

Capture Based Aquaculture of Eels: A Sustainable Ecological and Economic Way Forward?

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Biological and Environmental Engineering

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Cooperative Extension



RAS Technologies for eels in Europe

Ep Eding

Aquaculture and Fisheries Group, WU, WUR, The Netherlands



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Elver Fishing

2008 ~3,150 kg valued @ \$1.5 million (\$476/kg)

2012 ~8,620 kg valued @ \$38 million (\$4,408/kg)

Maine's **second most valuable fishery** after lobster



Is This Sustainable? Rational? A Set of Preferred Outcomes?

~90% Maine Elvers Go to **Aquaculture Systems in Asia**
China/Taiwan, Korea (only ~10% to Europe)

90% of freshwater eel Unagi (うなぎ) consumed in USA **is**
farm-raised

USA has **increased its consumption** of processed eel
[unagi kabayaki]

~580 tons were imported 2012 from China (~\$58 million)

In 2007, FDA put import controls on farmed eels from China due to
numerous cases of contamination

Why should we ship all of our elvers to aquaculture farms in Asia when the Northeast has a strong aquaculture industry and academic expertise to develop eel aquaculture here?



Feeds, Nutrition: **well known, Skretting/BioMar**

Diseases: **susceptible (vibriosis, eel herpes, aeromonads, pseudomonads, edwardsiellosis, etc.) Immune responses/antibodies/vaccines?**

Systems Designs: **well known, but opportunities exist**

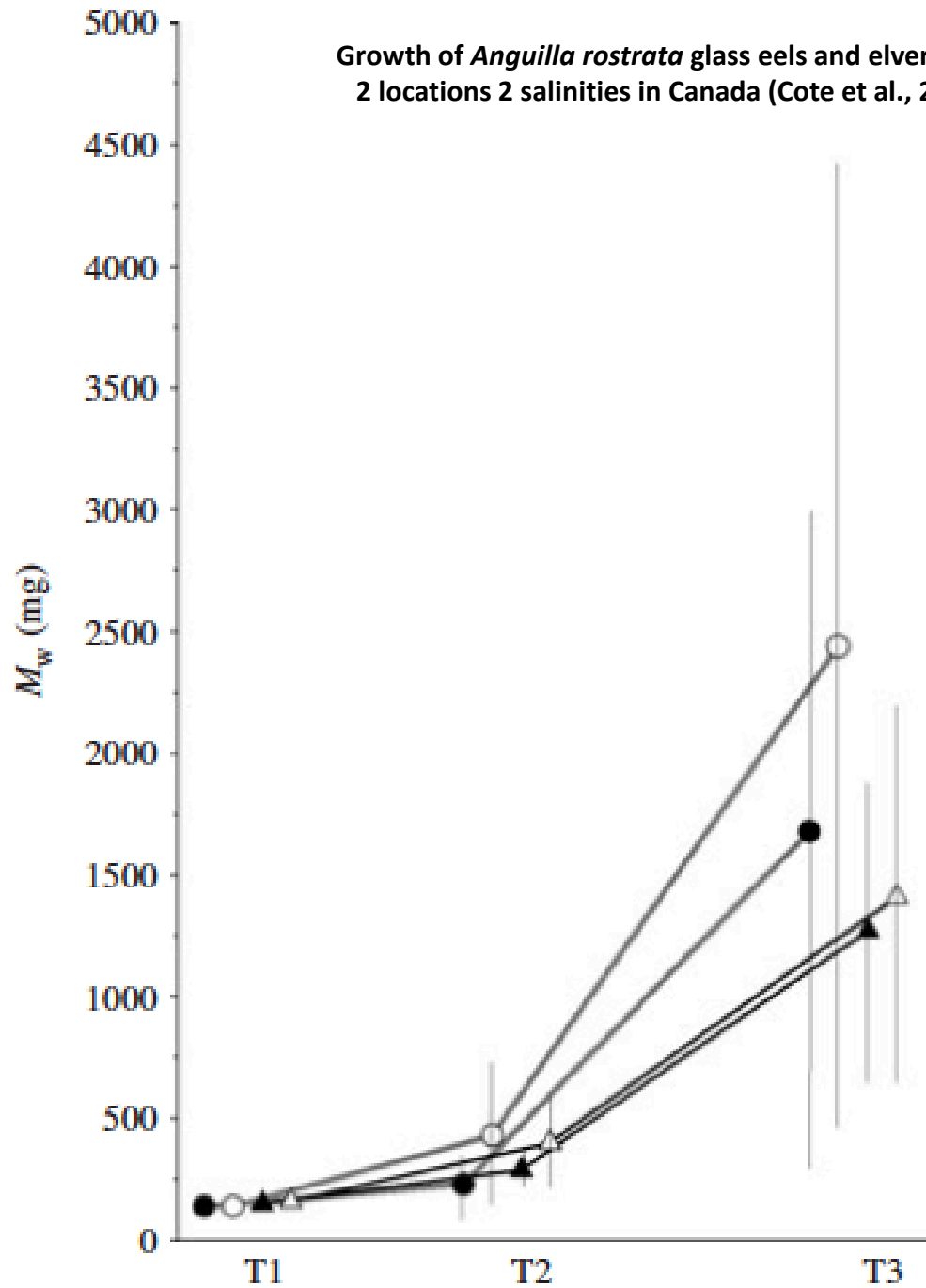
Environmental Impacts: **well known**

Regulatory: **risky [ASMFC, USFWS, IUCN; States; International]**

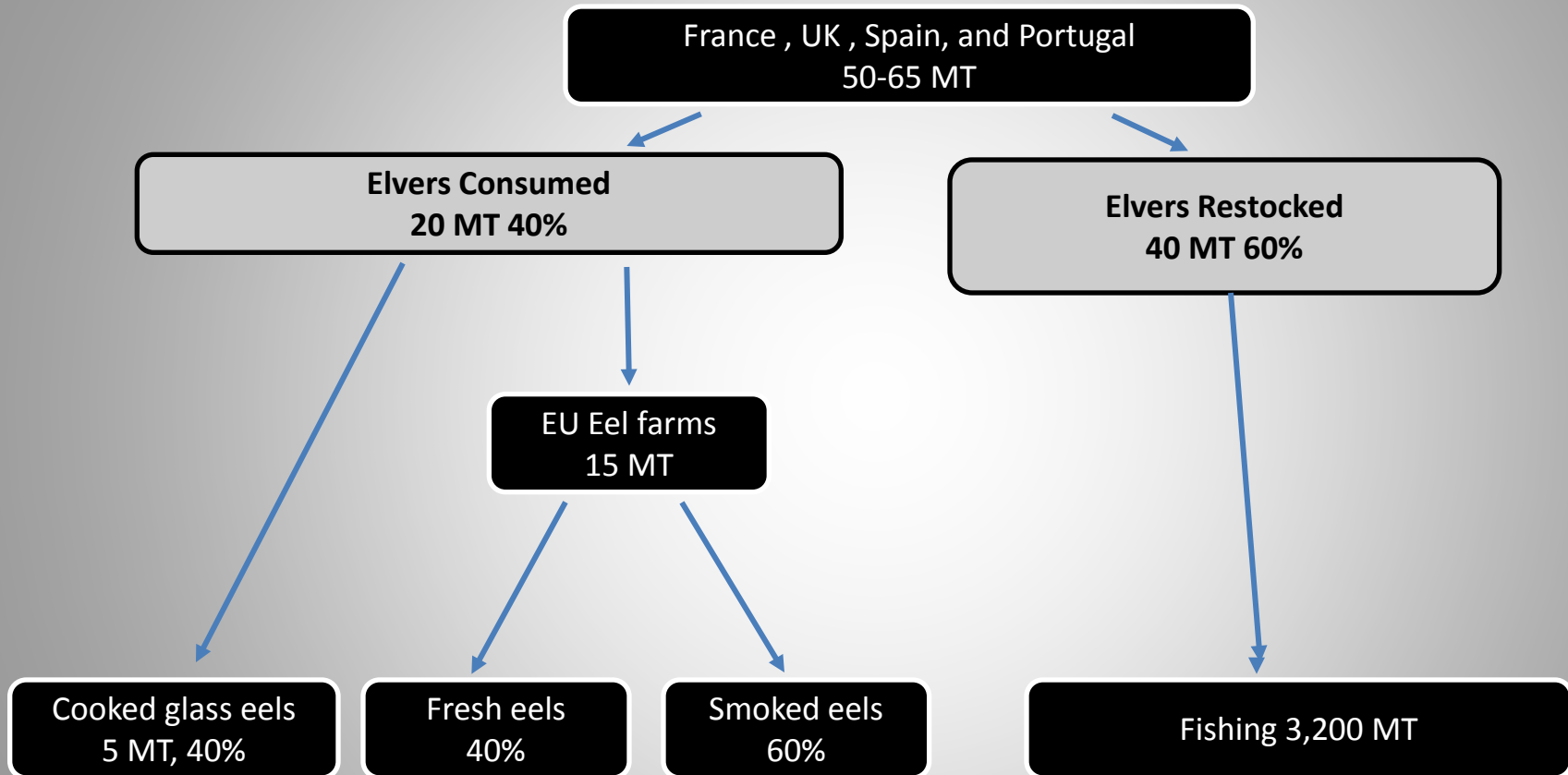
Marketing and Economics: **risky**



Growth of *Anguilla rostrata* glass eels and elvers from 2 locations 2 salinities in Canada (Cote et al., 2009)



European Eel Value Chain (Eding, 2014)



Based on FRANCE AGRIMER eel market chain study 2014

FISHERIES:

Continuum of Capture and Culture Fisheries and Trade for Sustainable Seafood Supplies

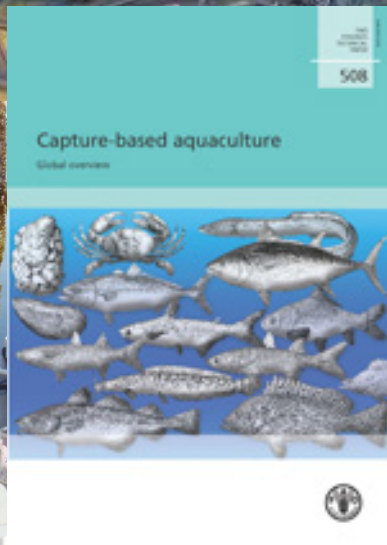
TRADE,

TRANSPORTATION

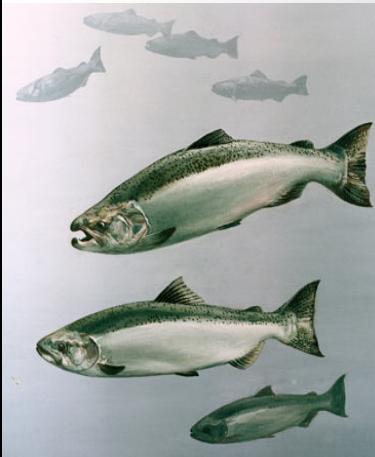
Culture Fisheries
AQUACULTURE



**Capture-Based
AQUACULTURE**

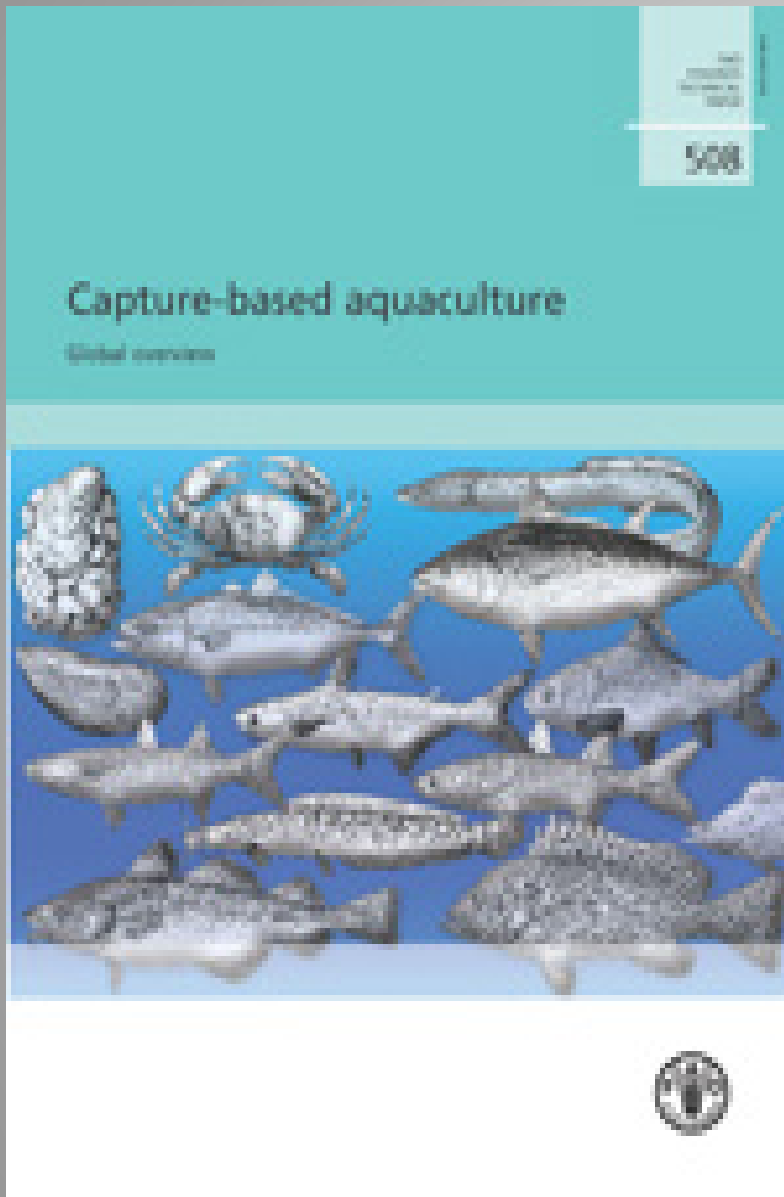


**Aquaculture-Enhanced
FISHERIES**



Wild Harvests
FISHERIES





Alessandro Lovatelli and P F Holthus. 2008.

Capture-based aquaculture : global overview.

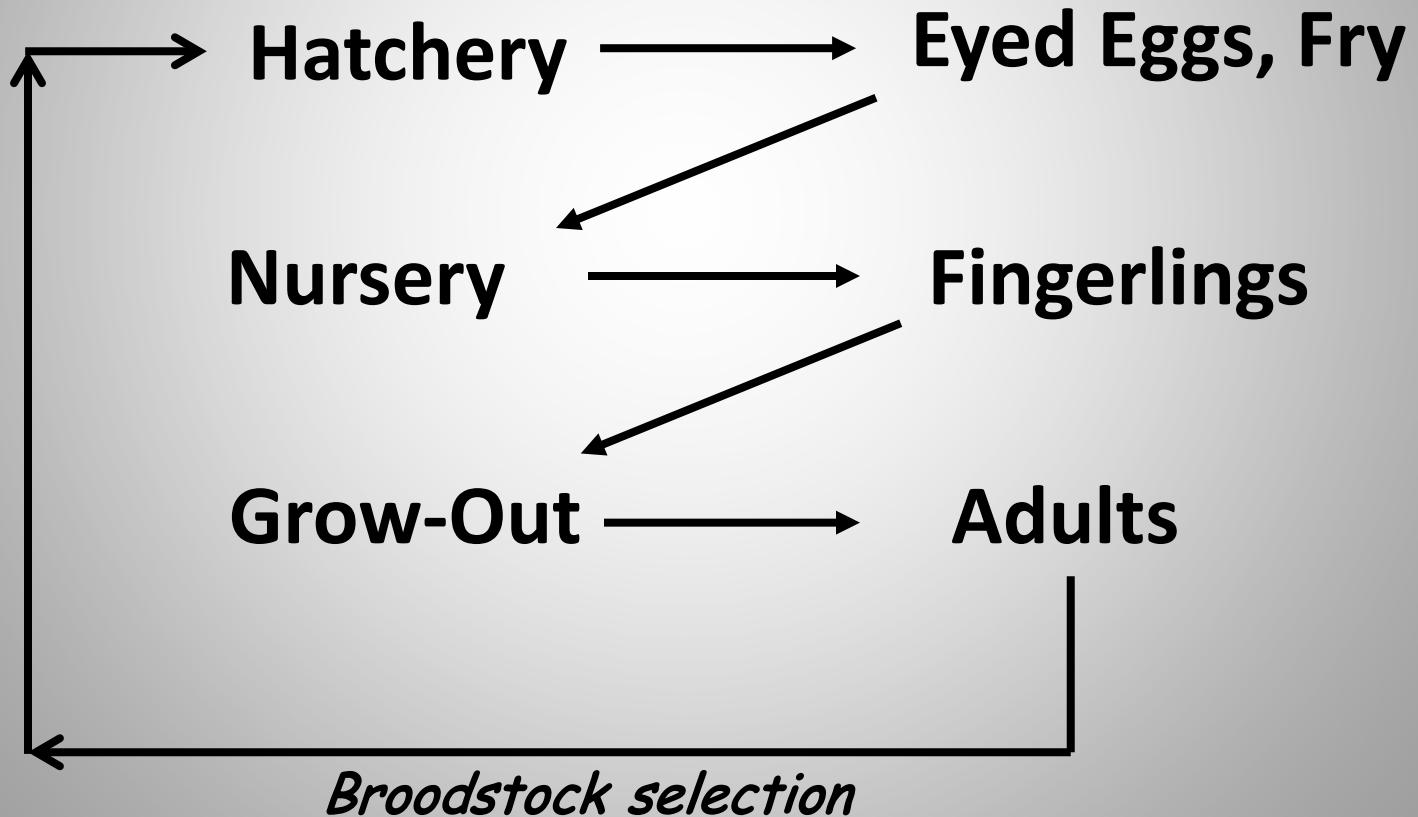
Food and Agriculture Organization of the United Nations.
FAO Fisheries Technical Paper Number 508.

FAO:
90-95% of current
eel aquaculture
production is from
wild-caught elvers



Closed aquaculture production network

Culture Fisheries "aquaculture"



Capture Fisheries

The "Wild"

Broodstock

*"Open" aquaculture
production networks*

Culture Fisheries "aquaculture"

Hatchery

Nursery

Growout

Fry

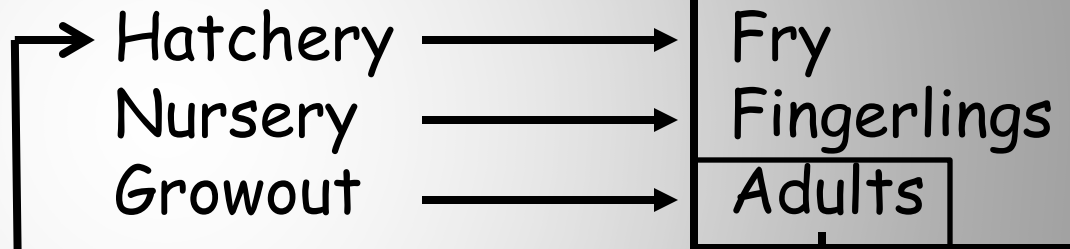
Fingerlings

Adults

Broodstock selection

*Closed aquaculture production
networks*

Culture Fisheries "aquaculture"



Broodstock selection
Closed aquaculture production network

Aquaculture
Enhanced Fisheries
"ranching"
"stock enhancement"



The World Needs Sustainable Ecological Aquaculture AND Sustainable Fisheries Ecosystems

Costa-Pierce (2010)

Capture Fisheries
"hunting"
The "Wild"

Culture Fisheries "aquaculture"

Hatchery → Fry
Nursery → Fingerlings
Growout → Adults

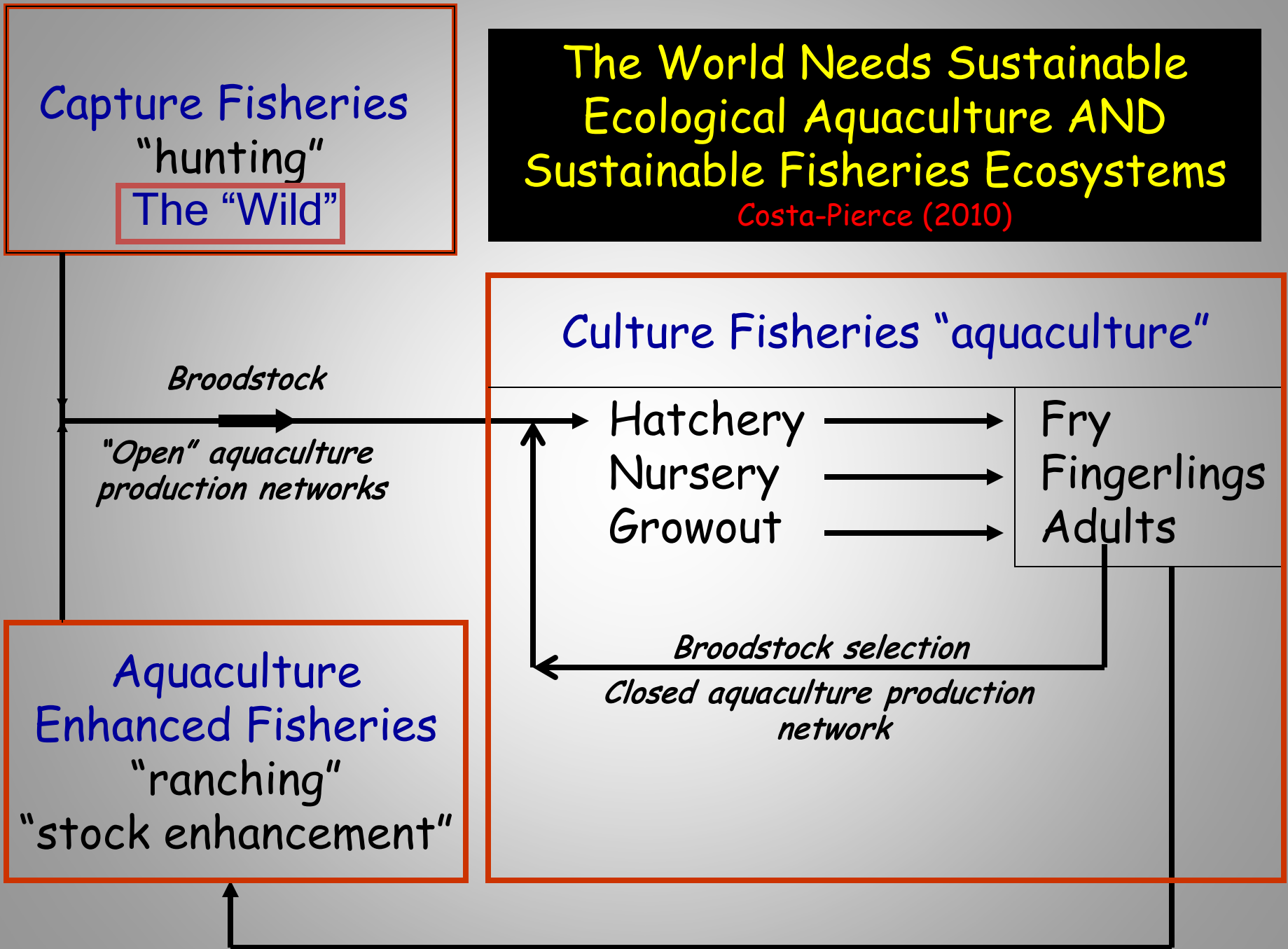
Broodstock

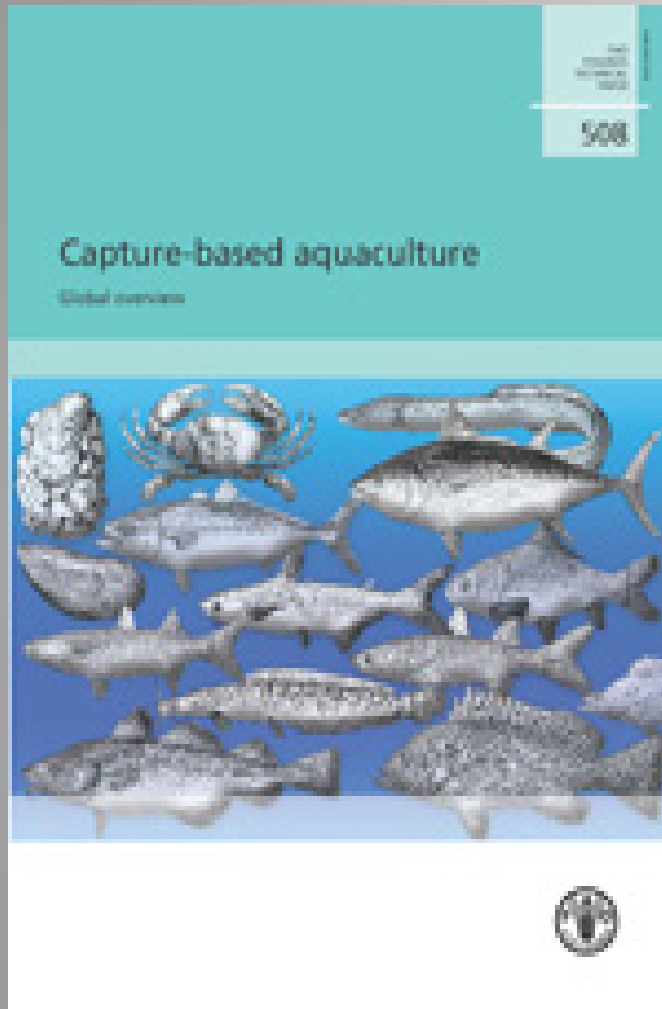
"Open" aquaculture production networks

Broodstock selection

Closed aquaculture production network

Aquaculture Enhanced Fisheries
"ranching"
"stock enhancement"





Is a Hatchery Really Needed?

High Capital, Operating Costs

Genetic Issues – Panmixia

Can Insure Genetic Integrity

Aquaculture Can Lead to Fisheries Sustainability?

The Aquaculture Toolbox

Fisheries and aquaculture interact with increasing intensity as fishers shift from fishing to aquaculture and by competing in the same markets with similar products. The need to integrate planning and management of the two sectors seems vital to their future development and sustainability.

FAO. 2012. *The State of World Fisheries and Aquaculture*. FAO, Rome.





THANK YOU!



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