# 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 2016

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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 116/2016) on the 6th June 2016 titled "*Tender for an independent scientific study on the influx or passage of migratory Common Quail and Turtle Dove in Malta during Autumn 2016*". The Terms of Reference (ToR) specified in the tender document are as follows:

### *2. Contract Objectives and Expected Results*

### *2.1 Overall Objectives*

*The overall objectives of the project of which this contract will be a part are as follows:*

- *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 2016 to the 31st October 2016, inclusive of both dates.*

### *2.2 Specific Objectives*

*The objectives of this contract [which are not necessarily those of the project] are as follows:*

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

### *2.3 Results to be Achieved by the Consultant*

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

2. *A monitoring report for the stipulated Autumn 2016 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 during the past studies; and*
   f) *A comparative assessment of the results obtained through observations/extrapolation vis-a-vis hunting bag data for these two species, which data shall be provided by the Wild Birds Regulation Unit at the end of the monitoring period.*

## *3. Assumptions and Risks*

### *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.*

*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.*

### *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 21 in number). It shall be the responsibility of the consultant to ensure that the monitoring stations (at least 21 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 which can be accessed from http://environment.gov.mt/en/Pages/WBRU/Reports-and-Statistics.aspx.*

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

*The Contracting Authority reserves the right to cancel award of the tender at its discretion. The publication of this tender shall in no way be construed or perceived as obliging the Government or any other relevant authority to take any decision in connection with any derogation under the European Union Birds Directive or any other law or regulation*

## *4 Scope of the Work*

### *4.1 General*

#### *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 2016 period that is, between the 1st of September 2016 till the 31st of October 2016, both dates included for at least two hours in the morning (prior to 12:00hrs) for Common Quail and for seven hours starting from 7:00hrs in the case of Turtle doves at each station in the case of Turtle doves. The consultant shall mobilise all staff and equipment by the 15th of August 2016, in preparation for the execution of the Autumn 2016 bird migration study. The bird monitoring phase shall commence on the 1st of September 2016.*

*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 2016.*

*Once the draft Autumn 2016 study report has been certified for quality assurance by the Contracting Authority, the final Autumn 2016 monitoring report is to be submitted within ten (10) working days from such a review that is, by 14th November 2016.*

### *4.1.2 Geographical Area to be covered*

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

### *4.1.3 Target Groups*

*Not applicable*

### *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 21 monitoring stations. The number of active stations on any given day shall be six (6) sites manned by at least two ornithologists and/or field assistants each site has to be surveyed every 4 days. 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 knowledge 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 listed by contractor who are commissioned to undertake this bird migration study. Such details should be included in the methodology submitted in Section 4 Technical Offer (Organization and Methodology) by the contractor. 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 starting from 7:00hrs at each of the monitoring stations in operation.*

*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 2016. 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 2016 study is to be submitted by the 14th of November 2016. Once such draft report has been certified for quality assurance by the Contracting Authority, the final Autumn 2016 monitoring report is to be submitted within 10 working days from such a review. All Autumn 2016 study project activities must be completed to the Contracting Authority's satisfaction within four 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 including analysis and comparison with the results of past studies.*

### *4.3 Project Management*

#### *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.*

#### *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.*

#### *4.3.3 Facilities to be provided by the Contracting Authority and/or other parties*

*None*

## *5. Logistics and Timing*

### *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.*

### *5.2 Commencement Date & Period of Execution*

*The intended commencement date for the bird migration monitoring phase is from the 1st September 2016 and the period of execution of the contract will be 3 months from this date. Article 18 of the Special Conditions will determine the actual commencement date and period of execution.*

## *6. Requirements*

### *6.1 Personnel*

#### *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/or 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 familiarity with the work involved. The findings of the selection panel shall be recorded. The selection of experts shall be subject to approval by the Contracting Authority.*

#### *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.*

### *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.*

### *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.*

### *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.*
- *Research equipment*

## *7. Reports*

### *7.1 Reporting Requirements*

*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*
- *comparison of the results with the data obtained from previous studies*
- *comparison of the results with hunting bag data for the species concerned for this period*

*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 2016 bird monitoring phase. The draft Autumn 2016 report and analysis is to be submitted by the 14th November 2016.*

*Once such draft report has been certified for quality assurance by the Contracting Authority, the final Autumn 2016 monitoring report is to be submitted within ten working days from such a review. All Autumn 2016 project activities must be completed to the Contracting Authority's satisfaction within four 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.*

### *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 Monitoring and Evaluation*

### *8.1 Definition of Indicators*

| ***Results*** | ***Objectively verifiable indicators*** | ***Sources of verifications*** |
|---|---|---|
| *Daily datasheets with raw counts of the Turtle Dove and Common Quail* | *The original raw datasheets which are to be completed on site during the monitoring process to be submitted by the end of each week of the monitoring phase.* | *The original datasheets submitted to the Contracting Authority.* |
| *Autumn season 2016 Monitoring report which presents a clear analyses of* | *The draft monitoring report shall be completed within the 14th November 2016.* | *The actual monitoring report presented by the contractor.* |

| | | |
|---|---|---|
| *the monitoring carried out as well as analysis and comparison with results of past studies* | *The monitoring report will be finalised by the consultant and approved by the Contracting Authority within five weeks from the termination of the Autumn 2016 bird monitoring phase.* | |

### *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 the company 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 Ecoserv during the period 1 September to 31 October 2016, which coincides with the 2016 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 a previous similar studies undertaken in autumn 2014 and 2015 (Ecoserv, 2014a; 2015a) 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 the report by Ecoserv (2011). Since 2011, similar studies have also been previously undertaken during spring; for details on the findings of these studies the reader is referred to the respective survey reports (Ecoserv, 2011; 2012; 2013; 2014b; 2015b, 2016).

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 2014, 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 held by Federazzjoni Kaccaturi Nassaba u Konservazzjonisti (FKNK) and BirdLife Malta (BLM).

The findings from the autumn 2014 survey, which was undertaken by Ecoserv during the period 1 September to 31 October, 2014, and was based on ToR that were similar to the ones for the spring 2011–2014 (Ecoserv, 2011; 2012; 2013; 2014b) and present studies, are as follows (see Ecoserv, 2014a):

Turtle Dove

- When comparing the results of the autumn 2014 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 was noted overall; the pattern of counts for the three years compared indicated a migratory influx during September. However, no appreciable peaks in migration were recorded during the autumn 2014 survey, whereas a small peak in mean counts was recorded in 2009. When comparing the grand mean value recorded during the autumn 2014 survey to that recorded by Thomaidis (nd) in 2008 and 2009, a lower value was evident for the former, which indicated a lower influx of Turtle Dove in autumn 2014.

- The total influx of Turtle Dove for the autumn 2014 survey period (1 September – 31 October 2014) was estimated at 7,956 individuals. No such estimates were available from the same period for previous years. It was 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.

Common Quail

- When comparing the results of the autumn 2014 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 was noted overall; the pattern of counts for the three years compared indicated a migratory influx between mid-September and the beginning of October. However, no appreciable migratory peaks for Common Quail were recorded during the autumn 2014 survey, whereas appreciably more pronounced peaks were recorded in 2008 and 2009. When comparing the grand mean value recorded during the autumn 2014 survey with that recorded during the previous two surveys (autumn 2008 and 2009), a lower value was evident for the former, which indicates a lower influx of Common Quail for autumn 2014.

- The total influx of Common Quail for the autumn 2014 survey period (1 September – 31 October 2014) was estimated at 45,683 individuals. No estimates were available from the same period for previous years. 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 amounted 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 autumn 2014 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 had already been highlighted in Ecoserv (2011; 2012; 2013; 2014b), were reiterated, namely:
    - The data reported on in the autumn 2014 survey report 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 2014 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, was 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 autumn 2014 study provided a useful indication of the autumn influx of Turtle Dove and Common Quail, provided that results are interpreted in the context of these limitations.

The findings from the autumn 2015 survey, which was undertaken by Ecoserv during the period 1 September to 31 October, 2015, and was based on ToR that were similar to the ones for the spring 2011–2015 (Ecoserv, 2011; 2012; 2013; 2014b; 2015b) and present studies, are as follows (see Ecoserv, 2015a):

Turtle Dove

- When comparing the results of the autumn 2015 with those from Thomaidis' (nd) surveys held in 2008 and 2009 and those from the autumn 2014 survey by Ecoserv (2014a), a similar trend of counts recorded during the period 1 September – 31 October was noted overall; the pattern of counts for the survey years compared indicates a migratory influx during September. A migratory peak was recorded on 9 September 2015 during the 2015 survey; similar peaks were recorded during the 2009 survey but not during the 2008 or 2014 surveys. The grand mean value recorded during the autumn 2015 survey was slightly higher than that recorded by Thomaidis (nd) in 2008, but lower than that recorded by the same author in 2009, and slightly higher than that recorded by Ecoserv (2014a) from the previous autumn 2014 survey.
- The total influx of Turtle Dove for the autumn 2015 survey period (1 September – 31 October 2015) was estimated at 12,386 individuals, which is slightly higher than the estimate for the same period in 2014 (Ecoserv, 2014a). When comparing the daily influx of Turtle Dove recorded during the autumn 2015 survey with that recorded during the spring 2015 survey (see Ecoserv, 2015b); mean values of daily influx of the species recorded during the autumn survey are overall much lower than values recorded during spring for the same year.

- The authors 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. The authors also emphasised 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 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.

Common Quail

- When comparing the results of the autumn 2015 survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 and those from the autumn 2014 survey by Ecoserv (2014a), a similar trend of Common Quail counts recorded during the period 1 September – 31 October was noted overall; the pattern of counts for the 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 autumn 2015 survey, whereas appreciably higher peaks were recorded in 2008 and 2009, but not in 2014. The grand mean value recorded during the autumn 2015 survey was lower than values recorded by Thomaidis (nd) in 2008 and 2009, but similar to that recorded by Ecoserv (2014a) in autumn 2014.

- The total influx of Common Quail for the autumn 2015 survey period (1 September – 31 October 2014) was estimated at 50,514 individuals, which is slightly higher than the estimate for the same period in 2014 reported by Ecoserv (2014a). When comparing the daily influx of Common Quail recorded during the autumn 2015 survey with that recorded during the spring 2015 survey (see Ecoserv, 2015b); mean values of daily influx of the species recorded during the autumn survey were overall much lower than values recorded during spring for the same year. The authors 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 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 autumn 2015 survey included counts made over a 61 day period between 1 September – 31 October 2015, 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 had already been highlighted in Ecoserv (2011; 2012; 2013; 2014a; 2014b; 2015b), were reiterated, namely:
  - The data reported on in the autumn 2015 survey report 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 2015 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, was 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 autumn 2015 study provided a useful indication of the autumn 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 2016 survey is identical to that used in surveys made by the same company in previous autumn (see Ecoserv, 2014a; 2015a) and spring seasons (see Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016); 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 over 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. Prior to enrolment for the survey, the field assistants would have been assessed by Ecoserv's environmental consultants and ecologists to ensure that they are capable of identifying the two bird species. The observers were given briefings by Ecoserv's consultants on identification of the two bird species and received further training in the field on same by the field assistants. Throughout the survey, Ecoserv's environmental consultants and ecologists ensured close monitoring of the activities of the field personnel to ensure that collection of data proceeded as per designated protocol by carrying out field visits (most of which were 'surprise visits') on a regular basis. The survey was undertaken over a 9 week period between 1 September and 31 October, 2016. 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 autumn 2014–2015 (Ecoserv, 2014a; 2015a) and spring 2011–2016 (see Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016), 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 |

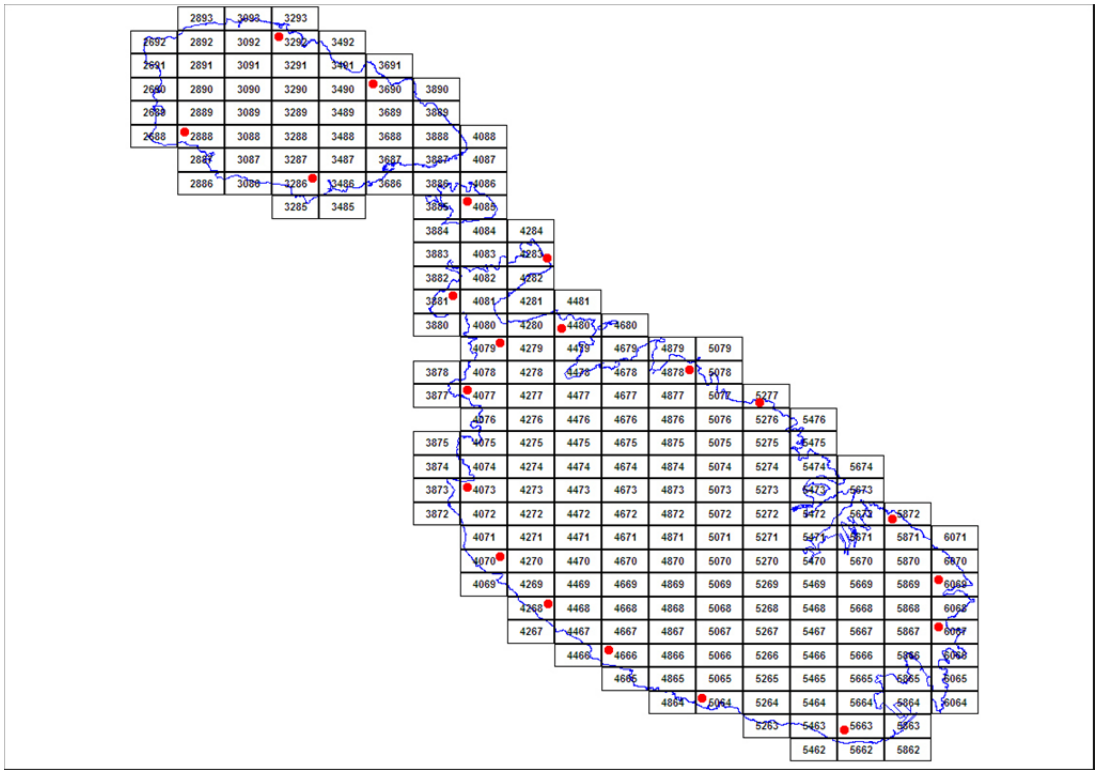

**Figure 1. Map of the Maltese Islands showing the 21 sites (grid cells indicated by the red filled circle) where the bird counts were made; see also Table 1.**

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 over 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 07:00 and 14:00, while monitoring of Quail was made during a 2 hour window between 07:00 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 **122-16**. The sample reference codes for the bird count data are **B-061-16** to **B-101-16**.

**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 1.2 (Table 2). No peaks in migratory counts were recorded during the present (2016) autumn migration, but a period characterised by slightly higher numbers of Turtle Dove occurred during the period 3 to 7 September 2016. The recorded counts did not vary appreciably between the different sites over the whole survey period: at the lower end, no Turtle Dove individuals were recorded throughout the survey period from grid locations 3690 (northeast Gozo), 5872 and 6069 (east/southeast Malta), while at the higher end, 15 Turtle Dove individuals were recorded from the site at grid location 4085 (Comino), which was surveyed almost daily, while nine individuals were recorded from the site at grid location 4077 located in northwestern Malta.

Values of mean daily counts and total counts of Turtle Dove recorded during the period 1 September to 31 October 2016 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), 2014 (Ecoserv, 2014a) and 2015 (Ecoserv, 2015a) 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, and by Ecoserv (2014a; 2015a) in autumn 2014–2015; that is, the main migratory influx occurs during September.

Values of the grand mean of Turtle Dove counts recorded during the period 1 September to 31 October 2016 from the present survey, together with values of the grand mean for the same period in 2008, 2009 (Thomaidis, nd), 2014 and 2015 (Ecoserv, 2014a; 2015a) are shown in Figure 3. Overall, the grand mean recorded during the present (autumn 2016) survey is considerably lower than that recorded from the 2008, 2009 and 2015 surveys, but only marginally lower than that recorded from the 2014 survey.

**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-16 | 0.67 | ± 1.03 | 4 | 362 |
| 2-Sep-16 | 0.50 | ± 0.84 | 3 | 271 |
| 3-Sep-16 | 0.83 | ± 0.98 | 5 | 452 |
| 4-Sep-16 | 1.00 | ± 1.55 | 6 | 542 |
| 5-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 6-Sep-16 | 1.17 | ± 0.98 | 7 | 633 |
| 7-Sep-16 | 1.00 | ± 0.89 | 6 | 542 |
| 8-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 9-Sep-16 | 0.50 | ± 0.55 | 3 | 271 |
| 10-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 11-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 12-Sep-16 | 0.33 | ± 0.82 | 2 | 181 |
| 13-Sep-16 | 0.00 | ± 0.00 | 0 | 0 |
| 14-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 15-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 16-Sep-16 | 0.00 | ± 0.00 | 0 | 0 |
| 17-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 18-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 19-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 20-Sep-16 | 0.67 | ± 0.82 | 4 | 362 |
| 21-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 22-Sep-16 | 0.50 | ± 0.84 | 3 | 271 |
| 23-Sep-16 | 0.33 | ± 0.82 | 2 | 181 |
| 24-Sep-16 | 0.00 | ± 0.00 | 0 | 0 |
| 25-Sep-16 | 0.00 | ± 0.00 | 0 | 0 |
| 26-Sep-16 | 0.50 | ± 1.22 | 3 | 271 |
| 27-Sep-16 | 0.17 | ± 0.41 | 1 | 90 |
| 28-Sep-16 | 0.00 | ± 0.00 | 0 | 0 |
| 29-Sep-16 | 0.33 | ± 0.52 | 2 | 181 |
| 30-Sep-16 | 1.17 | ± 0.98 | 7 | 633 |
| 1-Oct-16 | 0.17 | ± 0.41 | 1 | 90 |
| 2-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 3-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 4-Oct-16 | 0.17 | ± 0.41 | 1 | 90 |
| 5-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 6-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 7-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 8-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 9-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 10-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 11-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 12-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 13-Oct-16 | 0.17 | ± 0.41 | 1 | 90 |
| 14-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 15-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 16-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 17-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 18-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |

| Date | Mean Count ± SD | | Total count | Estimated Daily Influx |
|---|---|---|---|---|
| 19-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 20-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 21-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 22-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 23-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 24-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 25-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 26-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 27-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 28-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 29-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 30-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| 31-Oct-16 | 0.00 | ± 0.00 | 0 | 0 |
| | | | **Estimated Total Influx** | **6868** |

As has been done in previous surveys undertaken in autumn (Ecoserv, 2014a; 2015a) and spring (Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016), an estimate of the total influx of Turtle Dove over the Maltese Islands was made using the daily counts (Figure 2). 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; 2014a; 2014b; 2015a; 2015b; 2016), 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 14.00 and does not start again before 07.00, 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.

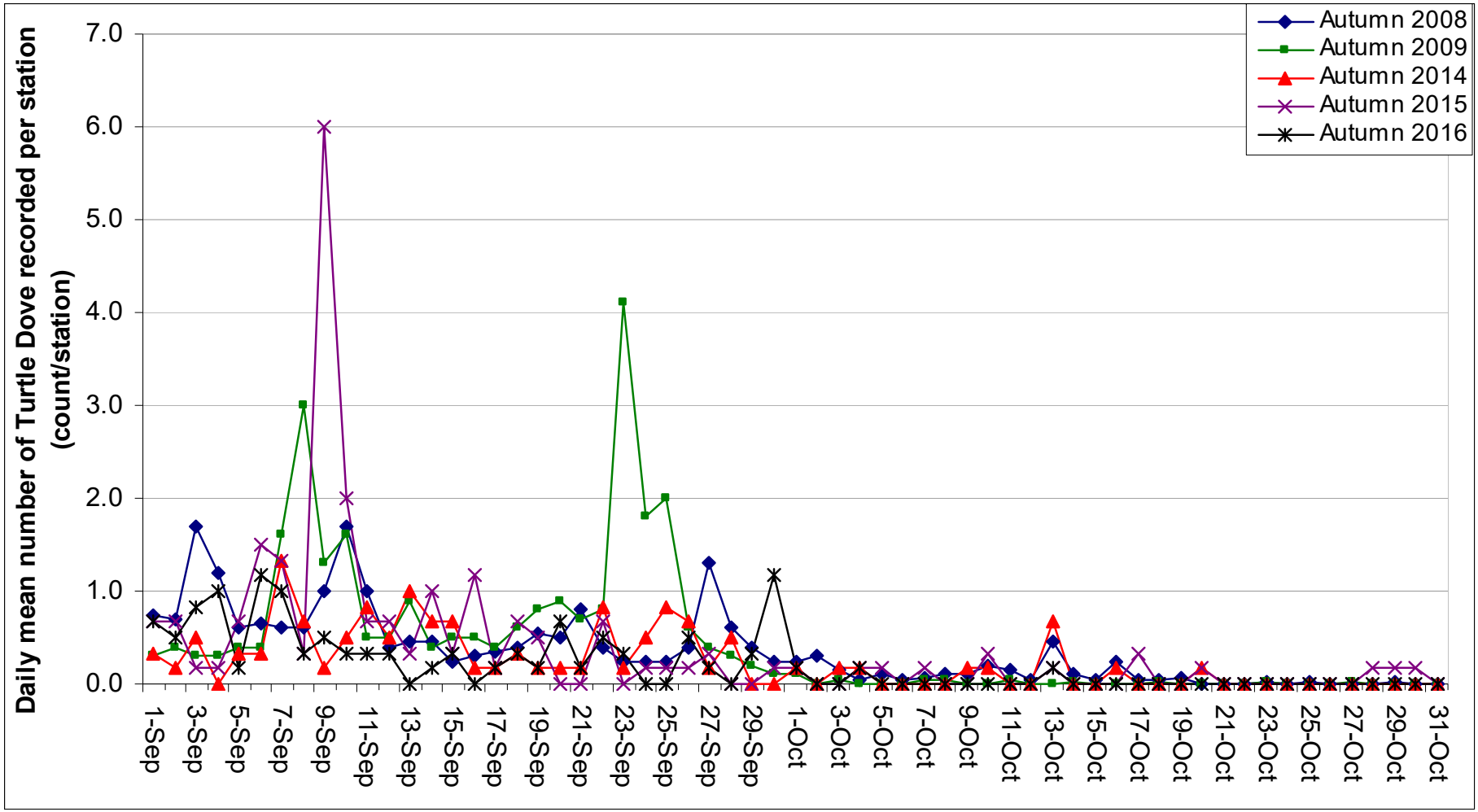


**Figure 2.** **Daily mean counts of Turtle Dove per station (= site) recorded during the present survey during the period 1 September to 31 October 2016, together with values of the same statistic for autumn 2008 and 2009 as reported in Thomaidis (nd), for autumn 2014 as reported in Ecoserv (2014a), and for autumn 2015 as reported in Ecoserv (2015a).**

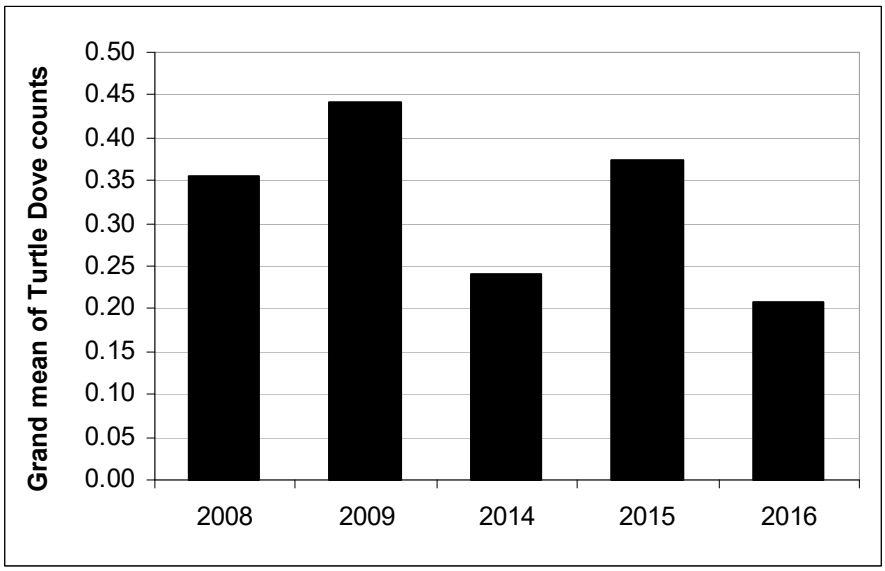


**Figure 3. Grand mean of Turtle Dove counts made using data from the period 1 September to 31 October for autumn 2016 (present survey), autumn 2015 (Ecoserv, 2015a), autumn 2014 (Ecoserv, 2014a), autumn 2009 (Thomaidis, nd) and autumn 2008 (Thomaidis, nd).**

The estimated daily influx was obtained by extrapolating the recorded mean daily values (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 633 individuals, with a total influx over the survey period (1 September to 31 October; i.e. 61 days) of 6,868 individuals, i.e. some 113 birds per day; see Table 2.

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 Għajn Tuffieħa (Grid 4077) located in northwestern Malta, while overall high counts were recorded from study sites located along the western parts of Malta. The lowest mean counts were recorded from the eastern parts of Malta, particularly from study sites located in the stretch between Pembroke and Żonqor Point. The mean count recoded from the study site on Comino is 0.246; this is slightly higher than median value of 0.188 for the whole range of recorded mean counts.

**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 8 (see Appendix I), while the mean daily counts ranged between 0 and 2.3. 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 located in western Malta, while

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

at the lower end, no Quail were recorded throughout the survey period from grid locations 4085, 5663 and 6069 located in Comino and in southern and southeastern Malta respectively.

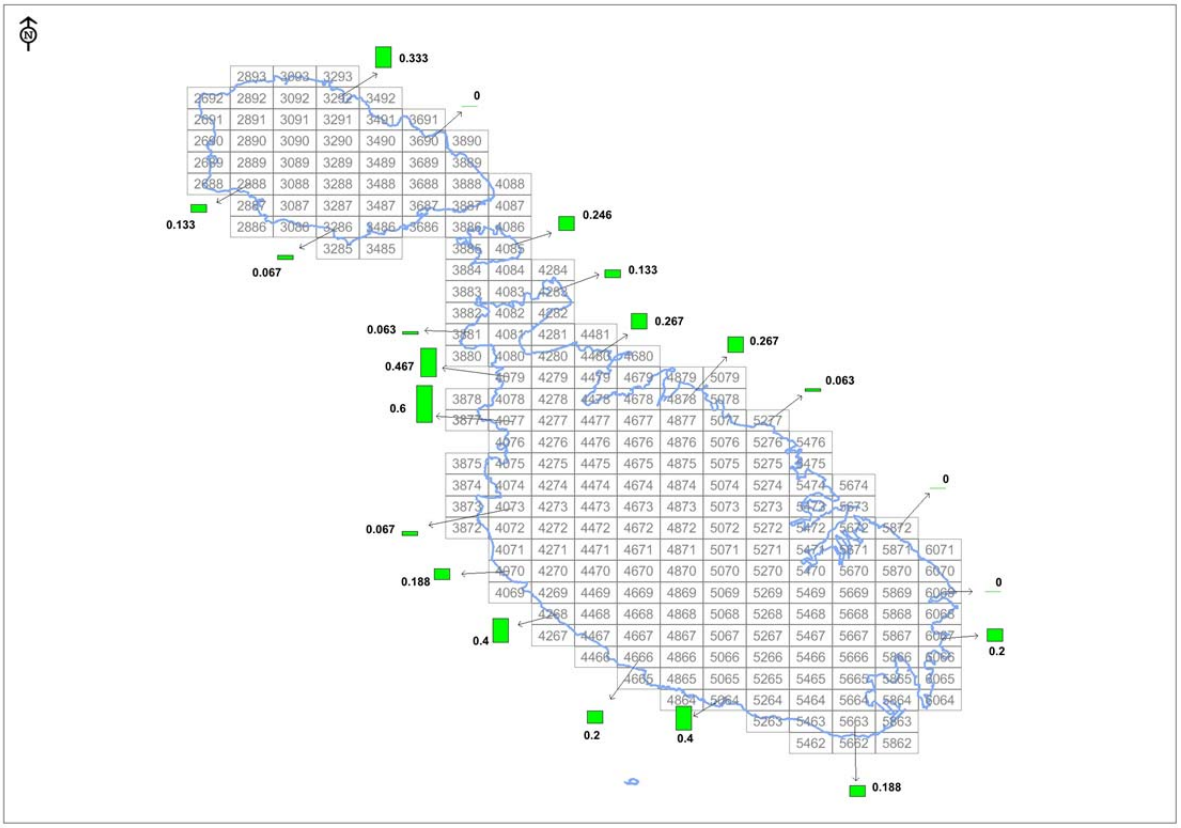


**Figure 4. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Turtle Dove recorded from study sites in the respective cells during the present (autumn 2016) survey.**

Values of mean daily counts and total counts of Common Quail recorded during the period 1 September to 31 October 2016 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 3. 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), 2014 (Ecoserv, 2014a) and 2015 (Ecoserv, 2015a), in Figure 5. The daily mean counts recorded during the period 1 September to 31 October 2016 (present survey) are overall lower than values recorded in 2008 and 2009 (Thomaidis, nd) for the same period, but similar to those recorded in 2014–2015 (Ecoserv, 2014a; 2015a). A single migration peak (with a mean count >2) was recorded on 30 September during the present survey. The general pattern from all 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 2016 (present survey), autumn 2015 (Ecoserv, 2015a), autumn 2014 (Ecoserv, 2014a), and autumn 2008 and autumn 2009 (Thomaidis, nd) surveys, are shown graphically in Figure 6. The comparison in Figure 6 is based on data collected during the same period (1 September to 31 October) in each of the surveys. The grand mean recorded during the present (autumn 2016) survey is lower than that recorded during the 2008 and 2009 (Thomaidis, nd) surveys, but marginally higher than values recorded during the 2014 and 2015 surveys (Ecoserv, 2014a; 2015a).

**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-16 | 0.00 | ± 0.00 | 0 | 0.184 | 0 |
| 2-Sep-16 | 0.17 | ± 0.41 | 1 | 0.187 | 1182 |
| 3-Sep-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 4-Sep-16 | 0.00 | ± 0.00 | 0 | 0.383 | 0 |
| 5-Sep-16 | 0.00 | ± 0.00 | 0 | 0.184 | 0 |
| 6-Sep-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 7-Sep-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 8-Sep-16 | 0.00 | ± 0.00 | 0 | 0.383 | 0 |
| 9-Sep-16 | 0.00 | ± 0.00 | 0 | 0.158 | 0 |
| 10-Sep-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 11-Sep-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 12-Sep-16 | 0.33 | ± 0.82 | 2 | 0.383 | 1155 |
| 13-Sep-16 | 0.00 | ± 0.00 | 0 | 0.158 | 0 |
| 14-Sep-16 | 0.50 | ± 0.84 | 3 | 0.187 | 3547 |
| 15-Sep-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 16-Sep-16 | 0.00 | ± 0.00 | 0 | 0.383 | 0 |
| 17-Sep-16 | 0.17 | ± 0.41 | 1 | 0.184 | 1201 |
| 18-Sep-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 19-Sep-16 | 0.17 | ± 0.41 | 1 | 0.301 | 736 |
| 20-Sep-16 | 0.00 | ± 0.00 | 0 | 0.357 | 0 |
| 21-Sep-16 | 0.00 | ± 0.00 | 0 | 0.158 | 0 |
| 22-Sep-16 | 0.00 | ± 0.00 | 0 | 0.161 | 0 |
| 23-Sep-16 | 0.17 | ± 0.41 | 1 | 0.301 | 736 |
| 24-Sep-16 | 0.50 | ± 0.84 | 3 | 0.383 | 1733 |
| 25-Sep-16 | 0.33 | ± 0.52 | 2 | 0.184 | 2403 |
| 26-Sep-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 27-Sep-16 | 0.50 | ± 1.22 | 3 | 0.301 | 2209 |
| 28-Sep-16 | 0.67 | ± 0.82 | 4 | 0.383 | 2311 |
| 29-Sep-16 | 0.50 | ± 0.84 | 3 | 0.184 | 3604 |
| 30-Sep-16 | 2.33 | ± 3.39 | 14 | 0.187 | 16554 |
| 1-Oct-16 | 0.50 | ± 0.84 | 3 | 0.274 | 2424 |
| 2-Oct-16 | 0.67 | ± 1.03 | 4 | 0.357 | 2484 |
| 3-Oct-16 | 0.33 | ± 0.82 | 2 | 0.184 | 2403 |
| 4-Oct-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 5-Oct-16 | 0.00 | ± 0.00 | 0 | 0.274 | 0 |
| 6-Oct-16 | 0.50 | ± 0.84 | 3 | 0.383 | 1733 |
| 7-Oct-16 | 0.33 | ± 0.52 | 2 | 0.184 | 2403 |
| 8-Oct-16 | 0.17 | ± 0.41 | 1 | 0.187 | 1182 |

| Date | Mean Count ± SD | | Total count | Total Area Surveyed (km$^2$) | Estimated Daily Influx |
|---|---|---|---|---|---|
| 9-Oct-16 | 0.33 | ± 0.82 | 2 | 0.301 | 1473 |
| 10-Oct-16 | 0.00 | ± 0.00 | 0 | 0.357 | 0 |
| 11-Oct-16 | 0.00 | ± 0.00 | 0 | 0.184 | 0 |
| 12-Oct-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 13-Oct-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 14-Oct-16 | 0.67 | ± 1.03 | 4 | 0.383 | 2311 |
| 15-Oct-16 | 0.17 | ± 0.41 | 1 | 0.184 | 1201 |
| 16-Oct-16 | 0.50 | ± 0.55 | 3 | 0.187 | 3547 |
| 17-Oct-16 | 0.50 | ± 0.84 | 3 | 0.301 | 2209 |
| 18-Oct-16 | 0.33 | ± 0.82 | 2 | 0.383 | 1155 |
| 19-Oct-16 | 0.17 | ± 0.41 | 1 | 0.184 | 1201 |
| 20-Oct-16 | 0.00 | ± 0.00 | 0 | 0.187 | 0 |
| 21-Oct-16 | 0.00 | ± 0.00 | 0 | 0.274 | 0 |
| 22-Oct-16 | 0.17 | ± 0.41 | 1 | 0.377 | 587 |
| 23-Oct-16 | 0.50 | ± 0.55 | 3 | 0.137 | 4852 |
| 24-Oct-16 | 0.00 | ± 0.00 | 0 | 0.161 | 0 |
| 25-Oct-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 26-Oct-16 | 0.00 | ± 0.00 | 0 | 0.383 | 0 |
| 27-Oct-16 | 0.00 | ± 0.00 | 0 | 0.158 | 0 |
| 28-Oct-16 | 0.17 | ± 0.41 | 1 | 0.161 | 1379 |
| 29-Oct-16 | 0.00 | ± 0.00 | 0 | 0.301 | 0 |
| 30-Oct-16 | 0.00 | ± 0.00 | 0 | 0.357 | 0 |
| 31-Oct-16 | 0.00 | ± 0.00 | 0 | 0.184 | 0 |
| | | | | **Estimated Total Influx** | **69915** |

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-Riħ (Grid 4073) located in western Malta, while overall high counts were recorded from study sites located in the northern half of Malta and southwestern Gozo. The lowest mean counts were recorded from the sites in the southern parts of Malta and from Comino.

As has been done in previous surveys undertaken in autumn (Ecoserv, 2014a; 2015a) and spring (Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016), 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. 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 located in western Malta, while at the lower end, no Quail were recorded throughout the survey period from grid locations 408, 5663 and 6069 located in Comino, and in southern and southeastern Malta respectively. 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.

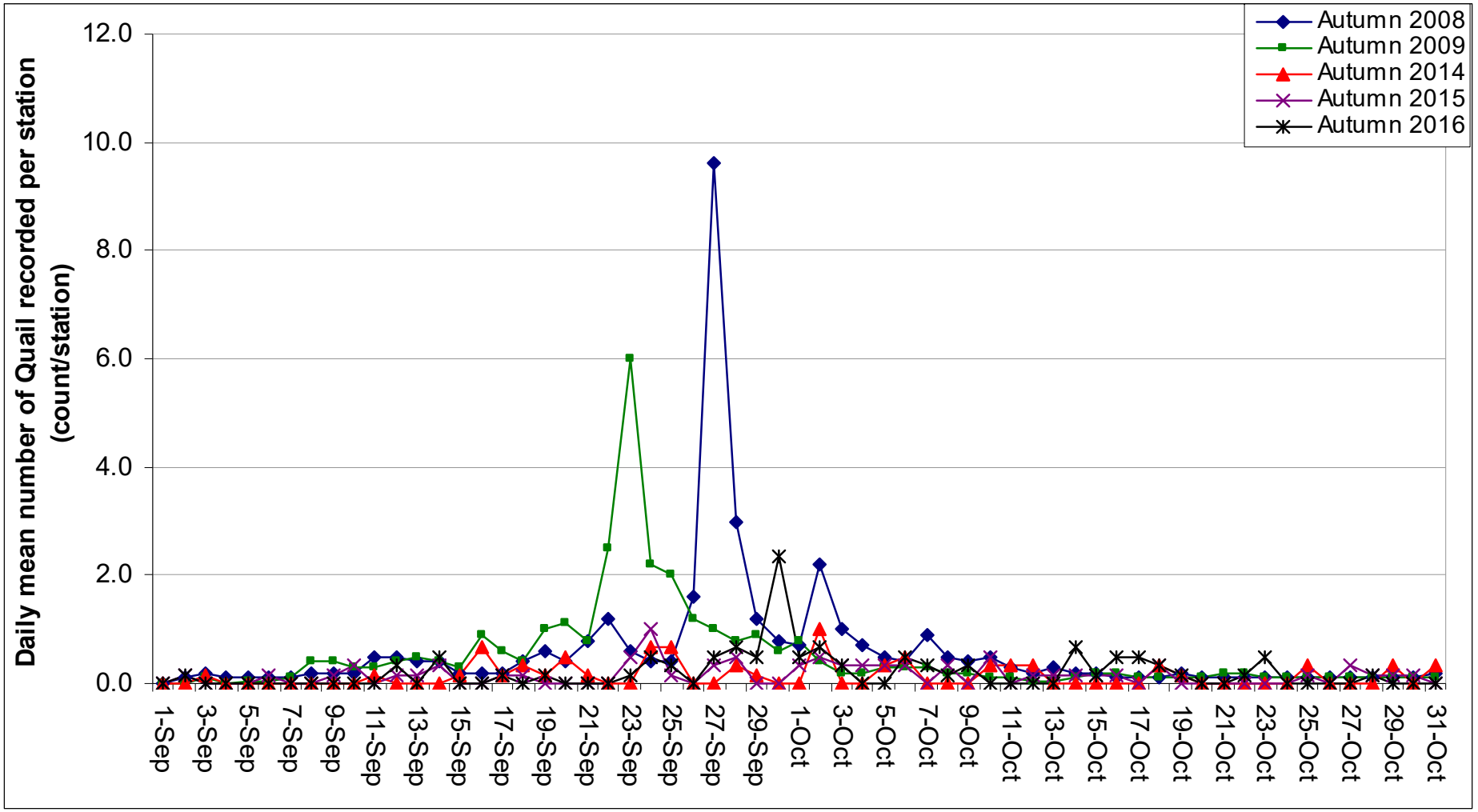


**Figure 5. Daily mean counts of Common Quail per station (= site) recorded during the present survey during the period 1 September – 31 October 2016, together with values of the same statistic for autumn 2008 and 2009 as reported in Thomaidis (nd) and for autumn 2014 as reported in Ecoserv (2014a), and for autumn 2015 as reported in Ecoserv (2015a).**

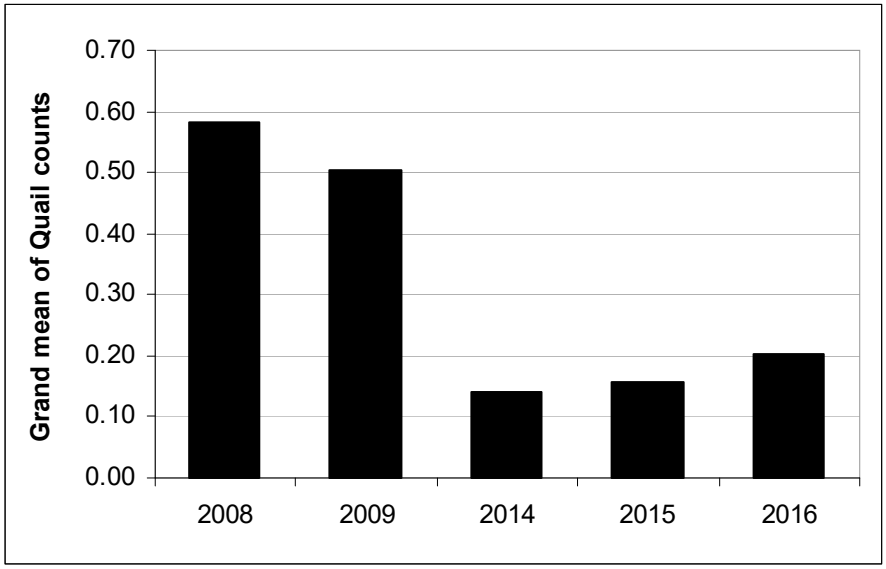


**Figure 6. Grand mean of Common Quail counts made using data from the period 1 September – 31 October for autumn 2016 (present survey), autumn 2015 (Ecoserv, 2015a), autumn 2014 (Ecoserv, 2014a), autumn 2009 (Thomaidis, nd) and autumn 2008 (Thomaidis, nd).**

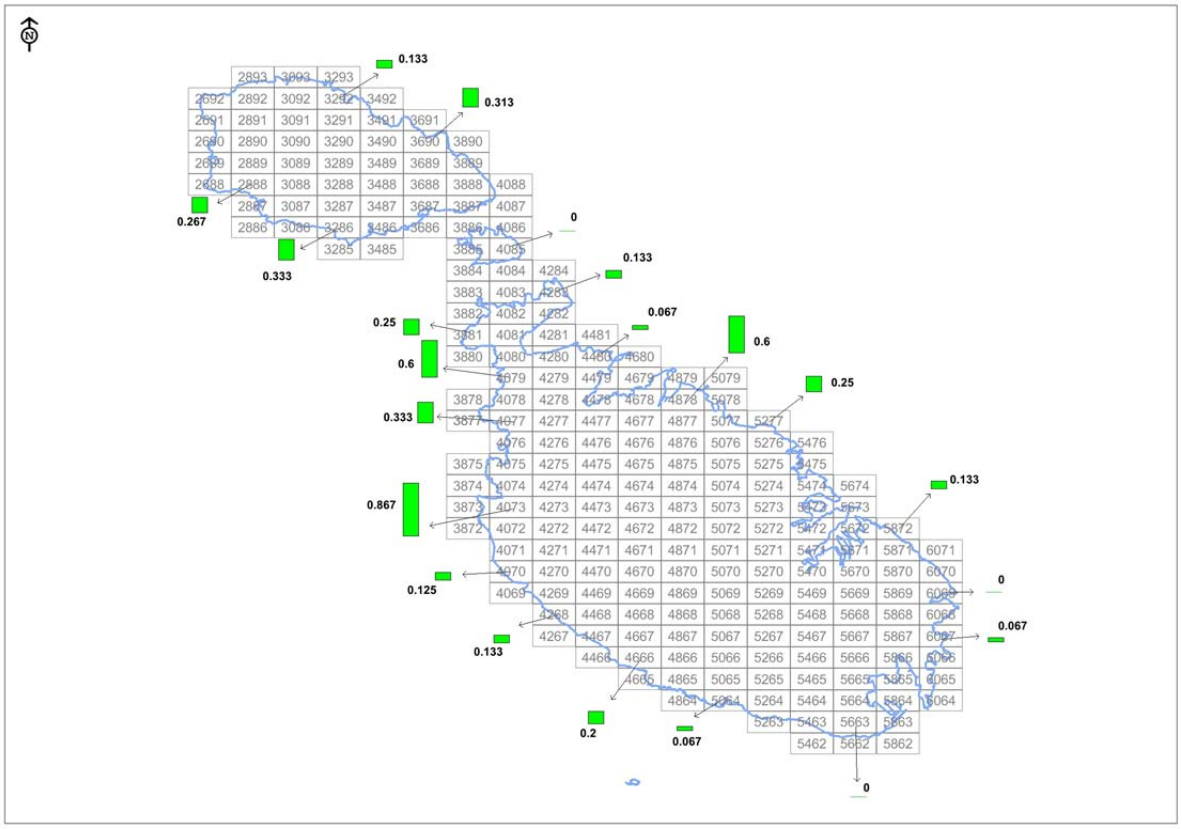


**Figure 7. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Common Quail recorded from study sites in the respective cells during the present (autumn 2016) survey.**

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 2016 of 69,915 individuals, or some 1,146 Quail per day (see Table 3). However, as already emphasised in the reports of previous surveys (Ecoserv, 2011; 2012; 2013; 2014a; 2014b; 2015a; 2015b; 2016), 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.

# 4. Comparison with bag data

A comparative analysis of data from the present study with bag data provided by the Wild Birds Regulation Unit (WBRU) of the MSDEC was undertaken. The dataset provided by the WBRU comprised the daily bag count of Turtle Dove and Common Quail (as reported by hunters) for the period 01 September to 31 October 2016. It should be noted that the two sets of data were collected for different purposes, using very different methodologies, and therefore the magnitudes of values are not directly comparable. However, the temporal trends can be expected to follow a similar pattern, that is within the same season, the periods when higher mean daily counts were recorded during the present survey should broadly follow the days when higher numbers of turtle dove or common quail were caught (and reported in the bag data). Graphical representations of the mean or total daily counts made during the present (2016) survey and the daily bag counts for the same time period (01 September to 31 October 2016; MSDEC unpublished data) of Turtle Dove and Common Quail were prepared to compare temporal trends among the two different data sets.

**Turtle Dove**

The daily bag counts indicating the number of Turtle Dove caught during the 2016 autumn hunting season and the mean daily counts of Turtle Dove made during the present (2016) survey are shown in Figure 8, while Figures 9 shows the same data but with the results from the present (2016) survey given as total daily counts. As already noted, the magnitudes of the bag counts and those of the mean/total counts made in the 2016 survey are not directly comparable; hence the two sets of values are on different scales. Therefore, in Figures 8 and 9, two separate y-axes are used: the bag count data is plotted on the left-side y-axis, whereas the counts from the 2016 survey are plotted on the right-side y-axis.

Overall, the general trend of daily counts recorded during the 2016 survey is of relatively higher counts in the first ten days of the survey period, followed by smaller counts until the end of September, with most of October characterised by zero counts. The bag count data includes a similar trend with higher numbers caught in the first few days of September and lower numbers caught until the end of the month; no Turtle Dove individuals were bagged in October. Therefore, overall, there was a similar temporal trend of slightly higher counts up to 10 September 2016, followed by slightly

lower counts until 30 September 2016 and few or no counts throughout October in both the daily counts made during the present survey and the bag count data.

**Common Quail**

The daily bag counts indicating the number of Common Quail caught during the 2016 autumn hunting season and the mean daily counts of Common Quail recorded during the present (2016) survey are shown in Figure 10, while Figures 11 shows the same data, but with the results from the present (2016) survey given as total daily counts. As already noted, the magnitudes of the bag counts and those of the mean/total counts made in the 2016 survey are not directly comparable; hence the two sets of values are on different scales. Therefore, in Figures 10 and 11, two separate y-axes are used: the bag count data is plotted on the left-side y-axis, whereas the counts from the 2016 survey are plotted on the right-side y-axis.

Overall, the general trend of daily counts recorded during the 2016 survey is of very low or zero counts at the start of the survey up to 23 September, followed by a period of relatively higher counts between the end of September and mid to end October, including a small migratory peak on 30 September, although low counts were recorded between 10-13 October and after 23 October. The bag count data includes a similar trend; very few Quail were captured up to 23 September, and comparatively low numbers were caught between 10-13 October and after 23 October; the highest numbers were caught between 27 September and 2 October, including a peak in the number of bagged Quail on 30 September. Therefore, overall, there was a similar temporal trend of zero or low counts up to 23 September, followed by higher counts until 23 October (except for the period 10-13 October), and subsequently lower counts until the end of October, in both the daily counts made during the present survey and the bag count data.

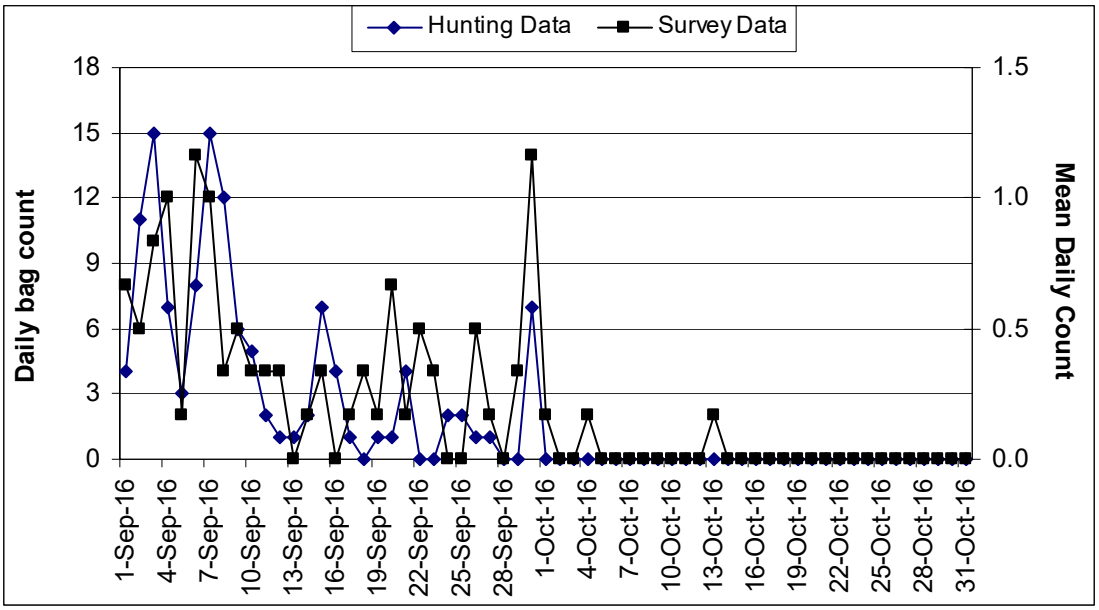


**Figure 8. Daily bag count of Turtle Dove during 2016 (blue line; values on left-side y-axis), together with the mean daily counts recorded during the 2016 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2016.**

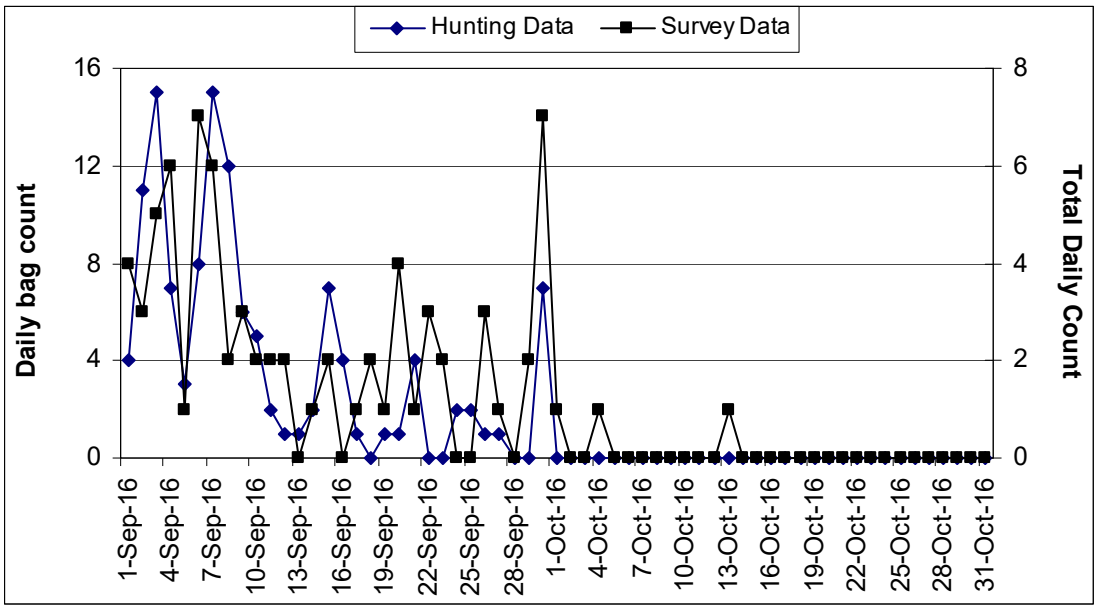


**Figure 9.** **Daily bag count of Turtle Dove during 2016 (blue line; values on left-side y-axis), together with the total daily counts recorded during the 2016 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2016.**

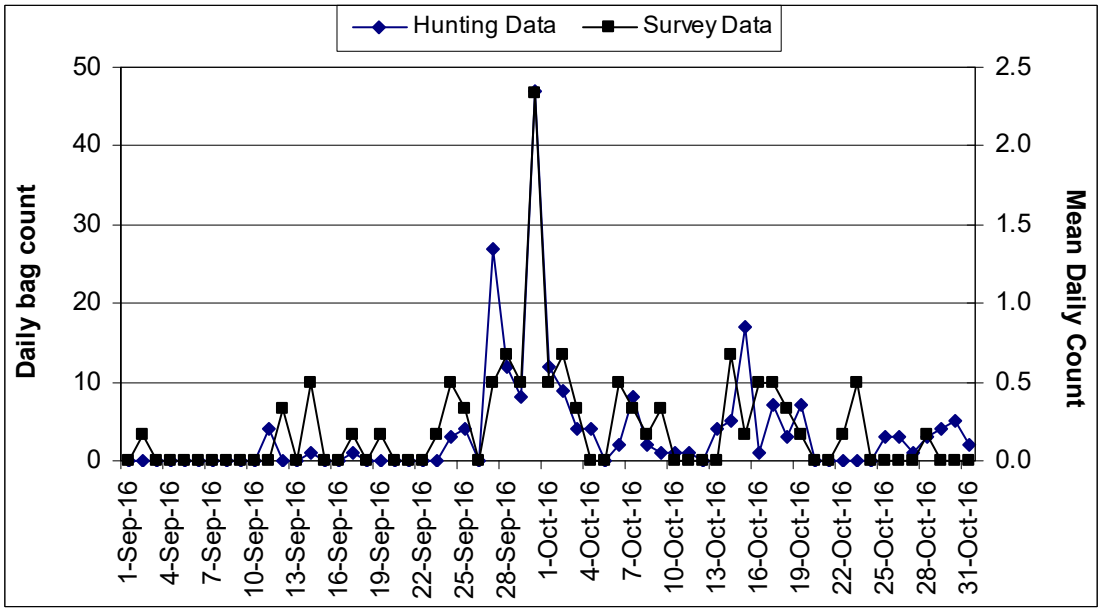


**Figure 10.** **Daily bag count of Common Quail during 2016 (blue line; values on left-side y-axis), together with the mean daily counts recorded during the 2016 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2016.**

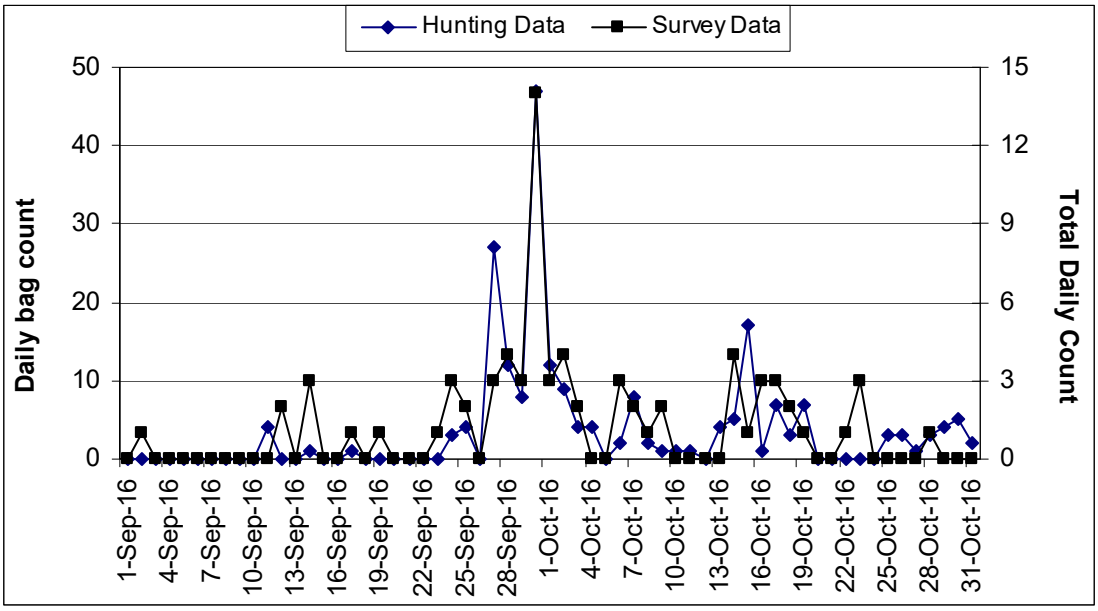


**Figure 11. Daily bag count of Common Quail during 2016 (blue line; values on left-side y-axis), together with the total daily counts recorded during the 2016 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2016.**

# 5. Appraisal

The present survey provides data on counts of Turtle Dove and Common Quail recorded during September and October 2016, as well as estimates of the migratory influx of the two species. Government had established the autumn open season during the period 1 September 2016 – 31 January 2017; the present survey therefore coincided with the initial two months of the 2016 autumn hunting season.

For Turtle Dove, when comparing the results of the present survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 and those from the autumn 2014–2015 surveys by Ecoserv (2014a; 2015a), a similar trend of counts recorded during the period 1 September – 31 October is noted overall; the pattern of counts for the years compared indicates a migratory influx during September. No migratory peaks were recorded during the present survey; such peaks were recorded during the 2009 and 2015 surveys but not during the 2008 or 2014 surveys. The grand mean value recorded during the present (autumn 2016) survey was considerably lower than that recorded from the 2008, 2009 and 2015 surveys, but only marginally lower than that recorded from the 2014 survey.

The total influx of Turtle Dove for the present survey period (1 September – 31 October 2016) is estimated at 6,868 individuals, which is lower than the estimate for the same period in 2014 (Ecoserv, 2014a) and 2015 (Ecoserv, 2015a). When comparing the daily influx of Turtle Dove recorded during the present autumn 2016 survey with that recorded during the spring 2016 survey (see Ecoserv, 2016), mean values of daily influx of the species recorded during the present (autumn) survey are overall lower than values recorded during spring for the same year.

As highlighted in previous reports, 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 should be noted that the total coastline length used in the present extrapolation includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema, Valletta and Cottonera areas, where 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 (07:00 - 14:00), 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 14:00 and 07:00. On the other hand, the 07:00-14:00 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 and those from the autumn 2014–2015 surveys by Ecoserv (2014a; 2015a), a similar trend of Common Quail counts recorded during the period 1 September – 31 October is noted overall; the pattern of counts for the years compared indicates a migratory influx between mid-September and the beginning of October. Only a single small migratory peak for Common Quail was recorded during the present survey, whereas appreciably more pronounced peaks were recorded in 2008 and 2009, but not in 2014 or 2015. The grand mean value recorded during the present (autumn 2016) survey was lower than values recorded by Thomaidis (nd) in 2008 and 2009, but slightly higher than values recorded by Ecoserv (2014a; 2015a) in autumn 2014 and 2015.

The total influx of Common Quail for the present survey period (1 September – 31 October 2016) is estimated at 69,915 individuals, which is slightly higher than the estimate for the same period in 2014 and 2015 reported by Ecoserv (2014a; 2015a). When comparing the daily influx of Common Quail recorded during the present autumn 2016 survey with that recorded during the spring 2016 survey (see Ecoserv, 2016), mean values of daily influx of the species recorded during the present (autumn) survey are similar to those recorded during spring for the same year.

As already indicated above, 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 all 21 sites, 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 2016, 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; 2014a; 2014b; 2015a; 2015b; 2016), 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 2016 study, while partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, is not identical. In addition, the survey times for the 2014 and 2015 studies covered the period 06:00–13:00, whereas in the present 2016 study surveys were held over the period 07:00–14:00.
- 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 (nd) in 2008 and 2009, and by Ecoserv (2014a; 2015a) in autumn 2014–2015 using a similar methodology, was recorded during the present survey period (1 September – 31 October 2016); the main migratory influx occurred during September. Raw daily counts for Turtle Dove recorded from the 21 sites during the present study varied between 0 and a maximum of 8, while the mean daily counts ranged between 0 and 2.3. Slightly higher numbers of Turtle Dove occurred during the period 3 to 7 September 2016. At the lower end of the recorded counts, no Turtle Dove individuals were recorded throughout the survey period from grid locations 3690 (northeast Gozo), 5872 and 6069 (east/southeast Malta), while at the higher end 15 Turtle Dove individuals were recorded from the site at grid location 4085 (Comino), which was surveyed daily, while nine individuals were recorded from the site at grid location 4077. The total influx of Turtle Dove for the present survey is estimated at 6,868 individuals. When comparing the grand mean value recorded during the present survey with that recorded during previous surveys made in autumn (2008, 2009, 2014, 2015), the influx of Turtle Dove in autumn 2016 was considerably lower than that recorded from the 2008, 2009 and 2015 surveys, but only marginally lower than that recorded from the 2014 survey. When comparing the recorded daily influx of Turtle Dove between the present autumn 2016 survey and the spring 2016 survey (see Ecoserv, 2016) mean values of daily influx of the species recorded during the present (autumn) survey are overall lower than values recorded during spring for the same year.

For Common Quail, when comparing the results from the present survey with ones held in autumn in previous years (2008, 2009, 2014 and 2015), a similar trend of counts was recorded; a migratory influx occurred between mid-September and the beginning of October. Only a small migratory peak for Common Quail were recorded during the present survey, in contrast with the appreciably higher peaks recorded in 2008 and 2009. 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 8, while the mean daily counts ranged between 0 and 2.3. 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 at the lower end, no Quail were recorded throughout the survey period from grid locations 4085, 5663 and 6069. The total influx of Common Quail for the present survey period is estimated at 69,915 individuals. When comparing the grand mean value recorded during the present survey with that recorded during previous surveys made in autumn (2008, 2009, 2014 and 2015), the influx of Common Quail in autumn 2015 was lower than that in 2008 and 2009, but marginally higher to those recorded during the 2014 and 2015 surveys. When comparing the recorded daily influx of Common Quail between the present autumn 2016 survey and the spring 2016 survey (see Ecoserv, 2016), mean values of daily influx of this species recorded during the present (autumn) survey are similar to those recorded during spring 2016.

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.

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**APPENDIX I - Raw counts**

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

| Ecoserv Sample Reference Code | B-060-16 | B-061-16 | B-062-16 | B-063-16 | B-064-16 | B-065-16 | B-066-16 | B-067-16 | B-068-16 | B-069-16 | B-070-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grid Location** | **4085** | **3690** | **3881** | **4070** | **5663** | **5277** | **3292** | **4079** | **4268** | **6067** | **4878** |
| 1-Sep-16 | 2 | 0 | 0 | 2 | 0 | 0 | | | | | |
| 2-Sep-16 | 1 | | | | | | 0 | 0 | 2 | 0 | 0 |
| 3-Sep-16 | 1 | | | | | | | | | | |
| 4-Sep-16 | 1 | | | | | | | | | | |
| 5-Sep-16 | 0 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 6-Sep-16 | 0 | | | | | | 1 | 1 | 1 | 3 | 1 |
| 7-Sep-16 | 2 | | | | | | | | | | |
| 8-Sep-16 | 1 | | | | | | | | | | |
| 9-Sep-16 | 1 | 0 | 0 | 1 | 1 | 0 | | | | | |
| 10-Sep-16 | 1 | | | | | | 1 | 0 | 0 | 0 | 0 |
| 11-Sep-16 | 0 | | | | | | | | | | |
| 12-Sep-16 | 0 | | | | | | | | | | |
| 13-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 14-Sep-16 | 0 | | | | | | 0 | 1 | 0 | 0 | 0 |
| 15-Sep-16 | 0 | | | | | | | | | | |
| 16-Sep-16 | 0 | | | | | | | | | | |
| 17-Sep-16 | 0 | 0 | 0 | 0 | 1 | 0 | | | | | |
| 18-Sep-16 | 0 | | | | | | 0 | 1 | 0 | 0 | 1 |
| 19-Sep-16 | 0 | | | | | | | | | | |
| 20-Sep-16 | 2 | | | | | | | | | | |
| 21-Sep-16 | 0 | 0 | 0 | 0 | 1 | 0 | | | | | |
| 22-Sep-16 | 0 | | | | | | 2 | 0 | 1 | 0 | 0 |
| 23-Sep-16 | 0 | | | | | | | | | | |
| 24-Sep-16 | 0 | | | | | | | | | | |
| 25-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 26-Sep-16 | 0 | | | | | | 0 | **3** | 0 | 0 | 0 |

| Ecoserv Sample Reference Code | B-060-16 | B-061-16 | B-062-16 | B-063-16 | B-064-16 | B-065-16 | B-066-16 | B-067-16 | B-068-16 | B-069-16 | B-070-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27-Sep-16 | 0 | | | | | | | | | | |
| 28-Sep-16 | 0 | | | | | | | | | | |
| 29-Sep-16 | 1 | 0 | 0 | 0 | 0 | 1 | | | | | |
| 30-Sep-16 | 2 | | | | | | 1 | 0 | 2 | 0 | 2 |
| 1-Oct-16 | 0 | | | | | | | | | | |
| 2-Oct-16 | 0 | | | | | | | | | | |
| 3-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 4-Oct-16 | 0 | | | | | | 0 | 1 | 0 | 0 | 0 |
| 5-Oct-16 | 0 | | | | | | | | | | |
| 6-Oct-16 | 0 | | | | | | | | | | |
| 7-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 8-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 9-Oct-16 | 0 | | | | | | | | | | |
| 10-Oct-16 | 0 | | | | | | | | | | |
| 11-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 12-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 13-Oct-16 | 0 | | | | | | | | | | |
| 14-Oct-16 | 0 | | | | | | | | | | |
| 15-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 16-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 17-Oct-16 | 0 | | | | | | | | | | |
| 18-Oct-16 | 0 | | | | | | | | | | |
| 19-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 20-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 21-Oct-16 | 0 | | | | | | | | | | |
| 22-Oct-16 | 0 | | | | | | | | | | |
| 23-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 24-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 25-Oct-16 | 0 | | | | | | | | | | |
| 26-Oct-16 | 0 | | | | | | | | | | |
| 27-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |

| Ecoserv Sample Reference Code | B-060-16 | B-061-16 | B-062-16 | B-063-16 | B-064-16 | B-065-16 | B-066-16 | B-067-16 | B-068-16 | B-069-16 | B-070-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 29-Oct-16 | 0 | | | | | | | | | | |
| 30-Oct-16 | 0 | | | | | | | | | | |
| 31-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |

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

| Ecoserv Sample Reference Code | B-071-16 | B-072-16 | B-073-16 | B-074-16 | B-075-16 | B-076-16 | B-077-16 | B-078-16 | B-079-16 | B-080-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Grid Location** | **2888** | **4077** | **4666** | **6069** | **4480** | **3286** | **4073** | **5064** | **5872** | **4283** |
| 1-Sep-16 | | | | | | | | | | |
| 2-Sep-16 | | | | | | | | | | |
| 3-Sep-16 | 0 | **2** | 0 | 0 | **2** | | | | | |
| 4-Sep-16 | | | | | | 1 | 0 | **4** | 0 | 0 |
| 5-Sep-16 | | | | | | | | | | |
| 6-Sep-16 | | | | | | | | | | |
| 7-Sep-16 | 1 | 1 | 2 | 0 | 0 | | | | | |
| 8-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 1 |
| 9-Sep-16 | | | | | | | | | | |
| 10-Sep-16 | | | | | | | | | | |
| 11-Sep-16 | 0 | 1 | 1 | 0 | 0 | | | | | |
| 12-Sep-16 | | | | | | 0 | 0 | 2 | 0 | 0 |
| 13-Sep-16 | | | | | | | | | | |
| 14-Sep-16 | | | | | | | | | | |
| 15-Sep-16 | 1 | 0 | 0 | 0 | 1 | | | | | |
| 16-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 17-Sep-16 | | | | | | | | | | |
| 18-Sep-16 | | | | | | | | | | |
| 19-Sep-16 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 20-Sep-16 | | | | | | 0 | 1 | 0 | 0 | 1 |

| Ecoserv Sample Reference Code | B-071-16 | B-072-16 | B-073-16 | B-074-16 | B-075-16 | B-076-16 | B-077-16 | B-078-16 | B-079-16 | B-080-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 21-Sep-16 | | | | | | | | | | |
| 22-Sep-16 | | | | | | | | | | |
| 23-Sep-16 | 0 | 2 | 0 | 0 | 0 | | | | | |
| 24-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 25-Sep-16 | | | | | | | | | | |
| 26-Sep-16 | | | | | | | | | | |
| 27-Sep-16 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 28-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 29-Sep-16 | | | | | | | | | | |
| 30-Sep-16 | | | | | | | | | | |
| 1-Oct-16 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 2-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 3-Oct-16 | | | | | | | | | | |
| 4-Oct-16 | | | | | | | | | | |
| 5-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 6-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 7-Oct-16 | | | | | | | | | | |
| 8-Oct-16 | | | | | | | | | | |
| 9-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 10-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 11-Oct-16 | | | | | | | | | | |
| 12-Oct-16 | | | | | | | | | | |
| 13-Oct-16 | 0 | 0 | 0 | 0 | 1 | | | | | |
| 14-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 15-Oct-16 | | | | | | | | | | |
| 16-Oct-16 | | | | | | | | | | |
| 17-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 18-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 19-Oct-16 | | | | | | | | | | |
| 20-Oct-16 | | | | | | | | | | |
| 21-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |

| Ecoserv Sample Reference Code | B-071-16 | B-072-16 | B-073-16 | B-074-16 | B-075-16 | B-076-16 | B-077-16 | B-078-16 | B-079-16 | B-080-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 22-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 23-Oct-16 | | | | | | | | | | |
| 24-Oct-16 | | | | | | | | | | |
| 25-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 26-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 27-Oct-16 | | | | | | | | | | |
| 28-Oct-16 | | | | | | | | | | |
| 29-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 30-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 31-Oct-16 | | | | | | | | | | |

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

| Ecoserv Sample Reference Code | B-081-16 | B-082-16 | B-083-16 | B-084-16 | B-085-16 | B-086-16 | B-087-16 | B-088-16 | B-089-16 | B-090-16 | B-091-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grid Location** | **4085** | **3690** | **3881** | **4070** | **5663** | **5277** | **3292** | **4079** | **4268** | **6067** | **4878** |
| **Surveyed Area ($km^2$)** | **0.037** | **0.061** | **0.037** | **0.016** | **0.060** | **0.037** | **0.030** | **0.040** | **0.040** | **0.010** | **0.034** |
| 1-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 2-Sep-16 | 0 | | | | | | 0 | 0 | 1 | 0 | 0 |
| 3-Sep-16 | 0 | | | | | | | | | | |
| 4-Sep-16 | 0 | | | | | | | | | | |
| 5-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 6-Sep-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 7-Sep-16 | 0 | | | | | | | | | | |
| 8-Sep-16 | 0 | | | | | | | | | | |
| 9-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 10-Sep-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 11-Sep-16 | 0 | | | | | | | | | | |

| Ecoserv Sample Reference Code | B-081-16 | B-082-16 | B-083-16 | B-084-16 | B-085-16 | B-086-16 | B-087-16 | B-088-16 | B-089-16 | B-090-16 | B-091-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12-Sep-16 | 0 | | | | | | | | | | |
| 13-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 14-Sep-16 | 0 | | | | | | 0 | 2 | 0 | 1 | 0 |
| 15-Sep-16 | 0 | | | | | | | | | | |
| 16-Sep-16 | 0 | | | | | | | | | | |
| 17-Sep-16 | 0 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 18-Sep-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 19-Sep-16 | 0 | | | | | | | | | | |
| 20-Sep-16 | 0 | | | | | | | | | | |
| 21-Sep-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 22-Sep-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 23-Sep-16 | 0 | | | | | | | | | | |
| 24-Sep-16 | 0 | | | | | | | | | | |
| 25-Sep-16 | 0 | 1 | 0 | 0 | 0 | 1 | | | | | |
| 26-Sep-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 27-Sep-16 | 0 | | | | | | | | | | |
| 28-Sep-16 | 0 | | | | | | | | | | |
| 29-Sep-16 | 0 | 0 | 2 | 0 | 0 | 1 | | | | | |
| 30-Sep-16 | 0 | | | | | | 0 | 5 | 1 | 0 | 8 |
| 1-Oct-16 | 0 | | | | | | | | | | |
| 2-Oct-16 | 0 | | | | | | | | | | |
| 3-Oct-16 | 0 | 2 | 0 | 0 | 0 | 0 | | | | | |
| 4-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 5-Oct-16 | 0 | | | | | | | | | | |
| 6-Oct-16 | 0 | | | | | | | | | | |
| 7-Oct-16 | 0 | 1 | 0 | 1 | 0 | 0 | | | | | |
| 8-Oct-16 | 0 | | | | | | 0 | 1 | 0 | 0 | 0 |
| 9-Oct-16 | 0 | | | | | | | | | | |
| 10-Oct-16 | 0 | | | | | | | | | | |
| 11-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 12-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |

| Ecoserv Sample Reference Code | B-081-16 | B-082-16 | B-083-16 | B-084-16 | B-085-16 | B-086-16 | B-087-16 | B-088-16 | B-089-16 | B-090-16 | B-091-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13-Oct-16 | 0 | | | | | | | | | | |
| 14-Oct-16 | 0 | | | | | | | | | | |
| 15-Oct-16 | 0 | 0 | 1 | 0 | 0 | 0 | | | | | |
| 16-Oct-16 | 0 | | | | | | 1 | 1 | 0 | 0 | 1 |
| 17-Oct-16 | 0 | | | | | | | | | | |
| 18-Oct-16 | 0 | | | | | | | | | | |
| 19-Oct-16 | 0 | 0 | 0 | 0 | 0 | 1 | | | | | |
| 20-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 21-Oct-16 | 0 | | | | | | | | | | |
| 22-Oct-16 | 0 | | | | | | | | | | |
| 23-Oct-16 | 0 | 1 | 0 | 1 | 0 | 1 | | | | | |
| 24-Oct-16 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 25-Oct-16 | 0 | | | | | | | | | | |
| 26-Oct-16 | 0 | | | | | | | | | | |
| 27-Oct-16 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 28-Oct-16 | 0 | | | | | | 1 | 0 | 0 | 0 | 0 |
| 29-Oct-16 | 0 | | | | | | | | | | |
| 30-Oct-16 | 0 | | | | | | | | | | |
| 31-Oct-16 | 0 | 0 | 0 | 0 | 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-092-16 | B-093-16 | B-094-16 | B-095-16 | B-096-16 | B-097-16 | B-098-16 | B-099-16 | B-100-16 | B-101-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Grid Location** | **2888** | **4077** | **4666** | **6069** | **4480** | **3286** | **4073** | **5064** | **5872** | **4283** |
| **Surveyed Area ($km^2$)** | **0.053** | **0.020** | **0.015** | **0.020** | **0.080** | **0.355** | **0.040** | **0.030** | **0.090** | **0.060** |
| 1-Sep-16 | | | | | | | | | | |
| 2-Sep-16 | | | | | | | | | | |
| 3-Sep-16 | 0 | 0 | 0 | 0 | 0 | | | | | |

| Ecoserv Sample Reference Code | B-092-16 | B-093-16 | B-094-16 | B-095-16 | B-096-16 | B-097-16 | B-098-16 | B-099-16 | B-100-16 | B-101-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 5-Sep-16 | | | | | | | | | | |
| 6-Sep-16 | | | | | | | | | | |
| 7-Sep-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 8-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 9-Sep-16 | | | | | | | | | | |
| 10-Sep-16 | | | | | | | | | | |
| 11-Sep-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 12-Sep-16 | | | | | | 0 | 2 | 0 | 0 | 0 |
| 13-Sep-16 | | | | | | | | | | |
| 14-Sep-16 | | | | | | | | | | |
| 15-Sep-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 16-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 17-Sep-16 | | | | | | | | | | |
| 18-Sep-16 | | | | | | | | | | |
| 19-Sep-16 | 0 | 0 | 1 | 0 | 0 | | | | | |
| 20-Sep-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 21-Sep-16 | | | | | | | | | | |
| 22-Sep-16 | | | | | | | | | | |
| 23-Sep-16 | 0 | 0 | 0 | 0 | 1 | | | | | |
| 24-Sep-16 | | | | | | 0 | 2 | 0 | 0 | 1 |
| 25-Sep-16 | | | | | | | | | | |
| 26-Sep-16 | | | | | | | | | | |
| 27-Sep-16 | 0 | 3 | 0 | 0 | 0 | | | | | |
| 28-Sep-16 | | | | | | 2 | 0 | 1 | 0 | 1 |
| 29-Sep-16 | | | | | | | | | | |
| 30-Sep-16 | | | | | | | | | | |
| 1-Oct-16 | 0 | 2 | 1 | 0 | 0 | | | | | |
| 2-Oct-16 | | | | | | **2** | 2 | 0 | 0 | 0 |
| 3-Oct-16 | | | | | | | | | | |
| 4-Oct-16 | | | | | | | | | | |

| Ecoserv Sample Reference Code | B-092-16 | B-093-16 | B-094-16 | B-095-16 | B-096-16 | B-097-16 | B-098-16 | B-099-16 | B-100-16 | B-101-16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 6-Oct-16 | | | | | | 1 | 2 | 0 | 0 | 0 |
| 7-Oct-16 | | | | | | | | | | |
| 8-Oct-16 | | | | | | | | | | |
| 9-Oct-16 | 2 | 0 | 0 | 0 | 0 | | | | | |
| 10-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 11-Oct-16 | | | | | | | | | | |
| 12-Oct-16 | | | | | | | | | | |
| 13-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 14-Oct-16 | | | | | | 0 | 2 | 0 | 2 | 0 |
| 15-Oct-16 | | | | | | | | | | |
| 16-Oct-16 | | | | | | | | | | |
| 17-Oct-16 | 2 | 0 | 1 | 0 | 0 | | | | | |
| 18-Oct-16 | | | | | | 0 | 2 | 0 | 0 | 0 |
| 19-Oct-16 | | | | | | | | | | |
| 20-Oct-16 | | | | | | | | | | |
| 21-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 22-Oct-16 | | | | | | 0 | 1 | 0 | 0 | 0 |
| 23-Oct-16 | | | | | | | | | | |
| 24-Oct-16 | | | | | | | | | | |
| 25-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 26-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 27-Oct-16 | | | | | | | | | | |
| 28-Oct-16 | | | | | | | | | | |
| 29-Oct-16 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 30-Oct-16 | | | | | | 0 | 0 | 0 | 0 | 0 |
| 31-Oct-16 | | | | | | | | | | |

**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 2016 | 4085 | 07:00 - 09:00 | 9 Sep 2016 | 4085 | 07:00 - 09:00 |
| 1 Sep 2016 | 3690 | 07:30 - 09:30 | 9 Sep 2016 | 3690 | 08:00 - 10:00 |
| 1 Sep 2016 | 3881 | 07:00 - 09:00 | 9 Sep 2016 | 3881 | 07:00 - 09:00 |
| 1 Sep 2016 | 4070 | 07:00 - 09:00 | 9 Sep 2016 | 4070 | 07:00 - 09:00 |
| 1 Sep 2016 | 5663 | 07:30 - 09:30 | 9 Sep 2016 | 5663 | 07:00 - 09:00 |
| 1 Sep 2016 | 5277 | 07:00 - 09:00 | 9 Sep 2016 | 5277 | 07:00 - 09:00 |
| 2 Sep 2016 | 4085 | 07:00 - 09:00 | 10 Sep 2016 | 4085 | 07:00 - 09:00 |
| 2 Sep 2016 | 3292 | 07:00 - 09:00 | 10 Sep 2016 | 3292 | 07:00 - 09:00 |
| 2 Sep 2016 | 4079 | 07:00 - 09:00 | 10 Sep 2016 | 4079 | 08:00 - 10:00 |
| 2 Sep 2016 | 4268 | 08:00 - 10:00 | 10 Sep 2016 | 4268 | 08:00 - 10:00 |
| 2 Sep 2016 | 6067 | 07:00 - 09:00 | 10 Sep 2016 | 6067 | 07:00 - 09:00 |
| 2 Sep 2016 | 4878 | 07:00 - 09:00 | 10 Sep 2016 | 4878 | 07:30 - 09:30 |
| 3 Sep 2016 | 4085 | 08:00 - 10:00 | 11 Sep 2016 | 4085 | 07:00 - 09:00 |
| 3 Sep 2016 | 2888 | 07:00 - 09:00 | 11 Sep 2016 | 2888 | 08:00 - 10:00 |
| 3 Sep 2016 | 4077 | 07:30 - 10:30 | 11 Sep 2016 | 4077 | 07:00 - 09:00 |
| 3 Sep 2016 | 4666 | 07:00 - 09:00 | 11 Sep 2016 | 4666 | 07:00 - 09:00 |
| 3 Sep 2016 | 6069 | 07:30 - 09:30 | 11 Sep 2016 | 6069 | 07:00 - 09:00 |
| 3 Sep 2016 | 4480 | 08:00 - 10:00 | 11 Sep 2016 | 4480 | 07:30 - 09:30 |
| 4 Sep 2016 | 4085 | 07:00 - 09:00 | 12 Sep 2016 | 4085 | 07:00 - 09:00 |
| 4 Sep 2016 | 3286 | 07:00 - 09:00 | 12 Sep 2016 | 3286 | 07:00 - 09:00 |
| 4 Sep 2016 | 4073 | 07:00 - 09:00 | 12 Sep 2016 | 4073 | 08:00 - 10:00 |
| 4 Sep 2016 | 5064 | 07:30 - 09:30 | 12 Sep 2016 | 5064 | 07:00 - 09:00 |
| 4 Sep 2016 | 5872 | 07:00 - 09:00 | 12 Sep 2016 | 5872 | 07:00 - 09:00 |
| 4 Sep 2016 | 4283 | 08:00 - 10:00 | 12 Sep 2016 | 4283 | 08:00 - 10:00 |
| 5 Sep 2016 | 4085 | 07:00 - 09:00 | 13 Sep 2016 | 4085 | 07:00 - 09:00 |
| 5 Sep 2016 | 3690 | 07:00 - 09:00 | 13 Sep 2016 | 3690 | 07:00 - 09:00 |
| 5 Sep 2016 | 3881 | 07:00 - 09:00 | 13 Sep 2016 | 3881 | 07:00 - 09:00 |
| 5 Sep 2016 | 4070 | 07:00 - 09:00 | 13 Sep 2016 | 4070 | 08:00 - 10:00 |
| 5 Sep 2016 | 5663 | 07:00 - 09:00 | 13 Sep 2016 | 5663 | 07:30 - 09:30 |
| 5 Sep 2016 | 5277 | 08:00 - 10:00 | 13 Sep 2016 | 5277 | 09:30 - 11:30 |
| 6 Sep 2016 | 4085 | 07:00 - 09:00 | 14 Sep 2016 | 4085 | 07:00 - 09:00 |
| 6 Sep 2016 | 3292 | 07:00 - 09:00 | 14 Sep 2016 | 3292 | 07:00 - 09:00 |
| 6 Sep 2016 | 4079 | 07:00 - 09:00 | 14 Sep 2016 | 4079 | 07:00 - 09:00 |
| 6 Sep 2016 | 4268 | 07:00 - 09:00 | 14 Sep 2016 | 4268 | 08:00 - 10:00 |
| 6 Sep 2016 | 6067 | 07:00 - 09:00 | 14 Sep 2016 | 6067 | 09:30 - 11:30 |
| 6 Sep 2016 | 4878 | 07:00 - 09:00 | 14 Sep 2016 | 4878 | 07:00 - 09:00 |
| 7 Sep 2016 | 4085 | 07:00 - 09:00 | 15 Sep 2016 | 4085 | 07:00 - 09:00 |
| 7 Sep 2016 | 2888 | 07:00 - 09:00 | 15 Sep 2016 | 2888 | 07:00 - 09:00 |
| 7 Sep 2016 | 4077 | 08:00 - 10:00 | 15 Sep 2016 | 4077 | 07:00 - 09:00 |
| 7 Sep 2016 | 4666 | 07:00 - 09:00 | 15 Sep 2016 | 4666 | 08:00 - 10:00 |
| 7 Sep 2016 | 6069 | 07:00 - 09:00 | 15 Sep 2016 | 6069 | 07:30 - 09:30 |
| 7 Sep 2016 | 4480 | 07:00 - 09:00 | 15 Sep 2016 | 4480 | 08:00 - 10:00 |
| 8 Sep 2016 | 4085 | 07:00 - 09:00 | 16 Sep 2016 | 4085 | 07:00 - 09:00 |
| 8 Sep 2016 | 3286 | 07:00 - 09:00 | 16 Sep 2016 | 3286 | 07:00 - 09:00 |
| 8 Sep 2016 | 4073 | 08:00 - 10:00 | 16 Sep 2016 | 4073 | 07:00 - 09:00 |
| 8 Sep 2016 | 5064 | 07:00 - 09:00 | 16 Sep 2016 | 5064 | 07:00 - 09:00 |
| 8 Sep 2016 | 5872 | 07:00 - 09:00 | 16 Sep 2016 | 5872 | 07:00 - 09:00 |
| 8 Sep 2016 | 4283 | 07:15 - 09:15 | 16 Sep 2016 | 4283 | 07:00 - 09:00 |

**APPENDIX II continued.**

| Date | Location | Observation time | Date | Location | Observation time |
|---|---|---|---|---|---|
| 17 Sep 2016 | 4085 | 07:00 - 09:00 | 25 Sep 2016 | 4085 | 07:00 - 09:00 |
| 17 Sep 2016 | 3690 | 08:00 - 10:00 | 25 Sep 2016 | 3690 | 07:00 - 09:00 |
| 17 Sep 2016 | 3881 | 07:00 - 09:00 | 25 Sep 2016 | 3881 | 07:00 - 09:00 |
| 17 Sep 2016 | 4070 | 08:30 - 10:30 | 25 Sep 2016 | 4070 | 07:30 - 09:30 |
| 17 Sep 2016 | 5663 | 07:00 - 09:00 | 25 Sep 2016 | 5663 | 07:00 - 09:00 |
| 17 Sep 2016 | 5277 | 07:00 - 09:00 | 25 Sep 2016 | 5277 | 07:00 - 09:00 |
| 18 Sep 2016 | 4085 | 07:00 - 09:00 | 26 Sep 2016 | 4085 | 07:00 - 09:00 |
| 18 Sep 2016 | 3292 | 07:00 - 09:00 | 26 Sep 2016 | 3292 | 08:00 - 10:00 |
| 18 Sep 2016 | 4079 | 08:00 - 10:00 | 26 Sep 2016 | 4079 | 07:00 - 09:00 |
| 18 Sep 2016 | 4268 | 07:00 - 09:00 | 26 Sep 2016 | 4268 | 07:00 - 09:00 |
| 18 Sep 2016 | 6067 | 07:00 - 09:00 | 26 Sep 2016 | 6067 | 08:00 - 10:00 |
| 18 Sep 2016 | 4878 | 07:00 - 09:00 | 26 Sep 2016 | 4878 | 07:00 - 09:00 |
| 19 Sep 2016 | 4085 | 07:00 - 09:00 | 27 Sep 2016 | 4085 | 07:00 - 09:00 |
| 19 Sep 2016 | 2888 | 08:00 - 10:00 | 27 Sep 2016 | 2888 | 07:00 - 09:00 |
| 19 Sep 2016 | 4077 | 07:00 - 09:00 | 27 Sep 2016 | 4077 | 07:00 - 09:00 |
| 19 Sep 2016 | 4666 | 08:00 - 10:00 | 27 Sep 2016 | 4666 | 07:00 - 09:00 |
| 19 Sep 2016 | 6069 | 07:00 - 09:00 | 27 Sep 2016 | 6069 | 07:00 - 09:00 |
| 19 Sep 2016 | 4480 | 07:00 - 09:00 | 27 Sep 2016 | 4480 | 07:00 - 09:00 |
| 20 Sep 2016 | 4085 | 07:00 - 09:00 | 28 Sep 2016 | 4085 | 08:00 - 10:00 |
| 20 Sep 2016 | 3286 | 07:00 - 09:00 | 28 Sep 2016 | 3286 | 07:00 - 09:00 |
| 20 Sep 2016 | 4073 | 08:00 - 10:00 | 28 Sep 2016 | 4073 | 08:30 - 10:30 |
| 20 Sep 2016 | 5064 | 07:00 - 09:00 | 28 Sep 2016 | 5064 | 07:00 - 09:00 |
| 20 Sep 2016 | 5872 | 07:00 - 09:00 | 28 Sep 2016 | 5872 | 07:00 - 09:00 |
| 20 Sep 2016 | 4283 | 07:00 - 09:00 | 28 Sep 2016 | 4283 | 07:00 - 09:00 |
| 21 Sep 2016 | 4085 | 07:00 - 09:00 | 29 Sep 2016 | 4085 | 07:00 - 09:00 |
| 21 Sep 2016 | 3690 | 07:00 - 09:00 | 29 Sep 2016 | 3690 | 07:00 - 09:00 |
| 21 Sep 2016 | 3881 | 07:00 - 09:00 | 29 Sep 2016 | 3881 | 09:30 - 11:30 |
| 21 Sep 2016 | 4070 | 07:00 - 09:00 | 29 Sep 2016 | 4070 | 07:00 - 09:00 |
| 21 Sep 2016 | 5663 | 07:00 - 09:00 | 29 Sep 2016 | 5663 | 07:00 - 09:00 |
| 21 Sep 2016 | 5277 | 07:30 - 09:30 | 29 Sep 2016 | 5277 | 07:30 - 09:30 |
| 22 Sep 2016 | 4085 | 07:00 - 09:00 | 30 Sep 2016 | 4085 | 07:00 - 09:00 |
| 22 Sep 2016 | 3292 | 08:00 - 10:00 | 30 Sep 2016 | 3292 | 07:00 - 09:00 |
| 22 Sep 2016 | 4079 | 07:00 - 09:00 | 30 Sep 2016 | 4079 | 07:00 - 09:00 |
| 22 Sep 2016 | 4268 | 07:00 - 09:00 | 30 Sep 2016 | 4268 | 07:00 - 09:00 |
| 22 Sep 2016 | 6067 | 07:30 - 09:30 | 30 Sep 2016 | 6067 | 07:00 - 09:00 |
| 22 Sep 2016 | 4878 | 07:00 - 09:00 | 30 Sep 2016 | 4878 | 07:00 - 09:00 |
| 23 Sep 2016 | 4085 | 07:00 - 09:00 | 1 Oct 2016 | 4085 | 07:00 - 09:00 |
| 23 Sep 2016 | 2888 | 07:00 - 09:00 | 1 Oct 2016 | 2888 | 08:30 - 10:30 |
| 23 Sep 2016 | 4077 | 07:00 - 09:00 | 1 Oct 2016 | 4077 | 07:30 - 09:30 |
| 23 Sep 2016 | 4666 | 07:00 - 09:00 | 1 Oct 2016 | 4666 | 07:00 - 09:00 |
| 23 Sep 2016 | 6069 | 07:00 - 09:00 | 1 Oct 2016 | 6069 | 07:30 - 09:30 |
| 23 Sep 2016 | 4480 | 08:00 - 10:00 | 1 Oct 2016 | 4480 | 08:00 - 10:00 |
| 24 Sep 2016 | 4085 | 07:00 - 09:00 | 2 Oct 2016 | 4085 | 07:00 - 09:00 |
| 24 Sep 2016 | 3286 | 08:00 - 10:00 | 2 Oct 2016 | 3286 | 07:00 - 09:00 |
| 24 Sep 2016 | 4073 | 07:30 - 09:30 | 2 Oct 2016 | 4073 | 08:00 - 10:00 |
| 24 Sep 2016 | 5064 | 07:15 - 09:15 | 2 Oct 2016 | 5064 | 07:00 - 09:00 |
| 24 Sep 2016 | 5872 | 08:00 - 10:00 | 2 Oct 2016 | 5872 | 07:30 - 09:30 |
| 24 Sep 2016 | 4283 | 07:00 - 09:00 | 2 Oct 2016 | 4283 | 08:30 - 10:30 |

**APPENDIX II continued.**

| Date | Location | Observation time | Date | Location | Observation time |
|---|---|---|---|---|---|
| 3 Oct 2016 | 4085 | 07:00 - 09:00 | 11 Oct 2016 | 4085 | 07:00 - 09:00 |
| 3 Oct 2016 | 3690 | 07:00 - 09:00 | 11 Oct 2016 | 3690 | 07:00 - 09:00 |
| 3 Oct 2016 | 3881 | 07:00 - 09:00 | 11 Oct 2016 | 3881 | 07:00 - 09:00 |
| 3 Oct 2016 | 4070 | 07:00 - 09:00 | 11 Oct 2016 | 4070 | 07:00 - 09:00 |
| 3 Oct 2016 | 5663 | 07:00 - 09:00 | 11 Oct 2016 | 5663 | 07:30 - 09:30 |
| 3 Oct 2016 | 5277 | 08:00 - 10:00 | 11 Oct 2016 | 5277 | 07:00 - 09:00 |
| 4 Oct 2016 | 4085 | 07:00 - 09:00 | 12 Oct 2016 | 4085 | 07:00 - 09:00 |
| 4 Oct 2016 | 3292 | 07:00 - 09:00 | 12 Oct 2016 | 3292 | 07:00 - 09:00 |
| 4 Oct 2016 | 4079 | 07:00 - 09:00 | 12 Oct 2016 | 4079 | 07:30 - 09:30 |
| 4 Oct 2016 | 4268 | 07:00 - 09:00 | 12 Oct 2016 | 4268 | 07:00 - 09:00 |
| 4 Oct 2016 | 6067 | 07:30 - 09:30 | 12 Oct 2016 | 6067 | 07:30 - 09:30 |
| 4 Oct 2016 | 4878 | 07:00 - 09:00 | 12 Oct 2016 | 4878 | 07:00 - 09:00 |
| 5 Oct 2016 | 4085 | 07:00 - 09:00 | 13 Oct 2016 | 4085 | 07:00 - 09:00 |
| 5 Oct 2016 | 2888 | 07:00 - 09:00 | 13 Oct 2016 | 2888 | 07:00 - 09:00 |
| 5 Oct 2016 | 4077 | 07:30 - 09:30 | 13 Oct 2016 | 4077 | 07:00 - 09:00 |
| 5 Oct 2016 | 4666 | 07:00 - 09:00 | 13 Oct 2016 | 4666 | 07:30 - 09:30 |
| 5 Oct 2016 | 6069 | 08:00 - 10:00 | 13 Oct 2016 | 6069 | 07:00 - 09:00 |
| 5 Oct 2016 | 4480 | 07:00 - 09:00 | 13 Oct 2016 | 4480 | 07:00 - 09:00 |
| 6 Oct 2016 | 4085 | 07:00 - 09:00 | 14 Oct 2016 | 4085 | 07:00 - 09:00 |
| 6 Oct 2016 | 3286 | 07:00 - 09:00 | 14 Oct 2016 | 3286 | 07:00 - 09:00 |
| 6 Oct 2016 | 4073 | 07:00 - 09:00 | 14 Oct 2016 | 4073 | 09:00 - 11:00 |
| 6 Oct 2016 | 5064 | 07:00 - 09:00 | 14 Oct 2016 | 5064 | 08:00 - 10:00 |
| 6 Oct 2016 | 5872 | 07:00 - 09:00 | 14 Oct 2016 | 5872 | 07:00 - 09:00 |
| 6 Oct 2016 | 4283 | 07:00 - 09:00 | 14 Oct 2016 | 4283 | 07:00 - 09:00 |
| 7 Oct 2016 | 4085 | 07:00 - 09:00 | 15 Oct 2016 | 4085 | 07:30 - 09:30 |
| 7 Oct 2016 | 3690 | 07:30 - 09:30 | 15 Oct 2016 | 3690 | 07:00 - 09:00 |
| 7 Oct 2016 | 3881 | 07:00 - 09:00 | 15 Oct 2016 | 3881 | 07:00 - 09:00 |
| 7 Oct 2016 | 4070 | 08:00 - 10:00 | 15 Oct 2016 | 4070 | 07:30 - 09:30 |
| 7 Oct 2016 | 5663 | 07:00 - 09:00 | 15 Oct 2016 | 5663 | 07:15 - 09:15 |
| 7 Oct 2016 | 5277 | 07:00 - 09:00 | 15 Oct 2016 | 5277 | 07:00 - 09:00 |
| 8 Oct 2016 | 4085 | 08:00 - 10:00 | 16 Oct 2016 | 4085 | 08:00 - 10:00 |
| 8 Oct 2016 | 3292 | 07:00 - 09:00 | 16 Oct 2016 | 3292 | 08:00 - 10:00 |
| 8 Oct 2016 | 4079 | 07:30 - 09:30 | 16 Oct 2016 | 4079 | 07:30 - 09:30 |
| 8 Oct 2016 | 4268 | 07:30 - 09:30 | 16 Oct 2016 | 4268 | 07:00 - 09:00 |
| 8 Oct 2016 | 6067 | 08:00 - 10:00 | 16 Oct 2016 | 6067 | 07:00 - 09:00 |
| 8 Oct 2016 | 4878 | 07:45 - 09:45 | 16 Oct 2016 | 4878 | 08:00 - 10:00 |
| 9 Oct 2016 | 4085 | 07:00 - 09:00 | 17 Oct 2016 | 4085 | 07:00 - 09:00 |
| 9 Oct 2016 | 2888 | 07:00 - 09:00 | 17 Oct 2016 | 2888 | 09:00 - 11:00 |
| 9 Oct 2016 | 4077 | 07:30 - 09:30 | 17 Oct 2016 | 4077 | 07:15 - 09:15 |
| 9 Oct 2016 | 4666 | 07:00 - 09:00 | 17 Oct 2016 | 4666 | 07:00 - 09:00 |
| 9 Oct 2016 | 6069 | 07:00 - 09:00 | 17 Oct 2016 | 6069 | 07:00 - 09:00 |
| 9 Oct 2016 | 4480 | 07:00 - 09:00 | 17 Oct 2016 | 4480 | 07:00 - 09:00 |
| 10 Oct 2016 | 4085 | 07:00 - 09:00 | 18 Oct 2016 | 4085 | 07:00 - 09:00 |
| 10 Oct 2016 | 3286 | 07:00 - 09:00 | 18 Oct 2016 | 3286 | 07:00 - 09:00 |
| 10 Oct 2016 | 4073 | 07:00 - 09:00 | 18 Oct 2016 | 4073 | 07:00 - 09:00 |
| 10 Oct 2016 | 5064 | 07:00 - 09:00 | 18 Oct 2016 | 5064 | 07:00 - 09:00 |
| 10 Oct 2016 | 5872 | 07:30 - 09:30 | 18 Oct 2016 | 5872 | 07:30 - 09:30 |
| 10 Oct 2016 | 4283 | 07:00 - 09:00 | 18 Oct 2016 | 4283 | 07:00 - 09:00 |

**APPENDIX II continued.**

| Date | Location | Observation time | Date | Location | Observation time |
|---|---|---|---|---|---|
| 19 Oct 2016 | 4085 | 07:00 - 09:00 | 26 Oct 2016 | 4085 | 07:00 - 09:00 |
| 19 Oct 2016 | 3690 | 07:00 - 09:00 | 26 Oct 2016 | 3286 | 07:00 - 09:00 |
| 19 Oct 2016 | 3881 | 07:00 - 09:00 | 26 Oct 2016 | 4073 | 07:00 - 09:00 |
| 19 Oct 2016 | 4070 | 07:00 - 09:00 | 26 Oct 2016 | 5064 | 07:00 - 09:00 |
| 19 Oct 2016 | 5663 | 07:00 - 09:00 | 26 Oct 2016 | 5872 | 07:00 - 09:00 |
| 19 Oct 2016 | 5277 | 07:00 - 09:00 | 26 Oct 2016 | 4283 | 07:00 - 09:00 |
| 20 Oct 2016 | 4085 | 07:00 - 09:00 | 27 Oct 2016 | 4085 | 07:00 - 09:00 |
| 20 Oct 2016 | 3292 | 07:00 - 09:00 | 27 Oct 2016 | 3690 | 08:00 - 10:00 |
| 20 Oct 2016 | 4079 | 07:30 - 09:30 | 27 Oct 2016 | 3881 | 07:00 - 09:00 |
| 20 Oct 2016 | 4268 | 07:00 - 09:00 | 27 Oct 2016 | 4070 | 07:00 - 09:00 |
| 20 Oct 2016 | 6067 | 07:00 - 09:00 | 27 Oct 2016 | 5663 | 08:00 - 10:00 |
| 20 Oct 2016 | 4878 | 07:00 - 09:00 | 27 Oct 2016 | 5277 | 07:00 - 09:00 |
| 21 Oct 2016 | 4085 | 07:00 - 09:00 | 28 Oct 2016 | 4085 | 07:00 - 09:00 |
| 21 Oct 2016 | 2888 | 07:00 - 09:00 | 28 Oct 2016 | 3292 | 07:00 - 09:00 |
| 21 Oct 2016 | 4077 | 07:00 - 09:00 | 28 Oct 2016 | 4079 | 07:30 - 09:30 |
| 21 Oct 2016 | 4666 | 07:00 - 09:00 | 28 Oct 2016 | 4268 | 07:00 - 09:00 |
| 21 Oct 2016 | 6069 | 07:00 - 09:00 | 28 Oct 2016 | 6067 | 08:00 - 10:00 |
| 21 Oct 2016 | 4480 | 07:00 - 09:00 | 28 Oct 2016 | 4878 | 10:45 - 12:45 |
| 22 Oct 2016 | 4085 | 07:00 - 09:00 | 29 Oct 2016 | 4085 | 07:00 - 09:00 |
| 22 Oct 2016 | 3286 | 08:00 - 10:00 | 29 Oct 2016 | 2888 | 08:00 - 10:00 |
| 22 Oct 2016 | 4070 | 07:00 - 09:00 | 29 Oct 2016 | 4077 | 10:45 - 12:45 |
| 22 Oct 2016 | 5064 | 07:00 - 09:00 | 29 Oct 2016 | 4666 | 07:00 - 09:00 |
| 22 Oct 2016 | 5872 | 07:00 - 09:00 | 29 Oct 2016 | 6069 | 09:00 - 11:00 |
| 22 Oct 2016 | 4283 | 07:00 - 09:00 | 29 Oct 2016 | 4480 | 07:00 - 09:00 |
| 23 Oct 2016 | 4085 | 08:00 - 10:00 | 30 Oct 2016 | 4085 | 08:00 - 10:00 |
| 23 Oct 2016 | 3690 | 07:00 - 09:00 | 30 Oct 2016 | 3286 | 07:00 - 09:00 |
| 23 Oct 2016 | 3881 | 07:00 - 09:00 | 30 Oct 2016 | 4073 | 07:00 - 09:00 |
| 23 Oct 2016 | 4073 | 07:00 - 09:00 | 30 Oct 2016 | 5064 | 07:00 - 09:00 |
| 23 Oct 2016 | 5663 | 07:00 - 09:00 | 30 Oct 2016 | 5872 | 07:00 - 09:00 |
| 23 Oct 2016 | 5277 | 07:00 - 09:00 | 30 Oct 2016 | 4283 | 07:00 - 09:00 |
| 24 Oct 2016 | 4085 | 07:00 - 09:00 | 31 Oct 2016 | 4085 | 07:00 - 09:00 |
| 24 Oct 2016 | 3292 | 07:00 - 09:00 | 31 Oct 2016 | 3690 | 07:00 - 09:00 |
| 24 Oct 2016 | 4079 | 09:00 - 11:00 | 31 Oct 2016 | 3881 | 07:30 - 09:30 |
| 24 Oct 2016 | 4268 | 09:00 - 11:00 | 31 Oct 2016 | 4070 | 07:00 - 09:00 |
| 24 Oct 2016 | 6067 | 07:30 - 09:30 | 31 Oct 2016 | 5663 | 07:00 - 09:00 |
| 24 Oct 2016 | 4878 | 07:00 - 09:00 | 31 Oct 2016 | 5277 | 07:00 - 09:00 |
| 25 Oct 2016 | 4085 | 07:00 - 09:00 | | | |
| 25 Oct 2016 | 2888 | 07:00 - 09:00 | | | |
| 25 Oct 2016 | 4077 | 09:00 - 11:00 | | | |
| 25 Oct 2016 | 4666 | 07:00 - 09:00 | | | |
| 25 Oct 2016 | 6069 | 07:00 - 09:00 | | | |
| 25 Oct 2016 | 4480 | 07:00 - 09:00 | | | |