THE ALL- GIRLS ECO-PROGRAMME	Analysis of the Impact of Hydrological Energy on Freshwater Animals

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ABSTRACT

Water is one of the most valuable resources in the world, in fact, life depends on water. The recent scarcity of water is growing day by day. Despite multiple methods being employed to improve the quality of the oceans, seas, rivers, lakes and ponds, pollution is still a prevalent problem. All over the world scientists, biologists and oceanographers are trying their best to seek solutions for the degradation in the life cycles of animals living in the water bodies. However, answers are yet to come. It is important to note that pollution is not the only cause for the degradation, but energy resources play a huge role. Even if the energy resources are not directly polluting the water, they can have a negative impact on the aquatic organisms. Hydrological energy is used for the generation of electricity. In previous decades, this energy source was considered as environmentally-friendly, and thus, hydropower plants were set up in as many rivers as possible. In this study, we will demonstrate the various ways through which these freshwater animals face problems due to the hydrological energy. We also tried to outline the various solutions, both ours and various organizations, regarding this problem.

INTRODUCTION

Hydrological energy is considered to be one the most environmentally sustainable forms of energy, when compared to other sources. Although the use of hydropower and the process of generating the electricity are not a recent invention, throughout history we can find the uses of hydropower in the form of water wheels or water mills. This hydropower at those times was run either with the use of hands by men or by animals (1-6). As time progressed, machinery was introduced which accelerated the energy created using this system. However, due to this advancement, living organisms in these waters have faced negative impacts. The turbines are very dangerous as it causes the instantaneous death of large numbers of fish as they try to pass through. In addition to this, although hydropower is free from carbon emissions unlike fossil fuels, the water stored in the reservoir goes through eutrophication (7). For this reason, even the once dubbed eco-friendly energy resource, is now being considered as a contributor to environmental degradation, especially in the case of freshwater animals.

For this reason, various organizations are working towards the betterment of the freshwater animals. Even the people responsible for the construction of dams in the river water are now taking up various measures for the upliftment of the conditions of these animals. This paper aims to show the various problems associated with the construction of hydropower plants and how these problems can be mitigated.

METHODS

- Books
- Peer-reviewed academic papers
- Internet sources

ANALYSING THE PROBLEM FACED BY FRESHWATER ORGANISMS

Freshwater is one of the most used water sources all over the world. For thermal generation, like nuclear and fossil fuels, even for hydropower, large volumes of water are being used (8). Although the construction of dams reaps immense economic benefits, it threatens freshwater biodiversity (9) and does not provide climate-neutral electricity(10).

The negative impacts on freshwaters are as follows:

Diversion of River Flow – Freshwater habitats are home to many animals although freshwater ecosystems cover very little surface of the earth (11). The natural flow of a river is disrupted upon the construction of dams which affects the life cycle of many aquatic organisms, especially fish (12). Due to the storage of water in the reservoir, the water becomes increasingly stagnant compared to normal river water. As a result, there are higher levels of sediments and other nutrients that cultivate the growth of excess algae and other aquatic weeds. This problem can be controlled by harvesting the excess algae and weeds or by introducing fishes that can eat these plants (13). Another problem that could occur is that if the water is not released proportionately every year, the downstream levels will drop which will affect both the plants and animals living near the water. The water being released can

negatively impact animals as it tends to be much colder than the normal river water (13). The difference in temperature and minerals and dissolved oxygen in the water sometimes affect the animals drinking the water making them fall sick.

Migration - Some fish migrate every year. However, the dams block the upstream and downstream flow of the rivers (14), which affects the movement of the animals to catch their prey (16). This block creates a habitat fragmentation which degrades the ecosystems and disrupts the life cycles of the aquatic animals (14). The fish can still migrate to their preferred location by opening of the gates of the reservoir, however, they sometimes get sucked into the turbines or are impaled (14). That is the reason why fish friendly turbine technology is emerging to give safe passages to the fishes during their migration (15).

Division in the river water – Hydrological power divides the water, allowing it to move either through a pipeline or power canals. This mimics the natural hydrograph (14). When the flowing water becomes stagnant, the fluctuation in temperature of water occurs. This also decreases the clarity of the river water by reducing the sediment contents and also disrupts the dissolved oxygen which leads to lack of availability of food (which decreases with the decrease in the valuable components in the river water), this leads to the loss of species habitat (17).

Extinction – The building of dams is changing the morphology, hydrology and freshwater ecosystems, which is causing major changes in species distribution and abundance which is causing major shifts ultimately to extinction (18, 19).

CURRENT MEANS TO MITIGATE PROBLEMS

New technologies are being developed to further successfully operate hydropower to reduce their impacts. Here are some examples of methods employed for this purpose (20):

i. Reservoir sediment and river erosion management
ii. Constructing fish passage facilities
    - Fish lifts
    - Fish ladders
iii. Modifying dam operations to restore river flows
iv. Building fish hatcheries
    - Habitation restoration
v. Controlling the temperature and oxygen levels of water released from dams
vi. Conserving and remediating land surrounding reservoirs, rivers and dams
vii. Constructing Small Hydropower Projects (SHP) in place of Large Hydropower Projects (LHP). However, in India, this did not reduce the negative impacts on aquatic animals (21).

CONCLUSION

Hydrological energy creates various negative impacts on freshwater organisms, yet it's one of the most employed methods to generate electricity. This paper outlined how dams can divert and divide river flow patterns, impact the migration of fish, and ultimately cause their extinction. We have also demonstrated how the fish feed does not survive when there is great fluctuation in the temperature of the water. This is what causes the loss of habitat among the animals. Due to the stagnation of the river water, which is considered as the free flowing water, the proportion of the minerals, sediments and other ingredients becomes disrupted. Despite great efforts to reduce the stagnation of dam reservoirs, the negative impacts are still unacceptably high. Thus, we can say that even though there are a large number of environmentalists and conservationists working together with the governments of many countries towards this problem, the final solutions are yet to come. This research paper aims to serve as a starting point to raise awareness for the harmful impacts of the dam construction, and urges scientists, engineers and strategic thinkers to come up with better practices for constructing dams that do not harm the life of aquatic animals or disrupt the properties of the water bodies involved in the project.

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