Chronicle of Aquatic Science
Open Access Peer Reviewed Journal
Vol. 1, Issue 6
https://chronicleofaquaticscience.in/

Mini-review
Koreti et al. (2023)
Manuscript Id: **CoAS_V1IS6_05**

OPEN ACCESS

Minireview on Addressing the Effects of Non-Point Source (NPS) Pollution in Aquatic Ecosystem

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How to cite this article:

Koreti, K., Kashyap, N., Kurmi, R. K. and Sarang, N. 2023. Minireview on Addressing the Effects of Non-Point Source (NPS) Pollution in Aquatic Ecosystem. *Chronicle of Aquatic Science* 1(6): 55-60.

ABSTRACT

Pollution from non-point sources is a much bigger issue. When water from rain, snow, or irrigation flows over or through the ground, picking up pollutants along the way, it causes them to end up in bodies of water. Therefore, the goal of this study is to present some best management practices for addressing the issue as well as a complete analysis of the primary effects of NPS pollution on aquatic ecosystems. For the purposes of making this study thorough, data on chemical usages in fisheries and aquaculture around the world were gathered from 82 research articles and they were then grouped, analyzed, and summarized in accordance with the study's objectives. In the study, the primary sources of NPS pollution load and their consequences on the water quality of water bodies were reviewed, together with the volume of agricultural runoff and rainfall-runoff. Numerous studies have demonstrated that fertilizers, pesticides, and agricultural runoff can bio-accumulate in the tissues of aquatic animals and endanger the safety of food. Public knowledge of source reduction should be encouraged, and related regulations should be put into place, in order to further reduce the NPS pollution load and maintain a pollution-free environment.

KEYWORDS

Nonpoint source pollution, rain water runoff, agricultural runoff, modeling, and best management practices.

Introduction

One of the significant variables that directly impacts the water quality of rivers is non-point source (NPS) pollution. Lakes and reservoirs become eutrophicated as a result of it. Water pollution from diffuse sources, such as contaminated runoff from agricultural lands emptying into a river, is referred to as NPS pollution. According to Novotny (1999), NPS contamination is a global issue that has the attention of many nations. The majority of the effort put in to reduce pollution comes from point sources, such as industrial or municipal wastewater outfalls, or point sources. The term "nonpoint" refers to all other sources, which include spills, atmospheric deposition of pollutants, hydrologic modifications (dams, diversions, channelization, over-pumping of groundwater), urban and industrial runoff, combined sewer overflows and leaks, hazardous waste dumpsites, septic tank systems, mining and logging operations, and spills. The United States conducts the most studies and planning for NPS pollution controls, but other nations have also produced a significant amount of work, including Canada, the United Kingdom, Australia, and Germany (Leon et al., 2000; Leon et al., 2001; Worrall and Burt, 1999; Johnes, 1996; Viney et al., 2000; Krysanova et al., 1998). The most effective tactics for abatement in the U.S. have entailed designating some "nonpoint" sources as "point" sources and regulating them through permit systems.

Runoff from Agriculture Causes NPS Pollution

In 2014, agricultural runoff was the main factor affecting water bodies' water quality. Inadequate pesticide use, irrigation water and fertilizer use, poorly run animal feeding operations, and sediment were the main contributors to NPS pollution in rural regions. Crop and animal production, according to Barden and Shortle (2014), can significantly and widely affect water quality and aquatic ecosystems. An important environmental problem was non-point-source (NPS) contamination caused by sediment and nutrient loads coming from agricultural catchments. In areas where the entire water resources were impacted, particularly aquifers, agriculture was a significant source of nonpoint pollution (e.g., nitrates) (PochMasseg et al., 2014). One of the main causes of the decline in animal biodiversity in freshwater habitats was the use of agricultural insecticides. Insecticide discharge into streams was estimated using a spatially explicit model by

Ippolito et al. (2014), who discovered that water bodies within 40% of the world's land surface were susceptible.

The US Environmental Protection Agency conducted national studies in 1990 and found that agricultural operations polluted water sources four times more than municipal point source discharges. Significant hydrologic changes, mining, and urban storm water all contribute to significant stream and river pollution. Nutrients, pesticides, organic compounds, silt, metals, salinity, and pathogens are the main contaminants. Sediment contamination is predicted to result in off-site damages of at least $6 billion annually (Duda and Johnson, 1985; Clark et al., 1985). As a result, there are significant financial expenses associated with this pollution.

Rural nonpoint sources

Large amounts of water contaminants might come from rural sources. Fertilizers, insecticides, and other agricultural chemicals are the source of agricultural pollution. The geography of the area, soil types, temperatures, types of land use, cover crops, management techniques, and other factors all have an impact on water quality. Wallace and Dague's (1973) investigation revealed a connection between agricultural sources and the do content of Iowa waterways. The issue of pollution from nonpoint sources was exacerbated by agricultural fields, pasture grounds, orchards, and groves.

Urban nonpoint sources

Numerous polluting substances may be present in urban runoff. These contaminants come from a wide range of sources, including "city" birds like pigeons, car tires, and building activities. pollution include, among other things, chemicals, airborne particles, solid waste litter, and vehicle pollution. The quantity and aerial dispersion of the contaminating material will vary greatly. There are various sorts of street surface contaminants, including heavy metals, fertilizers, pesticides, microorganisms, and dirt (including dust). The majority of the dirt and dust is made up of organic elements.

The contaminated samples that were taken from roadway surfaces contained sizable levels of heavy metals. When the number of metals in sanitary sewage and urban runoff were examined, loadings of 10 to 100 times the concentration (mg/1) of sanitary sewage metals were detected. Zinc and lead were the two metals that Sartor, Boyd, and Agardy (1974) discovered to be most common.

Those with the highest concentrations were Pitt and Amy (1973).

NPS pollution in Latin America and Africa

Deforestation, soil erosion, and sedimentation harm aquatic habitats and water development infrastructure throughout Africa. Desertification and climatic changes further exacerbate the plight of the poor. Surface waterways in Ethiopia have been reported to be contaminated by sediment, pesticides, and fertilizers (Abate, 1992). According to Ojiako (1988), irrigated agriculture in Nigeria has led to the destruction of fisheries communities that provide food for the underprivileged. Important coral reefs have been silted up and killed in Kenya and Tanzania as a result of sedimentation and the destruction of mangrove swamps. The cost of output reductions due to soil erosion can reach 1.5–3% of the country's GDP in nations as different as Mali, Malawi, Mexico, and Costa Rica (World Bank, 1992).

Eastern Europe and the former Soviet Union: NPS Pollution

Similar to those reported for North America and Europe, NPS pollution impacts on waterbodies in the former Soviet Union and Eastern Europe are more severe in scope and size. Industrial waste sites, polluted silt from previous releases, agricultural pollution, military sites, and air deposition are all important sources that have an adverse effect on both the environment and human health. There are numerous reports of harmful effects on human health related to nitrate and pesticide pollution from aerial application and livestock manure (Bridges, 1992). In comparison to point source discharges, these sources are more responsible for the eutrophication of the Baltic, Azor, and Black Seas. For instance, Lithuania's agriculture contributes four times as much nitrogen and a little more phosphorus to the Baltic Sea than sewage discharges do (Duda, 1993).

Conclusion

Hundreds of millions of people are afflicted by disease as a result of NPS contamination, billions of dollars' worth of economic development investments are lost, and trillions of dollars' worth of environmental cleanup demands are amassing for future generations to deal with. Only recently has the severity of this harm become completely understood. As a result, rather than through a water pollution management program, improvements to water quality will be accomplished through various sectoral development plans. A better understanding of NPS formation, evolution, and migration requires the development of long-term monitoring and modeling systems. It was noted that agricultural areas with NPS pollution had received increased attention. Using less fertilizer and using it more effectively could be realistic ways to reduce this pollution source. Additionally, in order to further reduce the NPS pollution load and maintain a pollution-free environment, public awareness of source reduction should be fostered and associated legislation should be implemented.

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