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NOTES: COMPARISONS OF CATCH BETWEEN TWO BAIT TYPES WITH AN EMPHASIS ON PALLID STUR- GEON

Thad W. Huenemann

Kirk D. Steffensen

NOTES

COMPARISONS OF CATCH BETWEEN TWO BAIT TYPES WITH AN EMPHASIS ON PALLID STURGEON— Trotline sampling has been a common practice used by commercial and recreational anglers to target specific fish species (e.g. Ictaluridae and Acipenseridae), while biologists have used them as a management tool to monitor and evaluate fish populations (Graham 1997, Vokoun and Rabeni 1999, Arterburn and Berry 2002, Steffensen et al. 2011). Different trotline configurations have been evaluated to determine which combination of hook type and bait produces higher catch rates for catfish species (Johnson 1987, Arterburn and Berry 2002) but this information is lacking for sturgeon species. For example, Arterburn and Berry (2002) concluded that channel catfish (*Ictalurus punctatus*) were more likely caught with cut bait while flathead catfish (*Pylodictis olivaris*) were more likely captured with live bait.

Trotlines have been used as a way to evaluate populations for sturgeon species in large rivers (Killgore et al. 2007, Shuman et al. 2011, Hubert et al. 2012, Steffensen et al. 2012). Two studies, Steffensen et al. (2011 and 2013) found trotlines were capable at targeting *Scaphirhynchus* species while also identifying how set duration affected catch rates. These studies documented over half of the fish captured on trotlines are captured four hours post-deployment and decline throughout the duration of a set. Previous studies have documented fish loss on overnight sets, which influence catch rates (Steffensen et al. 2011 and 2013). However, an evaluation of set durations and bait types on the efficiency of sturgeon capture have not occurred, especially in regards to targeting adult pallid sturgeon (*S. albus*). Typically, night crawlers (*Lumbricus terrestris)* are the primary bait utilized for sturgeon capture because of their availability and higher catch rates compared to other sampling methods (e.g. gill nets; Killgore et al. 2007, Steffensen et al. 2011, Steffensen et al. 2013). However, recreational anglers have reported catching adult pallid sturgeon >1,100 mm in fork length and > 6 kg in total weight with cut bait and night crawlers (K. D. Steffensen, Nebraska Game and Parks Commission, personal communication). These anglers' observations brought into question whether the current standard methods of only using night crawlers as bait was effectively capturing adult pallid sturgeon (i.e. > 1,100 mm and 6 kg). Thus, further investigation was needed to assess whether a different bait type may capture larger adult pallid sturgeons than night crawlers. Therefore, the objectives of this study were to: 1) Determine if catch rates are influenced by bait type and set duration with an emphasis on pallid and shovelnose sturgeon (*S. platorynchus*) catch dynamics; and 2) evaluate potential differences in size distribution of pallid and shovelnose sturgeon by each bait type and set duration.

Our study was conducted in the channelized reach of the Missouri River along the eastern border of Nebraska during May 2014. We selected two reaches, including the upper channelized reach (between rkm 1,059 and 1,030) and lower channelized reach (between rkm 943 and 886). We selected the lower channelized reach based upon previous research that suggested a high abundance of sturgeon species (Steffensen et al. 2012). We sampled the upper channelized reach when high water conditions in the lower reach prevented sampling. We sampled 120 trotline deployments from each reach within a two-week period. We combined all data for analysis and results to encompass a representation fish community in the channelized Missouri River along the eastern border of Nebraska.

We deployed trotlines using protocols similar to those outlined for the Pallid Sturgeon Population Assessment Program funded by the U.S. Army Corps of Engineers (Welker and Drobish 2011*a*, 2011*b*). Trotlines were 61 m long with forty 5/0 circle hooks per line. We tied hooks to a 38-cm leader and fastened them to the main line using trotline snaps. We placed hooks every 1.5 m to avoid hook and fish entanglement. We used two types of bait, including night crawlers and cut bait, which included goldeye (*Hiodon alosoides*), grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*) and silver carp (*Hypophthalmichthys molitrix*). We alternated baited hooks with night crawlers and cut bait on each trotline, resulting in 20 hooks per trotline per bait type. We deployed all trotlines parallel to the river current on an inside river bend. We set half of the lines (n = 60) in the morning and fished them for a median time of four hours (short duration). We set the other half in the afternoon, left them overnight, and retrieved them the following morning with a median soak time of 20:50 hr. All captured fish were identified by species and measured for length (mm; fork length for sturgeon species and total length for all other species). We calculated catch per unit effort (CPUE) for trotlines as the number of individuals collected per 20 hooks set. We compared mean CPUE for each species by trotline durations and bait types independently using an ANOVA (PROC GLM, SAS Institute, Cary, NC). Length frequencies of pallid sturgeon, shovelnose sturgeon, and channel catfish were compared using a two-sample Kolmogorov-Smirnov test to evaluate differences between bait types and trotline duration. Statistical tests were considered significant at $\alpha = 0.05$ and adjusted for multiple comparison testing using the Tukey-Kramer procedure.

Crews deployed 60 short-duration trotlines and 60 overnight trotlines equaling 2,400 hooks with each bait type. In total, 373 fish representing seven different species were collected (Table 1). Shovelnose sturgeon (n = 225), channel catfish (n = 97), and pallid sturgeon (n = 30) were the most frequently collected species. Overnight trotlines collected the majority (61%) of fish compared to short duration deployments, regardless of bait type used ($F_{1, 59} = 5.81$, P =

0.016, Table 1). Overnight trotlines baited with night crawlers (CPUE = 0.128, SE = 0.006) produced higher catch rates than those baited with cut bait (CPUE = 0.063, SE = 0.003; $F_{1, 59}$ = 7.63, P = 0.006). Similarly, short-duration trotline sets frequently caught more fish baited with night crawlers (CPUE = 0.088, SE = 0.004) than cut bait (CPUE = 0.033, SE = 0.001; $F_{1, 59}$ = 11.84, P = 0.001). Both shovelnose and pallid sturgeon were caught at higher rates on trotlines set overnight than those set for shorter durations (Table 1). Overall, pallid sturgeon were caught more often with night crawlers (CPUE = 0.009, SE = 0.004) than with cut bait (CPUE = 0.003, SE = 0.002; $F_{1, 59}$ = 6.6, P = 0.011), similar to shovelnose sturgeon (night crawlers, CPUE = 0.089, SE = 0.021; cut bait, CPUE = 0.005, SE = 0.003; $F_{1, 59}$ = 62.43, P < 0.001). Channel catfish were most frequently captured using cut bait on trotlines that were set overnight (Table 1). Furthermore, channel catfish were captured more often using cut bait on short-duration trotlines compared to captures using night crawlers. Overall, catch rates for channel catfish were higher using cut bait compared to night crawlers ($F_{1, 59}$ = 31.42, P < 0.001). However, catch rate comparisons showed no difference between day and overnight trotline duration ($F_{1, 59}$ = 3.76, P = 0.054). No further inferences about other fish species were included due to low capture frequencies.

Fork lengths of pallid sturgeon ranged from 405 to 1,192 mm among both set duration and bait type (Fig. 1). The length-frequency distribution of pallid sturgeon was not different among those caught by different bait (KSa = 0.743, P = 0.639; Fig. 1) or set duration (KSa = 0.775, P = 0.586). Fork length of shovelnose sturgeon ranged from 348 to 720 mm. Similarly, the size distribution of shovelnose sturgeon also showed no difference between bait type (KSa = 0.874, P = 0.429) or set duration (KSa = 1.034, P = 0.235). Mean total lengths of channel catfish were 77 mm greater on trotlines baited with cut bait (KSa = 1.36, P = 0.049) and 35 mm greater on trotlines set overnight (KSa = 1.478, P = 0.025).

Fish were most frequently captured on trotlines baited with night crawlers and deployed overnight. Results from this study also showed that overnight trotline sets baited with night crawlers may be the preferred method for sampling adult pallid and shovelnose sturgeon in the Missouri River. Since more fish were collected on overnight sets rather than

Table 1. Trotline catch rates (CPUE, fish per 20 hooks) and standard error (SE) for different bait types and set durations deployed on the Missouri River, May 2014. Data superscripted with an asterisk (*) indicate significant differences and number sign (#) indicates insufficient sample size for comparison analysis.

	Night crawlers		Cut bait	
Species	CPUE	SE	CPUE	SE
Trotline (Short duration)				
Pallid sturgeon *Scaphirhynchus albus**	0.007	0.002	0.002	0.001
Shovelnose sturgeon *Scaphirhynchus platorynchus**	0.073	0.012	0.003	0.001
Common carp *Cyprinus carpio*#	0.000	0.000	0.001	0.001
Blue catfish *Ictalurus furcatus*#	< 0.001	< 0.001	0.003	0.001
Channel catfish *Ictalurus punctatus**	0.008	0.002	0.020	0.005
Flathead catfish *Pylodictis olivaris*#	0.000	0.000	0.000	0.000
Freshwater drum *Aplodinotus grunniens*#	< 0.001	< 0.001	0.002	0.001
Overall	0.088	0.004	0.033	0.001
Trotline (Overnight)				
Pallid sturgeon *Scaphirhynchus albus*	0.012	0.003	0.005	0.002
Shovelnose sturgeon *Scaphirhynchus platorynchus**	0.105	0.017	0.008	0.003
Common carp *Cyprinus carpio*#	0.003	0.002	0.000	0.000
Blue catfish *Ictalurus furcatus**	0.000	0.000	0.006	0.002
Channel catfish *Ictalurus punctatus**	0.007	0.002	0.043	0.007
Flathead catfish *Pylodictis olivaris*#	0.000	0.000	< 0.001	< 0.001
Freshwater drum *Aplodinotus grunniens*#	0.002	0.002	0.000	0.000
Overall	0.128	0.006	0.063	0.003

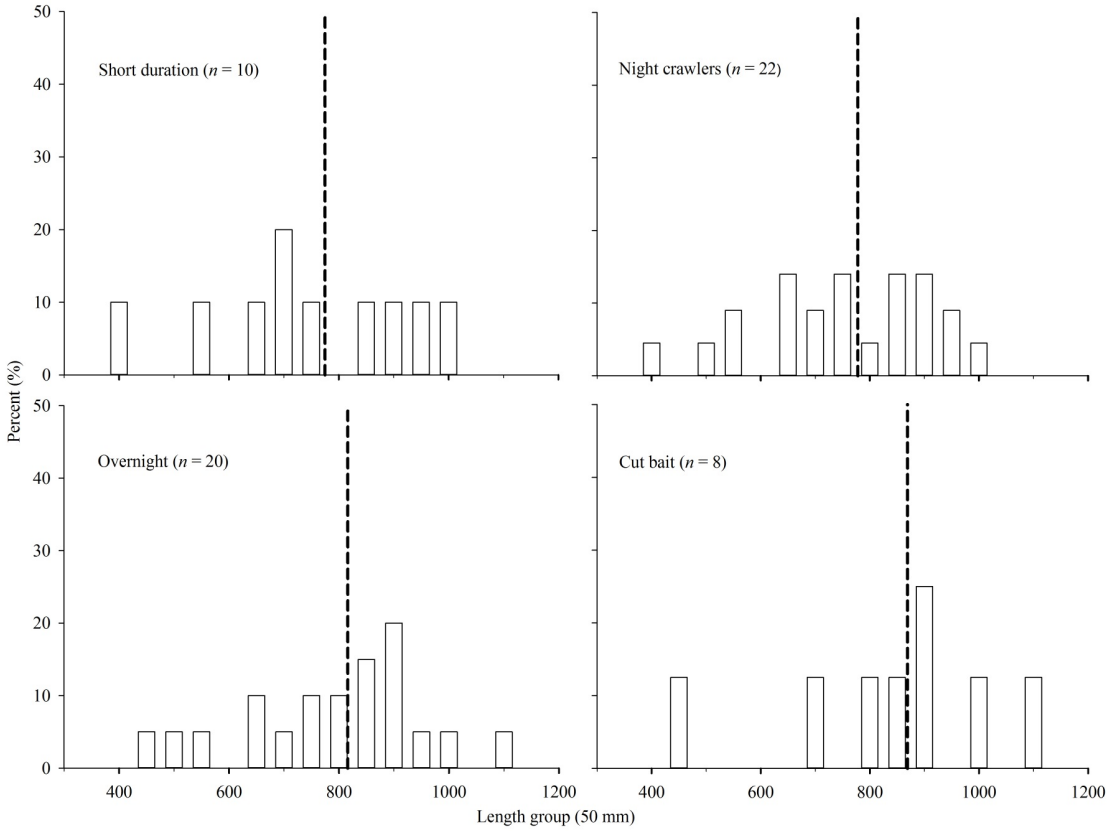

Figure 1. Percent length group distributions of pallid sturgeon collected on trotlines with different set durations (left graphs) and bait types (right graphs) deployed on the Missouri River, May 2014. Vertical dashed line represents mean length of pallid sturgeon collected per set duration or bait type. There was no significant difference in size distributions between set durations (KSa = 0.775, $P = 0.586$) or bait types (KSa = 0.743, $P = 0.639$).

short-duration sets, the probability of catching pallid sturgeon likely increases on overnight sets. However, fish need to remain hooked for a long period of time, and until the trotline is retrieved the next day. A previous study had discussed retention rates and determined that 31% of fish escaped the hook prior retrieval the following morning (Steffensen et al. 2011). Broken hooks do occur after trotlines are deployed but the cause remains unknown and further investigation is needed to determine if the hook gets broken by a large fish or debris. Previous observations have collected larger catfish weighing near 8 kg on overnight trotline sets, which suggests large fish species are likely can remain hooked for a long period of time until the trotline is retrieved (K. D. Steffensen, Nebraska Game and Parks Commission, unpublished data). If the purpose of using trotlines is to capture *Scaphirhynchus* species, including mature adult pallid sturgeon, we suggest using overnight set deployment with night crawlers as bait. Otherwise, if the objective is to assess multiple species by use of trotlines, then using multiple bait types deployed overnight may maximize catch rates for a variety of species that exist in the channelized Missouri River.

The size structure of pallid sturgeon caught with different bait types was not significantly different. We determined that our current trotline configuration (e.g., overnight trotline sets baited with night crawlers) adequately sampled the adult sturgeon population, and therefore, would not benefit from the use of cut bait. Furthermore, the use of cut bait in sampling methods would likely impact sturgeon catch rates due to hooks being saturated with catfish species, as our results indicated that channel catfish were more frequently captured on cut bait. Excluding shovelnose sturgeon, channel catfish were the most frequently collected species on baited trotlines, and their prevalence could reduce the probability for pallid sturgeon being captured (Steffensen et al. 2011). If the goal is to only capture adult pallid sturgeon, then methods should be designed to minimize bycatch.

One caveat we did not investigate is the use of live bait in comparison to cut bait. Adult pallid sturgeon are piscivorous, and adults > 700 mm in length almost exclusively feed on other fish (Winders et al. 2014). Gerrity et al. (2006) documented sturgeon chubs (*Macrhybopsis gelida*) and sicklefin chubs (*M. meeki*) as a common prey fish of pallid sturgeon in the

upper Missouri River, whereas shoal chubs (*M. hyostoma*), silver chubs (*M. storeriana*), and other unidentified cyprinids were recovered from pallid sturgeon stomach samples in the Mississippi River (Hoover et al. 2007). Winders et al. (2014) noted Cyprinidae species were the most dominant family in pallid sturgeon diets from the channelized Missouri River, mostly belonging to the *Macrhybopsis* genus. Using live bait may decrease capture probability for shovelnose sturgeon and sub-adult pallid sturgeon, but it remains unknown how live bait would affect adult pallid sturgeon catches.

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