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Advances in Applied Science Research, 2014, 5(2):133-143

ISSN: 0976-8610
CODEN (USA): AASRFC

A study on larvivorous fish species efficacy of lower Manair dam at Karimnagar, Andhra Pradesh, India

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ABSTRACT

Present study was carried out to determine the larvivorous activity of fishes was found in Lower Manair Dam to identify the potential fish species for consuming larval forms. The listed 58 larvivorous potential fish species were collected and identified in the laboratory based on the morphometric and meristimatic characters. Pelagic feeders occupy 25.59%, bentho pelagic feeders occupy 24.14%, demersal feeders occupy 43.10% and feeding of all substrata occupies 05.17%. Only 22 species of larvivorous fishes are consuming mosquito larvae effectively and contributed to 37.93% in the total population. Within the individual orders Perciformes contributed to 66.67%, Cypiniformies contributed to 52% and Beloiniformes contributed to 50%. Most of the species have a high larvivorous potential at early stages, hence these are the feasible in controlling reservoir larval forms. The common name, local name, IUCN (2013.2) and CAMP (1998) conservation status of each fish was listed.

Key words: larvivorous, Pelagic, Benthopelagic, Demersal.

INTRODUCTION

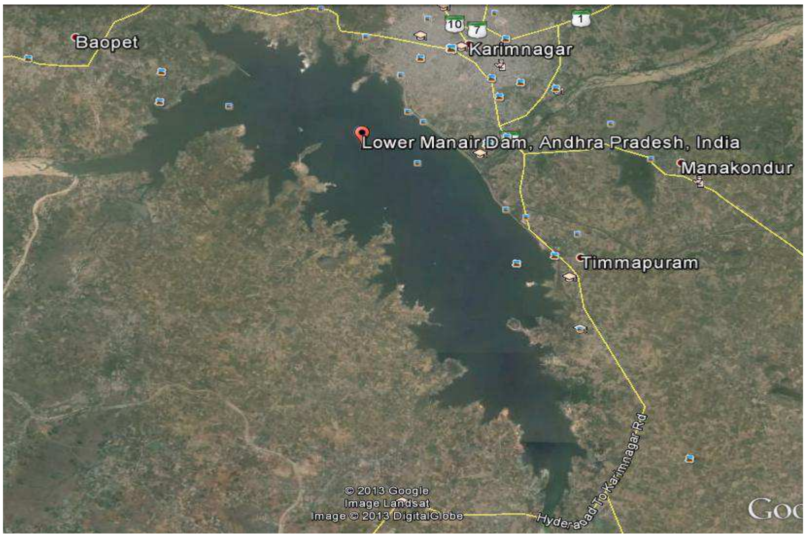
Lower Manair Dam (LMD) is situated in Karimnagar District of Telangana region **(Fig. 1)**. This is a large new impoundment of Godavari basin with medium productive potential. The Lower Manair Dam is situated at Kakatiya Canal about 146.00 km to 234 kms and Distributaries D 84 to D 94 and DBM 1 to DBM2. LMD water goes up to 2, 62,326 acs, catchment area of river 6,475 sq. m. Reservoir full level is 280.416 mt. Full capacity of reservoir 0.68 TM Cusecs and water spread area is 81.024 sq. kmt. This review presents information on different larvivorous fish species and the present status of their use consumption of Crustacean larvae, Tadpole larvae, Fish larvae, Nymphs, Glochidium larvae, veliger larvae, trochophore larvae and embryonated eggs. The presence of *Chanda nama* checks mosquito breeding only to a small extent while it effectively reduces the density of Cyclops. So, this species could effectively be used in the control of guinea worms and also for malarial control. Bhuiyan and Ahmad [1, 2] states that the fish breeds freely in confined water. In confinement, on an average it feeds on about 120 larvae and pupae of mosquito a day during the first few days but this number continues to decrease as time passes. *Osteobrama cotio cotio* larvicide [3] *Colisa lalius* a small carnivorous fish, feeding on mosquito larvae, can be recommended for the stocking tanks and ponds as an antimalarial measure [4]. *Ambasius ranga* is found in sluggish and standing waters, most abundant during the rainy season and feeds on invertebrates, worms and crustaceans.

Categorization of larvivorous fish

The position of mouth is one of the important characteristics to determine the larvivorous capability of a fish. From the point of view of their efficacy in controlling mosquito larvae, Hora and Mukherjee [5] 16 classified the larvivorous fish into the following categories: (*i*) Typical surface feeders such as *Aplochelius* and *Gambusia*, which fulfil the characteristic features of larvivorous fish; (*ii*) Some surface feeders, which are less efficient owing to their mode of life, *e.g.*, *Oryzias, Lebistes (Poecilia), Aphanius, etc.*; (*iii*) Sub-surface feeders like *Amblypharyngodon mola, Danio, asbora, etc.*; (*iv*) Column feeders like *Puntius* spp., *Colisa, Chanda, Anabas, etc*., which feed on mosquito larvae when chance permits; (*v*) Fry of carps and mullets, which are helpful in controlling mosquito larvae; (*vi*) Predatory fishes like *Wallago, Channa, Notopterus* and *Mystus* whose fry may destroy mosquito larvae but whose adults may predate upon other fish including larvicidal fish species.

Chatterjee & Chandra reported 44 species the efficacy of *X. Cancila* as bio control agent against fourth stage larval form of *An. Subpictus*, *Cx. Quinquefasciatus* and *Ar.subalbatus* under laboratory conditions. *O. Mossambica* were effective for controlling mosquitoes in cow dung pits, when introduced against III and IV instar larvae and pupae of *Cx. Quinquefasciatus* and *An. Culicifacies* at the rate of 5 fish per square meter surface area. In order to obtain high production per ha of water body, fast growing compatible species of fish of different feeding habits, or different weight classes of the same species are stocked together in the same pond so that all its ecological niches are occupied by fish. This system of pond management is called mixed fish farming or composite fish culture or polyculture. Natural habitats – Ghosh *et al* [6] reported 50 species that predation experiment using *C. carpio* (*Ctenopharyngdon idella, O. niloticus* and *Clarias gariepinus* were conducted against fourth instar *An. stephensi* larvae. A significant decrease in larval abundance in dipper samples was observed at 30 and 45 days since introduction of fish under field conditions.

Fig: 1. Lower Manair Dam Map (Google courtesy)



MATERIALS AND METHODS

Larvivorous fish samples were collected from different corners of Lower Manair Dam surrounding areas through fishermen, fish collectors, local fish markets and fish sellers at ever week during January 2013 to December 2013. Different types of nets (Drag nets, Push nets, Cast nets Stationary gill nets) and Bamboo baskets (Traps) were used for collection of fishes. The collected fishes were preserved at fresh condition immediately in 10% formalin without any post-mortem changes and recorded vernacular name [7, 8]. Smaller fishes were directly placed in the 10% formalin solution and larger fishes were given an incision on the abdomen and removed the gut content before they were preserved. Sample fishes were brought to the laboratory and fixed in this solution in separate glass jars according to size. Identification was done based on keys for fishes of the Indian subcontinent [3, 9, 10, 11] and classification was carried out on lines of [12, 13,14] identification of the species was done mainly on the morphometric and meristematic characters. The orders have been arranged phylogenetically and species under a genus followed alphabetic sequence. The correct scientific name, common name and vernacular name based on IUCN [15] and CAMP status [16] are shown against each species.

RESULTS AND DISCUSSION

The results of the present study revealed that the occurrence of fifty eight larvivorous fish species belong to eight orders, 19 families and 35 genera. List of larvivorous fish including their order, family, genus, species, common name and vernacular name were recorded in the present investigation was given in **Table 1.** The listed species are *Notopterus notopterus, Catla catla, Labeo ariza, Labeo bata, Labeo calbasu, Labeo fimbriatus, Labeo porcellus, Cirrhnus mrigala, Cirrhnus reba, Ctenopharyngodon idella, Cyprinus carpio, Osteobrama cotio cotio, Puntius chola, Puntius ticto, Puntius sarana sarana, Puntius sophore, Rasbora daniconius, Rasbora elanga, Salmostoma bacaila, Salmostoma phulo, Amblypharyngodon microlepis, Amblypharyngodon mola, Danio devario, Lepidocephalicthys berdmorei, Lepidocephalicthys guntea, Schistura cirica, Mystus bleeker, Mystus cavasius,* *Mystus tengra, Mystus vittatus, Spherata seenghala, Spherata oar, Ompok bimaculatus, Wallago attu, Eutropneustes vacha, Clarias batrachus, Heteropneustes fossilis, Anguilla bengalensis bengalensis, Anguilla bicolor bicolor, Xenentodon cancila, Hyporhampus gaimardi, Channa marulius, Channa orienalis, Channa panctatus, Channa striatus, Glosogobius giuris, Mastacembelus armatus, Mastacembelus pancalus, Trichogaster faciatus, Colisa lalio, Nandus nandus, Oreochromis mossambicus, Oreochromis variables, Etroplus suratensis, Etroplus maculatus, Chanda nama, Ambassis ranga, Rhinomugil corsula.*

The number and percentage composition of families, genera and species under different orders are shown in **Table 2 and Fig 2, 3, 4.** Order cypriniformes was dominant with 23 species which contributed to 45.10% of the total species followed by Perciformes with 12 (20.69%), Siluriformes 11 (18.97%), Channiformes 04 (6.90%), Anguilliformes and Beloiniformes each 02 (3.45%), Osteoglossiformes and Mogiliformes each 01 (1.72%). Recorded families out of 19, Perciformes contributed 06 (31.58%) families followed by Siluriformes 05 (26.32%), Cypiniformies and Beloiniformes each with 02 (10.53%), Osteoglossiformes, Anguilliformes, Channiformes and Mogiliformes each with 01 (05.26%). Recorded genera out of 35, Cypiniformies contributed 13 (37.14%) species followed by Perciformes 09 (17.14%), Siluriformes 07 (20.00%), Beloiniformes with 02 (05.71%), Osteoglossiformes, Anguilliformes, Channiformes and Mogiliformes each with 01 (2.86%).

The number and percentage composition of larvivorous fish species, genus, families and orders for four types of feeding habitat in Lower Manair Dam is shown in **Table 3. Fig. 6**.The bottom or demersal feeders was dominant with 25 species which contributes to 43.10% of the total species followed by Pelagic feeders with 16 (27.59%), bentho pelagic feeders contributes to 14 (24.14%) and feeding in all substratum contributed 03 (05.17%). Out of recorded 35 genera's demersal feeders were dominant with 14 (40.00%) followed by Pelagic feeders 12 (34.29%), bentho pelagic feeders 10 (28.57%) and feeding in all substratum's 03 (08.57%). Out of recorded 19 families demersal feeders were dominant with 10 (52.63%) of the total families followed by bentho pelagic feeders with 07 (36.84%), pelagic feeders with 06 (31.58%) and feeding all substratum's contributing 02 (10.53%). Recorded 08 orders demersal feeders were dominant with 06(75.00%) of the total orders followed by bentho pelagic feeders with 05 (62.50%), pelagic feeders with 03 (37.50%) and feeding all substratum's contributing 02 (25.00%). The number and percentage of mosquito larvae feeding fishes are fewer than three orders shown in **Table. 4, Fig: 5.**The total number of 58 fish species only 22 (37.93%) are mosquito larval feeders. Out of 12 species, the order perciformis contributing 08 (66.67%) followed by cypriniformies 13 (52.00%) and beloiniformes 01 (50.00%).

Hora, S. L. and M. Dev. [17] studied for the identification of Indian fresh water fishes, with description of certain families and observations on the relative utility of the probable larvivorous fishes of India. Chandra. G, et al [18] explained a detailed study on mosquito larval feeding habitat in *Colisa lalia*, it is a carnivorous, surface feeder found in both still and running waters. Though primarily as estuarine and brackish water fish, it is found inhabiting fresh waters such as ponds, lakes, rivers, canals and creeks, in large number. An excellent larvivorous form suitable for open shallow water stretches especially in rice fields for control of mosquitoes. *C. fasciatus*, a locally available indigenous fish collected from stone quarries of Shankargarh block of Allahabad district and ponds/ pools of Dadraul block of Shahjahanpur district (U.P.). Menon and Sharma [19, 20] reported to mosquito control potential of some species in indigenous fishes in Pondicherry. A similar study conducted by Sinnathamby [21] use of tilapia (*Oreochromis mossambicus*) for the control of mosquito breeding in water storage tanks in the Jaffna district of Sri Lanka. W H O [22] discussed the use of larvivorous fish for larval control in aquatic system.

The number and percent composition of genera and species under various families are represented in **Table-5. Fig.7.** The generic composition of fishes belonging to different families shows that eleven genera under Cyprinidae contributed to 31.43%, two genera each under Cobitidae, Bagridae, Siluridae, Anabantidae, Cichlidae and Ambassidae contributed to 05.71% each and one genus under Notopteridae,Schilbeidae, Clariidae, Heteropneustidae, Anguillidae, Belonidae, Exocoetidae, Channidae, Gobiidae, Mastacembelidae, Nandidae and Mugilidae contributed to 02.86% each. The species composition of fishes belonging to different families has revealed that 22 species belong to family Cyprinidae that made up to 37.93%, 6 species to family Bagridae that contributed to 10.35%, four species each to families Channidae and Cichilidae contributed to 06.90%, three species to family Cobitidae constituted 05.17%, two species to families Siluridae, Anguillidae, Mastacembelidae, Anabantidae and Ambassidae making to 03.45%, one species to families Notopteridae, Schilbeidae, Clariidae, Heteropneustidae , Belonidae, Exocoetidae, Gobiidae, Nandidae and Mugilidae contributed 01.725each of total fish species.

Table: 1. List of larvivorous fishes and their order, family, genus, species, common name, vernacular name, feeding habitat, population status, IUCN and CAMP status in Lower Manair Dam

Order / Family	No.	Scientific Name	Common Name	Vernacular Name	Feeding Habitat	Population Status	IUCN Status (2013.2)	CAMP Status
Osteoglossiformes/	**I**							
1. Notopteridae (1)	1	*Notopterus notopterus*	Grey feather back	Vellenka	Demersal, insects, fish crustaceans roots of aquatic plants	M	LC	LRnt
Cypriniformies/	**II**							
2. Cyprinidae (22)	2	*Catla catla*	Catla	Botchea	Surface layer and zooplankton	C	VU	LRnt
	3	*Labeo ariza*	Reba carp	Arju	Benthopelagic, Feeds on diatoms, algae, insects and detritus	C	LC	NE
	4	*Labeo bata*	Bata labeo	Yerrakandla chepa	Bottom dwellers, Crustaceous and insect larvae at early stages	R	LC	LRnt
	5	*Labeo calbasu*	Black rohu	Kakibonda	Bottom dweller & Scavenger	M	LC	LRnt
	6	*Labeo fimbriatus*	Gangetic latia	Chintara	Benthopelagic, Feeds on diatoms, algae, insects and detritus	M	LC	LRnt
	7	*Labeo porcellus*	Bombay Labeo	Moyya	Benthopelagic, Feeds on diatoms, algae, aquatic plants, insects and detritus	R	LC	DD
	8	*Cirrhinus mrigala*	Mrigal	mrigala	Bottom dweller & detritus eater	C	LC	LRnt
	9	*Cirrhinus reba*	Reba carp	Moyya	Demersal, feed on vegetables, crustaceans and insect larvae	C	LC	VU
	10	*Ctenopharyngodon idella*	grass carp	Gasscutter	All substratum's, feed on vegetables, crustaceans and insect larvae	M	LC	NE
	11	*Cyprinus carpio*	Common carp	Banraruteega	Bottom dweller feed on plankton and detritus	M	VU	NE
	12	*Osteobrama cotio cotio*	Cotio	Kagitamparaka	**B**enthopelagic & Larvicide	A	LC	LRnt
	13	*Puntius chola*	Swamp barb	Paraka	Benthopelagic, feed on crustaceans, insects and plant matter	A	LC	VU
	14	*Puntius ticto*	Ticto barb	Paraka	Surface feeder, feed on Diatom, Algae, Crustaceans, Rotifer, insects	C	LC	LRnt
	15	*Puntius sarana sarana*	Olive barb	Gandeparaka	Surface habitat & Omnivorous	C	LC	VU
	16	*Puntius sophore*	Spot-fin swamp barb	Buddaparaka	Benthopelagic, feed on Surface phytoplankton and zooplankton	A	LC	LRnt
	17	*Rasbora daniconius*	Slender rasbora	Katte kodipe	Surface, feed on algae, aquatic insects	M	LC	LRnt
	18	*Rasbora elanga*	Bengala barb	Katte kodipe	Demersal, feeds on Aquatic insects, algae and protozoan's	M	LC	NE
	19	*Salmostoma bacaila*	Large razorbelly minnow	Chandamama	Surface feeder & a useful larvivorous fish	A	LC	DD
	20	*Salmostoma phulo*	Fine scale razor belly minnow	Chandamama	Surface feeder & a useful larvivorous fish	C	NE	NE
	21	*Amblypharyngodon microlepis*	Indian carplet	Kodipe	Surface feeder & a useful larvivorous fish	A	LC	NE
	22	*Amblypharyngodon mola*	Mola carplet	Irnam Kodipe	Surface feeder, Phyto and zooplankton	A	LC	LRlc
	23	*Danio devario*	Devario danio, Dind Danio	Eela Kodipe	Benthopelagic feeds on Worms, crustaceans and insects	C	EN	NE
3. Cobitidae (3)	24	*Lepidocephalichthys berdmorei*	Leopard Loach	Vulicha	Demersale	M	EN	NE
	25	*Lepidocephalus guntea*	Guntea Loach	Vulicha	Demersale	M	LC	NE
	26	*Schistura corica*	Polka Dotted Loach	Vulicha	Benthopelagic feeds on Worms, crustaceans and insects	R	LC	NE
Siluriformes/	**III**							
4. Bagridae (6)	27	*Mystus bleeker*	Day's mystus	Kode Jella	Demersal, feed on Crustacean, Algae	A	LC	VU
	28	*Mystus cavasius*	Gangetic mystus	Guddi jella	Demersal, feed on Crustacean, Algae	A	LC	LRnt
	29	*Mystus tengara*	Tengara mystus	Karri Jella	Demersal, predatory	A	LC	NE
	30	*Mystus vittatus*	Striped dwarf catfish	Natta Jella	Demersal, feed on Crustacean, Algae	A	LC	VU
	31	*Spherata seenghala*	Giant river catfish	Pedda Jella	Demersal, Carnivore	C	LC	DD

	32	*Spherata oar*	Long-whiskered catfish	Pedda Jella	Bottom, Carnivore	C	LC	DD
5. Siluridae (2)	33	*Ompok bimaculatus*	Butter Catfish	Bugga damma	Demersal, Crustacean, Algae	M	NT	EN
	34	*Wallago attu*	Boal	Waaluga	Benthopelagic feeder, carnivorous	M	NT	LRnt
6. Schibeidae (1)	35	*Eutropiichthys vacha*	Air breathing catfishes/ Magur	Seerva jella	Surface feeder, carnivorous	R	LC	VU
7. Claridae (1)	36	*Clarias batrachus*	Batchwa vacha	Marpoo	Demersal, Omnivorous	C	LC	NE
8. Heteropneustidae (1)	37	*Heteropneustes fossilis*	Stinging catfish	Inglikam	Demersal, Omnivorous	R	LC	VU
Anguilliformes/	**IV**							
9. Anguillidae (2)	38	*Anguilla bengalensis bengalensis*	Indian Long fin eel	Malugu papera	Demersal, small fishes, crustaceans, molluscans	R	LC	EN
	39	*Anguilla bicolor bicolor*	Short fin eel	Malugu papera	Demersal, small fishes, crustaceans, molluscans	R	LC	EN
Beloiniformes/	**V**							
10. Belonidae (1)	40	*Xenentodon cancila*	Freshwater garfish	Kongamuti chapa	Pelagic, voracious	C	LC	LRnt
11. Exocoetidae (1)	41	*Hyporhamphus gaimardi*	Congaturi halfbeak	Okkamuti chapa	Pelagic, Zooplankton	M	DD	NE
Channiformes/	**VI**							
12. Channidae (4)	42	*Channa marulius*	Spotted snakehead	Korramatta	Bottom, Carnivorous	A	LC	LRnt
	43	*Channa orienalis*	Walking snakehead	Malapankiri	Bottom, Voracious and predatory	C	NE	VU
	44	*Channa panctatus*	Giant snakehead	Pubomme	Bottom, Carnivore	R	LC	LRnt
	45	*Channa striatus*	Banded snakehead	Bomme	Bottom, carnivorous	M	LC	LRnt
Perciformes/	**VII**							
13. Gobiidae (1)	46	*Glossogobius giuris*	Tank/Bar-eyed goby	Uske donthi	Benthopelagic, Omnivorous	A	LC	LRnt
14. Mastacembelidae (2)	47	*Mastacembelus armatus*	Zig zag spiny eel	Papera	Bottom, crustaceans	M	LC	VU
	48	*Mastacembelus pancalus*	Barred spiny eel	Chinna papera	Benthopelagic, insect larvae	C	LC	LRnt
15. Anabantidae (2)	49	*Trichogaster faciatus*	Banded gaurami	Papera	Surface, carnivorous	M	LC	LRnt
	50	*Colisa lalio*	Dwarf gaurami	Papera	Surface, mosquito larvae	A	LC	NE
16. Nandidae (1)	51	*Nandus nandus*	Mud perch	Ganga getchu	Benthopelagic feed on aquatic insects and fishes	M	LC	LRnt
17. Cichlidae (4)	52	*Oreochromis mossambicus*	Mozambique Tilapia	China guraka	Surface dweller, omnivorous	C	NT	NE
	53	*Oreochromis variables*		Pedda guraka	Surface dweller, omnivorous			
	54	*Etroplus suratensis*	Green chromid	Pamplete	Benthopelagic, Omnivorous	M	LC	NE
	55	*Etroplus maculatus*	Ornage chromid	Pandi paraka	Benthopelagic, omnivorous	M	LC	NE
18. Ambassidae (2)	56	*Chanda nama*	Elongate glass perchlet	Sirabara	All substratum’s of water, checks mosquito breeding	C	LC	NE
	57	*Ambassis ranga*	Indian glassy fish	Podugu sirabara	All substratum’s of water, checks mosquito breeding, Oarnivorous	M	LC	NE
Mogiliformes	**VIII**							
19. Mugilidae (1)	58	*Rhinomugil corsula*	Corsula mullet	Meedhi kandla chapa	Surface dweller, Insects & plant leaves	M	LC	NE

***A**- (13) Abundant (76-100%); **C**-(16) Common (51-75%); **M**- (20) Moderate (26-50%); **R**- (09) Rare (1-25%) of the total catch.*
EN- Endangered; VU- Vulnerable: LRnt- Lower risk near threatened; LRlc- Lower risk least concern; LC- Least concern; DD- Data Deficient; NE- Not evaluated.

Table: 2. Number and percent composition of families, genera and species of larvivorous fishes under various orders

S.No	Orders	Families	genus	Species	% of families in an order	% of genera in an order	% of species in an order
1	Osteoglossiformes	01	01	01	5.26	02.86	01.72
2	Cypriniformies	02	13	25	10.53	37.14	43.10
3	Siluriformes	05	07	11	26.32	20.00	18.97
4	Anguilliformes	01	01	02	5.26	02.86	03.45
5	Beloiniformes	02	02	02	10.53	05.71	03.45
6	Channiformes	01	01	04	5.26	02.86	06.90
7	Perciformes	06	09	12	31.58	17.14	20.69
8	Mogiliformes	01	01	01	5.26	02.86	01.72
Total		19	35	58			

Table: 3. Number and % of larvivorous fish species, genus, families and orders of feeding habitat in Lower Manair Dam

S.No.	Type of Feeding Habitat	No. of species	% of 58 species	No. of genus	% of 35 genera	Family	% of 19 families	Order	% of 8 orders
1	Pelagic or Surface feeders	16	27.59	12	34.29	06	31.58	05	62.50
2	Bentho Pelagic feeders	14	24.14	10	28.57	07	36.84	03	37.50
3	Bottom or Demersal feeders	25	43.10	14	40.00	10	52.63	06	75.00
4	Feeding on All substratum's	03	05.17	03	08.57	02	10.53	02	25.00

Table: 4. Number and percentage of Mosquito larval feeding fishes under various orders

Orders	No. of species	No. of Mosquito larvae feed fishes	% of Mosquito fishes
Cypriniformies	25	13	52.00
Beloiniformes	02	01	50.00
Perciformes	12	08	66.67
Total larvivorous fishes	58	22	37.93

Table: 5. Number and percentage composition of genera and species under various families

S. No	Families	Genera	% of genera in a family	Species	% of species in a family
1	Notopteridae	01	02.86	01	01.72
2	Cyprinidae	11	31.43	22	37.93
3	Cobitidae	02	05.71	03	05.17
4	Bagridae	02	05.71	06	10.35
5	Siluridae	02	05.71	02	03.45
6	Schilbeidae	01	02.86	01	01.72
7	Clariidae	01	02.86	01	01.72
8	Heteropneustidae	01	02.86	01	01.72
9	Anguillidae	01	02.86	02	03.45
10	Belonidae	01	02.86	01	01.72
11	Exocoetidae	01	02.86	01	01.72
12	Channidae	01	02.86	04	06.90
13	Gobiidae	01	02.86	01	01.72
14	Mastacembelidae	01	02.86	02	03.45
15	Anabantidae	02	05.71	02	03.45
16	Nandidae	01	02.86	01	01.72
17	Cichlidae	02	05.71	04	06.90
18	Ambassidae	02	05.71	02	03.45
19	Mugilidae	01	02.86	01	01.72
Total		35		58	

Table: 6. Percentage occurrence of larvivorous fish species in LMD under the conservation status IUCN (2013.2) and CAMP (1998)

Category		EN	VU	NT	LRnt	LRlc	LC	DD	NE
IUCN (2003.2)	No. of species	02	02	03	-	-	47	02	02
	% contribution	03.45	03.45	05.17	-	-	81.03	03.45	03.45
CAMP (1998)	No. of species	03	09	-	20	01	-	05	20
	% contribution	05.17	15.52	-	34.48	01.72	-	08.62	34.48

Number and percentage composition of families, genera and species of ornamental fishes under various orders.

Fig:2. % contribution of families in an order

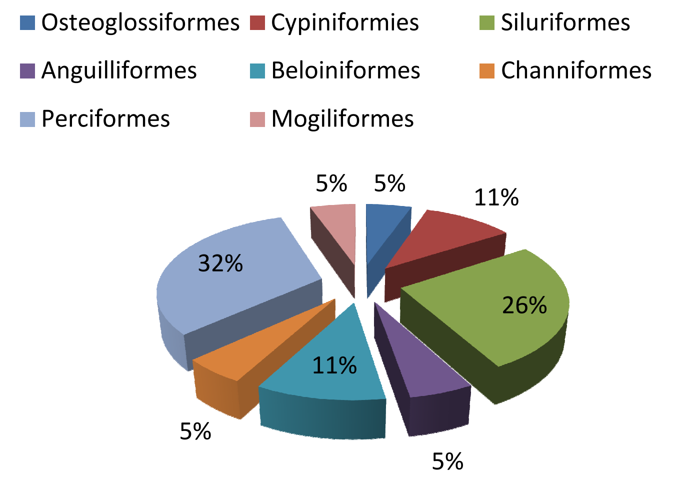


Fig: 3. % contribution of genera in an order

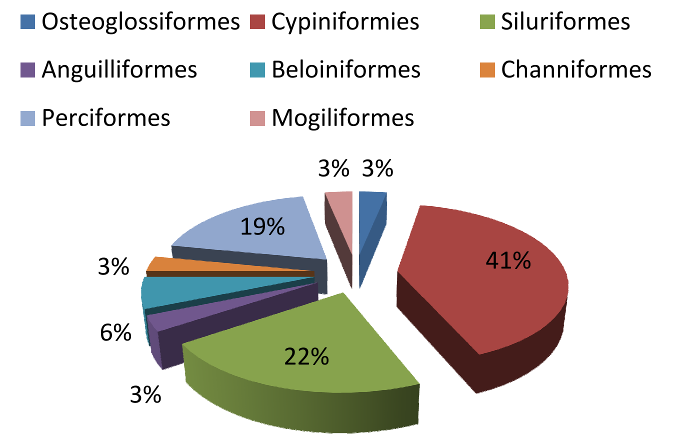


Fig: 4. % contribution of species in an order

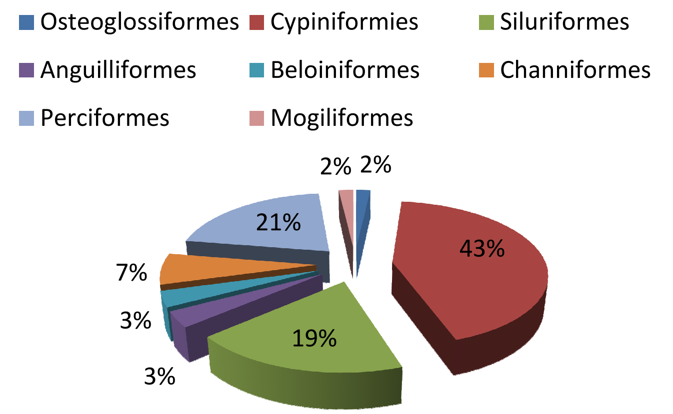


Fig: 5. Contribution of mosquito larvae feeding fishes

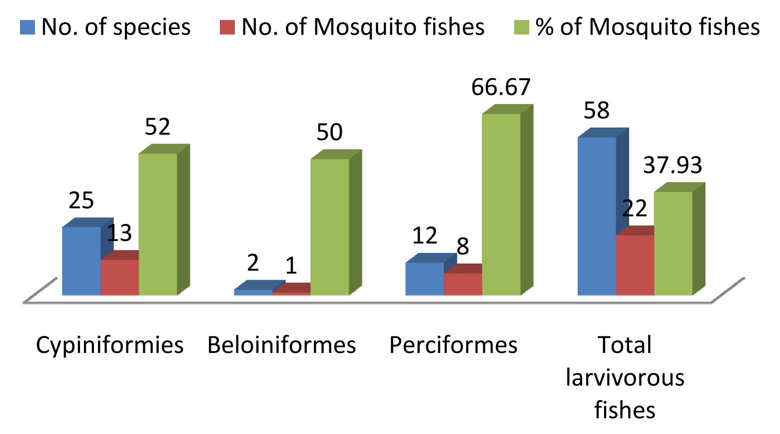


Fig: 6. Number and % contribution of fishes feeding habitat in LMD

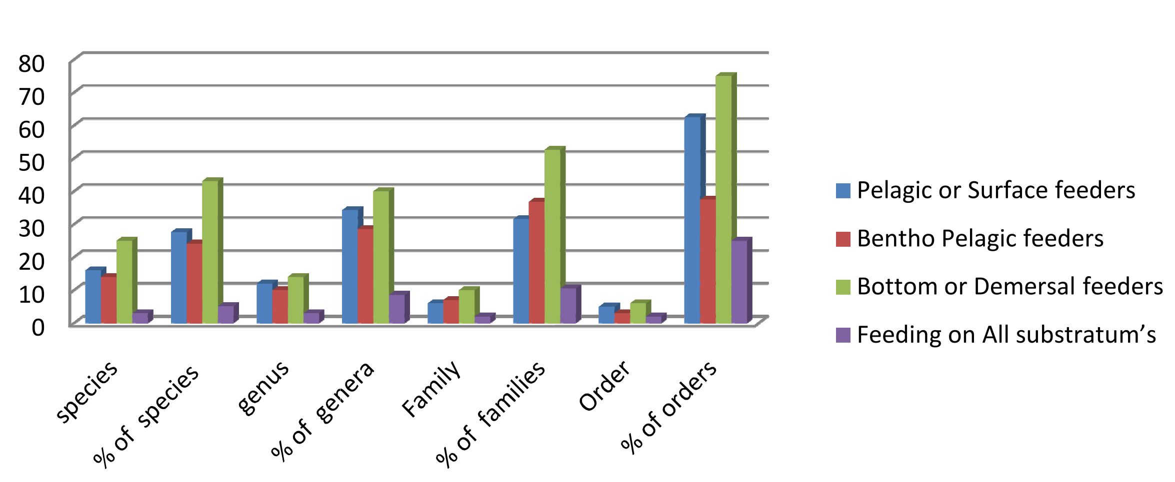
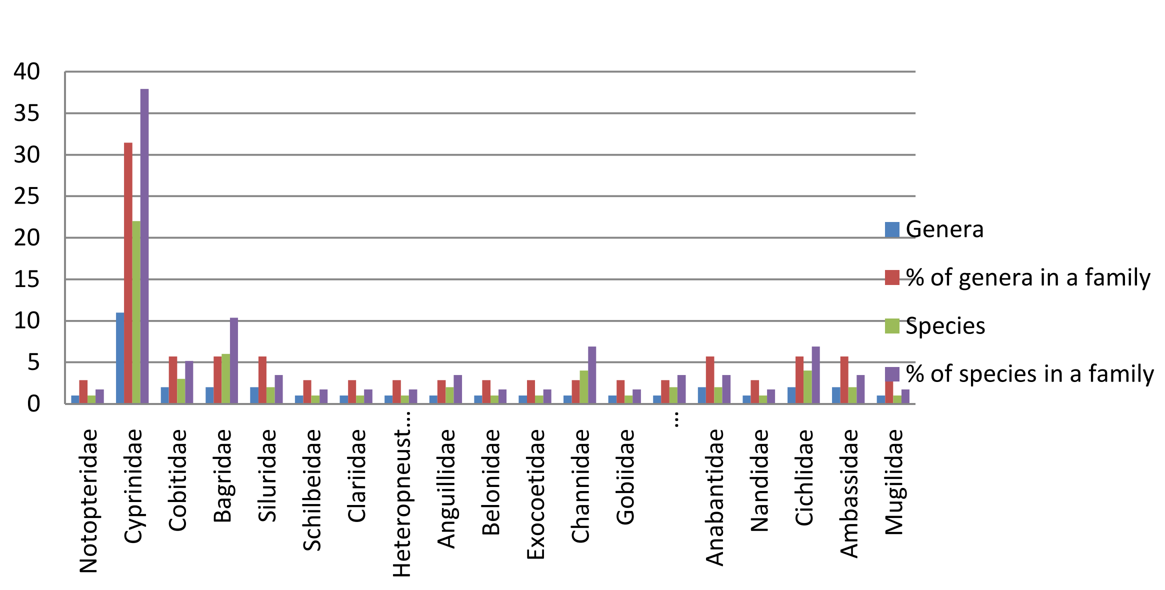
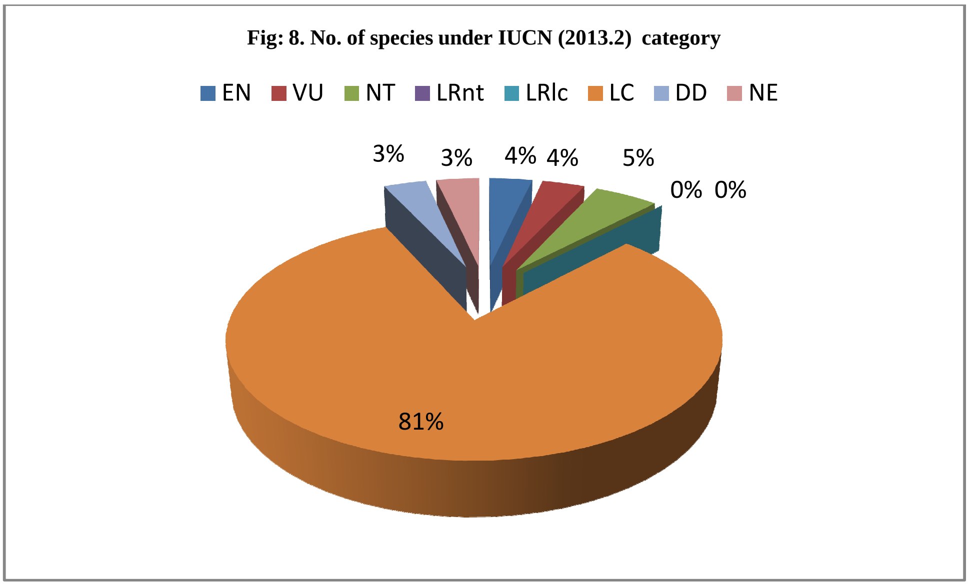
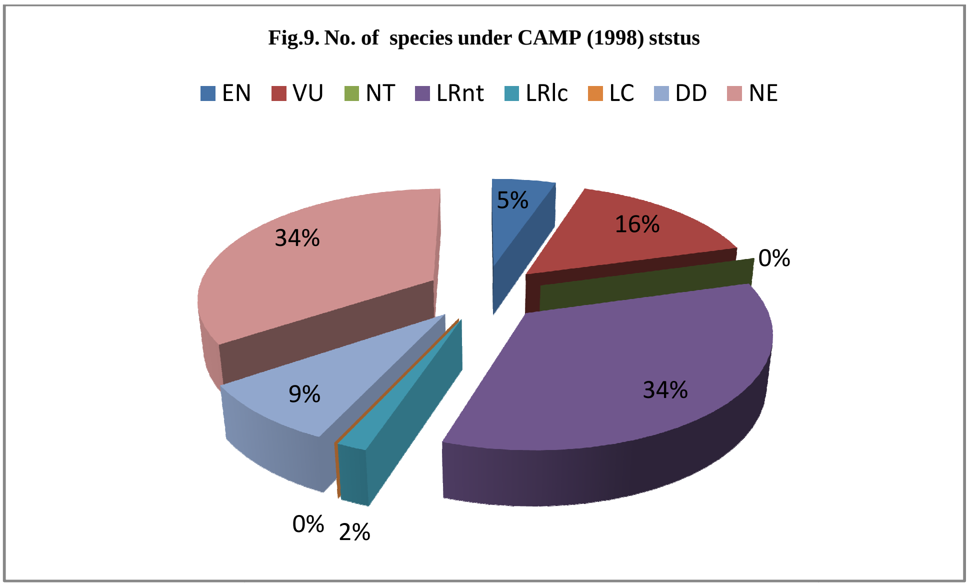


Fig: 7. No. and % composition of genera and species under varies families







Bellini R, Veronesi R, Rizzoli M. [23] studied the efficacy of various fish species *Carassius auratus* (L.), *Cyprinus carpio* (L.), *Gambusia affinis* (Baird and Girard) in the control of rice field mosquitoes in Northern Italy. Dev, V. and B. Shahi [24], Sharma V. P., Apurba Ghosh [25] studied a preliminary report on larvivorous fishes in Sonapur Assam and an Investigation on larvicidal efficacy of some indigenous fish species of inland ecosystems. Haq S, and Yadav R. S. [26] reported developing larvivorous fish network for mosquito control in urban areas. Job T. J. [27] an investigation of the nutrition of the perches of the Madras coast and larvivorous potential of fish species found in river bed pools below the major dams in Sri Lanka. Marti G. A, [28] discussed on predation efficiency of indigenous larvivorous fish species on *Culex pipiiens* larvae in drainage ditches in Argentina.

Ghosh *et al* [29] performed an experiment and established *O. niloticus* as a strong biological agent against larval mosquitoes in the laboratory. Natural habitats Predatory efficacy was positively related with prey density and inversely related with water volume *i.e*. search area. P. H. D. Kusumawathie et al. [30] discussed on larvivorous potential of the 12 fish species collected and determined in the laboratory based on the number of larvae consumed per fish within 10 min and an hour. *Danio malabaricus* Jerdon, *Oreochromis mossambicus* Peters, *Oreochromis niloticus* L., and *Poecilia reticulata* Peters consumed nine or more larvae per fish within 10 min. *Aplocheilus dayi* Steindachner and *Rasbora daniconius*. Predatory fishes like *Wallago*, *Channa*, *Notopterus* and *Mystus* whose fry may destroy mosquito larvae but whose adults may predate upon other fish including larvicidal fish species.

H.K. Phukon and S. P. Biswas [31] *Channa gachua* was found to consume a maximum number of mosquito larvae (179±21.21/hr) followed by *P. sophore* and *T. fasciata* with a maximum of 66.33±1.52 and 45.67±0.58 respectively.

A total of 44 species of fishes belonging to 8 orders such as Cypriniformes (18 species) Siluriformes (11species), Perciformes (6 species), Channiformes (4 species) Beloniformes(2 species), Angulliformes (one species) Osteoglossiformes (one species) and Mogiliformes(one species). Of these, 24 species of fish are least concerned, 8 are data deficient (DD), 10 are not evaluate (NE), 1 species of fish is vulnerable and 1 species of fish is near threatened reported by Thirupathaiah et al [32] at Lower Manair Dam. In this present study only fifty eight larvivorous fish species were reported in the same place. Among all the 58 larvivorous fish species recorded in the Lower Manair Dam shown in **Table. 6., Fig. 8, 9.** According to CAMP status [16] twenty species of fish are each with Low risk near threatened (LR nt) and not evaluated (NE) contributed to 34.48%, nine (15.52%) species of fish are vulnerable (VU), five species (08.62%) data deficient (DD), three (05.17%) species of fish is endangered (EN) and one species of fish is low risk least concern (LRlc). According to IUCN [15] forty seven species contributed to 81.03% are least concern (LC), three species contributed to05.17% are not evaluated (NT), two species each contributed to 03.45% are endangered (EN), vulnerable (VU), data deficient (DD) and not evaluated (NE).

CONCLUSION

Fifty eight larvivorous fish species are reported for the first time in Lower Manair Dam. The information collected from the local people and fishermen of the area reveals that there is decline in the population in last decade. This may be due to un-controlling fishing to meet the high market demand of the local fishes. In addition, the fishing activities were intensified with the introduction of modern fishing gears and techniques. Larvicidal fishes are an important tool for biological control by consuming mosquito larva; help in reducing the population of vectors minimize the occurrence of mosquito borne diseases. Another important consideration is the recognition of the fact that, in developing countries like India, success of such strategies depends on developing simple technology backed by a campaign of public education to community.

Acknowledgements
The author would like to thank University Grant Commission for rendering financial assistance and Commissioner Collegiate Education Andhra Pradesh, Govt. Degree College, Jammikunta, for providing necessary facilities.

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