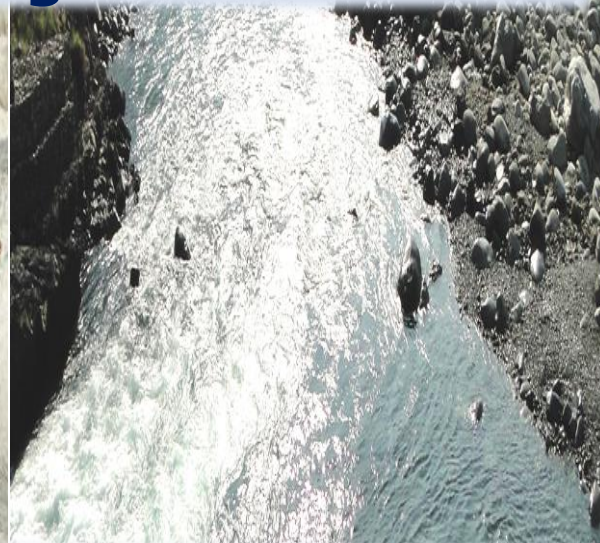


Aquatic Genetic Resource Management



Kuldeep K. Lal

ICAR-National Bureau of Fish Genetic Resources Lucknow

Aquatic Genetic Resources

❑ Majority of the genetic resources for food still come from the wild due to low domestication level in fisheries sector.

- Aquaculture contribute near 50% but Capture Fishery is relevant.
- Wild relatives source of genetic diversity for aquaculture improvement.

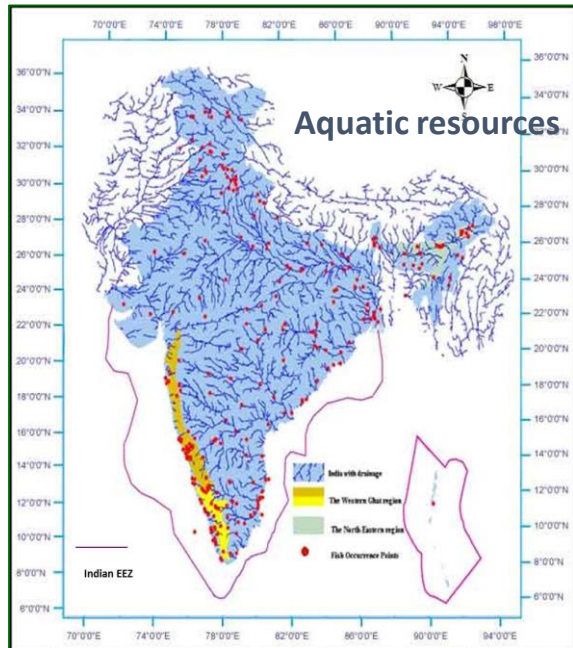
The AqGR management :

Applies concepts from Agriculture and Wild Life as well

Fish Diversity of India

❑ Diverse aquatic biodiversity different ecosystems

❑ Palearctic, Temperate and tropical climates



9.5% of Global biodiversity

Finfish species

Marine:	1887
Brackishwater:	113
Freshwater:	936
Total :	2936
Exotic fish :	462

Shellfish species

Crustaceans:	2934
Molluscs:	~5000
Echinoderms:	765

Exploring Genetic resources and species characterization

- 8 new species discovered and published; rivers in North East, Central Plateau, Western Rajasthan; and Andaman Sea
- New Distributions and species revalidations



- ❑ The number of valid species of fishes is about 33,395 & Valid Genera is 5,131,
- ❑ Between 1996-2014, total > 7500 new species: average 367 per year.

By William N. Eschmeyer and Jon David Fong

<http://researcharchive.calacademy.org/research/ichthyology/catalog/speciesbyfamily.asp>

- ❑ Even established aquaculture and fishery species, found Cryptic

1. *Lates* (*Pethyagoda* 2012)

2. Genus *Puntius*---- 5 new Genra (*Pethyagoda* 2012)

3. *Mahseers*; *Tor* sp.

4. *Pangasius silasi*

CBD-Global Taxonomic Initiative : Remove Impediment

Acknowledge the existence of a "taxonomic impediment" to the sound management of biodiversity (include AqGR)

Shortage of trained taxonomists and curators

Obligatory to build taxonomic and Repository capacity

Link Taxonomy to Genetic Resource Management to Food Security



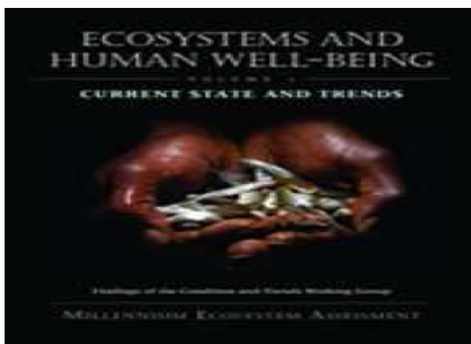
Belgian CBD NFP

Page 3 of 18

Increased taxonomic capacity combats poverty

Nowadays, there is compelling evidence that the ever-growing impact of human activities has an adverse impact on biodiversity and ecosystem functioning and that this leads to a lowering of ecosystem services, that is, the free profits humans get from ecosystems.

People who rely directly on provisioning (including food, water, fuel, fiber and medicine), regulating (prevention of soil erosion and flooding) and supporting (e.g. soil formation, nutrient cycling) ecosystem services that healthy ecosystems provide them face the most serious and immediate risks from biodiversity loss. Combating inequality and marginalisation of the most vulnerable segments of society thus goes hand in hand with the restoring and protecting of the ecological functioning of healthy ecosystems. To achieve this, scientists rely primordially on such basic information as local, regional and global taxonomic inventories that reveal what organisms are living where, in what abundance and in what composition.



Ecosystems and human well-

Saving Indigenous Species and Utilization a Primary Need for Adaptive Traits

Indian AqGR Precious
and as survived
through Geological &
Climatic changes, as
occurring today ▽



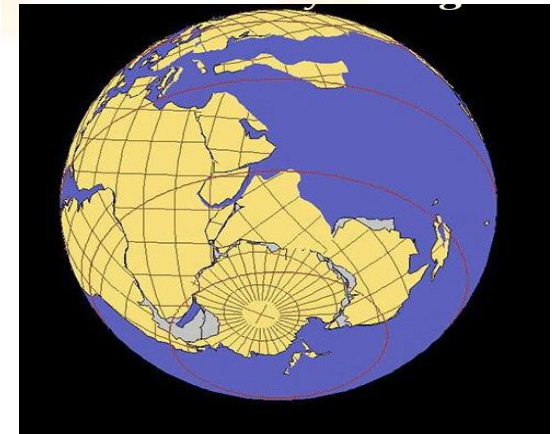
Speciation

- Likely to have basal populations
- Strengthen Genomic Knowledge for
 - Evolutionary scale **(need framework)**
 - Genome wide selection for aquaculture
**(Need Phenotyped /selected material
for using genomic data)**



Present

200 million years ago



Completed Whole
Genome Draft
Assembly of 3
Indigenous species



ISO 9001:2008

Food production need to grow: **Aquaculture role critical**



- ❑ **Growing population and health food and Rising income**
- ❑ **Health benefits for every country and every strata of human society**
- ❑ **High on Trade : 38 % of fish produced; developing Countries: directed to developed countries- Livelihood for small scale farmers**
- ❑ **India likely to grow 121% by 2030 fish production (highest growth in world)**

Consistent rise @ 9% last 2 decades

Sustainable rise ?

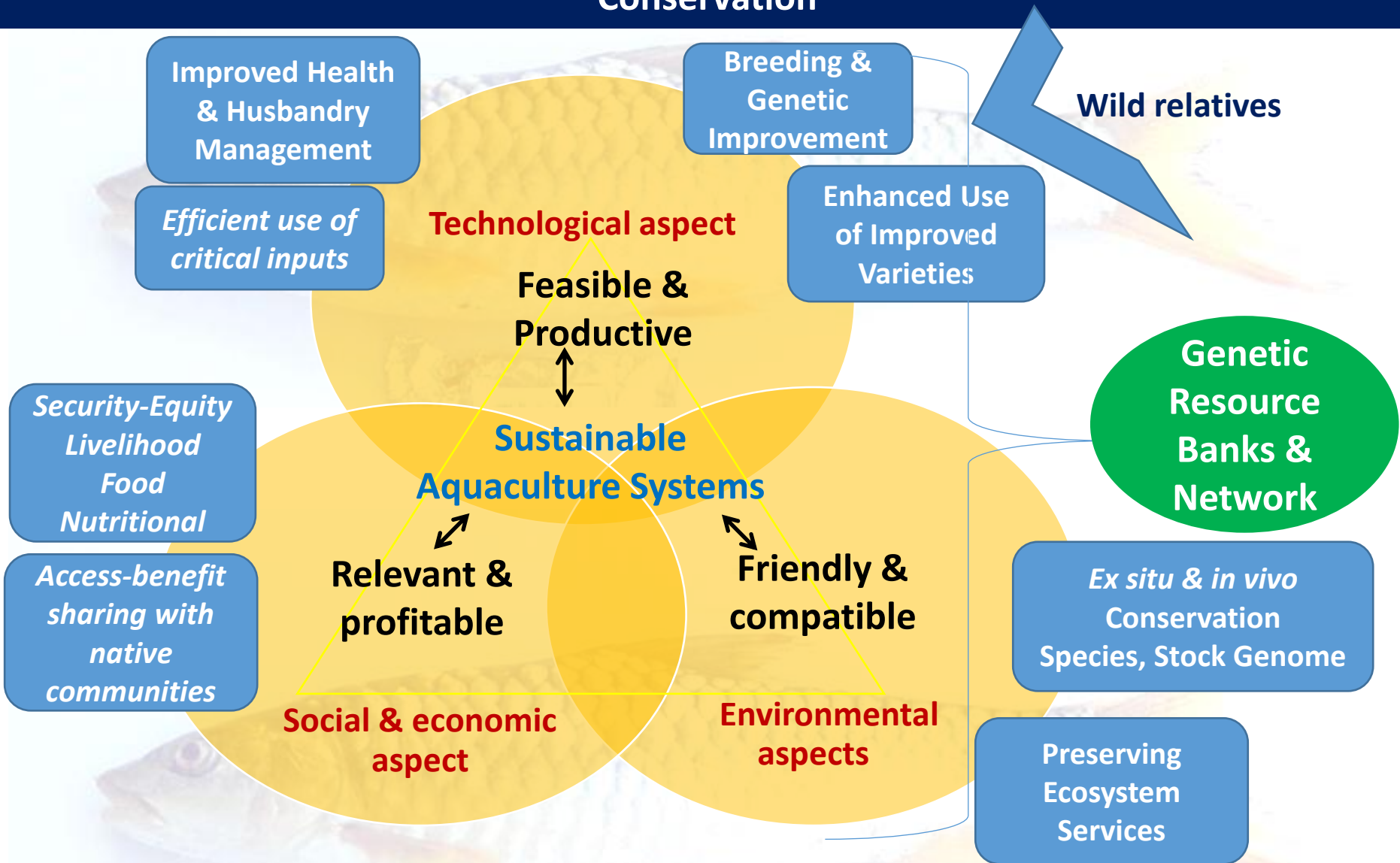
**Critical inputs finite Space, Water, Feed
Biodiversity impacts**

**Need to aim for Increase productivity :
Produce more from less**

- **Improved varieties (to raise use from meagre 8.2%)**
- **Sustained genetic diversity during domestication**

**Concern: Only 3 Indigenous
species contributing to
production**

Sustainable Aquaculture Intensification : Science Led & balancing with Conservation



Aichi Biodiversity Targets & FAO Tools



“Copyright BIP/SCBD”.

- Target 6. All fish and invertebrate stocks and aquatic plants are managed and harvested Sustainably**
- Target 7. Areas under agriculture, aquaculture and forestry are managed sustainably**
- Target 12. Prevent extinction of known threatened species**
- Target 13. Minimizing genetic erosion and safeguarding genetic diversity**
- Target 16. Implementation of Nagoya Protocol on Access to Genetic Resources**
- Target 17. Implementation of national biodiversity strategy and action plan**

FAO's Tools and Policies

- **Commission on Genetic Resources for Food and Agriculture**
- **FAO Technical Guidelines for Responsible Fisheries – Guidelines on Aquaculture Development**
- **Code of conduct on responsible fisheries**

Commission on Genetic Resources for Food & Agriculture

*SoWAqGR production to genetics genomics conservation
Focus on Aquaculture species and their wild relatives*

To locate information gaps and develop action plan

AqGR management Minimum Framework



Ref: SCBD/SAM/DO/DCo/83767

23 July 2014

NOTIFICATION

FAO's tools and guidance on food and agriculture
to assist implementation of the Convention on Biological Diversity
and the Strategic Plan for Biodiversity 2011-2020

Dear Madam/Sir,

As part of the Secretariat's strengthened collaboration with the Food and Agriculture Organization of the United Nations (FAO), I am pleased to circulate the annexed information provided by the FAO which can assist CBD National Focal Points and their partners in the involvement of the different food and agriculture sectors in the implementation of the Strategic Plan for Biodiversity 2011 - 2020. The information is particularly relevant to National Biodiversity Strategies and Action Plans with regard to the integration of biodiversity into other economic sectors. The information highlights FAO's work on agriculture (including livestock, fisheries and aquaculture) because this is generally less well known to the biodiversity/environment community than its work on forestry.

This information includes: an overview of how biodiversity is mainstreamed into the activities of the FAO, including its various bodies; FAO's biodiversity related knowledge platforms; and, tools and areas of work with respect to Aichi Biodiversity Targets 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 and 18, bearing in mind that much of FAO's work is cross-cutting. Web links are provided to the relevant information on the FAO website and you are invited to contact your local FAO office for further information if required.

I encourage you to use and widely disseminate this information, which I believe is especially useful for implementation at national level through coordinated efforts between the food and agriculture and environment constituencies.

Please accept, Madam/Sir, the assurances of my highest consideration.

CBD Recognises FAO's Tools and Guidance

Dr Lucio Parreira de Sousa Dias
Executive Secretary

Enclosure

To : CBD National Focal Points



Convention on
Biological Diversity

Secretariat of the Convention on Biological Diversity
United Nations Environment Programme
413 Saint-Jacques Street, Suite 800, Montreal, QC, H2Y 1N9, Canada
Tel : +1 514 288 2220 Fax : +1 514 288 0588
secretariat@cbd.int www.cbd.int



ISO 9001:2008

AqGR: Time to Move Vertical Down From Species to Genetic Stocks

A gap wrt Crops and Livestock

Knowledge on Genetic Variation distribution & performance considered critical before they are lost (CGRFA & GTI, CBD)

- Indicate genetic diversity
- Adaptive variability
- Track gene flow and exchange
- Evolutionary pressures

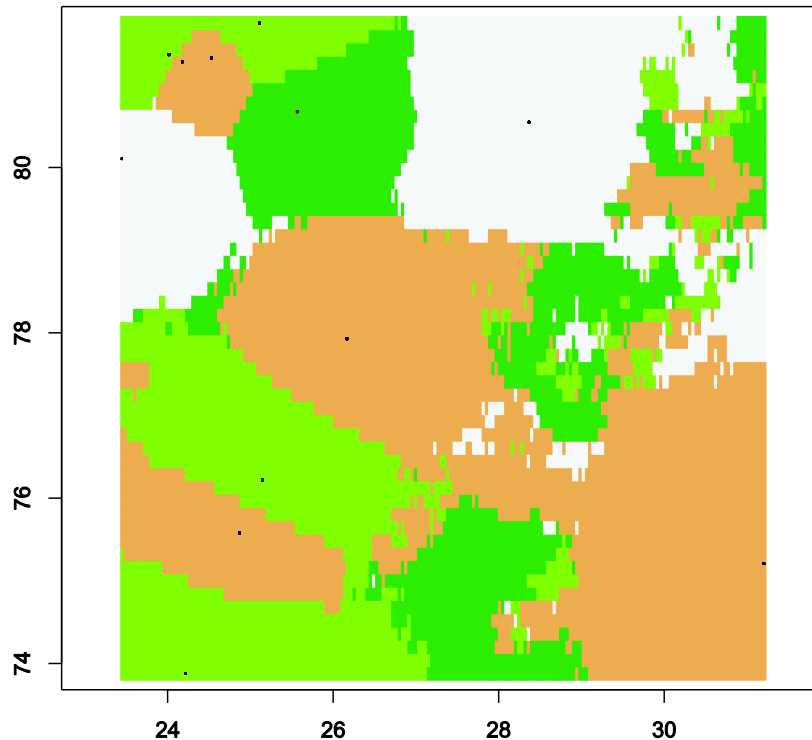
Need to strengthen

- **Species specific standardized Marker Panels**
- **Reference genetic indices**
- **Phenotype parameters**
- **Performance evaluation of distinct Genetic stocks**

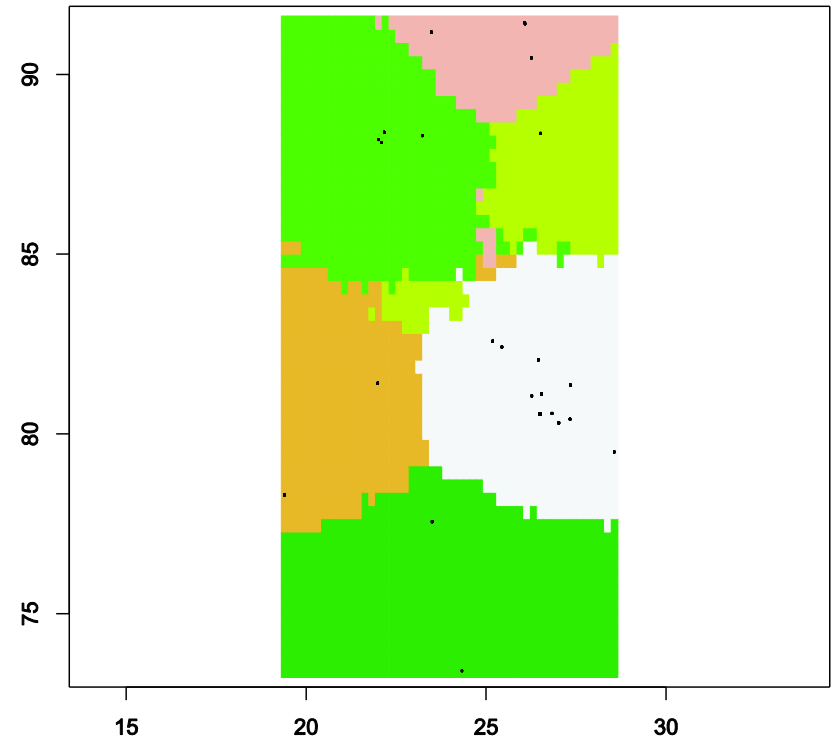
- Performance evaluation of genetic stocks - Indian major carps & *Clarias* species - evaluate genetics, biological data including **immunity profiles**.

Spatial Distribution of Genetic Variability: Map of probability of cluster membership

L. rohita



C. batrachus



Long

Estimated cluster membership

Estimated cluster membership

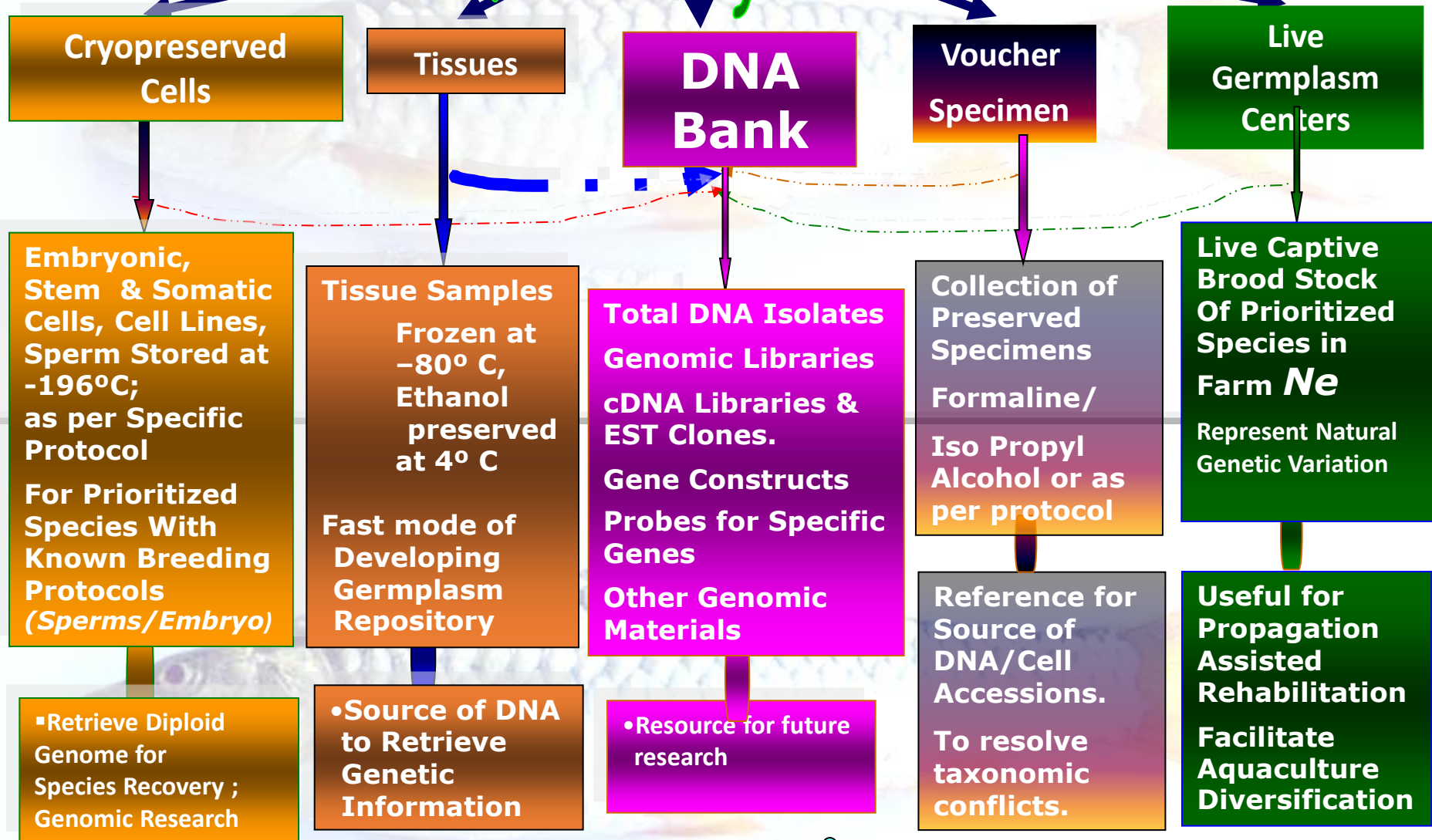
Colors represent clusters

Lat

Genetic stock structure 18 fish species
Wild Populations

Integrated Germplasm & Genomic Repository

Aquatic Organisms



AqGR Sovereign Rights of the Nations

Fish Cell Lines
(Embryonic & Somatic) :
repository with 50 Cell

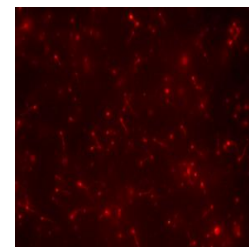
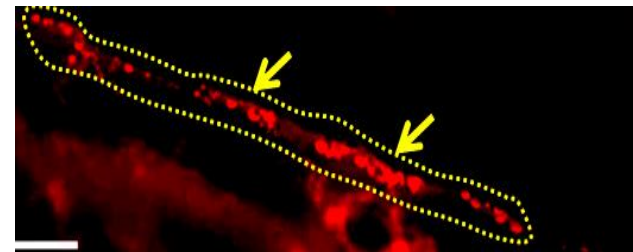
- Sperm Cryopreservation protocols : 30 species
- Tested 23 years old frozen sperm successfully
- Concern: haploid genome; No control on quality & quantity from wild
- Useful in associatin with On-farm conservation



Stem Cells : Surrogate broodstock development

- ❑ Isolated spermatogonial stem cells (from goldfish (*Carassius auratus*))
- ❑ Transplanted Stem cells in *C. Carpio* (host)

Stem cells were observed to undergo proliferation, vertical differentiation inside the common carp gonads and produced surrogate gametes (18 weeks after the cell transplantation)



Surrogate sperm



Surrogate eggs

Merging Knowledge to On-Farm Conservation

- supported by *ex-situ* conservation
- for *in-situ* Conservation and Germplasm evaluation

AqGR: Evaluate new prioritised fish species for domestication, or building broodstock for species, important but rare in nature.

Opportunity to converge bureax for livelihood

- Can we look towards location specific on-farm conservation models with indigenous diversity; where with conservation, develop farming model with integration of plants, animal and fish.
- Fish does not use water but conserve water for other commodities
- Can we search such locations which are diversity rich, endemic and potential to improve out of 100 most backward areas.
- Can we search a model, which does not export but keep locals nutritionally secure for a quality human life.



Thank
You

Conserve
Beyond Physical maintenance of
organisms

to preserve genetic identity and integrity
of organism

both at inter and intra specific level
&
together with its interacting
environment.