Aquaculture Development in Nepal—Pointers for Success

ROGER S.V. PULLIN
ICLARM

Background

Nepal is a small landlocked country with immense problems of rural poverty, population growth (2.6%/year) and infrastructural inadequacies. However, in the last ten years its table fish production has shown an annual growth rate of about 10% from 2,441 t in 1975-1976 to 4,925 t in 1984-1985 outpacing all other food production sectors. The 1986 per capita consumption of fish is forecast at 430 g, up from 225 g in 1976 and annual production of 10,000 t is confidently predicted by 1990. Much of this increase has come from polyculture of common, Chinese and Indian major carps in the hot lowlands known as the Terai. In the last four years, 700 ha of new ponds have been constructed here and total production from July 1984 to June 1985 was 3,045 t from 2,470 ha.

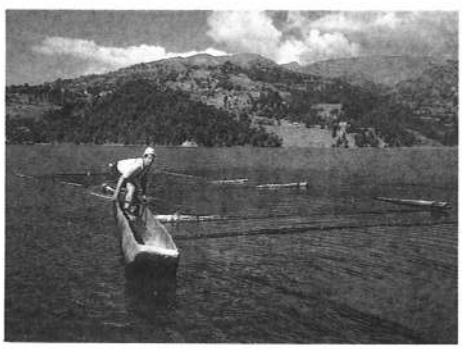
Nepal participates in the Network of Aquaculture Centers in Asia (NACA) of the FAO/UNDP Aquaculture Development and Coordination Programme and hosted the Fifth NACA Advisory Committee Meeting in November 1985. This was in itself a mark of Nepal's achievements in aquaculture development which were shown to the participants from all over Asia.

Pond Culture in the Terai

Carp polyculture, particularly integrated farming, in the Terai has been well supported—to a total of $16.3 million since 1981, including contributions from His Majesty's Government of Nepal. The Asian Development Bank has played a major role in financing this development, as has the Agriculture Development Bank of Nepal.

Development of farms has been possible largely through a strong system of Fisheries Development Centres (FDCs) staffed by well-trained personnel who have benefitted from a wide variety of overseas training courses through NACA and university linkages. This has ensured good programs of adaptive research to develop management guidelines for carp polyculture appropriate to local conditions and excellent extension services.

The cornerstone of the FDC system is the National Aquaculture Centre for Training and Allied Research (NACTAR) at Janakpur. Here, training and fingerling production have been so successful that the staff have conducted training courses for visitors from Bhutan and Laos and have distributed carp seed to Bangladesh, Bhutan and Pakistan in addition to domestic distribution. This is a good example of technical cooperation among developing countries.



Above: Cage culture of carps in Lake Begnas, Pokhara. The cages are simple net cubes with bamboo frame flotation. *Below:* The town pond at Jaleshwar, which is leased by a family for fish production. Ducks and community activities contribute to aquatic productivity. Photos by R.S.V. Pullin.

Other major FDCs are at Hetauda, responsible for applied research on integrated farming, including duck-fish, pig-fish and pond dyke crop-fish systems (mainly bananas and fodders like napier grass and legumes) and at Bhairawaha, a center for breeding and grow-out technology extension work.

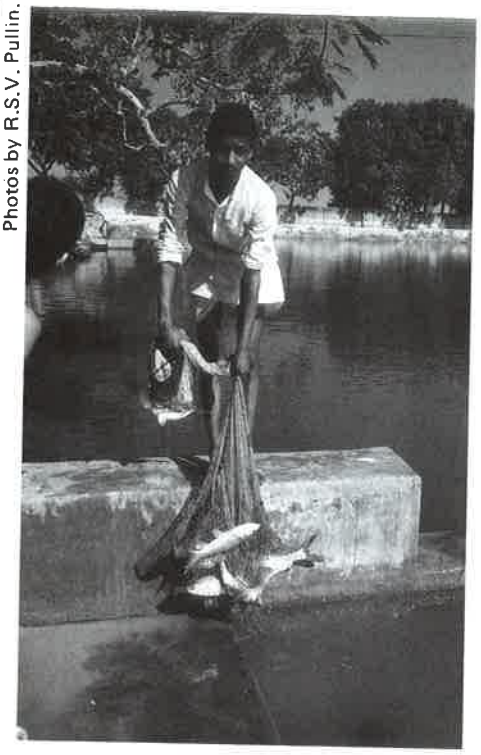
NACTAR has the lead role in research and training. Its hatchery, laboratories and ponds cover 32 ha. NACTAR and the other FDCs also have seed supply roles. Hetauda FDC and NACTAR annually sell about 3 and 4 million carp seed, respectively.

The private sector is being encouraged to play an increasing role in seed production. Many farmers already breed common carp, which does not require hormone injections, while some are now beginning to spawn Chinese and Indian major carps. For example, the Mishara farm, adjacent to NACTAR, spawns common, Chinese and Indian major carps (including the difficult *Catla catla*) and produced 339,000 carp fingerlings in 1984-1985. Total fry and fingerling production was about one million. The farmer repaid his initial investment loan of about $8,000 within two years. The private sector is expected to supply 35% of the country's carp seed requirements within 5 to 10 years. Producers are also keen to export to India.

The average farm size is 3.5 ha (range 0.5-5.0 ha) and average annual fish yield is said to be 1.2 t/ha with a maximum of 3.2 t/ha. This seems low, but fish are stocked only at 7,000/ha and low manure loadings (e.g., 50-60 pigs/ha) are used. There are plans to increase fish stocking density to 9,000 fish/ha. No supplemental feeds are given. Interest in grass carp is low at present and common carp are not well liked since they are prone to predation at the hatchling/fry stage. The farmer's order of preference is catla > bighead carp > silver carp > rohu or mrigal (for some reason both grow slowly in Nepal, about 300 g/yr) > common carp. Current seed prices from government and private sources, irrespective of species, are: hatchlings $50/100,000; fry $10/1,000;

A duck-fish integrated farming production trial at the Hetauda Fisheries Development Centre.

Photos by R.S.V. Pullin.



A cast-net sample of Chinese and Indian major carps from the Jaleshwar town pond.

fingerlings $20/1,000; yearlings $5/100. Common carp fry cost $5/1,000.

Grow-out systems comprise household ponds and community (village or town) ponds. The latter are particularly interesting. For example at Jaleshwar town, Panchayat, a fairly wealthy family has leased the 1.5-ha town pond for $6,000 for three years. The money goes into community development financing. The family stocks and fertilizes the pond, placing no restrictions on its use for normal community purposes—watering and washing. The last annual harvest was 2.5 t (probably an underestimate). Labor for harvesting is recruited locally. At Mahendranagar village, Dhanusha, 14 families have combined to lease the 2.0-ha village pond for $3,000 for three years. They have borrowed $2,800 as a Small Farmer Development Project Loan and stocked with 40,000 mixed carp fingerlings. Harvesting has yielded 1 t after one year and is continuing. The local market price for all carps is about $1.0/kg.

Cage Culture in Natural and Artificial Lakes

The low productivity of most of Nepal's waterbodies can be judged from a recent Ministry of Agriculture forecast annual catch of 2,200 t from 5,750 ha of lakes and 380,000 ha of rivers and streams. However the Pokhara valley lakes Phewa (500 ha), Begnas (225 ha) and Rupa (117 ha) and some other minor lakes are potentially very productive.

Capture fisheries in the three major lakes supported about 300 fishing families until yields went down in the 1960s due to increases in effort (mainly gill netting). The Pokhara FDC persevered with cage culture trials through many years of frustration and failures (caused mainly by lack of appropriate materials) and now they have assisted over 200 families operating 1 to 4 cages each. The total cage volume is about 15,000 m^3 soon to be expanded to 20,000 m^3. The lives of these people, some of whom are landless, have been transformed by this part-time activity. They stock the cages at 10 fish/m^3 or usually about 300-400 fish/50-m^3 cage. After 14-15 months, with no feeding, each cage yields about 200 kg of silver carp, bighead carp and rohu. They sell at a fixed price of $1.0/kg to middlemen who resell at $1.15/kg. They make their own cage netting from imported synthetic twine. The projected life of cage netting is 10 years. Rohu *(Labeo rohita)* keep the cages free from algal fouling. If rohu are not stocked, cleaning is necessary twice each month. All the fishermen and culturists belong to a local fishermen's association which meets monthly with FDC personnel and middlemen. The number of cages is strictly controlled and the productivity of the lakes constantly and accurately monitored. The total production in 1984-1985 was 30 t from cage culture and 25 t from capture fisheries. Corresponding projected figures for 1985-1986 are 40 t and 25 t. The program has been supported by a number of agencies, including the International Development Research Centre (IDRC) of Canada and Japanese Overseas Volunteers.

Future Trends

For the future, Terai pond yields of exotic carps could be increased with higher stocking levels and inputs. However finding suitable low-cost organic inputs and optimizing integrated farming systems is difficult. Some communities will not accept pigs and the demand for ducks is low except at certain festivals. A duck promotion campaign is underway. Perhaps ruminant wastes could also be used.

Nepal has just imported about 5,000 Nile tilapia from Thailand and founder stocks are being held at the Janakpur FDC and the Balaju hatchery, Kathmandu. Many were opposed to this introduction and fear overpopulation of culture ponds and natural waters. However tilapia/carp polyculture could raise pond yields especially if monosex tilapia are stocked. Tilapia could also increase cage culture and fishery yields in lakes where the Chinese carps and indigenous species are not cropping the phytoplankton and detritus efficiently as evidenced by blue-green algal blooms. Plans to utilize tilapias are likely to advance cautiously.

Parallel to these efforts with exotic species, research for artificial stocking and cage culture of native coldwater species, such as asla or snowtrout *(Schizothorax)* and mahseer (*Tor* spp.), is also underway, based on hatchery work at Trisuli.

Nepal has made great advances in aquaculture development by a combination of sustained support, perseverance through difficulties, well-trained and dedicated staff, and the extension of appropriate technology to communities and individuals where its application and (particularly for cage culture) compliance with regulations and professional advice have brought success. That this has been achieved in a small, landlocked and desperately poor nation reflects great credit on all concerned and provides pointers for success elsewhere. ●