

GROWTH AND BODY COMPOSITION OF SIBLING MALE AND FEMALE  
CHANNEL CATFISH WITH XY SEX GENOTYPE<sup>1</sup>

K B Davis, Ecological Research Center  
Division of Ecology and Organismal Biology  
Department of Biology, The University of Memphis, Memphis, TN 38152  
(901) 678-2594, (901) 327-8001, daviskb@cc.memphis.edu

B A Simco, Ecological Research Center  
Division of Ecology and Organismal Biology  
Department of Biology, The University of Memphis, Memphis, TN 38152  
(901) 678-2594, (901) 327-8001, simcoba@cc.memphis.edu

C A Goudie, Catfish Genetics Research Unit  
US Department of Agriculture, Agricultural Research Service  
PO Box 38, Stoneville, MS 38776  
(601) 686-5460, (601) 686-3004, cgoudie@ag.gov

**Abstract**

Male channel catfish grow larger than females in mixed sex culture and size differences due to sex vary with family and age. The relative roles of sex genotype and sex phenotype in regulating sexually-dimorphic growth have not been completely addressed in this species. Sibling male and female channel catfish with XY sex genotype (males were produced by mating YY males with XX females and female siblings were produced by hormonal sex reversal) were used to evaluate genetic and physiological influences on growth and body composition. In separate experiments, males were grown in separate ponds from their sibling females (six families) or males and sibling females were grown together in ponds (nine families). Normal XY males and XX females were grown together in ponds (three families) as controls. All fish were stocked as large fingerlings (300 fish/0.04 ha) and were maintained until they reached marketable size. Average weight of males was higher than that of females in 16 of the 18 families evaluated, although statistical differences between sexes existed only in two of three control families, one of six XY genotype families with sexes maintained separately and four of nine XY genotype families with sexes maintained together. Dress-out percentage of females was equal to or significantly greater than that of males in 16 of 18 families, and liposomatic index was significantly higher in females in 10 of 18 families. Although an overall weight advantage of males was evident, differential growth of males and females was diminished when sexes with the same genotype were maintained communally, and additional reductions were realized when sexes were maintained separately. Both sex genotype and sex phenotype influenced growth and body composition of channel catfish in this study.

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## Introduction

Male channel catfish grow larger than females in mixed sex culture (Beaver et al., 1966; Simco et al., 1989). Size differences due to sex increase with age and vary among families (Simco et al., 1989). The influence of sex on size is apparent in some families when fingerlings are as small as 3 g (Goudie et al., 1993).

Channel catfish females have an XX sex genotype and males have an XY sex genotype (Davis et al., 1990); thus, normal matings produce a sex ratio of 1:1 male:female progeny. However, all female populations can be produced by dietary administration of exogenous hormones during early development (Goudie et al., 1983), and feminization results from a variety of estrogens and androgens (Davis et al., 1990). Male channel catfish with YY sex genotype have been identified by evaluation of progeny sex ratios from a series of hormonal treatments and genetic matings (Davis et al., 1995). When YY males are mated with XX females, all male offspring with XY sex genotype are produced. Female siblings with an XY genotype can be produced by hormonal sex-reversal of some of the progeny.

The relative roles of sex genotype and sex phenotype in regulating sexually-dimorphic growth have not been completely addressed in this important aquaculture species. Growth of hormonally sex-reversed females (Simco et al., 1989) and hand-separated male and female monosex populations (Goudie et al., 1994) have been studied. However, female (XX) and male (XY) sex genotypes were equally represented in sex-reversed female populations, and hand-selected populations represented fish with normal sex genotype and sex phenotype. In the present study, sibling male and female channel catfish, both with XY sex genotype, were used to evaluate genetic and physiological influences on growth and body composition.

## Materials and Methods

All male XY populations were produced by mating previously identified YY males with normal XX females. A portion of each spawn was feminized with  $17\alpha$ -ethynyltestosterone (100 mg/kg diet; Davis et al., 1990) during the first 21 days of feeding. Fish were maintained separately by family and hormone treatment and grown to fingerling size. Fish were then stocked into ponds (300 fish/0.04 hectare) and reared until they were marketable size at 15 to 16 months of age. Three experimental designs were used: (1) three families with normal sex genotypes and phenotypes were separated by family and both sexes of a family were grown together in a pond; (2) six families of sibling males and females with XY genotypes were reared separately by family and sex; and (3) nine families of sibling males and females with XY genotypes were reared together separated by family.

At harvest, 50 fish from each pond were weighed, measured for standard length, and condition factor (K) calculated. Twenty fish were used to assess body composition. Mesenteric fat was dissected and weighed, and liposomatic index (LSI) was calculated as mesenteric fat weight/body weight  $\times$  100. Carcasses with head and viscera removed were weighed, and dress-out percentage was calculated as carcass weight/body weight  $\times$  100. Analysis of variance was used to resolve significant differences between sexes within families for each of the three experimental designs.

## Results and Discussion

Survival was good in all treatments and was similar between the sex genotypes and phenotypes. The average weight of males was higher than that of females in 16 of the 18 families evaluated, although statistical differences between sexes existed only in two of three control families, one of six XY genotype families with sexes maintained separately, and four of nine XY genotype families with sexes maintained together. Length and condition factor differences between sexes followed

with sexes maintained together. Length and condition factor differences between sexes followed a similar pattern. Liposomatic index was statistically higher in females in 10 of 18 families, while the LSI of males exceeded that of females in only one family. Dress-out percentage of females was significantly higher than males in seven of 18 families and equal to that of males in nine additional families. Male dress-out percentage exceeded that of sibling females in only one family.

In an earlier study, we found that growth characteristics of sex-manipulated channel catfish were typical of the phenotypic sex rather than the genotypic sex (Simco et al., 1989). In a subsequent study, hand-sexed XX monosex females in a single pond had harvest weights similar to those of males cultured in ponds with mixed sexed or monosex male populations (Goudie et al., 1994), while two other ponds of females, which contained 1 and 2% males, exhibited the typically observed lower growth of females. Use of sibling males and females with a common XY sex genotype in the present study appeared to diminish the growth differences usually observed between the sexes, as statistical differences were apparent in only seven of 18 families evaluated. Additionally, similar weights of males and females in five of six families when the sexes were maintained separately suggest that behavioral or physiological (perhaps pheromonal) influences might inhibit the full growth potential of females in mixed sex culture.

Both sex genotype and sex phenotype influenced gender bias in growth of channel catfish in this study. Removing the influence of sex genotype decreases, but does not eliminate, the difference in size between the sexes. Even though female fish appear to have higher dress-out percentage and mesenteric body fat than males; the quantitative male growth advantage must be considered in selecting strains of fish for development of monosex populations. Factors which limit growth of females in mixed sex culture warrant further investigation.

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