LENGTH AT MATURITY, TOTAL-COLLARBONE LENGTH, AND DRESSOUT FOR FLATHEAD CATFISH AND LENGTH AT MATURITY OF BLUE CATFISH, SOUTHWEST LOUISIANA

W. GUTHRIE PERRY, Louisiana Department of Wildlife and Fisheries, Grand Chenier, LA 70643
DUDLEY C. CARVER, Louisiana Department of Wildlife and Fisheries, Lake Charles, LA 70601

Abstract: Length at maturity computed for female flathead catfish (*Pylodictus olivaris*) from marshes of southwest Louisiana was 589 mm. Empirical data showed males approach maturity in the 390-439 mm size range. The length-weight regression for flathead catfish was best described by: Log W = −8.9640 + 3.3732 Log L, where W = weight in kg and L = length in mm, r = 0.97. The computed total length-collarbone length conversion equation for flathead catfish was Y = 10.3428 + 0.7251, where Y = total collarbone length in mm and X = total body length in mm, r = 0.99. Dressout-live weight relationship for flathead catfish was Y = 0.3308 + 0.7123 X, where Y = cleaned (headed and eviscerated) weight in kg and X = live weight in kg, r = 0.70. Computed length at maturity for blue catfish (*Ictalurus furcatus*) was 481 mm.

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The commercial harvest of fish constitutes a major supplement to Louisiana's economy. A value of $137,613,002 was assessed for this industry in 1976 (Ovide Plaiance, Personal Communication, Southeast Region, National Marine Fisheries Service). Approximately 95 percent was saltwater species, of which shrimp and menhaden were dominant. Freshwater species contrbiuted $6,467,307. The reported harvest of 4,067,979 kg of catfish alone comprised 48 percent of the freshwater value.

Commercially harvested catfish in Louisiana are mostly channel catfish (*Ictalurus punctatus*) and blue catfish (*I. furcatus*) and to a lesser extent, flathead catfish (*Pylodictus olivaris*). Little life history data on the 2 latter species in Louisiana are available, despite their importance. Channel catfish maturity has received the most attention (Davis and Posey 1958, Lantz 1970, Schafer et al. 1965, and Perry and Carver 1972). Total length-collarbone conversions and length-weight relationships have been reported along with some basic maturity data for blue catfish (Perry and Carver 1972). Virtually no published maturity data exist for flathead catfish in Louisiana, but several workers reported on this fish in northern rivers and impoundments (Barnickol and Starrett 1951, Minckley and Deacon 1959, Turner and Summerfelt 1971). Studies of the reproductive biology and management requirements are needed to determine suitable exploitation rates for sustained optimum yield.

Present commercial size limits in Louisiana are based upon the theory that immature fish must escape harvest to perpetuate the fishery. In establishing these size limits for total length, it is also necessary to describe corresponding collarbone length for aiding in the measurement of (collarboned) fish for enforcement purposes. These comparisons are lacking for flathead catfish in Louisiana.

Many commercial fishermen dress their catch before sale. As a result, records of production are confusing; there is no consistency of reported harvest data. Some markets report dressed weight, some fishermen give live weight and vice versa. Dressout data are described for cannel and blue catfish (Ammerman et al. 1974 and Burnside et al. 1975). Mensinger and Brown (1968) gave data for flathead catfish rough dressed, but included no data for fish which had been both headed and gutted as commonly practiced in Louisiana.

This study was designed to: (1) determine length at maturity for flathead catfish, (2) to compute total length-collarbone length, length-weight, and dressing percent for flathead catfish, and (3) gather additional data on the length at maturity of blue catfish.

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MATERIALS AND METHODS

This study was conducted in the coastal prairie marshes of southwest Louisiana. Fishes were taken from the Superior Canal system of Rockefeller Wildlife Refuge and adjoining Miami Corporation marshes. The complex extends northward for approximately 14.5 km from Grand Chenier, LA to Grand Lake, a 12,800 ha freshwater lake. Catfish were also netted in the Old Intracoastal Canal extending for 5.6 km to the 20,700 ha White Lake.

Data collection for this study began in 1972 and continued through 1977. Gonads of 347 flathead catfish and 2,651 blue catfish were examined for maturity.

Gear used to collect fish included a 4.9 m, 2 cm^2 balloon-type otter trawl; 1.5 x 0.6 m single throated wire traps; 5.1 cm^2 mesh hoop nets; and rotenone. Data collected by these gear was supplemented by periodic examination of fish caught by commercial fishermen on trotlines and in hoop nets.

Gonad observations began in April of each year and continued to the end of July in 1974 and into June of 1975 and 1977. This period afforded visual observations of prespawning gonadal characteristics. Morphological measurements were total length and collarbone length (distance from the posterior end of the cleithrum to the tip of the tail) in mm and weight to the nearest 0.1 lb. Weight was later converted to kgs. After flathead catfish were dressed (headed and gutted, skin still intact) each was re-weighed. Gross field examination of catfish determined sex and gonadal development. Criteria for maturity were similar to those Davis and Posey (1958) used for channel catfish and accepted by Perry and Carver (1972) for both blue and channel catfish. Mature fish included all females in which the overaies were fully swollen or were spent for the present year. Males were considered mature when they possessed enlarged or swollen testes, milkish in color. Fish with stringy and pinkish testes were classed as immature.

Analysis of maturity data included grouping individuals of a species by 10 mm total-length intervals, determining average total lengths, and determining percentage mature for each interval. These values were used in computing a linear regression. Against this regression, the 50 percent mature level was applied for calculated size at maturity for both blue and flathead catfish. Length-weight, total length-collarbone length, and live weight-dressed weight regressions were calculated for flathead catfish by sex. A t-test was used to determine if sexual dimorphism existed.

RESULTS

Flathead Catfish

Length at Maturity. Gonads of 347 catfish were observed. Females comprised 47 percent of the sample. Sizes ranged from 390 mm to 1,080 mm total length (Table 1).

Table 1. Numbers of mature and immature flathead catfish collected from the marshes of southwest Louisiana, 1974, 1975, 1977.

Total Length (mm)	*Mature Males*	*Immature Males*	*Mature Females*	*Immature Females*
390- 439	1	0	0	3
440- 489	1	2	0	4
490- 539	15	6	5	10
540- 589	29	6	12	13
590- 639	24	2	19	10
640- 689	27	0	24	5
690- 739	18	0	18	1
740- 789	16	0	16	1
790- 839	5	0	9	0
840- 889	16	0	9	0
890- 939	7	0	1	0
940- 989	5	0	2	0
990-1,039	2	0	1	0
1,040-1,080	2	0	1	0

Maturity data collected from female flathead catfish revealed 5 of 15 fish in the 490-539 mm size interval were mature. After fish attained this size, percentage maturity for each size interval was progressively greater. The 740-789 mm size group was the largest interval containing immature fish with one immature female (of 17 collected). No immature females were observed in larger size groups, although 23 larger specimens were classed as mature. Collecting began each year in April but spent females were not observed until mid-May 1974, and the first week of June 1975.

The regression equation computed for female flathead catfish is represented in Fig. 1 by $Y = -64.7513 + 0.1949\ X$, where Y = percent maturity and X = total length in mm, r = 0.81. The minimum size at maturity as defined by 50 percent maturity level on this equation was 589 mm for female flathead catfish.

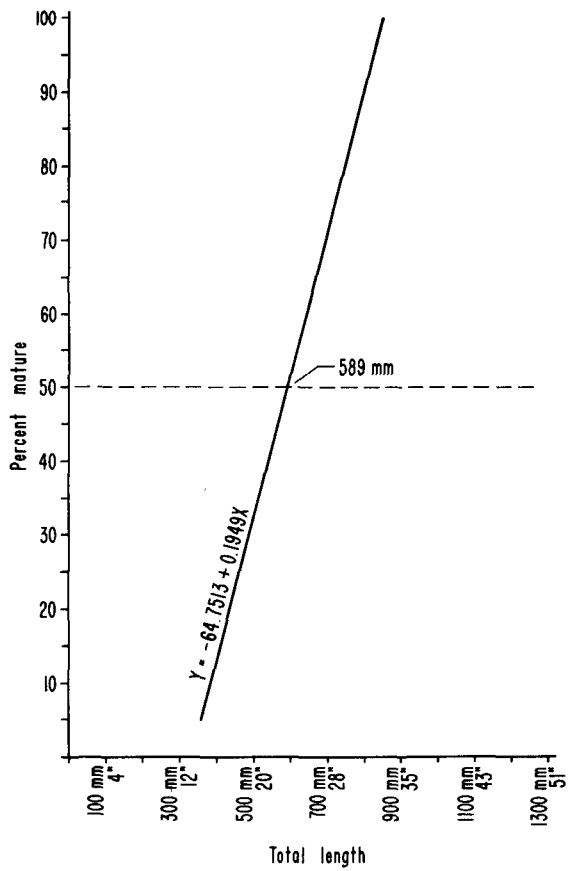

Fig. 1. Length at maturity of female flathead catfish collected from southwest Louisiana marshes, 1974, 1975, and 1977.

One hundred eighty-four male flathead catfish were examined during the study of which 91 percent were mature. The smallest sexually mature male observed was in the 390-439 mm total length size class. Small flathead catfish having testes not swollen, but stringy and creamy in color contained motile sperm. These were classed as mature though they probably would not have spawned during the present year. Immature males were evident in larger classes, but disappeared once the 590-639 mm size was attained.

The equation computed for male flathead catfish was $Y = 46.2159 + 0.0636\ X$, r = 0.48. Due to poor correlation, the regression obtained for male catfish was not included in Fig. 1.

Length-Weight. The mathematical relationship between total length and weight of female and male flathead catfish was non-significant due to sex ($t = 0.4495$; d.f. = 3.30; $P > 0.05$). Therefore an equation with sexes combined was determined and is Log W = −8.9640 + 3.3732 Log L, where W = weight in kg and L = length in mm, r = 0.97 (Fig. 2). Comparison of Table 1 with Fig. 2 indicated female flathead catfish

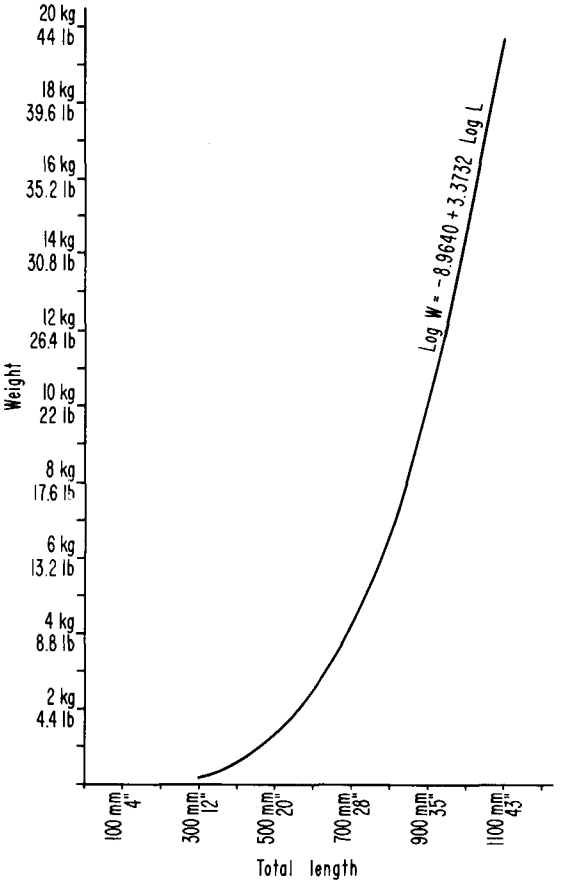

Fig. 2. Length-weight relationships of flathead catfish collected from southwest Louisiana marshes, 1974, 1975, and 1977.

to be approaching maturity at 1.5 kg. Based upon this regression, the fish are approximately 2.4 kg when the 50 percent maturity level is reached.

Total Length-Collarbone Length Conversion. A regression for conversion of total length to collarbone length using observations from 323 flathead catfish was computed. The resulting equation for 156 female and 167 male catfish were non-significant due to sexual dimorphism ($t = 1.267$; d.f. = 323; $P > 0.05$). These data were combined and the regression illustrated in Fig. 3 was obtained (Y = 10.3428 + 0.7251 X, where Y = collarbone length in mm and X = total length in mm, r = 0.99).

Dress-out Conversions. A linear regression was determined for live weight versus cleaned weight of each sex of flathead catfish. Data collected from 143 female and 143 male flathead catfish proved non-significant ($t = 0.4931$; d.f. = 286; $P > 0.05$). Further analysis of the data resulted in Fig. 4 which illustrates the quation Y = 0.3308 + 0.7123 X (where Y = cleaned weight in kg and X = live weight in kg), r = 0.70, obtained when observations for both sexes were combined.

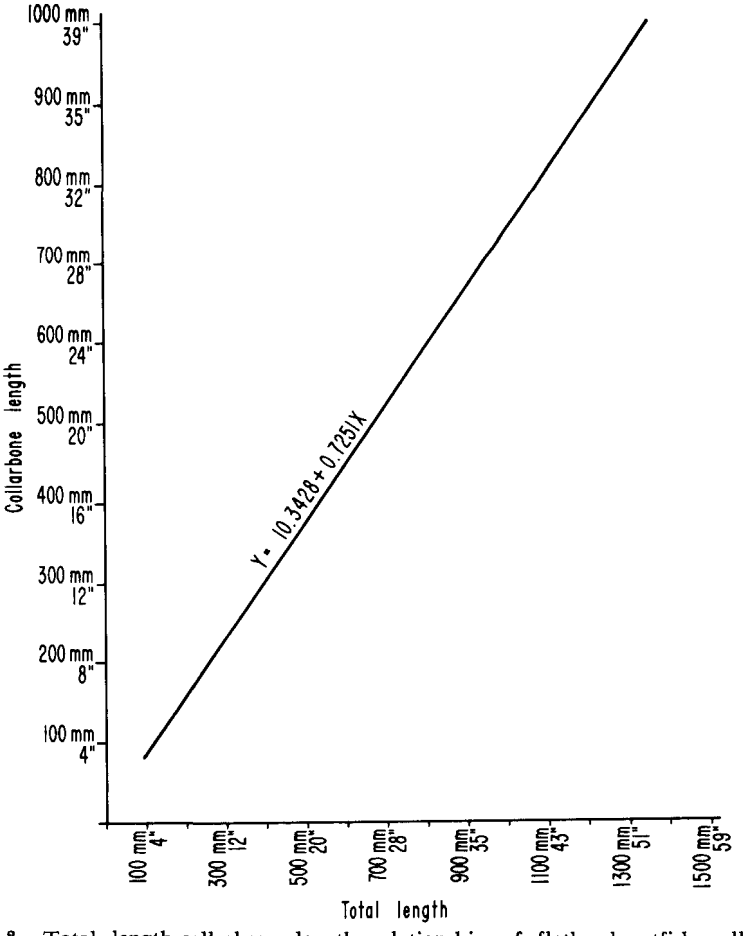

Fig. 3. Total length-collarbone length relationship of flathead catfish collected from southwest Louisiana marshes, 1974, 1975, and 1977.

Blue Catfish Length at Maturity

A total of 1,396 male and 1,255 female blue catfish were observed for maturity. Of the males, 41 percent were sexually mature; and 36 percent of the females contained swollen ovaries with advanced eggs.

The smallest female was in the 100-149 mm interval, the smallest mature in the 350-399 mm interval, and the largest fish in the 850-899 mm size interval. No immature females were observed beyond 699 mm total length (Table 2).

Males ranged from 100 to 930 mm total length. The smallest considered mature was 350 mm total length. Fish observed for maturity between 350 and 649 mm total length range were characterized by a gradual change in maturity. Beyond 649 mm, 100 percent of the males were mature.

A statistical analysis of data revealed the equation $Y = -41.8280 + 0.1878\ X$, $r = 0.92$ for female and $Y = -42.7232 + 0.1956\ X$, $r = 0.93$, for male blue catfish. The 50 percent maturity level as defined by these equations is 489 and 474 mm total length respectively for female and male blue catfish. Further analysis revealed they were not significantly different ($t = 0.3927$; d.f. = 130; $P > 0.05$). Therefore, the regression equation $Y = -42.4860 + 0.1923\ X$, $r = 0.93$, was determined for both sexes combined

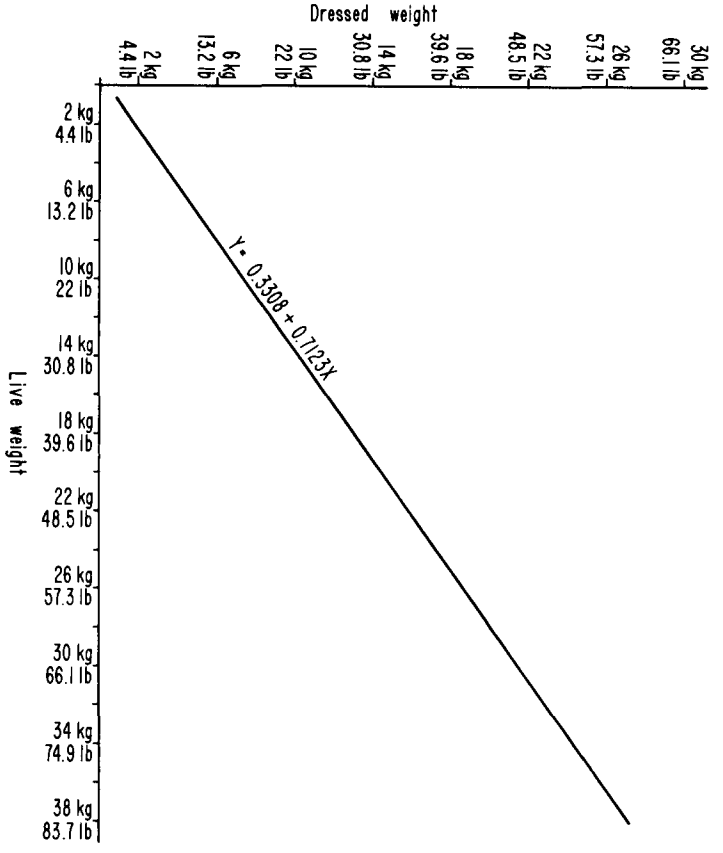

Fig. 4. Live weight-cleaned weight relationship of flathead catfish collected from southwest Louisiana marshes, 1974, 1975, and 1977.

(where Y = percent maturity and X = total length in mm, Fig. 5). This regression suggests that blue catfish in southwest Louisiana may be considered mature once they reach 481 mm total length. Calculated weight for a fish of this size would be 1.1 kg using the length-weight equation described by Perry and Carver (1972).

DISCUSSION

Length at maturity for flathead catfish in southwest Louisiana agrees basically with data of other workers from more northern areas. Barnickel and Starrett (1951) found that flathead catfish mature at lengths of 432 to 483 mm total length in 4 or 5 yr. in the upper Mississippi River. They reported that although the majority of females were 457 mm or more in length, some were mature at sizes less than 381 mm. In Kansas, Minckley and Deacon (1959) reported male flathead catfish mature at 380-460 mm (3 to 5 yr old) and females at 460-510 mm (4 to 6 yr old). A major criterion for their judgment of sexual maturity was observation of 212 spent fish. These researchers were first to report on the loss of the light-colored patch at the tip of the upper lobe of the caudal fin as an indicator of sexual maturity. Turner and Summerfelt (1971) after computing gonadal-somatic indexes and using pectoral and dorsal spines for age determinations concluded female flathead catfish in an Oklahoma reservoir reached maturity at 458 to 573 mm during their fifth to seventh year. The smallest mature female observed was 458 mm. Male flathead catfish matured at 406-421 mm (age groups 4 and 5). Sneed and Green (1961) in a report on culture of this fish stated that this species grows rapidly in most lake habitats and that fish in the 3.2-3.6 kg range are often immature, although in

Table 2. Numbers of mature and immature blue catfish collected from the marshes of southwest Louisiana, 1972, 1974, 1975.

Total Length (mm)	*Mature Males*	*Immature Males*	*Mature Females*	*Immature Females*
100-149	0	1	0	9
150-199	0	17	0	9
200-249	0	26	0	27
250-299	0	20	0	33
300-349	0	31	0	27
350-399	41	272	274	285
400-449	124	301	357	263
450-499	144	95	201	88
500-549	140	42	130	40
550-599	63	7	51	14
600-649	34	4	30	3
650-699	17	0	15	1
700-749	7	0	3	0
750-799	6	0	4	0
800-849	1	0	2	0
850-899	2	0	1	0
900-949	1	0	0	0

some streams 0.4 to 0.9 kg fish may be mature. Fish cultured at the San Marcos State Fish Hatchery in Texas could not be sexed and successfully spawned until 4 yr old and ranged from 1.4 to 2.7 kg (Henderson 1963). Summerville (1970) in a study of egg production of flathead catfish collected from the Arkansas River obtained 4,405 eggs/kg from a 1.7 kg fish.

In southwest Louisiana, female flathead catfish began maturing at 490 mm and all were mature once they reached 790 mm. The 50 percent maturity level when applied to the calculated regression indicated that the fish matured at 589 mm. Males began maturing at 390 mm and all were mature once they reached 640 mm.

Perhaps the fact that flathead catfish in southwest Louisiana did not become sexually mature until larger than described in other studies may best be explained by Sneed and Green (1961). They assumed flathead catfish in reservoirs would mature at larger sizes than in rivers because of faster growth rates. The collection area for this study due to high fertility, abundant forage, and extended growing seasons provides maximum growth.

Live weight-dressed weight were described by Ammerman et al. (1974) and Burnside et al. (1975) as ranging from 55 to 60 percent for channel catfish. Rodger Yant (Personal communication, Plant Manager, Farm-Fresh Catfish, Hollingdale, MS) reported blue catfish dress out from 63 to 65 percent and if skin is left intact, 2 to 3 percent should be added. Eviscerated flathead catfish were described by Mensinger and Brown (1968) as ranging from 78 to 85 percent live weight. The total weight-dressed weight (headed, gutted, and skin still intact) relationship for the present study was best described by the linear regression: $Y = 0.3308 + 0.7123\ X$.

Only one reference was found for length at maturity for blue catfish in the literature in addition to Perry and Carver (1972). Barnickel and Starrett (1951) reported upon the fishes of the upper Mississippi River. They concluded that their data for this species were incomplete and assumed the fish matured at approximately 381 mm. Male blue catfish collected in 1972 approached maturity at 410 mm and were 100 percent mature once the fish reached the 490-499 mm interval. Females were observed mature in the 590-599 mm interval. Additional data included in the present study revealed males began maturing at 350 mm and 100 percent were classed as mature at 650 mm total length. Some females were mature at 350 mm and were all mature at 700 mm. The regression computed for these data with both sexes combined revealed that 50 percent of the fish were mature at 481 mm total length.

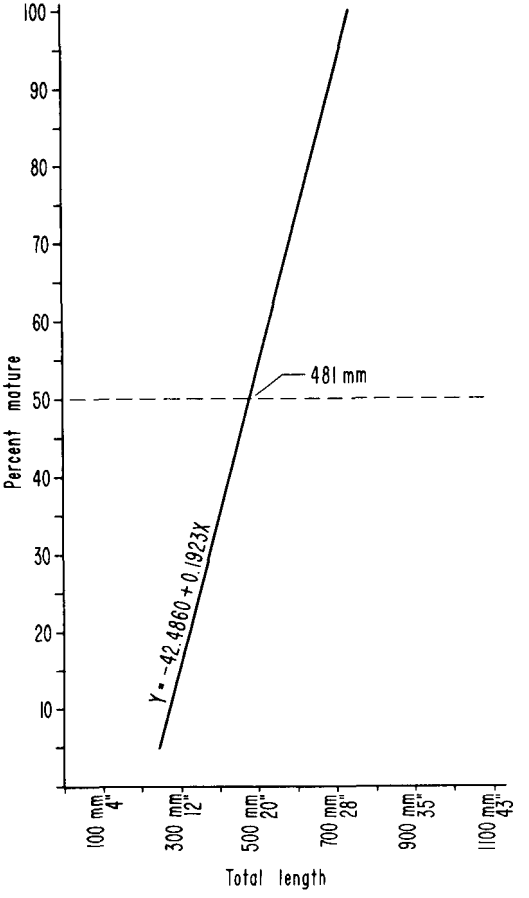

Fig. 5. Length at maturity of blue catfish collected from the marshes of southwest Louisiana, 1972, 1974, and 1975.

LITERATURE CITED

Ammerman, G. R., T. S. Boggess, R. T. Lovell, E. W. McCoy, C. A. Oravetz. 1974. Processing farm raised catfish. Southern Cooperative Series Bull. 193. 59 pp.

Barnickel, P. G., and W. C. Starrett. 1951. Commercial and sport fishes of the Mississippi River between Caruthersville, Missouri, and Dubuque, Iowa. Bull. Ill. Nat. Hist. Surv. 25:267-350.

Burnside, M. C., J. W. Avault, and W. G. Perry. 1975. Comparison of a wild and domestic strain of channel catfish grown in brackish water. Prog. Fish-Cult. 37:52-54.

Davis, J. T., and L. E. Posey. 1958. Length a maturity of channel catfish in Louisiana. Proc. Annual Conf. Southeastern Assoc. Game. and Fish. Comm. 12:72-75.

Henderson, H. 1963. Observations on the propagation of flathead catfish in the San Marcos State Fish Hatchery, Texas. Proc. Annual Conf. Southeastern Assoc. Game and Fish. Comm. 17:173.177.

Lantz, K. E. 1970. An ecological survey of factors affecting fish production in a Louisiana natural lake and river. La. Wildl. and Fish. Comm., D-J Job Compl. Rept. Proj. F-11-R. 92 pp.

Mensinger, G., and B. E. Brown. 1968. Live weight-dressed weight relationship for commercial fishes from four Oklahoma reservoirs. Proc. Annual Conf. Southeastern Assoc. Game and Fish. Comm. 22:465-470.

Minckley, W. L., and J. E. Deacon. 1959. Biology of the flathead catfish in Kansas. Trans. Am. Fish Soc. 88:344-355.

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. Annual Conf. Southeastern Assoc. Game and Fish. Comm. 26:541-553.

Schafer, H., L. Posey, and G. Davidson. 1965. The use of cans in harvesting catfish. Proc. Annual Conf. Southeastern Assoc. Game and Fish. Comm. 19:210-217.

Sneed, K. E., and O. L. Green. 1961. Observations on the culture of flathead catfish (*Pylodictis olivaris*) fry and fingerlings in troughs. Proc. Annual Conf. Southeastern Assoc. Game and Fish. Comm. 15:3-6.

Summerville, V. C. 1970. Egg production of flathead catfish. Prog. Fish-Cult. 32:191.

Turner, P. R., and R. C. Summerfelt. 1971. Reproductive biology of the flathead catfish, *Pylodictus olivaris* (Rafinesque), in a turbid Oklahoma reservoir. Pages 107-119 *in* G. E. Hall ed., Reservoir fisheries and limnology, Spec. Pub. No. 8, Am. Fish. Soc., Washington, D.C.