The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program on Saipan, Commonwealth of the Northern Mariana Islands: 2010 Report

Peter Pyle, James F. Saracco[1], Paul Radley[2], and Danielle R. Kaschube

The Institute for Bird Populations,
P.O. Box 1346, Point Reyes Station, CA 94956-1346

Suggested citation:

[1] Corresponding author e-mail: jsaracco@birdpop.org
[2] CNMI Division of Fish & Wildlife, P.O. Box 10007, Saipan, MP 96950

Pyle, P., J. F. Saracco, P. Radley, and D. R. Kaschube. 2010. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program on Saipan, Commonwealth of the Northern Marianas Islands: 2010 Report. The Institute for Bird Populations, Point Reyes Station, CA.

Cover photographs by A. Lindsay Crary

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 focused on counts of birds with the principal goal of estimating trends (Bart 2005). Monitoring of demographic rates (productivity, recruitment, and survival) lends critical additional insight by providing data on causes of population changes (DeSante et al. 2005). Because demographic rates are directly affected by environmental stressors or management actions, they should more accurately (compared to abundance) and sensitively reflect short-term and local environmental changes (Temple and Wiens 1989, DeSante and George 1994). In addition, demographic data can be used to identify stages of the life cycle that are most important for limiting bird populations (Green 1999, Peach et al. 1999, DeSante et al. 2001, Holmes 2007, Saracco et al. 2008a). Finally, demographic data can be modeled as functions of environmental variables and incorporated into predictive population models to assess the viability of populations (Noon and Sauer 1992).

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). Such an effort was initiated in North America by The Institute for Bird Populations (IBP) in 1989 with the establishment of the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante 1992), a cooperative network of nearly 500 constant-effort mist-netting stations operated across North America each summer, that provides demographic data for > 180 landbird species (DeSante and Kaschube 2007). 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 was endorsed in 1991 by the Monitoring Working Group of Partners in Flight (PIF) and the USDI Bird Banding Laboratory, and has attracted participation from many U.S. agencies, including the National Park Service, Department of Defense, Texas Army National Guard, USDA Forest Service, and Fish and Wildlife Service, as well as hundreds of independent banding-station operators.

IBP, in collaboration with the Division of Fish and Wildlife of the Commonwealth of the Northern Mariana Islands, established and operated the first six “Tropical MAPS” (TMAPS) stations on the island of Saipan in spring/summer 2008 and continued operation of all six stations in spring/summer 2009 and spring through fall 2010. The overall goal of this effort is to provide baseline data on trends, vital rates, and habitat associations for up to nine populations of bird species indigenous to Saipan, upon which to base a sound foundation for developing informed conservation strategies for this insular avifauna. Long-term goals of the TMAPS program on Saipan are to: (1) provide annual indices of adult population size and post-fledging productivity (from constant-effort capture data); (2) provide annual estimates of adult population size, survival rates, proportions of residents, and recruitment into the population (from capture-recapture data); (3) relate avian demographic data to weather and habitat; (4) identify population trends and proximate and ultimate causes of population change; (5) use these data to inform management; and (6) assess the success of management actions in an adaptive management framework. Saracco et al. (2008b) provided a summary of the first year of TMAPS operation on Saipan and Pyle et al. (2009) summarize the second year of data collection. Here we provide a summary of captures and indices of population size (capture rates) and productivity for TMAPS stations operated during 2010 and provide average values of these indices during 2008-2010.

STUDY AREAS AND METHODS

In April 2008 we established six TMAPS stations in typical habitats utilized by landbirds on Saipan (Table 1; Fig. 1). We operated the six stations in April-July 2008 and again, in the exact same locations in which they were established in April-July 2009 and in February-October 2010 (Table 1). We expanded the length of the sampling season to gain further insight into breeding and molting seasonality of landbirds on Saipan. One station name was changed just after the 2008 season, from Naftan Point to Obyan, but the location remained the same in all three years. Each station consisted of a sampling area of about 20 ha. Within the central 8 ha of each station, ten 12-m long, 30-mm mesh, 4-tier nylon mist nets were erected at fixed net sites, in the exact same positions each year.

Stations were operated according to the standardized protocol established by The Institute for Bird Populations for use in the MAPS Program (DeSante et al. 2010). We operated each station on 10 days (separated by about 10 days) between 13 April and 17 July 2008, between 11 April and 15 July 2009, and between 21 February and 9 October 2010 (Table 1). 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 opening and closing times (to the nearest 10 min) for nets, as well as the time at which each net check commenced. We aimed to operate nets for six morning hours per day beginning 15 minutes after sunrise (on or near 05:30 AST). Inclement weather (mostly high sun and wind exposure) and very high capture rates at some sites, however, resulted in variable effort among stations (Table 1). Station operation was carried out by five IBP biologist interns (see Acknowledgments) who were experienced MAPS-station operators and were trained in TMAPS protocols, including molt patterns and ageing criteria of indigenous species of Saipan, by PP and IBP staff biologist Ron Taylor.

With few exceptions, all birds captured were identified to species, age, and sex based on criteria outlined by Pyle et al. (2008) and Radley et al. (in press) and, if unbanded, they 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. 2010):

- capture code (newly banded, recaptured, band changed, unbanded)
- band number
- species
- age and how aged
- 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

Breeding (summer residency) status (confirmed breeder, likely breeder, non-breeder) 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 (see Appendix I). We used these data to classify each species at each station according to three residency categories: breeder, migrant, or transient (Appendix I). Data on habitat structure and floristics were also collected and will be incorporated as covariates in future analyses of bird data. John W. Shipman of Zoological Data Processing, Socorro, NM, entered banding data. IBP staff biologists entered effort data and proofed and verified digitized banding data. Verification of banding data involved running all records through a series of specialized computer programs. These programs included:

- Clean-up programs to check the validity of all codes entered and the ranges of all numerical data.
- Cross-check programs to compare station, date, and net fields from the banding data with those from the effort and breeding status data.
- Cross-check programs to compare species, age, and sex determinations against degree of skull pneumaticization, breeding condition (extent of cloacal protuberance and brood patch), extent of juvenal plumage, extent of body and flight-feather molt, extent of primary-feather wear, and presence of molt limits and plumage characteristics.
- Screening programs, which allow identification of unusual or duplicate band numbers or unusual band sizes for each species.
- Verification programs to screen banding and recapture data for inconsistent species, age, or sex determinations for each band number. Discrepancies or suspicious data identified by these programs were corrected if necessary. We used wing chord, body mass, fat content, date and station of capture, and pertinent notes as supplementary information for the correct determination of species, age, and sex.

In addition, digital images of the wing upper-surface were obtained for many captures to further refine our knowledge on molt patterns and ageing criteria for these species (see Pyle 2008). All digital images of open wings were also compared with banding data during the verification process to improve the accuracy of age and sex designations.

For each species and for all species pooled at each location, we calculated (1) numbers of newly banded birds, recaptured birds, and birds released unbanded; (2) numbers and capture rates (per 600 net-hours) of first captures (in each year) for individual adult and young birds; and (3) the ratio of young to adult birds ("reproductive index"; Peach et al. 1996). To further facilitate comparison of landbird dynamics among stations and to values obtained by the MAPS program in North America, we also calculated three-year means for the numbers of adult and young birds captured per 600 net hours and the reproductive index for each individual species and for all species pooled at each of the six stations and for all six stations combined.

RESULTS

We recorded 2,015 captures of 14 species of birds during the extended 2010 TMAPS season on Saipan (Table 2). Of these, 1,318 (65.4%) were of newly banded birds, 671 (33.3%) were of recaptures, and 26 (1.3%) were of birds released unbanded (primarily due to escape before processing). The most commonly captured species was Rufous Fantail (see Appendix I for scientific names), of which 1,055 captures were recorded, representing 52.4% of all captures. This was followed by Bridled White-eye (381 captures), Golden White-eye (288), Micronesian Honeyeater (129), Collared Kingfisher (58), Orange-cheeked Waxbill (30), White-throated Ground-Dove (18), Micronesian Starling (17), Nightingale Reed-Warbler (11), Philippine Turtle-Dove (9), Eurasian Tree Sparrow (6), Mariana Fruit Dove (5), Red Junglefowl (4), and Yellow Bittern (3). Most of these species are endemic or indigenous to Saipan, whereas the waxbill, turtle-dove, sparrow, and junglefowl are non-native. Nine additional species were recorded at stations but not captured (Appendix I), primarily consisting of waterbirds but also including the indigenous Micronesian Megapode and Mariana Swiftlet.

Among the six stations (Table 3) the greatest number of captures in 2010 occurred at the Laderan Tangke station (542 captures), followed by Obyan (510), Bird Island Conservation Area (496), Mount Tapochau (195), Kingfisher (150), and Sabana Talofofo (122). Species richness was highest at Bird Island, Laderan, and Talofofo (12 species each) and lowest at Obyan (9 species). In order to standardize the number of captures with respect to variation in mist-netting effort (see Table 1), we present capture rates (per 600 net-hours) of individual adult and young birds, as well as the reproductive index (young captured per adult), for each species and for all species pooled at each station (Table 4). These capture indices suggest that the total adult population size in 2010 was greatest at Laderan (120.9 adults/600 net hours), followed by Bird Island (109.5), Obyan (89.0), Tapochau (60.6), Kingfisher (51.1), and Talofofo (47.3).

Compared with 2009 all six stations showed much lower capture rates, varying from a 33.3% lower capture rate at Talofofo to a 59.9% lower capture rate at Obyan. The capture rate of adults at the six stations combined was 83.2 per 600 net hours (Table 2), down 54.0% from the 180.7 per 600 net-hours recorded in 2009.

The most abundant indigenous breeding landbird at the six Saipan TMAPS stations in 2010, as determined by adult capture rate, was Rufous Fantail (38.0 per 600 net-hours), followed in descending order by Bridled White-eye (18.0), Golden White-eye (11.3), Micronesian Honeyeater (5.7), Collared Kingfisher (3.8), Micronesian Starling (1.1), White-throated Ground-Dove (1.0), Nightingale Reed-Warbler (0.7), and Marianas Fruit-Dove (0.4). The capture rate of Mariana Fruit-Dove was the same as it was in 2009 whereas all other rates were lower, by amounts ranging from 17.4% lower in Collared Kingfisher and 49.6% lower in Bridled White-eye to 59.1% lower in Rufous Fantail and 81.3% lower in White-throated Ground-Dove.

Captures of young of all species pooled (Table 4) showed a somewhat different order to captures of adults, being highest at Obyan (82.1 young/600 net hours), followed by Laderan (63.5), Bird

Island (55.0), Tapochau (29.5), Kingfisher (15.1), and Talofofo (7.6). The reproductive index in 2010, as determined by the number of young per adult, was 0.54 when all six stations were combined (Table 2), up substantially (by 600%) from the 0.09 recorded in 2009. The reproductive index was highest at Obyan (0.44), followed by Tapochau (0.38), Bird Island (0.35), Laderan (0.31), Kingfisher (0.25), and Talofofo (0.13). Reproductive Index was higher at all six stations, by 1,466% at Obyan, followed by Tapochau (422%), Laderan (388%), Kingfisher (313%), Bird Island (250%), and Talofofo (11%).

Mean numbers of individual adults (an index of adult population size) and young captured per 600 net-hours, and productivity (reproductive index), averaged over the three-year period 2008-2010, are presented in Table 5 for each station and for all six stations combined. Values for all species pooled indicate that the largest breeding populations (adult captures) occurred at Laderan, followed by Bird Island, Obyan, Tapachou, Kingfisher, and Talafofo. This order has remained consistent during all three years. Productivity over the two years was highest at Obyan, followed by Tapachou, Bird Island, Laderan, Kingfisher, and Talafofo. In contrast to adult captures, the order of the averaged productivity values differed substantially between years. The highest capture rates during 2008-2010 for each of the indigenous landbird species were: Rufous Fantail (86.8 adults per 600 net hours overall and the highest rate at Laderan), Bridled White-eye (41.2 and Obyan), Golden White-eye (35.6 and Bird Island), Micronesian Honeyeater (14.4 and Talofofo), Collared Kingfisher (9.0 and Laderan), White-throated Ground-Dove (3.6 and Kingfisher), Micronesian Starling (2.6 and Talofofo), Nightingale Reed-Warbler (1.5 and Bird Island), and Mariana Fruit-Dove (0.7 and Tapochau). That all six stations have the highest capture-rates for at least one indigenous species indicates that the stations are well-placed to sample the landbirds of Saipan. For all six stations combined, the three-year capture rate was 200.3 adults per 600 net-hours and the reproductive index over the three years was 0.33 young/adults.

DISCUSSION

The first three field seasons of the Tropical Monitoring Avian Productivity and Survivorship (TMAPS) program on Saipan have been highly successful. Specifically, we have (1) established six monitoring stations, representing a range of terrestrial habitats typical of the region, across the length of the island; (2) met mist-netting effort goals for all stations in both years of station operation; and (3) registered over 4,000 captures of birds over the 3-year period. These first two field seasons have also enabled us to collect extensive data on molt, plumage, breeding condition, skull pneumaticization, and morphometrics; and have provided a foundation for developing criteria for determining age and sex in these birds (Pyle et al. 2008, Radley et al. in press). Additional publications based on TMAPS data on molt patterns of specific landbirds in Saipan are planned.

The 2010 season was marked by much lower capture rates of adults but much higher productivity rates (young/adult) than were recorded in 2008 and 2009. This could pertain to several factors, including especially the very dry 2010 spring and summer seasons that apparently resulted in much lower capture rates in comparison with the wetter 2008 and 2009 seasons, apparently successful reproductive success despite the dry season, a bias in the data due to the extended effort, and other landbird population dynamics. At MAPS seasons we often see an alternating pattern of high and low adult population sizes coupled with low and high reproductive rates, respectively, and suspect that this relates to density-dependent effects on breeding success and lower success by first-time breeders after high recruitment. It will be interesting to see if such dynamics are occurring on Saipan, and a thorough analysis of this and other aspects of landbird breeding success and survival will be undertaken in 2011.

Given the dearth of data on Micronesian landbirds (Rodda et al. 1998, Mosher and Fancy 2002, Sachtleben et al. 2006, Camp et al. 2009), establishment of the TMAPS program on Saipan represents a significant advance in improving our understanding of this insular avifauna. The need for continued data collection and analysis is pressing given the many threats to the persistence of these populations such as those associated with habitat loss the potential introduction of brown treesnake *Boiga irregularis* (Rodda et al. 1998; Camp et al. 2009), and the general vulnerability of insular endemic landbird taxa. Continuation of the current sampling protocol including a full, year-round season in 2011 will yield critical data on the survival, recruitment, and population growth rates of several indigenous species or subspecies, such as Golden White-eye, Rufous Fantail, and Bridled White-eye, and will allow us to more fully understand breeding and molt seasonality and interactions. We look forward to continuing this important work in the coming years.

ACKNOWLEDGMENTS

We thank the U.S. Fish and Wildlife Service for providing funding to the CNMI Division of Fish and Wildlife through both the State Wildlife and Pittman-Robertson Wildlife Restoration Grants. Laura Williams, formerly of CNMI DFW, assisted in securing these funds. Field data from 2008 were collected by IBP biologist interns James Bradley and Christina Carter, data from 2009 were collected by Anne Lindsey Crary and James Junda, and data from 2010 were collected by Crary, Nathan Banfield, Caroline Poli, Lauren Helton, and Daniel Webb. Daniel Lamar and Leno Olopai assisted us in gaining access to lands adjacent to their properties for the purpose of data collection. IBP Staff biologist Ron Taylor helped recruit and train the field crews, provided office support during the field season, and assisted with data entry and verification. This is Contribution No. 404 of The Institute for Bird Populations.

LITERATURE CITED

Baker, R.H. 1951. The avifauna of Micronesia, its origin, evolution and distribution. University of Kansas Publications, Museum of Natural History 3:1-359.

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

BirdLife International. 2010. Species factsheet: *Cleptornis marchei*. Downloaded from http://www.birdlife.org on 14/12/2010.

Camp, R. J., T. K. Pratt, A. P. Marshall, F. Amidon, and L. L. Williams. 2009. Recent status and trends of the land bird avifauna on Saipan, Mariana Islands, with emphasis on the endangered Nightingale Reed-warbler *Acrocephalus luscinia*. Bird Conservation International 19:323-337.

Craig, R. J. 1996. Seasonal population surveys and natural history of a Micronesian bird community. Wilson Bulletin 108:246-267.

Craig, R. J., and K. G. Beal. 2001. Microhabitat partitioning among small passerines in a Pacific island bird community. Wilson Bulletin 113:317-326.

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., and D. R. Kaschube. 2009. The Monitoring Avian Productivity and Survivorship (MAPS) Program 2004, 2005, and 2006 report. Bird Populations 9:86-169.

DeSante, D.F., Burton, K.M., Velez, P., and Froehlich, D. 2010. 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.

Green, R. E. 1999. Applications of large scale studies of demographic rates to bird conservation. Bird Study 46:S279-288.

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

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.

Marshall, J.T. Jr. 1949. The endemic avifauna of Saipan, Tinian, Guam, and Palau. Condor 51:200-221.

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

Mosher, S. M., and S. G. Fancy. 2002. Description of nests, eggs, and nestlings of the endangered Nightingale Reed-Warbler on Saipan, Micronesia. Wilson Bulletin 114:1-10.

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.

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.

Peach, W. J., G. M. Siriwardena, and R. D. Gregory. 1999. Long-term changes in over-winter survival rates explain the decline of reed buntings *Emberiza schoeniclus* in Britain. Journal of Applied Ecology 36:798-811.

Pyle, P., P. Radley, J. Bradley, and C. Carter. 2008. Manual for Ageing and Sexing Birds of Saipan, with notes on Breeding Seasonality. The Institute for Bird Populations, Point Reyes Station, CA.

Pyle, P., J. F. Saracco, P. Radley, D. R. Kaschube, A. Lindsay Crary, and J. Junda. 2009. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program on Saipan, Commonwealth of the Northern Marianas Islands. The Institute for Bird Populations, Point Reyes Station, CA.

Radley, P., A. L. Crary, J. Bradley, C. Carter, and P. Pyle. In press. Molt patterns, Biometrics, and age and gender classification of landbirds on Saipan, Northern Mariana Islands. Wilson Journal of Ornithology.

Rodda, G. H., E. W. Campbell, and S. R. Derrickson. 1998. Avian conservation and research in the Mariana Islands, western Pacific Ocean. Pp. 367-381 *in* Avian conservation: research and management (J. M. Marzluff and R. Sallabanks, Eds.) Island Press, Washington, D.C.

Sachtleben, T. 2005. Predation and nest success of forest birds in native and non-native habitat on Saipan, Mariana Islands. M.S. Thesis. Colorado State University.

Sachtleben, T., J. L. Reidy, and J. A. Savidge. 2006. A description of the first Micronesian Honeyeater (Myzomela rubrata saffordi) nests found on Saipan, Mariana Islands. Wilson Journal of Ornithology 118:309-315.

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

Saracco, J.F., P. Radley, D. R. Kaschube, J. Bradley, C. Carter, and P. Pyle. 2008b. The Tropical Monitoring Avian Productivity and Survivorship (TMAPS) Program on Saipan, Commonwealth of the Northern Mariana Islands: 2008 report. The Institute for Bird Populations, Point Reyes Station, CA.

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.

Table 1. Summary of the 2010 TMAPS program on the island of Saipan, Commonwealth of the Northern Marianas Islands (CNMI), Micronesia.

Station					2010 operation		
Name	Code	Major Habitat Type	Latitude-longitude	Avg Elev. (m)	Total number of net-hours[1]	No. of periods	Inclusive dates
Bird Island Conservation Area	BICA	Lowland tropical evergreen tangantangan forest	15°15'45"N,145°48'50"E	30	1407.7 (445.2)	24	02/28 – 10/07
Laderan Tangke	LATA	Lowland tropical evergreen tangantangan forest and lowland tropical rainforest	15°15'10"N,145°47'54"E	207	1379.8 (403.8)	24	03/01 – 10/09
Sabana Talofofo	SATA	Tropical *Casuarina* savannah with dense swordgrass thicket	15°13'07"N,145°45'44"E	161	1102.8 (331.5)	24	02/24 – 10/06
Kingfisher	KIFI	Lowland tropical broad-leaf evergreen rainforest with riparian zone	15°13'02"N,145°46'37"E	23	1033.3 (356.0)	24	02/21 – 10/08
Mount Tapochau	MTAP	Submontane tropical mixed broad-leaf evergreen rainforest	15°11'01"N,145°44'04"E	274	1078.3 (335.2)	24	02/26 – 10/05
Obyan	OBYA	Lowland tropical evergreen tangantangan forest	15°06'31"N,145°43'49"E	1	1314.8 (390.5)	24	02/25 – 10/03
ALL STATIONS					7316.8(2262.2)	24	02/21 – 10/09

[1] Total net-hours in 2010. Net-hours in 2010 that could be compared in a constant-effort manner to 2009 are shown in parentheses.

Table 2. Summary of combined results for all six Saipan TMAPS stations operated in 2010.

	Birds captured			Birds/600 net-hours		
Species[1]	Newly banded	Un-banded	Recap-tured	Adults	Young	Prop. Young
Red Junglefowl		4				
Yellow Bittern	3			0.0	0.2	und.[2]
Philippine Turtle-Dove	9			0.7	0.0	0.00
White-throated Ground-Dove	18			1.0	0.5	0.50
Mariana Fruit-Dove	5			0.4	0.0	0.00
Collared Kingfisher	31		27	3.8	0.2	0.06
Micronesian Honeyeater	107	2	20	5.7	4.0	0.70
Rufous Fantail	556	7	492	38.0	20.6	0.54
Nightingale Reed-Warbler	9		2	0.7	0.2	0.25
Bridled White-eye	333	10	38	18.0	10.2	0.56
Golden White-eye	194	2	92	11.3	8.4	0.75
Micronesian Starling	17			1.1	0.3	0.31
Orange-cheeked Waxbill	30	1		2.0	0.1	0.04
Eurasian Tree Sparrow	6			0.4	0.1	0.20
ALL SPECIES POOLED	1318	26	671	83.2	44.9	0.54
Total Number of Captures		2015				
Number of Species	13	6	6	12	11	
Total Number of Species		14			13	

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

Table 3. Capture summary for the six individual TMAPS stations operated on the island of Saipan, Commonwealth of the Northern Marianas Islands (CNMI), Micronesia, in 2010. N = Newly banded, U = Unbanded, R = Recaptures of banded birds.

	Bird Island Cons. Area			Laderan Tangke			Sabana Talofofo			Kingfisher			Mount Tapochau			Obyan		
Species[1]	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Red Junglefowl		1			1						1			1				
Yellow Bittern	1						1			1								
Philippine Turtle-Dove	2			1						1						5		
White-throated Ground-Dove	2			3			2			5			2			4		
Mariana Fruit-Dove				1			2						2					
Collared Kingfisher	5		7	9		15	1			8		5	5			3		
Micronesian Honeyeater	34		7	14			21	1	10	10	1	1	14			14		2
Rufous Fantail	114		120	143		151	7		10	40	2	41	46	1	33	206	4	137
Nightingale Reed-Warbler	3			2			4		2									
Bridled White-eye	62	2	12	111	3	7	21	1	6	5			28	1	2	106	3	11
Golden White-eye	72		42	54	1	19	6		4	16	1	10	40		15	6		2
Micronesian Starling	5			4			2			2			3			1		
Orange-cheeked Waxbill	5			3			15						2			5	1	
Eurasian Tree Sparrow							6											
ALL SPECIES POOLED	305	3	188	345	5	192	88	2	32	88	5	57	142	3	50	350	8	152
Total Number of Captures		496			542			122			150			195			510	
Number of Species	11	2	5	11	3	4	12	2	5	9	4	4	9	3	3	9	3	4
Total Number of Species		12			12			12			10			10			9	

[1] Scientific names given in Appendix.

Table 4. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual TMAPS stations operated on the island of Saipan, Commonwealth of the Northern Marianas Islands (CNMI), Micronesia, in 2010.

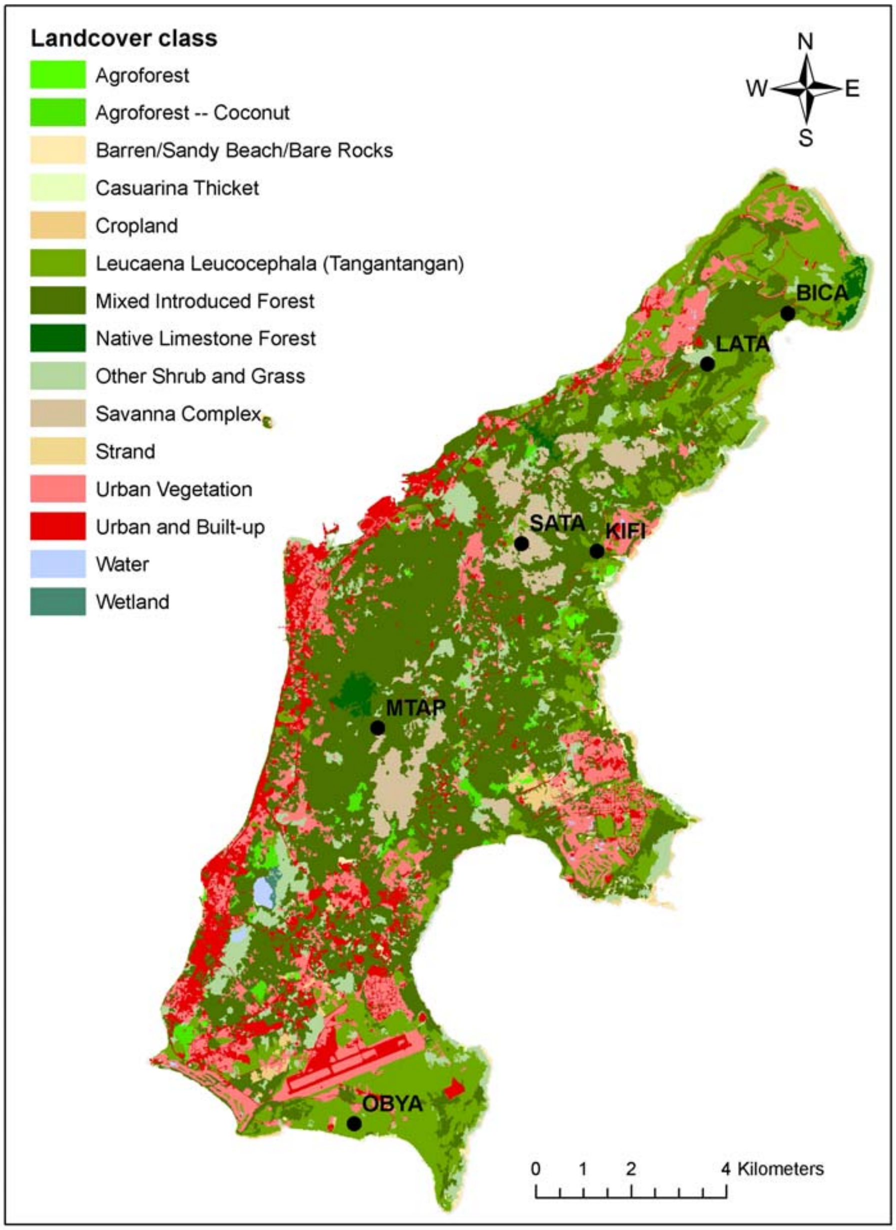
	Bird Island Cons. Area			Laderan Tangke			Sabana Talofofo			Kingfisher			Mount Tapochau			Obyan		
Species[1]	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Yellow Bittern	0.0	0.4	und.[2]				0.0	0.5	und.[2]	0.0	0.6	und.[2]						
Philippine Turtle-Dove	0.9	0.0	0.00	0.4	0.0	0.00				0.6	0.0	0.00				2.3	0.0	0.00
White-throated Ground-Dove	0.9	0.0	0.00	0.4	0.9	2.00	1.1	0.0	0.00	1.7	1.2	0.67	0.6	0.6	1.00	1.4	0.5	0.33
Mariana Fruit-Dove				0.4	0.0	0.00	1.1	0.0	0.00				1.1	0.0	0.00			
Collared Kingfisher	3.8	0.9	0.22	7.0	0.0	0.00	0.5	0.0	0.00	7.0	0.6	0.08	2.8	0.0	0.00	1.4	0.0	0.00
Micronesian Honeyeater	9.4	7.2	0.77	3.9	2.2	0.56	11.4	2.7	0.24	2.9	3.5	1.20	5.6	2.2	0.40	1.4	5.5	4.00
Rufous Fantail	44.3	23.0	0.52	61.7	27.4	0.44	5.4	1.1	0.20	27.9	4.6	0.17	18.4	13.4	0.73	58.0	46.1	0.79
Nightingale Reed-Warbler	0.9	0.4	0.50	0.9	0.0	0.00	2.2	0.5	0.25									
Bridled White-eye	22.2	5.5	0.25	31.3	17.8	0.57	12.0	1.6	0.14	2.9	0.0	0.00	11.7	3.9	0.33	21.9	27.4	1.25
Golden White-eye	23.4	17.0	0.73	13.0	14.4	1.10	3.8	0.5	0.14	7.5	4.1	0.54	17.8	9.5	0.53	0.5	2.3	5.00
Micronesian Starling	1.7	0.4	0.25	0.9	0.9	1.00	1.1	0.0	0.00	0.6	0.6	1.00	1.7	0.0	0.00	0.5	0.0	0.00
Orange-cheeked Waxbill	2.1	0.0	0.00	0.9	0.0	0.00	6.0	0.0	0.00				1.1	0.0	0.00	1.8	0.5	0.25
Eurasian Tree Sparrow							2.7	0.5	0.20									
ALL SPECIES POOLED	109.5	55.0	0.50	120.9	63.5	0.53	47.3	7.6	0.16	51.1	15.1	0.30	60.6	29.5	0.49	89.0	82.1	0.92
Number of Species	10	8		11	6		11	7		8	7		9	5		9	6	
Total Number of Species		11			11			12			9			9			9	

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

Table 5. Mean numbers of aged individual birds captured per 600 net-hours and reproductive index at the six individual MAPS stations operated the island of Saipan, Commonwealth of the Northern Marianas Islands (CNMI), Micronesia, averaged over the three years, 2008-2010.

	Bird Island Cons. Area			Laderan Tangke			Sabana Talofofo			Kingfisher			Mount Tapochau			Obyan			All stations pooled		
Species	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.	Ad.	Yg.	Repr. Ind.[2]
Yellow Bittern	0.0	0.3	0.00				0.0	0.4	0.00	0.0	0.4	0.00							0.0	0.2	0.00
Philippine Turtle-Dove	1.1	0.0	0.00	2.3	0.0	0.00				1.0	0.0	0.00	0.6	0.0	0.00	2.4	0.0	0.00	1.3	0.0	0.00
White-thrtd. Grd. Dove	6.3	1.3	0.20	1.8	0.7	0.67	1.5	0.0	0.00	9.3	0.9	0.22	1.0	0.4	0.50	1.6	0.8	0.67	3.6	0.7	0.29
Mariana Fruit-Dove	0.4	0.0	0.00	0.8	0.0	0.00	2.1	0.0	0.00				0.9	0.0	0.00				0.7	0.0	0.00
Collared Kingfisher	11.3	1.6	0.30	17.6	1.5	0.08	0.4	0.0	0.00	14.5	1.0	0.09	5.6	0.0	0.00	3.0	0.9	0.22	9.0	0.9	0.12
Micronesian Honeyeater	23.6	6.7	0.29	8.9	2.2	0.24	29.6	4.6	0.14	8.9	3.2	0.43	13.3	3.5	0.35	3.0	5.6	1.67	14.4	4.3	0.31
Rufous Fantail	102.9	54.0	0.83	151.7	49.4	0.42	14.5	2.1	0.15	48.4	17.5	0.68	41.3	29.6	0.91	132.5	53.8	0.43	86.8	36.3	0.54
Nightingale Reed-Warb.	2.9	0.3	0.25	2.1	0.5	0.33	3.5	1.0	0.42				0.5	0.0	0.00				1.5	0.3	0.17
Bridled White-eye	45.1	7.9	0.16	67.2	16.5	0.23	18.6	3.7	0.27	5.6	0.0	0.00	28.9	8.0	0.29	67.5	28.7	0.51	41.2	11.3	0.27
Golden White-eye	76.9	20.2	0.33	39.4	15.6	0.51	6.7	0.4	0.05	29.5	3.6	0.20	46.0	10.5	0.24	7.5	2.4	1.72	35.6	9.4	0.33
Micronesian Starling	3.1	0.3	0.08	2.1	0.7	0.33	5.0	0.0	0.00	2.8	1.5	0.67	2.4	0.0	0.00	0.8	0.0	0.00	2.6	0.4	0.16
Orange-cheeked Waxbill	1.7	0.0	0.00	1.2	0.0	0.00	8.3	0.0	0.00				0.9	0.0	0.00	4.8	0.4	0.13	2.8	0.1	0.01
Eurasian Tree Sparrow							5.7	0.4	0.10										0.8	0.1	0.10
ALL SPECIES POOLED	275.3	92.7	0.35	295.3	87.0	0.31	95.9	12.7	0.13	120.0	28.2	0.25	141.3	52.1	0.38	223.2	92.6	0.44	200.3	64.0	0.33
Number of Species	11	9		11	8		11	7		8	7		11	5		9	7		12	11	
Total Number of Species		12			11			12			9			11			9			13	

Figure 1. Locations of the six Tropical Monitoring Avian Productivity and Survivorship (TMAPS) stations operated during 2008-2010 on Saipan, Commonwealth of the Northern Mariana Islands, and distribution of land cover classes on the island. Station codes are listed in Table 1. Land cover data were obtained from the US Forest Service (for detail on methodology, see: http://www.fs.fed.us/r5/spf/fhp/fhm/landcover/islands/CNMI_Report.pdf).



Appendix I. Numerical listing (in AOU checklist order) of species sequence numbers, species alpha codes, and species names for birds banded or encountered during the first two years (2008-2010) of the TMAPS Program at the six stations on Saipan, Commonwealth of the Northern Marianas Islands (CNMI), Micronesia.

Cumulative breeding status for all years in which each station was operated are also included (B = Regular Breeder (all years); U = Usual Breeder (>½, not all, years); O = Occasional Breeder (<½ years); T = Transient; M = Migrant; ? = Uncertain Species ID

NUMB	SPEC	SPECIES COMMON NAME	GENUS SPECIES	Bird Island Cons. Area (BICA)	Laderan Tangke (LATA)	Sabana Talofofo (SATA)	Kingfisher (KIFI)	Mount Tapochau (MTAP)	Obyan (OBYA)
99054	MIME	Micronesian Megapode	*Megapodius laperouse*	T				T	
02900	REJU	Red Junglefowl	*Gallus gallus*	U	U	O	U	U	U
00730	WTTR	White-tailed Tropicbird	*Phaethon lepturus*	T	T	T	T	T	
00750	RTTR	Red-tailed Tropicbird	*Phaethon rubricauda*		T				
00920	GREF	Great Frigatebird	*Fregata minor*			T			
00960	YEBI	Yellow Bittern	*Ixobrychus sinensis*	U	B	U	U	T	U
99080	PRHE	Pacific Reef Heron	*Egretta sacra*	T	T	T	T	T	T
03520	COMO	Common Moorhen	*Gallinula chloropus*				T		
03690	PAGP	Pacific Golden-Plover	*Pluvialis fulva*	T		T			
05090	BRNO	Brown Noddy	*Anous stolidus*	T		T			T
05100	BLNO	Black Noddy	*Anous minutus*	T	T	T	T	T	T
05120	WHTT	White Tern	*Gygis alba*	U	U	B	U	U	B
99007	PHTD	Philippine Turtle-Dove	*Streptopelia bitorquata*	B	B	B	B	B	B
99073	WTGD	White-throated Ground-Dove	*Gallicolumba xanthonura*	B	B	B	B	B	B
99006	MAFD	Mariana Fruit-Dove	*Ptilinopus roseicapilla*	B	B	B	B	B	B
07490	MASW	Mariana Swiftlet	*Aerodramus bartschi*	T	T	O	O	U	T
99057	COLK	Collared Kingfisher	*Todiramphus chloris*	B	B	B	B	B	B
99062	MIHO	Micronesian Honeyeater	*Myzomela rubratra*	B	B	B	B	B	B
99063	RUFA	Rufous Fantail	*Rhipidura rufifrons*	B	B	B	B	B	B
99053	NIRW	Nightingale Reed-Warbler	*Acrocephalus luscinia*	B	B	B	B	U	B
99064	BRWE	Bridled White-eye	*Zosterops conspicillatus*	B	B	B	B	B	B

Appendix I. continued. Cumulative breeding status for all years in which each station was operated are also included (B = Regular Breeder (all years); U = Usual Breeder (>½, not all, years); O = Occasional Breeder (<½ years); T = Transient; M = Migrant; ? = Uncertain Species ID

NUMB	SPEC	SPECIES COMMON NAME	GENUS SPECIES	BICA	LATA	SATA	KIFI	MTAP	OBYA
99065	GOWE	Golden White-eye	*Cleptornis marchei*	B	B	B	B	B	B
99066	MIST	Micronesian Starling	*Aplonis opaca*	B	B	B	B	B	B
19990	OCHW	Orange-cheeked Waxbill	*Estrilda melpoda*	O	B	B	B	B	B
19930	ETSP	Eurasian Tree Sparrow	*Passer montanus*	T		B			