THE UNIVERSITY OF RHODE ISLAND
COLLEGE OF THE ENVIRONMENT AND LIFE SCIENCES

Ecosystem Services and United Nations Sustainable Development Goals: Examining Estuarine Aquaculture the Philippines

Michael A. Rice, Ph.D.
Professor of Fisheries & Aquaculture
University of Rhode Island

THINK BIG WE DO℠

Summary

- The origins of the UN sustainable development goals Brundtland Commission, 1987
- Traditional small-scale fisheries & aquaculture (a form of integrated multitrophic aquaculture or IMTA)
- Intensification and monoculture
- Food security issues and milkfish kills in the Philippines
- Modeling of aquaculture carrying capacity
- Incentives for maintaining IMTA

The Origin of the UN Sustainable Development Concept

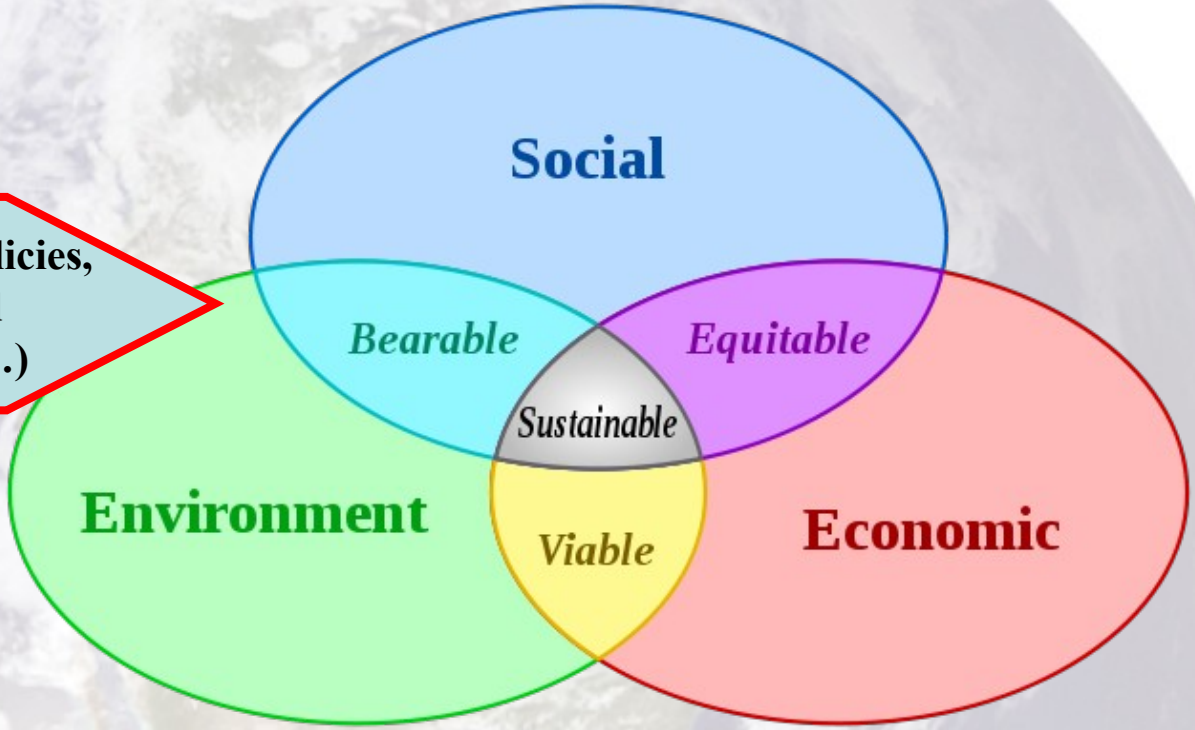
The **Brundtland Commission**, was convened by the United Nations in **1983** to address growing concern: « about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development »

The Report of the Brundtland Commission, ***Our Common Future*,** was published by Oxford University Press in **1987**.

Mrs. Gro Harlem Brundtland, 1987

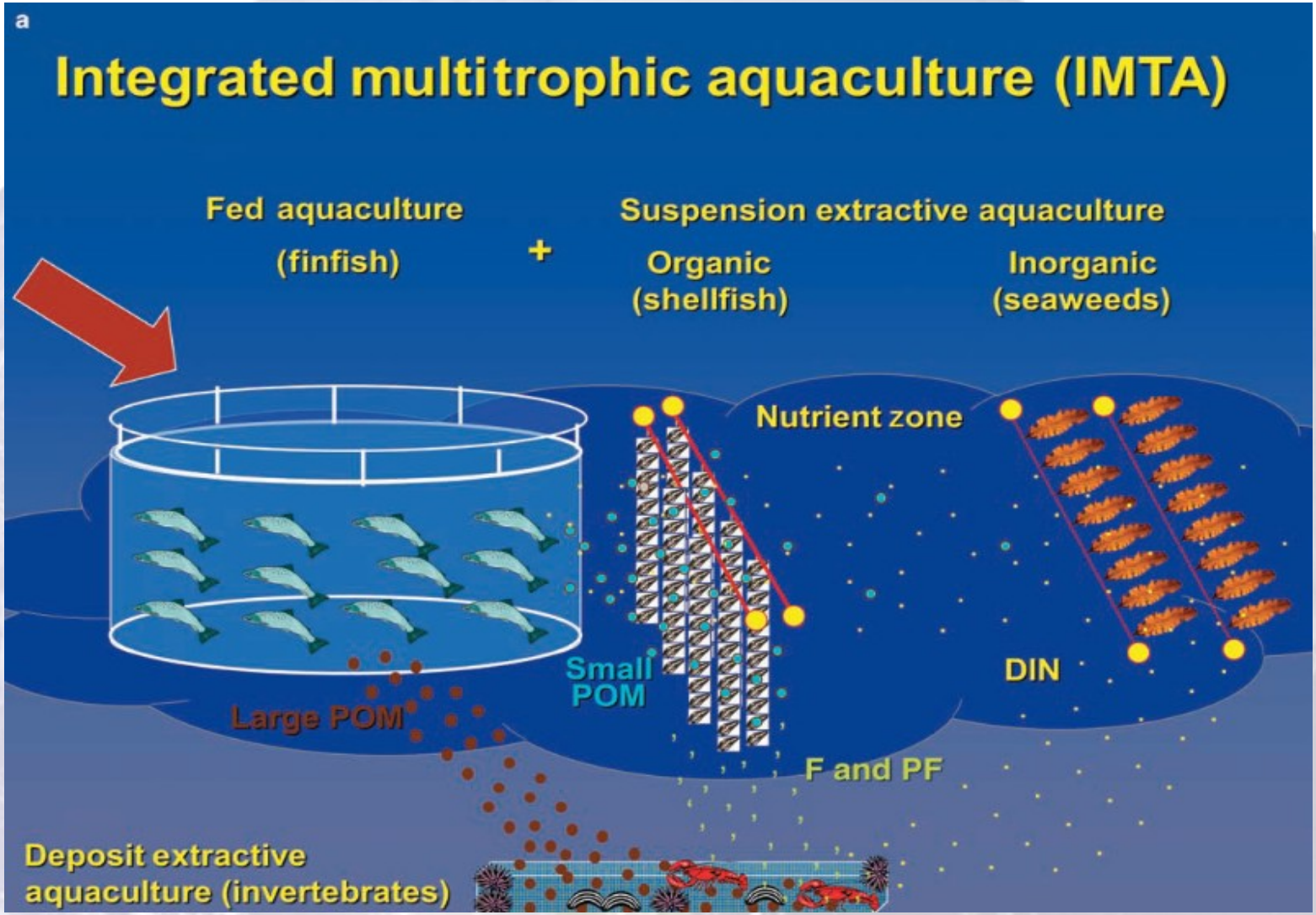
The Sustainable Development Concept:

GOVERNANCE (public policies, laws, community based governance, traditions…)



SD necessitates to compromise between social, environmental and economic requirements. Enforcing it necessitates an appropriate and accepted governance (the best being the enemy of the good!)

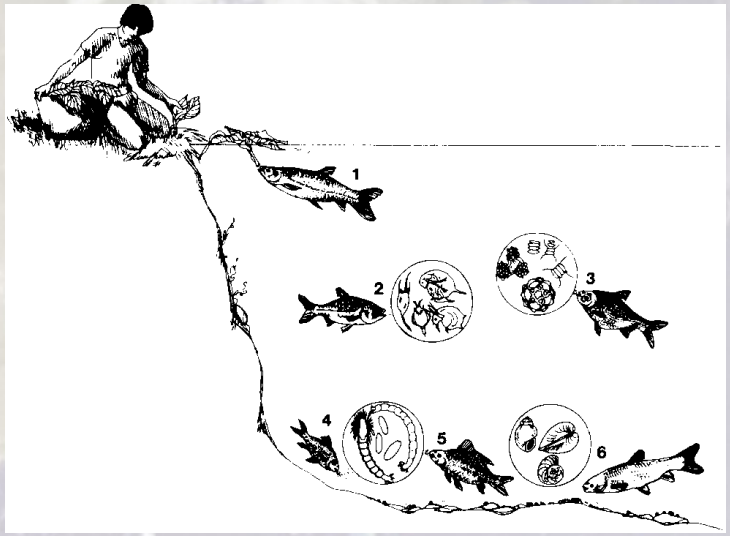
Traditional Philippine Estuarine Fisheries and Aquaculture



(IMTA term coined by Ridler et al 2007)

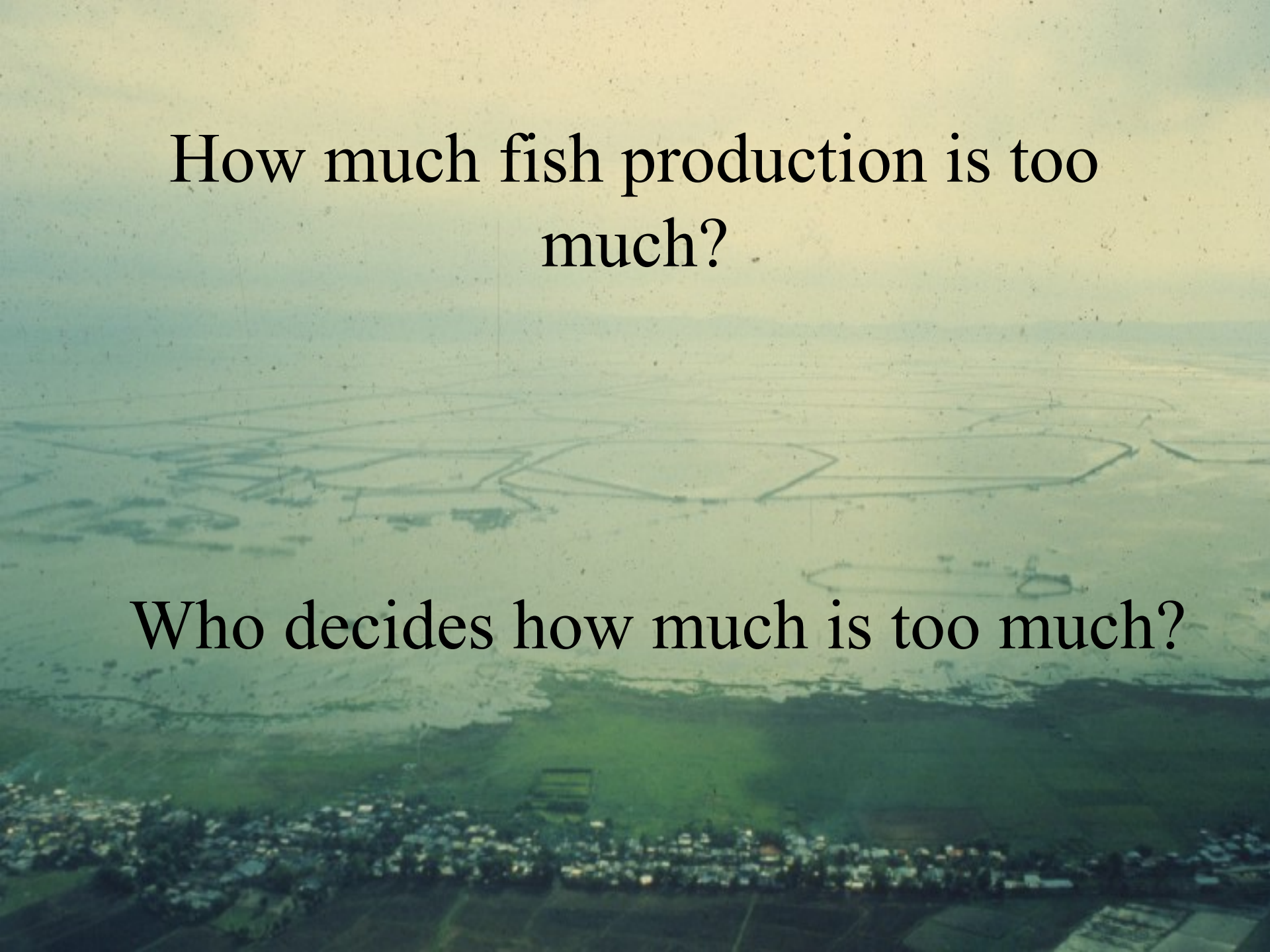
Asian polyculture…Is it IMTA?

- Polyculture of carps in traditional Chinese, Indian ot Indonesian freshwater pond systems often w/ integrated terrestrial crops?
- Traditional Asian multispecies aquaculture as a *de facto* form of IMTA?

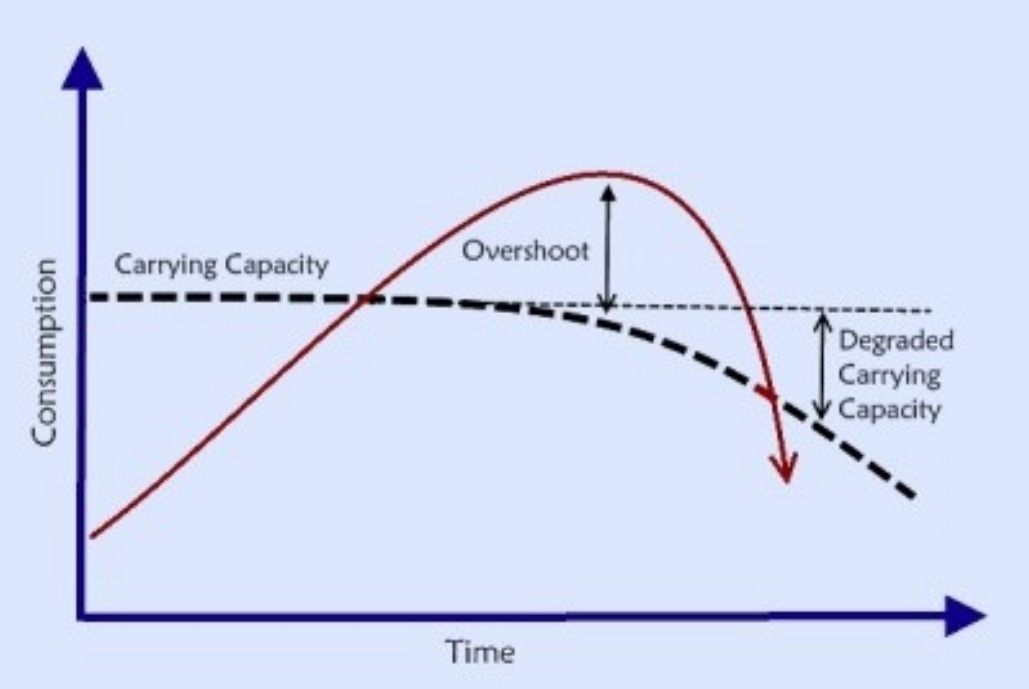


The Issue: Intensification & Monoculture

- Fish kills associated with fish pen and have been a recurring problem since the 1980s
  - Laguna de Bay 1980s
  - Binmaley-Dagupan 1997 to 2013
  - Bolinao 2002 to present
  - Lake Taal 2005 to present
  - Many others since


How much fish production is too much?
Who decides how much is too much?

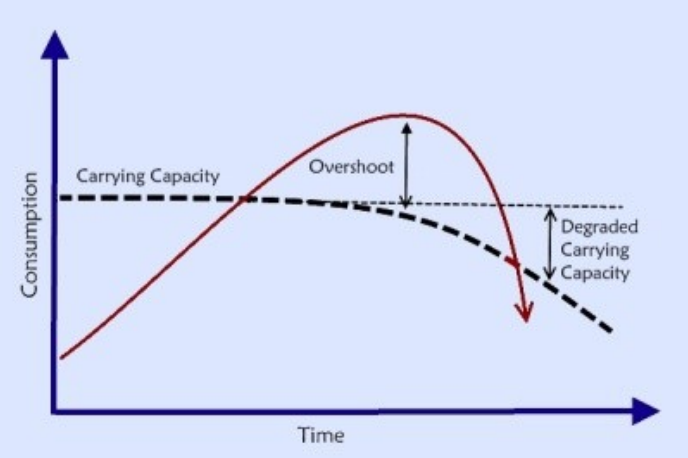
Aquaculture carrying capacity

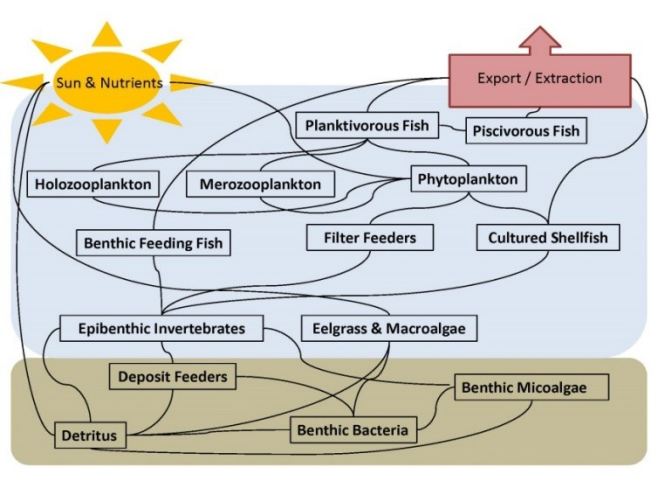


- Physical CC
- Production CC
- Ecological CC
- Social CC

After: Inglis et al. 2002 & McKindsey et al. 2006

Carrying Capacity Models





- A model is a representation of the relationships among variables; an artificial representation of reality
- Can be very simple
- Can be very complex

Utility of models

- To be useful, a model should be:
  - Complex enough to realistically describe the system under consideration
  - Not so complex that regulators refuse to use it

Case Study: Dagupan City, Philippines

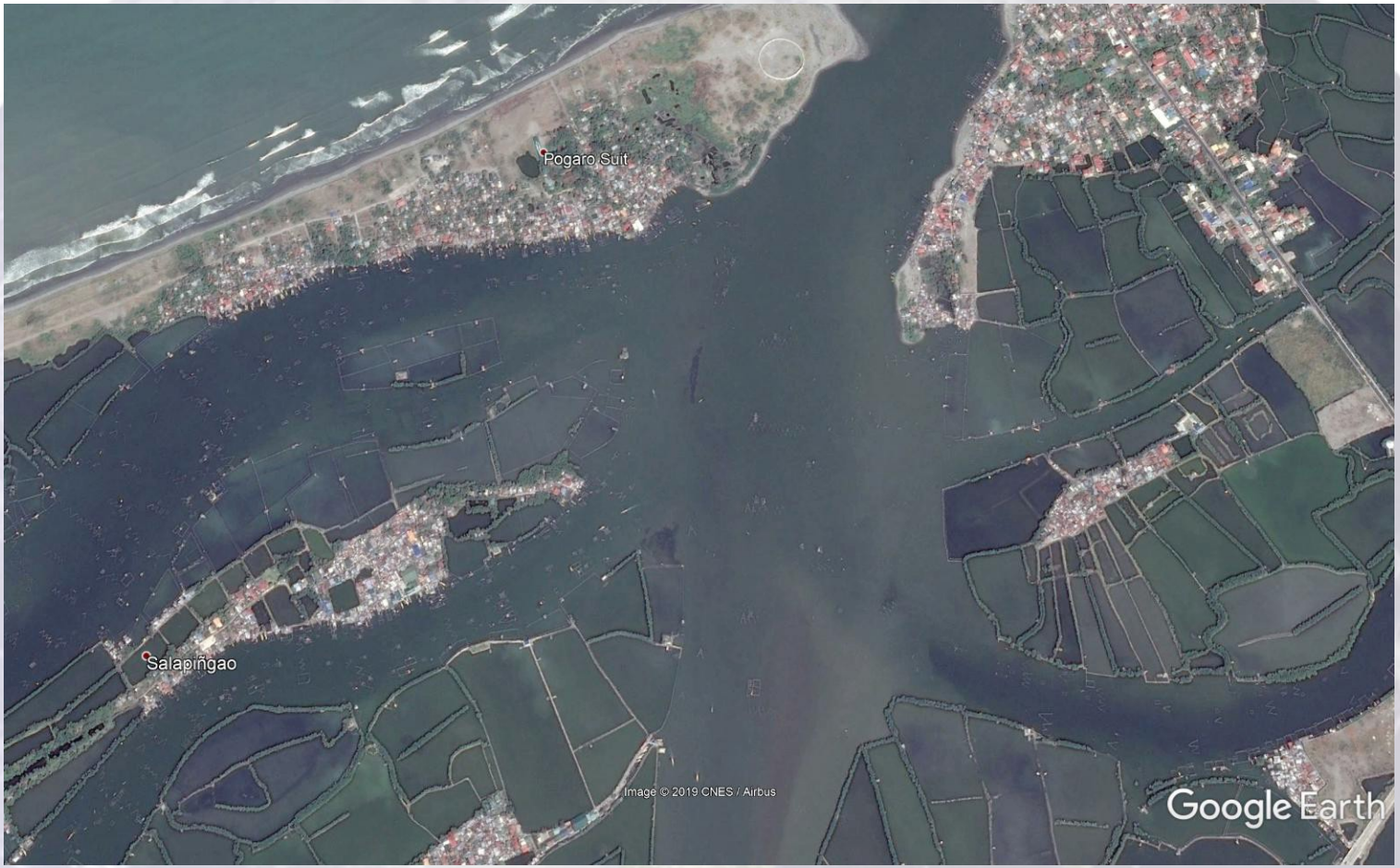
- Adoption of floating net cage culture for groupers in 1983
- Adoption of netpen culture of milkfish 1992
- Over-intensification & fish kills beginning 1997
- Strong city government effort in area use aquatic zoning beginning 2003
- Carrying capacity study 2007 (BFAR-Akvaplan-Niva)
- Extension workshops on carrying capacity 2013
- Periodic fish kills until 2013
- City government institute system of carrying capacity management 2013 to present

Image from White et al. (2007)

Dagupan Estuary -- November 2004

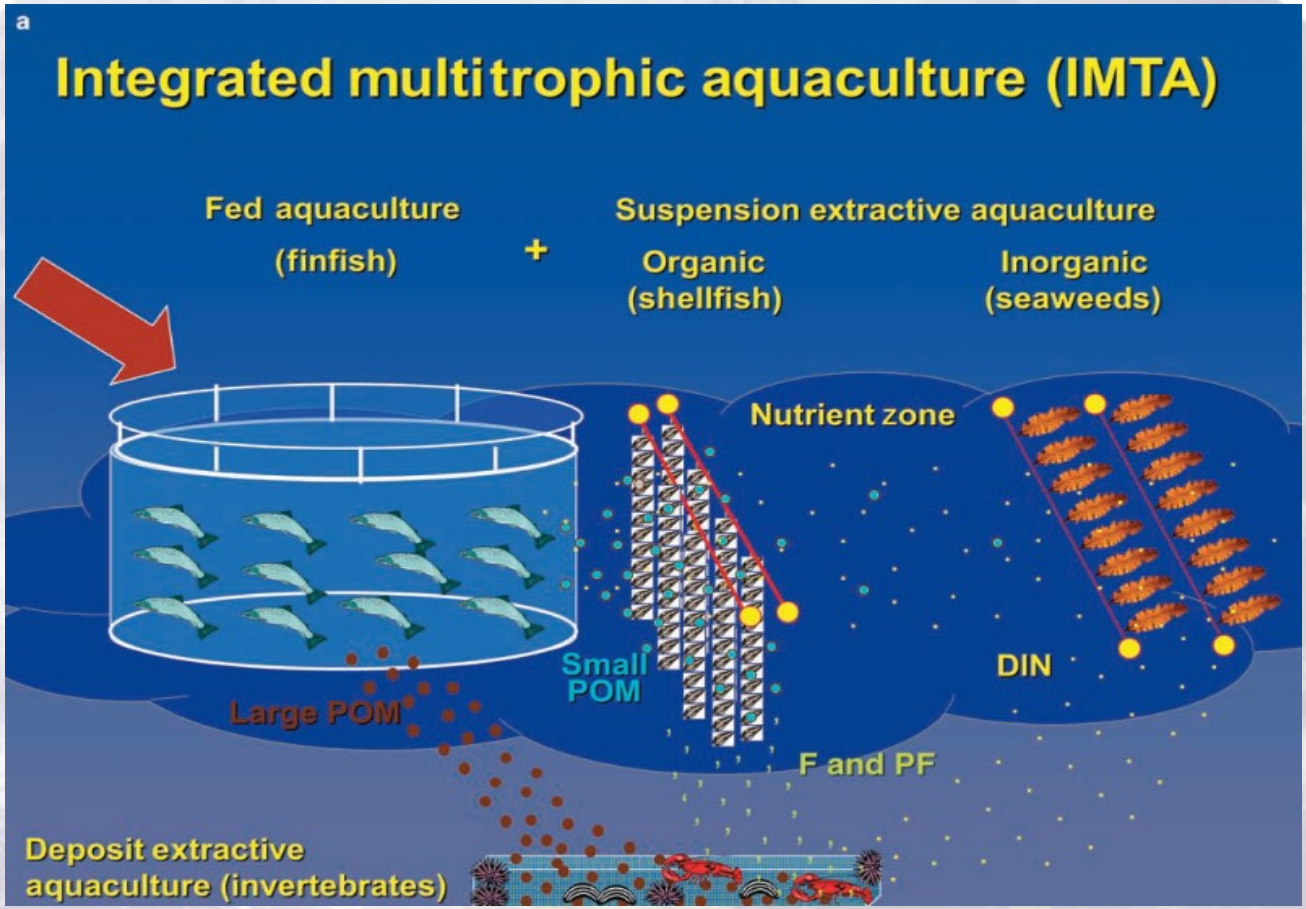
Predominance of unregulated fish pens in waterways near physical carrying capacity

Dagupan Estuary -- March 2014



Prohibition of fish pens in main channels

Incentives for IMTA? Is it a Pipe Dream?



Problem of uneven market values for individual IMTA crops!

Example of Economic Modeling of Social Costs as a Means Toward Quantifying IMTA value

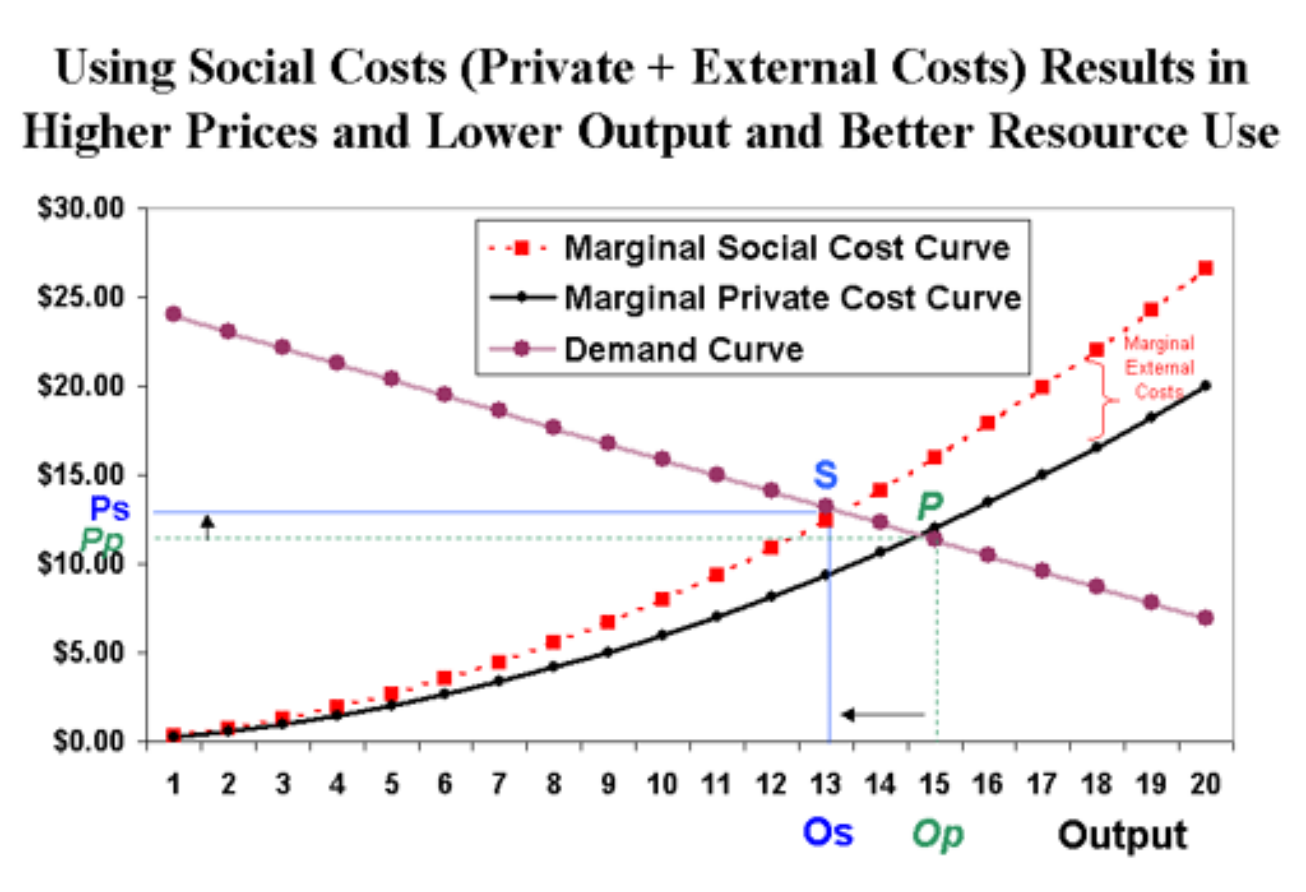


Figure from U.S. Federal Reserve Bank of San Francisco

Data needs for IMTA economic models

- Production costs of each crop component
- Market prices for each crop component
- Estimate of (costs borne by aquafarmer)
- Estimates of costs to restore water & sediment quality (costs borne by public)
- Estimates of degree of remediation that extractive forms of aquaculture (seaweeds, shellfish, benthic invertebrates) contribute
- Possible calculation of 'pollution credits' to be provided to extractive aquaculturists

Possible Policy Alternatives for Pollution Reduction and/or IMTA Incentives

- Capping of number of fishpens/cages & providing relatively high fixed permit fees to cover water quality and environmental enforcement costs
- Providing differential permit fees for fishpens/cages and various forms of extractive aquaculture
- Capping of number of fishpens/cages, holding auctions for 'fed aquaculture' permits, with trading of effluent discharge privileges (a cap and trade system), allowing payments from relatively 'dirty' producers to the 'cleaner' producers.

The Takeaways

- Some traditional form of Asian multi-species aquaculture may be classified as IMTA, arising organically over decades or centuries
- Economic pressure forced aquaculture intensification and focus on monoculture of higher value species
- Capping of number of fishpens/cages, holding auctions for 'fed aquaculture' permits, with trading of effluent discharge privileges (a cap and trade system), allowing payments from relatively 'dirty' producers to the 'cleaner' producers.

Some References

- Andelecio, M.N. and P. Cruz. (2010). Integrating Aquaculture in Coastal River Planning: the Case of Dagupan City, Philippines Chapter 3, In: Tropical Deltas and Coastal Zones: Community Environment and Food Production at the Land-Water Interface. Comprehensive Assessment of Water Management in Agriculture Series: No. 9. C.T. Hoanh, B. Szuster, K.S. Pheng, A. Noble and A. Ismael (eds.), CABI International.
- Beveridge, M.C.M. (1984). Cage and pen fish farming: carrying capacity models and environmental impact. FAO Fisheries Technical Paper 255, 131pp.
- Inglis, G.J., Hayden, B.J. & Ross, A.H. 2002. An overview of factors affecting the carrying capacity of coastal embayments for mussel culture. NIWA, Christchurch. Client Report CHC00/69: vi+31 pp.
- McKindsey, C.W. H. Thetmeyer, T. Landry, and W. Silvert. (2006). Review of recent carrying capacity models for bivalve culture and recommendations for research and management. Aquaculture 261:451-462.
- Rice, M.A. and A.Z. DeVera. (1998). Aquaculture in Dagupan City, Philippines. World Aquaculture 29(1):18-24.
- Rice, M.A. (2014). Extension programming in support of public policy for the management of aquaculture in common water bodies. Aquacultura Indonesiana 15(1):26-31
- White, P. et al. (2007). Environmental Monitoring and Modelling of Aquaculture in risk areas of the Philippines (EMMA): Dagupan City. Akvaplan-niva report no: PN-2415.03. Akvaplan-niva, Tromso, Norway.

Thank You