International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 20s, (2025)
https://theaspd.com/index.php/ijes

A Review of the Ecological and Hydrological Dynamics of Rewasa Salt Lake: Implications for Avian Diversity and Water Quality Management

Pooja Jangir[1], Rashmi Sharma[2]
[1,2]Department of Zoology, SPC Govt. College, Ajmer, Rajasthan, India.

Corresponding author's email: p.k.jangir996@gmail.com

Abstract
Rewasa Salt Lake, situated in Sikar, Rajasthan, India, is an ecologically significant hypersaline water body in the arid Thar Desert. As an endorheic lake, it accumulates salts due to the absence of outflow, creating a unique environment characterized by high salinity levels. Despite the harsh climatic conditions, it supports a variety of specialized flora and fauna, including halophytic plants and migratory bird species. The lake plays a critical role in the Central Asian Flyway, providing a vital stopover for migratory birds. However, human-induced pressures such as agricultural runoff, wastewater discharge, and industrial pollution threaten the lake's water quality, leading to a transition from oligotrophic to eutrophic conditions, which disrupts the ecosystem. This review explores the key physicochemical parameters of salt lakes, including salinity, pH, temperature, and nutrient concentrations, which govern biodiversity. These factors influence species distribution, food availability, and the physiological tolerances of organisms in such extreme environments. Salt lakes, though challenging habitats, are crucial for supporting bird species like Wilson's Phalaropes and American Avocets, which have adapted to high salinity environments through specialized salt glands and behavioral strategies. However, anthropogenic activities have caused nutrient loading, eutrophication, and alterations to the lake's ecological balance, impacting both invertebrate and avian populations.
The review further compares Rewasa Salt Lake with other saline lakes globally highlighting shared challenges of salinization, contamination, and the need for effective conservation strategies. The importance of maintaining water quality, regulating nutrient inputs, and implementing sustainable management practices is emphasized. The paper concludes by recommending integrated management approaches involving monitoring of physicochemical parameters, mitigation of pollution, and community engagement to preserve the ecological integrity of Rewasa Salt Lake and similar ecosystems. Such efforts are essential to sustain the biodiversity and ecological services provided by these unique habitats.
Keywords: *Rewasa Salt Lake, salinity, avian biodiversity, eutrophication, conservation strategies*

INTRODUCTION

Rewasa Salt Lake, located in the Sikar district of Rajasthan, India, is an ecologically significant site situated within the arid zone of the Thar Desert. As an endorheic lake, it accumulates salts and minerals due to the absence of drainage to the sea, resulting in a hypersaline environment. The surrounding landscape, characterized by desert soils and sandy plains, experiences extreme temperature variations and low annual rainfall (525-675 mm), contributing to the lake's unique ecological characteristics. Despite its harsh conditions, Rewasa Salt Lake supports a diverse range of flora and fauna, including specialized plant species like halophytes and various avian species, particularly migratory birds. The lake serves as a vital stopover for birds migrating across the Indian subcontinent, offering crucial feeding and breeding grounds (Kotia, 2003; Chitrakshi & Haritash, 2022). However, human-induced pressures such as agricultural runoff, wastewater discharge, and industrial pollution threaten the water quality and ecological health of the lake, highlighting the urgent need for conservation strategies.
Water quality is fundamental in determining the health of aquatic ecosystems, especially in salt lakes. Key physicochemical parameters, including salinity, pH, dissolved oxygen, temperature, and nutrient concentrations, directly influence biodiversity. Salt lakes, especially those in arid regions, are defined by high salinity due to evaporation exceeding precipitation. This selective environment supports extremophilic organisms, such as halophilic bacteria and archaea, which play vital roles in biogeochemical

cycles like nitrogen and sulfur cycling. These parameters also regulate the abundance and distribution of both aquatic organisms and higher trophic levels, including birds. Seasonal variations in these factors, particularly temperature and nutrient concentrations, further influence the biological productivity and species interactions in salt lake ecosystems (Gao et al., 2024; Sacco et al., 2021).

Despite the extreme conditions, salt lakes provide critical habitats for both resident and migratory birds. The availability of food sources like brine shrimp and algae makes these lakes vital for supporting the energy needs of migratory birds, especially in regions with limited freshwater resources. The diversity of avian species in these lakes is closely linked to water quality parameters such as nutrient levels and salinity (Sacco et al., 2021; Herbst, 2001). For Rewasa Salt Lake, anthropogenic activities, such as nutrient loading from agricultural runoff, can lead to eutrophication, which alters bird habitats and reduces biodiversity. Maintaining stable water quality is essential for preserving the unique avian populations dependent on the lake (Chitrakshi & Haritash, 2022; Zhang & Li, 2024).

This review aims to provide a comprehensive overview of the ecological and hydrological dynamics of Lake system with possible relevance to Rewasa Salt Lake, with a focus on its implications for avian diversity and water quality management. The review will address the role of physicochemical parameters in shaping biodiversity, the impact of human-induced pressures on water quality, and the need for integrated conservation strategies to ensure the preservation of this vital ecosystem. Through a comparative analysis with other saline lakes globally, this review seeks to highlight effective management practices and provide recommendations for sustainable conservation of Rewasa Salt Lake and similar ecosystems.

Physicochemical Parameters in Salt Lake Ecosystems

Physicochemical parameters of water are crucial for understanding the ecological dynamics and health of salt lake ecosystems. These parameters, including salinity, pH, temperature, total dissolved solids (TDS), electrical conductivity (EC), and concentrations of ions like chloride, sulfate, and nitrate, directly influence species distribution and ecosystem processes. The unique characteristics of salt lakes make the study of these parameters essential for effective conservation and management. Salinity is one of the most critical parameters in salt lakes, as it dictates the ionic composition and overall chemical balance of the water. Salt lakes, especially those in arid regions, are characterized by high salinity levels due to the low rainfall and high evaporation rates that concentrate dissolved salts over time. High salinity can limit the range of species that can survive in such environments, as most organisms in freshwater habitats are not adapted to these extreme conditions. For instance, the Puthalam saltpan in India, with its high salinity, exhibits altered species distribution, as only halophytes and other salt-adapted organisms can thrive in such an environment (Banu & Reginald, 2010). The pH of salt lakes also varies, generally ranging from slightly acidic to alkaline. These pH variations influence nutrient and metal solubility, which directly affects the biological activity and growth of aquatic organisms (Abid & Saxena, 2015).

Temperature fluctuations in salt lakes play a crucial role in water column stratification and nutrient cycling. Seasonal temperature changes, such as those observed in Lake Nasser, significantly impact water quality and the biological distribution of species within the lake. For example, higher temperatures in the summer lead to increased salinity and reduced dissolved oxygen levels, which affects the health of aquatic species. Electrical conductivity (EC) and TDS are also important indicators of water quality, as they measure the concentration of dissolved ions in the water. High EC and TDS levels typically indicate elevated ionic strength, which can alter habitat suitability for various species, particularly those sensitive to ion concentration changes. In the case of Keana Salt Lake, Nigeria, elevated salinity and TDS levels pose ecological risks, as the high ion concentration exceeds permissible limits, affecting local biodiversity (Ogah, 2020). Rewasa Salt Lake, located in the Sikar district of Rajasthan, India, provides an example of how water chemistry in salt lakes is influenced by natural processes like rock-water interactions and silicate weathering. The lake primarily contains magnesium bicarbonate ($MgHCO3$) and calcium magnesium chloride (CaMgCl), with chloride ions originating from both natural and anthropogenic sources. The Nitrogen:Phosphorus (N:P) ratio of 10:1 indicates that the lake is transitioning from oligotrophic to eutrophic conditions due to nutrient inputs from agricultural runoff and wastewater discharge, leading to potential algal blooms that can degrade water quality and biodiversity (Chitrakshi & Haritash, 2022).

Seasonal changes such as temperature fluctuations and precipitation patterns have a profound effect on the physicochemical parameters of salt lakes, influencing both water quality and ecological processes. For instance, in Adzhi-Baichi Lake, seasonal temperature increases result in higher salinity and reduced dissolved oxygen levels, patterns that can similarly affect Rewasa Salt Lake (Rudneva et al., 2021). These seasonal dynamics also influence parameters like pH and EC, which help assess how the lake responds to climate and water availability changes. Temperature and salinity tend to rise in warmer months, affecting the ionic environment and biological distribution (Kumar & Prasad, 2015; Solanki et al., 2015). To maintain the ecological balance in salt lakes, it is essential to monitor key physicochemical parameters such as pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), TDS, and concentrations of ions like chloride, sulfate, calcium, and magnesium. These parameters influence the solubility of nutrients and gases, the ionic content of the water, and the overall habitat suitability for various species. Regular monitoring of these factors is critical for understanding and managing the complex dynamics of salt lake ecosystems (Lapa et al., 2024).

Moreover , the physicochemical parameters of salt lakes are vital for assessing the ecological health of these unique ecosystems. Changes in parameters like salinity, pH, and temperature can significantly impact species diversity and ecosystem functioning. Monitoring these parameters is crucial for implementing effective management and conservation strategies, ensuring the continued ecological integrity of salt lake ecosystems.

Table 1: Physicochemical parameters of the Lake system and their Ecological implications

Physicochemical Parameter	Description	Ecological Relevance	Impact on Biodiversity	References
Salinity	High salt concentration due to evaporation.	Influences water chemistry, supports extremophiles.	Supports halophytes and migratory birds, but extreme levels limit species diversity.	Chitrakshi & Haritash (2022); Waiser & Robarts (2009)
pH	Acidity or alkalinity of the water.	Affects nutrient and metal solubility.	Alkaline conditions support more diverse species; acidic limits fauna diversity.	Timms (2009); Herbst (2001)
Dissolved Oxygen (DO)	Oxygen dissolved in the water.	Essential for aquatic life, especially invertebrates.	Low DO stresses aquatic life and reduces food availability for birds.	Devkota & Joshi (2022); Gao et al. (2024)
Temperature	Seasonal fluctuations in water temperature.	Affects oxygen solubility and nutrient cycling.	Affects species distribution and abundance.	Kumar & Prasad (2015); Solanki et al. (2015)
Total Dissolved Solids (TDS)	Concentration of dissolved ions in the water.	Affects ionic environment and habitat suitability.	High TDS limits habitat suitability for some species.	Nayak & Mohanty (2018); Ogah (2020)
Electrical Conductivity (EC)	Measures water's ionic strength, related to salinity.	Indicates dissolved ions concentration.	High EC alters species composition and affects invertebrates.	Lapa et al. (2024); Borzenko (2022)
Chloride Ions	Key ion in salt lake water.	Affects chemical composition and salinity.	Influences species survival, particularly halophytes.	Chitrakshi & Haritash (2022); Waiser & Robarts (2009)

Nitrate and Phosphate	Nutrients from agricultural runoff.	Lead to nutrient loading and eutrophication.	Causes algal blooms, reducing oxygen and food availability.	Islam (2023); Ioannidou & Stefanakis (2020)

Avian Diversity in Salt Lake Ecosystems

Salt lake ecosystems provide critical habitats for a variety of avian species, particularly those adapted to survive in high-salinity environments. These birds have developed remarkable physiological adaptations, enabling them to thrive in conditions that would otherwise be inhospitable. One such adaptation is the development of large kidneys and specialized supraorbital salt glands (SSGs), which help birds excrete excess salt and maintain osmoregulatory balance (Chiu et al., 2024). This adaptation is seen across various bird species in saline habitats, such as Wilson's Phalaropes and American Avocets, which exhibit behaviors that minimize salt-loading. For instance, they remove salt-laden water from their prey before ingestion, reducing the intake of harmful ions. These birds primarily rely on the fluids from brine shrimp and brine flies, which thrive in hypersaline lakes due to the absence of fish predators (Mahoney & Jehl, 1985; Conover & Bell, 2020). Salt glands in these birds secrete a hyperosmotic fluid, further aiding in the excretion of ingested ions and supporting their survival in saline environments (Holmes & Phillips, 1985).

Rewasa Salt Lake in Sikar, Rajasthan, plays a crucial role as a habitat for migratory birds, particularly those reliant on saline and alkaline ecosystems. Although direct studies on Rewasa are limited, similar salt lakes provide insights into the importance of such habitats for migratory species. Birds like Wilson's Phalaropes and American Avocets frequent salt lakes, benefiting from abundant invertebrate populations (Mahoney & Jehl, 1985). The Central Asian Flyway, which includes Rajasthan, is a significant migratory route for over 180 species of waterbirds, including pelicans, ducks, and cranes. These birds rely on wetlands like Rewasa for resting and refueling, replenishing energy reserves during migration (Szabo & Mundkur, 2017; Donnelly et al., 2019). However, these critical habitats are increasingly threatened by human activities such as land reclamation, pollution, and climate change, which disrupt migratory patterns and reduce reproductive success (Smith & Deppe, 2008). Therefore, maintaining the ecological integrity of salt lakes like Rewasa is vital for supporting diverse avian populations.

Changes in water quality significantly affect avian populations in salt lakes. Poor water quality, marked by high salinity, low dissolved oxygen (DO), and pollution, can reduce avian diversity. High salinity levels, for example, limit the number of species that can survive, as these organisms have narrow salinity tolerance ranges. The presence of heavy metals such as lead, mercury, and cadmium can lead to bioaccumulation in birds, causing health problems like organ damage and reproductive issues (Aslam et al., 2024; Pandiyan et al., 2023). Anthropogenic activities like agricultural runoff and industrial pollution exacerbate these effects by degrading the habitat and reducing the availability of clean water, which is critical for the survival of aquatic birds (Singh et al., 2021). Eutrophication, driven by excessive nutrient inputs, can lead to algal blooms, depleting oxygen levels and reducing water clarity, negatively impacting species that depend on clear water for feeding, such as diving ducks (Álvarez-Cobelas, 2010). Studies have shown that maintaining high water quality is essential for supporting avian biodiversity, as ponds with better water quality tend to support higher species richness and greater trophic diversity (Sekhon et al., 2024). Therefore, managing water quality in Rewasa Salt Lake is crucial for preserving avian populations.

Salt lakes in arid and semi-arid regions, such as the Great Salt Lake and the Salton Sea, serve as essential habitats for migratory and resident bird populations. These ecosystems offer abundant food sources, including brine shrimp and brine flies, which thrive in hypersaline environments (Sacco et al., 2021; Conover & Bell, 2020). Conservation efforts for these habitats should focus on managing salinity levels, improving water quality, and ensuring habitat availability, thus supporting migratory birds and maintaining ecological balance (Shuford et al., 2002). Rewasa Salt Lake, with its diverse bird species, is part of this global conservation challenge, highlighting the need for integrated management practices to protect these vital ecosystems.

Table 2: Avian Diversity and Ecological Parameters in the Lake system.

Avian Species	Adaptations to Hypersaline Environments	Food Sources	Impact of Water Quality on Avian Populations	References
Wilson's Phalarope	Specialized salt glands to excrete excess salt.	Brine shrimp, brine flies	Sensitive to changes in salinity and DO, requires stable conditions for feeding and breeding.	Mahoney & Jehl (1985); Herbst (2001)
American Avocet	Large kidneys and supraorbital salt glands for salt excretion.	Brine shrimp, brine flies	Affected by salinity fluctuations and eutrophication; stable water quality is crucial for survival.	Herbst (2001)
Flamingos	Salt tolerance via specialized feeding behavior.	Algae, brine shrimp	Depend on stable salinity levels for feeding; high salinity can reduce prey availability.	Conover & Bell (2020); Sacco et al. (2021)
Pelicans	Adapted to saline conditions through specialized osmoregulatory systems.	Fish, small invertebrates	High salinity and low DO can affect feeding efficiency and chick survival.	Szabo & Mundkur (2017); Manning & Paul (2003)
Ducks (Various Species)	High tolerance to saline environments; behavioral adaptations to avoid salt-loading.	Algae, aquatic invertebrates	Eutrophication and reduced DO impact feeding grounds and migration patterns.	Frank (2016); Belovsky et al. (2011)

Interactions Between Physicochemical Parameters and Avian Diversity

The physicochemical parameters of salt lake ecosystems, including salinity, pH, dissolved oxygen, and nutrient levels, play a significant role in determining the avian species composition and overall biodiversity. These factors directly influence the availability of food resources and the physiological tolerances of bird species, making them essential in shaping bird populations in these unique environments.

Salinity is one of the most critical factors for salt lake ecosystems, impacting both invertebrate and avian species richness and distribution. High salinity levels tend to limit species diversity, particularly in hypersaline lakes. For instance, in the Paroo region of Australia, avian species richness is generally lower in hypersaline lakes, indicating that extreme salinity levels may restrict bird diversity (Timms, 2009). Similarly, in the Great Basin of North America, high salinity levels are linked to reduced populations of both invertebrates and waterbirds, showing that birds can only tolerate a narrow range of salinity (Senner et al., 2020). In contrast, species like the greater flamingo and slender-billed gull in the Algerian Sahara show a preference for more saline environments (Betrouche & Moulaï, 2021). Behavioral adaptations in species such as Wilson's Phalaropes and American Avocets further illustrate the role of salinity. These birds avoid excessive salt-loading by removing excess lake water from their prey before ingestion, thus minimizing the intake of harmful ions (Mahoney & Jehl, 1985). Despite the challenges posed by high salinity, these environments remain attractive to birds due to abundant food sources like brine shrimp and brine flies (Roberts, 2013).

pH levels also significantly influence bird populations in salt lakes. Acidic environments, created by groundwater with low pH, can limit fauna diversity. On the other hand, alkaline lakes generally support more diverse bird populations. For example, Western Australia's acid groundwaters create low pH conditions that restrict avian diversity, whereas alkaline lakes tend to host more diverse bird species

(Timms, 2009). This emphasizes the importance of maintaining stable, alkaline conditions to support a broader range of species.

In addition to salinity and pH, other factors such as dissolved oxygen, nutrients, and turbidity directly affect the suitability of salt lake habitats for birds. Dissolved oxygen (DO) is essential for sustaining aquatic life, which in turn supports bird populations. In Gökçeada Salt Lake, fluctuations in DO levels due to seasonal eutrophication impact zooplankton abundance, a critical food source for waterbirds (Aslan et al., 2021). Similarly, in the Great Salt Lake, the availability of brine shrimp and brine flies, which are important food sources for birds like Eared Grebes, is closely linked to oxygen levels and nutrient dynamics (Conover & Bell, 2020). Nutrient levels, particularly nitrogen and phosphorus, are vital in driving phytoplankton production, which forms the foundation of the food web in salt lakes. In the Great Salt Lake, nutrient availability is a limiting factor for phytoplankton growth, affecting the entire food chain up to the bird species that rely on these primary producers (Belovsky et al., 2011). High turbidity, often caused by human activities, can negatively affect light penetration, reducing the growth of submerged plants and algae that serve as food sources for birds (Russell et al., 2014). Turbidity also degrades the habitat and limits food availability, further compromising the ecosystem's ability to support diverse bird populations (Aslan et al., 2021).

Seasonal changes in water quality have profound effects on bird migration patterns and population health. Fluctuations in water levels and salinity in the Great Salt Lake, for example, influence the abundance of brine flies and shrimp, which are essential food sources for migratory birds like phalaropes and grebes (Manning & Paul, 2003; Frank, 2016; Roberts, 2013). Similarly, seasonal eutrophication and pollution in Gökçeada Salt Lake have altered water quality, impacting bird abundance and diversity (Aslan et al., 2021). Seasonal variations in water quality, driven by factors such as nutrient loading from bird excrement and climate-induced changes, can lead to shifts in bird migration patterns, with birds altering their stopover sites depending on food availability and habitat quality (Sorensen et al., 2020). Therefore, comprehensive monitoring of these physicochemical factors is crucial for managing and conserving salt lake habitats to ensure they continue to support healthy migratory bird populations.

Table 3: Influence of Water Quality Parameters on Avian Species in the Lake system

Water Quality Parameter	**Impact on Avian Species**	**Threshold Levels for Optimal Avian Habitat**	**References**
Salinity	High salinity supports halophilic bird species but extreme levels limit diversity.	Optimal salinity levels for species like flamingos and phalaropes.	Waiser & Robarts (2009); Timms (2009)
Dissolved Oxygen (DO)	Low DO can result in hypoxic conditions, reducing available food and impacting bird health.	Stable DO levels above 5 mg/L are essential for most waterfowl.	Devkota & Joshi (2022); Gao et al. (2024)
Nutrient Levels (Nitrogen, Phosphorus)	Excessive nutrients lead to eutrophication, reducing food availability for birds.	Low nutrient concentrations to prevent algal blooms and oxygen depletion.	Islam (2023); Ioannidou & Stefanakis (2020)
pH	Extreme pH levels (either acidic or highly alkaline) can limit biodiversity.	Slightly alkaline conditions (pH 7-9) support a wider range of species.	Timms (2009); Herbst (2001)
Temperature	Temperature fluctuations affect breeding and migration patterns of birds.	Stable temperatures that do not exceed optimal thresholds for breeding.	Kumar & Prasad (2015); Frank (2016)

Human Impacts on Water Quality and Avian Populations

Human activities significantly influence the physicochemical parameters of salt lakes, impacting their salinity and overall water quality. One major contributing factor is the diversion of water for irrigation, which has caused the drying of major salt lakes, such as the Great Salt Lake, the Dead Sea, and Lake Urmia. The diversion increases salinity and alters microbial communities, disrupting the food web (Oren, 2009). In regions like western China, human actions have led to the shrinkage and salinization of inland lakes, exacerbating water salinization due to irrigation and freshwater shortages (Zhihua et al., 2011). Urbanization and land-use changes further intensify these effects, such as in Baiyangdian Lake, where wastewater discharges from expanded urban areas degrade water quality (Huang et al., 2016).

The cumulative effects of these changes are linked to freshwater salinization syndrome, which results from the interaction of human activities, climate, and geology, leading to ecosystem dysfunctions (Kaushal et al., 2022). This anthropogenic salinization of inland waters poses long-term environmental challenges, emphasizing the need for effective management strategies.

Agricultural runoff and wastewater are additional significant sources of contamination in salt lakes. Fertilizers and pesticides used in agriculture introduce pollutants like nitrates and phosphates into water bodies, contributing to eutrophication and increasing salinity levels. These changes disrupt the delicate balance in saline ecosystems, which have a narrow salinity tolerance for both invertebrates and birds (Ioannidou & Stefanakis, 2020). For example, in the Great Salt Lake, rising salinity due to human activity has led to a decline in brine shrimp and brine fly populations, critical food sources for migratory birds. The reduction in these prey species has negatively impacted avian populations that depend on the lake for their migratory stopovers (Roberts, 2013). The introduction of heavy metals from agricultural runoff and industrial wastewater also degrades water quality, posing risks to both aquatic life and human health (Aslan et al., 2021). Mitigation strategies, such as constructed wetlands, have been proposed to treat agricultural runoff and reduce nutrient and pollutant loads before they reach sensitive ecosystems (Ioannidou & Stefanakis, 2020). However, the success of these interventions depends on maintaining proper management and monitoring to ensure water levels and salinity remain within natural ranges to support diverse biological communities (Senner et al., 2020; Stephens & Arnow, 1987).

Conserving water quality and avian populations in salt lakes is challenging due to issues like eutrophication and pollution, which are exacerbated by the accumulation of toxic chemicals. Hypersaline ecosystems, like the Salton Sea, face declines in fish and bird populations due to increasing salinity and nutrient runoff, highlighting the stress on these habitats. Similarly, the Great Salt Lake faces declining water levels due to climate change and human activities, further stressing its avian habitats (Baxter & Butler, 2020). Proactive management, including monitoring and maintaining water levels and salinity, is crucial for improving avian populations (Tatenhove et al., 2024). Holistic approaches, integrating ecological, hydrological, and climatic factors, are necessary for the sustainable conservation of salt lake ecosystems (Takekawa et al., 2015).

Case Studies and Comparative Analysis

Rewasa Salt Lake in Rajasthan, India, offers a distinct case for comparison with other saline lakes globally due to its unique geochemical and ecological dynamics. Situated in an arid region, it exhibits high salinity levels resulting from evaporation exceeding precipitation, a common feature in saline lakes worldwide (Singh et al., 2021; Waiser & Robarts, 2009). The water quality of Rewasa is shaped by natural geochemical processes, such as rock-water interactions and silicate weathering, which result in MgHCO3 and CaMgCl water types. However, like many saline lakes, Rewasa is transitioning from oligotrophic to eutrophic conditions due to nutrient inputs from agricultural runoff and wastewater, highlighting the need for effective management interventions (Chitrakshi & Haritash, 2022).

Comparing Rewasa with other Indian lakes, such as Sambhar Lake, reveals similar challenges of contamination, salinization, and the need for sustainable management to prevent ecosystem degradation. Globally, lakes like the Great Salt Lake and the Dead Sea face issues like water diversion and mineral extraction, which exacerbate salinity and pollution, affecting their ecological balance (Singh et al., 2021; Waiser & Robarts, 2009). Despite these challenges, saline lakes provide critical ecological services, such as supporting migratory bird populations and serving as mineral resources. Management strategies from global examples, such as the Great Salt Lake and Lake Urmia, emphasize the need for collaborative management involving local stakeholders (Wurtsbaugh & Sima, 2022). In Rajasthan, conservation efforts should consider both natural dynamics and human impacts on lakes (Roy, 1999). The National Lake Conservation Plan highlights the need for comprehensive strategies to address watershed degradation, pollution, and urbanization (Gopal & Chauhan, 2005).

Saline lakes globally face threats from drying, pollution, and climate change, as seen in the Orumieh Lake case (Heydari & Jabbari, 2012). Effective conservation of these lakes requires international cooperation, as demonstrated by restoration efforts for the Aral Sea (Williams, 1993). In Rajasthan, climate change poses additional threats to aquatic ecosystems, necessitating adaptive management (Chahar & Mukherji, 2022). A multifaceted approach integrating ecological understanding, stakeholder collaboration, and adaptive management is essential for conserving Rewasa Salt Lake and similar ecosystems.

CONCLUSION

Rewasa Salt Lake, located in Sikar, Rajasthan, is a vital ecological site, playing a significant role in supporting diverse species of flora and fauna, including halophytes and migratory birds. However, this ecological balance is increasingly threatened by human activities, particularly agricultural runoff, wastewater discharge, and industrial pollution. These anthropogenic pressures are shifting the lake from an oligotrophic to a eutrophic state, leading to nutrient imbalances, algal blooms, and the degradation of its ecosystem. The lake serves as a critical stopover for migratory birds, especially species adapted to hypersaline environments, thus making it crucial for regional biodiversity. Unfortunately, the deterioration of water quality, driven by human-induced factors, poses a serious threat to both the lake's biodiversity and its role in supporting migratory bird populations.

The conservation and management of Rewasa Salt Lake require a comprehensive and multi-faceted approach that tackles the underlying causes of water quality degradation. Regular monitoring of key physicochemical parameters such as salinity, pH, dissolved oxygen, and nutrient concentrations is essential to assess the health of the ecosystem and to ensure it remains conducive to supporting the species that depend on it. As salinity and nutrient levels continue to rise, immediate action is required to mitigate the effects of eutrophication. Reducing the impacts of agricultural runoff and wastewater discharge is essential to preserving the ecological integrity of the lake, ensuring that it can continue to support its unique biodiversity, including migratory birds.

To effectively safeguard the ecological health of Rewasa Salt Lake, policy interventions and sustainable practices are necessary. Establishing a robust water quality monitoring system to track the lake's key physicochemical parameters will aid in managing this delicate ecosystem. Regulations to control agricultural runoff and wastewater discharges, coupled with the promotion of sustainable farming practices, are critical to preventing further degradation. Constructed wetlands may also be useful in filtering nutrients and pollutants before they reach the lake. Moreover, protecting critical habitats for migratory birds is essential, as these areas serve as vital stopover sites during their long migrations. Public engagement and heightened community awareness of the lake's ecological importance are key components of any conservation effort. Collaboration among local stakeholders—farmers, industries, and conservationists—is crucial for the preservation of both biodiversity and water quality. The ecological significance of Rewasa Salt Lake underscores the need for integrated conservation strategies. By managing water quality effectively and involving local communities in the conservation process, Rewasa can continue to provide essential habitats for both flora and fauna, safeguarding its ecological integrity for generations to come.

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