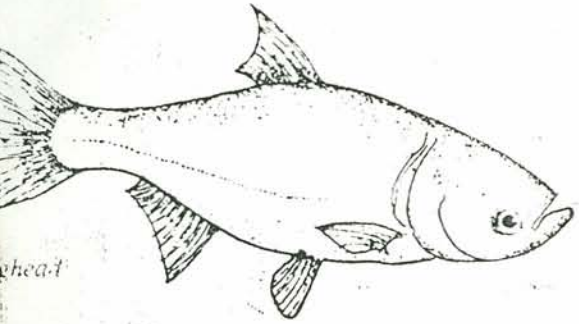
ECOLOGICAL CONSIDERATIONS IN INTRODUCTION OF EXOTIC FISHES IN INLAND WATERS OF INDIA



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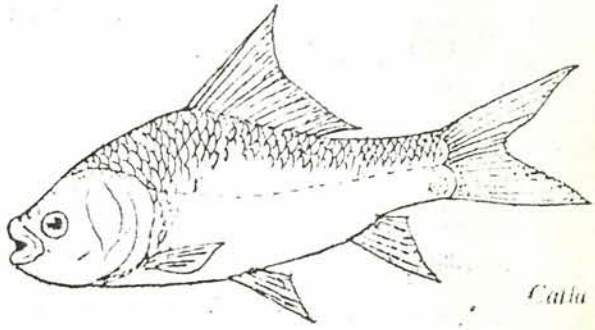

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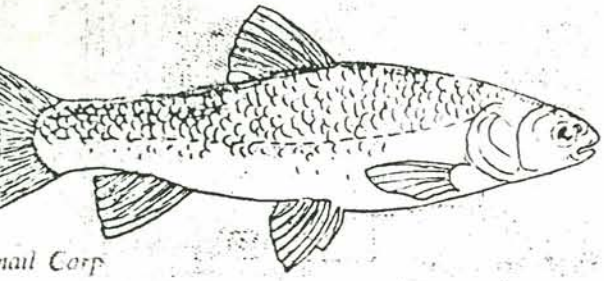
ECOLOGICAL CONFRONTATION



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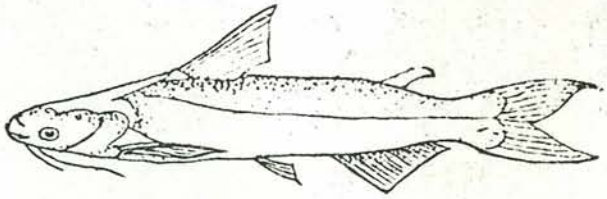

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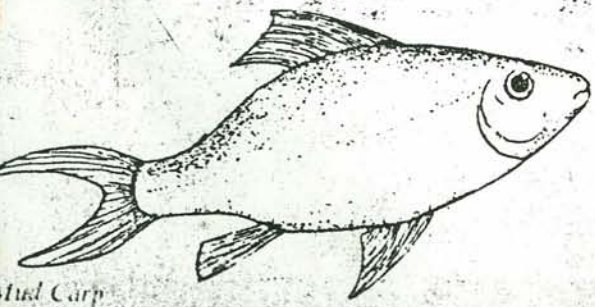

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ECOLOGICAL CONSIDERATIONS IN INTRODUCTION OF EXOTIC FISHES IN INLAND WATERS OF INDIA

The country has a rich wealth of fish wildlife that dwell in our perennial Himalayan rivers viz. the Indus, the Ganga and the Brahmaputra. A little over 200 species of fishes are known to inhabit these river systems. Peninsular rivers are equally rich in fish fauna. In addition the country also has distinctive ichthyofauna that dwell in marshes, swamps, beels, lakes, hill streams etc. We have in the country world-renowned fast growing food fishes which include such major carps like catla, rohu, mrigal, kalbasu, mahseers, large catfishes like Mystus punctatus, M. aor, M. seenghala, Wallago attu, Silonia silondia, Pangasius pangasius, cluepids like hilsa, murrels, air breathing catfishes, feather-backs and host of other fishes of economic importance. In addition we have economic freshwater prawns like Macrobrachium rosenbergii, M. malcolmsonii, M. birmanicum choprai etc. Nowhere in the world is a country so blessed as India's in respect of range and diversity of fish wildlife that dwell the inland waters. There has been a growing concern in recent years on the increasing adverse impact of human activities on environment and living resources. Much of this concern, however, is focussed on soil conservation, pollution, forest cover and wildlife of animals and birds. Little thought, however, is given to fish wildlife. This is unfortunate in a country like India that teem with fish life of great economic importance.

The world conservation strategy prepared by the International Union For Conservation of Nature and Natural Resources (IUCN) and the National Conservation and the recent Environment Policy of this country have laid due importance on preservation of flora and fauna, maintenance of ecological balance, preservation of genetic diversities and the need to desist actions by man that may result in irreversible damage to the ecosystem. In addition the IUCN has stipulated that families and genera that are monotypic should receive priority in conservation strategies over polytypic ones.

Increasing developmental activities of man involving raising of dams in inland waterways for hydropower generation, mining, industries, agriculture, human settlements have already led to environmental degradation, water pollution and ecological distortions coming in the way of aquatic productivity,

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comprehensive changes in normal breeding, recruitment etc. in fishes. These aspects found reflection in 68th Indian Science Congress Session which adopted the focal theme on the 'Impact of Development of Science and Technology on Environment'. The introduction of exotic fishes is a double-edged tool and they may, especially the primary consumer, bring about large scale changes in trophic structure and functions of our waterways and may lead to irreversible ecological distortions. The foregoing observations underscore the importance of preservation of environment and living resources. The introduction of fishes will have, therefore, to satisfy the following norms.

1 That the introduced fishes do not share the same ecological niche as the indigenous fishes

2 That they do not bring about sharp ecological distortions of the ecosystem

3 That they do not endanger or displace the indigenous economic fishes that dwell inland waters.

The meeting of the Central Board of Fisheries held at New Delhi on 29 August 1981 has made the following recommendation vide Agenda Item 10, Item 2.3 -

> "The introduction of T. nilotica, big-head, mudcarp, blackcarp, channel catfish on an experimental basis and introduction undertaken after taking due precautions and safeguards against the new transplants affecting our indigenous fisheries".

Subsequently the Department of Agriculture and Cooperation also desired similar consideration of T. zilli. The following account provides a brief sketch of ecological and cultural merits of these fishes as well as remarks about the advisability or otherwise of introducing these fishes into our aquatic ecosystems.

1 ECOLOGICAL AND CULTURAL TRAITS OF EXOTIC FISHES PROPOSED FOR INTRODUCTION

Saratherodon niloticus (=Tilapia nilotica)

The natural geographical range of this species extends from Syria into East Africa through the Congo to Liberia. The fish has the reputation as the hardiest among Tilapia spp.

It is physiologically well-equipped for a wide-range of salinities, from fresh to brackishwater. It is also eurythermal and can thrive in water temperatures in the range 15°-40°C. The fish is basically a plankton-feeder and is known to favour planktonic filamentous algae. It is also known to feed on higher plants but not to the extent that it may be used for weed control. It shares with S. mossambicus the mouth-brooding trait. The fish is known to be agressive to other species. It reaches a maximum size of 50 cm. Its hybrids with S. mossambicus are more cold resistant. The crosses of males of Zanzibar stock of S. mossambicus with females of Lake Albert stock of S. niloticus are known to yield 100% male offspring.

Tilapia zilli

The fish is native to Near East and Africa north of the equator. The salinity tolerance of the fish is not known. The fish thrives well in the temperature range 20°-26°C. The North African stocks are also known to thrive on temperatures as low as 14°-16°C. The fish is herbivorous and lives on higher plants. It has been tried to control aquatic weeds. Unlike S. mossambicus and S. niloticus it does not mouth-incubate but lays the eggs on clean stones or other smooth objects. It produces larger number of eggs than other species.

Remarks on introduction of Tilapia and Saratherodon

S. niloticus has a feeding range very similar to S. mossambicus. Before we examine S. niloticus it is desirable to examine the performance of S. mossambicus introduced in this country in 1952. According to available information S. mossambicus competes severely for food with Indian major carps and is highly detrimental to carp ponds. In addition, the fish being a prolific breeder overpopulates the system resulting in stunted fishes. The fish was brought to this country originally with a view to utilising it for marine fish farms in low-lying coastal areas (Pannikar and Tampi, 1954). It was subsequently introduced in freshwater habitats in south India. In Vigai reservoir S. mossambicus has replaced all other fishes including the major carps and indigenous fishes and contributed 99% in total fish catches during 1964-65 (Sreenivasan and Sundararajan, 1966). In Amravathi reservoir the species again dominated in fish catches forming

as much as 60% of total landings (Chacko, 1970). In large water areas like Powai lake near Bombay S. mossambicus has been reported to have drastically brought down the yield of Indian major carps. Though S. niloticus grows faster and bigger than S. mossambicus it has more or less similar feeding habits as the latter and as such it may also prove ecologically incompatible with Indian major carps. In addition the introduction of S. niloticus may not also serve the purpose of generating all-male monosex hybrids by crossing with the Java stock (Thailand stock) of S. mossambicus now available in this country. But no firm opinion can be offered on this since the genetic traits of Saratherodon and Tilapia stocks are little understood as yet. On available information monosex all-male hybrids are known to be produced by crossing males of S. mossambicus of Zanzibar stock with females of S. niloticus of Lake Albert stock.

T. zilli is known to feed largely on large aquatic plants. Since we have in this country already the exotic grass carp (Ctenopharyngodon idella), the exotic Tawes (Puntius gonionotus) and the endemic Puntius pulchellus suitable for similar ecological niches there is hardly any justification of having one more fish to fill up a similar role. In addition the fish potentials to overpopulate culture ponds on a much bigger scale than S. mossambicus.

Tilapia species being on short food chain and having a prolonged breeding season with a tendency to overpopulate the ecosystem, considerable caution is indicated before these fishes are introduced in this country. It also merits mention that the Fisheries Research Committee of the Government of India has placed on ban on the propagation of S. mossambicus in this country since 1959.

Cirrhinus molitorella

A cyprinid, the fish is popularly known as mud carp and is indigenous to river basins in South and Central China. Suitable for culture in confined waters. Does not breed in ponds. The fish breeds in rivers in China from April to May. An omnivore it lives off detritus, either of vegetable or animal origin. Takes artificial food in culture ponds. In China the fish attains 300 g in 2nd year and 600 g in 3rd year. It reaches a maximum length of 350 mm in natural habitat. The fish is also cultivated in Formosa, Thailand and Malaya.

Remarks

The mud carp, C. molitorella is a bottom dwelling omnivore. It occupies the same ecological niche as common carp as well as crucian carp, Carassius carassius. The last two have already been introduced in India and as such there is no particular advantage in introducing another fish of the same ecological niche except that the mud carp is supposed to be a slightly superior table fish than common carp. The indigenous C. mrigala and L. calbasu which have similar ecological niche are incomparably superior to mud carp in terms of growth rate, maximum size and flesh quality.

Mylopharyngodon piceus

A cyprinid, the fish is popularly known as Black carp. It is indigenous to West River System and Yang-tse in South and Central China. It is suitable for cultivation in confined waters. The fish lives off bottom dwelling animals but shows special preference for molluscs. The fish attains a length of 2.5 kg at the end of second year and 3.5 to 5 kg at the end of third year in culture ponds. The flesh is considered coarse and is little esteemed as a pond fish outside China. In lakes and rivers the fish attains a length of 1.5 to 1.8 m and a weight of more than 15 kg. The fish found entry in Formosa and Malay accidentally.

Remarks

The black carp M. piceus is a bottom-dwelling carnivore. It subsists largely on snails. The endemic Pangasius pangasiu occupies a similar ecological niche as the black carp. Unlike black carp which has a coarse flesh and not much esteemed as a food fish outside China the indigenous P. pangasius is a superior table fish. As such there is no justification whatsoever to introduce snail carp. This fish has never been introduced in any country except in Formosa and Malaya where they found accidental entry.

Aristichthys nobilis

Popularly known as Bighead. Indigenous to river systems in South and Central China. Transplanted to North China, Japan, Formosa, Vietnam, Thailand, Malaya and Ceylon. In recent years the fish had been introduced to USSR, East European countries and the USA. Freshwater fish widely used in fish culture. Does not breed in confined waters. Larval stages feed on unicellular planktonic organisms. Fry and adults are planktophagic. The branchio-spine filter is larger and thus is well equipped to filter zooplankton. In ponds the fish attains an average length of 30 cm and weight of 900 g at the end of 2nd year and 45 cm and 1.8 kg at the end of 3rd year.

Remarks

The fish is largely a zooplankton feeder though its feeding range also includes phytoplankton. The fish occupies an identical ecological niche as that of Catla catla, the highly-prized giant freshwater fish. This fish in combination with silver carp which has already been introduced into this country has all the potential to eliminate Catla catla (CIFRI's note, 1981) from our inland waters. Great caution is indicated before this fish is introduced into this country.

Ictalurus punctatus

Popularly known as channel catfish. The species is indigenous to Mississippi river basin and extends from the great lakes to the Gulf of Mexico. It is known in its natural habitat to prefer the rapid water courses. It is a renowned sport fish and reaches a maximum size of 12 kg. The fish breeds in specially prepared spawning ponds. The fish seed is produced both for restocking lakes and streams and for raising table fish in culture ponds. It is an omnivorous species. Larger specimens feed off small fish. In culture ponds they take to artificial food. The production in culture system ranges from 1000 to 2000 kg/ha/2 year. The 2nd year fish reaches about 500 g.

Remarks

The channel catfish, indigenous to Mississippi river basin is extensively used in aquaculture enterprises in U.S.A. In this country where we have large-sized and fast-growing catfishes like Wallago attu, Pangasius pangasius,

Silonia silondia, Mystus aor, M. seenghala etc. it is inadvisable to introduce any catfish either for inland waters or for aquaculture. Further we have yet to develop appropriate aquaculture system based on Indian catfishes and evaluate their cultural merits.

2 GENERAL CONSIDERATIONS

In the end it is mentioned that both caution and circumspection are indicated before any fish is introduced in this country. We have a rich natural fisheries resources in our inland waters in this country which have been providing human nutrition for centuries. Recent studies have revealed the existence of three ecological populations in C. catla, one of which is oriented to zooplankton feeding, the second to phytoplankton and the third to planktons in general. This finding is of great importance to fish culture as well stocking reservoirs where phytoplankton dominates. More critical observations are likely to bring out similar ecotypes/sub-species in other indigenous species as well. We need to know more about the cultural traits of our genetic resources. Much of the present estimated inland fish production of 9.0 lakhs tonnes is largely accounted for by natural capture fisheries. It is very essential that these renewable aquatic resources are developed and conserved for posterity and no hasty steps by way of introduction of exotic fishes is taken that may endanger these gene pools. The natural waterways have finite carrying capacity. Introduction of exotic fishes is not likely to enhance fish production to any remarkable degree over and above what is provided by indigenous fish stocks. Further since many of the exotic species proposed for introduction have feeding habits similar to endemic commercial fish species it would be difficult to forecast the possible ecological fall-out that may follow including possible elimination or displacement of indigenous genetic resources. It merits mention here that German phenotypes of common carp introduced in open waters have already seriously affected to the point of elimination of the once-prized snowtrouts (Schizothorax spp.) in Kashmir basin. It may also be mentioned that the exotic silver carp which accidentally got introduced into Govindsagar reservoir is fast becoming an important fishery and formed 75 tonnes in 1980 while it formed less than 1 tonne in 1977-78. C. catla which formed the dominant fishery in Govindsagar reservoir before the advent of silver carp is already showing signs of decline, i.e. from 209 tonnes in 1977-78 to 74 tonnes

in 1980. Catla catla population also showed downward trend in Kulgarhi reservoir after introduction of silver carp. Saratherodon mossambicus has proved detrimental to carp fishery in Vigai and Amravathy reservoirs in Tamil Nadu. Common carp which was introduced in USA has become a pest and it was no longer possible to remove the fish from the river systems. Both in Europe and USA many of the above Chinese carps have recently been introduced for experimental purposes and where inland fisheries do not count much except for the anadromous salmon and a few game fishes. The rationale behind introduction of Chinese carps in USSR and East European countries is largely due to the fact that these countries face rigors of extreme climates and have no suitable indigenous fishes that may provide useful yield from inland waters.

At a time when Government of India is evincing great concern for environmental protection and conservation of living resources and when a Bureau of Fish Genetic Resources is being established by ICAR with a view to conservation of indigenous fish resources it is necessary to go slow in the matter of introduction of exotic fishes till we have a better appraisal of our aquatic living resources including fish wildlife.

Many of the Chinese carps are found to be eurythermal and as such they operate at a higher metabolic pitch when set in a warmer environment like India. This eco-physiological advantage is certainly of great advantage for derivation of superior yield from feed-subsidised aquaculture system. Here again there is no indication that the food conversion efficiency (food quotient) is superior to Indian carps. Being poikilothermal, set in warmer aquatic habitat Chinese carps, on available evidence consumes thrice as much as Indian carp (a case in point is silver carp Vs catla in Kulgarhi reservoir, Madhya Pradesh, where gastrosomatic index is 27 for silver carp as against 9 of catla) and grow 1½ times faster than catla. Until these baseline studies are completed introduction of additional exotic carps should be deferred. Further and the most important point is that the fish intended for aquaculture would easily find easy entry into natural water courses like rivers, beels, reservoirs etc. Once this should take place there is no longer any check available to control them in open waters.

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