THE TROPICAL MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (TMAPS) PROGRAM IN AMERICAN SAMOA: 2014 REPORT

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Blue-crowned Lory, Ta'u, and Long-tailed Cuckoo, Tutuila

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EXECUTIVE SUMMARY

Few data exist on the ecology, population status, and conservation needs of landbirds in American Samoa. In an effort to improve our understanding of this insular avifauna and to provide baseline population data for these species, we initiated a Tropical Monitoring Avian Productivity and Survivorship (TMAPS) program on Tutuila Island in 2012. Long-term goals of this project are to: (1) provide annual indices of adult population size and post-fledging productivity; (2) provide annual estimates of adult population densities, adult survival rates, proportions of residents, and recruitment into the adult population (from capture-recapture data); (3) relate avian demographic data to weather and habitat; (4) identify proximate and ultimate causes of population change; (5) use monitoring data to inform management; and (6) assess the success of managements actions in an adaptive management framework.

In August 2012 through August 2014 we established and operated eight TMAPS stations in typical habitats utilized by landbirds on Tutuila, American Samoa; two stations needed to be replaced by two others for logistical reasons. During this first 13 months of the program we established seasonality for resident breeding birds on Tutuila, and that the best four-month period for a TMAPS program in Samoa moving forward would be during December-March. Therefore, in November 2013, four stations, Malaeloa, Malota, NPAS - Mount Alava, and Amalau, were re-established on Tutuila and two new stations, Tula and NPAS - Vatia, were also established to replace Loto'asi and Aoloau, which could not continue to be operated due to access problems. We also established six new stations on Ta'u Island during November 2013, two of which, NPAS - Luamaa and NPAS - Laufuti Stream are, along with Mount Alava and Vatia on Tutuila, on National Park of American Samoa (NPAS) lands. Each of these 12 stations were operated for three or four pulses (three consecutive days) each during the 2014 season (December 2013-March 2014).

Here we provide a comprehensive summary of landbird captures, indices of population size (capture rates), and reproductive index for the 12 stations operated on Tutuila and Ta'u during the period December 2013 through March 2014. We also compare capture and vital rates between the two islands, and perform a year-to-year comparison on Tutuila using data from four stations operated in December-March of both 2012-2013 (hereafter the "2013 season") and 2013-2014 (hereafter the "2014 season").

Overall, we banded 106 birds on Tutuila and 340 birds on Ta'u, we recaptured 41 birds on Tutuila and 77 birds on Ta'u, and 9 birds on Tutuila and 11 birds on Ta'u were released unbanded; thus, we recorded a total of 156 captures on Tutuila, 428 captures on Ta'u, and 584 captures overall. Sixteen species were captured during the 2014 season on the two islands combined, the most common of which were Wattled Honeyeater (323 captures), Samoan Starling (94), Collared Kingfisher (74), Samoan Shrikebill (35), Polynesian Starling (23), Purple-capped Fruit-Dove (13), and Blue-crowned Lory (9). The remaining nine species were captured fewer than 4 times each, and included three waterbirds, three native landbirds, one migrant landbird, and two non-native landbirds. Only one Cardinal Honeyeater was captured; this species had higher capture rates at some of the discontinued stations, explaining the relative paucity of captures during the 2014 season.

Because of variation in the number of net-hours it is best to compare overall population densities in terms of individual adults captured per 600 net-hours. Using this metric, landbird population sizes at the six Ta'u stations combined (74.6 adults per 600 net-hours) were nearly five times those of the Tutuila stations (15.7 adults per 600 net-hours). Capture rates of young birds were also higher on Ta'u (9.3 young per 600 net-hours) than on Tutuila (4.4 young per 600 net-hours), though not by as much as were adult capture rates between the islands. We suspect that the disparity in adult population sizes reflects higher bird desities on Ta'u than on Tutuila, but the disparity in reproductive index is more difficult to explain. This result may be dominated by very low reproductive index in Wattled Honeyeater on Ta'u, the most commonly captured species by far. Often adult population size and reproductive success alternate from year to year and we might expect to see productivity by Wattled Honeyeater increase during the 2015 season.

On Tutuila, for all three of adults captured, young captured, and reproductive index, values decreased between the 2013 and 2014 seasons, adults by 29%, young by 40%, and reproductive index by 12.5%. Decreases were essentially noted for adults and young for all six native species in which comparisons could be made. For reproductive index, two species showed decreases while two showed increases. It is very typical among MAPS and TMAPS programs elsewhere to have this level of year-to-year variation as responding to variation in climatic factors including localized small-scale events such as rain or wind storms during peak breeding. Once we have more years of data we will be able to assess the effects of both global and local weather patterns on bird dynamics in American Samoa.

Extensive data on molt, plumage, breeding condition, skull pneumaticization, and morphometrics have been collected to provide a comprehensive manual on molt, age and sex determination criteria for the resident birds of American Samoa. The information compiled for this manual will be submitted for publication in the scientific literature during 2014.

Continuation of the current sampling protocol will yield critical data on the survival, recruitment, and population growth rates for up to seven target native landbird species on Tutuila and Ta'u. More seasons worth of data will allow us to better understand year-to-year dynamics, including trends in population sizes, and will enable us to estimate survival rates for up to seven target species. We can then assess how much reproductive success and survivorship are driving population size dynamics, allowing us to make recommendations for habitat and land management.

Realization of TMAPS goals over the next five years will thus aid identification of conservation needs and formulation of management approaches for Samoan landbirds. The need for such approaches is pressing given the many potential threats to the persistence of Pacific insular landbird populations. We look forward to continuing this important work in the coming years.

INTRODUCTION

Birds are sensitive indicators of environmental quality and ecosystem health (Morrison 1986, Hutto 1998), and they are the focus of many regional and continental scale monitoring efforts (Gregory et al. 2005, Sauer et al. 2008). Most broad-scale bird monitoring has involved counts

of birds to index abundance and estimate trends (Bart 2005), but monitoring of demographic rates (including productivity, recruitment, and survival) is needed to infer actual causes of population changes (DeSante et al. 2005). Because demographic rates are directly affected by environmental stressors or management actions, they can more-accurately reflect short-term and local environmental changes (Temple and Wiens 1989, DeSante and George 1994). Demographic data can also be used to identify stages of the life cycle that are most important for limiting bird populations (DeSante et al. 2001; Holmes 2007; Saracco et al. 2008, 2009) and can be modeled as functions of predictive population analyses to assess the viability of populations (Noon and Sauer 1992; Saracco et al. 2010a, 2010b).

Application of standardized, constant-effort mist netting and modern capture-recapture analytical techniques is an effective means of monitoring demographic rates of many landbird species (DeSante et al. 2005). A long-term landbird mark-recapture effort was initiated in North America by The Institute for Bird Populations (IBP), with the establishment of the Monitoring Avian Productivity and Survivorship (MAPS) program in 1989 (DeSante 1992). The MAPS program is a cooperative network consisting of hundreds of constant-effort mist-netting stations operated across North America each summer (over 1,200 stations overall) that has provided demographic data for over 180 landbird species (DeSante and Kaschube 2007, Saracco et al. 2010b). Similar programs exist in Europe, where they are central components of national and international bird-monitoring efforts (e.g., Peach et al. 2004). The MAPS program has been utilized to monitor bird demography by many U.S. federal agencies, including the National Park Service, Department of Defense, USDA Forest Service, and USDI Fish and Wildlife Service.

IBP has also established a "Tropical MAPS" (TMAPS) program to collect similar data on avian vital rates in tropical areas, where breeding may occur year-round. The first TMAPS project was established on Saipan, Commonwealth of the Northern Marianas Islands, in 2008 and has provided important new information on population abundance and trends, breeding and molting seasonality, vital rates, age-determination criteria, morphology, and ecology of the resident landbirds on this island (Radley et al. 2011, Junda et al. 2012, Pyle et al. 2012a).

IBP, in collaboration with the Department of Marine and Wildlife Resources in American Samoa, established TMAPS stations on the island of Tutuila in August 2012 to initiate a five-year TMAPS program there. This effort aims to provide baseline data on landbird populations of American Samoa and a foundation for informing conservation strategies for the indigenous insular avifauna found there. Long-term goals are to: (1) provide annual indices of adult population size and post-fledging productivity (from constant-effort capture data); (2) provide annual estimates and trends of adult population size, adult survival rates, proportions of residents, and recruitment into the adult population (from capture-recapture data); (3) relate avian demographic data to seasonal weather patterns and habitat; (4) identify proximate and ultimate causes of population change; (5) use monitoring data to inform management; and (6) assess the success of any management actions in an adaptive management framework. In order to estimate productivity and recruitment, accurate criteria for determination of each captured bird's age is needed, which in turn relies on knowledge of molting seasons and strategies.

The initial establishment of TMAPS stations on Tutuila and a preliminary summary of capture data from seven TMAPS stations were described by Pyle et al. (2012b, 2013), and molting

patterns and age-determination criteria for Samoan landbirds based on museum specimens and captures on Tutuila is detailed by Pyle et al. (2014a). In November 2013 we re-established four stations and established two new stations on Tutuila, and we established six new stations on the island of Ta'u. We operated each of these 12 stations during December 2013-March 2014, the "2014 season." Here we provide a comprehensive summary of captures, indices of population size (capture rates), and productivity for the 12 stations operated on Tutuila and Ta'u during the 2014 season. We also compare capture and vital rates between the two islands, and perform a year-to-year comparison on Tutuila using data from four stations operated in December-March of both 2012-2013 (the "2013 season") and the 2014 season.

STUDY AREAS AND METHODS

In July-August 2012 we established six TMAPS stations in typical habitats utilized by landbirds on Tutuila, American Samoa (Fig. 1). All six stations would be operated on three consecutive days (representing a "pulse"), once per month, during August 2012 through August 2013. However, during this period two stations, Fagatele Bay and Olovalu Crater, were discontinued due to access problems and low capture rates, and two new stations, NPAS - Mount Alava and Malota, were established in their stead. The six remaining stations, including Loto'asi, Malaeloa, Aoloau, and Amalau, were operated for most of the period, including the 2013 season (December 2012-March 2013). Locations of these eight stations are shown in Figure 1, and descriptions and a summary of effort for these eight stations are provided by Pyle et al. (2013).

In November 2013 four stations, Malaeloa, Malota, NPS - Mount Alava, and Amalau, were re-established on Tutuila in the exact same locations as they were operated in 2012-2013. Two new stations Tula and NPAS - Vatia, were also newly established to replace Loto'asi and Aoloau, which could not continue to be operated during the 2014 season due to access problems. Each of these six stations were operated for four pulses each during the 2014 season. The locations of these six stations are shown in Figure 1 and descriptions and a summary of effort for each station during the 2014 season are given in Table 1. On Ta'u, the names and locations of the six new stations are shown in Figure 2, and descriptions and a summary of effort for each station during the 2014 season are given in Table 2. Due to logistical problems (primarily gasoline shortages to operate vehicles), four stations on Ta'u (NPAS- Luamaa, NPAS - Laufuti Stream, Fala'a, and Aoukso) were only run for three pulses each during the 2014 season, whereas the remaining two stations (Usu Nua and Saunoa) were operated during all four pulses (Table 2). The four stations, two on Tutuila and two on Ta'u, whose names are preceded by "NPAS" are located in the National Park of American Samoa.

Each station consisted of a sampling area of about 20 ha. Within the central 8 ha of each station, 10 12-m long, 30-mm mesh, 4-tier nylon mist nets were erected at fixed net sites. Stations were operated according to the standardized protocol established by The Institute for Bird Populations for use in the MAPS Program (DeSante et al. 2013). Mist-netting effort data (i.e., the number and timing of net-hours on each day of operation) were collected in a standardized manner by recording net-opening, net-checking, and net-closing times to the nearest 10 minutes. We aimed to operate nets for six morning hours per day, beginning at local sunrise. Inclement weather (especially heavy rain) sometimes truncated operation on a particular day, resulting in variable

overall effort among stations (Tables 1 and 2). Station operation was carried out by biologist interns and assistants, including Tranquillo, Kayano, Jones, and Doyle (see also Acknowledgements), who were trained in TMAPS protocols by IBP staff biologist Taylor and supervised by locally by Tranquillo and Dauphine and remotely by Rowan and Pyle.

With few exceptions, all birds captured were identified to species, age, and sex based on criteria outlined by Pyle (2014a), and, if unbanded, were banded with USGS/BRD numbered aluminum leg bands. Birds were released immediately upon capture and before being banded or processed if situations arose where bird safety would be compromised. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines (DeSante et al. 2013):

- capture code (newly banded, recaptured, band changed, unbanded)
- band number
- species
- age, how aged, and molt-plumage code (see below)
- sex (if possible to determine) and how sexed (if applicable)
- extent of skull pneumaticization
- breeding condition of adults (i.e., extent of cloacal protuberance or brood patch)
- extent of juvenal plumage in young birds
- extent of body and flight-feather molt
- extent of primary-feather wear
- presence of molt limits and plumage characteristics
- wing chord
- fat class and body mass
- date and time of capture (net-run time)
- station and net site where captured
- any pertinent notes.

Detailed molt data and images were obtained for most captures, to continue documenting molt strategies and ageing and sexing criteria for American Samoan landbirds (Pyle 2014a). These data and images were examined by Pyle to assess accuracy of age determinations and to maintain seasonal criteria for acceptable age coding. Because breeding can occur year-round in American Samoa, and the peak breeding season spans the end of the calendar year (December/January), the calendar-year-based ageing system used for MAPS (DeSante et al. 2013) could not be used for this program. Instead, we aged birds according to a molt-plumage (WRP) system following Wolfe et al. (2010) and Johnson et al. (2011). Our system was modified to reflect the molt and plumage strategies found for our captured species in American Samoa (Pyle 2014a, 2014b). In addition, first-cycle birds were scored as either greater than or less than six months of age, based on skull and feather wear data. A final determination of age for productivity analyses, young or adult, was determined through a combination of the WRP designation and whether or not young birds were at least six months of age (Pyle 2014b).

Breeding status of each species seen, heard, or captured at each TMAPS station on each day of operation was recorded, using techniques similar to those employed for breeding bird atlas projects, as confirmed breeder, likely breeder, or non-breeder (DeSante et al. 2013). Habitat data

were collected for each station following Nott et al. (2003), and using the vegetation classification system of Viereck et al. (1992). John W. Shipman of Zoological Data Processing, Socorro, NM, entered all banding data. We verified banding data by running all records through a series of specialized computer programs to (1) check the validity of all codes entered and the ranges of all numerical data, (2) compare station, date, and net fields from the banding data with those from the effort and breeding status data, (3) cross-check species, age, and sex determinations against data such as skull pneumatization and breeding characters indicative of age and sex, and (4) detect unusual or duplicate band numbers, unusual band sizes, or recaptures indicating inconsistent species, age, or sex determinations. Discrepancies or suspicious data identified by these programs were corrected by hand, if necessary. We used wing chord, body mass, fat content, date and station of capture, and pertinent plumage criteria as supplementary information for the correct determination of species, age, and sex (Pyle 2014a). As mentioned above, photographs of most captures were examined to verify age and sex determinations.

For each species and for all species pooled, we calculated (1) numbers of newly banded birds, recaptured birds, and birds released unbanded, (2) numbers and capture rates of individual birds at each station (birds per 600 net-hours, a standard unit for between-station or regional comparisons; DeSante et al. 2013), and (3) the ratio of young to adult birds representing a reproductive index (Peach et al. 1996). We used these standardized indices to make comparisons of bird dynamics between stations and between the two islands. We also compared capture and productivity rates between the 2013 and 2014 seasons on Tutuila, using data from the four stations operated during December-March of both seasons.

RESULTS

A summary of captures of each species during the four TMAPS pulses during the 2014 season (December 2013 through March 2014), is provided for all 6 stations on each island (Table 3) and for each station separately on Tutuila (Table 4) and Ta'u (Table 5). Overall, we banded 106 birds on Tutuila and 340 birds on Ta'u, we recaptured 41 birds on Tutuila and 77 birds on Ta'u, and 9 birds on Tutuila and 11 birds on Ta'u were released unbanded; thus, we recorded a total of 156 captures on Tutuila, 428 captures on Ta'u, and 584 captures overall (Table 3). Sixteen species were captured during the 2014 season (see Table 3 for scientific names).

The most commonly captured species on both islands combined were Wattled Honeyeater (323 captures), Samoan Starling (94), Collared Kingfisher (74), Samoan Shrikebill (35), Polynesian Starling (23), Purple-capped Fruit-Dove (13), and Blue-crowned Lory (9). The remaining nine species were captured fewer than 4 times each, and included three waterbirds (White-tailed Tropicbird, Buff-banded Rail, and White Tern), three native landbirds (Pacific Pigeon, White-rumped Swiftlet, and Cardinal Honeyeater), one migrant landbird (Long-tailed Cuckoo), and two non-native landbirds (Red-vented Bulbul and Jungle Myna). Species captured previous to but not during the 2014 season on Tutuila included Purple Swamphen (*Porphyrio porphyria*) and Jungle Myna (*Acridotheres fuscus*); the myna and Cardinal Honeyeater had higher capture rates at some of the discontinued stations, explaining the relatuive paucity of captures during the 2014 season. Two other native landbird species found on these islands, Many-colored Fruit-Dove (*Ptilinopus perousii*) and Shy Ground-Dove (*Alopecoenas stairi*), have not yet been captured at TMAPS

stations; the ground-dove is only found on Ofu Island where we as yet have no stations.

On Tutuila (Table 4), when all species were pooled, the highest numbers of captures were recorded at the Amalau station (35), followed by Malota (33), NPAS - Mount Alava (32), NPAS - Vatia (25), Tula (20), and Malaeloa (11). Species richness was highest at Malota (8 species), followed by Malaeloa, NPAS - Mount Alava, and NPAS - Vatia (6 species each), Amalau (5 species), and Tula (3 species). On Ta'u (Table 5), the highest numbers of captures were recorded at Usu Nua (109), followed by Aukosu (99), NPAS - Luamaa (73), Saunoa (62), Fala'a (57), and NPAS - Laufuti Stream (28), whereas species richness was highest at Saunoa (7 species), followed by Usa Nua (6), Fala'a and Aokuso (5 each), and NPAS - Luamaa and NPAS - Laufuti Stream (4 each).

Because of variation in the number of net-hours (Tables 1 and 2), especially regarding the four stations on Ta'u operated for either 3 or 4 pulses, it is best to compare overall population densities in terms of individual adults captured per 600 net-hours (Tables 3, 6 and 7). Using this metric, overall population sizes at the Ta'u stations (74.6 adults per 600 net-hours) were nearly five times those of the Tutuila stations (15.7 adults per 600 net-hours), when data from all six stations and all species were pooled (Table 3). This was also true for 3 of the 5 native landbird species captured on both islands (Collared Kingfisher, Wattled Honeyeater, and Samoan Starling), whereas for 2 species (Purple-capped Fruit-Dove and Polynesian Starling), adult capture rates were higher on Tutuila. Capture rates of young birds overall were also higher on Ta'u (9.3 young per 600 net-hours) than on Tutuila (4.4 young per 600 net-hours), though not by as much as were adult capture rates between the islands. Among the above five species, capture rates of young were higher on Tutuila for Purple-capped Fruit-Dove and higher on Ta'u for the other 4 species (Table 3). This disparity in relative capture rates in adults and young resulted in the overall reproductive index being over twice as high on Tutuila (0.28 young/adult) then on Ta'u (0.13 young/adult). All but one of the above five species, Polynesian Starling, showed higher reproductive rates on Tutuila than on Ta'u (Table 3).

Among stations on each island, adult capture rates followed somewhat similar orders to those for number of captures. On Tutuila (Table 6), when all species were pooled, adult capture rates were highest at Malota (19.8 adults per 600 net-hours), followed by NPAS - Mount Alava (19.0), Amalau (18.3), NPAS - Vatia (17.0), and Tula (9.0). Captures of young showed greater variation between stations, being highest at Malota (8.8 young per 600 net-hours), followed by NPAS - Vatia (7.4), NPAS - Mount Alava (3.6), Amalau (3.5), Malaeloa (2.1), and Tula (2.0). As such, reproductive index showed a different order among the stations, being highest at Malota and NPAS - Vatia (0.44 young/adult each), followed by Tula (0.22), NPAS - Mount Alava and Amalau (0.19 each), and Malaeloa (0.13). On Ta'u (Table 7), adult capture rates were highest at Aukuso (85.2 adults per 600 net-hours), followed by Usu Nua (76.7), NPAS - Luamaa (72.4), Fala'a (50.2), Saunoa (46.5), and NPAS - Laufuti Stream (41.8). Capture rates of young again followed a different order than those of adults, being highest at Usa Nua (14.0 young per 600 net-hours), followed by Fala'a (9.7), Aukuso (8.5), Saunoa (6.0), NPAS - Laufuti (3.5), and NPAS - Luamaa (3.0). As such, reproductive index again showed a completely different order, being highest at Fala'a (0.19 young per adult), followed by Usu Nua (0.18), Saunoa (0.13), Aokuso (0.10), NPAS - Laufuti (0.08), and NPAS- Luamaa (0.04).

On Tutuila, we compared captures between the 2013 and 2014 seasons at four stations which were operated during December-March of both seasons, for six native species and all species pooled (Table 8). Comparisons were made based on constant-effort sampling, which makes between-season comparisons of the same nets and hours of operation within each pulse. For all three parameters, adults captured, young captured, and reproductive index, values decreased between the 2013 and 2014 seasons, adults by 29%, young by 40%, and reproductive index by 12.5%. Decreases were essentially noted for adults and young for all six species (Table 8). For reproductive index, two species (Collared Kingfisher and Polynesian starling) showed decreases while two (Wattled Honeyeater and Samoan Starling) showed increases.

DISCUSSION

During the first 13 months of the Tropical Monitoring Avian Productivity and Survivorship (TMAPS) program in American Samoa, from August 2012 to August 2013, we established seasonality for resident breeding birds on Tutuila, and that the best four-month period for a TMAPS program in Samoa would be during December-March. During November 2013, we therefore re-established four stations on Tutuila and established two new stations on Tutuila and six new stations on Ta'u Island, and operated these 12 stations for three or four pulses during the 2014 season (December 2013-March 2014). Data from this second season will allow us to compare bird dynamics between the two islands, and compare dynamics between the two seasons at the four stations which were operated during December-March of both seasons. The effort on Ta'u has also allowed us to investigate population sizes and vital rates of two new species, Blue-crowned Lory and Samoan Shrikebill, species of landbirds that have been studied very little in the past.

During the 2014 season, we recorded 156 captures on Tutuila, 428 captures on Ta'u, and 584 captures overall, of 16 bird species. The most commonly captured species, on both islands combined, were Wattled Honeyeater, Samoan Starling, Collared Kingfisher, Samoan Shrikebill, Polynesian Starling, Purple-capped Fruit-Dove, and Blue-crowned Lory. These are all native indigenous species. The remaining nine species were captured fewer than 4 times each, and included three waterbirds, three native landbirds, one migrant landbird, and two non-native landbirds.

Overall population sizes at the Ta'u stations were 74.6 adults per 600 net-hours, nearly five times those of the Tutuila stations (15.7 adults per 600 net-hours). Overall reproductive index, however, was over twice as high on Tutuila (0.28 young/adult) then on Ta'u (0.13 young/adult). With only one year of data we cannot say how tenable these differences are or will be. We suspect that the disparity in adult population sizes reflects bird dynamics, as both habitat quality and bird population sizes appeared to be much higher at our Ta'u stations than at the Tutuila stations. The disparity in reproductive index, however, is much more difficult to explain. This result may be dominated by very low reproductive index in Wattled Honeyeater on Ta'u, the most commonly captured species by far. Often adult population size and reproductive success alternate from year to year, in opposite cycles, and if this is the case we might expect to see much higher productivity by Wattled Honeyeater and the other species on Ta'u during the 2015 season.

On Tutuila, all three parameters, adults captured, young captured, and reproductive index, decreased between the 2013 and 2014 seasons at the four stations operated both seasons; adults decreased by 29%, young by 40%, and reproductive index by 12.5%. Decreases in adults and young captured were noted for all six species in which comparisons were made, whereas reproductive index decreased in two species and increased in two species. It is very typical among MAPS and TMAPS programs elsewhere to have this level of year-to-year variation. Often, this variation has to do with climatic factors including both overall patterns and small-scale events such as rain or wind storms during peak breeding. Once we have more years of data we will be able to assess the effects of both global and local weather patterns on bird dynamics in American Samoa.

Extensive data on molt, plumage, breeding condition, skull pneumaticization, and morphometrics were collected on eight of the 12 species, and have been coupled with preliminary data from museum specimens to provide a comprehensive manual on molt, age and sex determination criteria for the resident birds of American Samoa (Pyle 2014a). The information compiled for this manual will be submitted for publication in the scientific literature (cf. Radley et al. 2011) during 2014. We have determined that the preformative molt is absent in one target species (Collared Kingfisher), partial in three species (Wattled Honeyeater and the two starlings), and incomplete or complete in three species (Purple-capped Fruit-Dove, Cardinal Honeyeater, and Jungle Myna). The prebasic molt peaks in January-April in most species, following peak breeding season.

Continuation of the current sampling protocol will yield critical data on the survival, recruitment, and population growth rates for up to seven target native landbird species on Tutuila and Ta'u. Our goal is to continue to operate six stations on each island during November-March of each season through at least 2017. Five seasons worth of data will allow us to better understand year-to-year dynamics, including trends in population sizes, and will enable us to estimate survival rates for up to seven target species. We can then assess how much reproductive success and survivorship are driving population size dynamics. In turn, we can use our habitat data to assess how habitat quality affects each of these parameters, reproductive success in particular. This will allow us to make recommendations for habitat and land management.

Realization of TMAPS goals over the next five years will aid identification of conservation needs and formulation of management approaches for Samoan landbirds. The need for such approaches is pressing given the many potential threats to the persistence of Pacific insular populations such as habitat loss, avian disease, and exotic predators such as brown treesnake (*Boiga irregularis*), which has reduced or eliminated many landbirds on Guam in the Marianas Islands (Frits and Rhodda 1998). We look forward to continuing this important work in the coming years.

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LITERATURE CITED

Bart, J. 2005. Monitoring the abundance of bird populations. Auk 122:15-25.

DeSante, D.F. 1992. Monitoring Avian Productivity and Survivorship (MAPS): a sharp, rather than blunt, tool for monitoring and assessing landbird populations. Pages 511-521 *in* D. R. McCullough and R. H. Barrett, editors. Wildlife 2001: Populations. Elsevier Applied Science, London, UK.

DeSante, D.F. and T.L. George. 1994. Population trends in the landbirds of western North America. Pages 173-190 *in* J. R. Jehl, Jr. and N. K. Johnson (eds.), A century of avifaunal change in North America, Studies in Avian Biology No 15, Cooper Ornithological Society.

DeSante, D.F., and D.R. Kaschube. 2007. The Monitoring Avian Productivity and Survivorship (MAPS) Program 2002 and 2003 Report. Bird Populations 8:46-115.

DeSante, D.F., K.M. Burton, P. Velez, and D. Froehlich. 2013. MAPS Manual. The Institute for Bird Populations, Point Reyes Station, CA.

DeSante, D.F., M.P. Nott, and D.R. Kaschube. 2005. Monitoring, modeling, and management: Why base avian monitoring on vital rates and how should it be done? Pages 795-804 *in* C. J. Ralph and T. D. Rich, editors. Bird Conservation Implementation and Integration in the Americas. U.S. Forest Service General Technical Report PSW-GTR-191.

DeSante, D.F., M.P. Nott, and D.R. O'Grady. 2001. Identifying the proximate demographic cause(s) of population change by modeling spatial variation in productivity, survivorship, and population trends. Ardea 89:185-207.

Fritts, T.H, and G.H. Rodda. 1998. The role of introduced species in the degradation of island ecosystems: A case history of Guam. Annual Review of Ecology and Systematics 29:113-140.

Gregory R.D., A.J. van Strien, P. Vorisek, A.W. Gmelig Meyling, D.G. Noble, R.P.B. Foppen, and D.W. Gibbons. 2005. Developing indicators for European birds. Philosophical Transactions of the Royal Society London B 360: 269-288.

Hines, J.E., W.L. Kendall, and J.D. Nichols. 2003. On the use of the robust design with transient capture-recapture models. Auk 120:1151-1158.

Holmes, R.T. 2007. Understanding population change in migratory songbirds: long-term and experimental studies of Neotropical migrants in breeding and wintering areas. Ibis 149:2-13.

Hutto, R.L. 1998. Using landbirds as an indicator species group. Pages 75-92 *in* J. M. Marzluff and R. Sallabanks, editors. Avian Conservation: Research and Management. Island Press, Washington, D.C., USA.

Johnson, E.I., J.D. Wolfe, T.B. Ryder, and P. Pyle. 2011. Modifications to a molt-based ageing system proposed by Wolfe et al. (2010). Journal of Field Ornithology 82:421-423.

Junda, J., A.L. Crary, and P. Pyle. 2012. Two modes of primary replacement during prebasic molt of Rufous Fantails *Rhipidura rufifrons*. Wilson Journal of Ornithology 124:680-685.

Morrison, M.J. 1986. Bird populations as indicators of environmental change. Current Ornithology 3:429-451.

Noon, B.R. and J.R. Sauer. 1992. Population models for passerine birds: structure parameterization, and analysis. Pages 441-464 in D. C. McCullough and R. H. Barrett (eds.), Wildlife 2001: Populations. Elsevier Applied Science, London.

Nott, P., D.F. DeSante, and N. Michel. 2003. Monitoring Avian Productivity and Survivorship (MAPS) Habitat Structure Assessment (HSA) Protocol: describing vertical and horizontal spatial habitat patterns at MAPS stations. The Institute for Bird Populations, Point Reyes Staion, California.

Peach, W.J., S.R. Baillie, and S.T. Buckland. 2004. Current practices in the British Trust for Ornithology Constant Effort Sites scheme and comparisons with temporal changes in mist-net captures with changes in spot-mapping counts a the extensive scale. Studies in Avian Biology 29:46-56.

Peach, W.J., S.T. Buckland, and S.R. Baillie. 1996. The use of constant effort mist-netting to measure between-year changes in the abundance and productivity of common passerines. Bird Study 43:142-156.

Pyle, P. 2014a. Updated manual for ageing and sexing landbirds of American Samoa. The Institute for Bird Populations, Point Reyes Station, CA.

Pyle, P. 2014. Applying "WRP" molt and age codes at TMAPS stations: a case study based on American Samoan landbirds. MAPS Chat 14:1-6.

Pyle, P., J.F. Saracco, P. Radley, and D.R. Kaschube. 2012a. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program on Saipan, Commonwealth of the Northern Marianas Islands: 2011-2012 Report. The Institute for Bird Populations, Point Reyes Station, CA.

Pyle, P., N. S. Dauphine, D. Lipp, R. Badia, R. Taylor, and E. Rowan. 2012b. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program in American Samoa: 2012 Report. The Institute for Bird Populations, Point Reyes Station, CA.

Pyle, P., N. S. Dauphine, K. Tranquillo, C. Nell, E Jeffreys, D. Kaschube, R. Taylor, and E. Rowan. 2013. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program in American Samoa: 2013 Report. The Institute for Bird Populations, Point Reyes Station, CA.

Radley, P., A.L. Crary, J. Bradley, C. Carter, and P. Pyle. 2011. Molt patterns, biometrics, and age and gender classification of landbirds on Saipan, Northern Mariana Islands. Wilson Journal of Ornithology 123:588-594.

Saracco, J.F., D.F. DeSante, and D.R. Kaschube. 2008. Assessing landbird monitoring programs and demographic causes of population trends. Journal of Wildlife Management 72:1665-1673.

Saracco, J. F., D. F. DeSante, M. P. Nott, and D. R. Kaschube. 2009. Using the MAPS and MoSI programs to monitor landbirds and inform conservation. Pp. 651-658 in: T. D. Rich, C. D. Thompson, D. Demarest, and C. Arizmendi, editors, Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics. University of Texas-Pan American Press.

Saracco, J. F., J. A. Royle, D. F. DeSante, and B. A. Gardner. 2010a. Spatial modeling of survival and residency and application to the Monitoring Avian Productivity and Survivorship Program. Journal of Ornithology. On-line: doi: 10.1007/s10336-010-0565-1.

Saracco, J. F., J. A. Royle, D. F. DeSante, and B. A. Gardner. 2010b. Modeling spatial variation in avian survival and residency probabilities. Ecology 91:1885-1891

Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD.

Temple, S.A., and J.A. Wiens. 1989. Bird populations and environmental changes: can birds be bio-indicators? American Birds 43:260-270.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick, 1992. The Alaska Vegetation Classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 p

Wolfe, J.D., T.B. Ryder, and P. Pyle. 2010. Using molt cycles to categorize age in tropical birds: An integrative system. Journal of Field Ornithology 81:186-194.

Table 1. Summary of the TMAPS program on the island of Tutuila, American Samoa (AMSA) during the 2014 season, December 2013 through March 2014. Two stations operated during the 2013 season, Loto'asi and Aoolau, were replaced during the year by two new stations, Tula and NPAS- Vatia, due to access and logistical considerations.

Station					December 2013 – March 2014 operation		
Name	Code	Major Habitat Type	Latitude-longitude	Avg Elev. (m)	Total number of net-hours	No. of pulses	Inclusive dates
Malaeloa	MALA	Old-growth moderate-slope, lowland tropical evergreen forest; ephemeral wetlands	14°19'50"S, 170°46'26"W	43	493.33	4	11/27/13 – 03/05/14
Malota	MALO	Ridge-spine, natural tropical forest	14°18'17"S, 170°49'11"W	144	546.33	4	12/07/13 – 03/08/14
NPAS -Mount Alava	MTAL	Old-growth steep-slope, tropical forest; some secondary forest and plantation	14°17'05"S, 170°42'46"W	215	663.17	4	12/22/13 – 03/13/14
Amalau	AMAL	Mixed, old-growth and secondary lowland tropical forest; some plantation	14°15'19"S, 170°39'32"W	35	689.00	4	12/13/13 - 3/18/14
Tula	TULA	Primary forest on steep ridge with mature *Callophylum* and *Dysoxylum* trees.	14°14'58"S, 170°34'35"W	380	599.33	4	12/18/13 – 03/26/14
NPAS - Vatia	VATI	Mixed, old-growth and secondary lowland tropical forest on a hillside with banana and coconut plantation at base.	14°14'41"S, 170°40'35"W	135	565.33	4	12/27/13 – 03/21/14
ALL STATIONS					3556.50	4	11/27/13 – 03/26/14

Table 2. Summary of the TMAPS program on the island of Tau, American Samoa (AMSA) during the 2014 season, December 2013 through March 2014.

Station					December 2013 – March 2014 operation		
Name	Code	Major Habitat Type	Latitude-longitude	Avg Elev. (m)	Total number of net-hours	No. of pulses	Inclusive dates
NPAS-Luamaa	LUAM	Coral rubble lowland littoral forest	14°15'24"S, 169°25'28"W	8	397.83	3	12/24/13 – 03/05/14
NPAS - Laufuti Stream	LAUF	Gentle-slope mature lowland secondary forest	14°14'54"S, 169°26'31"W	835	344.33	3	12/28/13 – 03/08/14
Fala'a	FALA	Gentle-slope mature lowland secondary forest	14°14'49"S, 169°29'59"W	424	370.33	3	12/18/13 – 03/03/14
Usu Nua	USUN	Agriculturally managed secondary forest	14°13'59"S, 169°30'39"W	210	555.33	4	12/13/13 - 2/25/14
Saunoa	SNOA	Agriculturally managed land with some moderate-slope secondary forest alongside clearcut plantation	14°13'11"S, 169°30'14"W	435	503.33	4	12/15/13 – 02/27/14
Aokuso	AOKU	Agriculturally managed secondary forest bordering herbaceous sand strand	14°12'49"S, 169°27'13"W	43	422.33	3	12/21/13 – 02/12/14
ALL STATIONS					2593.50	4	12/13/13 – 03/08/14

Table 3. Summary of combined results for all 12 American Samoan TMAPS stations operated during the 2014 season, December 2013 through March 2014.

Species (Common and Scientific Names)	Island of Tutuila						Island of Tau					
	Birds captured			Birds/600 net-hours			Birds captured			Birds/600 net-hours		
	Newly banded	Un-banded	Recap-tured	Adults	Young	Repr. Index[2]	Newly banded	Un-banded	Recap-tured	Adults	Young	Repr. Index[2]
White-tailed Tropicbird, *Phaethon lepturus*		1										
Buff-banded Rail, *Gallirallus philippensis*							1					
White Tern, *Gygis alba*		1										
Pacific Pigeon, *Ducula pacifica*		1										
Purple-capped Fruit-Dove, *Ptilinopus porphyraceus*	8		1	1.4	0.2	0.13	4			1.1		
Blue-crowned Lory, *Vini australis*							9			1.9	0.3	0.14
Long-tailed Cuckoo, *Eudynamys taitensis*	1	1		0.0	0.2	und.[1]	1			0.3		
White-rumped Swiftlet, *Aerodramus spodiopygia*		1						2				
Collared Kingfisher, *Todiramphus chloris*	17		9	2.5	1.0	0.40	30	1	17	6.8	1.4	0.20
Red-vented Bulbul, *Pycnonotus cafer*								1				
Samoan Shrikebill, *Clytorhynchus [vitiensis] powelli*							25		10	4.4	1.9	0.44
Cardinal Honeyeater, *Myzomela cardinalis*	1				0.2	und.[1]						
Wattled Honeyeater, *Foulehaio carunculata*	57	1	26	8.4	2.4	0.28	192	5	42	45.4	2.5	0.05
Samoan Starling, *Aplonis atrifusca*	12	2	3	1.5	0.5	0.33	68	2	7	13.7	1.9	0.14
Polynesian Starling, *Aplonis tabuensis*	9	1	2	1.7			10		1	1.1	1.4	1.25
Jungle Myna, *Acridotheres fuscus*	1			0.2								
ALL SPECIES POOLED	106	9	41	15.7	4.4	0.28	340	11	77	74.6	9.3	0.13
Total Number of Captures		156						428				
Number of Species	8	8	5	6	6		9	5	5	8	6	
Total Number of Species		12			8			11			8	

[2] Reproductive index (young/adult) is undefined because no adults of this species were captured at these stations in this year.

Table 4. Capture summary for the six individual TMAPS stations operated on the island of Tutuila, American Samoa (AMSA) during the 2014 season, December 2013 through March 2014. N = Newly banded, U = Unbanded, R = Recaptures of banded birds.

	Malaeloa			Malota			Mount Alava			Amalau			Tula			Vatia		
Species[1]	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
White-tailed Tropicbird		1																
Buff-banded Rail																		
White Tern								1										
Pacific Pigeon					1													
Purple-capped Fruit-Dove				2			3		1	1						2		
Blue-crowned Lory																		
Long-tailed Cuckoo				1										1				
White-rumped Swiftlet		1																
Collared Kingfisher	1		1	4		1	1		3	5		2	4		2	2		
Red-vented Bulbul																		
Samoan Shrikebill																		
Cardinal Honeyeater																1		
Wattled Honeyeater	2		3	12		4	8		7	12		9	10	1	2	13		1
Samoan Starling	1			1	1	2	5			2		1				3	1	
Polynesian Starling	1			2		1	2		1	2	1					2		
Jungle Myna				1														
ALL SPECIES POOLED	5	2	4	23	2	8	19	1	12	22	1	12	14	2	4	23	1	1
Total Number of Captures		11			33			32			35			20			25	
Number of Species	4	2	2	7	2	4	5	1	4	5	1	3	2	2	2	6	1	1
Total Number of Species		6			8			6			5			3			6	

[1] Scientific names given in Table 3.

Table 5. Capture summary for the six individual TMAPS stations operated on the island of Tau, American Samoa (AMSA) during the 2014 season, December 2013 through March 2014. N = Newly banded, U = Unbanded, R = Recaptures of banded birds.

	Luamaa			Laufuti Stream			Fala'a Land			Usu Nua Land			Saunoa Land			Aokuso Land		
Species[1]	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
White-tailed Tropicbird																		
Buff-banded Rail																1		
White Tern																		
Pacific Pigeon																		
Purple-capped Fruit-Dove										3			1					
Blue-crowned Lory										2			5			2		
Long-tailed Cuckoo				1														
White-rumped Swiftlet														2				
Collared Kingfisher	15		8				2	1		5		2	4		2	4		5
Red-vented Bulbul								1										
Samoan Shrikebill				8		1	17		9									
Cardinal Honeyeater																		
Wattled Honeyeater	35		8	16		1	21	2	3	57	1	9	24		11	39	2	10
Samoan Starling	6									22		3	9		1	31	2	3
Polynesian Starling	1			1			1			5			2		1			
Jungle Myna																		
ALL SPECIES POOLED	57	0	16	26	0	2	41	4	12	94	1	14	45	2	15	77	4	18
Total Number of Captures		73			28			57			109			62			99	
Number of Species	4	0	2	4	0	2	4	3	2	6	1	3	6	1	4	5	2	3
Total Number of Species		4			4			5			6			7			5	

[1] Scientific names given in Table 3.

Table 6. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated on the island of Tutuila, American Samoa (AMSA) during the 2014 season, December 2013 – March 2014.

	Malaeloa			Malota			Mount Alava			Amalau			Tula			Vatia		
Species[1]	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.
Buff-banded Rail																		
Purple-capped Fruit-Dove				2.2	0.0	0.00	3.6	0.0	0.00	0.9	0.0	0.00				1.1	1.1	1.00
Blue-crowned Lory																		
Long-tailed Cuckoo				0.0	1.1	und.[2]												
Collared Kingfisher	1.2	1.2	1.00	4.4	1.1	0.25	1.8	0.9	0.50	2.6	1.7	0.67	4.0	0.0	0.00	1.1	1.1	1.00
Samoan Shrikebill																		
Cardinal Honeyeater																0.0	1.1	und.[2]
Wattled Honeyeater	6.1	0.0	0.00	6.6	5.5	0.83	9.0	1.8	0.20	12.2	1.7	0.14	5.0	2.0	0.40	10.6	3.2	0.30
Samoan Starling	1.2	0.0	0.00	2.2	1.1	0.50	2.7	0.9	0.33	0.9	0.0	0.00				2.1	1.1	0.50
Polynesian Starling	1.2	0.0	0.00	3.3	0.0	0.00	1.8	0.0	0.00	1.7	0.0	0.00				2.1	0.0	0.00
Jungle Myna				1.1	0.0	0.00												
ALL SPECIES POOLED	9.7	1.2	0.13	19.8	8.8	0.44	19.0	3.6	0.19	18.3	3.5	0.19	9.0	2.0	0.22	17.0	7.4	0.44
Number of Species	4	1		6	4		5	3		5	2		2	1		5	5	
Total Number of Species		4			7			5			5			2			6	

[1] Scientific names given in Table 3.
[2] Reproductive index (young/adult) is undefined because no adults of this species were captured at this station in this year.

Table 7. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated on the island of Tau, American Samoa (AMSA) during the 2014 season, December 2013 – March 2014.

	Luamaa			Laufuti Stream			Fala'a Land			Usu Nua Land			Saunoa Land			Aokuso Land		
Species[1]	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.	Ad.	Yg.	Rep. Ind.
Buff-banded Rail																0.0	0.0	0.00
Purple-capped Fruit-Dove										3.2	0.0	0.00	1.2	0.0	0.00			
Blue-crowned Lory										2.2	0.0	0.00	4.8	0.0	0.00	1.4	1.4	1.00
Long-tailed Cuckoo				1.7	0.0	0.00												
Collared Kingfisher	21.1	1.5	0.07				3.2	0.0	0.00	3.2	2.2	0.67	3.6	1.2	0.33	4.3	1.4	0.33
Samoan Shrikebill				12.2	3.5	0.29	14.6	8.1	0.56									
Cardinal Honeyeater																		
Wattled Honeyeater	40.7	1.5	0.04	27.9	0.0	0.00	30.8	1.6	0.05	49.7	5.4	0.11	26.2	2.4	0.09	51.1	0.0	0.00
Samoan Starling	9.0	0.0	0.00							16.2	3.2	0.20	10.7	0.0	0.00	28.4	5.7	0.20
Polynesian Starling	1.5	0.0	0.00	0.0	0.0	0.00	1.6	0.0	0.00	2.2	3.2	1.50	0.0	2.4	und.[2]			
Jungle Myna																		
ALL SPECIES POOLED	72.4	3.0	0.04	41.8	3.5	0.08	50.2	9.7	0.19	76.7	14.0	0.18	46.5	6.0	0.13	85.2	8.5	0.10
Number of Species	4	2		3	1		4	2		6	4		5	3		4	3	
Total Number of Species		4			3			4			6			6			4	

[1] Scientific names given in Table 3.
[2] Reproductive index (young/adult) is undefined because no adults of this species were captured at this station in this year.

Table 8. Numbers of constant effort aged individual birds and reproductive index at the four MAPS stations[1] pooled operated on the island of Tutuila, American Samoa (AMSA), in both December- March of both the 2013 and 2014 seasons.

Species[1]	Adults 2013	Adults 2014	Young 2013	Young 2014	Reprod. Index 2013	Reprod. index 2014
Purple-capped Fruit-Dove	8	6	0	0	0.00	0.00
Collared Kingfisher	8	6	8	4	1.00	0.67
Cardinal Honeyeater	1	0	0	0	0.00	und.[3]
Wattled Honeyeater	37	26	8	6	0.22	0.23
Samoan Starling	4	3	2	2	0.50	0.67
Polynesian Starling	5	4	2	0	0.40	0.00
ALL SPECIES POOLED	63	45	20	12	0.32	0.28
Number of Species	6	5	4	3	6	6

[1] Only the Malaeloa, Malota, NPAS - Mount Alava, and Amalau stations are included in this analyses.
[2] Only resident landbird species for which there was at least one aged individual of the species in either of the seasons are included in this table.
[3] Reproductive index (young/adult) is undefined because no adults of this species were captured in this year.

Figure 1. Locations of the ten Tropical Monitoring Avian Productivity and Survivorship (TMAPS) stations operated on Tutuila Island, American Samoa, in 2012-2014.

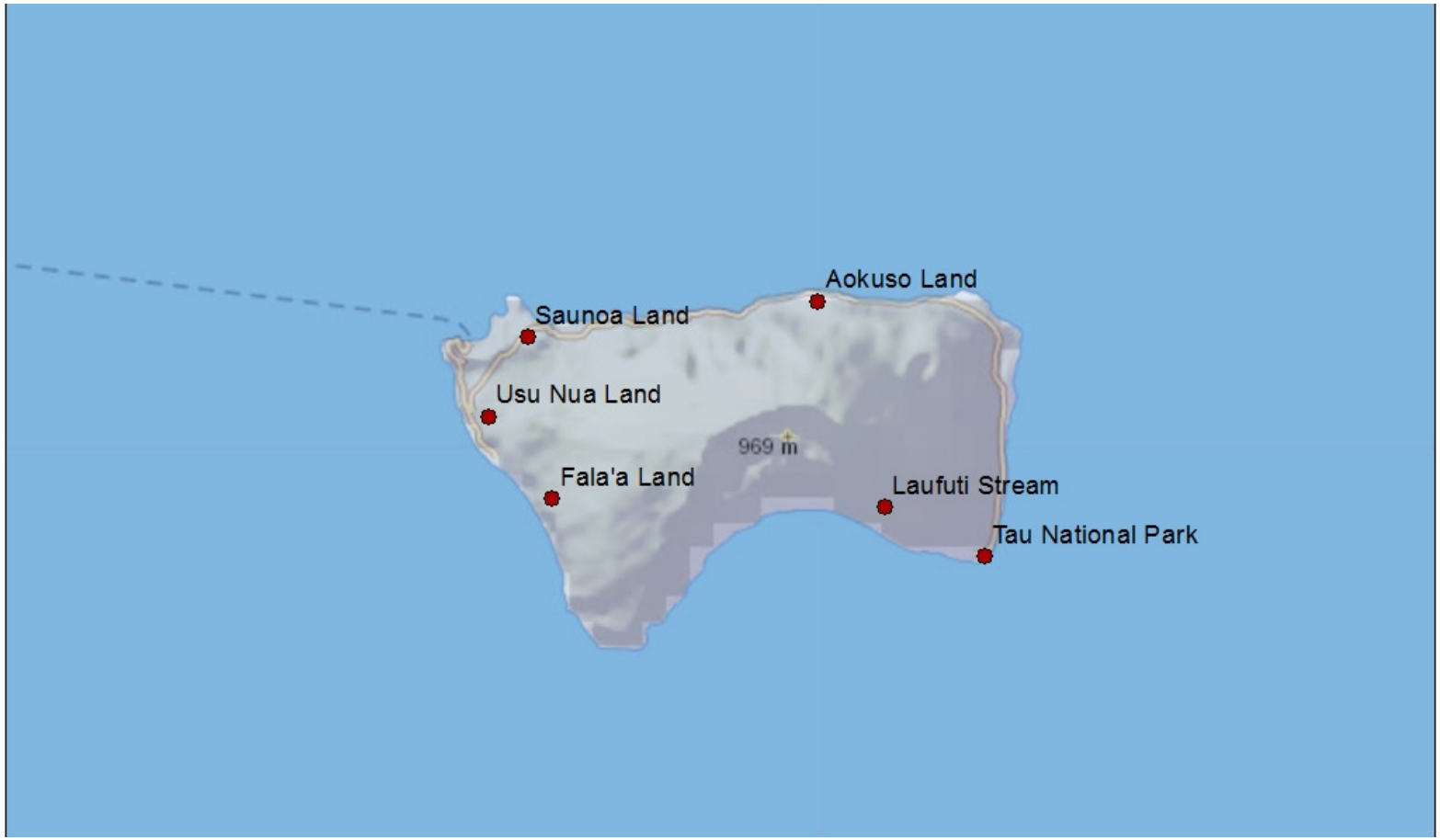

Figure 2. Locations of the six Tropical Monitoring Avian Productivity and Survivorship (TMAPS) stations operated on Tau island, American Samoa, during the 2014 season (December 2013-March 2014).