Wilds Birds Regulation Unit

Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2023

Prepared by

12, Sir Arthur Borton Street
Mosta, MST1881
MALTA

Telephone: (+356) 2143 1900
Fax: (+356) 21424 137
e-mail: info@ecoserv.com.mt

www.ecoserv.com.mt

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This report has been compiled by:

JOSEPH A. BORG
BSc MSc PhD (Plymouth) CBiol FRSB FMBA FIBMS

and

JULIAN EVANS
BSc (Hons) MSc PhD (Plymouth) CBiol MRSB MMBA

Coordinator of study logistics:

SARAH DEBONO
BSc (Hons) MSc MRSB

Report checked by:

Julian Evans
BSc(Hons) MSc PhD CBiol MRSB MMBA

Report approved by:

Joseph A Borg
BSc MSc PhD CBiol FRSB FMBA FIBMS

1. Introduction

The Sectoral Procurement Directorate published a call for tenders (reference SPD3/2023/061) titled "*Tender for independent scientific studies on the influx or passage of migratory Common Quail and Turtle Dove in Malta during autumn 2023 - 2025 and the influx or passage of migratory finches, Golden Plover and Song Thrush in Malta during the 2023 - 2025 autumn/winter seasons (3 years)*", on behalf of the Wild Birds Regulation Unit (WBRU) of the Ministry for Gozo (hereafter 'MGOZ').

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 objective of this contract is:

1. *To provide an independent study on the influx or passage of the migratory Turtle Dove* Streptopelia turtur *and Common Quail* Coturnix coturnix *during the Autumn period, between the 1st of September and 31st October, inclusive of both dates for the year 2023, 2024 and 2025; and*
2. *To provide an independent study on the influx or passage during the Autumn/Winter, between the 15th of October till the 15th January, inclusive of both dates for each contracted year, of the following species:*
   *Common Linnet (*Linaria cannabina*),*
   *Common Chaffinch (*Fringilla coelebs*),*
   *European Serin (*Serinus serinus*),*
   *European Goldfinch (*Carduelis carduelis*),*
   *European Greenfinch (*Chloris chloris*),*
   *Hawfinch (*Coccothraustes coccothraustes*),*
   *Eurasian Siskin (*Spinus spinus*),*
   *Golden Plover (*Pluvialis apricaria*), and*
   *Song Thrush (*Turdus philomelos*)*

2.2 Specific Objectives

The objectives of this contract are as follows:

- *To survey and scientifically monitor the daily influx of Turtle Dove, Common Quail, seven species of finches, Golden Plover and Song Thrush on the respective dates/periods specified above;*
- *To estimate the overall presence (influx) of these eleven species per day and for the whole study period for each respective species as specified above, subject to scientifically justified assumptions;*
- *To correlate migration data gathered through the present survey with bag data for the relevant species, should any live-capturing derogations or research derogation be applied during the autumn season of the contracted years.*

2.3 Results to be Achieved by the Consultant

The following results are expected to be delivered:

1. *Daily datasheets with raw counts for seven (7) finch species: (Common Linnet* Linaria cannabina*, Common Chaffinch* Fringilla coelebs*, European Serin* Serinus serinus*, European Goldfinch* Carduelis carduelis*, European Greenfinch* Chloris chloris*, Hawfinch* Coccothraustes coccothraustes*, Eurasian Siskin* Spinus spinus
2. *Daily datasheets with raw counts for Golden Plover* Pluvialis apricaria *and Song Thrush* Turdus philomelos*;*
3. *Daily datasheets with raw counts for the Turtle Dove* Streptopelia turtur *and Quail* Coturnix coturnix*; and*
4. *Submission of three (3) monitoring reports for Autumn/Winter for each of the contracted years: one report comprising the monitoring of the influx of seven species of finches, a separate report comprising the monitoring of the influx of Golden Plover and Song Thrush and another separate report comprising of the monitoring of Turtle Dove and Common Quail (nine (9) reports in total). Each of these reports must include:*
   a) *List of monitoring stations which recorded high/low counts;*
   b) *Dates which showed high/low peaks in the migration of each of the bird species;*
   c) *A daily estimate of the influx of each of the bird 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*
   A comparative assessment of the results obtained with the bag data extracted from telephonic reports for the year in question, which data shall be provided by the Wild Birds Regulation Unit at the end of each monitoring period, (for Golden Plover, Song Thrush and Finches reports, this would only apply in case relevant derogations permitting live-capturing or research derogations are applied in the years concerned).

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 contractor shall use the daily counts obtained from the monitoring stations to extrapolate the approximate estimate of the total influx of each of the bird species: Common Linnet Linaria cannabina*, Common Chaffinch* Fringilla coelebs*, European Serin* Serinus serinus*, European Goldfinch* Carduelis carduelis*, European Greenfinch* Chloris chloris*, Hawfinch* Coccothraustes coccothraustes*, Eurasian Siskin* Spinus spinus*, Golden Plover* Pluvialis apricaria*, Song Thrush* Turdus philomelos*, Turtle Dove* Streptopelia turtur *and Common Quail* Coturnix coturnix *over the Maltese Islands.*

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 contractor to ensure that the active monitoring stations are manned by a sufficient number of ornithologists and/or field assistants. The number of active stations on any given day shall be six (6) sites manned by at least two ornithologists and/or field assistants and each site has to be surveyed every 4 days. 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 on https://mgoz.gov.mt/en/Pages/WBRU/Reports%20and%20Statistics/Autumn-Live-Capturing-

Derogations%E2%80%8B-.aspx.

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 nine bird species (Common Linnet Linaria cannabina*, Common Chaffinch* Fringilla coelebs*, European Serin* Serinus serinus*, European Goldfinch* Carduelis carduelis*, European Greenfinch* Chloris chloris*, Hawfinch* Coccothraustes coccothraustes*, Eurasian Siskin* Spinus spinus*, Golden Plover* Pluvialis apricaria*, Song Thrush* Turdus philomelos*) shall take place during the period between the 15th October and the 15th January both dates included for the contracted years. The Contractor shall mobilise all staff and equipment for this study by the 25th of September of each of the contracted years, in preparation for the execution of Autumn/Winter migration study.*

The monitoring of the influx or passage of the Turtle Dove Streptopelia turtur *and Common Quail* Coturnix coturnix *at each station shall take place between the 1st of September till the 31st of October, both dates included of each of the contracted years, 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 Dove. The consultant shall mobilise all staff and equipment for this study by the 16th of August of each contracted year, in preparation for the execution of the Autumn bird migration study. The bird monitoring phase shall commence on the 1st of September.*

The bird migration studies should comprise the on-field surveying and scientific monitoring of the daily influx of migration of all seven (7) finch species, Golden Plover, Song Thrush, Turtle Dove and Common Quail. This would provide an independent verification of the level of presence of the species in Autumn/Winter and the timing of their migration. This shall be achieved by generating a "Migration Count," that is a count of migrant birds of each species in question in the stipulated time span when monitoring is undertaken.

The collection of scientific data to elucidate general population trends for these species is beyond the scope of this bird migration study. The Contractor must submit the daily datasheets with raw counts to the Contracting Authority at the end of each week. The draft monitoring reports and analysis for the Finches and Golden Plover and Song Thrush reports are to be submitted by the 24th of January of each contracted year (2024, 2025, 2026).The draft monitoring report for Turtle Dove and Quail is to be submitted within five (10) working days from the study phase, that is, by not later than the 15th November of each contracted year (2023, 2024, 2025).

Once the draft Autumn study reports have been certified for quality assurance by the Contracting Authority, the final monitoring reports are to be submitted each year for quality assurance within five (5) working days from such review.

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

As appropriate.

4.2 Specific Activities

The bird migration studies shall monitor the influx of migratory specimens of Common Linnet Linaria cannabina*, Common Chaffinch* Fringilla coelebs*, European Serin* Serinus serinus*, European Goldfinch* Carduelis carduelis*, European Greenfinch* Chloris chloris*, Hawfinch* Coccothraustes coccothraustes*, Eurasian Siskin* Spinus spinus*, Golden Plover* Pluvialis apricaria*, Song Thrush* Turdus philomelos*, Turtle Dove* Streptopelia turtur *and Common Quail* Coturnix coturnix *bearing in mind any methodological and physical limitations in the monitoring of these species, such as ability to identify or differentiate species of finches on the basis of their call rather than appearance and as identified in the European Union Management Plan for the Common Quail.*

The Contractor should be available to physically meet the Contracting Authority's representative/s at the Contracting Authority's offices or at the monitoring stations as may be required throughout the contract within a 12-hour notice. The Contractor must also hold onsite meetings with stakeholders and be available to physically visit any of the monitoring stations within a 12-hour notice. Should the Contractor not prove to be available during the contract, or provide untruthful information, the contract will be immediately terminated.

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 periods. Such a network would need to comprise of 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 all of the eleven (11) bird species visually as well as capable of recognizing the flight calls of finches.

For Golden Plover, Song Thrush and Finches monitoring study, daily monitoring at each station shall be conducted from 09:00hrs to 14:00hrs during the first part of the study until the day Malta changes to Daylight Saving Time. After this day, daily monitoring at each station shall be conducted from 08:00hrs to 13:00hrs.

For Turtle Dove and Common Quail monitoring study, daily monitoring at each station shall be conducted from 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 Dove at each station during the study period ie. 1st September till the 31st October, both dates included.

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. The exact number of the monitoring stations and the location should should be included in the Technical offer Form by the Contractor. Given that the survey is aimed at quantifying the influx or passage of migrating birds, 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 overall timing of the migration and prevailing weather conditions. The location of the monitoring stations shall be selected with care and shall not include areas where the settlement or sighting of the birds under study cannot in practice occur.

The Project coordinator should be able to co-ordinate a team of scientists and scientific experts and conduct environmental monitoring, nature-related and/or ornithological studies. The role of the scientists accompanying the Project coordinator should also include the ability to conduct environmental monitoring, nature-related and/or ornithological studies. The Project Coordinator and the scientist must hold weekly on site meetings with the Contractor, the Ornithologists and field assistants as well as visit the monitoring stations themselves. Both key experts must be in fluent in Maltese and English languages.

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, particular 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 Finches, Golden Plover and Song Thrush have a preference for migrating during particular times of day, observations should focus on such peak times. In this respect the monitoring is to be carried out from 09:00hrs to 14:00hrs and from 08:00hrs to 13:00hrs following change in the Daylight Saving Time.

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.

It is imperative that the observers, or persons deployed by the consultant to man the stations and/or conduct counts or observations for the purpose of this study shall not be directly or indirectly involved with the practice of live-capturing or hunting.

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 each of the eleven (11) bird species. 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.

The field study for Golden Plover, Song Thrush and Finches shall cover 88 full days during the Autumn/Winter migration period, between the 15th October and the 15th January for each contracted year. The field study for the Turtle Dove and Quail shall cover 61 full days between the 1st September and 31st October for each contracted year. The collection of scientific data to elucidate population trends for each bird species is beyond the scope of this bird migration study. The contractor 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 Autumn/Winter

Finches, Golden Plover and Song Thrush Migration monitoring reports and analysis is to be submitted by the 24th January of each contracted year (2024, 2025 and 2026). Once such draft reports have been certified for quality assurance by the Contracting Authority, the Finches Migration monitoring report and Golden Plover and Song Thrush Migration monitoring report are to be submitted within five (5) working days from such a review. The draft monitoring report and analysis for Turtle Dove and Quail Autumn study is to be submitted by the 15th of November of each contracted year. Once such draft reports have been certified for quality assurance by the Contracting Authority, the final Autumn monitoring reports are to be submitted within five (5) working days from such a review.

These activities will result in:

1. Daily datasheets with raw counts for each of the above mentioned bird species and three monitoring reports for each study period, including comparative analysis for Autumn/Winter season 2023.
2. Daily datasheets with raw counts for each of the above mentioned bird species and three monitoring reports for each study period, including comparative analysis for Autumn/Winter season 2024.
3. Daily datasheets with raw counts for each of the above mentioned bird species and three monitoring reports for each study period, including comparative analysis for Autumn/Winter season 2025.

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 the Environment, Sustainable Development 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

As appropriate.

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 and for on-site meetings as may be required throughout the contract within a 12-hour notice.

5.2 Commencement Date & Period of Execution

The intended commencement date for the monitoring phase for Turtle Dove and Quail study is from the 1st September and the study of the Golden Plover, Song Thrush and Finches is the 15th October of each contracted year.

Article 18.1 of the Special Conditions will determine the actual commencement date and period of execution.

6. Requirements

6.1 Personnel

6.1.1 Key experts

The Service Provider/s must be a natural person, or a legal entity providing the below Key Experts:
A list of the key experts and other staff proposed for the execution of the contract as per Form marked Key Experts to be submitted online through the prescribed tender response format (tender structure).

Key Expert 1
A Project coordinator who must be:
In possession of a Ph.D. or other academic qualification at MQRIC Level 8 or equivalent related to Natural Sciences. The project coordinator must be able to communicate fluently in both Maltese and English.

Key Expert 2
A Scientist who must be:
In possession of a Masters degree or other academic qualification at MQRIC level 7 or equivalent in Natural Sciences. The scientist must be able to communicate fluently in both Maltese and English.

Key Experts must hold weekly on-site meetings with the Contractor, the Ornithologists and field assistants as well as visit the monitoring stations themselves.

The above key expertise can be provided by a single person, provided that he/she has the required qualifications as stipulated above.

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 Contractor

The Contractor 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 Contractor 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/beneficiary country as part of this service contract or transferred to the Contracting Authority/beneficiary country 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 report should indicate:

- *the raw counts for the species covered by the corresponding migration report*
- *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 each of the relevant species migrating over the Maltese Islands for each day*
- *an estimated total influx of each of the relevant bird species for the whole study period*
- *assumptions taken for such estimates*
- *For Turtle Dove and Quail, comparison of the results with hunting bag data for this period*
- *For Golden Plover, Song Thrush and seven finch species comparison of the results with live-capturing bag data for the species concerned for the current period (this would only apply in case relevant derogations permitting live-capturing are applied in the respective years)*

These reports should only concern information/data on the influx of the migratory birds and should not include personal opinions of the Contractor.

The Contractor must submit the daily datasheets with raw counts to the Contracting Authority at the end of each week during the bird monitoring phase. The draft Autumn report and analysis for Turtle Dove and Quail is to be submitted by the 15th November of each contracted year. The draft Autumn/Winter Migration monitoring Finch report and the Golden Plover and Song Thrush Migration monitoring report analysis are to be submitted by the 24th January of each contracted year.

Draft reports are to be submitted to the Contracting Authority for quality assurance certification. The Contracting Authority reserves the right to request the necessary modifications to bring the reports in line for issuance of quality assurance certification. In this regard, the Contractor is bound to submit his final version for quality assurance certification to the Contracting Authority, five (5) working days after the Contracting Authority reviews the report.

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, a hard copy 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 progress reports must be written in English. The Project Manager is responsible for approving the progress reports.

8 Monitoring and Evaluation

8.1 Definition of Indicators

Specific performance measures chosen because they provide valid, useful, practical and comparable measures of progress towards achieving expected results. Can be quantitative: measures of quantity, including statistical statements; or qualitative: judgements and perception derived from subjective analysis.

8.2 Special Requirements

As appropriate.

Ecoserv Ltd (hereafter 'Ecoserv') submitted a response to the tender and was subsequently notified that the company's bid was successful. 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 2023, which coincides with part of the 2023 autumn hunting season, and is based on the ToR stated above.

An overview of the migratory behaviour of the two bird species, as well as an overview of local bird hunting and trapping activities, and of EU legislation concerning these activities, are presented in Ecoserv (2011). Although there is a dearth of published information on migration of the Common Quail and Turtle Dove across the Maltese Islands, a considerable amount of data has been collected over the past decade, with such collection of data being initiated by Thomaidis (nd), who studied the occurrence and patterns of movement of these two species over the Islands between spring 2008 and autumn 2009. The data used to compile the report by Thomaidis (nd) were recorded by assigned hunters who contributed to the surveys under his supervision and coordination. Subsequently, regular local surveys of migration of these two species in autumn were carried out between 2014 and 2022 by Ecoserv (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a).

In order to put the present study in perspective, an overview of the findings from the previous similar studies undertaken in autumn 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) follows. The main findings from the autumn surveys, including the survey period and duration, range of mean daily counts, and estimated total influx for Turtle Dove and Common Quail recorded in different years, are summarised in Table 1.

Table 1

Summary of findings made during surveys of the migration of Turtle Dove and Common Quail undertaken in autumn 2014 – 2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a).

Year	Survey period	Duration (days)	Turtle Dove		Common Quail	
			Range of mean daily counts	Estimated total influx	Range of mean daily counts	Estimated total influx
2014	01 Sep – 31 Oct	61	0.00 – 1.33	7,956	0.00 – 1.00	45,683
2015	01 Sep – 31 Oct	61	0.00 – 6.00	12,386	0.00 – 1.00	50,514
2016	01 Sep – 31 Oct	61	0.00 – 1.17	6,868	0.00 – 2.33	69,915
2017	01 Sep – 31 Oct	61	0.00 – 2.17	9,943	0.00 – 1.50	97,965
2018	01 Sep – 31 Oct	61	0.00 – 2.33	15,369	0.00 – 1.00	78,454
2019	01 Sep – 31 Oct	61	0.00 – 10.67	17,809	0.00 – 1.17	79,245
2020	01 Sep – 31 Oct	61	0.00 – 9.00	24,319	0.00 – 1.83	130,099
2021	01 Sep – 31 Oct	61	0.00 – 3.50	15,278	0.00 – 0.83	76,289
2022	01 Sep – 31 Oct	61	0.00 – 2.30	15,003	0.00 – 1.00	79,731

For Turtle Dove, when comparing the results of the various surveys, a similar trend of counts amongst the different survey sessions is noted overall. The general pattern of counts indicates a migratory influx during September. These included peak counts in some years, namely in 2009 (mean count of 4.1, recorded on 23-09-09; Thomaidis, nd), 2015 (mean count of 6.0, recorded on 09-09-15; Ecoserv, 2015a), 2019 (mean count of 10.7, recorded on 02-09-19; Ecoserv, 2019a) and 2020 (mean count of 9.0, recorded on 16-09-20; Ecoserv, 2020a). No mean counts greater than 4.0 were recorded in any of the other years. Thus, the main autumn migration of Turtle Dove usually occurs in September, occasionally with migratory peaks occurring on some days during that month.

In the case of Common Quail, the overall trend recorded from the various surveys is that the main migratory influx occurs between mid-September and mid-October. High peak counts were recorded in 2008 (mean count of 9.6, recorded on 27-09-08) and 2009 (mean count of 6.0, recorded on 23-09-09) by Thomaidis (nd), whereas no particularly high peak counts (i.e., a mean count >3.0) were recorded in any of the subsequent surveys held between 2014 and 2022. Thus, the main autumn migration of Common Quail mostly occurs between mid-September and mid-October, occasionally with migratory peaks occurring on some days during that period.

In the various reports (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a), the authors stressed that estimates of total influx for Turtle Dove and Common Quail must be treated with utmost caution, given the relatively small number of field sites used in the surveys, that counts were not made daily at each site, and since the extrapolation procedure used is likely to result in a rough estimate. Birds may migrate along specific pathways, such that the influx at different localities can be extremely variable, with potential large differences in the number of individuals recorded from two different localities, even if these are separated by a very small distance. In the case of Turtle Dove, the authors also emphasised that the length of coastline surveyed per day (4 km) amounted to less than 1.5% of the total Maltese coastline; the accuracy of the estimated total migratory influx would be higher if a larger proportion of local coastline is surveyed. It was also noted that the total coastline length used in the extrapolation includes stretches of coast that are highly developed and densely inhabited, for example, the Sliema – Valletta and Cottonera areas, where one would expect some disturbance to birds migrating at low altitude, hence their numbers there would be expected to be lower, resulting in an overestimate. Another limitation emphasised by the authors is that the Turtle Dove migration counts were recorded over a seven-hour period, hence any individuals migrating at other times of the day were not included. This could have led to a potential underestimate of the total influx if significant Turtle Dove migration occurred outside of the survey time period, although the one used in the surveys (06:00–13:00 or 07:00–14:00) represents the time during which the activity of Turtle Dove is deemed maximum. In the case of the Common Quail, the authors noted that the daily area surveyed amounts to less than 1% of the total local area that can potentially be used by this species; the accuracy of the estimated total migratory influx would thus be higher if a larger area is surveyed.

The authors stressed that the Turtle Dove and Common Quail migratory count data presented in Ecoserv's reports (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) can only be used for purposes of trend analysis. Even in this respect, due caution should be exercised given that the sampling effort used in the studies undertaken by Ecoserv, while is partly based on that reported and utilized by Thomaidis (nd) for the years 2008 and 2009, was not identical. The authors emphasised that robust and rigorous assessment of migratory influx requires trend analysis based on data from monitoring carried out regularly over a sufficiently long period comprising subsequent years, and using the same methodology. For each year, the data should ideally be collected over the whole migratory season and using a larger sampling effort; for example, by making counts daily at a minimum of 21 sites. Nevertheless, data from the surveys provides a useful indication of the influx of Turtle Dove and Common Quail over the years, provided that results of the studies are interpreted in the context of these limitations.

2. Methodology

The methodology used by Ecoserv during the present autumn 2023 survey is identical to that used in surveys made by the same company in previous autumn (see Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and spring seasons (see Ecoserv, 2011; 2012; 2013; 2014b; 2015b;

2016b; 2017b; 2018b; 2019b; 2020b; 2021b; 2022b; 2023); 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 Ecoserv's staff and the recruited 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 (which were mainly 'surprise visits') on a regular basis. The survey was undertaken over an eight-week period between 1 September and 31 October 2023. 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. On days when access to Comino by boat was not possible due to adverse weather conditions, the surveys were instead undertaken at a nearby alternative site located on the northern tip of mainland Malta. The sampling sites used in the present study include ones used in the previous surveys undertaken during autumn 2014–2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and spring 2011–2023 (see Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016b; 2017b; 2018b; 2019b; 2020b; 2021b; 2022b; 2023), and are represented by the grid cell reference numbers listed in Table 2, while their locations are shown in Figure 1.

Since the survey was mainly aimed at quantifying the influx of migrating individuals, field sites were located 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 Common 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 two-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 then 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).

Table 2

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

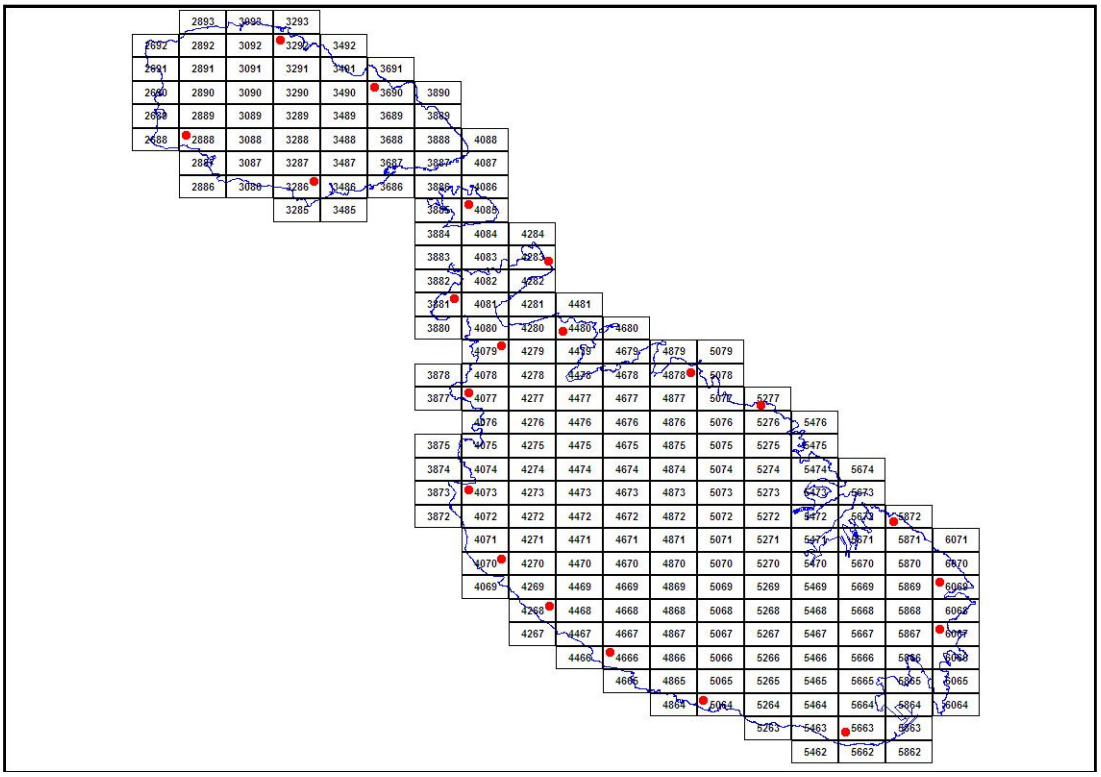

Figure 1. Map of the Maltese Islands showing the 21 sites (grid cells indicated by the red filled circle) where the bird counts were made; see also Table 2.

3. Results

Ecoserv's laboratory report reference for the present survey is **119-23**. The sample reference codes for the bird count data are **B-080-23** to **B-121-23**.

Turtle dove

Raw daily counts for Turtle Dove recorded from any given site (out of the 21 sites) during the present study varied between 0 and a maximum of 7 (see Appendix I), while the mean daily counts ranged between 0 and 2.17 (Table 3). No appreciable peaks in migratory counts were recorded throughout the survey period. The recorded counts showed little variation 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 location 4077 (northwest Malta), while at the higher end, 11 Turtle Dove individuals were recorded from the site at grid location 4268 (west Malta).

Values of mean daily counts and total counts of Turtle Dove recorded during the period 1 September to 31 October 2023 from the present survey are summarised in Table 3. 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, 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), 2015 (Ecoserv, 2015a), 2016 (Ecoserv, 2016a), 2017 (Ecoserv, 2017a), 2018 (Ecoserv, 2018a), 2019 (Ecoserv, 2019a), 2020 (Ecoserv, 2020a), 2021 (Ecoserv, 2021a) and 2022 (Ecoserv, 2022a) 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; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) in autumn 2014–2022; that is, the main migratory influx occurs during September, with occasional migratory peaks recorded in some years.

Values of the grand mean of Turtle Dove counts recorded during the period 1 September to 31 October 2023 from the present survey, together with values of the grand mean for the same period in 2008, 2009 (Thomaidis, nd), 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) are shown in Figure 3. Overall, the grand mean recorded during the present (autumn 2023) falls within the range of those recorded during previous surveys held in autumn.

As has been done in previous surveys undertaken in autumn (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and spring (Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016b; 2017b; 2018b; 2019b; 2020b; 2021b; 2022b; 2023), 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 from previous surveys (Ecoserv, 2011; 2012; 2013; 2014a; 2014b; 2015a; 2015b; 2016a; 2016b; 2017a; 2017b; 2018a; 2018b; 2019a; 2019b; 2020a; 2020b; 2021a; 2021b; 2022a; 2022b; 2023), such an estimate must be treated with utmost caution, given that the 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 the 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, which may end up being shot within a very short time, and therefore these may have not been recorded by the field observers during the survey. On the other hand, the estimate given in the present report is useful when making comparison between different years, assuming data from surveys based on a similar design are available to assess whether the trend in influx is increasing or decreasing with time. Since the coastal length surveyed at each site during the present survey is approximately 0.5 km, the mean daily count represents the mean influx of Turtle Dove per 0.5 km coastline.

The estimated daily influx was obtained by extrapolating the 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. Values of the 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 3), extrapolation translates to an estimated daily influx ranging between 0 and 1,175 individuals, with a total influx over the survey period (1 September to 31 October; i.e. 61 days) of 10,123 individuals, i.e. some 166 birds per day; see Table 3.

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 Dingli (Grid 4268) located in west Malta, while overall high counts were recorded from other study sites located along the western parts of Malta. A count of zero was recorded from Għajn Tuffieħa (Grid 4077), while relatively low counts were also recorded from Comino (Grid 4085) and some sites located on the northern parts of Malta.

Table 3

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

Date	Mean Count ± SD		Total count	Estimated Daily Influx
01-Sep-23	0.17	± 0.41	1	90
02-Sep-23	0.33	± 0.52	2	181
03-Sep-23	0.17	± 0.41	1	90
04-Sep-23	0.33	± 0.52	2	181
05-Sep-23	0.50	± 0.55	3	271
06-Sep-23	0.50	± 0.84	3	271
07-Sep-23	0.67	± 0.82	4	362
08-Sep-23	0.83	± 0.41	5	452
09-Sep-23	1.17	± 1.33	7	633
10-Sep-23	2.17	± 2.64	13	1175
11-Sep-23	1.00	± 0.89	6	542
12-Sep-23	1.00	± 0.89	6	542
13-Sep-23	0.50	± 0.55	3	271
14-Sep-23	0.50	± 0.84	3	271
15-Sep-23	0.33	± 0.82	2	181
16-Sep-23	0.67	± 1.21	4	362
17-Sep-23	1.17	± 1.17	7	633
18-Sep-23	1.17	± 0.98	7	633
19-Sep-23	0.00	± 0.00	0	0
20-Sep-23	0.17	± 0.41	1	90

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

Date	Mean Count ± SD		Total count	Estimated Daily Influx
21-Sep-23	0.50	± 0.84	3	271
22-Sep-23	0.33	± 0.82	2	181
23-Sep-23	0.17	± 0.41	1	90
24-Sep-23	0.33	± 0.82	2	181
25-Sep-23	0.33	± 0.82	2	181
26-Sep-23	0.17	± 0.41	1	90
27-Sep-23	0.33	± 0.52	2	181
28-Sep-23	0.17	± 0.41	1	90
29-Sep-23	0.17	± 0.41	1	90
30-Sep-23	1.17	± 1.17	7	633
01-Oct-23	0.00	± 0.00	0	0
02-Oct-23	0.33	± 0.82	2	181
03-Oct-23	0.33	± 0.82	2	181
04-Oct-23	0.33	± 0.52	2	181
05-Oct-23	0.00	± 0.00	0	0
06-Oct-23	0.00	± 0.00	0	0
07-Oct-23	0.17	± 0.41	1	90
08-Oct-23	0.00	± 0.00	0	0
09-Oct-23	0.33	± 0.82	2	181
10-Oct-23	0.00	± 0.00	0	0
11-Oct-23	0.00	± 0.00	0	0
12-Oct-23	0.00	± 0.00	0	0
13-Oct-23	0.00	± 0.00	0	0
14-Oct-23	0.00	± 0.00	0	0
15-Oct-23	0.17	± 0.41	1	90
16-Oct-23	0.00	± 0.00	0	0
17-Oct-23	0.00	± 0.00	0	0
18-Oct-23	0.00	± 0.00	0	0
19-Oct-23	0.00	± 0.00	0	0
20-Oct-23	0.00	± 0.00	0	0
21-Oct-23	0.00	± 0.00	0	0
22-Oct-23	0.00	± 0.00	0	0
23-Oct-23	0.00	± 0.00	0	0
24-Oct-23	0.00	± 0.00	0	0
25-Oct-23	0.00	± 0.00	0	0
26-Oct-23	0.00	± 0.00	0	0
27-Oct-23	0.00	± 0.00	0	0
28-Oct-23	0.00	± 0.00	0	0
29-Oct-23	0.00	± 0.00	0	0
30-Oct-23	0.00	± 0.00	0	0
31-Oct-23	0.00	± 0.00	0	0
		Sum total	**112**	**10123**

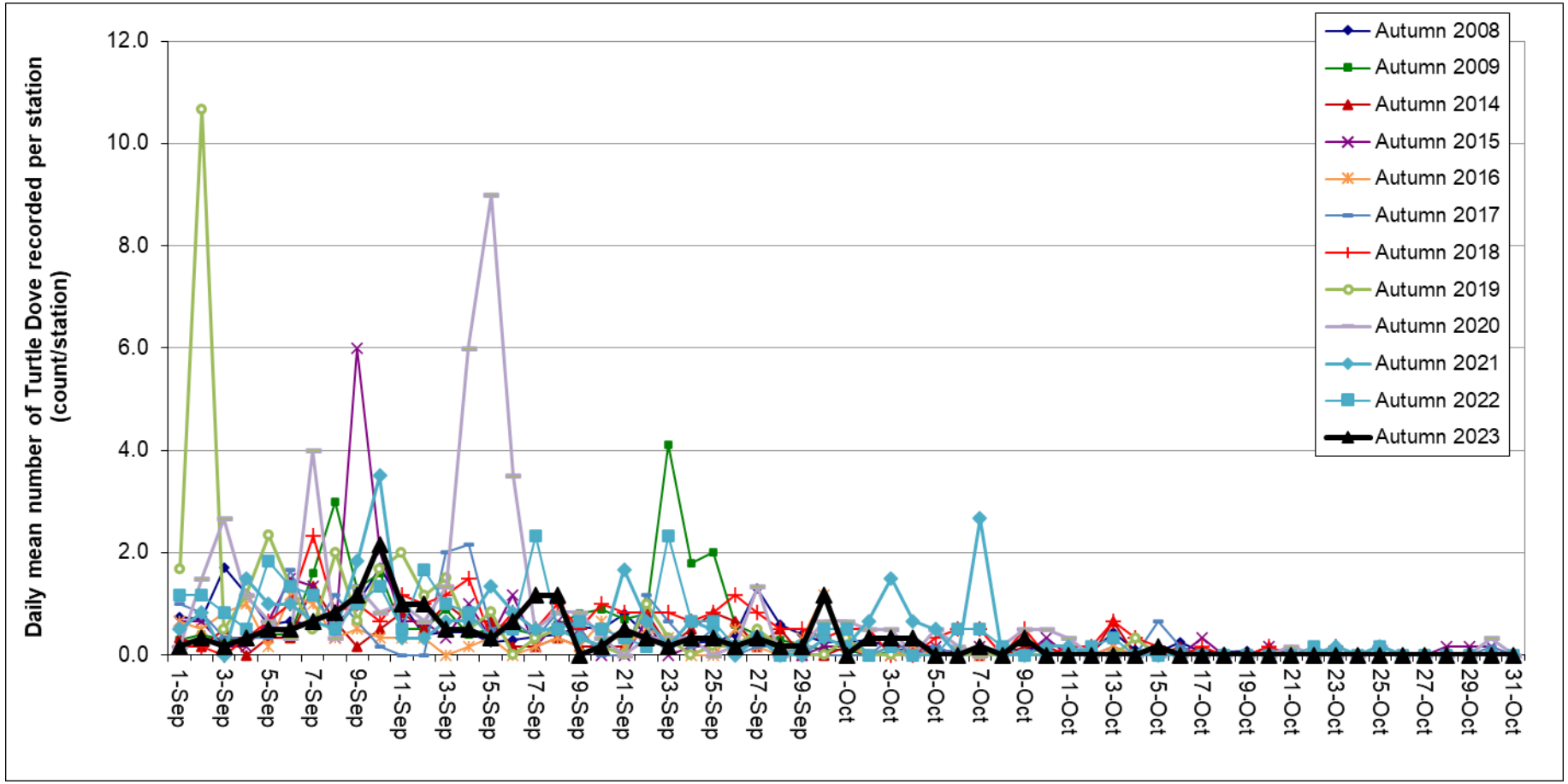

Figure 2. Daily mean counts of Turtle Dove per station (= site) recorded during the present survey from 1 September to 31 October 2023, together with values of the same statistic for autumn 2008 and 2009 as reported in Thomaidis (nd), and for autumn 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 as reported in Ecoserv (2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a).

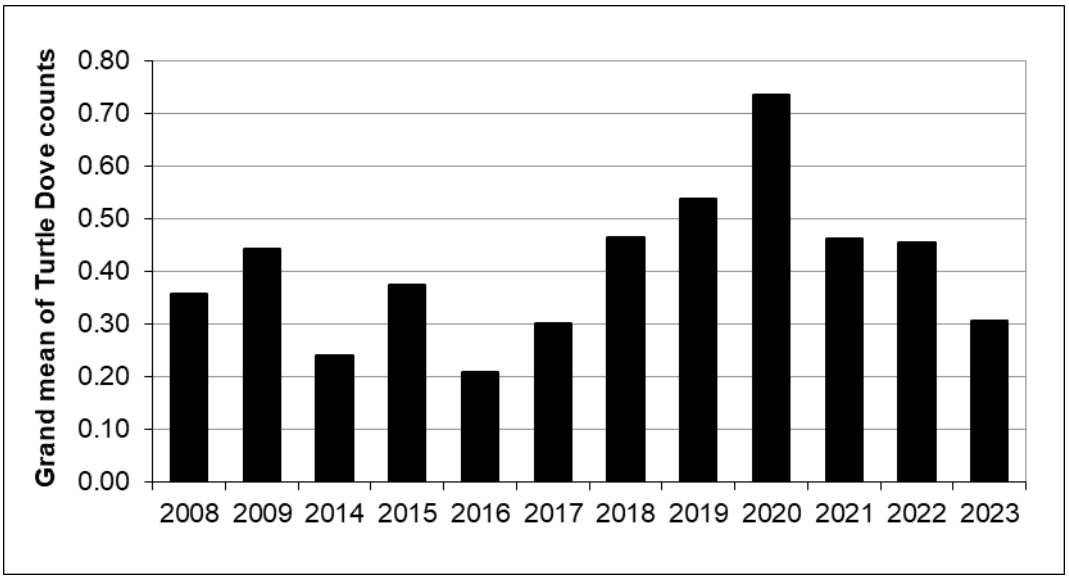

Figure 3. Grand mean of Turtle Dove counts made using data from the period 1 September to 31 October for autumn 2023 (present survey), autumn 2014–2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and autumn 2008–2009 (Thomaidis, nd).

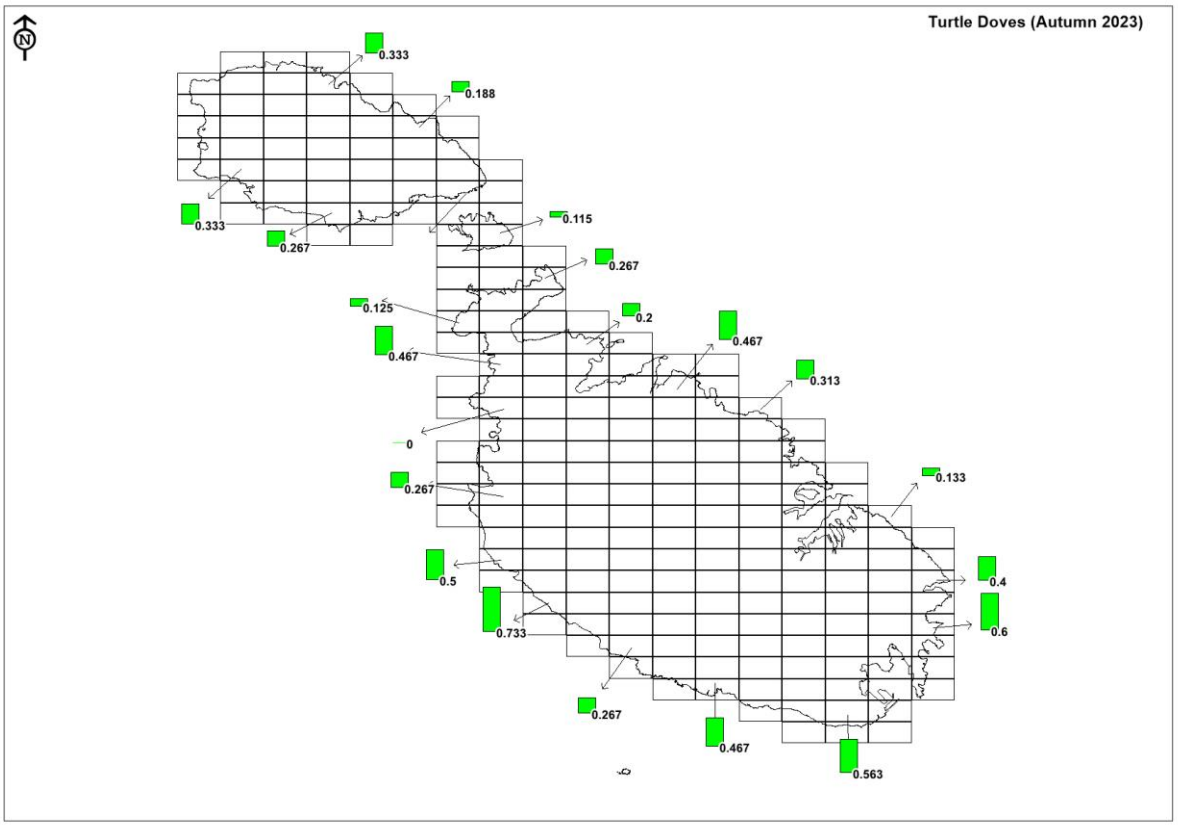

Figure 4. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Turtle Dove recorded from study sites in the respective cells during the present (autumn 2023) survey.

Common Quail

The daily observation times by the field observers spent at each Common Quail monitoring station are given in Appendix II. Raw daily counts for Common Quail recorded from any given site (out of the 21 sites) during the present study varied between 0 and a maximum of 3 (see Appendix I), while the mean daily counts ranged between 0 and 1.0. The recorded counts did not vary appreciably between the different sites: at the higher end, a total of 10 individuals were recorded from grid location 4666 located in west Malta; at the lower end, no Quail individuals were recorded throughout the survey period from grid locations 5663, 5277 and 5872, located in different regions around Malta.

Values of mean daily counts and total counts of Common Quail recorded during the period 1 September to 31 October 2023 from the present survey, as well as the respective area surveyed at each site, are given in Table 4. Values of standard deviation associated with the mean daily counts are also provided in Table 4. As already indicated above for Turtle Dove, standard deviation is a measure of the 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 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), 2015 (Ecoserv, 2015a), 2016 (Ecoserv, 2016a), 2017 (Ecoserv, 2017a), 2018 (Ecoserv, 2018a), 2019 (Ecoserv, 2019a), 2020 (Ecoserv, 2020a), 2021 (Ecoserv, 2021a) and 2022 (Ecoserv, 2022a), in Figure 5. The daily mean counts recorded during the period 1 September to 31 October 2023 (present survey) are overall lower than values recorded in 2008 and 2009 (Thomaidis, nd) for the same period, but similar to those recorded in 2014–2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a). No migration peaks (with a mean count >3.0) were recorded during the present survey. The general pattern from all years being compared is a main migratory influx between mid-September and mid-October.

Values of the grand mean for Common Quail counts recorded during the period 1 September to 31 October 2023 from the present survey, together with values of the grand mean for the same period in 2008, 2009 (Thomaidis, nd), 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a), are shown graphically in Figure 6. The grand mean recorded during the present (autumn 2023) survey is lower than that recorded during the 2008 and 2009 (Thomaidis, nd) surveys, but similar to values recorded during the 2014–2022 surveys (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a).

As has been done in previous surveys undertaken in autumn (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and spring (Ecoserv, 2011; 2012; 2013; 2014b; 2015b; 2016b; 2017b; 2018b; 2019b; 2020b; 2021b; 2022b; 2023), the total influx of Common Quail was estimated for the whole Maltese Islands using the recorded area surveyed for Common Quail at each site. However, such an estimate should be considered with the greatest caution because of the assumption that the rate of Common 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 Common Quail tend to settle in larger numbers in coastal areas compared to inland ones. Common Quail also tends to appear in certain localities before others (Fenech, 2010; Fenech, *in. litt.*). On the other hand, coastal areas are more likely to serve as short-term stopover sites immediately following a migratory flight compared to inland locations; thus including inland locations as study sites in the survey may result in an overestimate of the total influx due to repeat counting of resident Quail.

To ensure that the total area used to estimate the migration count does not include areas within which Quail do not normally settle, even though some birds may fly over urbanized areas, the former 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 4. The estimated daily influx was obtained by extrapolating the mean daily values obtained for the surveyed areas indicated in Table 4 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 Quail for the eight-week study period. Based on these data, extrapolation translates to a total influx of Common Quail during 1 September – 31 October 2023 of 102,620 individuals, or some 1,682 Quail per day (see Table 4). However, as already emphasised in the reports of previous surveys (Ecoserv, 2011; 2012; 2013; 2014a; 2014b; 2015a; 2015b; 2016a; 2016b; 2017a; 2017b; 2018a; 2018b; 2019a; 2019b; 2020a; 2020b; 2021a; 2021b; 2022a; 2022b; 2023), 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.

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 Fawwara (Grid 4666) located in west Malta, while overall high counts were also recorded from sites in nortwestern Malta. The lowest mean counts were recorded from Għar Ħasan (Grid 5663), White Rocks (Grid 5277) and Xgħajra (Grid 5872), located in different areas of the island of Malta. The mean count recorded from the study site on Comino was 0.098, which was lower than the median value for the whole range of recorded mean counts.

Table 4

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

Date	Mean Count ± SD		Total Area Surveyed (km^2)	Total count	Estimated Daily Influx
01-Sep-23	0.00	± 0.00	0.162	0	0
02-Sep-23	0.00	± 0.00	0.182	0	0
03-Sep-23	0.17	± 0.41	0.148	1	1493
04-Sep-23	0.00	± 0.00	0.197	0	0
05-Sep-23	0.00	± 0.00	0.162	0	0
06-Sep-23	0.00	± 0.00	0.182	0	0
07-Sep-23	0.17	± 0.41	0.148	1	1493
08-Sep-23	0.00	± 0.00	0.197	0	0
09-Sep-23	0.00	± 0.00	0.162	0	0
10-Sep-23	0.17	± 0.41	0.182	1	1217
11-Sep-23	0.67	± 0.82	0.148	4	5973
12-Sep-23	0.33	± 0.52	0.197	2	2246
13-Sep-23	0.00	± 0.00	0.162	0	0
14-Sep-23	0.00	± 0.00	0.182	0	0
15-Sep-23	0.50	± 0.84	0.148	3	4480
16-Sep-23	0.00	± 0.00	0.197	0	0
17-Sep-23	0.17	± 0.41	0.162	1	1364
18-Sep-23	0.17	± 0.41	0.182	1	1217
19-Sep-23	0.50	± 0.55	0.148	3	4480
20-Sep-23	0.33	± 0.52	0.197	2	2246
21-Sep-23	0.17	± 0.41	0.162	1	1364
22-Sep-23	0.83	± 1.17	0.182	5	6085
23-Sep-23	0.50	± 0.84	0.148	3	4480
24-Sep-23	0.33	± 0.82	0.197	2	2246

Date	Mean Count ± SD		Total Area Surveyed (km²)	Total count	Estimated Daily Influx
25-Sep-23	0.33	± 0.82	0.162	2	2729
26-Sep-23	0.00	± 0.00	0.182	0	0
27-Sep-23	0.00	± 0.00	0.148	0	0
28-Sep-23	1.00	± 1.26	0.197	6	6737
29-Sep-23	0.50	± 0.84	0.162	3	4093
30-Sep-23	0.17	± 0.41	0.182	1	1217
01-Oct-23	0.17	± 0.41	0.148	1	1493
02-Oct-23	0.50	± 0.84	0.197	3	3369
03-Oct-23	0.33	± 0.52	0.162	2	2729
04-Oct-23	0.33	± 0.52	0.182	2	2434
05-Oct-23	0.50	± 0.84	0.148	3	4480
06-Oct-23	0.33	± 0.52	0.197	2	2246
07-Oct-23	0.00	± 0.00	0.162	0	0
08-Oct-23	0.33	± 0.82	0.182	2	2434
09-Oct-23	0.33	± 0.52	0.148	2	2987
10-Oct-23	0.17	± 0.41	0.197	1	1123
11-Oct-23	0.17	± 0.41	0.162	1	1364
12-Oct-23	0.33	± 0.52	0.182	2	2434
13-Oct-23	0.17	± 0.41	0.148	1	1493
14-Oct-23	0.33	± 0.52	0.197	2	2246
15-Oct-23	0.33	± 0.52	0.162	2	2729
16-Oct-23	0.17	± 0.41	0.182	1	1217
17-Oct-23	0.00	± 0.00	0.148	0	0
18-Oct-23	0.00	± 0.00	0.197	0	0
19-Oct-23	0.00	± 0.00	0.162	0	0
20-Oct-23	0.00	± 0.00	0.182	0	0
21-Oct-23	0.00	± 0.00	0.148	0	0
22-Oct-23	0.00	± 0.00	0.197	0	0
23-Oct-23	0.00	± 0.00	0.162	0	0
24-Oct-23	0.00	± 0.00	0.182	0	0
25-Oct-23	0.83	± 1.33	0.148	5	7466
26-Oct-23	0.17	± 0.41	0.197	1	1123
27-Oct-23	0.00	± 0.00	0.162	0	0
28-Oct-23	0.00	± 0.00	0.182	0	0
29-Oct-23	0.00	± 0.00	0.148	0	0
30-Oct-23	0.00	± 0.00	0.197	0	0
31-Oct-23	0.50	± 1.22	0.162	3	4093
			Sum total	**78**	**102620**

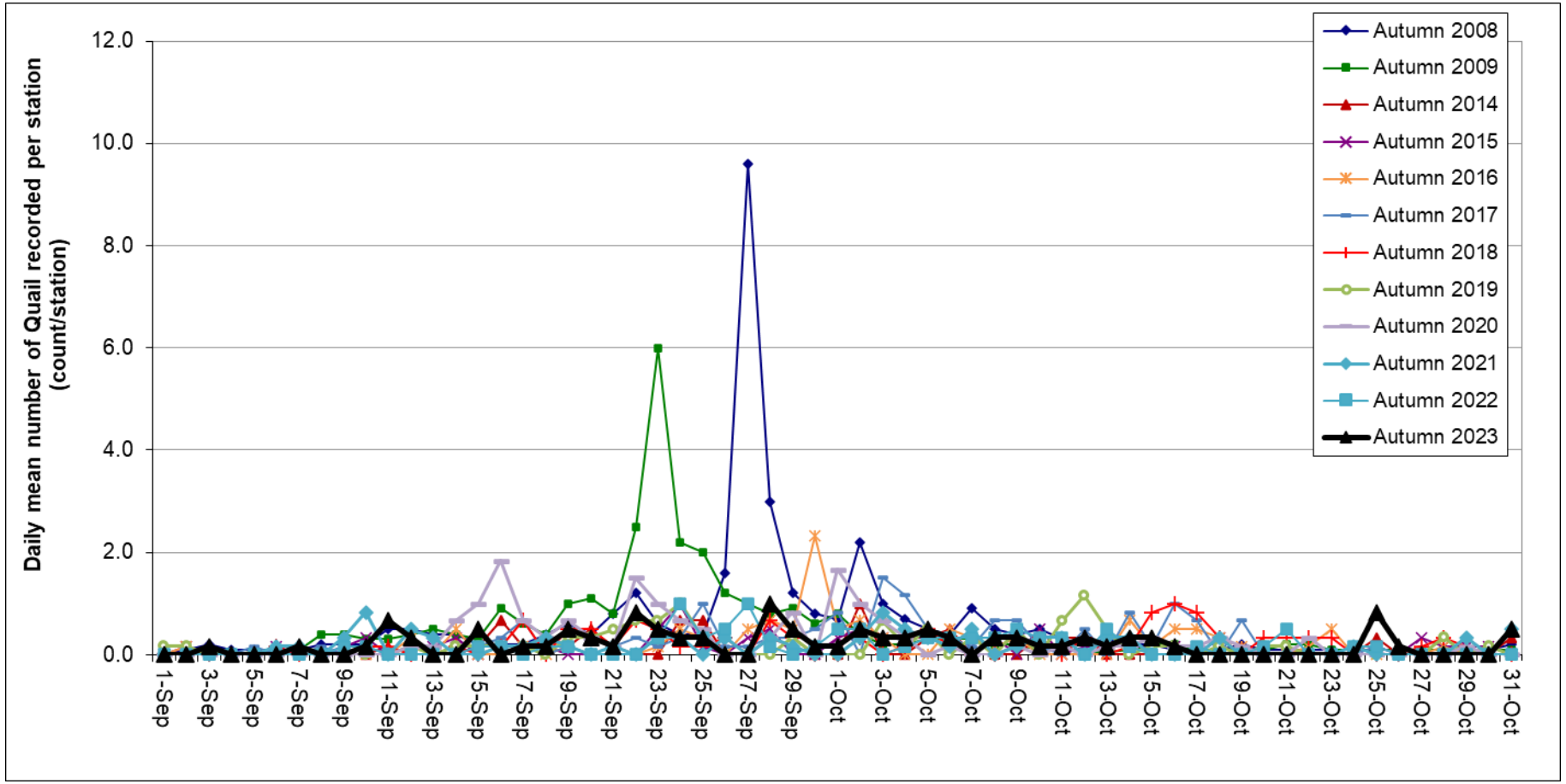

Figure 5. Daily mean counts of Common Quail per station (= site) recorded during the present survey from 1 September to 31 October 2023, together with values of the same statistic for autumn 2008 and 2009 as reported in Thomaidis (nd), for autumn 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 as reported in Ecoserv (2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a).

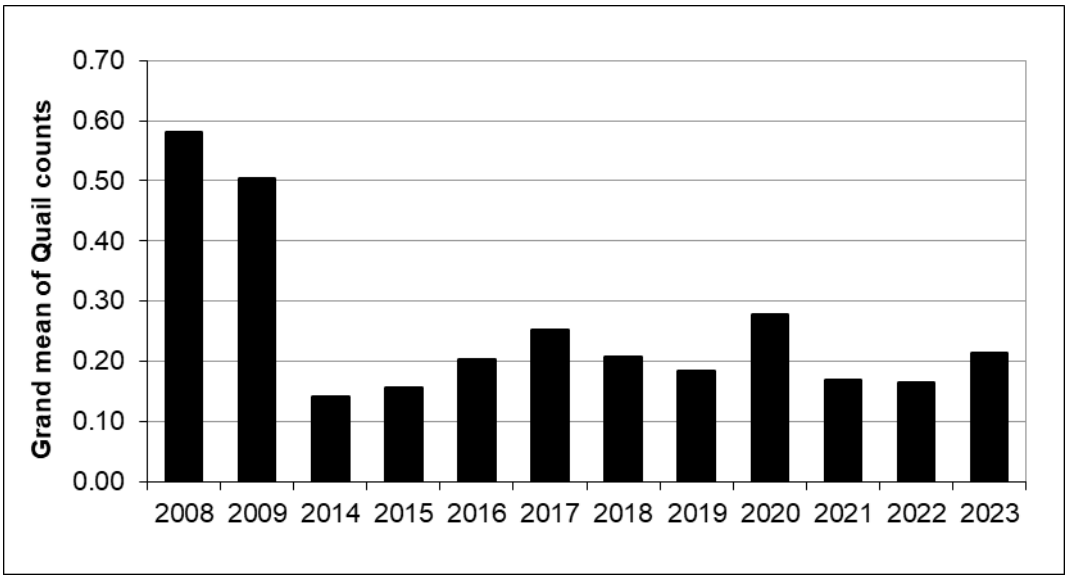

Figure 6. Grand mean of Common Quail counts made using data from the period 1 September to 31 October for autumn 2023 (present survey), autumn 2014–2022 (Ecoserv, 2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) and autumn 2008–2009 (Thomaidis, nd).

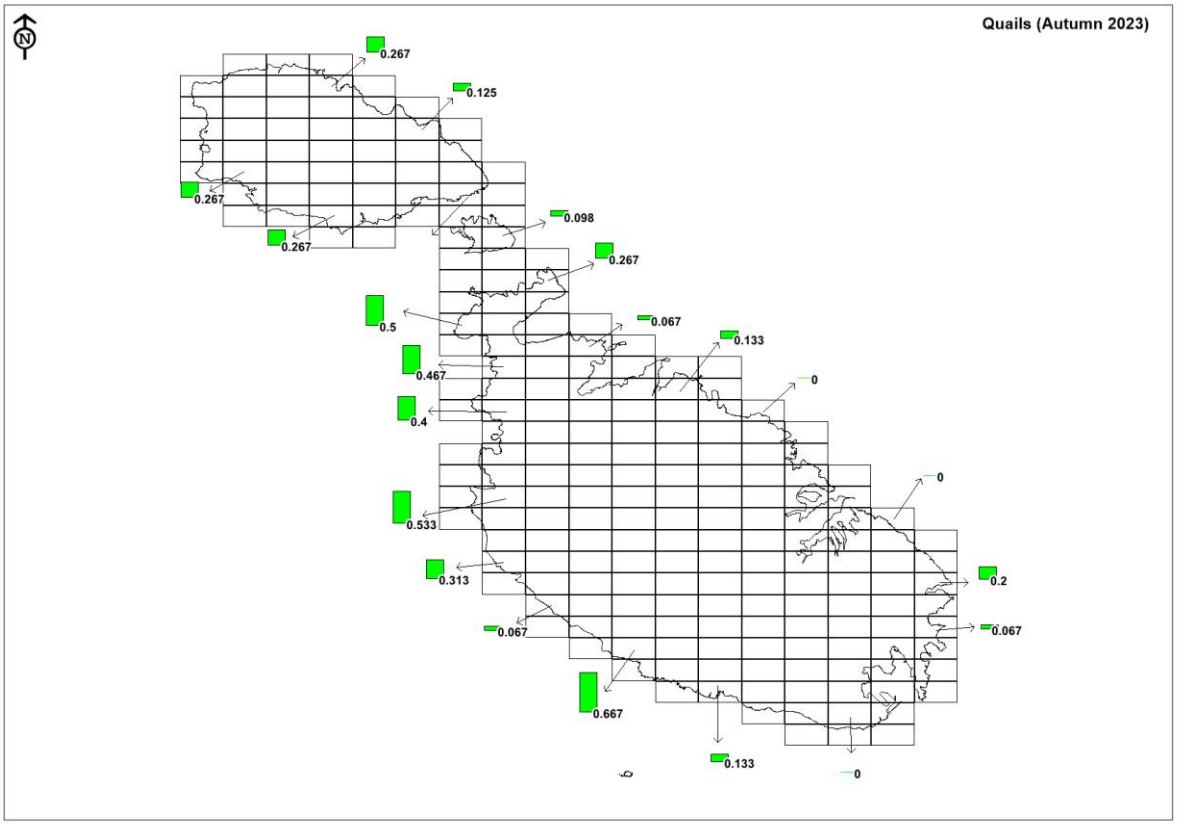

Figure 7. Map of the Maltese Islands showing the standard grid and respective codes, including ones used in the present study. The green bars indicate mean counts of Common Quail recorded from study sites in the respective cells during the present (autumn 2023) survey.

4. Comparison with bag data

A comparative analysis of data from the present study with bag data provided by the WBRU 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 2023, noting that the hunting season for Turtle Dove was closed on 20 September 2023. It should also be noted that the two sets of data were collected for different purposes, using very different methodologies, and therefore the magnitude 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 (2023) survey and the daily bag counts for the same time period (01 September to 31 October 2023; WBRU 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 2023 autumn hunting season and the mean daily counts of Turtle Dove made during the present (2023) survey are shown in Figure 8, while Figure 9 shows the same data but with the results from the present survey given as total daily counts. As already noted, the magnitude of the bag counts and those of the mean/total counts made in the 2023 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 survey are plotted on the right-side y-axis.

Overall, the general trend of daily counts recorded during the 2023 survey is of relatively higher counts in September and early October, with the rest of October mostly characterised by zero counts. The bag count data for the period 1 to 20 September includes higher counts on 6, 9 and 10 September and an overall declining trend thereafter; no Turtle Dove individuals were bagged after 20 September given that the hunting season for Turtle Dove was closed on this date. Overall, there was a similar temporal trend of counts in September 2023, in both the daily counts made during the present survey and the bag count data, while no comparison could be made for the period 21 September to 31 October since the hunting season for Turtle Dove was closed on 20 September 2023.

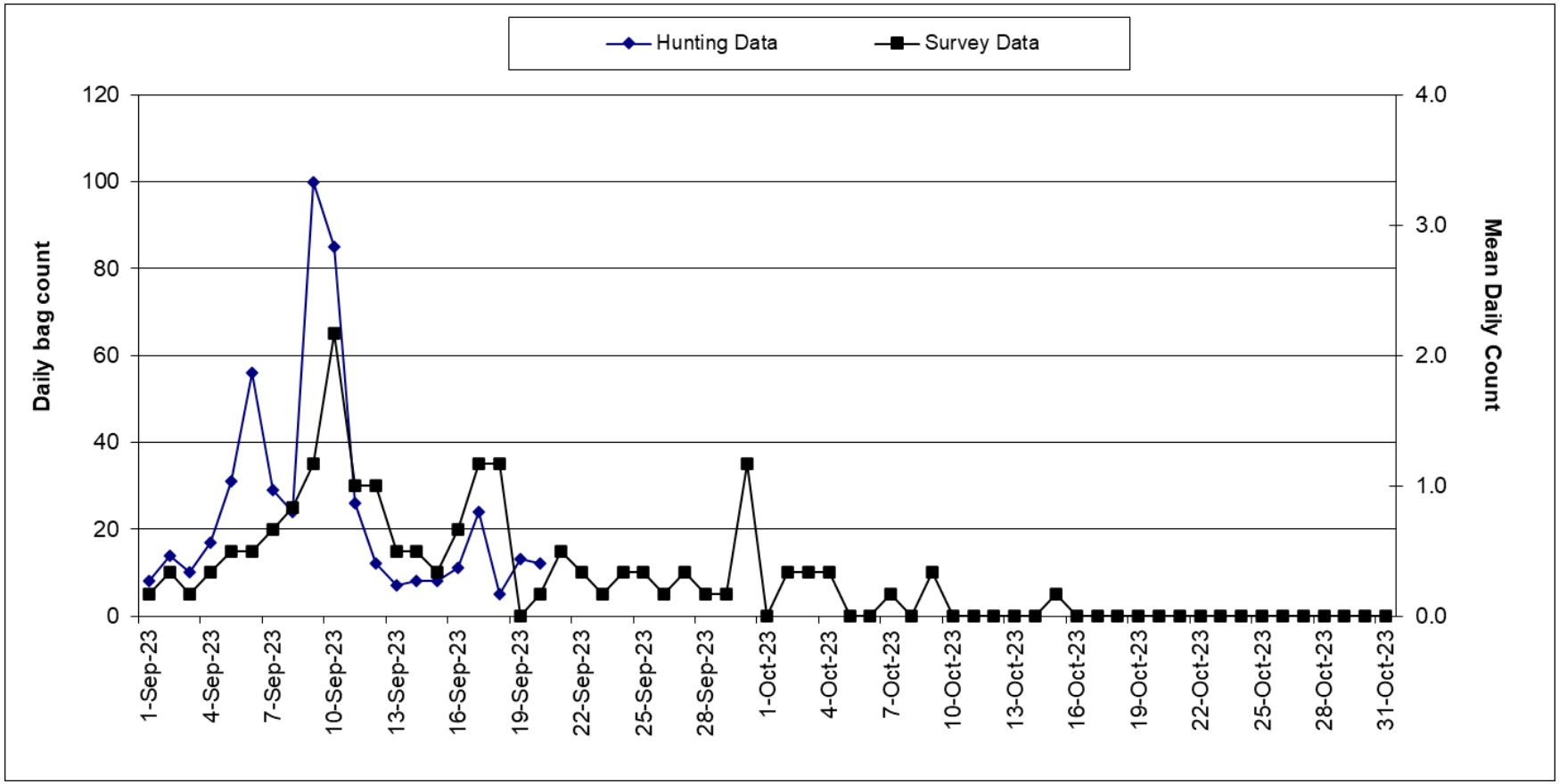

Figure 8. Daily bag count of Turtle Dove during 2023 (blue line; values on left-side y-axis), together with the mean daily counts recorded during the 2023 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2023. It should be noted that bag counts after 20 September are all zero given that the hunting season for this species closed on this date.

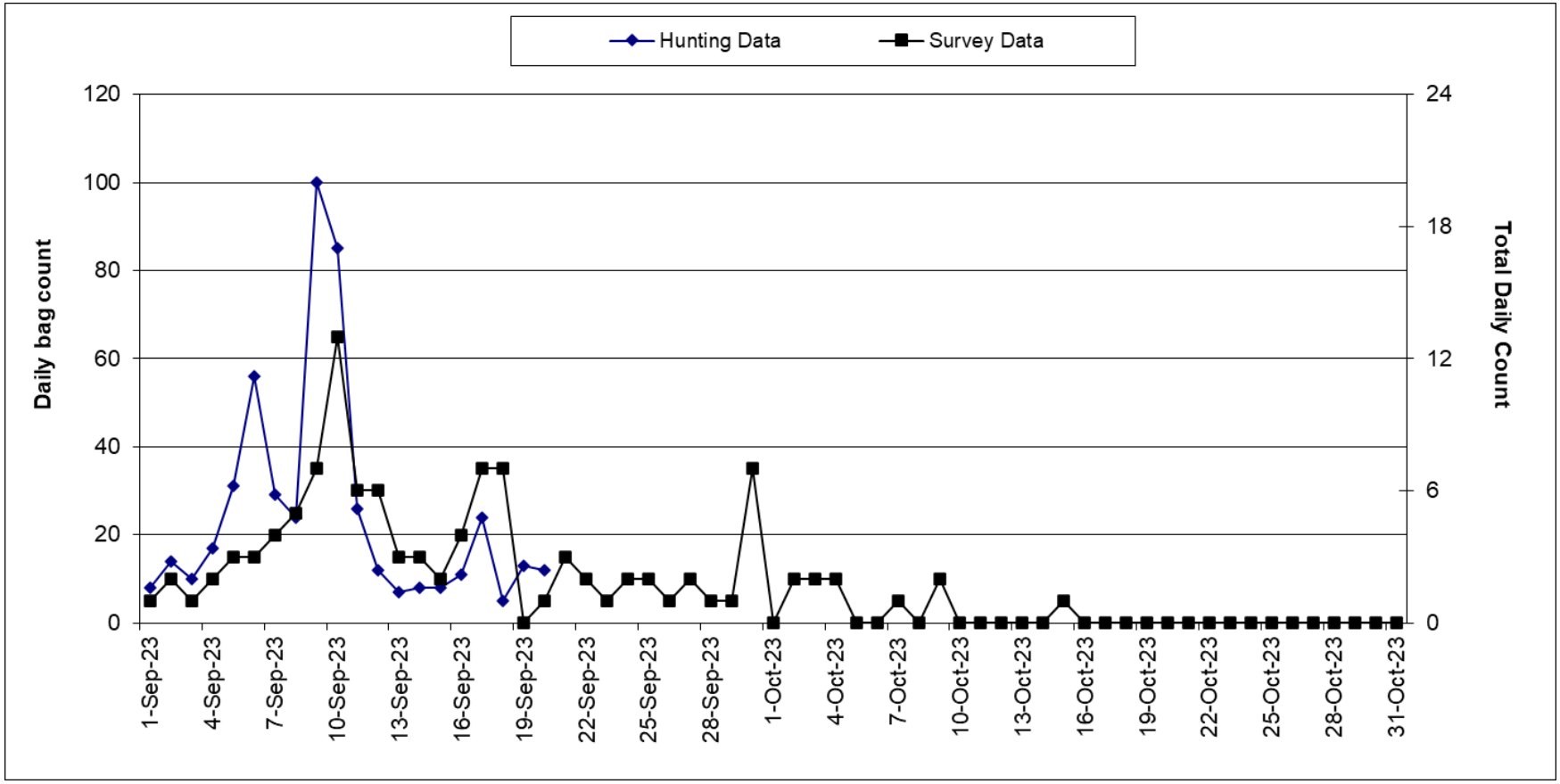

Figure 9. Daily bag count of Turtle Dove during 2023 (blue line; values on left-side y-axis), together with the total daily counts recorded during the 2023 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2023. It should be noted that bag counts after 20 September all zero given that the hunting season for this species closed on this date.

Common Quail

The daily bag counts indicating the number of Common Quail caught during the 2023 autumn hunting season and the mean daily counts of Common Quail recorded during the present (2023) survey are shown in Figure 10, while Figure 11 shows the same data, but with the results from the present survey given as total daily counts. As already noted, the magnitude of the bag counts and those of the mean/total counts made in the 2023 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 survey are plotted on the right-side y-axis.

Overall, the general trend of daily counts recorded during the 2023 survey is of low counts throughout the survey period. Very low or zero counts were recorded during the first week of the survey, followed by a period of relatively higher counts between the mid-September and mid-October, and lower counts until the end of October. The bag count data includes a similar trend: few Common Quail were captured in early September, and higher numbers were caught between mid-September and mid-October, while lower bag counts were generally reported thereafter until end-October. Therefore, overall, there was a similar temporal trend of zero or low counts in early September followed by higher counts until around mid-October, and a subsequent decline in counts in late October, in both the daily counts made during the present survey and the bag count data.

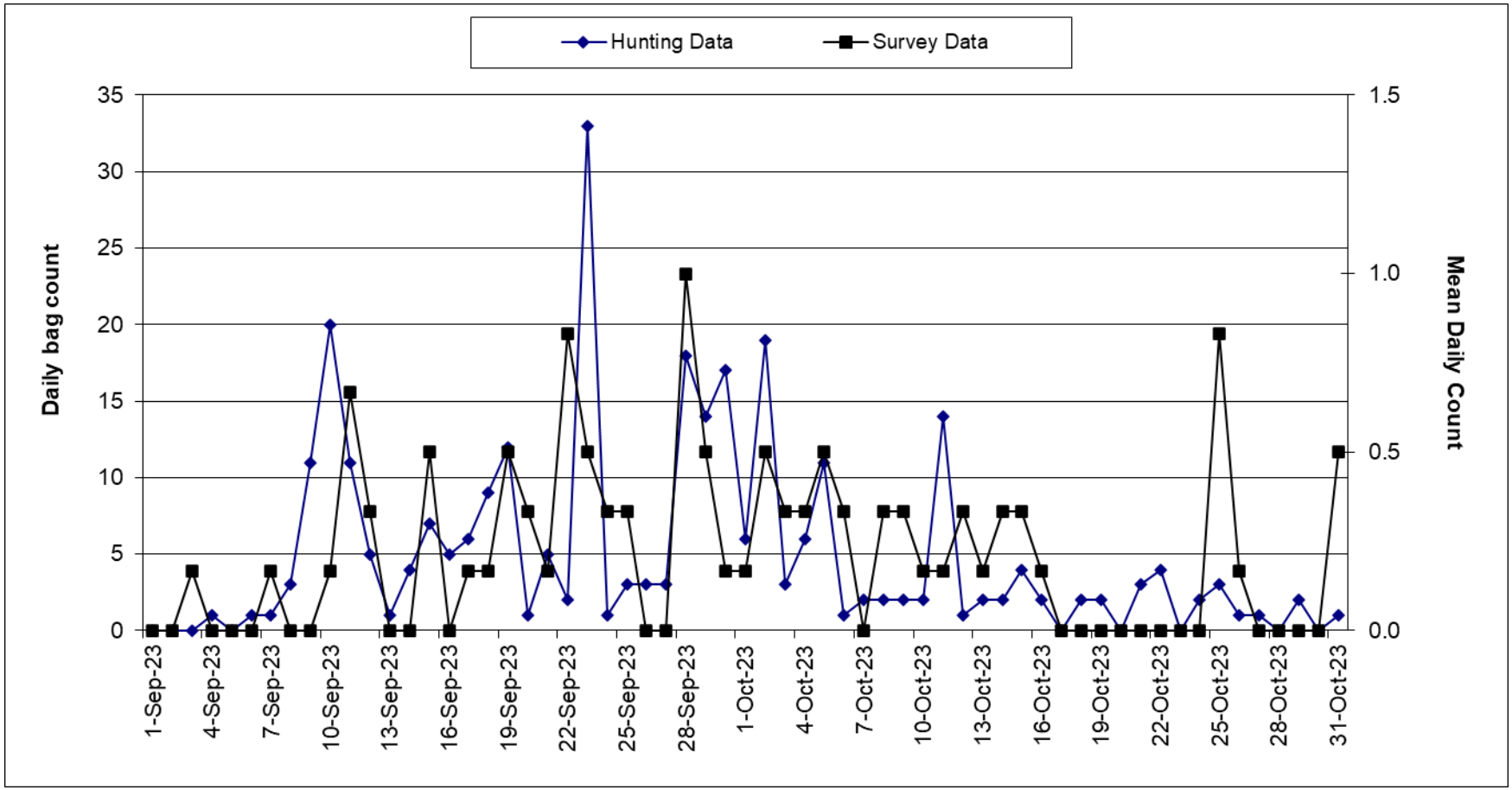

Figure 10. Daily bag count of Common Quail during 2023 (blue line; values on left-side y-axis), together with the mean daily counts recorded during the 2023 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2023.

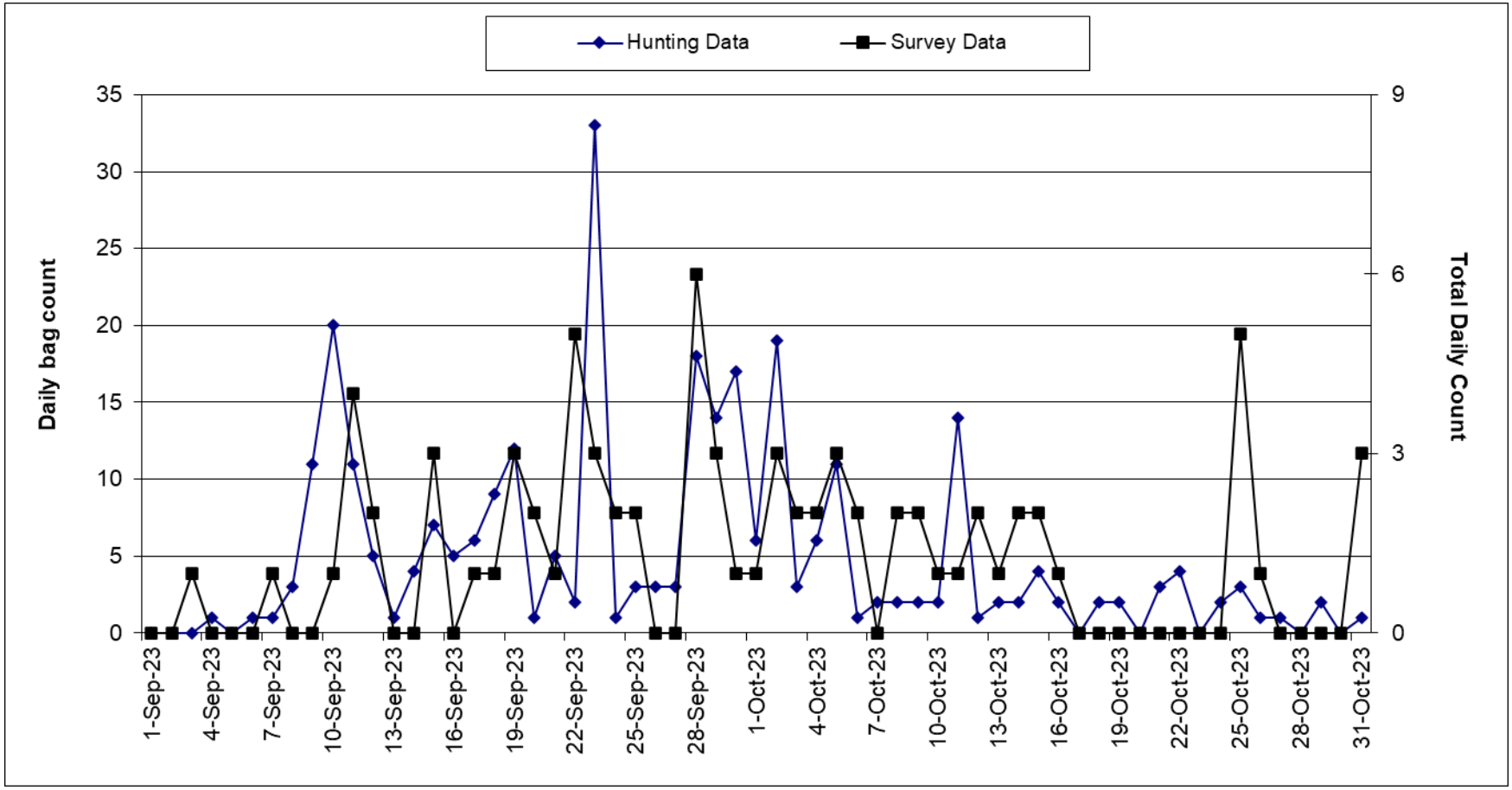

Figure 11. Daily bag count of Common Quail during 2023 (blue line; values on left-side y-axis), together with the total daily counts recorded during the 2023 survey (black line; values on right-side y-axis), for the period 1 September – 31 October 2023.

5. Appraisal

The present survey provides data on counts of Turtle Dove and Common Quail recorded during September and October 2023, as well as estimates of the migratory influx of the two species. Government had established the autumn open season during the period 1 September 2022 – 31 January 2023; the present survey period therefore coincided with the initial two months of the 2023 autumn hunting season.

For Turtle Dove, when comparing the results of the present (autumn 2023) survey with those from Thomaidis' (nd) surveys held in 2008 and 2009, and those from the autumn 2014–2022 surveys by Ecoserv (2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a), 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. In previous years, migratory peaks (mean count >4.0) had been recorded in the 2009, 2015, 2019 and 2020 surveys, but not during the 2008, 2014, 2016, 2017, 2018, 2021 or 2022 surveys. The grand mean value recorded during the present (autumn 2023) survey was within the range of those recorded in previous surveys.

The total influx of Turtle Dove for the present survey period (1 September – 31 October 2023) is estimated at 10,123 individuals, which is similar to the estimates for the same period in 2015 (Ecoserv, 2015a) and 2017 (Ecoserv, 2017a), higher than those made in 2014 (Ecoserv, 2014a) and 2016 (Ecoserv, 2016a), and lower than the estimates from 2018–2022 (Ecoserv, 2018a; 2019a; 2020a; 2021a; 2022a). When comparing the daily influx of Turtle Dove recorded during the present autumn 2023 survey with that recorded during the spring 2023 survey (see Ecoserv, 2023), 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 of the following day. 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 (autumn 2023) survey with those from Thomaidis' (nd) surveys held in 2008 and 2009 and those from the autumn 2014–2022 surveys by Ecoserv (2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a), 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 mid-October. No migratory peak for Common Quail was recorded during the present survey, whereas pronounced peaks were recorded in 2008 and 2009, but not in 2014, 2015, 2017, 2018, 2019, 2020, 2021 or 2022, while a small peak was recorded in 2016. The grand mean value recorded during the present (autumn 2023) survey was lower than values recorded by Thomaidis (nd) in 2008 and 2009, but similar to values recorded by Ecoserv (2014a; 2015a; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) in autumn 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022.

The total influx of Common Quail for the present survey period (1 September – 31 October 2023) is estimated at 102,620 individuals, which is similar to the estimates for the same period in 2017 (Ecoserv, 2017a), higher than those made in 2014 (Ecoserv, 2014a), 2015 (Ecoserv, 2015a), 2016 (Ecoserv, 2016a), 2018 (Ecoserv, 2018a), 2019 (Ecoserv, 2019a), 2021 (Ecoserv, 2021a) and 2022 (Ecoserv, 2022a), and lower than the estimate from 2020 (Ecoserv, 2020a). When comparing the daily influx of Common Quail recorded during the present autumn 2023 survey with that recorded during the spring 2023 survey (see Ecoserv, 2023), mean values of daily influx of the species recorded during the present (autumn) survey are marginally lower than 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 2023, 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; 2016a; 2016b; 2017a; 2017b; 2018a; 2018b; 2019a; 2019b; 2020a; 2020b; 2021a; 2021b; 2022a; 2022b; 2023), 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 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 2016–2023 studies, the 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 of 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 indicate 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; 2016a; 2017a; 2018a; 2019a; 2020a; 2021a; 2022a) in autumn 2014–2022 using a similar methodology was recorded during the present survey period (1 September – 31 October 2023); the main migratory influx occurred during September. Raw daily counts for Turtle Dove recorded from any given site (out of the 21 sites) during the present study varied between 0 and a maximum of 7 (see Appendix I), while the mean daily counts ranged between 0 and 2.17. The recorded counts showed little variation 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 location 4077 (northwest Malta), while at the higher end, 11 Turtle Dove individuals were recorded from the site at grid location 4268 (west Malta). The total influx of Turtle Dove for the present survey is estimated at 10,123 individuals. Overall, the grand mean recorded during the present (autumn 2023) survey falls within the range of those recorded during previous surveys held in autumn. When comparing the daily influx of Turtle Dove recorded during the present autumn 2023 survey with that recorded during the spring 2023 survey (see Ecoserv, 2023), 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, 2015, 2016, 2017, 2018, 2019, 2020, 2021), a similar trend of counts was recorded; a migratory influx occurred between mid-September and mid-October. No migratory peaks 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 any given site (out of the 21 sites) during the present study varied between 0 and a maximum of 3 (see Appendix I), while the mean daily counts ranged between 0 and 1.0. The recorded counts did not vary appreciably between the different sites: at the higher end, a total of 10 individuals were recorded from grid location 4666 located in west Malta; at the lower end, no Quail individuals were recorded throughout the survey period from grid locations 5663, 5277 and 5872 located in different regions around Malta. The total influx of Common Quail for the present survey period is estimated at 102,620 individuals. The grand mean recorded during the present (autumn 2023) survey is lower than that recorded during the 2008 and 2009 surveys, but similar to values recorded during the 2014–2022 surveys. When comparing the recorded daily influx of Common Quail between the present autumn 2023 survey and the spring 2023 survey (see Ecoserv, 2023), mean values of daily influx of this species recorded during the present (autumn) survey are marginally lower than those recorded during spring 2023.

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

7. References

Ecoserv (2011). Report on a survey of the influx of migratory Common Quail and Turtle Dove following the spring hunting open season in Malta, made in May 2011. Malta, unpublished report; 37pp.

Ecoserv (2012). Report on a survey of the influx of migratory Common Quail and Turtle Dove following the spring hunting open season in Malta, made in April - May 2012. Malta, unpublished report; 26pp.

Ecoserv (2013). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2013. Malta, unpublished report; 30pp.

Ecoserv (2014a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2014. Malta, unpublished report; 54pp.

Ecoserv (2014b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2014. Malta, unpublished report; 34pp.

Ecoserv (2015a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2015. Malta, unpublished report; 42pp.

Ecoserv (2015b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2015. Malta, unpublished report; 41pp.

Ecoserv (2016a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2016. Malta, unpublished report; 47pp.

Ecoserv (2016b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2016. Malta, unpublished report; 43pp.

Ecoserv (2017a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2017. Malta, unpublished report; 51pp.

Ecoserv (2017b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2017. Malta, unpublished report; 44pp.

Ecoserv (2018a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2018. Malta, unpublished report; 54pp.

Ecoserv (2018b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2018. Malta, unpublished report; 47pp.

Ecoserv (2019a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2019. Malta, unpublished report; 51pp.

Ecoserv (2019b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2019. Malta, unpublished report; 47pp.

Ecoserv (2020a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2020. Malta, unpublished report; 51pp.

Ecoserv (2020b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2020. Malta, unpublished report; 48pp.

Ecoserv (2021a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2021. Malta, unpublished report; 52pp.

Ecoserv (2021b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2021. Malta, unpublished report; 48pp.

Ecoserv (2022a). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2022. Malta, unpublished report; 52pp.

Ecoserv (2022b). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2022. Malta, unpublished report; 50pp.

Ecoserv (2023). Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2023. Malta, unpublished report; 50pp.

Fenech, N. (2010). A complete guide to the birds of Malta. Malta, Midseabooks; 424 pp.

Fenech, N. (*in litt.*). Some observations of variances in Quail migration patterns in spring and autumn in Malta.

Mallia, A., Briguglio, M., Ellul, A.E. and Formosa, S. (2002). Physical Background, Demography, Tourism, Mineral Resources and Land-Use. In: State of the Environment Report for Malta, 2002. Ministry for Home Affairs and the Environment; 120 pp.

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

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

APPENDIX I - Raw counts

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

Ecoserv Sample Reference Code	B-080-23	B-081-23	B-082-23	B-083-23	B-084-23	B-085-23	B-086-23	B-087-23	B-088-23	B-089-23	B-090-23
Grid Location	**4085**	**3690**	**3881**	**4070**	**5663**	**5277**	**3292**	**4079**	**4268**	**6067**	**4878**
01-Sep-23	0	0	1	0	0	0					
02-Sep-23	0						1	0	0	0	1
03-Sep-23	0										
04-Sep-23	0										
05-Sep-23	1	0	0	1	1	0					
06-Sep-23	0						0	0	2	0	1
07-Sep-23	0										
08-Sep-23	1										
09-Sep-23	2	0	0	2	**3**	0					
10-Sep-23	0						2	0	**7**	**3**	1
11-Sep-23	0										
12-Sep-23	1										
13-Sep-23	1	0	0	0	1	1					
14-Sep-23	0						0	0	0	1	**2**
15-Sep-23	0										
16-Sep-23	0										
17-Sep-23	0	1	0	**3**	1	**2**					
18-Sep-23	1						1	**3**	1	1	0
19-Sep-23	0										
20-Sep-23	0										
21-Sep-23	0	0	1	2	0	0					
22-Sep-23	0						0	0	0	2	0
23-Sep-23	0										
24-Sep-23	0										
25-Sep-23	0	0	0	0	2	0					
26-Sep-23	0						0	1	0	0	0

Ecoserv Sample Reference Code	B-080-23	B-081-23	B-082-23	B-083-23	B-084-23	B-085-23	B-086-23	B-087-23	B-088-23	B-089-23	B-090-23
27-Sep-23	0										
28-Sep-23	0										
29-Sep-23	0	0	0	0	1	0					
30-Sep-23	0						1	3	0	1	**2**
01-Oct-23	0										
02-Oct-23	0										
03-Oct-23	0	2	0	0	0	0					
04-Oct-23	0						0	0	1	1	0
05-Oct-23	0										
06-Oct-23	0										
07-Oct-23	0	0	0	0	0	1					
08-Oct-23	0						0	0	0	0	0
09-Oct-23	0										
10-Oct-23	0										
11-Oct-23	0	0	0	0	0	0					
12-Oct-23	0						0	0	0	0	0
13-Oct-23	0										
14-Oct-23	0										
15-Oct-23	0	0	0	0	0	1					
16-Oct-23	0						0	0	0	0	0
17-Oct-23	0										
18-Oct-23	0										
19-Oct-23	0	0	0	0	0	0					
20-Oct-23	0						0	0	0	0	0
21-Oct-23	0										
22-Oct-23	0										
23-Oct-23	0	0	0	0	0	0					
24-Oct-23	0						0	0	0	0	0
25-Oct-23	0										
26-Oct-23	0										
27-Oct-23	0	0	0	0	0	0					

Ecoserv Sample Reference Code	B-080-23	B-081-23	B-082-23	B-083-23	B-084-23	B-085-23	B-086-23	B-087-23	B-088-23	B-089-23	B-090-23
28-Oct-23	0						0	0	0	0	0
29-Oct-23	0										
30-Oct-23	0										
31-Oct-23	0	0	0	0	0	0					

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

Ecoserv Sample Reference Code	B-091-23	B-092-23	B-093-23	B-094-23	B-095-23	B-096-23	B-097-23	B-098-23	B-099-23	B-100-23
Grid Location	**2888**	**4077**	**4666**	**6069**	**4480**	**3286**	**4073**	**5064**	**5872**	**4283**
01-Sep-23										
02-Sep-23										
03-Sep-23	0	0	0	1	0					
04-Sep-23						0	0	1	0	1
05-Sep-23										
06-Sep-23										
07-Sep-23	1	0	2	0	1					
08-Sep-23						0	1	1	1	1
09-Sep-23										
10-Sep-23										
11-Sep-23	**2**	0	1	2	1					
12-Sep-23						1	0	2	0	2
13-Sep-23										
14-Sep-23										
15-Sep-23	**2**	0	0	0	0					
16-Sep-23						**3**	0	1	0	0
17-Sep-23										
18-Sep-23										
19-Sep-23	0	0	0	0	0					
20-Sep-23						0	0	0	1	0

Ecoserv Sample Reference Code	B-091-23	B-092-23	B-093-23	B-094-23	B-095-23	B-096-23	B-097-23	B-098-23	B-099-23	B-100-23
21-Sep-23										
22-Sep-23										
23-Sep-23	0	0	0	1	0					
24-Sep-23						0	2	0	0	0
25-Sep-23										
26-Sep-23										
27-Sep-23	0	0	1	0	1					
28-Sep-23						0	1	0	0	0
29-Sep-23										
30-Sep-23										
01-Oct-23	0	0	0	0	0					
02-Oct-23						0	0	**2**	0	0
03-Oct-23										
04-Oct-23										
05-Oct-23	0	0	0	0	0					
06-Oct-23						0	0	0	0	0
07-Oct-23										
08-Oct-23										
09-Oct-23	0	0	0	**2**	0					
10-Oct-23						0	0	0	0	0
11-Oct-23										
12-Oct-23										
13-Oct-23	0	0	0	0	0					
14-Oct-23						0	0	0	0	0
15-Oct-23										
16-Oct-23										
17-Oct-23	0	0	0	0	0					
18-Oct-23						0	0	0	0	0
19-Oct-23										
20-Oct-23										
21-Oct-23	0	0	0	0	0					

Ecoserv Sample Reference Code	B-091-23	B-092-23	B-093-23	B-094-23	B-095-23	B-096-23	B-097-23	B-098-23	B-099-23	B-100-23
22-Oct-23						0	0	0	0	0
23-Oct-23										
24-Oct-23										
25-Oct-23	0	0	0	0	0					
26-Oct-23						0	0	0	0	0
27-Oct-23										
28-Oct-23										
29-Oct-23	0	0	0	0	0					
30-Oct-23						0	0	0	0	0
31-Oct-23										

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

Ecoserv Sample Reference Code	B-101-23	B-102-23	B-103-23	B-104-23	B-105-23	B-106-23	B-107-23	B-108-23	B-109-23	B-110-23	B-111-23
Grid Location	**4085**	**3690**	**3881**	**4070**	**5663**	**5277**	**3292**	**4079**	**4268**	**6067**	**4878**
Surveyed Area (km^2)	**0.024**	**0.034**	**0.035**	**0.009**	**0.031**	**0.029**	**0.048**	**0.052**	**0.021**	**0.019**	**0.017**
01-Sep-23	0	0	0	0	0	0					
02-Sep-23	0						0	0	0	0	0
03-Sep-23	0										
04-Sep-23	0										
05-Sep-23	0	0	0	0	0	0					
06-Sep-23	0						0	0	0	0	0
07-Sep-23	0										
08-Sep-23	0										
09-Sep-23	0	0	0	0	0	0					
10-Sep-23	0						0	1	0	0	0
11-Sep-23	0										

Ecoserv Sample Reference Code	B-101-23	B-102-23	B-103-23	B-104-23	B-105-23	B-106-23	B-107-23	B-108-23	B-109-23	B-110-23	B-111-23
12-Sep-23	0										
13-Sep-23	0	0	0	0	0	0					
14-Sep-23	0						0	0	0	0	0
15-Sep-23	0										
16-Sep-23	0										
17-Sep-23	0	0	1	0	0	0					
18-Sep-23	0						0	1	0	0	0
19-Sep-23	1										
20-Sep-23	0										
21-Sep-23	0	0	0	1	0	0					
22-Sep-23	0						**3**	0	1	0	1
23-Sep-23	2										
24-Sep-23	2										
25-Sep-23	0	2	0	0	0	0					
26-Sep-23	0						0	0	0	0	0
27-Sep-23	0										
28-Sep-23	0										
29-Sep-23	0	0	2	1	0	0					
30-Sep-23	0						0	1	0	0	0
01-Oct-23	0										
02-Oct-23	0										
03-Oct-23	0	0	1	1	0	0					
04-Oct-23	0						1	0	0	1	0
05-Oct-23	0										
06-Oct-23	0										
07-Oct-23	0	0	0	0	0	0					
08-Oct-23	0						0	2	0	0	0
09-Oct-23	0										
10-Oct-23	0										
11-Oct-23	0	0	0	1	0	0					
12-Oct-23	0						0	1	0	0	1

Ecoserv Sample Reference Code	B-101-23	B-102-23	B-103-23	B-104-23	B-105-23	B-106-23	B-107-23	B-108-23	B-109-23	B-110-23	B-111-23
13-Oct-23	0										
14-Oct-23	1										
15-Oct-23	0	0	1	1	0	0					
16-Oct-23	0						0	1	0	0	0
17-Oct-23	0										
18-Oct-23	0										
19-Oct-23	0	0	0	0	0	0					
20-Oct-23	0						0	0	0	0	0
21-Oct-23	0										
22-Oct-23	0										
23-Oct-23	0	0	0	0	0	0					
24-Oct-23	0						0	0	0	0	0
25-Oct-23	0										
26-Oct-23	0										
27-Oct-23	0	0	0	0	0	0					
28-Oct-23	0						0	0	0	0	0
29-Oct-23	0										
30-Oct-23	0										
31-Oct-23	0	0	3	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-112-23	B-113-23	B-114-23	B-115-23	B-116-23	B-117-23	B-118-23	B-119-23	B-120-23	B-121-23
Grid Location	**2888**	**4077**	**4666**	**6069**	**4480**	**3286**	**4073**	**5064**	**5872**	**4283**
Surveyed Area (km^2)	**0.015**	**0.016**	**0.018**	**0.032**	**0.043**	**0.085**	**0.015**	**0.012**	**0.025**	**0.036**
01-Sep-23										
02-Sep-23										
03-Sep-23	0	0	1	0	0					

Ecoserv Sample Reference Code	B-112-23	B-113-23	B-114-23	B-115-23	B-116-23	B-117-23	B-118-23	B-119-23	B-120-23	B-121-23
04-Sep-23						0	0	0	0	0
05-Sep-23										
06-Sep-23										
07-Sep-23	1	0	0	0	0					
08-Sep-23						0	0	0	0	0
09-Sep-23										
10-Sep-23										
11-Sep-23	0	0	1	2	1					
12-Sep-23						1	1	0	0	0
13-Sep-23										
14-Sep-23										
15-Sep-23	1	0	2	0	0					
16-Sep-23						0	0	0	0	0
17-Sep-23										
18-Sep-23										
19-Sep-23	0	1	1	0	0					
20-Sep-23						0	1	1	0	0
21-Sep-23										
22-Sep-23										
23-Sep-23	0	0	0	1	0					
24-Sep-23						0	0	0	0	0
25-Sep-23										
26-Sep-23										
27-Sep-23	0	0	0	0	0					
28-Sep-23						2	3	0	0	1
29-Sep-23										
30-Sep-23										
01-Oct-23	0	1	0	0	0					
02-Oct-23						0	1	0	0	2
03-Oct-23										
04-Oct-23										

Ecoserv Sample Reference Code	B-112-23	B-113-23	B-114-23	B-115-23	B-116-23	B-117-23	B-118-23	B-119-23	B-120-23	B-121-23
05-Oct-23	1	0	2	0	0					
06-Oct-23						0	1	1	0	0
07-Oct-23										
08-Oct-23										
09-Oct-23	1	0	1	0	0					
10-Oct-23						1	0	0	0	0
11-Oct-23										
12-Oct-23										
13-Oct-23	0	1	0	0	0					
14-Oct-23						0	1	0	0	0
15-Oct-23										
16-Oct-23										
17-Oct-23	0	0	0	0	0					
18-Oct-23						0	0	0	0	0
19-Oct-23										
20-Oct-23										
21-Oct-23	0	0	0	0	0					
22-Oct-23						0	0	0	0	0
23-Oct-23										
24-Oct-23										
25-Oct-23	0	3	2	0	0					
26-Oct-23						0	0	0	0	1
27-Oct-23										
28-Oct-23										
29-Oct-23	0	0	0	0	0					
30-Oct-23						0	0	0	0	0
31-Oct-23										

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 September 2023	Comino	07:00 – 09:00	8 September 2023	Comino	07:30 – 09:30
1 September 2023	Gozo: San Blas	07:00 – 09:00	8 September 2023	Gozo: Ta Cenc	07:30 – 09:30
1 September 2023	Cirkewwa / Paradise Bay	08:15 – 10:15	8 September 2023	Fomm ir-Rih	07:30 – 09:30
1 September 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00	8 September 2023	Lapsi	07:30 – 09:30
1 September 2023	Ghar Hassan	07:30 – 09:30	8 September 2023	Rinella	07:10 – 09:10
1 September 2023	White Rocks	08:00 – 10:00	8 September 2023	L-Ahrax	07:15 – 09:15
2 September 2023	Comino	07:00 – 09:00	9 September 2023	Comino	07:00 – 09:00
2 September 2023	Gozo: Marsalforn	07:30 – 09:30	9 September 2023	Gozo: San Blas	07:00 – 09:00
2 September 2023	Anchor Bay	07:30 – 09:30	9 September 2023	Cirkewwa / Paradise Bay	09:00 – 11:00
2 September 2023	Rdum ta Had-Dingli	07:15 – 09:15	9 September 2023	Mtahleb to Migra l-Ferha	07:15 – 09:15
2 September 2023	San Tumas	07:30 – 09:30	9 September 2023	Ghar Hassan	07:30 – 09:30
2 September 2023	Ghallis	07:30 – 09:30	9 September 2023	White Rocks	07:00 – 09:00
3 September 2023	Comino	07:30 – 09:30	10 September 2023	Comino	07:00 – 09:00
3 September 2023	Gozo: Kercem	07:00 – 09:00	10 September 2023	Gozo: Marsalforn	07:30 – 09:30
3 September 2023	Ghajn Tuffieha	07:15 – 09:15	10 September 2023	Anchor Bay	07:00 – 09:00
3 September 2023	Fawwara	09:00 – 11:00	10 September 2023	Rdum ta Had-Dingli	07:30 – 09:30
3 September 2023	Zonqor Point	07:00 – 09:00	10 September 2023	San Tumas	09:30 – 11:30
3 September 2023	Mistra / Mgiebah	08:00 – 10:00	10 September 2023	Ghallis	07:00 – 09:00
4 September 2023	Comino	07:00 – 09:00	11 September 2023	Comino	07:00 – 09:00
4 September 2023	Gozo: Ta Cenc	07:00 – 09:00	11 September 2023	Gozo: Kercem	07:00 – 09:00
4 September 2023	Fomm ir-Rih	08:15 – 10:15	11 September 2023	Ghajn Tuffieha	07:00 – 09:00
4 September 2023	Lapsi	07:30 – 09:30	11 September 2023	Fawwara	07:00 – 09:00
4 September 2023	Rinella	07:00 – 09:00	11 September 2023	Zonqor Point	07:00 – 09:00
4 September 2023	L-Ahrax tal-Mellieha	07:30 – 09:30	11 September 2023	Mistra / Mgiebah	07:30 – 09:30
5 September 2023	Comino	07:00 – 09:00	12 September 2023	Comino	07:45 – 09:45
5 September 2023	Gozo: San Blas	07:00 – 09:00	12 September 2023	Gozo: Ta Cenc	07:00 – 09:00
5 September 2023	Cirkewwa / Paradise Bay	07:30 – 09:30	12 September 2023	Fomm ir-Rih	07:30 – 09:30
5 September 2023	Mtahleb to Migra l-Ferha	07:30 – 09:30	12 September 2023	Lapsi	07:05 – 09:30
5 September 2023	Ghar Hassan	08:00 – 10:00	12 September 2023	Rinella	08:00 – 10:00
5 September 2023	White Rocks	08:30 – 10:30	12 September 2023	L-Ahrax	08:30 – 10:30
6 September 2023	Comino	08:00 – 10:00	13 September 2023	Comino	07:00 – 09:00
6 September 2023	Gozo: Marsalforn	07:00 – 09:00	13 September 2023	Gozo: San Blas	07:00 – 09:00
6 September 2023	Anchor Bay	07:30 – 09:30	13 September 2023	Cirkewwa / Paradise Bay	07:10 – 09:10
6 September 2023	Rdum ta Had-Dingli	07:00 – 09:00	13 September 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00
6 September 2023	San Tumas	07:00 – 09:00	13 September 2023	Ghar Hassan	08:00 – 10:00
6 September 2023	Ghallis	07:30 – 09:30	13 September 2023	White Rocks	07:30 – 09:30
7 September 2023	Comino	07:00 – 09:00	14 September 2023	Comino	07:00 – 09:00
7 September 2023	Gozo: Kercem	07:00 – 09:00	14 September 2023	Gozo: Marsalforn	07:00 – 09:00
7 September 2023	Ghajn Tuffieha	07:30 – 09:30	14 September 2023	Anchor Bay	09:30 – 11:30
7 September 2023	Fawwara	07:00 – 09:00	14 September 2023	Rdum ta Had-Dingli	07:30 – 09:30
7 September 2023	Zonqor Point	07:00 – 09:00	14 September 2023	San Tumas	07:15 – 09:15
7 September 2023	Mistra / Mgiebah	07:30 – 09:30	14 September 2023	Ghallis	07:15 – 09:15

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
15 September 2023	Comino	07:00 – 09:00	22 September 2023	Comino	07:00 – 09:00
15 September 2023	Gozo: Kercem	07:00 – 09:00	22 September 2023	Gozo: Marsalforn	07:00 – 09:00
15 September 2023	Ghajn Tuffieha	07:05 – 09:05	22 September 2023	Anchor Bay	08:00 – 10:00
15 September 2023	Fawwara	08:00 – 10:00	22 September 2023	Rdum ta Had-Dingli	07:00 – 09:00
15 September 2023	Zonqor Point	07:00 – 09:00	22 September 2023	San Tumas	07:00 – 09:00
15 September 2023	Mistra / Mgiebah	07:00 – 09:00	22 September 2023	Ghallis	07:00 – 09:00
16 September 2023	Comino	07:00 – 09:00	23 September 2023	Comino	07:00 – 09:00
16 September 2023	Gozo: Ta Cenc	07:00 – 09:00	23 September 2023	Gozo: Kercem	07:00 – 09:00
16 September 2023	Fomm ir-Rih	07:00 – 09:00	23 September 2023	Ghajn Tuffieha	07:30 – 09:30
16 September 2023	Lapsi	07:00 – 09:00	23 September 2023	Fawwara	08:45 – 10:45
16 September 2023	Rinella	07:30 – 09:30	23 September 2023	Zonqor Point	09:15 – 11:15
16 September 2023	L-Ahrax tal-Mellieha	08:00 – 10:00	23 September 2023	Mistra / Mgiebah	07:30 – 09:30
17 September 2023	Comino	07:00 – 09:00	24 September 2023	Comino	07:30 – 09:30
17 September 2023	Gozo: San Blas	07:00 – 09:00	24 September 2023	Gozo: Ta Cenc	07:00 – 09:00
17 September 2023	Cirkewwa / Paradise Bay	07:30 – 09:30	24 September 2023	Fomm ir-Rih	07:15 – 09:15
17 September 2023	Mtahleb to Migra l-Ferha	07:30 – 09:30	24 September 2023	Lapsi	07:30 – 09:30
17 September 2023	Ghar Hassan	08:00 – 10:00	24 September 2023	Rinella	07:15 – 09:15
17 September 2023	White Rocks	07:00 – 09:00	24 September 2023	L-Ahrax tal-Mellieha	07:15 – 09:15
18 September 2023	Comino	07:15 – 09:15	25 September 2023	Comino	07:30 – 09:30
18 September 2023	Gozo: Marsalforn	08:00 – 10:00	25 September 2023	Gozo: San Blas	07:00 – 09:00
18 September 2023	Anchor Bay	07:00 – 09:00	25 September 2023	Cirkewwa / Paradise Bay	07:00 – 09:00
18 September 2023	Rdum ta Had-Dingli	07:10 – 09:10	25 September 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00
18 September 2023	San Tumas	08:00 – 10:00	25 September 2023	Ghar Hassan	07:00 – 09:00
18 September 2023	Ghallis	07:00 – 09:00	25 September 2023	White Rocks	07:00 – 09:00
19 September 2023	Comino	07:00 – 09:00	26 September 2023	Comino	07:30 – 09:30
19 September 2023	Gozo: Kercem	07:00 – 09:00	26 September 2023	Gozo: Marsalforn	07:00 – 09:00
19 September 2023	Ghajn Tuffieha	07:30 – 09:30	26 September 2023	Anchor Bay	07:15 – 09:15
19 September 2023	Fawwara	09:00 – 10:00	26 September 2023	Rdum ta Had-Dingli	07:00 – 09:00
19 September 2023	Zonqor Point	07:00 – 09:00	26 September 2023	San Tumas	08:00 – 10:00
19 September 2023	Mistra / Mgiebah	07:00 – 09:00	26 September 2023	Ghallis	07:30 – 09:30
20 September 2023	Comino	07:05 – 09:05	27 September 2023	Comino	07:15 – 09:15
20 September 2023	Gozo: Ta Cenc	07:00 – 09:00	27 September 2023	Gozo: Kercem	07:00 – 09:00
20 September 2023	Fomm ir-Rih	07:00 – 09:00	27 September 2023	Ghajn Tuffieha	08:00 – 10:00
20 September 2023	Lapsi	07:00 – 09:00	27 September 2023	Fawwara	07:00 – 09:00
20 September 2023	Rinella	07:30 – 09:30	27 September 2023	Zonqor Point	07:30 – 09:30
20 September 2023	L-Ahrax tal-Mellieha	07:00 – 09:00	27 September 2023	Mistra / Mgiebah	09:00 – 11:00
21 September 2023	Comino	07:00 – 09:00	28 September 2023	Comino	07:30 – 09:30
21 September 2023	Gozo: San Blas	07:00 – 09:00	28 September 2023	Gozo: Ta Cenc	07:00 – 09:00
21 September 2023	Cirkewwa / Paradise Bay	07:00 – 09:00	28 September 2023	Fomm ir-Rih	08:00 – 10:00
21 September 2023	Mtahleb to Migra l-Ferha	07:15 – 09:15	28 September 2023	Lapsi	07:00 – 09:00
21 September 2023	Ghar Hassan	07:00 – 09:00	28 September 2023	Rinella	08:30 – 10:30
21 September 2023	White Rocks	07:30 – 09:30	28 September 2023	L-Ahrax tal-Mellieha	07:00 – 09:00

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
29 September 2023	Comino	07:00 – 09:00	6 October 2023	Comino	07:00 – 09:00
29 September 2023	Gozo: San Blas	07:00 – 09:00	6 October 2023	Gozo: Ta Cenc	07:35 – 09:35
29 September 2023	Cirkewwa / Paradise Bay	07:00 – 09:00	6 October 2023	Fomm ir-Rih	07:30 – 09:30
29 September 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00	6 October 2023	Lapsi	07:00 – 09:00
29 September 2023	Ghar Hassan	07:30 – 09:30	6 October 2023	Rinella	07:00 – 09:00
29 September 2023	White Rocks	07:15 – 09:15	6 October 2023	L-Ahrax	07:00 – 09:00
30 September 2023	Comino	07:00 – 09:00	7 October 2023	Comino	07:00 – 09:00
30 September 2023	Gozo: Marsalforn	07:30 – 09:30	7 October 2023	Gozo: San Blas	07:00 – 09:00
30 September 2023	Anchor Bay	07:30 – 09:30	7 October 2023	Cirkewwa / Paradise Bay	07:30 – 09:30
30 September 2023	Rdum ta Had-Dingli	07:00 – 09:00	7 October 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00
30 September 2023	San Tumas	07:00 – 09:00	7 October 2023	Ghar Hassan	07:30 – 09:30
30 September 2023	Ghallis	07:15 – 09:15	7 October 2023	White Rocks	08:00 – 10:00
1 October 2023	Comino	07:00 – 09:00	8 October 2023	Comino	07:30 – 09:30
1 October 2023	Gozo: Kercem	07:00 – 09:00	8 October 2023	Gozo: Marsalforn	07:00 – 09:00
1 October 2023	Ghajn Tuffieha	08:00 – 10:00	8 October 2023	Anchor Bay	07:15 – 09:15
1 October 2023	Fawwara	07:30 – 09:30	8 October 2023	Rdum ta Had-Dingli	08:00 – 10:00
1 October 2023	Zonqor Point	08:00 – 10:00	8 October 2023	San Tumas	10:00 – 12:00
1 October 2023	Mistra / Mgiebah	07:30 – 09:30	8 October 2023	Ghallis	07:15 – 09:15
2 October 2023	Comino	07:00 – 09:00	9 October 2023	Comino	07:00 – 09:00
2 October 2023	Gozo: Ta Cenc	07:00 – 09:00	9 October 2023	Gozo: Kercem	07:00 – 09:00
2 October 2023	Fomm ir-Rih	07:15 – 09:15	9 October 2023	Ghajn Tuffieha	07:30 – 09:30
2 October 2023	Lapsi	07:00 – 09:00	9 October 2023	Fawwara	08:00 – 10:00
2 October 2023	Rinella	07:00 – 09:00	9 October 2023	Zonqor Point	10:00 – 12:00
2 October 2023	L-Ahrax tal-Mellieha	07:00 – 09:00	9 October 2023	Mistra / Mgiebah	07:15 – 09:15
3 October 2023	Comino	07:00 – 09:00	10 October 2023	Comino	07:00 – 09:00
3 October 2023	Gozo: San Blas	08:00 – 10:00	10 October 2023	Gozo: Ta Cenc	07:00 – 09:00
3 October 2023	Cirkewwa / Paradise Bay	07:30 – 09:30	10 October 2023	Fomm ir-Rih	07:30 – 09:30
3 October 2023	Mtahleb to Migra l-Ferha	07:15 – 09:15	10 October 2023	Lapsi	07:15 – 09:15
3 October 2023	Ghar Hassan	09:00 – 11:00	10 October 2023	Rinella	08:00 – 10:00
3 October 2023	White Rocks	07:00 – 09:00	10 October 2023	L-Ahrax	07:30 – 09:30
4 October 2023	Comino	07:00 – 09:00	11 October 2023	Comino	07:00 – 09:00
4 October 2023	Gozo: Marsalforn	08:00 – 10:00	11 October 2023	Gozo: San Blas	07:00 – 09:00
4 October 2023	Anchor Bay	07:30 – 09:30	11 October 2023	Cirkewwa / Paradise Bay	07:30 – 09:30
4 October 2023	Rdum ta Had-Dingli	07:15 – 09:15	11 October 2023	Mtahleb to Migra l-Ferha	09:00 – 11:00
4 October 2023	San Tumas	10:00 – 12:00	11 October 2023	Ghar Hassan	09:00 – 11:00
4 October 2023	Ghallis	07:30 – 09:30	11 October 2023	White Rocks	07:30 – 09:30
5 October 2023	Comino	07:00 – 09:00	12 October 2023	Comino	07:00 – 09:00
5 October 2023	Gozo: Kercem	07:00 – 09:00	12 October 2023	Gozo: Marsalforn	07:00 – 09:00
5 October 2023	Ghajn Tuffieha	07:15 – 09:15	12 October 2023	Anchor Bay	07:30 – 09:30
5 October 2023	Fawwara	07:15 – 09:15	12 October 2023	Rdum ta Had-Dingli	07:30 – 09:30
5 October 2023	Zonqor Point	07:30 – 09:30	12 October 2023	San Tumas	08:00 – 10:00
5 October 2023	Mistra / Mgiebah	07:00 – 09:00	12 October 2023	Ghallis	07:45 – 09:45

APPENDIX II continued.

Date	Location	Observation time	Date	Location	Observation time
13 October 2023	Comino	07:30 – 09:30	20 October 2023	Comino	07:30 – 09:30
13 October 2023	Gozo: Kercem	07:00 – 09:00	20 October 2023	Gozo: Marsalforn	07:00 – 09:00
13 October 2023	Ghajn Tuffieha	07:30 – 09:30	20 October 2023	Anchor Bay	07:15 – 09:15
13 October 2023	Fawwara	08:00 – 10:00	20 October 2023	Rdum ta Had-Dingli	07:20 – 09:20
13 October 2023	Zonqor Point	08:00 – 10:00	20 October 2023	San Tumas	07:00 – 09:00
13 October 2023	Mistra / Mgiebah	07:00 – 09:00	20 October 2023	Ghallis	07:30 – 09:30
14 October 2023	Comino	07:00 – 09:00	21 October 2023	Comino	07:00 – 09:00
14 October 2023	Gozo: Ta Cenc	07:00 – 09:00	21 October 2023	Gozo: Kercem	07:00 – 09:00
14 October 2023	Fomm ir-Rih	10:00 – 12:00	21 October 2023	Ghajn Tuffieha	07:30 – 09:30
14 October 2023	Lapsi	07:45 – 09:45	21 October 2023	Fawwara	08:00 – 10:00
14 October 2023	Rinella	08:00 – 10:00	21 October 2023	Zonqor Point	07:15 – 09:15
14 October 2023	L-Ahrax tal-Mellieha	07:30 – 09:30	21 October 2023	Mistra / Mgiebah	07:00 – 09:00
15 October 2023	Comino	07:00 – 09:00	22 October 2023	Comino	07:00 – 09:00
15 October 2023	Gozo: San Blas	07:30 – 09:30	22 October 2023	Gozo: Ta Cenc	07:30 – 09:30
15 October 2023	Cirkewwa / Paradise Bay	08:00 – 10:00	22 October 2023	Fomm ir-Rih	09:00 – 11:00
15 October 2023	Mtahleb to Migra l-Ferha	07:30 – 09:30	22 October 2023	Lapsi	07:30 – 09:30
15 October 2023	Ghar Hassan	07:00 – 09:00	22 October 2023	Rinella	07:30 – 09:30
15 October 2023	White Rocks	08:00 – 10:00	22 October 2023	L-Ahrax tal-Mellieha	07:30 – 09:30
16 October 2023	Comino	07:30 – 09:30	23 October 2023	Comino	07:00 – 09:00
16 October 2023	Gozo: Marsalforn	07:00 – 09:00	23 October 2023	Gozo: San Blas	07:00 – 09:00
16 October 2023	Anchor Bay	08:00 – 10:00	23 October 2023	Cirkewwa / Paradise Bay	07:30 – 09:30
16 October 2023	Rdum ta Had-Dingli	07:30 – 09:30	23 October 2023	Mtahleb to Migra l-Ferha	07:30 – 09:30
16 October 2023	San Tumas	07:00 – 09:00	23 October 2023	Ghar Hassan	08:00 – 10:00
16 October 2023	Ghallis	07:30 – 09:30	23 October 2023	White Rocks	07:30 – 09:30
17 October 2023	Comino	07:30 – 09:30	24 October 2023	Comino	07:00 – 09:00
17 October 2023	Gozo: Kercem	07:00 – 09:00	24 October 2023	Gozo: Marsalforn	07:00 – 09:00
17 October 2023	Ghajn Tuffieha	07:30 – 09:30	24 October 2023	Anchor Bay	07:30 – 09:30
17 October 2023	Fawwara	08:00 – 10:00	24 October 2023	Rdum ta Had-Dingli	08:30 – 10:30
17 October 2023	Zonqor Point	07:30 – 09:30	24 October 2023	San Tumas	07:00 – 09:00
17 October 2023	Mistra / Mgiebah	07:30 – 09:30	24 October 2023	Ghallis	07:30 – 09:30
18 October 2023	Comino	07:00 – 09:00	25 October 2023	Comino	07:00 – 09:00
18 October 2023	Gozo: Ta Cenc	07:00 – 09:00	25 October 2023	Gozo: Kercem	07:00 – 09:00
18 October 2023	Fomm ir-Rih	07:25 – 09:25	25 October 2023	Ghajn Tuffieha	08:00 – 10:00
18 October 2023	Lapsi	08:00 – 10:00	25 October 2023	Fawwara	08:00 – 10:00
18 October 2023	Rinella	07:30 – 09:30	25 October 2023	Zonqor Point	07:00 – 09:00
18 October 2023	L-Ahrax tal-Mellieha	07:30 – 09:30	25 October 2023	Mistra / Mgiebah	08:00 – 10:00
19 October 2023	Comino	07:00 – 09:00	26 October 2023	Comino	07:00 – 09:00
19 October 2023	Gozo: San Blas	07:00 – 09:00	26 October 2023	Gozo: Ta Cenc	07:00 – 09:00
19 October 2023	Cirkewwa / Paradise	07:15 – 09:15	26 October 2023	Fomm ir-Rih	07:30 – 09:30
19 October 2023	Mtahleb to Migra l-	07:30 – 09:30	26 October 2023	Lapsi	07:30 – 09:30
19 October 2023	Ghar Hassan	08:00 – 10:00	26 October 2023	Rinella	07:30 – 09:30
19 October 2023	White Rocks	07:30 – 09:30	26 October 2023	L-Ahrax tal-Mellieha	07:30 – 09:30

APPENDIX II continued.

Date	Location	Observation time
27 October 2023	Comino	07:00 – 09:00
27 October 2023	Gozo: San Blas	07:00 – 09:00
27 October 2023	Cirkewwa / Paradise Bay	07:30 – 09:30
27 October 2023	Mtahleb to Migra l-Ferha	07:00 – 09:00
27 October 2023	Ghar Hassan	07:10 – 09:10
27 October 2023	White Rocks	07:30 – 09:30
28 October 2023	Comino	07:00 – 09:00
28 October 2023	Gozo: Marsalforn	07:00 – 09:00
28 October 2023	Anchor Bay	08:00 – 10:00
28 October 2023	Rdum ta Had-Dingli	07:00 – 09:00
28 October 2023	San Tumas	08:00 – 10:00
28 October 2023	Ghallis	07:30 – 09:30
29 October 2023	Comino	07:00 – 09:00
29 October 2023	Gozo: Kercem	07:30 – 09:30
29 October 2023	Ghajn Tuffieha	07:00 – 09:00
29 October 2023	Fawwara	07:30 – 09:30
29 October 2023	Zonqor Point	07:00 – 09:00
29 October 2023	Mistra / Mgiebah	07:30 – 09:30
30 October 2023	Comino	07:00 – 09:00
30 October 2023	Gozo: Ta Cenc	07:00 – 09:00
30 October 2023	Fomm ir-Rih	07:30 – 09:30
30 October 2023	Lapsi	07:30 – 09:30
30 October 2023	Rinella	07:00 – 09:00
30 October 2023	L-Ahrax tal-Mellieha	07:30 – 09:30
31 October 2023	Comino	07:00 – 09:00
31 October 2023	Gozo: San Blas	07:00 – 09:00
31 October 2023	Cirkewwa / Paradise Bay	08:00 – 10:00
31 October 2023	Mtahleb to Migra l-Ferha	08:00 – 10:00
31 October 2023	Ghar Hassan	08:00 – 10:00
31 October 2023	White Rocks	07:30 – 09:30