Malta Environment and Planning Authority

Report on a survey of the influx of migratory Common Quail and Turtle Dove following the spring hunting open season in Malta, made in April - May 2012

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1. INTRODUCTION

On 28-2-12, Ecoserv Ltd (hereafter 'Ecoserv') received a request from the Malta Environment and Planning Authority (hereafter 'MEPA') for a quotation for an independent scientific study undertaken during a 5 week study period in spring and aimed at assessing the influx of two largely migratory bird species in Malta, the Common Quail *Coturnix coturnix* and the European Turtle Dove *Streptopelia turtur*.

The MEPA's Terms of Reference (ToR) are as follows:

Overall Aim and Scope of the Study

This independent study shall focus on two species – Common Quail and Turtle Dove - and shall take place for the duration of a seven week period during spring migration and in particular during a possible spring hunting derogation. This study needs to commence before the start of a possible spring hunting season at the very latest, if such a spring hunting season is opened. The Study should comprise the surveying and scientific monitoring of the daily influx of migration of both species concerned. This would provide an independent verification of the level of presence of the two species in spring and the timing of their migration. This shall be achieved by generating a "Migration Count," that is a count of migrant birds of both species in question in the stipulated time span when monitoring is undertaken.

This study shall only cover a seven week period in Spring. The collection of scientific data to elucidate
population trends for both species is beyond the scope of this study.

Expertise Required

The work is to be coordinated by a team of scientists and scientific experts with proven track record and experience on scientific studies, preferably hold a Ph.D. or equivalent related to natural sciences, and including persons with relevant expertise in environmental monitoring and ornithology.

These are to be supported by further field assistants or ornithologists, with adequate scientific background and/or experience capable of identifying birds. The following are the basic requirements:

- *Identification skills by call and by sight of the two bird species under study (with trained surveyors assisted by experts in bird recognition);*
- *Skills at statistical analysis of the scientific data collected;*
- *Any 'nature permitting' requirements in line with LN 79 of 2006 (as amended) and LN221 of 2010 (as amended);*
- *Reporting requirements of research progress to be submitted by scientific researchers undertaking the study – number of reports to be submitted to MEPA throughout the study etc.;*
- *Research equipment;*
- *Health and safety considerations.*

Methodology

The Study shall monitor the influx of migratory specimens of both species, bearing in mind any methodological difficulties in monitoring these species. A field protocol of standard operating procedures, which will be used in the same manner from day to day, should be designed by the commissioned experts on the basis of best practice procedures. There might be the need to take

into consideration however flexibility of techniques used to meet constraints imposed by local geographical conditions and the availability of skilled personnel.

A network of monitoring stations will need to be set up throughout the three inhabited islands of the Maltese archipelago with every station working daily throughout the migration season (e.g. each operated on one or two days per week or with a greater frequency of monitoring but most or all days should however be covered by at least one station). The exact number, location and area of stations will be determined in consultation with scientific experts who are commissioned to undertake this Study. The count station should include or encompass a defined "count area" that has features that are compatible with the chosen count procedures. Moreover, no matter the type of method, the experts should also define the total daily "count period", as well as the standard daily time periods during which the various component activities of bird sampling procedures occur. Length of count period should take into account the normal numbers of personnel and the hours that they are available. Surveys should focus on observations and migration counts, and should be coordinated by a scientific person or team, so as to enable an appropriate scientific determination (with ecological statistics and/or models leading to possible population estimates, with standard errors) and should cover, at least, the three main inhabited islands of Malta. The migration count can include birds counted at a site, observed flying past a fixed point in diurnal migration, seen on radar screens, or whose calls are recorded in nocturnal migration. For monitoring small land birds, particularly nocturnal migrants, attention should be drawn to birds observed at short-term stopover sites immediately following a migratory flight. Depending on the situation, a migration count may be derived exclusively from observations. There are several options for producing a useful migration count of small land birds. More than one type of data can be collected simultaneously, which can be useful to facilitate assessment of each method. These options include: visible migration count; area search or route census counts; incidental observations; and daily estimated totals. The commissioned experts should define what they will consider as a migration count and what standardised methods will be used. Standardisation of counting methods can make a major contribution to removing extraneous variation derived from variable observer effort and sampling procedures. Nevertheless, migration counts will still be subject to uncontrollable variation from weather, observer differences, and unavoidable changes in the level of effort. Such problems should be addressed by the use of appropriate analytical procedures.

Surveys carried out should use similar methodologies and sampling efforts to those utilised in the 'Report on a survey of the Influx of Migratory Common Quail and Turtledove following the Spring Hunting Open Season in Malta (May 2011, Ecoserv Ltd)' as this shall allow for the comparison of the migratory influx data.

The methodology shall not involve trapping or any taking of birds from the wild.

Expected Deliverables

Independent scientific data is required on the observations and migration counts of migrating individuals of Streptopelia turtur *and* Coturnix coturnix *for a seven week period during the spring migration. The results of the study should indicate the population numbers during the spring migration of these birds and must be presented in a final monitoring report.*

Timeframes

The independent monitoring study shall commence on the 9th April 2012 and shall be carried out for 48 days during the spring migration, ending on 26th May 2012.

Among the most comprehensive data on migration of the Common Quail and Turtle Dove across the Maltese Islands are those collected in recent years by Thomaidis (nd), who studied the occurrence and patterns of movement of these two species within the Islands between spring 2008 and autumn 2009. The data used to compile the report by Thomaidis (nd) had been recorded by hunters under his supervision and coordination, although there have been claims that the collected data may be biased, given that they were collected by hunters. Records on the number of individuals of Common Quail and Turtle Dove, caught or trapped by hunters and trappers in spring and autumn of 2002 through to 2012, are also available in the *Carnet de Chasse* reports for the respective years, while data and other relevant information pertaining to the aforementioned species may also be held by Federazzjoni Kaccaturi Nassaba u Konservazzjonisti (FKNK) and BirdLife Malta (BLM).

Since long-term, independent and reliable published data on influx of Common Quail and Turtle Dove over the Maltese islands are lacking, MEPA had issued a call for a first independent study in spring 2011, to which Ecoserv submitted a response. Eventually, the MEPA commissioned Ecoserv to undertake the survey in spring of 2011. The methodology used by Ecoserv (2011) is as follows: two individuals – a hunter and an independent observer – were deployed at a total of 24 sites distributed over Malta, Comino and Gozo. In its proposal, Ecoserv had recommended that a third individual – a member of BirdLife Malta (hereafter BLM) be included in the team deployed at the field stations, however, BLM eventually refused to participate in the survey. Counts of Common Quail and Turtle Dove were made daily during a 21-day period between 8 and 28 May, 2011. Counts were made at 8 different stations each day, with each group of 8 stations being surveyed once every 3 days; thus a total of 24 survey localities were surveyed in all. Since the survey was mainly aimed at quantifying the influx of migrating individuals, field stations were sited at strategic locations within coastal areas, which are more likely to serve as short-term stopover sites immediately following landfall during migration than are inland locations. In the case of Turtle Dove, the number of individuals observed flying within each study site was recorded, while the count area was estimated as the area within the observer's field of view when observing horizontally (c. 500m) and vertically upwards (as far as the birds were detected by sight). Since the Common Quail is a mainly a nocturnal migrant, monitoring of this species was based on counts of individuals that would have settled in during the previous night. Surveys of Quail entailed the use of dogs to locate and flush birds in order to count them.. The count area was taken as the total area surveyed in this manner at a particular site. Monitoring of Turtle Dove was always made between 06:00 and 13:00, while monitoring of Quail was made between 06:30 and 08:30. The count data collected for the pre-defined area and count period at each study site was used to establish the mean number of birds observed for each day of the survey. This enabled comparison with the data collected by Thomaidis (nd) for the same study period (ie. 8 – 28 May) in 2008 and 2009.

The findings from the Spring 2011 survey undertaken by Ecoserv, which was based on ToR that are similar to the ones reproduced above, and undertaken during the period 8th – 28th May 2011 (see Ecoserv), are as follows:

- Counts for Turtle Dove recorded from the 24 field stations varied between a minimum of 0 and a maximum of 14, with mean daily counts ranging between 0.38 and 4.25. With extrapolation, the daily mean figures translated to an estimated daily influx ranging between 203 and 2,305 individuals, with a total influx over the survey period (21 days) of 18,057 individuals. It was noted that the recorded counts varied appreciably between the different field stations, which is to be expected, given that the birds may have a strong influx at one site and a potentially much lower one at a different site, even if the two sites are separated by a very small distance of even a few hundred meters. Another limitation of the estimated counts is that some birds may pass overhead, maintaining high altitude and avoiding landfall, while others migrate during the night. Nonetheless, the counts for Turtle Dove recorded by

Ecoserv (2011) did not appear to differ markedly from those reported by Thomaidis (nd) for the years 2008 and 2009.

- Counts for Common Quail recorded from the 24 field stations varied between a minimum of 0 and a maximum of 11, while the mean daily counts ranged between 0 and 1.38. Through extrapolation, this translated to a total influx of 22, 699 individuals over the survey period (21 days). No Common Quail were recorded at 13 of the 24 stations, on any of the survey dates. As in the case of Turtle Dove, migration of Common Quail is dependent on climatic conditions and high numbers may be recorded at one site and a potentially much lower number at a different site, even if the two sites are separated by a very small distance of even a few hundred meters. Given that Common Quail tend to stay in the same area for a few days if left undisturbed, it was not possible to ascertain whether high numbers of individuals recorded successively at the same field station included fresh migratory individuals, or whether they comprised individuals already included in counts from previous days.

- Overall, when comparing the results of Ecoserv's spring 2011 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 for the same period, similar counts are noted for Turtle Dove. In the case of Common Quail, there was a tendency for overall higher counts recorded during the spring 2011 survey. Therefore, no decreased influx of migratory Turtle Dove and Common Quail was evident when comparing the results of the spring 2011 survey with those from Thomaidis' (nd) 2008 and 2009 surveys.

- A number of constraints were pointed out in Ecoserv (2001)'s report:
    - The length of coastline surveyed per day (4 km) amounts to less than 1.5% of the total coastline; the accuracy of the estimated total migratory influx would be higher if a larger proportion of coastline is surveyed. Furthermore, the migration count was based on count data recorded over part of the day only (06:00 - 13:00), hence any individuals migrating at other times of the day (including night time) were not taken into consideration, leading to a potential underestimate of the total influx of birds if significant migration occurred between 13:00 and 06:00. Furthermore, the total coastline length used in the extrapolation includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema – Valletta and Cottonera areas, where influx of birds would be expected to be lower, hence this may result in an overestimate.
    - The survey commenced late during the migratory season; it effectively incorporated only the tail end of the Turtle Dove migratory season and essentially missed the peak period of Quail migration. The data set from the spring 2011 study is therefore limited and limits the value of comparisons with data collected from previous years.
    - Given resource limitations and time constraints, it was not feasible to collect a larger data set; the relatively small sampling effort used in the spring 2011 study is reflected in the observed high standard deviation values. Inasmuch, the extrapolations made were estimated using limited count data and the stated estimates of total influx should therefore be treated as indicative, and used with caution.
    - The data can only be used for purposes of trend analysis, and even in this respect, due caution should be exercised given the limited data collected; the sampling effort used, while based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical, hence comparison of data over a three-year period may not be sufficient to determine migratory influx with accuracy. Comparisons made in Ecoserv's (2011) report are therefore purely indicative.

- Ecoserv (2011) recommended that robust and rigorous assessment of migratory influx would require trend analysis based on data from monitoring carried out regularly over a sufficiently long period comprising subsequent years, and using the same methodology. For each year, the data should be collected over the whole migratory season and, ideally, the study would entail a larger sampling effort, for example by making counts daily at all of a minimum 24 stations.

The present submission comprises a survey of sightings of Turtle Dove and Common Quail made during the period 9th April – 26th May 2012. Ecoserv had submitted their proposal (reference: P-090312-Spring_2012_Bird_Study) on 14-3-12; this detailed the proposed methodology, which is identical to the one used by Ecoserv in their spring 2011 survey. On 28-3-12, Ecoserv received confirmation from the MEPA that the company had been commissioned to undertake the survey during a seven week period held in April and May 2012. Therefore, the survey period adopted in the present study is considerably longer compared to the previous spring 2011 (48 days versus 21 days). The present survey period also includes the peak migration period of Turtle Dove and a considerable part of the peak migratory period of Common Quail.

Since a review of migratory behaviour of the two species, as well as an overview of local bird hunting and trapping activities and of EU legislation concerning these activities has already been presented in Ecoserv (2011), this will not be repeated here and the reader is referred to the latter report.

2. METHODOLOGY

Fieldwork in relation to the present study was undertaken daily during a 7-week period between 9 April and 26 May, 2012. Counts were made at 8 different stations each day, with each group of 8 stations being surveyed once every 3 days; thus a total of 24 survey localities were surveyed in all. The sampling sites are represented by the grid cells listed in Table 3, while their locations are shown in Figure 3. Since the survey was mainly aimed at quantifying the influx of migrating individuals, field stations were sited at strategic locations in coastal areas, which are more likely to serve as short-term stopover sites immediately following a migratory flight than inland locations. At each study site, the observers also recorded the prevalent meteorological conditions, namely wind direction and strength, and degree of cloud cover. This information is available on the raw data sheets, a copy of which had been submitted to the MEPA. Monitoring of migratory influx of birds was carried out as per the following schedule:

Survey of Turtle Dove: 06:00 – 13:00
Survey of Quail: Two hour period sometime between 06:30 – 12:00

Table 3

List of grid locations where monitoring of influx of migratory birds was carried out.

Location	Day 1	Day 2	Day 3
Gozo	2892	3690	3292
Gozo	3887	2888	3286
Comino			4085
Malta	3881	4283	4077
Malta	4480	4070	6069

Malta	4073	5064	4268
Malta	4666	5277	5663
Malta	6064	4079	4878
Malta	5872	6067	

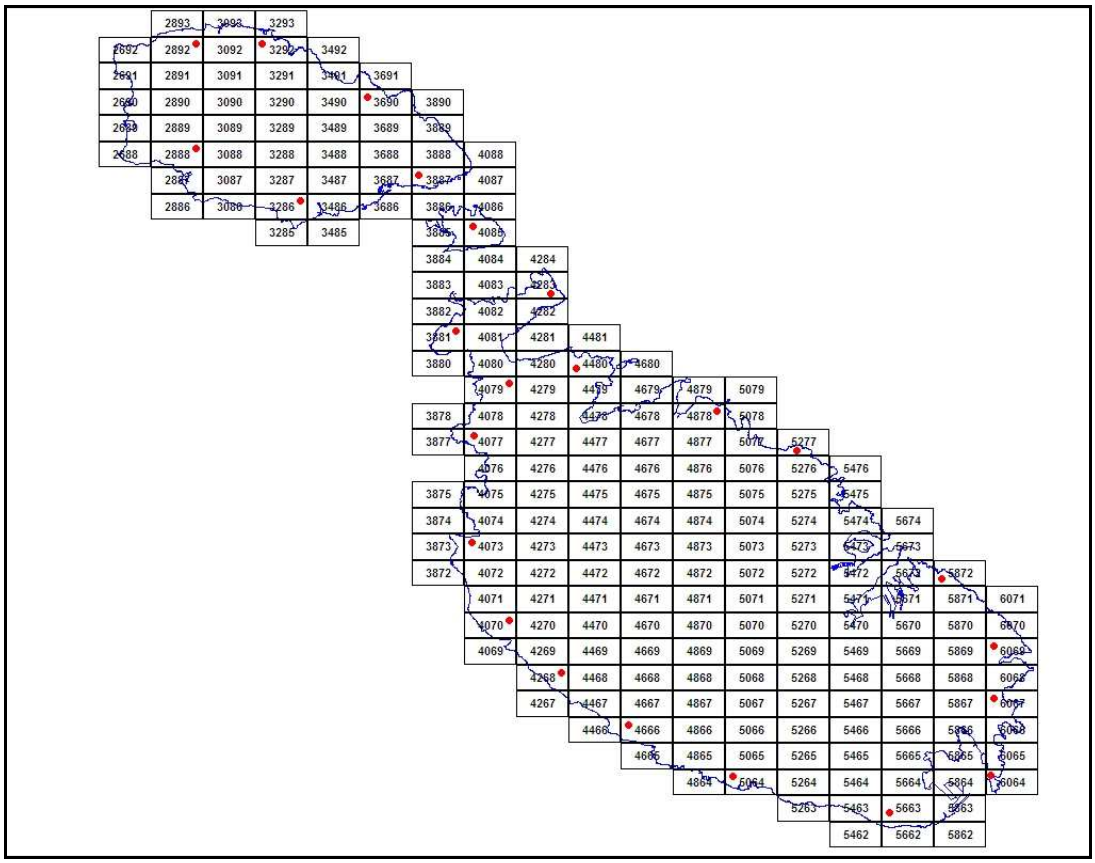

Figure 3. Map of the Maltese Islands showing the localities (grid cells indicated by the red filled circle) where the bird counts were made; see also Table 3.

In the case of Turtle Dove, the number of individuals observed in flight or alighting onto the ground or trees within each study site was recorded within each study site was recorded, while the count area was estimated as the area within the observer's field of view when viewing horizontally (*c.* 500m) and vertically upwards (as far as the birds were detected by sight). As indicated above, since the Common Quail is a nocturnal migrant, monitoring of this species was based on counts of individuals that would have settled in during the previous night. Surveys of Quail entailed the use of dogs to flush the birds and count them. The count area was taken as the total area surveyed in this manner at a particular site.

The survey localities and methodology used in the present study were the same as those used in Ecoserv's spring 2011 survey (see Ecoserv, 2011); the survey design is aimed at assessing changes in migratory influx, which entails trend analysis based on data from monitoring carried out regularly over a sufficiently long period comprising subsequent years, and using the same methodology.

The count data collected for a pre-defined area and the count period at each study site was used to establish the mean number of birds observed for each day of the survey. This enabled comparison with the data collected by Thomaidis (nd) in 2008 and 2009, and by Ecoserv (2011) in 2011, although not all three studies covered exactly the same time period.

3. RESULTS

Ecoserv's laboratory report reference for the present survey is **099-12**. The sample reference codes for the bird count data are **B-039-12** to **B-086-12**.

Turtle dove

Raw counts for Turtle Dove recorded from the 24 stations during the present study vary between a minimum of 0 and a maximum of 38 (see Appendix 1), while the mean daily counts range between 0.0 and 11.75 (Table 4). It is noted that raw counts from different stations incorporate peaks (such as a count of 38 at one station on 22 April, and another count of 35 at a different station on 29 April).

During the return migration of 2012, the peak numbers of Turtle Dove occurred on 16 April, between 21 and 22 April, on 24 April, between 27 April and 30 April, between 4 to 7 May and on 18 and 19 May. Significant numbers also occurred between 8 and 12 May. The Birdlife Malta report cited earlier refers to "good passages" of Turtle Doves without quantifying them on 16, 26 to 28 and 30 April (http://www.birdlifemalta.org/Content/springwatch2012/1144/). These dates tally with the peaks recorded during the present survey.

The recorded counts also varied appreciably between the different stations. At the lower end, at grid location 5064 (see Figure 3), only a single Turtle Dove was recorded throughout the survey period. At the higher end, comparatively high counts were recorded for stations at grid locations 2888 (71 individuals), 4283 (76 individuals), 3292 (80 individuals) and 3887 (70 individuals).

The mean daily counts of Turtle Dove recorded during the present survey are summarised in table 4. These values, together with the mean counts for Spring 2008 and Spring 2009 reported by Thomaidis (nd), as well as for Spring 2011 reported by Ecoserv (2011), are shown graphically in Figure 4. Overall, counts recorded from the present survey show a similar trend to those recorded by Thomaidis (nd) in Spring 2008 and 2009 for the same survey period. Likewise, for the same survey period (May), counts recorded from the present survey show a similar trend to those recorded by Ecoserv (2011) in May 2011. No very high mean counts as recorded in 2008 (98 on 15-4-08 and 26 on 20-4-08; see Figure 4) and in 2009 (33 on 23-4-09; see Figure 4) were recorded during the present survey. Overall, the pattern for counts from the four years under comparison (Figure 4) indicates a migratory influx during April, while the last 2-3 weeks of May represent the tail end of the Turtle Dove' migration period, when mean counts tend to be lower and in gradual decline.

Values of the total mean count of Turtle Dove for Spring 2012 (present survey), Spring 2011 (Ecoserv, 2011), and Spring 2008 and Spring 2009 (Thomaidis, nd), are shown graphically in Figure 5. The comparison in Figure 5 is made for a similar period of the year (April and May), except for 2011 when the survey period was restricted to May. The total mean count recorded during the present (Spring 2012) survey is slightly higher than that recorded during the previous (spring 2011) survey, but lower than that recorded in 2008 and in 2009.

Table 4

Mean (± SD) daily counts of Turtle Dove recorded during the present study, together with estimates of daily and total influx of migratory individuals.

Date	Mean Count ± SD		Estimated Daily Influx
9-Apr-12	0.50	± 1.41	271
10-Apr-12	0.38	± 0.74	203
11-Apr-12	0.75	± 1.16	407
12-Apr-12	0.25	± 0.46	136
13-Apr-12	1.25	± 0.89	678
14-Apr-12	0.88	± 1.46	475
15-Apr-12	1.38	± 1.69	746
16-Apr-12	7.75	± 5.50	4204
17-Apr-12	3.50	± 3.12	1899
18-Apr-12	0.88	± 0.64	475
19-Apr-12	0.50	± 0.53	271
20-Apr-12	1.38	± 1.85	746
21-Apr-12	2.25	± 3.06	1220
22-Apr-12	9.25	± 12.83	5018
23-Apr-12	0.50	± 0.93	271
24-Apr-12	1.75	± 2.12	949
25-Apr-12	1.25	± 1.39	678
26-Apr-12	3.38	± 2.39	1831
27-Apr-12	11.75	± 9.27	6374
28-Apr-12	7.38	± 9.87	4000
29-Apr-12	6.00	± 11.93	3255
30-Apr-12	4.63	± 3.29	2509
1-May-12	2.38	± 2.39	1288
2-May-12	2.13	± 2.53	1153
3-May-12	1.75	± 1.28	949
4-May-12	2.25	± 2.66	1220
5-May-12	4.38	± 3.58	2373
6-May-12	3.88	± 5.64	2102
7-May-12	3.00	± 3.55	1627
8-May-12	1.50	± 1.41	814
9-May-12	1.75	± 2.38	949
10-May-12	0.88	± 0.83	475
11-May-12	1.50	± 1.31	814
12-May-12	1.50	± 2.00	814
13-May-12	0.63	± 1.06	339
14-May-12	1.13	± 1.25	610
15-May-12	1.13	± 1.89	610
16-May-12	0.88	± 1.36	475
17-May-12	0.75	± 1.16	407
18-May-12	2.13	± 3.36	1153
19-May-12	1.25	± 1.58	678
20-May-12	0.75	± 0.89	407
21-May-12	0.38	± 0.74	203
22-May-12	0.75	± 1.75	407
23-May-12	0.38	± 0.74	203
24-May-12	0.00	± 0.00	0
25-May-12	0.63	± 1.19	339
26-May-12	0.25	± 0.46	136
Estimated Total Influx			**57,160**

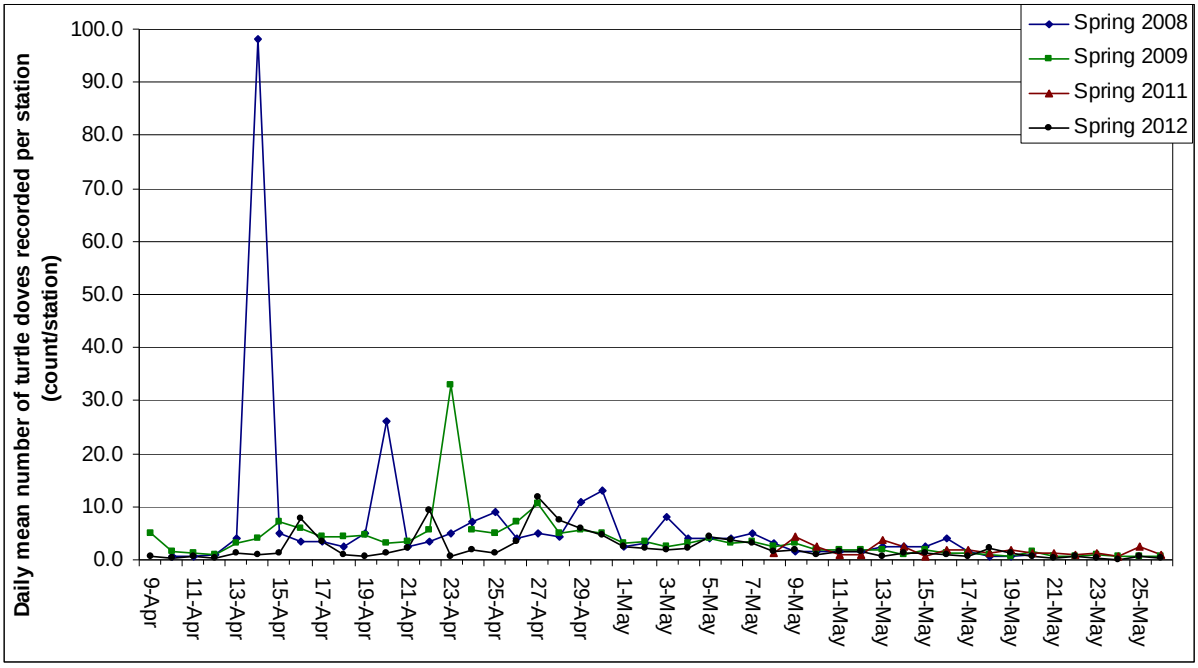

Figure 4. **Daily mean counts of Turtle Dove per station recorded form the present survey during the period 9 April - 26 May, together with values of the same statistic for Spring 2008 and 2009 as reported in Thomaidis (nd), and for May 2011 as reported in Ecoserv (2011).**

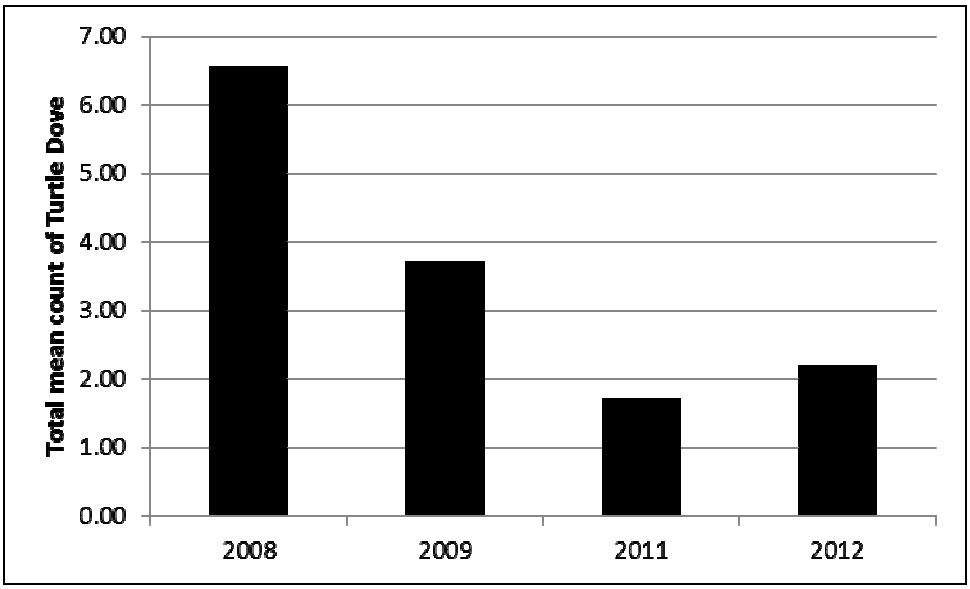

Figure 5. **Values of total mean count of Turtle Dove for Spring 2012 (present survey undertaken between 9 April and 26 May 2012), Spring 2011 (undertaken between 8 and 28 May 2011; Ecoserv, 2011), Spring 2008 (undertaken between 10 April and 20 May 2008; Thomaidis, nd) and Spring 2009 (using data from the period 9 April to 26 May 2009).**

To obtain an approximate estimate of total influx over the Maltese Islands, one can use daily counts and extrapolate these to obtain an indication of the total number of birds that could be migrating over the Maltese Islands on a particular day. However, such an estimate must be treated with utmost caution, given the relatively small number of count stations used in the present survey and that counts were not made daily at each station. Furthermore, passage of birds at different localities is extremely variable, with potential large differences in birds passing at two different localities, even if these are separated by a very small distance. On the other hand, such an estimate would be useful when making comparison between different years, assuming data from surveys based on a similar design are available, to assess whether the trend in influx is increasing or decreasing with time. Since the coastal length surveyed at each station during the present survey is approximately 0.5 km, the total influx of migrating Turtle Dove for the seven-week study period was estimated by extrapolating the values obtained to the total coastline length for the Maltese Islands, which have a perimeter of 271.22 km (Mallia *et al*, 2002)[1]. Based on the mean daily counts (Table 4), extrapolation translates to an estimated daily influx ranging between 0 and 6,374 individuals, with a total influx over the survey period (9 April – 26 May 2012; i.e. 48 days) of 57,160 individuals, i.e. some 1,190 birds per day; see Table 4.

Common Quail

Raw counts for Common Quail recorded from the 24 stations during the present study vary between a minimum of 0 and a maximum of 23 (see Appendix 1), while the mean daily counts range between 0 and 3.13. It is noted that raw counts from different stations incorporate high peaks (such as a count of 23 at one station on 19 April). The recorded counts also varied appreciably between the different stations. At the lower end, at grid location 5064 (see Figure 3), no Quails were recorded throughout the survey period. At the higher end, comparatively high counts were recorded for stations at grid locations 3690 (37 individuals; but note that this was partly due to 23 individuals being recorded on a single date), 5277 (11 individuals), 2893 (10 individuals) and 3286 (15 individuals).

During the return migration of 2012, the peak numbers of Quail occurred on 16 and 19 April. There were several days with significant passages: 11, 20, 29 April and 3 and 7 May. The Birdlife Malta report (http://www.birdlifemalta.org/Content/springwatch2012/1144/) does not mention anything about the migration of this species.

The recorded mean daily counts of Common Quail and area surveyed at each site during the present survey (Spring 2012) are summarised in Table 5, while these values together with the mean counts for Spring 2008 and Spring 2009 reported by Thomaidis (nd), and for Spring 2011 reported by Ecoserv (2011), are shown graphically in Figure 6. The daily mean counts recorded during the period 9 April – 26 May 2012 (present survey) are generally comparable to those obtained in 2008 and 2009 for the same dates (Thomaidis, nd), which indicate that migratory influx was higher in April, with the latter part of May representing the tail end of the Common Quail's migration period. On the other hand, comparison of counts from the present survey with those from the previous year 2011 (Ecoserv, 2011) indicate overall lower values (see Figure 6), although occasional small migratory peaks also occurred during the present study period; such peaks, however, were lower and less frequent than those recorded in May 2011 (Ecoserv, 2011).

Values of the total mean count of Common Quail for Spring 2012 (present survey), Spring 2011 (Ecoserv, 2011), and Spring 2008 and Spring 2009 (Thomaidis, nd), are shown graphically in Figure 7. The comparison in Figure 7 is made for a similar period of the year (April and May), except for 2011 when the survey period was restricted to May. The total mean count recorded during the present

[1] Note, however, that this estimate includes the perimeter of minor islets and rocks.

(Spring 2012) survey is slightly lower than that recorded during the previous (spring 2011) survey, and also lower than that recorded in 2008 and in 2009.

Table 5

Mean (± SD) daily counts of Common Quail recorded and area surveyed, together with estimates of daily and total influx of migratory individuals.

Date	Mean Count ± SD		Total Area	Estimated Daily
9-Apr-12	0.38	± 1.06	1.28	519
10-Apr-12	0.25	± 0.46	0.81	544
11-Apr-12	1.13	± 0.83	1.03	1933
12-Apr-12	0.25	± 0.46	1.28	346
13-Apr-12	0.63	± 0.74	0.81	1359
14-Apr-12	0.25	± 0.71	1.03	430
15-Apr-12	0.13	± 0.35	1.28	173
16-Apr-12	3.00	± 2.51	0.81	6524
17-Apr-12	0.38	± 0.74	1.03	644
18-Apr-12	0.63	± 0.52	1.28	864
19-Apr-12	3.13	± 8.06	0.81	6796
20-Apr-12	0.63	± 1.19	1.03	1074
21-Apr-12	0.50	± 0.53	1.28	691
22-Apr-12	0.13	± 0.35	0.81	272
23-Apr-12	0.00	± 0.00	1.03	0
24-Apr-12	0.25	± 0.71	1.28	346
25-Apr-12	0.25	± 0.46	0.81	544
26-Apr-12	0.38	± 0.52	1.03	644
27-Apr-12	0.13	± 0.35	1.28	173
28-Apr-12	0.38	± 0.74	0.81	816
29-Apr-12	0.75	± 0.89	1.03	1289
30-Apr-12	0.25	± 0.71	1.28	346
1-May-12	0.00	± 0.00	0.81	0
2-May-12	0.50	± 0.76	1.03	859
3-May-12	0.75	± 1.49	1.28	1037
4-May-12	0.25	± 0.46	0.81	544
5-May-12	0.00	± 0.00	1.03	0
6-May-12	0.13	± 0.35	1.28	173
7-May-12	0.63	± 0.74	0.81	1359
8-May-12	0.13	± 0.35	1.03	215
9-May-12	0.50	± 0.76	1.28	691
10-May-12	0.25	± 0.46	0.81	544
11-May-12	0.00	± 0.00	1.03	0
12-May-12	0.13	± 0.35	1.28	173
13-May-12	0.25	± 0.71	0.81	544
14-May-12	0.13	± 0.35	1.03	215
15-May-12	0.13	± 0.35	1.28	173
16-May-12	0.13	± 0.35	0.81	272
17-May-12	0.13	± 0.35	1.03	215
18-May-12	0.13	± 0.35	1.28	173
19-May-12	0.00	± 0.00	0.81	0
20-May-12	0.00	± 0.00	1.03	0
21-May-12	0.00	± 0.00	1.28	0
22-May-12	0.38	± 0.74	0.81	816
23-May-12	0.00	± 0.00	1.03	0

24-May-12	0.50	± 1.07	1.28	691
25-May-12	0.00	± 0.00	0.81	0
26-May-12	0.00	± 0.00	1.03	0
			Estimated Total Influx	**35,018**

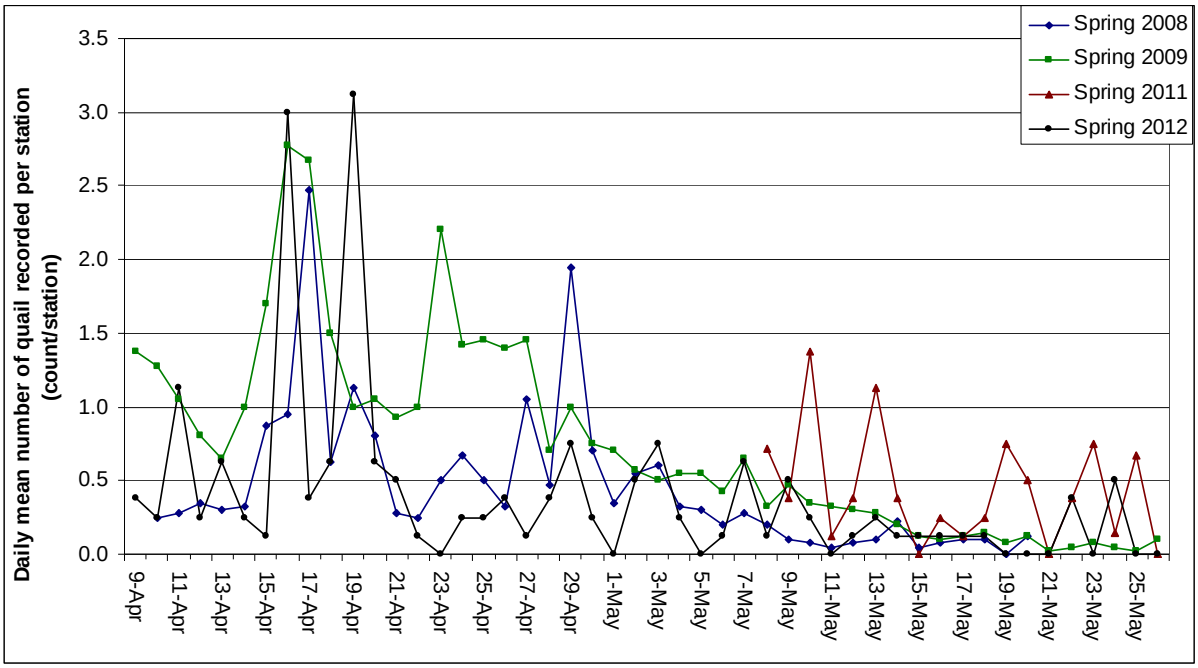

Figure 6. **Daily mean count of Common Quail per station recorded during the period 9 April – 26 May during the present (Spring 2012) survey, together with values of the same statistic for Spring 2008 and 2009 as reported in Thomaidis (nd), and for May 2011 as reported in Ecoserv (2011).**

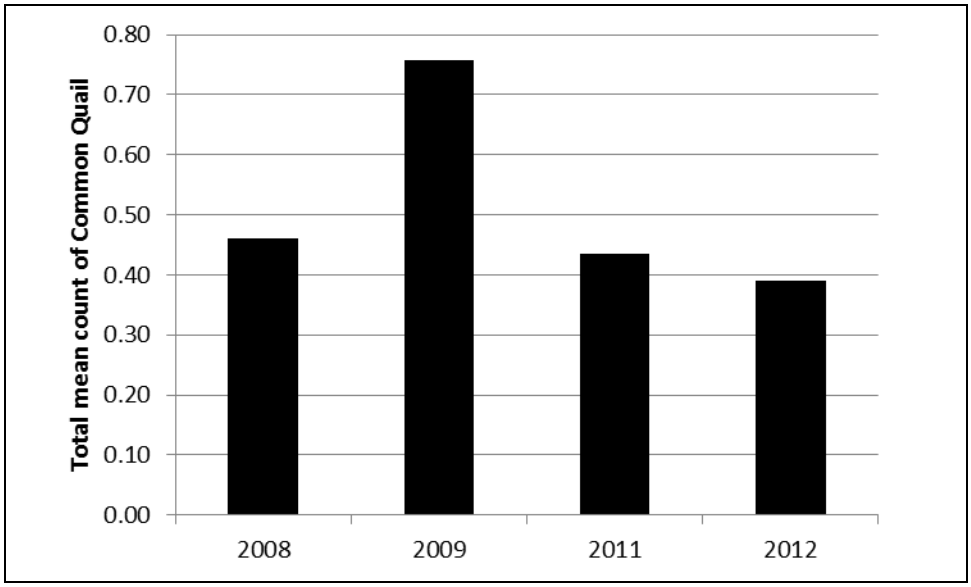

Figure 7. **Values of total mean count of Common Quail for Spring 2012 (present survey undertaken between 9 April and 26 May 2012), Spring 2011 (undertaken between 8 and 28 May 2011; Ecoserv, 2011), Spring 2008 (undertaken between 10 April and 20 May**

2008; Thomaidis, nd) and Spring 2009 (using data from the period 9 April to 26 May 2009).

Since the area surveyed for Quails at each site was recorded, the total influx of Quail could be estimated for the whole area of the Maltese Islands provided that the following assumptions are made: (i) the rate of Quail settling at coastal sites (where the survey was carried out) is equal to that at inland locations, and (ii) the total area used to estimate the migration count does not include areas where settlement of Quail cannot occur in practice. Since Quail tend to migrate to inland sites, settling of Quail in coastal areas will likely be less than or equal to that in inland regions, but not greater, meaning that the estimated total would be an underestimate. The use of coastal sites only is still justified since these are more likely to serve as short-term stopover sites immediately following a migratory flight than inland locations; thus, including inland locations would have resulted in overestimating the total influx due to repeat counting of resident Quails. To ensure that the total area used to estimate the migration count does not include regions within which Quail do not normally settle, even though some birds may fly over, for example, urbanized areas, the total area was calculated as the sum of agricultural areas (161.5 km^2), forested areas (2.1 km^2) and areas of natural vegetation (57.8 km^2) which amounts to 221.4 km^2, representing 72% of the 315 km^2 total area of the Maltese Islands (Land cover data source: MEPA, 2010). The mean (± SD) daily counts and estimated total influx of birds per day are shown in Table 5. Based on these data, extrapolation translates to a total influx of Common Quail during 9 April – 26 May 2012 of 35,018 individuals, or some 729 Quails per day; see Table 5.

4. APPRAISAL

The present survey provides data on counts of Turtle Dove and Common Quail recorded during April and May 2012. In 2012, Government had established the open season during the period 12 – 30 April.

When comparing the results of the present survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 for the same period and those from the May 2011 survey by Ecoserv (2011), a similar trend of Turtle Dove counts is noted overall; the pattern of counts for the four years compared indicates a steady migratory influx during April, while the last 2-3 weeks of May represent the tail end of the Turtle Dove' migration period. However, in contrast to the occasional high mean counts recorded in 2008 and in 2009, no such peaks were recorded during the present survey. When comparing the total mean count recorded during the present (Spring 2012) survey to that recorded during the previous (spring 2011) survey, a higher value is evident for the former. This is to be expected given that the data from the previous 2011 survey were collected late in the migratory period; namely over a short period of 21 days between 8 and 28 May 2011, while the data from the present survey were collected over a much longer period of 48 days that spanned April and May, and therefore included the peak migratory period for the species. However, the total mean count recorded during the present survey is lower than that recorded in 2008 and in 2009. While this would seem to indicate a lower influx of Turtle Dove for Spring 2012, the data collected by Thomaidis (nd) during 2008 and 2009 utilised a greater number of field stations per day, which would increase accuracy. Hence, the lower total mean count recorded during the present survey may have resulted from the lower sampling effort compared to that considered in Thomaidis (nd)' surveys. On the other hand, the occasional very high peak counts of Turtle Dove recorded in 2008 and 2009 (see Figure 4)

from Thomaidis (nd)' surveys contribute to a high total mean count. No such very high peak counts were recorded during the present survey.

The total influx of Turtle Dove for the present survey period (9 April – 26 May 2012) is estimated at 57, 160 individuals. For the period 8 – 28 May 2011, Ecoserv (2011) estimated a total influx of 18, 057 individuals. However, it is emphasised that such estimates must be treated with utmost caution, given the relatively small number of count stations used in the present survey and that counts were not made daily at each station. Increasing the number of field stations per day is desirable since influx of birds at different localities is extremely variable, with potential large differences in Turtle Dove passing at two different localities, even if these are separated by a very small distance, as indicated above. Furthermore, the length of coastline surveyed per day (4 km) amounts to less than 1.5% of the total coastline; the accuracy of the estimated total migratory influx would be higher if a larger proportion of coastline is surveyed. It should also be noted that the total coastline length used in the present extrapolation includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema – Valletta and Cottonera areas, where influx of birds would be expected to be lower, hence this may result in an overestimate. Another limitation is that the Turtle Dove migration counts have been recorded over a seven hour survey period (06:00 - 13:00), hence any individuals migrating at other times of the day were not taken into consideration, leading to a potential underestimate of the total influx if significant Turtle Dove migration occurred between 13:00 and 06:00. On the other hand, the 06:00-13:00 time period represents the time during which the activity of Turtle Dove is at a maximum. Nevertheless, the stated estimate is useful when making comparison between different years, assuming data from surveys based on a similar design are available, to assess whether influx of Turtle Dove is increasing or decreasing with time.

When comparing the results of the present survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 for the same period and those from the May 2011 survey by Ecoserv (2011), a similar trend of Common Quail counts is noted overall; the pattern of counts for the four years compared indicates a steady migratory influx during April, while the last 2-3 weeks of May represent the tail end of the migration period for this species. As recorded in 2008 and in 2009, some peaks of Common Quail counts were recorded during the present survey. When comparing the total mean count recorded during the present (Spring 2012) survey to that recorded during the previous (Spring 2011) survey, a slightly lower value is evident for the former. This is somewhat unexpected, given that the data from the previous 2011 survey were collected late in the migratory period; namely over a short period of 21 days between 8 and 28 May 2011, while the data on Common Quail from the present survey were collected over a much longer period of 48 days that spanned April and May, and therefore included the peak migratory period for the species. Evidently, this resulted from the unusual high counts for Common Quail recorded during May 2011. However, although the total mean count of Common Quail recorded during the present survey is lower than that recorded in 2009, it is similar to that recorded in 2008.

The total influx of Common Quail for the present survey period (9 April – 26 May 2012) is estimated at 35,018 individuals. For the period 8 – 28 May 2011, Ecoserv (2011) estimated a total influx of 22, 699 individuals. However, such estimates must be treated with utmost caution, given the relatively small number of count stations used in the present survey and that counts were not made daily at each station. The considerations emphasised above for Turtle Dove also apply to the Common Quail – birds may migrate along specific pathways, with the result that high numbers may be recorded at one site and a potentially much lower number at a different site, even if the two sites are separated by a very small distance of even a few hundred meters. Hence increasing the number of field stations per day to account for such variation in counts between different sites is desirable. Furthermore, the daily area surveyed for Common Quail amounts to less than 1% of the total area; the accuracy of the estimated total migratory influx would be higher if a larger area is surveyed.

The design of the present survey is largely improved compared to that of the previous survey made in Spring 2011, since counts made in Spring 2012 (present survey) were made over a period of 48 days, which includes a great part of the peak migratory period of both Turtle Dove and Common Quail.

For both Turtle Dove and Common Quail, a number of limitations, which have already been highlighted in *Ecoserv* (2011), are reiterated, namely:

- The data presented in the present report can only be used for purposes of trend analysis, and even in this respect, due caution should be exercised; the sampling effort used In the present study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical, hence comparison of data with that collected in 2008 and 2009 may not be sufficient to determine migratory influx with accuracy. Comparison with data collected by Ecoserv (2011) during Spring 2011 is limited since the bird counts from that year are restricted to a 21 day period during May, unlike bird counts from the present Spring 2012 survey which spanned nearly both April and May. Comparisons made in this report should therefore be interpreted with caution.
- Robust and rigorous assessment of migratory influx requires trend analysis based on data from monitoring carried out regularly over a sufficiently long period comprising subsequent years, and using the same methodology. For each year, the data should be collected over the whole migratory season and, ideally, the study would entail a larger sampling effort, for example by making counts daily at all of a minimum 24 stations. Nevertheless, the data from the present study provides a useful indication of influx of Turtle Dove and Common Quail, provided that results are interpreted in the context of these limitations.

5. REFERENCES

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MEPA (2010). The Environment Report 2008, Sub-Report 4: Land. Malta Environment and Planning Authority; 51 pp.

Thomaidis (nd). Study of the migration patterns of Turtle Dove *Streptopelia turtur* and quail *Coturnix coturnix* over the Maltese Islands. Technological Education Institute of Lamia, Department of Forestry and Management of Natural Environment, Kapenisi, Greece; 56 pp.

APPENDIX I - Raw counts

Table I-1. Daily counts of Turtle Dove recorded per station.

Ecoserv Sample Reference Code	B-063-12	B-064-12	B-065-12	B-066-12	B-067-12	B-068-12	B-069-12	B-070-12	B-071-12	B-072-12	B-073-12	B-074-12
Grid Location	**3690**	**2888**	**4283**	**4077**	**4070**	**5064**	**6069**	**5277**	**2892**	**3286**	**4085**	**4079**
9-April-12									0			
10-April-12	2	0	0		1	0		0				0
11-April-12				0			0			0	2	
12-April-12									0			
13-April-12	2	2	2		1	0		1				2
14-April-12				0			1			2	0	
15-April-12									0			
16-April-12	8	15	5		12	0		1				13
17-April-12				1			8			8	1	
18-April-12									1			
19-April-12	1	0	0		1	0		1				0
20-April-12				2			1			0	0	
21-April-12									0			
22-April-12	12	2	38		0	0		0				12
23-April-12				0			0			0	2	
24-April-12									1			
25-April-12	2	4	1		1	0		0				0
26-April-12				1			8			4	4	
27-April-12									14			
28-April-12	5	29	7		2	1		1				0
29-April-12				2			0			7	2	
30-April-12									4			

Ecoserv Sample Reference Code	B-063-12	B-064-12	B-065-12	B-066-12	B-067-12	B-068-12	B-069-12	B-070-12	B-071-12	B-072-12	B-073-12	B-074-12
Grid Location	**3690**	**2888**	**4283**	**4077**	**4070**	**5064**	**6069**	**5277**	**2892**	**3286**	**4085**	**4079**
1-May-12	4	4	7		1	0		1				1
2-May-12				0			8			2	2	
3-May-12									1			
4-May-12	6	4	0		1	0		1				0
5-May-12				0			5			10	6	
6-May-12									0			
7-May-12	3	4	11		2	0		3				1
8-May-12				0			0			1	3	
9-May-12									6			
10-May-12	1	1	1		2	0		0				0
11-May-12				1			2			0	4	
12-May-12									1			
13-May-12	0	1	0		0	0		0				1
14-May-12				0			3			1	1	
15-May-12									1			
16-May-12	0	4	1		0	0		1				0
17-May-12				0			3			0	2	
18-May-12									3			
19-May-12	4	1	3		0	0		0				0
20-May-12				0			0			0	1	
21-May-12									2			
22-May-12	0	0	0		1	0		0				0
23-May-12				0			0			0	2	
24-May-12									0			
25-May-12	3	0	0		2	0		0				0
26-May-12				0			0			0	0	

Table I-1 cont. Daily counts of Turtle Dove recorded per station.

Ecoserv Sample Reference Code	B-075-12	B-076-12	B-077-12	B-078-12	B-079-12	B-080-12	B-081-12	B-082-12	B-083-12	B-084-12	B-085-12	B-086-12
Grid Location	**4268**	**5663**	**6067**	**4878**	**3292**	**3887**	**3881**	**4480**	**4073**	**4666**	**6064**	**5872**
9-April-12						0	0	0	0	0	0	4
10-April-12			0									
11-April-12	1	0		0	3							
12-April-12						1	0	0	0	0	1	0
13-April-12			0									
14-April-12	0	0		0	4							
15-April-12						0	3	0	0	4	3	1
16-April-12			8									
17-April-12	2	4		0	4							
18-April-12						2	0	1	1	1	1	0
19-April-12			1									
20-April-12	0	0		3	5							
21-April-12						4	0	1	2	0	9	2
22-April-12			10									
23-April-12	0	0		0	2							
24-April-12						1	1	0	0	1	6	4
25-April-12			2									
26-April-12	2	2		1	5							
27-April-12						24	27	4	10	2	7	6
28-April-12			14									
29-April-12	0	1		1	35							
30-April-12						9	10	2	5	1	2	4

Ecoserv Sample Reference Code	B-075-12	B-076-12	B-077-12	B-078-12	B-079-12	B-080-12	B-081-12	B-082-12	B-083-12	B-084-12	B-085-12	B-086-12
Grid Location	**4268**	**5663**	**6067**	**4878**	**3292**	**3887**	**3881**	**4480**	**4073**	**4666**	**6064**	**5872**
1-May-12			1									
2-May-12	1	2		0	2							
3-May-12						2	2	3	1	1	4	0
4-May-12			6									
5-May-12	3	0		3	8							
6-May-12						17	3	2	2	0	6	1
7-May-12			0									
8-May-12	0	3		3	2							
9-May-12						1	5	0	0	1	1	0
10-May-12			2									
11-May-12	0	2		1	2							
12-May-12						5	0	0	0	2	4	0
13-May-12			3									
14-May-12	0	1		0	3							
15-May-12						3	0	0	0	0	5	0
16-May-12			1									
17-May-12	0	0		0	1							
18-May-12						1	1	2	0	0	10	0
19-May-12			2									
20-May-12	0	1		2	2							
21-May-12						0	0	0	1	0	0	0
22-May-12			5									
23-May-12	0	0		0	1							
24-May-12						0	0	0	0	0	0	0
25-May-12			0									
26-May-12	0	0		1	1							

Table I-2. Daily counts of Common Quail recorded per site station, together with the area surveyed at each site.

Ecoserv Sample Reference Code	B-039-12	B-040-12	B-041-12	B-042-12	B-043-12	B-044-12	B-045-12	B-046-12	B-047-12	B-048-12	B-049-12	B-050-12
Grid Location	**3690**	**2888**	**4283**	**4077**	**4070**	**5064**	**6069**	**5277**	**2892**	**3286**	**4085**	**4079**
Surveyed Area (km^2)	0.032	0.119	0.142	0.201	0.008	0.059	0.072	0.114	0.026	0.139	0.251	0.185
9-April-12									0			
10-April-12	0	0	1		1	0		0				0
11-April-12				1			1			3	1	
12-April-12									1			
13-April-12	0	1	1		1	0		0				0
14-April-12				0			0			2	0	
15-April-12									1			
16-April-12	5	4	3		0	0		7				4
17-April-12				0			0			2	0	
18-April-12									0			
19-April-12	23	0	2		0	0		0				0
20-April-12				0			0			3	0	
21-April-12									1			
22-April-12	0	0	0		0	0		0				0
23-April-12				0			0			0	0	
24-April-12									2			
25-April-12	1	1	0		0	0		0				0
26-April-12				0			1			1	0	
27-April-12									0			
28-April-12	1	0	0		0	0		2				0
29-April-12				0			0			2	0	
30-April-12									2			

Ecoserv Sample Reference Code	B-039-12	B-040-12	B-041-12	B-042-12	B-043-12	B-044-12	B-045-12	B-046-12	B-047-12	B-048-12	B-049-12	B-050-12
Grid Location	**3690**	**2888**	**4283**	**4077**	**4070**	**5064**	**6069**	**5277**	**2892**	**3286**	**4085**	**4079**
1-May-12	0	0	0		0	0		0				0
2-May-12				0			0			2	0	
3-May-12									2			
4-May-12	1	1	0		0	0		0				0
5-May-12				0			0			0	0	
6-May-12									0			
7-May-12	2	1	1		0	0		1				0
8-May-12				0			0			0	0	
9-May-12									1			
10-May-12	1	0	0		0	0		1				0
11-May-12				0			0			0	0	
12-May-12									0			
13-May-12	2	0	0		0	0		0				0
14-May-12				0			1			0	0	
15-May-12									0			
16-May-12	0	1	0		0	0		0				0
17-May-12				0			1			0	0	
18-May-12									0			
19-May-12	0	0	0		0	0		0				0
20-May-12				0			0			0	0	
21-May-12									0			
22-May-12	1	0	0		2	0		0				0
23-May-12				0			0			0	0	
24-May-12									0			
25-May-12	0	0	0		0	0		0				0
26-May-12				0			0			0	0	

Table I-2 cont. Daily counts of Common Quail recorded per site station, together with the area surveyed at each site.

Ecoserv Sample Reference Code	B-051-12	B-052-12	B-053-12	B-054-12	B-055-12	B-056-12	B-057-12	B-058-12	B-059-12	B-060-12	B-061-12	B-062-12
Grid Location	**4268**	**5663**	**6067**	**4878**	**3292**	**3887**	**3881**	**4480**	**4073**	**4666**	**6064**	**5872**
Surveyed Area (km^2)	0.014	0.051	0.155	0.266	0.039	0.025	0.509	0.148	0.081	0.419	0.034	0.038
9-April-12						0	0	0	0	3	0	0
10-April-12			0									
11-April-12	1	0		1	1							
12-April-12						0	0	0	1	0	0	0
13-April-12			2									
14-April-12	0	0		0	0							
15-April-12						0	0	0	0	0	0	0
16-April-12			1									
17-April-12	0	0		1	0							
18-April-12						1	0	0	1	1	1	1
19-April-12			0									
20-April-12	0	2		0	0							
21-April-12						0	1	0	1	0	0	1
22-April-12			1									
23-April-12	0	0		0	0							
24-April-12						0	0	0	0	0	0	0
25-April-12			0									
26-April-12	1	0		0	0							
27-April-12						1	0	0	0	0	0	0
28-April-12			0									
29-April-12	0	1		1	2							
30-April-12						0	0	0	0	0	0	0

Ecoserv Sample Reference Code	B-051-12	B-052-12	B-053-12	B-054-12	B-055-12	B-056-12	B-057-12	B-058-12	B-059-12	B-060-12	B-061-12	B-062-12
Grid Location	**4268**	**5663**	**6067**	**4878**	**3292**	**3887**	**3881**	**4480**	**4073**	**4666**	**6064**	**5872**
1-May-12			0									
2-May-12	0	0		1	1							
3-May-12						4	0	0	0	0	0	0
4-May-12			0									
5-May-12	0	0		0	0							
6-May-12						0	1	0	0	0	0	0
7-May-12			0									
8-May-12	0	0		0	1							
9-May-12						0	1	2	0	0	0	0
10-May-12			0									
11-May-12	0	0		0	0							
12-May-12						1	0	0	0	0	0	0
13-May-12			0									
14-May-12	0	0		0	0							
15-May-12						0	1	0	0	0	0	0
16-May-12			0									
17-May-12	0	0		0	0							
18-May-12						1	0	0	0	0	0	0
19-May-12			0									
20-May-12	0	0		0	0							
21-May-12						0	0	0	0	0	0	0
22-May-12			0									
23-May-12	0	0		0	0							
24-May-12						3	0	1	0	0	0	0
25-May-12			0									
26-May-12	0	0		0	0							