

Identifying People’s Values of Maunalua Bay Using Surveys

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I. Introduction

Maunalua Bay is a treasure of Hawai‘i and has a special history of biological and cultural importance. It is a socially, economically, and culturally diverse area and there are many different people groups that care about different aspects of the bay. There is a current knowledge gap in what people value about Maunalua Bay and its surrounding watersheds. Identifying what exactly the different users value about Maunalua Bay is crucial for long-term successful management of the area. If Mālama Maunalua were to consider implementing a values survey such as the one proposed here, they could use the results to try to target their activities and outreach that are strongly valued by people living in the area or who care about the area, which may ultimately assist in informing policy change to support the improvement of the social, economic, and ecological health of Maunalua Bay and its users.

Values and Why They’re Important

Human and ecological “values” have become significant concepts in environmental management. This is because environmental decisions affect people in diverse ways and have the ability to infer behavior. The study of values is extensive, and spans several research disciplines that each perceive ‘value’ differently. A definition of value in environmental management is the worth, importance, or usefulness of something. More specifically, “four concepts—value as a magnitude of preference, value as contribution to a goal, values as individual priorities, and values as relations,” comprise the different ways one might approach values (Tadaki et al., 2017). Values can help researchers and practitioners categorize, measure, and understand diverse human-environment relations. Often these tools are sought after to inform environmental decision making.

Individuals attach values to specific goods, activities, or services and recently, these assigned values have been a focus of environmental management and planning with the aim to understand community’s perceptions of a specific place (Seymour et al., 2011). Tadaki et al. (2017) synthesized insights about environmental values concepts to help practitioners and researchers reflect upon what kind of environmental values assessments might be appropriate in different settings and why. After an extensive literature review, we decided that surveys are the most appropriate way for us to ascertain people’s values of Maunalua Bay. Therefore, our values survey aims to draw on the analysis of survey data to understand which values provided by Maunalua Bay are more or less important to different user types. This is because identifying what exactly different people value about the bay can allow Malama Maunalua, Conservation International as well as other managers, volunteers, community members, and legislators to direct efforts to aspects of the bay that are highly valued and can also provide outreach opportunities to different groups with the newfound understanding of what their priorities are.

Research Questions:

The research in this project includes a comprehensive assessment of survey techniques to identify the most appropriate survey questions and determine the most effective method(s) of delivery to aid in understanding user values of Maunalua Bay. The project had the following research objectives.

Objectives:

- Create a survey that could lead to developing a typology of values to potentially separate how individual characteristics such as demographics and practices such as fishing correlate with people's values
- Pilot survey questions to provide to Mālama Maunalua.
- Assess the pros/cons of survey data collection and delivery methods (in-person/intercept survey, online, mail, telephone).

What Kind of Data Will it Generate and What Can it Show?

We designed our survey instrument utilizing a 'values as individual priorities' concept because in environmental management, this values-as-priorities concept attempts to identify patterns of priorities within "the public" or affected communities, and considers what this means for representative or inclusive decision making" which is essentially the goal of our survey.

Values, when defined as 'individual priorities,' are reflected by the structure of an individuals' priorities with the assumption that human individuals possess core priorities that drive their actions (Tadaki et al., 2017). These values are presumed to be distributed differently across individuals, which allows researchers to map distributions of priorities within individuals and across a given population. Researchers can then attempt to identify patterns of values and priorities within "the public" or people groups, and ascertain how those considerations can be represented in an inclusive decision-making process. This often takes the form of structured surveys -- such as the one we created for Maunalua Bay. By asking participants to rate the importance of each "item" personally, they can be classified according to the similarity of their values, which will be described more in the 'How to Analyze Data' section.

II. Methods

Literature Review

We read fifteen scientific and instructional articles on survey design while creating our survey to maximize the quality of our design. The following sections summarize these sources and our lessons learned from each in designing our own survey, including methods of determining user values and methods of survey design.

First, we explored literature related to determining user values in watersheds and marine ecosystems. The case study, "Using stakeholders' perspective of ecosystem services and biodiversity features to plan a marine protected area" is one such example (Cárcamo, Garay-Flühmann, Squeo, & Gaymer, 2014). In this study, researchers used face-to-face interviews with 44, "relevant stakeholders

related to the use, management and/or conservation of natural resources on the area” and the method of, “snowball sampling.” They included a “questionnaire with three sections: (i) stakeholder background information; (ii) valuation of ES (ecosystem goods & services), biodiversity, uses, and threats; and (iii) expectations for the possible establishment of a MU-CMPA.” Researchers also utilized the common technique of “likert scale statements (5-point scale ranging from strongly disagree to strongly agree).” The results of this study showed that, “stakeholders identified and valued 13 ecosystem services, 28 biodiversity features, 20 uses and activities, and 22 threats” (Cárcamo, Garay-Flühmann, Squeo, & Gaymer, 2014). This study is notable to us because it utilized the likert 5 point scale, it relates to use of an area targeted for conservation, researchers used questionnaires with usage and background info like helps to aim at gathering similar information in a similar manner to our survey, and it contains examples of goods and services of a similar ecosystem and an example of how to value them via survey. The paper also shows examples of how people and organizations were categorized (here it was direct user and indirect user; Artisanal Fishermen Organizations, Land Owner, Government Agencies, Civil Society Organizations, Universities or Research Institutes, and Tourism Enterprises).

The paper, “The Natural Area Value Scale: A New Instrument for Measuring Natural Area Values,” was also valuable in our review of the literature (Winter & Lockwood, 2004). The 20-item NAVS can measure, distinguish between and gauge the relative strengths of individuals' intrinsic, non-use and use values for nature. This was intended for mail survey. Three scenarios were developed to test if scenarios affected the strength of values (they didn't). Each item was a statement that required respondents to indicate the extent of their agreement or disagreement on a 7 point scale: strongly disagree, to strongly agree. While the NAVS is a simple and effective means to assess individuals and interest groups' values for natural areas- its scale is too general for our survey and only allows insight in whether people value natural areas for use, non-use, or intrinsically. We want to know more specifically what they value. However it did remind us that we want to include use, non-use, and intrinsic values in our survey as well.

One research paper that was particularly helpful to us was, “Same river, different values and why it matters” (Seymour, Curtis, Pannell, Roberts, & Allan, 2011). This was a mail survey used to examine the differences and similarities in values assigned by people to the Loddon River in Australia. It examined environmental, social and economic values across five different community types using 17 assigned value items (six environmental values, seven social values and four economic value. Respondents were asked to rate each assigned value statement from 1-5 (1 = not important; 5 = very important), with a ‘not applicable’ option. A mixture of techniques were used to identify the survey samples. Survey implementation followed the Dillman approach; involving the development of a distinctive booklet, mailed out with a personalized and hand-signed covering letter, a pre-stamped return envelope, and several reminder notices posted to non-respondents. To explore the differences in values assigned to the river between community types, a Kruskal–Wallis one-way analysis of variance was conducted along with another analysis and correction. This paper was helpful in deciding our environmental, social, and economic values assigned to Maunalua Bay. We also took several aspects of their participant description information and formatted it to our demographics section. Such as: gender, age, number of years in the area, occupation, and if they are part of an environmental group. We also used a 1-5 scale- however

instead of assessing importance- we are using assessing agreement. Instead of a not-applicable option, we have a neutral category.

Another paper we referenced was, “An Overview of the Schwartz Theory of Basic Values” (Schwartz, 2012). This paper offers great background on the nature of values and the ten basic personal values that are recognized across cultures. It presents two methods the Schwartz Value Survey and the Portrait Values Questionnaire. SVS-Respondents rated the importance of each value item as a guiding principle in their life on a 9-point scale. PVQ-measures the ten basic values in samples of children from age 11-14 and of persons not educated in Western schools. The PVQ method is not relevant to our survey. The SVS method is similar to the style of survey we are developing. However, the SVS survey is used to analyze people on ten already established basic personal values, whereas we are trying to find what specific measures of the bay users value.

Another approach was found in the article, “Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale” (Dunlap, Van Liere, Mertig, & Jones, 2000). Authors revised the concept, new ecological paradigm (NEP), which focuses on beliefs of humanity’s ability to upset nature, the existence of limits to growth for human societies, and humanity’s right to rule over nature. Researchers listed 15 statements about relationships between humans and the environment. Then, using a likert scale, asked respondents to what degree they agree/disagree with each statement. The NEP scale provides more comprehensive coverage of key facets of an ecological worldview. This survey instrument was used by Dr. Noa Lincoln to assess environmental values of farmers in South Kona, Hawai‘i. We decided not to use this scale because the terminology might be difficult for people to interpret especially if the survey will be distributed electronically. Nonetheless, this instrument uses a likert scale and gave our group a sense of some example statements used for environmental values.

A related approach we reviewed was, “Exploring the dimensions of place: a confirmatory factor analysis of data from three ecoregional sites” (Ardoin, Schuh, & Gould, 2012). In this paper, authors revised the sense of place concept, which is a holistic concept that focuses on the subjective and shared experiences to the landscapes, emotionally or symbolically, and functions as link to between social experiences and geographic areas. Researchers created a survey instrument with 23 sense of place items developed from past studies and survey instruments. The items were grouped into different dimensions: biophysical, psychological, socio-cultural, and political-economic. We decided to incorporate the sense of place instrument into our survey because the statements issued focus on different values and our particular survey instrument is focusing on a specific place, Maunaloa.

The former two papers come together in, “Cultivating values: environmental values and sense of place as correlates of sustainable agricultural practices,” where Lincoln and Ardoin (2016) created a survey instrument to assess how environmental values and a sense of place impacts farming practices for South Kona Farmers. They conducted 100 preliminary surveys with all people willing to participate and then a final run with 28 respondents. Their entire survey instrument included environmental values, sense of place, farming practices, and demographics. Lincoln and Ardoin’s article used the NEP from (Dunlap, Van Liere, Mertig, & Jones, 2000) and the SEP from Ardoin et al. (2012). We are including the same

sense of place statements from this article into our survey instrument. Statements are measured on a likert scale, which we also used in our survey.

One paper we reviewed that focused on behavior was, “Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?” (Kollmuss & Agyeman, 2002). This explored the gap between attitude and behavior and direct vs. indirect behavior in the following definitions: *Direct experiences* (like field trips) have a greater influence on people’s behavior than indirect (classroom learning). *Normative influences*: People’s attitudes are shaped by cultural traditions, family customs etc. There is likely to be a gap between attitude and action if the dominant culture propagates an un-sustainable lifestyle. *Temporal discrepancy*: if data collection for attitudes is far away from the action, there may be inconsistent results. *Attitude-behavior measurement*- there are discrepancies in results when the measured attitudes are broader in scope than the measured actions, (eg. “Do you care about the environment?” vs. “Do you recycle?”). Variables associated with pro-environmental behavior include: knowledge of issues, knowledge of action strategies, locus of control (individuals perception of whether one has the ability to bring change through their behavior), attitudes, verbal commitment, and individual sense of responsibility. This paper emphasized how there are conflicting and competing factors that shape our daily decisions, actions, and pro-environmental behavior.

“Making sense of environmental values a typology of concepts” was a paper that explored typology in depth (Tadaki, Sinner, & Chan, 2017). This paper discussed four fundamental concepts of value from across the literature. These four concepts—value as a magnitude of preference, value as contribution to a goal, values as individual priorities, and values as relations—entail fundamentally different approaches to environmental valuation. We selected the concept of values as individual priorities to base our survey off of because in environmental management, this “values-as-priorities concept attempts to identify patterns of priorities within “the public” or affected communities, and considers what this means for representative or inclusive decision making” which is essentially the goal of our survey. Examples of surveys using this concept included: researchers listing a range of environmental social, and economic goals, and asked respondents to indicate how important each of these items was to them (on a 1–5 scale), which is the approach we decided to take. Another method option was to use Q-methodology which involves presenting participants with a series of sample statements that reflected different discourses and then positioning these statements on a distribution curve, we decided against this as we wanted to keep this process as straightforward as possible.

Another paper that we referenced was, “If someone wants my carbon, let them pay”: Examining nonindustrial private forest owner (NIPF) interest in selling forest carbon credits under California’s carbon market” (Di Tommaso, 2015). This thesis study used a mail in questionnaire to assess perceptions of forest project requirements, and interest in a non-industrial private forest program. It has been useful for us as an example of how to structure demographic questions.

Lastly, we also looked at the paper, “Linking ecosystem services and human-values theory” (Hicks, Cinner, Stoeckl, & McClanahan, 2015). This paper included psychological theory in the ecosystem service (ES) approaches to find ES motivations and priorities. Motivations included:

- Sanitation: Safe and clean water for community and environment

- Coastal habitat protection: safe fishing environment and safe homes
- Recreation: harnessing ecosystem qualities for environment
- Fishery: harnessing ecosystem for food and income
- Materials bequest: harnessing ecosystem for food and shelter
- Culture: maintaining traditions
- Education: creating or maintaining responsible fishing

The motivations for ecosystem services from this study were adapted for inclusion in our survey.

Survey Design:

We designed a survey to collect data on the values and users of Maunalua Bay. To begin, we thoroughly reviewed literature of environmental user value frameworks and survey design and implementation techniques which served as baseline information for the creation of our survey design process. This information also aided in our team's ability to develop important considerations including benefits and drawbacks of different survey delivery methods.

The book "*Survey research and analysis: applications in parks, recreation and human dimensions*" outlines the following steps for survey question design in chapter 7 (Vaske, 2008):

1. Identify exactly what kind of info you want respondents to provide
2. Use close-ended questions or scales
3. Keep it simple -- use simple words and phrases
4. Use as few words as possible to ask a question
5. Use complete sentences and avoid cryptic phrases when asking questions
6. Avoid vague quantifiers if precise estimates can be obtained (NO "rare" etc)
7. Use an equal number of negative and positive options; avoid bias
8. Distinguish "neither" from "no opinion"
9. Avoid double negatives
10. Do not write double-barreled questions

Once the objectives of information to gather were known, these steps became valuable. We used them to inform our creation of the survey.

In order to comply with the University of Hawai'i standards for ethical research, which are based on national law, we referenced the website of the UH IRB Office, as well as a UH IRB Consent form Sample (UH University of Hawai'i Office of Research Compliance, Office of Research Compliance, & IRB Office, 2018; Wilson, n.d.). They outlined how consent forms need to include certain sections such as information on risk and privacy. The documents and sample consent forms gave us the basis for an appropriate consent form in our survey.

Once we created a draft of the survey, we piloted it on students in our class and department. We used the feedback from our peers and mentors in this pilot to create our final survey. We drafted and piloted survey questions aiming to obtain information about the users including where the user lives, their activities that they do in the bay, and what in the bay that they value. Lastly, we compared the different

methods of survey implementation including online surveys, mail surveys, in-person, and telephone surveys. This comparison is presented in the results.

III. Results

Pilot Survey Data Analysis:

The survey was piloted on a group of 20 students from the NREM 601 class. Of those 20 students, 14 consented to participation in this survey. Pilot survey data was cleaned and clustered in R, an open source programming language. We chose R as our platform for data analysis because R scripts help with easily replicable data analysis methods, and the R language has a large support community online.

Data Cleaning:

The survey results export as a CSV file with each field pertaining to a survey question, and each record a single person's answers. Blank records were imported as "NA". To start, columns were re-labelled to increase ease of analysis. Likert scale survey answers were re-coded 1-5. Records from people who did not consent to the survey were removed and not included in the analysis. Likert values were averaged across economic, environmental, socio-cultural, and psychological categories within each of the frequency of use, values statements, and sense of place categories. These means were then standardized using the `scale()` function in R so that the variables all have a mean of zero and a standard deviation of one.

User Typology Clustering:

Clustering is a set of techniques that are used to find subgroups of observations (or users) within a dataset (Krantz, 2009). K-means clustering is an unsupervised machine learning algorithm that identifies relationships between n observations without training by a response variable. K-means clustering is one approach to grouping users by values, and has some advantages in comparison to more traditional regression approaches. Due to the ordinal nature of likert scale data, ordinary least squares (OLS) regressions are not always appropriate for ordinal data types. Methods like ordinal logistic regression and ordinal stepwise regression work, but the results are difficult for an NGO like Malama Maunalua to interpret on their own. K-means clustering has been used in for user typology analysis in the literature by Gabriel Damant-Sirois et. al (2014) in a study of cyclist typologies, and by Krantz et. al. (2009) in museum user typology research.

Clustering algorithms were used from the package `cluster` by Maechler, M. et. al. (2018). Specifically, we used the function `kmeans()`, that is the Hartigan-Wong algorithm (1979). K-means clustering reduces intra-cluster variation, which is the sum of squared distances Euclidean distances between observations and cluster centroids. The algorithm begins by randomly selecting k objects from the dataset to serve as initial centroid clusters. Then, the remaining observations are assigned to a cluster via the closest Euclidean distance between the observation and the cluster mean. Next, the algorithm performs "centroid update" where the computer computes the new means for each cluster, and each

observation is again checked to see if the observation might be “closest” to a different cluster, and all the observations are reassigned to the closest updated cluster means. Cluster assignment and centroid mean updates repeatedly iterate until convergence, which is when the observation’s cluster assignments no longer change (K-means cluster analysis, n.d.).

For the sample `kmeans()` analysis in the provided R code, the first positional argument is the data frame of our values, the second argument `centers` is the number of centroids, and the third argument `nstart` is the initial number of cluster configurations that we want the algorithm to try. We used the Elbow Method to determine the optimal number of clusters to specify as `centers` in the algorithm using the R package *factoextra* by Alboukadel Kassambara and Fabian Mundt (2017).

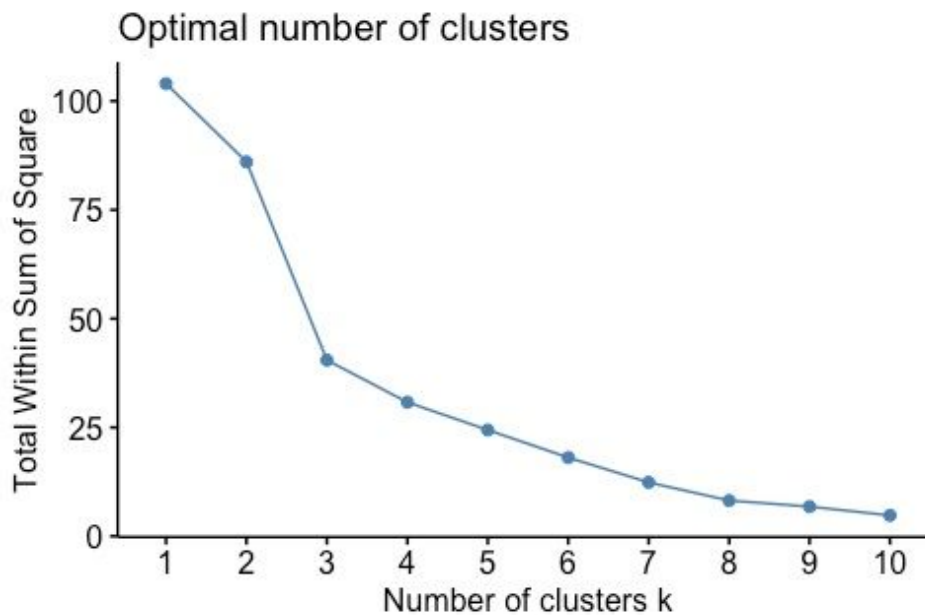


Fig. 1) Elbow plot depicting the optimal number of clusters within the pilot survey dataset.

The function `fviz_nbclust()` identifies the optimal value of `k` by computing the `k`-means algorithm for many different values of `k`, and plots the curve of total within-cluster sum of squares. On this plot, the elbow or “bend” in the plot indicates the optimal number of clusters. For our pilot survey sample of ~14 observations three clusters were identified as the optimal cluster size. We summarized descriptive statistics of each value, use, or sense of place questions for each of the clusters.

After clustering, demographic information is applied to the clusters to better understand the representation within each cluster. One way to conceptualize cluster demographics is through frequency tables that present the proportional contribution of each categorical variable within a cluster. For example, we could see the proportion male, female, and queer genders within each cluster. This demographic information then helps create the “typologies” of each cluster.

Pilot Survey Results:

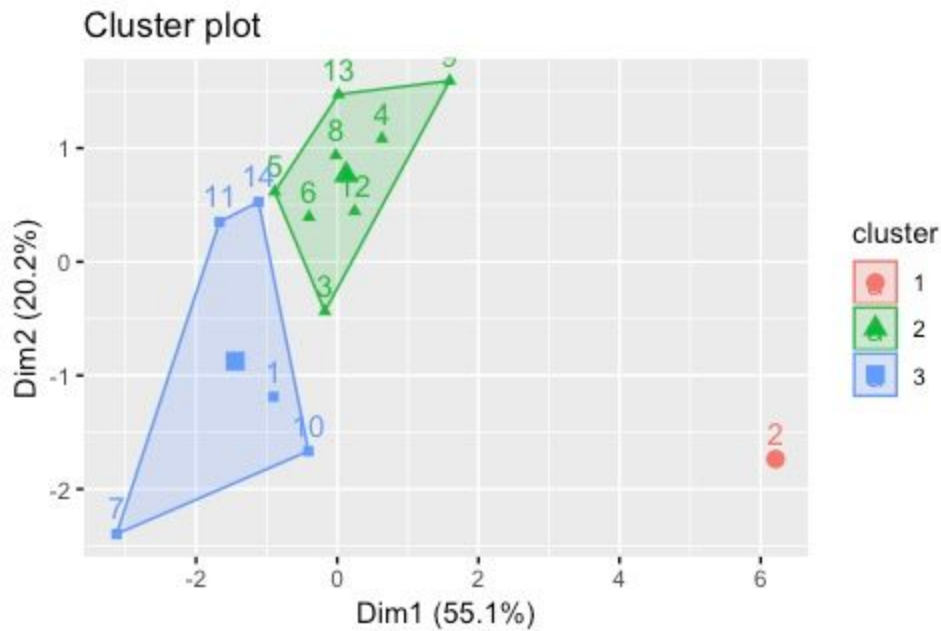


Fig. 2.) Cluster plot showing the size and closeness of the three main user clusters in the pilot sample group using the k-means algorithm, where each point is an individual user.

The k-means analysis resulted in three main clusters of users for the pilot survey dataset. Clusters two and three (Fig. 2) had very similar, high environmental, sense of place, and low frequency of use values in comparison to cluster one. Cluster two demographic information revealed that these users also are involved in civic, environmental, and volunteer groups, while cluster three is aware of volunteer opportunities but not as active. Cluster one was very different than clusters two and three, with low frequency of use, low environmental, social, and ecological values, and low sense of place values. In a larger more unbiased sample, it is likely that there would be a larger number of clusters, and a more interesting diversity of typologies.

The R code we created for this user typology analysis (“nrem601_survey_analysis.R”) is available on scholarspace, along with the pilot survey results CSV file (“user_values_responses.CSV”).

Survey Delivery Methods:

As mentioned in our literature review search, surveys can be implemented through multiple delivery methods. There are important considerations for the group to consider when implementing their survey, which is knowing what method will work best in achieving their goals such as reaching a specific population/audience and how much the group is willing to spend because certain survey methods can be pricey. The four survey methods we focus on are online, mail, in-person, and telephone surveys. Below, we discuss the four survey methods with their benefits/drawbacks. Survey should be conducted using random sampling to ensure that results are reliable and unbiased. If surveys are delivered online, they should not be sent out to an organization’s LISTSERV or posted on their website. Qualtrics and other

survey consultant companies (mentioned more below) can assist with ensuring that your survey will be randomly distributed among the populations you are targeting.

Online Surveys: With recent technological advancements, online surveys have become increasingly popular and useful for individuals/groups conducting surveys. Some of the main benefits of doing online surveys are that they tend to reach a larger audience because they are not geographically bounded and they cost less than other methods. One of the main drawbacks and worries of online surveys is that they are known to receive one of the lowest response rates compared to other methods and it is difficult to obtain a random sample, particularly when related to a specific geographic area or resource. Nonetheless, there are ways that can be addressed. Some literature suggests to send postcards to respondents before the survey in order to increase the response rates, but this requires having the mailing addresses of the proposed respondents. With online surveys, no one is asking the questions to the respondents in real time, making it extremely important that the questions are framed in a simple and concise manner, so it is not misinterpreted. If Mālama Maunalua was to implement an online survey, we recommend they contact Qualtrics, which is a software company that specializes in helping individuals/organizations develop and implement online surveys. In Hawai'i, Qualtrics charges \$6 per survey, so depending on the amount of respondents needed, the price of the total survey is relatively cheap. Unlike other survey consultants, Qualtrics does not clean or analyze the data obtained from the surveys.

Mail Surveys: Mail surveys is another convenient option for groups to implement. Similar to online surveys, mail surveys are able to receive a large sample size of respondents and they have good geographic coverage. There are a number of weaknesses associated with mail surveys as well. Once a survey is sent out to potential respondents, the surveyors have little control of when the survey will be returned back. This is an issue because it can slow down the process in receiving and analyzing survey results. There are consultant companies in Hawai'i that offer services for mail surveys and can help with addressing these potential weaknesses of mail surveys.

Survey consultant companies:

- SMS Hawai'i – Email: info@smshawaii.com; website: www.smshawaii.com
- Omnitrak Group – Email: omnitrak@omnitrakgroup.com
- Ward Research Incorporated – Email: wrstaff@wardresearch.com; website: <https://www.wardresearch.com/>

There are different costs associated with mail surveys, especially when done through survey consulting companies. There are labor costs to pay the survey consultants and costs for printing the mail survey packets. The costs depends on the length of the survey because that may require more printing services for the survey packet. Another aspect that increases survey costs is whether the group implementing the survey want to send out postcard invitations to participants

In-person Surveys: In-person surveys are useful for groups doing surveys that ask complex questions. In contrast to other survey delivery methods, in-person surveys have interviewers that can clarify the survey instructions or questions. Another strength of in-person surveys is that they could specifically target users of a specific place or group. Intercept surveys are a form of in-person delivery where the researcher seeks to administer the survey to a random sample of individuals who are using a particular resource or trail. They are often conducted in the field as the resource or area is being used. In this survey, researchers

could conduct intercept survey of users of MB. An advantage of this approach is that the survey could target bay users, many of whom may not live in the watershed or surrounding area. With in-person surveys, interviewers can also use probing techniques to receive answers from respondents that focus on a person’s feelings and emotions. This may be a viable option for our particular survey because some participants in the pilot survey mentioned some instruments to be confusing. However, there are major weaknesses with in-person surveys, which is that it is time-consuming for people to implement it and that usually will result in a small sample size. A small sample size is not favorable because the comments/results cannot be attributed to the rest of a population.

Telephone Surveys: Telephone surveys do a great job at achieving a random sample size and achieving good geographic coverage of respondents. Similar to in-person surveys, it allows for personal interaction between the interviewer and interviewee (respondent), which allows for real-time clarification about the survey and the questions asked. However, there are some major weaknesses with telephone surveys reducing its validity for our particular survey. Telephone surveys can be an inconvenience for participants because the call may interfere with someone’s schedule. In contrast to the other survey methods, telephone surveys lack visual aids and the ability to read the questions asked. This poses as a problem because an interviewer may not pronounce a word correctly or they are difficult to understand over the phone by the respondent and vice-versa, the interviewer cannot understand the respondent. There has been a decline over the years in response rates of telephone surveys, which points to more benefits associated with other survey methods.

Table 1: Comparison of popular survey delivery methods

Delivery Method	Pros	Cons	Estimated Cost (\$\$)
Online	Convenient for participants Larger audience Low \$\$	Misinterpretation of questions Low response rate Difficulty in getting a targeted sample, particularly of users	\$6 per survey ~ \$1800 total
Mail	Larger audience Good geographic coverage	Selection bias Incomplete answers Would focus on residents of watershed rather than users	\$0.34/postcard \$1.19/survey packet ~ 3500 for labor ~ \$4000 total
In-person	Clear instructions Use of probing techniques	Time-consuming Small sample size	“Free” as a project for future class or graduate student? Otherwise expensive in terms of paying technicians to implement
Telephone	Random sampling Good geographic coverage	Inconvenient for participants Lack of visual aids	Above the cost of online, exact estimate unavailable

IV. Discussion

Results from fielding this survey will help answer current questions about the frequency of uses in the bay, environmental, economic, and sociocultural values of bay users, and sense of place values that can inform agencies and NGOs of user typologies within Maunalua. Knowing user typologies can help stakeholders including government agencies and NGOs focus their policy efforts to seek support from those groups who have common values.

We have provided a survey and the corresponding tools that may be used to assess user values. We recommend the commission of a professional survey service that can use this survey to reach a large and random pool of bay users. While there is a significant cost to use such a contractor, their access to random contact information for the large target population critical to gathering meaningful data.

Our suggested cluster analysis can help inform the different “groups” of users in the bay with simple graphics that are easy to interpret. We suggest that Malama Maunalua hire an entity to perform their data analysis if they wish to investigate deeper results because the ordinal nature of Likert scale data makes regression results difficult to understand and easy to misinterpret. The R code we provide is a tool to quickly understand the present user groups and average values across each category of economic, conservation, and socio-cultural values for all three sections of the survey.

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