

EVALUATING VISITATION AT DON EDWARDS NWR: ENCOURAGING  
ENVIRONMENTAL EDUCATION AND URBAN CONSERVATION

A Thesis submitted to the faculty of  
San Francisco State University  
In partial fulfillment of  
the requirements for  
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Master of Arts

In

Geography: Resource Management and Environmental Planning

by

Jessica Beth Sloan

San Francisco, California

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## CERTIFICATION OF APPROVAL

I certify that I have read *Evaluating Visitation at Don Edwards NWR: Encouraging Environmental Education and Urban Conservation* by Jessica Beth Sloan, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirement for the degree Master of Arts in Geography: Resource Management and Environmental Planning at San Francisco State University.

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EVALUATING VISITATION AT DON EDWRADS NWR: ENCOURAGING  
ENVIRONMENTAL EDUCATION AND URBAN CONSERVATION

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2017

Urban green spaces offer residents and visitors multiple ecosystem services and psychological benefits. Resource managers at urban green spaces have a unique opportunity to connect with visitors and build an informed conservation community through environmental education to promote urban conservation. The Don Edwards SF Bay National Wildlife Refuge is an example of an urban green space that has a multifaceted mission to both provide quality wildlife habitat and visitor services. This study was conducted in the spring of 2016 and collected over 200 surveys at Don Edwards NWR to examine five visitor objectives: demographics and trip characteristics, behaviors and values, awareness levels regarding the refuge, awareness of visitor impacts, and visitor opinions of the refuge. The results of this survey indicate that visitors are mainly using the refuge for recreation and exercise, very much as they might use a neighborhood park. During their visit, however, they are incidentally interacting with interpretative materials that build their interest in environmental education and pro-environmental behavior. Visitors were found to be more ethnically diverse, showed higher than expected awareness levels regarding urban green space benefits, and showed an appetite for continued environmental education. This case study highlights the opportunity for urban green space managers to build a more informed conservation community and promote stewardship by supporting urban wildlife conservation.

I certify that the Abstract is a correct representation of the content of this thesis.

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Chair, Thesis Committee

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Date

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## **Evaluating Visitation at Don Edwards NWR: Encouraging Environmental Education and Urban Conservation**

### **Introduction:**

Almost 80% of Americans choose to live in urban areas (McKinney 2002, USFWS 2011, USFWS 2016a). These areas offer residents many opportunities for sustainable living, such as reductions in car use, and increases in resource efficiency, accessibility, and economic viability (Van den Berget et al. 2007, Thompson 2002). However, urban areas can also have adverse psychological effects on people, and do not offer the physical benefits of open or green space (Chiesura 2004, van den Berg et al. 2007, Matsuoka and Kaplan 2008). Because urban areas include diverse land uses—from areas that are natural to those that have been heavily modified—and are increasing in abundance, managing urban green spaces has become even more important and complicated (Niemelä 1999, Adams 2005).

Urban green spaces (and blue spaces, such as wetlands, ponds, rivers, lakes, and streams), whether small city parks or large preserved areas, offer urban residents a multitude of physical and psychological benefits (Matsuoka and Kaplan 2008). The Don Edwards San Francisco Bay National Wildlife Refuge (Don Edwards NWR or the refuge) is an example of an urban green space that benefits its surrounding community (Figure 1) and requires careful management. This wetland wildlife refuge is nestled next to an extensive metropolis in the southern part of the San Francisco Bay, and was the first federally-managed urban wildlife refuge

overseen by the United States Fish and Wildlife Service (USFWS) (USFWS 2016b, Leong et al. 2016).



**Figure 1:** An aerial view of Don Edwards SF Bay NWR. Notice the grey in the image representing the dense metropolitan area surrounding the vivid greens of the wildlife refuge. Image Source: United States Geographic Survey (USGS)

The USFWS, the National Wildlife Refuge System that manages its lands, and the Urban Wildlife Conservation Program have a challenging multi-faceted mission (USFWS 2016a). They are not only responsible for managing the ecology of their landscapes to provide quality wildlife habitat, but also for educating the public about environmental issues and creating opportunities for outdoor recreation (USFWS 2011). This mission can be challenging as it means managing landscapes near urban centers and the visitors who use them. Given the growth of urbanized areas and the diversity of people living there, new strategies on how to educate

diverse visitor populations about environmental awareness and conservation require up-to-date information about visitors, their activities and their perceptions.

This study aims to better understand the visitor populations of the Don Edwards NWR by examining visitor demographics and trip characteristics, behaviors and values regarding the refuge, awareness of the refuge's purpose and functions, awareness of potential visitor impacts to the refuge, and visitor opinions regarding existing services and facilities. Visitors also assessed how the refuge could address each of these objectives to better enhance their experience at Don Edwards NWR, in an effort to inform visitor services and environmental education strategies.

This information will help to answer two main research questions: First, how does understanding visitation in urban green spaces enhance visitor experiences? And secondly, how does visitation promote and maintain wildlife habitat and urban ecology? Understanding visitation at an urban wildlife refuge like Don Edwards NWR can act as a case study for concepts in environmental education in outdoor spaces, urban ecology, diversity in outdoor places (especially in urban areas), and aspects of recreation ecology. Comparing the results of this study to results of other urban wildlife refuges and urban green spaces can help gauge the success of urban outreach and determine what management strategies are working and which are not. As urban areas continue to grow, this study can highlight the importance of creating more urban green spaces and keeping these spaces relevant to their larger

communities by educating residents about the physical and social benefits of open space.

## **Literature Review**

### **Urban Wildlife Ecology**

Urban wildlife ecology and conservation is a discipline that is global in scope (Adams 2005). Broadly, it refers to the scientific study of living organisms and their relation to the urban environment (Niemela 1999). While the field of urban wildlife ecology is complex and has traditionally focused on the biota in urban areas, for the purpose of this paper the focus will be on research from North America that has been oriented towards the social sciences (ibid.).

While many human activities cause habitat loss, urban development produces some of the highest local extinction rates and loss of habitat for native species (McKinney 2002). Urban areas cover over 5% of the surface area of the United States, which is more than the combined total of national and state parks (ibid.). This highlights the intrinsic ecological value of urban green spaces in maintaining biodiversity in urban areas (Niemela 1999).

Urban wildlife refuge management is grounded in urban ecology, and is a response to this loss of habitat in urban areas. Urban ecology is reflected in the USFWS's core mission to "work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American

people” (USFWS 2015). As early as the 1960s, researchers in the United States began to pay attention to ecology in urban areas, and recognize the importance of urban green spaces to wildlife and biodiversity, but also to local residents (Adams 2005, Nilon 2011). Raymond Dasmann coined the term “new conservation” in 1966, and pointed out that generations of Americans were growing up in cities with little experience in the natural world (Adams 2005). He stated that more wildlife biologists should:

“. . . get out of the woods and into the cities. They must work with city and metropolitan regional planners, with landscape architects and all others concerned with the urban environment to make the cities and metropolitan regions, the places where people live, into environments where each person’s everyday life will be enriched to the maximum extent possible by contact with living things and natural beauty” (Dasmann, 1966).

One way the study of urban ecology can support conservation is by helping to develop a more ecologically informed public (McKinney 2002, Adams 2005). Places like Don Edwards NWR have the unique opportunity to connect with urban residents and teach them about the advantages of urban green spaces. These urban residents can wield huge economic and political pressure when it comes to promoting conservation policies at the local and national scales (McKinney 2002, Nilon 2011). Additionally, urban residents have been found to hold a greater appreciation for many urban species, such as birds, than those living in rural areas (Clergeau et al. 2001). In fact, legislators from highly urbanized areas tend to be more supportive of strengthening conservation policies (McKinney 2002). This is

increasingly important as continued expansion of urban areas seems inevitable (Niemelä 1999). If urban residents value green spaces, have a deep awareness of urban ecology issues, and understand the physical and social benefits associated with urban green spaces, it will strengthen their conservation ethic and create new opportunities for supporting urban green spaces in the future.

### **Ecosystem Services of Urban Green Spaces**

The physical benefits of urban green spaces are often termed ecosystem services. These collective benefits include microclimate regulation, water quality regulation, pollution reduction, wildlife habitat, and cultural services (Elmqvist et al. 2015, Van Riper et al. 2011). Wetland environments, in particular, sequester carbon and help local communities with flood protection and sea level rise (Trulio et al. 2007). Because nearly 85% of the Bay's original marshes and shorelines have been altered, refuge lands provide critical habitat for indigenous wildlife in the Bay Area as well as space for people to engage in outdoor recreation (Dietsch et al. 2013).

As of 2005, over 3.8 million people lived in the region abutting Don Edwards NWR (United States Census Bureau 2010a,b & 2015, Trulio et al. 2007). Flood management, water filtration, mosquito control, and infrastructure protection are some of the physical benefits or ecosystem services the refuge provides to the larger community (Trulio et al. 2007). One objective of this study was to ascertain whether

residents knew or wanted to know more about these ecosystem services that support their communities.

### **Psychological Benefits of Urban Green Spaces**

In addition to the ecosystem services provided by urban open space, there are myriad physiological benefits. Many people find urban life stressful and demanding, and take solace in urban open areas (Van den Berget et al. 2007). In a study of over 90 different urban environments, the social benefits of natural areas fell into three main categories: contact with nature, aesthetics, and recreation (Matsuoka et al. 2008).

Contact with nature refers to the different ways people behave in natural spaces and how that interaction contributes to improved quality of life. This can include the environmental education a visitor discovers during a visit that was planned only as a recreational outing. According to research in environmental psychology, people's desire for contact with nature serves the important adaptive function of providing psychological restoration from stress and mental fatigue (Van den Berg et al. 2007).

Aesthetics can be defined as the scenic beauty of a place, including the degree of cleanliness, and pleasant or natural sounds (Matsuoka et al. 2008). Sometimes just the act of getting out of the urban environment and into an aesthetically pleasing area can help reduce stress and enhance contemplation, and many people

travel to open space for the change of view (Chiesura 2004). The more aesthetically pleasing an urban green area is, the more likely visitors will seek it out and want to spend time there.

Recreation can incorporate a wide range of activities, including wildlife-dependent priority uses such as hunting, fishing, wildlife observation, photography, environmental education, and interpretation. In addition, people use outdoor spaces to bike, picnic, hike, jog, and walk (USFWS 2011, Matsuoka et al. 2008). People who participate in these activities are more likely to get out and exercise, and are often healthier and experience less stress (Chiesura 2004). In addition, recreation in nature has been found to increase social interactions (Tompson 2002).

These social and spatial benefits of urban green spaces can lead to new lifestyles, value systems, attitudes about nature and sustainability, and serve as models for future city life (Thompson 2002).

### **Environmental Education and the Conservation Community**

“To garner broad support for conservation, the U.S. Fish & Wildlife Service must provide a reason, and opportunities, for urban residents to find, appreciate, and care for nature in their cities and beyond. Therefore, engaging urban neighbors, and fostering a sense of stewardship, reflects the heart of the Urban Wildlife Conservation Program.” (USFWS 2016a)

As a society, Americans today are more ethnically and culturally diverse, older in age, and increasingly living in urban areas in greater numbers (Sexton et al. 2012). As a nation, Americans have become more connected to technology and, at

the same time, less connected to nature and the outdoors (Floyd et al. 2016). With changing populations, the conservation challenges continue to grow and become more complex. Americans will increasingly experience nature primarily in an urban setting (DeStefano and DeGraaf 2003), and, thus, urban settings will shape the nation's conservation values, ethics, and priorities. Therefore, the future success of conservation in America ultimately depends on the ability to connect with urban audiences and encourage them to become stewards of the environment (Vaske 2001, Sexton 2015), or in other words, to create an informed conservation community.

Chapin et al. (2011) suggest that sense of place can foster an individual's willingness to engage in environmental stewardship. In fact, research shows that different aspects of sense of place contribute to pro-environmental behaviors which strengthen a conservation community (Stedman 2002, Walker and Chapman 2003, Scannell and Gifford 2010, Kudryavtsev et al. 2012). Given the growing need for environmental stewardship in urban areas, environmental education is a powerful tool to explore the relationship between sense of place and pro-environmental behavior. Kudryavtsev et al. (2012) suggest that urban environmental education programs may significantly increase visitors' ecological place meaning, i.e., their perceptions of the presence and importance of nature in the local urban setting, thus increasing the likelihood they will engage in environmental stewardship.

By encouraging urban environmental education, resource managers in urban green spaces can help urban residents see ecological aspects of their surrounding landscapes as legitimate and worthwhile—even in small, private spaces like backyards (Walker and Chapman 2003). Environmental education can highlight cities as places to interact with nature and native species and to engage in outdoor recreation and learning. Such sense of place coupled with environmental education may ultimately enhance environmental stewardship in urban communities to help create the informed conservation community of urban residents (Vaske 2001, Kudryavtsev et al 2012).

Interpretation is key to environmental education for visitors because it can raise visitor awareness by illustrating the resources and goals of urban green spaces. Often visitors can care deeply about a place, but do not fully understand how their actions affect it (Manning et al. 1999). If visitors better understand the USFWS's main mission, they are more likely to change their own behaviors to support that mission. By understanding who visitors are and why they are visiting, managers can better allocate resources and staff, build natural stewardship through targeted education and outreach, and understand how visitors value and interact with the refuge.

In addition to environmental education, resource managers can benefit from understanding what visitors value about urban green spaces. Visitor values often

fundamentally shape their experience and motivations (Borrie et al. 2002, Tanner et al. 2008), attitudes related to ecosystem management (Manning et al., 1999), voting preferences (Vaske & Donnelly 1999), and support for conservation (Vining & Saunders 2004). Educating visitors about how ecosystem services and psychological benefits of urban green spaces can be an asset to their local communities encourages visitor respect for urban wildlife refuges, and creates a conservation community that values natural spaces in urban areas and beyond (Van Riper & Kyle 2014).

Visitor values can also clarify what visitors perceive as important (Kyle et al. 2004), find out if there is visitor interest in ecosystem services, understand how to deliver that information, and help refuge staff gauge how visitors will react to changing policies (Manfredo et al. 2003, van Riper et al. 2012). By learning how aware visitors are of what the refuge has to offer, managers will have a more complete understanding of how to provide quality experiences to outdoor recreationists while also building stewardship for urban wildlife refuges (van Riper et al. 2012).

### **Ethnic Diversity in Outdoor Recreation**

All urban residents need access to urban green spaces, regardless of their demographic characteristics. While it is vital to create an informed conservation community, ethnic minorities are often not well represented in outdoor spaces.

People who engage in outdoor recreation are predominantly U.S. citizens with above-average income and education, and are overwhelmingly non-Hispanic and white (Sexton et al. 2012, The Outdoor Foundation, 2014). Younger/millennial visitors and people of color are referred to as nontraditional audiences (Floyd et al. 2016, The Outdoor Foundation 2014), but the physical and psychological benefits of using urban open spaces are just as essential to these audiences, especially considering that they are often disproportionately exposed to environmental pollution (Roberts & Chitewere 2011). People of color may have less access to open spaces, and may also feel uncomfortable or out of place there. Roberts and Chitewere (2011) argue that managers should move away from simplistic notions of how people of color have access to parks and urban green spaces, and call for resource managers to determine and understand the different cultural preferences, expectations, and needs of diverse users.

In light of this, it is important to understand not only what motivates current outdoor users, but also the potential barriers keeping people from visiting (USFWS 2014). A 2014 workshop conducted at Don Edwards NWR with local community groups determined that there are multiple barriers to nontraditional audiences' visitation of the refuge (USFWS 2014). They may not visit outdoor areas due to concerns for safety, fears associated with outdoor recreation, a lack of awareness about outdoor areas and recreational opportunities, or the potential to feel

culturally out of place outside. The feeling of “otherness” for minorities might include feeling uncomfortable being the only minority in the outdoors and/or not being represented in the cultural and historical dialogue about America’s natural landscapes and conservation (Roberts & Chitewere 2011,USFWS 2014).

### **Visitor Impacts and Recreation Ecology**

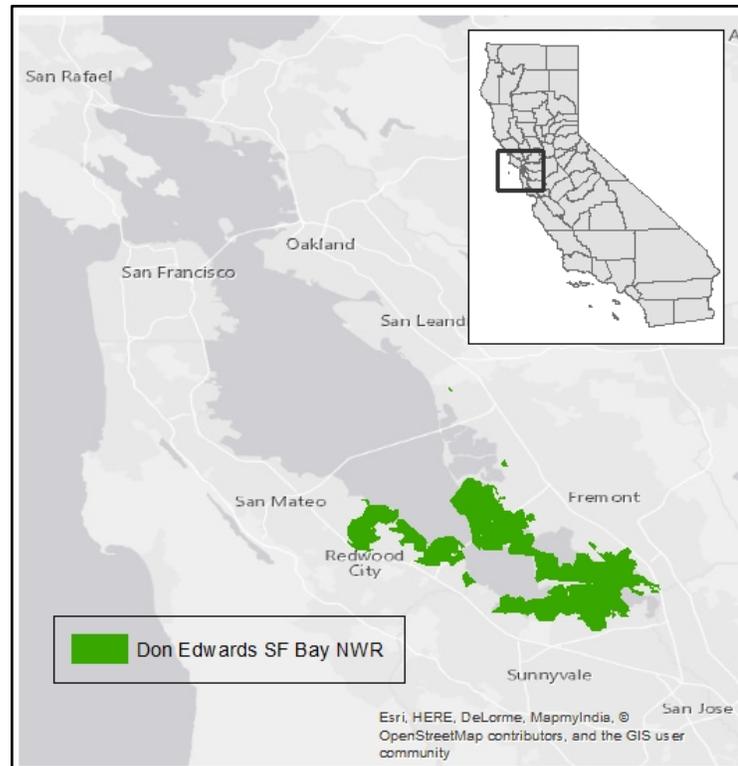
People engaged in recreational activities in natural places can have an adverse effect on environmental management, so it is important to understand and mitigate visitors’ impacts and effects on natural areas (Cole 1996, Hammitt et al. 2015). Recreation Ecology examines how to manage natural protected areas, and mitigate impacts left by outdoor recreational activities to keep these landscapes functioning as vital habitat areas, per the original mission of the USFWS (Manning et al. 2004, Hammit et al. 2015). Recreation Ecology examines both the environmental consequences of outdoor recreation activities and effective management strategies to avoid those impacts (Monz et al 2010, Hammit et al. 2015). Refuge managers need to understand not only how to protect the landscapes from visitors, but how those visitors perceive the impacts they cause, and how to best educate visitors who don’t understand their impacts (Tanner et al. 2008, Van Riper et al. 2011). If managers and visitors can agree about the values of wildlife refuge areas, then getting visitors to follow regulations and build meaningful connections with their environments will be easier. This agreement encourages the growth of stewardship

while also engaging the public in long-term support for wildlife (van Riper et al. 2012).

## **Methods**

### **Site Background:**

The Don Edwards San Francisco Bay National Wildlife Refuge spans the southern end of the San Francisco Bay (Figure 2). Its creation was initiated by a local grass-roots effort made up of individuals who wanted to restore the wetland environment (USFWS 2016b). The South San Francisco Baylands Planning, Conservation and National Wildlife Refuge Committee lobbied Congress directly because at the time the USFWS was not interested in establishing a refuge in an urban area (Leong et al. 2016). After two failed attempts, legislation for the refuge passed in 1972 with an approved boundary of 23,000 acres (ibid.). On October 8, 1974, the San Francisco Bay National Wildlife Refuge became the 19th national wildlife refuge in the state of California and the first urban refuge in the nation. (Dietsch et al. 2013). In 1995, the refuge was named after Congressman Don Edwards who worked with local citizens and Congress to create the refuge.



**Figure 2.** Overview of the location of Don Edwards San Francisco Bay National Wildlife Refuge in the greater SF Bay Area. Map created by author using Arcmap

Today Don Edwards NWR covers 30,000 acres of mostly aquatic habitat including marsh, salt ponds, mudflats, vernal pools and upland environments (USFWS 2016b, USFWS 2016c). Salt marsh habitat, which makes up 37% of the refuge, is one of the most productive habitats on earth and is vital in supporting two endangered species found in the refuge: the California Clapper Rail and the Salt Marsh Harvest Mouse (Dietsch et al. 2013). As part of the SBSPP, ponds constructed by corporations to harvest salt are currently being restored or returned to tidal influence (Trulio et al. 2007). Because the refuge is primarily aquatic habitat, it is home to numerous species of fish, waterfowl, shorebirds, wading birds, raptors,

and more (USFWS 2016b, USFWS 2016c). The refuge also provides safe grounds for migrating birds in the spring and fall, and millions of birds winter at the refuge (Dietsch et al. 2013).

The Don Edwards San Francisco Bay National Wildlife Refuge Final Comprehensive Conservation Plan (2013) indicates that visitation to the Refuge, the largest urban refuge in the United States, ranged from approximately 750,000 to 900,000 visitors annually from 2006 to 2010 (USFWS 2016c). Visitor activities include boating, fishing, hunting, wildlife observation, bird watching, photography, hiking or biking on 30 miles of trails, as well as use of the Visitor Center, interpretation and environmental education programs (Dietsch et al. 2013).

### **Survey Design**

A survey was designed to provide information needed to meet the study objectives outlined above. The survey was created from examples of past studies, and meetings held with Don Edwards NWR staff for feedback about specific questions (Dietsch et al. 2013, Sexton et al. 2012, Sokale & Trulio 2013, van Riper & Kyle 2014). Each objective was addressed in a series of questions formulated to identify visitors' demographics and trip characteristics, their behaviors and motivations, their awareness of the refuge, their impact awareness, and their opinions about existing facilities and services. Each objective also included a

question to find out if there were other options or alternative methods that could be used to better communicate with visitors or address the elements of the objective.

### **Survey Objectives:**

The survey was broken into five visitor objectives to answer who is visiting Don Edwards NWR, why they visit, and how they interact with their environment. The first objective was to identify the demographic makeup of visitors. The second was to better understand visitors' behaviors—how and why they are using the refuge—and their values regarding the refuge. The third was to ascertain how aware people are of the refuge, and fourth, to detect whether visitors are aware of their potential recreational impacts on the refuge. The fifth objective was to understand how visitors perceive existing facilities, and what their preferred communication strategies might be. Each objective included questions designed to better determine how resource managers can better inform environmental educational strategies to promote urban wildlife conservation.

### **Field Crew Volunteer Training**

Eight field crew volunteers were recruited to assist with administration of the survey. These volunteers were chosen based upon their willingness to participate, their ability to follow protocol, and their friendly and approachable personalities. The eight volunteers all knew the principal investigator on a personal basis.

An initial training session for the field crew volunteers was held on March 1, 2016. This meeting utilized resources and advice provided from researcher Carena van Riper, University of Illinois at Urbana-Champaign (personal communication, December 15, 2015). Volunteers were given an introduction to the project and an orientation to their roles in survey administration. The topics covered included safety protocol, field methods, sampling plan, interview process, and data compilation.

During the project overview, field crew volunteers were informed of the study's research questions and objectives, and familiarized with the survey instrument. The importance of the study was emphasized, and use of the research results was reviewed. In addition, the methods of the project and role of the field crew were discussed—including how to keep the sample random, the potential for the field crew to bias response rates, and how to approach and initiate the survey with willing participants. Field crew volunteers were given an example of how to introduce the study to potential participants, but also encouraged to use their discretion and own words when in the field.

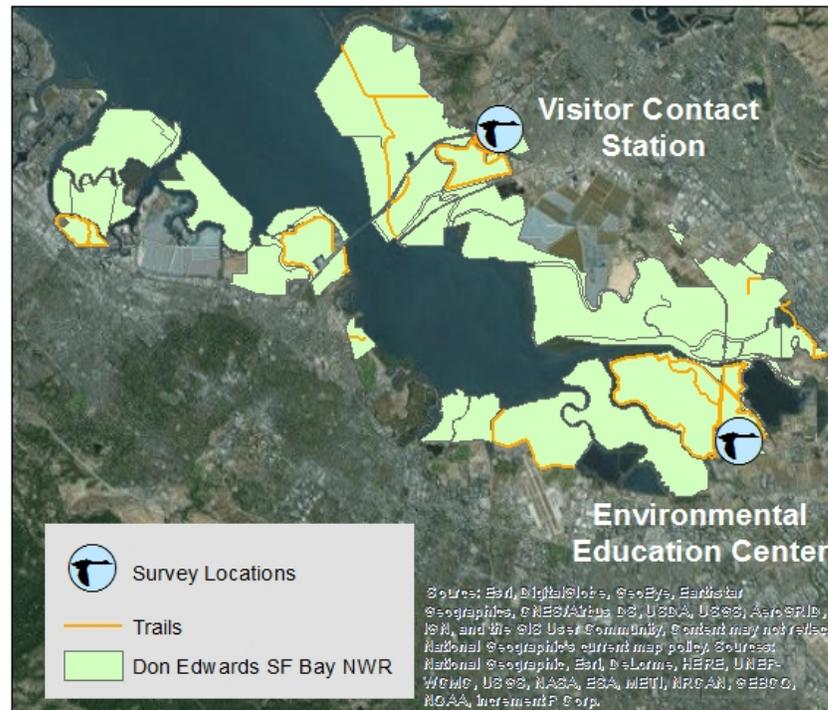
Field crew volunteers were asked to spend 3-4 hours on site on weekdays or until 10 surveys were completed (whichever came first) for each survey period. On weekends, the period was extended to 4-7 hours or until 20-25 surveys were completed. Field crew volunteers were encouraged to take breaks as necessary, and

to abort the survey period during bad weather or if they felt unsafe for any reason. While specific times were encouraged, field crew volunteers were given some leeway in adjusting surveying times to fit their personal schedules. Finally, basic study procedures were reviewed: surveying materials, visitor counts, record sheets, and overall distribution goals.

### **Data Collection and Analysis**

The visitor survey was conducted from March-June 2016 at Don Edwards NWR to represent springtime visitation, which best represents visitation to the refuge over the course of a year; spring is not as busy as the summer season, but more active than the winter. Twenty-nine surveying days were selected to create a stratified sampling period for each month. Proportionate allocation was applied for the times and days of the week to represent visitation at the refuge (Booth 1991). Data were collected using an onsite survey administered by the author or field crew volunteers at two locations on the refuge—the Environmental Education Center in Alviso and the Visitor Contact Station in Fremont (Figure 3). These two locations were chosen with the assistance of refuge staff to best reflect the diversity of use and specific visitation patterns of the refuge, and because of their high visitation traffic due to their location near main trailheads (Dietsch et al. 2013). A common sampling protocol was followed for each visitor. For groups, the individual with the

most recent birthday completed the survey to minimize potential group leader bias (Booth 1991).



**Figure 3:** The two survey locations, the first outside the Visitor Contact station in Fremont, CA, the second at the Environmental Education Center in Alviso, CA. map created by the author using Arcmap

Data were collected and administered by the author and the field crew volunteers using either a Lenovo tablet or paper surveys that were later manually entered onto the tablet by the author or a trained field crew volunteer. The survey was designed using Qualtrics survey software, and cross tabulation and frequency statistical analysis was conducted. The cross tabulation data explored the correlation between individual questions and demographic data provided by the respondents, where  $p < 0.05$ .

## **Results:**

### **Survey Bias**

There were several sources of potential bias associated with this study. The study was limited to springtime, although surveying over the course of a year would have better represented visitors' seasonal activities like hunting, which is only allowed in the fall. Secondly, only two survey locations were chosen for this study, both next to trailheads, only one allowed dogs. This meant that the majority of respondents were coming to these sites for specific trail-oriented activities and visitors using the refuge for other activities were underrepresented.

Another source of potential bias is that only willing participants over the age of 18 were asked to complete the survey. Future studies could include children's responses to better understand how to communicate with younger generations. Additionally, the survey was only administered and written in English. While only 8% of those who refused the survey did so because of a language barrier, if the surveyor and survey were bilingual these visitors might have been willing to participate. Finally, visitors accompanied by children or dogs, or those enjoying the refuge on their lunch breaks, often didn't have the time to take the survey. While a few took and returned a paper version of the survey, future studies could try a different option to include these individuals.

### **Demographics and Trip Characteristics:**

A total of 332 groups (or 707 individuals) were encountered over 29 surveying days. 201 groups (421 individuals) agreed to participate and completed surveys, giving this study a 61% response rate. Every individual or group of people who approached the survey location were asked to participate in the study. If people declined to participate, they were asked for a reason and thanked. The main reasons given for denial were lack of time (44%) and lack of interest (30%).

Of the respondents who completed surveys, 52% were male and 48% were female (Figure 4). These percentages align nicely with a 2014 national survey on outdoor participation that show 54% of outdoor participants are male and 46% female (The Outdoor Foundation 2014). 28% of the respondents were between the ages of 18 and 34 years old, while 32% were 35 to 54 years old, and 39% were 55 and older (Figure 4). The recorded income and education of those surveyed aligned well with the averages typical in the Bay Area, with 62% of participants having some sort of college degree, and 58% making over \$75,000 a year; the highest number of respondents made \$100,000 to \$149,999 a year (Dietsch et al. 2013) (Figure 4).

<b>Gender</b>		<b>Where people visit from</b>	
Male	105 (52%)	California	191 (95%)
Female	96 (48%)	Out of State	10 (5%)
<b>Age</b>		<b>People per group</b>	
18 - 34	58 (28%)	1	87 (43%)
35 - 54	65 (32%)	2	70 (35%)
55 and older	78 (39%)	3	22(11%)
<b>Education</b>		4	12(6%)
High School	20 (20%)	5+	11 (5%)
Some College	55 (27%)	<b>Group Dynamics</b>	
Bachelors degree	67 (33%)	Traveling alone	84 (42%)
Graduate Degree	59 (29%)	Family	86 (43%)
<b>Income</b>		Friends	28 (14%)
less than \$34,999	36 (18%)	Organized Group	3 (1%)
\$35,000 - \$74,999	49 (24%)	<b>Visit Frequency a Year</b>	
\$75,000 - \$149,000	69 (35%)	About once a week	123 (61%)
\$150,000-\$199,999	18 (9%)	About twice a week	21 (10%)
\$200,000 or more	28 (14%)	about 3 times a week	9 (4%)
<b>Racial Identity</b>		About 4 times a week	5 (3%)
White or Caucasian	99 (49%)	More than 4 times	8 (4%)
Asian or Asian American	58 (29%)	N/A (first visits)	36 (18%)
Hispanic or Latino	32 (16%)	<b>Visit Length</b>	
Native American	6 (3%)	0-1 hours	91 (54%)
Pacific Islander	6 (3%)	2-3 hours	69 (41%)
Indian/Indian American	4 (2%)	4-6 hours	8 (5%)
Black/African American	3 (1%)	6+hours	0
Other	8 (4%)		

**Figure #4:** Demographics and Trip Characteristics (n=201).

Resource Managers, especially those in urban areas, need to pay attention to the ethnic makeup of visitors to see if those who are visiting the refuge represent their communities (USFWS 2014). While a 2012 study at Don Edwards NWR found that 73% of people surveyed were white (Dietsch et al. 2013), this study found

greater diversity, with only 49% of respondents identifying as white (Figure 4). According to refuge staff, this survey's lower proportion of white respondents seems to better represent the diversity of visitors. The most likely explanation for this discrepancy is the different method of surveying used in this study than the 2012 study. Other potential reasons could include actual changes in visitation at Don Edwards NWR over time, or language barriers that keep some people from responding.

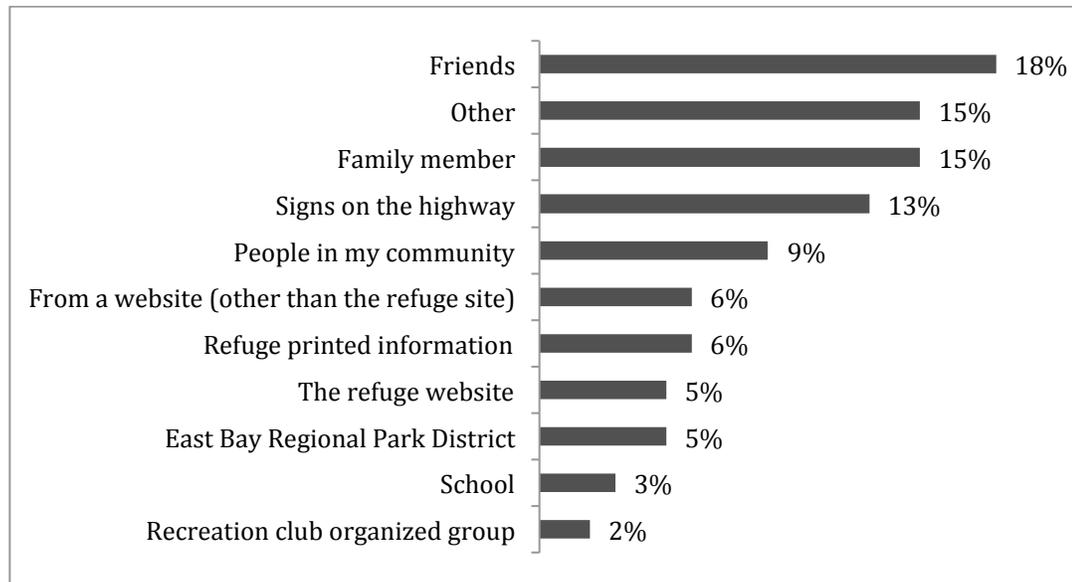
Most visitor groups were small, with 43% of respondents traveling alone and 35% traveling in pairs (Figure 4). 11% of the groups included 3 people and only 10% of the groups included more than 3 people. Most visitors who traveled with companions indicated they were with family (43%), or friends (14%) (Figure 4). Only three participants indicated they were traveling with an organized group, which could suggest an opportunity for the refuge to engage in community outreach to increase visitation.

Most (95%) of the visitors were from the nearby area (Figure 4). Many indicated they had visited the refuge before (84%); indeed, a majority of participants came from Fremont, Newark, or Union City—representing 55% of all respondents from California. Therefore Alameda County and Santa Clara County, the two closest counties to the refuge, were home to the majority of all respondents. Of all those who participated, 61% indicated they visited the refuge about once a week

(Figure 4). The 2012 study at Don Edwards NWR found similar results (Dietsch et al. 2013). A relatively high proportion of visitors (17%) indicated they visited between two to four times a week. Groups usually stayed at the refuge for an hour or less (54%), although 41% stated they stayed 2 to 3 hours; only 5% of those surveyed stayed longer than 3 hours (Figure 4).

### **How did people learn about Don Edwards NWR?**

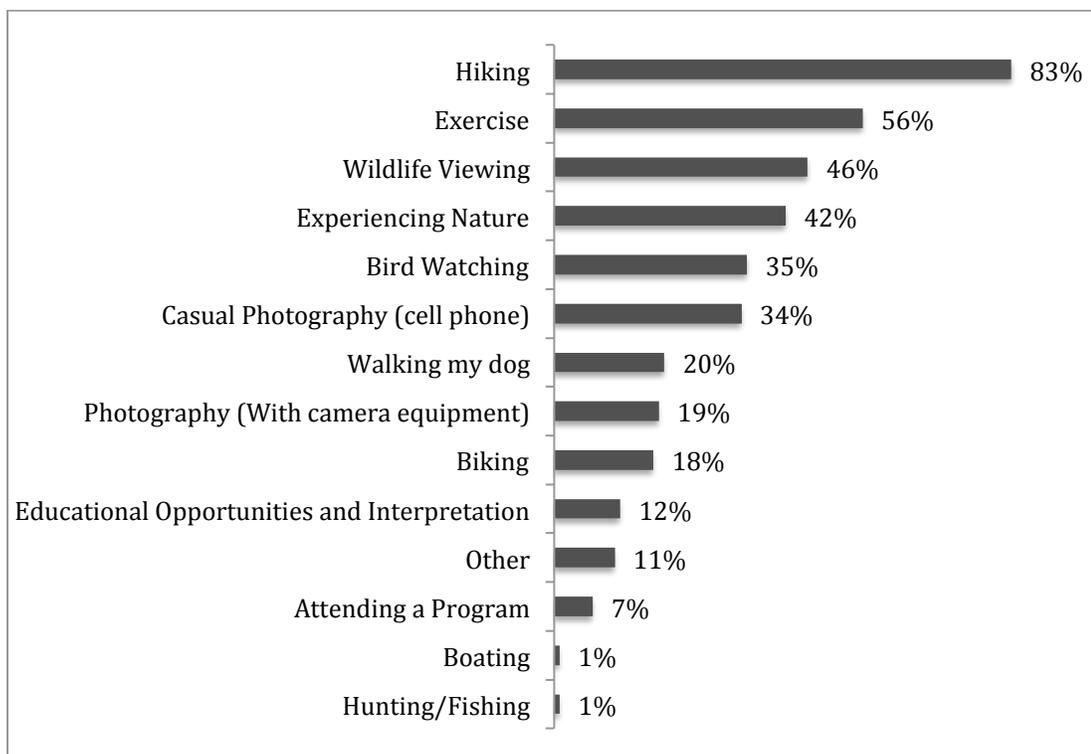
Knowing how people learned about the refuge can highlight opportunities for outreach to new audiences. Since so many visitors to Don Edwards NWR were from the local area, it is not surprising this study found the majority of participants had heard of the refuge from a family member or friend (33%) (Figure 5). There were also a large number of people who responded with Other (15%), most whom indicated they lived in the area and had seen the refuge established. Only 11% of the respondents said they had heard about the site online, suggesting that greater outreach through social media, and partnering with companies that promote outdoor recreation might benefit the refuge and increase visitation. This suggests an opportunity for the refuge to reach out to a broader audience through virtual avenues, and a potential way for them to connect with nontraditional audiences. (Later in the study participants indicated visitors would like to be contacted via social media and virtual outreach)



**Figure 5:** How visitors learned about the refuge (n=201).

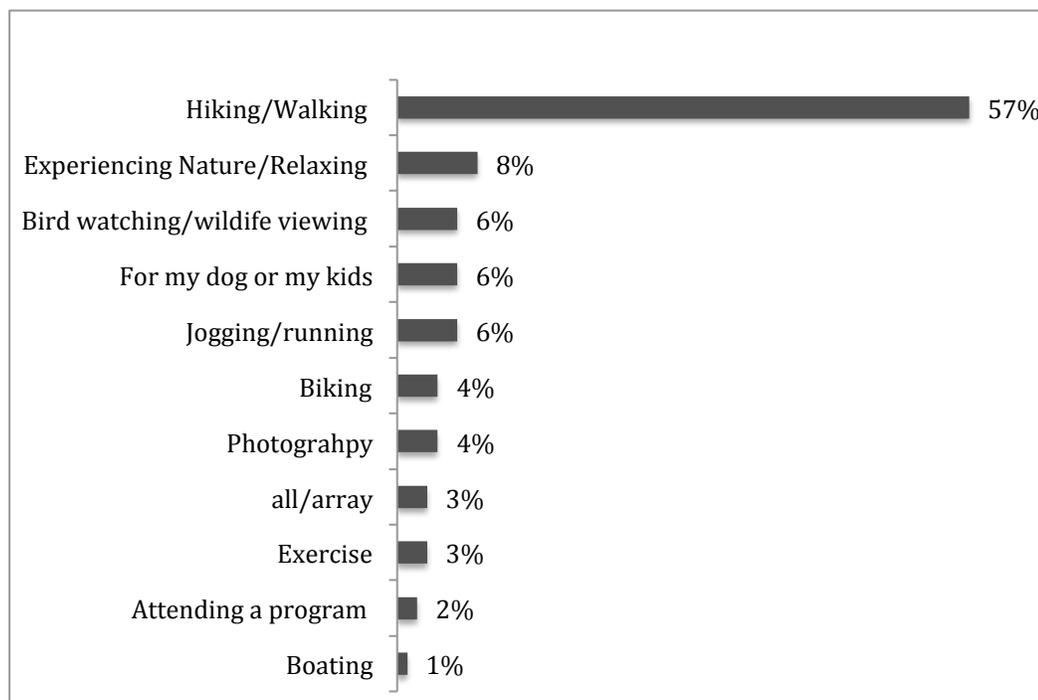
### **Behaviors and Values**

Visitors were asked about their recreational activities at the refuge. Each respondent was first asked to identify all the activities they participated in from a list of options (Figure 6). Hiking was the most frequently chosen activity (83%), and Exercise the second most chosen option (56%). Wildlife Viewing (46%) and Experiencing Nature (42%) ranked 3<sup>rd</sup> and 4<sup>th</sup>. Hunting/Fishing and Boating (1% or less) were the least frequently chosen options. This could be because of several factors including the cost and time commitment of hunting/fishing and boating, or the fact that these activities were not generally practiced in the locations where the survey was administered.



**Figure 6:** Visitor Activities (n=201). Respondents were allowed to choose multiple options.

Visitors were then asked to enter their primary activity at the refuge into a text box, giving them full control as to what they entered (Figure 7). Many visitors choose to enter Walking instead of Hiking. The main activities that visitors identified as their primary activity were Hiking/Walking (57%), Experiencing Nature (8%), and Bird/Wildlife Watching (6%), Jogging and Running (6%) and Coming For Kids or Dogs (6%). Hiking in both instances, whether respondents were given one option or multiple options, ranked as the main activity for many of the participants.



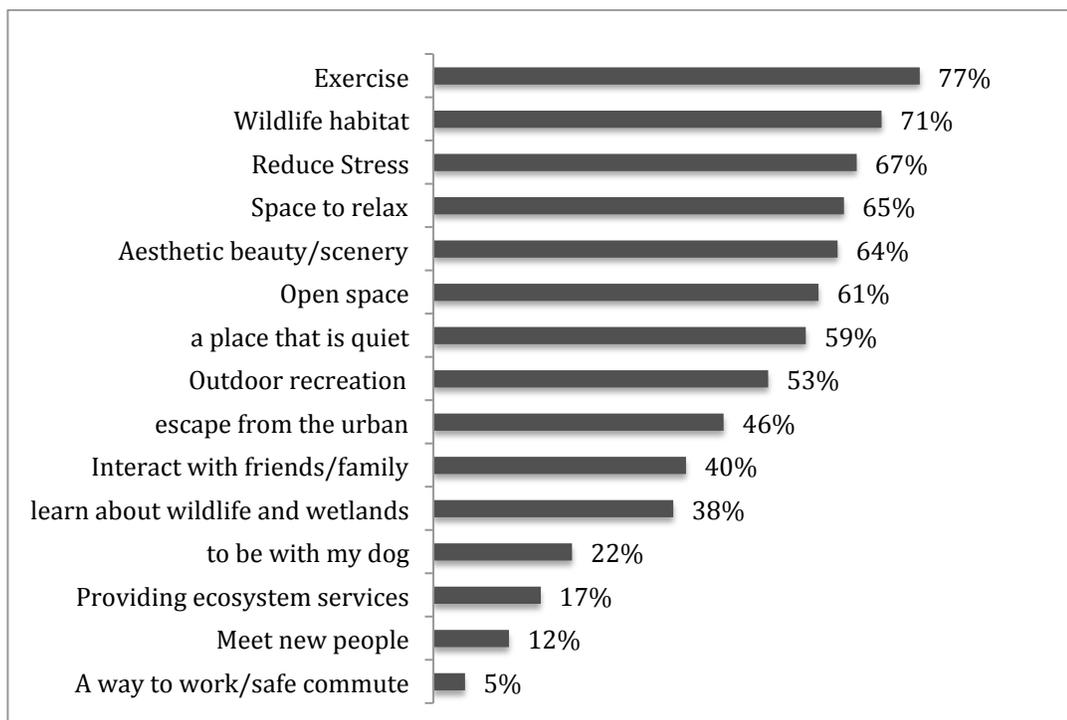
**Figure 7:** Primary Activity (n=201). Participants used a Text box for responses.

## Refuge Values

Asking visitors what they value about the refuge can help determine if the visitor and the management are working together and can help staff ascertain why people are visiting the refuge. Respondents were allowed to choose as many options as they wanted from a list of values (Figure 8).

The main value that respondents ascribed to Don Edwards NWR was Exercise (77%) (Figure 8). The South Bay is a highly urban area, with many people working at desk jobs. Evidently, many people value the refuge as a place to move about in a more natural setting than a gym. The next most chosen value about Don Edwards NWR was Wildlife Habitat (71%). In a place where so much of the area has

been affected by humans, it was interesting to discover that so many visitors cared about the site because it is a place for animals. The next most chosen values ascribed to Don Edwards NWR were A Place to Reduce Stress, Space to Relax, Aesthetic Beauty, Open Space, A Place that is Quiet, and A Place for Outdoor Recreation. This matches research documenting the importance of urban open spaces as places to enhance the urban lifestyle while still being close to home (Chiesura 2004).



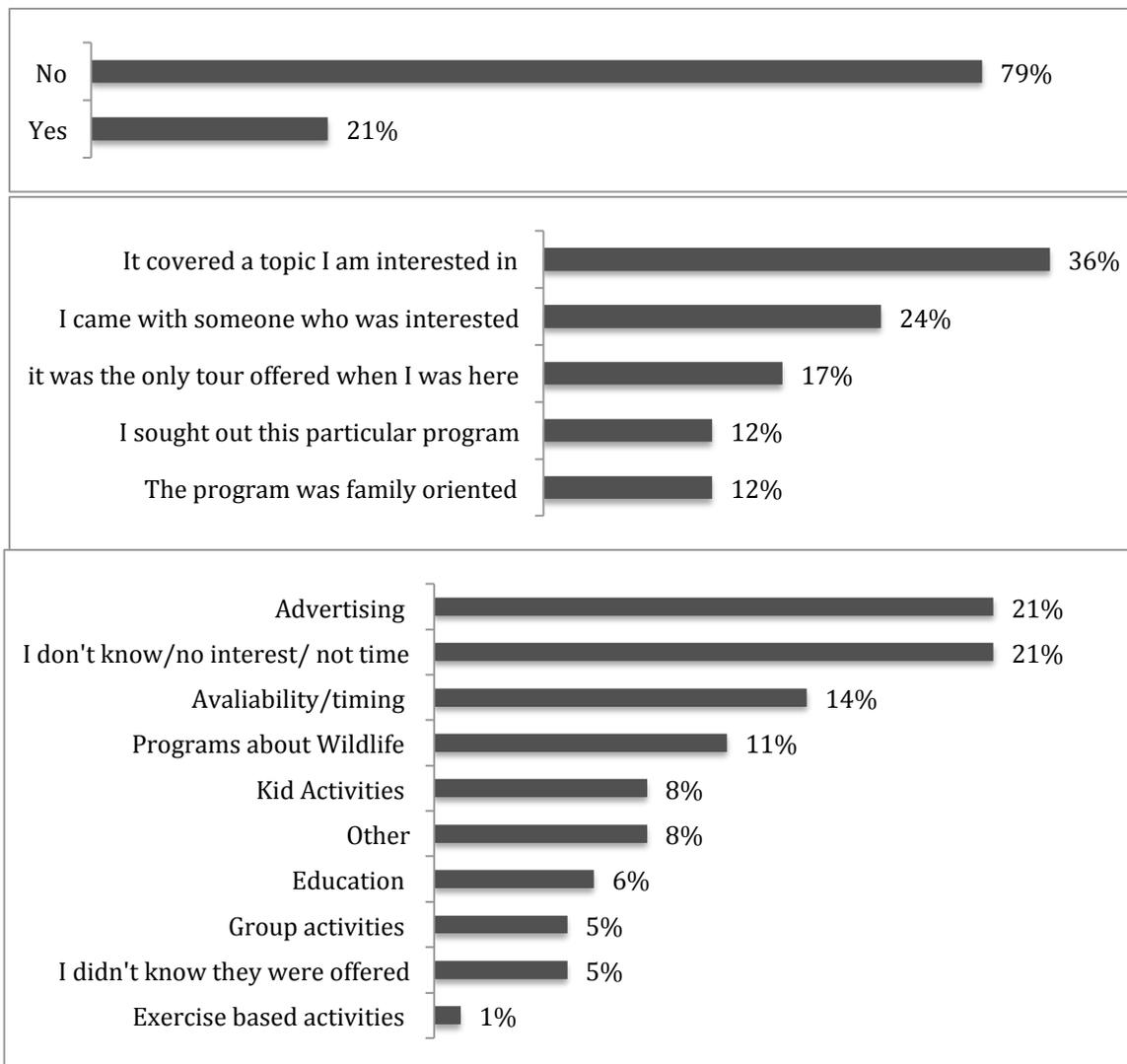
**Figure 8:** Visitor Values (n=201). Respondents were allowed to choose multiple options.

## Guided Tours

Guided tours are a way to directly connect with visitors, and to help educate them about proper ethics and behaviors to protect and preserve wildlife habitat on the refuge (Sexton et al. 2012). Unfortunately, it can be challenging to encourage

participation when visitors are unaware of such programs, uninterested in them, don't have time, don't find programs to be child or dog friendly, or when there is not enough staff to accommodate different schedules or diverse program topics. Because of this, it is helpful to know why visitors attend or do not attend certain programs.

At Don Edwards NWR, of the 201 survey respondents, 79% had never attended a program (figure 9). Of the 21% who had attended a program, 36% did so because the program was of specific interest, and another 24% came with someone else who was interested (Figure 9). Those who had never attended a program were asked to suggest what would encourage them to attend. Many expressed that they didn't know there were programs, with 23% of those who had not attended a program stating they wanted programs to be better advertised, and 14% said they would attend if the programs were offered at different times, like at night and on weekends. 11% would attend a program focused on wildlife, and another 8% said they would attend if there were family focused programs (Figure 9).



**Figure 9: Top-**Has the Visitor ever attended a Program? (n=201).

**Middle -** If yes, why did you attend this program (n=42).

**Bottom-** If no, what might encourage you to attend a program in the future (n=112).

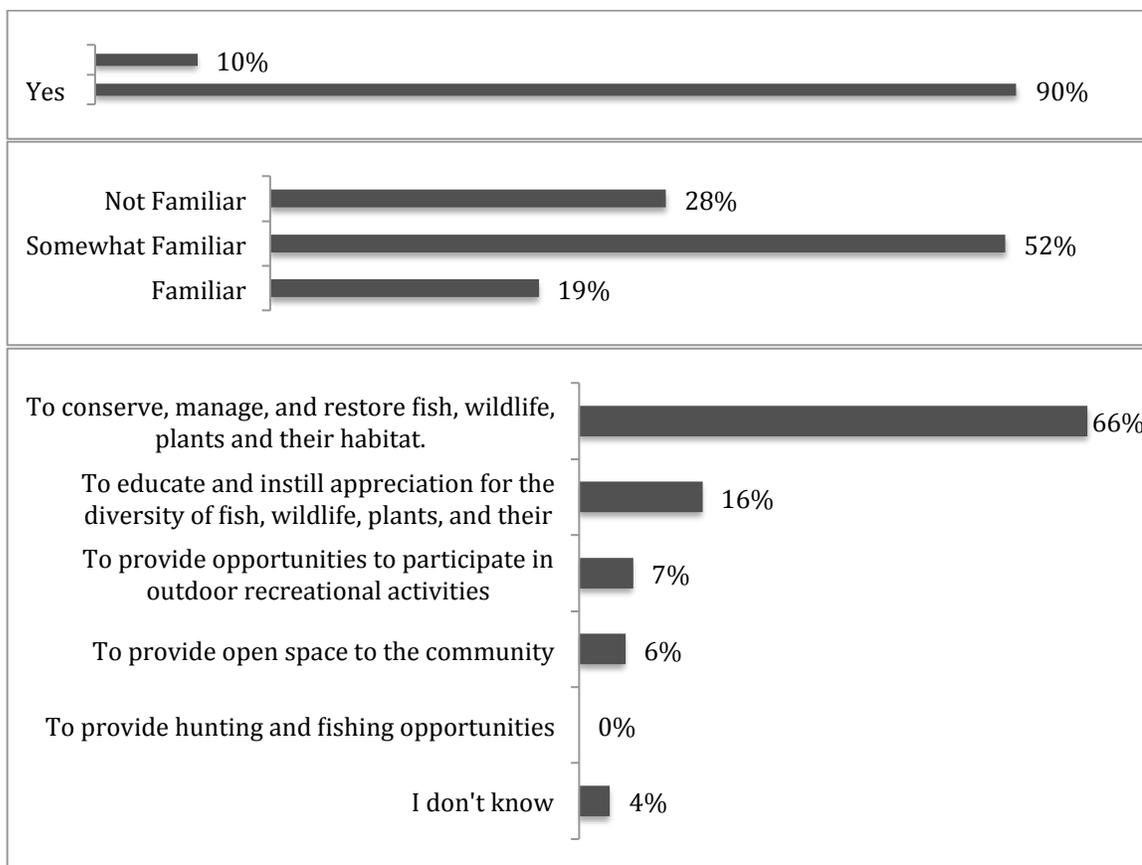
In each question, participants were only allowed one response.

### Refuge Awareness

Because of the location of Don Edwards NWR in a metropolis, and because it is near other open space areas, refuge managers wanted to know if visitors were

aware of the fact they were in a National Wildlife Refuge. Most visitors (90%) did know this (Figure 10). However, when asked how familiar they were with the mission of the U.S. National Wildlife Refuge System, only 19% said they were very familiar, 52% indicated they were somewhat familiar, and 28% stated they were not at all familiar (Figure 10). So while visitors may be aware they are in a wildlife refuge, they may be less familiar with the purpose of a wildlife refuge.

Respondents were next asked to choose the primary mission of the refuge from a list of options. Each of the 6 options plays a role in the establishment of the wildlife refuge, but only one answer was the correct choice. 66% of the respondents chose the correct mission statement about conserving and restoring habitat. The next highest-scoring option (16%) was to educate and instill appreciation for the diversity of fish, wildlife, plants and their habitats (Figure 10). This is a good sign for the refuge if people are willing to be educated—it could be easier to connect with individuals if they understand that education is part of the purpose of the site.

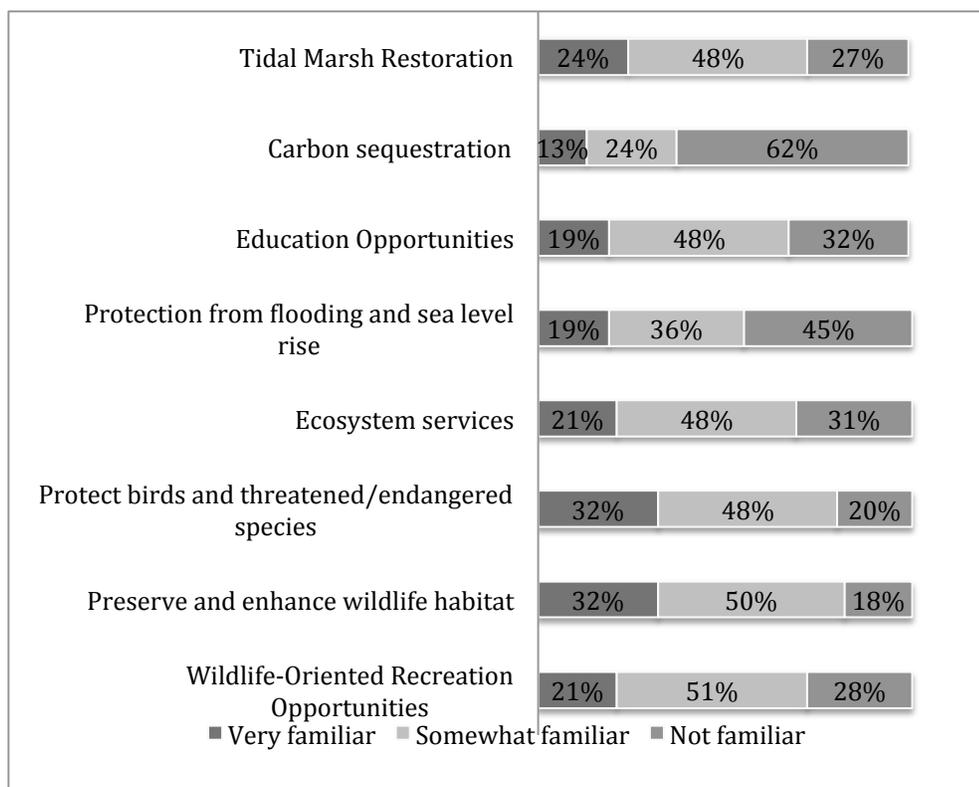


**Figure 10: Top-** Did you know you were in a wildlife Refuge (n=201)  
**Middle-** Familiarity with the USFWS Mission (n=201)  
**Bottom-** Primary Mission of the USFWS (n=201). Top response is the correct mission.  
 Participants were only given one choice for above questions.

### Refuge Advantages and Ecosystem Services

The next questions were designed to determine visitors' understanding of the purposes and benefits of Don Edwards NWR. While previous questions aimed to evaluate visitors' emotional connections with the refuge, these questions were based more on the physical characteristics of an urban wildlife refuge. Participants were given 8 options and asked to rate their knowledge of each purpose as either familiar, somewhat familiar, or not familiar (Figure 11). The eight options were

Wildlife-oriented Recreation Opportunities, the Preservation and Enhancement of Wildlife Habitat, to Protect Migratory Birds and Threatened/Endangered Species, To Provide Ecosystem Services, To Provide Protection from Flooding and Sea Level Rise, Education Opportunities, Carbon Sequestration, and Tidal Marsh Restoration. It should be noted that the option Ecosystem Services was added specifically to determine if participants had ever heard of this term.

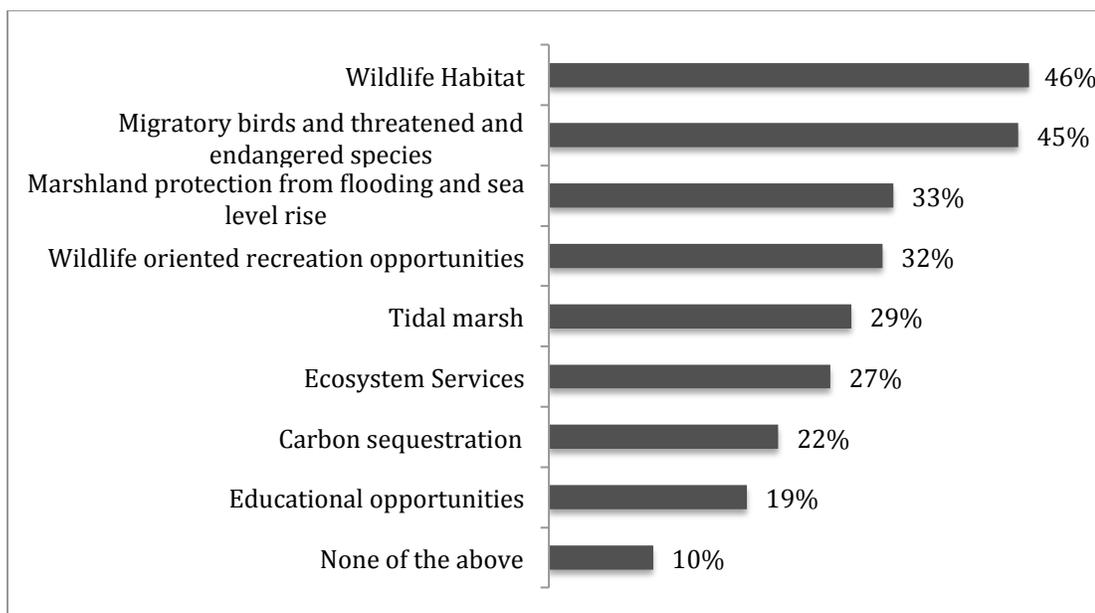


**Figure 11:** Familiarity with Refuge Advantages (n=201).

The options that participants were most familiar with were Wildlife Habitat, Protection of birds and other species, and Recreational Opportunities. The options that were rated as least familiar were Carbon sequestration and Protection from sea

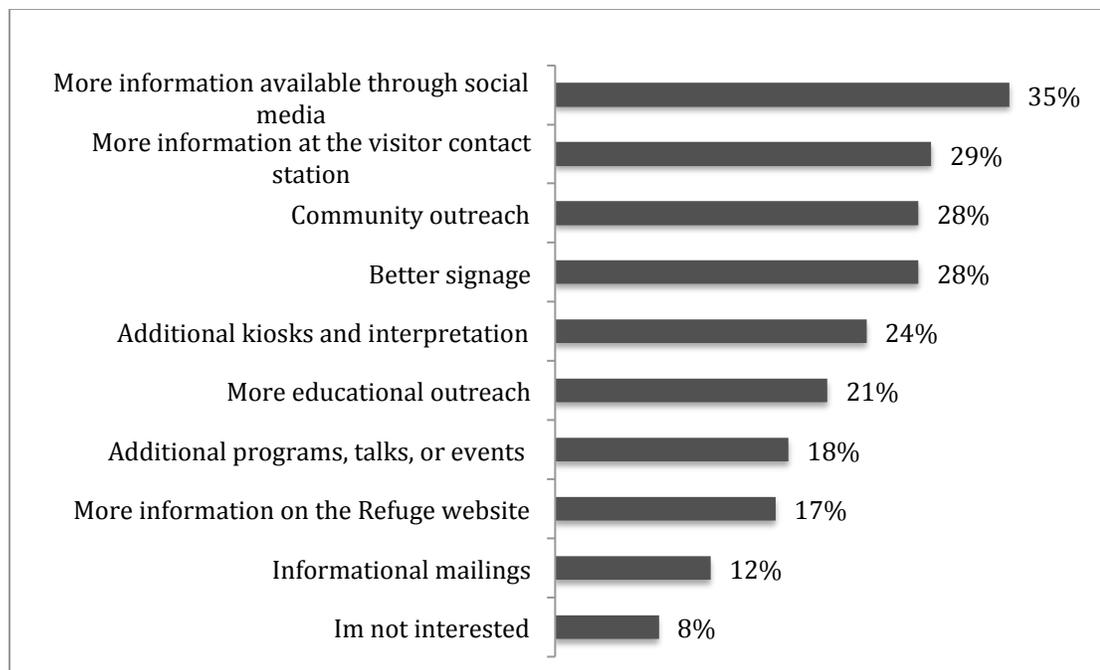
level rise. This represents new opportunities to educate visitors to Don Edwards NWR about how the refuge benefits their local community, perhaps through interpretative panels or ranger led programs.

The second part of this section asked participants which of the 8 options they would like to learn more about (Figure 12). Only 10% answered that they were uninterested in learning more. The main topics participants wanted to know more about were wildlife habitat (46%), migratory birds and threatened and endangered species (45%), protection from sea level rise (33%), and tidal marsh restoration (29%)—all issues that are important to both the refuge and the overall vision of the USFWS.



**Figure 12:** Interest in the Advantages of Don Edwards NWR(n=201). Respondents were allowed to choose multiple options.

Finally, visitors were asked the best way for refuge staff to educate the public about the advantages of Don Edwards NWR (Figure 13). Participants were allowed to choose multiple answers to this question. 35% responded they would like to see more information available through social media, while 29% stated they wanted more information at the visitor contact station. Better signage and community outreach were suggested by 28% of respondents, while 24% wanted to see additional kiosks and more educational outreach. These results suggest ways staff at Don Edwards NWR can help educate visitors, to create advocates and stewards in the future.



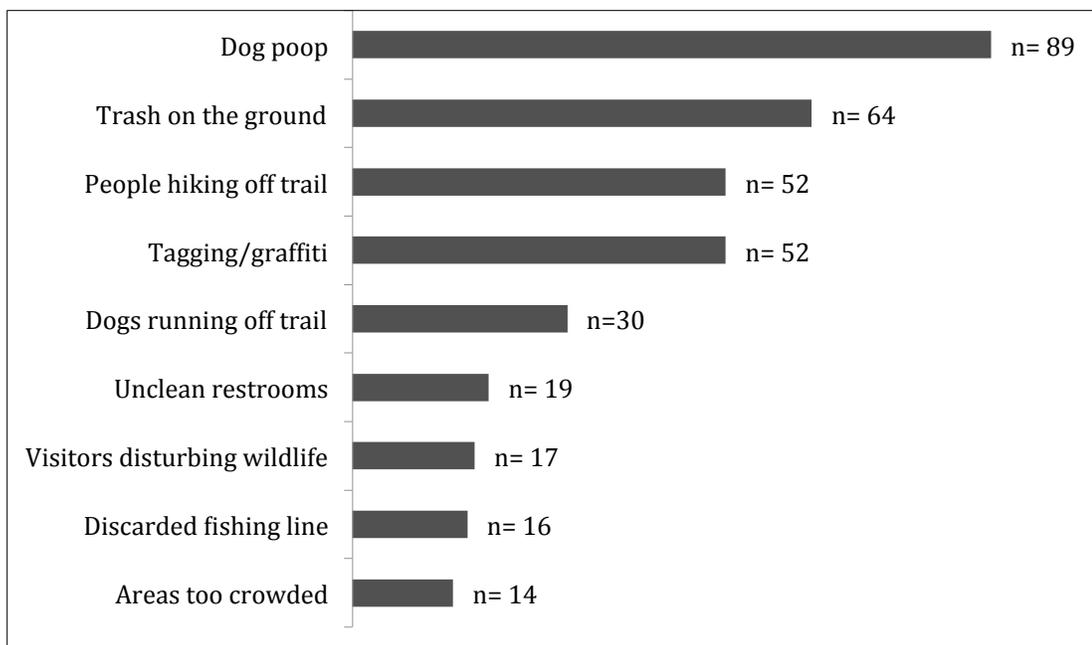
**Figure 13:** The best way to educate Visitors (n=201). Respondents were allowed to choose multiple options.

### **Visitor Impacts**

This set of questions attempted to determine if visitors to Don Edwards NWR were aware of, and if they witnessed, previous users' recreational impacts. Visitors can be unaware of their impacts on an environment, even if they notice the impacts of others (Van Riper et al. 2011, van Riper et al. 2012). These questions served a dual purpose—not only to find out if the visitors' experience was impacted by others' recreational impacts, but also to educate them if they were not aware of the impacts their actions might have.

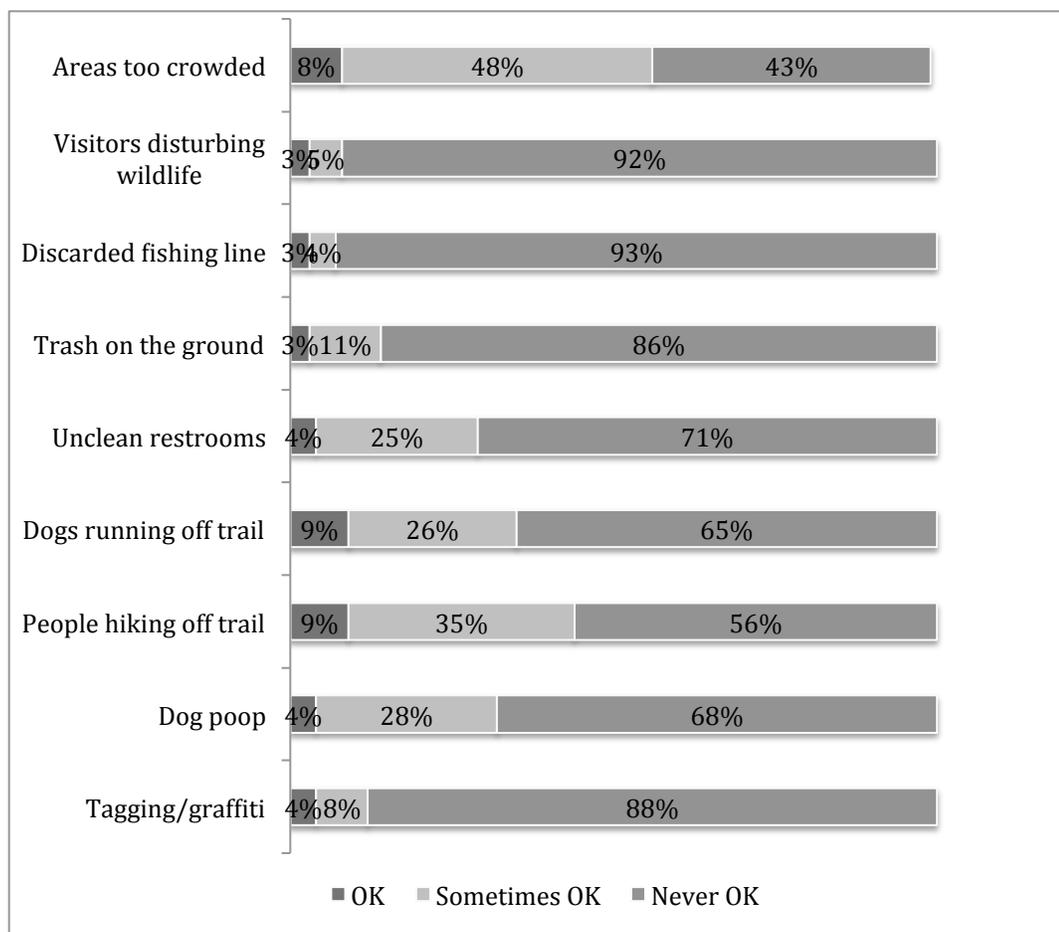
The survey asked first whether people had witnessed nine different impacts, and then whether they found those impacts to be acceptable in natural areas (Figure 14). The nine options were intended to include both physical impacts such as dog waste and trash on the ground, and social impacts such as crowding and other people's inappropriate behaviors (van Riper & Kyle 2014).

The most witnessed impact was Dog Waste; 25% of participants indicated they had seen dog waste in the refuge. (Figure 14). This was followed by sightings of trash on the ground (18%), tagging and graffiti (15%), people hiking off trail (15%), and dogs running off trail (8%).



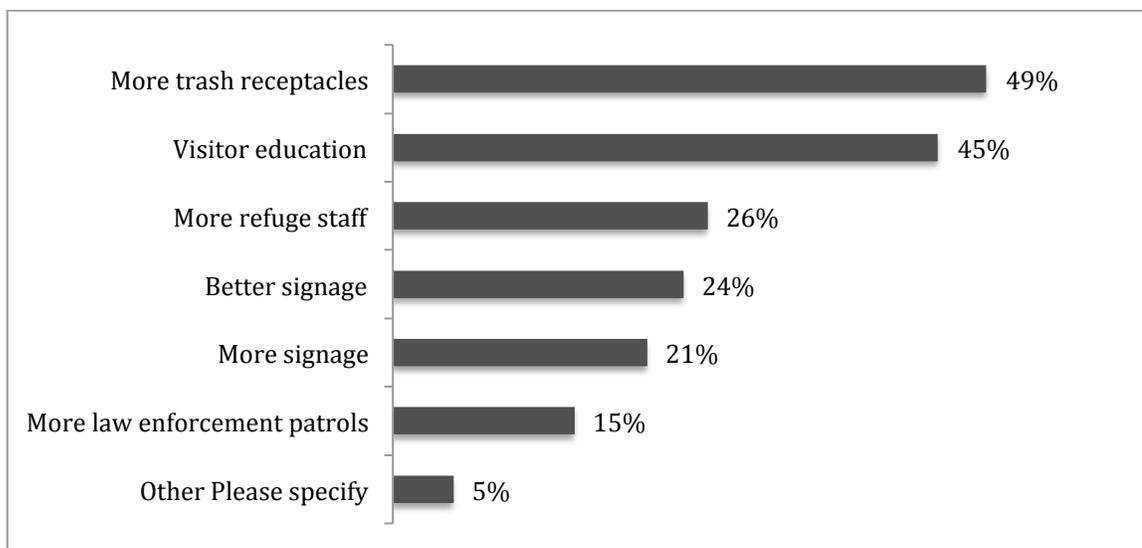
**Figure 14:** Impacts Visitors noticed at Don Edwards. Respondents were allowed to choose multiple options.

Next, visitors were asked to gauge how acceptable each of these nine impacts were (Figure 15). This question did not receive a response from every participant, perhaps due to confusion based on its layout. None of the impacts were highly rated as ok, but Areas Too Crowded and People or Dogs Off Tail got the highest acceptability rating. Dog Poop and Unclean restrooms were also seen as sometimes ok. Most respondents (81%) indicated that impacts at Don Edwards NWR had not influenced their visit. This seems to indicate that human impacts are not significant enough to disturb visitors.



**Figure 15:** Acceptability of refuge impacts. (n=167, 164, 162, 159, 156, 162, 157, 152, 153)

Finally, participants were asked how to best address the impacts from the previous question by choosing as many options from a list as they wanted. (Figure 16). More trash receptacles (49%) and visitor education (43%) were the most-chosen options, followed by more refuge staff (26%) and better signage (24%).



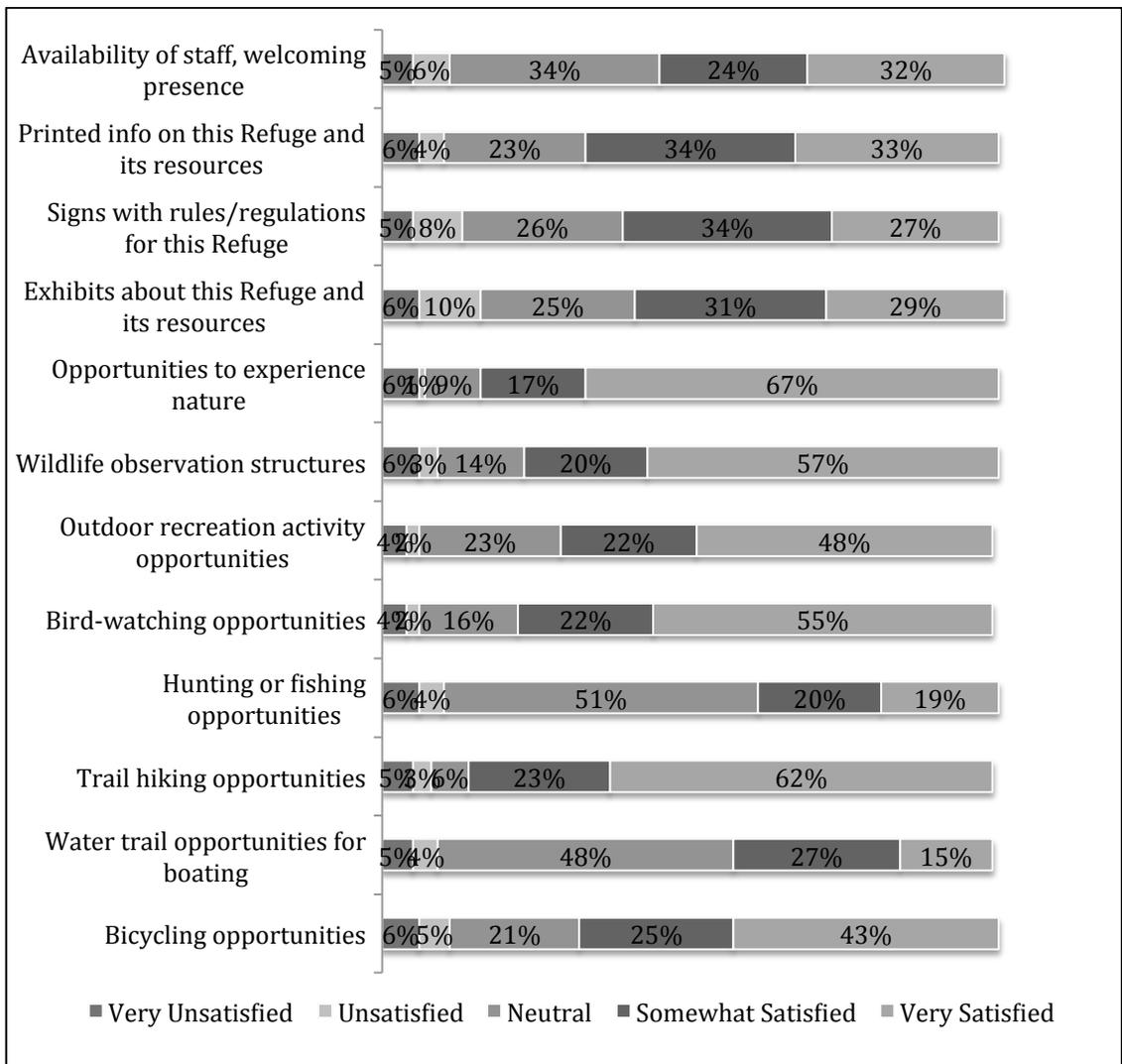
**Figure 16:** How to better address visitor impacts. (n=201).

### **Visitor Opinions**

Participants were asked to rate the services and facilities offered at Don Edwards NWR on a point scale from Very Unsatisfied to Very Satisfied, with a N/A option (Figure 17). The twelve services and facilities included Availability of staff/welcoming presence, Printed information about the site, Signage about rules, Exhibits, Opportunities to experience nature and escape the urban environment, Wildlife observation decks and structures, Outdoor recreation opportunities, Wildlife/bird watching opportunities, Hunting or fishing opportunities, Hiking opportunities, Boating opportunities, and Biking opportunities.

Not one of the options was judged as Very Unsatisfactory by a majority of participants. Respondents consistently ranked Hiking opportunities, Bird watching, Ability to experience nature, and Escape the urban environment as Satisfactory or

Very Satisfactory. The two facilities or services that ranked the lowest were Fishing/hunting and Boating, likely due to the fact that many did not know these options existed at Don Edwards NWR, perhaps because the survey location was far from the boat dock.



**Figure 17:** Visitor Opinions (n= 174, 181, 194, 185, 187, 188, 184, 179, 113, 183, 112, 150)

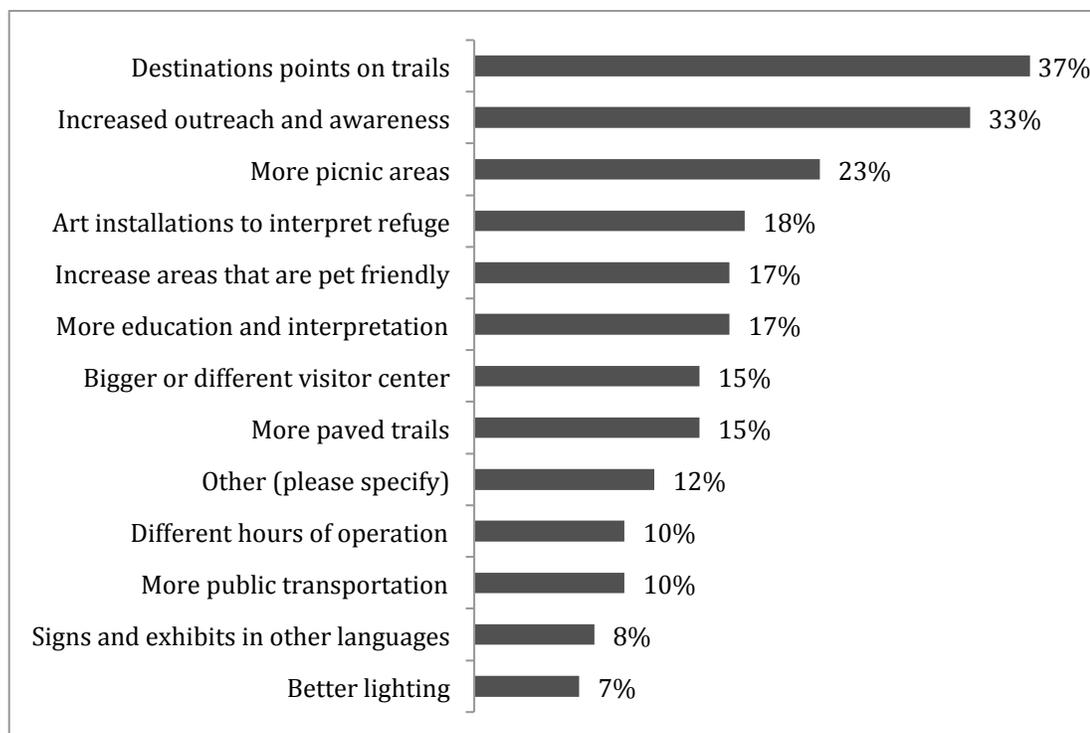
The mean scores for all other services and facilities were ranked as Somewhat Satisfied except for the two listed above (Figure 18). This indicates that overall, visitors are generally content with the current offerings at Don Edwards NWR. With such a high approval rating by visitors, the refuge seems to uphold its mission to provide services, resources, and expertise to its community. Most visitors responded that they are satisfied with trails, opportunities to experience nature, bird watching, and other outdoor recreational opportunities at Don Edwards NWR.

	Mean	N=	Bottom 2 Box	Top 2 Box
Trail hiking opportunities	4	183	9%	85%
Opportunities to experience nature	4	187	7%	84%
Bird-watching opportunities	4	179	6%	78%
Wildlife observation structures	4	188	9%	77%
Outdoor recreation activity opportunities	4	184	7%	71%
Bicycling opportunities	4	150	11%	68%
Printed info on this Refuge and its resources	4	181	10%	67%
Availability of staff, welcoming presence	4	174	11%	55%
Water trail opportunities for boating	3	112	10%	42%
Hunting or fishing opportunities	3	113	10%	39%

**Figure 18:** Visitor Opinions: Mean n score, top scores, and bottom scores.

## How to Enhance the Visitors' Experience at Don Edwards

One of the last questions visitors were asked addressed what they thought might enhance their visit to Don Edwards NWR (Figure 19). The most popular choice was designating destination points on trails (37%) that might encourage visitors to walk, hike, or jog further into the refuge. These points could be chosen to interpret and educate visitors who want increased awareness of the refuge, they could also be sites for art installations, a proposal that received 18% of respondent's approval. Given participants' emphasis on the value of exercise, these points might act as incentives for visitors to extend their hikes and get more exercise.



**Figure 19:** How to enhance the visitor visit (n=201)

The second enhancement option favored by participants was increased outreach and awareness (33%). One way staff can reach out is by engaging with schools and the community through events and field trips. Respondents also suggested that more picnic areas (23%), art installations (18%), more areas that are pet friendly (17%), and a bigger visitor center (15%) could enhance the refuge without the need for more staff, and could serve to afford education and interpretation opportunities if new signage that addresses refuge advantages were installed as well.

### **Discussion**

The results of this study highlight some fascinating trends regarding visitors to the refuge. Many visitors came from the local area, and they represented the full range of demographic attributes that might be expected from this diverse area. Additionally, many respondents came to the refuge for similar reasons, held values that represented the refuge's main mission, had good opinions of the existing services and facilities offered at the refuge, and had higher-than-expected levels of awareness of the mission and benefits of Don Edwards NWR. All these findings were considered positive by staff at Don Edwards NWR, and serve to further our understanding of urban wildlife ecology, recreation ecology, diversity in outdoor spaces, environmental education, and awareness levels that can help create a conservation community and continued stewardship for urban green spaces.

### **Demographics and Trip Characteristics**

Knowing visitor demographics and trip characteristics can result in a better understanding of factors that facilitate or inhibit visits to urban green spaces (USFWS 2014, Roberts & Chitewere 2011). Most of the demographic results of this study are unsurprising when compared to national averages, census data from the two nearest counties, the highest represented cities, and the 2012 study conducted at Don Edwards NWR (The Outdoor foundation 2014, Dietsch et al. 2013, United States Census Bureau 2010 a, b & 2015).

In terms of visitors' ethnic identities (Figure 20 & 21), respondents in this study closely resemble the census data, but diverge from a previous study in 2012. This may be due to changes in the visitor populations at Don Edwards NWR, but is more likely due to the methods deployed by the two studies. The 2012 study asked people to mail in their surveys, adding another step in the process that was outside the surveyors' control (Dietsch et al. 2013). The in-situ nature of this survey, and the fact that all who agreed to participate did so on the spot, may have obtained a sample that better represented the diversity of the visitors at Don Edwards NWR.

	Alameda	Santa Clara	My Study	2012 study
White	43%	47%	49%	73%
Black/African American	12%	3%	1%	2%
American Indian	1%	1%	3%	3%
Asian	26%	32%	31%	25%
Pacific Islander	1%	0.50%	3%	0%
Hispanic or Latino	23%	27%	16%	6%

**Figure 20:** Ethnic or Racial Identity Comparison. Census data is shown as Alameda County/ Santa Clara County (Dietsch et al. 2013, United States Census Bureau 2010a, United States Census Bureau 2015).

	Fremont (25%)	Newark (24%)	Union City (6%)	This study
White	33%	41%	24%	49%
African America/Black	3%	5%	6%	1%
Asian	51%	27%	51%	31%
Hispanic	15%	35%	23%	16%
Native American	0.50%	0.50%	0.50%	3%
Pacific Islander	0.50%	2%	1%	3%

**Figure 21:** City Census Data (United States Census Bureau 2010b). 55% of respondents came from these three cities, and this study's results matched fairly well.

At the same time, comparing this study's results to county and city census data highlights underrepresentation of Hispanic and African American visitors. This represents an opportunity to reach out to new, nontraditional audiences. Urban green spaces provide an opportunity to engage new and diverse audiences, and for many urban residents these spaces may be their only contact with nature (USFWS 2014, Elmqvist et al. 2015). Cultural barriers, like feeling uncomfortable in natural settings, can be linked to race or ethnicity (ibid), and those who identify as white are far more likely to visit outdoor places (The Outdoor Foundation 2014). Some ethnic groups may feel uncomfortable in the outdoors, not having outdoor experience, not being exposed to the outdoors in a positive way, or not wanting to be viewed as an outsider when participating in outdoor recreation (USFWS 2014, Floyd et al. 2016).

Another barrier might be that some individuals or groups don't see outdoor recreation as something they would participate in regularly—meaning they might only think of it as an occasional or special thing (Floyd et al. 2016). Educating community members about the health benefits of regular outdoor recreation, the safety measures at the refuge, and the willingness of the staff to try to reach a diverse audience and accommodate different cultures might have a positive effect on attracting more non-traditional visitors.

This study did identify a diversity of visitors at Don Edwards NWR, and it is apparent that visitors to the refuge generally represent the surrounding community. The negative results of the cross tabulation analysis also indicate that regardless of visitor demographics, results from each question in the survey should be seen as inclusive of all visitors to Don Edwards NWR, and not just a specific survey population. Other urban green spaces can benefit from understanding their own visitation, and may use examples from Don Edwards NWR, and this study, to learn to connect with their community members and expand environmental education opportunities to create an informed conservation community.

### **Behaviors and Values**

The activities respondents engaged in at the refuge represent not only the values they associate with Don Edward NWR, but also an interesting trend in their activity choices. There is some research regarding intentional vs. incidental visits to tourist destinations that focuses on whether visitors sought out a destination or stumbled upon it (Hall & Page 2014, Gursoy & McCleary 2004). The results of this study—namely that visitors often already knew of the refuge, came from the local area, visited on average once a week, and mostly participated in activities for exercise—indicate that the activities that visitors engage in at Don Edwards NWR were intentional. When asked about their primary activity at the refuge, most people chose hiking or exercise. However when allowed multiple choices, it appears that many may have come for multiple reasons, such as engaging in bird watching, casual photography, or experiencing nature while they hiked. As visitors are coming to Don Edwards NWR to engage in an intentional activity, they are also incidentally engaging in additional activities. This highlights that they may be using the refuge more like a neighborhood park than a wildlife refuge.

Comparing participants' activity choices to what they valued about Don Edwards NWR, and considering their awareness of the mission and benefits of the refuge, it becomes clear that visitors are using the site as a place to exercise. Incidentally, however, they have become attached to the place and are interested in the ecosystem services it offers and new opportunities for environmental education.

Providing additional information to visitors could promote pro-environmental behavior and help create an informed conservation community. This interface between intentional and incidental visitor behavior highlights a way the study of Urban Ecology can play a role in urban green space management, and an opportunity for the refuge to better engage their visitors.

Activities chosen by respondents at Don Edwards also reflect the dual mission urban green space managers are trying to promote by focusing on both outdoor recreation and wildlife habitat (USFWS 2011). The main visitor activities at the refuge may center on their physical fitness, but also strongly relate to the physical and psychological benefits urban green spaces offer like experiencing nature and creating habitat for wildlife (Elmqvist et al. 2015). There also appeared to be an appetite among participants to learn more about these benefits.

Recreational opportunities in urban green spaces are seen as an asset provided to the community (Chiesura 2004, Elmqvist et al. 2015). This study provides as an example of a refuge that is protecting wildlife while also giving the community a place to recreate and learn. With this knowledge, Don Edwards NWR staff can better promote their mission and garner support by encouraging visitors to learn more about the physical, mental, and social benefits of time spent outdoors (ibid).

### **Awareness of Refuge Mission and Advantages**

The behaviors discussed above are tied to participants' awareness of the mission of wildlife refuges. More respondents than anticipated were aware they were visiting a refuge, and were at least somewhat aware of the mission of a wildlife refuge. This could mean that short-term goals of educating current visitors about the importance of wildlife refuges may already have been achieved. Yet, while participants seemed to know about the mission of the refuge, they knew less about some of the purposes and benefits the refuge offers to the surrounding community, and showed an appetite to learn more. This highlights an opportunity for the refuge to expand environmental education in the form of interpretation through direct contact with refuge staff, well-placed panels and signage, or an expanded online presence. It may also serve as a template to gauge visitors' interest in ecosystem services in other urban green spaces.

Wetland environments are laboratories where we can study the effects of climate change. Showcasing how these environments help sequester carbon and act as protection from sea level rise is an excellent way to advocate for more preservation and restoration of wetlands, and to expand environmental education through incidental activities such as interpretive signage, information at the visitor center, handouts that can be placed around the community, and staff-lead programs about these topics. This could all help create an informed conservation community and build support and stewardship.

### **Recreation Ecology**

Most respondents had witnessed recreational impacts at Don Edwards NWR , but overall didn't seem affected by them. This may have been because the question was formatted in a way that was confusing to some respondents, indicated by the lower number of responses, however all respondents read the question so in this way it served as a subtle form of environmental education. Visitor education about recreational impacts can vastly decrease the impact of visitors; informed visitors may even advise others of misdoings (Monz et al. 2010, van Riper et al. 2011).

Respondents indicated the easiest way to mitigate the most common impacts they witnessed was to simply install more trash receptacles, and to enhance visitor education about how to reduce their own impacts. However, the two impacts ranked the highest as OK or Sometimes OK were dogs and people going off-trail. This is problematic because those two behaviors disrupt wildlife and create erosion problems, a major concern for a wildlife refuge. The only way to mitigate this kind of behavior is to better educate refuge visitors as to the seriousness of people or dogs going off trail. This could highlight an educational strategy that may be used in other wildlife refuges in the future.

### **Recommendations**

Environmental education is one way resource managers communicate with the public to establish a mutual understanding, promote involvement, and influence attitudes and actions. The goal is to create an informed conservation community that understands the physical and psychological resources provided by urban green spaces (Niemelä 1999, McKinney 2002). In each case above, the visitors to Don Edwards had positive things to say about the refuge. But effective communications is an ongoing process, and in order to reach out to new audiences, managers have to try new ways to connect with individuals or groups who are not currently using the refuge.

Resource managers of urban green spaces can promote environmental education and create a conservation community by engaging with schools and the community through events and field trips. This requires extra staff hours and can reduce time available for other refuge activities. Social media offer options for community engagement and outreach that do not require much ongoing staffing, have the potential to reach large audiences, and offer an effective way to educate the community about what the refuge has to offer.

Don Edwards NWR provides services, resources, and expertise to the urban community in a way that contributes to the health and welfare of the community as a whole. The survey highlights an opportunity to expand the range of visitor activities. Many seemed unaware of boating opportunities at Don Edward NWR.

This may have been due to the survey location, but many participants seemed unaware that these activities were even allowed at the refuge and showed some interest in learning more about them. The wetland environment offers a unique potential to promote waterway activities like fishing, hunting, boating, or kayaking.

If resource managers are clear about what is and isn't allowed, boating is a great way for people to engage with the wetland because, when done properly, it tends to leave a relatively small impact and can be very enjoyable. But the costs and necessary storage required to own one's own boat pose formidable barriers. If the refuge were to have kayaks available for rent, and could educate visitors about good boating behaviors to reduce impacts on bird habitat, it could open new avenues to connect with the public and get visitors engaged in their refuge.

Additionally, visitors' general lack of awareness regarding staff-guided programs highlighted an opportunity for Don Edwards NWR. The Refuge is supposed to provide time, expertise, and resources to the community (USFWS 2014). Offering more programs at different times, and getting the word out to current visitors could create further opportunities for direct interaction with visitors. Don Edwards NWR could also promote its staff-led programs on social media and through the refuge website, or have a specific meet-up location with better signage to reach a larger audience. Programs are an effective way to educate visitors, and can help address their interests and questions while gauging their

reactions and concerns about the refuge. Programs also serve as useful ways to educate visitors about the goals, missions, advantages, and proper behaviors in the refuge, and garner support and build stewardship with new and diverse audiences

### **Future Studies**

Hopefully this research can serve as a case study for other urban green spaces on why analyzing visitation is important and how to better understand visitors' motivations and appreciation of these spaces. Additionally, it can help to inform how environmental education can play a role in urban wildlife ecology, recreation ecology, and diversity in urban green spaces.

If this survey were to be repeated, there were several questions that needed to be better formatted or re-worked. The question about how respondents learned of the refuge should have included a "previous knowledge" option, as indicated by the large number of participants who chose the "Other" option. Many long-term residents had seen the refuge established, and this would have been better represented if that option had been present. The question about impacts also could have been reworked. The question was designed to address both what the respondent witnessed, and how acceptable they thought that impact was. This ultimately seemed confusing to many respondents, and in the future should be separated into two separate questions. Additionally, if this study were to be repeated at Don Edwards NWR, it should include different survey locations and a

longer survey time period. A year-long survey would better capture a full view of visitation and visitor activities at the refuge, and the impact of seasonal changes.

This study highlighted higher than expected visitor awareness and a continued appetite for environmental education. Knowing that visitors to Don Edwards NWR are using the refuge as a neighborhood park for exercise, but incidentally acquiring environmental education, opens the door to new questions. It would be enlightening to gauge if visitors are using any of the knowledge of conservation learned on their visits in their daily lives, say by planting native species in their gardens or better understanding how the wetland is protecting them from sea level rise. Answering questions like this can further our understanding of the best way to create a conservation community and foster stewardship of urban green spaces.

### **Conclusion**

As the global population becomes increasingly urban, attention must be paid to how humans can foster sustainability and provide for ecosystem services in urban areas (Kudryavtsev et al. 2012). In particular, scholars have called for enhancing environmental stewardship and environmental education in cities, and suggest that this may promote place attachment and facilitate stewardship for ecosystem resilience and human well-being (Chapin et al. 2011, Kudryavtsev et al. 2012).

The results of this study can help resource managers understand visitation and visitor experiences in urban green spaces. The results from this study indicate that many people are intentionally using Don Edwards NWR like a neighborhood park and their primary interest is in getting outside to exercise. However, while they are intentionally coming to Don Edwards NWR for exercise, they are incidentally enjoying the ecosystem services and psychological benefits the open space provides, and learning about the advantages of urban green space through interpretative panels, talks, and contact with refuge staff. This highlights the unique opportunity that urban green spaces have to promote environmental education and build an informed conservation community.

Moving forward, resource managers who better understand visitation to urban green spaces can promote wildlife habitat and urban ecology by building stewardship. Places like Don Edwards NWR have the unique opportunity to connect with urban residents and encourage environmental education. In the future, the informed conservation community created through environmental education can exercise economic and political pressure to promote conservation policies at the local and national scales (McKinney 2002, Nilon 2011). The connection people feel to space and nature in urban green spaces can encourage pro-environmental behavior (Kudryavtsev et al. 2012). When residents value green spaces, have an awareness of urban ecology issues, and understand the physical and social benefits

associated with urban green spaces, this will strengthen the conservation ethic and create new opportunities for supporting urban green spaces in the future.

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## Appendix 1: Survey Questions and Results

### **Don Edwards San Francisco Bay National Wildlife Refuge Visitor Survey, Spring 2016**

As part of her Masters thesis for San Francisco State University, Jessica Sloan is conducting a survey to learn more about recreationists at Don Edwards San Francisco Bay National Wildlife Refuge (SFB NWR). This information will be used to inform refuge managers and better serve the public.

*Your opinion and participation is important to the refuge, and greatly appreciated.*

All Information will be kept strictly confidential and your response is voluntary. Please read each question carefully and save additional comments for the final page. This survey should take approx. 10-15 minutes to complete.

#### **Trip Characteristics:**

#### **1. How many people are in your group (including you)?**

**421adults /69 children** Total # (adults/children under 18)

#### **2. How would you describe your group?**

**42%**  Traveling alone

**43%**  Friends

**14%**  Family

**1%**  Organized Group

#### **3. Please tell us about your visit to Don Edwards SFB NWR:**

**17%**  This is my first visit

**84%**  This is not my first visit. (Please specify below)

a. Approximate visits a year **Most responded once a week**

b. About how many hours per visit?

**54%**  0-1 hours

**5%**  4-6 hours

**41%**  2-3Hours

**0%**  All day

#### **4a. What activities do you participate in here? (check all that apply)**

**83%**  Hiking

**46%**  Wildlife Viewing

**12%**  Educational opportunities and interpretation

**18%**  Biking

**19%**  Photography with camera equipment

**1%**  Hunting/  
Fishing

**34%**  Casual photography (cell phone)

**35%**  Bird watching

**1%**  Boating

**56%**  Exercise

- 42%**  Experiencing Nature      **7%**  Attending a Program      **11%**  Other  
**20%**  Walk my dog

**5. What is your primary recreational activity? Hiking/Walking 57%**

**6. Where did you first learn about Don Edwards SFB NWR?**

- |  |  |
|--|--|
| <b>6%</b> <input type="checkbox"/> Refuge printed information        | <b>3%</b> <input type="checkbox"/> School                          |
| <b>9%</b> <input type="checkbox"/> People in my community            | <b>15%</b> <input type="checkbox"/> Family member                  |
| <b>18%</b> <input type="checkbox"/> Friends                          | <b>5%</b> <input type="checkbox"/> East Bay Regional Park District |
| <b>5%</b> <input type="checkbox"/> The refuge website                | <b>13%</b> <input type="checkbox"/> Signs on the highway           |
| <b>2%</b> <input type="checkbox"/> Recreation/organized group        |  |
| <b>6%</b> <input type="checkbox"/> From a different website          |  |
| <b>15%</b> <input type="checkbox"/> Other— <u>previous knowledge</u> |  |

**7. Did you attend a guided tour or ranger led talk?**

- 21%**  Yes      **79%**  No

**If yes, why did you choose this program?**

- |  |   |
|--|---|
| <b>24%</b> <input type="checkbox"/> I came with someone who was interested | <b>36%</b> <input type="checkbox"/> It covered a topic I am interested in |
| <b>17%</b> <input type="checkbox"/> It was offered when I was here         | <b>12%</b> <input type="checkbox"/> I sought out this program             |
|  | <b>12%</b> <input type="checkbox"/> the program was family motivated      |

**If no, what would encourage you to come to a program?**

- Better advertising 21%, I don't know/not interested 21%**

**Motivations for your Visit**

At Don Edwards SF Bay NWR we would like to know some of your motivations for spending time outdoors. The next question aims to better understand why our visitors choose to spend their time outside.

**8. Why is this refuge important to you? Please check all that apply.**

- |  |  |
|--|--|
| <b>40%</b> <input type="checkbox"/> Interact with friends/family | <b>17%</b> <input type="checkbox"/> to provide the community with ecosystem services |
| <b>71%</b> <input type="checkbox"/> Wildlife habitat             | <b>61%</b> <input type="checkbox"/> Open space                                       |
| <b>77%</b> <input type="checkbox"/> Exercise                     | <b>53%</b> <input type="checkbox"/> Outdoor recreation                               |
| <b>65%</b> <input type="checkbox"/> Space to relax               | <b>64%</b> <input type="checkbox"/> Aesthetic beauty/scenery                         |
| <b>5%</b> <input type="checkbox"/> A way to work/safe commute    | <b>67%</b> <input type="checkbox"/> Reduce stress                                    |

- 12%**  Meet new people                      **46%**  Escape the urban environment  
**38%**  Learn about wildlife and wetlands                      **59%**  A place that is quiet  
**22%**  To be with my dog

### Refuge Awareness

The following questions are designed to better understand your awareness of the mission and benefits of the U.S. Fish and Wildlife Service and Don Edwards San Francisco Bay National Wildlife Refuge.

**9. Before you were contacted for this survey, were you aware you were in a National Wildlife Refuge?**

- 90%**  Yes                      **10%**  No

**10. How would you rate your knowledge of the mission of the U.S. National Wildlife Refuge System?**

- 19%**  Very familiar                      **52%**  somewhat familiar                      **28%**  Not familiar

**11. What would you chose as the PRIMARY mission of this refuge—Don Edwards SF Bay NWR?**

- 66%**  to conserve, manage, and restore fish, wildlife, plants and their habitat.  
**16%**  to educate and instill appreciation for the diversity of fish, wildlife, plants, and their habitats  
**7%**  to provide opportunities to participate in outdoor recreational activities  
**6%**  to provide open space to the community  
**0%**  to provide hunting and fishing opportunities  
**4%**  I don't know

**12. How familiar are you with the following purposes and benefits of the Don Edwards SFB NWR?**

Purpose/Benefit	Not at all Familiar	Somewhat Familiar	Very familiar
Wildlife-Oriented Recreation Opportunities	<b>21%</b> <input type="checkbox"/>	<b>51%</b> <input type="checkbox"/>	<b>28%</b> <input type="checkbox"/>
Preserve and enhance wildlife habitat	<b>32%</b> <input type="checkbox"/>	<b>50%</b> <input type="checkbox"/>	<b>18%</b> <input type="checkbox"/>

Protect migratory birds and threatened and endangered species	32% <input type="checkbox"/>	48% <input type="checkbox"/>	20% <input type="checkbox"/>
Ecosystem services	21% <input type="checkbox"/>	48% <input type="checkbox"/>	31% <input type="checkbox"/>
Protection from flooding and sea level rise	19% <input type="checkbox"/>	36% <input type="checkbox"/>	45% <input type="checkbox"/>
Education Opportunities	19% <input type="checkbox"/>	48% <input type="checkbox"/>	32% <input type="checkbox"/>
Carbon sequestration	13% <input type="checkbox"/>	24% <input type="checkbox"/>	62% <input type="checkbox"/>
Tidal Marsh Restoration	24% <input type="checkbox"/>	48% <input type="checkbox"/>	27% <input type="checkbox"/>

**13. Which of the above would you be interested in learning more about?**

- |  |  |
|--|--|
| 32% <input type="checkbox"/> Wildlife oriented recreation opportunities            | 33% <input type="checkbox"/> Marshland protection from flooding and sea level rise |
| 46% <input type="checkbox"/> Wildlife habitat                                      | 19% <input type="checkbox"/> Educational opportunities                             |
| 29% <input type="checkbox"/> Migratory birds and threatened and endangered species | 22% <input type="checkbox"/> Carbon sequestration                                  |
| 27% <input type="checkbox"/> Ecosystem services                                    | 29% <input type="checkbox"/> Tidal marsh   |

**14. How do you think Don Edwards SFB NWR could better educate visitors about how the refuge is working towards the above goals?**

- |  |   |
|--|---|
| 8% <input type="checkbox"/> Not Interested                                   | 21% <input type="checkbox"/> More educational outreach              |
| 29% <input type="checkbox"/> More information at the visitor contact station | 12% <input type="checkbox"/> Informational mailings                 |
| 35% <input type="checkbox"/> More information through social media           | 17% <input type="checkbox"/> More information on the refuge website |
| 28% <input type="checkbox"/> Better signage                                  | 28% <input type="checkbox"/> Community outreach                     |
| 24% <input type="checkbox"/> Additional Kiosks and interpretation            | 18% <input type="checkbox"/> Additional programs, talks, or events  |

**Impacts**

At Don Edwards SFB NWR we would like to better understand how to best communicate with visitors about the potential impacts they can have on the refuge's wildlife and their habitats. Please indicate the impacts that you have witnessed here, and what could be some solutions to these concerns.

15. Please mark the box if you have witnessed any of the following impacts here at Don Edwards SFB NWR, and then rate how acceptable you believe each individual impact is.

Witnessed Impacts	Always OK OK	Sometimes OK	Never OK
<b>N=52</b> <input type="checkbox"/> Tagging/graffiti	<b>4%</b> <input type="checkbox"/>	<b>8%</b> <input type="checkbox"/>	<b>88%</b> <input type="checkbox"/>
<b>N=89</b> <input type="checkbox"/> Dog poop	<b>4%</b> <input type="checkbox"/>	<b>28%</b> <input type="checkbox"/>	<b>68%</b> <input type="checkbox"/>
<b>N=52</b> <input type="checkbox"/> People hiking off trail	<b>9%</b> <input type="checkbox"/>	<b>35%</b>	<b>56%</b> <input type="checkbox"/>
<b>N=30</b> <input type="checkbox"/> Dogs running off trail	<b>9%</b> <input type="checkbox"/>	<b>26%</b> <input type="checkbox"/>	<b>65%</b> <input type="checkbox"/>
<b>N=19</b> <input type="checkbox"/> unclean restroom facilities	<b>4%</b> <input type="checkbox"/>	<b>25%</b> <input type="checkbox"/>	<b>71%</b> <input type="checkbox"/>
<b>N=64</b> <input type="checkbox"/> Trash on the ground	<b>3%</b> <input type="checkbox"/>	<b>11%</b> <input type="checkbox"/>	<b>86%</b> <input type="checkbox"/>
<b>N=16</b> <input type="checkbox"/> Discarded-fishing line	<b>3%</b> <input type="checkbox"/>	<b>4%</b> <input type="checkbox"/>	<b>93%</b> <input type="checkbox"/>
<b>N=17</b> <input type="checkbox"/> Visitors disturbing wildlife	<b>3%</b> <input type="checkbox"/>	<b>5%</b> <input type="checkbox"/>	<b>92%</b> <input type="checkbox"/>
<b>N=14</b> <input type="checkbox"/> Areas are too crowded	<b>8%</b> <input type="checkbox"/>	<b>48%</b> <input type="checkbox"/>	<b>43%</b> <input type="checkbox"/>

16. Did these impacts influence the quality of your visit?

**81% = no 19% =yes**

17. What do you think is the best way to focus refuge resources to address these impacts?

**15%**  More law enforcement patrols

**49%**  More trash receptacles

**21%**  More signage

**24%**  Better signage

**26%**  More refuge staff

**45%**  Visitor Education

**5%**  Other

#### Refuge Opinions:

We would like to know about your Impressions and opinions of Don Edwards San Francisco Bay National Wildlife Refuge. Please rate the following services, facilities and activities.

**18. Please tell us your opinion about the following elements of Don Edward SF Bay NWR.**

<i>Circle one for each item</i>	<b>Satisfaction</b>				
<b>Refuge Services, Facilities, and Activities</b>	Very Unsatisfied	Unsatisfied	Neither	Somewhat satisfied	Very satisfied
<b>N=174</b> Availability of staff, welcoming presence at visitor center	5%	6%	34%	24%	32%
<b>N= 181</b> Printed info on this Refuge and its resources (ie, maps and brochures)	6%	4%	23%	34%	33%
<b>N=194</b> Signs with rules/regulations for this Refuge	5%	8%	26%	34%	27%
<b>N=185</b> Exhibits about this Refuge and its resources	6%	10%	25%	31%	29%
<b>N=187</b> Opportunities to experience nature and escape the urban environment	6%	1%	9%	17%	67%
<b>N= 188</b> Wildlife observation structures (decks, blinds) for hunting or photography	6%	3%	14%	20%	57%
<b>N=184</b> Outdoor recreation activity opportunities	4%	2%	23%	22%	48%
<b>N=179</b> Bird-watching opportunities	4%	2%	16%	22%	55%
<b>N=113</b> Hunting or fishing opportunities	6%	4%	51%	20%	19%
<b>N=183</b> Trail hiking opportunities	5%	3%	6%	23%	62%
<b>N=112</b> Water trail opportunities for boating	5%	4%	48%	27%	15%
<b>N=150</b> Bicycling opportunities	6%	5%	21%	25%	43%

**19. How can we enhance your experience here at Don Edwards SFB NWR?**

- |  |   |
|--|---|
| <b>10%</b> <input type="checkbox"/> More public transportation           | <b>10%</b> <input type="checkbox"/> Different hours of operation                  |
| <b>33%</b> <input type="checkbox"/> Increased outreach and awareness     | <b>17%</b> <input type="checkbox"/> More education and interpretation             |
| <b>17%</b> <input type="checkbox"/> Increase areas that are pet friendly | <b>18%</b> <input type="checkbox"/> Art installations to interpret refuge         |
| <b>23%</b> <input type="checkbox"/> More picnic areas                    | <b>15%</b> <input type="checkbox"/> More paved trails                             |
| <b>7%</b> <input type="checkbox"/> Better lighting                       | <b>8%</b> <input type="checkbox"/> Signs and exhibits in multiple other languages |
| <b>15%</b> <input type="checkbox"/> Bigger/different visitor center      | <b>37%</b> <input type="checkbox"/> Destination points on trails                  |
| <b>12%</b> <input type="checkbox"/> Other                                |   |

**Demographics**

Knowing the demographics of our visitors will help us know our community and better serve you. Please answer the following questions.

**20. Are you visiting from:**

- California? **95%**  
 Out of State? **5%**

**21. Are you?**

- 52%**  Male **48%**  Female

**22. What is your age range?**

- |   |   |
|---|---|
| <b>9%</b> <input type="checkbox"/> 18 – 24  | <b>16%</b> <input type="checkbox"/> 45-54       |
| <b>19%</b> <input type="checkbox"/> 25 – 34 | <b>24%</b> <input type="checkbox"/> 55-64       |
| <b>16%</b> <input type="checkbox"/> 35 – 44 | <b>15%</b> <input type="checkbox"/> 65 and over |

**23. What is the highest level of education you have completed?**

- |  |   |
|--|---|
| <b>0%</b> <input type="checkbox"/> Some high school                    | <b>6%</b> <input type="checkbox"/> Associates degree            |
| <b>9%</b> <input type="checkbox"/> High school diploma                 | <b>33%</b> <input type="checkbox"/> Bachelor's degree           |
| <b>16%</b> <input type="checkbox"/> Some college                       | <b>20%</b> <input type="checkbox"/> Graduate degree             |
| <b>4%</b> <input type="checkbox"/> Trade/technical/vocational training | <b>9%</b> <input type="checkbox"/> Ph.D., Law or medical degree |

**24. What is your approx. annual household income before taxes?**

- |  |   |
|--|---|
| <b>11%</b> <input type="checkbox"/> less than 25,000 | <b>14%</b> <input type="checkbox"/> 50,000—74,999   |
| <b>8%</b> <input type="checkbox"/> 25,000—34,000     | <b>15%</b> <input type="checkbox"/> 75,000—99,999   |
| <b>10%</b> <input type="checkbox"/> 35,000—49,999    | <b>20%</b> <input type="checkbox"/> 100,000—149,999 |

**9%**  150,000—199,999

**14%**  200,000 or more

**25. What ethnicity or racial identity do you consider yourself (please mark all that apply):**

**3%**  Native American

**16%**  Hispanic or Latino

**33%**  Asian or Asian American

**49%**  White

**1%**  Black or African American

**4%**  Other

**Thank you so much for helping us with this important study. If there is anything else you would like to share with us, please do so below.**