CHAPTER-3

FISHERIES MANAGEMENT PLAN

3.1 INTRODCUTION

A water resources project may have adverse or beneficial impact on the fish fauna, depending upon the particular situation and the fish fauna inhabiting the concerned river. Similarly it has various impacts on the people, the livelihood of which depends on the fish. The construction of the barrage leads the fragmentation of habitat, modification in hydrologic regime and may have adverse effects on indigenous and migratory fish. On the other hand pondage provides a large volume of water, which is beneficial with respect to fish culture and can play an important role in the upliftment of economic growth.

3.2 FISHERIES STATUS

The fisheries in the project area are poorly developed since the potential has remained unexploited owing to difficult terrain, unfavorable climate and poor infrastructure facilities. The elevation, temperature, current, velocity and natural biota are the factors governing the growth of fish in the rivers and water bodies in the area. Most of the streams, rivers, and village ponds and other aquatic body in the upper reaches maintains fairly low temperature, which results into low primary productivity. Hence, small sized fish may be available in the streams. Commercial fishing is not in practices in the study area.

This may be due to high elevation, low temperature and fast water velocity. The list of fish species available downstream the power house is given in Table-3.1. The commercial fisheries in the area are non- existent. The growth of the coldwater fish is also very poor due to low temperature and scarcity of food resources for fish. There is no specific spawning and breeding reserves in the Supin River in the project area. Therefore, present ecological survey revealed that there is no substantive loss of fish habitat due to the construction of Jakhol-Sankari HEP.

TABLE-3.1
Fish species reported in the Tons river near confluence with Supin d/s of PH

Sl. No.	Name of the Fish	Local Name	IUCN Status	CAMP 1998
	Family:Cyprinidae			
1.	*Schizothorax richardsoni** (Gray) 1832	Maseen	VU	VU
2.	*Schizothorax progastus** (McClelland, 1839)	Chongu	LC	LRnt
3.	*Garra gotyla gotyla*(Gray, 1830)	Gondal	LC	VU
4.	*Barilius bendelisis* (Hamilton, 1807)	Fulra	LC	LRnt
	Family:Nemacheilidae			
5.	*Paraschistura montana* (McClelland, 1838)	Gadiyal-Loch	-	-
	Family: Sisoridae			
6.	*Glyptothorax pectinopterus* (McClelland, 1842)	Nau (River cat)	LC	LRnt

Note- *VU-Vulnerable; LC-Least Concern; LRnt-* Lower risk-near threatened; * *Snow trouts-migratory species*

Fish catch composition

The fishery survey was conducted for three seasons form January 2017 to September 2017 with the help of local fishermen using cast net having mesh size 1 cm in the study area, in pools and rapids wherever possible in the river supin. There is no fish was observed near proposed barrage and power house site.

Total Six species *Schizothorax richardsonii, Schizothorax progestus*, *Paraschistura montanus*, *Barilius bendelisis,, Glyptothorax pectnopteerus* and *Garra gotyla gotyla* were reported during the study period at the downstream site of confluence Supin & Tons Rivers.

Spawning and breeding

Most of the species of fish are periodic in breeding and regular spawning ground throughout the year. *Schizothorax* species (snow trout) generally spawn /breed from May-June to August-September, depending upon the water temperature. There is no spawning ground observed in the river Supin in the study area.

Fish Migration

The migration of *Schizothorax* species is generally related to water temperature of the stream. This species can service between 2^0C to 25^0C. The favorable temperature of these species ranges from 10-22°C. During winter when temperature fall below the favorable ranges these species migrate towards lower elevation. Upstream migration again took place on set of summer due to rise in water

temperature. It is worthwhile to mention here that the *Schizothorax* species has been observed upto the confluence of Supin & Tons rivers and further downstream zone only.

3.3 IMPACTS ON FISHERIES

3.3.1 Construction phase

Impacts due to excavation of construction material from river bed

During the construction phase a large quantity of construction material like stones, pebbles, gravel and sand would be needed. Significant amount of material is available in the river bed. It is proposed to extract construction material from borrow areas in the river bed. The extraction of construction material may affects the river water quality due to increase in the turbidity levels. This is mainly because the dredged material gets released during one or all the operations mentioned below:

- excavation of material from the river bed.
- loss of material during transport to the surface.
- overflow from the dredger while loading
- loss of material from the dredger during transportation.

The cumulative impact of all the above operations is increase in turbidity levels. Good dredging practices can however, minimize turbidity. It has also been observed that slope collapse is the major factor responsible for increase in the turbidity levels. If the depth of cut is too high, there is possibility of slope collapse, which releases a sediment cloud. This will further move outside the suction radius of dredged head. In order to avoid this typical situation, the depth of cut be restricted to:

$$\gamma H/C < 5.5$$

where,

γ - unit weight of the soil
H - depth of soil
C - Cohesive strength of soil

The dredging and deposition of dredged material may affect the survival and propagation of benthic organisms. The macro-benthic life which remains attached to the stones, boulders etc. gets dislodged and is carried away downstream by turbulent flow. The areas from where construction material is excavated, benthic fauna gets destroyed. In due course of time, however, the area gets recolonized, with fresh benthic fauna. The density and diversity of benthic fauna, will however, be less as

compared with the pre-dredging levels.

The second important impact is on the spawning areas of fishes. Almost all the cold water fish breed in the flowing waters. The spawning areas of these fish species are found amongst pebbles, gravel, sand etc. The eggs are sticky in nature and remain embedded in the gravel and subsequently hatch. Any disturbance of stream bottom will result in adverse impacts on fish eggs. Even increase in fine solids beyond 25 ppm will result in deposition of silt over the eggs, which would result in asphyxiation of developing embryo and also choking of gills of young newly emerged fry. Thus, if adequate precautions during dredging operations are not undertaken, then significant adverse impacts on aquatic ecology are anticipated.

Impacts due to discharge of sewage from labour camp/colony

The proposed hydro-power project would envisage the construction of temporary and permanent residential colonies to accommodate labour and staff engaged in the project. This would result in emergence of domestic waste water which is usually discharged into the river. However, it is proposed to commission adequate number of septic tanks for treatment of domestic sewage before its disposal in to the river. Due to perennial nature of river supin, it maintains sufficient flow throughout the year which is sufficient to dilute the treated sewage from residential colonies. Therefore, as mentioned earlier, no adverse impacts on water quality are anticipated due to discharge of sewage from labour camp/colony.

Impacts due to human activities

Accumulation of labour force in the project area might results in enhancement in indiscriminate fishing including use of explosives. The use of explosive material to kill fishes in the river in the project area would result in complete loss of fishes and other aquatic life making a river stretch completely barren. Indiscriminate fishing will reduce fish stock availability for commercial and sport fishermen.

3.3.2 Operation Phase

Impacts due to damming of river

The damming of river supin will lead to formation of a reservoir 0.24 ha. The barrage site change the fast flowing river to a quiscent lacustrine environment. The creation of a pond will bring about a number of alterations in physical, abiotic and biotic parameters both in upstream and downstream directions of the proposed barrage site. The micro

and macro benthic biota is likely to be most severely affected as a result of the proposed project.

The positive impact of the project will be the formation of a water body which can be used for fish stocks on commercial basis to meet the protein requirement of region. The commercial fishing in the proposed reservoir would be successful and other undesirable objects are removed before submergence.

The reduction in flow rate of river Supin especially during lean period is likely to increase turbidity levels downstream of the barrage. Further reduction in rate of flow may even create condition of semi-dessication in certain stretches of the river. This would result in loss of fish life by poaching. Hence, it is essential to maintain minimum flow required for well being of fish life till the disposal point of the tail race discharge.

Impacts on migratory fish species

It is proposed that the artificial propagation in hatchery may be adopted which can be stocked in the river stretches downstream and upstream of the proposed barrage site.

The *Schizothorax* species are steno-thermal. During winter months, they migrate from upper reaches to near flood plains in search of suitable temperature, feeding and breeding grounds. The spatio-temporal characteristic of river Supin both on upstream and downstream of the proposed diversion site found supportive for macro-benthic life that gave 5 units/sq.m. of fry of *Schizothorax* species. This observation further strengthens the fact that *Schizothorax* species migrate during winter months. With the onset of summer season, these species migrates upstream. These species from henceforth would congregate in the reservoir. It is expected that in due course of time these species will adapt themselves to the changed habitat.

3.4 MANAGEMENT MEASURES

Provision of minimum flow

The construction of the proposed project will lead to reduction in flow, especially during dry months, in the intervening stretch between the diversion site and the tail race disposal point. Such a situation will adversely affect the benthic communities and fish.

The dry segment of river between diversion site and tail race at certain places may retain some water in shallow pools subjecting the fish to prey by birds and other

animals. Such a condition will also enable the poachers to catch fish indiscriminately. It is therefore, very essential for the project authorities to maintain the minimum flow for the survival and propagation of invertebrates and fish. In order to avoid possible loss of aquatic life, a minimum flow will always be released.

The proposed project is a run of the river scheme. The river flow will be diverted through a small-gated barrage and no major storage is envisaged in the project. Water will be diverted through a tunnel for power generation and the tail race discharge outfall in supin river about 7 km downstream from the barrage site. The river stretch downstream of the barrage site upto the confluence point of tailrace discharge (about 7 km) will have reduced flow. The flow will be augmented by release of adequate quantity of Environmental Flows for sustenance of riverine ecology. In addition, various streams will also be contributing flow in the intervening stretch. The reduction in flow or drying of the river in the intervening stretch is not likely to have any adverse impact on the downstream users. This is mainly because of the fact that settlements/ villages within this dry stretch are not dependent on the water of river supin, as the villagers use water of small streams or nallahs flowing adjacent to their habitation.

(ii) Sustenance of fisheries

The stocking program shall comprise of the following:

- Acclimatization stocking (a new fish species is introduced in a water course)
- Supplementary stocking (a species already living in a water body)
- Transfer stocking (transportation of mature fish from one water body to another)
- Repetitive stocking (species which do not propagate in natural conditions).

To carry out the stocking programme on annual basis, suitable aquaculture facilities have to be created in river supin to meet the requirements of fingerlings. The endemic stocks in supin river are the Trout. The proposed aquaculture facilities have to meet the requirements of fingerlings of the Trout. The proposed aquaculture facilities have to be in flow through system facility for Trout species.

Commercial fishing is not in vogue in the project area. The diversion site on river Supin to be developed as a part of the project will act as a barrier to the free movement of fish species. Since, *Schizothorax richardsonii -Snow trout* is categorized as vulnerable species amongst the threatened fishes of India, scientific management of the existing

stock needs to be adopted. It is proposed to implement supplementary stocking programmes for the project area. In addition to reservoir area, it is proposed to stock river Supin for a length of 10 km each on the upstream and the downstream side of the diversion site. The rate of stocking is proposed as 100 fingerlings of about 30 mm size per km. For reservoir area, the rate of stocking could be 200 fingerlings of about 30 mm size per ha. The stocking can be done annually by the Fisheries Department, State Government of Uttarakhand and due consultation of the Directorate of Coldwater Fisheries Nainital (ICAR). Directorate of Coldwater Fisheries has successfully artificially propagated *Schizothorax richardsonii and S, progastus* in nature. A brief description of artificial propagation is mentioned below as per information retrieved from the literature and Directorate of coldwater fisheries. Snow trout, ***Schizothorax richardsonii*** (Gray) is an important indigenous cold water fish species, endemic to the Himalayas and found in streams and lakes which receive snow melt water from the hills. Artificial propagation and seed production in captivity is required for species diversification in cold water aquaculture. Technology for artificial fecundation of snow trout and rearing of young ones in controlled condition has been developed at DCFR. Spawning can be done by dry stripping method and egg are incubated in the flow through hatchery. This is a farm based eco friendly and location specific technique. Maturity of the brooder depends on the favorable temperature range *i.e* 14-18℃. Fertilized eggs remain bright orange in colour at the time of stripping. The average fecundity is 10560-22120 eggs/kg. Incubation period depends on the water temperature in the range of 110-270 hours. Good recovery of the fry can be achieved by proper nutritional care of brooder prior to the breeding season.

Therefore, to achieve this objective, facilities to produce seed of trout need to be developed at suitable sites. The cost required for developing of hatcheries shall be Rs. 25.2 lakh. The dimension of the hatching nurseries and rearing unit and their approximate cost is given in Table-3.2. The recurring expenditure for hatchery will be 17.55 lakh/year. The total recurring expenditure for 4 years including 10% escalation will be Rs. 80.68 lakh. The detail of recurring expenditure are given in Table-3.3.

TABLE-3.2
Cost required for development of hatcheries

Farm Component	Area (m)	Number	Rate of flow (lpm)	Cost (Rs. Lakh)
Hatchery building	15x 6 x 5	1	-	3.0
Hatching trough each with 4 trays each	2.0x0.5x 0.4	20	3.0-5.0	2.0
Nursery ponds (Cement lined)	3.0 x 0.75 x 0.5	9	25-50	2.7
Rearing tanks (cement lined)	10.0x 1.5 x 1.0	9	75-100	4.5
Stock raceways (cement lined)	30.0 x 6.0x 1.5	2	150-200	3.0
Storage – cum – Silting tank	4.0 x 4.0	1	-	1.0
Office store & laboratory room	8.0 x 6.0	3	-	6.0
Watchmen hut	4. 4.0	1	-	2.0
Other items like Dragnet, wide mouth earthen pots miniature happa bucket bamboo patches etc.	Lumpsum			1.0
Total				**25.2**

TABLE-3.3
Recurring expenditure for hatchery

S. No.	Particular	Number	Rate	Amount (Rs. Lakh)
1.	Salaries			
i)	Farm Manager	1	25000/month	3.0
ii)	Farm Assistants	1	15000/ month	1.8
iii)	Farm Attendants	1	10000/ month	1.2
iv)	Chowkidars	1	10000/ month	1.2
2.	Fish food	Lumpsum		0.10
3.	Brooders	200 kg	150	3.0
4.	Ponds manuring			
i)	Cow dung	20 tons	200/tons	0.0
ii)	Urea	100 kg	10/kg	0.0
iii)	Potash, phosphate	100 kg	100/kg	1.0
5.	Lime	300 kg	10/kg	0.3
6.	Training and Research	Lumpsum		0.10
7.	Chemical	Lumpsum		0.10
8.	Maintenance	Lumpsum		0.10
9.	Travel	Lumpsum		0.10
10	Miscellaneous	Lumpsum		0.10

S. No.	Particular	Number	Rate	Amount (Rs. Lakh)
	Sub-total for one year **Total recurring expenditure for four years including 10% escalation (B)**			17.6 **80.68**

Thus total cost for fish seed farm will be Rs. 105.88 lakh (Rs. 25.2 + 80.68 lakh). The above facility can be developed and implemented by Fisheries Department, State Government of Uttarakhand at an appropriate site. Seeds can be transported from this hatchery. The supply of seeds can also be augmented by collecting them from natural sources. Production, transportation and stocking of fish material is a highly technical subject for which project proponent may not have the required expertise. Thus, implementation of this proposal may be done by the Fisheries Department. The funding can be done by Project Proponents.