The Journal of the Iowa Academy of Science: JIAS

Volume 108 | Number Article 4

2001

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Jour. Iowa Acad. Sci. 108(1):6–7, 2001

Tests of a Rotenone-Impregnated Bait for Controlling Common Carp

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An experimental rotenone-impregnated pelleted (approximately 10 mg/pellet) bait was tested in force-feeding and field-feeding experiments as a method of control for common carp (*Cyprinus carpio*). Mortality rates of force-fed fish ranged from less than 40% when fed one pellet to 100% when fed more than 10 pellets. Mortality occurred within 48 h. Mortality rates of control fish did not exceed 10%. In reservoir feeding trials in 1994 and 1995, carp were fed for 2–3 weeks on a non-toxic, vegetable-based bait dispensed by automatic feeders, followed by one feeding of the bait with rotenone added. Carp ceased feeding on the rotenone bait within minutes. Only three dead common carp were observed in 1994 and no dead carp were observed in 1995. The common carp would not consume enough rotenone pellets for a fatal dosage. Their selectiveness is attributed to their ability to detect the rotenone in the pellets. More palatable rotenone baits are needed for common carp.

INDEX DESCRIPTORS: Carp, Fish Management, Rotenone.

The introduction of the common carp (*Cyprinus carpio*) to the United States in the 1830's (Moyle and Kuehn 1964) has had deleterious effects on native fishes, sport fisheries, water quality, and aquatic ecosystems in general (Sigler 1955, Panek 1987, Verrill and Berry 1995). Numerous methods have been used to reduce common carp populations, including seining, trapping, complete and partial eradication with fish-toxicants, artificial barriers, and water level fluctuations (Ricker and Gottschalk 1940, Shields 1957, McCrimmon 1968, Bulow et al. 1988). One possible method is the use of baits mixed with fish toxicants such as rotenone (Fajt and Grizzle 1993), but previous attempts at killing common carp with oral doses of rotenone have had little success (Loeb and Kelly 1963, Hashimoto and Fukami 1969, Rach et al. 1994). We tested the effectiveness of a floating pellet containing 2.64% (approximately 10 mg) rotenone (Fish Management Bait, Prentiss Inc., Floral Park, New York).

METHODS

We tested the potency of the rotenone bait using adult common carp (average weight 2.7 kg, range 2.3 to 3.2 kg) in a 6 × 20 × 1 m holding pen at 24–26° C. In one trial, fish (10 fish per treatment) were force-fed none, one, three, or six pellets. In the second trial, fish were force-fed none (30 fish), one (20 fish), three (20 fish), six (20 fish), 10 (15 fish), or 20 (15 fish) pellets, and a control group (20 fish) was force-fed 10 pellets with no rotenone. We counted and removed dead fish daily for 9 days. Probit analysis (Finney 1952) was used to relate percent mortality at each dose level to the logarithm of the dose.

Feeding trials were conducted at Bowman-Haley Reservoir in southwestern North Dakota. A fish feeder was placed near the mouth of two tributaries. Nine trials (four in 1994 and five in 1995) were performed, each of which included an initial training period of 2–3 weeks to attract common carp to the feeders and train them to feed on a non-toxic, trainer bait. Feeders dispensed 4.5 kg of trainer bait twice daily in 1994 and three times daily in 1995. After the training period, 1.5 kg of rotenone bait was dispensed during one feeding in place of the trainer bait. Moribund and dead fish were counted daily for 10 days following the application of the rotenone pellets. In both years, barrier fences were present within 100 m upstream of feeders to help concentrate carp and prevent carp from continuing upstream. In 1995, block nets were placed approximately 200 m downstream of the feeders immediately prior to application of rotenone feed to prevent dying carp from escaping. In 1994, when downstream block nets were not used, we searched for dead or dying carp within two kilometers of the feeder.

RESULTS AND DISCUSSION

Common carp which were fed rotenone bait began to gulp air within 2 h of force-feedings. Higher numbers of pellets resulted in higher mortality rates. All fish force-fed 20 pellets died within 24 h; all fish fed 10 pellets died within 48 h. Seven of 10 fish receiving six pellets died within 3 days in the first trial and 19 of 20 fish receiving six pellets died within 3 days in the second trial. Less than 70% of the fish receiving three pellets died, and less than 40% of the fish receiving one pellet died. Although force-fed fish were observed for 9 days, no fish died after the fourth day. Mortality rates of control fish never exceeded 10%. The 24 and 96 hr LD50's were 18.5 and 7.5 mg/kg respectivly, for the 2.7 kg fish (Fig. 1).

Common carp typically began to appear at the feeders within 3 days following the first dispensation of trainer bait, with largest concentrations at the end of the training periods. After 2–3 weeks of training, all food was being consumed within 30 min of feed dispensation. Fish ceased feeding within 5 min following the application of the rotenone bait, and most of the bait remained uneaten. We found only three dead carp in 1994 and no dead carp in 1995. The three dead carp found in 1994 did contain bait. It is unlikely that we were unable to find the dead carp. In 1995, when blocknets were used to contain dying carp, we did not find any dead carp. Apparently, even with training, common carp were unwilling to consume a lethal amount of rotenone bait.

Fajt and Grizzle (1993) reported that all deaths of common carp given oral doses of rotenone (7–10 mg/kg) occurred within 16 hr, but mortality occurred for up to 4 days in our study. The discrepancy

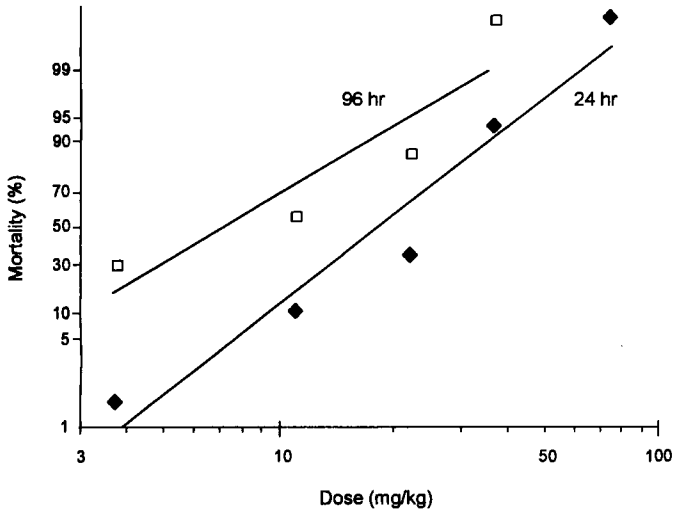

Fig.1. Relationship between percent mortality (plotted on a probit scale) and the approximate dose of rotenone (plotted on a logarithmic scale) administered by force-feeding to common carp.

may be due to the smaller fish (121–168 g) used in their study or to differences in the rotenone bait pellets. One cause of failure of the rotenone bait was that the bait had a low palatability; most pellets released at the feeders remained uneaten even though trainer baits were completely consumed. Common carp have a highly developed sense of taste (Panek 1987), and discrimination of rotenone-impregnated pellets from trainer pellets is not surprising. Rotenone-impregnated baits have the potential to be an effective and economical method of carp control, but further research is necessary to make these baits more palatable to the fish.

ACKNOWLEDGEMENTS

We thank E. Berard, K. Baer, J. Hendrickson, and G. Power of the North Dakota Game and Fish Department for assistance, M. Johnson for help with data collection, J. Fajt for supplying fish feed and feeders; and C. Moffitt, J. Rach, and W. Hubert for valuable comments. Funding for this project was provided by the North Dakota Game and Fish Department through the Federal Aid to Fish Restoration Program.

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