Environmental Impact of Hydroelectric power plants (HPP) and Fishways

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Abstract

Hydroelectric power plants (HPP), which are not cause environment pollution relatively and renewable, inexpensive, has increased importance. However, there are positive and negative impacts on the ecological balance of these systems. One of the main environmental impact of hydropower development is related to fish passage both upstream and downstream.

Hydroelectric power plants (HPP) adversely impact both fish biodiversity and local fishing communities. Ecosystem change destroys feeding as well as breeding grounds, with a resultant loss of fish species. Where the movement of migratory fish up and down river is affected by hydropower development, fish hatcheries near the dam sites or fish ladders for fish movement should be considered as mitigation options. Local user groups and other stakeholders should be involved in decision-making, to keep good relations concerning peoples' livelihoods and the sustainability of aquatic resources. The fish maintain the existence with feeding and reproduction migration of fish, a sufficient amount of water flows in the stream bed and with proper planning of fish ways. Depending on aquatic habitat and fish movement corridor values and other site characteristics, use of culvert fishways may preclude the need to adopt over-conservative and unnecessarily expensive designs using bridges. The suitability of culvert fishway facilities in meeting fish passage and other multipurpose design requirements can be demonstrated for numerous waterway types and structure configurations, and particularly for retrofit facilities. Recognising the need for ongoing design development and evaluation of fish passage facilities for road crossings and other waterway structures and for innovative solutions to address aquatic fauna connectivity barriers. The remaining water in the line of river, life line support will allow to the presence of fish in streams continue. Transverse structures to do with the river flow as well as standing water and thus fish would have the opportunity. The development and increase the number of aquatic species, fish would be affected positively by increase the feeding.

Keywords: Hydroelectric power plants, fish way, ecosystem.

1. INTRODUCTION

Environmental problems, which are eventuated during production and the use of energy, is one of the main reasons to be disuse of old technologies. Coal, oil and natural gas power plants threatens the world. The plants damages areas where they are established. Carbon dioxide, sulfur dioxide, nitrogen oxide and dust, which are released into the atmosphere, pollute the environment and cause to deaths when fossil fuels are burned. In addition, carbon dioxide and other greenhouse gases cause to global climate change (Uyar, 2001).

Today, world population growth, water conservation and energy requirement is made a current issue to construction of new dams and HEPP. The importance of dam and HEPP gradually increase due to be cheap and renewable (Akkaya et al., 2009; Kocabaş et al. 2011).

Although, there are benefits use of water for renewable electricity generation, interactions carry with the environment (Aksungur et al., 2011). The effects of hydroelectric power plants is quite varied and HEPP cause to significant impacts on the area as physical, biological and on human beings. Damages to natural life, destruction of local cultures and historic sites, changes in water quality occurring in the river bed are some of adverse effects.

Hydroelectric power plants affect to aquatic life. Especially, fish are negatively affected from the structures due to prevent migration of fish. Fishways are the most frequently used systems in the world.

In review, environmental impact of hydroelectric power plants (HEPP) and importance and design of fishways are presented.

2. HYDROELECTRİC POWER PLANTS (HEPP)

Hydroelectric power plants (HEPP), which are not cause environment pollution relatively and renewable, inexpensive, has increased importance. Hydroelectric powerplants do not use up resources to create electricity nor do they pollute the air, land, or water, as other powerplants may. Hydroelectric power has played an important part in the development of electric power industry.

Growing populations and modern technologies require vast amounts of electricity for creating, building, and expanding. In the 1920's, hydroelectric plants supplied as much as 40 percent of the electric energy produced. Hydropower is an essential contributor in the national power grid because of its ability to respond quickly to rapidly varying loads or system disturbances, which base load plants with steam systems powered by combustion or nuclear processes cannot accommodate.

3. ENVİRONMENTAL AND SOCİAL IMPACTS OF HYDROELECTRİC POWER PLANTS (HEPP)

Effects on animal populations (fauna) vegetation (flora) and the human, social and economic problems, physical, biological impacts, problems of energy transmission lines are major problems.

3.1. Effects on land

Physical environment is substantially affected by the construction of hydroelectric power plants. Both the river and the surrounding ecosystem will change with beginning of the construction studies. The changes can be listed as the topography changes, loss of farmland, forest land, settlement and cultural field. Water will begin to accumulate in reservoir with construction of barriers. Areas, which are used for agriculture, forestry and other purposes, become unavaliable.

3.2. Ecological impacts

Ecological impacts can be listed as loss of fauna and flora (biotopes / biomass), habitat loss, climate change, effects on water resources, groundwater and thermal effects, surface water impacts, the soil and agricultural production, metals and other fossil resources, socio-economic environment, landscape and recreation areas, noise, vibration impacts (work tools, and blasting), ecosystem degradation, geological and soil impact, division of highway, railway, waterway routes (Satılmış, 2009).

HEPPs have various effects on vegetation, especially during the construction phase. Negative effects on vegetation such as direct destruction of vegetation, fragmentation of forests and other natural ecosystems, destroying of aluvial / riperian vegetation occur during the operation phase of the plants (Kurdoğlu and Özalp, 2010). Forests are important to the continuity of water resources. The destruction of forests and fragmentation of valleys cause to landslides and changes in flow rates of water.

Destruction of feeding and breeding areas, intraspecific and interspecific competition, deterioration of habitats of wild animals, decreases in the number of rare species are adverse effects on fauna. In addition, ongoing construction, blasting, construction equipment, a high amount of dust in construction sites, noise and vibration cause to escape of wild animals to other areas (Kurdoğlu and Özalp, 2010; Kocabaş et al., 2011).

To be inhibit of water flow in river will affect the amount and diversity of fish species. Similarly, changes in mineral levels will adversely affect to aquatic productivity as a one-

sided. Hydroelectric power plants affect to aquatic systems. Especially, fish are negatively affected from the structures due to prevent migration of fish. Excavation, which are spilled to river beds, cause to turbidity, temperature change of water and destruction of aquatic organisms.

Destruction of spawning areas, changes in water flow rate due to drought, the oxygen depletion as a result of high temperature cause to death of adult and juvenile fish. Fish have to do short- long distance migration for feeding or reproduction depending on the season. The migrations are a natural phenomenon for fish.

Changes in hydrology of estuary and flow rate of water because of water collection ponds cause to changes in diversity of phytoplankton depending on changes in water quality. Distrupting of food chain negatively affected to feeding of fish.

Life line support is another problem resulting from construction of hydroelectric power plants. Life line support should be available in sufficient amount for the maintenance of natural life, drinking and irrigation water and fish farms (Kurdoğlu and Özalp, 2010).

Construction of energy transmission lines for transmission of produced energy, destruction of forests and distruption of ecosystems because of energy transmission lines are important problem. Energy transmission lines cause adverse effects on human health because of high voltage and currents, low frequency electromagnetic fields (Muluk et al. 2009).

3.3. Effects of hydroelectric power plants on fish and fishways

Fish have instinct to migrate long or short distances in streams due to feeding, reproduction and sudden changes in the water quality (sudden rainfall, snow melting, etc.). Spawning migration is the most important of these migrations. The migrations is very important for their life cycle and the cycle should be maintain by fish. Catadromous species such as Blacksea trout (Salmo trutta labrax), sturgeon (Acipenser sturio), pearl mullet (Chalcalburnus tarichii) are hatched at sea but spends much of its adult life in freshwater streams. By contrast, anadromous species such as salmon, eel fish (Anguilla anguilla), hatched upstream in a freshwater environment but spend their adult lives at sea in the salt water. Some species such as Capoeta sp., Barbus sp. migrate to water resource in the river for reproduction.

Water in small-scale hydroelectric power plants transport from river bed through the tunnels or channels in order to provide adequate water downfall. Water completely remove from the river bed. In this way, remaining as dry of river bed affect of these migrations. Serious changes on the quality and quantity of water occur depending on seasonal, day, annual climate change.

Fishways are facilitating structures to fish migration. Effectiveness of fishways and collectors is tried to enhance due to prevent of fish migration of the structures. For this reason, studies have been performed related to species-specific fishways for many years. Recently, developed methods and monitoring systems are used to be maintain behaviour and migration of fish (Aksungur et al., 2011). The use of artificial channels has also been the object of recent development. Fish ladders technically can be built in such a way that mimic to nature. In addition, there are technical solutions such as bypass channels and fish ramps, fish elevators and transverse structures.

4. CONCLUSIONS

Fish populations and the ecosystems of rivers and streams negatively affected from the structures because of changes in the flow and quality of water. Lower levels of oxygen in the water can present a threat to animal and plant life. However, these issues can be addressed if fish ladders are put in place to ensure safe passage around the area, and the water is aerated on a regular basis to maintain adequate oxygen levels safe for animal and plant life. The flow of water should be monitored closely to prevent the ecological dangers associated with over-stressing bodies of water. These dangers can easily be avoided by shutting down pumping operations temporarily to allow balance to return to damaged ecosystems.

The suitability of culvert fishway facilities in meeting fish passage and other multipurpose design requirements can be demonstrated for numerous waterway types and structure configurations, and particularly for retrofit facilities. Recognising the need for ongoing design development and evaluation of fish passage facilities for road crossings and other waterway structures and for innovative solutions to address aquatic fauna connectivity barriers. The remaining water in the line of river, life line support will allow to the presence of fish in streams continue. Transverse structures to do with the river flow as well as standing water and thus fish would have the opportunity. The development and increase the number of aquatic species, fish would be affected positively by increase the feeding.

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