

Surveys of Texas Bow Anglers, with Implications for Managing Alligator Gar

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Abstract: Increasing interest in conservation and management of alligator gar, a species considered at risk of imperilment by the American Fisheries Society, has made it important to ascertain angling effort and harvest for this species. Bowfishing is believed to constitute the majority of the recreational harvest of alligator gar, yet little is known about bow anglers and their fishing practices. To obtain baseline demographic and fishing information from bow anglers in Texas, we distributed surveys to 173 participants at three Trinity River bowfishing tournaments in 2011. We received 15 completed surveys for a response rate of 9%. In addition, we conducted an online survey of Texas Bowfishing Association members in 2012 and received 82 returned surveys, resulting in a 46% response rate. All survey responses were pooled for a total sample size of 97 bow anglers. Bow anglers were generally similar to statewide Texas anglers, but were primarily male (97%), and on average were younger than anglers statewide. Bow anglers fished an average of 46 days annually, predominately in Texas reservoirs. Fifty-seven percent of bow anglers reported harvesting an alligator gar in the previous 12 mo. Average number of alligator gar harvested per bow angler in the previous 12 mo was three (range 0 to 40). Managers should consider this small but important angling constituency when imposing new regulations to assess potential impacts on participation and fishing license sales. It is also important to monitor bow angler harvest rates for species of concern.

Key words: bowfishing, harvest, angler demographics, *Atractosteus spatula*

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Data on angler groups and their harvest practices help fisheries professionals better understand angler needs while providing information needed to evaluate resource use. Surveys are typically used to determine attitudes regarding a fishery (Hicks et al. 1983, Zweifel and Stanovick 2003) and to estimate harvest, catch, and angling effort (Malvestuto et al. 1978, Yeager and Van Den Avyle 1979, Zweifel and Stanovick 2003). Biologists also use angler information and opinions when considering regulation changes (Wilde et al. 1996, Arterburn et al. 2002).

Bowfishing is practiced throughout the United States; however, there is a paucity of literature on the subject, especially for bowfishing tournaments (Quinn 2010, Bennett and Bonds 2012). No known publication in the peer-reviewed literature adequately describes bow angler demographics or fishing practices. Traditional creel survey techniques are ineffective at intercepting bow anglers because bowfishing often occurs at night (Bennett and Bonds 2012). Also, bow anglers may be difficult to survey because they represent a small constituency, accounting for just 3% of Texas freshwater anglers in 2012 (Kyle et al. 2012). Sampling methodologies based on traditional, design-based sampling theory are inadequate in obtaining representative catch and effort data, social or demographical characterization, or fisher behavior from small hard-to-reach components within recreational fisheries (e.g. specialized sport fisheries; Griffiths et al. 2010). However, these

groups may account for the majority of the catch for some species.

It is important to understand the bow-angler constituency because they target a wide variety of fish species and generally fish caught in this manner do not survive; thus, angling mortality rates can be high relative to other fishing methods (Quinn 2010, Bennett and Bonds 2012). The Texas Parks and Wildlife Department (TPWD) is tasked with providing quality fishing opportunities through conservation, and risk from overharvest by bowfishing is largely unknown. It is suspected that bow anglers may be a threat to some vulnerable and threatened species such as alligator gar (*Atractosteus spatula*); a species that has declined in its historical range and is considered vulnerable to habitat loss and overfishing (Jelks et al. 2008, Buckmeier et al. 2013). Alligator gar are especially sensitive to overharvest due to their long life span and inconsistent recruitment (Ferrara 2001), and bowfishing is believed to be responsible for a majority of recreational harvest of alligator gar (Buckmeier 2008). Because alligator gar are sensitive to overharvest, TPWD imposed a conservative statewide daily bag limit of one fish on 1 September 2009 (Bennett and Bonds 2012).

A better understanding of bowfishing and bow anglers can help resource managers identify potential threats, angler preferences, and craft appropriate management regulations. The objective of this study was to determine demographics, angling practices, and characteristics of bow anglers in Texas. Results will be used to bet-

ter understand Texas bow anglers and help guide resource managers in decision making regarding future harvest regulations.

Methods

Surveys were distributed to 170 participants at three bowfishing tournaments on the Trinity River occurring in April, May and October 2011. The survey was distributed along with a postage-paid pre-addressed envelope for anglers to return their completed surveys. Due to a poor response rate, we replicated the survey online (Kwik Surveys 2011) and distributed survey invitations by email to all documented members (*n* = 178) of the Texas Bowfishing Association (TBA) in October 2011. Anglers were instructed to answer questions pertaining to temporal harvest and fishing activity as occurring within the 12 mo prior to completing the survey. To ensure reported temporal harvest rates were not affected by regulation changes, all surveys were distributed more than 12 mo after the daily bag limit of one alligator gar became effective in Texas.

Anglers were asked to report age and gender, last year of school completed, and income (Table 1). A five-digit residential zip code was also requested to determine approximate spatial distribution of respondents, and to estimate distances traveled to preferred fishing locations.

To identify popular bowfishing locations, anglers were asked to list their three most preferred locations to bowfish in Texas. Preferred fishing locations did not account for fishing frequency at these locations. Geospatial data layers for these waterbodies (obtained from the Texas Water Development Board) were plotted in a geographical information system (GIS, Environmental Systems Research Institute [ESRI] ArcMap version 10.1) and overlaid with reported angler residence zip codes. Zip-code centroids (approximate geographic center of angler’s reported residential zip code) were derived from geospatial layers (created and distributed by ESRI) that detail approximate geographic boundaries for U.S. zip codes. To estimate distance of preferred top three bowfishing locations from each angler’s home zip code, we used ESRI’s Multiple Ring Buffer tool to create and cast polygons representing fixed distances from each calculated zip-code centroid at 80-km intervals from 80-km to 640 km. Each preferred angling location was then identified and the corresponding 80-km buffer interval from the angler’s residence zip code centroid was recorded. Minimum linear distance of preferred fishing location corresponded to the nearest 80 km buffer polygon, containing any portion of each preferred fishing location, to each angler’s zip code centroid.

Bow anglers were asked to list the approximate number of days spent bowfishing in each of four seasons (December to February, March to May, June to August, and September to November) corresponding to winter, spring, summer, and fall. Mean days spent

Table 1. Categories for select questions from two surveys of Texas bow anglers.

How many bowfishing tournaments in Texas did you participate in during the past 12 months?	
___ None	___ 1 to 5 ___ 6 to 10 ___ more than 10
How many years have you been bowfishing?	
<1 year	11 to 15 years
1 to 5 years	16 to 20 years
6 to 10 years	>20 years
Compared to your other fishing activities, would you rate bowfishing as:	
Bowfishing is your most important fishing activity	
Bowfishing is your second most important fishing activity	
Bowfishing is your third most important fishing activity	
None of the above	
Compared to your other outdoor activities (hunting, camping, etc.), would you rate bowfishing as:	
Bowfishing is your most important outdoor activity	
Bowfishing is your second most important outdoor activity	
Bowfishing is your third most important outdoor activity	
None of the above	
During the past 12 months, list the approximate number of days you have bowfished in each season.	
___ December to February	___ March to May,
___ June to August	___ September to November
Besides bowfishing, what other gears have you used to catch alligator gar in Texas?	
None	Rod and Reel
Jugline	Other
Trotline	
What is your approximate annual household income before taxes?	
Under \$20,000	\$60,000 – \$79,999
\$20,000 – \$39,999	\$80,000 – \$99,999
\$40,000 – \$59,999	\$100,000 and Above
What was the last year of school you completed?	
Elementary	Some College
Some High School	College
High School/GED	Post Graduate

bowfishing by anglers in each season was calculated to assess seasonal trends. To estimate bowfishing tournament activity, bow anglers were asked to list the number of tournaments they participated in during the previous 12 mo. Bow anglers were asked about their participation in online forums related to fishing, and asked to list specific forums they frequently visited.

Bow anglers were asked to list their top three target species while bowfishing, and to select species harvested within the previous 12 mo from a list of common Texas non-game species, including other gars (*Lepisosteus* spp.), buffalo (*Ictiobus* spp.), and common carp (*Cyprinus carpio*). Bow anglers were also asked four questions about alligator gar fisheries in Texas, including the num-

ber of alligator gar harvested in the previous 12 mo, other gear types used, and opinions about trophy length. Anglers were also asked their opinion about the current 1-per-day bag limit for alligator gar on a 5-point Likert-type scale (Likert 1932). The scale was used to determine if anglers felt the regulation was too liberal or too restrictive on a scale of 1 to 5; 1 not restrictive enough, 3 being neutral and 5 being too restrictive. Proportions of liberal (1 and 2) and conservative opinions (4 and 5) were pooled and a Chi-square test was used to examine differences in proportion of angler responses (SAS Institute 2001). Neutral responses (3) were omitted from this analysis.

To understand how bow anglers compare to all Texas anglers, we compared their demographic characteristics to those in a 2012 statewide survey of anglers. The 2012 statewide angler survey was distributed to 4,000 anglers between the ages of 17 and 65, selected randomly from the nearly 1.2 million Texas residents who purchased a fishing license between 1 September 2011 and 31 August 2012 (Kyle et al. 2012). Ages of bow anglers were grouped into categories (<20, 20 to 29, 30 to 39, 40 to 49, 50 to 59, ≥60) corresponding to those in the 2012 statewide survey for analysis. Bow anglers under the age of 17 (3%), and those older than 65 (1%), were omitted from comparison because they do not require a fishing license and therefore those age groups were not included in the 2012 statewide survey. Annual household income categories were identical to those used in the 2012 statewide survey to facilitate comparison of median income. Chi-square analysis was used to analyze the proportion of categorical responses to identical demographic questions between surveys. Significance was determined at $P \leq 0.05$ for all statistical tests.

Results

We only received 15 completed surveys out of the 170 surveys distributed at 2011 Trinity River Bowfishing tournaments, resulting in a 9% response rate. Despite the low response rate, we received completed surveys from tournament participants representing four U.S. states: Texas ($n=12$), Oklahoma ($n=1$), Louisiana ($n=1$), and Mississippi ($n=1$). We received 82 returned surveys out of 178 distributed surveys (46% response rate) from the online survey of Texas Bowfishing Association (TBA) members. Despite the survey being administered specifically to this Texas-based association, we also received responses from members in Arkansas ($n=1$), Oklahoma ($n=1$), Florida ($n=1$), and Michigan ($n=1$).

Only one question in the 15 surveys returned from tournament distributed surveys received statistically different responses from those received in the online survey: the proportion of tournament respondents who listed alligator gar among their top three pre-

ferred species was greater ($P=0.04$). Therefore, both surveys were pooled for all subsequent analyses. In total, we received 97 completed surveys for a 28% combined response rate.

Mean age was 34 yrs (SE=1.2; range=10 to 67 yrs); 56% of bow anglers were mean age or below. The majority of bow anglers (97%) were male. Seventy-nine percent of survey respondents had some college education, with 46% of anglers indicating they had a college degree or higher. Median annual household income of bow anglers was US\$60,000 to \$79,999.

Sixty-five percent of respondents reported bowfishing 10 yrs or less, whereas 21% bowfished 20 or more yrs. The majority (79%) of respondents indicated that bowfishing was their most important fishing activity, while nearly half (44%) suggested that bowfishing was their most important outdoor activity. Seventy-one percent of bow anglers fished in at least one bowfishing tournament in the previous year, and 27% participated in more than five tournaments. Sixty-five percent of bow anglers indicated that they participated in online forums related to bowfishing. Of those, 66% listed the Bowfishing Association of America (BAA) online forum as a source of online communication about the sport, whereas about 29% reported using the Texas Bowfishing Association (TBA) online forum.

More than half (56%) of all preferred fishing locations listed by survey respondents were located within 160 linear km of their residential zip code, and 26% of those locations were within 80 linear km of angler's residential zip codes. Twelve percent of preferred fishing locations were located over 200 linear km from respondent's home zip code. Survey respondents reported fishing more often in lakes and reservoirs (average of 32 days yr⁻¹, SE=3) than in rivers or streams (average 15 days yr⁻¹, SE=2) ($X^2=370$, df=1, $P<0.01$). Most anglers fished from a boat; bowfishing from shore or piers accounted for just 14% (average of 7 days yr⁻¹, SE=2) of reported fishing days for survey respondents.

Bow anglers reported fishing an average of 46 days during the previous 12 mo (SE=4). The majority (76%) of bowfishing days occurred in spring through summer (March to August). Sixteen percent of bowfishing days occurred between September and November, and winter (December to February) accounted for only 8% of all days anglers spent bowfishing during the previous 12 mo. Mean number of fishing days reported by survey respondents in the spring and summer was 18 (SE=2) and 19 (SE=2) days, respectively.

The most frequently reported target species (68% of anglers) was buffalo (*Ictiobus* spp.). Sixty-seven percent listed other gar species (Lepisosteidae) among their top three species to target, and about half (51%) listed common carp (*Cyprinus carpio*). Sixty-three percent of survey respondents indicated alligator gar was

among their top three species to target while bowfishing, and 57% of respondents reported to have harvested an alligator gar in the previous year. Respondents reported harvesting between 0 and 40 alligator gar per angler while bowfishing in the previous 12 mo; however, the average number of alligator gar harvested was 3.0 fish (SE = 0.6) (Figure 1). Most (77%) survey respondents had used bowfishing exclusively to catch alligator gar, but 20% also used rod-and-reel. Only 7% used juglines or trotlines.

Forty-two percent of respondents indicated that the minimum length for a trophy alligator gar was 1,829 mm TL; 23% and 16% indicated a trophy size was 1,524 mm and 2,134 mm, respectively (Figure 2). Five and six percent of bow anglers felt the one-per-day bag limit for alligator gar was too liberal (options 1 and 2). Forty-five percent of survey respondents felt neutral (3) about the one fish-per-day bag limit for alligator gar. And, 21% and 23% of bow

anglers believed the regulation was too restrictive (options 4 and 5). A significantly greater proportion (43%) of bow anglers felt the regulation was too restrictive versus not restrictive enough ($X^2 = 18.13$, $P < 0.001$).

Mean age of bow anglers (34 yrs) was younger than the mean age of anglers (43 yrs) in the 2012 statewide angler survey. The proportion of bow anglers in each of six age classes also represented younger anglers ($X^2 = 63.6$, $df = 5$, $P < 0.0001$) than those in the statewide angler survey. Females only accounted for 3% of bow anglers, compared to 15.7% of all anglers in the statewide angler survey. Bow angler's median household income (\$60,000 to \$79,999) was the same as that reported in the 2012 statewide survey.

Discussion

Demographic characteristics of bow anglers were similar to anglers in the 2012 statewide survey (Kyle et al. 2012), with the exception of age and gender. Bow anglers appeared to comprise a younger, predominately male segment of Texas anglers and were relatively new to the fishing method. Because this study represents the first survey of bow anglers, it is unknown if recruitment and participation in bowfishing is increasing or if the number of bow anglers in Texas has remained constant. Considering the high bowfishing harvest rates for some species (Quinn 2010, Bennett and Bonds 2012), it may be important to monitor long-term demographic trends within the constituency to understand angler immigration and emigration from the fishing method. Mean number of alligator gar reported harvested per angler in the previous year (3), and mean harvest rate of alligator gar in Texas bowfishing tournaments was low ($0.018 \text{ fish h}^{-1}$) (Bennett and Bonds 2012). However, an increase in the number of bow anglers targeting an

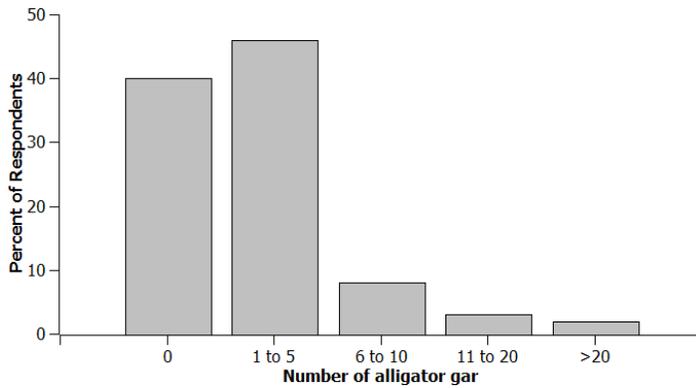


Figure 1. Number of alligator gar reported harvested by bow anglers in the previous 12 mo.

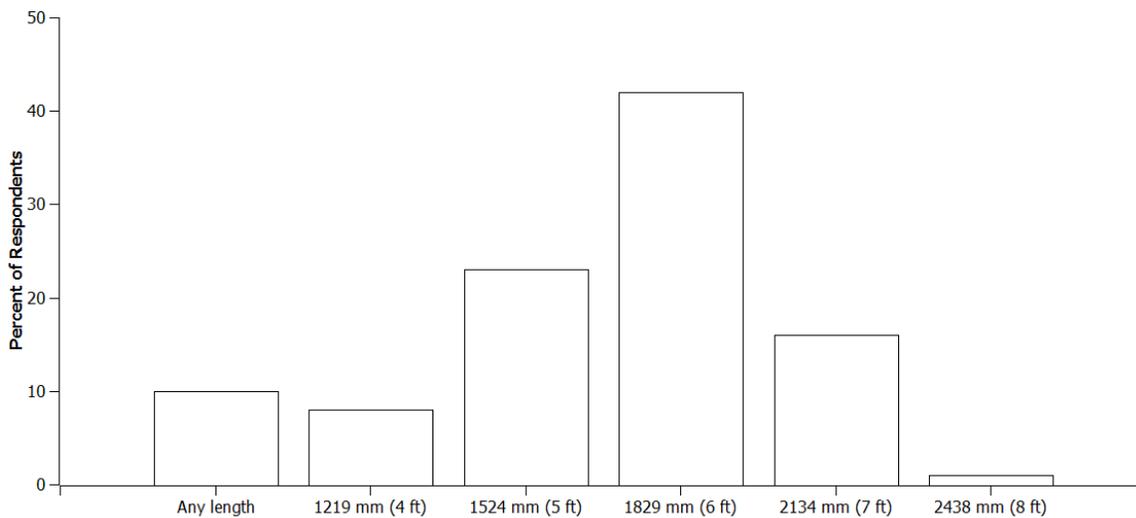


Figure 2. Frequency of survey respondent opinion of alligator gar "trophy" length.

at-risk species may be cause for concern. Bow anglers comprised a small proportion (3%) of Texas anglers; however, that equates to approximately 26,000 bow anglers statewide (Kyle et al. 2012). If the proportion of bow anglers statewide who harvested alligator gar in the previous year is similar to the proportion in our survey (57%), harvest may be significant; especially if the statewide fishing effort for alligator gar is focused on a few populations.

Bow anglers appeared to be a dedicated constituency with specialized boats and equipment. The majority of these anglers indicated bowfishing was their most important fishing activity. Considering the low number of reported bowfishing days during fall and winter seasons, many Texas bow anglers may participate in other outdoor recreational activities, such as hunting, during these seasons, as half of respondents indicated that bowfishing was not their most important outdoor activity. This supposition was supported by anecdotal accounts by anglers who used bowfishing as an important way to prepare for the bowhunting season. If this is the case, bow anglers may represent a portion of Texas license holders who might otherwise not purchase a fishing license or participate in fishing. It will be important for resource managers to strike a balance between the conservation needs of alligator gar and potential negative economic impact of reduced fishing participation that may result from highly restrictive regulations.

Most (76%) reported bowfishing angler days took place between March and August. It is unknown if anglers specifically target alligator gar during certain seasons; however, anecdotal accounts suggest the majority of effort takes place in the spring and summer months. This seasonality is likely related to lower angling success during cooler months, because bowfishing success depends on target fish being visible and in close proximity to the water surface. For gar species, the rate of aerial breathing and periodic surfacing is known to decline with cooler water temperatures and subsequent reduction in metabolic rate below 24 C (Renfro and Hill 1970), which may reduce their vulnerability to bowfishing during fall and winter months. Correspondingly, Quinn (2010) observed an increase in the number of gars harvested at Arkansas bowfishing tournaments during the summer. The vulnerability of many fish species to bowfishing may also increase during spring because spawning occurs in shallow, littoral areas (Echelle and Riggs 1972) where they are more likely to be observed by bow anglers. Information related to bowfishing frequency and gear vulnerability may benefit fisheries managers in the future when considering seasonal fisheries regulations, or when designing creel surveys targeting bow anglers.

Bow anglers reported fishing in reservoirs more frequently than in rivers in Texas, which was consistent with other angler types in the state. About 66% of Texas freshwater anglers reported fish-

ing in reservoirs or lakes from a boat, and 53% reported fishing in reservoirs or lakes from shores or piers in 2012 (Kyle et al. 2012). For this reason, traditional creel surveys are seldom conducted on Texas Rivers. Because bowfishing is frequently conducted at night (Quinn 2010, Bennett and Bonds 2012), reservoir creel surveys may require modification to adequately intercept bow anglers if harvest information is needed by resource managers. Reservoirs may require different creel and length regulations where alligator gar populations exist, although more information is needed.

Angler's fishing site selection is known to be positively correlated with decreasing distance from an angler's home (Hunt et al. 2007, Kyle et al. 2012). Few anglers (37%) in the 2012 Texas statewide survey reported traveling more than 160 km one way during a typical fishing trip (Kyle et al. 2012). Although respondents selected their top three locations to bowfish in Texas, the frequency in which anglers fished these locations was not estimated. However, almost half of top three preferred bowfishing locations listed were over 160 km from angler's resident zip code, which suggested that distance may not be the most important factor when selecting a fishing location.

Eighty-six percent of anglers in the 2012 statewide angler survey reported they did not belong to any angler organization (Kyle et al. 2012). Our survey was distributed to anglers that were either fishing in a tournament or members of a bowfishing organization, which therefore may indicate a bias associated with our survey methods. We don't know how many Texas bow anglers are members of angling organizations. Responses related to tournament activity may also be biased because tournament participants may be more likely to also be members of bowfishing associations than non-tournament anglers (Wilde et al. 1998), and were therefore more likely to have been included in the survey group. However, reported tournament activity suggests that most (72%) bow anglers participate in fewer than five bowfishing tournaments annually. Because our survey results indicated that these anglers were active on online forums, especially the BAA forum, this may be an important way for communicating with this constituency in the future.

The majority of survey respondents indicated alligator gar was a preferred target species. Respondents harvested an average of three alligator gar during the previous year. Four respondents harvested 20 or more alligator gar annually, suggesting some bow anglers may harvest well beyond the average number of alligator gar each year. Although a few bow anglers may be proficient at harvesting the species, most are not, similar to what Bennett and Bonds (2013) observed for Trinity River bowfishing tournaments.

The majority of bow anglers (73%) did not use any other type of gear to fish for alligator gar, suggesting there may not be much

overlap of gear type among anglers. However, in a recent survey of alligator gar anglers at Lake Falcon, Texas, 40% of anglers had used both bow angling and rod and reel to fish for alligator gar (TPWD, unpublished). Although bowfishing is believed to represent a majority of the harvest of alligator gar (Buckmeier 2008), it will be important to consider all angling methods when proposing changes to alligator gar regulations. Fourteen percent of freshwater anglers in the 2012 statewide survey reported fishing for alligator gar during the previous year; however, only 3% reported bowfishing during the this time (Kyle et al. 2012). Thus, future studies are needed to better understand rod and reel harvest and associated mortality of the species.

Because 43% of survey respondents felt Texas' one-alligator-gar-per-day bag limit was too restrictive, many bow anglers favor liberalizing the current regulation, and would not be supportive of greater harvest restrictions. However, a majority (57%) of bow anglers were either neutral or felt the regulation was not restrictive enough, suggesting that a small majority would not oppose increased harvest restrictions.

Because alligator gar are a long-lived species and may require a decade or more to recruit to "trophy" size (Ferrara 2001), it is important to define exactly what length constitutes a "trophy" alligator gar. Angler perception of "trophy" length is an important baseline parameter when considering the management of a fishery for trophy potential or considering certain length-based regulations. Gabelhouse (1984) suggested a fish classified as minimum trophy length should be between 74% and 80% of world record length. Applying this standard to alligator gar, minimum trophy length would measure between 1748 mm and 1890 mm. Angler perceptions in our study were in line with this standard, as they most frequently suggested minimum "trophy" length was 6 feet (1829 mm). However, 56% of alligator gar anglers in a survey at Lake Falcon, Texas, suggested that minimum "trophy" length was at least 7 feet or 2134 mm (TPWD, unpublished). Bow anglers often state anecdotally that they target alligator gar for their trophy potential, which suggest there may be disproportionate harvest of larger fish (>1829 mm), that are predominately female (Ferrara 2001). Because alligator gar exhibit late sexual maturity at total lengths of 950 mm for males and 1,400 mm for females (Ferrara 2001, de León et al. 2001), fish may become increasingly vulnerable to harvest upon reaching maturity. Ferrara (2001) suggested that mid-size, adult alligator gar had the greatest influence on population growth rate and that limited harvest of older, larger fish would not cause population growth rates to decline substantially. Managers should consider age at maturity and size-specific vulnerability of populations to understand the potential for recruitment overfishing.

We believe we obtained an adequate sample size considering the difficulties apparent with surveying bow anglers. However, some nonresponse bias may have occurred as a manifestation of survey methods (Fisher 1996). Online surveys have been found to over-represent those who are more highly educated (Vaske et al. 2011), and less representative of people from lower education and income levels (de Leeuw 2005). We are unsure why the response rate from tournament-distributed surveys was low (9%). Discontentment with the regulation and fear of further harvest restrictions may explain some reluctance to participate in an agency survey. Response rate from TBA members was higher (46%), and similar responses in the online survey supported those from the tournament survey. Despite inherent biases associated with this survey, we believe vital information and characteristics were obtained about a little-studied angling constituency that will prove valuable to management of alligator gar fisheries.

Bowfishing appears to be a seasonal fishery, and bow anglers make up a relatively small constituency comprised primarily of young, male anglers who primarily fish reservoirs in Texas. Bow anglers also comprise a group of anglers who may not otherwise purchase recreational fishing licenses, and it is important to consider these anglers when regulation changes are proposed that may impact bowfishing. Management of alligator gar for trophy fisheries potential must consider that this species may take a decade or more to reach 1829 mm, and that low harvest rates are prudent to allow adequate recruitment to trophy size to provide for sustainable fisheries in the future.

Because this is the first survey of bow anglers, it is unknown if bowfishing participation is increasing; however, it will be important to monitor trends through state-wide angling surveys, online communication, creel surveys, and additional bow angler surveys to better identify potential impacts to species of concern such as alligator gar. Because bow anglers reported fishing more in Texas reservoirs than in rivers, regulations may need to be site specific. Due to the difficulty intercepting bow anglers during traditional creel surveys at water bodies, alternative methods, such as our survey, must be considered and used when designing survey methods to determine the harvest, effort, and species preference of these anglers. Increased creel-length or night-time surveys may be required to intercept bow anglers.

Considering recent concerns about declining alligator gar populations in many areas of the species' range as a result of habitat destruction and over-harvest (Ferrara 2001, Jelks et al. 2008), it is important to better understand harvest of this species. Bowfishing has been observed to result in high harvest rates of some non-game species, and is believed to represent a majority of the recreational harvest of this species (Buckmeier 2008). However, recent studies

indicate catch rates of alligator gar by bow anglers may be lower than suspected (Bennett and Bonds 2012). Catch and harvest rates of alligator gar by rod-and-reel anglers are largely unknown, but may make up a significant portion of overall harvest (Kyle et al. 2012). Because of the widespread distribution of alligator gar fisheries and anglers, managers may need to employ tagging and reporting systems, similar to systems used to monitor harvest of some wildlife and marine fisheries, if accurate harvest information and further study of alligator gar anglers is needed statewide.

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