# Current Trends in Catfish Sampling Techniques and Information Needs

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*Abstract:* Catfish managers and researchers were asked to participate in an online survey describing current information needs, sampling techniques, and known gear biases for projects during 2002–2006. One hundred eighty two responses were collected in a four-month period in early 2006. Channel catfish (*Ictalurus punctatus*) were the most targeted species, followed by flathead (*Pylodictis olivaris*) and blue (*I. furcatus*) catfish, respectively. A variety of methods were used to collect catfishes. Flathead and blue catfish were most often sampled by low-frequency electrofishing (30 Hz or less), whereas channel catfish were often sampled with a variety of gears. Sixty-one percent of respondents indicated a need for information concerning sampling gear efficiency and gear bias. Limited quantitative information exists regarding bias of gears used to sample catfish, especially low-frequency electrofishing. As catfish sampling increases, future research should focus on quantifying the bias associated with various collection techniques so that the associated population metrics can be validated.

*Key Words:* catfish, sampling techniques, gear bias, online survey

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As interest in catfish angling has increased and evolved, so has the need for scientifically based catfish management. Many state and federal agencies that once paid little attention to catfish are now looking for ways to assess and manage catfish resources (Michaletz and Dillard 1999, Rachels and Ashley 2002). In the southeast and the majority of the United States, the most sought after species of ictalurids are channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), and blue catfish (*I. furcatus*) (Vokoun and Rabeni 1999). During the 2002–2006 time period, 18 articles dealing with catfishes were published in the North American Journal of Fisheries Management whereas in the 10 years prior to that (1992–2001) only 17 catfish related articles were published in the same journal. Catfish managers need accurate and reliable data in order to face the challenge of creating trophy fisheries and sustaining harvest (Arterburn et al. 2002).

When researchers and managers sample catfish populations, many have encountered problems collecting adequate samples or questioned if the samples they collected were representative of their respective populations. Techniques developed to collect catfishes with lower labor requirements, including tandem baited hoop nets (Sullivan and Gale 1999) and low-frequency electrofishing (Gilliland 1988), may produce sample biases that have yet to be quantified. Managers need to know gear bias in order to accurately estimate population parameters (Sokal and Rohlf 1995) and make informed management decisions.

This survey was conducted under the auspices of the Catfish Management Technical Committee of the Southern Division of the American Fisheries Society in cooperation with the North Central Division Ictalurid Technical Committee. The objectives of this survey were to identify current information needs of catfish managers and researchers, to summarize current sampling techniques, and to identify known biases of sampling techniques.

## Methods

A web-based survey was created in 2005 by a subcommittee of individuals from both the Southern Division and the North Central Division of the American Fisheries Society using Survey Monkey (2005). Questions included contact and classification information, queries about self-perceived information needs, listing of catfish projects performed in the last five years, and an option to give detailed information on up to three catfish sampling projects. This survey was beta-tested by members of both committees and further refined to its final form. Participation in the survey was solicited beginning December 2005 on the "Ictalurids" list-server and in February 2006 via the American Fisheries Society email list.

## Results and Discussion

From December 2005 to April 2006, 182 valid responses were submitted. Survey participants came from 39 different states (Figure 1), four from Canada and one from Peru. Most participants (72%) classified themselves as being part of a state agency while academic institutions (including USGS Cooperative Fish and Wildlife Research Units) were the second most abundant at 17%.

Participants were asked to indicate all the catfish projects they had participated in by species and habitat type during 2002–2006 (Table 1). After grouping together habitat types, 79% of the participants had worked with channel catfish, 55% with flatheads, 42% with blue catfish, 26% with bullheads (*Ameiurus* spp.), 14% with white catfish (*Ameiurus catus*), and 7% with other species. Free flowing rivers and streams were the most often sampled unique


**Figure 1.** Geographical distribution of survey respondents in the United States.

**Table 1.** Percentage of respondents that sampled catfish species from 2002–2006 by habitat type (*n*=154).

| Species | Lakes & reservoirs (200 + ha) | Small impoundments (<200 ha) | Free flowing rivers & streams | Large navigation rivers | Tailwaters |
|---|---|---|---|---|---|
| Channel catfish | 40 | 41 | 40 | 26 | 8 |
| Flathead catfish | 25 | 12 | 36 | 25 | 10 |
| Blue catfish | 20 | 9 | 21 | 21 | 8 |
| White catfish | 3 | 4 | 8 | 7 | 1 |
| Bullhead catfish | 10 | 12 | 16 | 9 | 2 |
| Other catfish | 2 | 2 | 4 | 4 | 1 |

habitat with 54% of the respondents indicating that they had sampled this habitat for at least one species of catfish during the five-year time period. When responses were grouped by water type, 66% of the participants had sampled in lotic systems while 59% had sampled in lentic systems.

Participants were asked to indicate whether their agency had a standardized technique for each species and habitat type listed (Table 2). When responses were compared from individuals within the same agency, agreement rarely occurred. In fact the only agencies whose members' responses agreed entirely were those that listed no standardized protocols. Even if internal disagreement is ignored it is important to note that over 65% of all respondents reported no standardized techniques for sampling any catfish species.

## Information Needs

Responses to the question "What are your most important information needs in regards to catfish sampling?" were reviewed and sorted into general categories (Table 3). Many participants gave responses which fit multiple categories. This classification revealed that concerns about gear bias and gear efficiency dominated 61% of the responses. The only other category to receive more than 5% of the responses was "population metrics" which accounted for 26% of the responses. The need for population metric information can also be related back to gear bias since valid estimates of population metrics depend on unbiased samples.

## Current Sampling Techniques

Information was submitted concerning 154 individual projects involving catfishes. Projects were classified as dealing with one species or multiple species. For simplicity, only those involving one species of catfish were further analyzed to gauge the current methods used to evaluate catfish populations. Fifty-four projects focused solely on channel catfish, 32 on flathead catfish, and 12 on blue catfish. Catfishes were sampled in 48% of the studies using electrofishing (high-frequency and low-frequency combined), 26% used hoop nets, and 23% used gill nets. However, when broken down by species and habitat type some interesting patterns emerged (Table 4.). Low frequency electrofishing was used in 67% and 59% of the blue and flathead catfish studies, respectively. Flat-

**Table 2.** Percentage of respondents that stated their organization had standardized methods for sampling catfish (*n*=172).

| Species | Lakes & Reservoirs (200+ha) | Small Impoundments (<200ha) | Free Flowing Rivers & Streams | Large Navigation Rivers | Tailwaters |
|---|---|---|---|---|---|
| Channel catfish | 33 | 28 | 23 | 18 | 2 |
| Flathead catfish | 18 | 10 | 19 | 15 | 2 |
| Blue catfish | 16 | 8 | 13 | 12 | 2 |
| White catfish | 3 | 2 | 6 | 5 | 0 |
| Bullhead catfish | 6 | 5 | 11 | 7 | 1 |
| Other catfish | 2 | 1 | 3 | 2 | 0 |

**Table 3.** Classification of self-reported information needs of catfish managers and researchers (*n*=157).

| Classification | Classification criteria | Percent |
|---|---|---|
| Gear efficiency | Determining which methods collect the most fish consistently per unit effort over different habitats and for different species | 34 |
| Gear bias | Determining size/age selectivity, seasonal/water condition variability, and/or sexual selection by gear type | 27 |
| Population metrics | Recruitment, mortality, length frequency, exploitation | 26 |
| Standardized methods | Developing widely accepted standardized sampling techniques for different catfish species | 4 |
| Life history | Determining age at sexual maturity, maximum age/size, spawning behavior | 3 |
| Ecological interactions | Determining introduced catfish interactions with other species (including native catfishes) | 2 |
| Abiotic factors | Temperature, water quality, etc | 1 |
| Age validation | Aging techniques represent actual ages | 1 |
| Fish health | Disease and parasite detection methods | 1 |
| Marking techniques | Developing reliable marking techniques | 1 |

**Table 4.** Techniques used by survey respondents when describing individual catfish sampling projects.

| | | Techniques | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Catfish species | Habitat | HF EF[b] | LF EF[c] | HN[d] | TD HN[e] | GN[f] | Set/trot lines | Trawl | Trap nets | Slat traps | Totals |
| Channel | SI[a] | 4 | 0 | 0 | 5 | 4 | 1 | 0 | 2 | 1 | 17 |
| Channel | River | 5 | 3 | 6 | 1 | 4 | 3 | 1 | 4 | 1 | 28 |
| Channel | Reservoir | 2 | 0 | 1 | 1 | 10 | 1 | 0 | 0 | 0 | 15 |
| Blue | SI | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| Blue | River | 2 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 7 |
| Blue | Reservoir | 0 | 4 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 9 |
| Flathead | SI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flathead | River | 4 | 14 | 7 | 1 | 1 | 3 | 0 | 0 | 1 | 31 |
| Flathead | Reservoir | 0 | 5 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 8 |

a. SI = small impoundment (less than 200 ha)
b. HF EF = electrofishing with 60 Hz or greater
c. LF EF = electrofishing with 30 Hz or less
d. HN = hoop netting
e. TD HN = tandem baited hoop nets
f. GN = gill nets

**Table 5.** Summary of reported catfish sampling gear bias.

| Catfish species | Habitat sampled | Sampling gear | Observed gear bias |
|---|---|---|---|
| Channel | Impoundment | Experimental gill nets | Young of year fish are not adequately represented. Large individuals are under-represented. Does not sample age 1 and 2 effectively. |
| | | Trot lines and experimental gill nets | Trot lines yield higher maximum size. |
| | | Tandem baited hoop nets | Fish less than 250 mm not caught in proportion to abundance. |
| | River | High-frequency electrofishing | More effective than baited and un-baited hoop nets, trotlines, and angling. |
| | | Hoop nets | Smaller meshed nets caught smaller fish. |
| | | Low-frequency electrofishing | Caught slowest growing (smallest) fish, missed larger fish. |
| | | Trap nets | Fish less than 240 mm not completely vulnerable. |
| | | Trot lines (size 4/0) hooks | Fish less than 470 mm not vulnerable. |
| Blue | Impoundment | Low-frequency electrofishing | Biased against fish greater than 500 mm. Biased against fish less than 200 mm. |
| Flathead | Impoundment | Low-frequency electrofishing | Biased against fish over 600 mm. |
| | River | High-frequency electrofishing | May be missing larger fish. |
| | | Hoop nets | Larger mesh size biased against smaller fish. |
| | | Low-frequency electrofishing | Is not effective in cooler months or conductivities below 40µs. Biased against older (larger) fish. |

head research was concentrated in lotic systems with no sampling being reported for small impoundments. Channel catfish were sampled using multiple methods possibly in order to try to obtain a more complete population structure. The methods most frequently used to collect channel catfish included experimental gill netting (33%), high-frequency electrofishing (20%), and tandem bait hoop nets (13%).

### Known Gear Bias

One of the most obvious things learned from asking the question "Has selectivity of the gear been evaluated? If known please describe the gear bias" was that for 67% of the responses bias had not been evaluated or that respondents were not aware of bias evaluation. Responses describing known gear biases were difficult to classify (Table 5). Many responses were not quantified measures of bias but were qualitative observations of bias. Also, each project had its own methods, thereby injecting small factors that could play a large part in the observed bias. For example, most projects using trotlines described using hooks of only one size ranging from 2/0 through 8/0. Intuitively this should cause differences in the size of fish captured.

Several respondents gave literature references as examples of the bias associated with sampling gears. A review of these references revealed that some gear bias and efficiency studies have already occurred. Michaletz and Sullivan (2002) showed that tandem-baited hoop nets with 25-mm mesh fished for three days can catch large numbers of channel catfish but do not sample fish under 250 mm total length in proportion to their abundance in small impoundments. Santucci et al. (1999) showed that only experimental gill nets and complete creel census gave representative samples of channel catfish in a small impoundment that was eventually drained when compared to A/C electrofishing, baited slat and wire traps, and trotlines. Vokoun and Rabeni (1999) demonstrated that in rivers, large mesh hoop nets collect larger fish and trotlines select for larger fish as well. Schramm and Pugh (2000) determined that relative gear selectivity may be the way to examine bias when sampling lotic habitats since absolute selectivity might not be possible in an open system.

## Conclusions and Management Implications

Regardless of gear bias, information on catfish populations is being collected at an increased rate. Catfish sampling continues as agencies and anglers recognize the importance of these species. In this survey, individual information needs concerning sampling techniques were very similar in nature. Managers and researchers alike want to know "What gear(s) should I use to get the least biased size and age structure estimates?" whether from streams, small impoundments, rivers or reservoirs. All gears used to sample fish have some level of bias (Ricker 1975, Miranda and Schramm 2000). Bias associated with new and innovative collection techniques should be investigated and quantified so that population metrics generated from these collection techniques can be validated.

Current catfish sampling techniques vary widely. Accepted standardized sampling techniques for catfish appear to be in the early stages of development (Flammang and Schultz 2007). The benefits of standardized sampling techniques have been demonstrated (Bonar and Hubert 2002), and the challenge of creating these techniques for various catfish species should be addressed. If efficient standardized techniques are to be developed and validated, then those entities overseeing the formation of these techniques must be very specific when describing methods. Minor changes in sampling methods and/or water conditions can greatly affect catch rates and sampling bias.

Intense catfish sampling was reported in both lentic and lotic environments indicating a need for evaluating sampling bias across a range of habitats. Channel catfish have received the bulk of research attention during 2002–2006. Consequently, most of the research performed concerning sampling bias deals with channel catfish. Flathead and blue catfish were second and third, respectively, in the amount of research reported but are increasing in popularity due to trophy potential. Since low-frequency electrofishing appears to be the gear of choice when sampling these two species, it is imperative that the sampling bias associated with this technique be quantified.

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