Carp, an Old Enemy at Malheur National Wildlife Refuge, Oregon

by Gary L. Ivey

Common carp *(Cyprinus carpio)* were one of the treasures brought to Europe from Asia during trading expeditions inspired by Marco Polo in the 15th century, and were among the first aquatic nuisance species introduced to North America. Although poorly documented, common carp may have been in New York as early as the 1830s to provide a new food resource (DeKay 1842), and next appeared in 1872 in California (Moyle 1976). The U.S. Fish Commission imported common carp from Germany in the1870s and distributed them to most states and U.S. territories between 1889 and 1897 for sport fishing purposes (Courtenay 1991). With human help, common carp found their way into most major U.S. drainages by the turn of the century.

Soon after the introduction of common carp, adverse effects such as reductions in populations of aquatic plants and invertebrates resulted in reductions of native and sport fish and in lower waterfowl use and production in many wetland systems. During this century, attempts to eliminate carp became a common practice in management efforts to improve wetlands for waterfowl, since carp are detrimental to waterfowl habitat (Threnan & Helm 1950; Robel 1961; King & Hunt 1967; Crivelli 1983).

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Effects of Carp

Carp destroy aquatic vegetation, and their foraging, spawning, and feeding habits increase water turbidity which decreases aquatic plant and invertebrate production, resulting in reduced waterfowl food supplies (Berry 1983). The carp's primary foods are aquatic invertebrates, putting them in direct competition with waterfowl and waterbirds for those resources. Studies have found a high percentage of invertebrates in the diets of carp, especially midge larvae (Chironomidae) (Sigler 1958). Midge larvae are important food for fish, breeding ducks, and ducklings, and also have been shown to be important to some duck species during migration season (Swanson 1984). Female ducks laying eggs eat invertebrates to acquire protein for egg production. This protein source is crucial to diets of ducklings, which are dominated by invertebrates (Krapu 1979; Eldridge 1990). Finally, invertebrates may also be an important nutrient source to ducks during molt (Brown 1985).

In shallow wetlands, carp often dominate the aquatic fauna to the exclusion of other fish species. Carp outcompete other fish for food and will consume eggs and fry of other species. While feeding they stir up silt, creating muddy water, making it difficult for predatory fish to find food. When the silt settles out, it can fill in gravel spawning sites used by other species. Carp monopolize the food chain, locking up much of the productivity as carp biomass. If carp populations could be reduced or eliminated from wetland systems, it would be beneficial to waterfowl, other fish, and native fauna and flora.

In 1981 the Malheur National Wildlife Refuge staff distributed a questionnaire to the national wildlife refuges in the lower 48 states to determine the extent of the problem. One hundred sixty-two refuges were surveyed, and of the refuges with freshwater impoundments, 80% had carp problems. If these results were extrapolated to the rest of the nation, it would suggest that a large percentage of our wetlands, lakes, and rivers are degraded by carp.

Carp Management in Malheur National Wildlife Refuge

Malheur Refuge is the largest national wildlife refuge managed as waterfowl production and migration habitat in the West (see map). Encompassing over 186,000 acres, the refuge is the most important waterfowl breeding area in Oregon and among the major migratory bird production sites in the Pacific Flyway. Located in the northern Great Basin, Malheur Refuge lies within southeast Oregon's Harney Basin. The most prominent feature of Malheur Refuge is Malheur Lake, the largest unaltered freshwater marsh in the western U.S. The refuge is an oasis in a shrub-steppe desert.

Carp were introduced in the late 1920s into the Silvies River, which flows into Malheur Lake, but were not found in Malheur Lake until large numbers of adult carp were flushed into the lake by high flows in 1952. Refuge biologists observed that large numbers of carp caused an 80% decline in sago pondweed *(Potamogeton pectinatus)* between 1953 and 1954. Before carp invaded the refuge, duck production averaged over 101,000 ducks annually in the 1940s, and peaked at 139,000 ducks in 1946. During the 1950s, with carp established in Malheur Refuge wetlands, duck production was significantly lower ($P<0.0001$), averaging fewer than 38,000. By 1955, no sago pondweed was evident in the lake and carp were abundant. This prompted the U.S. Fish and Wildlife Service to undertake a major carp control project using the **piscicide** rotenone in the Malheur Lake drainage in 1955. Since then, six other major rotenone projects for carp control have been completed in the drainage. Generally, waterfowl use and production greatly increased following use of rotenone. However, because carp were never eliminated, the beneficial effects of the treatments were limited to a few years, until the carp population rebounded.

Carp in Malheur Refuge wetlands lowered the refuge's potential for waterfowl production and maintenance to about 25% of its historic capability. If carp could be eradicated, the refuge could produce an additional 80,000 ducks a year, at least in years of abundant water. If these data are extrapolated to other carp-infested wetlands in North America, this would suggest that carp could be reducing continental waterfowl production by several million ducks each year. Besides crippling waterfowl production, carp have detrimental effects on other native **fauna** as well, especially other fish. Carp affect our economy by reducing sport hunting and fishing opportunities, increasing costs to agencies, and diminishing our native biological diversity.

Rotenone treatments are very expensive and at Malheur can only be applied during drought periods when water levels are low. Every year, state and federal agencies spend large sums of money on this chemical, with only short-term success. Based on experiences at Malheur, rotenone treatments are not the long-term solution to carp problems. Continued management of carp requires an integrated approach, using a combination of strategies such as barriers, traps, removal by electroshocking, redesign of wetland impoundments for better water management, and occasional application of rotenone as needed to improve habitat for waterfowl. Even so, this approach will likely never eliminate the problem which will continue to require action and funds for years to come.

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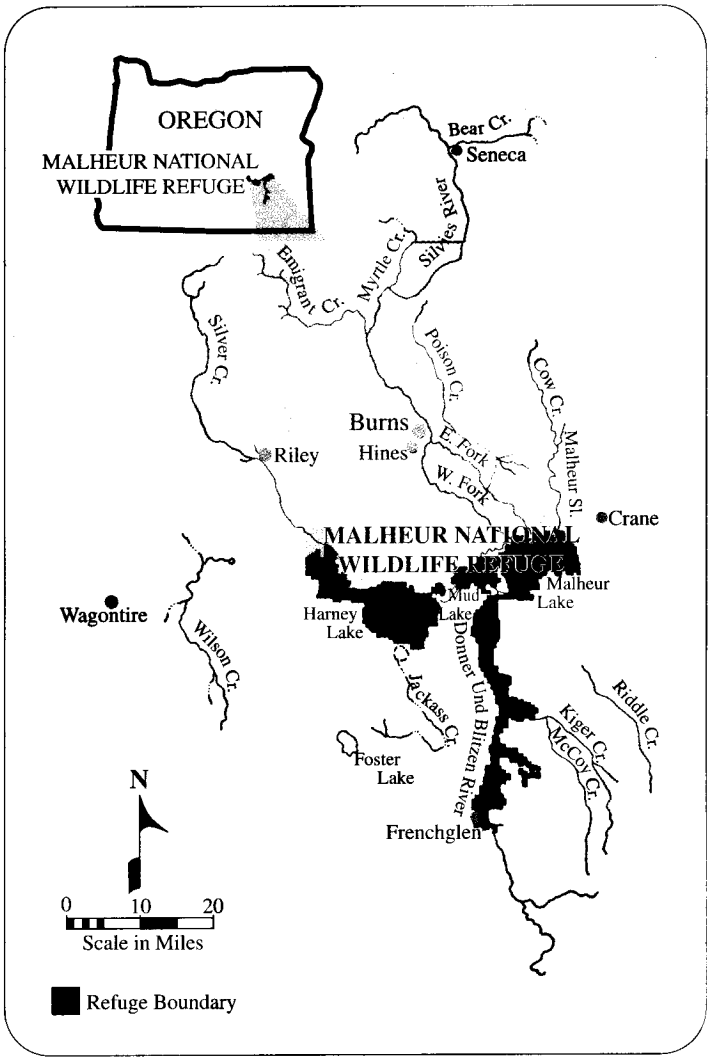

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Research Needed

Better tools for carp control are needed. With research, a technique may be found to reduce carp to tolerable levels, if not totally eliminate carp from wetlands and river systems. Possible control methods include genetic manipulation, introduction of sterile hybrids, or exploration of biological control agents that could kill carp or interfere with their reproduction. An ideal method would target only carp while safeguarding native and sport fish. Because Malheur Refuge is within a closed system, it would be both an ideal and challenging area for designing and testing experimental carp eradication schemes—and would serve as a model for carp control in other wetlands on the continent.

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