

# Asian Carp: Generation Z prefer Transparency over Branding

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Received: May 24, 2024

Accepted: August 28, 2024

Online Published: September 8, 2024

doi:10.5539/jfr.v14n1p1

URL: <https://doi.org/10.5539/jfr.v14n1p1>

## Abstract

Asian carp is an invasive species of fish in the Midwest and southern United States. Asian carp has been rebranded as “Copi” for human consumption. Copi is nutritious and a great source of protein and omega 3 fatty acids, and costs much less than most other domestic fish. The purpose of this study was to evaluate sensory perceptions and attitudes of Generation Z college students to the newly branded fish. The study utilized a quasi-experimental design carried out with three treatment groups to observe the effects of product rebranding on the taste perception of Asian Carp, rebranded as Copi. Sensory analysis results indicated no significant differences in the three treatment groups (white fish-control, Copi-experimental, and Asian carp-experimental). In fact, Asian carp had higher mean scores than the control, as well as the newly branded Copi. The importance of Health, Environment, and Local Foods had significant effects on students’ willingness to buy sustainable, local fish. The results of this study are important for marketing Copi, aka Asian carp for human consumption.

**Keywords:** Asian carp, sensory analysis, Copi, Gen Z, branding

## 1. Introduction

Over the past twenty years, Asian carp have invaded rivers and lakes in the Midwest and southern United States (US), resulting in negative economic and environmental impacts. Silver Carp is one of four species in the Asian carp family (Bighead, Silver, Grass and Black). Silver Carp, originally non-native to North America, was imported to the US in the mid-seventies from Asia for distribution to state and private hatcheries in the Midwest for phytoplankton control (Williamson & Garvey, 2005). Subsequently, the fish escaped from the hatcheries and made its way to the Missouri, Illinois and Mississippi Rivers in 1983. Since that time, Silver Carp has proliferated to the point of invasiveness and is present in the upper and lower Mississippi River, Missouri River, Illinois River, and Ohio River, while threatening the brackish waters of the southern Gulf Coast and the fishing industry in the Great Lakes.

“Invasive species are plants, animals, and other organisms that are not native and have the potential to cause harm” (Indiana Department of Natural Resources, n.d.). Silver carp are large, omnivorous fish consuming phytoplankton and zooplankton while competing with other native fish and water birds for feeding grounds. The fish can grow up to 40 inches and weigh over 60 pounds. The fish have negatively impacted the sport fishing industry. Silver carp eat the forage fish that largemouth bass feed on competing with native fish. In addition, when startled, silver carp jump out of the water in masses, potentially harming boaters, as well as fishermen. Since 2004, researchers have collected data showing the negative impacts from the proliferation of Asian carp on sport fish populations in the upper Mississippi River (Chick, Gibson-Reinemer, Soeken-Gittinger, & Casper, 2020). The Great Lakes commercial, recreational, and tribal fisheries have been valued at over \$7 billion dollars and support more than 75,000 jobs (Great Lakes Fishery Commission, 2023). At the present, the Asian carp are devastating local and regional economies that rely on recreational tourism (Alliance for the Great Lakes, 2023).

### 1.1 Importance of the Problem

What can be done to reduce the numbers of invasive Asian carp? A variety of strategies and solutions have been suggested by researchers, government agencies, public and private stakeholders, as well as environmental sectors. In 2012, The Illinois Department of Natural Resources (IDNR) suggested harvesting Asian carp for human consumption as a viable option. However, many challenges exist with this suggestion. On the marketing side, one

of the biggest challenges is that American consumers have a negative opinion of “carp.” The familiar Common carp is a bottom feeder and has the reputation as an undesirable fish for human consumption. On the other hand, Asian carp are top, filter feeders, and have vastly different flavor profiles than Common carp (Ferguson, 2021; Varble & Secchi, 2013). Educating the public and changing their perceptions of Asian carp is one of the biggest hurdles.

### *1.2 Relevant Scholarship*

Several studies have examined the importance of seafood labeling in regards to impacts on consumer purchasing behavior, such as local and sustainable, environmental, and health attributes (Smith, Varble & Secchi, 2015). In 2006, a group of local, community fishermen and stakeholders from Carteret County North Carolina joined together to launch their own brand *Carteret Catch* in order to promote and increase demand for their local seafood products. Researchers surveyed visitors to the area after the initial launch and found 84% said it was important that the seafood was local, but the majority of respondents hadn’t heard of the new brand. A year later, a follow-up survey was conducted and 40% of those surveyed were then aware after significant marketing efforts (Andreatta et al., 2011). Bronnmann et al., (2021) measured the impacts of environmental concerns for choosing ecolabeled seafood. Findings from the study indicated German consumers were highly influenced by seafood ecolabels that provided reliable information about environmentally friendly production. Another study by Smith, Varble and Secchi (2015) segmented US fish consumers into two groups: Ecofriendly and Indifferent. The Ecofriendly group were more likely to be male from non-rural areas and eat fish for health and environmental reasons. A study by Cheplick et al. (2021) analyzed awareness and attributes important to South Carolinians and their seafood preferences, the authors noted the importance of local when purchasing, but a lack of awareness of environmental, sustainable and local seafood labeling. In addition, the authors noted the importance of education and outreach for growing awareness of domestic seafood products.

Creating demand for Asian carp in the US could be a market based, cost effective solution for the invasive species (Varble & Secchi, 2013). However, the importance of marketing and educating the consumer about local and environmentally friendly seafood choices cannot be overstated. Social marketing has been described as a process that uses traditional marketing techniques to educate and bring awareness to issues and behaviors that have an impact on society (CDC.gov). The goal of social marketing is to influence behavior. Changing seafood purchasing behaviors can be a challenge because consumers are the most risk averse to products of animal origin (Pliner & Pelchat, 1991). However, rebranding Asian carp as a new fish on the market to eliminate the negative connotation of “carp” may provide an opportunity to harvest the fish for human consumption.

### *Generation Z*

The current generation of college students, Generation Z or post-Millennials, born between 1997 and 2010 are the most racially and ethnically diverse generation (Pew Research Center, 2019). They have had lifelong internet, cell phones, and social media, and are on track to be the most educated generation with higher high school graduation rates and college attendance rates (LeDuc, 2019). The young adults also stand out for their strong sense of social responsibility and high levels of climate change engagement and activism (Ching-Hui, Chin-Hsun, Chen, & Lv, 2019; Tyson, Kennedy, & Funk, 2021). Moreover, there is a growing movement to purchase local, seasonal, and sustainable food – with college students being a powerful voice behind the movement (Engel, n.d.). In fact, environmental protection and health-related characteristics were necessary in sustainable food purchase decisions of most (92.8%) Gen Z consumers (Ching-Hui et al., 2019). Additionally, Gen Z prioritize health when making food decisions and want a higher quality of life as compared to previous generations (Ching-Hui et al., 2019).

Diffusion of Innovation Theory (DIT) is the process by which an innovation is communicated to a group through certain channels over a period of time (Rogers, 2003). An innovation is an idea, practice or product that is perceived as new by an individual or group for adoption. According to DIT, individuals who are the first to buy a new product or service are considered “innovators.” Early adopters are next in the timeline to adopt an innovation. Early adopters, however, possess more influence in the social system than the innovators. Potential adopters look to early adopters for advice and information. Therefore, early adopters are as important as innovators when promoting a new innovation.

### *1.3 Purpose of Study*

Understanding purchasing behaviors can positively impact ecological issues and Gen Z college students present unique opportunities to market a sustainable and nutritious foods such as Copi. Harvesting Copi from inland waterways protects the environment by stabilizing the natural flow of nutrients through the ecosystem allowing native species to thrive (Altenritter, DeBoer, Maxson, Casper, & Lamer, 2022); and Copi is high in protein, health-promoting omega-3 fatty acids, and other essential vitamins and minerals (Ferguson et al., 2020). The question

remains, will college students like the taste and how will they respond to the new name?

## Study Objectives

Objectives for the current study:

1. Analyze the taste profile of Copi with Gen Z college students.
2. Analyze the impacts of “Asian carp” on taste perceptions.
3. Examine the attitudes of Gen Z college students regarding fish products and the impacts that local, environmental and health attitudes have on their purchase decision making.
4. Identify differences in new product purchase behavior among Gen Z college students applying Diffusion of Innovation adopter categories.

## 2. Methods

### 2.1 Experimental Design

The study utilized a quasi-experimental design carried out with three treatment groups to observe the effects of product rebranding on the taste perception of Asian Carp, rebranded as Copi. The treatment groups were Copi and Asian carp, while the control group was “white fish”. All fish were the same, they simply had different names. A sensory analysis test was implemented with college students (Gen Z) at a Midwestern university in Illinois. Participants included students, living on campus and eating at the college dining halls. Two dining halls were used on campus to assure a representative demographic sample was collected. According to data provided by University Housing, demographics of students living on campus and using the dining halls were closely half males and females, 51% white, while 26% are black and 10% Hispanic. Just over half of the students were eighteen, while thirty-eight percent were between the ages of nineteen and twenty, 85% were freshmen or sophomores, and 95% of students received some form of financial aid (University Housing, personal communication, October 26, 2022). Two researchers with two trained research assistants conducted the sensory analyses at each dining hall simultaneously. The survey was approved by Southern Illinois University’s Human Subjects Committee and all participants were provided informed consent (protocol 22179).

Asian carp, rebranded as Copi, was purchased from Sorce Freshwater Co. in Peoria, IL (<https://sorcefreshwater.com/>). The locally sourced, wild caught, select Asian carp was processed, minced and packaged on October 27, 2022. Twenty pounds was delivered by next day UPS mail, frozen and vacuum-sealed in two-pound Cryovac packages.

### 2.2 Sampling Procedures

Fish from each treatment (white fish-control, Copi-rebrand, and Asian carp) were prepared and cooked using common cooking methods for a consumer panel. Minced fish was thawed and oven-baked until the samples reached an internal temperature of 145°F. Prepared fish were portioned, coded and labelled, and placed in stainless steel chafing pans before being transported to two dining halls for tasting.

Each fish sample (White fish-control, Copi and Asian carp) was served independently from the other for a thirty-minute interval in dining hall lobbies. Students were randomly asked to participate in the study with no penalties for declining. The survey cover letter included a brief description of the fish (White fish-control, Copi and Asian carp). Students willing to participate (n=166) were asked to scan a barcode which linked to the survey instrument in Qualtrics. Students then received a sample of fish (served in a corn tortilla) served on a disposable plate and were asked to analyze sensory properties including appearance, aroma, flavor, texture, and overall liking. The sensory analysis test was conducted under normal lighting within the dining hall lobbies. No additional food odors from the dining halls were observed to affect sensory analysis. Students were asked to indicate their overall liking of the fish tacos on a scale from 1- 9 where 1 is dislike extremely and 9 is like extremely. Analysis of variance (ANOVA) was used to compare mean scores of the three samples.

### 2.3 Survey Methodology

Additionally, the survey asked the Gen Z college student population (n=165) a series of questions concerning their behavior toward fish products, fish consumption habits, and attitudes towards the environment, local food consumption, and personal health, along with socio-demographics information. Participants were also asked about their purchasing habits concerning new food products and their willingness to buy sustainable fish and local and regionally produced fish. Sustainable fish was defined as “fish is from sources, either fished or farmed, that can maintain or increase production into the long-term without jeopardizing the affected ecosystems.” While local and regionally produced fish was defined as 400 miles from its origin.

## 2.4 Survey Measures

Two questions measured participants' fish consumption habits: 1) how often do you eat fish at restaurants; and 2) how often do you eat fish at home. Three questions from Garcia and De Magistris (2008) were used to create one construct for Environment Friendly attitudes (reliability 0.893). The five survey questions that represented Health Consciousness were combined to make one construct for Health (reliability 0.805) (Lo, King, & Mackenzie, 2017). Three questions were used from Kumar and Smith (2017) to identify respondents' attitudes to Local Foods (reliability 0.843). One question from Varble and Secchi (2013) was asked to identify respondents' adoption rate to new products in the market place (Varble & Secchi, 2013). Lastly, respondents were asked about their awareness of the environmental damage done by Asian carp in the US.

## 2.5 Data Analysis

Descriptive statistics including frequencies and percentages were used to describe the sample in terms of demographic variables. Means tests including t-tests and analysis of variance (ANOVA) were used to analyze differences between groups concerning health consciousness (Lo, King, & Mackenzie, 2017), environmentally friendly attitudes (DeMagistris & Garcia, 2008), local foods, and adoption rate to new products.

The data generated was analyzed using SPSS version 28 (SPSS, Inc., Chicago, IL, USA) to assess the overall liking of Asian carp with different labels (white fish-control, Copi or Asian carp). To analyze the results of the comparison, analysis of variance (ANOVA) was performed to determine significance. Differences were considered significant at  $p < 0.05$ .

## 3. Results

One hundred and sixty-five Gen Z college students participated in this study. Student demographic information (Table 1) included: 100% between the ages of 18 and 26, 51% were male and 55% were white, while 24% were Black or African American. Gender and Race coincided with population of students living on campus, e.g., 50% of students were male and 26% were Black. Twenty-nine percent of student sample were science, technology, engineering or math (STEM) majors.

Table 1. Demographic Information of College Student Sample

Variable	Frequency	Percent
<b>Age</b>		
Gen Z (18-26)	165	99%
<b>Gender (149)</b>		
Male	85	57%
Female	64	43%
<b>Race (148)</b>		
American Indian or Alaska Native	1	1%
Asian	7	5%
Black or African American	40	27%
White	92	62%
Multiple Ethnicities	8	5%
<b>Major (139)</b>		
Science, Technology, Engineering, Math	41	29%
Other	98	71%

n=165

The First objective for the study was to analyze the sensory profile of Copi with Gen Z college students (Table 2). Students were asked to analyze the sensory properties of the fish sample, including appearance, aroma, flavor, texture, and overall liking. Students rated the appearance of the Copi with the lowest mean score of 4.82, while aroma, flavor and texture received a mean score from 5.71 to 5.88, respectively. Students rated their overall liking of the Copi sample with a mean score of 5.83 on a liking scale (1 = dislike extremely to 9 = like extremely) indicating a tendency to like the fish more than dislike it.

Table 2. Sensory Profile of Copi

	Appearance Mean	Aroma Mean	Flavor Mean	Texture Mean	Overall Mean
<b>Copi (60)</b>	4.82	5.71	5.72	5.88	5.83

n=60

Respondents used a nine-point Likert scale to indicate like or dislike of the flavor profile of Copi: 1 = Dislike Extremely and 9 = Like Extremely

The second objective for this study was to analyze effects (if any) that the name “Asian Carp” had on taste perceptions of the fish. Table 3 shares the flavor profile of the experimental design to include White fish (control), Copi and Asian carp. Mean scores under all categories of sensory analysis (Appearance, Aroma, Flavor, and Overall) were relatively the same with no significant difference from an Analysis of Variance test (ANOVA). However, texture for the Asian carp was significantly different with a higher mean score compared to the other two samples at the  $p < 0.10$ . Notably, in all five categories, Asian carp had higher mean scores than the control, as well as the newly branded Copi.

Table 3. Analysis of Variance Test Comparing Taste Profile of Fish Samples

	Appearance Mean	Aroma Mean	Flavor Mean	Texture Mean	Overall Mean
<b>White fish (46)</b>	5.04	5.41	5.60	5.20	5.80
<b>Copi (60)</b>	4.82	5.71	5.72	5.88	5.83
<b>Asian carp (56)</b>	5.25	5.88	5.95	6.09	5.96
<b>ANOVA F-statistic</b>	0.712	0.722	0.320	2.423	0.113
<b>ANOVA p-value</b>	0.49	0.49	0.73	0.09*	0.89

n=165

Respondents used a nine-point Likert scale to indicate like or dislike of the flavor profile of the three fish samples: 1 = Dislike Extremely and 9 = Like Extremely

\*Significant at the  $p < 0.10$  level

Table 4 gives an overview of Gen Z college students' fish-eating habits. In terms of eating fish in restaurants, 26% eat fish once or twice or more a month. When eating at home, 53% eat fish once or twice or more a month. Almost half (49%) of the student sample indicated buying new products after a few others have purchased.

Table 4. Fish Consumption and Purchasing Habits

Variable	Frequency	Percent
<b>How often do you eat fish in Restaurants?</b>		
Never	38	25%
Once every 2-3 months	76	49%
Once or twice a month	31	20%
Once or twice a week	8	5%
More than twice a week	2	1%
<b>How often do you eat fish at Home?</b>		
Never	17	11%
Once every 2-3 months	55	36%
Once or twice a month	48	31%
Once or twice a week	24	16%
More than twice a week	9	6%
<b>When thinking about buying new food products, how would you describe yourself?</b>		
Will not purchase	12	7%
After many people have purchased	39	24%
After a few others have purchased	82	49%
One of the first to buy	20	12%
Missing	13	8%

n=155

The third objective was to examine the effects health, environmental and local attitudes had on Gen Z college students fish purchase decisions. Table 5 assesses college student Awareness of Asian carp and their willingness to buy sustainable and locally produced fish. On an agreement scale from one to seven, there was slight awareness (4.79) of the damage done by Asian carp in the US. In terms of willingness to buy sustainable and local and regionally produced fish, mean scores (5.29; 5.32 respectively) indicate favorable attitudes to these environmental

issues.

Table 5. Asian Carp Awareness, Willingness to Buy Sustainable Fish and Local/Regionally Produced Fish

Variable	Mean	Std
I am aware of the environmental damage done by Asian carp in the United States.	4.74	2.194
Willingness to buy Sustainable fish?	5.29	1.536
Willingness to buy Local and Regionally produced fish?	5.32	1.443

n=146

Respondents used a seven-point Likert scale to indicate their awareness of Asian carp damage: 1 = not at all aware to 7 = very aware

Respondents used a seven-point Likert scale to rate their willingness to buy Sustainable fish: 1 = not at all willing at all to 7 = very willing

Respondents used a seven-point Likert scale to rate their willingness to buy Local and Regionally produced fish: 1 = not at all willing at all to 7 = very willing

To examine student attitudes towards health, environmental friendliness, and local foods, eleven items were factor analyzed to determine underlying dimensions. Two factors emerged with Eigenvalues greater than 1.0 and a scatterplot confirmed this number. A Bartlett test of sphericity was significant ( $p < 0.001$ ) and the Kaiser-Meyer-Olkin measure of sampling adequacy (0.87) confirming the factor analysis was appropriate. A principle component factor analysis with varimax rotation subsequently was used to delineate the underlying dimensions of student attitudes. The two factor dimensions were named Health and Environment ( $\alpha=0.89$ ) and Local Foods ( $\alpha=0.84$ ) accounting for 62% of the variance (Table 6). The Cronbach's alpha value indicated strong reliability for both factors.

The Health and Environment factor had eight items loading high with health consciousness attitudes such as "I take responsibility for my health" and "I understand about healthy eating." Additionally, the Health and Environment factor had environmental attitudes such as "I am the type of person who acts environmentally friendly" and "I see myself as an environmentally friendly person." The Local Foods factor had three items singling out attitudes of quality, flavor and health of local foods.

Table 6. Factor Analysis Results of Gen Z Student Attitudes to Local Food, Health and Environment

Items	Factor loading	Eigenvalue	% Variance explained	Reliability coefficient
<b>Health and Environment</b>				
Responsibility for my health	0.79	5.54	50.32	0.89
Understand healthy eating	0.72			
Health conscious	0.70			
Value health	0.68			
Type who acts environmentally friendly	0.68			
See myself as environmentally friendly	0.65			
Environmentally friendly is who I am	0.64			
Health aware	0.62			
<b>Local Foods</b>				
Local foods are superior quality	0.87	1.29	11.71	0.84
Local food has more flavor	0.81			
Local foods are healthier	0.79			
<b>Total Variance Explained</b>			<b>62.02</b>	

n=143

To determine if Gen Z attitudes of Health and Environment and Local Foods had any effects on their willingness to purchase sustainable fish such as Copi, a simple linear regression analysis was run using factor analysis scores. Table 7 shows the results indicating both factors had significant effects ( $p < 0.001$ ) on students' willingness to purchase sustainable fish.

Table 7. Simple Linear Regression of Factors: Health and Environment and Local Foods on Willingness to Buy Sustainable Fish

Model	B	Std. Error	Standardized Coefficients Beta	t value	Significance
<b>Constant</b>	5.330	0.112		47.57	0.001***
<b>Health and Environment</b>	0.491	0.113	0.316	4.345	0.001***
<b>Local Foods</b>	0.730	0.112	0.476	6.540	0.001***

Dependent Variable: Buy Sustainable Fish

n=145

\*\*\*Significant at the  $p < 0.001$  level

Again, examining Gen Z attitudes of Health and Environment and Local Foods on willingness to buy local foods, a simple linear regression was run on the saved factor scores. Table 8 shows the results indicating both attitudes of Health and Environment and Local Foods had significant effects ( $p < 0.001$ ) on students' willingness to buy local foods.

Table 8. Simple Linear Regression of Factors: Health and Environment and Local Foods on Willingness to Buy Local Food

Model	B	Std. Error	Standardized Coefficients Beta	t value	Significance
<b>Constant</b>	5.321	0.115		46.359	0.001***
<b>Health and Environment</b>	0.381	0.115	0.259	3.297	0.001***
<b>Local Foods</b>	0.537	0.116	0.364	4.624	0.001***

Dependent Variable: Buy Sustainable Fish

n=145

\*\*\*Significant at the  $p < 0.001$  level

The last objective was to apply the DIT adopter categories to analyze differences within Gen Z college students. Students were asked about their purchasing habits when buying new foods on a range from "will not purchase," "after many people have purchased", "after a few others have purchased" to "one of the first to buy" (Table 4). Students who identified themselves as "one of the first to buy" were labelled Innovators (n=20 or 13%); those that responded "after a few others have purchased" were considered Early Adopters (n=82 or 53%) lastly, responses of "after many people have purchased" were considered Late Majority (n=39 or 25%). Table 9 details demographic similarities and difference of the three purchasing groups. Innovators indicated a higher percentage of White (75%), Male (65%) college students, while majors among the Early Adopters were more Non-STEM (78%).

Table 9. Demographic Information Comparing Innovators, Early Adopters and Late Majority

Variable	Innovators (first to buy) 13%	Early Adopters (after a few have purchased) 53%	Late Majority (after many have purchased) 25%
<b>Gender (138)</b>			
Male	13 (65%)	43 (54%)	25 (68%)
Female	7 (35%)	36 (46%)	12 (32%)
<b>Race (137)</b>			
Asian	-	4 (5%)	2 (5%)
Black or African American	4 (20%)	22 (28%)	9 (24%)
White	15 (75%)	49 (63) %	22 (60) %
Multiple Ethnicities	1 (5%)	3 (4%)	4 (11%)
<b>Major (131)</b>			
STEM	7 (39%)	16 (22%)	13 (36%)
Other	11 (61%)	58 (78%)	23 (64%)

n=154

To understand differences (if any) between Innovators, Early Adopters, and Late Majority in terms of their overall liking of the three fish samples, ANOVA tests were conducted and compared for significance. There were no significant differences in overall liking of White fish and Copi. However, Asian carp had a significantly ( $p < 0.05$ )

higher mean score among Innovators and Early Adopters (Table 10). Innovators had higher mean scores compared to Early Adopters. Additionally, Innovators had a significantly higher mean score on the attitudes factor Health and Environment compared to Early Adopters (Table 11).

Table 10. Means Analysis of Fish Samples Comparing Innovators, Early Adopters and Late Majority

Variable	Innovators Mean	Early Adopters Mean	Late Majority Mean	F statistic	Significance
<b>White Fish (control)</b>	6.17	6.29	5.00	1.77	0.18
<b>Copi</b>	6.20	6.15	5.39	0.85	0.44
<b>Asian carp</b>	6.89	5.55	6.55	3.42	0.05**

n=134

\*\*Significant at the  $p < 0.05$  level

Table 11. Means Analysis of Health and Environment and Local Foods Comparing Innovators, Early Adopters and Late Majority

Variable	Innovators Mean	Early Adopters Mean	Late Majority Mean	F statistic	Significance
<b>Health and Environment</b>	0.40	0.16	-0.27	3.04	0.05**
<b>Local</b>	-0.01	0.12	-0.80	0.55	0.58

n=134

\*\*Significant at the  $p < 0.05$  level

Table 12 compares Innovators, Early Adopters, and Late Majority awareness of Asian carp environmental damage, as well as their willingness to buy sustainable and locally produced fish. Innovators had significantly higher ( $p < 0.10$ ) awareness of the environmental damage caused by Asian carp compared to Early Adopters. In addition, Innovators were significantly more willing to purchase Sustainable fish ( $p < 0.10$ ) and to purchase Local and Regionally produced fish ( $p < 0.001$ ) compared to Early Adopters.

Table 12. Means Analysis of Asian Carp Awareness, Willingness to Buy Sustainable Fish and Local/Regionally Produced Fish Comparing Innovators to Early Adopters

Variable	Innovators Mean	Early Adopters Mean	Late Majority Mean	F statistic	Significance
Awareness of Asian carp damage	5.47	4.68	4.54	1.19	0.31
Willingness to buy Sustainable fish	5.95	5.47	4.97	3.29	0.04**
Willingness to buy Local and Regionally produced fish	6.16	5.39	5.05	4.01	0.02**

n=136

Respondents used a seven-point Likert scale to indicate their awareness of Asian carp damage: 1 = not at all aware to 7 = very aware

Respondents used a seven-point Likert scale to rate their willingness to buy Sustainable fish: 1 = not at all willing at all to 7 = very willing

Respondents used a seven-point Likert scale to rate their willingness to buy Local and Regionally produced fish: 1 = not at all willing at all to 7 = very willing

\*Significant at the  $p < 0.10$  level

\*\*Significant at the  $p < 0.05$  level

#### 4. Discussion

The purpose of this study was to evaluate sensory perceptions and attitudes of Gen Z college students to the newly branded Copi fish formerly known as Asian carp. Previous research assumed Asian carp carried a negative connotation to consumers (Ferguson, 2021; Varble & Secchi, 2013), however this assumption had not been tested on Gen Z consumers. This study investigated the impact the term Asian carp had on sensory perceptions of Gen Z



college students. The study utilized a quasi-experimental design to conduct a sensory analysis test using Asian carp named three different ways (White fish-control, Copi and Asian carp). The sensory test was followed by a short online survey to identify purchasing habits and attitudes to the environment, local food, and personal health.

Findings from this study indicated no significant differences in overall liking of the three fish, in fact Asian carp had higher mean scores for all sensory categories (appearance, aroma, flavor, texture, overall liking). Gen Z attitudes towards health, environmental friendliness, and local foods were factor analyzed to determine underlying factors labeled: Health and Environment and Local Foods. These factors significantly predicted willingness to purchase sustainable fish and local foods. Over half of the Gen Z student sample indicated purchasing fish for home consumption at least twice per month and Local Food was identified as a significant predictor for purchasing sustainable fish. Therefore, marketing efforts should concentrate on packaging to indicate the local and regional nature of the sustainable fish.

This study demonstrates that regardless of the name, Asian carp, white fish, or Copi, young adults were accepting of the fish for human consumption. In fact, when presented as Asian carp, participants had overall more positive perceptions in terms of appearance, aroma, flavor, and texture than when presented as white fish or Copi. This is especially significant given the fact that 11-25% of the sample population “never” eat fish, and 36-49% eat fish only once every two to three months. During all three taste tests, the fish was marketed as a locally and sustainably-sourced nutritious fish. The participants had positive attitudes toward personal health as well as environmental friendliness. Additionally, they indicated that locally sourced food is of better quality, flavor, and healthier. The positive attitudes toward health and sustainability may contribute to the positive perceptions of the fish. This is consistent with published literature suggesting that younger generations are more eco-conscious (Ching-Hui et al., 2019) and focused on a more holistic view of personal health including nutrition, fitness, sleep, and emotional health, stress management, and economic security (Elenga & Krishnaswamy, 2022; The Linus Group, 2019).

Time is a factor which impacts the rate of adoption (Rogers, 2003). Most innovations have an s-shaped curve for rate of adoption in a social system. The social system for this study were Gen Z college students at a Midwestern university. Those to the left of the mean were considered either “Innovators” or “Early Majority” and those to the right of the mean “Late Majority.” In this research, the Gen Z sample who responded to the question when buying new foods (Table 3) as “one of the first to buy” were considered Innovators. Those that responded “after a few others have purchased” were considered the Early Majority. Lastly, those that responded “after many have purchased” were considered the Late Majority. ANOVA tests compared Innovators with Early Majority and Late Majority in terms of overall liking of the fish, awareness of Asian carp damage, and their willingness to buy sustainable and locally produced fish. In terms of overall liking of the fish samples, Innovators had significantly higher mean scores than Early Majority. Attitudes to Health and Environment were significantly stronger for Innovators compared to Early Adopters and Late Majority. Willingness to buy Sustainable fish and Willingness to buy Local and Regionally produced fish was significantly higher for the Innovators. Innovators are venturesome with a desire for new ideas and products as well as the ability to cope with high levels of uncertainty. Innovators are different than Early Adopters. Early Adopters are next in the timeline to adopt an innovation. However, Early Adopters possess more influence in the local social system than the innovators. Late Majority Adopters look to early adopters for advice and information. Therefore, Early Adopters are important when promoting a new innovation. Research by Rogers (2003) prioritizes the need for both Innovators and Early Adopters to adopt and promote a new innovation such as Copi.

Helping to control invasive species such as the Asian carp through human consumption appears to be a viable strategy to help remove them from our local waterways. In fact, Seaman and colleagues (2022) proposed that because of the increased interest in food, “authentic cuisine,” and individuals self-identifying as “foodies,” now is the perfect time to further explore consumption of “local” invasive species. Specifically, recruiting local and celebrity chefs may be the answer to improving the public’s acceptance of eating invasive species as well as helping to create a cultural shift around perceptions of the new foods (Seaman, Franzidis, Samuelson, & Ivy, 2022). Since eating Asian carp is both sustainable and nutritious, this creates an opportunity for food industry professionals to develop effective marketing strategies to attract and meet the sustainability and health expectations of Gen Z (Ching-Hui et al., 2019). Over half of the Gen Z participants in the study indicated eating fish at home several times a month. While the influence of Health and Environment was significant ( $\beta = 0.49$ ) on willingness to buy sustainable fish, Local Foods was more ( $\beta = 0.73$ ).

It is important to note that when asked to indicate their awareness of environmental damage caused by Asian carp, not all participants had heard of Asian carp. Interestingly, the study location is situated in the Midwest very close to the Mississippi River basin and its tributaries, the Missouri and Ohio rivers, where Asian carp are thriving. There are no published studies specifically investigating awareness among young adults of environmental damage caused

by Asian carp, however, studies have found that environmental health education in grades 6-12 in US schools receives little attention (Keselman, Levin, Kramer, Matzkin, & Dutcher, 2011) which may help explain why participants in our study were not familiar with the fish. Further, a 2018 study of 465 licensed anglers in Missouri by Morgan and Ho (2018) found that knowledge about Asian carp was poor, suggesting education on this invasive species may be lacking on a larger scale. Morgan and Ho (2018) also found that while only 15% of the anglers had actually tried Asian carp, 53% indicated they were willing if given the opportunity.

The results of this study are important for marketing Copi for human consumption. According to Nielsen IQ Research, 78% of U.S. consumers care about buying ethically and environmentally sustainable products, and over 60% indicated they would pay more for products with sustainable packaging. Additionally, when consumers perceive companies as socially responsible, they may be more willing to buy products from these companies at higher prices (Frey, Bar Am, Doshi, Malik, & Noble, 2023). Companies who invest in green labeling can positively influence purchase intentions along with brand attitudes (de Freitas Netto, Sobral, Ribeiro, & Soares, 2020).

This study was designed to address some methodological limitations including the use of a control group, along with two experimental groups to test influence of the fish name on overall perceptions, taste, appearance, flavor, and texture. However, when interpreting the results of this study, the following limitations should be considered. A convenience sample was used and study participants were limited to undergraduate students who resided on campus and utilized the dining halls. Secondly, the results rely on self-reported data. Finally, the results may not be generalizable outside of the Midwest. Future research should include a broader sample of adults from the Midwest region of the US where Copi is known to understand in-depth consumer behavior concerning product marketing and labeling.

Overall, participants liked the fish regardless of name, and were willing to pay more for fish that is sustainable, locally sourced, and healthy. Marketing campaigns should include education on the benefits of removing Asian carp from the waterways as well as the nutritional benefits of eating, using strategies designed specifically for Gen Z consumers. Additionally, materials must be designed in a way to influence perceptions as this is key to determining willingness to try new foods (Seaman et al., 2022). Finally, collaborating with local chefs to create new and unique recipes using Copi may be a good way to expose individuals to new foods and decrease neophobia associated with the fish. Increasing consumer demand will help return balance to the inland river waterways ecosystems.

### **Acknowledgments**

SIUC Center for Supply Chain Management

SIUC Culinary and Nutrition Services

### **Competing interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### **Informed consent**

Obtained.

### **Ethics approval**

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

### **Provenance and peer review**

Not commissioned; externally double-blind peer reviewed.

### **Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

### **Open access**

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