Aquaculture: With Special Reference to Developments in Asia

Why fish? Why Aquaculture?

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The topics covered

• What is NACA
• Why eat fish
• Changes of the Fishery sector
  – Production
  – consumer habits/ demands
• Why aquaculture
• Aquaculture
  – Global trends
  – Asian trends
About NACA

• Intergovernmental organization
  – 17 member countries (governments)
  – 1 associate member (SPC)
• Promotes rural development through sustainable aquaculture
  – Technical cooperation among members
• NACA members produce > 80% of world aquaculture production by volume
  – Members are:
    • Australia, Bangladesh, Cambodia, China, Hong Kong SAR, India, Indonesia, IR Iran, DPR Korea, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam
NACA:
17 Member Nations
21 Participating Nations
NACA- Structure & operating mechanisms

NACA Structure

Governing Council (GC)

Technical Advisory Committee (TAC)

Secretariat

Administrative Support

Technical Services Wing

Regional programmes and initiatives

STREAM Initiative
Information & Communications
Health
R & D Collaboration
Education & Training

Network

Fiscal Agencies
NACA Collaborating Centres
Regional Lead Centres
People-centered networks
Regional Resource Centres
Associated Institutions

Projects / TCDC Activities / Exchanges / Initiatives

National Coordinators
Project Implementation Teams
Working Groups
Advisory Groups
Operatives
NACA Centres

• **Regional Lead Centres**
  – Freshwater Fisheries Research Centre, China
  – Central Institute for Freshwater Aquaculture, India
  – Inland Fisheries Research & Development Bureau, Thailand

• **Collaborating Centres**
  – Aquaculture Department of SEAFDEC

• **More than 30 participating centres throughout the region**
  – Collaborating in research
  – Sharing information and resources
  – Training and exchanging expertise
Asia-Pacific Marine Finfish Aquaculture Network

- Cooperative R&D programme to support development of sustainable marine fish farming
  - People-based network with institutional participation
  - Multi-sector participation: Government Policy and R&D, Farmers Groups, Traders, Industry, NGOs
    - ACIAR, Skretting, CSIRO, QDPI, RIM-Gondol, RIA 1, Krabi CFRDC, BADC-Situbondo, AFCD-Hong Kong and more
  - Electronic Newsmagazine and newsletter
Aquatic Animal Health

- Reduce the risk of aquatic animal disease impacting on trade, environment & human health
  - Development of policy framework
  - Implementation of practical health management strategies at farm, local, national and regional levels
  - Regional surveillance system
  - Technical support through sharing of expertise and laboratory facilities
  - Participation of primary producers
  - Address emerging issues such as food safety and new disease (KHV, WTD, TS)
  - FAO, OIE, ACIAR, AusAID, SEAFDEC, AAHRI, DAF, MPEDA and more
Genetics & Biodiversity

- Support members to conserve aquatic biodiversity and genetic resources by:
  - Building capacity for national aquatic resource management programs
  - Coordinate cooperative R&D programs
  - Development of broodstock management programmes for economically important and newly emerging indigenous species
  - Contribute to conservation plans for endangered species
    - e.g. Mekong giant catfish
  - Kasetsart University, DOF Thailand, FAO, MRC, WFC, Deakin University, Malaysian Fisheries Society
Culture-based Fisheries

- Development of extensive, community-based aquaculture through:
  - Development of ‘best practice approaches’ to culture-based fisheries
  - Effective use of small water bodies for low cost fish production amongst rural communities
  - Application of co-management principles to culture-based fishery and stock enhancement activities
  - Dissemination of findings from completed projects in member countries
  - ACIAR, Deakin University, RIA 1(Vn), Laos PDR, Kelaniya University (SL), University of Stirling

Translated into Lao & Vietnamese
Support to Regional Aquatic Resource Management

- Address rural development and poverty alleviation issues by promoting:
  - Improved understanding of the livelihoods of poor fishers and farmers
  - Institutions that better support the livelihoods objectives of poor fishers and farmers
  - Policy development that reflects the livelihoods objectives of the poor fishers and farmers
  - Improved communications among the poor, service providers, institutions & policy makers
  - AusAID, DFID, FAO, VSO APEC
Special Programme in Response to the Tsunami

- Practical (needs-driven) assistance (direct) to affected farmers
  - Implementation is by community
  - Emphasis on self help
- Regional – CONSRN (BOB-IGO, FAO, NACA, SEAFDEC, WFC)
- Thailand
  - Rehabilitation of cage culture (Rotary Int’, AmerFS)
  - Training in marine finfish culture (FAO, DOF)
  - Environmental education (Chiba, Japan civic group)
  - Support to DOF coordination
  - Microcosm hatchery pilot (NORAD and AQVAPLAN NIWA)
- Aceh Indonesia
  - Supporting local governments and communities in rehabilitation of the aquaculture sector (ETESP Grant, ADB);
  - Microcosm hatchery pilot (NORAD and AQVAPLAN NIWA)
- Sri Lanka
  - Community participatory and livelihoods training (STREAM with FAO Grant)
• Promote (capacity building,) human resource development and technical exchange

  – Participating centres share expertise
  – Short term courses, workshops, study visits
  – Training is coordinated by Secretariat
  – Customized training as requested
  – RLCC, DOF Thailand, CIFA India, Pulau Sayak Prawn Production Centre, Malaysia, GRIM and Situbondo Centres, Indonesia, many more
Communications

• Improve communication and information sharing between members through:
  – Portal website on aquaculture
    • News and events
    • Free download of all NACA publications (>700)
    • Discussion forums / online community
  – Training in digital publishing and website management
• Visit www.enaca.org
Adoption of BMPs: the case of shrimp farming, India

Shrimp Farming & the Environment
• Support development & adoption of Better Management Practices
  – Focused on small-scale farmers
  – Increase productivity by reducing risk of shrimp health problems
  – Reduce impacts of farming on environment
  – Improve food safety & product quality
  – Improve social benefits of shrimp farming
  – Consortium with FAO, NACA, UNEP, World Bank, WWF
Progress in last 6 years

2001
- Survey
- 365 ponds
- Nellore
- West Godavari
- Risk factors
- BMPs

2002
- Farm level demonstration
  - 5 farmers
  - 10 ponds
  - 7 Ha
  - 4 tonnes

2003
- Village level extension
  - 1 Village
  - 1 Aquaclub
  - 58 farmers
  - 108 ponds
  - 58 Ha
  - 22 tonnes

2004
- Creek level extension
  - 6 Villages
  - 7 Aquaclubs
  - 130 farmers
  - 254 ponds
  - 173 Ha
  - 40 tonnes

2005
- State level expansion
  - 3 States
  - 19 Aquaclubs
  - 736 farmers
  - 1187 ponds
  - 663 Ha
  - 672 tonnes

2006
- 5 States
  - 28 Aquaclubs
  - 730 farmers
  - 1370 ponds
  - 813 Ha
  - 1000 t (exp)

2007+
- National Centre for Sustainable Aquaculture

Expansion to 5 states
Expansion to other states
Pilot traceability
Contract hatchery Seed Production

2007
Calibration of PCR service providing Labs

• India
  – One Voluntary WSSV PCR calibration exercise completed in June 2006 (37/49 labs returned results)
  – PCR calibration in Feb 2007 (33/51 labs returned results)
  – PCR laboratory accreditation program for India being developed (in conjunction with MPEDA)

• Indonesia
  – I PCR calibration completed in Indonesia in March 2007 (33/34 labs returned the results)
  – II PCR inter calibration planned in August 2007

• Lessons learnt
  – Assess the quality of results received by the shrimp farmers
  – Opportunity for the labs to evaluate their own performance and compare with other labs
  – Opportunity for labs to maintain confidentiality and seek technical assistance
  – Possibility of expanding the scope of the exercise to other countries e.g. Malaysia, Vietnam
ACIAR funded regional project
“Application of PCR for improved shrimp health management” (Jan 2005- Dec 2007)
Partners:
- CSIRO (Australia), Mahidol U. (Thailand), MPEDA, CIBA, COF (India) and NACA
Purpose:
- to prepare the labs for a future laboratory accreditation programme
The Process:
- Preparation of samples (5 DNA+5 Tissue samples per lab)
- Validation of results in 3 laboratories (CSIRO, CIBA, COF)
- Seeking expression of interest from labs
  - Allotment of laboratory codes
  - Distribution of samples
  - Collation of results
- Providing summary results back to all the participating labs
- Providing technical assistance, where required
New initiatives (1): South-South cooperation

- South-south dialogue
  - General view:
    - The need of a “NACA Like Network” for Africa

- NACA working closely with FAO and African Colleagues
  - Study tours in Asia
  - Familiarization with NACA functioning

- NACA has agreed to support all initiatives
New initiatives (2): Certification

- Addressing issues on certification of cultured commodities
  - A necessary entity for export markets
- Initiatives in conjunction with FAO & Regional Governments e.g. Thai (Shrimp)
- Work with WWF on development of "standards" for selected commodities
New initiatives (3): BMPs

- Extending the development of BMPs for other major commodities
- BMPs:
  - Increase marketability
  - Impacts environment minimally
- Activities:
  - Extension of successful experiences with shrimp
  - Marine finfish (funding ACIAR)
  - Tra catfish (*Pangasianodon hypophthalmus*: 1.2 million tonnes production), Vietnam (AusAID)
Want to know more?

• Contact us at:
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  – Ph: +66 (0)2 561 1728
  – Fax: +66 (0)2 561 1727
  – Email: naca@enaca.org

• Or visit:
  – www.enaca.org
Fish in Asian Culture: Why eat fish?

- Fish have been long associated with man; food; festivities etc.; temple inscriptions from Bayon Temple, Angkor Wat complex, Siem Reap, Cambodia; 12/13 th century
Fish in human Culture; Why eat fish?

- 3000 yr old inscriptions from an Egyptian tomb

A garden pond painting; 3500 yrs
Why eat fish?

- Fish provide nutrition;
  Nutrition: provision of basic chemicals needed for tissue growth, repair and well-being and energy for metabolism; movement, maintenance of body temperature, all activities;

- Fish are also known to be especially important from another perspective;
  provide poly-unsaturated fatty acids of the n-3 and n-6 series, health benefits
Why eat fish?

Fish provide very important nutrients

- **Best food source of iodine, selenium etc.**
- **Vitamins**
- **Best source of co-enzyme Q10** (anti-oxidant; drops in degenerative conditions such as in Alzheimer’s disease)
- **Fatty acids**
  - DHA- docosahexaenoic acid; 22:6n-3
  - EPA- eicosapentaenoic acid; 20:5n-3
  - AA- arachidonic acid; 22:4n-6
- **Fatty acids**
  - important to human health:
  - Pre-cursor to eicosanoids
  - General well being
  - Fatty acids also thought to have played a major role in human evolution; human brain (Crawford *et al.*, 1999)
Fish consumption is associated with a wide range of health benefits (FRDC, 2004)

<table>
<thead>
<tr>
<th>Disease/health condition</th>
<th>Strong evidence</th>
<th>Promising prelim. Results</th>
<th>Require study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary heart disease</td>
<td>+</td>
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<tr>
<td>High blood pressure</td>
<td>+</td>
<td></td>
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<tr>
<td>Irregular heart beat</td>
<td>+</td>
<td></td>
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<tr>
<td>Diabetes</td>
<td>+</td>
<td></td>
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<tr>
<td>Cancer</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>– Bowel</td>
<td></td>
<td>+</td>
<td></td>
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<tr>
<td>– Laryngeal</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>– Pancreatic</td>
<td></td>
<td>+</td>
<td></td>
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<tr>
<td>Asthma</td>
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<td>+</td>
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</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>+</td>
<td></td>
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<tr>
<td>Crohn’s disease</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>Central nervous system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Neural development</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>– Memory</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>
Fish in human life

- Fish is also an affordable source of protein for most communities

- Fish related activities provide significant employment to communities; especially rural, poor communities
  - >200 million people depend on fishery activities for their livelihoods

- Inland fisheries tend to supplement agricultural income
Food fish availability

- Globally fish provide >2.8 billion people with 20% of per caput protein intake

- Contribution of fish to world Animal protein supplies peaked in 1996 at 16%

- Fish consumption patterns vary markedly between continents and countries
Food fish consumption patterns: some highlights

• the per caput consumption in 1996 was 15.8 kg per annum

• consumption has grown at an annual rate of 4.7% from 1990-to 95

• the per caput consumption differs from continent to continent:
  – within a continent major regional differences;
    • European Union nations it is 22 Kg per annum
    • but only 6-9 Kg in Central and Eastern Europe

• Consumption LIFDC is only 12.7 Kg per annum
  – compared to the WORLD AVERAGE OF 19.5 Kg per annum.

➢ Inland fish accounts for about 20-25% of the animal protein intake
  ➢ particularly in rural populations in the developing world (Delgado et al. 2003)
Food fish consumption patterns: some highlights

- the Asian region highest population concentration in the world

- currently consumes about 17.2 kg of fish caput\(^{-1}\) annum\(^{-1}\) (world avg. 15.8 kg).
  - Percent of fish in animal protein intake (Tacon & Forster, 2001)
  - Korea - 55.7
  - Sri Lanka - 54.3
  - Indonesia - 53.1
  - Bangladesh - 48.3
  - Malaysia - 34.5
  - Vietnam - 39.4
  - Cambodia; Siem Reap Province 80-85

- The population in the Asian region is expected to reach 4.16 billion by year 2020.

- If the current fish consumption rate is to be maintained the region will require 70 million tonnes of fish by 2020

- an increase of nearly 26x 10^6 tons from the present Asian production of 43.96 million tons.
Food fish consumption patterns: some highlights

- a shift towards increased consumption of fish in the developing world;
- production is dominated by the latter accounting for nearly 70% of global production (Delgado et al. 2003);
- most markedly, the consumption of inland, freshwater fish has increased over ten fold between 1981 and 1997;
- consequently, there is an increasing emphasis on the development of inland fisheries as a significant contributor in narrowing the growing gap between supply and demand for fish food (Welcomme and Bartley 1998; De Silva 2003);
- inland fish accounts for about 20-25% of the animal protein intake, particularly in rural populations in the developing world (Delgado et al. 2003).
What is the future?

- Fish consumption is on the increase
- Fish supplies- traditional sources have plateaued
- What is the future?
## The predicted needs of fish food supplies

<table>
<thead>
<tr>
<th>Forecasts and forecast dates</th>
<th>By the forecast date</th>
<th>Calculated quantities required from aquaculture by the forecast date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global per capita consumption (kg/ year)</td>
<td>Food fish demand (x million tonnes)</td>
</tr>
<tr>
<td>Delgado et al., (2003), (IFPRI ) 2020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>17.1</td>
<td>130</td>
</tr>
<tr>
<td>Lowest</td>
<td>14.2</td>
<td>108</td>
</tr>
<tr>
<td>Highest</td>
<td>19.0</td>
<td>145</td>
</tr>
<tr>
<td>Wijkström (2003)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>17.8</td>
<td>121.1</td>
</tr>
<tr>
<td>2050</td>
<td>30.4</td>
<td>270.9</td>
</tr>
<tr>
<td>Ye (1999)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>15.6</td>
<td>126.5</td>
</tr>
<tr>
<td></td>
<td>22.5</td>
<td>183.0</td>
</tr>
</tbody>
</table>
The predicted needs of fish food supplies

- **World population increases and future fish demand**

<table>
<thead>
<tr>
<th>Region</th>
<th>2005 population ('000)*</th>
<th>2020 population ('000)*</th>
<th>%increase</th>
<th>Per capita fish supply (kg) (2001)**</th>
<th>Current fish supply (tonnes)***</th>
<th>2020 fish demand (tonnes)****</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>905936</td>
<td>1228276</td>
<td>35.6</td>
<td>7.8</td>
<td>7,066,301</td>
<td>9,580,553</td>
</tr>
<tr>
<td>Asia (excluding China)</td>
<td>2589571</td>
<td>3129852</td>
<td>20.9</td>
<td>14.1</td>
<td>36,512,951</td>
<td>44,130,913</td>
</tr>
<tr>
<td>Europe</td>
<td>728389</td>
<td>714959</td>
<td>-1.8</td>
<td>19.8</td>
<td>14,422,102</td>
<td>14,156,188</td>
</tr>
<tr>
<td>Latin America &amp; the Caribbean</td>
<td>561346</td>
<td>666955</td>
<td>18.8</td>
<td>8.8</td>
<td>4,939,845</td>
<td>5,869,204</td>
</tr>
<tr>
<td>North America</td>
<td>330608</td>
<td>375000</td>
<td>13.4</td>
<td>17.3</td>
<td>5,719,518</td>
<td>6,487,500</td>
</tr>
<tr>
<td>Oceania</td>
<td>33056</td>
<td>38909</td>
<td>17.7</td>
<td>23</td>
<td>760,288</td>
<td>894,907</td>
</tr>
<tr>
<td>China</td>
<td>1315844</td>
<td>1423939</td>
<td>8.2</td>
<td>25.6</td>
<td>33,685,606</td>
<td>36,452,838</td>
</tr>
<tr>
<td>World</td>
<td>6464750</td>
<td>7577889</td>
<td>17.2</td>
<td>16.3</td>
<td>105,375,425</td>
<td><strong>123,519,591</strong></td>
</tr>
</tbody>
</table>

*Source: UN
**Source: FAO
***2005 population x 2001 per capita supply
****2020 population x 2001 per capita supply
Meeting the demand and supply gap:

- The population in the Asian region is expected to reach 4.16 billion by year 2020.

- If the current fish consumption rate is to be maintained the region will require 70 million tonnes of fish by 2020.
  - An increase of nearly $26 \times 10^6$ tons from the present Asian production of 43.96 million tons.
    - Lack of new exploitable marine stocks

- The gap between supply and demand to be met with from aquaculture?
Major, global changes taking place in the fishery sector

- Change from a developed country dominated sector to a developing country dominated sector
- This trend is being further consolidated

Data based on Delgado et al. (2003)
What is the reality: current trend

- The global aquaculture production has been on the increase
- Capture fishery almost stagnant
- Inland aquaculture still predominant
What is the reality: current trend

- The contribution of aquaculture to the food fish supplies have been increasing over the last three decades
- Freshwater food fish supplies predominated by aquaculture
- Currently of all food fish consumed globally 34% percent is from aquaculture
- 2006 estimates preliminary indicate that it is gone up to 43%
  - By 2010, 50% of all food fish consumed is likely to be from aquaculture
What is the reality: current trend

- Global aquaculture is dominated by Asia
- >85% of global production
- Eight out of 10 leading aquaculture producing nations are in Asia
We live in an era in which fish is a most traded commodity: More than 40% of this is cultured: >85% of this in Asia

For developing countries fisheries is becoming an increasingly important and significant traded commodity (ies)

- Income generation
- Increased livelihood opportunities
- Better nutrition
- Foreign exchange earnings

(From Kurien, 2005)
Fisheries – trade: increasing dominance in aquaculture in Asia

In Asia an overall increase in the predominance of the aquaculture sector: reflected in the trade of fishery products also
In almost all major ‘fish’ producing countries in Asia the dominance of aquaculture is increasing & hence in the trade of fishery products...
Aquaculture in Asia—trade: Increasing contribution to GDP

Increased dominance of aquaculture is reflected in the GDP of Asian nations

<table>
<thead>
<tr>
<th></th>
<th>Capture Fisheries</th>
<th>Aquaculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>1.884</td>
<td>2.688</td>
</tr>
<tr>
<td>PR China</td>
<td>1.132</td>
<td>2.618</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2.350</td>
<td>1.662</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>1.432</td>
<td>5.775</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.128</td>
<td>0.366</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.184</td>
<td>2.633</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.044</td>
<td>2.071</td>
</tr>
<tr>
<td>Vietnam</td>
<td>3.702</td>
<td>3.497</td>
</tr>
</tbody>
</table>

Guanzhou-China: Shrimp culture

Myanmar

CatBa-N.Vietnam
Conclusions: Part 1

• Food fish needs are increasing
  – Due to health reasons; in the developed world
  – An affordable animal protein supply to rural communities
• Traditional supplies stagnating
• Major changes in
  – Fish consumption patterns and
  – Fishery production; dominance shifted from developed to developing nations
• Aquaculture is expected to meet most of the increasing demand
  – Currently inland aquaculture more predominant
• Aquaculture is increasingly dominant in fishery trade
• Aquaculture production and fishery trade dominated by Asia
Conclusions: Part 1

• Give a person a fish and you feed them for a day; teach a man how to grow fish and you feed them for a lifetime
  – An old Chinese proverb

Thank you all