

# **Aquaculture Biotechnology**

## **Applications**

# Use of synthetic hormones

The potential area of biotechnology in aquaculture include the use of synthetic hormones in:

gene banking

transgenic fish

induced breeding,

uniparental

polyploidy population

health management

# Gene Banking

- A gene bank is a managed collection of genetic resources
- They are type of biorepository which preserve genetic material
- They are important wherever the genetic resources fundamental to farming and harvesting animal are threatened
- Most gene banks are collection either of whole organisms, their reproductive cells or early life stages.
- The technologies used for aquatic gene banking are as applicable to industry (broodstock collection, prospecting for new genetic material)

# Cryopreservation

Fish cells/tissues/ organs are preserved and are viable for an indefinite period by storing at -196 C .

Cryopreservation of sperms are successful .

Large size of egg, complex str., presence of several membranes with variable permeability- obstacles in teleost egg preservation.

Knowledge of the composition of milt and sperm quality essential for optimum rate of fertilization and healthy hatchlings..

# Cryopreservation

The successful cryopreservation of gametes (sperms and eggs) and embryos could offer

- new commercial opportunities in unlimited production of seed
- fry along with potentially healthier and better conditioned fish
- genetic management of brood stock
- ex situ conservation of the genomes of threatened and endangered species

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# Cryopreservation

## ADVANTAGES OF CRYOPRESERVATION

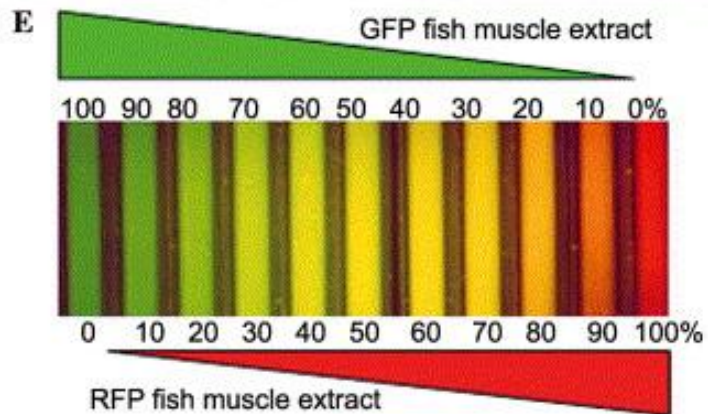
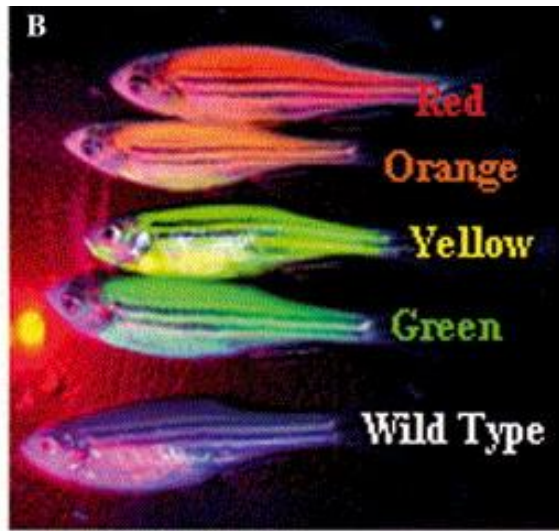
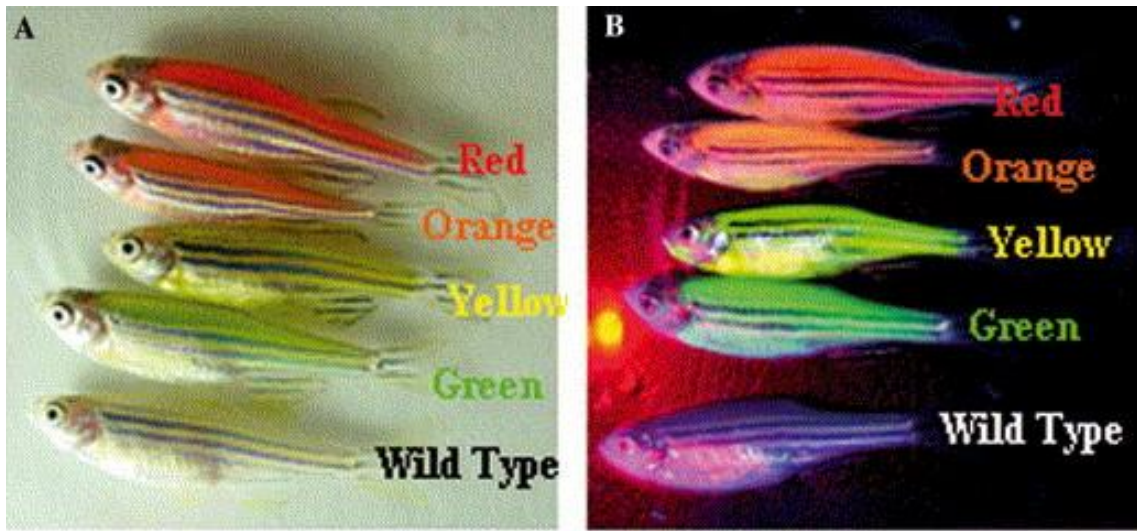
1-In seasonal breeders such as carps seed can be produced and supplied to farmers at any time of the year.

2- Helps in selective breeding and in development of other techniques meant for genetic upgradation of cultivable fishes- production of strains which have faster growth rate, disease resistance , adaptability to extreme conditions and better feed conversion efficiency.

# Cryopreservation

## ADVANTAGES OF CRYOPRESERVATION

3. Help in preventing inbreeding depression.
4. Helpful in preserving genetic diversity and in conserving endangered species by developing gene banks
5. Reduces the cost of brood stock maintenance through the exploitation of a limited stock.
6. Cryopreservation is useful in conditions where male and female mature at different times.



## Transgenic models of fish

<https://www.google.com.pk/url?sa=i&url=https%3A%2F%2Fwww.sciencedirect.com%2Fscience%2Farticle%2Fpii%2FS0006291X03012828&psig=AOvVaw2GCMY5ONphqboH30wUQ6b&ust=1589738908892000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCICYtpT9uOkCFQAAAAAdAAAAABBF>



# Transgenic fish (more detail)

- Salmon were genetically engineered for more rapid growth using the growth hormone gene under the control of the ocean pout antifreeze protein gene promoter and 3' untranslated region (currently under FDA consideration)
- Madaka fish were genetically engineered to serve as biosensors for environmental pollutants (e.g., estrogens) by using an estrogen-inducible promoter (the vitellogenin promoter) to control expression of the GFP gene

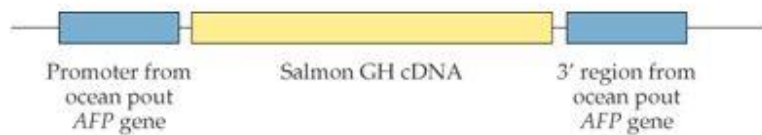


Fig. 21.33

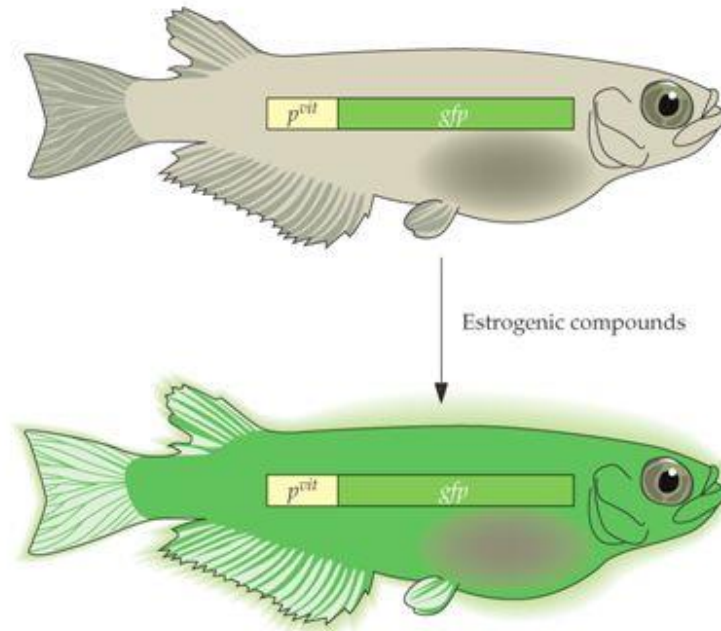
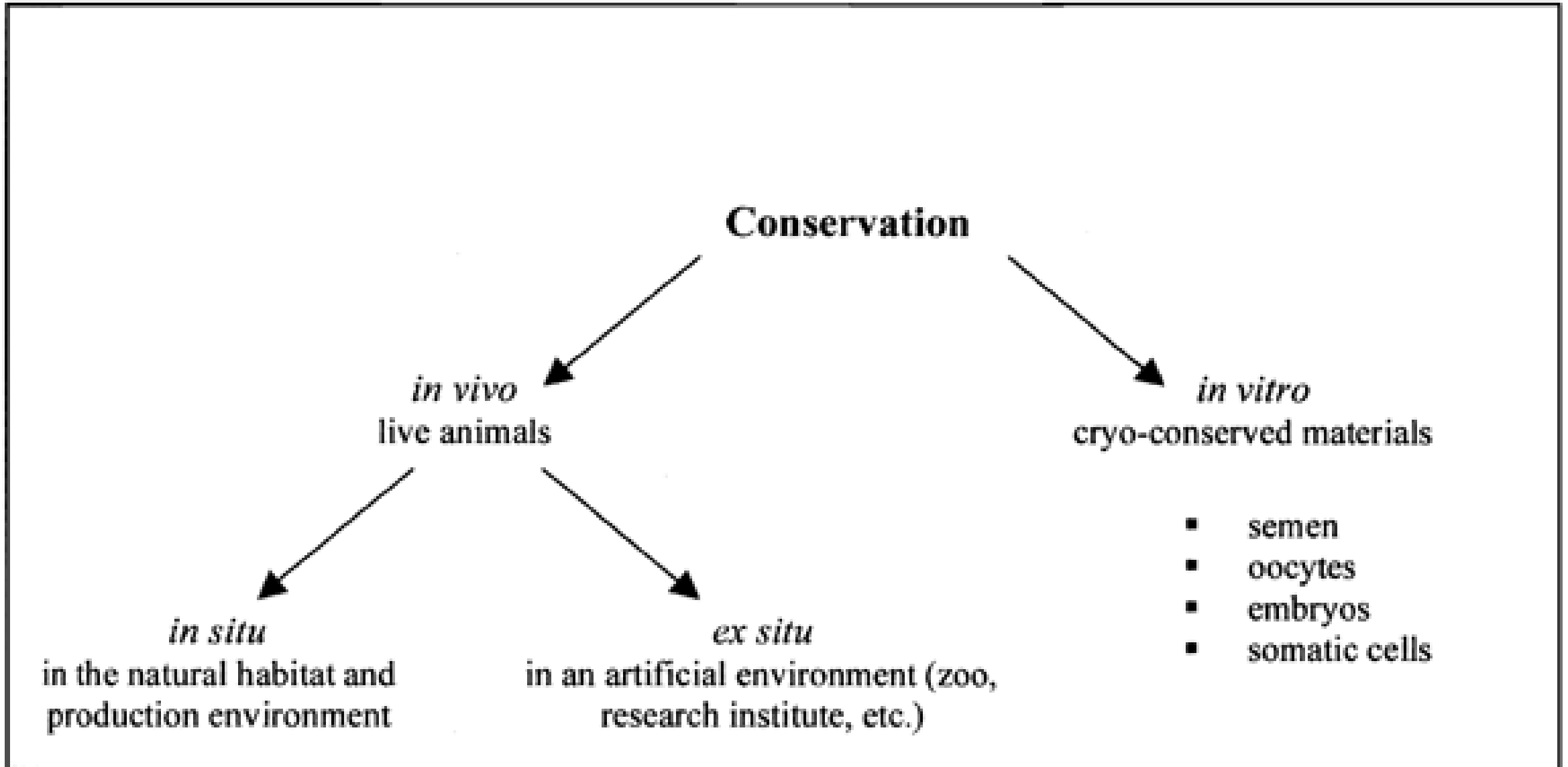


Fig. 21.34

<https://www.google.com.pk/url?sa=i&url=https%3A%2F%2Fslideplayer.com%2Fslide%2F14690680%2F&psig=AOvVaw2GCMY5ONphqboH30wUQ6b&ust=1589738908892000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCICytpT9uOkCFQAAAAAdAAAAABBR>

# Basic conservation schemes for farm animals



# WHY INDUCED BREEDING??

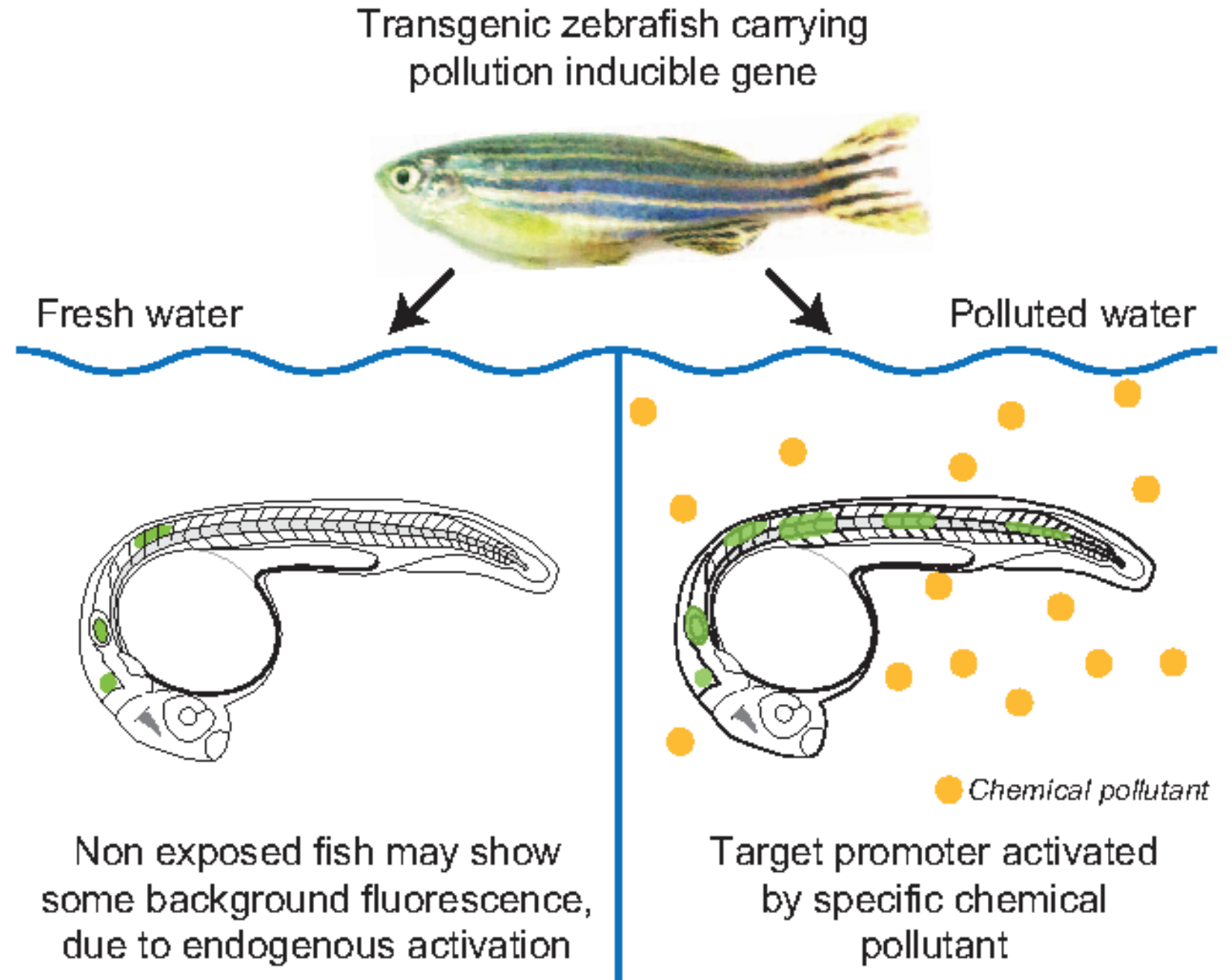
- Induced breeding is a technique where organism is stimulated by particular hormone or other synthetic hormone or by providing condition, introduced to breed in captive condition.
- The stimulation promotes timely release of sperms and eggs from ripe gonads.

## POINTS TO BE KEPT IN MIND

- ❑ The brooders should be healthy, fully ripe and medium sized.
- ❑ Large sized breeders are avoided for difficulty in handling.
- ❑ Dose of the hormone should be calculated, according to given protocols

# Pollution control

- ✓ Transgenic zebrafish has been used to monitor environmental pollution



# Bioremediation

## Environmental Applications of Aquatic Biotechnology

- The variety of environmental applications of marine biotechnology is quite astounding
- From developing new ways of dealing with biofouling on engineered materials in the ocean environment
- Bioremediation and restoration of damaged marine habitats
- Monitoring for disease outbreak and management of natural resources

# Bioremediation

Bioremediation is a technology by which pollutants are eliminated from fish ponds

contaminated water are re-distributed and considered as best for fish culture.

Bioremediation technology has been used to eliminate environmentally-hazardous chemical or to detoxify them into non-toxic forms.

# Bioremediation

## TYPES OF BIOREMEDIATION

1. Biostimulation:- Motivated to start the process of bioremediation
2. Bioaugmentation:- It is special sites where micro- organisms are needed to remove the contaminants. eg- Municipal wastewater.
3. Intrinsic bioremediation:- Use of micro-organism to remove the harmful substances from soil and water. eg- Underground petroleum tank.



Biotech aquaculture also offers **environmental benefits**.

When appropriately integrated with other technologies for the production of

- food
- agricultural products
- and services

biotechnology can be of significant assistance in meeting the needs of an expanding and increasingly urbanized population in the next millennium.