

# Hoop Net Selectivity and Catch Rates for Channel Catfish

**Michael R. Walker**, Louisiana Department of Wildlife and Fisheries,  
2415 Darnall Road, New Iberia, LA 70560

**Gary Tilyou**, Louisiana Department of Wildlife and Fisheries, P.O.  
Box 98000, Baton Rouge, LA 70898-9000

**Mark G. McElroy**, Louisiana Department of Wildlife and Fisheries,  
P.O. Box 98000, Baton Rouge, LA 70898-9000

---

*Abstract:* A 2-phase study of 6 variations of hoop nets was conducted in 3 Louisiana lakes to determine if mesh size or the addition of escape rings could be used to regulate the catch of channel catfish (*Ictalurus punctatus*) in hoop nets. Commercial and recreational fishermen in Louisiana must abide by a 279.4-mm minimum total length restriction during a year long season. A total of 10,226 channel catfish were caught in 1,033 net days during both phases of the study. In Phase 1, 25.4-, 28.6-, and 31.8-mm (bar) mesh hoop nets were fished. For all channel catfish total lengths, the catch per unit effort (CPUE) of the hoop nets in Phase 1 increased with the decrease in mesh size of the hoop nets. There was no significant difference in the CPUE of lengths >279.4 mm among all 3 mesh sizes. CPUE of lengths <279.4 mm for the 25.4-mm mesh net (6.6) was significantly greater than the 31.8-mm mesh net (0.2). In Phase 2, 25.4-mm mesh hoop nets were altered with placement of 2 different size escape rings to provide 3 more variations of hoop nets. The total catch CPUE of the hoop nets in Phase 2 decreased with an increase in the size of the escape rings and with an increase in the number of escape rings placed in the tail of the net. The only significant difference found in the CPUE of lengths >279.4 occurred between the 25.4-mm mesh net with 4 large rings in the tail (10.3) and the 31.8-mm mesh net (4.6). The CPUE of lengths <279.4 mm in the 31.8-mm mesh net (0.3), the 25.4-mm mesh net with 8 large rings in the tail (8.2), and the 28.6-mm mesh net (8.4) were significantly less than the 25.4-mm net with small escape rings (20.3). There were no significant differences between the 28.6-mm mesh net and the 25.4-mm net modified with large rings. The total catch of the 31.8-mm mesh hoop net consisted of only 7.7% channel catfish with total lengths  $\leq$  279 mm. Sixty-nine percent of all channel catfish caught in the 25.4-mm mesh hoop net were  $\leq$ 279 mm total length. The addition of escape rings to the 25.4-mm mesh net reduced its catch of lengths  $\leq$ 279.4 mm by 22% in the most successful of the modified nets, the 25.4-mm mesh net with 8 large rings in the tail. This study shows that hoop net regulations could be used to selectively harvest length groups of channel catfish.

Management of channel catfish in Louisiana has been accomplished by regulating gear types and imposing minimum length limits for commercial and recreational fishermen. Since the early 1950s some commercial fishermen have sought to reduce the legal minimum length limit of channel catfish to satisfy the developing markets which were seeking smaller catfish. Perry and Williams (1986), Zeringue (1989), and McElroy et al. (1990) gave a thorough historical account of the numerous reports that, in 1972, resulted in the reduction of the minimum length limit from 330 to 279.4 mm. Perry and Carver (1972) justified the 279.4 mm length limit by concluding that a minimum length limit corresponding to the average length at maturity would ensure adequate recruitment.

The mesh size of a hoop net has profound effects on length frequencies of channel catfish in catch data (Hesse et al. 1982). Capture efficiency, size and species selectivity have been shown to vary with mesh size and, although location sampled is a significant part of the variation in size of captured fish, mesh size is the most critical effect (Holland and Peters 1992). Stopha (1994) reported no channel catfish with total lengths below the Mississippi legal minimum length of 305 mm were captured in 38.1-mm mesh (bar) hoop nets and that size selection was attributable to mesh size alone for all species except blue catfish.

Commercial fishermen in Louisiana were successful in having the minimum square mesh size of hoop nets reduced from 50.8 mm to 25.4 mm in the early 1970s. For management purposes, the preferred gear would entrap few channel catfish below the minimum length limit. Researchers were interested in manipulating the length frequency of catch data by using hoop nets with different mesh sizes. Tilyou (1988) demonstrated the effect of grading channel catfish by using escape rings in wire traps. The use of escape rings in 25.4-mm mesh hoop nets was studied for possible use with currently legal hoop nets during a transition period if larger minimum mesh size of hoop nets are required in the future.

Support for this investigation was provided by the Sportfish Restoration Funds, Federal Aid Project F-60.

## Methods

Three lakes were selected to test for potential differences in catches of channel catfish by gear type. These 3 lakes have varying degrees of channel catfish commercial fishing activities.

The Lake Verret-Palourde complex is made up of 2 natural lakes, Lake Verret and Lake Palourde, and many other natural and man-made bayous and canals. The complex is located in south-central Louisiana near Morgan City, St. Mary Parish. Lake Verret is a 5,992-ha freshwater lake that receives water from Bayou Pierre Part to its north. Lake Palourde is a 4,664-ha freshwater lake and is confluent to Lake Verret at its north. Both lakes contain primarily open water areas and have average depths of 1.8 m. Standing and submerged timber is confined to the shoreline areas.

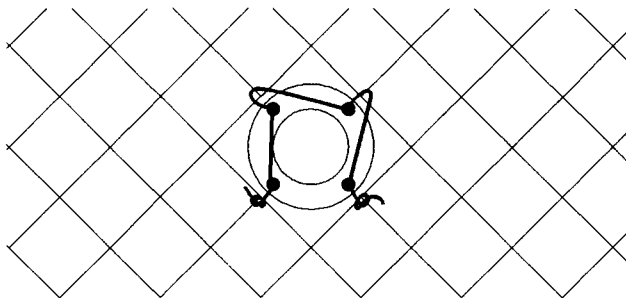
Lake Fausse Pointe is a 6,325-ha freshwater lake located 17.5 km east of

New Iberia, Iberia Parish, in south-central Louisiana. Most freshwater enters Lake Fausse Pointe through Lake Dauterive at its north. Drainage and occasional tidal influences in Lake Fausse Pointe occur through the Charenton Drainage and Navigation Canal at its southern border. Alluvial deposition has occurred throughout the lake which has an average depth of 1.8 m. Standing and submerged timber is sparse and confined to the shoreline areas.

Hoop nets used in this study had 7 76-cm inside diameter (ID) hoops with 3 throats tied to the 2nd, 3rd, and 4th hoops. Hoops were counted with the open end of the net being hoop number 1. Six variations of this design were used. Mesh sizes included 25.4 mm, 28.6 mm, and 31.8 mm (bar). Modified 25.4-mm mesh hoop nets utilizing escape rings provided the other 3 gear types. One modification used large escape rings (41.3 mm ID) which were sewn into hoop nets (Fig. 1) in a configuration as follows: 4 rings in the tail, 4 rings between the 6th and 7th hoops, 4 rings between the 5th and 6th hoops, and 4 rings between the 3rd and 4th hoops (25.4 mm-LR4). Another modification used small escape rings (31.8 mm ID) which were sewn into hoop nets as follows: 8 rings in the tail, 4 rings between the 7th and 6th hoops, and 4 rings between the 5th and 6th hoops (25.4 mm-SR8). The third modification used large rings which were sewn into hoop nets in the same configuration as the small ring net described above (25.4 mm-LR8).

Hoop nets were fished in strings of 3 hoop nets tied throat to tail with 6 m of rope separating each net. Each net was baited with 6 bait bags of either cheese or soybean cake as follows: 1 bait bag behind the first throat, 2 bait bags behind the 2nd throat, and 3 bait bags behind the 3rd throat. Cheese was selected during the cooler months while soybean cake was used during warmer months. Nets were fished from 2 to 4 net days depending on water temperature with fewer net days in summer months. A net day was a 24-hour period. All gears were fished at sample sites selected prior to the beginning of the project.

Hoop net sampling was conducted in 2 phases. In Phase 1, July 1988 to May 1989, hoop net strings consisted of 1 mesh size per string, 25.4 mm, 28.6 mm, or 31.8 mm. Phase 2 started in August 1989 and continued until June 1990. The non-modified 25.4-mm nets were no longer used and a string consisted of



**Figure 1.** How catfish escape rings were tied into mesh of hoop net.

1 28.6-mm mesh hoop net, 1 31.8-mm mesh hoop net, and 1 modified 25.4-mm hoop net with 1 of the 3 ring configurations.

Channel catfish were measured to the nearest millimeter for total length (TL) and length frequency was calculated by gear type. The dependent variable, catch per unit of effort (CPUE), was calculated for total catch of each hoop net type by dividing the total number of channel catfish caught by the total number of net days. CPUE of channel catfish measuring above and below the statewide minimum length was also calculated for each gear type. CPUEs for each gear were tested for significant differences ( $P < 0.05$ ) by Proc GLM (SAS Inst. Inc. 1991) using Duncan's new multiple range test.

## Results

During Phase 1, 1,768 channel catfish were caught in 465 net days. The total catch CPUE (Table 1) for the 25.4-mm mesh net (9.0) was significantly higher than the 31.8-mm mesh net (2.0). No significant differences in total catch CPUE were found between the 25.4-mm and the 28.6-mm mesh nets or between the 28.6-mm and the 31.8-mm mesh nets. All 3 mesh sizes were not significantly different in CPUE of lengths  $>279.4$  mm. For lengths  $<279.4$  mm, the CPUE of the 25.4-mm mesh net (6.6) was significantly greater than the 31.8-mm mesh net (0.2). No significant differences in CPUE of lengths  $<279.4$  mm were found between the 25.4-mm and the 28.6-mm mesh nets or between the 28.6-mm and the 31.8-mm mesh nets.

In Phase 2, 8,458 channel catfish were caught in 568 net days (Table 2). There was a significant difference found in the total catch CPUE between the 28.6-mm mesh net (14.3) and the 31.8-mm mesh net (4.9). No significant difference in total catch CPUE was found between the 25.4 mm-SR8 and the 25.4 mm-LR4 mesh nets. Additionally, no significant difference was found in total catch CPUE among the 25.4 mm-LR4, the 25.4 mm-LR8, or 28.6-mm mesh hoop nets. The only significant difference found in the CPUE of lengths  $>279.4$  occurred between the 25.4 mm-LR4 net type (10.3) and the 31.8-mm mesh net (4.6). For CPUE of lengths  $<279.4$  mm, there was a significant difference between the 25.4 mm-SR8 (20.3) and the 31.8-mm mesh net (0.3). No significant

**Table 1.** Mean catch per net day (CPUE) for 3 hoop net types fished during Phase 1 in Lake Verret, Lake Palourde, and Lake Fausse Point. Means with the same letter are not significantly different ( $P < 0.05$ ).

Gear	N	All lengths			Lengths $>279$ mm			Lengths $\leq 279$ mm		
		Mean CPUE	SD	Duncan grouping	Mean CPUE	SD	Duncan grouping	Mean CPUE	SD	Duncan grouping
25.4 mm	15	9.0	16.4	A	2.5	4.3	A	6.6	12.6	A
28.6 mm	15	4.2	6.9	A B	1.8	3.6	A	2.4	3.4	A B
31.8 mm	15	2.0	1.9	B	1.8	1.7	A	0.2	0.3	B

**Table 2.** Mean catch per net day (CPUE) for 5 hoop net types fished during Phase 2 in Lake Verret, Lake Palourde, and Lake Fausse Point. Means with the same letter are not significantly different ( $P < 0.05$ ).

Gear	N	All lengths			Lengths >279mm			Lengths ≤279mm		
		Mean CPUE	SD	Duncan grouping	Mean CPUE	SD	Duncan grouping	Mean CPUE	SD	Duncan grouping
25.4 mm-SR8 <sup>a</sup>	41	26.8	34.0	A	6.5	8.9	A B	20.3	28.2	A
25.4 mm-LR4 <sup>b</sup>	30	23.5	27.4	A B	10.3	11.6	A	13.2	18.5	A B
25.4 mm-LR8 <sup>c</sup>	38	15.8	29.9	B	7.6	12.8	A B	8.2	19.5	B C
28.6 mm	47	14.3	17.0	B	5.9	7.2	A B	8.4	11.5	B C
31.8 mm	47	4.9	5.0	C	4.6	5.0	B	0.3	0.4	C

<sup>a</sup>25.4 mm mesh with 8 small rings in tail of net.

<sup>b</sup>25.4 mm mesh with 4 large rings in tail of net.

<sup>c</sup>25.4 mm mesh with 8 large rings in tail of net.

**Table 3.** Length frequency of channel catfish captured in 6 hoop net types from Lake Verret, Lake Palourde, and Lake Fausse Point. Entries are percentages of the total number of fish caught corresponding to the length group for each net type.

Length group (mm)	Type hoop net					
	25.4 mm N = 707	28.6 mm N = 2,283	31.8 mm N = 917	25.4mm-SR8 <sup>a</sup> N = 2,966	25.4mm-LR4 <sup>b</sup> N = 1,599	25.4mm-LR8 <sup>c</sup> N = 1,400
77-102	0.1					
103-127			0.1			0.1
128-152	0.8	0.3	0.4			
153-178	0.6	0.4	0.4		0.1	0.1
179-203	1.0	0.6	0.3	0.5	0.4	0.4
204-229	8.2	1.9	0.3	8.9	2.2	3.1
230-254	30.6	15.7	0.9	33.2	12.6	10.6
255-279	27.7	39.7	5.3	32.5	36.2	32.7
280-305	15.0	23.6	32.7	14.8	33.4	32.6
306-330	7.8	9.1	33.4	5.9	9.1	12.4
331-356	4.2	5.3	15.5	2.6	3.3	4.6
357-381	3.2	2.2	6.8	1.1	1.4	2.0
382-406	0.7	0.9	3.0	0.4	1.1	0.9
407-432		0.3	0.6	0.1	0.1	0.2
433-457		0.1	0.2		0.1	0.1
458-483		0.1			0.1	
484-508					0.1	

<sup>a</sup>25.4 mm mesh with 8 small rings in tail of net.

<sup>b</sup>25.4 mm mesh with 4 large rings in tail of net.

<sup>c</sup>25.4 mm mesh with 8 large rings in tail of net.

differences were found between the 25.4 mm-SR8 and the 25.4 mm-LR4 net types or among the 25.4 mm-LR4, the 25.4 mm-LR8, or the 28.6-mm mesh net. There also were no significant differences in the CPUE of lengths <279.4 mm among the 25.4 mm-LR8 (8.2), the 28.6 mm (8.4), or the 31.8-mm mesh nets.

The length frequency distribution (Table 3) for all hoop net types shows that the 31.8 mm mesh hoop net total catch consisted of only 7.7% channel

catfish with total lengths  $\leq 279$  mm. Sixty-nine percent of all channel catfish caught in the 25.4-mm mesh hoop net were  $\leq 279$  mm TL. A comparison of length distributions for nets fished in both phases shows that the catch of lengths  $\leq 279.4$  mm for the 28.6-mm mesh net was 60.3% in Phase 1 (Table 4) and 58.1% in Phase 2 (Table 5). For lengths  $\leq 279$  mm, the percent of catch for the 31.8-mm mesh was 10.9% for Phase 1 and 6.2% for Phase 2. In Phase 2 the catches of lengths  $\leq 279$  mm by the 25.4 mm-SR8, 25.4 mm-LR4, and the 25.4 mm-LR8 nets were 75.1%, 51.5%, and 47.0%, respectively.

## Discussion

The preferred method of fishing channel catfish populations by commercial fishermen is with 25.4-mm mesh hoop nets, but their catch in both numbers and biomass are predominately fish below the 279.4-mm minimum TL limit (La. Dep. Wildl. and Fish. (LDWF) unpubl. data). LDWF biologists observed some nets catching channel catfish in excess of 230 kg/net of which an approximate 70% were below 279.4-mm TL. The usual routine for running hoop nets is to dump the entire contents of the net onto the deck or into a sorting area. Undersized individuals are handpicked and returned to the water. This process of grading is stressful to the fish and no doubt results in mortality to some of these undersize fish.

This study demonstrates that only the 31.8-mm mesh net allows substantial

**Table 4.** Length frequency of channel catfish captured during Phase 1 in 3 hoop net types from Lake Verret, Lake Palourde, and Lake Fausse Point. Entries are percentages of the total number of fish caught corresponding to the length group for each net type.

Length group (mm)	Type hoop net		
	25.4 mm <i>N</i> = 707	28.6 mm <i>N</i> = 440	31.8 mm <i>N</i> = 267
77-102	0.2		
103-127		0.4	
128-152	0.9	0.7	0.8
153-178	0.6	0.7	0.4
179-203	0.9	0.4	0.4
204-229	8.5	2.0	0.4
230-254	31.0	18.6	2.2
255-279	28.1	37.5	6.7
280-305	13.7	23.9	36.7
306-330	7.6	9.6	33.3
331-356	4.5	3.2	12.7
357-381	3.4	2.0	3.8
382-406	0.8	1.1	2.2
407-432		0.2	

**Table 5.** Length frequency of channel catfish captured during Phase 2 in 5 hoop net types from Lake Verret, Lake Palourde, and Lake Fausse Point. Entries are percentages of the total number of fish caught corresponding to the length group for each net type.

Length group (mm)	Type hoop net				
	28.6 mm <i>N</i> = 1,843	31.8 mm <i>N</i> = 650	25.4 mm-SR8 <sup>a</sup> <i>N</i> = 2,966	25.4 mm-LR4 <sup>b</sup> <i>N</i> = 1,699	25.4 mm-LR8 <sup>c</sup> <i>N</i> = 1,400
77-102					
103-127					0.1
128-152	0.2				
153-178	0.3	0.5		0.1	0.1
179-203	0.6	0.3	0.5	0.4	0.4
204-229	1.8	0.3	8.9	2.2	3.1
230-254	15.0	0.3	33.2	12.6	10.6
255-279	40.2	4.8	32.5	36.2	32.7
280-305	23.5	31.1	14.8	33.4	32.6
306-330	9.0	33.4	5.9	9.1	12.4
331-356	5.8	16.6	2.6	3.3	4.6
357-381	2.2	8.0	1.1	1.4	2.0
382-406	0.9	3.4	0.4	1.1	0.9
407-432	0.3	0.8	0.1	0.1	0.2
433-457	0.1	0.3		0.1	0.1
458-483	0.1			0.1	
484-508				0.1	

<sup>a</sup>25.4 mm mesh net with 8 small rings in tail of net.

<sup>b</sup>25.4 mm mesh net with 4 large rings in tail of net.

<sup>c</sup>25.4 mm mesh net with 8 large rings in tail of net.

escapement of channel catfish under 279.4-mm TL. Only 7.7% of the catch of this net was at or below 279-mm TL. The 25.4-mm mesh net caught 69% undersize fish and the 28.6-mm mesh net caught 58.6%. The addition of escape rings to the small mesh nets did reduce the number of undersize fish caught to 47% in the most successful of these modified nets, the 25.4 mm-LR8.

The population of structures of channel catfish in Louisiana and the landing of large numbers of undersize fish indicate that a change from 25.4-mm mesh hoop nets to nets with 31.8 mm mesh could be beneficial to the channel catfish populations in these lakes. Such a change may increase the number of fish reaching the minimum size limit by reducing the accidental but unavoidable mortality associated with releasing undersize fish from hoop nets. The use of escape rings in 25.4-mm nets during a transition period would ease the financial burden on the commercial fishermen while reducing the catch of undersize fish by 32%.

## Literature Cited

- Hesse, L. W., G. Zuerlein, B. Newcomb, and L. A. Devore. 1982. The relationship of hoopnet mesh size to channel catfish catches. Pages 40-43 in L. W. Hesse, ed. The Missouri River channel catfish. Neb. Game and Parks Comm., Neb. Tech. Ser. 11, Norfolk, Neb.

- Holland, R. S. and E. J. Peters. 1992. Differential catch by hoop nets of three mesh sizes in the lower Platte River. *North Am. J. Fish. Manage.* 12:237-243.
- McElroy, M. G., T. Morrison, and R. Gouguet. 1990. Age, growth, and maturity of channel catfish in two southeast Louisiana lakes. *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 44:13-19.
- 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. Game and Fish Comm.* 26:541-553.
- and A. Williams. 1986. A note on size differences of channel catfish, *Ictalurus punctatus*, collected from southwest and southeast Louisiana. *Proc. La. Acad. Sci.* 49:45-52.
- SAS Institute, Inc. 1991. *SAS/STAT guide: Vers. 6 Ed.* Cary, N. C. 1028pp.
- Stopha, M. E. 1994. Hoop and mesh size influences on hoop net catches of buffalofishes (Catostomidae) and catfishes (Ictaluridae) in the upper Yazoo River basin of north-central Mississippi. M.S. Thesis, Miss. State Univ., Mississippi State. 62pp.
- Tilyou, G. A. 1988. Effects of wire traps on gamefish. *La. Dep. Wildl. and Fish., Baton Rouge. Final Rep., Fed. Aid Proj. F-48*, 49pp.
- 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.