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CONSERVATION OF MARINE FISH GENETIC RESOURCES—PRESENT STATUS AND ACTION NEEDED

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ABSTRACT

Overfishing, unscientific commercial exploitation, and destruction of habitats caused by nature and also induced by man have been, of late, causing serious threat to the marine fish germplasm resources. Judicious exploitation, protection for improvement and conservation are, thus, required for keeping the natural resources truely renewable.

Conservation approaches are in situ, ex situ, entire biomass or flexible mix with the responsibilities required to be equally shared by the professional personnel, policy makers and the people themselves. Top priority may be given for conservation of endangered species for maintaining genetic variability to maximize probability of their long term survival.

The present status of knowledge about resource conservation has been outlined in the paper with mention about the present Indian strategy for the research on the subject. This broadly includes a thorough survey of fish fauna, cataloguing of genotypes, study of genetic variability, scanning of polymorphic characters, development of practicable methodologies for conservation of exploited and endangered species and implementation of the same through concerned agencies.

INTRODUCTION

Many of the conventional fishing grounds indentified and charted in the seas during periods of early exploration and also the feeding and breeding grounds of fishes have undergone changes due to various reasons like increased fishing pressures, pollution and environmental changes. Migratory varieties are also subjected to pressure of diversion of flowing waters, artificial barriers and have been found to adjust to changes by restricting their sojourn to lower reaches of estuaries or become endemic. Sedimentation and siltation from land sources also have been altering the ecosystems. Overfishing and unscientific commercial exploitation of some species or in some fishing grounds leading to depletion of the fishery have aggravated the situation in the country. Some of the species, as a result of all those factors, are probably even endangered.

Domestication of species and induced genetic manipulations of selected species are, at the same time, continuously interfering with the links of co-evolution. Such interferences are likely to be intensified with the advancement of knowledge and applicability of genetic technologies.

It is thus necessary to remain vigilant on the changes that have been taking place in the marine environment and adopt conservancy measures, according to requirement of a particular situation in order to keep the fish germplasm resources truely renewable.

GENETIC VARIABILITY OF FISHES

Genetic variation is the means by which a species adapts to changes in its environment. New genetic variation arises in a population from either spontaneous mutation of a gene or by immigration from a population of genetically different individuals. The number of relative abundance of alleles in a population is a measure of genetic variation or heterozygosity. Owing to various reasons, as indicated in the foregoing paragraphs the existing genetic variability is feared to be under threat of extinction, Particularly in some cases.

Assessment of fish germplasm resources - present status

Fish genetic studies has, so far, been largely restricted to elaborate chromosomal studies of different species in the country.

For any broad programme of conservation of fish genetic resources, survey is the foremost requirement which is yet to be geared up to its desired extent. There is a general need for identifying important biogeographic areas, species and their distribution in order to provide background on the preservation of resources of exploited and potentially threatened species (Jhingran & Gupta, 1986) which is yet to be accomplished.

A thorough taxonomic and ecological survey of fish species occurring in each area aad a full checklist of these species indicating a status of each and its significance in terms of ecological, economic, scientific and social terms are basic needs, which also are yet to be achieved in India.

There is dearth of information on the genetic differentiations within most of the naturally occurring species and the quantitative estimates of the magnitude and relative importance at various levels of organization. This is a significant gap from the standpoint of resource conservation and efficient use of existing variation.

A quantitative estimate of the absolute and relative importance of various sources of variation constituting the total gene diversity is yet to be studied heirarchially *i. e.* within and between populations by collecting samples from areas of different ecosystems and multiple locations within each ecosystem on different forms over a large geographical range.

Morphological, meristic, cytotaxonomic and electrophoretic studies are yet to be undertaken to survey exploited species to determine specific indicators of distinct populations within each species by unique phenotypes, degrees of asymmetry in karyotypes or gene frequencies. Correlations between these will resolve the soundness of the method which gives unbiased estimate of genetic variations (Jhingran and Gupta, 1986).

Analytical approach to resource protection

In the past, regulations based on empirical knowledge were imposed to cater to maximum sustainable yield. These regulations assumed the forms of protective legislations of mesh limit, legal sizes, closed season, declaration of sanctuaries, limit on catches, restriction on effort, prohibition of use of destructive methods of fishing etc.

Research in the last few decades has given rise to an analytical approach in contrast with the above empirically determined methods. The analytical approach seeks to investigate the causes of change in the population size and yield so that these are analysed first into separate components and synthesized ultimately into formulations or mathematical models determining the means of obtaining the optimum yields, (Jhingran, 1985).

Resource conservation approaches

Conservation methodologies for marine fisheries resources can take the following 3 possible forms (Das *et al.*, 1986).

(a) *In-situ* preservation of land races and wild relatives where genetic diversity exists and where wild forms are present. This can be done through their maintenance within natural or man-made ecosystems in which they occur. The major advantages of *in situ* conservation are (i) continued coevolution. In the wild, these species can continue to coevolve with other forms providing the breeder with a dynamic source of resistance that is lost *in-vitro* conservation (ii) maintenance of *in situ* conservation permits the breeder to study its auto-ecology and to obtain data that can assist in the selection of germplasm that might otherwise be overlooked (iii) natural parks and biosphere reserves may provide less expensive protection for the wild relatives of fishes than *in-vitro* measures.

(b) *In-vitro* conservation can be done outside their natural habitats either perpetuating sample population in genetic resources centre or in the form of gene pools of gamete storage, germplasm banks etc. The seed or *in-vitro* cell lines are stored in gene banks under appropriate conditions for long-term storage. While this is the mode for preservation of most plant and animal genetic resources, the technique is yet to be adopted for fish gamete conservation.

(c) *Entire biomass*- This implies the entire preservation of animals and plants in a biomass.

The National Marine Parks which are being established in Lakshadweep, areas of Palk Bay and Kutch are in the lines of entire biomass conservation. This type of preservation will be extremely important in slowing the rate of species extinction (Swaminathan, 1983).

(d) *Flexible mix of methods*- In view of some problems in the different approaches, flexible mix of various methods may be necessary in particular situations.

Conservation genetics of endangered fishes

Management of endangered fishes is yet to fully incorporate conservation genetics into recovery programmes. Genetic aspects of small populations must be considered at the outset of management programmes in order to maximize probability of their long-term survival and continued adaptability. Total genetic variance of a species consists of within population genetic diversity, and the differences found among populations. Both types of variance should be maintained to maximize adaptive flexibility of endangered fishes.

Forces that erode genetic variation include small population size, population bottlenecks, genetic drift, inbreeding depression, artificial selection in captivity, and mixing of distinct genetic stocks. These can lead to increased homozygosity, loss of quantitative variation, and exposure of deleterious recessive alleles, all of which may reduce fitness.

Suggestions for genetically sound management of endangered fishes include genetic monitoring of natural and captive populations, use of large numbers for captive breeding where feasible, selective mating to avoid inbreeding where necessary, minimization of time in captivity and separate maintenance of distinct stocks (Meffe, 1986).

Classified spheres of responsibilities

Three major types of responsibilities for resource conservation can be discussed as follows, based on the action needed. (a) The professional responsibility has to be discharged by geneticists, fish breeders, ecologists, conservationists and a whole series of scientists and technologists connected with the identification, collection, conservation and utilization of genetic variability. (b) The political aspects of the problem relates to the development of national policies which will help to accord priority to the protection of the environment, conservation of genetic material, and appreciation of the dangers arising from genetic erosion and vulnerability and the consequent need to provide enough financial and technical resources to all work related to conservation. (c) Even if the necessary professional skill and political will are available, the cause of conservation can go astray if there is no widespread awareness among the general public on the need to promote development without destruction and of the pivotal role the people themselves can play in genetic conservation.

Present strategy of resource conservation

Though the need to conserve animal and forest resources was taught and decreed in parts of China and India as far back as 700 B. C, the fish genetic resource conservation on modern lines is a very young concept and recent venture in the country. This is being implemented through the newly established research organisation which has come to be known as the National Bureau of Fish Genetic Resources. The identified immediate priorities and main thrusts for the task include (i) ecological and taxonomic surveys of natural habitats to identify genetically distinct populations with the help of advanced techniques, (ii) cataloguing of the genotypes, (iii) collection of information on genetic variability for suggesting steps for conservation of genetic diversity, (iv) ascertaining the characters that are polymorphic in nature for inclusion in studies of genetic resources and (v) development of practicable methodologies for conservation of the exploited and endangered species under Indian conditions.

Future additional strategies of conservation

With the advent of new techniques for genetic manipulation and analysis of biological functions, it may be possible in future as already demonstrated in some cases of animals and plants, to tailor make genes for the hyper expression of functions of desired traits in fishes also. It can be visualised that casettes of DNA

clones carrying useful genes in forms for their maximal expression will be constructed. Prior to a detailed molecular analysis of fish genetics and application of genetic technology, preservation of specific genetic traits is necessary to provide most of the material for DNA analysis.

In view of the enormous quantitative and qualitiative dimensions of the problem of conservation, it is obvious that efforts will have to be selective. It thus need be directed towards more realistic approach in view of our limitations in the country and the same should meet our immediate requirements.

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