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Values, attitudes, preferences and socio-economic profile of
recreational paddlefish *Polyodon spathula* snaggers on the lower
Yellowstone River, Montana

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Abstract

In 1993, a 36-question written questionnaire was administered to recreational snaggers of paddlefish *Polyodon spathula* at Intake, an irrigation diversion dam on the lower Yellowstone River and the site of a 500-5,000 annual paddlefish harvest. Three hundred fifty three snaggers were polled to obtain information on their socio-economic characteristics, underlying motivations for and expectations from paddlefishing, their perceptions and knowledge of paddlefishing, and their opinions on specific management regulations. Snaggers were most likely to be young and middle-aged men (modal age 30-39), and to be either unemployed or employed in blue collar professions yielding annual incomes of \$20,000-\$40,000. More than 9 of 10 respondents characterized their paddlefishing habits as snagging at or near Intake rather than at other sites in the region. Primary motivations for paddlefishing included the opportunity to be outdoors, for the experience and thrill of hooking one, and to be with friends. A less strong motivation was to obtain meat for consumption (even though snaggers rated paddlefish meat highly), and few snaggers had any use for the eggs as caviar. Snagging was thought to be an acceptably sporting way to catch paddlefish, and snaggers preferred the prospect of being permitted to catch and keep two fish, even though they did not in general have to actually catch two fish to be satisfied with the fishing experience. Additional analyses were also conducted by

stratifying responses according to age, sex, state of residence, annual income, and educational level. Although catch and release without any harvest was favored by less than a fourth of the respondents, catch and release with some harvest opportunities was a common write-in request.

Introduction

Although the use of surveys to assess angler values, attitudes and preferences has become commonplace in many inland fisheries management programs (Chipman and Helfrich 1988; Quinn 1992), most such surveys have been developed for conventional fisheries such as those for trout (Salmonidae), bass (Centrarchidae) or walleye *Stizostedion vitreum vitreum* (Spencer and Spangler 1992), or for anglers in general within a state or region (e.g., Harris and Bergersen 1985; Brooks 1991). In eastern Montana and western North Dakota, recreational fisheries based on snagging exist for the paddlefish *Polyodon spathula*, an ancient, large, zooplanktivorous fish native to the Missouri and Mississippi rivers and adjacent gulf-coast drainages (Gengerke 1986; Russell 1986). An important paddlefishery exists at Intake, 27 km northeast of Glendive, immediately below a low-head irrigation diversion dam on the Yellowstone River (Scarnecchia et al. 1994). From 1972 to 1993, between 550 and 5,318 paddlefish have been harvested annually from the Intake site (Stewart 1994). As of 1993, regulations at Intake limited the season to May 15-June 30 and limited the catch to two paddlefish per person per year, with mandatory retention of snagged paddlefish.

Because of the paddlefish's eating habits and its unwillingness to take baits, snagging has become the primary method

of recreational harvest. Each fishery in each region or state has developed its own loyal participants, tackle and fishing methods. Little information exists on values, attitudes, and preferences of recreational snag fishermen in general, and no such information is available for the fishery on this stock (called the Yellowstone-Sakakawea stock) in particular. For this reason, in 1993 a survey was conducted at the Intake fishing site with the objectives of obtaining information from snaggers on their 1) socio-economic characteristics, 2) underlying motivations for and expectations from paddlefishing, 3) perceptions and knowledge of paddlefish and paddlefishing, and 4) opinions on specific management regulations.

Methods

Based upon observations by the authors on fishing patterns at the main fishing site (a <0.5 km-long river stretch on both river banks immediately below the diversion dam), it was concluded that a written questionnaire (Duttweiler 1976) would be an appropriate survey method. Snaggers fishing about 2 km downriver at a site commonly known as "the fenceline" were also sampled. Snagging is typically conducted by jerking a large treble hook (8/0 to 10/0) and 113-170 g (4-6 oz) lead weight through the water on 9-23 kg (20-50 lb) test line with a long spinning rod and reel. Snagging is permitted only from shore within 0.37 km (1/4 mi) of the diversion dam, but is legal either from a boat or from shore

further downstream of the dam. Because paddlefish snagging is strenuous, a person typically rests a high percentage of the time he or she is at the fishing site. For this reason, snaggers were often willing or even enthusiastic about filling out a questionnaire, even a questionnaire with numerous questions.

The questionnaire consisted of 36 questions, including two questions with multiple parts (22 parts for one question and 16 for another). General questions not specific to the paddlefish fishery at Intake were modeled after surveys administered by the Texas Parks and Wildlife Department (1986 Texas Survey of Saltwater Fishermen (Texas Parks and Wildlife Department and Texas A&M University 1986) and 1987 Survey of Texas Sport Fishermen (Texas Parks and Wildlife Department and Texas A&M University 1987)). Numerous other questions were added for specific relevance to the paddlefish fishery at the Intake site. Questionnaires were reviewed by two outside human dimensions specialists for inconsistencies, wording, and question sequence. No more than one actively-fishing person per fishing party was surveyed, unless the fishing party consisted of both males and females, in which case one male and one female were surveyed. The survey was conducted during the entire snagging season, from May 15 to June 30, 1993. More than 90% of those approached to fill out a questionnaire were willing to do so. The sample of people surveyed was believed to be representative of the snaggers at the site.

Questions 1 and 2 related to which state, region, or fishing site the snagger did most of his paddlefishing. Questions 3-10 were for those living outside of the Glendive and Intake areas, and concerned how they learned about paddlefishing, as well as how satisfied they were with the site and accommodations and how much money they spent for the trip. Questions 11, 12, 16, 17, 18, 19, 29 and 36 queried the snaggers likes and dislikes about the fishery and regulations at Intake. Questions 13, 21, 25, and 27 concerned the frequency of angling for other species at Intake. Question 14, a 22-part question, queried the snaggers attitudes on snagging, paddlefish, and bag limits. Questions 15, 22, 23, 28 were related to ecology and life history of paddlefish and were designed to inform us on how knowledgeable the snaggers were on paddlefish. In Question 24, snaggers were asked to rank the overall desirability of paddlefish in relation to four other popular game species. In question 20, snaggers were asked for opinions on lead versus steel weights for snagging. Question 26, which consisted of 16 parts, queried the underlying motivations of snaggers for paddlefishing. Questions 30-35 related to demographic information: age, sex, state of residence (MT resident versus non-resident), occupation, annual income and education. The entire questionnaire is presented in Appendix Table 1. Responses of completed questionnaires were entered onto a computerized data file, and responses were tallied and summarized for all questions. Responses for questions 14 (22 parts) and 26 (16 parts) were analyzed with Chi-square tests according to age (35 and older, 34 and under), sex (male vs.

female), state of residence (MT resident versus non-resident), annual income (less than \$30,000 versus \$30,000 or more) and educational level (high school attendee or graduate versus college attendee or graduate). A Kruskal-Wallis test was used to compare fish preferences (Question 24) and rankings of responses for the multiple-part questions 14 and 26. A $P < 0.05$ was required for significance.

Results

Demographics and fishing habits of snaggers

All or portions of 353 questionnaires were completed, although some missing responses occurred for most questions. Responses were obtained for 307 males, 33 females, as well as 13 persons who did not identify their gender on the questionnaire (Q32; a Q before the number refers to the original question number on the questionnaire; Appendix Table 1). Two hundred and three questionnaires were completed by residents of Montana, 130 by non-residents, and the remaining 20 responses were not identified by place of residence (Q33). Snaggers were most likely to be young and middle-aged men. The most common age groups (males and females combined) were 30-39 (99), 20-29 (79), and 40-49 (67). Fewer older persons actively snagged (60-79 age group: 19; Q31). Questionnaires were nearly

evenly split between persons 35 and older (50%) and 34 and younger (49%), with 1% of unknown age.

Although there are other locations within eastern Montana and western North Dakota where paddlefish can be snagged, more than 9 of 10 respondents best characterized their habits as snagging at or near Intake rather than at one or more other sites in the region (Q1). Only 6% had snagged for paddlefish above Fort Peck reservoir in the past five years (Q2B), and only 2% had snagged or bowhunted paddlefish in the Dredge Cuts below Fort Peck Dam during the past five years (Q2C). In contrast, 30% had snagged for paddlefish at Intake each of the past five years, and about half had snagged there at least three of the past five years. In addition to these experienced Intake snaggers, 40% had snagged only one year out of the past five, or were snagging at Intake for the first time in 1993 (Q2A).

About half of the snaggers also fished for other species during their paddlefishing trip to Intake, mainly channel catfish *Ictalurus punctatus* (115 responses), shovelnose sturgeon *Scaphirynchus platorynchus* (52), sauger *Stizostedion canadense* (33), and walleye (29; Q13A, Q13B). Eighty-five percent of the snaggers had not competed in any organized fishing tournaments in the past year, another 12% had competed in one, and 3% in more than one (Q25). Overall fishing activity of snaggers ranged widely from very active to essentially inactive. Twenty-seven percent of the

snaggers fished at least 50 days per year, whereas 12% fished at least one but less than 10 days, and another 12% fished at no other time except for paddlefish (Q27). During the rest of the year, the active anglers fished mostly often for trout (117 first responses), walleye (91), and channel catfish (38; Q21).

Visitation habits and expenditures of non-local snaggers

Ninety-eight percent of non-local snaggers (i.e., those living outside of the Glendive/Intake area) learned about opportunities at Intake for paddlefishing from friends (undoubtedly including relatives; 86%; Q3A) and family members (19 of 35 write-in responses; Q3B). Only 2% of snaggers learned about snagging through advertisement in audio-visual media (television, radio, magazine, newspaper, Chamber of Commerce brochures). Nearly half (47%) of non-local snaggers brought no non-snagging companions, and another 29% brought only 1 or 2 non-snagging companions (Q4). Average duration of stay in the Glendive/Intake area (excluding one stay of 35 nights) was 2.4 nights, and ranged from 0 to 12 nights (one response of 35 nights was excluded). The most common stay durations were zero nights (52 responses), two nights (80), three nights (57) and one night (47); Q5). Only 1 in 10 respondents visited Makoshika State Park, a nearby badlands area, during their visit to Intake (Q8).

As for lodging for non-locals, 57% slept in either trailers, campers, or tents, 8% stayed in residences of family or friends,

and 14% traveled out of the area without needing lodging. Several people slept in their car or truck. Only 14% stayed in a motel or hotel in Glendive, so expenditures for lodging were generally low. About 82% of snaggers spent less than \$30 for lodging during their trip; less than 10% spent more than \$70 for lodging (Q10). More than 9 of 10 respondents rated lodging facilities (all types) satisfactory or better (Q7).

Based on responses, expenditures for gasoline and food were somewhat higher than for lodging. About 40% of the snaggers spent more than \$30 for gasoline locally during their visit (Q9), and about 58% spent more than \$20 for food and 30% spent more than \$65 for food (Q9).

Socio-economic characteristics of snaggers

In general, paddlefish snaggers at Intake tended to have blue-collar, as opposed to white-collar, professions, or to be unemployed. The most common occupations were unemployed (41), mining or oilfield worker (37), construction workers, including electricians and pipefitters (35), sales, services, or small business employment (33), students (31), farmer, rancher, or farmhand (24), equipment operator or truck driver (16), state government (15), mechanic (11), self-employed (11), and railroad employee (10). Essentially absent were attorneys (1), executives (1), engineers (3) and other white-collar professions (Q30).

Most snaggers had low to moderate household incomes and educational backgrounds. The most common responses to household income before taxes were \$30,000-39,999 (21%), \$20,000-29,999 (20%), and \$10,000-19,999 (16%). About 9% of respondents had an income exceeding \$70,000 (34). Nearly half best described their educational level as high school graduate, 10% did not graduate high school, only 16% had degrees from 4-year institutions, and only 5% had advanced degrees (Q35).

Paddlefishing motivations and expectations

Based on questions asked, rated and averaged from most important (score=5) to least important (score=1), paddlefish snaggers came to Intake to be outdoors (mean = 4.47; Q26A), for the experience and thrill of hooking a paddlefish (4.46; Q26H), to be with friends (4.35; Q26I), to get away from the regular routine (4.29; Q26L), for the challenge or sport (4.28; Q26N), and for relaxation (4.02; Q26D). Lower ranking motivations were to experience new and different things (3.98; Q26C), to catch an unusual fish (3.96; Q26O), for family recreation (3.88; Q26B), to catch a really large fish (3.88; Q26M), to experience natural surroundings (3.82; Q26K), to get away from the demands of other people (3.78; Q26G), and to be close to the river (3.71; Q26E). Still less important motivations were to meet new people (3.51; Q26P), and to obtain meat for eating (3.14; Q26F). In contrast to all of the foregoing responses, where positive motivation was

indicated, few were motivated to snag a paddlefish to eat the eggs as caviar (1.37; Q26J). When responses were analyzed with a non-parametric Kruskal-Wallis test of multiple comparisons, results were consistent with mean values of responses calculated above (Table 1).

Even though eating the paddlefish was not highly ranked compared to other motivations for snagging paddlefish, nearly 7 of 10 snaggers either agreed (23%) or strongly agreed (45%) that they enjoyed eating paddlefish (Q14A). Nearly half agreed (13%) or strongly agreed (34%) that it was equal in eating quality to trout, whereas about one in four thought it inferior to trout (Q14D). In contrast, meat from walleye was somewhat more highly regarded than that of paddlefish (Q14U). When all 22 parts of question 14 were submitted to multiple comparisons, we found that the most agreement was in the appreciation for the cleaning services at Intake (Q14O), followed by the opinion that paddlefish are a special fish that snaggers feel privileged to catch (Q14Q), and that snagging is an acceptably sporting way to catch them (Q14S). Strong agreement was also voiced about the fine eating qualities of paddlefish (Q14A), and the snaggers' preference for having the fish cleaned immediately (Q14P). There was a high degree of agreement, in general, with the idea that fishing could be successful while catching just one fish (Q14I; Table 1).

Perceptions and knowledge of paddlefish and paddlefishing

Perceptions on paddlefish - To most snaggers, the distinctiveness of paddlefish was well recognized. When asked to rank the desirability of the species in general (i.e., the fish itself, including food value, sport value, and all other unarticulated values; 1 = most desirable, 5 = least desirable) against four other species--walleye, northern pike *Esox lucius*, cutthroat trout *Oncorhynchus clarki*, and largemouth bass *Micropterus salmoides*--walleye (mean = 1.98) ranked higher than paddlefish (2.32), followed by cutthroat trout (2.44), northern pike (2.82), and largemouth bass (2.91; Q24). Statistically, walleye were the most preferred, then the group including cutthroat trout and paddlefish, then the group including northern pike and largemouth bass. More than 6 in 10 (61%) strongly agreed, and another fourth (25.3%) agreed that "the paddlefish is a really special fish and I feel privileged to be able to fish for them" (Q14Q). They did not, however, necessarily attribute their high esteem for paddlefish to its physical appearance. They found it to be not uglier, nor more appealing in appearance, than a trout (Q14M), nor did they attribute its distinctive qualities solely to its large size (Q14N). Although more than half of the snaggers agreed or strongly agreed that "the bigger the paddlefish I catch, the better the trip", a third of the respondents were neutral on this question, indicating that the need to catch a large paddlefish was strong for a portion of snaggers, but much less relevant for others (Q14B).

The appreciation of the complimentary paddlefish cleaning

service at Intake (for the donation of the roe) was higher than the tendency for snaggers to immediately bring in their catch to have it cleaned while the fish was still fresh (Q140, Q14P).

Knowledge of paddlefish- When asked to rate how well informed they were about the life cycle and ecology of paddlefish in Montana, nearly half said they "know something" about them; a third said they did not know very much, 10% said they were very well informed, and 8% said they knew nothing about paddlefish (Q22).

Sixty two percent of the respondents knew that paddlefish were filter feeders on planktonic organisms, although many were confused about whether paddlefish ate zooplankton or algae. Many of the 55 missing responses may also have indicated lack of knowledge of feeding habits (Q28).

When asked how old a 39-kg (85 lb.) paddlefish from eastern Montana might be (typically 25 to 40; Scarnecchia et al. 1994), nearly 30% estimated the age to be within this range. Most responses were in the range of 10 to 50, but 12% estimated ages to be 60 and greater, and another 12% estimated ages to be less than 10. Nearly 10% of those surveyed did not respond to the question (Q23).

When asked what rivers or states in the U. S. paddlefish were found, responses were predominantly the Missouri and Yellowstone

Rivers in Montana and North Dakota. Only a few snaggers knew of paddlefish populations in other rivers or states (Q15).

Perceptions on snagging - Although respondents found snagging to be an acceptably sporting way to catch paddlefish (61% strongly agree, 25% agree, only 2% disagree or strongly disagree; Q14S), they did not necessarily find paddlefishing to be more enjoyable, or less enjoyable, than other types of fishing (30% D/SD, 27% A/SA, 43% neutral; Q14K). They showed no overall preference for day versus night snagging (Q14T).

General perceptions about paddlefishing at Intake - Among snaggers returning to Intake in 1993, 72% were satisfied or very satisfied with their most recent (past) paddlefishing trip to Intake; only 17% were dissatisfied or very dissatisfied (Q18). Higher satisfaction was indicated by those snaggers catching (and harvesting) more paddlefish. Mean catch of snaggers highly satisfied with their last fishing trip was 1.6 fish/snagger (N = 144); for those satisfied, 1.2 fish/snagger (n = 66), for those neutral, 0.7 fish/snagger (n = 32), for those dissatisfied, 0.6 fish/snagger (n = 30), and for those very dissatisfied, 0.9 fish/snagger (n = 19; Q18, Q19).

When asked what they most liked about paddlefishing at Intake, snaggers cited fishing for and catching paddlefish (132), the

social environment (68), and entertainment and excitement (25; Q11). When asked what one aspect of paddlefishing at Intake they would most like to see improved, snaggers responded better boating, fishing, and access conditions (41), some catch and release opportunities for paddlefish (33) and better camping facilities (32; Q12). More than 9 of ten respondents said they were planning to return to Intake for paddlefishing in 1994 (Q29a). Of those who were not planning to return, or were unsure, the most cited reasons were the travel distance to the site (6) and potential regulation changes (5; Q29B). For closing comments (Q36), the most common responses were that paddlefishing was much fun (39), that a catch and release option is needed (19), and that they appreciated the uniqueness of paddlefish, and that the protection of the species should be insured (15).

Attitudes toward regulations

Several questions related to the current regulations on the paddlefish fishery and what the snagger's response might be to changes in regulations. As of 1993, the bag limit was two fish per person per year, with mandatory retention of snagged fish (i.e., no high grading), and no size limits. Landed paddlefish had to be tagged at the front of the dorsal fin with one of the two individually-numbered, locking tags each snagger was permitted to purchase. Once a person had caught two fish, he was not permitted

to continue snagging, and there was no catch and release program.

In general, snaggers did not find the prospect of a one-fish annual limit as satisfactory as a two-fish annual limit. Sixty-one percent of snaggers thought it would be less satisfactory, and only 24% thought it would be as satisfactory or more satisfactory (Q14L; Figure 1a). If the neutral responses are interpreted as satisfactory, the percentage of snaggers that would be satisfied with a one-fish limit increased to 39%. Faced with an option of a three-fish limit, nearly half (49%) thought it would be at least as satisfactory as a two-fish limit, but 31% thought it would not be as satisfactory, which indicated that although many snaggers did not prefer a more conservative bag limit, neither did they prefer a more liberal bag limit than two fish (Q14R; Figure 1b). The extra satisfaction gained from being able to catch two paddlefish rather than just one did not, however, necessarily mean that snaggers felt unsuccessful if they caught only one fish. When asked if they felt unsuccessful in they caught only one paddlefish, 60% said no, and only 16% said yes; the rest were neutral (Q14I; Figure 1c). This response was consistent with their response to the statement: "I am just as happy if I catch one paddlefish as two fish, so long as I do not get skunked"(skunked = catch no fish; Q14E; Figure 1d). Sixty-four percent of respondents agreed or strongly agreed with this statement, and only 18% disagreed or strongly disagreed. Evidently is was the legal possibility, the prospect, of continuing fishing and perhaps catching the second

paddlefish that was important to the snaggers, not necessarily the actual capture of the second fish.

Trip satisfaction was related in some manner to this prospect, even if not actualized, of continuing fishing in pursuit of the second fish. Nearly half (49%) the respondents thought that it would not be worthwhile for them to come to Intake for paddlefishing with less than a two-fish limit, and only 36% thought the trip would still be worthwhile (Q14J). Furthermore, six of ten respondents thought that without paddlefishing, they would not spend much time in the Glendive/Intake area (Q14H).

Catch and release, *without any retention of paddlefish*, was not found to be a favorable alternative. When snaggers were asked if they would be just as happy if they didn't catch the two fish they were entitled to, as long as they could be photographed next to the fish, less than a fourth of the snaggers answered affirmatively (Q14G; Figure 1e). No questions were asked during this survey to ascertain the views of a one fish retention plus catch and release on the second fish. Snaggers generally preferred the prospect of catching one large paddlefish (typically female fish) to two small paddlefish (typically male fish), but many snaggers (30%) were neutral on this question (Q14F). Two-thirds of snaggers agreed with the two-fish annual limit in place as of 1993, and only 18% disagreed with the two-fish limit (Q16). Of those 18% (63 snaggers) who disagreed with the regulation, only 17 snaggers

thought the regulations were too restrictive; 18 snaggers thought a catch and release option was needed. Overall, therefore, snaggers were satisfied with the two-fish bag limit and tag system in place as of 1993.

As of 1993, most sinkers used on paddlefish lines are made of lead. Snaggers were evenly split (52% Yes, 48% No) about supporting steel sinkers (Q20).

Responses by age, sex, state of residence, income and education (Table 2)

Age - Snaggers 35 and older had lower demands for harvesting and eating paddlefish than did younger snaggers. Older snaggers did not equate catching their limit with a successful trip as strongly as did younger snaggers ($P < 0.05$; Q14C). The older snagger was also much more likely to be just as happy catching only one fish as two fish, as long as he did not get "skunked" (i.e., catch no fish; $P < 0.01$; Q14E). Younger snaggers placed more importance than older snaggers on eating paddlefish ($P < 0.05$; Q26F), on being with friends ($P < 0.01$; Q26I), on meeting new people ($P < 0.05$; Q26P), and on the thrill and enjoyment of hooking a paddlefish ($P < 0.05$; Q26H). Although snaggers as a group were largely neutral about daytime versus nighttime snagging, older snaggers were much more apt to prefer daytime over nighttime snagging than were younger snaggers ($P < 0.05$; Q14T).

Sex - Catching a large paddlefish had much more significance to male snaggers than female snaggers ($P < 0.01$; Q26M). To male snaggers, catching one large paddlefish rather than two small paddlefish was much more important than it was to female snaggers ($P < 0.05$; Q14F). Although male snaggers found paddlefish not to be as good to eat as walleye, female snaggers as a rule found paddlefish superior to walleye ($P < 0.01$; Q14U). Female snaggers rated the family recreation aspect of paddlefishing as much more important than did male snaggers ($P < 0.01$; Q26B).

State of residence (MT resident versus non-resident) - As expected, in the absence of paddlefishing, non-residents of Montana were less likely than residents to spend much time in the Glendive/Intake area ($P < 0.01$; Q14H). They were also less interested in returning to Intake with less than a two-fish annual limit ($P < 0.01$; Q14J). But although a less than two-fish limit would discourage fishing by non-residents more than residents, actual harvest expectations were higher for residents than non-residents. Significantly more residents than non-residents indicated that they felt unsuccessful if they caught only one paddlefish ($P < 0.01$; Q14I). Non-residents were more favorably inclined toward snagging at night than were residents ($P < 0.05$; Q14T), and although both residents and non-residents tended to enjoy the people and the social environment at Intake, residents tended to enjoy it more than non-residents ($P < 0.05$; Q14V).

Responses of non-residents tended to reflect a newness of experience denied to long-time residents of the area. Non-residents expressed greater interest than residents in the novelty and distinctiveness of paddlefishing ($P < 0.01$; Q26C), in catching an unusual fish ($P < 0.01$; Q26O), in the challenge or sport of paddlefishing ($P < 0.05$; Q26N), in the experience and thrill of hooking a paddlefish ($P < 0.01$; Q26H), in being close to the river ($P < 0.05$; Q26E), and in meeting new people ($P < 0.01$; Q26P).

Annual income - Although paddlefish were not rated, overall, as a less attractive fish than trout, snaggers with annual incomes greater than \$30,000 were more apt to rate the paddlefish's appearance favorably than were people with incomes less than \$30,000 ($P < 0.05$; Q14M). Despite near unanimity of support for the cleaning services at Intake, people with higher incomes were significantly more supportive of the services than were those with lower incomes ($P < 0.05$; Q14O). Snaggers with higher incomes placed more emphasis than those with lower income on the relaxation value derived from paddlefishing ($P < 0.05$; Q26D), and less emphasis on the meat value of a paddlefish ($P < 0.05$; Q26F).

Education - Although neither college-educated nor high-school-educated snaggers preferred catch and release with no harvest (i.e., merely being photographed next to the fish rather than retaining it), college-educated snaggers were significantly more supportive of this release strategy than were high-school educated

snaggers ($P < 0.01$; Q14G). High-school educated snaggers also indicated more value than college-educated snaggers in paddlefishing to get away from the demands of other people ($P < 0.05$; Q26G).

Discussion

Paddlefish snaggers tended to be predominantly young and middle-aged males, employed in blue-collar occupations or unemployed (including retired), of somewhat lower educational level than Montana residents at large, and of generally low to moderate income common to Montana and the immediate region. Although a random survey of warmwater anglers (McFarland and Brooks 1993) and the 1990 census indicated that 46-47% of Montanans 18 and older (anglers and non-anglers) had at least some college education, only 42% of Intake snaggers had that level of education. There was some illiteracy among snaggers documented during the survey process. Despite a relatively low level of formal education, however, snaggers clearly recognized the distinctiveness and special qualities of paddlefish (Q14Q), and demonstrated a reasonable knowledge of the life history of the species. Although the source of this knowledge is not known, information displays at the Intake site and in the Montana Department of Fish, Wildlife and Parks Region 7 Office in Miles City, MT, two informational brochures distributed at Intake, and considerable daily interaction between biologists and snaggers at Intake may have contributed to a more

informed snagger.

Numerous responses in this study were consistent with broader, statewide surveys conducted by McFarland and Brooks (1993) on warmwater anglers and Brooks (1991) on Montana anglers in general. For example, both this study and McFarland and Brooks' (1993) study found that primary motivations for fishing were to be outdoors and to get away from routine activities (Q26A, Q26L; their Table 4). Similarly, eating fish was of lesser priority than the outdoor experience, both in this study and in McFarland and Brooks' (1993) study (Q26F; their Table 4). Despite this lower emphasis on eating fish, however, neither paddlefish snaggers (Q14G) nor warmwater Montana anglers sampled by McFarland and Brooks (1993) were especially enthusiastic about catch and release as a substitute for harvesting at least some fish. When warmwater anglers were asked by McFarland and Brooks what restrictive regulations would be preferred if more restrictive regulations were needed to increase or maintain the number of large fish in a water body, a total catch and release regulation was never among the top three options (their Question V4; their Table 8).

Although eating fish was thus not found to be a primary motivation for fishing for most of Montana's warmwater anglers, nor for Intake's paddlefish snaggers (Q26F), eating at least some of the fish caught is evidently an important part of the overall fishing experience. A similar result was reported by Matlock et

al. (1988) for Texas coastal fisheries for Scienids (drums and seatrout), where anglers were strongly opposed to catch and release without a harvest option. A catch and release program was encouraged by many respondents (Q36) at Intake, and strongly supported in another survey in 1994 (Scarnecchia and Stewart 1994), but only when catch and release was *in addition to*, not *in place of*, a harvest. In this study, individuals of higher education were more willing to accept total catch and release than were less educated snaggers, but neither group was in favor of it.

As might be expected, the paddlefish rated much more favorably as a species to paddlefish snaggers than it did to Montana anglers in general. Whereas snaggers rated the paddlefish over largemouth bass, northern pike, and on par or preferable to cutthroat trout (Q24), to the general Montana public, paddlefish was not even on the list of the top 15 species or species groups. Species preferences of Montana anglers statewide for trout, bass, walleye, and northern pike all greatly exceeded that for paddlefish (McFarland and Brooks 1993). Despite considerable media publicity and efforts at education through information displays and brochures, many people throughout Montana remain unfamiliar with the paddlefish and the specialized form of fishing for them. On the Missouri and Yellowstone rivers, however, paddlefish were the primary target species for 17% and 4% of the anglers fishing those areas, respectively. Even on the Yellowstone, the paddlefish is much less sought after than channel catfish, walleye, and sauger

(Brooks 1991), perhaps in part because paddlefish season is so short (May 15-June 30), the total catch so limited (annual bag limit of two fish as of 1993), the fishing gear so specialized and the fishing technique so strenuous compared to those for the other species.

The low participation of females in snagging is consistent with the McFarland and Brooks's (1993) result that 85% of Montana's non-anglers are female, and that only about a third of females currently fish. Similarly, the largest group of anglers in their study was in the age group 31-45, again consistent with results from Intake, where their modal age group was 30-39. At Intake, however, a third of the respondents were less than age 30, whereas the 18-30 age group constituted less than 20% of anglers statewide, which suggested to us that the strenuous effort involved in snagging may favor younger participants.

Inasmuch as Dawson County (1990 population 9,505; median household income \$23,414; Montana Department of Commerce 1993), which includes Glendive and Intake, has suffered economically since the 1980s, paddlefishing has been looked upon as a means of increasing tourism. Although the paddlefish fishery has been a contributor to the local Glendive economy since the mid-1960s, when the fishery developed (Robinson 1966), lodging, food, and gasoline expenses indicate that many snaggers paddlefishing at Intake are quite self-contained and contribute less to the local economy than

we had supposed. Only 14% of the non-local snaggers sought motel or hotel accommodations in Glendive. More than 9 of 10 respondents were satisfied with their lodging accommodations; of the 31 that were not satisfied, 27 would have preferred improved camping, showers, or other facilities at Intake that might have resulted in still fewer snaggers lodging in Glendive, as well as the loss of naturalness to the fishing site for a 6 week season. Our observations indicate that usage of the Intake site is highest during paddlefish season, and it does not seem prudent to us to develop the site extensively for a 6-week paddlefish season.

Information obtained on attitudes toward fishing regulations has immediate relevance to paddlefish management at Intake. In 1994, after this survey was conducted, the Montana Department of Fish, Wildlife and Parks reduced the annual bag limit from two fish to one fish based on information indicating declining catch rates at Intake, increased rates of recovery of tagged fish (Stewart 1994), and an aging paddlefish population (Scarnecchia et al. 1995). North Dakota's annual bag limit for fish of this stock remained at two at all fishing sites on the Missouri river above Garrison Dam. Although catch rates (fish per hour) for paddlefish in North Dakota tend to be lower than at Intake (North Dakota Game and Fish Department, Unpublished), which reduces the actual harvest differential between states, informal comments from anglers at Intake in 1994 nevertheless indicated considerable unhappiness with this difference in bag limits. Even though anglers were generally

satisfied with catching and retaining just one paddlefish (Figure 1d), the prospect of being able to continue fishing for a second fish was evidently important to them. Although catch and release has been considered for this stock (Scarnecchia and Stewart 1994), any such implementation would need to be undertaken cautiously, under strict control at specific sites, only during daylight hours, and be closely monitored (Scarnecchia and Stewart 1994).

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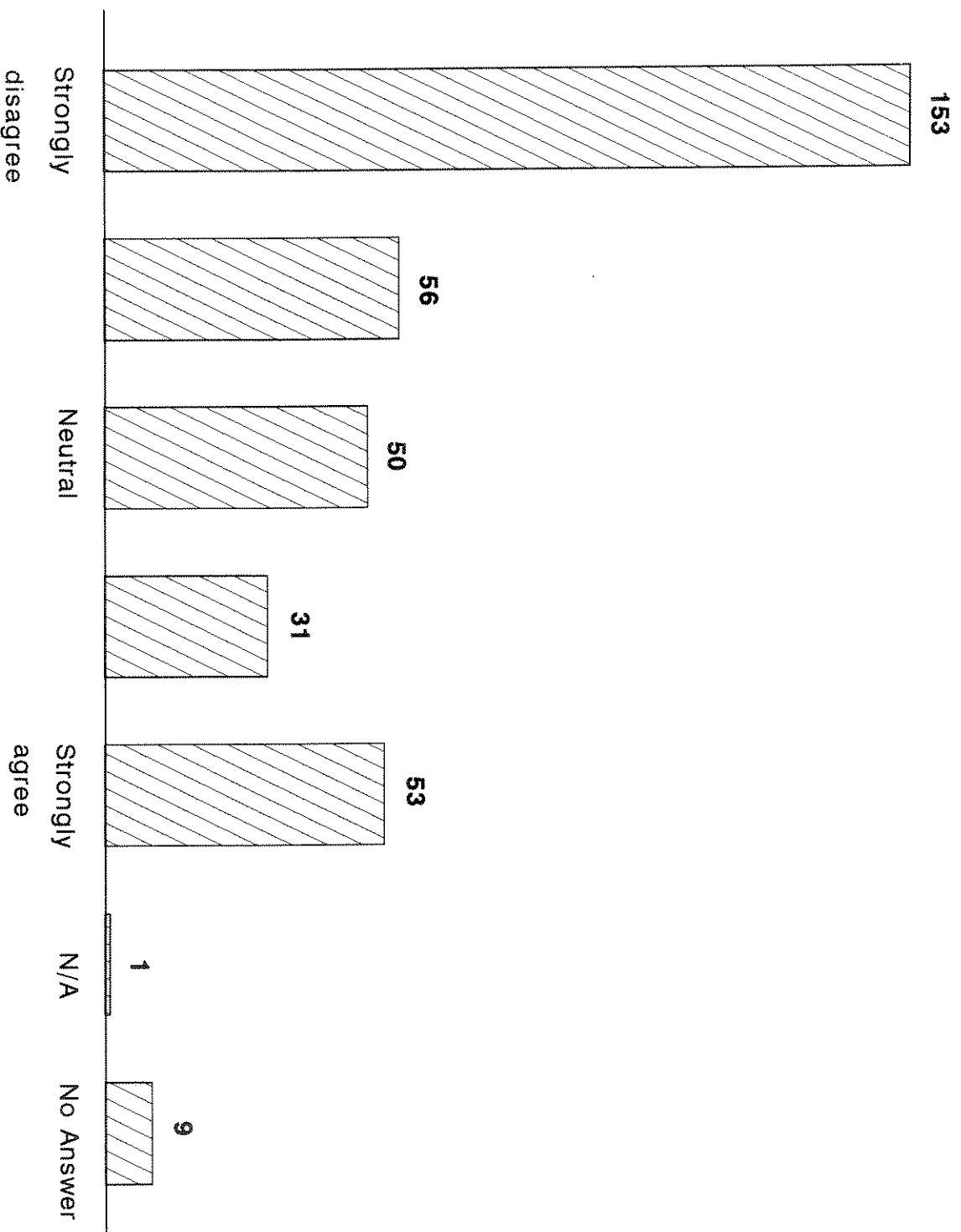
Table 2. Parts of questions 14 and 26 showing significant differences (Chi-Square; $P < 0.05$) according to age (<35 vs. 35 and older), sex (M vs. F), state of residence (MT resident versus non-resident), income (<\$30,000 versus \$30,000 or more), and education (High school attendee or graduate versus college attendee or graduate) of respondents. *Italics indicate $P < 0.01$.*

	Question	
	14	26
Age	C, E, T	F, H, I, P
Sex	F, U	B, J, M
Residence	H, I, J, T, V	C, E, H, N, O, P
Income	M, O	D, F
Education	G	A, G, H, I, N

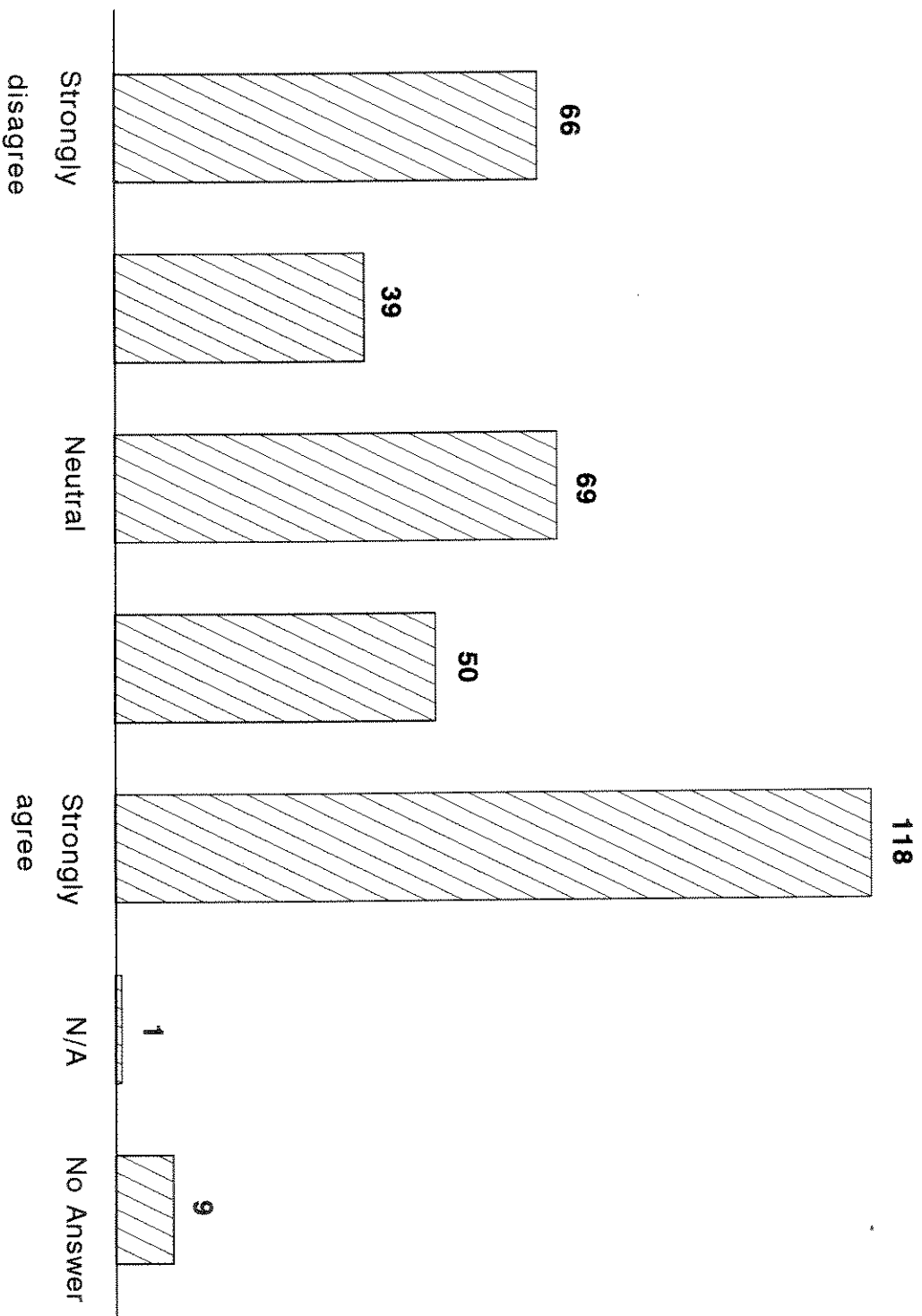
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Figure 1. Responses to statements on bag limits, harvest, and catch and release options for Intake paddlefishery: a) one fish annual bag limit; b) three fish annual bag limit; c) feeling of success with only one paddlefish retained; d) satisfaction with one fish retained; and e) catch and release satisfaction.

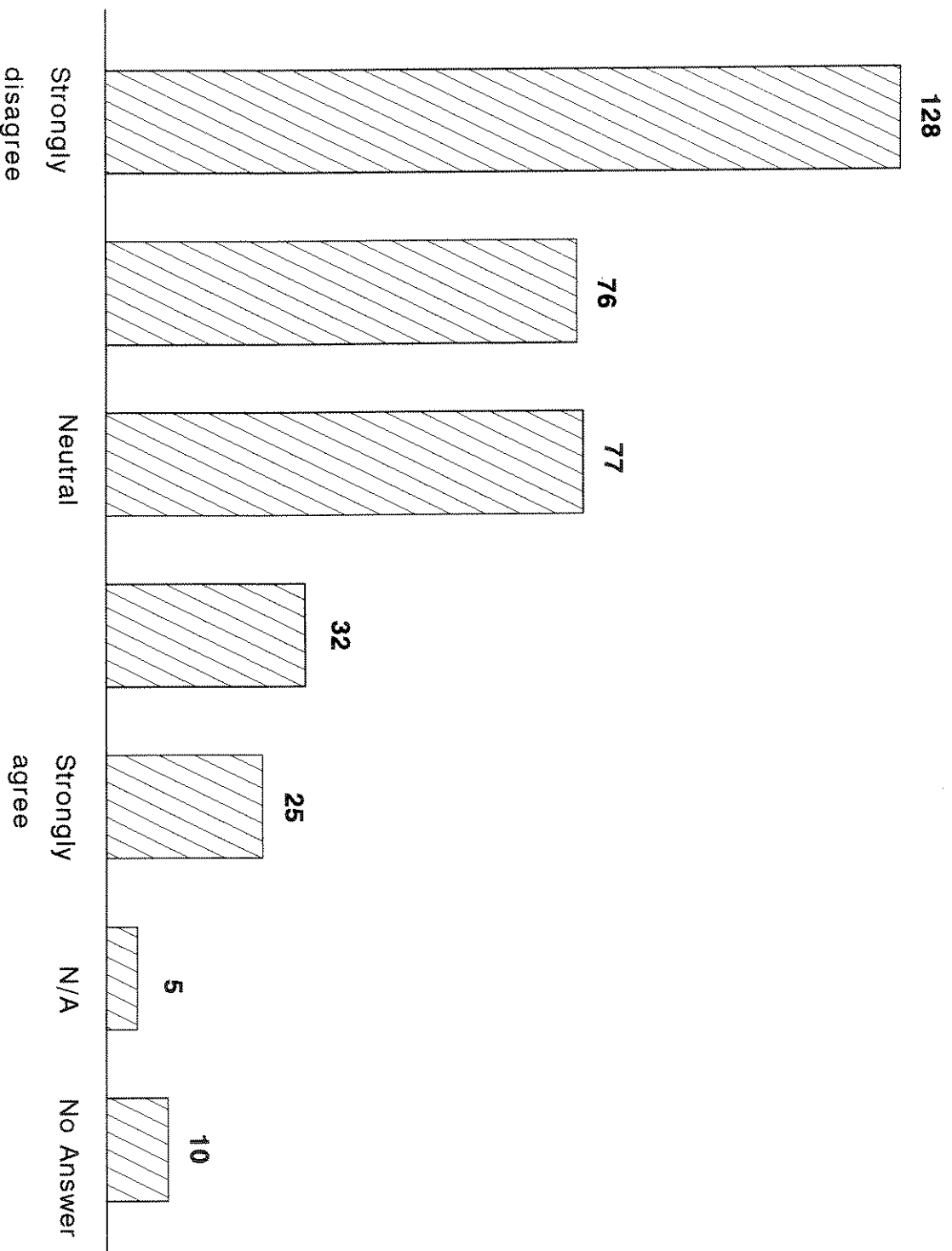
" I would find a one fish annual limit just about as satisfactory as the current two fish limit. "



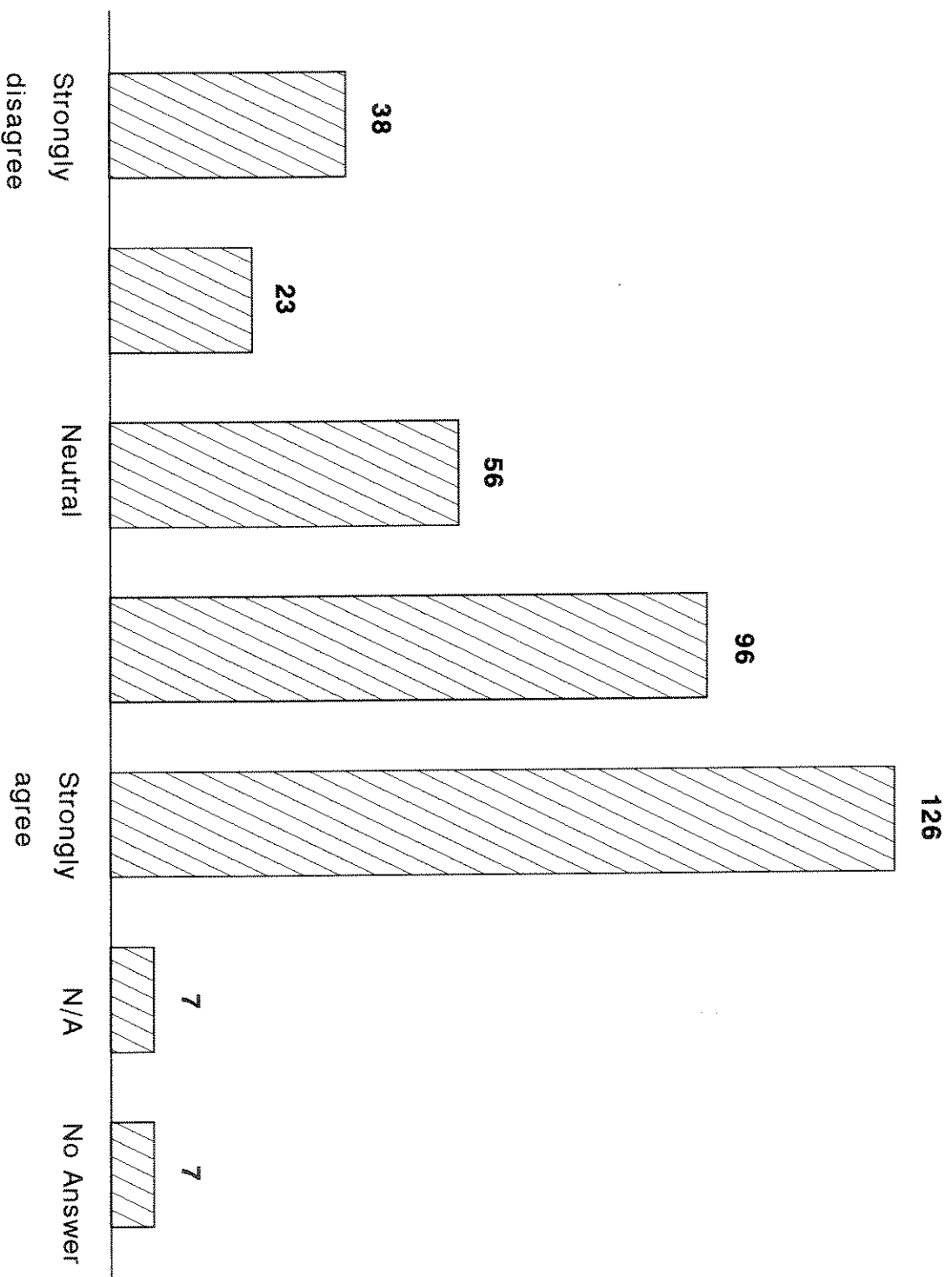
" I would find a three fish annual limit just about as satisfactory as the current two fish limit. "



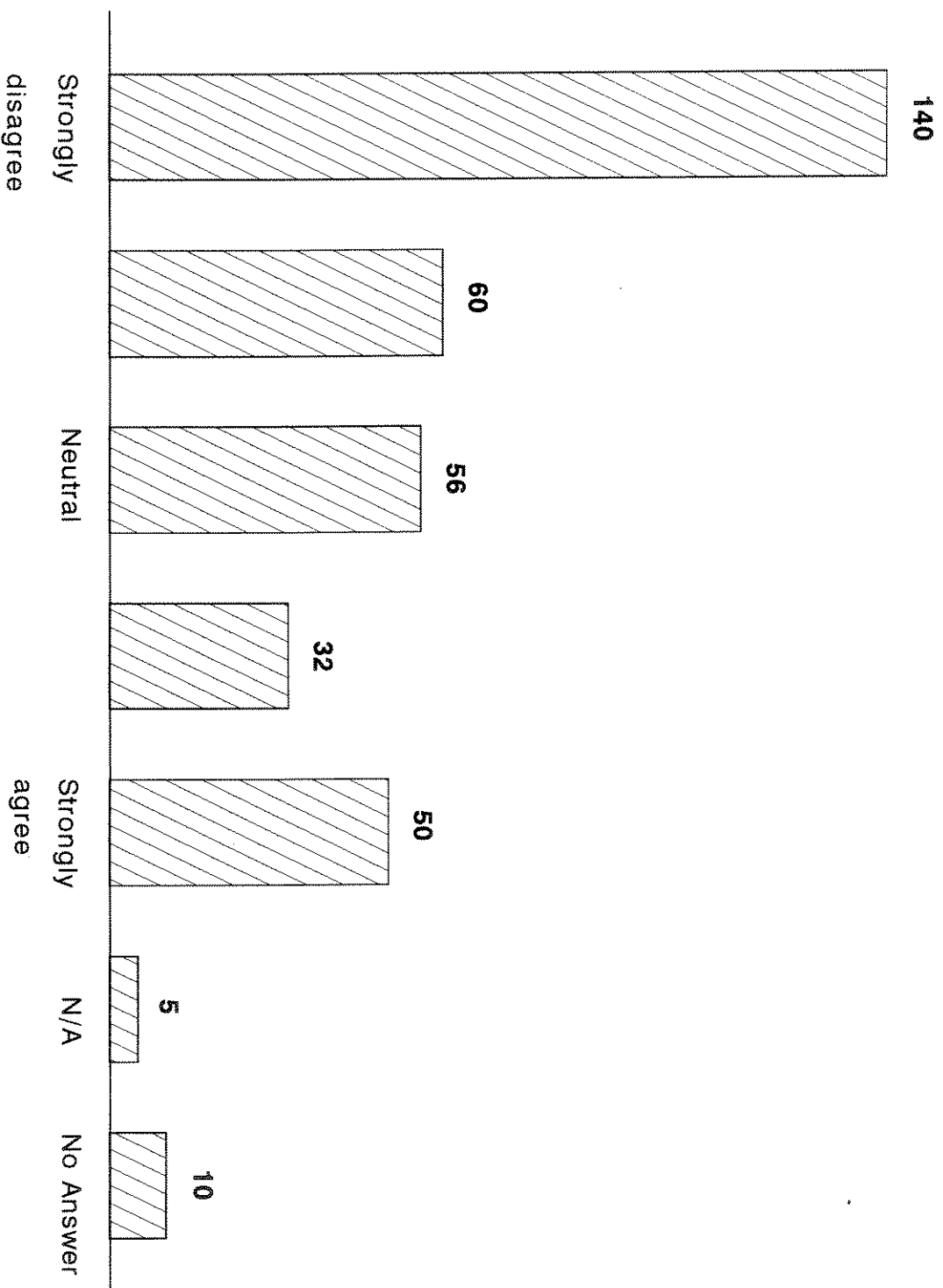
" I feel unsuccessful if I catch only one paddlefish. "



" I am just as happy if I catch one paddlefish as two fish, as long as I do not get skunked. "



" I would be just as happy if I didn't keep the two fish I'm entitled to catch, as long as I could be photographed next to them. "



Appendix Table 1. Paddlefish survey questions and responses (in italics).

INTAKE PADDLEFISH SURVEY -- 1993

This questionnaire was developed to obtain information on your activities, preferences, and attitudes concerning paddlefish and paddlefishing. PLEASE DO NOT PUT YOUR NAME ON THE SURVEY. Results of your specific questionnaire will remain confidential and not be identifiable with you. The survey is targeted especially for paddlefishing at Intake on the Yellowstone river, but some of the questions are for general opinions toward fishing in Montana. Please try to answer all questions applicable to you. Thank you for your cooperation and interest in paddlefish!

1. Which one of the following best describes where you fish for paddlefish?

- a. At or near Intake (312)
 - b. The Missouri River above Fort Peck Dam (3)
 - c. The dredge cuts below Fort Peck Dam (0)
 - d. At the confluence of the Missouri and Yellowstone Rivers (19)
 - e. I fish two or more of these sites. (0)
- Other responses (1)*

2. In how many years in the past 5, including this year, have you fished for paddlefish:

Yrs (No. responses)

- a. At or near Intake? 0(24), 1(94), 2(52), 3(39), 4(36), 5(108)
- b. On the Missouri River above Fort Peck? 0(331), 1(11), 2(3), 3(4), 4(2), 5(2)
- c. In the dredge cuts below Fort Peck? 0(346), 1(3), 2(3), 5(1)
- d. At the confluence of the Missouri and Yellowstone Rivers? 0(335), 1(10), 2(4), 3(1), 4(2), 5(1)
- e. In states other than Montana or North Dakota? 0(344), 1(4), 2(3), 5(2)

QUESTIONS 3-10 SHOULD BE ANSWERED ONLY BY THOSE PEOPLE WHO ARE NOT RESIDENTS OF THE GLENDIVE/INTAKE AREA. LOCAL RESIDENTS, SKIP TO QUESTION 11.

3. How did you first find out about paddlefishing at Intake? (Select one)

- a. Friends (263)
- b. Radio outdoor show (1)
- c. Television fishing show (2)
- d. Magazine (1)
- e. Newspaper (0)
- f. Chamber of Commerce brochure (2)
- g. Other (19) - *most common write-in response - informed by family members*

4. How many non-fishing family members, non-fishing relatives, and non-fishing friends in total came with you on your most recent trip to Intake?

- a. 0 (122)
- b. 1 - 2 (75)
- c. 3 - 4 (45)
- d. 5 - 6 (13)
- e. 7 or more (5)

5. How many nights did you spend in the Glendive/Intake area specifically for the purpose of fishing for paddlefish? _____ Nights

<u>Nights</u>	<u>Number of Responses</u>
0	52
1	47
2	80
3	57
4	36
5	14
>5	21

- GASOLINE: \$0-4 (63), \$5-10 (17), \$11-20 (46), \$21-30 (55), \$31-65 (82), \$66-100 (28), > \$100 (16)

10. Please estimate the total amount which was spent for LODGING in the Glendive area during your last completed visit that was mainly for paddlefishing.

LODGING: \$0-4 (180), \$5-10 (27), \$11-20 (28), \$21-30 (16), \$31-65 (26), \$66-100 (15), > \$100 (15)

11. What one thing did you like most about paddlefishing at Intake?

Fishing for and catching paddlefish (132)
People, social aspect (68)

12. What one thing about paddlefishing at Intake would you most like to see changed?

Better boating/fishing access (41)
Allow catch and release (33)
Better camping facilities (32)

13. When you are paddlefishing at Intake, do you ever fish for other species?

- a. Yes (167)
b. No (175)
No answer (11)

If yes, which species?

Other species *Catfish (115); Sturgeon (52); Sauger (33); Walleye (29)*

14. Please indicate the extent to which you agree or disagree with each of the following statements about paddlefishing.

- 1 = strongly disagree
- 2 = disagree
- 3 = neutral: no real opinion
- 4 = agree
- 5 = strongly agree
- N/A = not applicable

	Strongly disagree		Neutral		Strongly agree		N/A	No answer
a. I enjoy eating paddlefish	9	10	62	79	154	26	13	
b. The bigger the paddlefish I catch, the better the trip.	20	29	109	43	134	9	9	
c. A successful trip is one in which my limit of 2 paddlefish is caught.	40	47	78	58	107	11	12	
d. Paddlefish is as good to eat as trout.	46	31	68	43	114	31	20	
e. I am just as happy if I catch one paddlefish as two fish, as long as I do not get skunked.	38	23	56	96	126	7	7	
f. I would rather catch one big paddlefish than two small paddlefish.	59	31	102	50	97	6	8	
g. I would be just as happy if I didn't keep the two fish I'm entitled to catch, as long as I could be photographed next to them.	140	60	56	32	50	5	10	
h. Without paddlefishing at Intake, I wouldn't spend any time in the Glendive/Intake area.	61	34	38	53	148	5	13	
i. I feel unsuccessful if I catch only one paddlefish.	128	76	77	32	25	5	10	

14. Continued

	Strongly disagree		Neutral		Strongly agree		N/A	No answer
j. With less than a two fish annual limit, I wouldn't find it worthwhile to come to Intake for paddlefishing.	82	43	48	42	128	1	9	
k. I enjoy paddlefish snagging more than other types of fishing.	56	45	146	46	47	2	11	
l. I would find a one fish annual limit just about as satisfactory as the current two fish limit.	153	56	50	31	53	1	9	
m. The paddlefish is an ugly fish compared to a trout.	83	50	69	52	81	7	11	
n. There's really not that much special about paddlefish to me other than that they are large.	147	79	58	34	22	3	10	
o. I appreciate the cleaning services offered at Intake.	1	9	25	35	270	3	10	
p. When I catch my first paddlefish, I immediately clean and refrigerate it or have it taken to the concessionaire to have it cleaned.	12	16	54	62	182	16	11	
q. The paddlefish is a really special fish and I feel privileged to be able to fish for them.	4	3	39	87	211	0	9	
r. I would find a three fish annual limit just about as satisfactory as the current two fish limit.	66	39	69	50	118	1	9	
s. Snagging is an acceptably sporting way to catch paddlefish.	3	5	35	78	217	1	14	
t. I prefer snagging paddlefish at night								

to snagging during daylight hours. 38 23 186 39 39 18 10

14. Continued

	Strongly disagree		Neutral		Strongly agree	N/A	No answer
u. Paddlefish is as good to eat as walleye.	75	46	80	46	56	35	15
v. I enjoy the people and the social atmosphere on a busy day at Intake. It makes paddlefish snagging more fun.	26	27	67	76	143	4	10

15. To the best of your knowledge, in what rivers or states of the U. S. are paddlefish found?

Missouri River (153) North Dakota (42) No answer (38)
Yellowstone River (151) Montana (41)
Mississippi River (19) Missouri (20)

16. Do you agree with the two fish annual limit and tagging system in place for paddlefish?

- a. Strongly disagree (34)
- b. Disagree (29)
- c. Neutral (54)
- d. Agree (138)
- e. Strongly agree (89)
- No Answer (9)

17. If you disagree (b) or strongly disagree (a) in question 16, why?

Catch and release option needed (18)
Bag limit too restrictive (17)

18. How satisfied were you with your most recent paddlefishing trip in past years to Intake?

- a. Very satisfied (146)
- b. Somewhat satisfied (65)
- c. Neutral (33)
- d. Somewhat unsatisfied (30)
- e. Very unsatisfied (20)
- Not applicable (36)*
- No answer (23)*

19. How many paddlefish did you catch on your last paddlefishing trip in past years to Intake?

- 0 fish (48)*
- 1 fish (57)*
- 2 fish (117)*

20. Since lead is known to be a poisonous substance and many pounds of lead are added to the river each year by snaggers, would you support the required use of steel sinkers rather than lead sinkers (weights) for paddlefish snagging?

- a. Yes (172)
- b. No (156)
- Not applicable (3)*
- No answer (22)*

21. Please list, in order, the species of fish that you fish for most often during the year. Please specify only one species for each category.

Fish for most often	<i>Trout (34.8%); Walleye (27.7%); Catfish (10.7%)</i>
Fish for next most often (2nd)	<i>Trout (17.2%); Walleye (15.2%); Paddlefish (13.9%)</i>
Fish for next most often (3rd)	<i>Paddlefish (27.8%); Catfish (14.7%); Trout (12.0%)</i>

22. How well informed do you consider yourself about the life cycle and ecology of paddlefish in Montana?

- a. I am very well-informed. (36)
- b. I know something. (165)
- c. I don't know very much. (117)
- d. I know nothing about them. (27)
- No answer (8)

23. How old do you think an 85-pound paddlefish from eastern Montana might be?

<u>Age</u>	<u>Number of Responses</u>	<u>Age</u>	<u>Number of Responses</u>
0	34	40-49	44
1- 9	41	50-59	26
10-19	67	> 60	44
20-29	49		
30-39	48		

24. Rank the desirability of the following fish species to you from 1 to 5 based on whether the species (not just the food value or sport value, but the fish itself) is most desirable (1) or least desirable (5).

	<u>Most desirable</u>			<u>Least desirable</u>		<u>Missing values</u>
a. Northern pike	47	91	99	51	38	27
b. Walleye	165	71	45	27	20	25
c. Cutthroat trout	114	73	66	24	47	29
d. Largemouth bass	56	76	86	51	54	30
e. Paddlefish	107	93	68	32	27	26

25. How many organized, competitive fishing tournaments did you participate in during the last 12 months?

- a. none (292)
- b. 1 - 2 (42)
- c. 3 - 4 (3)
- d. 5 or more (6)
- Not Applicable (2)*
- No answer (8)*

26. Each person enjoys paddlefishing for different reasons. Please indicate how important each reason for paddlefishing listed below is to you.

<u>Reasons:</u>	<u>Not important</u>			<u>Very important</u>		<u>No answer</u>
a. To be outdoors	4	6	28	92	211	9
b. For family recreation	20	22	70	96	132	13
c. To experience new and different things	16	20	61	102	142	12
d. For relaxation	14	18	56	112	140	13
e. To be close to the river	19	35	85	89	114	11
f. To obtain fish meat for eating	62	47	85	78	70	11
g. To get away from the demands of other people	33	27	63	78	140	12
h. For the experience and thrill of hooking one	9	6	28	74	224	12
i. To be with friends	4	11	32	109	185	12
j. To eat the eggs	268	32	25	8	5	15
k. To experience natural surroundings	22	18	82	96	123	12
l. To get away from the regular routine	8	13	32	106	182	12
m. To catch a really large fish	24	23	69	78	147	12
n. For the challenge or sport	5	15	43	96	182	12
o. To catch an unusual fish	20	19	68	82	152	12
p. To meet new people at the fishing site	41	30	86	82	102	12

27. About how many days in the past 12 months did you spend fishing (not including paddlefishing)?

<u>No. Days</u>	<u>No. Responses</u>	<u>No. Days</u>	<u>No. Responses</u>
0	43	40-49	16
1- 9	48	50-59	18
10-19	57	60-99	36
20-29	46	> 100	41
30-39	48		

28. To the best of your knowledge, what do the paddlefish eat to grow as large as they do?

Plankton (218); Algae (37); Bottom feeders (moss, mud vegetation) (32); Minnows/fish (4); No answer (56)

29. Do you plan to fish for paddlefish at Intake next year?

- a. No (26)
b. Yes (304)
No answer (23)

If not, why not? Too far to travel (6); depends on 1994 regulations (5)

30. What is your occupation? (If unemployed, retired, a student or home-maker, please state so.)

Unemployed (disabled, retired, work at home) (41); mining, oil field worker (37); Construction/electrician/pipe fitter (35); Sales/business owner/services (33); student (31)

31. What is your year of birth?

<u>Age</u>	<u>No. People</u>
< 20	29
21-29	83
30-39	102
40-49	70
50-59	36
60-69	16
70-79	3
No answer	14

32. Are you:
- a. Male (307)
 - b. Female (33)
 - Unknown gender (13)*
33. What is the Zip Code of your permanent home residence?
- Non-residents (128); residents (199); unknown (12)*
34. What is your approximate annual household income before taxes? [Your response is confidential and optional.]
- a. Under \$10,000 (24)
 - b. \$10,000-19,999 (46)
 - c. \$20,000-29,999 (56)
 - d. \$30,000-39,999 (61)
 - e. \$40,000-49,999 (33)
 - f. \$50,000-59,999 (26)
 - g. \$60,000-69,999 (13)
 - h. \$70,000 and above (27)
35. Which of the following best describes you?
- a. Attended high school, but did not graduate (33)
 - b. High school graduate (145)
 - c. Attended college but did not graduate (66)
 - d. College degree from 4-year institution (48)
 - e. Advanced degrees from colleges or universities (16)
36. Is there anything else you would like to share with us related to paddlefish or paddlefishing?
- Paddlefishing is fun (39)*
Catch and release option is needed (19)
Appreciate the uniqueness of paddlefish; their protection is necessary (15)

Thank you for your cooperation!