

Potential development interventions for fisheries and aquaculture in Nepal



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**POTENTIAL DEVELOPMENT INTERVENTIONS FOR
FISHERIES AND AQUACULTURE DEVELOPMENT IN NEPAL**

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Foreword

FAO Regional Office for Asia and the Pacific was requested to conduct a review of the development potential for fisheries and aquaculture in Nepal. This document is the output of this mission. The document provides a brief status of the sector in Nepal based on a literature review and interviews with main stakeholders in the sector. The document also list of number of priority areas where the Government of Nepal and FAO potentially can follow up with smaller projects to facilitate the development of aquaculture and fisheries in Nepal. The review concludes that there are plenty of good smaller case studies in Nepal which could be built upon into larger scale initiatives if funding was available. It is clear that there is a considerable potential to develop both fishery and aquaculture further in Nepal and some discussions have already taken place on how to potentially link fishery and aquaculture components to other FAO activities in Nepal. The main findings from the mission were presented to a broad range of stakeholders on 9th Nov 2007 in Katmandu, Nepal and this report also contains comments received at this meeting.

This review was prepared by the national consultant and technical backstopping officer from the fisheries group (RAPI) of the FAO regional office. All findings in this report are based on interviews, field visits and review of literature conducted during a field visit in Nepal from 28 Oct – 10 Nov 2007.

Key words: Aquaculture and fisheries; Nepal; Poverty alleviation and alternative income.

Table of Contents

Foreword.....	2
Table of Contents.....	3
Background information on fisheries and aquaculture	4
Resources and production.....	5
Fisheries and aquaculture production	5
Research and Development.....	6
Marketing and trade	7
Domestic market	7
Regional markets	7
Aquaculture and fisheries policies	8
Opportunities for aquaculture and fisheries development	9
Policy development.....	9
Research and development	9
Distribution and conservation of cold water fish species	9
Farmer organization and cooperatives	10
Training and capacity building	11
References.....	11
Annex 1: Indicative proposals for projects or program components.....	12
Scaling up of rice-fish culture nationwide	13
Community base Aquaculture in Swamps or Ghols	15
Post harvest technology development.....	17
Sahar breeding lead centre and riverine fish study for biodiversity and conservation	19
Breeding and culture technology development of ornamental fish	20
Annex 2: People consulted during the review	21

Background information on fisheries and aquaculture

Fisheries have been practiced in Nepal for a long time and have a strong tradition in Nepal. Aquaculture is a relatively new activity and was started in early 1950's. Over the past 20-25 years there have been a significant increase in the production of fish and the annual per capita fish consumption have increased significantly from 0.330 kg per person per year in 1982 up to 1.753 kg per person per year in 2006. There is some export of fish and the export is increasing but still not high. Fisheries and aquaculture is not a main agricultural activity in Nepal but it is an important supplement to the daily food in rural areas. The Nepal Agriculture Perspective Plan (APP) has categorized fisheries and aquaculture in Nepal as a small but important and promising sub-sector of agriculture contributing about 2.47 percent of agricultural gross domestic product (AGDP). Fish is considered as good luck (Sagun) in Nepal and is acceptable for consumption by all groups.

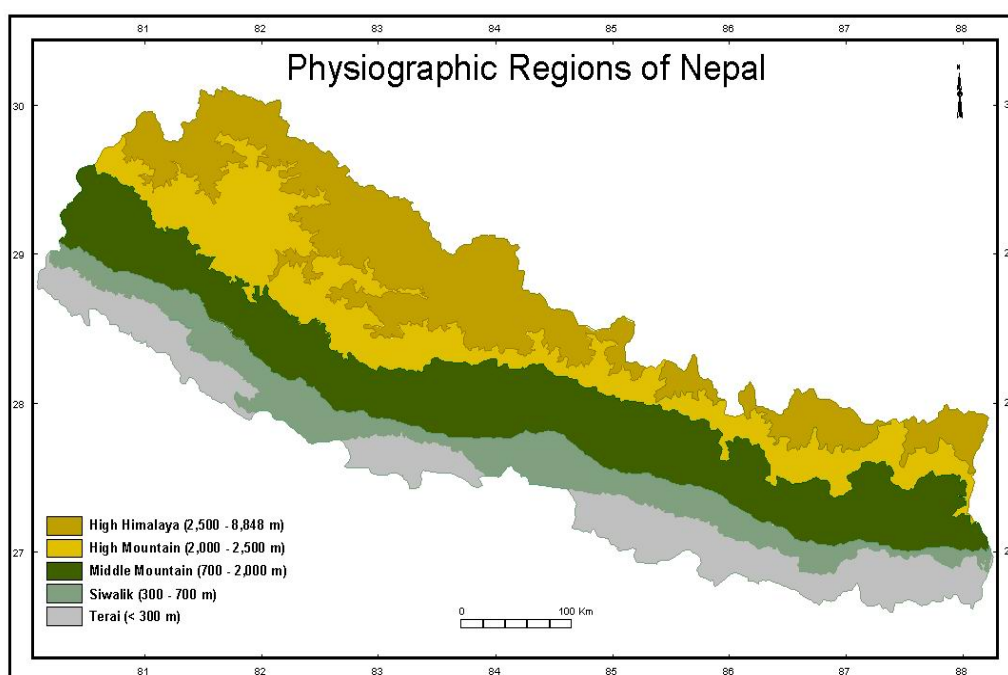


Figure 1: Physiographic regions of Nepal showing five main regions (often summed into only three regions being: 1 Mountainous region (High Himalaya and High Mountain); Hilly Region (Middle Mountain) and Terai Plain (Siwalik and Terai).

Nepal is divided into three geographical regions namely the high altitude and colder mountainous region along the northern border of Nepal, the moderate climate medium altitude hilly region in the central part and the southern region, the Terai-plain with low altitude and warm climatic conditions. Nepal is the second richest country in the world measure against freshwater resources and possesses about 2.27 percent of the world fresh water reserves (CBS 2005). Please see Figure 1 which is an outline of the three regions.

Rivers are one of the major source of capture fishery, contributing almost 50% of total captured fish production and a large number of fishermen and their families are involve in capture fishery which provide income and partial employment for them. Out of total 818 500 ha of total water surface area, about 6 000 rivers and rivulets cover 395 000 ha (or 48 percent). There are also some fisheries activities in the lakes especially around Pokhara valley but the main capture fisheries production is from the rivers. Fishing activities in irrigation channels, rice fields, swampy areas and ghols is also a significant source of capture fisheries production.

Aquaculture is mainly done in the Terai-plain consisting of carp production in ponds. However there are also aquaculture done in cages in lakes and reservoirs in the hilly region as well as raceway production of Rainbow trout also in the hilly region. There is about 11 100 ha of scattered swamps and Ghols in the marginal forest areas in the Terai region. This land is considered waste land and not useful for agriculture activities. Irrigated rice field covers about 398 000 ha but rice-fish culture is done only 1 percent and is currently producing only 111 MT. Warmwater carp culture is the main practice and concentrated in the terai of southern region, though coldwater fish culture also started recently in small scale in the hilly region and has shown high potential for its promotion.

Resources and production

Fisheries and aquaculture production

Warm water fish species such as Rohu (*Labeo rohita*), Bhakur (*Catla catla*), and Naini (*Cirrhina mrigala*) and common carp (*Cyprinus carpio*) introduced in 1956 from India are main species cultured at a commercial scale in Nepal. The herbivore grass carp (*Ptenopharyngodon idella*) was introduced in 1966 from India, phytoplankton feeder the silver carp (*Hypophthalmichthys molitrix*) in 1968 from Japan and zooplankton feeder bighead carp (*Aristichthys nobilis*) in 1971 from Hungary for polyculture. These seven carp fish species are the main species commonly used by the farmers for commercial production. An overview of the main production areas and the production is shown in Table 1.

Table 1: Estimated water surface area and fish production in Nepal in 2006 (DoFD 2006/'07).

Production system	Production (MT)	Area (ha)	Productivity (MT/ha)	Potential area (ha)
Fisheries				
Rivers	6 992	395 000	0.018	-
Lakes	800	5 000	0.159	-
Reservoirs	363	1 500	0.242	78 000
Marginal swamps/ ghols	4 976	11 100	0.448	-
Irrigated rice fields	6 885	398 000	0.017	-
Total capture	20 016			
Aquaculture				
Ponds	22 545	6 337	3.558	-
Govt. farms	28			-
Enclosure	140	100	1.400	-
Rice/fish culture	120	300	0.400	-
Cage culture	480	80 000 m ³	6 kg/m ³	-
Ghol culture	2 096	1 612	1.300	
Total aquaculture	25 409			
Total national production	45 425			

The total production in 2006/'07 was 45 425 MT with 20 016 MT from natural water bodies and 25 409 MT from ponds and aquaculture (DoFD 2006/'07). As can be seen in Table 1 there is considerable scope for expansion of fisheries activities related to reservoirs, irrigated rice fields and Marginal swamps/ ghols.

Fishery centers and hatcheries were established after 1967 in different places for fingerlings supply and for technical and extension support to the farmers and fishermen. For the

aquaculture sector, both breeding and culture technologies have been developed both in government and the private sector. The private sector is now contributing about 75 percent of the total fingerlings to fulfill the farmers demand and only 25 percent comes from the government centers.

As an interesting initiative on cross-sectoral work, it is worth mentioning the Hydroelectric Project in Kali Gandaki by Nepal Electricity Authority (NEA). Here a 144 MW dam has been built to produce electricity. In recognizing that dam structures have potential negative impacts especially on some of the traditional migratory fish species living in the rivers, a hatchery for mass seed production of indigenous species was built to offset the loss of the economically and ecologically important indigenous riverine fish species. Restocking with a number of indigenous species both up and down stream of the reservoir, and sustaining the income and employment opportunities of fisher community by fishing and conserving for the local people in that localities are main benefits from this hatchery and its activities. The hatchery has been running jointly between NEA and Nepal Agricultural Research Council (NARC) since 2002.

The Kali Gandaki River is important because it has 56 indigenous fish species available in the River system. Among the successful breeding of fish species, sahar *Tor spp* has shown one of the potential for breeding and there are ambitions and potential for the hatchery to be a regional center of excellence for *Tor spp* breeding. The coldwater fishery is very important in the hilly regions of Nepal, where the people have less opportunity for warmwater fish culture as compared with the urban/terai area. There is a need to develop technology of cold water fish to support the people living around. Kali Gandaki Fish hatchery could be a suitable station for the study of cold water riverine fish species.

Research and Development

The Directorate of Fisheries Development is the national focal point for fisheries and aquaculture. It is under the Department of Agriculture, Ministry of Agriculture and Cooperatives. To increase the productivity in agriculture sector, Nepal Agricultural Research Council (NARC) was established in 1991 as an autonomous apex body at the national level to undertake agricultural research activities to increase agricultural production and productivity by generating appropriate technologies suitable to various agro-ecological zones for the country's diversified crops, horticulture, livestock and also fisheries.

The mandate of NARC is to develop new technologies and to give policy advice to Nepal Government. They are also strongly involved in research and development for the fisheries and aquaculture sector. The development of new technologies need to suitable for farmers and there is therefore a strong link between research and development of new technologies and to the extension work. The goal is to have fisheries and aquaculture making a significant contribution to livelihoods, especially those of the rural poor.

There is a strong need for capacity building in the research and development institutions in Nepal. The lack of staff is a potential bottleneck for further expansion of the sector. The work load is carried by an only a small group of people. There is a need to increase both the number of technicians, researchers and extension workers in order to use the potential of the natural resources.

There is also a need to develop facilities to produce more seed and feed. This was raised at several occasions during meetings with stakeholders. A reliable system that can produce sufficient fish seed is necessary and is one of the key factors for further fish production development in the sector. The fish feed production in Nepal is undertaken at a small scale and is based around dried freshwater shrimp which are imported from mainly India and the pounded into to shrimp meal in Nepal. The supply is inconsistent and of varying quality and there is a clear need for alternatives to be investigated. There are limited ways for the feed

producers and farmers to get contact with alternative sources of feed and it is difficult to get information on prices and quality.

Marketing and trade

Most of the fisheries and aquaculture production in Nepal is consumed by the domestic market. There is also some export but this is still quite limited and imports far exceed exports.

Domestic market

The per capita consumption of fish has increased significantly from 0.330 kg per person per year in 1982 up to 1.753 kg in 2006. Fish is acceptable to every segment of the population, but still Nepal has a low per capita consumption compared to neighboring countries despite the increasing trend. The domestic production of fish is not sufficient to meet the domestic demand and there is a significant import every year from neighboring countries mainly India. The domestic commercial fish production is mainly from the carp species and with high potential of the economically high value rainbow trout. There are only a few rainbow trout farms. According to the farmers they cannot produce enough trout for the market and consumers come directly to their farms to buy. There is no need to transport the fish to the market. Often the fish is sold before normal market size is reached. These are clear indications that there is a potential domestic market of a considerable size to be exploited

Marketing infrastructures have been developed in most cities in the Terai region and one of the main wholesale markets in Kathmandu has developed infrastructure that includes chilled, refrigerated and icing facilities. These facilities are used by fish traders at all levels, including middlemen, wholesalers, retailers and vendors on a community and co-operative basis. Around the lake fisheries in Pokhara valley there are also smaller fish market facilities. This model has been successfully operated for several years and is being assessed with a view to wider application in other areas.

There seems to be a considerable domestic market demand for good quality especially fresh fish.

Regional markets

In the region, there is a high demand for especially higher value cold water species. Fisheries and aquaculture officers from Nepal have investigated potential regional markets and have found there is a real demand for rainbow trout (e.g. in India and Singapore). At the current development level the Nepalese industry cannot deliver enough volume, consistently enough to tap into this market. The quality demand from this high value species market is high. In order to export to the regional market there would need to be a good quality control system in place and possibilities for branding should be investigated. "Himalaya Rainbow Trout" or "Everest Rainbow Trout" would be a strong starting point.

Aquaculture and fisheries policies

The Nepal Agriculture Perspective Plan (APP) has categorized Nepal fishery a small but important and promising sub sector of agriculture contributing about 2.47% of agricultural gross domestic product (AGDP) in the country (DoFD 2005/'06). Substantial progress had been achieved in aquaculture sub sector as Government has given due priority during the last few decades with the help of some donor agencies. Nepal is land locked and therefore deprived of oceanic resources so all fisheries and aquaculture is based entirely on the use of inland water bodies in rivers, streams, lakes, reservoirs, ponds, swampy lands as well as rice fields. Among the agricultural sectors, aquaculture has been considered as one of the potential areas recently through which substantial improvements in the income generation of farmers are achieved.

Under the APP a Fisheries Prospective Plan (FPP) have been developed. The three years interim program (2007/'08-2009/'10) has given priority to increase fish production and productivity providing income generation and poverty alleviation to the poor people by aquaculture enhancement using swampy area or ghols for aquaculture to the local people in community basis, post harvest management, marketing, ornamental fish promotion, and commercial production of high value of cold water fish e.g. trout culture. In addition, it has given emphasis on biodiversity conservation management of indigenous fish species, as well as community river management.

The long term goal for fisheries and aquaculture development is to enhance livelihoods through sustainable fisheries and aquaculture technology for food, employment and income.

There have been some very successful stories of international donor support in the fisheries sector. One example is the Integrated Fishery and Fish Culture Development Project (NEP/73/025) which was launched with the technical and financial assistant of UNDP/FAO from 1975-1980. The project was part of the success of increasing the fish production six fold during 1975 to 1985.

An estimated 750 000 people are directly or indirectly involved in aquaculture activities nationally and the number is increasing. It is clear that the fisheries and aquaculture sector in Nepal is under development and is one of the priority areas for the Ministry of Agriculture and Cooperatives. It is however also clear that there are other areas under the Ministry that are more important and receive more attention and resourcing.

Opportunities for aquaculture and fisheries development

Given the background above and following issues identified during the field visit a number of areas of special interest were identified. These areas were mainly identified by stakeholders interviewed during the field trip and during the final stakeholder meeting in Kathmandu. Also previous work done in Nepal and a literature review was part of the identification process. Below is listed the areas identified and a brief background description and justification for choosing these areas are given. A number of specific project proposals have been developed based on the areas and these are attached in *Annex 1*.

It was agreed at the stakeholder meeting that it was necessary to make the proposals flexible and able to be part of larger projects (poverty alleviation, irrigation programs etc.) and that it was important to get clear signals and guidelines from Government of Nepal to show fisheries and aquaculture is a priority. A list of the stakeholders the consultants meet during the field trip is attached in *Annex 2*. The full program for the field visit is attached in *Annex 3* and Terms of Reference for the mission is attached in *Annex 4*.

Policy development

For the fisheries and aquaculture sector to develop in a planned and sustainable manner there is a need to have continued clear policies stating where fisheries and aquaculture in Nepal is going and what is prioritized by the Ministry of Agriculture and Cooperatives.

It is advisable when developing policies, to base fisheries and aquaculture development on international recognized guidelines and recommendations (e.g. FAO Code of Conduct for Responsible Fisheries). From these overall guidelines a national “Code of Conduct” could be developed to adapt to the national scenario. A clear policy will help raise funds to develop some of the below identified areas.

Research and development

There is a need to both do research and development in the fisheries sector in Nepal. It was noted by many stakeholders that there had been more work done on development than on research in recent years. To ensure a strong development it is recommended that more adaptive research and development is done related to seed production. Currently quality and quantity of fish seeds is a bottle neck for further development of the aquaculture sector. This would focus on improving quantity and quality. There is a need for more work to be done on improved feeding which is currently a major cost and quality is highly variable. Genetic improvement of carp was also mentioned as an area for potential research.

To ensure a high quality and safe product it was recommended to work on post-harvest technologies and post-harvest handling.

In the lakes and reservoirs of Nepal there have been successful development of cage culture is a successful program involving local communities that had little or no access to land. Keeping in mind the environmental carrying capacity of these lake and reservoirs it should be investigated if these low input extensive cage systems could be expanded.

Distribution and conservation of cold water fish species

Nepal has a comparative advantage compared to most countries in the region given the colder climate in the mountains and mid-hill regions. Cold water fish species such as Rainbow trout

has a high potential in especially the mid-hill region, where other income sources are limited. Both domestic and regionally there is a high demand for this valuable fish and there is plenty of opportunities to tap into this market. However, there are a number of constraints and issues that need to be taken into account in development of trout culture. The initial investment is high and quite high levels of technical skill are also needed in order to raise the fish in the raceway ponds. Trout growth is highly dependent upon good quality pellet feed, which is expensive in Nepal. In Nepal the fingerling production is limited and there is a need to support the development of a reliable hatchery setup for sufficient fingerling production. This could be lead by private or government.

There are 56 indigenous fish species available in the Kaligandaki River. But aftwer damming the river, some of the fish species mainly the migratory fishes are affected greatly as a result the population could be decreased. Visualizing this, hydroelectric project has built a fish hatchery near the river to breed local riverine fish species and release in up and down the river system as a mitigation program to maintain or minimize the decreasing population. The hatchery has good facilities for fish breeding and is running jointly with the cooperation of Nepal Electricity Authority (NEA) and Nepal Agricultural Research Council (NARC). The hatchery has great potential for cold water riverine fish breeding and can be a lead centre of excellence to support fingerling production both for commercial use and most importantly for support of the biodiversity and conservation in the river. More work should be done on supporting the Trans Himalayan Cold Water Fisheries network.

Farmer organization and cooperatives

In the lakes around Pokhara valley there are some small fishing communities living around the lakes. These fishing communities are using the lakes and at the same time being a very effective way of controlling the environment in the lakes. Fishermen organizations with a bi-yearly elected chairman are managing the amount of fish being raised, fish being caught and also monitoring the resource, not allowing any illegal fishing or aquaculture to take place. A good example on how the group works is how they have dealt with outsiders fishing illegally. The women group in the community is responsible for the “guarding”. Before it was the men from the community confronting the illegal fishers, but too often it came to trouble and even fighting between the involved persons. After the responsibility was taken on by the womens group, there have been no incidents. It would be interesting to try developing some farmer organizations in the Terai area based on the lessons learnt in the Pokhara area. The members from the well functioning communities from the Pokhara lakes could be trainers and based on their experience farmer organizations could be developed more widely. Lessons from India and VietNam on engaging aquaculture farmers in groups or clusters have proven effective both in increased income for farmers and in implementation of better management practices related to environmental and social aspects of aquaculture. Establishment of more organized farmer groups will have the potential to ease extension work giving the extension service and others a one-point-entry to the farmers in a given area.

In the Terai-region there are large areas used for irrigation run-off areas that could be used by integrated aquaculture and ponds by local communities and help raise their livelihood. Work should be done on how to integrate management of irrigation and aquaculture in an ecosystem type approach.

Rice-fish culture has great potential and can potentially raise the production of fish as well as rice but it will be depending on a sustainable seed supply which is currently not in place. When a good fingerling system is in place there will be great potential in scaling up of rice-fish farming at community level.

Training and capacity building

The mission observed that there is a need to develop the capacity at research centers and stations. There are currently a few hard working scientists and technicians that are working on research, development and management. There is a need for more contact with universities and technical schools in order to develop a Nepalese curriculum for aquaculture and fisheries and possibly create chances for some overseas training. Shorter training courses for researchers and technicians should be investigated and prioritized. The current limited number of researchers and technicians can be a constraint for further development of the sector and it is likely that more staff will be required.

There is also a need for capacity building at laboratories in terms of infrastructure but this should not be done before it is made sure there is sufficient technical staff to maintain and operate the laboratories.

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Annex 1: Indicative proposals for projects or program components

There is a considerable potential to develop both fishery and aquaculture further in Nepal given the available natural resources. However, there are a number of constraints that need to be addressed in order to have a sustainable development of the sector. The five areas identified above as being the priority areas and the proposals attached in Annex 1 are both covering broad areas and more specific areas.

Fisheries and aquaculture are not main elements of the agriculture sector in Nepal. However it is a very important part of development in rural areas as well as in developing public health both in rural and urban areas given the benefits from eating fish. It is suggested that fisheries and aquaculture try to link its development to other areas such as poverty alleviation, integrated water management, and other areas that will benefit from having a fisheries or aquaculture component. Some discussions have already taken place on how to potentially link fishery and aquaculture components to other FAO activities in Nepal and a number of draft concept notes have also been prepared as an outcome of the mission.

In Nepal the development of swamps and ghols are currently underdeveloped. Also rice-fish culture is done only in 1 percent of the available area and has considerable scope for development.

The development of community based farmer groups or organizations have in other countries proven to be a good way of creating a change in management practices from the bottom up. This combined with strong policy recommendations would create a good platform for development of a fisheries and aquaculture sector being sustainable and hence both benefit the Nepalese people and the same time, maintain a pristine environment and a high biodiversity.

The following small concepts notes are a collection of identified areas where development or support to the aquaculture and fisheries sector in Nepal can be realized. These concepts are deliberately scaled in such a way that they could be developed as stand alone initiatives (small projects) or as components within a larger aquaculture and fisheries development programme.

It is also possible that as components some of these may be quite suited to integration within a more multi-sectoral programme that seeks to address improvement of livelihoods, management of the water sector (e.g. irrigation projects, water management projects) or similar interventions which are not primarily focused on the fisheries sector, but which have common objectives to those set out in the concept notes (e.g. livelihoods projects, multi-sectoral support to farmer organization, rural marketing; rice field productivity improvement etc.)

These concept notes should be considered as “building blocks” which could be added together or used individually as appropriate and in response to specific directions provided under country or provincial/district priorities or donor supported initiatives.

Scaling up of rice-fish culture nationwide

Background

Irrigated rice field covers about 398,000 ha but rice-fish culture is done only 0.07% and producing only 111 Mt. Therefore there is huge scope for enhancing aquaculture practices in the country if the unused irrigated rice field is used for integrated aquaculture properly. Rice fish culture increases rice more than 10% and additional more than 500 kg/ha fish will harvest annually. No insecticide use in rice fish culture and healthy rice will harvest. The only rice fish culture can enhance fish production as well as rice together. Individual farmers afraid of doing rice fish culture due to poaching, so rice fish culture should launch widely in community. Small farmers are more reliable and more care taker by which their family members involve and will be benefited. There is a clear link to irrigation and water management projects with livelihoods as a component.

Objectives

Support improved adoption/uptake of rice-fish culture in Nepal

Indicative outputs

- Integration of rice fish culture training ‘modules’ into water management projects
- Training of farmers and extension workers
- Support to reliable fingerling supply and decentralized hatcheries
- Support initiatives to interlink with irrigation project and water management projects

Beneficiaries

Huge water bodies of irrigated rice field will be utilized for rice fish culture and mostly low income or poor/landless people living around will get benefit for income generation by which their family member can get job, involve and support for poverty alleviation. Fish can market in urban areas by market management and also can consume by family members as good animal protein sources produce themselves. National fish production will increase as a whole and at the same time more aquaculture can be done, more people get job for income generation.

Indicative budget 800 000 – 1 000 000 USD

Indicative project period 4 years

Promotion of large scale production of carp fingerlings in public and private sector

Background

Annual national total fish production is 45 425 Mt in 2005/2006 (DoFD 2006/'07) of which 44% from capture fisheries and 56% from culture practice. Total water surface area of Nepal is 818 500 ha, which covers 5% of the total land area (Bhandari 1992). Total fish production comes more from culture than capture though fish culture in limited area mostly from pond fish culture that covers only 6 220 ha producing 20 213 Mt annually. Irrigated rice field covers 398 000 ha but rice-fish culture is only 1% producing only 111 Mt. Cage fish culture is also practiced but at a limited scale. There are about 11 100 ha scattered of Swamps or Ghols in the marginal forest areas in the terai and comprises about 1.4% of the total water resources of the country (DoFD 2005/'06) but not being able to utilize properly. Therefore there are huge scope for enhancing aquaculture and increasing fish production in the country if the integrated aquaculture practices done properly in unused water bodies in Swamps or Ghols, rice field as well as in lakes and reservoirs. But the available resources have not been used fully though by aquaculture though potential mainly due to shortage of fingerlings quantitatively and qualitatively. Therefore reliable fingerlings production for quality and quantity should be identified and support both in public and private hatcheries.

Objective

Improve the supply and quality of fingerlings of selected fish species through a linked network of private suppliers which receive some primary services from state hatcheries.

Indicative Outputs

- A functioning brood stock maintenance systems within state hatcheries
- Decentralized hatcheries promoted in the private sector
- Training of private entrepreneurs
- System of fingerling supply into rural areas, fingerling traders
- Improved state infrastructure for quality control

Beneficiaries

Unused water bodies in swampy/ghols will be utilized for aquaculture and poor or landless people living around should involve in community by which the family member can involve and support for poverty alleviation. Huge irrigated rice field area could be used and produce fish as well as increase rice by more than 10% with rice-fish culture integration. Cage fish culture and open water fish stocking will increase in lakes and reservoir. National fish production will increase as a whole and at the same time more aquaculture can be done, more people get job for income generation.

Indicative Budget

300 000 – 1 000 000 USD depending whether a component within a program or a stand alone project.

Indicative project period

3 years

Community base Aquaculture in Swamps or Ghols

Background

There are about 11,100 ha scattered of Swamps or Ghols in the marginal forest areas in the terai comprises about 1.4% of the total water resources of the if use properly for aquaculture in community people living around of low income or landless can be launched to increase fish production as opportunities for economic generation for livelihood and support in poverty alleviation as well as increase in national fish production. In Nepal there are a number of good examples for development of community groups being involved in fisheries and aquaculture. These could act as case studies for development of community based groups in other parts of Nepal.

Objectives

Based on support to establishment of community groups facilitate utilization of water bodies by integrated aquaculture in Swamps or Ghols to benefit local people with no land rights.

Indicative outputs

- Aquaculture Training of community groups in the Terai region
- Technical support and training to extension workers
- Improved access to fingerlings
- Support studies and activities on linkage between aquaculture farmers and markets

Beneficiaries

Unused huge water bodies in swamps or ghols will be utilized for integrated aquaculture involved mostly low income or poor/landless people living around and get benefit for income generation by which their family member can get job, involve and support for poverty alleviation. Fish can market in urban areas by market management and also can consume by family members as good animal protein sources produce themselves. National fish production will increase with the people's income generation.

Indicative budget US \$ 500 000

Indicative project period 3 years

Support in up scaling for mass seed production of rainbow trout

Background

The technology for culture and breeding of rainbow trout has been developed in Nepal and some farmers are applying the technology but in small scale. People are becoming familiar with its taste due to no Y-bone and also tasty than other cultured carps. Aquaculture is mainly concentrated in southern terai region using warm water carp fish species whereas hilly region, where enough cold water available, is away from income generation source including aquaculture. People living in the hilly region have less opportunity in every field. The cold water fish like high value trout has great potential for income generation for the people living there. But due to shortage of fingerlings, trout culture has not been widened. Therefore visualizing the culture potential and its demand, reliable hatchery for fingerlings production qualitatively and quantitatively should identify and support for establishment initially.

Objectives

Improve the production and technology for production of rain bow trout brood stock and fingerlings production.

Indicative outputs

- Establishment of cold water trout hatchery in hilly region
- Improved brood fish management training
- improved fingerling production (quantity & quality) through training and improved feds and health
- Improved cost effective Feed production
- Training of government and private hatchery technicians
- Market linkages and cold chain/live fish marketing systems

Beneficiaries

Unused water bodies in hilly areas will be utilized for cold water trout production and people living around will get benefit for income generation by which the family member can get job, involve and support for poverty alleviation. Fish can export in neighboring and overseas countries and earn foreign currency. Cold water bodies in hilly region from east to west are potential and can be used widely. National fish production will increase as a whole and at the same time more aquaculture can be done, more people get job for income generation. The project will be establish hatchery, support equipment, brood fish management, fingerlings production, manpower development and overall management.

Indicative Budget 500 000 USD

Indicative project period 3 years

Post harvest technology development

Background

Post harvest technology also should be visualized with the development of aquaculture and fisheries to ensure a sustainable development of the sector in Nepal. Fish production is not running in full swing and use of resource is limited. Market of fish production is not a problem yet and the produced fish either consume locally or take to the urban market or even goes to boarder areas of India. But the fish after harvesting can not bring to the buyers big cities in good condition due to long distance for transportation as well the lack of a good system to transport fish in good condition due to lack of technology. If the potential of fisheries and aquaculture is further developed there will be a need for an infrastructure to handle the fish during post harvest. This will support both income generation to the poor and low income earners and support for poverty alleviation and at the same time ensure the food safety of fish and support the public health in general.

Objective

Support development of post harvest facilities to ensure the availability of good quality fish and seafood to consumers.

Indicative outputs

- Support post harvest infra structure
- Training of farmers and middlemen in post harvest handling
- Support to development of transport facilities
- Market chain analysis and support to improved in country and export focused marketing

Beneficiaries

Low risk to the producers as well as dealers from spoiling harvested fish. Encourage to flourish aquaculture that helps to increase national fish production. Consumers can get better quality of fish.

Indicative budget 300 – 500 000 USD

Indicative budget period 2 years

Cage fish culture enhancement of nationwide

Background

Cage culture is a successful program but concentrated only in the lakes of Pokhara valley and Kulekhani reservoir. It can be extended in lakes and reservoirs in other parts of the country including large water bodies. Lakes cover 5000 ha and reservoir 1,500 ha with future expansion of reservoir more than 68,000 ha water surface area. So there is wide scope for cage fish culture in large water bodies that also help for poor people to uplift their income status. If this development is done in a planned and managed way there is a potential for the cage fish culture to act as a net remover of nutrients. The examples given above are all based on low eutrophic level species like grass carp.

Objective

Support well managed expansion of cage culture within the environmental carrying capacity in the potential lakes, reservoirs or large water bodies.

Indicative outputs

- Transfer of technology from existing good examples in Nepal to potential new areas.
- Training of farmers
- Support to establishment of management groups (Community based groups)

Beneficiaries

Unused huge water bodies in lakes, reservoirs or large water bodies will be utilized fully for integrated aquaculture involved mostly low income or poor/landless people living around and get benefit for income generation by which their family member can get job, involve and support for poverty alleviation. Fish can market in urban areas by market management and also can consume by family members as good animal protein sources produce themselves. National fish production will increase with the people's income generation.

Indicative budget 250 000 USD

Indicative project period 3 years

Sahar breeding lead centre and riverine fish study for biodiversity and conservation

Background

Sahar (*Tor spp*) is a high value the second largest riverine fish after *Bagarius yerillii*. The breeding technique has been developed and the breeding is doing of domesticated second generation. Kaligandaki Fish Hatchery is potential for Sahar breeding and can be a lead centre. In addition out of 184 fish species recorded in Nepal, some are economically important species, which should be studied to develop technology for commercial production either for consumption or for ornamental purpose. And Kaligandaki Fish Hatchery will be a *Tor spp* breeding centre as well as study for biodiversity and conservation of other riverine fish species. In this regard, local community fishers should be fully empowered for fishing and conservation in the river system as they can play very important role for the management of fish biodiversity and conservation.

Objectives

Support development of improved breeding technologies of Sahar (*Tor spp*)

Indicative outputs

- Support regional experts and national experts in networking and sharing of information.
- Brood stock maintenance systems
- Trained private entrepreneurs
- System of fingerling supply into rural areas and release

Beneficiaries

High value riverine fish increase in population due to mass seed production and use for stocking in river system as well as increase income generation by using high value indigenous fish for commercial culture practice. Technical experts from different countries can be benefited by visiting and exchanging experiences, which help for further aquaculture development internationally. Fisher community living around the river system where fish stoked will be directly benefited supporting the livelihood by increasing income generation.

Indicative budget 300 000 – 400 000 USD

Indicative project period 4 years

Breeding and culture technology development of ornamental fish

Background

Ornamental fish is becoming a very fast growing demand particularly in urban areas. Almost all ornamental fish imported from overseas countries spending a lots of money and also very expensive due to high transportation cost. Some ornamental fish are studied and bred successfully but not being able to breed in mass scale due to insufficient know-how. Indigenous ornamental fish species also are available and can develop for commercial production once the complete technology developed. Ornamental fish culture can be a good source of income generation industry that can provide job opportunity for the low income earners and support to maintain the livelihood. Therefore the technology in breeding, nursing, rearing, feed and culture is necessary for fulfilling the increasing demand in the country.

Objectives

Development of technology package of ornamental fish species for commercial production.

Indicative outputs

- Training in new technologies
- Support to market surveys on ornamentals both domestically and regionally

Beneficiaries

Once the technology developed for commercial production, it will be a sustainable income generation to the number of poor or low earners, who will get benefit providing job opportunity. Manpower will be developed within the country and customers also will get in cheaper price and need not depend outside the countries.

Indicative budget 300 000 USD

Indicative project period 2 years

Annex 2: People consulted during the review

29-10-2007

Mr L Gautam, Asst FAO Rep (Program)
Mr AB Singh, Program Office, FAO
Mr A Thapa, Program Office, FAO
Mrs Sonam Dhakhwa, Administrative Assistance, FAO
Dr DB Swar, Secretary and former DG, DoA
Mr BP Upadhyaya, Officiating DG, DoA
Mr BB Karmacharya, Dy DG, DoA

30-10-2007

Dr TB Gurung, Chief, FRD, Godawari
Mrs A Raymajhi, Scientist, FRD, Godawari
Mr AP Nepal, Technical Officer, KFH, Beltari
Mr NK Roy, Technical Officer, FRD, Godawari
Mr Raja Man Mulmi, Technical Officer, FRD, Godawari
Mr SP Adhikary, Administration

Mr DM Singha, Program Director, DoFD, Balaju
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Dr A Pradhan, Livestock and Fisheries Director, NARC, Sighadarbar Plaza
Mr PR Lal Karna, Planning Director, NARC, Sighadarbar Plaza

31-10-2007

Dr AP Baidhya, Senior Technical Officer, KFH, Beltari
Mr D KC, Technician, KFH, Beltari
Mr CM Bhusal Technician, KFH, Beltari
Mr P Shrestha, Accountant, KFH, Beltari

1-11-2007

Mr JD Bista, Chief, FRC, Pokhara
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Mr RP Dhakal, Technical Officer, FRC, Pokhara
Mr SP Shaha, Technical Officer, FRC, Pokhara
Mr DR Acharya, Technician, FRC, Pokhara
Fisher groups, Phewa Lake

2-11-2007

Mr L Dhakal, President, Rupatal Restoration and Fishery Co-operative Ltd, Rupa

Mr T Pageni, Vice President, Rupatal Restoration and Fishery Co-operative Ltd, Rupa
Mrs G Adhikari, member, Rupatal Restoration and Fishery Co-operative Ltd, Rupa

Mr SP Paudel, President, Sukla Gandaki Fish production Ltd, Bharatpokharai
Mr TR Pageni, Sukla Gandaki Fish production Ltd, Bharatpokhari
Mr CB KC, Vice President, Sukla Gandaki Fish production Ltd, Bharatpokharai
Fisher groups, Begnas Lake

3-11-2007

Mr K KC, FDO, RFDC, Kulekhani
Mr R Mandal, Technician, RFDC, Kulekhani
Mr S Upadhyaya, Technical asst, RFDC, Kulekhani

4-11-2007

Mr KP Gautam, Technical Officer, FRC, Trisuli
Mr Thapaliya, Technian, FRC, Trisuli
Mr M Krana, Technian, FRC, Trisuli

Mr K Tamang, Rainbow Trout Fish Farmer, Ranipauwa
Mr P Lama, Rainbow Trout Fish Farmer, Ranipauwa
Mr G Lama, Rainbow Trout Fish Farmer and President of trout farmers association,
Ranipauwa
Mrs B Glan Rainbow Trout Fish Farmer, Ranipauwa

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