FIS 512 :FISHERIES POLICY AND LEGISLATION (2 UNITS)

Conservation Strategies

Human modifications to the environment, overexploitation, habitat loss, exotic species and others factors are greatly threatening aquatic biodiversity. Ecosystems and species important in sustaining human life and the health of the environment are disappearing at an alarming rate. In order to preserve these threatened areas and species for future generations, immediate action in the form of aquatic biodiversity conservation strategies are necessary.

Aquatic conservation strategies support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems. In order for biodiversity conservation to be effective, management measures must be broad based. This can be achieved through many mechanisms including:

- **Marine Reserves:** A marine reserve is a defined space within the sea in which fishing is banned or other restrictions are placed in an effort to protect plants, animals, and habitats, ultimately conserving biodiversity. Marine reserves can also be used for educational purposes, recreation, and tourism as well as potentially increasing fisheries yields by enhancing the declining fish populations. Marine reserves are also very similar to marine protected areas, fishery reserves, sanctuaries, and parks. Examples include the Aquatic Reserves Program in the State of Washington and the National Oceanic and Atmospheric Science National Marine Protected Areas.
- **Bioregional Management:** Bioregional management is a total ecosystem strategy, which regulates factors affecting aquatic biodiversity by balancing conservation, economic, and social needs within an area. This consists of both small-scale biosphere reserves and larger reserves. Biosphere reserves, generally small in scale, have a strong conservation focus, and consist of one or more protected central habitats and surrounding buffer zones. In these bioresevation units, activities such as fishing, hunting, harvesting, and development activities are strictly limited. In contrast, nonbiosphere reserve areas encompass much broader ranges, and many more habitat types (e.g., the Florida Keys National Marine Sanctuary). Other examples of National Marine Sanctuaries include Stellwagen bank, and Monterey Bay.
- **Threatened or endangered species designations:** The World Resources Institute documents that the designation of a particular species as threatened or endangered has historically been the primary method of protecting freshwater biodiversity. Threatened species include organisms likely to become endangered if not properly protected. Endangered species are plants and animals that need protection in order to survive, as they are in immediate danger of becoming extinct. Once species are "listed," they become subject to national recovery programs and will be placed under international protection. Severe monetary penalties can occur if threatened and endangered species regulations are broken, and can even result in jail sentences. For more information, please visit EPA's Endangered Species Protection Program, Endangered Species Act, or U.S. Fish and Wildlife Service's Endangered Species Program .

- **Local watershed groups:** Rivers and streams, regardless of their condition, often go unprotected since they often pass through more than one political jurisdiction, making it difficult to enforce conservation and management of resources. However, in recent years, the protection of lakes and small portions of watersheds organized by local watershed groups has helped this situation. For more information on how you can become involved in your watershed please visit EPA's Adopt Your Watershed Website.
- **EPA's Healthy Watersheds Initiatives:** Once healthy watersheds or healthy components of watersheds are identified, a variety of conservation and protection approaches are available. See examples of conservation and protection approaches and tools. These approaches are generally site-specific and tailored to the particular situation. Watershed managers are encouraged to use these examples as guidance in developing their own conservation and protection strategies. A combination of approaches has been found to be most effective at maintaining watershed health and integrity.
- **Specialized Programs:** Many specialized programs have been instituted to protect biodiversity. For example, the USDA Forest Service initiated Bring Back the Natives EXIT Disclaimer, a cooperative state-federal program. The goal of this program is to restore the health of riverine systems and associated species. Areas targeted for this program include lands managed by the U.S. Forest Service and the Bureau of Land management.
- **Research:** Various organizations and conferences that research biodiversity and associated conservation strategies help to identify areas of future research, analyze current trends in aquatic biodiversity, even conduct specialized studies. Examples of such organizations include the Nature Conservancy EXIT Disclaimer, Natural Heritage Network EXIT Disclaimer, World Conservation Monitoring Centre EXIT Disclaimer, World Resources Institute EXIT Disclaimer, NOAA Fisheries Office of Protected Resources , and Convention on Biological Diversity (CBD) .
- **Increase Public Awareness:** Increasing public awareness is one of the most important ways to conserve aquatic biodiversity. This can be accomplished through educational programs, incentive programs, and volunteer monitoring programs. For example, the State of Delaware has an Adopt-a-Wetland Program EXIT Disclaimer designed increase public awareness as to the value and of wetlands and the need for conservation. The EPA developed a site with links to organizations that teach the public how to become involved in volunteer monitoring programs. Read about how fish and freshewater mussels are used as environmental indicators to protect aquatic biodiversity.
- **Restoration/Mitigation Efforts:** Aquatic areas that have been damaged or suffered habitat loss or degradation can be restored. Even species populations that have suffered a decline can be targeted for restoration (e.g., Pacific Northwest salmon populations). Some management practices such as the establishment of riparian buffer zones and the restoration of natural flow patterns and discharge regimes are being applied to riverine areas. Recently, habitat restoration has also been performed in various areas to replace losses from dredging projects and in many wetland habitats. Learn about the Great Lakes Restoration Initiative, Cheseapek Bay restoration, and River Corridor and Wetland Restoration.
- **Regulatory Measures:** This may include wastewater discharge regulations like NPDES or fishery conservation measures, fisheries management councils, even fishery bans. For example, the Magnuson-Stevens Fishery Conservation and Management Act EXIT Disclaimer of 1976 and the associated 1996 Sustainable Fisheries Amendment require

the conservation and management of the marine fishery resources in the United States, predominately managed by NOAA's National Marine Fisheries Service (NMFS). This creation of sustainable fisheries is largely completed through regulatory actions including the collection of the best scientific data available. Learn more about EPA's efforts to protect our oceans, coasts, estuaries and beaches.

- **Local community actions:** The demand for freshwater - and the threats to its health - originate from the actions of millions of people. To solve these challenges also requires actions of many. State and federal governments, and many local governments and public agencies, are already at work. So, too, are numerous citizen volunteers. Any individual can take steps to make healthy water a welcome part of everyday life. Learn how **you** can make a difference.

Fishes exhibit enormous diversity in size, shape, biology and in the habitats they occupy. The great majority comprises bony fishes, mainly teleosts. In addition, there are around 800 species of cartilaginous and 70 of jawless fishes (lampreys and hagfishes). It is believed that out of 4000 species of vertebrate recognised world over 22000 are fish species; of which 8411 are fresh water while 11650 are marine. As per the report more than 24500 fin fish species exist throughout the world. However, there is prediction of around 28500 fish species representing more half of the vertebrate diversity. They surveys emphasised that there could well be at least 5000 species more to be discovered.

In India 2163 species of finfish have been recorded from upland cold (157; 7.26%), warm waters of the plain (454; 20.99%), brackish water (182; 8.41%) and marine environment (1370; 63.3%).In terms of habitat, fishes live in almost all conceivable aquatic habitats, ranging from Antarctic icecap to hot springs as well as fresh to saline waters. As per the FAO, a sustainable fisheries development envisages an eco-friendly, equitable mode of development that can sustain livelihood over generations. An attempt has been made to assess the current status of fish biodiversity, delineate the threatened species of India vis-a - vis their causative factors to formulate appropriate strategies for their conservation and rehabilitation.

Due to factors such as human modifications to the environment, overexploitation, habitat loss, exotic species and others, aquatic biodiversity is greatly threatened. Ecosystems and species important in sustaining human life and the health of the environment are disappearing at an alarming rate. In order to preserve these threatened areas and species for future generations,

immediate action in the form of aquatic biodiversity conservation strategies are necessary. In general, aquatic conservation strategies should support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems. In order for biodiversity conservation to be effective, management measures must be broad based.

Since maintenance of fish biodiversity along with other biotic resource has been viewed as prerequisite for the well being of even human beings, it is essential to prevent further decline of fish resources by devising all possible measures of conservation and rehabilitation. The conservation policy should promote the management practices that maintain integrity of aquatic ecosystem, prevent endangerment and enhance recovery of the threatened species. Five principal elements or tasks in the recovery programmes have been to be identified as

(i) Habitat management

(ii) Habitat development and maintenance

(iii) Native fish stock

(iv) Non native and sport fishing

(v) Research data management and monitoring

The main goal in a conservation programme is to conserve the genetic diversity. The fish genetic resources can be conserved by protecting an ecosystem which is broad-based, on-specific, cost effective and relatively simplistic in approach .It may aim in general or at specific species like endangered or threatened ones. This can be achieved through many mechanisms including *in situ* and *ex situ* methods

Insitu conservation

In situ conservation of fish as landraces and wild relatives is useful where genetic diversity exists and where wild forms are present. This is done through their maintenance within natural or man - made ecosystem in which they occur. The major advantages of insitu conservation to co-evolve with other forms, providing the breeders with a dynamic source of resistance that is lost in ex situ

conservation and (ii) natural parks and biosphere reserves may provide less expensive protection for the wild relatives than ex situ measures.

Ranching:

Stock enhancement through ranching is feasible only (i) if there is incomplete colonization of available carrying capacity. The successful induced spawning and larval rearing of endangered *Tenuolosa* (Hilsa) *ilsha, Tor kkudree, Tor putitora, Labeo dussumieri, Ompok pabda ,Clarias dussumieri,Ompak malabaricus, Osteobrama belangeri, Notopterus chitala* have opened up the avenues of replenishment. In the 3 important lakes, Bhimtal, Naukuchiatal and Sattal of the Kumaon Himalayas, there are evidences of auto-stocking due to natural breeding of mahseer fingerlings in Ladhiya and Sharda rivers by NBFGR ,Lucknow, and National Research Centre on Cold water Fisheries (NRCCWF) Bimetal, has already been initiated .Ranching of the pond-reared fingerlings in Pama river of Kerala improved landings of the endangered *Labeo dussumieri.*

It is felt that restocking programmes involving hatchery stocks are unlikely to fully solve the problem since these stocks were selected for adaptation to hatchery conditions and not to the natural environments. The hatchery stocks, in addition, may be even inbred. Two strategies could be implemented in restocking programmes (i) stocking spawners of domestic strain (preferably of sex) for interbreeding with the resident population or (ii) direct stocking of crossbred fry. However, in absence of facilities, we start with fingerlings from the hatchery avoiding inbreeding.

Conservation aquaculture:

Through probability of inbreeding in hatchery-bred seed normally can not be ruled out, conservation aquaculture is gaining importance in rehabilitation programmes of endangered / threatened fishes. It implies aquaculture in rehabilitation programmes of endangered fish populations by increasing the effective population size (Ne) of the threatened species .In India too, fry of the mahaseeer (*Tor putitora)* have successfully been reared from 0.20g to 105 g in about 240 days under pond environment in terrain region of Uttaranchal State. Interestingly, sea

bass (*Lates calcarifer*) a vulnerable species of the brackish water, has been successfully cultured in West Bengal for about 6 months by stocking the hatchery-produced seed.

Marine Reserve/Protected waters:

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Declaration of certain protected areas/ biosphere reserves for in situ conservation of resources appears to be the pragmatic approach. Reserves are a system approach to fishery management that allows the re-establishment of age distribution and inter and intra specific relationships like un altered community. Established of Marine Parks is perhaps the best way for in situ conservation of marine resources. (Established in 1980; Okha to Jodia, Gujrat coast covering 42 islands; area 400sq. Km) (II) the Gulf of Mannar National Marine Park (III) the Wandoor National marine park (South Andaman ; covering 10 islands ;area 282.5 sq. Km); and Marine sanctuary -Bhitarkanika Gahirmatha Sanctuary (Orissa) and Malvan Marine Park Sanctuary (Maharashtra).

Aquatic Diversity Management Areas (ADMAs):

The creation of ADMAs, are a systematic management approach for watersheds, where the primary goal is to protect the aquatic biodiversity in a given area. ADMAs range from individual species protection acts to full-scale biodiversity oriented programs. The best way to properly manage ADMAs is to stop or greatly reduce all human activity contributing to habitat degradation in that area.

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Local watershed groups:

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Freshwater Initiatives:

The Nature Conservancy has instituted a program referred to as the Freshwater Initiative. The objective of the FWI is to significantly increase freshwater conservation within the country, through three strategies: watershed action, water science, and water lessons.

Specialized Programs:

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Regulatory Measures:

The Indian Fisheries Act of 1897 (modified in 1956) is a landmark in the conservation of fishes. Besides provision to and monitor gears, mesh size and observance of fishing or closed seasons, the Act also prohibits the use of explosives or poisons to indiscrimately kill fish in any water at present, the ministry of agriculture, Government of India is modifying the Indian Fisheries Act to incorporate all the relevant legal to conserve fish germplasm resource. This may include wastewater discharge regulations like NPDES or fishery conservation measures, fisheries management councils, even fishery bans. This creation of sustainable fisheries is largely completed through regulatory actions including the collection of the best scientific data available.

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Ex situ conservation:

In this measure, the threatened are conserved outside their natural habitats. The main pillars of ex situ conservation programme are (I) live gene bank and (II) gene bank with gamete and (III) gene bank with DNA.

Live gene bank:

in a live gene bank which is a genetic resource centre, the endangered species are reared in captivity, bred therein and genetically managed avoiding inbreeding depression, domestication and unintended selection. The NBFGR is maintaining the wild stocks of threatened species like *Notopterus chitala,Channa marulius Tor putitora ,Labeo bata ,L dyocheilus and L. Calbasu* in the Mini Germplasm Repository.Simultaneously are being made to establish such repositories in different regions. One such has already been established in Guwahati for in different for North-East region.

Gene bank gamete:

In Gamete/Embryo gene bank, adequate samples representative of the natural genetic variation of endangered species are kept in suspended animation under extra low temperature (-196^0C) in liquid nitrogen (LN_2) availability of genetic materials of threatened categories and for intensive breeding programmes of economically important species. Long-term cryopreservation of milt of the endangered and economically important fishes like *Tor putitora, T.khudree,labeo dussumieri,Labeo rohita,Catla catla cirrhinus mrigala,Cyprinus carpio var.communis Tenualosa (Hilsa)ilisha,Horabragrus brachysoma and Oncorhynchus mykiss* has been achieved by

NBFGR. Since the technique is successful only sperm, and no method for cryopreservation of eggs/embryos has yet been developed, it is felt that the technique is at moment only limited value in relation to conservation of threatened species. Efforts should now be focussed on the androgenesis through which the whole genome can be constituted from the cryopreserved milt alone. However, the technique has enabled development of gene bank ensuring availability of male gamete of several species all around the year for seasonal breeders, easy transport of germplasm and genetic and hybridization programmes.

Gene bank with DNA:

DNA banking which is yet to be imitated would (I) genomic DNA (II) DNA library (genomic DNA or cDNA library (III) cloned DNA fragments etc.