Age, Growth, and Maturity of Channel Catfish in Two Southeast Louisiana Lakes

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Abstract: Channel catfish (*Ictalurus punctatus*) were sampled in 2 southeast Louisiana lakes for 3 years to determine if these populations were stunted based on age structure, growth rate, and length at maturity. Mean total length at age II for Lake Maurepas and Lac Des Allemands catfish were 262 mm and 256 mm, respectively, which compared favorably to other commercially fished populations in other areas in the lower Mississippi drainage. Channel catfish in Lake Maurepas exhibited a reduced length and age at maturity when compared to other areas. These characteristics may be due to physicochemical characteristics of the lake, an abundance of forage, or overfishing, which could select for early maturity as a survival mechanism.

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Channel catfish is 1 of the most sought after freshwater commercial fish in Louisiana, with 1985 landings of 2,569,727 kg valued at $2,674,592 (U.S. Dep. Comm. 1986). Controversy has surrounded the length limits that have been imposed for the commercial harvest of channel catfish in Louisiana. Davis and Posey (1958) studied channel catfish length at maturity throughout Louisiana in response to attempts by commercial fishermen in 1956 to lower the 356 mm total length (TL) minimum commercial length limit. Although no age structure, growth, mortality, or recruitment data were analyzed, the authors concluded, based on lengths at maturity of 305–317 mm TL and 267–279 mm TL for male and female fish, that the length limit could be reduced, at least on a trial basis. These lengths at maturity were similar to those reported by Perry and Carver (1972) for catfish in Louisiana marshes. Perry and Carver (1972) concluded that a minimum length limit corresponding to the average length at maturity would ensure adequate recruitment.

In 1967 the legal length limit for commercially-harvested channel catfish was

lowered to 330 mm TL and was lowered again in 1972 to 279 mm TL. In 1981, commercial fishermen in the Lac Des Allemands and Lake Maurepas area of southeastern Louisiana requested another reduction in the minimum size limit for channel catfish, based on perceived slow growth and early maturity. Length limits were subsequently suspended statewide through 1984 and remained suspended in southeastern Louisiana from 1984 to 1989. During this time, the Louisiana Department of Wildlife and Fisheries (LDWF) initiated a 3-year study to determine if the catfish populations in Lake Maurepas and Lac Des Allemands were stunted, and if so, possible causes of stunting. Based on preliminary data collected during this study, Zeringue et al. (1988) concluded that age I channel catfish in Lac Des Allemands and Lake Maurepas were smaller than age I catfish in other populations and exhibited reduced length at maturity. This paper presents the results of the 3-year study of growth and maturity of channel catfish in Lac Des Allemands and Lake Maurepas.

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Methods

Lake Maurepas is a 23,569-ha lake located 25 km northwest of New Orleans. It is connected to Lake Pontchartrain through Pass Manchac and North Pass with its major tributaries being the Tickfaw River on the north shore and the Amite and Blind rivers to the west and southwest. Lac Des Allemands is a 6,070-ha lake located 25 km west of New Orleans. Several small canals empty into the lake, but the major tributaries are Bayou Chevreuil and Bayou Boeuf. Lac Des Allemands drains to Lake Salvador through Bayou Des Allemands.

In each lake, channel catfish populations were sampled at 4 sites annually from 1985 to 1987 during 1 week in the summer spawning period. Sampling sites in Lake Maurepas were characterized by hard bottom (3 sites) and mud (1 site) substrates and depths of 1.5–1.8 m.

Two of the 4 sites selected in Lac Des Allemands, 1 open water and 1 shoreline location, were the same as those sampled with rotenone in previous studies in 1981 and 1983. These sites varied in depth from 1.5 to 2.1 m and had soft substrates; the open water site had numerous submerged cypress stumps. The 2 remaining sites were located approximately 3.2 km apart at the mouth of Bayou Des Allemands and were characterized by soft substrates and depths of 1.8 m; 1 of these sites also had numerous submerged cypress stumps. Sample areas (0.4 ha) were surrounded with a block-net (2.54-cm square mesh) and treated with liquid rotenone at a 1 ppm concentration. All fish that surfaced the first and second days were collected, identified by species, and measured and weighed.

Pectoral spines were removed from each catfish for age and growth determination. Cross sections (approximately 1 mm) were made at the distal end of the spine's basal recess with a low-speed microsectioning saw (Buehler Inc., Ann Arbor, Mich.). Spine sections were cleaned and mounted on glass slides with Permount.

Annuli were counted and measured with a Bausch and Lomb microprojector. Back-calculations of growth were performed with the Lee method (Carlander 1981). Lengths at age were compared with ANOVA, with statistical significance declared at the $P < 0.01$ level.

Gonads from all channel catfish were visually examined. Testes were classified as either mature or immature, and ovaries as immature, maturing, or spent as distinguished by Sneed and Clemens (1963) and Grizzle and Rogers (1976). Data was fitted by least square regression with SAS PROC GLM (SAS Inst., Inc. 1989).

To determine the robustness of channel catfish from both populations, a coefficient of condition was calculated for each fish with the equation:

$$K = \frac{W \times 10^5}{L^3}$$

where K = coefficient of condition; W = weight (in grams); L = total length (in millimeters). Condition factors were compared with ANOVA (SAS Inst., Inc. 1989).

Results

Age and Growth

Estimated total lengths (TL) in millimeters at time of annuli formation for channel catfish in Lake Maurepas and Lac Des Allemands were described by the following spine radius (SR) total length regression equations:

Lake Maurepas	$\log TL = 0.358 + (1.113) \log SR$	$(r^2 = 0.85)$
Lac Des Allemands	$\log TL = 1.007 + (0.978) \log SR$	$(r^2 = 0.93)$

Mean estimated lengths for each annulus were calculated for each age class in each population (Tables 1, 2). Mean length of Lake Maurepas channel catfish at age I (166 mm TL) was significantly less than the mean length found for age I Lac Des Allemands catfish (177 mm TL). However, growth increased in Lake Maurepas fish after age I so that by age II the mean length for channel catfish from Lake Maurepas (262 mm TL) slightly exceeded the mean length of age II fish in Lac Des Allemands (256 mm TL). Mean length of Lake Maurepas fish (323 mm TL) continued to surpass age III Lac Des Allemands fish (314 mm TL). Statistical comparisons of mean lengths of fish at age II and age III revealed no significant differences between Lake Maurepas and Lac Des Allemands Fish. Growth in Lake Maurepas appeared to exceed that for Lac Des Allemands for ages II–V, although the sample sizes for age groups III–V were too low for statistical comparisons.

Sexual Maturity

Sexual maturity in Lac Des Allemands was described by the following regression equations:

males	$P = 0.3659 + (0.0337)TL$	$(r^2 = 0.75)$
females	$P = 0.4416 + (0.0374)TL$	$(r^2 = 0.84)$

Table 1. Estimated lengths (mm) and growth increments for channel catfish in Lake Maurepas, Louisiana.

Age class	N	Estimated lengths	Annuli I	II	III	IV	V
1	183	Mean	138				
		increment					
2	2	Mean	151	252			
		increment		101			
3	21	Mean	166	249	308		
		increment		83	59		
4	4	Mean	182	277	336	415	
		increment		95	59	78	
5	2	Mean	206	271	323	434	477
		increment		66	52	111	43
Total	212	Mean	166	262	323	424	477
		Standard error	1.50	6.23	5.33	10.65	

where P is the proportion mature, and TL is total length in millimeters. The 50% level of sexual maturity for Lac Des Allemands male and female catfish was 256 and 252 TL (Fig. 1). A 100% maturity level was found for catfish between 360 mm and 379 mm TL. Because only 3 fish <200 mm were collected from Lake Maurepas, no maturity TL regression or 50% level of sexual maturity were calculated for Lake Maurepas fish. One hundred percent of the Lake Maurepas channel catfish from 280–299 mm TL were mature. Sexual maturity of fish from 300–319 mm TL was 91%, and was 100% for all fish >340 mm TL.

Fish from Lake Maurepas achieved higher percentages of sexual maturity in smaller size classes than found in Lac Des Allemands, which, given the similarity

Table 2. Estimated lengths (mm) and growth increments for channel catfish in Lac Des Allemands, Louisiana.

Age class	N	Estimated lengths	Annuli I	II	III	IV	V
1	151	Mean	182				
		increment					
2	120	Mean	187	257			
		increment		71			
3	9	Mean	167	237	293		
		increment		71	56		
4	3	Mean	201	256	319	378	
		increment		55	63	59	
5	1	Mean	150	252	330	396	431
		increment		103	78	66	35
Total	284	Mean	177	256	314	387	431
		Standard error	1.86	2.51	9.28	14.8	

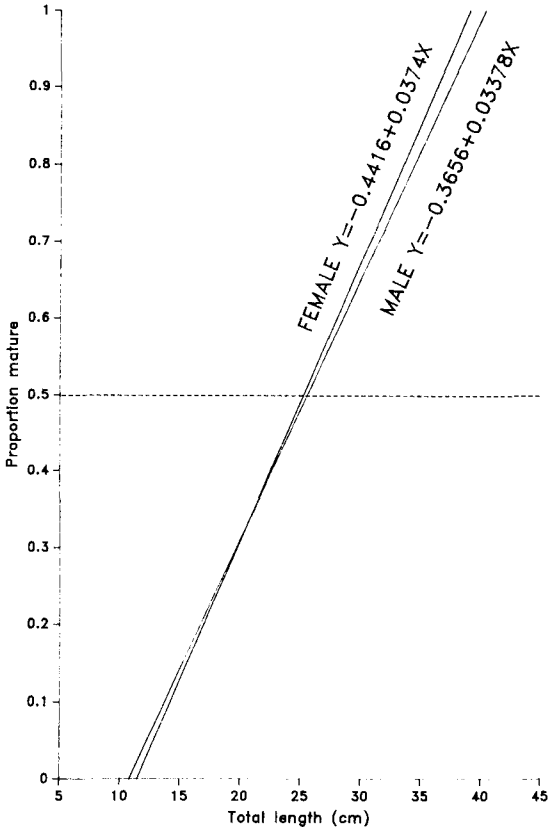

Figure 1. Percent mature—total length relationship of male and female catfish in Lac Des Allemands, Louisiana.

in growth between the 2 populations, indicated that fish in Lake Maurepas matured at a younger age. The 100% level of sexual maturity in Lake Maurepas was achieved by age II+ fish (280–290 mm TL), which was 1 year less than Lac Des Allemands fish (360–379 mm TL).

Coefficients of Condition

Coefficients of Condition (k) values were calculated for 214 and 373 channel catfish from Lake Maurepas and Lac Des Allemands, respectively. The overall mean coefficient of condition for Lake Maurepas channel catfish was 0.81, which was lower than the 0.86 value for Lac Des Allemands catfish.

Discussion

Results reported in this study suggest that the channel catfish populations in Lake Maurepas and Lac Des Allemands are not stunted. Burrough and Kennedy (1979) define "stunted growth" as an individual growth rate well below the potential

for a species and note it can be caused by overcrowded populations competing for limited trophic resources. Results of diet composition analysis (Zeringue et al. 1988) indicated that overcrowding of channel catfish in both Lake Maurepas and Lac Des Allemands was not evidenced by low stomach content volumes. In fact, channel catfish in both lakes were exploiting a more diverse and presumably nutritionally adequate vertebrate and invertebrate forage base than catfish in the lower Atchafalaya Basin. Additionally, the overall mean condition for channel catfish from Lake Maurepas and Lac Des Allemands were in the middle range of values reported by Carlander (1969) and therefore support Zeringue's findings.

Data analyses indicate that age and growth and sexual maturity of channel catfish in Lake Maurepas and Lac Des Allemands are comparable after age I to other commercially fished catfish populations in Louisiana (Zeringue 1989). Length of age I catfish in these 2 lakes (166–177 mm TL) is substantially greater than the length of age I channel catfish in the lower Mississippi River [146 mm TL (Lee 1983); incorrectly cited as approximately 200 mm TL in Zeringue et al. (1988)], and similar differences in length-at-age between Mississippi River and Maurepas/Des Allemands channel catfish are evident through age V.

Age at first maturation for channel catfish in Lac Des Allemands is similar to other commercially important areas of the state (Tilyou 1984, Davis and Posey 1958), whereas Lake Maurepas catfish mature at smaller sizes. However, Lake Maurepas channel catfish do not exhibit stunted characteristics. Stunted populations include fish that are mature at their normal age, but are short for their age (Comfort 1960, Nikolsky 1962, Woodhead 1978, Dadzie and Wangila 1980). Healey (1978) examined the dynamics of exploited lake trout (*Salvelinus namaycush*) populations and found no correlation of age and size at first maturity. Lake Maurepas has small mature fish, but they are not short for their age. Instead, Lake Maurepas channel catfish appear to be precocious compared to other channel catfish populations in the state and the lower Mississippi River drainage.

There are several possible explanations for this precocious maturation observed in Lake Maurepas channel catfish. Zeringue (1988) suggested that the mesohaline environment or some other physicochemical characteristics of the lake might account for early maturity of Lake Maurepas channel catfish. It is also possible that the Lake Maurepas catfish population is overfished, and precociousness has evolved as a life history adaptation to low survival. This hypothesis is supported by Diana (1983), who reported that increased fishing intensity for northern pike *Esox lucius* in 3 Michigan lakes may have induced higher mortality rates, earlier ages at first maturation, and higher energy allocations to reproduction at earlier ages.

Literature Cited

Burrough, R. J. and C. R. Kennedy. 1979. The occurrence and natural alleviation of stunting in a population of roach, *Rutilus rutilus* (L.) J. Fish Biol. 15:93–109.

Carlander, K. D. 1969. Handbook of freshwater fishery biology. Vol. 1. Iowa State Univ. Press, Ames. 752 pp.

———. 1981. Caution on the use of the regression method of back-calculating length from scale measurements. Fisheries 6(1):2–4.

Comfort, A. 1960. The effect of age or growth-resumption in fish (Lebistes) checked by food restriction. Gerontology 4:177–186.

Dadzie, S. and B. C. C. Wangila. 1980. Reproductive biology, length-weight relationship and relative condition of pond-raised *Tilapia zilli* (Gervais). J. Fish Biol. 17:(2–3):243–253.

Davis;, J. T. and L. E. Posey. 1958. Length at maturity of channel catfish in Louisiana. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 12:72–75.

Diana, J. S. 1983. Growth, maturation, and production of northern pike in three Michigan lakes. Trans. Am. Fish. Soc. 112:38–46.

Grizzle, J. M. and W. A. Rogers. 1976. Anatomy and histology of the channel catfish. Auburn Univ. Agric. Exp. Sta. Auburn, Ala. 94pp.

Healey, M. C. 1978. The dynamics of exploited lake trout populations and implications for management. J. Wildl. Manage. 42:307–328.

Lee, D. C. 1983. Growth of blue, channel, and flathead catfish in selected habitats of the lower Mississippi River. M.S. Thesis, Univ. Tenn., Knoxville. 58pp.

Nikolsky, G. V. 1962. On some adaptations to the regulation of population density in fish species with different types of stock structure. Pages 265–282 *in* E. D. LeCren and M. W. Holdgate, eds. The exploitation of natural animal populations. Blackwell Sci. Publ., Oxford, England.

Perry, W. G. and D. C. Carver. 1972. Length at maturity and total length-collarbone length conversions for channel catfish, *Ictalurus punctatus*, and blue catfish, *Ictalurus furcatus*, collected from the marshes of southwest Louisiana. Proc. Annu. Conf. Southeast. Assoc. Game and Fish. Comm. 26:541–553.

SAS Institute, Inc. 1989. SAS/STAT guide: Version 6 Edition. Cary, N.C. 1028pp.

Sneed, K. E. and H. P. Clemens. 1963. The morphology of the testes and accessory reproductive glands of the catfishes (*Ictaluridae*). Copeia 4:606–611.

Tilyou, G. 1984. Blue and channel catfish investigations. La. Dep. Wildl. and Fish., Baton Rouge. Final Rep., Fed. Aid Project F-43, 22pp.

U.S. Department of Commerce. 1986. Fisheries statistics of the United States. Natl. Ocean. Atmos. Admin., Natl., Mar. Fish. Serv., Washington, D.C.

Woodhead, A. D. 1978. Fish in studies of aging. Exp. Gerontol. 13:125–140.

Zeringue, J. P. 1989. Isozyme variability and growth of channel catfish, *Ictalurus punctatus*, in eight Louisiana lakes. M.S. Thesis, La. State Univ., Baton Rouge. 44pp.

———, W. E. Kelso, C. Fred Bryan, and M. G. McElroy. 1988. Diet composition of stunted catfish populations in Louisiana. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 42:133–140.