



## Mosquitofish

**For Prelims:** [Mosquitofish](#), *Gambusia affinis*, *Gambusia holbrooki*, [Mosquito-borne diseases](#), [Invasive alien species](#), genetically modified OX5034 mosquito, [National Vector Borne Disease Control Programme](#).

**For Mains:** Negative Impacts of Mosquitofish, Major Challenges Related to Mosquito and Related Disease Control.

[Source: TH](#)

### Why in News?

Recently, various regions in **Andhra Pradesh, Odisha, and Punjab** have witnessed the release of [mosquitofish into local water bodies](#) as a measure to combat the increasing mosquito menace.

- However, a recent study highlights unexpected issues with this approach, bringing attention to potential drawbacks in the biological control method.

### What is the Mosquitofish Approach and its Related Consequences?

- **Background- Rise of Mosquito-borne Diseases:**
  - Global climate and habitat changes in the last century have heightened the prevalence of [mosquito-borne diseases](#), impacting over **500 million people in 150+ countries**.
  - In India, approximately **40 million individuals** annually suffer from these diseases, posing a persistent public health challenge for decades.
- **The Mosquitofish Approach:**
  - **Mosquitofish**, native to fresh waters of the southeastern **United States**, are known for their **appetite for mosquito larvae**.
    - They can consume up to **250 larvae per day**, making them a potential weapon against mosquito populations.
  - Two species of mosquitofish, ***Gambusia affinis* and *Gambusia holbrooki***, were considered environmentally friendly and sustainable.
    - Yet, the unintended result was the worldwide dissemination of these fish from the U.S., causing ecological disturbances.
- **Introduction of Mosquitofish in India:**
  - ***Gambusia*** was first introduced in India in **1928 during British rule**, as a way to combat rapid mosquito spread.
  - Subsequently, government bodies and private organizations in India collectively joined efforts to combat malaria through this method.
    - The initial idea was for the fish to control mosquito larvae, but the strategy backfired, resulting in their transformation into **invasive alien species**.
- **Negative Impacts of Mosquitofish:**
  - **Invasive Nature:** Their adaptability and high tolerance to fluctuating environmental conditions contribute to their extensive dispersion, making them highly invasive.

- Mosquitofish are now considered among the hundred **most detrimental** [invasive alien species](#).
- **Disruption of Native Fish Communities:** They are aggressive feeders, **consuming not only mosquito larvae but also eggs of native fish species**.
  - This can lead to the extinction of local species, particularly smaller, less competitive fishes.
- **Loss of Unique Species:** Their introduction can threaten the existence of endemic and ecologically important fish species, potentially leading to a **loss of biodiversity and ecosystem resilience**.
  - Reports indicate a decline in **Microhyla tadpoles (rice frogs or narrow-mouthed frogs)** following the introduction of *Gambusia* in India.
- **Related Significant Steps:**
  - The [World Health Organization](#) **stopped recommending *Gambusia* as a mosquito control agent in 1982**.
  - In 2018, the **National Biodiversity Authority** of the Government of India designated ***G. affinis* and *G. holbrooki*** as invasive alien species.

## Genetic Engineering Methods for Mosquito Control

- **Gene Drive Technology**, pioneered by **Austin Burt in 2003**, aims to control mosquito populations by altering their inheritance of specific genes.
  - This technique employs **proteins to modify mosquito DNA**, disrupting their ability to spread diseases like malaria.
- The [genetically modified OX5034 mosquito](#), authorized by the **US Environmental Protection Agency**, was released in 2020. It is developed with a gene sensitive to an antibiotic, **tetracycline**.
  - It **carries a self-limiting gene that prevents female offspring from surviving**, leading to a reduction in mosquito populations.

## What are the Major Challenges Related to Mosquito and Related Disease Control?

- **Challenges in Mosquito Control:**
  - **Complex Environment:** Diverse **climates, geography, and socio-economic conditions** across India lead to varied breeding patterns of mosquitos.
  - **Insecticide Resistance:** Mosquitoes have developed resistance to commonly used insecticides and repellents, necessitating frequent rotation and development of new alternatives.
  - **Poor Sanitation:** Open drains, uncollected garbage, and stagnant water sources in urban and rural areas in India provide abundant breeding grounds.
- **Challenges in Disease Control:**
  - **Underreporting:** Many cases of mosquito-borne diseases, **especially in rural areas**, go unreported or misdiagnosed, hindering accurate data and targeted interventions.
    - Also, limited access to proper healthcare in remote areas delays treatment and increases complications.
  - **Vaccine Limitations:** Currently, no effective vaccines exist for all mosquito-borne diseases, making prevention mainly reliant on vector control and personal protection measures.

## Way Forward

- **Improved Sanitation and Infrastructure:** Efficient waste collection and disposal can eliminate breeding grounds in urban areas.
  - Proper drainage systems can **prevent stagnant water accumulation**, a major breeding source for mosquitoes.

- Providing communities with **clean water storage** solutions can reduce dependence on open containers, which attract mosquitoes.
- **Integrated Vector Management (IVM):** Implement a comprehensive approach that combines various strategies such as **biological control, insecticide use, and environmental management** to address mosquito-related challenges by accelerating the implementation of the [National Vector Borne Disease Control Programme](#).
- **Community Engagement and Education:** Foster public awareness and involvement in mosquito control through **educational campaigns**, emphasizing preventive measures, and encouraging community participation.

## UPSC Civil Services Examination, Previous Year Question

### Q. Consider the following statements: (2017)

1. In tropical regions, Zika virus disease is transmitted by the same mosquito that transmits dengue.
2. Sexual transmission of Zika virus disease is possible.

### Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Ans: (c)**

### Q. 'Wolbachia method' is sometimes talked about with reference to which one of the following? (2023)

- (a) Controlling the viral diseases spread by mosquitoes
- (b) Converting crop residues into packing material
- (c) Producing biodegradable plastics
- (d) Producing biochar from thermo-chemical conversion of biomass

**Ans: (a)**

### **Mains:**

**Q.** Identify the Millennium Development Goals (MDGs) that are related to health. Discuss the success of the actions taken by the Government for achieving the same. **(2013)**

**Q.** What do you understand by nanotechnology and how is it helping in health sector? **(2020)**