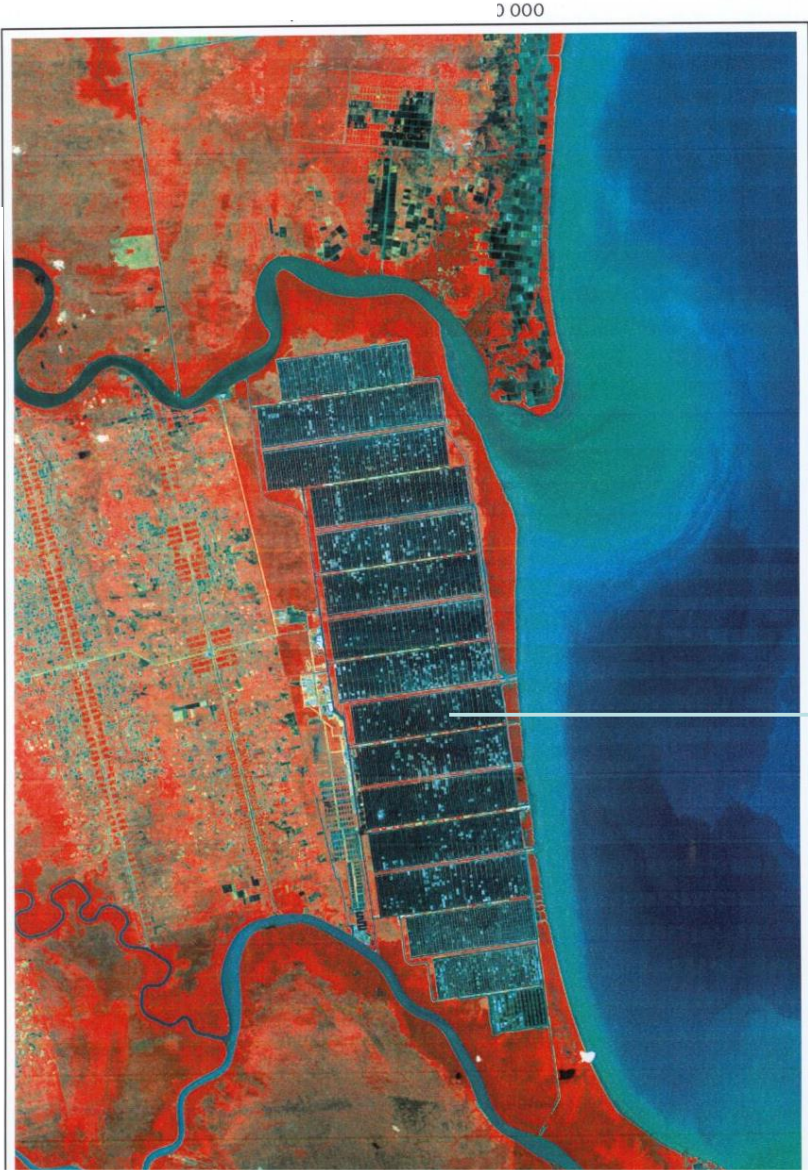
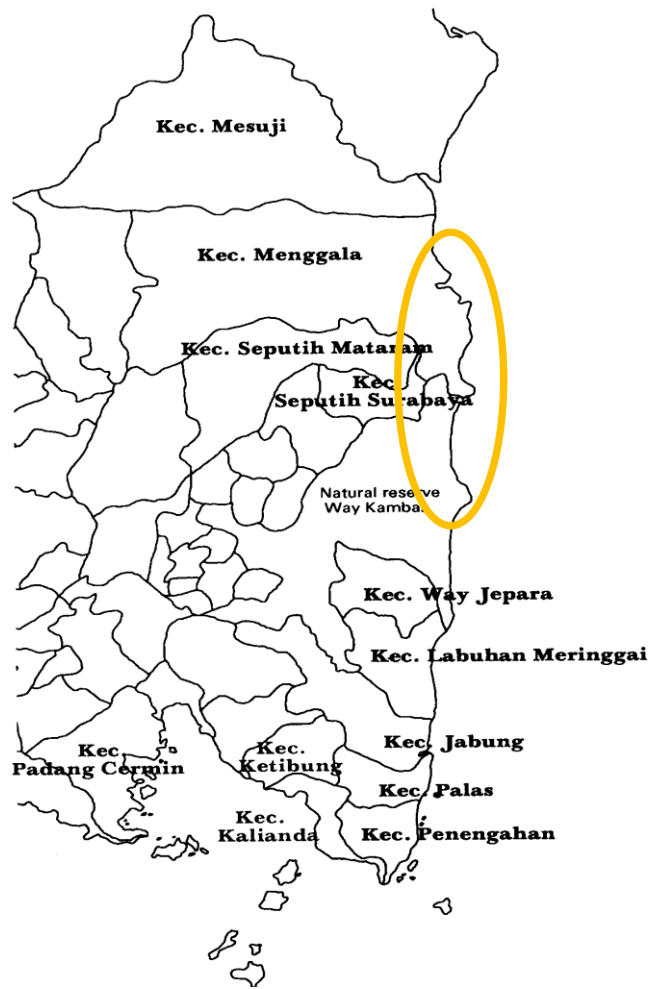


**Inti Plasma Farms
(Satellite farms)**

East Lampung Est : Java Sea – Plasma Farms



East Lampung Est : Java Sea – Plasma Farms



Dipasena:

9,000 Farms

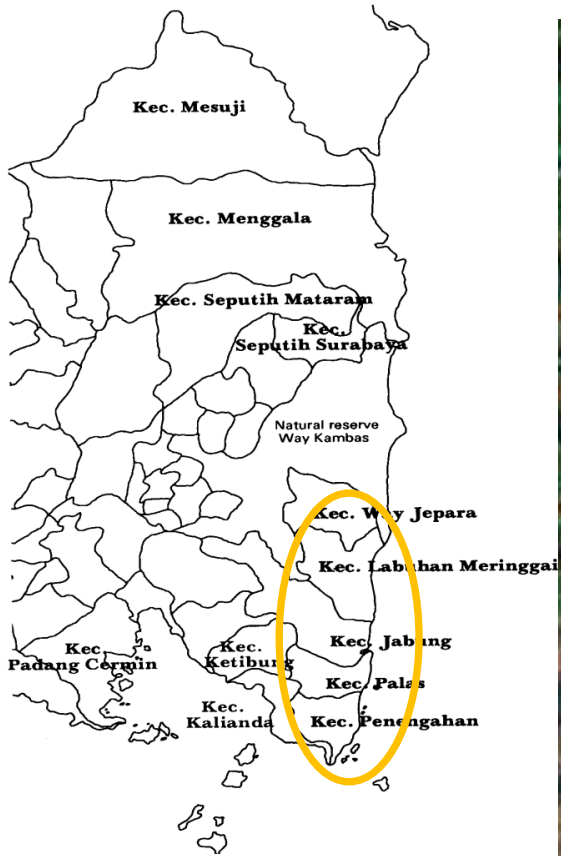
18,000 ponds

16,250 ha of which 4,500 ha of ponds

More than 20,000 people: farmers (households) and employees

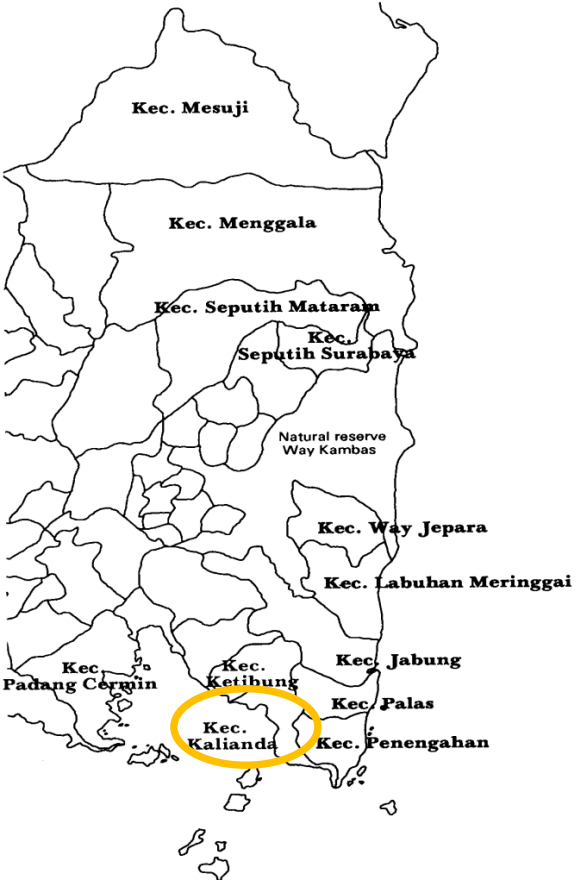


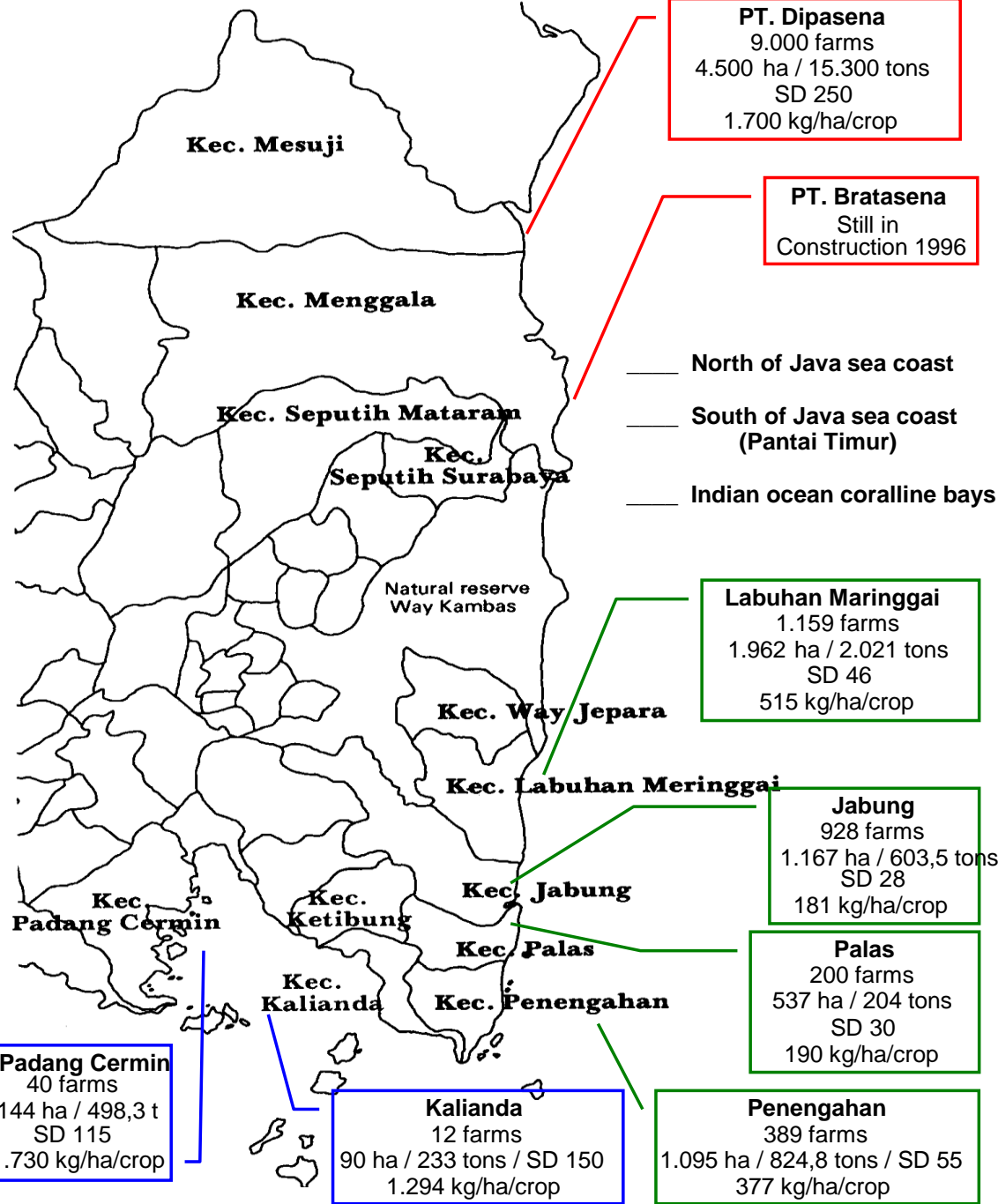
East Lampung : Java Sea – Small scale private or family based farms (endogenous development)



Courtesy of Wijayanto Soehadi
Infrastructure Improvement for Shrimp Aquaculture Project (IISAP)

South Lampung : Kalianda, coralline bay site





Plasma Farms



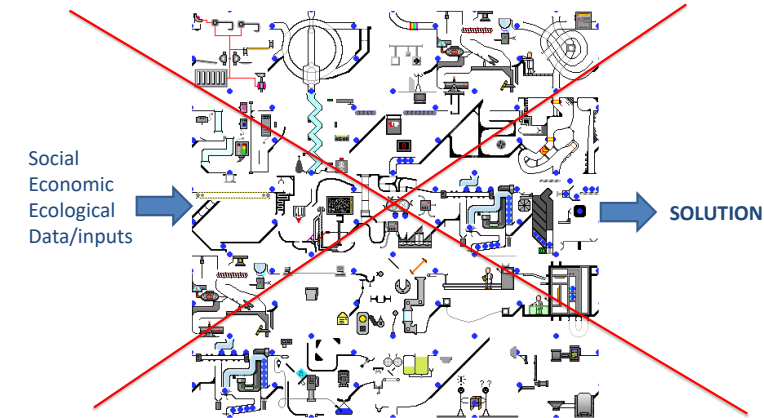
Typical farm of South of Java sea coast

Always contextualize

SD: Stocking Density in 1.000 PL / ha as a global indicator.

Lesson learned: sustainability and governance

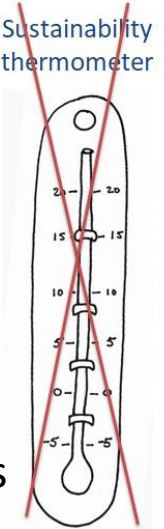
- This example of shrimp farming development, where environmental and social dimension are assessed through proxy, illustrates quite well the need for integration.
 - It is not just a question of available technology and access to capital, but also of integration into a socio-ecosystem that will condition the development, and especially the institutional and social arrangements that are not enough taken into account.
 - An analysis of the literature (Cavallo, 2023) demonstrates a gap in literature investigating social aspects of aquaculture development. Moreover, social acceptability of aquaculture is usually assessed as part of consumer perception of environmental and health issues, but less about economic impact, or benefits for coastal communities. Studies of the effects on social values and institutional and political aspects, such as trust and transparency, are almost non-existent.
- This **difficulty in integrating the social or public dimension** of sustainability leads to a too simplistic view of the diversity of aquaculture development and denies the development profiles.
- Why it fails in integrating the social dimension, expressed as the public dimension? Because we **don't know how to proceed with** and it is put off to the last or put aside without being integrated from the very beginning.



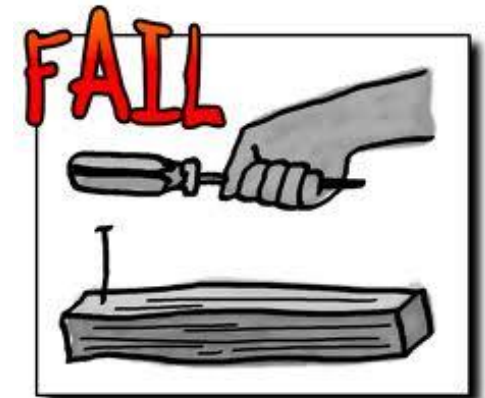
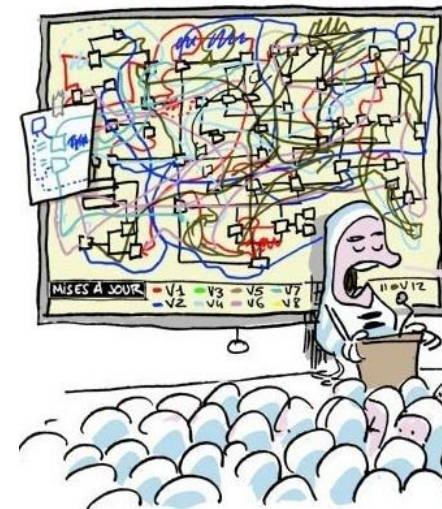
Faced with the difficulty of implementing integration, and especially the social dimension, tools come before questions and concepts follow concepts, with a mismanagement between tools and processes... In the field of marine and coastal ecosystems solely in terms of Ecosystem Based Approaches (and non exhaustive...):

- Ecosystem approach to fisheries (EAF)
- Ecosystem-based fisheries management (EBFM)
- Sustainable livelihoods approach (SLA)
- Integrated coastal management (ICM)
- Integrated coastal area management (ICAM)
- Coastal zone management (CZM)
- Marine Spatial Planning
- ...

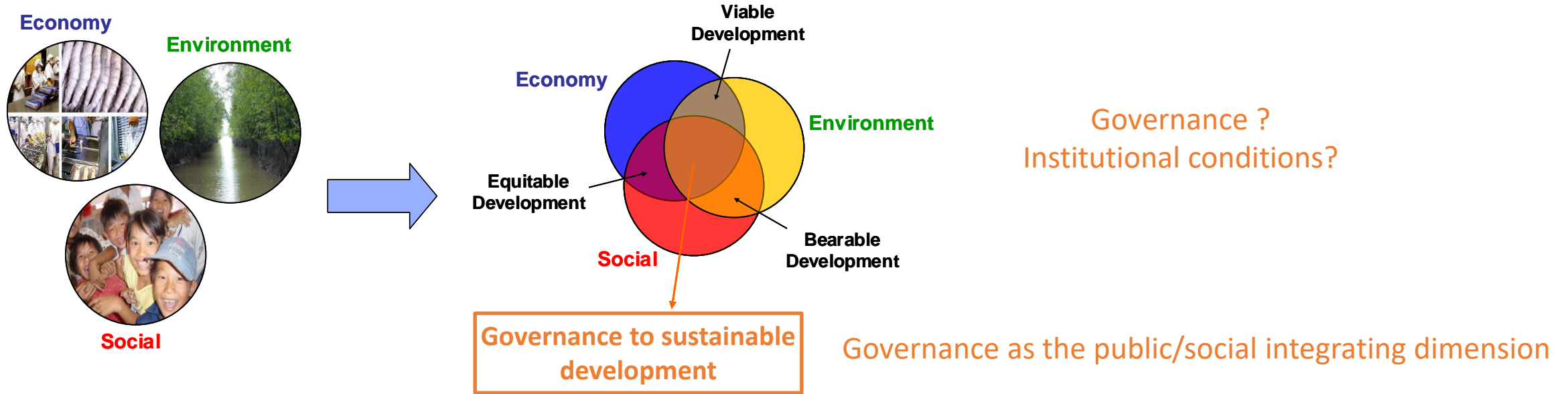
- Ecosystem approach to aquaculture (EAA)
- Ecosystem-based aquaculture management (EBAM)
- Wealth-based fisheries management (WBFM)
- Integrated coastal resource management (ICRM)
- Integrated catchment management (ICM)
- Integrated coastal zone management (ICZM)
- Social acceptability assessment of coastal developments



Social Acceptability approaches or NbS seem to be different than the previous ones in the way they address directly the social dimension (as long as they are not first translated into tools and solutions (e.g. SDD, SLO...)).



Sustainability...



- The difficulty related to integration is rooted in the way sustainability is assessed: whereas integration is the very spirit of sustainability, it is broken down into parts to analyze its components separately.
- The first issue faced by aquaculture attached to environmental impacts of some developments, led to first isolate environmental sustainability, then address “social” impacts through BAPs/BMPs/CoC and finally economic sustainability (being profitable facing a context of collapsing prices).
- Objective is then to maintain this integration rather than disintegrate it and try to reaggregate it later. Sustainability is much more than the sum of its components. In that way, this emerging property rather calls for system approach as an holistic and integrated approach (property of a system is much more than the sum of its components’ properties).
- System approach seems promising to address sustainability of complex socio-ecological systems. **Attention has to be paid when formulating the issue of Aquaculture Development in an integrated way.**

How building and formulating an integrated issue?

Co-construction and stakeholders engagement are usually the way supported to achieve such goal. But it can be paved of difficulties, especially in the context of complex coastal and marine socio-ecosystems. System Approach and participatory process are then not an end in themselves.

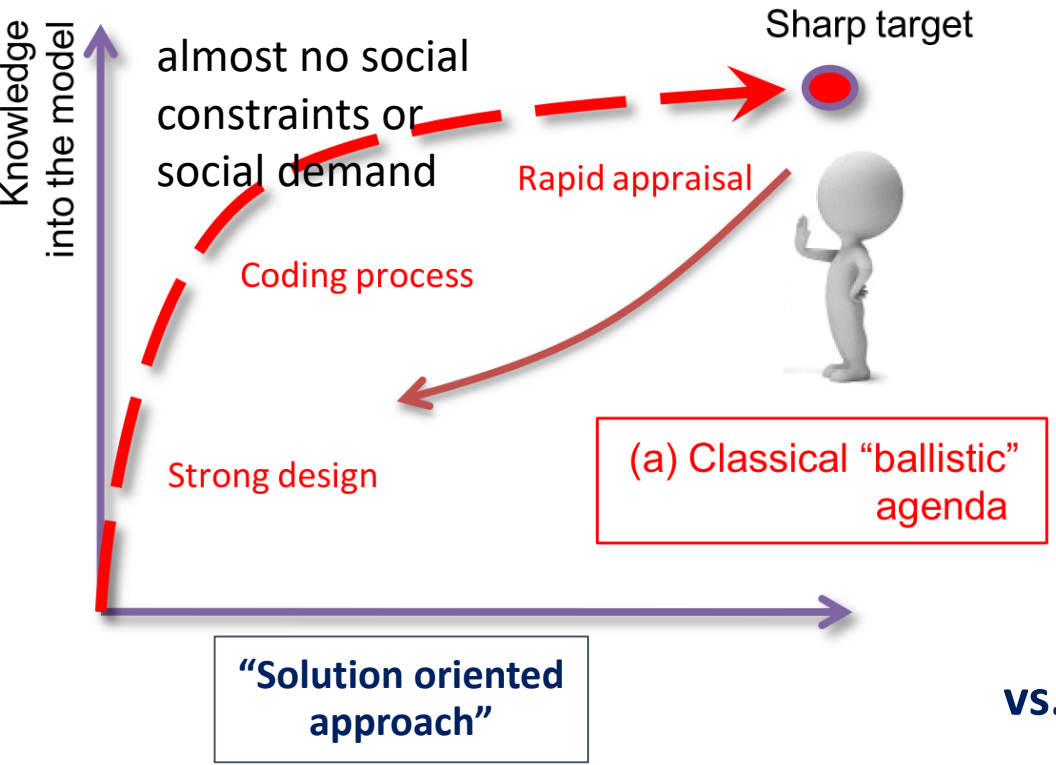
Co-constructing is a drift-sensitive process. Typology of social attractors that destroy the co-construction process:

- Too strong design (Solution model)
- Solutions sellers
- False problems
- Refraction
- Symbolic capital
- Galapagos Syndrome
- Chimerical consensus (Denying the truth to preserve the social consensus)

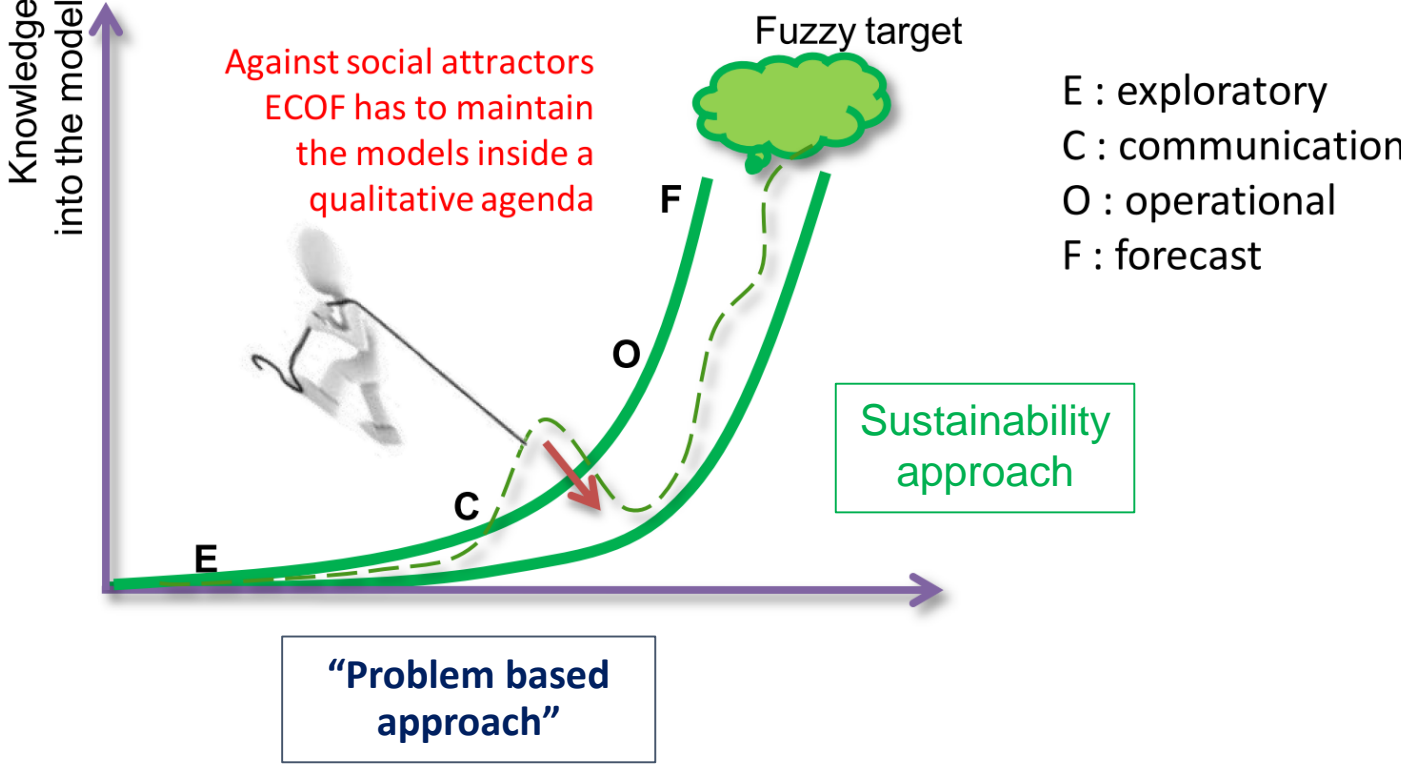


System Approach and stakeholders involvement... the panacea?

Co-constructing is a drift-sensitive process; we need to adopt the relevant tools to prevent against all sort of social attractors : moving from the classic/usual “Ballistic” approach



vs.



- Exploratory: the problem is explored; false problems are ruled out and the first conceptual models are built
- Communication: the models are able to produce the first numerical results (new communication medium)
- Operational: the results of the models correspond to a measurable reality
- Forecast: this is a level of quality which ensures scenario modelling.

From Solution Approach/Sellers to Problem oriented Approach

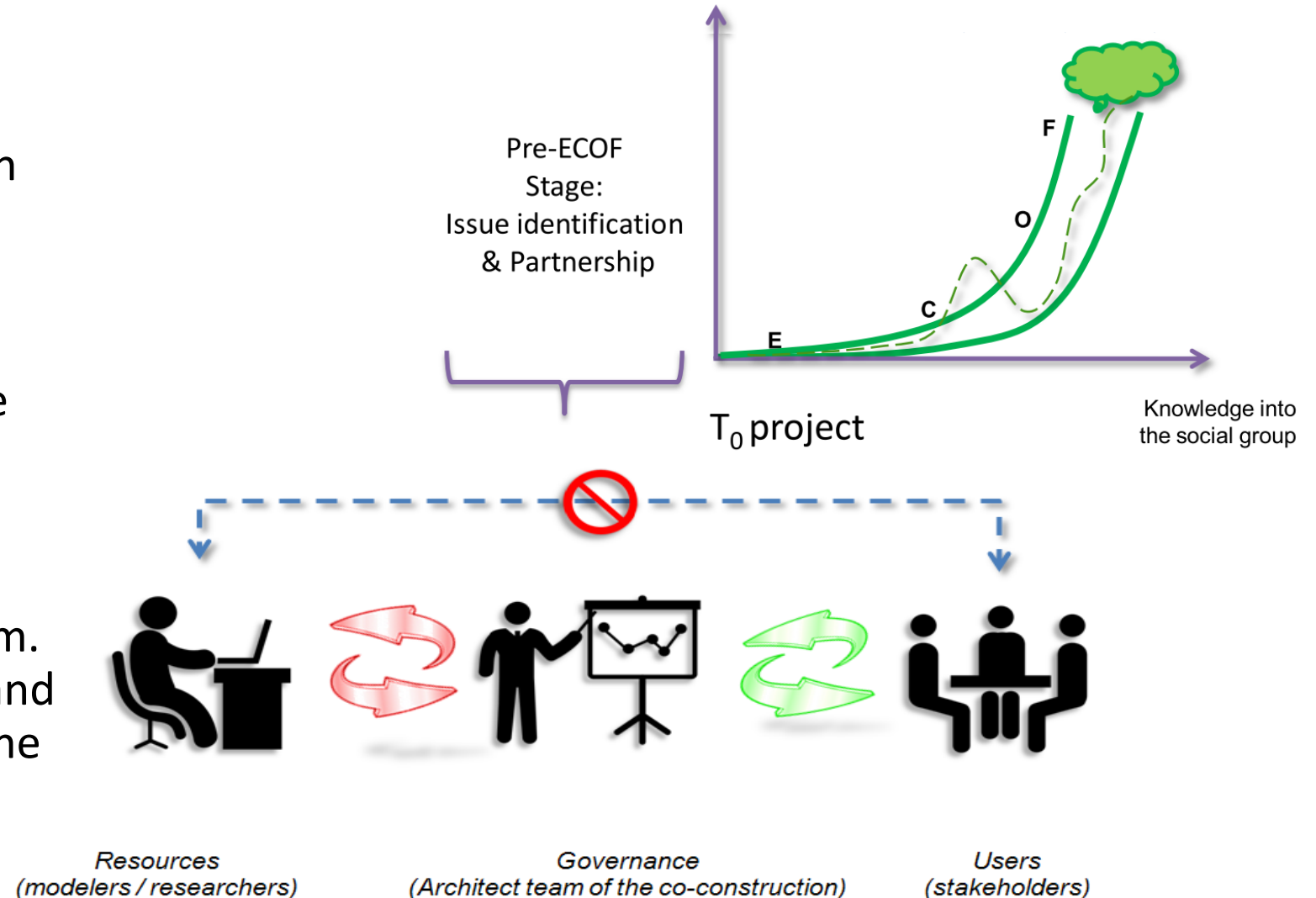
Co-constructing is a drift-sensitive process; we need to adopt the relevant tools to prevent against all sort of social attractors : organization of the partnership, the social RUG scheme

The social RUG scheme:

The Resources of the co-construction are the modeller & scientists by providing knowledge and scientific expertise

The Users are those who will use the results of the co-construction (the model) or will be impacted by its application

The Governance is the Architect team. This group has to carefully manage and document the exchanges between the Resources and Users



Solution oriented vs. Problem based: the case of pearl culture in French Polynesia



Pearl production cycle

Spat collection

Launch of spat collectors Spat harvest

12 to 18 months



Growth

Oysters stringing Harvest for grafting

3 to 12 months



GRAFTING

Pearl production

Oysters stringing

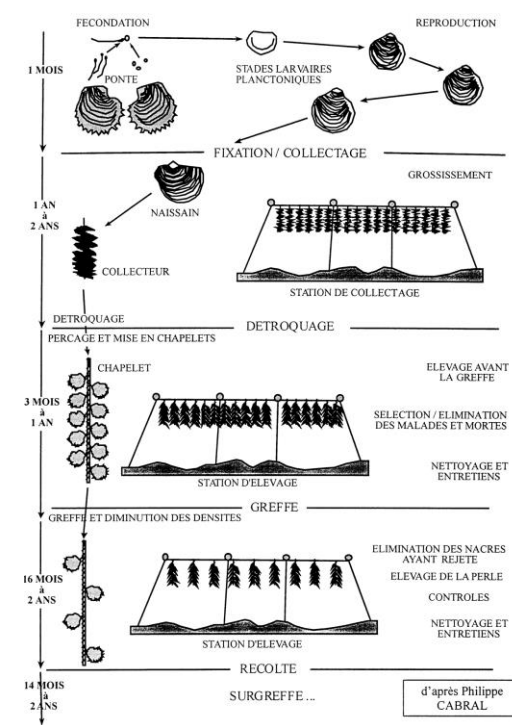
1st Harvest of pearls

14 to 18 months

About 4 years long to produce the first pearl

2nd GRAFT

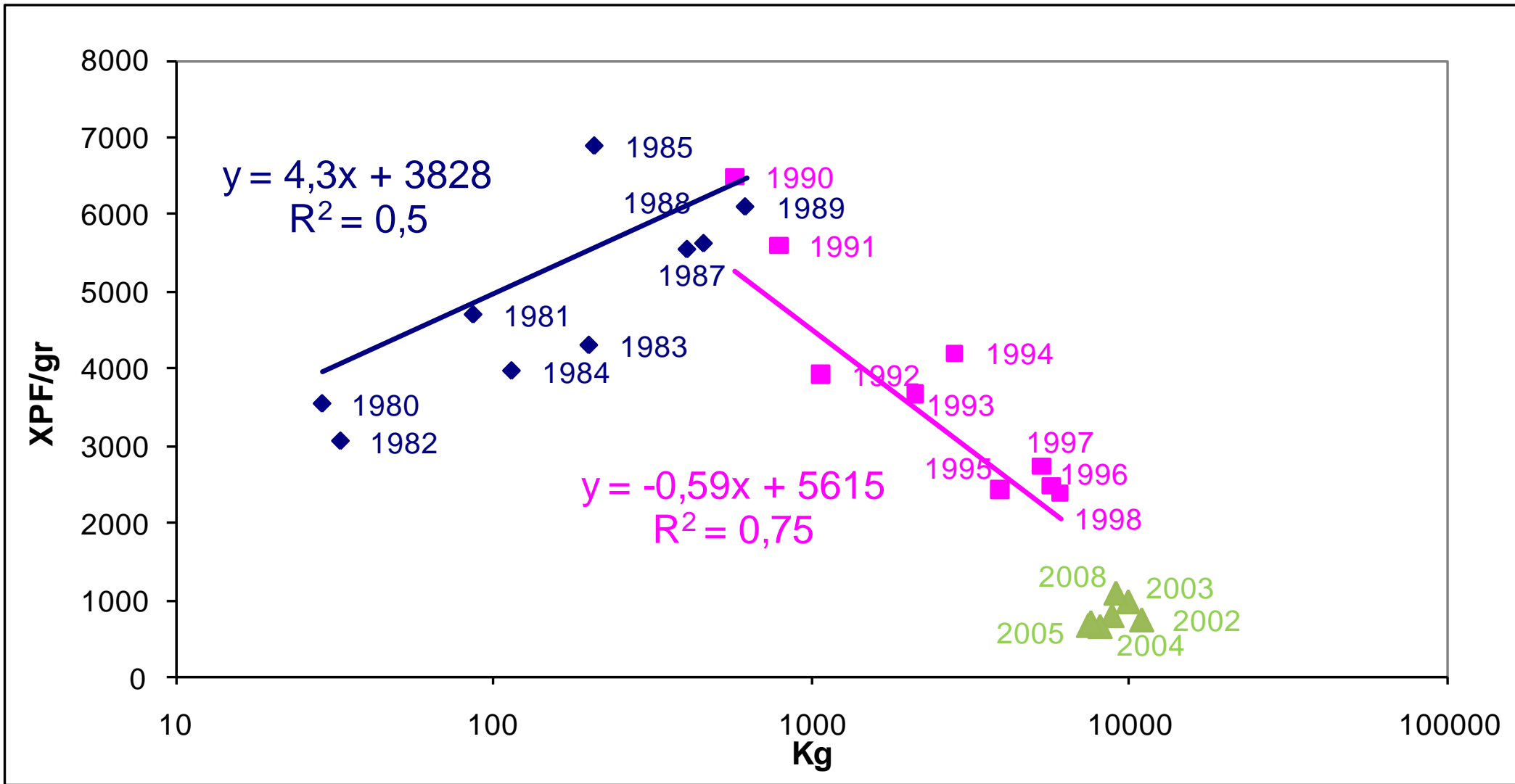
2nd Harvest of pearls



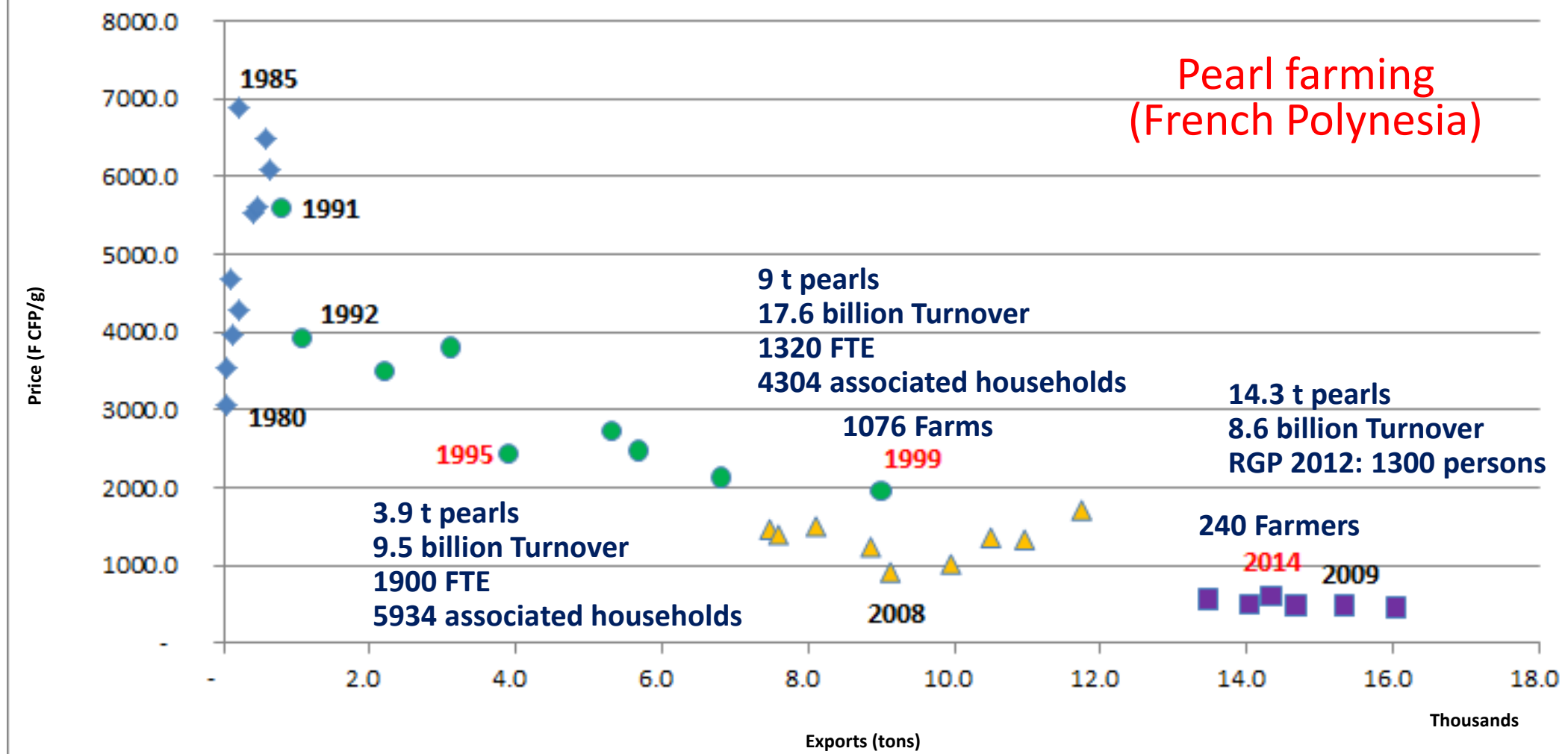
d'après Philippe CABRAL



Average price (F CFP/g) and Export of pearl (1980 – 2014)



Average price (F CFP/g) and Export of pearl (1980 – 2014)



“Solutions”:

1. Genetic improvement of pearl oysters through genetic selection for donor effect on pearl quality
2. Development of hatcheries to provide pearl oysters
3. Control of pearl quality before selling (Xray)
4. Improvement of production costs through technological innovation

Objective

Increase of price (target)

An issue formulated into a need for increasing pearl quality and an increase of oysters availability to increase farms' income

“Issues”:

1. Price decrease due to increase of low quality pearl
2. Farms' income decreases because of price decrease and lack of oysters for grafting due to low/bad spat collection

Solution oriented approach

Time

Result: Rationale of Solutions at individual scale, not at the industry level. Worsening of the initial situation and distance from the target

Typical of numerous Aquaculture Developments (e.g. seabass/seabream, even for extensive systems such as oyster farming)

“Proposal of action agenda to be continuously implemented and monitored”:

1. To manage the pearl manage the lagoon (legitimacy of public action)
2. Devolution of management at lagoon scale, partly relying on customs inherited from traditional management
3. Incentives to restructuration and reduced production through conditional “Solutions” (conditional availability of new technologies and innovations)
4. Segmentation and discrimination of pearl products, Traceability...

Objective

“Exploration of Issue”: a deliberated and shared diagnosis

1. Price decreases due to both overproduction and increase of low quality pearl proportionally as well as poorer management practices to reduce production costs (early harvest, questionable practices...)
2. No incentive to better management. Free rider behavior within the industry
3. No incentive to act collectively at the industry level to cope with the issue. Strategy of the last survivor

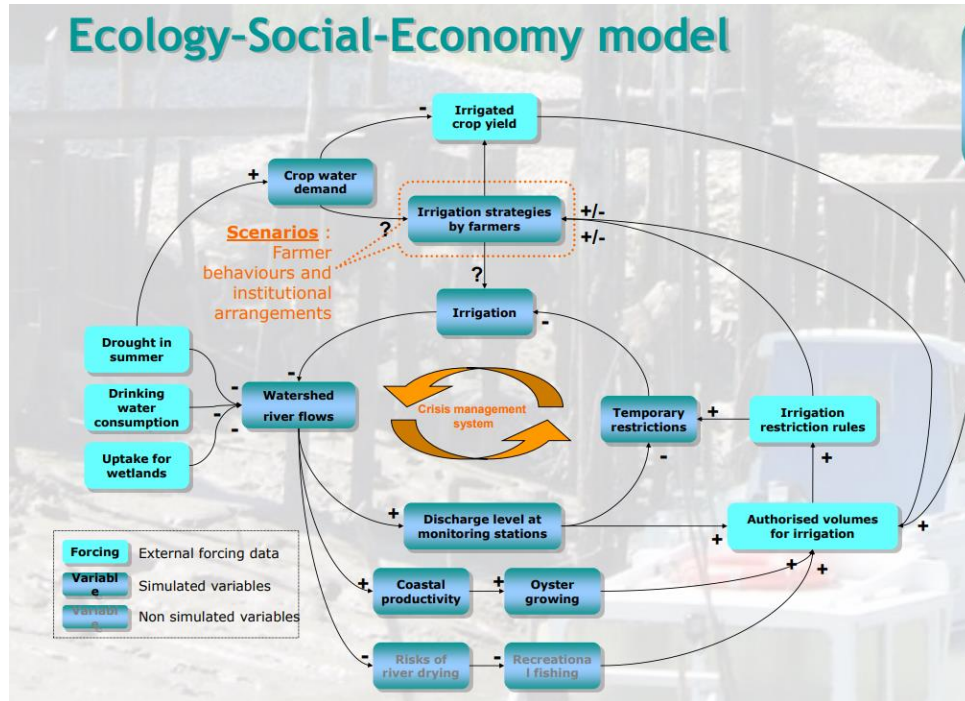
Stabilisation/Increase of prices (target), fixation of population in remote archipelago

Problem based approach

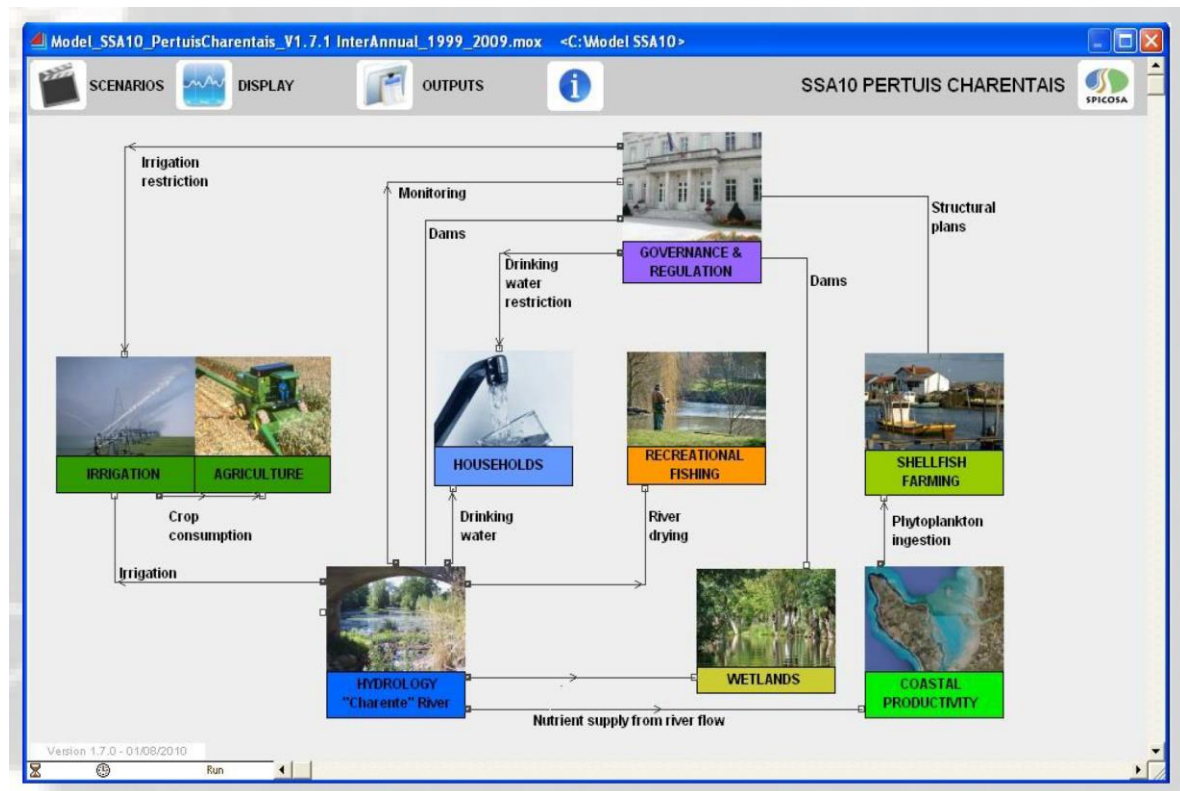
Time

The case of Shellfish farming and Freshwater allocation in a river catchment (France)

Another drifting process from co-construction



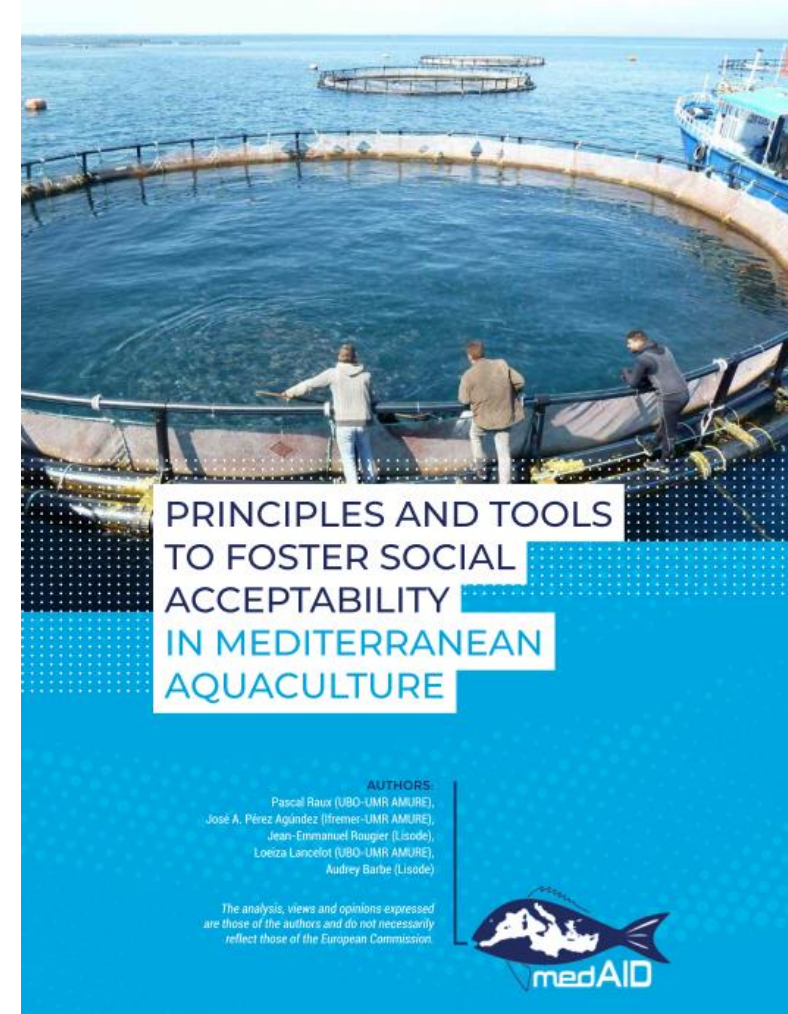
From conceptual model of the issue to simulation



The issue is used as a hidden means of making claims (moving from coastal to offshore by claiming offshore concessions).

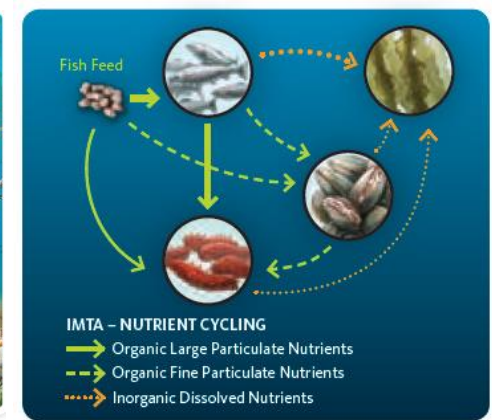
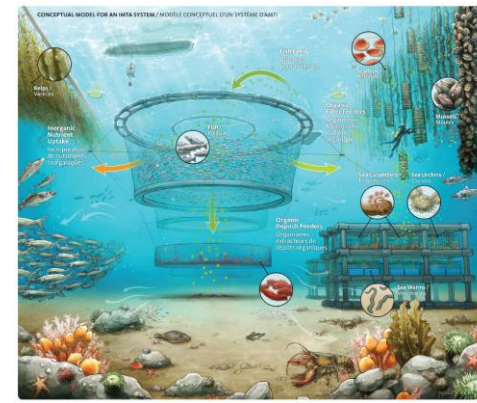
Lesson learned from social attractors in formulating aquaculture development issues

- Needs to reverse the way of thinking aquaculture development.
- Aquaculture doesn't decrete itself bus has to be co-constructed
- Needs to move from sites selection first
- Social Integration calls for:
 - Replacing 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
 - A more integrated approach of Carrying Capacity through an integrated Carrying Capacity
- Transfer of skills from traditional territorial approaches (integration of stakeholders, territorial facilitation, long term consultation bodies, etc.)
 - A matter of process, not of tools or solutions first.
 - Move from Solution to Problem oriented approach!
 - Make the paint, choose the frame later!



And what about IMTA ?

IMTA echoes a number of the issues and questions we've addressed.



- ✓ The first thing that emerges is the constant energy put into demonstrating and **inventorying new benefits of IMTA**, as if it had always needed to justify itself. Every time, it seems that the IMTA needs to find additional benefits beyond those already demonstrated and listed if it is to move forward. A never-ending battle?
- ✓ **IMTA's polyvalence remains poorly understood** by public authorities that are more accustomed to managing single species under specific regulations. It's precisely this polyvalence that makes IMTA so valuable and that can act as a factor of social acceptability of aquaculture developments. But social acceptability is much more than a matter of communication to correct what are perceived as misperceptions of aquaculture and IMTA by society, by citizens, consumers, decision-makers...
- ✓ In the global development approach thought in volume and driven by the demand, **IMTA has difficulty to voice and asserting its rights**. Similar to the case of the so called integrated aquaculture by the end of the 90s in the context of shrimp farming and mangroves.

What about IMTA ?



Freshwater integrated system (*Macrobrachium rosenbergii*, fruits and vegetables)

The traditional integrated systems in Asia, end 90s begining 2000s, under the poverty alleviation and mangrove preservation issues

Integrated farm in Vietnam (Mekong Delat)



What about IMTA ?

1. **Stop defining what is IMTA what is not IMTA** and being trapped into a classification issue. Make the Point choose the frame later. It will be the critical mass of local demonstrators in different contexts and objectives that will support the development and gives evidences of the benefits from IMTA.
2. **Stop trying to monetary value the whole benefits of IMTA** to give evidence of these benefits: adverse effects of the monetary valuation of non merchant goods and services in decision making (CVM, TCM, Hedonic prices...). Solely relevant for sensitivity analysis and attachment to the environment. Numerous evidences of the benefits from IMTA. If it is not enough that's maybe because the problem is also elsewhere and especially in a solution based approach. Move to the problem oriented one where IMTA is debated and part of a problem oriented approach.
3. **The potential of IMTA for integrating beyond of ecological processes.** If deliberated through a problem oriented approach, IMTA has a potential to act as an integrator factor for different social levels and/or economic levels and not only trophic levels.

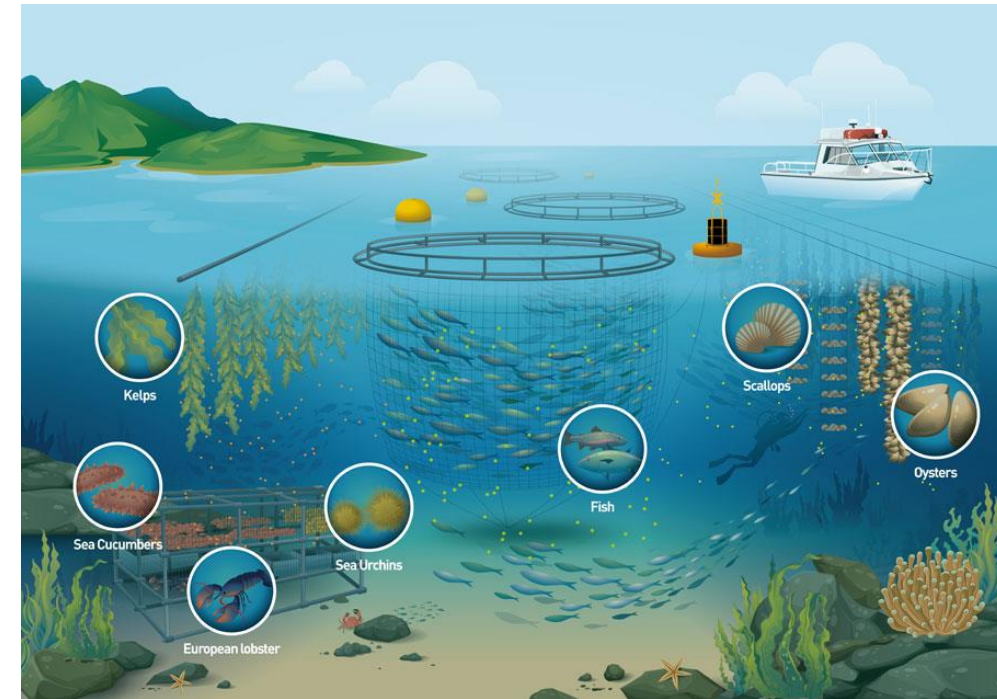


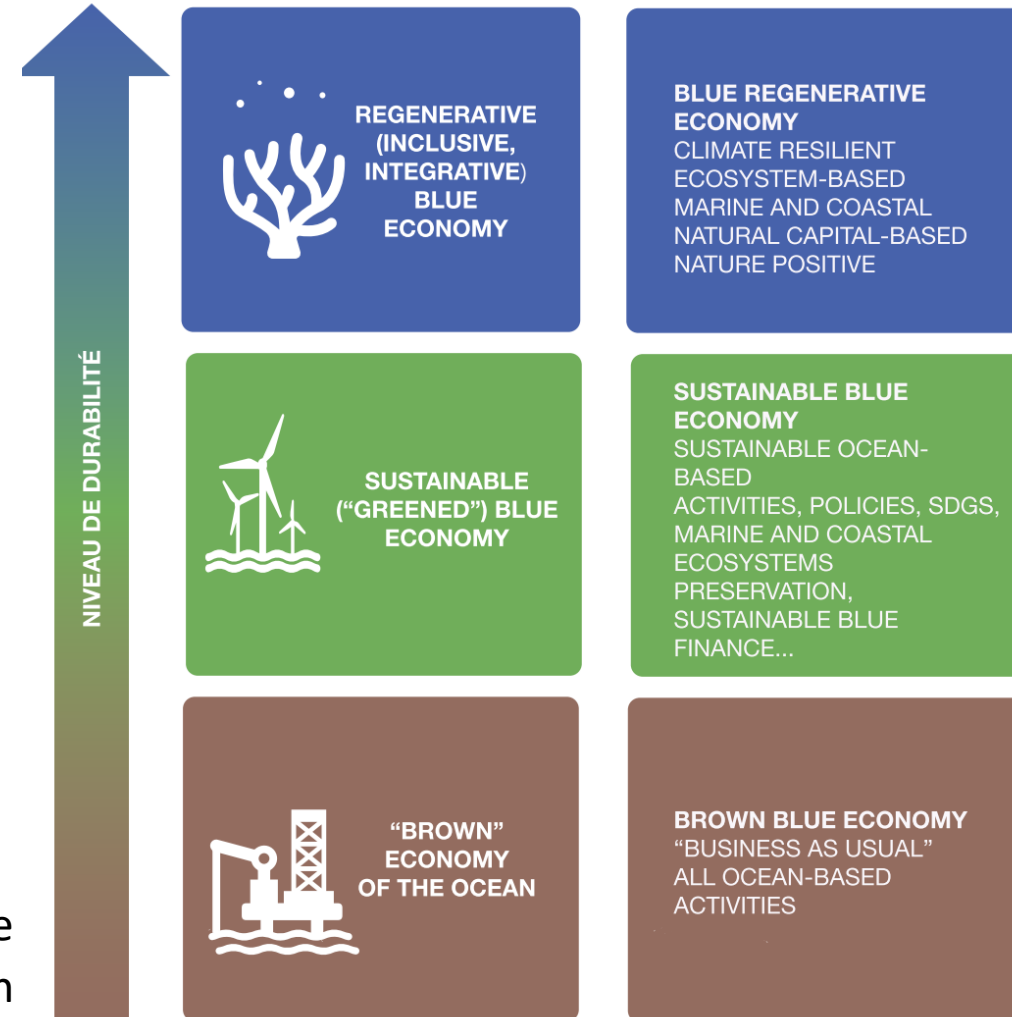
Image Credit - Marine Institute Foras na Mara

Conclusion: from Thierry's Turquoise Revolution to Blue Regenerative Economy

In the frame of a **regenerative aquaculture** supported by NbS, IMTA and aquaculture more globally can tick most of boxes of the societal demand regarding the sustainability of coastal and marine socio-ecosystems (Le Gouvello et al. 2024).

- The “failure” of the Blue Economy, so called **Brown Blue Economy**: a Blue Economy rooted in the maritime industry. A simple transposition of a neo-classical, anthropocentric vision of the economy to the maritime.
- The **sustainable Blue Economy** (2012): more sustainable and more inclusive than the Blue Economy. A greening Blue Economy. Criticism on capacity of the Blue Economy: to integrate climate emergencies, and truly protect marine and coastal biodiversity, to adequately take into account societal and social issues (Brugere 2023).
- **Regenerative Blue Economy** (2020): beyond mere economic factors, it is integrative, inclusive, and regenerative. Some of the activities are excluded (those considered as incompatible with the carbon reduction objectives). Ensure that local societal requirements are met.

Toward **Blue Regenerative Economy** (Le Gouvello 2024): rather adding blue dimension to the emerging trend of regenerative economy instead of an evolution of the Blue Economy. Break away from Blue Economy.



(Le Gouvello 2024; Gibbons 2020)

The “**GLAZ**” Economy: GLAZ in northern Brittany language is a word used to define a “color” straddling blue, green and grey. A word also found in Gaelic language and in Wales



Thank You!