Rampant Development of Water Diversion Projects as a Threat to Fish Diversity: A Case of the Modi Khola

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Abstract: The current focus of the country in meeting the increasing demands for energy has led to the increase in number of river water diversion projects for hydropower generation. But the lack of proper guidelines and monitoring mechanism has resulted in rampant licensing of hydropower projects. There are no rules for determining the appropriate number of water diversion projects in a single river. By discussing the case of rampant water diversion projects in the Modi Khola, of western Nepal, this paper raises an important issue of environmental feasibility of projects in the context where, only the engineering and economic feasibility of a project is taken as the basis for project approval and implementation.

Keywords: Fish diversity, water diversion, hydropower, dewatered stretch, Nepal

Introduction

The rivers of Nepal are rich in fish diversity. There are 232 species of fish recorded in Nepal (Shrestha, 2008). Some of these are long distance migratory fish which often come to shallow headwaters of Nepal from the Bay of Bengal and Ganges for breeding. But this rich diversity of fish is under threat as the construction of river diversion projects is on the rise.

Construction of any kind of barrier (dam/barrage/weir) in order to divert water for other uses will certainly have impacts on downstream aquatic environment. The river impoundment created upstream of such barrier as well as the dewatered or reduced flow stretch downstream of the barrier creates complex impacts on humans, vegetation and wildlife in addition to the aquatic environment.

Study Area

The Modi Khola (Nepali name for a small river or stream) is one of the major tributaries of Kali Gandaki River in western Nepal. The total length of the main-stream of the Modi Khola is about 50 km. The Khola originates from the melting of snow and glaciers of the Annapurna Range, in Kaski district and finally joins the Kali Gandaki River at Modi-Beni of Parbat district. The upper reaches of the Khola lies within the Annapurna Conservation Area.

Figure 1: Location of the Modi Khola

Materials and Methods

Field visits were carried out to those stretches of Modi Khola where various hydropower projects are under construction and in operation. This study involved the review of relevant literature and research papers as a part of desk review for secondary data collection.

S. No.	Scientific Name	Common Name	Local Name	Migratory Status	Protected Status
1	Garra annandalei	Stone roller	Nakatuwa	R	C
2	Garra gotyla	Stone roller	Buduna	R	C
3	Glyptothorax pectinopterus	Torrent Catfish	Telkabre	R	C
4	Pseudecheneis sulcatus	Catfish	Kabre	R	O
5	Schizothorax plagiostomus	Snow-Trout	Buchhe Alsa	M	V
6	Schizothorax richardsonii	Point nosed snow trout	Chuhhe Asala	M	V
7	Schizothoraichthys progastus	Snow-Trout	Asla	M	V

Source: NEA, 2003

[Legend: Migratory Status R=Resident, M= Midrange Migrant, Protected Status V= Vulnerable, O= Occasional, C=Common]

Table 1: Fish Species in the Modi Khola

Major Findings

Fish Diversity in Modi Khola

Modi Khola is a tributary of the Kali Gandaki River which drains the central part of Nepal. This interconnection of the Modi Khola with the Kali Gandaki River makes this Khola, one of the important breeding grounds for migratory fishes. In this regard, Shrestha (1999) has listed 35 species of cold-water fishes in the Kali Gandaki River. However, for the Modi Khola – a tributary

of the Kali Gandaki River, fewer species are reported. The Environmental Impact Assessment (EIA) of the 42 MW Upper Modi 'A' HEP, which has been approved by the then Ministry of Population and Environment, in 2004, records a total of seven fish species, mainly in the upper and mid region of the Modi Khola (Table 1). Out of these, five species (Schizothorax plagiostomus, Schizothorax richardsonii, Schizothoraichthys progastus, Garra gotyla and Garra annandalei) are carps and remaining two species (Glyptothorax pectinopterus and Pseudecheneis sulcata) are catfish. Snow trout is the dominant species of Modi Khola throughout the year, in terms of number and quantity (NEA, 2003).

Water Diversion Projects in Modi Khola

There are no large water diversion projects for irrigation or drinking water purposes in Modi Khola. The main focus is on the hydropower generation. Unlike irrigation and drinking water, hydropower is a non-consumptive use of water. Nevertheless, the water diversion from river for hydropower generation and releasing same diverted water back into the river downstream leaves a section of river dewatered or with reduced flow. This problem of dewatered stretch is more prominent during dry season when the discharge in the river is low and demand for electricity is high. The problem is less serious during wet (Monsoon) season, when discharge is high in river. Table 2 depicts the status of hydropower projects in Modi Khola.

S. No.	Hydropower Project	Capacity (MW)	Promoter	Status
1.	Modi Khola	14.8	NEA	In Operation
2.	Lower Modi 1	9.9	United Modi HP Development Company P. Limited	In Operation
3.	Lower Modi Khola	20.0	Manang Trade Link P. Limited	Under Construction
4.	Middle Modi	15.1	Middle Modi HP Limited	Under Construction
5.	Upper Modi A	42.0	NEA	Planned, applied for generation license
6.	Upper Modi	14.0	NEA	Planned, survey license issued
7.	Lower Modi 2 (Cascade)	10.5	United Modi HP Development Company P. Limited	Under construction
8.	Ghandruk Modi	111.0	Panchjanya HP Ltd	Planned, survey license issued
	Total	237.3		

source: www.doed.gov.np

Table 2: Hydropower Projects in the Modi Khola

Out of these, two hydropower projects which are in operation have already created a dewatered zone of about 6 km (2.73 km of dewatered zone by the Lower Modi 1 HEP and 3.27 km by Modi Khola HEP) in the Modi Khola. The two hydropower projects which are under construction shall be creating a dewatered zone of about 6.65 km (4.1 km dewatered stretch by Lower Modi Khola HEP and 2.55 km by Middle Modi HEP). These four hydropower projects are to convert about one fourth of the total river length into dewatered stretch. Such increase in the dewatered stretch of the river is expected to increase the threats to fish diversity.

Weak Monitoring Mechanism

The Environment Protection Act (1997) and the Environment Protection Rules (1997) have provisions for environmental monitoring. Based on the legal provisions, Ministry of Energy, Water Resources and Irrigation (MoEWRI) is empowered to approve the Initial Environmental Examination (IEE) report and conduct environmental monitoring, whereas Ministry of Forest and Environment (MoFE) is empowered for Environmental Impact Assessment (EIA) approval and monitoring.

With regard to the dewatered zones, the IEE or EIA recommends at least 10% of the minimum flow as the environmental flow. Such provision of maintaining minimum flow zone downstream of hydropower dam is directed by Hydropower Development Policy, 2001. In addition to this, the IEE/EIA also comes up with other recommendations for mitigating the negative impact on environment. However, in most of the cases, EIA/IEE recommendations are not found to be implemented properly. This is because of the fact that the agencies responsible for environmental monitoring are not well functioning.

In case of the Modi Khola, fish ladder has been constructed as a mitigation measure for migration of fish in Lower Modi Khola 1 HEP. The field visit revealed that the fish ladder is not functional as no water was flowing downstream of the dam. Figure 2 also depicts the dewatered stretch of the HEP indicating the fragmentation and discontinuity of the fish habitat.

Figure 2: Google Image of Headworks of Lower Modi 1 HEP

Impact on Fish Diversity

Degradation and loss of habitat probably has been more responsible for the decline of native fish species (Gurung, 2012). The construction of a dam on a river can block or delay upstream fish migration and thus contribute to the decline and even the extinction of species. The dewatered stretch in Modi Khola has fragmented the habitat for fish and thus disrupted their migration. This has created a serious impact on fish and aquatic diversity. In some cases, fish hatcheries and release of fingerlings are proposed as compensatory measures. But compensation for loss in yield from river fisheries can be difficult to achieve through development of reservoir fisheries (Jackson and Marmulla, 2001).

Similarly, the downstream hydropower dams and consequent water diversion reduce the possibility of long-distance migratory fishes to reach upstream region. In case of the whole Modi Khola, there is very low possibility for availability of long-distance migratory fishes, as a big project is constructed in the Kali Gandaki River. The 44m high Kali Gandaki "A" Hydroelectric Dam, cuts off local and migratory fish species, e.g. Sahar (*Tor sp.*) and Gooch (*Bagarius bagarius*), from their valuable spawning grounds upstream (Larinier, 2001). In addition, this dam has also stopped the migration of Raj Bam (*Anguilla bengalensis*)-a long distance migratory species. A. bengalensis migrates from fresh water to marine water for spawning.

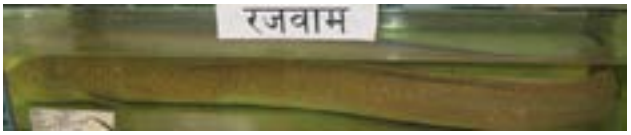

Figure 3: Raj Bam (Anguilla bengalensis) from Kali Gandaki River preserved at the Kali Gandaki Fisheries Centre, Syangja, Nepal

Conclusion and Way Forward

This study reveals that there is a lack of serious consideration of environmental impacts on implementation of hydropower projects. The rampant development of water diversion projects on the Modi Khola has created serious implications on the availability and biodiversity of fish. Though environmental assessment (EIA/IEE) of development projects is legally mandatory, the outputs of such assessments are limited, mainly due to lack of implementation of mitigation measures and weak monitoring mechanism.

Research in the direction of determining the appropriate number of water diversion projects for a single river is limited. There is no proper baseline of the status of fish biodiversity. Hence, there is an urgent need for updating better biological information (e.g. type of species, migration period, migratory behavior) so that proper mitigation measures can be devised. Additionally, water diversion projects alter river flow and obstruct fish migration and possess threat to fish diversity. Therefore, during the planning process of such projects, mitigation measures must be considered, realized and implemented during the construction phase, and monitored regularly.

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