Final Report on the Current Sampling Techniques and Information Needs of Catfish Researchers and Managers

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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 conducted over the past 5 years. One hundred eighty two responses were collected in a 4 month period in early 2006. Channel catfish (Ictalurus punctatus) were the most targeted species followed by flathead (Pylodictis olivaris) and blue (Ictalurus 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 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.

Introduction

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 (Ictalurus furcatus) (Vokoun and Rabeni 1999). During the last five years (2002-2006) 18 articles dealing with catfishes were published in the North American Journal of Fisheries Management. In the 10 years prior to that (1992-2001) only 17 catfish related articles were published in the same journal. Catfish managers are sampling more as they realize the need for accurate and reliable data as they face the challenge of creating trophy fisheries as well as 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 were collecting 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 bring sample biases that have yet to be quantified. Managers need to know gear bias in order to produce accurate estimates of 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 purpose of this survey was 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 the Survey Monkey (2005) web service. Questions included contact and classification information, queries about self perceived information needs, listing of catfish projects performed in the last 5 years, and an option to give detailed information on up to three catfish sampling projects (Appendix 1). This survey was beta-tested by members of both committees and further refined. 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 over the past 5 years (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 habitat with 54% of the respondents indicating that they had sampled this habitat for at least one species of catfish during the last five years. 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). Only channel catfish in lakes and reservoirs greater than 200 ha and small impoundments less than 200 ha received more than 25% affirmative responses. However the data from this particular question seemed suspect. When responses were compared from individuals within the same agency agreement rarely occurred. In fact the only agencies whose member's responses agreed entirely were those that had no standardized protocols.

The respondents were informed that the sponsoring committees were considering organizing a multiple day event to evaluate different sampling gears and asked if they would like to participate. One hundred individuals responded in the affirmative and 73 in the negative. When positive responses were examined by region, Missouri stood out as the most likely place to hold such an event. Thirty-nine of the individuals that were willing to participate either lived in a state that directly bordered Missouri or in Missouri itself. Even though the idea for a "Cat-a-thon" may be effectively dead for the time being, it should be noted that there is support and a willingness to volunteer for it in the managers and researchers surveyed.

Information Needs

One of the main objectives of this survey was to learn the current information needs of catfish managers. 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. The top three techniques used to sample catfishes included electrofishing (high-frequency and low-frequency), hoop nets, and gill nets. However when broken down by species and habitat type some interesting patterns emerged (Table 4.).

Respondents had a definite preference for low-frequency electrofishing when targeting blue and flathead catfish. Flathead research was concentrated in lotic systems with no sampling being reported for small impoundments. Channel catfish were sampled using multiple methods in order to try to obtain a more complete picture of their population structure. The methods most frequently used to collect channel catfish included experimental gill netting, high-frequency electrofishing, tandem bait hoop nets, and trap nets.

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 in 67% of the responses indicated that bias had not been evaluated or that they 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 3 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, data on catfish populations are 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 should I use to get unbiased 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 associated with these collection techniques can be validated.

Most researchers and managers are still "doing their own thing" in regards to catfish sampling. 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 shown (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 sampling bias illumination across a range of habitats. Channel catfish have received the bulk of research attention during the last 5-year period. 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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Table 1. Percentage of respondents that sampled catfish species within the past 5 years by habitat type.

Species	Lakes & Reservoirs (200+ha)	Small Impoundments (<200ha)	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

Table 2. Percentage of respondents that stated their organization had standardized methods for sampling catfish.

Species	Lakes & Reservoirs (200+ha)	Small Impoundments (<200ha)	Free Flowing Rivers & Streams	Large Navigation Rivers	Tailwaters
Channel catfish	31	27	21	17	2
Flathead catfish	17	10	18	14	2
Blue catfish	15	8	13	12	2
White catfish	3	2	6	5	0
Bullhead catfish	5	5	10	7	1
Other catfish	2	1	3	2	0

Table 3. Classification of self-reported information needs of catfish managers and researchers.

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**	**LF EF**	**HN**	**TD HN**	**GN**	**Set/Trot Lines**	**Trawl**	**Trap Nets**	**Slat Traps**	**Totals**
Channel	SI	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

SI =small impoundment (less than 200 ha)
HF EF =electrofishing with 60 Hz or greater
LF EF =electrofishing with 30 Hz or less
HN = hoop netting
TD HN =tandem baited hoop nets
GN =gill nets, almost always experimental

Table 5. Summary of reported catfish sampling gear bias.

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

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

Appendix 1. Questions asked on the online survey of catfish managers and researchers.

Q1. Contact Information

All names, email addresses, and phone numbers will be maintained as private and will not be reported in the results. We will only use this information with your permission to clarify an answer or to notify you of the results. Name: Organization: Classification (State, Federal, Academic, Private): Email Address: Phone:

Q2. May we contact you to clarify an answer or to notify you of the results?

Q3. The Southern Division Catfish Management Technical Committee in cooperation with the North Central Division Ictalurid Technical Committee may be conducting a multiple day gathering of fisheries experts to evaluate different catfish sampling gear. Would you like to participate in this study?

Q4. What are your most important information needs in regards to catfish sampling?

Q5. Please mark all catfish sampling projects you conducted or in which you participated within the last five years.(Respondents were shown a matrix with habitats across the top and species in the first column)

Habitats: Lakes & Reservoirs (200+ha), Small Impoundments (<200ha),

Free Flowing Rivers & Streams, Large Navigation Rivers, Tailwaters

Species: Channel Catfish, Flathead Catfish, Blue Catfish, White Catfish, Bullhead Catfish, Other

Q6. Please mark all catfish sampling projects for which your agency has a standardized sampling protocol. (Respondents were shown a matrix with habitats across the top and species in the first column)

Habitats: Lakes & Reservoirs (200+ha), Small Impoundments (<200ha), Free Flowing Rivers & Streams, Large Navigation Rivers, Tailwaters

Species: Channel Catfish, Flathead Catfish, Blue Catfish, White Catfish, Bullhead Catfish, Other

Specific Project Details 1

You will be given the opportunity to describe up to three catfish sampling projects. Please provide as much of the following information as possible:

Q7. For your first catfish sampling project, please give the following information:

Species: Sampling Gear(s) [e.g. electrofishing, gill net, hoop net]: Habitat sampled:

Months sampled: Water Temperature (C): Water Conductivity: Water Depth (m):

Size range of fish collected: Type(s) of data collected (e.g. length, age, CPUE):

Population metrics calculated (e.g. abundance, mortality):

Does your agency use this method as a standard technique for this species:

Q8. Please list the objectives of this project:

Q9. Please describe the gear used to collect fish in this project (e.g. settings, bar mesh size, net length):

Q10. Has selectivity of the gear been evaluated? If known please describe the gear bias:

Q11. Other comments:

Q12. Do you wish to submit information on a second catfish sampling project?

Questions 8-11 were repeated 2 additional times if the respondent wished to give information on two more projects.

FSWC Final Report Appendix A 090305.pdf. FSWC Final Report Appendix B 090225.pdf. FSWC Final Report Appendix C 090225.pdf.Â We identified four cultural reasons for the current state. First, cost and schedule pressure lead managers and developers to reduce or eliminate activities other than the production of code. Improvements that require time and training are vulnerable, particularly if their benefits are hard to quantify.Â Are there techniques that effectively manage the complexity of fault protection systems? o Approach 1: Fault protection tends to require coordination features, attention to limited resources, goal-driven behaviors, observability requirements, and more that should originate as part of the core architectural concepts. Essentially, sampling consists of obtaining information from only a part of a large group or population so as to infer about the whole population. The object of sampling is thus to secure a sample which will represent the population and reproduce the important characteristics of the population under study as closely as possible. The principal advantages of sampling as compared to complete enumeration of the population are reduced cost, greater speed, greater scope and improved accuracy.Â The probability that. any sampling unit will be selected in the sample depends on the sampling procedure used. The important point to note is that the precision and reliability of the estimates obtained from a sample can be evaluated only for a probability sample. various multivariate techniques can appropriate be utilized in research studies, specially in behavioural and social sciences. Factor analysis has been dealt with in relatively more detail. Chapter Fourteen has been devoted to the task of interpretation and the art of writing research reports.Â 344 Technique of Interpretation: 345 Precaution in Interpretation 345 Significance of Report Writing 346 Different Steps in Writing Report 347 Layout of the Research Report 348 Types of Reports 357 Oral Presentation 353. Mechanics of Writing a Research Report 353 Precautions for Writing Research Reports 358 Conclusions 359.Â In analytical research, on the other hand, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material. Generally, sampling allows researchers to obtain enough data to answer the research question(s) without having to query the entire population - saving time and money. However, sampling differs depending on whether the study is quantitative or qualitative. Quantitative sampling is based on two elements: Power Analysis (typically using G*Power3, or similar), and random selection.Â For example, in the study on the yield of a particular variety of plant, the soil type, irrigation, type of fertilizers used, etc, are all important to the final result. So if the sample is taken only for some the cases, say soil types or only for a certain type of fertilizer, the results would not be conclusive. Backpackers in Global Sydney Final Report. Dr Fiona Allon, Australian Postdoctoral Industry Fellow, Centre for Cultural Research With Associate Professor Robyn Bushell and Professor Kay Anderson, Centre for Cultural Research And assistance from Dr Nathalie Apouchtine Centre for Cultural Research, University of Western Sydney, 2008.Â This report is based on the research undertaken for the Australian Research Council Linkage Scheme project Backpacker Tourism in Global Sydney.Â The survey data together with information from the focus groups and interviews revealed, not surprisingly, a mix of positive and negative responses.