Mortality of White Crappie After Catch and Release

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Abstract: We conducted tests to quantify delayed mortality of white crappie (*Pomoxis annularis*) after catch and release by anglers. White crappie were subjected to 1) catch and release in shallow water using traditional hook-and-line methods and 2) rapid depressurization to simulate catch in deep water. Mortality 6–11 days after catch and release from shallow water averaged 3%. No significant differences ($P > 0.05$) were detected between mortality rates of white crappie 15–25 cm and >25 cm total length, nor between fish caught using live and artificial baits. No mortalities occurred 96 hours after white crappie were depressurized from depths ≤10m, but 29% and 67% of the fish died when depressurized from 13 and 16 m, respectively. Regulations involving catch and immediate release of white crappie can reduce fishing mortality, but may be less effective when and where fish are frequently caught from deep water.

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Despite the popularity of crappie (*Pomoxis* spp.) fishing in the southeastern United States, crappie populations have generally remained unmanaged. This neglect has resulted not from lack of concern, but from a general perception that crappie populations can seldom be overfished under normal sporting conditions, coupled with a lack of adequate sampling and assessment methodologies. However, during this decade efforts to develop methods for sampling and assessing crappie populations have intensified (Mitzner 1984, Colvin and Vasey 1986, Boxrucker and Ploskey 1988), and detrimental effects of high exploitation rates recognized (Redmond 1986).

Results from improved crappie sampling and assessment methodologies have led to more management inputs, including implementation of regulations involving catch and release. An informal survey of 16 states in the southeastern United States

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revealed that between 1984 and 1989, 12 states enforced regulations on harvest of crappie, 6 states reduced creel limits, and 5 implemented length limits. Catch-and-release regulations potentially reduce total mortality and maximize or balance benefits from recreational fisheries (Clark 1983, Zagar and Orth 1986). However, these regulations would be less effective if the trauma produced by catch and release results in excessive mortality.

Crappie fisheries have traditionally been consumptive, with catch and release practiced only with fish considered too small to eat; thus, until recently no effort was made to quantify post-release mortality. Survival after catch and release has been estimated for other centrarchids (Schramm et al. 1985, Burdick and Wydoski 1987, Weidlein 1987), and results indicate that impacts from trauma appear to be species specific. Trauma can decrease resistance to initial infections or activate latent infections (Wedemyer 1970, Wydoski 1977). Crappies are reportedly susceptible to columnaris infections (Davis 1953) and vulnerable to handling shock (Smeltzer 1981). Additional physiological disorders may occur when crappies caught from deep water undergo rapid reductions in hydrostatic pressure.

Mortality after catch and release should be quantified before a regulation requiring such action is imposed. We conducted this study to estimate mortality rates of white crappie subjected to 1) catch and release in shallow water using traditional hook-and-line methods, and 2) depressurization through rapid ascent from deep water. Partial funding for this study was provided by Dingell-Johnson Federal Aid to Mississippi Project F-68. We thank R. Dillard, D. Jackson, C. Henry, S. Malvestuto, and K. Meals for facilitating our access to creel-survey data sets; G. Fornshell for his assistance in caring for crappie held in ponds; M. Brunson, M. Colvin, W. Kelso, R. Wydoski, and an anonymous referee for reviewing the manuscript; and the U.S. Army Corps of Engineers for their cooperation during the depressurization test at the Bay Springs Lock and Dam.

Methods

Catch-and-Release Test

White crappie were collected from Columbus and Aliceville reservoirs, Mississippi, on 14–17 November 1988 and 9 March 1989 using DC pulse electrofishing. Fish were stocked into 2 0.05-ha, 1.2-m deep ponds according to total length groups: 15–25 cm (small) and >25 cm (large). Sixty-two percent of the crappie were stocked in November. Mosquito fish (*Gambusia affinis*) and green sunfish (*Lepomis cyanellus*) were stocked as forage.

Catch and release of white crappie was conducted 20–24 March 1989 when morning water temperature in the ponds fluctuated around 15° ± 2° C. We targeted these temperatures because creel surveys in Alabama, Kentucky, and Mississippi indicated that angler catch and effort for crappies were highest at 12°–20° C surface water temperature (Miss. Coop. Fish and Wildl. Res. Unit, unpubl. data). White crappie were caught using size 2/0 (style 202A) Eagle Claw hooks baited with live golden shiners (*Notemigonus crysoleucas*) or on jigs with hood sizes 6 or 8. Hook sizes and angling methods simulated that of typical crappie anglers. Fishing occurred between 0600 and 1200 hours each day, but most fish were caught at dawn. White crappie were measured and released into adjacent 0.05-ha ponds according to length group and type of bait taken. We noted hooking location and general condition of each fish. Rough handling was avoided and hooks were removed cautiously; however, a few fish were accidentally dropped, as anglers often do, or held in a bucket with water for a few minutes before being released. Fish in both length groups were treated equally.

Ponds holding caught-and-released fish were searched daily for dead fish, then drained 6 days after the last fishing day to determine post-release mortality. Ponds holding the fishing stock were also drained to determine harvest success (percentage of fish caught). Differences in mortality between the 2 length groups and bait types were determined using a chi-square test of homogeneity (SAS Institute Inc. 1985).

Depressurization Test

White crappie >200 mm were collected 23–26 January 1989 from Columbus Reservoir with trap nets and DC electrofishing. Fish were stocked into a 0.05-ha pond with mosquito fish and green sunfish stocked as forage. On 15 February 1989, crappie were seined and transported to Bay Springs Reservoir in northeast Mississippi. Testing was conducted in cool weather because this is when most reservoirs exhibit fairly homogeneous chemical and physical conditions through the water column and crappie are most likely to inhabit deep water (Gebhart and Summerfelt 1974). Fish were acclimated to Bay Springs' water temperature and stocked into 5 wire cages (60 × 90 × 90 cm). The cages were then lowered gradually at a rate of 2.5 m/hour to 1, 5, 10, 13, and 16 m, each with 8, 9, 5, 7, and 9 fish, respectively. This rate of descent should have allowed sufficient time for the fish to attain neutral buoyancy (Kanwisher and Ebeling 1957).

After 48 hours, the cages were lifted rapidly and held just below the water surface for 0.5 hour to observe fish behavior and determine mortality. Then, the cages were lowered 2 m and lifted after 96 hours to determine delayed mortality.

Results and Discussion

Catch-and-Release Test

Electrofishing collected 354 white crappie, 15 (4%) of which died either during transport or within 1 week after stocking. A total of 226 fish was caught and released; and at draining, 75 were collected from the ponds holding the original stock. We assume that the 38 missing fish represent natural mortality (11%).

Water temperature averaged 15.3°, 12.0°, and 16.0 C°, respectively, the weeks before, during, and after investigations of catch-and-release mortality. The drop in temperature was caused by the passage of a cold front during the second day of fishing. A total of 121 white crappie of the small length group ($\bar{x}$ = 21.9 cm, SD=1.8) and 105 of the large length group ($\bar{x}$ = 28.3 cm, SD=2.3) was caught and released. About 47% of the crappie were caught with jigs and 53% with live bait in both ponds. Harvest success was 71% and 81% for fish in the small and large length groups, respectively. Catch-and-release mortality of small and large white crappie was 4% and 1%, and did not differ significantly (X^2 = 2.11, P = 0.15). Mortality rates of fish caught with live and artificial bait were both 3% and were not significantly different (X^2 = 0.02, P = 0.90). Survivors appeared to be in good health and showed no distinct signs of distress.

Catch-and-release mortality of white crappie, averaged over the 2 length groups, was 3%. Childress (1987) reported a 29% mortality rate for white crappie hooked with live bait and handled similarly to fish in our study except that water temperature was 23° C. Post-release mortality of various species has been reported to increase with temperature (Wydoski 1977, Lee 1987), and the difference between Childress' results and ours may be due primarily to differences in experimental temperature.

Other studies designed to compare mortality rates of fish hooked with artificial or live bait indicate similar mortality rates for largemouth bass (*Micropterus salmoides*) (Rutledge and Pritchard 1977), but higher mortality rates for smallmouth bass (*M. dolomieui*) hooked with live bait (Clapp and Clark 1989). Mortality rate may be more directly related to hook swallowing than to bait type, although these factors may interact. In largemouth and smallmouth bass, hook swallowing significantly increased post-release mortality (May 1973, Pelzman 1978, Clapp and Clark 1989). In our study only 12 of the 226 white crappie caught were considered to be deeply hooked. Most white crappie were hooked in the ventral side of the snout near the narial openings or maxillary, while deeply hooked fish were caught in the orbital region or in the roof of the mouth near the olfactory lobe of the brain. Pelzman (1978) found no mortality when largemouth bass were hooked in the roof of the mouth and reported minimal overall catch-and-release mortality except when largemouth bass were hooked in the esophageal area. Because white crappie showed low tendency for deep hooking when caught on hooks of sizes typically used by anglers, mortality after catch and release may be more closely related to temperature, handling, and the general health of the fish prior to catch.

Depressurization Test

Mid-day water temperature and dissolved oxygen averaged 9.5° C and 9.3° mg/liter through this test, and neither parameter differed by more than 0.5° C or 0.2 mg/liter from 1 to 16 m. No mortalities occurred during the 48-hour period of pressurization or the 0.5-hour observation period immediately after depressurization. However, erratic swimming and abnormal buoyancy were exhibited by 1 fish raised from 5 m and by all fish raised from depths ≥ 10 m. External hemorrhaging around the anal and caudal fins was observed in fish raised from depths ≥10 m but incidence was not quantified. All fish raised from depths ≤10 m survived 96 hours after depressurization. However, 29% and 67% of the fish raised from 13 and 16 m, respectively, died.

Despite low sample size, these results are generally consistent with observations on other centrarchid species. Childress (1987) reported 77% catch-and-release mortality for black crappie (*P. nigromaculatus*) hooked from depths of at least 12 m in a reservoir with water temperature at 7° C. Feathers and Knable (1983) determined that 25%, 42%, and 45% mortality was suffered by largemouth bass when depressurized at 14.8°–21.8° C from simulated depths corresponding to 9, 18, and 27 m, respectively. As in our study, mortalities reported by Feathers and Knable (1983) do not include stress from hooking and handling. Although more refined studies are needed in fish depressurization, it appears that rapid decompression may affect crappies more severely than largemouth bass.

Management Implications

Because we could not study all possible physicochemical situations in which crappie angling occurs, nor simulate the range of anglers' gear, techniques, and handling procedures, our experiments were conducted in what we considered typical crappie-angling conditions. With this in mind, we offer the following generalizations.

Our findings suggest that catch-and-release regulations requiring the immediate release of white crappie can in most cases be effective management tools for reducing fishing mortality. Post-release mortality could be higher if crappie are subjected to additional stress, such as rough handling or retainment in live wells with inadequate water quality. Catch and release should be most effective during spring and fall when water temperature is <20° C, but substantial mortality may be expected in summer. In the Southeast, most catch and effort for crappies typically occur during the cooler months.

Additional mortality due to depressurization occurs when crappies are caught below 10 m. Depth distribution of crappies is affected by seasonal changes in temperature and dissolved oxygen concentration (Gebhart and Summerfelt 1974), and in some reservoirs crappies inhabit depths >10 m (Childress 1987, Grinstead 1969). Catch-and-release regulations may not significantly reduce fishing mortality in reservoirs where a high percentage of the crappies are caught from deep water. In reservoirs where crappies inhabit deep water seasonally, year-round catch and release may not be justified.

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