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Date: 24 May 2024

MICROPLASTIC IN ASHTAMUDI LAKE

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF **"MICROPLASTIC IN ASHTAMUDI LAKE".** THIS TOPIC IS RELEVANT IN THE **"ENVIRONMENT AND ECOLOGY"** SECTION OF THE UPSC CSE EXAM.

Why in the News?

Recently, a study titled "**Microplastic contamination in Ashtamudi Lake, India: Insights from a Ramsar wetland**" was carried out by the Department of Aquatic Biology and Fisheries, University of Kerala, with support from the Ecomarine Project.

ANALYSIS OF STUDY

- **Extensive microplastic contamination:** researchers discovered microplastics extensively distributed throughout the lake's ecosystem, including in fish, shellfish, sediment, and water samples. This widespread contamination underscores the significant issue of microplastic pollution in this ecologically vital wetland.
- **High microplastic levels in aquatic life:** the study revealed particularly high concentrations of microplastics in the lake's macrofauna. Fish exhibited a 19.6% microplastic composition, while shellfish showed an even higher content at 40.9%. These elevated levels in consumable aquatic organisms pose major public health concerns.
- **Presence of hazardous heavy metals in microplastics:** the analysis identified hazardous heavy metals such as molybdenum, iron, and barium in the microplastics. These contaminants, likely absorbed from the environment, threaten both aquatic organisms and humans who consume the contaminated fish and shellfish.
- **Immediate need for intervention:** researchers highlighted the urgent need for ongoing monitoring of microplastic pollution in ashtamudi lake and the implementation of strategies to reduce microplastic entry into this estuarine system. Prompt action is necessary to address the escalating threat of microplastic contamination and protect the ecological integrity and public health of this ramsar wetland.

ABOUT MICROPLASTIC

- Microplastics are tiny plastic fragments, less than 5 mm (0.2 inches) in length, resulting from plastic pollution. Microplastics are composed of carbon and hydrogen atoms linked in polymer chains and often contain chemical additives like phthalates and flame retardants.
- These particles are not biodegradable and accumulate in various ecosystems, including marine, freshwater, and terrestrial environments.

TYPES OF MICROPLASTIC:

Primary Microplastics

These are small plastic particles that are originally less than 5 mm in size before they enter the environment. Examples include microbeads in personal care products, plastic pellets used in manufacturing processes, and microfibers released from synthetic fabrics during laundry.

Secondary Microplastics

These microplastics are produced from the degradation of larger plastic items due to environmental factors such as weathering, UV radiation, and wave action. Examples include small pieces broken off from plastic bottles, bags, and fishing nets.

IMPACT OF MICROPLASTIC ON MARINE ECOSYSTEM

- **Ingestion by Marine Organisms:** Due to their small size, microplastics are often mistaken for food by a variety of marine organisms, ranging from plankton to large filter-feeding whales. When these particles are ingested, they can accumulate in the digestive systems of marine animals, causing physical blockages, impaired nutrient absorption, and potential starvation.
- **Bioaccumulation and Biomagnification:** Microplastics can accumulate in the tissues of marine organisms over time, a process known as bioaccumulation. This accumulation can lead to biomagnification, where the concentration of microplastics increases up the food chain, ultimately impacting predators at higher trophic levels.
- **Chemical Contamination:** Microplastics have the capacity to absorb and concentrate toxic chemicals from their surroundings. When marine organisms ingest these microplastics, the

chemicals can leach into their tissues, causing toxic effects and disrupting their physiological functions.

- **Physical Harm:** Beyond ingestion, microplastics can physically harm marine organisms by causing entanglement. Animals such as sea turtles, seabirds, and marine mammals can get entangled in microplastics, leading to injuries, reduced mobility, and even death.
- **Disruption of Ecosystems:** The presence of microplastics in marine environments can disrupt entire ecosystems. They can alter the behaviour, reproduction, and survival rates of various species. For instance, changes in plankton communities can have cascading effects throughout the food web, impacting biodiversity and the stability of ecosystems.

ADVERSE IMPACT OF MICROPLASTIC ON HUMAN HEALTH

- **Bioaccumulation in the food chain:** aquatic organisms can ingest microplastics contaminated with heavy metals such as cadmium, lead, chromium, and arsenic. These metals, which do not easily degrade, can accumulate up the food chain, ultimately exposing humans to higher levels when consuming seafood.
- **Desorption in the digestive system:** ingested microplastics can release these heavy metals more effectively in the acidic environment of the human stomach. This process increases the metals' bioaccessibility and potential absorption into the body.
- **Toxic effects of heavy metals:** heavy metals like cadmium, chromium, and arsenic are known carcinogens and can cause various health problems. Exposure to these metals is associated with organ dysfunction, metabolic disorders, immune system damage, neurotoxicity, and reproductive and developmental toxicity.
- **Synergistic toxicity with microplastics:** the combined presence of microplastics and heavy metals can result in more severe toxic effects than either pollutant alone. Microplastics, with their rough surfaces and functional groups, can adsorb and transport heavy metals, enhancing their persistence in the environment and their bioavailability.

MEASURES TO REMOVE MICROPLASTIC FROM AQUATIC SYSTEM

- **Filtration technology:** filtration is widely used to remove microplastics from water, utilising various types of filters, such as membrane filters. These filters are effective in capturing microplastics but can suffer from membrane fouling and require frequent replacement, which increases costs.
- **Adsorption and magnetic separation:** adsorption and magnetic separation are straightforward methods for microplastic removal. While effective, they often involve additive sorbents, which can lead to secondary pollution issues.
- **Coagulation and oxidation treatment:** coagulation is used to remove microplastics from water, but it may leave chemical residues. Similarly, oxidation treatments can be effective but might also result in residual chemicals that need to be addressed.

- **Biodegradation and bioreactors:** biodegradation and bioreactors provide eco-friendly solutions for microplastic removal. However, these methods typically have lower degradation efficiency compared to other techniques.

- **Photocatalytic technology:** photocatalytic degradation uses light to break down microplastics with high efficiency, making it an effective method for removing these particles from water systems.

- **Electrocoagulation:** electrocoagulation is an effective method for microplastic removal, involving the electrical production of coagulants that destabilize and entrap microplastics, facilitating their removal from water.

- **Distillation:** water distillation is a highly effective method for removing microplastics, involving boiling water and collecting the condensation, which leaves impurities like microplastics behind. However, it is less practical for large-scale use.

- **Reducing plastic use:** a sustainable, long-term solution to microplastic pollution is to reduce plastic consumption. By minimising the use of single-use plastics and choosing reusable alternatives, the input of microplastics into the environment can be significantly reduced.

SIGNIFICANCE OF WETLANDS

- **Biodiversity and Habitat:** Wetlands and lakes are highly productive ecosystems that sustain a diverse array of plant and animal species, many of which are endangered or at risk. These environments serve as crucial habitats for various wildlife populations. Wetlands and lakes play a critical role in supporting migratory bird populations by acting as essential stopover sites and wintering grounds.
- **Water Quality and Quantity:** Wetlands function as natural filtration systems, capturing sediments and absorbing pollutants, thereby enhancing water quality. They also play a pivotal role in regulating water levels by storing excess water during periods of flooding and releasing it gradually, which helps mitigate downstream flooding and erosion.
- **Flood and Storm Protection:** Coastal wetlands, such as mangroves and salt marshes, provide vital protection for shorelines, mitigating erosion and reducing the impact of severe storms and hurricanes. Inland wetlands and lakes serve as reservoirs for floodwaters, lessening flood heights and minimising associated damages.
- **Economic and Recreational Benefits:** Wetlands and lakes offer significant natural resources, including fish, shellfish, timber, and wild rice, which support local economies and livelihoods. Moreover, they provide recreational opportunities such as fishing, hunting, birdwatching, and photography, which contribute to economic activity and tourism.
- **Climate Regulation:** Wetlands play a crucial role in carbon sequestration and storage, aiding in the global regulation of climate by capturing and storing substantial amounts of carbon dioxide.

Prelims Based Question

Q1. Consider the following statement:

1. Microplastics are tiny plastic particles with a size less than 5 mm.

2. Electrocoagulation is one of the most effective measures to remove microplastic from aquatic ecosystems.

Choose the correct answer using the codes given below:

1. 1 Only
2. 2 Only
3. Both 1 and 2
4. Neither 1 nor 2

ANSWER: C

Mains Based Question

Q1. Analyse the public health implications of high microplastic levels in consumable aquatic organisms, as highlighted by the study on Ashtamudi Lake. What measures can be taken to mitigate these risks?

Vikas

ECONOMIC CAPITAL FRAMEWORK (ECF)

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "ECONOMIC CAPITAL FRAMEWORK (ECF)". THIS TOPIC IS RELEVANT IN THE "ECONOMY" SECTION OF THE UPSC CSE EXAM.

WHY IN THE NEWS?

The Reserve Bank of India (RBI) recently approved the transfer of Rs 2.11 lakh crore as a dividend to the Government of India for the financial year 2023-24. This is the highest-ever dividend despite the Contingent Buffer Risk being increased to 6.5% for 2023-24. The transferable surplus for the year (2023-24) has been arrived at based on the Economic Capital Framework (ECF).

ABOUT ECONOMIC CAPITAL FRAMEWORK(ECF):

- The Economic Capital Framework (ECF) is an extensive risk management mechanism mainly utilised by financial institutions to ascertain the capital required to maintain solvency and protect against assorted risks.
- It offers a systematic approach for calculating the suitable amount of risk provisions and the distribution of profits, as mandated by Section 47 of the RBI Act, 1934.
- According to these provisions, the central bank must transfer its remaining profits to the central government after setting aside funds for potential bad debts, asset depreciation, and staff benefits.
- The old Economic Capital Framework (ECF) was formulated during 2014-15 and became functional in the fiscal year 2015-16. In 2018, the Reserve Bank of India (RBI) established an Expert Committee led by Dr Bimal Jalan to assess the existing ECF and recommend an appropriate policy for surplus distribution.

- On August 26, 2019, the Reserve Bank of India implemented a new Economic Capital Framework (ECF) based on the suggestions from the **Bimal Jalan Committee**, which is Subject to a review every five years.
- The Economic Capital Framework helps the RBI manage financial risks by determining the surplus reserves it can transfer to the government. The Expert Committee recommended that the Reserve Bank of India's (RBI) surplus distribution policy should include not just the total economic capital—comprising capital, reserves, risk provisions, and revaluation balances—but also realised equity, including capital, reserve fund, and risk provisions.
- They advised that the RBI's total economic capital should be between 20.8% and 25.4% of its balance sheet, with the Contingent Risk Buffer (CRB), designed for monetary, fiscal stability, credit, and operation risks, maintained at 5.5-6.5%. The CRB acts as a national financial stability reserve. If realised equity exceeds required levels, all of RBI's net income goes to the government; if below, risk provisioning is prioritised, and only the remainder is transferred.

KEY OBJECTIVES OF THE ECONOMIC CAPITAL FRAMEWORK(ECF) INCLUDE:

1. **Financial Stability**: Ensure the RBI has sufficient capital to manage financial and operational risks, thereby maintaining financial stability.
2. **Risk Management**: Enhance the RBI's ability to absorb losses from its operations and external shocks.
3. **Transparent Surplus Distribution**: Establish a systematic approach to distributing surplus reserves to the government, balancing the need for the RBI to maintain adequate reserves and the government's fiscal needs.
4. **Regulatory Compliance**: Align the RBI's practices with international best practices for central banks, ensuring a robust and transparent financial management framework.

ABOUT BIMAL JALAN COMMITTEE:

In 2018, the Reserve Bank of India established a committee led by Dr Bimal Jalan to evaluate its Economic Capital Framework. The primary goal of this committee was to recommend an appropriate framework for risk provisioning and capital requirements for the RBI. **The recommendations of the committee are**:

1. **Realised Equity**: The committee recommended that the RBI maintain a Contingent Risk Buffer (CRB) of 5.5% to 6.5% of its balance sheet. This buffer is meant to cover monetary and financial stability risks.
2. **Revaluation Balances**: The committee recommended treating the revaluation balances (gains from currency and gold revaluation) separately and not using them to meet operational losses.
3. **Surplus Distribution**: It proposed a clear distinction between realised and unrealised gains. Only realised gains (net income) should be available for distribution as surplus to the government.
4. **Periodicity of Review**: The ECF should be reviewed periodically (every five years) to ensure it remains relevant and effective.

In August 2019, the RBI adopted most of the Jalan Committee's recommendations, establishing an updated Economic Capital Framework. This revamped framework introduces a more transparent and systematic approach to defining capital levels and risk provisioning.

CONCLUSION:

The Economic Capital Framework is pivotal in enabling financial institutions to manage their risk exposure effectively, efficiently allocate capital, and comply with regulatory requirements. It ensures the financial system remains stable and promotes a clear and transparent process for distributing surplus with the government. The framework has evolved under the guidance of the Bimal Jalan Committee's recommendations to harmonise the RBI's operations with international norms while catering to the unique needs of domestic financial stability.

MAINS PRACTICE QUESTIONS:

Q. How do regulatory bodies view financial institutions' use of the Economic Capital Framework, and how does this impact compliance requirements?

Amit Pradhan