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Reviving Ecosystems and Beating Mosquito Menace: The Gambusia Affinis Solution

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Abstract:- In an era marked by growing environmental challenges, the introduction of mosquito fish (Gambusia affinis) into aquatic ecosystems has emerged as a potent solution for the control of disease-spreading mosquitoes. This research journal article presents a comprehensive study conducted in Tekrial Lake, located in the Kamareddy district, to unravel the electrifying potential and multifaceted impact of Gambusia fish.

The investigation delves into the diverse facets of Gambusia fish, including its ecological characteristics and adaptation to Tekrial Lake's unique environment. We explore the intricate process of transporting Gambusia fish to ponds and lakes, highlighting essential precautions to ensure their well-being during transit.

Central to this research is the role of Gambusia fish in mosquito control, elucidating their impact on mosquito populations within lakes and ponds. We delve into the intricate interplay between Gambusia fish and environmental factors, shedding light on their influence on the aquatic ecosystem's equilibrium. Our research demonstrates how Gambusia fish can serve as a potent tool in controlling this menace, thus ensuring the ecological sustainability of aquatic environments.

This research article stands as a testament to the electrifying potential of Gambusia fish in shaping and revitalizing aquatic ecosystems. The findings herein provide valuable insights for policymakers, environmentalists, and researchers alike, offering a path towards harnessing nature's solution to combat mosquito-borne diseases while maintaining ecological balance.

Keywords:- *Gambusia ,Mosquito Fish ,Tekrial Lake, Gambusia Affinis, Larviciding, Adulticiding, Gambusia Holbrooki, Poecilia.*

I. INTRODUCTION

- Mosquito fish are very small fish with a greenish, upturned mouth ,and aflattened head.
- Mosquito Fish are very native in United State They grow very rapidly, reaching the maximum size in inches. Female Fish reaching an overall lengthof 7cm (2.8 in), & male reaches length of 4cm (1.6 in). • The female can be distinguished from the male by her large body, and a gravid spot at the posterior of her abdomen.
- The name "Mosquito Fish" was given, because the diet of this fish some times consists of large number of mosquito larvae, relative to body size. A large female can eat 100-200 larvae in the day. They also eat insects larvae and fry fish.
- The life span of this fish is about 3-4 years and can tolerate wide range of temperature up to 42 degree centigrade for a short periods. Mosquito Fish cansurvive relatively in hospitable environment, and are resilient to low oxygen concentration, high salt concentration (up to the twice that of sea water).

II. IMPORTANCE OF GAMBUSIAFISH

- The aim of the project is to provide necessary on the biology of mosquito fish (gambusia),
- The species of gambusia affinis fishes were observed in four main landings areas at Tekrial lake Sarampally lake , college pond and Kamareddy lake.
- Invasive fishes, via competition and predation, may be an important factor in endangering populations of amphibians and other aquatic fauna. The mosquito fish, gambusia affinis, commonly stocked into amphibian breeding sites for mosquito control worldwide, has recently been found in some breeding sites of the endangered salamander salamandra infraimmaculata in northern Israel.
- A comparison of salamandra larvae in natural pools varying in gambusia densities suggested that gambusia negatively affects salamandra by causing damage to its appendages, in particular, its tailfin (as manifested in a smaller tail : body ratio).After a short period, mosquito fish strongly reduced larval wet weight and survival, and increased body damage in the form of a reduced larval tail: body ratio and partially missing gills and limbs. No salamandra larvae exposed to mosquito fish survived to metamorphosis in either habitat type. We conclude that gambusia strongly and negatively affects salamandra larvae and that the introduction of gambusia into sites containing salamandra is inconsistent with the goal of preserving this endangered urodel.
- There are four basic approaches to controlling mosquitoes: prevention, source reduction, larviciding and adulticiding. Preventing mosquitoes from breeding is the most desirable solution.

➢ *Relvanace of the Topic*

- For this sake we have under taken this project to determine the importance ofgambusia fishes
- Mosquito fish do not lay eggs, but rather give birth to live young, these fish there fore require no special environment as most other fish do for deposing and hatching their eggs. They breed through out the summer and new broods are produced at the interval of about six weeks, with 50-100 young in a single brood. The young an approximately 1/4 inch in length when born.
- Mosquito fish have been known to kill or injure other small fishes by their aggressive behavior and will attack fish much larger than them self. This has much led them being nickname (killer guppies).
- Gambusia is a fish that preys upon the larvae and pupa of mosquitoes. It is also known as mosquito fish. It is a natural enemy of mosquitoes and considered as a biological agent for the control of mosquito larvae.

➢ *Larvivorous Efficency*

The larvivorous efficiency of Poecilia is due to followingcharacters.

- A single fish eats about 80 to 100 mosquito larvae in 24 hours. Therefore it is comparatively less efficient than Gambusia affinis.
- It is a surface feeder.
- Negotiates margins of ponds more easily.
- It is highly carnivorous and parents or older brood may eat up their own young ones. Therefore, a fair amount of weeds is required in the water so that young ones can hide and survive.
- Tolerates handling and transportation very well.
- Does not require specialized equipment for transportation.
- Survives and reproduces when introduced into new water bodies. Once well established, it can be found in the habitateven after many years

➢ *Characteristics of Larvivorous Fish*

- Should be small in size to survive in shallow water.
- Should be surface feeders and carnivorous.
- Should be able to survive in the absence of mosquito larvae .Shouldbe easy to rear.
- Should be able to withstand a wide range of temperature and lightintensity.
- Should be hardy and able to withstand transport and handling.
- Should be insignificant/useless as food for other predators.
- Should have preference for mosquito larvae over other types offood available at the water surface

III. REVIEW OF THE TOPIC

- These fishes are self-perpetuating after its establishment and continuous to reduce mosquitolarvae for long time.
- The cost of introducing larvivorous fish is relatively lower than that of chemical control.
- Use of fish is an environment friendly method of control.
- Larvivorous fish such as Gambusia and Poecilia prefer shallow water where mosquito larvaealso breed.
- SPECIES OF FISH Gambusia affinis has been in use in India since 1928. It is an exotic species and has been distributed throughout the warmer and some temperate parts of the world .
- Breeding Habit The female matures in about 3 to 6 months.
- Each ovary contains approximately 120 eggs. Young ones are released in broods of at a time.
- The young females have two gestations per season while the older females may have upto six generations per season. A season lasts about 30 days.
- A single female may produce between 900 and 1200 offsprings during its life span.

➢ *Area of Research*

- *Telrial Lake*

✓ *To Identity the Water Bodies with Larvicidal Fishes.*

Fig 1 Tekrial Lake

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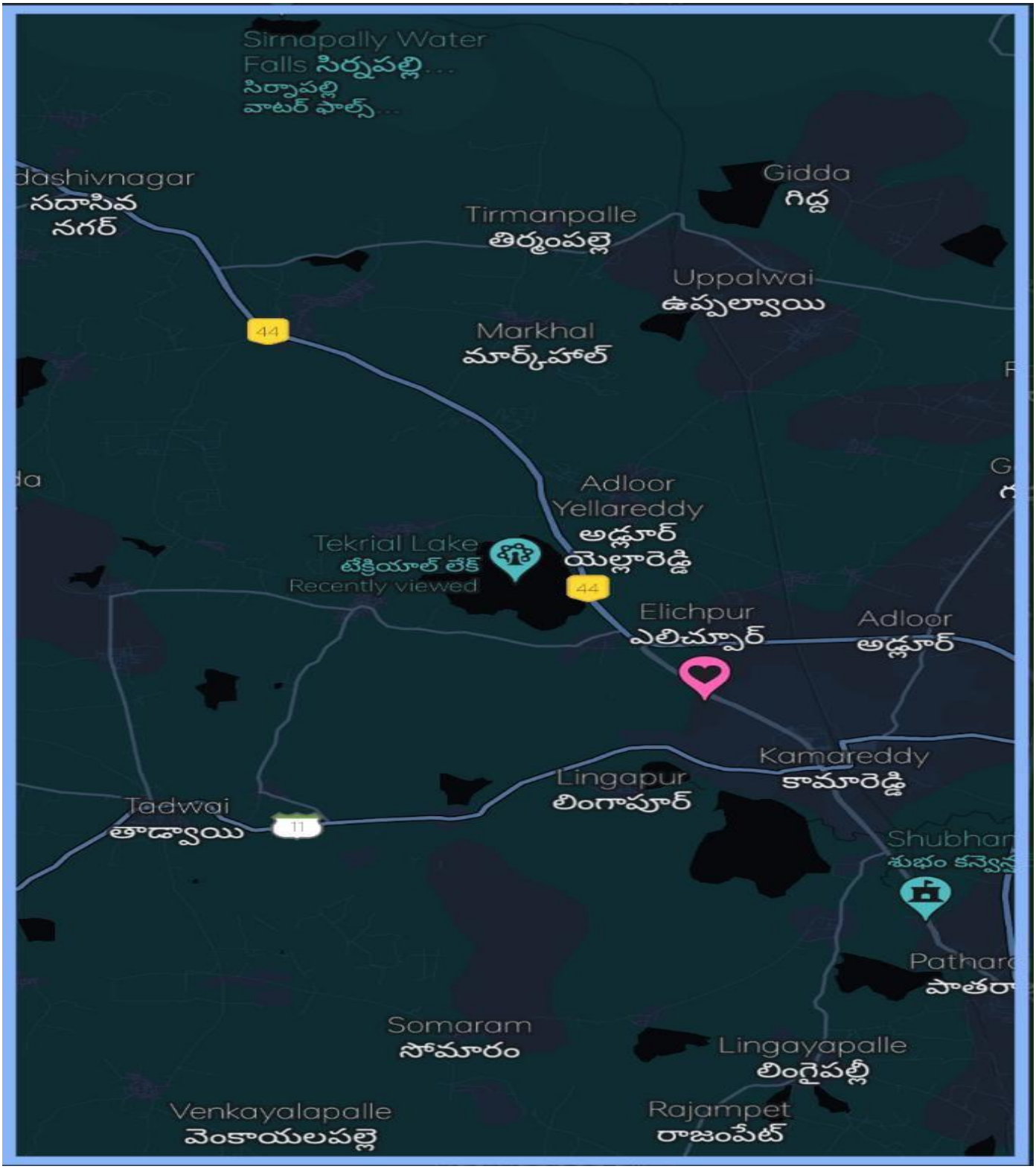

Map 1 Tekrial Lake

This lake covers about 580 hectares.{ 973X+5QR, Tekriyal, Adloor Yellareddy, Telangana 503111} {18.3553° N, 78.2964° E}

- To study the function of Gambusia
- Fish in controlling mosquito population
- To analyse the ecological importance of gambusia fish.
- Adoptions and unique features ofmosquito fish.
- To compare the larval population in changing water bodies based on BOD.
- To study the relationship between Gambusia fish population and decline of mosquito disease in its surroundings

IV. METHODOLGY

➢ *Transportation of Fish*

- Fishes are best transported in small containers of up to 40 liters , such as plastic buckets and jerry cans, or in strong plastic bags, half filled with water from the rearing pond.
- Fish should be transported in water at ambient temperatures and should not be exposed to direct sunlight. The containers should have sufficient openings to allow flow of air. Take polythene bag of 3-5 liters capacity.
- Fill it with 1.5 lit. Of water. Introduce the fish in the bag till the total volume of water + fish is two liters ss.
- Bubble the oxygen in bag from 02 cylinder or from air pump. Close the mouth of bag with a string leaving sufficient space at the top.
- Put the bag in a thermocol container and close the mouth of container. The container can be transported for a period of 24 hours without further filling oxygen.
- If the period of transport is more than 24 hours then arrange for change of water and oxygenate. Collection of fishes.
- Fishes are collected with help of netting, which is fitted on a circular iron ring of 60to 90 cm diameter with a wooden handle. Sufficient quantity is collected by repeated dips.
- Collection in bucket or drum till they are packed for transportation.

➢ *Precautions*

- Precaution during transportation fish do not tolerate sudden temperature changes. Preferably the fishes should not be given any food for 10.12 hours period prior to packing for transportation.
- 2.RELEASE OF FISH- to release the fish in a water body, measure the perimeter of water body
- Release the fishes at the rate of 5.10 fish per linear meter. If the larval density is high more fish up to 20 can be released.
- Precautions during release of fish: → fishes should be released in the morning hours or in the evening .Be fore releasing ensure that the temperature of water both in container and in the larvalhabitat is more or less same.
- Clean out dense vegetation from the water body. Ensure that water body is free from predators of larvivorus fishes *like murrel , korrameenu, jella , catfishes, pangasius / frogs- taodpole larvae* etc.
- As the officers in fisheries are less it is prepared to create wider awareness to the concerned officers and public for necessary procedure for bio-control and regulatory control for preventing its escapement in the natural wild water bodies.

➢ *Where to use Fish*

- Fish should be preferably introduced in all unused waste water wells in the rural village and municipalities/peri-urban areas before the high mosquito breeding season to maximize impact.
- However, the fish may be used in such wells even if the seeding has been delayed
- Fresh water bodies in rural areas such as stagnant ponds, slow moving streams quarry pits, large borrow pits, margins of ponds should be targetted apart from wells.
- Such places which having at least 0.4m to Im(40cm to 100cm) water depth waterdepth should be surveyed and numbered to facilitate subsequent monitoring of impact.
- In open mosquito breeding sites or waste water ditches, the fishes need to be protected from pesticides, applied to crops, chlorinated water/ other chemicals spraying on water when used this mosquito fish in water body for mosquito control

V. FINDING AND ANALYSIS OF GAMBUSIA

➢ *They Effective in Mosquito Control*

- Early 19th century experiments to evaluate the larvicidal efficiency of gambusia were subjective with small sample sizes and observational experiments showing a drastic reduction in mosquito larvae in the presence of mosquito fish.
- Conversely, some studies reported that gambusia are ineffective as a larvacidae.
- In fact, pyk reported that gambusia have resulted in increased population ofmosquito larvae, as they prey on other larverous predators.
- Multiple studies have reported that although Gambusia are quite effective in maintaining low larval densities, they can never succeed in completely replacechemicals. Guppies also have been introduced into ponds to control mosquito larvae population, but seem less efficient than gambusia and have poor survival rates. However, few studies show that guppies have better efficiency as a larvicidae than gambusia.

➢ *Maintenance of Gambusia Fishes*

- Chlorinated drinking water should not be used as high chlorine content in water where damage the health condition of fishes which leads to gambusia fish mortality.
- Gambusia fishes not advised to use in any waterbody /impoundments with less than 30cm depth as in sunny day the water will be heated at surface upto this depth so there is more prone to death of gambusia fishes results in poor achievement/mosquito larval will not be control.
- Gambusia fishes are not advised to use in any fish cultivable water bodies (cheruvu/kuntalu) as it is invasive fish species it will compete for food and space in its habitat, hencekindly it is not advised to use in wild water source/rivers/irrigation canals(running)/water supply canals to prevent the escapement of fishes into wild.

- Monitoring should check the fish hatcheries/ponds/sites which are stocked with gambusia fishes at least once in month during the high transmission season. At least 10% of the sites where fish have been introduced should be checked for. Whether fish have been introducedor not
- Whether the fish are surviving or not identification of possible reasons, in case the introduced fish are not surviving.

➢ *Influence of Environmental Factors*

- A stepwise multiple-regression analysis was used to search for significant correlations between some biological and demographic parameters of mosquito fish and the following environmental variables: dissolved.
- Gaschütz's growth model of standard length (mm) for the 1996 female + immature cohort, merged with the last data on the 1995 cohort, of Gambusia holbrooki. Data points used to calibrate the model are also plotted (the last five black data points belong to the 1995 cohort).
- Figure 9. Variation of the average density of Gambusia holbrooki throughout the study period. The mixed-age females and males (top and middle graphics) and immature (bottom graphic) are considered separately. The standard deviations from the mean are also indicated.
- Life history, population dynamics and production of mosquito fish oxygen, water temperature, pH, conductivity,water volume and photoperiod.
- Photoperiod seemed have the greatest effect on biotic parameters. The percentage of gravid females and fecundity index were positively correlated with photoperiod (PHO), and sex-ratio was negatively correlated with this factor (table II). On the other hand, photoperiod was positively correlated with water temperature ($r = 0.85$, $P < 0.001$) and water volume ($r = 0.66$, $P < 0.01$). The correlations between biotic parameters and these environmental factors cannot be defined as cause-and-effect, since most were also inter correlated. Moreover, water temperature (TMP) and volume (VOL) did not influence all mosquito fish parameters (table II).
- The total density of mosquito fish was positively correlated with conductivity (CND), and the fecundity index was positively correlated with pH and negatively correlated with dissolved oxygen(OXI) and conductivity (CND)

➢ *Production Estimates, Average Biomass and P/B Ratio*

- Production was estimated from a plot of the relationship between the density andthe average weight of the mixed-age population (Allen curve method).
- A curve of the type $y = a \times 10^{-bx}$ was then adjusted to data points. The resulting figure is basically a growth survivorship curve with the density of survivors plotted against mean individual ash-free dry weight (AFDW) , and the total production within the study period (411 d) being given by the integral of this function.
- Production (P) was then estimated as 3.10 g m^{-2} $year^{-1}$ (AFDW). Total biomass values for each sampling date were estimated from the products of densities andaverage weights (AFDW) of the mixed-age population.
- A fourth order polynomial function was then adjusted to these data, and the average biomass (B) was calculated by dividing the integral of this function within the study interval by 411.
- The obtained value was 2.90 g m^{-2} (AFDW). The P/B ratio was then estimated as1.07.

VI. RESULTS

- Gambusia is now widespread across India. Despite being listed as an invasive sp Authority (NBA) and lack of conclusive studies on its effectiveness in mosquito control, it continues to be introduced in Indian water bodies.
- It is critical that further introduction are avoided and existing sites of introduction are actively monitored to limit the negative impacts of this fish on native biodiversity.
- Efforts should also be made to eradicate this species fromfreshwater ecosystems in India.

➢ *Advantages of the Fish*

- These fishes are self-perpetuating after its establishment andcontinuous to reduce mosquito larvae for long time.
- The cost of introducing larviverous fish is relatively lower than that ofchemical control.
- Use of fish is an environment friendly method of control.
- Larviverous fish such as Gambusia and Poecilia prefer shallow waterwhere mosquito larvae also breed.

➢ *Threats of Gambusia*

- Threats of Gambusia Seven decades after the first introduction outside its native environment, the negative impacts of Gambusia on native biodiversity are becoming clear.
- Several experimental studies showed a reduction in rotifers, crustaceans, backswimmers, water beetles and odonate larvae in the presence of Gambusia.
- The negative impacts of G. holbrooki on native species include competition, predation and aggressive interactions which can lead to trophic cascades in the invaded ecosystem
- Gambusia are also known to devour amphibian tadpoles. They have been shownto feed on Microhyla tadpoles and can significantly reduce the tadpole density 43–45 .
- Tadpoles of bullfrog (Lithobates catesbeianus) and American toad (Bufo americanus) often fail to recognize the presence of alien predators like G. affinis
- In India, there have been few studies on the interactions of Gambusia with the native freshwater communities. In fact, the major focus of prior research has been to evaluate Gambusia as an effective player in mosquito control .

VII. CONCLUSIONS

- From this project ,we came to know about ,the most common and dangerous diseases, such asmalaria, dengue ,filariasis , chickengunya, brain fever and zika virus etc…
- Gambusia The diseases can be controlled by
- introducing the gambusia fish into stagnant water and local water bodies
- As a part of the project when we visited the tribal areas and we interacted with people who were suffering from above disease.
- we observed their surroundings and we found mosquito larvae in stagnant water and near by waterbodies .

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