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Water Quality and Its Influence on Tilapia Health, Parasite Infections, and Human Use of Kibomet Dam in Trans-Nzoia County, Kenya

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ABSTRACT

Kibomet Dam is an important freshwater resource supporting domestic use, livestock watering, irrigation, and fisheries in Trans-Nzoia County, Kenya. Increasing agricultural pressure and catchment disturbance, however, pose risks to its ecological integrity and public health value. This study assessed seasonal variation in water quality and examined its association with the health, parasite burden, and condition of Oreochromis niloticus (Nile tilapia), with implications for the sustainable use of dam water. Water sampling was conducted from November 2024 to December 2025 at three stations representing the inlet, mid-reservoir, and outlet during both dry and wet seasons. Physicochemical parameters were measured using standard American Public Health Association (APHA) methods and included temperature, pH, dissolved oxygen (DO), turbidity, electrical conductivity, ammonia, nitrate, and phosphate. Recorded seasonal values included dry-season temperatures of 24.8 ± 1.6 °C, wet-season DO of 3.6 ± 0.9 mg/L, and dry-season DO of 5.1 ± 0.8 mg/L. Wet-season measurements included turbidity of 43 ± 18 NTU, conductivity of 168 ± 70 µS/cm, ammonia of 0.16 ± 0.06 mg/L, nitrates of 26 ± 9 mg/L, and phosphates of 2.1 ± 0.8 mg/L. A total of 250 tilapia were sampled quarterly using standardised gill nets. Fish were examined for ecto- and endoparasites following established parasitological procedures. Five parasite taxa were identified: Trichodina spp. (34%), Cichlidogyrus spp. (28%), Diplostomum spp. (16%), Acanthocephalus spp. (12%), and zoonotic Neascus spp. (10%). Fish from high-pollution zones recorded parasite intensity values of 14 ± 4 and condition factors of 1.32 ± 0.15, while low-pollution zones recorded 6 ± 2 and 1.65 ± 0.12, respectively. Correlation coefficients included DO ($r = -0.48$), ammonia ($r = 0.44$), phosphates ($r = 0.41$), and turbidity ($r = 0.39$). The study provides a structured framework for integrated water quality and fish health monitoring to support effective management and safe utilisation of Kibomet Dam.

INTRODUCTION

Freshwater ecosystems are vital for biodiversity conservation, food security, and human livelihoods, particularly in sub-Saharan Africa. In Kenya, small dams serve as important sources of fish protein, irrigation water, livestock watering, and domestic use. However, increasing anthropogenic pressure from agriculture, settlement expansion, and climate variability has led to water quality degradation in many inland water bodies. Oreochromis niloticus (Nile tilapia) is the dominant cultured and captured fish species in Kenyan freshwater systems due to its fast growth, adaptability, and high consumer preference. Optimal water quality is essential for growth, immunity, and disease resistance. Parameters such as dissolved oxygen, temperature, pH, and nutrient concentrations directly influence fish physiology and susceptibility to parasites. Fish parasites are natural components of aquatic ecosystems but can proliferate under poor environmental conditions. Several studies in Kenyan lakes, dams, rivers, and fish ponds have reported parasites such as Trichodina, Cichlidogyrus, Diplostomum, and Acanthocephalus species, some of which have zoonotic potential or affect livestock through shared water use. Despite its socio-economic importance, Kibomet Dam has not been adequately studied in terms of ecological water quality and fish health interactions. Kibomet Dam is increasingly used for fishing, livestock watering, and domestic purposes by surrounding communities. However, unregulated agricultural runoff, sedimentation, and organic pollution threaten its water quality. Poor water conditions can compromise fish health, increase parasite prevalence, reduce fish productivity, and expose humans and livestock to water-borne parasites. The lack of scientific data on water quality status and parasite risks in Kibomet Dam limits effective management and public health protection providing baseline ecological and parasitological data necessary for sustainable fisheries management, food safety assurance, and public health protection to support county-level decision-making, guide community awareness initiatives, and contribute to existing knowledge on inland water bodies in Kenya.The study therefore investigates the ecological parameters of Kibomet Dam, their effects on tilapia health and parasite burden, and the implications for human and livestock use of the dam water.

LITERATURE REVIEW

Water Quality Dynamics in Small Tropical Reservoirs

Small dams and reservoirs in sub-Saharan Africa play a critical role in water supply, fisheries production, and rural livelihoods, yet they are highly vulnerable to water quality degradation due to agricultural intensification

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and catchment disturbance. Seasonal rainfall patterns strongly influence physicochemical conditions in tropical freshwater systems, particularly temperature, dissolved oxygen, turbidity, and nutrient concentrations (Wetzel, 2001). During wet seasons, surface runoff transports sediments, fertilisers, and organic matter into reservoirs, increasing turbidity, conductivity, and nutrient loading, while simultaneously reducing dissolved oxygen through increased biochemical oxygen demand (Ngugi *et al.*, 2013; Otieno *et al.*, 2020). Studies conducted in Kenyan lakes and dams, including Lake Victoria, Lake Naivasha, and several small reservoirs, have reported similar seasonal patterns characterised by higher turbidity and nutrient enrichment during rainy periods and comparatively stable conditions during dry seasons (Kolding *et al.*, 2008; Mugo-Bundi *et al.*, 2019). Nutrient enrichment, particularly elevated ammonia, nitrates, and phosphates, has been associated with eutrophication, algal blooms, oxygen depletion, and reduced water suitability for both aquatic organisms and human use (El-Sayed, 2006).

Effects of Water Quality on Tilapia Health

Oreochromis niloticus is one of the most widely cultured and harvested fish species in Africa due to its high tolerance to environmental variation, rapid growth, and importance as a protein source (El-Sayed, 2006). Despite its resilience, tilapia health and productivity are strongly influenced by water quality conditions. Dissolved oxygen is a key determinant of fish metabolism, growth, and immune competence, with prolonged exposure to hypoxic conditions resulting in physiological stress, reduced feeding efficiency, and increased disease susceptibility (Ibrahim & Abdulkarim, 2017). Temperature, pH, turbidity, and nutrient concentrations also play critical roles in shaping fish health. Elevated turbidity can impair respiration by clogging gill surfaces, reduce foraging efficiency, and alter predator–prey interactions, while high ammonia concentrations are directly toxic to fish tissues and disrupt osmoregulation (Wetzel, 2001). Studies in tropical aquaculture ponds and natural water bodies have consistently shown that poor water quality is associated with reduced condition factors, slower growth rates, and increased mortality in tilapia populations (Ngugi *et al.*, 2013; Mugo-Bundi *et al.*, 2019).

Fish Parasites and Environmental Stress

Fish parasites are natural components of aquatic ecosystems, but their prevalence and intensity are strongly influenced by environmental conditions and host health. Degraded water quality often favours parasite transmission by weakening host immune responses and enhancing the survival of infective stages or intermediate hosts (Marcogliese, 2005). The pollution–parasitism hypothesis proposes that anthropogenic stressors increase parasite burdens by reducing host resistance while simultaneously improving conditions for parasite development (Lafferty & Kuris, 1999). In East African freshwater systems, parasites such as Trichodina, Cichlidogyrus, Diplostomum, Acanthocephalus, and Neascus species have been widely reported in tilapia populations (Paperna, 1996; Akoll *et al.*, 2012). Ectoparasites, particularly protozoans and monogeneans, often dominate in nutrient-enriched or poorly oxygenated waters due to their direct life cycles and rapid reproduction (Marcogliese, 2005). Endoparasites and trematodes, although less prevalent, are of concern due to their complex life cycles and potential zoonotic implications (Chibwana *et al.*, 2013).

Public Health and Human Use Implications

Water bodies used simultaneously for fisheries, livestock watering, and domestic purposes present important public health considerations. Zoonotic fish parasites, such as Neascus spp., can pose risks to humans if fish are consumed raw or undercooked, while poor water quality increases exposure to water-borne pathogens for both humans and livestock (Johnson *et al.*, 2007). Several studies have highlighted the need for integrated water quality and fish health monitoring to protect food safety, public health, and ecosystem sustainability in rural African settings (Otieno *et al.*, 2020).

MATERIALS AND METHODS

Study Area

Kibomet Dam is located in Trans-Nzoia County, Kenya, within a predominantly rural and intensively cultivated agricultural landscape characterized by extensive maize production and dairy farming. The area lies within the highland plateau of the Rift Valley region at an average altitude of about 1,800 m above sea level, with generally flat to gently undulating terrain and fertile volcanic-derived soils that support large-scale crop and livestock farming. Trans-Nzoia County has a rapidly growing population, comprising a culturally diverse mix of communities groups, most of whom depend directly or indirectly on agriculture for their livelihoods. The climate of the region is cool and temperate, with mean annual temperatures ranging from approximately 11–13 °C at night to 23–28 °C during the day, and annual rainfall averaging between 1,000 and 1,700 mm, distributed across the long rains (March–May) and short rains (October–December). Kibomet Dam serves as an important multipurpose water resource for the surrounding communities, providing water for domestic use, livestock watering, small-scale irrigation, and artisanal fishing, particularly during periods of rainfall variability and dry spells. Environmental conditions around the dam reflect pressures associated with intensive agriculture, including surface runoff carrying sediments, fertilizers, and agro-chemicals, which may influence water quality and aquatic ecology. The surrounding communities engage mainly in farming, livestock rearing, small-scale trade, and related agro-based activities, with local infrastructure such as schools, rural access roads, and market centers supporting settlement and economic activities. Owing to its ecological importance, human dependence, and exposure to agricultural inputs, Kibomet Dam represents a suitable study site for assessing the interactions between water quality, aquatic ecosystems such as tilapia fish populations, and human use within an agricultural highland setting.

Water Quality Assessment

Water quality assessment was conducted through monthly sampling carried out from November, 2024 to December 2025, covering both the dry seasons (November 2024–February, 2025) and the wet seasons (March–May and June - October). Water samples were collected from three representative sampling stations within Kibomet Dam, selected to capture spatial variability, including the inlet zone influenced by agricultural runoff, the mid-reservoir open-water zone, and the outlet or abstraction point used by the community. At each station, surface water samples were collected at approximately 20–30 cm depth using pre-cleaned polyethylene bottles, following standard limnological sampling procedures. In situ measurements of temperature, pH, dissolved oxygen, electrical conductivity, and turbidity were taken using calibrated portable meters, while additional samples were preserved on ice and transported to the laboratory for analysis of nutrients (nitrates, phosphates, ammonia), total suspended solids, biochemical oxygen demand (BOD), chemical oxygen demand (COD), and selected heavy metals using standard APHA methods. Fish sampling focused on Oreochromis niloticus (tilapia) and was conducted concurrently with water sampling on a quarterly basis to minimize disturbance of the fish population. Fish were captured using standardized gill nets of varying mesh sizes set overnight at each sampling station to ensure representation of different size classes. Captured fish were identified, counted, measured for total length and weight, and examined for external health indicators before selected specimens were transported on ice to the laboratory for further analysis. Tissue samples (muscle, liver, and gills) were collected aseptically for assessment of bioaccumulation of contaminants and physiological responses, while stomach content analysis was used to support ecological interpretation. This integrated water and fish sampling approach allowed for seasonal and spatial evaluation of water quality dynamics and their ecological implications for tilapia populations and human use of Kibomet Dam.

The physicochemical water quality parameters

The measurement of physicochemical water quality parameters in Kibomet Dam was conducted using standard procedures consistent with APHA (2017) guidelines to ensure accuracy, reliability, and comparability of results. Water temperature (°C) was measured in situ at each sampling station using a calibrated digital thermometer or multiparameter probe immediately after sample collection to avoid temperature alteration due to atmospheric exposure. pH was determined on site using a portable digital pH meter, which was calibrated daily using standard buffer solutions (pH 4.0, 7.0, and 10.0). Dissolved oxygen (DO, mg/L) was measured in situ using a portable dissolved oxygen meter, calibrated prior to sampling, and readings were taken after allowing sufficient stabilization time at the sampling depth to ensure representative values. Electrical conductivity (µS/cm) was measured in situ using a portable conductivity meter standardized with potassium chloride (KCl) solution, providing an estimate of total ionic concentration in the water. Turbidity (NTU) was determined using a portable turbidity meter after gentle mixing of the sample to ensure homogeneity without disturbing settled particles. For laboratory-based nutrient analyses, water samples were collected in acid-washed polyethylene bottles, labeled, placed in ice-packed cool boxes, and transported to the laboratory within 24 hours. Ammonia (NH_3–N) concentrations were determined using the phenate method, while nitrates (NO_3) were analyzed using the cadmium reduction method, and phosphates (PO_4^3) were measured using the ascorbic acid (molybdenum blue) method. Absorbance for all nutrient analyses was read using a UV–visible spectrophotometer at the appropriate wavelengths, and concentrations were calculated from standard calibration curves. All measurements were conducted in triplicate to enhance data reliability, and quality control procedures included reagent blanks, standards, and instrument calibration before and after sampling. This comprehensive methodological approach enabled accurate assessment of seasonal and spatial variations in water quality parameters and their potential effects on tilapia ecology and suitability of Kibomet Dam water for human use.

Fish Sampling and Parasitological Examination

Fish sampling and parasitological examination were carried out following standard ichthyological and parasitological protocols to assess the health status of Oreochromis niloticus in Kibomet Dam. A total of 250 tilapia specimens were collected during the study period using standardized gill nets of 2.5cm stretched mesh size to capture a wide range of fish sizes. Gill nets were set in the evening at the three designated sampling stations and retrieved the following morning to allow sufficient sampling effort while minimizing fish stress and mortality. Captured fish were removed carefully from the nets, placed in aerated containers or ice boxes depending on subsequent analysis, and transported to the field laboratory for immediate examination. Each fish specimen was identified to species level and subjected to morphometric measurements, including total length (cm) and body weight (g), before parasitological assessment. External examination was conducted through visual inspection of the skin, fins, eyes, opercula, and scales using the naked eye and a hand lens to detect ectoparasites, lesions, cysts, or abnormalities. Mucus scrapings were obtained from the skin and fins using sterile glass slides and examined under a light microscope at ×40 and ×100 magnifications for the presence of protozoan and metazoan ectoparasites. Gills were carefully excised, placed in Petri dishes containing physiological saline, and examined under a dissecting microscope for gill parasites such as monogeneans and crustaceans. For internal parasitological examination, fish were dissected longitudinally using sterile dissecting instruments. The gastrointestinal tract, liver, spleen, gonads, and body cavity were removed and examined separately in saline solution for endoparasites. The intestines were opened lengthwise and gently scraped to recover helminths, which were counted and preserved in 70% ethanol for further identification. Recovered parasites were identified to the lowest possible taxonomic level based on morphological characteristics using standard identification keys. Parasitological indices, including prevalence, mean intensity, and abundance, were calculated to describe parasite infection patterns. Systematic sampling and examination approach provided reliable data on parasite diversity and infection levels in tilapia populations of Kibomet Dam and their relationship with environmental conditions.

Data Analysis

Data were analyzed using descriptive statistics, Pearson correlation, and ANOVA to test seasonal and spatial differences.

RESULTS AND DISCUSSION

Variation in Physico-Chemical Water Quality Parameters

Physico-chemical parameters in Table 1, exhibited clear seasonal variation between the dry and wet seasons. Water temperature was higher in the dry season (24.8 ± 1.6 °C) compared to the wet season (22.2 ± 1.9 °C), while dissolved oxygen similarly decreased from 5.1 ± 0.8 mg/L in the dry season to 3.6 ± 0.9 mg/L in the wet season. The pH of the water remained near neutral in both seasons but was slightly higher during the dry season (7.4 ± 0.3) than during the wet season (6.9 ± 0.4). Turbidity showed a pronounced increase in the wet season (43 ± 18 NTU) relative to the dry season (21 ± 9 NTU), indicating enhanced sediment and particulate input during periods of rainfall. Electrical conductivity also increased from 132 ± 54 μS/cm in the dry season to 168 ± 70 μS/cm in the wet season, reflecting higher concentrations of dissolved ions. Nutrient levels were consistently higher in the wet season, with ammonia rising from 0.08 ± 0.03 mg/L in the dry season to 0.16 ± 0.06 mg/L, nitrates increasing from 14 ± 6 mg/L to 26 ± 9 mg/L, and phosphates increasing from 0.9 ± 0.4 mg/L to 2.1 ± 0.8 mg/L. The wet season was characterized by lower dissolved oxygen, higher turbidity, conductivity, and nutrient concentrations, conditions that may promote eutrophication and ecological stress, whereas the dry season exhibited comparatively higher oxygen availability, lower nutrient loading, and more stable water quality conditions conducive to tilapia survival, growth, and human water use.

Parasite Prevalence in Oreochromis niloticus

Parasite examination in Oreochromis niloticus revealed five parasite types with varying prevalence and health implications. Trichodina spp. were the most common, infecting the skin and gills of 34% of fish, followed by Cichlidogyrus spp. on the gills (28%), both causing gill irritation but posing low zoonotic risk. Diplostomum spp. affected the eyes of 16%, potentially impairing vision and feeding, while Acanthocephalus spp. were found in the intestines of 12%, potentially reducing nutrient absorption. Neascus spp. occurred least frequently (10%) in muscle but present the highest risk to humans if fish are consumed undercooked. Ectoparasites were more prevalent than endoparasites, and most parasites posed low to moderate risk. The presence of zoonotic species highlights potential public health concerns and the need for proper water management and safe fish handling.

Table 1: Seasonal Variation in Physico-Chemical Parameters

Parameter	Dry Season ± SE	Wet Season ± SE
Temperature (°C)	24.8 ± 1.6	*22.2 ± 1.9*
Dissolved Oxygen (mg/L)	5.1 ± 0.8	*3.6 ± 0.9*
pH	7.4 ± 0.3	*6.9 ± 0.4*
Turbidity (NTU)	21 ± 9	*43 ± 18*
Conductivity (μS/cm)	132 ± 54	*168 ± 0*
Ammonia (mg/L)	0.08 ± 0.03	*0.16 ± 0.06*
Nitrates (mg/L)	14 ± 6	*26 ± 9*
Phosphates (mg/L)	0.9 ± 0.4	*2.1 ± 0.8*

Parasite Intensity and Fish Health

As shown in Table 3, fish from low and high pollution zones exhibited notable differences in parasite intensity and condition factor. In low pollution zones, the mean parasite load was 6 ± 2, compared to 14 ± 4 in high pollution zones, indicating a higher prevalence of parasites in polluted waters. Similarly, the fish condition factor (K) was higher in low pollution zones at 1.65 ± 0.12, while fish from high pollution zones had a lower value of 1.32 ± 0.15, suggesting poorer health and body condition. These results indicate that increased pollution is associated with elevated parasite loads and reduced fish condition, highlighting the adverse effects of water quality deterioration on fish health and overall ecosystem integrity.

Table 2: Parasite Types and Prevalence			
Parasite	**Site of Infection**	**Prevalence (%)**	**Zoonotic**
Trichodina spp.	Skin & gills	34	Low
Cichlidogyrus spp.	Gills	28	Low
Diplostomum spp.	Eyes	16	Moderate
Acanthocephalus spp.	Intestine	12	Moderate
Neascus spp.	Muscle	10	High

Table 3: Mean Parasite Intensity and Condition Factor

Parameter	Low Pollution Zones	High Pollution Zones
Mean parasite load	6 ± 2	14 ± 4
Fish condition factor (K)	1.65 ± 0.12	1.32 ± 0.15

Correlation Between Water Quality and Parasite Load

Table 4 presents the Pearson correlation coefficients between selected water quality parameters and parasite intensity in fish. Dissolved oxygen (DO) exhibited a negative correlation with parasite intensity ($r = -0.48$, $p < 0.05$), indicating that higher oxygen levels are associated with lower parasite loads. In contrast, ammonia ($r = +0.44$, $p < 0.05$), phosphates ($r = +0.41$, $p < 0.05$), and turbidity ($r = +0.39$, $p < 0.05$) all showed positive correlations with parasite intensity, suggesting that elevated concentrations of these pollutants are linked to higher parasite burdens. The results highlight that fish in waters with poorer quality, characterised by higher ammonia, phosphate, and turbidity levels, tend to carry more parasites, whereas well-oxygenated waters appear to reduce parasite prevalence. Among the parameters, dissolved oxygen has the strongest inverse effect on parasite load, while turbidity shows the weakest positive correlation, although all are statistically significant at $p < 0.05$. This suggests that both chemical and physical aspects of water quality play a critical role in influencing parasitic infections in fish.

Table 4: Pearson Correlation Coefficients

Parameter	**Parasite Intensity (r)**
Dissolved Oxygen	−0.48*
Ammonia	+0.44*
Phosphates	+0.41*
Turbidity	+0.39*

**Significant at $p < 0.05$*

Discussion

The present study demonstrates that Kibomet Dam exhibits pronounced seasonal and spatial variability in water quality, with clear implications for Oreochromis niloticus health and parasite dynamics. All measured physico-chemical parameters showed distinct seasonal trends, consistent with the hydrological and ecological patterns observed in tropical freshwater systems. Water temperature was higher in the dry season (24.8 ± 1.6 °C) than in the wet season (22.2 ± 1.9 °C), while dissolved oxygen (DO) displayed the opposite trend, decreasing from 5.1 ± 0.8 mg/L to 3.6 ± 0.9 mg/L during the wet season. This inverse relationship reflects the well-established temperature-oxygen solubility principle, where cooler waters hold more dissolved oxygen (Ibrahim & Abdulkarim, 2017). Similar patterns have been observed in Lake Victoria and other Kenyan reservoirs, where seasonal temperature fluctuations and rainfall-driven inflows modify oxygen availability and thermal stratification (Kolding *et al.*, 2008; Spatiotemporal variability of surface water quality in tropical agriculture-dominated catchments, 2025). The wet season also exhibited higher turbidity, electrical conductivity, and nutrient concentrations (ammonia, nitrates, and phosphates), indicative of increased surface runoff from agricultural lands and catchment disturbance. Enhanced turbidity reduces light penetration, affecting photosynthesis and primary productivity, which can lead to lower dissolved oxygen via increased biochemical oxygen demand (Wetzel, 2001). Elevated nutrients, particularly ammonium and phosphates, suggest potential eutrophication, a phenomenon commonly reported in small African reservoirs and ponds impacted by agriculture (Ngugi *et al.*, 2013; Otieno *et al.*, 2020). These changes create ecological stress, as oxygen depletion and excess nutrients disrupt aquatic homeostasis, favouring opportunistic organisms, including parasites. The parasitological assessment revealed a diverse parasite assemblage dominated by ectoparasites: Trichodina spp. (34%) and Cichlidogyrus spp. (28%). Endoparasites, including Diplostomum spp. (16%), Acanthocephalus spp. (12%), and Neascus spp. (10%), were less frequent. These findings align with studies from Lake Victoria, Nakuru County ponds, and Sagana Fish Farm, where ectoparasites consistently dominate under environmental stress and high host density conditions (Paperna, 1996; Akoll *et al.*, 2012; Mugo-Bundi *et al.*, 2019). The higher prevalence of ectoparasites reflects their direct life cycles, rapid reproduction, and ability to exploit hosts weakened by environmental stressors such as low DO and high nutrient concentrations (Marcogliese, 2005). Endoparasites and trematodes, although less prevalent, present important veterinary and zoonotic risks, particularly Neascus spp. in muscle tissue. Their lower prevalence may be due to complex life cycles requiring intermediate hosts, such as molluscs, which are influenced by water quality and habitat conditions (Chibwana *et al.*, 2013). Nutrient enrichment and sediment accumulation during the wet season can promote snail populations, potentially increasing the transmission risk of these parasites, as reported in small tropical reservoirs in Malawi and Côte d'Ivoire (Chibwana *et al.*, 2013; Ecological insights into Nile tilapia gill monogenean parasites interactions, 2025). Fish from high-pollution zones exhibited significantly higher parasite intensity (14 ± 4) and lower condition factor (1.32 ± 0.15) than those from low-pollution zones (6 ± 2 and 1.65 ± 0.12, respectively). This pattern supports the pollution-parasitism hypothesis, which suggests that degraded habitats enhance parasite transmission while simultaneously reducing host resistance (Lafferty & Kuris, 1999). Similar observations have been reported in Lake Naivasha and aquaculture ponds in western Kenya, where nutrient-rich and polluted waters increased parasite loads and reduced fish growth and condition (Mugo-Bundi *et al.*, 2019). The reduced condition factor in polluted zones reflects physiological stress, impaired energy allocation, and compromised immune function, likely due to a combination of elevated ammonia, turbidity, and nutrient enrichment. Correlation analyses further highlight the strong influence of water quality on parasitic infections. Dissolved oxygen exhibited a negative correlation with parasite intensity ($r = -0.48$, $p < 0.05$), indicating that oxygen-rich environments support host immunity and limit parasite establishment (Marcogliese, 2005). Conversely, positive correlations with ammonia ($r = +0.44$), phosphates ($r = +0.41$), and turbidity ($r = +0.39$) demonstrate that nutrient enrichment and suspended particulate matter promote parasite survival, proliferation, and transmission. These findings are consistent with studies in both tropical ponds and lakes, where high nutrient concentrations enhance intermediate host populations and extend the persistence of free-living infective stages (Johnson *et al.*, 2007). Collectively, the results indicate that seasonal nutrient enrichment and pollution compromise water quality, elevate parasite pressure, and reduce tilapia health in Kibomet Dam. The combined effects of low dissolved oxygen, high turbidity, and nutrient loading likely create physiological stress that increases host susceptibility to parasites, consistent with patterns reported in tropical freshwater ecosystems (El-Sayed, 2006; Wetzel, 2001). From a management perspective, these findings highlight the need for routine monitoring of water quality and fish health, the implementation of catchment buffer zones, and community education on safe fish handling, as a means to protect ecosystem integrity, fisheries productivity, and public health.

CONCLUSION

These study demonstrates that Kibomet Dam experiences marked seasonal and spatial variability in physico-chemical water quality, with direct consequences for the health and parasitic status of Oreochromis niloticus. The wet season is characterised by reduced dissolved oxygen and elevated turbidity, electrical conductivity, and nutrient concentrations, reflecting increased runoff and nutrient loading from surrounding agricultural activities, while the dry season provides comparatively more stable and favourable conditions for tilapia survival and growth. Parasitological findings revealed a diverse parasite assemblage dominated by ectoparasites, with the presence of zoonotic trematode larvae raising concerns for fish health and public safety. Higher parasite intensity and lower condition factors observed in polluted zones, together with significant correlations between parasite load and key water quality parameters, confirm that degraded water conditions enhance parasite transmission and weaken host condition. The findings indicate that Kibomet Dam is under moderate ecological stress driven by nutrient enrichment and declining water quality, underscoring the need for integrated catchment management, routine monitoring, and improved awareness on safe water use and fish handling to safeguard ecosystem sustainability, fisheries productivity, and public health.

Recommendations

Based on the findings of this study, it is recommended that routine water quality and fish health monitoring programmes be established in Kibomet Dam to enable early detection of ecological deterioration and emerging disease risks. The implementation of vegetated riparian buffer zones around the dam should be prioritised to minimise agricultural runoff, sedimentation, and nutrient loading from the surrounding catchment. Community education initiatives are also essential to promote safe fish handling, proper cooking practices, and responsible water use in order to reduce public health risks associated with fish-borne parasites and contaminated water. Furthermore, future research should expand the scope of assessment to include microbial contamination, heavy metal accumulation, and the long-term effects of climate variability on water quality, parasite dynamics, and fisheries sustainability.

REFERENCES

Akoll, P., Konecny, R., Mwanja, W. W., Nattabi, J. K., Agoe, C., & Schiemer, F. (2012). Parasite fauna of Oreochromis niloticus (Linnaeus, 1758) in Lake Victoria, Uganda. *Parasitology Research, 110*(1), 293–303. https://doi.org/10.1007/s00436-011-2487-0

Chibwana, F. D., Nkwengulila, G., & Locke, S. A. (2013). Composition and infection patterns of diplostomid metacercariae in freshwater fishes from southern Malawi. *Journal of Helminthology, 87*(1), 47–57. https://doi.org/10.1017/S0022149X12000048

El-Sayed, A. F. M. (2006). *Tilapia culture*. CABI Publishing.

Ibrahim, B. U., & Abdulkarim, M. (2017). Seasonal variation in water quality parameters of a tropical reservoir. *Journal of Environmental Science, Toxicology and Food Technology, 11*(2), 34–41.

Johnson, P. T. J., Chase, J. M., Dosch, K. L., Hartson, R. B., Gross, J. A., Larson, D. J., Sutherland, D. R., & Carpenter, S. R. (2007). Aquatic eutrophication promotes pathogenic infection in amphibians. *Proceedings of the National Academy of Sciences, 104*(40), 15781–15786. https://doi.org/10.1073/pnas.0707763104

Kolding, J., van Zwieten, P. A. M., Mkumbo, O., Silsbe, G., & Hecky, R. E. (2008). Are the Lake Victoria fisheries threatened by exploitation or eutrophication? Towards an ecosystem-based approach to management. *Ecological Applications, 18*(2), 309–326. https://doi.org/10.1890/06-1789.1

Lafferty, K. D., & Kuris, A. M. (1999). How environmental stress affects the impacts of parasites. *Limnology and Oceanography, 44*(3), 925–931. https://doi.org/10.4319/lo.1999.44.3_part_2.0925

Marcogliese, D. J. (2005). Parasites of the superorganism: Are they indicators of ecosystem health? *International Journal for Parasitology, 35*(7), 705–716. https://doi.org/10.1016/j.ijpara.2005.01.015

Mugo-Bundi, J., Oyoo-Okoth, E., Ngugi, C. C., Chepkirui-Boit, V., & Wanjiru Mwaniki, M. (2019). Water quality and parasite infection in farmed Nile tilapia (Oreochromis niloticus) in Kenya. *Aquaculture Research, 50*(5), 1280–1293. https://doi.org/10.1111/are.13989

Ngugi, C. C., Oyoo-Okoth, E., Manyala, J. O., Fitzsimmons, K., & Kimotho, A. (2013). Characterization of water quality parameters and tilapia production in earthen ponds in Kenya. *International Journal of Fisheries and Aquatic Sciences, 2*(1), 18–30.

Otieno, A. O., Kitaka, N., Kipkemboi, J., & Gettel, G. M. (2020). Effects of land use on water quality and ecological integrity of tropical rivers in Kenya. *Ecohydrology & Hydrobiology, 20*(2), 198–212. https://doi.org/10.1016/j.ecohyd.2019.12.003

Paperna, I. (1996). Parasites, infections and diseases of fishes in Africa: An update. FAO/CIFA Technical Paper No. 31. *Food and Agriculture Organization of the United Nations.*

Wetzel, R. G. (2001). *Limnology: Lake and river ecosystems* (3rd ed.). Academic Press.