

ICAR-NACA

Regional Expert Consultation

“Genetically Responsible Aquaculture”

Sustainability of Genetically Fit Broodstock and Seed of Certified origin in Asian Aquaculture

Date: 26 & 27 February, 2019

ICAR-NBFGR



Indian Council of Agricultural Research, New Delhi, India
and
Network of Aquaculture Centres in Asia-Pacific (NACA),
Bangkok, Thailand

Background

At present, 90 percent of global aquaculture production is the product of the intensification of aquaculture in Asia and the global South, where the majority (80 percent) are small-scale rural farmers, growing fish and shellfish for local consumption as well as export of high value species.

Broodstock management protocols that are both required and expected to produce quality seed with high genetic fitness are not part of any GAP or BMP standards, although the FAO Code of Conduct for Responsible Fisheries (CCRF), in particular Article 9.3, highlights the general need for genetic planning in broodstock management to alleviate the negative effect of inbreeding on development of high quality seed for aquaculture. We can identify several highly important missing components in the current aquaculture seed production economy in the global South; components that must be brought into existence if Asia is to become the global hub for sustainable intensification of aquaculture (SIA).

One very important component, essential to aquaculture code of conduct schemes, is the lack of any field validated assay protocol and reference standards to test genetic composition and inbreeding in smallholder farms and hatcheries where most production takes place in the global south. Secondly, there is no empirical assessment of linkages between disease and other losses and the use of seed of low genetic fitness produced from generations of genetic erosion. Even worse, there is currently little discussion of sustainable solutions to these problems -- broodstock management protocols that lead to smallholder farming systems that minimize and reverse the cumulative effects of poor genetic seed quality.

In all likelihood sustainable improvement of aquaculture in the global south, will use genetically improved varieties (more than approx. 20% as now) and will depend upon domesticated broodstock that are genetically diverse and capable of adapting to varied and changing environments and culture systems. Standards for verifying the origin and genetic composition of aquaculture broodstock and certified seed of predictable performance will be a critical necessity when Asia is the hub for sustainable intensification of aquaculture.

The Genetically Responsible Aquaculture (GRA) plan proposed for discussion envisages biosecure aquaculture genetic exchange networks modeled on existing breed associations for terrestrial livestock and domestic animals. Such networks will, in aggregate, constitute a global aquaculture gene pool with enhanced environmental resilience, long-term capacity for adaptation and minimal

inbreeding depression (which is linked to susceptibility to new and emerging pathogens). New and revised regulatory, microbiological, molecular genetics and social tools will be needed to facilitate the organization of such networks

The focal themes of the proposed expert consultation will be

- New procedures for rapid appraisal of genetic erosion at global, national and hatchery levels, and inbreeding at farm (production) level.
- New procedures for biosecure transfer and exchange of broodstock and/or seed and/or gametes, and/or sub-cellular genetic components, as appropriate.
- New traceability protocols for verifying origin and composition of broodstock and seed at various levels from national importation of broodstock to local seed sale to farmers.
- Specification of genetic indices and standards for various stages in the seed production process.
- Procedures for establishing collaborative genetic exchange networks for agriculture modelled on those that currently exist for livestock breeding and production in the global South.
- Information management databases and information access protocols for national/regional broodstock improvement networks (NBIN)

The larger mission envisioned is a national or regional network of registered small, rural broodstock holdings that, in aggregate, can sustain high genetic diversity, linked through IT based Database under the umbrella of National/Regional Broodstock Information and Registration Centers. The program will incorporate novel approaches in the context of institutionalizing the protection of genetic biodiversity of rural aquaculture broodstock for its sustainability as a rural food source. It employs modern science to develop tool and benchmark standards to estimate genetic erosion (inbreeding + diversity loss) and design and implement a sustainable solution to the genetic erosion problem.

The proposed consultation aims to evaluate establishing system of novel standards, protocols and policies for genetic management of broodstock, not addressed before, a paradigm change in the aquaculture seed production system that will provide quality assurance to importers and exporters of aquaculture broodstock and seed, as well as to hatcheries and small-hold farmers. These standards, protocols and policies will empower the ultimate consumers (small hold rural farmers and hatchery managers) to understand, if the broodstock or seed is compliant to standards of origin and composition (including inbreeding) before stocking and thus increasing their confidence. The quantifiable genetic standards available will be assessed for incorporation into available policy standards of Good Aquaculture Practices for aquaculture, which at present

considers risks to species-level biodiversity in nature, but does not count sustainable genetic diversity and fitness of species under culture.

Specific objective of the expert consultation

The objective of this proposal is to conduct a multidisciplinary, expert workshop to deliberate mechanisms for institutionalized quality seed production system that not only has verified seed and broodstock, empower the farmers and monitoring agencies with quantifiable standards but establish biosecure procedures for germplasm exchange to improve hatchery and on-farm genetic diversity. The consultation will involve invited experts working in India and abroad (NACA network) in the field of molecular and quantitative genetics, epidemiology, social science, aquaculture and policy etc.

Topics for deliberation and required expertise

- Need for awareness and strengthening genetic management of broodstock in seed production system and necessary policies and procedures. (Expertise: quantitative genetics, aquaculture health and zoosanitary policies)
- Preliminary assessment of seed production and accreditation system in different countries in the context of genetic erosion. (expertise: quantitative genetics, aquaculture socio-economics)
- Linkages between genetic erosion (monoculture, inbreeding) and disease and production losses. (expertise: quantitative genetics, epidemiology)
- Design plan for implementing protocols for standardizing and certifying aquaculture origin and composition protocols for genetically responsible seed production systems. (Expertise: national and international aquaculture policy)
- Identify molecular markers (and associated mathematics) suitable for simple diagnostic tools for inbreeding assessment in seed and broodstock and establishing origin/composition protocols and standards. (Expertise: molecular genetics and genomics)
- Discuss possible imbibing of experience from livestock management associations into National Broodstock Improvement Networks (NBIN) .as source of on-farm diversity, sustainable local adaption and germplasm exchange. (Expertise: breed associations and farm collaborative associations)

Expected output of the expert consultation

- **Document:** Framework for long-range and large scale funding and implementation of a regional, Genetically Responsible Aquaculture programme
- **Publication:** Review of current estimates of genetic erosion in smallholder

- aquaculture and the likely epidemiological consequences, proposed estimators of genetic parameters at field level, summary of proposed biosecurity, genetic and socioeconomic structure of a practical aquaculture genetic exchange network.

Organizers

Indian Council of Agricultural Research, New Delhi, India and Network of Aquaculture Centers in Asia-Pacific, Bangkok, Thailand. The organizers also seek collaborations with other organization, Government as co-organizers or Non-government for sponsoring the event.

Venue: ICAR-National Bureau of Fish Genetic Resources, Lucknow

Dates: 26 and 27 February, 2019

Expected Participants: 25 to 30

Experts and Participation

Dr. Roger Doyle (Geneticist and Mentor NACA, G&B program), NACA Director General and Coordinators, two or three identified experts from China, Australia, Thailand, India; Identified Epidemiologist from India or abroad and FAO Experts. The brochure will be circulated among NACA network and countries for inviting participation of country representatives. Nominated participants from ICAR fisheries institutes, MPEDA, DADF and NFDB, Aquaculture Industry will be invited to participate.

Synergy among the organizers

The organizations, ICAR and NACA brings in complementary scientific strength and range of expertise of several disciplines including, Social science, and gender studies, Aquaculture, Genetics and Biotechnology. ICAR is lead organization in India addressing the research and education need in the field of agriculture science including livestock and fisheries. ICAR has dedicated institutes, called National Bureaus for research on genetic resource management. ICAR-NBFGR, is part of Indian Council of Agricultural Research is working for aquatic genetic resource management in India with multidisciplinary expertise available such as genetics and biotechnology, fish diseases and epidemiology, resource management etc. The NBFGR has scientific strength in the specific area of marker and genomic technologies. ICAR-NBFGR, India, has implemented projects funded by World Bank (NATP, NAIP initiatives), Global Environment Facility, BOBLME and also World fish Centre. NBFGR hosted the International conference on gender in fisheries and aquaculture (GAF5) during 2014. Dr. Roger Doyle, an academician and researcher of aquaculture genetics, interfacing between research, industry and policy and involved with Asia-Pacific aquaculture and is also mentor for Genetics and Biodiversity program of NACA.

NACA is an intergovernmental organization with 19 members from Asia-Pacific and India is one of the founding members. NACA also has other regional networks like SPC - Secretariat of the Pacific Community, FAO on board. These contribute most of the global aquaculture production and are vulnerable to negative effects genetic mismanagement. NACA has implemented several projects granted by international agencies like ACIAR (culture based fisheries), USAID (Gender program for ASEAN), Darwin's Initiative, DFID UK and several programs funded by FAO. NACA implemented a widely acclaimed program on Best management Practices for shrimp farming through cluster approach with funding from Government of India, which led to policy level institutionalization in the form of The National Centre for Sustainable Aquaculture (NaCSA) and success stimulated many other projects for adaption in other countries. The two organizations bring together capacity of science, knowledge and implementation expertise across the countries.

Organizers

Chief Patron

Dr. Trilochan Mahapatra, DG, ICAR & Secretary, DARE

Patrons

**Dr. J.K. Jena, DDG (Fy), ICAR
and**

Dr. Cherdsak Virapat, DG, NACA

Conveners

**Dr. Kuldeep K. Lal, Director, ICAR-NBFG
and**

Dr. Roger Doyle

(Mentor, NACA, G&B program & President, Genetic Computation Ltd)



ICAR-National Bureau of Fish Genetic Resources

Canal Ring Road, P.O.Dilkusha, Lucknow-226 002, Uttar Pradesh, INDIA

Phone: 0522-2441735 email: director.nbfg@icar.gov.in; director@nbfg.res.in

