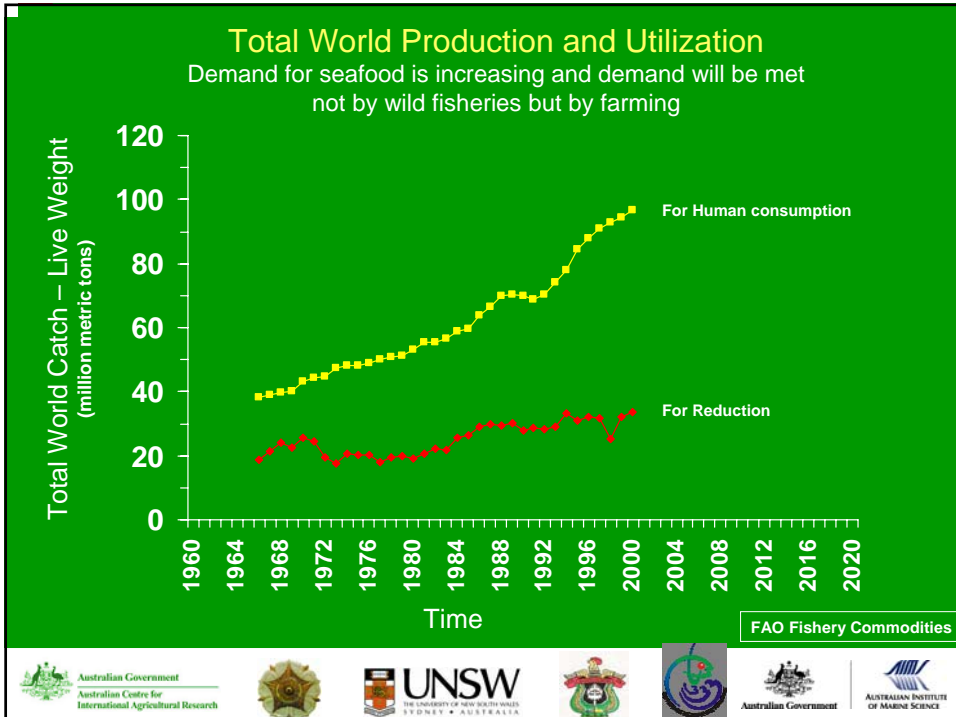




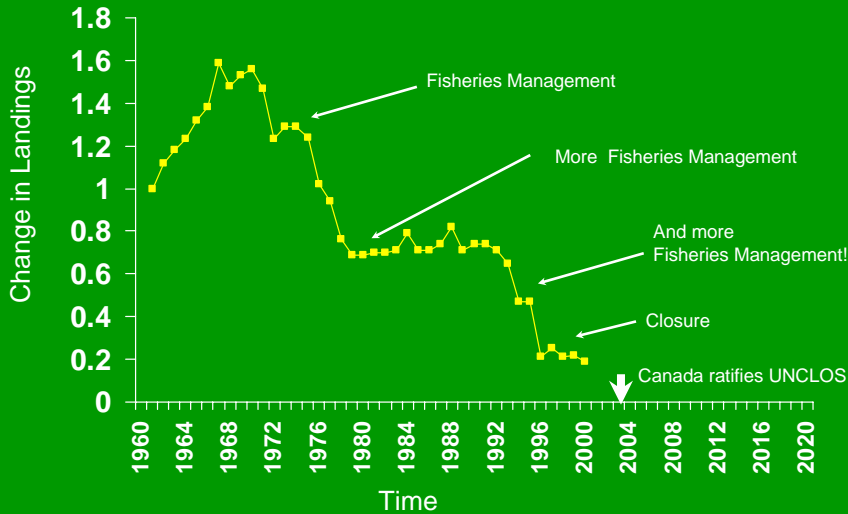
Planning for Sustainable Mariculture for East Indonesia

David McKinnon (AIMS)
 Rachmansyah (RICA)
 Jes Sammut (UNSW)
 Akhmad Mustafa (RICA)



Hunter-Gatherer Harvest – Unsustainable

Landings of Demersal Fishes in Northwestern Atlantic 1960 - 2000



letters to nature

Rapid worldwide depletion of predatory fish communities

Ransom A. Myers & Boris Worm

as well as mammals and reptiles, were especially pronounced, and precipitated marked changes in coastal ecosystem structure and function'. Such baseline information is scarce for shelf and oceanic ecosystems. Although there is an understanding of the magnitude of the decline in single stocks¹⁰, it is an open question how entire communities have responded¹¹. In this paper, we examine the trajectory of global fisheries, and estimate global rates of decline.

Towards sustainability in world fisheries

David Pauly, Billy Christman, Sylvie Gnanades, Terry J. Pitcher, G. Bartel Semadi, Carl J. Walters, B. Watson & DSA Jodda

Philosophical Transactions of the Royal Society B: Biological Sciences, 2005, 360, 1301-1312

Oceans raped of their former riches

Ten times as many whales as thought may once have swum the seas. Is it the latest sign that our plundering has irrevocably upset the world's marine ecosystems?



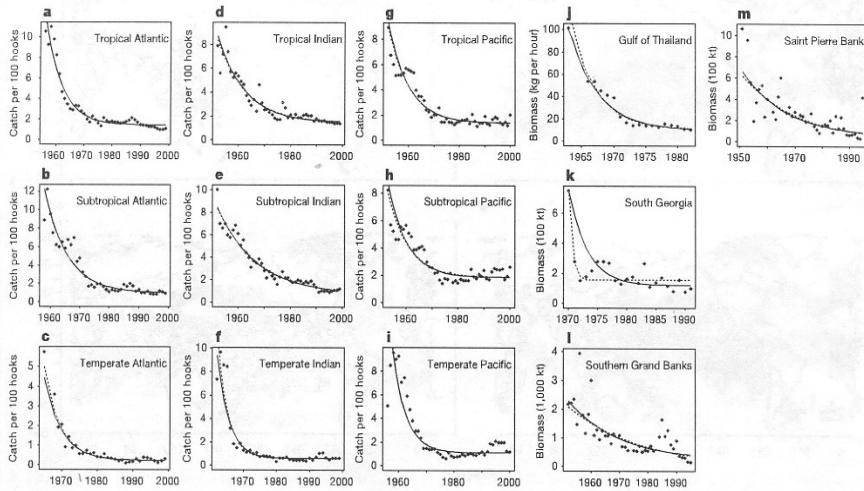


Figure 1 Time trends of community biomass in oceanic (a-i) and shelf (j-m) ecosystems. Relative biomass estimates from the beginning of industrialized fishing (solid points) are shown with superimposed fitted curves from individual maximum-likelihood fits (solid lines) and empirical Bayes predictions from a mixed-model fit (dashed lines).

Myers & Worm 2003

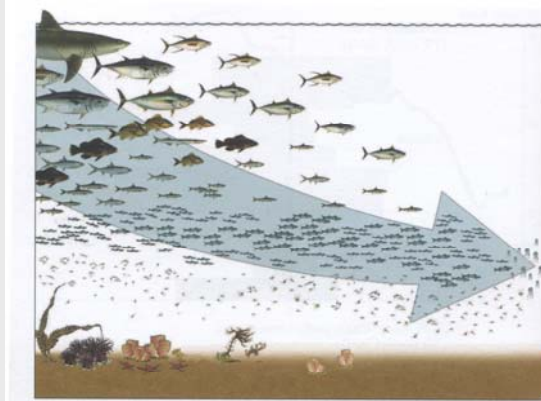


FIGURE 17. FISHING DOWN: WHAT IT ACTUALLY MEANS.

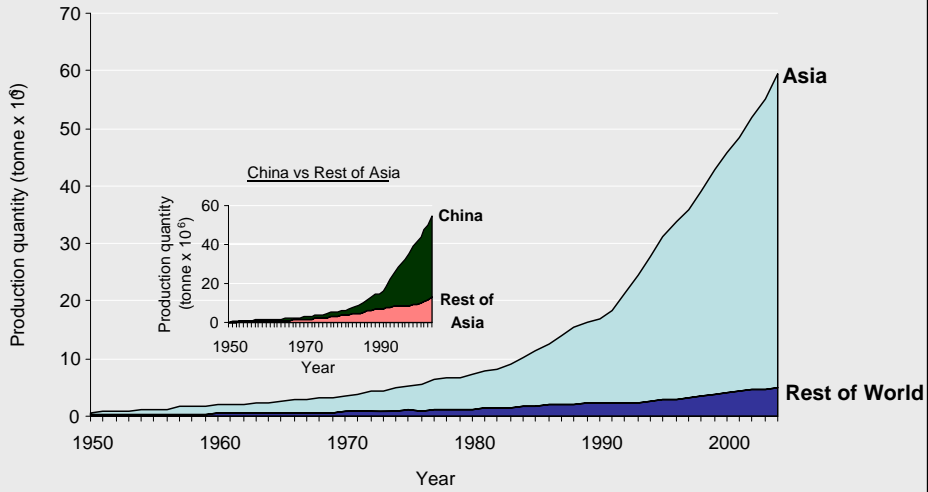
Fishing down marine food webs means that the fisheries (blue arrow), having at first removed the larger fishes at the top of various food chains, must target fishes lower and lower down, and end up targeting very small fishes and plankton, including jellyfish.

In some parts of the world, the fisheries have indeed gone all the way down. In the North Atlantic, most fisheries still operate at the level represented by the center of the figure; however, the trend is down. The invertebrates in the lower left part of the graph gradually disappear because of trawling, which smothers them and turns the sea bottom into vast mudflats (Design: D. Pauly; artist: Ms. Aque Atanacio, FishBase Project, Los Baños, Philippines).

Pauly 2004

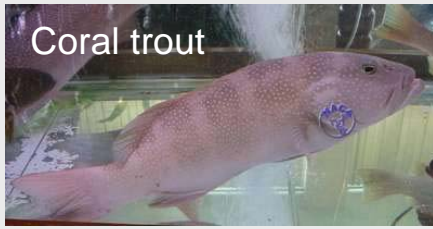


Global Aquaculture Production



Tropical finfish aquaculture: SE Asia

Photos: www.enaca.org





Habitat destruction & Overdevelopment

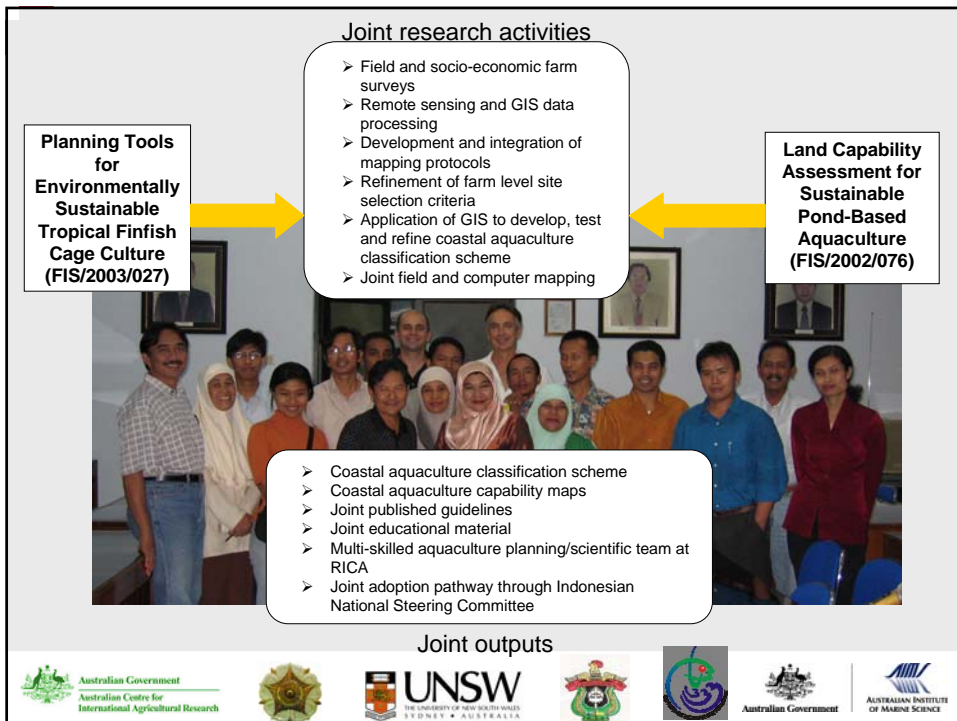


Inappropriate site selection & Abandonment




Land management & Siltation











Marine Harvest 1999



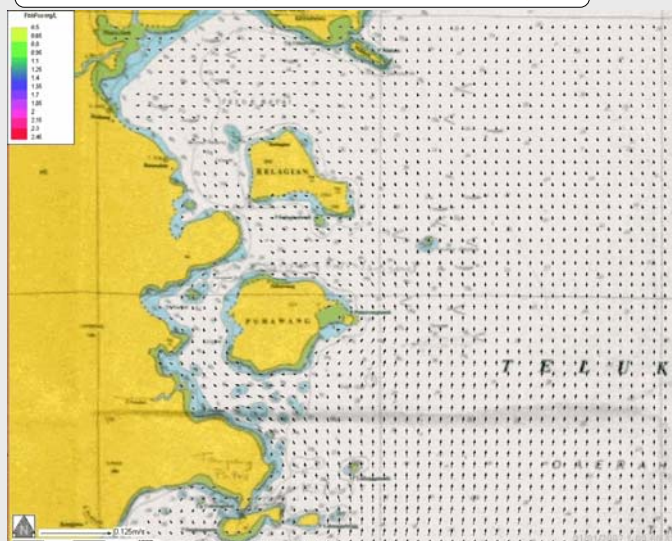
- Only industrial fish farm in SE Asia
- Held 1300 t barramundi
- Harvested 25-30 t per week
- Fed 5.5 t pellets per day
- 8m tidal range
- Tidal currents 1.3 m sec^{-1} (2.6 knots)
- *No documented environmental effects*

Ayong Farm 2006

- Commercial scale
- Holding ~30 tonnes grouper
- Harvested intermittently
- Fed trash fish
- 1.5m tidal range
- Tidal currents ~10cm sec⁻¹
- Localised environmental effects

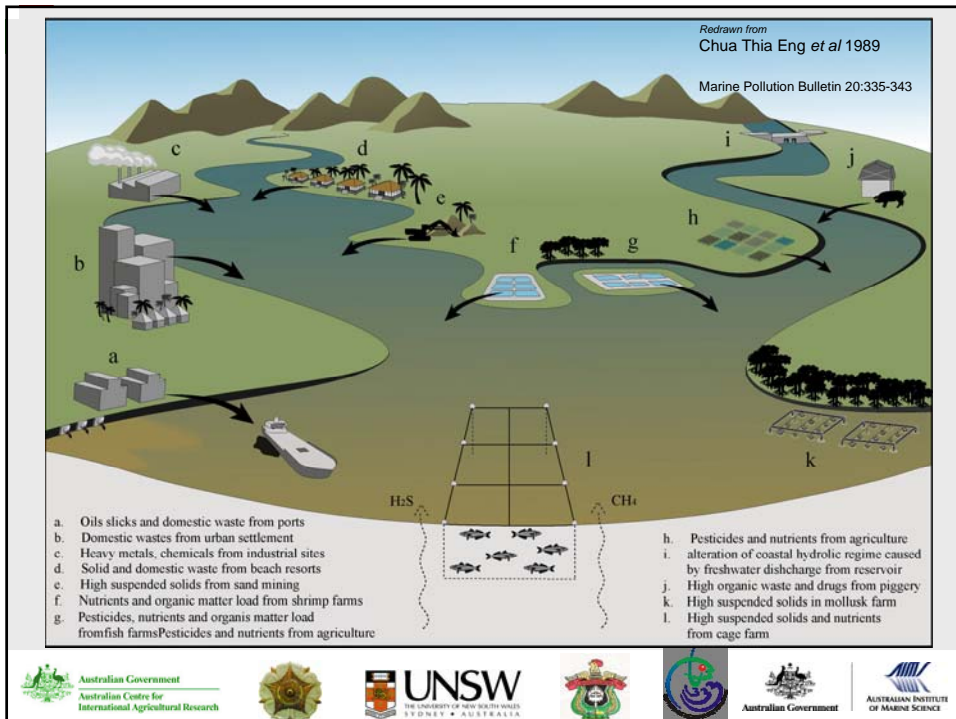
Teluk Lampung physical modelling

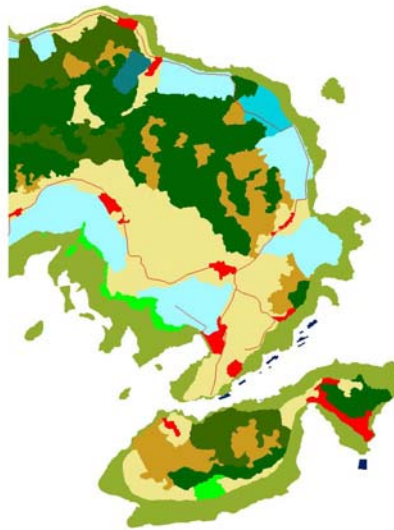


Dispersion of tracer (1 kg s⁻¹) Jan 2007.

Sustainable Aquaculture

- Coastal Zone management
- Site Selection
- Carrying Capacity
- Extension/Implementation
- Farm management
- Monitoring





LEGEND

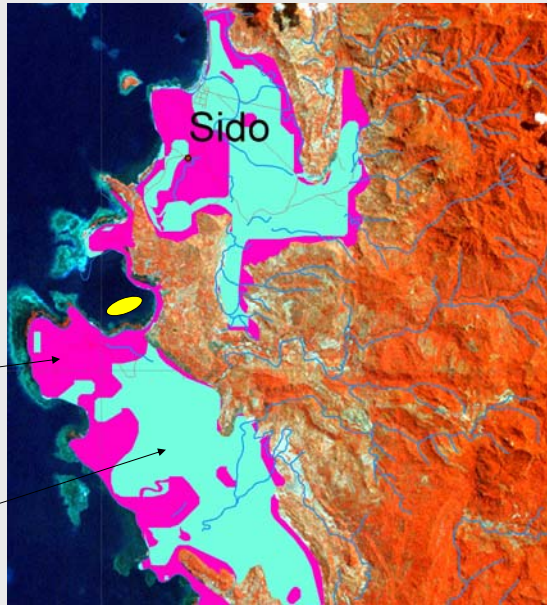
- Roads
- Abandoned Ponds
- Coral Reef
- Forest
- Mangrove
- Mixed Garden
- Plantation (Banana Tree)
- Plantation (Coconut Tree)
- Ponds
- Ponds Candidate
- Sea Cages
- Village



Coastal Capability series

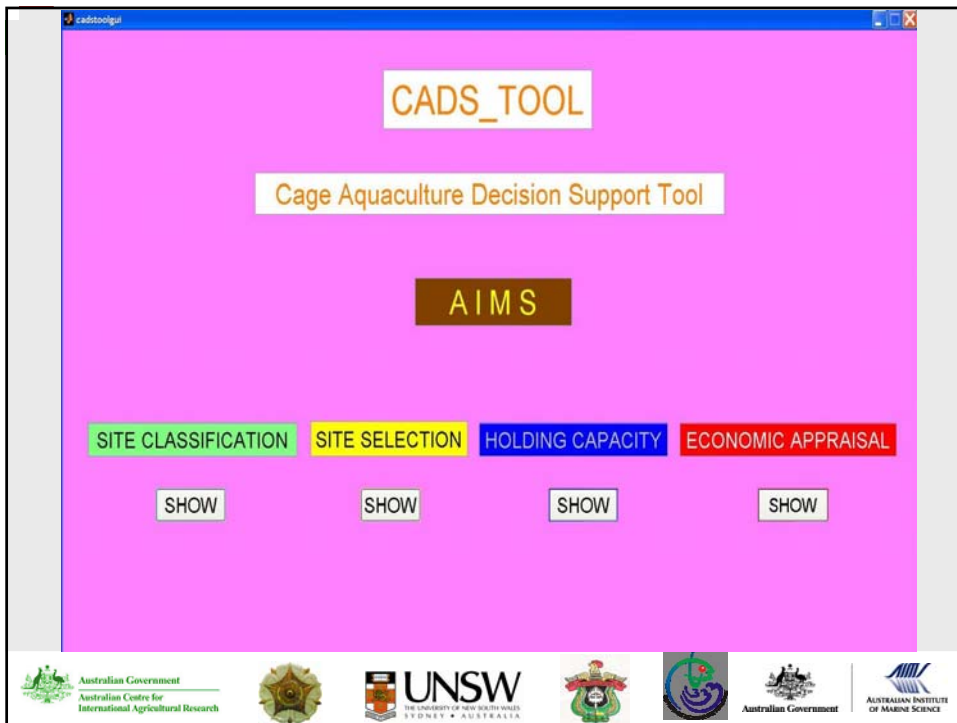
Suitable

Not Suitable



Land-based aquaculture - Buffer zones





The 8 principles for responsible shrimp farming

1. Farm Siting
2. Farm Design
3. Water Use
4. Broodstock and postlarvae
5. Feed Management
6. Health Management
7. Food Safety
8. Social Responsibility

