Comparison of Initially Fast and Slow Growing Sibling Largemouth Bass Through Age 17

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ABSTRACT

This study followed individually-marked fast and slow growing sibling largemouth bass *Micropterus salmoides* (based on growth rates through their first 5.5 months of age) annually from hatching through age 17 in ponds at Heart of the Hills Fisheries Science Center, Ingram, Texas. Survival rates among slow and fast growing siblings were similar. Growth rate designations (e.g., fast or slow growing) often applied only when they were assigned at age 0. These designations were not necessarily indicative of growth rate patterns later in life. In the most literal sense, slow growing siblings did indeed live longer and grow larger, with 13 of 15 surviving fish remaining at age 17 that were initially slow growing at age 0 and the longest and heaviest specimens measured were also initially slow growers. However, slow growing siblings did not substantially outnumber faster growing specimens until test fish were > age 8. Annual mean lengths of fast growing siblings averaged slightly greater than slow growing fish, but annual change in length increment was typically greater in slow growing bass. Annual mean weights were also usually greater for fast growing bass, but weights varied much more than length from year to year and at any point in time. Generally, slow growing fish approximated the sizes of their faster growing siblings by age 3 - 5 and were similar thereafter. Bass produced progeny annually throughout the study, though only a single young bass was found when test fish were age 17. Additionally, this study also generated information on annual natural mortality, tag retention rates, and sex-related sizes and survival.

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INTRODUCTION

It is generally recognized that among cultured fishes considerable growth differences exist within progeny, even when parents are the same (Huet 1972). Hatcheries have long practiced selective breeding for traits like rapid growth and early maturity (Bardach et al. 1972). Donaldson and Menasveta (1961) and Donaldson (1968) produced classic work in which 2-year-old, selectively bred rainbow trout *Oncorhynchus mykiss* grew to 4.86 kg compared to same-age wild fish of only 36 g. However, selection for rapid growth in species with long histories of culture has not always been uniformly successful (Smitherman et al. 1978). Selection for growth in common carp *Cyprinus carpio* has been less encouraging, perhaps due to 20 centuries of cultivation where a growth plateau may have already been reached (Moav and Wohlfarth 1966).

Selection for rapid growth can decrease the time fish must be held at a production hatchery before stocking in the field or harvest. Fish often grow rapidly until sexual maturity is reached and more slowly thereafter (Moyle and Cech 1982). Optimum harvest size for many species in aquaculture is often at or near sexual maturity (Stickney 1979). Therefore, rapidly maturing strains may also be advantageous in some situations.

Largemouth bass *Micropterus salmoides* is one of the most important game fishes nationwide and is particularly important in Texas. This species has been cultivated in hatchery settings since the 1800s and large numbers are produced and stocked both locally and in other states annually. Despite their importance and history of culture, relatively little information exists on largemouth bass genetics (Joint Subcommittee on Aquaculture 1983). Numerous studies have examined genetics of subspecies and their intergrades, but possible genetic association to growth rate, size at maturity, or other potentially heritable traits are still largely unknown.

Selection for fast growing and rapidly maturing largemouth bass enables hatchery-produced fish to be stocked sooner (reducing production costs) and enter the fishery earlier (reduces time between stocking and impact on the fishery). However, there is no indication whether rapidly growing largemouth bass eventually attain large, trophy sizes more frequently than slower growing fish. Indeed, work with blueback herring *Alosa aestivalis* and alewife *A. pseudoharengus* by R.G. Howells and C.C. Miller (Public Service Electric and Gas Company 1982a, b), sailfin molly *Poecilia latipinna* (Brown and Gratzek 1980), and channel catfishes *Ictalurus punctatus* (Ashley et al. 1981) suggests that fish that grew slowly initially and took longer to reach maturity may live longer and become larger than others that grew more rapidly when young and matured sooner. Thus, hatcheries selecting the most rapidly growing, largest young adults as future brood fish may not be contributing to the maximum production of potentially trophy fish.

Although not all authorities agree (Fuhr et al. 2002), several studies have shown that among largemouth bass, slow growing "runts", that may be present among each brood or year class, often fail to survive their first winter or at least have significantly poorer survival than larger, faster growing specimens (Gutreuter and Anderson 1985), and rarely, if ever, reach age 2 (Shelton et al. 1979). Similar observations have been reported for smallmouth bass *M. dolomieu* (Oliver and Holeton 1979). If this is true, most largemouth bass populations would be expected to be heavily dominated by fish with initially fast and moderate growth rates, with many or all slow growing young eliminated early in life. Increased growth and ultimately increased survival has been associated with a shift from diets dominated by invertebrates to consumption of other fishes and the availability of those forage fishes (Aggus and Elliott 1975; Shelton et al. 1979; Garvey et al. 2002; Parkos and Wahl 2002).

In 1985, Texas Parks and Wildlife Department's (TPWD) Heart of the Hills Fisheries Science Center (HOH) initiated a study to monitor annual growth, survival, and ultimate size of initially fast and slow growing sibling largemouth bass in ponds with an abundant, diverse forage base to investigate whether surviving slow growing young-of-the-year (YOY) would ultimately live longer or grow larger than faster growing individuals.

METHODS AND MATERIALS

A single pair of Florida largemouth bass *M. s. floridanus* brood fish obtained from a TPWD hatchery in spring 1985 produced the progeny for this study. These fish had been electrophoretically certified as Florida subspecies based on understanding and information available at that time (Research Staff 1989). Young bass were found in the 0.2-hectare HOH pond in late May 1985 in which the brood pair had been stocked. Based on average size when discovered and approximate growth rates, hatching appeared to have occurred on or about 1 May 1985. On 30 May 1985, this pond was drained and the YOY bass ($N = 4{,}512$) were restocked in a 0.74-hectare pond that was previously fertilized to promote a plankton bloom and was stocked with brood goldfish *Carassius auratus* whose offspring would provide forage for the young bass. At this time, all YOY bass were 20-49 mm TL (total length), except 12 that were 70-79 mm TL.

On 24-25 October 1985, YOY bass were removed from the pond and sorted by size. A total of 1,741 sibling bass were recovered. The largest (hereafter designated as fast growers) and smallest (hereafter designated as slow growers) siblings were separated. Slow growers ranged from 70 to 130 mm TL and fast growers ranged from 190 to 320 mm TL. Size distribution among all the young was clearly bimodal, with only a minimal amount of overlap in the range of 130-160 mm TL. Numbers of slow growers were limited, with 405 specimens obtained. Fast and slow growers were randomly selected from their respective groups. 400 fast and 400 slow growers were thus selected as test fish. Test fish were then stocked into three ponds (0.74-1.00 hectares each) in the following numbers and groups:

(a) Fast growers stocked alone in one pond ($N = 300$);
(b) Slow growers stocked alone in one pond ($N = 300$); and
(c) Fast growers ($N = 100$) and slow growers ($N = 100$) mixed in one pond (later termed mixed group).

Prior to stocking, bass in the mixed group were fin clipped (anterior 3-4 dorsal spines in fast growers and posterior 4-5 dorsal rays in slow growers) and heat cauterized with a soldering iron. These fish were held for several hours to assess possible mortalities from marking. Two slow growers that had been badly stressed by the process were replaced by two additional slow growers that had been similarly marked. Fast and slow growers stocked alone were not marked.

Following the initial sorting and stocking of test fish in October 1985, all ponds were drained every October through 2002 when water temperatures were < 25° C. Each year, test fish were individually weighed and measured, then restocked into another pond. Any YOY largemouth bass produced were removed. Numbers of test fish recovered and then restocked each October are reported in Table 1. Pond sizes ranged from 0.69 to 1.00 hectares, except for one group in 1993 (0.18 hectare) when only a small number of fish in one group remained. On several occasions during this study, YOY removed from test ponds were electrophoretically examined to evaluate subspecific status following procedures outlined in Research Staff (1989).

Prior to the introduction of test fish each year, ponds were stocked with a variety of forage fishes including combinations of goldfish, common carp, gizzard shad *Dorosoma cepedianum*, threadfin shad *D. petenense*, golden shiner *Notemigonus crysoleucas*, fathead minnow *Pimephales promelas*, sailfin molly *Poecilia latipinna*, western mosquitofish *Gambusia affinis*, inland silverside *Menidia beryllina*, redbreast sunfish *Lepomis auritus*, green sunfish *L. cyanellus*, bluegill *L. macrochirus*, redear sunfish *L. microlophus*, warmouth *L. gulosus*, and blue tilapia *Oreochromis aureus*. On two occasions, YOY channel catfish *Ictalurus punctatus* and blue catfish *I. furcatus* stocked into the test ponds as part of other research (Howells 1989, 1993) also served as forage. Efforts were made to maintain a large, diverse forage base, particularly in the early and middle years of the study. Forage density was not quantitatively monitored, except during pond draining each October and when ponds were restocked, but additional forage was occasionally introduced throughout the year when deemed necessary, based on observed forage density and apparent condition of test fish. Forage stocking and recovery history are presented in Appendix Table I. In addition to deliberately stocked forage fishes, ponds were maintained under relatively natural conditions, containing beds of aquatic macrophytes and communities of crustaceans, aquatic insects, and amphibians that probably contributed to the bass forage base as well.

Each test fish was injected with a PIT (passive integrated transponder) tag (Northwest Marine Technology, Seattle, Washington) in October 1988 to allow subsequent monitoring of each fish as an identifiable individual. At that time, a tag reader malfunction prevented recording some tag numbers (primarily among fast growers stocked alone). Therefore, prior to October 1988, although individual lengths and weights were recorded, these could not be associated to specific individuals. Some statistics herein for 1985-1987 for all test fish and in 1988 for most fast growers stocked alone represent group means and ranges. Examination of all test fish during annual pond drainings enabled a determination of PIT tag retention rates.

In May 1990, 50 fast and 50 slow growers that had been stocked alone were randomly selected and restocked in a single pond as a new mixed group. Additionally, the 100 test fish in the new mixed group were designated to be utilized in a companion age determination study, with removal of 50 in 1991, 25 in 1992, and 25 in 1993 (see discussion in Howells et al. 1995). Thus, after October 1993, only test fish in the original mixed group remained.

Although test fish were not sexed at the outset of this study, because of dramatic bimodal length distributions observed among the fish in each study pond, an additional pond draining was performed in March 1991. Fish were measured, weighed, and sexed, then immediately restocked.

Because of the lack of true replication among elements of this study, most standard statistical analyses could not be applied to data generated. Individual length and weight measurements that were recorded annually were grouped (e.g., fast growers compared to slow growers, males compared to females) and means, minimum and maximum values, and standard deviations were determined to make qualitative comparisons.

RESULTS AND DISCUSSION

General Overview

Previous research that observed largemouth bass over time has dealt with fish in groups (without identification of individuals) and has only extended through 5 years (see summary in Howells et al. 1995). No prior research has examined individually marked largemouth bass on an annual basis for over 17 years. The density of test fish in this study (Table 2) was often high, but still fell within ranges occasionally documented in field situations in Texas (TPWD, Austin, unpublished database).

One of the shortcomings of this study was the absence of pond or growth type replication. Unquestionably, this would have dramatically enhanced the meaning and value of the following data. However, in practical terms, it is nearly impossible for most research or hatchery facilities to devote a large number of study or research ponds to a single study that will run nearly two decades. Additionally, even if large numbers of replicate ponds were available, obtaining a sufficient amount of forage to support the large biomass of test fish would generally prove functionally or cost prohibitive. Even within this study, massive forage demands were a factor in combining and ultimately eliminating the fast and slow growers in ponds that had originally been stocked alone. Similarly, the small gene pool from which the test fish originated (a single pair of parents) probably did not represent the full range of possible variation typical of either this species or even this specific subspecies. Nonetheless, the degree of variation apparent in the study data suggests that even greater variability might be expected among largemouth bass from more diverse gene pools.

Mortality

The number of test fish (800) initially employed in this study (Appendix Tables II and III) was largely dictated by a limited number of initially small, slow growing YOY. However, this number served to provide a fair indication of natural, annual losses throughout most of the study period. In this study, like most long term longitudinal studies, reduced numbers of very old individuals typically clouded mortality estimates among the oldest year classes.

When this study was planned in early 1985, little information was available concerning natural mortality in largemouth bass in the absence of angling. Because angling could potentially account for significant losses and impact estimates available at that time, lack of data on expected natural mortality levels made it difficult to judge how many test fish would be needed at the outset of the study in order to produce meaningful information over an extended period of time.

Test fish tolerated annual pond draining and handling very well and the only obvious mortalities directly related to this process were clearly evident and easily excluded from subsequent calculations (Table 3). Non-natural losses occurred on only three occasions. In October 1986, 8 test fish were lost during pond draining when exceptionally large numbers of large goldfish actually mortally injured some smaller bass while being removed from the same pond. In October1987, 20 fast and 11 slow growers were lost when a turtle, that had jammed the pond drain and slowed the draining rate, abruptly broke free and cause a rapid decrease of water level that stranded and killed these fish before staff could rescue them. Finally, 22 test fish were lost in October 1988 during the original PIT tagging process. A tag reader malfunction necessitated holding some test fish in an indoor raceway overnight while awaiting delivery of a second reader and some jumped from the holding tank. In all cases, these handling mortalities were random and fishes lost did not differ significantly from survivors from the same groups. All handling related losses were excluded from natural mortality rate calculations.

In answer to the question "Do slow growing YOY live longer than fast growing siblings?", in this case, it appears that they did. However, it required many years for this to become evident (> age 8). Slow growers did not die during the first two winters at rates substantially different from fast growers. Indeed, higher mortality occurred among the fast growers (31.5%) than among slow growers (16.0%) between age 0 and age 1. However, this trend appeared to reverse the following year. Certainly, annual pond differences, variation in forage availability in each pond, and other factors no doubt contributed to this variation. At the termination of this study in 2003, 13 slow growers had survived in contrast to only two fast growers. Fast grower males were completely eliminated at age 16, leaving only two fast grower females, seven slow grower females, and six slow grower males at age 17. The proportion of slow growers surviving from one year to the next ranged from 50 to 60% of the total test fish (ages 0 through 16) until age 17, when nearly 87% of the surviving test fish were slow growers (Table 1).

Mortalities varied during the first 4 years, ranging from < 3% to 34% (Table 3). In general, by age 5, annual mortality was usually below 5% and often 0 to 1% and remained in this range for several more years. An unusual spike in mortality occurred in 1994 at age 9 for both fast (34%) and slow (23 %) growers that could have reflected a variety of possible causes. By age 11, mortalities again reached into double digits and total mortality ranged from 11 to 28% (although with the reduced number of surviving fish at this time, loss of only one or two individuals could dramatically alter annual mortality values).

Mortality was also related to sex, with females more abundant each year than males. Although no sex ratios were determined for ages 0 through 5, when fish were first sexed in 1991 at age 6, 33% of 119 surviving fish were males (Appendix Tables IV and V). From age 7 - 12, males accounted for 24 - 33% of the surviving test fish. This increased to 37% at age 13, and rose to 40 - 42% for ages 14 through 17.

Growth

General:

During the early years of this study, total lengths (Fig. 1; also see Figs. 2-9 and Appendix Tables II and IV) and weights (Fig. 10; also see Figs. 11-18 and Appendix Tables II and V) were within ranges for other largemouth bass populations in Texas (TPWD, Austin, unpublished database) and elsewhere in the U.S. (Carlander 1977), generally falling in the high-median of size-at-age ranges for largemouth bass populations reported by Carlander. Thus, although test fish in this study were maintained in research ponds, growth patterns were similar to those in wild populations.

Weight values in this study often showed wide variation reflecting annual pond differences (including variable forage levels and pond conditions from year to year that impacted fish growth) and the influence of gut contents on individual weights at any given point in time (e.g., weight might be elevated in a test fish that consumed several large forage items just before being weighed, but then appear to drop dramatically the following year if the gut was empty when the specimen was weighed). Length and weight means were sometimes biased by the loss of particularly large or small individuals, especially in the later years of the study when far fewer test fish remained (e.g., in 2002 at age 17, only two females remained among the fast growers).

A number of fish in this study experienced slight decreases in length from one year to the next. Generally, this was minor and only amounted to a few mm; however, some annual reductions in length were as much as 16 mm. Most such decreases were largely due to erosion of the posterior margin of the caudal fin. Possible explanation of this decline in fin length might include fish that spawned late with associated fin wear, then experienced early, cool fall temperatures that delayed fin regeneration or which had reduced fin regrowth due to age or health status. Minor differences in position on measuring boards during annual examinations may also have been responsible for some of these apparent declines in length. Decrease in fin length was also apparent on other fins as well, especially in very old fish; several at age 16 and 17 had pectoral and pelvic fins reduced to short stubs.

Length Comparisons:

Comparison of mean annual lengths for fast and slow growers (Fig. 2; Appendix Table IV) indicated that means were slightly greater for fast growers in all years except 2000 (age 15) when slow growers averaged only 4 mm longer. Standard deviations around annual mean lengths were also similar for both groups. However, the largest individual specimen measurements were both 625 mm TL and in both cases were slow grower females in 1998 (age 13) and 2000 (age 15) (Appendix Table IV). The largest fast grower reached a maximum of 620 mm TL (Appendix Table IV).

Annual length increments (change in mean length from one year to the next) calculated from values on Appendix Table IV were greater for slow growers every year except twice, in 1994 (age 9) and 2000 (age 15), when means for fast growers were < 0.5 mm greater than for the slow growers. For all test fish combined, the greatest mean increases in length from one year to the next occurred, logically, from age 0 to 1 (120 mm), age 1 to 2 (36 mm), and age 2 to 3 (58 mm), with reduced annual increases thereafter. However, a change of 17 mm occurred between age 12 and 13. Females (all growth rate groups combined) generally had greater annual length increment changes than did males, except in the last few years of the study when too few fish remained to allow meaningful comparisons.

Comparing lengths among males and females of like groups in like ponds found a separation in length ranges occurring between ages 3 and 5 (Appendix Table IV). Thereafter, females were always longer than same-age males. Among all males and females combined (Fig. 3), standard deviations around the annual mean length also failed to overlap at age 5 and older.

Weight Comparisons:

Mean annual weights for fast and slow growers combined (Fig. 11, Appendix Table V) were slightly greater for fast growers throughout the study. Standard deviations around annual mean weights were also similar between groups, except for limited differences at age 1 (1986) and 2 (1987), when annual pond differences may have been involved, and at age 17 when only two fast growers remained. The two heaviest fish weighed were 5,076 g (11.2 pounds) in 1998 (age 13; a slow grower female) and 4,903 g (10.8 pounds) in 1999 (age 12; a fast grower female). Collectively, 12 test fish exceeded 4,000 g (8.8 pounds) at some point in their lives, including five fast and seven slow growers, all of which were females. Some males remained relatively small throughout the study, with one slow grower at age 15 (2000) only 1,474 g (3.3 pounds).

Annual mean weight increments (changes in weight from one year to the next) calculated from values on Appendix Table V were only slightly greater for fast growers for the first 6 years, then became quite variable for both groups. Limited numbers of larger test fish that could consume larger forage items appeared to be associated with much of this variability. The greatest individual annual weight increase occurred in one fast grower female that gained over 1,500 g from 1987 (age 2) to 1988 (age 3). The greatest weight loss was –748 g for a fast grower male between 2000 (age 15) and 2001 (age 16); this loss probably related to rapid decline associated with senility, as the specimen died prior to examination in 2002. Annual mean weight increments were generally greater among females, except among males from 1994 to 1995 (ages 9 to 10) and 1995 to 1996 (age 11), when males gained more weight.

Comparing weights among males and females from like groups in like ponds indicated less distinct differences than found among total lengths, where no overlap occurred at age 5 and older (Appendix Table V). However, among all males and females combined (Fig. 12), standard deviations around annual mean weights also failed to overlap at age 5.

Comparisons of Groups Stocked Alone and Mixed:

For the years for which comparisons were available, lengths of fast grower females (Fig. 5, Appendix Table IV), fast grower males (Fig. 7, Appendix Table IV), slow grower females (Fig. 8, Appendix Table IV), and slow grower males (Fig. 9, Appendix Table IV), fish that were stocked in ponds with mixed fast and slow growers had superior growth rates after age 1 than those that had been stocked alone. This pattern held true even after fast and slow growers that had been stocked alone were combined in 1990. Examining similar weight comparisons (Figs. 14, 16-18; Appendix Table V) also indicated similar trends with increased weight gains among the initially mixed group for both males and females and fast and slow growers.

A variety of factors may have influenced these differences in growth. Initially, fish that were stocked in ponds alone were stocked in higher numbers (Table 1) and typically higher densities (Table 2), even during the first few years after the alone groups were mixed. For both fast and slow growers, test fish had to compete with siblings of similar sizes (especially in the early years of the study). The original mixed group not only had reduced numbers of fish at the outset of the study with lower densities, but competition for food may have been further reduced by focusing predation-on two distinct size groups of forage items as well. Additionally, annual pond differences also may have impacted these data.

Tag Retention

Among 393 test fish that were given PIT tags in 1988 at age 3, 347 were recovered during pond draining one year later. Of these, no tag readings were obtained for 15 fish (4.3%) (Table 4). However, among the three ponds of test fish, most apparent losses, 13 of the 15 tags, occurred in a single pond containing 80 recovered test fish. Superficially, this would seem to suggest operator error during implantation. However, two staff members tagged all of the 393 fish in 1988 and periodically alternated tagging activity during the process. Why two groups in one pond had substantially higher tag losses than the other two groups in other ponds remains enigmatic.

In subsequent years, only six additional tags were implanted in test fish for which no reading could be obtained. Additionally, fish that died of natural causes during the study often had visceral cavities damaged by decay or scavengers prior to discovery and no PIT tags were found to remain (Table 4). Test fish that were never found (e.g., taken by predatory birds, turtles, etc.) may or may not have had functional PIT tags at the times of their deaths, but this aspect could not be quantified.

The apparent need to replace 21 PIT tags among 393 initially tagged test fish is, however, an overestimated number. Over the course of this study, tag retention was determined to be better than this number indicates. Different PIT tags appear to be detectable to different tag readers to varying degrees. Additionally, some PIT tags become more difficult to detect over time, particularly as test fish become large or tags move into different positions within the fish. Further, tag reader efficiency varies dramatically between units and within a given unit over time. At times, two tag readers were used in concert; if one failed to detect a tag, occasionally the second unit would produce a reading. Indeed, fragility and variability in the tag reader appears to be the weakest element of this system. Collectively, these problems resulted in occasions when tags could not be detected, were assumed lost or to be malfunctioning, and were replaced with new tags. As a result, over a period of years, several test fish were found to have been double tagged. A number of others were suspected of being double tagged as well, but died or were lost before this could be confirmed. Because some tags appear to be more easily detected than others by certain readers, it often required many years before the presence of multiple tags could be confirmed in these test fish (this problem might not have been evident in a short term study).

All bass present when the study was terminated had been fin clipped and heat cauterized in 1985. Specimens that had dorsal spines clipped at the base maintained this mark through all 17 years. Those that had the posterior-most dorsal rays clipped at their bases also retained the mark, but were much more difficult to recognize than spine- clipped fish. As ray-clipped fish became large and heavy, their dorsal fins became fleshier at their bases and the posterior fin margin often rounded into a nearly natural shape. There was no fin ray regrowth; however, at a quick glance, many larger ray-clipped bass could have been mistaken for unmarked individuals.

Production of YOY

No particular pattern of production or survival of young between fast and slow growers was evident. The numbers and weights of YOY produced by the test fish and obtained each October (Table 5) represent only the numbers recovered each fall and may or may not reflect the actual numbers of young from spawns the previous spring and summer. Annual pond differences, variable forage availability for both YOY and cannibalistic adults, and other factors likely impacted YOY survival over the first few months. It is interesting, however, to note that YOY production was greatest when test fish were young (age 1 - 4), with a spike at age 11 and production continued through age 17 (albeit only a single YOY obtained at that age). Clearly, some very old largemouth bass were still capable of reproduction, but the most significant production levels occurred among smaller, younger fish.

Genetic Identity of Test Fish

The brood stock (P generation) originally obtained from the TPWD hatchery system to produce test fish (F_1's) in this study was electrophoretically certified as Florida largemouth bass. Similarly, YOY from the test fish (F_2's) that were removed from the study ponds were not only examined electrophoretically to confirm the initial identification, but when no non-Florida alleles were found to be present, were subsequently used as Florida standards (knowns) in other largemouth bass electrophoretic analyses done at HOH (e.g., Howells 1988; Howells and Prentice 1991). The electrophoretic techniques employed during those times examined alleles at only 2 or 3 genetic loci to generate conclusions about subspecific status (Research Staff 1989), thus providing only a very limited view of actual genetic makeup.

SUMMARY CONCLUSIONS

1) Terms "fast growers" and "slow growers" that were applied at age 0, often failed to characterize growth patterns in subsequent years for some individuals.

2) Slow growers survived at essentially the same rate as fast growers, when sufficient forage was present, whether groups were stocked alone or mixed.

3) From the time fish were sexed at age 6, males accounted for about one third of the surviving test fish. This general proportion was maintained through age 12 and then increased slightly before too few surviving fish remained to provide meaningful results. Unfortunately, proportion of males and females at the outset of the study was not known.

4) At the end of the study (age 17), 13 slow growers and two fast growers remained. Slow growers appeared to live longer (as originally speculated), but this distinction did not become evident until test fish were > age 8.

5) Throughout most of the study, mean lengths of fast growers were just slightly greater than for slow growers. However, annual change in length increment was typically greater for slow growers.

6) The longest test fish measured during this study was initially designated as a slow grower.

7) Mean weights of fast growers were also slightly greater most years than those of slow growers, but the heaviest fish weighed during the study was a slow grower female.

8) Despite test fish originating from an exceptionally small gene pool (one pair of parents), significant variations in individual and annual lengths and weights were apparent.

9) Among 393 fish given PIT tags at age 3, 21 tags had to be replaced over the course of the study, but several fish were known or suspected of being double tagged. PIT tags remained functional 14 years after implantation.

10) YOY bass were produced annually in the test ponds throughout the study, including at age 17 (albeit only a single YOY was recovered in October that year).

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Table 1. Numbers of largemouth bass stocked, recovered, and restocked annually in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 - 2002 listed by growth rate designation. Data includes both sexed fish and unsexed fish that died before sex was determined in March 1991. All counts were taken in October each year except for May 1990.

Fish age	Year	Action	Fast alone *N*	Slow alone *N*	Fast Mixed *N*	Slow Mixed *N*	All Fast *N*	All slow *N*	Total *N*
0	1985	stocked	300	300	100	100	400	400	800
1	1986	recovered	198	262 [a]	76	74	274	336	610
		restocked	198	254	76	74	274	328	602
2	1987	recovered	176	175	60 [b]	57 [b]	236	232	468
		restocked	176	175	40	46	216	221	437
3	1988	recovered	168 [c]	164	39	44	207	208	415
		restocked	146	164	39	44	185	208	393
4	1989	recovered	121	146	38	42	159	188	347
		restocked	121	146	38	42	159	188	347
5	May 1990[d]	recovered	120	144	38	42	158	186	344
		restocked	50	50	38	42	88	90	178
	Oct 1990	recovered	50	50	38	40	88	90	178
		restocked	50	50	38	40	88	90	178
6	1991[e,f]	recovered	50	49	38	40	88	89	177
		restocked	28	22	38	40	66	62	128
7	1992[f]	recovered	26	22	36	39	62	61	123
		restocked	14	11	36	39	50	50	100
8	1993[f]	recovered	14	11	36	37	50	48	98
		restocked	terminated	terminated	36	37	50	48	98
9	1994	recovered			33	37	33	37	70
		restocked			33	37	33	37	70
10	1995	recovered			33	36	33	36	69
		restocked			33	36	33	36	69
11	1996	recovered			27	32	27	32	59
		restocked			27	32	27	32	59
12	1997	recovered			20	29	20	29	49
		restocked			20	29	20	29	49
13	1998	recovered			19	23	19	23	42
		restocked			19	23	19	23	42
14	1999	recovered			14	22	14	22	36
		restocked			14	22	14	22	36
15	2000	recovered			13	19	13	19	32
		restocked			13	19	13	19	32
16	2001	recovered			9	14	9	14	23
		restocked			9	14	9	14	23
17	2002	recovered			2	13	2	13	15

[a] 8 test fish were killed by large numbers of struggling goldfish during pond draining.
[b] 20 fast growers and 11 slow growers were killed when a turtle that had blocked the drain pipe from the pond broke free and caused water levels to fall very quickly, stranding these fish before they could be recovered.
[c] Fish were held one night in an indoor tank and 22 jumped out and died by morning.
[d] The fast and slow alone groups were each reduced to 50 and combined into a mixed group.
[e] Ponds were drained to determine sex test fish.
[f] Fish from the mixed group were sacrificed in 1991 (N=50), 1992 (N=25), and 1993 (N=25) to obtain scales and otoliths for use in another study.

NOTE: Lengths and weights of test fish lost in 1986, 1987, and 1988 were not significantly different from survivors. These fish were also excluded from annual mortality calculations.

Table 2. Number/hectare (*N*/ha) and kg/hectare (kg/ha) of largemouth bass in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 - 2002 listed by growth rate designation. Data include both sexed fish and unsexed fish that died before sex was determined.

Fish age	Year	Action	Fast alone *N*/ha	Fast alone kg/ha	Mixed *N*/ha	Mixed kg/ha	Slow along *N*/ha	Slow along kg/ha	Mixed *N*/ha	Mixed kg/ha
0	1985	stocked	300	48.7			405	4.7	263	17.9
1	1986	recovered	198	91.7			354	63.1	197	27.4
1	1986	restocked	261	89.3			368	88.9	156	32.1
2	1987	recovered	232	79.6			254	72.2	122	50.5
2	1987	restocked	238	81.8			175	49.8	125	51.7
3	1988	recovered	227	150.5			164	80.4	120	105.5
3	1988	restocked	154	103.0			164	80.4	109	95.8
4	1989	recovered	126	77.8			146	92.3	105	111.6
4	1989	restocked			135	225.6			116	123.9
5	1990	recovered			135	172.7			113	182.6
5	1990	restocked			104	133.0			78	126.0
6	1991	recovered			103	159.2			78	144.0
6	1991	restocked			50	85.8			78	144.0
7	1992	recovered			50	98.5			75	160.1
7	1992	restocked			139	291.1			101	216.4
8	1993	recovered							99	233.9
8	1993	restocked							73	173.1
9	1994	recovered							70	176.1
9	1994	restocked							95	238.0
10	1995	recovered							93	242.3
10	1995	restocked							69	179.3
11	1996	recovered							59	128.9
11	1996	restocked							80	174.1
12	1997	recovered							66	172.6
12	1997	restocked							49	127.7
13	1998	recovered							42	132.2
13	1998	restocked							57	178.6
14	1999	recovered							49	145.1
14	1999	restocked							38	111.8
15	2000	recovered							33	97.3
15	2000	restocked							43	126.3
16	2001	recovered							31	89.0
16	2001	restocked							23	65.9
17	2002	recovered							15	46.6

Table 3. Annual mortality (percentage) among largemouth bass test fish in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 - 2002, listed by growth rate designation. Data include both sexed individuals and unsexed fish that died before sex was determined. Individuals known to have died from handling-related causes were excluded from these calculations. Counts used to calculate mortalities were made in October each year.

Fish age	Year	Fast alone %	Slow alone %	Fast mixed %	Slow mixed %	All fast %	All slow %	Total %
0	1985							
1	1986	34.0	12.7	24.0	26.0	31.5	16.0	23.8
2	1987	11.1	31.1	22.9	23.0	13.9	29.3	22.3
3	1988	4.5	6.3	2.5	4.3	4.2	5.9	5.3
4	1989	17.1	11.0	2.6	4.5	14.1	9.6	13.3
5	1990	0.8	1.4	0.0	4.8	0.6	1.1	0.9
6	1991	0.0	2.0	0.0	0.0	0.0	1.1	0.6
7	1992	7.1	0.0	5.3	2.5	6.1	1.6	3.9
8	1993	0.0	0.0	0.0	5.1	0.0	4.0	2.0
9	1994			34.0	22.9	34.0	22.9	28.5
10	1995			0.0	2.7	0.0	2.7	1.4
11	1996			18.2	11.1	18.2	11.1	14.4
12	1997			25.9	9.4	25.9	25.9	16.9
13	1998			5.0	20.7	5.0	20.7	14.3
14	1999			26.3	4.3	26.3	4.3	14.3
15	2000			7.1	13.6	7.1	13.9	11.1
16	2001			30.8	26.3	30.8	26.3	28.1
17	2002			77.8	7.1	77.8	7.1	34.8

Table 4. Numbers of largemouth bass and PIT (Passive Integrated Transponder) tags documented annually in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, from 1988, when test fish were initially tagged, through 2002, listed by growth rate designation. Data includes both sexed fish and unsexed fish that died before sex was determined in March 1991. PIT tag numbers after 1988 represent both replacement tags for fish recaptured at annual pond draining for which no reading could be obtained and specimens found dead (indicated parenthetically) throughout the year.[a]

			Fast alone		Slow alone		Mixed		Total	
Fish age	Year	Action	*N* fish	*N* tags	*N* fish	*N* tags	*N* fish	*N* tags	*N* fish	*N* tags
3	1988	restocked	146	146	164	164	83	83	393	393
4	1989	recovered	121	1	146	1	80	13	347	15
		restocked	121		146		80		347	
5	May 1990	recovered	120		144		80		344	
		restocked	50		50		80		178	
	Oct 1990	recovered	50		50		78	1	178	1
		restocked	50		50		78		178	
6	1991	recovered	50		49		78		177	
		restocked	28		22		78		128	
7	1992	recovered	26		22	1	75		123	1
		restocked	14		11		75		100	
8	1993	recovered	14		11		73		98	
		restocked	terminated		terminated		73		98	
9	1994	recovered					70		70	
		restocked					70		70	
10	1995	recovered					69		69	
		restocked					69		69	
11	1996	recovered					59	(4)	59	(4)
		restocked					59		59	
12	1997	recovered					49	(1)	49	(1)
		restocked					42		49	
13	1998	recovered					42	(1)	42	(1)
		restocked					42		42	
14	1999	recovered					36	2 (2)	36	2 (2)
		restocked					36		36	
15	2000	recovered					32	2	32	2
		restocked					32		32	
16	2001	recovered					23	1 (5)	23	1 (5)
		restocked					23		23	
17	2002	recovered					15		15	

[a] At least three, and possibly several other, test fish were found to have been tagged twice. Tags that could not be read on a given occasion (which were assumed to have been lost) were sometimes detected in the future after a second tag had been implanted. Additionally, some fish found dead in the test ponds occasionally lacked their visceral cavities and associated PIT tags and other test fish were not recovered (e.g., consumed by predatory birds, turtles, etc.), thus making it unclear if those tags had been lost before or after death.

Table 5. Number and weight of young-of-the year largemouth bass removed from test ponds each October during growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1986 - 2002. Age of the test fish that produced these young is indicated. Numbers, weights, or both were not documented in the early years of this study.

Fish		Fast and slow mixed			Fast alone			Slow alone			Total all ponds	
Age	Year	Pond	*N*	kg	Pond	*N*	kg	Pond	*N*	kg	*N*	kg
1	1986	8	2018		3	4000		5	0		6018	
2	1987	3			9			3				
3	1988	4	1159	4.0	5	412	4.1	3	1537	5.0	3108	13.1
4	1989	8	660	0.6	9	1548	9.8	6	728	3.2	2936	13.6
		Fast and slow mixed			Fast alone & slow alone combined							
		Pond	*N*	kg	Pond	*N*	kg					
5	1990	4	10	3.9	3	11	3.3				21	7.2
6	1991	9	200	5.6	6	240	6.7				440	2.0
7	1992	5	215	35.5	9	114	7.3				329	42.8
8	1993	3	3	0.1	14	4	0.1				7	0.2
9	1994	5	147	2.1							147	2.1
10	1995	3	32	2.3							32	2.3
11	1996	5	2063	4.3							2063	4.3
12	1997	3	7	1.4							7	1.4
13	1998	5	37	4.3							37	4.3
14	1999	3	42	17.2							42	17.2
15	2000	6	1789	16.3							39	6.8
16	2001	3	85	4.5							85	4.5
17	2002	5	1	<0.1							1	<0.1

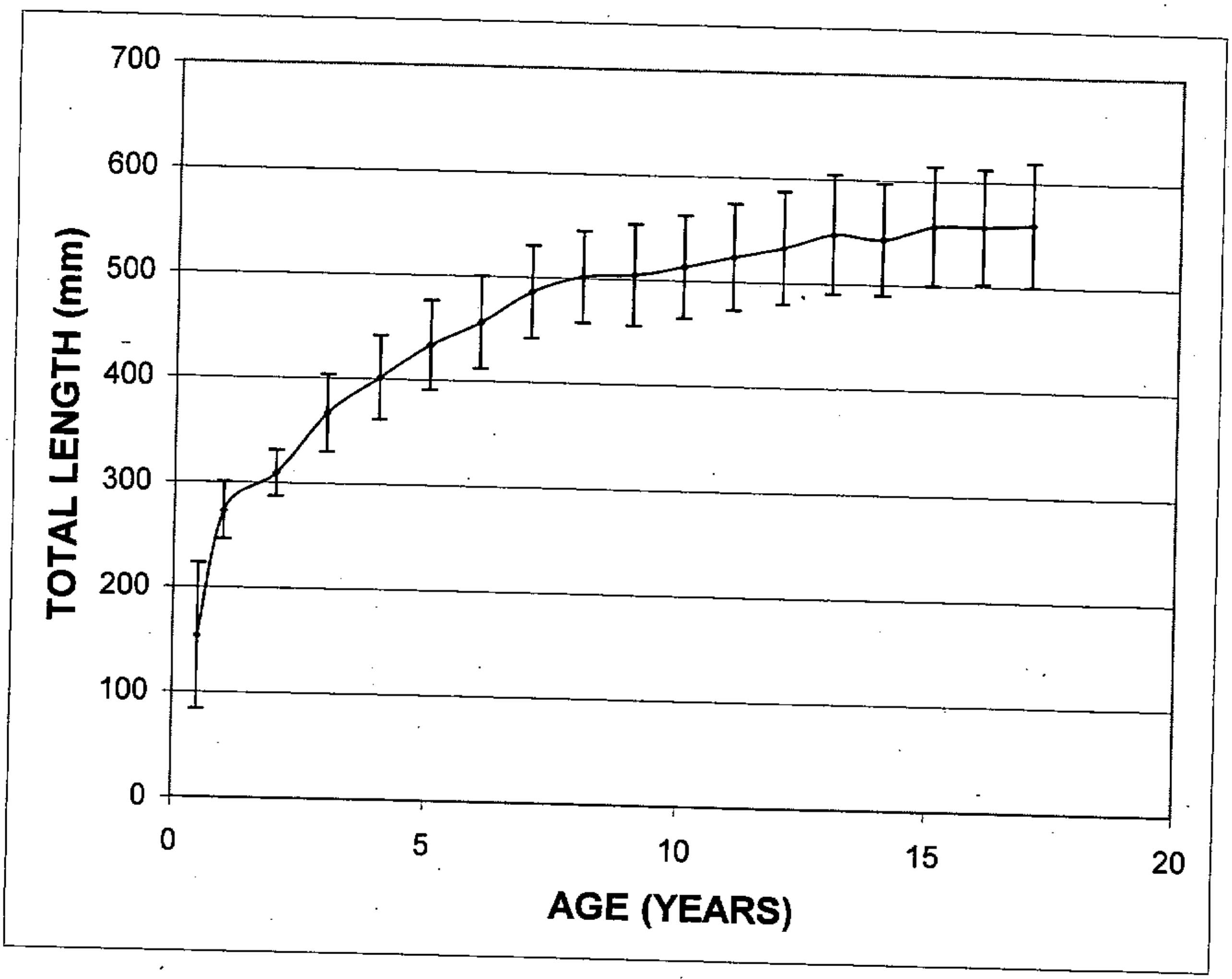

Figure 1. Mean total length and standard deviation among all largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including fast and slow growers and both sexes.

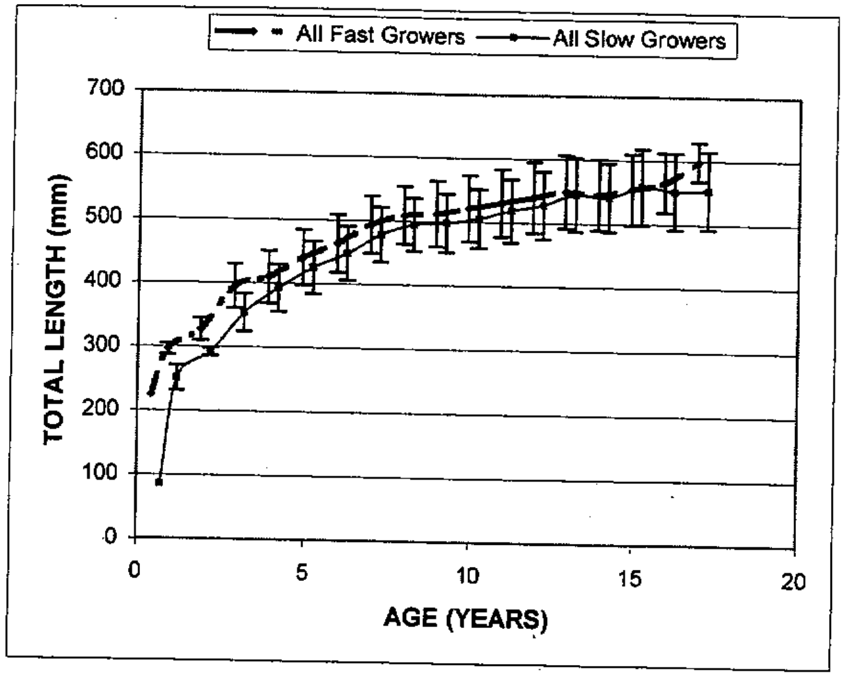

Figure 2. Mean total length and standard deviation among all fast and slow grower largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including both sexes. Data sets are offset ± 0.1 year to avoid overlap confusion.

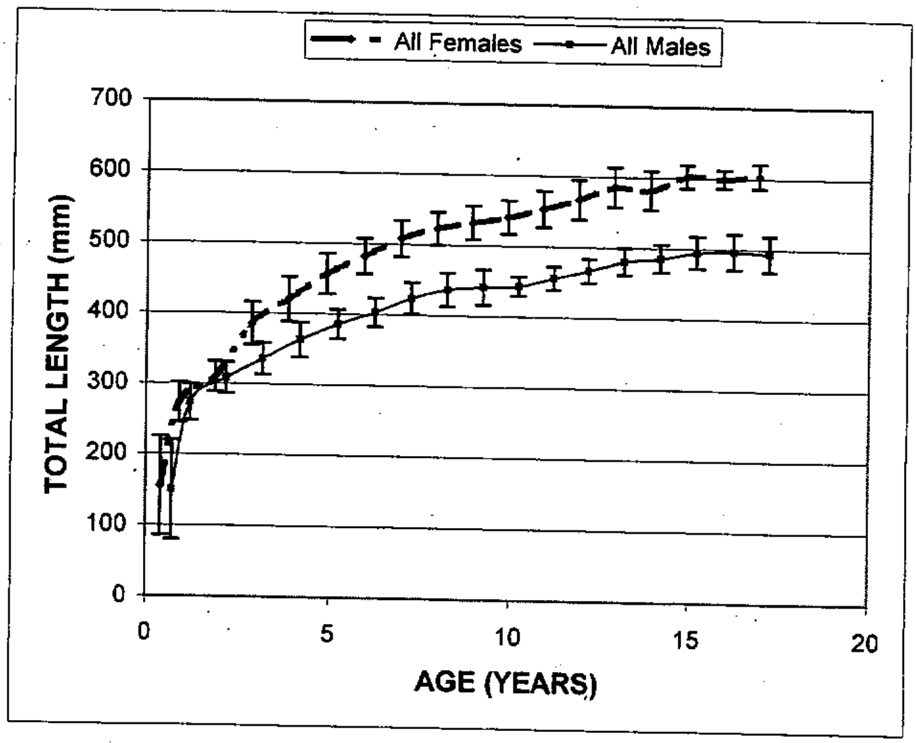

Figure 3. Mean total length and standard deviation among all male and female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including both fast and slow growers. Data sets are offset ± 0.1 year to avoid overlap confusion.

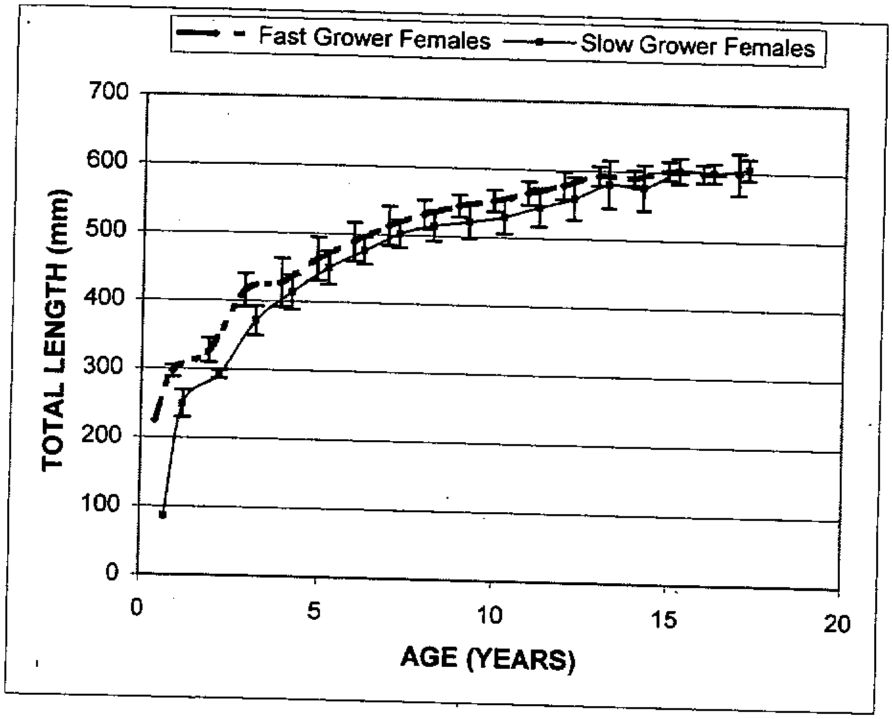

Figure 4. Mean total length and standard deviation among all fast and slow grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds. Data sets are offset ± 0.1 year to avoid overlap confusion.

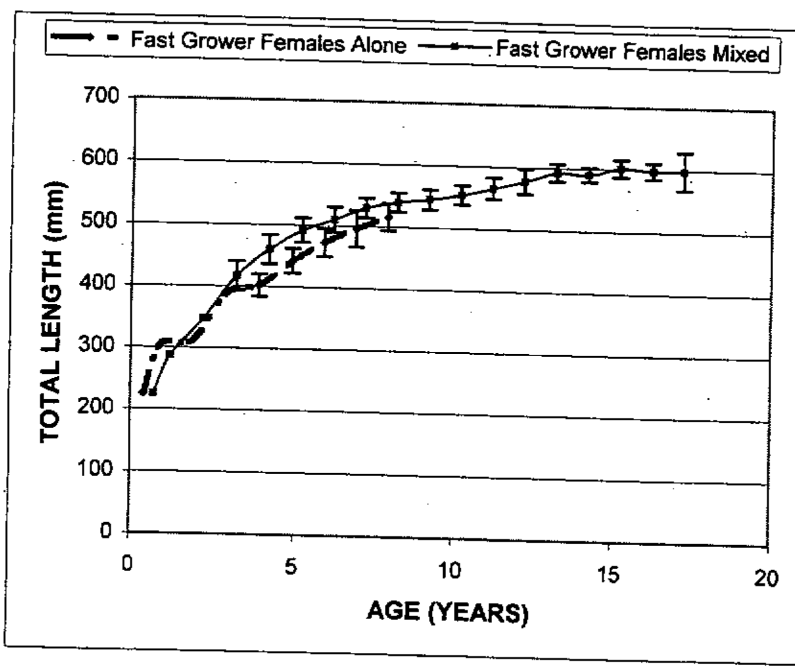

Figure 5. Mean total length and standard deviation among fast grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with slow grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

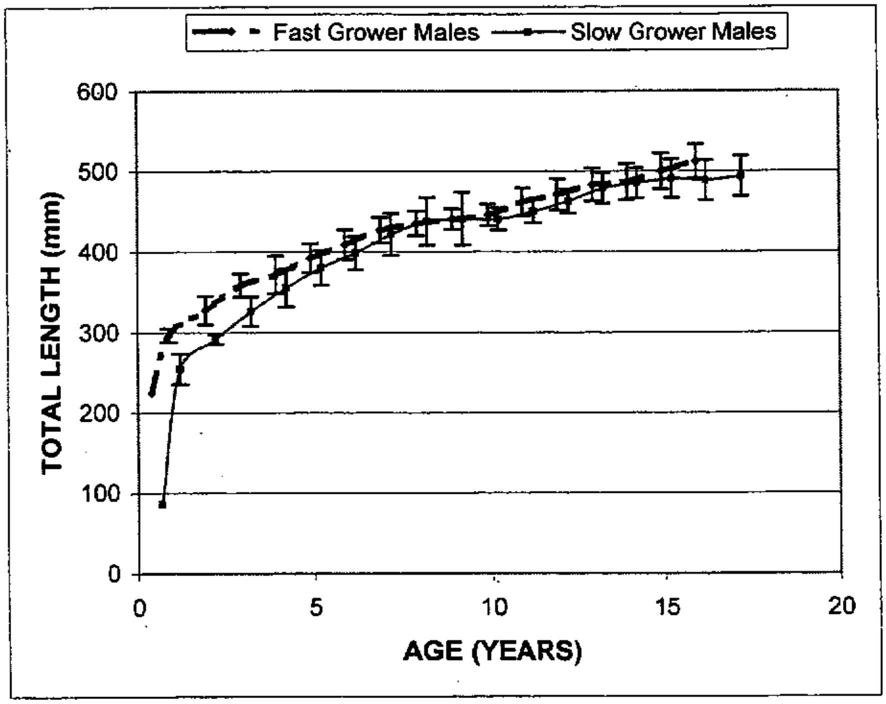

Figure 6. Mean total length and standard deviation among all fast and slow grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds. Data sets are offset ± 0.1 year to avoid overlap confusion.

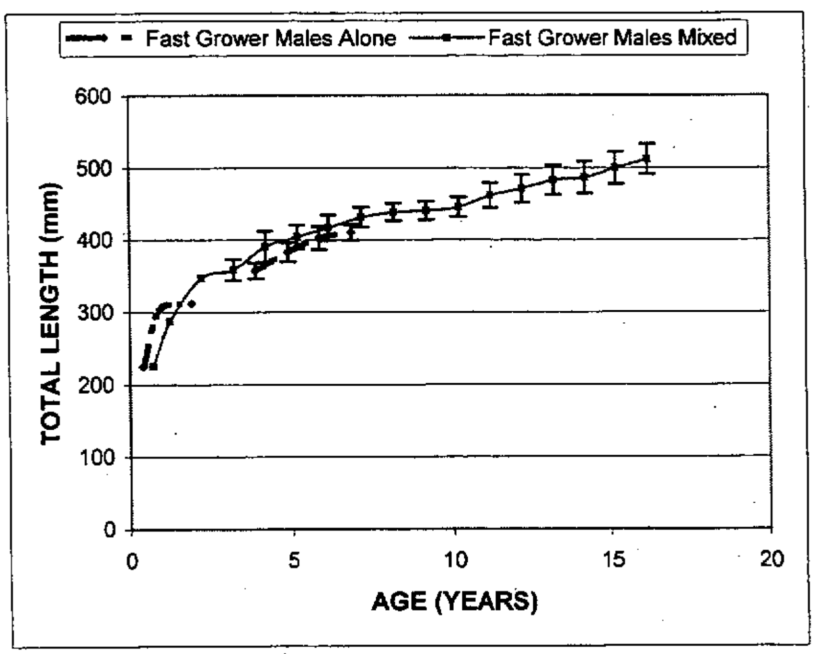

Figure 7. Mean total length and standard deviation among fast grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds. Data sets are offset ± 0.1 year to avoid overlap confusion.

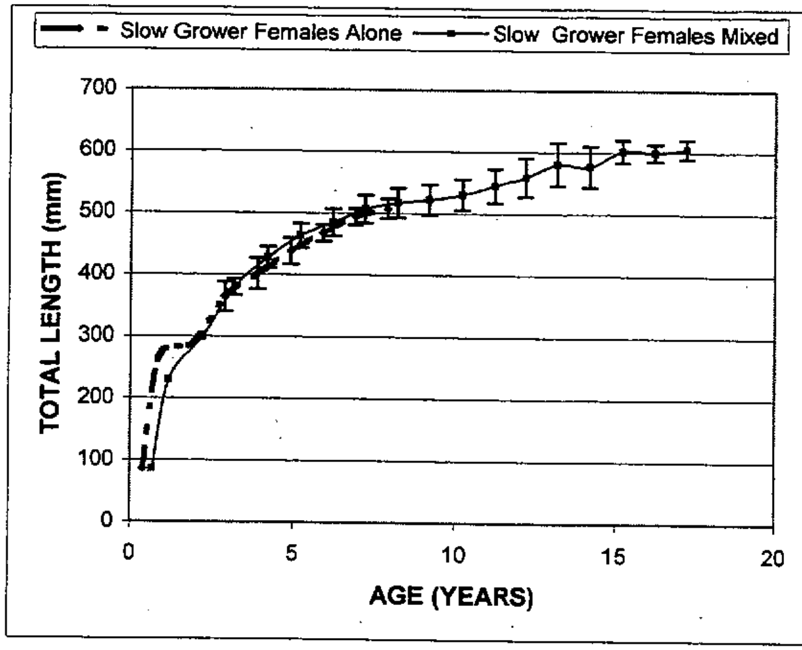

Figure 8. Mean total length and standard deviation among slow grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with fast grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

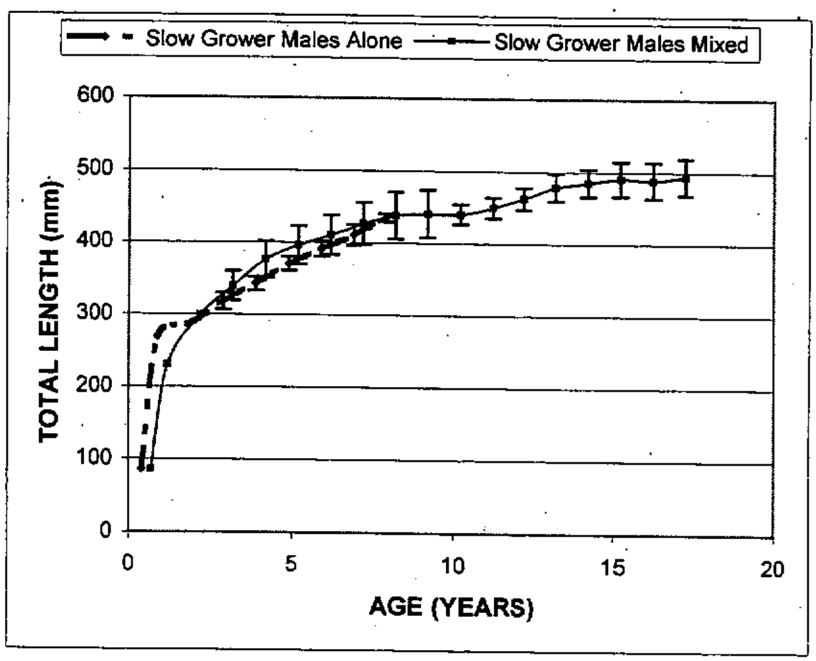

Figure 9. Mean total length and standard deviation among slow grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with fast grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

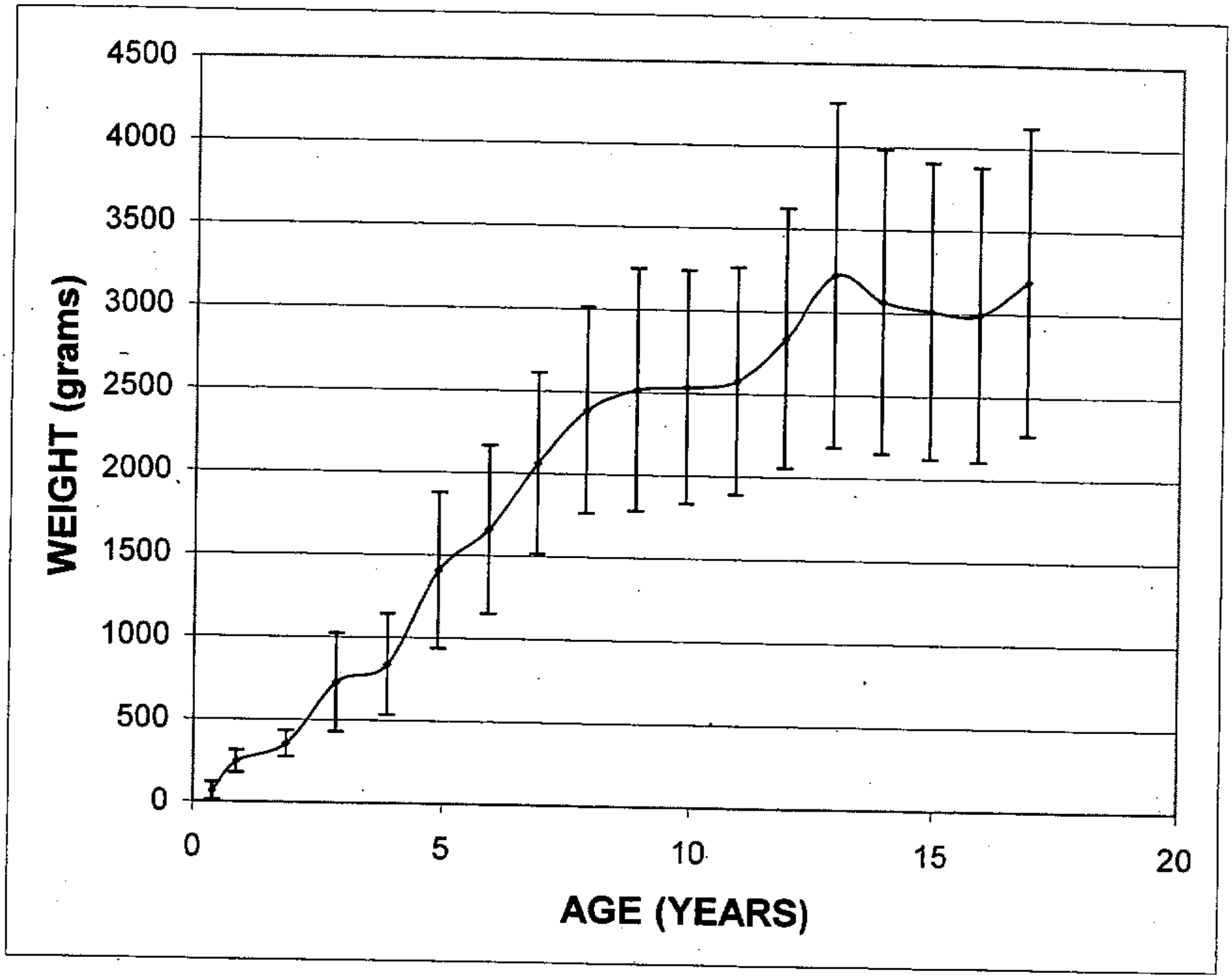

Figure 10. Mean weight and standard deviation among all largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) through 2002 (age 17), including fast and slow grower groups and both sexes.

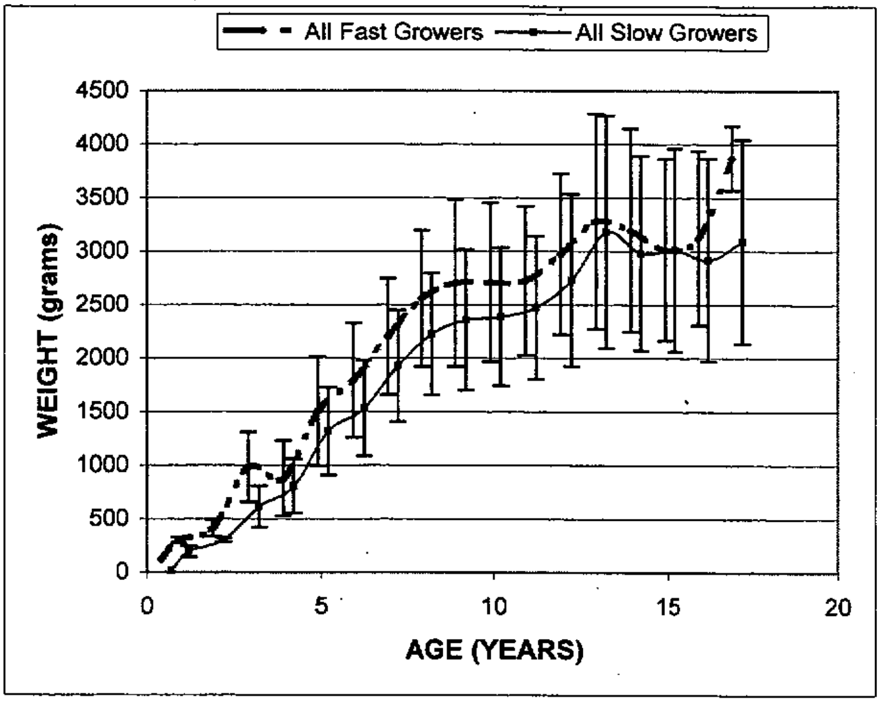

Figure 11. Mean weight and standard deviation among all fast and slow growing largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including both sexes. Data sets are offset ± 0.1 year to avoid overlap confusion.

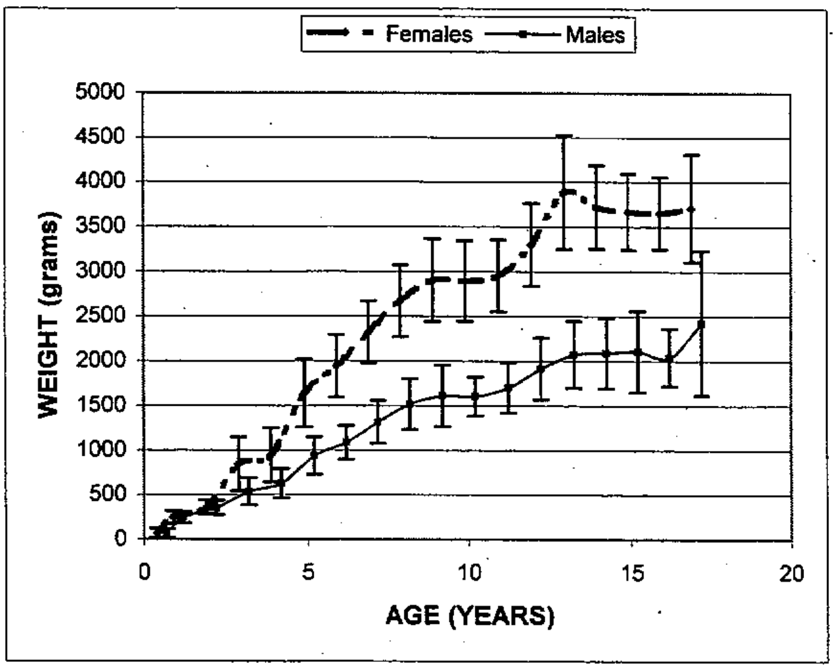

Figure 12. Mean weight and standard deviation among all male and female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including both fast and slow grower groups. Data sets are offset ± 0.1 year to avoid overlap confusion.

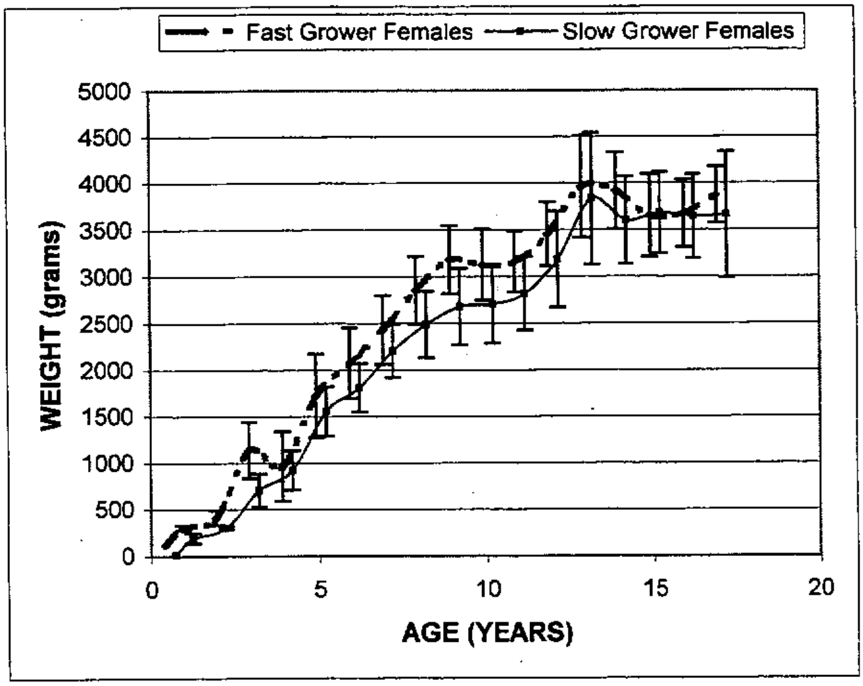

Figure 13. Mean weight and standard deviation among all fast and slow grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds. Data sets are offset ± 0.1 year to avoid overlap confusion.

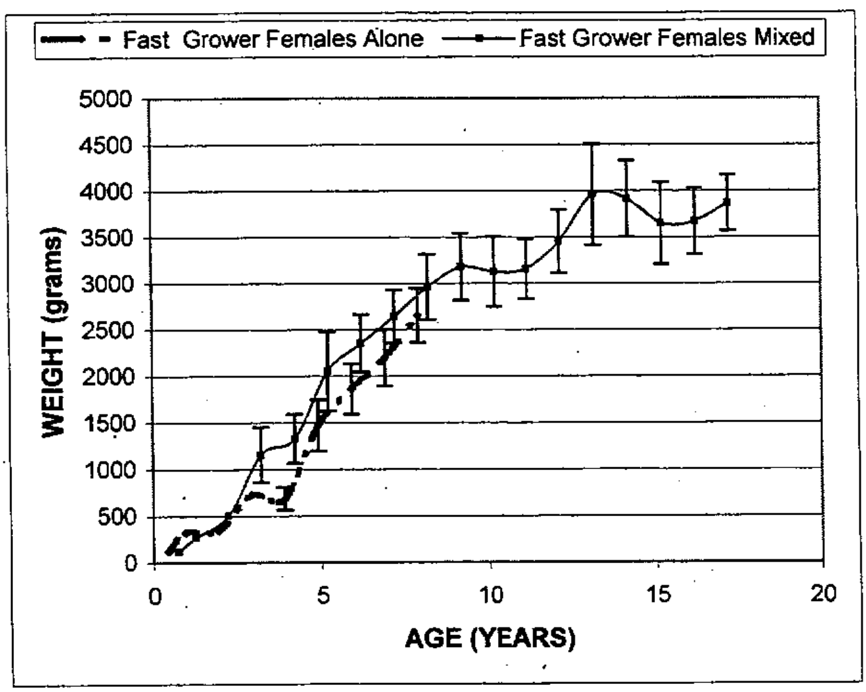

Figure 14. Mean weight and standard deviation among fast grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with slow grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

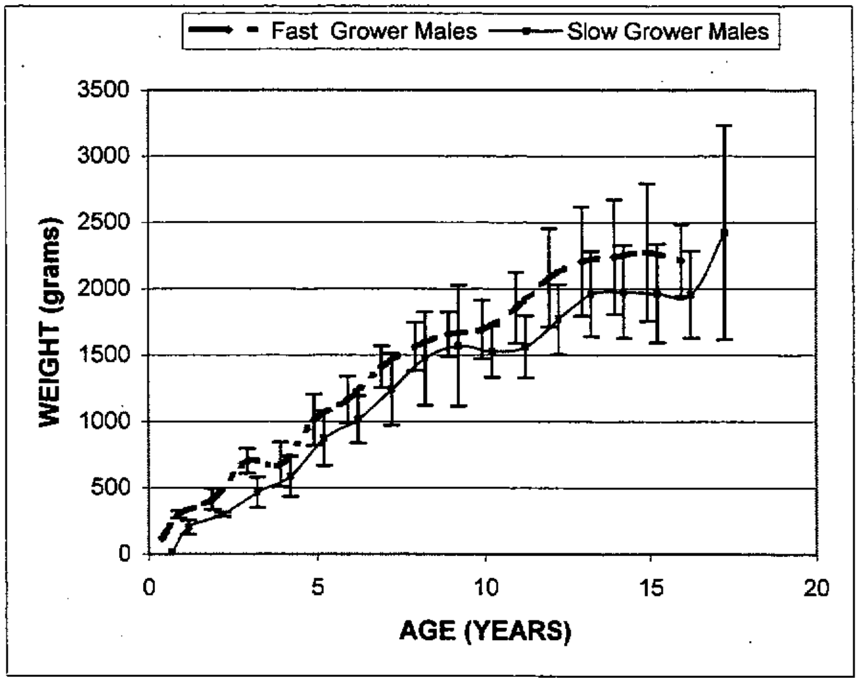

Figure 15. Mean weight and standard deviation among all fast and slow grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds. Data sets are offset ± 0.1 year to avoid. overlap confusion.

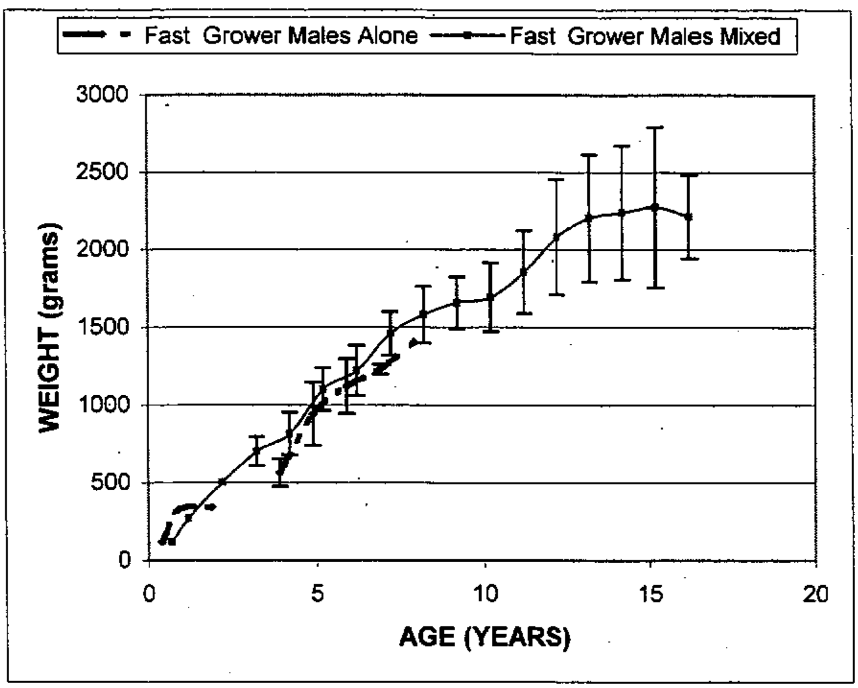

Figure 16. Mean weight and standard deviation among fast grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with slow grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

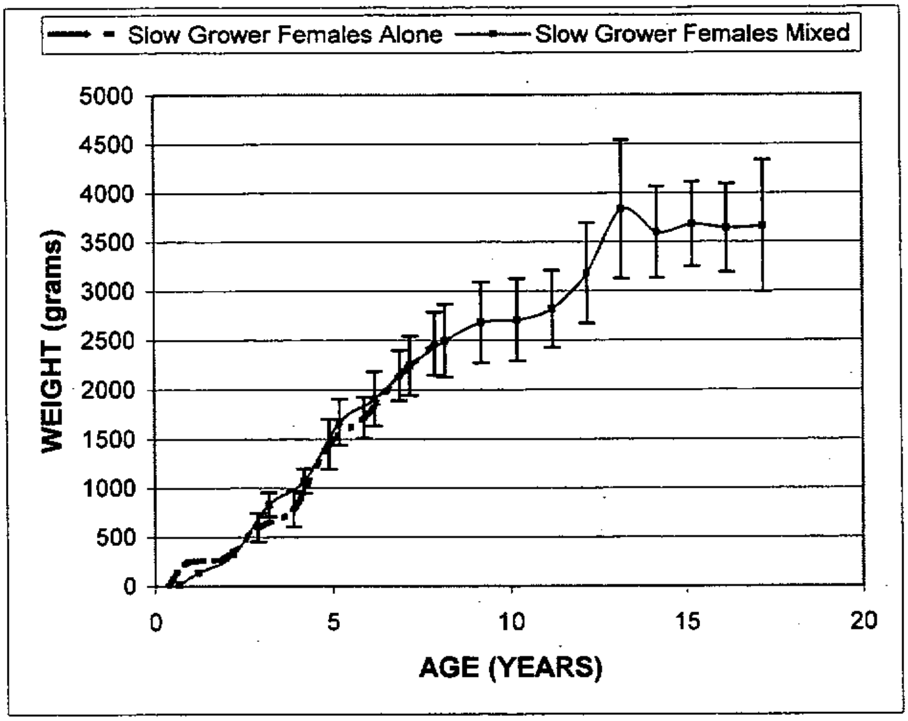

Figure 17. Mean weight and standard deviation among slow grower female largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 (age 0) - 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with fast grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

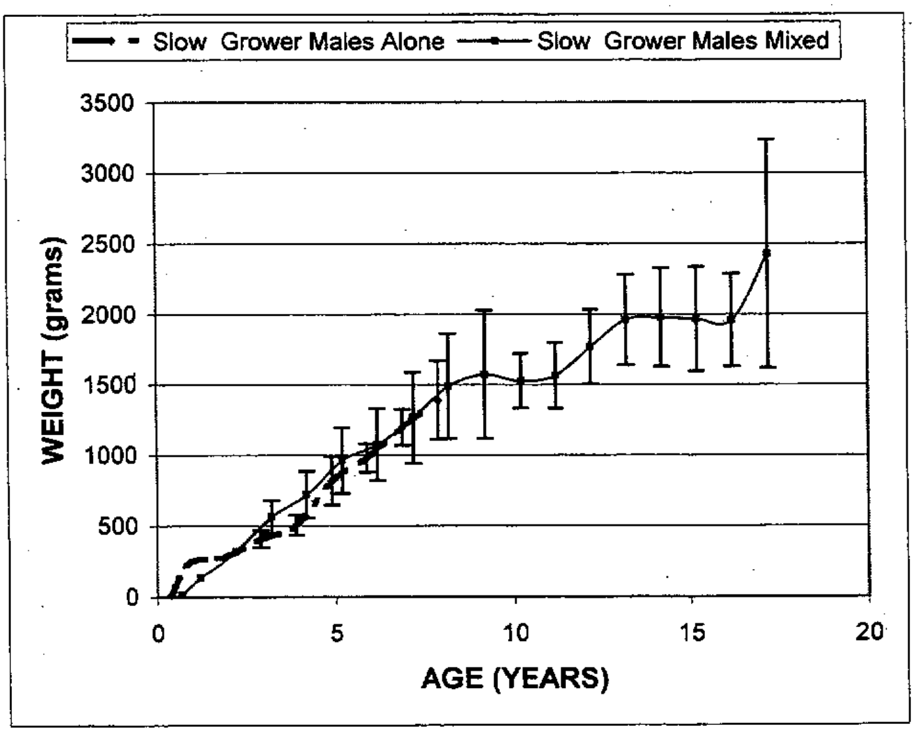

Figure 18. Mean weight and standard deviation among slow grower male largemouth bass in growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, from 1985 (age 0) through 2002 (age 17), including groups stocked alone and in mixed growth rate ponds with fast grower bass. Data sets are offset ± 0.1 year to avoid overlap confusion.

APPENDICES I – V

Appendix Table I. Forage species stocked into and removed from growth rate study ponds (pond numbers in column headings) at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1988 - 2002. Species comprising the groups given include: (a) goldfish; (b) common carp; (c) shad – gizzard and threadfin shad; (d) minnows – golden shiner and fathead minnow; (e) poeciliids - sailfin molly and western mosquitofish; silverside – inland silverside; sunfishes – redbreast sunfish, green sunfish, bluegill, redear sunfish, and warmouth sunfish; (f) blue tilapia; and (g) catfishes – channel and blue catfishes. P indicates present in minimal numbers or record lost; + indicates additional specimens were stocked (numbers unavailable); * indicates fish were stocked, but data is unavailable.

	Stocked from Oct 1987 to Oct 1988						Recovered Oct 1988					
	4		3		5		4		3		5	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	448	36.0	566	64.0	70430	225.0	243863	292.0	816	169.0	745	83.0
Shad	6	1.0	9	1.0	6	1.0	1	1.0	3342	75.0	2	1.0
Minnows	2156	13.0	2724	16.0	2170	13.0	46	1.0	5	< 1.0	2	< 1.0
Sunfishes	P	P	P	P	P	P	1	< 1.0	1	< 1.0	5586	23.0
Blue tilapia	31	15.0	39	18.0	30	14.0	133	17.0	3	1.0	76	10.0
Catfishes	1364	< 1	1364	< 1	1364	< 1	2	< 1.0	26	5.0		

	Stocked from Oct 1988 to Oct 1989						Recovered Oct 1989					
	8		6		9		8		6		9	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	12712	227.0	12712	227.0	12712	227.0	53086	66.0	204	83.0	177	83.0
Shad	12	2.0	12	2.0	12	2.0	1696	77.0	295	63.0	3136	119.0
Minnows	700	3.0	700	3.0	700	3.0	99	2.0	636	5.0	33	< 1.0
Silverside											6258	2.0
Sunfishes	15	1.0	15	1.0	15	1.0	10288	44.0	12401	52.0	2908	13.0
Catfishes	238	< 1	238	< 1	238	< 1	47	< 1.0	13	5.0	7	< 1.0

	Stocked from Oct 1989 to Oct 1990				Recovered Oct 1990			
	4		3		4		3	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	5200	100.0	5200	45.4	71358	585.7	15505	178.2
Common carp	P	P	P	P	40	72.6	14	8.8
Shad	12700	100.0	12700	100.0	12412	109.8	9053	70.5
Minnows	109	1.5	109	1.5	250	1.1	170	1.5
Sunfishes	5200	100.0	5200	100.0	3430	32.6	19727	172.7
Catfishes			P	P			3	4.9

	Stocked from Oct 1990 to Oct 1991				Recovered Oct 1991			
	9		6		9		6	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	74038	611.8	74038	611.8	19056	248.6	18109	299.3
Common carp			P	P			1	0.7
Shad	10823	94.4	10823	94.4	1716	64.9	4772	82.2
Minnows	85	0.7	85	0.7	200	2.0	200	2.0
Sunfishes	42045	366.6	42045	366.6	1260	8.6	5699	41.1

Appendix Table I (Continued).

	Stocked from Oct 1991 to Oct 1992				Recovered Oct 1992			
	5		9		5		9	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	28279	494.4	23543	283.9	61719	551.6	4815	179.3
Shad	5621	79.8	2067	22.2	59449	206.3	1016	39.7
Poeciliids	P	P	P	P	12724	11.1	4266	0.4
Minnows	200	0.9	200	0.9				
Sunfishes	5844	31.8	5320	33.7	81650	182.8	61967	125.8

	Stocked from Oct 1992 to Oct 1993				Recovered Oct 1993			
	3		14		3		14	
Species	*N*	kg	*N*	kg	*N*	kg	*N*	kg
Goldfish	*	*	*	*	7756	346.1	*	*
Shad	30	8.4	*	*	202	42.9	*	8.0
Sunfishes	26	3.2	30	3.2	203	15.1		

	Stocked from Oct 1993 to Oct 1994		Recovered Oct 1994	
	5		5	
Species	*N*	kg	*N*	kg
Goldfish	7756	346.1	18659	594.1
Shad	202	42.9	8291	39.5
Sunfishes	203	15.1	11	0.2

	Stocked from Oct 1994 to Oct 1995		Recovered Oct 1995	
	3		3	
Species	*N*	kg	*N*	kg
Goldfish	18147	504.7	33990	265.8
Shad	8322	39.5	2858	57.6
Sunfishes	10	0.2	21740	162.8

	Stocked from Oct 1995 to Oct 1996		Recovered Oct 1996	
	5		5	
Species	*N*	kg	*N*	kg
Common carp	29594	239.1	1066	232.3
Shad	2857	57.6	217	29.5
Sunfishes	200	0.2	302	1.8

	Stocked from Oct 1996 to Oct 1997		Recovered Oct 1997	
	3		3	
Species	*N*	kg	*N*	kg
Common carp	126+	28.4+	1066	534.6
Shad	112	18.8	207	29.5
Sunfishes	302	1.8	2571	154.4

	Stocked from Oct 1997 to Oct 1998		Recovered Oct 1998	
	5		5	
Species	*N*	kg	*N*	kg
Common carp	1066	534.6	70	4.5
Shad	207	29.5	1435	26.8
Sunfishes	2571	154.4	46476	137.2

Appendix Table I (Continued).

	Stocked from Oct 1998 to Oct 1999		Recovered Oct 1999	
	3		3	
Species	*N*	kg	*N*	kg
Common carp	70+	8.2+	285	8.2
Shad	622	21.8	1118	14.8
Sunfishes	14936	43.0	7503	149.6

	Stocked from Oct 1999 to Oct 2000		Recovered Oct 2000	
	6		6	
Species	*N*	kg	*N*	kg
Common carp	285+	8.2+	28108	201.9
Shad	1118	14.8	1987	19.6
Sunfishes	7503	149.6	2160	5.5

	Stocked from Oct 2000 to Oct 2001		Recovered Oct 2001	
	3		3	
Species	*N*	kg	*N*	kg
Common carp	28108	201.9	4700	140.6
Shad	1987	19.6	P	P
Sunfishes	2160	5.5	200	0.9

	Stocked from Oct 2001 to Oct 2002		Recovered Oct 2002	
	5		5	
Species	*N*	kg	*N*	kg
Common carp	4700	140.6	1252	272.8
Shad	P	P	175	5.4
Sunfishes	200	0.9	P	P

Appendix Table II. Annual total lengths (mm TL) for individual, largemouth bass from growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1988 - 2002, with group means presented for 1985 through 1987 and fish listed by PIT (Passive Integrated Transponder) tag number (last 6 characters), group type (Fast-A= fast growers stocked alone in one pond; Slow-A= slow growers stocked alone in one pond; Fast-M and Slow-M= fast and slow growers mixed together in one pond, and sex. Unsexed fish that died prior to being sexed in 1991 are not included on this table. Numbers under years in column headings are test fish ages.

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
5C3C26	Fast-M	F	225	287	347	412	450	488	499	516	525	528	537	549						
5C3D23	Slow-M	M	86	230	299	339	380	403	419	440	449	451	452							
657 E15	Slow-A	F	86	269	287	382	402	438	465											
660F6A	Fast-A	F	225	304	312		405	452	482	507										
661139	Fast-A	M	225	304	312		362	400	425											
661710	Fast-A	F	225	304	312		393	422	447											
661B5C	Slow-A	M	86	269	287	317	338	370	393											
662372	Fast-M	F	225	287	347	429	471	502	510	535	545	548	559	570	575	592	595	609	593	
662C6E	Slow-M	F	86	230	299	380	430	474	495	518	534	540	550							
665151	Slow-M	M	86	230	299		355	380	395	405	418	416	428	442	453	471	475	480	485	491
665D7B	Fast-M	F	225	287	347		470	489	516	528	542	544	547							
66670A	Slow-A	M	86	269	287	318	343	364	388	430	431									
666716	Fast-M	M	225	287	347	338	363	385	396	410	419	425	430	444	454	468	465	480		
666748	Fast-A	F	225	304	312		443	475	508	524	537									
666759	Fast-M	M	225	287	347	374	410	420	433	445	447	448	446	463	471	483	486	502		
666828	Fast-M	M	225	287	347	361	408	415	425	443	451	456	465	486	499	517	522	536	535	
666847	Slow-A	F	86	269	287	348	393	422	457											
666867	Slow-M	F	86	230	299	380	431	466	486	503	515	522	529	543	558	570	565	578	577	
666874	Fast-A	F	225	304	312		378	433	467	491										
666944	Slow-A	F	86	269	287	368	396	421	446											
666963	Slow-A	M	86	269	287	310	342	363	384	404										
666975	Fast-M	F	225	287	347	416	459	488	509	524	520	541	555							
666A04	Slow-A	F	86	269	287	346	384	424	452											
666A0D	Slow-M	F	86	230	299	375	415	450	469	489	498	500	510	533	550	574	580	589	584	579
666A0E	Slow-A	F	86	269	287	301	387	426	459	482										
666A16	Slow-A	M	86	269	287		341	372	390											
666A1B	Fast-A	F	225	304	312		408	458	487	533										
666A40	Fast-M	M	225	287	347	352	370	396	416	425	433	438	445	459	461	468				
666A49	Fast-A	F	225	304	312		417	480	525	560	560									
666A4B	Slow-A	F	86	269	287	368	415	440	468	486										
666B10	Fast-M	F	225	287	347	430	475	510	529	543	556	560	574							
666B48	Fast-A	F	225	304	312		406	433	466											
666C01	Slow-M	M	86	230	299	325	360	374	387	399	409	412	422	431	444	459	462	479	481	481
666C03	Slow-A	F	86	269	287	365	390	436	474											
666C10	Fast-M	F	225	287	347	442	486	520	541	554	562	567	576	586	612	620				
666C39	Slow-M	F	86	230	299	384	440	481	501	523	533	538	546	562	574	597	605	625	616	623

Appendix Table II (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
666C47	Slow-M	F	86	230	299	395	442	478	494	509	520	529	535							
666C4D	Fast-M	M	225	287	347	366	404	417	429	440	448	448								
666C68	Fast-M	M	225	287	347	343	372	389	405	423	434	438	446							
666C74	Fast-M	F	225	287	347		456	492	515	525	534	540	549							
666D0E	Slow-M	M	86	230	299	330	377	387	397	409	414	416	425	430	442	447	458	450	446	452
666D10	Slow-A	M	86	269	287	317	342	368	390											
666D38	Slow-M	F	86	230	299	385	444	468	485	509	516									
666D39	Slow-M	F	86	230	299	340	376	394	412	427	436	438	445	461	474	494	498			
666D66	Fast-A	M	225	304	312		344	372	394											
666D69	Slow-M	F	86	230	299	400	457	495	526	546	558	564	573	589	603	625				
666D73	Slow-A	F	86	269	287	362	406	435	466											
666D74	Fast-A	M	225	304	312		348	365	378	398	405									
666E19	Fast-M	F	225	287	347	411	473	476	501	510	529	526	535	553	562	582	584	596		
666E33	Slow-A	M	86	269	287	312	336	360	381	402										
666E42	Slow-M	F	86	230	299	389	445	470	495	512	522	528	540	551	547					
666E50	Fast-A	M	225	304	312		356	387	414	419										
666E78	Slow-A	F	86	269	287	343	384	415	445											
666E7F	Fast-A	M	225	304	312		350	381	396											
666F2C	Slow-M	M	86	230	299	342	380	400	412	431	439	442	452	463	479	496	501			
666F55	Slow-A	F	86	269	287	442	505	525												
667024	Slow-A	F	86	269	287	385	424	463	495	515										
667025	Slow-A	M	86	269	287	327	361	383	408											
667048	Fast-A	F	225	304	312		388	433	464	484	499									
66705B	Fast-A	F	225	304	312		388	426	460	483										
66706D	Fast-A	M	225	304	312		353	378	397											
667113	Slow-M	F	86	230	299		420	456	479	507	517	517	529							
667120	Fast-M	F	225	287	347	405	446	487	509	531	544	547	552	566	578	601	601	619	612	
667127	Slow-M	F	86	230	299	366	420	454	475	501	511	521	526							
66712F	Slow-M	M	86	230	299	330	367	386	401	410	423	427	438	457	471	487	494	509	514	511
667154	Slow-M	F	86	230	299	378	429	464	486	510	523	528	538	551	569	592	596	612	606	610
66720E	Fast-M	F	225	287	347	405	450	480	497	518	520	528	538							
667213	Slow-A	M	86	269	287	312	336	370	393	413										
667225	Slow-A	M	86	269	287	320	344	368	391											
667226	Fast-A	F	225	304	312		383	424	453											
66722D	Fast-A	M	225	304	312		361	386	403											
667245	Fast-A	F	225	304	312		411	453	478	497	509									
66725B	Slow-A	F	86	269	287	348	383	415	453	462	476									
667261	Slow-A	F	86	269	287	344	378	411	447	476	490									
667317	Slow-M	F	86	230	299	393	445	473	494	516	525	530	537	555	568	581	583	596		
667334	Slow-M	F	86	230	299		420	457	484	500	512	521	522							
667335	Slow-M	F	86	230	299		388	426	446	467	472	484	491	509	525	550	543	565		
667356	Fast-M	F	225	287	347	490	533	544	560	575	582	595	597	605	610	607				
667373	Fast-A	M	225	304	312		385	420	445											
667419	Fast-A	F	225	304	312		383	426	455	481										
667469	Slow-A	M	86	269	287	301	325	359	380											

Appendix Table II (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
66747B	Slow-A	F	86	269	287	379	415	450	482	494										
667642	Fast-M	F	225	287	347		481	497	516	546	546	553	561	563	574	586	588			
667674	Slow-A	M	86	269	287		337	363	384											
667704	Slow-M	F	86	230	299	365	410	446	469	490	500	502	510	525						
667713	Slow-A	F	86	269	287		415	449	485	504	522									
667715	Slow-A	F	86	269	287	388	404	439	475	494	507									
667750	Slow-A	M	86	269	287	312	335	375	396											
667757	Slow-A	F	86	269	287	355	385	428	463	495	502									
667774	Slow-A	F	86	269	287		385	430	473	490	509									
667800	Slow-A	M	86	269	287	320	345	369	395											
667805	Fast-M	M	225	287	347	345	374	390	401	411	424	420	425	436	444	457	461	472		
667819	Fast-A	F	225	304	312		411	450	480	499	510									
66782C	Fast-M	F	225	287	347	435	473	497	506	523	536	540	546	561	565	581	579	591		
667872	Fast-A	M	225	304	312		370	375	396											
66787F	Slow-A	M	86	269	287	315	354	371	385											
667900	Fast-A	F	225	304	312		410	458	490	510	518									
667911	Slow-M	M	86	230	299	397	446	472	488	508	525	529								
667938	Fast-M	F	225	287	347	391	407	433	445											
66795B	Fast-A	M	225	304	312		370	387	407											
667974	Slow-M	F	86	230	299	369	415	456	471											
66797A	Slow-M	F	86	230	299	390	437	483	505	530	541	545	553	566	584	608	607	620		
667A00	Slow-A	F	86	269	287	372	403	440	473	495										
667A05	Slow-A	F	86	269	287	367	393	433	469											
667A09	Slow-M	M	86	230	299	325	348	380	394	412	420	425	432	448	459	476	480	486	493	504
667A0B	Slow-A	M	86	269	287	342	361	392	412	425	439									
667A15	Fast-A	M	225	304	312		347	370	381											
667A2D	Fast-A	F	225	304	312		413	460	500											
667A72	Fast-M	F	225	287	347	404	449	480	501	521	530									
667A7A	Fast-M	F	225	287	347	412	450	485	495	515	523	528	537	541	548					
667B0C	Slow-A	M	86	269	287	326	342	360	375	392										
667B41	Fast-M	M	225	287	347	384	410	425	435	445	453	456	460	474	484	496	496	505	507	
667B5F	Slow-M	M	86	230	299	344	377	394	404	422	434	434	446	463	475	497	504	513	512	523
667C01	Slow-M	F	86	230	299		412	443	459	485	491	496	503	510	513	526	530			
667C17	Fast-A	F	225	304	312		398	425	451	475										
667C23	Slow-A	F	86	269	287	377	405	439	469											
667C41	Fast-M	F	225	287	347		465	509	532	551	556	562	572	582	601					
667C57	Fast-A	F	225	304	312		408	446	475											
667C5A	Slow-A	M	86	269	287	327	344	382	405											
667D0C	Slow-M	M	86	230	299	328	360	375	389	412										
667D0D	Fast-M	M	225	287	347	359	391	410	429	438	446	448	457	470	483	492	490	503	494	
667D15	Slow-M	F	86	230	299	370	430	464	482	510	518	524	535	552	565					
667D18	Fast-M	M	225	287	347	348	370	380	386											
667D47	Fast-A	F	225	304	312		403	430	456											
667D76	Fast-A	F	225	304	312		410	459	487	512										

Appendix Table II (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
667E0A	Slow-M	F	86	230	299	392	444	478	499	519	528	534	548	558						
667E35	Slow-M	F	86	230	299	392	437	468	486	505	509	519	526	545	564	595	599	617	611	621
667E3D	Slow-A	F	86	269	287		447	472	492											
667F02	Fast-M	F	225	287	347	417	472	495	512	530	536	542	551	553	560	574	576	582	581	577
667F03	Slow-M	F	86	230	299		440	497	526	542	554	564	573	586	600	620				
667F40	Slow-A	F	86	269	287	365	407	448	483	506	520									
667F53	Fast-A	F	225	304	312		386	438	473	488										
667F6A	Fast-A	F	225	304	312		427	463	494	526	535									
67003D	Fast-A	F	225	304	312		397	430	455	474										
670043	Fast-A	M	225	304	312		355	381	404											
670053	Fast-A	F	225	304	312		421	456	483	498	511									
670069	Fast-M	F	225	287	347	398	449	478	501	519	529	537	540							
67011A	Fast-A	F	225	304	312		350	380	397	408										
67011B	Slow-M	F	86	230	299		425	455	478	498	510	512	524							
670146	Fast-M	M	225	287	347	355	384	397	403	419	428	428	436							
67015D	Fast-A	F	225	304	312		405	443	481											
67016E	Slow-A	M	86	269	287	341	359	388	406											
67020C	Fast-A	M	225	304	312		353	384	401											
670212	Fast-A	F	225	304	312		385	425	458	480	496									
67021E	Slow-A	F	86	269	287	365	395	432	470											
67022E	Fast-M	F	225	287	347	396	444	477	494	516	529	533	540	550	562	582				
670249	Fast-A	M	225	304	312		350	378	399											
67025C	Fast-A	F	225	304	312		393	433	465	483	497									
670300	Fast-A	F	225	304	312		404	443	478											
67030F	Fast-M	F	225	287	347	421	470	502	521	545	555									
67032D	Slow-A	F	86	269	287	366	395	440	478	505	518									
670330	Slow-M	F	86	230	299	375	427	468	490	508	540	527	538	558	575	595	596	609	600	598
670346	Slow-M	F	86	230	299	381	428	471	489	525	525	528	539	547						
67034A	Slow-M	M	86	230	299	344	392	410	426	443	456	460	464							
67036E	Slow-M	F	86	230	299	375	430	465	495	515	531	536	542	560	573	597	601	610	610	609
67036F	Fast-M	F	225	287	347	442	466	508	526	541	556	557	564	575	591	607	610	617	610	620
670371	Slow-M	F	86	230	299		429	461	482	507	516	521	532	546	561	585	591	602	593	597
670375	Fast-A	M	225	304	312		352	378	399	414										
67037E	Fast-M	F	225	287	347		445	477	501	516	530	537	545							
670402	Slow-A	F	86	269	287		410	446	478	505										
670408	Slow-A	M	86	269	287	304	334	365	386											
670410	Fast-M	F	225	287	347	410	455	493	509	526	533	541	552							
670419	Slow-M	M	86	230	299	329	372	392	417	429	434	437	446	465	478	497	505	516		
670436	Slow-A	M	86	269	287	304	335	363	380											
67043B	Fast-A	F	225	304	312	388	421	428	462	476	486									
67043C	Fast-A	F	225	304	312		417	460	489											
67045F	Fast-A	F	225	304	312		376	430	467	487	500									
670460	Fast-A	F	225	304	312		390	425	451											
670478	Fast-M	F	225	287	347	374	450	484	502	517	530	532	545	561	571	587	591	598	595	

Appendix Table II (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
670523	Fast-M	M	225	287	347	377	430	425	442	446										
670526	Slow-A	F	86	269	287		388	448	483	504	521									
67052F	Slow-A	F	86	269	287	359	381	432	457											
670562	Fast-A	F	225	304	312		405	448	474											
670563	Slow-A	F	86	269	287	344	379	425	462	489										
670615	Slow-A	F	86	269	287	378	406	440	467											
2D2648	Slow-M	F	86	230	287			470	499	508	515	517	522	536						

Appendix Table III. Annual weights (g) for individual largemouth bass from growth rate studies at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1988 -2002, with group means presented for 1985 through 1987 and fish listed by PIT (Passive Integrated Transponder) tag number (last 6 characters), group type (Fast-A=ifast growers stocked alone in one pond; Slow-A= slow growers stocked alone in one pond; Fast-M and Slow-M= fast and slow growers mixed together in one pond), and sex. Unsexed fish that died prior to being sexed in 1991 are not included on this table. Numbers under years in column headings are test fish ages.

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
5C3C26	Fast-M	F	120	269	502	1043	1270	1905	2014	2213	2408	2581	2721	2748						
5C3D23	Slow-M	M	15	135	320	521	657	861	907	1247	1360	1447	1447							
657 E15	Slow-A	F	15	240	284	635	771	1496	1814											
660F6A	Fast-A	F	120	324	343		680	1496	1787	2127										
661139	Fast-A	M	120	324	343		635	1134	1247											
661710	Fast-A	F	120	324	343		725	1270	1474											
661B5C	Slow-A	M	15	240	284	408	521	861	993											
662372	Fast-M	F	120	269	502	1338	1542	2313	2553	2748	3089	3234	3234	3148	3374	4254	4508	4141	3828	
662C6E	Slow-M	F	15	135	320	861	1088	1905	2154	2581	2948	3261	3261							
665151	Slow-M	M	15	135	320		680	861	1020	1134	1419	1388	1474	1501	1728	1900	1900	1900	2068	2240
665D7B	Fast-M	F	120	269	502		1292	1905	2213	2494	2721	2835	2694							
66670A	Slow-A	M	15	240	284	499	499	771	966	1079	1193									
666716	Fast-M	M	120	269	502	612	725	907	1047	1220	1274	1646	1360	1587	1814	1986	1927	2240		
666748	Fast-A	F	120	324	343		839	1814	2268	2608	2921									
666759	Fast-M	M	120	269	502	816	997	1270	1388	1560	1646	1587	1787	1927	2127	2381	2408	2354		
666828	Fast-M	M	120	269	502	725	929	1270	1388	1646	1873	2014	2154	2327	2721	2948	2948	3129	2381	
666847	Slow-A	F	15	240	284	408	725	1270	1587											
666867	Slow-M	F	15	135	320	793	997	1587	1760	2154	2467	2608	2608	2667	3148	3261	3148	3315	3234	
666874	Fast-A	F	120	324	343		499	1406	1701	2068										
666944	Slow-A	F	15	240	284	612	725	1179	1474											
666963	Slow-A	M	15	240	284	408	544	771	1020	1134										
666975	Fast-M	F	120	269	502	1179	1406	1995	2213	2522	2354	3007	3288							
666A04	Slow-A	F	15	240	284	476	703	1360	1614											
666A0D	Slow-M	F	15	135	320	816	975	1406	1587	1955	2068	2295	2295	2522	3148	3515	3515	3234	2948	2268
666A0E	Slow-A	F	15	240	284	544	771	1315	1587	2014										
666A16	Slow-A	M	15	240	284		499	861	934											
666A1B	Fast-A	F	120	324	343		567	1633	2041	2381										
666A40	Fast-M	M	120	269	502	725	771	1088	1274	1501	1728	1673	1787	1814	1955	1841				
666A49	Fast-A	F	120	324	343		635	1814	2494	2862	3148									
666A4B	Slow-A	F	15	240	284	567	907	1406	1415	2154										
666B10	Fast-M	F	120	269	502	1406	1678	2358	2608	2948	3347	3574	3742							
666B48	Fast-A	F	120	324	343		589	1224	1474											
666C01	Slow-M	M	15	135	320	544	680	861	1020	1134	1388	1306	1419	1419	1701	1814	1701	2240	1873	2100
666C03	Slow-A	F	15	240	284	589	680	1270	1587											
666C10	Fast-M	F	120	269	502	1406	1633	2404	2581	2921	3374	3628	3601	3628	3996	4563				
666C39	Slow-M	F	15	135	320	499	1088	1633	1814	2213	2381	2553	2721	2862	2862	3742	3628	3828	3742	4082

Appendix Table III (Continued).

PIT tag	Group	Sex	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
666C47	Slow-M	F	15	135	320	907	1134	1723	1927	2213	2408	2667	2667							
666C4D	Fast-M	M	120	269	502	635	907	1179	1306	1501	1587	1587								
666C68	Fast-M	M	120	269	502	589	635	907	1047	1333	1419	1447	1614							
666C74	Fast-M	F	120	269	502		1270	2086	2408	2667	3061	3261	2835							
666D0E	Slow-M	M	15	135	320	499	657	907	1020	1020	1193	1220	1333	1220	1388	1501	1474	1388	1474	1814
666D10	Slow-A	M	15	240	284	408	499	816	907											
666D38	Slow-M	F	15	135	320	861	1134	1723	1900	2268	2467									
666D39	Slow-M	F	15	135	320	635	771	997	1193	1388	1560	1501	1587	1728	2014	2327	2467			
666D66	Fast-A	M	120	324	343		544	997	1134											
666D69	Slow-M	F	15	135	320	997	1292	2041	2408	2667	3175	3315	3374	3628	3969	5075				
666D73	Slow-A	F	15	240	284	567	839	1406	1769											
666D74	Fast-A	M	120	324	343		589	861	1020	1193	1406									
666E19	Fast-M	F	120	269	502	1111	1224	1814	2041	2268	2581	2721	2667	3007	3120	3542	3542	3288		
666E33	Slow-A	M	15	240	284	408	544	907	1020	1247										
666E42	Slow-M	F	15	135	320	839	1066	1633	1955	2240	2581	2894	2862	2921	2553					
666E50	Fast-A	M	120	324	343		544	952	1161	1247										
666E78	Slow-A	F	15	240	284	521	725	1179	1388											
666E7F	Fast-A	M	120	324	343		476	907	966											
666F2C	Slow-M	M	15	135	320	612	771	997	1134	1333	1501	1587	1701	1787	2041	2440	2295			
666F55	Slow-A	F	15	240	284	1224	1678	2494												
667024	Slow-A	F	15	240	284	680	907	1542	1873	2295										
667025	Slow-A	M	15	240	284	408	612	952	1020											
667048	Fast-A	F	120	324	343		589	1451	1701	2068	2295									
66705B	Fast-A	F	120	324	343		657	1224	1646	1927										
66706D	Fast-A	M	120	324	343		499	1043	1106											
667113	Slow-M	F	15	135	320		1066	1542	1814	2154	2268	2440	2349							
667120	Fast-M	F	120	269	502	1134	1360	2268	2608	2522	3429	3601	3488	3488	3828	4903	4449	4336	4195	
667127	Slow-M	F	15	135	320	748	907	1633	1900	2268	2467	2667	2807							
66712F	Slow-M	M	15	135	320	544	725	907	1047	1220	1333	1447	1587	1841	2100	2213	2381	2354	2327	2494
667154	Slow-M	F	15	135	320	839	1088	1723	2014	2327	2694	2948	2948	3089	3628	4254	4223	4309	4309	4282
66720E	Fast-M	F	120	269	502	997	1247	1859	2127	2295	2494	2721	2667							
667213	Slow-A	M	15	240	284	408	499	861	1079	1306										
667225	Slow-A	M	15	240	284	408	499	816	852											
667226	Fast-A	F	120	324	343		680	1315	1587											
66722D	Fast-A	M	120	324	343		1020	907	1020											
667245	Fast-A	F	120	324	343		725	1814	2154	2440	2903									
66725B	Slow-A	F	15	240	284	476	635	1179	1419	1501	1841									
667261	Slow-A	F	15	240	284	521	657	1224	1587	1900	2381									
667317	Slow-M	F	15	135	320	907	1224	1769	1986	2354	2494	2862	2780	3148	3288	3828	3601	3288		
667334	Slow-M	F	15	135	320		1020	1451	1646	2014	2381	2467	2494							
667335	Slow-M	F	15	135	320		771	1315	1587	1955	2154	2408	2327	2553	2807	3515	3601	3288		
667356	Fast-M	F	120	269	502	2041	1905	3039	3374	3628	3801	4055	3855	3542	3515	3089				
667373	Fast-A	M	120	324	343		680	1360	1646											
667419	Fast-A	F	120	324	343		635	1270	1873	2041										
667469	Slow-A	M	15	240	284	362	476	816	966											
667474	Fast-M	F	120	269	502	1070	1134	1900	2213	2553										

Appendix Table III (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
66747B	Slow-A	F	15	240	284	635	861	1496	1927	1955										
667642	Fast-M	F	120	269	502		1451	2131	2381	2807	3202	3374	3461	3315	3488	4309	3855			
667374	Slow-A	M	15	240	284		521	816	880											
667704	Slow-M	F	15	135	320	748	929	1542	1614	2014	2268	2381	2381	2721						
667713	Slow-A	F	15	240	284		839	1496	1814	2154	2522									
667715	Slow-A	F	15	240	284	589	771	1315	1587	2041	2327									
667750	Slow-A	M	15	240	284	385	453	907	1020											
667757	Slow-A	F	15	240	284	589	725	1496	1814	2268	2630									
667774	Slow-A	F	15	240	284		680	1406	1873	2240	2494									
667800	Slow-A	M	15	240	284	430	499	861	966											
667805	Fast-M	M	120	269	502	635	771	1043	1134	1274	1501	1533	1587	1614	1646	1760	1814	1587		
667819	Fast-A	F	120	324	343		725	1633	2068	2440	2667									
66782C	Fast-M	F	120	269	502	1315	1451	2131	2381	2467	2807	3120	2894	3175	3261	3742	3429	3315		
667872	Fast-A	M	120	324	343		567	861	966											
66787F	Slow-A	M	15	240	284	362	589	771	793											
667900	Fast-A	F	120	324	343		839	1723	2154	2381	2835									
667911	Slow-M	M	15	135	320	884	1202	1633	1814	2181	2553	2835								
667938	Fast-M	F	120	269	502	975	952	1542	1701											
66795B	Fast-A	M	120	324	343		748	952	1047											
667974	Slow-M	F	15	135	320	861	1134	1769	1900											
66797A	Slow-M	F	15	135	320	1020	1247	2041	2381	2721	3061	3175	3234	3175	3742	4735	4282	4309		
667A00	Slow-A	F	15	240	284	680	793	1406	1701	2041										
667A05	Slow-A	F	15	240	284	544	725	1315	1587											
667A09	Slow-M	M	15	135	320	476	521	771	852	934	1193	1247	1193	1306	1419	1587	1614	1560	1728	1900
667A0B	Slow-A	M	15	240	284	430	589	997	1161	1360	1587									
667A15	Fast-A	M	120	324	343		567	816	907											
667A2D	Fast-A	F	120	324	343		771	1723	2041											
667A72	Fast-M	F	120	269	502	1111	1270	1995	2268	2608	2748									
667A7A	Fast-M	F	120	269	502	1179	1270	2086	2268	2553	2948	3148	2921	2748	2975					
667B0C	Slow-A	M	15	240	284	408	499	816	880	1047										
667B41	Fast-M	M	120	269	502	861	975	1224	1360	1587	1787	1873	1760	2041	2408	2408	2408	2408	2354	
667B5F	Slow-M	M	15	135	320	557	680	952	1020	1274	1419	1501	1614	1701	1873	2068	2181	2268	2268	2635
667C01	Slow-M	F	15	135	320		1020	1678	1728	2100	2268	2381	2408	2408	2635	3007	3234			
667C17	Fast-A	F	120	324	343		680	1315	1646	1927										
667C23	Slow-A	F	15	240	284	657	816	1451	1701											
667C41	Fast-M	F	120	269	502		1496	2358	2748	2975	3234	3601	3628	3542	4028					
667C57	Fast-A	F	120	324	343		680	1360	1701											
667C5A	Slow-A	M	15	240	284	499	521	997	1193											
667D0C	Slow-M	M	15	135	320	499	635	771	852	1134										
667D0D	Fast-M	M	120	269	502	680	793	1088	1247	1447	1501	1614	1646	1673	1900	2100	1927	1927	1900	
667D15	Slow-M	F	15	135	320	793	1088	1633	1873	2181	2327	2581	2780	2825	3542					
667D18	Fast-M	M	120	269	502	612	544	907	880											
667D47	Fast-A	F	120	324	343		680	1406	1701											
667D76	Fast-A	F	120	324	343		635	1587	2127	2494										

Appendix Table III (Continued).

PIT tag	Group	Sex	1985 0	1986 1	1987 2	1988 3	1989 4	1990 5	1991 6	1992 7	1993 8	1994 9	1995 10	1996 11	1997 12	1998 13	1999 14	2000 15	2001 16	2002 17
667E0A	Slow-M	F	15	135	320	1043	1270	1950	2327	2721	2835	3120	3120	2921						
667E35	Slow-M	F	15	135	320	907	1134	1633	1814	2154	2154	2440	2494	2608	2948	3828	3855	4195	3969	3656
667E3D	Slow-A	F	15	240	284		816	1905	2213											
667F02	Fast-M	F	120	269	502	1202	1496	2358	2440	2767	3061	2921	3061	2894	3261	3828	3646	3315	3402	3656
667F03	Slow-M	F	15	135	320		1156	2222	2522	2975	3402	3628	3769	3429	3828	4790				
667F40	Slow-A	F	15	240	284	544	816	1587	1927	2408	2780									
667F53	Fast-A	F	120	324	343		567	1496	1900	1927										
667F6A	Fast-A	F	120	324	343		907	1633	1955	2440	2667									
67003D	Fast-A	F	120	324	343		771	1451	1587	1927										
670043	Fast-A	M	120	324	343		589	997	1134											
670053	Fast-A	F	120	324	343		725	1723	2041	2181	2667									
670069	Fast-M	F	120	269	502	1134	1383	2086	2268	2667	3007	3261	3261							
67011A	Fast-A	F	120	324	343		567	1043	1247	1474										
67011B	Slow-M	F	15	135	320		1043	1587	1787	2154	2295	2467	2494							
670146	Fast-M	M	120	269	502	680	816	1088	1220	1388	1474	1587	1533							
67015D	Fast-A	F	120	324	343		725	1542	1986											
67016E	Slow-A	M	15	240	284	544	567	997	1079											
67020C	Fast-A	M	120	324	343		544	1043	1106											
670212	Fast-A	F	120	324	343		567	1360	1728	2041	2327									
67021E	Slow-A	F	15	240	284	589	725	1451	1787											
67022E	Fast-M	F	120	269	502	997	1179	1859	1986	2467	2608	2780	2721	2667	3007	3402				
670249	Fast-A	M	120	324	343		567	952	1247											
67025C	Fast-A	F	120	324	343		657	1496	1927	2100	2440									
670300	Fast-A	F	120	324	343		635	1360	1673											
67030F	Fast-M	F	120	269	502	1179	1270	2131	2408	2635	3175									
67032D	Slow-A	F	15	240	284	544	703	1360	1701	2068	2268									
670330	Slow-M	F	15	135	320	771	997	1496	1787	2041	2862	2522	2667	2948	3515	3855	3769	3656	3628	3488
670346	Slow-M	F	15	135	320	861	1134	1723	2041	2381	2581	2835	2807	2608						
67034A	Slow-M	M	15	135	320	589	748	1134	1193	1474	1614	1873	1873							
67036E	Slow-M	F	15	135	320	771	1134	1678	1955	2181	2522	2807	2748	2975	3402	4055	3828	3769	3969	3769
67036F	Fast-M	F	120	269	502	1156	1360	2313	2522	2807	3175	3347	3234	3315	3601	4309	4168	3801	3642	4082
670371	Slow-M	F	15	135	320		1088	1678	1900	2154	2354	2581	2522	2807	3061	3687	3628	3288	3315	4082
670375	Fast-A	M	120	324	343		544	861	1079	1247										
67037E	Fast-M	F	120	269	502		1224	1814	2213	2494	2807	3120	2721							
670402	Slow-A	F	15	240	284		861	1633	2041	2494										
670408	Slow-A	M	15	240	284	362	499	907	966											
670410	Fast-M	F	120	269	502	1088	1270	2131	2440	2635	2948	3120	3120							
670419	Slow-M	M	15	135	320	453	657	880	993	1079	1388	1419	1614	1728	1900	2154	2268	2041		
670436	Slow-A	M	15	240	284	362	499	771	880											
67043B	Fast-A	F	120	324	343	725	952	1360	1814	1986	2177									
67043C	Fast-A	F	120	324	343		907	1723	2041											
67045F	Fast-A	F	120	324	343		544	1406	1787	2127	2494									
670460	Fast-A	F	120	324	343		816	1360	1646											
670478	Fast-M	F	120	269	502	816	1315	1950	2213	2440	2694	2921	2948	2975	3429	3628	3715	3347	3288	
670510	Fast-A	F	120	324	343		725	1859	2381	2553	2948									

Appendix Table III (Continued).

			1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PIT tag	Group	Sex	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
670523	Fast-M	M	120	269	502	839	907	1224	1360	1587										
670526	Slow-A	F	15	240	284		771	1723	2181	2553	2948									
67052F	Slow-A	F	15	240	284	612	680	1360	1646											
670562	Fast-A	F	120	324	343		748	1678	1900											
670563	Slow-A	F	15	240	284	499	703	1406	1728	2181										
670615	Slow-A	F	15	240	284	703	816	1496	1673											
2D2648	Slow-M	F	15	135	320			1723	1986	2268	2408	2494	2553	2608						

Appendix Table IV. Annual largemouth bass total lengths (mm TL), including mean, minimum (min), maximum (max), and standard deviation (Std Dev), in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 - 2002. Fish were PIT (Passive Integrated Transponder) tagged in 1988 and sexed in 1991. Therefore, values for 1985 through 1987 represent group means and ranges (prior to identification of specific individuals). During tagging in 1988, most fast growers stocked alone received PIT tags, but number for these and several other specimens could not be recorded and subsequently are not listed in the 1988 column. From 1988 through 2002, numbers reported were derived from values for individual, sexed specimens. Any test fish that died prior to being sexed in 1991 were not included.

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
ALL BASS (males+female; fast+slow growers; stocked alone+mixed)																		
N	179	179	179	110	178	179	178	124	98	70	68	50	45	41	35	31	22	15
Mean	153	273	309	366	401	433	456	486	501	504	513	523	533	547	543	556.	557	559
Min	86	230	287	301	325	359	375	392	405	412	422	430	442	447	458	450	446	452
Max	225	304	347	490	533	544	560	575	582	595	597	605	612	625	610	625	616	623
Std Dev	69.7	27.3	21.7	36.6	39.9	42.6	44.2	44.4	43.8	48.5	49.1	50.8	54.1	56.9	53.9	57.0	54.9	59.3
ALL FAST GROWERS (males+females; stocked alone+mixed)																		
N	87	87	87	34	87	87	87	62	48	32	31	21	20	18	14	13	8	2
Mean	225	296	327	395	409	441	463	493	509.	512	522	530	540	550	546	554	565	598
Min	225	287	312	338	344	365	378	398	405	420	425	436	444	457	461	472	494	577
Max	225	304	347	490	533	544	560	575	582	595	597	605	612	620	610	619	612	620
Std Dev		8.5	17.5	34.6	41.1	43.3	45.0	44.9	45.2	51.4	51.9	52.8	55.7	57.4	55.7	55.8	47.0	30.4
ALL SLOW GROWERS (males+females; stocked alone+mixed)																		
N	92	92	92	76	91	92	91	62	50	38	37	29	25	23	21	18	14	13
Mean	86	251	292	353	393	425	448	478	494	498	505	518	528	545	541	558	552	553
Min	86	230	287	301	325	359	375	392	409	412	422	430	442	447	458	450	446	452
Max	86	269	299	442	505	525	526	546	558	564	573	589	603	625	607	625	616	623
Std Dev		19.5	6.0	29.8	37.2	40.8	42.3	42.8	41.6	45.7	46.2	49.7	53.2	57.8	53.6	59.5	59.9	61.1
ALL FEMALES (fast+slow growers; stocked alone+mixed)																		
N	120	120	120	69	119	120	119	92	74	49	49	35	30	26	21	18	13	9
Mean	155	273	309	385	420	456	482	507	522	532	540	553	567	585	581	601	599	603
Min	86	230	287	301	374	394	412	427	436	438	445	461	474	494	498	565	577	577
Max	225	304	347	490	533	544	560	575	582	595	597	605	612	625	610	625	616	623
Std Dev	69.8	28.1	21.6	30.2	31.4	28.7	25.2	25.6	23.1	23.9	24.1	25.8	28.3	28.2	27.7	16.4	12.9	17.3
ALL MALES (fast+slow growers; stocked alone+mixed)																		
N	59	59	59	41	59	59	59	32	24	21	19	15	15	15	14	13	9	6
Mean	149	273	308	335	362	385	403	423	436	440	442	455	466	480	485	494	496	493
Min	86	230	287	301	325	359	375	392	405	412	422	430	442	447	458	450	446	452
Max	225	304	347	397	446	472	488	508	525	529	465	486	499	517	522	536	535	523
Std Dev	69.8	26.0	22.1	22.7	24.7	20.8	20.0	21.9	23.6	24.8	13.5	16.4	17.1	19.1	19.6	22.7	25.2	25.2

Appendix Table IV (Continued).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FAST FEMALES (stocked alone+mixed)																		
N	60	60	60	22	60	60	60	48	37	22	22	14	13	11	8	7	5	2
Mean	225	296	327	415	427	463	488	513	531	544	553	565	577	592	590	601	598	598
Min	225	287	312	374	350	380	397	408	486	526	535	541	548	574	576	582	581	577
Max	225	304	347	490	533	544	560	575	582	595	597	605	612	620	610	619	612	620
Std Dev		8.5	17.5	23.9	35.5	31.5	28.4	28.6	21.1	16.2	15.6	17.2	20.1	14.2	11.4	13.8	12.9	30.4
SLOW FEMALES (stocked alone+mixed)																		
N	60	60	60	47	59	60	59	44	37	27	27	21	17	15	13	11	8	7
Mean	86	249	292	371	413	450	476	501	514	521	530	544	559	580	576	602	599	605
Min	86	230	287	301	374	394	412	427	436	438	445	461	474	494	498	565	577	579
Max	86	269	299	442	505	525	526	546	558	564	573	589	603	625	607	625	616	623
Std Dev		19.7	6.1	21.3	25.1	24.2	19.9	20.4	22.3	24.4	24.9	27.7	31.5	34.8	33.5	18.6	13.9	15.3
FAST MALES (stocked alone+mixed)																		
N	27	27	27	12	27	27	27	14	11	10	9	7	7	7	6	6	3	
Mean	225	296	327	358	371	392	408	426	435	440	445	461	470	483	486	499	512	
Min	225	287	312	338	344	365	378	398	405	420	425	436	444	457	461	472	494	
Max	225	304	347	384	430	425	445	446	453	456	465	486	499	517	522	536	535	
Std Dev		8.6	17.7	14.5	23.4	17.9	18.2	15.8	15.3	12.8	13.6	17.3	19.2	20.5	22.3	22.4	20.9	
SLOW MALES (stocked alone+mixed)																		
N	32	32	32	29	32	32	32	18	13	11	10	8	8	8	8	7	6	6
Mean	86	254	291	326	355	379	398	421	437	440	440	449	462	478	484	490	488	493
Min	86	230	287	301	325	359	375	392	409	412	422	430	442	447	458	450	446	452
Max	86	269	299	397	446	472	488	508	525	529	464	465	479	497	505	516	514	523
Std Dev		19.2	5.9	18.4	23.5	21.5	20.5	25.9	29.5	32.9	13.7	14.4	15.2	18.9	18.8	23.8	24.9	25.2
FAST FEMALES ALONE																		
N	34	34	34	1	34	34	34	23	13									
Mean	225	304	312	388	401	441	472	495	515									
Min	225	304	312	388	350	380	397	408	486									
Max	225	304	312	388	443	480	525	560	560									
Std Dev					18.3	19.8	22.7	29.3	21.9									
FAST FEMALES MIXED																		
N	26	26	26	21	26	26	26	25	24	22	22	14	13	11	8	7	5	2
Mean	225	287	347	416	460	491	509	529	539	544	553	565	577	592	590	601	598	598
Min	225	287	347	374	407	433	445	510	520	526	535	541	548	574	576	582	581	577
Max	225	287	347	490	533	544	560	575	582	595	597	605	612	620	610	619	612	620
Std Dev				23.6	23.4	19.5	20.2	15.7	15.3	16.2	15.6	17.2	20.1	14.2	11.4	13.8	12.9	30.4

Appendix Table IV (Continued).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SLOW FEMALES ALONE																		
N	31	31	31	26	31	31	30	16	9									
Mean	86	267	287	364	401	437	467	493	507									
Min	86	269	287	301	374	411	445	462	476									
Max	86	269	287	442	505	525	495	515	522									
Std Dev				23.9	24.8	21.4	13.7	13.2	15.8									
SLOW FEMALES MIXED																		
N	29	29	29	21	28	29	29	28	28	27	27	21	17	15	13	11	8	7
Mean	86	230	299	379	427	463	484	506	516	521	530	544	559	580	576	602	599	605
Min	86	230	299	340	376	394	412	427	436	438	445	461	474	494	498	565	577	579
Max	86	230	299	400	457	497	526	546	558	564	573	589	603	625	607	625	616	623
Std Dev				13.5	17.2	19.9	21.8	22.4	23.8	24.4	24.9	27.7	31.5	34.8	33.5	18.6	13.9	15.3
FAST MALES ALONE																		
N	15	15	15		15	15	15	3										
Mean	225	304	312		357	382	402	410										
Min	225	304	312		344	365	378	398										
Max	225	304	312		385	420	445	419										
Std Dev					10.93	13.3	16.4	10.9										
FAST MALES MIXED																		
N	12	12	12	12	12	12	12	11	10	10	9	7	7	7	6	6	3	
Mean	225	287	347	358	390	404	416	431	438	440	445	461	470	483	486	499	512	
Min	225	287	347	338	363	380	386	410	419	420	425	436	444	457	461	472	494	
Max	225	287	347	384	430	425	442	446	453	456	465	486	499	517	522	536	535	
Std Dev				14.5	21.5	16.3	17.9	14.1	12.2	12.8	13.6	17.3	19.2	20.5	22.3	22.4	20.9	
SLOW MALES ALONE																		
N	20	20	20	18	20	20	20	6	2									
Mean	86	269	287	318	342	370	391	411	435									
Min	86	269	287	301	325	359	375	392	431									
Max	86	269	287	342	361	392	412	430	439									
Std Dev				11.4	9.5	9.4	10.2	14.5	5.7									
SLOW MALES MIXED																		
N	12	12	12	11	12	12	12	12	11	11	10	8	8	8	8	7	6	6
Mean	86	230	299	339	376	396	410	426	438	440	440	449	462	478	484	490	488	493
Min	86	230	299	325	348	374	387	399	409	412	422	430	442	447	458	450	446	452
Max	86	230	299	397	446	472	488	508	525	529	464	465	479	497	505	516	514	523
Std Dev				20.5	25.3	26.4	27.3	29.2	32.3	32.9	13.7	14.4	15.2	18.9	18.8	23.8	24.9	25.2

Appendix Table V. Annual largemouth bass weight (g), including mean, minimum (min), maximum (max), and standard deviation (Std Dev), in growth rate studies conducted at Heart of the Hills Fisheries Science Center, Ingram, Texas, 1985 - 2002. Fish were PIT (Passive Integrated Transponder) tagged in 1988 and sexed in 1991. Therefore, values for 1985 through 1987 represent group means and ranges (prior to identification of specific individuals). During tagging in 1988, most fast growers stocked alone received PIT tags, but number for these and several other specimens could not be recorded and subsequently are not listed in the 1988 column. From 1988 through 2002, numbers reported were derived from values for individual, sexed specimens. Any test fish that died prior to being sexed in 1991 were not included.

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
ALL BASS (males+female; fast+slow growers; stocked alone+mixed)																		
N	179	179	179	110	178	179	178	124	98	70	68	50	45	41	35	31	22	15
Mean	66	245	355	727	838	1407	1658	2062	2387	2515	2534	2576	2838	3223	3067	3013	2993	3194
Min	15	135	284	312	336	368	793	934	1192	1220	1192	1220	1388	1501	1474	1388	1474	1814
Max	120	324	502	2041	1905	3039	3374	3628	3801	4055	3855	3628	4027	5075	4508	4336	4309	4281
Std Dev	52.4	68.2	79.8	296.1	305.3	469.3	507.9	548.3	624.3	733.3	705.4	686.0	783.6	1040.8	917.9	893.2	887.7	928.4
ALL FAST GROWERS (males+females; stocked alone+mixed)																		
N	87	87	87	34	87	87	87	62	48	32	31	21	20	18	14	13	8	2
Mean	120	300	412	983	875	1503	1792	2199	2557	2703	2709	2723	2973	3277	3196	3015	3124	3869
Min	120	269	343	405	361	386	879	1192	1274	1446	1360	1587	1646	1759	1814	1587	1900	3656
Max	120	324	502	2041	1905	3039	3374	3628	3801	4055	3855	3628	4027	4903	4508	4336	4195	4082
Std Dev		27.4	79.2	325.1	350.8	510.2	535.0	543.3	638.4	782.5	742.3	696.9	753.6	1006.7	950.7	848.3	815.8	301.5
ALL SLOW GROWERS (males+females; stocked alone+mixed)																		
N	92	92	92	76	91	92	91	62	50	38	37	29	25	23	21	18	14	13
Mean	15	193	300	612	804	1317	1530	1926	2224	2357	2387	2471	2729	3180	2981	3013	2918	3090
Min	15	135	284	312	336	368	793	934	1192	1220	1192	1220	1388	1501	1474	1388	1474	1814
Max	15	240	320	1224	1678	2494	2522	2975	3402	3628	3769	3628	3969	5075	4281	4309	4309	4281
Std Dev		52.5	17.9	194.7	251.5	409.5	447.3	522.4	569.9	658.4	646.6	670.1	805.5	1087.3	908.6	948.6	947.6	954.2
ALL FEMALES (fast+slow growers; stocked alone+mixed)																		
N	120	120	120	69	119	120	119	92	74	49	49	35	30	26	21	18	13	9
Mean	67	245	357	841	944	1639	1943	2323	2670	2903	2894	2953	3299	3886	3719	3668	3651	3707
Min	15	135	284	405	383	424	1192	1388	1560	1501	1587	1728	2013	2326	2467	3234	2948	2268
Max	120	324	502	2041	1905	3039	3374	3628	3801	4055	3855	3628	4027	5075	4508	4336	4309	4281
Std Dev	52.5	69.8	79.8	302.1	304.4	378.3	349.5	348.6	400.5	461.1	449.4	399.7	461.4	636.2	464.5	424.6	402.7	600.1
ALL MALES (fast+slow growers; stocked alone+mixed)																		
N	59	59	59	41	59	59	59	32	24	21	19	15	15	15	14	13	9	6
Mean	63.52	246	351	534	626	935	1083	1315	1514	1611	1604	1699	1915	2073	2089	2107	2041	2424
Min	15.70	135	284	312	336	368	793	934	1192	1220	1192	1220	1388	1501	1474	1388	1474	1814
Max	120.20	324	502	884	1202	1632	1814	2181	2553	2835	2154	2326	2721	2948	2948	3129	2381	3996
Std Dev	52.51	65.2	80.4	152.6	165.2	210.2	189.9	240.3	284.7	344.1	218.7	283.7	346.3	373.6	394.9	455.1	319.2	807.6

Appendix Table V (Continued).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FAST FEMALES (stocked alone+mixed)																		
N	60	60	60	22	60	60	60	48	37	22	22	14	13	11	8	7	5	2
Mean	120	300	412	1137	965	1724	2074	2430	2853	3179	3125	3157	3452	3961	3914	3649	3671	3869
Min	120	269	343	405	383	424	1247	1474	2177	2580	2667	2667	2975	3089	3429	3288	3288	3656
Max	120	324	502	2041	1905	3039	3374	3628	3801	4055	3855	3628	4027	4903	4508	4336	4195	4082
Std Dev		27.5	79.4	301.9	374.6	450.6	377.7	369.1	362.2	364.7	379.0	325.6	342.9	548.0	412.8	443.6	360.4	301.5
SLOW FEMALES (stocked alone+mixed)																		
N	60	60	60	47	59	60	59	44	37	27	27	21	17	15	13	11	8	7
Mean	15	189	301	703	922	1555	1809	2206	2487	2678	2706	2817	3182	3832	3598	3680	3639	3661
Min	15	135	284	408	612	997	1192	1388	1560	1501	1587	1728	2013	2326	2467	3234	2948	2268
Max	15	240	320	1224	1678	2494	2522	2975	3402	3628	3769	3628	3969	5075	4281	4309	4309	4281
Std Dev		52.9	18.1	178.7	211.7	266.6	259.6	285.6	354.1	409.9	417.9	392.6	513.7	707.6	468.0	433.5	450.9	673.7
FAST MALES (stocked alone+mixed)																		
N	27	27	27	12	27	27	27	14	11	10	9	7	7	7	6	6	3	
Mean	120	300	414	701	675	1012	1164	1409	1563	1656	1692	1855	2082	2203	2239	2274	2212	
Min	120	269	343	589	361	386	879	1192	1274	1446	1360	1587	1646	1759	1814	1587	1900	
Max	120	324	502	861	997	1360	1646	1646	1873	2013	2154	2326	2721	2948	2948	3129	2381	
Std Dev		27.9	80.4	93.9	168.1	192.3	174.3	156.9	180.3	166.8	220.9	266.6	371.5	411.1	432.4	519.4	270.1	
SLOW MALES (stocked alone+mixed)																		
N	32	32	32	29	32	32	32	18	13	11	10	8	8	8	8	7	6	6
Mean	15	201	298	465	585	871	1014	1241	1472	1570	1525	1563	1769	1960	1977	1964	1956	2424
Min	15	135	284	312	336	368	793	934	1192	1220	1192	1220	1388	1501	1474	1388	1474	1814
Max	15	240	320	884	1202	1632	1814	2181	2553	2835	1873	1841	2100	2440	2381	2354	2326	3996
Std Dev		51.7	17.7	113.9	153.4	205.6	176.9	270.8	352.3	455.9	194.1	233.6	263.3	320.4	349.9	371.0	328.2	807.6
FAST FEMALES ALONE																		
N	34	34	34	1	34	34	34	23	13									
Mean	120	324	343	725	687	1473	1860	2197	2653									
Min	120	324	343	725	383	424	1247	1474	2177									
Max	120	324	343	725	952	1859	2494	2862	3147									
Std Dev					122.5	274.3	270.7	303.8	293.2									
FAST FEMALES MIXED																		
N	26	26	26	21	26	26	26	25	24	22	22	14	13	11	8	7	5	2
Mean	120	269	502	1156	1329	2052	2353	2644	2961	3179	3125	3157	3452	3961	3914	3649	3671	3869
Min	120	269	502	405	450	480	1701	2213	2354	2580	2667	2667	2975	3089	3429	3288	3288	3656
Max	120	269	502	2041	1905	3039	3374	3628	3801	4055	3855	3628	4027	4903	4508	4336	4195	4082
Std Dev				294.8	261.4	426.9	310.9	286.8	354.5	364.7	379.0	325.6	342.9	548.0	412.8	443.6	360.4	301.5

Appendix Table V (Continued).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fish age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SLOW FEMALES ALONE																		
N	31	31	31	26	31	31	30	16	9									
Mean	15	240	284	598	788	1447	1716	2142	2466									
Min	15	240	284	408	612	1179	1388	1501	1841									
Max	15	240	284	1224	1678	2494	2213	2553	2948									
Std Dev				145.3	181.9	252.9	208.9	253.2	319.8									
SLOW FEMALES MIXED																		
N	29	29	29	21	28	29	29	28	28	27	27	21	17	15	13	11	8	7
Mean	15	135	320	832	1071	1670	1905	2243	2494	2678	2706	2817	3182	3832	3598	3680	3639	3661
Min	15	135	320	498	771	997	1192	1388	1560	1501	1587	1728	2013	2326	2467	3234	2948	2268
Max	15	135	320	1043	1292	2222	2522	2975	3402	3628	3769	3628	3969	5075	4281	4309	4309	4281
Std Dev				123.0	125.9	233.5	274.9	300.7	369.7	409.9	417.9	392.6	513.7	707.6	468.0	433.5	450.9	673.7
FAST MALES ALONE																		
N	15	15	15		15	15	15	3	1									
Mean	120	324	343		563	942	1119	1229	1406									
Min	120	324	343		361	386	907	1192	1406									
Max	120	324	343		748	1360	1646	1247	1406									
Std Dev					88.1	204.4	175.5	31.4										
FAST MALES MIXED																		
N	12	12	12	12	12	12	12	11	10	10	9	7	7	7	6	6	3	
Mean	120	269	502	701	814	1099	1221	1458	1579	1656	1692	1855	2082	2203	2239	2274	2212	
Min	120	269	502	589	544	907	879	1220	1274	1446	1360	1587	1646	1759	1814	1587	1900	
Max	120	269	502	861	997	1270	1388	1646	1873	2013	2154	2326	2721	2948	2948	3129	2381	
Std Dev				93.9	137.3	138.3	162.3	139.3	181.9	166.8	220.9	266.6	371.5	411.1	432.4	519.4	270.1	
SLOW MALES ALONE																		
N	20	20	20	18	20	20	20	6	2									
Mean	15	240	284	406	505	817	979	1195	1390									
Min	15	240	284	312	336	368	793	1047	1192									
Max	15	240	284	544	612	997	1192	1360	1587									
Std Dev				60.3	69.5	171.2	100.9	127.6	279.1									
SLOW MALES MIXED																		
N	12	12	12	11	12	12	12	12	11	11	10	8	8	8	8	7	6	6
Mean	15	135	320	562	718	961	1073	1264	1487	1570	1525	1563	1769	1960	1977	1964	1956	2424
Min	15	135	320	453	521	771	852	934	1192	1220	1192	1220	1388	1501	1474	1388	1474	1814
Max	15	135	320	884	1202	1632	1814	2181	2553	2835	1873	1841	2100	2440	2381	2354	2326	2635
Std Dev				116.9	164.8	232.9	254.1	322.8	373.6	455.9	194.1	233.6	263.3	320.4	349.9	371.0	328.2	807.6