



## 6. Livestock Improvement

### ANIMAL IMPROVEMENT

**Cattle:** Frieswal strain of cattle was developed. In addition genetic improvement and conservation of indigenous Haryana and Ongole breeds of cattle at their native tract was continued. Total strength of Frieswal females at 43 Military Farms was 18,147 including 10,458 adult cows, 6,352 young stocks and 1,337 calves. Frieswal semen doses (40,830) were distributed, and 9,650 doses of pure HF semen and 436,281 doses of Frieswal semen are available in the gene bank. The overall least squares mean of 300 days milk yield (MY300), total milk yield (TMY), peak yield (PY) and lactation length (LL) was 3,223.33 kg, 3,274.70 kg, 14.65 kg and 323.45 days, respectively. Frieswal cows at MF, Mhow, produced the highest MY300 (4,048.17 kg) followed by those at Kanpur (4,014.50 kg) and Lucknow (3,908.45 kg).

**Haryana.** With an overall conception rate of 53%, the female herd strength at the end of reporting period was 1,214. Under test mating 51 bulls were used to produce 1,920 daughters. Total available frozen semen doses of test bulls are 27,931. The cows in milk, wet average and herd average were 38.8%, 4.54 and 1.82 kg, respectively. Average age at first calving, first lactation milk yield and peak yield were 1,489 days, 988 kg and 6.27 kg, respectively. Eight young bulls put to training for draught took an average of  $37.75 \pm 1.25$  days to be ready for draught purposes. The mean fatigue score for empty cart ranged from 2.10 to 2.40. The average carting ability was 12.34.

**Ongole.** The female population size at the end of reporting period was 1,306. Under 6 sets of test mating 2,366 daughters of 49 bulls were produced. At Germplasm Unit 156,965 semen doses are available. The cows in milk, wet average per day per cow and herd average per day were 36.69%,

2.78 and 1.00 kg, respectively. Age at first calving, first lactation milk yield and peak yield were recorded. First dry period and calving interval averaged 384.1 and 531.8 days, respectively.

*System analysis of dairy based crossbred cattle production system.* The production data of KS and KF was collected and analyzed for the effect of exotic blood level and proportion of X chromosome on milk productivity. The correlation coefficient of blood level of KS and KF, first lactation 305 days milk yield was 0.12 and 0.13, respectively, whereas, correlation coefficient of level of X chromosome was 0.36 and 0.39, respectively.

**Buffalo:** Selection of elite bulls for 10<sup>th</sup> set from the 6 participating centres of Network Project was completed including screening for breeding soundness and specific disease free status as per OIE norms for frozen semen production and trade. Microbial load determination of semen samples for quality assurance was within permissible limits. Murrah field progeny testing programme was continued with frozen semen of 15 test bulls and semen from two progeny tested bulls in adopted villages.



Murrah bull ranked first with sire index of 2,187 kg based on daughter's first lactation milk yield



## SUCCESS STORY

### Vrindavani cattle

The genetic constitution of *Vrindavani* cattle carries 50–75% inheritance from exotic temperate cattle breeds involving Holstein-Friesian, Jersey and Brown Swiss. However, the native indigenous component has been stabilized in between 25–50% from Haryana breed. The population is maintained through *inter se* mating of these animals within the said group with continuous selection.

The Vrindavani cattle being a crossbred composite synthetic strain exhibits almost all possible coat colours in the population as possessed by their parental generations in addition to co-dominant patterns (roan, light-dark brown, black and white and brown and white, a very small proportion is white). Under organized farm conditions, the Vrindavani cattle

was put to yield around 3,000 kg milk in 305 days of lactation with 4–4.5% fat, 8–9% SNF and 12–13% total solids. The mean wet average varied between 9.5 and 10.0 kg/day under organized conditions. The mean herd average is 7.69 kg/day. Out of a total 284.48 cow heads, 89.92% (255.52 heads) were in milk throughout the year. The least square means for lactational traits like total lactation milk yield, lactation length and 305 days' milk yield were 3,135.42 ± 42.15 kg (195), 336.94



Vrindavani cattle has short dry period and about 90% of cow heeds milk throughout the

± 4.37 days (195) and 2,916.33 ± 57.50 (167) kg, respectively. The least square means for live body weights at birth, 3, 6, 12, 18 and 24 months were 20.80 ± 0.26 (275), 51.37 ± 0.63 (219), 92.98 ± 1.51 (153), 168.78 ± 3.24 (107), 248.93 ± 4.89 (87) and 293.97 ± 4.30 (73) kg, respectively. The overall conception rate ranges from 75 to 80%. Average age at first calving, dry period, service

period and calving interval in crossbred cattle group were 1,141.53 ± 43.72 (27) days, 59.03 ± 6.53 days, 114.87 ± 6.25 days and 401.59 ± 8.28 days. The overall mortality percentage in Vrindavani cattle is around 6–7%, which could be better managed under permissible limits (<10%). Currently, of the total milch cows, 33–34% cows

yielded up to 3,000 kg and 66–67% more than 3,000 kg of milk in 305 days of lactation. At the same time, 38–39% of the cows expressed an average 305 days yield of 3,218.75 ± 51.88 kg whereas 28–29% expressed a 305 days yield of 4,089.97 ± 59.13 kg. The Vrindavani cattle is well adapted to the local agro-climatic conditions and is very popular among dairy farmers of Uttar Pradesh, Uttarakhand, Rajasthan and adjoining areas.

Under the Network Project on Buffalo Improvement, fifth set of 15 Murrah bulls were progeny tested. Bull number 4393 from the NDRI, Karnal was ranked first with sire index of 2,187 kg based on 13 daughters' first lactation yield and 21.87% superiority over contemporary daughters' average of 1,794 kg. Tenth set of 14 Murrah breeding bulls was initiated for progeny testing with dam's best yield ranging from 2,572 to 3,369 kg. All bulls entering into the progeny testing programme were tested to be free from diseases as per OIE norms.

Elite herds of different breeds of buffaloes have been established for Jaffarabadi at JAU Junagarh; Surti at MPUAT Vallabh Nagar; Bhadawari at IGFRI Jhansi; Pandharpuri at MPKV Kolhapur; Nili Ravi at CIRB sub campus Nabha; Godavari at SVVU Venkataramanagudem; and swamp at AAU Khanapara. Genetically superior bulls of all the breeds were selected for progeny testing on the

farmers' buffaloes in the field. Test mating has been initiated for Jaffarabadi, Surti, Pandharpuri and Godavari breeds at the respective field units.

Weighted average for fat percent from all the centres of Murrah breed was estimated as 7.51. The averages at various centres ranged from 7.05 to 8.17%. The average fat percent in milk was estimated in Murrah (7.51), Nili Ravi (6.65), Jaffarabadi (6.63), Surti (7.23), Bhadawari (7.50), Godavari (7.84), Pandharpuri (8.08), and Swamp (8.42) buffaloes.

**Sheep:** SHEEP FOR MUTTON—*Malpura*. In Malpura sheep there is pronounced higher gain in body weights and growth rate of lambs produced after backcrossing of GM rams with Malpura ewes compared to the reciprocal backcrossing. Lambs produced from backcrossing were analyzed for the identification of *FecB* gene. It was detectable in 53% of lamb crop thereby demonstrating the *FecB* gene inheritance in the progeny produced





after backcrossing.

**Muzaffarnagri.** The Muzaffarnagri sheep is being improved for mutton production. The male lambs were selected using selection index incorporating body weight at six months and first six monthly greasy fleece weights. The least square means for birth, 3, 6, 9 and 12 month body weights of lambs were 3.20, 14.81, 19.76, 22.79 and 29.13 kg, respectively.

**Nellore.** The Nellore sheep is being improved through selection for mutton production using selection index incorporating body weight at three and six months of age. Overall, mortality was very much within the norms.

**DUAL TYPE SHEEP—Avikalin.** Avikalin strain of sheep has the potential to be developed as dual type sheep for carpet wool and mutton production. The body weights at birth, 3, 6, 9 and 12 months of age were 2.89, 14.29, 21.56, 23.34 and 25.42 kg, respectively. Overall least square means for first six monthly and adult annual greasy fleece yields were 943 and 1,602 g respectively

**SHEEP FOR CARPET WOOL—Chokla.** Chokla breed was improved for carpet wool production. The greasy fleece yields in first six monthly clips, adult six monthly and adult annual were 1.005, 1.138 and 2.312 kg respectively.

**Marwari.** The Marwari breed is being improved for carpet wool production. Average annual greasy fleece yield during the year was 1,283 g.

**Deccani.** Average body weight in Deccani breed at birth, weaning, 6 months, 9 months, and 12 months of age was 3.27, 15.04, 21.52, 23.33 and 25.91 kg respectively. Overall greasy fleece yields in first, second six monthly and adult six monthly clips were 0.385, 0.395 and 0.375 kg.

**Magra.** The Magra sheep is being improved through selection for carpet wool production. Average greasy fleece weight at 6-month age and adult annual were 918 and 2,188 g, respectively.

**Madras Red.** Madras Red sheep, one of the important meat breeds of Tamil Nadu, is being improved. Sheepskins are preferred in tanning due to better grains in finished leather. Average body weight at birth, 3, 6, 9 and 12 months were 2.69, 9.67, 14.85, 18.65 and 21.03 kg, respectively

**Goats—Barbari.** The precise and reliable genetic parameters for growth, reproduction and lactation traits of Barbari breed were established. Positive genetic trends were observed for body weight growth over last 25 years. The kidding rate was 1.56 and overall mortality was 6.56%.

**Jamunapari.** Year, season of kidding, type of birth, sex of kid and weight of dam at kidding significantly influenced, the body weights at all the ages. Average milk yield in 90 days, 140 days and total lactation were  $80.86 \pm 1.83$ ,  $111.15 \pm 3.13$



In Barbari goats positive genetic trends for body weight growth were observed

and  $119.68 \pm 4.20$  litres, respectively. The genetic and phenotypic correlations among body weight traits were high, however, magnitude of estimate decreased with the increase of age as compared to adjacent body weight traits. The ranking of sires on the basis of sire indices was computed by combining 9 months body weight and 90 days milk yield of their dams. The average value of constructed sire indices was 16.44 ranging from 15.04 to 21.38.

**Sirohi.** The body weights at birth, 3, 6, 9 and 12 months of age were  $3.22 \pm 0.04$ ,  $11.51 \pm 0.38$ ,  $15.31 \pm 0.29$ ,  $18.32 \pm 0.27$  and  $23.02 \pm 0.30$  kg, respectively. Heritability of birth weight was moderate.

**Pigs:** Litter size at birth and weaning of indigenous pigs of Jharkand improved to  $4.95 \pm 0.53$  and  $4.02 \pm 0.95$  kg, respectively. Large White Yorkshire and Hampshire crossbreds (75%) showed litter traits superior to their respective halfbreds.

**Rabbits:** Performance of broiler rabbits maintained in semiarid region and sub-temperate climatic conditions and Angora rabbits in sub-temperate climatic condition were improved, and research efforts are on to achieve 2.0 kg weight at 84 days of age in broiler rabbits. Average annual wool yield of 867, 594, 603 and 531 g in German Angora, British Angora, Russian Angora and A-1 cross-colonies was achieved. The staple length, fibre diameter and guard hair of fibre of 6.04 cm,  $13.64 \mu$  and 4.04% were recorded in German Angora rabbit.

**Poultry—Poultry for egg:** Six pure lines of White Leghorn were improved through intra population selection under the AICRP on Poultry Breeding. The IWN strain matured early by 2 days over last generation. In S-23 generation, fertility and hatchability improved and remained above 95% in both the lines. The phenotypic response to egg production up to 64 weeks of



age was 3.2 and 6.8 eggs/generation in IWN and IWP, and the corresponding genetic response was 8.3 and 4.7 eggs/generation, respectively, over last 5 generations. IWN and IWP lines showed improvement in hatchability over previous generation. The pullets of IWN and IWP matured early by 9.8 days and 5.9 days, respectively. The egg production up to 40 weeks of age increased in IWN line over previous generation. The phenotypic response to egg production up to 64 weeks of age was 4.73 and 5.43 eggs in IWN and IWP, respectively.

IWD and IWF lines showed an improvement in egg production up to 40 weeks of age over previous generation. The improvement of egg production up to 64 weeks of age was 1.60 and 2.10 eggs on phenotypic scale and 2.90 and 3.40 eggs on genetic scale in IWD and IWF, respectively. In IWD egg weight at 40 weeks of age improved by 1.2 g and in IWF by 1.3 g. In IWH and IWI strains 28 selection generations were completed. The fertility was more than 91% in both the lines and improved over the preceding generation. The age at sexual maturity decreased compared to previous generation. The early egg weight at 28 weeks of age showed an improvement and egg number up to 64 weeks improved in IWH and IWI strains over last generation. The genetic response to selection for 64 week egg production per generation was positive and significant in both IWH and IWI.

The White Leghorn pureline populations consisted of IWH, IWI, IWK and a pedigreed random-bred control population. The egg production up to 40 weeks of age increased in the current generation in IWH, IWI and IWK, over the previous generation on phenotypic scale. The egg production up to 64 and 72 weeks of age was higher in HK and IK groups than that of IH and KH genetic groups. Performance of IWK line at different levels of energy revealed that reduction in major nutrients up to 8% did not affect egg weight, egg production, antibody titre to SRBC or NDV, and CBH response to PHA-P.

*Poultry for meat:* The S-11 generation of SDL population was reproduced with 89.7% fertility. The body weight at 5 weeks of age was 1,159 and

936 g in selected and control lines and the corresponding FCR was 1.99 and 2.07, respectively. The phenotypic and genetic response for 5-week body weight was 23.4 and 15.7 g, respectively. In Pb-2 population, the body weight at 5 weeks of age improved over previous generation. The improvement of body weight at 5 weeks of age in Pb-2 was 19.7 g/generation on phenotypic scale. The genetic response to body weight at 5 weeks of age in Pb-2 was 15.6 g/generation in the last five generations. The fertility (88.7%), hatchability on fertile eggs set (88.3%) and total eggs set (78.3%) in Pb-2 line increased over previous generation. During S-11 generation, the Pb-2 females matured at 186 days of age and laid 67.56 eggs up to 40 weeks of age. The body weight at 5 weeks of age was 1,075 and, 1,067 g in CSML and CSFL populations with corresponding FCR of 2.32 and 2.34, respectively. The phenotypic response per generation was 25 and 29 g and the significant genetic response was 23.3 and 27.3 g, respectively, in CSML and CSFL for 5-week body weight.

The G-8 generation of a white dwarf pure line and coloured dwarf line showed good per cent fertility in both the populations (80.1 to 88.5%). The body weight at 6 weeks of age showed an improvement of 31 g in white dwarf and 30 g in coloured dwarf line over previous generation. The egg production up to 40 weeks of age improved by 1.7 eggs in white and 1.2 eggs in coloured dwarf populations over previous generation. Commercial broiler chicks were produced by crossing dwarf dams with normal bodied sires. Genetic gain of 5-week body weight of Pb-1 was 66 g over the last three years. Early maturity, improvements in egg weights, fertility and hatchability and reduction in adult body weight were achieved in the current generation in Pb-1. The genetic gain of 5-week body weight of Pb-2 was 73 g over last three generations. There was improvement in egg production, egg weight, fertility and hatchability in the present generation.

*Improvement of gene lines for utilization in tropical poultry production:* Naked neck and dwarf developed at the PD on Poultry, were subjected to genetic selection. In male chicks 6-week body weight was 1,271 g and in females 1,040 g. Selection differential was 170 g in males and 140 g in females. The selection differential was 98 g in males and 79 g in females for sixth week body weight. In both gene lines, the fertility and hatchability improved over the previous generation.

## Biotechnology

**Faster multiplication of superior germplasm through biotechnological intervention:** Immature buffalo oocytes obtained from slaughterhouse

### Random sample poultry performance test

In the 27<sup>th</sup> Random Sample Poultry Performance Test for Broilers, held at Gurgaon, the IBL-80 strain cross from Ludhiana, recorded 1,736 and 2,240 g body weight at 6 and 7 weeks of age, respectively, with an FCR of 2.09 and 2.22. The strain cross from Central Avian Research Institute, Izatnagar, achieved body weight of 1,520 and 1,998 g at 6 and 7 weeks, respectively, with the corresponding FCR of 2.31 and 2.41 kg.



### Molecular characterization of pathogens/receptors

Antigenic typing of pestivirus isolates obtained from sheep and goats revealed prevalence of BVDV type 1 predominantly and BVDV type 2 occasionally in India. The phylogenetic analysis revealed prevalence of BVDV 1b and 1c subtypes in sheep and goats and BVDV 2a subtype in goats indicating genetic heterogeneity. Molecular characterization of cDNAs encoding Toll-like receptors namely TLR2, TLR3 and TLR4 of nilgai, buffalo, sheep and goat was done. Higher expression of TLR3 in skin and immune cells of nilgai as compared to buffalo indicated stronger innate antiviral immunity.

ovaries were subjected to *in vitro* maturation, fertilization and culture for production of blastocysts. The culture of inner cell mass on a homologous fetal fibroblast feeder layer could be a better choice for production of embryonic stem cells in buffaloes. Buffalo amniotic fluid, umbilical cord matrix and fetal explants were identified as potential sources of adult stem cells. In contrast to slow initial growth of adult fibroblasts, fetal explant cells started proliferating as early as 24 hr in culture. These cells could be trypsinized and frozen. Cells harvested from umbilical cord matrix and amniotic fluid have also shown good growth potential during *in vitro* culture.

**Protein profile of porcine spermatozoal proteins during epididymal transit:** Proteins having molecular weight (MW) of 105, 97, 89, 79, 73, 64, 32, 29, 24, 22, 20 and 18 kilodaltons present in the testicular spermatozoa could not be identified in the epididymal sperms. On the other hand, the epididymal spermatozoa expressed proteins having MW of 102, 93, 82, 66, 62, 55, 28 and 21 kilodaltons were absent in testicular spermatozoa. The epididymal fluid shared proteins having MW of 55, 52, 42 and 39 kilodaltons with testicular and epididymal spermatozoa.

**Molecular characterization of pathogens/receptors:** Phylogenetic analysis of HA, NA, NP and PB2 genes of 17 H5N1 avian influenza viruses isolated from outbreaks in India, revealed that the isolates belong to the Qinghai-like (clade 2.2) sub-lineage of H5N1 virus. Barring one isolate from Surat, same observation was found with M1 and NS1 genes. The Surat isolate falls within clade 1 viruses isolated from Vietnam-Thailand-Malaysia, indicating the reassortant nature of the isolate between clade 1 and clade 2.2. Phylogenetic analysis of Indian H9N2 virus indicated that the strain was a reassortant between sub-lineages in the Eurasian lineage. The HA, NA and M1 genes are closely related to G1-like viruses, whereas the remaining 3 genome fragments (PB2, PA and NS1) are from Indian cluster.

## Animal Generic Material

**Livestock:** Frieswal semen doses (9,650) of pure HF semen and 436,281 doses of Frieswal semen are available in the gene bank. Total available frozen semen doses of Hariana test bulls are 27,931. At Germplasm Unit 156,965 semen doses of Ongole cattle are available. The semen doses of Frieswal cattle (50,430), other crossbred cattle (4,850) and Murrah buffalo (22,705) were distributed/supplied to farmers/development agencies. German Angora rabbits (35), British Angora (2) and broiler rabbits (149) were supplied to farmers interested in rabbit farming. Gaddi Synthetic sheep (20 males + 8 females) and Bharat Merino sheep (12 males) were supplied to interested agencies.

**Production of superior quality mules:** The cryopreserved semen of Poitu jacks was used to inseminate 14 mares for mule production, and farmers were educated for better mule production through strategic interventions.

**Poultry:** Fertile eggs as well as day-old eggs were distributed to poultry farmers. Details are as follows:

Name	Fertile eggs	Day-old chicks
Layer and broiler	4,15,860	1,67,954
Desi fowl	3,334	6,518
Quail	9,178	–
Guinea fowl		
Turkey	1,045	7,458
Duck	–	45,650
Fish		

## FISH IMPROVEMENT

**Freshwater aquaculture — Selective breeding of rohu (*Labeo rohita*) for innate resistance to aeromoniasis:** Based on repeated challenge tests performed on 50 fullsib families (2005 year class) of rohu (*Labeo rohita*) against the common bacterial pathogen, *Aeromonas hydrophila*, a wide range of variations (20–70.37%) was observed among them as compared to the control groups. The heritability was  $0.114 \pm 0.0378$ , but the common environment variance was too small to estimate the effect. Resistant and susceptible lines of rohu were produced against aeromoniasis with 31% higher genetic gain of resistant over susceptible line. Several non-specific immune parameters along with blood glucose level were studied in 64 families from 2 year classes of rohu that demonstrated differential susceptibilities to aeromoniasis in experimental challenge study. The results revealed — large genetic variation for all the measured parameters as well as for survival among and





within full-sib families. Serum natural agglutinins, haemolysin titre and ceruloplasmin level with moderate to high heritabilities although account partly for aeromoniasis resistance, were found as more reliable markers of indirect selection for disease resistance in rohu.

*Purification and characterization of a  $\beta$ -glucan binding protein from serum of Macrobrachium rosenbergii:* A  $\beta$ -glucan binding protein (BGBP) was purified from the serum of giant freshwater prawn, *Macrobrachium rosenbergii*. The purified sample enhanced the prophenoloxidase activity after binding to yeast  $\beta$ -1, 3-glucan. The molecular weight of the protein was ~316 kD. Considering the molecular weights of native BGBP molecule and its constituent polypeptide chains, it is deduced that the BGBP is possibly a homotrimeric molecule and further confirmed as a glycolipoprotein through staining.

## Biotechnology

*Cloning of gonadotropin (GTH) and its releasing hormone (GnRH) encoding cDNAs in rohu (Labeo rohita):* Rohu, like other Indian major carps, is a seasonal breeder and understanding the molecular regulation of this seasonality requires identification of the relevant hormonal genes, and their expression to be studied in detail. Brains and pituitaries were collected during pre-spawning and spawning phases from mature rohu. Primers were designed for both GnRHs[salmon (sGnRH) and chicken-II (cGnRH) type] and beta sub units of GTHs[GTH I and GTH II] from different carp sequences available in the Genbank database. cDNA fragments of ~186 bp and ~113 bp were amplified from the whole

brain cDNA by the respective primers, cloned in pGEM-T easy vector (Promega) and sequenced in automated cycle sequencer (ABI310). The sequences when BLASTed produced significant similarity with the salmon type and chicken-II type GnRH precursors, respectively, of *Carassius auratus*, *Cyprinus carpio*, *Rutilus rutilus* and *Danio rario* both at the nucleotide and protein level. The partial cDNA sequence (186 bp) of rohu represented 20–81<sup>st</sup> amino acids of salmon type GnRH precursor while 113 bp fragment represented 28–65<sup>th</sup> amino acid of chicken-II type GnRH of the above carps. The sequences have been submitted to the NCBI Genbank database (Acc# EF198467 for rohu sGnRH, Acc# EF428123 for rohu cGnRH). Similarly, cDNA fragments of ~258 bp for GTH I and ~192 bp for GTH II beta subunits were amplified from mature rohu pituitary cDNA, cloned in pGEM-T vector and sequenced. The sequence BLAST produced significant similarities with the respective gonadotropin I and gonadotropin II beta subunit sequences of *Cyprinus carpio*, *Ctenopharyngodon idella* and *Carassius auratus* at the nucleotide and protein level. The partial cDNA sequence of rohu i.e. 258 bp GTH I represented the 21–106<sup>th</sup> amino acids of GTH I precursor, while 192 bp represented 54–116<sup>th</sup> amino acids of GTH-II precursors of *Cyprinus carpio*. The partial cDNA sequence of rohu gonadotropin beta subunits have been submitted to the Genbank database [Acc#EF494675 (GTH-I); Acc#EF494676 (GTH-II)].

*Cloning, nucleotide sequence and phylogenetic analysis and tissue specific expression of transferrin gene in Indian carps:* Transferrin partial complementary DNAs were cloned from the liver of 5 species in 4 genera of Indian carps (Indian major carp species: *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*; medium carp: *Puntius sarana*; minor carp: *Labeo bata*) subsequent to polymerase chain reaction amplification with published heterologous primers or self-designed primers derived from conserved regions of transferrin cDNA sequences. The partial transferrin cDNAs of the 5 species of carps had sizes from 624 to 633 bp (487 bp for *L. rohita*) and encoded an open reading frame consisting of 206–211 (162 for *L. rohita*) amino acids. The alignments of carp cDNA sequences showed 85 to 97% homology and 71–93% homology in deduced amino acid sequences. A phylogenetic tree of amino acid sequences of transferrin cDNAs from carps was also drawn. The tissue-specific expression of this gene in bacteria-infected fish is also being analyzed.

*Bioactive compounds from marine organisms:* Marine sponges collected from Kochi waters of Arabian sea were sampled on Marine Zobell agar (MZA) and Nutrient agar (NA) with seawater.

### Breeding and mass seed production of *Ompok pabda*

Catch trends of pabda, *Ompok pabda*, a highly prized catfish, has been showing a declining trend in open waters in recent years. This has also been enlisted as threatened species. Mass breeding and seed production of *O. pabda* was achieved at the Regional Research Centre of CIFA, Kalyani. Brood fishes weighing above 40 g were used for breeding by administering the hormone, Ovaprim as inducing agent. *O. pabda* spawn to the tune of 1.5–2.0 lakh were obtained, and reared in yard and earthen ponds on a diet of nanoplankton. After attaining the fingerling size (8.8 cm/2.5 g) they were cultured in farm ponds to marketable size. Development of technology for mass seed production of *O. pabda* is a significant landmark in the production of quality catfish seed in the country. The standardization of breeding technique as well as grow out farming system of catfishes was one of the priority areas in fisheries sector.



The bacterial counts on MZA and NA were in the range of  $2.4 \times 10^6$  to  $3.7 \times 10^8$  cfu/ml and  $3.1 \times 10^4$  to  $3.7 \times 10^6$  cfu/ml, respectively, and the count on MZA was 2 log high as compared with NA indicating its marine origin. The samples were also analyzed for *Actinomyces* on actinomycetes isolation agar (AI) and antimicrobial properties of actinomycetes isolates (n=44) are being determined.

### Fish Seed

Under the Project on Mega seed production in agricultural crops and fisheries, 37 institutions including ICAR institutes, SAUs and other universities, are participating. In this project the emphasis is on production of fry and fingerlings. The status of fish seed production under the ICAR

Seed component	Production in 2007 (lakh)
Carp	1940.51
Catfishes	4.72
Ornamental fishes	2.71
Freshwater prawn	8.04
Shrimp	82.90
Sea bass	1.80
Marine crab and oysters	166.00
Total	2,206.68

Mega Seed Project in Agricultural crops and Fisheries during the year is as follows:

*Photothermal manipulation of early maturation and breeding in Indian major carp (Labeo rohita):* Early maturation and breeding of rohu (*Labeo*



Riverine catfish (*Pangasius pangasius*) was bred in captivity thus paving way for mass scale seed production

### Breeding of tangra (*Mystus vittatus*) and production of post larvae/fry

*Mystus vittatus*, locally known as tangra is a minor bagrid catfish occurring in the eastern and northeastern regions of the country. Living in swamps, canals and low lying paddy fields, this fish has high food value and a good market demand. Tangra supported a strong fishery in early 1970s, but the catches declined during the 1980s. Successful breeding and rearing of its post larva and fry were achieved in the Regional Research Centre of CIFA, Kalyani, West Bengal. During the early monsoon, male and female brooders weighing 15–20 g and 30–40 g, respectively, were induced-bred. The hatchlings were reared in aerated fibreglass tanks with natural food (zooplankton). The mass breeding and seed production of tangra in captivity is a breakthrough in aquaculture.

*rohita*), the prized Indian major carp, has been achieved as early as first week of March for the first time in eastern India under controlled conditions. The spawning fecundity and spawn recovery were high at 1.76 lakh/kg and 1.47 lakh/kg body weight respectively. This finding will lead to development of technologies to produce fish seed early in the season to prolong the rearing time and thereby improve pond fish productivity.

**Artificial breeding of *Pangasius pangasius*:** Breeding of the riverine catfish, *Pangasius pangasius* was achieved in captivity paving the way for its artificial propagation and mass-scale seed production. At present, this catfish is not extensively cultured due to lack of a viable seed production technology. These fingerlings achieved 120–150 mm in size in 60 days of rearing at a density of 1–1.5/m<sup>2</sup>.

**Cryopreservation of catfish spermatozoa:** Air breathing Indian catfish, *Heteropneustes fossilis* is an important table fish and preferred candidate for aquaculture with high market value. Successful cryopreservation of *H. fossilis* spermatozoa was achieved and demonstrated through viable production of hatchlings. The extender composition was found to have a significant effect on cryopreservation and hatching success. The extender (modified HBSS with dimethyl sulfoxide) yielded the highest hatching, 96% of the control value. The long term storage (9 months) was also evaluated, which showed no significant change in the hatching success. The study provides a successful tool for cryostorage of *H. fossilis* spermatozoa which holds a great promise for seed production and aquaculture diversification.

□

