CITIZEN SCIENCE AND ITS CONTRIBUTION TO THE CONSERVATION OF SACRAMENTO VALLEY RED FOXES IN CALIFORNIA

BY

AMY BRASCH

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Abstract

Red foxes found in the Sacramento Valley of California, referred to as SV red foxes throughout this thesis, were assumed to be of non-native ancestry until recent genetic testing confirmed their historical link to the area. The development of an effective conservation strategy for SV red foxes is currently underway, but was initially hindered by the lack of details regarding habitat requirements, occupancy patterns, and population sizes. In 2007, the University of California, Davis launched a fox reporting website for the public to document any fox sightings. Researchers actively pursued the public fox sighting reports from 2007-2009 and found 51 active red fox dens, 48 of which were native SV red fox dens, throughout the Sacramento Valley based on the locations provided in the reports.

The objectives of my research are to answer the following questions: (1) What can the data provided in the previously obtained fox sighting reports reveal about the website trends and fox ecology? (2) What types of relationships occur between the public and the SV red fox research efforts, and how can the participants' experience be improved to ensure long-term participation? (3) Can a recently developed presence-only SV habitat model be used as a filter for future incoming reports, and what are the relationships between the reports with a high probability of fox presence and its associate report components?

In chapter one, I assess how effective the public sighting reports (n= 248) were in: assisting researchers with locating SV red fox dens, providing information about habitat preferences of the SV red foxes, and supplying insights of the website. The results showed that the distance from Yolo County, where the highest amount of SV red fox dens is located and where the initial study was conducted, can explain 38% of the variation in the quantity of reports collected from the website.

In chapter two, I administered an online survey to the residents of the Sacramento Valley to gauge their outlook on SV red foxes and their opinions of the fox reporting website. The survey respondents included both previous website visitors and new website visitors. I summarized the responses (n= 310 total, n= 210 complete) and ran a series of statistical analyses to evaluate the social characteristics of the participants utilizing the website. Overall, the majority of participants responded positively to the website, declaring it interesting and helpful. However, there is a low rate of return visitors. The main users of the fox sighting website are older participants and/or participants with a higher level of education.

In the third chapter of this research, I overlaid the fox sighting report locations onto the SV habitat model using ERSI® ArcMap v 10.0 and coded them for habitat suitability values. Analysing previously obtained fox sighting reports provided the necessary insight to define the criteria for the data filter. By implementing a habitat model filter at moderate habitat suitability levels, researchers can reduce the time it takes them to validate the public data received. However, a coinciding filter recording distribution frequency for report locations should also be implemented to compensate for dens located in low habitat suitability levels.

Prior to this research, the data collected from the public had never been evaluated for purposes other than locating potential SV red foxes. By reviewing feedback from the participants, I was able to characterise the participants using the fox reporting website and assess their general SV red fox knowledge. The findings of my research also lead to insights about SV red fox ecology. However, the major finding in this research shows that the majority of local citizens participating in this study indicated awareness of SV red foxes nativity and endangerment.

The methods used in my research can be applied to other citizen science projects, to improve the overall efficiency and effectiveness of collecting data.

Acknowledgements

It is with immense gratitude that I acknowledge the support of my academic supervisor, Dr. Heiko Wittmer. This research would not have been possible without his extensive knowledge and guidance. It was an honour to work with someone whom I consider an expert in the field of conservation biology. I would also like to extend my gratitude to Dr. Ben Sacks for graciously providing me with the necessary materials and Sacramento Valley red fox information for this research. I thank Dr. Dalice Sim as well for the statistical support she contributed. Lastly, I thank my family and friends for their constant love, support, and encouragement while I pursued my academic goals in New Zealand.

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Introduction

Red Foxes

The red fox (*Vulpes vulpes*) is one of the most widely distributed terrestrial mammals in the world (Lariviere and Pasitschniak-Arts, 1996; Nowak, 1999). Indigenous to the northern hemisphere, native red fox regions include: Asia, Europe, North Africa, Middle East, and North America (Macdonald and Reynolds, 2008). Their ranges vary from native desolate outskirts of the tundra to non-native semi-arid deserts of Australia, ultimately making red foxes generalist species with a broad range of adaptations across the various regional habitats (Lewis et al., 1999; Lloyd, 1980).

Both native and non-native species of red foxes are found in North America (Aubry 1983; Churcher, 1959). The native red fox populations have been genetically linked to three lineages tracing back to the Boreal forests and mountainous regions of Alaska, western Canada, and the eastern United States (Sacks et al, 2010a; Statham et al., 2012). These native populations established territories throughout the United States, excluding regions in the southern east coast, the southern Great Plains, and the Pacific coast (Lariviere and Pasitschniak-Arts, 1996). Non-native red foxes were introduced by early European settlers in the late 1800s for fur farming and hunting purposes (Aubry, 1984; Churcher, 1959; Lariviere and Pasitschniak-Arts, 1996; Lewis, 1999). This introduction led to non-native red fox populations establishing in areas in the United States previously unoccupied by native red foxes (Lariviere and Pasitschniak-Arts, 1996). Over time, native and non-native fox distribution in the United States expanded due to factors including: competition with wolves and coyotes, habitat alteration, climate change, and urban encroachment (Macdonald and Reynolds, 2008; Moore, 2009; Rhymer and Simberloff, 1996; Storm et al., 1976).

In California, red fox populations spread widely from low-elevation coastal areas to high-elevation mountainous regions (Fig. 1). Native red fox species, typically adapted to colder climates, presumably had different habitat preferences than the non-native red foxes, which occur at lower and warmer elevations (Aubry, 1983; Grinnell et al., 1937; Lewis et al., 1999; Perrine et al., 2007; Sacks et al., 2010a; Statham et al., 2012). Sierra Nevada red foxes (*Vulpes vulpes necator*), one of the most iconic keystone species in red fox conservation in California, reside in the Sierra Nevada mountain range and southern Cascade Range (Grinnell et al., 1937). Due to extreme low remaining population sizes, Sierra Nevada red foxes are considered critically endangered and remain the focus of active conservation management (Perrine et al., 2010; Sacks et al., 2010a).

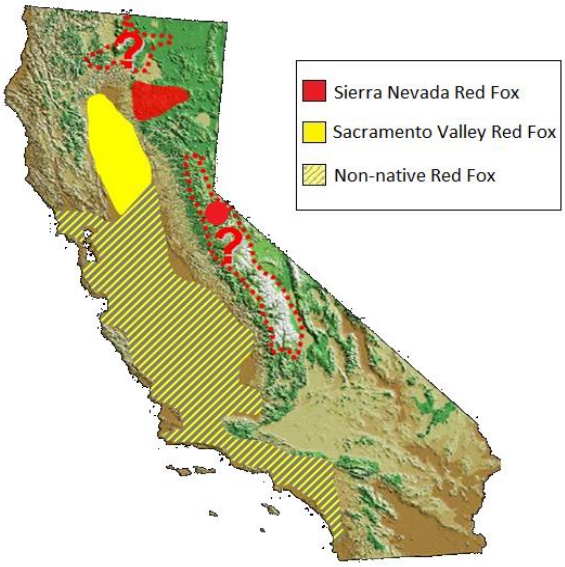

Figure 1: The current distribution of red foxes in California, based on observations provided by Grinnell et al., 1937 and Sacks et al., 2010b

Red foxes residing in some lowland habitats including coastal marshes are descendants of individuals escaping or being released from fur farms that were common in California in the late 1800s (Lewis et al., 1999; Perrine et al., 2007; Sacks et al., 2010a; Sacks et al., 2010b; Statham et al., 2012). Prior to the 1990's, non-native red foxes were primarily restricted to the Sacramento Valley; however, recent reviews have found non-native red fox range vastly expanded, currently stretching from the foothills of the Sierra Nevada mountain range to the southernmost part of Los Angeles County (Grinnell et al., 1937; Lewis et al., 1999; Perrine et al., 2007). Recent molecular analyses confirmed these foxes are of non-native ancestry (e.g. Statham et al., 2012).

The Sacramento Valley's southern boundary begins north of the Sacramento-San Joaquin delta and stretches as far north as Shasta County (Plank, 2010). The valley is bordered by the foothills of the Sierra Nevada mountain range to the east and the Siskiyou Mountains to the north (Plank, 2010). The area includes twelve counties, which contain several large cities (e.g. Sacramento, Redding, and Yuba) (Plank, 2010). The Sacramento Valley is relatively flat and predominantly characterised by seasonal wetlands and floodplains (Jones and Klar, 2007). Agriculture is a major form of subsistence for local communities in the area (Plank, 2010).

Red foxes found in the Sacramento Valley were, until recently, assumed to be of non-native ancestry because of their occurrence in lowland habitats and observed spatial separation from native foxes found at higher elevations. Recent genetic analyses, however, showed these foxes to be historically linked to California's Sacramento Valley and phylogenetically related to the native Sierra Nevada red fox (Perrine et al., 2007; Sacks et al., 2010a). Consequently these foxes are now recognized as a native subspecies, the Sacramento Valley (SV) red fox (*Vulpes vulpes patwin*), and the only native red foxes west of the Rocky Mountains found naturally in low elevation habitats (Sacks et al., 2010a). Despite the possibility of distribution overlap with non-native red foxes, DNA tests confirmed that there was a clear distinction between the native genomic composition

of SV red foxes and non-native genomic composition of the red foxes residing outside of the Sacramento Valley (Perrine et al., 2007; Sacks et al., 2011).

Non-native red foxes in California are managed as pests. Thus, prior to the genetic confirmation of native ancestry, the SV red fox faced threat of eradication, as indicated in an informational report published by the California Department of Fish and Game in response to what was currently being done to keep red foxes from threatening California's biodiversity (Jurek, 1992):

> *The Department of Fish and Game and U.S. Fish and Wildlife Service are increasing efforts to control exotic red foxes, including use of lethal measures. Such control will be necessary to protect native wildlife in more places in the future as red fox population expands* (12).

The impact of potentially lethal measures on the SV red fox could have a devastating effect on their abundance, particularly because the estimated effective population size of SV red foxes is very small, indicating possible conservation concerns (Sack et al., 2010a, b).

In addition to lacking an appropriate management plan, SV red foxes also face the threat of increased habitat loss. SV red foxes occur in highly modified landscapes, which are currently used for intensive farming purposes. A preliminary habitat analyses indicates that the current distribution of SV red foxes in the northern part of the Central Valley overlaps with a floodplain once characterized by native grasslands and riparian forests (Sacks et al. 2010b; Sacks et al., 2013). Today, most of these floodplains are used for agricultural purposes (Plank, 2010). The continuous modification of these habitats for agriculture, in combination with expanding urban encroachment, in the Sacramento Valley may further reduce the limited habitats available to the SV red foxes. These habitat alterations also facilitate fox displacement. Areas previously abundant with SV red foxes, as indicated from documented sightings in the 1930s, have slowly been replaced with coyote populations through competition with SV red foxes for existing habitats (Grinnell et al., 1937; Sacks et al, 2010b).

Unfortunately, the SV red foxes face direct threats as well. These direct threats, which frequently result in mortalities, are attributed to a variety of causes, including: residents protecting their poultry, vehicle collisions, exposure to pathogens from domestic animals, and digestion of poison from associated rodenticide (Sacks et al., 2010b). Additional threats to the viability of SV red foxes are due to the species' limited range

and distribution. Species isolated in a single region with a small population, like the SV red fox, experience minimal gene flow, and could potentially face genetic introgression from adjacent non-native populations (Rhymer and Simberloff, 1996; Sacks et al., 2010a). The increasing direct and in-direct threats warrant placing the SV red fox on the threatened species list in the near future (Sacks et al., 2010b).

The need to develop an effective management plan for SV red foxes and distinguish these foxes from other non-native red foxes is crucial. However, this is a difficult task due to the lack of detailed ecological knowledge about the SV red fox, including precise habitat requirements, occupancy patterns and population sizes and trends (Sacks et al., 2010b). Efforts addressing knowledge gaps are currently underway with a portion of the research utilizing the help of the general public through citizen science.

Citizen Science

Citizen science, an emerging field within conservation biology, is broadly defined as a method of public outreach that uses volunteers to collect data through observation or measurement (Cooper et al., 2007; Danielsen et al., 2009; Silvertown, 2009). There are numerous benefits associated with the use of citizen science, particularly the potential educational impacts. For researchers, citizen science helps with gathering preliminary data, collecting data over larger geographic areas, carrying-out large scale projects, supporting long-term monitoring, reducing project costs, and raising general awareness (Silvertown, 2009; Tinker, 1997). If properly facilitated, citizen science can positively contribute to current research projects and conservation efforts.

Citizen science plays a functional role in a variety of research projects, bird conservation being the most common field of research to utilize it. A prime example of successful long-term citizen-based monitoring is “Species Gateway,” a voluntary Swedish online biodiversity database that received over 19 million observations of birds from approximately 9,500 local Swedish birdwatchers between 2000 and 2010 (Snäll et al., 2011). The contributions from this monitoring provided a substantial amount of information regarding migration patterns and relative abundance for researchers that would not have been possible without the help of the public. The process of involving the public in ornithology-related projects is easier than other projects, since there is already a captive audience—bird watchers. Bird watching is a fairly common pastime; thus, asking people to simply document their findings requires less work than getting people to donate

their time for something they would not normally do. However, there is always potential for shifting this paradigm by expanding the interest and increasing involvement of the public towards other species.

Several other successful projects applied citizen science for monitoring purposes, with focal species including: fish, coral reefs, crabs, butterflies, ladybugs, and rare plants (Cohn, 2008; Havens et al., 2012; Marshall et al., 2012; Silvertown, 2009). These projects vary in geographical coverage, ranging from a single site to an entire country. For instance, the "Plants of Concern" project focuses only on documenting the rare plants within Chicago, Illinois (Havens et al., 2012); whereas, the "MEGA-Transect project" includes monitoring the state of the environment at 600 sites, stretching from Minnesota to Texas to the east coast of the Atlantic (Cohn, 2008). These various projects support the notion that citizen science can be applied to species other than birds.

The continuous expansion of tools and technologies simplifies the process of citizen science. New developments, particularly in the realm of internet use, help engage audiences that normally would not participate; essentially, these modern advancements aid in diversifying citizen science participants (Dickenson et al., 2012; Newman et al., 2012). In terms of data collecting, advantages of adopting more internet-based citizen science projects include: "streamlining data collection, improving data management, automating quality control, and expediting communication" (Newman et al., 2012). However, incorporating overly complex technologies could result in marginalizing certain participants (Newman, 2012). For a citizen science project to be successful, finding a suitable outlet that satisfies both the target audience and geographic spatial range is crucial.

Bringing foxes and citizen science together

Sacramento Valley red foxes, along with other red fox subspecies, are ideal candidates for citizen science monitoring projects for a variety of reasons. Firstly, foxes are not nomadic; they spend most of their life settled in a defined area, known as a home-range (Lloyd, 1980). A home-range study, executed by Ables (1969), showed that red foxes form clear, set boundaries to their home-ranges and they infrequently wander outside of those limits. Secondly, the distinctive features of foxes make them fairly easy to identify. Red foxes are characterized by: long, bushy tails, slender faces, elongated muzzles, reddish-brown body colouring, black legs and ear tips, and a white tip at the end of their tail (Churcher, 1959; Lloyd, 1980; Lariviere and Pasitschniak-Arts, 1996). Lastly,

foxes have a reputation for interacting with humans. Local residents reported providing supplemental food for foxes, possessing a fox den on their private property, witnessing fox road kill mortality, and observing foxes preying on poultry (Lewis, 1993; Sacks et al., 2010b). Therefore, the public becomes a valuable asset for providing information and access to SV red fox locations (Sacks et al., 2010b).

In 2007, an online reporting system was launched by the University of California, Davis with goals of involving the public in documenting any potential fox sightings (Sacks et al., 2010b). The website (http://foxsurvey.ucdavis.edu/) acts as a tool for locating active fox dens, guided by the reports completed by public volunteers. The researchers, Ben Sacks (UC Davis Veterinary Genetics Laboratory) and Heiko Wittmer (UC Davis Department of Wildlife, Fish & Conservation Biology), then verified the locations described in each individual fox sighting report completed on the website deemed likely to lead to an active fox den. If the report location matched the SV red fox habitat characteristics, the report was followed up by a field visit by one of the researchers. However, given the limited staff and funding for the project, sighting reports that did not match SV red fox physical characteristics or were located in habitats presumed unsuitable for SV red foxes were not investigated. The aim of this research project was to collect faecal matter and hair/tissue samples for genetic testing, as well as establishing surveillance cameras and field observations for monitoring behavioural patterns. Ultimately, data collected were also used to describe the current range of the SV red fox (Sacks et al., 2011).

The process of reporting a fox sighting is reasonably straightforward. To report a fox sighting, the participant answered several questions listed under the ¨report a sighting¨ tab on the webpage. The sighting report can be viewed in Appendix 1. The one page report is divided into five categories: species, date and time, location, comments, and contact. The first four questions of the report ask the participant to describe the features of the observed animal. These are a series of multiple-choice categories, where the participant selects the most relevant option. The following section relates to the date and time of the sighting. Next is the location information; the participant completes this information by selecting from pre-determined choices and by filling in a single free response section. The coordinates automatically appear in the report once the participant clicks on the inset map, simplifying the process for the participant. The following section focuses on comments regarding the participant's sighting; essentially, any significant details that the researcher should know about the sighting (e.g. number foxes or road kill).

Lastly, the participant has the option of filling in contact details; however, this is not required for the report to be properly submitted.

In addition to the fox-reporting feature, the website included several other components as well: an introduction page containing a brief explanation of the study, a fox and coyote photo identification/clarification page, and the research report from 2007-2009. The contact information of the researcher could also easily be found.

With the help of the several hundred reports and field searches by the researchers, 81 fox-presence locations were found, including 51 active dens (Sacks et al., 2010b). Of the 51 located dens, 48 were native SV red fox dens (Sacks et al., 2010b). These fox-presence locations were used to develop a habitat model, using a presence-only maximum entropy model (Phillips et al. 2006); this habitat model provided previously unknown information regarding habitat preference of the native SV red foxes (Sacks et al., 2013). In addition to a more comprehensive understanding of the SV red fox habitats, the website helps increase awareness throughout central and northern California. The fox survey website was originally advertised through a variety of media outlets, including: local television news programmes, several newspapers, radio stations, flyers, and informational magnets. These outlets facilitated by alerting the general public that these particular foxes were native and should not be considered as pests. Furthermore, this research project provided the local public with an opportunity to participate in current conservation efforts.

Measuring success

There is an apparent lack of post-data evaluations in current citizen science projects (Brossard et al., 2005). Analysing the outcome of this SV red fox project, and other similar projects, is important for determining the quality of data received and gauging the participants' experience. By taking into account these details, the researcher can then use the previously obtained data to predict trends, as well as establish data filters to improve the data collecting process and ease the workload on the researchers. Additionally, the researcher can attain increased long-term participant commitment to the project by simply improving the overall data collecting process based on the participants´ feedback. Analysing data quality and identifying the factors influencing the participants' experience in citizen science projects can lead to higher and more efficient success rates in locating SV red foxes.

The objectives of my research are to answer the following questions: (1) What can the data provided in the fox sighting reports obtained from 2007-2009 reveal about the website trends and fox ecology? (2) How the public perceives SV red foxes and the SV red fox research efforts, and how can the participants' experience be improved to ensure long-term participation? (3) What type of reports should have been investigated based on a spatial analysis of a recently developed presence-only habitat model, can this habitat model be used as a filter for future incoming reports, and what are the relationships between the reports with a high probability of fox presence and their associate report components? The first question helps address how useful data collected by the fox sighting website were in locating foxes/fox dens and, ultimately, determining the range of SV red foxes in California. The second question addresses participants' experience with the website and areas where the website excels and needs improvement. The last question compares the spatial location of the reports with report characteristics to see if any patterns emerge. Each question will constitute a chapter in this thesis.

To answer these three primary questions, I utilize a variety of data sources. In the first chapter, I describe the reports of fox sightings gathered from the website. The website reports used in this research were chosen based on the following criteria: (1) the report was submitted between 2007-2009, the period researchers were actively investigating sighting reports, (2) the fox sighting occurred between 2006-2009, thus incorporating only recent sightings, (3) the report included enough detail that the approximate fox location can be deduced, and (4) the sighting location was within the vicinity of the Sacramento Valley. In the second chapter, I assess the public perception of the website based on the feedback from an online survey. In the third chapter, I applied sighting report locations, using the same conditions set out in the first chapter, to a recently developed habitat model using ArcGIS v.10 to analyse the spatial relationship between the report locations and habitat suitability. Supplementary details pertaining to the methods of these three chapters will be expanded upon in the following chapters.

Chapter 1: An Evaluation of Citizen Science Data Obtained from the Sacramento Valley Fox Sighting Website

Introduction

The validity behind data collected using citizen scientists has long been a topic of concern (e.g. Bonter and Cooper, 2012; Cohn, 2008; Dickinson et al., 2010). Researchers need to review previously obtained data so that they have an in-depth understanding of the data, which helps identify areas causing errors and bias (Dickinson et al., 2010). In this chapter, I review the data trends of the fox sighting reports submitted from 2007-2009 through means of descriptive statistics to better understand the overall usefulness of the public contributions in locating SV red foxes. The data quality was evaluated based on the spatial and distribution frequencies of the information embedded within the sighting reports.

I examine several aspects to determine what drivers influence the data quality, including: (1) the general trends for the website report categories, (2) the number of reports within the home-range of a fox, (3) the number of reports per county, (4) the location of dens with multiple reports within the home-range, (5) the number of reports per participant and (6) how the participants found out about the website. The first objective covers general trends of the reports over time, providing a broad outlook of the data collected. In the second aspect, I quantify the number of reports within the home-range of a den to determine the accuracy of the report locations. In other words, what was the probability of a website report falling within a fox home-range? As previously discussed, foxes do not typically roam outside their home-ranges so reports located within home-ranges can be considered ideal indicators for finding den(s). For the third objective, I examine the gradient between sighting reports and Sacramento Valley counties, which should indicate if spatial relationships occur between the sighting reports and their locations. For example, do counties with a high number of reports have more dens than counties with a lower number of reports? Or, since the study was conducted by researchers based at UC Davis in Yolo County, are more reports likely to come from Yolo County? For the fourth objective, I identify dens that have multiple reports within close distance and characterize the attributes of those dens. It is expected that dens with multiple associated reports have a higher probability of being within close proximity to infrastructure than dens with no associated reports. By examining the number of reports per participant, I can see how frequently participants are submitting sighting reports, as well as calculate whether or not participants who submit multiple reports have an

increased probability of a report location being within a fox home-range. The last objective that I investigate in this chapter, how the participants found out about the website, tells us the sources that informed the participants of the project and/or website. The responses should indicate which media outlets are the most effective for targeting participants.

Methods

The data assessed included 248 reports obtained from the fox reporting website and 48 confirmed SV red fox den locations (Sacks et al, 2010b). The fox den locations were based on the coordinates presented in Sacks et al.'s (2010b) Sacramento Valley red fox report to the California Department of Fish and Game. These are the only confirmed SV red fox den locations to date. The coordinates for the public reports were provided by the participant in the report using a Google Map® coordinate locator. For the reports that did not include coordinates, I assigned coordinates, providing the participants' description was detailed enough to extract a location within a 1 km distance (e.g. a physical address or street crossings).

The website reports were subdivided into three categories—public reports, phone interview reports, and road kill reports—to provide a more in-depth coverage of the general trends from the reports obtained from the website. Public reports include any sighting report submitted online by a member of the general public; the public reports account for the vast majority of website reports. Phone interview reports were entered as a sighting report by the researchers following a phone-in sighting report. These reports were transcribed by one of the project researchers—e.g. Dr. Benjamin Sacks or Dr. Mark Statham. Any sighting report that mentioned a deceased fox, resulting from a vehicle collision, was labelled as a road kill report. The reports were also separated by the year to obtain a more comprehensible overview of the annual report trends.

Next, the sighting reports and den locations were plotted in ESRI® ArcMap v.10.0 for spatial analysis. To determine the quantity of sighting reports within a fox home-range, a buffer with a 2 km radius was drawn around each den location to represent the foxes' home-range. This distance was estimated based on previous red fox home-range studies, since the specific SV red fox home-range is unknown. Home-ranges vary depending on dispersal, population density, habitat features and resource availability (Ables, 1969; Lloyd, 1980). Trewhella et al. (1988) compared red fox home-range studies from various countries, and cited fox home-ranges in the United States to be as minimal

as 1.02 km^2 (Ables, 1969) and as large as 9.6 km^2 (Storm et al., 1976). The assigned 2 km radius, or 12.56 km^2 area, for this study assures that SV red fox home-range is presumably covered, even if it is larger than typical red fox home-ranges in the United States.

For the qualitative analysis portion of this chapter, certain components of the website reports were categorized and coded for comparative purposes. I categorized each report by how the participant was informed about the website, a detail that was specified by the participant in the sighting report. Counties were assigned to each report location based on the coordinates provided in the report. Additionally, I assigned a landscape type (urban, suburban, or rural) to each SV red fox den based on the characteristics of the landscape within the home-range area using similar criteria found in McKinney's (2002) urban-rural gradient. A den's landscape was labelled urban if it contained >50% impervious surface area within the home-range; a suburban landscape contained 20-50% impervious surface; a rural landscape was classified as an area with <20% impervious surface.

Once the reports and dens were plotted and categorized, simple descriptive statistics were applied. Proportions, sample means, and trends were calculated in the summary statistics of the data obtained from the website. Proportions are used to compare the outcomes of categorical variables, means are used to describe average distribution of the observed response values, and trends are used to estimate the tendencies of the data by comparing the observed values over time (Kirk, 2008; Mendenhall, 2012).

Results

General trends of report types

The majority (48%) of website reports—including public, road kill, and phone interview reports—were submitted in 2007 (Table 1). Public reports were ranked the highest in both quantity and rate of reports within home-range among reports submitted in 2007. Phone interview reports were the least common form of the fox sighting reports, with a total of eight submissions across all three years.

Table 1: Characteristics of the general annual trends for website sighting reports obtained from 2007-2009

Year	Annual Reports			Total Annual Reports	Reports in Home-Range			Total Annual Reports in Home-Range	Percentage of Annual Reports in Home-Range
	Public Reports	Road Kill Reports	Phone Interview Reports		Public Reports	Road Kill Reports	Phone Interview Reports		
2007	108	11	1	120	34	3	0	37	31%
2008	53	4	3	60	11	1	1	12	22%
2009	57	7	4	68	19	4	0	23	34%

Reports within fox home-range

A total of 73 (29%) reports were located within the home-range of a fox den: 64 public reports, 8 road kill reports, and 1 phone interview reports (Table 1). The largest quantity of reports within home-ranges occurred in 2007, although the highest proportion of reports within a fox home-range out of the total annual reports occurred in 2009. When examining the relation between the proportion of public sighting reports within a fox home-range and the proportion of public sighting reports outside a fox home-range across all three years (2007-2009) using a Pearson's chi-square test, I found no significant variation (χ^2= 2.56, df= 2, p= 0.278). Although relatively low in numbers, road kill reports had significant rates of reports within fox home-ranges across all three years, particularly in 2009. On average, 36% of submitted road kill reports were within a fox home-range, most of which were located near urban areas (e.g. Sacramento, Davis, and Vacaville city).

Reports per county

The highest number of reports and dens in the Sacramento Valley, by a relatively considerable margin, was recorded in Yolo County (Table 2). The counties neighbouring Yolo County, Sacramento County and Solano County, also received a large portion of the total sighting reports. A graph was created to illustrate the distance gradient between Sacramento Valley counties and associated report quantities, using the relative centre of Yolo County as centre point since Yolo County contained the majority of reports and dens (Fig. 2). The number of reports exponentially decreases as the distance from Yolo County increases. Approximately 38% of the variation can be explained by this distance gradient.

Table 2: Sacramento Valley county locations of the fox sighting reports obtained from the website from 2007-2009 and Sacramento Valley dens.

County	Sighting Reports	SV Red Fox Dens
Butte	3	1
Colusa	8	7
El Dorado	11	0
Glenn	6	8
Nevada	1	0
Placer	11	0
Sacramento	56	1
San Joaquin	9	0
Shasta	2	2
Solano	35	9
Sutter	7	2
Tehama	3	3
Yolo	92	12
Yuba	4	0

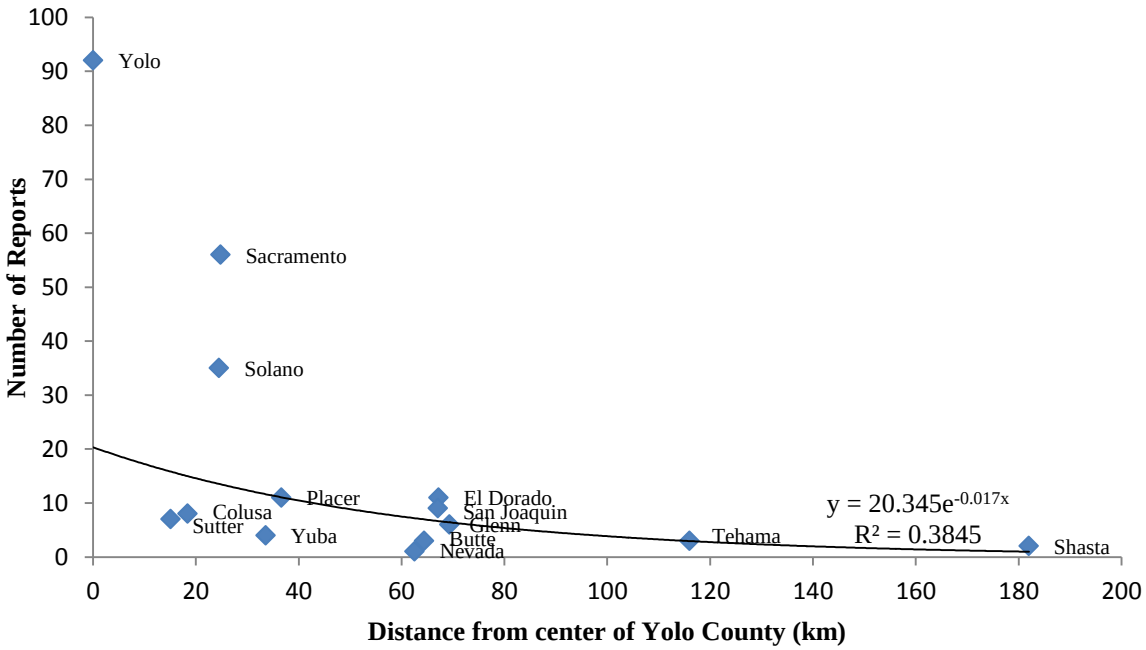

Figure 2: Number of reports received from the website from 2007-2009 in relation to distance from the relative centre of Yolo County.

Table 3: Summary of the number of reports within fox home-ranges, landscape type, and location of Sacramento Valley red fox dens

Den Number	Number Reports in Home-Range	Landscape	Township	County
1*	21	Urban	Davis	Yolo
2*	21	Urban	Davis	Yolo
3*	9	Suburban	Woodland	Yolo
4*	10	Suburban	Woodland	Yolo
5	3	Rural	Madison	Yolo
6	2	Rural	Zamora	Yolo
7*	5	Suburban	Esparto	Yolo
8	3	Urban	Vacaville	Yolo
9	3	Urban	Vacaville	Solano
10	2	Urban	Vacaville	Solano
11	0	Rural	Yolo	Yolo
12*	5	Suburban	Dixon	Solano
13*	10	Suburban	Woodland	Yolo
14	4	Rural	Arbuckle	Colusa
15	0	Rural	Chico	Butte
16	0	Rural	Red Bluff	Tehama
17	0	Rural	Williams	Colusa
18	0	Rural	Knights Landing	Yolo
19	0	Rural	Arbuckle	Colusa
20	0	Suburban	Williams	Colusa
21	0	Rural	Knights Landing	Yolo
22	0	Suburban	Dixon	Solano
23	0	Rural	Dixon	Solano
24	0	Suburban	Sutter Buttes	Sutter
25	0	Rural	Cottonwood	Shasta
26	0	Suburban	Grimes	Colusa
27	0	Rural	Willows	Glenn
28	0	Suburban	Willows	Glenn
29	0	Rural	Live Oak	Sutter
30	0	Rural	Cottonwood	Shasta
31	4	Urban	Vacaville	Solano
32	0	Suburban	Williams	Colusa
33	0	Rural	Arbuckle	Colusa
34	1	Rural	Corning	Tehama
35	0	Rural	Gerber	Tehama
36	1	Rural	Orland	Glenn
37	1	Suburban	Willows	Glenn
38	1	Rural	Willows	Glenn
39	0	Rural	Willows	Glenn
40	0	Rural	Willows	Glenn
41	0	Rural	Willows	Glenn
42	0	Suburban	Yolo County Airport	Yolo
43	3	Urban	Natomas	Sacramento
44	1	Rural	Montezuma Hills	Solano
45	0	Rural	Bird Landing	Solano

Dens containing 5+ reports within home-range

Dens with multiple reports in home-range

There were 25 dens, over half of the total 45 dens, with zero reports within the fox home-range (Table 3). The remaining 20 dens contained one or more reports within the home-range. Seven dens contained five or more reports, all of which were located in Yolo County with the exception of one den located in Solano County. Of these seven dens, five dens received all three categories of reports—public report, road kill report, and phone interview report. Dens containing multiple reports were predominantly in suburban and urban landscapes.

Reports per participant

Contact information is an optional section of the sighting report; therefore, the 27 reports that did not supply any contact information were removed from this review. Phone interview reports were also removed from this analysis since all of the reports were transcribed by the associated researchers. Of the remaining 221 reports, the vast majority (66%) of participants submitted only one report. The reports per participant ranged from 1-3 reports, other than one outlying participant who submitted 13 reports. Participants who submitted two reports had the highest rate of reports within a den home-range (Fig. 3).

How participants discovered the website

The most effective method of communication, as indicated by 22 participants, was newspapers articles (Fig. 4). The internet, particularly Google search engine and news websites, was also a popular source for locating the website, according to 21 participants. A significant portion of participants were also informed via KCRA, a local Sacramento news channel. A combined 17 participants stated that they learned about the website either by the KCRA television news segment or by the KCRA news website. However, it should be noted that 166 reports were removed from this review because the participants did not specify in the report how they found out about the research project.

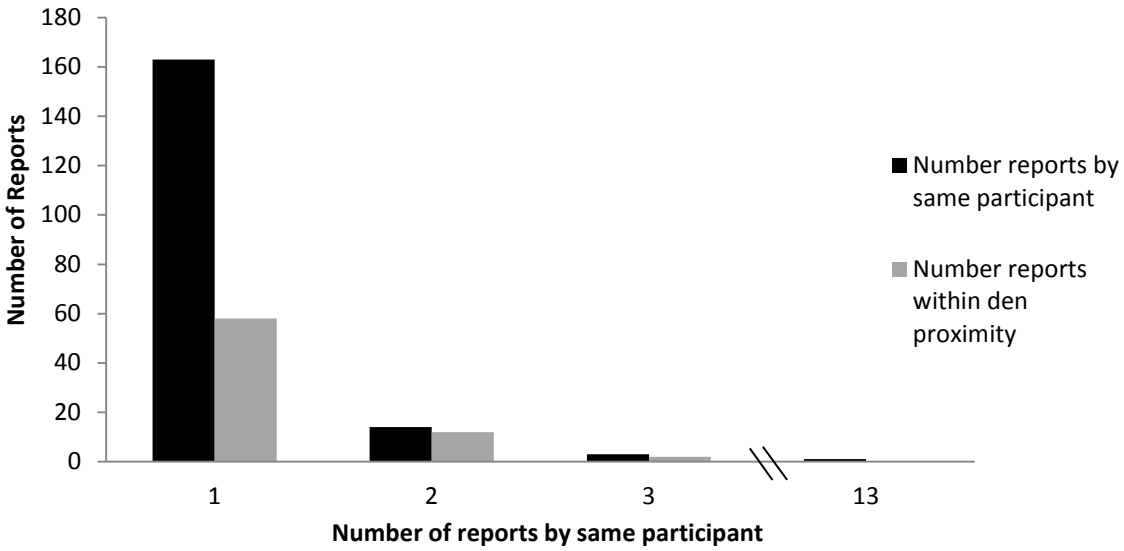

Figure 3: Number of reports per participant (excluding phone interviews & reports lacking contact information) from the fox sighting reports obtained from the website from 2007-2009.

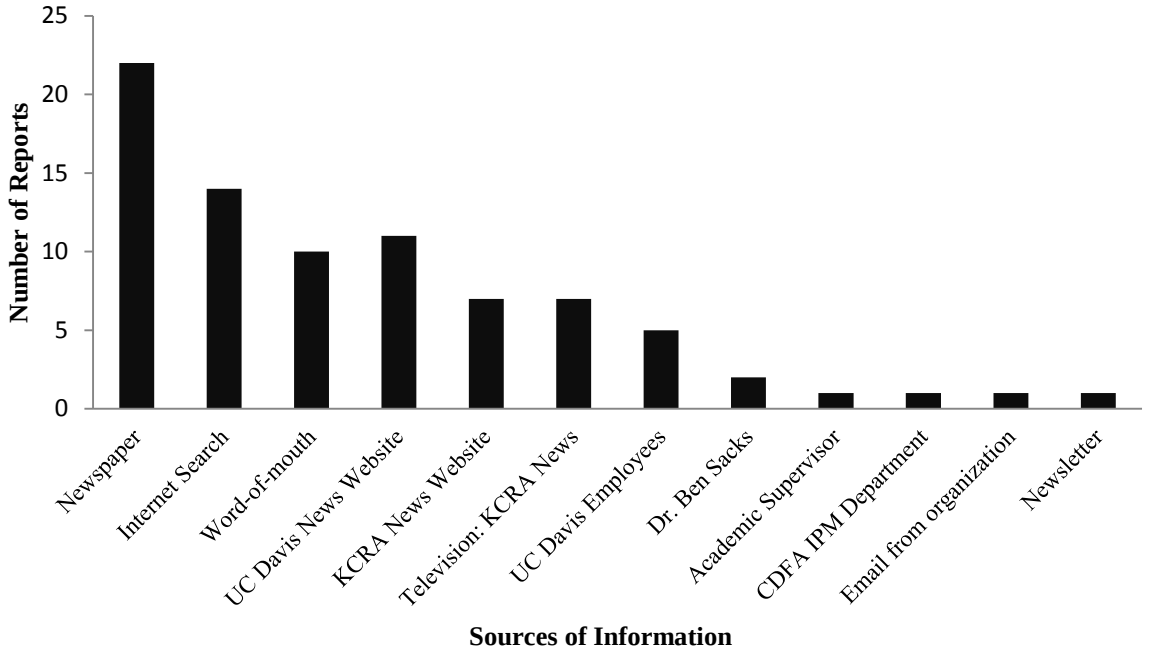

Figure 4: Summary of the sources that informed the participants (n= 82) who submitted a sighting report from 2007-2009 about the Sacramento Valley red fox project and/or website. Note: This figure excludes the 166 reports that did not specify how they found out

Discussion

Public reports are the most common form of sighting reports, given that it is the simplest method of submitting a sighting and does not require direct contact with the researcher. Citizen science projects that use online applications need to be simple and user-friendly so participants can experience success with their data input (Dickinson et al., 2012; Newman et al., 2010).

The distance from Yolo County can explain 38% of the variation in the quantity of reports collected from the website. The quantity of sighting reports is dependent to some degree on the distance from Yolo County, where the highest number of current SV dens is located and where the study was executed. The remaining variation contributing to the decrease of reports over distance can likely be attributed to the advertisement and communication methods implemented during the duration of the study. Initial advertisement efforts for the Sacramento Valley red fox research project were predominantly concentrated in Yolo and Sacramento County (Sacks et al., 2010b), which could partially explain the decrease in reports as the distance from Yolo County increases. Details of this relationship and the extent to which advertising plays a role in the quantity of reports submitted needs to be examined in further detail. However, it can be concluded that researchers should consider increasing their advertising efforts to other counties containing SV red foxes.

The most effective source for informing the public about the research project was news outlets. News channels and newspapers are ideal forms of advertising because they already have a large, captive audience; whereas, newsletters typically target a specific audience or a selected group of members. Despite the costs associated with printing, printed information is still considered the most common and easily accessible communication method by most people (Silvertown, 2009). Another benefit of using media sources is that news channels and newspaper audiences are quite diverse; therefore, news outlets reduce the amount of exclusion associated with interest groups. However, other outlets of information may have been overlooked, since the majority of participants did not indicate how they heard about the website. As previously mentioned, the effectiveness of advertising methods may be skewed due to researchers targeting specific areas rather than implementing large scale broadcasting regimes. Chapter two will expand on identifying which media sources are ideal for informing the public about this and other conservation projects.

A significant number of foxes that died as a result of a vehicle collision were within their assumed home-range. Road kill reports had the highest average rate of reports located within a typical fox home-range. This finding supports the notion that red foxes typically do not often venture out of their defined home-range (Ables, 1969). Therefore, researchers should regard road kill reports as key indicators for locating dens. A majority of the dens associated with the road kill reports were located near developed areas, indicating that foxes located in urban areas have higher vehicle-related mortality rates, which is an expected outcome.

It is unclear how the 28 dens that did not include reports within the home-range were discovered. There are several factors that may have guided researchers to finding these dens: sighting reports located slightly outside of the home-range perimeter, undocumented sighting reports, or other neighbouring dens in the area. However, due to the lack of information, the sighting reports cannot be accredited the finding of these dens. Additionally, it is important to note that foxes do not necessarily have a symmetrical home-range, as applied in this review. Red foxes typically use features to define their home-range boundaries, such as a road or fence (Ables, 1969); therefore, some reports located on the outskirts of the home-range may have been grouped incorrectly.

Dens without any reports within the home-range were predominantly located in rural or suburban landscapes, and, conversely, dens that had multiple sighting reports within the home-range were mostly located in suburban or urban landscapes (Table 3). Dens further away from development were less likely to be reported than dens in heavily developed areas. Previous studies have shown that there is a bias when recording the presence of species with vast ranges, because the public tends to record sightings close to developed settlements and roads (Phillips et al., 2009; Reddy and Dávalos, 2003). This bias leaves a potentially substantial number of dens, located in remote areas, unaccounted for. On the other hand, this finding suggests that dens located in densely populated areas are well documented, which implies that local citizens are aware of the fox presence. Ecologically informed communities have a higher probability of socially supporting native species conservation (Campbell and Vainio-Mattila, 2003; Mckinney, 2002). Therefore, public awareness provides the foundation for community-based SV red fox conservation efforts.

On average, the participants submitted one report per person. The reason why participants predominantly submitted only one report per participant is either a result of

fox sighting rarities or lack of long-term commitment. The data in the report do not provide adequate information to draw any conclusions on this issue; however, this topic will be investigated in further detail in chapter two. Participants that submitted two or three reports had a significant probability of being within den home-range. Therefore, researchers need be aware of the quantity of reports submitted per participant. Multiple reports from the same participant could indicate frequent encounters with the same fox, ultimately signifying there is a den within close proximity.

Conclusion

Overall, the data obtained from the website assisted the researchers in locating 51 active fox dens. The sighting reports supplied information that helped define characteristics of the SV red fox previously unknown, such as distribution and habitat preferences. The data from this chapter summarize distribution patterns from previous years; however, there is insufficient data to draw conclusions about the overall effectiveness of the website. In the next chapter, I will characterize the participants using the website and identify the areas the website need improvement to encourage long-term commitment.

Chapter 2: Characteristics of citizen science participants contributing to Sacramento Valley red fox conservation efforts: results of an online survey

Introduction

Citizen science uses volunteers to assist with research projects; however, it is important to bear in mind that citizen science is mutually beneficial for both parties involved: the volunteer benefits from the education and experience received while the scientists benefit from the free source of labour and data (Jordan et al., 2012; Silvertown, 2009). Most citizen science related research focuses on the data collecting process, an undoubtedly crucial element; however, researchers often overlook the importance of maintaining a positive experience and overall satisfaction for the participants (e.g. Dickinson et al., 2012). Researchers need to create a positive experience for the participants if they want to attain long-term participation. Long-term commitment can be achieved by assessing feedback from participants' on their experience and accommodating feasible requests that would help enhance their experience (Lazarus and Francisco, 2000).

By addressing any challenges participants face and creating user-friendly websites, researchers can expect to see improvement in the data quality while enhancing the participants' learning experience (Newman et al., 2010). Essentially, for a citizen science project to be entirely successful, it needs to implement adaptive strategies. Adaptive strategies, in this context, refer to evolving data collecting processes and management plans over time as ecological knowledge increases, environmental conditions change, and social mechanisms improve (Berkes et al., 2000). Citizen science projects should be a collaborative effort between researchers and volunteers, revising approaches and techniques when called for. Newman et al. (2010) touches on this subject by emphasizing the need for researchers to implement changes according to the feedback of their citizen science participants, especially given the recent technological advancements and complexity of modern websites.

In this chapter, I evaluate public feedback from an online survey to better understand the characteristics of the participants utilizing the fox sighting website. The first objective is to assess the participants' opinions of and recommendations for the website, which will highlight the areas of the website that excel and the areas that need technical revisions. The second objective is to identify the significant characteristics and traits of the website participants. I want to find out who is using the website and how the website can be tailored to meet their interests. The results of this assessment will help

improve the methods for future web-based citizen science by making it more engaging for the various participants.

Methods

I developed and administered an online survey using SurveyMonkey®, an internet survey programming tool (SurveyMonkey, 2012). I opted for an online survey over a mail survey for three main reasons: (1) accessibility to a larger geographical range, particularly more remote areas, (2) cost-effectiveness, and (3) shorter time lapse (Wright, 2005). The link for the survey was strategically placed on the homepage of the fox sighting report website. The survey was active from 1 August 2012 to 12 December 2012, targeting the general public of northern and central California. My objective was to gather responses from areas overlapping with the SV red fox range.

Sampling

I contacted multiple organizations within the greater Sacramento Valley region via email to alert them about my research project and survey. The locations of these groups, ranging from as far south as Vacaville city to as far north as Siskiyou County, predominantly coincided with the SV red fox range. The email included a brief description about the project, a media release (Appendix 2), and a photo of a SV red fox. Appendix 3 contains a complete list of organizations that publicized the research and survey to their associated members. These organizations were a compilation of various interest groups, including: fishing groups, conservation groups, farmers, ranchers, orchards, local media outlets, political parties, homeowners associations, and schools. Organizations used their website, Facebook page, email lists, newsletters, and/or newspapers to advertise the survey. In addition, I also sent emails to 199 people who previously submitted reports and left contact information, inviting them to take the survey. By targeting diverse audiences, I aimed to gain a representative sample reflective of the greater Sacramento Valley population.

Design

The survey was comprised of 22 questions (refer to Appendix 4 for a copy of the survey), a combination of ranked, multiple choice, and open-ended question types. The questions were sectioned according to the topics covered, and each section progressed from general questions to advanced questions. Topics covered in the survey included the participants': history with the website, SV red fox knowledge, fox sightings, opinions of SV red foxes, opinions of the website features, suggestions for improving the website,

and personal demographic information. Participants were given the option to skip any questions they desired. Additionally, if the participant did not qualify for a specific question, the survey was programmed to automatically move to the next relevant questions. For example, if the participant responded "yes" for question 1 (Is this your first time visiting the fox sighting website?), then the survey skipped question 2 (Approximately how many times have you visited this website?) and went straight to question 3 (How did you find out about this website?). Without skipping any questions, the survey took an estimated 5 minutes to complete.

Analysis

The survey was designed to produce both discrete (nominal and ordinal) and continuous type responses. For statistical purposes, I needed to categorize and code the open-ended survey questions, which included questions: 2, 3, 6, 8, 10, 16, and 19. The responses for these questions were categorized and/or grouped based on common, recurring themes. Unique or outlying responses that drastically differed from the other submitted responses were grouped as "other." Questions that measured attitudes used a ranked Likert format, scaling from 1 (strongly disagree) to 5 (strongly agree) (Clason and Dormody, 1994). In some cases, the responses obtained from the attitude related questions were then grouped as three levels (disagree, neutral, or agree) to illustrate general outlooks of overall agreement and/or disagreement (Vaske et al., 2011).

Initial descriptive statistics, including general trends and proportions, of the survey responses were executed in Microsoft Excel. The survey responses were then divided into two groups for comparative purposes: website or fox related responses and demographic responses. The demographic variables that were evaluated in this statistical analysis included: gender, age, county, employment, income, and education. Any demographic variables that received responses categorized as "do not know" or "unsure" were removed prior to statistical analysis.

All of the statistical tests were run using R statistical programming software (R Development Core Team, 2012). A Welch's two-sample t-test was used to compare the mean outcomes of questions with two samples (Lomax, 2007); an analysis of variance (ANOVA) was used to compare the means across the groups (Lomax, 2007); and a Pearson's chi-squared test was used to test whether or not frequency distribution amongst various categorical groups differed (Kirk, 2008).

Results

A cumulative 310 participants responded to the survey, with 210 participants fully completing the survey. All responses were included in the descriptive statistics; however, only the 210 completed surveys were used in subsequent analyses. Descriptive statistics are presented in Appendix 5 and the details of the statistical analysis are covered in Appendix 6.

Descriptive statistics

The vast majority of responses (90%, n=280) indicated that it was their first time visiting the website. Return visitors typically visited the website 1-2 additional times. The numbers of participants steadily decrease as the number of website visits increase. The most common sources for finding out about the survey were internet browsing (20.7%), word of mouth (19.1%), and newspapers (16.9%) (Fig. 5). The majority (78%, n= 285) of participants said that they did not look for additional fox information in addition to the website.

A comparable proportion of participants had seen a SV red fox (43%, n=286) as had not seen a SV red fox (33%, n= 286); however, a noteworthy number of participants were unsure as to whether or not they had seen a SV red fox (24%, n=286).The majority of SV red fox sightings occurred near infrastructure, such as roads and houses, and many were also sighted near agricultural fields and waterways (Fig. 6). Only 27% (52 of 192) participants who saw a potential SV red fox reported their sighting. Many of those who reported a sighting did so as a response of the survey advertisement.

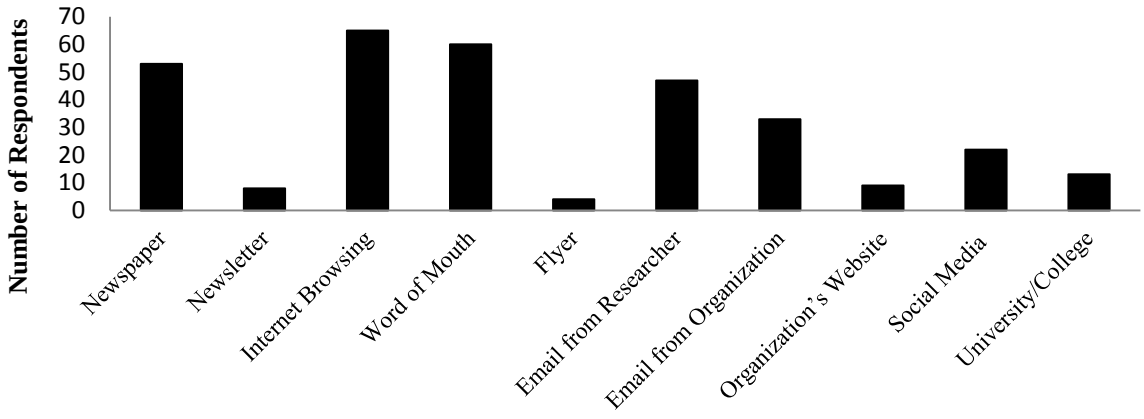

Figure 5: The method that survey respondents (n= 303) used to find out about the Sacramento Valley red fox sighting website

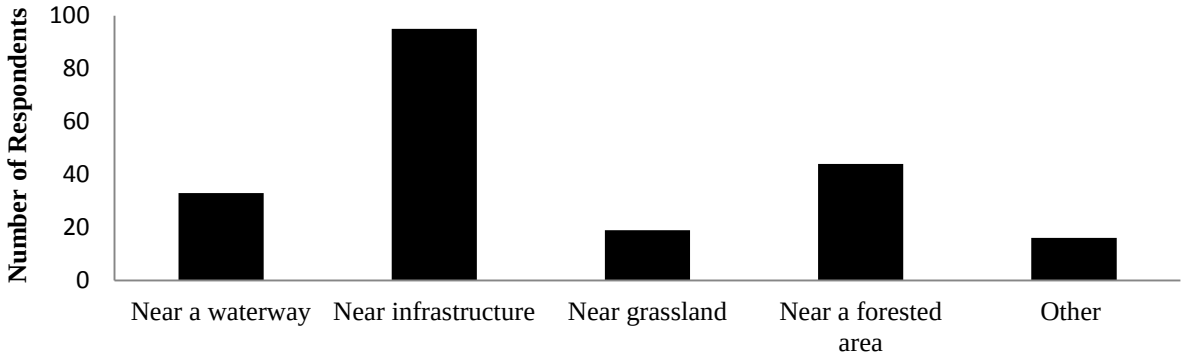

Figure 6: The landscape types where survey respondents (n= 141) observed a SV red fox. Note: Responses were placed in all relevant landscape types; therefore, some sightings were placed in multiple landscape types.

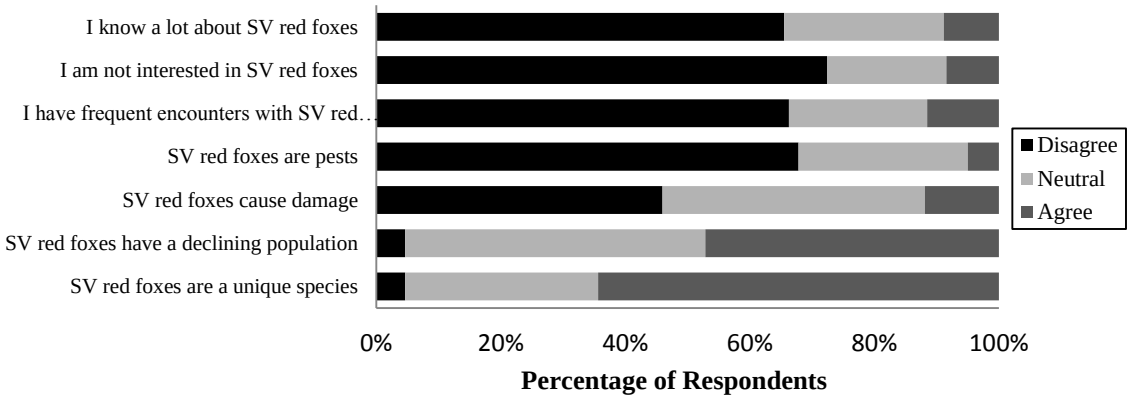

Figure 7: Survey respondents' (n= 261) level of agreement/disagreement with several statements regarding Sacramento Valley red foxes.

Participants generally agreed that SV red foxes are unique species and have a declining population (47%) (Fig. 7). Many participants disagreed (46%) or neither agreed or disagreed (42%) about whether SV red foxes cause damage. The majority of participants stated that they do not have frequent encounters with SV red foxes (66%) or know a lot about SV red foxes (66%); however, the majority of participants expressed that they are interested in SV red foxes (72%). Participants expressed interest in animal conservation (75%) and research based websites (53%) (Fig. 8).

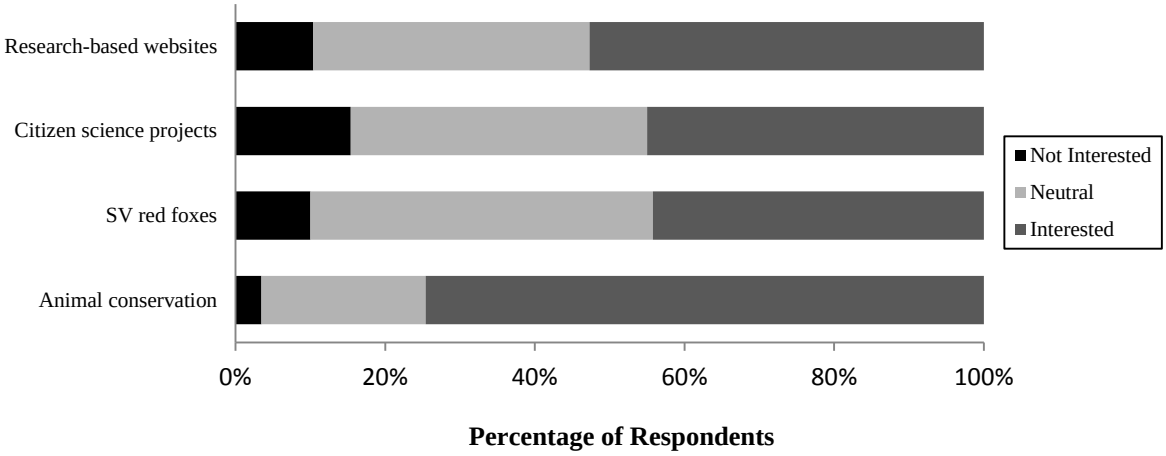

Figure 8: The degree of interest in which survey respondents (n= 260) have for animal conservation, Sacramento Valley red foxes, citizen science, and research based websites.

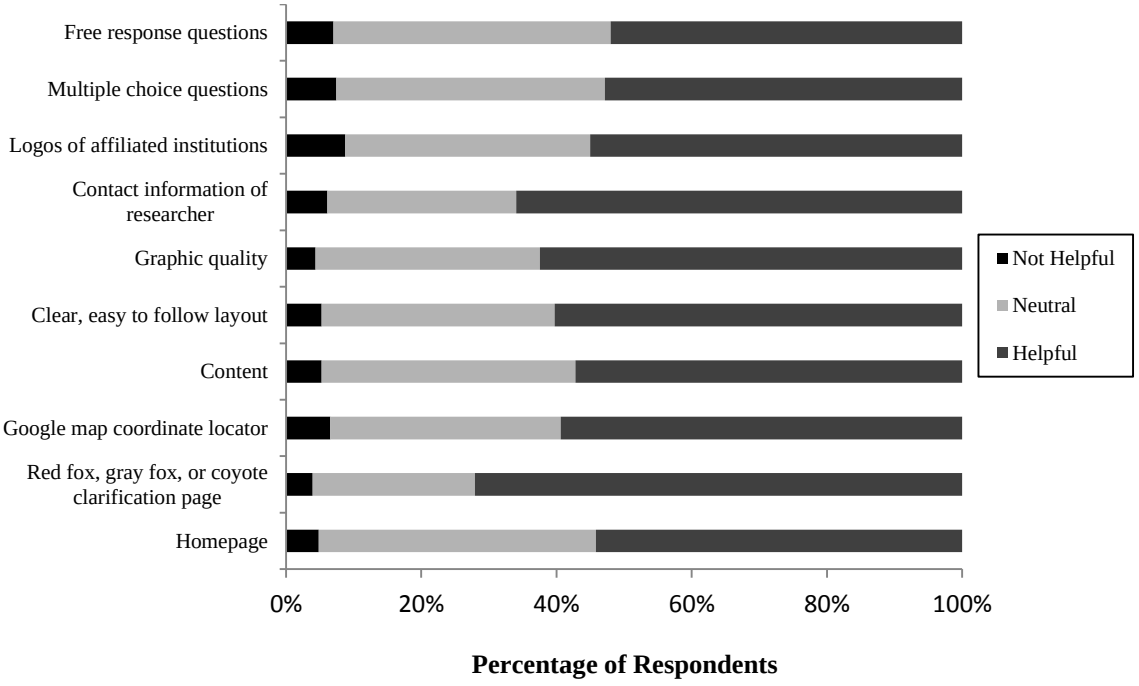

Figure 9: Survey respondents' (n= 229) rating of the helpfulness of various website features.

Most participants indicated that website features were very and extremely helpful, with the species clarification page receiving the highest amount of agreement (72%) (Fig. 9).

Demographic traits

First time website visitors were younger (M= 2.92, SE= 0.09, t= -2.07, p= 0.047) and had a lower incomes (M= 4.06, SE= 0.15, t= -2.49, p= 0.019) than multiple time visitors (M_{age}= 3.39, SE= 0.21; M_{income}= 4.86, SE= 0.34).

Participants indicated in the survey that internet browsing, word of mouth, and newspapers were the three most common sources for advertising the fox sighting website. Participants that found the website via internet browsing had lower education levels (M= 4.12, SE= 0.22) than those that found website using another source (M= 4.78, SE= 0.09) (t= 2.82, p= 0.007). Participants that found the website via word-of-mouth were younger (M= 2.24, SE= 0.18) (t= -4.58, p < .001) and via newspaper were older (M= 3.76, SE= 0.12) than participants that used other sources (t= 6.20, p < .001).

When asked if they looked for additional SV red fox information, participants' responses varied depending on age (t= 2.86, p= 0.005) and level of education (t= 2.76, p= 0.007). Participants that looked for fox information, outside of the website, were older (M= 4.67, SE= 0.15) and had a higher level of education (M= 5.04, SE= 0.16) than participants that did not. As indicated in the summary statistics, internet searches were the most common source used by participants to look up additional information. The participants that specifically used the internet to look up additional fox information, on average, earn a higher income (M= 5.07, SE= 0.17) than participants that used other sources (M= 4.54, SE= 0.11) (t= 2.75, p= 0.007).

A two sample t-test revealed that participants that claimed to have seen a SV red fox were older (M= 3.41, SE= 0.12, t= 5.06, p < .001) and earned a higher income (M= 4.51, SE= 0.17, t= 3.82, p < .001) than participants that have not seen a SV red fox (M_{age}= 2.46, SE= 0.15; M_{income}= 3.52, SE= 0.19). When examining the relation between fox sightings and county locations using a Pearson's chi-square test, I found a significant difference in the proportion of participants that saw and did not see SV red foxes across the counties in Sacramento Valley (χ^2= 21.60, df= 1, p= 0.017). Participants living in the greater Sacramento Valley have a high probability of seeing a SV red fox. However, this result may have been affected by insufficient sample sizes in some counties (e.g. Tehama, Placer, and Solano County) that did not see a SV red fox, yielding a higher amount of error. A Welch's two sample t-test showed that participants that reported their fox sighting had a higher mean age (M= 3.74, SE= 0.15) than participants that did not report their fox sighting (M= 2.98, SE= 0.13) (t= 3.80, p < .001).

There was a significant variation between males and females regarding the extent in which they agreed that: SV red foxes are unique species ($t= 3.65$, $p < .001$), SV red foxes have a declining population ($t= 3.21$, $p= 0.002$), and SV red foxes do not cause damage ($t= -2.25$, $p= 0.026$). Female participants tended to agree to a greater extent than male participants on all of these issues. Females expressed an overall higher interest in SV red foxes (M= 1.66, SE=0.09) than males (M= 2.01, 0.12) ($t= -2.28$, $p= 0.024$). Additionally, female participants indicated a more enthusiastic interest for animal conservation (M= 4.28, SE= 0.08) than males (M= 3.97, SE= 0.09) ($t= 2.52$, $p= 0.011$).

The results of a one-way ANOVA test showed that age impacts the degree in which participants agreed that SV red foxes have a declining population ($F_{(4,203)}= 2.61$, $p= 0.037$). Younger participants were in stronger agreement that SV red foxes have a declining population (M= 3.97, SE= 0.13) than older participants (M= 3.23, SE= 0.20). However, there was variation in the frequency of SV red fox encounters and a participants' age ($F_{(4, 203)}= 3.11$, $p= 0.016$). Participants within the age group 36-50 (M= 2.12, SE= 0.19) and 51-70 (M= 2.09, SE= 0.14) encountered SV red foxes more frequently than other participants.

General knowledge of SV red foxes differed across age groups ($F_{(4, 203)}= 4.23$, $p= 0.003$). A majority of the variation in age occurred in middle aged, 36-70 year old, participants, who indicated that they have slightly greater knowledge about SV red foxes than other aged participants. However, all participants agreed that they do not have a great deal of knowledge.

The differences between participants' interest in animal conservation and level of education were tested using an ANOVA test ($F_{(5, 203)}= 3.80$, $p= 0.003$). The results indicate that participants with grade school as their highest level of education (M= 3.00, SE= 1.15) were slightly less interested in animal conservation than participants with a Bachelor degree education (M= 4.52, SE= 0.09). Participants' interest in citizen science projects significantly varied when compared with participants' levels of education ($F_{(5, 203)}= 2.24$, $p= 0.052$). There was a progressive increase of interest in citizen science projects as the participants' level of education increased. Participants that possess a postgraduate degree had the highest level of interest in citizen science projects (M= 3.75, SE= 0.10). Additionally, education was the only demographic variable with variation in participants' interest in research based websites ($F_{(5, 203)}= 3.49$, $p= 0.005$). Participants with a technical or associate degree had the highest level of interest in research based

websites (M= 4.00, SE= 0.22), shortly followed by participants with a postgraduate degree (M= 3.98, SE= 0.10).

The website features viewed as most helpful varied across gender, age, and education level of the respondents. In general, females had a more positive outlook, in terms of helpfulness, on the website. Female participants gave higher mean ratings than male participants on nearly every listed website feature: homepage, species clarification page, Google map tool, content, layout, graphic quality, logos, multiple choice questions, and open-ended questions (Appendix 6). Females particularly found the homepage (M= 3.80, SE= 0.07, t= 3.88, p <.001) and the species clarification page (M= 4.05, SE= 0.07, t= 3.42, p < .001) more helpful than males ($M_{homepage}$= 3.40, SE= 0.08; $M_{species}$= 3.69, SE= 0.08). Older participants found the website features slightly less helpful than younger participants. In particular, participants aged 18-25 rated that the species clarification page (M= 4.03, SE= 0.12, $F_{(4, 203)}$= 3.11, p= 0.017), Google map tool (M= 3.95, SE= 0.13, $F_{(4,203)}$= 4.09, p= 0.003), and website layout (M= 3.95, SE= 0.13, $F_{(4, 203)}$= 3.32, p= 0.012) as more helpful than participants aged 70 or older ratings ($M_{species}$= 3.31, SE= 0.29; M_{Google}= 2.92, SE= 0.21; M_{layout}= 3.15, SE= 0.25). Participants with higher education rated the species clarification page ($F_{(5, 203)}$= 2.28, p= 0.048) and Google map tool ($F_{(5, 203)}$= 2.26, p=0.050) as significantly more useful than participants with lower education. Participants with a Bachelor's degree gave the highest rating for the species clarification page (M= 4.06, SE= 0.08), and the lowest rating was given by participants with grade school education (M= 3.00, SE= 0). The Google map tool was given the lowest rating of helpfulness by participants with grade school education (M= 2.33, SE= 0.66) compared to participants with Bachelor degrees (M= 3.81, SE= 0.10).

Discussion

In this chapter, I investigated the areas of the website the participants view as successful and unsuccessful and characterized some demographic traits of the participants using the website. Overall, the survey participants gave predominantly positive reviews of the website. Additionally, the vast majority of respondents agreed that SV red foxes are unique species, not pests, and have a declining population. This feedback indicates that the participants realise SV red foxes are native species.

The vast majority of participants do not return to the website. Improving the website in accordance to the feedback, particularly from older participants, may increase

the number of return visits. Older participants are more likely to see and report a fox sighting, yet older participants gave lower ratings in the overall helpfulness of the website compared to younger participants. The reasons behind these ratings are unclear and, when asked what additional features would increase their participations, older participants suggested similar responses as younger participants. Previous studies have concluded that an age-friendly website should be inviting, easy to navigate through, contain large font, and utilize hyperlinks (Cleaver, 1999; Sanner, 2004). Specific details on what components of the SV red fox sighting website need to be improved or altered to appeal to older audiences require further investigation.

The best communication methods for informing the public about the website and research project varied with age. Newspapers appear to be the best method for targeting older participants, and, given that the results showed that older participants are more likely to see and report a SV red fox, it's crucial that this project maintain news media coverage. Other studies also concluded that newspapers are a primary source for environmental information (McCallum et al., 1991; Wakefield and Elliott, 2003). However, for younger audiences, word of mouth proved to be a better source for communicating the existence of the fox sighting website. This method is arguably a more effective method, because it indicates that people have internalized key environmental messages (Wakefield and Elliott, 2003). Information shared via word of mouth implies that an active discussion regarding SV red foxes occurred. Word of mouth information sharing is essentially a product of other forms of advertisement, and these discussions would not occur if it were not for alternative outlets. Therefore, increasing media coverage will increase awareness in older participants, while indirectly increasing word of mouth conversations in younger participants.

Participants indicated that the three most significant changes that would increase their participation were (1) frequent website updates of study results, (2) links to other informational websites, and (3) a discussion board on the website. Frequently updating the website with study results keeps the participants informed of the research progress while also creating new website experiences for the participants. Frequent updates also remove the repetitiveness of receiving the same information every time. Links to other informational websites, also referred to as hyperlinks, encourage participants to look for additional fox information. Hyperlinks simplify the search process for the participant by including relevant and credible sources directly on the fox sighting website (Sanner, 2004). Discussion forums, like word of mouth conversations, are an ideal way to get

participants talking about SV red foxes, increasing the likelihood of participants internalizing key concepts. Another feature that should be considered for increasing participation is email notifications, a feature participants thought would somewhat increase their participation but not as likely as other features. Studies show that emailing is the most common activity for internet users (Nie and Erbring, 2000). Email notifications are likely to be seen, even if the participant does not open the message.

The majority of participants did not look for additional SV red fox information outside of the website, either because the website provided adequate information or because they lacked further interest. Of the participants that searched for additional fox information, the internet was the main source for finding information, utilized most by participants with higher incomes. Other studies have shown similar outcomes; Americans with the highest internet usage are younger, educated, and wealthier individuals (Lazarus and Francisco, 2000; Madden, 2003; Porter and Donthu, 2006). Less educated and lower income groups are often deterred from using the internet due to their perception of the lack of usefulness associated with the internet (Porter and Donthu, 2006). The complexity of the content on a website also poses a potential barrier to low income internet users (Lazarus and Francisco, 2000). However, these trends are slowly shifting. For example, the internet is becoming increasingly accessible to under-served communities and information-seeking activities have steadily been increasing since 2000 (Lazarus and Francisco, 2000; Madden, 2003; Porter and Donthu, 2006). For the fox sighting website to be fully successful, it needs to appeal to a wide demographic market, including those of lower socio-economic status. Recommendations for achieving this include: providing website help or assistance for those that require it, posting simple content at an appropriate reading level, and offering incentives that make the participant feel valued (Lazarus and Francisco, 2000).

Participants most likely to see a SV red fox were older and had a higher level of income. Foxes were most commonly spotted near infrastructure, which mainly entailed roads and houses. Sightings near infrastructure can be expected given the amount of time people spend near roadways and settlements (Phillips et al., 2009). Additionally, these fox sightings can also be linked with property ownership; individuals that own property in the Sacramento Valley, particularly within close proximity to agricultural fields, have a higher probability of seeing an SV red fox. Older individuals are more likely to be homeowners than younger individuals; research shows that homeownership in younger individuals (25-34) decreased over the last couple decades, while homeownership in older

individuals (65-74) has increased (Myers and Wolch, 1995). The idea that fox sightings are linked with property ownership is further supported by the responses from older participants indicating that they thought SV red foxes caused damage more than younger participants. The most frequent encounters with SV red foxes occurred in age groups 36-51 and 51-70, which are ages where property ownership are highly probable. However, these sightings are rarely being reported. Targeting property owners to report their fox sightings would increase the website activity (e.g. emailing homeowners associations). Additionally, researchers are not allowed to enter private properties without permission, stressing the need for researchers to communicate with property owners. By establishing a two-way communication, property owners may be more likely to participate in SV red fox research efforts, especially given the overall expressed interest in animal conservation and SV red foxes.

On average, female participants found the website features to be more helpful than male participants. Additionally, females had significantly higher ratings of interest in animal conservation and SV red foxes. The internet has long been labelled a technology that is dominated by males (Shaw and Grant, 2002; Weisser, 2000; Whitley, 1997); however, this bias has been diminishing over the years. Weisser (2000) found that females engage in more social communication and academic activities on the internet than males, who use the internet more for entertainment purposes. Additionally, a recent review by Herzog (2007) revealed that in every case the study reviewed, females were more active in animal protection efforts, often leading grassroots conservation projects. In this case, females clearly had more positive attitudes towards SV red fox conservation efforts.

Participants with higher education expressed higher interest in conservation and research efforts, which is expected. Animal conservation, citizen science projects, and research based websites all sparked significant interest by the survey participants with higher education. Additionally, participants with higher education also gave higher ratings of usefulness to some of the more technical features on the website, such as the Google map coordinate locator and the species clarification page. Previous studies have correlated high levels of education with greater conservation efforts. Granzin and Olsen's (1991) review of various studies, ranging from 1972-1989, concluded that individuals with higher education levels are more inclined to participate in environmental activities. The fox sighting website seems to capture the interest of most participants with some form of college education; however, participants with lower levels of education do not

possess as strong interests. Implementing some of the previously mentioned recommendations may improve this.

Employment status does not appear to influence the participants' interest or attitudes regarding the website and their experiences with SV red foxes. Participants' location created minimal variation in the feedback provided, other than whether or not the participant saw a SV red fox, which is expected given that the foxes are confined to the Sacramento Valley area. Participants' level of income had moderate influence over their opinions. The most influential demographic variables influencing the views and contributions of the participants were gender, age, and education. Therefore, future alterations to the website need to consider how it will be perceived across gender, age, and level of education.

In order to achieve a better understanding of the interests of the participants utilizing the fox sighting website I needed to have a representative sample of the general population, as well as website users. Internet surveys that produce a non-representative sample risk yielding biased or unreliable data that could lead to false conclusions (Duda and Nobile, 2010). All internet surveys have some degree of bias associated with them, whether it is selective sampling or overlooking non-responses, but when used in conjunction with other data (e.g. data previously collected from the fox sighting website), the survey results can provide meaningful data that could help contribute to important conservation decision making (Duda and Nobile, 2010; Vaske et al., 2012). Additionally, the survey responses showed a relatively normal distribution for the majority of demographic questions, indicating that the data may very well be representative sample of the Sacramento Valley population.

Conclusion

Overall, the website is an effective tool. The majority of participants responded positively to the website, declaring it predominantly interesting and helpful. Very few negative comments were conveyed in the responses. Therefore, it can be assumed that the website does an adequate job of educating and informing the public, although there is still capacity for improvement. The main users of the fox sighting website can be classified as older participants and/or participants with a higher level of education. Female and higher educated participants showed significant interest in participating in animal conservation, and therefore should be considered when searching for future participants. Although the

vast majority of participants gave the website positive reviews, there was still a low rate of return visitors. Participants indicated that they would be more likely to return to the website if it were frequently updated, had links to other websites, and contained a discussion board; hence, the need to establish a strong two-way communication between the researchers and website participants. Additional media coverage, particularly newspapers, would also increase website activity. Researchers may consider implementing some of the participant recommendations to enhance the participants' experience and increase future use of the website.

Chapter 3: Validating citizen science data using species habitat models: a case study of Sacramento Valley red foxes and public sighting reports

Introduction

Citizen science allows researchers to collect large quantities of data across extensive geographical ranges, and utilization of citizen science is linked to growing use of the internet (Bonney et al., 2009; Cooper et al., 2007; Lepczyk et al., 2009; Sullivan et al., 2009). Large quantities of data supply fundamental biological and ecological information for species under investigation, but verifying such large quantities of data becomes a difficult task (Yu et al., 2012). For long-term success, broad-scale citizen science projects need data filters to reduce the time it takes to remove bias or erroneous information (Dickinson et al., 2010). If a SV red fox presence is probable, utilizing filters based on previous data trends can improve the data validation process.

Species distribution models are effective methods for predicting the presence of a species in a defined area (Elith et al., 2006). In particular, maximum-entropy (maxent) models are more precise for determining species distribution using limited information about the species than other modelling approaches (Eith et al., 2006; Phillips et al., 2006). Maxent models take into consideration the specific locations of species and multiple associated environmental variables to produce spatial predictions of suitable habitat locations (Hirzel et al., 2006; Phillips et al., 2006). Sacks et al. (2013) recently applied this technique to develop a preliminary distribution model for SV red foxes.

Sacks et al. (2013) used environmental predictor variables (e.g. grassland, flooding, and development) and known fox occurrences (e.g. dens and road kills) to execute a presence-only maxent habitat model for SV red foxes. This model ranked habitat suitability throughout the Sacramento Valley, scaling areas from 1 (low habitat suitability) to 9 (high habitat suitability). The SV red fox dens under investigation, located throughout the valley, varied in associated habitat suitability levels. The habitat suitability model was limited to the geographical boundaries of the Sacramento Valley, and any SV red fox dens located outside of these boundaries of the habitat model were removed from the analysis.

The habitat model created by Sacks et al. (2013) took a broad scale perspective, mainly extrapolating and interpolating relationships between various variables to generate general areas of habitat suitability. This generalized approach to habitat modelling risks a loss of information that could have importance in locating species. Most of the fox occurrences used in the model were found as a result of public sighting reports.

Additionally, the majority of the fox occurrences used in this model occurred near human settlements and roadways, likely creating a sample bias because the data did not come from random sampling of the area (Phillips et al., 2009; Reddy and Dávalos, 2003). However, given that presence-only models operate with a limited amount of species data, some degree of bias and error is practically inevitable (Barry and Elith, 2006; Phillips et al., 2006).

Despite the discussed limitations, the model presented by Sacks et al. (2013) is the only model to-date that describes habitat preferences for SV red foxes. The model aids mapping out potential SV red fox distribution. My investigation involves testing if this habitat model can also be used to accurately predict SV red fox presence at locations specified by sighting reports. For my analysis, I utilize Sacks et al. (2013) habitat model on a much finer scale than originally designed to investigate trends in the fox sighting reports. Sacks et al.'s (2013) model extrapolates points based on several environmental predictor variables, whereas I examine single points (e.g. coordinates) within the model. The information provided by this study will define the criteria for data filters. The filters will be determined by comparing the locations and content of previously collected fox sighting reports' with habitat suitability values specified in Sacks et al. (2013) SV red fox habitat model.

In this chapter, I seek to answer three questions: (1) What does the habitat model tell us about the SV red fox den and sighting report locations? (2) Is there a relationship between the SV red fox sighting report components and habitat suitability values? (3) Which reports should have been investigated based on habitat suitability values and can the habitat model be used to filter future incoming sighting reports? The first objective requires running descriptive statistics, which will provide information regarding the distribution of dens and reports across habitat suitability levels. For the second objective, I investigate if the species description details in the sighting report have an effect on habitat suitability values. Lastly, I incorporate the findings from the summary statistics to create the filter criteria for determining the priority level of the incoming reports. The results will save researchers' time by eliminating the need to investigate reports where a SV red fox is likely improbable.

Methods

The first step of analysis required overlaying the SV red fox den and valid sighting report locations on the SV red fox habitat model, using ESRI® ArcMap v10.0.

The fox dens and sighting locations were individually coded for their associated habitat suitability values, which were extracted from the Sacks et al. (2013) model. The habitat suitability values were dependent on the den and report locations. Dens and reports outside the geographical boundaries of the model were removed from this analysis, since they do not have an assigned habitat suitability value.

For explanatory purposes, I grouped the habitat suitability values, scaled 1 to 9, into three categories: low, moderate, and high habitat suitability. Low habitat suitability contains habitat suitability values 1-3, moderate habitat suitability contains habitat suitability values 4-6; and, high habitat suitability contains habitat suitability values 7-9.

The sighting locations used in this study were obtained from citizen sighting reports submitted through the website from 2007-2009. These reports included both fox and coyote sightings. The initial descriptive analysis included reports that specified a coyote as the observed species to see if there was any relationship between the habitat suitability levels for total reports locations (including coyote reports) and the habitat suitability levels for only red foxes report locations. However, the main component of this project focuses on the reports that specified red foxes.

Once all of the den and report locations were coded, I executed two separate linear regression models. The regression models illustrate the distribution of report and den locations across all habitat suitability levels. A secondary investigation that measured the distance from the dens located in low habitat suitability levels to moderate habitat suitability levels was also executed. The secondary analysis only investigated dens located in habitat suitability levels of 3 or lower. The goal of this analysis was to describe and classify the den outliers to help explain the wide range of habitat suitability values for SV red fox dens, similar to the analysis presented in Kelling et al. (2011). The distance from the den location to the nearest habitat suitability level 4 or higher was measured using the tools provided in ArcMap.

The red fox reports were then divided into subgroups to investigate the relationship between the descriptions provided in the red fox sighting reports from the general public and SV red fox habitat suitability levels. The reports were separated based on the number of SV red fox physical identifiers accurately described in the participants' observed species description. Participants were asked to fill out three physical identifiers related to the observed species' in the fox sighting report: tail colour, ear colour, and body colour. If the participant accurately identified all three of the SV red fox features—white tip on tail, black backside on ear, and mostly orange body colour—the report was placed

in Group 1. If two of the three features were accurate, the report was categorized in Group 2. The reports with one accurate physical description were assigned to Group 3. If none of the description components accurately depicted a SV red fox, the report was placed in Group 4.

Replicating the methods used in Elith et al. (2006) and Hirzel et al. (2006), I then ran a Pearson's correlation test between dens and reports in relation to habitat suitability levels. Additionally, I examined the relationship between the red fox report groups and number of reports within fox home-ranges. The home-ranges were represented using a 2 km radius around the den, the same approach used in previous chapters. The trends were summarized in table format.

Results

Summary

Figure 10 represents a total of 184 reports, 154 of which specified SV red foxes, overlaid onto the habitat suitability model developed by Sacks et al. (2013). The majority of reports were located in moderate (habitat suitability levels 4-6) to high (habitat suitability levels 7-9) habitat suitability areas. Relatively few reports (n=12) were found in low habitat suitability areas (habitat suitability levels 1-3). There was a strong, positive correlation (R^2= 0.61) between the sighting report locations, including both coyote and red fox reports, and habitat suitability; whereas, dens had a very low correlation (R^2= 0.03). When only taking into consideration the website reports that specified the observed species as a red fox, there was a slight decrease in the associated correlation (R^2= 0.59). Figure 11 illustrates the increasing trend between habitat suitability and numbers of reports.

The relationship between the number of sighting reports and habitat suitability is stronger than the relationship between the number of SV red fox dens and habitat suitability. Only 3% of the variation in SV red fox den numbers can be explained by the habitat suitability levels (Fig. 12). Based on the distribution, dens and reports appeared to increase in numbers at moderate habitat suitability. Seven (17.1%) of the SV red fox dens (n= 41) were located in low habitat suitability. When investigating the distance from these seven dens to the nearest moderate habitat suitability area, the dens were close to moderate habitat suitability levels (Table 4). On average, these dens were 1.95 km away from the nearest moderate habitat suitability area, with distances ranging from 0.58-3.91 km. The average distance, 1.95 km, is still within a typical fox home-range. So, although

a reasonable number of dens were located in low habitat suitability levels, the dens were all within close distance to areas considered moderate habitat suitability.

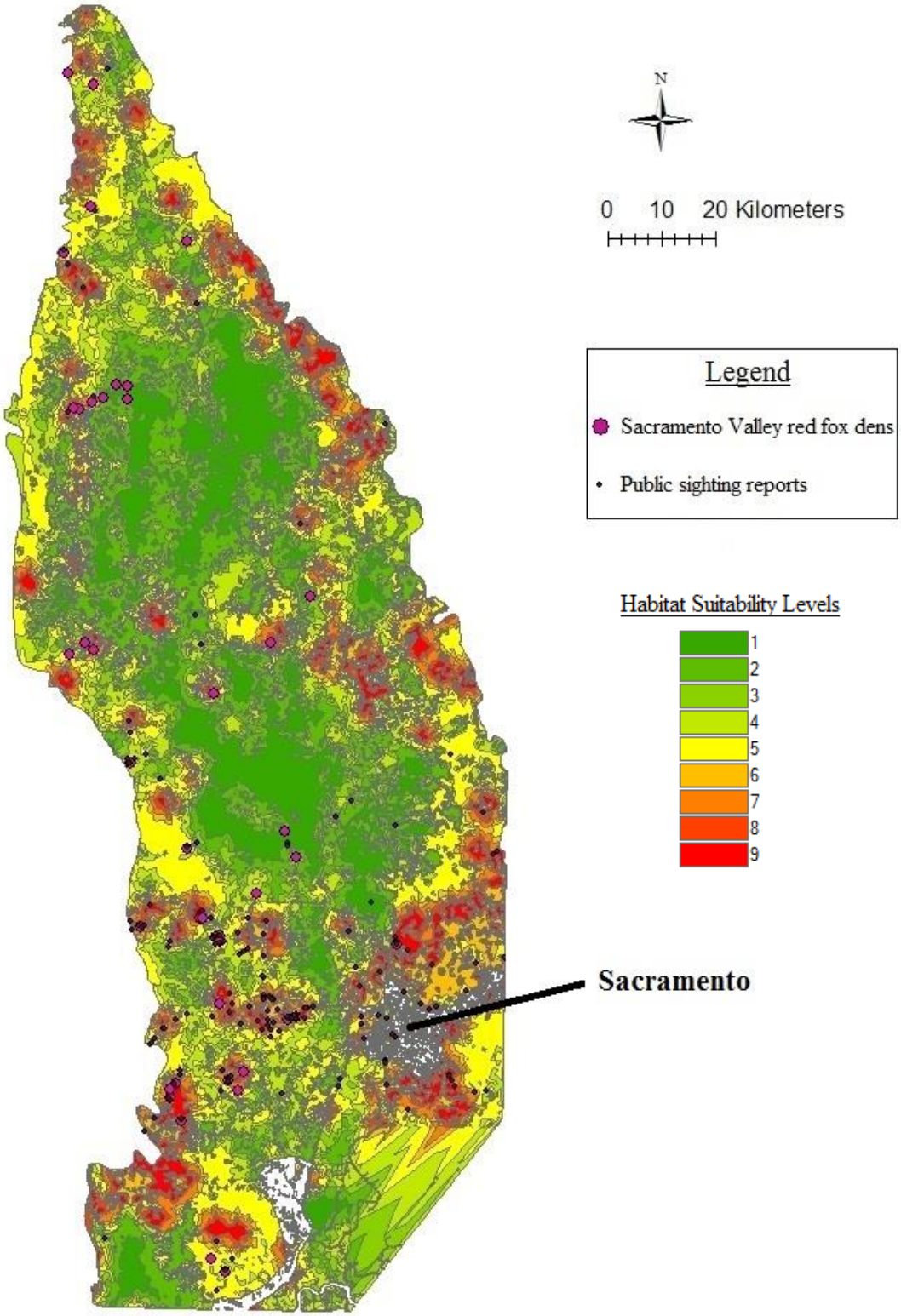

Figure 10: The Sacramento Valley red fox den and public sighting report locations overlaid onto the habitat suitability model developed by Sacks et al. (2013) using ERSI® ArcMap v.10.0.

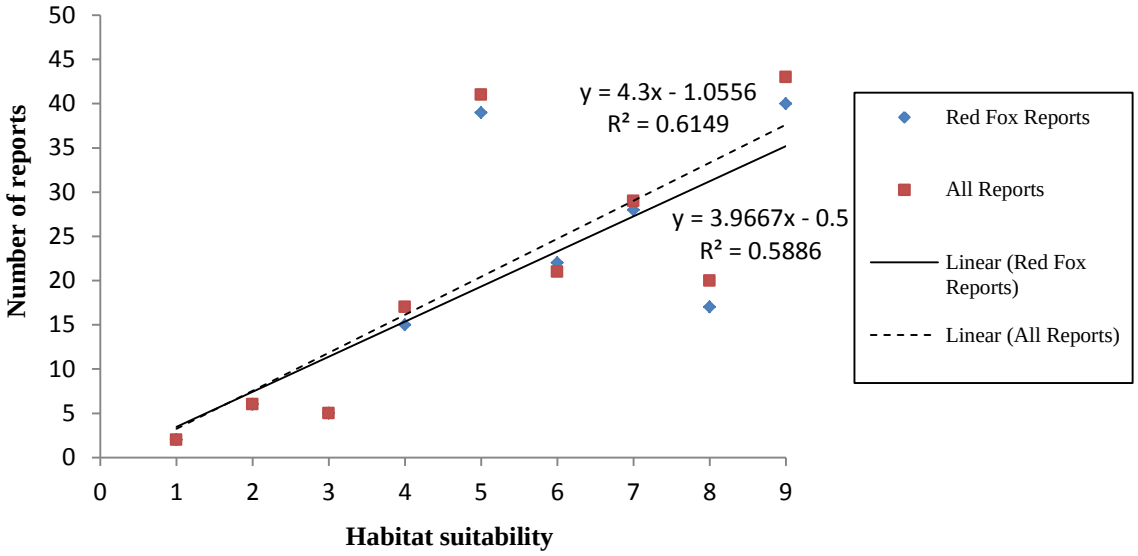

Figure 11: Distribution of report frequencies across habitat suitability levels obtained from Sacks et al. (2013) presence-only habitat model for Sacramento Valley red foxes. Habitat suitability ranges from 1 (low habitat suitability) to 9 (high habitat suitability.

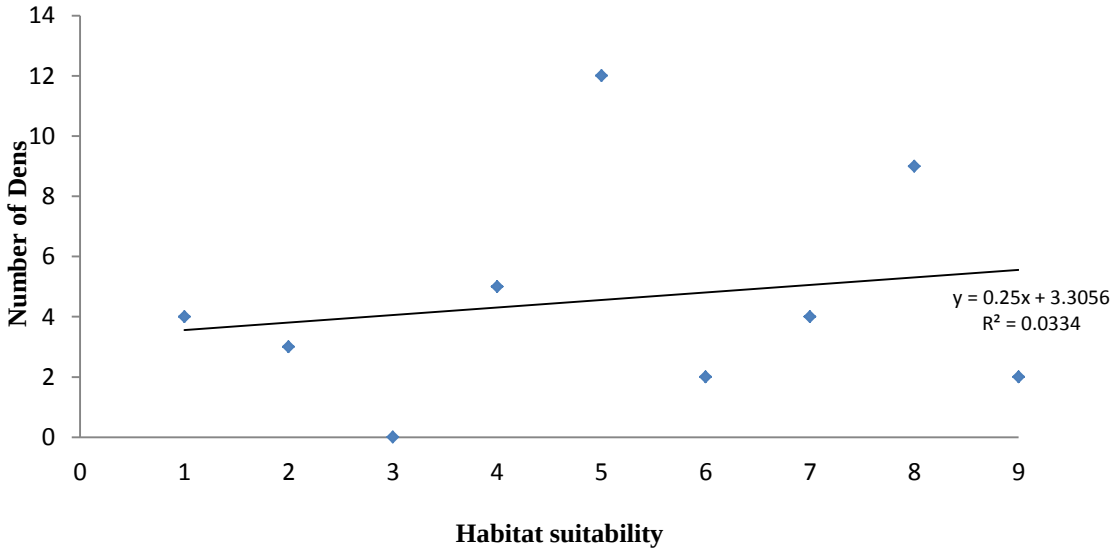

Figure 12: The distribution of dens (n= 41) across habitat suitability levels obtained from Sacks et al. (2013) presence-only habitat model for Sacramento Valley red foxes. Habitat suitability ranges from 1 (low habitat suitability) to 9 (high habitat suitability

Table 4: Location characteristics of the SV red fox dens found in relatively low habitat suitability (≤ 3) and distance to nearest moderate habitat suitability level (≥ 4).

Den	Township	County	Habitat Suitability Level	Distance to Nearest Moderate Habitat Suitability Area (km)
18	Knights Landing	Yolo	2	0.58
21	Knights Landing	Yolo	1	3.16
27	Willows	Glenn	1	3.91
29	Live Oak	Sutter	2	0.75
39	Willows	Glenn	1	1.57
40	Willows	Glenn	2	1.23
41	Willows	Glenn	1	2.47

Red fox reports and habitat suitability conditions

Group 1, the reports that correctly identified the three SV red fox physical features, contained 21 of the total 154 (13.6%) red fox reports. The majority of the red fox reports were located in Group 2 and Group 3 (see Table 5). These reports accurately identified 1-2 SV red fox features, even though most participants marked "did not see" for some of the described fox features.

A larger portion of SV red fox sighting reports were located in areas considered more suitable for the species (Table 5). Group 1 had the highest mean habitat suitability level while Group 4 had the lowest mean habitat suitability. A Pearson's correlation test showed that Group 1 and Group 2 showed a fairly strong correlation between reports and habitat suitability; whereas, Group 3 and Group 4 displayed moderate correlations (Table 6). The combination of accurate species description and high habitat suitability could increase the likelihood of SV red fox presence.

Table 5: Summary of habitat suitability levels across red fox sighting report groups (1-4).

Sighting Report Groups	Habitat Suitability									Mean	Median	SE	Total Reports
	1	2	3	4	5	6	7	8	9				
Group 1	0	0	1	1	3	4	4	2	6	6.86	7	1.82	21
Group 2	1	2	2	2	8	7	11	3	16	6.65	7	2.15	52
Group 3	1	3	1	6	19	7	6	5	11	5.97	5	2.08	59
Group 4	0	1	0	5	6	0	3	5	2	5.95	5	1.99	22

Group 1- all three physical features of a Sacramento Valley red fox properly identified.
Group 2- two physical features of a Sacramento Valley red fox properly identified.
Group 3- one physical feature of a Sacramento Valley red fox properly identified.
Group 4- zero physical features of a Sacramento Valley red fox properly identified.

Table 6: Summary of relationships between red fox sighting report groups and habitat suitability levels.

Sighting Report Groups	Pearson's Correlation (r)	Coefficient of determination (R^2)	Reports in Home-range
Group 1	0.86	0.75	5
Group 2	0.76	0.58	26
Group 3	0.46	0.21	19
Group 4	0.40	0.16	10

Group 1- all three physical features of a Sacramento Valley red fox properly identified.
Group 2- two physical features of a Sacramento Valley red fox properly identified.
Group 3- one physical feature of a Sacramento Valley red fox properly identified.
Group 4- zero physical features of a Sacramento Valley red fox properly identified.

A large portion of report locations fell within areas considered typical fox home-ranges. In general, the red fox reports presented a strong correlation (Pearson r= 0.88) between the frequency of reports in each group and frequency of reports within home-range. The participants' accuracy in identifying SV red fox features did not influence whether or not a report was located within a presumed home-range. The percentage of reports located within a SV red fox home-range ranged from 24% to 50% across all four groups. A notable 50% of the reports from Group 2 were located within a fox home-range. Group 1, on the other hand, contained the lowest percentage of reports within a fox home-range. Nearly all of the reports within a fox home-range, other than the exception

of one report in Group 2, were located in habitat suitability levels of four or higher, as illustrated in Figure 13.

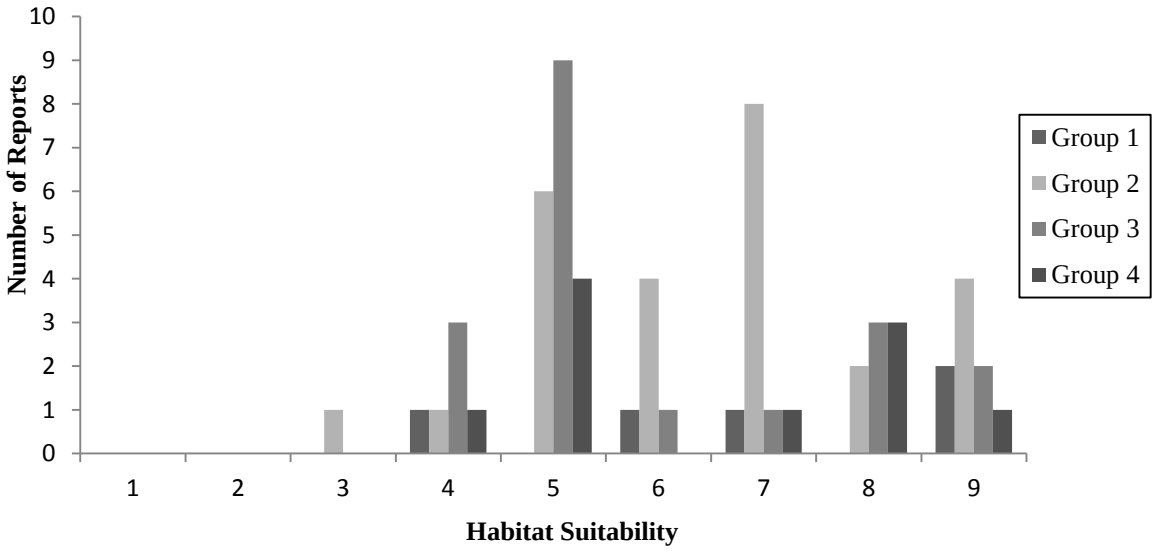

Figure 13: The distribution of reports within Sacramento Valley red fox home-range across Sacramento Valley red fox habitat suitability range in Groups 1-4. Habitat suitability levels range from 1 (low habitat suitability) to 9 (high habitat suitability).
Group 1- all three physical features of a Sacramento Valley red fox properly identified.
Group 2- two physical features of a Sacramento Valley red fox properly identified.
Group 3- one physical feature of a Sacramento Valley red fox properly identified.
Group 4- zero physical features of a Sacramento Valley red fox properly identified.

Filtering future reports

This analysis shows that reports located in low habitat suitability are less likely to be within a fox home-range. Relatively few dens and red fox sighting reports were distributed across the low (1-3) levels of habitat suitability, as highlighted in Table 7. An increase in the number of dens and reports, as well as sighting reports within a fox home-range (Fig. 13), is found between habitat suitability levels 3 and 4. By grouping the habitat suitability levels into categories, this inflection point in the data becomes more apparent (Fig. 14).

According to this study, a potential filtering criterion for future sighting reports would be assigning a low priority for investigating reports located in low habitat

suitability levels for two main reasons. Firstly, the previously obtained reports had reasonably few, 12 of the 154 (7.8%), red fox reports within low habitat suitability levels. Secondly, of the 12 reports in low habitat suitability areas, only one report was located within a fox's home-range. This one report accounts for a mere 0.6% of the total reports within fox home-ranges (Table 7). Furthermore, as previously mentioned, comparatively fewer SV dens are located in low habitat suitability than in moderate and high habitat suitability levels.

Table 7: Summary of dens and red fox sighting reports located in low, moderate, and high habitat suitability levels.

Habitat Suitability Group	Number of Dens	Number Red Fox Sighting Reports	Reports within Home-range	Rate of reports within home-range	
				Habitat suitability group	Total
Low (1-3)	7	12	1	0.08	0.01
Moderate (4-6)	19	68	31	0.46	0.20
High (7-9)	15	74	28	0.38	0.18

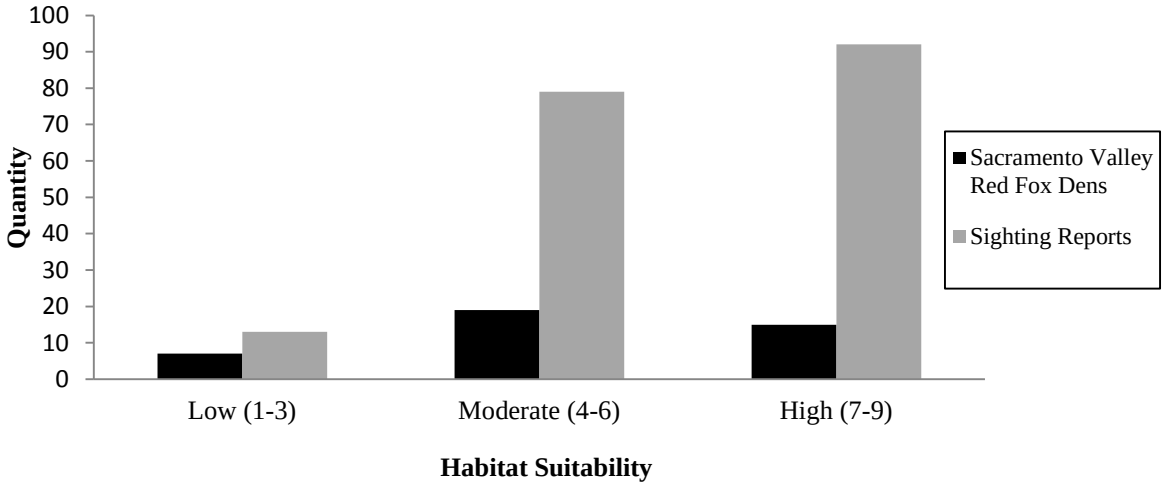

Figure 14: Distribution of fox dens and sighting reports across low, moderate, and high habitat suitability levels derived from Sacks et al. (2013) presence-only habitat model for Sacramento Valley red foxes.

Discussion

Although the relationship between den locations and habitat suitability levels was not a strong correlation, relatively few dens were located in low habitat suitability (habitat suitability levels ≤ 3). The factors causing the diverse distribution can be attributed to several factors: (1) the small sample size, (2) the habitat suitability scale, (3) unaccounted environmental variables. The sample size of dens (n=41) is small for assuming SV red fox habitat preferences for an area as large as the Sacramento Valley. Studies show that when applying a limited amount of documented species occurrences to a presence-only model (n < 50 occurrences), it creates noise in the data that reduces the correlation between the environmental variables and species presence (Hirzel et al., 2006). In this case, the model utilized 81 fox presence points, slightly above the amount recommended by Hirzel et al. (2006). Another explanation for why the dens are located in low habitat suitability relates to the habitat suitability scale utilized in Sacks et al.'s (2013) model. The implemented 1-9 scale is an arbitrary measurement. For example, when grouping the habitat suitability levels into three categories (low, moderate, and high), as displayed in Figure 5, the distribution of dens resemble a normal distribution. The data can easily be manipulated by using a different scale. Lastly, when executing the model, Sacks et al. (2013) may have overlooked additional variables that influence habitat suitability for SV red foxes, such as the distribution of competing species or abundance of food resources. However, further research regarding SV red fox habitat preferences is required to support this claim.

A number of factors influence den locations in the Sacramento Valley. For instance, coyotes and red foxes share similar habitat preferences and prey species, creating competitive interactions between coyotes and SV red foxes (Harrison et al., 1989; Voigt and Earle, 1983). To reduce typically fatal encounters, red foxes avoid suitable habitats if the area overlaps with coyote territories, potentially displacing SV red foxes to less suitable habitat areas (Harrison et al., 1989). This could also explain why a large portion of the SV red fox dens were located on the outskirts of towns and within close proximity to development (e.g. roads). Red foxes use human infrastructures as shelter from coyotes and other threats (Dekker, 1983). Therefore, in this context, urban encroachment has an indirect positive effect on SV red foxes. Research has shown that urban encroachment in certain areas of California reduced coyote populations while increasing the habitat availability for red foxes (Lewis et al., 1993). Despite competition

pressures, the majority of SV red fox dens were located in either moderate to high habitat suitability areas.

Sighting reports had a closer association with higher habitat suitability levels than dens. This positive correlation is expected given the biased data used in the habitat model. In this study, there was a stronger correlation between reports and habitat suitability levels when incorporating the entire collection of the sighting reports rather than just red fox reports. This supports the notion that coyotes compete for similar habitat, assuming that the species were correctly identified in the original sighting report. When considering only the red fox reports, the correlation between reports and habitat suitability increased as the number of SV red fox physical features in the report accurately identified increased. This does not imply that accurately identified SV red fox reports have a higher probability of being within proximity to a fox home-range. For example, Group 1, reports that accurately identified all of the red fox components, had the lowest portion of reports located within a fox home-range. Therefore, researchers should not prioritize investigating reports based only on the accuracy of SV red fox physical identifiers.

The habitat model developed by Sacks et al. (2013) serves as a potential tool for filtering future sighting reports. Categorizing the dens and reports into three habitat suitability categories (low, moderate, and high) plays an advantageous role in filtering future sighting reports by making them easier to manage and evaluate. Reports located in low habitat suitability levels would be given a low priority for follow-up investigation. Researchers would focus the majority of their time and efforts on investigating reports located in moderate to high habitat suitability levels, as shown in this study to have the highest amount of reports within a fox home-range.

One concerning limitation to filtering reports located in low habitat suitability is the potential to overlook any dens located in low habitat suitability. However, the relatively few dens located in low habitat suitability levels were all within 3.91 km from moderate habitat suitability levels. Additionally, if researchers take into account the distribution of sighting reports, the margin of error would subsequently decrease. This emergent filter flags reports from particular areas where several occurrences have been reported but are below the established filter threshold (habitat suitability ≤ 4) (Yu et al., 2012). This alerts the researcher that, although the habitat is considered low habitat suitability, there are signs of SV red fox activity present.

Conclusion

The previously obtained sighting reports provide the necessary insights to define the criteria for the data filter. By implementing the habitat model filter a habitat suitability levels ≤ 4, researchers can essentially reduce the time it takes them to validate the public data received. Even with a data filter in place, some potentially valuable reports may get overlooked so it is crucial to implement a coinciding filter that records distribution frequency for report locations, particularly since there were a few dens are located in relatively poor habitat suitability conditions. With these two filters applied, investigating fox sighting reports will become more efficient and effective.

Conclusion

In this study, I reviewed various aspects of the previously obtained fox sighting reports to find if there are any trends and correlations that help guide researchers with future sighting reports. Additionally, I evaluated public feedback on the fox reporting website through an online survey to determine what components of the website participants liked and what components participants thought need improvement. General demographic attributes of the participants visiting the website were also assessed through means of statistical analysis. General SV red fox knowledge was measured in the survey as well. Lastly, I performed an analysis using the Sacks et al. (2013) presence-only habitat model to investigate if there was a relationship between the sighting report locations and habitat suitability. I also tested the applicability of the habitat model as a potential filter for future sighting reports.

The results of this study will improve future fox-related research by: reducing the time it takes researchers to collect relevant data, making the participants' website experience more enjoyable so they are more inclined to contribute, and helping to create a filtration system for future reports by prioritizing the reports more likely to have fox presence. Prior to this research, the data collected from the public had never been evaluated for purposes other than locating potential SV red foxes. By reviewing feedback from the participants, I was able to characterise the participants using the fox reporting website and assess their general knowledge on SV red foxes. The results indicated that the main users of the fox sighting website were older and/or had a higher level of education. Additionally, survey respondents stated that they would be more likely to report their fox sighting if there were frequent website updates of study results, links to other informational websites, and a discussion board on the website. Applying the participants' suggestions to the website can increase long-term participation.

The findings of my research also lead to insights about SV red fox ecology. When reviewing the report locations, I found that most road kills occur within a fox home-range, supporting the notion that SV red foxes do not typically venture outside of their home-range territories. I discovered a stronger correlation between reports and habitat suitability levels when I included coyote sighting reports, implying that coyotes and SV red foxes compete for similar habitats. Lastly, public sighting reports where SV red fox features were accurately identified possessed a stronger correlation with high habitat suitability than sighting reports that did not accurately identify all of the SV red fox

features. This study also defined a habitat model filter to assist researchers by reducing the time it takes them to validate the public data received.

One major finding in this research, posited towards SV red fox conservation, quantifies that the majority of local citizens participating in this study indicated awareness of SV red foxes nativity and declining population. The importance of public education on the current status of SV red foxes promotes participation in sighting reports that that help researchers learn more about the ecological traits and behavioural patterns of SV red foxes. This information provides the foundation for developing an effective management plan for species conservation.

Reviewing the previously obtained data and analysing participant feedback revealed important SV red fox information that otherwise would have gone overlooked. The methods used in my research can be applied to other citizen science projects, to improve the overall efficiency and effectiveness of collecting data.

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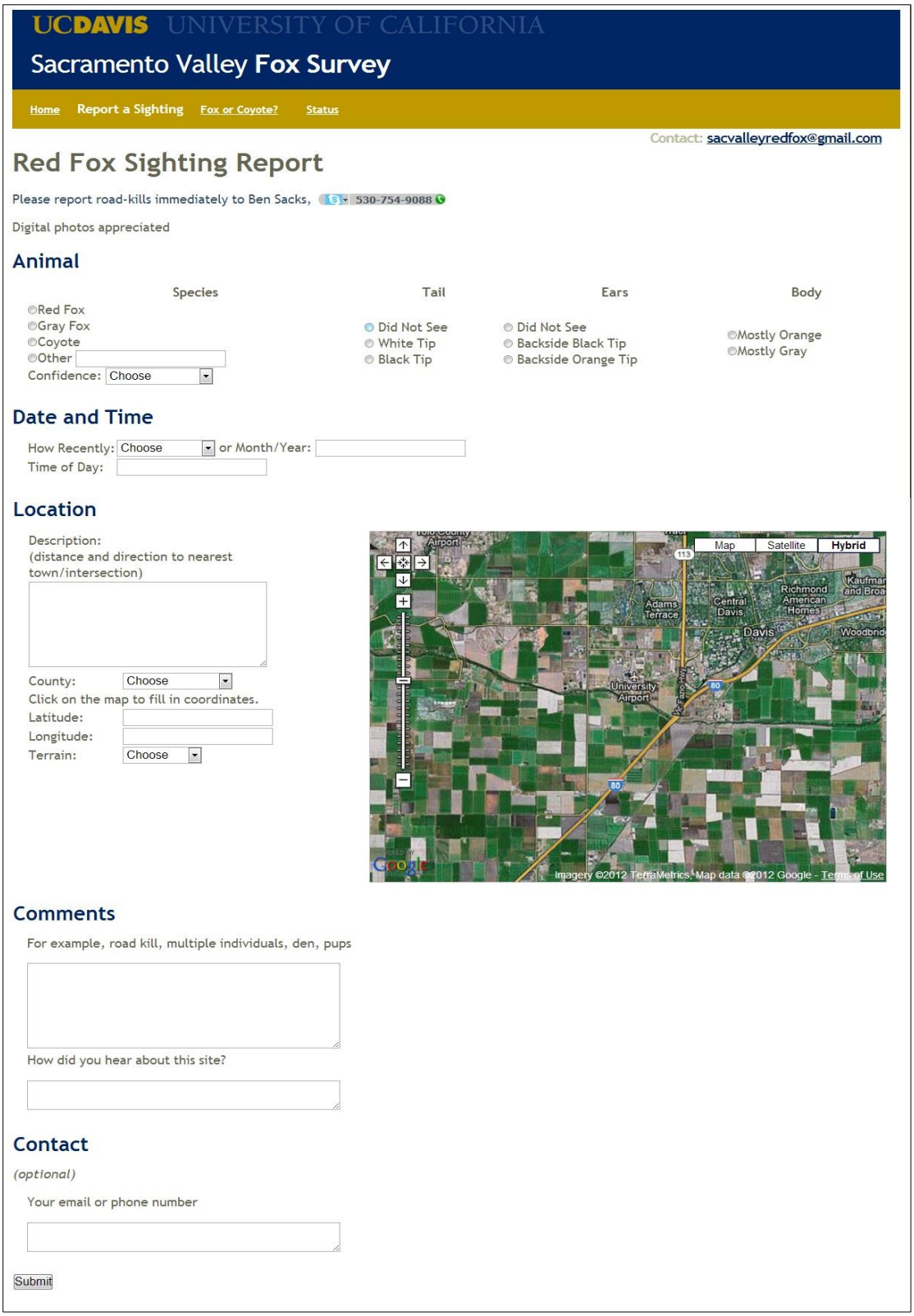
Appendix 1: Screenshot of the complete fox sighting report available to the public. The report is located under the report a sighting tab on the website (https://foxsurvey.ucdavis.edu).



Appendix 2: Media release distributed to various organizations regarding my research and the public survey posted on the fox sighting website.

Media Release

Contact: Amy Brasch, B.S.
Email: braschamy@myvuw.ac.nz
Affiliation: Victoria University of Wellington, New Zealand
Date: 1st August 2012 – 1st November 2012
Re: Getting involved with citizen science and the conservation of the Sacramento Valley Red Foxes

Red foxes in the Sacramento Valley were long thought to be non-native. However, in 2005 genetic analyses performed in the UC Davis School of Veterinary Medicine's (SVM), Veterinary Genetics Laboratory (VGL) revealed these foxes to be native to the region and potentially in decline. These discoveries set off a joint effort by UC Davis and the California Department of Fish and Game to characterize the fox's range extent, and potential interbreeding with non-native red fox populations to the south. Led by Dr. Ben Sacks, Assistant Adjunct Professor in the SVM and director of the Canid Diversity and Conservation Unit of the VGL, this project relied on citizen science, the centerpiece of which was an online reporting system for the public to communicate red fox sightings. During 2007-2009, over 400 reports were submitted by the public, which were instrumental in locating a total of 51 fox dens mapped throughout the Sacramento Valley and, ultimately, in advancing their conservation priority, currently under consideration as a California Mammal Species of Special Concern.

Now, the citizen science that was central to the 2007-2009 red fox study is itself the topic of a Masters project being conducted by Amy Brasch, a UC Davis alumna, in collaboration with her advisor, Dr. Heiko Wittmer, a Senior Lecturer at Victoria University of Wellington in New Zealand with an adjunct affiliation in the Department of Wildlife, Fish, and Conservation Biology at UC Davis, and Dr. Sacks. Their project seeks to better understand factors affecting public participation to more effectively utilize citizen science in future research and to seek ways to increase the educational value of participation for members of the public. To accomplish this, Ms. Brasch designed a web-based survey that she is asking the public to visit. It is linked to the original survey website, http://foxsurvey.ucdavis.edu and can be completed in 5 minutes.
The findings of this study will be used immediately to enhance the reporting web site, which will be re-launched for phase II of the Sacramento Valley red fox study, slated to begin January 2013 and extend over through 2016. This next phase, which will focus on better understanding the habitat needs and current abundance of the Sacramento Valley red fox, represents a continuation in the collaborative effort among UC Davis, the California Department of Fish and Game, and the US Fish and Wildlife Service.

For Further Media Information Contact:
Dr. Heiko Wittmer
Email: Heiko.Wittmer@vuw.ac.nz

Dr. Ben Sacks
Email: bnsacks@ucdavis.edu

Appendix 3: Summary of the organizations and advertisement methods used to publicize the Sacramento Valley red fox research project and the public survey

Organization	Method of Advertising	Date of Advertisement	Location
Lake County News	Newspaper, website	27 July 2012	Lake County
Sacramento Valley CNPS	Email circulation	27 July 2012	Sacramento County
The Daily Democrat	Newspaper, website	28 July 2012	Yolo County
Sac-Sierra Trout Unlimited	Website	4 August 2012	Sacramento County
Amador Flyfishers Organization	Website	5 August 2012	Amador County
Calfood	Email Listserv	9 August 2012	All counties in Ca
Sacramento Recreation Department	Email circulation, newsletter	10 August 2012	Sacramento County
Sacramento Valley Conservancy	Facebook	10 August 2012	Sacramento County
Rotary Club of Lincoln	Email circulation	13 August 2012	Placer County
Paradise Post	Newspaper, website	14 August 2012	Butte County
Butte Environmental Council	Newsletter	15 August 2012	Butte County
Winters Express	Newspaper	15 August 2012	Yolo County
Hammond Landowners Association	Website	16 August 2012	Siskiyou County
Society for Conservation Biology- California Chapters	Email listserv	21 August 2012	All counties in Ca
Solano County Farm Bureau	Website	21 August 2012	Solano County
Shasta Community College	Email circulation	24 August 2012	Shasta County
California Rangeland Conservation Coalition	Newsletter	24 August 2012	All counties in Ca
Davis Enterprise	Newspaper, website	30 August 2012	Yolo County
Laguna Creek Watershed Council	Website	31 August 2012	Sacramento County
The Rose Foundation	Facebook	1 September 2012	Alameda County, Contra Costa County
Friends of the River	Newsletter, email circulation	5 September 2012	All counties in Ca
Yolo Basin Foundation	Facebook	6 September 2012	Yolo County
Northern California Bats	Facebook	6 September 2012	Sacramento County
Ann's Orchard	Website	11 September 2012	Placer County
Solano Land Trust	Website, Facebook, email circulation	11 September 2012	Solano County
University of California: California Naturalist	Website	11 September 2012	All counties in Ca
Chico Creek Nature Center	Newsletter	12 September 2012	Butte County
Shasta Roots and Shoots: Tehama Wild Care	Website	14 September 2012	Shasta County, Tehama County
Shasta Roots and Shoots: Pree's Nature Lessons	Website	14 September 2012	Shasta County, Tehama County
U.S. Fish & Wildlife Service: Sacramento National Wildlife Refuge Complex	Facebook	14 September 2012	Sacramento County

Placer County Resource Conservation District	Website	15 September 2012	Placer County
American River Natural History Association	Website	16 September 2012	Sacramento County
Agricola Grassfed Beef Ranch	Email circulation	17 September 2012	Yolo County
Butte College	Facebook	18 September 2012	Butte County
California State University, Sacramento	Email circulation, website	19 September 2012	Sacramento County
Tree Davis	Newsletter	25 September 2012	Yolo County
Save the American River Association	Newsletter	5 October 2012	Sacramento County
Butte County Resource Conservation District	Website, email circulation	10 October 2012	Butte County
Central Valley Bird Club	Facebook	10 October 2012	Sacramento County
The Sacramento Bee	Newspaper, website	11 October 2012	Sacramento County
University of California: Green Blog	Website	19 October 2012	All counties in Ca
Dixon Resource Conservation District	Email circulation	26 October 2012	Counties in Northern California
Greater Vallejo Recreation District	Facebook	27 October 2012	Solano County
Sutter County Animal Services	Bulletin post	30 October 2012	Sutter County
Sacramento City College	Facebook	1 November 2012	Sacramento County
Wildlife and Aquatic Animal Medicine Club- UC Davis	Email circulation	9 November 2012	Yolo County
UC Davis Campus Center for the Environment	Website, email circulation	14 November 2012	Yolo County
Sacramento County Green Party	Newsletter	30 November 2012	Sacramento County

Appendix 4: The Sacramento Valley red fox public survey made available for the residents of the Sacramento Valley from August-December 2012 on the fox sighting website (https://foxsurvey.ucdavis.edu).

1. Is this your first time visiting the fox survey website?

- ○ Yes
- ○ No

2. Approximately how many times have you visited this website?

3. How did you find out about this website?

- ☐ Newspaper
- ☐ Monthly newsletter
- ☐ Television
- ☐ Radio
- ☐ Internet browsing
- ☐ Word of mouth
- ☐ Flyer
- ☐ Magnet

Other (please specify)

4. How informative do you think this website is?

Not Informative at All	Somewhat Informative	Informative	Very Informative	Extremely Informative
○	○	○	○	○

5. Have you ever looked for information on Sacramento Valley red foxes, other than this website?

- ○ Yes
- ○ No

6. Where have you looked for information on Sacramento Valley red foxes?

- ☐ Books
- ☐ Published Articles
- ☐ Internet Searches
- ☐ Magazines
- ☐ Newsletters
- ☐ Acquaintances (e.g. friend, co-worker, neighbor)

Other (please specify)

7. Have you seen a Sacramento Valley red fox before?

- ○ Yes
- ○ No
- ○ Don't know

8. Where did you see the Sacramento Valley red fox?

9. Did you report this sighting?

- ○ Yes
- ○ No

10. Why or why not did you choose to report this sighting?

11. To what extent do you agree or disagree with the following statements:

	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
Sacramento Valley red foxes are unique species	○	○	○	○	○
Sacramento Valley red foxes have a declining population	○	○	○	○	○
Sacramento Valley red foxes cause damage	○	○	○	○	○
Sacramento Valley red foxes are pests	○	○	○	○	○
I have frequent encounters with Sacramento Valley red foxes	○	○	○	○	○
I am not interested in Sacramento Valley red foxes	○	○	○	○	○
I know a lot about Sacramento Valley red foxes	○	○	○	○	○

12. Please indicate the degree of interest you have on the following topics:

	Not Interested at All	Not Very Interested	Somewhat Interested	Very Interested	Extremely Interested
Animal conservation	○	○	○	○	○
Sacramento Valley red foxes	○	○	○	○	○
Citizen science projects	○	○	○	○	○
Research based websites	○	○	○	○	○

13. How would you rate the following features on this website?

	Not Helpful at All	Not Very Helpful	Somewhat Helpful	Very Helpful	Extremely Helpful
The home page	○	○	○	○	○
Red fox, gray fox, or coyote clarification page	○	○	○	○	○
Google map coordinate locator	○	○	○	○	○
Content	○	○	○	○	○
Clear, easy to follow layout	○	○	○	○	○
Graphic quality	○	○	○	○	○
Contact information of researcher	○	○	○	○	○
Logos of the affiliated institutions	○	○	○	○	○
Multiple choice questions	○	○	○	○	○
Free response questions	○	○	○	○	○

14. Which of the following features would help increase your website participation?

- ☐ A discussion board
- ☐ Frequent website updates of study results
- ☐ Email reminders and notifications
- ☐ Links to other informational websites
- ☐ A search toolbar within the website
- ☐ Mobile application (smart phone app)
- ☐ An accompanying tutorial

15. Can you think of any additional features you would like to see on this website?

- ○ Yes
- ○ No

16. What type of features would you like to see on the website?

17. What is your gender?

- ◯ Female
- ◯ Male

18. Which category below includes your age?

- ◯ 18-25
- ◯ 26-35
- ◯ 36-50
- ◯ 51-70
- ◯ 70 or older

19. What county in California do you reside in?

20. Which of the following categories best describes your employment status?

- ◯ Full Time Employee
- ◯ Part-time Employee
- ◯ Student
- ◯ Retired
- ◯ Unemployed
- ◯ Beneficiary

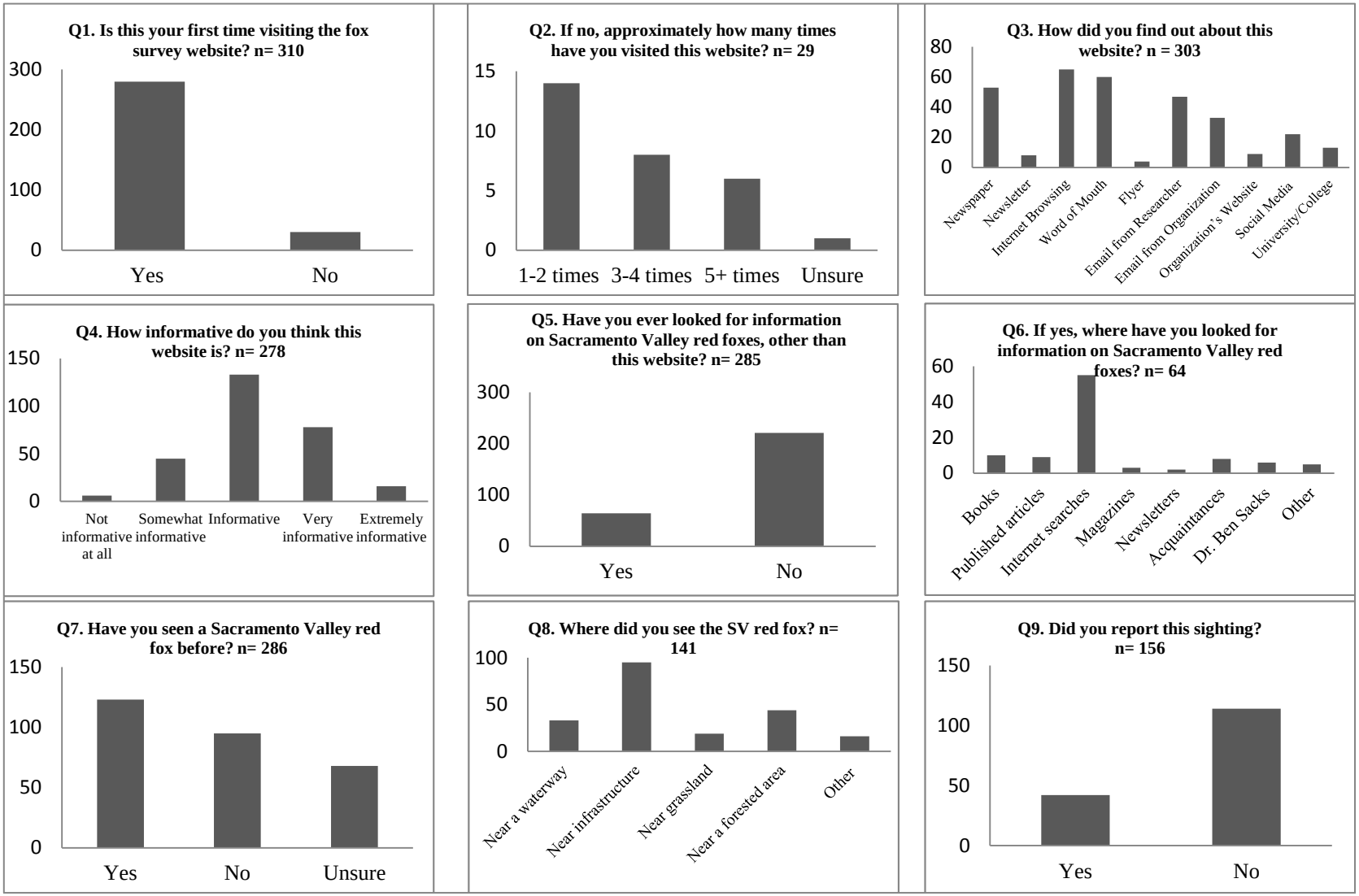
21. What range best describes your annual household income before taxes?

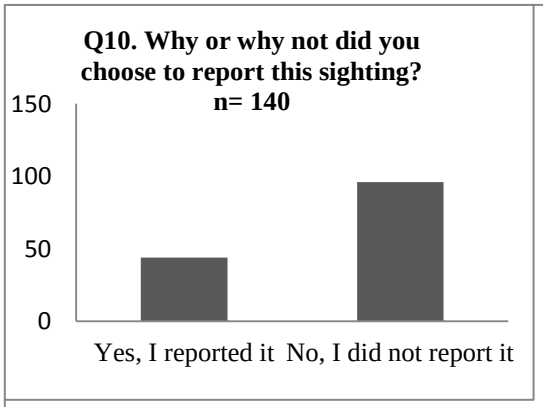
- ◯ Less than $10,000
- ◯ $10,001 - 25,000
- ◯ $25,001 - 50,000
- ◯ $50,001 - 75,000
- ◯ $75,001 - 100,000
- ◯ $100,000 - 150,000
- ◯ $150,001 or more
- ◯ Do not know

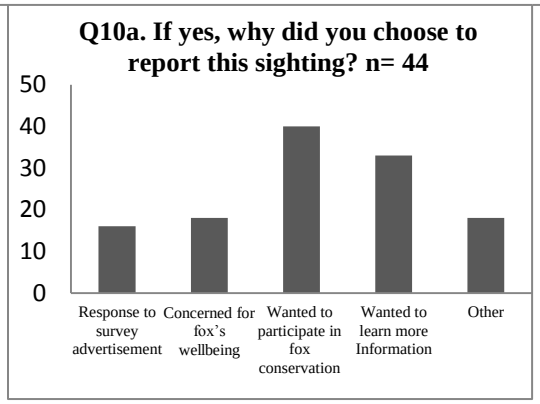
22. What is the highest level of education you have completed?

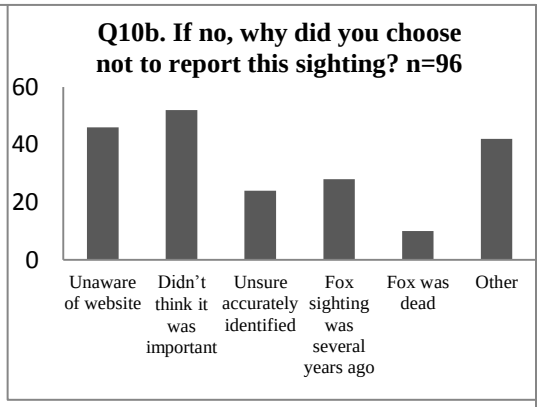
- ◯ Grade school
- ◯ High school
- ◯ Some college work
- ◯ Technical or Associate degree
- ◯ Bachelor degree
- ◯ Postgraduate degree (Master's or PhD)

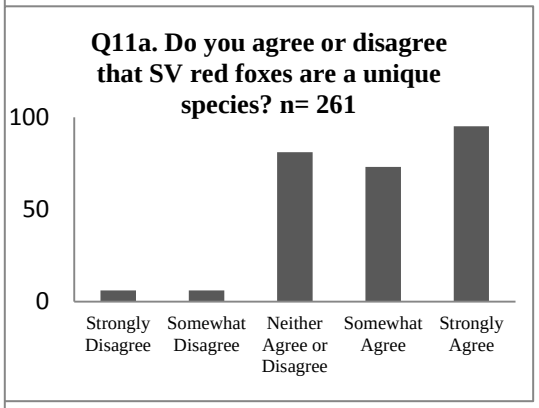
Appendix 5: Descriptive statistics of the results gathered from the Sacramento Valley red fox public survey, which was active on the Sacramento Valley red fox sighting website (http://foxsurvey.ucdavis.edu/) from August-December 2012. Note: the scale of the y-axis differs amongst the graphs in each plate. The numbers depended on the amount of responses per question.

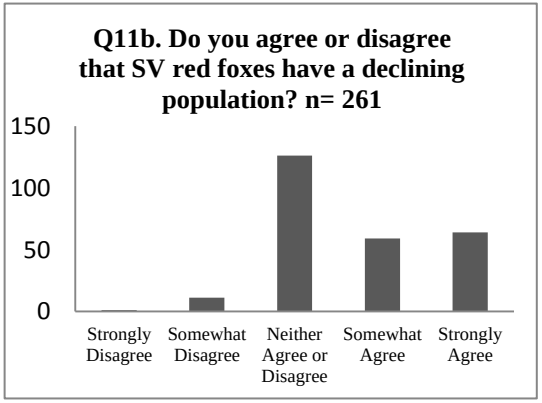


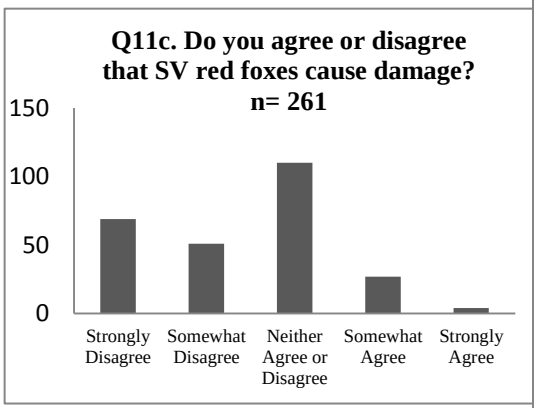

Q10. Why or why not did you choose to report this sighting? n= 140
150
100
50
0
Yes, I reported it
No, I did not report it

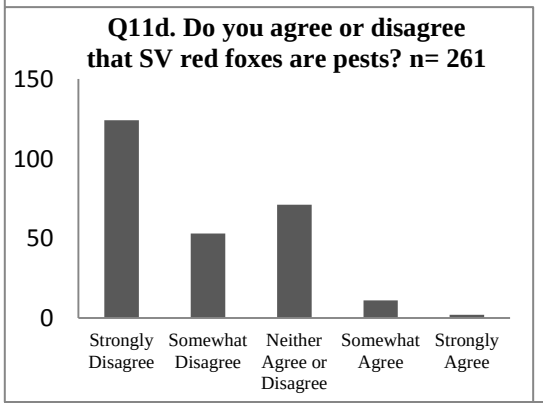

Q10a. If yes, why did you choose to report this sighting? n= 44
50
40
30
20
10
0
Response to survey advertisement
Concerned for fox's wellbeing
Wanted to participate in fox conservation
Wanted to learn more Information
Other

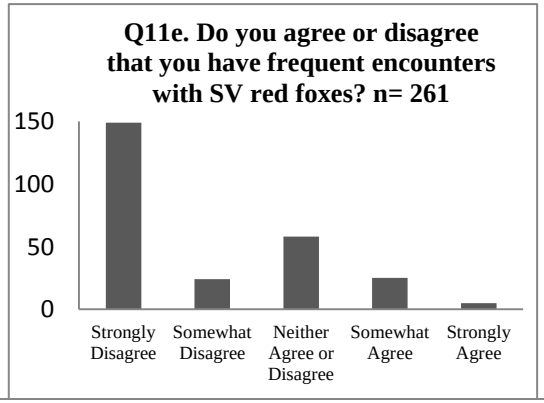

Q10b. If no, why did you choose not to report this sighting? n=96
60
40
20
0
Unaware of website
Didn't think it was important
Unsure accurately identified
Fox sighting was several years ago
Fox was dead
Other

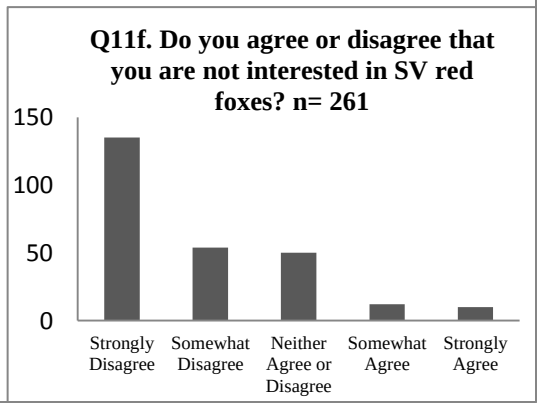

Q11a. Do you agree or disagree that SV red foxes are a unique species? n= 261
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

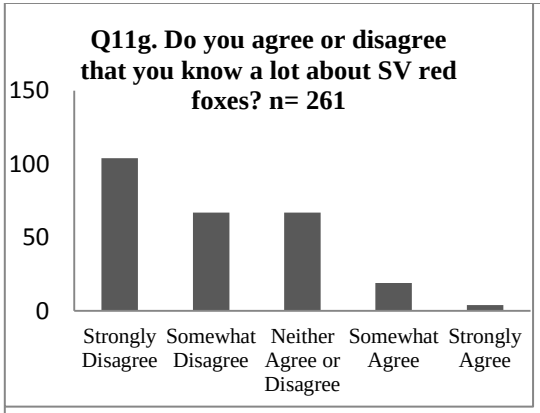

Q11b. Do you agree or disagree that SV red foxes have a declining population? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

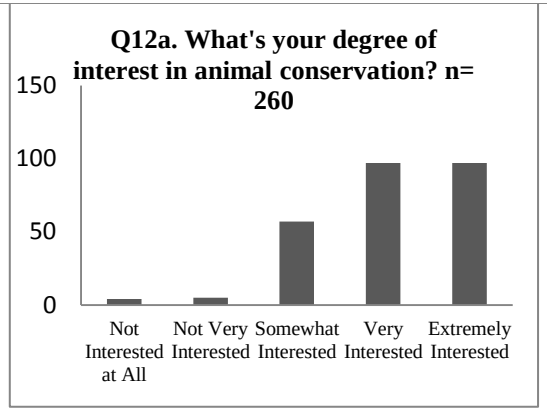

Q11c. Do you agree or disagree that SV red foxes cause damage? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

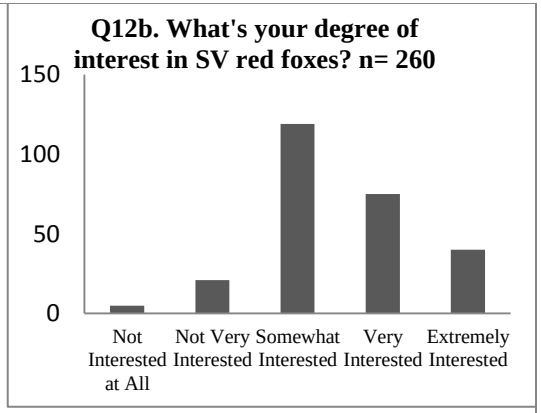

Q11d. Do you agree or disagree that SV red foxes are pests? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

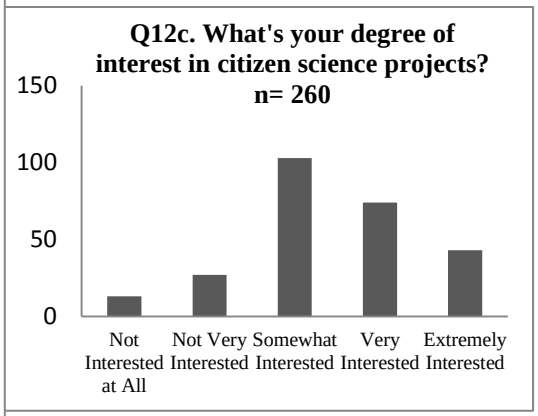

Q11e. Do you agree or disagree that you have frequent encounters with SV red foxes? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

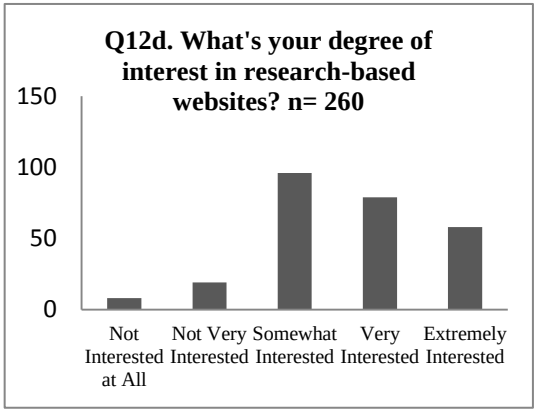

Q11f. Do you agree or disagree that you are not interested in SV red foxes? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

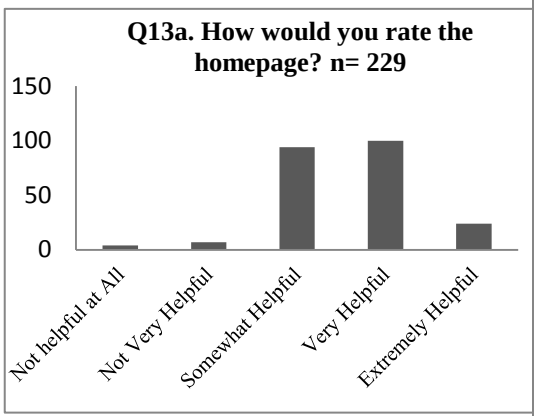

Q11g. Do you agree or disagree that you know a lot about SV red foxes? n= 261
150
100
50
0
Strongly Disagree
Somewhat Disagree
Neither Agree or Disagree
Somewhat Agree
Strongly Agree

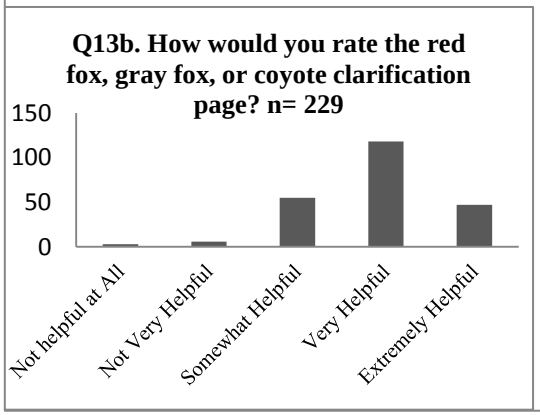

Q12a. What's your degree of interest in animal conservation? n= 260
150
100
50
0
Not Interested at All
Not Very Interested
Somewhat Interested
Very Interested
Extremely Interested

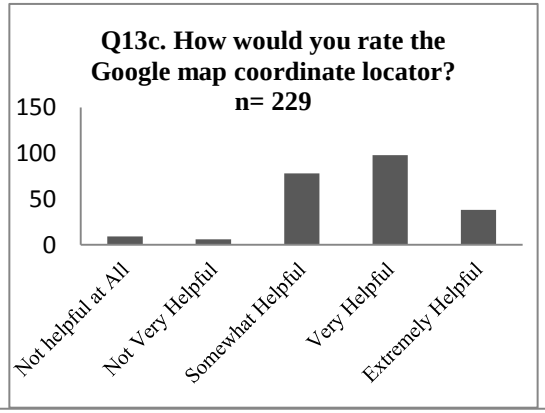

Q12b. What's your degree of interest in SV red foxes? n= 260
150
100
50
0
Not Interested at All
Not Very Interested
Somewhat Interested
Very Interested
Extremely Interested

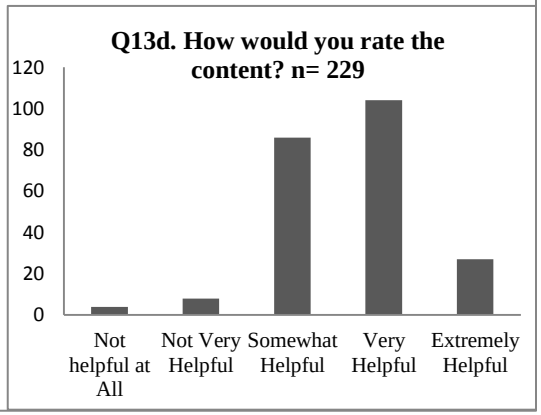

Q12c. What's your degree of interest in citizen science projects? n= 260
150
100
50
0
Not Interested at All
Not Very Interested
Somewhat Interested
Very Interested
Extremely Interested

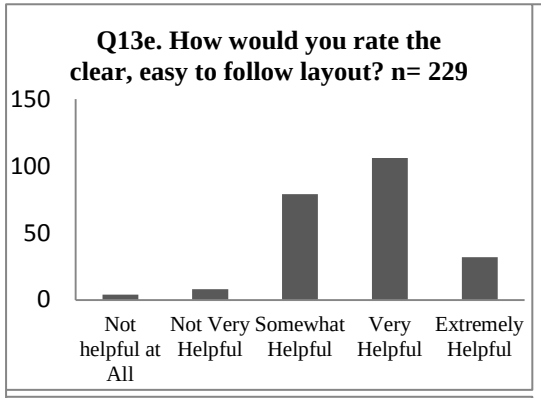

Q12d. What's your degree of interest in research-based websites? n= 260
150
100
50
0
Not Interested at All
Not Very Interested
Somewhat Interested
Very Interested
Extremely Interested

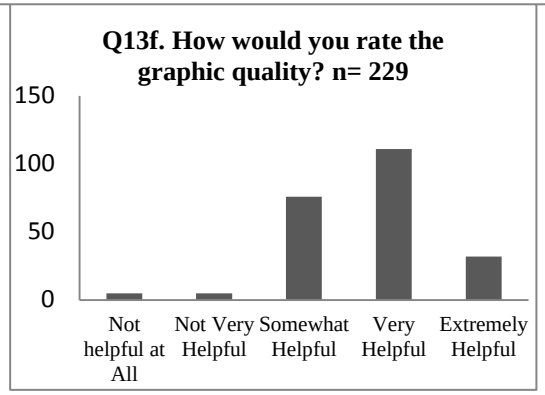

Q13a. How would you rate the homepage? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

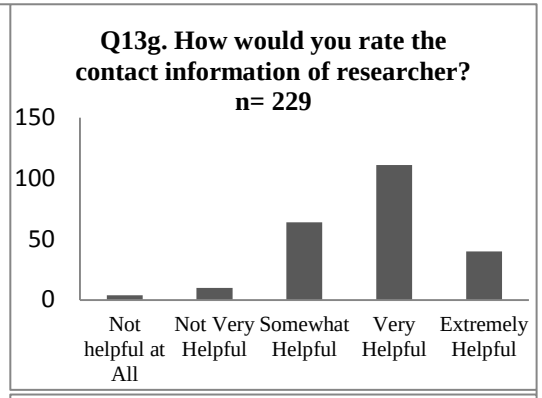

Q13b. How would you rate the red fox, gray fox, or coyote clarification page? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

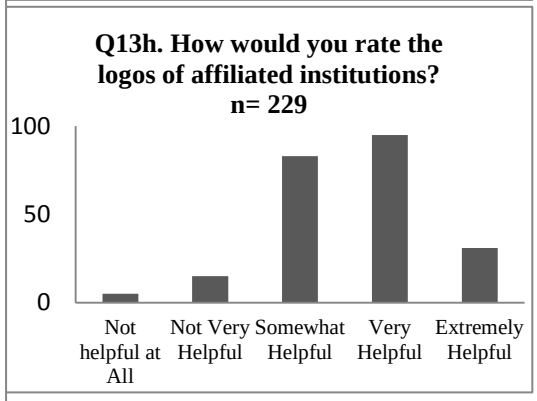

Q13c. How would you rate the Google map coordinate locator? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

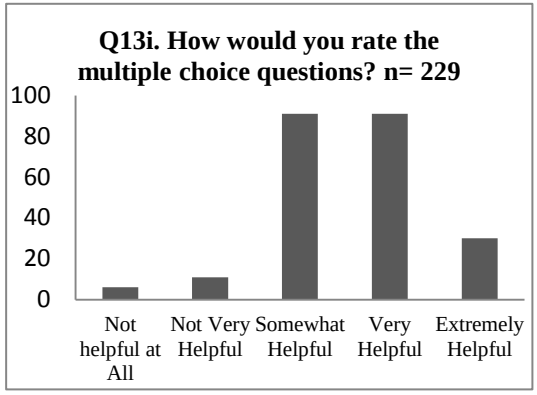

Q13d. How would you rate the content? n= 229
120
100
80
60
40
20
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

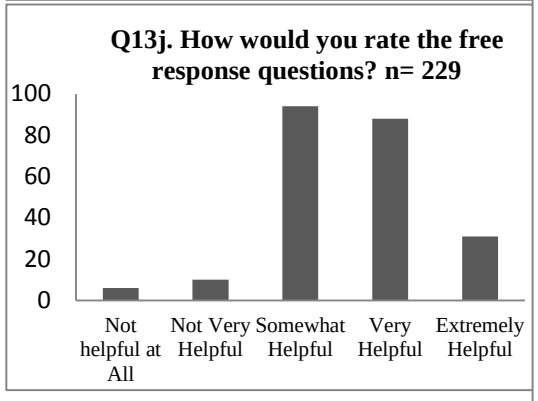

Q13e. How would you rate the clear, easy to follow layout? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

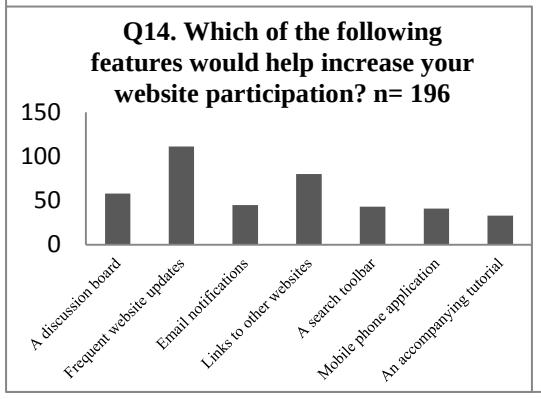

Q13f. How would you rate the graphic quality? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

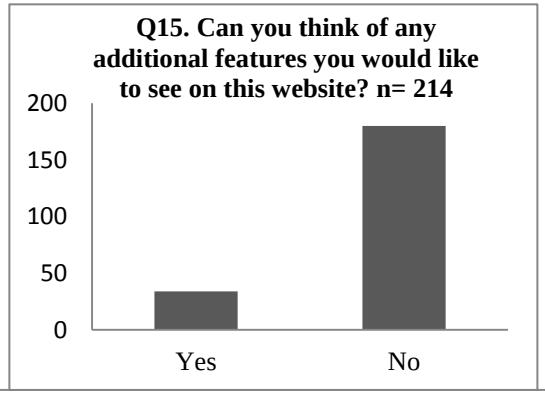

Q13g. How would you rate the contact information of researcher? n= 229
150
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

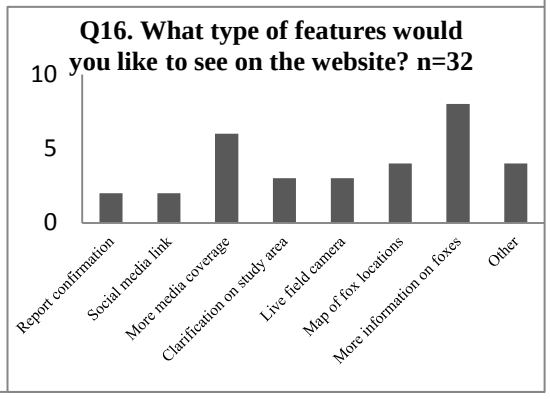

Q13h. How would you rate the logos of affiliated institutions? n= 229
100
50
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

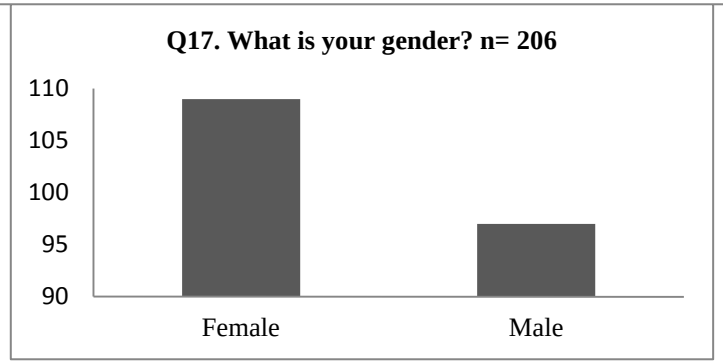

Q13i. How would you rate the multiple choice questions? n= 229
100
80
60
40
20
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

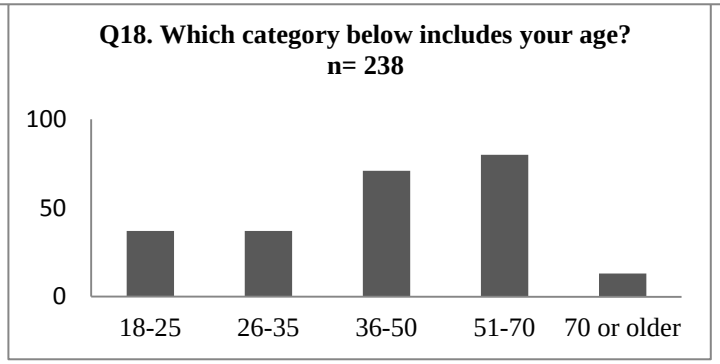

Q13j. How would you rate the free response questions? n= 229
100
80
60
40
20
0
Not helpful at All
Not Very Helpful
Somewhat Helpful
Very Helpful
Extremely Helpful

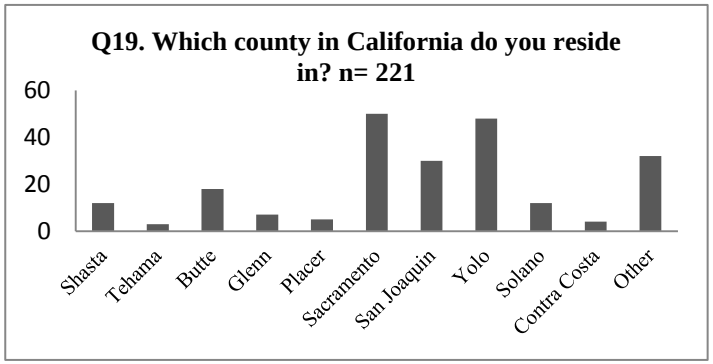

Q14. Which of the following features would help increase your website participation? n= 196
150
100
50
0
A discussion board
Frequent website updates
Email notifications
Links to other websites
A search toolbar
Mobile phone application
An accompanying tutorial

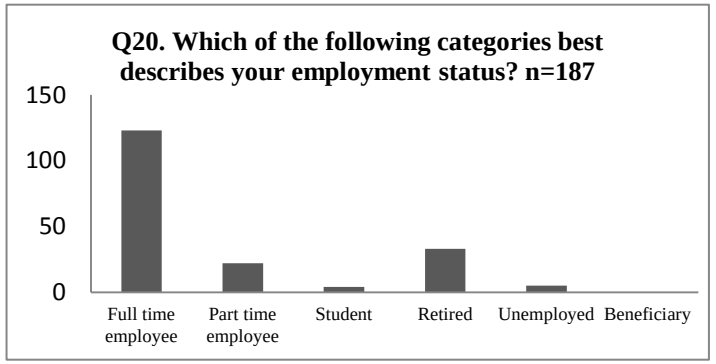

Q15. Can you think of any additional features you would like to see on this website? n= 214
200
150
100
50
0
Yes
No

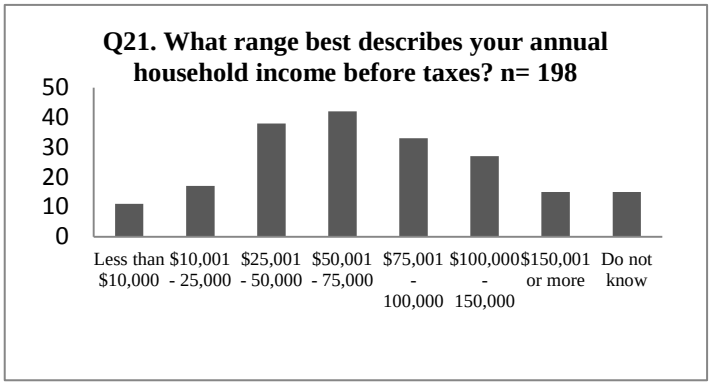

Q16. What type of features would you like to see on the website? n=32
10
5
0
Report confirmation
Social media link
More media coverage
Clarification on study area
Live field camera
Map of fox locations
More information on foxes
Other

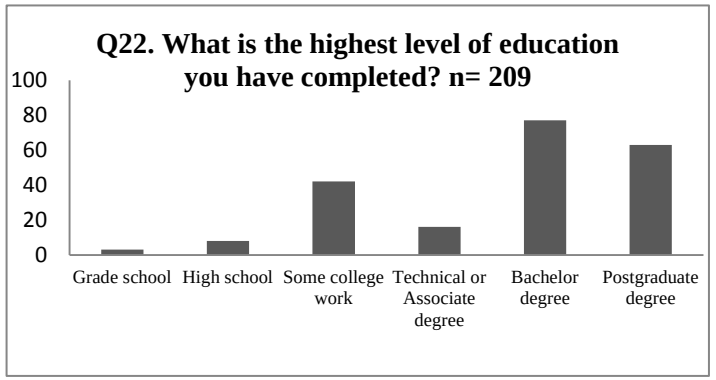

Q17. What is your gender? n= 206
110
105
100
95
90
Female
Male


Q18. Which category below includes your age? n= 238
100
50
0
18-25
26-35
36-50
51-70
70 or older


Q19. Which county in California do you reside in? n= 221
60
40
20
0
Shasta
Tehama
Butte
Glenn
Placer
Sacramento
San Joaquin
Yolo
Solano
Contra Costa
Other


Q20. Which of the following categories best describes your employment status? n=187
150
100
50
0
Full time employee
Part time employee
Student
Retired
Unemployed
Beneficiary


Q21. What range best describes your annual household income before taxes? n= 198
50
40
30
20
10
0
Less than $10,000
$10,001 - 25,000
$25,001 - 50,000
$50,001 - 75,000
$75,001 - 100,000
$100,000 - 150,000
$150,001 or more
Do not know


Q22. What is the highest level of education you have completed? n= 209
100
80
60
40
20
0
Grade school
High school
Some college work
Technical or Associate degree
Bachelor degree
Postgraduate degree

Appendix 6: Statistical analyses tables for the Sacramento Valley red fox public survey responses.

Table 1: Welch's two sample t-test comparing first time visitors and multiple time visitors (Question 1 of the Sacramento Valley red fox public survey).

	1st time visitors				Multiple time visitors				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	185	2.92	1.26	0.09	23	3.39	0.99	0.21	-2.068	31.598	0.0469
Income	162	4.06	1.88	0.15	21	4.86	1.58	0.34	-2.492	28.135	0.0189
Education	186	4.61	1.29	0.09	23	5.00	1.21	0.25	-1.461	28.563	0.1549

Table 2: Pearson's Chi-squared test comparing first time visitors and multiple time visitors (Question 1 of the Sacramento Valley red fox public survey).

	1st time visitors		Multiple time visitors		X^2	df	p-value
Gender							
Female	95	(51.9%)	14	(60.9%)	0.348	1	0.5555
Male	88	(48.1%)	9	(39.1%)			
County							
Shasta	12	(7.0%)	0	(0%)			
Tehama	2	(1.7%)	1	(4.3%)			
Butte	15	(8.8%)	3	(13.0%)			
Glenn	6	(3.5%)	1	(4.3%)			
Placer	4	(2.3%)	1	(4.3%)	13.559	10	0.1941
Sacramento	42	(24.6%)	8	(34.8%)			
San Joaquin	3	(1.8%)	0	(0%)			
Yolo	39	(22.8%)	9	(39.1%)			
Solano	12	(7.0%)	0	(0%)			
Contra Costa	4	(2.3%)	0	(0%)			
Other	32	(18.7%)	0	(0%)			
Employment							
Full time employee	106	(57.6%)	17	(73.9%)			
Part time employee	21	(11.4%)	1	(4.3%)			
Student	22	(12.0%)	2	(8.7%)	2.824	4	0.5877
Retired	30	(16.3%)	3	(13.0%)			
Unemployed	5	(2.7%)	0	(0%)			
Beneficiary	0	(0%)	0	(0%)			

Table 3: Welch's two sample t-test comparing participants that found the website via internet browsing and participants that did not find the website via internet browsing (post hoc analysis for Question 3 of the Sacramento Valley red fox public survey).

	Respondents that found the website via internet browsing				Respondents that did not find the website via internet browsing				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	42	2.90	1.23	0.19	166	2.99	1.24	0.10	0.420	64.032	0.6758
Education	42	4.12	1.40	0.22	167	4.78	1.22	0.09	2.823	57.568	0.0065

Table 4: Welch's two sample t-test comparing participants that found the website via word of mouth and participants that did not find the website via word of mouth (post hoc analysis for Question 3 of the Sacramento Valley red fox public survey).

	Respondents that found the website via word of mouth				Respondents that did not find the website via word of mouth				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	42	2.24	1.16	0.18	166	3.16	1.19	0.09	-4.578	64.290	P < .001
Education	42	4.86	1.12	0.17	167	4.60	1.32	0.10	1.290	72.523	0.2011

Table 5: Welch's two sample t-test comparing participants that found the website via reading a newspaper and participants that did not find the website via reading a newspaper (post hoc analysis for Question 3 of the Sacramento Valley red fox public survey).

	Respondents that found the website via newspaper				Respondents that did not find the website via newspaper				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	37	3.76	0.72	0.12	171	2.81	1.26	0.10	6.204	90.756	P < .001
Education	37	4.32	1.47	0.24	172	4.72	1.23	0.09	-1.527	47.381	0.1333

Table 6: Welch's two sample t-test comparing gender and rated scales of how informative the website is (Question 4 of the Sacramento Valley red fox public survey).

	Respondents' rate of how informative the website is				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	108	3.28	0.88	0.08	1.432	200.100	0.1537
Male	95	3.11	0.83	0.09			

Table 7: One-way ANOVA test comparing rated scales of how informative the website is (Question 4 of the Sacramento Valley red fox public survey).

	Respondents' rates of how informative the website is				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.24	0.95	0.16	4, 200	0.680	0.6063
26-35	36	3.33	0.93	0.16			
36-50	40	3.02	0.83	0.13			
51-70	80	3.24	0.83	0.09			
70 or older	12	3.17	0.72	0.21			
County							
Shasta	12	3.25	1.14	0.33	10, 178	0.741	0.6850
Tehama	3	3.00	0	0			
Butte	18	3.50	0.79	0.19			
Glenn	6	3.33	1.03	0.42			
Placer	5	2.80	0.84	0.38			
Sacramento	49	3.27	0.78	0.11			
San Joaquin	3	3.00	1.00	0.58			
Yolo	45	3.02	0.84	0.13			
Solano	12	3.50	0.8	0.23			
Contra Costa	4	3.25	0.50	0.25			
Other	32	3.19	0.97	0.17			
Employment							
Full time employee	122	3.24	0.85	0.08	4, 199	0.378	0.8239
Part time employee	22	3.00	0.93	0.20			
Student	23	3.22	0.67	0.14			
Retired	32	3.16	0.88	0.16			
Unemployed	5	3.20	1.30	0.58			
Beneficiary	0	0	0	0.00			

Income							
Less than $10,000	11	3.27	0.90	0.27	6, 173	1.080	0.3765
$10,001-25,000	16	3.56	0.81	0.20			
$25,001-50,000	38	3.16	0.92	0.15			
$50,001-75,000	41	3.07	0.85	0.13			
$75,001-100,000	33	3.36	0.82	0.14			
$100,001-150,000	27	3.04	0.90	0.17			
$150,000 or more	14	3.36	0.74	0.20			
Education							
Grade school	3	2.33	1.15	0.66	5, 200	0.841	0.5218
High school diploma	8	3.38	0.92	0.33			
Some college work	42	3.26	0.80	0.12			
Technical or Associate degree	15	3.07	0.96	0.25			
Bachelor degree	76	3.25	0.87	0.10			
Postgraduate degree	62	3.18	0.86	0.11			

Table 8: Welch's two sample t-test comparing whether or not respondents looked for addition SV red fox information (Question 5 of the Sacramento Valley red fox public survey).

	Respondents that looked for additional fox information				Respondents that did not look for additional fox information				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	50	4.67	1.07	0.15	157	3.93	1.26	0.10	2.861	88.868	0.0053
Income	49	4.67	1.53	0.22	133	3.93	0.60	0.05	1.827	101.287	0.0706
Education	51	5.04	1.13	0.16	157	4.52	1.30	0.10	2.762	96.742	0.0069

Table 9: Pearson's Chi-square comparing whether or not respondents looked for addition SV red fox information (Question 5 of the Sacramento Valley red fox public survey).

	Respondents that looked for additional fox information		Respondents that did not look for additional fox information		X^2	df	p-value
Gender							
Female	25	(50.0%)	84	(54.2%)	0.1251	1	0.7235
Male	25	(50.0%)	71	(45.8%)			
County							
Shasta	3	(6.0%)	9	(6.3%)			
Tehama	1	(2.0%)	2	(1.4%)			
Butte	2	(4.0%)	16	(11.3%)			
Glenn	4	(2.0%)	3	(2.1%)			
Placer	1	(8.0%)	4	(2.8%)	10.2763	10	0.4166
Sacramento	15	(30.0%)	36	(24.6%)			
San Joaquin	1	(2.0%)	2	(1.4%)			
Yolo	14	(28.0%)	32	(22.5%)			
Solano	2	(4.0%)	10	(7.0%)			
Contra Costa	2	(4.0%)	2	(1.4%)			
Other	5	(10.0%)	27	(19.0%)			
Employment							
Full time employee	37	(72.5%)	86	(55.5%)			
Part time employee	3	(5.9%)	19	(12.3%)			
Student	5	(9.8%)	19	(12.3%)	5.7957	4	0.2149
Retired	6	(11.8%)	26	(16.8%)			
Unemployed	0	(0%)	5	(3.2%)			
Beneficiary	0	(0%)	0	(0%)			

Table 10: Welch's two sample t-test comparing respondents that looked for additional fox information via internet searches and respondents that did not look for additional fox information via internet searches (post hoc analysis for Question 6 of the Sacramento Valley red fox public survey).

	Respondents that looked for additional fox information via internet searches				Respondents that did not look for additional fox information via internet searches				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	44	3.27	1.11	0.17	164	2.90	1.26	0.10	1.942	75.714	0.0559
Income	43	5.07	1.10	0.17	140	4.54	1.31	0.11	2.752	81.768	0.0073
Education	45	4.51	1.50	0.22	164	4.04	1.64	0.13	1.777	75.430	0.0796

Table 11: Welch's two-sample t-test comparing whether or not the respondents have seen a SV red fox (Question 7 of the Sacramento Valley red fox public survey).

	Respondents that saw a SV red fox				Respondents that did not see a SV red fox				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	91	3.41	1.10	0.12	68	2.46	1.23	0.15	5.059	134.946	P < .001
Income	82	4.51	1.54	0.17	61	3.52	1.52	0.19	3.815	130.251	P < .001
Education	92	4.62	1.27	0.13	68	4.63	1.20	0.15	-0.065	149.235	0.9482

Table 12: Pearson's Chi-square test comparing whether or not the respondents have seen a SV red fox (Question 7 of the Sacramento Valley red fox public survey).

	Respondents that saw a SV red fox		Respondents that did not see a SV red fox		X^2	df	p-value
Gender							
Female	42	(45.7%)	39	(58.2%)	1.9692	1	0.1605
Male	50	(54.3%)	28	(41.8%)			
County							
Shasta	3	(3.3%)	7	(12.1%)			
Tehama	3	(3.3%)	0	(0%)			
Butte	7	(7.7%)	6	(10.3%)			
Glenn	6	(6.6%)	1	(1.7%)			
Placer	3	(3.3%)	0	(0%)	21.601	10	0.01727
Sacramento	25	(27.5%)	13	(22.4%)			
San Joaquin	1	(1.1%)	0	(0%)			
Yolo	21	(23.1%)	17	(29.3%)			
Solano	11	(12.1%)	0	(0%)			
Contra Costa	1	(1.1%)	1	(1.7%)			
Other	10	(11.0%)	13	(22.4%)			
Employment							
Full time employee	57	(62.6%)	40	(59.7%)			
Part time employee	8	(8.8%)	9	(13.4%)			
Student	8	(8.8%)	9	(13.4%)	6.4401	4	0.1686
Retired	18	(19.8%)	7	(10.4%)			
Unemployed	0	(0%)	2	(3.0%)			
Beneficiary	0	(0%)	0	(0%)			

Table 13: Welch's two-sample t-test comparing respondents that reported their fox sighting and respondents that did not report their fox sighting (Question 9 of the Sacramento Valley red fox public survey).

	Respondents that reported the fox sighting				Respondents that did not report the sighting				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	38	3.74	0.92	0.15	87	2.98	1.24	0.13	3.802	93.484	P < .001
Income	34	4.82	1.42	0.24	74	4.27	1.67	0.19	1.772	74.605	0.0806
Education	39	4.95	1.23	0.20	87	4.62	1.30	0.14	1.358	76.583	0.1786

Table 14: Pearson's chi-square comparing participants that reported their fox sighting and participants that did not report their fox sighting (Question 9 of the Sacramento Valley red fox public survey).

	Respondents that reported the fox sighting	Respondents that did not report the fox sighting	X^2	df	p-value
Gender					
Female	21 (53.8%)	40 (46.5%)	0.3214	1	0.5707
Male	18 (46.2%)	46 (53.5%)			
County					
Shasta	1 (2.6%)	4 (4.9%)			
Tehama	1 (2.6%)	2 (2.4%)			
Butte	1 (2.6%)	11 (13.4%)			
Glenn	2 (5.1%)	3 (3.7%)			
Placer	1 (2.6%)	2 (2.4%)			
Sacramento	13 (33.3%)	19 (23.2%)	8.9015	10	0.5415
San Joaquin	0 (0%)	2 (2.4%)			
Yolo	12 (33.3%)	17 (20.7%)			
Solano	3 (7.7%)	9 (11.0%)			
Contra Costa	1 (2.6%)	1 (1.2%)			
Other	3 (7.7%)	12 (14.6%)			
Employment					
Full time employee	26 (66.7%)	49 (57.0%)			
Part time employee	3 (7.7%)	8 (9.3%)			
Student	2 (5.1%)	12 (14.0%)	3.4094	4	0.4918
Retired	8 (20.5%)	15 (17.4%)			
Unemployed	0 (0%)	2 (2.3%)			
Beneficiary	0 (0%)	0 (0%)			

Table 15: Welch's two-sample t-test comparing respondents' rating of SV red foxes as a unique species (Question 11a of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes as a unique species				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	4.18	0.89	0.09	3.645	188.240	p < .001
Male	97	3.68	1.07	0.11			

Table 16: One-way ANOVA comparing respondents' rating of SV red foxes as a unique species (Question 11a of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes as a unique species				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	4.22	0.79	0.13	4, 203	1.234	0.2978
26-35	37	3.92	0.92	0.15			
36-50	41	4.05	0.95	0.15			
51-70	80	3.81	1.17	0.13			
70 or older	13	3.77	0.83	0.23			
County							
Shasta	12	4.33	0.65	0.19	10, 182	0.840	0.5907
Tehama	3	3.33	1.53	0.88			
Butte	18	4.17	0.99	0.23			
Glenn	6	4.00	0.89	0.36			
Placer	5	3.60	0.89	0.40			
Sacramento	50	4.04	0.95	0.13			
San Joaquin	3	3.00	2.00	1.15			
Yolo	48	3.92	0.99	0.14			
Solano	12	3.92	0.90	0.26			
Contra Costa	4	3.75	1.26	0.63			
Other	32	3.75	1.27	0.22			
Employment							
Full time employee	123	3.90	1.00	0.09	4, 202	0.674	0.6108
Part time employee	22	3.86	1.17	0.25			
Student	24	4.04	0.81	0.17			
Retired	33	3.97	1.07	0.19			
Unemployed	5	4.60	0.89	0.40			
Beneficiary	0	0.00	0.00	0			

Income							
Less than $10,000	11	4.09	0.70	0.21	6, 176	1.830	0.0958
$10,001-25,000	17	4.53	0.72	0.17			
$25,001-50,000	38	3.92	0.97	0.16			
$50,001-75,000	42	3.88	1.04	0.16			
$75,001-100,000	33	4.15	1.00	0.17			
$100,001-150,000	27	3.81	0.88	0.17			
$150,000 or more	15	3.53	1.30	0.34			
Education							
Grade school	3	2.33	1.15	0.66	5, 203	3.034	0.0116
High school diploma	8	4.62	0.52	0.18			
Some college work	42	4.07	0.87	0.13			
Technical or Associate degree	16	3.69	1.14	0.29			
Bachelor degree	77	4.03	0.93	0.11			
Postgraduate degree	63	3.83	1.10	0.14			

Table 17: Welch's two-sample t-test comparing respondents' rating of SV red foxes having a declining population (Question 11b of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes having a declining population				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.90	0.89	0.085	3.211	202.372	0.0015
Male	97	3.51	0.87	0.088			

Table 18: One-way ANOVA test comparing respondents' rating of SV red foxes as a unique species (Question 11b of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes having a declining population				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.97	0.80	0.13	4, 203	2.607	0.0369
26-35	37	3.81	0.97	0.16			
36-50	41	3.85	0.94	0.15			
51-70	80	3.58	0.88	0.10			
70 or older	13	3.23	0.73	0.20			
County							
Shasta	12	4.00	0.85	0.25	10, 182	0.891	0.5432
Tehama	3	3.33	1.53	0.88			
Butte	18	3.94	1.00	0.24			
Glenn	6	4.00	0.89	0.36			
Placer	5	3.00	0	0			
Sacramento	50	3.74	0.90	0.13			
San Joaquin	3	3.67	1.15	0.66			
Yolo	48	3.75	0.81	0.12			
Solano	12	3.75	0.97	0.28			
Contra Costa	4	4.00	0.82	0.41			
Other	32	3.50	0.98	0.17			
Employment							
Full time employee	123	3.72	0.89	0.08	4, 202	0.504	0.7325
Part time employee	22	3.73	1.08	0.23			
Student	24	3.88	0.85	0.17			
Retired	33	3.58	0.87	0.15			
Unemployed	5	4	1	0.45			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.09	0.70	0.21	6, 176	1.009	0.4207
$10,001-25,000	17	4	0.87	0.21			
$25,001-50,000	38	3.82	0.83	0.13			
$50,001-75,000	42	3.67	1.03	0.16			
$75,001-100,000	33	3.73	0.84	0.15			
$100,001-150,000	27	3.48	0.89	0.17			
$150,000 or more	15	3.67	0.9	0.23			
Education							
Grade school	3	3	0	0	5, 203	0.943	0.4539
High school diploma	8	3.88	0.83	0.29			
Some college work	42	3.71	0.89	0.14			
Technical or Associate degree	16	3.75	0.77	0.19			
Bachelor degree	77	3.83	0.99	0.11			
Postgraduate degree	63	3.59	0.84	0.11			

Table 19: Welch's two sample t-test comparing respondents' rating of SV red foxes causing damage (Question 11c of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes causing damage				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	2.24	1.01	0.10	-2.249	197.264	0.0256
Male	97	2.57	1.08	0.11			

Table 20: One-way ANOVA test comparing respondents' rating of SV red foxes causing damage (Question 11c of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes causing damage				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	2.16	0.83	0.14	4, 203	1.291	0.2749
26-35	37	2.32	0.97	0.16			
36-50	41	2.24	1.07	0.17			
51-70	80	2.52	1.15	0.13			
70 or older	13	2.69	0.95	0.26			
County							
Shasta	12	2.25	0.87	0.25	10, 182	0.275	0.9859
Tehama	3	2.33	1.15	0.66			
Butte	18	2.67	1.19	0.28			
Glenn	6	2.33	1.21	0.49			
Placer	5	2.20	1.10	0.49			
Sacramento	50	2.44	1.01	0.14			
San Joaquin	3	2.67	1.53	0.88			
Yolo	48	2.29	1.11	0.16			
Solano	12	2.17	1.11	0.32			
Contra Costa	4	2.25	1.26	0.63			
Other	32	1.12	1.12	0.20			

Employment							
Full time employee	123	2.39	1.05	0.09	4, 202	1.205	0.3100
Part time employee	22	2.73	0.88	0.19			
Student	24	2.08	0.83	0.17			
Retired	33	2.48	1.23	0.21			
Unemployed	5	2.20	1.10	0.49			
Beneficiary	0	0	0	0.00			
Income							
Less than $10,000	11	2.09	0.94	0.28	6, 176	0.215	0.9717
$10,001-25,000	17	2.29	0.92	0.22			
$25,001-50,000	38	2.45	0.98	0.16			
$50,001-75,000	42	2.43	1.06	0.16			
$75,001-100,000	33	2.42	1.12	0.19			
$100,001-150,000	27	2.41	1.05	0.20			
$150,000 or more	0	2.33	1.23	0.00			
Education							
Grade school	3	3.33	0.58	0.33	5, 203	1.083	0.3707
High school diploma	8	2.00	1.07	0.38			
Some college work	42	2.57	0.80	0.12			
Technical or Associate degree	16	2.44	1.31	0.33			
Bachelor degree	77	2.35	1.05	0.12			
Postgraduate degree	63	2.30	1.12	0.14			

Table 21: Welch's two sample t-test comparing respondents' rating of SV red foxes as pests (Question 11d of the Sacramento Valley red fox public survey).

Respondents' rate of SV red foxes as pests					**t**	**df**	**p-value**
	n	**Mean**	**Std. Deviation**	**Std. Error**			
Gender							
Female	109	1.74	0.93	0.09	-1.792	194.013	0.0748
Male	97	1.99	1.04	0.11			

Table 22: One-way ANOVA test comparing respondents' rating of SV red foxes as pests (Question 11d of the Sacramento Valley red fox public survey).

	Respondents' rate of SV red foxes causing damage				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	2.16	0.83	0.14	4, 203	1.291	0.2749
26-35	37	2.32	0.97	0.16			
36-50	41	2.24	1.07	0.17			
51-70	80	2.52	1.15	0.13			
70 or older	13	2.69	0.95	0.26			
County							
Shasta	12	2.25	0.87	0.25	10, 182	0.275	0.9859
Tehama	3	2.33	1.15	0.66			
Butte	18	2.67	1.19	0.28			
Glenn	6	2.33	1.21	0.49			
Placer	5	2.20	1.10	0.49			
Sacramento	50	2.44	1.01	0.14			
San Joaquin	3	2.67	1.53	0.88			
Yolo	48	2.29	1.11	0.16			
Solano	12	2.17	1.11	0.32			
Contra Costa	4	2.25	1.26	0.63			
Other	32	1.12	1.12	0.20			
Employment							
Full time employee	123	2.39	1.05	0.09	4, 202	1.205	0.3100
Part time employee	22	2.73	0.88	0.19			
Student	24	2.08	0.83	0.17			
Retired	33	2.48	1.23	0.21			
Unemployed	5	2.20	1.10	0.49			
Beneficiary	0	0	0	0.00			
Income							
Less than $10,000	11	2.09	0.94	0.28	6, 176	0.215	0.9717
$10,001-25,000	17	2.29	0.92	0.22			
$25,001-50,000	38	2.45	0.98	0.16			
$50,001-75,000	42	2.43	1.06	0.16			
$75,001-100,000	33	2.42	1.12	0.19			
$100,001-150,000	27	2.41	1.05	0.20			
$150,000 or more	0	2.33	1.23	0.00			
Education							
Grade school	3	3.33	0.58	0.33	5, 203	1.083	0.3707
High school diploma	8	2.00	1.07	0.38			
Some college work	42	2.57	0.80	0.12			
Technical or Associate degree	16	2.44	1.31	0.33			
Bachelor degree	77	2.35	1.05	0.12			
Postgraduate degree	63	2.30	1.12	0.14			

Table 23: Welch's two sample t-test comparing respondents' rating of the frequency of SV red foxes encounters (Question 11e of the Sacramento Valley red fox survey).

	Respondents' rate of frequency of SV red fox encounters				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	1.81	1.08	0.10	-1.012	193.942	0.3127
Male	97	1.97	1.97	0.20			

Table 24: One-way ANOVA test comparing respondents' rating of frequency of SV red fox encounters (Question 11e of the Sacramento Valley red fox public survey).

	Respondents' rate of frequency of SV red fox encounters				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	1.54	0.96	0.16	4, 203	3.110	0.0164
26-35	37	1.57	0.87	0.14			
36-50	41	2.12	1.19	0.19			
51-70	80	2.09	1.24	0.14			
70 or older	13	1.54	0.88	0.24			
County							
Shasta	12	1.08	0.29	0.08	10, 182	0.874	0.5588
Tehama	3	1.67	1.15	0.66			
Butte	18	2.00	1.19	0.28			
Glenn	6	2.33	1.21	0.49			
Placer	5	1.60	0.89	0.40			
Sacramento	50	1.92	1.24	0.18			
San Joaquin	3	2.00	1.73	1.00			
Yolo	48	1.94	1.17	0.17			
Solano	12	2.00	1.35	0.39			
Contra Costa	4	2.50	1.29	0.65			
Other	32	1.97	1.06	0.19			

Employment							
Full time employee	123	1.98	1.15	0.10	4, 202	0.853	0.4935
Part time employee	22	1.91	1.19	0.25			
Student	24	1.58	1.06	0.22			
Retired	33	1.85	1.15	0.20			
Unemployed	5	1.40	0.89	0.40			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	1.64	0.92	0.28	6, 176	1.872	0.0880
$10,001-25,000	17	1.41	1.06	0.26			
$25,001-50,000	38	1.66	1.02	0.17			
$50,001-75,000	42	1.74	0.96	0.15			
$75,001-100,000	33	2.15	1.25	0.22			
$100,001-150,000	27	2.19	1.24	0.24			
$150,000 or more	15	2.20	1.15	0.30			
Education							
Grade school	3	3.00	0	0	5, 203	1.283	0.2725
High school diploma	8	2.12	1.25	0.44			
Some college work	42	1.86	1.16	0.18			
Technical or Associate degree	16	2.31	1.54	0.39			
Bachelor degree	77	1.82	1.07	0.12			
Postgraduate degree	63	1.78	1.07	0.13			

Table 25: Welch's two sample t-test comparing respondents' rating of disinterest in SV red foxes (Question 11f of the Sacramento Valley red fox survey).

	Respondents' rate of disinterest in SV red foxes				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	1.66	0.99	0.09	-2.280	188.068	0.0238
Male	97	2.01	1.19	0.12			

Table 26: One-way ANOVA test comparing respondents' rating of disinterest in SV red foxes (Question 11f of the Sacramento Valley red fox survey).

	Respondents' rate of disinterest in SV red foxes				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	1.92	0.95	0.16	4, 203	0.541	0.7057
26-35	37	1.81	0.91	0.15			
36-50	41	1.95	1.38	0.22			
51-70	80	1.74	1.13	0.13			
70 or older	13	1.54	0.78	0.22			
County							
Shasta	12	2.00	1.04	0.30	10, 182	1.021	0.4275
Tehama	3	2.67	0.58	0.33			
Butte	18	1.83	1.15	0.27			
Glenn	6	1.17	0.41	0.17			
Placer	5	1.40	0.89	0.40			
Sacramento	50	1.84	1.23	0.17			
San Joaquin	3	1.00	0	0.00			
Yolo	48	1.65	0.91	0.13			
Solano	12	1.83	1.27	0.37			
Contra Costa	4	1.25	0.50	0.25			
Other	32	2.06	1.29	0.23			
Employment							
Full time employee	123	1.85	1.19	0.11	4, 202	0.603	0.6613
Part time employee	22	1.73	0.83	0.18			
Student	24	1.96	0.86	0.18			
Retired	33	1.73	1.10	0.19			
Unemployed	5	1.20	0.45	0.20			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	1.55	0.69	0.21	6, 176	0.700	0.6504
$10,001-25,000	17	1.82	0.88	0.21			
$25,001-50,000	38	1.95	1.04	0.17			
$50,001-75,000	42	1.90	1.16	0.18			
$75,001-100,000	33	1.88	1.27	0.22			
$100,001-150,000	27	1.48	0.70	0.13			
$150,000 or more	15	1.93	1.67	0.43			
Education							
Grade school	3	2.00	1.00	0.58	5, 203	1.364	0.2395
High school diploma	8	1.62	1.41	0.50			
Some college work	42	1.83	0.85	0.13			
Technical or Associate degree	16	1.56	0.73	0.18			
Bachelor degree	77	2.04	1.30	0.15			
Postgraduate degree	63	1.60	0.98	0.12			

Table 27: Welch's two sample t-test comparing respondents' rating of personal SV red fox knowledge (Question 11g of the Sacramento Valley red fox survey).

	Respondents' rate of personal SV red fox knowledge				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	2.14	1.13	0.11	0.867	203.745	0.3871
Male	97	2.01	0.97	0.10			

Table 28: One-way ANOVA test comparing respondents' rating of personal SV red fox knowledge (Question 11g of the Sacramento Valley red fox survey).

	Respondents' rate of personal SV red fox knowledge				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	1.70	0.88	0.14			
26-35	37	1.65	0.82	0.13	4, 203	4.226	0.0026
36-50	41	2.29	1.08	0.17			
51-70	80	2.30	1.13	0.13			
70 or older	13	2.15	1.14	0.32			
County							
Shasta	12	1.42	0.79	0.23			
Tehama	3	2.00	1.00	0.58			
Butte	18	1.94	1.11	0.26			
Glenn	6	2.17	1.17	0.48			
Placer	5	2.20	1.30	0.58	10, 182	0.886	0.5474
Sacramento	50	2.24	1.10	0.16			
San Joaquin	3	2.33	0.58	0.33			
Yolo	48	2.19	1.12	0.16			
Solano	12	2.50	1.00	0.29			
Contra Costa	4	2.00	0.82	0.41			
Other	32	1.97	1.03	0.18			

Employment							
Full time employee	123	2.11	1.10	0.10			
Part time employee	22	1.82	0.91	0.19			
Student	24	1.83	0.92	0.19	4, 202	1.426	0.2268
Retired	33	2.33	1.11	0.19			
Unemployed	5	1.60	0.55	0.25			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	1.82	0.75	0.23			
$10,001-25,000	17	1.88	0.86	0.21			
$25,001-50,000	38	1.87	1.04	0.17	6, 176	1.270	0.2733
$50,001-75,000	42	1.98	1.00	0.15			
$75,001-100,000	33	2.33	1.14	0.20			
$100,001-150,000	27	2.15	1.13	0.22			
$150,000 or more	15	2.47	0.92	0.24			
Education							
Grade school	3	2.00	1.00	0.58			
High school diploma	8	2.12	1.46	0.52			
Some college work	42	1.67	0.85	0.13	5, 203	1.878	0.0997
Technical or Associate degree	16	2.12	0.96	0.24			
Bachelor degree	77	2.08	1.07	0.12			
Postgraduate degree	63	2.30	1.10	0.14			

Table 29: Welch's two sample t-test comparing respondents' rating of interest in animal conservation (Question 12a of the Sacramento Valley red fox survey).

	Respondents' rate of interest in animal conservation				**t**	**df**	**p-value**
	n	**Mean**	**Std. Deviation**	**Std. Error**			
Gender							
Female	109	4.28	0.84	0.08	2.561	195.741	0.0112
Male	97	3.97	0.92	0.09			

Table 30: One-way ANOVA test comparing respondents' rating of interest in animal conservation (Question 12a of the Sacramento Valley red fox survey).

	Respondents' rate of interest in animal conservation				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	4.16	0.83	0.14	4, 203	1.835	0.1234
26-35	37	4.27	0.93	0.15			
36-50	41	4.39	0.83	0.13			
51-70	80	3.98	0.91	0.10			
70 or older	13	4.00	0.71	0.20			
County							
Shasta	12	3.92	1.00	0.29	10, 182	0.832	0.5988
Tehama	3	4.00	1.00	0.58			
Butte	18	4.22	0.65	0.15			
Glenn	6	4.33	0.82	0.33			
Placer	5	3.60	0.55	0.25			
Sacramento	50	4.26	0.80	0.11			
San Joaquin	3	4.00	0.00	0.00			
Yolo	48	4.31	0.90	0.13			
Solano	12	4.08	0.67	0.19			
Contra Costa	4	4.50	1.00	0.50			
Other	32	3.94	1.11	0.20			
Employment							
Full time employee	123	4.19	0.84	0.08	4, 202	0.702	0.5912
Part time employee	22	4.00	0.87	0.19			
Student	24	4.08	0.83	0.17			
Retired	33	4.03	1.13	0.20			
Unemployed	5	4.60	0.55	0.25			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.55	0.52	0.16	6, 176	1.001	0.4265
$10,001-25,000	17	3.94	0.75	0.18			
$25,001-50,000	38	3.92	0.91	0.15			
$50,001-75,000	42	4.17	1.01	0.16			
$75,001-100,000	33	4.24	0.71	0.12			
$100,001-150,000	27	4.04	0.94	0.18			
$150,000 or more	15	4.20	1.21	0.31			
Education							
Grade school	3	3.00	2.00	1.15	5, 203	3.797	0.0026
High school diploma	8	4.00	0.93	0.33			
Some college work	42	3.74	0.94	0.15			
Technical or Associate degree	16	4.38	0.81	0.20			
Bachelor degree	77	4.52	0.83	0.09			
Postgraduate degree	63	4.29	0.77	0.10			

Table 31: Welch's two sample t-test comparing respondents' rating of interest in SV red foxes (Question 12b of the Sacramento Valley red fox survey).

	Respondents' rate of interest in SV red foxes				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.64	0.88	0.08	1.733	197.632	0.0846
Male	97	3.42	0.93	0.09			

Table 32: One-way ANOVA test comparing respondents' rating of interest in SV red foxes (Question 12b of the Sacramento Valley red fox survey).

	Respondents' rate of interest in SV red foxes				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.38	0.83	0.14	4, 203	1.233	0.2979
26-35	37	3.35	0.98	0.16			
36-50	41	3.71	0.93	0.15			
51-70	80	3.62	0.91	0.10			
70 or older	13	3.62	0.87	0.24			
County							
Shasta	12	3.08	0.90	0.26	10, 182	1.009	0.4376
Tehama	3	3.33	0.58	0.33			
Butte	18	3.61	0.92	0.22			
Glenn	6	3.83	0.75	0.31			
Placer	5	3.40	0.55	0.25			
Sacramento	50	3.80	0.90	0.13			
San Joaquin	3	4.00	0.00	0.00			
Yolo	48	3.60	0.92	0.13			
Solano	12	3.58	0.67	0.19			
Contra Costa	4	3.75	0.50	0.25			
Other	32	3.38	1.04	0.18			

Employment							
Full time employee	123	3.54	0.88	0.08			
Part time employee	22	3.77	0.81	0.17			
Student	24	3.21	0.83	0.17	4, 202	1.254	0.2894
Retired	33	3.64	1.11	0.19			
Unemployed	5	3.60	0.89	0.40			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.55	0.93	0.28			
$10,001-25,000	17	3.41	0.71	0.17			
$25,001-50,000	38	3.32	0.99	0.16	6, 176	1.544	0.1663
$50,001-75,000	42	3.45	0.97	0.15			
$75,001-100,000	33	3.70	0.73	0.13			
$100,001-150,000	27	3.52	0.89	0.17			
$150,000 or more	15	4.07	0.96	0.25			
Education							
Grade school	3	3.33	1.53	0.88			
High school diploma	8	3.38	1.19	0.42			
Some college work	42	3.33	0.87	0.13	5, 203	1.565	0.1714
Technical or Associate degree	16	4.00	0.89	0.22			
Bachelor degree	77	3.51	0.93	0.11			
Postgraduate degree	63	3.65	0.83	0.10			

Table 33: Welch's two sample t-test comparing respondents' rating of interest in citizen science projects (Question 12c of the Sacramento Valley red fox survey).

	Respondents' rate of interest in citizen science projects				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.58	1.03	0.10	1.319	202.603	0.1888
Male	97	3.39	1.00	0.10			

Table 34: One-way ANOVA test comparing respondents' rating of interest in citizen science projects (Question 12c of the Sacramento Valley red fox survey).

	Respondents' rate of interest in citizen science projects				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.46	1.17	0.19	4, 203	0.069	0.9913
26-35	37	3.46	1.12	0.18			
36-50	41	3.56	0.98	0.15			
51-70	80	3.49	0.90	0.10			
70 or older	13	3.46	1.13	0.31			
County							
Shasta	12	3.00	1.21	0.35	10, 182	0.756	0.6709
Tehama	3	3.67	0.58	0.33			
Butte	18	3.61	0.98	0.23			
Glenn	6	3.17	0.75	0.31			
Placer	5	2.80	0.45	0.20			
Sacramento	50	3.50	1.05	0.15			
San Joaquin	3	3.67	0.58	0.33			
Yolo	48	3.56	0.94	0.14			
Solano	12	3.58	0.79	0.23			
Contra Costa	4	4.00	0.82	0.41			
Other	32	3.47	1.19	0.21			
Employment							
Full time employee	123	3.48	0.91	0.08	4, 202	0.208	0.9339
Part time employee	22	3.59	0.96	0.20			
Student	24	3.33	1.05	0.21			
Retired	33	3.52	1.30	0.23			
Unemployed	5	3.40	1.52	0.68			
Beneficiary	0	0	0	0.00			
Income							
Less than $10,000	11	3.73	0.90	0.27	6, 176	1.527	0.1719
$10,001-25,000	17	3.53	1.18	0.29			
$25,001-50,000	38	3.39	1.13	0.18			
$50,001-75,000	42	3.40	0.96	0.15			
$75,001-100,000	33	3.70	0.81	0.14			
$100,001-150,000	27	3.19	0.88	0.17			
$150,000 or more	15	4.00	1.13	0.29			
Education							
Grade school	3	3.00	2.00	1.15	5, 203	2.237	0.0520
High school diploma	8	3.12	1.25	0.44			
Some college work	42	3.14	1.07	0.17			
Technical or Associate degree	16	3.56	1.09	0.27			
Bachelor degree	77	3.51	1.02	0.12			
Postgraduate degree	63	3.75	0.78	0.10			

Table 35: Welch's two sample t-test comparing respondents' rating of interest in research-based websites (Question 12d of the Sacramento Valley red fox survey).

	Respondents' rate of interest in research based websites				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.81	0.97	0.09	1.563	201.832	0.1197
Male	97	3.60	0.95	0.10			

Table 36: One-way ANOVA test comparing respondents' rating of interest in research-based websites (Question 12d of the Sacramento Valley red fox survey).

	Respondents' rate of interest in research based websites				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.78	1.03	0.17	4, 203	0.657	0.6225
26-35	37	3.89	0.97	0.16			
36-50	41	3.56	0.95	0.15			
51-70	80	3.67	0.92	0.10			
70 or older	13	3.69	1.03	0.29			
County							
Shasta	12	3.50	1.24	0.36	10, 182	0.595	0.8166
Tehama	3	3.33	0.58	0.33			
Butte	18	3.72	0.96	0.23			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.40	0.55	0.25			
Sacramento	50	3.66	1.04	0.15			
San Joaquin	3	3.67	0.58	0.33			
Yolo	48	3.85	0.92	0.13			
Solano	12	3.58	0.67	0.19			
Contra Costa	4	4.50	1.00	0.50			
Other	32	3.66	1.04	0.18			

Employment							
Full time employee	123	3.68	0.90	0.08			
Part time employee	22	3.77	1.02	0.22			
Student	24	3.75	1.03	0.21	4, 202	0.075	0.9897
Retired	33	3.73	1.13	0.20			
Unemployed	5	3.60	0.89	0.40			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.18	0.75	0.23			
$10,001-25,000	17	4.06	0.83	0.20			
$25,001-50,000	38	3.63	1.08	0.18	6, 176	1.323	0.2492
$50,001-75,000	42	3.55	0.97	0.15			
$75,001-100,000	33	3.82	0.77	0.13			
$100,001-150,000	27	3.59	0.97	0.19			
$150,000 or more	15	3.93	1.16	0.30			
Education							
Grade school	3	3.33	1.53	0.88			
High school diploma	8	3.00	1.20	0.42			
Some college work	42	3.38	1.06	0.16	5, 203	3.487	0.0048
Technical or Associate degree	16	4.00	0.89	0.22			
Bachelor degree	77	3.69	0.92	0.10			
Postgraduate degree	63	3.98	0.79	0.10			

Table 37: Welch's two sample t-test comparing respondents' helpfulness rating of the website homepage (Question 13a of the Sacramento Valley red fox survey).

	Respondents' rate of website homepage				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.80	0.72	0.07	3.876	199.188	p < .001
Male	97	3.40	0.75	0.08			

Table 38: One-way ANOVA test comparing respondents' helpfulness rating of the website homepage (Question 13a of the Sacramento Valley red fox survey).

	Respondents' rate of website homepage				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.70	0.81	0.13	4, 203	2.082	0.0844
26-35	37	3.73	0.73	0.12			
36-50	41	3.56	0.71	0.11			
51-70	80	3.61	0.72	0.08			
70 or older	13	3.08	0.86	0.24			
County							
Shasta	12	4.17	0.72	0.21	10, 182	1.506	0.1400
Tehama	3	3.33	0.58	0.33			
Butte	18	3.78	0.55	0.13			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.20	0.45	0.20			
Sacramento	50	3.66	0.72	0.10			
San Joaquin	3	3.33	0.58	0.33			
Yolo	48	3.40	0.79	0.11			
Solano	12	3.75	0.62	0.18			
Contra Costa	4	3.75	0.50	0.25			
Other	32	3.62	0.91	0.16			
Employment							
Full time employee	123	3.67	0.70	0.06	4, 202	1.003	0.4072
Part time employee	22	3.41	0.73	0.16			
Student	24	3.58	0.65	0.13			
Retired	33	3.45	0.97	0.17			
Unemployed	5	3.80	0.84	0.38			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.45	0.69	0.21	6, 176	1.383	0.2240
$10,001-25,000	17	3.88	0.70	0.17			
$25,001-50,000	38	3.79	0.87	0.14			
$50,001-75,000	42	3.48	0.83	0.13			
$75,001-100,000	33	3.73	0.45	0.08			
$100,001-150,000	27	3.59	0.69	0.13			
$150,000 or more	15	3.40	0.74	0.19			
Education							
Grade school	3	2.67	0.58	0.33	5, 203	1.659	0.1462
High school diploma	8	3.62	0.74	0.26			
Some college work	42	3.64	0.88	0.14			
Technical or Associate degree	16	3.50	0.73	0.18			
Bachelor degree	77	3.73	0.74	0.08			
Postgraduate degree	63	3.51	0.67	0.08			

Table 39: Welch's two sample t-test comparing respondents' helpfulness rating of the species clarification page on the website (Question 13b of the Sacramento Valley red fox survey).

	Respondents' rate of website species clarification page				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	4.05	0.70	0.07	3.419	193.901	0.0008
Male	97	3.69	0.78	0.08			

Table 40: One-way ANOVA test comparing respondents' helpfulness rating of the species clarification page on the website (Question 13b of the Sacramento Valley red fox survey).

	Respondents' rate of website species clarification page				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	4.03	0.76	0.12	4, 203	3.105	0.01651
26-35	37	4.08	0.68	0.11			
36-50	41	3.83	0.77	0.12			
51-70	80	3.84	0.68	0.08			
70 or older	13	3.31	1.03	0.29			
County							
Shasta	12	4.25	0.62	0.18	10, 182	0.699	0.7249
Tehama	3	3.67	0.58	0.33			
Butte	18	4.06	0.54	0.13			
Glenn	6	3.83	0.75	0.31			
Placer	5	3.80	1.10	0.49			
Sacramento	50	3.88	0.72	0.10			
San Joaquin	3	4.00	1.00	0.58			
Yolo	48	3.73	0.87	0.13			
Solano	12	4.00	0.60	0.17			
Contra Costa	4	4.25	0.50	0.25			
Other	32	3.84	0.92	0.16			

Employment							
Full time employee	123	3.89	0.70	0.06			
Part time employee	22	3.95	0.72	0.15			
Student	24	3.88	0.74	0.15	4, 202	0.429	0.7876
Retired	33	3.73	0.98	0.17			
Unemployed	5	4.00	0.71	0.32			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.18	0.75	0.23			
$10,001-25,000	17	3.94	0.83	0.20			
$25,001-50,000	38	3.97	0.72	0.12	6, 176	0.976	0.4427
$50,001-75,000	42	3.83	0.79	0.12			
$75,001-100,000	33	4.03	0.59	0.10			
$100,001-150,000	27	3.89	0.75	0.14			
$150,000 or more	15	3.60	0.74	0.19			
Education							
Grade school	3	3.00	0	0			
High school diploma	8	3.75	0.71	0.25			
Some college work	42	3.86	0.90	0.14	5, 203	2.275	0.04847
Technical or Associate degree	16	3.75	0.86	0.22			
Bachelor degree	77	4.06	0.71	0.08			
Postgraduate degree	63	3.76	0.64	0.08			

Table 41: Welch's two sample t-test comparing respondents' helpfulness rating of the Google map coordinates locator tool (Question 13c of the Sacramento Valley red fox survey).

	Respondents' rate of website Google map coordinates locator				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.87	0.77	0.07	3.128	186.412	0.0020
Male	97	3.49	0.94	0.10			

Table 42: One-way ANOVA test comparing respondents' helpfulness rating of the Google map coordinates locator tool (Question 13c of the Sacramento Valley red fox survey).

	Respondents' rate of website Google map coordinates locator				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.95	0.78	0.13	4, 203	4.094	0.0033
26-35	37	3.86	0.67	0.11			
36-50	41	3.59	0.87	0.14			
51-70	80	3.67	0.94	0.11			
70 or older	13	2.92	0.76	0.21			
County							
Shasta	12	4.08	0.90	0.26	10, 182	1.339	0.2129
Tehama	3	3.33	0.58	0.33			
Butte	18	3.78	0.73	0.17			
Glenn	6	3.67	0.52	0.21			
Placer	5	2.80	1.10	0.49			
Sacramento	50	3.72	0.70	0.10			
San Joaquin	3	4.33	0.58	0.33			
Yolo	48	3.69	0.85	0.12			
Solano	12	3.75	0.75	0.22			
Contra Costa	4	4.00	0.82	0.41			
Other	32	3.41	1.29	0.23			
Employment							
Full time employee	123	3.71	0.85	0.08	4, 202	0.780	0.5391
Part time employee	22	3.68	0.72	0.15			
Student	24	3.71	0.69	0.14			
Retired	33	3.52	1.15	0.20			
Unemployed	5	4.20	0.45	0.20			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.91	0.70	0.21	6, 176	0.316	0.9278
$10,001-25,000	17	3.88	0.70	0.17			
$25,001-50,000	38	3.79	0.87	0.14			
$50,001-75,000	42	3.67	0.87	0.13			
$75,001-100,000	33	3.79	0.74	0.13			
$100,001-150,000	27	3.63	1.08	0.21			
$150,000 or more	15	3.67	1.05	0.27			
Education							
Grade school	3	2.33	1.15	0.66	5, 203	2.261	0.0498
High school diploma	8	3.50	1.20	0.42			
Some college work	42	3.55	0.86	0.13			
Technical or Associate degree	16	3.56	0.96	0.24			
Bachelor degree	77	3.81	0.87	0.10			
Postgraduate degree	63	3.76	0.73	0.09			

Table 43: Welch's two sample t-test comparing respondents' helpfulness rating of the website content (Question 13d of the Sacramento Valley red fox survey).

Respondents' rate of website content					t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.78	0.71	0.07	2.957	196.973	0.0035
Male	97	3.47	0.77	0.08			

Table 44: One-way ANOVA test comparing respondents' helpfulness rating of the website content (Question 13d of the Sacramento Valley red fox survey).

Respondents' rate of website content					df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.76	0.76	0.12	4, 203	2.824	0.02605
26-35	37	3.81	0.70	0.12			
36-50	41	3.54	0.67	0.10			
51-70	80	3.62	0.75	0.08			
70 or older	13	3.08	0.86	0.24			
County							
Shasta	12	4.08	0.79	0.23	10, 182	1.257	0.258
Tehama	3	3.33	0.58	0.33			
Butte	18	3.72	0.57	0.13			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.20	0.45	0.20			
Sacramento	50	3.60	0.76	0.11			
San Joaquin	3	4.00	0	0			
Yolo	48	3.42	0.71	0.10			
Solano	12	3.75	0.75	0.22			
Contra Costa	4	4.00	0	0			
Other	32	3.69	1.03	0.18			

Employment							
Full time employee	123	3.65	0.74	0.07			
Part time employee	22	3.55	0.67	0.14			
Student	24	3.62	0.65	0.13	4, 202	1.022	0.3971
Retired	33	3.52	0.91	0.16			
Unemployed	5	4.20	0.45	0.20			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.73	0.65	0.20			
$10,001-25,000	17	3.82	0.73	0.18			
$25,001-50,000	38	3.68	0.93	0.15	6, 176	0.566	0.7569
$50,001-75,000	42	3.62	0.76	0.12			
$75,001-100,000	33	3.76	0.50	0.09			
$100,001-150,000	27	3.67	0.68	0.13			
$150,000 or more	15	3.40	0.83	0.21			
Education							
Grade school	3	2.67	0.58	0.33			
High school diploma	8	3.62	0.74	0.26			
Some college work	42	3.62	0.82	0.13	5, 203	1.619	0.1564
Technical or Associate degree	16	3.62	0.72	0.18			
Bachelor degree	77	3.75	0.81	0.09			
Postgraduate degree	63	3.54	0.59	0.07			

Table 45: Welch's two sample t-test comparing respondents' helpfulness rating of the website layout (Question 13e of the Sacramento Valley red fox survey).

	Respondents' rate of website layout				**t**	**df**	**p-value**
	n	**Mean**	**Std. Deviation**	**Std. Error**			
Gender							
Female	109	3.84	0.75	0.07	2.997	195.660	0.0031
Male	97	3.52	0.82	0.08			

Table 46: One-way ANOVA test comparing respondents' helpfulness rating of the website layout (Question 13e of the Sacramento Valley red fox survey).

	Respondents' rate of website layout				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.95	0.81	0.13	4, 203	3.325	0.01155
26-35	37	3.86	0.75	0.12			
36-50	41	3.61	0.70	0.11			
51-70	80	3.61	0.79	0.09			
70 or older	13	3.15	0.90	0.25			
County							
Shasta	12	4.00	0.85	0.25	10, 182	1.384	0.1908
Tehama	3	2.67	0.58	0.33			
Butte	18	3.94	0.54	0.13			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.20	0.84	0.38			
Sacramento	50	3.74	0.75	0.11			
San Joaquin	3	4.00	0	0			
Yolo	48	3.52	0.80	0.12			
Solano	12	3.75	0.87	0.25			
Contra Costa	4	3.75	0.50	0.25			
Other	32	3.72	0.99	0.18			
Employment							
Full time employee	123	3.67	0.79	0.07	4, 202	1.558	0.187
Part time employee	22	3.73	0.77	0.16			
Student	24	3.79	0.59	0.12			
Retired	33	3.52	0.91	0.16			
Unemployed	5	4.40	0.89	0.40			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.09	0.54	0.16	6, 176	1.078	0.3773
$10,001-25,000	17	3.82	0.81	0.20			
$25,001-50,000	38	3.76	0.94	0.15			
$50,001-75,000	42	3.67	0.79	0.12			
$75,001-100,000	33	3.64	0.55	0.10			
$100,001-150,000	27	3.48	0.89	0.17			
$150,000 or more	15	3.87	0.64	0.17			
Education							
Grade school	3	3.00	0	0	5, 203	2.163	0.05956
High school diploma	8	3.88	0.83	0.29			
Some college work	42	3.74	0.86	0.13			
Technical or Associate degree	16	3.50	0.82	0.21			
Bachelor degree	77	3.86	0.84	0.10			
Postgraduate degree	63	3.51	0.64	0.08			

Table 47: Welch's two sample t-test comparing respondents' helpfulness rating of the website's graphic quality (Question 13f of the Sacramento Valley red fox survey).

	Respondents' rate of website graphic quality				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.88	0.69	0.07	3.000	186.103	0.0031
Male	97	3.56	0.84	0.09			

Table 48: One-way ANOVA test comparing respondents' helpfulness rating of the website's graphic quality (Question 13f of the Sacramento Valley red fox survey).

	Respondents' rate of website graphic quality				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.89	0.91	0.15	4, 203	2.592	0.0378
26-35	37	3.84	0.73	0.12			
36-50	41	3.63	0.66	0.10			
51-70	80	3.74	0.72	0.08			
70 or older	13	3.15	0.99	0.27			
County							
Shasta	12	4.17	0.72	0.21	10, 182	0.993	0.4511
Tehama	3	3.00	1.00	0.58			
Butte	18	3.83	0.51	0.12			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.40	0.89	0.40			
Sacramento	50	3.78	0.71	0.10			
San Joaquin	3	4.00	0	0			
Yolo	48	3.62	0.82	0.12			
Solano	12	3.83	0.72	0.21			
Contra Costa	4	3.75	0.50	0.25			
Other	32	3.69	1.00	0.18			

Employment							
Full time employee	123	3.72	0.76	0.07			
Part time employee	22	3.64	0.79	0.17			
Student	24	3.75	0.68	0.14	4, 202	0.587	0.6721
Retired	33	3.67	0.89	0.15			
Unemployed	5	4.20	0.84	0.38			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	4.00	0.63	0.19			
$10,001-25,000	17	3.82	0.88	0.21			
$25,001-50,000	38	3.79	0.91	0.15	6, 176	0.310	0.9314
$50,001-75,000	42	3.67	0.82	0.13			
$75,001-100,000	33	3.76	0.61	0.11			
$100,001-150,000	27	3.74	0.76	0.15			
$150,000 or more	15	3.73	0.59	0.15			
Education							
Grade school	3	3.00	0	0			
High school diploma	8	3.88	0.83	0.29			
Some college work	42	3.76	0.82	0.13	5, 203	1.350	0.2450
Technical or Associate degree	16	3.56	0.81	0.20			
Bachelor degree	77	3.84	0.84	0.10			
Postgraduate degree	63	3.62	0.63	0.08			

Table 49: Welch's two sample t-test comparing respondents' helpfulness rating of the website contact information of researcher (Question 13g of the Sacramento Valley red fox survey).

	Respondents' rate of website contact information of researcher				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.89	0.7	0.07	1.871	182.227	0.0630
Male	97	3.68	0.88	0.09			

Table 50: One-way ANOVA test comparing respondents' helpfulness rating of the website contact information of researcher (Question 13g of the Sacramento Valley red fox survey).

	Respondents' rate of website contact information of researcher				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.84	0.87	0.14	4, 203	1.962	0.1016
26-35	37	4.00	0.71	0.12			
36-50	41	3.73	0.71	0.11			
51-70	80	3.75	0.80	0.09			
70 or older	13	3.31	1.03	0.29			
County							
Shasta	12	4.08	0.79	0.23	10, 182	1.256	0.2587
Tehama	3	3.33	0.58	0.33			
Butte	18	4.11	0.58	0.14			
Glenn	6	3.83	0.75	0.31			
Placer	5	3.40	1.14	0.51			
Sacramento	50	3.82	0.80	0.11			
San Joaquin	3	4.33	0.58	0.33			
Yolo	48	3.65	0.73	0.11			
Solano	12	4.00	0.85	0.25			
Contra Costa	4	4.00	0	0			
Other	32	3.59	1.01	0.18			
Employment							
Full time employee	123	3.79	0.81	0.07	4, 202	0.428	0.7884
Part time employee	22	3.59	0.80	0.17			
Student	24	3.83	0.56	0.11			
Retired	33	3.79	0.89	0.15			
Unemployed	5	4.00	1.00	0.45			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.91	0.54	0.16	6, 176	0.515	0.7967
$10,001-25,000	17	3.71	0.85	0.21			
$25,001-50,000	38	3.89	0.89	0.14			
$50,001-75,000	42	3.76	0.85	0.13			
$75,001-100,000	33	3.94	0.61	0.11			
$100,001-150,000	27	3.74	0.81	0.16			
$150,000 or more	15	3.60	0.91	0.23			
Education							
Grade school	3	2.67	0.58	0.33	5, 203	1.840	0.1065
High school diploma	8	3.62	0.74	0.26			
Some college work	42	3.86	0.84	0.13			
Technical or Associate degree	16	3.81	0.66	0.17			
Bachelor degree	77	3.88	0.83	0.09			
Postgraduate degree	63	3.67	0.76	0.10			

Table 51: Welch's two sample t-test comparing respondents' helpfulness rating of the website logos of affiliated institutions (Question 13h of the Sacramento Valley red fox survey).

	Respondents' rate of website logos of the affiliated institutions				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.70	0.79	0.08	2.013	195.228	0.0455
Male	97	3.46	0.87	0.09			

Table 52: One-way ANOVA test comparing respondents' helpfulness rating of the website logos of affiliated institutions (Question 13h of the Sacramento Valley red fox survey).

	Respondents' rate of website logos of the affiliated institutions				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.92	0.86	0.14	4, 203	6.695	P < .001
26-35	37	3.78	0.75	0.12			
36-50	41	3.49	0.78	0.12			
51-70	80	3.52	0.75	0.08			
70 or older	13	2.69	0.95	0.26			
County							
Shasta	12	3.67	0.78	0.23	10, 182	1.644	0.0973
Tehama	3	2.67	0.58	0.33			
Butte	18	4.17	0.51	0.12			
Glenn	6	3.50	0.55	0.22			
Placer	5	3.00	0	0			
Sacramento	50	3.52	0.89	0.13			
San Joaquin	3	3.33	0.58	0.33			
Yolo	48	3.52	0.80	0.12			
Solano	12	3.58	0.67	0.19			
Contra Costa	4	3.75	0.50	0.25			
Other	32	3.53	1.08	0.19			

Employment							
Full time employee	123	3.64	0.80	0.07			
Part time employee	22	3.55	0.80	0.17			
Student	24	3.58	0.78	0.16	4, 202	2.075	0.0855
Retired	33	3.27	0.88	0.15			
Unemployed	5	4.20	1.10	0.49			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.45	0.93	0.28			
$10,001-25,000	17	3.82	0.81	0.20			
$25,001-50,000	38	3.76	0.85	0.14	6, 176	1.230	0.2931
$50,001-75,000	42	3.60	0.77	0.12			
$75,001-100,000	33	3.67	0.65	0.11			
$100,001-150,000	27	3.59	0.75	0.14			
$150,000 or more	15	3.20	0.86	0.22			
Education							
Grade school	3	3.00	1.00	0.58			
High school diploma	8	3.50	1.31	0.46			
Some college work	42	3.62	0.94	0.15	5, 203	1.872	0.1007
Technical or Associate degree	16	3.56	0.73	0.18			
Bachelor degree	77	3.77	0.78	0.09			
Postgraduate degree	63	3.38	0.73	0.09			

Table 53: Welch's two sample t-test comparing respondents' helpfulness rating of the website multiple choice questions (Question 13i of the Sacramento Valley red fox survey).

	Respondents' rate of website multiple choice questions				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.73	0.82	0.08	2.632	201.691	0.0092
Male	97	3.43	0.8	0.08			

Table 54: One-way ANOVA test comparing respondents' helpfulness rating of the website multiple choice questions (Question 13i of the Sacramento Valley red fox survey).

	Respondents' rate of website multiple choice questions				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.84	1.04	0.17	4, 203	3.168	0.0149
26-35	37	3.76	0.76	0.12			
36-50	41	3.63	0.70	0.11			
51-70	80	3.45	0.76	0.08			
70 or older	13	3.08	0.86	0.24			
County							
Shasta	12	3.67	1.23	0.36	10, 182	0.593	0.8184
Tehama	3	3.00	1.00	0.58			
Butte	18	3.83	0.62	0.15			
Glenn	6	3.33	0.52	0.21			
Placer	5	3.40	0.55	0.25			
Sacramento	50	3.52	0.76	0.11			
San Joaquin	3	3.67	0.58	0.33			
Yolo	48	3.52	0.87	0.13			
Solano	12	3.67	0.65	0.19			
Contra Costa	4	4.00	0	0			
Other	32	3.66	0.97	0.17			
Employment							
Full time employee	123	3.59	0.81	0.07	4, 202	1.285	0.2771
Part time employee	22	3.45	0.74	0.16			
Student	24	3.75	0.90	0.18			
Retired	33	3.45	0.83	0.14			
Unemployed	5	4.20	1.10	0.49			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.82	0.75	0.23	6, 176	0.200	0.9764
$10,001-25,000	17	3.59	0.87	0.21			
$25,001-50,000	38	3.63	0.94	0.15			
$50,001-75,000	42	3.52	0.94	0.15			
$75,001-100,000	33	3.61	0.61	0.11			
$100,001-150,000	27	3.63	0.74	0.14			
$150,000 or more	15	3.60	0.74	0.19			
Education							
Grade school	3	3.33	0.58	0.33	5, 203	0.794	0.5549
High school diploma	8	3.75	0.89	0.31			
Some college work	42	3.64	0.96	0.15			
Technical or Associate degree	16	3.31	0.79	0.20			
Bachelor degree	77	3.68	0.83	0.09			
Postgraduate degree	63	3.51	0.74	0.09			

Table 53: Welch's two sample t-test comparing respondents' helpfulness rating of the website free response questions (Question 13j of the Sacramento Valley red fox survey).

	Respondents' rate of website free response questions				t	df	p-value
	n	Mean	Std. Deviation	Std. Error			
Gender							
Female	109	3.72	0.85	0.08	2.309	203.850	0.0220
Male	97	3.45	0.78	0.08			

Table 56: One-way ANOVA test comparing respondents' helpfulness rating of the website free response questions (Question 13j of the Sacramento Valley red fox survey).

	Respondents' rate of website free response questions				df_1, df_2	F-value	p-value
	n	Mean	Std. Deviation	Std. Error			
Age							
18-25	37	3.92	0.95	0.16	4, 203	3.511	0.0085
26-35	37	3.68	0.75	0.12			
36-50	41	3.63	0.70	0.11			
51-70	80	3.46	0.79	0.09			
70 or older	13	3.08	0.86	0.24			
County							
Shasta	12	3.67	1.15	0.33	10, 182	1.097	0.3670
Tehama	3	3.33	0.58	0.33			
Butte	18	4.06	0.64	0.15			
Glenn	6	3.33	0.52	0.21			
Placer	5	3.00	1.22	0.55			
Sacramento	50	3.54	0.76	0.11			
San Joaquin	3	3.67	0.58	0.33			
Yolo	48	3.50	0.80	0.12			
Solano	12	3.83	0.58	0.17			
Contra Costa	4	3.50	0.58	0.29			
Other	32	3.53	1.05	0.19			

Employment							
Full time employee	123	3.59	0.79	0.07			
Part time employee	22	3.64	0.79	0.17			
Student	24	3.58	0.88	0.18	4, 202	0.934	0.4452
Retired	33	3.45	0.87	0.15			
Unemployed	5	4.20	1.10	0.49			
Beneficiary	0	0	0	0			
Income							
Less than $10,000	11	3.91	0.83	0.25			
$10,001-25,000	17	3.47	0.87	0.21			
$25,001-50,000	38	3.66	0.97	0.16	6, 176	0.649	0.6910
$50,001-75,000	42	3.57	0.86	0.13			
$75,001-100,000	33	3.67	0.54	0.09			
$100,001-150,000	27	3.41	0.89	0.17			
$150,000 or more	15	3.60	0.63	0.16			
Education							
Grade school	3	3.33	0.58	0.33			
High school diploma	8	3.88	0.83	0.29			
Some college work	42	3.57	0.94	0.15	5, 203	1.801	0.1141
Technical or Associate degree	16	3.38	0.81	0.20			
Bachelor degree	77	3.77	0.83	0.09			
Postgraduate degree	63	3.41	0.71	0.09			

Table 57: Welch's two sample t-test comparing participants that responded frequent website updates would increase their participation and participants that responded frequent website updates would not increase their participation (post hoc analysis for Question 14 of the Sacramento Valley red fox survey).

	Respondents that responded frequent website updates would increase their participation				Respondents that responded frequent website updates would not increase their participation				t	df	p-value
	n	Mean	Std. Deviation	Std. Error	n	Mean	Std. Deviation	Std. Error			
Age	104	3.04	1.24	0.12	104	2.91	1.24	0.12	0.728	206.000	0.4676
Education	105	4.52	1.34	0.13	104	4.78	1.21	0.12	-1.443	205.444	0.1505