

## **Koi, the Prevalence and Destructive Potential of an Invasive Aquatic Species Within Dog River and its Tributaries.**

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Tributaries of Dog River have experienced a number of changes through the years, due to urbanization. Channelization and diversion have permanently altered these waterways, changing their flow patterns, depths, and temperatures. The Dog River watershed has also seen the introduction of an invasive species to its waterways, the Koi. Koi are a domesticated, ornamental variety of carp. These Koi hold the potential to further degrade an already degraded waterway. In order to capture and quantify the population of this invasive species within the watershed, traps were set out at several locations within the watershed including Dog River, Spring Creek, Moore Creek, and Montlimar Canal. Traps of varying dimensions, aimed at capturing several different sized Koi, were set in order to observe whether or not breeding populations potentially inhabited the waterway. Another aim of the study was to observe whether or not the channelization of waterways presented a favorable habitat for the invasive species to live and reproduce.

Keywords: Koi, invasive species, channelization

### **Introduction**

The common carp (*Cyprinus carpio*) and sub-species have been cited as being “one of the world’s most invasive fish” (Bajer, 2011). They are a hardy breed, with the ability to adapt to and reproduce in varied habitats and climatic conditions. This species can be very destructive to the native flora and fauna living within the aquatic ecosystems of several continents to include North America. A study from the United Kingdom described *C. carpio* as being “a vigorous benthic feeder whose foraging behavior [resulted] in declines in submerged vegetation directly through uprooting or herbivory and indirectly through bioturbation and excretion” (Britton, 2010). As well, it was stated that “the species also induces the resuspension of sediments that could change water transparency from clear to turbid” (Britton, 2010). This destructive behavior is alarming, and carp populations in the United States have been observed as being on the rise.

Two sub-species of carp, within the United States, the bighead and silver carp have become such a problem that a 104 million dollar endeavor was convened by President Obama in 2010; The Asian Carp Regional Coordinating Committee (ACRCC) was formed for the sole purpose of preventing the carp from entering the Great Lakes (Hinterthuer, 2012).

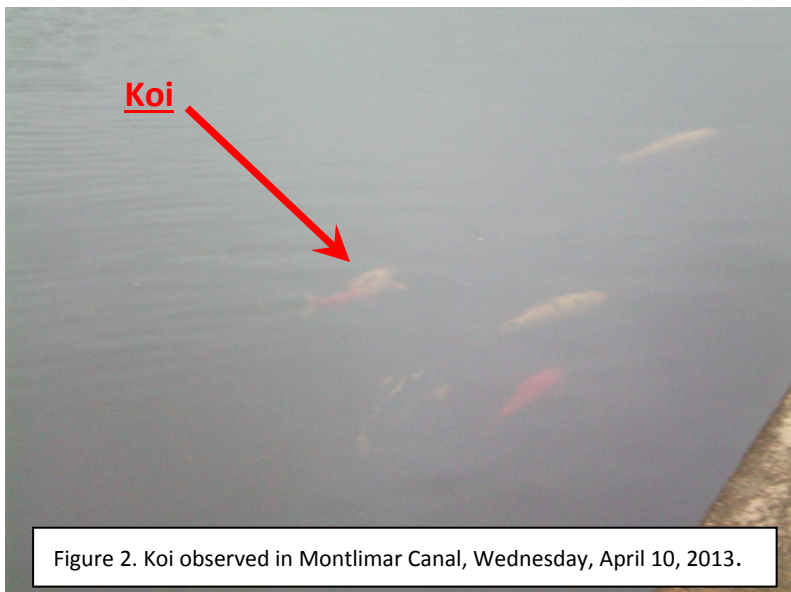
It has been observed, in previous studies, that warmer temperatures can possibly lead to faster growth rates, earlier reproduction, and the increased reproductive investment of carp (Oyugi, 2011). Many waterways within the Dog River Watershed have been altered through the decades. Increased urban development has led to the alteration and channelization of several creeks and streams within the watershed. It has been noted that these types of alterations can lead to increased water temperature. The ideal water temperatures for Koi to thrive are between 65 and 75°F, but they can tolerate temperatures exceeding 85°F (koiclubsandiego.org). The mean annual temperature for Mobile Bay was 63.5°F last year, and it can be assumed that Dog River and its tributaries had similar, if not warmer, temperatures, ideal for Koi (mondata.disl.org). The Koi, an ornamental variety of carp, had, earlier this year, been reported to be living within Dog River and its tributaries, which prompted this study.

### **Research Question**

The question to be pondered is, can it be shown that the invasive Koi is more predominant in manmade waterways within the Dog River Watershed? Also, could these waterways be areas that provide a habitat that is free of competition from other species for the Koi, and are Koi reproducing there?

## Methods

Fish traps of varying sizes were emplaced within the waters of Montlimar Canal, Moore Creek, Spring Creek, and Dog River. These traps (Fig.1) were all baited with bread. The Olympic Koi Club stated that Koi would feed on several easily procured items including, bread, Cheerios, and watermelon (olympickoiclub.org). Considering that it was desirable to catch several species of fish for the study, in order to compare populations, a bait item was selected that would attract a host of species, so bread was chosen. I had personally observed Koi within Montlimar Canal (Fig. 2) so the study was primarily focused there and in Moore Creek, which the canal feeds into. Out of six days of fishing, four days were spent at these two waterways, two days at each location. Traps



were set at dawn, on each day of fishing, and were checked for fish every afternoon. After being pulled and checked, traps were re-baited and set approximately 100 to 200 meters downstream of their original locations, and left in place over night. During the day, I patrolled the banks of each waterway to determine whether or not I could observe adult Koi swimming within them. Due to the size of Dog River, I elected to not walk the banks. Rather, I fished with hook and line, baited with bread pressed into a ball, in hopes of catching a mature Koi.

## Results

Six days of fishing produced 319 fish total. (See Table 1 on the following page) The most fish were captured in Spring Creek and the least in Montlimar Canal. The first two days of fishing were at Moore Creek, near Halls Mill Road. Eight mullet were caught on the first day. On the second, six small perch were caught (all Bluegill) as well as twenty-eight minnows. A total of forty-two fish were caught. The next day, traps were set at Montlimar Canal, near Pleasant Valley Road. No fish were captured the first day at the site. Five adult Koi were spotted here however, estimated to be about two feet in length each. Several fruitless attempts were made to catch them using hook and line, and, later, a cast net. The next day, the traps were moved and set south of Cottage Hill Road. This site produced

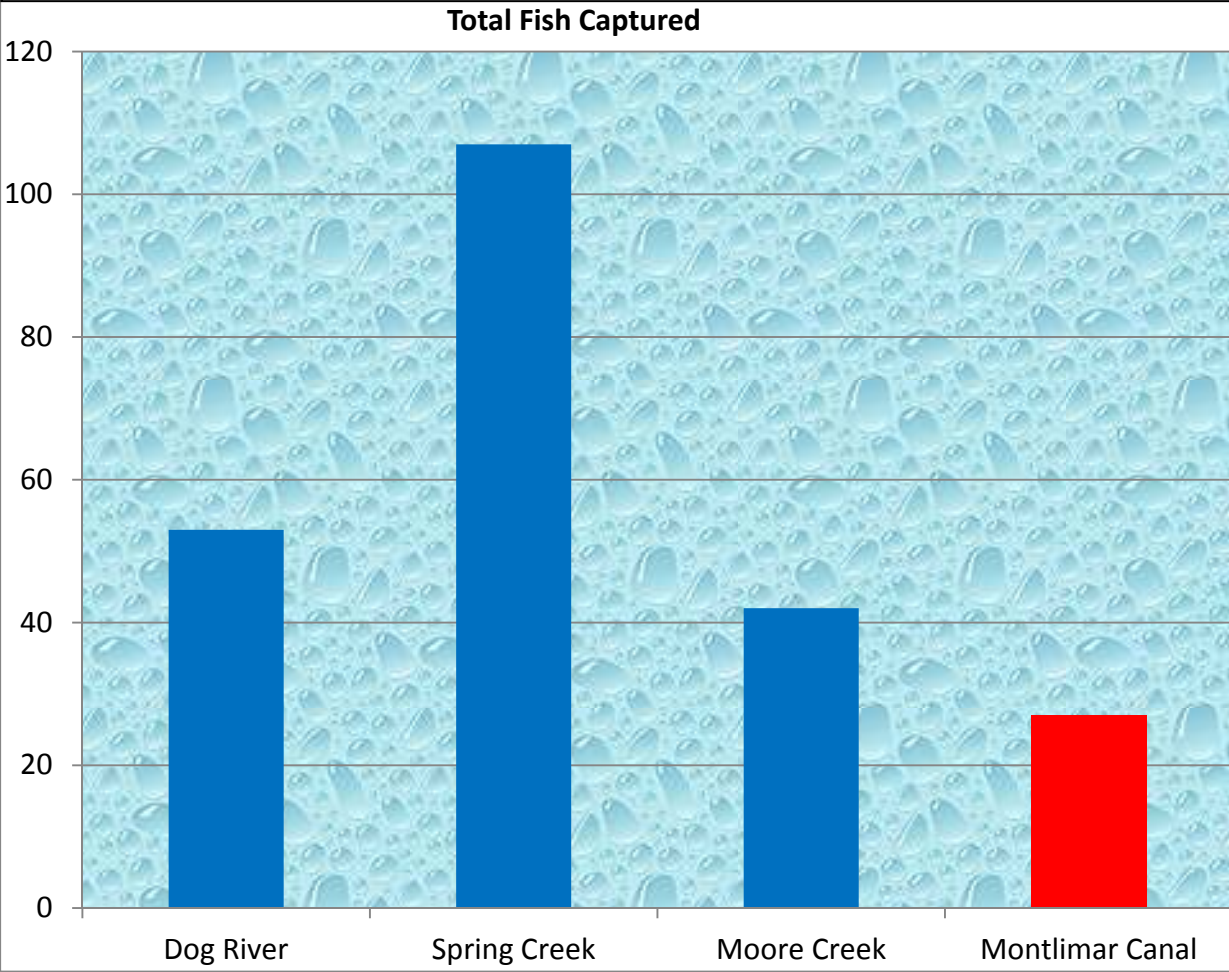


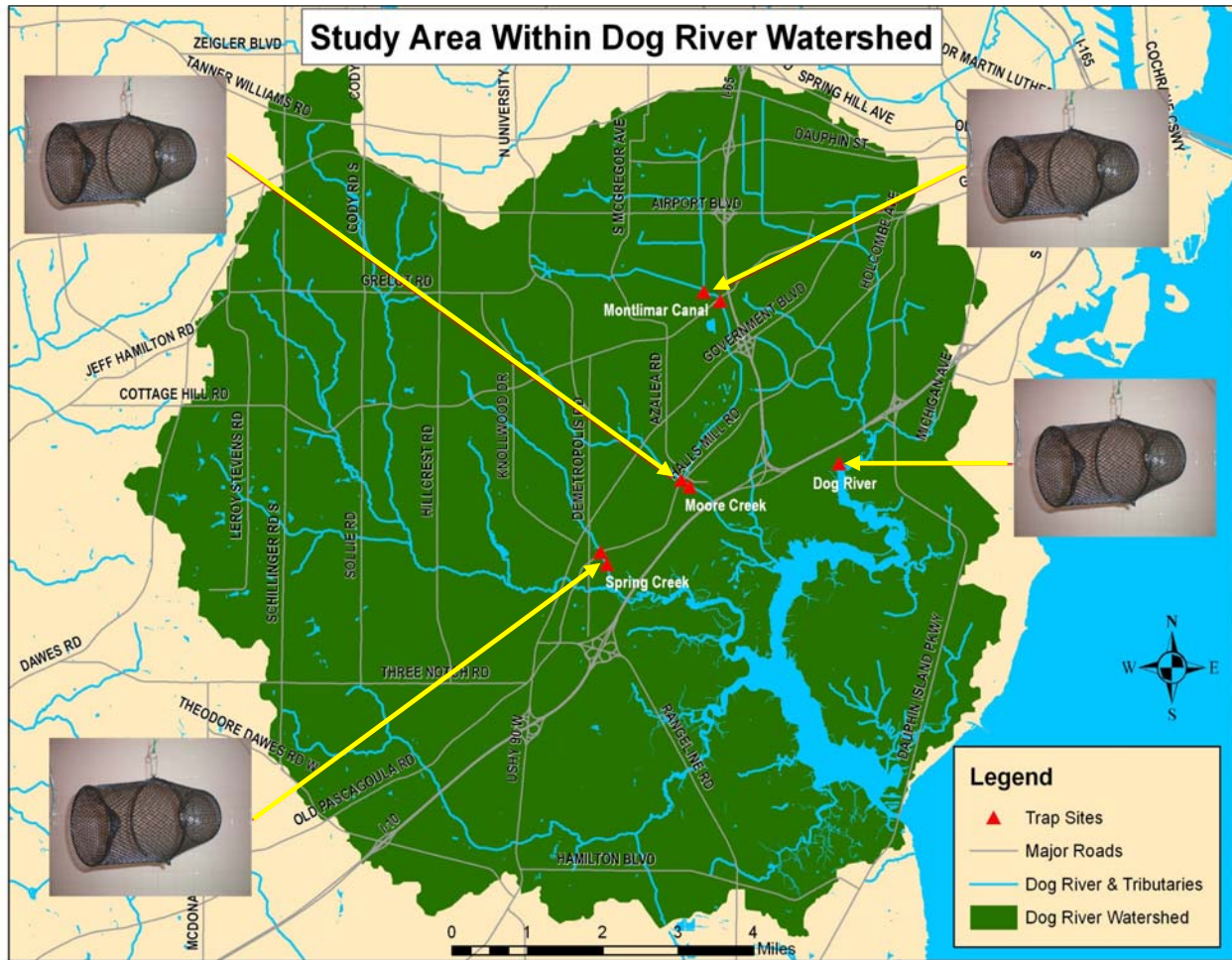
Two perch from Dog River caught on hook and line. A Shellcracker (top) and Bluegill (bottom)



twenty-seven fish total, twenty-three minnows and four perch. All perch were Bluegill at this site as well. The fifth day of fishing was at Spring Creek, near Halls Mill Road. This site was the most productive, yielding 107 fish total. Fish caught included, one War Mouth, one Red Eye Bass, two Largemouth Bass, two Suckers, thirty-one perch (predominantly Sun Perch), and roughly seventy minnows. The final day of fishing was at Dog River at Dog River Park. This site yielded fifty-three fish total. Forty-five fish were trapped and included twelve perch, and thirty-three minnows. Line fishing at this site produced eight fish total, one small Largemouth Bass, and seven perch of which three were Bluegill, and four Shellcracker. Sites can be located by observing the map on the following page.

Table 1. This table displays the number of fish captured in each waterway. Montlimar Canal is colored red to illustrate that Koi were spotted swimming in that waterway.





## Discussion and Conclusions

After six days of setting traps at four different sites, no juvenile Koi were captured. Also, adult Koi were only observed at Montlimar Canal. In relation to my first two research questions; are Koi more predominant in manmade waterways within the Dog River Watershed, and could these waterways be areas that provide a habitat that is free of competition from other species for the Koi, there was a slight positive correlation. This correlation was not substantial due to the limited number of Koi observed. As well, measurements of water temperature and dissolved oxygen content should have been taken to determine whether or not specific waterways exhibited conditions that are known to be favorable for Koi. Future studies will need to be done in order to

determine this. My third research question, are Koi reproducing in these waterways, appears to be a resounding no. Due to the relatively large number of adolescent fish trapped in each waterway, one would assume at least a few adolescent Koi would have been captured as well. Also, while walking the banks of the canal and creeks, substantially more fish were observed in the waterways than those trapped. If the Koi observed at Montlimar Canal were reproducing at an alarming rate, I would assume that I would have observed a few adolescent Koi, without trapping them. Therefore, I do not believe Koi represent a significant threat to Dog River and its tributaries. More research is needed to come to a definitive answer to the study questions I have posed.

### **Works Cited**

- Adam Hinterthuer (2012). The Explosive Spread of Asian Carp. *BioScience*. **62**, pp.220-224.
- Dalmas O. Oyugi, Julien Cucherousset, Micheni J. Ntiba, Set M. Kisia, David M. Harper, J. Robert Britton (2011). Life history traits of an equatorial common carp *Cyprinus carpio* population in relation to thermal influences on invasive populations. *Fisheries Research*. **110**, pp.92-97.
- J.R. Britton, J. Cucherousset, G.D. Davies, M.J. Godard, G.H. Copp (2010). Non-native fishes and climate change: predicting species responses to warming temperatures in a temperate region. *Freshwater Biology*. **55**, pp. 1130-1141.
- Koi club of San Diego* [online]. (2013). Available from:  
<<http://koiclubsandiego.org/library/temperature.php>> [Accessed 03/20/13]
- Mobile Bay National Estuary Program* [online]. (2013). Available from:  
<[http://mondata.disl.org/mondata/station\\_sensor.cfm?id=middlebay](http://mondata.disl.org/mondata/station_sensor.cfm?id=middlebay)>.  
[Accessed 03/20/13]
- Olympic Koi Club* [online]. (2013). Available from:  
<<http://www.olympickoiclub.org/aboutkoi.html>>. [Accessed 02/28/13]
- P.G. Bajer, C.J. Chizinski, P.W. Sorensen (2011). Using the Judas technique to locate and remove wintertime aggregations of invasive common carp. *Fisheries Management and Ecology*. **18**, pp.497-505.