

Ensuring data integrity and user retention within BANDIT

by

Brandon Turner

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Approved by: \_\_\_\_\_

[Greg Walsh, Thesis Advisor]

\_\_\_\_\_  
[Bridget Blodget, Committee Member]

## Abstract

Data collection is a vital service completed by the government to help ensure accuracy on a range of issues. Currently the Bird Banding Lab (BBL) is tasked with the collection of bird migratory data across North America. Data collection by the BBL is vital to the continued implementation of policies and regulations that affect far reaching sectors such as the environment, economy, and healthcare. In order to collect data sets of the magnitude that the BBL is mandated to do a large-scale citizen science program has been created, by crowdsourcing data from a large group of users who voluntarily submit data. While crowdsourcing has been proven to be a powerful tool it does not come without its own set of issues, in particular keeping participants engaged and keeping data accurate. This paper uses user research to examine the issues plaguing the BANDIT system and attempts to provide solutions on how the organization should address these issues.

## Acknowledgments

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This paper is also dedicated to my parents Barbara Lawhorn and Nathree Turner whose unwavering support has allowed me to excel in this program. Finally, a special shout-out also to my cat Bruce and dog Madison who help provide me with a smile day after day.

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## Chapter 1: Introduction

In 1902 Dr. Paul Bartsch of the Smithsonian Institute began placing small bands on birds in an effort to learn more about the species. The bands would be collected from others to help track the migratory patterns, and to better understand the behaviors of birds. This practice grew with more and more scientist joining in until 1909 when the American Bird Banding Association was formed (Houston, 2008). By the early 1920's both the United States and Canada had setup federal bird banding programs replacing the previous bird banding organizations and allowing for a centralized collection of data (Houston, 2008). The data collected by these organizations helped the government keep track of behaviors, migration and even toxicology and disease research. The foundation for collecting such data was a process called crowdsourcing. Crowdsourcing as a method of data collection is not new, and in fact can be traced as far back as the early 1700's. In 1714 the British Government offered a prize to whoever could help them develop a way to compute longitudinal data, and later in the 1800's, the Oxford English dictionary relied on feedback from over 800 readers to catalog words (Chrum, 2017).

The purpose of crowdsourcing varies from task to task, but the overarching theme has been to help use the knowledge of a larger group to collect information. Scientist in particular have taken advantage of crowdsourcing as a tool for large projects requiring citizen science. Oxford defines "citizen science" as the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with scientist (Oxford, 2018). Historically, citizen science has been

popular with ecological and environmental scientist as it allows for large-scale low-cost data collection from a diverse group, being used for projects such as plant and animal identification and migration. In fact, Cohn (2008), points out that many large-scale research programs would be impossible without the incorporation of citizen volunteers. The effectiveness of citizen science programs has been proven over the years. Kosmala (2016) discusses in her study how effective the use of citizen science programs can be, stating that the quality of data collection via citizen volunteers can in cases be higher or on par with data collected by professionals.

The Bird Banding Laboratory (BBL) is an integrated scientific program established in 1920 supporting the collection, archiving, management and dissemination of information from banded and marked birds in North America (Bird Banding Laboratory Patuxent Wildlife Research Center). Currently the Bird Band Lab is experiencing issues with data integrity, and user retention in the bird banding program. The system, which up until recently relied on paper reports, has moved online and with that user frustrations have peaked. Frustrated users have moved to individualized shadow systems to collect data, creating issues surrounding data integrity. Many users have also stopped reporting data in timely manners causing massive backlogs of missing and mismatched data. Although several updated versions of the software have been released, Bird Banding Lab staff have continued to report that frustrations among users remain high. Due to these issues the Bird Banding Lab has decided that they will be upgrading

BANDIT again but have requested that research looking into the usability of the software be done first in an effort to ease users' stress.

This paper looks at the bird banding program and its software BANDIT, to examine how the system is currently meeting and failing to meet the needs of users called banders. Through research, this paper aims to help the Bird Banding Lab address current concerns along with make user friendly improvements to the software to help retain users, and shorten time needed to enter data.

## Chapter 2: Literature Review

### **Introduction**

As internet usage has continued to grow in the United States (Pew, 2018) researchers have begun to explore new innovative ways to encourage citizens to participate in citizen science programs. Gamification and Peer to Peer engagement have become popular methods for crowdsourcing due to their list of potential benefits. As their use as tools for crowdsourcing continues to increase there are concerns of what drawbacks may come with these techniques such as data integrity or continued user engagement. Although concerns exist both of these methods have remained popular showing with developers. Instead of moving away from these tools developers and researchers have been working to understand these issues and make necessary changes to mitigate their effect on future projects.

### **Gamification**

Gamification according to Oxford Dictionary is the application of game like elements to other areas of activity (Oxford, 2018). The process is typically used to help incentivize certain behaviors by users and disincentivize others using a rewards-based system. Currently many of the world's most popular applications are using some form of gamification crowdsourcing, applications such as Waze where users are rewarded with badges and pins for reporting traffic advisories incentivizing them to participate. The rewards given out within the app have no monetary value in the real life however they help add a layer of playfulness and competitiveness for users. The application works by

collecting data from a large group of users on traffic patterns (Google, 2018). It then turns that information around to give users the fastest route to their destination. Since traffic patterns can be fast changing Waze incorporates an additional feature that allows users to report real-time updates for traffic causing events such as accidents, potholes, and construction (Google, 2018).

Based on preliminary studies the use of gamification correlates with a rise in user engagement, however this positive can be offset by incorrect data (Hamari, et al., 2014). Feng discusses this as part of his research (Feng, et al., 2018) where he found that factors such as self-presentation, self-efficacy, and playfulness all result in positive growth of user participation. Instead of providing a monetary value his studies showed that users can be incentivize with leadership boards, or other monikers that display their value to others within the application.

The use of gamification has been found to be pivotal in the engagement of millennials specifically for crowdsourcing (Bowser, et al., 2013; ) (Newman, et al., 2012). A 2013 study found that by using gamification enthusiasm among millennials increased for citizen science applications (Bowser, et al., 2013). This study also found similar results of Feng (Feng, et al., 2018) that user interest in the project or data collection was key to retention. An interesting additional find that Bowser points out is that an easy way to gain interest in users is to make the project they are working on easy to understand. For example, in her study that looked at gamification of a citizen science program that focused on collecting data of plant types, students recommended that she

instead use simpler language to describe the species or genus of the plants instead of their scientific names. The importance of using the simpler language is that it helps users more easily understand the language within the app, and in theory better understand the purpose of the project.

Since gamification involves giving rewards for certain behaviors, users are often inadvertently incentivized to cheat the system by exhibiting said behavior even when it may be incorrect. For example, a gamified citizen science project that focuses on bird species collection that rewards users for entering data on certain types may inadvertently encourage users to enter incorrect false information in an effort to collect additional rewards, thus creating issues of data integrity. Unwanted effects such as this can be mitigated through means such as recruitment of purpose driven participants, in fact a study found that data usefulness wasn't affected when user population was decreased to include more passionate users (Marchionda, 2018). Feng found that self-efficacy and self-presentation are two of the most prominent causes of the positive effects of gamification techniques (Feng, Ye, Yu, Yang, & Cui 2018). This means that users are motivated by not only the points and reward systems implemented via gamification, but also by the self-gratification they receive by assisting with a project that they feel to be important.

Along with recruiting a quality group of participants, developers can also disincentivize cheating through the gaming experience (Newell, 2017). Prestopnik (2017) described how developers have explored the possibilities of penalizing players who enter incorrect data as a way to discourage such behavior amongst users. Tactics such as this can

incentivize users to be more careful and attentive when entering data, however the study does point out that some data entry can be complicated and due to such have a natural high rate of entry errors (Prestopnik, Crowston, & Wang, 2017). Prestopnik (2017) recommends that developers examine their own projects individually to determine whether this method of disincentivizing users would work with their target population.

The Bird Banding Lab could integrate any of the above forms of gamification for an increased participant engagement and satisfaction of the project. Since the project revolves around bird data collection a reward system that consist of points or a monetary value could be set up to incentivize users to collect required data. The project could also look into simplifying terms and increasing visuals cues so that users are better able to gage their progress in data collection.

### **Social Media**

Social media was used by an estimated 2.6 billion individuals in 2018, which is an increase from 1.9 billion in 2014 (Statista, 2017) as a way for users to interact with others. With the usage of social media so high researchers have begun looking into ways it can be used for crowdsourcing or citizen science programs.

Social media is able to engage users in a unique way for crowdsourcing and unlike gamification the incentive in providing data through this method is that other users have access to it. Studies have shown that finding users who are passionate about topics that correlate with the data being collected is incentive enough for many users to participate. In example, a study found that a group of photographers when asked to

crowdsource photos were eager to participate with the only incentive being that their work would be seen by others in the industry (Micholia, et al., 2017).

Social media has proven to be a powerful tool in retention, for example a study found that using social media led to a 100% retention rate for high risk HIV patients for at least 6-months of care (Tanner, et al., 2016). A different study into the retention of secondary mathematics teacher found a similar result that social media played a major role in the consistent engagement and increased retention amongst teachers who used a social media support group (Oliver, 2016).

With the rise in social media access via smartphones (Statista, 2016) government officials have been working to better monitor activities that up until now would be hard to track such as crime and natural disasters. In 1996 Baltimore became the first city to pilot a new federal non-emergency service called 311. The number which allowed city residents to call in and report non-emergency issues became an instant success by using crowdsourcing to find and fix day-to-day problems in the city. Fast forward to today and that same system has continued to grow and spread nationwide thanks to innovations such as the creation of a mobile application. Applications such as Baltimore's 311 allow users to interact with each other and with city personnel to report non-emergency services to the proper authorities (Goodyear, 2015). Additionally, the application has added a function that allows users to see reports others in their area have made to get a better view of issues in their communities. Similarly, the application Next Door has taken the concept of 311 further by allowing communities to crowdsource data and discuss topics

of crime, safety, traffic, events and more with community members and government officials (Popper, 2016). Cities have also begun looking to social media crowdsourcing to detect emergency events, China for example has established a new system that relies significantly on information gathered via social media to detect unexpected emergency situations (Meena & Shanthi, 2017). The system is used to both detect the event along with to dispatch services. They have been able to do this by taking advantage of a combination of conscious and unconscious decisions (Meena & Shanthi, 2017). In this case the conscious data being surrendered by users is messages sent via social media applications while the subconscious is the metadata that is embedded within these messages such as time and location.

The importance of incorporating social media into an application such as BANDIT are increased retention, data collection and shared knowledge. Allowing users to communicate with each other can help users gain additional knowledge about the project or organization without having to create new content. Users can use their shared knowledge for troubleshooting and through comradery can even encourage retention in crowdsourced projects. All of these benefits also come at a minimal cost to the organization as many social media channels already exist and can be incorporated into specialized projects for free.

### **Conclusion**

Organizations such as the Bird Banding Lab stand to benefit immensely from the proper engagement of gamification and social media crowdsourcing techniques. For

example, currently the program has implemented a gamification technique of incentivizing bird capture data entry with reward tags that can be exchanged for a monetary value. This program has proven to be successful for engaging users and based off the data outlined in this review it seems that program could be expanded without adding much cost. Instead the BBL could add additional bands that could be used as a point/reward system instead with some monetary prizes for high point banders.

The Bird Banding Lab benefits by having a motivated group of bird banders who personally know the importance of their work. Unlike many crowdsourcing projects, banders are more likely to be employed, or take leisure in environmental activities, and conservation. Newel (2017) points out that a group who is more engaged in the subject of the data collection is the more likely to present accurate data, by implementing peer level encouragement the BBL could encourage their users to not only submit more accurate data but to also rely on each other more for troubleshooting support alleviating stress for both users and the organization.

It is clear from research that both gamification and social media serve as powerful tools for enhancing crowdsourcing efforts. Gamification has the benefit of engaging a wider set of users and keeping their attention, while social media has the ability to help with retention among users along with a lower overhead cost. It is important to note that although these tools are useful they still require developers to create content that can bring in a highly engaged audience. As mentioned previously a large audience is not always best for crowdsourcing and may lead to wasted resources. A smaller more

engaged crowd can help save developers resources and maintains the accuracy of data being collected. To ensure that a more engaged crowd is used, developers should identify stakeholders in the data they are researching and target them directly. Developers should also look at how to allow users to interact and provide data with the greatest ease of use possible. This will allow engaged users to be able to easily understand and navigate through the application.

By engaging in these techniques correctly the BBL can grow participants in the bird banding program while maintaining the integrity of the data collected. The engaging of gamification and social media to increase important factors such project awareness, user interactions, and ease of use can help create a much smoother user experience. It is important that while engaging in these new methods of crowdsourcing that developers keep in mind the drawbacks to all changes and make the necessary adjustments to minimize their effect on the overall project.

### Chapter 3: Methods

For the purpose of this research it was decided to solicit feedback from two groups for the purpose of learning how to increase participation and data integrity within BANDIT. The first group would be banders, individuals who band birds and are typically not employed by the Bird Banding Lab, the second group would be the Bird Banding Lab staff. I thought that by interviewing both sides I could better understand the issues with the system and take a more holistic approach to implementing changes and fixing issues. The goal of this research would be to better identify how to better engage users and to increase data integrity.

#### **Bander Survey**

To better understand the needs of banders and how to best help boost user participation and data accuracy it was decided that a survey would be conducted. The survey would consist of questions relating to the experience of the user, along with questions pertinent to design implications such as “Which operating system do you use?” and “How frequently do you have internet access during banding season?”. To gather as diverse of a sample as possible it was decided that the opportunity to complete the survey would be extended to all 1500+ bird banders across the United States and Canada with the hopes of minimizing any bias (Banerjee & Chaudhury, 2010) . Due to the high volume of expected participants it was decided that an online surveying tool would be used. Qualtrics an online survey and data analytics tool was selected due to its easier to use interface, and comprehensive analytics.

Questions for the survey were developed by interviewing a team of staff in various roles at the Bird Banding Lab. The interviews took place over the course of two days and included five staff members from various roles including, Director, Biologist, and IT Specialist. During these interviews respondents were asked on the specifics of how BANDIT worked, and not about their personal experience using BANDIT.

Questions were also based on feedback gathered in a project completed by the University of Baltimore's Spring 2018 Research and Methods Class. The class had previously worked with the BBL to determine some preliminary points of focus for any redesign and had provided the staff with reports of their findings. Using these reports, I was able to determine some additional questions and answer selections that should be focused on. The goal was to gather what responses users were most likely to give and be able to pre-code those questions with appropriate answer selections. The survey aimed to take no longer than 15 minutes for banders to complete, to accomplish this I worked with the BBL to simplify language and to strike questions deemed unnecessary to design implications from the survey. Rating scales were introduced to the survey to help better gauge user feedback, to keep responses balanced each rating question contained two positive response options, two negative response options and a neutral option.

Prior to my engagement with this project it had been determined that to increase accessibility the new redesign of the software would be web-based. To account for design implications this change would have additional questions surrounding compatibility concerns were added such as; "What is your preferred internet browser?" and "How

frequently do you have access to the internet during banding season?”. Questions surrounding specific features were added to help understand what was working for banders. This was done to prevent creating increase frustrations for users, if a feature was shown to be popular and useful that would affect how it would be incorporated into the new design. To better expedite participants through the survey logic patterns were introduced to certain questions allowing users to bypass questions that wouldn't pertain to them, such as questions relating to features they didn't use. The logic also helped prevent us from receiving feedback on certain application features that specific users were not using and therefore tainting our data pool. Lastly, it was decided to include a question about the participants permit number, these questions were added to ensure all participants were in fact authorized to use the survey. Additionally, since permit numbers are determined by geography and seniority banding birds this information could be used in the case additional responses would be needed from a specific subgroup of the target population. In the end 64 questions were selected to be used for the survey.

The survey was promoted prior to release through email communications announcing the survey and its intended goal sent to all banders. Due to a University of Baltimore spring 2018 Mearch and Methods class collaboration with the Bird Banding Lab many banders had already been put on alert that the lab was soliciting feedback for the redesign of the software. The survey officially opened up to participants on October 1st 2018 and officially closed on November 4th, 2018 allowing participants a little over a month to participate. Participants were notified of the survey through an email sent out to

all banders, along with a post to the Bird Banding Lab websites. Participation in the survey was high from the very beginning with 172 responses in the first day alone, by the end of the first week the survey had already received 281 responses. After the initial rollout of the survey participation began to gradually slow, with responses averaging around 40 per day. To ensure continued participation a second email was sent out, banders were also encouraged to spread the word about the survey via word of mouth. A bird banding conference occurred during the survey window and a representative from the Bird Banding Lab was able to make an additional request for participation from banders in-person.

To minimize the amount of coding of qualitative data needed to be done survey answers were altered slightly to account for high frequency answers that may not have been included. The best example was Q9 “Which internet browser do you most frequently use?” originally there were 5 answer choices along with a other (write-in) option. After the first day of the survey was open to the public I was able to go through look at what write-ins had been entered and quickly noticed that the popular Mac OS browser Safari had been entered several times due to being left out of the answer choices. I was able to go in to the survey immediately and add the option to prevent additional participants from having to write-in their option. Data from the survey was exported at least twice a week to check for any areas of concerns, along with to start the long task of coding qualitative entries.

Survey participants were sent a notification that the survey would close at the end of the month, however due to the month ending on a Wednesday we decided to extend it until the end of the week and instead closed it on November 4th, 2018. Although the survey was closed to new participants officially on November 4th participants who were currently in the survey were allowed to finish.

### **Bird Banding Lab Staff Interviews**

The creation and execution of the Bird Banding Lab staff interviews occurred simultaneously with the banders online survey. To prepare for the interviews a set of questions were drafted in partnership with Jennifer Malpass, a biologist at the BBL. The goal of the interviews was to understand the BANDIT experience from the point of view of the staff. The questions developed asked a series of questions about their experience with BANDIT specifically from their roles within the organization. The final list of interview questions contained demographic questions about participants, questions about concerns with the software and goal-oriented questions such as “What do you think BANDIT should accomplish for the BBL?” and “How would you measure success in BANDIT?”. It was agreed that in an effort to get as honest feedback as possible names of participants would not be tied to their answers in the final report. To ensure that the interviews wouldn't take longer than 20 minutes the number questions were trimmed down to 14. Selection of which questions would make the final list were determined through meetings with leadership at the Bird Banding Lab and myself.

Some members of the staff at the BBL also worked as banders on separate projects giving these select individuals a very unique perspective. To capture this perspective an additional six questions were added to the end of the survey. These questions were only asked to staff who also reported being bird banders. These additional questions essentially sought to see if experienced professional staff were experiencing the same frustrations as users, and if so were they troubleshooting their problems in a similar manner as regular users.

Once the final list of questions was agreed upon by leadership at the Bird Banding Lab, interviews were scheduled. Interviews occurred over several days in 15 to 20 minute blocks. Participants were asked what time they would like to be interviewed and were scheduled in time slots based off of their choice. In-person interviews began on October 2nd, 2018 and continued until October 4th, 2018. Additionally, two members of the Bird Banding Office, which is the sister agency of the Bird Banding Lab located in Canada completed over the phone interviews. All responses were recorded in Microsoft Word documents and labeled according to participants last name. Once all interviews were completed a written summary report of the interviews was compiled.

Chapter 4: Results

User Surveys

The BANDIT user survey was closed on November 4th, 2018 with 594 responses logged. The survey found that 84% of participants reported using BANDIT themselves while the other 16% reported they did not use the software personally. 91% of respondents reported banding birds in only one country, either the United States or Canada. Survey participants ranged in age but skewed older with 43% reporting being 55+ and 34% being 38-54 seen in Figure 1.

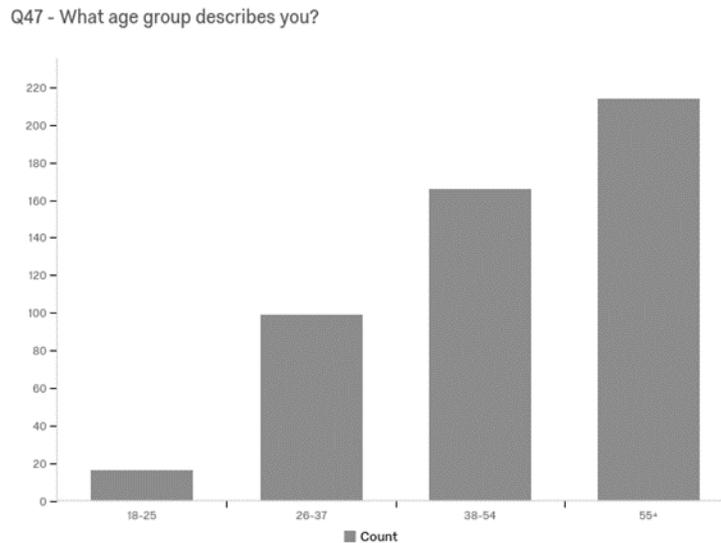


Figure 1. Age distribution

Participants also reported that Google Chrome was by far their most commonly used internet browser with 48% of respondents saying this was their preferred browser of choice. 80% of participants also reported having daily access to internet during the banding season. 70% of users reported submitting data to more than one citizen science program. Experience using BANDIT was skewed towards more advanced users with 310

(64%) respondents stating that they had 5 years or more experience using the software. Only 7% of participants reported using a mobile device currently to submit data. 73% of participants reported using BANDIT solely for the purpose of data submission.

User satisfaction with BANDIT was found to be mixed as seen in Figure 2 with 48.66% of respondents reporting the overall satisfaction to be good or excellent, while another 38.43% reported their satisfaction level to be fair or poor. User satisfaction correlated with experience using the software with users reporting having five or more years of experience with BANDIT having a slightly more positive perspective of the software at 58.90%, shown in Figure 3. Less experience with the software also correlated with a more negative overall experience with the software with only 28.13% of users reporting a good or excellent satisfaction when experience was only between 1 and 3 years. 60% users reported using BANDIT v4 the latest edition of the software, 10% reported using v3 and 20% reported not knowing which version they were using. Users who reported using version 3 of BANDIT had the highest overall satisfaction shown in Figure 4 with the software with 63.2% of respondents reporting positive satisfaction with the software.

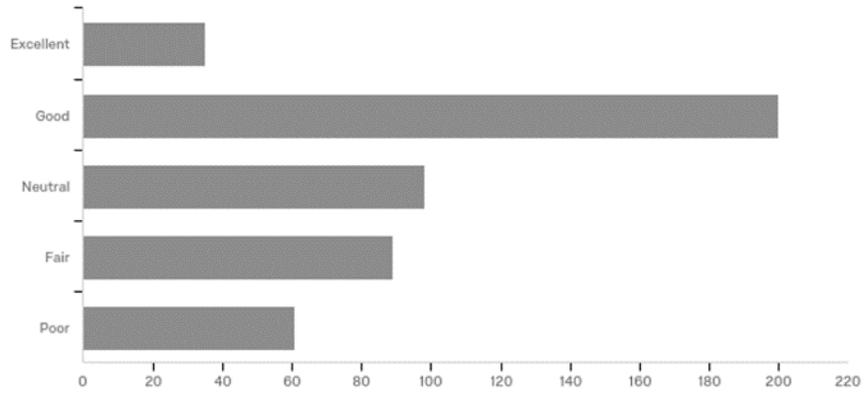


Figure 2. Overall user satisfaction

Q45 - How would you rate the BANDIT software as a tool to submit required data to...

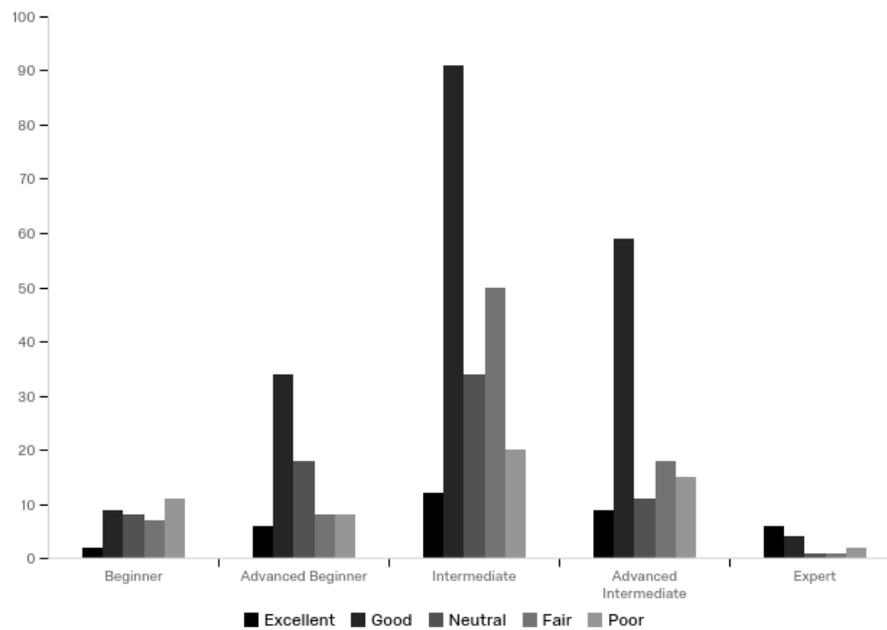


Figure 3. Satisfaction when broken down by experience

Q10 - What version of BANDIT is currently being used to submit data for your perm...

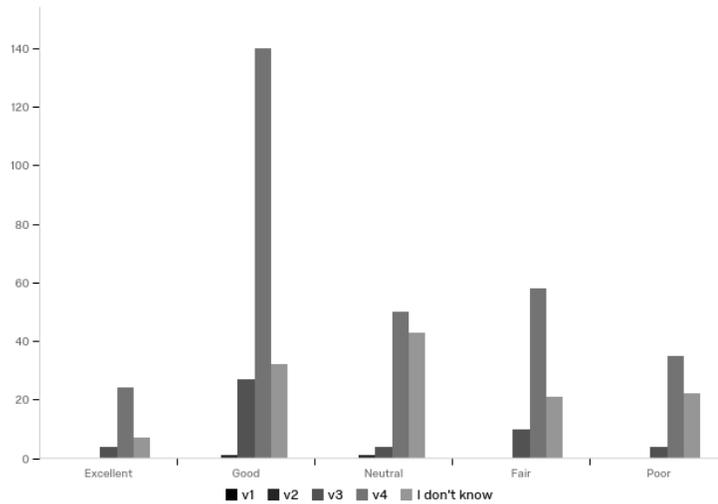


Figure 4. User satisfaction broken down by version of software

Questions on user issues revealed that invalid “Age/Sex unlikely on date” an error that is caused by user data not fitting within preset parameters set by the lab was the most common encountered error for participants with 48.9% of responding choosing this option, followed by “invalid status type vs marker” with 21% seen in Figure 5. Most common errors of Age/Sex were consistent regardless of version of BANDIT participant was running as seen in Figure 6.

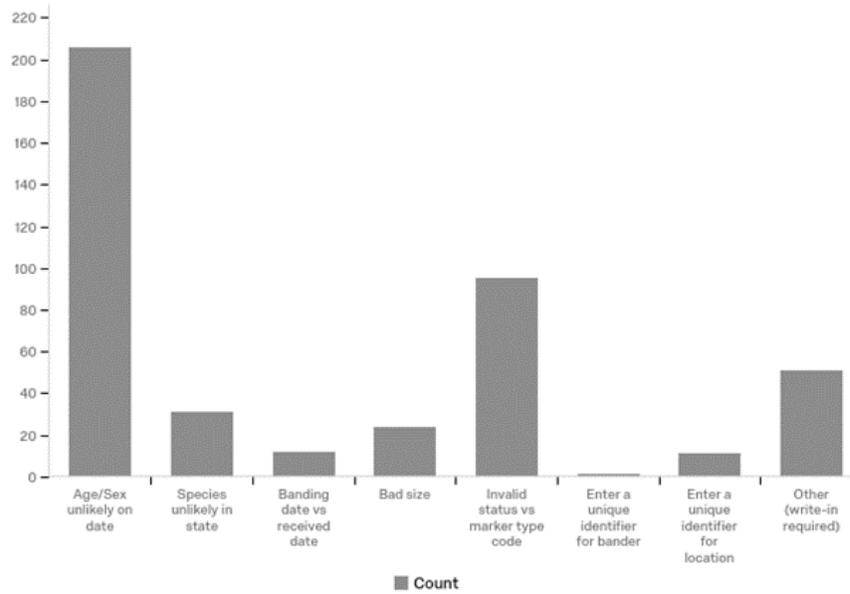


Figure 5. Most common errors in BANDIT

Q23 - Which error message do you most commonly encounter when entering or submitt...

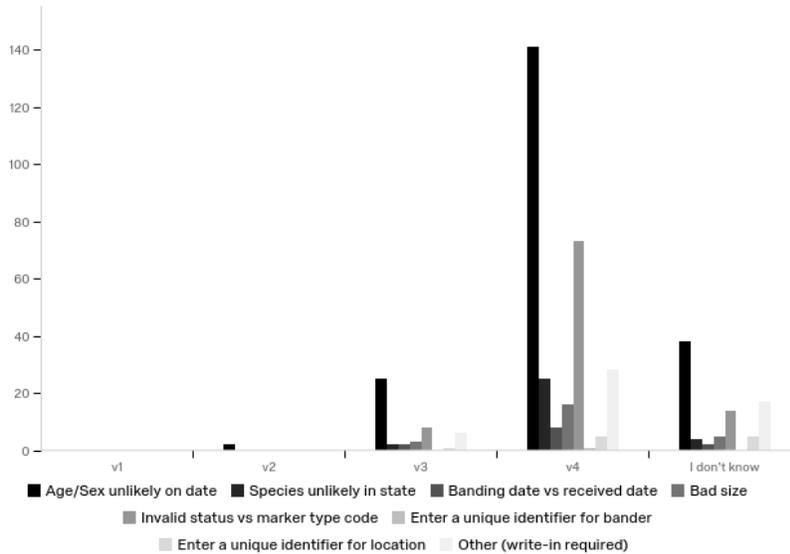


Figure 6. Most common errors in BANDIT by version

Questions about additional features found auxiliary markers were used by 64% of participants and that use of markers correlated with a 13% less positive view of the software than those participants who did not use auxiliary markers as shown in Figure 7. This negative skew on satisfaction was true no matter which auxiliary marker(s) participants reported using shown in figure 8. Issues with auxiliary markers were also frequently mentioned in the write-in feedback portion of the survey. Microsoft Excel usage seemed to be correlated with how many birds participants banded annually with usage around 5% for users with the lowest amount of birds and around 70% for users with the highest amount (3000+). Of the banders who used excel to upload data only 30% of them reported using the official template provided by the lab. Use of Microsoft Excel correlated with a slightly lower user satisfaction with BANDIT lowering the reported positive experience with BANDIT by 5%. 72% of banders reported collecting additional fields beyond the required fields by BBL. Figure 9 shows how fields collected varied greatly with wing length, tail length, fat composition, and weight being the most popular additional fields.

Q45 - How would you rate the BANDIT software as a tool to submit required data to...

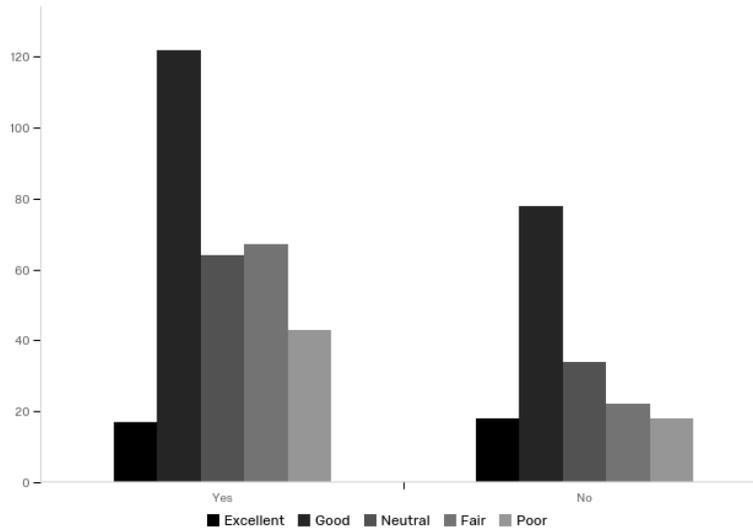


Figure 7. User Satisfaction of BANDIT broken down by use of auxiliary markers

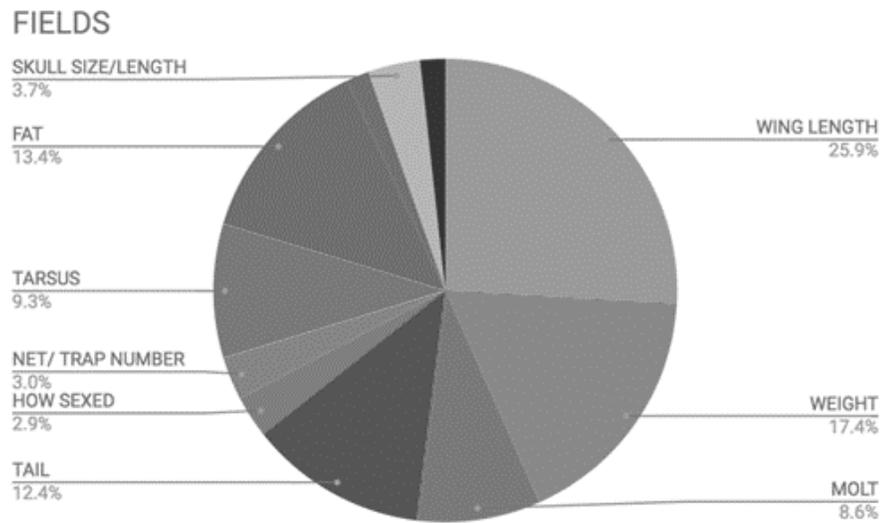


Figure 8. User defined fields

Q45 - How would you rate the BANDIT software as a tool to submit required data to...

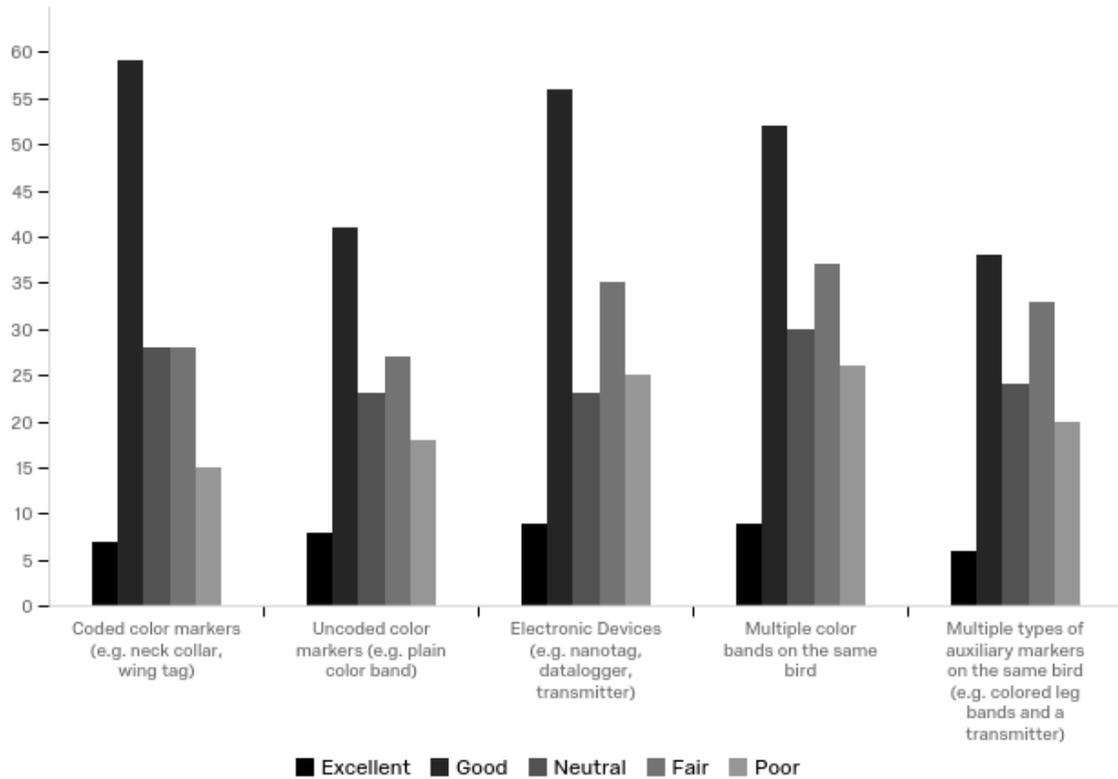


Figure 9. Satisfaction broken down by auxiliary marker used

Write-in responses about how to make BANDIT better revealed that fixing errors was the biggest concern accounting for 56% of responses, of these responses “age/sex” errors account for 36% of that feedback, while errors with the excel template accounted for another 30%. Simplifying the interface and creating a more intuitive experience was the second largest recommendation with 20% of participants stating this in write-in feedback. Request for the application to be web-based was 9% of feedback, while issues with compatibility accounted for another 8% of responses. Users requesting features that already existed within the application also accounted for 10% of the responses.

### **Staff Interviews**

Staff Interviews occurred over several days and included 11 interviews. Roles of participants included a (1) help desk manager, a (1) contract specialist, an (1) IT specialist, a (1) supply tech, six (6) biologists, and the (1) director of the BBL. Only three of these participants also reported being bird banders in addition to being staff. The breakdown of the staff can be seen in Table 1. Results from the interviews found that the goal of the organization was clear with all respondents stating that the purpose of BANDIT was to provide “clean” data for the BBL. This seemed to line up with the staff perceptions of banders goal when using BANDIT Staff members frustrations with banders varied by role, however it was a frequent theme that banders did not read/ follow instructions thoroughly and relied on support of staff to heavily.

Table 1

*Staff member roles*

<b>User</b>	<b>Role</b>	<b>Country</b>	<b>Bands Birds</b>
<i>Staff Member 1</i>	<i>Biologist</i>	<i>Canada</i>	<i>No</i>
<i>Staff Member 2</i>	<i>Biologist</i>	<i>Canada</i>	<i>No</i>
<i>Staff Member 3</i>	<i>Biologist</i>	<i>USA</i>	<i>No</i>
<i>Staff Member 4</i>	<i>Biologist</i>	<i>USA</i>	<i>No</i>
<i>Staff Member 5</i>	<i>Biologist</i>	<i>USA</i>	<i>Yes</i>
<i>Staff Member 6</i>	<i>Biologist</i>	<i>USA</i>	<i>Yes</i>
<i>Staff Member 7</i>	<i>Contract specialist</i>	<i>USA</i>	<i>No</i>
<i>Staff Member 8</i>	<i>IT Specialist</i>	<i>USA</i>	<i>No</i>
<i>Staff Member 9</i>	<i>Director</i>	<i>USA</i>	<i>Yes</i>
<i>Staff Member 10</i>	<i>Help Desk Manager</i>	<i>USA</i>	<i>No</i>
<i>Staff Member 11</i>	<i>Supply Tech</i>	<i>USA</i>	<i>No</i>

Results showed that reduction of staff engagement in banders issue would be the biggest indicator that BANDIT was working as intended. Request for what should not be changed found that profile settings, overall layout, and filters were important to participants. The most frequently requested change was a more web-based system with five participants stating this, the reasons stated that they could interact in real-time with banders. This was followed by four requests for the new platform to be more user-friendly for banders.

## Chapter 5: Discussion

### **Results Discussion**

After completing the research and analyzing the results we first began to look at our user population. Although banders ages skewed older, it was noted by staff at the lab that many banders participate in the program well after their retirement from their respective fields, and often they see an increase in bird banding from users that are in retirement. This put BANDIT in a unique position in that it is a technology program with an older user base, in which some of its oldest users may be some of its most frequent also. Results of the banders survey revealed a low satisfaction rate for banders in BANDIT with only 60% of users stating they had a positive view of the system. This was contrary to our belief when first going into this project, and because of such we reevaluated how to approach the redesign of BANDIT. Instead of focusing on the addition of new features designed to bring in new users, which could lead to additional unintentional frustrations with the system we chose to focus on the correction of current issues to hopefully bring satisfaction into the 90 percentiles. This choice was reinforced by write-in comments in the user survey that by large showed that users biggest request was for a more user-friendly system. By increasing user satisfaction, it is believed that we could increase user retention within the program and even encourage new participation in the program.

Survey results revealed around 16% of Banders do not input data at all into the software and instead rely on others to input their information. While this is allowed

through the current system it was discussed if banders inputted their own data, staff expected to see a decrease in data entry errors. Moving to user needs we began exploring some of the questions about data collection, and system compatibility. One thing we noticed is that although BANDIT v4 had been out for several years only 60% of users reported using this version. This has led to many users having a different experience using the program. Written comments revealed around 10% of users were struggling with issues that had been resolved through updated versions of the software. Staff at the Bird Banding Lab was aware of that not all users had switched over to v4 due to some compatibility issues with Mac OS platforms however it was not believed that this was the cause of such a large percentage. Comments left in the survey and discussions with staff revealed that this may also be in part due to resistance to change. Users complained of previous updates which attempted to fix issues, but instead made them more complicated. This may be in part due to the software's lack of intuitive design. The current platform is difficult to navigate and required users to read manuals to fully understand the product. Since many banders only submit data once per year many found the idea of learning a new system to be over burdensome. Another frequent request of lab staff h was that banders and staff could not be in the same data set at the same time. As it currently stood staff was unable to resolve banders errors in real time and instead had to wait for banders to send a copy of their data to them, at which point they could fix the issues, and then send the dataset back to the bander. This created delays in data being submitted,

additional workload for staff, and prevented key on the spot training opportunities from occurring.

Additional features of BANDIT showed a mix of emotions from users. Auxiliary markers were found to be a negative drag on user experience. Users reporting using auxiliary markers actually saw a decrease in overall satisfaction of the software. Auxiliary markers are additional markings, or tags placed on bird populations to help better track and spot them. Depending on the type of marker there can also be additional information attached to the actual marker itself, such as color or identification numbers. Due to the complex nature of the data the entry process itself can be quite difficult to navigate, especially if you don't band birds with auxiliary markers frequently. The excel upload feature of BANDIT also correlated with a lower user satisfaction of overall BANDIT but much at a much lower percent of only a 5% decline. This decline could be caused by frustrations with importing the data, comments showed that many users using this feature were also spending lots of time cleaning data after it was imported. This may be due to low adoption rates of the official BANDIT excel template of only 30%, which has been designed to properly import all data. Instead many users have been using personal or office-specific spreadsheets to upload data.

### **Design Discussion/Implications**

Based off of feedback acquired through both the survey and write-in responses a few design goals became clear. The adoption of a web-based platform was confirmed by these results. The primary goal of this step was to allow users ease of access when trying

to use the program. As previously stated survey results revealed that a large percentage of users were not working with the latest update of the system. Hosting BANDIT on a web platform will resolve the issue of users operating within different versions of the software. This will allow updates and patches for software issues to be pushed directly to users. Moving to an online system will also help with current compatibility issues surrounding different operating systems. As it stands now certain users are unable to access the latest version of the system due to a range of issues including incompatibility with Mac OS X and later versions and software restrictions at local agencies.

Additionally, the web-based platform would allow for the correction of data in real time, and even the implementation of a records log so that users could keep track, and export their own information, a request given by several users. It is important that the web-based program be accessible across a range of browsers but most importantly Google Chrome.

Simplicity was another goal in the redesign. Over 70% of users reported using the software solely for the purpose of submitting banding data rather than for data management, this coupled with the limited resources available at the Bird Banding Lab led to the belief that the redesign should have a focus on simplicity for both users, and staff. Users frustrations with the program revolved a lot around what they perceive to be complex process to do what they consider to be a simple task, submitting data. Since many of the banders use the program so infrequently it is important that they when they do need to use it that they are able to access the program and complete task without having to endure extended trainings, or excessive troubleshooting. As user populations

continue to age it will also be important to have the system as easy as possible as some older users may have a larger learning curve. Additionally, it will allow new users, or users that are known to have high turnover such as research assistants and doctoral students an ability to more quickly and accurately report data of their respective offices. Two specific scenarios were sketched out in wireframes to allow for a more detailed view of the redesign, one being error corrections, and the other being excel upload.

### **Error Correction**

Error correction was a major frustration of users that should be addressed in the redesign. Comments such as “improved explanation of error messages” and “A little handier way to access the full meaning of error codes” were common throughout the feedback. Lack of detailed error descriptions can be seen in figure 10. Although only 5% of users reported not being able to understand error messages 56% percent of write-ins were in relation to frustrations fixing certain errors (Appendix D). Currently users who experience errors complain about the intuitiveness and user-friendliness of the error-correction process. In the current version of the software a user who submits data with errors must go look up the error code in the manual either in print or in the in-app version. The system is further complicated by a multi-level filtering system, that allows some errors to be submitted as bypassable, and others not to be (figure 10). Staff reported that many users were completely unaware that their data contained non-bypassable errors and thus continue sending in incorrect data. Vice versa the same issues existed as other users withheld data they believe to contain non-bypassable errors only to find out that

they were indeed bypassable. Users also seemed confused of how to fix errors within the system. To address this issue a solution was offered to provide clearer feedback for users as shown in Figure 12. Pop out dialog boxes were added to help users understand the cause of errors were added without requiring users to search for additional information. Since some error corrections may take several steps the process was also broken up into smaller steps guiding users through each step of the error correction process to prevent cognitive overload. Color was added to error messages to help users quickly identify whether errors were bypassable or non-bypassable. Color was also introduced to the data input page to help users quickly identify which field contained the error on the details page, in the current version of BANDIT fields containing errors were not indicated at all and users had to rely on text boxes instructions to direct them to errors (figure 11). It is also recommended that the Bird Banding Lab comes up with simplified language that explains the cause of the error in short blurbs that are able to quickly be deciphered by staff.

Nest...	Net Ne...	Nest Location	Pl...	S...	Submission Timestamp	Modify Timestamp	Additional Errors	Bypass errors	Error Nonbypassable
					9/29/2016 2:03:23 PM	10/4/2016 11:58:34 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:34 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:34 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
						10/4/2016 11:58:34 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	Banding Date Greater Than
					9/29/2016 2:03:23 PM	10/4/2016 11:58:34 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:35 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:36 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:36 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:36 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	
					9/29/2016 2:03:23 PM	10/4/2016 11:58:36 AM		<input type="radio"/> Y <input checked="" type="radio"/> N	

Figure 10. BANDIT error descriptions list view

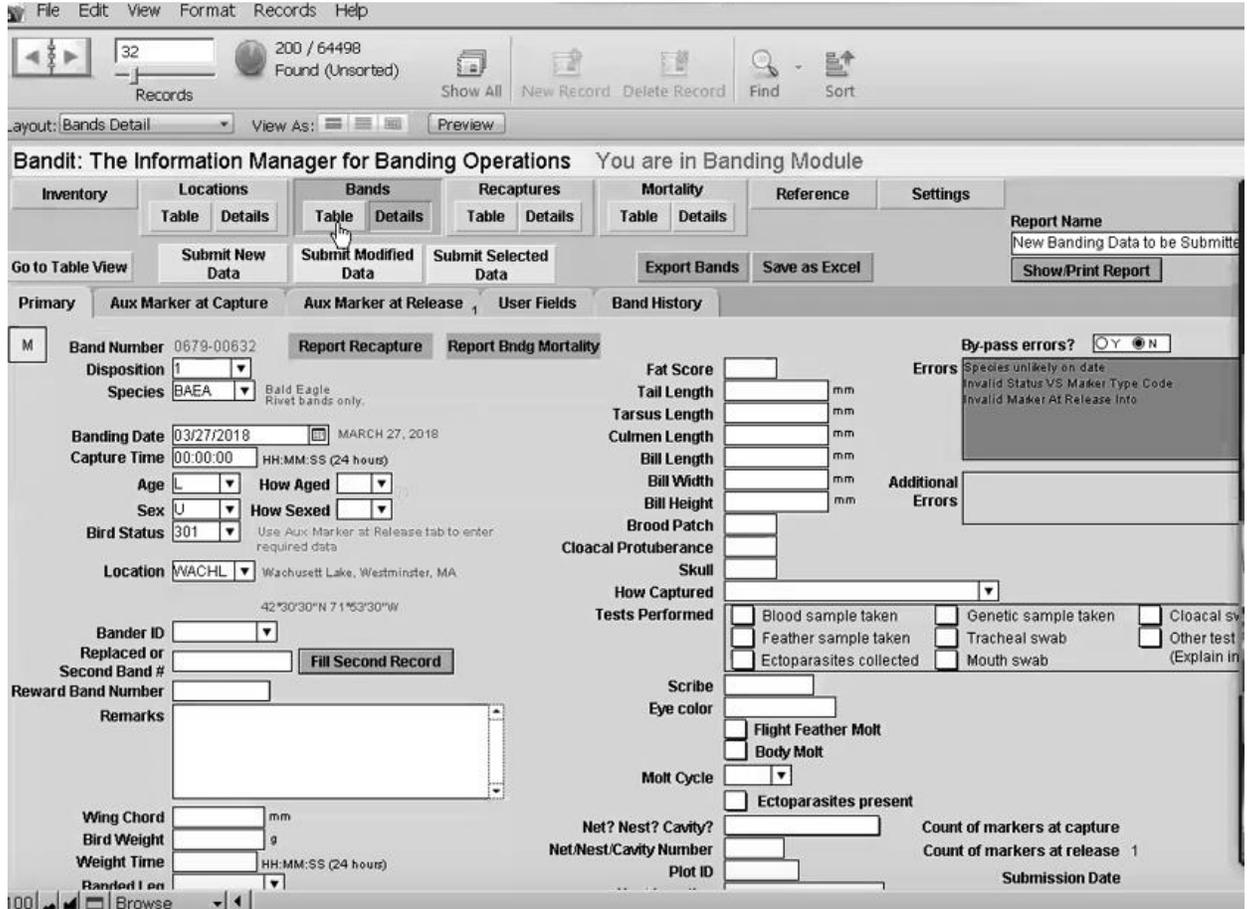


Figure 11. BANDIT detailed screen with error notification



Figure 12. Error correction flow wireframe

Fixing multiple files was a major factor in redesigning the error correction system. Users complained about simple errors such as misspellings, or incorrect coordinate locations that would then flag all of their data as non-bypassable. The current BANDIT allows for the correction of multiple files at once, but the process was not

intuitive leading many users to correcting errors one by one in a long tedious process.

The fastest way to do the process was using a fill down option that was not easily

discovered and complex as seen in Figure 13. The redesign as mocked up in Figure 14

recommends providing users with the option to apply edits to multiple files with similar

errors automatically. To prevent the system from mistakenly applying changes to

incorrect files that have similar errors, users will have an option to choose to fix

additional files and they will be provided with a preview of the files and allowed to select

which ones to apply changes.

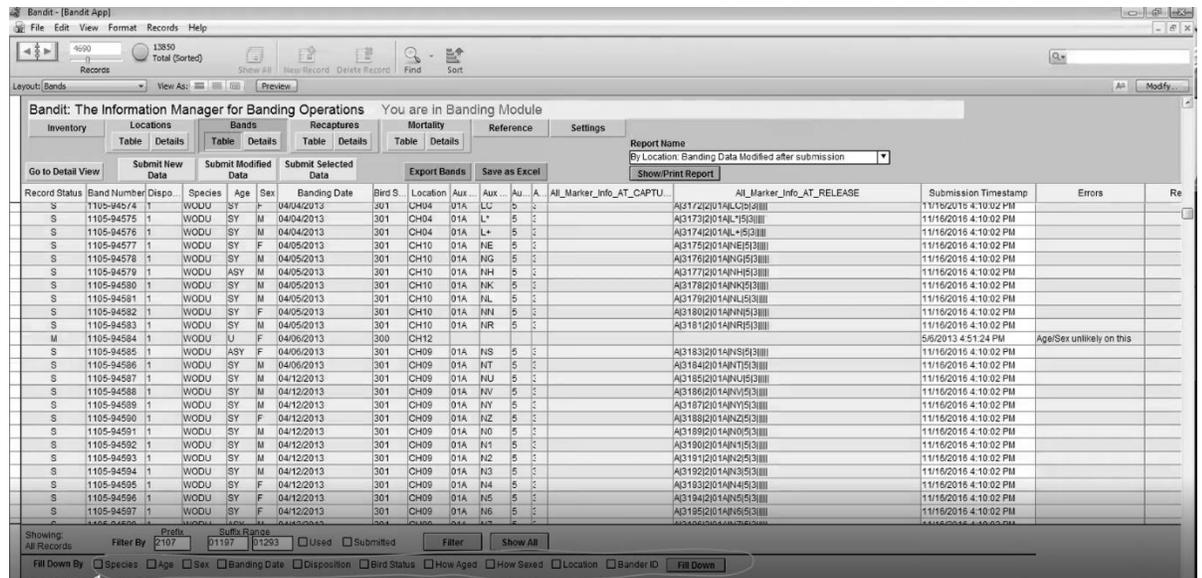


Figure 13. Fill down option can be seen circled in the bottom of screen

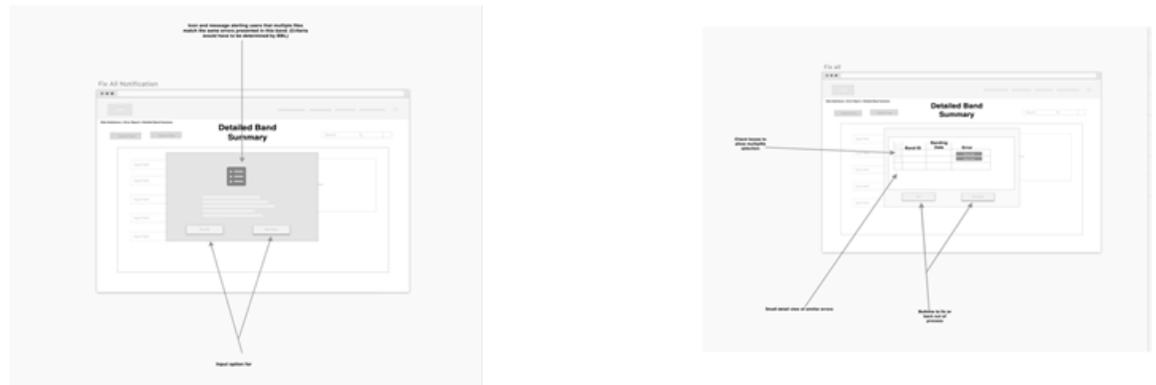


Figure 14. Fix all process wireframe

### Excel Upload

The excel upload feature was chosen to be wireframed because of its flexibility and popularity. The feature that allows users to upload a spreadsheet directly into the BANDIT database for data submission, the feature is popular among banders who collect data on large quantities of birds. This is due to the ability to enter in data outside of the database and while using keyboard shortcuts such as copy and paste. In looking at how to bring this feature into the next version of BANDIT there were many discussions surrounding whether or not to keep the feature in the program. Users reporting using the feature had a slightly lower overall satisfaction with the software, written comments revealed users' frustrations with fields not being imported correctly, leaving users to spend additional time correcting their data. This is believing to be at least in part to the lack of adoption of the official BANDIT excel template amongst users. The template is designed in a way that allows data to be imported simply and without error. Survey

results found that only 30% of banders were actually using the template, while the rest were using some alternative form. To help curb this in the redesign it is recommended that a Microsoft Excel Online plug in feature be built directly into the website (Figure 15).

The incorporation a plug-in would have several benefits, such as cloud abilities, mobile-friendly, and encouragement of official template. Cloud abilities would allow users to easily switch between platforms while entering data, this is important as data is typically collected outdoors, and often in areas hours away from banders homes. Excel also allows an offline feature where users could access the template when offline. Mobile-friendliness would also be a result of as Microsoft Excel is available on most mobile platforms and since the information is stored in the cloud users would be able to quickly go between mobile and desktop devices with ease. This again can help increase direct input by banders by allowing them to enter data while in the field or shortly after via mobile phone or tablet. Finally, the redesign recommendation would help encourage use of the official template. Users would only be able to use the template in the MS Excel Online plug-in and therefore would be incentivized to input data within the template to be able to benefit from the previously listed pros.



*Figure 15. Excel data entry system*

## Chapter 6: Conclusion

### **Limitations**

The recommendations presented in this paper are a result of the research I collected over the course of a few months. Due to timing constraints for this paper recommendations have not been user-tested and would require so before a definitive solution could be established. Recommendations themselves were also limited due to time, allowing for only three user task flows to be established. Further research, and analysis would be required to build a new BANDIT since the software includes several different tasks. Although participation in the research used in this study was high it is hard to estimate the actual percentage of users this represents due to the complex support staff structures that exist within local agencies. Speaking with lab staff it was noted that many banders have a team of research assistants that handle data entry and other administrative task, since the survey was sent via email to banders with addresses on file many of these users may have been missed. These users might have had better insight into the strengths and flaws of the system. In future studies a better effort to engage all users, along with additional time set aside for testing.

### **Implications of research**

The paper presented hopes to serve as a guide when developing the newest version of the BANDIT software. Using the research provided additional recommendations can continue to be developed based off of user feedback. The recommendations provided serve as a framework and would still require additional visual

design to be properly integrated into the BANDIT system. As mentioned earlier the recommendations provided are under the assumption that the newest iteration of BANDIT will be web-based and would not pair well with another computer-based update of the software. The possibilities in a web-based BANDIT seem limitless as far as features goes, but as the research pointed out users are primarily looking to use the system as a data submission system. Developers should keep this in mind as they plan for the redesign of the new system. Although gamification and social media were not explicitly integrated into the discussion and recommendations these features still remain a possibility within a new web-based system. User retention and data integrity continue to be the two most important goals in the redesign of BANDIT. By easing access and increasing simplicity of the application it is believed that users will be more incentivized to submit data more frequently and personally, rather than relying on others.

### **Overview**

At the beginning of this paper I sought to help with an increase in user retention and data integrity at the Bird Banding Lab. Initially, it was believed that this could be accomplished through implementing new features to help draw new users in and encourage increased participation among existing users. Through the research conducted in this paper it was determined that instead of implementing new features that it would be better to correct existing features plaguing users. Users requested through comments that their needs in a new system was simple a functioning one. This aligned with staff as concerns surrounding long term sustainability of additional features arose. Due to these

revelations the focus was shifted to creating new user-friendly interfaces that would address the concerns brought up in the survey.

Using the information provided by the research I was able to develop two user paths that aim towards the goal of increasing retention and data integrity. Using the recommended modified error correction, fix all, and batch upload processes users can look forward to a more intuitive process that requires a less robust training to use. By reducing training and frustrations using the application it is believed that this will create the desired results outlined in this papers goal.

In conclusion it is important for the Bird Banding Lab to retain users and maintain integrity as part of their mission. Bird Banding Lab benefits from a motivated group of banders who are eager to assist with this mission. However, they are only as good as the tools provided to them. By implementing some of the recommendations mentioned in this paper the BBL will be able to ease the ability to collect data on banders and by doing such excel at their mission.

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## Appendix

**Appendix A: User Survey****BANDIT User survey**

---

**Start of Block: Default Question Block**

**Q50 Welcome and thank you for taking the time to provide your feedback on BANDIT.** You have been asked to participate in this study conducted by Brandon Turner, a graduate student at the University of Baltimore, in cooperation with the U.S. Geological Survey's Bird Banding Lab. Dr. Greg Walsh is the supervising faculty member for this study. You are being asked to participate because you are a permitted bander in the US or Canada, or you are managing banding data for a permitted bander. The purpose of this study is to better understand the needs of the users of the software BANDIT to ultimately redesign the application to a more user-friendly and effective product. The study will take approximately 10-15 minutes to complete and is composed of multiple choice and short answer questions. Your responses will be kept confidential and will be used for research purposes only. Your name and email address, if you choose to provide them, will never be reported in any of our findings, or associated with any answers that you provide. You have the choice whether or not to participate in this study. If you choose to participate, you may withdraw at any time. If you have any questions about the research, you may contact Brandon Turner at [Brandon.turner@ubalt.edu](mailto:Brandon.turner@ubalt.edu) or Dr. Greg Walsh at [Gwalsh@ubalt.edu](mailto:Gwalsh@ubalt.edu).

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Page Break

Q52  
**BANDIT Survey**

---

Q1 Do you use BANDIT yourself?

- Yes (1)
  - No (2)
- 

Page Break

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Q58  
**BANDIT SURVEY**

---

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q2 How long have you been using BANDIT?

- Less than a year (1)
  - Between 1 and 3 years (2)
  - Between 3 and 5 years (3)
  - More than 5 years (4)
- 

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q3 How would you rate your experience level with BANDIT?

- Beginner (1)
  - Advanced Beginner (2)
  - Intermediate (3)
  - Advanced Intermediate (4)
  - Expert (5)
- 

Q4 What type of permit do you have?

- Master Permit (with OR without sub-permit) (1)
  - Sub-Permit (I do NOT have a master permit) (2)
  - Not a permit holder but use BANDIT under someone else's permit number (3)
- 

Page Break

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Q59  
BANDIT SURVEY

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*Display This Question:*

*If What type of permit do you have? = Master Permit (with OR without sub-permit)*

Q5 What is your master permit number?

---

---

*Display This Question:*

*If What type of permit do you have? = Sub-Permit (I do NOT have a master permit)*

Q6 What is your sub permit number? (if you have multiple permits please enter your most frequently used permit number)

---

*Display This Question:*

*If What type of permit do you have? = Not a permit holder but use BANDIT under someone else's permit number*

Q7 What master permit number do you use for entering data? (If multiple enter most frequently used permit number)

---



Q8 For how many permits do you report data?

---

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Page Break

Q51  
**BANDIT SURVEY**

Q9 Which internet browser do you most frequently use?

- Google Chrome (1)
  - Internet Explorer (2)
  - Firefox (3)
  - Opera (4)
  - Microsoft Edge (5)
  - Safari (7)
  - Other (write-in required) (6)
- 

Q10 What version of BANDIT is currently being used to submit data for your permit?

- v1 (1)
  - v2 (2)
  - v3 (3)
  - v4 (4)
  - I don't know (5)
- 

Q11 Do multiple people submit data under your permit number via BANDIT (this includes sub permittees, research staff, interns, data assistants, and other similar roles)?

- Yes (1)
  - No (2)
-

Q13 Do you have multiple installations of BANDIT on your computer?

- Yes (1)
  - No (2)
  - I don't know (4)
- 

Q14 Do you use a mobile device to collect data electronically in the field?

- Yes, I use a mobile device to collect data electronically in the field (1)
  - No, I do not use a mobile device to collect data electronically in the field (2)
- 

Page Break

---

Q53  
**BANDIT Survey**

---

*Display This Question:*

*If Do you use a mobile device to collect data electronically in the field? = Yes, I use a mobile device to collect data electronically in the field*

Q15 What kind of device do you use to electronically collect data in the field?

- iPhone (1)
  - Android Mobile Phone (2)
  - Tablet (not an Apple product) (3)
  - iPad (4)
  - Laptop (Windows) (5)
  - Laptop (Mac/Apple) (7)
  - Other (6)
- 

Q16 How often do you have access to the internet during your banding operations, or during your banding season?

- Access everyday WHILE & AFTER collecting data in the field (1)
  - Access everyday ONLY AFTER collecting data in the field (2)
  - Access once or twice a week (3)
  - Access once or twice a month (4)
  - I have access less frequently than once a month (5)
  - I never have access to the internet during banding season (6)
-

Q17 How many birds do you band annually (approximately) ?

- Fewer than 100 birds (1)
  - 101-1000 birds (2)
  - 1001-3000 birds (3)
  - More than 3000 birds (4)
  - I don't know (5)
- 

Page Break

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Q68  
BANDIT Survey

---

Q18 The following data fields are required by BBL: band number, species, age, sex, status, location, date; depending on bird status, remarks and aux marker fields may also be required. Do you regularly collect data on any fields *beyond* these mentioned above (such as weight or wing length)?

- Yes (1)
  - No (2)
- 

Page Break

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Q57  
BANDIT Survey

---

*Display This Question:*

*If The following data fields are required by BBL: band number, species, age, sex, status, location,... = Yes*

Q19 Please list the additional data fields you collect. (Please do **not** include fields required by BBL such as band number, species, age, sex, status, location, and date).

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*Display This Question:*

*If The following data fields are required by BBL: band number, species, age, sex, status, location,... = Yes*

Q20 Is the data associated with these fields stored in BANDIT?

- Yes (1)
  - No (2)
  - I don't know (3)
-

Q21 How many banding locations do you normally use each year?

- One location (1)
  - Fewer than 10 locations (2)
  - 10-99 locations (3)
  - More than 100 locations (4)
  - I don't know (5)
- 

Q22 How do you determine the coordinates for your banding locations? (check all that apply)

- Phone GPS (1)
  - GPS unit (2)
  - Map within BANDIT software (3)
  - Paper map, e.g. gazetteer (4)
  - Google Map or Google Earth (5)
  - Other (write-in required) (6)
- 

Page Break

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*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q54  
**BANDIT Survey**

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*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q23 Which error message do you **most commonly** encounter when entering or submitting data?

- Age/Sex unlikely on date (1)
  - Species unlikely in state (2)
  - Banding date vs received date (3)
  - Bad size (4)
  - Invalid status vs marker type code (5)
  - Enter a unique identifier for bander (6)
  - Enter a unique identifier for location (7)
  - Other (write-in required) (8)
- 

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q24 Some people use other systems such as Microsoft Excel or Access to manage banding data, and only use BANDIT to submit data. Do you use BANDIT for data submission only, or do you also manage your data within BANDIT?

- I use BANDIT for data submission only (1)
- I use BANDIT for data management AND submission (2)

---

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q25 Do you use alpha or numeric codes for the following fields?

	Alpha (1)	Numeric (2)	I don't know (4)
Species (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Age (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sex (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

---

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q26 Please rate the usefulness of the following help resources:

	Always useful (1)	Often useful (2)	Neutral (3)	Rarely useful (4)	Not at all useful (5)	Didn't know this resource existed (6)	Never used this resource (7)
Reference tables in BANDIT or on the website (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Error code descriptions in BANDIT or on the website (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BANDIT manual (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BANDIT release notes (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BANDIT FAQs (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BANDIT helpdesk (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Call or email an individual staff member at the BBL or BBO (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q27 What is typically your *first* resource when experiencing errors in BANDIT?

- Reference tables in BANDIT or on the BBL website (1)
  - Error descriptions in BANDIT or on the BBL website (2)
  - BANDIT manual (3)
  - BANDIT release notes (4)
  - BANDIT FAQs (5)
  - BANDIT helpdesk (6)
  - Call or email an individual staff member at the BBL or BBO (7)
  - Other (write-in required) (8)
- 

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q28 How often are you able to understand the error messages that appear in BANDIT prior to submission of your data?

- Always (1)
  - Often (2)
  - Sometimes (3)
  - Rarely (4)
  - Never (5)
- 

*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q29 How do you usually enter your data into BANDIT?

- Enter individual record(s) directly into BANDIT (1)
  - Import record(s) into BANDIT from another program (e.g. MS Excel, MS Access) (2)
  - I use both entry methods equally (3)
- 

*Display This Question:*

*If How do you usually enter your data into BANDIT? = Import record(s) into BANDIT from another program (e.g. MS Excel, MS Access)*

Q55

**BANDIT Survey**

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*Display This Question:*

*If Do you use BANDIT yourself? = Yes*

Q33 How often do you use the customizable fields (user-defined fields) within BANDIT?

- Always (1)
  - Often (2)
  - Rarely (4)
  - Never (5)
  - Didn't know this resource existed (6)
-

*Display This Question:*

*If How do you usually enter your data into BANDIT? = Import record(s) into BANDIT from another program (e.g. MS Excel, MS Access)*

*Or How do you usually enter your data into BANDIT? = I use both entry methods equally*

Q30 Do you use the MS Excel template for BANDIT v4 found on the BBL website to prepare data for input into BANDIT?

- Yes (1)
  - No (2)
  - I don't know (3)
- 

Page Break

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Q60  
**BANDIT Survey**

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Q32 Are you required to report your banding data to another organization such your state fish and wildlife agency, US Fish and Wildlife Service, or the Institute of Bird Populations (which manages MAPS)?

- Yes (1)
  - No (2)
  - I don't know (3)
-

Q34 Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band)

- Yes (1)
- No (2)

---

*Display This Question:*

*If Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band) = Yes*

Q65  
BANDIT Survey

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*Display This Question:*

*If Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band) = Yes*

Q35  
*The banding data I collect and enter.....*

- Always contain auxiliary markers (1)
- Almost always contain auxiliary markers (2)
- Rarely contain auxiliary markers (3)
- Almost never contain auxiliary markers (4)
- Sometimes contain auxiliary markers (5)

---

*Display This Question:*

*If Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band) = Yes*

Q36 What types of auxiliary markers do you use? (check all that apply)

- Coded color markers (e.g. neck collar, wing tag) (1)
  - Uncoded color markers (e.g. plain color band) (2)
  - Electronic Devices (e.g. nanotag, datalogger, transmitter) (3)
  - Multiple color bands on the same bird (4)
  - Multiple types of auxiliary markers on the same bird (e.g. colored leg bands and a transmitter) (5)
- 

*Display This Question:*

*If Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band) = Yes*

Q37 How do you enter auxiliary marker data? (check all that apply)

- I enter data for each bird individually within BANDIT (1)
  - I use the MS Excel template for BANDIT v4 (provided on the BBL's website), and then import this data into BANDIT (2)
  - Other (write-in required) (3)
- 

*Display This Question:*

*If Do you band birds with auxiliary markers? (i.e. any markers besides the federal metal band) = No*

Q69  
BANDIT Survey

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Q38 Do you regularly collect recapture data?

Yes (1)

No (2)

---

*Display This Question:*

*If Do you regularly collect recapture data? = Yes*

Q72

BANDIT Survey

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*Display This Question:*

*If Do you regularly collect recapture data? = Yes*

Q39 Where do you submit recapture data? (check all that apply)

BANDIT (1)

Reportband.gov (4)

I submit recapture data to another program, but not the BBL (2)

I don't submit recapture data (3)

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Page Break

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Q66

BANDIT Survey

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*Display This Question:*

*If Do you regularly collect recapture data? = Yes*

*And Where do you submit recapture data? (check all that apply) != BANDIT*

Q40 What is preventing you from submitting recapture data in BANDIT? (check all that apply)

- I don't have the time to submit recapture data in BANDIT (1)
  - I wasn't aware that recapture data could be submitted in BANDIT (2)
  - I submit recapture data to another database and find it duplicative to also submit in BANDIT (3)
  - I am unaware of how to enter recapture data in BANDIT (4)
  - I don't think the BBL is interested in my recapture data (5)
  - I prefer to submit recapture data at Reportband.gov instead of BANDIT (6)
  - Other (write-in required) (7)
- 

*Display This Question:*

*If Where do you submit recapture data? (check all that apply) = BANDIT*

*Or Where do you submit recapture data? (check all that apply) = I submit recapture data to another program, but not the BBL*

*Or Where do you submit recapture data? (check all that apply) = Reportband.gov*

Q41 What types of recapture data do you submit?

- Birds banded under my permit (1)
- Birds banded under other permits ("foreign recaptures") (2)

---

Q42 Do you submit banding data from more than one country?

- Yes (1)
- No (2)
- 

Q43 Are you also contributing data to other avian citizen science programs? (Check all that apply)

- eBird (1)
- Breeding Bird Survey (2)
- Monitoring Avian Productivity and Survivorship (MAPS) (3)
- Other (write-in required) (4)
- 
- I don't contribute data to any other avian citizen science programs (5)
- 

*Display This Question:*

*If Are you also contributing data to other avian citizen science programs? (Check all that apply) = Monitoring Avian Productivity and Survivorship (MAPS)*

Q67  
BANDIT Survey

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*Display This Question:*

*If Are you also contributing data to other avian citizen science programs? (Check all that apply) = Monitoring Avian Productivity and Survivorship (MAPS)*

Q44 How are you managing your MAPS data?

- Enter in BANDIT first, then import into MAPSProg (1)
- Enter in MAPSProg first, then import into BANDIT (2)
- Enter in a spreadsheet or other database system, then import separately into MAPSProg and BANDIT (3)
- Manually enter data in MAPSProg; separately, manually enter data in BANDIT (4)
- Other (write-in required) (5)

---

Page Break

Q56

**BANDIT Survey**

Q45 How would you rate the BANDIT software as a tool to submit required data to the BBL?

- Excellent (1)
- Good (2)
- Neutral (3)
- Fair (4)
- Poor (5)

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Q46 What is one thing you would like to see changed in BANDIT?

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Q47 What age group describes you?

- 18-25 (1)
- 26-37 (2)
- 38-54 (3)
- 55+ (4)

---

Q48 If you are interested in being interviewed about your experience with BANDIT or you would like to participate in user testing of the new product, please enter your contact information below. These interviews would last 30-45 minutes and would take place using a phone and computer. You may also contact the researcher directly by email at [brandon.turner@ubalt.edu](mailto:brandon.turner@ubalt.edu) with additional feedback, or to be included in interviews or testing.

- Name (4) \_\_\_\_\_
- Email address (5) \_\_\_\_\_

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**Q49 Thank you for taking the time to provide your feedback. Your response is very important to us. Your answers have been submitted.** This study was conducted by Brandon Turner, a graduate student at the University of Baltimore, in cooperation with the U.S. Geological Survey Bird Banding Lab. Dr. Greg Walsh is the supervising faculty member for this study.

Your participation today will help provide research for the redesign of the BANDIT software. If you are interested in providing any additional feedback or have any questions/concerns with this survey, please contact Brandon Turner at [Brandon.Turner@ubalt.edu](mailto:Brandon.Turner@ubalt.edu).

End of Block: Default Question Block

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## Appendix B: Staff Survey

### Bird banding Lab Staff Questionnaire

1. How long have you worked for BBL
2. What is your role at the BBL
3. In what capacity do you interact with Bandit?
4. What should Bandit accomplish for users/ banders?
  - a. What about for BBL Staff?
  - b. Do you feel like Bandit in its current state accomplishes these task?
5. Do users have any technological limitations that you are aware of?
6. What is the user's goal in using this product?
7. What frustrations/pain points do users experience with the current process?
8. What are the most common errors that appear in submitted data?
9. Do you have any frustrations with users? If so can you explain?
10. What should this product accomplish for the BBL?
11. How would you measure the success of bandit?
  - a. What indicators would you look for to know bandit is working as intended?
12. Is there anything that **MUST** be changed about the current process/product?
13. Is there anything that you feel **CANNOT** be changed from the current process/product?

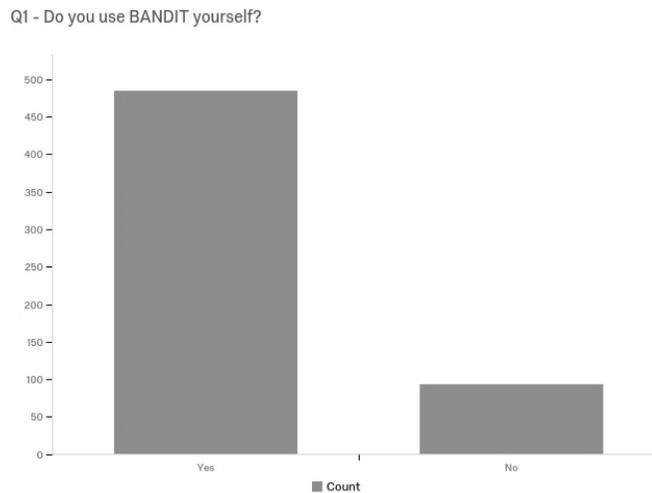
14. What feature could you add to bandit to make your job easier?

**This Section for Staff who also serve as Banders only**

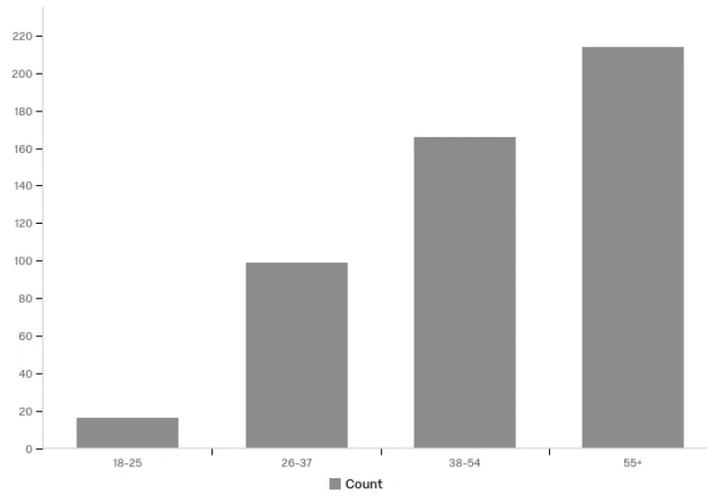
Along with your work here at the BBL do you also band birds yourself?

1. If yes how long?
2. What type of banding do you do? (Band a lot of birds, Auxiliary markers, combo)
3. Have you had any issues using bandit?
4. Compared to other banders (not employed by BBL) do you see yourself having similar issues or different ones? Explain?
5. What do you like least about using Bandit? What about best?
6. What would you like to see in Bandit redesign to make Banding easier?

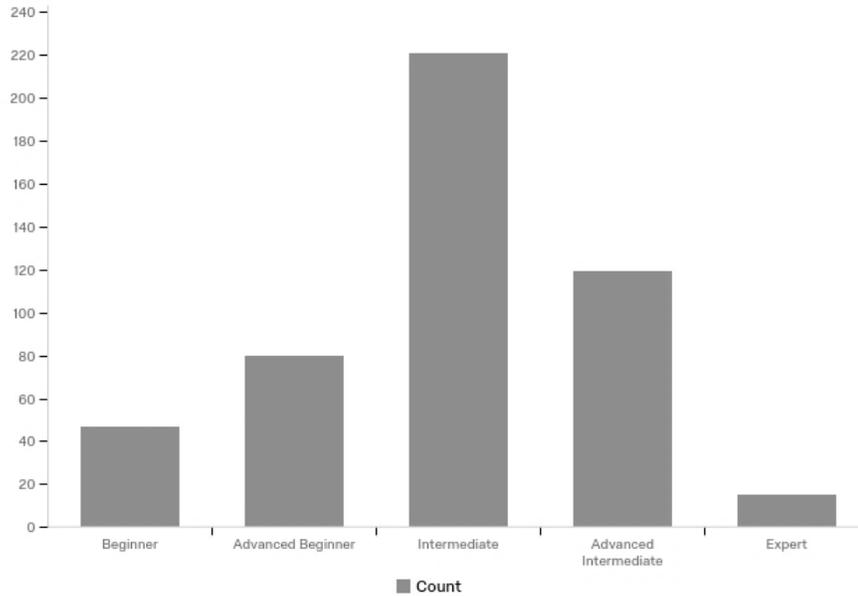
**Appendix C: Results**



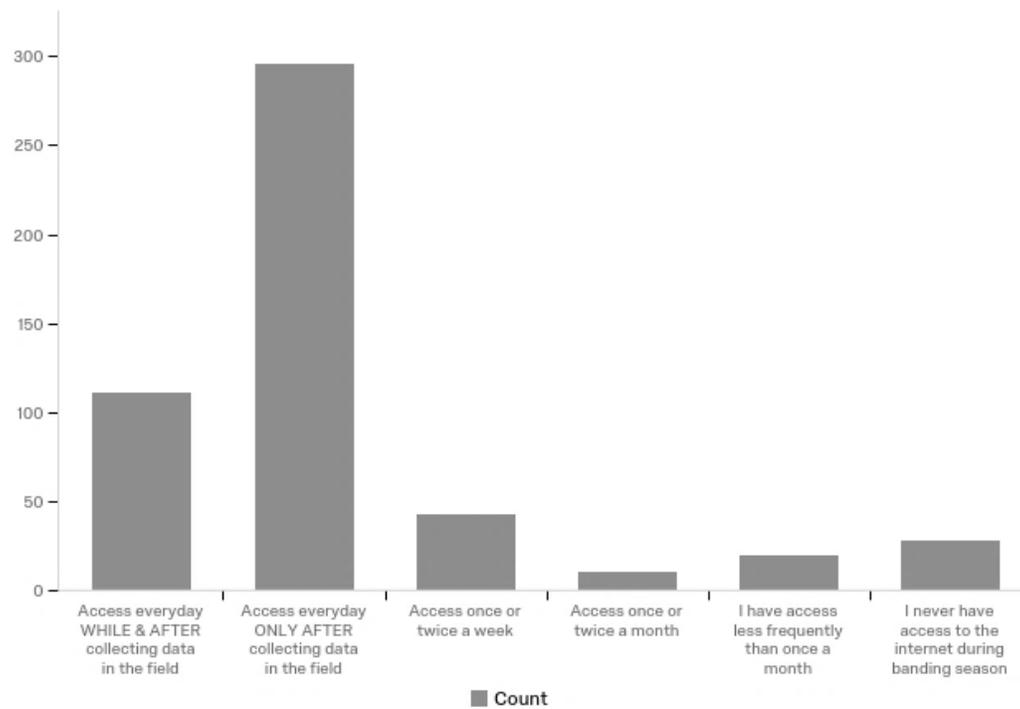
Q47 - What age group describes you?



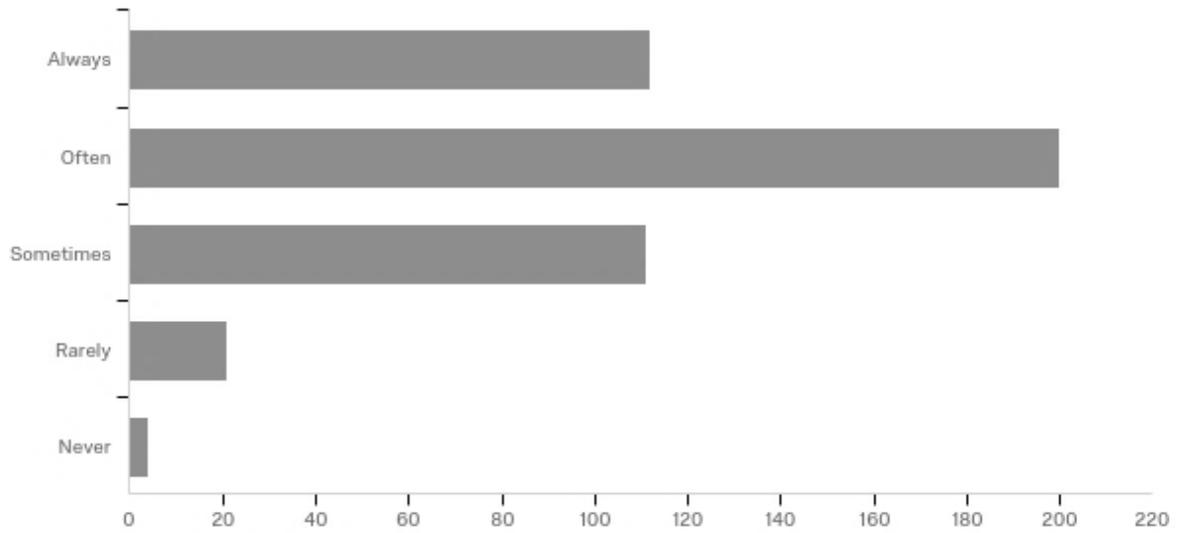
Q3 - How would you rate your experience level with BANDIT?



Q16 - How often do you have access to the internet during your banding operations...



Q28 - How often are you able to understand the error messages that appear in BAND...



## Appendix D Wireframes

