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Antibiotics- Contaminating the Rivers

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This article is based on **“Antibiotics are contaminating rivers and posing health risks”** which was published in Livemint on 28/11/2019. It talks about the risks antibiotics pose to water resources in the form of antimicrobial resistance.

According to various reports on the presence of high amount of **pharmaceutical effluent residues** in water bodies, several rivers in the world including those in India, have been **reported to have high concentrations of antibiotics**.

- This poses a serious threat to the **marine ecosystem** as well as adversely impacts **human health**.
- It also affects the **Biomes** (distinct communities of flora and fauna) and **tissue-specific microbiomes** (a mix of organisms that coexist in tissues) that have an intimate link with each other.

Antimicrobial Resistance

- **Antimicrobial Resistance (AMR)** is the **resistance acquired** by any microorganism (bacteria, viruses, fungi, parasites, etc.) against antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintics) that are **used to treat infections**.
- The wastewater effluents from pharmaceutical industries especially the antibiotic manufacturing units contain a substantial amount of antibiotics, leading to contamination of rivers and lakes. This antibiotic present in water bodies generates AMR in the residing living organisms.
- As pharmaceuticals are designed to interact with living organisms at low doses, even their low concentrations affect the **freshwater ecosystems** (rivers, streams, wetlands, etc). According to an **OECD report**, 10% of pharmaceuticals (especially related to hormones, painkillers, and antidepressants) have the potential to cause **environmental harm**.

- Also, according to a report by the **United Nations' Interagency Coordination Group on Antimicrobial Resistance**, drug-resistant diseases cause at least 700,000 deaths globally a year.

Causes of Water Contamination

- The common causes of poor water quality in rivers are- **industrial discharge, open defecation, untreated waste from chemical and pharmaceutical industries, waste generated by hospitals, clinics, and animal husbandry units.**
- In India, several rivers have been reported to have **high concentrations of antibiotics such as ciprofloxacin, norfloxacin, oxytetracycline, and ofloxacin.**

Impact of High Concentration of Chemicals in Water-bodies

Various researches have highlighted the reason and impact of contaminated water on human health:

Sr. No.	Research	Outcome
1.	London's "Broad Street cholera outbreak" in 1854	It was due to the leakage of sewage full of fecal bacteria into a public well that posed a severe health hazard in the form of cholera.
2.	Brandon and Homman in 1995 (Expert Team from World Bank)	<ul style="list-style-type: none"> • Estimated the impact of domestic water pollution on illness in India. • It found that providing clean water supply and sanitation to the whole of India would save around \$ 3-8 billion annually. • In particular, it suggested that 59% of annual environmental costs (costs associated with the actual or potential deterioration of natural assets due to economic activities) in India are incurred on treating surface water pollution.
3.	Cifuentes et al (2000)	Identified irrigation as a link between water pollution and health. Other water contamination pathways include source of vegetables from farms and households, sanitation and hygiene.

4.	Fewtrell and Bartram, 2001	<ul style="list-style-type: none"> ● Infants are highly susceptible to water-borne pathogens leading to high infant mortality rate. ● Infant mortality serves as a good yardstick in India where infant mortality rate (32 per 1,000 live births in 2017) remains higher than the global average (29 deaths per 1000 live births in 2017).
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5.	Ebenstein in 2010	Reported that deterioration in Chinese river water quality was associated with a 9.7% increase in digestive cancer incidents .
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6.	Brainerd and Menon in 2011	Reported that pregnant women being exposed to a 10% increase in agrochemical levels in Indian rivers during their first month of conception was associated with an 11% increase in the likelihood of one-year mortality among newborns.
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7.	Quy-Toan Do (The World Bank), 2014	This research found that the average effect of a 1% increase in fecal coliforms (organisms present in the environment and in the feces of animals and humans) in river Ganga leads to an additional 3-5 deaths per 100,000 births in a given month.

It has been observed that industries in India often discharge **untreated or partially treated water** into nearby water bodies or rivers, leading to severe water pollution and water toxicity.

- Continuous discharge of such fluids gradually pollutes river water and makes it useless for drinking, agriculture, and further industrial use.
- It also leads to enhanced cases of **antimicrobial resistance**.

Government Initiatives

- **To tackle Water Pollution:**

- In **1985**, the government launched the **Ganga Action Plan** (GAP) to clean up the river Ganga.

Later GAP was extended to cover all the major rivers of India and was named as the **National River Conservation Plan (NRCP)**- India's flagship water pollution clean-up policy.

- **National Water Policy (2002):** started by the then Ministry of Water Resources, highlighted the importance of water for human existence as well as for economic development related activities. It addresses the problem of scarcity of water and the need to conserve this resource through optimal, economical, sustainable and equitable means.
- **National Water Mission (2010):** To ensure **integrated water resource management** leading to **water conservation, less wastage, equitable distribution** forming better policies.

- **To control AMR:**

National Action Plan (NAP) for AMR was released in April 2017 by the **Union Ministry of Health and Family Welfare**.

The objectives of the NAP include improving awareness, enhancing surveillance measures, strengthening infection prevention and control, research and development, promoting investments, and collaborative activities to control AMR.

Conclusion

- The use of pharmaceuticals has risen in the recent past with ageing populations, advances in healthcare, rising meat and fish production, and the increased use of antibiotics for livestock.
 - The negative impacts of pharmaceuticals are evident from laboratory and field tests showing traces of oral contraceptives causing **feminization in fish and amphibians** (pollutants in water bodies sometimes cause male fish/amphibians to produce eggs which is a female characteristic; this might lead to decline in their population), and residues of psychiatric drugs altering the fish behaviour.
 - Therefore, there is a need for **timely intervention** so as to **manage** the associated risks and **control** the worsening situation.
- Data is one of the keys to understand the scope of freshwater antibiotic concentrations. Getting an accurate picture of the environmental risks of pharmaceuticals around the world depends on the availability of data, which is currently limited. The global fraternity needs to collaborate with each other to overcome this challenge.

Drishti Mains Question

In addition to generic water pollution rivers now face the problem of antibiotic contamination. Discuss.