

Fisheries Study

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1.1 INTRODUCTION

The proposed Allain Duhangan Hydroelectric Project (ADHEP) may pose potential impacts on fisheries downstream and related socio-economic implications. This requires prior investigation and adequate mitigative measures.

A detailed fisheries study on Allain and Duhangan streams and River Beas was carried out to determine the impact of the project on fish populations and to identify appropriate mitigation measures. Information was also collected on existing aquatic fish species and resources within the project catchment from secondary sources. Fish catch attempts were also made to establish baseline data on fish resources in the project streams and Beas River.

1.2 FISH RESOURCES IN RIVER BEAS & ITS TRIBUTARIES

The streams in which fish are found in Himachal Pradesh are known as either General or Trout waters depending on the type of fish available in the streams. It is estimated that Himachal Pradesh comprises of water length of 600km under general water and 2,400 km of Trout water. Fishing in these streams is regularised under the state Fisheries Act. In trout waters, licences only for rod and line fishing are permitted while in General waters, rod, line as well as cast netting is allowed. The Department of Fisheries has identified the following stretches as potential fishing sports for trout and mahseer in the Beas Catchment.

Table 1: Trout Waters designated for Trout and Mahseer Fish within the Catchment of Beas River

Water Stretch	River	Stretch `	Length in km
Trout	Beas	Katrain to Manali	18
Trout	Tirthan	Largi to Nagni	20
Trout	Sainj	Largi to Ropa	22
Trout	Uhl	Barot to Kothikhad	10
Mahseer	Beas	Seri mulag- Confluence of Binwa to Beas.	5
Mahseer	Beas	Harsipattan- Confluence of Kunha tributary of Beas.	10
Mahseer	Beas	Chambapattan	5
Mahseer	Beas	Kuran	5
Mahseer	Beas	Dehra Gopipur	10
Mahseer	Beas	Baner	5

The major streams in the State include - Beas, Satluj, Ravi, Tirthan, Sainj, Uhl, Baspa, Pabar, Lambadug, Giri, Rana, Nugal Gai, Baner, Bata, etc. The most common fishes species available in these streams include `Tor sp., Nemacheilus spp, Barilus sp, Schizothoracids, Crossocheilus sp. Glyptothorax spp. etc.

For fish such as the golden mahseer, the snow-melt induces the fish to spawn only by the onset of snow melts in the months of April to May. During this period, fish migrates upstream for spawning. After spawning, the fish migrates downstream during September. Fish proliferation depends upon favourable temperature and good water quality. However, deterioration of water quality due to increased soil erosion has resulted in declining of fish catch in the past. The soil erosion due to deforestation of mountains has led to heavy siltation of rivers and streams thus, impairing the basic ecological requirements of mahseer.

Special type of fishes with adaptation to cling to the exposed surfaces of bare rocks in slower current, with adhesive modified gill on their ventral surface for attachment to rocks are also found in Beas River, for e.g. *Glyptothorax*, etc. However, attempts to catch such fish by using dragnets failed to yield any catch.

The study area for the proposed ADHEP falls within Tehsil Manali in the District Kullu, which is honey combed by the perennial River Beas and other streams joining it with considerable water flow. The district is already engaged in lot pisciculture activities. The Kullu district has 302-registered fisherman. The total production of fish in the district is 177 tonnes per annum. The market price of fish is about Rs. 40 per kilogram.

1.3 *APPLICABLE REGULATORY FRAMEWORK*

Fishing in the state is regularised under the Himachal Pradesh Fisheries Act, 1976. This Act empowers the Government of Himachal Pradesh to make rules for prohibition or regulation of

- erection and use of fixed engine's;
- construction of temporary or permanent weirs, dams and bunds; and
- killing of fish by diversion of natural waters.

This law regulates fishing season, bag limit and the prescribed baits. In trout water, licences for fishing are permitted only with rod and line fishing-baits while in General waters cast netting fishing is also allowed. In certain regions where fishing as a sport is permitted, the State allows every method of fishing. However, the minimum legal size of fish such as trout to be caught ranges from 25-30 cm. The bag limit ranges from 5-7 fish.

1.4 *APPROACH & METHODOLOGY*

A participatory and consultative approach was followed for undertaking Fisheries Study. The information was collected from two sources i.e. from

- Secondary sources i.e. from Himachal Pradesh Fisheries Department, discussion with local people and literature survey and
- Primary sources i.e. by investigating fish in the project water bodies and making fish catch attempts.

A team of consultants visited the project catchment near Manali and conducted the study in the area in January and again in April'2003. Meetings were also

held during the study with officers from the fisheries department and local villagers, as part of public consultations. Fish catch attempts made during this study have been shown in the *Plate 1 to Plate 4*.

1.5

FISH IN THE PROJECT AREA

To ascertain the fish biodiversity, a visit was made to the fisheries department at Pattlikuhl and Kullu. No records of fish biodiversity could be found from the Fisheries Department. At Pattlikuhl, some fishermen were found to be angling. After enquiry the only fish catch recorded from them was Desi carp – a local fish. No other fishes were found. Pictorial guidebooks were shown to the fishermen, who reported some fishes are available in Beas only in the post monsoon period.

The streams in the Kullu district are fed by snowmelts from higher reaches, only cold water fish are expected to withstand such low temperature and habitat conditions. According to the local fishermen, sometimes Mahaseer and Rainbow Trout are also found in River Beas. The Trout water stretch in the Beas River extends from Katrain to Manali as identified by Fisheries Department downstream the project streams confluence with Beas.

Fish catches were also evaluated at fish markets near Manali. The fishes were brought by local fishermen caught through angling in river Beas. Again only Desi carp fish catch was found. The fish varieties identified through secondary sources have been described in *Table 2*.

Table 2: *Reported Fish species in River Beas identified through Secondary Sources*

S. No	Species	Endan gered	Threa tened	Vulne rable	Rare	Common	Whether listed in Schedule 1of Wildlife Protection Act
1	<i>Salma gairdnerii gairdnerii</i> (Rainbow Trout)					✓	No
2	<i>Salma trutta fario</i> (Brown Trout)					✓	No
3	<i>Tor Pitutora</i> (Mahaseer)					✓	No
4	<i>Catla catla</i>					✓	No
5	<i>Labeo rohita</i>					✓	No
6	<i>Labeo batu</i>					✓	No
7	<i>Labeo dero</i>					✓	No
8	<i>Labeo dyochelus</i>					✓	No
9	<i>Cirrhina mrigala</i>					✓	No
10	<i>Notopterus chitala</i>					✓	No
11	<i>Wallgo attu</i>					✓	No
12	<i>Nemachilus botio</i>					✓	No
13	<i>Pontius ticto</i>					✓	No
14	<i>Pontius sarana</i>					✓	No
15	<i>Silver Carp</i>					✓	No
16	<i>Mastacimballus armatus</i>					✓	No

The fish catch attempts were made at several locations during January 2003 at the following locations:

- Near Aleo bridge on Allain stream.
- Near Jagatsukh bridge on Duhangan stream.

Again, during April 2003 another fish catch attempts were repeated at the following locations:

- Near Aleo bridge on Allain stream.
- Near Jagatsukh bridge on Duhangan stream.
- Duhangan stream before confluence with Beas.
- Allain stream before confluence with Beas.
- Beas river, downstream of confluence between Beas and Duhangan.

During the survey periods, the project catchment area was undergoing winter season. As a result of fresh snowfall, the higher reaches of the project catchment area were snow bound. The temperature during the survey period ranged approximately from 2°C to 17°C. The temperature of the Allain and Duhangan streams were recorded at 5°C to 6°C and 7°C to 8°C respectively during the survey periods.

Different types of methods were used for surveying the streams for fishes. Three trap nets, three dragnets, and three fish traps were used. Trap nets and fish traps were laid in three locations simultaneously for a period of 5 hours, after which they were taken out and checked for any yield or fish catch. Dragnets were used for checking for fishes with special adaptations that remain attached to under surfaces of rocks to avoid fast stream flow. For each of the two streams, nets were fixed in six locations. Therefore, nets were fixed in a total of twelve locations. Similarly, Dragnets were also used at twelve locations.

1.6.1

Observations on fish catch attempts

As both Allain and Duhangan streams are fed by snowmelts from higher reaches, only cold water fish were expected to withstand such low temperature and habitat conditions. During both occasions Allain and Duhangan streams were found devoid of any fish species. However, during April 2003, near the confluence of Duhangan and Beas, fingerlings of Desi carp were caught in the nets.

1.7

ASSESSMENT OF IMPACTS DUE TO THE PROPOSED PROJECT

It is envisaged that operation of the proposed Allain Duhangan hydroelectric project poses potential impacts on the hydrology and water quality of particular stretches of Allain, Duhangan streams and Beas river. As observed during the fish catch attempts and the discussions with near-by fish farm, fish market no occurrence of fish were found in the Allain and Duhangan streams, except at the confluence point of Duhangan with Beas. This leads to a conclusion that no fish source exists in the Allain and Duhangan streams. The extreme cold

temperatures and rapid currents of these streams seem to be the obvious reasons for non-occurrence of fish in these streams.

However, the ecological conditions of the catchment suggest that there is a possibility of upward migration of fishes from Beas to these streams. The upward migration of fishes from Beas to Allain and Duhangan is season specific and is mostly during monsoon when the water in Beas swells up. The Allain and Duhangan streams flow with many abrupt falls leaving lesser chances of migrating fish to traverse upstream. However, during peak flow or monsoon season, there is possibility of fish to migrate upstream for some of the distance.

1.8

FISHERIES MONITORING PLAN

The most effective mitigation measure for the impact on aquatic ecology is to ensure minimum ecological flows and adequately maintain water quality downstream of the diversion. This ecological flow may be designed based on the habitats of the most valued aquatic species in the river. Special care is required to ensure minimisation of losses of spawning grounds.

Since the project involves reservoir storage also, it is recommended that periodic water releases be optimised in a strategic way to maximise revenues and minimise environmental impact of the project. Likewise attention should be paid to mandatory releases to the downstream river.

In order to demonstrate RSWML's commitment to downstream users, it is proposed that flow measuring devices both electronic and manual measurement basis are installed on both Allain and Duhangan streams. Also to preserve water quality downstream due to flushing from de-silting chambers, the flushing is to be done over longer period and during high flow periods like afternoon period or depending upon flow pattern for each month.

The results of fish catch attempts made during the baseline study in the month of January and April 2003 showed presence of no fish in the Allain and Duhangan streams. However, in early April 2003, before confluence of Duhangan stream with Beas River, a few of the fingerlings of Desi carp fish varieties were observed as a result of migration from Beas to the Duhangan river.

In order to perform the monitoring of fish during a calendar year for establishing the baseline for each month of the year, it is necessary to investigate the possible impact and find the means of mitigating the same. It is also recommended that detailed fish catch studies be carried out at the following locations and with the frequency mentioned along with.

Table 1.1 *Proposed Monitoring of Fish Catch in the Area*

S.No.	Location	Frequency (across a complete year)
1.	Near Jagatsukh bridge, on Duhangan stream	Once a month
2.	Near Aleo bridge, on Allain stream	Once a month
3.	Upstream (100-200m) of Allain stream before confluence with Beas river.	Once a month
4.	Upstream (100-200m) of Duhangan stream before confluence with Beas river	Once a month

The average inflow observed at diversion sites in the past indicates variation in flows ranging from 1.54 to 21.78 m³/sec in Allain and 1.38 to 7.31 m³/sec in Duhangan streams. A 90% dependability flow of 3.028 m³/sec is available in Allain while 1.301 m³/sec is available in Duhangan stream.

Based upon minimum flows contributed by other channels post diversion structure on Allain and Duhangan and water required for local demand and minimum water required for ecological sustenance, minimum flows have been recommended downstream the diversion structures. The minimum flow post diversion structure on Allain has been found to be 0.226 m³/sec in the month of February during driest year of 1973-74. It is recommended that RSWML maintain a minimum flow of 0.150 m³/sec (i.e. 150 liters per second or 12,960 m³/day) downstream the Allain barrage all the time. This flow along with minimum flow available through other channels downstream the Allain would make the available flow to be more than 0.376 (0.150+0.226) m³/sec i.e. 32,466 m³/day, which is about 21% of the minimum flow ever observed on Allain at Aleo.

Similarly, the minimum flow contributed by other channels post diversion structure on Duhangan has been found to be 0.360 m³/sec in the month of February during 1987-88. It is recommended that RSWML also maintain a minimum flow of 0.150 m³/sec (i.e. 150 liters per second or 12,960 m³/day) downstream the Duhangan-weir structure all the time. This flow along with minimum flow available through other channels downstream the Duhangan would make the available flow to be more than 0.510 (0.150+0.360) m³/sec i.e. 44,064 m³/day, which is approximately 40% of the ever observed minimum flow on Duhangan stream at Jagatsukh.

It is important to mention that flows recommended above on Allain and Duhangan are far more than the 100 liters per day as suggested by Manali Town and Country Planning, a Division of Government of Himachal Pradesh.

The minimum recommended discharges downstream the Allain and Duhangan are to be maintained so as to maintain ecological sustenance and local demand downstream. RSWML is to ensure this monitoring of minimum recommended water flow by installing electronic and manual measurements devices at the diversion structures.

There will also be change in flow of Allain stream in the stretch of about 1.5km falling between tailrace outlet to the point of confluence in Beas River. In this stretch, a peak flow of approximately 26.8m³/sec (96,480 m³/hr) will be

discharged during 4 hours of peak power generation period. This significant impact of increased flow through tailrace discharge would result in increased level and discharge rate by 8.85 times the present 90% dependable flow in Allain.

Further, adequate sewage treatment plant for domestic wastewater from the project would be maintained to assure safe water quality. Adequate measures as spelled out in the Catchment Area Treatment plan for soil erosion control will be implemented to conserve water quality of the streams.

1.9 CONCLUSIONS

The Allain and Duhangan streams do not seem to be a source of any fish, except the possibility of season-specific fish migration from Beas. This could get impacted due to the change in hydrology and water quality of Allain and Duhangan streams, during construction and operational stages of the Allain Duhangan Hydroelectric project. To ascertain the baseline, impact and hence coming up with relevant mitigation measures, more detailed baseline studies as suggested are required. The project will maintain minimum water flow for sustenance of biological life.

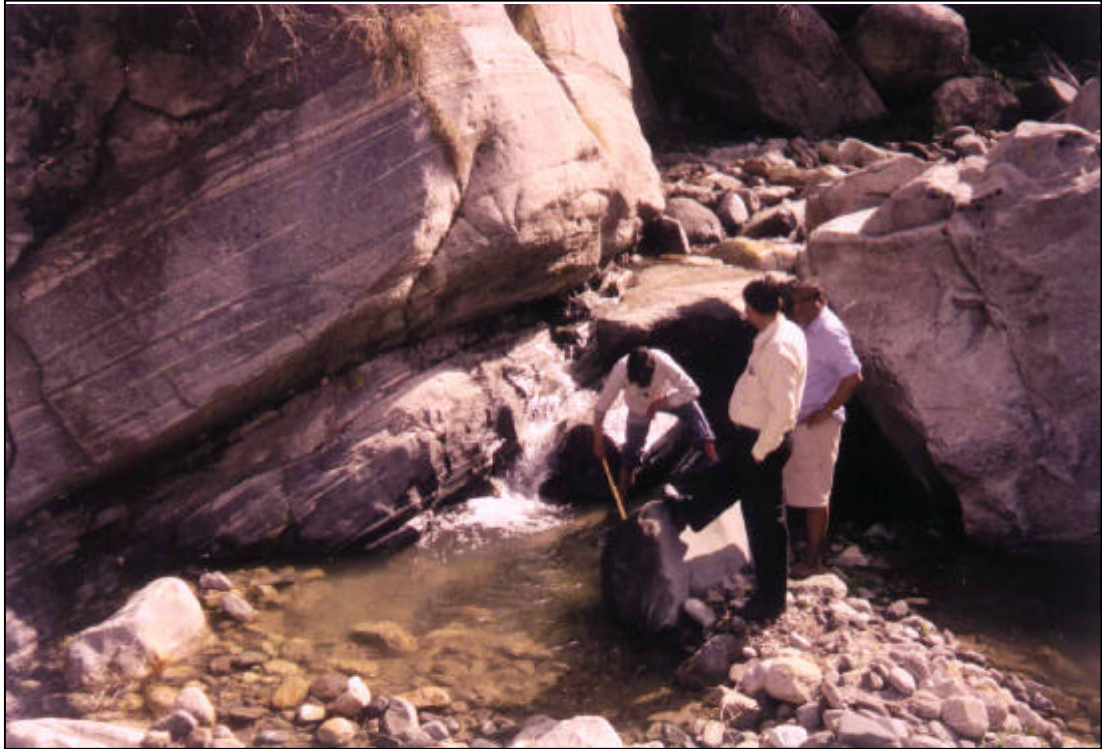


Plate 1: Attempts for catching fish at Allain Stream during ecological survey



Plate 2: Attempts for catching fish at Duhanan Stream during ecological survey



Plate 3: Fish catch – Fingerling caught at the confluence of Duhangan stream and Beas river



Plate 4: Fish catch from Beas at a local trader near Manali