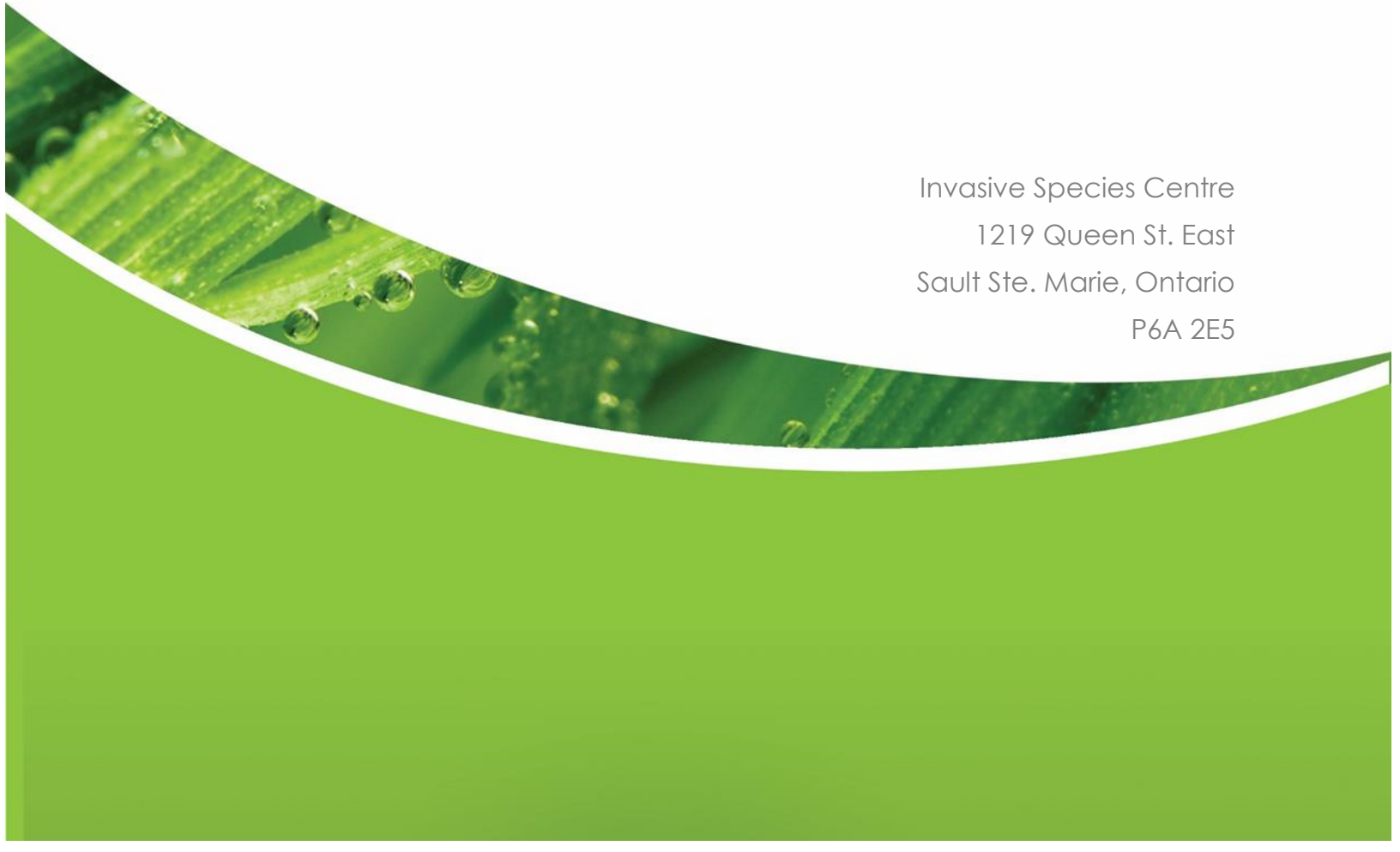


# Asian Carp Baseline Knowledge Survey for Ontario



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## 1.0 Introduction

Invasive species are a growing threat to Canada's terrestrial and aquatic ecosystems, economy, and society. To protect native species from invasive species impacts it is important to prevent them from entering and to detect them as early as possible, should they arrive. This proves difficult with aquatic species as they tend to be less visible and more difficult to track through a water system and is why prevention is critical to stopping the spread of aquatic invasive species (AIS). AIS pathways are often human aided. For example, live bait movement and dumping, transport on boats and water recreation equipment, release of aquarium species, and illegal import for personal or commercial use. All of these pathways can be minimized by proper education and understanding of the threats that AIS pose to Canada. The hope is, once the public understands the risks that AIS present, citizens will be more vigilant in helping to prevent their spread. Many of these pathways are unintentional and therefore could be easily averted through education. For example, knowledge and identification of legal bait fishes being bought and/or sold is a good way to reduce the chance of potentially invasive fishes establishing in new waterbodies.

Recognizing the common characteristics of all invasive species is crucial to developing knowledge and understanding of invasive species prevention. To understand the importance of individuals' actions towards the management of invasive species, Ontarians first must know what invasive species are and why they pose such a great threat. This survey gauged Ontarians' perceptions regarding the importance of ecosystem protection and their knowledge of invasive species in general. The survey specifically targets Asian carps; general knowledge of the species, opinions on their impacts, knowledge of what the public can do, and what is currently being done by various organizations.

## 2.0 Survey Methodology

As part of the Fisheries and Oceans Canada's Asian Carp Outreach and Education program the Invasive Species Centre developed a baseline survey to gauge Ontarians' knowledge of invasive species, specifically Asian carps. The information was collected by Leger, a survey company, via a web based survey from August 28 to September 6, 2015. The respondents were weighted, using Statistics Canada information, by gender, age, language, education, and region to ensure a representative sample of Ontario demographics. Respondents were also asked questions to gauge their outdoor activity level to determine whether being engaged with the outdoors improves the likelihood that individuals will have more invasive species knowledge. When comparing results, the margin of error for the 1 002

respondents is  $\pm 3.1\%$  (with a 95% probability of random sampling,  $p=0.05$ ) unless otherwise stated. Results are presented as percentages for each demographic subsection to factor in the different sample sizes.

## 3.0 Public Perception of Invasive Species Impacts and Management

### 3.1 Results

Knowledge of invasive species begins with understanding what makes something invasive. This survey asked individuals to choose the best definition for invasive species from a selection of four possibilities. Respondents were given the following options to choose from:

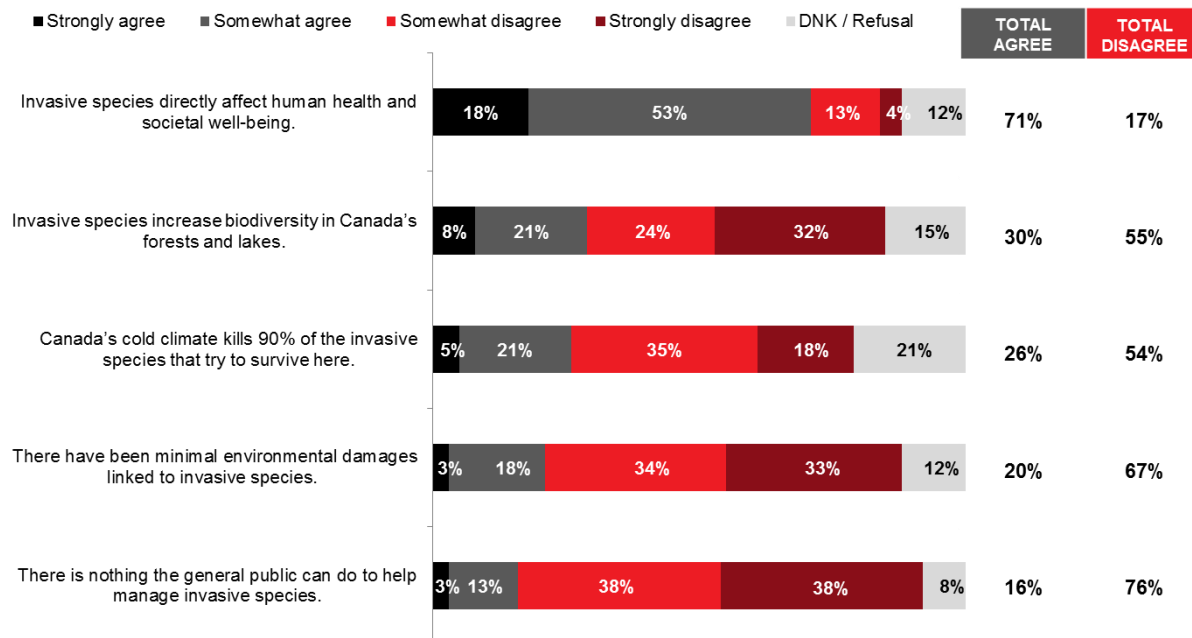
- a) plants, animals, and micro-organisms introduced by humans to new environments;
- b) the most common species within an ecosystem;
- c) species whose introduction or spread to a new area threatens the environment, economy, or society; or
- d) native species of plants, animals, and micro-organisms that take over an ecosystem.

Sixty percent of individuals correctly chose option 'c' as the definition of invasive species. However, the remaining 40% of Ontarians selected incorrect or less correct definitions. Option 'a' was the second most selected choice with 19%, then 'd' with 9%, and 'b' with 3% (9% didn't know or refused to answer). Of the respondents who indicated that they were worried about invasive species only 63% correctly identified the proper definition.

To gauge Ontarians' knowledge of invasive species' potential impacts, respondents were asked to agree or disagree with five statements:

- a) invasive species directly affect human health and societal well-being;
- b) invasive species increase biodiversity in Canada's forests and lakes;
- c) Canada's cold climate kills 90% of the invasive species that try to survive there;
- d) there have been minimal environmental damages linked to invasive species; and

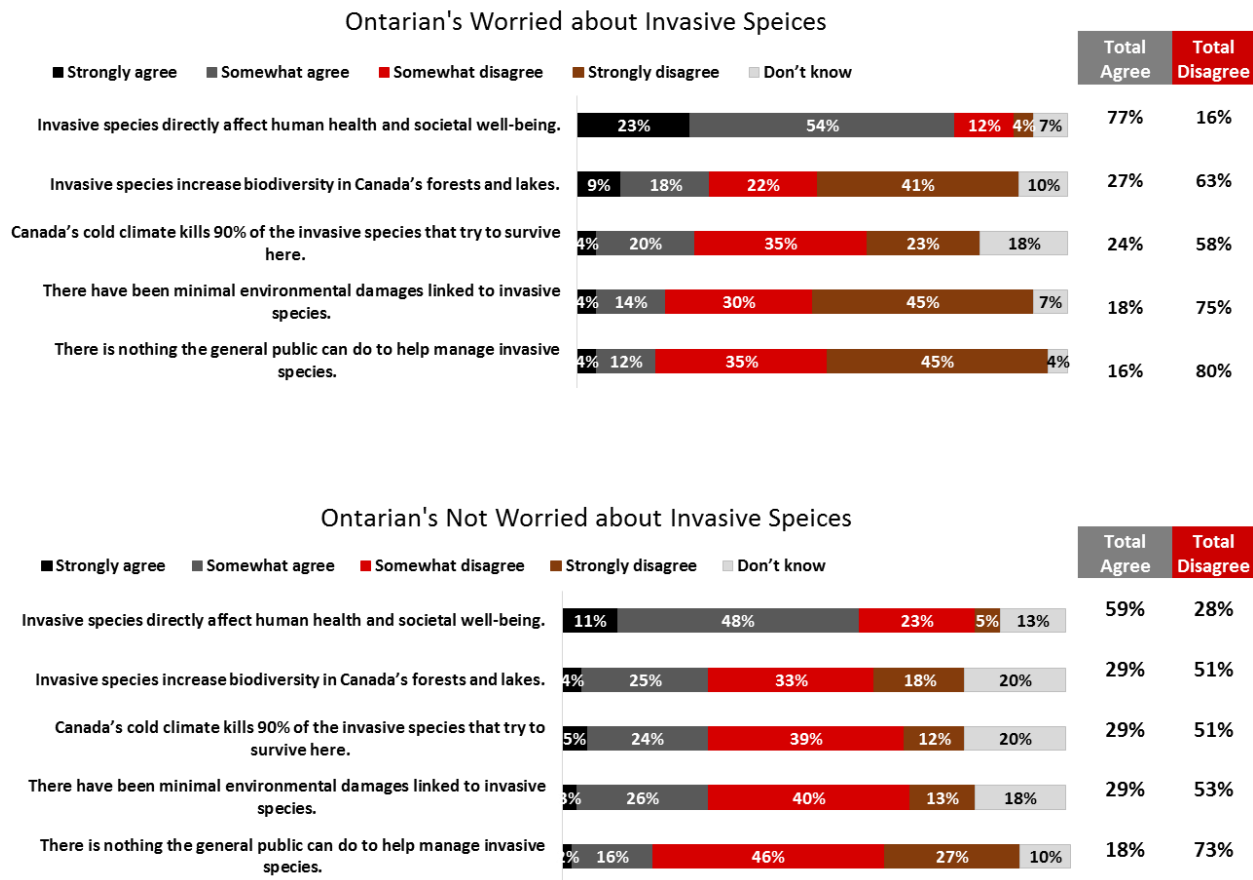
e) there is nothing the general public can do to help manage invasive species.



**Figure 1** Percentages of level of agreement by Ontarians with five statements regarding invasive species.

*\*percentages of total agree and total disagree reflect the percentage of participants that selected either strongly agree or somewhat agree, and somewhat disagree or strongly disagree, respectively. The discrepancy of totals is due to rounding of the raw data.*

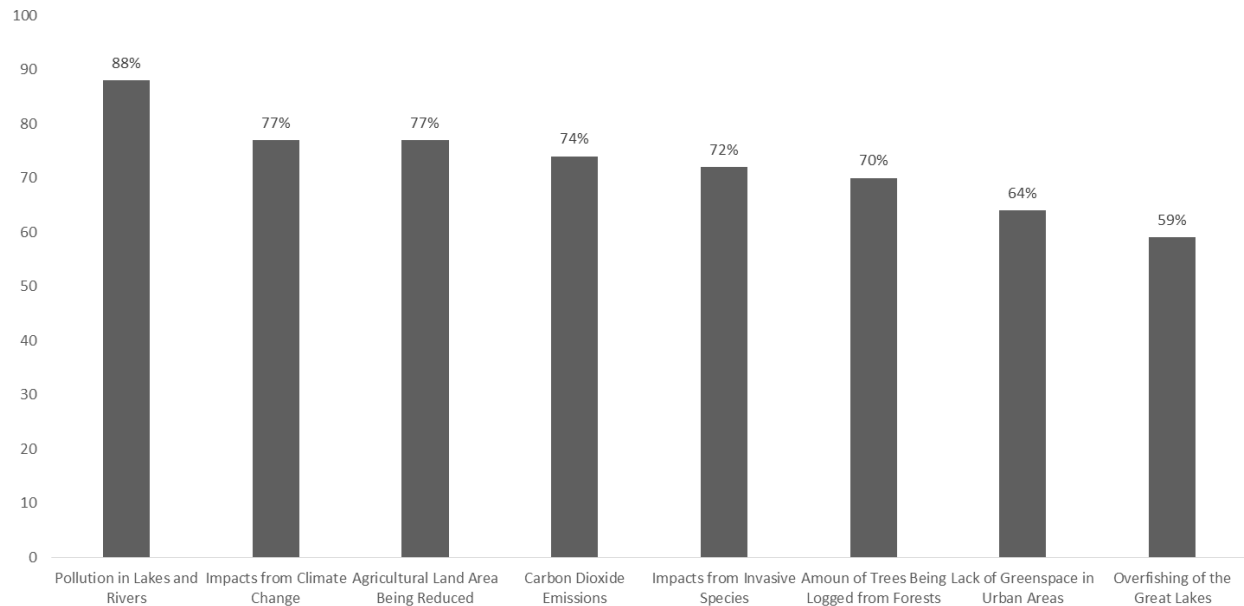
While the majority of Ontarians chose the correct answer for each statement, a substantial amount (over 20%) answered incorrectly or did not know the answer (Figure 1). There appears to be confusion among the public on what exactly happens when an invasive species enters an ecosystem; 30% of Ontarians believe that invasive species increase biodiversity, and 26% think that Canada's cold climate kills the majority of invasive species. Respondents who indicated that they were not worried about invasive species answered "I don't know/refuse to answer" as well as "somewhat disagree" whereas individuals that are worried about invasive species answered "strongly disagree" more frequently (Figure 2). Respondents who were worried about invasive species also agree at a higher percentage that invasive species impact societal well-being (77% agreement versus 59% of people not worried about invasive species).



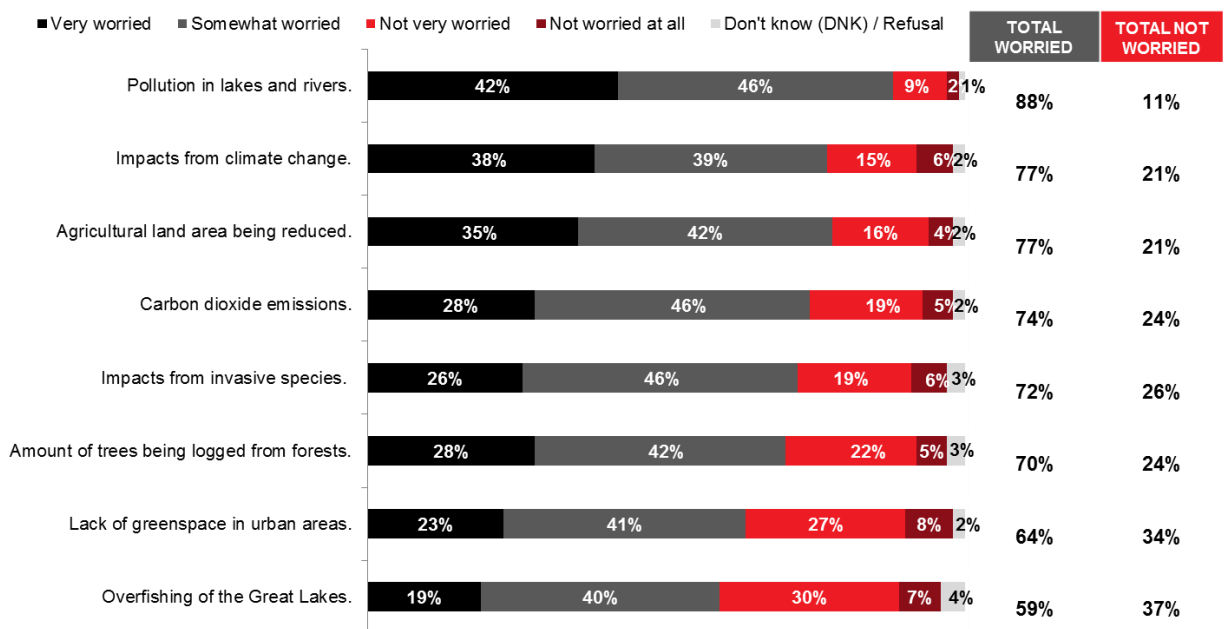
**Figure 2** Percentages of level of agreement by Ontarians with five statements regarding invasive species. Top graph shows answers by individuals that indicated they were worried about invasive species impacts, bottom graph shows answers from those not worried about invasive species impacts.

To determine how invasive species ranked in relation to other environmental issues, survey participants were asked to identify their degree of concern (not worried at all to very worried) about eight environmental issues. The issues, in order of “most worried about” to “least worried about” are:

1. Pollution in Lakes and Rivers,
2. Impacts from Climate Change,
3. Agricultural Land Area Being Reduced,
4. Carbon Dioxide Emissions,
5. Impacts from Invasive Species,
6. Amount of Trees Being Logged from Forests,
7. Lack of Greenspaces in Urban Areas, and
8. Overfishing of the Great Lakes (Figure 3, Figure 4).



**Figure 3** Percentage of Ontarians worried about eight environmental impacts. Respondents were asked to rank each from very worried to not worried at all, percentages are a total of respondents that answered very worried and worried.



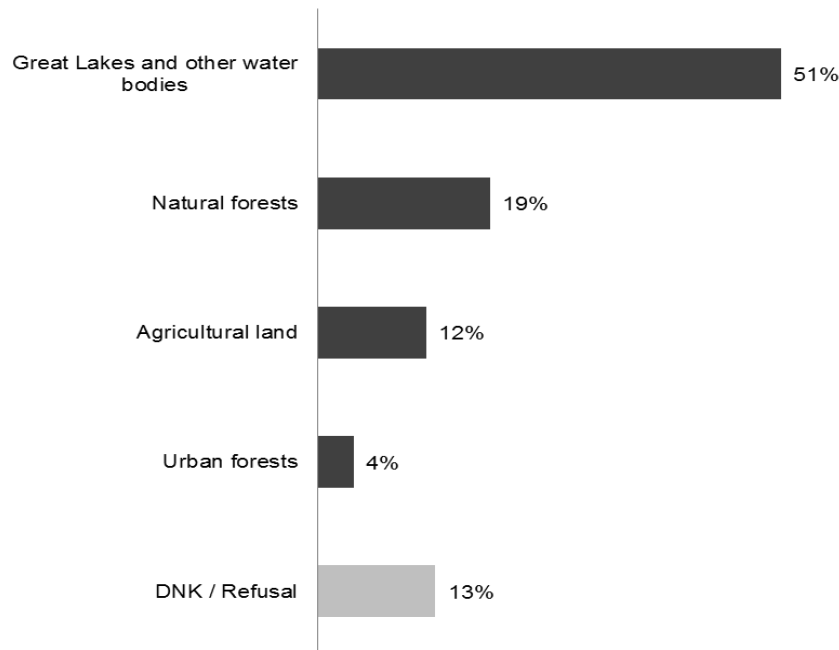
**Figure 4** Breakdown of concern level of Ontarians for eight different environmental threats.

\*percentages of total worried and total not worried reflect the percentage of participants that selected either very worried or somewhat worried, and not very worried or not worried at all, respectively. The discrepancy of totals is due to rounding of the raw data.



Pollution of lakes and rivers was ranked as the highest concern, however water quality is also deteriorated by many aquatic invasive species. The large discrepancy might be a case of people not knowing how water quality can be negatively impacted from invasive species. Certain lifestyle factors influence public concern about invasive species; on average 72% of Ontarians are worried about invasive species, however that number increases significantly for people who report that they participate in outdoor activities (75%), and people who already had knowledge of Asian carps (83%). This average percentage is on par with the percentage of people who know that invasive species directly affect human health and societal well-being (Figure 2). Location appears to play a small role in reported concern about invasive species; the Hamilton-Niagara area and the Northeast show lower than average concern, whereas 100% of people from the Northwest Ontario indicated that they were worried about invasive species (Table 1, see appendix).

As described above, more respondents were worried about the quality of lakes and rivers than other environmental issues. This was reaffirmed by asking participants what habitat should receive the highest protection against invasive species. The majority of Ontarians believe the Great Lakes and other water bodies should be the most protected (51%), followed by forests (19%), agricultural land (12%), and urban forests (4%) (Figure 5). The proportion of people that chose the Great Lakes increases for respondents who indicated they are worried about invasive species (55%), are anglers (57%), and know about Asian carps (59%).



**Figure 5** Percentage of Ontarians that think each natural area should receive the highest protection from invasive species in Ontario.

Invasive species are an expensive threat to Canada due to the loss of natural resource revenue, and cost of management. The Canadian Food Inspection Agency estimates the annual impact of invasive species to be \$30 billion (\$20 billion in the forest sector, \$7 billion for aquatic invasive species in the Great Lakes, and \$2.2 billion for invasive plants in the agricultural sector)<sup>1</sup>. Results suggest that the public is unaware of the total cost of invasive species as only 5% of respondents knew the true estimated cost. The majority of Ontarians (47%) did not know and 27% thought the cost was \$30 million. It is worth noting that individuals who indicated that they were worried about invasive species and that knew about Asian carps selected \$30 billion at a significantly higher percentage, however the number was still extremely low at 6% and 7% respectively.

### 3.2 Section Observations

Improving public knowledge about invasive species and their impacts could improve public desire to behave in ways that help prevent invasive species introduction and spread. While the majority of Ontarians know that invasive species are a concern, they do not have a firm understanding on why, exactly, they should be worried. A large percentage of Ontarians do not understand the threat that

<sup>1</sup> <http://www.inspection.gc.ca/about-the-cfia/accountability/reports-to-parliament/2013-2014-dpr/eng/1409769354767/1409769355486?chap=0#c32s3c>

invasive species pose. Individuals who indicated that they were worried about invasive species were generally more confident in their knowledge of invasive species impacts than people who were not worried about invasive species; as seen by them selecting “very worried” over “somewhat worried” and “I don’t know”. These results indicate that Ontarians may have an idea of what invasive species do, but are not aware of their impacts enough to be concerned. Messaging around invasive species should be clearer regarding what invasive species actually are, rather than simply, that they are harmful. Teaching the public the potential impacts of invasive species would provide better context to what is at risk. Messaging could be focused on what Ontarians have to lose if specific invasive species established.

Each region in Ontario views invasive species threats and management from different perspectives. For example, 100% of people from the northwest region of Ontario indicated that they are worried about impacts from invasive species, whereas only 58% from the northeast region are worried. Using this type of information, invasive species awareness campaigns could be modified to provide a better return on investment with a more directed approach. For example, in the northwest an action driven campaign, such as boat washing, would have a better impact because they are already concerned about invasive species impacts and this would provide information on what they can do to help with prevention. Alternatively, in the northeast, the outreach might be better targeted at providing more basic information about invasive species and their impacts.

Since the majority of participants stated that the Great Lakes require the most protection, use of messaging regarding the protection of the Great Lakes from invasive species would be an effective tool to engage Ontarians. A similar survey conducted by the Invasive Species Centre through the Early Detection Rapid Response Network Ontario (EDRR) program, yielded different results. Those results showed natural forests as the area that the public believed should receive the most protection (36%), followed by agricultural land (28%), wetland and coastal areas (28%), and urban forests (8%). There could be a number of reasons for these differences including sample area and size. It is possible that a portion of the discrepancy could be due to the wording around waterbodies being very different. This could imply that in order to invoke more action from Ontarians regarding invasive species management, using “Great Lakes and waterbodies” is more effective than using “wetland and coastal areas”.

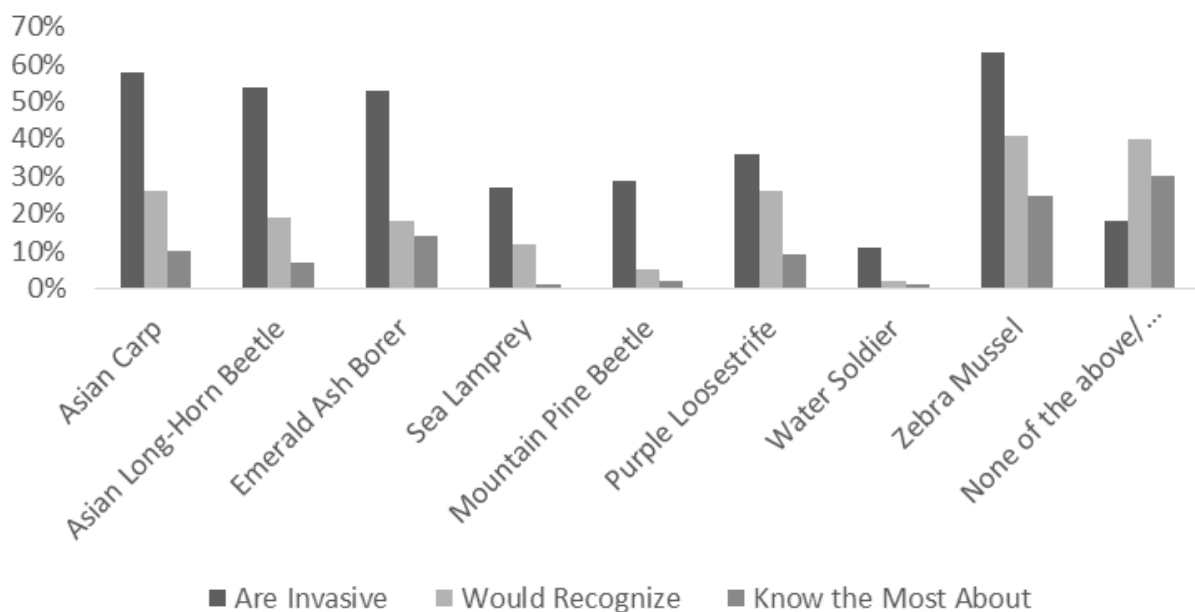
Ontarians do not know the cost of invasive species and of those that thought they knew, the majority selected a value that was one thousand times lower than the actual cost (selecting \$30 million instead of \$30 billion). These results suggest that an effective way to inspire the public to be more involved with the prevention and management of invasive species is to provide knowledge on the financial impacts of

invasions. Cost is a driving factor in how the public views an issue, therefore underlining the cost of invasive species, which is currently in the tens of billions of dollars, could improve the public's desire to focus on prevention.

## 4.0 Ontarians' Knowledge of Specific Invasive Species

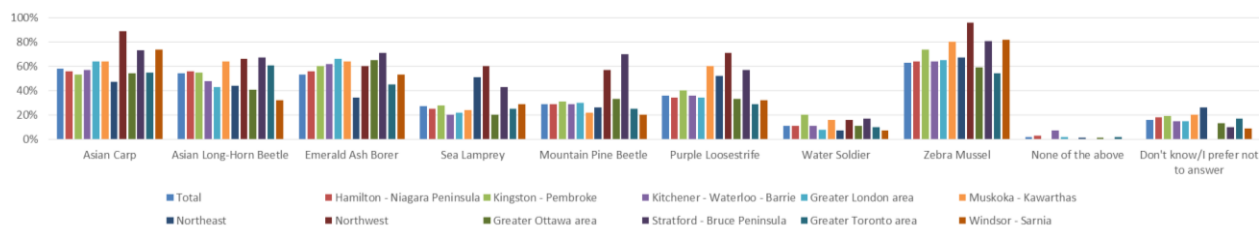
### 4.1 Results

To gauge the public's awareness of key invasive species, respondents were asked three questions regarding eight invasive species. This gave an understanding of which invasive species the public hears about most, and therefore may help to direct outreach and education efforts. The eight invasive species listed in the survey were; Asian carp, Asian long-horn beetle, emerald ash borer, sea lamprey, mountain pine beetle, purple loosestrife, water soldier, and zebra mussels. When asked which of the species are invasive, 18% of Ontarians did not know or thought none were invasive, whereas only 7% correctly identified all species listed as invasive. Two major aquatic invasive species, zebra mussels and Asian carp, were indicated as invasive by the highest proportion of Ontarians, 63% and 58% respectively. The next most selected species were two forest pests of concern, Asian long-horn beetle and emerald ash borer (54% and 53%). This trend fits with the findings that Ontarians are more concerned with protecting the Great Lakes from invasive species than forests (Figure 5).



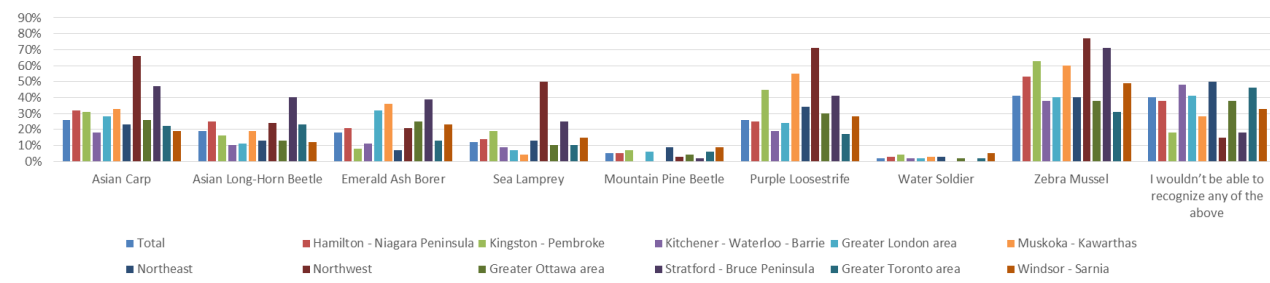
**Figure 6** Percentages of Ontarian that are aware of eight invasive species. Respondents were asked: which species are invasive, which they would recognize, and which they know the most about.

Water soldier had the lowest proportion (11%) of individuals selecting it as an invasive species (Figure 6). This could be due to its fairly localized invasion however, individuals from the Trent-Severn region, the only location in Ontario where water soldier is found, were not the highest proportion to indicate it as invasive. Kingston had the highest proportion (20%) to indicate that it is invasive, followed by Stratford (17%), followed by the Kawartha's and the Northwest (16%) (Figure 7). There is a trend of Northwest Ontario having a higher proportion of individuals correctly identifying invasive species, whereas the Greater Toronto Area was less knowledgeable (Figure 7).



**Figure 7** Percentage of Ontarian, by region, that indicated each invasive species as invasive according to them.

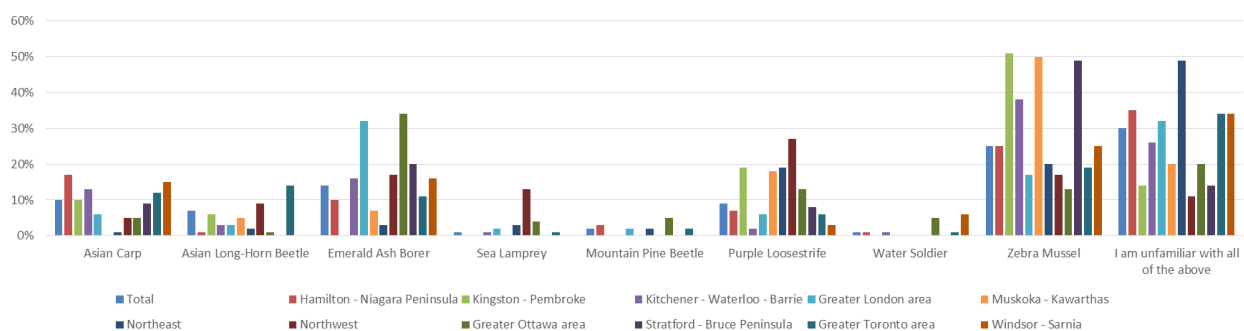
Men and anglers had a higher proportion indicate the aquatic species listed as invasive, compared to women and non-anglers, but there was no difference between these groups for the other invasive species. People aged 18 to 34 had below average knowledge for most of the species, whereas a higher percentage of ages 55 and older were more knowledgeable about the species. This implies that the younger generation is not as aware of individual invasive species as those over 55 years of age. Participants who indicated that English was their first language indicated recognition of invasive species at a higher percentage than those whose first language was not English. In addition, people who indicated that they are engaged in outdoor activities or that they are worried about invasive species answered more correctly than those who are not (Table 2, see appendix).



**Figure 8** Percentages of Ontarian, by region, that indicated they would be able to recognize each species. Note: this is self-reporting and does not reflect whether they can accurately identify these species.

Although people have an idea of what species are invasive, they are much less confident that they could correctly identify the species (Figure 6). The most identifiable species was zebra mussels (41%) however, 40% of people indicated that they would not be able to identify any of the species listed. Asian carps and purple loosestrife were the second and third most likely species that respondents were able to identify at 26%. This number is likely overinflated since specific knowledge of Asian carps is very low (as shown in Ontarians' Knowledge of Asian Carp below). The results do not indicate whether individuals can correctly identify the species, only whether they believe they could. More research into the actual identification skills of the public would be needed for better understanding. People 45 years of age and older indicate a higher identification confidence than the younger age groups. People worried about invasive species, anglers, and those that participate in outdoor activities also had an above average percentage indicate that they could identify the species listed (Table 3, see appendix).

When asked which species they knew the most about, 30% of respondents selected none of the above and 25% selected zebra mussels (Table 4, see appendix). There tends to be a higher awareness of zebra mussels than the other listed species. With further research into why people are more aware of zebra mussels, and a comparison about how people feel about zebra mussels versus other aquatic invasive species, successful outreach plans could be designed for other species. Asian carps are most well known in the Hamilton-Niagara region (17%) and Windsor (15%). The southern cities, that are closer to the lower Great Lakes, selected Asian carps as the species they knew the most about more than the cities removed from the lower Great Lakes (Figure 9). This is likely due to the southern Great Lakes being the most threatened by Asian carp invasions.



**Figure 9** Percentages of Ontarian, by region, that indicated they know the most about each species. Note: this is self-reporting and does not reflect what level of knowledge each respondent has of a given species.

## 4.2 Section Observations

Approximately half of Ontario is aware of the invasiveness of high profile invasive species such as zebra mussels, Asian carps, emerald ash borer, and Asian long-horned beetle. This implied that invasive species education is reaching the public and they know the common species to be concerned about. Also, targeted campaigns appear to be successful as anglers are more aware of the aquatic invasive species. However, there is a lack of younger Ontarians being able to correctly indicate which species are invasive, or identify them, which could be due to the message platform (as seen in Source of Asian Carp Information). These results suggest that targeted ads in different platforms could improve the proportion of Ontarians that are knowledgeable about these species. The survey shows that 87% of Ontarians who have heard of Asian carps know that they are invasive. However, only 56% of Ontarians surveyed have heard of Asian carps, so while the message currently improves awareness, the reach needs to improve.

Almost half of Ontario would not be able to identify any of the species that we listed in this survey, this is an area in need of improvement. Public identification and citizen science plays a large role in early detection of invasive species. Outreach and education surrounding invasive species should be more focused on species identification because even though the public knows a species is invasive, it does not mean that they could identify it correctly and respond accordingly. While it is good that people know Asian carps are invasive, they may still be contributing to their spread if they do not know how to identify them. It may also lead to native fishes being killed when they do not need to be, or invasive fishes being released when they should be removed. Identification education should include adult and juvenile fishes because juvenile Asian carps closely resemble common Ontario baitfish.

## 5.0 Ontarians' Knowledge of Asian Carp

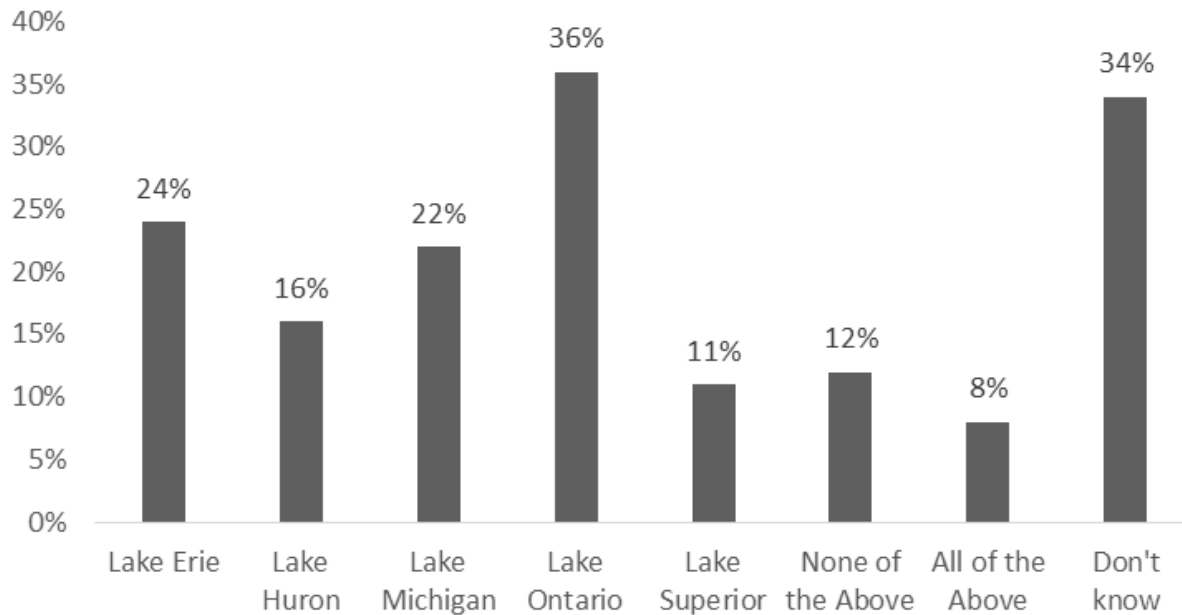
### 5.1 Results

Respondents were asked whether they had heard of Asian carps outside of this survey. The 56% of people that had heard of Asian carps, were then asked a series of questions to determine their specific Asian carp knowledge. Seventy-one percent of this group indicated that they do not know how many species of Asian carps there are, and only 3% selected four species. Of those people who thought they knew, 12% said one species, 6% said two, 5% said three and 3% said five species. The only demographic that correctly answered this question above provincial average were people aged 24 to 34 (10%) and people who live in Hamilton-Niagara region (9%).

To narrow down whether Ontarians know more about a specific Asian carp species, participants were asked to indicate which fishes were Asian carps, from a list that included Bighead, Black, Grass, and Silver Carp, as well as, “all of the above”, “none of the above”, and “I don’t know”. This question closely reflected the previous question regarding number of Asian carps, as 67% did not know if any of the listed fishes were Asian carps. More individuals selected “none of the above” (6%) than “all of the above” (5%). All four species were selected with similar frequency, Silver Carp (14%), Bighead and Black Carp (12%), and Grass Carp were the least frequency selected (10%). This is unexpected considering the media coverage of Grass Carp findings in the Greater Toronto Area just months prior to the survey. However, Silver Carp are shown more frequently in the media due to their jumping behaviour. The age group of 25 to 34 showed an above average proportion select each of the species whereas the age group of 65+ showed a below average proportion select each species and actually had a much higher percentage who selected “I don’t know” (Table 5, see appendix). People who do not participate in outdoor activities, as well as non-anglers, selected “I don’t know” more often than average (Table 5, see appendix).

There is confusion about whether or not Asian carps are established in the Great Lakes. Respondents were asked which Great Lake Asian carps were currently established in or whether they were established in any. Only 12% of respondents know that Asian carps are not established in the Great Lakes, 8% think that they are established in all of the Great Lakes, and 34% indicated that they do not know. Lake Ontario was selected the most often (36%) followed by Lake Erie (24%) and Lake Michigan (22%) (Figure 10). Hamilton-Niagara region responded above average once again with 21% saying “none of the above” as opposed to Ottawa where 21% indicated that Asian carp are established in all of the Great Lakes.



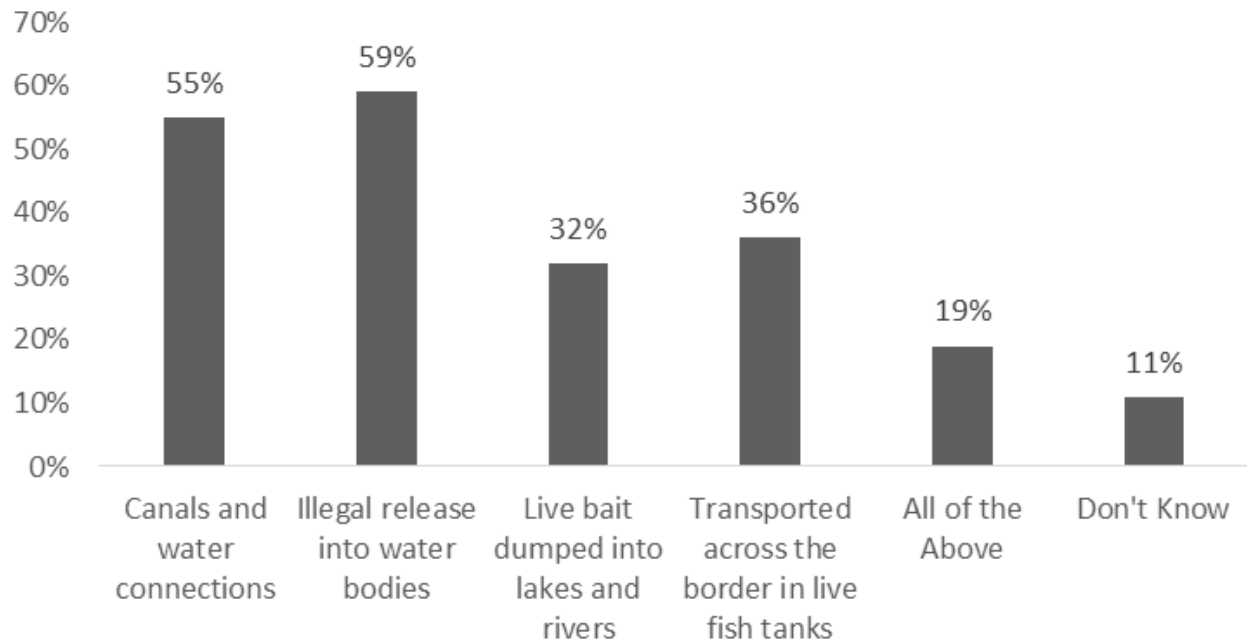


**Figure 10** Percentages of Ontarians that believe that Asian carps are established in each Great Lake, none of the Great Lakes, or all of the Great Lakes.

Aquatic invasive species can arrive by many pathways into a water body, often aided by humans; therefore education on these pathways is important. Respondents were asked how Asian carps could enter the Great Lakes:

- a) canals and water connections;
- b) illegal release into water bodies;
- c) live bait dumped into lakes and rivers;
- d) transported across the border in live fish tanks; or
- e) all of the above.

Illegal release (59%) was identified as the most commonly thought method for Asian carps' entry point into the Great Lakes. This was followed closely by canals and water connections (55%) (Figure 11). Only 19% of Ontarians know that all of these methods could allow Asian carps entry into the Great Lakes and 11% indicated that they "did not know".



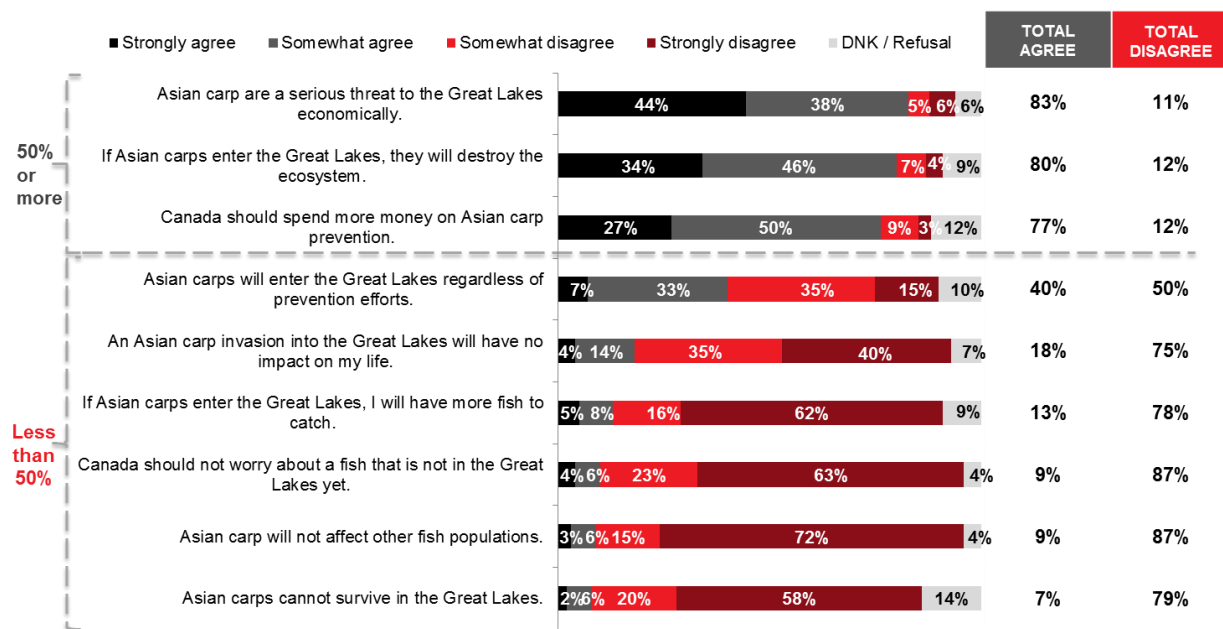
**Figure 11** Percentages of Ontarians that know the pathways in which Asian carps can enter the Great Lakes.

To determine the public's perception of Asian carps in Ontario, respondents were asked to indicate their level of agreement (strongly agree to strongly disagree) regarding nine statements:

- a) Asian carps are a serious threat to the Great Lakes economically
- b) if Asian carps enter the Great Lakes, they will destroy the ecosystem;
- c) Canada should spend more money on Asian carp prevention;
- d) Asian carps will enter the Great Lakes regardless of prevention efforts;
- e) An Asian carp invasion into the Great Lakes will have no impact on my life;
- f) If Asian carps enter the Great Lakes, I will have more fish to catch;
- g) Canada should not worry about a fish that is not in the Great Lakes yet;
- h) Asian carps will not affect other fish populations and;
- i) Asian carps cannot survive in the Great Lakes.

The majority of Ontarians agreed with statements a, b, and c, including 77% of people indicating that Canada should spend more money on Asian carp prevention (Figure 12). However, 40% believe that Asian carps will enter the Great Lakes regardless of prevention efforts, 18% think that an Asian carp invasion would have no impact, and 13% think that they would increase the number of fish available to catch (Figure 12). Anglers (18%), and age groups 25-34 years (25%) and 35-44 years (19%) believe that

they would have more fish to catch if Asian carps established in the Great Lakes. These percentages are higher than the average for Ontario, determined through this survey.



**Figure 12** Break down of percentages of Ontarians' level of agreement with nine statements regarding Asian carp.

Where 50% or more indicates majority agreement.

\*percentages of total agree and total disagree reflect the percentage of participants that selected either strongly agree or somewhat agree, and somewhat disagree or strongly disagree, respectively. The discrepancy of totals is due to rounding of the raw data.

## 5.2 Section Observations

There is a lack of knowledge when it comes to specific Asian carp information. Although the survey shows that greater than 50% of the population in Ontario have heard about Asian carps, this information is not always accurate. Only 3% of Ontarians correctly identified that there was four species of carps and very few people could identify which species are Asian carps. The term "Asian carp" might be causing confusion among the public and leading people to believe that there is only one invasive carp species. A more effective approach may be to talk about each carp individually and use invasive carps or invasive carp species when referring to all four as a whole. This would allow people to understand that there are four species, each with their own specific impacts and challenges for control. It could also improve identification knowledge because the public would understand that they are not just looking for one species. Targeting the species that they are most likely to encounter could result in the greatest return on investment.

A large percentage of Ontarians believe that there are Asian carps already established in the Great Lakes. These results are concerning because if people think that Asian carps are already established, they could be less likely to change behaviours to prevent Asian carps from getting into the Great Lakes. Messaging about Asian carp should include more information about keeping Asian carps out of the Great Lakes to educate the public that there is no established population in the Great Lakes. As seen above, Ontarians are very worried about protecting the Great Lakes from invasive species and therefore educating them on the fact that there are actions that can be taken to prevent Asian carps from establishing could help mitigate human aided pathways.

Aquatic invasive species are often transported via human aided pathways, either intentionally or because they are not aware that certain actions can carry unwanted species. In order to close these pathways people have to be aware that they are a potential entry way for invasive species.

Unfortunately 89% of Ontarians do not know all of the ways in which aquatic invasive species can enter the Great Lakes. Examination of demographics shows that anglers, in general, are more aware of bait dumping and illegal transport than the general public. This could indicate that the “don’t dump your bait” campaign that was targeted at anglers has raised awareness. More campaigns such as this should be done for Asian carps specifically, to improve knowledge of how to stop them from being released into the Great Lakes. This could also be a good opportunity to show all four species and their identification. Adding an identification piece to the “don’t dump your bait” which shows juvenile carps, or creating a “know your bait” campaign could improve anglers’ reporting potential.

Over three quarters of Ontarians who have heard of Asian carps know that they pose serious threats to both the environment and the economy and agree that those threats are important enough that they deserve more funding. While it is encouraging to see that most people understand the risks associated with Asian carps, there needs to be more education surrounding the tangible impacts that would result from their establishment. Some Ontarians still believe that having the carps in the Great Lakes would either not impact their life or improve fishing opportunities. These beliefs could increase the risk of illegal human aided introductions or inaction when it comes to reporting Asian carps. In addition, the assumption that there is nothing that can be done to stop them is dangerous as it could cause inaction on the part of the public. Outreach to encourage the public that they can prevent the spread of aquatic invasive species would help to combat that belief.

## 6.0 Sources of Asian Carp Information

### 6.1 Results

To develop a complete outreach and education program it must be delivered effectively to the public, through delivery methods including television, internet engagement, or print media. The majority of Ontarians (62%) heard about Asian carps on television. This number is higher among individuals over the age of 55 (76%) and lower among the younger age groups (31%). Younger audiences had heard about Asian carp via online resources such as the internet and social media. Audiences aged 25 to 34 indicate that they use social media to learn about new things, therefore educational material on social media would best be geared to that age group. Audiences aged 35 to 44 indicate that they tend to go to websites to read information, and those over the age of 55 years indicate that they prefer to hear information from television.

Reporting is a very important tool for the detection and management of invasive species. Invasive species sightings, in Ontario, should go through the Invading Species Awareness Program, via EDDMapS Ontario or through the Invading Species Hotline. Unfortunately a large portion of Ontarians do not know the proper way to report invasive species; 14% of respondents think that there is no reporting method and 31% did not know, whereas only 25% know to report via the hotline or online. Thirty-one percent of people think that they need to contact their city official or government office to report invasive species which could lead to misdirected and missed reports. This number is higher for people 65 years of age and older (40%) and in people living in Ottawa (40%). A higher percentage of the younger age groups know how to report online or via the hotline (38%), however the majority still do not know proper reporting methods. Participants in the Hamilton-Niagara region, which had above average knowledge of Asian carps, also have an above average belief that there is no reporting method (23%).

To determine whether or not the public is aware of who is working to monitor and prevent Asian carps from entering the Great Lakes, respondents were asked to select all of the organizations they thought were involved from the following options:

- a) Fisheries and Oceans Canada (DFO)
- b) Ministry of Natural Resources and Forestry (MNRF)
- c) Ontario Federation of Anglers and Hunters (OFAH)
- d) Environment Canada
- e) Ontario Conservation Authority

f) Invasive Species Centre (ISC)

DFO and MNRF were recognized the most often as doing work with regard to Asian carps (46% and 42%), followed by Environment Canada (34%), OFAH (31%), Conservation Authority (28%), and the ISC (25%). Eight percent of participants selected all of the agencies and 29% indicated that they “did not know”. The percentages were significantly lower for all agencies selected by the age groups of 25-34 years with DFO (26%), MNRF (21%), OFAH (16%) and the ISC (12%). The percentages were significantly higher for all agencies selected by participants who are 55 to 64 years of age.

## 6.2 Section Observations

When it comes to receiving information there is a clear divide in age demographics. Younger audiences go to social media, middle-aged go to websites, and the older ages want their information on television. It is important to deliver messages in all three of these formats to ensure that all age demographics are easily accessing the information. This can also allow for more targeted outreach to specific demographic populations. Each demographic can receive the same message tailored to them through changing the platform on which it is broadcast. For example, people over 55 years of age prefer information via television but they are also a group that has a below average knowledge of proper invasive species reporting procedures. This knowledge could be used when developing education programs, such as having television commercials on how to properly report invasive species.

Ontarians are not sure of how to report invasive species once they are discovered, 45% either do not know how to report or think that there is no reporting method. Only a quarter are aware that you can report online or via the Invading Species Hotline. This suggests that education and outreach programs need to incorporate many different aspects of invasive species including identification and reporting. All invasive species outreach programs should also include reporting information that is easy to see and understand.

Ontarians are also unaware of how much money was spent on invasive species management so it might make more of an impact if government organizations indicated the amount of time and money spent to manage invasive species. The survey results suggest that there is confusion and a lack of knowledge about who is working on the Asian carp problem, which may make people uneasy about whether or not it is being addressed. These organizations should be promoting what they are doing to prevent Asian carps and other invasive species to reassure the public that the right people are working on this growing

threat. The question “so what is being done?” needs to be answered by the organizations that are managing the problem.

## 7.0 Conclusion

Outreach and education for Asian carps is a unique situation in the Invasive Species world where there is still a possibility of preventing them from establishing in the Great Lakes, and keeping them out of Canada. Therefore the awareness strategy needs to provide Ontarians with all of the knowledge needed to understand the threat and the proper information on how to act. This information should be packaged to allow the public to see the whole picture. Information should be species specific, featuring Grass, Black, Silver, and Bighead Carp individually. This provides proper identification education and informs Ontarians that there are more than one species of Asian carp. Using each species individually also allows for education of the specific impacts that the Great Lakes could face if one of the carps were to establish. Utilizing messaging about protection of the Great Lakes informs the public that Asian carps have not yet established and that there are actions they can still be taken to help prevent the spread of Asian carps. This could include an action statement about how Ontarians can help in outreach and education and as a result could improve the understanding that it is feasible to think an Asian carp invasion can be stopped. All outreach and information should include reporting methods to improve the likelihood that if an Asian carp happens to be found it is handled accordingly. Improved knowledge in these key areas will assist in early detection of invasive species which will improve management efforts and encouraging the public to help will save money in the long run.

Asian carp awareness programs also provide an opportunity for management organizations to promote the work they are doing. Ontarians indicated that they would like the government to spend more money on Asian carp prevention and that they do not have a good idea of who is working on Asian carp. Informing the public on the great work that is currently being done and indicating the future work that could be done could help to reassure Ontarians that Asian carp can be kept out of the Great Lakes.

## Appendix: Tables



**Table 1** Percentage of Ontarian that is worried about eight environmental impacts separated by region in Ontario. Red numbers indicate significantly lower averages than total Ontario average, green numbers indicate significantly higher averages than total Ontario average (p=0.05, ±3.1%).

	Ontarians	Hamilton - Niagara Peninsula	Kingston - Pembroke	Kitchener- Waterloo- Barrie	Greater London area	Muskoka - Kawarthas	Northeast	Northwest	Greater Ottawa area	Stratford - Bruce Peninsula	Greater Toronto area	Windsor - Sarnia
<b>Pollution in Lakes and Rivers</b>	88%	88%	91%	94%	83%	93%	92%	96%	88%	91%	87%	81%
<b>Impacts from Climate Change</b>	77%	75%	89%	84%	76%	82%	69%	73%	72%	75%	79%	67%
<b>Agricultural Land Area Being Reduced</b>	77%	80%	61%	85%	81%	85%	74%	88%	75%	91%	76%	73%
<b>Carbon Dioxide Emissions</b>	74%	74%	75%	80%	70%	81%	68%	71%	75%	72%	76%	51%
<b>Impacts from Invasive Species</b>	72%	63%	59%	76%	66%	78%	58%	100%	77%	86%	73%	66%
<b>Amount of Trees Being Logged from Forests</b>	70%	65%	62%	75%	63%	77%	67%	65%	67%	70%	71%	69%
<b>Lack of Greenspace in Urban Areas</b>	64%	69%	39%	66%	61%	81%	50%	66%	55%	54%	69%	54%
<b>Overfishing of the Great Lakes</b>	59%	57%	51%	62%	58%	62%	68%	85%	58%	75%	59%	43%

**Table 2** Percentages of Ontarian that indicated each invasive species as invasive according to them. Red numbers indicate significantly lower averages than total Ontario average, green numbers indicate significantly higher averages than total Ontario average (p=0.05, ±3.1%).

Among the following, please indicate the ones that are invasive species according to you.

		Gender		Age						Mother Tongue		Worried about impacts from invasive species		Fishes recreationally		Participates in outdoor activities		Has heard about Asian carps	
	Total	Man	Woman	18-24	25-34	35-44	45-54	55-64	65+	English	Other	Worried	Not Worried	Yes	No	Yes	No	Yes	No
<b>Unweighted Totals :</b>	1002	531	471	81	129	174	210	170	238	809	192	748	231	303	699	644	358	648	354
<b>Asian Carp</b>	58%	64%	52%	46%	39%	49%	58%	75%	79%	61%	49%	67%	36%	68%	53%	61%	52%	87%	20%
<b>Asian Long-Horn Beetle</b>	54%	57%	51%	46%	39%	51%	55%	66%	66%	57%	47%	60%	40%	55%	53%	57%	49%	69%	35%
<b>Emerald Ash Borer</b>	53%	55%	51%	34%	38%	47%	58%	65%	72%	58%	40%	61%	34%	57%	51%	57%	47%	67%	35%
<b>Sea Lamprey</b>	27%	30%	24%	12%	11%	23%	27%	35%	49%	28%	25%	31%	19%	34%	24%	29%	24%	38%	13%
<b>Mountain Pine Beetle</b>	29%	30%	28%	13%	18%	28%	28%	35%	47%	31%	25%	33%	19%	31%	28%	30%	27%	39%	16%
<b>Purple Loosestrife</b>	36%	35%	36%	16%	19%	24%	36%	57%	60%	41%	23%	41%	23%	40%	34%	38%	33%	48%	20%
<b>Water Soldier</b>	11%	10%	12%	3%	9%	15%	11%	11%	13%	12%	9%	12%	9%	14%	10%	14%	6%	14%	8%
<b>Zebra Mussel</b>	63%	67%	59%	41%	46%	57%	67%	81%	82%	68%	51%	70%	48%	68%	61%	66%	58%	80%	41%
<b>None of the above</b>	2%	2%	2%	3%	2%	3%	3%	1%	0%	2%	3%	1%	5%	2%	2%	1%	3%	1%	4%
<b>Don't know / prefer not to answer</b>	16%	13%	20%	25%	25%	20%	16%	8%	6%	15%	19%	12%	24%	11%	19%	13%	22%	3%	33%

**Table 3** Percentages of Ontarian that indicated they would be able to identify each invasive species. Red numbers indicate significantly lower averages than total Ontario average, green numbers indicate significantly higher averages than total Ontario average (p=0.05, ±3.1%).

Among the following, what invasive species would you be able to recognize if you would see one?

	Total	Gender		Age						Mother Tongue		Worried about impacts from invasive species		Fishes recreationally		Participates in outdoor activities		Has heard about Asian carps	
		Man	Woman	18-24	25-34	35-44	45-54	55-64	65+	English	Other	Worried	Not Worried	Yes	No	Yes	No	Yes	No
<b>Unweighted Totals :</b>	1002	531	471	81	129	174	210	170	238	809	192	748	231	303	699	644	358	648	354
<b>Asian Carp</b>	26%	30%	22%	20%	17%	26%	23%	41%	30%	27%	22%	31%	14%	36%	21%	31%	16%	43%	4%
<b>Asian Long-Horn Beetle</b>	19%	19%	20%	16%	24%	18%	20%	27%	12%	19%	21%	21%	16%	26%	16%	23%	13%	25%	12%
<b>Emerald Ash Borer</b>	18%	20%	15%	19%	10%	16%	18%	23%	21%	20%	13%	21%	10%	26%	14%	22%	10%	25%	8%
<b>Sea Lamprey</b>	12%	13%	10%	10%	2%	7%	12%	23%	18%	14%	6%	15%	4%	18%	9%	15%	6%	19%	2%
<b>Mountain Pine Beetle</b>	5%	6%	5%	6%	6%	3%	5%	12%	2%	5%	4%	5%	5%	6%	4%	6%	3%	7%	3%
<b>Purple Loosestrife</b>	26%	25%	27%	10%	12%	13%	27%	49%	46%	31%	14%	32%	12%	29%	24%	29%	20%	40%	7%
<b>Water Soldier</b>	2%	1%	3%	3%	2%	3%	3%	1%	2%	2%	2%	3%	1%	4%	2%	3%	0%	3%	2%
<b>Zebra Mussel</b>	41%	44%	39%	28%	31%	37%	48%	54%	46%	46%	29%	46%	32%	54%	35%	48%	28%	55%	24%
<b>None of the above</b>	40%	39%	42%	47%	49%	46%	41%	27%	32%	35%	53%	35%	50%	28%	46%	31%	57%	25%	60%

**Table 4** Percentages of Ontarian that knew the most about each invasive species. Red numbers indicate significantly lower averages than total Ontario average, green numbers indicate significantly higher averages than total Ontario average (p=0.05, ±3.1%).

Among the following, what invasive species do you know the most about?

		Gender		Age						Mother Tongue		Worried about impacts from invasive species		Fishes recreationally		Participates in outdoor activities		Has heard about Asian carps	
	Total	Man	Woman	18-24	25-34	35-44	45-54	55-64	65+	English	Other	Worried	Not Worried	Yes	No	Yes	No	Yes	No
<b>Unweighted Totals :</b>	1002	531	471	81	129	174	210	170	238	809	192	748	231	303	699	644	358	648	354
<b>Asian Carp</b>	10%	12%	9%	12%	10%	12%	8%	13%	8%	10%	10%	11%	9%	12%	10%	11%	9%	17%	2%
<b>Asian Long-Horn Beetle</b>	7%	6%	8%	10%	7%	10%	7%	4%	3%	6%	8%	7%	6%	8%	7%	7%	6%	7%	7%
<b>Emerald Ash Borer</b>	14%	15%	14%	13%	7%	14%	16%	14%	20%	13%	17%	16%	9%	12%	16%	14%	15%	18%	10%
<b>Sea Lamprey</b>	1%	2%	1%	1%	0%	1%	0%	2%	4%	2%	0%	2%	1%	3%	1%	1%	1%	2%	0%
<b>Mountain Pine Beetle</b>	2%	3%	2%	4%	3%	1%	2%	2%	1%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%
<b>Purple Loosestrife</b>	9%	8%	10%	1%	5%	5%	9%	16%	17%	11%	4%	10%	6%	10%	8%	9%	8%	12%	5%
<b>Water Soldier</b>	1%	2%	1%	2%	3%	2%	2%	0%	0%	1%	3%	1%	2%	3%	1%	1%	2%	1%	2%
<b>Zebra Mussel</b>	25%	28%	21%	21%	20%	24%	28%	30%	25%	28%	18%	28%	18%	30%	22%	30%	15%	29%	19%
<b>None of the above</b>	30%	25%	35%	35%	44%	32%	28%	19%	22%	27%	38%	22%	46%	21%	34%	24%	41%	13%	52%

**Table 5** Percentage of Ontarian that considers bighead, black, grass, and/or silver carp to be a species of Asian carp. Red numbers indicate significantly lower averages than total Ontario average, green numbers indicate significantly higher averages than total Ontario average (p=0.05, ±3.1%).

According to you, which of the following is a type of Asian carp?																				
	Total	Gender		Age						Mother Tongue		Education			Worried about impacts from invasive species		Fishes recreationally		Participates in outdoor activities	
		Man	Woman	18-24	25-34	35-44	45-54	55-64	65+	Eng	Other	Elem/HS	Coll	Univ	Worried	Not Worried	Yes	No	Yes	No
<b>Unweighted Totals :</b>	648	384	264	26	59	102	137	133	191	540	108	107	223	311	540	104	214	434	431	217
<b>Bighead Carp</b>	12%	11%	14%	20%	23%	15%	10%	11%	4%	11%	15%	8%	18%	11%	13%	9%	15%	10%	14%	8%
<b>Black Carp</b>	12%	13%	12%	18%	35%	13%	11%	8%	4%	13%	9%	9%	19%	10%	13%	9%	16%	10%	14%	8%
<b>Grass Carp</b>	10%	9%	12%	5%	26%	10%	11%	12%	4%	10%	11%	9%	13%	10%	11%	9%	14%	8%	13%	5%
<b>Silver Carp</b>	14%	11%	18%	11%	29%	21%	11%	15%	4%	14%	15%	11%	17%	14%	14%	16%	16%	13%	17%	9%
<b>None of the Above</b>	6%	6%	5%	8%	3%	5%	7%	6%	6%	6%	6%	7%	6%	5%	6%	5%	6%	6%	8%	2%
<b>All of the Above</b>	5%	3%	7%	3%	18%	4%	5%	5%	1%	5%	6%	3%	8%	4%	6%	3%	6%	5%	6%	3%
<b>Don't know/I prefer not to answer</b>	67%	67%	66%	55%	48%	58%	69%	70%	82%	67%	65%	67%	59%	71%	67%	64%	59%	71%	61%	79%