Jersey NARRS Report 2007 - 2012

Results of the first full NARRS cycle in Jersey: setting the baseline

amphibian and reptile conservation

NARRS National Amphibian and Reptile Recording Scheme

JARG Jersey Amphibian & Reptile Group

Working to save the Amphibians and Reptiles of Jersey

States of Jersey

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ACKNOWLEDGEMENTS

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This report is dedicated to the members of Jersey Amphibian and Reptile Group, and other NARRS surveyors, without whom it would not have been possible.

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1. INTRODUCTION TO JERSEY NARRS

In 2007, the States of Jersey Department of the Environment (DoE) launched the National Amphibian and Reptile Recording Scheme (NARRS) in Jersey. The scheme forms part of the Department's integrated ecological monitoring programme for Jersey in order to carry out 'State of the Environment Monitoring'. NARRS is coordinated by the UK organisation Amphibian and Reptile Conservation (ARC) and Jersey's scheme is run in partnership with the DoE and the Jersey Amphibian and Reptile Group (JARG). The scheme is financed by the States of Jersey but is based almost entirely on volunteer recorders, making it highly cost-effective.

Jersey possesses three amphibians (the agile frog, toad [crapaud] and palmate newt) and four reptiles (the grass snake, slow-worm, wall lizard and green lizard), meaning seven native species of herpetofauna in total. Ecological data on these species are collected over a six-year cycle in order to (a) generate sufficient records on which to base an assessment of conservation status and (b) investigate changes in species' occupancy over a realistic timescale. The use of established survey protocols is intended to provide a robust basis for conservation decision-making.

Jersey NARRS uses trained volunteers to carry out surveys within an allocated 1 km survey square. At annual training events, arranged by the Department of the Environment and JARG, participants are trained in NARRS species identification, survey methodologies, bio-security and health and safety, and given survey forms to fill in and other materials facilitating the completion of their surveys. The first Jersey NARRS training event was conducted at the Frances Le Sueur Centre in 2007 and subsequent events have been held at Howard Davis Farm and Les Noyers training centre (Durrell).

Jersey NARRS data (2007 – 2012) are presented here for the first time. For an earlier, interim assessment of Jersey's NARRS results, see Wilkinson & Arnell (2010) and for more information on NARRS, see **www.narrs.org.uk**. Jersey data is analysed separately from the UK NARRS results because of Jersey's unique herpetofaunal composition. Data concerning species which co-occur (in Jersey and in "GB") may, however, be usefully compared.

Jersey NARRS also has a "focus species" in most years, often subject to wider recording efforts and publicity. The present report includes comparisons with the slow-worm survey of 2012 and palmate newt "hunt" of 2013.

Since the previous NARRS report (Wilkinson & Arnell, 2010), the Jersey toad has been discovered to be a distinct species from *Bufo bufo* (the common toad found on the GB mainland) and should now be referred to as *Bufo spinosus* (see Arntzen *et al*., 2014); the same species is also found in North Africa, Iberia and western France.

2. METHODS

NARRS surveying in Jersey is carried out using the same protocols as are used throughout the other jurisdictions taking part. A 1 km survey square is randomly allocated to each surveyor.

Amphibian surveyors identify the pond nearest the south-west corner of their survey square and, where necessary, obtain permission to survey it from the landowner and/or tenant. Letters of introduction are provided if required. Up to four (sometimes more) visits are carried out using (i) visual searching, (ii) netting, (iii) night torching and (iv) – where appropriate and if the surveyor is confident – bottle-trapping in order to detect the amphibian species present. In practice, bottle-trapping rarely occurs during NARRS surveys in Jersey. Use of multiple methods over four survey visits result in the best chance of detecting all amphibian species present in a pond (Sewell *et al.*, 2010). Survey conditions (weather etc.), species present and habitat characteristics are recorded. For amphibian surveys, the latter take the form of the Habitat Suitability Index (HSI), developed for use with great crested newt surveys (Oldham *et al.*, 2000). Obviously, this species is not found in Jersey but the HSI is a good comparative, standard metric with which to investigate any changes in pond habitat between surveys.

Reptile surveyors use maps or aerial photographs to identify potential reptile habitat in their survey square and obtain permission to visit promising areas as necessary. Up to four (sometimes more) visits are carried out using (i) visual searching, (ii) checking existing refugia and (iii) checking artificial refugia (where it has been possible to lay these) in order to detect all reptile species present. The use of refugia is particularly important in finding slow-worms and grass snakes (*sensu* Sewell *et al.*, 2012) and they are also used by green lizards. Particular efforts to encourage the use of refugia were made in 2012 to coincide with slow-worms being the NARRS focus species for that year. Survey conditions, species present and habitat characteristics are recorded. It is particularly important for reptile surveys to be conducted during appropriate conditions (e.g. of sun and temperature) to maximise detection probability. A variety of habitat descriptors are recorded in reptile surveys as no equivalent of the pond HSI is currently available for reptiles.

For both amphibians and reptiles, if no pond or habitat exists, or survey permission is refused by a landowner, alternative squares are identified by examining the square immediately to the north of the original, then moving around that square in a clockwise direction until a suitable one is found (though this is usually unnecessary).

Results from Jersey NARRS surveys were used to calculate occupancy rates (the percentage of surveyed squares occupied) for each species and for amphibians and reptiles overall. These were mapped on the Jersey grid to provide a visual representation of

species square occupancy. “Hotspots” of herpetofauna species occupancy and amphibian and reptile species richness by square were also calculated. It is theoretically possible for species occupancy rates to remain stable over time whilst species richness changes, thus perhaps indicating a change in habitat characteristics.

For amphibians, mean HSI, and percentages of ponds with “good” (scoring over 0.7) HSI and “bad” (scoring under 0.3) HSI were calculated. Reptile habitat was assessed by quantifying the mean length and range of length of survey route. Longer surveys are possible in squares with a greater extent of habitat. Reptile habitat connectivity, isolation and designation status was also quantified from the data recorded by surveyors.

Finally, the statistical power of Jersey NARRS results 2007 – 2012 was examined in order to determine the ability of the present methods to detect “real” changes in species’ occupancy rates. Analyses were carried out using two-tailed power proportion tests in the statistical package “R”. These tests assess the ability of changes survey results between samples to detect either *increases* or *decreases* in occupancy rates, and therefore to give an objective quantification of trends in distribution. In other words, they can be used to target and prioritize conservation for species that are becoming less common.

3. RESULTS

For the purposes of analysis, all surveys from within the NARRS cycle period 2007 – 2012 are treated as one sample (in this case the baseline sample for Jersey against which future results can be compared). This sample included 38 unique amphibian squares (7 of which were surveyed in more than one year) and 50 unique reptile squares (again 7 of which were surveyed in more than one year). Both taxa were surveyed for in 26 squares. Of squares that were surveyed in more than one year, one amphibian survey detected a species (toad) that had not been recorded previously. Repeat surveys of reptile squares, however, resulted in two new slow-worm, two new grass snake, and one new green lizard records. Overall, 62 squares on the Jersey grid are now established as NARRS squares for either amphibians, reptiles, or both taxa (see Appendices A and B).

Results on the same measures from NARRS surveys over the same time period elsewhere in the British Isles are also presented for comparative purposes.

3.1 Species Occupancy Rates

Table 1. Pond occupancy rates for Jersey amphibians **2007 – 2012.**

	Species (% occupancy in NARRS squares)				
	Bufo spinosus	***Lissotriton helveticus***	***Rana dalmatina***	**Other**	**Overall amphibian occupancy (all spp.)**
Pond occupancy in Jersey	61%	34%	11%	0%	**68%**
Palmate newt survey		**47%***			
Pond occupancy in GB	N/A	27%	N/A	<1%	**82%**

*This percentage represents the proportion of occupied NARRS survey squares adjusted for additional positive records resulting from the palmate newt survey of 2013.

Jersey NARRS amphibian squares and those occupied by each species are listed in Appendix A.

Table 2. Square occupancy rates for Jersey reptiles **2007 – 2012.**

	Species (% occupancy in NARRS squares)					
	Anguis fragilis	***Podarcis muralis***	***Lacerta bilineata***	***Natrix natrix***	**Other**	**Overall reptile occupancy (all spp.)**
Square occupancy in Jersey	24%	8%	58%	6%	0%	**72%**
Slow-worm survey	**42%***					
Square occupancy in GB	22%	N/A	N/A	22%	3%	**52%**

*This percentage represents the proportion of occupied NARRS survey squares adjusted for additional positive records from the slow-worm survey of 2012

Jersey NARRS reptile squares and those occupied by each species are listed in Appendix B.

Figure 1. Jersey NARRS amphibian survey squares 2007 – 2012 (n = 38).

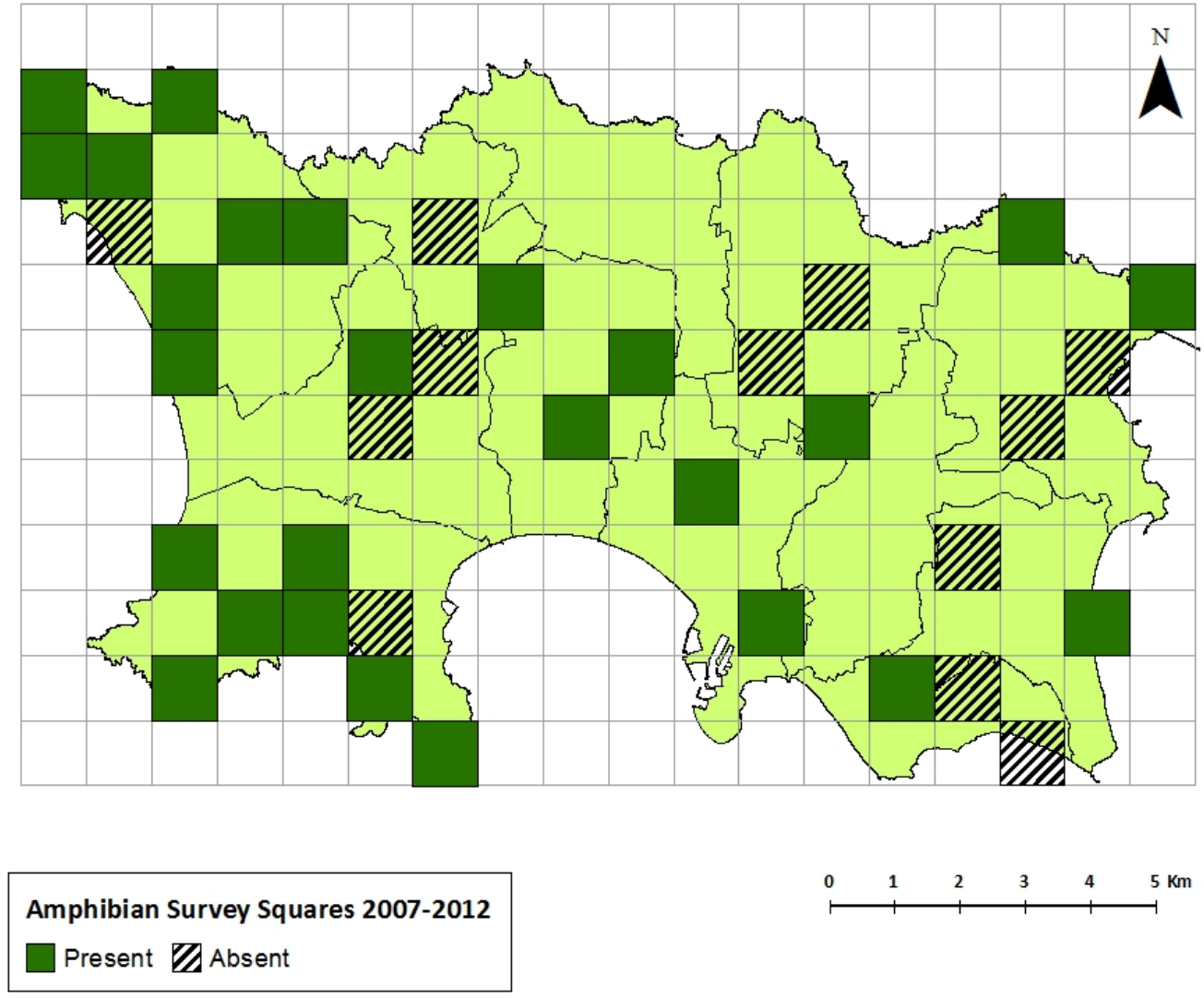


Figure 2. Jersey NARRS reptile survey squares 2007 – 2012 (n = 50).

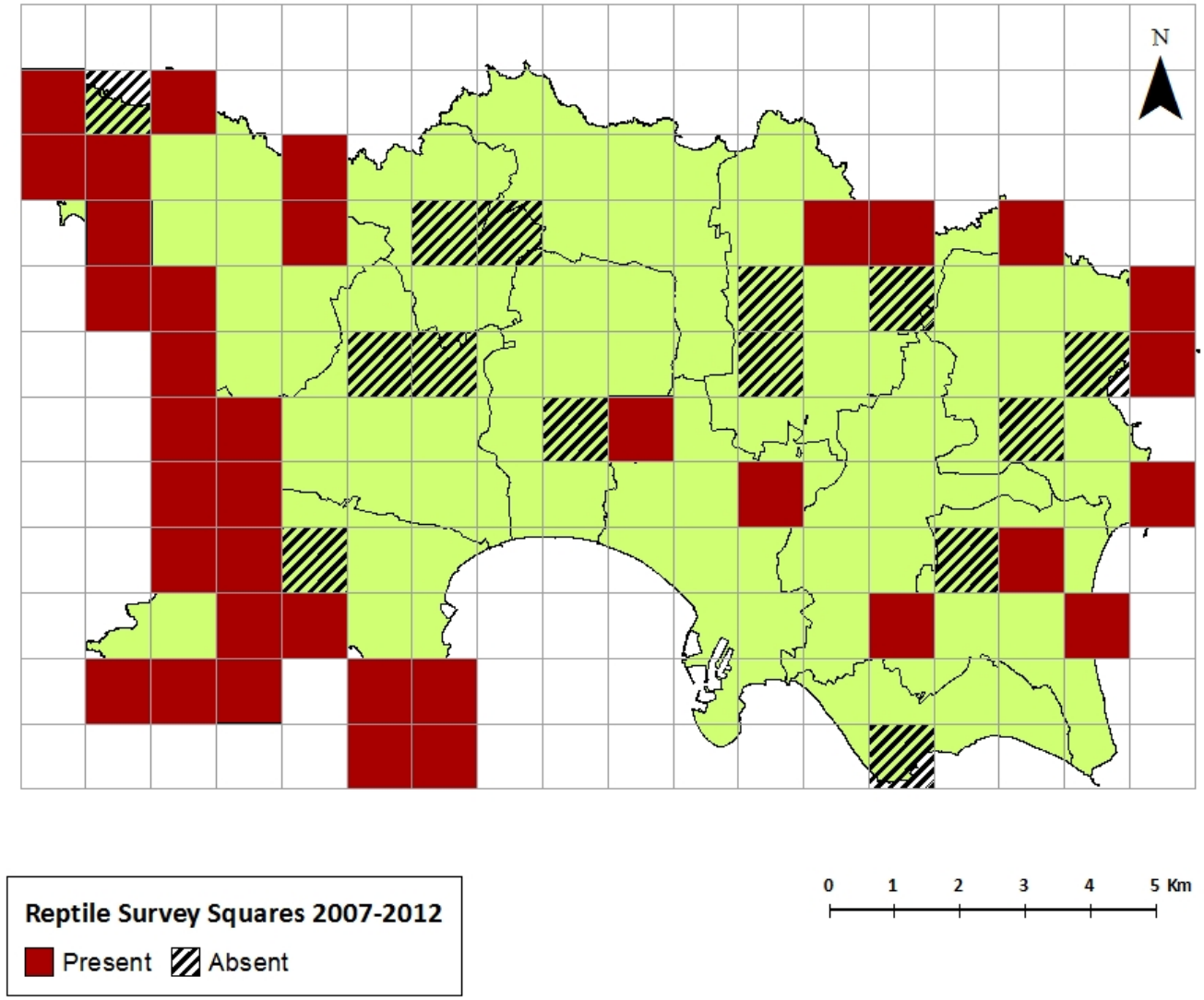


Figure 3. Baseline occupied Jersey grid squares for the toad *Bufo spinosus* (from NARRS surveys 2007 – 2012).

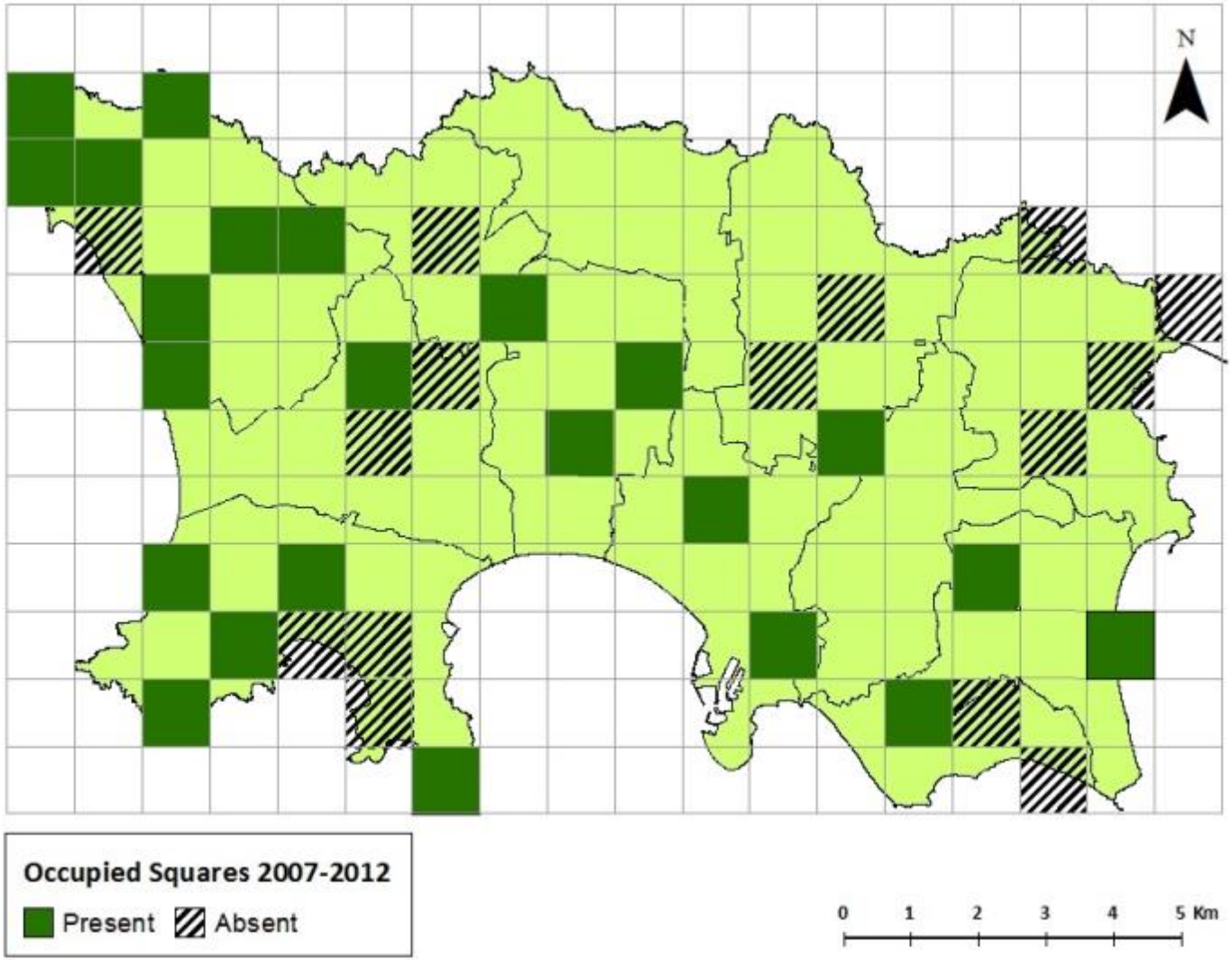


Figure 4. Baseline occupied Jersey grid squares for the palmate newt *Lissotriton helveticus* (from NARRS surveys 2007 – 2012).

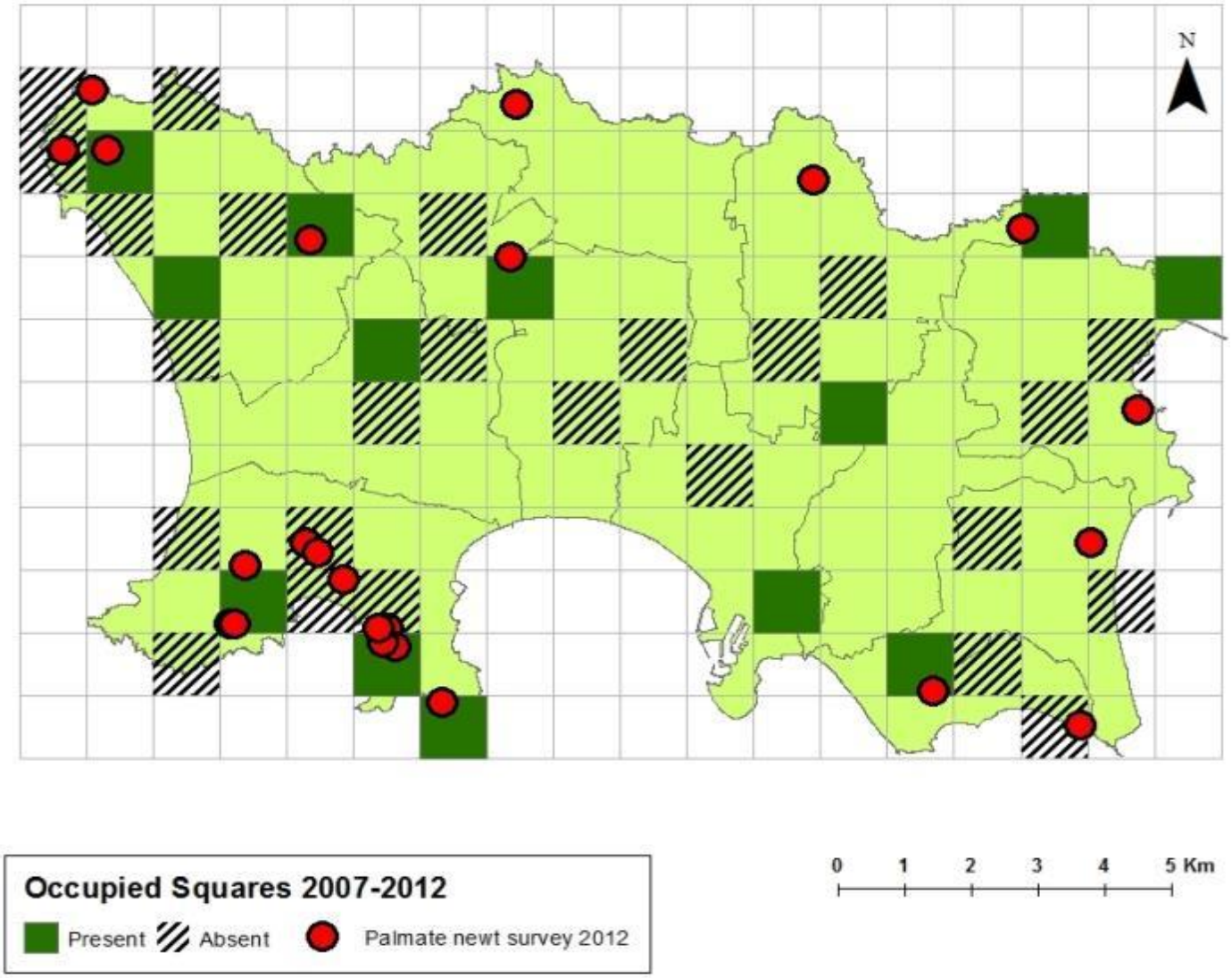


Figure 5. Baseline occupied Jersey grid squares for the agile frog *Rana dalmatina* (from NARRS surveys 2007 – 2012).

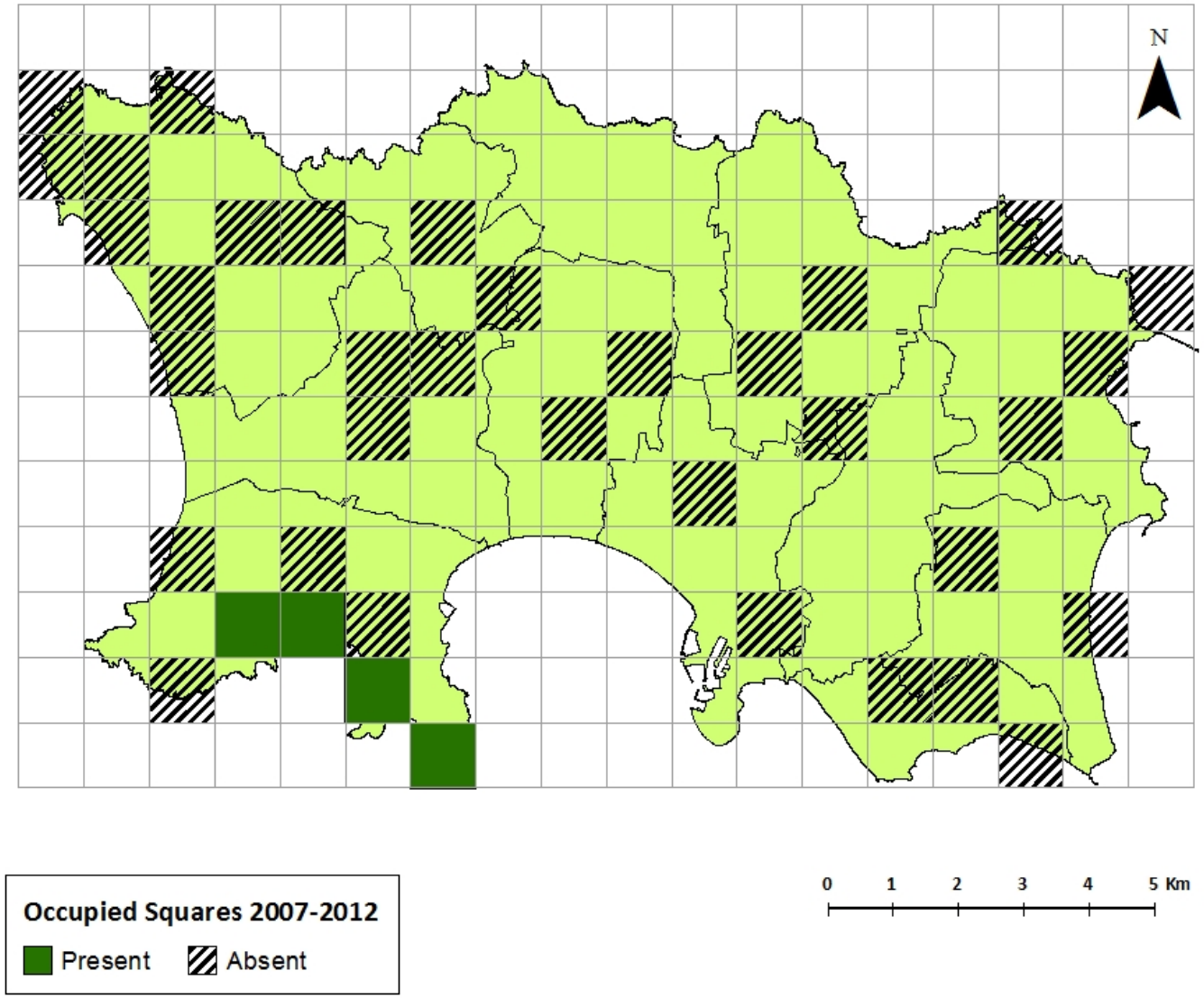


Figure 6. Baseline occupied Jersey grid squares for the slow-worm *Anguis fragilis* (from NARRS surveys 2007 – 2012).

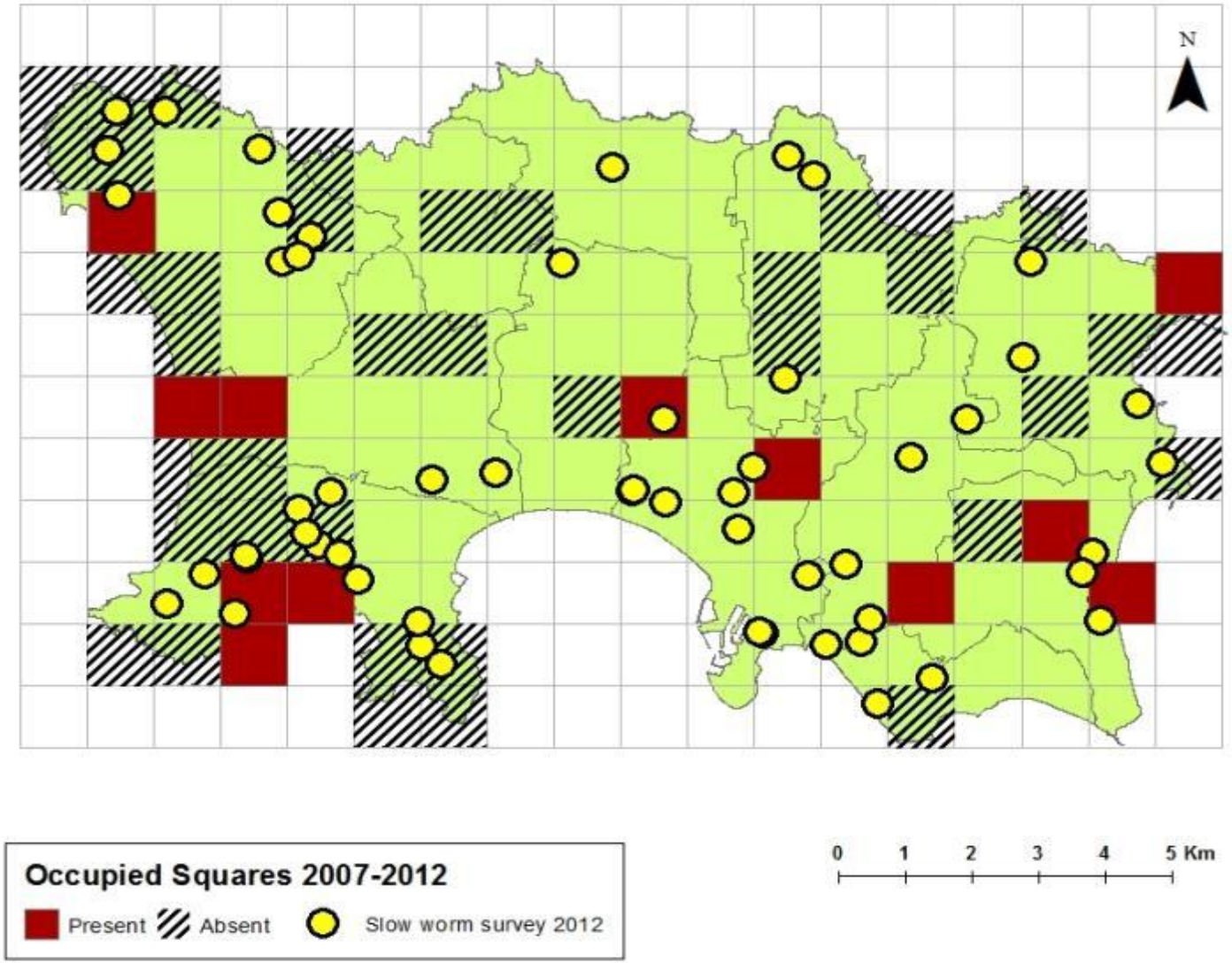


Figure 7. Baseline occupied Jersey grid squares for the wall lizard *Podarcis muralis* (from NARRS surveys 2007 – 2012).

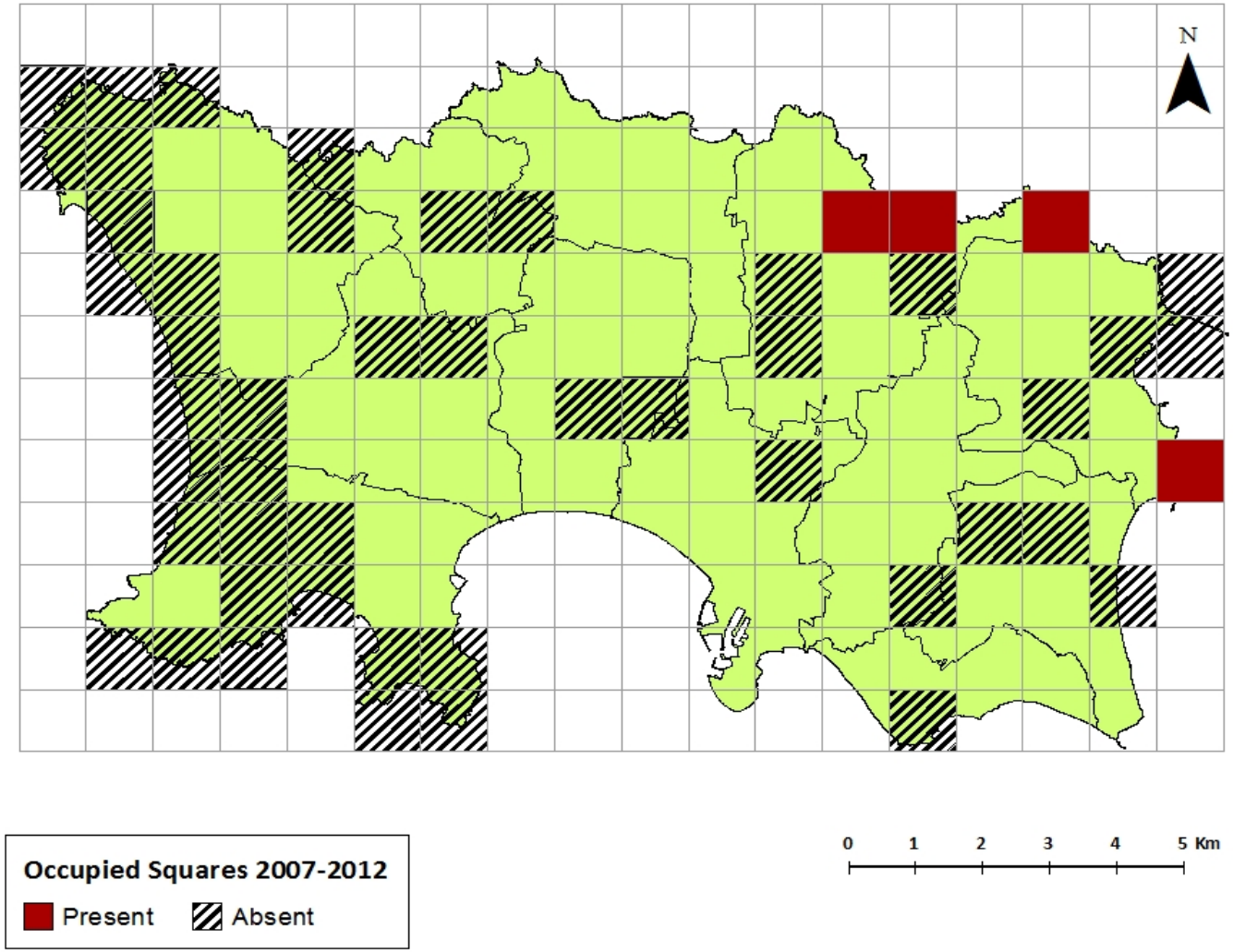


Figure 8. Baseline occupied Jersey grid squares for the green lizard *Lacerta bilineata* (from NARRS surveys 2007 – 2012).

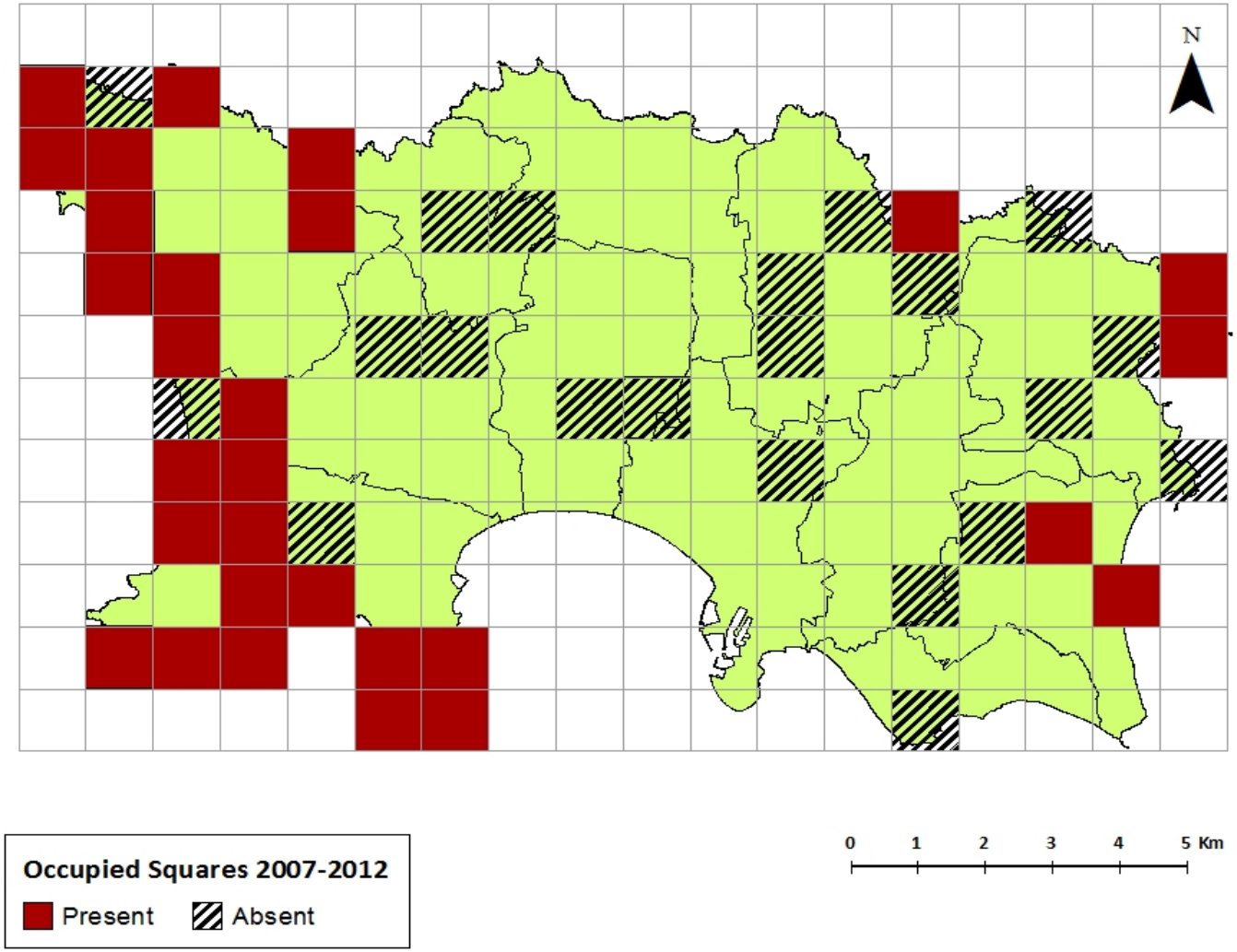
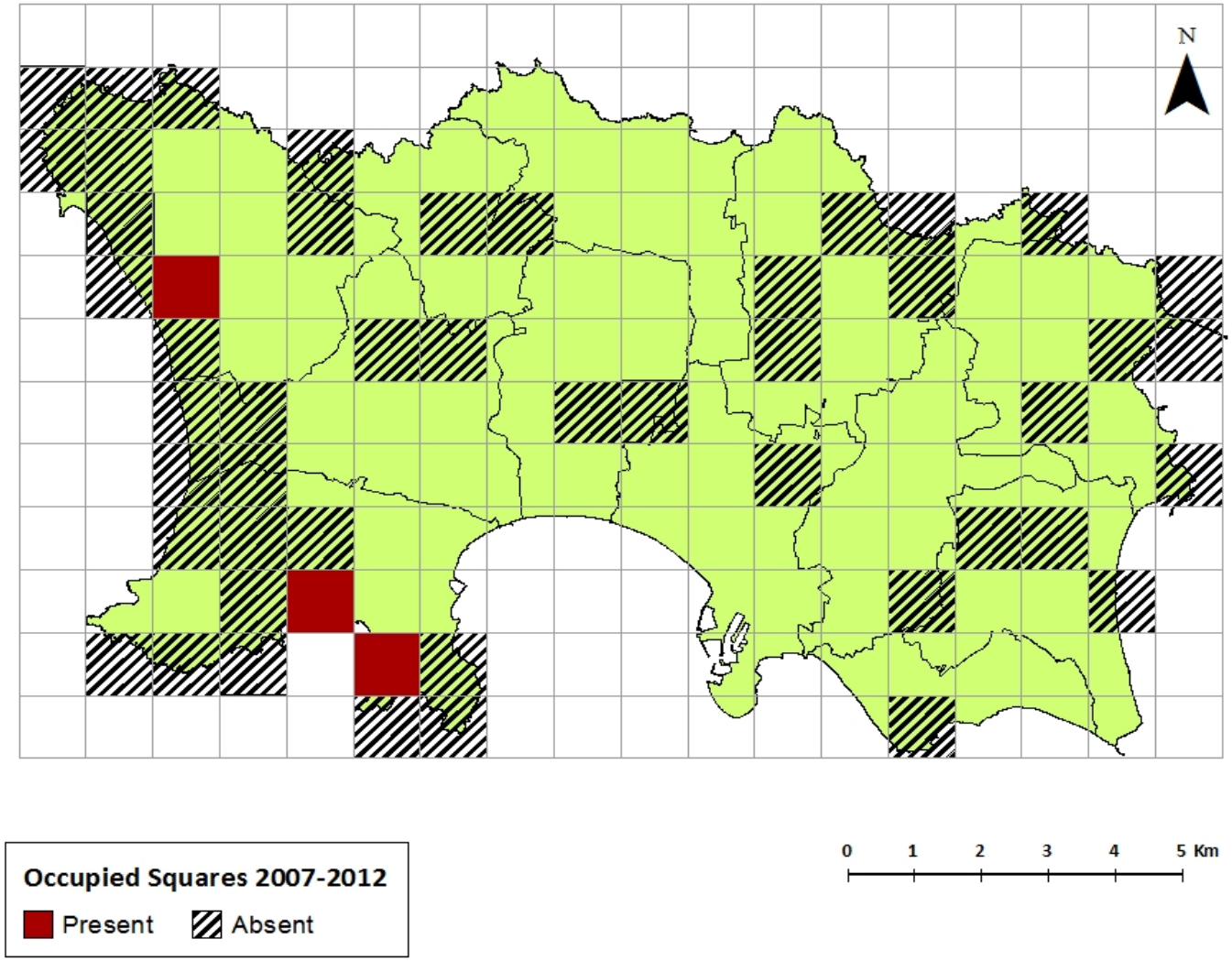


Figure 9. Baseline occupied Jersey grid squares for the grass snake *Natrix natrix* (from NARRS surveys 2007 – 2012).



3.2 Species Richness

Species richness by square for amphibians and reptiles (respectively) is presented and compared with GB in Figs. 10 and 11 (GB data are shown for comparison). A combined map of species richness for both taxa is presented in Fig. 12.

Figure 10. Number of amphibian species per square (%) in Jersey NARRS amphibian squares 2007 – 2012.

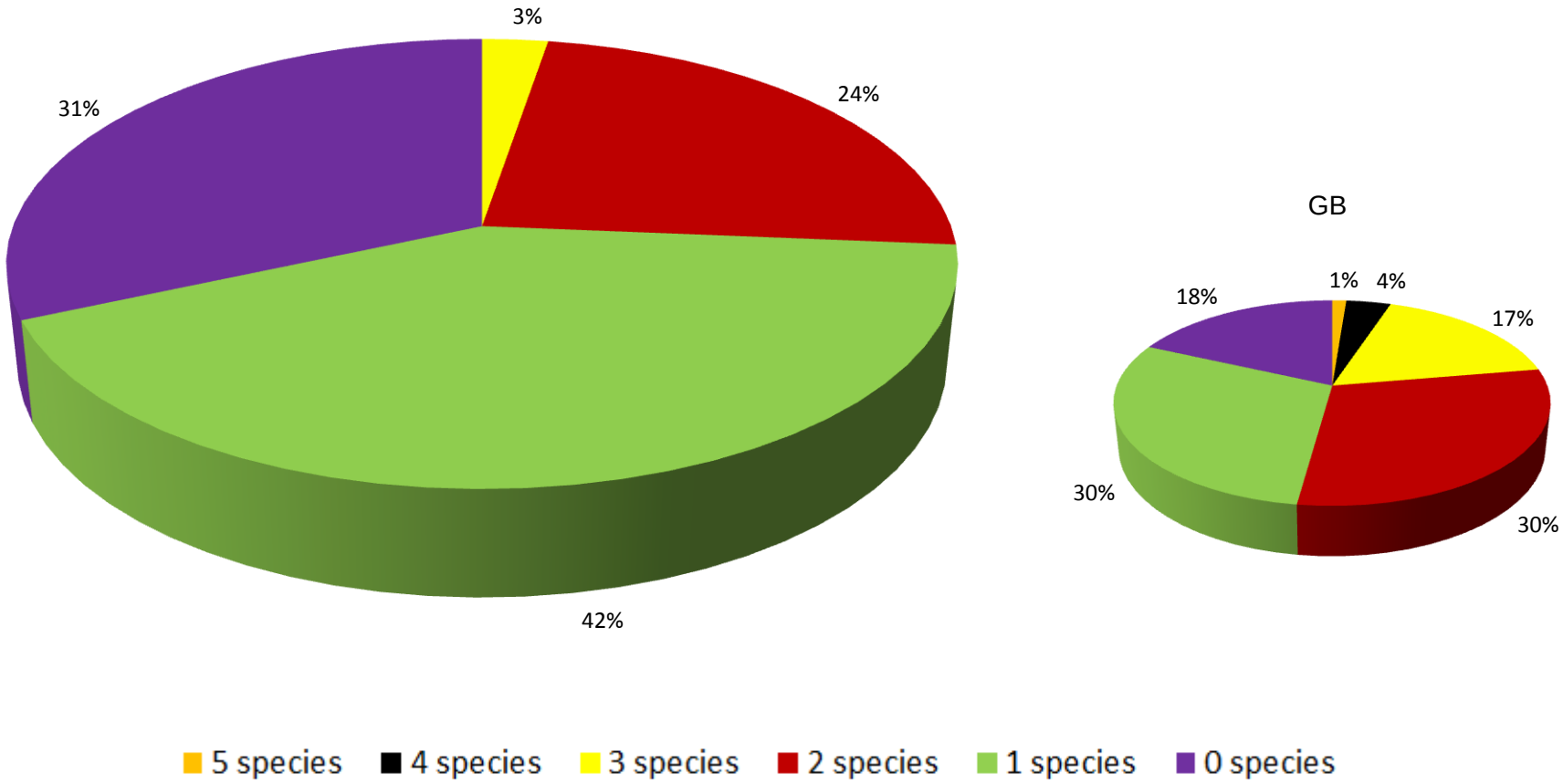


Figure 11. Number of reptile species per square (%) in Jersey NARRS reptile squares 2007 – 2012.

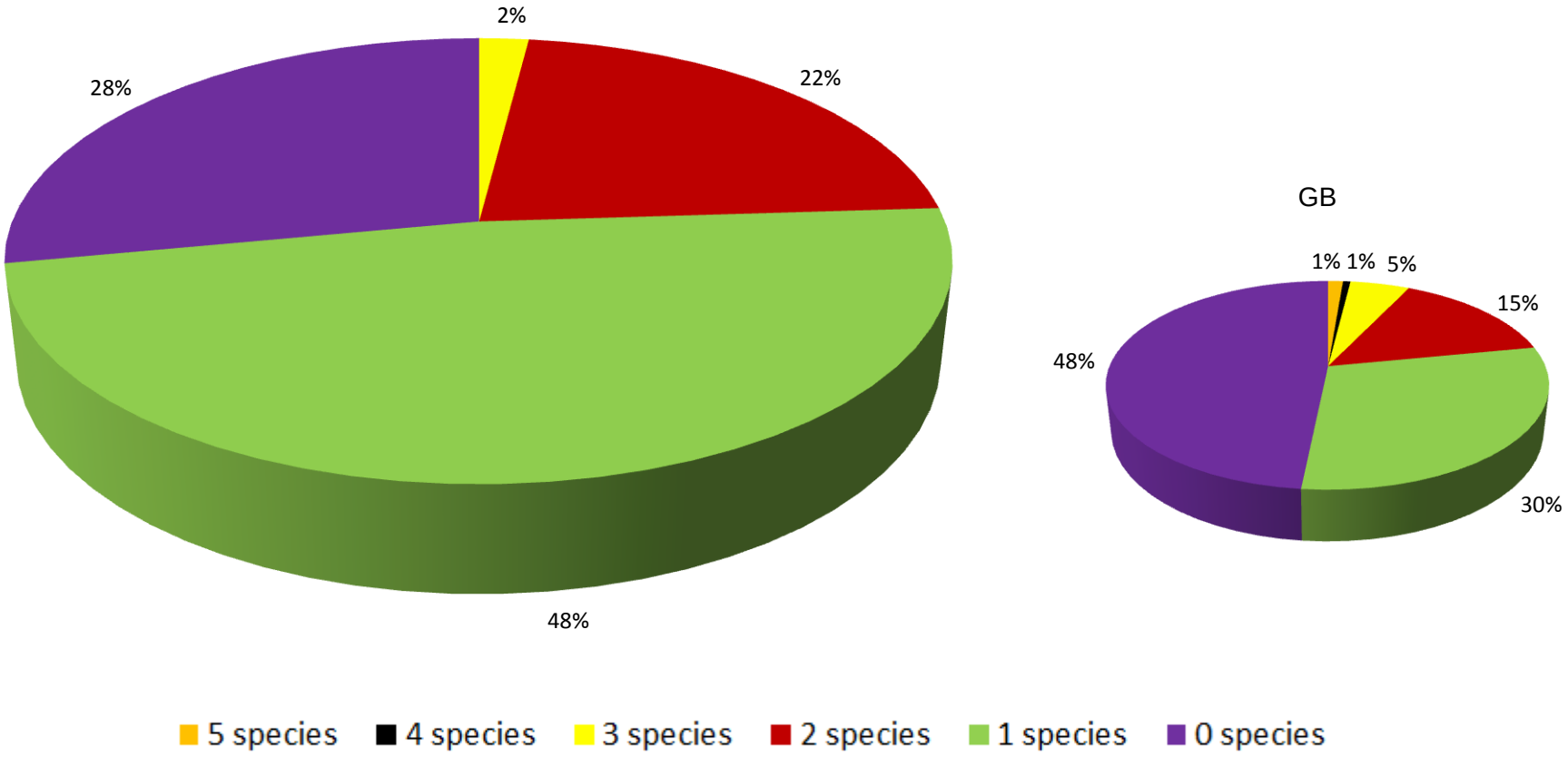


Figure 12. Total (amphibian *and* reptile) species per square in Jersey NARRS squares 2007 – 2012 ("NARRS Hotspots").

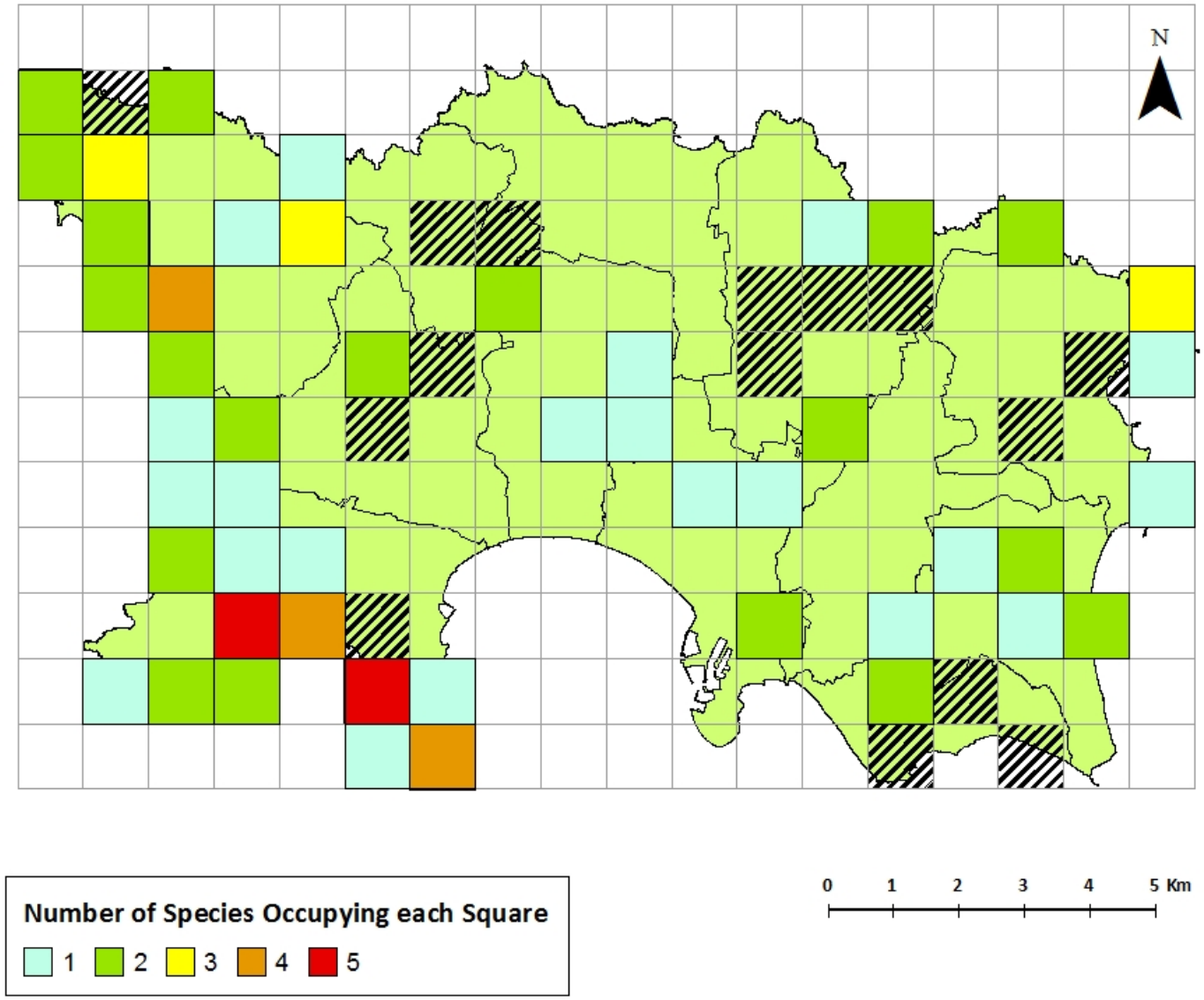


Table 3. Summary of species richness by square.

	Amphibian Species Richness (number of squares)	Reptile Species Richness (number of squares)	Both Groups: "NARRS Hotspots" (number of squares; see Fig. 12)
5 species	-	-	2
4 species	-	-	3
3 species	1	1	3
2 species	9	11	19
1 species	16	24	21
0 species	12	14	15

3.3 Measures of Habitat Quality

Table 4. Descriptors of amphibian habitat (HSI) in Jersey.

	Mean (range)	Ponds with HSI >0.7	Ponds with HSI <0.3
Jersey HSI*	0.52 (0.21 – 0.72)**	4.76%***	9.52%****
GB HSI	0.53 (0.12 – 0.94)	19.61%	10.77%

* This is a 9-factor HSI, which ignores bias in the score due to location
** n = 21 *** n = 1 **** n = 2

Table 5. Descriptors of reptile habitat in Jersey.

	Mean length of survey route (range)	Surveys in which survey route was part of larger area of good habitat	Surveys in which reptile habitat was isolated*	Surveys within protected/ designated areas
Jersey	1.54 km (0.1 – 5 km)	32.00%	28.00%	40.00%
GB	1.70 km (0.1 – 10.0 km)	23.18%	48.44%	24.52%

*completely isolated or isolated by sub-optimal habitat

3.4 Using the Baseline Results

Table 6. Occupancy summary and ability of Jersey NARRS baseline results 2007 – 2012 to detect significant changes in occupancy rates*.

Species	Number of NARRS Squares 2007 – 2012	Occupancy Rate (% Squares Occupied)	"Real" Change Detectable by Future Surveys (%); α=0.05, power=80%	"Real" Change Detectable by Future Surveys (%); α=0.1, power=65%	Number of Squares Difference Indicative of "Real" Change; α=0.1, power=65%
Bufo spinosus	38	61	44	34	8 squares
Lissotriton helveticus (with newt survey)	38	47	64	49	9 squares
Rana dalmatina	38	11	N/A**	N/A**	*Any change*
Anguis fragilis (with slow-worm survey)	50	42	64	48	11 squares
Podarcis muralis	50	8	N/A**	N/A**	*Any change*
Lacerta bilineata	50	58	43	33	10 squares
Natrix natrix	50	6	N/A**	N/A**	*Any change*

* two-tailed power analyses assuming equal sample sizes
** rare species – any change in occupancy rate indicates further study required

4. DISCUSSION AND RECOMMENDATIONS

4.1 Species Occupancy rates

Most species' occupancy rates have not changed substantially since the 2010 interim NARRS Report (Wilkinson & Arnell, 2010). A focus on the use of refugia in reptile surveys has, however, resulted in better information on slow-worm presence and an increase in occupancy rate from just 11% to 24%. Additional data from supplementary "focus" surveys have also increased our knowledge of the distribution of both slow-worms and newts in Jersey, with a concurrent increase in occupancy rate in NARRS squares (42% and 47% occupancy respectively, Tables 2 and 1). These additional data should be added to the NARRS survey square results (see Appendices and below).

The toad or crapaud *Bufo spinosus*

Though toads have undoubtedly declined in Jersey (e.g. Tonge, 1986), they remain the most widespread amphibian in the island (Fig. 3). The NARRS baseline data presented here confirm the south and west of the island as a stronghold for this species but do not yet reflect the return of breeding toads to Ouaisne (JWW, *pers. obs.*); this should nevertheless be picked up in the next cycle of NARRS surveys (2013 – 2018).

Now that Jersey toads have been revealed to be a separate species from *B. bufo*, with its own distinctive ecology (Arntzen *et al.,* 2014), it is probably inappropriate to continue to compare occupancy rates between Jersey and GB toads, despite declines in both jurisdictions. The responses of these respective species to prevailing habitat and development conditions would likely be very different (see Wilkinson *et al.,* 2007).

The conservation of Jersey toads will be further informed by the continuation of *Toadwatch,* an analysis of the data from which is currently being carried out by Amphibian and Reptile Conservation (in prep.). This will include the results of a predictive model, highlighting the areas most important for population connectivity and where to target conservation.

The palmate newt *Lissotriton helveticus*

Data from both NARRS square surveys and additional newt observations now suggest that the palmate newt is less ubiquitous in Jersey than it formerly was (or has been assumed to be). Current information (Fig. 4) suggests a near-absence of the species from the island's agricultural centre, most records originating from the south west. It is also notable that palmate newt NARRS square occupancy in Jersey is just 77% of the occupancy rate of the toad (Table 6), even though the latter species is known to have undergone declines in the island.

Five NARRS squares turn positive for palmate newts when data from the additional survey are added (see Fig. 4 and App. A). These data will be incorporated into the NARRS baseline dataset and efforts should be made to re-locate the species in those five squares during NARRS surveys in the second cycle.

The occupancy rate of palmate newts in Jersey is now higher than that found for the species in GB (47% as compared to 27%), perhaps unsurprising in the absence of competition from other newt species in Jersey. Nevertheless, factors influencing the distribution of palmate newts in Jersey need further investigation. This should include a multi-season trapping study in order to examine population sizes and local trends, and comparisons with local water chemistry.

The agile frog *Rana dalmatina*

Though the occupancy rate recorded by NARRS surveys for this species has not changed substantially, there are in fact twice as many squares now occupied as compared to 2010 (up to four squares from two in 2010). This change represents a real improvement in the status of agile frogs in Jersey as a result of ongoing conservation efforts (spawn protection, head-starting), rather than being an artefact of more survey results. Power analysis (Table 6) is not required to detect "real" changes in occupancy for this species. Any future reduction detected should be regarded as a decline and additional squares should be surveyed for agile frogs as the species continues to expand to new breeding sites.

The slow-worm *Anguis fragilis*

Extra efforts to employ refugia during NARRS surveys, and additional survey data, have improved knowledge of slow-worm distribution and substantially increased the occupancy rate since Wilkinson & Arnell's (2010) report. As with the palmate newt, data from slow-worm surveys for the nine additional positive records from NARRS squares will be incorporated into the NARRS baseline dataset (see Fig. 6 and App. B), and efforts made to re-locate the species in those squares during the second NARRS cycle (to 2018). Slow-worms appear to remain widely distributed in the island (Fig. 6) though the addition of further presence records from central Parishes would confirm this. As a fossorial species, detection rates are poor in areas without refugia present.

An intensive study on the slow-worm (and grass snake) is currently underway by a PhD student from DICE, University of Kent. Search effort and methodology is *not* comparable to those of NARRS surveys, however, so the data ultimately resulting should *not* be added to the NARRS dataset. This study will nevertheless add substantially to our knowledge of distribution and ecology of slow-worms in the island.

The wall lizard *Podarcis muralis*

An increase in the number of NARRS squares surveyed since 2010 has doubled the positive NARRS squares for wall lizards from two to four (Fig. 7). The distribution of wall lizards in Jersey is well known and the species has been the subject of MSc research (Cornish, 2011). It is possible, however, that the species could turn up in existing NARRS reptile survey squares where it has not yet been recorded. As with agile frogs, the restricted distribution of the wall lizard means that any apparent future reduction in occupancy rates should be seen as a possible decline.

The green lizard *Lacerta bilineata*

Green lizard records from the west of Jersey remain abundant and NARRS data indicate that it is by far the most widespread Jersey reptile (Fig. 8). Future NARRS cycles should attempt to detect the species in other coastal survey squares. NARRS records may also arise from elsewhere in the island as the species is sometimes reported away from the coast.

The grass snake *Natrix natrix*

The grass snake is Jersey's most endangered reptile and unsurprisingly has the lowest occupancy rate (Table 2, Fig. 9). As with slow-worms, data from the present PhD study should *not* be used to augment the NARRS baseline because of the intense survey effort involved in the former study. It may be hoped, however, that the data resulting from that PhD can be used as a basis for conservation actions resulting in positive population trends which future NARRS cycles will be able to monitor.

Wilkinson & Arnell (2010) speculated that part of the reason for the rarity of Jersey's grass snakes may be the species' dependency on amphibian prey. Now that at least some Jersey amphibian populations are apparently recovering (e.g. the toads at Ouaisne), there may also be some recovery of grass snakes that will track this. The present PhD study had not begun at the time of the interim report (Wilkinson & Arnell, 2010) and will likely reveal more data on the importance of connectivity and egg-laying site availability that will benefit the species in Jersey long-term. It should remain a goal for the species' occupancy rate in Jersey to approach that for grass snakes in the UK (22%).

As with agile frogs and wall lizards, any reduction in the occupancy rate of grass snakes detected in future NARRS cycles should be regarded as a possible decline. Because of this species' high mobility, however, an apparent change in the squares where the species may be detected does not necessarily represent a change in distribution. The effective distribution of Jersey grass snakes will be better informed once egg-laying sites are discovered and egg-laying condition requirements in the island become better understood.

4.2 Species Richness

Species richness data presented here establish the baseline for this parameter in Jersey for 2007 – 2012 surveys. The pattern seen in Wilkinson & Arnell (2010) remains true, in that reptiles occupy relatively more squares in Jersey than they do in GB, the reverse being true for amphibians (Figs. 10 and 11). Though reptile species richness might be accounted for at least partly by the relatively gentle climate (for reptiles) in Jersey, the amphibian figures probably reflect the recent and well documented declines in amphibians recently seen there (e.g. Gibson and Freeman, 1997; Racca, 2002, Wilkinson *et al.,* 2007). At present, over 70% of NARRS squares for both taxa have either zero or one species recorded from them, a situation which may change with ongoing conservation measures and which should be picked up in future NARRS surveys.

Now that the 2007 – 2012 NARRS survey cycle is complete, it has also been possible to create a "NARRS Hotspot" map showing overall herpetofauna species richness in Jersey NARRS squares (Fig. 12 and Table 3). Just four Jersey grid squares contain four or five species (out of a potential seven), three-quarters of these are in the south west. Another three squares, however contain three species and these are all in the north of the island, of especial note being the one in the north east (St. Martin). This new metric can be used to track the combined status and fortunes of Jersey's herpetofauna (through comparison with future data), as well as to highlight those areas of most importance for amphibian and reptile conservation in Jersey, and to inform development control.

4.3 Measures of Habitat Quality

Amphibian habitat: mean Jersey pond HSI is remarkably similar to that in GB. HSI data is available only for 21 out of a total of 38 established NARRS amphibian squares in Jersey, however, so the proportions of "high" and "low" scoring habitat are based on very few squares (n=1 and n=2 respectively). This indicates that more data are required; Jersey NARRS training in 2015 should emphasize the need for recording habitat parameters.

Reptile habitat: there is currently no HSI or equivalent for reptile habitat. Jersey reptile survey routes were, on average, shorter than those in GB, which may perhaps be expected. Jersey reptile surveyors, however, recorded relatively more connectivity (and less isolation) for reptile habitat than in GB (Table 5). This is undoubtedly good news for Jersey's reptiles, where overall reptile occupancy and species richness is higher than in GB (Table 2; Fig. 11). The fact that 40% of Jersey NARRS reptile surveys occurred in protected areas also suggests that designation of sites with reptile interest is currently proving effective.

4.4 Using the Baseline Results

Wilkinson & Arnell (2010) created an artificial "confidence index" to try to ensure sufficient effort was put into generating robust, comparable survey results. Efforts were, broadly, very successful, with 50 NARRS reptile squares and 38 NARRS amphibian squares being surveyed in the island between 2007 and 2012. It is desirable to add a few more amphibian squares in the next survey cycle, if practical, to add to the comparative power of future surveys.

Now that NARRS baseline data have been generated (this report), we are able to use more informative statistics to examine the ability of Jersey NARRS to detect future changes in status of the island's herpetofauna. Occupancy rates and the results of power analyses showing the ability of future surveys to detect changes are presented in Table 6. Detection of highly-significant changes with very high statistical power is, however, problematic in Jersey, simply because of the total number of survey squares potentially available in the island. Power analyses at conventional thresholds (α=0.05, power=80%; Table 6, column 4) indicate that repeat surveys of the present number of squares may only detect changes of around 40 – 60% occupancy (i.e. substantial changes) for any species. This is rather lower than may be useful and practical (i.e. occupancy changes of that order of magnitude may only demonstrate substantial conservation problems). Nevertheless, if slightly lower thresholds are used (α=0.1, power=65%; Table 6, column 5), detection of more informative changes closer to 30% (range 33 – 49%) become achievable (see column 6 of Table 11).

In summary, a drop in occupancy rate of eight or more squares over a six-year NARRS cycle may indicate genuine declines in any of Jerseys widespread species (toad, palmate newt, slow-worm and green lizard). These results (Table 11) can therefore be used as an alert that would trigger detailed investigation into possible conservation problems with any of these species. *N.B.* any reduction at all in occupancy rate for restricted-distribution species (agile frog, wall lizard and grass snake) should be regarded as worthy of further investigation.

4.5 Recommendations for the Future

The above analyses suggest the following key recommendations to ensure the success of herpetofauna monitoring, trend detection and conservation initiatives in Jersey:

1. ***Any* reduction in square occupancy for agile frogs, wall lizards or grass snakes over a six-year NARRS cycle should be regarded as a possible decline worthy of investigation.**

2. **A reduction in square occupancy of <u>eight or more</u> squares over a six-year NARRS cycle should trigger investigation into possible real and substantial declines for toads, palmate newts, slow-worms or green lizards. (Conversely, an increase of the same magnitude would likely indicate "real" range expansion/increase.)**

3. **NARRS training in 2015 (and beyond) should include a field element that emphasizes and demonstrates the collection of habitat data (i.e. pond HSI).**

4. **The results of recent slow-worm and palmate newt surveys should be incorporated into NARRS results (where those species were detected in NARRS squares by these supplementary surveys) and strive to detect the species in those squares during the next NARRS cycle (2013-2018).**

5. **Increase the number of Jersey NARRS amphibian squares to 40 (or more) if possible.**

6. **Continue to promote the use of refugia in NARRS surveys.**

7. **Continue to promote autecological research on Jersey's herpetofauna species, including at this time the island-specific ecology of the palmate newt. It is recommended that newt population sizes and trends are investigated through an aquatic trapping study and compared with abiotic (water chemistry) and habitat factors, and possibly genetics.**

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Appendix A: List of Jersey NARRS Amphibian Squares 2007 – 2012, with Occupancy by Each Species. Black fill = sp. detected in NARRS survey, blue fill = sp. detected in NARRS square by supplementary survey.

Jersey Grid Square	*Bufo spinosus*	*Lissotriton helveticus*	*Rana dalmatina*
A10	■	■	
A11	■		
B9			
B10	■	■	
C2	■		
C4	■		
C7	■		
C8	■	■	
C11	■		
D3	■	■	■
D9	■		
E3		■	■
E4	■	■	
E9	■	■	
F2		■	■
F3		■	
F6			
F7	■	■	
G1	■	■	■
G7			
G9			
H8	■	■	
I6	■		
J7	■		
K5	■		
L3	■	■	
L7			
M6	■	■	
M8			
N2	■	■	
O2			
O4	■		
P1		■	
P6			
P9		■	
Q3	■		
Q7			
R8		■	

Appendix B: List of Jersey NARRS Reptile Squares 2007 – 2012, with Occupancy by Each Species. Black fill = sp. detected in NARRS survey, blue fill = sp. detected in NARRS square by supplementary survey.

Jersey Grid Square	*Anguis fragilis*	*Podarcis muralis*	*Lacerta bilineata*	*Natrix natrix*
A10				
A11				
B2				
B8				
B9				
B10				
B11				
C2				
C4				
C5				
C6				
C7				
C8				
C11				
D2				
D3				
D4				
D5				
D6				
E3				
E4				
E9				
E10				
F1				
F2				
F7				
G1				
G2				
G7				
G9				
H9				
I6				
J6				
L5				
L7				
L8				
M9				
N1				
N3				
N8				
N9				
O4				
P4				
P6				
P9				
Q3				
Q7				
R5				
R7				
R8				