Regional Capacity Building Programme
on

Application of Modern Biotechnological Tools for Management of Aquatic Genetic Resources

Module 1: 16 December to 23 December, 2021
Module 2: 04 January to 12 January, 2022
Module 3: 13 January to 21 January, 2022

Organized By
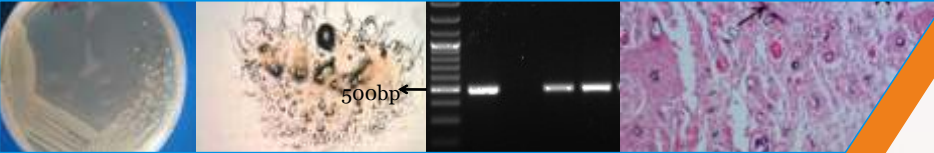**ICAR-National Bureau of Fish Genetic Resources, Lucknow**

(Virtual Mode)
in collaboration with
Indian Council of Agricultural Research (ICAR)
and
Asia-Pacific Association of Agricultural Research Institutions (APAARI)

BACKGROUND AND RATIONALE:

Aquaculture is growing at a fast pace of over 6% globally since 1970, contributes nearly 50% to global fish production, and is expected to meet the additional demand of fish of 40 million tons by 2030. Asia contributes over 70% to global fish production and also has enormous potential. The ongoing aquaculture intensification faces the risk of emerging diseases, and the transboundary movement of the species exposes the countries to exotic diseases. The credible reporting through systematic surveillance and early alerts can provide adequate opportunities for mitigation and avoiding losses due to diseases.

Global developments following biodiversity regulations and intellectual property regimes will enhance the need for documentation, research on, *ex-situ* conservation and ultimately sustainable utilization of aquatic genetic resources (AqGR). Convention on Biological Diversity (CBD) not only addresses the biodiversity issues but also sovereign rights of nations on this wealth. Most of the countries in Asia are signatory to the CBD and have implemented or are in the process of legislating appropriate biodiversity laws, to regulate the access and use of genetic resources, including AqGR. CBD and Global Taxonomy Initiative (GTI) also make it obligatory for the countries to develop and document knowledge on genetic diversity. The implementation of CBD is accomplished through several relevant frameworks, such as Nagoya Protocol, Aichi Biodiversity Targets, Sustainable Development Goals, which are targeted to be accomplished through national actions. Commission on Genetic Resources for Food and Agriculture (CGRFA) has prepared reports on the status of World Genetic Resources for plants, animals, microbes, forestry, agrobiodiversity and AqGR with inputs from various nations. Global Plan of Action is also being finalized to help countries in developing national strategies for sustainable utilization of genetic resources. During the last several years, on an average, over 350 finfish species per year, new to science have been discovered. Molecular tools are effective means to complement taxonomy in such programs and, therefore, capacity building on integrated taxonomy is becoming critical need for effective AqGR management

Inadequate knowledge on genetic stocks of fish species of cultivable and conservation value is a major constraint. The genetic stocks are the local evolutionary significant units, developed through adaptions to forces such as climate change, reproductive isolation, *etc.* Bioprospecting of genes and alleles and trait-specific germplasm are becoming important to enhance productivity in fishery sector. In this context, documenting genetic diversity at species and below the species level (genetic stocks and strains) is of paramount importance. Such knowledge will also help in planning to safeguard the wild relatives of cultivable species, which face the risks of losing their genetic diversity in their native distribution due to escapes and stocking in rivers, resulting in genetic mixing with conspecifics of non-native origin. Conserving and managing the natural AqGR are important as nearly half of the fish production for food is still contributed from the wild. The foremost objective of the sector today is to develop strategies for increasing productivity from aquaculture, while sustaining its natural resources such as wild relatives. Such balancing efforts that enhance conservation and allow effective utilization of diversity are important and need strategies based on knowledge and technology. Genetic erosion or inbreeding in farmed stocks is an immediate concern as it adversely affects performance of the most critical input for aquaculture *i.e.* seed. This needs the mitigation strategies to achieve outbreeding, exchange of gametes between quality performing broodstock and at the same time molecular resources to characterize the genetic diversity. These efforts need expertise of biotechnological tools and *ex-situ* conservation technologies including live germplasm resource centres with certified broodstock of known origin and cryofrozen sperm/cells.

The lack of scientific capacity of many countries in research areas of AqGR management is a bottleneck in knowledge development required for planning conservation and sustainable aquaculture improvement.
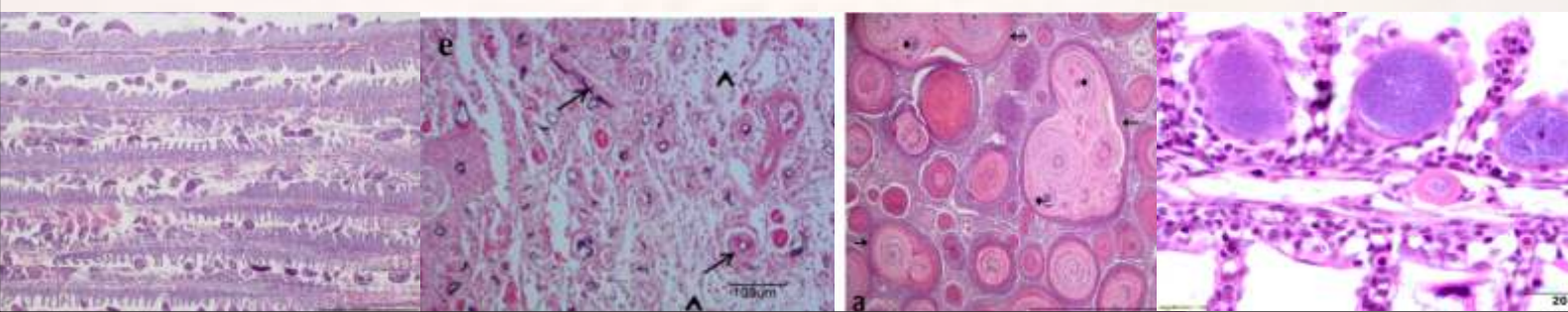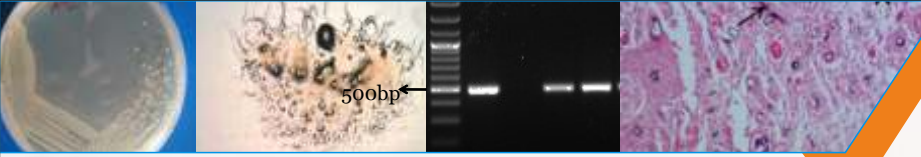
Therefore, to overcome these, the nations need to build their strength for research capacity on various aspects on the AqGR management

Capacity building in modern biotechnological tools has a significant role in generating the knowledge on genetic resources for aquaculture improvement and conservation. Further, *ex-situ* conservation tools serve to preserve material for future use/research and at the same time, also find immediate aquaculture applications *e.g.* sperm cryopreservation, preservation of diploid cells, *etc.* The capacity on disease diagnostics and biosecurity can help the nations to enhance aquaculture production, while minimizing the risk of losses due to diseases and contribute to 'One Health'. The competent researchers available in these areas will not only help the countries to advance their knowledge but also make the way for developing regional collaborative programs on the species of common interest. Genomics is an important area for utilizing genetic resources through insights into adaptive mechanisms and identification of trait-specific germplasm. The genomics and bioinformatics hold great promise to develop capacity in targeted selection for genetic improvement of aquaculture species. Therefore, the envisaged training programme is designed with three modules which cover important aspects of AqGR management (see Section 4).

The concept of this capacity building program is inspired from a recommendation emanated from Regional Workshop on Fish and Marine Genetic Resources and its Amelioration during July 10-12, 2019. This regional workshop was organized by APAARI in collaboration with Sri Lanka Council of Agricultural Research and Policy (SLCARP) and National Aquatic Resources Agency (NARA) in Sri Lanka. The workshop emphasized the need for a training programme on *ex-situ* conservation of AqGR for the benefit of scientists working in Asia-Pacific region. To support this need, ICAR-National Bureau of Fish Genetic Resources (ICAR-NBFGR) conducted a training program on the subject during December 7-18, 2020, which was considered very useful and appreciated by the participants from 15 countries. The training was conducted using virtual mode in view of the travel restrictions and more or less similar situation still persists. On the basis of feedback of the participants under the prevailing circumstances, this training program will be conducted by creating virtual laboratory conditions and class rooms. Three modules have been designed for addressing the thematic areas on AqGR Management and Conservation, Biosecurity, and Genomics and Bioinformatics.

2. PURPOSE

This concept proposal makes use of the vast experience of ICAR-NBFGR in the development of a comprehensive training course on AqGR management, which has importance for the countries of Asia-Pacific. The programme envisages developing nuclei of technical expertise within the countries, which can carry out research, link with researchers from other nations in the region to implement collaborative programmes on common interests in future.

3. OBJECTIVES

1. To develop a comprehensive multi-module training curriculum on AqGR management.

2. To build awareness among participants from Asia-Pacific on AqGR management and emerging global needs on biosecurity, its positive role in nutritional security, preparedness of the nations to fulfil obligations towards global frameworks such as CBD, GTI, and CGRFA etc.

3. To develop research expertise on biotechnological tools used in genetic diversity analysis, *ex- situ* conservation, genomics, bioinformatics and biosecurity.
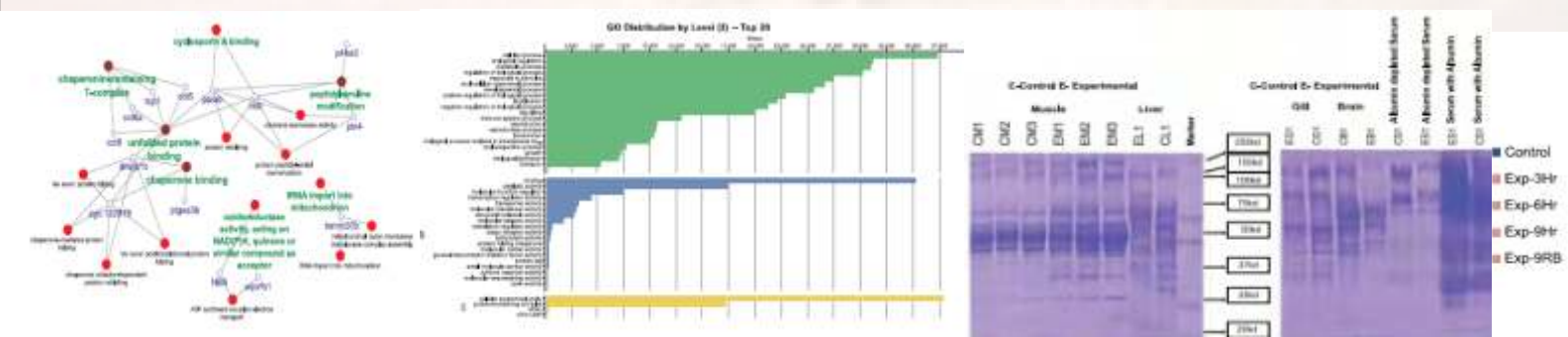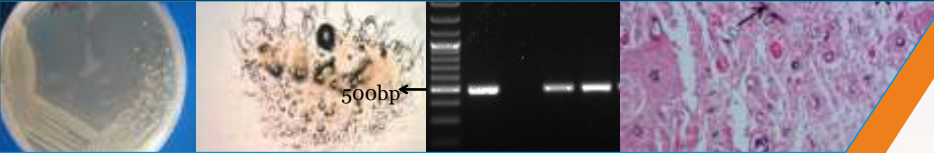
4. STRUCTURE OF THE COURSE AND DURATION

The programme will be conducted under the three specialized modules and managed by experts from ICAR-NBFGR during different time-frames as mentioned below. Nominations from countries in Asia-Pacific region can be made as per need and expertise of the candidates from respective countries. The nominated candidates are expected to register for the module as per their need. However, the expert lectures will be open to all the participants. The participants from all the three modules need to join in opening and closing sessions. The course will have a mix of theoretical lectures and practical demonstrations.

(i) Dates and Duration

Opening Session on 16 December, 2021

Module 1

Genetic Diversity and *Ex-Situ* Conservation: 8 days; December 16 to 23 December, 2021

Module 2

Aquatic Animal Diseases and Biosecurity: 9 days; 4 January to 12 January, 2022

Module 3

Genomics and Bioinformatics: 9 days; 13 January to 21 January, 2022

Closing Session 22 January, 2022

(ii) Training contents

Concept building

i.   Aquatic genetic resources (AqGR); their importance in production system and livelihood security and overview of global initiatives

ii. Concepts and tools in genetic diversity analysis

iii. Aquaculture genetics, selective breeding, inbreeding and broodstock management

iv. *Ex-situ* conservation tools; sperm cryopreservation and applications

v.   Biosecurity and disease diagnosis

vi. Antimicrobial resistance

vii. Genomics and transcriptomics, technological advancements and applications

viii. Bioinformatics

Expert from different countries and organizations will be invited to deliver lectures.

(iii) Step-wise Technical Demonstrations

Module 1. Genetic Diversity and *Ex-situ* conservation:

a.   Genetic Diversity: Demonstration on methodologies such as DNA extraction, quality check, primer designing, PCR and sequencing including Sanger's and NGS for the following analysis

- Molecular marker development and polymorphism (nuclear/mtDNA)
- Species discrimination with molecular markers and complimenting conventional taxonomy
- Statistical methods in molecular marker data analysis, population genetics genetic variability on geographic spatial scale and use of software

b.   *Ex-situ* conservation tools

- Sperm cryopreservation, freeze, thawing and fertilization
- Cell culture, development, preservation and characterization

Module 2: Aquatic Animal Diseases and Biosecurity:

Demonstration of methodologies such as Pathogen DNA/RNA extraction, PCR & qPCR, Histopathology, Cell culture, Virus isolation and Bacterial isolation and identification, Detection of antimicrobial resistance
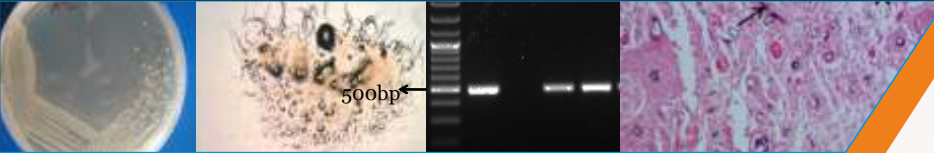
- Diagnostics of OIE-listed pathogens
- Disease surveillance
- Biosecurity in aquaculture
- Antimicrobial mapping

Module 3. Genomics and Bioinformatics Demonstration of methodologies such as DNA and RNA extraction, PCR and qPCR, Expression analysis and Bioinformatic tools for:

- Genome and transcriptome characterization
- Genome completeness
- Functional annotation
- Pathways analysis
- SNP discovery

5.   Mode of participation:

- Number of participants: 30 per module, including from India. For Module # 1, 2 &3, nominated participants with relevant background and involved in similar work at their parent organizations.
- Selection of candidates: APAARI/APCoAB will facilitate nominations and selection of the candidates from APAARI-member countries. ICAR-NBFGR will invite nominations from Indian organizations. Announcement will also be circulated on The Network of Aquaculture Centres in Asia-Pacific (NACA), Asian Institute of Technology (AIT), and Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP). The candidates will be finalized in consultation between organizers, who have specific relevance to the course. After candidates are finalized, ICAR-NBFGR will communicate on day-to-day basis for programme.

6.   Organizers:

The training programme will be organized at ICAR- National Bureau of Fish Genetic Resources (ICAR-NBFGR), India; under the aegis of Indian Council of Agricultural Research (ICAR), India; in collaboration with Asia-Pacific Association of Agricultural Research Institutions (APAARI) under its programme on Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB) Thailand; and Council of Agriculture (COA), Taiwan.

Coordination of the programme

The international programme will be coordinated by

|	
Patrons:	**• Dr. Trilochan Mohapatra** **Secretary (DARE) & Director General (ICAR), India**
	• Dr. Ravi Khetarpal **Executive Secretary, APAARI, Thailand**
International Coordination:	**• Dr. J K Jena** **Deputy Director General (Fisheries Science), ICAR, India**
	• Dr. Rishi Tyagi **Coordinator, APCoAB, APAARI, Thailand**
Course Director:	**• Dr. Kuldeep K Lal** **Director, ICAR-NBFGR, India**
Course Coordinators:	**• Dr. Vindhya Mohindra** **Principal Scientist & HoD Fish Conservation, ICAR-NBFGR, India**
	• Dr. Neeraj Sood **Principal Scientist, ICAR-NBFGR, India**
	• Dr. Rajeev K Singh **Principal Scientist, ICAR-NBFGR, India**
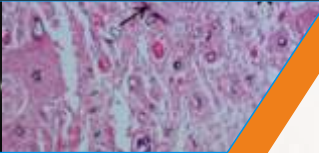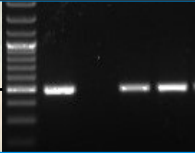
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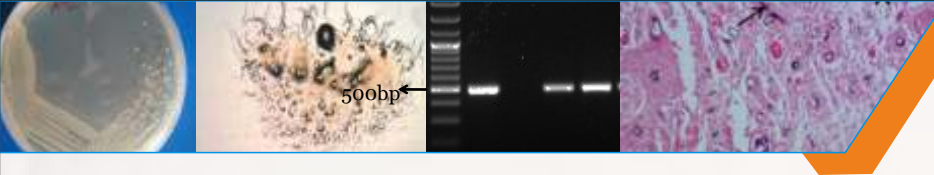
December 2021 to January 2022

APPLICATION FORM

Title (Dr/Mr/Ms/Mrs) _____ Gender (Male/Female) _____

First Name _____

Middle Name _____

Family Name _____

Designation/Job title _____

Organization _____
(with address) _____

State/Province _____

City _____

Postal/Zip Code _____

Country _____

Date of joining in the present position _____

Nationality _____

Date of Birth _____ (Age in years) _____

Address _____
(as in passport) _____

State/Province _____

City _____

Postal/Zip Code _____

Country _____

Passport No. _____

Date of Issue of Passport _____

Date of Expiry of Passport _____

Email _____
(give primary and alternate
email, if available)

Mobile No. _____

Phone No. _____

Affix Recent Passport size Photograph

Educational Qualifications (B.Sc./M.Sc./Ph.D/any other)			
Degree	Year	Subject(s)	University/Institute

How did you find about the training? (Restrict 100 words)

Describe your duty and job description (Restrict 300 words)

Did you attend previous (APAARI) training held during December,2020 (Yes/No) _____

How will this training help you? (Restrict 300 words)

I am interested in participating in following of the Modules of training programme (X mark):

Module 1: Genetic Diversity and Ex-Situ Conservation ( )
Module 2: Aquatic Animal diseases and Biosecurity ( )
Module 3: Genomics and Bioinformatics ( )

Full Name of Applicant _____

Date _____   Signature _____

Remarks and Recommendations of the Host Organization (Please state clearly the strong and weak points about applicant and how this training will be useful for your organization/country)
_____
_____
_____

Date _____   Signature _____

Place_____

Name of Forwarding Authority _____

Seal _____