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The Economic and Environmental Effects of Recycling Plastic in South Carolina

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THESIS SUMMARY

The state of South Carolina generated 4,809,041 tons of municipal solid waste during the fiscal year of 2019 (July 1, 2018 to June 30, 2019). During this same period, the state maintained an average municipal solid waste recycling rate of 28.2% (Toomey, 2019b). This thesis gives an in-depth look in to the economic and environmental effects of recycling, specifically plastic, in South Carolina. I have researched and analyzed the process, capabilities, and impact of recycling plastic in South Carolina. This includes all seven types of plastic as classified by their chemical makeup. In addition, I surveyed South Carolina residents to capture their behaviors, motivations, and knowledge of recycling plastic in the state. Survey results showed that individuals are strongly motivated to recycle but would rarely go out of their way to do so. I also found that many individuals do not recycle properly and are not knowledgeable of South Carolina's recycling capabilities. I have used these results to consider how recycling could be improved in South Carolina. I have researched how South Carolina benefits from recycling, both economically and environmentally. I have also acknowledged the limitations of recycling. I hope that readers will learn the value of recycling and the importance of doing so.

INTRODUCTION

Over the past several years, bettering the environment has become of growing importance to individuals and brands alike. In the face of climate change, more people are making conscious efforts towards sustainability through their purchases and behaviors. A survey conducted by Hotwire Global in 2019 found that 47% of consumers surveyed had switched to a different product or service because a company violated their personal values. The personal value most commonly cited as violated by a company was listed as "protecting the environment" (Highwire Global, 2019). An increasing number of brands are using buzzwords such as "eco-friendly," "organic," and "sustainable" to market their products to consumers. There are numerous ways for individuals to live a more environmentally conscious lifestyle, with recycling being a simple way to do so from home.

The United States began recycling in the late 1600s with the introduction of the recycled paper manufacturing process (Bradbury, 2017). The throwaway culture of the United States began to pose a threat in the late 1900s when the country started to run out of space to put all of the garbage that was being generated. Landfills were closing down, and Americans began to panic that the country could not store any more garbage. The reality was that the Environmental Protection Agency (EPA) was creating stricter regulations for landfills in order to protect the environment. These regulations made it illegal for many small-town landfills to accept garbage, as the landfill owners did not follow the regulations, and in their place, large regional landfills began to open (EPA, 2014). This shift began the push for recycling in the United States. During this time, curbside recycling emerged and slowly began to spread across the country as national concern for the environment was rising.

In the 1970s, plastic recycling started as a response to the growing amount of plastic waste. As national concern for the environment was rising, the public took notice to the large amount of plastic waste that was being generated. Though plastic industry leaders knew that the material was not made for recycling, they pushed the recyclability of their product to satisfy consumers' concerns. Plastic industry leaders did not want consumers' environmental concerns to hinder the success of their product. In the late 1980s, the plastic industry launched a $50 million per year ad campaign to promote the benefits and recyclability of plastics (Sullivan, 2020). Industry leaders such as Exxon, Chevron, and DuPont were paying for advertisements to promote the benefits of plastic. These companies were launching projects, such as recycling in plastic in national parks, knowing that recycling plastic did not make economic sense at the time (Sullivan, 2020). Making new plastic out of oil was easier and less expensive than recycling old plastic into new product. Since this, the recyclability of plastic has been controversial. The plastic industry manipulated consumers into buying their products on a false premise. Fortunately, the plastics recycling market has potential, if it is done correctly.

MOTIVATION

Sustainability first became a passion of mine during my senior year of high school when I was enrolled in an AP Environmental Science course. The class opened my eyes to the importance of living an environmentally conscious lifestyle. Since then, I have incorporated environmental studies and sustainability into my coursework, extracurriculars, and my lifestyle. When choosing my thesis topic, I knew that I wanted to pursue my passion for sustainability. For that reason, I have decided to explore the economic and environmental effects of recycling, specifically plastic, in South Carolina. I was largely inspired by an episode of National Public Radio's Planet Money podcast titled "So, Should We Recycle?" (Gonzalez & Malone, 2019). The episode explores how the United States responded to China's "National Sword Policy" which banned nearly all recycling imports in January 2018. Hosts Sarah Gonzalez and Kenny Malone explain the effects that this ban had on the United States recycling market.

I chose to focus on recycling because it is a relatively simple aspect of sustainability, to which most people have access. Yet, some individuals doubt the effects of recycling. Many learn the waste hierarchy phrase "reduce, reuse, recycle" when they are young. These actions are in the order of most to least impactful way of removing waste from the environment. While recycling is last in this hierarchy, it is still a positive way to reduce waste. Plastics can also have a negative connotation because people do not understand all the implications of recycling plastic. Plastics can be difficult for both the consumer and the recycling facility to properly recycle. Precautions must be taken ensure that plastic is recycled correctly. Reducing and reusing are great ways to help the environment; however, these efforts do little to support the economy. Reducing and reusing are not always practical, or even possible. In these situations, recycling is a great alternative. While I try to reduce and reuse as much as I can, I always make an effort to recycle.

From my research, I hope to learn more about plastic recycling in South Carolina. I want to learn why South Carolinians choose or choose not to recycle plastic, what their typical recycling behaviors are, and how knowledgeable they are about recycling. With this information, I will know what must be done to improve recycling rates in South Carolina. I want to inform residents about South Carolina's recycling capabilities. I will explain the value of recycling and how it boosts the state's economy and helps the environment. I hope that readers will acknowledge the importance of recycling. I will teach readers how to recycle and why it is so important to do so correctly. I believe that from this thesis, South Carolinians will be motivated to recycle and encourage others to do so as well.

METHODOLOGY

Literature Review

The first step in conducting my thesis was to complete literature research. I studied sources such as South Carolina legislation, South Carolina Department of Health and Environmental Control (SC DHEC) Solid Waste Management Annual Reports, South Carolina Department of Commerce Recycling Market Development Advisory Council (RMDAC) Annual Reports, national recycling reports, and various articles. I knew little about recycling as an industry, and these resources provided me with a foundation to know what I wanted to focus on in my thesis. The SC DHEC Solid Waste Management Annual Reports were of key importance because it allowed me to see how recycling changed from year to year. I could identify what improvements were made and what challenges emerged. I could also see how habits varied for plastics specifically. These annual reports were made possible because of the South Carolina Solid Waste Policy and Management Act.

In 1991, South Carolina enacted the South Carolina Solid Waste Policy and Management Act. At the time, over 3,800,000 tons of solid waste were generated annually in the state of South Carolina and approximately 80% of this waste ended up in landfills (SC Solid Waste Policy and Management Act, 1991). Experts warned that if this Act were not passed, by the year 2000, South Carolina would generate over five million tons of solid waste annually. This Act was established to promote the reduction, recycling, reuse, and treatment of solid waste. It was also created to support educating the general public to reduce the generation of solid waste and ensure proper disposal and recycling practices (SC Solid Waste Policy and Management Act, 1991). The enactment of this Act set the tone for how South Carolina would manage environmental problems for years to come. This Act created transparency in the reporting of solid waste

management by requiring the South Carolina Department of Health and Environmental Control (SC DHEC) to publish an annual report on solid waste management for the previous fiscal year. These reports must include an overview of the amount of waste that is recycled, disposed of, and incinerated, the progress of the state and each county toward meeting the state's recycling and disposal goals, revisions to the state plan, and recommendations to the governor and general assembly for improving solid waste management. The establishment of this act has proven to be successful in slowing the rate of waste generation in South Carolina. In SC DHEC's most recent Solid Waste Management annual report (fiscal year 2019), it was reported that 4,809,041 tons of municipal solid waste was generated for the year (Toomey, 2019b). Nineteen years later, the number is still below what was projected for the year 2000 when the Act was created in 1991.

Recycling Plastic in South Carolina Survey

To gain insight into South Carolinians' motivations, behaviors, and knowledge of recycling plastic, I created and distributed a survey titled "Recycling Plastic in South Carolina." I developed my survey with the help of Dr. Kealy Carter of the Darla Moore School Business and Jane Hiller of Sonoco Recycling. I created the survey using Qualtrics because of its ease of use, advanced data analysis features, and ability to export data to other software. I distributed the survey primarily through South Carolina community FaceBook pages. I also sent the survey directly to friends and family and requested that they send it to their friends and family as well. This surveying methodology is referred to snowball sampling. Snowball sampling is a nonprobability sampling technique in which existing subjects recruit future subjects to grow the sample size. There is possible cause for bias in my survey because of the way it was distributed.

Individuals who actively recycle and care about its effect may be more likely to participate in the survey. This can be seen in the higher than average recycling rates found in my survey.

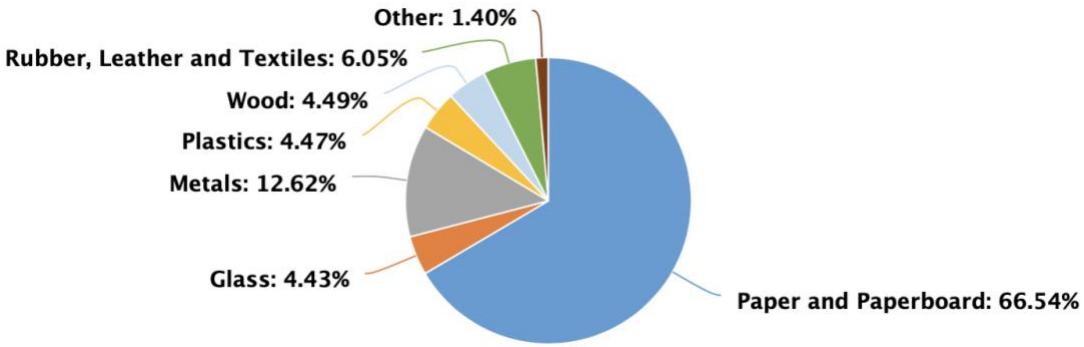
The survey consisted of 33 multiple choice questions grouped into five categories. Respondents were first asked about their access to recycling, then their motivations to or to not recycle, then their recycling behaviors, a knowledge quiz, and finally demographic questions for research purposes. Responses were collected for one week in March 2021. The survey generated 122 complete responses with an average response time of 7 minutes. The survey was designed to be quick and easy to complete in order to maximize the completion rate. This was found to be successful, as 82.6% of those who opened the survey, completed it. Only results from completed surveys were used for analysis.

The survey was administered to South Carolina residents of all ages, income levels, and backgrounds. Participants were asked demographic questions to ensure that it was representative of all South Carolinians. There was a wide spread of age, with both the mode and median being in the 35-44 years old age group. 73.6% of survey respondents described their current housing as "House in a subdivision." Those in such suburban communities typically have access to curbside recycling at higher rates than those in other housing communities. Income varied with the mode in the $150,000 or more category for total annual household income and the median in the $100,000-$149,000 category. The gender of respondents was strongly female, with 67.21% identifying as female. Respondents were then asked the highest degree or level of education that they have completed; the largest group (49.18%) had completed a bachelor's degree, and the next largest group (27.05%) had completed "some college." When asked their political affiliation 16.39% of respondents chose not to say, 16.39% selected moderate/independent, 25.41%

selected democrat, and 41.08% selected republican. The survey questions and results in their entirety can be found in Appendix A.

COMPREHENSIVE OVERVIEW OF PLASTIC RECYCLING PROCESS

Plastics are one of the most commonly recycled materials. When consumers think of recyclables, the materials that often first come to mind are paper, plastic, and aluminum. Typically, all recycling bins accept some varieties of plastic waste. According to the EPA's Total Municipal Solid Waste (MSW) Recycling by Material report of 2018, of the 69 million tons of MSW recycled across the nation, paper encompassed approximately 67% of this, metals accounted for about 13%, and glass, plastic, and wood each made up 4-5% (EPA, 2019).



Source: epa.gov

However, what the average consumer likely does not realize is that plastics are among the most challenging materials for recycling facilities to process and most difficult for consumers to properly recycle. There is a wide range of different types of plastics consisting of different polymers. These plastics must be manually sorted according to their chemical make-up in order to be recycled properly. There are seven different types of plastic. Products are marked with a number 1-7 to indicate what type of resin it is made from.

Number 1: PETE (or PET) – Polyethylene Terephthalate

This is one of the most common types of plastics used for manufacturing products. PETE is normally used to make plastic food containers and bottles (Mosaic, 2020).

Number 2: HDPE – High-Density Polyethylene

This type of plastic is hard, opaque, and rigid. HDPE is sturdier than PETE, and so it is often used for bulkier products such as milk jugs, detergent bottles, and thicker shopping bags (Mosaic, 2020). It can also be used for toys and helmets.

Number 3: PVC – Polyvinyl Chloride

PVC is a very versatile and widely used material for products such as water and waste pipes, shower curtains, flooring, and furniture. This plastic is biologically and chemically resistant, which helps to protect the products it is used for (Mosaic, 2020).

Number 4: LDPE – Low-Density Polyethylene

This is a thinner and highly flexible plastic, but it is still strong. LDPE is often used for produce bags, trash bags, and containers (Mosaic, 2020). While the material of LDPE itself is recyclable, it depends on the design of the product for what number 4 plastics can be recycled at different recycling centers. For example, many recycling centers do not accept plastic grocery bags because they can clog the machinery; thus, delaying the process of recycling other materials.

Number 5: PP – Polypropylene

Polypropylene is a very versatile plastic. It can be made translucent, opaque, or colored and can be used for products such as food packaging, surgical tools, and clothing (Mosaic, 2020). A benefit of polypropylene is that it has a high melting point so it works well for food packaging that would go in the microwave of dishwasher. Products made from number 5 plastic are often not accepted by recycling centers. The used plastic tends to have a strong odor from its original use and once recycled, the material turns a black or grey color. These properties of polypropylene make it difficult to repurpose into new products.

Number 6: PS – Polystyrene

Polystyrene is a hard, colorless plastic that is used very widely. It is often converted into Styrofoam through a process of expansion. It can then be used for fountain drink cups, hot beverage cups, and egg cartons. In its more pure form, it can be molded into plastic utensils, lids, and test tubes. Polystyrene can be recycled, but it is not always cost-effective. Especially in its expanded form, number 6 plastic is rarely accepted by recycling facilities because it requires more energy than it saves to be recycled (Mosaic, 2020).

Number 7: Other

This last category serves to encompass all other types of plastic or combinations of the previous six. Number 7 plastic could consist of polycarbonate or bioplastic polylactide ("Types of plastic," 2019). Because of the ambiguity that comes with number 7 plastics, it is difficult to know whether or not specific products are recyclable. Typically, the best case is to not include number 7 plastics in recycling, as it could containment other good recyclable materials.

These symbols emerged on plastic products in the late 1980s (Sullivan, 2020). The corresponding number surrounded by three arrows forming a triangle, known as the international recycling symbol, was stamped on plastic products. Consumers saw this symbol and assumed it meant the product could be recycled. Plastics were being sent to recycling facilities at increasing rates. However, just because a product had this symbol, did not mean that it could or would be recycled. In 1989, oil and plastic executives lobbied to mandate that the symbol be required on all plastic because it tricked consumers into thinking that the product would be recycled, which would increase sales of their product (Sullivan, 2020). Even some environmentalists supported

mandating the symbol because it would make it easier to sort plastics for recycling. Now, all plastic products are marked with the symbol.

The exact process for recycling these different types of plastic varies. For that reason, the first step in recycling is to sort them into categories by type. Mosaic (2020) explains that once separated, the plastics are shredded and washed. Then, they are melted down to create small resin that can be molded into new products. As this process is done, the long polymer chains that make up plastic are broken down into smaller chains. This process of breaking down the polymer chains weakens the plastic. Because of this property, plastics have a finite life for recyclability. Plastics therefore pose a challenge that other commonly recycled materials, such as glass and aluminum, do not. The same piece of plastic can only be recycled 2-3 times before it starts to degrade to a point of obsolescence. Unlike glass and aluminum, for example, which can be recycled infinitely without ever decreasing in quality (Mosaic, 2020). Because of this, it is impossible to have a truly circular economy so long as plastics continue to be used as they are. This is another reason why the recyclability of plastic is debated.

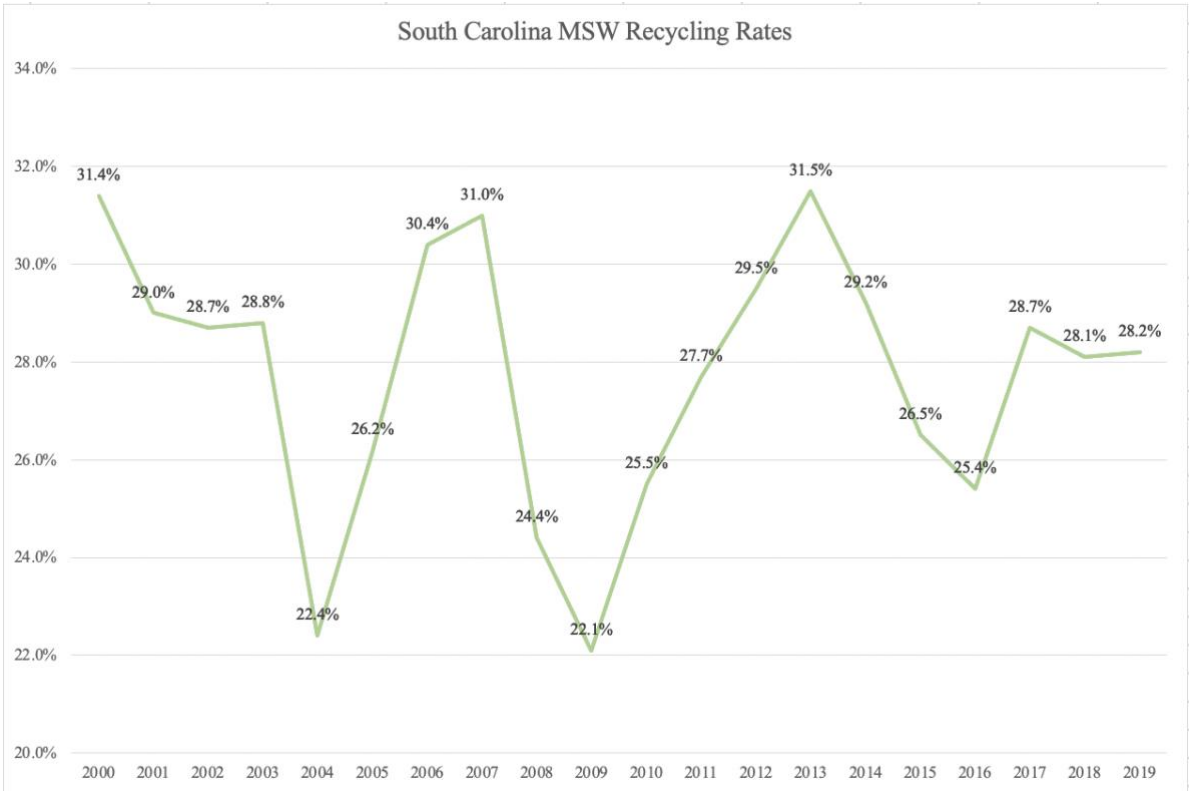
RECYCLING IN SOUTH CAROLINA

Average Municipal Solid Waste Recycling Rates

According to SC DHEC's most recent Solid Waste Management Annual Report from fiscal year 2019, South Carolina has a MSW recycling rate of 28.2%. This equates to 1,356,363 tons of recycled material, of which 4.8% was plastic. The MSW recycling rate has fluctuated over the past 20 years, with a peak of 31.5% in 2013 and a low of 22.1% in 2009. This rate is calculated by SC DHEC using the following formula:

$$Recycling\ Rate\ (\%) = \frac{Amount\ Recycled}{Amount\ generated} \times 100$$

The below chart shows how the state's annual MSW recycling rate has varied since the year 2000.



In the Solid Waste Management Annual Report of fiscal year 2011, SC DHEC set a goal to reach a MSW recycling rate of 40% by 2020 (Templeton, 2012). At the time, the state's measured recycling rate was 27.7% and had been increasing for the past three years. This goal was among several recommendations that SC DHEC made to promote effective, efficient, and environmentally responsible solid waste management. SC DHEC has continued to stress this goal in the following years, despite the recycling rate remaining stagnant. Anderson County, SC was the first county in South Carolina to reach this goal in 2016 when they boasted a 42% MSW recycling rate ("Solid waste," 2021). In 2018, two counties met this goal with Lexington County achieving a 43.75% MSW recycling rate and York County reaching a 41.94% MSW recycling rate (Toomey, 2019a). In an effort to help achieve this goal, the 40by2020 Partnership was established in Columbia, SC in 2015. This group consisted of public and private shareholders who were committed to sharing knowledge and coordinating resources to help the state meet its 40% recycling rate goal set for 2020 ("Recycling & waste reduction," n.d). Members of the group include PalmettoPride, Sonoco Recycling, the S.C. Beverage Association, the S.C. Department of Commerce, and the S.C. Department of Health and Environmental Control. The group created simple informational materials to explain to South Carolinians the importance of recycling and to teach them how to recycle properly. Educational materials created by the group include infographics such as "Top 10 Reasons to Recycle More," "Recycling's Most Wanted," and "Recycling's Dirty Dozen." Despite these strides, the MSW recycling rate across the state has only increased by 1.8% since this goal was set in 2011.

Household Recycling Rates Survey Analysis

After reviewing the statewide MSW recycling rates, I analyzed the results of my survey to see how the two compared. Household recycling rates of respondents of the Recycling Plastics in South Carolina survey are nearly 3 times that of the statewide MSW recycling rate from fiscal year 2019. I also found that respondents indicated that they are more likely to recycle plastic over other materials (paper, glass, aluminum, steel). This is surprising because the SC Solid Waste Management Annual Report for FY19 shows that plastic makes up the second smallest category of MSW recycled by type at 4.8%, followed only by glass at 1.0% (Toomey, 2019b). From the survey, 28.68% of respondents use curbside recycling services, 45.59% take their recyclables to a drop-off collection center, and 8.09% do a combination of both. Of the respondents, 17.65% do not recycle in their household at all. Though 82.35% of households may recycle, this does not mean that they are recycling all the materials that they can, nor does it mean that they are recycling correctly. This statistic only indicates that most households have access to recycling. Of the 82.35% of households that do recycle, nearly 17% of respondents indicated on a 5-point scale that they only recycle half of the time or less in their household. Of those same respondents, nearly 13% indicated that they recycle half of the time or less when it is available outside of their home, for example at school or work. The 17.65% of respondents that do not recycle in their households at all, are also infrequent to recycle outside of their home. When asked of their recycling habitats when it is available outside of the home, nearly 38% stated that they would recycle half of the time or less. These results show that though South Carolina is far from its recycling rate goal, there is strong potential to reach it. If those who are already recycling in their households recycled more frequently, and if those who do not recycle in their households made the effort to do so when it is available elsewhere, the state's recycling

rate could significantly increase. This is precisely where the problem lies. Individuals will recycle when it is easy and convenient but will not go out of their way to do so.

Significance Test

The responsibility of recycling should not be placed solely on individuals, however. It is also up to local government to make improvements in the state's recycling abilities. To examine the role of convenience in one's likelihood to recycle I have analyzed and compared the recycling rates across different counties. Of the 46 counties in South Carolina, there are 19 counties with no curbside recycling programs. I believe that these counties will have lower recycling rates when compared to the state's average. To test this, I ran a one sample T-test to test if the average recycling rate of counties with no curbside recycling program varied from the state's average of recycling rate of 28.2%. I used this statistical test to test the following hypothesis:

$\boldsymbol{H_0}$: The average MSW recycling rate for counties with no curbside recycling program is not different from the average MSW recycling rate for the state.

$\boldsymbol{H_1}$: The average MSW recycling rate for counties with no curbside recycling program is different from the average MSW recycling rate for the state.

The test resulted in an absolute t-statistic of 4.898 and a critical t-value of 2.101. The full output of this test can be found in Appendix B, Figure 1. Because the t-statistic (4.898) is greater than the critical t-value (2.101), I can reject the null hypothesis that the average MSW recycling rate for counties with no curbside recycling program is not different from the average MSW recycling rate for the state. I can therefore conclude that the difference between the average MSW recycling rate in counties without curbside recycling programs and the state's average

MSW recycling rate is statistically significant and that the former is lower than the state's average.

Recycling Behavior

I next wanted to investigate what efforts were being made toward proper recycling. I analyzed the results from a series of questions respondents were asked about their recycling behaviors to gauge what efforts they take when recycling. First, respondents were asked on a 5-point scale how likely they were to do the following when they had recyclable waste outside of their household:

I will look for a recycling bin.

I will ask if recycling is available.

I will throw my recyclable waste in the trash if recycling is not an option.

I will hold onto my recyclable waste until I can properly recycle.

From this question, 20% of respondents indicated that they were neutral or unlikely to look for a recycling bin and 56.15% indicated that they were neutral or unlikely to ask if recycling is available. These are simple tasks that could make a big difference in the amount of recyclable waste that is landfilled. If recycling is not an apparent option, consumers will most likely dispose of their recyclables in the trash, as indicated by nearly 90% of respondents. Approximately 26% of respondents stated that the were likely to hold on to their recyclables until they could properly recycle it. The simple task of asking if recycling is available or holding on to something to recycle it could prevent recyclables from being landfilled.

Respondents were then asked about how they prepare their plastic materials to be recycled. These precautions are important to take to prevent contamination of recyclables.

Respondents were again presented with a 5-point scale to indicate how frequently they do the following when recycling plastic:

I rinse my recyclables if necessary.

I remove lids if necessary.

I check the label to see if the plastic is recyclables.

I check the plastic number to see if the type of plastic is recyclable.

If unsure if the plastic is recyclable, I research what can be recycled in my area.

Between 55-60% of respondents rinse their recyclables if necessary, remove lids if necessary, or check the label to see if the plastic is recyclable more than half of the time (58.4%, 57.6%, 55.2% respectively). These preparations are fast and simple and should always be made when recycling plastic. On the other hand, 50% of respondents stated that the never check the plastic number to see if the plastic is recyclable and 50% of respondents stated that they would never research what can be recycled in their area if they were unsure about a material. This again shows that individuals will not go out of their way to recycle, supporting that individuals recycle when it is easy and convenient for them.

PROPER RECYCLING

The survey distributed to South Carolinians focused on three major areas– motivation, behavior, and knowledge. While South Carolinians are strongly motivated to recycle for various reason, there is a knowledge gap. To test their knowledge of proper plastic recycling, respondents were asked whether or not four different types of plastic waste were eligible for curbside recycling. The materials were "plastic grocery bags," "Styrofoam plastics," "plastic water bottles," and "plastic food containers with food remnants." By computing a weighted average, I found that overall, respondents scored an 81% on this knowledge quiz. I then filtered the results to this knowledge quiz using the results of another question. I had previously asked respondents on a 5-point scale how knowledgeable they believe themselves to be on how to recycle plastic correctly. Those who believe themselves to be "extremely knowledgeable" or "very knowledgeable" on how to recycle plastic scored slightly higher at an average of 88.07% on the knowledge quiz. Those who believe themselves to be "slightly knowledgeable" or "not knowledgeable at all" scored an average of 73.08% on the knowledge quiz.

Of the four materials that participants were asked about, plastic grocery bags received the most incorrect responses, with only 64.52% of respondents answering correctly. Plastic grocery bags are recyclable, but not through curbside recycling in South Carolina. Even better for the environment than being recycled, plastic bags can almost always be reused by local food banks (SC DHEC, 2019b). They are also accepted by many grocery stores for recycling. However, it can be very harmful if plastic bags are placed in curbside recycling. The plastic film material can damage recycling equipment and contaminant the rest of the recyclables. Contamination from this material can also pose a risk for Material Recovery Facility workers (Rosengren, 2019). These employees are responsible for separating and preparing recyclable materials for marketing

to end-user manufacturers. Workers can seriously hurt themselves trying to remove materials such as plastic bags from the line.

The next material that respondents were asked about was plastic Styrofoam. As stated previously, Styrofoam is very rarely accepted by recycling facilities because it consumes more energy to recycle than it saves. Styrofoam is 95% air and so there is minimal material that could be valuable if recycled (Mosaic, 2020). In addition to this, Styrofoam is often used for food or drink and is easily contaminated. The porous material of this type of plastic is especially hard to clean, and so if tainted Styrofoam is mixed in with other plastic recyclables, it can contaminate them as well. This trait of Styrofoam also makes it difficult to reuse. The best practice for Styrofoam is for consumers to simply avoid it when possible. The material is non-biodegradable, meaning it cannot be broken down by natural organisms. While experts vary on their estimates, some believe it would take up to 1 million years for Styrofoam to decompose (Dilthey, 2019).When Styrofoam is used, it almost always must be placed in the trash to be sent to the landfill.

Respondents were then asked about the recyclability of plastic water bottles. This was the only question where the correct answer was yes, and the only question that 100% of respondents answered correctly. While respondents know that plastic water bottles can be recycled, this does not mean that they are always being recycled. The SC DHEC reported in 2018 that over 70% of all plastic water bottles are thrown away instead of recycled (Toomey, 2019a). In an effort to lessen the number of plastic water bottles that end up in the landfill, in 2014, the Carolinas Plastic Recycling Council developed the Your Bottle Means Jobs campaign. This campaign was developed to show people the impact that they can make on the local economy when they choose to recycle. Often, one of the reasons that people fail to recycle is because they do not believe that

their individual choices and actions make any significant difference. This campaign creates a clear connection between plastic bottles, which nearly everybody uses, and jobs, which nearly everyone needs. It is difficult for individuals to ignore this clear correlation from plastic bottles to jobs. The Carolinas Plastic recycling council found that if every household across both North and South Carolina recycled an additional 2 plastic bottles each week, it would generate $10 million in savings and could create 300 new jobs in the plastics recycling industry ("Your bottle," 2018).

Finally, respondents were asked about "plastic food containers with food remnants". Plastic food containers are often made from Number 1 plastic and are commonly recycled. However, these containers must not contain any food remnants. The survey shows that 20.16% of respondents do not know that they must rinse their plastics before recycling. this can be extremely harmful because as SC DHEC warns, "containers contaminated with food may result in rejection of the entire bin of recyclables" (SC DHEC, 2019a). If plastic containers are not empty, clean, and dry, the contents can spill out and make other materials such as paper and cardboard ineligible for recycling, causing the entire bin to be landfilled. The cleanliness of recyclables has become of increased importance in recent years as the recycling market has become more domestic. When recyclables were being sent overseas, the quantity of materials was more important than the quality of the materials. China was receiving a large percentage of the world's waste. However, the profitability for China began to decline as contaminated trash being sent was difficult and expensive to recycle (Katz, 2019). Recycling products from other countries was causing a great deal of pollution in China. Products that were sent to China to be recycled were not rinsed or sorted properly. While China used to be able to profit by employing people to rinse and sort the recyclables, as their economy evolved and labor became more

expensive, it was no longer worth it to them (Gonzalez & Malone, 2019). The Chinese government began to cut down on plastic trash imports and in January 2018 it banned nearly all imports with is “National Sword” policy (Katz, 2019). Now that many overseas markets have closed, the domestic markets demand a higher quality of material. Because of this, the cost of managing solid waste has risen in recent years. Local governments in South Carolina reported $390,420,298 spent on solid waste management for FY19, which is an increase of over $26 million compared to FY18 (Toomey, 2019b). The majority of this difference can be explained by increases in recycling costs, as processors are charging higher rates (Toomey, 2019b). Making sure that recyclables are prepared for recycling before placing them in the bin can help reduce costs at the facilities.

Plastics can be confusing to people, as there are several different types and different regulations of what can and cannot be recycled. Some are not aware of the different types of plastics and their respective recyclability at all. The image that denotes the different classifications of plastic looks very similar to the commonly known recycling symbol of three arrows forming a triangle. However, this symbol only indicates the resin type of the material, and it does not mean that the material is necessarily recyclable. Consumers cannot rely on what is written on a product to know if it is recyclable or not. However, it is very simple to access the appropriate information to know for certain. When respondents were asked on a 5-point scale how often they research what can be recycled in their area if they were unsure, 50% answered “never”. In a similar question, respondents were asked what they do when unsure if an item can be recycled or not, and only 26.98% stated that they would research what items are recyclable in their area if unsure. This information can easily be accessed on the South Carolina Department of Health and Environmental Control website (SC DHEC, 2019a). Users can simply select their

county to view a list of acceptable curbside recycling items. Other items that cannot be recycled curbside can sometimes be taken to a drop-off facility to be recycled or be reused in some other way.

IMPACT ON THE ECONOMY

Job Multiplier Effect

People are all motivated to recycle for different reasons. Over 60% of survey respondents stated that they are motivated to recycle because it supports the economy and 75.76% of respondents stated that they are motivated to recycle because it creates jobs. It is important for individuals to know the impact that they can have on the local economy by properly recycling. The plastics recycling industry directly employees approximately 3,500 people across both North and South Carolina (SC Department of Commerce, 2019). The recycling industry as a whole in South Carolina has a 2.4-person job multiplier (Heigel, 2017). This means that for every 1 job created in the recycling industry, it is estimated that 2.4 jobs are also created either directly or indirectly. This statistic is similar to that of other industries in the state such as aerospace, automotive, and timber. This ripple effect shows that growth in the recycling industry has a doubling effect across the state. The multiplying effect of recycling can be seen in many different ways, both simple and complex. One example would be a truck driver employed by an industrial plastic recycling facility; he is thus a direct employee of the recycling industry. When he stops for lunch at a local restaurant on his driving route, this sale generates business for that restaurant and the need for a server or cashier, creating an indirect job in a different industry.

Market Size

In the state of South Carolina, the economic impact of recycling is over $13 billion each year (SC Department of Commerce, 2019). There are over 300 recycling companies across the state. This number represents the growth and success of the industry. In South Carolina, there are 25 recycling processors dedicated to plastics, with 10 PETE plastic recycling facilities and 15

industrial plastics recycling facilities (SC Department of Commerce, n.d.). The PETE recycling facilities have the ability to process over 500 pounds of plastic bottles annually. The industrial plastic recyclers can process over 200 million pounds of industrial plastics each year. Among these 25 facilities, 1,500 workers are employed in roles such as collectors, processors, recycled product manufacturers, and equipment makers (SC Department of Commerce, n.d.). These facilities convert plastics into new products such as carpeting, textiles, plastic piping, and plastic lumber. In South Carolina, there is more demand for recyclable plastic than there is supply. SC DHEC reported that 65,689 tons of plastic were recycled in fiscal year 2019 (Toomey, 2019b). Most South Carolinians are unaware of the state's recycling capabilities. When asked "Where do you think that *most* of your plastic recyclables go?" only 30% of respondents answered that they are processed in South Carolina. Respondents were then asked, "How many recycling facilities dedicated to plastic do you think there are in South Carolina?" Less than 5% of respondents answered correctly by selecting 21-25. Nearly 70% of respondents answered less than 10 plastic recycling facilities. This shows that respondents are not aware of what a large and successful industry plastic recycling is in South Carolina. The previously discussed Your Bottle Means Jobs campaign, has helped to move some plastic materials away from landfills and instead to recycling facilities. The Carolinas Plastics Recycling Council measured a 2% increase in tons of plastic bottles sold by local recycling facilities in the year following the campaign's debut in 2016 (Freyer, C. & Pollock, B., 2017).

IMPACT ON THE ENVIRONMENT

Microplastic Pollution

In 2018, the United States Environmental Protection Agency (EPA) estimated that 35.7 million tons of plastic were generated in the U.S. that year, of which 27 million tons or 75.6% ended up in landfills. In comparison, only 3 million tons or 8.4% of all plastics generated that year were recycled (EPA, 2018). Most plastics are not biodegradable, and so when they end up in landfills, they can take up to 1,000 years to decompose. When decomposing, plastics gain new physical and chemical properties that can be toxic. These toxic substances then leach out and can contaminate the soil and nearby water sources. A German study estimated that one third of all plastic produced globally disintegrates into microplastic and ends up in soil and freshwater sources (Bunk, 2018). Microplastic pollution has been found across the globe in soil, water, air, aquatic organisms, and terrestrial beings. The health effects of microplastics in humans is unknown; however, harmful effects have been observed in other living creatures (de Souza Machado, 2018).

Fortunately, microplastic pollution can be mitigated through recycling. Though plastic recycling is far from a perfect process, recent improvements have made it a more accessible and reliable option. Large advancements have come from a partnership between PureCycle Technologies and Milliken & Company. Chief technologist and founding inventor of PureCycle, John Layman, has developed a process focused on polypropylene (Number 5 plastic), one of the most commonly used but rarely recycled plastics in the world (Cook, 2021). This process removes color, odor, and contaminants from polypropylene waste to make it easier to recycle and more desirable as an end product. Milliken, headquartered in Spartanburg, SC, has contributed additives that modify the properties of plastics to be more versatile. The two are working

together to bring this technology to a large scale and advance the production of recycling polypropylene.

Landfills

In South Carolina there are three unique landfill classifications. On their website, SC DHEC details the classifications and requirements for landfills operating in the state. Class One Landfills are for the disposal of land-clearing debris such as trees, stumps, and wood chips. Class Two Landfills accept wastes generated from construction, demolition, land-clearing, industrial activities, manufacturing activities, and segregated commercial waste. Examples of such waste includes rock, vegetation, concrete, pipes, mattresses, and bricks. Class Three Landfills accept municipal solid waste, industrial solid waste, sewage sludge, and nonhazardous waste (SC DHEC, n.d.). In South Carolina, MSW can only be properly managed in one of two ways, it is either recycled or it is disposed of in a Class 3 landfill. The definition of MSW can vary by state, but in South Carolina MSW commonly consists of household trash such as paper, cans, bottles, and food scraps. Much of the waste that ends up in Class 3 landfills could have been recycled. There are 27 Class 3 landfills operating in South Carolina, both publicly and privately owned. These landfills must comply with strict Environmental Protection Agency (EPA) and SC DHEC regulations for their location, design, operation, and closing. Issues often arise with the location planning of landfills. Public landfills are assigned a location directly from the local government, while privately owned landfills select a potential site and then must have the site approved by local governments. Residents will always have the opportunity to comment on the potential location of a landfill, whether it be public or private, at local meetings. The public typically opposes new landfills for a variety of reasons. Reasons for opposition commonly include concern

for their health and environment, potential loss of property value, loud noise, foul odor, and increased traffic.

In 2011, SC DHEC received 19 complaints about odor from the state's largest landfill located in Lee County, SC (Fretwell, 2012). In addition to this, the landfill operator Republic Services Inc., was sued by at least 14 individuals, most of whom owned property near the landfill (Fretwell, 2012). However, there were no compliance violations found against the landfill during the same period. A federal jury ordered Republic to pay $2.3 million in damages to six of the neighbors who argued that the landfill was ruining the enjoyment of the property and asserted nuisance, trespass, and negligence claims against Republic based on the odors. Republic challenged this judgement, and the case was brought to the South Carolina Supreme Court (Fretwell, 2012). The S.C. Supreme Court then sided with Republic, stating that the claims of nuisance, trespass, and negligence were not sound (Babb v. Lee, 2013). This case is not unique, as landfills often generate complaints from nearby residents. Most people can dispose of their waste without much thought of where it goes or what happens to it. However, there is not unlimited space for landfills on the planet. Land is a valuable natural resource that must be protected. As waste continues to be generated and disposed of, more landfills will have to developed in order to keep up. Though the waste is steadily increasing, people still do not want landfills in their backyards. This stance is commonly referred to as "NIMBY" (not in my backyard), in which people do not want a landfill near their home but will do little to work toward creating less waste (Lee, et al., 1994).

The Recycling Plastics in South Carolina survey results show that 12.80% of respondents believe that most of their plastic recyclables end up in a landfill and 40.80% claim to not think about what happens to their recyclables. If people believe that their recyclables will just end up

in the landfill anyway, they will not be motivated to recycle. Typically, recyclables are only sent to the landfill if they are not eligible for curbside recycling or if they are contaminated. Consumer goods companies are reluctant to buy contaminated recycled plastic, especially when virgin plastic is so affordable and readily available (Cho, 2020). To prevent recyclables from ending up in the landfill, consumers must be supplying high quality recycled materials to recycling facilities. While recycling should not be contaminated with product, high quality recycling does not need to be sparkling clean either. In order to prepare materials for recycling, containers should be emptied, rinsed, and dried. Minimizing contamination of recyclables requires consumer effort, which is why it is so important for people to be aware of what is accepted by curbside recycling and to properly prepare waste for recycling.

CONCLUSION

From my research I have learned valuable insights into the attitudes of South Carolinians on recycling plastic. The biggest takeaway I have gotten from the Recycling Plastic in South Carolina survey is that people will recycle when it is easy and convenient for them but will rarely go out of their way to do so. This is especially significant because plastics require additional knowledge and effort to be properly recycled, compared to other materials that are easier to recycle. The reasons cited as most influential on respondents' motivation to recycle were "Recycling reduces waste in landfills" and "I think that it is the right thing to do." This shows that individuals are strongly motivated to recycle for valid reasons. The statement that respondents most strongly disagreed with is "Recycling is easy and convenient." Similarly, the most influential reason for South Carolinians not to recycle is "Recycling is not provided for by my housing community." I was surprised to find a gap between South Carolinians motivation to recycle and their willingness to actually do so. This gap was made clear in how respondents answered these different questions. If recycling is not provided for the individual and made easy, they most likely will not recycle.

In order to increase recycling rates and decrease the amount of plastic waste in landfills, recycling must be widely available. Counties in the state with at least one curbside recycling program have a MSW recycling rate that is 7.18% higher than those with no curbside recycling programs. All counties should have at least one curbside recycling program available in order to boost the state's recycling rate. I also found that nearly 80% of survey respondents are motivated to recycle because others in their household recycle. This means that if one person makes the initial effort to recycle, it is likely that others in the household will follow suit. This is important because the EPA found that on average, each person generates 4.9 pounds of waste daily (EPA,

2019). One person can make this change for their household and have a dramatic impact on the amount of waste sent to the landfill from their home.

I hope that readers have found the value in recycling plastic from this thesis. Prior to my research, I was not aware of what a large and successful industry recycling is in South Carolina. I was pleased to learn of the recycling capabilities of the state, especially those dedicated to plastic. I hope that others will share in my efforts to lessen the plastic waste on our planet and in the state of South Carolina. Plastic will not disappear from the environment nor from our economy anytime soon. The plastic industry is incredibly successful and as long as they produce plastic products, consumers will continue to buy them, and the plastic waste will remain on the earth. Recycling will not solve the earth's climate problems, especially not those related to plastic. The plastic industry must be transparent with consumers about the real limitations of their products and consumers must be aware of when and how certain types of plastic can be recycled. When possible, it is best to reduce our plastic consumption at the start or to reuse products such as plastic grocery bags for other purposes. When these are not options, proper recycling is a better alternative to throwing away plastic waste. Action must be taken on both an individual and government level to improve South Carolina recycling rates. Education must be in place to teach South Carolinians of the steps that need to be taken for proper plastic recycling. Doing so will improve both the state's economy and environment.

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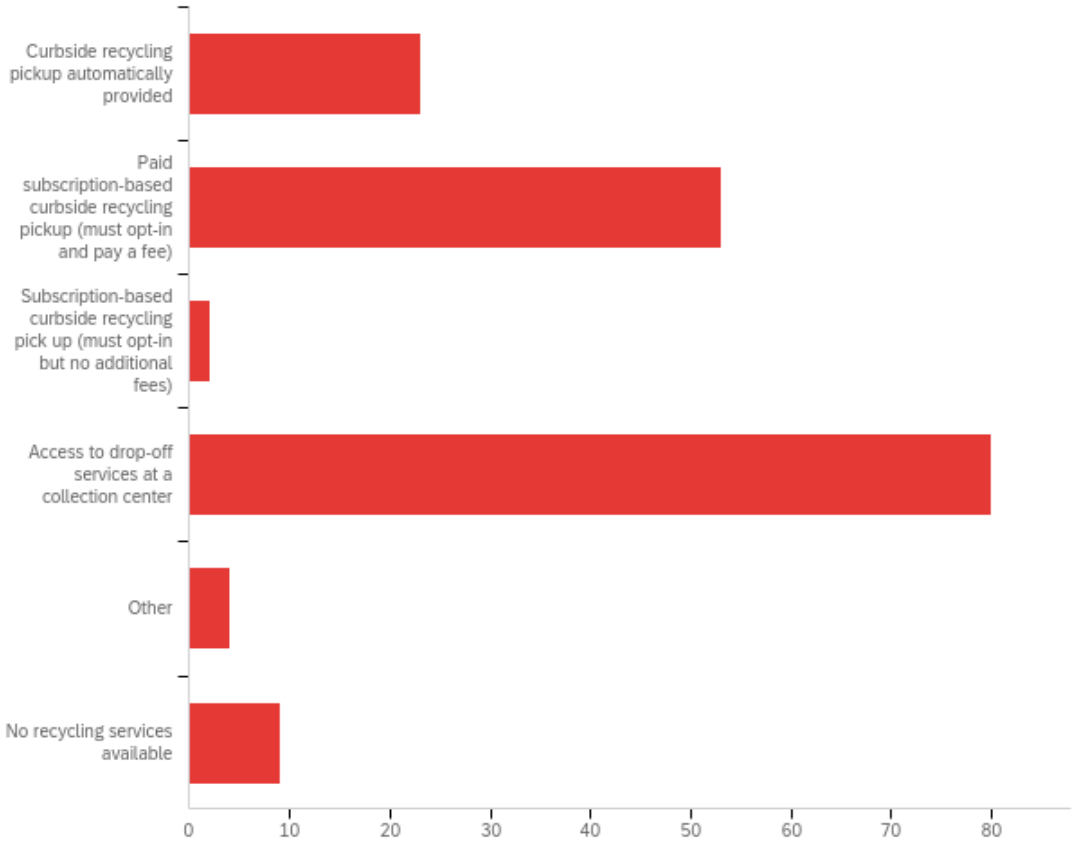
APPENDIX A

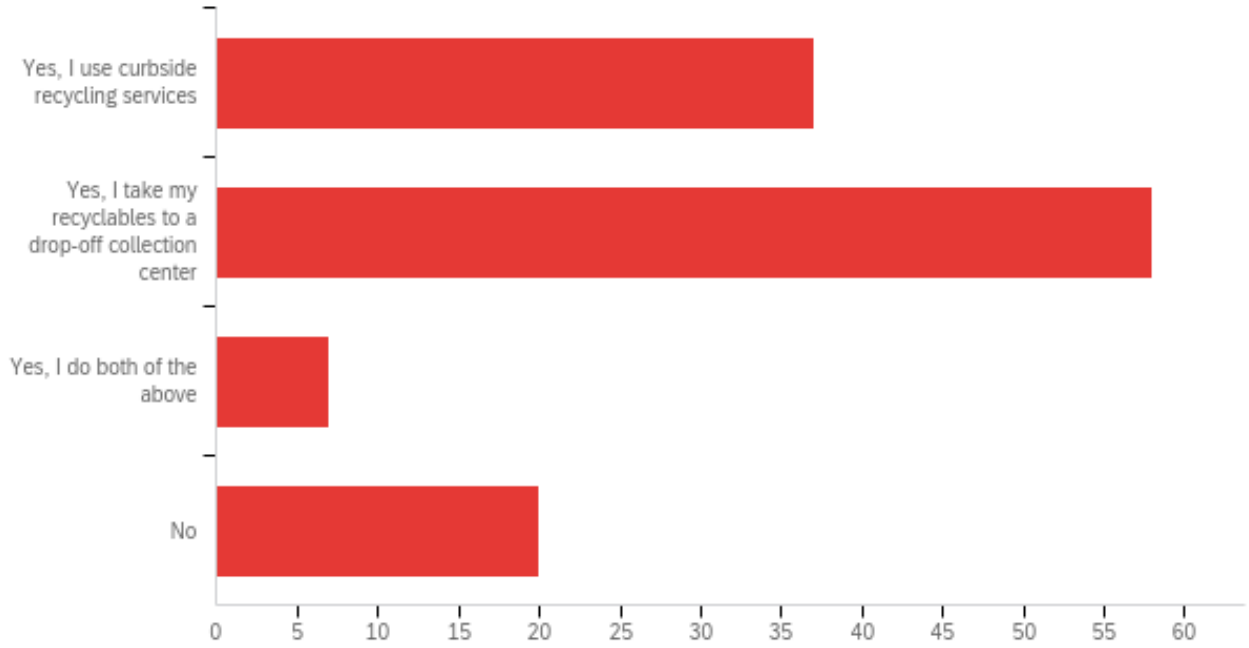
Recycling Plastic in South Carolina Survey

1. Which of the following describes access to recycling in your community? Check all that apply



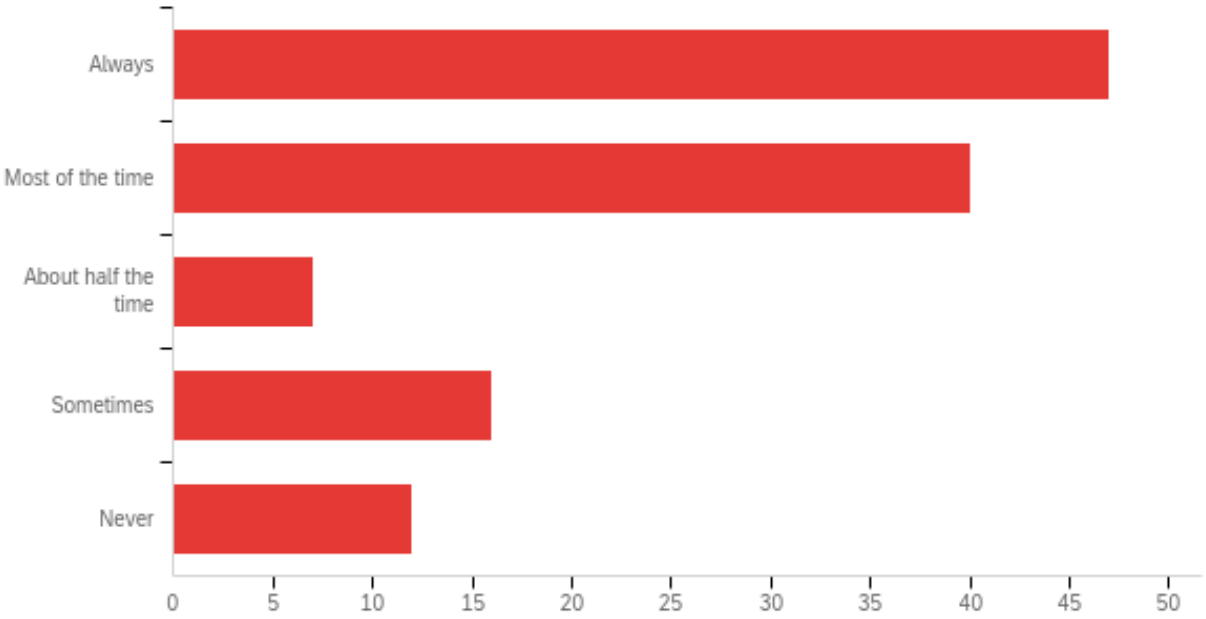
#	Answer	%	Count
1	Curbside recycling pickup automatically provided	13.45%	23
2	Paid subscription-based curbside recycling pickup (must opt-in and pay a fee)	30.99%	53
3	Subscription-based curbside recycling pick up (must opt-in but no additional fees)	1.17%	2
4	Access to drop-off services at a collection center	46.78%	80
5	Other	2.34%	4
6	No recycling services available	5.26%	9
	Total	100%	171

2. Do you recycle in your household?



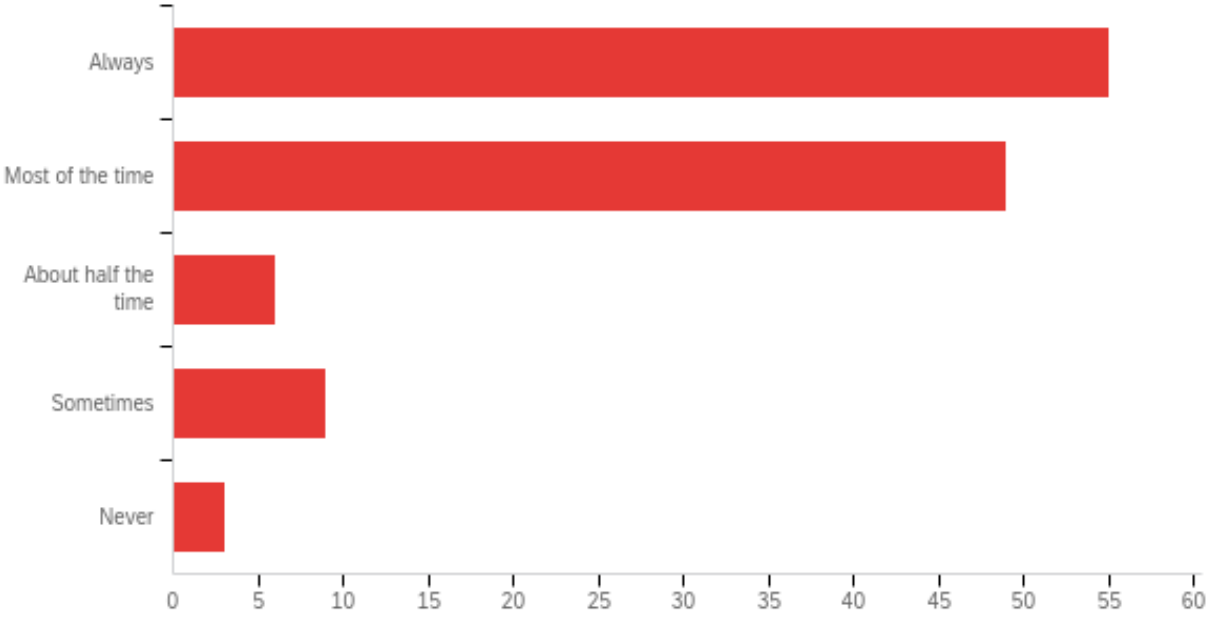
#	Answer	%	Count
6	Yes, I use curbside recycling services	30.33%	37
7	Yes, I take my recyclables to a drop-off collection center	47.54%	58
8	Yes, I do both of the above	5.74%	7
9	No	16.39%	20
	Total	100%	122

3. How frequently do you recycle in your household?



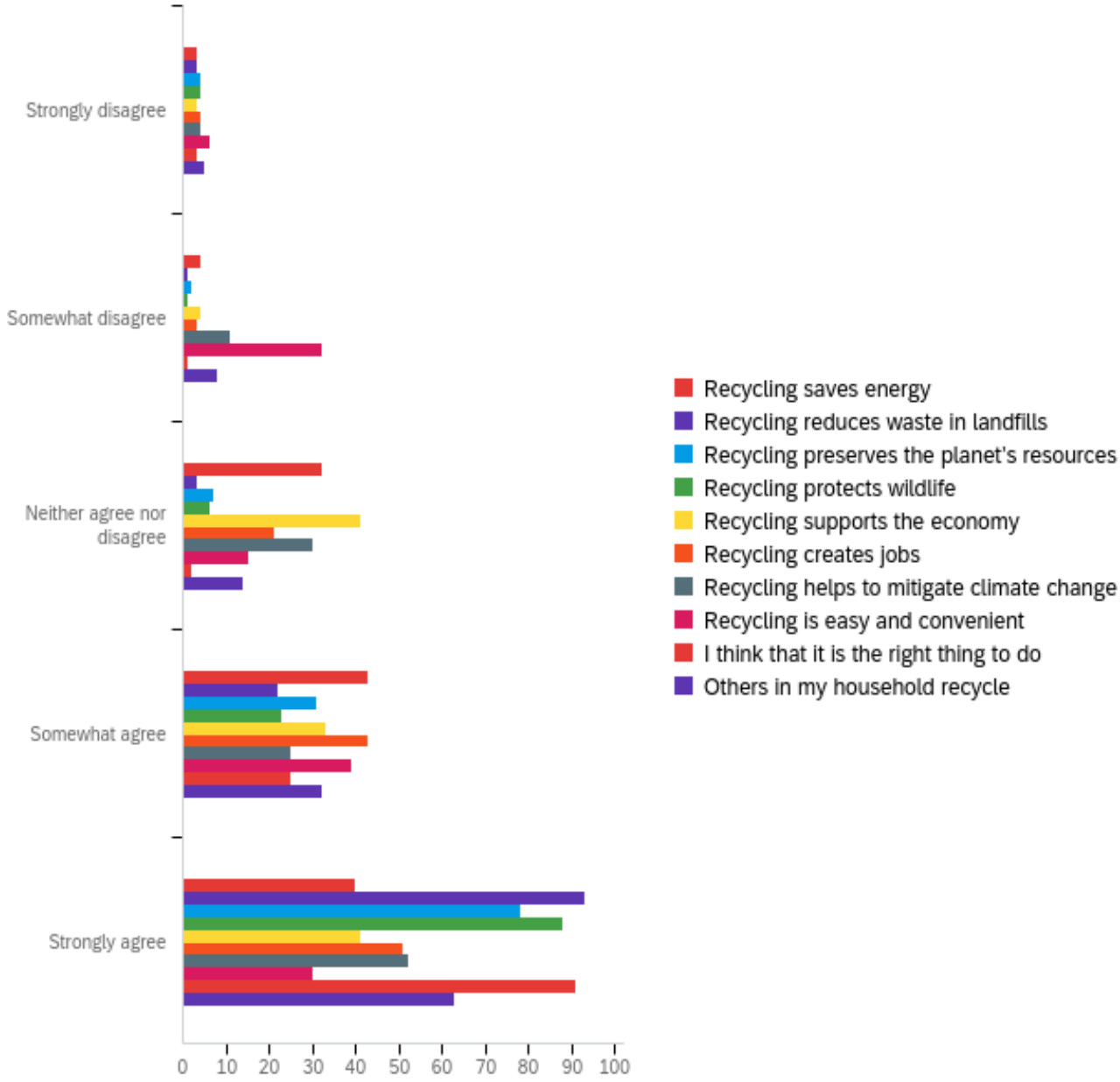
#	Answer	%	Count
1	Always	38.52%	47
2	Most of the time	32.79%	40
3	About half the time	5.74%	7
4	Sometimes	13.11%	16
5	Never	9.84%	12
	Total	100%	122

4. How frequently do you recycle if it is an option at school/work/store etc.?



#	Answer	%	Count
3	Always	45.08%	55
4	Most of the time	40.16%	49
5	About half the time	4.92%	6
6	Sometimes	7.38%	9
7	Never	2.46%	3
	Total	100%	122

5. Please indicate the level of influence the following statements have on your motivation to recycle.

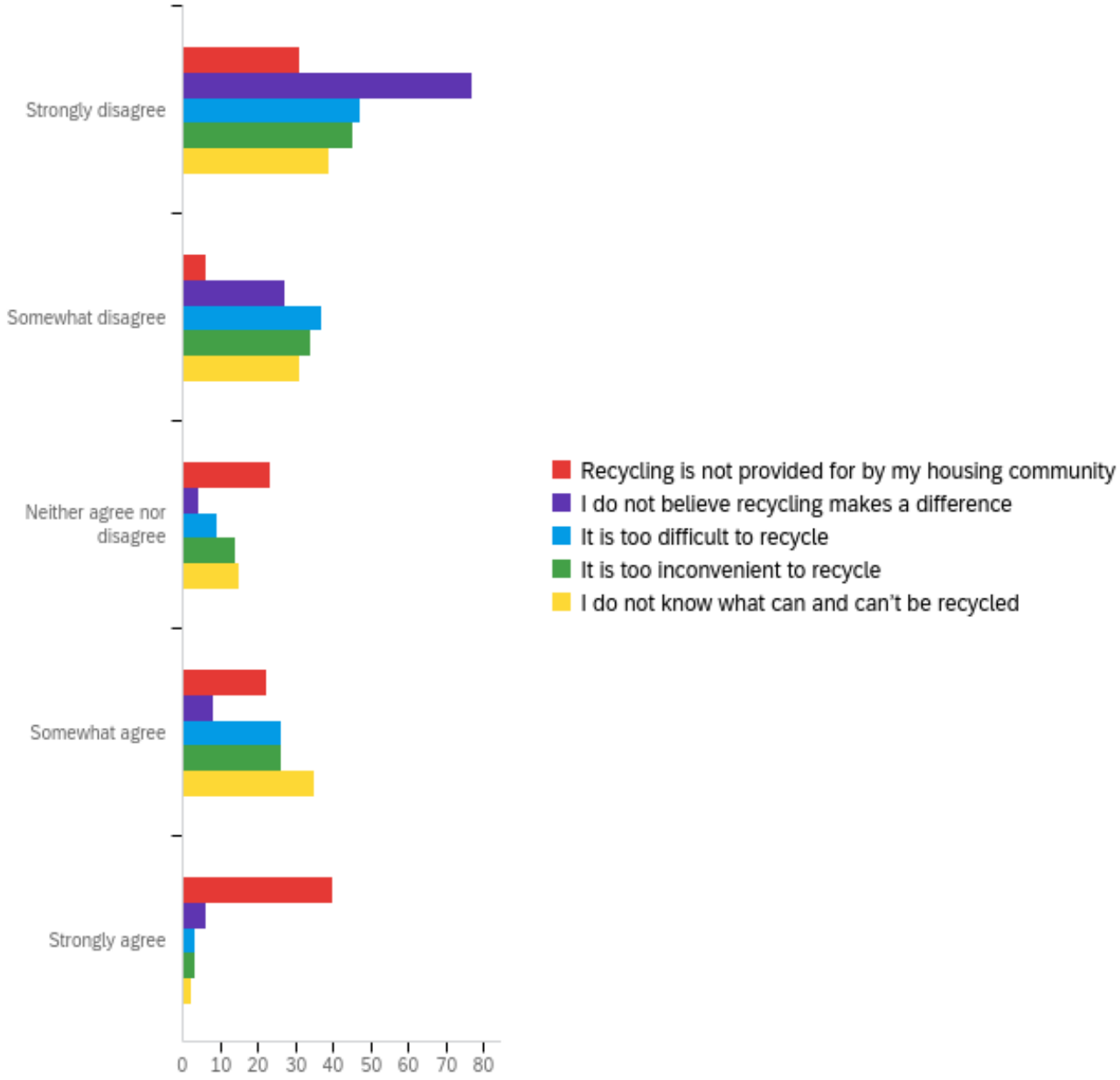


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Recycling saves energy	1.00	5.00	3.93	0.97	0.94	122
2	Recycling reduces waste in landfills	1.00	5.00	4.65	0.79	0.62	122

3	Recycling preserves the planet’s resources	1.00	5.00	4.45	0.92	0.85	122
4	Recycling protects wildlife	1.00	5.00	4.56	0.89	0.79	122
5	Recycling supports the economy	1.00	5.00	3.86	1.00	1.01	122
6	Recycling creates jobs	1.00	5.00	4.10	0.99	0.97	122
7	Recycling helps to mitigate climate change	1.00	5.00	3.90	1.15	1.32	122
8	Recycling is easy and convenient	1.00	5.00	3.45	1.25	1.56	122
9	I think that it is the right thing to do	1.00	5.00	4.64	0.78	0.61	122
10	Others in my household recycle	1.00	5.00	4.15	1.11	1.24	122

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	Recycling saves energy	2.46%	3	3.28%	4	26.23%	32	35.25%	43	32.79%	40	122
2	Recycling reduces waste in landfills	2.46%	3	0.82%	1	2.46%	3	18.03%	22	76.23%	93	122
3	Recycling preserves the planet’s resources	3.28%	4	1.64%	2	5.74%	7	25.41%	31	63.93%	78	122
4	Recycling protects wildlife	3.28%	4	0.82%	1	4.92%	6	18.85%	23	72.13%	88	122
5	Recycling supports the economy	2.46%	3	3.28%	4	33.61%	41	27.05%	33	33.61%	41	122
6	Recycling creates jobs	3.28%	4	2.46%	3	17.21%	21	35.25%	43	41.80%	51	122
7	Recycling helps to mitigate climate change	3.28%	4	9.02%	11	24.59%	30	20.49%	25	42.62%	52	122
8	Recycling is easy and convenient	4.92%	6	26.23%	32	12.30%	15	31.97%	39	24.59%	30	122
9	I think that it is the right thing to do	2.46%	3	0.82%	1	1.64%	2	20.49%	25	74.59%	91	122
10	Others in my household recycle	4.10%	5	6.56%	8	11.48%	14	26.23%	32	51.64%	63	122

6. Please indicate the level of influence the following statements have on your motivation not to recycle

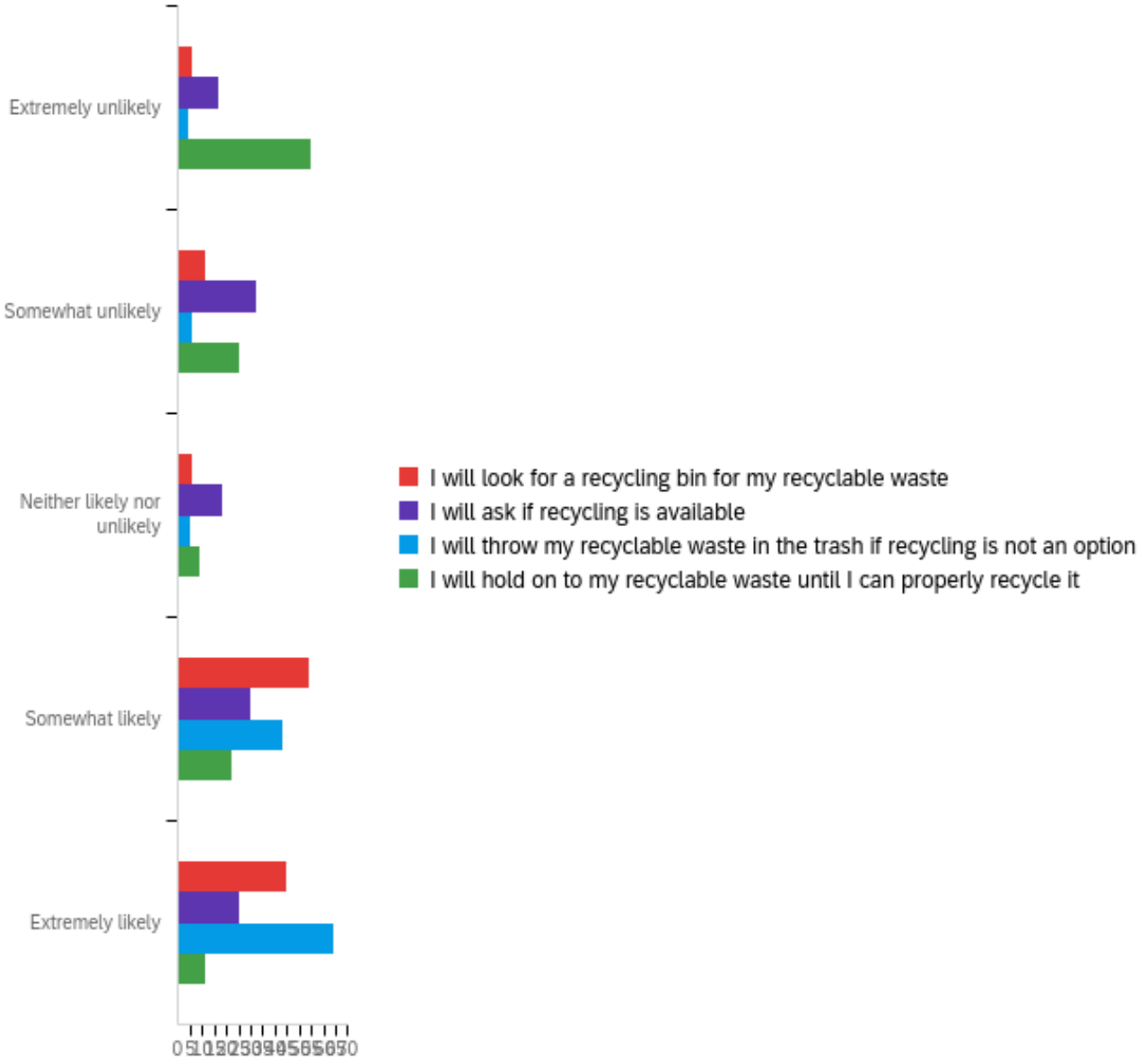


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Recycling is not provided for by my housing community	1.00	5.00	3.28	1.57	2.48	122
2	I do not believe recycling makes a difference	1.00	5.00	1.68	1.13	1.27	122

3	It is too difficult to recycle	1.00	5.00	2.19	1.22	1.50	122
4	It is too inconvenient to recycle	1.00	5.00	2.25	1.22	1.50	122
5	I do not know what can and can't be recycled	1.00	5.00	2.43	1.25	1.56	122

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	Recycling is not provided for by my housing community	25.41%	31	4.92%	6	18.85%	23	18.03%	22	32.79%	40	122
2	I do not believe recycling makes a difference	63.11%	77	22.13%	27	3.28%	4	6.56%	8	4.92%	6	122
3	It is too difficult to recycle	38.52%	47	30.33%	37	7.38%	9	21.31%	26	2.46%	3	122
4	It is too inconvenient to recycle	36.89%	45	27.87%	34	11.48%	14	21.31%	26	2.46%	3	122
5	I do not know what can and can't be recycled	31.97%	39	25.41%	31	12.30%	15	28.69%	35	1.64%	2	122

7. Please indicate how likely you are to do the following with recyclable waste when you are outside of your household

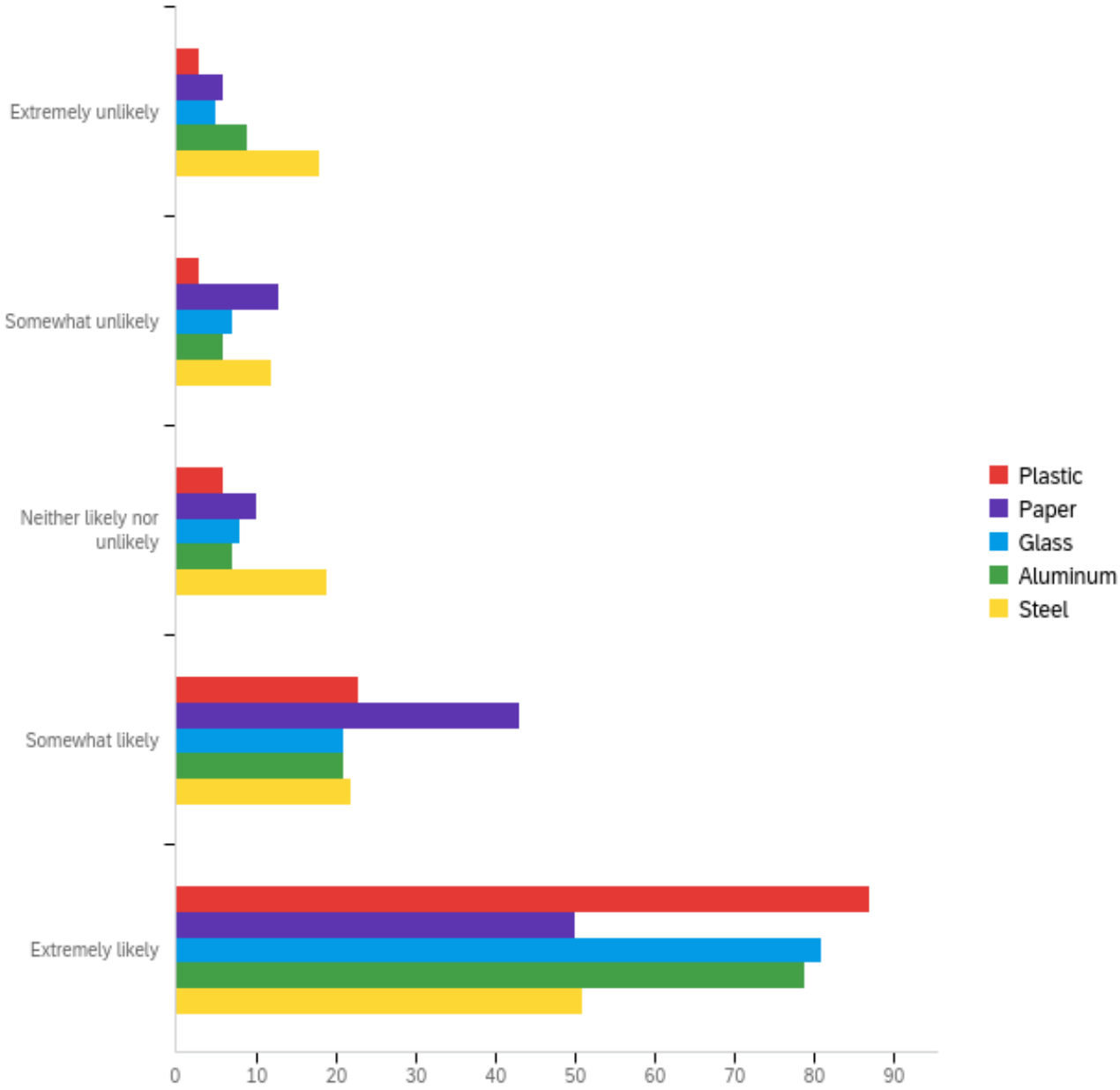


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I will look for a recycling bin for my recyclable waste	1.00	5.00	3.99	1.11	1.22	122
2	I will ask if recycling is available	1.00	5.00	3.11	1.37	1.87	122
3	I will throw my recyclable waste in the trash if recycling	1.00	5.00	4.29	0.99	0.98	122

	is not an option						
4	I will hold on to my recyclable waste until I can properly recycle it	1.00	5.00	2.25	1.41	1.99	122

#	Question	Extremely unlikely		Somewhat unlikely		Neither likely nor unlikely		Somewhat likely		Extremely likely		Total
1	I will look for a recycling bin for my recyclable waste	4.92%	6	9.02%	11	4.92%	6	44.26%	54	36.89%	45	122
2	I will ask if recycling is available	13.93%	17	26.23%	32	14.75%	18	24.59%	30	20.49%	25	122
3	I will throw my recyclable waste in The trash if recycling is not an option	3.28%	4	4.92%	6	4.10%	5	35.25%	43	52.46%	64	122
4	I will hold on to my recyclable waste until I can properly recycle it	45.08%	55	20.49%	25	7.38%	9	18.03%	22	9.02%	11	122

8. Please indicate how likely you are to recycle the following materials

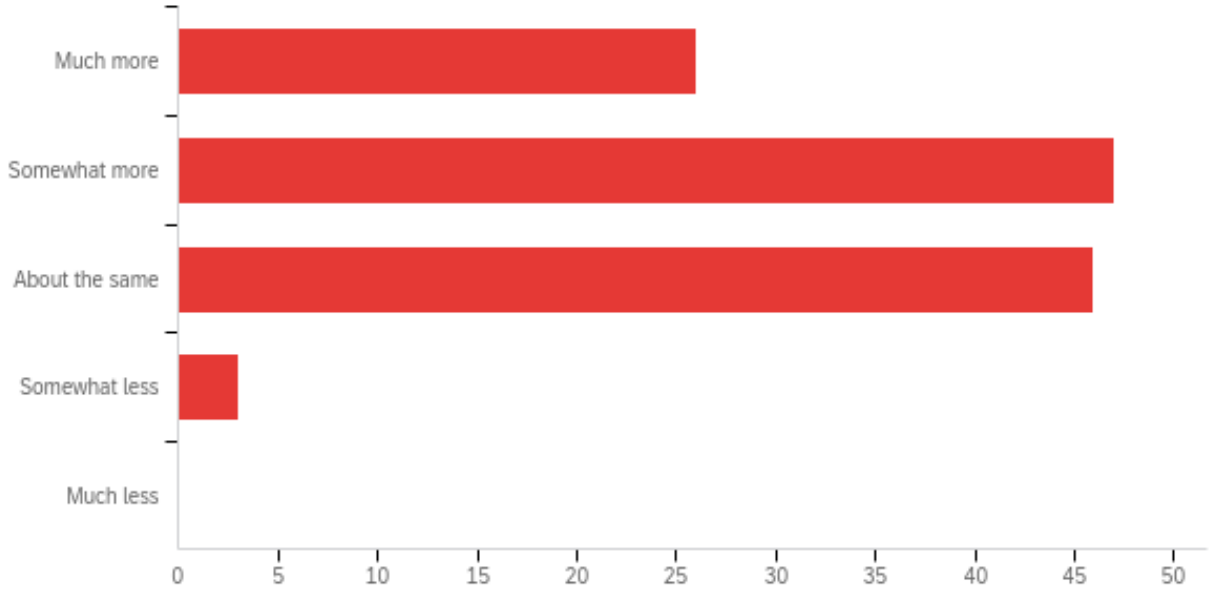


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Plastic	1.00	5.00	4.54	0.89	0.79	122
2	Paper	1.00	5.00	3.97	1.17	1.36	122
3	Glass	1.00	5.00	4.36	1.09	1.20	122

4	Aluminum	1.00	5.00	4.27	1.22	1.49	122
5	Steel	1.00	5.00	3.62	1.47	2.15	122

#	Question	Extremely unlikely		Somewhat unlikely		Neither likely nor unlikely		Somewhat likely		Extremely likely		Total
1	Plastic	2.46%	3	2.46%	3	4.92%	6	18.85%	23	71.31%	87	122
2	Paper	4.92%	6	10.66%	13	8.20%	10	35.25%	43	40.98%	50	122
3	Glass	4.10%	5	5.74%	7	6.56%	8	17.21%	21	66.39%	81	122
4	Aluminum	7.38%	9	4.92%	6	5.74%	7	17.21%	21	64.75%	79	122
5	Steel	14.75%	18	9.84%	12	15.57%	19	18.03%	22	41.80%	51	122

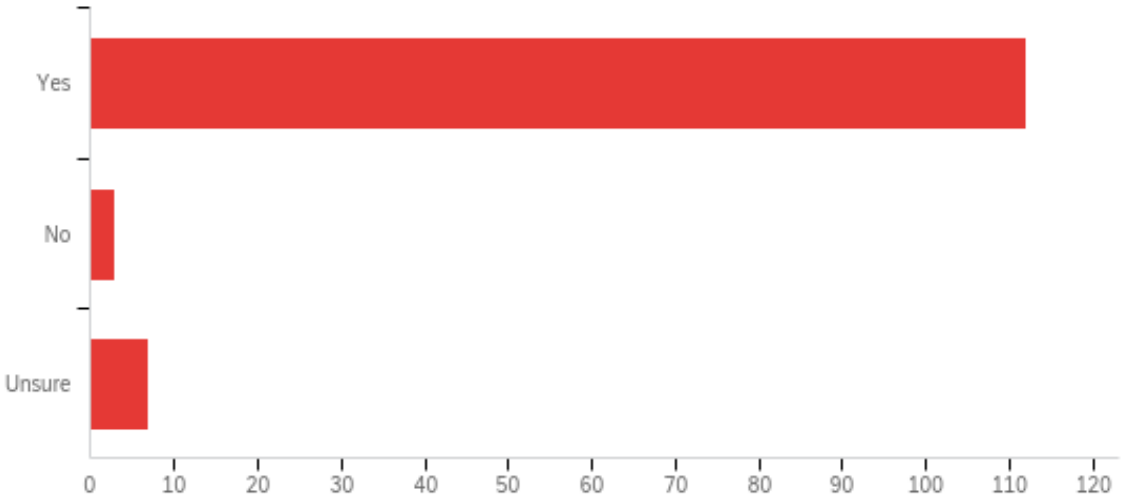
9. Do you believe that recycling plastic makes more of a positive environmental impact than recycling other materials (paper, glass, aluminum, steel)?



#	Field	Minimum	Maximum	Mean	Std viation	Variance	Count
1	Do you believe that recycling lastic makes more of a positive onmental impact than recycling other materials (paper, glass, aluminum, steel)?	1.00	4.00	2.21	0.80	0.64	122

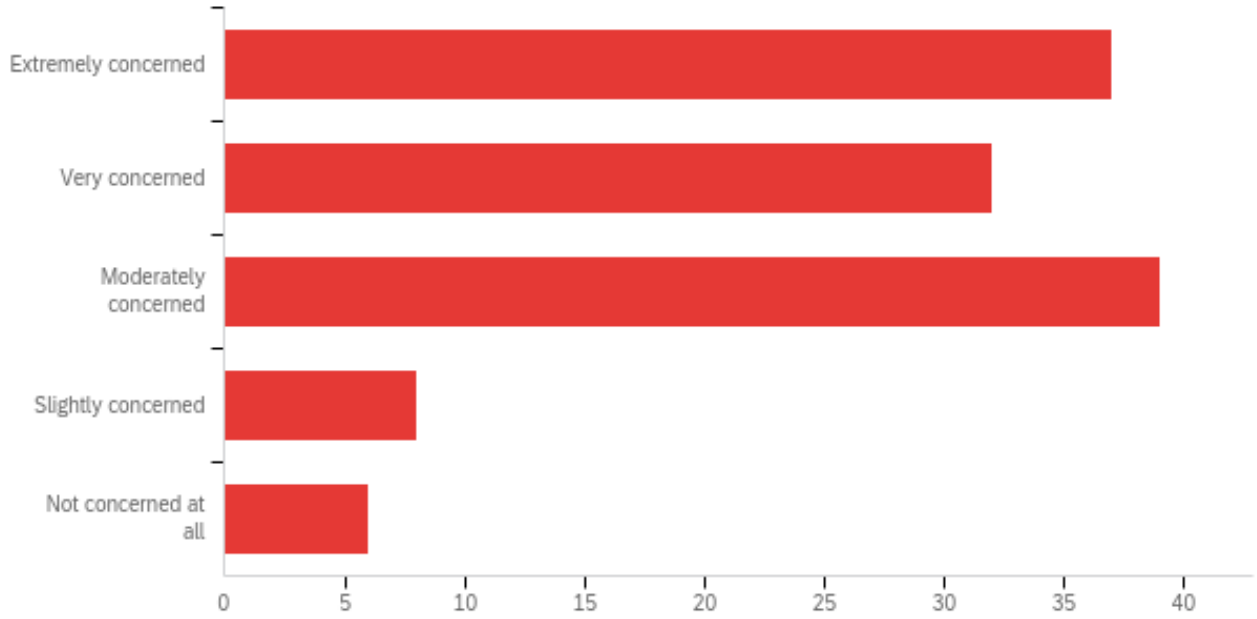
#	Answer	%	Count
1	Much more	21.31%	26
2	Somewhat more	38.52%	47
3	About the same	37.70%	46
4	Somewhat less	2.46%	3
5	Much less	0.00%	0
	Total	100%	122

10. Do you believe that recycling plastic makes a positive difference for the environment?



#	Answer	%	Count
1	Yes	91.80%	112
2	No	2.46%	3
3	Unsure	5.74%	7
	Total	100%	122

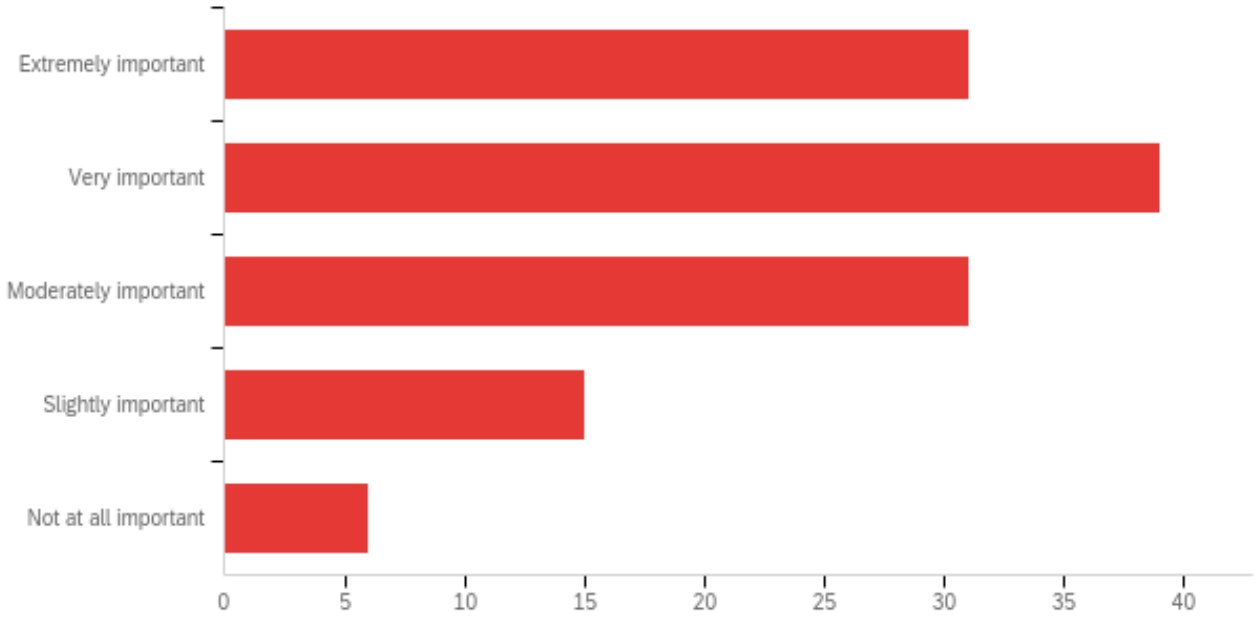
11. How concerned are you with how plastic waste affects the environment?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How concerned are you how plastic waste affects the environment?	1.00	5.00	2.30	1.11	1.24	122

#	Answer	%	Count
1	Extremely concerned	30.33%	37
2	Very concerned	26.23%	32
3	Moderately concerned	31.97%	39
4	Slightly concerned	6.56%	8
5	Not concerned at all	4.92%	6
	Total	100%	122

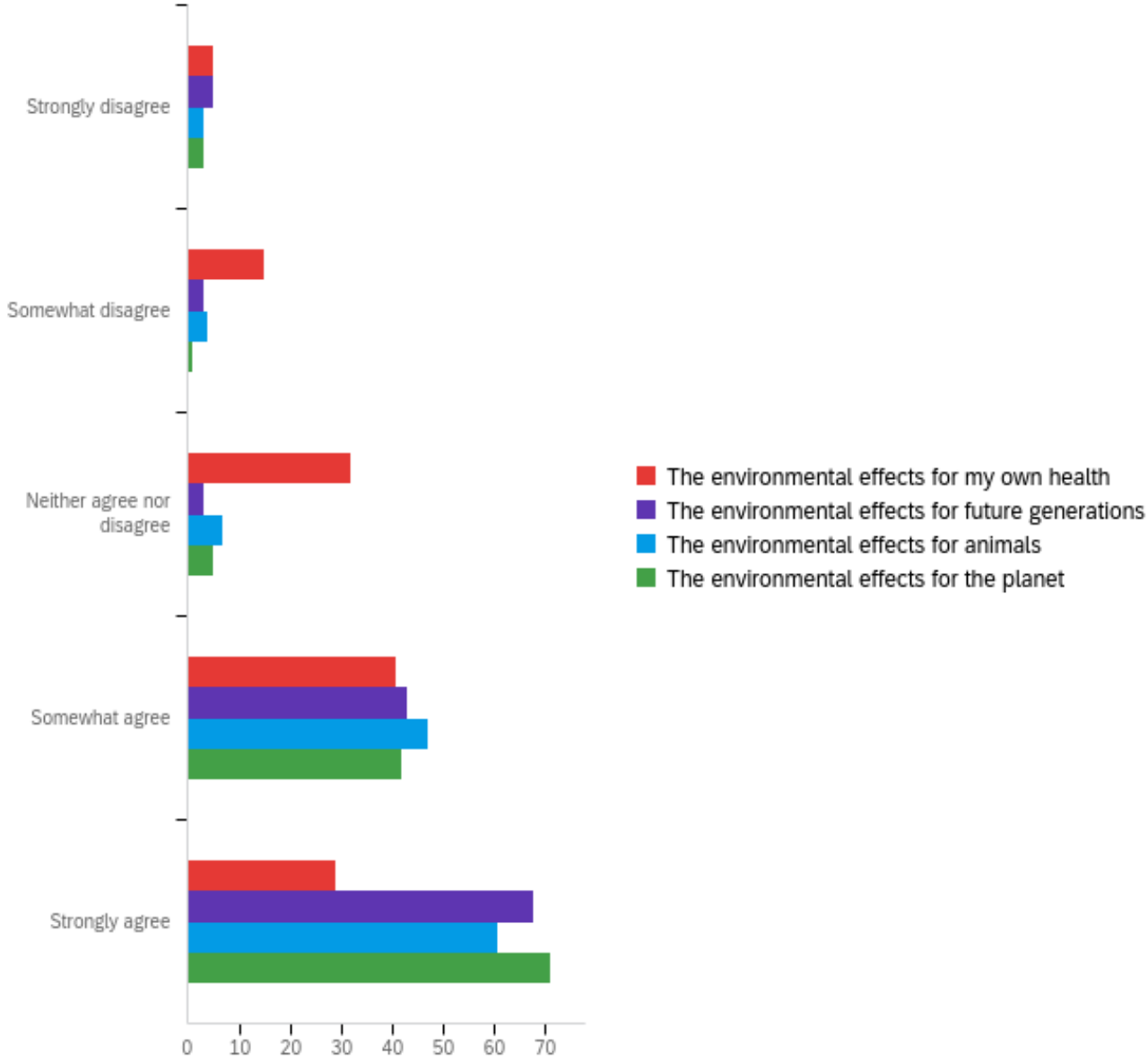
12. How important is it to you that others recycle?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How important is it to you that others recycle?	1.00	5.00	2.39	1.13	1.29	122

#	Answer	%	Count
1	Extremely important	25.41%	31
2	Very important	31.97%	39
3	Moderately important	25.41%	31
4	Slightly important	12.30%	15
5	Not at all important	4.92%	6
	Total	100%	122

13. What environmental effects are you most concerned about if others don't recycle?

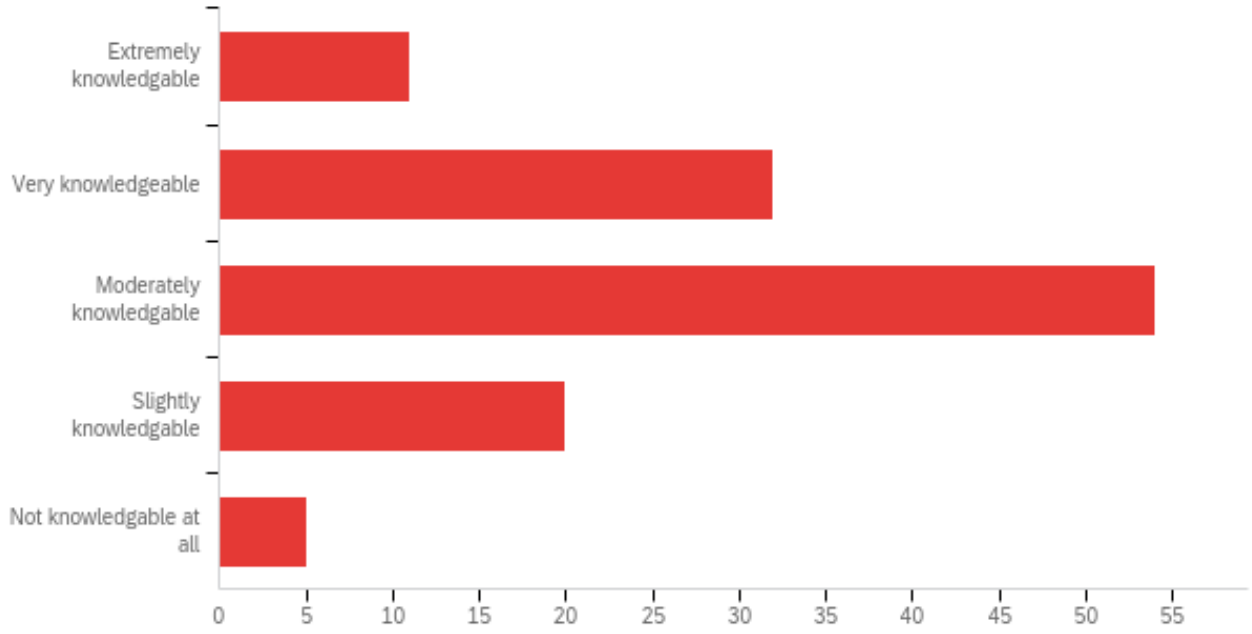


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The environmental effects for my own health	1.00	5.00	3.61	1.10	1.21	122
2	The environmental effects for future generations	1.00	5.00	4.36	0.96	0.92	122
3	The environmental effects for animals	1.00	5.00	4.30	0.90	0.82	122

4	The environmental effects for the planet	1.00	5.00	4.45	0.82	0.67	122

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	The environmental effects for my own health	4.10%	5	12.30%	15	26.23%	32	33.61%	41	23.77%	29	122
2	The environmental effects for future generations	4.10%	5	2.46%	3	2.46%	3	35.25%	43	55.74%	68	122
3	The environmental effects for animals	2.46%	3	3.28%	4	5.74%	7	38.52%	47	50.00%	61	122
4	The environmental effects for the planet	2.46%	3	0.82%	1	4.10%	5	34.43%	42	58.20%	71	122

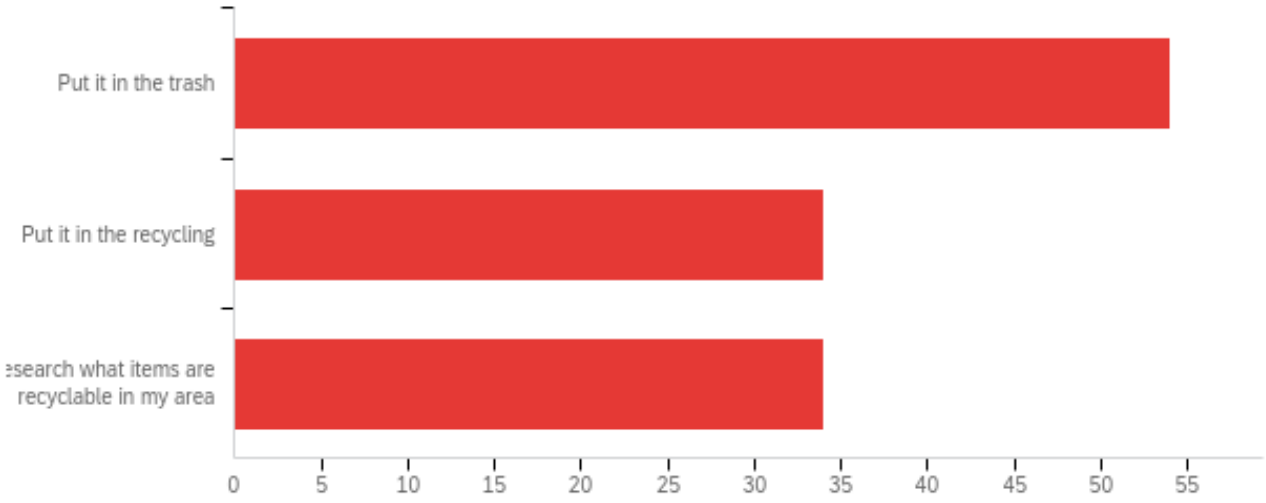
14. How knowledgeable do you believe you are on how to properly recycle plastic?



#	Field	Minimum	Maximum	Mean	Std eviation	Variance	Count
1	How knowledgeable do you ve you are on how to properly recycle plastic?	1.00	5.00	2.80	0.96	0.91	122

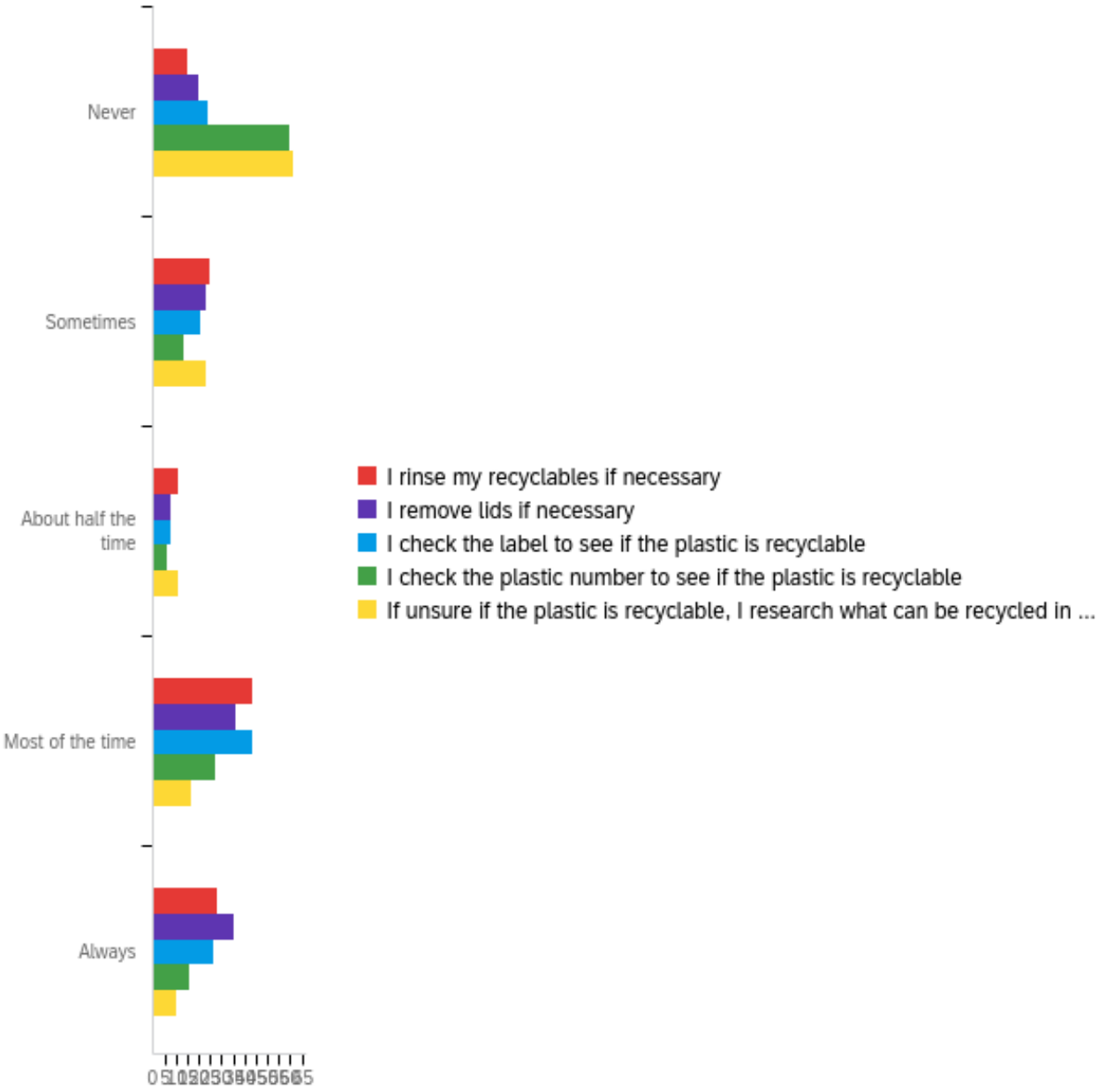
#	Answer	%	Count
1	Extremely knowledgable	9.02%	11
2	Very knowledgeable	26.23%	32
3	Moderately knowledgable	44.26%	54
4	Slightly knowledgable	16.39%	20
5	Not knowledgable at all	4.10%	5
	Total	100%	122

15. When unsure if an item can be recycled or not I:



#	Answer	%	Count
1	Put it in the trash	44.26%	54
2	Put it in the recycling	27.87%	34
3	Research what items are recyclable in my area	27.87%	34
	Total	100%	122

16. How often do you do the following when recycling plastic?

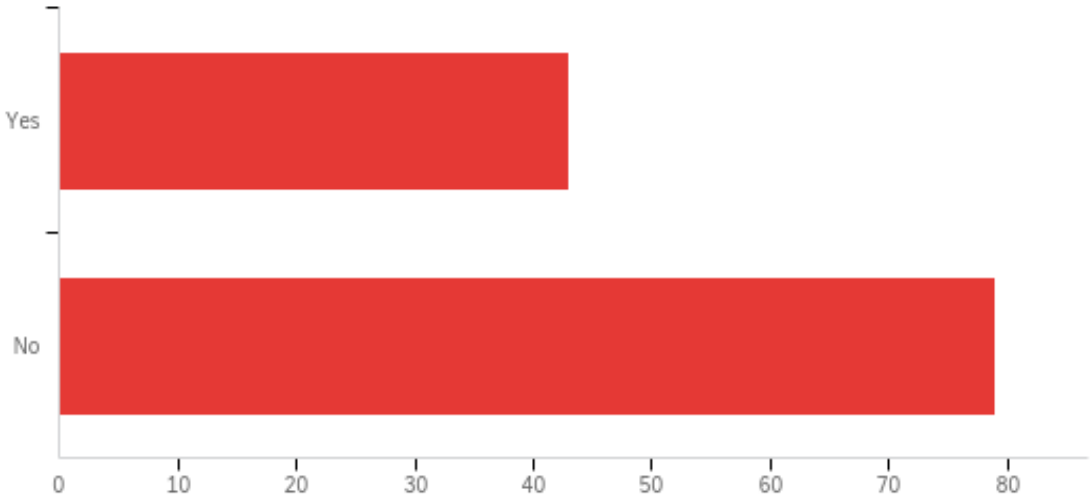


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I rinse my recyclables if necessary	1.00	5.00	3.36	1.36	1.84	122
2	I remove lids if necessary	1.00	5.00	3.35	1.47	2.16	122
3	I check the label to see if the plastic is recyclable	1.00	5.00	3.21	1.46	2.12	122

4	I check the plastic number to see if the plastic is recyclable	1.00	5.00	2.39	1.57	2.45	122
5	If unsure if the plastic is recyclable, I research what can be recycled in my area	1.00	5.00	2.11	1.37	1.87	122

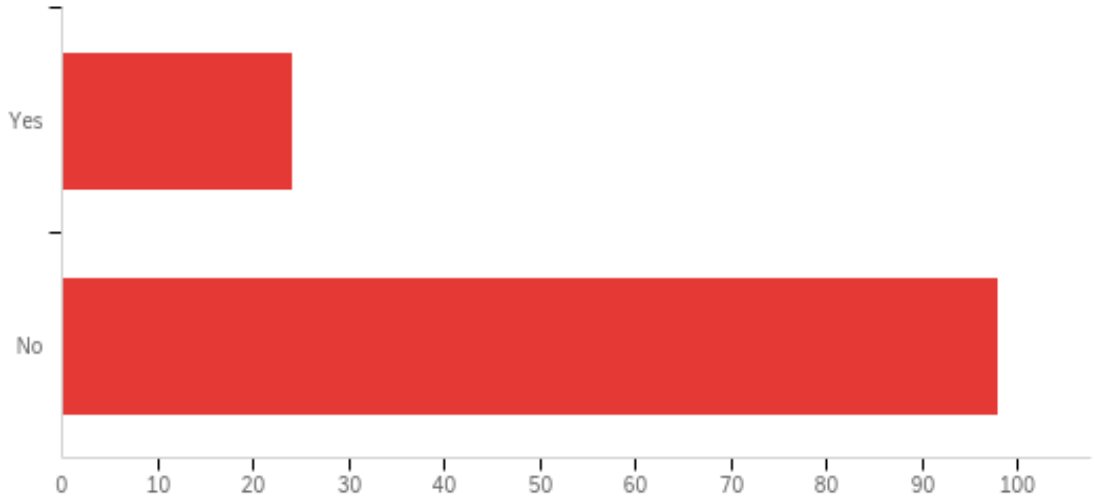
#	Question	Never		Sometimes		About half the time		Most of the time		Always		Total
1	I rinse my recyclables if necessary	12.30%	15	20.49%	25	9.02%	11	35.25%	43	22.95%	28	122
2	I remove lids if necessary	16.39%	20	18.85%	23	6.56%	8	29.51%	36	28.69%	35	122
3	I check the label to see if the plastic is recyclable	19.67%	24	17.21%	21	6.56%	8	35.25%	43	21.31%	26	122
4	I check the plastic number to see if the plastic is recyclable	49.18%	60	10.66%	13	4.92%	6	22.13%	27	13.11%	16	122
5	If unsure if the plastic is recyclable, I research what can be recycled in my area	50.00%	61	18.85%	23	9.02%	11	13.93%	17	8.20%	10	122

17. Plastic grocery bags



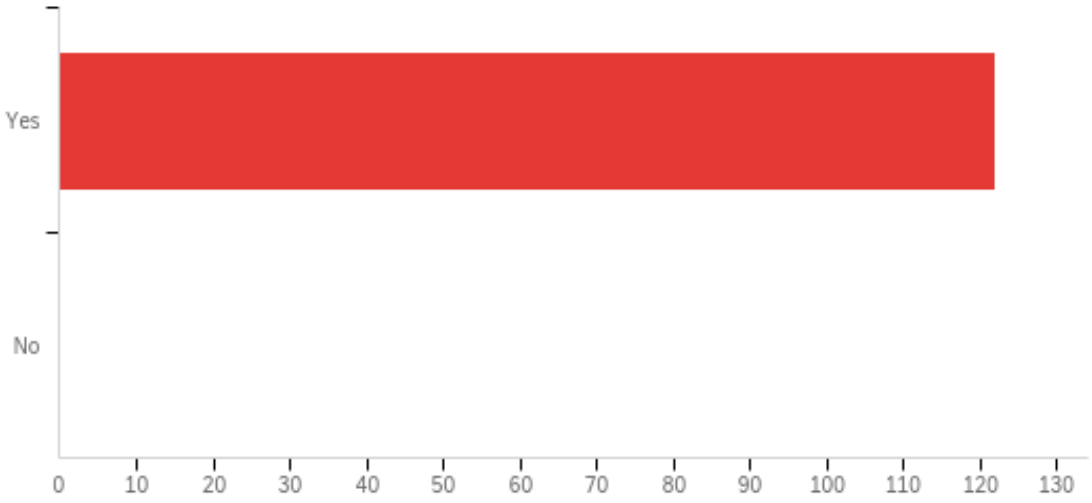
#	Answer	%	Count
1	Yes	35.25%	43
2	No	64.75%	79
	Total	100%	122

18. Styrofoam plastics



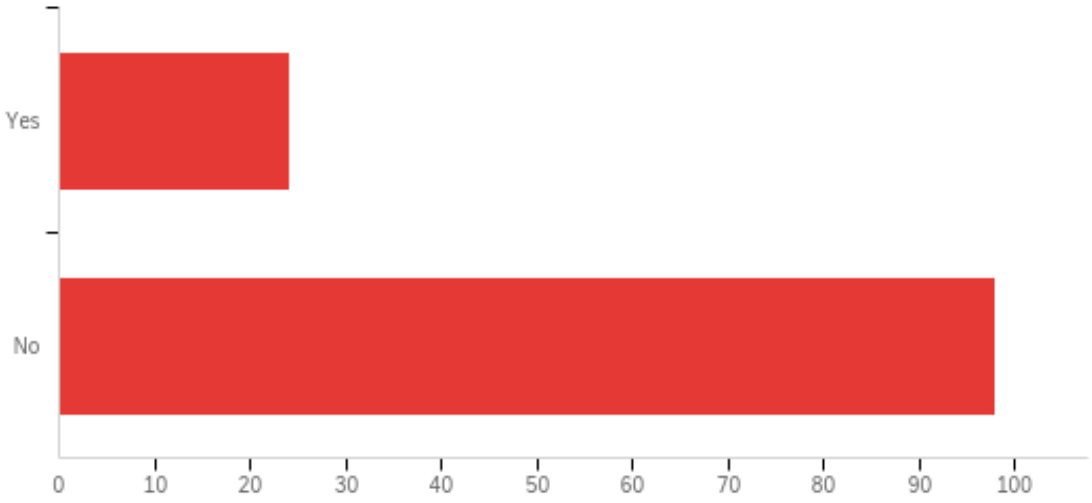
#	Answer	%	Count
1	Yes	19.67%	24
2	No	80.33%	98
	Total	100%	122

19. Plastic water bottles



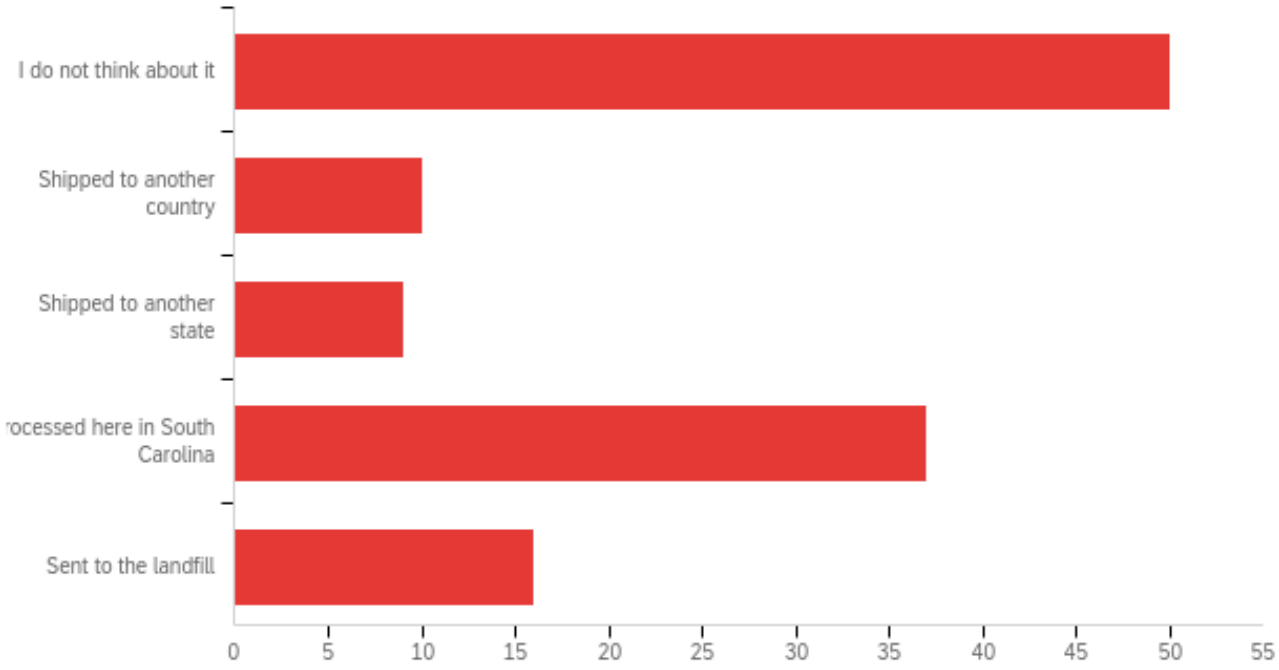
#	Answer	%	Count
1	Yes	100.00%	122
2	No	0.00%	0
	Total	100%	122

20. Plastic food containers with food remnants



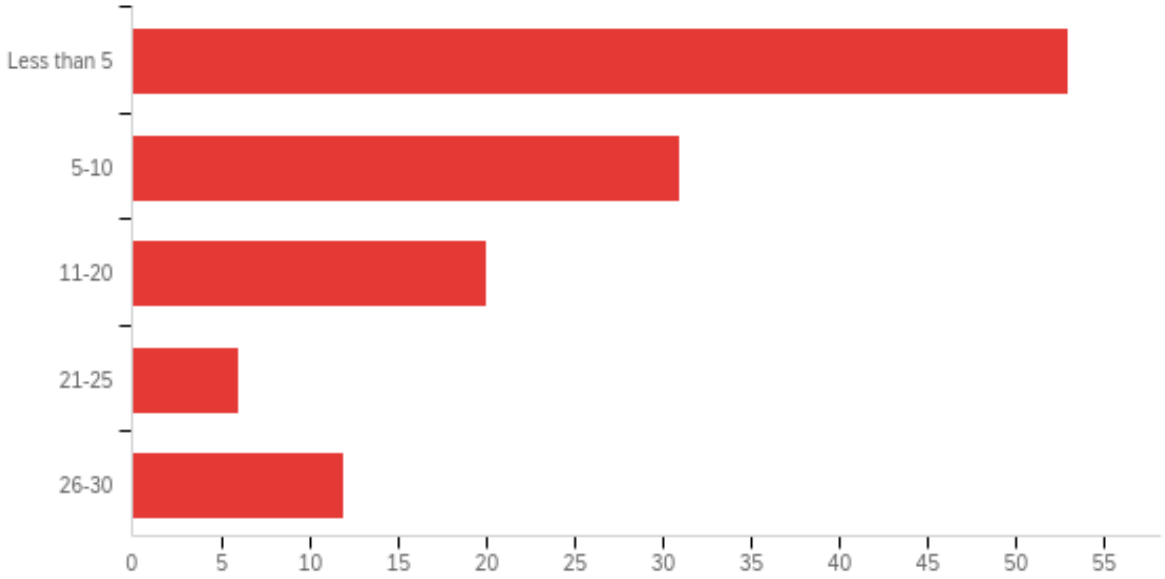
#	Answer	%	Count
1	Yes	19.67%	24
2	No	80.33%	98
	Total	100%	122

21. Where do you think that most of your plastic recyclables go?



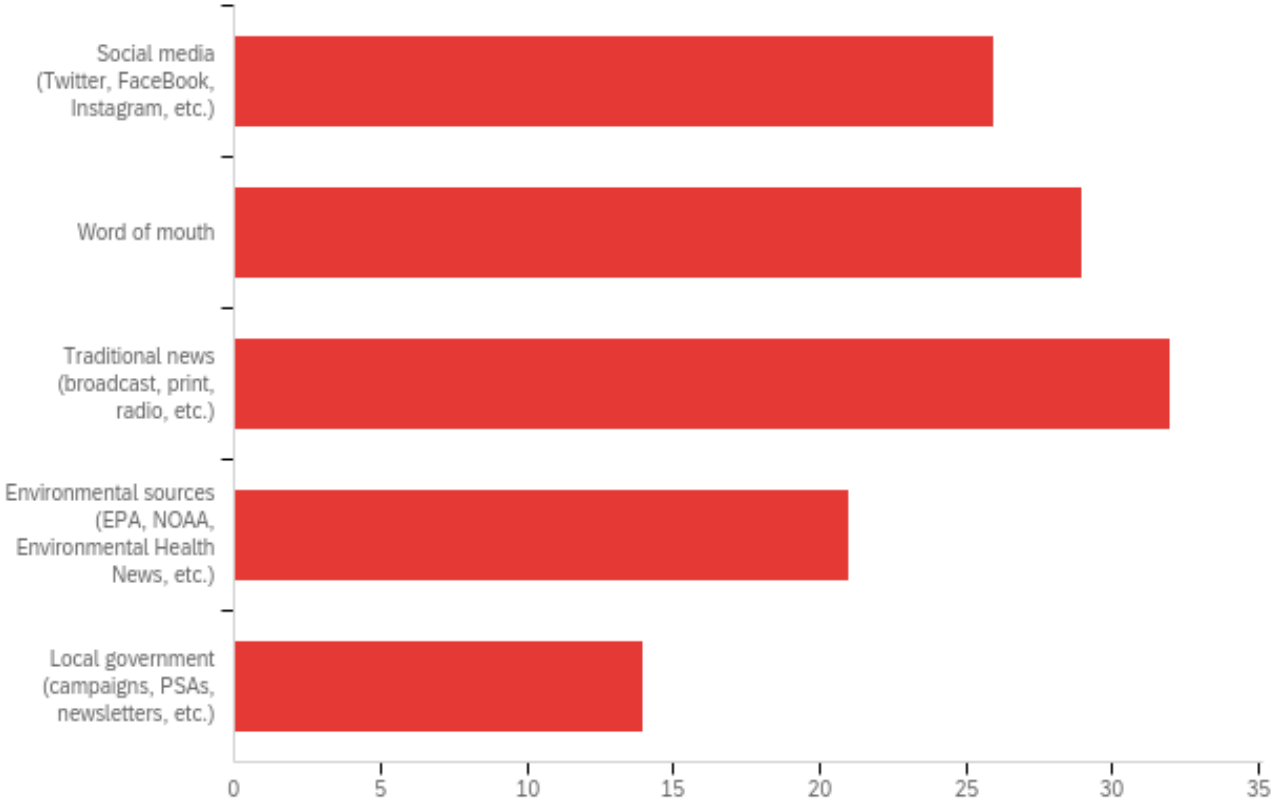
#	Answer	%	Count
1	I do not think about it	40.98%	50
2	Shipped to another country	8.20%	10
3	Shipped to another state	7.38%	9
4	Processed here in South Carolina	30.33%	37
5	Sent to the landfill	13.11%	16
	Total	100%	122

22. How many recycling facilities dedicated to plastic do you think there are in South Carolina?



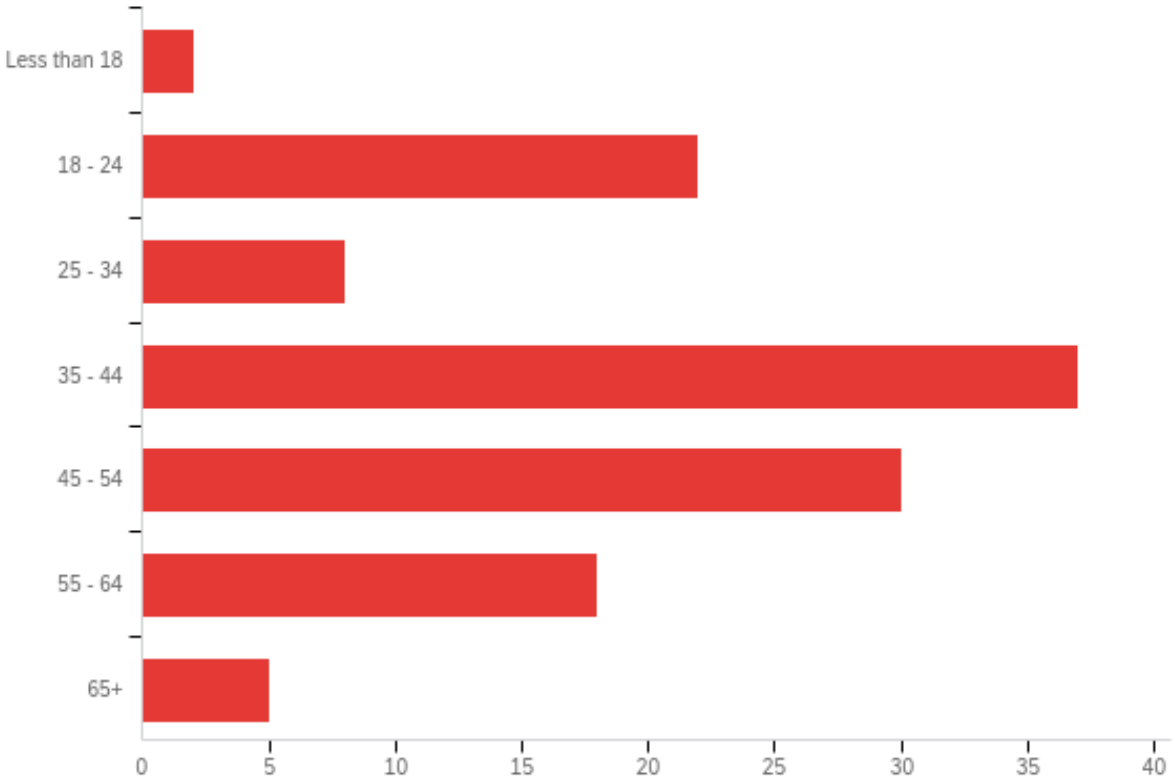
#	Answer	%	Count
1	Less than 5	43.44%	53
2	5-10	25.41%	31
3	11-20	16.39%	20
4	21-25	4.92%	6
5	26-30	9.84%	12
	Total	100%	122

23. Where do you get most of your information about environmental effects of recycling?



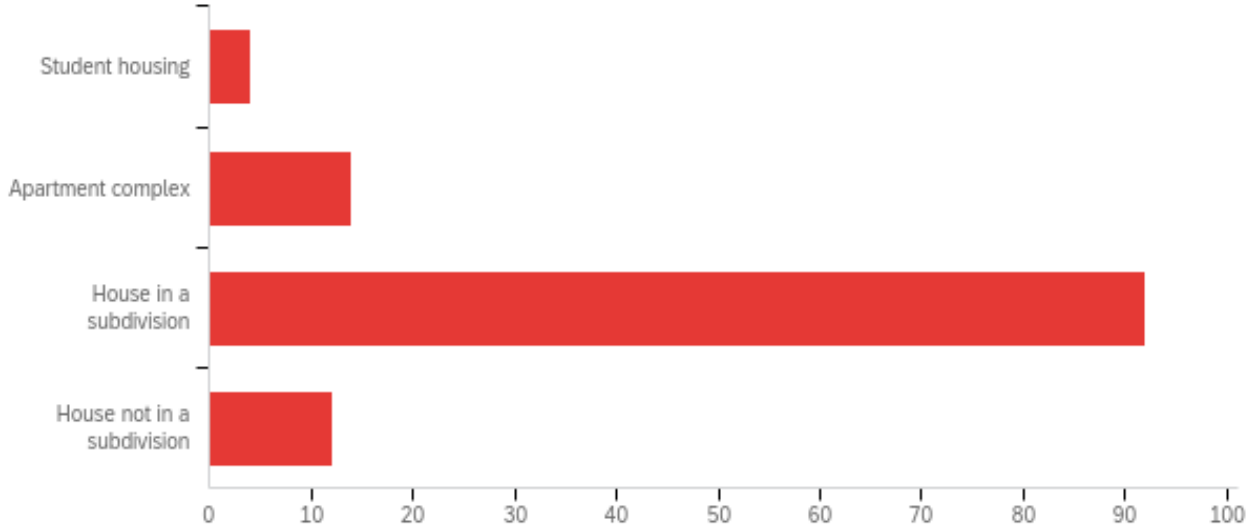
#	Answer	%	Count
1	Social media (Twitter, FaceBook, Instagram, etc.)	21.31%	26
2	Word of mouth	23.77%	29
3	Traditional news (broadcast, print, radio, etc.)	26.23%	32
4	Environmental sources (EPA, NOAA, Environmental Health News, etc.)	17.21%	21
5	Local government (campaigns, PSAs, newsletters, etc.)	11.48%	14
	Total	100%	122

24. Age



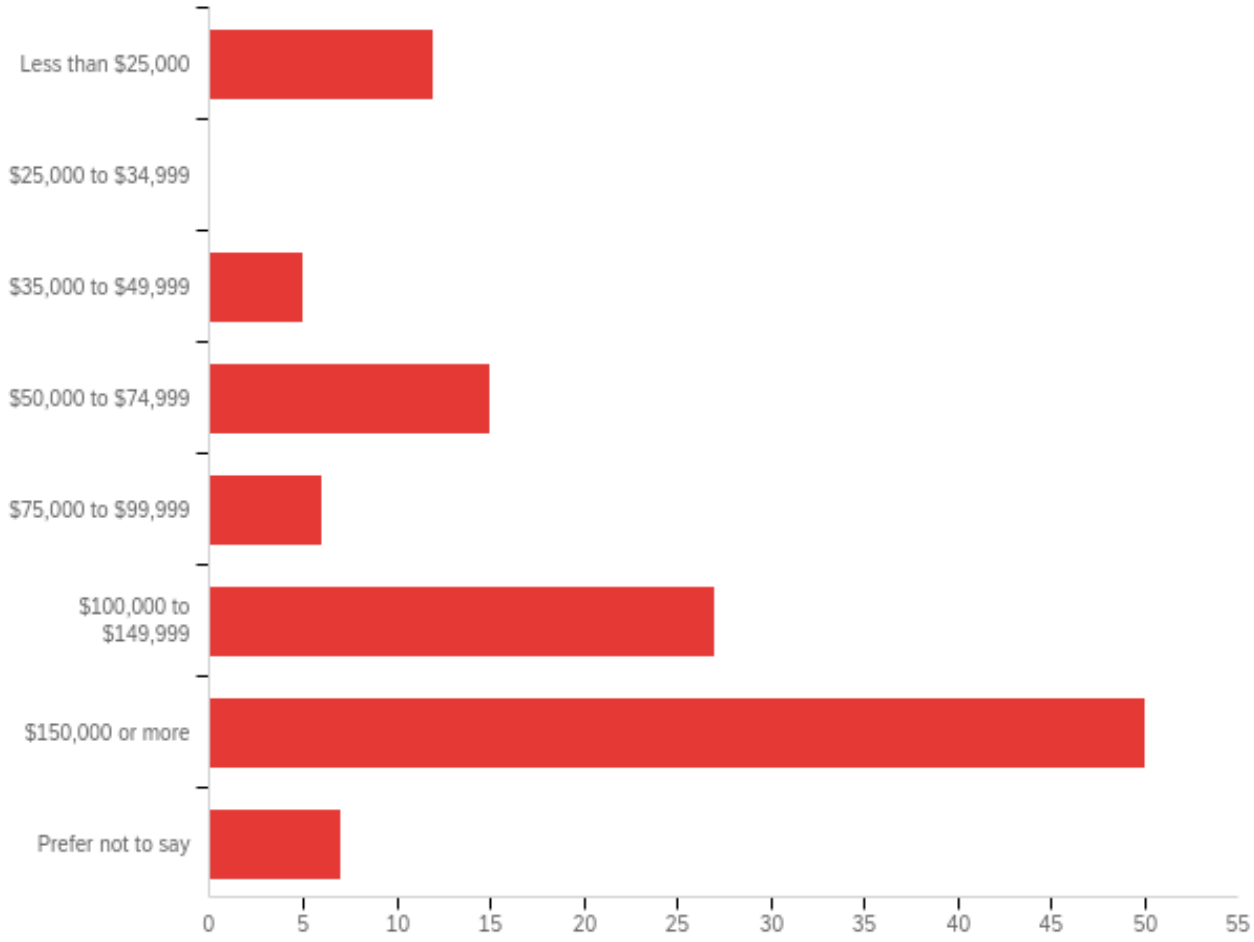
#	Answer	%	Count
1	Less than 18	1.64%	2
2	18 - 24	18.03%	22
3	25 - 34	6.56%	8
4	35 - 44	30.33%	37
5	45 - 54	24.59%	30
6	55 - 64	14.75%	18
7	65+	4.10%	5
	Total	100%	122

25. Which of the following best describes your current housing?



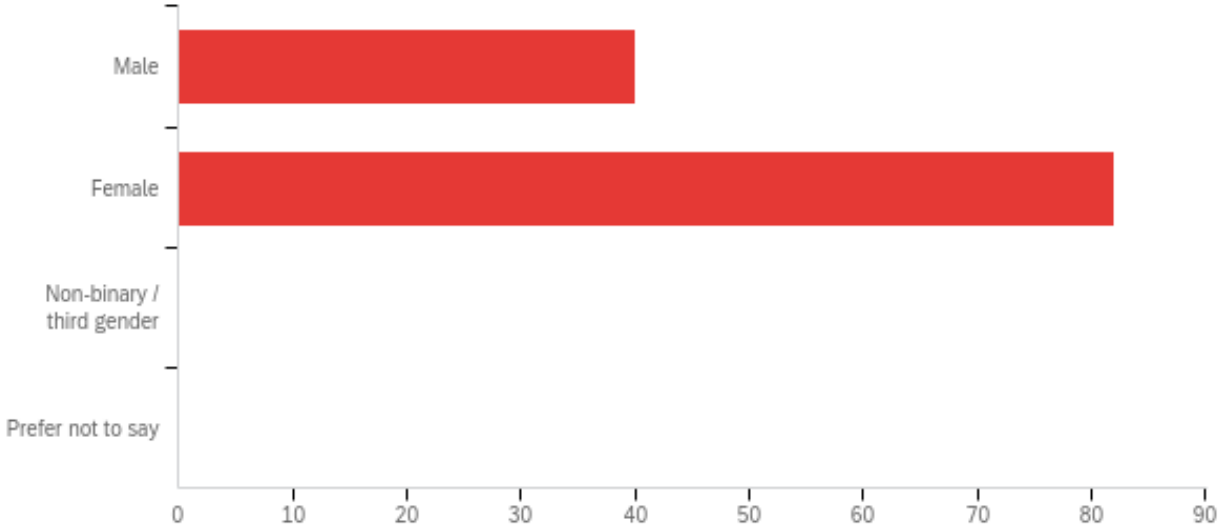
#	Answer	%	Count
1	Student housing	3.28%	4
2	Apartment complex	11.48%	14
3	House in a subdivision	75.41%	92
4	House not in a subdivision	9.84%	12
	Total	100%	122

26. What was your total household income before taxes during the past 12 months?



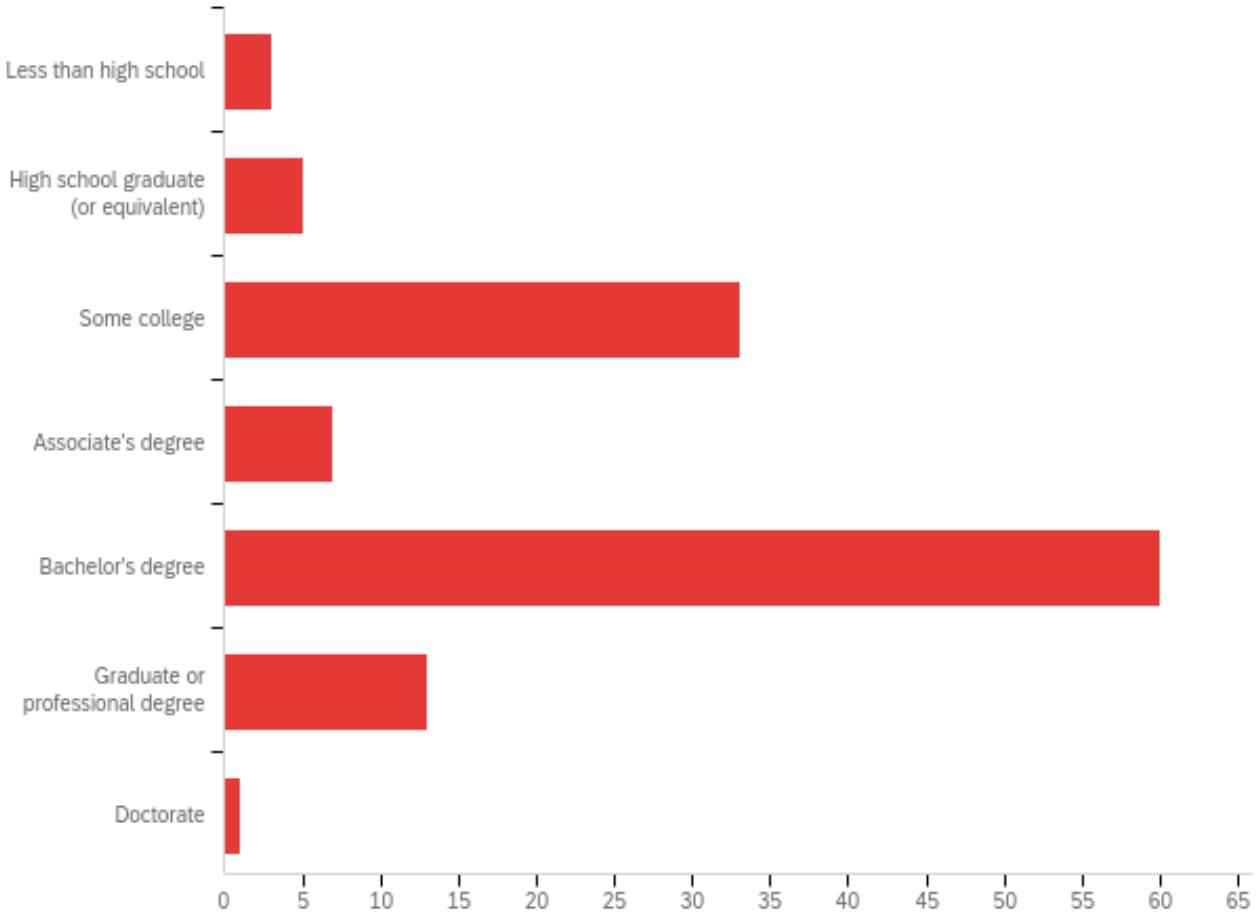
#	Answer	%	Count
1	Less than $25,000	9.84%	12
2	$25,000 to $34,999	0.00%	0
3	$35,000 to $49,999	4.10%	5
4	$50,000 to $74,999	12.30%	15
5	$75,000 to $99,999	4.92%	6
6	$100,000 to $149,999	22.13%	27
7	$150,000 or more	40.98%	50
8	Prefer not to say	5.74%	7
	Total	100%	122

27. What is your gender?



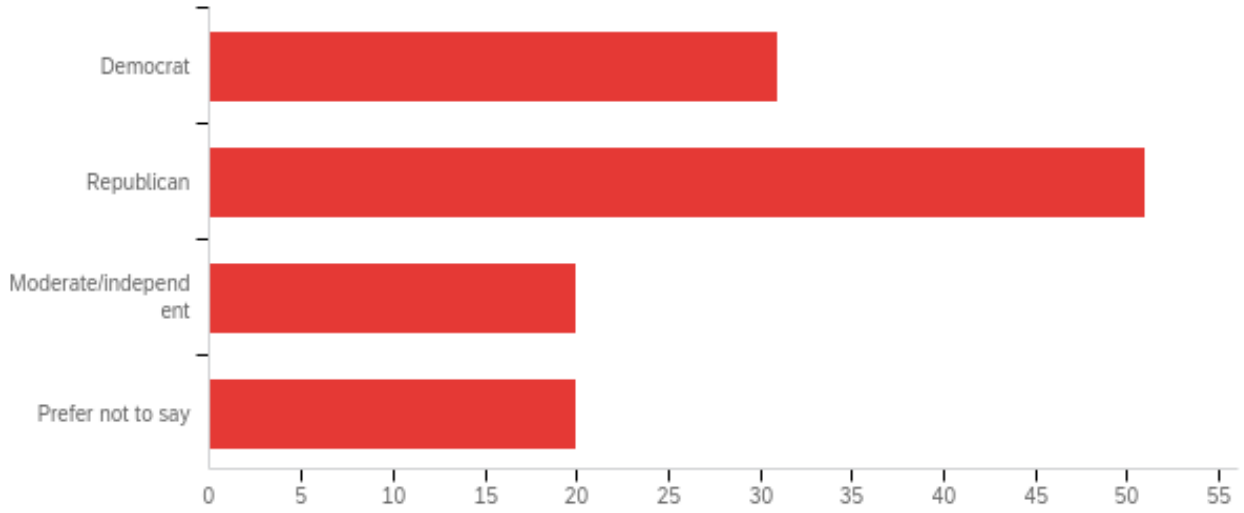
#	Answer	%	Count
1	Male	32.79%	40
2	Female	67.21%	82
3	Non-binary / third gender	0.00%	0
4	Prefer not to say	0.00%	0
	Total	100%	122

28. What is the highest degree or level of education you have completed?



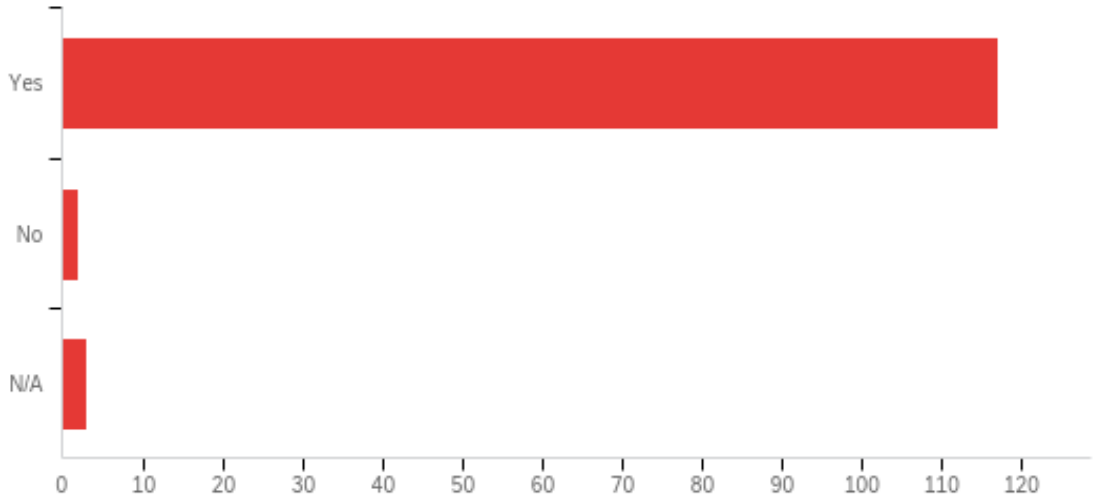
#	Answer	%	Count
1	Less than high school	2.46%	3
2	High school graduate (or equivalent)	4.10%	5
3	Some college	27.05%	33
4	Associate's degree	5.74%	7
5	Bachelor's degree	49.18%	60
6	Graduate or professional degree	10.66%	13
7	Doctorate	0.82%	1
	Total	100%	122

29. What is your political affiliation?



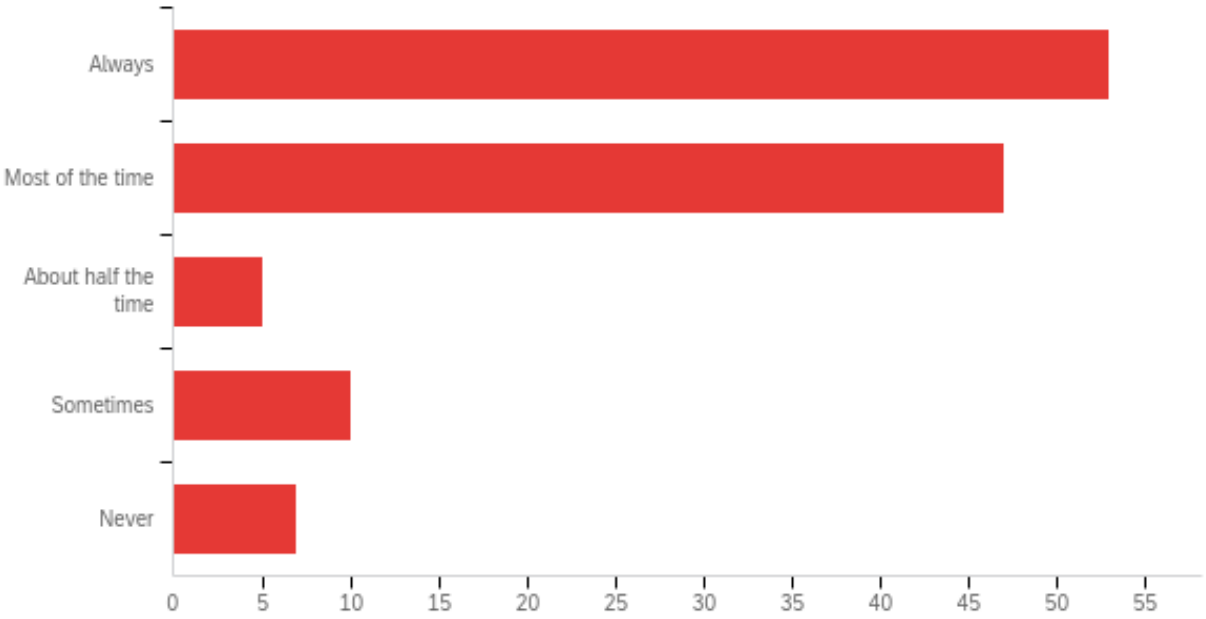
#	Answer	%	Count
1	Democrat	25.41%	31
2	Republican	41.80%	51
3	Moderate/independent	16.39%	20
4	Prefer not to say	16.39%	20
	Total	100%	122

30. Are you registered to vote?



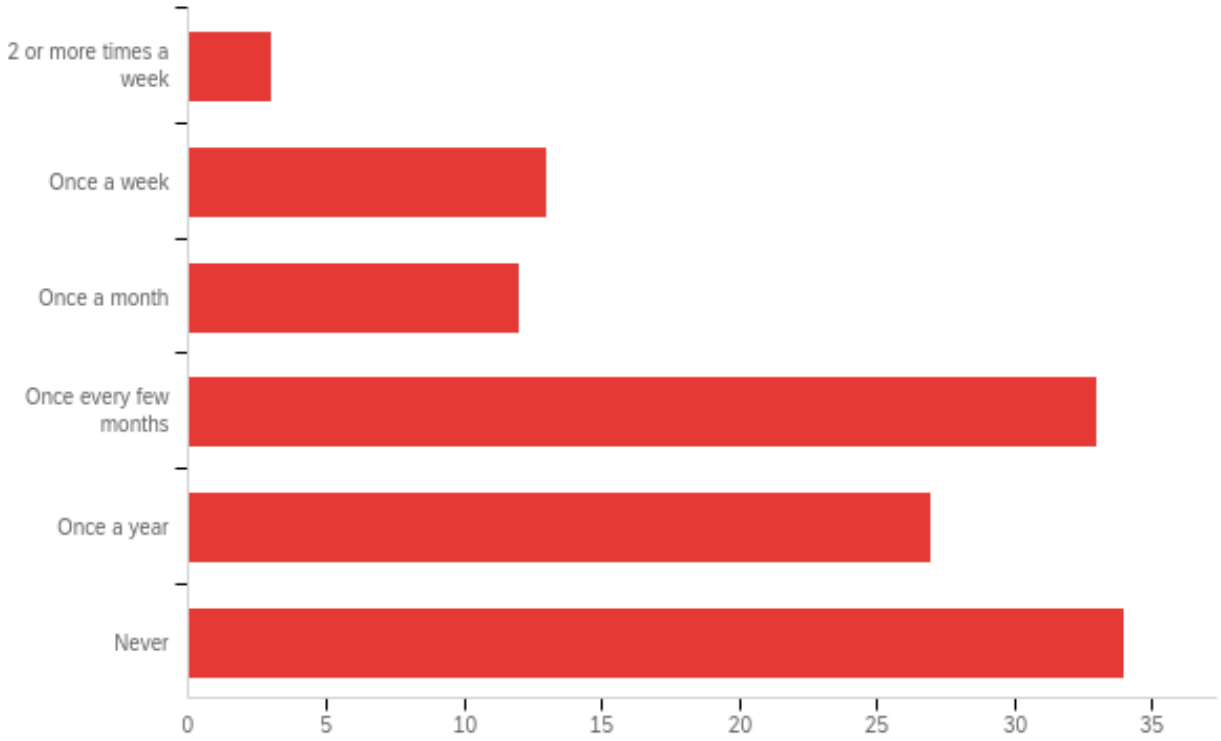
#	Answer	%	Count
1	Yes	95.90%	117
2	No	1.64%	2
3	N/A	2.46%	3
	Total	100%	122

31. Do you vote in both national and local elections?



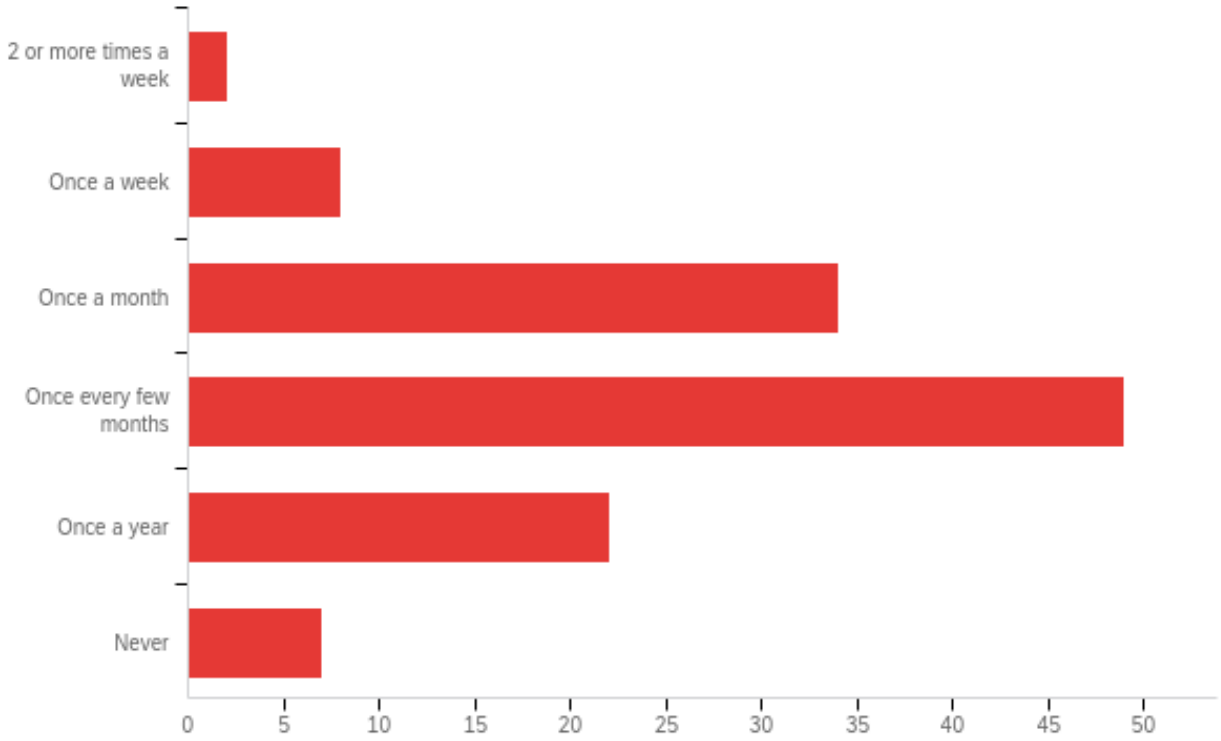
#	Answer	%	Count
1	Always	43.44%	53
2	Most of the time	38.52%	47
3	About half the time	4.10%	5
4	Sometimes	8.20%	10
5	Never	5.74%	7
	Total	100%	122

32. How often do you volunteer in your community?



#	Answer	%	Count
1	2 or more times a week	2.46%	3
2	Once a week	10.66%	13
3	Once a month	9.84%	12
4	Once every few months	27.05%	33
5	Once a year	22.13%	27
6	Never	27.87%	34
	Total	100%	122

33. How often do you donate to or raise money for a charitable cause?



#	Answer	%	Count
1	2 or more times a week	1.64%	2
2	Once a week	6.56%	8
3	Once a month	27.87%	34
4	Once every few months	40.16%	49
5	Once a year	18.03%	22
6	Never	5.74%	7
	Total	100%	122

APPENDIX B

Figure 1

	Counties with no curbside recycling program
Mean	14.68842105
Variance	144.580114
Observations	19
Hypothesized Mean Difference	0
df	18
t Stat	-4.898110993
P(T<=t) one-tail	5.79022E-05
t Critical one-tail	1.734063607
P(T<=t) two-tail	0.000115804
t Critical two-tail	2.10092204