Common Myna

Jungle Myna

2015 MYNA SURVEY

Report to inform the Samoan Myna Management Plan

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GEF-PAS INVASIVES PROJECT

MNRE/DEC, SPREP, UNEP & GEF

ABSTRACT

In May 2015, 74 line transects in three different habitat types (plantation, mixed crops, urban) were surveyed on Upolu and Savai'i islands, Samoa, with an aim of estimating the population size, density and distribution of two invasive bird species, Common Myna (*Acridotheres tristis*) and Jungle Myna (*Acridotheres fuscus*). Based on the available literature, the surveyed habitats were identified as preferred foraging habitat for the two myna species. The three habitats make up 24.9% of Samoa's land area.

Survey data were analysed using the Distance program. It was estimated that the population of myna birds occurring in the plantation, mixed crops and urban habitats of Samoa is approximately 158,995 (+- 29,588). Approximately 130,030 (+- 19,837) myna were estimated to live on Upolu and 28,968 (+- 9,751) on Savai'i, across the three habitat types. Survey results also revealed that both species show a significant preference for urban habitat.

Jungle Myna were estimated to be the most numerous (population estimate: 133,925 +-24,321), occurring on both islands and in all surveyed habitat types. Jungle Myna seem to have saturated the urban habitat available in Upolu and therefore have proceeded to colonise plantations and mixed crops adjacent to urban areas.

Common Myna (population estimate: 23,367 +- 7,612), having reached the shores of Samoa ca. 20 years later than Jungle Myna, show highest density in urban environments. They are concentrated in the north-west section of Upolu, with only a few individuals observed on the east coast of Savai'i.

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Introduction

Jungle Myna (*Acridotheres fuscus*) and Common Myna (*Acridotheres tristis*) were introduced into Samoa between the 1960s and the 1980s, possibly as an attempt to control livestock insect pests, i.e. ticks and fleas (Doherty, 2006; Esera, 2012). Common Myna are known to eat a wide variety of insects (Sengupta, 1976) and in India, their native country, there is some evidence that they control agricultural crop insect pests (Kirk, Evenden, & Mineau, 1996). However, there is no evidence that they feed on cattle ticks or fleas.

There are many reasons to be concerned about the spread of Jungle Myna and Common Myna. Other than their potential effect on the insect biodiversity of Samoa, they may become severe agricultural pests, with the potential to reduce Samoa's agricultural exports. When insects are scarce, fruit and seeds make up a more important component of their diet and at such times, Common Myna can impact on agricultural production (Martin, 1996). Sixty years after their introduction to New Zealand, Common Myna have switched their diet preference from insects to fruit (Sengupta, 1976), causing agricultural crop losses (Dawson & Bull, 1970).

Mynas have also been implicated in the spread of invasive alien plants in some parts of the world, by acting as seed dispersal agents e.g. Lantana vines in Hawaii (Pimentel, Zuniga, & Morrison, 2005). In addition, mynas can potentially contribute to the spread of parasites e.g. the mite *Ornithonyssus bursa*, which can cause dermatitis in humans (Central Coast Indian Myna Action Group Inc, 2003) and disease e.g. avian malaria *Plasmodium circumflexum* (Feare & Craig, 1998), especially in areas where mynas congregate in close proximity to humans, such as communal roost sites (Peacock, Rensburg, & Robertson, 2007).

In countries where myna birds have become established they have quickly become a pest species, posing a serious threat to biodiversity (Grarock, Tidemann, Wood, & Lindenmayer, 2012; S. Lowe, Browne, Boudjelas, & De Poorter, 2004; Pell & Tidemann, 1997; Tidemann, n.d.); spreading invasive plants (Doherty, 2006); damaging fruit crops (Dawson & Bull, 1970) and acting as an annoyance to people (ABC, 2014; Central Coast Indian Myna Action Group Inc, 2003; Tidemann, n.d.).

The Jungle Myna was introduced to Apia, Samoa, in the early 1960s. It remained localised around Apia township until 1979 (Dhondt, 1976). Between 1979 and 1989 it spread rapidly around Upolu (Child, 1979; Gill, Lovegrove, & Hay, 1993; Reed, 1980) and colonised south-east Savai'i sometime after 1984 (Bellingham & Davis, 1988; Reed, 1980). During July 1986 Jungle Myna were first noted in American Samoa, possibly introduced by boat from Samoa (Engbring & Ramsey, 1989). By 1993 Jungle Myna were considered well established in Samoa (Evans, Fletcher, Loader, & Rooksby, 1992; Trail, 1994), and by 1998 they were scattered around Savai'i and common in most inhabited areas of Upolu (Gill, 1999). In 2004 the Jungle Myna was found throughout most of the northern, eastern and south-eastern parts of Savai'i (McAllan & Hobcroft, 2005).

The first record of Common Myna in Samoa is from 1988 (Beichle, 1989). It is possible they arrived by boat from American Samoa, as an individual was first sighted in Pago Pago Bay, Tutuila in 1980 (Potter, 1981). By 1992 the Common Myna was established in Apia (Evans et al., 1992) but still relatively uncommon compared to the number of Jungle Myna (Trail, 1994). Up until 1999 the Common Myna was still restricted to suburban Apia (Gill, 1999). By 2004 Common Myna had spread from Apia township to form a continuous population from at least Afega in the west, to Vailele in the east, and south to Vailima (i.e. the north-western coastal sector surrounding Apia). Outlying populations were also observed at Laulii in the east and at Faleolo International Airport, and a population was found established on Savai'i, from Siufaga south to Fatausi, in an area centred on Tuasivi (McAllan & Hobcroft, 2005).

Common Myna and Jungle Myna have been introduced to and become pests in many South Pacific countries (Gill et al., 1993). Several countries have attempted eradication or control efforts; most without monitoring programs to assess the effectiveness of control (Copsey & Parkes, 2013; Manpreet & Nagle, 2009; Nagle, 2006; Parkes & Lattimore, 2006).

Samoa's Ministry for Natural Resources and Environment (MNRE) began to manage the myna bird population in Samoa in 2004 through the use of traps (Doherty, 2006); then in 2008 the Samoan cabinet authorised the use of poison baits (Copsey & Parkes, 2013; Esera, 2012). Over a 4 year period (2008-2012) MNRE estimated a 100% increase in the number of myna birds across Upolu and Savai'i (Esera, 2012), but the method used for establishing population estimates is unknown. Since the introduction of myna control programs by MNRE no standardised monitoring system has been put in place to assess if the programs are having an impact on myna population size, density and distribution.

As part of a regional GEF-PAS Invasive Project (MNRE/UNEP/SPREP) a survey was conducted in May 2015 to establish baseline data for myna population size, density and distribution across the three most preferred foraging habitats on Upolu and Savai'i, to support the preparation of Samoa's first Myna Management Plan.

Aims

The survey aimed to:

1. estimate the population size, density and distribution of myna birds within three specific habitat types (urban, plantations and mixed crops) on the two main islands of Samoa, Savai'i and Upolu, to provide baseline data for use in the Samoan Myna Management Plan; and
2. establish standardised monitoring methods to support future population monitoring efforts.

Methods

Habitat types

A literature review suggested that myna birds in general and in Samoa, prefer disturbed habitats and urban environments (Evans et al., 1992; Manpreet & Nagle, 2009; Tidemann, 2005). In addition, previous bird surveys in Samoa did not record any myna species in

forested areas (Evans et al., 1992; SPREP, 2012). Therefore, to maximise survey effort and to make good use of limited funds and time, three habitat types most likely to be regularly used by myna birds were selected for the transect surveys: mixed crops, plantation and urban habitats. The three habitats make up 24.9% of the total surface area of Samoa. These habitat types were identified using a GIS habitat layer compiled as part of the FAO Technical Co-operation Programme (FAO, 2005). Table 1 provides a definition of each habitat type from the SamFRIS classification system (FAO, 2005).

Table 1. Description of habitat types (adapted from SamFRIS classification descriptions).

Main Category	*Description*
Plantation	Permanent agricultural installations, mostly tree crops or continued / repeated planting of crops such as coconuts or banana.
Mixed Crops	Land currently and recently cultivated with a mixture of herbaceous and tree crops such as root crops, taro, yam, cassava, breadfruit etc. This includes areas of current cropping and adjacent areas recently abandoned and now overgrown with secondary shrub and tree species.
Urban	All settlement areas, encompassing continuous developments, industrial or commercial built-up areas, scattered isolated houses, gardens and inner-city parks. All roads (hard surfaced or loose) and infrastructure related facilities (e.g. airports / airstrips, ports, wharves, sports compounds etc.)

Using QGIS the coverage area of each habitat type was determined in square kilometres (km^2) for Upolu and Savai'i (Table 2). The number of transects surveyed in each habitat type was proportional to its area of coverage.

Table 2. Area of each habitat type by island and the number of transects within each habitat type.

	Area (km^2)		*Number of transects*	
Habitat	*Upolu*	*Savai'i*	*Upolu*	*Savai'i*
Mixed Crops	77.7	24.83	9	3
Plantation	269.83	263.67	25	25
Urban	59	18.15	8	4
Total	406.53	306.65	42	32

Surveys

Several methods to estimate population were considered: counts at landfill sites, roost counts and transect surveys. As there is only one designated landfill site on Upolu and one on Savai'i, it was decided that counts at landfill sites would not provide a good estimate of the total population. Roost counts were considered to be impractical at this stage due to the time it would take to locate enough active roosts. Transect surveys, within the myna

foraging habitats, were selected as they allow for a large area to be quickly surveyed and can provide robust population estimates and a basis for ongoing monitoring.

Using Distance and QGIS (QGIS Development Team, 2015) software a random stratified grid design was used to establish 74 x 1 km long survey transects proportionally distributed across the three selected habitat types (plantation, mixed crops, urban) (Table 2) on the two main islands of Samoa, Upolu (Map 1) and Savai'i (Map 2). Forty two transects were surveyed on Upolu and 32 on Savai'i.

From preliminary eradication trials on St Helena and Ascension islands there is some evidence that Common Myna forage within 3 km of their communal roots (Feare, 2010). In Samoa, positioning transects at least 3 km apart would reduce the total number of transects to a non-statistically viable level. As such, it was decided that 2 km would be the minimum distance between transects to minimize possible double-counting of birds and obtain a statistically robust number of samples.

Transect surveys were undertaken during May 2015. All transects (Maps 1 and 2) were located along roads (Maps 3 and 4) and were surveyed from a 4WD utility vehicle, which was driven at an average speed of 5.5 km/hour. Two survey teams were in the vehicle; each team comprised an observer and a scribe. One team surveyed the left side of the road and the other surveyed the right side. The same observers were used for all transects and stayed on their respective sides of the vehicle to maintain consistency. The observers and scribes were staff from MNRE/DEC whom were in-service trained in myna bird surveying.

Transect surveys commenced each morning 10 minutes after sunrise, to allow the myna birds time to disperse from their roost sites, and continued for 2.5 hours. Afternoon surveys commenced 3 hours before sunset and continued for 2 hours. Survey times were based on the periods of the day when myna birds are most active and visible. On average 3-4 transects were surveyed during each morning / afternoon period.

All myna birds seen on the ground or perched, were counted. Their perpendicular distance from the vehicle (i.e. perpendicular distance from the transect line) was estimated in metres. Practise with MNRE/DEC staff/observers in estimating distances was carried out prior to the surveying. Where possible, myna birds were recorded to species level, otherwise just to genus. This information was recorded on a data sheet (Annex 1) and later entered into Excel.

Data analysis

Bird survey data were entered into the population estimating programme Distance, along with transect length, habitat type and total coverage area (km^2) of each surveyed habitat.

Outputs from the Distance programme show the myna population size for both islands, with a standard error (SE) and 95% confidence intervals, and the density of birds per square kilometre, with a standard error (SE) and 95% confidence intervals. The data from each island were analysed separately and where possible the density per habitat type and/or by myna species was also estimated. Myna bird density was calculated by the Distance

programme by dividing the estimate of population size (n. of birds) by the area of habitat surveyed (km^2).

Standard error bars were used to indicate the accuracy of the population estimates. Standard error is a statistical term that measures the accuracy with which a sample represents a population. In statistics, a sample mean deviates (is different) from the actual mean of a population; this deviation is the standard error. The smaller the standard error, the more representative the sample will be of the overall population. The standard error is also inversely proportional to the sample size; i.e. the larger the sample size, the smaller the standard error because the statistic will approach the actual value (McDonald, 2014).

To allow for more detailed analysis the island of Upolu was further divided up into two sections: the north west (highly urbanized) and the rest of Upolu (less urbanized, comparable to Savai'i) (Table 3), with approximately even representation of transects and habitat types in each section.

In some instances there were insufficient records of myna birds in each habitat for Distance to make a reasonable density estimate. In these cases the data was pooled across habitat types and analysed to obtain a reasonable density estimate.

Table 3. Area of each habitat by section on Upolu and the number of transects in each section.

	Area (km^2)		*Number of Transects*	
Habitat	*NW Upolu*	*Rest of Upolu*	*NW Upolu*	*Rest of Upolu*
Mixed Crops	35.23	42.46	4	5
Plantations	114.66	155.23	12	13
Urban	44.05	13.96	5	3
Total	193.94	211.66	21	21

While commuting between transects and other locations, any myna birds that could be positively identified to species level were recorded. A GPS location was taken where the bird(s) were sighted and a note was made about the number of individuals.

The preference of myna birds for one of the three foraging habitats was assessed by comparing the habitat availability to the relative occurrence of myna birds in each habitat.

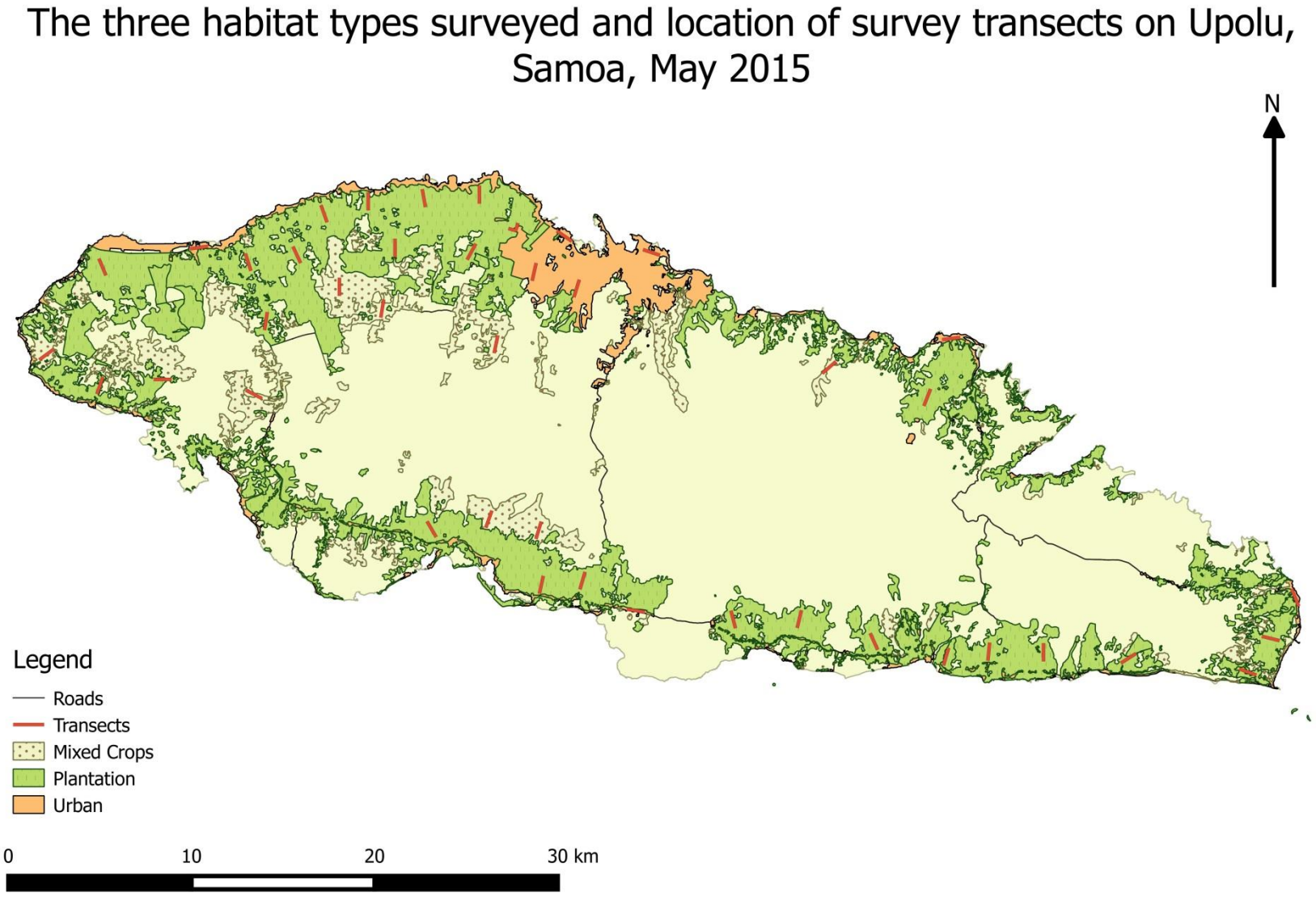
Habitat availability is derived by comparing the proportion of a surveyed habitat (measured in km^2) divided by the total area of surveyed habitat, as shown in the equation below.

Habitat availability = a*rea of habitat surveyed / total area of surveyed habitats*

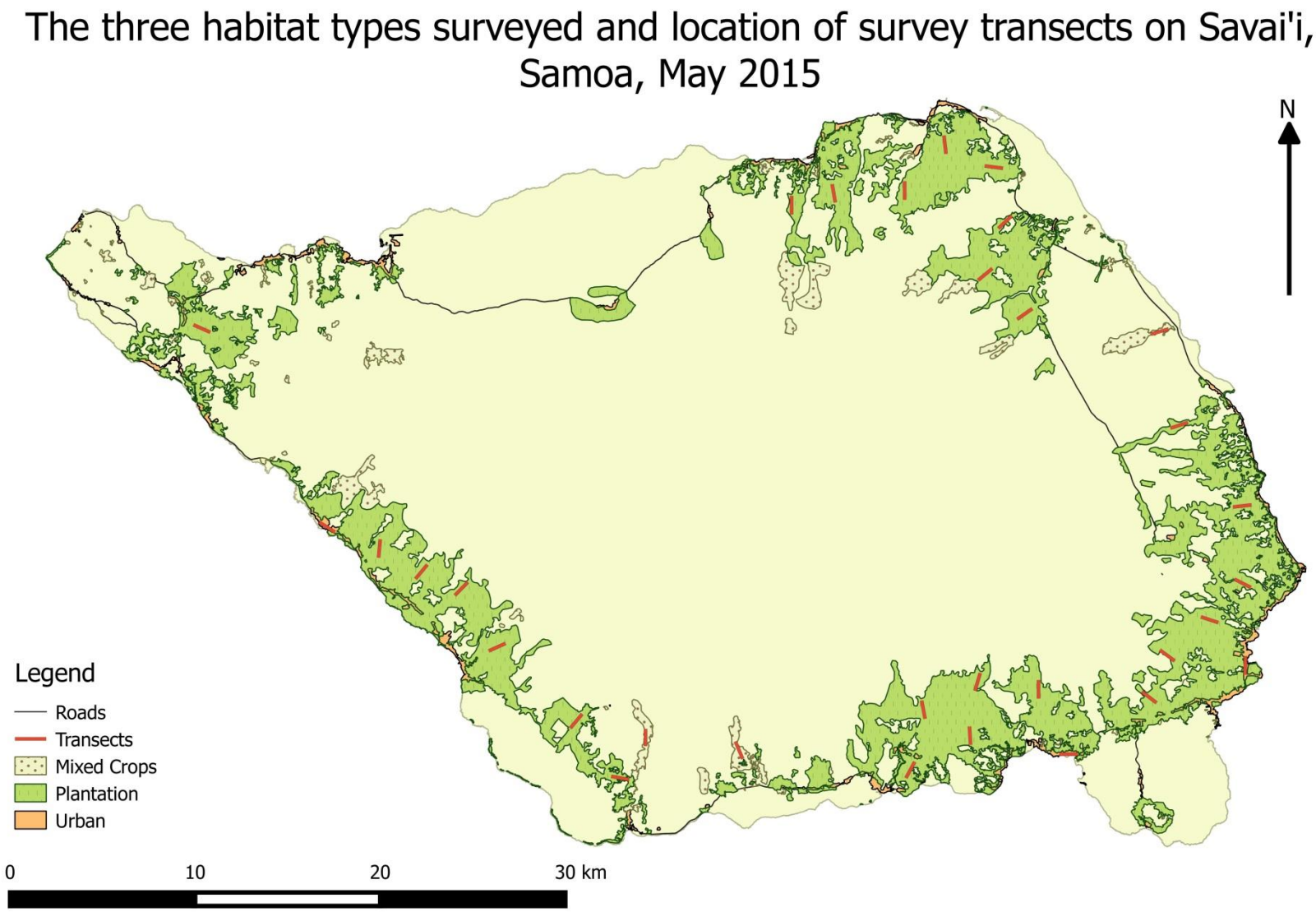
i.e. the habitat availability of urban habitat on Upolu
= 44.05 (area of urban habitat) /193.94 (total area of surveyed habitats)
= 0.227

Relative occurrence is the number of birds in a habitat divided by the total number of birds across all habitats surveyed.
Relative occurrence = *number of birds in a surveyed habitat/total number of birds counted*

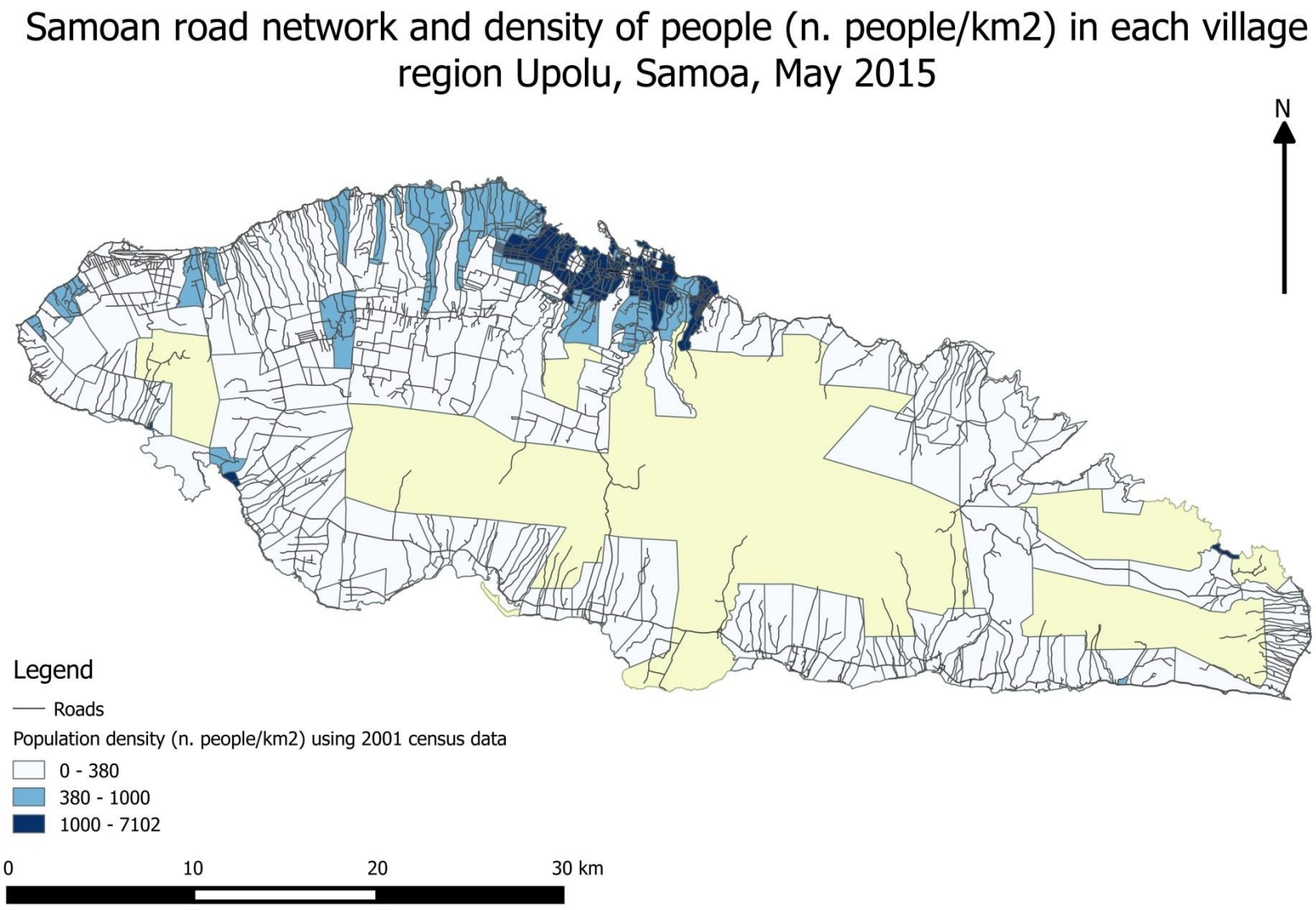
across all surveyed habitats



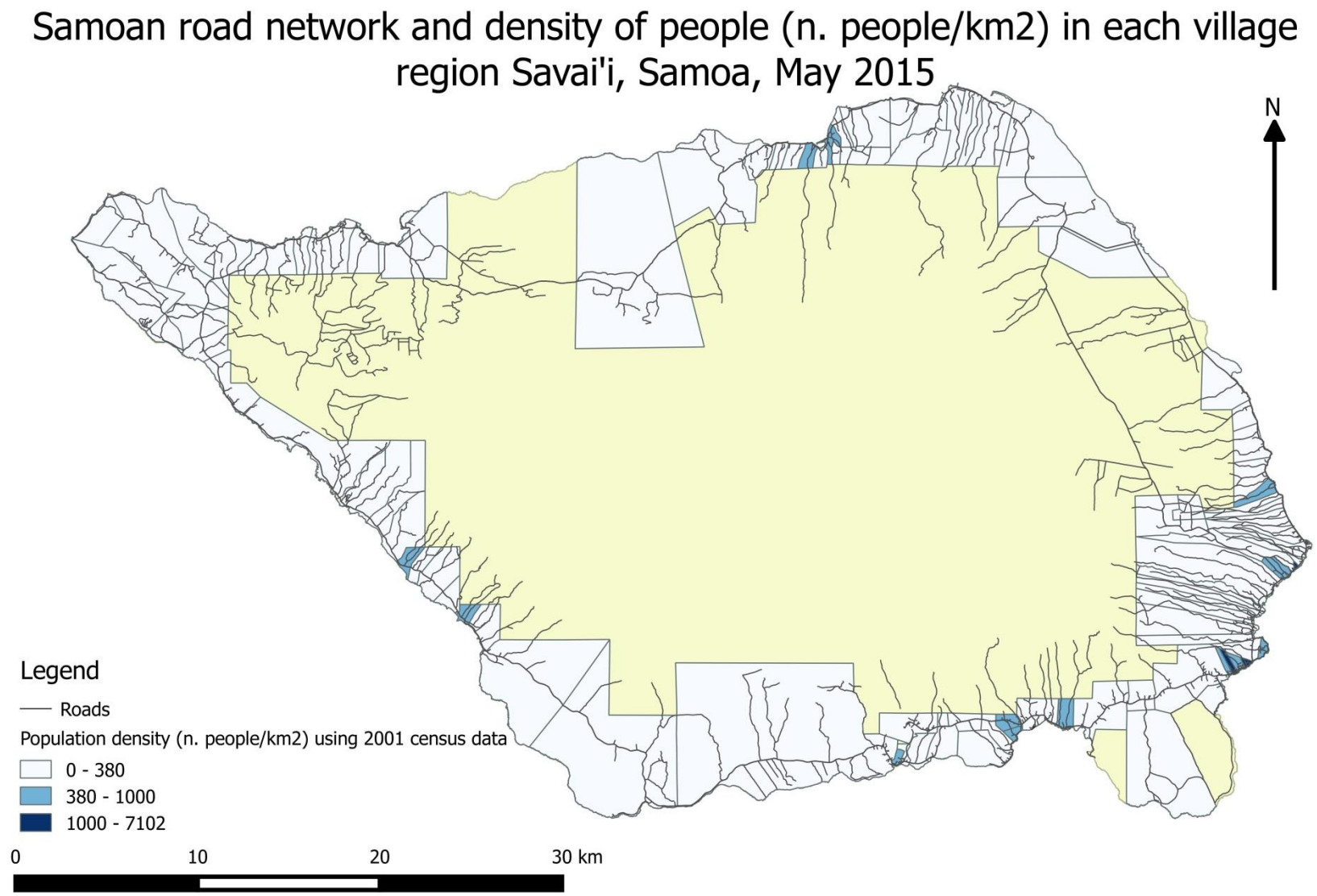
Map 1. Distribution of survey transects and habitats surveyed on Upolu, Samoa.



Map 2. Distribution of survey transects and habitats surveyed on Savai'i, Samoa



Map 3. Average density of people per village region (2001 census data) and road network on Upolu, Samoa.



Map 4. Average density of people per village region (2001 census data) and road network on Savai'i, Samoa.

Results

Transects

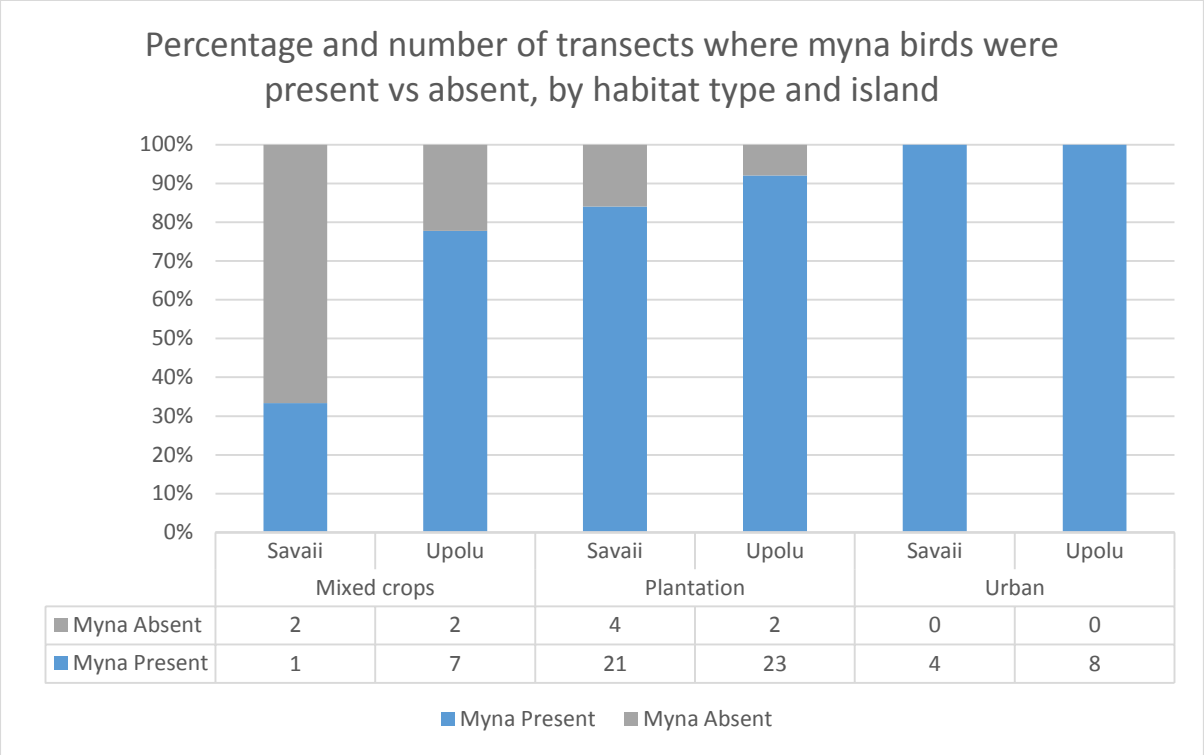


Figure 1. Percentage and number of transects with myna birds present vs absent by habitat type and island.

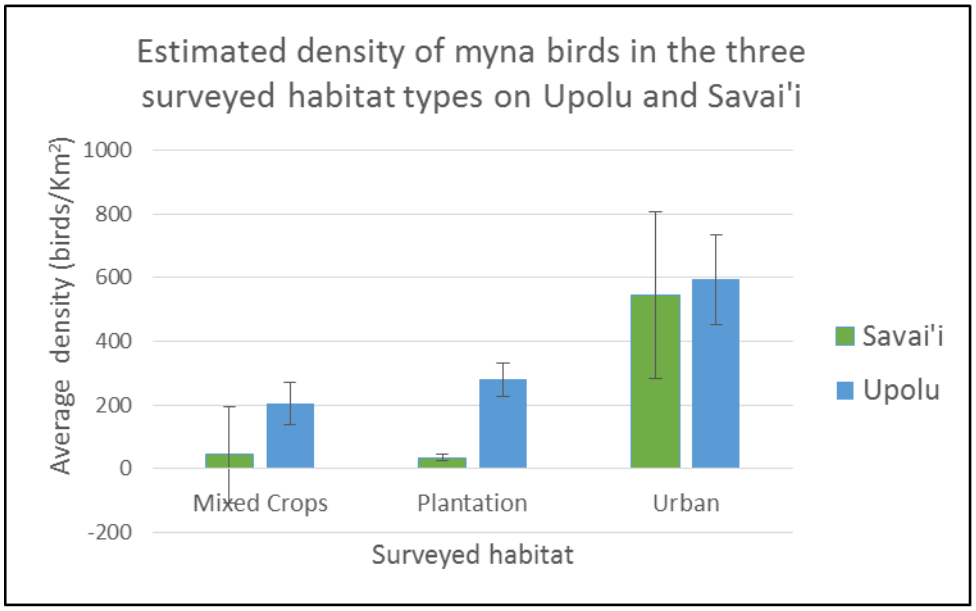
On Upolu myna birds were recorded in 7 of the 9 mixed crop transects, 23 of the 25 plantation transects and all 8 urban transects (Figure 1). On Savai'i myna birds were recorded in 1 of the 3 mixed crops transects, 21 of the 25 plantation transects and all 4 urban transects.

Distance analysis

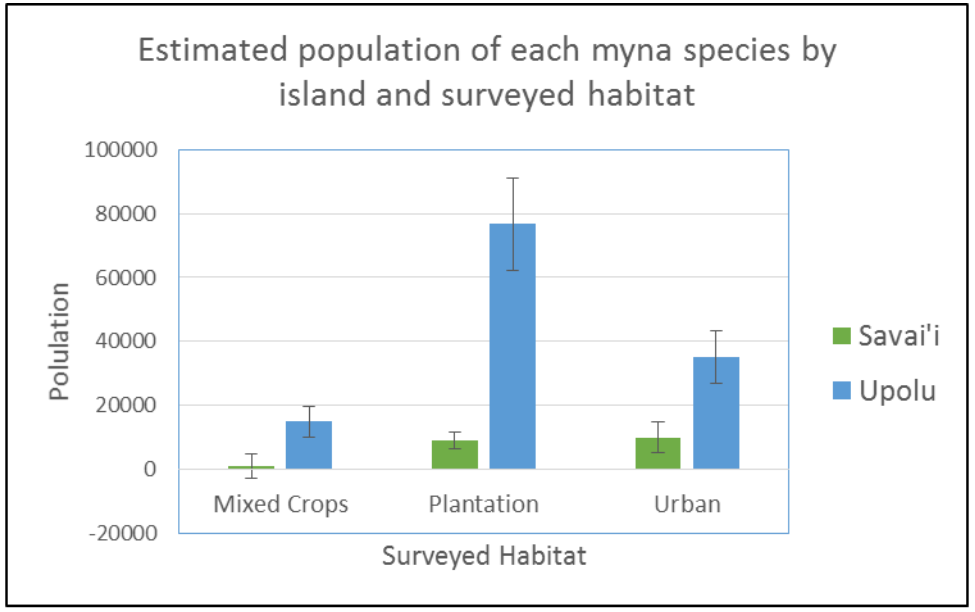
The Distance programme estimated the population of myna birds in Samoa to be 158,995 with a standard error (SE) of +/- 29,588 (Table 4). The total number of myna birds for each island, and the total number of each species on each island, were also calculated (Table 4). As Common Myna birds were not recorded on any of the Savai'i transects a population estimate could not be made.

Table 4. Estimated population size and density (n. birds/km^2) for both myna species on each main island and within each habitat type.

All Myna records	Population size	Range (based on SE)	Density	Range (based on SE)
Savai'i	28,965	19,214 – 38,716	94	63 - 126
Mixed Crops + Plantation	9,894	6,996-12,792	34	24 - 44
Urban	9,904	5,167 – 14,641	545	285 - 807
Upolu	130,030	110,193 – 149,867	320	271 - 370
Mixed Crops	14,879	10,043 – 19,715	205	139 - 272
Plantation	39,097	31,452 – 46,742	281	228-333
Urban	35,082	26,766 – 43,398	594	454 - 736
Samoa Total	**158,995**	**129,407-188,583**		



a)

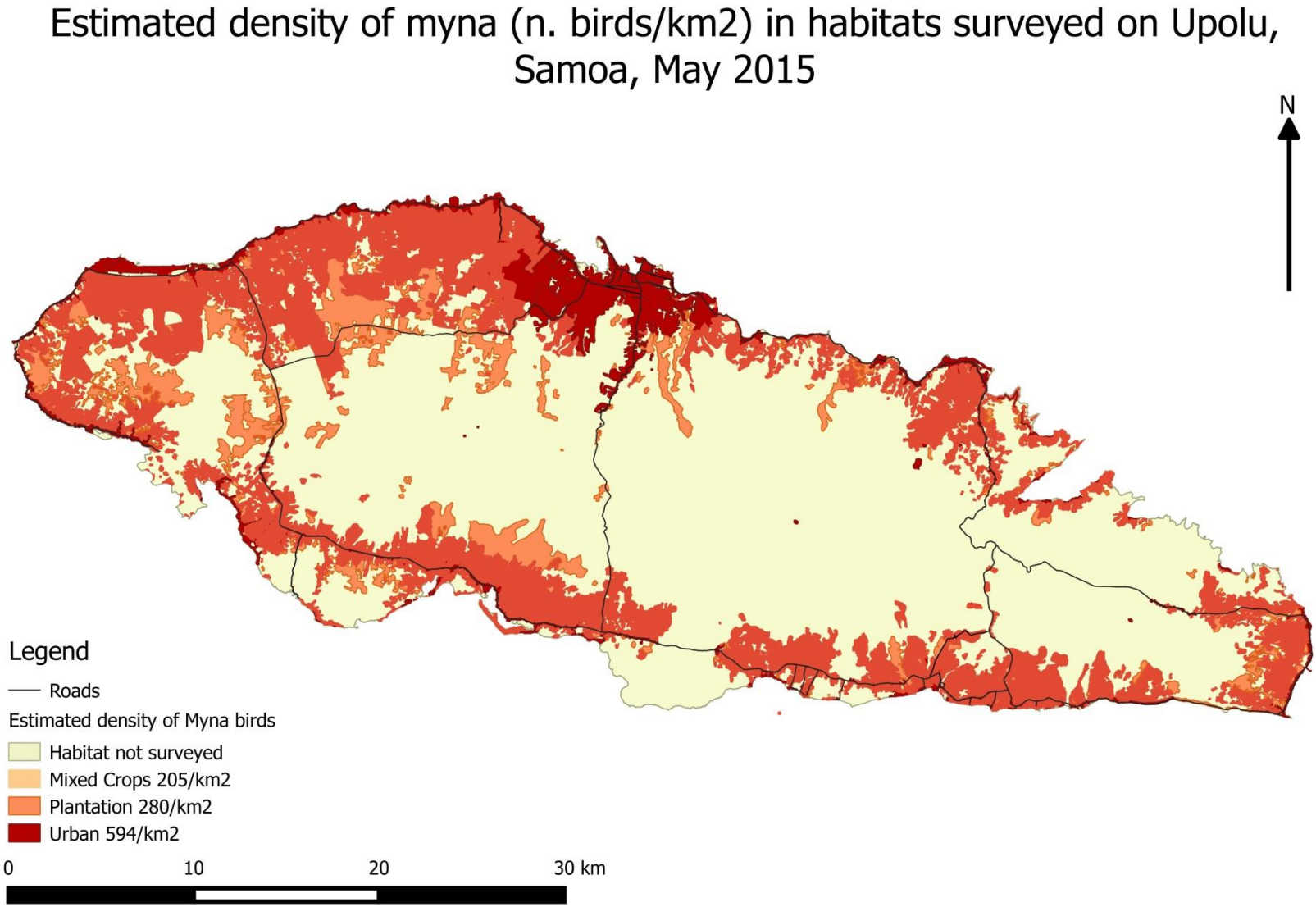


b)

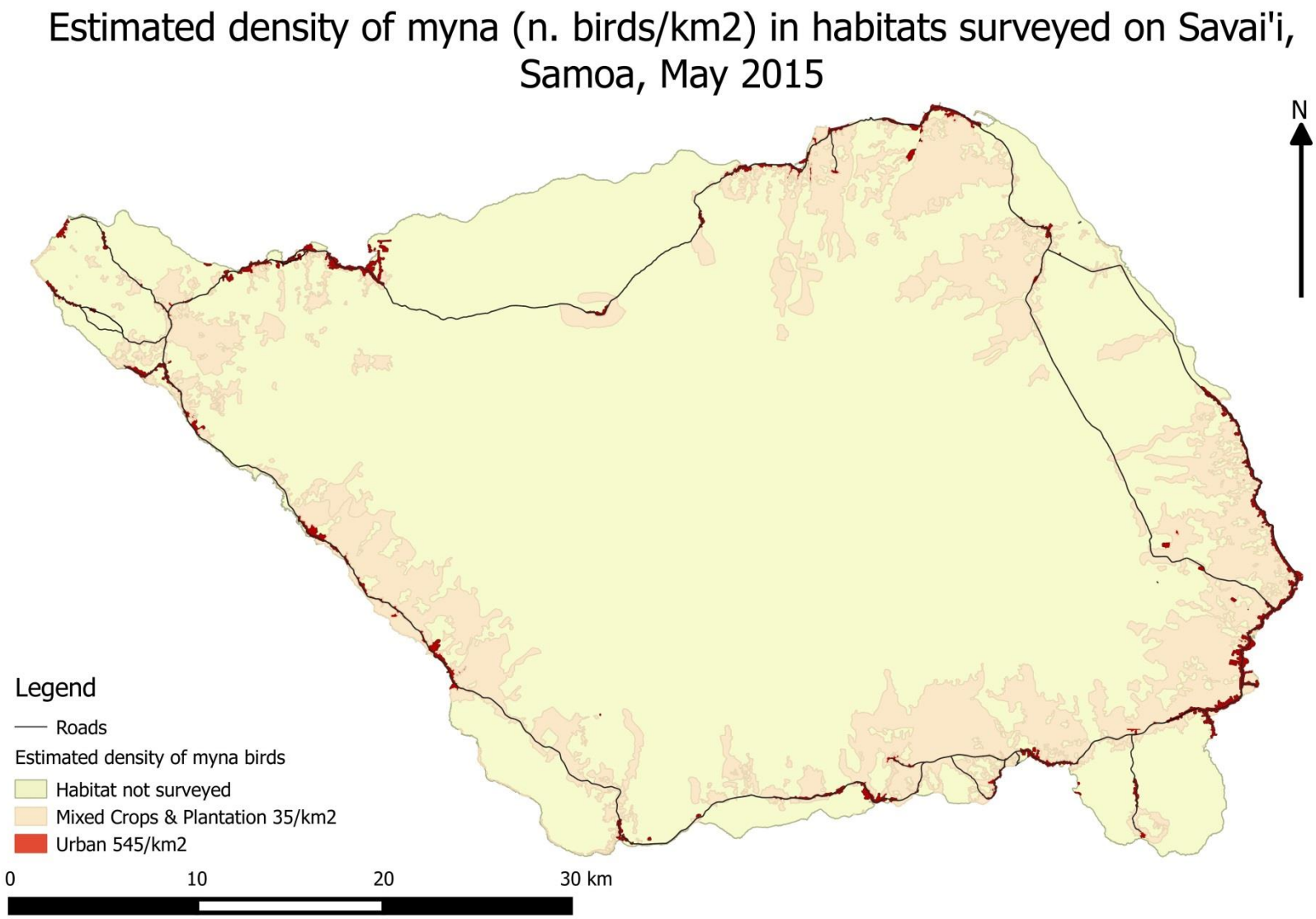
Figure 2. Estimated a) density and b) population of myna birds by surveyed habitat type on each of the two main islands of Samoa. With standard error bars.

From the data in Table 4 we can see that Upolu recorded the highest population (130,030) and density (320/km^2) of myna birds between the two islands. Upolu also recorded highest densities in all habitats. The density of myna birds in the urban habitat on both Upolu and Savai'i is very similar and much greater than the densities recorded in the other habitat types. On Upolu the plantation habitat is the next most densely populated habitat followed by mixed crops. On Savai'i the density of myna birds in the mixed crops and plantation habitat is much lower than all the other recorded densities.

The highest densities of myna birds were recorded in the urban habitat of both islands (Figure 2 a), but in terms of absolute numbers the highest figure was recorded in the plantations of Upolu (Figures 2 b). The information from Table 4 is also presented in the corresponding Maps 5 and 6.



Map 5. Estimated density of myna birds in the three habitat types surveyed on Upolu, Samoa



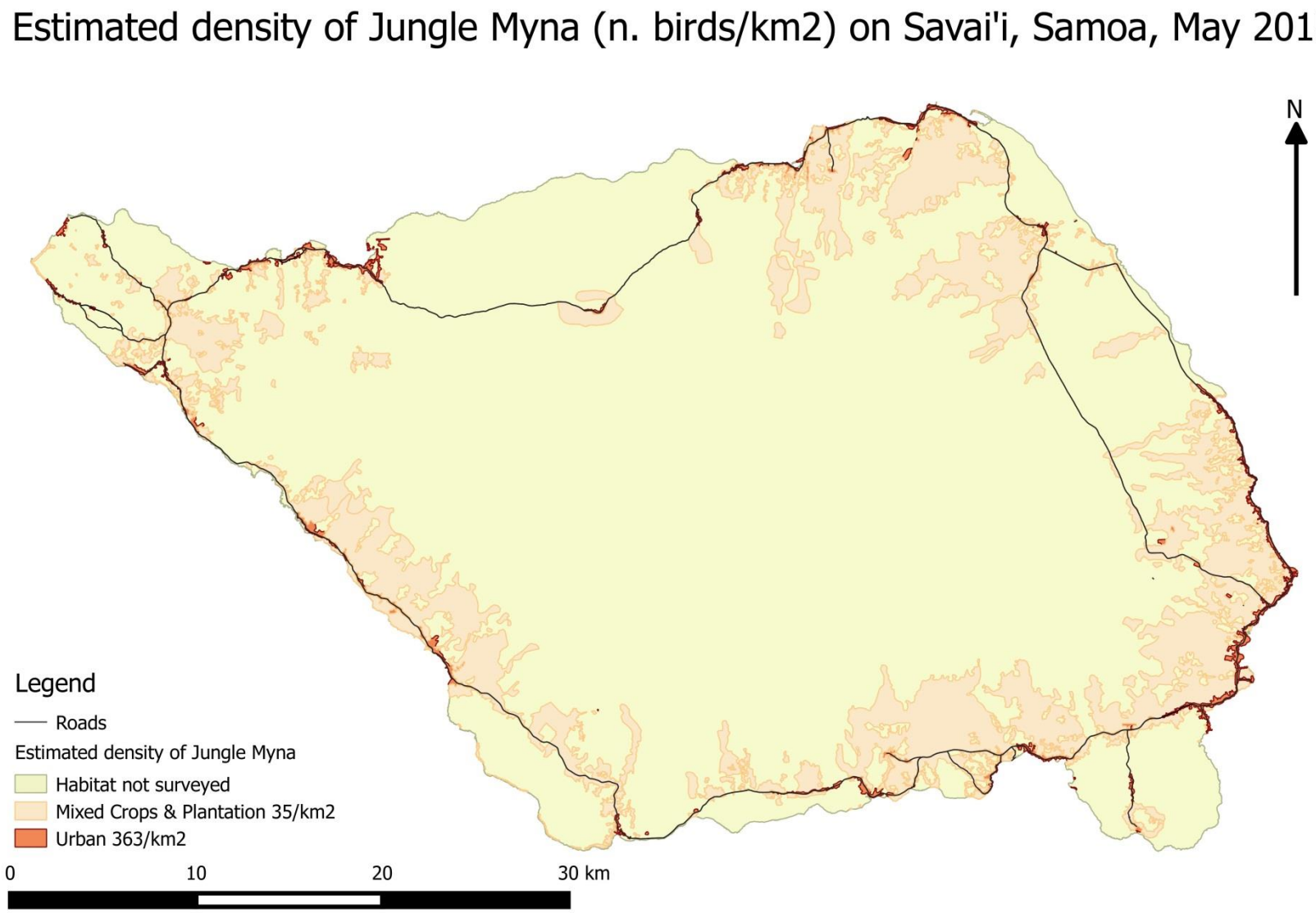
Map 6. Estimated density of myna birds in the habitat types surveyed on Savai'i, Samoa

Table 5. Estimated population of each myna species on each island and within each habitat type

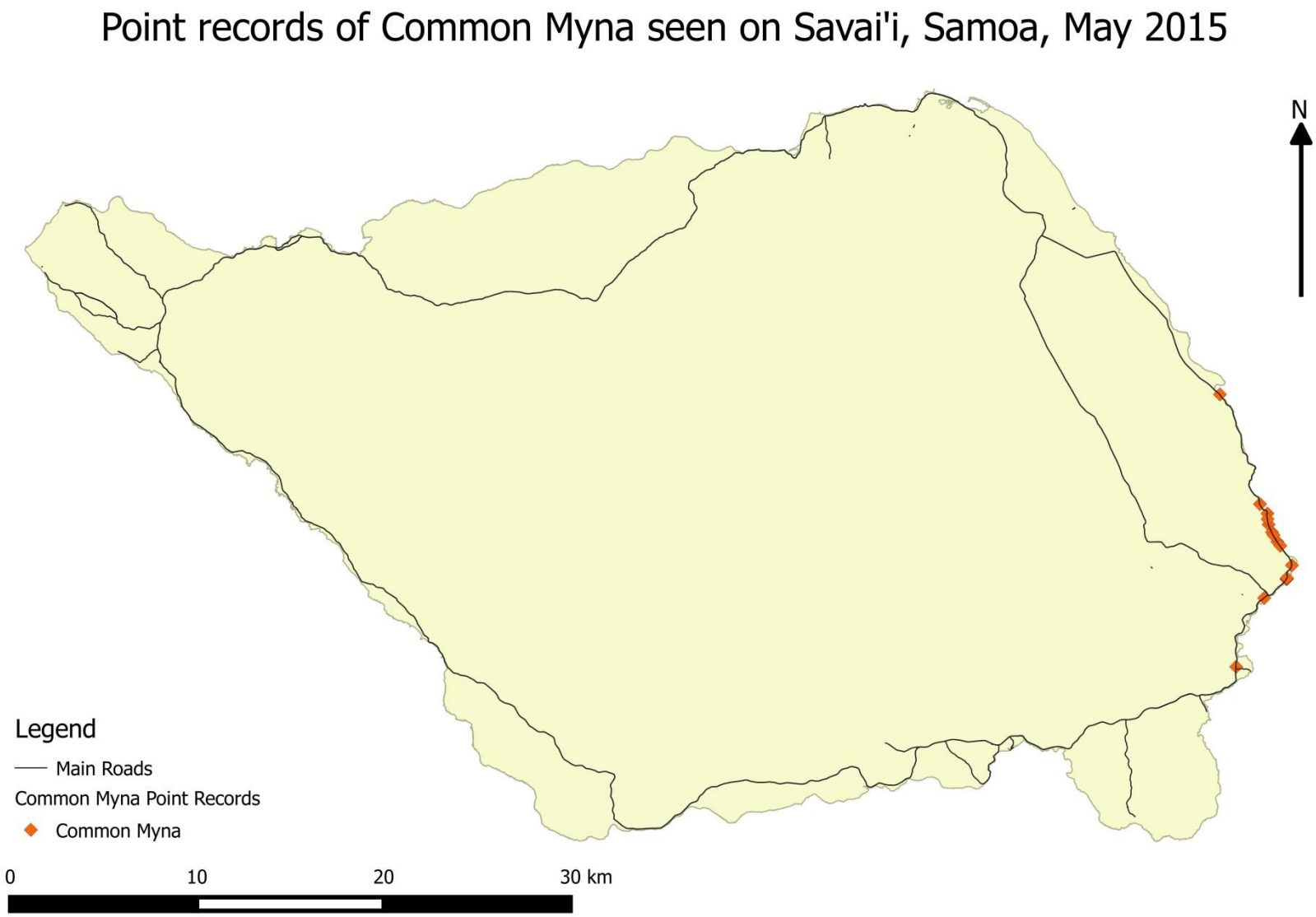
Jungle Myna	Population size	Range (based on SE)	Density	Range (based on SE)
Savai'i	25,872	17,369 – 34,375	84	57 - 112
Mixed Crops + Plantation	10,162	7,064-13,260	35	24 - 46
Urban	6,584	3,595-9,573	363	198-527
Upolu	104,960	90,390 – 119,530	258	222 - 294
Mixed Crops	14,761	10,615-18,907	190	137-243
Plantation	66,234	52,122-80,346	245	193-298
Urban	17,753	12,656-22,850	301	215-387
JM Samoa Total	***133,925***	***109,604-158,246***		
Common Myna	**Population size**	**Range (based on SE)**	**Density**	**Range (based on SE)**
Savai'i	NA	NA	NA	NA
Upolu	23,367	15,755 – 30,979	163	110 - 216
CM & JM Samoa Total	***157,292***	***125,359-189,225***		

Table 5 shows the estimated populations and densities of each species of myna bird on the two main islands and within the surveyed habitat types. Jungle Mynas are the most populous myna on both islands. On Savai'i the density of Jungle Myna varies from 34 birds/km^2 in the mixed crop and plantation habitats, to 363 birds/km^2 in the urban habitat. There is less variation in the density of Jungle Mynas on Upolu with the densities ranging from 189 birds/km^2 in mixed crops habitat to 301 birds/km^2 in urban habitat. While the density of Jungle Myna in the urban habitat of Savai'i and Upolu is similar, the densities of Jungle Myna in the plantation and mixed crops on Savi'I is much lower than on Upolu. There are about four times more Jungle Myna (104,960) on Upolu than Common Myna (23,967). We were unable to estimate a density for Common Myna on Savai'i as none were recorded along transects. The density of Common Myna on Upolu is much lower than the Jungle Myna.

Map 7 shows the estimated density and distribution of Jungle Myna on Savai'i. There were several incidental sightings of Common Myna on Savai'i. This data is displayed in Map 8.



Map 7. Average density of Jungle Myna in surveyed habitat types on Savai'i, Samoa



Map 8. Point records of Common Myna sighted during surveys on Savai'i, Samoa.

Table 6 shows a more detailed analysis of the myna data from Upolu. Here the densities of myna birds in the north-west section is presented along with myna densities for the rest of Upolu. It is clear that there are more than four times the number of myna in the north-west section than in the rest of Upolu (Table 6). The densities of myna birds for each of the surveyed habitats in the north-west section is greater than the corresponding habitats on the rest of Upolu. Overall the urban habitat in the north-west section has the highest density of myna birds (693 birds/km^2).

Table 6. Estimated population and density (n. birds/km^2) of myna birds in the north- west (NW) section of Upolu vs the rest of Upolu.

Upolu	Popn size	Range (SE)	Density	Range (SE)
NW Upolu	106,070	88,345 – 123,795	547	456 - 638
Rest of Upolu	26,305	21,164 – 31,446	124	100 - 149
NW Upolu (MC)	12,815	9,882 – 15,748	364	280 - 447
Rest of Upolu (MC)	2,652	1,347 – 3,957	62	32 - 93
NW Upolu (PL)	60,273	47,300 – 73,246	526	413 - 639
Rest of Upolu (PL)	15,499	12,718 – 18,280	100	82 - 118
NW Upolu (UR)	30,533	20,947 – 40,119	693	476 - 911
Rest of Upolu (UR)	4,715	3,336 – 6,094	338	239 - 436

The information from Table 6 is visually presented in Figure 3 and Map 10 and 11.

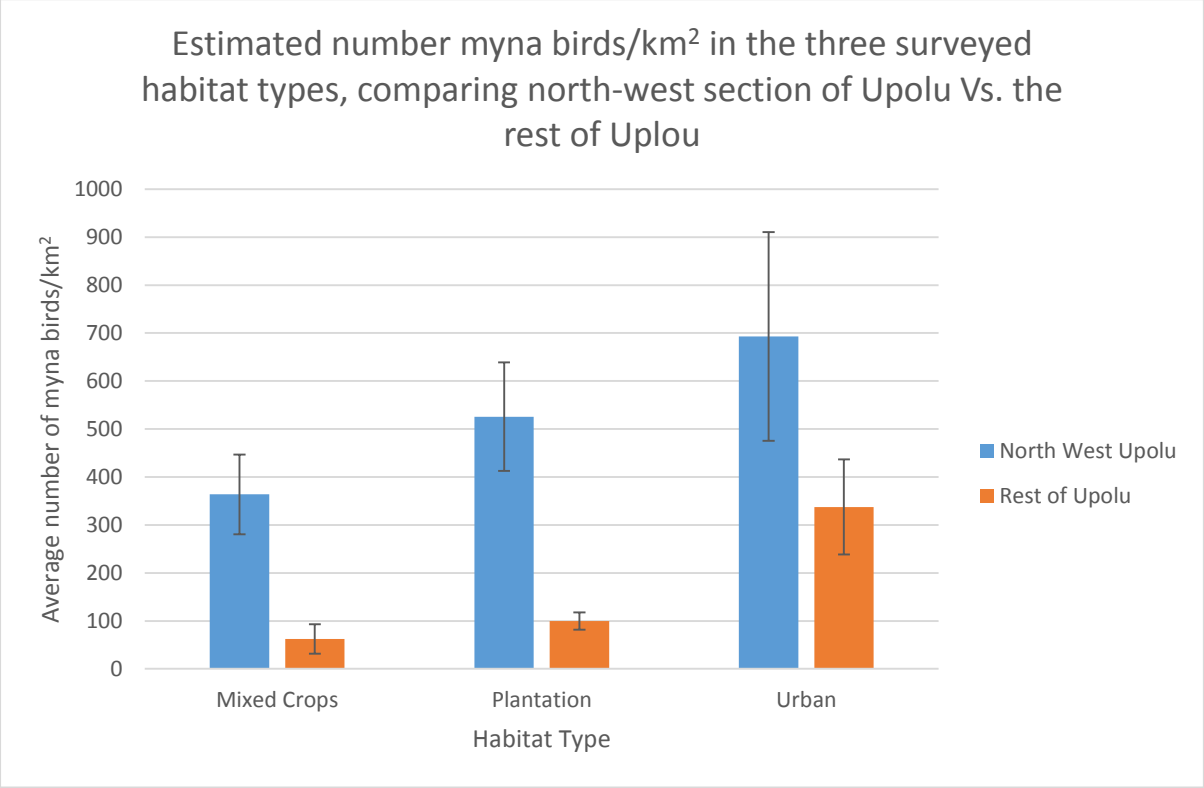
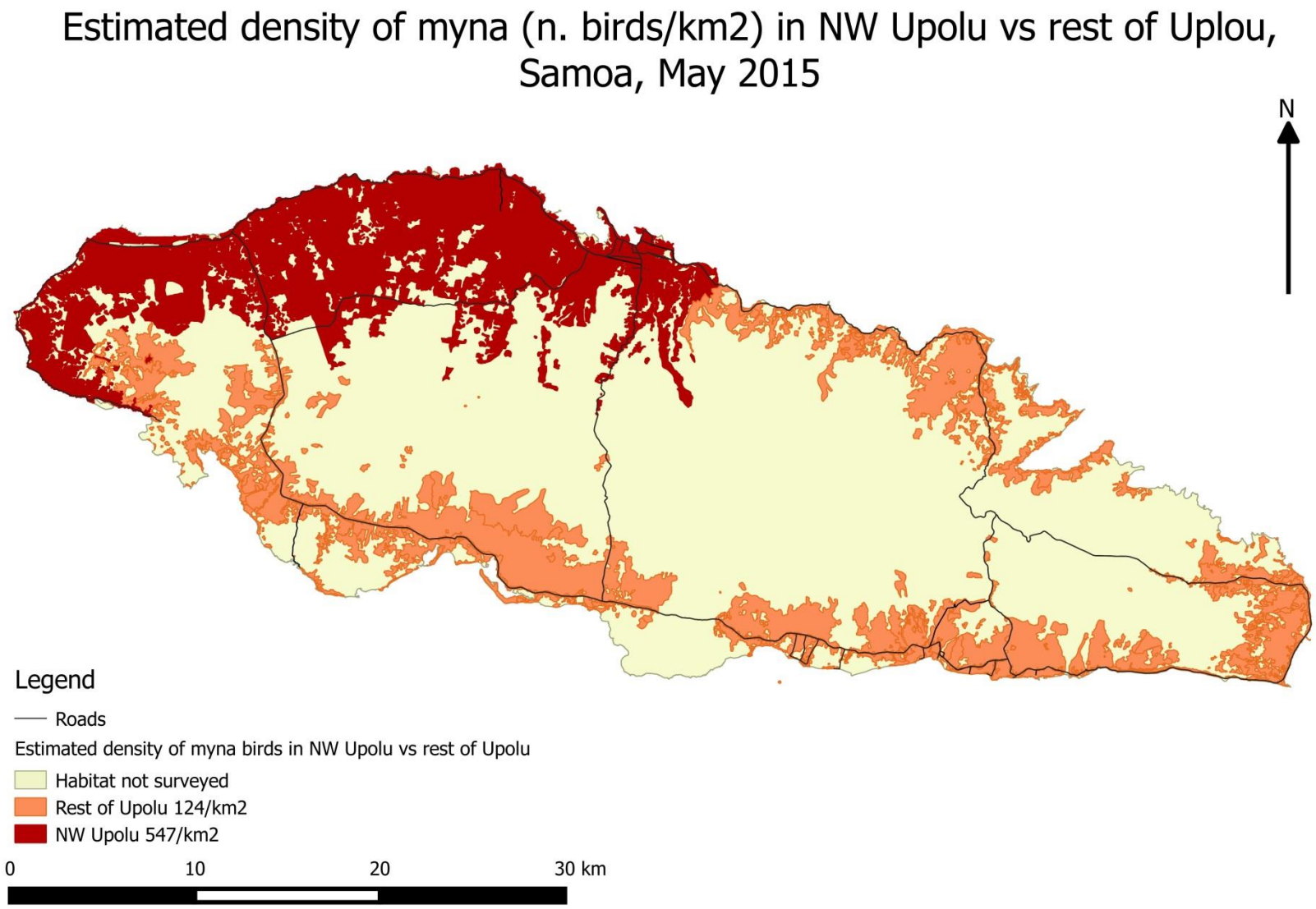
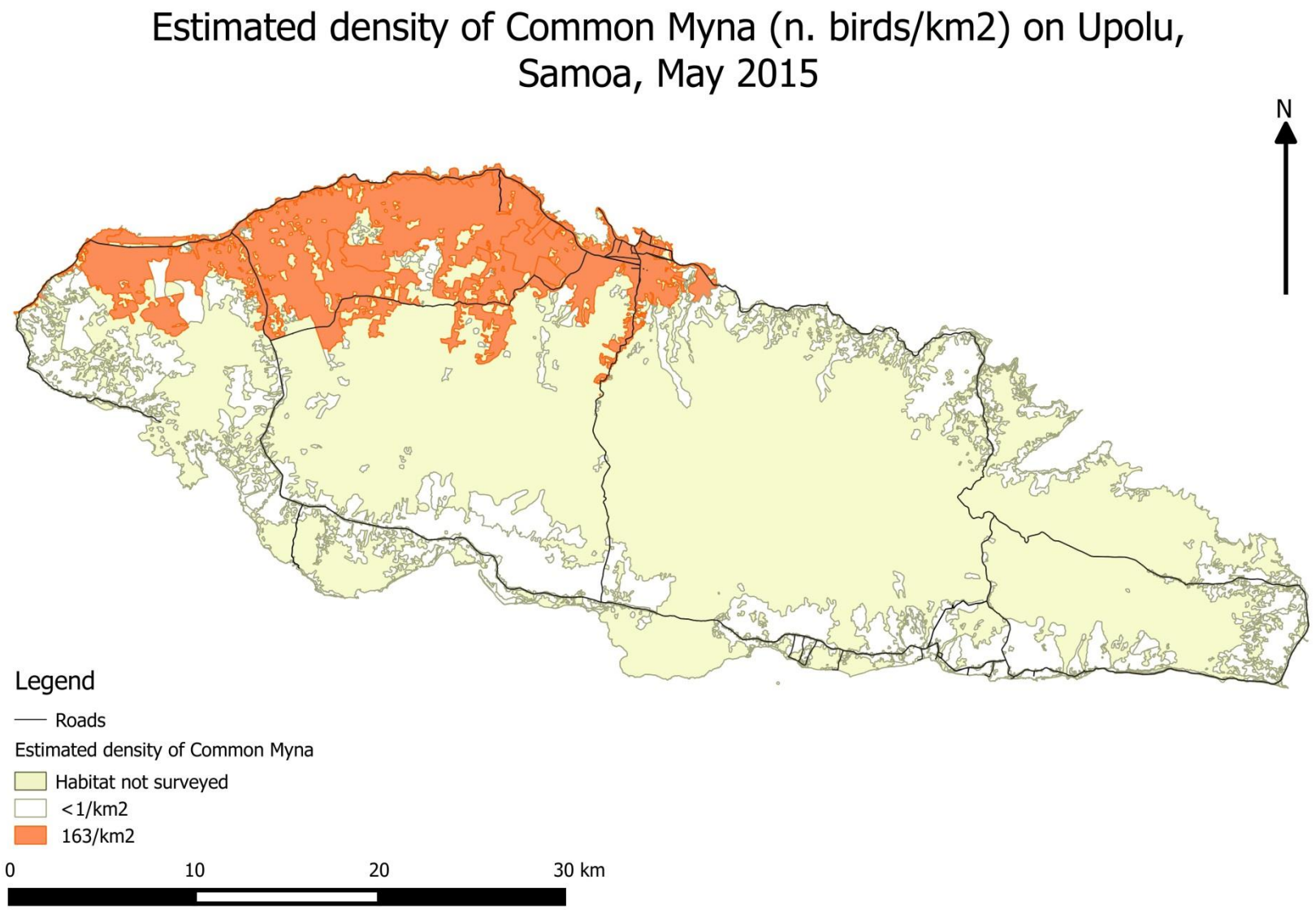


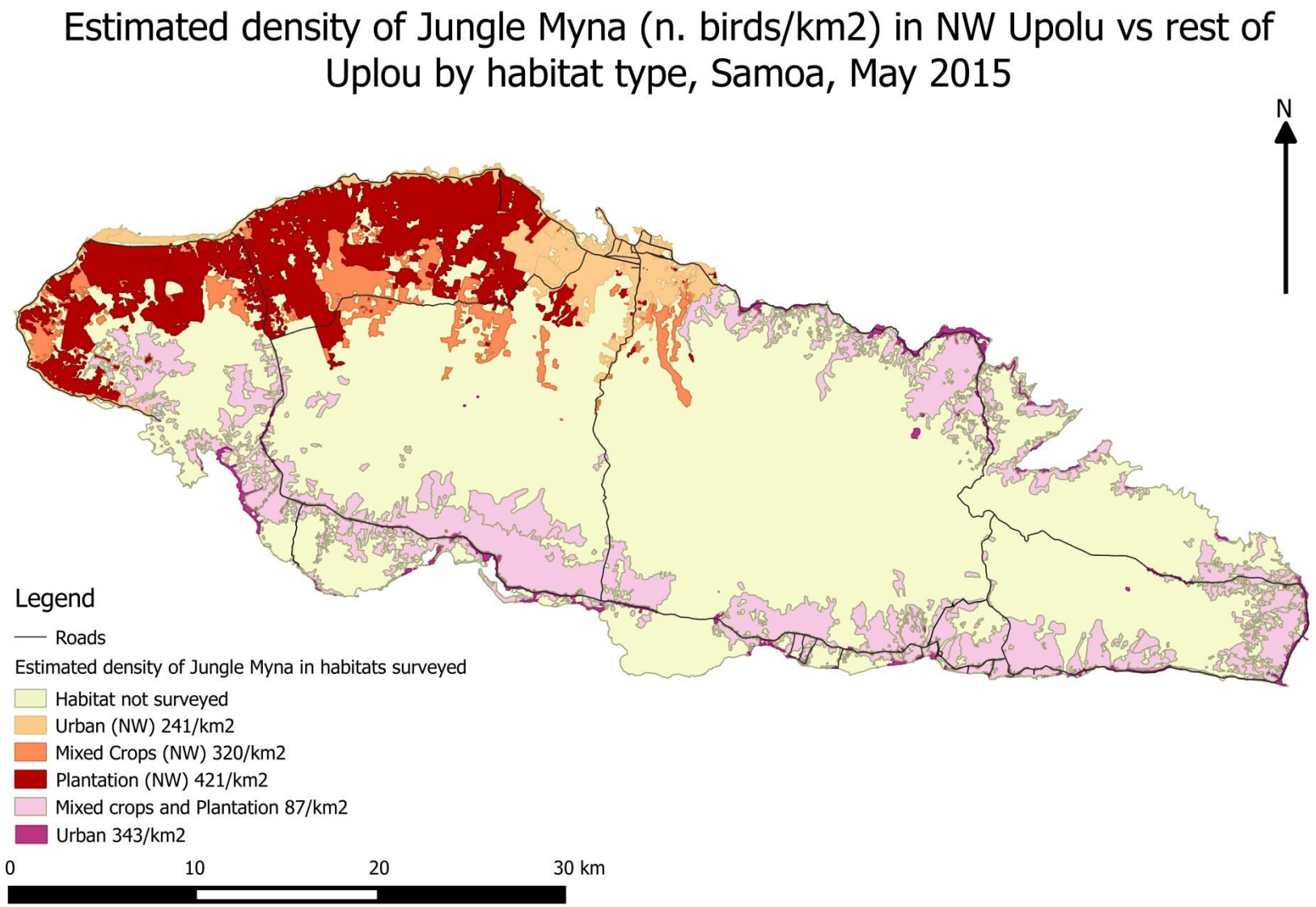
Figure 3. Average density of myna birds recorded in the three surveyed habitats, comparing north-west section of Uplou against the rest of Uplou. Data from table 6.



Map 9. Average density of myna birds in NW Upolu vs rest of Upolu, Samoa.



Map 10. Average density of Common Myna in the habitats surveyed on Upolu, Samoa



Map 11. Average density of Jungle Myna on Upolu, comparing surveyed habitats in NW section to surveyed habitats in the rest of Upolu, Samoa.

The comparison of percentages of availability of the three habitats versus the relative occurrence of myna birds shows a significant preference of both species for the urban habitat (Figures. 4-6).

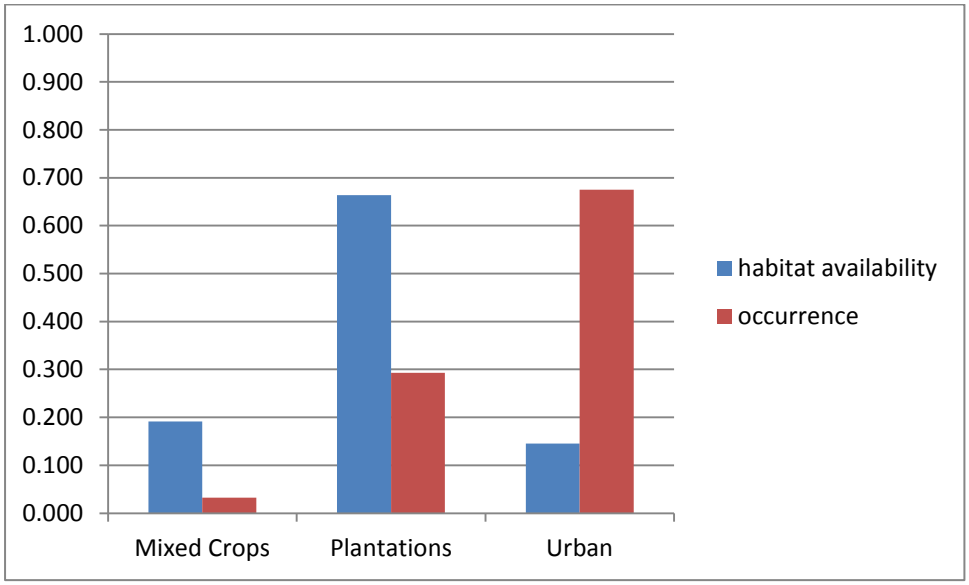


Figure 4. The proportion of available habitat versus the relative occurrence of Common Mynas in the three surveyed habitats on Upolu.

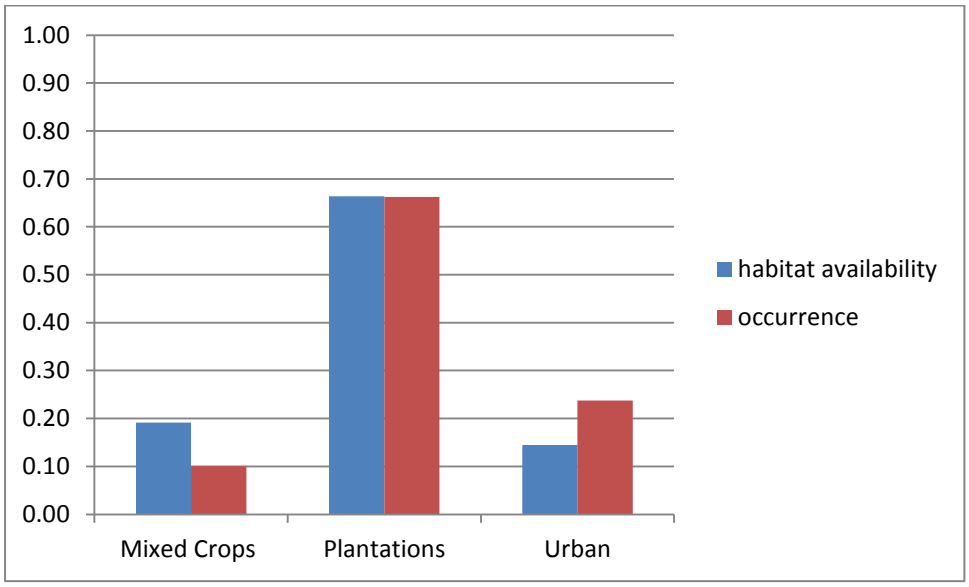


Figure 5. The proportion of available habitat versus the relative occurrence of Jungle Mynas in the three surveyed habitats on Upolu.

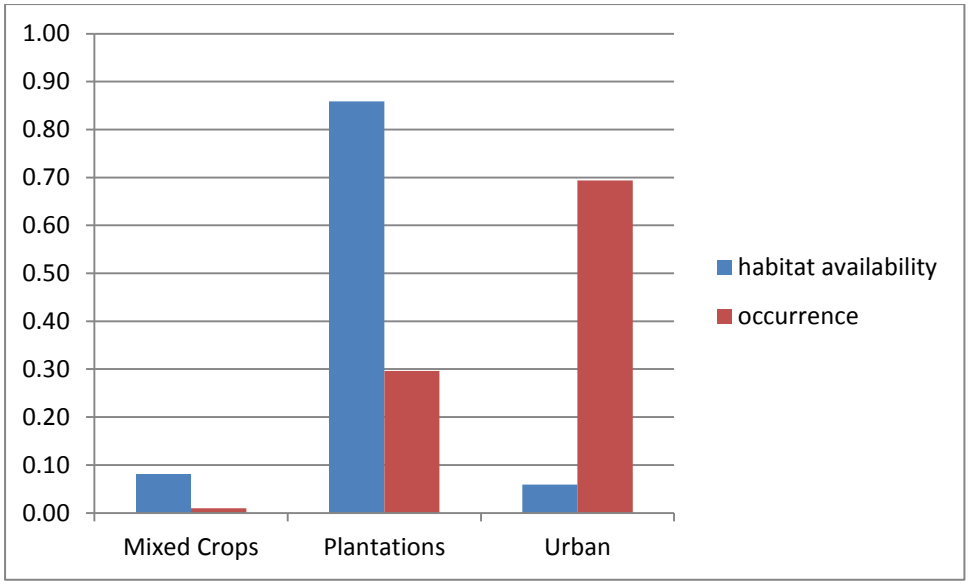


Figure 6. The proportion of available habitat versus the relative occurrence of Jungle Mynas in the three surveyed habitats on Savai'i.

Discussion

Population of myna birds

Based on the results of the surveys it is estimated that in May 2015 the population of myna birds (both Common and Jungle Myna combined) occurring within the three habitats surveyed in Samoa is between 129,407 and 188,553 (158,995 +- 29,588). It is also estimated that the total population of myna birds on Upolu is approximately 130,030 +- 19,837, and the population on Savai'i (mostly Jungle Myna) is approximately 28,968 (+- 9,751). These figures clearly reflect the history of invasion by the two species in Samoa; both species were introduced to Upolu first, with Jungle Myna being introduced approximately 20 years earlier than Common Myna.

We speculate that these estimates are ca. 10-20% lower than the actual total population occurring within Samoa to allow for the fact that less preferred habitats by myna birds, according to literature, were not surveyed (e.g. mangroves, and secondary forest).

However, the data collected will serve well as baseline information that can be used in the future, by means of the same survey method, to monitor the occurrence of this invasive species on Samoa.

Distribution of myna population

From our results we can see that the population and density of myna birds is not evenly distributed between the two main islands. The island of Upolu has a significantly larger myna population than Savai'i, with both species of myna mostly recording higher densities on Upolu on an overall basis, most likely due to the fact that they have been present on Upolu for longer and there is a lot of favourable habitat.

Of the three habitat types myna bird densities were highest in the urban habitat, on both islands, followed by the plantation and mixed crops habitat types. Both species show a significant preference for the urban habitat type, where most infrastructure is located, including roads (which act as invasion corridors), and where the highest density of people is found. This is consistent with the history of invasion and with the fact that both myna species benefit from living in close association with humans (Canning, 2011; Manpreet & Nagle, 2009; Tidemann, 2005), as people create favourable habitat for the mynas.

Due to the above, the majority of the myna population on Upolu is found in the north-west section, from Apia past Mulifanua wharf to Monono Uta on the west coast. Similarly on Savai'i most of the myna birds recorded were in urban areas especially on the more populous eastern side of Savai'i.

The preference of Jungle Mynas for urban habitat is clearer on Savai'i where the invasion is still in its early stages. On Upolu it is less clear because this species seems to have started colonizing less preferred sub-optimal habitats (plantations and mixed crops), possibly due to the saturation of urban habitat, or they may have greater ecological flexibility and more generalist behaviour. Or possibly direct competition with the larger Common Myna, has forced them into less favourable habitat.

On Savai'i the Jungle Myna appears to have successfully started their invasion. They are rapidly saturating the urban areas and have started to infiltrate the plantation areas. There were only few incidental records of Common Myna on the east coast. They have been there since 2004 and it is likely they are still in the early stage of their invasion. Common Myna are known to have a close association with people, preferring urban areas and permanent cultivated lands (Crisp & Lilli, 2006; K. Lowe, Taylor, & Major, 2011; Peacock et al., 2007; van Rensburg, Peacock, & Robertson, 2009), often choosing to nest in more highly modified habitats, and in artificial structures rather than in native vegetation (K. Lowe et al., 2011). As such, it is likely they will spread through the more highly urbanised areas on the east coast before invading other urban areas on Savai'i.

Future distribution of myna in Samoa

Across the world, mynas avoid closed forest, but occupy habitats including desert oases, grasslands, woodlands (especially for nesting), secondary forest and mangroves – from sea level to 3000 m above sea level. Mynas are strongly commensal – attracted to human habitation and modified habitats (with available food supply) - but they are highly adaptable and perfectly capable of existing without humans (Tidemann, 2005).

As urban areas spread it is likely more forest will be cleared, with new roads made into plantations and secondary forests. These actions will assist myna birds through the creation of new favourable habitat and road networks could act as invasion corridors, by providing preferred foraging habitat along roadsides (Amico, Rouco, Russell, Román, & Revilla, 2013).

As the urban areas of Upolu and Savai'i become saturated with mynas it is possible the Common Myna may dominate urban areas pushing Jungle Mynas to plantations and mixed crops habitat before invading secondary forests. Without a suitable management plan that

is well executed, the population, distribution and impacts of myna birds in Samoa will continue to increase.

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Annex 1 – Myna survey proforma

MNRE GEF IAS MYNA SURVEY SHEET

TRANSECT _____ **DATE** / /2015 **NAME OF OBSERVER** _____

START TIME: _____ **END TIME:** _____ **SIDE OF CAR:** Left / Right (circle)

MAX DISTANCE OBSERVABLE: _____

	Distance from car (m)	# individuals	Species			Notes
			M	J	C	
1						
2						
3						
4						
5						
6						
7						
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