Comparison of Electrofishing and Hoop Nets for Collecting Blue Catfish in 2 South Texas Rivers

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Abstract: Baited hoop nets and low-frequency DC electrofishing were compared to determine which method would provide numbers of blue catfish (*Ictalurus furcatus*) to sufficiently describe population characteristics using the least effort in 2 South Texas rivers. Catfish were collected with both gear types, July–August, 1995–1996. Electrofishing resulted in 11.4 fish/man-hour of effort, while hoop netting resulted in 0.1 fish/man-hour. Size of fish collected ranged from 42 to 865 mm with electrofishing and from 320 to 398 mm with hoop netting. Low-frequency DC electrofishing provides an efficient method for collecting blue catfish in South Texas rivers during summer.

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Catfishes rank second in popularity among Texas anglers (Ditton and Hunt 1996) and are the primary sport fish in many Texas rivers. In 1994, the Texas Parks and Wildlife Department (TPWD) began surveying riverine catfish populations during summer months. Gill nets were considered impractical for riverine fishery surveys due to abundant woody snags, recreational boat traffic, and flow; therefore, survey crews elected to use hoop nets for the survey period (Jun through Sep). Hoop nets were baited with cheese trimmings and set near instream woody cover. Although anecdotal reports indicate blue catfish are abundant in many South Texas rivers, baited hoop net catch rates are often so low they preclude any population assessment.

Hoop nets are considered an effective sampling gear for catfishes in lotic systems (Hubert 1983), but may be seasonally biased in relation to periods when fish movement is greatest (Gerhardt and Hubert 1989, Stopha 1994) and size and species of fish captured (Holland and Peters 1992). Gerhardt and Hubert (1989) found hoop nets baited with cheese caught more channel catfish (*I. punctatus*) during the postspawning period. Pierce et al. (1981) found that hoop nets baited with soybean cake may reduce catches of flathead catfish (*Pylodictis olivaris*). Hoop nets have been shown to be size-selective based on mesh size (Hesse et al. 1982, Holland and Peters 1992) and possibly hoop size (Bernard et al. 1991, Stopha 1994).

Much information exists concerning low-frequency DC electrofishing for catfish, but evaluation of the technique's effectiveness has been limited primarily to flathead catfish (Quinn 1986, Gilliland 1987, Pugibet and Jackson 1989). Justus (1994)

determined blue catfish could be collected over a wide range of DC pulse rates, but had greatest success at 15 pulses/sec. Success rate also varied with water temperature, with optimum conditions ranging from 27 to 31 C (Justus 1994). Nelson and Little (1986) determined hoop nets were more efficient than DC electrofishing for collecting blue catfish in North Carolina, but did not report the current frequency used. Pugibet and Jackson (1989) found low-frequency DC electrofishing more effective than hoop nets in sampling small flathead catfish (<280 mm), while overall catch rates did not differ.

Since 1993, TPWD biologists have been experimenting with collecting catfishes using low-frequency DC electrofishing as an alternative to hoop netting. Biologists reported varying degrees of success in rivers across the state, and a decision was made to compare the 2 gear types. The objectives of this study were to compare size distribution and total catch/effort of blue catfish caught from 2 rivers using hoop nets and low-frequency DC electrofishing during summer.

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Methods

The Nueces River drains a large semi-arid region of South Texas and is impacted by 2 major reservoirs. These reservoirs and low rainfall (50–75 cm/year) result in low flows throughout much of the year. The lower section drains the coastal plain area surrounding Corpus Christi and has good public access. The Guadalupe River, in contrast, drains a portion of south-central Texas and has only 1 major and several smaller reservoirs in the upper river. Watershed rainfall is heavier (55–100 cm/year) and the lower river section is subject to frequent flooding. The lower section drains the coastal plain area south of Victoria and has poor public access. Flow is usually lowest in both rivers during summer.

The Nueces River was sampled in July and August 1995 and the Guadalupe River was sampled in July and August 1996. Three reaches in the lower coastal section of each river were sampled. Each reach was separated into an upper and a lower site. One gear type was randomly chosen for the upper site while the remaining gear type was employed in the lower site. Sites were separated by ≥0.8 km.

Hoop nets consisted of 25.4-mm bar mesh and ranged from 3.0 to 3.7 m in length. Nets were constructed using 7 hoops, ranging from 1.00 m to 1.07 m at the entrance and tapering to 0.76 m at the cod end. Six nets, baited with commercial cheese trimmings, were each fished 48 hours (12 net-nights) on each river reach. Previous electrofishing surveys indicated blue catfish were concentrated around instream snags; thus, hoop nets were placed parallel to the current within or slightly upstream of large snags.

Low-frequency DC electrofishing was conducted concurrently with hoop net surveys. Electrofishing equipment consisted of a Smith-Root GPP 5.0 pulsator and

generator system mounted in an 18-foot aluminum boat. Two umbrella-type anodes were used while the boat hull served as the cathode. Direct current with a pulse rate of 15 Hz was used. The pulse width was adjusted as necessary, usually 40%–60%, to maintain a minimum of 2 amperes. Thirty minutes of electrofishing were conducted within each reach. The operator maneuvered the boat slowly downstream in a figure-S pattern as described by Quinn (1986). Although electrofishing was not limited to woody structure, most snags were located within 30 m of each other and within the effective electrofishing field.

Two people were required for hoop netting surveys and 3 people were required for electrofishing surveys. Effort was expressed in man-hours and did not include travel time or fish work-up time. The study encompassed a total effort of 24 man-hours (72 net-nights) of hoop netting, and 9 man-hours (3 hours) of electrofishing. To compare the gear types based on effort, catch rates were expressed on a per man-hour basis.

Conductivity, surface water temperature, surface dissolved oxygen, and secchi depth measurements were recorded prior to each sampling event (Table 1). Stream flow data for the nearest upstream gauge recorder was obtained from U.S. Geological Survey discharge records.

Blue catfish collected were measured to the nearest mm total length and weighed to the nearest g. All fish were returned to the water.

Low sample sizes for hoop nets precluded quantitative length-frequency comparisons. Prior experience indicated that while electrofishing samples consisted of a wide size range of fishes, hoop netting samples selected only larger fish. Catch rates of these larger fish are important to managers as they are considered to be recruited into the fishery (subject to a 305-mm minimum length limit in Texas). In an effort to better compare catch rates between the 2 gear types, analyses were done for 2 size groups, fish ≥300 mm and all fish. Student's *t*-test was used to compare overall catch/man-hour between rivers for each gear type and between gear types for both rivers combined.

Table 1. Average and range of selected habitat parameters measured during blue catfish surveys, Texas, July–August 1995–1996.

Parameter	Nueces River		Guadalupe River	
	Average	Range	Average	Range
Conductivity (µmhos/cm)	863	400–900	683	500–850
Water temperature (C)	29.7	29–31	29.3	28–32
Secchi disk reading (cm)	35	5–60	40	10–60
Dissolved oxygen (mg/liter)	7.1	5–8	5.4	5–6
Water depth (m)	2.3	2–4	3.7	2–5
Channel width (m)	19.9	15–27	30.5	20–42
Sample period discharge (m^3/sec)[a]	7	1–12	16	4–37
Mean annual discharge (m^3/sec)[a]	21		82	
Drainage area (km^2)[a]	43,823		26,232	

a. Data taken from U.S. Geological Survey.

Results and Discussion

No blue catfish were collected with hoop nets from the Nueces River; however, 27 were collected with electrofishing. Fish ranged in size from 42 to 625 mm (Fig. 1). From the Guadalupe River, 2 fish were collected with hoop nets (320 and 398 mm) and 75 with electrofishing. Fish collected by electrofishing ranged from 45 to 865 mm long (Fig. 1). Although hoop net catch rates were low for blue catfish, a

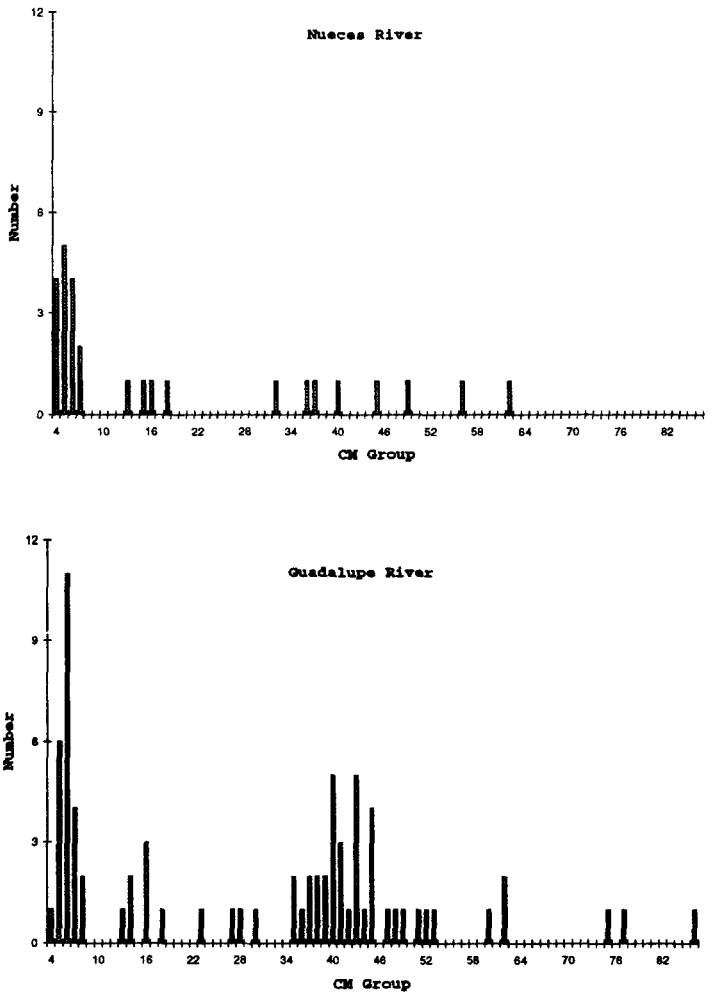

Figure 1. Number and total length of blue catfish collected using low-frequency DC electrofishing, Nueces and Guadalupe rivers, Texas, July–August 1995–1996.

Table 2. Catch composition of hoop nets set in the Nueces and Guadalupe rivers (72 net-nights), Texas, July–August 1995–1996.

Common name	Scientific name	*N* caught
Spotted gar	*Lepisosteus oculatus*	1
Longnose gar	*L. osseus*	6
Alligator gar	*L. spatula*	1
Common carp	*Cyprinus carpio*	1
Smallmouth buffalo	*Ictiobus bubalus*	12
Blue catfish	*Ictalurus furcatus*	2
Channel catfish	*I. punctatus*	6
Flathead catfish	*Pylodictis olivaris*	1
Green sunfish	*Lepomis cyanellus*	2
Bluegill	*L. macrochirus*	4
Longear sunfish	*L. megalotis*	1
White crappie	*Pomoxis annularis*	2
Black crappie	*P. nigromaculatus*	4

number of non-target species were captured in both rivers in the hoop nets (Table 2). Low-frequency electrofishing occasionally stunned scaled fish, but appeared to be very selective for catfish species.

There were no significant differences between the 2 rivers for fish of all lengths sampled by either gear type (electrofishing $df = 3$, $P = 0.3140$; hoop netting $df = 3$, $P = 0.3739$), or for those ≥300 mm long (electrofishing $df = 3$, $P = 0.3608$; hoop netting $df = 3$, $P = 0.6667$). Therefore data from both rivers were combined for catch rate analyses by gear type.

For both rivers combined, electrofishing resulted in an average catch rate of 11.4 fish/man-hour, whereas hoop netting resulted in an average catch rate of 0.1 fish/man-hour (Table 3). Although electrofishing catch rates were not significantly higher ($df = 5$, $P = 0.0655$) than those of hoop nets, variability among sampling sites was high for both gear types (electrofishing SE = 4.78; hoop netting SE = 0.09). No fish were collected at 2 electrofishing sites (1/river) located near angler access points.

For blue catfish ≥300 mm, electrofishing resulted in an average catch rate of 5.3 fish/man-hour, whereas hoop netting resulted in an average catch rate of 0.1 fish/man-hour (Table 3). Electrofishing catch rates were not significantly higher ($df = 5$, $P = 0.1540$) than those of hoop nets, while variability among sampling sites

Table 3. Catch/effort of blue catfish collected from the Nueces and Guadalupe rivers, Texas, July–August 1995–1996.

Gear	Effort[a]	River	*N* caught/man-hour	
			All lengths	≥300 mm
Low-frequency DC electrofishing	1.5	Guadalupe	16.7	9.1
	1.5	Nueces	6.0	1.8
Hoop netting	36	Guadalupe	0.2	0.2
	36	Nueces	0.0	0.0

a. Electrofishing effort in man-hours; hoop netting effort in net-nights.

was high for both gear types (electrofishing SE = 4.27; hoop netting SE = 0.06).

High variability within each system masked any significant differences between the 2 rivers. Apparent, though non-significant, differences in electrofishing catch rates between the 2 rivers may be reflective of differences in fish abundance. The lower Guadalupe River has relatively unregulated flow and an abundance of instream woody structure. In addition, public access is poor, likely resulting in low angler exploitation. In contrast, the Nueces River has flow regulated by upstream reservoirs, less woody structure and well-developed public and private access, likely resulting in high angler exploitation.

Low catch rates in hoop nets may have been caused by several factors. Hoop nets may be more effective if fished when fish movement is greatest, such as during the spring spawning period. This study was conducted during the post-spawn period when reduced catfish movements may have resulted in decreased contact with nets. Flow in both rivers was negligible throughout most of the study period, and may have minimized distribution of bait scent. Although local anglers catch blue catfish on cheese baits, it is unknown if this bait selects for a certain size of fish.

The high variability in electrofishing catch rates may be reflective of fish abundance due to angler exploitation or habitat. Catch rates of blue catfish were substantially higher in the less accessible areas of both rivers. Gilliland (1987) reported catch rates of flathead catfish were most affected by type of habitat electrofished. However, although no quantitative measures of habitat were made in this study, the abundance of woody structure appeared similar throughout all sampling reaches.

During electrofishing, stunned blue catfish would surface within approximately 30 m of the boat, 15–90 sec after encountering the current. Fish would either thrash on the surface or lay motionless. Although electroshocked blue catfish exhibited behavior similar to that reported for flathead catfish (Quinn 1986), they stayed on the surface longer than flathead catfish. Many more fish were observed than could be collected. The addition of a "chase" boat would increase catch rates at the expense of extra manpower. Fish exhibited similar behavior in both rivers, likely a result of similar water quality characteristics (Table 1).

The large variability associated with the low number of sampling sites likely resulted in a low power statistical test. Additionally, electrofishing sampled fish as small as 42 mm which could not be sampled by the hoop nets. Holland and Peters (1992) indicated that although hoop nets with 25-mm mesh provided the highest catch rates, several mesh sizes need to be fished to adequately sample population size structure. With this in mind, low-frequency DC electrofishing can be effective at providing adequate sample sizes of blue catfish across a wide size range in certain rivers with minimal effort. Results of this study indicate it to be a more effective sampling gear not subject to the seasonal variability which appears to be associated with hoop netting.

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