

Session 2: Impact of different uses on coastal and estuarine marine resources and on their exploitation in a context of global change?

Meeting

Dynamics of shellfish-exploited ecosystems under oligotrophication

Objectives of the research exchange project between France and Japan

Masakazu Hori & Franck Lagarde

A research exchange project between France and Japan

France:

PhD: Franck Lagarde, Valérie Derolez.

Researchers : Dr Marion Richard, Dr Vincent Ouisse, Dr Annie Fiandrino, Dr Sandrine Vaz



Japan:

PhD: Dr. Masaaki Sato, Juri Hori

Researchers: Dr Masakazu Hori, Dr Masami Hamaguchi, Dr Jun Shoji, Pr Toshihiro Miyajima, Dr Mitsutaku Makino, Dr Masahito Hirota



HOKKAIDO
UNIVERSITY



東京大学
THE UNIVERSITY OF TOKYO



HIROSHIMA UNIVERSITY



FRA
Fisheries Research Agency



A research exchange project between France and Japan focuses on the Japanese oyster

Crassostrea gigas



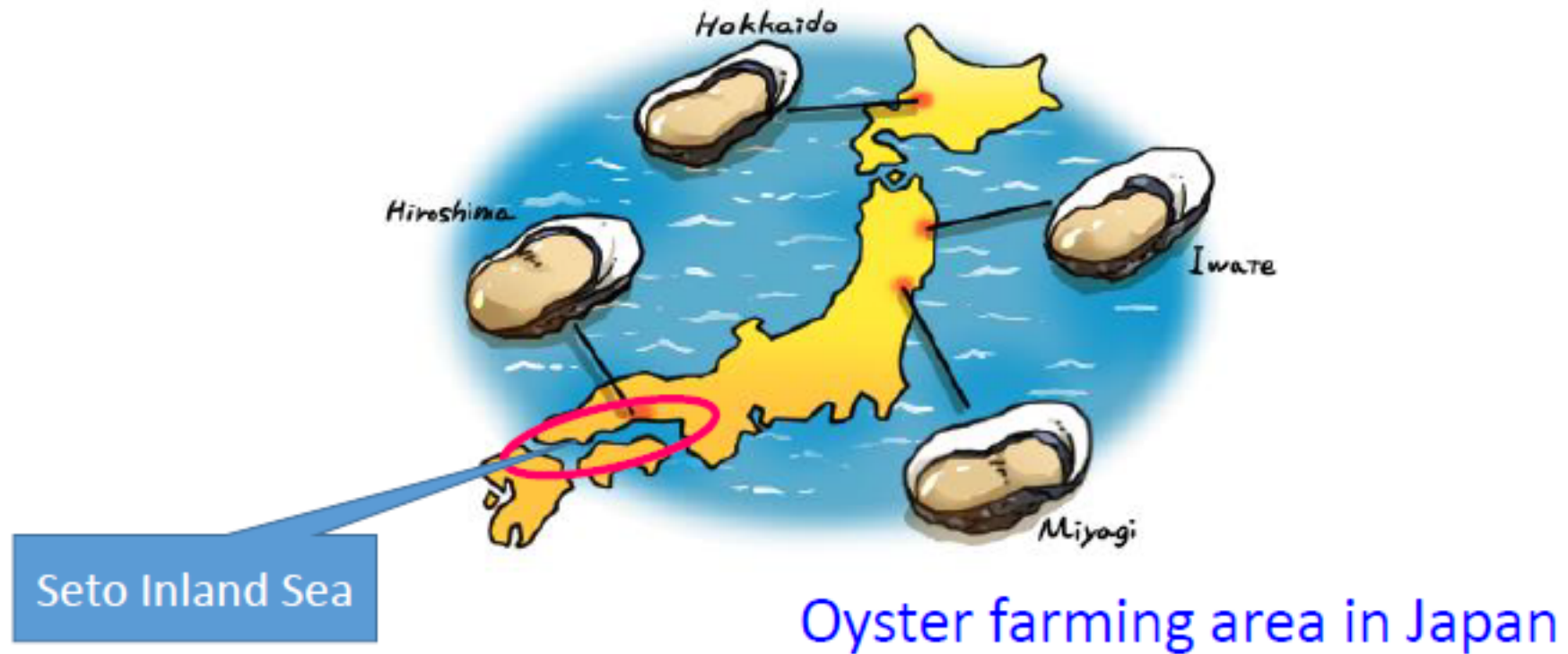
Cupped oyster

Pacific oyster

Japanese oyster

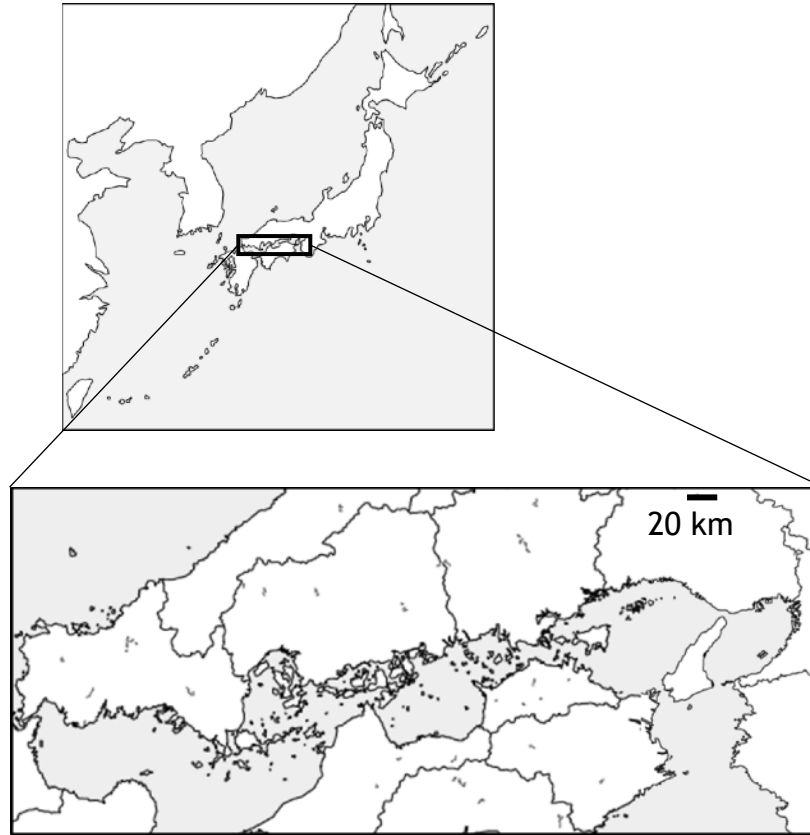


The Inland Sea of Seto is in the South of Japan

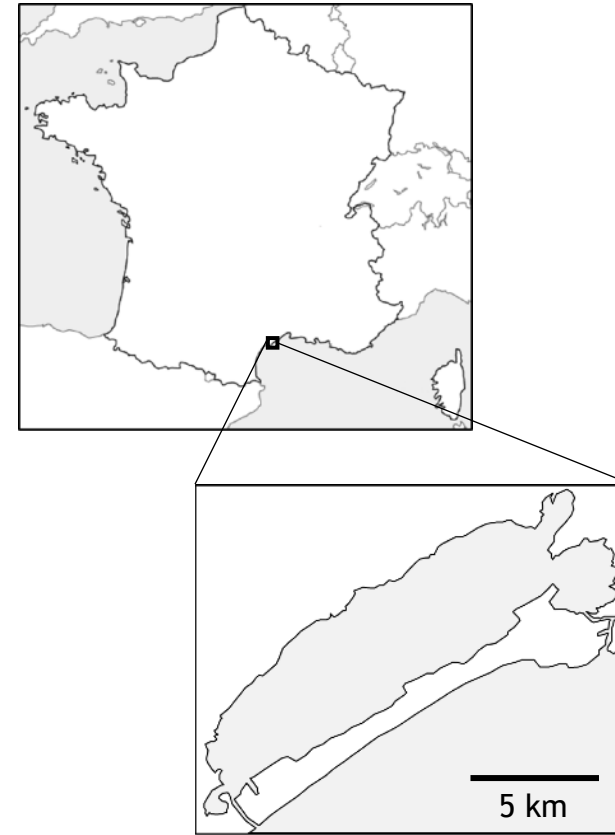


Source: Dr Masami Hamaguchi

Processes at different scales allow complementary knowledge.



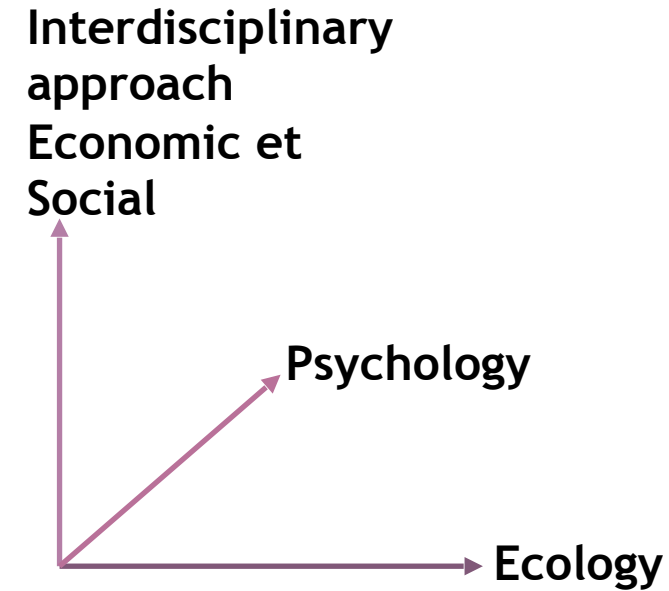
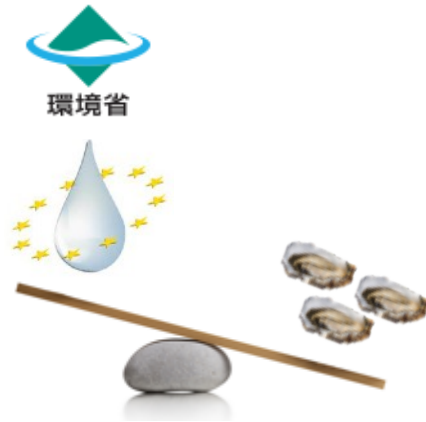
Seto inland sea and Hiroshima bay



Thau lagoon

Hori et al., accepted

The objectives of our project are the research exchanges between France and Japan



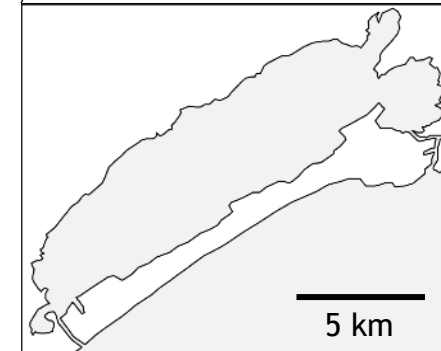
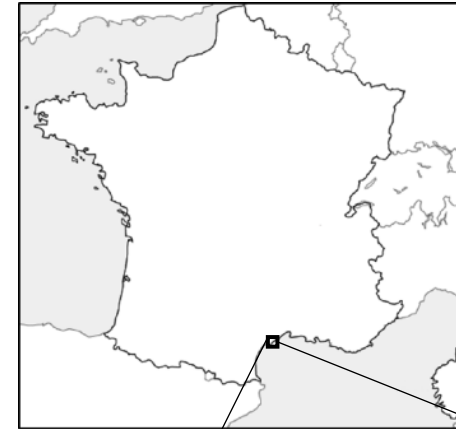
Sustainable exploitation
of ressources

Environmental management

→ Social and economical
dynamic

→ To characterize the well-
being in coastal zone

Thau lagoon is a dynamic ecosystem



449 incorporations

7000 to 11 000 t of oysters

2000 to 3000 t of mussels

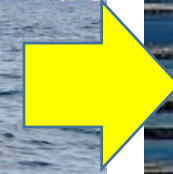
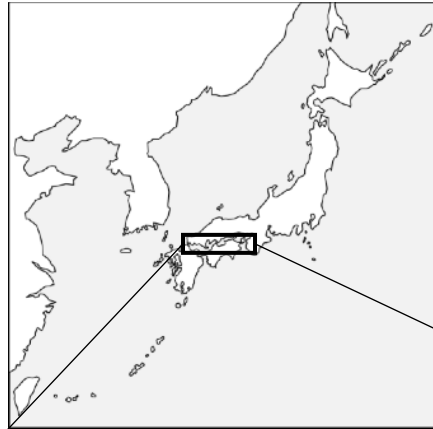
75 M Euros/year

More than 1000 direct employments

Source: Cepralmar

Eutrophication has changed the activity of coastal fishermen towards oyster farming and seaweed farming.

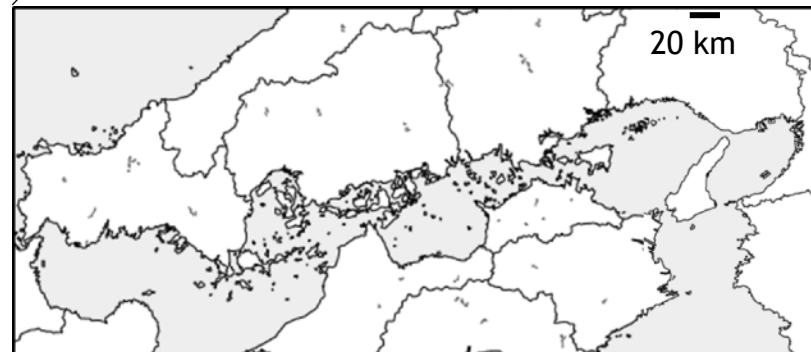
Coastal fisheries



Hiroshima bay
~ 400 incorporations

145 000 t of oysters
No mussels

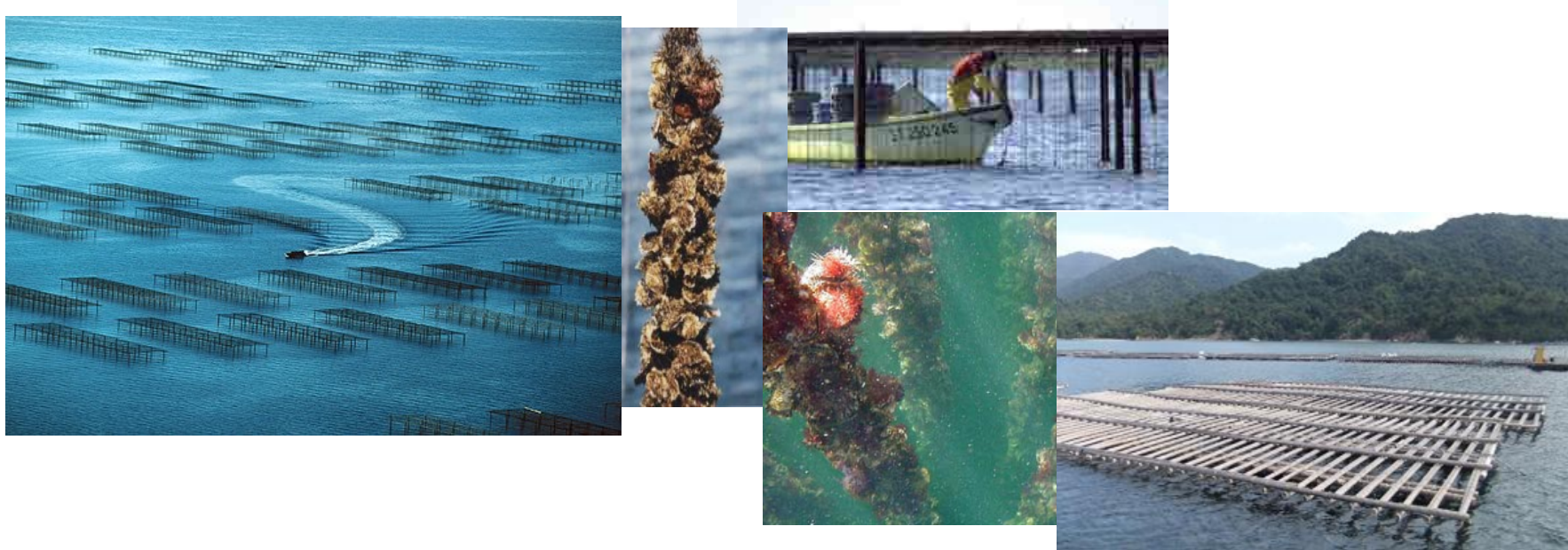
24 300 M yen/year



Aquaculture

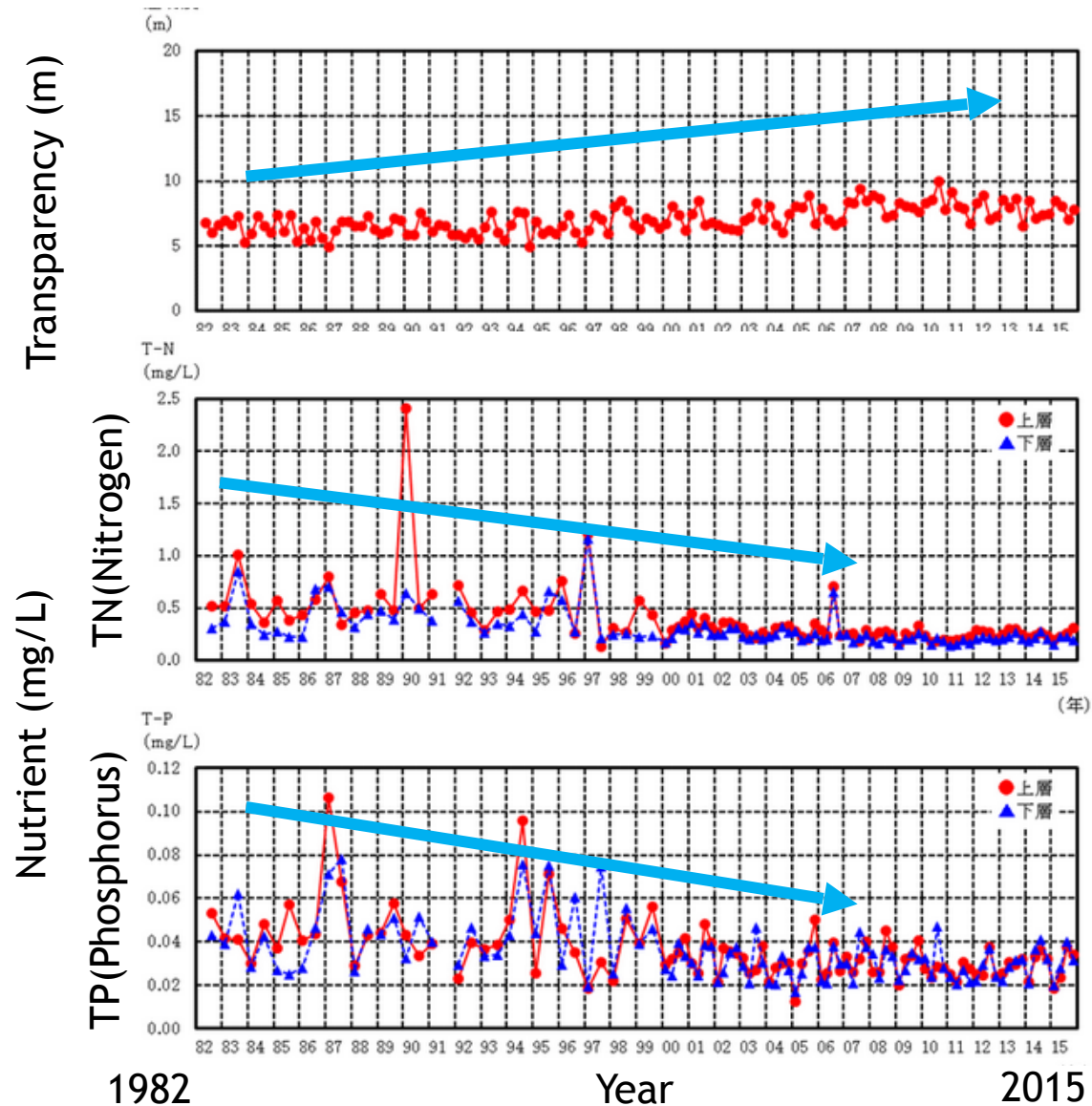
Source: Ministry of Agriculture
and Forestry and fisheries
Japan

Regulation has necessitated recent actions of environmental management of eutrophic ecosystems.



Nutrient inputs from catchment areas have been gradually reduced in coastal ecosystems, including ecosystems exploited for fishing and shellfish aquaculture.

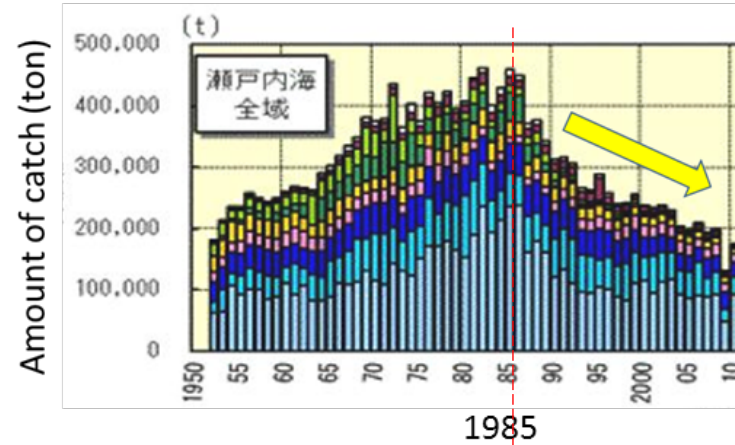
A recent change from eutrophication towards oligotrophication in the Japanese coastal environment



(Japanese Ministry of the Environment 2016)

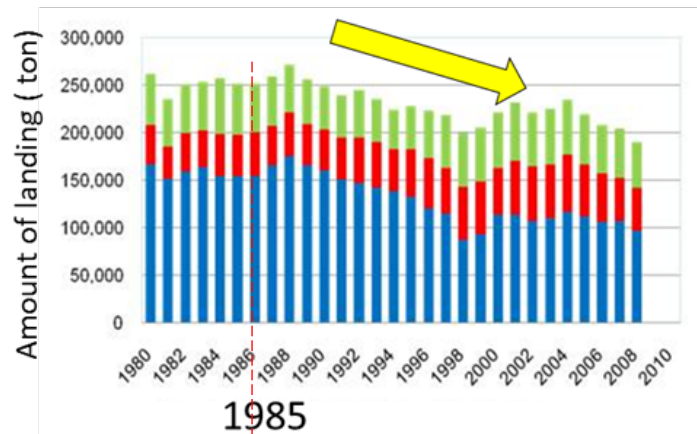
A decrease in pelagic phytoplankton biomass, fishery catches under 2 hypothesis of 1. over-exploitation and 2. oligotrophication

Pelagic fish

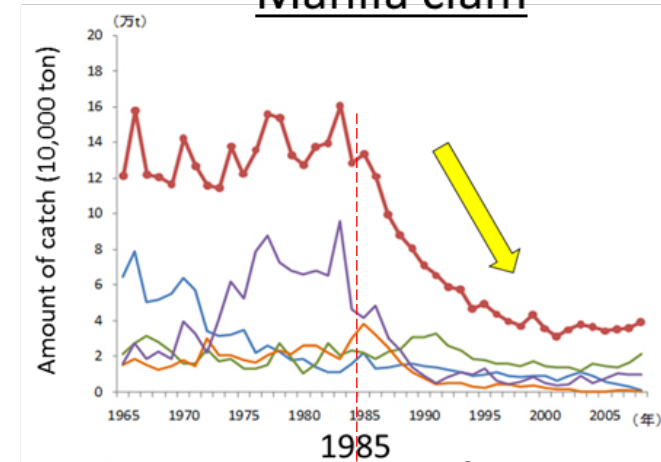


Seto inland sea

Oyster culture



Manila clam

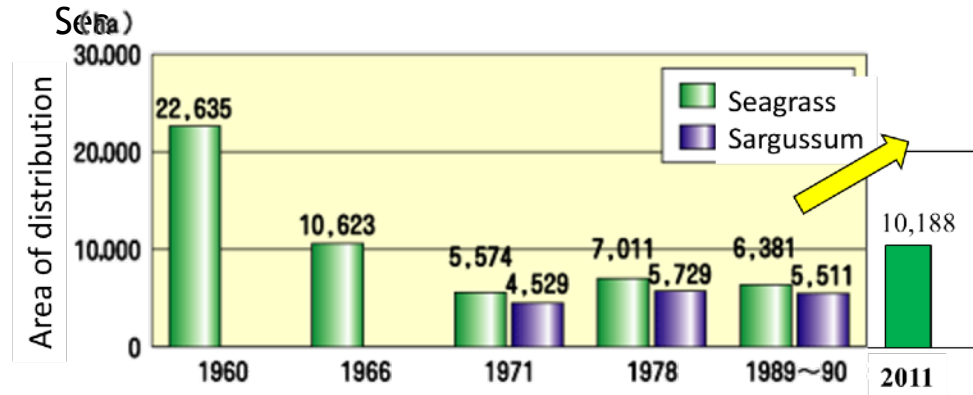


Source : Masakazu Hori

Oligotrophication to benthic primary production in the Seto Inland Sea



Distribution of seagrass beds in the Seto Inland



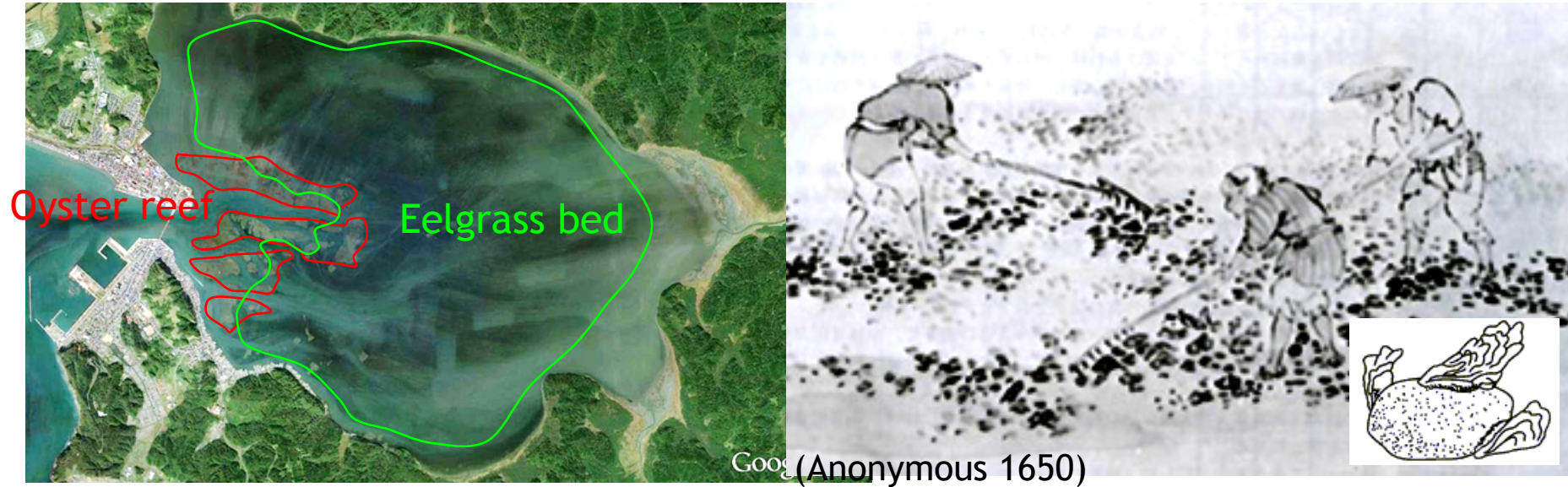
(Hori and Tarutani, 2015)

Seagrasses are quite important for:

- environmental improvements
 - sanitary /quality of waters
- climate change mitigation and adaptation :
 - carbon storage (Blue carbon sink)
 - modifying marine acidification
 - protection from sea-level rise & storm surges

(Arkema et al. 2013, Duarte et al. 2013)

Seagrass - oyster interaction in original habitats



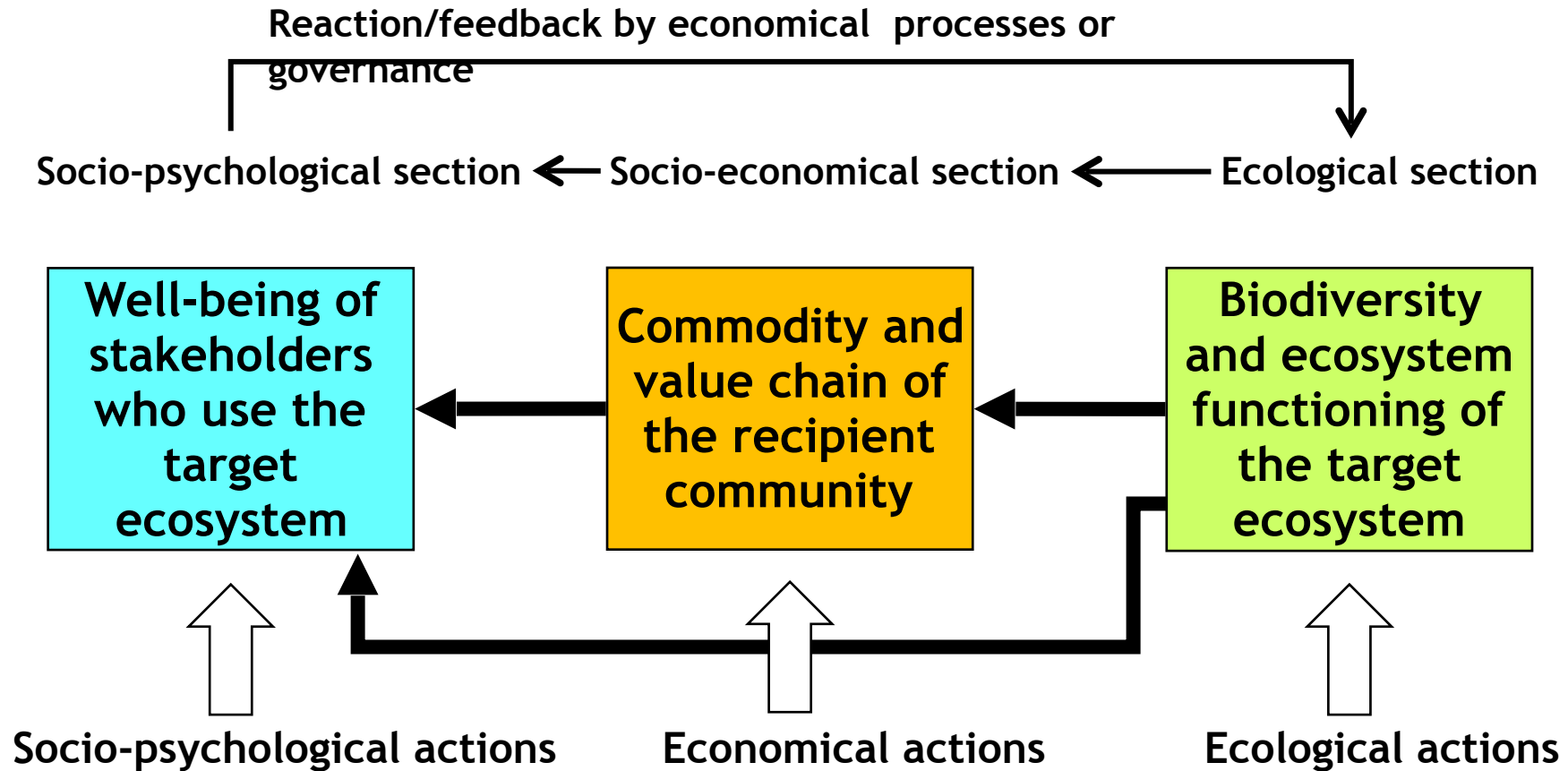
The ancient Japanese fishermen had empirically known
“oyster spats grow well on the tidal flat with seagrass beds”



More tasty!
More healthy!

Indigenous & local knowledge (ILK) (IPBES 2013)

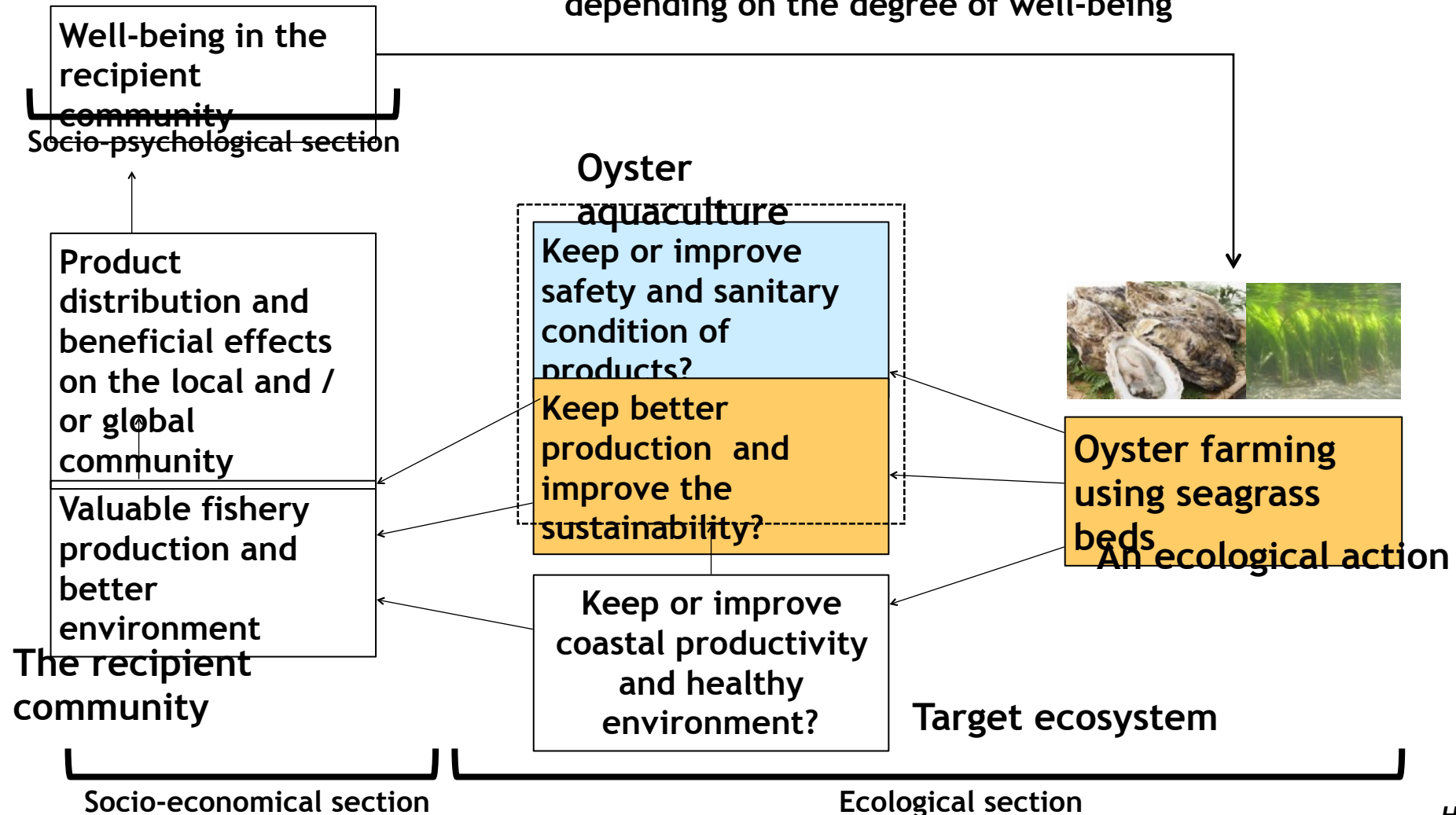
We want to study the dynamics of shellfish ecosystems under oligotrophication



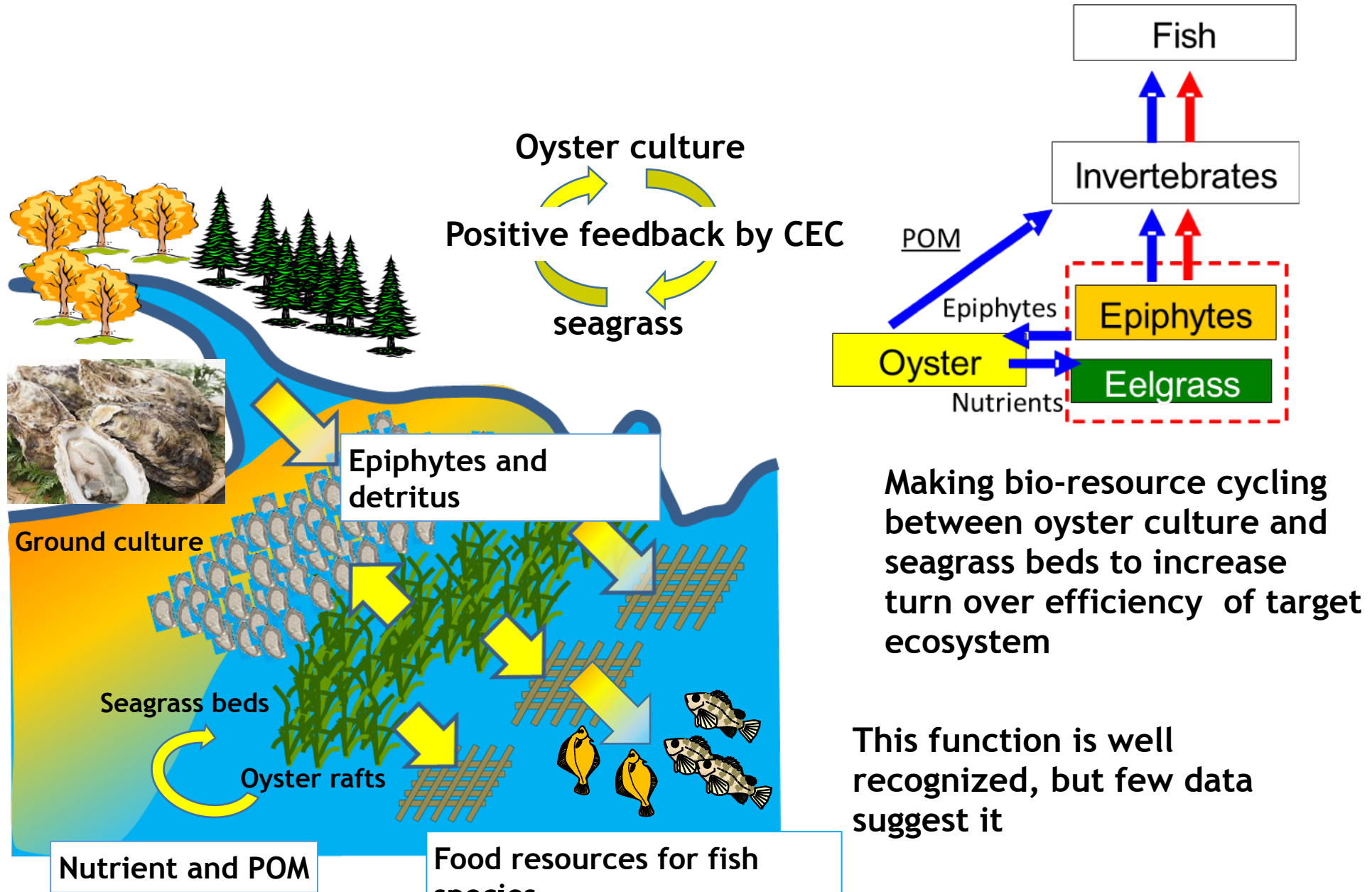
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Human well-being

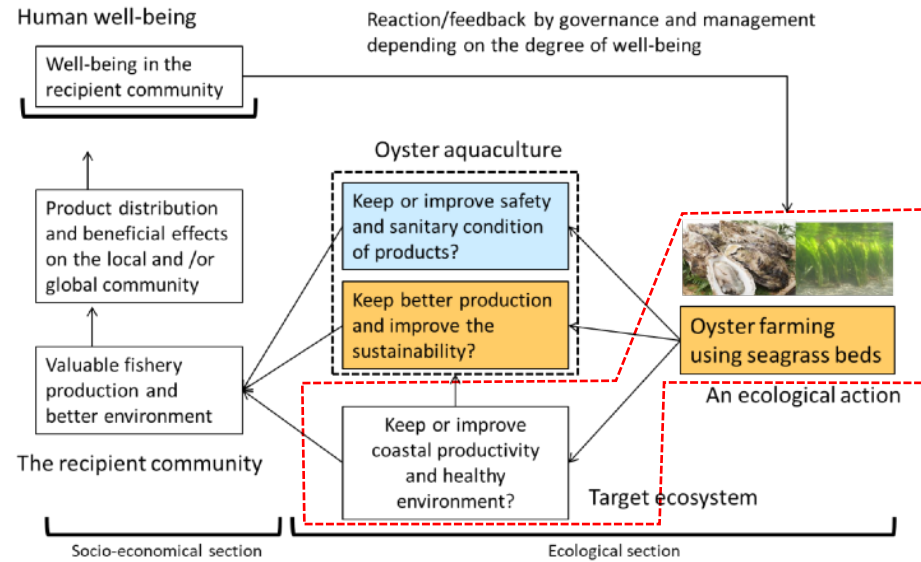
Reaction/feedback by governance and management depending on the degree of well-being



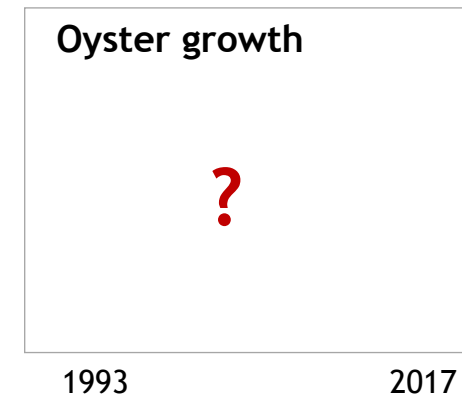
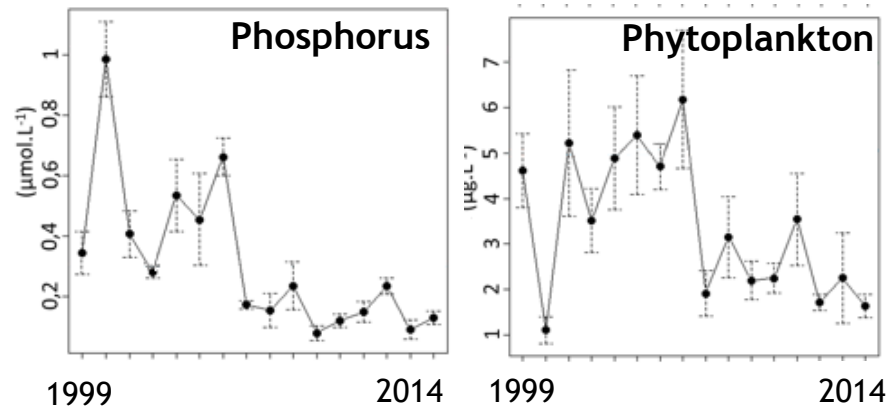
Reciprocal resource subsidies between oyster and seagrass



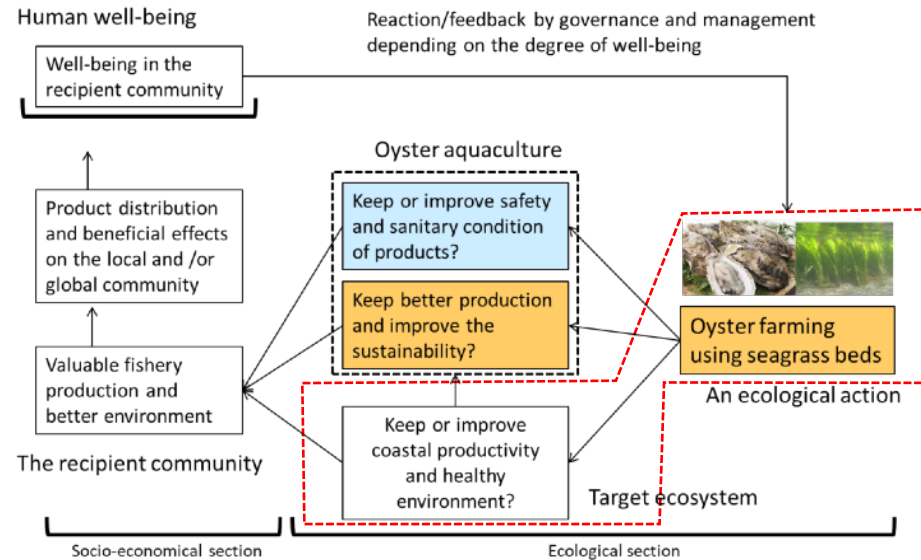
1. We want to study ecological functions



To improve the understanding the ecological function "Food for bivalves"



1. We want to study ecological functions



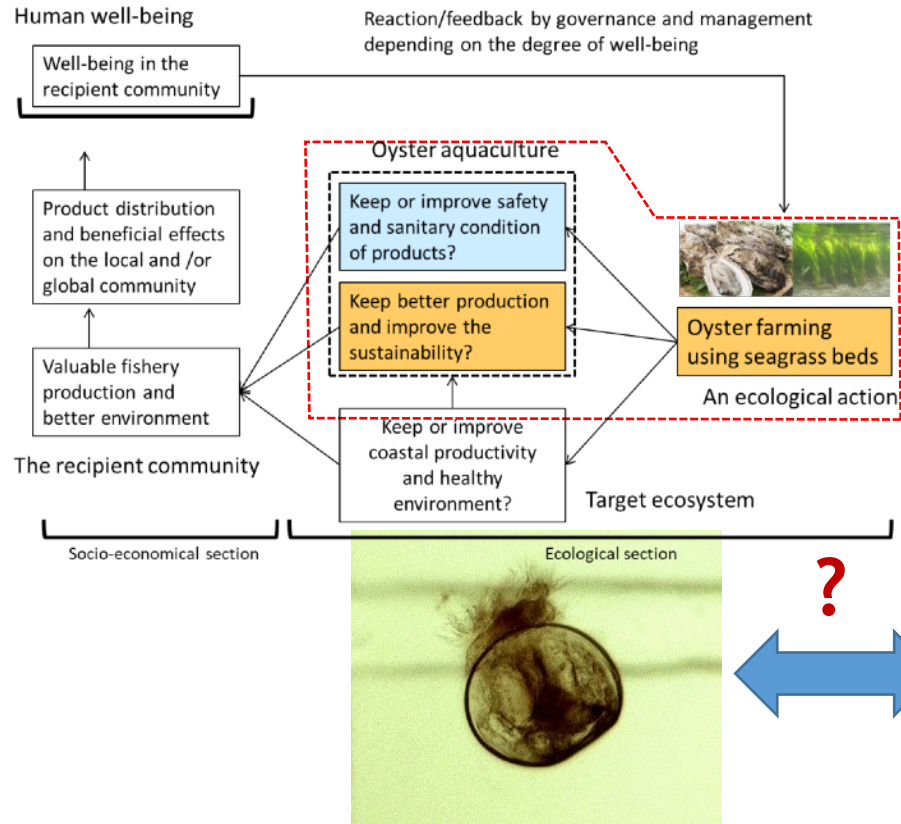
To improve the understanding the ecological function "Food for bivalves"

1-1. Clarify the relationship between nutrient dynamics, benthic production / composition, pelagic production / composition

1-2. Contribution of submarine groundwater to the cycle of matter and ecosystem functioning

1-3. Ecological modeling to integrate knowledge

2. We want to study ecosystem services



Development of sustainable farming practices in a context of good ecological status



Experiments are being conducted in 2017 and 2018 to:

2-1 Exploring the variability of larval recruitment of Japanese oyster into French Thau lagoon

2-2 Testing the influence of zoster seagrass beds on oyster production

2-3 Identify the food contribution of herbariums for oysters

2. We want to study ecosystem services

Interactions Between Harmful Algae and Algicidal and Growth-Inhibiting Bacteria Associated with Seaweeds and Seagrasses

Chapter (PDF Available) · January 2015 · *W. O. S. J.*

DOI: 10.1007/978-4-431-55130-0_25
In book: *Marine Protists*, pp.597-619

Fish Sci (2014) 80:353–362
DOI 10.1007/s12562-013-0688-4

ORIGINAL ARTICLE

Environment

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COASTAL ECOSYSTEMS

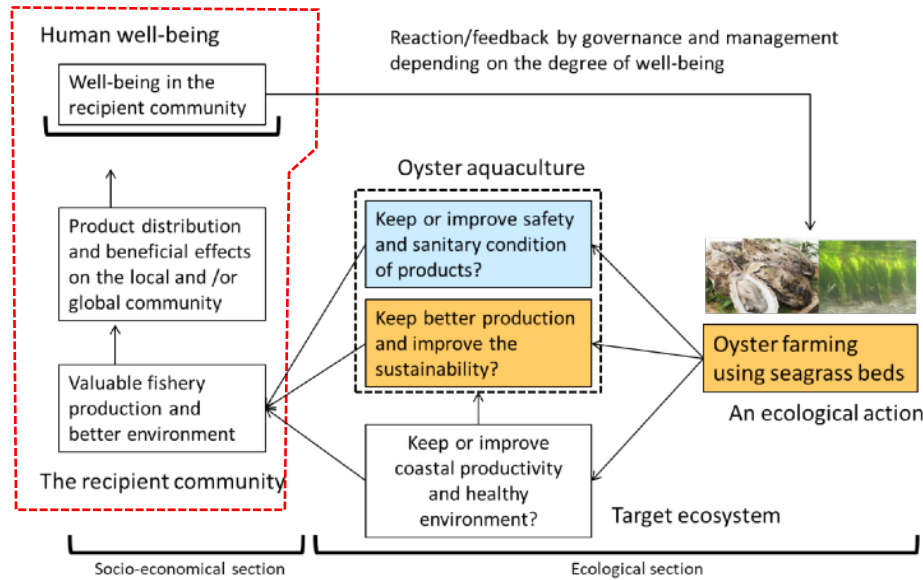
Seagrass ecosystems reduce exposure to bacterial pathogens of humans, fishes, and invertebrates

Joleah B. Lamb,^{1*} Jeroen A. J. M. van de Water,^{2,3} David G. Bourne,^{2,4} Craig Altier,⁵ Margaux Y. Hein,⁴ Evan A. Fiorenza,¹ Nur Abu,⁶ Jamaluddin Jompa,⁶ C. Drew Harvell¹

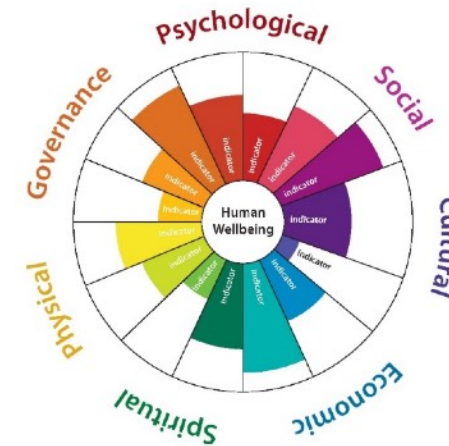
Plants are important in urban environments for removing pathogens and improving water quality. Seagrass meadows are the most widespread coastal ecosystem on the planet. Although these plants are known to be associated with natural biocide production, they have not been evaluated for their ability to remove microbiological contamination. Using amplicon sequencing of the 16S ribosomal RNA gene, we found that when seagrass meadows are present, there was a 50% reduction in the relative abundance of potential bacterial pathogens capable of causing disease in humans and marine organisms. Moreover, field surveys of more than 8000 reef-building corals located adjacent to seagrass meadows showed twofold reductions in disease levels compared to corals at

humans and marine organisms (11), we first used *Enterococcus* assays to test whether the presence of seagrass meadows influenced the level of a single bacterial pathogen (7). Our shore seawater samples, collected from all four paired island sites [median colony forming units (CFU) 100 ml⁻¹ = 1123, $n = 33$ samples for each status (seagrass present versus absent)], exceeded the U.S. Environmental Protection Agency (EPA)-recommended human health risk exposure levels of *Enterococcus* in recreational water by 10-fold (12) (Fig. 1). Seawater collected in open water between the study islands (7) had low levels of *Enterococcus* (range = 0 to 12 CFU, median = 4 CFU, $n = 40$ samples), indicating that wastewater pollution was diffuse and likely originated from individual islands. Levels of *Enterococcus* in seawater were reduced when seagrass meadows were present compared with paired sites without seagrass meadows (generalized linear mixed model, estimate \pm SE_{status \times location} = -0.786 ± 0.202 , $P < 0.001$) (Fig. 1 and table S2). On the intertidal

3. We want to study the link shellfish ecosystem and human well-being



Connectivity of the "well-being" to the functioning of the ecosystem and oyster culture



Project 3. Social/economical connectivity to Ecosystem functioning and Shellfish farming

3-1. Identification of value chains, networks and the systems around oyster business

3-2. Identification of Human Well-beings for local community peoples

3-3. Identification of interactions between social human activities and ecosystem services

A research exchange project between France and Japan

Chûgoku Shimbun, 28-31 mai 2017

第4415号 17歳

地中海広島湾タグ アマモの力比較検証

共同研究

飛員育成に際し、アマモの力比較検証。フランスと日本の研究者が、地中海広島湾でアマモの成長と環境回復の効果を比較検証している。フランスの研究者は、アマモの成長を促進するための技術を開発し、日本の研究者は、その技術を広島湾に導入している。

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16歳 2017年(平成29年)4月30日(日曜日)

藻場に託す環境回復 拡大へ市民巻き込む

貧栄養化 成育不良か 湖で幼生調達目指す

危機再び

藻場の環境回復に、市民の力を借りて拡大を目指す。貧栄養化による成育不良が懸念され、湖で幼生を調達する計画が立てられている。

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16歳 2017年(平成29年)5月1日(月曜日)

藻場新たな価値に光 アマモのCO2吸収に期待

模索

藻場の新たな価値に光を当て、アマモのCO2吸収能力に期待を寄せている。模索が続けられている。

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16歳 2017年(平成29年)5月21日(火曜日)

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