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# Vulnerable endangered, threatened and rare species categories in the submergence area of Polavaram area

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## ABSTRACT

*Environmental studies of any project are prime to protect the environment at the best possible. New venture to do important for the development of mankind while taking proper precautions to protect the natural ecosystem. The study has tried to estimate the loss in respect of biological resources in the submergence areas of the Polavaram project. The estimate is based on several and relevant criteria's, norms, approaches adopted by various agencies. And also the study suggests alternate ways and means and strategies for the improvement of the biotic environment in and around submergence area of the Polavaram project.*

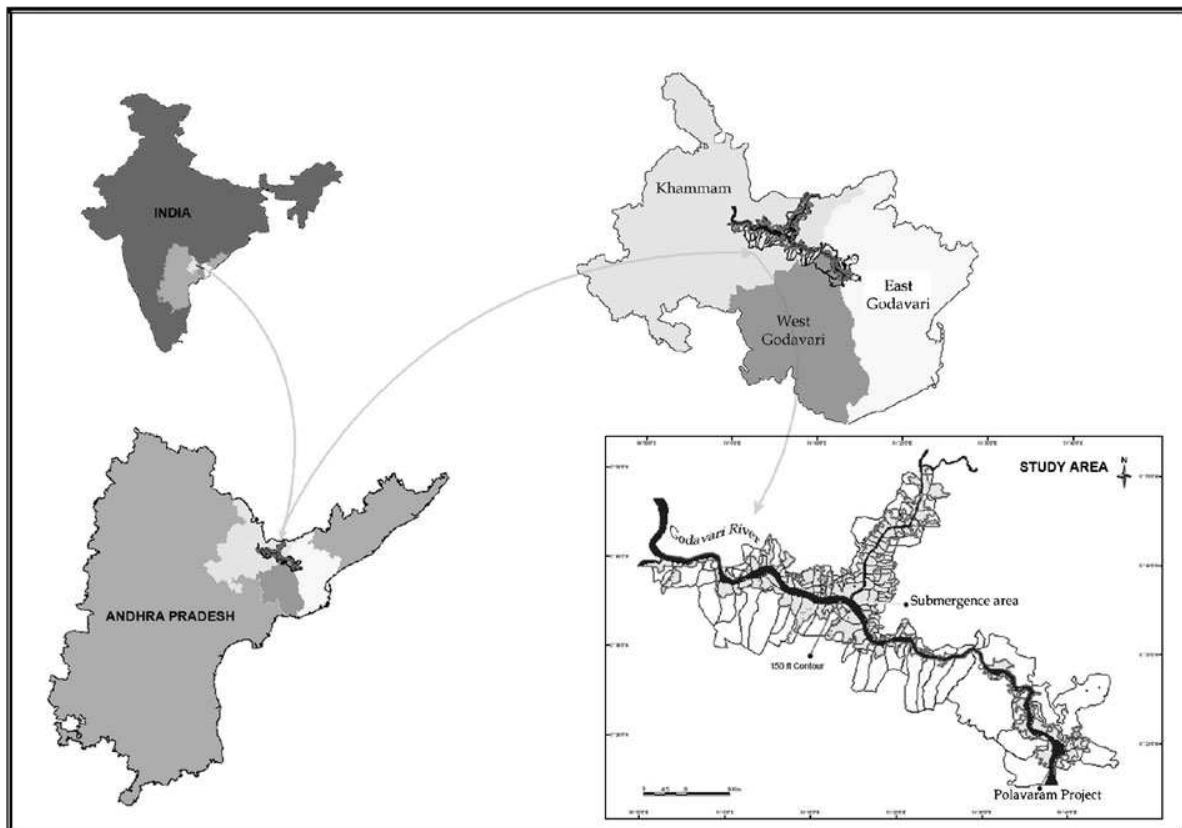
**Key Words:** Faunal resources, biotic environment and Polavaram area.

## INTRODUCTION

India has the second highest population density among the Asian countries. It has about 16% of the total world's population concentrated in slightly more than 2% of the world's land area, a population which is growing annually at a rate of 2.3% [1]. About a third of this population subsists below the poverty line. Traditional and substantial dependence on the biodiversity resources for fodder, fuel wood, timber and minor forest produce has been an accepted way of life of the rural population that accounts for nearly 74% of India's population. With the radical demographic changes, the land to man ratio and forest to man ratio has rapidly declined. From about 20 ha in 1951, the per capita forest area had been reduced to 0.11 ha in 1981 [2] with further trends of reductions in subsequent years. Apart from the primary loss of biodiversity due to development, there are numerous other problems contributing to the loss and endangered status of several floral and faunal species. These include habitat losses and fragmentation leading to the formation of isolated scattered populations becoming increasingly vulnerable to inbreeding depressions, high infant mortality, susceptibility to environmental stochasticity and in the long run, possible extinction. According to the Red list of Threatened Plants [3], 19 species are already extinct and 1236 species are threatened. Of these, threatened 41 taxa are possibly extinct in the wild, 152 are endangered, 102 are vulnerable, 251 are rare, and 690 are indeterminate.

## MATERIALS AND METHODS

The present study is limited to submergence area of the Polavaram project extends along the river Godavari on both sides in West Godavari, East Godavari and Khammam districts in Andhra Pradesh, India shown in Fig. – 1. The study area has mammals, birds, reptiles, amphibians, invertebrates and aquatic fauna. The river Godavari, Papikonda hills and flood plains along the river provide rich habitat for various animal communities. A few of them were rare and vulnerable as per the norms of IUCN (International Union for Conservation of Nature and Natural resources) and protected under Schedule category of India wildlife (Protection) Act, 1972. The study also identified rare categories of the mammals in the study area of wild life significance are presented with their zoological names, common names, habitat types and status in Table -1 shows that 20 species of mammals occur in the submergence area.



**Fig.- 1 Location map of the study area [4]**

## RESULTS AND DISCUSSION

### Mammals:

The study has identified two categories of mammals – domestic (cow, buffalo, goat and sheep etc.) and wild life as shown in Table -1. The farm animals grown in the back yards and at cultivated lands for obtained substantial income and also to assist in the cultivation operations. The study also identified rare categories of the mammals in the study area of wild life significance are presented with their zoological names, common names, habitat types and status in. Table-1 shows that 20 species of mammals occur in the submergence area, 6 of them (30%) - bonnet macaque, common langur, striped palm squirrel, Indian mongoose, Indian pangolin and jackal are found in open habitats of forest fellings or clearings, nearer to forest edges, cultivated areas and human habitations, where as 5 (25%) species - jungle cat, hyena, Indian tiger, Sambhar deer and Indian bison are found in dense forest areas with thick canopy cover at high altitudes and undisturbed forest areas with flat terrain and lesser human activity[5].

**Table-1: Distribution of Habitat and Status of the Mammals in the submergence area of Polavaram area**

S. No.	Zoological Name	Common Name	Habitat Type	*Status
1.	Macaca radiate	Bonnet Macaque	1,2,5	Vulnerable (Part-1)
2.	Presbytis entellus	Common langur	1,2,5	Vulnerable (Part-1)
3.	Lepus nigricollis	Rufoustailed Hare	1,5	Common
4.	Hystrix indica	Indian porcupine	2,3	Common
5.	Ratufa indica	Indian giant squirrel	3	Endangered / Threatened
6.	Funambulus palmarum	Striped palm squirrel	1,2,5	Common
7.	Herpestes edwardsi	Indian mongoose	1,2,5	Common
8.	Manis crisscaudata	Indian pangolin	1,2,5	Common
9.	Melursus usinus	Sloth bear	2	Endangered / Threatened
10.	Vulpes bengalensis	Indian fox	1,5	Vulnerable (Part-11)
11.	Canis aureus	Jackal	1,2,5	Vulnerable (Part-11)
12.	Felis chaus	Jungle cat	3,4	Vulnerable (Part-11)
13.	Sus scrofa	Wild boar	1,3,4,5	Rare
14.	Hyena hyena	Hyena	3,4	Rare
15.	Panthera tigris	Indian Tiger	3,4	Endangered / Threatened
16.	Panthera pardus	Leopard	2,3,4	Endangered / Threatened
17.	Cervus unicolor	Sambar deer	3,4	Vulnerable
18.	Muntiacus muntjac	Barking deer	2,3,4	Vulnerable
19.	Boselaphus tragocamelus	Nilgai	3	Vulnerable
20.	Bos gaurus gaurus	Indian bison	3,4	Vulnerable

\*Source: Zoological Survey of India

**Table-2: Distribution of Birds as per species-wise in the submergence of Polavaram area**

Systematic Position and Scientific name	Common English name	Status
Order : Ciconiiformes		
Family : Ardeidae		
Bubulcus coromandus	Cattle egret	Common
Herodias intermedia	Smaller egret	Common
Herodias garzetta	The little egret	Common
Ardeola grayii	Indian pond heron	Common
Nycticorox nycticorox	Night heron (Nocturnal)	Common
Ardea cinerea	Grey heron (Solitary)	Rare
Family : Ciconiidae		
Ibis leucocephalus	Painted stork	Rare
Anastomus oscitans	Open billed stork	Rare
Family : Ardeidae		
Butorides striatus	Little green bittern	Common
Ixobrychus cinnamomeus	Chestnut bittern	Common
Order : Jacanidae		
Sub-family : Scolopacinae		
Tringa stagnatilis	Common sand piper	Common
Limosa limosa	Black tailed God-wit	Rare
Tring nebularia	Green shank	Rare
Tring tetanus	Red shank	Rare
Family : Burhinidae		
Numenius arquata	Curlew	Rare
Family : Rostratulidae		
Rostratula benghalensis	Painted snipe	Rare
Sterna aurantia	River tern	Rare
Chlidonias hybride	Indian Whiskered tern	Rare
Family : Recurvirostridae		
Calidris minutes	Little stint	Rare
Himantopus himantopus	Black winged stilt	Rare
Recurviostra avosetta	Acocet	Rare
Family : Jacanidae		
Sub-family : Charadriinae		
Lecopoliu alexandrius	Indian Kentish plover	Common
Charadrius bubius	Little ringed plover	Common
Order : Podicipitiformes		
Family : Podycipitidae		
Pediceps ruficollis	Little greb	Common
Family : Phalacrocoracidae		

Phalacrocorax niger	Little cormorant	Common
Family : Rallidae		
Fulica atra	The coot	Common
Gallinula chloropus	Indian moor hen	Common
Gallicrex cinerea	Water cock	Common
Amauormis phoenicurus	White breasted water hen	Common

Systematic Position and Scientific name	Common English name	Status
Family : Falconidae		
Haliastur Indus	Brahminy kite	Common
Milvus migrans	Pariah kite	Common
Order : Anseriformes		
Family : Anatidae		
Anas platyrhynchos	Gad wall	Rare
Anas acuta	Pin tail	Rare
Anas crecca	Common teal	Rare
Tadonnaferruginea	Ruddyshdducy	Rare
Order : Galliformes		
Family : Phasianidae		
Centropus sinensis	Crow pheasant	Common
Francolinus francolinus	Black partridge	Common
Coturnix coturnix	Common quail	Common
Order : Columbiformes		
Family : Pteroclididae		
Pterocles exustus	Common sand grouse	Common
Family : Columbidae		
Chalcophaps indica	Brownze winged dove	Common
Order : Cittaciformes		
Family : Psittacidae		
Psittacula krameri	Parakeet	Common
Order : Cuculiformes		
Family : Cuculidae		
Eudynamus scolopacea	Koel	Common
Order : Strigiformes		
Family : Strigidae		
Athene brama	Spotted owlet (Nocturnal)	Common
Order : Caprimugiliformes		
Family : Caprimugiliae		
Caprimulgus asiaticus	Common Indian nightjar	Common
Order : Apodiformes		
Family : Apodidae		
Apus affinis	House swift	Common
Order : Coraciiformes		
Family : Alcedinidae		
Alcedo atthis	Small blue king fisher	Common
Halcyon pileata	Black capped king fisher	Common
Family : Meropidae		
Merops leschenaultia	Chestunt-headed bee-eater	Common
Family : Coraciidae		
Coracias benghalensis	Blue-jay (Roller)	Common
Family : Upupidae		
Upupa epops	Hoopy	Common

Systematic Position and Scientific name	Common English name	Status
Order : Piciformes		
Family : Picidae		
Dinopium benghalenses	Golden backed woodpecker	Rare
Order : Passeriformes		
Family : Corvidae		
Corvus splendens	Common crow	Common
Corvus macrorhynchos	Jungle crow	Common
Dendrocitta vagabunda	Tree pie	Common
Family : Pittidae		
Pitta brachyuran	Indian pitta	Rare
Family : Hirundinidae		
Hirundorustica pied	Common shallow	Common

Family : Strunidae		
Struns contra	Pied myna	Common
Family : Campephagidae		
Turdoides striatus	Jungle babbler	Common
Turdoides caudatus	Common babbler	Common
Pellorneum ruficeps	Spotter babbler	Common
Sylvia hortensis	Orphen warbler	Common
Rhipidur albicollis	White spotted fan tail Fly catcher	Rare
Family : Motacilidae		
Anthus novae	Indian pipit	Common
Family : Ploceidae		
Passer domesticus	House sparrow	Common
Petronia xanthocollis	Yellow throated sparrow	Common
Family : Zosteropidae		
Zosterops palpebrosa	White eye	Common
Family : Ploceidae		
Ploceus phillippinus	Baya waver bird	Common
Family : Paridae		
Parus xanthogenys	Yellow cheeked tit	Common
Family : Lanidae		
Hirundo rustica	Ashy swallow	Common
Family : Pycnonotidae		
Pycnonotus melanicterus	Black headed yellow bulbul	Common

*Source: Zoological Survey of India*

Three (15%) species - Rufostailed hare, Indian fox and Indian Fruit bat inhabit degraded forest zones and forest edges nearer to cultivated lands and human habitations. Two species (10%) - Indian giant squirrel and nilgai are found in dense forest areas with thick canopy cover at higher altitudes and two species (10%) - leopard and barking deer are observed in hilly terrain of rocky slopes and deep valleys of dense forest with thick canopy cover of undisturbed areas of flat terrain and lesser human activity. Apart from the above faunal species the other categories such as bandicoot rat, Indian porcupine, sloth bear and wild boar are also found in the above mentioned habitats.

Regarding the status of wild life fauna, maximum number of mammals, 9 species (45%), bonnet macaque, common langur, Indian fox, jackal, jungle cat, Sambhar deer, barking deer, nilgai and Indian bison are vulnerable and will be easily affected by submergence. Five species (25%), rufostailed hare, Indian porcupine, striped palm squirrel, Indian mongoose and Indian pangolin are of common occurrence and 4 species (20%), Indian giant squirrel, sloth bear, Indian tiger and leopard are in endangered / threatened status.

#### **Birds:**

The vegetation of terrestrial and aquatic origin, scrub forest of foot hills and on hilly terrain of Papikonda ranges and sand banks of river Godavari provide favourable habitat for a rich diversity of birds in the submergence area. The study recorded 70 species of birds in the study area (Table -2).

The birds belonging to 14 Orders and 38 families / Sub-families. The maximum number of birds about 19 (27.14%) are found in Passeriformes Order, followed by 13 species (18.57%) in Jacanidae Order, 7 species (10.00%) in Podicipitiformes Order, 6 species (8.57%) in Ciconiiformes and 5 species (7.14%) in respectively. Further, about 13 species (18.57%) such as common sand piper, black tailed God-wit, green shank, Red shank, curlew, Indian whiskered tern, little stint, black winged stilt, ayocet, gad wall, pin tail, common teal and Common quail are winter visitors and 9 species (12.85%) such as painted stork, open billed stork, chestnut bittern, river tern, the coot, brahmyn kite, koel, blue-jay (roller) and hoopy are resident category and locally migrating birds. The Migratory category belonging to the order Ansenformes of family Anatidae represented by 4 species utilize the rivers waters and sand bars for their feeding and nesting.

#### **Herptile Species:**

Herptio fauna includes amphibians and reptiles. Of the 650 species of herptiles are reported from India, about 60 species have been reported from the Easternghats existing from Similipal of Orissa state to Nilagiri of Tamilnadu state along the Eastcoast of India. About 8 species of amphibians and 40 species of reptiles were recorded in Easternghats areas of Andhra Pradesh. The present study has listed out 22 species of herptiles found in and around the submergence area (Papihills and river Godavari). The details are presented in Table-3.

Table-3 shows the 22 herpetile species found in the study area. All these species belong to 12 families in the order Anura of the class Amphibia; Maximum number (14 species) prefer to stay on land, 7 species are aquatic, 3 species are lotic (running water), 6 species are boreal, 3 are arboreal and 2 species live on bushes.

In respect of status, 8 species (36.36%) such as *Rana hexadactyla*, *Bufo melanostictus*, *Homidactylus prashadii*, *H. brooki*, *Calotes versicolor*, *Sitana ponticeriana* and *Natrix piscater* are very frequent; 13 (39.39%) - *R. trigrina*, *Lissemys punctata granosa*, *Kachuga tectum tentorica*, *Geochelone elegana*, *Chamaeleon zeylanicus*, *Varanus bengalensis*, *Python molurus*, *Eryx johni johni*, *Dryophis pulverulentus*, *Enhydris enhydris*, *Bungarus caeruleus*, *Naja naja* and *Vipera russelli* are threatened species. Nineteen species (86.36%) are of common occurrence and 2 species are occasionally found and one species comes under rare category.

**Table- 3: Distribution, Habitat, Status and Abundance of Herpetile species of the Polavaram area.**

Herpetile Species	Habitat Code	Status
Class: AMPHIBIA; Order: ANURA		
Family Ranidae <i>Rana hexadactyla</i>	Amphibious, Preference to water, Not known (240)	Common
<i>R. cyanophlyctus</i>	Amphibious, Preference to water, Not known (240)	Common
<i>R. trigrina</i>	Amphibious, Preference to water, Not known (240)	Threatened
Family Bufonidae <i>Bufo melanostictus</i>	Amphibious, Preference to land, Not known (250)	Common
Family Emydidae : <i>Lissemys punctata granosa</i>	Aquatic, Fresh water, Lotic (Running waters) (132)	Threatened
<i>Kachuga tectum tentorica</i>	Aquatic, Fresh water, All Community type (137)	Threatened
Family Testudinae : <i>Geochelone elegana</i>	Terrestrial, All land types, All Community type, Bushes (397e)	Threatened
Family Gekkonidae : <i>Homidactylus prashadii</i>	Terrestrial, All land types, All Community type, Semi-natural (397h)	Common
<i>H. brooki</i> Gray	Terrestrial, All land types, All Community type, Semi-natural (397h)	Common
Family Agamidae : <i>Calotes versicolor</i>	Terrestrial, All land types, All Community type, Semi-arboreal (397f)	Common
<i>Sitana ponticeriana</i>	Terrestrial, Flat, Community type, Bushes (387e)	Common
Herpetile Species	Habitat Code	Status
Family Chamaeleonidae : <i>Chamaeleon zeylanicus</i>	Terrestrial, All land types, Arboreal (393g)	Threatened
Family Varanidae : <i>Varanus bengalensis</i>	Terrestrial, All land types, All Community type, Boreal (397b)	Threatened
Family Boidae : <i>Python molurus</i>	Terrestrial, All land types, Boreal (393b)	Threatened
<i>Eryx johni johni</i>	Terrestrial, All land types, All Community type, Boreal (397b)	Threatened

Herpetile Species	Habitat Code	Status
Family Colubridae : <i>Atractium schistosum</i>	Aquatic, Fresh water, Lotic (Running waters) (132)	Vulnerable
<i>Dryophis pulverulentus</i>	Terrestrial, All land types, Body, Arboreal (393g)	Threatened
<i>Enhydris enhydris</i>	Aquatic, Fresh water, Lotic (Running waters) (132)	Threatened
<i>Natrix piscater</i>	Aquatic, Fresh water, Body (133)	Common
Family Elapidae : <i>Bungarus caeruleus</i>	Terrestrial, All land types, All Community type, Boreal (397b)	Threatened
<i>Naja maha naja</i>	Terrestrial, All land types, All Community type, Boreal (397b)	Threatened
Family Viperidae : <i>Vipera russelli</i>	Terrestrial, All land types, All Community type, Boreal (397b)	Threatened

Source: Zoological Survey of India

#### Fishery resources:

The river Godavari has abundant fish resources which is the source of livelihood for a large population on the banks around the submergence area. The predominant species were common Carps – *Cirrhinun mrigala*, *Labeo calbasu*, *Catla catla*, and cat-fishes – *Mytos Seenghala*, *Mytus aor*, *Silonia childreni*, *Wallago attu*, *Pangasius pangasius*, *Bangarius bangarius*, Chipeids – *Hilsa clisha*; Prawns – *Macrobrachium malcolhsoni*.

It is evident from the above analysis that a considerable extent of land resources including cropped areas and built-up areas floral and faunal resources including rare and endangered species particularly in flood plains and foot hills

will face submergence owing to Polavaram Project. Hence, the present thesis makes an attempt to assess the consequences and effects due to submergence by Polavaram reservoir on various aspects including environmental and socioeconomic scenario. The details are presented in the following chapters.

## LOSS OF BIOTIC RESOURCES

### Fauna:

Table-4 exhibits about 13 species of mammals belonging to the vulnerable, endangered and threatened categories will be affected due to the disturbance of habitat conditions in the submergence study area.

**Table-4: Loss of Mammals as per status in the submergence area of the Polavaram area.**

S. No.	Common Name	Status
1	Bonnet Macaque	Vulnerable
2.	Common langur	Vulnerable
3.	Indian giant squirrel	Endangered / Threatened
4.	Sloth bear	Endangered / Threatened
5.	Indian fox	Vulnerable
6.	Jackal	Vulnerable
7.	Jungle cat	Vulnerable
8.	Wild boar	Rare
9.	Hyena	Rare
10	Indian Tiger	Endangered / Threatened
11	Leopard	Endangered / Threatened
12	Sambar deer	Vulnerable
13	Barking deer	Vulnerable
14	Nilgai	Vulnerable
15	Indian bison	Vulnerable

*Source: Computed from Zoological Survey of India & Forest Dept. records*

**Table 5: Losses of migrated Bird species in the submergence area of Polavaram area**

S. No.	Systematic Position and Scientific name	Common English name
1	Ibis leucocephalus*	Painted stork
2.	Anastomus oscitans*	Open billed stork
3.	Ixobrychus cinnamomeus*	Chestnut bittern
4.	Sterna aurantia*	River tern
5.	Fulica atra*	The coot
6.	Haliastur Indus*	Brahminy kite
7.	Eudynamus scolopacea*	Koel
8.	Coracias benghalensis*	Blue-jay (Roller)
9.	Upupa epops*	Hoopy

*\* Residential and locally migratory.*

**Table 6: Loss of Herpetile species of the submergence area of Polavaram area**

S. No.	Herpetile Species	Status
1	R. trigrina Daudin	Threatened
2.	Lissemys punctata granosa (Schosopff)	Threatened
3.	Kachuga tectum tentorica (Gray)	Threatened
4.	Geochelone elegana Schospff	Threatened
5.	Chamaeleon zeylanicus Laurenti	Threatened
6.	Varanus bengalensis Boulenger	Threatened
7.	Python molurus Linnaeus	Threatened
8.	Eryx johni johni Russell	Threatened
9.	Dryophis pulverulentus Dumm. & Bibr.	Threatened
10	Enhydryis enhydryis Schneider	Threatened
11	Bungarus caeruleus Schneider	Threatened
12	Naja maja naja Linnaeus	Threatened
13	Vipera russelli Shaw	Threatened

*Source: Computed from Zoological Survey of India & Forest Dept. records*

Regarding birds it may be observed from Table-5 that there are about 9 category of residential and locally migrants and 13 species of winter visitor birds. These are effected due to loss of habitat conditions in the submergence area of the project. It may be observed from Table-6 that about 13 species of herpertiles comes under threatened category and will be affected due to disturbances and damages of habitat conditions in submergence area of the project.

**Ecosystem:**

The studies of [6, 7, 8, 9], have analyzed the impact of development projects of Irrigation and hydropower projects on ecosystems particularly with reference to floral resources. Further, these studies analyzed the impacts such as clearance of vegetation cover and forest in physical in various zones in and around projects. The studies have also suggested various (alternative) ways to minimise the damages and comprehensive losses in ecosystems in and around the project region in varied empirical situations.

**Faunal resources:**

The investigations of [10, 11, 12,13] deal with analysis of the distribution, habitat, status of the faunal resources such as mammals, reptiles, fisheries and wild life resources existing in and around various lakes associated with the command area of the project. They also suggested prevention, protection and conservation measures for the mitigation of undesirables impacts of the project and other development works in the region. Similarly, the present thesis also has tried to recommend suitable and location-specific steps to mitigate the impact of the Polavaram project on floral and faunal resources in the submergence area.

Keeping the above aspects in view, the present study analyses the terrestrial and aquatic vegetation. Similarly the study analyzed the distribution of faunal resources particularly domestic and farm animals, wild life and, aquatic fauna .The data used in the study were taxonomy reports and zoological survey reports and records of Forest Department and Wildlife Organizations [14, 15].

**CONCLUSION**

The study was suggested to develop bird, wild life sanctuaries for the mammal species which come under vulnerable endangered, threatened and rare species categories in the submergence area of Polavaram area and was suggested development of suitable habitat zones for the herpatile population which come under threatened categories. All the facilities including funds should be provided for the habitat zones. In other hand the present study also investigated that the fish resource in the submergence area of Polavaram is very rich and provides livelihood for a large number of the population in and around project region. Hence, the study suggested chalking out a plan for the development of fisheries both in the reservoir and their canals. Further, the study suggested creation of habitats for endangered and rare species of fishes in separate zones. The fisheries department is to be involved in these programmes for effective implementation of the development programmes.

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