Ministry for Sustainable Development, the Environment and Climate Change

Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2014

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1. Introduction

The Ministry for Sustainable Development, the Environment and Climate Change (hereafter 'MSDEC') issued a call for tenders (reference: MSDEC Tender 52-2014) on the 13th July titled "*Service tender for an independent scientific study on the influx or passage of migratory Common Quail and Turtle Dove in Malta during the 2014 Autumn hunting season*". The Terms of Reference (ToR) specified in the tender document are as follows:

8.1 Contract Objectives and Expected Results

8.1.1 Overall Objectives

The overall objective of the contract is:

- *To provide an independent study on the influx or passage of the migratory turtle dove and common Quail in Malta during the Autumn period, between the 1st of September 2014 to the 31st October 2014, inclusive of both dates.*

8.2.2 Specific Objectives

The objectives of this contract are as follows:

- *To survey and scientifically monitor the daily influx of the Turtle Dove and Common Quail;*
- *To estimate the overall presence (influx) of these two species per day and for the whole study period, subject to scientifically justified assumptions;*

The findings of the study will assist the Contracting authority in providing additional verification mechanism for assessing the numbers of Turtle Doves and Quail reported hunted via Carnet de Chasse data.

8.2.3 Results to be Achieved by the Consultant

The tender results are the following:

1. *Daily datasheets with raw counts for the Turtle Dove and Common Quail;*

2. *A monitoring report for the stipulated Autumn 2014 period which must include:*
   a) *List of monitoring stations which recorded high/low counts*
   b) *Dates which showed high/low peaks in the migration of the Turtle Dove and Common Quail*
   c) *A daily estimate of the influx of these two species for the whole of the Maltese Islands*
   d) *The estimated total influx for these species for the whole of the study period, subject to scientifically justified assumptions*
   e) *A comparative analysis of the results obtained with the bag data extracted from Carnet de Chasse for the same period between 2002 and 2013. Relevant Carnet de Chasse reports for the periods 2002-2009 are available on: http://www.mepa.org.mt/biodiversity-reporting. Reports for the years 2010 onwards are available on: https://msdec.gov.mt/en/Pages/WBRU/Reports-and-Statistics.aspx*

8.3. Assumptions and Risks

8.3.1 Assumptions Underlying the Project Intervention

For the purposes of this bird migration study, it will be assumed that the consultant shall use the daily counts obtained from the monitoring stations to extrapolate the approximate estimate of the total influx of the Turtle Dove and Common Quail over the Maltese islands during the period stipulated in Clause 8.4.1.1.

Moreover, it shall also be assumed that the passage of birds at different localities is extremely variable and may be subject to local topographic, anthropogenic, climatic and other conditions which are to be taken into account in the appropriate extrapolation methods that shall be used to estimate the total influx of the species concerned.

8.3.2 Risks

Execution of the bird migration study is dependent on an adequate enrolment of the ornithologists / field assistants who shall be manning the monitoring stations (at least 20 in number). It shall be the responsibility of the consultant to ensure that the monitoring stations (at least 20 in number), are at all times, manned by a sufficient number of ornithologists and/or field assistants. The numbers and location of the monitoring stations, as well as the level of personnel deployed in each station should be consistent with the corresponding parameters deployed in past studies of this nature in Malta.

The consultants shall propose strategies to address the identified risks. These proposals shall be included in the tenderer's technical offer in Part 9 Section 9.2.

The award of the tender may be cancelled if a decision is taken that an Autumn 2014 season for the hunting of Turtle Dove or Quail is not to be opened or a derogation for Spring Hunting in 2015 is not to be applied. Provided further, that this tender shall in no way be construed or perceived as obliging the Government or any other relevant authority to take a decision in applying a derogation for the Spring Hunting 2015 season.

8.4 Scope of the Work

8.4.1 General

8.4.1.1 Project Description

The monitoring of the influx or passage of the Turtle Dove and Common Quail shall take place during the Autumn 2014 period that is, between the 1st of September till the 31st of October 2014, both dates included. The consultant shall mobilise all staff and equipment by the 15th of August 2014, in preparation for the execution of the Autumn 2014 bird migration study. The bird monitoring phase shall commence on the 1st of September 2014.

The bird migration study should comprise the on-field 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 this Autumn period 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.

The collection of scientific data to elucidate general population trends for both species is beyond the scope of this bird migration study. The consultant must submit the daily datasheets with raw counts to the Contracting Authority at the end of each week. The draft monitoring report and analysis is to be submitted within ten (10) working days from the study phase, that is, by the 14th November 2014.

Once the draft Autumn 2014 study report has been certified for quality assurance by the Contracting Authority, the final Autumn 2014 monitoring report is to be submitted within ten (10) working days from such a review.

8.4.1.2 Geographical Area to be covered

The three inhabited islands of the Maltese archipelago, namely Malta, Gozo and Comino.

8.4.1.3 Target Groups

Not applicable

8.4.2 Specific Activities

The bird migration study shall monitor the influx of migratory specimens of the Turtle Dove and the Common Quail, bearing in mind any methodological limitations in the monitoring of these species (as identified in the European Union Management Plan for the Common Quail). 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 a need to take into consideration however, the flexibility of the techniques used to meet the constraints imposed by local geographical conditions.

A network of monitoring stations will need to be set up throughout the three inhabited islands of the Maltese archipelago for the study period. Such a network would need to comprise at least 20 monitoring stations. Each of these monitoring stations shall be operated on at least two days per week and manned by at least two ornithologists and/or field assistants. The number of active stations on any given day shall be at least 6. Monitoring in Malta, Gozo and Comino shall be carried out on a daily basis, however this requirement shall be waived with respect to Comino on those days when access to the Island would not be possible due to adverse weather conditions. The ornithologists and/ or field assistants shall be persons with relevant experience in bird identification and shall have the capacity to identify both Turtle Dove and Quail in the field with ease.

For each day during the bird monitoring phase, at least six (6) monitoring stations must be fully manned. The exact number, location and area of the monitoring stations will be determined in consultation with scientific experts who are commissioned to undertake this bird migration study. Given that the survey is aimed at quantifying the influx or passage of migrating specimens, all monitoring stations shall be placed in strategic locations depending on the species being surveyed and the expected geographical occurrence of the species depending on the timing of the migration. The location of the monitoring stations shall be selected with care and shall not include areas where the settlement or sighting of the Turtle Dove and the Common Quail cannot in practice occur.

Each, monitoring 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 counting procedures occur.

Surveys should focus on observations made, and should be coordinated by the Project co-ordinator or/and scientist/s, so as to enable an appropriate scientific determination with ecological statistics and/or models leading to population estimates (possibly through the extrapolation of results, with standard errors being indicated) and should cover, at least, the three main inhabited islands of the Maltese archipelago. The migration count can include birds counted at a site, observed flying past a fixed point in diurnal migration or alighting onto the ground or trees. For monitoring small landbirds, particularly nocturnal migrants, attention should be drawn to birds observed at short-term stopover sites immediately following a migratory flight. There are several options for producing a useful migration count of small landbirds; these options include: visible migration count; area search or route census counts; incidental observations; and daily estimated totals. The commissioned experts should define in the final monitoring report what they will consider as a migration count and what standardised methods will be used.

Nonetheless, in view that the Common Quail has a preference for cover and may be more difficult to observe or be detected, the surveys for this species should focus on area searches. These may include, the use of dogs to flush the birds out and/or through the use of line transects (a method where observers traverse the monitoring area in close parallel lines to search the area). Surveys for the Common Quail should be carried out for at least two hours in the morning (prior to 12:00hrs) at each of the monitoring stations in operation..

The surveys of the Turtle Dove, on the other hand, should focus mainly on observations (which should include both specimens observed in flight as well as those alighting within the study site). The monitoring of this species needs to be carried out during the times of maximum activity/ major influx of the Turtle Dove and for a minimum of seven hours at each of the monitoring stations in operation.

The consultant may also propose a variation to such methodology, but this shall not take effect unless previously agreed with and confirmed in writing by the Contracting Authority and shall in any case not involve any trapping or any taking of any bird, whether alive or dead, nor any part of any bird.

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.

Daily datasheets with raw counts need to be drawn for each of the monitoring stations in use, such that the prevalent meteorological conditions, namely wind direction and speed, the degree of cloud cover; the habitat type; bird counts; the times and locations; and the names of the field assistants, are all recorded.

The count data collected for a pre-defined area and the count period at each study site shall be used to establish the average counts (per day) recorded in a typical monitoring station for both the Common Quail and Turtle Dove. The calculations for such counts also need to include the standard deviation errors. Such mean counts shall then be extrapolated so as to cover the total area where the species may settle / which serves as short-term stopover sites, in order to estimate the total number of birds migrating daily over the Maltese Islands.

The appropriate methodology for extrapolation shall be determined by the scientific experts taking into account the possibility of repeat counting of observed birds; the patchiness of each species' distribution and frequency depending on available appropriate habitat; the seasonal geographical variation in the frequency of sightings dependent on the expected migration flow direction and any assumptions taken for such calculations need to be clearly stated in the monitoring report.

Relevant seasonal, local topographic (e.g. configuration of the coast), climatic and anthropogenic factors (such as degree of local urbanization) shall be duly taken into account in the extrapolation methodology, subject to scientifically justified assumptions.

The methodology shall not involve trapping or any taking of any bird, whether alive or dead, nor any part of any bird.

The field study shall cover 61 full days between the 1st of September and 31st October 2014. The collection of scientific data to elucidate population trends for both species is beyond the scope of this bird migration study. The consultant must submit the daily datasheets with raw counts to the Contracting Authority at the end of each week of each of the bird monitoring periods. The draft monitoring report and analysis for Autumn 2014 study is to be submitted by the 14th of November 2014 Once such draft report has been certified for quality assurance by the Contracting Authority, the final Autumn 2014 monitoring report is to be submitted within 10 working days from such a review. All Autumn 2014 study project activities must be completed to the Contracting Authority's satisfaction. within five weeks from the termination of the bird monitoring phase.

These activities will result in:

1. Daily datasheets with raw counts for the Turtle Dove and Common Quail
2. A monitoring report for the season.

8.4.3 Project Management

8.4.3.1 Responsible Body

The overall responsibility of the implementation of this contract lies with the Contracting Authority. An official will be appointed to oversee the implementation of the contract.

8.4.3.2 Management Structure

The Head of the Wild Birds Regulation Unit within the Ministry for Sustainable Development, the Environment and Climate Change is the official responsible for this contract. The Head may delegate various tasks to other officials within the Wild Birds Regulation Unit and may appoint an official to act as a project manager and to monitor the progress of this project.

8.4.3.3 Facilities to be provided by the Contracting Authority and/or other parties

None

8.5. Logistics and Timing

8.5.1 Location

The Republic of Malta. The monitoring stations shall be set up at appropriate locations within the three inhabited Maltese Islands, namely in Malta, Gozo and Comino.

The contractor, moreover, is expected to compile reports, prepare scientific analysis, and prepare the setup of the administrative framework from his own premises. The contractor should be available during office hours via e-mail and telephone.

8.5.2 Commencement Date & Period of Execution

The intended commencement date is the date of signature of the contract and the period of execution of the contract will be 3.5 months from this date.

8.6. Requirements

8.6.1 Personnel

8.6.1.1 Other Experts

CVs for experts other than the key experts are not examined prior to the signature of the contract.

The Consultant shall select and hire other experts as required according to the profiles identified in the Organisation & Methodology and these Terms of Reference. For the purposes of this contract, international experts are considered to be those whose permanent residence is outside the beneficiary country while local experts are considered to be those whose permanent residence is in the beneficiary country.

The Consultant should pay attention to the need to ensure the active participation of local professional skills where available, and a suitable mix of international and local staff in the project teams. All experts must be independent and free from conflicts of interest in the responsibilities accorded to them.

The selection procedures used by the Consultant to select these other experts shall be transparent, and shall be based on pre-defined criteria, including professional qualifications, language skills and work experience. The findings of the selection panel shall be recorded. The selection of experts shall be subject to approval by the Contracting Authority.

Note that civil servants and other staff of the Public Service of the beneficiary country cannot be recruited as experts. See sub-article 9.5 of the General Conditions.

8.6.1.2 Support Staff and Backstopping

- *The bird migration study is to be supported by ornithologists or field assistants with relevant experience in bird identification.*
- *Other support staff should be capable in carrying out statistical analysis, report writing and/or other relevant administration work.*

8.6.2 Accommodation

Office accommodation of a reasonable standard and of approximately 10 square metres for each expert working on the contract is to be provided by the Consultant.

8.6.3 Facilities to be provided by the Consultant

The Consultant shall ensure that experts are adequately supported and equipped. In particular it shall ensure that there is sufficient administrative, secretarial and interpreting provision to enable experts to concentrate on their primary responsibilities. It must also transfer funds as necessary to support its activities under the contract and to ensure that its employees are paid regularly and in a timely fashion.

The contractor shall provide the equipment, software and hardware needed for carrying out surveys, data gathering, storage, analysis and evaluation.

If the Consultant is a consortium, the arrangements should allow for the maximum flexibility in project implementation. Arrangements offering each consortium partner a fixed percentage of the work to be undertaken under the contract should be avoided.

8.6.4 Equipment

No equipment is to be purchased on behalf of the Contracting Authority as part of this service contract or transferred to the Contracting Authority at the end of this contract. Any equipment related to this contract which is to be acquired by the beneficiary country must be purchased by means of a separate supply tender procedure.

The contractor shall be responsible for establishing his own sources for goods, equipment, materials and software to perform the necessary activities and tasks, which may include:

- *Field Monitoring equipment, as appropriate e.g. binoculars, compass (to measure wind direction), radar equipment etc.*
- *Gun dogs to flush out Common Quail*
- *Research equipment*

8.7. Reports

8.7.1 Reporting Requirements

(Please refer/peg to Article 26 of the Special/General Conditions)

Daily data sheets with raw counts need to be drawn for each of the monitoring stations in use, such that the prevalent meteorological conditions, namely wind direction and speed, the

degree of cloud cover, the habitat type, bird counts, the times and locations, the names of the field assistants all need to be recorded.

Following the survey/study period a detailed analysis shall be carried out on the data collated which are to be presented in a Report. Such a report is to indicate:

- *the raw counts*
- *sampling methodology used*
- *the time schedule for the monitoring taken place*
- *the locations where monitoring was carried out and the estimated area of each site of observation*
- *the peak and low counts for each of the species under study*
- *the locations/monitoring stations which had peak/low counts*
- *an extrapolation indicating the total influx of the Turtle Dove and the Common Quail migrating over the Maltese Islands for each day*
- *an estimated total influx of the Turtle Dove and the Common Quail for the whole study period*
- *assumptions taken for such estimates*

This report should only concern information/data on the influx of the migratory Turtle Dove and Common Quail and should not include personal opinions of the consultant.

The consultant must submit the daily datasheets with raw counts to the Contracting Authority at the end of each week during the Autumn 2014 bird monitoring phase. The draft Autumn 2014 report and analysis is to be submitted by the 14th November 2014.

Once such draft report has been certified for quality assurance by the Contracting Authority, the final Autumn 2014 monitoring report is to be submitted within ten working days from such a review. All Autumn 2014 project activities must be completed to the Contracting Authority's satisfaction within five weeks from the termination of the bird monitoring phase.

All reports and other forms of written communication must be presented in an editable format using commonly available software. All reports must be approved by the Contracting Authority before these can be considered finalised. All reports will be property of the Contracting Authority and it will have sole copyright.

8.7.2 Submission & approval of progress reports

The daily data sheets with raw counts and 2 hard copies and a soft copy of each of the monitoring reports referred to above must be submitted to the Project Manager identified in the contract. The raw datasheets and the report must be written in English. The Project Manager is responsible for approving the draft monitoring report.

8.8 Monitoring and Evaluation

8.8.1 Definition of Indicators

Results	***Objectively verifiable indicators***	***Sources of verifications***
Daily datasheets with raw	*The original raw datasheets*	*The original datasheets*

counts of the Turtle Dove and Common Quail	*which are to be completed on site during the monitoring process to be submitted by the end of each week of the monitoring phase.*	*submitted to the Contracting Authority.*
Autumn season 2014 Monitoring report which presents a clear analyses of the monitoring carried out	*The draft monitoring report shall be completed within the 14th November 2014.* *The monitoring report will be finalised by the consultant and approved by the Contracting Authority within five weeks from the termination of the Autumn 2014 bird monitoring phase.*	*The actual monitoring report presented by the contractor.*

8.8.2 Special Requirements

Not applicable

Ecoserv Ltd (hereafter 'Ecoserv') made a submission and was subsequently informed by the MSDEC that its bid was successful and, as a result, was awarded the tender.

The present submission constitutes Ecoserv's report of the independent scientific study on the influx of migratory Common Quail *Coturnix coturnix* and Turtle Dove *Streptopelia turtur* in Malta, undertaken by the company during the period 1 September to 31 October 2014, which coincides with the 2014 autumn hunting season, and is based on the ToR stated above.

In order to put the present study in perspective, an overview of the findings from previous similar studies undertaken in spring (Ecoserv, 2011; 2012; 2013; 2014) follows, however, the reader is also referred to the review on migratory behaviour of the two species, as well as the overview of local bird hunting and trapping activities and of EU legislation concerning these activities, that have been presented in Ecoserv's (2011) report. No similar studies have been previously undertaken during autumn.

Although there is a dearth of published data on migration of the Common Quail and Turtle Dove across the Maltese Islands, a considerable amount of data have been 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) were recorded by assigned local hunters who contributed to the surveys under his supervision and coordination.

Records of 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 2013, are also available in the *Carnet de Chasse* reports for the respective years, while it also appears that separate data and other relevant information pertaining to these two species are also held by Federazzjoni Kaccaturi Nassaba u Konservazzjonisti (FKNK) and BirdLife Malta (BLM).

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

- Counts for Turtle Dove recorded from the 24 field sites (= stations) varied between 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 sites, 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 sites varied between 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 sites, on any of the survey dates. As in the case of Turtle Dove, migration of Common Quail is dependent on weather 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 as little as a few hundred meters. Given that Common Quail tend to stay in the same general area for a few days if left undisturbed, even though this is highly unlikely because of the intense hunting pressure, as several hunters usually roam the same area with dogs after each other, it was not possible to ascertain whether high numbers of individuals recorded successively at the same field site included new 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 and trends 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 (2011)'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 one would expect some disturbance to birds migrating at low altitude, hence their numbers there would be expected to be lower, resulting 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 sites.

The findings from the spring 2012 survey, which was undertaken by Ecoserv during the period 9 April to 26 May, 2012, and was based on ToR that were similar to the ones for the 2011 (Ecoserv, 2011) and present studies, are as follows:

Turtle Dove

- When comparing the results of the 2012 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 for the same period and with 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 in spring 2012. When comparing the grand mean count recorded during the 2012 survey to that recorded during the previous 2011 survey, a higher value is evident for the former, however, this was attributed to collection of data late in the migratory period; namely between 8 and 28 May 2011, while the data from the 2012 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. On the other hand, the grand mean count recorded during the 2012 survey was 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 sites per day, which would increase accuracy. Hence, the lower grand mean count recorded during the 2012 survey may have resulted from the lower sampling effort compared to that made in Thomaidis' (nd) surveys. It was also noted that the occasional very high peak counts of Turtle Dove recorded in 2008 and 2009 during Thomaidis' (nd) surveys contributed to a high grand mean count. No such very high peak counts were recorded during the 2012 survey.

- A total influx of 57, 160 individuals of Turtle Dove was estimated for 2012, compared to a total influx of 18, 057 individuals estimated for 2011. However, Ecoserv (2011) emphasised that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the surveys and that counts were not made daily at each station. Increasing the number of field sites 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. 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. Furthermore, authors reiterated that 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 one would expect some disturbance to birds migrating at low altitude, hence their numbers there would be expected to be lower, resulting in an overestimate. Another limitation was that the Turtle Dove migration counts were 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.

Common Quail

- When comparing the results of the 2012 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 for the same period, and with those from the 2011 survey by Ecoserv (2011), a similar trend of Common Quail counts was 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 2012. When comparing the total mean count recorded during the 2012 survey with that recorded during the previous 2011 survey, a slightly lower value is evident for the former. This was 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 2012 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 grand mean count of Common Quail recorded during the 2012 survey turned out to be lower than that recorded in 2009, it was similar to that recorded in 2008.

- The total influx of Common Quail estimated for 2012 was 35,018 individuals, compared to 22, 699 individuals estimated for the previous year 2011. However, as emphasised above for Turtle Dove, such estimates must be treated with utmost caution, given the relatively small number of field sites used in the surveys and that counts were not made daily at each site. The considerations highlighted 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 relatively small distance of a few hundred meters. Hence, increasing the number of survey sites 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.

- It was noted that the design of the 2012 survey was largely improved compared to that of the previous survey made in 2011, since counts from spring 2012 were made over a period of 48 days, which included 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 had already been highlighted in Ecoserv's (2011) report, were reiterated, namely:
  - The data presented in the 2012 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 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 and trends over time with accuracy. Comparison of data from 2012 with data from 2011 is limited since the bird counts from the latter year were restricted to a 21 day period during May, unlike bird counts from the 2012 survey which spanned nearly both April and May. Comparisons made in Ecoserv's 2012 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 sites. Nevertheless, the data from the 2012 survey provided a useful indication of influx of Turtle Dove and Common Quail, provided that results are interpreted within the context of the stated limitations.

The findings from the spring 2013 survey, which was undertaken by Ecoserv during the period 10 April to 30 April, 2013, and was based on ToR that were similar to the ones for the 2011 (Ecoserv, 2011), 2012 (Ecoserv, 2012), and present studies, are as follows:

<u>Turtle Dove</u>

- When comparing the results of the 2013 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, and those from the 2012 survey by Ecoserv (2012), a similar trend of counts recorded during the period 10 – 30 April was noted overall; the pattern of counts for the four years compared indicated a steady migratory influx during the last two weeks of April. However, in contrast to the occasional high mean counts recorded in 2008 and in 2009, no such peaks were recorded during the 2013 survey. When comparing the grand mean value recorded during the spring 2013 survey to that recorded during the previous (spring 2012) survey, a higher value was evident for the former, but this difference was not statistically significant. However, the grand mean value recorded during the 2013 survey was lower than that recorded in 2008 and 2009. While this would seem to indicate a lower influx of Turtle Dove for spring 2013 compared to 2008 and 2009, the data collected by Thomaidis (nd) during the latter two years utilised a greater number of field sites per day, which would increase accuracy. Hence, the lower grand mean value recorded during the 2013 survey may have resulted from the lower sampling effort compared to that used in Thomaidis' (nd) surveys. On the other hand, the occasional very high peak counts of Turtle Dove recorded in 2008 and 2009 (see Figure 2) from surveys made in these two years by this worker (Thomaidis, nd) contribute to a high grand mean. No such very high peak counts were recorded during the 2013 survey.

- The total influx of Turtle Dove for the 2013 survey period (10 – 30 April 2013) was estimated at 42,521 individuals. For the period 9 April – 26 May 2012, Ecoserv (2012) estimated a total influx of 57,160 individuals, while a total influx of 18,057 individuals was estimated for the period 8 – 28 May 2011 (Ecoserv, 2011). However, Ecoserv (2013) emphasised that such values must be treated with utmost caution, given the relatively small number of field sites used in the surveys, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. Increasing the number of field sites 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. The authors pointed out that the total coastline length used in the 2013 survey includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema, Valletta and Cottonera areas, where one would expect some disturbance to birds migrating at low altitude, hence their numbers there would be expected to be lower, resulting in an overestimate. Another limitation is that the Turtle Dove migration counts were recorded over a seven hour survey period (06:00 - 13:00), hence any individuals migrating at other times of the day were not included, 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 expected to be highest. 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.

Common Quail

- When comparing the results of the 2013 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, and those from the 2012 survey by Ecoserv (2012), a similar trend of Common Quail counts recorded during the period 10 – 30 April was noted overall between the 2008, 2012 and 2013 surveys, while slightly higher counts were recorded in 2009. However, no migratory peaks for Common Quail were recorded during the 2013 survey, whereas such peaks had been recorded in 2008, 2009 and 2012. When comparing the grand mean value recorded during the 2013 survey with that recorded during the previous (2012) survey, a lower value was evident for the former, although this difference was not statistically significant. The grand mean value of Common Quail recorded during the 2013 survey was also lower than those recorded in 2008 and 2009

- The total influx of Common Quail for the 2013 survey period (10 – 30 April 2013) was estimated at 67,460 individuals. For the period 9 April – 26 May 2012, Ecoserv (2012) estimated a total influx of 35,018 individuals, while a total influx of 22,699 individuals was estimated for the period 8 – 28 May 2011 (Ecoserv, 2011). The estimate made for the 2013 survey was therefore much higher than for previous years and may be an overestimate resulting from an artefact of the extrapolation procedure. Ecoserv (2013) reiterated that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the present survey, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. 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 sites 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.

- It was noted that the design of the 2013 survey included counts made over a 21 day period between 10 and 30 April 2013, which covers the period when peak migration of Turtle Dove and Quail normally occurs and was therefore and improvement over the 2011 survey (which, having been held in May, only covered the tail end of the migratory periods). However, no information on potential migratory peaks, particularly for Turtle Dove, which may have occurred in May 2013, was available, given that no count data were collected during this month.
- For both Turtle Dove and Common Quail, a number of limitations, which had already been highlighted in Ecoserv's reports from the two previous spring seasons (Ecoserv, 2011; 2012), were reiterated, namely:
    - The data presented in the 2013 report can only be used for purposes of trend analysis, and even in this respect, due caution should be exercised given that the sampling effort used in the 2013 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical. Comparison with data collected by Ecoserv (2011) during spring 2011 was not possible since the bird counts from that year were collected in May, while the 2013 survey was made in April, which is deemed to be more representative of the period during which migratory influx of Turtle Dove, and to a lesser extent Common Quail, is highest.
    - 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 ideally be collected over the whole migratory season and using a larger sampling effort, for example by making counts daily at all of a minimum 24 sites. Nevertheless, the data from the 2013 study provides a useful indication of the influx of Turtle Dove and Common Quail, provided that results are interpreted in the context of these limitations.

The findings from the spring 2014 survey, which was undertaken by Ecoserv during the period 10 April to 30 April, 2014, and was based on ToR that were similar to the ones for the 2011 (Ecoserv, 2011), 2012 (Ecoserv, 2012), 2013 (Ecoserv, 2013) and present studies, are as follows:

<u>Turtle Dove</u>

- When comparing the results of the 2014 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, and those from the 2012 and 2013 surveys by Ecoserv (2012; 2013), a similar trend of counts recorded during the period 10 – 30 April was noted overall; the pattern of counts for the five years compared indicates a migratory influx throughout the periods when the survey was held. However, in contrast to the occasional high mean counts recorded in 2008 and in 2009, no such peaks were recorded during the 2014 survey. When comparing the grand mean value recorded during the spring 2014 survey to that recorded during the previous two surveys (spring 2012 and 2013), a lower value was evident for the former, but this difference was not statistically significant. Nevertheless, a general trend of decrease in migratory influx was evident; this was corroborated by reports from hunters and ornithologists who observed an overall low migratory influx in 2014. Furthermore, the grand mean value recorded during the 2014 survey was lower than that recorded by Thomaidis in 2008 and 2009, which indicates a lower influx of Turtle Dove for spring 2014. No such very high peak counts were recorded during the 2014 survey

- The total influx of Turtle Dove for the 2014 survey period (10 – 30 April 2014) was estimated at 24,922 individuals. For the period 10 April – 30 May 2013, a total influx of 42,521 individuals was estimated (Ecoserv, 2013); for the period 9 April – 26 May 2012, a total influx of 57,160 individuals was estimated (Ecoserv 2012), and for the period 8 – 28 May 2011, a total influx of 18,057 individuals was estimated (Ecoserv, 2011). However, it was reiterated that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the surveys, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. Increasing the number of field sites 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. As had already been pointed out in previous reports, 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 total coastline length used in the 2014 survey includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema, Valletta and Cottonera areas, where one would expect some disturbance to birds migrating at low altitude, hence their numbers there would be expected to be lower, resulting in an overestimate. Another limitation is that the Turtle Dove migration counts were recorded over a seven hour survey period (06:00 - 13:00), hence any individuals migrating at other times of the day were not included, 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 deemed 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.

Common Quail

- When comparing the results of the 2014 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, and those from the 2012 and 2013 surveys by Ecoserv (2012; 2013), a similar trend of Common Quail counts recorded during the period 10 – 30 April was noted overall over these years, while slightly higher counts were recorded in 2009. However, no migratory peaks for Common Quail were recorded during the 2014 survey, whereas such peaks had been recorded in 2008, 2009 and 2012. When comparing the grand mean value recorded during the spring 2014 survey with that recorded during the previous two surveys (spring 2012 and 2013), a lower value was evident for the former. In the case of the 2014 and previous (2013) surveys, the difference was marginal and not statistically significant. On the other hand, the grand mean value recorded in 2014 was significantly lower than that recorded in 2012. The grand mean value of Common Quail recorded during the 2014 survey was also lower than values recorded in 2008 and 2009.

- The total influx of Common Quail for the 2014 survey period (10 – 30 April 2014) was estimated at 37,773 individuals. For the period 10 April – 30 May 2013, a total influx of 67,460 individuals was estimated (Ecoserv, 2013); for the period 9 April – 26 May 2012, a total influx of 35,018 individuals was estimated (Ecoserv, 2012), and for the period 8 – 28 May 2011, a total influx of 22,699 individuals was estimated (Ecoserv, 2011). The estimate made for the 2014 survey was therefore lower than that for 2013 but similar to that recorded in 2012. It was reiterated that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the present survey, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. 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 sites 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.

- It was noted that the design of the 2014 survey included counts made over a 21 day period between 10 and 30 April 2014, which covers the period when peak migration of Turtle Dove and Quail normally occurs and is therefore and improvement over the 2011 survey, which, having been held in May, only covered the tail end of the migratory periods. However, no information on potential migratory peaks, particularly for Turtle Dove, which may have occurred in May 2014, was available, given that no count data were collected during this month.
- For both Turtle Dove and Common Quail, a number of limitations, which had already been highlighted in Ecoserv's reports from the three previous spring seasons (Ecoserv, 2011; 2012, 2013), were reiterated, namely:
    - The data presented in the 2014 report can only be used for purposes of trend analysis, and even in this respect, due caution should be exercised given that the sampling effort used in the 2014 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical. Comparison with data collected by Ecoserv (2011) during spring 2011 was not possible since the bird counts from that year were collected in May, while the 2014 survey was made in April, which is deemed to be more representative of the period during which migratory influx of Turtle Dove, and to a lesser extent Common Quail, is highest.
    - 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 ideally be collected over the whole migratory season and using a larger sampling effort, for example by making counts daily at all of a minimum 24 sites. Nevertheless, the data from the 2014 study provides a useful indication of the influx of Turtle Dove and Common Quail, provided that results are interpreted in the context of these limitations.

2. Methodology

The methodology used by Ecoserv during the present autumn 2014 survey is identical to that used in surveys made by the same company in previous spring seasons (see Ecoserv, 2011; 2012; 2013; 2014); 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. During the survey, two individuals - a field assistant capable of identifying Turtle Dove and Common Quail and an observer who was responsible for recording of data in the field - were stationed at a total of 21 sites (= count stations) distributed over Malta, Comino and Gozo. The survey was undertaken over a 9 week period between 1 September and 31 October, 2014. During the survey, counts of individuals of the two species *Coturnix coturnix* and *Streptopelia turtur* were made at each of 6 different sites on each day during the monitoring period. Each group of 6 sites was surveyed once every 4 days, such that a total of 21 sites were surveyed over each period of 4 days. The study site at Comino was included in the 6 sites

surveyed on any one day, such that this site was surveyed on a daily basis. The sampling sites used in the present study include ones used in the previous surveys undertaken during spring 2011-2014 (see Ecoserv, 2011; 2012; 2013; 2014), and are represented by the grid cell reference numbers listed in Table 1, while their locations are shown in Figure 1.

Table 1

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

Location	Day 1	Day 2	Day 3	Day 4
Gozo	3690	3292	2888	3286
Comino	4085	4085	4085	4085
Malta	3881	4079	4077	4073
Malta	4070	4268	4666	5064
Malta	5663	6067	6069	5872
Malta	5277	4878	4480	4283

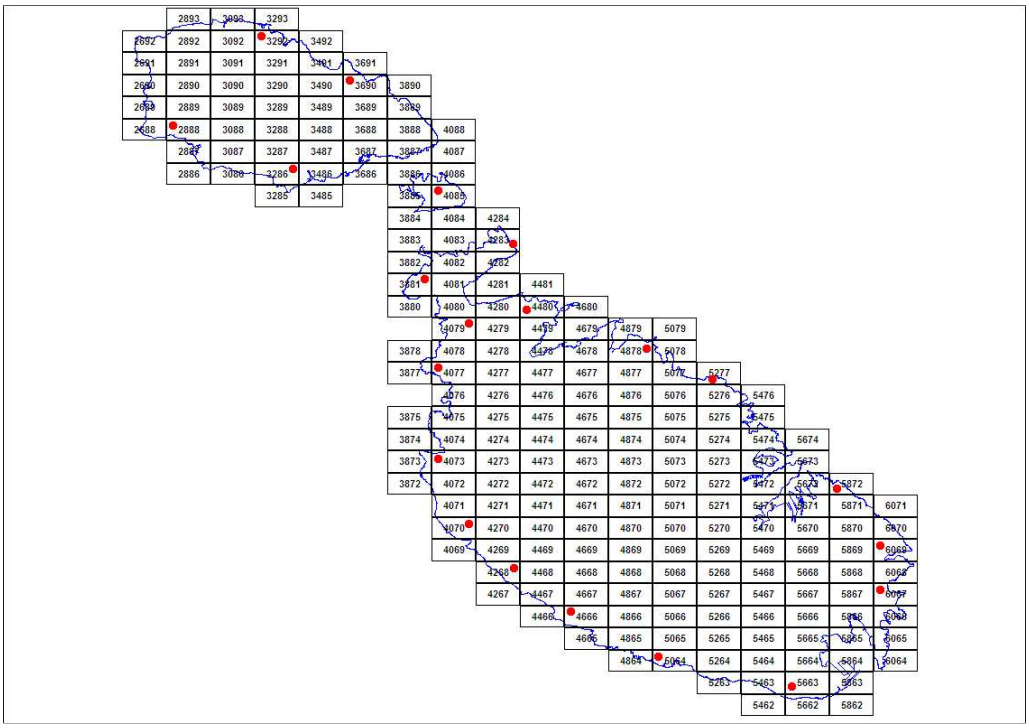

Figure 1. Map of the Maltese Islands showing the localities (grid cells indicated by the red filled circle) where the bird counts were made; see also Table 1.

Since the survey was mainly aimed at quantifying the influx of migrating individuals, field sites were sited at strategic locations within coastal areas. However, it should be noted that birds reach land at different altitudes; sometimes they are observed flying high at coastal areas and may either keep that course as they overfly or alight in inland areas. 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). In the case of Common Quail, it should be noted that this species has the tendency to reach the Maltese Islands late in the afternoon, particularly in late October and in November. As the survey period covered the earlier part of its migration period

and since Common Quail is mainly a nocturnal migrant, monitoring of this species was mainly based on counts of individuals that would have settled in during the previous night. Surveys of Quail entailed the use of trained dogs to locate and flush birds in order to count them when taking flight following disturbance. 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 during a 2 hour period sometime between 06:30 and 12:00. 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 recorded for each day of the survey.

At each study site, the observers also recorded the prevalent weather conditions, namely wind direction and strength, and degree of cloud cover. This information is available on the raw data sheets, copies of which have been submitted to the Wild Birds Regulation Unit (WBRU) of the MSDEC.

3. Results

Ecoserv's laboratory report reference for the present survey is **110-14**. The sample reference codes for the bird count data are **B-017-14** to **B-058-14**.

Turtle dove

Raw daily counts for Turtle Dove recorded from the 21 sites during the present study varied between 0 and a maximum of 4 (see Appendix I), while the mean daily counts ranged between 0 and 1.3 (Table 2). During the present (2014) autumn migration, no migratory peaks were recorded but slightly higher numbers of Turtle Dove occurred on 7–15 September, on 22–25 September and on 7 October 2014. The recorded counts did not vary appreciably between the different sites: at the lower end, at grid locations 4283, 4878 and 5872 (see Figure 1), only one individual Turtle Dove was recorded throughout the survey period, while at the higher end, 9 Turtle Dove individuals were recorded from the site at grid location 4666. Only individual birds were seen and no flocks of Turtle Doves were observed during the survey period.

Values of mean daily counts and total counts of Turtle Dove recorded during the period 1 September to 31 October 2014 from the present survey are summarised in Table 2. Values of standard deviation associated with the mean daily counts are also provided in Table 2. Standard deviation is a measure of variability among counts recorded from the different sites, that is, a low standard deviation implies that very similar counts were recorded at all six sites surveyed during a particular day, whereas dissimilar values would lead to high standard deviation. Standard deviation is influenced by sample size (i.e. number of study sites); it tends to increase with a decreased sample size. These same values are also shown, along with values of mean counts recorded for the same period in 2008, 2009 (Thomaidis, nd), in Figure 2. Overall, counts recorded during the present survey show a similar trend to those recorded by Thomaidis (nd) in autumn 2008 and 2009, although no peaks in mean counts as recorded in 2009 (4.1 on 23-9-09; see Figure 2) were recorded during the present survey. The general trend noted from comparison of count data from the three years is a main migratory influx during September.

Values of the grand mean of Turtle Dove counts recorded during the period 1 September to 31 October from the present survey, together with values of the grand mean for the same period in 2008, 2009 (Thomaidis, nd), are shown in Figure 3. Overall, the grand mean recorded during the present (autumn 2014) survey is lower than that recorded during the previous surveys.

Table 2

Values of mean (± SD) daily count and daily total count recorded from the six study sites, together with total influx of migratory Turtle Dove.

Date	Mean Count ± SD		Total count	Estimated Daily Influx
1-Sep-14	0.33	± 0.52	2	181
2-Sep-14	0.17	± 0.41	1	90
3-Sep-14	0.50	± 0.84	3	271
4-Sep-14	0.00	± 0.00	0	0
5-Sep-14	0.33	± 0.52	2	181
6-Sep-14	0.33	± 0.52	2	181
7-Sep-14	1.33	± 1.03	8	723
8-Sep-14	0.67	± 1.21	4	362
9-Sep-14	0.17	± 0.41	1	90
10-Sep-14	0.50	± 0.55	3	271
11-Sep-14	0.83	± 1.33	5	452
12-Sep-14	0.50	± 0.84	3	271
13-Sep-14	1.00	± 1.55	6	542
14-Sep-14	0.67	± 1.63	4	362
15-Sep-14	0.67	± 1.03	4	362
16-Sep-14	0.17	± 0.41	1	90
17-Sep-14	0.17	± 0.41	1	90
18-Sep-14	0.33	± 0.82	2	181
19-Sep-14	0.17	± 0.41	1	90
20-Sep-14	0.17	± 0.41	1	90
21-Sep-14	0.17	± 0.41	1	90
22-Sep-14	0.83	± 0.98	5	452
23-Sep-14	0.17	± 0.41	1	90
24-Sep-14	0.50	± 0.84	3	271
25-Sep-14	0.83	± 1.60	5	452
26-Sep-14	0.67	± 1.21	4	362
27-Sep-14	0.17	± 0.41	1	90
28-Sep-14	0.50	± 0.55	3	271
29-Sep-14	0.00	± 0.00	0	0
30-Sep-14	0.00	± 0.00	0	0
1-Oct-14	0.17	± 0.41	1	90
2-Oct-14	0.00	± 0.00	0	0
3-Oct-14	0.17	± 0.41	1	90
4-Oct-14	0.17	± 0.41	1	90
5-Oct-14	0.00	± 0.00	0	0
6-Oct-14	0.00	± 0.00	0	0
7-Oct-14	0.00	± 0.00	0	0
8-Oct-14	0.00	± 0.00	0	0
9-Oct-14	0.17	± 0.41	1	90
10-Oct-14	0.17	± 0.41	1	90
11-Oct-14	0.00	± 0.00	0	0
12-Oct-14	0.00	± 0.00	0	0
13-Oct-14	0.67	± 1.03	4	362
14-Oct-14	0.00	± 0.00	0	0
15-Oct-14	0.00	± 0.00	0	0
16-Oct-14	0.17	± 0.41	1	90
17-Oct-14	0.00	± 0.00	0	0
18-Oct-14	0.00	± 0.00	0	0

Date	Mean Count ± SD		Total count	Estimated Daily Influx
19-Oct-14	0.00	± 0.00	0	0
20-Oct-14	0.17	± 0.41	1	90
21-Oct-14	0.00	± 0.00	0	0
22-Oct-14	0.00	± 0.00	0	0
23-Oct-14	0.00	± 0.00	0	0
24-Oct-14	0.00	± 0.00	0	0
25-Oct-14	0.00	± 0.00	0	0
26-Oct-14	0.00	± 0.00	0	0
27-Oct-14	0.00	± 0.00	0	0
28-Oct-14	0.00	± 0.00	0	0
29-Oct-14	0.00	± 0.00	0	0
30-Oct-14	0.00	± 0.00	0	0
31-Oct-14	0.00	± 0.00	0	0
			Estimated Total Influx	**7956**

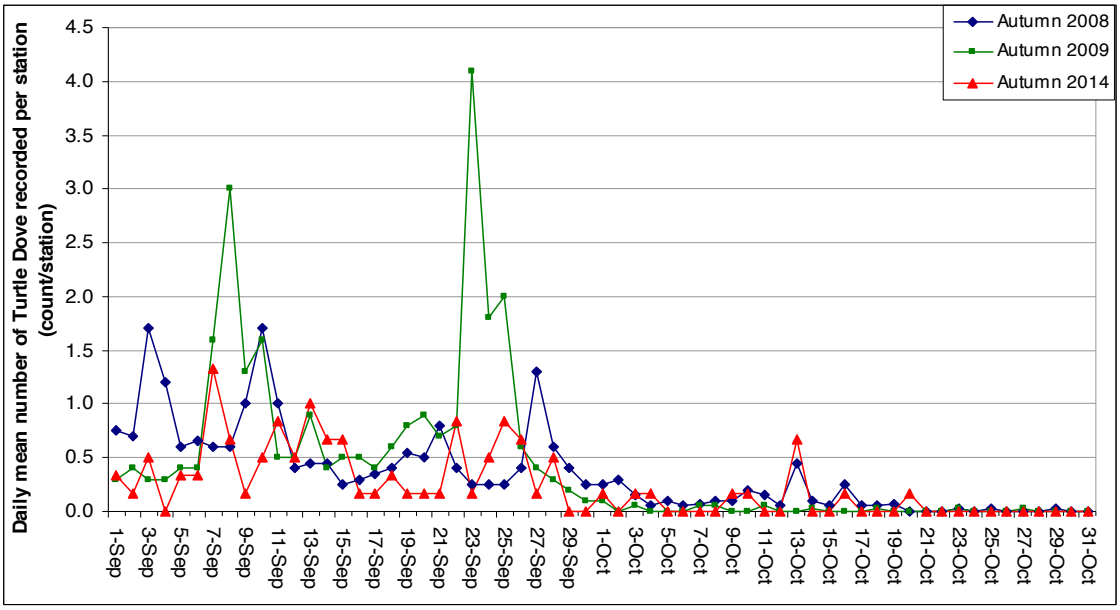

Figure 2. Daily mean counts of Turtle Dove per station (= site) recorded during the present survey during the period 1 September to 31 October, together with values of the same statistic for autumn 2008 and 2009 as reported in Thomaidis (nd).

As has been done in previous surveys undertaken in spring (Ecoserv, 2011; 2012; 2013; 2014), an estimate of total influx of Turtle Dove over the Maltese Islands was made using the daily counts (Figure 3). Extrapolations were then made to obtain the total number of individuals of this species that have migrated over the Maltese Islands on a particular date. However, as emphasised in reports of surveys from previous surveys (Ecoserv, 2011; 2012; 2013; 2014), such an estimate must be treated with utmost caution, given that Turtle Dove migration starts around the third week of August, which period is not covered by the present survey; the relatively small number of sites used; and that the counts were not made daily at each site. Furthermore, passage of birds at different localities is extremely variable, with potential large differences in number of birds passing at two different localities, even if these are separated only by a very small distance. As already stated, the

other limiting factor is that the field survey stops at 13.00 and does not start again before 06.00, hence potentially missing birds that arrive in the afternoon and during the night, which are usually seen at the very first light of day, many of which end up shot within a very short time, and therefore these may have not been recorded by the field observers during the survey. On the other hand, the estimate given in the present report is 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 site during the present survey is approximately 0.5 km, the mean daily count represents the mean influx of Turtle Dove per 0.5 km coastline. The estimated daily influx was obtained by extrapolating the mean daily values obtained (per 0.5 km) to the total coastline length for the Maltese Islands, which have a perimeter of 271.22 km (Mallia *et al*, 2002) [1]; that is, the estimated daily influx equals the mean daily count multiplied by an extrapolation factor of 271.22/0.5. The values of estimated daily influx were then summed to obtain an estimate of the total influx of migrating Turtle Dove for the eight-week study period. Based on the mean daily counts (Table 2), extrapolation translates to an estimated daily influx ranging between 0 and 723 individuals, with a total influx over the survey period (1 September to 31 October; i.e. 61 days) of 7,956 individuals, i.e. some 130 birds per day; see Table 2.

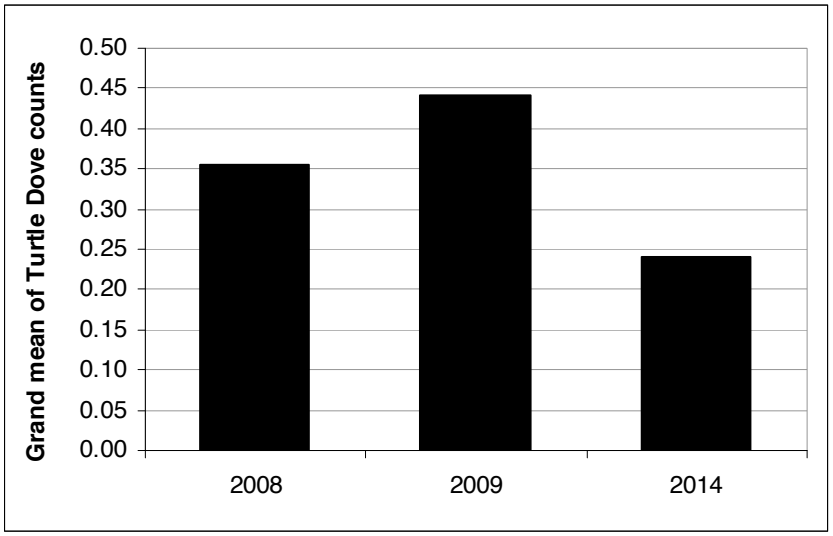

Figure 3. Grand mean of Turtle Dove counts made using data from the period 1 September to 31 October for autumn 2014 (present survey), autumn 2009 (Thomaidis, nd) and autumn 2008 (Thomaidis, nd).

Mean count values recorded from each of the 21 sites are indicated on the map shown in Figure 4. The highest mean count was recorded from Fawwara (Grid 4666), while overall high counts were recorded from study sites located along the southwestern parts of Malta and Gozo. The lowest mean counts were recorded from the northeastern parts of Malta, particularly from study sites located in the stretch between Salina Bay and Xghajra. The mean count recoded from the study site on Comino is 0.25; this corresponds exactly to the median value for the whole range of recorded mean counts.

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

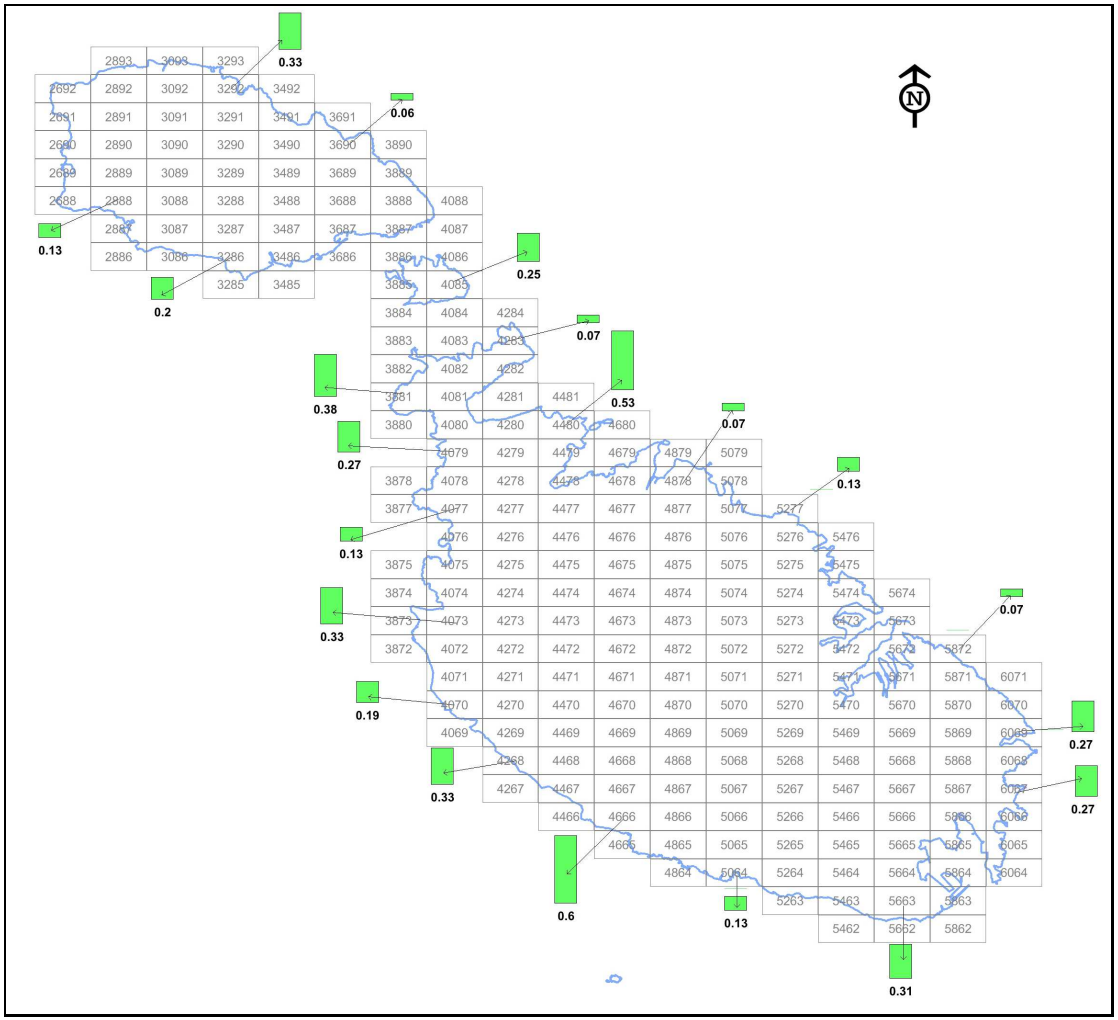

Figure 4. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Turtle Dove recorded from study sites in the respective cells.

Common Quail

The daily observation times by the field observers spent at each Quail monitoring station are given in Appendix II. Raw daily counts for Common Quail recorded from the 21 sites during the present study varied between 0 and a maximum of 3 (see Appendix I), while the mean daily counts ranged between 0 and 1.0. The recorded counts did not vary appreciably between the different sites: at the higher end, a total of 13 individuals were recorded from grid location 4073, while the lower end, no Quail were recorded throughout the survey period from grid locations 3690, 6067, 4878, 6069, 5064 and 5872.

Values of mean daily counts and total counts of Common Quail recorded during the period 1 September to 31 October 2014 from the present survey, as well as the respective area surveyed at each site, are given in Table 3. As already indicated above for Turtle Dove, values of standard deviation associated with the mean daily counts are also provided in Table 2. Standard deviation is a measure of variability among counts recorded from the different sites, that is, low standard deviation implies that very similar counts were recorded at all six sites surveyed during a particular day, whereas dissimilar values would lead to high standard deviation. Standard deviation is influenced by sample size (i.e. number of study sites); it tends to increase with a decreased sample size. These same values are also shown, along with values of mean counts for the same period in 2008, 2009 (Thomaidis, nd), in Figure 5. The daily mean counts recorded during the period 1 September to 31 October 2014 (present survey) are overall lower than those recorded in 2008 and 2009 (Thomaidis, nd) for the same period. Furthermore, no migration peaks (with a mean count >2) as recorded in 2008 and 2009 (Thomaidis, nd; see Figure 5) were recorded during the present survey. The general pattern from all three years being compared is a main migratory influx between mid-September and the beginning of October.

Values of the grand mean for Common Quail counts for autumn 2014 (present survey), and autumn 2008 and autumn 2009 (Thomaidis, nd) surveys, are shown graphically in Figure 6. The comparison in Figure 5 is based on data collected during the same period (1 September to 31 October) in each of the three surveys. The grand mean recorded during the present (autumn 2014) survey is lower than that recorded during the 2008 and 2009 (Thomaidis, nd) surveys.

Table 3

Values of mean (± SD) daily count and daily total count recorded from the six study sites, together with total influx of migratory Common Quail.

Date	Mean Count ± SD		Total count	Total Area Surveyed (km^2)	Estimated Daily Influx
1-Sep-14	0.00	± 0.00	0	0.195	0
2-Sep-14	0.00	± 0.00	0	0.170	0
3-Sep-14	0.17	± 0.41	1	0.211	1047
4-Sep-14	0.00	± 0.00	0	0.351	0
5-Sep-14	0.00	± 0.00	0	0.195	0
6-Sep-14	0.00	± 0.00	0	0.170	0
7-Sep-14	0.00	± 0.00	0	0.211	0
8-Sep-14	0.00	± 0.00	0	0.351	0
9-Sep-14	0.00	± 0.00	0	0.195	0
10-Sep-14	0.00	± 0.00	0	0.170	0
11-Sep-14	0.17	± 0.41	1	0.211	1047
12-Sep-14	0.00	± 0.00	0	0.351	0
13-Sep-14	0.00	± 0.00	0	0.195	0
14-Sep-14	0.00	± 0.00	0	0.170	0

Date	Mean Count ± SD		Total count	Total Area Surveyed (km^2)	Estimated Daily Influx
15-Sep-14	0.17	± 0.41	1	0.211	1047
16-Sep-14	0.67	± 1.03	4	0.351	2522
17-Sep-14	0.17	± 0.41	1	0.195	1135
18-Sep-14	0.33	± 0.52	2	0.170	2597
19-Sep-14	0.17	± 0.41	1	0.211	1047
20-Sep-14	0.50	± 0.84	3	0.351	1892
21-Sep-14	0.17	± 0.41	1	0.195	1135
22-Sep-14	0.00	± 0.00	0	0.170	0
23-Sep-14	0.00	± 0.00	0	0.211	0
24-Sep-14	0.67	± 1.21	4	0.351	2522
25-Sep-14	0.67	± 0.82	4	0.195	4541
26-Sep-14	0.00	± 0.00	0	0.170	0
27-Sep-14	0.00	± 0.00	0	0.211	0
28-Sep-14	0.33	± 0.52	2	0.351	1261
29-Sep-14	0.17	± 0.41	1	0.195	1135
30-Sep-14	0.00	± 0.00	0	0.170	0
1-Oct-14	0.00	± 0.00	0	0.211	0
2-Oct-14	1.00	± 1.26	6	0.351	3783
3-Oct-14	0.00	± 0.00	0	0.195	0
4-Oct-14	0.00	± 0.00	0	0.170	0
5-Oct-14	0.33	± 0.82	2	0.211	2095
6-Oct-14	0.50	± 0.84	3	0.351	1892
7-Oct-14	0.00	± 0.00	0	0.195	0
8-Oct-14	0.00	± 0.00	0	0.170	0
9-Oct-14	0.00	± 0.00	0	0.211	0
10-Oct-14	0.33	± 0.52	2	0.351	1261
11-Oct-14	0.33	± 0.52	2	0.195	2270
12-Oct-14	0.33	± 0.82	2	0.170	2597
13-Oct-14	0.00	± 0.00	0	0.211	0
14-Oct-14	0.00	± 0.00	0	0.351	0
15-Oct-14	0.00	± 0.00	0	0.195	0
16-Oct-14	0.00	± 0.00	0	0.170	0
17-Oct-14	0.00	± 0.00	0	0.211	0
18-Oct-14	0.33	± 0.82	2	0.351	1261
19-Oct-14	0.17	± 0.41	1	0.195	1135
20-Oct-14	0.00	± 0.00	0	0.170	0
21-Oct-14	0.00	± 0.00	0	0.211	0
22-Oct-14	0.00	± 0.00	0	0.351	0
23-Oct-14	0.00	± 0.00	0	0.195	0
24-Oct-14	0.00	± 0.00	0	0.170	0
25-Oct-14	0.33	± 0.52	2	0.211	2095
26-Oct-14	0.00	± 0.00	0	0.351	0
27-Oct-14	0.00	± 0.00	0	0.195	0
28-Oct-14	0.00	± 0.00	0	0.170	0
29-Oct-14	0.33	± 0.82	2	0.211	2095
30-Oct-14	0.00	± 0.00	0	0.351	0
31-Oct-14	0.33	± 0.82	2	0.195	2270
				Estimated Total Influx	**45683**

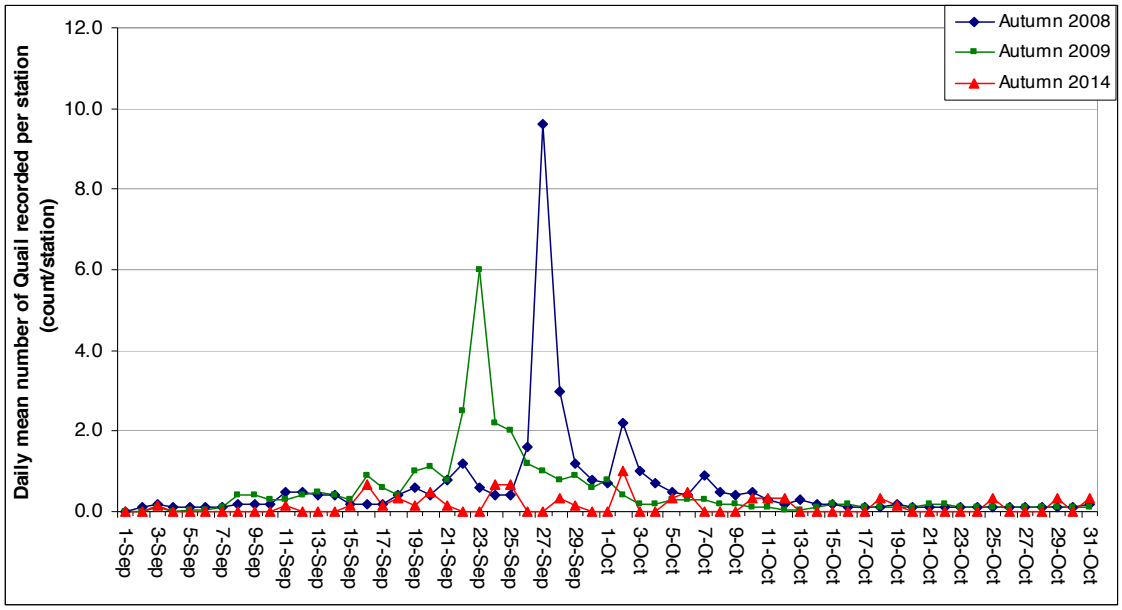

Figure 5. Daily mean counts of Common Quail per station (= site) recorded during the present survey during the period 1 September – 31 October 2014, together with values of the same statistic for spring 2008 and 2009 as reported in Thomaidis (nd).

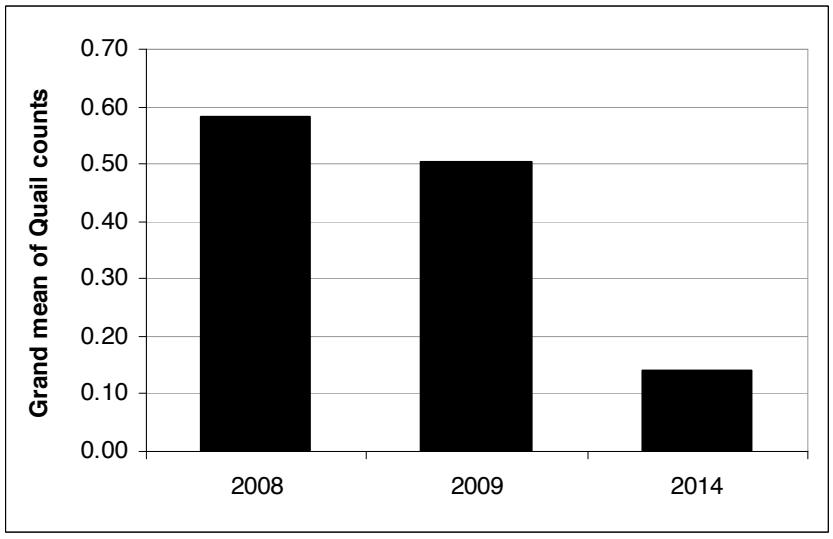

Figure 6. Grand mean of Common Quail counts made using data from the period 1 September – 31 October for autumn 2014 (present survey), autumn 2009 (Thomaidis, nd) and autumn 2008 (Thomaidis, nd).

Mean count values recorded from each of the 21 sites are indicated on the map shown in Figure 7. The highest mean count was recorded from Fomm ir-Rih (Grid 4073), while overall high counts were recorded from study sites located in the northern half of Malta and in Gozo. The lowest mean counts were recorded from the southeastern parts of Malta and from San Blas in Gozo. The mean count recoded from the study site on Comino is 0.08; this corresponds exactly to the median value for the whole range of recorded mean counts.

As has been done in previous surveys undertaken in spring (Ecoserv, 2011; 2012; 2013; 2014), the total influx of Quail was estimated for the whole area of the Maltese Islands using the recorded area surveyed for Quail at each site. However, such an estimate should be considered with the greatest caution because of the assumption that the rate of Quail settling at coastal sites (where the survey was carried out) is equal to that at inland locations. While this appears to hold true during spring, observations indicate that Quail tend to settle in larger numbers in coastal areas compared to inland ones. Furthermore, field data on the migration of this species collected locally may be distorted due to the use of live Quail left in cages in fields to call down Quail migrating during the night, as well as electronic callers used for the same purpose in many localities. Quail also tends to appear in certain localities before others (Fenech, 2010; Fenech, *in. litt.*). This is highlighted by one of the data records from the present study - a total of 13 individuals were recorded from grid location 4073, while at the lower end, no Quail were recorded throughout the survey period from grid locations 3690, 6067, 4878, 6069, 5064 and 5872. Coastal areas are more likely to serve as short-term stopover sites immediately following a migratory flight compared to inland locations; thus, including inland locations as study sites in the survey may result in an overestimate of the total influx due to repeat counting of resident Quail. 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 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); this 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 daily influx of birds per day are shown in Table 3. The estimated daily influx was obtained by extrapolating the mean daily values obtained for the surveyed areas indicated in Table 3 to an area of 221.4 km^2 obtained, as explained above. Values of estimated daily influx were then summed to obtain an estimate of the total influx of migrating Turtle Dove for the eight-week study period. Based on these data, extrapolation translates to a total influx of Common Quail during 1 September – 31 October 2014 of 45,683 individuals, or some 749 Quail per day (see Table 3). However, as already emphasised in the reports of previous surveys (Ecoserv, 2011; 2012; 2013; 2014), such an estimate must be treated with utmost caution, given the relatively small number of field sites used in the present survey and that counts were not made daily at each site, such that only a very small portion of the total area of potential habitat in the Maltese Islands was sampled.

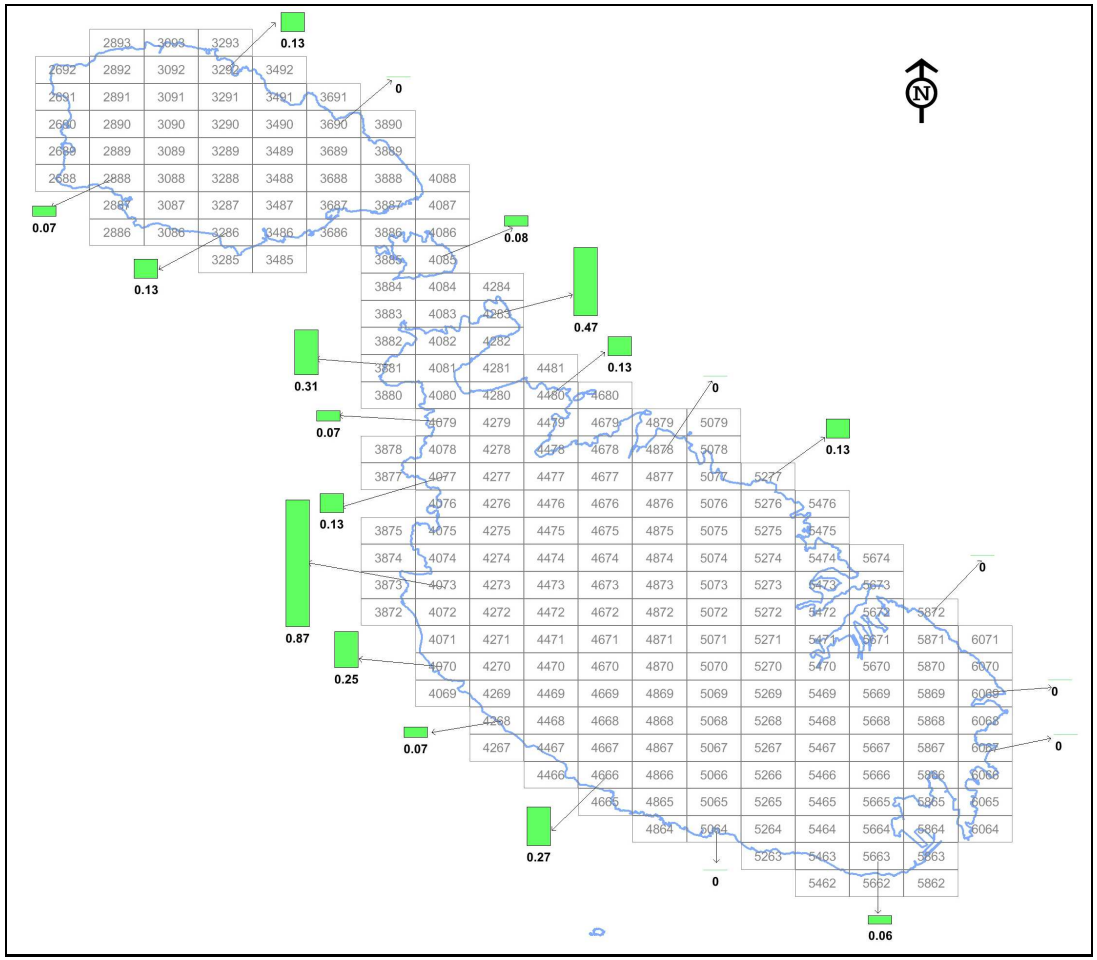

Figure 7. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Common Quail recorded from study sites in the respective cells.

4. Comparison with *Carnet de Chasse* data

A comparative analysis of the results obtained during the present study with the bag data extracted from *Carnet de Chasse* collected in previous years for the same period (1 September to 31 October), as provided by the WBRU, was undertaken. It should be stated from the outset that the two sets of data were collected for different purposes, using very different methodologies, and therefore values are not directly comparable. However, temporal trends obtained from the different data sources can be expected to follow similar patterns, that is, the period when higher mean daily counts were recorded during the present survey should broadly follow the period when higher numbers of Turtle Dove and Quail were caught (and reported in the bag data), assuming the influx of Turtle Dove or Quail follows the same temporal trend from year to year. On the other hand, if the latter assumption is incorrect, the trends would not be expected to correlate. This assumption can only be confirmed through a longitudinal study of influx of turtle Doves and Quail over a period of several years.

The periodicity of *Carnet de Chasse* data collection changed over the years: from 2002 to 2005, data were reported on weekly basis and no distinction between hunting and trapping was made, while data were reported on a decadal basis during 2006 and 2007. Thus, only 3-4 data points per month are available for these years, and no meaningful comparison between these and the daily data collected as part of the present survey could be made. The comparison was therefore based on *Carnet de Chasse* data collected during 2008 – 2013, when data were collected on a daily basis. Graphical representations of the mean or total daily counts made during the present (2014) survey and the daily bag counts (2008 – 2013, *Carnet de Chasse* data) of Turtle Dove or Quail were prepared to compare temporal trends among the two different data sets. For each year, the extent of variation among the daily counts was assessed using the coefficient of variation, which represents the extent of variability relative to the mean value. This coefficient is expressed as a percentage, with a higher value indicating a greater variability among the daily counts.

In a graphical plot showing daily counts, a high variation in counts from day to day may overshadow temporal trends over the two-month period. To aid visual interpretation, a second set of analyses was undertaken by computing a moving average using a rolling 5-day period for the time series count data of each year. This has the effect of smoothening out the day to day fluctuations and hence making longer-term trends in mean/total daily counts or daily bag counts more apparent, thus facilitating visual interpretation of temporal trends. It should be noted that analyses based on a moving average do not replace those based on the raw daily counts. Rather, the graphical representations showing a 5-day moving average should be seen in conjunction with those based on daily counts, which are also presented.

Turtle Dove

The daily bag count indicating the number of Turtle Dove caught during 2008 – 2013 and the mean daily counts of Turtle Dove made during the present (2014) survey are shown in Figure 8, while Figure 9 presents the 5-day moving average computed from these data. For reference, Figures 10 and 11 show the same data, but with the results from the present (2014) survey given as total daily counts. As already noted, the *Carnet de Chasse* counts and the mean/total daily counts recorded from the 2014 survey are not directly comparable; this is also evident from the different scales used for the two different sets of values. Therefore, in Figures 8 – 11, two separate y-axes are used: the 2008 – 2013 *Carnet de Chasse* daily bag count data is plotted on the left-side y-axis, whereas the daily counts from the 2014 survey are plotted on the right-side y-axis.

Overall, a relatively high variability in daily counts is observed in all the years; coefficient of variation for the 2008 – 2013 *Carnet de Chasse* daily bag counts ranged between 91% - 151%, which is comparable to the value (128%) observed in the present (2014) survey. The highest bag counts recorded during 2008 – 2013 occurred in the first 2 weeks of September, which also coincided with the period when the highest overall mean daily counts were made during the present (2014) survey. In the 2014 survey, mean daily counts higher than the overall average were also recorded between 20 and 28 September; a peak in Turtle Dove migration had also been recorded on 23 September 2009 by Thomaidis (nd; see Figure 2). No sizeable increase in the bag count data was reported during the third week of September.

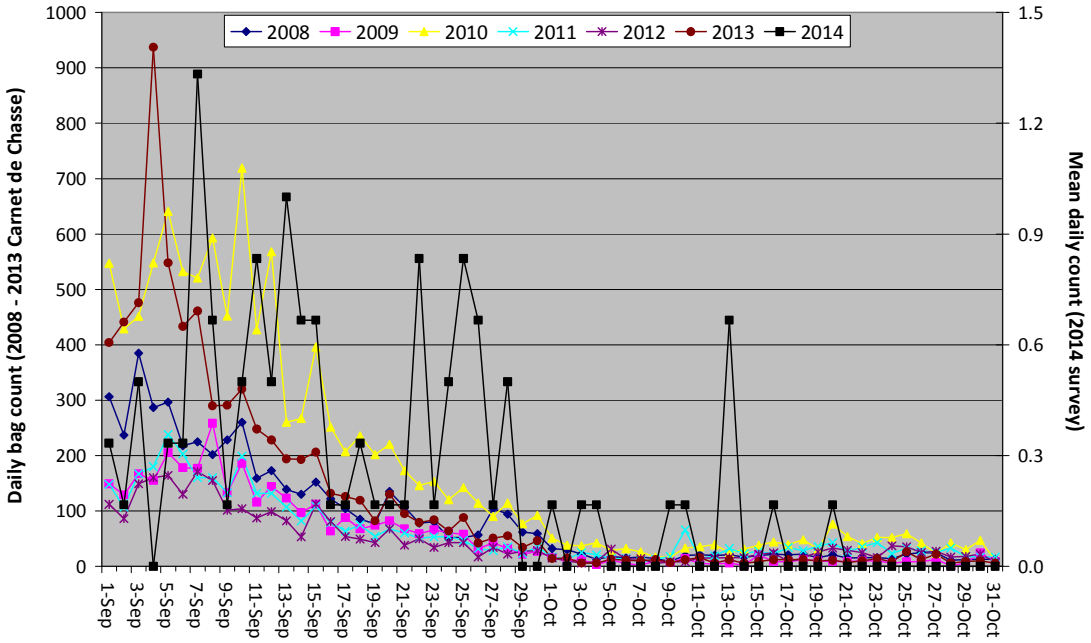

Figure 8. Daily bag count of Turtle Dove for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), together with the mean daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

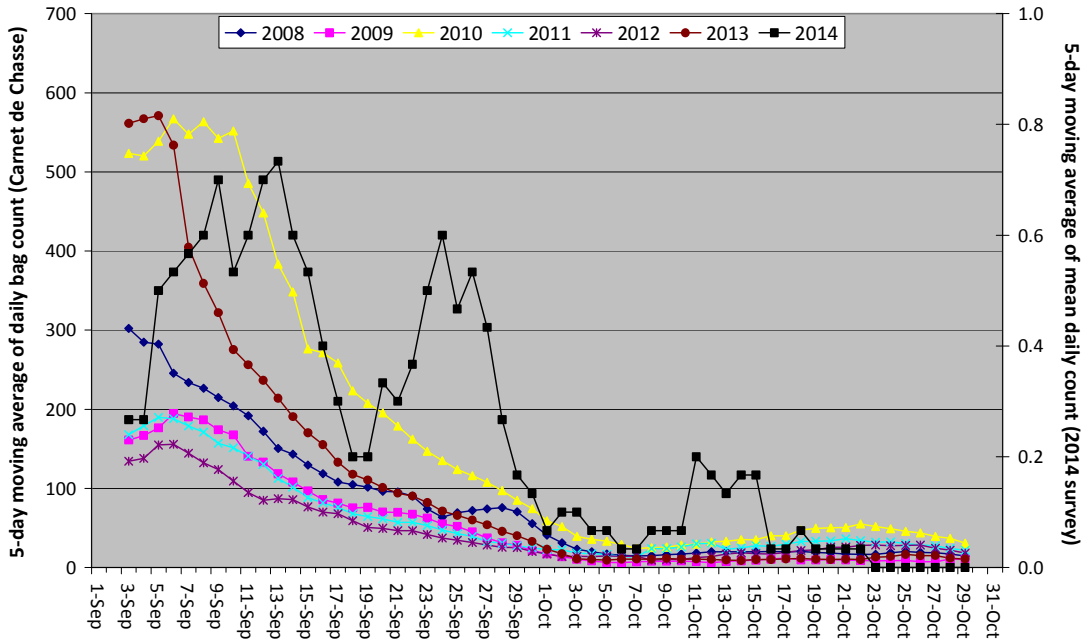

Figure 9. Moving average based on a 5-day rolling time period for the daily bag counts of Turtle Dove for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), and for the mean daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

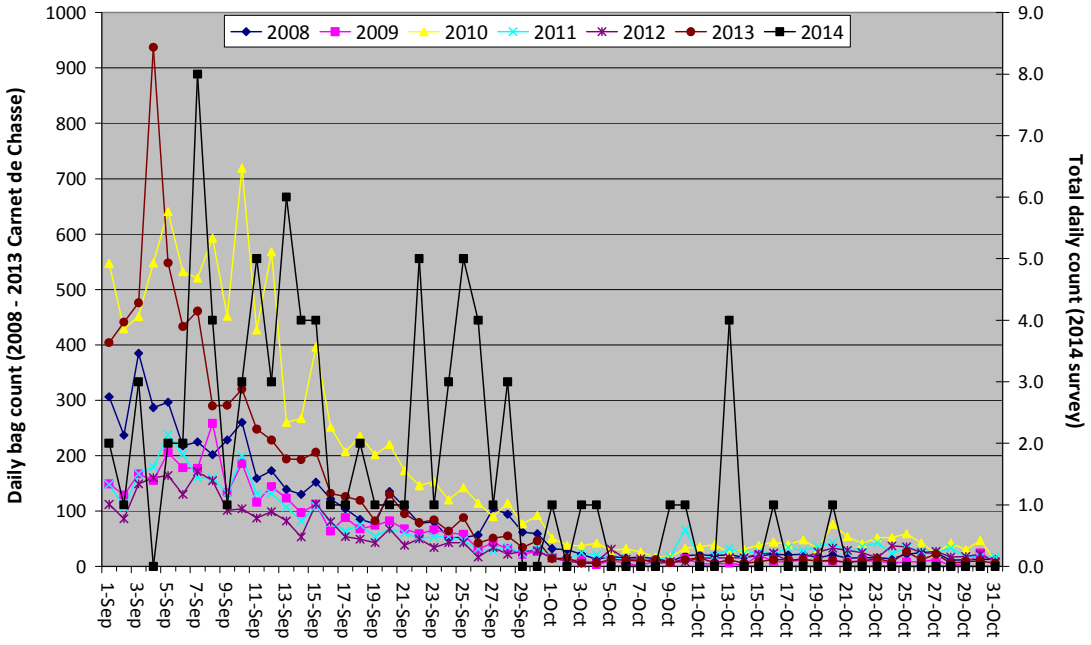

Figure 10. Daily bag count of Turtle Dove for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), together with the total daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

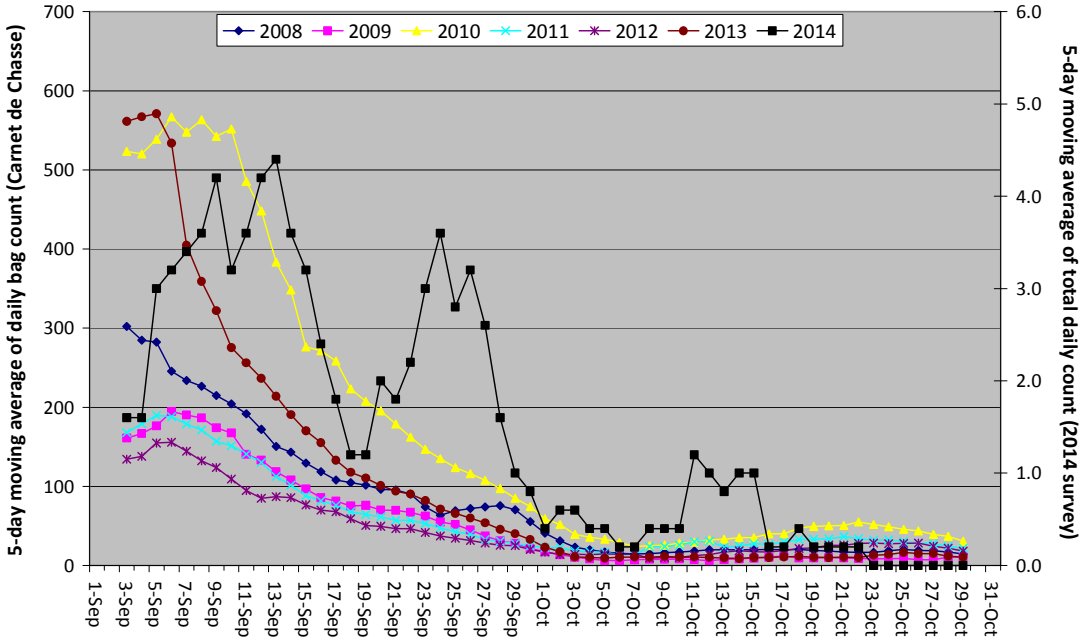

Figure 11. Moving average based on a 5-day rolling time period for the daily bag counts of Turtle Dove for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), and for the total daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

Quail

The daily bag count indicating the number of Quail caught during 2008 – 2013, and the mean daily counts of Quail made during the present (2014) survey are shown in Figure 12, while Figure 13 presents the 5-day moving average computed from these data. For reference, Figures 14 and 15 show the same data, but with the results from the present (2014) survey given as total daily counts. As already noted, the *Carnet de Chasse* counts and the mean daily counts made in the 2014 survey are not directly comparable. Hence, the two sets of values are plotted using different scales. Therefore, In Figures 12 – 15, two separate y-axes are used: the 2008 – 2013 *Carnet de Chasse* daily bag count data is plotted on the left-side y-axis, whereas the mean daily counts from the 2014 survey are plotted on the right-side y-axis.

Overall, a relatively high variability in daily counts is observed in all the years but especially in the case of mean counts recorded during the present (2014) survey. This is reflected by the coefficient of variation, which ranged from 48% to 104% in the case of the *Carnet de Chasse* daily bag counts for 2008 – 2013, while a higher value (155%) was recorded in the present survey. The highest counts recorded during 2008 – 2013 occurred mostly during the last 2 weeks of September, which also coincided with the period when the highest overall mean daily counts were made during the 2014 survey. The higher bag counts recorded on 22-25 September 2008 and on 26-29 September 2009 also coincide with the peaks in migratory influx of Quail recorded by Thomaidis (nd; see Figure 5) during those two years.

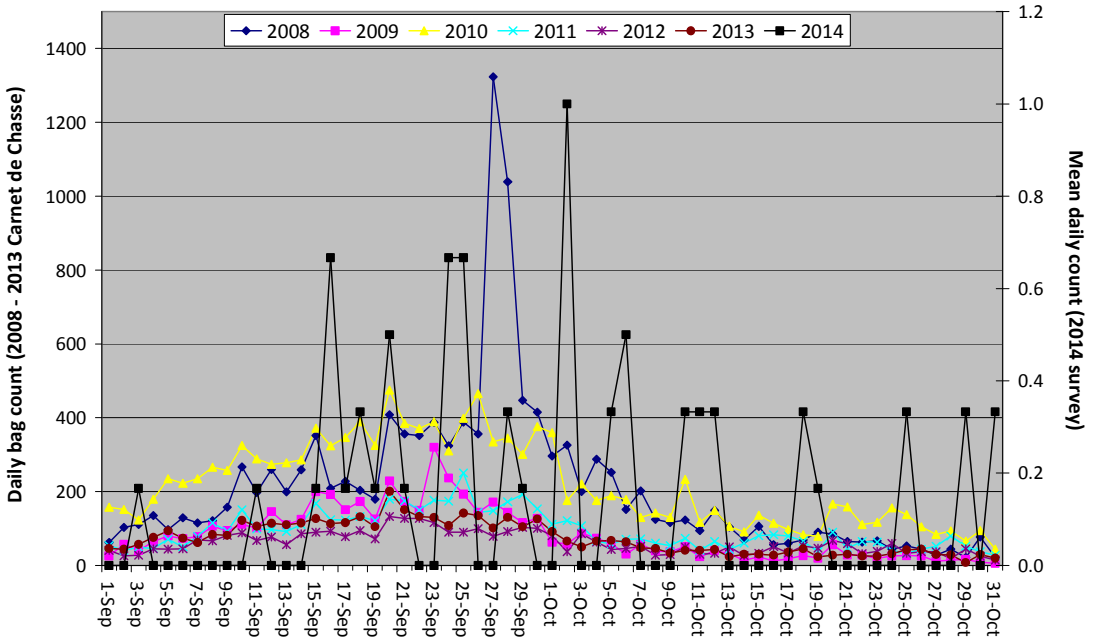

Figure 12. Daily bag count of Quail for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), together with the mean daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

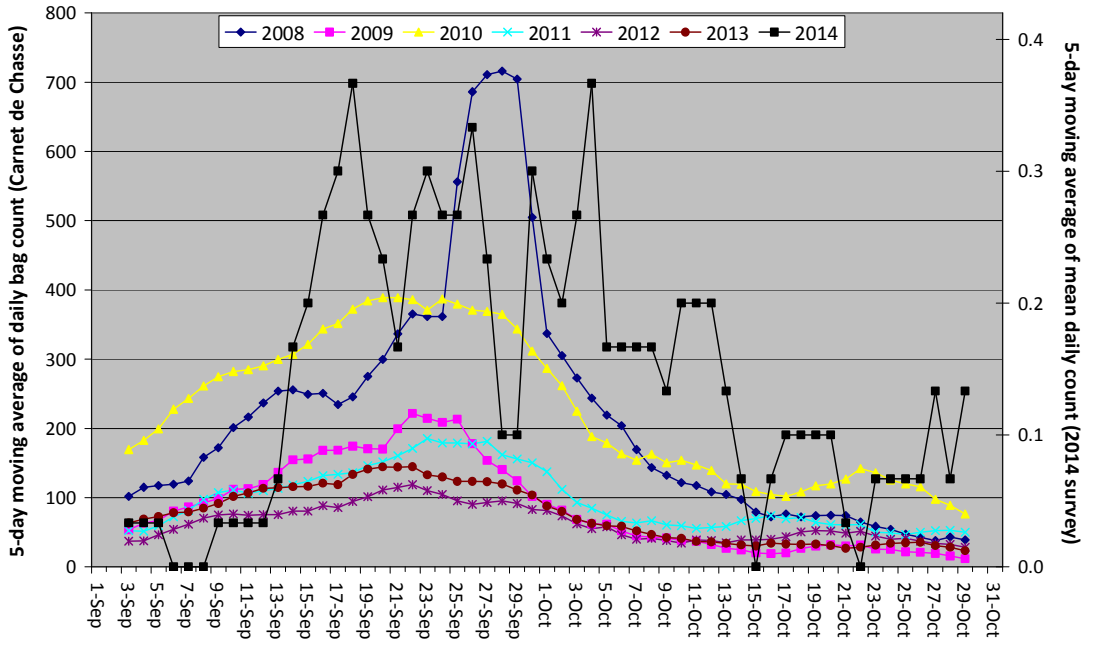

Figure 13. Moving averaged based on a 5-day rolling time period for the daily bag counts of Common Quail for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), and for the mean daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

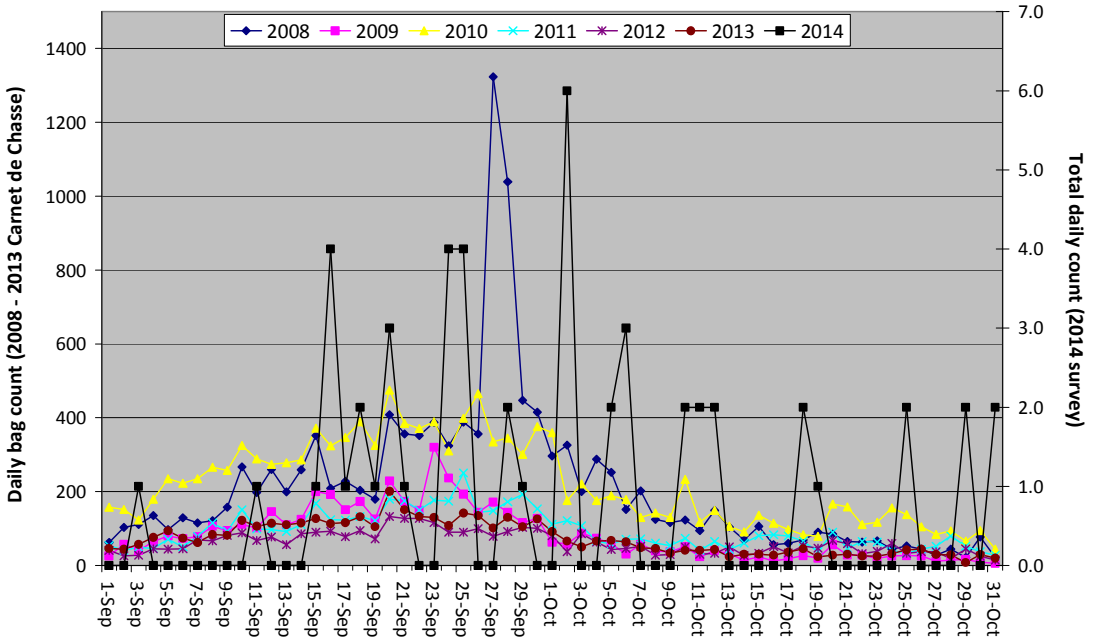

Figure 14. Daily bag count of Common Quail for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), together with the total daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

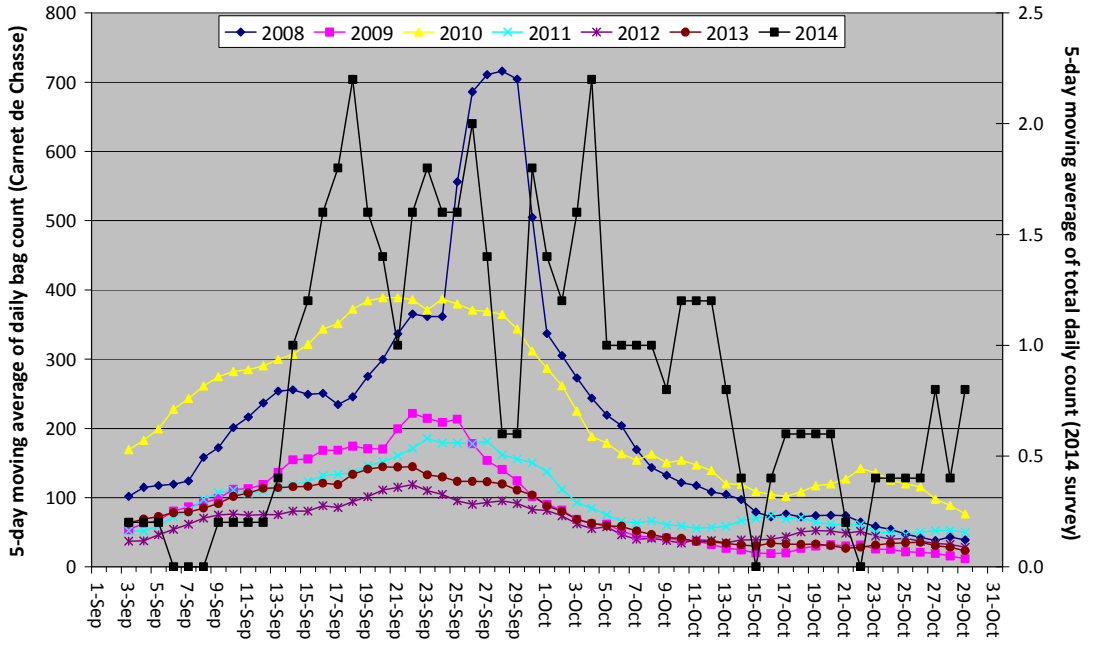

Figure 15. Moving averaged based on a 5-day rolling time period for the daily bag counts of Common Quail for the years 2008 – 2013 extracted from *Carnet de Chasse* data (coloured lines; values on left-side y-axis), and for the total daily counts recorded during the 2014 survey (black line; values on right-side y-axis), for the period 1 September to 31 October.

5. Appraisal

The present survey provides data on counts of Turtle Dove and Common Quail recorded during September and October 2104, as well as estimates of the migratory influx of the two species. Government had established the autumn open season during the period 1 September 2014 – 31 January 2015; the present survey therefore coincided with the initial two months of the 2014 autumn hunting season. However, it should be pointed out that on 20th September, Government suspended the autumn hunting season until 11 October.

For Turtle Dove, when comparing the results of the present survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, a similar trend of counts recorded during the period 1 September – 31 October is noted overall; the pattern of counts for the three years compared indicates a migratory influx during September. However, no appreciable peaks in migration were recorded during the present survey, whereas a small peak in mean counts was recorded in 2009. When comparing the grand mean value recorded during the present (autumn 2014) survey to that recorded by Thomaidis (nd) in 2008 and 2009, a lower value is evident for the former, which indicates a lower influx of Turtle Dove in autumn 2014.

The total influx of Turtle Dove for the present survey period (1 September – 31 October 2014) is estimated at 7,956 individuals. No such estimates are available from the same period for previous years. It is reiterated that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the survey, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. Increasing the number of field sites 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 is reiterated 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 one would expect some disturbance to birds migrating at low altitude, hence their numbers may be lower, resulting in an overestimate. Another limitation is that the Turtle Dove migration counts were recorded over a seven hour survey period (06:00 - 13:00), hence any individuals migrating at other times of the day were not included, 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 deemed 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.

For Common Quail, when comparing the results of the present survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, a similar trend of Common Quail counts recorded during the period 1 September – 31 October is noted overall; the pattern of counts for the three years compared indicates a migratory influx between mid-September and the beginning of October. However, no appreciable migratory peaks for Common Quail were recorded during the present survey, whereas appreciably more pronounced peaks were recorded in 2008 and 2009. When comparing the grand mean value recorded during the present (autumn 2014) survey with that recorded during the previous two surveys (autumn 2008 and 2009), a lower value is evident for the former, which indicates a lower influx of Common Quail for autumn 2014.

The total influx of Common Quail for the present survey period (1 September – 31 October 2014) is estimated at 45,683 individuals. No estimates are available from the same period for previous years. It is reiterated that such estimates must be treated with utmost caution, given the relatively small number of field sites used in the present survey, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. 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 sites 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 included counts made over a 61 day period between 1 September – 31 October 2014, which covers the period when peak autumn migration of Turtle Dove and Quail normally occurs. For both Turtle Dove and Common Quail, a number of limitations, which have already been highlighted in Ecoserv (2011; 2012; 2013; 2014), are reiterated, namely:

- The data reported on in the present document can only be used for purposes of trend analysis, and even in this respect, due caution should be exercised given that the sampling methodology and effort used in the present 2014 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical.
- Robust and rigorous assessment of migratory influx requires trend analysis based on data from monitoring should ideally be carried out regularly over a sufficiently long period comprising subsequent years, and using the same methodology. For each year, the data should ideally be collected over the whole migratory season and using a larger sampling effort, for example by making counts daily at all of a minimum 21 sites.

Nevertheless, the data from the present study provides a useful indication of the autumn influx of Turtle Dove and Common Quail, provided that results are interpreted in the context of these limitations.

6. Conclusion

The present results indicated that, for Turtle Dove, a similar trend of counts to that from previous surveys made by Thomaidis (2008 and 2009) in autumn using a similar methodology, was recorded during the present survey period (1 September – 31 October); the main migratory influx occurred during September. However, no appreciable migratory peaks for this species were recorded. Raw daily counts for Turtle Dove recorded from the 21 sites during the present study varied between 0 and a maximum of 4, while the mean daily counts ranged between 0 and 1.3. No appreciable migratory peaks were evident but slightly higher numbers of Turtle Dove occurred on 7–15 September, on 22–25 September and on 7 October 2014. The recorded counts did not vary appreciably between the different sites: at the lower end, at grid locations 4283, 4878 and 5872 (located on the northeastern side of Malta), only one individual Turtle Dove was recorded throughout the survey period, while at the higher end, 9 Turtle Dove individuals were recorded from the site at grid location 4666 (Fawwara). The total influx of Turtle Dove for the present survey is estimated at 7,956 individuals.

For Common Quail; again, when comparing the results from the present survey with ones held in autumn in previous years (2008 and 2009), a similar trend of counts was recorded; a migratory influx occurred between mid-September and the beginning of October. However, no appreciable migratory peaks for Common Quail were recorded. The daily observation times by the field observers spent at each Quail monitoring station are given in Appendix II. Raw daily counts for Common Quail recorded from the 21 sites during the present study varied between 0 and a maximum of 3), while the mean daily counts ranged between 0 and 1.0. The recorded counts did not vary appreciably between the different sites: at the higher end, a total of 13 individuals were recorded from grid location 4073 (Fomm ir-Rih), while at the lower end, no Quail were recorded throughout the survey period from grid locations 3690, 6067, 4878, 6069, 5064 and 5872 (most of which are located on the eastern side of Malta). The total influx of Common Quail for the present survey period is estimated at 45,683 individuals. When comparing the grand mean value recorded during the present survey with that recorded during previous surveys made in autumn (2008 and 2009), a lower influx of Common Quail is noted for autumn 2014.

Estimates of migratory influx reported in this report must be treated with utmost caution, given the relatively small number of field sites used in the present survey, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. A more reliable value is the daily mean count; hence it is more appropriate to use this estimate.

7. References

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APPENDIX I - Raw counts

Table A. Daily counts of Turtle Dove recorded per site.

Ecoserv Sample Reference Code	B-017-14	B-018-14	B-019-14	B-020-14	B-021-14	B-022-14	B-023-14	B-024-14	B-025-14	B-026-14	B-027-14
Grid Location	**4085**	**3690**	**3881**	**4070**	**5663**	**5277**	**3292**	**4079**	**4268**	**6067**	**4878**
1-Sep-14	1	0	0	1	0	0					
2-Sep-14	0						0	0	0	1	0
3-Sep-14	2										
4-Sep-14	0										
5-Sep-14	0	0	1	0	0	1					
6-Sep-14	1						1	0	0	0	0
7-Sep-14	1										
8-Sep-14	1										
9-Sep-14	0	0	0	1	0	0					
10-Sep-14	0						1	1	0	0	1
11-Sep-14	0										
12-Sep-14	0										
13-Sep-14	0	0	1	1	4	0					
14-Sep-14	0						0	0	4	0	0
15-Sep-14	0										
16-Sep-14	0										
17-Sep-14	0	1	0	0	0	0					
18-Sep-14	2						0	0	0	0	0
19-Sep-14	0										
20-Sep-14	0										
21-Sep-14	0	0	0	0	1	0					
22-Sep-14	2						2	1	0	0	0
23-Sep-14	0										
24-Sep-14	2										
25-Sep-14	1	0	4	0	0	0					
26-Sep-14	0						0	0	1	3	0

Ecoserv Sample Reference Code	B-017-14	B-018-14	B-019-14	B-020-14	B-021-14	B-022-14	B-023-14	B-024-14	B-025-14	B-026-14	B-027-14
27-Sep-14	0										
28-Sep-14	1										
29-Sep-14	0	0	0	0	0	0					
30-Sep-14	0						0	0	0	0	0
1-Oct-14	1										
2-Oct-14	0										
3-Oct-14	0	0	0	0	0	1					
4-Oct-14	0						1	0	0	0	0
5-Oct-14	0										
6-Oct-14	0										
7-Oct-14	0	0	0	0	0	0					
8-Oct-14	0						0	0	0	0	0
9-Oct-14	0										
10-Oct-14	0										
11-Oct-14	0	0	0	0	0	0					
12-Oct-14	0						0	0	0	0	0
13-Oct-14	0										
14-Oct-14	0										
15-Oct-14	0	0	0	0	0	0					
16-Oct-14	0						0	1	0	0	0
17-Oct-14	0										
18-Oct-14	0										
19-Oct-14	0	0	0	0	0	0					
20-Oct-14	0						0	1	0	0	0
21-Oct-14	0										
22-Oct-14	0										
23-Oct-14	0	0	0	0	0	0					
24-Oct-14	0						0	0	0	0	0
25-Oct-14	0										
26-Oct-14	0										
27-Oct-14	0	0	0	0	0	0					

Ecoserv Sample Reference Code	B-017-14	B-018-14	B-019-14	B-020-14	B-021-14	B-022-14	B-023-14	B-024-14	B-025-14	B-026-14	B-027-14
28-Oct-14	0						0	0	0	0	0
29-Oct-14	0										
30-Oct-14	0										
31-Oct-14	0	0	0	0	0	0					

Table A continued. Daily counts of Turtle Dove recorded per site.

Ecoserv Sample Reference Code	B-028-14	B-029-14	B-030-14	B-031-14	B-032-14	B-033-14	B-034-14	B-035-14	B-036-14	B-037-14
Grid Location	**2888**	**4077**	**4666**	**6069**	**4480**	**3286**	**4073**	**5064**	**5872**	**4283**
1-Sep-14										
2-Sep-14										
3-Sep-14	0	0	0	0	1					
4-Sep-14						0	0	0	0	0
5-Sep-14										
6-Sep-14										
7-Sep-14	1	0	3	2	1					
8-Sep-14						0	3	0	0	0
9-Sep-14										
10-Sep-14										
11-Sep-14	0	0	0	2	3					
12-Sep-14						2	1	0	0	0
13-Sep-14										
14-Sep-14										
15-Sep-14	0	2	2	0	0					
16-Sep-14						0	0	1	0	0
17-Sep-14										
18-Sep-14										
19-Sep-14	0	0	1	0	0					
20-Sep-14						0	0	0	0	1

Ecoserv Sample Reference Code	B-028-14	B-029-14	B-030-14	B-031-14	B-032-14	B-033-14	B-034-14	B-035-14	B-036-14	B-037-14
21-Sep-14										
22-Sep-14										
23-Sep-14	0	0	0	0	1					
24-Sep-14						0	0	1	0	0
25-Sep-14										
26-Sep-14										
27-Sep-14	0	0	1	0	0					
28-Sep-14						0	1	0	1	0
29-Sep-14										
30-Sep-14										
1-Oct-14	0	0	0	0	0					
2-Oct-14						0	0	0	0	0
3-Oct-14										
4-Oct-14										
5-Oct-14	0	0	0	0	0					
6-Oct-14						0	0	0	0	0
7-Oct-14										
8-Oct-14										
9-Oct-14	1	0	0	0	0					
10-Oct-14						1	0	0	0	0
11-Oct-14										
12-Oct-14										
13-Oct-14	0	0	2	0	2					
14-Oct-14						0	0	0	0	0
15-Oct-14										
16-Oct-14										
17-Oct-14	0	0	0	0	0					
18-Oct-14						0	0	0	0	0
19-Oct-14										
20-Oct-14										
21-Oct-14	0	0	0	0	0					

Ecoserv Sample Reference Code	B-028-14	B-029-14	B-030-14	B-031-14	B-032-14	B-033-14	B-034-14	B-035-14	B-036-14	B-037-14
22-Oct-14						0	0	0	0	0
23-Oct-14										
24-Oct-14										
25-Oct-14	0	0	0	0	0					
26-Oct-14						0	0	0	0	0
27-Oct-14										
28-Oct-14										
29-Oct-14	0	0	0	0	0					
30-Oct-14						0	0	0	0	0
31-Oct-14										

Table B. Daily counts of Common Quail recorded per site, together with the area surveyed at each site.

Ecoserv Sample Reference Code	B-038-14	B-039-14	B-040-14	B-041-14	B-042-14	B-043-14	B-044-14	B-045-14	B-046-14	B-047-14	B-048-14
Grid Location	**4085**	**3690**	**3881**	**4070**	**5663**	**5277**	**3292**	**4079**	**4268**	**6067**	**4878**
Surveyed Area (km^2)	**0.037**	**0.045**	**0.045**	**0.046**	**0.007**	**0.015**	**0.009**	**0.046**	**0.040**	**0.005**	**0.033**
1-Sep-14	0	0	0	0	0	0					
2-Sep-14	0						0	0	0	0	0
3-Sep-14	0										
4-Sep-14	0										
5-Sep-14	0	0	0	0	0	0					
6-Sep-14	0						0	0	0	0	0
7-Sep-14	0										
8-Sep-14	0										
9-Sep-14	0	0	0	0	0	0					
10-Sep-14	0						0	0	0	0	0
11-Sep-14	0										

Ecoserv Sample Reference Code	B-038-14	B-039-14	B-040-14	B-041-14	B-042-14	B-043-14	B-044-14	B-045-14	B-046-14	B-047-14	B-048-14
12-Sep-14	0										
13-Sep-14	0	0	0	0	0	0					
14-Sep-14	0						0	0	0	0	0
15-Sep-14	0										
16-Sep-14	0										
17-Sep-14	0	0	0	1	0	0					
18-Sep-14	0						0	1	1	0	0
19-Sep-14	1										
20-Sep-14	0										
21-Sep-14	0	0	1	0	0	0					
22-Sep-14	0						0	0	0	0	0
23-Sep-14	0										
24-Sep-14	0										
25-Sep-14	0	0	2	0	1	1					
26-Sep-14	0						0	0	0	0	0
27-Sep-14	0										
28-Sep-14	0										
29-Sep-14	0	0	0	1	0	0					
30-Sep-14	0						0	0	0	0	0
1-Oct-14	0										
2-Oct-14	2										
3-Oct-14	0	0	0	0	0	0					
4-Oct-14	0						0	0	0	0	0
5-Oct-14	0										
6-Oct-14	2										
7-Oct-14	0	0	0	0	0	0					
8-Oct-14	0						0	0	0	0	0
9-Oct-14	0										
10-Oct-14	0										
11-Oct-14	0	0	1	0	0	1					
12-Oct-14	0						2	0	0	0	0

Ecoserv Sample Reference Code	B-038-14	B-039-14	B-040-14	B-041-14	B-042-14	B-043-14	B-044-14	B-045-14	B-046-14	B-047-14	B-048-14
13-Oct-14	0										
14-Oct-14	0										
15-Oct-14	0	0	0	0	0	0					
16-Oct-14	0						0	0	0	0	0
17-Oct-14	0										
18-Oct-14	0										
19-Oct-14	0	0	1	0	0	0					
20-Oct-14	0						0	0	0	0	0
21-Oct-14	0										
22-Oct-14	0										
23-Oct-14	0	0	0	0	0	0					
24-Oct-14	0						0	0	0	0	0
25-Oct-14	0										
26-Oct-14	0										
27-Oct-14	0	0	0	0	0	0					
28-Oct-14	0						0	0	0	0	0
29-Oct-14	0										
30-Oct-14	0										
31-Oct-14	0	0	0	2	0	0					

Table B continued. Daily counts of Common Quail recorded per site, together with the area surveyed at each site.

Ecoserv Sample Reference Code	B-049-14	B-050-14	B-051-14	B-052-14	B-053-14	B-054-14	B-055-14	B-056-14	B-057-14	B-058-14
Grid Location	**2888**	**4077**	**4666**	**6069**	**4480**	**3286**	**4073**	**5064**	**5872**	**4283**
Surveyed Area (km^2)	**0.022**	**0.014**	**0.049**	**0.044**	**0.044**	**0.233**	**0.007**	**0.051**	**0.004**	**0.019**
1-Sep-14										
2-Sep-14										
3-Sep-14	1	0	0	0	0					

Ecoserv Sample Reference Code	B-049-14	B-050-14	B-051-14	B-052-14	B-053-14	B-054-14	B-055-14	B-056-14	B-057-14	B-058-14
4-Sep-14						0	0	0	0	0
5-Sep-14										
6-Sep-14										
7-Sep-14	0	0	0	0	0					
8-Sep-14						0	0	0	0	0
9-Sep-14										
10-Sep-14										
11-Sep-14	0	0	1	0	0					
12-Sep-14						0	0	0	0	0
13-Sep-14										
14-Sep-14										
15-Sep-14	0	0	0	0	1					
16-Sep-14						0	2	0	0	2
17-Sep-14										
18-Sep-14										
19-Sep-14	0	0	0	0	0					
20-Sep-14						0	2	0	0	1
21-Sep-14										
22-Sep-14										
23-Sep-14	0	0	0	0	0					
24-Sep-14						1	3	0	0	0
25-Sep-14										
26-Sep-14										
27-Sep-14	0	0	0	0	0					
28-Sep-14						0	1	0	0	1
29-Sep-14										
30-Sep-14										
1-Oct-14	0	0	0	0	0					
2-Oct-14						1	3	0	0	0
3-Oct-14										
4-Oct-14										

Ecoserv Sample Reference Code	B-049-14	B-050-14	B-051-14	B-052-14	B-053-14	B-054-14	B-055-14	B-056-14	B-057-14	B-058-14
5-Oct-14	0	2	0	0	0					
6-Oct-14						0	1	0	0	0
7-Oct-14										
8-Oct-14										
9-Oct-14	0	0	0	0	0					
10-Oct-14						0	1	0	0	1
11-Oct-14										
12-Oct-14										
13-Oct-14	0	0	0	0	0					
14-Oct-14						0	0	0	0	0
15-Oct-14										
16-Oct-14										
17-Oct-14	0	0	0	0	0					
18-Oct-14						0	0	0	0	2
19-Oct-14										
20-Oct-14										
21-Oct-14	0	0	0	0	0					
22-Oct-14						0	0	0	0	0
23-Oct-14										
24-Oct-14										
25-Oct-14	0	0	1	0	1					
26-Oct-14						0	0	0	0	0
27-Oct-14										
28-Oct-14										
29-Oct-14	0	0	2	0	0					
30-Oct-14						0	0	0	0	0
31-Oct-14										

APPENDIX II - The daily observation times by the field observers spent at each Quail monitoring station

Date	Location	Observation time	Date	Location	Observation time
1 Sep 2014	3690	06:00 - 08:00	9 Sep 2014	3690	06:00 - 08:00
1 Sep 2014	4085	06:45 - 08:45	9 Sep 2014	4085	08:00 - 10:00
1 Sep 2014	3881	07:00 - 09:00	9 Sep 2014	3881	07:00 - 09:00
1 Sep 2014	4070	07:00 - 09:00	9 Sep 2014	4070	07:00 - 09:00
1 Sep 2014	5663	08:00 - 10:00	9 Sep 2014	5663	06:30 - 08:30
1 Sep 2014	5277	06:00 - 08:00	9 Sep 2014	5277	06:30 - 08:30
2 Sep 2014	3292	06:00 - 08:00	10 Sep 2014	3292	07:00 - 09:00
2 Sep 2014	4085	06:45 - 08:45	10 Sep 2014	4085	07:00 - 09:00
2 Sep 2014	4079	06:00 - 08:00	10 Sep 2014	4079	07:00 - 09:00
2 Sep 2014	4268	06:30 - 08:30	10 Sep 2014	4268	07:00 - 09:00
2 Sep 2014	6067	06:30 - 08:30	10 Sep 2014	6067	07:00 - 09:00
2 Sep 2014	4878	08:00 - 10:00	10 Sep 2014	4878	07:00 - 09:00
3 Sep 2014	2888	07:00 - 09:00	11 Sep 2014	2888	07:00 - 09:00
3 Sep 2014	4085	08:00 - 10:00	11 Sep 2014	4085	07:00 - 09:00
3 Sep 2014	4077	07:30 - 09:30	11 Sep 2014	4077	07:00 - 09:00
3 Sep 2014	4666	06:30 - 08:30	11 Sep 2014	4666	06:15 - 08:15
3 Sep 2014	6069	06:30 - 08:30	11 Sep 2014	6069	06:00 - 08:00
3 Sep 2014	4480	07:00 - 09:00	11 Sep 2014	4480	06:30 - 08:30
4 Sep 2014	3286	07:00 - 09:00	12 Sep 2014	3286	07:00 - 09:00
4 Sep 2014	4085	08:00 - 10:00	12 Sep 2014	4085	07:00 - 09:00
4 Sep 2014	4073	07:30 - 09:30	12 Sep 2014	4073	06:30 - 08:30
4 Sep 2014	5064	09:30 - 11:30	12 Sep 2014	5064	06:00 - 08:00
4 Sep 2014	5872	06:30 - 08:30	12 Sep 2014	5872	06:30 - 08:30
4 Sep 2014	4283	07:00 - 09:00	12 Sep 2014	4283	07:00 - 09:00
5 Sep 2014	3690	06:00 - 08:00	13 Sep 2014	3690	06:30 - 08:30
5 Sep 2014	4085	08:00 - 10:00	13 Sep 2014	4085	08:00 - 10:00
5 Sep 2014	3881	07:00 - 09:00	13 Sep 2014	3881	07:00 - 09:00
5 Sep 2014	4070	06:30 - 08:30	13 Sep 2014	4070	07:00 - 09:00
5 Sep 2014	5663	06:30 - 08:30	13 Sep 2014	5663	06:00 - 08:00
5 Sep 2014	5277	07:30 - 09:30	13 Sep 2014	5277	06:30 - 08:30
6 Sep 2014	3292	07:00 - 09:00	14 Sep 2014	3292	07:00 - 09:00
6 Sep 2014	4085	06:30 - 08:30	14 Sep 2014	4085	07:00 - 09:00
6 Sep 2014	4079	07:00 - 09:00	14 Sep 2014	4079	06:45 - 08:45
6 Sep 2014	4268	06:00 - 08:00	14 Sep 2014	4268	07:00 - 09:00
6 Sep 2014	6067	06:30 - 08:30	14 Sep 2014	6067	07:00 - 09:00
6 Sep 2014	4878	07:00 - 09:00	14 Sep 2014	4878	06:30 - 08:30
7 Sep 2014	2888	07:00 - 09:00	15 Sep 2014	2888	07:00 - 09:00
7 Sep 2014	4085	08:00 - 10:00	15 Sep 2014	4085	07:00 - 09:00
7 Sep 2014	4077	07:00 - 09:00	15 Sep 2014	4077	06:30 - 08:30
7 Sep 2014	4666	06:30 - 08:30	15 Sep 2014	4666	06:00 - 08:00
7 Sep 2014	6069	07:00 - 09:00	15 Sep 2014	6069	06:00 - 08:00
7 Sep 2014	4480	06:30 - 08:30	15 Sep 2014	4480	06:30 - 08:30
8 Sep 2014	3286	06:30 - 08:30	16 Sep 2014	3286	07:00 - 09:00
8 Sep 2014	4085	08:00 - 10:00	16 Sep 2014	4085	06:30 - 08:30
8 Sep 2014	4073	06:30 - 08:30	16 Sep 2014	4073	06:30 - 08:30
8 Sep 2014	5064	06:30 - 08:30	16 Sep 2014	5064	07:00 - 09:00
8 Sep 2014	5872	06:00 - 08:00	16 Sep 2014	5872	07:00 - 09:00
8 Sep 2014	4283	07:00 - 09:00	16 Sep 2014	4283	07:00 - 09:00

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
17 Sep 2014	3690	06:30 - 08:30	25 Sep 2014	3690	07:00 - 09:00
17 Sep 2014	4085	07:00 - 09:00	25 Sep 2014	4085	07:00 - 09:00
17 Sep 2014	3881	07:00 - 09:00	25 Sep 2014	3881	07:00 - 09:00
17 Sep 2014	4070	07:30 - 09:30	25 Sep 2014	4070	07:30 - 09:30
17 Sep 2014	5663	07:00 - 09:00	25 Sep 2014	5663	07:00 - 09:00
17 Sep 2014	5277	06:30 - 08:30	25 Sep 2014	5277	07:00 - 09:00
18 Sep 2014	3292	07:00 - 09:00	26 Sep 2014	3292	06:45 - 08:45
18 Sep 2014	4085	07:00 - 09:00	26 Sep 2014	4085	07:00 - 09:00
18 Sep 2014	4079	07:00 - 09:00	26 Sep 2014	4079	07:00 - 09:00
18 Sep 2014	4268	07:00 - 09:00	26 Sep 2014	4268	07:00 - 09:00
18 Sep 2014	6067	07:00 - 09:00	26 Sep 2014	6067	07:30 - 09:30
18 Sep 2014	4878	06:00 - 08:00	26 Sep 2014	4878	06:00 - 08:00
19 Sep 2014	2888	07:00 - 09:00	27 Sep 2014	2888	06:30 - 08:30
19 Sep 2014	4085	06:30 - 08:30	27 Sep 2014	4085	07:00 - 09:00
19 Sep 2014	4077	06:30 - 08:30	27 Sep 2014	4077	07:00 - 09:00
19 Sep 2014	4666	07:00 - 09:00	27 Sep 2014	4666	06:30 - 08:30
19 Sep 2014	6069	06:00 - 08:00	27 Sep 2014	6069	08:00 - 10:00
19 Sep 2014	4480	07:00 - 09:00	27 Sep 2014	4480	07:00 - 09:00
20 Sep 2014	3286	07:00 - 09:00	28 Sep 2014	3286	07:00 - 09:00
20 Sep 2014	4085	07:00 - 09:00	28 Sep 2014	4085	07:00 - 09:00
20 Sep 2014	4073	06:30 - 08:30	28 Sep 2014	4073	07:00 - 09:00
20 Sep 2014	5064	06:30 - 08:30	28 Sep 2014	5064	07:00 - 09:00
20 Sep 2014	5872	07:00 - 09:00	28 Sep 2014	5872	06:15 - 08:15
20 Sep 2014	4283	06:30 - 08:30	28 Sep 2014	4283	07:00 - 09:00
21 Sep 2014	3690	07:00 - 09:00	29 Sep 2014	3690	07:00 - 09:00
21 Sep 2014	4085	07:00 - 09:00	29 Sep 2014	4085	07:00 - 09:00
21 Sep 2014	3881	07:00 - 09:00	29 Sep 2014	3881	07:00 - 09:00
21 Sep 2014	4070	07:00 - 09:00	29 Sep 2014	4070	07:00 - 09:00
21 Sep 2014	5663	06:15 - 08:15	29 Sep 2014	5663	07:00 - 09:00
21 Sep 2014	5277	07:00 - 09:00	29 Sep 2014	5277	06:45 - 08:45
22 Sep 2014	3292	07:00 - 09:00	30 Sep 2014	3292	07:00 - 09:00
22 Sep 2014	4085	06:30 - 08:30	30 Sep 2014	4085	07:00 - 09:00
22 Sep 2014	4079	06:30 - 08:30	30 Sep 2014	4079	07:00 - 09:00
22 Sep 2014	4268	07:30 - 09:30	30 Sep 2014	4268	06:00 - 08:00
22 Sep 2014	6067	07:30 - 09:30	30 Sep 2014	6067	06:30 - 08:30
22 Sep 2014	4878	07:00 - 09:00	30 Sep 2014	4878	07:00 - 09:00
23 Sep 2014	2888	07:00 - 09:00	1 Oct 2014	2888	07:00 - 09:00
23 Sep 2014	4085	07:00 - 09:00	1 Oct 2014	4085	07:00 - 09:00
23 Sep 2014	4077	06:30 - 08:30	1 Oct 2014	4077	07:00 - 09:00
23 Sep 2014	4666	07:15 - 09:15	1 Oct 2014	4666	06:00 - 08:00
23 Sep 2014	6069	06:30 - 08:30	1 Oct 2014	6069	07:00 - 09:00
23 Sep 2014	4480	06:30 - 08:30	1 Oct 2014	4480	07:00 - 09:00
24 Sep 2014	3286	07:00 - 09:00	2 Oct 2014	3286	07:00 - 09:00
24 Sep 2014	4085	06:30 - 08:30	2 Oct 2014	4085	06:30 - 08:30
24 Sep 2014	4073	06:30 - 08:30	2 Oct 2014	4073	07:00 - 09:00
24 Sep 2014	5064	07:00 - 09:00	2 Oct 2014	5064	06:30 - 08:30
24 Sep 2014	5872	06:00 - 08:00	2 Oct 2014	5872	07:00 - 09:00
24 Sep 2014	4283	07:00 - 09:00	2 Oct 2014	4283	07:00 - 09:00

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
3 Oct 2014	3690	07:00 - 09:00	11 Oct 2014	3690	07:00 - 09:00
3 Oct 2014	4085	07:00 - 09:00	11 Oct 2014	4085	07:00 - 09:00
3 Oct 2014	3881	07:00 - 09:00	11 Oct 2014	3881	07:00 - 09:00
3 Oct 2014	4070	07:00 - 09:00	11 Oct 2014	4070	07:00 - 09:00
3 Oct 2014	5663	07:00 - 09:00	11 Oct 2014	5663	06:30 - 08:30
3 Oct 2014	5277	07:00 - 09:00	11 Oct 2014	5277	07:00 - 09:00
4 Oct 2014	3292	07:00 - 09:00	12 Oct 2014	3292	07:00 - 09:00
4 Oct 2014	4085	08:00 - 10:00	12 Oct 2014	4085	07:00 - 09:00
4 Oct 2014	4079	06:30 - 08:30	12 Oct 2014	4079	07:30 - 09:30
4 Oct 2014	4268	07:00 - 09:00	12 Oct 2014	4268	07:00 - 09:00
4 Oct 2014	6067	07:00 - 09:00	12 Oct 2014	6067	07:00 - 09:00
4 Oct 2014	4878	07:00 - 09:00	12 Oct 2014	4878	06:45 - 08:45
5 Oct 2014	2888	07:00 - 09:00	13 Oct 2014	2888	07:00 - 09:00
5 Oct 2014	4085	07:00 - 09:00	13 Oct 2014	4085	07:00 - 09:00
5 Oct 2014	4077	07:00 - 09:00	13 Oct 2014	4077	07:30 - 09:30
5 Oct 2014	4666	07:15 - 09:15	13 Oct 2014	4666	07:00 - 09:00
5 Oct 2014	6069	06:30 - 08:30	13 Oct 2014	6069	07:00 - 09:00
5 Oct 2014	4480	07:00 - 09:00	13 Oct 2014	4480	07:00 - 09:00
6 Oct 2014	3286	07:00 - 09:00	14 Oct 2014	3286	07:00 - 09:00
6 Oct 2014	4085	07:00 - 09:00	14 Oct 2014	4085	06:30 - 08:30
6 Oct 2014	4073	07:00 - 09:00	14 Oct 2014	4073	07:00 - 09:00
6 Oct 2014	5064	07:00 - 09:00	14 Oct 2014	5064	06:45 - 08:45
6 Oct 2014	5872	07:00 - 09:00	14 Oct 2014	5872	08:00 - 10:00
6 Oct 2014	4283	07:00 - 09:00	14 Oct 2014	4283	07:00 - 09:00
7 Oct 2014	3690	07:00 - 09:00	15 Oct 2014	3690	08:00 - 10:00
7 Oct 2014	4085	07:00 - 09:00	15 Oct 2014	4085	09:00 - 11:00
7 Oct 2014	3881	07:00 - 09:00	15 Oct 2014	3881	07:00 - 09:00
7 Oct 2014	4070	07:15 - 09:15	15 Oct 2014	4070	07:00 - 09:00
7 Oct 2014	5663	07:00 - 09:00	15 Oct 2014	5663	08:00 - 10:00
7 Oct 2014	5277	07:30 - 09:30	15 Oct 2014	5277	07:00 - 09:00
8 Oct 2014	3292	07:00 - 09:00	16 Oct 2014	3292	07:00 - 09:00
8 Oct 2014	4085	07:00 - 09:00	16 Oct 2014	4085	07:00 - 09:00
8 Oct 2014	4079	07:30 - 09:30	16 Oct 2014	4079	07:00 - 09:00
8 Oct 2014	4268	07:00 - 09:00	16 Oct 2014	4268	07:30 - 09:30
8 Oct 2014	6067	08:00 - 10:00	16 Oct 2014	6067	08:00 - 10:00
8 Oct 2014	4878	06:30 - 08:30	16 Oct 2014	4878	07:00 - 09:00
9 Oct 2014	2888	07:00 - 09:00	17 Oct 2014	2888	07:00 - 09:00
9 Oct 2014	4085	07:00 - 09:00	17 Oct 2014	4085	07:00 - 09:00
9 Oct 2014	4077	07:00 - 09:00	17 Oct 2014	4077	07:00 - 09:00
9 Oct 2014	4666	07:00 - 09:00	17 Oct 2014	4666	07:00 - 09:00
9 Oct 2014	6069	07:00 - 09:00	17 Oct 2014	6069	07:00 - 09:00
9 Oct 2014	4480	07:30 - 09:30	17 Oct 2014	4480	07:30 - 09:30
10 Oct 2014	3286	08:00 - 10:00	18 Oct 2014	3286	07:00 - 09:00
10 Oct 2014	4085	07:00 - 09:00	18 Oct 2014	4085	07:00 - 09:00
10 Oct 2014	4073	07:00 - 09:00	18 Oct 2014	4073	08:00 - 10:00
10 Oct 2014	5064	06:30 - 08:30	18 Oct 2014	5064	07:15 - 09:15
10 Oct 2014	5872	08:00 - 10:00	18 Oct 2014	5872	07:30 - 09:30
10 Oct 2014	4283	07:00 - 09:00	18 Oct 2014	4283	07:00 - 09:00

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
19 Oct 2014	3690	08:00 - 10:00	27 Oct 2014	3690	07:00 - 09:00
19 Oct 2014	4085	08:00 - 10:00	27 Oct 2014	4085	07:00 - 09:00
19 Oct 2014	3881	07:30 - 09:30	27 Oct 2014	3881	06:30 - 08:30
19 Oct 2014	4070	07:00 - 09:00	27 Oct 2014	4070	08:00 - 10:00
19 Oct 2014	5663	06:30 - 08:30	27 Oct 2014	5663	07:00 - 09:00
19 Oct 2014	5277	07:00 - 09:00	27 Oct 2014	5277	07:00 - 09:00
20 Oct 2014	3292	07:00 - 09:00	28 Oct 2014	3292	07:00 - 09:00
20 Oct 2014	4085	06:45 - 08:45	28 Oct 2014	4085	07:00 - 09:00
20 Oct 2014	4079	07:30 - 09:30	28 Oct 2014	4079	07:30 - 09:30
20 Oct 2014	4268	07:45 - 09:45	28 Oct 2014	4268	07:30 - 09:30
20 Oct 2014	6067	07:30 - 09:30	28 Oct 2014	6067	07:00 - 09:00
20 Oct 2014	4878	07:00 - 09:00	28 Oct 2014	4878	07:00 - 09:00
21 Oct 2014	2888	07:00 - 09:00	29 Oct 2014	2888	07:00 - 09:00
21 Oct 2014	4085	06:40 - 08:40	29 Oct 2014	4085	07:00 - 09:00
21 Oct 2014	4077	07:45 - 09:45	29 Oct 2014	4077	08:00 - 10:00
21 Oct 2014	4666	08:00 - 10:00	29 Oct 2014	4666	07:00 - 09:00
21 Oct 2014	6069	07:30 - 09:30	29 Oct 2014	6069	07:00 - 09:00
21 Oct 2014	4480	07:30 - 09:30	29 Oct 2014	4480	07:00 - 09:00
22 Oct 2014	3286	07:00 - 09:00	30 Oct 2014	3286	08:00 - 10:00
22 Oct 2014	4085	06:40 - 08:40	30 Oct 2014	4085	07:20 - 09:20
22 Oct 2014	4073	07:30 - 09:30	30 Oct 2014	4073	07:00 - 09:00
22 Oct 2014	5064	07:30 - 09:30	30 Oct 2014	5064	07:00 - 09:00
22 Oct 2014	5872	08:00 - 10:00	30 Oct 2014	5872	07:00 - 09:00
22 Oct 2014	4283	07:00 - 09:00	30 Oct 2014	4283	07:00 - 09:00
23 Oct 2014	3690	07:00 - 09:00	31 Oct 2014	3690	07:00 - 09:00
23 Oct 2014	4085	07:00 - 09:00	31 Oct 2014	4085	07:00 - 09:00
23 Oct 2014	3881	08:00 - 10:00	31 Oct 2014	3881	07:00 - 09:00
23 Oct 2014	4070	07:30 - 09:30	31 Oct 2014	4070	07:00 - 09:00
23 Oct 2014	5663	08:00 - 10:00	31 Oct 2014	5663	07:30 - 09:30
23 Oct 2014	5277	08:00 - 10:00	31 Oct 2014	5277	07:00 - 09:00
24 Oct 2014	3292	07:00 - 09:00			
24 Oct 2014	4085	07:00 - 09:00			
24 Oct 2014	4079	07:30 - 09:30			
24 Oct 2014	4268	08:00 - 10:00			
24 Oct 2014	6067	08:00 - 10:00			
24 Oct 2014	4878	07:30 - 09:30			
25 Oct 2014	2888	07:00 - 09:00			
25 Oct 2014	4085	07:30 - 09:30			
25 Oct 2014	4077	08:00 - 10:00			
25 Oct 2014	4666	07:30 - 09:30			
25 Oct 2014	6069	07:00 - 09:00			
25 Oct 2014	4480	07:00 - 09:00			
26 Oct 2014	3286	07:00 - 09:00			
26 Oct 2014	4085	07:30 - 09:30			
26 Oct 2014	4073	06:00 - 08:00			
26 Oct 2014	5064	07:00 - 09:00			
26 Oct 2014	5872	07:00 - 09:00			
26 Oct 2014	4283	08:00 - 10:00			