Regional challenges and actions to support sustainable intensification

Conclusions and recommendations of the FAO/APFIC/NACA Regional Consultation on
Sustainable intensification of aquaculture in the Asia-Pacific
9-11 October, 2012, Bangkok, Thailand

"*Sustainable aquaculture intensification can be defined as producing more output from the same volume and/or area of water, while reducing the negative environmental impacts and at the same time increasing contributions to natural capital and the flow of environmental services*[1]"

A primary driver of intensification in Asia is the desire of households to improve their livelihoods and increase income. As with all livelihood activities, aquaculture must to be profitable enough, relative to other occupations, to sustain the interest of farmers. Intensification of aquaculture systems presents both opportunities as well as challenges.

The FAO/APFIC/NACA Regional Consultation identified key regional challenges to sustainable intensification of aquaculture in the Asia-Pacific region. Addressing these through regional/national actions and with private sector support, will help remove bottlenecks and constraints. The wide range of challenges and required action is a comprehensive picture of how sustainable intensification must be approached across multiple sectors and requires action both from government and private sector.

Intensified aquaculture requires increasingly robust regulatory framework to limit the potential impacts of overcrowding, environmental pollution, unregulated movements, biosecurity, food safety and the need for quality assurance on inputs. Since the bulk of the world's aquaculture takes place in developing and newly industrialized countries, these frameworks are often insufficiently developed to provide the necessary assurance to markets , which has resulted in a rising demand for certification, business to business quality assurance schemes.

The constraints to sustainable intensification or the key bottlenecks which if resolved would enable greater efficiency and intensification are highly context specific. As a result, any country of system will only require a subset of the issues below to be addressed.

In terms of regional initiatives there are a number of key issues that could be identified as priorities.

[1] Paraphrased from: Pretty, J., 2011. *Sustainable Intensification of Agriculture*. Annual Lecture at the British Ecological Society,12 - 14 September University of Sheffield, citing: Royal Society, 2009. *Reaping the benefits: Science and the sustainable intensification of global agriculture.* RS Policy document 11/09. Royal Society, London, October 2009; Godfrey, et al., 2010. Food Security the challenge of feeding 9 billion people. *Science* 327, 812 (2010).

1) Genetics, improved varieties and seed quality

Intensification of aquaculture production can be achieved through improved performance of the cultured species. There are considerable performance gains possible with selective breeding that remains to be captured, since most aquaculture stocks are not highly domesticated or remains essentially wild type. Poor broodstock and genetic management also results in performance loss and these trends will contribute greatly to the improvement of less intensive farming systems.

Promote the regional sharing of aquatic genetic resources

There is a considerable potential for improvement of breeds of cultured species through the selective breeding of different stocks and strains. In some cases this requires movement between countries and sharing of germplasm. The value of genetic resources is now increasingly recognized and therefore access to and sharing of germplasm is increasingly constrained. Many countries have stringent regulations.

- Look to the Nagoya/Cartagena protocols as a means to enable wider access to germplasm and reduce concerns over right to germplasm
- Establish regional agreements on the sharing and exchange of aquatic genetic resources – Nagoya protocol
- Strengthen use of relevant protocols for responsible movements, use of risk assessment and respect for Issue of CBD in case of irresponsible movement of broodstock/introductions.
- Facilitate bilateral arrangements for sharing germplasm
- Establish network for sharing information and experience on genetic improvement (Regional, NACA/FAO)
- There is a need for cooperation in establishing a regional broodstock development and genetic enhancement program for some key species
- Assist resource-limited countries to access higher quality broodstock for some key varieties, This is because they have limited capacity to maintain genetic quality of broodstock (e.g. inbreeding) due to small national hatchery capacity
- Develop a tropical cold water species programs for upland regions , where aquaculture development/intensification remains constrained by seed supply

Capacity development for the improvement of varieties and seed quality

- Develop broodstock genetic improvement and dissemination programmes (national, private sector)
- Improve management and regulation of hatcheries (seed quality, hybridization etc)
- Build level capacity in broodstock / hatchery management (national)
- Some countries need technical assistance for setting up national breeding programs
- Consolidated resource base for setting up and operating breeding programs (e.g. manuals, capacity building activities)

National domestication and breeding programmes for commodity species

There is a need to encourage public and private collaboration initiatives in domestication and brood stock programs. *P.vannamei* has benefitted from joint industry stock improvement programme, followed by well financed private sector breed development programmes. Tilapia was developed through a multi-country international programmes. There are some well developed national programs in the Asian region for some species (e.g. India, Jayanti rohu, tilapia), presently being disseminated within country.

- Asia, will benefit from the domestication of several other commodity species. Indian and Chinese major carp are identified in this regard. There will also be several other high value species of interest

- Establishment of well funded basic breeding program for rapid domestication and broodstock management programs
- Will benefit from cooperation between public and private players-for key commodities
- Initial investment for starting a founder population very high and requires public sector investment
- There is strong role for government investment in prescreening stocks and starting the domestication and captive breeding process

Identification and focus on a limited number of emerging species currently with no regional support

Asian consumers have a particular interest in consuming a diversity of fish species, this can be encouraged and there is scope for improvement of a number of breeds. The demand for a diverse range of minor species is very unique to Asia and there are some 166 species currently cultured in significant volumes. These species are often not part of large scale breeding programmes and are maintained either under state research facilities or within farmers own systems.

- Screen a number of promising species (e.g. climbing perch) for selection and improvement under a regional cooperative breeding programme
- Consumer and market requirements should be taken into account in breeding programs

Undertake species selection and breeding to fit poor rural areas need for high volumes of small fish.

Most breeding programs for commodity markets target increased size and rapid growth rate. Intensified systems that respond to developing country and poor rural needs, could focus on breeding for rapid early growth, high biomass and stress and disease tolerance. This provides rapid turnover for farmers, can reduce production cost, and the size of fish produced are affordable to poor consumers. Species that are of interest for local food security and that may not be of immediate commercial interest, will typically require national/regional government cooperation to assist in maintaining genetic quality of breeding stocks, as these are not commodities for which the industrial sector has commercial interest.

- Promote adaptive research with small-scale farmers and rural aquaculture systems to innovate on small fish production systems
- Screen a number of promising species (e.g. climbing perch) for selection and improvement under a regional cooperative breeding programme

2) Strengthen aquaculture biosecurity and health management

Intensified aquaculture, depends on high levels of health management. It is more vulnerable to the impacts of disease outbreak due to higher densities, and increased levels of investment in operations. The management of health links strongly to the quality of the seed used in the operation.

- Build capacity in development of farm-level biosecurity plans
- Build capacity in national / transboundary biosecurity plans (regional, national)
- Build capacity in disease surveillance, contingency planning and response (national)
- Promote Specific Pathogen Free programmes for key stocks
- Promote hatchery certification/quality assurance schemes

3) Availability, cost and utilization of feeds and feed ingredients

Intensified aquaculture requires more efficient feeds and feed utilization. This also links to the impacts on effluents. Feed costs are the predominant part of cost of production and therefore sustainable intensification will be highly dependent upon how the feed component of the system can be addressed

Improve the efficient utilization of feeds and feed ingredients

Efficient, more digestible feeds can reduce environmental impacts leading to higher yield, cleaner/lower water use systems and thereby contributing to moving towards sustainability. Lowering protein level diets can allow the more efficient use of feed resources without necessarily compromising performance.

- Addressing farmer/customer perceptions through communications and education
- Raise farmer awareness and influence expectations concerning feed protein content, low fishmeal feeds, performance Focus on improving awareness regarding digestible protein versus total protein level in diet more important
- Assess the current status and future potential of national agriculture to be able to provide plant-based aquafeed ingredients
- Provide regional guidance on species/systems feed-protein requirements; opportunities for innovate/mixed feeding schedules; communicate advantages of compounds feed versus fresh fish; also communicate potential of use of farm made feeds that may be as efficient as compound feeds
- Use of green water as a strategy to reduce the cost of pellet fed aquaculture.

Facilitate sourcing of cheaper aquaculture feed ingredients

- Review national regulations for optimizing the use of feed towards intensification, especially in relation to protein levels in feed. This could contribute to reducing cost of feed
- Review aquaculture feed ingredient import policies and tariffs (national)
- Information sharing on sources and prices of feed ingredients

Review and reform feed standards

National standard for feed for each species is a common practice in many countries but appear to be counter productive (e.g. regulations on total protein level). This was largely a historic result of attempting to protect small farmers from poor labeling and sub-standard feeds. Now there is more competition in the feed markets, particularly for intensified systems. There is a need to revisit national policies on mandatory protein inclusion levels in feeds. This may be unnecessarily high and limits the adaptation of feeds to costs, system and performance increases through genetic improvements.

- Improve quality assurance from feed producers, Labeling and feed composition through National regulations
- Revisit national feed regulations and consider recommending liberalization to improve the tailoring of feed to specific systems.
- Strengthen quality/crude content disclosure and monitoring of aquaculture feeds (national, private sector)
- Establish a regional mechanism to bring this type of discussions (having relevance to sustainability) to the attention of all stakeholders. Use this to develop a regional advisory note to inform policy and other stakeholders

4) Efficient or innovative use of land/water/energy

Intensification of aquaculture is not only increased production per unit area, it also includes the conversion of other production systems to or integration of other production systems with aquaculture. In this regard, it links strongly to agriculture intensification and diversification of farming systems. Aquaculture will increasingly be challenged for space and water in the region and thus innovations will include utilization of new areas for aquaculture and increased water utilization efficiency. At the same time, consolidation of aquaculture production units is occurring and this sees changing labour and ownership patterns.

Expansion of aquaculture into under-utilized areas with appropriate EIA (offshore aquaculture, reservoirs, irrigation infrastructure)

- Assess the feasibility of the expansion of aquaculture area
- Regional & international organizations such as FAO, NACA to facilitate aquaculture technology transfer and sharing of expertise based on needs assessment
- Region advisory on appropriate intensification technologies/strategies
- Strengthen national capacities for situation appraisal, carrying capacity assessment, EIA, zoning (regional); make the tools for this more accessible

Ensure aquaculture is able to access the water is needs for sustainable intensification

Aquaculture is often treated differently from agriculture with respect to energy tariffs, water allocation, water charges and subsidies in some of the countries in the region.

- Conduct water audits for the existing systems and projections for future intensification (using life-cycle analysis)
- Government support to infrastructure development for market accessibility and use of energy and water
- Irrigation systems are typically never intended for aquaculture, but future development should consider integration and allocation for aquaculture
- Promote Culture–Based Fisheries/multipurpose use of water resources
- Address unresolved issues relating to aquaculture payment for water services, allocation of water for aquaculture and effluent discharges

5) Reduction of environmental impacts of intensified aquaculture

Intensified aquaculture typically requires increased levels of feeding. This raises the challenge of management of effluents and impacts on receiving waters. Reduction, recycling or treatment of wastes and effluents from aquaculture facilities becomes an increasing priority. This also links to both farm bio-security and feed use efficiency.

Improve management of aquaculture effluent discharge (links to strengthened regulatory framework)

- Develop/strengthen law and regulations (national level)
- Facilitate the development, dissemination and implementation of BMP/GAP for communication to farmers (national, regional)
- Strengthen capacity in monitoring and compliance (national)
- Promote appropriate effluent-reduction technologies such as better management practices, recirculating systems (national)

- Continuously develop and improve technologies for effluent/waste management, including multi-trophic aquaculture systems (R&D)
- Encourage a multi-sector approach to waste/byproduct use from production and processing

6) Culture based fisheries is an option to intensify production of open waters

The open waters of Asia offer considerable potential for the increased production of fish from food through responsible enhancement. In some ways, the promotion of culture based fisheries is likely to deliver more immediate yield increases than the investment technology intensive approaches such as feed and breed improvement. This is a complex issue since it relates to access to water bodies, social equity arrangements, competition of water use as well as biodiversity dimensions.

- Explore the socio-economic issues related to increasing CBF opportunities of open waters
- Ensure that enabling policies are available for culture based fisheries development in small water bodies
- Conduct an assessment of the lessons learnt from previous culture based fisheries projects
- Incorporate risks of climate change and variability in CBF programmes

Reduce the threat of impacts of cultured fish release to open waters on wild varieties

Possibly 80-90% of all species cultured in the region are not highly domesticated. Inbreeding problems and small level of broodstock capacity means that wild stocks remain a source of genetic material . The stocking of open waters with large quantities of hatchery reared fish can threaten this resource. Impacts on the genetic quality of wild stocks has been identified in a number of wild species in the region (e.g. marine shrimp, silver barb, carps, catfish spp.).

- Effective genetic management of broodstock for hatchery stocks that are to be released to open waters
- Risk assessment for open water stocking
- National inventories on wild stocks resources that are targeted for aquaculture

7) Aquaculture as an attractive livelihood

Aquaculture presents considerable opportunities as means to diversify rural livelihoods – especially in staple, crop-based farming systems that are becoming economically uncompetitive due to their small-scale. Aquaculture intensification can offers a more competitive farming strategy that can maximize the productivity of small land units. There are risks and constraints associated with the intensification or diversification of small farm systems and this requires specific targeted policy, financial and technical assistance.

- Document productive, profitable and sustainable intensified aquaculture systems in the region
- Create an enabling environment for the development of the sector (national / private sector)
- Pay particular attention to organization and empowerment of small scale farmers (e.g. Servicing via farmer clusters)

8) Climate change and natural disasters

Climate change and climate variability is affecting aquaculture in the Asian region. This is seen as increase vulnerability to storm damage, vulnerability to flooding, unseasonal water shortage. As aquaculture intensifies, so does investment and concentration of assets, increasing the risk of catastrophic loss and consequent impact on livelihoods. Aquaculture also has an obligation to reduce

its contribution to greenhouse gas emission and improve its energy use efficiency. Aquaculture has the potential to contribute to the generation of renewable energy

Reduce the vulnerability of farmers to risks and increase their coping capacity

- Government explore possible mechanisms to provide insurance and credit services equivalent to those available to other sectors, to support intensification
- Use risk mapping for vulnerability to natural disasters – especially flooding, coastal storms and drought
- Assess aquaculture systems for their resilience and how farmers adapt to different kinds of risk

Seek to capture opportunities that may be presented by climate change

- Aquaculture opportunities may arise through environmental changes such as salinization, and coastal inundation, which degrade agricultural land but offer potential for aquaculture production

Improve the energy efficiency of aquaculture systems, and its contribution to mitigation of GHG emissions.

- Government support for energy efficient systems (e.g. Thailand-aerators, feeding machines)
- Support for alternate source of energy for use in aquaculture (e.g. establishment of wind farms in high energy coastal areas)
- Explore the potential of aquaculture products as biofuels (e.g. seaweeds, microalgae)

9) Markets

The intra-regional market is becoming important for the trade of seed, feed, fish. Inter-regional markets are important for a limited number of commodities (principally shrimp, tilapia, pangassius). Since the majority of production is still utilized domestically, there are strong potentials for intensified production to creating surplus, leading to gluts and subsequent dumping. The market linkage between white fish from aquaculture(e.g. tilapia, pangasius) compete in the global market with wild marine capture fishery products (cod, pollack etc.). In countries with significant inland fisheries(e.g. Cambodia), seasonal or periodic abundance can also result in depressed prices, and this market instability undermines sustainable intensification. Cross border trade between large producing countries can undermine the local aquaculture seed and growout operations. All of these impact on markets and price and therefore impact and constrain the economic potential for intensification.

- Quantify post harvest losses, or lost opportunities/value in aquaculture
- Review infrastructure constraints that limit markets
- Look at value chains – especially or business opportunities (R/D, action research)
- Invest in market research and market development
- Look for the opportunities offered by developing niche products and selling positive ecosystem benefit stories
- Address consumer misconceptions - seek ways to inform and increase consumer awareness in market countries
- Intensification should aim to lower cost of production (cycles of over and under production)
- Recognize the difference between urban (high income) and rural consumers and target intensification support to address consumer preference, needs and purchasing power

Role of certification as a driver for sustainability

There is an increasing role of certification in driving demands for sustainability. This through a range of mechanisms such as public certification, third party certification as well as the responsible sourcing arrangements of buyers (this probably the principal driver).

- Support national efforts to develop public aquaculture certification schemes (national)
- Raise awareness of and assist governments to make use of the FAO Guidelines on Aquaculture Certification
- Strengthen national regulatory processes to address key dimensions of food safety and environmental impact
- Strengthen cooperation with buyers for promoting certified products