9.5 Fisheries Development Plan

9.5.1 Migratory corridors and breeding locations

With the productive agricultural innovation and rapid industrialization of India and implementation of several important programmes, several river systems have been developed by establishing dams and barrages to cater to the agricultural/horticultural needs, floods controls, navigation, hydel-power generation etc. As time advances, to satiate the respective needs, more and more such structures will be commissioned. The river valley projects, in reality, interfere with the riverine environment, inevitably affecting the fishery resources of the concerned lotic water body. The effects of the interference may be beneficial, indifferent or harmful depending upon the particular situation and fish species harboured in such environment. Effects of dams/ barrages on fish population can be categorised under two 'heading – Viz: Obstructional and Ecological. Dams weirs and barrages act as physical barrages to migration, tending to prevent access of the fish to their usual compatible breeding, rearing and feeding grounds. The denials/prevention of such endeavours in its life span may result in permanent and irreversible reduction of its stock ranging from lowering the levels of abundance to absolute extermination.

The ecological changes brought about by river valley developmental programmes adversely affect both the migratory and the non migratory fish species. Consequent substantial morpho-ecological changes occur in the creation of an impoundment, substantial morpho-ecological changes occur in the original lotic water body, both above and below the dam/barrage site. These include conversion of the fluviatile system into water body of slow manoeuvred discharge characteristics and radical transformation of long- established ties and inter-relationships amongst the biotal faunal elements. Fluviatile biocoenosas are replaced by new ones; some species shift to new spawning and migration range; anadromous fish tend to settle down; local stocks of fish form; inter-specific biological differentiation of fish occurs and egg laying substrate change. Other substitutions also occur such as inundation of spawning or ineffective spawning of good many important fish species.

Considerable reduction of flow in the residual rivers tailing below the dam/ barrage, significantly alters the ecology of the spawning grounds, which may, even dry up, Reduction of water levels in the residual rivers results in formation of shallow areas which impede or even movements. In instances where dams, Weirs, barrages are constructed in estuarine eco-system due to reduction and salinity regimes of brackish waters/estuaries and of current velocities as also directions at the mouths of the rivers. The latters essentially constitutes the directive factors for migration of fish species – both the anadromous as also the catqdromous varieties resulting in unsuccessful migration at even total failure of runs.

Effects of barrages on fisheries are not always deleterious. The construction of a barrage across a river, results in creation of a reservoir which makes available an expansive water area for production and exploitation of varieties of fish suitable for such environments. Wherever barrages are constructed in regions beyond the areas of naturals occurrence of economics species, whether migratory or non migratory habits, or located far above the routes of migration of anadromous or datadromous fish, the effects of such constructions are of no consequences to fisheries.

From the point of view of migratory habits, fish species lodged in the Indian Rivers may be classified as (i) Resident species, which prefers to remain confined within the local territories (*Puntius, Labeo, Cirrhinus, Notopterus, Channa, Carra mastacembelus, Mystus* etc) (ii) short-distance migrants – *Bagarius, Mahseer* etc and (iii) long-distance migrants – *Hilsa* an*d Anguilla spp*.)
The fish species of the Godavari river comes under 'Resident and short-distance migratory' ones. The Long-distance migratory fish which been recorded from the River Godavari are the fresh water Eel – *Anguilla bengalensis* and *A. bicolour*.

Earlier workers (Ichthyologists), based on the collection of large number of levers of A*. Nebulous* measuring 152 mm in long that Nizamsagar dam in the river Godavari, around 725 km from the sea, opined that these, probably, breed in fresh waters (Rahimulla *et. al.* , 1994). Later researches, however, disproved this assumption based on the monthly growth rate of elvers (Pantulu, 1956) and regykar migration of elvers recorded at different upstream stretches of the river Godavari (Ibrahim, 1961). In the river Bann, Northern Ireland, elvers were caught almost at regular intensities; the chief factor for their migration is attributable to the river discharge into the estuary, as also, on the abundance of the elvers present at the time (Lowe, 1951). Further, the rugged Eels are quite capable of climbing vertical walls provided the surface is damp enough, over-coming walls/falls including vertical walls of 25 m (Frost, 1954) and negotiable the highest and steepest waterfalls in the country, and even travel across land in heavy rains or if the grass is wet with dew. The recording of the species in the Krishna River, the Tungabhadra reservoir/river and at Tunga River in Karnataka, located close-by, evokes interest from ichthyological considerations and calls for undertaking in depth studies on the subjects.

In India, Several fish passes were constructed without due regards to the effective performance of the species that might makes use of them. These fish passes have proved unsuccessful. These, in effect, serve as 'traps' for fishes rather than facilitate their migration. Lack of knowledge of the fish behaviour and leaping capacities of the migratory fish, combines with exorbitant cost of fish passes have prevented the construction of right type of fish passes.

A major threat faced by the mainstream Rivers is the prevention to the fish stocks from ascending to the upstream stretches and also to descend to the lower reaches for sustainable needs. Every care should hence be taken by the Authorities concerned to allow a minimum of 4ft of water column in the lower stretch of the river below the dam during the lean season in order to secure the fish species present; else, large scale fish mortality occurs which effects the entire stock. It is to be noted that by man-induced destructive means or by predation, once a species becomes EXTINCT, it is LOST to the society together with its potential contribution towards sustainable development. The precautionary PRINCIPLE hence is an important part of the rationale for sound CONSERVATION principles.

9.5.2 Enrichment of riverine fish fauna

The richness of the wide spectrum of native flora and fauna in the lotic and lentic water bodies is governed by their zoogeographical locations. Majority of the fluviatile systems in the country, based on such precise identities, inherently do not harbor the fast-growing fish species of commercial importance. Thus, in order to enrich the fish fauna of the systems and also to augment considerable fish production from such resources, efforts to transplant several native as well as the exotic fish species, from one river to the other or from river to the impounded waters such as tanks, natural – and manmade lakes are in practice. Often, selected fish of economic importance are transplanted from one river to the other. Farm – grown fish fingerlings of the Indian major carp, *Gibelion catla, Labeo rohita and Cirrhinus mirgala* and the exotic carp, *Cyprinus caris, Ctenopharyngodon idella, Hypophthalmichtya moltrix* are also stocked in both the lentic and lotic water bodies so as to improve the stock, better utilization of the fish feed available and to retard the extinction of native fish species. To a large extent, it is quite possible to enhance the productivity of a water mass by introducing and acclimatization process through supplanting a more viable and valuable commercially important fish species into the biotope which uses the same feed web as the less valuable members of the fauna indigenous to the system. This leads to establishment new food – niches resulting, considerably, in high fish yield. Transplantation of indigenous – and the exotic fish species in the state, however, appears, not so common. Proper attention in this sphere has to be directed by transplanting fast – growing compatible fish species, Sport-fish and the non-predatory catfish *Pangasius pangasius* after studying the environmental ad zoogeographical distribution patterns of each. On the lines of stocking of fish fingerlings of commercially importance in certain water sheets, be they thanks or reservoirs, the Department of fisheries in the state of Telangana and also the project proponent could explore the possibility of stocking such fish components, in good many lotic water bodies too which, profitably, boost the fish production facilitating scores of fishermen/ fisherwomen engaged in the profession since decades to ekk-out their livelihood honorably. It is quite knowledgeable, particularly for the persons in the Department of

Fisheries and the like that 'no class of workers in the country and elsewhere too, earn their livelihood at greater risk and hardship than do the fishermen/fisherwomen. Depending entirely for their earnings on conditions in the various markets and such other outlets and with no guaranteed income, on many occasions, their living in recent years has been the most precious. Facing the searching sun, rains, chill, wind and rough rivers, reservoirs and also marine environment, they do not complain however. Bad weather which damages their fishing gears and prevents them from earning a single rupee, quite often, is accepted bravely as a part of the business. It is, therefore, our humble submission is to look – into their problem=ms for the production of enough fish wealth through the transplantation of commercially important fish fingerlings in the River Godavari and other lotic water systems of the state of Telangana. The positive steps in this regard will definitely help the scores of fisher folk of the State to shape their, inclusively of their families, to ekk – out their livelihood honorably.

As a recourse to this very 'Objective', around 10 lakhs of fish fingerlings of every 75 mm in length, comprised of Catla – *Gibelion catla,* ROHU – *Labeo rohita* and MRIGAL – *Cirrhinus mirgala* be introduced annually accounting to be 40% Catla, 30% Rohu and 30% Mrigal in the Godavari River, above the dam and, in the reservoir to be established around 5 lakhs fish fingerlings be introduced. Studies in widely-separated regions of the world have revealed a constant pattern in the productivity cycle of reservoirs. Immediately after filling, there is an initial period of high productivity accompanied by steep increases in the fish food reserves on the account of fertilising action of the submerged vegetation, decay products from the forest and increase soil substratum. This initial spurt of high productivity last for a few years and the only obvious way to take advantage of this initial phase of high productivity is to stock large quantities of fish of desirable species during first year of filling since the indigenous fish stocks present in area would not be numerically adequate, to populate and exploit the food resources of the enormously–increased area. The survival rate of the generation of first year of filling exceeds ten-folds and sometimes hundred- folds that of the fry of merging rivers and the generation of the first year forms a robust basis for fishing for many years to come. The fish seed stocking in the river Godavari and the reservoir complex to be commissioned need to be implemented annually to ensure supply of fish stocks to the scares of fishermen depending upon the profession since long.

Departmental fish farms located at Khammam, Nizambad, Warangal, Adilabad and Karimnagar could be approached to affect the supply. A formal letter with the request to supply the seed required to be addressed to the Departmental Officers based at these fish farms in the State of Telangana be addressed by about March – April each year with the request to affect the supply of the stock as requested by around September – October of the every year.

In the Godavari River, above the dam and, in the reservoir to be established around 5 lakhs fish fingerlings be introduced. Studies in widely-separated regions of the world have revealed a constant pattern in the productivity cycle of reservoirs. Immediately after filling, there is an initial period of high productivity accompanied by a steep increases in the fish food reserves on the account of fertilising action of the submerged vegetation, decay products from the forest and increase soil substratum. This initial spurt of high productivity last for a few years and the only obvious way to take advantage of this initial phase of high productivity is to stock large quantities of fish of desirable species during first year of filling since the indigenous fish stocks present in area would not be numerically adequate, to populate and exploit the food resources of the enormously–increased area. The survival rate of the generation of first year of filling exceeds ten-folds and sometimes hundred- folds that of the fry of merging rivers and the generation of the first year forms a robust basis for fishing for many years to come. The fish seed stocking in the River Godavari and the reservoir complex to be commissioned need to be implemented annually to ensure supply of fish stocks to the scares of fishermen depending upon the profession since long.

9.5.3 Conservation, Management and Stocking

Protection to breeders migrating upstream into the river above during monsoon months is to be afforded to by 'Legislation'. If a reservoir is tax to be enriched by the fast – growing commercially important fish species during the major part of the year, proper protective measures are to be provided. No Closed season for migrating fish or protection to congregation centers spots below dam reservoir is being practiced endangering complete depletion of the fishery wealth from such stretches close to dam, barrages and weirs. Fish species migrating upstream for spawning are indiscriminately captured without any remorse. The process depletes the fish life in such Impoundments – presents and the one to be commissioned shortly.

The development of 'intensive fish management' is impossible at the present day without the artificial culture of food fishes. River systems are also 'farmed' and their fisheries can be categorised under 'CULTURE FISHERIES'. In fact, it is here that 'Culture and capture' fishery techniques join hands. Extensive stocking with fast growing carps can solve the problems of low production in lotic biotopes to a very great extent. Such stockings, perhaps, by well – grown fingerlings is, normally, not being practiced and, also, has not received due attention still. Major and other economic fish species should be encouraged to spawn above or in the rivers as artificial stockings by fingerlings produced elsewhere is a costly affair.

9.5.4 Fresh water fish species in the light of the IUCN categorisation

Fresh water fish species, in effect, are a poorly studied group since the data on their occurrence, distribution, population, dynamics and threats, to a considerable extent, is somewhat incomplete. Threats to the indigenous fresh water fish species in particular are mostly physical in nature, such as degradation of their habitats, fragmentation, pollution, poisoning, pesticide impact, destructive fishing methods and related human interferences. Trade also is an important destructive contributing factor, especially, from the Private Aquarium agencies in threatening majority of fish taxa preset in the lotic and the lentic water bodies in the country, in general.

The International Union for conservation of Nature and Natural Resources – IUCN, the world scientific body/ institution for the 'Conservation of the Animals and Plants, have published lists of the species of fish, Amphibians, birds, reptiles and mammals (Faunal elements) considered to be Globally under Endangered, Threatened or Rare categories in their Red data book, 2017, a follow up of such an exercise formulated earlier in the year 1994. At that time (1994) as a follow-up, 'Conservation Assessment of Management Plan' workshop was organised from 22nd to 26th September, 1997 at Lucknow (UP) for 329 taxa of fresh water fish species of India" to 'critically assess their respective *Status* in the wild'. The workshop was hosted by the National Bureau of Fish Genetic (NBFGR), Indian council of Agricultural research; Technical calibration was from Zoological Survey of India (ZSI), Central Inland Fisheries Research Institute (CFTRI) and National Research Centre on Cold Water Fisheries (NRCCWF). Approximately 50% of all Indian fresh water fishes were assessed at the workshop referred and discussed extensively on the check-list of the Indian Fresh Water Fishes prepared by NBFGR, Lucknow containing 650 fish species and sub-species. The check – list was scrutinized at the workshop and only these fish species/ sub-species that were known to have occurred or currently present in the country were evaluated.

The CAMP process methodology adopted for 'Rapid Assessment' of taxa in the wild proved quite effective which has been, technically and scientifically, recognized by the IUCN specialists group, Governmental & Non-Governmental institutions, Conservation Action Plan and Policy makers all over the world. The guidelines incorporated in the said report have been adopted while listing – out the fish species under particular 'status' in the studies carried-out in the Godavari River in the recent past.

9.5.5 Fishermen/fisherwomen co-oprative societies

The Telangana state situated in the Central stretch of the seaboard of the Indian Peninsula command an area 114800 sq.km. with nine districts – Adilabad, Karimnagar, Khammam, Mahabubnagar, Nalgonda, Nizamabad, Rangareddy, Sangarareddy and Warangal. The River

Godavari, in effects, flows close to Nizamabad, Adilabad, Karimnagar and Warangal districts in the state. The rivers and canals commands a length of 1808 km, the tanks – 4324 nos. with water spread area of 2,62,187.55 Ha (departmental tanks), 19,476 tanks with water spread area of 1,55,408.69 Ha and the reservoirs numbering 74 with their total water spread area accounting to 1,77,607.60 Ha.

While the Fishermen cooperative societies in the state of Telangana commands a membership of 2,86,844 nos. coming under 3513 societies, the fisherwomen societies, numbering 437, commands a total strength of 20,420 members. There are also district Fishermen cooperative societies numbering 10 with membership strength of 2736. While the total fishermen/fisherwomen population in the state accounts to be 19,04,281 nos. active fishermen/ fisherwomen are only around 3,07,234 nos. There are, likely to be functional in the state, 55 fish markets and 244 community halls

The department of fisheries in the State Telangana leases – out water bodies for the development of fisheries, stocking o fish seed, harvesting and marketing.

The Government of Telangana, through the Department of fisheries, has undertaken welfare schemes towards Group Accident Insurance Scheme to fishermen/fisherwomen and ex-gratia-payments to the needy ones; also relief – cum – savings scheme is provided; assistance towards construction of houses to fishermen/fisherwomen and many more welfare schemes are being implemented to the deserving fisher folk by the Government through the Department of Fisheries and the Fishermen/ Fisherwomen cooperative societies.

The State Government, through the Department of fisheries, also undertake Extension Programme such as (i) conducting awareness programmes to Fishermen/ Fisherwomen, Fish farmers, entrepreneurs and stake holders; organizes capacity building programmes to field functionaries to transfer the fish and fisheries knowledge to the fish farmers, fishermen/ fisherwomen. Also arranges field visits to educate the farmers, fishermen and fisherwomen Also organize state/ National level workshops, seminars, field trips in coordination with other fisheries related organizations such as KVK, ATMA, NGOs etc.,

9.5.6 A matter of concern

Perhaps no other area of aquatic ecology a serious and mere inter-disciplinary approach than the stream/ river ecology. Geology, Geomorphology, Fluid mechanisms, Hydrology, Biochemistry, nutrient dynamics, microbiology, botany, invertebrate zoology, fish and fish biology, food-web analysis, bio-production and bio-monitoring are but a few of the disciplines from which stream/ river ecology has drawn scientists, Government agencies, Resource managers and also General public to assemble on a common platform. Consequently, the above institutions and the individuals have felt keenly about the 'Status' of

streams/river ecology as an integrative science that can help societies and the like around the glove grappling with the environmental degradation of their water resources. Indeed, streams and rivers are fundamental to the human, floral and faunal part of the 'Biodiversity' existence, on compatible and supportive grounds and many institutions and user groups have come to a common platform to protect these unique habitats that are so vital to global biodiversity and its sustainability. Needless, to add, of-late, the lotic and the lentic water bodies, all over the areas of their existence, have, ecologically experienced many instances of advancing degradations prompting research, have, ecologically experienced many instances of advancing degradation prompting research, methodologies coupled with feasible technologies in order to put them again on the right tracts adhering to the quality and hygiene standards.

In order to maintain desirable ecological/biological parameters, as also, the aquatic life present in the Godavari River at the site and elsewhere too, attention is drawn to the following points for achieving long-term benefits.

1. Prevention of flow of domestic and industrial pollutants into the Godavari River: The human population explosion and the rapid industrialization in the country have resulted in the generation, correspondingly, of greater volume of domestic sewage and industrial wastes. These being discharged, indiscriminately, into the rivers, streams, lakes, tanks and other inland water bodies, alter, Physically, Chemically and Biological quality of waters by the addition of substance or a mixture of these which interfere by the use of medium by creating a condition known as POLLUTION. Pollution is an act akin the murder, charged the Government Environmental Officer, who argued that the Tax-payers money should not used to bail-out an Industrial polluter (Jun Ui, 1920). Besides, flow of municipal and industrial wastes, domestic sewage all the time and the extensive use of pesticides and related ingredients for greater yield of crops and protection of food grains and their entry subsequently during monsoon season into the river streams and such other water masses also cause pollution of both the water and the soil. Also clean drinking water is an essential human and other form of lives requisite for sustenance of life/ lives. Clean water is also a *sino qua non* for the development of fishery resources. With the country's rapidly growing population, accompanied by increasing hazards of domestic and industrial pollution to the inland waters of the country, scientists, as also, the man on the street, envisage a severe and rapid degradation of water quality unless concrete steps are taken to immediately abate pollution. The western countries have oblate, exercised deep concern both about air and aquatic pollutions and are adopting stringent measures to maintain their environment clean. As the human population rises and industrialization increases, water requirement rapidly approach the limits of available supply and in a short time, exceed the supply in most cases. This is how the present aquatic pollution in the country has come to be localized at

particular stretches of the different river systems of the country. Should the water quality of the Indian rivers and streams, in general, get degraded beyond certain limits, the situation may go out of control, which, may not get degraded beyond certain limits, the situation may go out of control, which, may not adversely affect all uses water is put-to, such as domestic, agriculture, aquaculture, industrial, recreational, aesthetic, navigational and power generation etc., but the entire aquatic system may be thrown out of gear and may head towards a severe biological imbalance. The latter, if it happens, would be an Ecological disaster.

The waters of the River Godavari and its tributaries are utilized for very many purposes all along the courses in which these traverses. Mostly, the medium is used for community water supply, irrigation, industrial water supply, bathing of humans/cattle, washings of cloths and as a recipient of industrial effluents and domestic sewage. Pollution of the river water takes place to a varying degree, on the manner of transport of the waste generated in liquid or solid format, whether it is directly discharged or indirectly. Sewage containing oxidizable organic matter, when discharged into the river, decomposes through the activity of micro – organism and exert a greater demand on the DO in the medium. Depending upon the degree of self-purification in such a situation in a biotope, the residual pollutant either diminishes or remains constant. Godavari River, in effect is no exception to Indian Rivers in being 'polluted', especially, when its waters are rich used for cash and agri based crops cultivation; also for industrial uses. Studies carried-out of the River Godavari at Rajahmundry during sixteen on the discharge of effluent of Andhra Paper mills, indicated, over-all, degrading water quality and also of biological faunal elements.

Every water body affirms certain inbuilt capacity of 'self-purification' and 'self-cleaning' within which, it is perfectly capable of cleaning itself. However, over-increasing population, land-usage, industrialization etc., are causing increased water pollution and thus, the amount of polluted water discharge in the systems are constantly exceeding their self – purification capabilities and, being so, the external purification process cannot effect treatment of the water entirely. Caution should be exercised to release only the treated waters into the rivers and such other water sheets.

2. Over-fishing problems: All animals produce a greater number of offspring's than would be necessary to perpetuate themselves as these entire have a natural tendency, based in-built capacity and genetical capabilities, to increase their respective population. In fact, of course, no single kind of animal has the world to itself and its rate of increase is modified, very much, by the presence of other compatible and complimentary inhabitants in nature. Most of these merely compete for food, water, breeding grounds and the like that makes life possible. There are no animals existing that are free from adversaries or competitors and, as a rule, in fact, normally, the population of any kind of animal is in equilibrium, at any given

time. But when the enemies, need-based or selfish, are so powerful that there is a decrease each year of the number of specimens reaching 'maturity', then, the stock is threatened with destruction.

Fish like all other animals, show a natural tendency to increase in numbers and some species produce as much as 10,00,000 eggs at each spawning. Bur life is very dangerous for fish, particularly when young and in certain instances, as much as around 99.99% of the eggs may perish, due mainly to pollutional or ecological imbalances. Amongst the many animals which are the enemies of fish, is the fisherman himself. Although, in oceans and such other expansive water areas, he may only be a slight nuisance to the fish and its habitat; in small and larger fluviatile and impounds water bodies, he is, often the 'worst' enemy who can destroy at will, the entire stock. If one is a good fisherman – an autodidact - , he will farm the stock by taking a rational yield only so that his supply of the fish lasts for days to come. And, if he is bad professional, he will grab all he can get, and, if there are many others like him, they will, amongst themselves, ever-fish the stock, result being, ultimately, the natural or even the 'farmed' ones gets harvested faster that it can hardly be replenished by natural production. If persisted to continue in this format, rapidly, the numbers gets reduced and may, in extreme cases, the entire stock gets destroyed.

Over-fishing may be brought about simply by fishing se intensively that not enough numbers are left to produce young ones to make good the loss or it may be caused by exploiting the available stock of all sizes by unsuitable, unethical and most unscientific methods like poisoning, dynamics, operation of small-method notes etc. So that a large proportion of young specimens – juveniles – are taken out which have not yet had time to reproduce themselves. This is 'precisely' what is being done by the local- and the migratory fishermen at the site/s studied and also in close – by the locations of the River Godavari. In such instances, as soon as the power of reproduction of the stock is reduced, it deduces as an act of over-fishing. Farming of fish in nature (Fish Sanctuaries) other than the fish farms, is possible for long-term gains. Nevertheless, it can be done as in fish sanctuaries located across many rivers in the country, though, of course, the results are slower to get recognition and appreciation for the over-all benefits of the society at large. For this very reason however if for no other, there is nearby, always, intense opposition to any scheme to save the stock by declaring the "Breeding season as closed season" to facilitate fish to breed and to improve its stock. This opposition, unfortunately, invariably, comes from the fishermen themselves and such as the losses, fish merchants, fish contractors directly concerned in the fishery and is the reflection of their own ignorance, conservation aptitude and also inability to look into the future.

In order to derive lift-long benefits, one has Martin H.Fisher (1879-1962) puts "Just go into the partnership with the nature, she does more than half the work and asks none of the fee".

3. Occurrence and proliferation of Alien fish species:

The exotic fish species *Oreochromis mossambica* (South America) and Claries gariepinus (Africa) are recognized the world-ever as 'Flag-ship' species in aquatic ecosystems due to their destructive efficiency in establishing themselves in the most shortest possible time ever. Their total extermination becomes a very serious challenge, especially, in larger water bodies where these are already well-established. The species have been recorded/reported to occur in the River Godavari in different areas, all along its course. Their inadvertent/accidental entry in majority of the water bodies in the country and the very serious influence – Negative – on the piscine – and also other faunal elements is very well documented. Very serious and concrete efforts are to be made for their total annihilation in order to secure all other fish species present in the lotic and lentic water sheets. The species may be a cause for good many aquatic organisms loss where these have been recorded. It is on record that unequivocal scientific evidence exists to prove the ill-effects of culture of alien fish species on the aquatic biodiversity of a given systems. It is to be noted that "once a species becomes EXTINCT, it is LOST to the society together with its potential contribution towards sustainable development". As Gerald Durrel aptly states that" I believe that the world is a poor place for each species that we lose. Extinction is not just a moral issue, involving responsibility for the loss of an individual species; each represents a loss of unique genetic material; The unfettered proliferation of the African catfish – *Clarias gariepinus* (1770 mm – 59.00 kg) in particular, has undoubtedly, exerted immense pressure on the native/indigenous fish germplasm, result being their depletion majority of the biotopes where these are present.

As if the devastating ill-effects of the fish species detailed just earlier is to enough, there are reports on the occurrence of Alligator catfish – *Atractosteus spatula* (Deccan chronicle, August 06, 2016) that the species has established in the Telangana and Andhra Pradesh water bodies. The species is the largest one in Texas (North America), considered as a threat to sport fish in the United States of America. The species has been recorded in ponds, rivers and other natural water bodies located in the states Telangana and Andhra Pradesh. Its source supply and clandestine entry into the Krishna is from Aquarium Outlets based in the states Telangana and Andhra Pradesh. Urgently preventive measures to check its established in the water areas observed is to be taken at the earliest before the species create insurmountable problems in the days to come.

One of the most dreaded fish in the world, the red-bellied PIRANHA, *Serrasalmus natterari* has been recorded from the Godavari River, Andhra Pradesh. The species is a native of rivers

traversing through South American Nations like Argentina, Brazil and Venezuela. The fish was first recorded from the Dowleswaram barrage in Rajahmundry, and Akividu, west Godavari. In view of the linking of the Krishna and the Godavari Rivers in the recent pasts, fisherman in Guntur district's Tadepalli village located on the banks of the River Krishna is worries-lot. The species has been observed near the Prakasam barrage.

9.5.7 Rehabilitation of Endangered and Threatened fish species

Dr. Rodolfo Dirzo *et. al.* (Proc. NAT. Acad. Sci., July 2017), have published an article stating that the "Sixth mass extinction of life on Earth is unfolding more quickly than feared". Over30% of animals – fish, birds, amphibians and reptiles are declining alarmingly, both, in range and population. The man-induced processes are also contributing towards this annihilation of fish germplasm in particular from our good many water bodies. On an average, two vertebrate species disappear every year. Tropical regions have seen the highest number of declining species. As many as half of the number of animals that once shared our planet are no longer here – a loss, as a 'massive erosion of the greatest biological diversity in the history of the Earth'. The main drivers of wild-life decline are habitat loss, over-fishing/consumption, degradation/pollution, invasive species, disease, as also, illegal activities. The massive loss of our fish populations from our Rivers, reservoirs, tanks, etc., compared to sixtees/seventees, reflects our total lack of 'EMPATHY towards these, who, incidentally, are our companions since origin.

Are we justified in assuming that the impact of the un-checked, un-controlled onslaught on the fish germplasm indigenous, also, the economic carps introduced for production and economic gains may not be so devastating? The introduction of exotic fish species, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Aristichthys nobilis, Oreochromis mossambica, O.nilotica* and *Clarias gariepinus* have left irreparable devastating impact on all aquatic life-particularly-the fish germplasm. Has not man's observation period- brief, incidental, or long-term, on the negative impact of these forces been 'very casual' to the knowledge data from all-over the world available on the subject. In studying the vastly scientific literature available, it becomes clear that, though there is one of comparative quietude and slow-change.

While a great deal of work has been done on the subject, much remains yet to be accomplished. Problems which appeared to be relatively simple, gather greater complexity and knowledge progresses, but, with patient work seemingly insurmountable obstacles, can be surpassed/over-come. "Advance in Science comes by "laying brick upon brick, not by the sudden erection of fairy palaces".

According to the International Union for Conservation of Nature and Natural Resources (IUCN), fish species have been categorized as Extinct, Critically Endangered and Endangered, Vulnerable and at Lower Risk. To categorize the fish from the inland water bodies of the

State of Telangana according to the IUCN standards, long term studies are required to be carried out for a period of 5-10 years covering all the major resources. However, based on the observations carried out and the literature available, a list of 'threatened fish species' is documented here. It could, however, be stated that, till date, it appears, no efforts have been made to 'rehabilitate these threatened fish species' in the State and elsewhere too in the country. The Godavari River, as published records indicate, harbors, around 105 fish species, of which, to begin with, if the following ones are collected from the River Godavari, also its tributaries located in the State and taken care of in certain fish farms for further growth, development, breeding and transplanted in the lotic/lentic water bodies, it will be a 'yeeman' service from the concerned towards the laudable efforts, which, warrants immediate attention, interest and execution.

Fish seeking rehabilitation and conservation measures:

Tor Khudree, Neolissochilus hexagonolepis, Systomus sarana, Hypselobarbus kolus, Hypselobarbus pulchellus, Cirrhinus cirrhosus, Labeo bata, Labeo calbasu, Labeo fimbriatus, Schismatorhynchus (Nukta) Nukta, Hemibagrus maydelli, Sperata aor, Sperata Seenghala, Ompok bimaculatus, Wallago attu, Proeutropiichthys taakre, Silonia childreni, Bagarius yarrelli, Glyptothorax lonah, Channa marulius and *Channa striatus*

The Research Institutes (Govt. of India/ ICAR), Department of Fisheries and such other Research and Development Establishments could be roped in for the implementation of the submission made.

9.5.8 Fisheries Conservation and Management Plan

The over-all activities of the PNVRKSSP across the Godavari River, at the site in particular, involve the construction of a barrage, intake water distribution components and related other facilities. The mitigation measures to be accessed to ward off unpalatable/hindering impacts, if any, during the 'construction and Operation' phases have been detailed in the following format. It is to be considered, however, that the 'potential' impacts scripted earlier, are just the 'predicted' ones considering the 'Mitigation' measures to be adopted to assess, if any, the 'Negative' influences while undertaking construction of all the components connected with the envisaged project.

9.5.9 Post project environmnetal monitoring

- A 'Monitoring Cell' will be constituted with representatives from fish and fisheries disciplines to oversee/guide for the effective implementation of the suggestions made.

- The limnological and fisheries investigations be organised on quarterly-basis for a period of 3-5 years to assess the ecological changes, if any, in order to introduce desired measures for overall sustainable development and processes of the aquatic life-fish species in particular-prevailing based on the scientific know-how available.

Towards development of indegenous, endangered, vulnerable and near threatened fish fauna in the Godavari riverine system, proper attention has to be directed towards large sized fish species, sport fish, cold water fish, after studying the environmental factors and zoogeographical distribution pattern of each species. These species will be released into the Godavari River at the barrage site for propagation of fisheries.

Table 9.15 Cost estimate for implementation of fisheries management plan

Sl. No.	Items	Time period	Cost in Rs	Implementing agency
1	Cost of sluice gates for fish movement	During construction	Cost included in DPR	Department of Fisheries and I&CAD Dept., GoT
2	Stocking of fingerlings (5,00,000)	During operation	25,00,000/-	
3	Miscellaneous (transportation, research and training)		2,50,000/-	
4	Establishment of Fisheries Monitoring Cell	During operation	--	
		Total	**27,50,000/-**	