



# Global Conference on Aquaculture 2010

Farming the waters for People and Food

22-25 September 2010, Phuket, Thailand

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## Citations

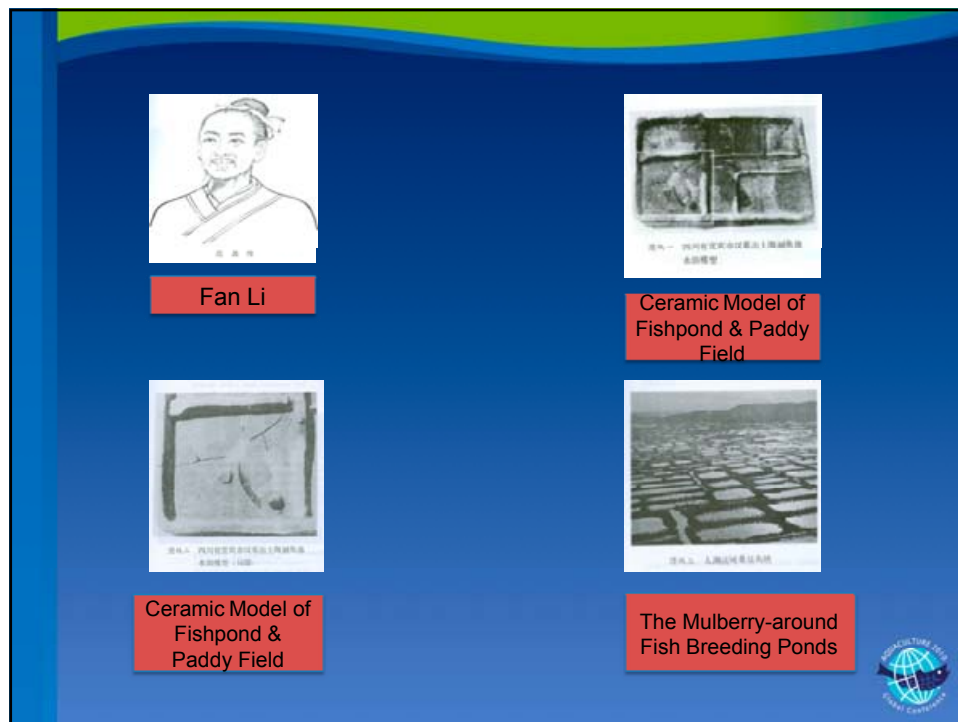
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## Contents of the presentation

- Indigenous knowledge systems
- Opportunities for consideration to harness benefits from indigenous knowledge systems
- Innovations of farmers
- Issues to be considered to promote farmers innovations
- Dissemination of success stories
- Strategies useful to make dissemination more successful



## Indigenous knowledge

- Indigenous traditional knowledge is a type of innovation by farmers that is stored in people's memories and activities and it is expressed in the form of stories, songs, proverbs, dances, myths, folklore, cultural values, beliefs, rituals, community laws, local language and taxonomy, agricultural practices, equipment materials, plant species and animal breeds (Grenier, 1998).

- Indigenous information systems are cumulative, dynamic, continually influenced by internal creativity and experimentation as well as by contact with external systems (Flavier et al., 1995).

## Integrated crop – livestock - fish



Peter Edwards

1000 years old rice-fish system in China

Red common carp integrated with rice in North Vietnam



## Pokkali Fields in Kerala

- Cover a large area in Kerala
- Pokkali paddy cultivation
- Shrimp filtration practice



## Khazan lands in Goa



Saline floodplains covering an area of 17,500 ha, reclaimed over centuries constructing an intricate system of bunds and sluice gates made of wooden doors



## Inundation of Khazan lands due to breaching of bunds





## Guinea Bissau traditional farming system

A traditional aquaculture system practiced in Guinea Bissau from the ancient times and based on the wild-collected fish being reared in brackish water area

It is based on the construction of a main dam and secondary dykes to regulate sea water entrance facilitating rainfall water store into the rice field, creating a brackish environment appropriate for rice-fish culture.



## Impact of developments on rice-fish systems

**Use of inorganic fertilizers and pesticides have contributed to the decline in biodiversity and the area under rice-fish systems**

**Urbanization is affecting several of the coastal rice-fish ecosystems.**

**Integrated past management practices are contributing for the resurgence of the rice –fish systems in many areas**

**Governments are taking measures to protect the traditional systems prevalent in coastal areas**

## Integrated crop – livestock - fish



Pigs integrated with fish in North Vietnam

Pigs integrated with fish on Chinese commune in Wuxi



## Integrated – livestock - fish



Small scale broiler chickens integrated with fish in Sukabumi

Small scale goat rearing integrated with fish in Subang



## Integrated crop-livestock - fish



Horticulture crops  
integrated with fish in  
North Vietnam

Duck-fish integration in  
North Vietnam



## Integrated crop – livestock - fish



Feeding Grass supplemented  
with pellet feed in a fish pond  
in China

Vegetables for human and  
fish consumption on  
Chinese commune in Wuxi





## PERIPHYTON TECHNOLOGY



Prof. Wahab

## Impact in the last decade

- Avian flu and Swine flu
- Increased use of factory made feeds

## Indigenous knowledge systems documentation

Documentation of indigenous knowledge prevalent in aquaculture and their validation through analysis and validation of such knowledge through research would help in stimulating aquaculture development in the coming decade

### Farmers' innovations:

The term "*innovative farmers*" refers to those who have tried or are trying out new and often value-adding practices, using their own knowledge and wisdom but also through appropriation of outsiders' knowledge.



## Significant innovations of farmers

1. Polyculture of different species based on their food habits and understanding their ecological niches .
2. Development of breeding technology for the carps cultured in China and India



Chinese carp hatchery



Indian Bundh  
breeding of carps



## Significant innovations of Indian and Myanmar farmers

1. Large ponds are better suited for the culture of Indian major carps
2. Large stunted fish seed essential to obtain better growth
3. Possible to culture rohu as the dominant species and obtain >10 ton/ha
4. Bag feeding technology to prevent the wastage of feed



## Carp culture innovations by Indian and Myanmar farmers



**Fertilization**



**Large size seed**



**Feeding with rice bran and cakes**



**High survival and good growth**

- Developed technology for the production less than a kilo fish called as Zero point fish that attain rapid weight when stocked in new environment.
- Developed technology for the fish seed transport, particularly fish weighing over 100g..
- Live fish transport for marketing is evolving gradually.



**Large size seed transport system**



**Feed distribution in Nursery**



## Myanmar

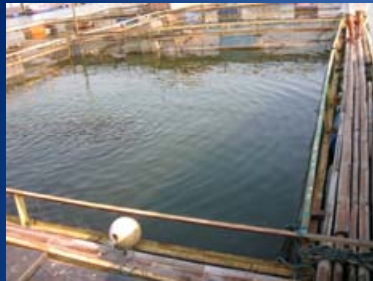


## Cage Culture in Cambodia





## Innovations in cage culture



## *Pangas* culture innovation by farmers

- *Cambodian farmers were able to obtain production up to 100 tons/ha with minimal water exchange*
- Technology refined by farmers Vietnam and improved production levels to average levels of 300-400 tons/ha.
- increased production with increased water depth , increased stocking density and increased water exchange
- Export demand



- Good quality feed with regular exchange of water to get the best meat quality.
- Harvesting at about one Kg size.
- Fish is exported to over 100 counties.
- The culture system is spreading to many counties including India.
- Good policy support from the Govt.



### *Seed nursing technology improvement by Indonesian farmers*

- Farmers in Indonesia obtain up to 60% survival in Pangas catfish larval rearing
- In milk fish seed nursing substantial improvement is done in larval rearing and reduced the larval rearing period to about two weeks
- In grouper larval rearing survival is improved with improved feeding strategies.
- All this is accomplished by farmers to remain competitive in the market



## Recycled water in Banchong's hatchery

- Location: Bampho district 60 km east of Bangkok.
- Rational for site selection: located far from sea, selected on the concept of water reuse system.
- Benefits: stable water quality,
- avoidance of pathogen introduction



### Water management

- Rainy season- salinity drop
- hypersaline water from Artemia pond added.
- Dry season salinity increase dilution with freshwater
- Algae, seaweeds & salinity tolerant plants used for water treatment.



- Hypersaline water for Artemia biomass production.
- Aquatic plants used as natural organic fertilizer.
- Water treatment 1 cycle- 7 to 10 days
- No water exchange last 8 years.



### Hatchery

- PCR –ve broodstock, formalin treatment.
- Efficient sperm penetration through egg wall due to high quality water.
- 600 millions nauplii per month.

## Economic efficiency

–Reduction in water cost by Baht 2,00,000-3,00,000 per month. Additional income Artemia biomass sale.

## Innovation recognised

– Awarded as well practised environmentalist as, his farm has never discharged effluents into natural water source.



## Gher rearing of giant fresh water prawn

- Gher is a method evolved for culture of prawn in Bangladesh by farmers
- Invented in South-western part and the Technology is now spread to several parts
- Annual production over 28,000 tons and Provides livelihood to thousands of families

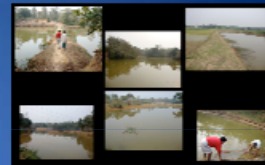




## Carp –mola culture innovation



S. Chowdhury, India



Mola-carp culture ponds



Bangladesh – Mola carp culture



Integration innovation

## Tilapia hatchery innovations





## Farmers' innovations:

### African case studies

- Innovations by small farmers and those engaged in commercial scale production are seen in Africa.
- We have case study examples from Nigeria and Uganda



## Farmers' innovations:

### Catfish culture - market driven approach in Nigeria: Innovative approaches to aquaculture in a African country:

- Species selection: The African catfish issue.
- Private-public sector link establishment.
- Sound management.
- Availability of skilled private/public extension services.
- Improved feeding strategies.
- Genetic improvement and brood stock management strategies.
- National Seed Production System: availability of high quality seed in remote areas.
- Market driven farming systems establishment.



## Farmers' innovations:

### Farmer innovations in Uganda:

- Private sector driven approach.
- Farming system diversification: net cages, pen culture, tank based culture, re-circulating systems...
- Sector-oriented Public Policies and Regulatory Framework.
- Genetic improvement and brood stock management strategies.
- National Seed Production System: availability of high quality seed in remote areas
- Improved feeding strategies.



### Farmer Innovations over the last 10 years in Uganda:



## Farmers' innovations:

### Australian freshwater crayfish *Cherax quadricarinatus* (redclaw) culture innovations in Ecuador and Mexico:

- Innovative farming practices: hiding places (tires, bricks)
- “Best-known practices” establishment and promotion.
- Seed production strategies: use of onion-bag bundles to protect and harvest small juveniles from ponds.



## Farmers' innovations:

### Australian freshwater crayfish innovations in Ecuador and Mexico

- Innovative supplemental feeding practices and feeding strategies: use of locally available raw materials.
- Harvesting methods: flow trap methods, attracting crayfish out from stagnated pond water, a systematic “self-harvesting” strategy.



Flow traps used for harvesting red claw in earthen ponds



## Farmers' innovations:

### Indigenous species (tropical gar) culture using Integrated Strategies in Tabasco, Mexico:

Tropical Aquaculture Laboratory, Academic Division of Biological Sciences, Universidad Juárez Autónoma de Tabasco, Mexico

- Market driven strategy: following local demand, tropical gar is a native species with a very high commercial value.
- Farming strategies: adapting proven aquaculture technologies used for tilapia culture to native species requirements: key factor for a sustainable development.



## Farmers' innovations:

### Indigenous species (tropical gar) culture using Integrated Strategies in Tabasco, Mexico:

- Integrated agriculture-irrigation-aquaculture approaches: community development programmes integrate aquaculture with horticulture and irrigation activities, also using wastewater from aquaculture tanks for daily irrigation.





## Farmers' innovations:

### Indigenous species (tropical gar) culture using Integrated Strategies in Tabasco, Mexico:

#### - Indigenous species-restocking activities:

Thanks to the promotion and innovative approach to tropical gar culture, specimens have been devoted to restocking, trying to counteract the decline of natural populations due to over fishing, habitat degradation and urban growth.



## Farmers' innovations:

### Indigenous species culture and breeding strategies in Colombia

Characins (*Characidae*) is the common name of native fish species that are prevalent in the waters of South America, Central America and Africa, with more than 1400 different species recognized.

Cachama (*Piaractus brachipomum*), Bocachico (*Prochilodus reticulatus magdalenae*) and Dorada (*Brycon moorei*) are among the most popular native species in Colombia.





## Farmers' innovations:

### Indigenous species breeding and culture innovations

Adapting proven aquaculture technologies and breeding strategies to suit local conditions has been crucial for a sustainable aquaculture development of these native species.

Caldas Aquaculture Research and Outreach Station has been crucial in this innovative process



## Farmers' innovations:

### Indigenous species in Colombia Culture and breeding strategies innovations:

#### - Breeding strategies:

The successful management of brooders depends on controlling stress factors: pond area, feeding strategies, water quality/temperature (use of greenhouses), stocking densities (low population densities in mono/polyculture are crucial for sexual maturity).



#### - Induced spawning methodologies:

Different treatments are described in the general report, including use of chorionic gonadotropin, freeze-dried extract of carp pituitary and chorionic gonadotropin and pituitary lyophilized tent.



## Farmers' innovations:

### 40 years of innovation in shrimp culture in Mexico:

#### Evolution in post larvae production:

- Species selection: from blue to white shrimp.
- Breeding strategies: origin of brood stock, brood stock management.
- Bio security measures: use of several "dry" periods, filtering and disinfecting methodologies, management of separate farming areas.
- Seed transportation and handling: delivering post larvae directly to the farm.
- Farming Systems: pond's location, size and shape, dykes, canals, pumping systems.
- Stocking densities: increased from 10-12 PL/m<sup>2</sup> to 40 PL/m<sup>2</sup>.
- Feeding strategies: feeding rates, formulated feeds improvement, supplemental feeding, use of fertilizers and probiotics.



## Factors that stimulate farmers' innovations

Poverty  
Necessity  
Desire  
Culture  
Extension methods adopted  
Attitude of researchers  
Policies of the Governments

## Dissemination of successful stories:

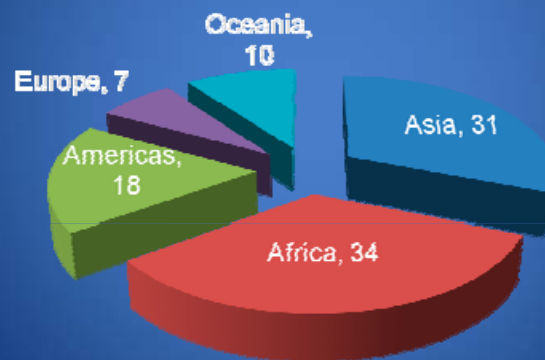
Wherever farmers have had access to adequate foundation knowledge on the science of a technology, they have been able to constantly improve the production systems, assuring sustainability and the adaptation to local conditions.



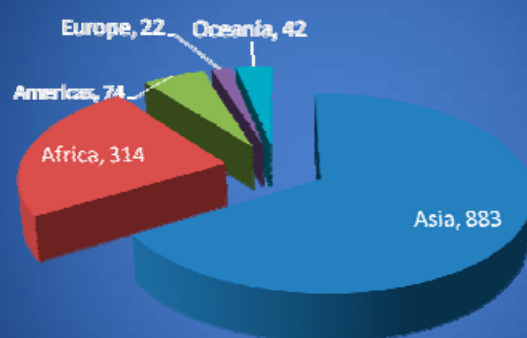
## Integrated fish farming training centre: Wuxi, China

- China: leader not only in production but also in dissemination of knowledge on aquaculture and fisheries management.
- Integrated fish farming training program started as FAO – UNDP supported activities, till date participants from 100 countries and altogether 1335 persons have been trained.
- Since 1992 program has been taken over by Govt. of China, with full funding support from Govt.
- Training gives an opportunity to gain experience in aquaculture technology and fisheries management.
- Noteworthy example of how a developing country can share technique for the benefit of people.

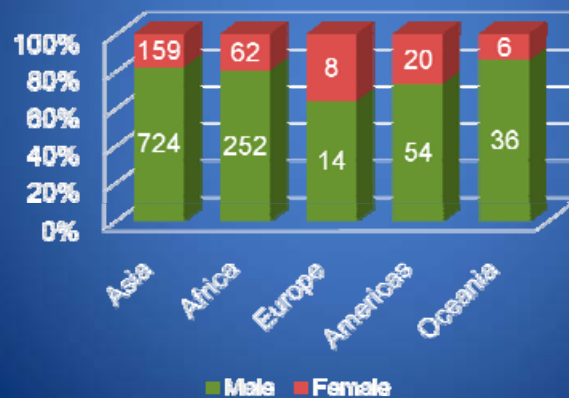
### Countries benefited through integrated fish farming training centre, Wuxi, China



### Number of trainees



## Ratio of male and female trainees



- Noteworthy example of how a developing country can share technique for the benefit of people.
- **Lessons learnt**: Practical training imparted to trainees enabled them to gain confidence in fish seed production, fish culture, with focus in integration, disease management, sustainable & responsible natural resource management and replicate them in their countries with suitable changes.
- Helping the trainees to learn from each other.
- Benefits of building strong linkage between trainees, the faculty of training centre and the companies in fishery industries.
- Building of cultural linkage




## Asian Institute of Technology – Aquatic Resources Division role in tilapia seed production and culture technology dissemination



- Post graduate degree program in aquaculture at AIT has contributed to quality human resource development in Asia
- With strategic research interventions in tilapia seed production technology and its dissemination has increased seed availability in many countries of Asia , Africa & Latin America.
- Institute's follow up support to address the problems has helped in building successful hatcheries
- Lesson learnt: well founded education combined with practical training & supported by active research would help to spread of technology and ensure success.

## Tilapia seed production technology dissemination

- 35 hatcheries in Thailand
- 17 hatcheries in Bangladesh
- 10 hatcheries in Latin America




## Network of Aquaculture Centres in Asia (NACA)

- Works on the concept of regional cooperation.
- 18 member countries at present

**Modus operandi**- dissemination of information, field based strategic research programs, influencing policies.

**Success story** :- Revival of tiger shrimp farming in Andhra Pradesh. Contributed to the creation of a separate institution for sustainable aquaculture development.



**Lessons learnt** :- Existence of regional bodies that are managed with professional approach would benefit people through exchange of expertise and effective dissemination of information

**Opportunities :-**

- More proactive role in capacity building of people in the member countries
- Improving interventions and programs by involving farmer representatives and NGOs in NACA programs management



## National centre for sustainable aquaculture

- NACA-MPEDA project accomplishments led to the creation of a national centre for sustainable aquaculture.
- Promotion of best management practices through cluster approach.
- Efforts made directly to link farmers to international buyers.

**Benefits** :- Higher profits, reduced disease incidence ,easy certification, eco-friendly sustainable production, increased food security, revival of abandoned ponds and empowerment of small scale farmers



Society Basic data				
State	Society	Ponds	Farmers	Area
Andhra Pradesh	532	17599	12073	11731.8
Tamilnadu	60	3660	1320	2700
Orissa	46	1948	1021	860.7
Karnataka	20	591	338	439.8
West Bengal	41	2204	980	358.1
Kerala	1	21	21	36
<b>Grand Total</b>	<b>700</b>	<b>26023</b>	<b>15753</b>	<b>16126.4</b>



Alternate crop of fish and shrimp			
<ul style="list-style-type: none"> <li>One of the cluster farmers in Andhra Pradesh, India experimented with crop of fish (Aug –Jan) followed by shrimp (March-July) in 10 ponds</li> <li>During the month of July to Dec salinity reduces to almost “0” in creek due to rains.</li> </ul>			
	Only shrimp	Only Fish	Alternate Fish and shrimp
Salinity Ranges	10 - 17	0 - 10	10 - 20
Stocking density	7	5	8
Months (Stocking Date)	Feb- May	July-Dec	March-June
Production (MT)/Ha	1480	4228	2314
Avg ABW	26	881	35.57
FCR	1.64	3.40	1.36
Cost of production per kg (INR)	192	33	187





**Lessons learnt :-** Better performance of employees with contractual employment .

Adoption of sustainable better management practices through cluster approach would help to reduce disease problems

Shrimp farming can be a powerful tool in poverty alleviation with effective management of risks through collective approach.

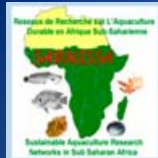


## ICT tools utility in information dissemination

a) Tilapia @ yahooogroups.com :-

- Proven successful network
- Group started in 1999 by MR. Tom Freese of the aquasol inc in Hawaii
- More than 3000 members .
- Global exchange of information specifically related to Tilapia.
- Members comprise small to large scale farmers with commercial focus, researchers & development professionals.
- Acts as a platform to share diverse experience.





## SARNISSA



### Issues

- Addressing existing and historical lack of access to information and communication about aquaculture and its development.
- Focal point:- building a sustainable aquaculture research network for Sub Saharan Africa in collaboration with other major players.

### Project objectives

- 1.Providing a comprehensive online interdisciplinary knowledge base by using bilingual online wiki websites and through online aquaculture compendium.
- 2.Promoting communication across borders and languages through email discussion in English and French

## SARNISSA Progress

- 1500 register members, 43 African & 49 other international
- Members engage in lively daily exchanges and discussion through African aquaculture Email discussion fora – English & French and SARNISSA website [www.sarnissa.org](http://www.sarnissa.org)
- SARNISSA now available on facebook also with 515 members.
- Recognised by and works together with FAO, AU, NEPAD, NORAD, GTZ, DFID and world bank.
- Beneficiaries:-** Aquaculture researchers, fish & shellfish farmers, hatchery sectors, students, NGOs, market, entrepreneurs, feed companies, nutritionists, post-harvest specialists and others.

## Establishment of fish seed networks

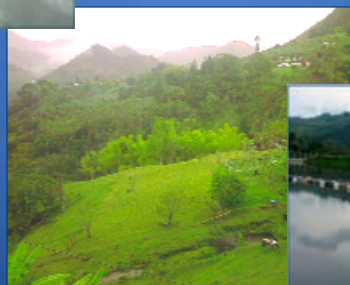
- Largely in private sector
- Developed in several Asian countries like India, Bangladesh, Vietnam, Lao PDR, Thailand & Cambodia.
- Fish seeds distribution to inaccessible areas.
- Cambodia success: Seed production & networks creation.
- Nursing operation is by group of farmers.
- Information Exchange & strategies development.
- Marketing, price fixation, technology, management discussion through farmers network
- Presenting problems to government.

## Networks in Colombia

“Bolívar Norte fish farmers’ network” was established to cope with the declining fish catches in the Cartagena region.

- Achieve a production that strongly contributes to poverty reduction.
- Ensure a democratic management of the organization.
- Improve local communities’ food security.
- Achieve a coherent market niche in the region through high quality products and homogeneous supply.
- Ensure high quality production processes and high quality/safe products delivered to the market.
- Implement adding-value techniques, such as filleting and vacuum packing.

**Caldas Aquaculture Research and Outreach Station  
Aquaculture Promotion Development Programme:  
Scientists-farmers successful collaborative approach**



## Dissemination of successful stories:

**Caldas Aquaculture Research and Outreach Station  
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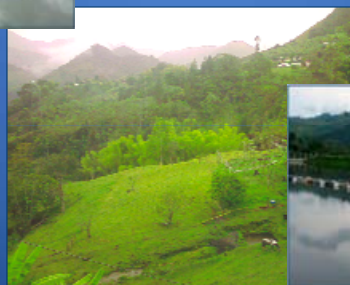
Christine M. Hahn von-Hessberg, Alberto Grajales-Quintero

### Main Research/Innovative Areas:

1. Development and promotion of integrated farming systems in coffee areas (integrated irrigation/agriculture and aquaculture).
2. Definition of native species biological bases.
3. Development of innovative approaches to native species breeding strategies and induced breeding techniques.
4. Native species restocking programmes.
5. Alternative feeding strategies and feeding formulation approaches using available raw materials and fertilization protocols.
6. Development of sustainable water recirculation systems.



**Caldas Aquaculture Research and Outreach Station  
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## Dissemination of successful stories:

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7. Development of water temperature control systems (traditional green houses for growout and breeding).
8. Implementation of limnological, entomological and biomarker studies within the Andean region.
9. Introduction of exotic aquatic species impact assessment.
10. Research on aquatic native species' classification.



## Promotion of carp polyculture in Bangladesh by the Government and NGOs

- Most families have pond for carp culture.
- NGO-credit without collateral security.
- Grameen bank prompted other NGOs.
- Banche Sheka: empowering woman with skills.
- Woman income improved over time
- Farmers field schools teaches agriculture & aquaculture.
- **Contribution** :- rice cum fish culture, ↑water utility, new ideas innovation.
- Trickle down system: effective way for rural aquaculture development.



## Examples to demonstrate productive linkage between farmers and scientists

### Uganda:

- Synergy between farmers and researchers.
- National Agriculture Research System: tap farmers innovation.
- Contributions: 3 new indigenous sp., improved fish feed, hatchery operation & management.
- Farmers involve from decision to completion of research.



## Examples to demonstrate productive linkage between farmers and scientists

### Uganda:

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- Contributions: 3 new indigenous sp., improved fish feed, hatchery operation & management.
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## Factors that contribute for successful dissemination

- Placing emphasis on science of the technologies
- Placing higher emphasis on skills
- Choosing the right persons for training
- Involving stakeholders and building consensus
- Transparent relationship with the community
- Good documentation
- Farmer to farmer focus



## WAY FORWARD

- Document indigenous technology prevalent in different countries, validate the technologies and scale up good practices to bring better benefits to people
- Promote research in partnership with farmers to address the field problems, increase the role of farmers in research planning and implementation
- Promote farmer to farmer exchange in all possible places and opportunities
- Place emphasis on building skills with knowledge



## THANK YOU



Innovation  
foundation of  
India  
([www.nif.org.in](http://www.nif.org.in))




Sir Peter Medawar - Nobel Laureate in Physiology states  
“**Commonsense and curiosity** are the two essential basic qualities necessary for innovators”





# WELCOME



**Aquaculture without Frontiers (AWF)**

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Join us - donate your time and money to help humanity make progress towards Millennium Development Goal #1 to eradicate extreme poverty and hunger by supporting the charitable work of Aquaculture without Frontiers (AwF).

For more information visit:  
[www.aquaculturewithoutfrontiers.org](http://www.aquaculturewithoutfrontiers.org)

**Aquaculture without Frontiers**

- AwF is a global charity dedicated to the development of sustainable aquaculture for poverty alleviation by improving rural livelihoods.
- AwF devotes its resources to aquaculture, but it does not offer support in isolation, rather it interacts with many rural and coastal development organisations dedicated to alleviating extreme poverty and hunger.
- AwF currently draws on the experience of more than 260 respected volunteer aquaculture professionals from over 20 countries.

AwF is unique in directing all of its charitable contributions to the poor. All AwF activities are carried out through the voluntary contributions of time by the Board of Directors and volunteers.



**AQUACULTURE**  
WITHOUT FRONTIERS

