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HILL AQUACULTURE IN UTTARAKHAND

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Uttarakhand, one of the Hilly states of India has enormous freshwater fisheries resources that comprised of 2,700 km of rivers, 24,200 hectares of reservoirs, 297 hectares of lakes and about 2000 hectares of ponds. The state comprises two major regions namely Kumaon and Garhwal and both the regions are blessed with an abundance of aquatic resources. Among the available resources, a number of natural lakes in the Kumaon region constitute a valuable water resource even for development of aquaculture fisheries in the region. The principal lakes are Bhimtal, Garudtal, Hanumantal, Khurpatal, Nainital, Naukuchiatal, Sattal and Shyamlatal. In addition to these lake resources, the low and mid Himalayan Kumaon region has small aquatic ponds and great potential for creating more water areas for aquaculture development.

Since, water temperature in the hills falls below 20°C, the exotic carps (common, grass and silver carps), mahseers and other such coldwater fishes that can grow and survive at lesser temperature than IMCs are more suitable for use in hill aquaculture. Among all the cultured species; Silver carp, Grass carp and Common carp are reported to perform better in composite culture system in the mid altitude conditions. Common carp plays an important role in augmenting fish production especially in the hill states of the region. Since the size of fish ponds in the hill areas are small and principally rain fed and seasonal, the small-scale integrated aquaculture utilizing available on-farm resources has great potential.

Uttarakhand climate diversification for aquaculture

Trout Zone	Areas above 4000 feet where temperature is below 20°C
Mahseer Zone	Areas below 4000 feet located in central Himalayan
Plain Zone	Hilly areas after Trout & Mahseer Zones
Major Carp Zone	Plain areas of state i.e., Udham Singh Nagar, Haridwar& Dehradun

Best practises in hilly areas of Uttarakhand

1. Angling with conservation
2. Cluster based trout farming

1. Angling with Conservation

- The rivers are an important natural resource available in the state in abundance that can be exploited for fish production and sport fishery.
- Due to various natural and man-made reasons the natural fishery is depleting in rivers.
- Development of rivers without participation by local residents and active groups was a challenge.

- Department has identified major river systems which are divided in beats of 5 to 8 km sand are being allotted to local groups /SHGs/ female groups for conservation & employment generations.
- Allocation of beat shave ensured check on illegal fishing, conservation of fish in natural rivers and a source of employment to locals.
- A beat is generating direct employment for a cooperative (min.11people) with an income of roughly Rs.1.60 lakh.
- Further development of beats as ANGLING VILLAGES for supporting recreational fisheries will enhance income manifold by attracting tourists and anglers worldwide.

Sport fishing

2. Cluster Based Trout Farming

- Upland area of the state, six districts have been identified for trout farming.
- Trout farming has observed slow pace of growth in past as trout growers were demotivated owing to various factors like capital intensive nature of trout farming, limited number of farmers, low momentum of production, absence of marketing linkages, etc.
- For development and establishment of trout farming as a primary occupation in uphills, department is now focusing on cluster-based trout farming through cooperatives where minimum of 20 farming units are established at one place.
- To achieve this, fisheries cooperatives have been formed in identified areas at mission mode resulting in existence of 39 fisheries cooperatives.
- For financial support to cooperatives and thereby enhancing trout fisheries in the state an integrated model has been developed which is funded through NCDC (National Cooperative Development Corporation).
- In proposed model FARM TO TABLE approach has been emphasized where 1000 trout raceways, hatcheries, retail outlets, OASIS (One Stop Aquaculture Shop & Information System) and Market are proposed to be developed.

Raceways for trout farming

Action Taken / Targets

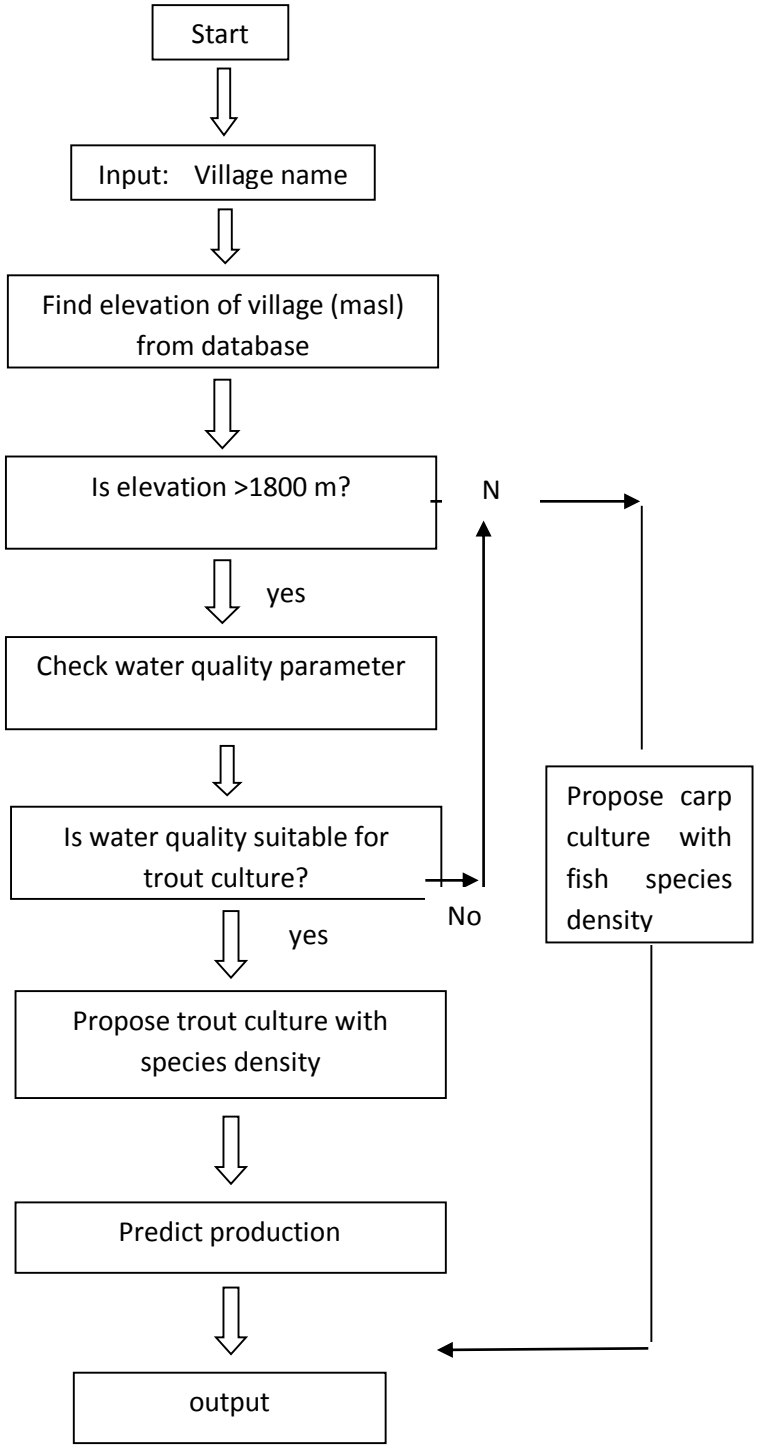
Number of Trout Raceways developed in last three years	305
Trout Raceways to be developed under NCDC	1000
Trout Hatcheries	02 (Established) 01 (Under Construction)
Additional Trout Hatcheries to be Established	08
Trout Brood Bank to be established	01 (Under Construction)
Number of Retail Shops to be established	04

Decision support system (DSS)

The decision support system (DSS) is an interactive computer-based system or subsystem intended to help decision makers by using communications technologies, data, documents, knowledge and/or models to identify and solve problems and decision-makings. The DSS development approach is based on the assumption that the information requirement of a system can be predetermined. The decision support system database was developed in Microsoft Visual Basic 6.0 software as front-end tool and Microsoft Access 2000 as back-end tool. Various forms, menus, text fields and command buttons were created in visual basic software and it was linked with the

backend tool of Microsoft Access **(Siler and Spotts, 2002).** The village information like name of the village, msal, latitude, longitude, population density, nearest market, nearest hatchery etc. were stored in the back end which was accessed on the system for taking appropriate decision.

Fig: Flowchart diagram of decision support system for aquaculture in Kumaon hills



Schemes related to promote hill aquaculture in Uttarakhand

S. No.	Name of project	Details of project
1.	**Schedule Cast Sub Plan (SCSP)**	For SC: 70 % subsidy (INR 42000) for hill areas on fishery pond of INR 6000/-per 0.01 hectare (unit).
2.	**Tribe Sub Plan (TSP)**	For Tribe: 70 % subsidy (INR 42000) for hill areas on fishery pond of INR 6000/-per 0.01 hectare (unit).
3.	**Fishery pond manufacture in hilly areas**	Small pond manufacture of 0.005-hectare area. pond manufacture of 0.005-hectare/ 50-meter area with 50% subsidy of total cost i.e., INR 25000/- of INR 50000/-. One candidate can have 3 units only. Training, field visit and holding public seminar for person in fish cultivation
4.	**Adrash fishery pond manufacture in hilly areas**	Manufacture and making Adrash fishery pond in state Manufacture of concrete pond of minimum 20 sq. meter/ 0.02-hectare size (20×10×1.5 mtr. / 01 unit) area. 1st year subsidy INR 150000 (of total investment INR (300000). One candidate can have maximum 3 units.
5.	**Development of cold-water fishes (75% centre funded)**	Promoting Fisheries in hilly areas. Constructing running water ponds in hilly areas and providing total investment of 60,000/- Rs in which 20 % is payable at 0.001 hecatre (unit) i.e., Rs. 12000/- Rs. per 0.001 hectare.

Constraints : Important constraints to sustainable aquaculture development in the hill region are:

- Difficult terrain
- Non- availability of quality fish seeds of appropriate fish species in time
- Non-availability of specific technology
- Non-availability of suitable fish food organisms/feeds
- Diseases
- Non-availability of trained technical manpower
- Urgent need to find alternate fish species which can grow in lower water temperature or grow to marketable size within short period of time (7-8 months)
- Lack of private entrepreneurship
- Poor extension machinery in transfer of appropriate technologies
- Inadequacy in generation of appropriate culture technologies to suit the local demand
- Under-utilization of aquatic resources and potential low-lying areas for fish farming
- Unscientific management and inadequate infrastructure facilities and financial assistance are some of the important bottlenecks in expansion of mid hill aquaculture

Conclusion

In general, the coldwater fish farming has been largely overlooked due to appropriate fish species, lack of suitable technology, poor growth of fish and inadequate infrastructures most tribal farmers of the region are resource poor and possess small to medium sized fish ponds for aquaculture. Therefore, there is tremendous scope for increasing productivity through introduction of suitable fast growing fish species appropriate to the region. The Government should take a policy decision to establish brood bank of suitable fish species for quality fish seed production in order to provide quality brood stocks to the selected farmer fish seed producers of the mid hill region. With large population of domestic animals and huge resources of green foliage in the region, there is ample scope for vertical expansion of aquaculture through use of on-farm resources to meet the demand. Development of site-specific farming systems suitable for the terrain based on the elevation and climatic conditions is therefore required for the region.

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