INTRODUCTION
Hormonal sex reversal using androgens and estrogens has been achieved in 48 species and the effective protocols for the successful sex reversal are available for various species (Pandian & Sheela, 1995). In general, a treatment involving a synthetic steroid results in higher mortality of most species. Growth of sex reversed individuals varies from equal to lesser than untreated controls and the available information on long-term growth studies on sex reversed individuals (George & Pandian, 1995) are quite scanty. The present attempt adds more information to the literature pertained to growth of a sex reversed characid.

MATERIAL AND METHODS
Experimental fish: Gymnocorymbus ternetzi (Boulenger), commonly known as black or widow tetra, belonging to family Characidae, has been selected as the candidate species in the present study.

Collection and maintenance of fish: G. ternetzi, obtained in their immature stage (30-45 days old), from local private ornamental fish dealers, were stocked in outdoor concrete tanks till they attained maturity. Later, they were transferred to indoor glass aquaria and maintained at 28 ± 1°C and 14L: 10D photothermal cycle. One week prior to breeding, sexes were maintained separately as it may considerably enhance the willingness to breed, besides avoiding breeding on their own without our eye on it.

Breeding in ornamental fish farm: Breeding was usually carried out in larger cement tanks of 200 - 700 l capacity. Females and males in the ratio of 5-6 to 12-20 were pooled and from that lot, the required number of posthatchlings were used for hormone treatment. Feeding regimes were similar to farm practices. For growth studies, the body weights of the fish were weighed accurately using a microbalance (August sauter, GmbH, D-7470, Albstadt - Ebingen, make).

Hormone administration: For treatment, a stock solution of hormone was prepared by dissolving the steroids (Sigma, USA)-17α-Methyltestosterone (17α-MT), a synthetic hormone mostly preferred for achieving masculinization (Pandian & Sheela, 1995) - in an appropriate solvent (ethanol) at a concentration of 1mg/ml. The stock solution was then added to the rearing water to achieve the desired concentration and experiments were done. Controls with neither hormone nor solvent were run side by side.

In short term immersion experiments, after exposure for a definite period, the fry were transferred back to rearing tanks. Five day old posthatchlings obtained using 6-10 females and 12-20 males, were pooled and from that lot, required number of posthatchlings were used for hormone treatment. Feeding regimes were similar to farm practices. For growth studies, the body weights of the fish were weighed accurately using a microbalance (August sauter, GmbH, D-7470, Albstadt - Ebingen, make).

RESULTS
Data from growth studies in sex reversed individuals were treated with Student’s ‘t’-test, to find out the significant differences at various ‘P’ levels.

DISCUSSION
Increased growth over control is observed at lower dose (sub-optimal) of 17α-Methyltestosterone, while growth decrement is observed at optimal and super-optimal doses, in the present study. A similar trend has also been reported in other species like O. kisutch (Goetz et al., 1979; Piferrer et al., 1994 – immersion method); similar negative growth in other species of fish when sex reversed, are given in Table 2. Females exhibit greater growth decrement than males, pointing out clearly that genetic or paradoxically resulted females which were not amenable for masculinization suffered the most in terms of growth.

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Table 1: Growth of G. ternetzi exposed to 17α-Methyltestosterone, STI for sex reversal (N=5)

| Sex | Body weight, in gms at 75 days | Hormone dose (µg/l) |
|-----|--------------------------------|---------------------|
|     | Control                        | 200 | 400* | 600 | 800 |
| Male| 0.630±0.02                     | 0.650±0.05 | 0.619±0.03 | 0.558±0.06 | 0.538±0.02 a |
| Female| 0.692±0.04                     | 0.701±0.1 | - | 0.549±0.03 | 0.526±0.05 b |

SEM ± STI – short term immersion for 4 hrs.

*optimal dose

- P<0.005
- P< 0.05

Table 2: Negative growth response (< lesser) reported for some of the sex reversed fishes

| Species                      | Hormone used         | Growth | Reference                  |
|------------------------------|----------------------|--------|----------------------------|
| Cyprinus carpio              | Mibolerone           | <      | Das et al., 1990           |
| Ctenopharyngodon idella      | Methyltestosterone   | <      | Jensen et al., 1983        |
| O. aureus                    | Mibolerone           | <      | Meriwether & Torrans, 1986 |
| Cichlasoma nigrofaciatum     | Methyltestosterone   | <      | George & Pandian, 1996     |
| Clarias gariepinus           | Methyltestosterone   | <      | Hurk et al., 1989          |
| Dicentrarchus labrax         | Methyltestosterone   | <      | Blazque et al., 1995       |

REFERENCE
Blazquez, M., Piferrer, F., Zanuy, S., Camillo, M. and Donaldson, E.M. 1995. Development of sex control techniques for European sea bass (Dicentrarchus labrax L) aquaculture. Effects of dietary 17α-methyltestosterone prior to sex differentiation. Aquaculture, 135:329-342.

Das, S.K., Shetty, H.P.C. and Nandeesh, M.C. 1990. Production of female-free common carp, Cyprinus carpio var. communis (L) through dietary administration of the androgen mibolerone. Asian Fish. Sci., 3: 197-203.

George, T. and Pandian, T.J. 1995. Ineffective masculinization and anabolic growth effect in Poecilia sphenops. Asian Fish. Sci. (Submitted, cited in Pandian and Sheela, 1995).

George, T. and Pandian, T.J. 1996. Hormonal induction of sex reversal and progeny testing in the zebra cichlid, Cichlasoma nigrofaciatum. J. Exp. Zool., 275: 374-382.

Goetz, F.W., Donaldson, E.M., Hunter, G.A. and Dye, H.M. 1979. Effects of 17β-estradiol and 17α-methyltestosterone on gonadal differentiation in the coho salmon, Oncorhynchus kisutch. Aquaculture, 17: 267-278.

Hurk, R.V.D., Richter, C.J.J. and Dommerhot, J.J. 1989. Effects of 17α-Methyltestosterone and 11β-hydroxyandrostenedione on gonadal differentiation in the African catfish, Clarias gariepinus. Aquaculture, 83: 179-191.

Jensen, G.L., Shelton, W.L., Yang, S.L. and Wilken, L.O. 1983. Sex reversal of gynogenetic grass carp by implantation of methyltestosterone. Trans. Am. Fish. Soc. 112:79-85.

Meriwether, F.H. and Torrans, E.K. 1986. Evaluation of new androgen (mibolerone) and procedure to induce functional sex reversal in tilapia. In: J.L. Maclean, L.B. Dixon and L.V. Hossillos (eds.) Proc. First Asian Fish. Soc. Manila, Philippines pp. 675-678.

Pandian, T.J. and Sheela, S.G. 1995. Induction of sterility in coho salmon (Oncorhynchus kisutch) by androgen immersion before first feeding. Aquaculture, 119: 409-423.