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Implementation and Evaluation of a Catch-and-Release Fishery for Paddlefish

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Abstract.—In 1995 and 1996, a mandatory catch-and-release fishery for paddlefish was conducted 2d/week during the 6-week paddlefish snagging season at the Intake fishing site on the lower Yellowstone River, Montana. The fishery was monitored by trained fisheries personnel to ensure compliance and to obtain information on hooking mortality and angler attitudes. In 1995, snaggers expended 838 angler-hours and caught and released 420 fish, or 0.5 fish/h. In all, 96 fish snagged, tagged, and released in 1995 were recaptured and either creeled or re-released in 1995 or 1996. Sixty-four (15.6%) of the fish inspected had one or more bleeding wounds beyond the hook puncture resulting from the snagging event. Some fish also had old wounds (4.7%) and arc-shaped scars, the latter probably caused by boat propellers. In 1996, snaggers expended 589 angler-hours and caught and released 127 fish, or 0.2 fish/h. Twenty-one fish tagged during catch and release in 1996 were recaptured at Intake in 1996; 19 were creeled and 2 were re-released. A total of 159 snaggers completed the brief written questionnaire on the catch-and-release snag fishery. The most common suggestions for improvement were the optional retention of fish and more days and hours for catch-and-release. Because of evidence of low hooking mortality and high snagger interest, continuation of catch-and-release is planned for future years.

In the last two decades, catch-and-release fishing, either mandatory or volitional, has emerged as valuable tool for management and assessment of recreational fisheries (Barnhart and Roelofs 1977, 1987). Catch-and-release fishing is used routinely in management of fisheries for salmonids (Lewynsky and Bjornn 1987; Turner 1987; Vincent-Lang 1993), largemouth bass *Micropterus salmoides* (Schramm and Heidinger 1988), and other freshwater fishes, as well as for marine game fishes (Epstein 1987; Witzell 1987).

Numerous factors affect the acceptability and success of a catch-and-release regulation, including the life history of the fish (Hunt 1977), its vulnerability to capture (Anderson and Nehring 1984), hooking mortality (Wydoski 1977; Booth et al. 1995), angler effort, and attitudes of anglers (Cordes 1977; Bielak 1987).

Paddlefish *Polyodon spathula* support recreational snag fisheries in several states in the Missouri and Mississippi river drainages (Elser 1986; Gengerke 1986). No mandatory catch-and-release fisheries were identified by Combs (1986). With a few exceptions, such as the Yellowstone River, Montana (Scarnecchia et al. 1995), voluntary release of snagged paddlefish was permitted if the fish was returned immediately to the water. High-grading (i.e., the release of a creeled fish in favor of another one to avoid exceeding a bag limit) was prohibited in 6 of 11 states with recreational paddlefish fisheries (Combs 1986).

In Montana's lower Yellowstone River paddlefish snag fishery (Robinson 1966; Rehwinkel 1978; Scarnecchia et al. 1996b), site of a 500–5,000-fish annual harvest, regulations gradually have become more restrictive since the fishery began in the early 1960s (Scarnecchia et al. 1995). From 1981 through 1993, the annual bag limit was two fish, with mandatory retention of snagged fish. In 1994, the annual bag limit was reduced to one fish. Licensed snaggers were required to purchase paddlefish tags which were attached to each fish captured. Written questionnaire surveys of snaggers (Scarnecchia and Stewart 1996; Scarnecchia et al. 1996a) at the main snag fishing site indicated strong support for catch-and-release fishing in addition to, but not in place of, the one-fish annual bag limit. In response, two 6-h catch-and-release periods were established weekly (Wednesdays and Sundays, 1500–2100 hours) during the 15 May–30 June snagging season. The intent was to provide additional recreational opportunity without additional paddlefish harvest.

Inasmuch as snaggers are often disparaged as meat fishers (Catchings 1985), the development of a biologically and socially acceptable catch-and-release snag fishery is unusual. Important concerns to be addressed included immediate and delayed

hooking and handling mortality, scarring of snagged paddlefish, and acceptance by snaggers of the regulation.

Little was known about immediate and delayed mortality of snagged-and-released paddlefish in late spring and early summer when water temperatures typically range from 10 to 20°C. In addition, little information was available on angler acceptance of catch-and-release regulations for paddlefish, even though attitude surveys indicated that many snaggers favored the opportunity to catch and release paddlefish, especially after their one-fish annual bag limit had been reached (Scarnecchia and Stewart 1996; Scarnecchia et al. 1996a). Additional information would help in the evaluation of catch-and-release regulations on the Yellowstone River, as well as provide information for managers elsewhere who may be considering catch-and-release paddlefish fisheries. In this paper, we report the results of 2 years of a mandatory catch-and-release fishery for paddlefish.

Methods

The catch-and-release fishery was conducted in 1995 and 1996 on the lower Yellowstone River at the Intake fishing access site, located 27 km downriver from Glendive, Montana. Catch-and-release fishing was mandatory during the periods 1500–2100 hours Wednesdays and Sundays from 15 May to 30 June, inclusive on both sides of the river within the section 0.40 km below the irrigation diversion dam. Retention of snagged paddlefish (up to a bag limit of one) was mandatory at all other times and locations during the season.

The entire catch-and-release fishery was monitored by trained state fisheries personnel. All snagged fish were observed being landed and were inspected, except for occasional instances when simultaneous capture of several fish resulted in the immediate release of fish before they could be inspected. The trained personnel demonstrated to the snagger the proper handling of landed fish. Fish were beached and handled by the rostrum and caudal fin, but not lifted into a vertical position. Captured fish were immediately measured for length and inspected for hooking location, jaw tags, open wounds, and scars. Untagged fish were tagged with individually numbered poultry bands attached to the dentary, and then released.

During 2 days in June 1995 immediately after catch-and-release days, both sides of the river were inspected by boat for a distance of 19 km downriver for dead or moribund paddlefish.

The number of snaggers participating was counted at hourly intervals. In 1995, snaggers participating in the catch-and-release fishery were randomly surveyed with a written questionnaire about their attitudes regarding the catch-and-release fishery. Snaggers were first asked to state what they liked most and least about the catch-and-release regulations, and why. Second, they were asked what changes, if any, they would make for next season. Third, they were asked if they would continue to participate in the catch-and-release fishery if they had to purchase a second tag for catch-and-release (cost, US$7.50) in addition to the first tag (cost, $7.50) for their bag limit.

TABLE 1.—Days between tagging of paddlefish by catch-and-release snaggers and recapture either during catch-and-release or mandatory retention periods, Intake, Yellowstone River, Montana, 1995 and 1996.

Days between tagging and recapture and totals	Number of recaptured fish tagged in:	
	1995	1996
0–1	12	3
2–5	35	9
6–10	24	5
11–15	8	1
16–20	3	2
21–25	6	0
26–30	2	0
30–35	1	1
365 (1 year)	5	
Total fish recaptured	96	21
Total recaptured fish creeled	73	19
Total fish re-released	23	2

Results

Catch-and-Release Fishery

1995.—In the 78 h of catch-and-release fishing during the season, snaggers expended 838 angler-hours and caught and released 420 fish, or 0.5 fish/h. Of those 420 fish, 409 were measured and inspected for jaw tags and scars. Of the 409 fish inspected, 380 fish were tagged with jaw tags; the other 29 were nearly all recaptures that had been jaw-tagged earlier that season after being snagged at Intake during catch-and-release fishing or gillnetted within 10 km downriver. In all, 96 fish snagged, tagged, and released in 1995 were recaptured and either creeled or re-released in 1995 or 1996 (Table 1). All but 3 fish were recaptured at Intake, and the other 3 fish were recaptured downriver in North Dakota. Ninety-three fish were recaptured once, 1 fish was recaptured twice, and 2 fish were recaptured three times. Elapsed time between initial capture and recapture within the 1995 season ranged from 0 to 35 d (Table 1).

Of 409 fish inspected after capture and released, 64 (15.6%) had one or more bleeding wounds beyond the hook puncture resulting from that snagging event. The open wounds consisted mainly of flesh tears resulting from hooks (11.2% of released fish) and circular necrotic lesions (2.2% of released fish). Flesh tears were usually less than 2 cm long but occasionally up to 10 cm long. The cause of observed circular necrotic lesions, which were usually 2–3 cm in diameter, was not confirmed, but probably resulted from tissue necrosis around hooks previously lodged in the flesh over long periods. No fungal growth was observed on either flesh tears or circular lesions.

Old wounds, healed or partially healed, found on 4.7% of the caught-and-released fish, consisted mainly of circular and arc-shaped scars. Circular scars (2.7% of fish) appeared as discolored spots on the skin and were the about same diameter as necrotic lesions. Eight fish (2.0%) had arc-shaped scars, typically multiple and in a row, and usually on the side or back of the fish. These scars were similar in appearance to wounds identified in previous years as having been caused by boat propellers.

No evidence of paddlefish mortality was found in the two 19-km surveys downriver in June following catch-and-release days. No dead or dying paddlefish were reported by paddlefish anglers commonly snagging downriver.

1996.—In 1996, anglers expended 589 h of effort and caught and released 127 fish, or 0.2 fish per hour. Of those 127 fish, 122 were tagged for the first time and released; the other 5 fish had been tagged previously. Two of the 122 newly tagged fish were recaptured once later in the season and released again, and 19 (15.6%) were creeled by snaggers later in 1996 during mandatory retention periods (Table 1). Recaptured fish were creeled from 1 to 35 d after tagging. Five fish tagged during the catch-and-release period in 1995 were recaptured in 1996 either during catch-and-release or mandatory retention periods; four of these fish were caught at Intake and one was caught downriver in North Dakota.

There was one immediate mortality from snagging. This fish was snagged on the underside in the area of arteries supplying the gills (Danforth 1912), resulting in a large loss of blood. The fish died shortly after being beached. Another snagged fish was visibly stressed after being snagged in an eddy and requiring 30 min to land. No dead paddlefish were reported by downstream snaggers.

Attitude Survey

One-hundred fifty-nine persons, an estimated 60% of all participating catch-and-release snaggers, completed the questionnaire. The most common positive comments received were that snaggers appreciated the opportunity to catch more than one fish (98 responses), and that keeping catch and release as a regular program was a good idea (54 responses). The most common negative comments were that mandatory release of large fish was undesirable because snaggers would have chosen to keep them (46 responses), and that too few days or hours were allocated to catch and release (34 responses). The most preferred regulation changes would have allowed more days and hours for catch and release (44 responses) and made catch and release voluntary, so that snaggers under their bag limit could have elected to keep a fish (40 responses). If snaggers were to be required to purchase a second tag for catch and release, 62% indicated they still would participate in catch and release and 38% said they would not.

Discussion

One major concern about the catch-and-release fishery was immediate and delayed hooking mortality of paddlefish. Although facilities were unavailable for holding snagged paddlefish in confinement, several pieces of evidence suggest high survival rates for adult fish in the Intake fishery, and elsewhere, if fish are handled carefully, and the gills are avoided. First, the numerous recaptures of caught-and-released fish in 1995 and 1996 at Intake (Table 1) within a month of initial capture, and the absence of dead or moribund paddlefish downriver indicated significant short-term survival. Long-term survival is also high. In 1984, 1986, and 1988, 860 paddlefish were snagged at Intake by volunteers in order to obtain adult fish for jaw-tagging. As of 1995, 336 (39%) of these fish had been recovered in creel censuses, 232 of them after being at large for one or more years (Table 2).

The idea that survival of snagged paddlefish can be high is supported by other sources elsewhere. Gengerke (1978) reported that of 2,012 paddlefish known to be snagged and released from the upper Mississippi River, at least 387 were later recaptured. Moen et al. (1992) found that snagged paddlefish implanted with radio transmitters generally survived to provide useful information on habitat use. In both of these studies, fish generally were snagged in winter and early spring when water temperatures were below 10°C. Our results indi-

TABLE 2.—Numbers of paddlefish recaptured in 1984–1995 that had been snagged, jaw-tagged, and released in 1984, 1986, and 1988 in the Yellowstone River, Montana.

Year tagged	Number tagged	Year recaptured												Total recaptured 1984–1995	Percent recaptured after 1 year or longer
		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995		
1984	551	73	2	33	42	13	19	21	11	10	3	4	6	237	69
1986	153			9	0	7	7	4	7	4	1	2	2	43	79
1988	156					22	3	8	14	1	3	5	0	56	61

cated that even in water above 10°C, as encountered in the Yellowstone River during spring and early summer, adult paddlefish can be snagged, released, and snagged again one or more times. Multiple recaptures of tagged paddlefish probably would have been higher if most recaptured fish had not been creeled at times when catch and release was not in effect. These results apply to the adult fish caught at Intake, which typically weigh 5–45 kg, and not to smaller fish, which have been reported to suffer significant mortality from snagging (K. Graham, Missouri Department of Conservation, personal communication). Small, premigratory paddlefish are not snagged at Intake.

The scars on recaptured paddlefish in this and other studies indicate that paddlefish have well-developed healing capabilities in the wild if no gill or other internal damage occurs. Rosen and Hales (1980) reported that of 458 paddlefish collected below Gavins Point Dam along the South Dakota–Nebraska border, 165 (36%) bore wounds and scars similar to those described here and 46 (10%) had severed rostrums. Scars included damage from boat propellers, snagging hooks, and fishing lines. The presence of numerous, often severe, scars and wounds on fish at Intake and elsewhere indicates that many fish in the wild survive these injuries. Although Rosen and Hales (1980) did not hold adult paddlefish in long- or short-term captivity to evaluate survival, we reject the idea that confinement studies would improve our understanding of survival in the wild. Friberg (South Dakota Department of Game, Fish and Parks, unpublished) held 21 paddlefish in a small hatchery pond for 4 months after snagging and reported healing in 10 fish, open and fungused wounds in 8 fish, and death in 3 fish. Adult paddlefish often survive poorly in captivity and we agree with Rosen and Hales (1980) that survival would be better if fish were released directly into the river.

One factor improving the survival of snagged fish may have been the concentrated fishery at Intake, where most fish are caught along only 0.4 km of river bank. The confined fishery greatly facilitated monitoring by trained fisheries personnel, and undoubtedly improved handling and public compliance, both of which are necessary for success of a regulation (Barnhart 1989). Time of air exposure, which has been shown to be positively related to stress in salmonids (Ferguson and Tufts 1992), was generally less than 60 s.

The preference of catch-and-release snaggers for voluntary rather than mandatory catch and release is consistent with previous surveys of the larger population of snaggers (i.e., those practicing both catch and release and mandatory retention). Scarnecchia et al. (1996a) reported that snaggers strongly preferred the larger fish and would have preferred to keep them. High grading has been reported in numerous places elsewhere (Rosen and Hales 1980; Combs 1986). Mandatory retention is enforced on the Yellowstone River, in part because of strong sexual size dimorphism of the stock; nearly all fish over 20 kg are female and nearly all fish less than 20 kg are male. Mandatory retention helps to insure that comparable numbers of males and females are creeled. In addition, mandatory retention reduces crowding at the fishing site. For these reasons, voluntary catch and release was not considered a viable option.

Results from 2 years of implementation of catch and release support its continuation at this site on the lower Yellowstone River. The higher number of fish caught during catch-and-release snagging in 1995 than in 1996 was associated with a higher overall success rate of snaggers that year, and with greater snagger enthusiasm. The program is proposed to be continued and monitored in the immediate future and modified according to additional biological information and public interest.

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