



Research report

Human consumption as an invasive species management strategy. A preliminary assessment of the marketing potential of invasive Asian carp in the US[☆]

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ABSTRACT

Over the past 20 years, Asian carp have invaded rivers and lakes in the Midwest and southern United States, with large negative impacts, such as encroachment on the habitat of native fish and mass die-off. They also respond to boat motors by jumping out of the water, which can cause harm to boaters and fishermen. Policymakers in the Great Lakes region between the US and Canada are worried about possible expansion of the Asian carp to their region and its effects on their fishing industry. A potential solution to the problem is to harvest Asian carp for human consumption. This study analyzes the results of the first national survey on the attitudes of US fish consumers towards Asian carp. We find that this is a potentially promising strategy. Most respondents would be willing to try a free sample of Asian carp and would be willing to pay for it. Because of the negative connotation attached to carp in general, this figure is encouraging. Creating demand for Asian carp could be a market based, cost-effective solution for a problem (invasive species) that is typically dealt with through command and control policies, if it is coupled with appropriate policies and safeguards to ensure the fish is eventually eradicated and not cultivated for profit after removal from US rivers and lakes.

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Introduction

Over the past 20 years, silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*), collectively known as Asian carp, have invaded rivers and lakes in the Midwest and southern United States. Their widespread distribution throughout the US is shown in Fig. 1. They have had negative impacts on native fish, such as paddlefish, bigmouth buffalo, and gizzard shad, by directly competing for food and space (Irons, Sass, McClelland, & Stafford, 2007), thus, reducing native fish diversity (Chick & Pegg, 2001). Their ability to outcompete native fish results in decreased fish landings of more profitable native fish for commercial fishermen, which affects their economic welfare. Asian carp affect recreationalists through their mass die-offs and propensity to jump out of the water in response to a boat's motor (Garvey, Ickes, &

Zigler, 2010). This causes dangerous and unpleasant situations for boaters, waterskiers, and recreational fishermen. In addition, their encroachment towards the Great Lakes has led to a federal lawsuit initiated by Michigan, Minnesota, Wisconsin, Ohio and Pennsylvania against the Metropolitan Water Reclamation District of Greater Chicago. The lawsuit would require the Army Corps of Engineers (a co-defendant) to build physical barriers between the Mississippi River and Lake Michigan in order to shut off all access routes (Egan, 2010). These states fear damage to a \$7 billion fishing industry if Asian carp move into the Great Lakes (Asian Carp Regional Coordinating Committee, 2012). Though a Federal judge dismissed the lawsuit on December 3rd 2012, he also noted that he would reconsider the case if the plaintiffs re-filed under different grounds (Flesher & Webber, 2012). Overall, Asian carp have cost tax payers millions of dollars and caused unmeasurable damages to aquatic ecosystems. A potential solution to the problem is to harvest Asian carp for human consumption. Previous carp marketing research has focused on a specific US state and canned carp preparation (Engle & Kouka, 1995). This study analyzes the results of the first national survey on the attitudes of US fish consumers towards Asian carp.

While Asian carp have continued to increase their abundance, this trend is not common among many other fish species. Chilean seabass, Atlantic cod, orange roughy, flounder and red snapper are only a few of the numerous fish that have been overfished

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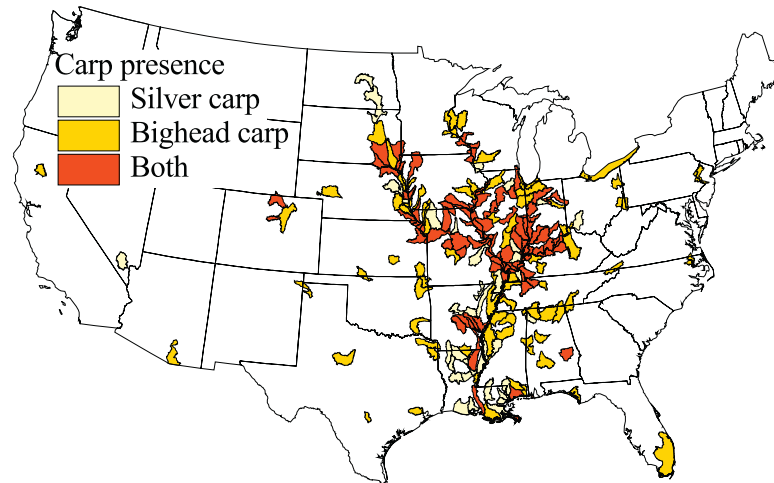


Fig. 1. Distribution of Asian carp in the US according to the US Geological Survey's Nonindigenous Aquatic Species database.

according to the Monterey Bay Seafood Watch (Monterey Bay Aquarium, 2012b). As researchers have touted the benefits of eating fish and a growing world population keeps demanding more protein, fish consumption has increased substantially. In the United States alone, consumption of edible fish meat has increased from 3.7 billion pounds in 1990 to 4.8 billion pounds in 2010 (Van Voorhees & Lowther, 2011), much of which is imported. US imports of edible fishery products in 2010 were worth \$14.8 billion. In the US, the expansion in total consumption in the last decade has been mainly due to population growth, with flat per capita consumption. Worldwide, however, in the last 20 years there has been an increase in per capita consumption, even excluding questionable statistics from China (FAO, 2012). The increase is entirely due to aquaculture, as capture fisheries have been unable to keep up with demand. Given this overall background, a proposed solution to the Asian carp invasion is to use the meat for domestic consumption. This would alleviate the stress on America's waterways and would provide a local, plentiful supply of fish.

However, many challenges must be overcome before this solution can be implemented. On the marketing side, one of the biggest hurdles at this moment is that American consumers have a negative view of Asian carp as food. Much of this stems from the misconception that bighead and silver carp taste like their cousins, the common and grass carps. Although all of these carp originated from Asia, silver and bighead carp have a much lighter, more delicate flavor than grass or common carp (Bardach, Ryther, & McLarney, 1972). This is one of the reasons why silver and bighead carp are the most cultured fish in the world by weight (FAO, 2012).

The difference in taste is mainly due to their diet. Both bighead and silver carp are filter feeders and their diet consists of zooplankton and phytoplankton. Grass and common carp are bottom feeders (Bardach et al., 1972), which impacts the flavor of their meat. Occasionally other factors can cause off flavors, such as algae that is occasionally present in the water, which can emit toxins such as geosmin and methylisoborneol (Persson, 1984; Tabachek & Yurkowski, 1976). However, research done by Papp, Kerepeczki, Pekár, and Gál (2007) found that bottom feeding common carp had 5–10 times the amount of geosmin present in their fillets than filter feeding silver carp, concluding that the type of feeding habits affects meat flavor (Papp et al., 2007). Another issue specific to the US is that, because they are so numerous in rivers and streams in the Midwest, silver and bighead carp are considered to have little value (carp is currently selling at about 5 cents a pound), thus consumers may not be willing to pay for their meat. Further, since they

will be harvested from rivers that may be thought to have water quality issues, demand for Asian carp meat may be decreased as consumers are already aware of the dangers of eating fish (Verbeke et al., 2008). On the other hand, carp would be locally harvested and processed, and this may be valued by consumers who prefer local food. Local production coupled with the fact that consuming carp is actually helping solve an environmental problem may make carp products more attractive. Indeed, in the US, proponents of the invasive movement promote the eating of invasive species as a management strategy (Weis, 2011).

On the production side, however, there are concerns because of potential ecological and fisheries management impacts of harvesting Asian carp. From an ecological perspective, preliminary stochastic simulation modeling results suggest that fishing could collapse the Asian carp population to functional extinction if all sizes of Asian carp are harvested (Garvey et al., 2012). Specifically, the probability of collapse is much less if only small or large Asian carp are harvested. As such, a market based solely on the human consumption of large adults would also have to be combined with markets that could target smaller Asian carp, such as organic fertilizer, livestock and aquaculture feeds, and pharmaceuticals (i.e., fish oil). However, the removal of the large, fecund females could have a larger effect on population declines than predicted given that recent evidence suggests that larger females spawn earlier within a spawning season than smaller Asian carp, potentially leading to greater reproductive success of larger females (Glover, 2012). From a fisheries management perspective, there is some evidence that the harvest of Asian carp will not negatively affect the harvest of other fish in the Illinois and Mississippi rivers, and that the supply of fish is relatively unresponsive to the price of fish (Speir & Brozovic, 2006). This suggests that fishermen in the area have either limited ability to fish one specific species or are unwilling to expend the extra effort necessary to target a particular species. The main caveat is that these conclusions are based on an inventory of existing fleet and technology/gear. The fishermen included in the analysis were mostly part-timers (273 out of 320, or 85%), and used small boats (Speir & Brozovic, 2006). If Asian carp prices were to increase well above historical averages, perhaps through the use of temporary subsidies, and rents were created in the fishery, economic theory and the history of fisheries' management indicate that more fishermen, possibly with larger boats, will enter the market (Beddington, Agnew, & Clark, 2007). This is indeed the same long term conclusion reached by the authors of the Asian carp fishery management paper (Speir & Brozovic, 2006).

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