Asian Aquaculture: Successes and Challenges and Way Forward

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Organization:

- What is NACA?
- Challenge facing the World food
  - Food fish supplies
  - Trend in production/ consumption
- Food fish needs
- Some notable successes in Asian aquaculture
  - What is success
  - Case studies
  - Successes often have to confront challenges
- Way forward
  - Inland
  - -Marine

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NACA- in a Nutshell

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Current Work Program

- Aquatic Animal Health
- Coastal aquaculture
  - Shrimp culture
  - Asia-Pacific Marine Finfish Aquaculture Network (APMFAN)
- Genetics and Biodiversity
  - Broodstock management
  - Use of molecular genetic tools
- Inland aquaculture
  - Culture-based Fisheries
- Emerging global issues
  - Climate change impacts
  - Food prices
- Food safety/ certification
  - Development and adoption of BMPs
- Special programs
  - Tsunami Effected Coastal Livelihoods Rehabilitation

Core Programs supported by:
•Training and Education
•Information and Communications

South-South Dialogue

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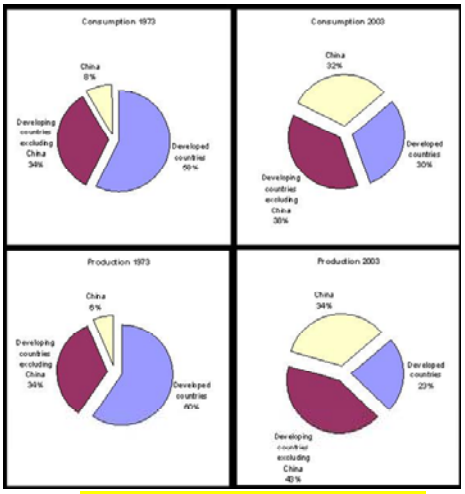
Current Status of World Fisheries

- **Major global changes:**
  - Last three decades
  - fish production
  - consumption patterns
- **A shift from:**
  - Developed to developing country dominance
  - China spearheading this change
- **Aquaculture production increased over the years**



Based on Delgado et al., 2003

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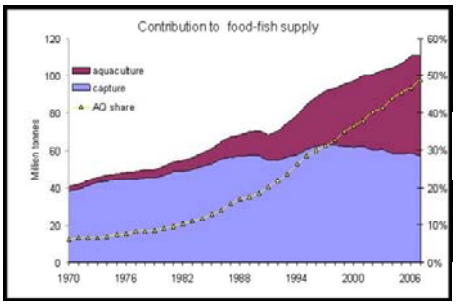
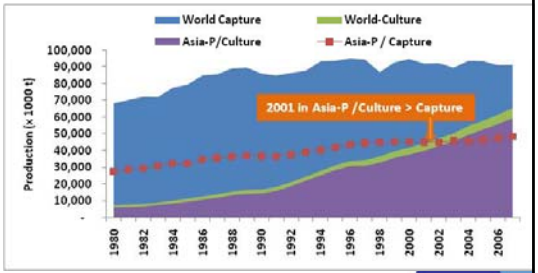
Current Status of World Fisheries

- Currently:
  - Aquaculture 50% of global seafood consumption
  - In Asia:
    - Culture > capture
    - In most countries:
      - Contribution to GDP
        - » Culture> capture





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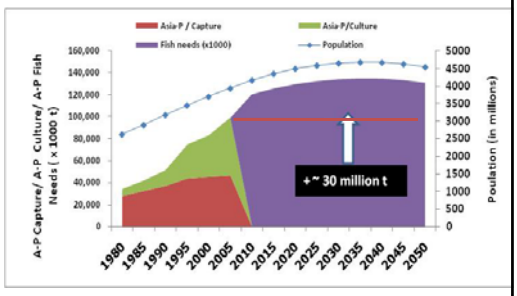
Current Status of World Fisheries -Food Fish Needs-

- Avg. consumption (kg/caput/year):
  - Global: 17.8
  - Asia: 28.7
- Permitting for population growth:
  - Additional food fish needs by 2050
    - Global: 70 x 10^6 t
    - Asia: 30 x10^6 t



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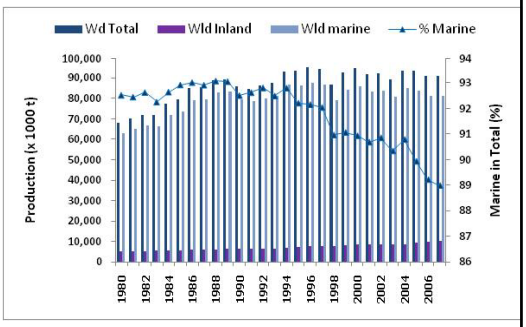
Current Status of World Fisheries -Food Fish Needs-

- How obtain the:
  - Additional food fish needs by 2050
    - Global: 70 x 10^6 t
    - Asia: 30 x10^6 t
- Aquaculture
- How?



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Aquaculture: what is it?

- **Farming the waters?**
  - Too simplistic
- **Does that mean**
  - sea ranching
  - release of fry/ fingerling ("fish day" constitute aquaculture?
- **Aquaculture has a definition:**
- **1992; accepted by all**
  - Some form of farming activity that enhances yield
  - Intervention in the life cycle
  - Ownership of the stock
    - Singly and/ or cooperate

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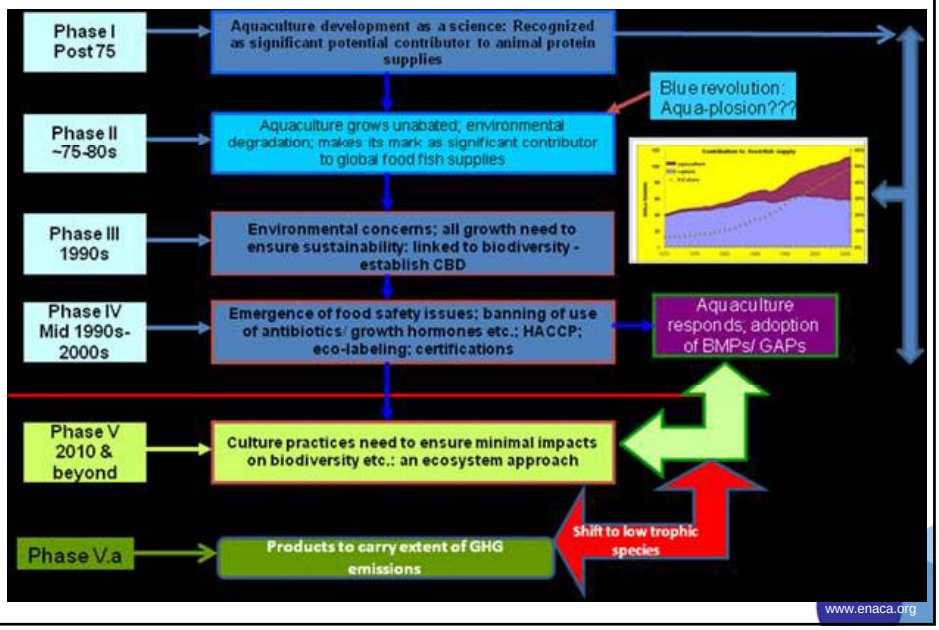
Aquaculture Development



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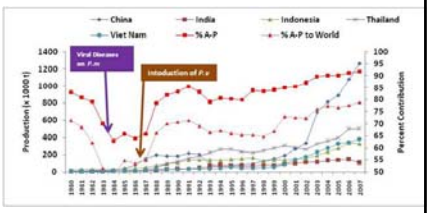
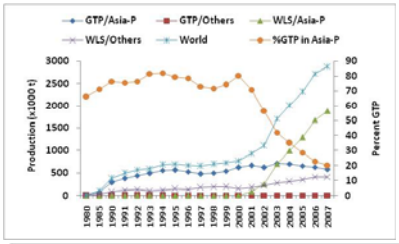
Noteworthy successes in Asia-Pacific Aquaculture in the last decade - case of shrimp-

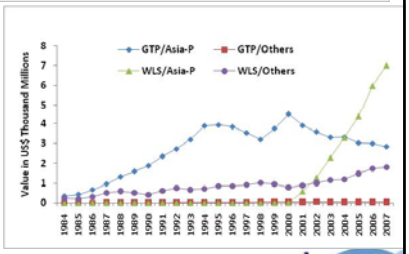
- Farmed shrimp to 70% of shrimp sold on world markets in 2006
- Average annual growth in crustacean
  - 1970 to 1990 - 24%,
  - 1990 to 2000 - 9% in the decade and rising again to between
  - 2000 and 2006 –16 %
  - 1970-2006: average annual growth of about 18%
- **Predominant production:**
  - A-P
  - -Species *Penaeus monodon*
- **Major disease outbreaks in the 1980 and beyond**
- **Needed strategies to maintain the :**
  - Sector
  - Generate income
  - Provide livelihoods



Noteworthy Successes in Asia-Pacific Aquaculture in the last decade - shift from giant fresh water prawn to white legged shrimp-

- **Some nations:**
  - Decision to introduce *P. vannamei*
  - Paid off
    - Production increased
    - Livelihoods safeguarded
    - Income generation continued
- **Lessons learned?**
  - Resilience of farmers
  - Adaptability
- **The sector is sustained (?)**
  - Perhaps not in the long term
  - Evidence of introduction of two exotic viruses
    - Long term biodiversity impacts?
  - Higher carbon emissions for 1 kg of P.v >P.m





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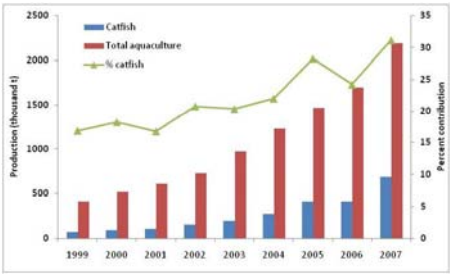
Noteworthy cases in Asia-Pacific Aquaculture in the last decade
- shift from giant fresh water prawn to white legged shrimp-

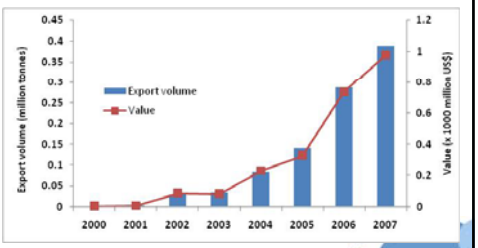
- **Some nation and farmer determination**
  - continue with *P. monodon,*
  - Successfully
- **Through adoption of BMPs**
- **Cluster approach**
  - Clusters already certified
- **Marketability enhanced**
- **Food quality standards met**
- **The final story *on P.monodon* vs *P. vannamei* not over**
- **In all possibility**
  - both will continue to exist
  - thrive in the A-P

Perhaps the best approach to:
-Attain sustainability
-Develop markets
-Attain food safety and quality

Noteworthy cases in Asia-Pacific Aquaculture in the last decade
- Striped catfish culture in the Mekong Delta, Vietnam-

- Possibly the fastest growth in any sector, globally, ever
- Total area of farming 10,000 ha
  - 2007: 683 x 10^3 t (645 x 10^3 t US$)
  - 2008: 835 x 10^3 t (800x 10^3 t US$- first seven months)
    - The fastest growth for any aquaculture sector, in a nation, in a small area
  - Over 200,000 employed
    - Bulk women





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Noteworthy cases in Asia-Pacific Aquaculture in the last decade
- Striped catfish culture in the Mekong Delta, Vietnam-

- **Perhaps most importantly:**
  - **Highest production per unit area**
    - **For any PP sector**
- **The sector has combated, successfully, major marketing obstacles**
  - **E.g. US embargo on Vn catfiish imports to USA**
- **Put in perspective:**
  - **Catfish culture in approximately 10,000 ha is as much as 67% of all European Aquaculture**

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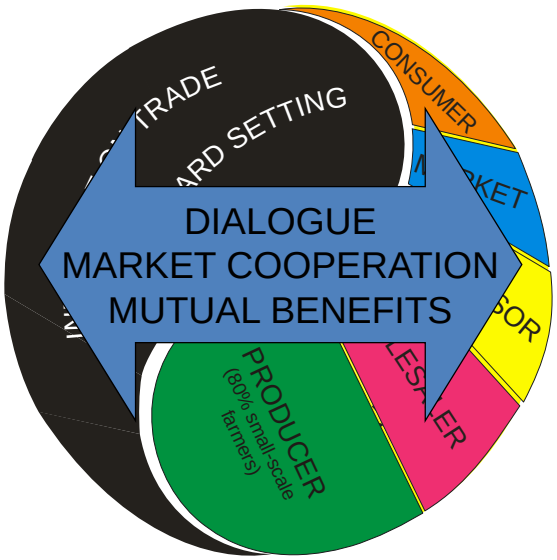
We are living in a relatively lopsided world??



RESTORING BALANCE

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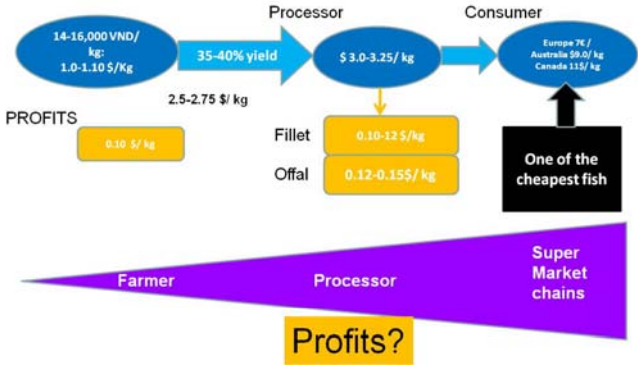
Successes Often Confront Obstacles



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Unfounded negative publicity to discredit a product; who is doing this? Competitive producers who are losing market for tra catfish?

1. **Pangas are teeming with high levels of poisons and bacteria**. (industrial effluents, arsenic, and toxic and hazardous by-products of the growing industrial sector, polychlorinated biphenyls (PCBs), DDT and its metabolites (DDTs), metal contaminants, chlordane-related compounds (CHLs), hexachlorocyclohexane isomers (HCHs), and hexachlorobenzene (HCB)).
The reasons are that the Mekong River is one of the most polluted rivers on the planet and this is where pangas are farmed and industries along the river dump chemicals and industrial waste directly into it. To Note: a friend lab tests these fish and tells us to avoid eating them due to high amounts of contamination < http://www.whytraveltofrance.com/2007/08/03/buying-fish-in-france-a-warning/ > . Regardless of the reports and recommendations against selling them, the supermarkets still sell them to the general public knowing they are contaminated.

2. **They freeze Pangas in contaminated river water.**

3. **Pangas are not environmentally sustainable, a most unsustainable food you could possibly eat** - 'Buy local' means creating the least amount of environmental harm as possible. This is the very opposite end of the spectrum of sustainable consumerism. Pangas are raised in Vietnam . Pangas are fed food that comes from Peru (more on that below), their hormones (which are injected into the female Pangas) come from China . (More about that below) and finally, they are transported from Vietnam to France . That's not just a giant carbon foot print, that's a carbon continent of a foot print.

Pangas are not environmentally sustainable, a most unsustainable food you could possibly eat - 'Buy local' means creating the least amount of environmental harm as possible.....

4. **There's nothing natural about Pangas** - They're fed dead fish remnants and bones, dried and ground into a flour, from South America , manioc (cassava) and residue from soy and grains.....

5. **Pangas are Injected with Hormones Derived from Urine** - I don't know how someone came up with this one out but they've discovered that if they inject female Pangas with hormones made from the dehydrated urine of pregnant women.....but just consider the rest of the reasons to NOT eat it..

6. **You get what you pay for** - and then some. Don't be lured in by insanely cheap price of Pangas. Is it worth risking your health and the health of your family?

7. **Buying Pangas supports unscrupulous, greedy evil corporations and food conglomerates** that don't care about the health and well-being of human beings.....

8. **Pangas will make you sick** - If (for reasons in #1 above) you don't get immediately ill with vomiting, diarrhea and effects from severe food poisoning, congratulations, you have an iron stomach! But you're still ingesting *POISON* not *poisson*.

Final important note: Because of the prodigious amount of availability of Pangas, '"".....
or eating out at cafes / food stalls by choosing fish-&-chips, think twice !!

You have been warned !!!

Are any of the above valid?
Definitely not!!

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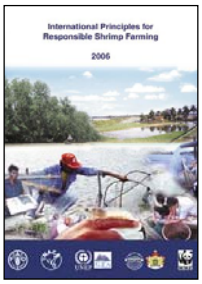
Noteworthy cases in Asia-Pacific Aquaculture in the last decade -Development and Adoption of BMPs-

- **Concept of BMPs:**
  - Developed as a consequence to solving disease problems in shrimp farming in India
- **First step:**
  - "International Principles for Responsible Shrimp Farming"
    - A consortium approach
    - WB Green Award for 2006
- **Carried further now**
  - BMPs developed for shrimp farming
  - Vn catfish farming etc.
- **BMPs ensures:**
  - Sustainability
  - Higher production
  - Increases competitiveness of small scale producers
  - Ensures food quality and food safety
  - Facilitates market accessibility to small scale farmers
  - Facilitates environmental integrity
  - Increases harmony among farmers



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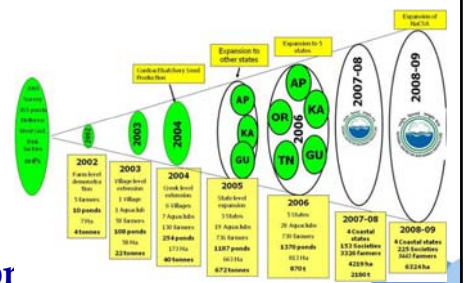
-Development and Adoption of BMPs- -Concept Taken Forward Through Farmer Associations-

- **Adoption of BMPs in shrimp farming (India)**
  - Significant results
  - Policy & governance changes
- **Farmers in a cluster act as a unit**
  - Increased incomes
  - Higher bargaining power
  - Ensures quality produce
  - Self policing system in place
  - -Enable to access niche markets
  - Enable to obtain "cluster" certification
- **Soon a regional strategy for important commodities**



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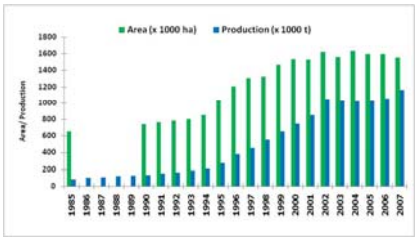
Noteworthy cases in Asia-Pacific Aquaculture in the last decade –Rice cum Fish Farming-

- **A-P region**
  - 137.5 x10^6 ha of rice
  - 90% of world area of rice cultivation
- **PR China:**
  - Rice-fish traditional
  - New improvements
    - Change of species
    - Production increased (1.6 x10^{6}t)
    - Marketable
    - Farmer livelihoods/ income improved by 4-5 fold
    - 2.3 x10^6 rural households impacted
- **Bangladesh comparable developments**
- **High possibility of adoption through the region**
- **Most importantly:**
  - Effective secondary use of water resources
  - Conformity with the paradigm on "ecosystem approach to aquaculture"



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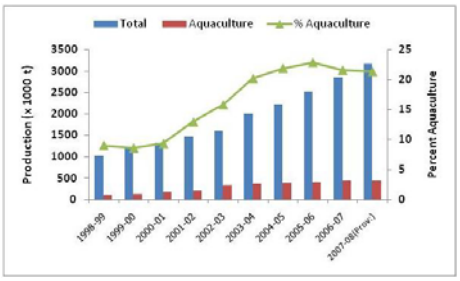
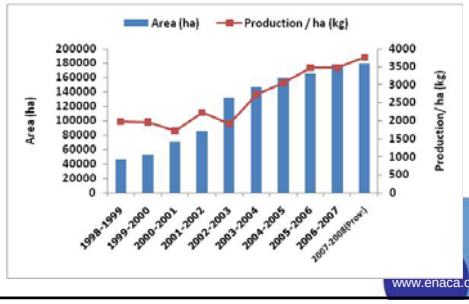
Noteworthy cases in Asia-Pacific Aquaculture in the last decade
- Aquaculture & Rohu Culture in Myanmar-





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- All aquaculture development:
  - Should be prudent in the use of primary resources
    - Land, water
  - Should be minimally environmentally perturbing
  - Should impact on biodiversity minimally
  - Should be socially responsible
  - Should be sustainable

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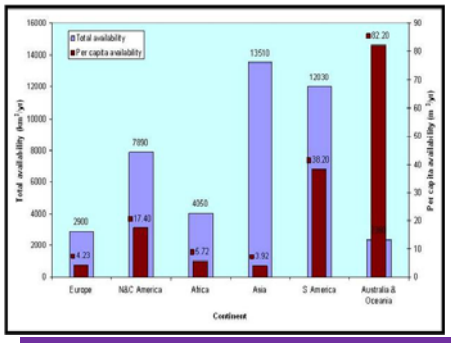
Global Fw Resources

- Planet:
  - >95% oceans
  - Useable Fw resources limited
    - Unevenly distributed



From Nguyen & De Silva, 2006; based on data from *Shiklomanov, 1998*

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Global Fw Resources

- **Global Fw resource:**
- **Small**
  - **less than 0.01% surface waters is the home to a very high level of biodiversity**
    - **nearly 25% of global vertebrate diversity (Groombridge, 1992)**
- **All developments should aim to safeguard this diversity**

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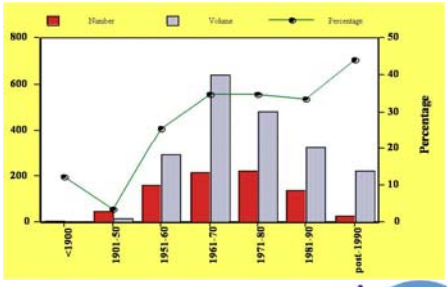
-Utilization of Reservoirs-

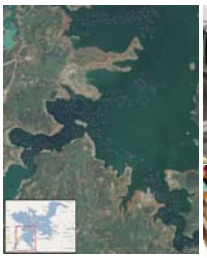
- Large resource in Asia
  - Very ancient
    - >2000 yrs old
    - Linked to rice cultivation
    - Centers of civilization
  - Modern age
    - E.g. China 86,000 since 1948!!
    - Asia- highest impoundment rate
- Controversies linger on
  - E.g. Mekong main stream damming



Changes in reservoir numbers and volume (>0.1 km³) in Asia, together with the volume of such reservoirs in Asia as a percentage of that in the world (based on data from Avakyan & Iakovleva, 1998)

-Utilization of Reservoirs-

- **In some intensive cage culture**
  - **Alternative livelihood to "displaced**
- **The cage culture potential in Asian reservoirs not adequately exploited**
  - **Exceptions: Indonesia**
    - **Ciratum water shed**
    - **3 reservoirs (~ 20, 000 ha)**
    - **60-80 x10³ t/ yr**
      - **~3000 kg/ ha/ yr**
    - **Local, stable market**
- **Development not without problems**
  - **Not insurmountable**



Reservoir & Lakes
-Culture-based Fisheries (CBF)-

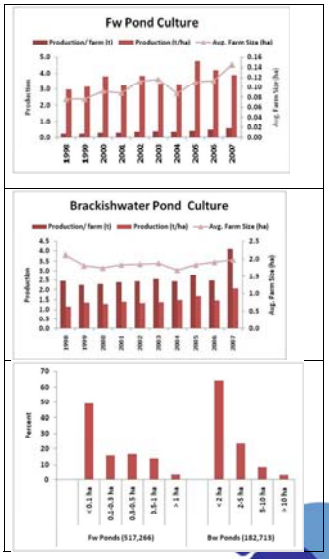
- Where operating:
  - Bangladesh, Lao, Cambodia, SL, Vn
- Governments encouraged
  - Legislative changes brought in
  - Communities (farming) organized



- Asian aquaculture is small scale:
  - Farmer/ family owned, operated & managed

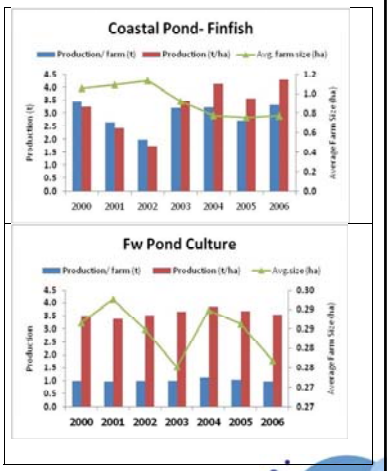
Lesser know entities on A-P Aquaculture -Pond Size (Indonesia)-

- A-P aquaculture is:
  - Small scale
    - "Defined as"
      - Farmer owned
      - Farmer operated
      - Farmer managed
- **Examples:**
  - Indonesia
    - FW Ponds: 0.14 ha
      - Increase in pond area &productivity
    - BW ponds:
      - 2.0 ha



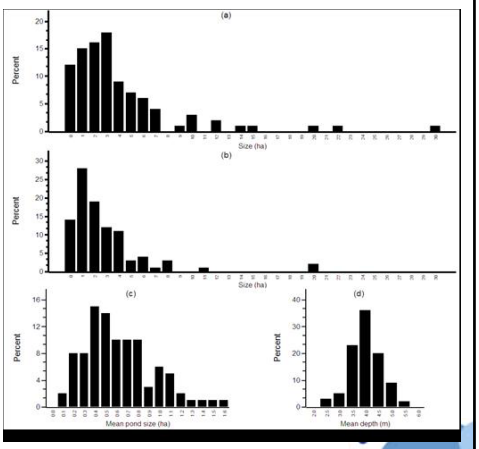
Lesser know entities on A-P Aquaculture -Pond Size (Thailand)-

- A-P aquaculture is:
  - Small scale
    - "Defined as"
      - Farmer owned
      - Farmer operated
      - Farmer managed
- **Examples:**
  - Thailand
    - Coastal pond:
      - Avg. farm size decreased to 0.8 ha
    - Fw ponds:
      - About 0.28 ha



Lesser know entities on A-P Aquaculture -Pond Size - Vn-catfish-

- > 55 % under 4 ha
- But production / ha :
  - Very high
  - Averages 350-400 t/ha/crop
- Still the great bulk:
  - owned, operated and managed



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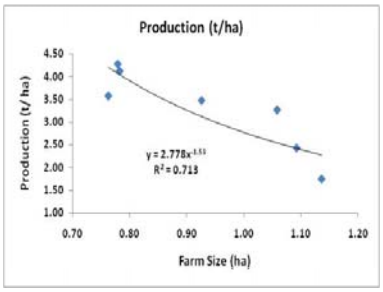
Farm size in A-P Aquaculture

- General take home message?
  - **Great bulk small, owned, operated and managed**
  - **No different to the rest of PP sectors in the A-P**
    - **Rice**
      - **E.g. PR China; worlds biggest rice producer**
      - **182.042 x 10^6 t (2006); 29% global production**
      - **Avg. farm size 0.93 ha/ farm**
    - **Dairy (RAP, 2008)**
      - **e.g. India; highest global producer**
      - **210 x 10^6 cows & buffaloes**
      - **But owned by 70 x 10^6 households**
- **Aquaculture in Asia will remain small scale**
  - **Development strategies have to "factor" this in**

Farm size- Productivity

- Not much data available
- Coastal pond culture Thailand
  - Clear trend
- It may be that:
  - Big farm size does not necessarily bring about higher production
- Scale of economies?
  - Is this applicable to PP sector in A-P?
  - Why would small scale farmers continue to practice their livelihoods?



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Aquaculture and the Environment

- Any farming system will:
  - Perturb the environment
- What is important is:
  - To minimize the perturbations
    - So resource use can be continued into the future
  - explicit & scientific in environmental perturbation assessments
  - Not be emotional
- Aquaculture a significant PP sector only in the last 3-4 decades:
  - More public awareness
    - More public policing
  - Perhaps more criticisms than deserved
  - Criticisms based on a few sub-sectors

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Aquaculture and the Environment
- example of Mekong Catfish Farming –

- Often cited as overly environmentally degrading
- Scientific evidence?
  - NO
  - Erroneous perceptions: YES
- What is the reality?

Variable	2007		2008 (Jan-July)	
Production level (x1,000 t)	678		837	
	N	P	N	P
Commercial feeds				
Feed required (using Median FCR of 1.69) (x 1,000 t)	1,146		1,415	
Nutrient loading (t) based on nutrient content of fish carcass	26,035	6,170	32,141	7,617
Nutrient loading (t) based on nutrient retention rate	27,866	5,356	34,401	6,612
Farmmade feeds				
Feed required (using Median FCR of 2.25) (x 1,000 t)	1,526		1,883	
Nutrient loading (t) based on nutrient content of fish carcass	26,578	9,221	32,810	11,383
Nutrient loading (t) based on nutrient retention rate	28,205	6,848	34,819	8,454

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Aquaculture and the Environment
- example of Mekong Catfish Farming –
-Is it different to other cultured species?-

- In effect the nutrient loading from catfish farming:
  - No different to other species per unit production
  - Miniscule from overall impacts on the Delta
- In fact + impact from CC Impact view point

Species	Culture System	Feed	Discharge (kg/t)		Authority
			N	P	
Rainbow trout	Cage and raceway culture	Commercial	47.3-71.1	6.5 – 24.2	Bureau *et al.* 2003, Lanari *et al.* 1995, Ingram 1999
Silver perch	Ponds and cages	Commercial	130	14.4-28.8	Gooley *et al.* 2001a, Gooley *et al.* 2000; Gooley *et al.* 2001b
Channel catfish and Bluntsnout bream			120-160	25-35	Guo and Li 2003, Guo *et al.* 2009
Areolated grouper	Cages	Trash fish	321		Leung *et al.* 1999
Bluefin tuna	Cages	Fish	260-502		Fernandesa *et al.* 2007
Gilthead seabream	Cages	Commercial	102.9	17.8	Lupatsch and Kissil 1998
Common carp		Various	30.9-86.0	8.5-26.4	Watanabe *et al.* 1999, Jahan *et al.* 2002
Striped catfish	Ponds	Commercial	38.4-41.1	7.9-9.1	Median values this study
Striped catfish	Ponds	Farmmade	39.12-41.6	10.1-13.6	Median values this study

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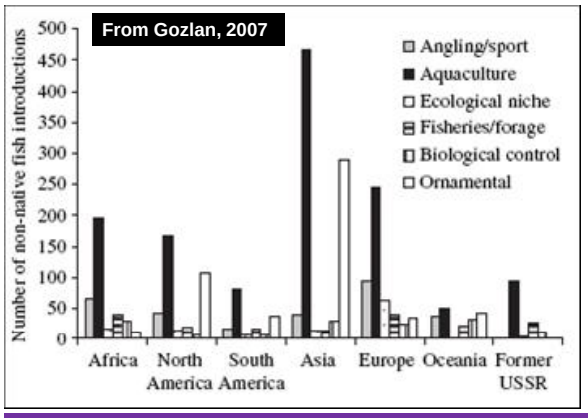
-Alien species-

For what? Where? How Many? etc.



- Most alien species - for aquaculture purposes
- Asia – the largest number of exotics/aliens

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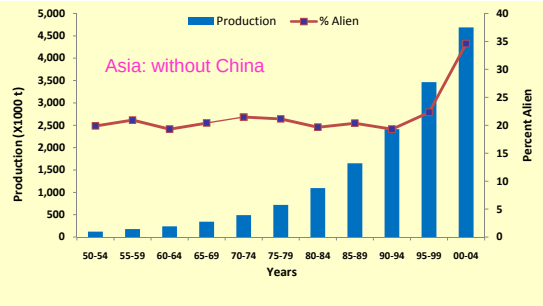
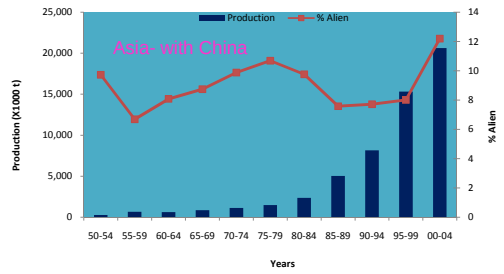
Alien species in aquaculture





Salient points:

- Domination of China of Asian/ global aquaculture
- Chinese production less dependent on alien species
  - Mostly Chinese major carps
  - Main alien spp., tilapia
- Rest of Asia- highly dependent on alien species
- The trend of dependence increasing markedly since 1990s
  - The era of upsurge in aquaculture development

Figures from De Silva *et al.*, 2008 (AMBIO, Vol. 37)

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Status of a few individual alien species (finfish) in aquaculture

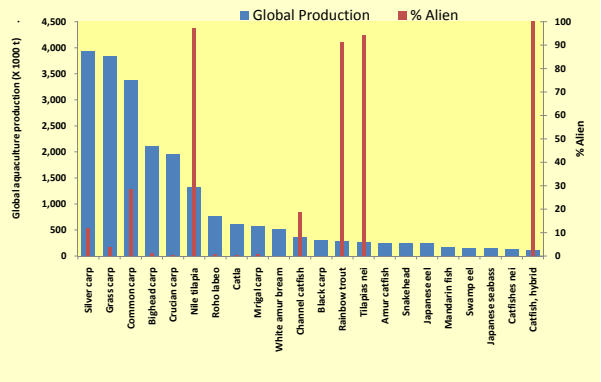

Figure from De Silva *et al.*, 2008 (AMBIO, 37)

Globally, in fw; major 22 species in production:

-Nearly 33% production higher in introduced areas

-- only four species groups, as alien species account for >50% of global production

-Another 2 species > 20% of global production

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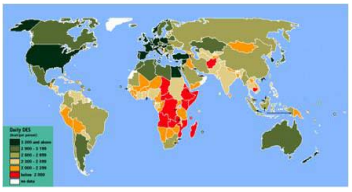
The current status in a nutshell: Major negative impacts (?)- tropics

- Chinese & Indian major carps across water sheds/ nations
  - Explicit evidence unavailable
  - Need for better planned broodstock management
- Tilapias into Asia
  - Balance of evidence suggest no apparent negative impacts
  - Tends to dominate natural habitats that have been degraded from anthropogenic activities (De Silva *et al.*, 2004)
  - No evidence of invasion of pristine habitats
    - Controversial though
      - See Canonico *et al.*, 2005

What are the take home messages?
Some pertinent facts

- Any take home message in relation to any form of food production should be taken in the context of:
  - **Developing world 4.79 x10^9 (out of 6.2 x 109)**
  - **815 x 10^6 undernourished (17%)**



- Malnourishment (WFP, 2007):
  - **Leads to diseases**
  - **Kill more people/ year > AIDS+ malaria+ tuberculosis**
  - **Hunger kills> all wars**

- Proteins of aquatic origin
  - **20% of all protein consumed (on the increase)**
  - **Global per caput consumption increased by 50% over the last 4 decades (McMichael, 2006)**
  - **50% of the above come from aquaculture**

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What are the take home messages?

- **Fish are becoming increasingly important in our diet**
- **The traditional supply sources stagnant**
- **Fish:**
  - **Variety available**
  - **Affordable to even poor rural communities**
    - **80% of cultured fish - Farm gate price < US$2.00**
  - **Though perishable used variously processed**
- **Aquaculture**
  - **bridge the gap between supply and demand**
  - **~ extra 60/ 70 x 10^6 tonnes by 2020**
- **Inland fisheries major scope for development**

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What are the take home messages?

- Aquaculture not overly different to other food production systems
  - Grains
  - Meats
    - Main areas of production in alien territory
- Aquaculture relatively new as food production sector
  - In the era of sustainable development
  - Increased public awareness of use of natural resources/ environmental integrity
    - "policed" much more stringently
- Overall percent dependence on alien species in aquaculture considerably less
- But this is no reason for complacency

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"The greatest disease of all is hunger"

(Lord Buddha)

Finding the day's protein needs may not be that easy for ~840 million people!!!
Let us not forget this


Thank you all !!!