

Fish Production and Processing

CAPTURE FISHERIES

Marine Sector

Estimation of marine fish production: The marine fish landings in India during 2002-2003 was estimated at 2.64 million tonnes, which is 0.314 million tonnes (13.5%) higher than that of the previous year. The increase was primarily due to enhanced catches of sharks, oil sardines, Bombay duck, ribbonfishes, carangids, seer fishes, tunas, penaeid prawns and cephalopods. Perches and non-penaeid prawns showed a decrease in landings. The mechanized sector accounted for 67.9%, motorized sector 25% and artisanal sector 7.1% of the production. The north-west coast accounted for 0.908 million tonnes, followed by south-west coast 0.86 million tonnes, south-east 0.611 million tonnes and north-east 0.227 million tonnes. Monitoring of environmental characteristics of coastal water was continued all through the year.

- Marine fish landings improved by 13.5% over previous year
- Effects of municipal and industrial effluents on index of biological integrity evaluated
- Hilsa population declining due to indiscriminate exploitation of young hilsa by drift gill net
- Digital base map developed on water bodies of some districts of Bihar and Rajasthan
- Hatchery seed production of freshwater prawn expected to boost prawn culture in land-locked states
- Sub-adults and fingerlings of *Puntius pulchellus* were cultured on artificial feed
- A natural lake developed as conservation site for *Tor putitora*
- Maturation period of exotic carps shortened at high altitudes
- Kit developed for detection of white spot virus
- Crude extract of *Arius dussumieri* and *Osteogoneisus militaris* showed haemolytic and oedematic activity
- Immune index of tiger shrimp developed to improve management of broodstock
- Broodstock of ornamental species developed
- Fishing vessel with fuel monitoring developed
- Natural genetic variation studied in important fish species
- Viable progeny produced using frozen-thawed sperms
- Polymerase chain reaction method used to detect exotic pathogens

Inland Sector

Application of an index of biological integrity (IBI) in river Hooghly: A multimetric index of fish assemblages integrity was developed for fish species in river Hooghly and the effects of municipal and industrial effluents and physical conditions on those indices were evaluated. The Biological integrity of fish assemblages from the site Hooghly ghat downstream of river Hooghly is impaired.

Ecological status of Hooghly Estuarine System: Ecology and fisheries of Hooghly and Mandovi-Zurai estuarine systems and production potential of estuarine wetlands were evaluated. Ecological studies revealed high production potentials reflecting total fish yield of 62,554.7 tonnes. Hilsa continued to be a major component contributing 10.4% of total yield from Hooghly estuary. Population of Hilsa is declining at a fast rate due to indiscriminate exploitation of young Hilsa by drift gill net.

Inventory and mapping of inland water bodies of Bihar: Geographical Information System (GIS) was developed on water bodies for eight districts of Bihar. The area was estimated utilizing LISS-III data of satellite IRS-1D. Digital base map was also prepared for six districts of Rajasthan.

CULTURE FISHERIES

Freshwater Aquaculture

Hatchery seed production of freshwater Prawn in inland saline water: The giant prawn popularly known as 'Scampi' is migratory and completes its life cycle in both fresh and coastal seawater. Seed production was done successfully in freshwater prawn (*Macrobrachium rosenbergii*) by using underground saline water with necessary ionic amendments at Rohtak, Haryana. Haryana, Rajasthan, Punjab and Uttar Pradesh have large areas of inland saline ground water reserves and hence the present practice is expected to provide boost to prawn culture programmes of land-locked states. *Macrobrachium rosenbergii* culture was initiated in saline affected waters of Punjab and Haryana. Prawn production in the range of 872 to 2,285 kg/ha was achieved in culture ponds of culture period of 6-7 months. Efforts were also made to transfer this technology to Uttar Pradesh.

Monosex culture of giant freshwater prawn: Monosex culture of *M. rosenbergii* conducted in outdoor cement



cisterns at two stocking densities revealed higher growth rates in all-male population as compared to all-female population reared under similar rearing condition and stocking densities. Further, the male population also yielded higher proportion of marketable size of the prawn.

Breeding of peninsular carps: Seven sets of *Labeo fimbriatus* were bred successfully using a portable hatchery at Bangalore. More than 0.1 million spawn were obtained. Sub-adults and fingerlings of *Puntius pulchellus* were collected from the Western Ghats and are being cultured under captivity on artificial feed.

In vitro culture of freshwater pearl mussel: Primary *in vitro* cell culture of nacre secreting pallial mantle epithelial tissue explants of freshwater pearl mussel (*Lamellidens marginalis*) was carried out successfully.

COLDWATER FISHERIES

Mahseer conservation initiative in Kumaon: A natural lake Shyاملatal in Kumaon region was developed as a conservation site for the threatened mahseer species *Tor putitora*. Mahseer fingerlings stocked for first time have established themselves well in the lake with 98% return in experimental netting. The maximum size of



Experimental fishing in Shyاملatal lake in Kumaon



Mahseer harvested from cultured ponds

Success in incubating and rearing of rainbow trout at Bhimtal

For the first time, eyed ova of rainbow trout, *Oncorhynchus mykiss* were incubated under warmer conditions at Bhimtal. Hatching was successful and fingerlings were produced within 70 days of rearing, while table size was attained just within one year of rearing. The trout is normally transported at eyed-ova stage but for the first time 600 fingerlings of rainbow trout having a weight range of 3.45-5.90g were successfully transported 200 km with no mortality. This investigation opens up the possibility of raising table trout at lower altitude and transporting the fingerlings by road in hills.



Egg stripping from female rainbow trout

mahseer caught during the trials in gill net operations was 700 g in weight and 260 mm in length. With the establishment of mahseer stocks in the lake, the availability of mature spawners for artificial propagation will be ensured, opening an additional resource for conservation and revival of endangered mahseer in Kumaon region. This will also promote angling tourism in Shyاملatal lake area.

Advanced maturation and breeding of exotic carps at high altitudes: Water temperature was the limiting factor for maturation and embryonic development of grass carp and silver carp at high altitudes. The experiments

SUCCESS STORY

Exotic carp farming in mid-hills

Previously standardized exotic carp farming technology for mid-hills, involving three species combination of grass carp, silver carp and common carp was successfully demonstrated in 24 farmers' ponds situated at different altitudes in two districts of Uttaranchal. One of the fish farmers from Toli village achieved highest estimated fish production of (6942 kg/ha/year) by harvesting 162 kg fish from 300 m² pond, with an additional income of Rs 11340 from a unit water area of 300 m². This supplements the income from small farm holdings, in which cereals, vegetables, and fruits are developed. This integration of crop and fish makes hill farming remunerative and sustainable. All the ponds in two districts under this programme registered an estimated average fish production of 3508 kg/ha/year with actual harvest in the range of 0.12 to 0.39 kg/ m²/year in ponds ranging in size between 125 – 500 m². The programme motivated more farmers especially in districts of Champawat and Nainital to take up fish culture. A self-help group has been organized in the village Toli to transfer this technology to farmers from other adjoining villages in the region.



conducted revealed that the maturity inducing hormone treatment with HCG @ 250-300 IU and pituitary extract plus ovaprim in 3:1 ratio @ 3ml/kg coupled with insulation against low temperature by polyhouse covering of ponds, was effective in advancing maturation period by 1-2 years. Hence, by application of maturity inducing hormones and raising water temperature through polyhouse insulation at high altitude regions, the maturation period of these species can be shortened.

BRACKISHWATER AQUACULTURE

Demonstration of shrimp feed technology to the coastal farmers: Shrimp feed developed by the CIBA was successfully tested in a farmer's pond at Kalpakkam, near Chennai. The 0.52 ha pond was stocked with tiger shrimp *Penaeus monodon* seed and the farmer used CIBA shrimp feed during the culture. After 137 days of culture, the farmer harvested 1,665 kg of shrimp and obtained a production of 3,330 kg/ha.

Latex agglutination kit for detection of white spot virus: Latex agglutination kit for detection of white spot virus in shrimps was developed. This is an on-farm test with the aid of the rapid diagnostic kit which can be completed within 3-4 min. Latex agglutination kit along with the ELISA and dot-ELISA kits for the detection of pathogenic bacteria, viz. *Pseudomonas fluorescens*, *Aeromonas hydrophila*, *Vibrio alginolyticus* and *Edwardsiella tarda* of fish, were commercialized.

Wound healing, antineoplastic and antioxidant compounds from two marine crinotoxic fishes: Crude mucus extract of *Arius dussumieri* and *Osteogobius militaris* exhibited toxicity when tested on mice. The crude mucus extract of *A. dussumieri* showed the highest toxicity @ of 0.30 ml and the mice died in 50 minutes, whereas in *O. militaris*, the toxic dose was 0.50 ml, which caused mortality in 80 minutes. Haemolytic assay conducted against chicken erythrocytes showed that the crude mucus extracts and partially purified fractions of both the fishes has haemolytic as well as oedematous activity.

Immune index of tiger shrimp: Immune index was developed to assess the health status of tiger shrimp, *Penaeus monodon*, based on the characteristics of its haemolymph. There was considerable variation in the haemocyte count of the normal shrimps. During white spot syndrome virus (WSSV) infection, the haemocyte counts dropped drastically. These observations have practical implication in the maintenance of broodstock.

Mariculture

Maturation, spawning and larval rearing of groupers: Induced maturation of groupers by hormone injection using LHRha was conducted at Mandapam. Natural spawning of *Epinephelus tauvina* and *E. polyphemus* was observed under captive conditions. In

E. tauvina, two spawnings occurred resulting in 3.9 million eggs, and 2.7 million larvae were produced from eggs.

Development of broodstock of ornamental fish: Broodstock of five species of damselfishes, filamentous tail black damselfish *Neopomacentrus cyanomos*, yellow tail damselfish, *N. nemurus*, blue damselfish, *Pomacentrus caeruleus*, peacock damselfish, *P. paco* and Indian dascyllus *Dascyllus carneus* were successfully developed.

Oyster farming in Kerala estuaries

The technology for the production of gourmet oysters was adopted by more than 250 farmers in estuarine areas of southern India covering an area of 2.2 ha. The total production during 2002 was 350 tonnes shell-on, yielding 3500 kg meat, worth Rs 210000/- from 9 months of farming. Oyster farming has been developed as a community-based programme in Kerala.

FISH HARVEST AND PROCESSING TECHNOLOGY

A novel design of a 15.5m OAL, 125 hp steel fishing vessel (CIFTECH -1) with split level deck constructed for trawling, gill netting and lining was developed and a vessel constructed. A fuel consumption monitor for measurement of fuel consumption rate, inflow and return flow was developed.

A simple technique was developed to reduce the chemical hazard of benzopyrene in hot smoked fishery products, particularly tuna. A product with calcium and phosphate in 2:1 proportion – an ideal requirement for human consumption – was obtained when tuna bones were hydrolysed enzymatically.



A fuel efficient deep sea multipurpose 15.5 m. OAL fishing vessel "CIFTECH -1" developed by CIFT, Kochi



Cattle/poultry feed from fishery waste

A method for preparation of good quality cattle/poultry feed supplement by ensiling fishery waste was popularised. This has solved the environmental problem caused by the decaying waste by converting it into a useful product. A method was developed for the isolation of chondroitin sulphate, a medicinal product used in the treatment of arthritis patients, from shark bones and shark cartilage. The process and production parameters for fermented fish meal was standardized. The product has average moisture content of 22%, protein 46%, fat 1.8% and mineral content 29%.

FISH GENETICS RESOURCES

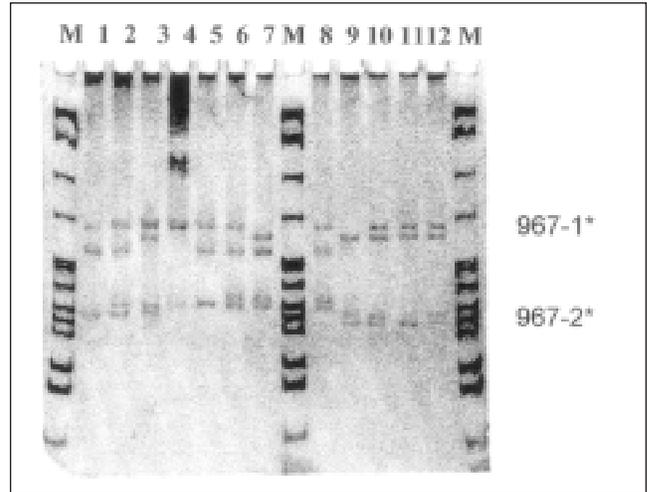
Molecular markers and natural genetic variation in important fish species

Combined genotypic data of 10 micro satellite loci of *Catla catla* were collected from rivers Sutlaj, Ganga, Ghagra, Rapti, Bhagirathi, Brahmaputra, Mahanadi and Godavari, and analyzed. Catla samples analysed exhibited significant variation at microsatellite loci. The results revealed that catla in different rivers in India has distinct population sub structure.



Species-specific RAPD profile of *Chitala chitala* and *Notopterus notopterus* obtained through OPB3 primer.

The microsatellite primers for yellow catfish *Horabagrus brachysoma*, an endangered fish of the Western Ghats, were developed through cross species amplification of heterologous primers. The identified micro satellite DNA markers exhibited significant potential to determine fine scale population structure of the species across its natural range of distribution. Microsatellite DNA markers studies revealed genetic variations at RAPD loci exhibiting significant divergence in *Chitala chitala* species collected from different locations. Diagnostic RAPD



Genetic variation in *Horabagrus brachysoma* at two microsatellite loci amplified through Sclerfor967 primer

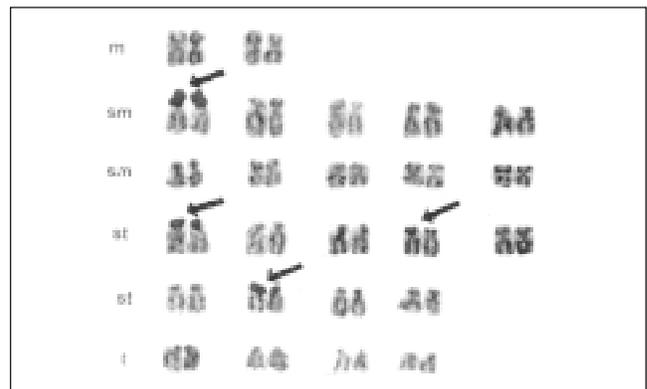
markers were developed to detect species-specific difference between *C. chitala* and *Notopterus notopterus*.

Karyological characterisation of fish species endemic to Western Ghats: Genetic characterization of *Labeo dussumeri*, *Puntius filamentosus*, *Puntius denisonii*, *Puntius sarana subnasutus*, *Horabagrus brachysoma*, *Horabagrus nigricollaris*, *Pristolepis marginata* and *Gerrus filamentosus* endemic to Western Ghats, was done.

Baseline frequency of micronuclei in Channa punctatus and Mystus vittatus: The frequency of micronuclei was 0.06078% in freshly collected *Channa punctatus* specimens, however, after acclimatization the frequency of micro nuclei reduced to 0.02597%. Similarly frequency of micronuclei in unacclimatized *Mystus vittatus* was 0.05674% and after acclimatization it was 0.0327%. These findings indicated that fishes of Gomti river were being exposed to genotoxicants present in the polluted river water.

Development of sperm cryopreservation protocols for Ompok malabaricus: Successful cryopreservation of *Ompok malabaricus* spermatozoa with M-HBSS extender and DMSO cryoprotectant was achieved. Viable progeny were produced using frozen-thawed sperms.

Diagnostic capability to detect exotic pathogens for



Karyotype of *Puntius denisonii* showing NORs



fish quarantine: Specific detection of *Yersinia ruckeri* and *Aeromonas salmonicida* was carried out through polymerase chain reaction. The detection of viral haemorrhagic septicaemia (VHS) was also carried out by reverse transcription polymerase chain reaction yielding. The rapid diagnosis of exotic pathogens will be used for screening the imported fish and fish products, and to prevent the entry of exotic pathogens in the country.

HUMAN RESOURCE DEVELOPMENT

At the CIFE, Mumbai, training programmes on Aquatic Animal Toxins and Pharmacological Bioresources were organised. Short term training programmes on various aspects of fish and fisheries were organised at Mumbai, 4 at Kolkata, 11 at Kakinada, 5 at Powerkheda, 2 at Rohtak and 6 at Lucknow. At the CMFRI, Kochi, training programmes were organised for Self Help Group on crab culture, mussel culture, ornamental fish culture, fish

processing, mariculture, fish disease and their management. The CIBA also conducted training programmes on brackishwater finfish breeding, crab breeding and culture, finfish breeding, soil and water quality management and shrimp breeding and hatchery technology.

TRAINING PROGRAMMES FOR RURAL WOMEN

Training programmes were conducted for rural women on fish/shrimp pickle preparation in Tiruvallur District of Tamil Nadu under the NATP-IVLP project, Brackishwater aquaculture at Nellore District, Andhra Pradesh, and preparation of value added fish products at Kattur village, Thiruvallur.

