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A Survey of Invasive Exotic Ants Found on Hawaiian Islands: Spatial Distributions and Patterns of Association

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ABSTRACT

A Survey of Invasive Ants Found on the Hawaiian Islands:
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An intensive sampling of all ant species encountered on 6 Hawaiian Islands: Big Island, Maui, Oahu, Kauai, Molokai, and Lanai took place between 1988 and 1996. Species presence and absence was recorded at each site. Using remote sensing, variables were added insitu and used throughout my analysis. Species accumulation curves suggest that sampling was comprehensive. There is a significant trend between island area and species richness which validates the Theory of Island Biogeography for invasive species. Islands were found to be significantly nested by area, order, and tourism. Cluster analysis shows a link between elevation, land-use and island, and species presence. Predictive models can be built to predict spread of particular ant species as they continue toward equilibrium.

Keywords: biological invasions, *Formicidae*, invasive species, species accumulation, species richness, island biogeography, remote sensing, predictive modeling, hyperniche, nestedness

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INTRODUCTION

Ants feature prominently in ecological studies and are a key indicator taxon in studies of diversity and ecosystem function (Agosti et al. 2000). They play various roles in terrestrial ecosystems (e.g., predators, scavengers, herbivores, detritivores, and granivores) and are involved in an array of ecological relationships with plants and other insects (Hölldobler & Wilson 1990).

Invasive ants form a small and somewhat distinct subset of at least 150 species which have been introduced into new environments by humans (McGlynn 1999). Most remain confined to human-modified habitats and are often referred to as "tramp ants" because they rely on humans for long-distance dispersal and survival (Hölldobler & Wilson 1990, Passera 1994). Invasive ants are an important conservation concern because they inhabit a broad, and steadily increasing, geographical range of habitats influenced by humans; exhibit high local abundance; and in many cases disrupt ecosystem function (Vitousek et al. 1997, Hartley et al. 2010). Holway et al. (2002) found that invasive ants are able to penetrate natural ecosystems, where they often reduce native ant diversity and affect other organisms, both directly and indirectly (Porter and Savignano 1990). Introduced ants can cause severe ecological and economic effects, including harm to agricultural and horticultural industries (Holway et al. 2002, Pimentel 2002).

Urbanization and biological invasions are the two major forces causing habitat degradation and the loss of biodiversity worldwide (Vitousek et al. 1997, Mack et al. 2000, McKinney 2006, Buczkowski 2010). These two processes are tightly linked. Urbanization causes massive disturbance, which destroys habitats in the process of creating an urban

ecosystem to which only a relatively few species can adapt (McKinney & Lockwood 1999). For example, King and Tschinkel (2008) found that human activity and habitat disturbance played a major role in the invasion of the red imported fire ant, *Soleopsis invicta,* in northern Florida. Urbanization creates intensively managed, homogenous landscapes and forces native species to adapt (or not) to a uniform environment that is often radically different from the surrounding undeveloped habitat. When this happens, many ecological specialists become locally extinct and are replaced by a few ecological generalists that are broadly adapted and able to tolerate humans (McKinney & Lockwood 1999, Buczkowski 2010).

The Hawaiian Islands contain no native ant species (Krushelnycky et al. 2005). Wilson and Taylor (1967) consider the Hawaiian Islands to be colonized entirely by introduced species of ants, producing what is termed a "completely synthetic ant fauna" (Huddleston & Fluker 1968). In some cases, ants that invade areas with no native ant fauna exhibit patterns of invasion different from those observed in regions with indigenous ants; thus, the widespread occurrence of invasive ants on this archipelago is likely due, in part, to the absence of native ants (Zimmerman 1970, Reimer 1994, Holway et al. 2002).

The Hawaiian Islands provide an interesting location for ecological studies because of their extreme geographic isolation contrasted with an abundance of open commercial ports. Most of the Hawaiian Islands are urbanized and have experienced significant ecological degradation because of tourism, agriculture, and other human-dominated land uses. The unplanned introduction of exotic ants to Hawai'i is hypothesized to have been caused initially by mainland commerce, and the ants' subsequent dispersion likely occurred by interisland commerce (Morrison 2008).

This thesis will describe the distribution of ants on 6 islands: Hawai'i (Big Island), Maui, Oahu, Kauai, Molokai, and Lanai. My objectives are to examine (1) which ant species are present, (2) ant species diversity patterns, (3) the cause of the introduction and establishment of invasive ants on Hawai'i, and (4) if presence or absence can be accurately determined through remote sensing and geographical niche modeling.

Currently, there are many ecological studies aiming to measure the effects of a particular species on its biotic community or ecosystem (Krushelnycky and Gillespie 2010). The data provided by this thesis should give future researchers a baseline or 'snapshot' of what the Hawaiian Island ant invasion looked like from 1988 to 1996, as well as a prediction of where the invaders are most likely to become established once the invasion has reached equilibrium.

METHODS

Area of Study

The Hawaiian Islands are a small archipelago in the Pacific Ocean (16.91667°N–23°N latitude, 154.6667°W–162°W longitude). The total land area of the Hawaiian Islands is 16,625 km^2. In this study, I focused on 6 major islands: the Big Island of Hawai'i (Big Island) (10, 432 km^2), Maui (1883 km^2), Oahu (1545 km^2), Kauai (1430 km^2), Molokai (673 km^2), and Lanai (364 km^2)(Fig. 1, Table 1). Two islands were not studied, Kaho'olawe (115 km^2) and Ni'ihau (180 km^2), which make up 1.8% of the total land area of the Hawaiian Islands.

Collection of Ants

During the summers of 1988 through 1996, field teams from Brigham Young University (BYU) collected ants on the islands noted above. The Big Island was sampled in

1988 and 1989; Maui in 1988, 1993, and 1996; Oahu in 1988, 1989, 1990, and 1994; Kauai in 1992; Molokai in 1990 and 1991; and Lanai in 1994 and 1996. Ants were sampled by aspiration at regular intervals (1–2 miles apart as access permitted) along trails, secondary roads, and highways for 30 man-minutes at microsites where ants were or could be observed (in flowers, under rocks and debris, on tree trunks, etc.). The search radius at each location was ≤100 m. When traveling up an elevational gradient, field researchers ceased sampling after consecutive locations stopped yielding ants. Ants were preserved in a 70% ethanol solution in glass vials. Location descriptions of collection sites were recorded in notebooks and later plotted on topographic maps (Figs. 2–8).

Species were identified by Dr. Lloyd W. Morrison (National Park Service and Missouri State University) and Clive D. Jorgensen (Brigham Young University). I updated synonymy by using a list compiled by the United States Department of Agriculture (USDA) (Reimer 2007), as well as the Hawaiian Ant Species List (Ant Web 2007–2012). Ant samples are curated and vouchered in the insect collection of the Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah.

Manipulation of Mapped Data

The BYU field team marked each sample location on topographic maps with a circular sticker and wrote descriptions for each location in notebooks. I transferred locations by eye estimation from the paper maps to georeferenced scanned topographic maps by using AllTopo Pro (All Topo Maps). The transfer generated UTM coordinates (NAD27, Zone 4), which were then imported to ARCGIS 9.2 (ESRI 2007) for further analysis.

In order to create appropriate maps for analysis, I downloaded shapefiles and digital elevation models (DEMs) of the islands from the Hawaii Statewide GIS Program (http://hawaii.gov/dbedt/gis/). Shapefiles were originally projected in either the Old Hawaiian Datum or NAD83. I reprojected them into NAD27, zone 4, by using a NADCON transformation in ARCGIS 9.2 (ESRI 2007). The locations and names of the samples collected from 1988 to 1996 are available digitally on request (Appendix A).

Maps were made of each island with sample locations plotted and represented by a point (Figs. 2–8). These samples were then reprojected with graduated symbols according to species quantity. If the location is represented by an x, no ant species were present. As the number of species present increases so does circle size. The smallest circle is green and represents the presence of 1–3 species; the blue circle represents 4–6 species; the purple circle represents 7–9 species; and the largest red circle represents 10–12 species (Figs. 9–15).

Patterns and Distribution

Species Accumulation Curves

The BYU field team's goal when collecting ants on the Hawaiian Island was to conduct a strict inventory, which is to compile the largest possible species list for the least effort (Longino 2000). I analyzed these data with the goal of community characterization, which is to use sampling to estimate species' abundances and community species richness. When researchers physically assess presence or absence of a species by collecting, a limited number of samples can make it difficult to detect all species and their relative abundances (Chazdon et al. 1998, Colwell et al. 2004, Chao et al. 2005). Species-accumulation curves are used to apportion sampling effort (rarefaction) and correct for sampling biases (Colwell

and Coddington 1994, Chazdon et al. 1998). Only two variables are needed to fit these logarithmic series: the total number of species in the sample and the total number of individuals.

The species-accumulation curve will appear nearly linear when the area is highly undersampled, whereas the curve for a thoroughly sampled area will reach a plateau, with few to no species added with additional sampling (Longino 2000). Projecting a species-accumulation curve allows one to estimate the effort needed to add a particular number of species to the inventory or to increase the species list by a particular percentage (Longino 2000).

To create my species-accumulation curves, I used Estimate S 8.00 software (Cowell 2005), which uses abundance data to estimate the number of unseen species (species likely to be present in a larger sample of the assemblage, but which are missing from the actual sample data) to assess the completeness of the sampling and to perform comparative analysis. Within Estimate S, the data is first analyzed with a parametric indicator—the observed species number (species richness) (Colwell and Coddington 1994). Then, the original data are analyzed with a variety of nonparametric indicators.

Nonparametric estimators perform substantially better than the observed number of species (S_{obs}) and simple species-accumulation curves, such as the power curve (Cowell and Coddington 1994, Gaston 1996, Brose 2002). Additionally, nonparametric estimators require only presence/absence data and are all incidence-based on patterns of species within samples (Chazdon et al. 1998). This approach does not require assumptions about species frequency distributions (Chao et al. 2005). While many richness estimators and indices are available in Estimate S, I used the following: a species-accumulation curve (with

confidence intervals) (S_{obs}), the incidence-based coverage estimator ICE (Lee and Chao 1994), Chao2 (Chao 1987), and Jack-knife 1 (Burnham and Overton 1979). These estimators were chosen because they have improved accuracy and accessibility over other species richness estimators and are commonly used in richness estimation (Lee and Chao 1994, Chazdon et al. 1998, Longino 2000, Chao et al. 2005). The corrected versions of the estimators Chao2 and ICE, given by Colwell (2005), were used to avoid complication presented by mathematically undefined graph space (Table 3). Chao2 was found to be the most accurate and precise estimator and significantly reduced bias compared to the results of species observed (S_{obs}) (Colwell & Coddington 1994, Brose 2000). ICE performs similarly to Chao2. It uses the number of unique species, as well as the number of duplicates, yet it is less sensitive to spatial patchiness. The first-order jackknife estimates species richness based on the number of unique species occurring in one sample (Longino 2000). Jackknife analysis is based on observed frequency of rare species within the community. The bias of jackknife analysis is that it overestimates number of species and cannot be used when there are high numbers of rare species or few samples (Krebs 1999).

The curve for a highly undersampled fauna will appear nearly linear, with each new sample adding many new species to the inventory. The curve for a thoroughly sampled fauna will reach a plateau, with few or no species added with additional sampling (Longino 2000).

I projected species-accumulation curves using a logarithmic trendline in order to estimate the sampling effort needed to add additional species to the inventory number (Table 4). Logarithmic trendlines are used for large and poorly known faunas (Soberón &

Llorente 1993). In a logarithmic model, the probability of encountering additional species declines as an exponential function of the size of the species list:

$$S(t) = \frac{\ln(1+zat)}{Z}$$

where t is the number of samples, $S(t)$ is the predicted number of species at t, and z and a are curve-fitting parameters. (Longino 2000).

For additional comparative analysis, I included results from the power curve trendline. I included the power curve because it is traditionally used in studies of animal ecology (Wright 1981, Rosenzweig 1995, Condit et al. 1996, Chave et al. 2002). Measures of c (y-intercept) and z (slope) values were obtained from the power curve equation, which is

$$S = cA^z,$$

where S is the number of species, c is a fitted constant relative to the y-intercept, A is the 'area' or effort related to the sample, and z is a fitted constant representing the slope of the curve (Arrhenius 1921)(Table 5).

SAMPLE DIVERSITY

Researchers use diversity indices to obtain a measure of community organization in relation to variation in relative abundance among the different species within a community. There are many approaches to measuring diversity; however, arguments continue because the utility of these methods is not theoretically supported (Krebs 1999). Nevertheless, there are methods/indices that are used widely in diversity studies and can be used for practical studies. Indices I chose to use in this study are Fisher's alpha, the Shannon index, and the Simpson index. All were calculated with Estimate S (Table 6).

Fisher's alpha was first used to analyze the evenness between the numerous rare species and the few common species. Alpha is an expression of species diversity in the community. It is low when the total number of species is low and high when the total number of species is high (Krebs 1999).

The Shannon Index (H') measures the amount of uncertainty surrounding the prediction of the species of the next individual collected. H' stands for the information content of the sample (bits/individual), which is a measure of the amount of uncertainty. Thus, the larger the H' value, the greater the uncertainty of predicting a specific species (Krebs 1999). This uncertainty comes from having high odds or greater diversity in a given area.

The Simpson's index is a nonparametric measure that suggests that diversity is inversely related to the probability that two individuals picked at random from an infinite population will belong to the same species (Simpson 1949). The reciprocal of Simpson's index is commonly used and can be interpreted most easily as the number of equally common species required to generate the observed diversity of the sample. Thus, the reciprocal of Simpson's index is the probability that two individuals chosen at random will be different species (Krebs 1999).

Linear Regression or Species-Area Curve

Islandic fauna and flora exhibit a positive relationship between land area and species numbers. Wilson (1999) found that the larger the land area, the greater the number of species. MacArthur and Wilson (1967) posited the theory of island biogeography, which was developed to explain the processes and patterns of variation in species diversity and abundance on islands. Thus, one way to predict the number of species in any given area is

by fitting a regression line to a dataset in order to predict the number of species (Krebs 1999). Species richness is the number of species present in a sample. It is proportional to the logarithm of area sampled, so Gleason (1922) suggested that the log area should be used. Colwell and Coddington (1994) found that the semi-log form of the species-area regression was highly correlated with species richness. The equation I used is

$$S = a + \log(A),$$

where S = the number of species (species richness), A=area sampled, and a = the y-intercept of the regression. I used the natural-log (ln) transformation to linearize island area (Ramsey and Shafer 2002). Then using simple linear regression, I analyzed the relationship between the natural log of island area and island species richness (Fig. 23).

SPECIES ABUNDANCE

A graphical depiction of ecological diversity is a species-abundance plot (Whittaker plot) or rank-abundance plot (Longino 2000). All of the species found in the samples were ranked from most abundant (1) to least abundant (41) for each island. Social insects, such as ants, pose a problem since they are colonial. Because it is impossible to count individuals within a colony in searching sampling methods, researchers use the number of occurrences (the total number of times a species is captured independently in the samples, ignoring the number of individuals of a species in any one sample) (Fisher 2002). Each species' rank based on frequency of occurrence was plotted on the horizontal axis and abundance was plotted on the vertical axis (Fig. 24). The total length of the curve shows species diversity. The steepness of the curve shows the evenness of abundance. The shallower a slope is, the more diverse the species is (Longino 2000).

NESTEDNESS ANALYSIS

Nestedness analysis is an ecological tool widely used to describe patterns of species occurrences and the mechanisms underlying those patterns. Nestedness is used to describe patterns of species composition within isolated habitats such as islands and landscape fragments. In a nested pattern, the species composition of each island represents a subset of the species composition on islands/mainlands that are more species rich (Morrison 2008, Ulrich et al. 2009). Nestedness data are usually organized as a presence-absence matrix: each row is a species, each column is a site (or sampling time), and entries indicate the presence (1) or absence (0) of a species in a site. The matrix is ordered according to the marginal row and column sums, with the common species placed in the upper rows, and species-rich sites placed in the left-hand columns; this is called a packed area nested matrix (Table 8) (Ulrich et al. 2009). The null hypothesis is that presences and absences of species occur at random (Simberloff and Martin 1991).

In ant communities, nestedness occurs when species composition and patterns on an island show structure and function similar to the mainland (Morrison 2008). The presence of appropriate habitat type, and dispersal opportunities, are likely the most important mechanisms underlying nestedness. Morrison (2008) hypothesized that competitive exclusion does not determine species occurrence patterns in Hawai'i, but rather that interspecific interactions are the primary driver of distribution patterns. One of my objectives was to investigate the mechanisms leading to the observed distribution of invasive ant species in Hawai'i. To do this, I obtained geographic and economic data from Hawai'i for the year 2011 (DBEDT) and made matrices in which rows are species incidence and columns are species composition. I created separate matrices for the following

variables: island area (km^2), distance from the United States mainland (km), tourism (numbers of visitors), harbors, interisland commerce, and incoming mail (US tons). (Table 8). Normally, a comprehensive matrix is ordered according to one of these measures, however, I hypothesize that one of the previously discussed variables is responsible for the observed species distribution. I ordered the islands of each matrix separately according to the above variables. Nestedness was evaluated for the ant faunas using the program NODF (Almeida-Neto and Ulrich 2011).

Three nestedness matrices were used for my desired analysis: BR, T, and NODF (Ulrich et al. 2009). BR is a discrepancy measure which counts the minimum number of discrepancies (absence or presences) for rows and columns that must be erased to produce a perfectly nested matrix. It deviates from a nested pattern by means of minimum number of replacements of presences to produce a new matrix (Brualdi and Sanderson 1999)

T is a matrix temperature: a normalized sum of squared relative distances of absences above and presences below the hypothetical isocline that separates occupied areas from unoccupied areas in a perfectly nested matrix. The aim of this metric is to quantify whether a metacommunity deviates from a nested pattern due to the unexpected extinctions and colonizations, respectively, in more or less "hospitable" sites (Atmar and Patterson 1993).

NODF stands for/is a nestedness measure based on overlap and decreasing fills. It uses the percentage of occurrences in the right columns and species in inferior rows (bottom right of isocline) which overlap, respectively, with those found in left columns and upper rows (top left of isocline). This technique equates higher marginal totals for all pairs of columns and of rows. NODF's aim is to quantify independently (1) whether depauperate

assemblages constitute subsets of progressively richer assemblages and (2) whether less frequent species are found in subsets of the sites where the most widespread species occur (Almeida-Neto et al. 2008, Ulrich et al. 2009).

The program NODF calculates these three parameters as well as a c-score, NODF-species, and NODF-islands (Table 9). Output includes *z*-values for all nestedness variables. This value expresses the divergence of the experimental result *x* from the most probable result as a number of standard deviations. The larger the value of *z*, the less probable the experimental result is due to chance. Thus, I ordered the results according to the *z*-value and then by the PZ(HO) in order to see which parameters had the best fit for my data set.

The program also calculates a separate value for each mechanism of nestedness by island. I ordered these according to the NODF values (largest to smallest), then by ExpNODF, then by (HO) (Table 10). This ordering will show how each mechanism is ranked by island, which will determine cause of nestedness and, for the purpose of my analysis, method of original distribution.

DENDROGRAMS

I ran a hierarchical cluster analysis for all islands combined using IBM SPSS statistical software 19 (SPSS 2012). Data were clustered using a between-groups linkage with a Euclidean distance interval. Proximity matrix dendrograms were created. I analyzed linkage between presence of ant species and other ant species located in the same samples (Fig. 31), linkage of Hawaiian Islands based on ant species presence (Fig. 32), linkage between ant species and Hawaiian Island presence (Fig. 33), linkage between elevation class and ant species presence (Fig. 34), linkage between ant species and elevation class (Fig. 35), linkage between ant species and elevation (low/medium/high) (Fig. 36), linkage

between land use and ant species presence (Fig. 37), and linkage between ant species and land use (Fig. 38).

In ArcGIS 9.2, I separated elevations into classes based on natural breaks: (A) 0–59 m, (B) 60–299 m, (C) 300–599 m, (D) 600–899 m, (E) 900–1199 m, (F) 1200–4000 m. I classified low elevations as 0 m (sea level) to 100 m, medium elevations as 101–1000m, and high as 1001–4200 m.

I obtained land-use data from the United States Geological Survey (USGS). I projected a land-use shapefile in ARCGIS 9.2 and then joined that with the Hawaiian Island ant species presence-absence data. The land-use categories I used were (1) urban or built-up land, (2) agricultural land, (3) rangeland, (4) forest land, (5) water, (6) wetland, and (7) barren land.

PREDICTIVE MODELING

Many authors use methods that are based on ecological niche theory in order to predict species distributions (Guisan and Zimmermann 2000, Peterson 2003, Guisan and Thuiller 2005, Elith et al. 2006, Kearney and Porter 2009). Geographic Information Systems (GIS) have enabled prediction of whether a species can establish in a specific area based on attributes essential to the species' survival. By the use of GIS tools, mapped environmental input variables and remotely sensed variables can be correlated with known species locations and can be applied to develop a probability-based map of species occurrence (McCune 2006). These predictive models have important conservation implications because they allow visualization/identification of areas where an invasive species is likely to cause the most damage. The predictive model is also useful because there are areas

within the Hawaiian Islands which are not accessible to researchers, but that could be analyzed remotely.

I examined the difference in ecological niche characteristics based on remote sensing of the Hawaiian Islands to see if distribution of invasive ant populations can be determined based on past habitat data such as the land use, elevation, and soil properties where specific species of ants were present.

To create predictive models, I used nonparametric multiplicative regression analysis (NPMR) (McCune 2006). NPMR analyzes environmental gradients, or predictor variables, against locations with known observations of the species of interest by using kernel functions to weight those observations multiplicatively, rather than using the additive approach typical of many models. The interactions of environmental variables in nature are complex and often do not interact additively; therefore, a multiplicative approach may potentially model those natural interactions better than an additive approach (Yost 2008). Unlike the majority of predictive models, NPMR uses a multiplicative kernel smoother method to analyze the effect of each predictor variable on species distribution based on the effects of the predictor variables on one another (McCune 2006). NPMR has been successfully used to predict the distribution of indicator plant species in northwest forests in the United States (Yost 2008), the potential responses of species following different climate-change scenarios (Ellis et al. 2007), and the distribution of introduced species in estuaries along the western coast of the United States (Reusser and Lee 2008).

I created predictive NMPR models of 7 species, by island, using HyperNiche software (McCune and Mefford 2004). The Department of Agriculture considers

Wasmannia auropunctata the greatest concern in Hawai'i, but *Technomyrmex* sp., *Ochetellus glaber, Tetramorium* sp., and *Lepisiota* sp. are also of concern (Reimer 2009). The following six taxa were present in at least some samples: *Tetramorium vicarinatum, Tetramorium caldarium, Tetramorium simillimum, Tetramorium tonganum, Ochetellus glaber*, and *Technomyrmex albipes*. The analysis was also run for *Pheidole megacephala,* the ant of highest abundance on the Hawaiian Islands.

Two types of data are required for predictive modeling and analysis: response variables and predictor variables[1]. The response-variable data includes the location attributes from where species were found (e.g., elevation, land-use, etc.), as well as the presence or absence of the species being modeled. Categorical variables were represented by numerals rather than text. Also, elevation could not be read as 0; thus, all locations at sea level were entered as 1 m.

The predictor variables I used were three vector variables—soil type (MUKEY = map unit key, HELwater = highly erodible land by water, MUSYM = mapping Unit Symbol), land use, and elevation—and two raster variables—aspect and slope. The raster datasets were derived from the DEM data by using the Spatial Analyst tool in ArcGIS 9.2. Shapefiles

[1] HyperNiche requires two Excel worksheets to start the analysis. The first is a response worksheet and the second is a predictor worksheet. Both are saved as .wk1 (1-2-3) files. The response worksheet includes the presence or absence of the species for which one is creating the predictive model. The predictor worksheet includes the environmental variables for each respective sample location.

and DEMs were downloaded from the Hawaii Statewide GIS Program (www.hawaii.gov/dbedt/gis/download.htm). Variables such as the normalized difference vegetation index (NDVI), the integrated moisture index (IMI), and climatic data were unfortunately not available at an appropriate resolution for all areas, and sampling periods and were not included in my analyses.

Variables were clipped so that all shapefiles were exactly the same size and shape. Then each shapefile was changed into an ASCII file from the original vector data format.

The first phase in the NPMR process is calibration, in which the best set of predictor variables is selected and each model is ranked based on a descriptive statistic and a tolerance (standard deviation) value. The second phase is application, in which species occurrence or abundance is predicted on the basis of predictor variables selected in the calibration phase (Davis 2009).

Model strength in NPMR is determined by the descriptive statistic log β, which is the log likelihood of ratios for two competing models (McCune 2006, Yost 2008). Log β is sensitive to the number of response variables and therefore can become larger with a larger sample size. The minimum value is 0 and the value increases with the predictive strength of a model (Davis 2009). A log β value ranging from 1.0 to 2.0 is strong, and a log β value >2.0 is decisive. Predictive estimation maps were created using the GIS function in HyperNiche for the models with the highest log β values selected in the calibration phase. Output shows a probability of occurrence from 0 (low) to 20 (high)(Table 11).

Local Mean–The Gaussian (NPMR) modeling function was used for all analysis in HyperNiche (McCune and Mefford 2004) and to fit models to the predictor and response variables. This function used a free search to identify the predictor combinations with the

highest log β value when compared with the response variables. A variable that increased the log β value of the largest model by at least 5% was retained and selected as the best model (Davis 2009).

RESULTS

Patterns and Distribution

Ants were collected at 1459 locations: 483 on the Big Island (161 in Volcanoes National Park), 226 on Maui, 280 on Oahu, 214 on Kauai, 135 on Molokai, and 121 on Lanai (Table 1). Forty-one species were captured. Islands had from 27 (Lanai) to 38 (Big Island) species (Tables 1 & 2).

The greatest number of species found at one location was 13. This occurred at 2 sample locations on Oahu (Fig. 12). Seventeen samples had 10 or more species present: 7 on the Big Island, 5 on Maui, 4 on Oahu, and 1 on Lanai (Figs.10, 11,12, & 15 respectively) . No ants occurred in 158 sampling events. Most sample locations without ants were at higher elevations (Figs. 9–15)(Appendix A).

On the Big Island, species diversity was highest along the ocean shoreline and in areas with high human populations and agricultural use (Fig. 10). At 4 locations near Hilo, 10–13 species were found. Twenty-three species were found in Hawaii Volcanoes National Park. Maui had 5 locations with over 10 species (Fig. 11), and three of those occurred along the coast in residential areas. One sample location had 11 species and occurred on the northwest side of the island in an agricultural area at an elevation of 61 m. Oahu had 4 locations with 10 species or more (Fig. 12). Three locations were along the coast in large residential areas, and one was in the middle of the island in a small residential area surrounded by agricultural fields. Kauai had 6 locations containing 7 species (Fig. 13). Two

locations in Molokai had more than 10 species (Fig. 14). Most had only 1 or 2 species. Lanai (Fig. 15) had one location with more than 10 species and 8 locations with 7–9 species. The location of greatest diversity was a seaport.

The 5 most abundant species in order from highest to lowest were *Pheidole megacephala*, *Paratrechina longicornis*, *Paratrechina bourbonica* (name recently changed to *Nylanderia bourbonica), Cardiocondyla emeryi,* and *Anoplopepis gracilipes*. *Pheidole megacephala* was, by far, the most widespread species occurring in just over 50% of samples. In comparison, the next most abundant species only occurred in 20% of sample locations (Appendix A).

The current species list for the Hawaiian Islands contains 62 species (antweb.org, Reimer 2007), indicating that there are 21 species that the BYU teams did not detect (Appendix B). Two species were found in the BYU study but were not found on Reimer's list or Antweb: *Hypoponera confinis* and *Monomorium latinode.* We also had 4 *Paratrechina* sp. *"A"–"D"* that were not identified; most likely *Nylanderia vaga* is one of those. Eighteen species were ubiquitous. The Big Island had 4 unique species: *Strumigenys emmae, Tetramorium tonganum, Hypoponera zwaluwenburgi,* and *Strumigenys godeffroyi.* Also, 3 species were not found on the Big Island: *Ochetellus glaber, Monomorium sechellense*, and *Pseudomyrmex gracilis. Pseudomyrmex gracilis* was found only on Oahu (Table 2)(Appendix C).

SPECIES ACCUMULATION CURVES

Species inventory efficiency is measured by the steepness and shape of the species-accumulation curves (number of species vs. sampling effort). If the curve shows a steady increase throughout, then the community species richness was undersampled, and

attempting a richness estimate is probably premature without additional sampling. Sample species richness is typically an underestimate of community species richness. If the species-accumlation curve approaches an asymptotic limit (as sampling effort increases), then the sample species richness will be considered an adequate estimate of community species richness. For this analysis, I defined the term plateau to mean a slope (z constant) less than 6.5 for the logarithmic trendline and the term asymptote to describe a slope (z constant) of less than 5 (Table 4). For each estimator, I ran a logarithmic trendline. I picked the logarithmic trendline over the power curve in my graphs because it consistently showed less variability (smaller R^2 value) (Tables 4 & 5). If the R^2 value was greater than 0.9, I considered the variability to be low enough to determine a trend.

All species-accumulation curves, (S_{obs}, Chao 2, ICE, and jack-knife 1) appear to reach an asymptote on each island (Fig. 16–22). The Hawaiian Islands seem to reach an asymptote at about 900 samples and around 45 species (Fig. 16). Jack1 and ICE estimated the highest richness which was 44 species although the Chao2 upper confidence interval went up to 50 species (Table 3). The logarithmic trendline Chao2 had high variability (Fig. 16, Table 4). More sampling will be needed to make a more accurate estimate of species richness.

The species-accumulation curves for the Big Island seem to have a more linear shape than that of the Hawaiian Islands, although the slope becomes less steep at around 350 samples, 45–55 species (Fig. 17). The ICE mean estimated the highest species richness at 48 although the Chao2 upper confidence interval estimated 82 species. The Chao2 slope was 7.45 on the logarithmic trendline although this slope was not a significant outlier on the Power Curve (0.2). The ICE and Chao2 logistic trendlines had R^2 values of 0.89 and 0.87,

respectively, indicating variability. More sampling on the Big Island would have yielded a better estimate of species richness.

The species-accumulation curves for Maui reaches a plateau near 100 samples with around 35 species (Fig. 18). On Maui, Jack1 estimated the highest species richness of 36 species (Table 3). the Jack1 logarithmic trendline is outside of the confidence intervals and shows little variability, indicating that perhaps the Jack1 is overestimating the amount of species and that sampling was adequate (Fig. 18).

The curves for Oahu also reached an asymptote at 100 samples with around 33 species (Fig. 19). On Oahu, Jack1 had the estimated highest species richness of 34 species (Table 3).The logarithmic trendlines show variability, which is most likely responsible for the Chao2 upper confidence interval of 46 species. More sampling is needed for a better estimate of species richness on this island.

Kauai has the second steepest slope for species observed (Table 4), however, the slope becomes less steep at around 175 samples, 33–43 species (Fig. 20). Chao2 estimated the highest species richness, 41. The ICE and Chao2 estimators were variable (Table 3). More samples are need on Kauai to obtain accurate estimated species richness.

The logistic trendlines on Molokai are sublinear, indicating that more samples are needed to more accurately estimate species richness (Fig. 21). ICE and Chao2 have more variance than Jack1, which never plateaus and is not inside the S_{obs} confidence intervals, but shows a small variance (Table 4).

Lanai also didn't seem to reach an asymptote for the logarithmic trendline, but the slope decreased for the raw mean estimators at about 50 samples, corresponding with 27–

30 species (Fig. 22). All estimators are within the S_{obs} confidence intervals, indicating adequate sampling on Lanai (Table 3).

Although many of the islands would have a better species richness estimate with additional sampling, curves for all islands plateau; thus, I proceeded to analyze diversity estimators.

SAMPLE DIVERSITY

The power curve trendline estimated species richness for each island and each estimator; S_{obs}, ICE, Chao2, and Jacknife 1 (Table 5). The richness estimated for the Hawaiian Islands was 55–63 species, the Big Island 77–100 species, Maui 42–65 species, Oahu 38–52 species, Kauai 44–66 species, Molokai 51–70 species, and Lanai 35–48 species. With the exception of Molokai, these appear to be good estimates.

The following diversity indices were calculated for each island: Fisher's alpha, Shannon Index, and the reciprocal Simpson index. Fisher's alpha had values from 6.65(Oahu) to 8.44(Big Island) (SD = 0.73). This suggests evenness in sampling throughout all the islands and that diversity has a distribution similar to that of species observed. The Shannon index shows the amount of uncertainty that one would be able to predict correctly the species of the next individual collected. Results range from 11.65 (Molokai) to 21.95 (Big Island) and correspond with island area and the number of observed species, with the exception of Molokai. Molokai also didn't fit in with the Fisher's alpha order. The result of the species accumulation curves show that Molokai had a larger margin of species increase than any other islands. The reciprocal Simpson's index ranges from 1.05 (Big Island) to 2.45 (Lanai) and is the number of equally common species required to generate the

observed diversity of the sample. The reciprocal Simpson's index island order corresponds with our observed species abundance data.

The island area was significantly and positively correlated with number of species present (R^2 = 0.9547, P = 0.000782, SE = 0.96) (Fig. 23a). If we run the linear regression counting Maui, Molokai, and Lanai as Maui Nui (a large, prehistoric island that formed these individual smaller islands more recently in geological time than the other islands), the islands show a strong linear regression in the geographic order that they are found naturally within the archipelago (R^2 = 0.9519, P = 0.000782, SE = 0.96) (Fig. 23b, c).

The rank abundance graph shows that throughout the Hawaiian Islands species abundance is evenly dispersed. The functions are initially steep and deeply curved and even throughout all islands showing that the islands have relatively low diversity between each other (Fig. 24). The most abundant species was Pheidole megacephala which accounts for 18.5% of total species abundance. The next most abundant species was Paratrechina longicornis, which made up 7.25% of total species abundance. Eleven of the 41 species were over 3% abundant, accounting for 70% of all samples. The remaining 30 species made up 30% of the overall samples.

NESTEDNESS ANALYSIS

Results of program NODF analysis show that the variables that produced significant results are NODF, NODF-species, and temperature, listed in order of Z-value. C-score produced a significant result for the first variable—harbors—but the other variables were not significant (>0.05). BR and NODF-Island did not produce significant results. The average of all matrices yielded the following ranks: (1) order, (2) area, (3) tourism, (4) harbors, (5) commerce, and (6) incoming mail. NODF and NODF-species were ordered the

same: (1) order, (2) area, (3) tourism, (4) harbors, (5) incoming mail, and (6) commerce. The temperature analysis ranked the variables quite differently: (1) harbors, (2) incoming mail, (3) area, (4) order, (5) tourism, and (6) commerce. Temperature had the smallest standard deviation and confidence limits with a significant P-value. C-score had smaller confidence limits and standard deviation, yet only one mechanism was significant (Table 9).

Upon visual inspection, it appears that area, incoming mail, tourism, and commerce have an obvious isocline. It doesn't appear obvious that order or harbors are nested (Table 8). However. order, area, and tourism appear to be the most important mechanisms of nestedness according to NODF. In the temperature analysis, incoming mail is ranked second and harbors is ranked first (Table 9).

Islands did not all exhibit the same mechanism of nestedness. However tourism, area, and order were always ranked top three. Tourism is the top mechanism of nestedness for the Big Island, Kauai, and Molokai (Figs. 25, 28, & 29). Order is the top mechanism for Maui, Oahu, and Lanai (Figs. 26, 27, & 30) (Table 10).

DENDROGRAMS

The first cluster diagram shows the dissimilarity of the ant communities between islands (Fig. 32). For all cluster diagrams, the line lengths scale to Euclidian distances. The ant assemblages on Lanai and Molokai are the least dissimilar (Euclidean distance = 6.1141) followed by the Oahu and Maui pair (Euclidean distance = 10.138). Kauai clusters with Molokai (Euclidean distance = 16.021) and Lanai (Euclidean distance = 15.165). The Big Island ties all the islands together with the highest dissimilarity to Molokai (Euclidean distance = 22.676) and somewhat less dissimilarity to Maui (Euclidean distance = 17.125).

The next cluster diagram shows dissimilarity of the islands between ant communities (Fig. 33). Pheidole megacephala encompassed the most area with the largest Euclidean distance (77.631). It was most closely ranked with Paratrechina bourbonica, which was then closely linked with Anopolepis gracilipies (Euclidean distance = 26.677) and Paratrechina longicornis (Euclidean distance = 25.826). Species that scored the lowest Euclidean distances were only found on one island (Fig. 18).

Cluster diagrams of elevational bands (based on natural breaks) show definite breaks in the species similarity based on their elevation class (ANOVA: F = 3.064632, df = 41, P = $2.21E^{-7}$) (Figs. 19–20). There is a significant difference between the number of species found in each elevation group. Species found in significant numbers (present in ≥10% of samples) in high-elevation clusters (E and F) are Cardiocondyla venustula, Hypoponera opaciceps, Cerapachys biroi, Hypoponera confinis, Linepithema humile, and Paratrechina sp. "A". Species prominent (present in ≥90% of samples) in low-elevation clusters (A and B) are: Hypoponera zwaluwenburgi, Monomorium pharaonis, Monomorium destructor, Ochetellus glaber, Paratrechina sp. "C", Paratrechina sp. "D", Pseudomyrmex gracilis, Paratrechina longicornis, Strumigenys emmae, Strumigenys godeffroyi, and Tetramorium tonganum. Species found predominantly (present in ≥50% of samples) in middle-elevation clusters are Hypoponera opaciceps, Pheidole fervens, Solenopsis papuana, and Stumigenys rogeri.

All of the Hawaiian Island data together show that elevation class E has the lowest species diversity (Euclidian distance = 5.125) when it joins with class D. This group then joins with class F (5.455). From there the distances get larger to classes C (15.881), B (21.324) and A (36.005) (Fig. 34). *Pheidole megacephala* is the most widespread (Euclidean

distance = 77.631). Following it is *Paratrechina bourbonica (*26.677), *Anoplopepis gracilipes* (26.77), and *Paratrechina longicornis* (25.898) (Fig. 35).

There is a significant difference between species dissimilarity and land-use (ANOVA: F = 6.761151, df = 6, P = $1.08E^{-6}$). The cluster that encompassed the greatest distance was the urban or agricultural land-use category (Fig. 37).

The land-use cluster for species frequency in all of the Islands shows that water and wetlands have a low dissimilarity (Euclidean distance = 2.674). Barrenland and urban land follow closely (10.993) followed by rangeland, forestland and agriculture (14.825) (Fig. 37). Ant species with the greatest distance are *Pheidole megacephala* and *Paratrechina bourbonica* (Fig. 38). When the Euclidian distances becomes greater, it shows that the ant species can inhabit more areas and is more adaptive to a wide range of ecological variables.

Predictive Modeling

Predictive models were made based on the best predictor variables. The predictors that were used most often were: elevation, land use, total (species present in each sample), and elevation class (Table 11). A log β >2 shows that a model is accurate. The Big Island created strong predictive models for *Technomyrmex albipes* (log β = 2.838) and *Tetramorium caldarium* (log β = 2.568). Maui did not have models with a significant log β for any species. Oahu had good fit models for *Pheidole megacephala* (log β = 1.86) and *Tetramorium caldarium* (log β = 1.48). Kauai had a strong predictive model for *Pheidole megacephala* (log β = 2.098). Molokai had good models for *Pheidole megacephala* (log β = 1.177) and *Technomyrmex albipes* (log β = 1.464). Lanai also had a good model for *Technomyrmex albipes* (log β = 1.073) (Table 11).

*Ochetellus glaber (*Fig. 36*), Pheidole megacephala* (Fig. 40), and *Technomyrmex albipes* (Fig. 41) were best predicted by soil type and elevation over all islands. Models of *Tetramorium bicarinatum* showed elevation range to be the strongest predicting variable (Fig. 42). *Tetramorium caldarium* was best predicted by soil type and associated species (Figs. 43). *Tetramorium simillimum* was best predicted by elevation (Fig. 44). *Tetramorium tonganum* could only be predicted on the Big Island, and soil type was the best indicator of its presence (Fig. 45).

DISCUSSION

Patterns and Distribution

SPECIES RICHNESS

Obtaining reliable estimates of species richness from diverse communities is difficult, requiring intensive sampling effort and large sample size. Most of the species accumulations curves approached an asymptotic limit which implies that the sample set was adequate to reliably estimate species richness on the Hawaiian Islands between the years of 1988 and 1996.

Patterns of species richness are essentially the same among islands, with a few variants. The S_{obs} value underestimates the true number of species present because it is the raw number of species we found in our sampling, thus making it always lower than the other indicators. The ICE mean always peaks at the first few samples and then evens out as the number of samples increases. This is because this estimator is based on species found in the first 10 samples; then the ICE starts accounting for unique species and duplicates that occur as the number of samples increase (Lee and Chao 1994). The ICE power curve is the first to even out on all islands this is most likely because it is the least sensitive to

sampling density and frequency or abundance of rare species (Chazdon et al 1998). The Chao2 mean estimator tends to peak and then decrease after it has reached the estimated number of species. Most of the information is concentrated on the low-order occupancy numbers. Chao2 first relies on the number of unique species and secondly on the number of duplicate species (Chao 1984, Chazdon et al. 1998).

The Jack-knife1 mean estimator shows the highest species accumulation for all islands except for the Big Island and Kauai. This is interesting because the literature suggests that jackknife methods usually underestimate diversity accumulation (Chao 1984, Chao 1987, Chazdon et al. 1998). Although, the Jack-knife 1 is accurate, it has a high standard error with large intervals. The Jack-knife 1 standard error increases with more samples whereas the Chao2 standard error decreases (Chao 1987, Chazdon et al 1998). On the Big Island and on Kauai, Chao2 showed the highest species accumulation. Chao2 estimated the peak of species diversity at 346 samples and then decreased as samples increased on the Big Island. At this point the Jack1 seems to plateau. This differs from Kauai where Chao2 peaks at 183 samples yet the Jack1 steadily increases. I interpret the lack of a plateau in the accumulation plots in these two islands to be due to a variety of land types. Both islands experience tourism, yet also have considerable expanses of agriculture and pristine land. All of these estimators fail in cases where the number of rare species continues to remain high as new areas are sampled (Chazden et al. 1998). As new areas with a variety of different land-uses are sampled, new species that are more niche specific will likely be found. The more developed islands seemed to have fewer accurate estimators because so much of the land is disturbed habitat and open to all invaders.

The highest species richness predicted by the nonparametric estimators was 50 species on the upper confidence interval of Chao2. This is lower than the number of species known to be present currently on the Hawaiian Islands (Appendix B). BYU found a total of 41 species. Antweb lists 57 species (antweb.org 2012) and Morrison (2008) found 44 species. The difference in this species richness prediction and the observed number (Antweb) could possibly be because the ants found on the Hawaiian Islands are non-native and new species can invade as long as there is a source of introduction. The nonparametric indicators could possibly be right for the species on Hawai'i at the time of our study (sampling ended in 1996). For example, *Wasmannia auropunctata* was first detected on the Big Island in 1999. The species was most likely introduced with some palm trees which were planted in 1995 as windbreaks (Conant and Hirayama 2000). There were 2 species which were included in this study (BYU) that were not found by Morrison (2008) or listed on Antweb (antweb.org 2012): *Monomorium latinode* was found on all islands except Kauai (29 incidences), and *Hyponera confines* was only found on the Big Island and Maui (5 incidences). Reasons that these species are not currently present on the Hawaiian Islands could be that the species never were established or they could have been replaced by a new invader in the last 16 years.

Another difference between the BYU study and other lists of Hawaiian Island ant species was that the BYU study had four unknown *Paratrechina* species found on all islands. Most likely one of the species is *Paratrechina vega.* The Antweb listed 11 species that were not found in either the Morrison or this study and Morrison and Antweb found 11 species that BYU did not find. This makes 22 species or 21, if you do not count *Paratrechina vega,* that may have been introduced since 1996. Making an assumption of

linearity and using simple math, I calculate the rate of species accumulation from 1996 to present is one per 0.76 years (or addition of 1.375 species per year). Huddleston (1968) listed 42 species present on the Hawaiian Islands. Since 1968, *Solenopsis "a"* and *"b"* have been grouped together as *Solenopsis papuana* which would make the species list 41 species. This is the same number of species that the BYU study found although the individual species found differ. (Appendix B).

SAMPLE DIVERSITY

There is a strong positive relationship between species diversity on each island and island size that supports predictions of the island biogeography theory (MacArthur and Wilson 1967). It is notable that even invasive species can reach this equilibrium.

NESTEDNESS ANALYSIS

In nested analysis, a larger z-value indicates a lower probability that the experimental results are due to chance. Nestedness implies that the geographic distribution of species is a function of physical, biological, or anthropogenic processes and has implications for biogeography, evolutionary ecology and conservation (Patterson and Atmar 1986, Patterson 1987, Wright and Reeves 1992, Cook 1995, Cook and Quinn 1995, Kadmon 1995, Wright et al. 1998, Morrison 2008). The introduced ant faunas of the Hawaiian Islands are nested at the level of species assemblages. This is most likely because most of the species were found on all of the islands. Nestedness can be shown more readily if the island tested for nestedness doesn't have all species present. When Morrison (2008) analyzed the Hawaiian Islands for nestedness, he also included many small islands (Laysan, Midway, French Frigate Shoals, Kure, Nihoa, Necker, and Pearl and Hermes Reef), which were not sampled for my analysis.

Morrison (2008) found that Oahu had the most species present followed in descending order by the Big Island, Kauai, Maui, Molokai, and then Lanai. This is a different order than what we encountered in our much heavier sampling. When I included Morrison's data I found that area was still significantly correlated with number of species present (R^2= 0.7745, P = 0.00207). The Big Island had 49 species, Oahu had 47, Maui had 43, Kauai had 41, Molokai had 33, and Lanai had 32. Morrison (2008) had 13 species that were not found in our study. *Cardiocondyla nuda* and *Paratrechina vaga* were found on all islands. *Ponera swezeyi* and *Strumigenys godeffroyi* were found on the Big Island, Maui, Oahu, and Kauai. *Solenopsis* sp. and *Pyramica membranifera* were on the Big Island and Oahu. *Wasmannia auropunctata* was found on the Big Island and Kauai. *Amblyopone zwaluwenburgi, Brachymyrmex obscurior, Lepisiota* sp., and *Strumigenys lewisi* were present only on Oahu. *Pheidole moerens* and *Tetramorium insolens* were present only on the Big Island.

The following species were not found by Morrison (2008): *Cardiocondyla minutior* and *Tetramorium caldarium* occurred on all islands; *Monomorium latinode* was found on all islands except Kauai; and *Hypoponera confines* was found on the Big Island and Maui. There were four different *Paratrechina* species found on all islands. One could have been *Paratrechina vaga,* now known as *Nylanderia vaga,* but we didn't make a direct comparison of our specimens to Morrison's. We found *Monomorium destructor* on Maui. *Monomorium sechellense* and *Tetramorium simillimum* were found on Molokai. Molokai and Lanai had *Monomorium destructor, Monomorium pharaonis,* and *Anoplolepis gracilipes* that Morrison (2008) listed as absent.

CLUSTER ANALYSIS

The cluster diagrams showing species similarities among islands show that Lanai and Molokai are the most similar (Fig. 32). They are close geographically and also have the fewest introduced ant species. This could be because, relative to Maui and Oahu, there is little tourism on Molokai and Lanai. For islands that receive high tourism, species can be easily transferred between each island because tourists may often travel to multiple islands on a single visit. The Big Island of Hawai'i has the highest dissimilarity because it has areas that attract tourists, it has the greatest area out of all the islands, and hosts a variety of climates so that it can host a large variety of species.

The elevation cluster diagram reflecting the cumulative data for the islands indicates that species group by elevation (Fig. 23). Species found in elevation groups A—C are grouped closely together, and species found in groups D–F are also closely grouped. Zone A is the lowest elevation (starting at sea level) and the most probable point for introduction. Species that are newly introduced may not have dispersed into other areas and likely have not reached an ecological equilibrium of filled niche space. Species in zones D and E have become more established and may have reached their elevational limits. This is evident because the same few species are predictably found in zones D and E on all islands.

Hypoponera confinis was never found at sea level but thrives only at higher elevations.

Species with a consistently high Euclidian distance determined by frequency of elevation over all of the islands are *Paratrechina longicornis, Paratrechina bourbonica, Pheidole megacephala, Tetramorium caldarium*, *Plagiolepis alluaudi, Cardiocondyla*

venustula, Cardiocondyla emeryi, and Paratrechina sp. "A". Species with a consistently high Euclidian distance determined by frequency of land-use over all islands were *Pheidole megacephala, Paratrechina* longicornis, *Paratrechina bourbonica,* and *Anoplopepis gracilipes.*

Urban and agricultural land-use areas showed the greatest species richness. Oahu, the Big Island, and Molokai had an abundance of diverse species in urban areas. Maui, the Big Island and Kauai had the greatest diversity in agricultural areas.

Maps

Proportional Symbols

The proportional symbol maps show areas with species-rich sites versus species-poor sites. Areas with high species richness were mostly agricultural or urban areas. Introduced species tend to establish populations in areas matching the environmental conditions of their native distribution (Peterson 2003, Roura-Pascual et al. 2006); however, it is possible that different environmental conditions in the area of introduction and/or evolutionary changes post-introduction may change a species' ecological niche characteristics (Peterson and Holt 2003, Wiens & Graham 2005, Roura-Pascual et al. 2006).

Predictive Modeling

Some islands produced strong predictive models and others did not. Reasons that some of the predictive maps may be weak are that most of the remotely sensed data had low resolution and the GPS locations may not have been precise because original locations were hand-drawn on a map. Many of the species are tramp ants and could have been found in transitional areas where an established population does not exist.

Roura-Pascual et al. (2010) found that distance to urban areas and characteristics of native and introduced populations explained the rate of spread of the invasions, while habitat-related variables determined the distribution of native ants and the impact of the invader on them. My models did not show that distance from ports or cities were significant predictors of the presence of ants. However, there was an increase in species diversity around port locations (Fig. 9).

Biological invasions are a significant consequence, and component, of human-caused ecological change (Vitousek et al. 1997, Roura-Pascual et al. 2006). The invasive species' aggressiveness and its ability to occupy an environment are the two main characteristics that determine successful establishment and spread (Richardson & Pysek 2006, Roura-Pascual et al. 2010). However, there are secondary factors that contribute to the success of introduced ant species. Firstly, most are introduced without their coevolved natural predators and competitors. Secondly, there could be phenotypic and genetic changes that occur during or after the introduction. Thirdly, the degree of tolerance to the new environmental conditions could also affect the extent of establishment for the invasive species. Holway and Suarez (2006) found that the Argentine ant, *Linepithema humile*, is adept at invading undisturbed habitat and is a primary driver of ecological change and degradation. Consequences of these changes are unknown, and comparison of the occupation of a habitat by native and introduced populations are necessary (Roura-Pascual et al. 2006). Research also needs to clarify the relationships between invasive species and how they compete against each other to establish in specific habitats. These lines of research are crucial to reducing problems associated with these invaders and preventing the introduction of other species that possess similar characteristics (Holway et al. 2002).

Ants were probably first introduced by ships and air transport. Some have suggested that during World War II unregulated imports introduced numerous species to the islands (Pimentel et al. 2000). For example, in 2008, Hawai'i had 200,612 tons of cargo incoming and 58,222 tons of mail (DBEDT). Not only do invasives come from overseas but also through inter-island commerce. In 2008, Hawai'i had 63,188 tons of interisland outgoing and incoming cargo (DBEDT). Currently in Hawai'i, there are around 22 species that the BYU teams did not find in their sampling. If this were a steady rate of increase there would be over 1 species introduced each year. This is consistent with the idea that non-native species richness is increasing at a rapid rate as a consequence of increased human mobility (Levine and D'Antonio 2003, Roura-Pascual et al. 2006).

Tourism increases the vulnerability of an island to the introduction of invasive species. In 2008, Oahu had a total of 4,193,685 visitors followed by Maui with 2,075,800. The Big Island had 1,321,277, Kauai had 1,030,647, Molokai had 68,883 and Lanai had 80,867 visitors (DBEDT). Morrison (2008) found that Oahu was the most species rich (42 species) which correlates with tourism popularity. However, my data did not follow this trend.

CONCLUSION

This information expands our knowledge of invasive ants in Hawai'i from 1988 to 1996. Patterns and characteristics of an ant invasion can alert managers to variables that can predict areas susceptible to future invasion. The ability to predict is important because "the cost of eradicating invasive species from a region is generally recognized to be much greater than the cost of surveillance and containment" (Mack et al. 2000, Hartley et al.

2006). By mapping the distribution of invasive ant species, we can improve the basis for rational decision-making in the management of ants found in Hawai'i.

Repeat sampling of Hawai'i with the intent to test the validity of the predictive models should be done. Hortal et al. (2010) specified that integrating how the elements of niche, distribution, and species-habitat association change through time will further improve our understanding of the dynamics of the distributions of species across spatial scales.

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TABLES

Table 1: Island Information

Islands sampled with the corresponding area (km^2) and maximum elevation (m) (HGIS), the number of sample locations, and the number of ant species present, as recorded herein. Note: The Hawaiian Islands is the total of all the island sampled, however, the maximum elevation on the Hawaiian Islands is located on the Big Island and the total ant species does not add up because many are shared.

Island	Area (km^2)	Maximum Elevation (m)	Number of Sample Locations	Ant Species Present
Big Island	10,432	4,205	483	38
Maui	1883	3055	226	34
Oahu	1545	1220	280	32
Kauai	1430	1576	214	31
Molokai	673	1813	135	28
Lanai	364	1026	121	27
Hawaiian Islands	16,327	4,205	1459	41

Table 2: Species Present on the Hawaiian Islands

Six Hawaiian Islands are listed with the corresponding ant species found. Presence is indicated with an X and absence is indicated by a blank space. Order is alphabetical by sub-family and then by Genus and species name. We found a total of 42 species on the Hawaiian Islands.

Subfamily	Latin Name	Big Island	Maui	Oahu	Kauai	Molokai	Lanai
CERAPCHYINAE	*Cerapachys biroi*	X	X			X	
DOLICHODERINAE	*Linepithema humile*	X	X		X		
DOLICHODERINAE	*Ochetellus glaber*		X	X	X		
DOLICHODERINAE	*Tapinoma melanocephalum*	X	X	X	X	X	X
DOLICHODERINAE	*Technomyrmex albipes*	X	X	X	X	X	X
FORMICINAE	*Anoplopepis gracilipes*	X	X	X	X	X	X
FORMICINAE	*Camponotus variegatus*	X	X	X	X	X	X
FORMICINAE	*Paratrechina bourbonica*	X	X	X	X	X	X
FORMICINAE	*Paratrechina longicornis*	X	X	X	X	X	X
FORMICINAE	*Paratrechina sp. "A"*	X	X	X	X	X	X
FORMICINAE	*Paratrechina sp. "B"*	X	X	X	X	X	X
FORMICINAE	*Paratrechina sp. "C"*	X	X	X	X		
FORMICINAE	*Paratrechina sp. "D"*	X	X	X	X		
FORMICINAE	*Plagiolepis alluaudi*	X	X	X	X	X	X
MYRMICINAE	*Cardiocondyla emeryi*	X	X	X	X	X	X
MYRMICINAE	*Cardiocondyla minutior*	X	X	X	X	X	X
MYRMICINAE	*Cardiocondyla venustula*	X	X	X	X	X	X
MYRMICINAE	*Cardiocondyla wroughtonii*	X	X	X	X	X	X
MYRMICINAE	*Monomorium destructor*	X	X	X	X	X	X
MYRMICINAE	*Monomorium floricola*	X	X	X	X	X	X
MYRMICINAE	*Monomorium latinode*	X	X	X		X	X
MYRMICINAE	*Monomorium liliuokalanii*	X	X	X		X	X
MYRMICINAE	*Monomorium pharaonis*	X	X	X	X	X	X
MYRMICINAE	*Monomorium sechellense*			X	X	X	X
MYRMICINAE	*Pheidole fervens*	X	X				
MYRMICINAE	*Pheidole megacephala*	X	X	X	X	X	X
MYRMICINAE	*Solenopsis geminata*	X	X	X		X	X
MYRMICINAE	*Solenopsis papuana*	X	X	X	X	X	X
MYRMICINAE	*Strumigenys emmae*	X					
MYRMICINAE	*Strumigenys rogeri*	X			X		
MYRMICINAE	*Tetramorium bicarinatum*	X	X	X	X	X	
MYRMICINAE	*Tetramorium caldarium*	X	X	X	X	X	X
MYRMICINAE	*Tetramorium simillimum*	X	X	X	X	X	X
MYRMICINAE	*Tetramorium tonganum*	X					
MYRMICINAE	*Strumigenys godeffroyi*	X					
PONERINAE	*Hypoponera confinis*	X	X		X		
PONERINAE	*Hypoponera opaciceps*	X	X	X	X	X	X
PONERINAE	*Hypoponera punctatissima*	X	X	X	X		X
PONERINAE	*Hypoponera zwaluwenburgi*	X					
PONERINAE	*Leptogenys falcigera*	X	X	X	X	X	X
PSEUDOMYRMECINAE	*Pseudomyrmex gracilis*			X			
	Species Present	38	34	32	31	28	27

Table 3: Estimate S Output

Data results from Estimate S. Shows species observed as well as the non-parametric estimators ICE, Chao 2, and Jack-knife 1 and corresponding confidence intervals and standard deviations if available. Estimators not located within the S_{obs} confidence intervals are bold. The highest species richness estimator is indicated with a star.

Estimate S Output variables	Hawaiian Islands	Big Island	Maui	Oahu	Kauai	Molokai	Lanai
Samples	1459	483	226	280	214	135	121
Individuals (computed)	3971	1078	777	945	551	274	346
Sobs (Mao Tau)	41	39	34	32	31	28	27
Sobs 95% CI Lower Bound	40.41	34.90	31.73	26.59	26.81	25.27	21.18
Sobs 95% CI Upper Bound	43.59	45.10	36.27	37.41	37.19	32.73	32.82
Sobs SD (Mao Tau)	0.81	2.60	1.16	2.76	2.65	1.90	2.97
ICE Mean	**43.63**	***48.18**	35.00	32.79	37.06	31.83	27.36
Chao 2 Mean	42.67	**48.17**	34.17	33.00	***41**	31.48	27.00
Chao 2 95% CI Lower Bound	42.06	41.57	34.01	32.07	33.52	29.36	27.00
Chao 2 95% CI Upper Bound	49.80	82.42	37.58	46.37	85.28	45.88	27.02
Chao 2 SD (analytical)	1.31	8.28	0.54	2.31	10.17	3.14	0.08
Jack 1 Mean	***44**	**46.99**	*35.99	*33.99	**37.97**	***33.96**	*27.99
Jack 1 SD (analytical)	1.41	2.62	1.40	1.41	2.41	2.19	0.99

Table 4: Logarithmic Trendline Output
Variables were taken from Microsoft Excel logarithmic trendline and uses the following equation:

$$S(t)= \frac{\ln(1+zat)}{Z}$$

Where t is the number of samples and $S(t)$ is the predicted number of species at t, and z and a are curve fitting parameters.

		Logarithmic Trendline		
Island	analysis	R^2	z (slope constant)	a (y-intercept constant)
All	SOBS	0.95	4.27	11.78
(t=1467)	ICE	0.90	3.35	20.29
	Chao 2	0.76	2.72	25.20
	Jack 1	0.90	3.52	19.65
Big Island	SOBS	0.99	6.35	0.82
(t=483)	ICE	0.90	5.64	9.99
	Chao 2	0.87	7.45	5.94
	Jack 1	0.99	6.70	5.23
Maui	SOBS	0.98	5.46	5.56
(t=229)	ICE	0.66	2.28	22.92
	Chao 2	0.93	3.26	18.04
	Jack 1	0.90	4.36	14.50
Oahu	SOBS	0.96	4.66	7.05
(t=280)	ICE	0.74	1.85	22.90
	Chao 2	0.89	2.87	17.80
	Jack 1	0.81	3.49	15.97
Kauai	SOBS	0.99	5.82	1.08
(t=219)	ICE	0.61	3.01	17.66
	Chao 2	0.88	6.30	7.81
	Jack 1	0.97	5.73	6.55
Molokai	SOBS	0.98	6.86	4.40
(t-135)	ICE	0.09	1.14	26.60
	Chao 2	0.85	4.57	10.19
	Jack 1	0.94	6.69	2.96
Lanai	SOBS	0.99	5.72	0.59
(t=121)	ICE	0.61	2.54	18.07
	Chao 2	0.67	3.70	12.31
	Jack 1	0.84	5.20	7.29

Table 5: Hawaiian Island Power Curve Output
Variables were taken from Microsoft Excel power curve trendline and uses the following equation: $S = cA^z$; S=species, *c* = y-intercept, A=area, and *z* =slope.

		Power Curve			
Island	analysis	S (estimated species richness)	c (y-intercept)	z (slope)	R^2
All	SOBS	63	15.12	0.15	0.75
(A=16,327 km²)	ICE	56	23.03	0.09	0.77
	Chao 2	55	25.91	0.08	0.61
	Jack 1	60	20.78	0.11	0.63
Big Island	SOBS	98	8.13	0.27	0.87
(A=10,432 km²)	ICE	77	16.17	0.17	0.85
	Chao 2	100	15.26	0.20	0.86
	Jack 1	100	11.76	0.23	0.82
Maui	SOBS	65	9.15	0.26	0.85
(A=1883 km²)	ICE	42	23.23	0.08	0.60
	Chao 2	46	19.29	0.12	0.88
	Jack 1	59	14.92	0.18	0.68
Oahu	SOBS	52	9.72	0.23	0.81
(A=1545 km²)	ICE	38	23.02	0.07	0.63
	Chao 2	42	18.59	0.11	0.82
	Jack 1	49	15.29	0.16	0.60
Kauai	SOBS	64	6.30	0.32	0.89
(A=1430 km²)	ICE	44	17.70	0.12	0.51
	Chao 2	66	13.14	0.22	0.83
	Jack 1	66	9.74	0.26	0.78
Molokai	SOBS	70	3.39	0.46	0.95
(A=673 km²)	ICE	38	22.25	0.08	0.17
	Chao 2	51	10.84	0.24	0.74
	Jack 1	72	6.63	0.37	0.82
Lanai	SOBS	46	5.24	0.37	0.93
(A=364 km²)	ICE	35	17.45	0.12	0.54
	Chao 2	39	12.43	0.19	0.68
	Jack 1	48	8.48	0.29	0.75

Table 6: Diversity Indices

Diversity indices were calculated in EstimateS for each island: Fisher's Alpha, Shannon Index, and Simpson's Reciprocal Index. Sample number, frequency of occurrence and species richness variables are from the original sampling dataset.

Island	Number of Samples (N)	Frequency of Species Occurance	Species Richness	Fisher's Alpha	Shannon Index	Reciprocal Simpson Index
Big Island	483	1080.00	41	8.44	21.95	1.05
Maui	229	777.00	35	7.53	21.25	1.45
Oahu	280	945.00	33	6.65	19.80	1.63
Kauai	219	551.00	31	7.10	16.39	1.85
Molokai	135	272.00	29	8.22	11.65	2.12
Lanai	121	346.00	27	6.85	14.35	2.45
mean	244.50	661.83	32.67	7.46	17.57	1.76
standard deviation	131.36	326.29	4.97	0.73	4.11	0.50

Table 7: Ant species incidences

Frequency of ant species occurrences are listed by island. Each island had a different sampling effort (N). Species order is sorted by incidence—largest to smallest and then alphabetical. Island order is based on species occurrences.

Latin Name	Big Island (N=483)	Maui (N=229)	Oahu (N=280)	Kauai (N=219)	Molokai (N=135)	Lanai (N=121)	incidence
Pheidole megacephala	139	109	146	145	108	88	735
Paratrechina longicornis	51	62	99	41	17	18	288
Paratrechina bourbonica	120	31	22	44	12	25	254
Cardiocondyla emeryi	27	64	44	33	26	42	236
Anoplopepis gracilipes	94	53	75	1	1	2	226
Cardiocondyla venustula	80	33	30	32	9	28	212
Solenopsis geminata	36	50	62	6	15	24	193
Plagiolepis alluaudi	52	42	41	33	4	16	188
Tetramorium caldarium	37	57	42	15	9	8	168
Tapinoma melanocephalum	44	34	33	15	8	21	155
Cardiocondyla minutior	43	24	30	16	3	11	127
Technomyrmex albipes	40	31	29	12	4	3	119
Monomorium liliuokalanii	28	26	27	7	4	4	96
Paratrechina sp. "A"	49	4	10	23	2	5	93
Solenopsis papuana	16	9	44	9	2	8	88
Ochetellus glaber	0	8	64	13	0	0	85
Leptogenys falcigera	11	12	30	21	1	2	77
Monomorium destructor	7	27	30	6	3	3	76
Monomorium pharaonis	7	22	17	8	6	2	62
Tetramorium bicarinatum	43	2	9	3	3	0	60
Camponotus variegatus	11	7	14	11	6	8	57
Linepithema humile	21	16	0	20	0	0	57
Paratrechina sp. "B"	12	14	6	9	5	4	50
Paratrechina sp. "C"	23	5	1	11	0	0	40
Cardiocondyla wroughtonii	11	7	3	9	4	2	36
Pheidole fervens	31	1	0	0	0	0	32
Monomorium floricola	10	8	6	2	2	3	31
Monomorium latinode	6	10	4	0	3	6	29
Hypoponera opaciceps	15	2	3	2	3	3	28
Monomorium sechellense	1	0	5	0	10	2	18
Tetramorium simillimum	2	2	3	1	1	7	16
Hypoponera punctatissima	1	2	5	1	0	1	10
Pseudomyrmex gracilis	0	0	10	0	0	0	10
Hypoponera confinis	2	2	0	1	0	0	5
Cerapachys biroi	1	1	0	0	1	0	3
Tetramorium tonganum	3	0	0	0	0	0	3
Hypoponera zwaluwenburgi	2	0	0	0	0	0	2
Paratrechina sp. "D"	1	0	1	0	0	0	2
Strumigenys rogeri	1	0	0	1	0	0	2
Strumigenys emmae	1	0	0	0	0	0	1
Strumigenys godeffroyi	1	0	0	0	0	0	1
ant species occurrences	1080	777	945	551	272	346	3971

Table 8: Packed Area Nestedness Matrices for Six Variables: Area, Order (distance from continental United States), Tourism, Commerce, Harbors, and Incoming Mail

All data was collected from the state of Hawaii Department of Business, Economic Development and Tourism from 2011 data. Islands are ordered from largest to smallest. Species are ordered by incidence, largest to smallest. Species that occurred on all islands were not included in this figure. A 1 indicates presence and a 0 means that the species was not detected.

AREA

Latin Name	Big Island	Maui	Oahu	Kauai	Molokai	Lanai	incidence
Tetramorium bicarinatum	1	1	1	1	1	0	5
Hypoponera punctatissima	1	1	1	1	0	1	5
Monomorium latinode	1	1	1	0	1	1	5
Monomorium liliuokalanii	1	1	1	0	1	1	5
Solenopsis geminata	1	1	1	0	1	1	5
Paratrechina sp. "C"	1	1	1	1	0	0	4
Paratrechina sp. "D"	1	1	1	1	0	0	4
Monomorium sechellense	0	0	1	1	1	1	4
Linepithema humile	1	1	0	1	0	0	3
Hypoponera confinis	1	1	0	1	0	0	3
Cerapachys biroi	1	1	0	0	1	0	3
Ochetellus glaber	0	1	1	1	0	0	3
Pheidole fervens	1	1	0	0	0	0	2
Strumigenys rogeri	1	0	0	1	0	0	2
Strumigenys emmae	1	0	0	0	0	0	1
Tetramorium tonganum	1	0	0	0	0	0	1
Strumigenys godeffroyi	1	0	0	0	0	0	1
Hypoponera zwaluwenburgi	1	0	0	0	0	0	1
Pseudomyrmex gracilis	0	0	1	0	0	0	1
species frequency	16	12	10	9	6	5	58

ORDER

Latin Name	Big Island	Maui	Molokai	Lanai	Oahu	Kauai	incidence
Tetramorium bicarinatum	1	1	1	0	1	1	5
Hypoponera punctatissima	1	1	0	1	1	1	5
Monomorium latinode	1	1	1	1	1	0	5
Monomorium liliuokalanii	1	1	1	1	1	0	5
Solenopsis geminata	1	1	1	1	1	0	5
Paratrechina sp. "C"	1	1	0	0	1	1	4
Paratrechina sp. "D"	1	1	0	0	1	1	4
Monomorium sechellense	0	0	1	1	1	1	4
Linepithema humile	1	1	0	0	0	1	3
Hypoponera confinis	1	1	0	0	0	1	3
Cerapachys biroi	1	1	1	0	0	0	3
Ochetellus glaber	0	1	0	0	1	1	3
Pheidole fervens	1	1	0	0	0	0	2
Strumigenys rogeri	1	0	0	0	0	1	2
Strumigenys emmae	1	0	0	0	0	0	1
Tetramorium tonganum	1	0	0	0	0	0	1
Strumigenys godeffroyi	1	0	0	0	0	0	1
Hypoponera zwaluwenburgi	1	0	0	0	0	0	1
Pseudomyrmex gracilis	0	0	0	0	1	0	1
species frequency	16	12	6	5	10	9	58

TOURISM

Latin Name	Oahu	Maui	Big Island	Kauai	Lanai	Molokai	incidence
Tetramorium bicarinatum	1	1	1	1	0	1	5
Hypoponera punctatissima	1	1	1	1	1	0	5
Monomorium latinode	1	1	1	0	1	1	5
Monomorium liliuokalanii	1	1	1	0	1	1	5
Solenopsis geminata	1	1	1	0	1	1	5
Monomorium sechellense	1	0	0	1	1	1	4
Paratrechina sp. "C"	1	1	1	1	0	0	4
Paratrechina sp. "D"	1	1	1	1	0	0	4
Linepithema humile	0	1	1	1	0	0	3
Hypoponera confinis	0	1	1	1	0	0	3
Cerapachys biroi	0	1	1	0	0	1	3
Ochetellus glaber	1	1	0	1	0	0	3
Strumigenys rogeri	0	0	1	1	0	0	2
Pheidole fervens	0	1	1	0	0	0	2
Strumigenys emmae	0	0	1	0	0	0	1
Tetramorium tonganum	0	0	1	0	0	0	1
Strumigenys godeffroyi	0	0	1	0	0	0	1
Hypoponera zwaluwenburgi	0	0	1	0	0	0	1
Pseudomyrmex gracilis	1	0	0	0	0	0	1
species frequency	10	12	16	9	5	6	58

COMMERCE

Latin Name	Oahu	Big Island	Maui	Molokai	Lanai	incidence
Monomorium latinode	1	1	1	1	1	5
Monomorium liliuokalanii	1	1	1	1	1	5
Solenopsis geminata	1	1	1	1	1	5
Tetramorium bicarinatum	1	1	1	1	0	4
Hypoponera punctatissima	1	1	1	0	1	4
Cerapachys biroi	0	1	1	1	0	3
Paratrechina sp. "C"	1	1	1	0	0	3
Paratrechina sp. "D"	1	1	1	0	0	3
Monomorium sechellense	1	0	0	1	1	3
Linepithema humile	0	1	1	0	0	2
Hypoponera confinis	0	1	1	0	0	2
Pheidole fervens	0	1	1	0	0	2
Ochetellus glaber	1	0	1	0	0	2
Strumigenys rogeri	0	1	0	0	0	1
Strumigenys emmae	0	1	0	0	0	1
Tetramorium tonganum	0	1	0	0	0	1
Strumigenys godeffroyi	0	1	0	0	0	1
Hypoponera zwaluwenburgi	0	1	0	0	0	1
Pseudomyrmex gracilis	1	0	0	0	0	1
species frequency	10	16	12	6	5	49

INCOMING MAIL

Latin Name	Big Island	Maui	Oahu	Molokai	Lanai	incidence
Monomorium latinode	1	1	1	1	1	5
Monomorium liliuokalanii	1	1	1	1	1	5
Solenopsis geminata	1	1	1	1	1	5
Tetramorium bicarinatum	1	1	1	1	0	4
Hypoponera punctatissima	1	1	1	0	1	4
Paratrechina sp. "C"	1	1	1	0	0	3
Paratrechina sp. "D"	1	1	1	0	0	3
Monomorium sechellense	0	0	1	1	1	3
Cerapachys biroi	1	1	0	1	0	3
Linepithema humile	1	1	0	0	0	2
Hypoponera confinis	1	1	0	0	0	2
Ochetellus glaber	0	1	1	0	0	2
Pheidole fervens	1	1	0	0	0	2
Strumigenys rogeri	1	0	0	0	0	1
Strumigenys emmae	1	0	0	0	0	1
Tetramorium tonganum	1	0	0	0	0	1
Strumigenys godeffroyi	1	0	0	0	0	1
Hypoponera zwaluwenburgi	1	0	0	0	0	1
Pseudomyrmex gracilis	0	0	1	0	0	1
species frequency	16	12	10	6	5	49

HARBORS

Latin Name	Oahu	Maui	Big Island	Kauai	incidence
Tetramorium bicarinatum	1	1	1	1	4
Hypoponera punctatissima	1	1	1	1	4
Paratrechina sp. "C"	1	1	1	1	4
Paratrechina sp. "D"	1	1	1	1	4
Monomorium latinode	1	1	1	0	3
Monomorium liliuokalanii	1	1	1	0	3
Solenopsis geminata	1	1	1	0	3
Linepithema humile	0	1	1	1	3
Hypoponera confinis	0	1	1	1	3
Ochetellus glaber	1	1	0	1	3
Monomorium sechellense	1	0	0	1	2
Cerapachys biroi	0	1	1	0	2
Pheidole fervens	0	1	1	0	2
Strumigenys rogeri	0	0	1	1	2
Strumigenys emmae	0	0	1	0	1
Tetramorium tonganum	0	0	1	0	1
Strumigenys godeffroyi	0	0	1	0	1
Hypoponera zwaluwenburgi	0	0	1	0	1
Pseudomyrmex gracilis	1	0	0	0	1
species frequency	10	12	16	9	47

Table 9: Program NODF Variable Comparisons of Nestedness Matrices

Area, order (distance from continental United States), tourism, commerce, harbors, and incoming mail nestedness was analyzed using the program NODF. Output included six nestedness indices: NODF, NODF-species, temperature, c-score, BR and NODF-islands. Significant PZ(HO) are shown in bold. BR and NODF-islands did not return any significant p-values. Nestedness mechanisms are listed in order of z-values starting with the NODF index. Temperature had the smallest standard deviation and confidence limits with a significant p-value. C-score had smaller confidence limits and standard deviation yet only one mechanism was significant. BR and NODF-island were not found to be significant. When all matrices were averaged, order followed closely by tourism had the highest average z-value and both were the only mechanisms found significant although harbors had the highest z-value.

NODF

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Tourism	3.7	**0.0001037**	61.87	47.78	3.81	0.27	-0.06	0.001	40.9	55.3
2	Order	3.66	**0.0001179**	61.87	47.57	3.9	0.27	-0.17	0.001	40.46	54.87
3	Area	3.65	**0.0001245**	61.87	47.56	3.92	0.27	-0.14	0.001	38.54	54.85
4	Harbors	3.57	**0.0001705**	52.62	40.01	3.53	0.21	-0.03	0.001	33.63	47.13
5	Incoming Mail	3.25	**0.0005456**	58.76	45.67	4.02	0.24	0.05	0.002	37.75	53.6
6	Commerce	3.21	**0.0006458**	58.76	45.47	4.14	0.24	-0.04	0.002	37.44	53.25

NODF-Species

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Tourism	3.68	**0.0001116**	61.25	47.09	3.85	0.27	-0.06	0.001	40.12	54.68
2	Order	3.65	**0.0001246**	61.25	46.86	3.94	0.27	-0.17	0.001	39.88	54.33
3	Area	3.63	**0.0001362**	61.25	46.86	3.97	0.27	-0.13	0.001	37.58	54.19
4	Harbors	3.56	**0.0001784**	52.32	39.69	3.55	0.21	-0.03	0.001	33.29	46.83
5	Incoming Mail	3.24	**0.0005743**	58.29	45.17	4.05	0.24	0.05	0.002	37.2	53.11
6	Commerce	3.19	**0.0006785**	58.29	44.96	4.18	0.24	-0.05	0.002	36.91	52.74

temperature

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Harbors	2.02	**0.0214537**	7.18	3.36	1.89	0.04	0.87	0.037	0.56	7.6
2	Incoming Mail	1.98	**0.0236472**	6.29	3.11	1.6	0.03	1.53	0.018	0.59	6.13
3	Area	1.87	**0.0304691**	6.57	3.62	1.57	0.03	0.92	0.041	0.97	7.07
4	Order	1.8	**0.0354348**	6.57	3.55	1.67	0.03	1.64	0.038	0.9	7.01
5	Tourism	1.77	**0.0379387**	6.57	3.6	1.67	0.03	1.06	0.045	0.79	6.99
6	Commerce	1.75	**0.0402478**	6.29	3.06	1.85	0.03	2.5	0.03	0.61	6.53

c-score

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Harbors	2.05	**0.0202382**	0.07	0.04	0.01	0	0.11	0.024	0.02	0.07
2	Area	1.51	0.065548	0.14	0.09	0.03	0	0.37	0.087	0.03	0.15
3	Order	1.5	0.0664007	0.14	0.09	0.03	0	0.32	0.092	0.03	0.16
4	Tourism	1.4	0.0805857	0.14	0.09	0.03	0	0.31	0.095	0.03	0.16
5	Commerce	0.41	0.3421018	0.07	0.06	0.02	0	0.35	0.35	0.02	0.11
6	Incoming Mail	0.32	0.3733374	0.07	0.06	0.02	0	0.26	0.384	0.02	0.11

BR

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Order	1.54	0.0617614	10	7.36	1.72	1.39	-0.17	0.098	4	11
2	Harbors	1.5	0.0664637	7	4.96	1.36	1.51	-0.18	0.121	2	7
3	Area	1.46	0.0718729	10	7.51	1.71	1.31	-0.06	0.122	4	11
4	Tourism	1.44	0.0745258	10	7.49	1.74	1.32	-0.2	0.125	4	11
5	Commerce	0.12	0.4526073	6	5.81	1.59	0.12	-0.08	0.5	3	9
6	Incoming Mail	0.04	0.4843779	6	5.94	1.63	0.04	-0.25	0.5	3	9

NODF-Island

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Area	1.13	0.1301633	95.5	86.19	8.28	0.67	-1.5	0.122	69.05	97.91
2	Order	1.11	0.1330783	95.5	86.41	8.18	0.67	-1.34	0.131	69.61	97.87
3	Tourism	1.11	0.1340458	95.5	85.89	8.68	0.68	-1.36	0.118	59.39	97.87
4	Commerce	1.02	0.1543856	96.68	86.78	9.73	0.75	-1.77	0.176	66.49	98.58
5	Incoming Mail	1.01	0.1553224	96.68	86.97	9.58	0.75	-1.38	0.183	66.67	98.6
6	Harbors	0.77	0.219914	94.2	84.02	13.18	0.64	-1.34	0.401	47.62	98.08

Average Matrices

Rank	Type	Z-Value	PZ(H0)	observed	expected	StdDev	Index	Skewness	P(H0)	L95%CL	U95%CL
1	Order	2.21	**0.04948628**	39.2217	31.9733	3.24	0.43833	0.01833	0.06017	25.8133	37.54
2	Area	2.20833	**0.049719**	39.2217	31.9717	3.24667	0.425	-0.09	0.06233	25.0283	37.52833
3	Tourism	2.18333	0.05455188	39.2217	31.99	3.29667	0.42833	-0.05167	0.06417	24.205	37.66667
4	Harbors	2.245	0.05473642	35.565	28.68	3.92	0.435	-0.1	0.0975	19.52	34.45167
5	Commerce	1.61667	0.16511113	37.6817	31.0233	3.585	0.23	0.15167	0.17667	24.0783	36.70167
6	Incoming Mail	1.64	0.17296747	37.6817	31.1533	3.48333	0.21667	0.04333	0.1815	24.205	36.75833

Table 10: NODF Output for each Island

Mechanisms of nestedness are ranked starting with most nested as (1). Significant p-values are bold. Order, tourism, and area are the most highly nested variables.

a. Big Island					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
tourism	2.077	0.371	**0.001**	0.056	0.895
area	2.077	0.363	**0.001**	0.051	0.838
order	2.077	0.358	**0.001**	0.054	0.892
commerce	2	0.349	**0.001**	0.051	0.821
incoming mail	2	0.347	**0.001**	0.053	0.784
harbors	1.333	0.251	**0.001**	0.026	0.553
b. Maui					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
order	1.152	0.333	**0.004**	0.054	0.838
area	1.152	0.33	**0.005**	0.054	0.833
tourism	1.152	0.347	**0.006**	0.028	0.861
incoming mail	1.061	0.328	**0.004**	0.029	0.806
commerce	1.061	0.331	**0.01**	0.027	0.861
harbors	0.909	0.177	**0.001**	0	0.486
c. Oahu					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
order	1.875	0.33	**0.001**	0.029	0.853
area	1.875	0.329	**0.001**	0.029	0.833
tourism	1.875	0.327	**0.001**	0.029	0.829
incoming mail	1.781	0.336	**0.001**	0.028	0.861
commerce	1.781	0.334	**0.001**	0.028	0.857
harbors	1.656	0.161	**0.001**	0	0.444
d. Kauai					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
tourism	2	0.347	**0.001**	0.029	0.909
order	2	0.337	**0.001**	0.029	0.882
area	2	0.333	**0.001**	0.029	0.879
harbors	1.161	0.129	**0.001**	0	0.4
e. Molokai					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
tourism	1.286	0.319	**0.003**	0	0.853
area	1.286	0.316	**0.003**	0.029	0.824
order	1.286	0.32	**0.004**	0.029	0.912
commerce	0.964	0.321	**0.019**	0	0.882
incoming mail	0.964	0.329	**0.027**	0	0.971
f. Lanai					
Variable	NODF	ExpNODF	P(H0)	L95%CL	U95%CL
order	0.481	0.219	0.105	0	0.688
area	0.481	0.215	0.108	0	0.688
tourism	0.481	0.229	0.121	0	0.688
incoming mail	0	0.207	0.17	0	0.69
commerce	0	0.199	0.216	0	0.7

Table 11: Hyperniche Output for Predictive Models

Model strength in NPMR is determined by the descriptive statistic log β which is the log likelihood of ratios for two competing models. Predictive estimation maps were created using the GIS function in HyperNiche for the models with the highest log β values selected in the calibration phase. The variable in the predictor column is the GIS layer that was the strongest indicator of species presence. A 1-2 log β output is strong and >2 is derisive.

Island	Species	Predictor	log β	Tolerance	N= averge neighborhood size
Big Island	*Pheidole megacephala*	elevation	0.4131	497.5	104.2
	Technomyrmex albipes	elevation	2.838	497.5	104.2
	Tetramorium bicarinatum	landuse	-0.2117	52.15	300.61
	Tetramorium caldarium	total	2.568	0.6	114.11
	Tetramorium simillimum	elevation	-0.4883	1990	282.02
	Tetramorium tonganum	landuse	0.4886	7.45	135.36
	Ochetellus glaber	landuse	0.07571	59.2	129.76
Maui	*Pheidole megacephala*	elevation	-0.4486	1500	107.59
	Technomyrmex albipes	elevation	-0.1575	3000	141.01
	Tetramorium caldarium	landuse	-0.4492	118.4	173.77
	Tetramorium simillimum	landuse	0.2692	14.8	48.24
	Ochetellus glaber	landuse	0.6161	15.9	61.74
Oahu	*Pheidole megacephala*	landuse	1.86	23.85	78.92
	Technomyrmex albipes	total	-0.06489	3.9	190.17
	Tetramorium bicarinatum	elevation class	0.09789	10.7	188.87
	Tetramorium caldarium	landuse	1.482	23.85	78.92
	Tetramorium simillimum	elevation	-0.513	3199	234.37
	Ochetellus glaber	elevation	-0.2155	191.9	101.14
Kauai	*Pheidole megacephala*	elevation	2.098	63.95	56.63
	Technomyrmex albipes	landuse	0.06429	6.4	28.52
	Tetramorium bicarinatum	elrange	-0.3828	1.5	113.24
	Tetramorium caldarium	landuse	0.1003	19.2	61.11
Lanai	*Pheidole megacephala*	total	0.04277	2	71.24
	Technomyrmex albipes	landuse	1.073	2.75	18.69
	Tetramorium caldarium	total	-0.311	1	44.99
	Tetramorium simillimum	total	-0.3321	1.5	60.24
Molokai	*Pheidole megacephala*	elevation class	1.177	3	89.03
	Technomyrmex albipes	total	1.464	0.4	27.94
	Tetramorium bicarinatum	total	0.03872	0.8	44.17
	Tetramorium caldarium	total	0.07396	0.8	44.17

FIGURES

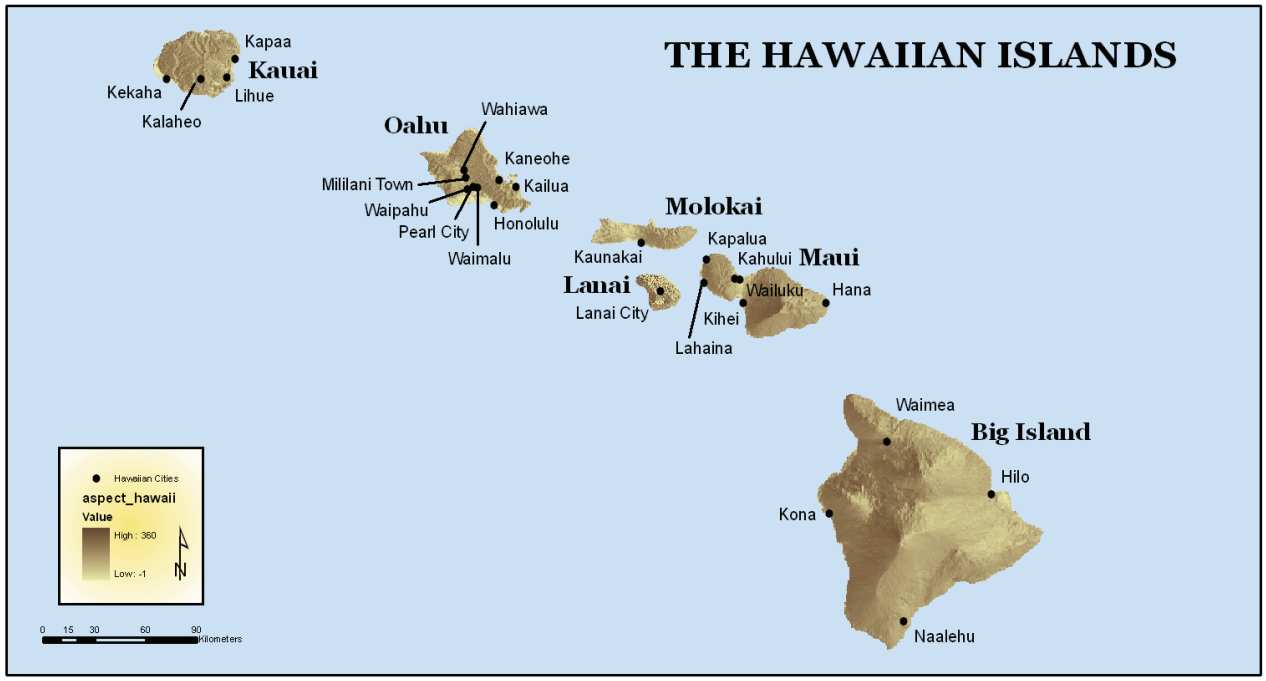


Figure 1: Map of Hawaiian Islands. Shows the six main islands included in our study: Kauai, Oahu, Molokai, Lanai, Maui, and the Big Island. Points show locations of main cities.

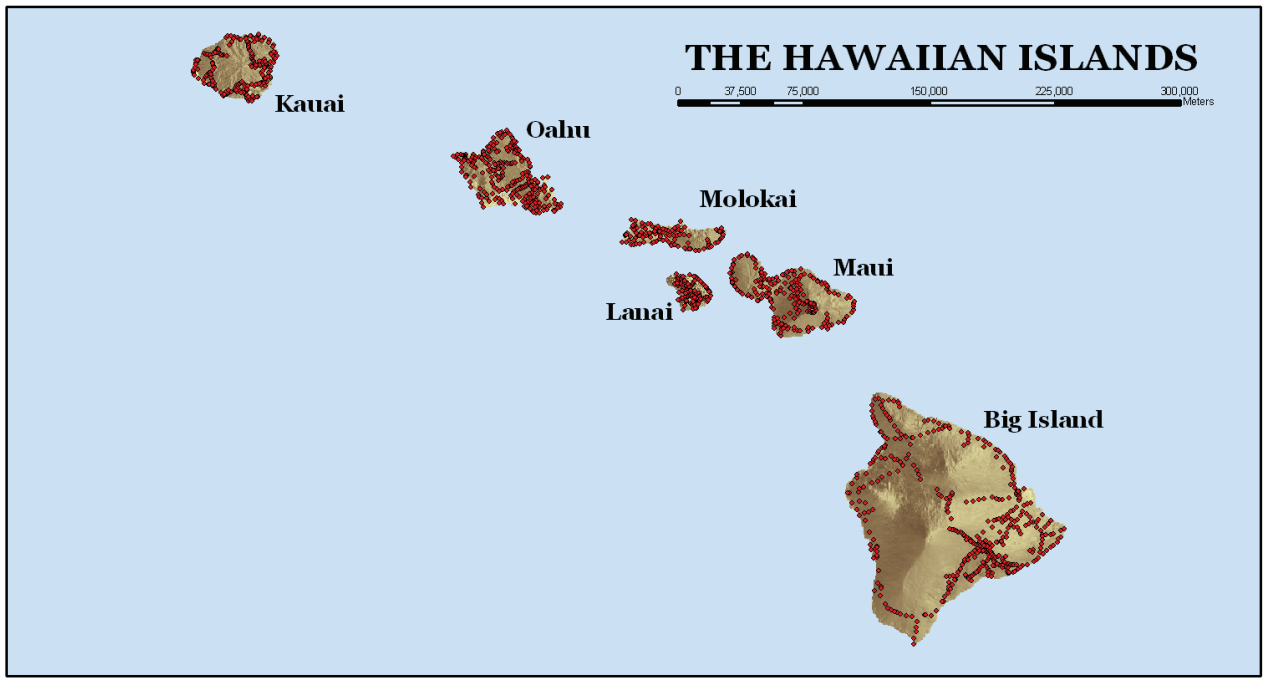


Figure 2: Hawaiian Island sampling locations. Depicted are the six main islands of Hawai'i, United States of America. Original sampling locations are shown by red dots.

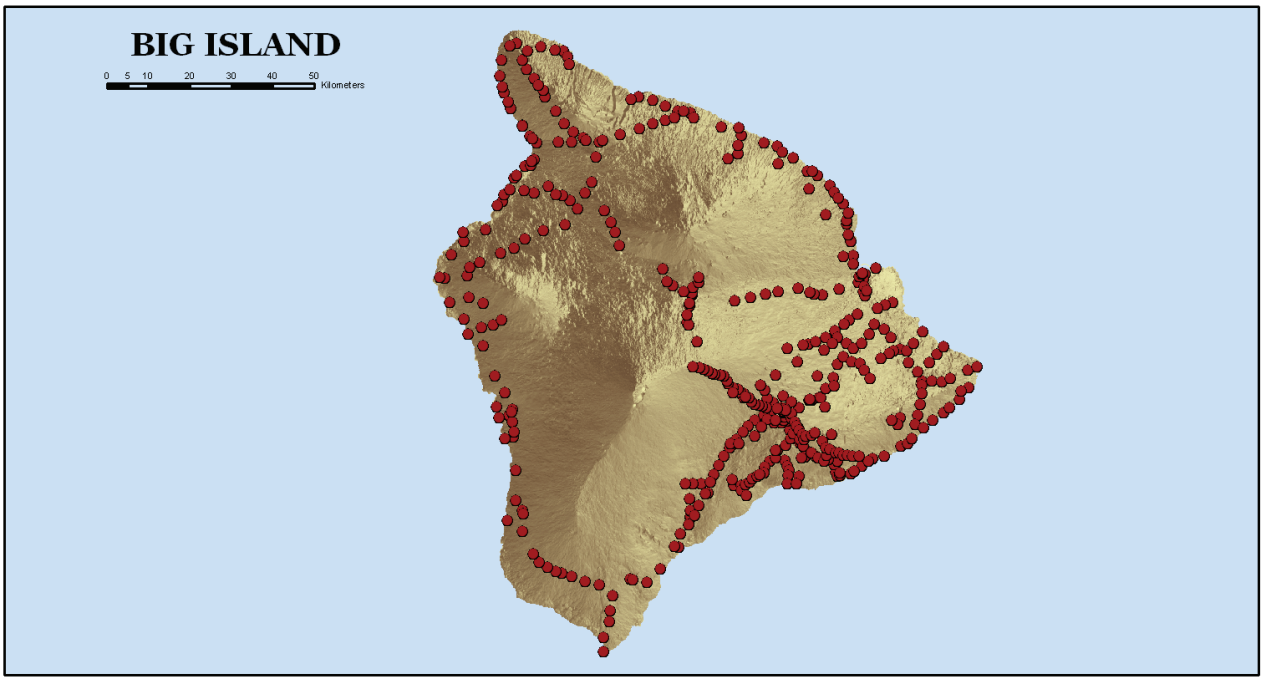


Figure 3: Map of the Big Island of Hawai'i. Sampled during the summers of 1988 and 1989.

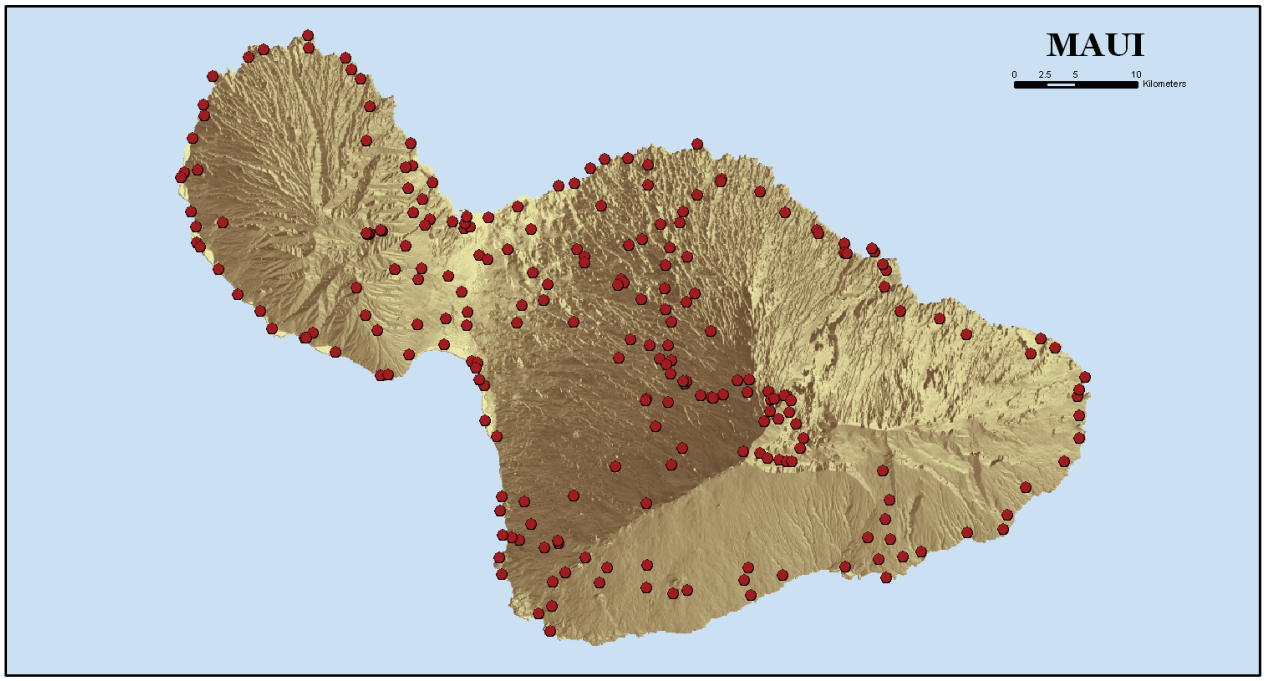


Figure 4: Map of Maui. Sampled during the summers of 1988, 1993, and 1996.

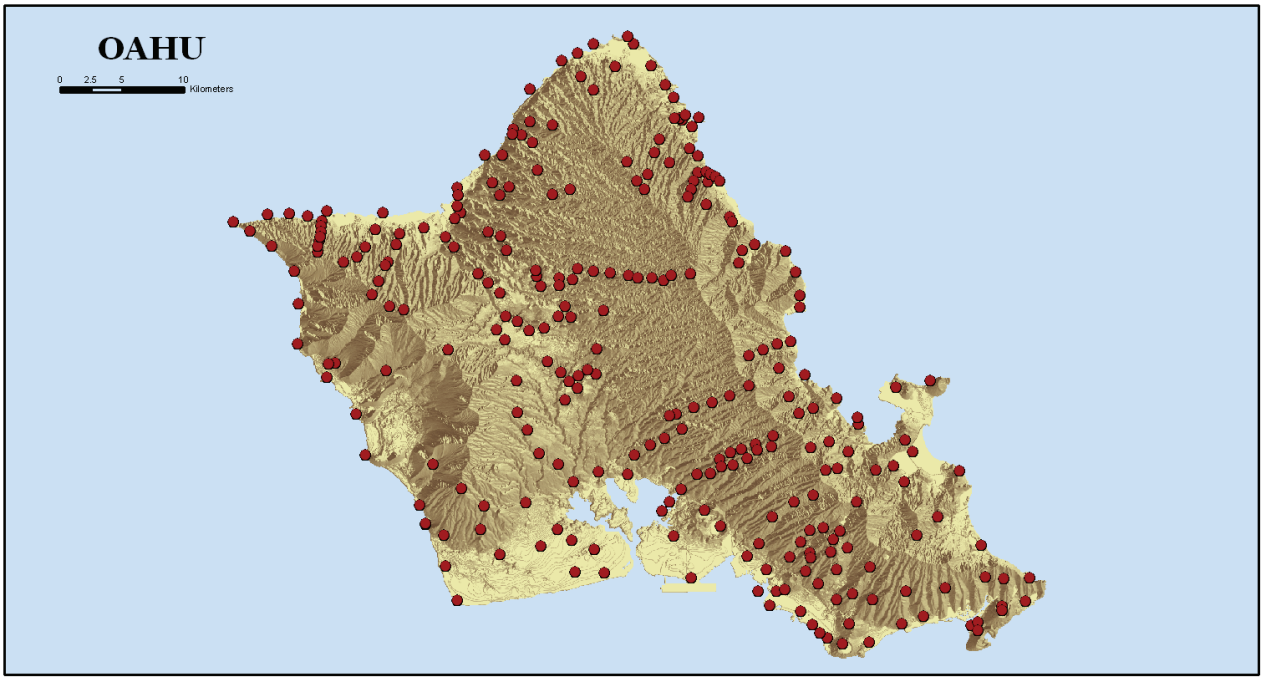


Figure 5: Map of Oahu. Sampled during the summers of 1988, 1989, 1990, and 1994.

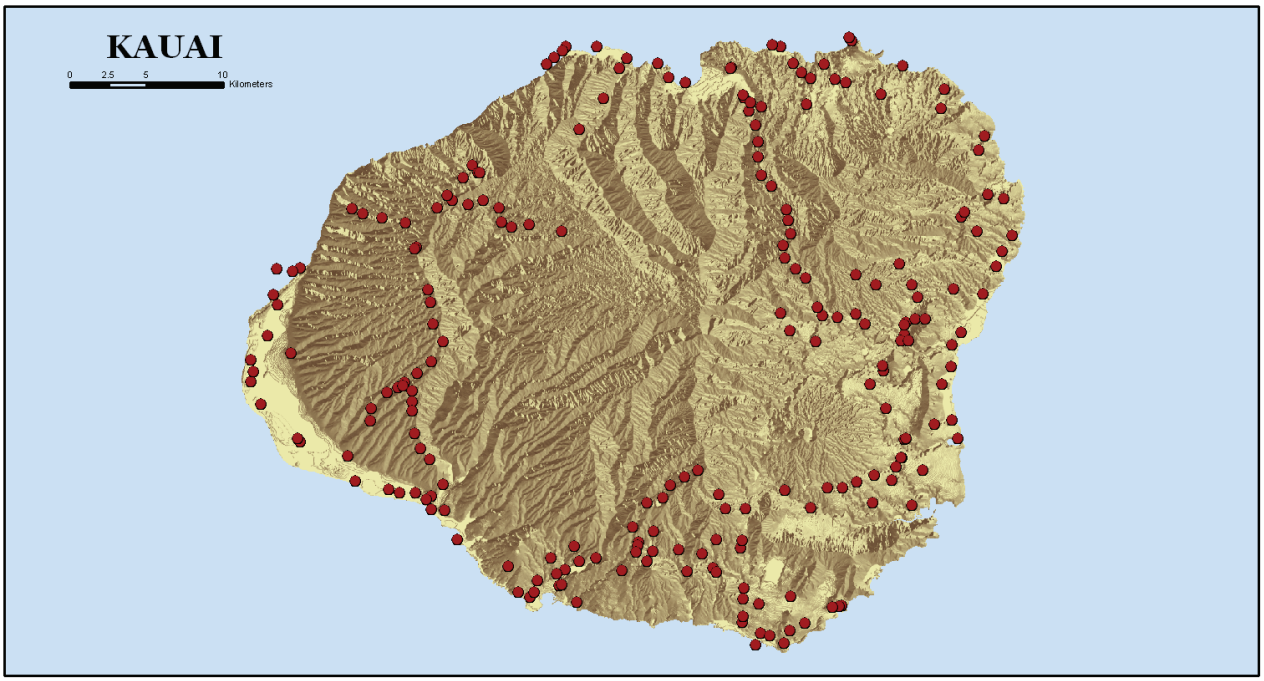


Figure 6: Map of Kauai. Sampled during the summer of 1992.

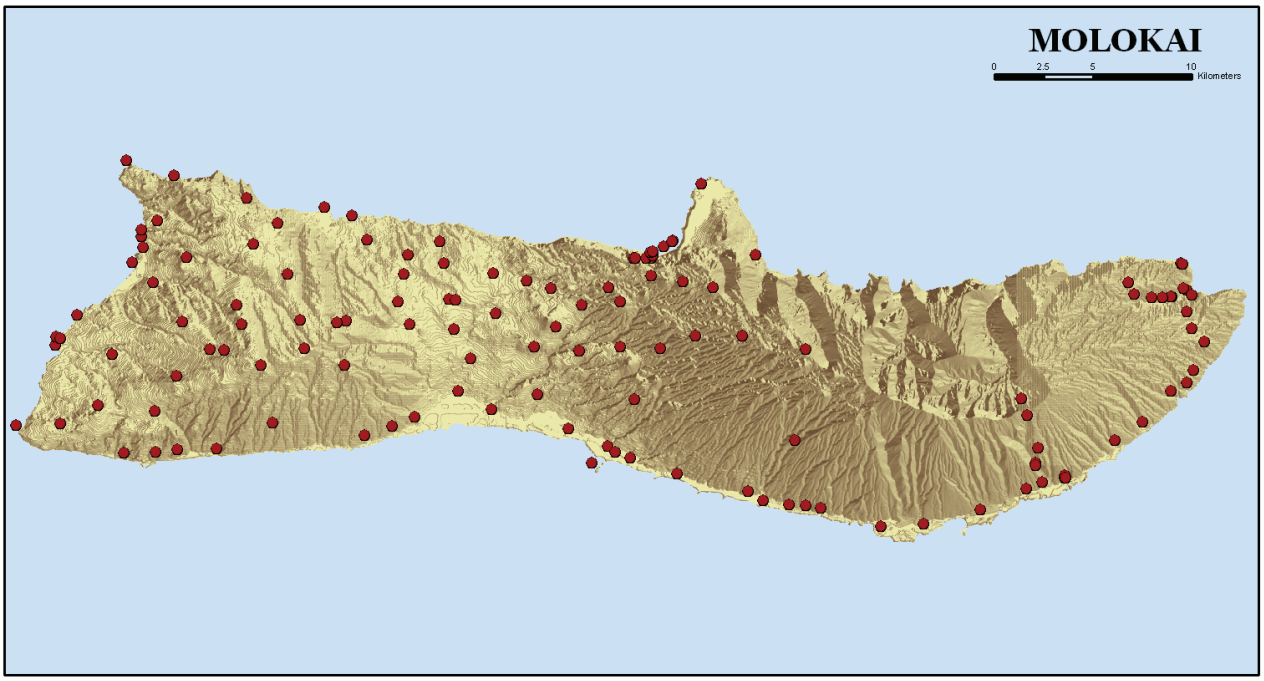


Figure 7: Map of Molokai. Sampled during the summers of 1990 and 1991.

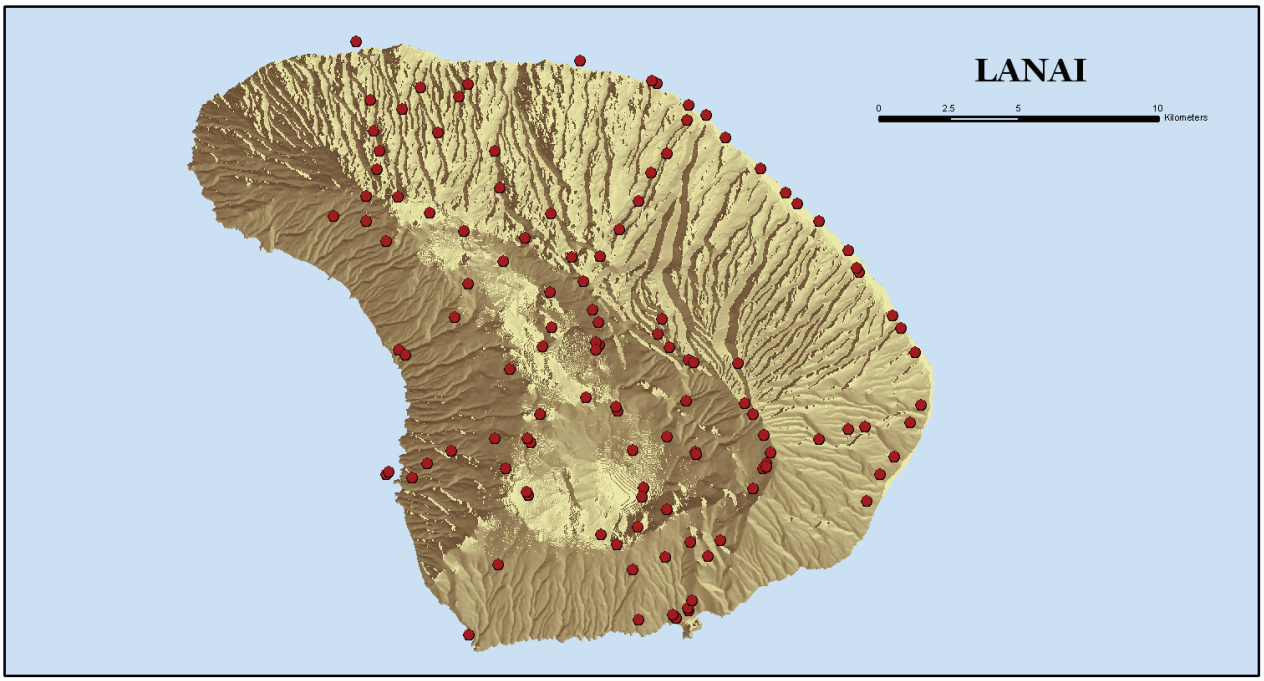


Figure 8: Map of Lanai. Sampled during the summers of 1994, and 1996.

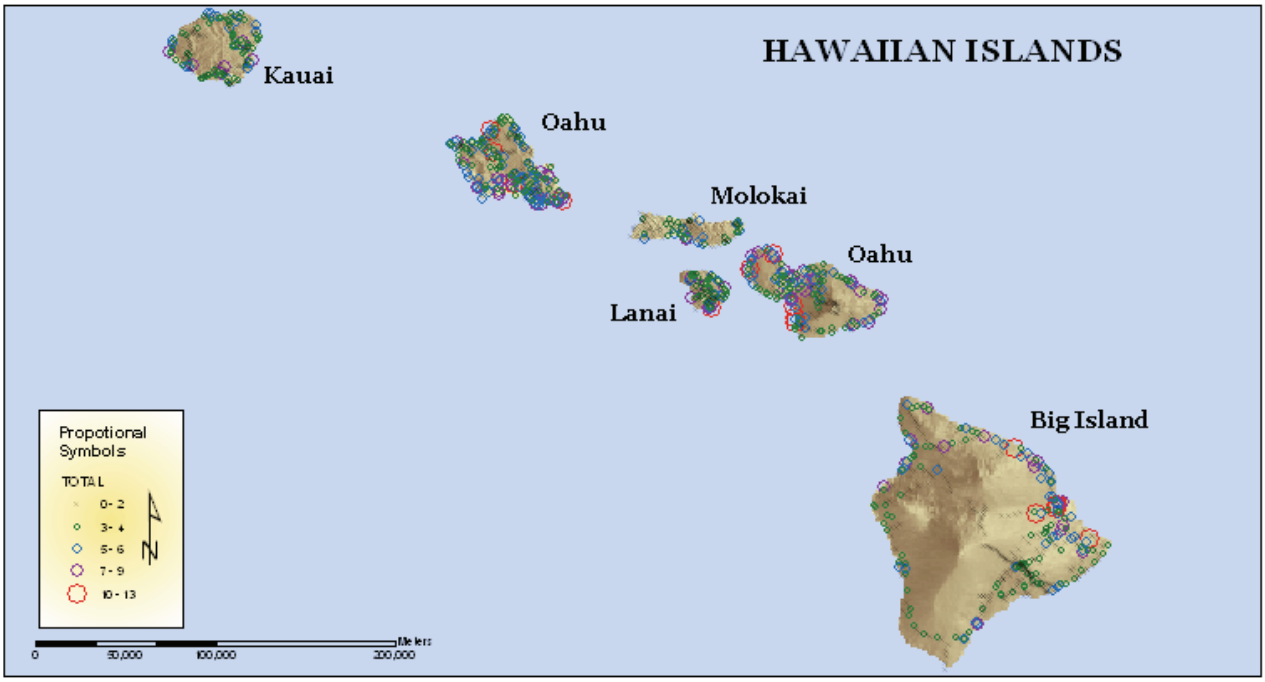


Figure 9: Map of the Hawaiian Islands, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

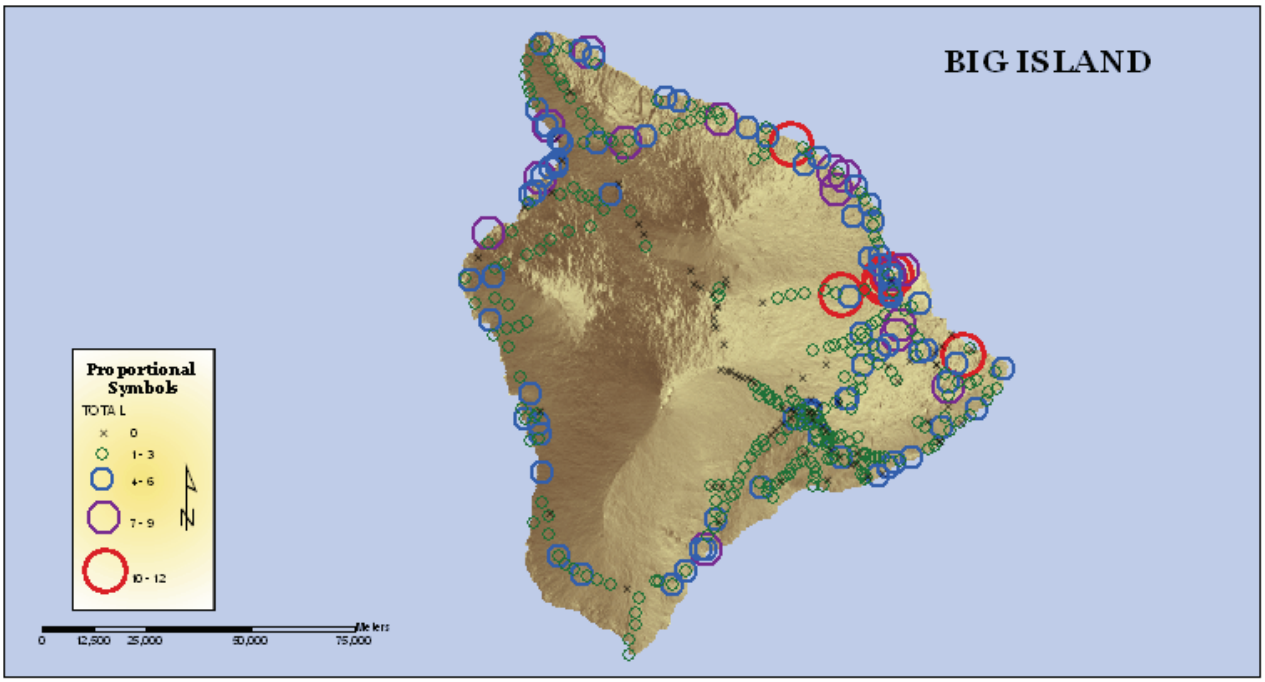


Figure 10: Map of the Big Island, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

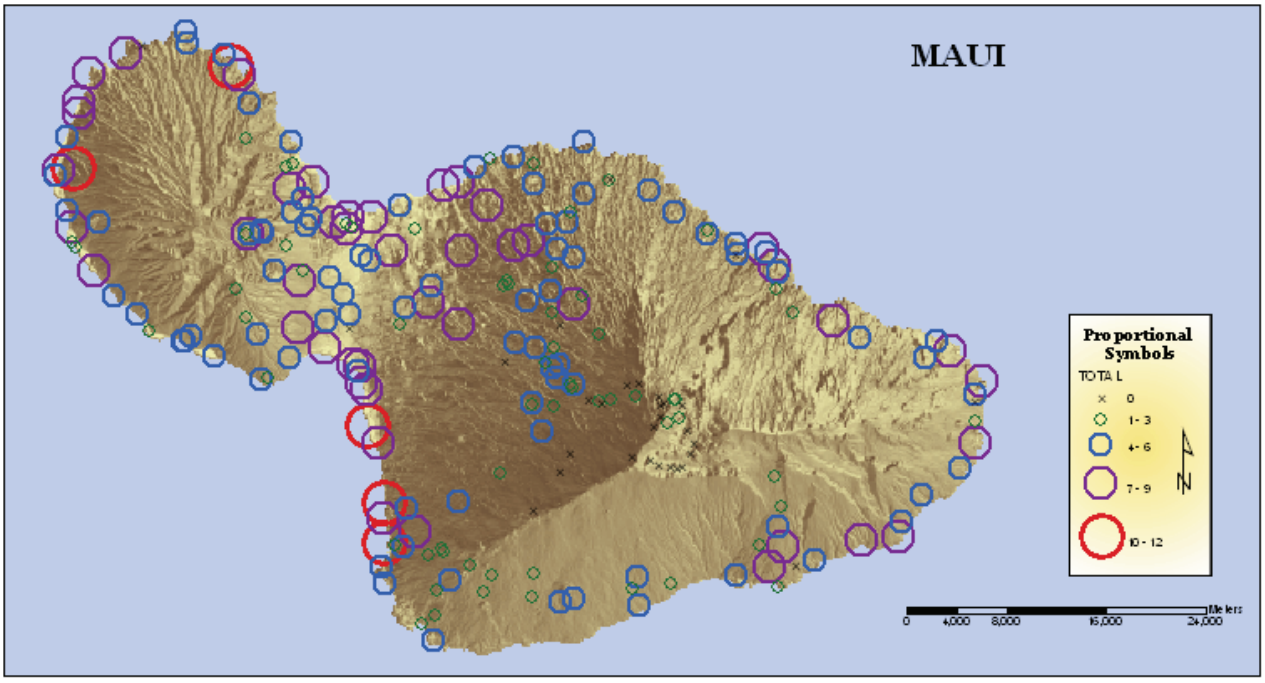


Figure 11: Map of Maui, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

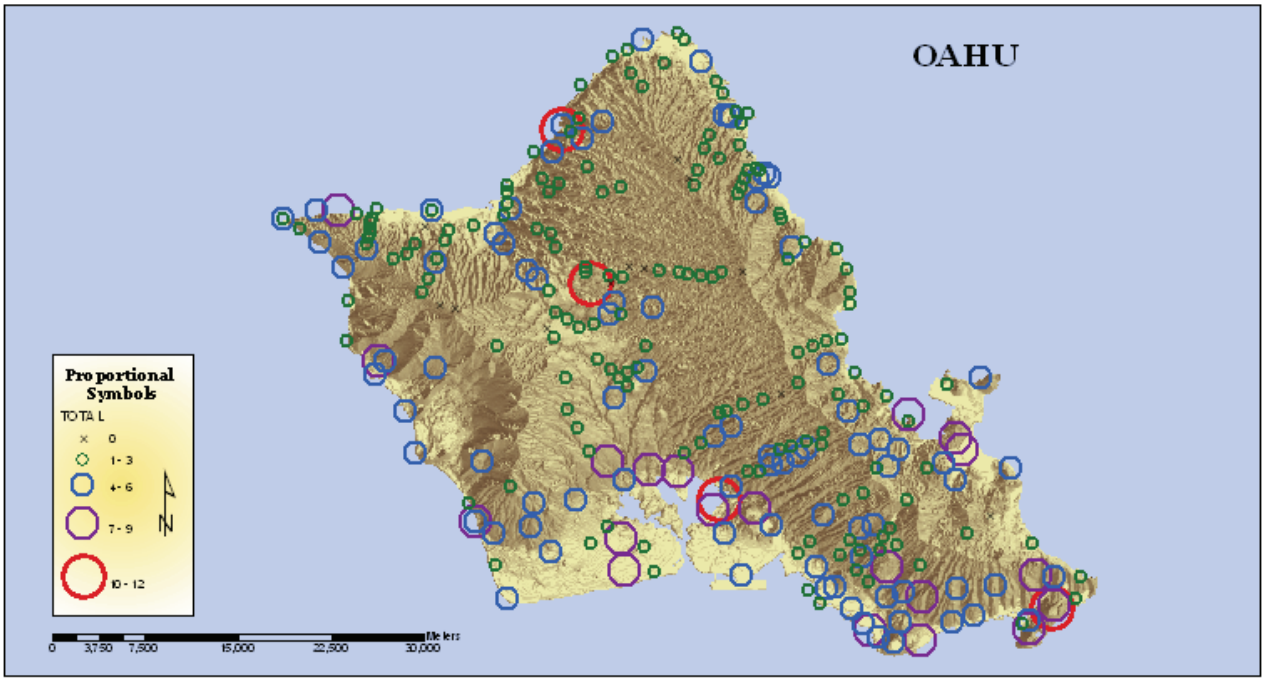


Figure 12: Map of Oahu, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

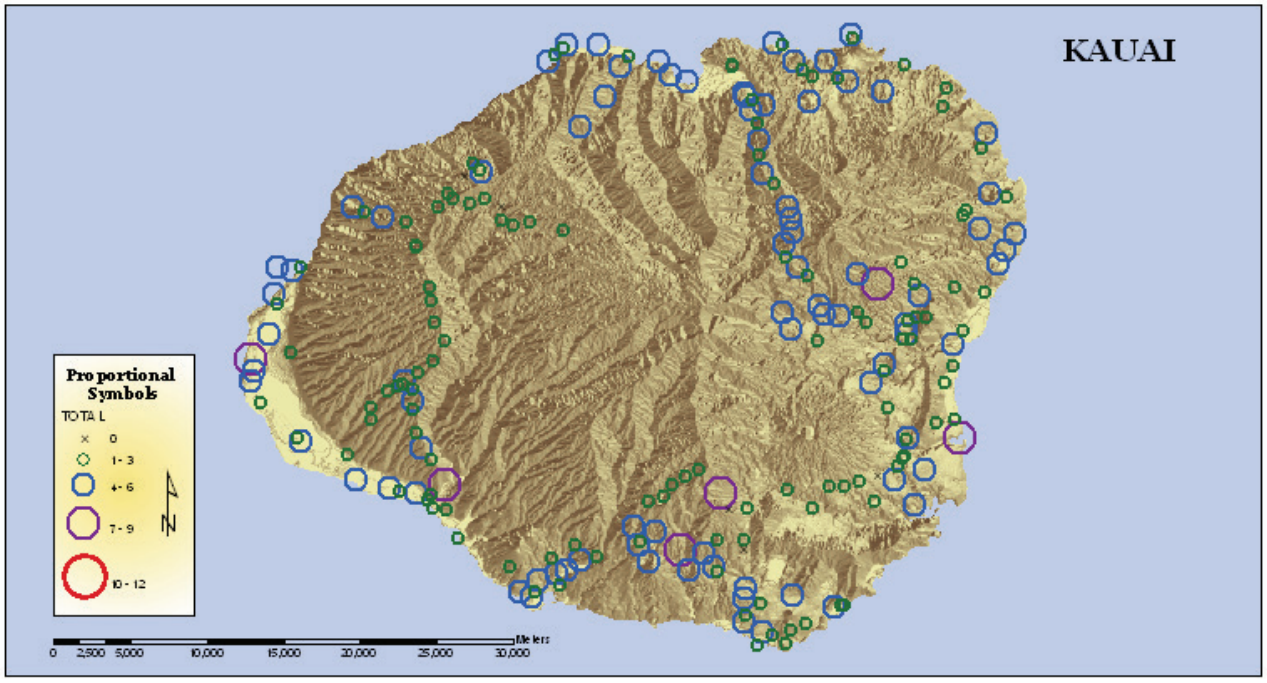


Figure 13: Map of Kauai, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

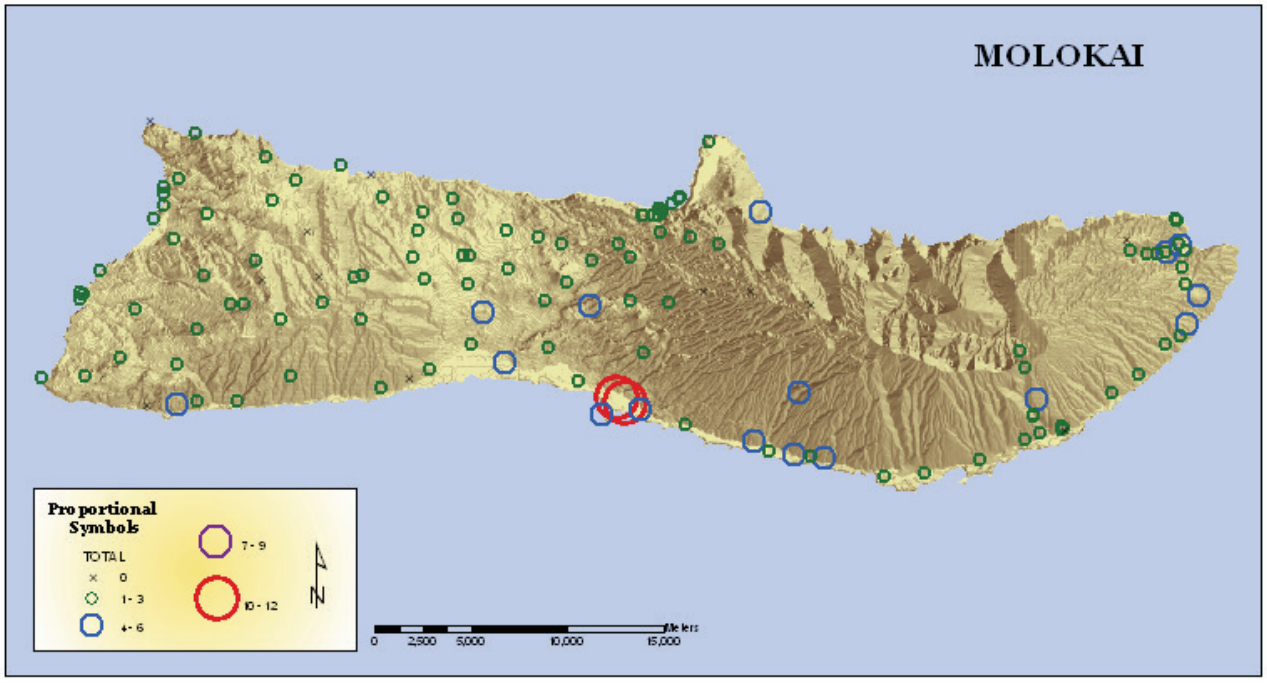


Figure 14: Map of Molokai, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

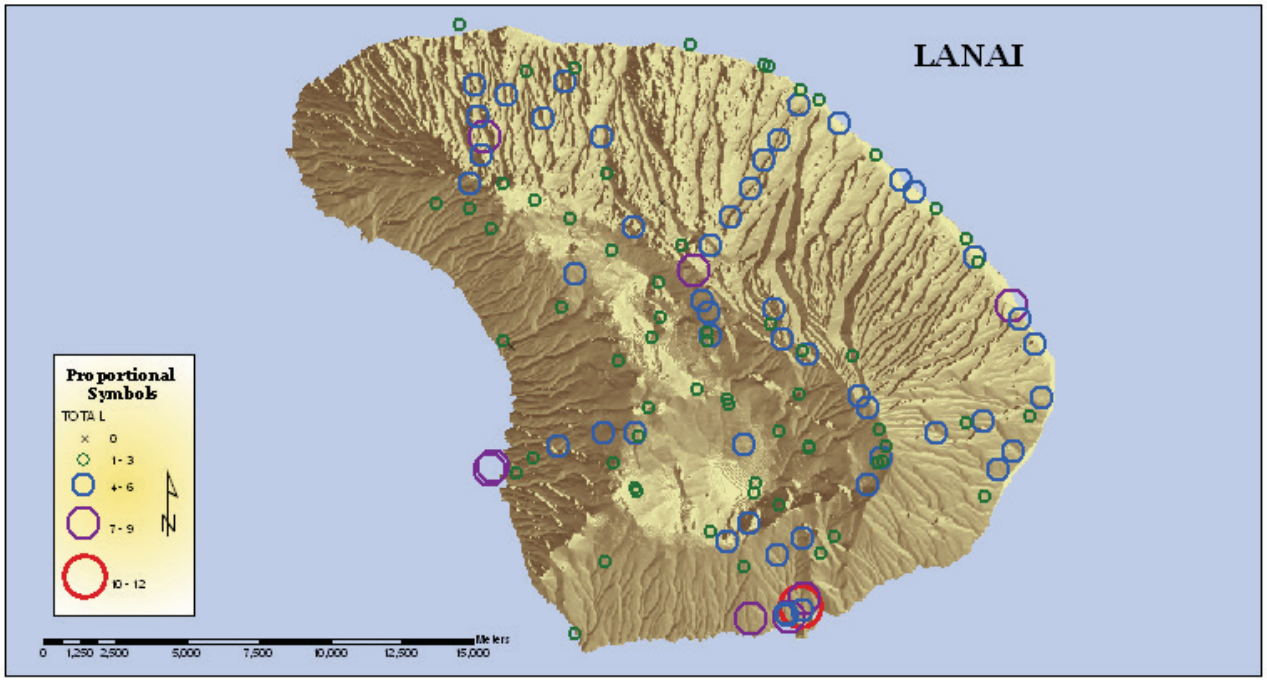


Figure 15: Map of Lanai, Hawai'i, USA. Proportional symbols show the locations sampled from 1988-1996. The size of the symbol increases with the number of species found at each location.

Figures 16—22: Show ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 as well as the corresponding logistic trendline (Table 3) covering six of the Hawaiian Islands: Hawai'i, Maui, Oahu, Kauai, Lanai, and Molokai.

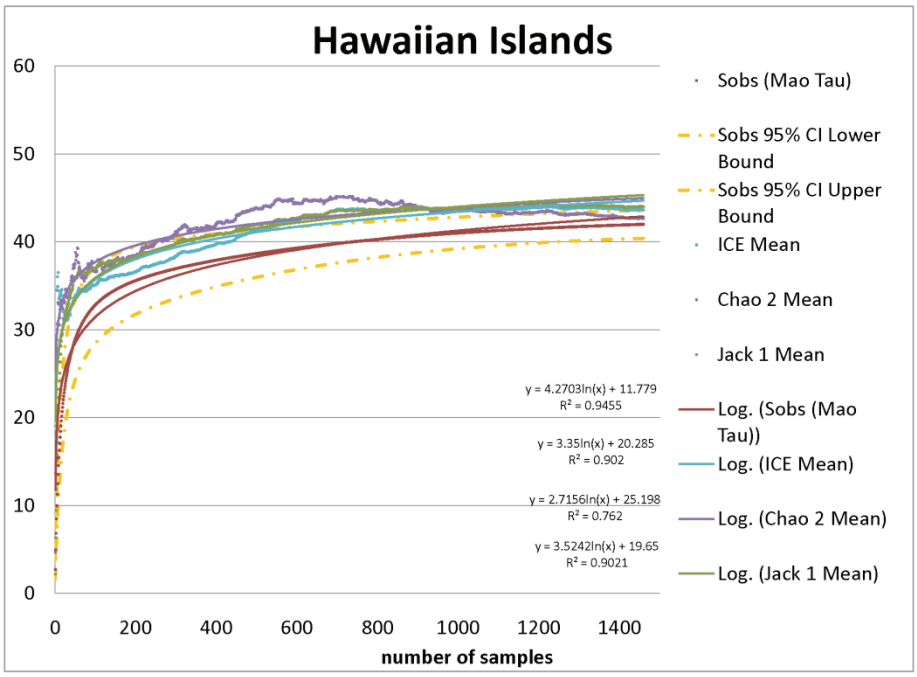


Figure 16: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on the Hawaiian Islands. All lines are flattening and converging to between 40-45 species showing that our sampling was extensive enough to get a confident grasp of the species richness on the Hawaiian Islands.

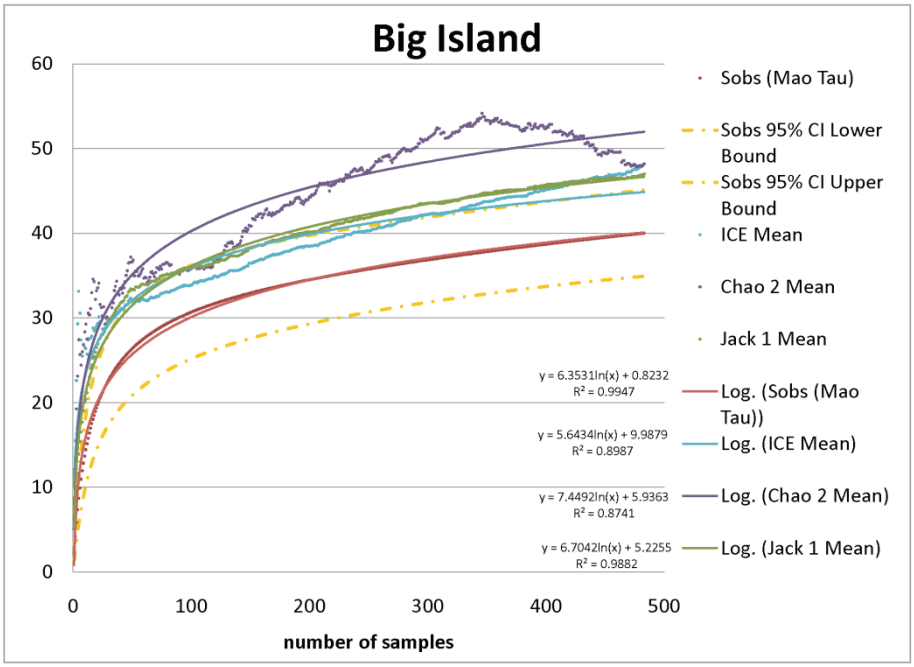


Figure 17: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on the big island of Hawai'i.

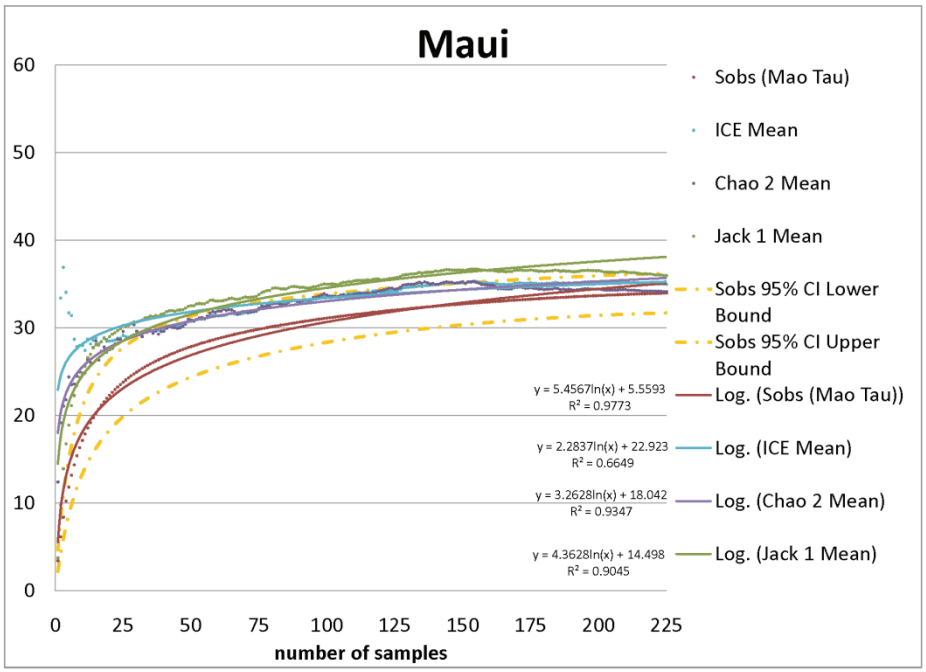


Figure 18: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on Maui. 32-40 species

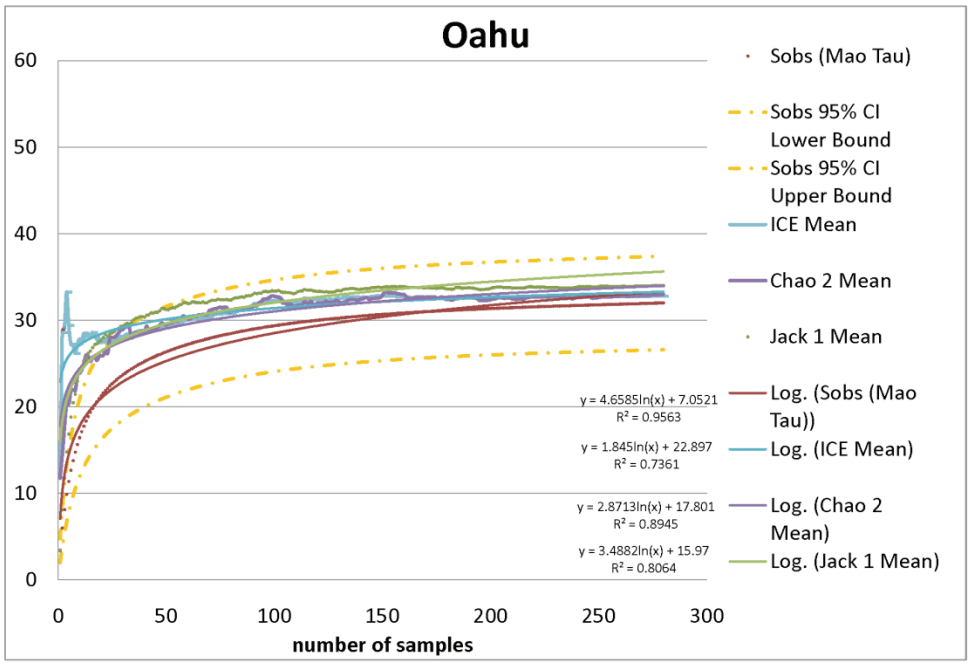


Figure 19: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on Oahu. 32 to 35 species, roughly.

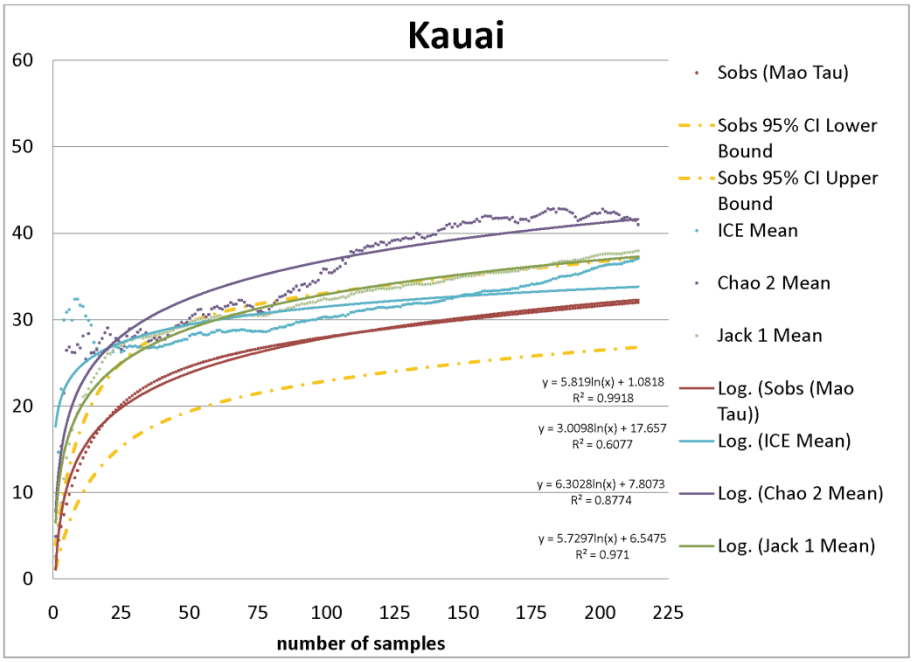


Figure 20: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on Kauai. 32-40 species.

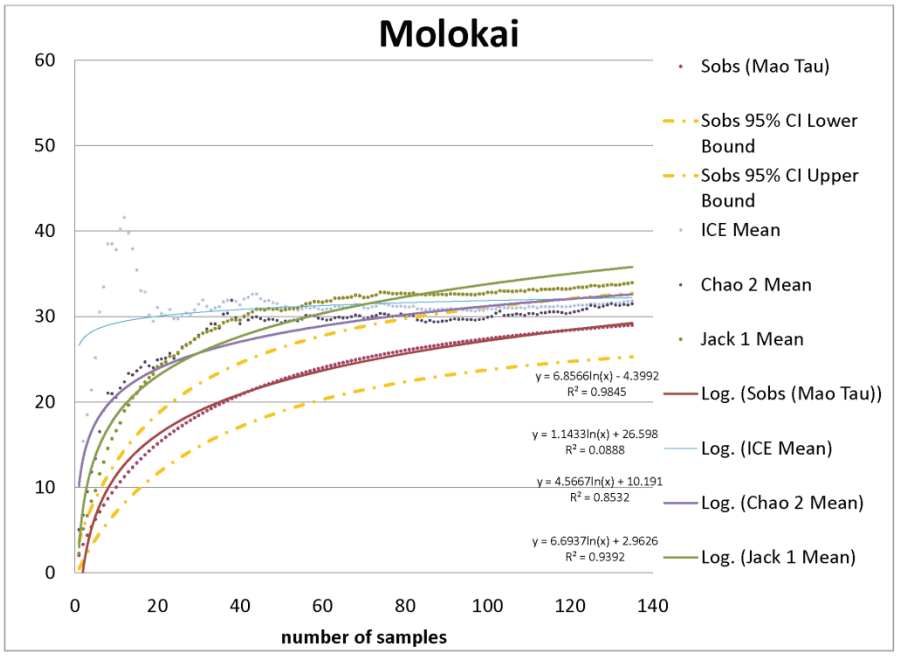


Figure 21: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on Molokai.

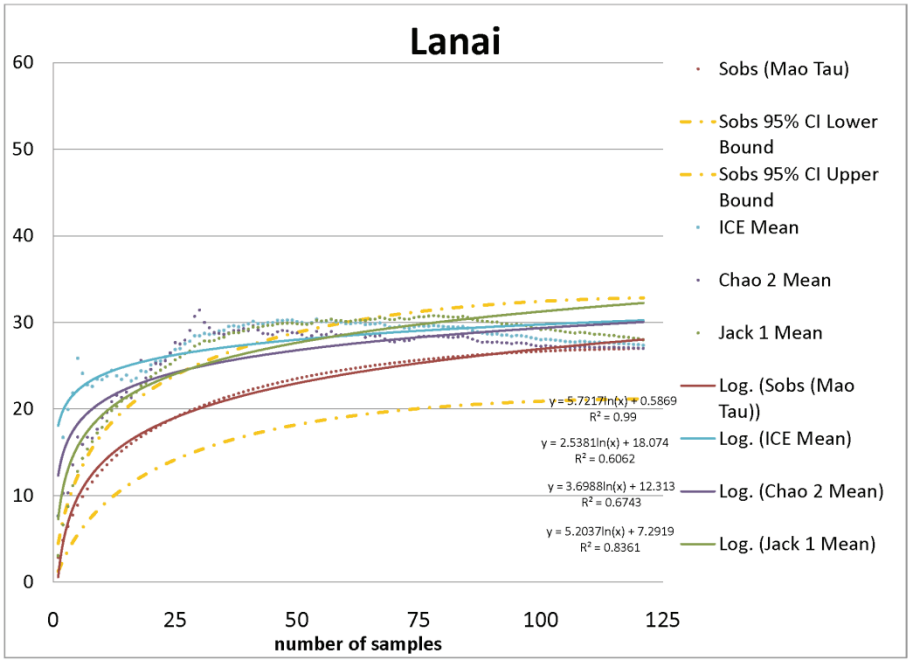
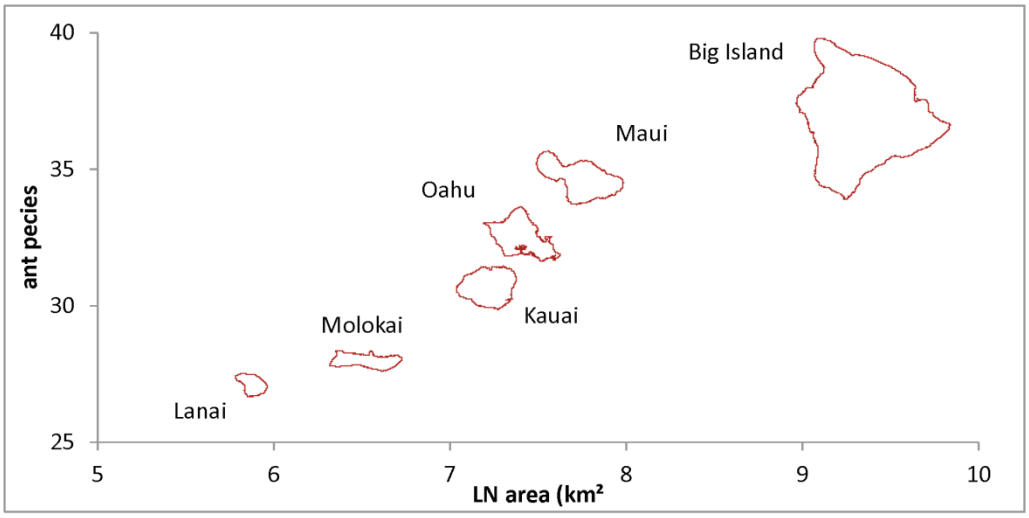
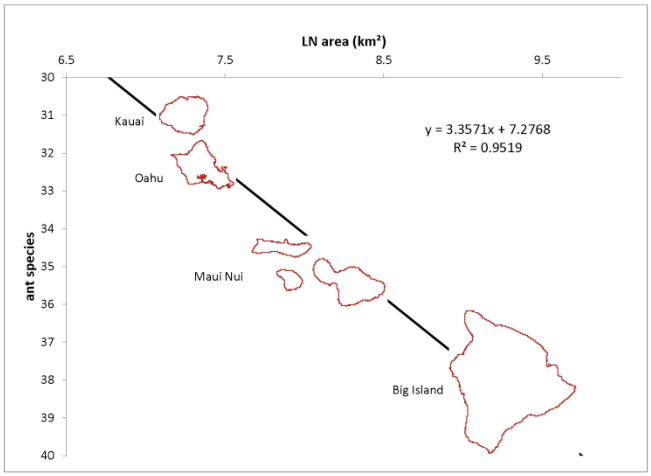


Figure 22: Ant species accumulation curve and the nonparametric estimator ICE, Chao 2, and Jack-Knife 1 and corresponding power curve, equation, and R^2 on Lanai.

(a.)



(b.)



(c.)

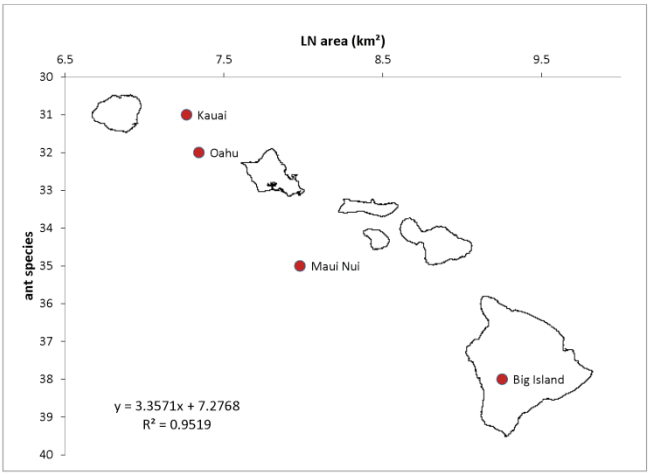


Figure 23: A species area curve. The x-axis shows the natural log of the area and the y-axis is the number of ant species found on corresponding island.

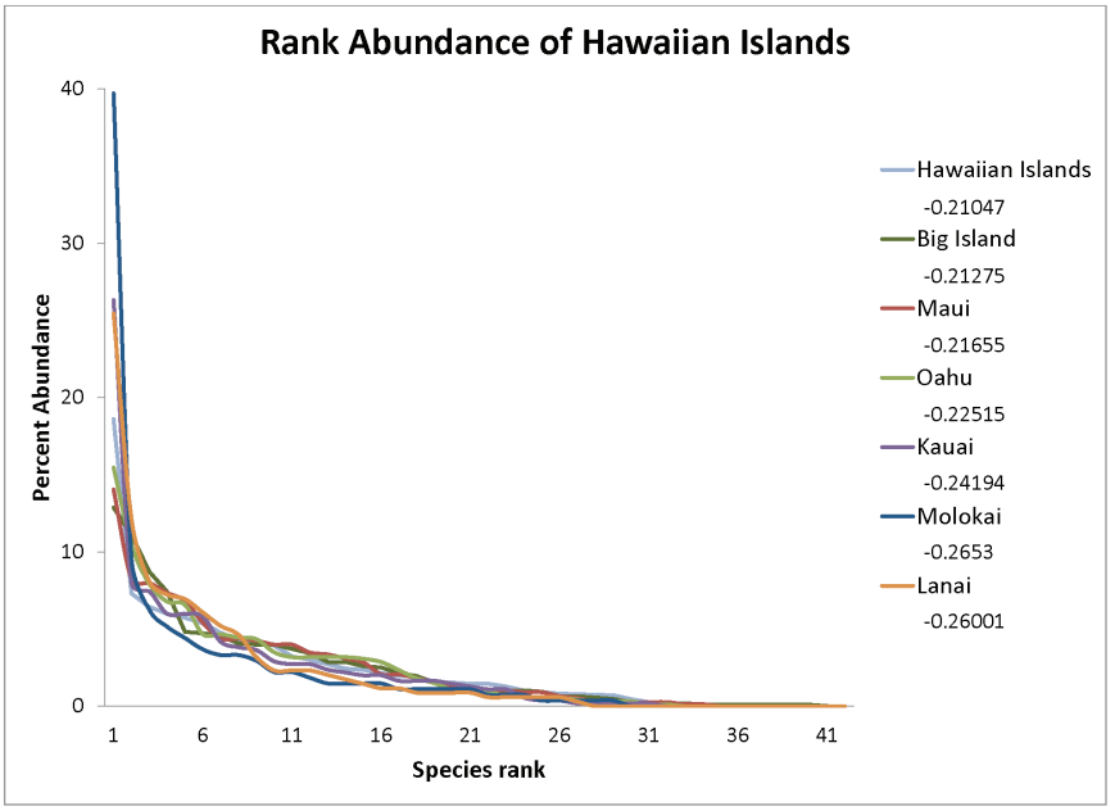


Figure 24: A rank abundance graph of Hawaiian Islands.

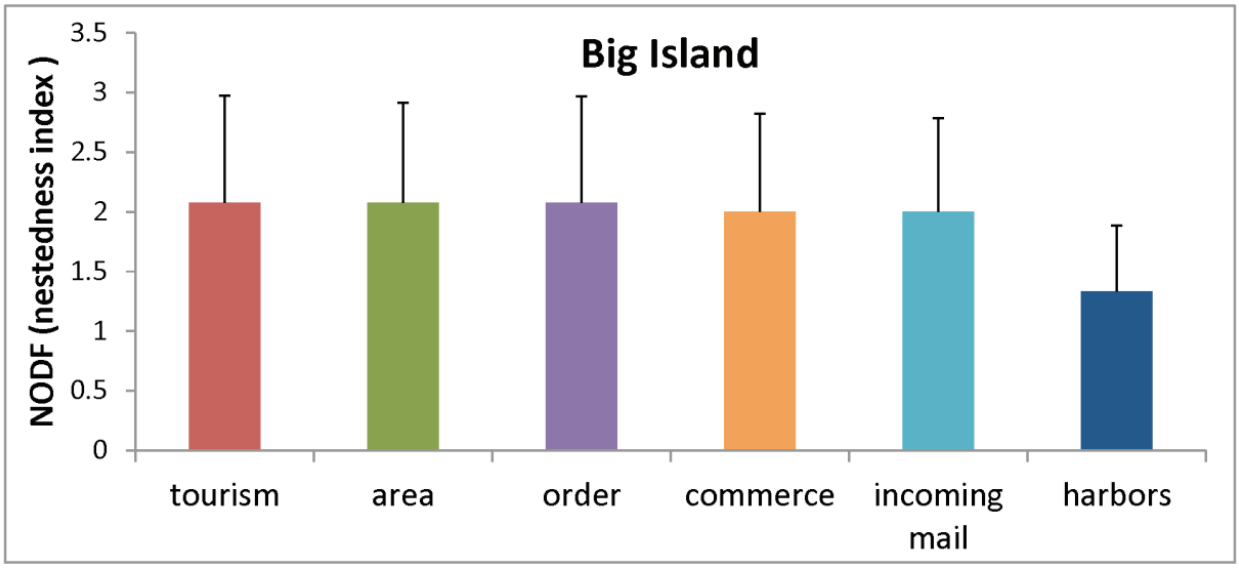


Figure 25: NODF output for nestedness mechanism on the Big Island.

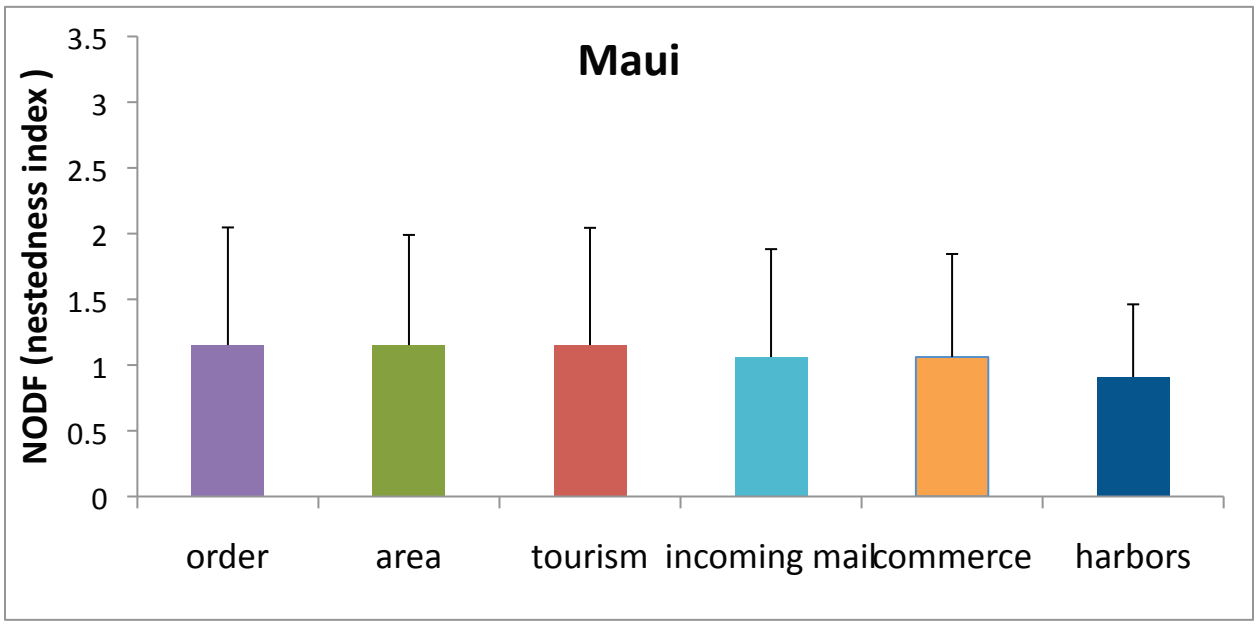


Figure 26: NODF output for nestedness mechanism on Maui

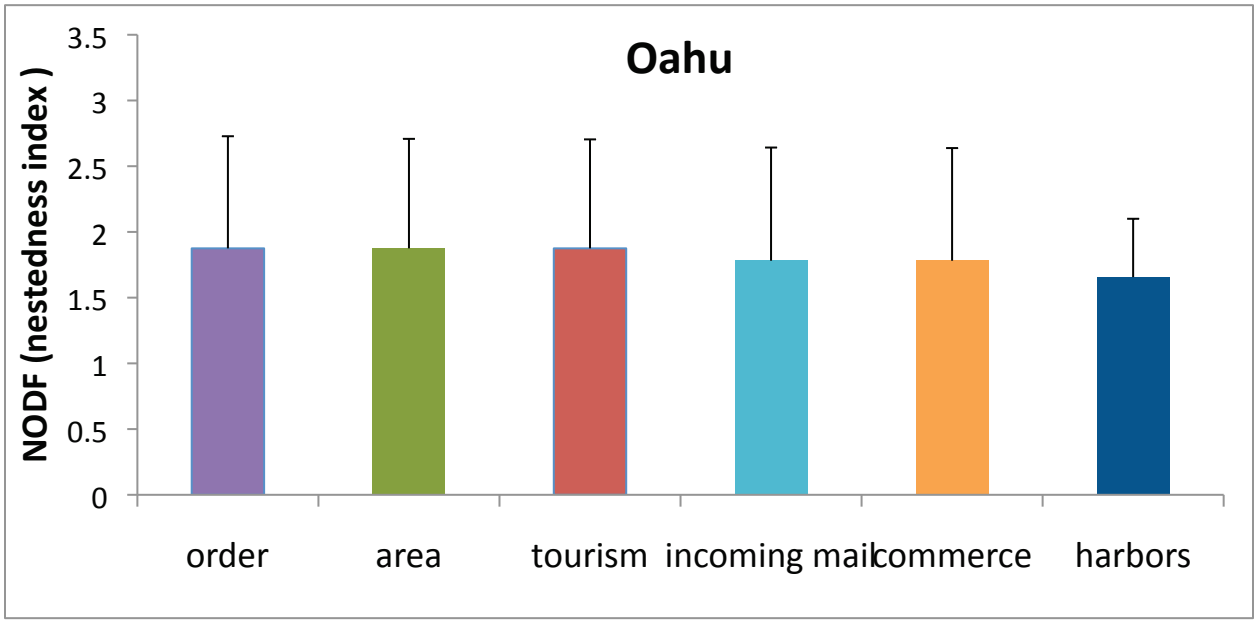


Figure 27: NODF output for nestedness mechanism on Oahu.

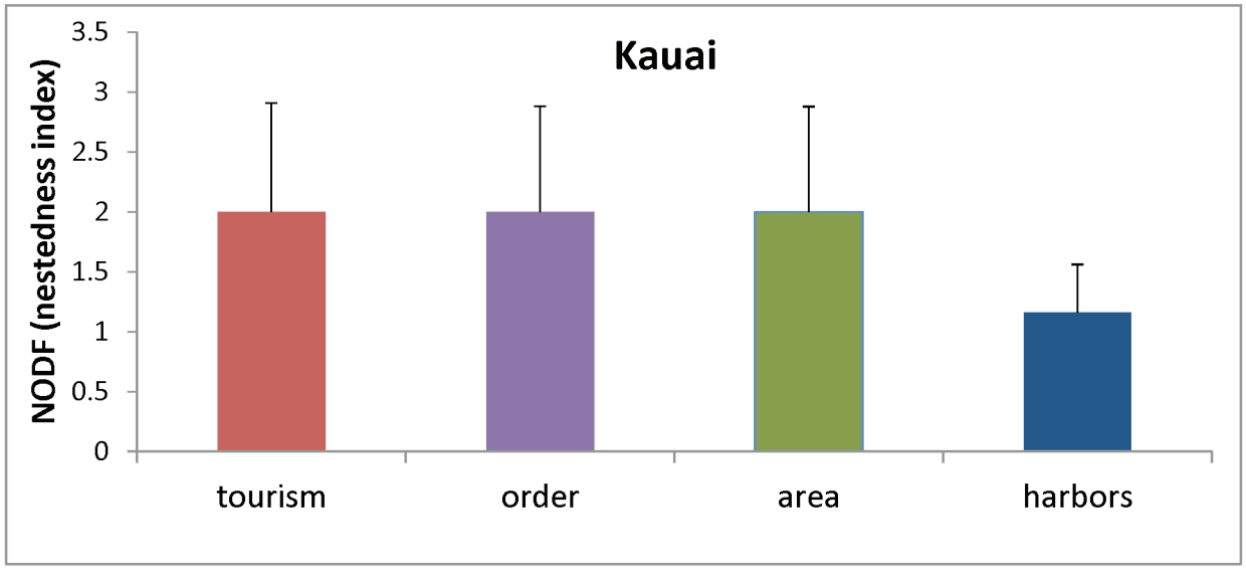


Figure 28: NODF output for nestedness mechanism on Kauai.

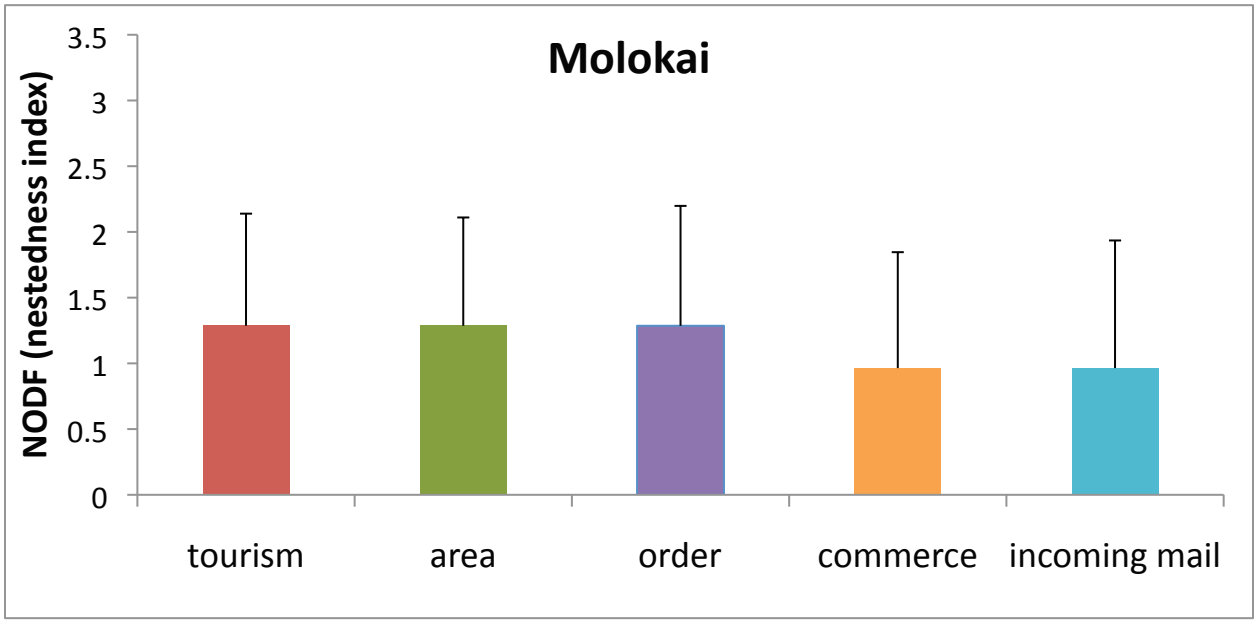


Figure 29: NODF output for nestedness mechanism on Molokai

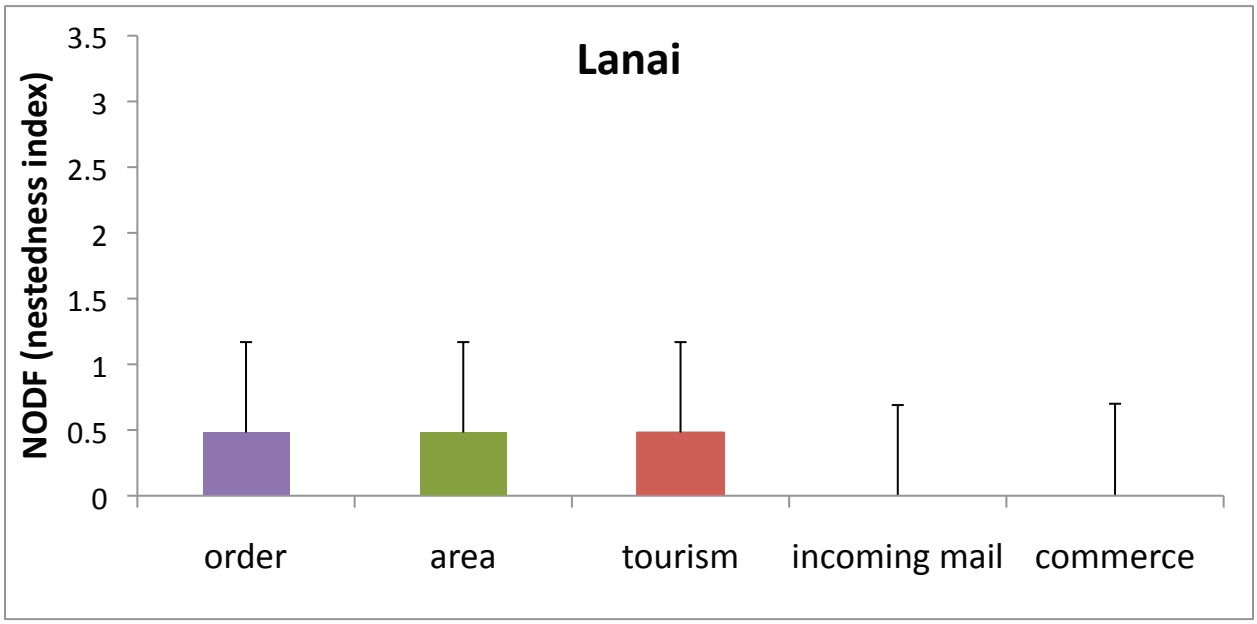


Figure 30: NODF output for nestedness mechanism on Lanai

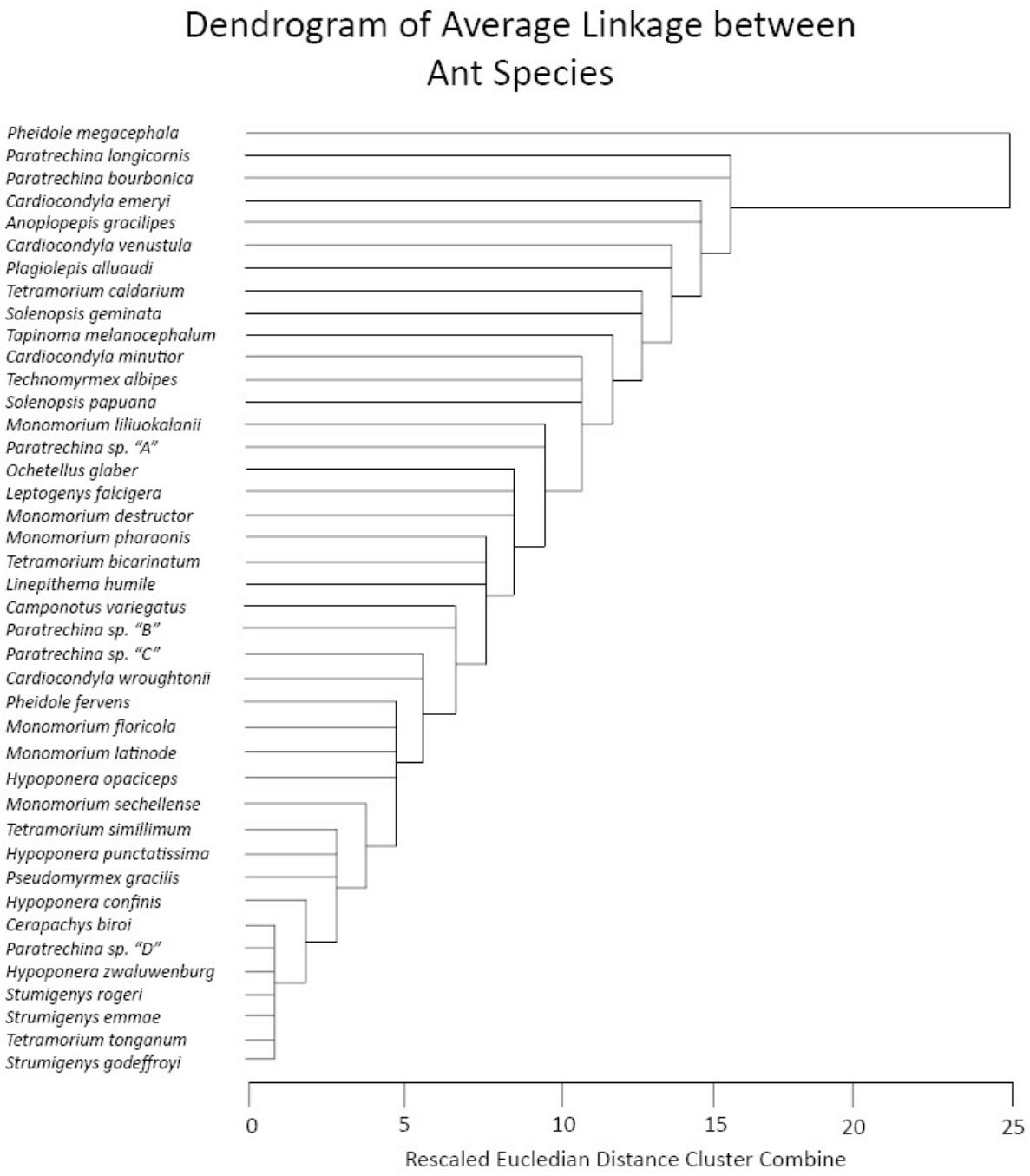


Figure 31: Cluster analysis plot of similarity of ant species based on ant species abundance from original sample locations. Based on relative frequency of ant species on the Hawaiian Islands, USA.

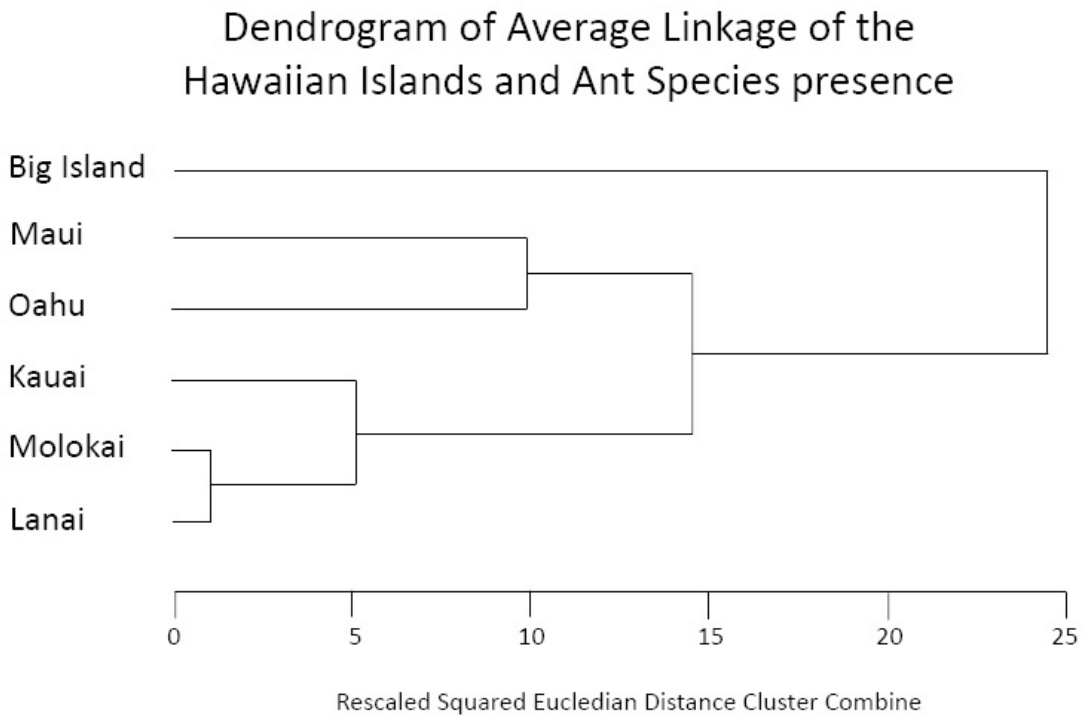


Figure 32: Cluster analysis plot of similarity of ant communities and island location: Big Island, Maui, Oahu, Kauai, Lanai, and Molokai; based on relative frequency of ant species on the Hawaiian Islands, USA.

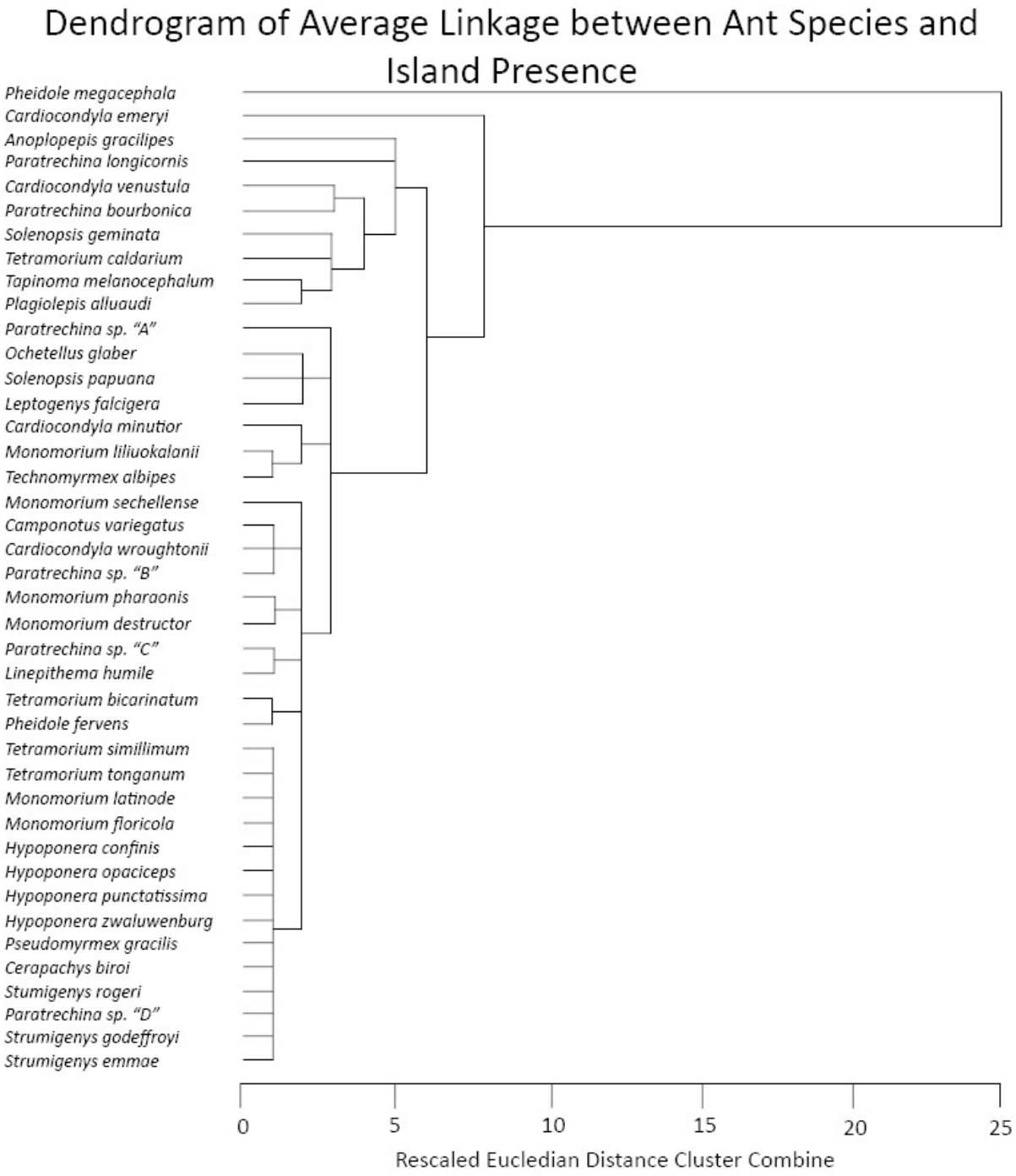


Figure 33: Cluster analysis plot of similarity of Islands based on relative frequency of ant species abundance from original sample locations.

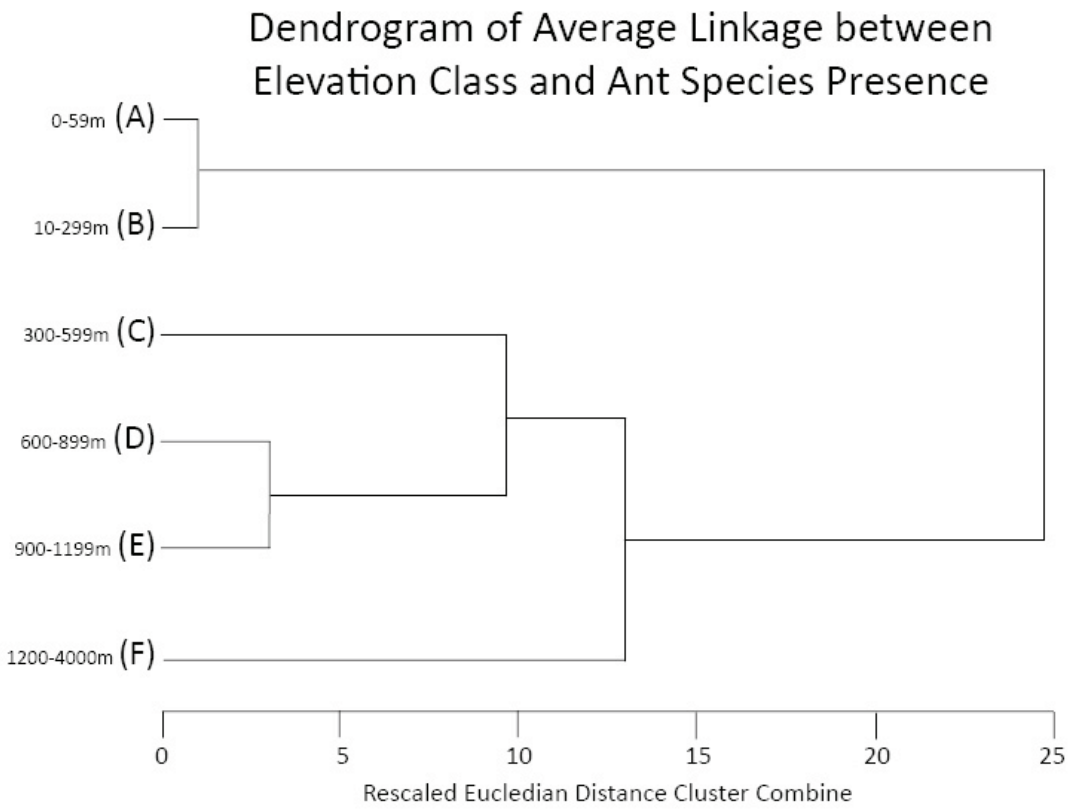


Figure 34: Cluster analysis of elevation class, based on relative frequency of ant species on Hawaiian Islands, USA.

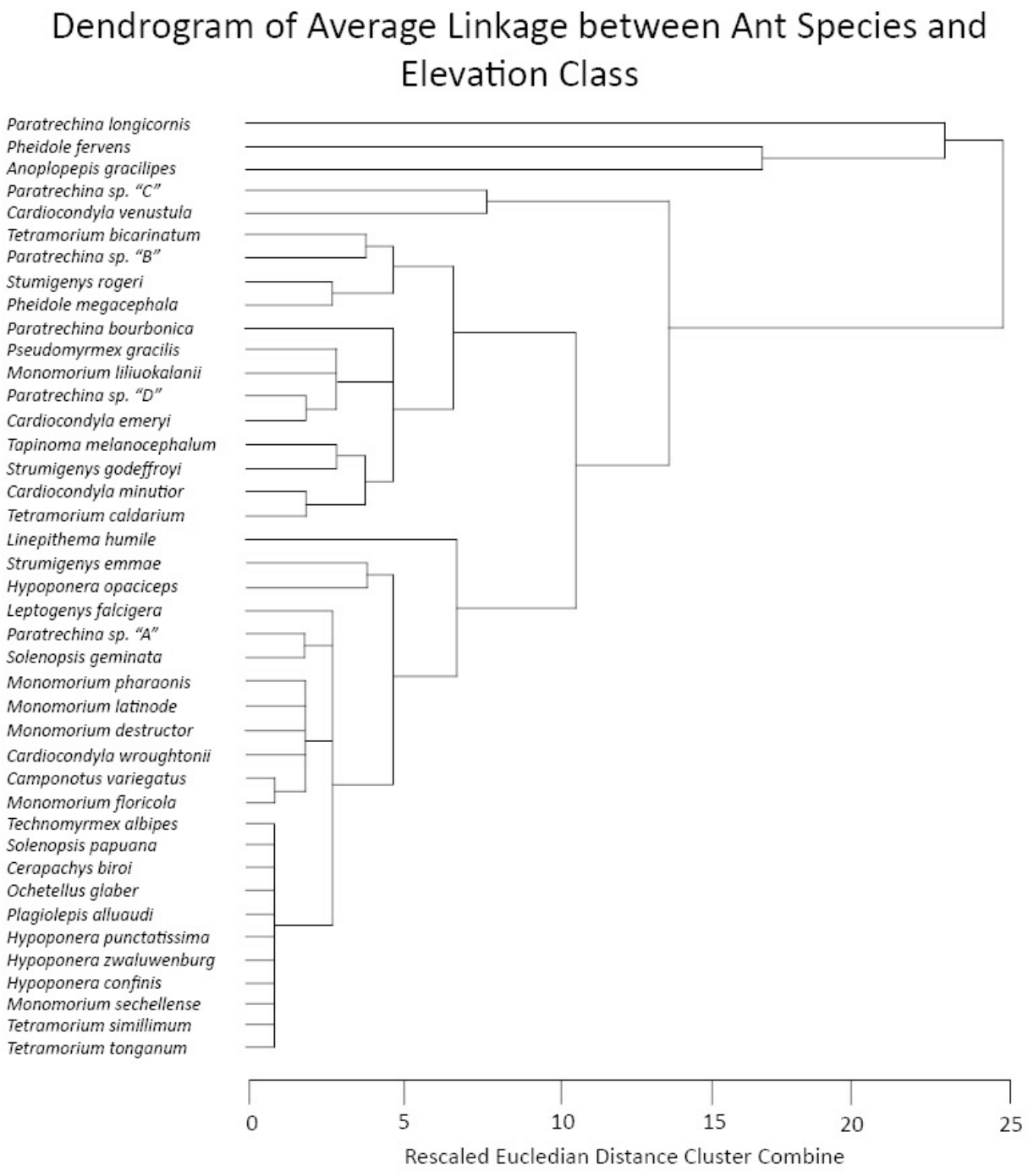


Figure 35: Cluster analysis of ant species, based on elevation class on The Hawaiian Islands, USA.

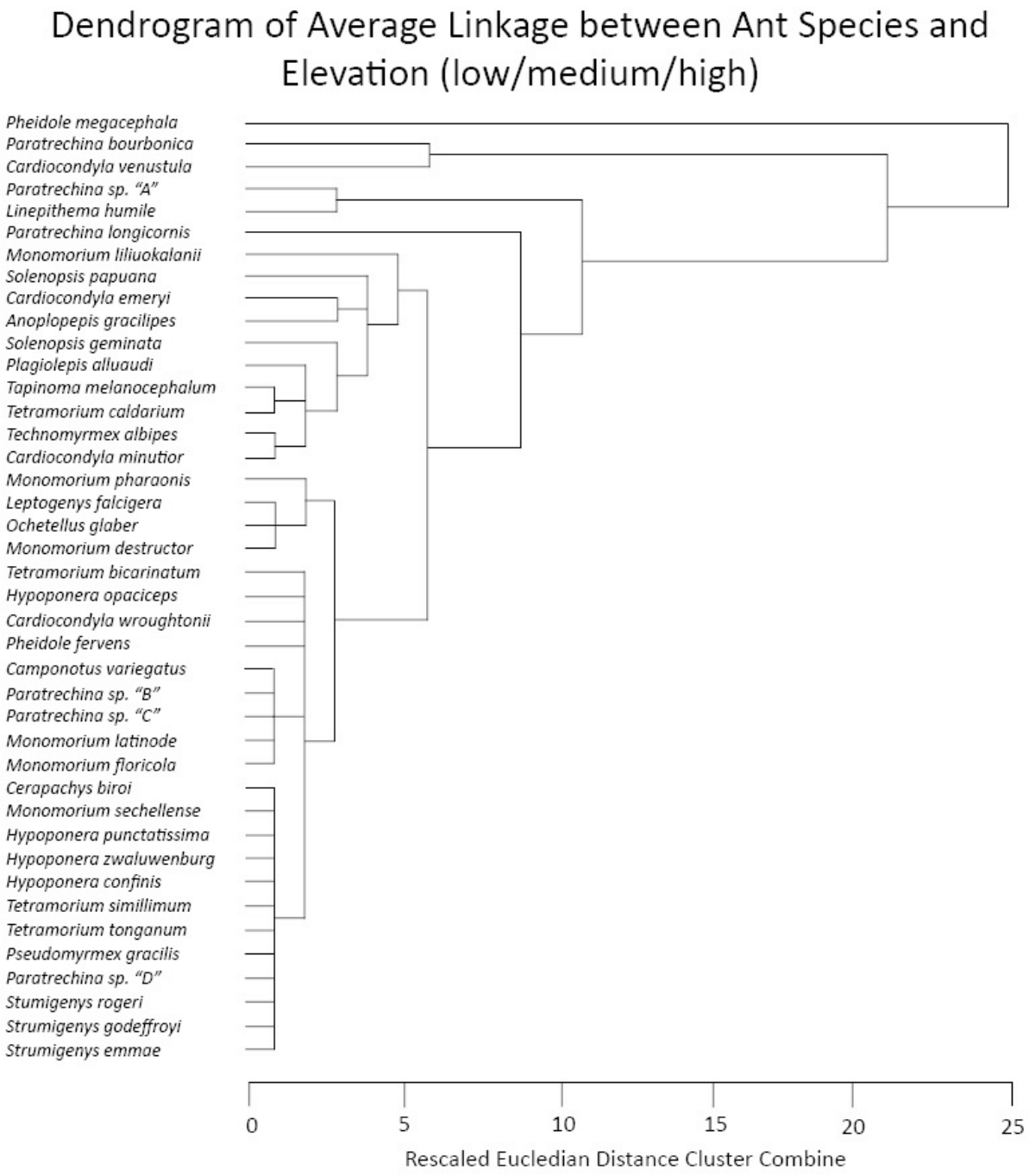


Figure 36: Cluster analysis plot of elevation (low, medium, high), based on relative frequency of ant species on the Big Island, Hawai'i, USA.

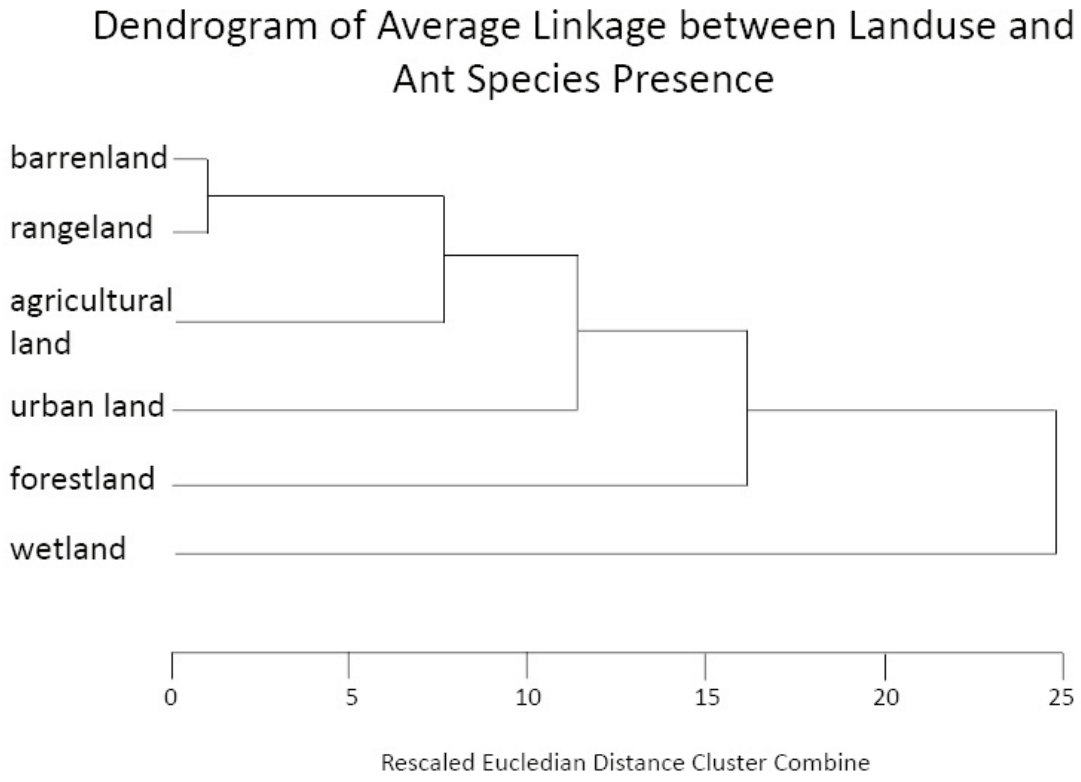


Figure 37: Cluster analysis of land-use, based on relative frequency of ant species on the Hawaiian Islands, USA.

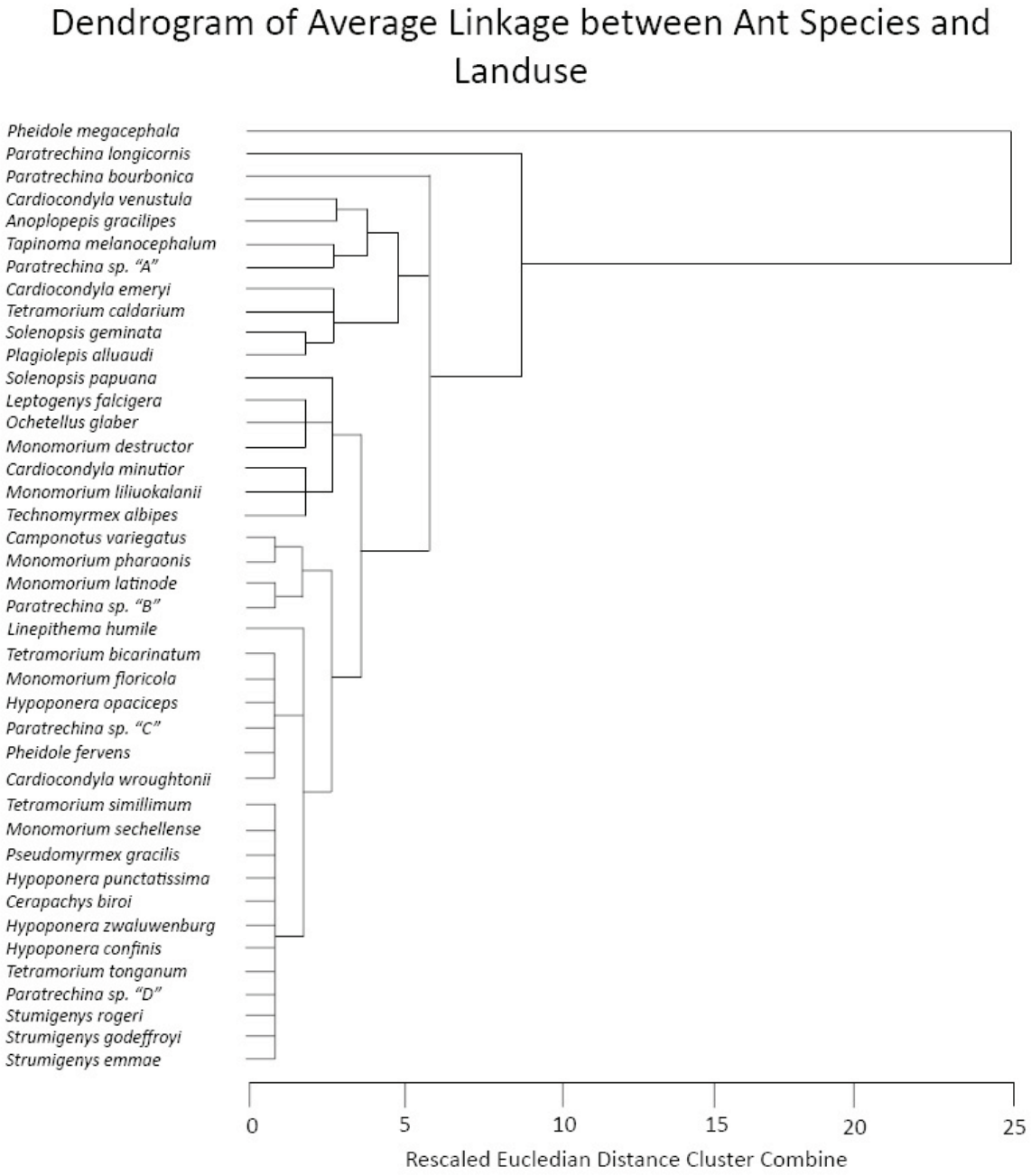


Figure 38: Cluster analysis plot of Ant species, based on relative frequency of land-use on the Hawaiian Islands, USA.

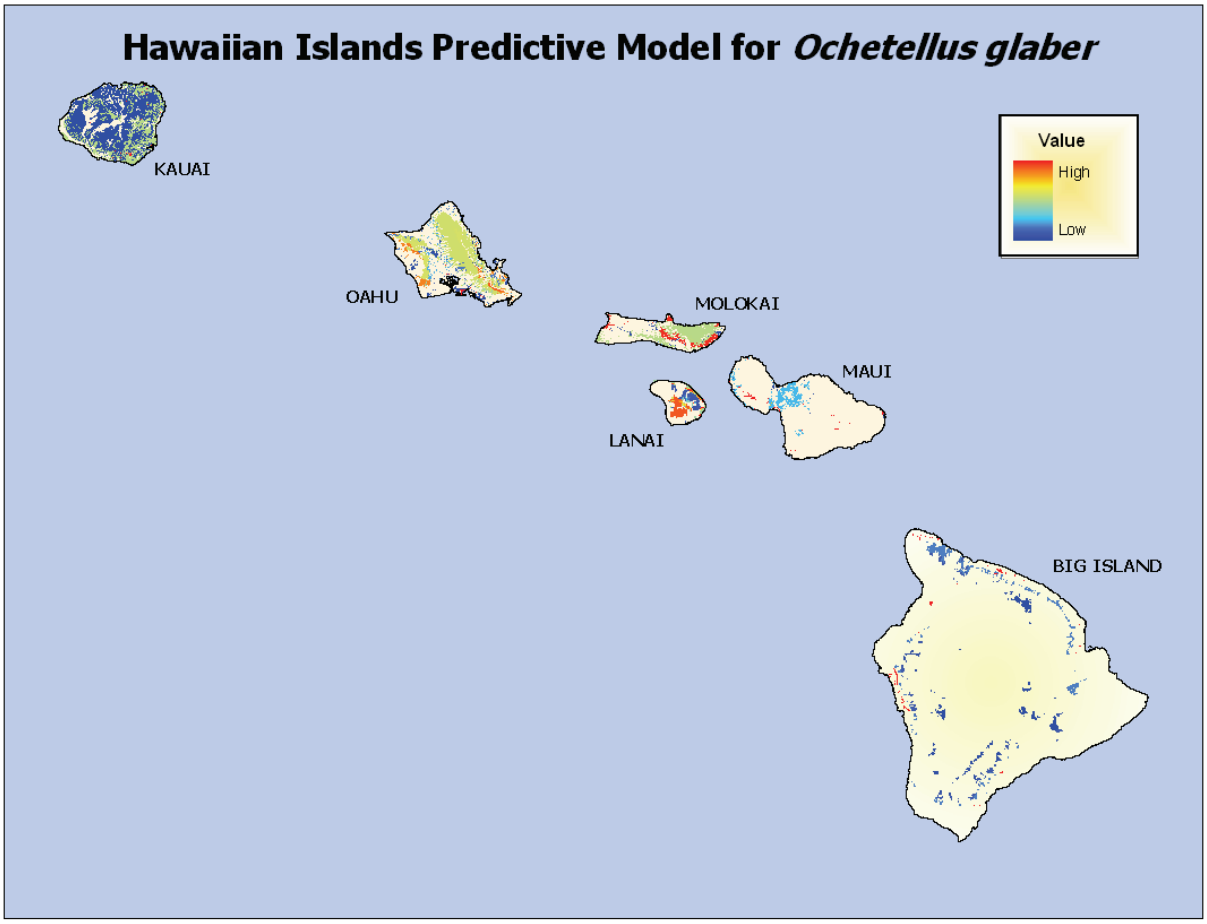


Figure 39: Map of Hawai'i, USA. Predictive Model for *Ochetellus glaber*.

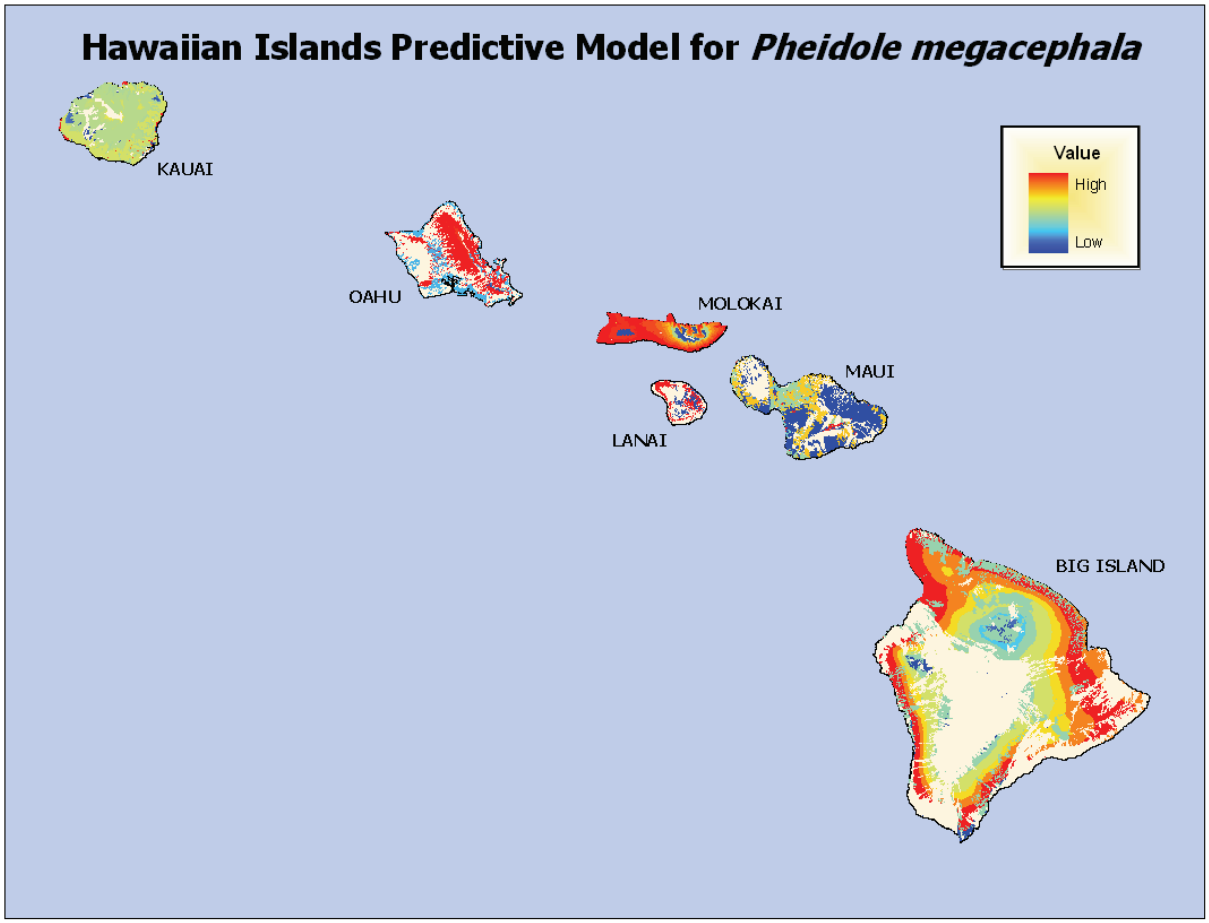


Figure 40: Map of Hawai'i, USA. Predictive model for *Pheidole megacephala*.

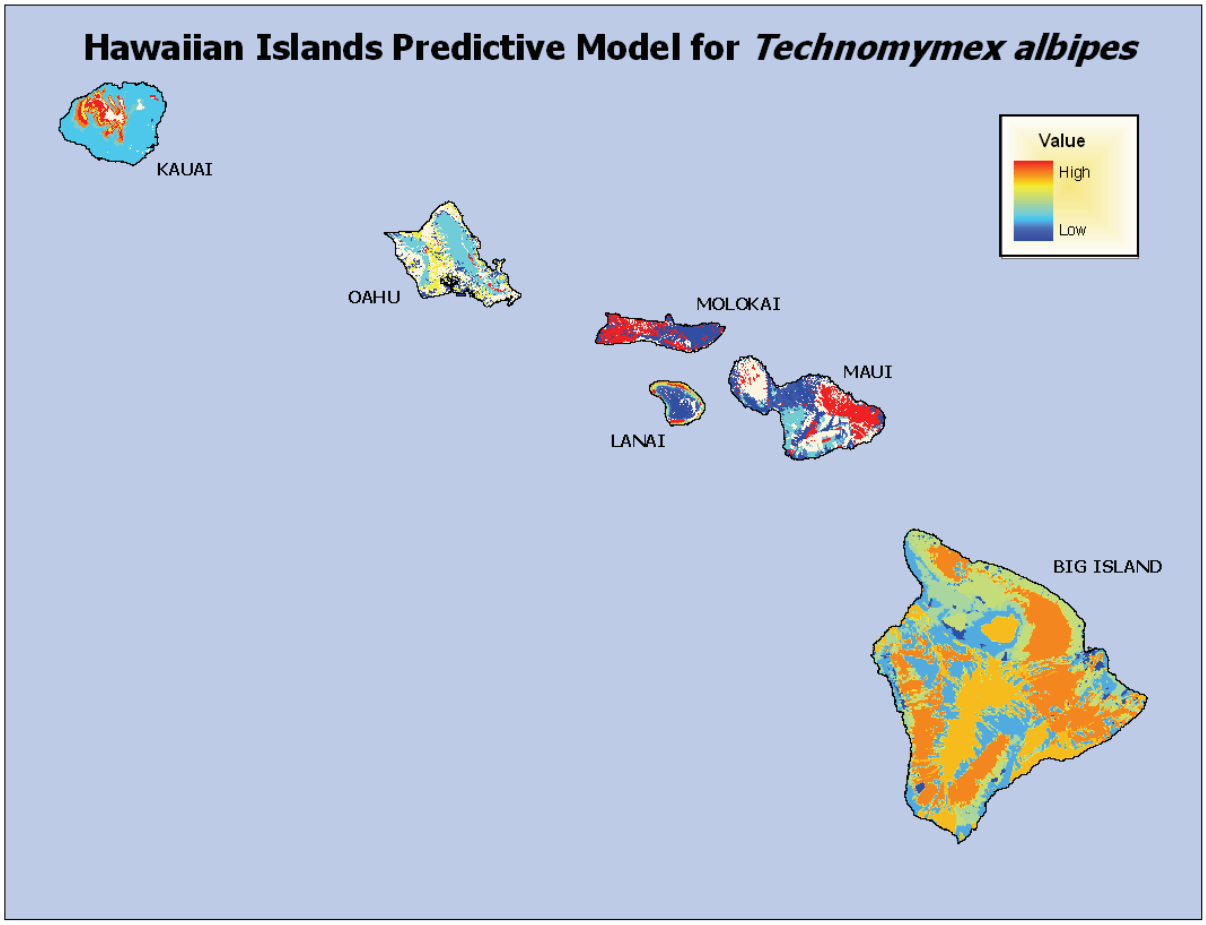


Figure 41: Map of Hawai'i, USA. Predictive model for *Technomyrmex albipes*.

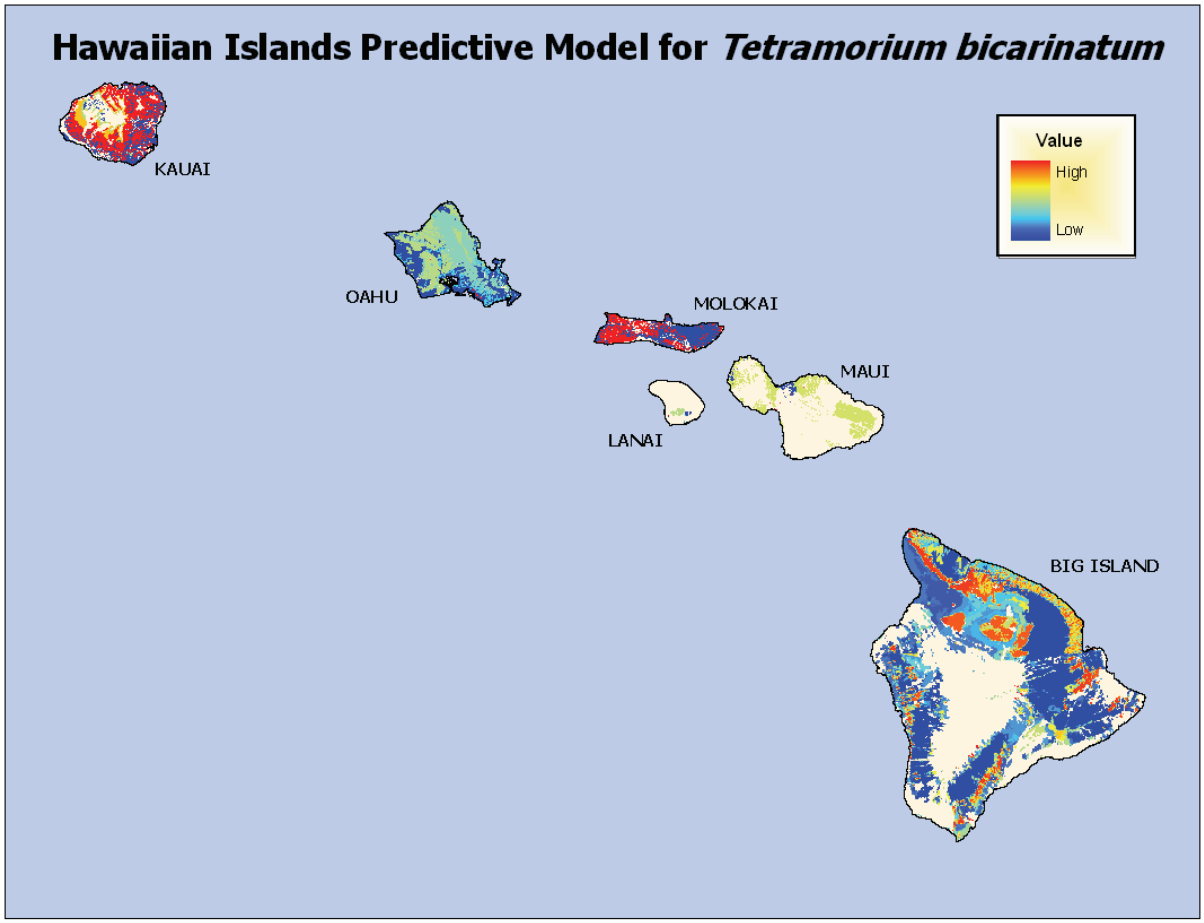


Figure 42: Map of Hawai'i, USA. Predictive model for *Tetramorium bicarinatum*.

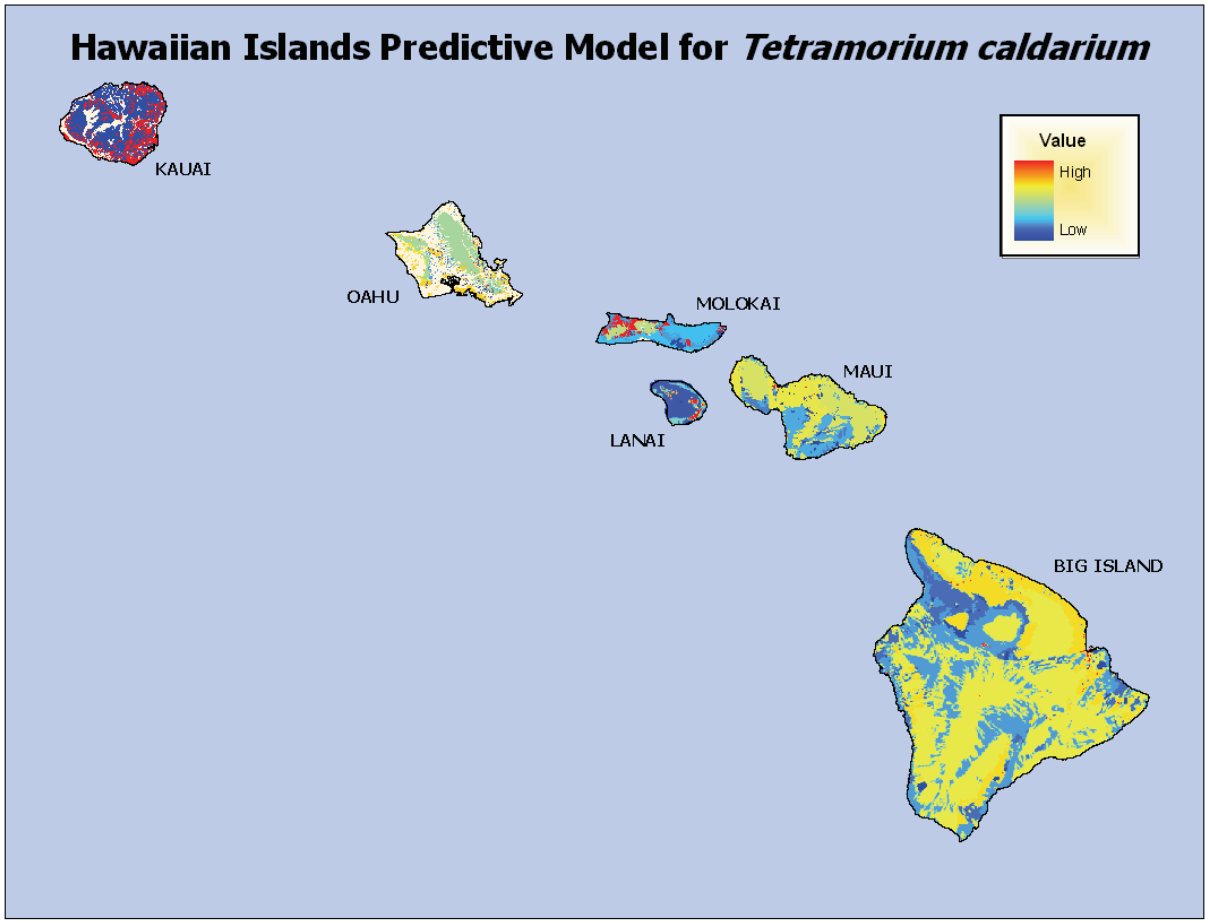


Figure 43: Map of Hawai'i, USA. Predictive model for *Tetramorium caldarium*.

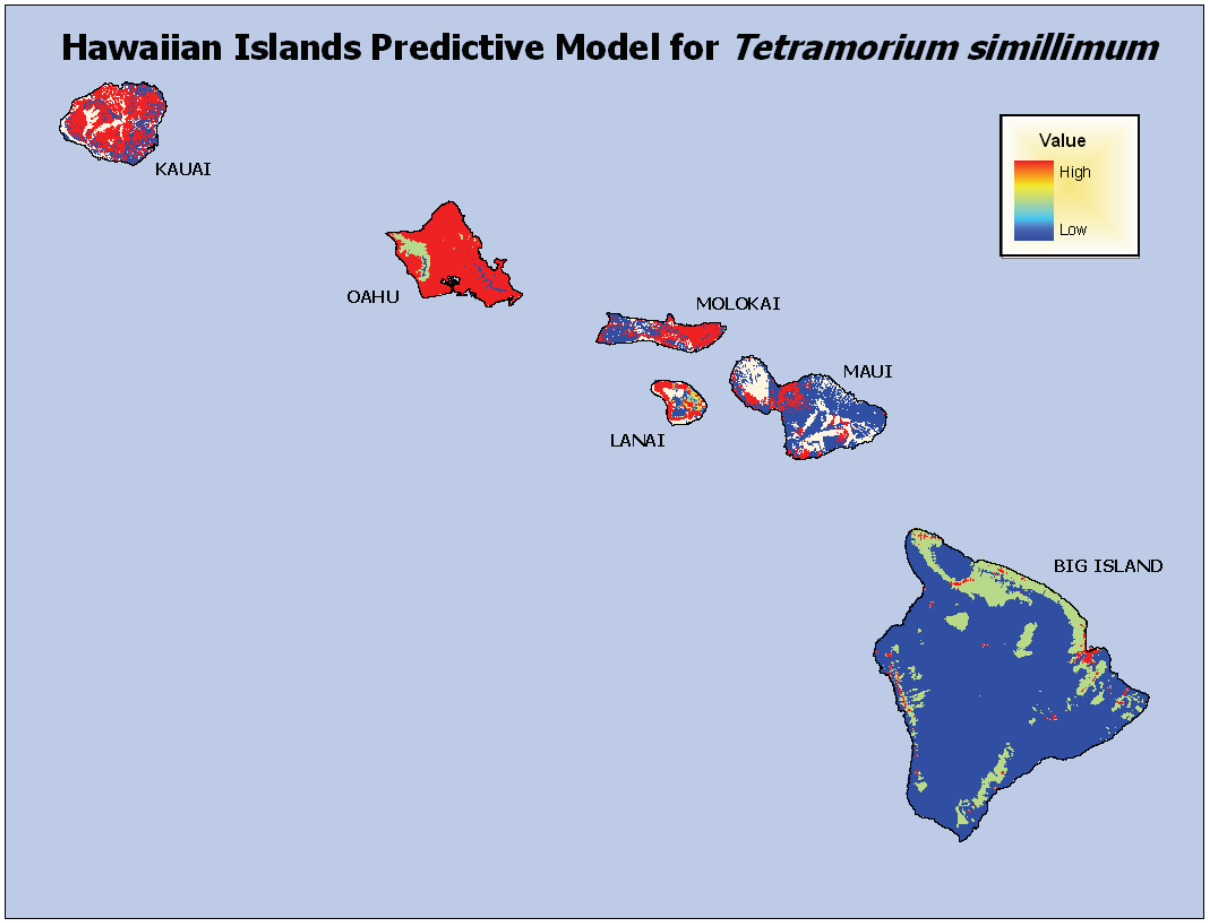


Figure 44: Map of Hawai'i, USA. Predictive model for *Tetramorium simillimum*.

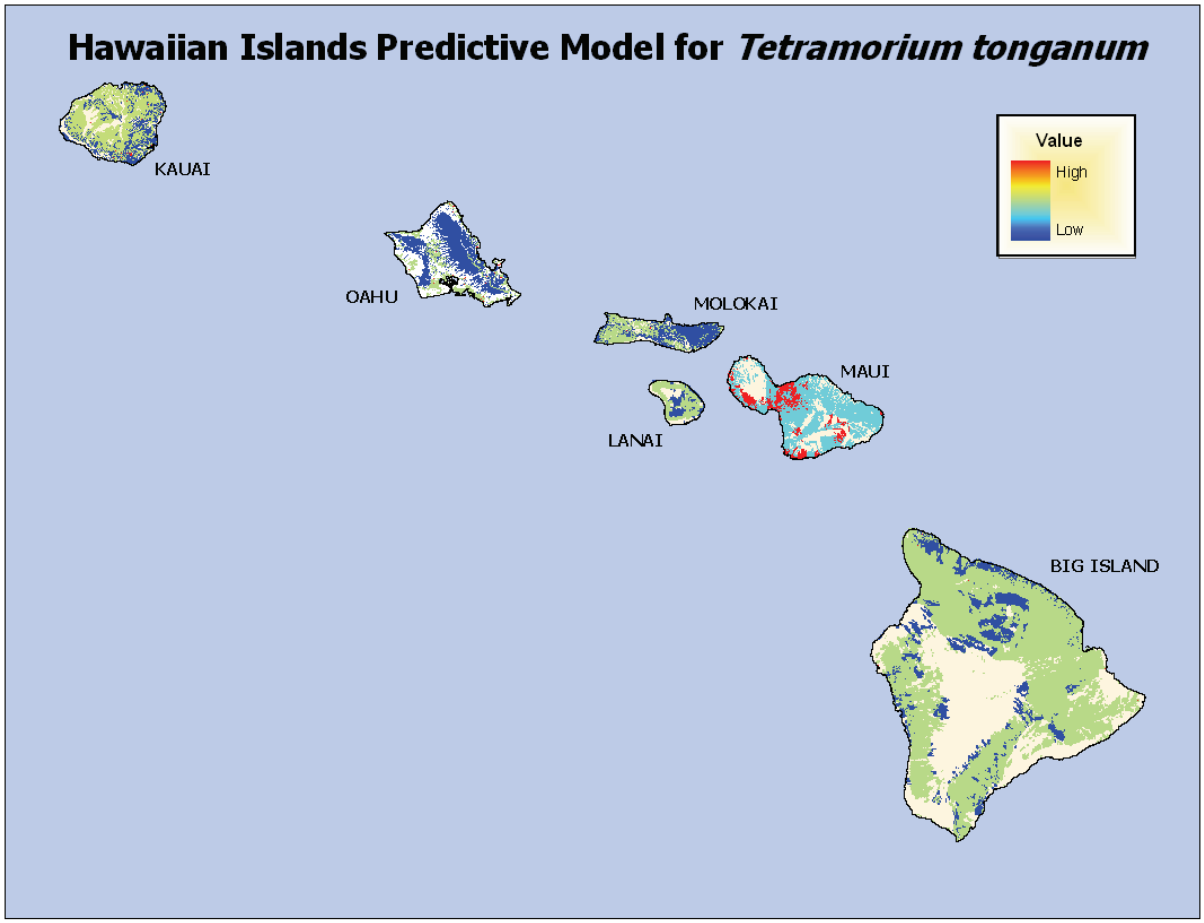


Figure 45: Map of the Hawaiian Islands, Hawai'i, USA. Predictive model for *Tetramorium tonganum*.

APPENDICES

Appendix A: Hawaiian Ant Raw Data

GPS locations and presence absence data found on the Hawaiian Islands by BYU students 1988-1996; for a digital copy inquire at camiefmartin@gmail.com

APPENDIX A: All Raw Data

Site	Island	Elevation (m)	X_CORDS	Y-CORDS	ANGR	CAEM	CAMI	CAVE	CAVA	CAWR	HYCO	HYOP	HYPU	CEBI	HYZW	LEFA	LIHU	MODE	MOFL	MOLA
B1	Big Island	1158	895563	2149504	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B10	Big Island	4176			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B11	Big Island	2073	869980	2178002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B12	Big Island	2134	869350	2173986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B13	Big Island	2316	869734	2173423	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B14	Big Island	2560	871739	2169458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B15	Big Island	1981	870594	2180779	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
B16	Big Island	0	912262	2185617	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
B17	Big Island	0	912262	2185617	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
B18	Big Island	0	911782	2185998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B19	Big Island	488	908536	2174600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B2	Big Island	1097	896145	2148617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B20	Big Island	914	905084	2171934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B21	Big Island	1097	898645	2168798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B22	Big Island	549	907870	2168927	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B3	Big Island	762	896389	2148184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B4	Big Island	1036	897135	2146980	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B5	Big Island	975	897089	2146113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B6	Big Island	2499	912011	2184564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B7	Big Island	2743			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B8	Big Island	3353			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B9	Big Island	3810			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D01	Big Island	945	896577	2144976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D02	Big Island	0	911614	2139450	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D03	Big Island	0			0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D04	Big Island	30	914141	2141217	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D05	Big Island	0	908895	2137617	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D06	Big Island	61	905869	2137792	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D07	Big Island	91	905203	2137921	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D08	Big Island	229	904824	2139783	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D09	Big Island	457	905626	2140625	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D10	Big Island	747	900393	2141818	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D100	Big Island	0	839687	2239417	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
D101	Big Island	0	824630	2237387	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D102	Big Island	61	824189	2233493	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
D103	Big Island	61	825385	2229444	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D104	Big Island	61	826929	2225515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
D105	Big Island	30	829631	2221512	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
D106	Big Island	0	833183	2217376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
D107	Big Island	884	853199	2219366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D108	Big Island	853	857950	2220718	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D109	Big Island	792	861155	2221932	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
D11	Big Island	838	898039	2143288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D110	Big Island	671	864182	2222862	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
D111	Big Island	213	877750	2221167	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D112	Big Island	213	882425	2219075	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D113	Big Island	183	887965	2217255	1	1	1	1	0	1	0	0	0	0	0	0	0	0	1	0
D114	Big Island	91	891129	2216457	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D115	Big Island	610	891411	2212256	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D116	Big Island	61	892476	2215069	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D117	Big Island	30	898346	2210583	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D118	Big Island	30	900871	2209418	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D119	Big Island	366	898831	2206280	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0
D12	Big Island	991	896918	2145904	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D120	Big Island	61	903773	2207010	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D121	Big Island	366	902864	2200048	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0

MOLI	MOSE	MOPH	OCGL	PA-A	PA-B	PA-C	PA-D	PHFE	PSGR	PALO	PHME	PABO	PLAL	STEM	SOGE	STGO	SOPA	STRO	TEAL	TEBI	TECA	TAME	TESI	TETO	total
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0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	5

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D122	Big Island	610	903502	2140976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D123	Big Island	183	896473	2136966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D124	Big Island	823	899464	2155365	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D13	Big Island	1067	894169	2148124	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
D14	Big Island	1143	893334	2150173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D15	Big Island	1173	890422	2149774	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D16	Big Island	1189	888853	2151238	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D17	Big Island	1219	890515	2153178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D18	Big Island	823	892950	2140728	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
D19	Big Island	564	893621	2139471	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D20	Big Island	427	894015	2138390	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D21	Big Island	305	893886	2137232	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D22	Big Island	30	893556	2135236	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D23	Big Island	30	895816	2135111	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D24	Big Island	930	901340	2155923	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
D25	Big Island	823	901632	2155933	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
D26	Big Island	747	902953	2158185	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D27	Big Island	671	904578	2160719	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D28	Big Island	625	905582	2164037	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
D29	Big Island	503	907187	2165679	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D30	Big Island	396	909520	2167857	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D31	Big Island	305	911447	2169019	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
D32	Big Island	213	913259	2171297	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
D33	Big Island	152	914447	2173714	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
D34	Big Island	24	921014	2144129	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D35	Big Island	9	922537	2144733	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D36	Big Island	213	925962	2159923	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D37	Big Island	777	898406	2142139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D38	Big Island	762	897768	2141693	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D39	Big Island	732	896937	2141443	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D40	Big Island	1158	892191	2149870	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
D41	Big Island	46			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D42	Big Island	40	905743	2136888	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D43	Big Island	30	906293	2137187	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
D44	Big Island	0	913228	2140626	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D45	Big Island	1128	892697	2150447	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
D46	Big Island	1158	892980	2151339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D47	Big Island	1158	892737	2152213	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D48	Big Island	1158	892723	2152382	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D49	Big Island	1158	892631	2152591	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D50	Big Island	1189	894391	2151473	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D51	Big Island	1158	894506	2150858	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D52	Big Island	0	915031	2187216	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D53	Big Island	1524	883046	2155895	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D54	Big Island	1554	883039	2156811	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D55	Big Island	1615	882343	2157066	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D56	Big Island	1707	881653	2157882	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D57	Big Island	1829	880596	2158277	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D58	Big Island	2042	879189	2159245	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D59	Big Island	1113	896356	2153501	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
D60	Big Island	244	905983	2182035	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D61	Big Island	488	902128	2180703	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
D62	Big Island	610	900083	2180953	1	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0
D63	Big Island	671	898992	2181338	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D64	Big Island	549	880718	2134741	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D65	Big Island	640	880324	2136067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D66	Big Island	2042	879086	2160005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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D67	Big Island	792	896167	2182307	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D68	Big Island	1097	891300	2181550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D69	Big Island	1280	888309	2180978	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D70	Big Island	1463	884798	2180014	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D71	Big Island	1692	880805	2179271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D72	Big Island	1981	870668	2181070	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
D73	Big Island	2042	870098	2178727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D74	Big Island	2103	869357	2175937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D75	Big Island	2073	870736	2182514	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
D76	Big Island	2134	872209	2183787	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D77	Big Island	2256	872154	2184854	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D78	Big Island	61	909471	2190182	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D79	Big Island	122	907940	2197894	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D80	Big Island	61	907102	2202555	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D81	Big Island	335	870287	2224682	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D82	Big Island	335	867266	2224942	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D83	Big Island	305	864176	2226217	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D84	Big Island	244	861183	2227545	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
D85	Big Island	213	857815	2228334	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D86	Big Island	914	842008	2219882	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D87	Big Island	1006	839885	2221906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D88	Big Island	1097	837774	2224954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D89	Big Island	975	835206	2228380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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D91	Big Island	762	832530	2232769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D92	Big Island	610	830815	2235077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D93	Big Island	518	829823	2237337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D94	Big Island	305	830955	2239576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D95	Big Island	183	828409	2241271	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
D96	Big Island	152	826623	2240780	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D97	Big Island	152	834203	2240473	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
D98	Big Island	61	837615	2239801	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D99	Big Island	122	840588	2238113	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
G01	Big Island	2073	894623	2152126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G02	Big Island	1219	892271	2153426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G03	Big Island	1219	890051	2152882	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
G04	Big Island	1189	887929	2151714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G05	Big Island	1097	885716	2150458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G06	Big Island	1036	884148	2148979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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G08	Big Island	930	881358	2145821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G09	Big Island	884	879624	2143768	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
G10	Big Island	899	879919	2144813	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
G11	Big Island	30	812269	2178833	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
G12	Big Island	46	810929	2184745	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
G13	Big Island	61	812679	2190422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G14	Big Island	61	815542	2193607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	Big Island	91	820840	2196337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G16	Big Island	30	824972	2203248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G17	Big Island	0	825274	2204907	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G18	Big Island	0	827712	2208938	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
G19	Big Island	0	830353	2211673	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
G20	Big Island	0	838295	2217526	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G21	Big Island	427	841618	2217506	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G22	Big Island	640	844337	2218539	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G26	Big Island	0	831634	2218960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H01	Big Island	2256	878184	2161067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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H02	Big Island	2316	877384	2161370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H03	Big Island	2454	876033	2161450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H04	Big Island	2560	875438	2161734	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H05	Big Island	2682	874352	2162256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H06	Big Island	2819	873367	2162781	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H07	Big Island	2880	872440	2163079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H08	Big Island	3033	870800	2163429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H09	Big Island	3048			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H10	Big Island	30	916960	2141884	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H11	Big Island	30	906236	2137711	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H12	Big Island	30	909740	2138206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H13	Big Island	30			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H14	Big Island	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H15	Big Island	61	910636	2183625	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
H16	Big Island	61	910838	2185100	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
H17	Big Island	61	911452	2185724	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H18	Big Island	305	870289	2126851	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H19	Big Island	610	870810	2135093	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
H20	Big Island	610	868918	2135129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H21	Big Island	0	867488	2119794	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
H22	Big Island	0	862888	2114515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H23	Big Island	30	859663	2111387	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
H24	Big Island	183	826516	2151663	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H25	Big Island	183	827383	2153144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H26	Big Island	61	829741	2128740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H27	Big Island	61	825455	2157160	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
H28	Big Island	61	822983	2161181	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
H29	Big Island	853	822645	2173370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H30	Big Island	1158	824681	2174679	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
H31	Big Island	914	820286	2178640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H32	Big Island	122	832589	2213361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H33	Big Island	244	866344	2223424	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
H34	Big Island	61	871058	2223331	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H35	Big Island	61	829700	2221424	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
H36	Big Island	61	826224	2227310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H37	Big Island	183	824847	2230925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H38	Big Island	0			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
H39	Big Island	61			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H40	Big Island	0	841031	2236300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H41	Big Island	914	833633	2231300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H42	Big Island	991			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H43	Big Island	107	922735	2164341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H44	Big Island	0	931248	2168178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H45	Big Island	1128	928578	2150391	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
H46	Big Island	549	870810	2135093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H47	Big Island	610	872899	2135242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H48	Big Island	1219	892082	2153004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H49	Big Island	61	923577	2146076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H50	Big Island	61	923577	2146076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H51	Big Island	107	922735	2164341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H52	Big Island	1097			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H53	Big Island	1097			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H54	Big Island	1402	896033	2164477	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H55	Big Island	1280	890737	2161287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H56	Big Island	1189	892503	2156259	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H57	Big Island	1158	894528	2154952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J01	Big Island	853	889368	2140570	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

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J02	Big Island	792	888144	2139171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J03	Big Island	671	887918	2137865	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J04	Big Island	884	890867	2141351	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J05	Big Island	975	891128	2143133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J06	Big Island	1006	893162	2144408	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J07	Big Island	1030	894435	2146081	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J08	Big Island	1036	894949	2147159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J09	Big Island	991	896656	2145759	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J10	Big Island	914	897472	2144125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J100	Big Island	1981	868652	2181521	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J101	Big Island	2271	866069	2182841	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J102	Big Island	2499	864498	2183888	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J103	Big Island	1981	863513	2187024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J104	Big Island	1798	853145	2192622	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J105	Big Island	1463	851152	2198170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J106	Big Island	1097	849570	2201116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J107	Big Island	762	847501	2214018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J108	Big Island	823	848282	2217595	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
J109	Big Island	610	841296	2203347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J11	Big Island	853	899366	2142588	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J110	Big Island	488	839464	2204602	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J111	Big Island	366	837816	2204805	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
J112	Big Island	305	835956	2206814	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J113	Big Island	213	832562	2205184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J114	Big Island	610	830097	2205776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J115	Big Island	945			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J116	Big Island	1128			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J117	Big Island	1219			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J118	Big Island	899	849036	2217871	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J119	Big Island	107	916899	2172511	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J12	Big Island	701	901088	2141367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J120	Big Island	91	918583	2170474	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J121	Big Island	128	920695	2167587	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J122	Big Island	168	928344	2159998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J123	Big Island	183	930957	2159784	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
J124	Big Island	122	932908	2160531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J125	Big Island	30	937038	2162560	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J126	Big Island	0	939350	2163447	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J127	Big Island	15	937381	2158336	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J128	Big Island	518	905084	2171934	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
J129	Big Island	655	902803	2170454	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J13	Big Island	610	902396	2140572	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J130	Big Island	808	900424	2169361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J131	Big Island	960	897416	2168526	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
J132	Big Island	1158	893560	2167729	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J133	Big Island	405	907356	2173668	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J134	Big Island	213	910493	2176137	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J135	Big Island	1219	892922	2153237	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J136	Big Island	30			1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
J137	Big Island	1219			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J138	Big Island	30			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J139	Big Island	1128	895340	2150039	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J14	Big Island	960	890760	2143230	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J140	Big Island	1097	895779	2149138	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J141	Big Island	1052	896498	2147984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J142	Big Island	1006	897135	2146980	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J143	Big Island	625	848197	2110824	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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J144	Big Island	610	839163	2113507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J145	Big Island	1737	852169	2195860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J146	Big Island	991	897524	2145781	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J147	Big Island	991	898003	2146646	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
J148	Big Island	914	899531	2146860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J149	Big Island	975	902099	2145465	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J15	Big Island	975			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J150	Big Island	792	904226	2146989	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J151	Big Island	914	900216	2147401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J152	Big Island	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J153	Big Island	366	925996	2158948	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J154	Big Island	305	926039	2156989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J155	Big Island	305	925641	2154294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J156	Big Island	244	924941	2151741	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J157	Big Island	122	924445	2149416	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
J158	Big Island	0	923577	2146076	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J159	Big Island	0	926435	2148551	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J16	Big Island	991			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J160	Big Island	0	928578	2150391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J161	Big Island	0	931322	2152243	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J162	Big Island	0	932608	2153578	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J163	Big Island	1219	891210	2153211	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J164	Big Island	183	925093	2162209	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J165	Big Island	122	927790	2164425	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J166	Big Island	61	929679	2166468	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
J167	Big Island	0	931248	2168178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J168	Big Island	198	919209	2167153	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
J169	Big Island	183	918187	2166515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J17	Big Island	991			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J170	Big Island	244	916168	2165316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J171	Big Island	122	922464	2167225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J172	Big Island	61	923929	2169016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J173	Big Island	0	926266	2171822	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J174	Big Island	853	902625	2153728	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J175	Big Island	853	900914	2161192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J176	Big Island	610	904864	2158625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J177	Big Island	381	909092	2164592	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
J178	Big Island	427	911217	2164226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J179	Big Island	427	912172	2162630	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
J18	Big Island	945			0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J180	Big Island	427	913459	2160537	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
J181	Big Island	472			1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
J182	Big Island	549	905733	2170353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J183	Big Island	610	904378	2169084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J184	Big Island	732	902488	2167355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J185	Big Island	15	919033	2178890	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
J186	Big Island	15	917158	2178162	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
J187	Big Island	15	915426	2177465	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J188	Big Island	1067	879263	2213524	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J189	Big Island	762	881670	2214714	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J19	Big Island	914			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J190	Big Island	610	881608	2216666	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J191	Big Island	152	868529	2224946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J192	Big Island	0	832139	2218371	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
J193	Big Island	305	920715	2151017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J194	Big Island	305	920186	2149386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J195	Big Island	427	918844	2150417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	10
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2

J196	Big Island	625	845101	2218033	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
J197	Big Island	15	831802	2211996	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
J20	Big Island	899	881844	2144769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J200	Big Island	0	831973	2212937	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J201	Big Island	0	828264	2209573	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
J202	Big Island	0	825274	2204907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J203	Big Island	0	826645	2206006	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J204	Big Island	0	823658	2202168	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J205	Big Island	0	815446	2195833	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
J206	Big Island	152	809785	2184868	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
J207	Big Island	1219			0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J208	Big Island	1707	880564	2157029	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J209	Big Island	1234			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J21	Big Island	1219	891210	2153211	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J210	Big Island	1234	890109	2154717	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J211	Big Island	1326	888777	2155714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J212	Big Island	1402	888223	2157730	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J213	Big Island	1494	887217	2158866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J214	Big Island	914	881844	2144769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J215	Big Island	914	881844	2144769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J216	Big Island	975	898926	2155202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J217	Big Island	975	898939	2155338	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J218	Big Island	930	898990	2155569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J219	Big Island	61	911989	2181569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J22	Big Island	1204	888527	2153389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J220	Big Island	61	912051	2182699	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J221	Big Island	15	912274	2180467	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
J222	Big Island	61	912801	2181657	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J223	Big Island	2073			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J224	Big Island	442	913459	2160537	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J23	Big Island	1219	887545	2153813	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J24	Big Island	1280	886771	2154142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J25	Big Island	1341	885724	2154233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J26	Big Island	1402	884937	2154918	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J27	Big Island	1463	884372	2155814	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J28	Big Island	1524	883423	2156010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J29	Big Island	716	902970	2142009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J30	Big Island	847	902819	2143777	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J31	Big Island	747	903953	2143366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J32	Big Island	701	905337	2142600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J33	Big Island	671	906099	2142652	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J34	Big Island	564	907020	2142039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J35	Big Island	472	908080	2142051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J36	Big Island	366	909341	2141874	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J37	Big Island	244	910844	2141850	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J38	Big Island	0	911782	2185998	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0
J39	Big Island	543	874495	2132974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J40	Big Island	1158	888706	2150588	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J41	Big Island	1113	887292	2148809	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J42	Big Island	1052	885732	2146609	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J43	Big Island	274	870223	2127281	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J44	Big Island	381	870156	2128737	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J45	Big Island	533	870100	2131584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J46	Big Island	671	870810	2135093	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J47	Big Island	701	868918	2135129	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J48	Big Island	0	849314	2094725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J49	Big Island	122	849186	2097984	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

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0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
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J50	Big Island	213	850768	2101809	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J51	Big Island	305	850895	2104543	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J52	Big Island	427	851389	2108196	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J53	Big Island	351	855659	2112092	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J54	Big Island	229	859663	2111387	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J55	Big Island	61	862888	2114515	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
J56	Big Island	533	882491	2134658	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
J57	Big Island	396	882503	2133590	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J58	Big Island	244	883808	2132389	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J60	Big Island	549	883462	2135040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J61	Big Island	549	884457	2135456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J62	Big Island	594	885208	2136304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J63	Big Island	655	886320	2137004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J64	Big Island	686	886991	2137460	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J65	Big Island	610	841581	2112691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J66	Big Island	610	837877	2113954	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J67	Big Island	549	835714	2115007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J68	Big Island	518	833717	2116158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J69	Big Island	488	832246	2118269	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
J70	Big Island	0	829909	2127814	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
J71	Big Island	305	826095	2126378	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J72	Big Island	0	934992	2155554	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J73	Big Island	30	935481	2157599	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J76	Big Island	427	828044	2131020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J77	Big Island	305	828187	2138274	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
J78	Big Island	244	827546	2146353	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J79	Big Island	305	827357	2150134	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
J80	Big Island	335	827197	2152375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J81	Big Island	0	824060	2151093	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1
J82	Big Island	0	823494	2153689	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
J83	Big Island	427			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J84	Big Island	305	820218	2168488	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J85	Big Island	427	819829	2172778	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J86	Big Island	0	815594	2174769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
J87	Big Island	0	816710	2171234	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
J88	Big Island	396	816835	2180010	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J89	Big Island	533	816524	2185345	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J90	Big Island	579	817070	2187266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J91	Big Island	610	819446	2188474	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J92	Big Island	549	824545	2190835	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J93	Big Island	579	827703	2191940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J94	Big Island	671	830404	2194159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J95	Big Island	701	834842	2196195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J96	Big Island	732	840064	2197652	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
J97	Big Island	792	843015	2201374	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J98	Big Island	792	844832	2205163	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
J99	Big Island	792	846479	2207969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P01	Big Island	808	878318	2141823	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
P02	Big Island	747	877073	2139583	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
P03	Big Island	671	875864	2137294	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
P04	Big Island	579	875092	2135563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P05	Big Island	503	873816	2132764	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P06	Big Island	396	872181	2130002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P07	Big Island	244	871130	2127533	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P08	Big Island	152	869785	2125239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P09	Big Island	122	867835	2123027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P10	Big Island	0	867488	2119794	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

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P11	Big Island	61	866327	2120033	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
P12	Big Island	1219	893284	2152826	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z01	Big Island	1219	891210	2153211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z02	Big Island	610	856342	2112070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z03	Big Island	610	844857	2111583	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z04	Big Island	610	829655	2123628	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z05	Big Island	610	832246	2118269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z06	Big Island	0	825483	2146027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z07	Big Island	305	827644	2147545	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Z08	Big Island	0	824060	2151093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z09	Big Island	61	909597	2188042	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z10	Big Island	305	907088	2189869	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
Z11	Big Island	61	908849	2193571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z12	Big Island	61	908304	2195095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z13	Big Island	61	907964	2198679	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z14	Big Island	305	908303	2200488	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z15	Big Island	305			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z16	Big Island	0	904945	2205475	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z17	Big Island	0	905926	2203991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z18	Big Island	0	900871	2209418	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z19	Big Island	61	899559	2210529	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z20	Big Island	0	894934	2213811	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Z21	Big Island	0			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z22	Big Island	183	881986	2221013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z23	Big Island	762			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z24	Big Island	305	871058	2223331	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Z25	Big Island	76	855893	2227724	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z26	Big Island	1158	890855	2150493	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK01	Kauai	0	428287	2428924	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
AK02	Kauai	0	422492	2432045	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
AK03	Kauai	0	419274	2435941	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK04	Kauai	30	461806	2431000	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK05	Kauai	30	459982	2429861	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK06	Kauai	30	457904	2429030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK07	Kauai	46	445129	2424191	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK08	Kauai	244	430845	2441988	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK09	Kauai	0	430735	2428237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK10	Kauai	15	431956	2427553	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK100	Kauai	15	451442	2421765	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK101	Kauai	0	451393	2420221	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK102	Kauai	0	452574	2419547	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK103	Kauai	0	455446	2420164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK104	Kauai	0	454470	2419661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK105	Kauai	30	449695	2423529	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK106	Kauai	46	447236	2424977	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK107	Kauai	46	448729	2424703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK108	Kauai	46	449671	2425609	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK109	Kauai	15	463179	2430187	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK11	Kauai	0	437501	2421873	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
AK110	Kauai	30	461650	2443664	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK111	Kauai	30	460097	2442304	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
AK112	Kauai	0	440740	2424224	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK113	Kauai	0	465058	2438363	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK114	Kauai	0	465681	2439159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK115	Kauai	0	437778	2422222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK116	Kauai	0	436737	2422201	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK117	Kauai	15	436077	2423868	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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AK118	Kauai	0	432730	2425648	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK119	Kauai	0	431062	2427607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK12	Kauai	15	439413	2422616	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
AK120	Kauai	0	430030	2428680	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
AK121	Kauai	0	426086	2429457	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK122	Kauai	0	422308	2432241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK123	Kauai	0	419915	2434469	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK124	Kauai	0	419418	2436588	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK125	Kauai	15	421884	2437801	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK126	Kauai	0	419247	2437356	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
AK127	Kauai	0	420376	2438942	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK128	Kauai	0	420736	2441657	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
AK129	Kauai	0	422473	2443382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK13	Kauai	0	421016	2440964	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK130	Kauai	46	441802	2424450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK131	Kauai	15	425584	2431118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK132	Kauai	61	427071	2433376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK133	Kauai	107	427113	2434201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK134	Kauai	152	428191	2435254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK135	Kauai	168	428865	2435598	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK136	Kauai	198	430129	2436516	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK137	Kauai	229	431078	2437265	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK138	Kauai	274	431186	2439712	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK139	Kauai	305	431011	2441151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK14	Kauai	0	420967	2443306	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
AK140	Kauai	390	434123	2449630	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK141	Kauai	381	433743	2450123	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK142	Kauai	366	433117	2449293	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK143	Kauai	366	432121	2448128	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK144	Kauai	335	431462	2447324	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK145	Kauai	305	429981	2444646	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK146	Kauai	168	429801	2435363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK147	Kauai	137	429816	2434029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK148	Kauai	91	430352	2431561	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
AK15	Kauai	122	449825	2428583	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
AK150	Kauai	0	451798	2453637	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK151	Kauai	0	451500	2454516	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
AK152	Kauai	30	452659	2453917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK153	Kauai	0	453908	2457842	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK154	Kauai	30	458520	2458229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK155	Kauai	15	456708	2456726	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK156	Kauai	30	460437	2454745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK157	Kauai	30	455877	2455779	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK158	Kauai	30	455597	2454088	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK159	Kauai	0	467238	2452032	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK16	Kauai	122	450294	2427653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK160	Kauai	30	466720	2445801	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK161	Kauai	30	465913	2447028	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AK162	Kauai	15	439232	2423387	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK163	Kauai	15	439825	2423658	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AK164	Kauai	0	431851	2429224	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
AK165	Kauai	61	444545	2425266	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK166	Kauai	122	444217	2426452	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK167	Kauai	137	445153	2428036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK168	Kauai	152	446194	2428370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK169	Kauai	183	446679	2429171	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK17	Kauai	0	452246	2418734	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

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AK170	Kauai	213	447612	2429734	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK171	Kauai	244	448494	2430167	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK172	Kauai	91	455516	2442749	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK173	Kauai	122	454884	2443351	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK174	Kauai	168	454134	2444013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK175	Kauai	183	454056	2444841	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK176	Kauai	183	454553	2445599	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK177	Kauai	183	454393	2446490	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK178	Kauai	61	453866	2440422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK179	Kauai	61	454493	2439296	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK18	Kauai	0	451448	2420630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK180	Kauai	91	463315	2440049	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK181	Kauai	61	462656	2440040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK182	Kauai	46	462053	2439811	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK183	Kauai	30	461945	2439033	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK184	Kauai	61	456184	2438595	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK185	Kauai	46	456281	2440801	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK186	Kauai	46	457592	2440143	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK187	Kauai	46	459390	2439707	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK188	Kauai	61	452243	2452736	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK189	Kauai	91	452409	2451627	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK19	Kauai	15	451291	2425085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK190	Kauai	107	452412	2450632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK191	Kauai	46	452614	2449460	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0
AK192	Kauai	137	453309	2448749	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK193	Kauai	168	454275	2447231	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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AK195	Kauai	0	465474	2432221	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AK196	Kauai	0	465100	2433465	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK197	Kauai	0	465037	2436962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK198	Kauai	183	425860	2447286	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
AK199	Kauai	213	426606	2446937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK20	Kauai	15	451505	2422457	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK200	Kauai	259	427868	2446651	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK201	Kauai	305	429343	2446344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK202	Kauai	335	437476	2446237	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK203	Kauai	335	436305	2446042	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
AK204	Kauai	335	435637	2446370	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK205	Kauai	335	435480	2447327	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK206	Kauai	305	434469	2447812	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK207	Kauai	335	433467	2447526	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK208	Kauai	91	455858	2427686	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK209	Kauai	15	454569	2421943	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AK21	Kauai	30	449452	2423803	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK210	Kauai	0	457733	2421282	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK211	Kauai	15	452471	2421419	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK212	Kauai	0	453203	2419336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK213	Kauai	30	460600	2436641	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK214	Kauai	30	459718	2435818	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AK215	Kauai	30	460786	2434195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK216	Kauai	30	462265	2438614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK217	Kauai	30	461991	2439684	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK218	Kauai	30	462825	2441459	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK219	Kauai	0	465167	2442015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK22	Kauai	183	429299	2435881	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK220	Kauai	0	461834	2456588	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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AK24	Kauai	0	422009	2443171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK25	Kauai	0	454088	2418867	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK26	Kauai	366	434252	2449603	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK27	Kauai	366	432401	2447833	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK28	Kauai	305	430060	2444730	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK29	Kauai	274	429205	2435706	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK30	Kauai	183	428973	2428717	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK31	Kauai	61	429783	2434625	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
AK32	Kauai	0	430954	2430859	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK33	Kauai	0	457893	2421315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK34	Kauai	61	445595	2426157	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK35	Kauai	30	444620	2425477	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK36	Kauai	0	457266	2421198	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK37	Kauai	30	438865	2424413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK38	Kauai	30	440379	2425214	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK39	Kauai	15	461439	2430412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK40	Kauai	274	431824	2438595	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AK41	Kauai	24	447793	2423562	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK42	Kauai	12	437998	2422965	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK43	Kauai	12	461734	2430969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK44	Kauai	15	461958	2432171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK45	Kauai	61	460549	2436972	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
AK46	Kauai	61	461762	2438617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK47	Kauai	61	458797	2440403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK48	Kauai	366	439574	2445786	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK49	Kauai	61	462460	2442269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK50	Kauai	152	458803	2442951	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK51	Kauai	0	439833	2457838	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
AK52	Kauai	0	443858	2457077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK53	Kauai	61	440706	2452456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK54	Kauai	61	443376	2456442	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AK55	Kauai	0	453357	2457960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK56	Kauai	0	431044	2428471	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK57	Kauai	15	451912	2454200	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK58	Kauai	15	455227	2456164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK59	Kauai	0	439114	2457170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK60	Kauai	0	438599	2456725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK61	Kauai	0	458354	2458476	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK62	Kauai	15	451416	2454694	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK63	Kauai	12	450663	2456499	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK64	Kauai	12	464601	2455047	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
AK65	Kauai	0	469035	2445511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK66	Kauai	152	456636	2440268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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AK73	Kauai	0	467111	2441667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK74	Kauai	0	467996	2443515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK75	Kauai	0	468352	2444471	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
AK76	Kauai	15	468457	2447925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK77	Kauai	30	467428	2448174	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
AK78	Kauai	0	466850	2451061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK79	Kauai	15	464384	2453829	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK80	Kauai	30	458131	2455482	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AK81	Kauai	30	457445	2455714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK82	Kauai	0	439659	2457576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK83	Kauai	0	441856	2457838	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
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AK86	Kauai	0	446575	2455834	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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AK88	Kauai	0	450639	2456433	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK89	Kauai	0	464432	2435820	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AK90	Kauai	0	463944	2433178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK91	Kauai	15	462099	2432220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AK92	Kauai	15	461165	2429491	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
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AK94	Kauai	30	459916	2428064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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AK96	Kauai	30	458859	2429416	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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AK99	Kauai	30	451378	2425600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C01	Lanai	0	708712.22	2300064.2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
C02	Lanai	457	719852.56	2300773.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C03	Lanai	701	719492.17	2302686.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C04	Lanai	914	722518.3	2300842.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
C05	Lanai	853	719774.9	2304084.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C06	Lanai	351	717960.56	2299576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C07	Lanai	335	719020.51	2295023.8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	
C08	Lanai	0	719587.58	2295161.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
C09	Lanai	396	717049.02	2302342.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C10	Lanai	518	716259.39	2304517.9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
C11	Lanai	381	713902.19	2301196.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
C12	Lanai	518	716370.63	2304706.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
C13	Lanai	381	714659.46	2305343.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C14	Lanai	0	707641.7	2315595.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C15	Lanai	411	708496.23	2311655.5	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0
C16	Lanai	512	709153.03	2310023.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C17	Lanai	381	713820.93	2299311.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C18	Lanai	244	710185.79	2300432.6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
C19	Lanai	0	719131.8	2294886	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	
C20	Lanai	457	717081.88	2308838.9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
C21	Lanai	0	720203.33	2312955.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C22	Lanai	0	718436.1	2314106.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C23	Lanai	0	725973.68	2299083.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C24	Lanai	0	727547.7	2301902.5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
C25	Lanai	0	726918.96	2305759	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C26	Lanai	0	725721.69	2307307.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C27	Lanai	0	723083.37	2310153.6	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JL101	Lanai	457	715906.68	2302821.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL102	Lanai	427	714254.33	2302225.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL103	Lanai	411	713783.02	2301331.9	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL104	Lanai	381	712629.09	2301337.3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL105	Lanai	320	711057.99	2300882.2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL106	Lanai	152	709644.03	2299939.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL107	Lanai	0	708809.73	2300150.9	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	
JL108	Lanai	427	713019.14	2300264.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL109	Lanai	381	713750.52	2299419.6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL110	Lanai	387	716423.67	2297885.5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL111	Lanai	351	717001.32	2297530.4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL112	Lanai	381	717764.47	2298171.6	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL113	Lanai	396	718813.82	2298786.4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL114	Lanai	244	719635.27	2297631.1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL115	Lanai	366	720281.82	2297117.1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL116	Lanai	488	716259.4	2304808.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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JL117	Lanai	396	716980.13	2302469.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL118	Lanai	351	717573.68	2300911.5	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
JL119	Lanai	351	717907.58	2299231.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL120	Lanai	229	717578.99	2296624.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL121	Lanai	15	717796.27	2294827.7	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JL122	Lanai	229	718744.92	2297090.5	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JL123	Lanai	15	711681.02	2294294.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL124	Lanai	274	712737.42	2296803	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL125	Lanai	213	708157.69	2313497.1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JL126	Lanai	213	708279.55	2312380	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL127	Lanai	244	709288.45	2313158.6	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
JL128	Lanai	122	709952	2313944	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL129	Lanai	457	708401.46	2311005.5	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
JL130	Lanai	305	710568.16	2312332.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL131	Lanai	198	711340.07	2313619	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL132	Lanai	91	711665.08	2314072.7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JL133	Lanai	518	710290.56	2309461.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL134	Lanai	518	711502.57	2308784.7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL135	Lanai	442	712924.46	2307714.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL136	Lanai	442	714603.68	2306584.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL137	Lanai	488	716129.16	2305952.6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JL138	Lanai	579	715808.93	2306983.7	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0
JL139	Lanai	549	716404.78	2307884.2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL140	Lanai	335	717799.6	2309868	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL141	Lanai	229	718246.49	2310876.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL142	Lanai	0	719573.62	2313327.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL143	Lanai	0	718253.27	2314201.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL144	Lanai	12	719519.44	2312765.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL145	Lanai	152	718815.25	2311581	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL146	Lanai	457	712795.82	2310362.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL147	Lanai	381	712626.54	2311675.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL148	Lanai	533	713696.36	2308534.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL149	Lanai	533	716344.23	2305529.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL150	Lanai	564	718473.51	2305099.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL151	Lanai	716	718896.28	2304628	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL152	Lanai	991	719597.13	2304176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL153	Lanai	680	721344.24	2304033.8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JL154	Lanai	936	721598.16	2302601.6	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL155	Lanai	91	722274.51	2301467.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL156	Lanai	823	722364.61	2300439.8	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
JL157	Lanai	610	722258.6	2300270.3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
JL158	Lanai	579	721898.24	2299544.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JL159	Lanai	457	724283.09	2301319.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL160	Lanai	305	725321.82	2301669.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL161	Lanai	152	725910.1	2301759.4	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JL162	Lanai	0	726975.32	2300673	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL163	Lanai	0	726471.86	2300058.3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL164	Lanai	0	727939.86	2302549	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL165	Lanai	0	727727.89	2304425	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL166	Lanai	0	727205.73	2305314.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL167	Lanai	0	725621.32	2307472.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL168	Lanai	549	715382.36	2307843.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL169	Lanai	503	714630.79	2309407.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL170	Lanai	0	720918.26	2312139.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL171	Lanai	0	722180.06	2311035.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL172	Lanai	0	723499.2	2309766.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JL173	Lanai	0	724259.16	2309135.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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JL174	Lanai	0	725334.53	2308088.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL175	Lanai	503	714345.7	2304658.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL176	Lanai	451	713172.53	2303835.7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL177	Lanai	451	711651.54	2306882.1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
JL178	Lanai	381	711197.86	2305683.7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL179	Lanai	152	709409.18	2304353.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL180	Lanai	91	709165.39	2304526.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL181	Lanai	457	708719.69	2308439.4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
JL182	Lanai	457	707995.19	2309157.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL183	Lanai	305	706823.79	2309312.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JL184	Lanai	503	707995.18	2310050.8	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JL185	Lanai	0	719545.16	2295256.9	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1
SL01	Lanai	0	719693.55	2295516.6	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1
SL02	Lanai	30	719068.2	2294954.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL03	Lanai	0	715687.05	2314898.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL04	Lanai	610	718638.41	2305630	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL05	Lanai	579	721902.9	2302220.7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SL06	Lanai	914	722391.1	2300333.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL07	Lanai	457	719836.65	2300863.8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SL08	Lanai	366	720742.9	2297678.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL09	Lanai	396	718803.22	2301393.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM101	Maui	0	764113	2300470	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
JM102	Maui	427	755239	2311180	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
JM103	Maui	0	741272	2310081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM104	Maui	914	779640	2300334	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
JM105	Maui	1219	781030	2299008	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
JM106	Maui	2164	786377	2298090	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
JM107	Maui	0	774606	2317263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM108	Maui	61	778182	2316819	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM109	Maui	122	789450	2312856	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM110	Maui	0	796833	2309640	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JM111	Maui	0	813665	2298308	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
JM112	Maui	0	773399	2316517	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
MJ104	Maui	107	769926	2306997	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ105	Maui	85	769586	2305636	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MJ106	Maui	85	767763	2305275	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ107	Maui	91	767328	2303832	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ108	Maui	15	764010	2300075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ109	Maui	0	764241	2299126	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
MJ110	Maui	0	764738	2295745	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
MJ111	Maui	0	766123	2289486	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
MJ112	Maui	0	766161	2286342	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ113	Maui	0	765937	2284458	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ114	Maui	0	769150	2279859	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ115	Maui	15	770113	2278425	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ116	Maui	91	770232	2280447	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ117	Maui	3048	785985	2293207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ118	Maui	2835	787713	2295708	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ119	Maui	2682	788206	2296542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ120	Maui	18	759797	2311868	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ121	Maui	18	760189	2312324	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ122	Maui	0	760423	2315362	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MJ123	Maui	244	758814	2312855	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ124	Maui	18	762064	2312138	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ125	Maui	18	763292	2304678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ126	Maui	37	762840	2306322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ127	Maui	12	761476	2304122	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

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MJ128	Maui	2438	788242	2297505	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ129	Maui	610	770813	2285624	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ130	Maui	366	769608	2285280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ131	Maui	122	767563	2285945	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MJ132	Maui	61	766950	2286137	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MJ133	Maui	213	768511	2287250	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ134	Maui	183	767955	2289085	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ135	Maui	305	770313	2282471	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ136	Maui	732	773003	2284478	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ137	Maui	91	774778	2283658	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ138	Maui	549	771352	2283253	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ139	Maui	488	778006	2281955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ140	Maui	823	778077	2283869	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ141	Maui	488	780244	2281526	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ142	Maui	244	786077	2282582	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ143	Maui	427	786418	2283640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ144	Maui	305	781062	2312929	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ145	Maui	0	756770	2299545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ146	Maui	0	749901	2302538	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MJ147	Maui	0	746241	2304748	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ148	Maui	0	744356	2306167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ149	Maui	0	742761	2308203	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ150	Maui	15	740947	2311709	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0
MJ151	Maui	15	750030	2302538	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ152	Maui	122	750525	2302968	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
MJ153	Maui	122	741089	2316389	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MJ154	Maui	0	741537	2321750	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ155	Maui	0	742297	2324096	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ156	Maui	0	745285	2325712	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
MJ157	Maui	30	746514	2326319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ158	Maui	46	750232	2326458	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ159	Maui	15	753211	2325616	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ160	Maui	305	755235	2321597	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ161	Maui	0	800666	2284927	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ162	Maui	15	797772	2282788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ163	Maui	30	804459	2286502	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MJ164	Maui	30	807763	2287958	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ165	Maui	0	812409	2292361	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ166	Maui	0	813666	2294291	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ167	Maui	91	809654	2301255	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ168	Maui	274	798123	2285961	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
MJ169	Maui	366	796227	2286086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ170	Maui	152	797123	2284341	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ171	Maui	518	777575	2305737	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MJ172	Maui	457	779979	2309988	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MJ173	Maui	488	781401	2309271	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ174	Maui	259	782193	2314368	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ175	Maui	30	782213	2318563	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ176	Maui	0	772094	2315276	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
MJ177	Maui	0	765011	2312503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MJ178	Maui	305	756166	2311455	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
MJ179	Maui	122	759243	2307405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ180	Maui	30	759148	2303671	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MJ181	Maui	24	764972	2309026	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MJ182	Maui	732	779633	2304896	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ183	Maui	853	779799	2301967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ184	Maui	975	780086	2300677	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

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MJ185	Maui	1036	780008	2299595	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MJ186	Maui	1341	781315	2299002	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
MJ187	Maui	1707	783380	2297656	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ188	Maui	1829	784329	2297861	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
MJ189	Maui	2073	786506	2299154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MJ190	Maui	2164	788866	2295899	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MS01	Maui	2743	787343	2293036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS02	Maui	2591	788025	2292643	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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MS04	Maui	2316	789593	2292375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS05	Maui	2256	790022	2292400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS06	Maui	2256	790652	2293472	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS07	Maui	2195	790958	2294299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS08	Maui	2134	790327	2295457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS09	Maui	2073	789769	2296408	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MS10	Maui	2195	789923	2297437	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS11	Maui	2316	789547	2297847	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
MS12	Maui	2438	788533	2297549	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS13	Maui	30	786613	2281336	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
MS14	Maui	610	755878	2303154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS15	Maui	853	754920	2304456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS16	Maui	975	754127	2306679	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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MS18	Maui	1128	798065	2289243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MS19	Maui	1707	797507	2291626	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
OM01	Maui	442	775963	2307374	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM02	Maui	488	779603	2308530	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM03	Maui	366	780764	2312044	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
OM04	Maui	168	784212	2315621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM05	Maui	0	776503	2317348	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM06	Maui	0	770826	2315117	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM07	Maui	46	768524	2311540	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM08	Maui	747	778270	2301962	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
OM09	Maui	853	777989	2297527	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
OM10	Maui	914	775480	2291956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM100	Maui	122	784134	2315460	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM101	Maui	0	794556	2309499	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM102	Maui	0	813662	2296160	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM103	Maui	0	740620	2318998	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
OM104	Maui	0	739957	2316223	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OM105	Maui	0	740540	2312982	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OM106	Maui	457	775686	2306924	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM107	Maui	2256	789369	2297820	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
OM108	Maui	0	739682	2315809	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
OM11	Maui	427	755115	2311097	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
OM12	Maui	244	756288	2311358	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
OM13	Maui	61	759577	2313965	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM14	Maui	0	758641	2318603	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
OM15	Maui	0	754452	2323926	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
OM16	Maui	61	753723	2324655	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0
OM17	Maui	30	750113	2327458	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
OM18	Maui	91	741585	2320840	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
OM19	Maui	183	743122	2312073	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
OM20	Maui	0	756153	2299472	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
OM21	Maui	15	763518	2311692	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM22	Maui	442	776138	2307094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM23	Maui	61	761696	2307644	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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OM26	Maui	0	747202	2303331	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
OM27	Maui	0	752396	2301386	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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OM29	Maui	0	764648	2298673	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
OM30	Maui	0	765666	2294412	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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OM33	Maui	15	763201	2303578	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM34	Maui	351	779186	2311959	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM35	Maui	122	778155	2315190	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM36	Maui	152	787380	2314619	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OM37	Maui	122	792054	2311445	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM38	Maui	122	794358	2310347	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM39	Maui	0	796592	2309935	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0
OM40	Maui	122	797628	2306768	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM41	Maui	396	798941	2304793	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM42	Maui	244	804357	2302851	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM43	Maui	0	810505	2302509	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
OM44	Maui	0	813496	2297747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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OM47	Maui	91	799159	2284527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM48	Maui	914	779779	2297291	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
OM49	Maui	853	777955	2297413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM50	Maui	610	772010	2289576	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
OM51	Maui	579	770740	2285821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM52	Maui	549	774141	2282405	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM53	Maui	457	781368	2281799	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM54	Maui	0	794382	2283734	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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OM64	Maui	0	763052	2311994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM65	Maui	1189	778787	2295245	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
OM66	Maui	1829	780998	2293495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM67	Maui	1951	778003	2288965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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OM69	Maui	792	780091	2303850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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OM71	Maui	823	781330	2305508	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
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OM73	Maui	732	781989	2306233	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
OM74	Maui	335	776569	2310225	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0
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OM76	Maui	792	754986	2318817	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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OM81	Maui	853	779104	2300831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM82	Maui	610	776682	2302413	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OM83	Maui	0	763638	2300625	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM84	Maui	0	761338	2302046	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
OM85	Maui	427	757331	2308227	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
OM86	Maui	244	758204	2310151	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM87	Maui	122	758426	2314857	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
OM88	Maui	55	758175	2316586	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM89	Maui	30	758777	2316749	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM90	Maui	0	763003	2311551	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OM91	Maui	0	763191	2312550	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM92	Maui	15	767413	2313395	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OM93	Maui	122	792168	2311150	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM94	Maui	0	794326	2309609	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM95	Maui	15	811657	2301725	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
OM96	Maui	0	814170	2299300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM97	Maui	244	802147	2304167	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OM98	Maui	61	797760	2308131	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
OM99	Maui	0	797508	2308633	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
G01	Molokai	15	732116	2341246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G02	Molokai	152	731828	2341836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ01	Molokai	0	728629	2331932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ02	Molokai	0	726629	2331375	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ03	Molokai	15	724287	2330316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ04	Molokai	0	721413	2329572	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ05	Molokai	0	719270	2329456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ06	Molokai	0	716203	2330361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ07	Molokai	0	714567	2330547	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ08	Molokai	0	713265	2330759	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ09	Molokai	30	712512	2331233	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
GJ10	Molokai	0	708915	2332119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ100	Molokai	0	693053	2334059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ101	Molokai	411	687793	2337647	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ102	Molokai	366	689987	2338466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ103	Molokai	381	692000	2337649	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ104	Molokai	122	688374	2334707	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ105	Molokai	213	683808	2339861	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ11	Molokai	0	705769	2333234	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
GJ12	Molokai	0	703369	2334417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ13	Molokai	40	701819	2336153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ14	Molokai	152	701653	2338570	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ15	Molokai	168	699703	2340247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ16	Molokai	107	697591	2339478	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ17	Molokai	107	695316	2339725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ18	Molokai	244	692122	2339864	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ19	Molokai	290	685205	2338432	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ20	Molokai	305	686818	2339714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ21	Molokai	290	689788	2339909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ22	Molokai	0	731131	2333810	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ23	Molokai	0	732545	2334741	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ24	Molokai	0	733964	2336326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ25	Molokai	0	734764	2336750	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
GJ26	Molokai	183	735047	2339500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ27	Molokai	152	734793	2340344	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
GJ28	Molokai	91	735027	2341216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ29	Molokai	46	734032	2341124	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ30	Molokai	0	734769	2341455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

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GJ31	Molokai	213	702745	2339574	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
GJ32	Molokai	305	704052	2340710	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ33	Molokai	427	706029	2340877	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ34	Molokai	518	707602	2342165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ35	Molokai	488	706797	2343056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ36	Molokai	396	705416	2341566	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ37	Molokai	61	702492	2341524	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ38	Molokai	213	701260	2341907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ39	Molokai	183	699586	2342294	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ40	Molokai	152	697065	2342830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ41	Molokai	61	695254	2343225	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ42	Molokai	70	693145	2344000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ43	Molokai	0	692414	2345243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ44	Molokai	0	690979	2345635	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ45	Molokai	122	695029	2342250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ46	Molokai	137	694733	2340844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ47	Molokai	146	697328	2340978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ48	Molokai	122	696843	2343924	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
GJ49	Molokai	168	686557	2340708	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ50	Molokai	122	684016	2343108	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ51	Molokai	15	681776	2343601	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
GJ52	Molokai	0	681224	2342869	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ53	Molokai	61	682281	2341821	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ54	Molokai	0	677347	2338657	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ55	Molokai	0	678457	2340179	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
GJ56	Molokai	366	707314	2343044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ57	Molokai	305	707570	2343052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ58	Molokai	274	707675	2343207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ59	Molokai	152	707557	2343353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ60	Molokai	91	707651	2343402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ61	Molokai	0	708687	2343967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ62	Molokai	0	712899	2343250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ63	Molokai	0	710151	2346843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ64	Molokai	0	708228	2343674	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ65	Molokai	213	708626	2343893	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ66	Molokai	213	703947	2338342	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
GJ67	Molokai	290	706036	2338558	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ68	Molokai	396	708069	2338489	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ69	Molokai	610	709830	2339108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ70	Molokai	884	712225	2339108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ71	Molokai	1067	715427	2338438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ72	Molokai	0	699498	2335375	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0
GJ73	Molokai	15	697805	2336301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ74	Molokai	58	698429	2337957	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
GJ75	Molokai	305	714882	2333825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ76	Molokai	335	706721	2335901	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
GJ77	Molokai	61	682508	2344982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ78	Molokai	183	688632	2344859	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ79	Molokai	0	680958	2348044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ80	Molokai	183	683356	2347283	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ81	Molokai	168	687389	2343805	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ82	Molokai	213	689149	2342250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ83	Molokai	15	705370	2333500	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
GJ84	Molokai	625	709183	2341879	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
GJ85	Molokai	671	710721	2341580	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
GJ86	Molokai	0	704594	2332688	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
GJ87	Molokai	335	685929	2338392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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GJ88	Molokai	213	683475	2337096	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ89	Molokai	137	682391	2335289	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
GJ90	Molokai	0	680809	2333178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ91	Molokai	0	682418	2333217	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
GJ92	Molokai	0	683519	2333348	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ93	Molokai	0	685533	2333387	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ94	Molokai	122	679487	2335599	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ95	Molokai	70	677601	2334664	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
GJ96	Molokai	0	675343	2334597	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
GJ97	Molokai	91	680224	2338176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GJ98	Molokai	0	695561	2334993	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
GJ99	Molokai	0	694452	2334552	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JT01	Molokai	183	727223	2333434	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JT02	Molokai	732	726656	2335098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JT03	Molokai	1067	726386	2335941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB01	Molokai	0	735125	2337379	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB02	Molokai	183	735690	2338822	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB03	Molokai	0	734627	2341519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB04	Molokai	0	728600	2331996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB05	Molokai	0	715440	2330496	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB06	Molokai	0	706544	2332917	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
MB07	Molokai	488	706696	2343060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB08	Molokai	0	681711	2344159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB09	Molokai	146	697669	2340939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S01	Molokai	0	728585	2332035	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
T01	Molokai	0	681700	2344487	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T02	Molokai	0	677388	2339065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T03	Molokai	0	677578	2338985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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T06	Molokai	15	732984	2341051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T07	Molokai	15	733530	2341075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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T09	Molokai	183	734471	2342826	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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T14	Molokai	0	728649	2331893	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T16	Molokai	0	687047	2346112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC01	Oahu	0	611487	2393786	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC02	Oahu	0	612018	2394511	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC03	Oahu	15	597723	2393115	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CC04	Oahu	0	592520	2388816	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CC05	Oahu	0	586497	2386772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC06	Oahu	0	574383	2386066	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC07	Oahu	15	592499	2387323	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CC08	Oahu	122	609648	2390893	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC09	Oahu	30	612624	2387457	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC10	Oahu	0	616570	2384232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC11	Oahu	0	620264	2379163	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CC12	Oahu	274	601725	2378342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC13	Oahu	0	589925	2361544	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CC14	Oahu	46	582608	2374632	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
CC15	Oahu	0	577443	2384115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC16	Oahu	15	610670	2394298	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC17	Oahu	0	621249	2353434	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1

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CJ01	Oahu	15	592276	2386327	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ02	Oahu	0	594714	2391458	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CJ03	Oahu	244	600231	2393916	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ04	Oahu	0	598412	2396812	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ05	Oahu	15	603511	2400485	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CJ06	Oahu	0	609353	2397146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ07	Oahu	15	612817	2389287	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ08	Oahu	0	616570	2384232	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ09	Oahu	0	619481	2376353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ10	Oahu	61	624145	2367424	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ11	Oahu	0	624969	2369677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ12	Oahu	305	621307	2363960	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ13	Oahu	305	619739	2363368	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ14	Oahu	30	618023	2362178	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ15	Oahu	152	623682	2351861	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CJ16	Oahu	61	616916	2360015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ17	Oahu	183	622357	2365987	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
CJ18	Oahu	0	620631	2373678	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ19	Oahu	0	619110	2383677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ20	Oahu	0	609997	2396147	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CJ21	Oahu	15	608190	2398732	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CJ22	Oahu	0	606802	2400475	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CJ23	Oahu	0	606300	2401112	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CJ24	Oahu	122	621073	2359252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL01	Oahu	0	579282	2382081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL02	Oahu	0	575709	2385303	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL03	Oahu	0	574391	2386086	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
GL04	Oahu	0	579662	2379404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL05	Oahu	0	579546	2376204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL06	Oahu	30	582072	2374588	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
GL07	Oahu	0	581904	2373505	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL08	Oahu	61	586741	2373985	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL09	Oahu	0	584293	2370508	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
GL10	Oahu	0	585057	2367197	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
GL11	Oahu	30	590505	2366414	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
GL12	Oahu	0	589442	2363107	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
GL13	Oahu	61	620698	2357747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL14	Oahu	152	621112	2358830	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
GL15	Oahu	183	622709	2359325	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL16	Oahu	488	622917	2360359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL17	Oahu	488	623473	2361017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL18	Oahu	15	632042	2356441	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL19	Oahu	0	630231	2354105	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
GL20	Oahu	107	628807	2356183	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0
GL21	Oahu	0	628490	2353510	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL22	Oahu	91	626096	2355494	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0
GL23	Oahu	0	625843	2352049	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
GL24	Oahu	30	624241	2353509	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
GL25	Oahu	0	621885	2352785	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
GL26	Oahu	0	620329	2354536	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL27	Oahu	305	625904	2358128	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL28	Oahu	122	624502	2355933	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
GL29	Oahu	183	624070	2359662	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL30	Oahu	122	623238	2357903	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL31	Oahu	0	617515	2357938	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
GL32	Oahu	0	617823	2355016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL33	Oahu	15	619030	2356321	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0

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GL34	Oahu	122	621727	2356779	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL35	Oahu	122	623236	2355477	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL36	Oahu	0	616874	2356136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL37	Oahu	15	615972	2358998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB01	Oahu	15	596929	2393164	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
HB02	Oahu	0	592560	2388237	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB03	Oahu	30	589813	2385579	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB04	Oahu	0	578920	2386707	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB05	Oahu	0	580376	2386524	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB06	Oahu	0	581963	2386918	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB07	Oahu	0	586497	2386797	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB08	Oahu	152	581529	2386109	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB09	Oahu	305	581451	2385748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB10	Oahu	366	581469	2385270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB11	Oahu	457	581400	2384844	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB12	Oahu	488	581349	2384544	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB13	Oahu	518	581174	2384078	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HB14	Oahu	610	581206	2383625	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
HB15	Oahu	0	577133	2386680	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HB16	Oahu	122	592197	2384014	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HB17	Oahu	152	595007	2381144	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
HB18	Oahu	274	600709	2378393	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB19	Oahu	305	598941	2381695	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
HB20	Oahu	122	595019	2385220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB21	Oahu	91	595923	2388227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB22	Oahu	61	598351	2394170	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB23	Oahu	183	602540	2397822	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB24	Oahu	0	630776	2373187	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB25	Oahu	15	628006	2372685	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB26	Oahu	122	619449	2358910	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB27	Oahu	183	620278	2360171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB28	Oahu	305	621027	2361088	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB29	Oahu	0	589904	2361662	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
HB30	Oahu	61	591437	2360717	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB31	Oahu	0	591549	2358152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB32	Oahu	0	592483	2355441	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
HB33	Oahu	122	594370	2361173	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
HB34	Oahu	305	594669	2363066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB35	Oahu	610	592805	2364469	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB36	Oahu	0	604417	2357618	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB37	Oahu	15	603559	2359520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB38	Oahu	21	600622	2361171	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
HB39	Oahu	15	601926	2365000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB40	Oahu	15	603955	2365807	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1
HB41	Oahu	259	626409	2365940	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB42	Oahu	152	628781	2368418	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
HB43	Oahu	152	627806	2366335	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HB44	Oahu	0	633178	2365881	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB45	Oahu	61	629342	2367458	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
HB46	Oahu	61	631377	2362208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB47	Oahu	91	629697	2360677	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB48	Oahu	91	636724	2357135	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB49	Oahu	15	634659	2353640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB50	Oahu	122	635242	2357319	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
HB51	Oahu	274	597354	2378026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB52	Oahu	274	596426	2378440	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
HB53	Oahu	457	591733	2375740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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HB54	Oahu	274	596340	2376506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB55	Oahu	274	599825	2374766	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB56	Oahu	183	603496	2396746	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB57	Oahu	61	605278	2398619	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
HB58	Oahu	244	584363	2383244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB59	Oahu	610	583320	2382786	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB60	Oahu	610	585068	2384049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB61	Oahu	24	585838	2385458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB62	Oahu	244	603797	2375761	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
HB63	Oahu	213	603035	2374095	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
HB64	Oahu	244	603756	2373740	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
HB65	Oahu	213	602233	2372622	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HB66	Oahu	122	608134	2367978	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB67	Oahu	183	609246	2368509	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB68	Oahu	244	610680	2369287	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB69	Oahu	213	610188	2370494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB70	Oahu	244	611631	2371031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB71	Oahu	366	613133	2371452	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB72	Oahu	488	614559	2371998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB73	Oahu	549	616091	2372827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB74	Oahu	122	609700	2370345	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
HB75	Oahu	0	606832	2367212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB76	Oahu	305	604854	2381938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB77	Oahu	305	606378	2381735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB78	Oahu	457	607089	2381542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB79	Oahu	488	608257	2381532	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB80	Oahu	549	609195	2381291	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB81	Oahu	640	609788	2381714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB82	Oahu	762	611386	2381857	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB83	Oahu	305	603533	2382101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB84	Oahu	305	602253	2382294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB85	Oahu	305	601811	2381388	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB86	Oahu	305	600729	2380922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB87	Oahu	152	636595	2354569	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
HB88	Oahu	0	609084	2362624	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	
HB89	Oahu	183	623308	2366100	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	
HB90	Oahu	91	587818	2385135	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB91	Oahu	107	587521	2384258	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB92	Oahu	183	586887	2382817	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HB93	Oahu	305	586650	2382520	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
HB94	Oahu	610	586163	2381259	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HB95	Oahu	274	595654	2377316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ100	Oahu	213	595984	2384915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ101	Oahu	213	596492	2383767	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JJ102	Oahu	320	598880	2382121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ103	Oahu	305	600759	2381532	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ104	Oahu	305	599286	2380861	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1
JJ105	Oahu	305	601217	2379256	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ106	Oahu	274	599502	2377489	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ107	Oahu	274	600851	2373849	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ108	Oahu	274	601674	2378362	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ109	Oahu	274	604346	2378860	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ110	Oahu	213	602293	2373618	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ111	Oahu	198	601206	2371657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ112	Oahu	15	610494	2394471	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ113	Oahu	91	596177	2391498	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
JJ114	Oahu	183	598992	2390228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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JJ115	Oahu	366	601653	2388684	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ116	Oahu	366	600225	2388264	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
JJ117	Oahu	183	596665	2388928	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ118	Oahu	91	595354	2389243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ119	Oahu	30	592794	2386825	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
JJ120	Oahu	76	600668	2366456	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
JJ121	Oahu	152	599122	2367350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ122	Oahu	183	598168	2369238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ123	Oahu	244	597349	2370623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ124	Oahu	244	597266	2373205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ125	Oahu	229	594187	2381898	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ126	Oahu	244	598281	2377289	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ127	Oahu	15	601732	2360249	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
JJ128	Oahu	0	602045	2357730	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
JJ129	Oahu	15	599237	2359820	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ130	Oahu	46	598052	2363309	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
JJ131	Oahu	229	595977	2359115	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
JJ132	Oahu	244	608885	2392786	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ133	Oahu	244	608481	2391684	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ134	Oahu	488	607913	2389938	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ135	Oahu	610	607623	2388704	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ136	Oahu	610	607072	2389402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ137	Oahu	610	606201	2390901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ138	Oahu	122	613709	2366875	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
JJ139	Oahu	244	614596	2367394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ140	Oahu	366	615493	2367648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ141	Oahu	488	616666	2368092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ142	Oahu	549	618054	2368770	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ143	Oahu	46	611916	2365612	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ145	Oahu	0	610634	2364432	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0
JJ146	Oahu	457	617966	2367855	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ147	Oahu	396	616771	2367599	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
JJ148	Oahu	183	615996	2366936	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ149	Oahu	122	614850	2366365	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
JJ150	Oahu	91	613869	2366209	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ151	Oahu	46	612992	2365717	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
JJ152	Oahu	0	615558	2383752	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ153	Oahu	122	615277	2382779	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ154	Oahu	1219	588157	2378952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ155	Oahu	1036	587043	2379233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JJ156	Oahu	732	585605	2380169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO01	Oahu	30	638521	2355359	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
JO02	Oahu	30	638819	2357219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO03	Oahu	0	634946	2359897	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO04	Oahu	61	628674	2365015	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JO05	Oahu	0	623233	2371769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO06	Oahu	0	620249	2380107	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JO07	Oahu	0	612983	2389926	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO08	Oahu	0	600984	2399151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO09	Oahu	15	597010	2393591	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
JO10	Oahu	24	591546	2384829	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
JO11	Oahu	274	595921	2380281	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JO12	Oahu	183	601592	2373167	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ101	Oahu	183	634130	2353405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ102	Oahu	0	634634	2352945	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
OJ103	Oahu	244	636639	2354905	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
OJ104	Oahu	0	619922	2382023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
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OJ105	Oahu	30	610060	2394418	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ106	Oahu	0	602226	2399738	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ107	Oahu	183	598616	2392514	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ108	Oahu	0	622495	2352339	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ109	Oahu	366	624850	2363426	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OJ110	Oahu	305	622156	2361310	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
OJ111	Oahu	30	618352	2356153	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SS01	Oahu	30	618397	2376192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS02	Oahu	91	617276	2375741	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS03	Oahu	122	616086	2375214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS04	Oahu	30	618512	2374251	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
SS05	Oahu	30	619327	2371893	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS06	Oahu	152	620141	2370554	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SS07	Oahu	122	622628	2368248	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SS08	Oahu	183	621094	2367767	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SS09	Oahu	0	624886	2370206	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SS10	Oahu	91	621309	2370962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS20	Oahu	0	609704	2363409	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0
SS21	Oahu	152	612539	2362707	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS22	Oahu	61	613814	2361405	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
SS23	Oahu	0	611458	2357222	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
SS24	Oahu	15	610047	2360610	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
SS25	Oahu	0	606276	2365629	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
TH01	Oahu	15	611309	2391999	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH02	Oahu	0	611983	2391387	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH03	Oahu	0	612636	2390102	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TH04	Oahu	122	611954	2390028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH05	Oahu	122	611646	2389360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH06	Oahu	183	611451	2388687	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH07	Oahu	183	611144	2388073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH08	Oahu	0	610997	2394710	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH09	Oahu	0	613383	2389743	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH10	Oahu	0	613726	2389407	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH11	Oahu	15	614736	2386056	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH12	Oahu	30	614551	2386480	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				total	226	236	127	212	57	36	5	28	10	3	2	77	57	76	31	29

0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0		2
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0		2
96	18	62	85	93	50	40	2	32	10	288	735	254	188	1	165	1	107	2	119	60	168	155	4	3		

Appendix B: Ant species found on the Hawaiian Islands.

Lists from 3 sources: Antweb.org, BYU, and Morrison 2008

Ant species identified in Hawai'i April 2012	Ant Web	BYU	Morrison 2008	Ant species identified in Hawai'i April 2012	Ant Web	BYU	Morrison 2008
Amblyopone zwaluwenburgi	X		X	*Paratrechina sp. "B"*		X	
Anoplolepis gracilipes	X	X	X	*Paratrechina sp. "C"*		X	
Brachymyrmex obscurior	X		X	*Paratrechina sp. "D"*		X	
Camponotus variegatus	X	X	X	*Pheidole fervens*	X	X	X
Cardiocondyla emeryi	X	X	X	*Pheidole megacephala*	X	X	X
Cardiocondyla kagutsuchi	X			*Pheidole moerens*	X		X
Cardiocondyla minutior	X	X	X	*Plagiolepis alluaudi*	X	X	X
Cardiocondyla obscurior	X			*Ponera swezeyi*	X		X
Cardiocondyla venustula	X	X	X	*PseudomyrmeX gracilis*	X	X	X
Cardiocondyla wroughtonii	X	X	X	*Pyramica membranifera*	X		X
Cerapachys biroi	X	X	X	*Solenopsis geminata*	X	X	X
Hypoponera confinis		X		*Solenopsis globularia*	X		
Hypoponera hi01	X			*Solenopsis hi0X*	X		X
Hypoponera opaciceps	X	X		*Solenopsis papuana*	X	X	X
Hypoponera punctatissima	X	X	X	*Strumigenys emmae*	X	X	X
Hypoponera zwaluwenburgi	X	X	X	*Strumigenys godeffroyi*	X	X	X
Lepisiota hi0X	X		X	*Strumigenys lewisi*	X		X
Leptogenys falcigera	X	X	X	*Strumigenys rogeri*	X	X	X
Linepithema humile	X	X	X	*Tapinoma melanocephalum*	X	X	X
Monomorium bicolor_complex	X			*Tapinoma sessile*	X		
Monomorium destructor	X	X	X	*TechnomyrmeX albipes*	X	X	X
Monomorium floricola	X	X	X	*TechnomyrmeX difficilis*	X		
Monomorium indicum	X			*TechnomyrmeX pallipes*	X		
Monomorium latinode		X		*TechnomyrmeX vitiensis*	X		
Monomorium liliuokalanii	X	X	X	*Tetramorium bicarinatum*	X	X	X
Monomorium pharaonis	X	X	X	*Tetramorium caldarium*	X	X	
Monomorium sechellense	X	X	X	*Tetramorium insolens*	X		X
Nylanderia bourbonica	X	X	X	*Tetramorium lanuginosum*	X		
Nylanderia vaga	X		X	*Tetramorium simillimum*	X	X	X
Ochetellus glaber	X	X	X	*Tetramorium tonganum*	X	X	X
Paratrechina longicornis	X	X	X	*Wasmannia auropunctata*	X		X
Paratrechina sp. "A"		X		total species present	57	41	44

Appendix C: Ant species individual locations on the Hawaiian Islands.

Maps of each individual ant species detected during our study on the Hawaiian Islands 1988 to 1996.

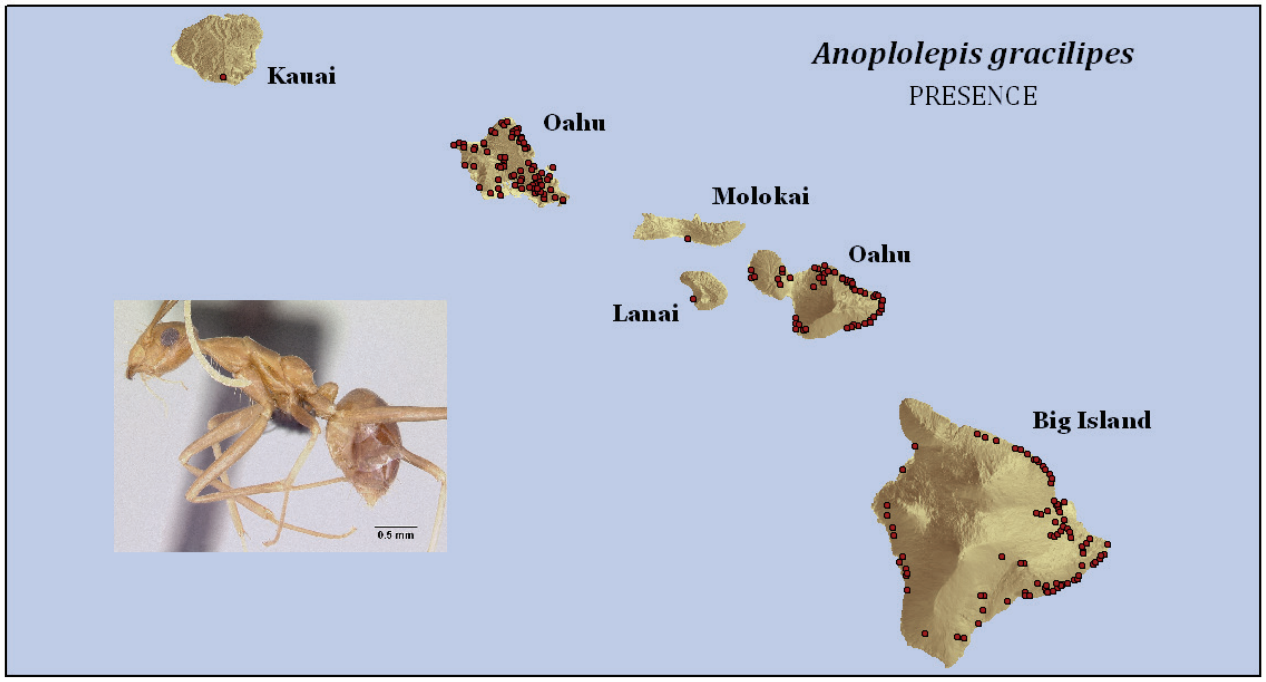

Figure 46: Map of Hawai'i, USA. Points show the presence of *Anopolepis gracilipes*.

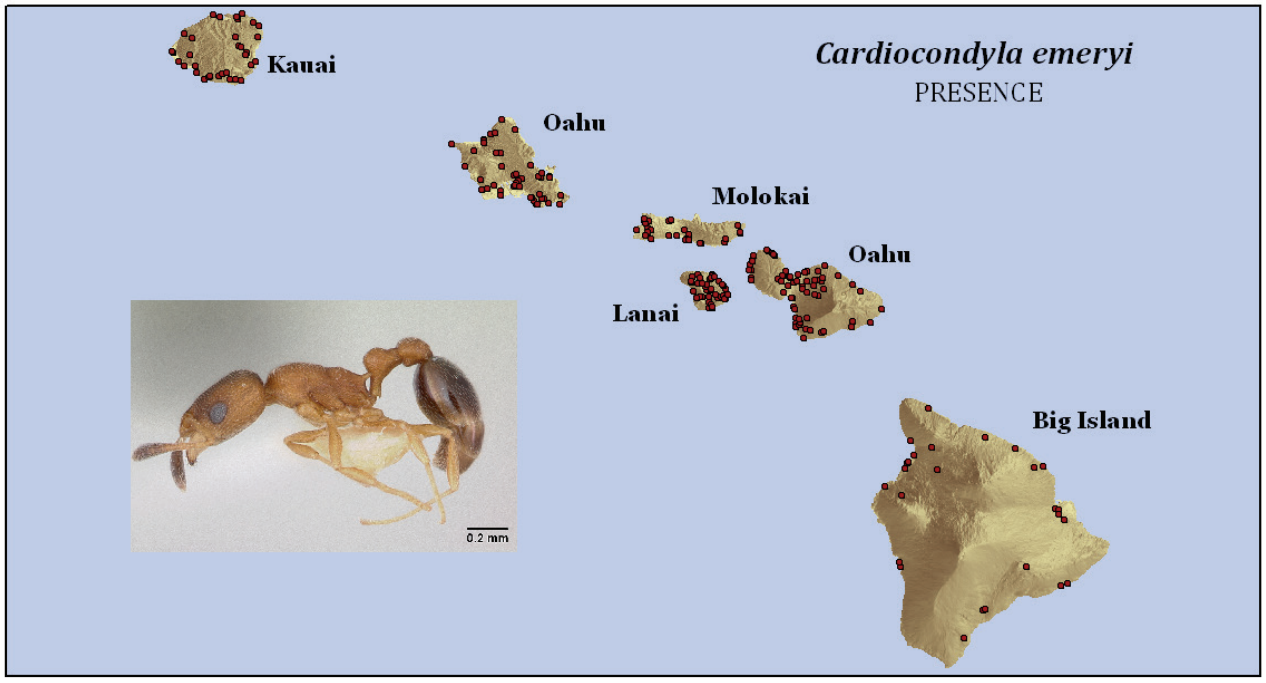

Figure 47: Map of Hawai'i, USA. Points show the presence of *Cardiocondyla emeryi.*

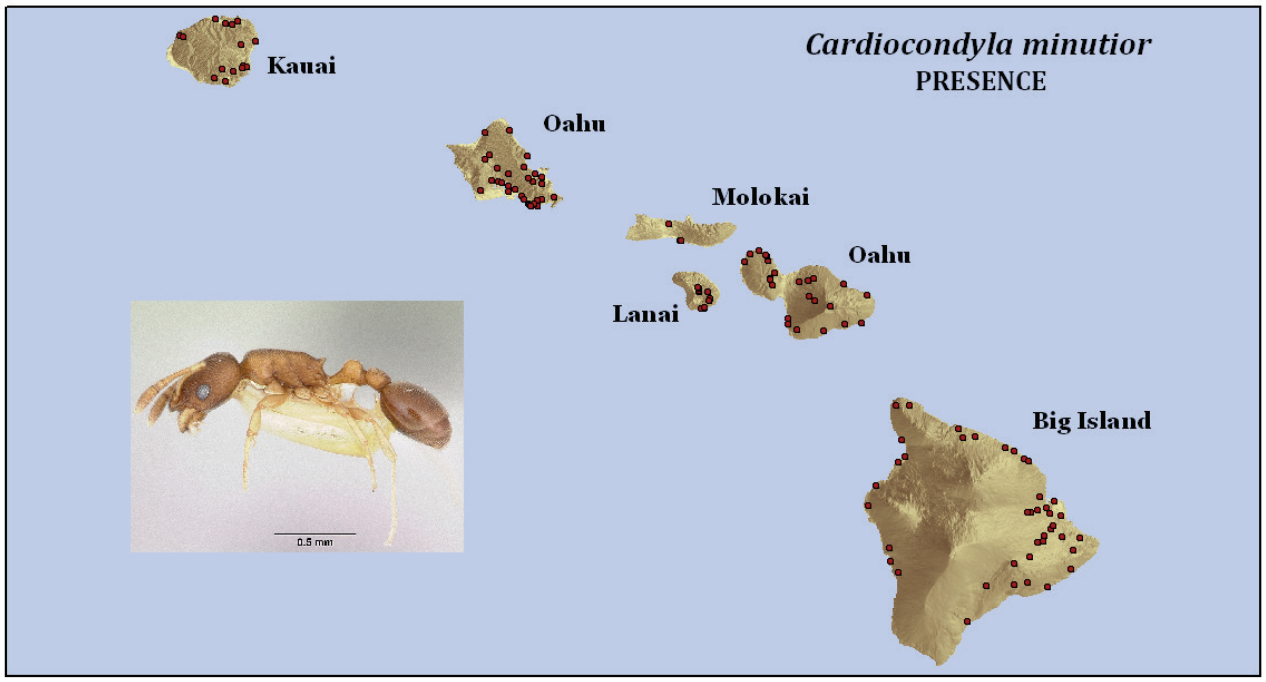

Figure 48: Map of Hawai'i, USA. Points show the presence of *Cardiocondyla minutior.*

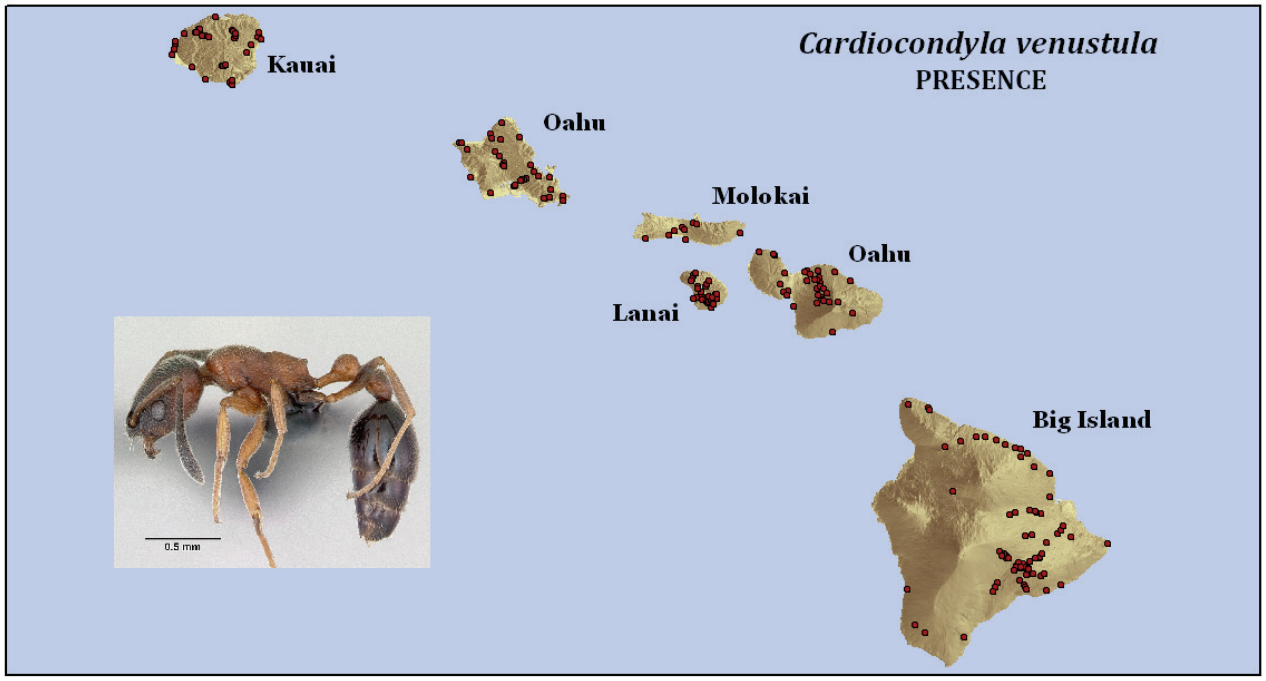

Figure 49: Map of Hawai'i, USA. Points show the presence of *Cardiocondyla venustula*.**g**

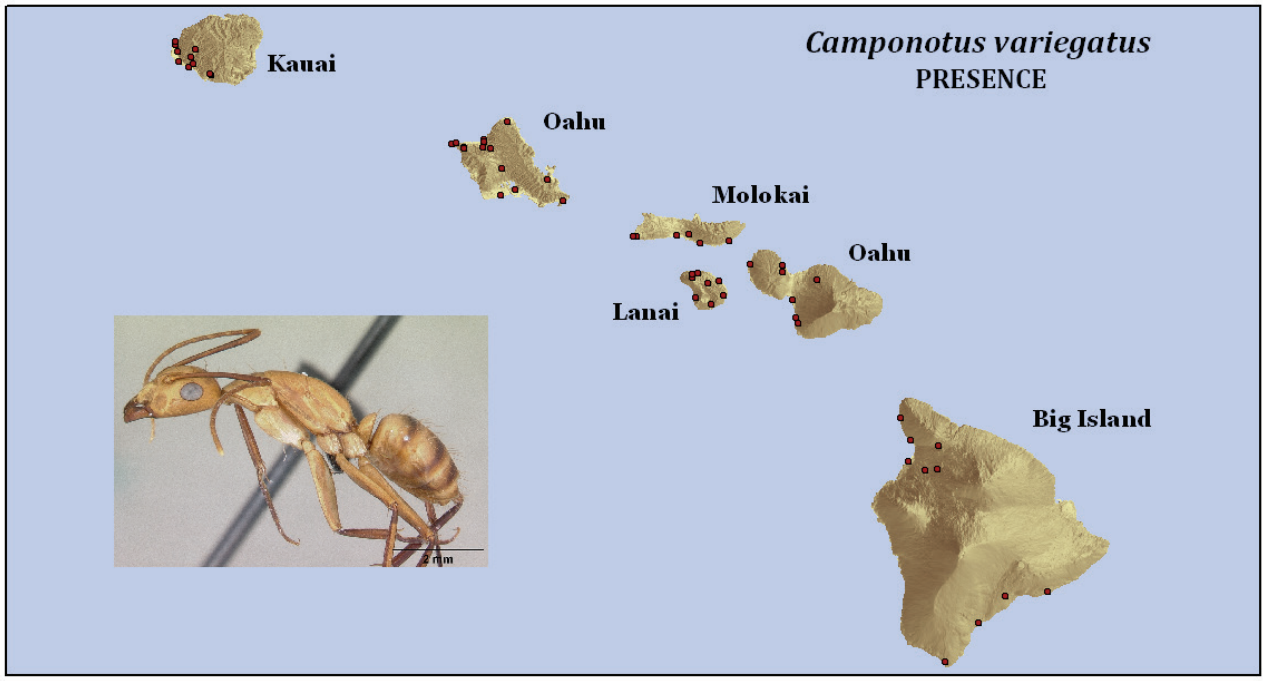

Figure 50: Map of Hawai'i, USA. Points show the presence of *Camponotus variegatus.*

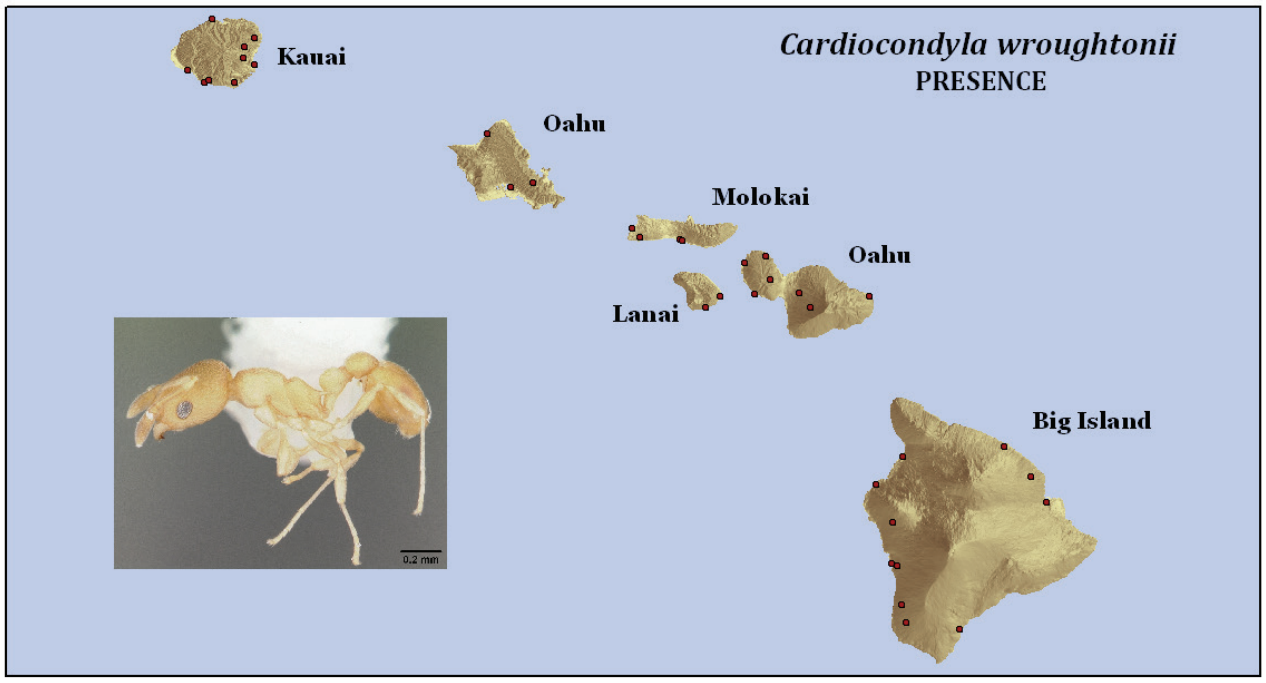

Figure 51: Map of Hawai'i, USA. Points show the presence of *Cardiocondyla wroughtonii.*

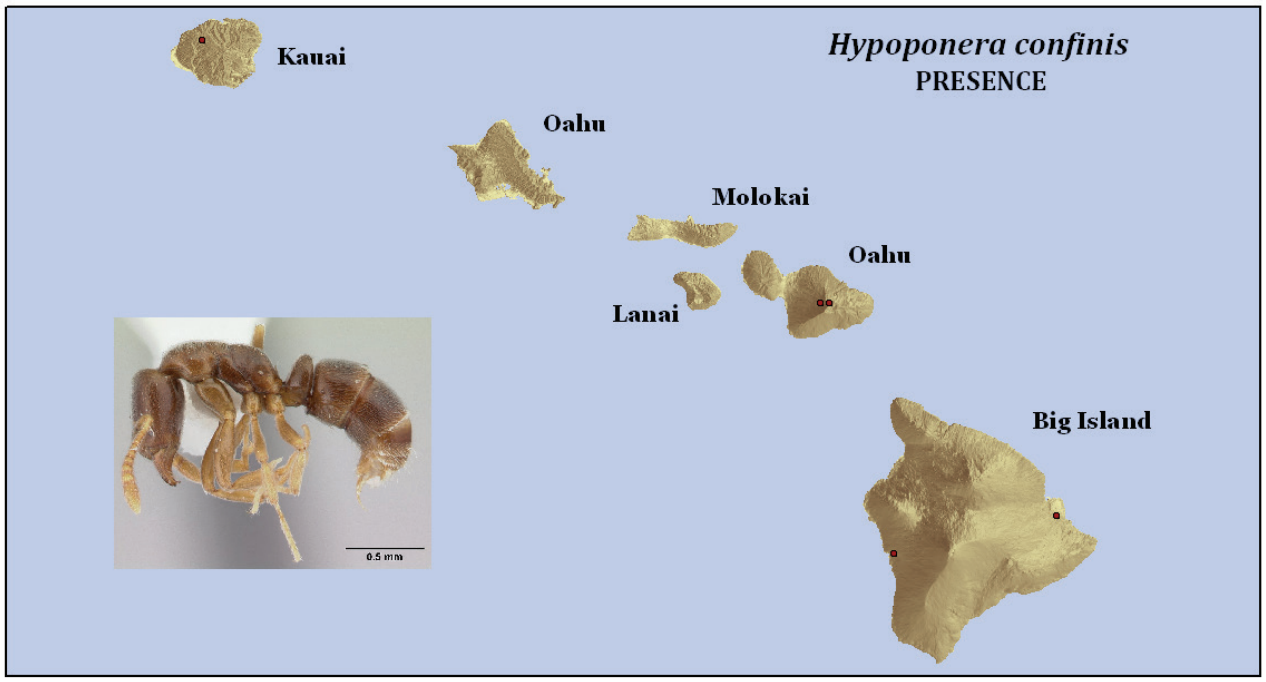

Figure 52: Map of Hawai'i, USA. Points show the presence of *Hypoponera confinis*. Photograph taken by Erin Prada antweb.org

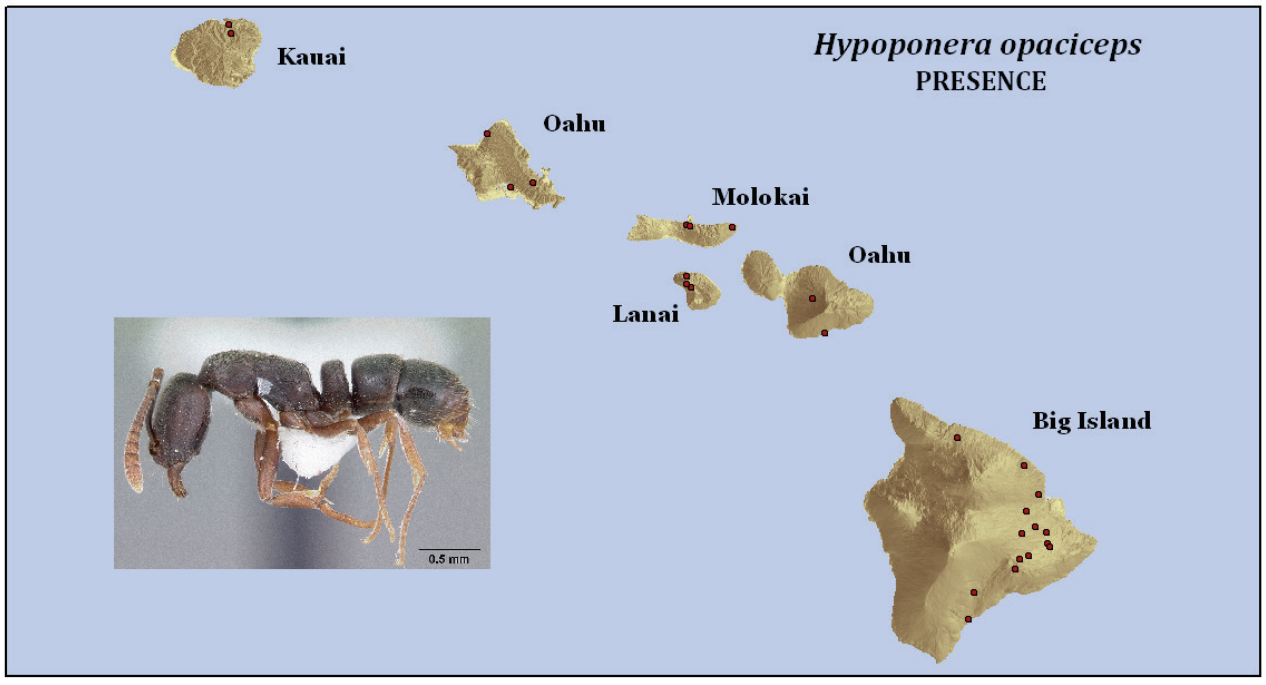

Figure 53: Map of Hawai'i, USA. Points show the presence of *Hypoponera opaciceps*.

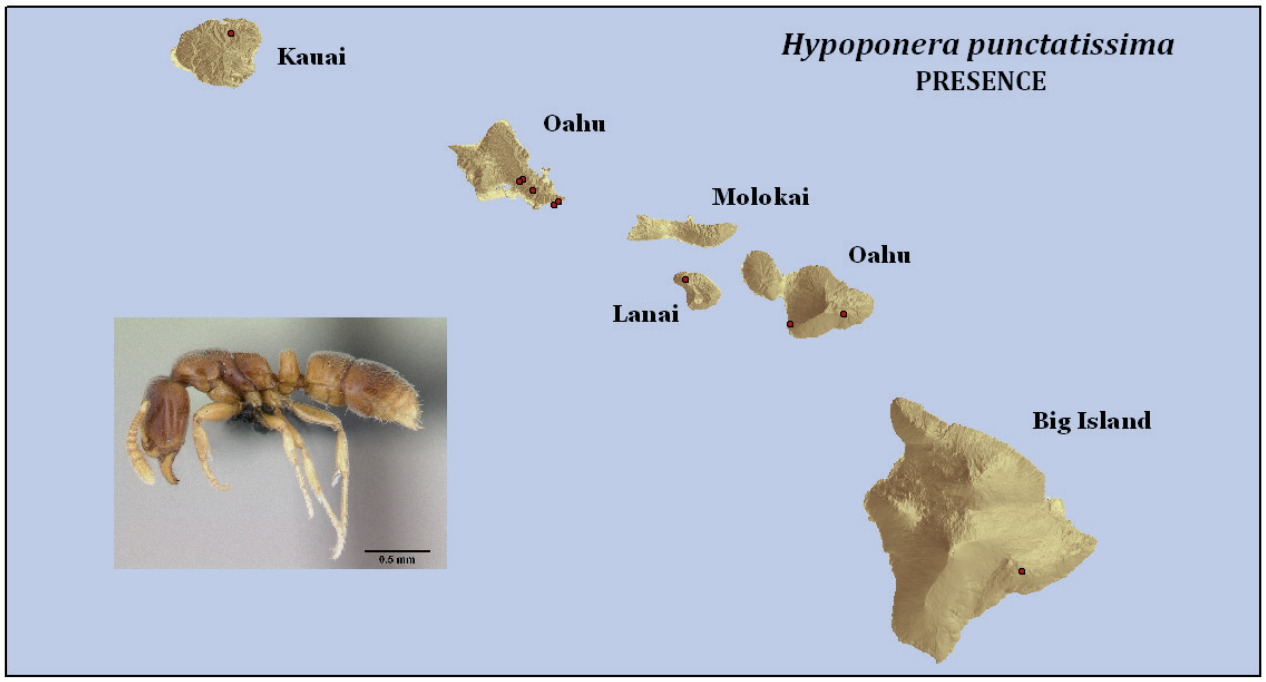

Figure 54: Map of Hawai'i, USA. Points show the presence of *Hypoponera punctatissima*.

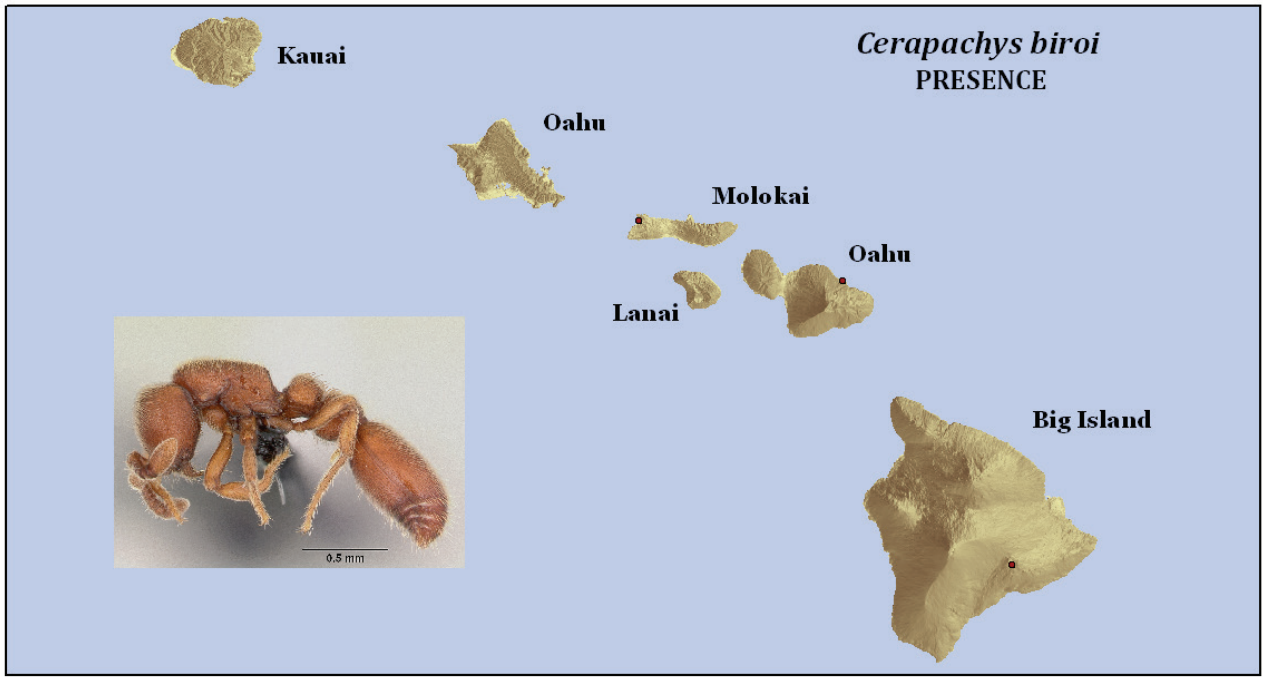

Figure 55: Map of Hawai'i, USA. Points show the presence of *Cerapachys biroi*.

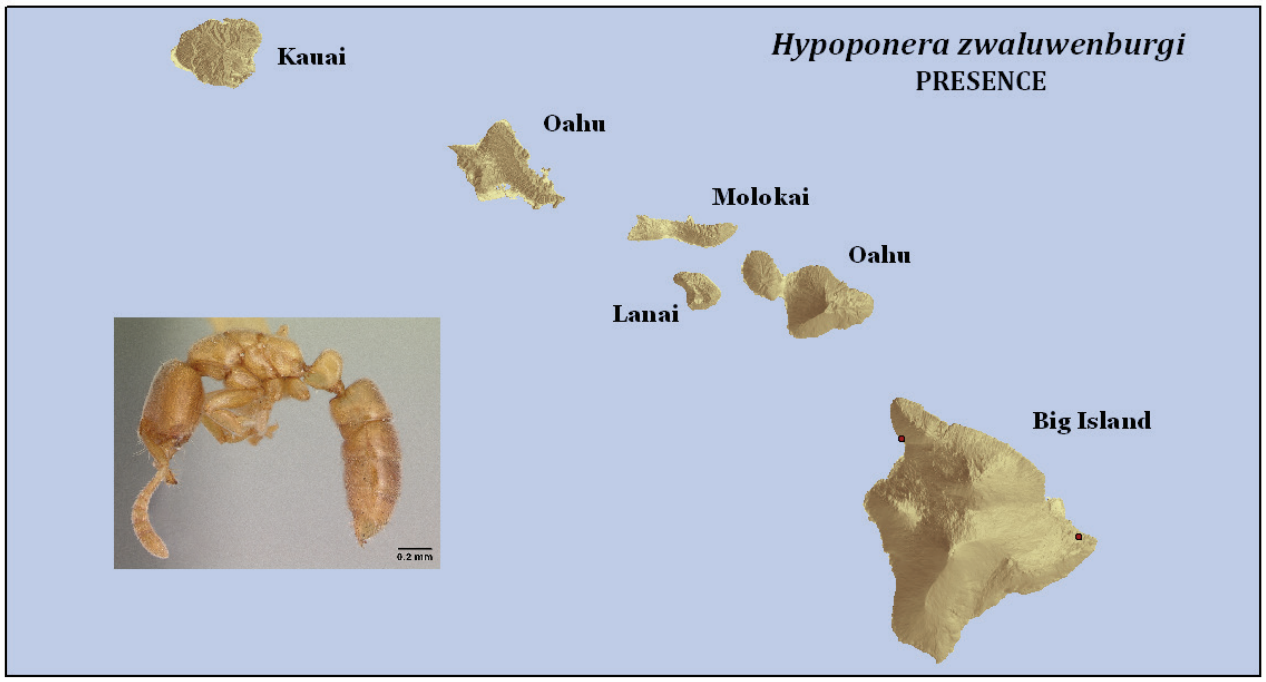

Figure 56: Map of Hawai'i, USA. Points show the presence of *Hypoponera zwaluwenburgi*.

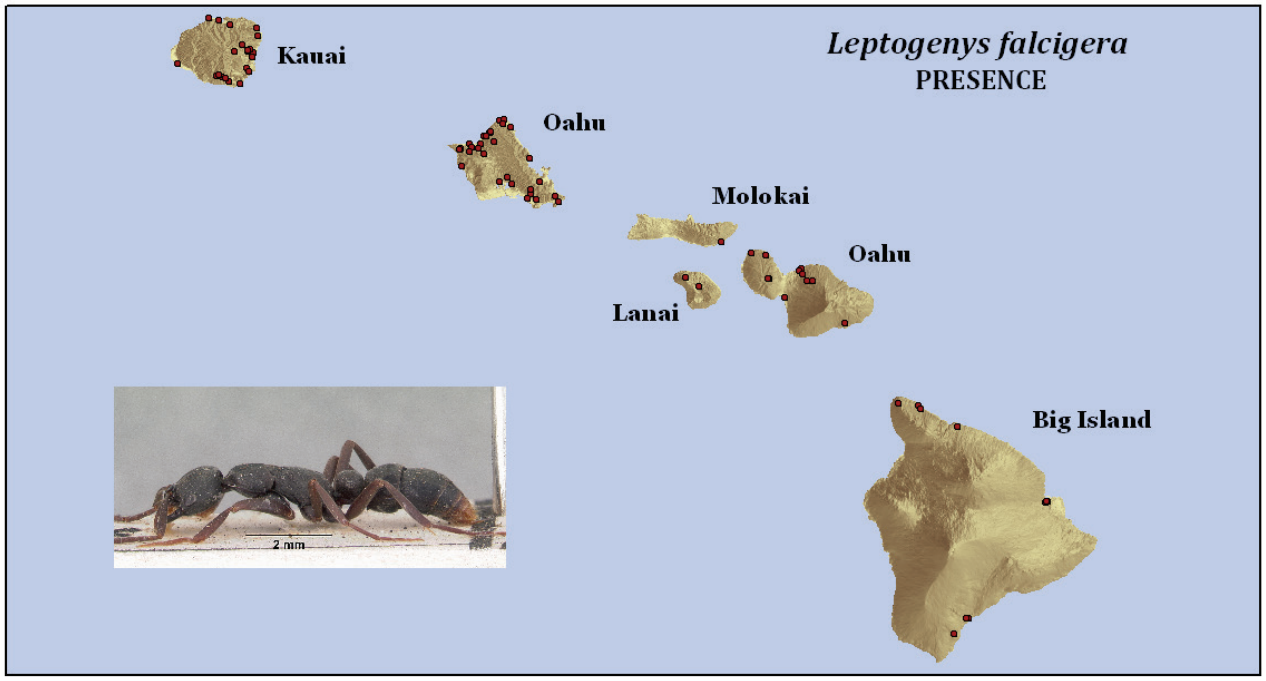

Figure 57: Map of Hawai'i, USA. Points show the presence of *Leptogenys falcigera*.

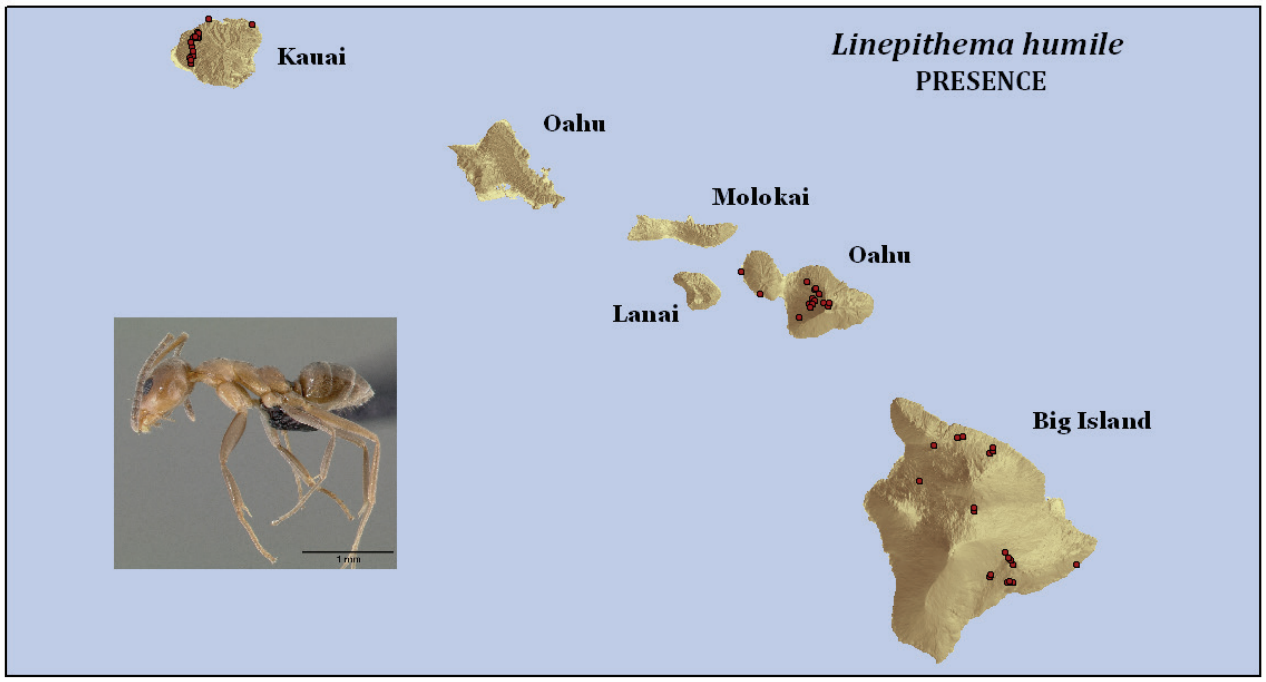

Figure 58: Map of Hawai'i, USA. Points show the presence of *Linepithema humile*.

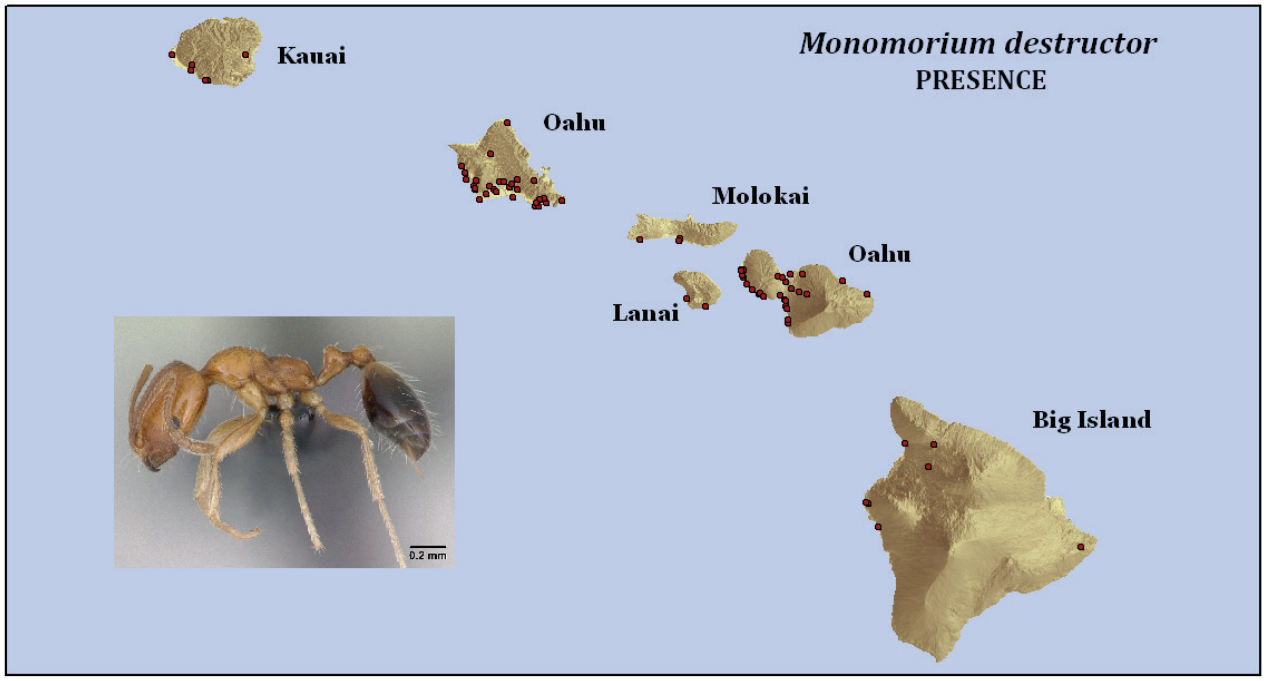

Figure 59: Map of Hawai'i, USA. Points show the presence of *Monomorium destructor*.

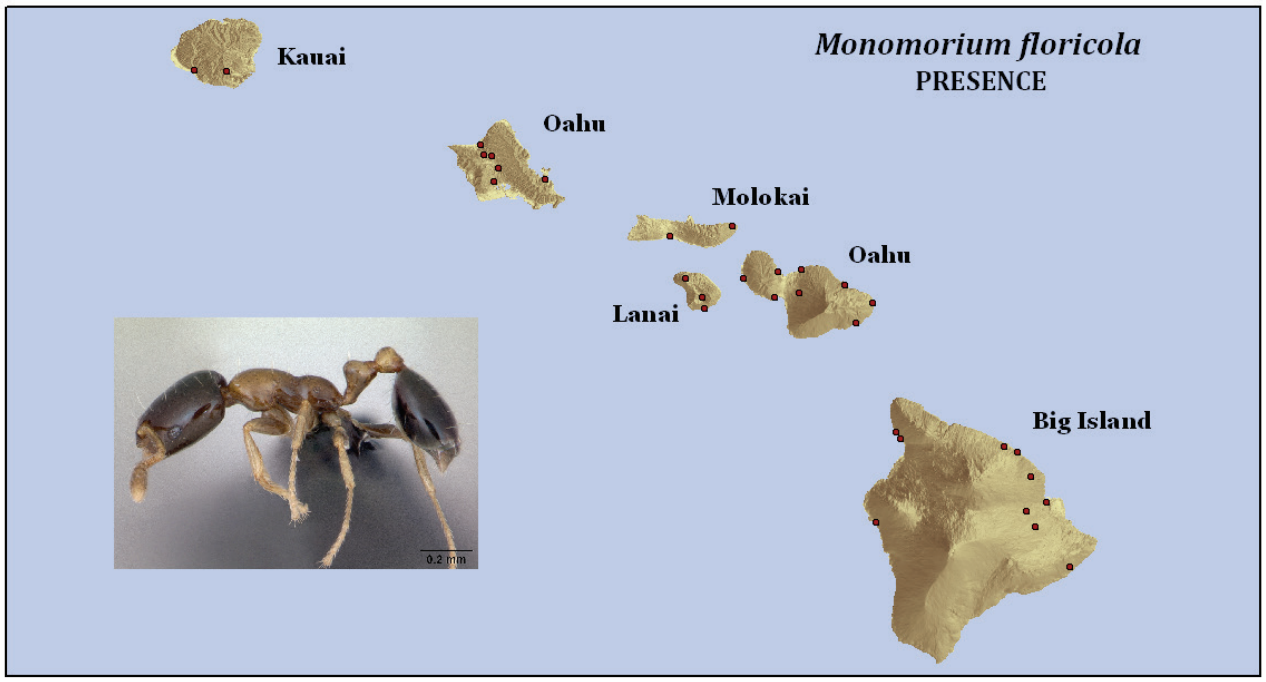

Figure 60: Map of Hawai'i, USA. Points show the presence of *Monomorium floricola*.

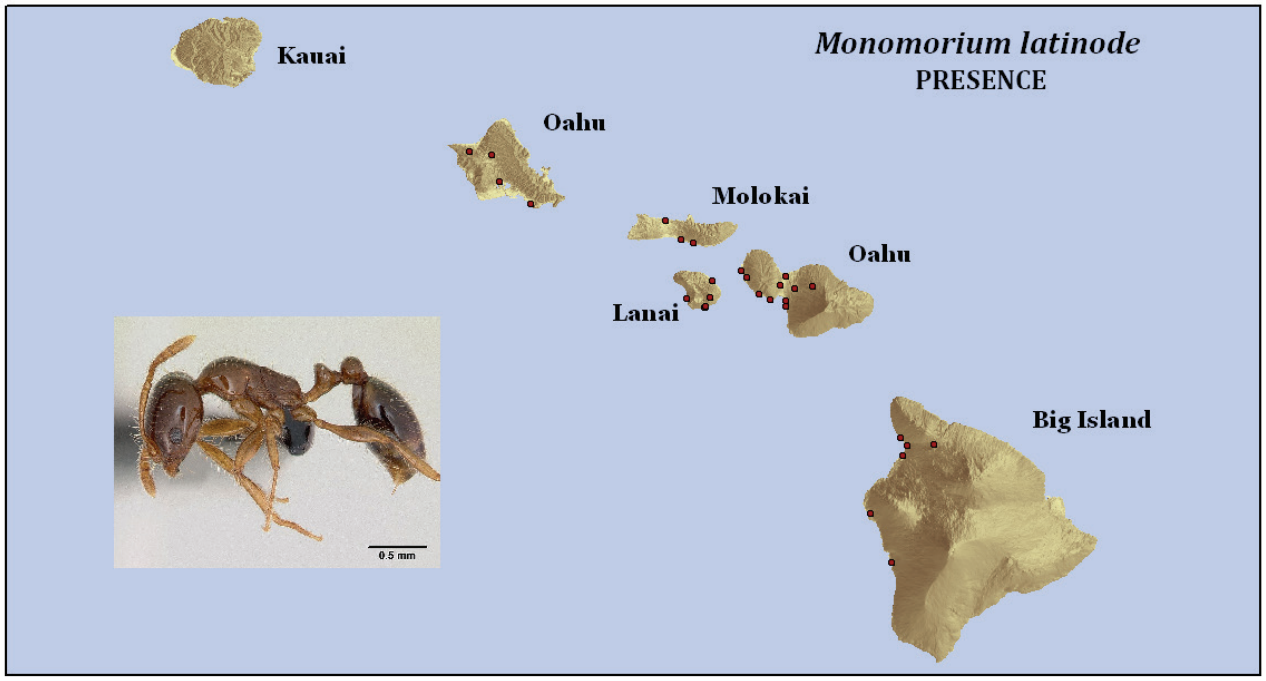

Figure 61: Map of Hawai'i, USA. Points show the presence of *Monomorium latinode*.

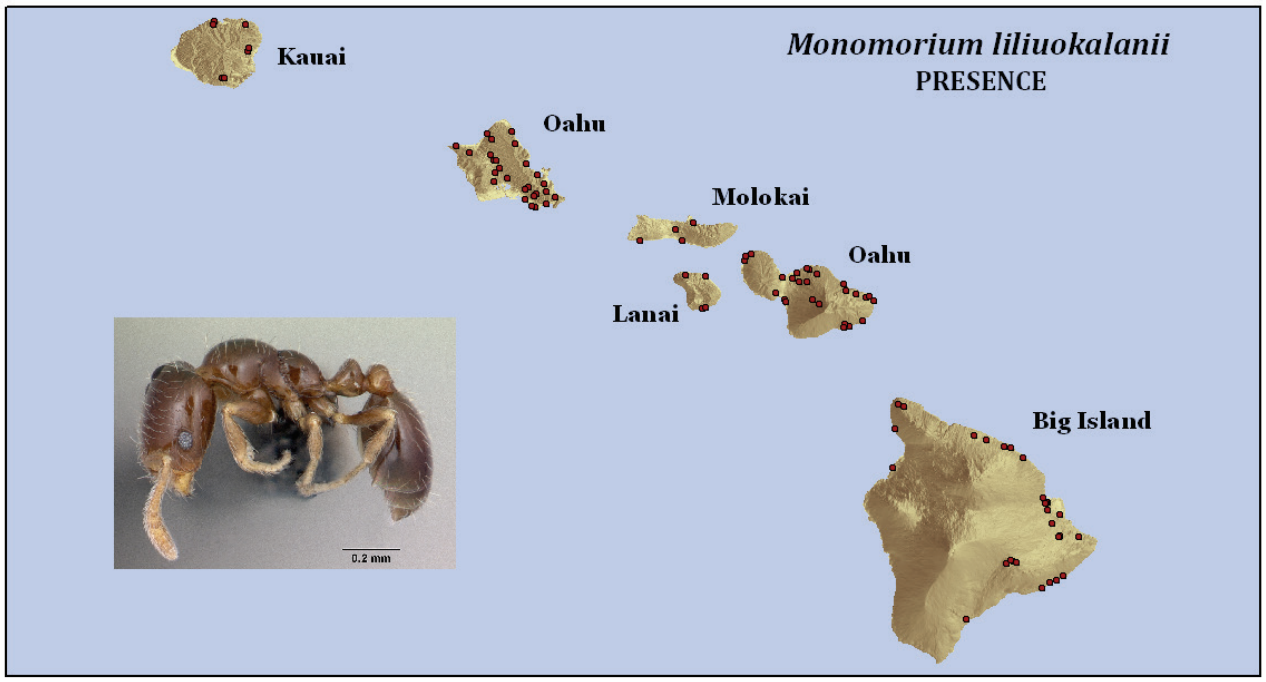

Figure 62: Map of Hawai'i, USA. Points show the presence of *Monomorium liliuokalanii*.

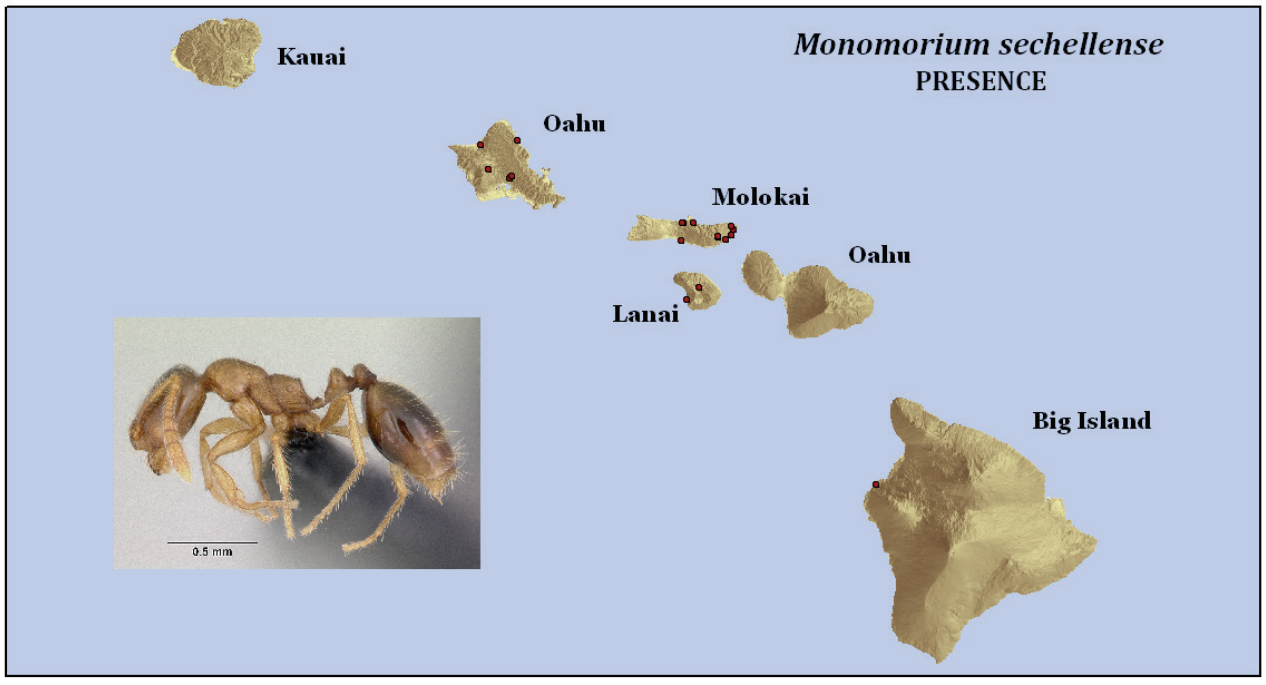

Figure 63: Map of Hawai'i, USA. Points show the presence of *Monomorium sechellense*.

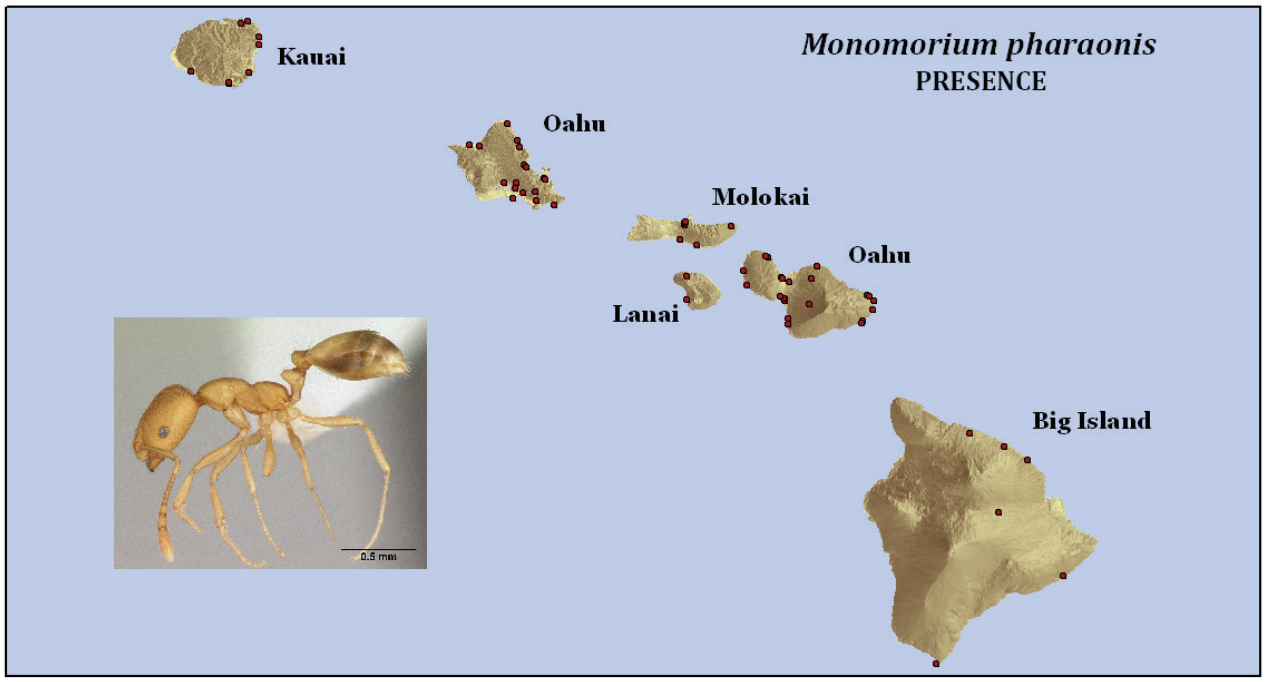

Figure 64: Map of Hawai'i, USA. Points show the presence of *Monomorium pharaonis*.

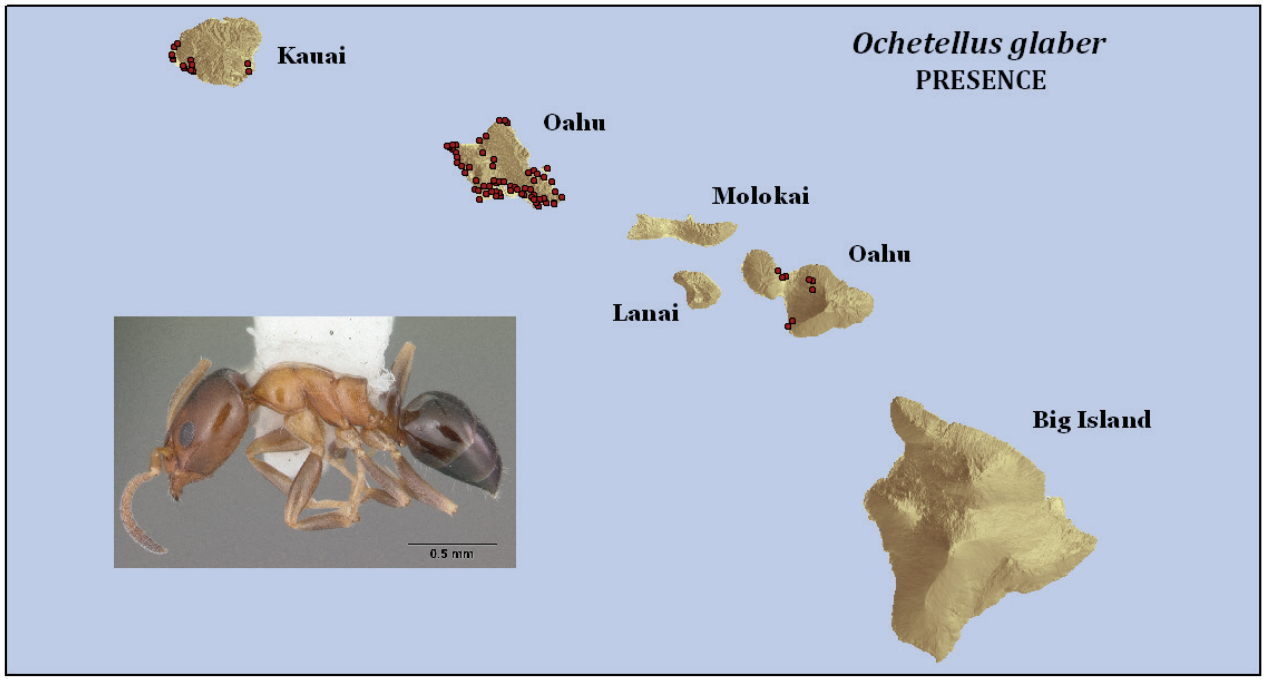

Figure 65: Map of Hawai'i, USA. Points show the presence of *Ochetellus glaber*.
Picture taken by April Nobel antweb.org

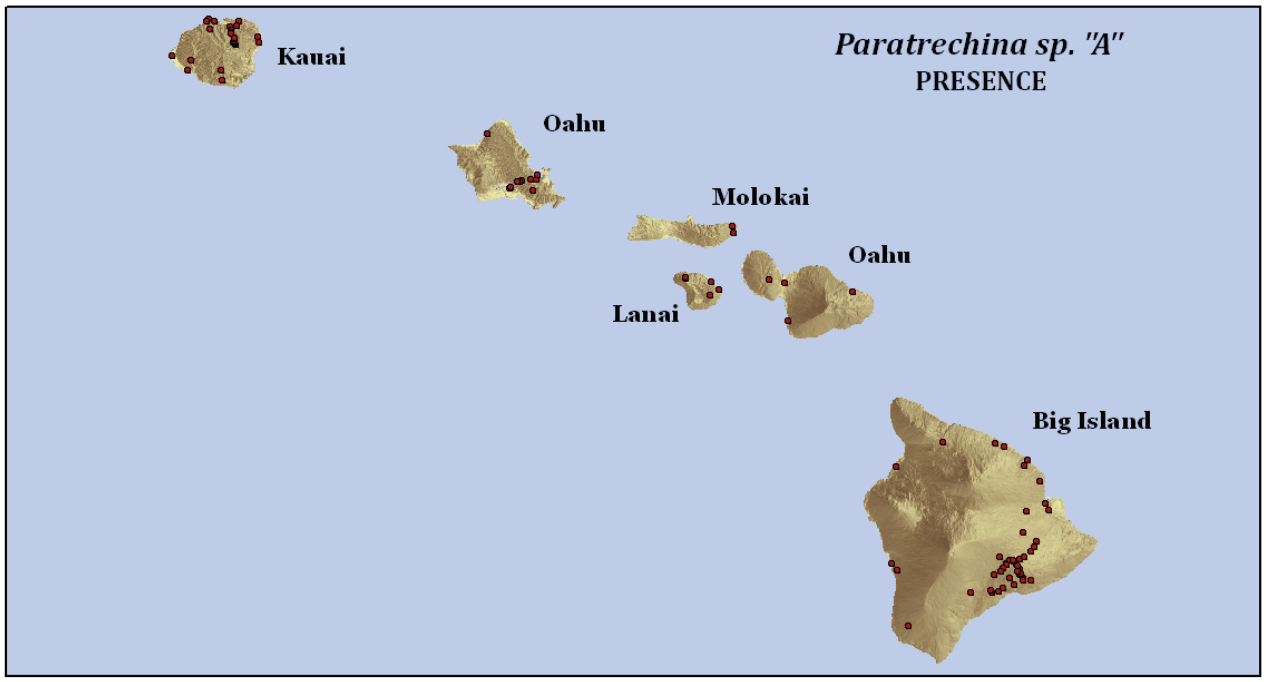

Figure 66: Map of Hawai'i, USA. Points show the presence of *Paratrechina sp. "A"*.

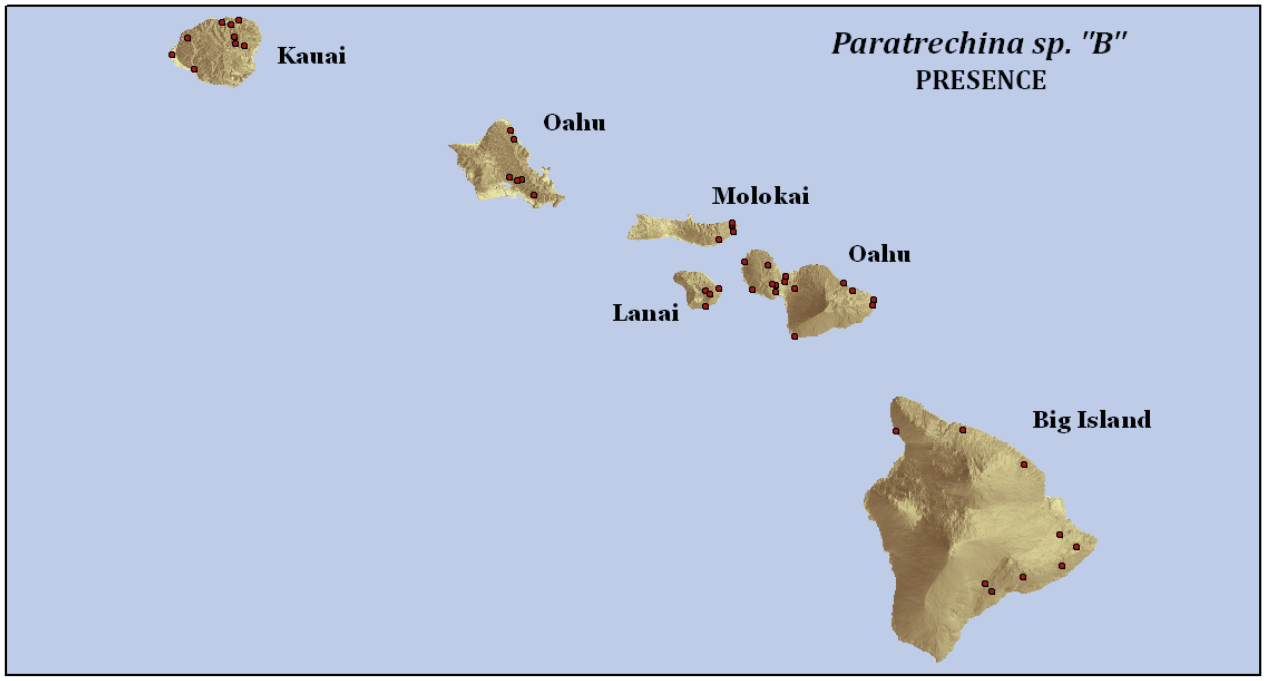

Figure 67: Map of Hawai'i, USA. Points show the presence of *Paratrechina sp. "B"*.

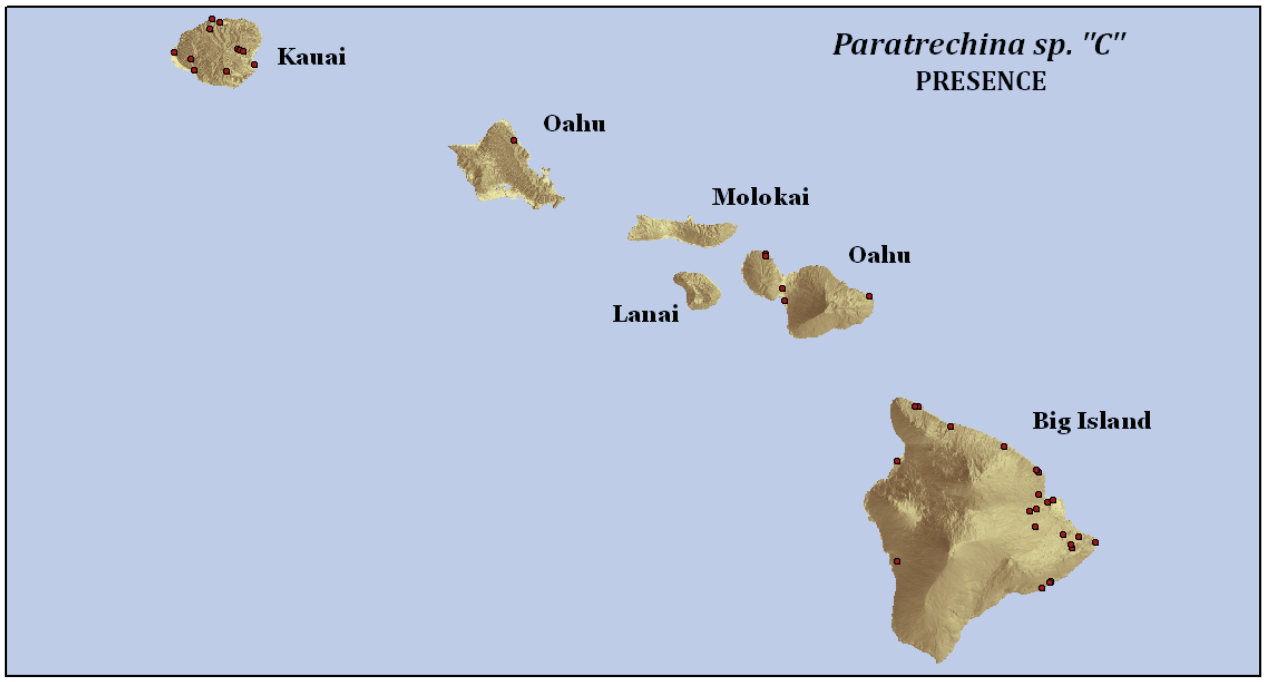

Figure 68: Map of Hawai'i, USA. Points show the presence of *Paratrechina sp. "C"*.

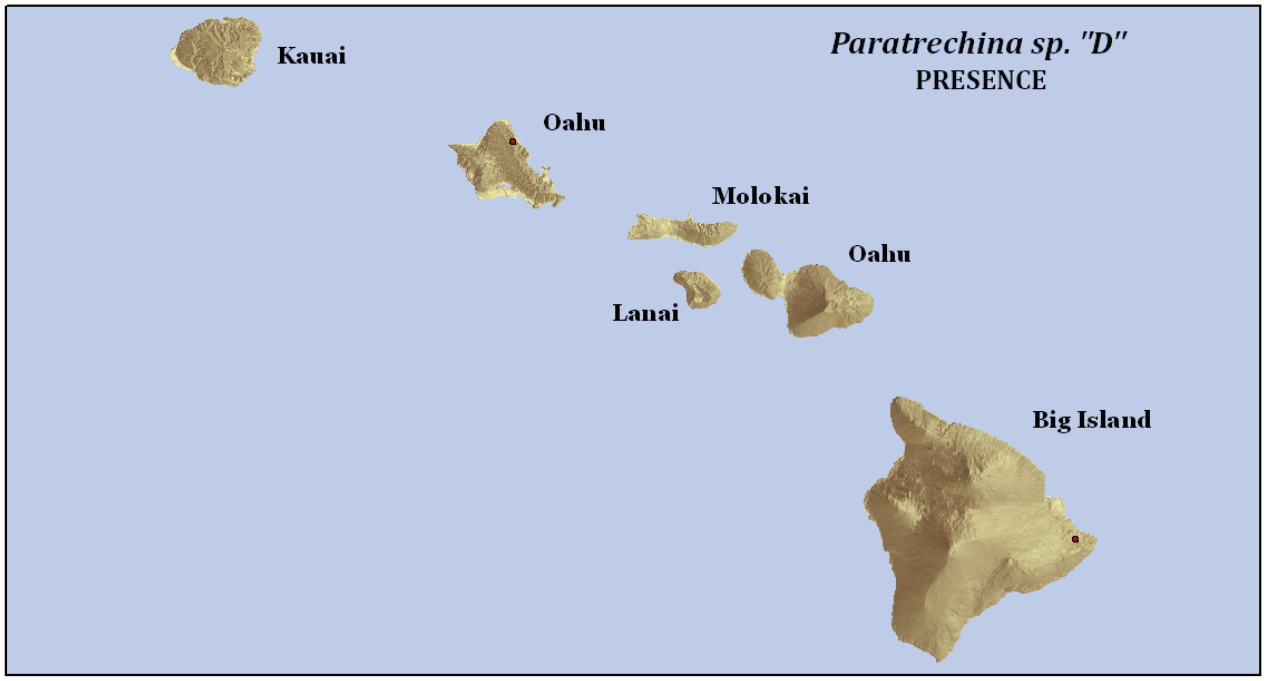

Figure 69: Map of Hawai'i, USA. Points show the presence of *Paratrechina sp. "D"*.

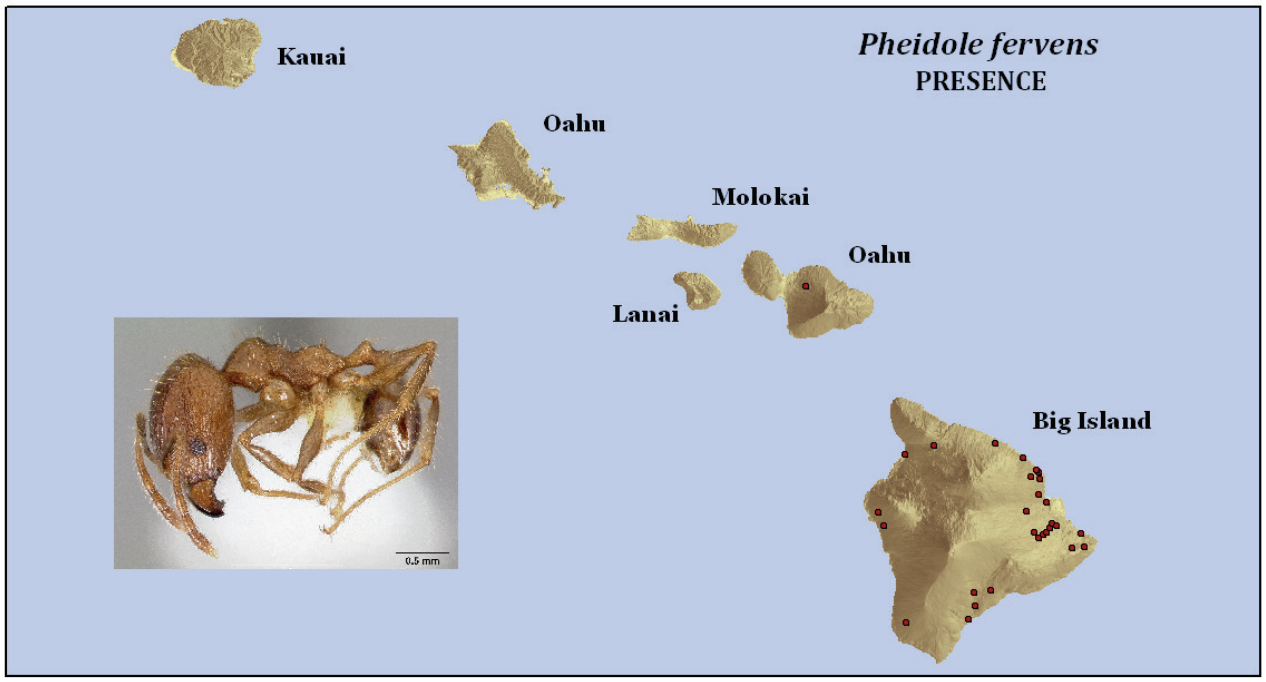

Figure 70: Map of Hawai'i, USA. Points show the presence of *Pheidole fervens*.

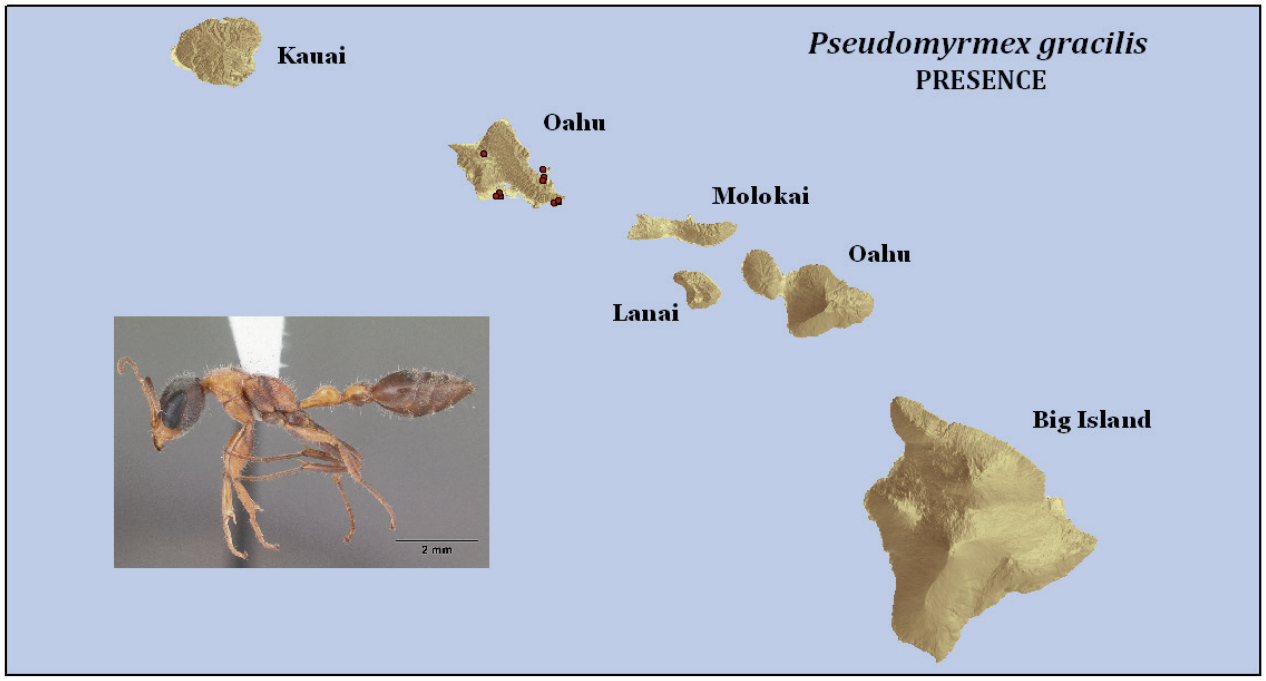

Figure 71: Map of Hawai'i, USA. Points show the presence of *Pseudomyrmex gracilis*.

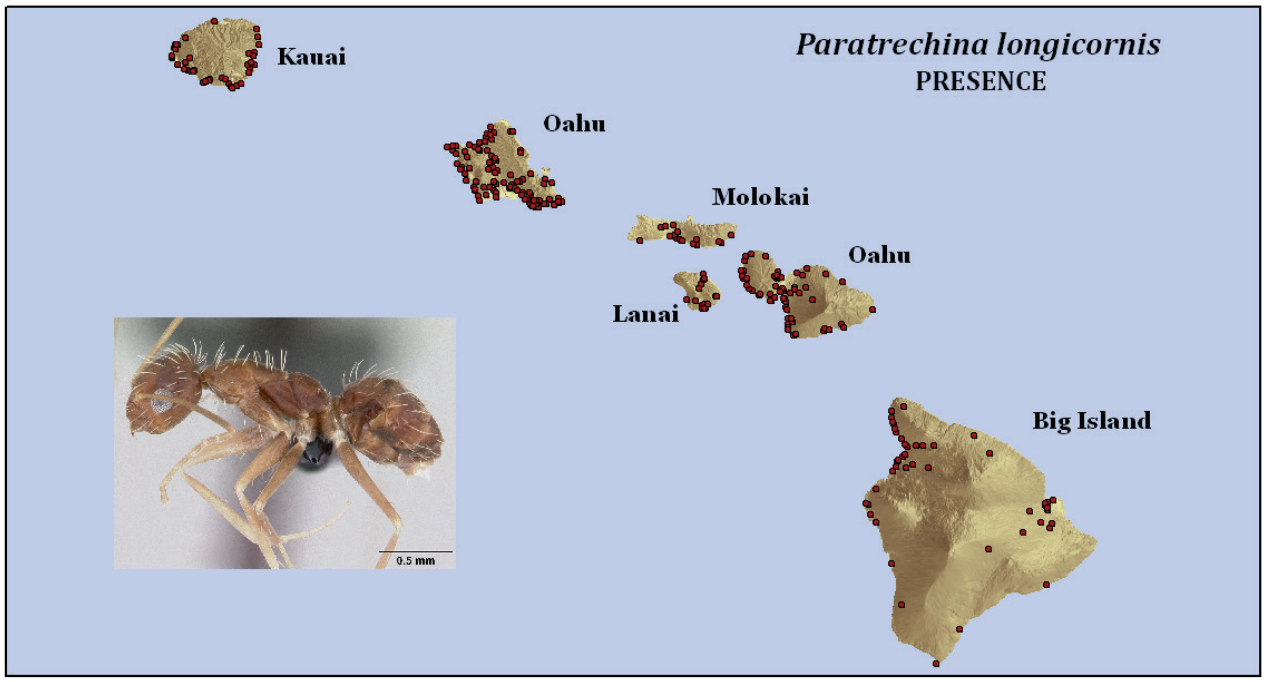

Figure 72: Map of Hawai'i, USA. Points show the presence of *Paratrechina longicornis*.

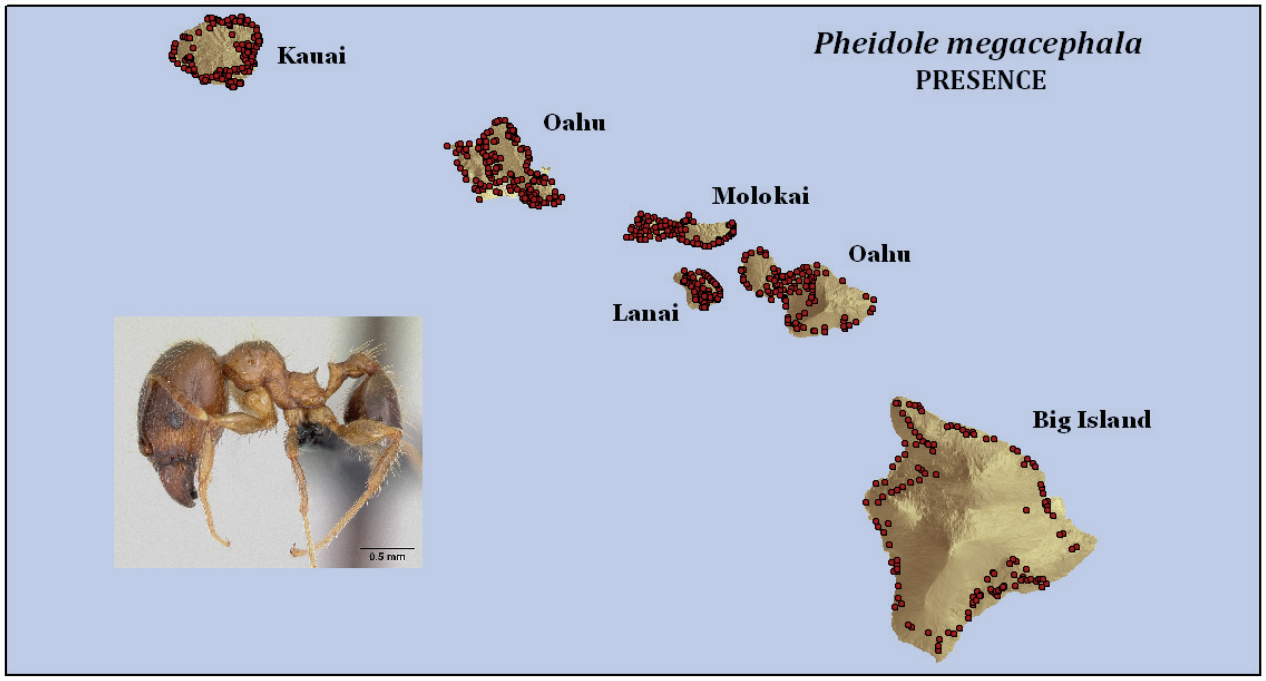

Figure 73: Map of Hawai'i, USA. Points show the presence of *Pheidole megacephala*.

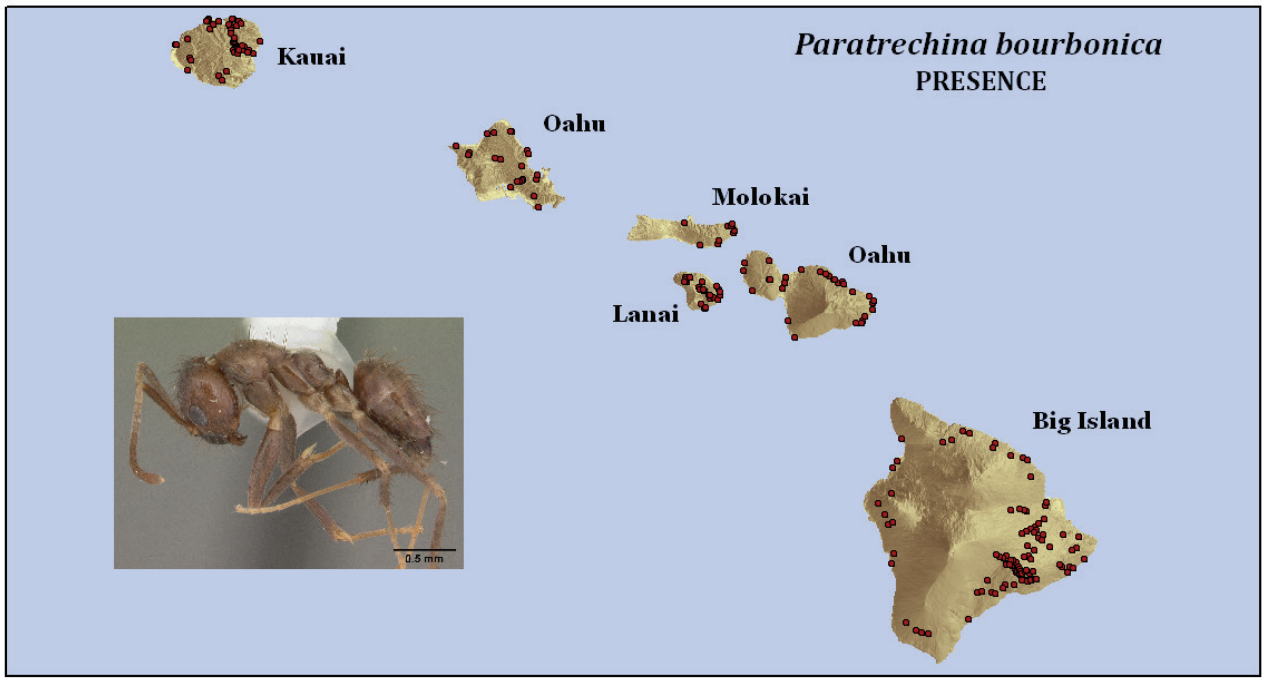

Figure 74: Map of Hawai'i, USA. Points show the presence of *Paratrechina bourbonica.*

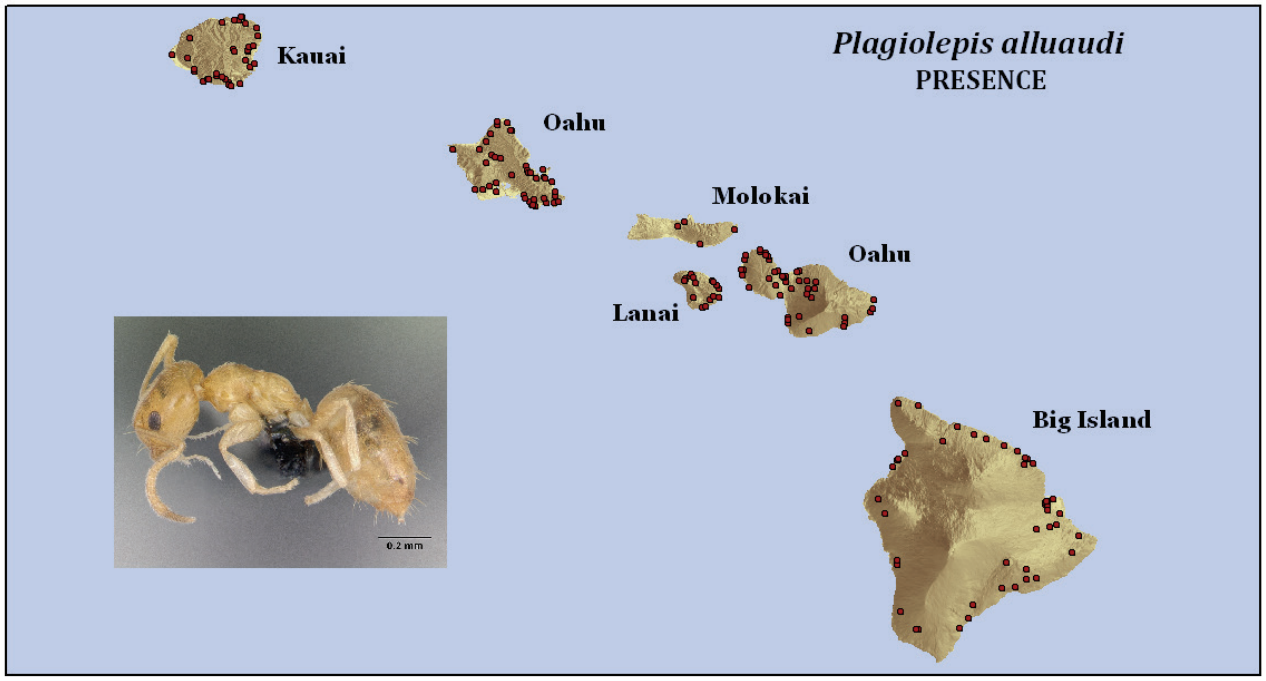

Figure 75: Map of Hawai'i, USA. Points show the presence of *Plagiolepis alluaudi.*

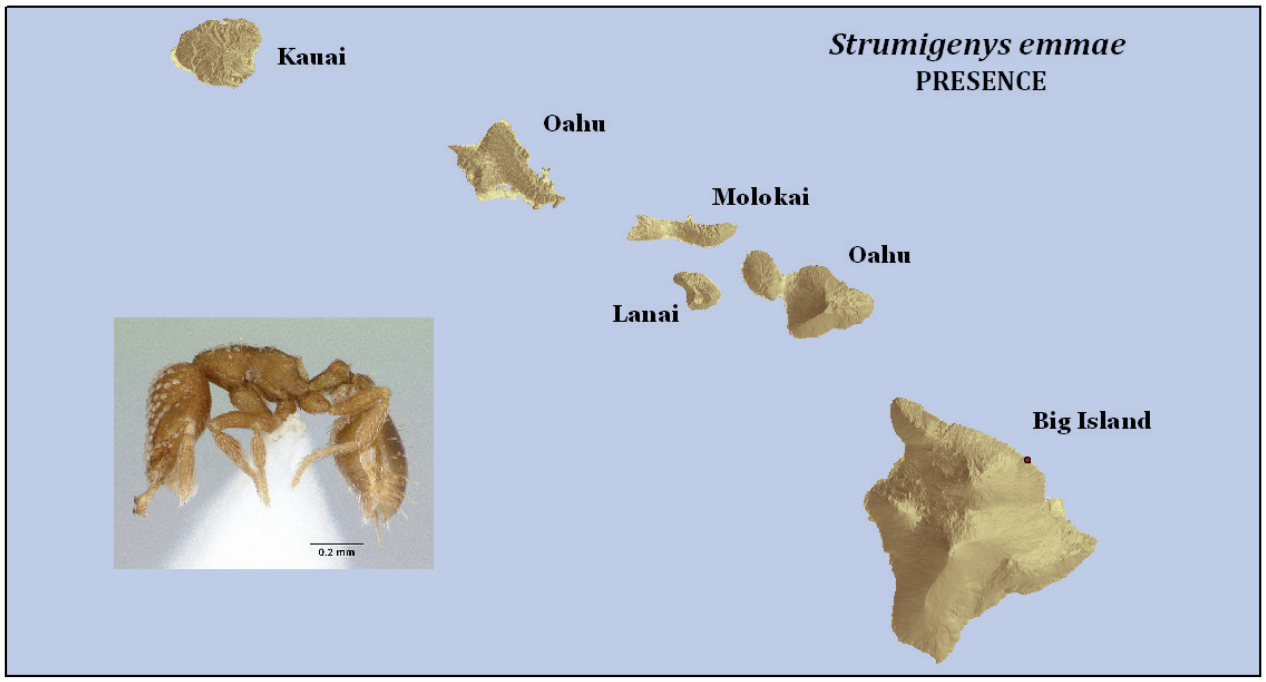

Figure 76: Map of Hawai'i, USA. Points show the presence of *Strumigenys emmae.*

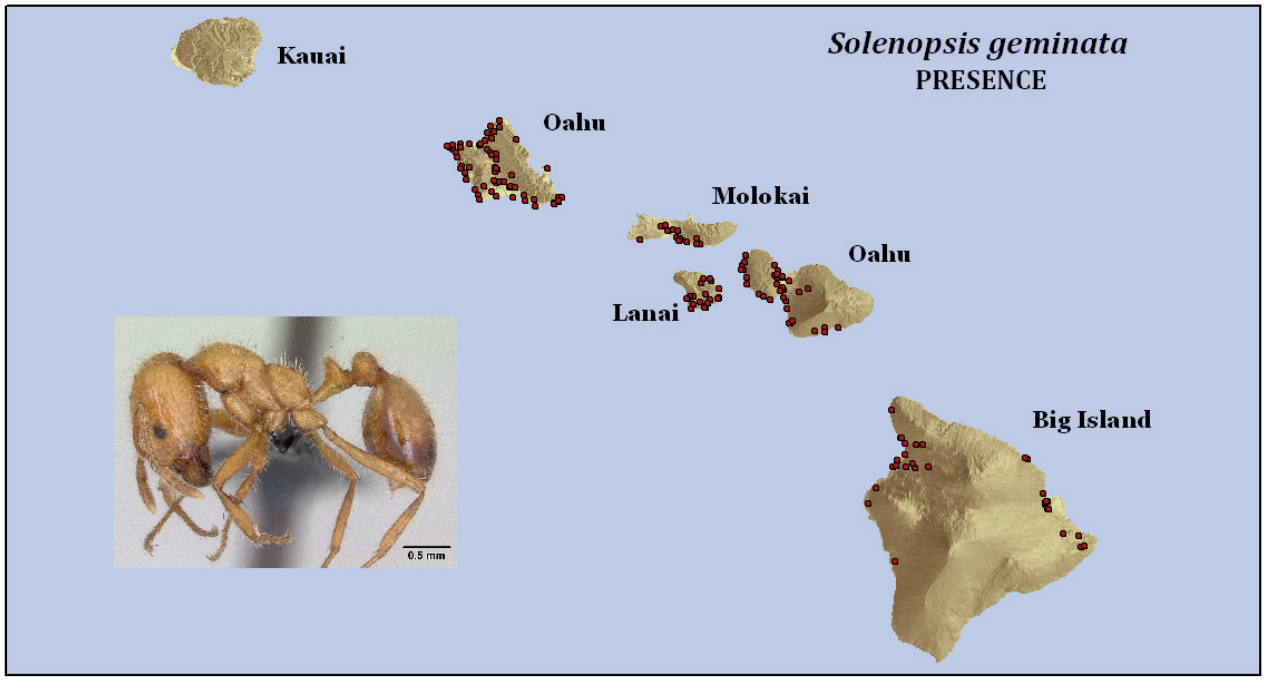

Figure 77: Map of Hawai'i, USA. Points show the presence of *Solenopsis geminata.*

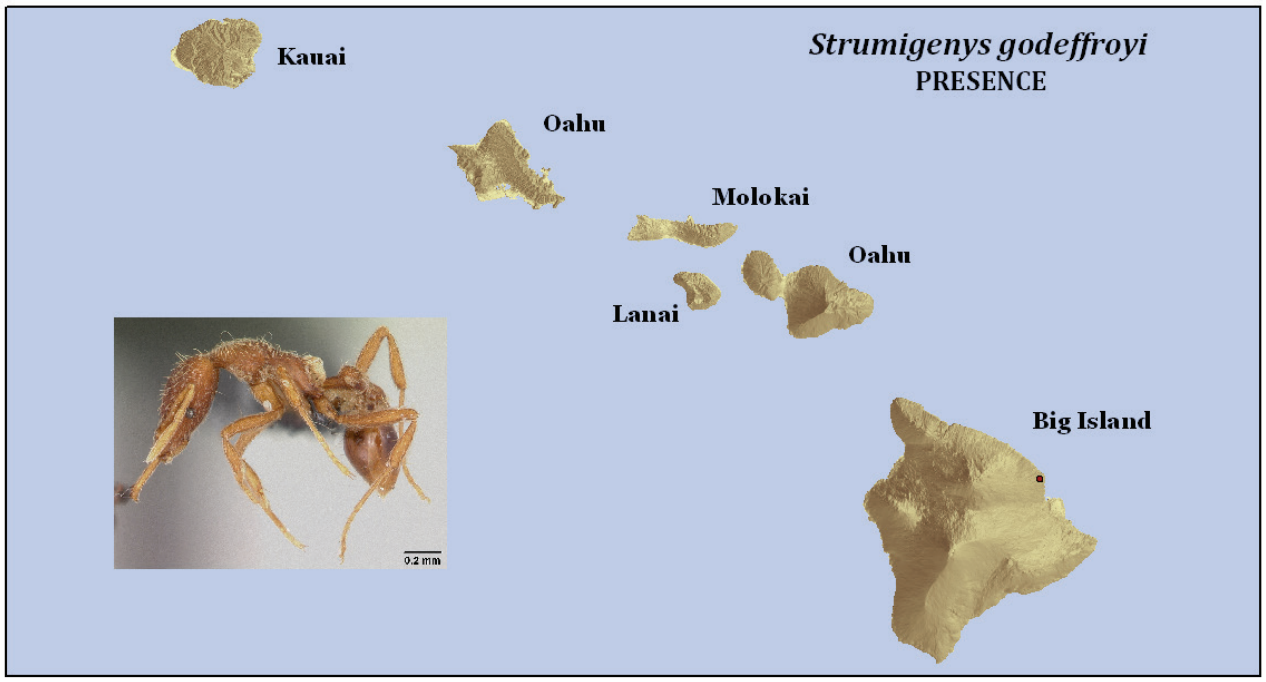

Figure 78: Map of Hawai'i, USA. Points show the presence of *Strumigenys godeffroyi.*

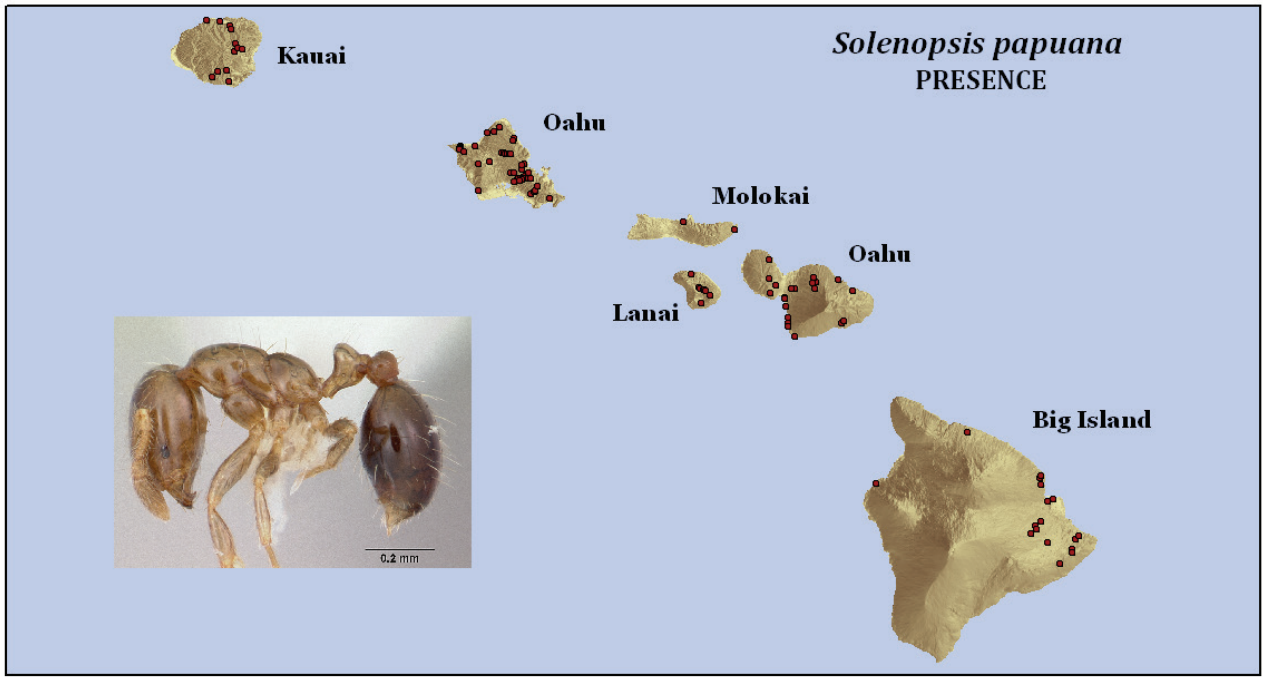

Figure 79: Map of Hawai'i, USA. Points show the presence of *Solenopsis papuana*.

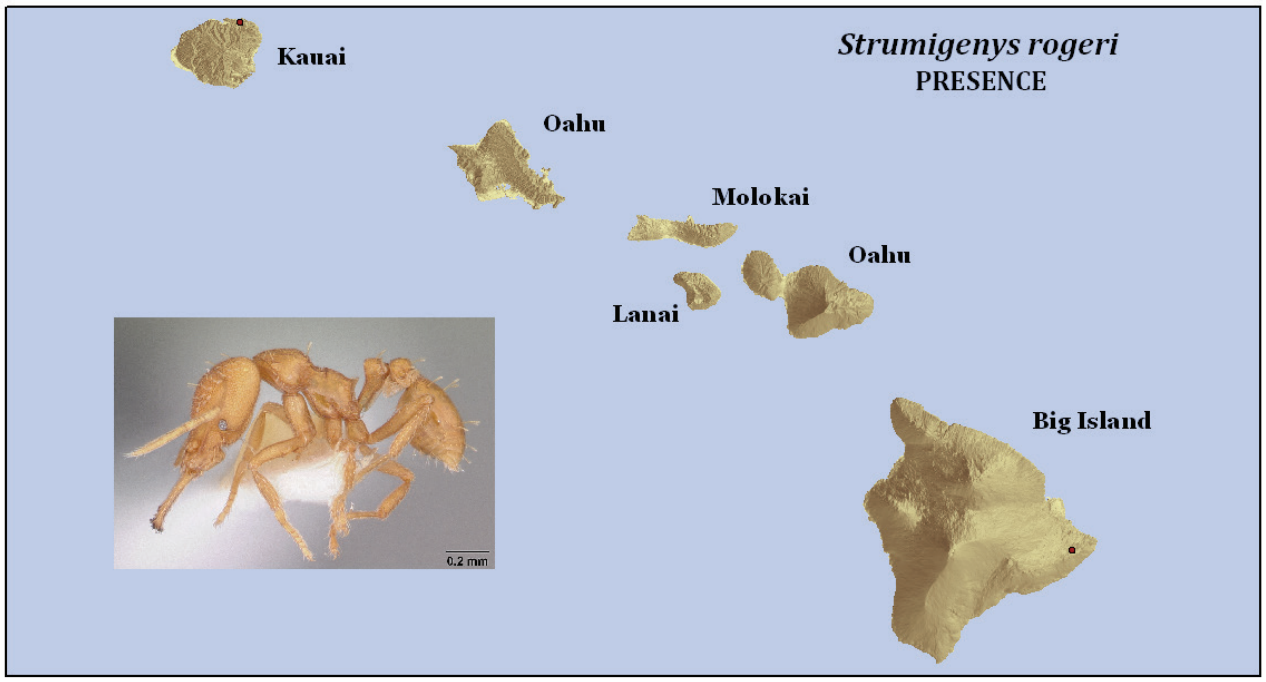

Figure 80: Map of Hawai'i, USA. Points show the presence of *Strumigenys rogeri.*

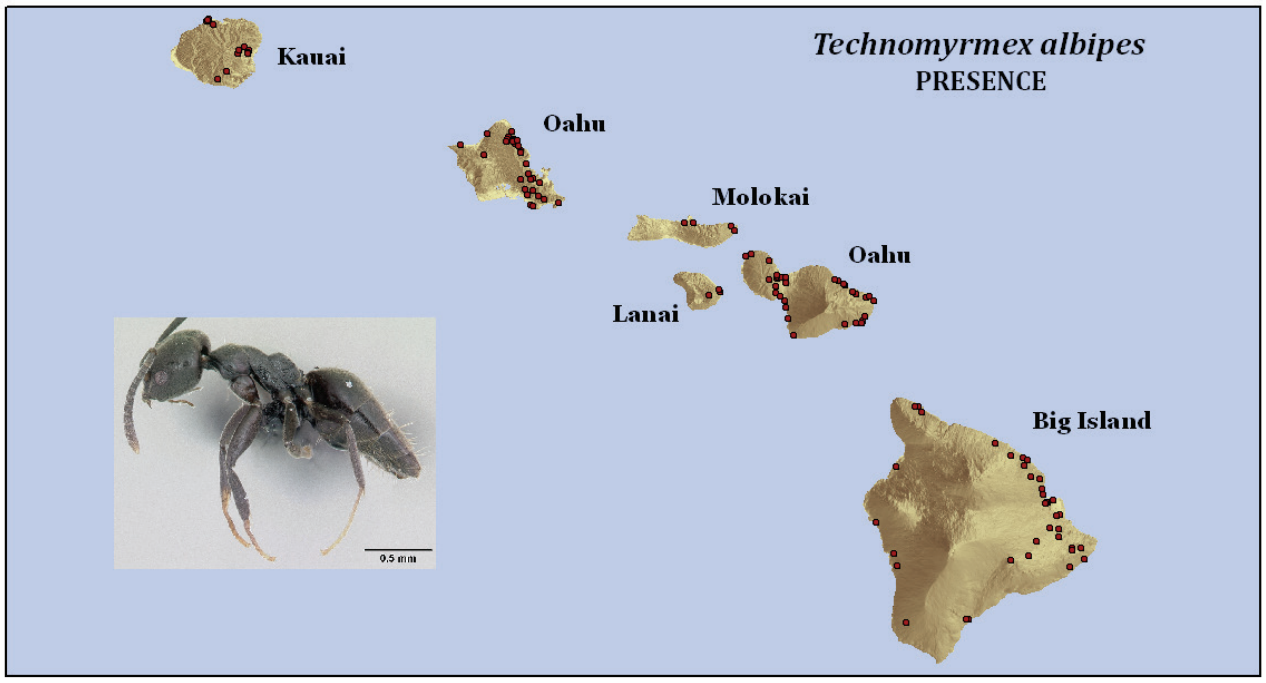

Figure 81: Map of Hawai'i, USA. Points show the presence of T*echnomyrmex albipes*.

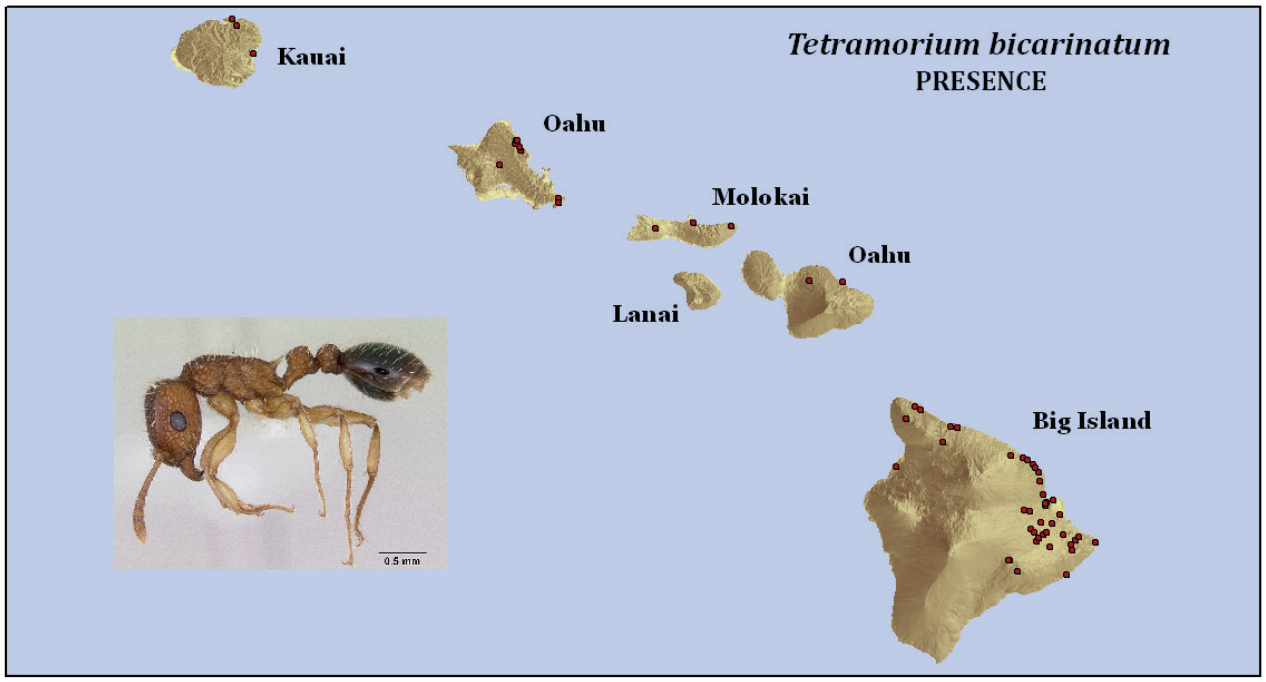

Figure 82: Map of Hawai'i, USA. Points show the presence of T*echnomyrmex bicarinatum.*

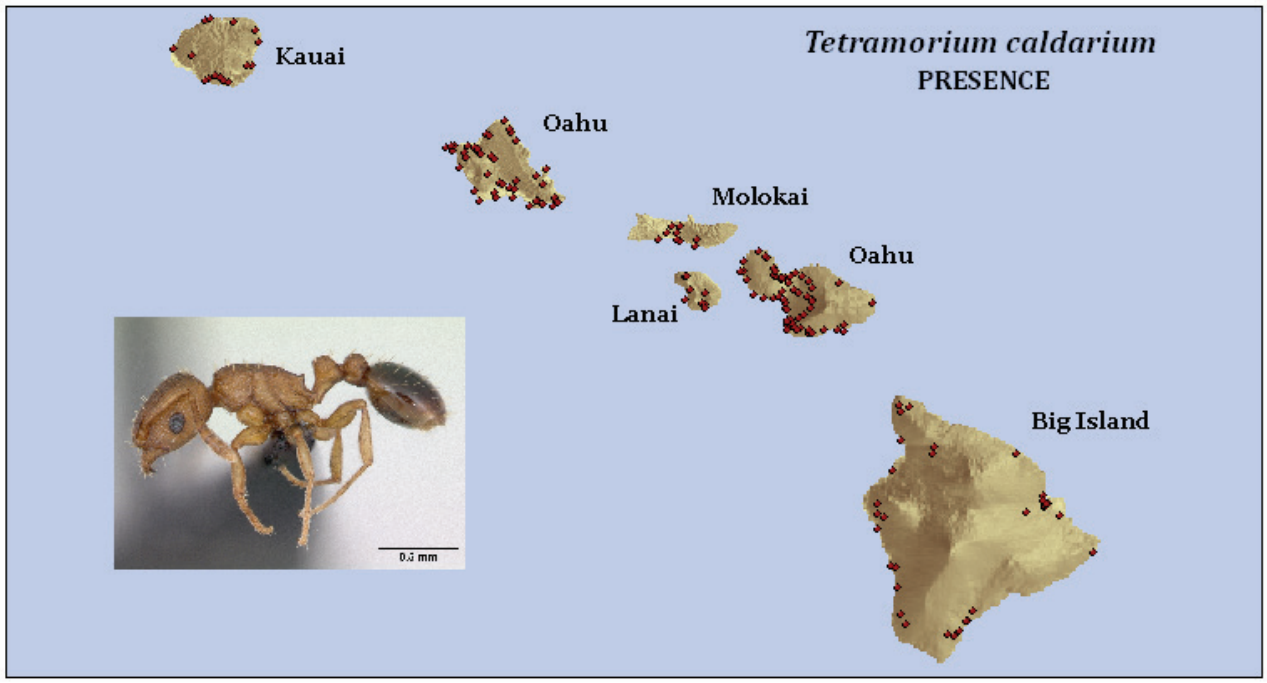

Figure 83: Map of Hawai'i, USA. Points show the presence of T*echnomyrmex caldarium.*

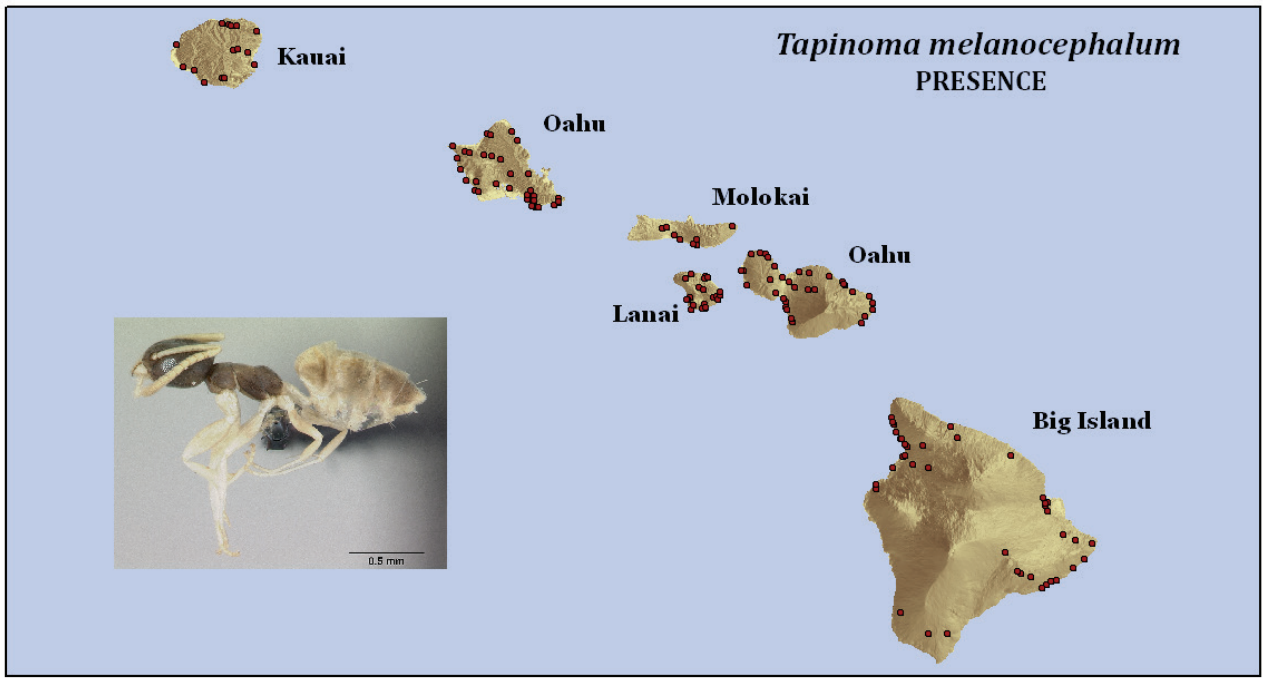

Figure 84: Map of Hawai'i, USA. Points show the presence of *Tapinoma melanocephalum.*

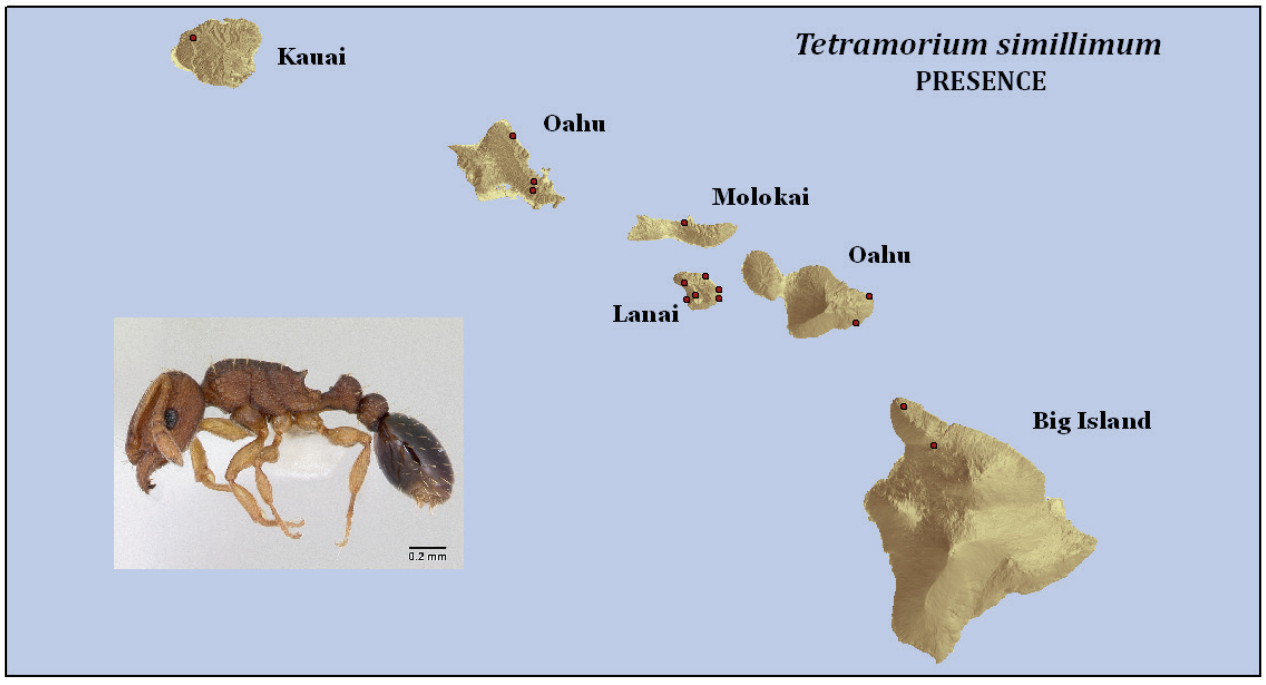

Figure 85: Map of Hawai'i, USA. Points show the presence of *Tetramorium simillimum.*

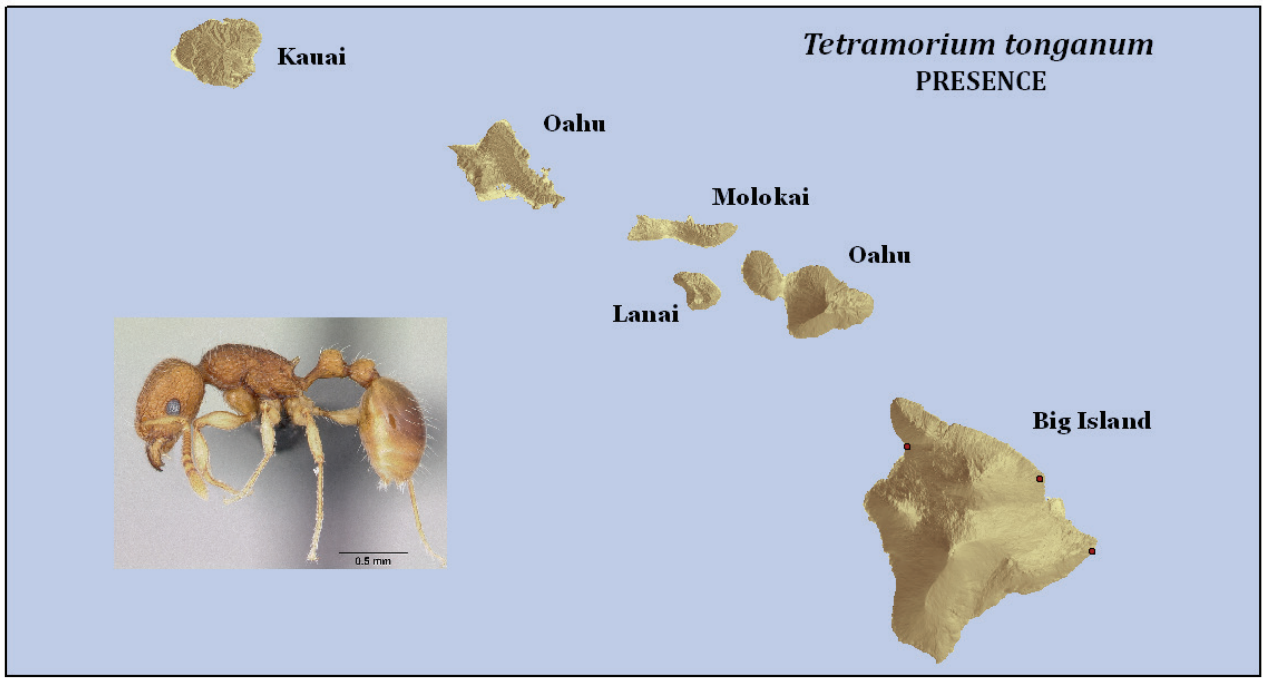

Figure 86: Map of Hawai'i, USA. Points show the presence of *Tetramorium tonganum.*