Impact Planning, Evaluation & Audience Research

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Formative Evaluation: Citizen Science Program

Prepared for the
Conservation Trust of Puerto Rico
Manati, PR

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SUMMARY AND RECOMMENDATIONS

The goal of formative evaluation is to reveal successes and challenges toward program improvement. This summary highlights the strengths and challenges of the Citizen Science Program as demonstrated by formative evaluation findings. Based on these strengths and challenges, RK&A has provided concrete recommendations for improving program implementation moving forward.

PROGRAM STRENGTHS

Findings reveal many strengths of the Citizen Science Program. First, those who participate are highly motivated by and interested in the program activities. Interviewees frequently cited a high level of existing interest in project-specific content and research, such as a personal or professional interest in archeology and past civilizations. Most interviewees were repeat participants in the research project activity they attended, and several had participated in other research projects and activities. Second, while the number of participants at each activity ranged from 1 to 17, a high level of engagement was observed across project activities. RK&A observed few barriers to program implementation, and participants actively participated during most activities. This engagement took many forms from asking questions of scientists to performing a variety of data collection tasks to conversing with their like-minded peers. Further, facilitators across projects were observed actively supporting participants' engagement. For instance, facilitators encouraged participants to assume a variety of data collection roles and take ownership of their individual tasks. Facilitators also consistently demonstrated data collection tasks and provided participants with encouragement when they were hesitant to take the lead. Most facilitators also asked and answered open-ended questions throughout the activity. In most activities, interviewees described a collaborative atmosphere created by the facilitators and other participants that they truly appreciated.

A strong alignment between what facilitators and participants perceive as most rewarding about program participation is evident. Facilitators described participating in real scientific research and gaining knowledge about project topics and scientific research as most rewarding for participants. Likewise, many participants also described their active role in the scientific process as very rewarding and sometimes unexpected (which they found pleasantly surprising). For instance, during *Murciélagos: Conócelos en Persona*, participants were surprised by how close they were able to get when observing the bats that were captured.

Lastly, from participants' perspectives, the overall program logistics were handled very well. No interviewees encountered any great challenges with logistics, such as registering for the program or traveling to the sites. Participants registered in a variety of ways—in person, by e-mail, and by phone—and all methods were described as easy and straightforward. Further, in all instances, interviewees described receiving clear and reliable communications from Trust staff with maps, directions, and project descriptions and expectations.

PROGRAM CHALLENGES

Participants perceived very few challenges to their participation (and this was corroborated by observations where very few barriers were observed and participants' level of engagement was high). However, interviews revealed that participants' understanding of how the individual activity they

participated in relates to the overall purpose of the Citizen Science Program is inconsistent. For example, while some interviewees had a very clear understanding of how participating in "collecting and analyzing sediment" linked to the overall goal of maintaining a healthy watershed, others had vague notions of how the activity linked to a larger research goal. On the other hand, the majority of participants understood that their participation in the activity was linked to a larger goal of encouraging citizens' participation in research. Further, observations showed that facilitators were also inconsistent in their descriptions of the overall goals of the program and research projects, which may have contributed to the inconsistencies experienced among participants.

Facilitators described challenges from broad (overall program recruitment) to specific (personal logistical challenges). The three primary challenges that facilitators perceived are: (1) participants' knowledge gap; (2) recruitment and sustaining participation; and (3) program logistics. First, facilitators described challenges with the constant need to adjust the research activities to accommodate different levels of participant knowledge. Not always knowing the prior knowledge of participants makes it difficult to predict how efficiently they can collect data during any given activity (which is an overall concern for the fidelity of the research). Interestingly, discomfort with their lack of knowledge or skills did not emerge as a challenge for participants. In fact, participants often spoke highly of the facilitators' ability to explain complex concepts and skills so they could understand them. Overall, participants appreciated the active role they were given and the consistent support of facilitators.

A second challenge discussed by facilitators is recruiting participants and sustaining their participation. While facilitators describe repeat participation as a positive result of the program, they also said that recruitment across the different projects has been inconsistent, with at times, very low participation levels in certain activities. Some facilitators said that confirming an individual's participation is a challenge and that the number registered does not always align with the number of participants. A few participants echoed the concern of low participation levels, expressing disappointment that an activity they find worthwhile is not better attended.

Last, while participants perceived very few logistical challenges, facilitators described several that they deal with consistently. For instance, facilitators expressed a great deal of concern about the amount of paperwork that participants are asked to complete. This particular concern did not emerge among participants who were interviewed (and it was not observed as a barrier to program participation). Facilitators also noted the level of effort to ensure programs run smoothly (from scheduling to setting up activities) is a constant challenge, mostly due to the time involved. Several facilitators suggested a need to meet more often to reflect on what is and is not working about program logistics and implementation.

RECOMMENDATIONS

While so many aspects of the Citizen Science Program are successful, RK&A suggests the following recommendations for program improvement.

- Consider regularly scheduling a time to reflect on successes and challenges. There are two key aspects to successful reflection—scheduling time to do so and preparing an agenda that guides the reflection so it remains focused and useful. For example, choose one aspect of program implementation to address at each reflection session (e.g., recruitment) and generate a list of no more than three questions that address the associated challenges. Documenting this reflection is also of the utmost importance so facilitators can build on what they discuss.

- During a scheduled reflection, consider the challenges of recruitment, listing aspects that may be within (marketing, confirming participation) and outside (no shows, late arrivals) the Trust's control; then, systematically address those items that are within the Trust's control.
- If participants' understanding of the larger research and participation goals are high priorities, consider being very explicit about these goals in a formal introduction and conclusion to each activity. Also, consider assigning this task to the same type of facilitator (scientist, volunteer leader, and/or Trust interpreter) so it is consistently implemented.

INTRODUCTION

The Conservation Trust of Puerto Rico (the Trust) contracted Randi Korn & Associates, Inc. (RK&A) to conduct formative evaluation of their National Science Foundation-funded Citizen Science Program, a program that recruits and trains local Puerto Ricans to conduct scientific research about the Rio Manati watershed alongside Trust scientists, staff, and interpreters. RK&A is contracted to conduct two rounds of formative evaluation; this report provides detailed findings from the first of two rounds.

The objectives of the evaluation are to explore:

- the evolution of each activity from beginning to end (orientation, roles/tasks, conclusion);
- scientists', staff's, and participants' roles during the activity;
- participants' level of engagement in the activity (successes and challenges);
- barriers to successful completion of the activity (within and outside of staff's control);
- participants' experiences with and opinions of program logistics (including: registration, transportation, preparatory materials and information);
- participants' motivation for participating; and
- participants' understanding of project and activity goals (including connections among projects).

METHODOLOGY

RK&A employed three methodologies in the formative evaluation: naturalistic observations of Citizen Science program activities, short-answer interviews with participants following their program experience, and in-depth interviews with scientists and other facilitators.

NATURALISTIC OBSERVATIONS AND SHORT-ANSWER INTERVIEWS

Naturalistic observations are useful because they are an objective account of the Citizen Science program experience. In naturalistic observations, the observer looks at the entire activity experience, taking handwritten notes on scientist, facilitator, and participant behaviors and conversations. RK&A developed an observation instrument to guide the observations (see Appendix A). RK&A and bilingual data collectors observed a variety of Citizen Science program activities October 3 to 6 and October 19, 2013. Following each observation, bilingual data collectors interviewed up to three participants who participated in the activity. Data collectors took notes in Spanish using an open-ended interview guide (see Appendix B).

IN-DEPTH INTERVIEWS

RK&A proposed in-depth telephone interviews with scientists, staff, interpreters, and volunteer leaders to explore the successes and challenges of the Citizen Science program from their perspectives. Through in-depth interviews, RK&A was able to probe interviewees about their experiences for clarity. The Trust presented RK&A with a list of all scientists, staff, interpreters, and volunteer leaders. RK&A interviewed 11 individuals—two staff selected by the Trust onsite and nine randomly selected scientists, interpreters, and volunteer leaders to interview via telephone. Interviews were conducted on October 4 and in November 2013 at interviewees' convenience. Interviews were audio recorded with interviewees' permission to facilitate analysis. See Appendix C for the interview guide.

DATA ANALYSIS AND REPORTING METHOD

Observations and interviews produce descriptive data that are analyzed qualitatively, meaning that the evaluator studies the data for meaningful patterns and, as patterns and trends emerge, groups similar responses. Where possible, participants' verbatim language (edited for clarity) is included to exemplify trends.

SECTIONS OF THE REPORT:

1. Observations and short-answer interviews
2. Facilitator interviews

OBSERVATIONS AND SHORT-ANSWER INTERVIEWS

INTRODUCTION

Between October 5 and October 19, 2013, RK&A attended all five research projects: Rio, Arqueología, Aves, Murciélago, and Costa. Each research project is comprised of multiple activities, such as collecting data in the field or entering data in the lab, and RK&A sometimes observed more than one activity taking place as part of the same research project. For this section of the report, data for multiple activities within the same research project were aggregated for analysis, and data for individual research projects were analyzed separately. Findings in this section of the report are based upon onsite observations and participant interviews.

RIO

RK&A observed the Rio activity *Conoce Tu Río: Camarones, Buruquenas y Calidad de Agua* at two site locations, visiting Barrio Pozas, Ciales on Saturday, October 5 and the Yuyú (Frontón), Ciales on Sunday, October 6. The scientist, an assistant, a volunteer leader, and a Trust interpreter were present on both days. The two activities attracted a total of three male participants, ages 38, 54, and 60.[1] Two of the three participants had attended a Rio activity before; the third participant attended the activity on both days, the first day as a first-time participant and the second as a repeat participant.

IMPLEMENTATION OF THE ACTIVITY

OVERVIEW OF THE ACTIVITY

Participants met at 7:30 AM and used their own vehicles to follow the facilitators to the activity site. At the site, the Trust interpreter handed out life jackets and went over safety-related hand signals.[2] The scientist then described the purpose of the Rio research project—to involve citizens in scientific research and collect shrimp and water quality samples. Participants divided into shrimp and water quality groups and the groups worked independently for most of the day. The water quality group was led by the scientist and volunteer leader who explained the reason for collecting the samples and showed the participant how to use the proper instruments. Over the course of an hour, the participant worked with facilitators to collect samples and report readings. Concurrently, the assistant leading the shrimp group explained the sampling procedures and type of samples the participants would collect. The two participants worked together to collect the samples as they alternated roles of agitating the riverbed and using a net to collect dislodged organisms. The shrimp group also collected river water to take an inventory of insects.[3] Around noon, the facilitators concluded the activity. On Saturday the conclusion was more formal, and the scientist conversed with participants about river conservation efforts. On Sunday, the assistant ended the activity by inviting participants to return to another Rio activity in the future.

SUCCESSFUL ASPECTS

The scientist, her assistant, and the volunteer leader facilitated an experience that kept participants active and engaged. Participants were observed attentively listening to the facilitators, asking questions about

[1] On Sunday, one of the Trust evaluators attended the activity and acted as an informal participant; demographic information for this individual is not included as he was not a formal participant.
[2] On Sunday, the Trust interpreter did not go over safety-related hand signals.
[3] On Saturday, the water quality and shrimp groups came together to do this activity, but on Sunday the insect sampling was handled only by the shrimp group.

the activity and conversing with facilitators and each other on topics related to the research. The scientist, assistant, and volunteer leader took on informal teaching roles, providing guidance as participants collected nearly all data themselves. These facilitators also reflected with participants about the importance of the sampling procedures in the context of the overall activity goals. For example, in the water quality group, the scientist described the importance of checking the oxygen levels of a water sample first, as the levels can be affected by organisms present in the water sample. Facilitators further provided encouragement to the participants, with the assistant commenting to participants in the shrimp group, "You guys are pros; I've never found so many samples!"

Participants conversed with each other and with the facilitators, expressing interest in and asking questions about the activity. For example, participants in the shrimp group showed particular excitement when organisms were found, asking questions about the shrimp they had captured. They also exchanged humorous comments throughout the activity, often joking about how many shrimp they needed to collect for their asopao (a traditional Puerto Rican stew). Similarly, in the water quality group, participants' conversation revolved around their passion for the activity and interest in exploring where the river at that activity site originated. Participants also asked questions, with one participant inquiring if a certain method of shrimp sampling might interfere with future samples downstream.

BARRIERS TO EFFECTIVE IMPLEMENTATION

Participants were attentive, engaged, and inquisitive throughout the entire four-and-a-half-hour-long activity. While there were no perceived barriers to implementation of the activity, interviewees did describe some disappointment in the low attendance, described further below.

PARTICIPANTS' EXPERIENCES

MOTIVATIONS FOR ATTENDING THE ACTIVITY

Both interviewees were motivated to attend because of an overall appreciation for nature as well as a specific interest in river sites near their homes. In addition, interviewees were also motivated by the opportunity to learn more about scientific methods—such as developing a research question and designing studies—and applying these methods to start research projects in their own communities.

OPINIONS OF ACTIVITY LOGISTICS

Interviewees said they met with few logistical challenges when getting information about the project and registering for the activity. Both interviewees learned about the project through a Conservation Trust presentation in their community and had received a follow-up phone call or email to register. In one case, an interviewee was initially provided an incorrect start time for the activity in a confirmation call, but later received a call with the correct start time. Interviewees described receiving promotional information about the purpose of the project, either through e-mail and/or handouts provided at the presentation. Logistical information about the activity was also provided, including a Google map with directions to the site and a description of what to wear and bring. Though neither interviewee experienced problems with transportation to the site, one suggested that he would not have been able to get to the activity if he had not owned a car.

MOST SATISFYING ASPECTS OF THE ACTIVITY

Both interviewees appreciated the camaraderie of the group and the learning environment the facilitators created. One described the excitement and satisfaction he felt when he found shrimp in the net during sampling, as only a few organisms had been found earlier that day. Another interviewee enjoyed learning how the water quality instruments used for sampling were used to gauge the health of the river.

DIFFICULT OR CHALLENGING ASPECTS OF THE ACTIVITY

Interviewees said they had no difficulties or challenges when participating in the activity, but both said they were disappointed by low attendance at the activity. As one interviewee stated, "It's not very enjoyable to come to something that you consider very important and find that there are only two volunteer persons." Both interviewees suggested the Conservation Trust make a greater effort at media and social media marketing. One interviewee further hypothesized that the early start time might be a barrier to participation.

PARTICIPANTS' UNDERSTANDING

UNDERSTANDING OF THE PURPOSE OF THE ACTIVITY

Interviewees made connections between the part of the activity they had participated in (shrimp or water quality sampling) and greater notions of conservation. For example, an interviewee from the shrimp group described how monitoring fauna led to an understanding of the river's health and ecological balance. An interviewee from the water quality group associated the activity with helping people understand how they can resolve water quality problems.

UNDERSTANDING OF THE PURPOSE OF THE CITIZEN SCIENCE PROGRAM

During the orientation, the scientist mentioned that the activity was part of the Citizen Science Program and described the importance of citizens participating in scientific activities. Yet, interviewees found it challenging to link the Rio research project activity to the greater purpose of the Citizen Science Program. One interviewee mentioned he was aware of some of the Program's other research projects, naming the Aves and Arqueología research projects. He described his participation in the Rio activity as a way of involving citizens in science. Another interviewee was unable to explain the relationship between the activity and the Program.

ARQUEOLOGÍA

On Saturday, October 19, 2013, RK&A observed the Arqueología activity *Trazando el Pasado: Brújula, Prospección y GPS*. The activity took place at Tierras Nuevas, Manati and was led by the scientist, two assistants, and a Trust interpreter. 10 participants took part in the activity, including seven males and three females; participants range in age from 11 to 62. Among the three participants who were interviewed, all had attended prior activities related to the Arqueología research project, and two had attended other research project activities through the Citizen Science Program.

IMPLEMENTATION OF THE ACTIVITY

OVERVIEW OF THE ACTIVITY

Participants gathered at noon at the Hacienda La Esperanza, where the Trust interpreter went over some safety guidelines before everyone boarded a trolley to go to the activity site. Onsite, the scientist explained the goals of the activity and the overall purpose of the research project—to investigate how people historically used the watershed. Over the course of an hour, the assistants taught participants how to use a GPS and compass. Participants practiced using the instruments and taking meter-long measured steps so they could accurately mark transects. After a half-hour snack break, participants divided into three groups, each led by an assistant or the scientist. The group's leader[4] invited participants to take on different roles, such as using the instruments to mark transects and way points, making surface observations, or filling out a standardized observation form.[5] Each group conducted surface observations at two sites and came back together at 3 PM to discuss their findings. To conclude the activity, the scientist summarized the work the groups had done and shared her insights about the

[4] The group leader observed for this activity was the scientist.

[5] In some groups, participants rotated roles, though in the observed group, participants engaged in the same role throughout.

site's importance as an ancient batey site (ceremonial plaza used as a ball court). The scientist then guided participants to a nearby beach where the group conducted more informal surface observations. Shortly after, the group boarded the trolley to return to the Hacienda La Esperanza. There, the scientist thanked everyone for participating and invited them to attend the next activity. She also encouraged those interested in helping with the research project to get trained to document areas near their own homes.

SUCCESSFUL ASPECTS

The activity successfully prompted dialogue between participants and facilitators, with facilitators answering questions and sharing their knowledge. In fact, this collegial learning environment was one of the aspects interviewees liked most about the activity. As part of this dialogue, the scientist sometimes posed questions to the participants, encouraging them to think about what their surface observations of a small area might mean in the greater context of the site. For instance, the scientist pointed out the different thickness and type of vegetation in one area and asked what it might indicate. Participants then hypothesized if the vegetation indicated the former presence of a home, crops, or an ancient batey.

In addition, participants were invested in their work. When learning how to use the instruments and collecting data onsite, participants checked in with the facilitators to make sure their GPS and compass techniques were sound. In response, the assistants engaged with participants and demonstrated how to hold the instruments to ensure accurate readings. Interviewees, too, were excited to use the instruments and have an active role in the data collection. As one interviewee commented, "They gave us the theory and then they actually showed us how to use [the instruments]. It was better because we were able to use it all; it wasn't like we could only observe." Facilitators also provided encouragement and support to participants. Assistants regularly checked in with participants during the instrument training session, answering questions and explaining the theory behind the techniques. The scientist further provided assurance to participants, particularly when a participant was concerned about the accuracy of her measured strides.

BARRIERS TO EFFECTIVE IMPLEMENTATION

There were no perceived barriers to implementation of the activity. Although the day was sunny and hot (a potential barrier), participants put on head coverings and sunscreen; regardless of the temperature, they remained actively engaged in the activity.

PARTICIPANTS' EXPERIENCES

MOTIVATIONS FOR ATTENDING THE ACTIVITY

All interviewees mentioned that they had taken part in prior Arqueología research project activities through the Citizen Science Program and expressed interest in the field. One person described his personal passion for connecting with past civilizations. Two others commented on their professional interest in archaeology, with one describing herself as a historian and the other noting his interest in studying archaeology. As the latter commented, "To be able to find this [opportunity] for free, for them to explain this to you and to be able to actually use the equipment, not just be told about it; it's something that you can't find any other place."

OPINIONS OF THE ACTIVITY LOGISTICS

Interviewees said they experienced no problems with the registration process or activity logistics. Each had communicated by e-mail or phone with staff from the Conservation Trust to confirm participation and found the staff accessible. One interviewee, in fact, said he had initially been waitlisted for the activity but had been contacted by staff when space became available. Interviewees received logistical information for the activity, including what to wear and bring, as well as specifics regarding the meeting location and time. Interviewees were particularly appreciative of the secure parking at the meeting point and the onsite transportation. All interviewees said they were aware of the age and activity-level

requirements and had been provided a description of what they would be doing onsite. In some cases the description was more general (observing and collecting surface samples) and in other cases it was more specific (using a GPS and compass).

MOST SATISFYING ASPECTS OF THE ACTIVITY

When asked about the most satisfying aspects of the activity, interviewees commented on the informative learning environment cultivated by the facilitators. Interviewees noted that facilitators treated participants equally and professionally and that facilitators genuinely wanted to share their knowledge. As one interviewee commented, "The volunteers [facilitators] help you with everything, if you have doubts, you can ask them, and they always give you the answers. There's always a dialogue." Interviewees also gained satisfaction from their ability to connect with nature and with other individuals interested in nature. In addition, one interviewee said he liked the ability to learn useful skills that he could apply to other areas of his life, such as navigating with a GPS or compass.

DIFFICULT OR CHALLENGING ASPECTS OF THE ACTIVITY

Based on RK&A's observations, participants took part in the activity without any difficulties, and interviewees' comments further suggest that they enjoyed all aspects of the activity. One interviewee did mention that she disliked the intense heat that day, but said the hot temperature was expected and was not anyone's fault.

PARTICIPANTS' UNDERSTANDING

UNDERSTANDING OF THE PURPOSE OF THE ACTIVITY

Interviewees spoke generally about the purpose of the activity, describing the importance of educating and involving citizens in archaeological work. One interviewee described the activity as learning the tools necessary to contribute to other Arqueología research project activities. The two other interviewees conflated the purpose of the Arqueología research project with the overall purpose of the Citizen Science Program, saying that all research projects incorporated citizen involvement in scientific and environmental work.

UNDERSTANDING OF THE PURPOSE OF THE CITIZEN SCIENCE PROGRAM

Interviewees had a strong understanding of the purpose of the Citizen Science Program, describing how the Program encouraged citizens to become more involved and knowledgeable about scientific studies and environmental research.

AVES

On Sunday, October 6, 2013, RK&A observed two different activities related to the Aves research project. *Sobre Aves y Bosques; ¡Observa, Escucha y Cuenta!* took place in the morning in Florida, and *Sobre Aves y Bosques: Datos y Patrones* took place in the afternoon at the Hacienda La Esperanza. A scientist, an assistant and a Trust interpreter led both activities. Participants in the morning activity included six males and one female, ranging in age from 33 to 55 years. At the afternoon activity, participants included three females, ages 15, 37, and 49; in addition, two males from the morning activity also took part. Among the three interviewees, all were repeat participants at Aves and had participated in other research projects as well.

IMPLEMENTATION OF THE ACTIVITIES

OVERVIEW OF THE SOBRE AVES Y BOSQUES; ¡OBSERVA, ESCUCHA Y CUENTA! ACTIVITY

At *Sobre Aves y Bosques; ¡Observa, Escucha y Cuenta!*, participants met at 6:15 AM and used their own cars to follow the facilitators to the observation site. Onsite, the assistant and the Trust interpreter welcomed participants and pointed out the two trail options. The Escalara 1 trail group (observed by RK&A)

stopped for 10 minutes at each of the eight stations to record weather data and bird observations. The scientist and participants listened quietly to the bird songs and used binoculars to observe birds nearby. During this time, people in the group made gestures when they heard a bird call and sometimes broke the silence to whisper the name of the bird they had heard or observed. Occasionally, the scientist gave clues to participants so they could guess which bird was associated with the bird song. The scientist also sometimes made bird calls, attracting birds to the area and prompting the birds to sing. The scientist recorded all the observations on his clipboard. The group concluded observations at the last station at 9:30 AM and casually observed birds until the other trail group arrived. Participants and facilitators informally shared their observations from the activity for about 15 minutes, but there was no formal conclusion to the activity.

OVERVIEW OF THE SOBRE AVES Y BOSQUES: DATOS Y PATRONES ACTIVITY

RK&A did not observe the beginning of *Sobre Aves y Bosques: Datos y Patrones*, as the activity began before the 1 PM indicated start time. During the activity, participants worked quietly and entered data in the new bird database, including information on climate as well as the species, behaviors, and routes of the observed birds. On occasion the scientist and participants talked about the activity, discussing the format of the new database, what data should be entered, and any problems with the data that arose. There was no formal conclusion to the activity, which was scheduled to end at 3 PM. Instead, participants stayed onsite until 3:45 PM, casually watching bird videos, talking about the data, and chatting amongst themselves about other topics.

SUCCESSFUL ASPECTS

Participants were focused on the activity, be it observing birds in nature or entering data generated from the observations. Due to the quiet nature of the work, participants and scientist did not converse extensively. When there was dialogue, the scientist posed questions to the participants and encouraged them to work out the answer. At *Sobre Aves y Bosques; ¡Observa, Escucha y Cuenta!*, the scientist asked, "Which one [bird] is that?" and at *Sobre Aves y Bosques: Datos y Patrones,* the scientist inquired, "How accurate is that temperature?" Interviewees described their interactions with the scientist and other facilitators as "excellent," with one interviewee commenting, "They try putting themselves at your level, and they know how to talk to you so that you understand." More so at the morning activity, participants also demonstrated a sense of camaraderie, informally comparing their knowledge of bird songs, laughing together at the scientist's bird calls, or making bird-related jokes.

In addition, at least two interviewees felt that their presence was important to the success of the activity; as one participant at *Sobre Aves y Bosques: Datos y Patrones* described, "They [the facilitators] were saying when they did the data entry on their own, it took longer and was more difficult. Now [that] we are doing [it] as a group, they said, 'Wow, you see the difference? It's faster with the group.'"

BARRIERS TO EFFECTIVE IMPLEMENTATION

Participants took part in the activity without any observable barriers. However, no conclusion was given at the end of either activity and interviewees also struggled to articulate the overall goals of the research projects and the Citizen Science Program.

MOTIVATIONS FOR ATTENDING THE ACTIVITY

Interviewees described a passion for nature as the motivating factor for their participation in the activity, with one specifically citing a personal interest in birds. All interviewees were repeat visitors and had taken part in multiple Citizen Science Program research projects; one had been a volunteer leader and another had taken part in other environmental activities through the Sierra Club. In addition, two of the interviewees liked that the activity was located near their home.

OPINIONS OF ACTIVITY LOGISTICS

No interviewees encountered problems when registering for the activity. In fact, interviewees described the process as "simple" and "easy," with one visiting the Conservation Trust in person to register and another signing up by e-mail. Most interviewees were informed in advance about the activity's goals. Logistical information was also provided to interviewees, with details on what to wear and any age restrictions for the specific activity. In addition, interviewees were appreciative of the offered transportation, though all lived near the activity sites and were familiar with the area.

MOST SATISFYING ASPECTS OF THE ACTIVITY

Immersion in nature was the aspect of the activities interviewees enjoyed most. At *Sobre Aves y Bosques; ¡Observa, Escucha y Cuenta!* , interviewees commented on the opportunity to spend time in the countryside, and at *Sobre Aves y Bosques: Datos y Patrones,* the interviewee liked learning the bird calls. Interviewees from both activities enjoyed the opportunity to meet people and the camaraderie created from participation in the activity.

DIFFICULT OR CHALLENGING ASPECTS OF THE ACTIVITY

Interviewees reported that they faced no challenges or difficulties with the activity itself. One interviewee commented that his least favorite aspect of the activity was the Gatorade provided as part of the snacks, but was otherwise happy with the activity.

PARTICIPANTS' UNDERSTANDING

UNDERSTANDING OF THE PURPOSE OF THE ACTIVITY

When asked to describe the purpose of the activity, interviewees from the *Sobre Aves y Bosques; ¡Observa, Escucha y Cuenta!* described the activity's goals as identifying birds, understanding the relationship between the vegetation and the birds, and gaining a greater understanding of the bird community year-round. The interviewee from *Sobre Aves y Bosques: Datos y Patrones* identified the goal of this activity as inputting data as well as becoming familiar with and learning how to differentiate bird calls.

Participants understood to varying degrees how the activity they participated in contributed to the overall Aves research project. One interviewee said data from the different Aves activity sites would be brought together at the end of the research project. Another interviewee said that the Aves research project activity sites were all connected to the Manati watershed.

UNDERSTANDING OF THE PURPOSE OF THE CITIZEN SCIENCE PROGRAM

Interviewees gave vague descriptions of the Citizen Science Program's purpose. Two interviewees described the Program as a framework for environmental work that has multiple branches (Aves being one of them). Another interviewee said that the Citizen Science Program's goal was to unite the community around environmental topics.

MURCIÉLAGO

RK&A observed two different Murciélago research project activities. *Murciélagos: Tras el Trabajo de Campo* took place in the afternoon on Friday, October 4 at the Hacienda La Esperanza and was facilitated by two assistants and a Trust interpreter. One male participant, age 36, attended the activity. *Murciélagos: Conócelos en Persona* was held on the evening of Saturday, October 5 in Yuyú (Frontón), Ciales. One assistant, a volunteer leader and a Trust interpreter facilitated the activity. Seven participants took part in the activity, including four females and three males; participants range in age from 19 to 30 years. Among the five interviewees, three had participated in other research projects.

IMPLEMENTATION OF THE ACTIVITIES

OVERVIEW OF THE MURCIÉLAGOS: TRAS EL TRABAJO DE CAMPO ACTIVITY

The activity was scheduled to take place between 1 and 4 PM. However, for the first hour of the activity, the two assistants entered data with one person dictating the data and the other typing it in. At 2 PM, the participant joined the activity, after filling out the necessary paperwork. During the activity, the participant alternated between entering data, conversing with the assistants about the Citizen Science Program, and observing the assistants prepare for the following day's *Murciélagos: Conócelos en Persona* activity. The participant asked many questions about the Murciélago research project and how the assistants had started working with bats.[6] The participant stayed at the activity until 3:30 PM.

OVERVIEW OF THE MURCIÉLAGOS: CONÓCELOS EN PERSONA ACTIVITY

At 4 PM, participants arrived at a meeting point and filled out consent forms. They traveled in their own vehicles and followed facilitators to the observation site. Onsite, the assistant introduced the activity and led participants down an unlevel trail to where the nets would be set up. Participants assisted with unrolling the nets and attaching them to poles, before gathering for a snack break in an open area. During the break, facilitators answered questions about bats and handed out identification sheets, gloves, and flashlights for participants to use. For the next four hours, the group checked the nets every 15 minutes to see if a bat had been caught. When waiting to check the nets, the assistant shared facts about bats and showed participants an AnaBat device used to detect the sound waves of each bat. When a bat was captured, participants gathered around it to take pictures and ask general questions about bats (e.g., "How big are bats?" or "How many types of bats are there?"). The assistant also talked with participants about the other locations where the research project activity was taking place. By 10 PM, the activity began to wind down and participants started to engage in side conversations unrelated to the activity. The assistant and Trust interpreter concluded the activity at 10:40 PM by asking if participants had any other questions, handing out feedback forms to fill out, and encouraging them to check back for other activities.

SUCCESSFUL ASPECTS

Participants expressed an interest in learning more about bats at both activities as demonstrated by the number and types of questions asked. Participants were curious about everything from different species of bats ("How many kinds of bats are out there?") to bat behaviors ("Why do bats just come out at night?") and the assistant's experience with bats ("What is the bat that you get more or [capture] most often?"). In fact, much of the dialogue taking place at the activities consisted of participants asking questions and the assistant(s) providing answers as well as generally sharing their knowledge. Several interviewees expressed gratitude for the rich learning environment created by the facilitators. As one interviewee commented, "It has been a good experience. . . . Those who lead the program [activity] are very good at explaining all the details about bats and the Citizen Science activity." In some cases, participants' questions suggested misconceptions about bats and the assistant would clarify whether something was a myth or stemmed from actual bat behavior. For instance, one participant was concerned that a bat could get caught in her hair, but the assistant assured her this was a myth. Interviewees said they learned a lot about bats that they had previously not known and at least one interviewee reported that the activity changed his impression of bats, noting, "I now see bats in a different way, because I used to see bats as diseased creatures."

At *Murciélagos: Conócelos en Persona*, in particular, participants were very involved in the activity. Although no participant was assigned a particular role, all interviewees said they had opportunities to contribute to the activity in a way that was comfortable to them, such as lending a hand setting up the nets or untangling bats caught in the nets. Facilitators also directly invited more hesitant participants, those

[6] In addition to taking part in the activity, the participant was conducting interviews with scientists at the Conservation Trust for a podcast on the scientific research community in Puerto Rico.

who had not yet taken on an active role, to do so if they liked. In fact, the extensive hands-on nature of the activity exceeded a few interviewees' expectations. As one interviewee commented, "It was much more interactive than I was expecting. I could see them [the bats], touch them. It was very good."

BARRIERS TO EFFECTIVE IMPLEMENTATION

Participants took part in the activities with only a slight barrier arising in the *Murciélagos: Tras el Trabajo de Campo* activity. The participant in this activity spent longer than anticipated filling out necessary paperwork; however, it is important to note that the paperwork was related to recording interviews with scientists at the Conservation Trust and did not pertain to taking part in the activity itself. One interviewee at *Murciélagos: Conócelos en Persona* also suggested that the Conservation Trust advertise more and in non-internet-based ways to encourage greater participation.

PARTICIPANTS' EXPERIENCES

MOTIVATIONS FOR ATTENDING THE ACTIVITY

At *Murciélagos: Conócelos en Persona*, interviewees said they were intrigued by the idea of capturing bats and learning more about the animals. Two interviewees noted that they were inspired to attend the activity by a friend or relative; one mentioned a sister studying biology and another said his friend had attended previously and recommended it. One interviewee also was generally interested in learning more about the environment in Puerto Rico. At *Murciélagos: Tras el Trabajo de Campo,* the interviewee said he attended the activity out of general interest, but more so to conduct interviews with scientists at the Conservation Trust.

OPINIONS OF THE ACTIVITY LOGISTICS

Interviewees spoke positively about the activity logistics. Two registered for the activity by phone and two others did so online. Of those who registered online, one experienced a glitch in the Web site or Internet connection that prevented him from registering; however, he was able to do so by e-mail. The Conservation Trust's Web site was an asset to participants, as three interviewees mentioned it as their source for information about the activity. Many also described receiving e-mail confirmations from the Conservation Trust with activity logistics, such as the activity's start and end time, directions to the site or meeting point, and details on what to wear or bring. Interviewees also received information about the age requirements and the type of physical activity they might be doing (e.g., sitting for long periods of time or walking on rocky trails). In addition, interviewees said they had no problems using their own transportation to get to the activity site.

MOST SATISFYING ASPECTS OF THE ACTIVITY

Seeing the bats close up and watching them be removed from the net were the highlights for interviewees at the *Murciélagos: Conócelos en Persona* activity. Interviewees vocalized the excitement they felt when checking the nets or seeing a bat, with one interviewee commenting on how the novel experience gave him an "adrenaline rush." An interviewee at each activity also enjoyed the opportunity to learn more about the animals, with the participant from the *Murciélagos: Tras el Trabajo de Campo* activity commenting as well on the passion the assistants showed when sharing their knowledge of bats.

DIFFICULT OR CHALLENGING ASPECTS OF THE ACTIVITY

Each activity had its own minor challenges. Two interviewees at *Murciélagos: Conócelos en Persona* said they disliked how trails were scattered with horse droppings, and one other found the 15-minute wait time in between checking the nets to be challenging. One other interviewee suggested that the Conservation Trust advertise more, particularly through non-web-based media to encourage more participation. At *Murciélagos: Tras el Trabajo de Campo,* the interviewee said he liked everything about the activity; however, he noted the activity would have become tedious if it had been exclusively data entry and did not include interesting conversations with the assistants.

PARTICIPANTS' UNDERSTANDING

UNDERSTANDING OF THE PURPOSE OF THE ACTIVITY

When asked to describe the purpose of the activity they had participated in, interviewees said it was to educate people about bats and create more awareness about the animals. Specifically, an interviewee at *Murciélagos: Conócelos en Persona* said the purpose was to "educate citizens [about the] bat, myths and truths of bats, and get them acquainted more with this type of animal and its species [so to] help people in the conservation." The participant at *Murciélagos: Tras el Trabajo de Campo* also had a concrete understanding of the activity, describing the data entry as a "crucial part of the entire research process" which was necessary to be able to conduct analysis.

UNDERSTANDING OF THE PURPOSE OF THE CITIZEN SCIENCE PROGRAM

A couple of interviewees made connections between the Murciélago research project and the Citizen Science Program. One interviewee said that both were meant to encourage the public to protect nature and culture through scientific work. Another stated that both provided opportunities for conducting fieldwork and seeing how science is done. Among the remaining interviewees, two commented on the importance of creating awareness about bats, and one other said he did not know how the research project and Program related.

COSTA

RK&A observed two activities taking place as part of the Costa research project. *Historias Escondidas en la Arean: Aprende a Escucharlas*, took place on Saturday, October 5 at Playa Machuca, Barceloneta. The scientist, an assistant-in-training and a Trust interpreter facilitated the activity. Six participants attended the activity, including four males and two females, who range in age from 8 to 47 years. *Historias Escondidas en la Arean: Sus Bloques de Armar* was held at the Hacienda La Esperanza on Thursday, October 19. Facilitation was provided by the scientist, two assistants, and two volunteer leaders. In total, 17 participants attended the activity, including nine males and eight females; participants range in age from 14 to 47 years. Of the eight participants interviewed, seven were repeat participants; some had taken part in activities for multiple research projects (this year or in past years), and some had participated in multiple activities related only to the Costa research project.

IMPLEMENTATION OF THE ACTIVITY

OVERVIEW OF THE HISTORIAS ESCONDIDAS EN LA AREAN: APRENDE A ESCUCHARLAS ACTIVITY

At 7:30 AM, participants met with facilitators to fill out paperwork. During this time, the scientist provided an overview of the Costa research project, explaining that this is the first time research is taking place outside of the reserve. The group then drove to the site with participants following the facilitators in their own cars. Onsite, the scientist handed out reflective vests and led the group down a short but difficult trail to the beach. There, the scientist described the purpose of the activity as "to capture [the] sediments and the morphological characteristics of the beach" and went over data collection instructions and procedures. Participants took turns doing each task associated with the activity; only the Trust interpreter had a consistent role of taking notes. Throughout the data collection, the scientist pointed out things that participants may not have noticed and encouraged participants to share their own observations. After samples were collected at each site, the scientist gathered the participants and the group speculated about the environmental processes causing the high salinity readings. The scientist concluded the activity by posing questions about the project and inviting group discussion. Then, everyone helped pack up the equipment and returned to the parking lot.

OVERVIEW OF THE HISTORIAS ESCONDIDAS EN LA AREAN: SUS BLOQUES DE ARMAR ACTIVITY

As the participants arrived around 7:30 AM, the scientist and a volunteer leader welcomed them and provided guidance to participants as they filled out consent forms. Around 8:10 AM the scientist started

the activity by describing the history of the research project and how the data could be used by the community. Facilitators next explained the specific tasks that participants would be doing that day (using the sieves, weighing samples, and entering data) and noted that participants would have the opportunity to perform all roles involved in the activity. The participants divided into groups, with each group at a different lab station. A core participant at each station demonstrated the task, before participants set to work on their own. As participants worked, the scientist posed questions about the procedures and methodologies, encouraging participants to think about why certain techniques are used and what the findings might mean. Once participants completed a rotation performing a certain role, they switched roles with other participants at their station; later, participants changed stations so that everyone had the opportunity to perform each task. At 9:45 AM, some participants stopped for a 15-minute snack break, though others stayed in the laboratory and kept working. Over the course of the next hour, the scientist moved about the laboratory conversing with each group and summarizing the work they had done that day. This served as an informal conclusion to the activity. Participants continued to work until 11:15 AM, and some stayed to take part in a different Costa activity that afternoon.

SUCCESSFUL ASPECTS

The scientists and facilitators established an inquiry-based learning environment that engaged participants in the activity. The scientist, in particular, showed continual awareness of participants' potential needs and was attuned to their comfort levels. For example, she spent additional time guiding a family with minors through the consent form process. She also double-checked participants' profiles to see if it was necessary to adjust the procedures for participants' age and physical ability levels and made sure they felt at ease with their tasks. At the beginning of one activity, she stated, "It is very important that everyone feels comfortable where they are. If you do not feel okay in this group, you can move; there is no problem." The scientist also made connections between the work participants were doing and their personal interests, pointing out to one young participant the similarities between tools used at one activity and those used in the pharmaceutical field she had expressed interest in.

The scientist also continually referred to the purpose of the activity, providing contextual information about the research project and sharing potential next steps. The scientist then used an inquiry-based teaching style to engage and encourage participants to develop hypotheses based on their contextual knowledge and observations. For instance, the scientist would ask participants, "Why do we do this?" to get them to think about the methodology or "What would happen [to the sediment] if there is deforestation?" to encourage participants to consider how environmental changes might be observed onsite. In addition to her questions, the scientist regularly pointed out things that participants may not have noticed. At one activity, she showed participants how the angular edges of a sand particle indicated where the particle came from, and at the other activity, she pointed out how a type of wave indicated it was from the Atlantic Ocean.

BARRIERS TO EFFECTIVE IMPLEMENTATION

No barriers to effective implementation of the activities were observed. Participants were observed taking part in each activity without experiencing any difficulties or challenges and appeared engaged throughout.

PARTICIPANTS' EXPERIENCES

MOTIVATIONS FOR ATTENDING THE ACTIVITY

Interviewees had a variety of reasons for attending the activity. Many interviewees were motivated by a professional interest, including students of environmental biology, physical geography, and at least one member of the Future Biologists and Biotechnologists Association. Some of these interviewees also said the activity offered a unique learning opportunity and way to gain experience—or as one interviewee said, a way "to see theory in reality." A passion for nature stimulated some other

interviewees to participate, one of whom was a community leader with an interest in environmental conservation of the local coastline.

OPINIONS OF THE ACTIVITY LOGISTICS

Interviewees were generally positive about their experience registering and receiving logistical information for the activity. They reported success registering for the activity through the Web site, by phone, and in-person at a community workshop. In many cases, interviewees received confirmation e-mails or phone calls with details about the activity logistics including the activity meeting time and place, age restrictions, and what to wear or bring. A few others received information about the tasks they would be doing and the activity's overall purpose, with varying levels of detail. Interviewees who did not receive this information were generally repeat participants or those in groups where another person had completed the registration. Interviewees also were complimentary of the transportation provided through the Conservation Trust, describing it as "effective," "comfortable," and "easy."

MOST SATISFYING ASPECTS OF THE ACTIVITY

Some interviewees enjoyed the learning opportunities offered through their participation in the activity, with several particularly interested in learning related to science. As one interviewee described, "I learn from everything. I can see other points of view, not only from biotechnology that I am studying or biology that my friends are studying. Now I am with geographers, and I am looking at things that I didn't used to pay attention to." A few interviewees also liked the opportunity to spend time in nature, be it at the coast or at La Hacienda de Esperanza, and a few others said they generally liked "everything" about the activity.

DIFFICULT OR CHALLENGING ASPECTS OF THE ACTIVITY

Nearly all interviewees enjoyed the activity they had participated in and were unable to name something that was challenging, difficult, or that they did not enjoy. Among the remaining interviewees, one said she found the early morning start time to be challenging, and another said there had been more participants and daily activity options in past Citizen Science Programs.

PARTICIPANTS' UNDERSTANDING

UNDERSTANDING OF THE PURPOSE OF THE ACTIVITY

Interviewees generally said the purpose of the activity was to collect data and preserve scientific knowledge gained from the Costa research project. Several interviewees suggested that the knowledge gained would be used to educate participants and help local communities make informed decisions about the coastline's future. As one interviewee commented, "The information obtained can be preserved through the Trust so communities and ourselves, as future scientists, [can access it] if there is any environmental problem."

UNDERSTANDING OF THE PURPOSE OF THE CITIZEN SCIENCE PROGRAM

Interviewees drew connections between the knowledge gained from the activity they attended and the wider scope of research projects taking place through the Citizen Science Program. Interviewees described how the aims of the Costa research project contribute to the overall understanding of the ecosystem and how findings from the project might relate to the findings of other research projects. Several interviewees specifically mentioned possible connections between the Costa and Rio research projects, with one interviewee stating, "What is happening up the river is reflected here, that is why we measure water density and salinity, what materials the river carries . . . everything is linked."

FACILITATOR INTERVIEWS

INTRODUCTION

RK&A conducted 11 interviews with project stakeholders, which included interviews with Conservation Trust staff, volunteer leaders, staff interpreters, and researchers (scientists). Most interviews were conducted over the telephone in November 2013. Two interviews were conducted in person on October 4, 2013.

COMPREHENSION OF THE GOAL OF CITIZEN SCIENCE

Almost all interviewees agreed that the goal of Citizen Science is to provide opportunities for people to get involved in and learn about scientific research in an informal setting (see the quotation below). A few also said that the program is creating a model for involving citizens in scientific research.

> [The main goal of the project is] to involve mainly people from the area that are not necessarily from academia or researchers, people that live preferably in the area, so they can know and participate in investigations and in the long-term get involved so they can even conduct investigations or be involved even more in the protection of the area. [Researcher]

Additionally, a few interviewees said that the Program provides an opportunity for local scientists and The Conservation Trust to educate citizens about changes to the watershed and how to conserve resources in the Manatí area. In doing so, interviewees hoped that people would begin to understand how people can affect the watershed (see the first quotation below). A few interviewees, all researchers, also talked about the opportunity to teach people about scientific thinking and encourage people to see the ways they use science in their everyday lives (see the second quotation).

> I understand that the goal is to integrate people within the various investigations to know the great changes that have occurred over the watershed. [Staff interpreter]

> I hope that from that scientific knowledge [that people gain through the Program] they can start using it and apply it in their daily lives. . . . So they understand the power they have with the knowledge and can apply it to other areas. [Researcher]

STRENGTHS OF CITIZEN SCIENCE PROGRAM

Interviewees were asked a series of questions about the strengths and rewarding aspects of the Citizen Science Program, starting with top-of-mind thoughts about the Program overall and then moving more specifically to the point of view of participants and facilitators. In some cases, similar strengths or rewarding aspects were addressed for different audiences and therefore may be discussed more than once.

TOP-OF-MIND PROGRAM STRENGTHS

When asked about strengths of the Program overall, most interviewees discussed recruitment and scheduling of activities as well as more specific aspects of Program management such as the reminder e-mails and maps sent to participants prior to each activity (see the quotation below).

> In terms of the logistics, we let them know the meeting place, because some activities are held outside the Hacienda, and we send them a map via e-mail and, at least until now, they have not gotten lost. In terms of the map logistics, I understand that it is very easy to follow the directions that they receive through email. [Volunteer leader]

Several interviewees also said that Trust staff's and scientists' commitment to the Program is a strength of the Citizen Science Program, citing the willingness of scientists to share their time and resources and that staff ensure that everything is in place for data collection (see the first quotation below). Additionally, several interviewees said the participants provide a strong asset to the Program. These interviewees spoke about repeat participation and participation in multiple projects as signs of interest from the community; and they also talked about the sense of ownership that comes with having the tools to share and spread new knowledge after the project ends (see the second quotation).

> I can have the Trust staff go get the equipment, contact the people responsible for recruitment, make sure things are good when one arrives in the field, and they have the ability to reach the field. I have access to many diverse people and have the support so that I can carry the message from science to archeology, for instance. [Researcher]

> [We can] link what is tangible with the intangible and the person is able to say, 'well, this [place] is mine and I also need to be involved in this because it applies to me.' So we create an ownership sense through these tools, and I believe that is something very important within informal education. . . . The difference [between our Citizen Science Program and others] is that we are looking continuously to make that connection and that the person grows that sense of ownership. Not with the project, but with all this that is called conservation. . . . So we are moving now, not to create dependency on a project like this, but so they can have their own tools to spread and disseminate and duplicate, so they can replicate this in many areas. [Conservation Trust staff]

REWARDING ASPECTS FOR PARTICIPANTS

Many interviewees said that the most rewarding aspect of the Citizen Science Program for participants is the knowledge they gain about the project topics and the scientific process. Several also mentioned the hands-on aspect of the Program, saying that the Program gives participants the opportunity to see and do scientific work (see the quotation below).

> When you practice the things, you have to say to them, 'Just by hearing it is not enough.' They have to practice it, see it, do it in person to understand what is being said. . . . For everyone the reward is to discover something that [they] didn't realize was there. [Researcher]

Another rewarding aspect of the Program, according to several interviewees, is that it gives participants an opportunity to cultivate an interest in science, citing the researchers' willingness to teach and re-teach concepts to participants as a key part of this process of discovery (see the quotation below). A few said that the most rewarding aspect of the Program is the increased awareness participants take away regarding the human impact on nature and the enthusiasm to preserve what is around them (see the second quotation).

> People think they are going to come just to listen. When the activity is over they say, or we hear them saying, 'Wow, we went to the forest and we saw that bird.' Or that they were able to do something with their hands, or they have a completely different vision because they thought the scientist was only going to talk to them or show them some slides, but no, they are not aware

that they are going to be in contact with nature or with the whole study, and are amazed so much that sometimes they don't want to leave. [Volunteer leader]

The knowledge they are acquiring in terms of how human beings' activit[ies] affect, in one way or another, our environment. They might not have thought about that before. They might have seen that some development was removing soil at Ciales, but they have not known that might affect the beach, or to see that some trees were cut, and that there were birds on those trees, they might not have been aware of how these things affect the environment. [Volunteer leader]

REWARDING ASPECTS FOR FACILITATORS

Most facilitators said the most rewarding aspect of the Citizen Science Program is the opportunity to continue learning on a personal level. These interviewees—mostly staff interpreters and volunteer leaders—said that the Program offers opportunities to learn how to teach people difficult concepts, work with volunteers, and take leadership roles (see the first quotation below). They also talked about having the opportunity to learn from the researchers they assist and applying that knowledge to their own scientific research (see the second quotation). Many also said that a rewarding aspect of the Program is the connection between facilitators and participants. Several of these interviewees spoke about the reactions participants have to the Program, including the joy and appreciation they have for the opportunity to participate, and a few spoke more specifically about the bond created between the scientific community and the larger community.

We have some staff that have not studied anything related to science and that exposure to science opens another field of possibilities. . . . [Volunteer] leaders are receiving training, the experience with the volunteers, with people, the direct work with the interpreters also. We support them in delivery, how they have to talk, all that. [Conservation Trust staff]

I studied the amphibians, but here are investigations that are done with crabs, with bats, with archeology and botany. Then one acquires knowledge, knowledge that is not going away, because I am [an] environmental interpreter, and I give many tours and information that I capture from there, then I can apply to my reflection. [Staff interpreter]

A few interviewees said the most rewarding aspect of the Program is the field help offered by participants, acknowledging that data collection would take longer without the participants (see the first quotation below). A few also enjoyed the opportunity to expose new people to science and bridge the knowledge gap that currently exists between the Conservation Trust, its researchers, and the people of the Rio Grande watershed. Additionally, interviewees liked seeing how repeat participants share their knowledge with others and are touched by the projects in which they participate (see the second quotation).

That is why participation has become so important because, let's take a study protocol. If it would have to be done only by the scientist and the interpreter they would be [spending] three or four weeks completing the protocol, when you can segregate the activities and share and have a group of people doing up to five different activities. That makes a huge difference because it would take a lot more time if those activities had to be done without the participants. It would take too much time. [Volunteer leader]

The response of the volunteers [has been the most personally rewarding part of the project]. It is incredible, incredible, when you touch them through the Program, you touch so many people and you don't realize how much. . . . All these unselfish people that are positively touched by the project, it is an experience I never thought I would have. [Conservation Trust staff]

CHALLENGES OF CITIZEN SCIENCE PROGRAM

Interviewees were also asked a series of questions about the challenges of the Citizen Science Program, starting with top-of-mind thoughts about the Program overall and then moving more specifically to the point of view of participants and facilitators. In some cases, similar challenges were addressed for different audiences and therefore may be discussed more than once. Additionally, some aspects that were seen as strengths of the Program were discussed as personally challenging for facilitators.

TOP-OF-MIND PROGRAM CHALLENGES

When asked about challenges they face in implementing the Citizen Science Program overall, several interviewees spoke about the large amount of paperwork that must be completed by participants before (consent forms) and after (assessment forms) the data collection as a challenge, both because it can affect the amount of time that remains for the activity and because the paperwork can become tedious for participants (see the first quotation below). A few also spoke about the logistics of managing a large number of project activities happening on any given day as a challenge (see the second quotation). Additionally, interviewees mentioned other logistical factors such as finding suitable locations for activities and maintaining the budget as challenges. A few interviewees spoke about the difficulties of recruitment, although they spoke about this generally.

> The paperwork [is a challenge]. I know that it is necessary, but it is tedious, because it involves too much, like giving the release of liability and all that. [Staff interpreter]

> The most challenging [aspect] so far is, in my experience, a matter of having the staff when you have five or six activities running at the same time on the same day. . . . Being able to work with all that is going on, [with] work happening in all areas at the same time, for me is the biggest challenge, because of the staff and obviously because you need to arrange the time. It is a matter of logistics, so that nothing will conflict, to have all the staff there when you need it. [Staff interpreter]

Several interviewees also talked about the challenges of working with untrained scientists who are participating in the Program voluntarily. For example, a few spoke about the time commitment required from participants, stating that the activities can be long. A few also spoke about the difficulty in identifying times to train staff interpreters and volunteer leaders how to use field equipment, which is necessary when working with untrained scientists in the field. Another challenge of working with volunteer participants during the field work is the lack of continuity of participation on each project, which means that researchers must repeat important details at each activity and plan a flexible program, as it can be difficult to know how much can be completed in a three-hour period (see the quotation below). Additionally, participants can be uncertain about using equipment, particularly if they are first-time participants.

> We [may] have a group with different interests that take all the time you have for the activity. As a volunteer, it is necessary to determine the types of activities that can be done in three hours, mainly. But due to the group's handicaps, because people come and are not duly prepared…they find it a bit difficult. . . . Some are very capable and enthusiastic and can do things, but when you have people in groups with different attitudes [toward the activity] among the group, then it is a bit more challenging. [Volunteer leader]

CHALLENGING ASPECTS FOR PARTICIPANTS

Many interviewees said that the most challenging aspect for participants is the knowledge gap that exists. In some cases, participants struggle to understand what the researchers are saying particularly when researchers use specific vocabulary and do not simplify their ideas (see the quotation below). In other cases, there is a knowledge gap among participants involved in a single activity. This is especially true of first-time participants who may be unsure of what to expect.

> Because this is science, it's really science, what happens is that it is done in a simple language and sometimes there are concepts that are complicated and then you have to teach them in an easier way, because there are sometimes people who have not studied science, so it's more difficult for them to understand. [Staff interpreter]

Several interviewees also talked about the struggle that participants face using equipment. According to these interviewees, participants are initially fearful of using the equipment, and there is not always sufficient time to train participants how to use all of the equipment (see the quotation below). Additionally, a few said that the physical terrain can pose a challenge to participants who may be unprepared for the hiking that is required to reach some activity sites.

> For participants, the lack of knowledge, although that has been taken care of with the workshops, but the instruments, for example the GPS, the instrument to measure pH in the river, the flow. . . the instruments in general [are] something more technical and young people sometimes find [learning about them] boring. . . . It is almost always the adults who do these tasks, but it is a challenge. We should continue offering these workshops so everyone can learn to use the GPS and the instruments. [Volunteer leader]

Overall, interviewees did address differences in experience that might exist between first-time participants and repeat participants, stating that repeat participants often felt more confident about what they are asked to do, whereas first-time participants are more hesitant. Additionally, one interviewee acknowledged that first-time and repeat participants come to the project for different reasons, and it is important to accommodate those differences when working with participants.

CHALLENGING ASPECTS FOR FACILITATORS

When asked about the most challenging aspects of the Program for facilitators including staff interpreters, volunteer leaders, and researchers, the responses fell into three broad categories: general program issues, differences in knowledge among participants, and learning the necessary skills and information to complete the job successfully.

Many interviewees talked about general program logistics as being personally challenging even though these same issues were seen as a strength of the overall Program, including time management, scheduling, and the number of people in each activity. Several—often volunteer leaders and staff interpreters—spoke about time management, specifically the challenge of balancing Program work with other professional and personal commitments (see the first quotation below). Additionally, a few talked about logistical concerns such as the scheduling of activities and the time required to prepare data collection materials prior to each activity (see the second quotation). One interviewee said that the uneven number of participants in each activity is a challenge that facilitators have to address each time because it can impact the amount of data that can be collected at a given activity.

> [The biggest challenge has been] time management, because there is a schedule for the interpreters, plus the [Citizen Science Program] activities. Often we find it a challenge to do an activity and then suddenly you get back and have to do another tour. [Staff interpreter]

> The preparation of activities, the materials, searching for the materials, that has always been a challenge that we have worked directly with the assistants and the scientists [to solve] and what they have done is that they are coming the day before and helping us leave everything ready, and the next day the interpreters just have to put up the materials [and] put them on the vehicle. [Conservation Trust staff]

Several interviewees also talked about the differences in knowledge among participants and how that can affect the project and activity. Not only do researchers have to re-state concepts to ensure all participants understand, but researchers must also address participants' prior knowledge (see the quotation below). Additionally, researchers have to ensure that the activities are interesting to a wide variety of participants who may be at different points in the citizen-science process.

> I think that sometimes [the researchers] have had trouble controlling some of the people that come with other habits from the get-go. In the bird activity, for example, you are not supposed to do phishing, imitating the sounds of birds, or use instruments that attract them, because the investigation is to count what you find within the perimeter and not to attract a thousand birds to your perimeter and then count them. So [the researchers] explain this once and again, but people continue disobeying. [Volunteer leader]

Several interviewees also talked about the challenge of finding time to learn new material and stay up-to-date on the information necessary to answer questions and provide support throughout the project. This encompassed both field-based learning and office-based learning about what works and what does not work in terms of managing the Program (see the quotation below). A few interviewees also talked about personal challenges, such as the fear of public speaking or frustration that they were unable to participate in more projects and activities.

> The greatest challenge continues to be learning how to do what I love most now. But the challenges are daily and different and very varied. That is why it is not tiring, because there is always a new different challenge, be it internal or external, there is always a different challenge. [Conservation Trust staff]

STRENGTHS AND CHALLENGES OF PROGRAM LOGISTICS

Interviewees were asked about the strengths and challenges of three specific logistical aspects of the Citizen Science Program: recruitment, registration and transportation. If interviewees did not have experience with one of the aspects, the interviewer moved on to the next question.

RECRUITMENT

Many interviewees had experience recruiting participants, either through the formal recruitment process or by more casually telling people about the Program. Interviewees who have been casually involved in recruitment talked about this experience in a positive, if general, way. They share the opportunity with interested people, but rarely run into challenges.

Formal recruiting has been more difficult. A few interviewees talked about the fact that recruitment has been uneven across the different projects and activities, and there is not a clear reason for this (see the first quotation below). One interviewee suggested that having a certain time by which participants have to confirm their registration may help, as interested participants on a waiting list would be able to register (see the second quotation).

> I think that in terms of recruitment, I don't think there is much fault in our part. . . . I don't know if [recruitment differences] have to do with logistic issues of the possible volunteers, but we have been having ads in radio and television and newspapers, but I do not know why I find that some activities, for example, in the bird activity, sometimes they have only two participants, sometimes none. The others almost always have more. [Volunteer leader]

> I believe that if people who sign up and have not confirmed participation by the next day, they should be dropped from enrollment. [The Trust] should make a process where the participant has to know that they have until a certain time to confirm, like they have 15 hours or the day before the activity to confirm, because a lot of people said they were coming, but they don't confirm and then, from an enrollment of 12 people, we ended up with only two, because then people that were willing to participate but didn't enroll on time are left out, when they could have participated had we had confirmations. [Researcher]

Interviewees identified a few challenges with the recruitment process. First, they said it is difficult to follow up and remind people of the Program because reaching people via phone or having them reply to an e-mail does not always work. Additionally, the Conservation Trust is interested in recruiting core participants from a narrow set of parameters and this makes it more difficult to find interested people who also meet the needs of the Program (see the first quotation below). Finally, one interviewee talked about the challenge of recruiting people to activities that take place at set (and sometimes inconvenient) times. This interviewee felt that the Conservation Trust might be able to recruit more participants if there was the flexibility to schedule activities at times when participants are most available (see the second quotation).

> In this case, the challenge has been greater [than the last Citizen Science project] because we have a very specific goal. Since we want to create a group of core volunteers that go through the stages of contributor, collaborator, and cooperator, and that come from the watershed, from the lower part of the watershed, it is more specific. . . . That is more difficult than before. [Conservation Trust staff]

> For me the biggest challenge [of recruitment] is a matter of the availability of activities for the availability of participants. . . . One goal is to engage the person the first time you call them, to book them and then many times the reality is that, no, that doesn't work out. The approach should not be, 'I have an activity on Saturday, want to come?' It should be more like, 'When can you come?' [Staff interpreter]

REGISTRATION

Most interviewees had experience with either the initial registration of participants or the onsite registration process that takes place at each activity.

As mentioned earlier as a challenge of the Citizen Science Program, many interviewees talked about the paperwork that participants need to fill out during the onsite registration process. Several of these interviewees said that there was too much paperwork required, although several also said that there was time built in to the schedule for participants to fill out paperwork at the beginning and end of each session (see the quotation below).

> The day of the activity, the interpreter that has been assigned is in charge of registering or taking attendance of the participants. From that point of view, we have not faced that much of a challenge, but the challenge is when we have to provide the assent and consent forms because it

takes too much time. The process gets a bit more complicated because the participants take more time. [Conservation Trust staff]

Aside from the paperwork, interviewees also talked about the difficulty of confirming participants and how to handle participants who do not arrive at the designated time. This makes it challenging to know how many participants will be attending each activity. One way volunteer leaders have tried to address this problem is by calling confirmed attendees if they do not arrive at the designated time (see the two quotations below).

> People are very interested. [However,] what happens is that in the end, many people do not confirm and therefore they don't go to the activities. Today, I was running one of the Program's activities and had about nine people in the system, but only one of the nine confirmed, so that makes it hard. [Staff interpreter]

> Basically what we do, what I do, is that when I arrive to the activity I make sure that the people that were registered are there and if they are not, we give them a call to see if they are coming. [Volunteer leader]

Other interviewees offered idiosyncratic thoughts about registration, such as the fluctuation in registered participants between the summer and fall months and that sometimes parents bring children who do not meet the age requirement for participation.

TRANSPORTATION

The majority of interviewees felt that transportation was working well, both onsite and offsite. A few interviewees did identify challenges with the current transportation arrangement. Firstly, since participants meet at an offsite location and then caravan to the activity site, it is difficult to accommodate participants who arrive late, and at some activity sites, parking is not always sufficient for the number of cars present. Secondly, for staff interpreters and volunteer leaders who meet at Hacienda La Esperanza before heading to the offsite meeting site, travel might not be done in the most efficient way.

DESIRED EFFECTS OF THE PROGRAM ON PARTICIPANTS

Overall, when asked about the desired effects of the Program on participants, interviewees provided responses that closely resembled perceived rewards to participants. Most interviewees said that the desired effect of the Program is that participants learn about science and, particularly, that they learn science can happen outside a lab in an informal environment. These interviewees also talked about the desire for participants to learn research techniques and get involved in the research process (see the first two quotations below). Several interviewees also talked about the desire for local participants to continue in the Program (see the third quotation). Additionally, a few talked about the desire to have citizens take community ownership of the project. This idea was separate from the idea of repeat participation. Rather, it stemmed from the idea of people becoming guardians of their communities (see the fourth quotation).

> Well, [the participant impact is] knowledge, for them to know the investigations and, if some of them turn into a core participant, well excellent. . . . I would love that when this cycle of Citizen Science ends, we can say we have scientist assistants as scientists and core participants running research and for them to have results for their hypothesis. I hope not only one, two, or three, but a bunch. [Volunteer leader]

> We are going to impact the way they are encouraged to get involved in research and take over. Obviously you motivate them and develop parallel investigations with the scientists and everything else. [Staff interpreter]

> In practical terms, I imagine [the desired effect] is for the person to continue attending, and there [have] been moments that it has been informally expressed that there are people that are repeating as participants and that is stimulating, no? I think that impact has been already felt in the sense that people are being motivated to continue participating and visit all the sites and get more involved. [Researcher]

> [The Trust tries] to involve people from the same community so they turn into the guardians of the community. It's curious to see that the people that are participating are not from the area. It would be ideal if people from the area could be identified to participate and learn and understand the significance, the scope of the project. I think that would be beneficial for future generations. [Volunteer leader]

ACTIVITIES' ABILITY TO ACHIEVE IMPACT

Most interviewees believe that, in general, the activities are well-aligned with achieving the impacts described above. When asked to articulate the ways in which the activities were well-aligned, two main ideas came through: the ability to make changes as the projects progressed, and the knowledge gain that takes place through participation.

Several interviewees spoke about the fact that Trust staff and researchers work to make adjustments to the activities to ensure that people make a personal connection with the project. Also, a few talked about the "open forum" that researchers try to put in place so that participants feel comfortable sharing their ideas and asking questions (see the first quotation below). Additionally, one interviewee mentioned that researchers make sure that each participant has a hands-on experience, rather than simply watching the activity unfold (see the second quotation). Several interviewees also spoke about the fact that participants gain knowledge as they participate and this can allow participants to take ownership of the project. As participants become more involved in the project, they also have the knowledge and opportunity to work with newer participants and share their knowledge.

> We always tell participants that if they have any preoccupation, if they have any question regarding one of the investigations, to say, not to keep that information for themselves. . . . We always tell them that if they have any doubt to share them, not to keep doubts or questions to themselves. [Volunteer leader]

> If what we want is for participants to evolve, our second goal, and go through the three stages, it is important for us to make sure that the activities are designed to allow their participation and that they learn what they are supposed to learn. . . . We can't pretend that a participant evolves if he or she is coming to activities just to look. No, he or she has to pick up the GPS, write the data, know how the samples are stored, how the information is filed, take notes, know what the data mean, why are they taken? [Conservation Trust staff]

SUGGESTIONS FOR PROGRAM IMPROVEMENT

Very few interviewees felt that any aspects of the activities are not well-aligned to achieving the desired impacts; however, they did offer suggestions for improvement. These suggestions varied widely. For example, a few interviewees suggested that researchers and assistants meet periodically and assess the individual projects together, to ensure that all of the projects are working to achieve the Program goals.

This meeting also would provide an opportunity to share experiences and learn from each other (see the first quotation below). One interviewee suggested a comprehensive seminar for participants that allows them to understand how the projects work together to achieve greater impact (see the second quotation). One interviewee suggested limiting the number of activities offered each day to decrease the amount of competition between activities and projects.

> Another element that we found interesting was that we can meet with all of the researchers and possibly their assistants to exchange experiences because they can identify things or techniques that have proven effective for some and that others might not know of. [Researcher]

> If there could be a comprehensive seminar given to all the participants of the difference disciplines, some sort of workshop to show how the different studies will mix at the end and contribute to a common purpose, [that would be helpful]. We are watching shrimps at the river, perfect, but what does this shrimp have to do with the lizards hiding in the forest? How do I connect both? How do we explain the particular purposes of each investigation? It would be good to see at the end of the road how all of them got to be interrelated. [Volunteer leader]

APPENDICES

APPENDIX A: OBSERVATION GUIDE

Removed for proprietary purposes.

APPENDIX B: SHORT-ANSWER INTERVIEW GUIDE

Removed for proprietary purposes.

APPENDIX C: IN-DEPTH INTERVIEW GUIDE

Removed for proprietary purposes.