LIFE14 PRE/UK/000002

International Single Species Action Plan for the Conservation of the European Turtle-dove *Streptopelia turtur* (2018 to 2028)

European Union (EU)

International Single Species Action Plan for the Conservation of the European Turtle-dove

Streptopelia turtur

LIFE14 PRE/UK/000002 Project

May 2018

Produced by
Royal Society for the Protection of Birds (RSPB)

Prepared in the framework of the
EuroSAP (LIFE14 PRE/UK/000002) LIFE preparatory project, coordinated by BirdLife International and co-financed by the European Commission Directorate General for the Environment, the African-Eurasian Migratory Waterbird Agreement (AEWA), and each of the project partners

Disclaimer and date of adoption/approval:
- Approved at the European Union Nature Directives Expert Group meeting on the 22-23 May 2018 by Member States of the European Union, with the following disclaimer:
  - Malta, Spain, Romania and and the Federation of Associations for Hunting and Conservation of the EU (FACE) do not support measure 3.1.1 "*Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed*",
  - Portugal will support Action 3.1.1 only if it is applied in all Member-states along the western flyway range, in order to be effective,
  - France considers that measure 3.1.1 is not relevant on its territory because it will implement an adaptive harvest management modelling framework from the beginning of 2019,
  - Austria opposes the moratorium, since it considers it goes beyond the requirements of the Birds Directive,
  - Bulgaria, Cyprus and Greece do not approve the Species Action Plan because of the inclusion of measure 3.1.1.
- The final position of Italy and still needs to be confirmed (20/09/2018).
- To be adopted by the 48th meeting of the CMS Standing Committee on 23-24 October 2018.

Adopting/Approval Frameworks:
European Union (EU)
Convention on the Conservation of Migratory Species of Wild Animals (CMS)

This International Single Species Action Plan for the Conservation of the European Turtle-dove was prepared in the framework of the LIFE EuroSAP project (LIFE14 PRE/UK/000002), co-financed by the European Commission Directorate General for the Environment, the African-Eurasian Migratory Waterbird Agreement (AEWA), and by each of the project partners, and coordinated by BirdLife International. The preparation of this Action Plan was coordinated by the Royal Society for the Protection of Birds (RSPB).

Compilers: Ian Fisher[1], Joscelyne Ashpole[1], David Scallan[2], Tara Proud[1] and Carles Carboneras[1].
[1]RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL, United Kingdom.
[2]European Federation for Hunting and Conservation (FACE), Rue Belliard 205, 1000 Brussels, Belgium.

Contributors*

Algeria: Ettayib Bensaci (ANAO); **Armenia:** Mamikon Ghasabyan (Armenian Society for the Protection of Birds);
Austria: Michael Dvorak (BirdLife Österreich, BirdLife Austria), Peter Lebersorger (Zentralstelle Österreichischer Landesjagdverbände), Norbert Teufelbauer (BirdLife Österreich, BirdLife Austria); **Azerbaijan:** Sevinj Humbatova (Baku State University), Elchin Sultanov (AOS, BirdLife Azerbaijan); **Belarus:** Siamion Levy (APB, BirdLife Belarus), Maxim Nemtchinov (APB, BirdLife Belarus), Alexandre Vintchevski (APB, BirdLife Belarus); **Belgium:** Thomas Defoort (Flemish Government), Gerald Driessens (Natuurpunt, BirdLife Belgium, Flanders), Sandrine Liegeois (Department of Nature and Forests), Els Martens (Flemish Government), Jean-Yves Paquet (Ornithological Society Aves), Michiel Vandegehuchte (Nature Agency), Floris Verhaeghe (Flemish Government), Glenn Vermeersch (Flemish Nature and Forest Research Institute); **Bulgaria:** Kristin Bakardzhieva (Union of Hunters and Anglers in Bulgaria), Valeri Georgiev (National Nature Protection Service), Grigor Gogov (Executive Forest Agency, Ministry of Agriculture, Food and Forestry), Iordan Hristov (BSPB, BirdLife Bulgaria), Petar Iankov (BSPB, BirdLife Bulgaria), Mihail Mihaylov (Ministry of Environment and Water), Svetoslav Spasov (BSPB, BirdLife Bulgaria), Vasil Vasilev (Union of Hunters and Anglers in Bulgaria), Krasimir Zhivkov (Ministry of Environment and Water); **Croatia:** Sanja Barišić (Institute of Ornithology CASA), Ivan Budinski (BIOM, BirdLife Croatia), Zrinka Domazetović (Ministry of Environment and Energy), Ivana Jelenić (Ministry of Environment and Energy), Sven Kapelj (BIOM, BirdLife Croatia), Jelena Kralj (Institute of Ornithology CASA), Vesna Tutiš (Institute of Ornithology CASA); **Cyprus:** Haris Hadjistyllis (Cyprus Game and Fauna Service), Christina Ieronymidou (BirdLife Cyprus), Nicos Kassinis (Cyprus Game and Fauna Service), Panicos Panayides (Cyprus Game and Fauna Service); **Czech Republic:** Jan Havlíček (Department of Zoology, University of South Bohemia; Nature Conservation Agency of the Czech Republic), Pavlína Kuncová (Department of Species Protection and Implementation of International Commitments, Ministry of Environment), Jana Škorpilová (ČSO, BirdLife Czech Republic), Zdeněk Vermouzek (ČSO, BirdLife Czech Republic); **Denmark:** Iben Hove Sørensen (Danish Hunters Association), Timme Nyegaard (DOF, BirdLife Denmark), Lars Rudfeld (Nature Planning and Biodiversity, Ministry of Environment); **Estonia:** Jaanus Elts (EOS, BirdLife Estonia), Renno Nellis (Eestimaa Looduse Fond); **Finland:** Heikki Korpelainen (Department of Agricultural Sciences, University of Helsinki), Teemu Lehtiniemi (BirdLife Finland); **France:** Jean-Pierre Arnauduc (La Fédération Nationale des Chasseurs), Jacques Comolet-Tirman (Muséum National d'Histoire Naturelle), Alexandre Czajkowski (OMPO), Bernard Deceuninck (LPO, BirdLife France), Cyril Eraud (ONCFS), Yves Ferrand (ONCFS), Nidal Issa (LPO, BirdLife France), Frederic Jiguet (Muséum National d'Histoire Naturelle), Hervé Lormée (ONCFS), Yves Muller (LPO, BirdLife France/SEOF); **The Gambia:** Clive R Barlow (Birds of The Gambia), Stephen Brown (GCT), Habitat Solomon Jallow (WABSA), Lamin Jobaate (WABSA), Mohamed Lamin Kassama (WABSA), Ebrima Njie (University of the Gambia), Modou Njie (WABSA), Lamin Sanyang (WABSA), Abdoulie Sawo (Department of Parks and Wildlife Management); **Germany:** Malte Busch (Dachverband Deutscher Avifaunisten), Lars Lachmann (NABU, BirdLife Germany), Benjamin Metzger (NABU, BirdLife Germany), Petra Quillfeldt (Justus Liebig Universität Gießen), Sven Trautmann (Dachverband Deutscher Avifaunisten); **Greece:** Dimitrios E Bakaloudis (Aristotle University of Thessaloniki), Christos Barboutis (HOS, BirdLife Greece), Danae Portolou (HOS, BirdLife Greece), Kyriakos Skordas (Hunting Federation of Macedonia and Thrace); **Hungary:** Attila Bankovics (Hungarian Natural History Museum), Zoltán Czirák (Ministry of Agriculture), Gergö Gábor Nagy (Department of Nature Conservation, Ministry of Agriculture), Gabriella Göcző (MME, BirdLife Hungary), Gergő Halmos (MME, BirdLife Hungary), Gábor Magyar (Kiskunsági Nemzeti Park), Károly Nagy (MME, BirdLife Hungary), András Schmidt (Ministry of Agriculture), Tibor Szép (University of Nyíregyháza), Béla Tokody (MME, BirdLife Hungary); **Ireland:** Ciaran O'Keeffe (Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs); **Israel:** Ohad Hatsofe (Israel Nature and Parks Authority), Eli Haviv (SPNI, BirdLife Israel), Yoav Perlman (SPNI, BirdLife Israel); **Italy:** Alessandro Andreotti (ISPRA), Elisabetta de Carli (MITO2000), Claudio Celada (LIPU, BirdLife Italy), Eugenio Duprè (ISPRA), Lorenzo Fornasari (MITO2000), Marco Gustin (LIPU, BirdLife Italy), Lorenzo Serra (ISPRA), Michele Sorrenti (Migratory Bird Office, Federazione Italiana della Caccia), Fernando Spina (ISPRA), Guido Tellini Florenzano (MITO2000), Marco Valentini (Ministerio dell'Ambiente); **Latvia:** Ainars Aunins (University of Latvia), Gita Strode (Nature Conservation Department); **Lebanon:** Shadi Indary (Institute of the Environment, University of Balamand), Ghassan Ramadan Jaradi (SPNL, BirdLife Lebanon); **Lithuania:** Džiugas Anuškevicius (Protected Area Strategy Division), Petras Kurlavicius (Lietuvos Edukologijos Universitetas), Liutauras Raudonikis (LOD, BirdLife Lithuania); **Luxembourg:** Mikis Bastian (natur&ëmwelt, BirdLife Luxembourg), Gilles Biver (Department of Environment, Ministry of Sustainable Development and Infrastructure); **Mali:** Abdoulaye Diallo (AMCFE), Moussa Sissoko (Direction Nationale des Eaux et Forêts); **Malta:** Nicholas Barbara (BirdLife Malta), Elaine Caruana (WBRU), Sergei Golovkin (WBRU), Richard Lia (WBRU), Anton Spiteri Shaw (Maltese Government), Josette Zerafa (Policy Department and Programme Implementation Directorate); **Mauritania:** Djibril Diallo (Nature Mauritanie, BirdLife Mauritania); **Moldova:** Vitalie Grimalschi (Society for Bird and Nature Protection); **Montenegro:** Darko Saveljic (Center for Protection and Research of Birds of Montenegro); **Morocco:** Ali El Ayoubi (Service de la Cynégétique et de la Pisciculture Continentale), Mohamed Dakki (GREPOM, BirdLife Morocco), Saâd Hanane (Forest Research Centre/High Commission For Water, Forests and Combating Desertification); **Netherlands:** Jules Bos (Vogelbescherming Nederland, BirdLife Netherlands), Ruud Foppen (SOVON, Dutch Centre for Field Ornithology), Wilmar J. Remmelts (Department of Nature and Biodiversity, Ministry of Economic Affairs), Chris van Turnhout (SOVON Dutch Centre for Field Ornithology); **Nigeria:** Joseph Onoja (Nigerian Conservation Foundation, BirdLife Nigeria); **Palestinian Territory:** Imad Atrash (Palestine Wildlife Society, BirdLife Palestine); **Poland:** Tomasz Chodkiewicz (OTOP, BirdLife Poland), Jakub Milczarek (Nature Conservation Department, General Directorate for Environmental Protection); **Portugal:** Júlia Almeida (Instituto da Conservação da Natureza e das Florestas), Gonçalo Nuno Carrasqueira Lopes (Instituto da Conservação da Natureza e das Florestas), Susana Dias (CEABN/InBIO, University of Lisbon), Domingos Leitão (SPEA, BirdLife Portugal), Gonçalo Lopes (Instituto da Conservação da Natureza e das Florestas), Joao Queiros (CIBIO/InBIO), Joaquim Teodósio (SPEA, BirdLife Portugal); **Romania:** Sebastian Bugariu (SOR, BirdLife Romania), Zoltán Szabo (Babeş-Bolyai University); **Russia:** Alexander Mischenko (Russian Society for Bird Conservation and Study, Birds Russia), Evgeny Syroechkovskiy (Russian Society for Bird Conservation and Study, Birds Russia); **Senegal:** Mouhamadou Aliou Bah (Nature Communautés Développement), Adrien Coly (Nature Communautés Développement), Moussa-Séga Diop (Nature Communautés Développement), Malang Saar (Nature Communautés Développement), Paul Ndiaye (Nature Communautés Développement), Issa Sylla (Nature Communautés Développement); **Serbia:** Milan Ružić (Bird Protection and Study Society of Serbia, BirdLife Serbia); **Slovakia:** Ivana Czocherova

(SOS, BirdLife Slovakia), Miro Demko (SOS, BirdLife Slovakia), Jozef Ridzoň (SOS, BirdLife Slovakia), Imrich Šuba (Slovenský Poľovnícky Zväz); **Slovenia:** Andrej Bibic (Sector for Nature Conservation), Primož Kmecl (DOPPS, BirdLife Slovenia); **Spain:** Beatriz Arroyo López (Instituto de Investigacion en Recursos Cinegeticos), Juan Carlos Atienza (SEO/BirdLife), David Howell (SEO/BirdLife), Oscar Beltrán (Oficina Nacional de Caza), Sara Cabezas (SEO/BirdLife), Ana Carricondo (SEO/BirdLife), Virginia Escandell (SEO/BirdLife), Sebastian J Hidalgo de Trucios (Research Group on Wildlife, Game Resources, and Biodiversity, University of Extremadura), Miguel Aymerich Huyghues-Despointes (Dirección General de Calidad y Evaluación Ambiental y Medio Natural), José Manuel Jaquotot Saenz de Miera (Dirección General de Desarrollo Rural y Política Forestal), Rubén Moreno-Opo Díaz-Meco (Dirección General de Calidad y Evaluación Ambiental y Medio Natural), Nicolás López-Jiménez (SEO/BirdLife), Juan Carlos del Moral (SEO/BirdLife), Lara Moreno Zárate (Instituto de Investigacion en Recursos Cinegeticos), Jorge F Orueta (SEO/BirdLife), Gregorio Rocha (Veterinary School, University of Extremadura); **Sweden:** David Schonberg-Alm (Research and Assessment Department, Swedish Environmental Protection Agency); **Switzerland:** Raffael Ayé (BirdLife Switzerland), Werner Müller (BirdLife Switzerland), Hans Schmidt (Swiss Ornithological Institute), Martin Schuck (BirdLife Switzerland); **Syria:** Nabegh Ghazal Asswad (SSCW, BirdLife Syria); **Tunisia:** Guidara Hela Selman (Point Focal Tunisie CMS/ AEWA), Sami Rebah (AAO, BirdLife Tunisia); **Turkey:** Zeynel Arslangündogdu (Forestry Department, Istanbul University), Levent Erkol (Doğa Derneği, BirdLife Turkey); **Ukraine:** Igor Gorban (Ivan Franko Lviv National University), Tatiana Kuzmenko (USPB, BirdLife Ukraine), Ganna Kuzyo (USPB, BirdLife Ukraine); **United Kingdom:** Keith Bensusan (Gibraltar Ornithological and Natural History Society), Pamela Braham (RSPB, BirdLife UK), Kate Brickett (Department for Environment, Food and Rural Affairs), Wendy Cain (RSPB, BirdLife UK), Andrew Callender (RSPB, BirdLife UK), Carole Cook (RSPB, BirdLife UK), Nicola Crockford (RSPB, BirdLife UK) Jenny Dunn (RSPB, BirdLife UK), Nick Folkard (RSPB, BirdLife UK), Richard Gregory (RSPB, BirdLife UK), Phil Grice (Natural England), Kate Hand (RSPB, BirdLife UK), Sarah Harris (BTO), Maija Marsh (RSPB, BirdLife UK), Tony Morris (RSPB, BirdLife UK), David Noble (BTO), Chris Orsman (RSPB, BirdLife UK), Will Peach (RSPB, BirdLife UK), Emma Phillimore (Department for Environment, Food and Rural Affairs), David Stroud (Joint Nature Conservation Committee), Peter Taylor (RSPB, BirdLife UK), Jonathan Tweney (Department for Environment, Food and Rural Affairs), Tim Wacher (Zoological Society of London); **Other:** Marita Arvela (DG ENV.D3 Nature Protection Unit), Olivier Biber (UNEP/CMS/AEMLWG), Willem van den Bossche (BirdLife Europe Secretariat), Micheál Ó Briain (DG ENV.D3 Nature Protection Unit), Anne-Laure Brochet (BirdLife International), Joost Brouwer (Brouwer Consultancy, West African Bird Database), Ariel Brunner (BirdLife Europe Secretariat), Sofia Capellan (BirdLife Europe Secretariat), Phillip Hall, Borja Heredia (CMS), Vicky Jones (BirdLife International), Leon Lamprecht (African Parks), Wim Mullié (Fondation Agir pour l'Education et la Santé), Alex Ngari (BirdLife Africa Secretariat/AEMLAP), Iván Ramírez (BirdLife Europe Secretariat), Tilman Schneider (CMS), Anna Staneva (BirdLife Europe Secretariat), José Tavares (Vulture Conservation Foundation), Zoltan Waliczky (BirdLife International).

*The Action Plan compilers have considered all comments submitted during the review stages of this project. Where there have been conflicting opinions, the available evidence has been assessed and content developed to reflect this.

Lifespan of Plan: 2018 – 2028

This International Species Action Plan should be reviewed and updated every 10 years (first revision in 2028). An emergency review will be undertaken if there is a significant change to the species' status before the next scheduled review.

Milestones in the production of the Plan:

Development of Species Status Report (Fisher *et al* 2016a): June to December 2016 (initial questionnaire, with two drafts circulated for comment).

Review of existing EU Species Management Plan (Fisher *et al* 2016b): June to November 2016 (initial questionnaire, with one draft circulated for comment).

Stakeholder workshop for western flyway: 19-21 December 2016, Valsain, Spain. Facilitators: Ian Fisher (RSPB, BirdLife UK), José Tavares (Vulture Conservation Foundation) and Joscelyne Ashpole (RSPB, BirdLife UK).

Stakeholder workshop for central and eastern flyway: 16-18 January 2017, Kecskemét, Hungary. Facilitators: Ian Fisher (RSPB, BirdLife UK), José Tavares (Vulture Conservation Foundation), Anna Staneva (BirdLife Europe Secretariat) and Joscelyne Ashpole (RSPB, BirdLife UK).

First draft (version 1): April 2017, circulated to the Expert Group on the Birds and Habitats Directive (NADEG) and experts across the species Range States.

Interim draft (version 1.5): June 2017, circulated to the Expert Group on the Birds and Habitats Directive (NADEG) and experts across the species Range States.

Second draft (version 2): October 2017, circulated to the Expert Group on the Birds and Habitats Directive (NADEG) and experts across the species Range States.

Final draft: May 2018, circulated to the Expert Group on the Birds and Habitats Directive (NADEG) and experts across the species Range States.

Recommended citation: Fisher I, Ashpole J, Scallan D, Proud T and Carboneras C (compilers) (2018) International Single Species Action Plan for the conservation of the European Turtle-dove *Streptopelia turtur* (2018 to 2028). European Commission 2018

Picture on the front cover: Turtle-dove (*Streptopelia turtur*) © Dmitry Yakubovich.

In 1947, Aldo Leopold wrote in his On a Monument to the Pigeon*:*

"Men still live who, in their youth, remember pigeons; trees still live who, in their youth, were shaken by a living wind. But a few decades hence only the oldest oaks will remember, and at long last only the hills will know" (Leopold, 1953).

He was referring to the passenger pigeon of North America, once numbering over 3 billion individuals, but now extinct through a lethal combination of causes early in the 20th century. With rapid declines across much of its range, the time for action for the European turtle-dove is now... before it is too late.

Manuscript completed in August 2018

Luxembourg: Publications Office of the European Union, 2018

PDF ISBN 978-92-79-92959-5 doi:10.2779/743376 KH-03-18-241-EN-N

In memory of Igor Gorban, who passed away before the final publication of this Action Plan.

Contents

TABLES

FIGURES

0 - Executive Summary

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

At the global level, the species was uplisted in 2015 from Least Concern to Vulnerable on the IUCN Red List. It is considered Near Threatened in the EU28 and Vulnerable in BirdLife International's Europe region (BirdLife International 2015). Populations are decreasing in many Member States. Breeding numbers show an overall decline (from the 1970s), especially in western Europe.

The turtle-dove is listed on Annex II/part B of the Birds Directive as a species for which hunting is permitted in the following ten Member States: Austria, Bulgaria, Cyprus, France, Greece, Italy, Malta, Portugal, Romania and Spain. It is an important quarry species in these countries, with estimates of approximately two million birds harvested annually. The nominate subspecies, *Streptopelia t. turtur* is also listed on Appendix II of the Convention on Migratory Species (CMS) as requiring international concerted action.

The three main threats to the species identified from expert opinion (two action planning workshops and wide consultation) are:

- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, critically during spring migration and in the breeding season;
- unsustainable hunting levels.

See Annex 2: PROBLEM ANALYSIS, page 88 for more details.

Other threats include:

- disease (eg *Trichomonas gallinae*);
- competition with other species;
- accidental and deliberate poisoning;
- weather events and climate change.

There remains a substantial knowledge gap on the threats that the species faces on the wintering grounds, south of the Sahara. This gap must be urgently filled in order to understand the factors negatively affecting the turtle-dove.

The **goal** of this Action Plan is:
To restore the European turtle-dove to a favourable population status so that it can be safely removed from the Globally Threatened categories of the IUCN Red List.

The **high level objective** is:
To halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next Action Plan (2028-2038).

The seven **objectives** detailed in the Framework for Action are:

Direct conservation actions (most critical first):

1. good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2. illegal killing in the European Union is eradicated and reduced elsewhere;
3. hunting across the range of the European turtle-dove is carried out at sustainable levels;
4. good quality habitats, with available and accessible water and food, are maintained and increased at key sites for stopover and wintering.

Supporting actions:

5. international co-operation is enhanced, through enabling sharing of information and expertise;
6. stakeholder awareness is raised;
7. knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds.

Section 2 Stakeholder summaries - results and actions starting on page 37 includes stakeholder-based quick reference action lists. All actions can be found in 2 – FRAMEWORK FOR ACTION on page 16.

1 - Basic Data

Taxonomy and bio-geographic populations

The European turtle-dove (*Streptopelia turtur*) is the smallest representative of the dove family in Europe. Its breeding area stretches from Europe to Asia and North Africa. There are four subspecies: *S. t. turtur* breeds from the UK east to Poland and northern Russia, and south to the northern Mediterranean coast as well as in the Canary Islands, Asia Minor and from Syria to Kazakhstan and western Siberia; *S. t. arenicola* breeds from Morocco east to Tripoli, and from Iraq and Iran east through Afghanistan, Turkestan and the Kyrgyz steppe to north-west China; *S. t. hoggara* is found in Ahaggar, Aïr, Tibesti and the Ennedi Massifs in the southern Sahara; *S. t. rufescens* is found in the Kufra Oasis in Libya, Dakhla and Kharga Oases in Egypt, as well as Faiyûm, and parts of the Nile Valley (Baptista *et al* 2018). All four subspecies appear to co-occur and mix on the wintering grounds.

The breeding area in Europe stretches from Portugal east to the Urals, and from the 35th parallel to the 65th parallel north (see Figure 1). Major breeding populations in Europe are found in the Mediterranean countries, and the European population is entirely migratory, wintering in Sahelian Africa from Senegal to Eritrea (Glutz von Blotzheim 1980, Geroudet 1983, Cramp 1985). Although the European population is still large, there is evidence that populations in most countries have been declining since the 1970s (BirdLife International 2004). The breeding range of the species has decreased in either the short or long term in nine EU Member States (EIONET 2017). For example, in France the range of the species decreased by 20-30% between the 1985-1989 and 2009-2012 breeding atlases (Jacques Comolet-Tirman *pers comm*). Genomic analysis suggests that the species shows signs of a long-term demographic decline, that it is prone to undergoing demographic fluctuations, and that these patterns make it sensitive to anthropogenic threats (Calderón *et al* 2016). The same analysis found no evidence that the species is genetically structured across flyways, at least within the European portion of its range. The populations are likely to face relatively similar threats and conservation actions, where relevant for each flyway, are likely to be similar.

In the EU, the turtle-dove is currently found in all Member States (including all Mediterranean islands) with the exception of Ireland and Sweden, and is absent from the Alpine Arc (Parslow 1967, Sharrock 1976, Snow and Perrins 1998, BirdLife 2016). It only colonized Denmark in the late 1980s, and is almost exclusively confined to the south-western corner of Jutland (mainland Denmark) (Grell *et al* 2004), with a few pockets of colonisation elsewhere. Its distribution is linked to an isotherm of a minimum of 16°C in July (19°C in Great Britain) (Glutz von Blotzheim 1980). In general, the species nests up to an altitude of 350 metres, but it may reach altitudes of up to 1,500 m in some areas (Glutz von Blotzheim 1980, Jarry 1994a, Dias 2016).

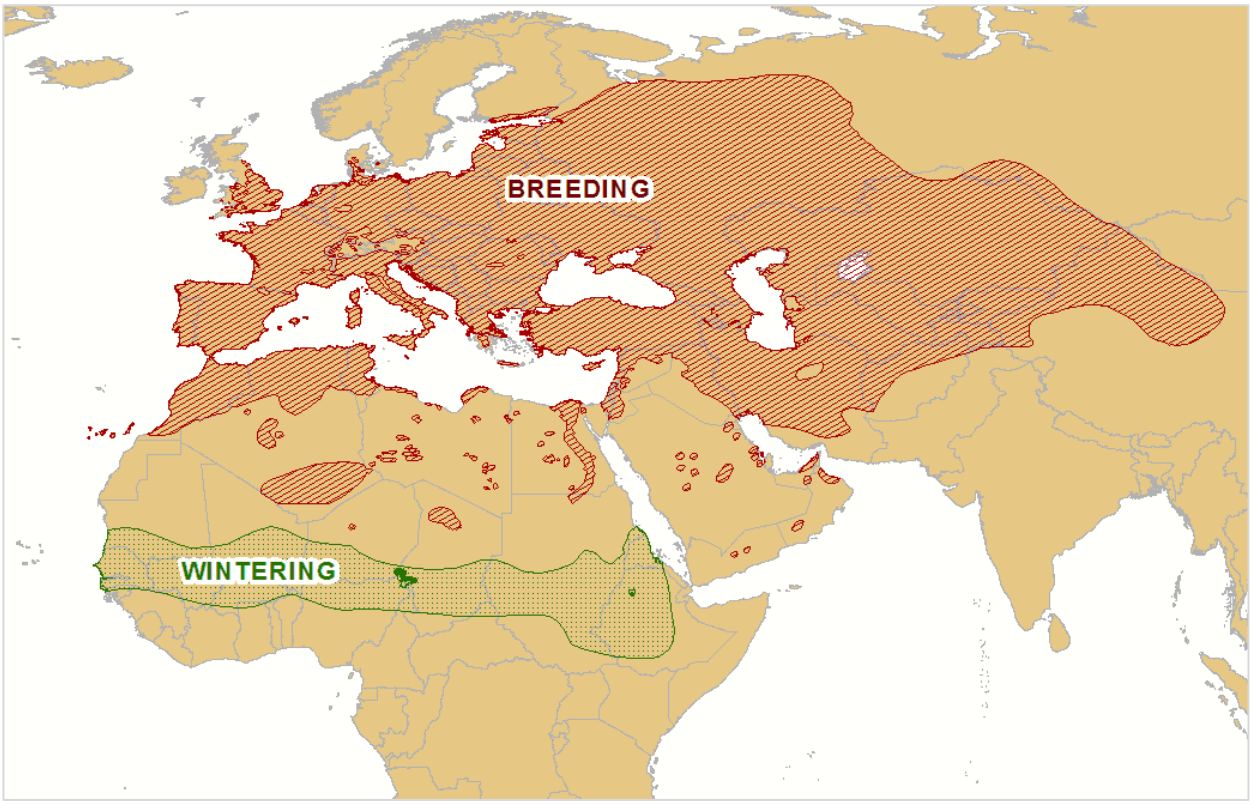


Figure 1. Map of breeding and wintering Range States for *Streptopelia turtur* (all subspecies)

Breeding in red lines, wintering in green spots (BirdLife International 2016).

Table 1. Range States for the European turtle-dove covered by the Action Plan.

Breeding	*Migrating* Autumn: August – November Spring: March – June	*Wintering*
EUROPEAN UNION • Austria • Belgium • Bulgaria • Croatia • Cyprus • Czech Republic • Denmark • Estonia • Finland • France • Germany • Greece • Hungary • Italy • Latvia • Lithuania • Luxembourg • Malta[1] • Netherlands • Poland • Portugal • Romania • Slovakia	The following EU countries have areas of particular importance for staging turtle-doves during migration : • Cyprus • France • Greece • Italy • Malta • Portugal • Spain Non-breeding birds are recorded during the summer in Ireland and Sweden.	None in Europe.

[1] The turtle-dove has not bred in Malta since 1956.

• Slovenia • Spain (and all Islands) • United Kingdom (England, Channel Islands)		
OTHER - *breeding* • Algeria • Albania • Andorra • Armenia • Azerbaijan • Belarus • Bosnia and Herzegovina • Egypt • Georgia • Israel • Jordan • Kosovo (UN Res 1244) • Lebanon • Libya	• Liechtenstein • Macedonia, The former Yugoslav Republic of • Mauritania • Moldova • Montenegro • Morocco • Palestinian Territory • Russian Federation (European) • Serbia • Switzerland • Syria • Tunisia • Turkey • Ukraine	*Wintering* • Benin • Burkina Faso • Cameroon • Central African Republic • Chad • Eritrea • Ethiopia • The Gambia • Ghana • Guinea • Guinea-Bissau • Mali • Mauritania (predominantly migrating) • Niger • Nigeria • Senegal • South Sudan • Sudan • Togo

Turtle-doves are also found eastwards of Europe and the Mediterranean (see Figure 1), but information is scarce. The Framework of Actions includes activities to expand knowledge for these Range States.

Relevant policy and legislation

In the European Union, the turtle-dove benefits from the general protection afforded by the Birds Directive 2009/147/EC to all species of naturally occurring birds in the wild state in the European territory of the EU Member States. It is prohibited to deliberately damage or destroy their nests and eggs, and the birds themselves are protected against deliberate disturbance, especially during the period of breeding and rearing young. In the ten EU Member States where the species may be hunted under national legislation (Austria, Bulgaria, Cyprus, France, Greece, Italy, Malta, Portugal, Romania and Spain, as specified in Annex II/part B of the Birds Directive), hunting should take place outside the pre-nuptial migration (spring) and breeding periods and should comply with the principles of wise use and ecologically balanced control of the species. Hunting must be compatible with maintaining the population at a level that corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements (European Commission 2014).

In a wider international context, the nominate subspecies *S. t. turtur* is listed on Annex II of the Convention on Migratory Species as potentially benefitting from international co-operation in matters of research and conservation measures. In that context, it is listed in the 2014 African-Eurasian Migratory Landbirds Action Plan (AEMLAP), which is aimed at improving the conservation status of migratory landbird species in the African-Eurasian region through the international coordination of action, and catalysing action at the national level. *S. turtur* is listed as Category B (non-threatened species with declining populations), although given current information, it fulfils the criteria to be listed as Category A (Critically Endangered, Endangered, Vulnerable, and Near Threatened migratory landbird species which should be the subject of strict protection measures and subject to a flyway recovery plan). The provisions for the latter include ensuring legal protection throughout their range. An update of status is expected in the near future and this would trigger legal protection measures throughout the turtle-dove range.

International conservation status

IUCN Global Red List	Vulnerable	www.iucnredlist.org/details/22690419/0 (last accessed 7 February 2018)
Pan-European Status	European Species of Global Conservation Concern SPEC 1	BirdLife International (2017)
EU Threat Status	Unfavourable, Near Threatened	BirdLife International (2015)
European Red List	Vulnerable	BirdLife International (2015)

The turtle-dove is now listed as 'Near Threatened' on the basis of relevant data provided by EU Member States as part of the reporting under Article 12 of the Birds Directive[2] for the years 2008-2012.

International and European protection policy and legislation

Instrument	Relevant section	Reference and notes
Bonn Convention/CMS	Appendix II	www.cms.int/en/species/streptopelia-turtur-turtur (last accessed 7 February 2018)
CITES	Not listed	-
Bern Convention	Appendix III	www.coe.int/en/web/conventions/full-list/-/conventions/treaty/104 (last accessed 7 February 2018)
Birds Directive	Annex II/part B	http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R1320 (last accessed 7 February 2018) The turtle-dove is listed on Annex II/part B of the Birds Directive so it may be hunted only in the ten indicated Member States.
Commission Regulation (EU) No 1320/2014 of 1 December 2014 amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein	Annex A	eur-lex.europa.eu/legal-ontent/EN/TXT/PDF/?uri=CELEX:32014R1320&from=EN (last accessed 7 February 2018)

Other EU policies, such as the Common Agricultural Policy (CAP), have an impact on turtle-dove populations, as do plans adopted by Member States under various EU policies (eg Rural Development Plans under the CAP, management plans for Natura 2000 sites under the Birds and Habitats Directives).

Other relevant international policy and legislation

Instrument	Relevant section	Reference
Convention on the Conservation of Migratory Species of Wild Animals	UNEP/CMS/ Resolution 11.17	www.cms.int/en/document/action-plan-migratory-landbirds-african-eurasian-region-aemlap (last accessed 7 February 2018) Resolution 11.17 adopted the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).
	Abuja Declaration	Abuja Declaration on Sustainable Land Use for People and Biodiversity including Migratory Birds in West Africa http://www.cms.int/en/news/workshop-abuja-agrees-key-policies-sustainable-land-use-west-africa (last accessed 7 February 2018)

[2] http://www.birdlife.org/datazone/userfiles/file/Species/erlob/summarypdfs/22690419_streptopelia_turtur.pdf The data from Member States as reported under Article 12 of Birds Directive was used for the European Red list of Birds 2015.

UN Convention to Combat Desertification	ICCD/COP(11) /23/Add.1	http://www2.unccd.int/sites/default/files/sessions/documents/ICCD_COP11_23_Add.1/23add1eng.pdf (last accessed 7 February 2018) UNCCD COP11 decision 22 adopted a Global Wild Bird Index as one of two indicators for its Strategic Objective 3.
Convention on Biological Diversity	Aichi targets 5 and 12	www.cbd.int/sp/targets (last accessed 7 February 2018)

National policies and legislation

The list below shows the National Red List status in the Range States, where known.

Country/Territory	National Red List status (where known)	Abbreviated status
Belgium – Flanders	Critically Endangered (Devos *et al* 2016)	CR
Belgium – Wallonia	Vulnerable (Paquet and Jacob 2010)	VU
Croatia	Least Concern (Tutiš *et al* 2013)	LC
Czech Republic	Least Concern (Šťastný *et al* 2017)	LC
Finland	Critically Endangered (Tiainen *et al* 2016)	CR
France	Vulnerable (UICN France, MNHN, LPO, SEOF and ONCFS 2016)	VU
Germany	Endangered (Grüneberg *et al* 2015)	EN
Greece	Not Evaluated (Legakis and Maragkou 2009)	NE
Hungary	Vulnerable (Gergő Gábor Nagy *pers comm*)	VU
Israel	Near Threatened (Mayrose *et al* 2017)	NT
Italy	Least Concern (IUCN Comitato Italiano 2012)	LC
Luxembourg	Endangered (Lorgé *et al* 2014)	EN
Netherlands	Vulnerable (van Beusekom *et al* 2005)	VU
Portugal	Least Concern (Cabral *et al* 2005)	LC
Russian Federation (European)	Proposed listing of Endangered status in the Red Data Book of the Russian Federation (not finalised). If listed as Endangered, hunting and destruction of nesting habitat will be strictly prohibited in Russia (Alexander Mischenko *pers comm*, Evgeny Syroechkovskiy *pers comm*).	
Spain	Vulnerable (Madroño *et al* 2004)	VU
Switzerland	Near Threatened (Vogelwarte 2016a)	NT
United Kingdom	Red list of Birds of Conservation Concern 4 (Eaton *et al* 2015); Critically Endangered (Stanbury *et al* 2017)	CR

In 2006, the European Union published the *2007-2009 Management Plan for Turtle-dove* (Lutz and Jensen 2007, developed from Boutin 2001), which included the following key measures:

1 Wooded farmland, hedges, and other habitats important for breeding are maintained and better protected.
2 Hunting seasons do not overlap with the breeding period (as defined in “Period of reproduction and prenuptial migration of Annex II bird species in the EU”), and hunting does not affect late breeding birds and birds during spring migration.
3 Annual bag statistics are available (where hunting is allowed).
4 Hunting bags information is collected from key countries outside of the EU where European populations pass on migration and winter (especially Maghreb and sub-Saharan countries).
5 A predictive model is developed to help determine sustainable annual bag.
6 From the existing monitoring schemes, common guidelines for monitoring the species are agreed and used to monitor populations.
7 National ringing activities and analyses of existing ringing data to estimate mortality and identify population units are supported.
8 Annual estimate of breeding success is provided on breeding grounds.
9 Accurate information is gathered on the breeding population size and trend in Turkey and Russia, and on numbers, distribution, and ecology of wintering populations in West Africa.

10 Research on reproduction, mortality, feeding ecology, and effective management is supported. Potential competition with collared dove (*Streptopelia decaocto*) also needs to be investigated.

The 2007-2009 EU Management Plan (Lutz 2007) was reviewed in 2014 (The N2K Group 2014), and more recently in preparation for this Action Plan (Fisher *et al* 2016b, using the methodology developed by BirdLife, Gallo-Orsi 2001). Four short-term objectives were assessed:

Objective 1: improving management and restoration of breeding habitats (review measure 1). This was relevant to 23 Member States, with seven achieving the short-term goal defined in the plan, and another three with partial progress (43% making some positive change).

Objective 2: monitoring and research, including international co-operation (measures 6 to 10). Of the 25 Member States for which this objective was relevant, six made significant progress, and another 16 some progress (88% making some positive change).

Objective 3: analysis of competition between collared dove and turtle-dove (measure 10). This objective was potentially relevant for 22 countries, but none made significant progress.

Objective 4: collection of more robust data to understand the effects of hunting (measures 3 to 5). This objective was relevant only to the 10 Member States where hunting is taking place (Austria, Bulgaria, Cyprus, France, Greece, Italy, Malta, Portugal, Romania, and Spain). Of these, nine collected data, but only Malta and France significantly fulfilled this objective.

Two indices were used to show progress (see Fisher *et al* 2016b for further details on calculating the indices). The National Implementation Score (Figure 2) shows progress of each Member State towards achieving all measures, from 1 (little or no implementation) to 4 (full implementation). The Average Implementation Score (Figure 3) shows progress of each measure across all relevant Member States, from 0 (none) to 4 (full implementation). See also Annex 8: EUROPEAN MEMBER STATE CODES.

Member States that had already banned hunting before the period of the Management Plan (Belgium, Croatia[3], Czech Republic, Denmark, Estonia, Germany, Hungary, Latvia, Lithania, Luxembourg, The Netherlands, Poland, Slovakia, Slovenia, United Kingdom) are not measured against activities that are related to hunting, as the NIS only records progress *within the period of the plan*. However, it is acknowledged that by previous implementation of control measures, these Member States are *de facto* contributing to conservation of the turtle-dove during that period.

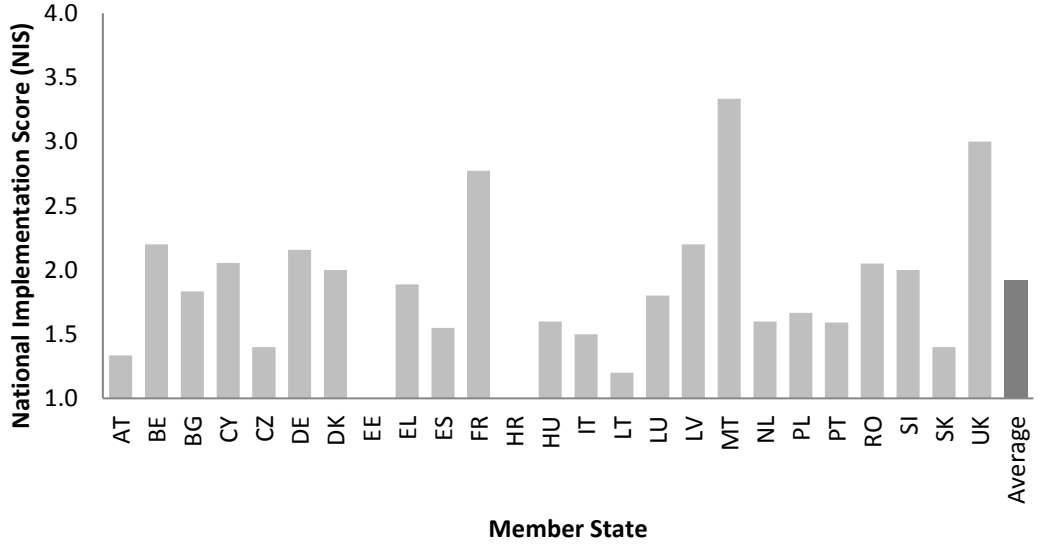


Figure 2. National Implementation Score (NIS) for each Member State and average across all States.

FI, EI, SE excluded as NIS not relevant. The scores are based only on those measures that were relevant to the country.

[3] Croatia was not a member of the European Union when the *2007-2009 Management Plan for Turtle-dove* was active.

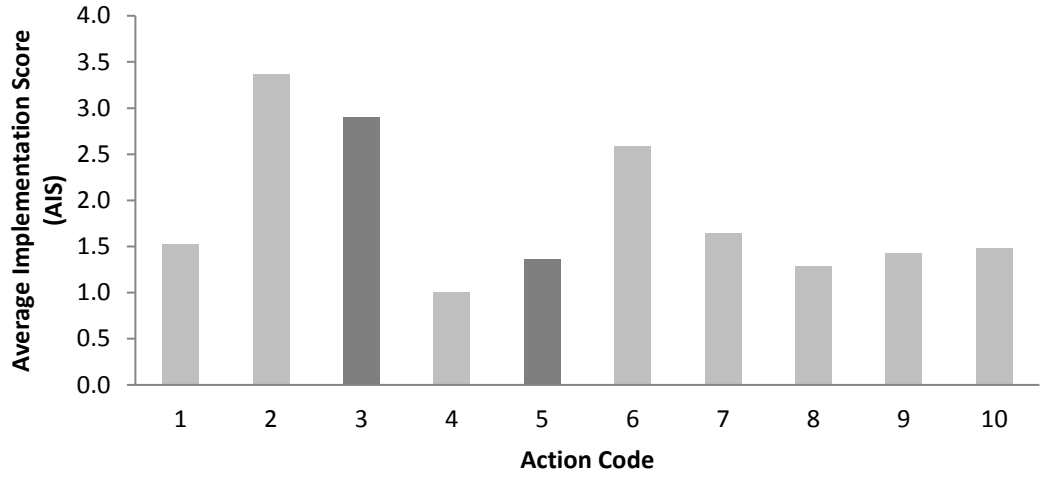


Figure 3. Average Implementation Score (AIS) for each action, across all relevant Member States.

All actions were Medium priority except 3 and 5 which were High (darker shaded). Each Member State evaluated the progress made towards each target based on a scoring system of 0 (action not needed/not relevant) to 4 (action fully implemented), forming the Implementation Score. Action Codes are based on the 10 key measures listed in the 2007-2009 Management Plan; see above for full details.

Overall implementation of the Management Plan was poor, and in terms of actions, those to mitigate hunting effects (avoidance of overlap of hunting and breeding seasons), to collect hunting information, and to monitor populations made most progress. There was little activity associated with predictive modelling (due to a lack of robust data, no resources, and no-one with the responsibility to deliver the work) and with working outside of the EU. However, most Member States carried out some form of habitat conservation work.

A limited number of the activities carried out for turtle-doves seem to have been triggered by the Management Plan, while most of the conservation measures were taken regardless of the Plan, under the framework of a wide range of different instruments: legislative, regulatory, planning, programmatic and financial. Many of the actions were carried out by academic institutions and NGOs, and hunting organisations contributed to implementation of some of the activities, including habitat management.

Where significant progress has taken place, this was often through the indirect effects of other actions; conservation of turtle-dove habitats was not the main focus of efforts. Self-reporting against the short-term objectives was into broad categories (no, partially, yes) and there are no quantified data on how much activity took place. When calculating the National Implementation Score, again the self-reporting categories of the methodology were broad: little implementation, some, significant, full. During the Management Plan implementation, Member State-specific measurable objectives were not developed, and so it is not possible to quantify effort or success. There is no correlation between reported level of implementation and population trend, so measures carried out have not had the expected impact.

It is likely that the turtle-dove directly and indirectly benefits from a range of other initiatives in many countries, including: Agri-environment Schemes; promotion of organic farming; other types of measures in Rural Development Programmes; national legislation that protects important features, such as hedgerows and riparian galleries; management of sites for nature conservation, such as Special Protection Areas; and other species and habitat-based projects not targeting turtle-doves. However, other policies and initiatives have continuing negative effects, such as some agricultural practices.

Information is sparse on whether or not the actions taken so far have globally contributed to improving conditions for the turtle-dove by preventing more significant declines, with long-running monitoring mostly absent or not specifically targeted at turtle-doves. There is consensus that isolated activities in some Range States are of insufficient scale to elicit a global-level response, and there is a need for more diagnostic research and solution testing outside of the western flyway.

2 – FRAMEWORK FOR ACTION

For background information, see the following:

Goal

To restore the European turtle-dove (*Streptopelia turtur*) to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

High Level Objective

To halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan (2028 to 2038).

Results and actions

IMPORTANT NOTE*: with such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States*. Discussion on the threat level assessment and associated limitations can be found in Annex 2: PROBLEM ANALYSIS on page 88.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Threat level assessment	**Action priority**	**Action timescale**
Critical - causing or likely to cause very rapid declines and/or extinction	**Essential**	**Immediate** - to commence within the next year
High - causing or likely to cause rapid decline leading to depletion	**High**	**Short** - to commence within the next 3 years
Medium - causing or likely to cause relatively slow, but significant, declines	**Medium**	**Medium** - to commence within the next 5 years
Low - causing or likely to cause fluctuations or minimal change	**Low**	**Long** - to commence within the next 10 years
Local - causing or likely to cause negligible declines in small parts of the population		**Ongoing** - currently implemented and should continue
Unknown - likely to affect the species, but extent unknown		**Completed** - completed during preparation of the Action Plan

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
1.1 Emergency scheme deployed to provide feeding opportunities for turtle-doves by 2018.	Action 1.1.1 **Put in place and further develop emergency feeding schemes** to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years). Applicable to: all EU Member States.	Essential	Immediate	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, conservation NGOs, academic institutions / research agencies, regional/district/community administration, land and water resource managers, Protected Area managers, hunting federations / associations, local hunting groups, agricultural associations	Existing studies on diet, habitat requirements, and ecology; existing scheme results.
1.2 National Conservation Strategies are developed by 2019 and implemented by 2020.	Action 1.2.1 **Develop National Conservation Strategies** for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6). Applicable to: all breeding Range States.	Essential	Immediate	**NATIONAL AUTHORITIES (agriculture and wildlife management),** conservation NGOs, academic institutions / research agencies, local hunting groups, hunting federations / associations, agricultural associations, regional/district/community administration	Action 7.4.1
	Action 1.2.1.1 [FOOD] Put in place and further develop national agri-environment packages that **create or maintain seed-rich habitats** within the species' current *or recent range*. This may include bespoke seed packages that provide specific plant species that turtle-dove are known to feed on. In highly fragmented habitats, it will be particularly important to provide nesting habitat, foraging habitat and water in close proximity. Applicable to: all breeding Range States where one or more of the following habitats (see sub-actions below) are present *or have recently been present*:				
	Action 1.2.1.1.1 Maintain existing **lower intensity arable landscapes** with fallow fields or low-input crops that provide accessible abundant seed (eg following an organic or reduced herbicide crop) and with a heterogeneous sward structure with at least one-third bare ground. Ensure the maintenance of all existing **no/low-input rotational fallow/crop land**. For landscapes with <5% (500 hectares per 10,000 hectares) of existing no/low-input habitat in turtle-dove-suitable/-near suitable agricultural landscape (for descriptions of suitable turtle-dove habitat in the UK, see Annex 3: JUSTIFICATION OF CONSERVATION / MANAGEMENT OBJECTIVES) throughout the turtle-dove breeding season (April-August for most EU Member States), create additional no/low-input habitat to a minimum of 5% of the landscape. As new information becomes available, this will be shared on the Turtle-dove Study Group website to be implemented as part of the Action Plan.				
	Action 1.2.1.1.2 Where evidence exists for **important arable plant communities**[4], create uncropped, cultivated field margins or plots to stimulate natural regeneration of arable plants. Annual cultivation between 1st September and 1st November is preferred, but for plant communities that primarily emerge in spring, later summer seed can be produced by cultivating during February to April. This creates areas for a wide range of arable plants, and provides patches of less densely-vegetated ground. Recommended minimum 2-3ha seed-rich habitat per km^2 of turtle-dove				

[4] Plant communities, the seeds of which are known to be regularly present in the turtle-dove diet, or have been identified by a number of studies as comprising a substantial volume of the turtle-dove diet.

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	suitable/near suitable agricultural landscape (recommendation relevant across Europe and based on best available knowledge in north-west Europe), which can be delivered in combination with 1.2.1.1.3.				
	Action 1.2.1.1.3 In areas with a **depleted seed bank and/or weeds that create agronomic problems**, sow a bespoke seed mix (for descriptions of suitable turtle-dove seed mixes in the UK, see Annex 3: JUSTIFICATION OF CONSERVATION / MANAGEMENT OBJECTIVES) to create new feeding resources for turtle-doves. The composition of the seed-mix will vary depending on local soil types, fertility and climate, but should comprise species known from turtle-dove diet and which provide available seed across most of the breeding season. Areas sown with the seed-mix should deliver a heterogeneous sward structure with at least one-third bare ground. Recommended minimum of 2-3ha per km^2 of turtle-dove suitable/near suitable agricultural landscape (recommendation generally more appropriate to north-west Europe or areas that have experienced a significant loss of semi-natural habitat, recommendation based on best available knowledge in north-west Europe), which can be delivered in combination with 1.2.1.1.2. As new information becomes available, this will be shared on the Turtle-dove Study Group website to be implemented as part of the Action Plan.				
	Action 1.2.1.1.4 In areas with **low pressure grazing or low intensity cutting of low-input traditional species-rich meadows**, the sward should provide abundant, accessible seeds (short vegetation with some bare areas) present in the diet of turtle-doves. It may be necessary to cut rotationally, or mob graze[5] at low livestock rates, to maintain these conditions. Recommended minimum of 5ha meadow habitat/km^2 in the current or recent turtle-dove range (recommendation relevant across Europe and based on best available knowledge in north-west Europe).				
	Action 1.2.1.2 [HABITAT] Put in place and further develop national agri-environment packages that **create or maintain suitable nesting habitat** for turtle-dove within the species' current *or recent range*. If existing nesting habitat is concentrated in one area, then habitat creation elsewhere will be required, near accessible seed-rich foraging habitats. Recommend at least 500m nesting habitat/km^2. Applicable to: all breeding Range States.				
	Action 1.2.1.2.1 Create or maintain suitable **open woodland nesting habitat** for turtle-doves in the following habitats: coniferous/deciduous/mixed forest; woodland and woodland edge habitats; forest plantations with young trees; traditional orchard habitats, including olive groves. Recommended minimum 5% of open or herbaceous understory (recommendation particularly relevant for southern Europe, recommendation based on best available knowledge).				
	Action 1.2.1.2.2 In landscapes with **linear boundary features** (overgrown treelines or hedgerows), or small areas of **dense successional vegetation or scrub** in farmed landscapes and bordering river channels, flooded quarries or mineral extraction pits, manage the existing habitat or create new areas to provide nest concealment. Recommended 500-2,000m of tree lines, arboreal hedgerows, riparian galleries, scrub or overgrown hedges (more than 4m wide and 3m tall), per 1km^2 of suitable agricultural landscape/rural land-use (eg mineral extraction, recreational, common land etc) (recommendation particularly relevant for areas with a mosaic of habitat types, recommendation based on best available knowledge from north-west Europe).				
	Action 1.2.1.3 [WATER] Promote retention or creation of 1 pond per 1km^2 that provides accessible drinking water for turtle-doves within the species' current *or recent range*.				

[5] Mob grazing (managed intensive rotational grazing, managed grazing, cell grazing or holistic managed planned grazing) is a system whereby grazing livestock is regularly and systematically moved to areas of fresh forage in order to maximize the quality and quantity of forage growth.

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: all breeding Range States.				
	Action 1.2.1.4 **Identify and designate Priority Intervention Areas** for turtle-dove where Actions 1.2.1.1-1.2.1.3 are implemented to ensure suitable nesting, feeding and drinking habitat exist in close proximity (within 300m) for the species. The size and number of these areas will vary in each Range State based on the national habitat mix. Applicable to: all breeding Range States.				
	Action 1.2.1.5 Develop **breeding season guidelines** on suitable management of the following for turtle-dove: - understory woodland/forest vegetation in Mediterranean zones - riparian forests - Protected Areas (including Natura 2000 sites) - Ecological Focus Areas - military land - hunting estates - quarries and other mineral extraction sites and **implement them**, including in Priority Intervention Areas, Key Biodiversity Areas (KBAs), SPAs under the Birds Directive (for EU States) and national protected areas. Applicable to: all breeding Range States.				
	Action 1.2.1.6 Establish **chemical-free areas** in important turtle-dove areas, including: - restricting/forbidding chemical use in Priority Intervention Areas - restricting the open on-ground storage of seeds treated with pesticides/fungicides - restricting the dispersal of pesticides via light aircraft in key breeding sites. Applicable to: all breeding Range States.				
	Action 1.2.2 Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are **financed under the new Common Agricultural Policy framework**, especially in the identified Priority Intervention Areas. Applicable to: all EU Member States.	Essential	Immediate	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, **EUROPEAN COMMISSION,** conservation NGOs, local hunting groups, hunting federations / associations, agricultural associations	Action 1.2.1
	Action 1.2.3 Ensure that measures identified in the National Conservation Strategies for turtle-dove are also **financed under other international, national,**	Essential	Immediate	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, **EUROPEAN COMMISSION,** conservation NGOs, local hunting groups, hunting	Action 1.2.1

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	private funds, especially in the identified Priority Intervention Areas. Applicable to: all breeding Range States			federations / associations, agricultural associations	
	Action 1.2.4 Ensure that **no measures that are detrimental to the turtle-dove**, such as conversion of extensive grassland management and promotion of intensive land-use practices, are financed under the new Common Agricultural Policy framework. Applicable to: EU Member States.	Essential	Short	**NATIONAL AUTHORITIES (agriculture and wildlife management), REGIONAL/DISTRICT/COMMUNITY ADMINISTRATION, EUROPEAN COMMISSION**	Action 1.2.1
	Action 1.2.5 Support and promote the maintenance of turtle-dove **friendly management in High Nature Value farming systems** within the turtle-dove's current *or recent range*. Applicable to: EU Member States.	Essential	Short	**NATIONAL AUTHORITIES (agriculture and wildlife management), REGIONAL/DISTRICT/COMMUNITY ADMINISTRATION, EUROPEAN COMMISSION**	Action 1.2.1
	Action 1.2.6 Use Species Distribution Models to **identify additional areas with a high likelihood of containing Priority Intervention Areas**, and to assess the sensitivity of turtle-doves to landscape characteristics. Develop scenarios of future distribution based on combinations of landscape features. Applicable to: all breeding Range States.	Medium	Immediate	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, CONSERVATION NGOs**	Up-to-date data on distribution, such as those being used for European Breeding Bird Atlas 2.
	Action 1.2.7 **Evaluate the effectiveness of agri-environment actions** (Action 1.2.1) for delivering suitable habitat for turtle-doves. Applicable to: all breeding Range States.	High	Short	**NATIONAL AUTHORITIES (agriculture)**	Action 1.2.1

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
1.3 Turtle-dove breeding season requirement guidelines are available to key stakeholders by 2020, and incorporated into planning by 2025.	Action 1.3.1 **Assess Important Bird Areas (IBAs/KBAs) and Natura 2000** sites with known or suspected presence of turtle-doves for their numbers. This applies in particular to EU Natura 2000 sites for which the Standard Data Form mention presence of the species. Turtle-dove numbers should continue to be monitored regularly. Applicable to: all breeding Range States.	High	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES,** national authorities (wildlife management), Protected Area managers	IBA/KBA inventories, national turtle-dove data, Natura 2000 Standard Data Forms.
	Action 1.3.2 Existing **Natura 2000 sites with ≥10 breeding pairs must be proposed as Special Protection Areas** for turtle-dove. This action includes updating the Standard Data Form of each site and all the linked databases. The management authority for each site will ensure that the site management plan includes appropriate measures for turtle-dove conservation as recommended in the Species Action Plan. Applicable to: all EU Range States.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, conservation NGOs, academic institutions / research agencies, Protected Area managers	IBA/KBA inventories, national turtle-dove data, Article 4-2 Birds Directive, Natura 2000 Standard Data Forms.
	Action 1.3.3 Promote at the national level the inclusion of **turtle-dove requirements into Protected Area Management Plans**. Applicable to: (in breeding Range States) all land managers.	High	Short	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES,** national authorities (wildlife management), land and water resource managers, Protected Area managers	Action 1.2.1
1.4 Local small-scale projects (relevant to specific environmental or cultural conditions) maintain, enhance or create suitable turtle-dove nesting or feeding habitats across the breeding range by 2020.	Action 1.4.1 **Develop best practice** and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake. Applicable to: all breeding Range States.	High	Short	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, NATIONAL AUTHORITIES (agriculture and wildlife management), REGIONAL/DISTRICT/COMMUNITY ADMINISTRATION**, agricultural associations, local hunting groups	Action 1.2.1
1.5 Environmental Impact Assessments include a	Action 1.5.1	Low	Short	**NATIONAL AUTHORITIES (wildlife management)**	Action 1.2.1

Objective 1: Good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds. Threat - Lack of one or more of the three essential requirements during the breeding season: food, water, nesting locations (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
turtle-dove evaluation, if relevant, by 2020.	**Influence legislation/guidelines** at national level to include turtle-dove conservation in the EIA processes (eg for important roosts). Applicable to: all breeding Range States.				

Objective 2: Illegal killing in the European Union is eradicated and reduced elsewhere. Threat - Illegal killing (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
2.1 Evaluation of the scale of illegal killing by end 2018.	Action 2.1.1 **Assess and report on the scale of illegal killing** across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed. Applicable to: all Range States, with focus on areas of current poor information, such as the Middle East, Africa, and some Mediterranean islands.	Essential	Immediate	**NATIONAL AUTHORITIES (wildlife management)**, law enforcement agencies, hunting federations / associations, local hunting groups, conservation NGOs, academic institutions / research agencies	National reports to the Bern Convention, EU Road-Map, CMS MIKT Scoreboard, IMPEL, National Action Plans, tagging projects and research, BirdLife International reports on illegal bird killing, reports and data from NGOs and national authorities.
2.2 Guidance on effective mechanisms for enforcing hunting regulations is available by end 2018.	Action 2.2.1 In conjunction with CMS MIKT and the Bern Convention**, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations**. Applicable to: all Range States with turtle-dove hunting.	High	Immediate	**NATIONAL AUTHORITIES (wildlife management)**, **LAW ENFORCEMENT AGENCIES**, conservation NGOs, hunting federations / associations, local hunting groups, academic institutions / research agencies	Government of Malta guidance, national reports to the Bern Convention, EU Road-Map, CMS MIKT Scoreboard, IMPEL, National Action Plans, tagging projects and research, existing data, National Action Plan on illegal killing of birds in preparation in Italy (CMS 2017).
2.3 Enhanced enforcement in EU hot-spots of illegal killing of turtle-dove by 2020 and non-EU hot-spots by 2025.	Action 2.3.1 In the framework of the CMS MIKT and the Bern Convention, **develop and deploy training** to enhance enforcement of hunting laws in hot-spot areas, both for local enforcement officers and the judiciary, and ensure enforcement at illegal killing hot-spots, with increased investment if required.	High	Immediate	**NATIONAL GOVERNMENTS (wildlife management)**, **LAW ENFORCEMENT AGENCIES**	Action 2.1.1 Action 2.2.1 Existing Programme of Work of the CMS Task Force on the Illegal Killing of Birds in the Mediterranean and the Bern Convention.

Objective 2: Illegal killing in the European Union is eradicated and reduced elsewhere. Threat - Illegal killing (Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: all Range States.				

Objective 3: Hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels. Threat - Unsustainable hunting (High/Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
3.1 Interim measures implemented during 2018 to ensure that hunting levels are modified to become sustainable.	Action 3.1.1 Implement a **temporary hunting moratorium** until an adaptive harvest management modelling framework (Action 3.2.1) is developed. Applicable to: all Range States with hunting of turtle-doves.	Essential	Ongoing	**HUNTING FEDERATIONS / ASSOCIATIONS, CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, LOCAL HUNTING GROUPS**, national authorities (wildlife management)	Existing population, trend and hunting data, demographic data (including survival, productivity). Action 3.2.3 Action 5.3.1 Action 7.2.2
3.2 Hunting legal regulations are informed by an adaptive harvesting modelling framework by 2018.	Action 3.2.1 **Develop a robust adaptive harvest management modelling framework** for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons. Applicable to: all Range States with hunting of turtle-doves.	Essential	Immediate	**INTERNATIONAL TURTLE-DOVE SUSTAINABLE HARVEST WORKING GROUP** (consisting of national authorities (wildlife management), conservation NGOs, hunting federations / associations, academic institutions / research agencies), European Commission	Action 3.1.1 Action 3.2.3 Action 7.2.2 Action 7.5.1 Action 7.8.1 EU Sustainable Hunting Guide, data from new studies commissioned under objective 8, AEWA Guidelines on Sustainable Harvest of Migratory Waterbirds, existing European approaches using adaptive harvest management under AEWA.
	Action 3.2.2 Based on recommendations emerging from the adaptive harvest modelling framework and other new knowledge on the impact of other threats, **implement yearly planning and national and local hunting quotas and seasons**. Applicable to: all Range States with hunting of turtle-doves.	Essential	Short	**INTERNATIONAL TURTLE-DOVE SUSTAINABLE HARVEST WORKING GROUP** (consisting of EU Member States, national authorities (wildlife management), conservation NGOs, hunting federations / associations, academic institutions / research agencies)	Action 3.2.1 Action 3.2.3 Action 5.3.1

Objective 3: Hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels. Threat - Unsustainable hunting (High/Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Action 3.2.3 **Collect robust and accurate hunting bag data** using standardised protocols, including on-the-spot reporting of harvested birds. For EU Member States, reporting of hunting bag data is introduced to the 2013-2018 Article 12 reporting format (Birds Directive). Report hunting bag statistics annually to the Turtle-dove Harvest Working Group. Calculate a yearly hunting bag statistic for each Range State, based on annual collections of hunting bag data. Applicable to: all Range States with hunting of turtle-doves.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, hunting federations / associations, local hunting groups	Action 5.3.1 Action 7.8.1
	Action 3.2.4 Range States ensure that **national hunting legislation is consistent with turtle-dove harvest management measures** based on the adaptive harvest modelling framework, that it excludes hunting during the breeding season and pre-nuptial migration, and that enforcement is carried out where infringements occur. Applicable to: all Range States with hunting of turtle-doves.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, hunting federations / associations, local hunting groups	Action 3.2.1 Action 3.4.1 National legislation.
3.3 Turtle-dove specific Sustainable Hunting Initiative promoted to hunters/hunting organisations by 2019.	Action 3.3.1 **Implement a turtle-dove-specific Sustainable Hunting Initiative** that would promote good hunting practice, especially at bottle-necks and large concentrations of the species. Applicable to: all Range States with hunting of turtle-doves.	Essential	Short	**HUNTING FEDERATIONS / ASSOCIATIONS, LOCAL HUNTING GROUPS**, national authorities (wildlife management)	Action 2.2.1 Data from Conservation NGOs.
	Action 3.3.2 The International Council for Game and Wildlife Conservation **promotes good hunting tourism** practice for turtle-doves outside Europe. Applicable to: Range States where hunting tourism occurs.	Medium	Short	**HUNTING FEDERATIONS / ASSOCIATIONS, LOCAL HUNTING GROUPS**	Action 2.2.1 Action 3.3.1 Actions 3.4.1-3.4.2
3.4 Best practice turtle-dove hunting legislation	Action 3.4.1 Carry out a **survey of national hunting legislation** across the flyway to understand best practices and	High	Short	**HUNTING FEDERATIONS / ASSOCIATIONS**, conservation NGOs, local hunting groups,	EU Sustainable Hunting Guide, national legislation, Birds

Objective 3: Hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels. Threat - Unsustainable hunting (High/Critical)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
implemented across the flyway by 2020.	identify Range States where legislation is poor or non-existent. Applicable to: all Range States.			national authorities (wildlife management)	Directive, BirdLife International reports on illegal bird killing.
	Action 3.4.2 **Review/assess the turtle-dove Threat Status** at the national level under IUCN criteria, taking into account the latest available information to ensure that the species' Red List status at the national, regional and global scale is used to inform national hunting legislation. Applicable to: all Range States with hunting of turtle-doves.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, conservation NGOs, hunting federations / associations	Action 3.4.1
3.5 Measures specifically designed to manage hunting tourism (in Europe and Africa) implemented by 2020.	Action 3.5.1 **Develop and implement legislation and raise awareness** to prevent companies from advertising trips to countries with no or poorly-implemented hunting regulations for the purpose of hunting turtle-doves. Applicable to: all Range States.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**	Action 3.4.1 Data collection on key turtle-dove hunting tourism destinations.

Objective 4: Good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering. Threat - Lack of one or more of the three essential requirements at key sites while on migration/overwintering: food, water, roosting locations (High)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
4.1 Water and food available for turtle-doves in Range States where the species overwinters or has important stopover sites by 2025.	Action 4.1.1 **Assess water and food availability** and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots). Applicable to: Range States in West and East Africa and southern Europe.	High	Short	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, conservation NGOs, development NGOs, hunting federations / associations, academic institutions / research agencies	Action 7.1.2 Action 7.4.3 Tracking and hydrology data, remote sensing imagery.
	Action 4.1.2 **Implement on-the-ground actions to manage water and food availability** at key stopover and wintering sites for turtle-dove.	Medium	Long	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, conservation NGOs, hunting federations / associations, local hunting groups,	Action 4.1.1

Objective 4: Good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering. Threat - Lack of one or more of the three essential requirements at key sites while on migration/overwintering: food, water, roosting locations (High)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: Range States in West and East Africa.			academic institutions / research agencies in conjunction with the AEMLWG	
4.2 Guidelines on management of turtle-dove passage and overwintering sites available for key stakeholders by 2020, and incorporated into planning by 2025.	Action 4.2.1 **Develop, test and implement guidelines** on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required. Applicable to (in wintering and key stopover Range States): land managers at turtle-dove passage and overwintering sites.	High	Short	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, conservation NGOs, hunting federations / associations, academic institutions / research agencies, land and water resource managers, regional/district/community administration, Protected Area managers, agricultural associations, local hunting groups, in conjunction with the AEMLWG	Existing studies on diet, habitat requirements and ecology. Action 1.2.1
	Action 4.2.2 **Identify Key Biodiversity Areas (KBAs)** for turtle-dove, and produce and implement tailored management guidelines for the species in KBAs. Applicable to: (in wintering and key stopover Range States) Protected Area managers.	Medium	Short	**CONSERVATION NGOs**, academic institutions / research agencies, land and water resource managers, regional/district/community administration, Protected Area managers	Action 4.2.1
4.3 Locally supported small-scale projects aimed at restoring or conserving turtle-dove habitat across the wintering range by 2020.	Action 4.3.1 **Inventory and evaluate small-scale local projects** that benefit turtle-dove habitats (eg native tree-planting projects where local people are encouraged to contribute and later harvest the wood). Applicable to: all wintering Range States.	High	Short	**CONSERVATION NGOs**, development NGOs in conjunction with the AEMLWG	Local project reports.
	Action 4.3.2 **Promote best practice** and case study examples of small-scale local projects that benefit the turtle-dove across the wintering range, with financial support from local authorities and micro-financing mechanisms. Applicable to: all wintering Range States.	Medium	Medium	**CONSERVATION NGOs**, development NGOs in conjunction with the AEMLWG	Action 4.3.1
4.4 Large turtle-dove roosts under the control of special	Action 4.4.1	Medium	Medium	**CONSERVATION NGOs**	Action 4.2.1

Objective 4: Good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering. Threat - Lack of one or more of the three essential requirements at key sites while on migration/overwintering: food, water, roosting locations (High)					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
interest groups are managed sympathetically by 2025.	**Establish Management Agreements** for specific turtle-dove roosting areas that are under the control of special interest groups (eg religious orders), based on the guidelines developed in Action 4.2.1. Applicable to: Range States in West and East Africa.				
4.5 Fewer wildfires recorded at key turtle-dove wintering sites by 2025.	Action 4.5.1 **Promote early controlled burning** of grassland and stubble in key areas to prevent wildfires that could destroy turtle-dove roosting or feeding sites. Applicable to: all wintering Range States.	High	Long	**NATIONAL AUTHORITIES (agriculture and wildlife management),** conservation NGOs, academic institutions / research agencies	Data on national wildfire occurrence.
4.6 Less wood harvesting in key turtle-dove wintering and stopover sites by 2025.	Action 4.6.1 Where wood is harvested in key areas, **identify the reasons for harvesting** (eg fuel). If the wood/wood product is exported, identify whether better regulations are required. Applicable to: all wintering Range States.	High	Long	**CONSERVATION NGOs**, development NGOs in conjunction with the AEMLWG	Locations of important turtle-dove wintering and stopover sites.
	Action 4.6.2 **Promote alternative fuel/cooking methods** in key areas for turtle-doves to prevent loss of roosting sites due to fuel wood harvesting. Applicable to: all wintering Range States.	High	Long	**CONSERVATION NGOs**, development NGOs in conjunction with the AEMLWG	Data on wood harvesting and uptake of alternatives.

Objective 5: International co-operation is enhanced, through enabling sharing of information and expertise					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
5.1 International Turtle-Dove Working Group to support the Action Plan active by 2018.	Action 5.1.1 **Create and maintain a regularly updated on-line workspace** to share documents and data (including developing joint databases), with a discussion forum. Applicable to: all Range States and interested parties.	High	Immediate	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, national authorities (agriculture and wildlife management), local hunting groups in conjunction with the AEMLWG	Research papers, grey literature, expert contact list, Action Planning documents, Terms of Reference.
	Action 5.1.2	High	Short	**CONSERVATION NGOs, HUNTING FEDERATIONS /**	Action 5.1.1

Objective 5: International co-operation is enhanced, through enabling sharing of information and expertise					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG. Applicable to: all Range States and interested parties.			**ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **NATIONAL AUTHORITIES (agriculture and wildlife management),** local hunting groups	
	Action 5.1.3 A representative of the Working Group to **liaise with CMS and Steering Committee of African-Eurasian Migratory Landbirds Action Plan** (AEMLAP), the Migrant Landbird Study Group (MLSG) and other relevant conventions/initiatives. Applicable to: all Range States and interested parties.	Medium	Short	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, national authorities (agriculture and wildlife management), local hunting groups	Action 5.1.2
5.2 International Turtle-dove Study Group active by end of 2018.	Action 5.2.1 **Convene an International Turtle-dove Study Group**, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration. Applicable to: all Range States and interested parties.	High	Immediate	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS,** national authorities (agriculture and wildlife management), local hunting groups	Action 5.1.1 Existing tracking projects and experts, EU COST Action funding.
5.3 International Turtle-dove Sustainable Harvest Working Group active by end of 2018.	Action 5.3.1 **Convene an International Turtle-dove Sustainable Harvest Working Group** to collaborate on development of sustainable harvest models and practice. Applicable to: all Range States.	High	Immediate	**HUNTING FEDERATIONS / ASSOCIATIONS, CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, national authorities (agriculture and wildlife management), local hunting groups	Action 3.1.1 Action 3.2.1
5.4 Documented standardised procedures for studying turtle-dove available by end 2019.	Action 5.4.1 **Develop a set of agreed standards** and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.	High	Immediate	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, national authorities (agriculture and wildlife	Action 5.1.1 Existing projects and methodologies.

Objective 5: International co-operation is enhanced, through enabling sharing of information and expertise					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: all Range States and interested parties.			management), local hunting groups	
5.5 National Action Plans are aligned with EU Action Plan by end 2019.	Action 5.5.1 **Ensure that National Action Plans are coordinated** with the overarching International Single Species Action Plan for European Turtle-dove. Applicable to: all Range States as they develop National Action Plans.	Essential	Immediate	**NATIONAL AUTHORITIES (wildlife management)**, conservation NGOs	Action 5.1.2 Action 5.2.1 Action 5.3.1 National Action Plans, EU Action Plan.
5.6 Common goals of Conservation NGOs and Development NGOs are identified by end 2018.	Action 5.6.1 In conjunction with the AEMLWG, **assess the goals of Conservation NGOs, Development NGOs, and international institutions** working in turtle-dove wintering range states and states with important stopover sites, **and identify where these goals overlap** to benefit turtle-dove (eg reducing tree felling and promoting alternative fuel/cooking methods). Applicable to: NGOs and international institutions working on livelihoods and human welfare across all Range States (including UNCCD, FAO, UNDP, World Bank, Great Green Wall).	Medium	Short	**CONSERVATION NGOs**, academic institutions / research agencies, development NGOs	Action 5.1.2 Mission statements of NGOs from other sectors, AEMLWG.
	Action 5.6.2 **Promote common goals** identified in Action 5.6.1 to other sector NGOs and international institutions, and develop working links as appropriate. Applicable to: NGOs and international institutions working on livelihoods and human welfare across all Range States (including FAO, UNDP, World Bank, Great Green Wall).	Medium	Medium	**CONSERVATION NGOs**, academic institutions / research agencies, development NGOs	Action 5.1.2 Action 5.6.1
5.7 National implementing partners in core areas are able to support turtle-dove activities by 2025.	Action 5.7.1 **Increase capacity in small conservation NGOs and civil societies** to carry out national conservation activities to support the conservation of the turtle-dove. Applicable to: Range States with no large existing conservation NGO.	High	Medium	**CONSERVATION NGOs**, academic institutions / research agencies, national authorities (wildlife management)	BirdLife Partnership Partner Support network.

Objective 6: Stakeholder awareness is raised					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
6.1 Communications Strategy for the International Turtle-dove Action Plan available by end 2018.	Action 6.1.1 **Develop a Communications Strategy** to promote the implementation of the Action Plan, raise stakeholder and national authority awareness, and keep the Plan high on the political and economic agenda for national governments. Applicable to: all Range States.	High	Immediate	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS,** local hunting groups, CMS	Action 3.3.1 Action 5.1.1-5.1.2
	Action 6.1.2 The biannual meeting of the **Expert Group on the Birds and Habitats Directives (NADEG) to discuss and inform on the progress/outputs** of the implementation of the Action Plan. Applicable to: all EU Range States.	High	Immediate	**NATIONAL AUTHORITIES (agriculture and wildlife management), EUROPEAN COMMISSION**	Action 5.1.1-5.1.2 Action Plan.
6.2 Turtle-doves incorporated in national Citizen Science projects in each Range State (breeding, wintering and passage) by 2025.	Action 6.2.1 **Promote the turtle-dove as a target species for national Citizen Science projects** with an emphasis on filling the knowledge gaps identified in Objective 7. Applicable to: all Range States.	Low	Long	**CONSERVATION NGOs**, **HUNTING FEDERATIONS / ASSOCIATIONS**, local hunting groups, national authorities (wildlife management)	Action 1.4.1 Action 4.3.2 Action 5.1.1
6.3 Zero-tolerance of illegal killing of turtle-doves by 2020. (The zero-tolerance approach is a principle of CMS MIKT and the Bern Convention and accepted by national government signatories; this action is about awareness-raising with the general public)	Action 6.3.1 **Promote zero-tolerance of illegal killing** of turtle-dove (and other birds). Applicable to: all Range States with illegal killing.	High	Short	**HUNTING FEDERATIONS / ASSOCIATIONS, LOCAL HUNTING GROUPS**, national authorities (wildlife management), law enforcement agencies, CMS	National reports to the Bern Convention, EU Road-Map, CMS MIKT, IMPEL, Larnaca Declaration of 2011.
6.4 Strong enforcement and support to fight illegal killing within CMS signatory countries and EU Member States by 2020.	Action 6.4.1 In conjunction with CMS MIKT and BC TAP, undertake an **advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund efforts to reduce illegal killing**. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services. Applicable to: EU Member States and CMS parties.	High	Long	**NATIONAL AUTHORITIES (wildlife management), HUNTING FEDERATIONS / ASSOCIATIONS,** local hunting groups, conservation NGOs, law enforcement agencies	Illegal killing data, national reports to the Berne Convention, EU Road-Map, CMS MIKT, IMPEL.
	Action 6.5.1	Medium	Medium	**NATIONAL AUTHORITIES (agriculture and wildlife**	Action 1.4.1 Action 4.3.2

Objective 6: Stakeholder awareness is raised					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
6.5 Reduced disturbance of breeding turtle-doves in North Africa by 2025.	**Develop and distribute guidelines for farmers** undertaking operations that disturb breeding turtle-doves and other wildlife (eg orange harvest) and provide alternative approaches that will allow farmers to operate efficiently without having a detrimental impact on turtle-doves at key times of the year. Applicable to: North African Range States.			**management)**, conservation NGOs	Action 5.1.1 Data and publication on disturbance.
	Action 6.5.2 **Develop and distribute educational materials** for schools to teach children not to disturb turtle-doves and other wildlife deliberately (eg using a sling-shot). Applicable to: North African Range States.	Medium	Medium	**NATIONAL AUTHORITIES (agriculture and wildlife management)**, conservation NGOs	Action 1.41 Action 4.3.2 Action 5.1.1 Data and publication on disturbance.
6.6 Good practice guidelines for provision of food and water for turtle-doves available and promoted by 2020.	Action 6.6.1 **Develop and promote good practice guidelines** for any party putting out food or water for turtle-doves and other wildlife (eg birdwatchers, hunters). Applicable to: all Range States.	Medium	Short	**CONSERVATION NGOs, HUNTING FEDERATIONS / ASSOCIATIONS,** local hunting groups, academic institutions / research agencies	Action 1.4.1 Action 5.1.1 Existing guidance (eg RSPB) and results of new publications on disease risk/spread. Action 7.10.1
6.7 Good practice guidelines for using chemically coated seeds available and promoted by 2020.	Action 6.7.1 **Develop and promote good practice for farmers** using chemically coated seeds in order to limit threat to turtle-doves and other wildlife. Applicable to: all Range States where chemically coated seeds are available to turtle-doves (ie both are present at same time).	Medium	Short	**NATIONAL AUTHORITIES (agriculture)**, academic institutions / research agencies	Action 1.4.1 Action 5.1.1 Action 7.11.1 Farming guidelines, agricultural supplier guidelines, results of new publications on poisoning, CMS Preventing Poisoning Working Group.
6.8 Turtle-dove listed as an EU priority species for funding by end 2018.	Action 6.8.1 European Commission **includes the turtle-dove on the EU list of priority species**, to enable access to funding (eg LIFE programme). Applicable to: EU Member States.	High	Short	**EUROPEAN COMMISSION**	Evidence of strong declines of turtle-doves in Europe; IUCN Red List status of turtle-doves.

Objective 7: Knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
7.1 More complete knowledge of turtle-dove movements throughout the yearly cycle by 2020.	Action 7.1.1 **Undertake studies to determine migration routes and key stopover/bottleneck areas** in Western Europe, Eastern Europe and Central Asia. Applicable to: all western Europe and African Range States.	Medium (W) High (E/C)	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Ringing and tagging studies, EURING, common bird monitoring, genetic studies.
	Action 7.1.2 **Undertake studies to determine movements and habitat use** of birds within their wintering grounds in Africa. Applicable to: Range States in West and East Africa	Essential	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Ringing and tagging studies, EURING, national databases (eg WABDaB for West Africa), genetic studies.
	Action 7.1.3 **Undertake studies to determine movements of birds breeding in North Africa**. Applicable to: North, West and East Africa.	Medium	Medium	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Ringing and tagging studies, EURING, national databases (eg WABDaB for West Africa).
	Action 7.1.4 **Undertake research to determine whether irrigated agriculture in North Africa has encouraged birds to nest** in areas where previously absent and to move away from traditional nesting areas. Applicable to: North, West and East Africa.	Low	Medium	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups	National databases, common bird monitoring, turtle-dove specific surveys.
7.2 More complete knowledge of national population sizes and trends by 2020.	Action 7.2.1 **Collate existing information on eastern populations** of turtle-dove that are not within the scope of this Action Plan to determine activities for future versions. Applicable to: some Range States in Central Asia, the Middle East, and Asia (as far east as China).	Low	Long	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	National databases, common bird monitoring, turtle-dove specific surveys.
	Action 7.2.2 **Ensure that national monitoring schemes include turtle-dove specific surveys** in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.	High	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting	National databases, common bird monitoring, turtle-dove specific surveys, Article 12 reporting under Birds Directive.

Objective 7: Knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia.			groups, national authorities (wildlife management)	
	Action 7.2.3 **Develop targeted data collection on population size and trends** of European turtle-dove populations in sub-Saharan Africa and collate information into a single database. Applicable to: all Range States in sub-Saharan Africa.	High	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	National databases, common bird monitoring, turtle-dove specific surveys.
7.3 More complete knowledge of sub-species distributions and movements by 2025.	Action 7.3.1 **Undertake research to determine movements, population sizes and trends for the turtle-dove sub-species**, including isotope and genetic analyses. Applicable to: those Range States holding less well-studied sub-species (in particular *S. t. hoggara* and *S. t. rufescens*).	Low	Medium	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Actions 7.1.1-7.1.3 Actions 7.2.1-7.2.3 Genetic studies.
7.4 Greater understanding of the key components needed in a turtle-dove's breeding and wintering habitat by 2020.	Action 7.4.1 **Improve knowledge of turtle-dove habitat selection and dietary needs**, and undertake regional comparisons of population changes to changes in the agricultural landscape. Applicable to: all Range States.	Essential	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Existing successful prescriptions for turtle-doves, research papers, hunting bag samples.
	Action 7.4.2 **Undertake tracking studies** to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity. Applicable to: all Range States.	High	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Actions 7.1.1-7.1.4 Action 7.4.1
	Action 7.4.3 **Conduct a Sahel-wide inventory of features** that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests. Applicable to: all Range States in sub-Saharan Africa.	High	Short	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Ramsar, CBD, UNCCD, CMS, EU Joint Research Centre for Remote Sensing.

Objective 7: Knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
7.5 Greater understanding of turtle-dove survival and breeding productivity by 2020.	Action 7.5.1 **Put in place systematic programmes of data collection**, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity. Applicable to: all Range States.	Essential	Short	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Research papers.
7.6 Characterisation of ideal stopover and wintering sites for turtle-doves by 2025.	Action 7.6.1 **Undertake research to characterise key stopover and wintering sites**, and assess remote sensing as a tool to predict other potentially suitable areas. Applicable to: wintering Range States and those with key stopover sites.	Medium	Medium	**CONSERVATION NGOs, ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Actions 7.1.1-7.1.2
7.7 Understanding of the country of origin of hunted birds by 2020.	Action 7.7.1 **Analyse new tracking, isotopic, ring recovery data and wing collection samples** of bagged birds to determine the origins and sub-species of birds killed in each country. Application: all Range States.	Medium	Medium	**NATIONAL AUTHORITIES (wildlife management)**, **ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, HUNTING FEDERATIONS / ASSOCIATIONS**, local hunting groups	Actions 7.1.1-7.1.3
7.8 More robust figures for hunting tourism by 2020.	Action 7.8.1 **Collect and analyse data on hunting tourism** to develop more accurate estimates of yearly take. Applicable to: all Range States.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, **ACADEMIC INSTITUTIONS / RESEARCH AGENCIES, HUNTING FEDERATIONS / ASSOCIATIONS**, local hunting groups	National reports to the Bern Convention, EU Road-Map, CMS MIKT, IMPEL, National Action Plans, EU Sustainable Hunting Guide, existing tagging projects and research, reports and data from NGOs and national authorities.
7.9 More robust figures for illegal killing by 2020.	Action 7.9.1 **Collect and analyse data on illegal killing** of turtle-doves to develop more accurate estimates of yearly take. Applicable to: all Range States.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**, **ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups	National reports to the Bern Convention, EU Road-Map, CMS MIKT, IMPEL, National Action Plans, EU Sustainable Hunting Guide, existing tagging projects and research, reports and data from NGOs and national authorities.

Objective 7: Knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Action 7.9.2 **Undertake a socio-economic study on the reasons that people illegally kill turtle-doves** and the role of the turtle-dove in their lives (eg their personal economy). Applicable to: all Range States.	Medium	Medium	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, hunting federations / associations, local hunting groups, national authorities (wildlife management)	Existing literature on subsistence hunting and illegal killing.
7.10 Understanding of the role of disease/parasites in turtle-dove mortality by 2025.	Action 7.10.1 **Undertake research on the effects of disease** (in particular, but not limited to, *Trichomonas gallinae*) **and parasites** on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures. Applicable to: all Range States.	High	Medium	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, **NATIONAL AUTHORITIES (wildlife management)**, hunting federations / associations, local hunting groups	Rapid sampling by hunters, existing studies on disease and parasitology.
7.11 Understanding of the role of poisoning in turtle-dove mortality or productivity by 2025.	Action 7.11.1 **Research the effects of pesticide/herbicide/lead ingestion** on mortality and sublethal effects, such as fertility, and immune response. Applicable to: all Range States.	Medium	Medium	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, national authorities (wildlife management), hunting federations / associations	Rapid sampling by hunters; existing studies on the effects of poisons, including lead; CMS Guidelines on Poisoning Prevention; CMS Preventing Poisoning Working Group; CMS Lead Task Group; ENEC.
	Action 7.11.2 **Assess the extent of use of pesticides and herbicides** in key wintering and stopover locations and collate information on poisoning incidents. Applicable to: mainly North and West Africa, and in particular quelea (*Quelea* spp) and locust control in the Sahel; key European stopover areas.	High	Long	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, national authorities (wildlife management), hunting federations / associations	CMS Guidelines on Poisoning Prevention, CMS Preventing Poisoning Working Group, CMS Lead Task Group, national databases, national and local government.
7.12 Understanding of the role of collisions in turtle-dove mortality by 2025.	Action 7.12.1 **Conduct detailed analysis to determine impact of collisions with wind and electrical infrastructure**. Applicable to: all Range States.	Low	Long	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, national authorities (wildlife management), hunting federations / associations	CMS Energy Task Force, existing literature and databases on collisions.
7.13 Understanding of the role of predation in turtle-dove mortality by 2025.	Action 7.13.1 **Research the effects of predation** (eg snakes, invasive raccoons, cats and other mammals, raptors, corvids) on turtle-dove mortality.	Low	Long	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, national authorities (wildlife	Existing literature on predation.

Objective 7: Knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited					
Result	Action and scope	Priority	Timescale	Organisations responsible	Inputs required
	Applicable to: all Range States.			management), hunting federations / associations	
7.14 Understanding of the role of competition in turtle-dove productivity by 2025.	Action 7.14.1 **Conduct analysis of evidence of competition** with collared doves and other species (eg wood pigeons *Columba palumbus*, laughing doves *Spilopelia senegalensis*). Applicable to: all Range States.	Low	Long	**ACADEMIC INSTITUTIONS / RESEARCH AGENCIES**, **CONSERVATION NGOs**, national authorities (wildlife management), hunting federations / associations	Existing literature on competition.
7.15 Understanding of the potential impact of the release of captive-bred birds on wild turtle-dove genetics by 2025	Action 7.15.1 **Conduct analyses to understand the impact of captive breeding programmes** on genetic diversity of the wild turtle-dove population. Applicable to: all Range States.	Low	Long	**NATIONAL AUTHORITIES (wildlife management)**, academic institutions / research agencies, conservation NGOs	Existing literature on genetic diversity.
7.16 Ensuring regular national reporting by 2020.	Action 7.16.1 **Include turtle-doves in National Biodiversity Strategy and Action Plans** linked to the Convention on Biological Diversity to ensure regular national reporting, particularly for non-EU Range States not covered by Article 12 reporting. Applicable to: all Range States.	High	Short	**NATIONAL AUTHORITIES (wildlife management)**	National Biodiversity Strategy and Action Plans.

Stakeholder summaries - results and actions

The following summaries are designed to provide stakeholders with a quick reference for their relevant area of activity. They are based on the Framework for Action, but are not intended as a replacement for the Action Plan content.

Summaries are available for:

1 National authorities (agriculture)

2 National authorities (wildlife management)

3 Regional/District/Community Public Administration

4 Managers/owners of: agricultural land, water resources, forest/woodland resources, military land, quarry/aggregate industry land

5 National/Regional/District agricultural associations

6 Managers of Protected Areas

7 Law enforcement agencies

8 Hunting federations/associations

9 Local hunting departments/groups

10 Conservation NGOs

11 Academic institutions/Research agencies

12 European Commission

13 Development NGOs

European Turtle-dove Action Plan Stakeholder Summary

1 *National Authorities (Agriculture)*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

National Authorities (Agriculture) are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
6 – stakeholder awareness is raised.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

1.2.4 [EU only, by 2020] Ensure that no measures that are detrimental to the turtle-dove, such as conversion of extensive grassland management and promotion of intensive land-use practices, are financed under the new Common Agricultural Policy framework.

1.2.5 [EU only, by 2020] Support and promote the maintenance of turtle-dove friendly management in High Nature Value farming systems within the turtle-dove's current or recent range.

High priority actions

1.2.7 [breeding Range States, by 2020] Evaluate the effectiveness of agri-environment actions (Actions 1.2.1.1-1.2.1.4) for delivering suitable habitat for turtle-doves.

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

4.5.1 [wintering Range States, by 2025] Promote early controlled burning of grassland and stubble in key areas to prevent wildfires that could destroy turtle-dove roosting or feeding sites.

5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.

5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG.

5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.

5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.

5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.

6.1.2 [EU Range States, by end 2018] Use the biannual meeting of the Expert Group on the Birds and Habitats Directives (NADEG) to discuss and inform on the progress/outputs of the implementation of the Action Plan.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

2 *National Authorities (Wildlife Management)*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

National Authorities (Wildlife Management) are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2 – illegal killing in the European Union is eradicated and reduced elsewhere;
3 –- hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
6 – stakeholder awareness is raised;
7 – knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

1.2.4 [EU only, by 2020] Ensure that no measures that are detrimental to the turtle-dove, such as conversion of extensive grassland management and promotion of intensive land-use practices, are financed under the new Common Agricultural Policy framework.

1.2.5 [EU only, by 2020] Support and promote the maintenance of turtle-dove friendly management in High Nature Value farming systems within the turtle-dove's current or recent range.

2.1.1 [all Range States, with focus on areas of current poor information, such as the Middle East and Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

3.1.1 [Range States with hunting of turtle-doves, by mid-2018] Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed.

3.2.1 [Range States with hunting of turtle-doves, by 2020] Develop a robust adaptive harvest management modelling framework for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons, coordinated by an International Turtle-dove Sustainable Harvest Working Group.

3.2.2 [Range States with hunting of turtle-doves, by 2020] Based on recommendations emerging from the adaptive harvest modelling framework and other new knowledge on the impact of other threats, implement yearly planning and national and local hunting quotas and seasons.

3.3.1 [Range States with hunting of turtle-doves, by 2019] Implement a turtle-dove-specific Sustainable Hunting Initiative that would promote good hunting practice, especially at bottle-necks and large concentrations of the species.

5.5.1 [all Range States as they develop National Action Plans, by end 2019 and ongoing] Ensure that National Action Plans are coordinated with the overarching International Single Species Action Plan for European Turtle-dove.

7.1.2 [West and East Africa Range States, by 2020] Undertake studies to determine movements and habitat use of birds within their wintering grounds in Africa.

7.4.1 [all Range States, by 2020] Improve knowledge of turtle-dove habitat selection and dietary needs, and undertake regional comparisons of population changes to changes in the agricultural landscape.

7.5.1 [all Range States, by 2020] Put in place systematic programmes of data collection, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity.

High priority actions

1.3.1 [breeding Range States, by 2025] Assess Important Bird Areas (IBAs/KBAs) and Natura 2000 sites with known or suspected presence of turtle-doves for their numbers. This applies in particular to EU Natura 2000 sites for which the Standard Data Form mention presence of the species. Turtle-dove numbers should continue to be monitored regularly.

1.3.2 [breeding Range States, by 2025] Existing Natura 2000 sites with ≥10 breeding pairs must be proposed as Special Protection Areas for turtle-dove. This action includes updating the Standard Data Form of each site and all the linked databases. The management authority for each site will ensure that the site management plan includes appropriate measures for turtle-dove conservation as recommended in the Species Action Plan.

1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

2.2.1 [all Range States with turtle-dove hunting, by end 2018] In conjunction with CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.

2.3.1 [EU Range States by 2020, other Range States by 2025] In the framework of the CMS MIKT and the Bern Convention, develop and deploy training to enhance enforcement of hunting laws in hot-spot areas, both for local enforcement officers and the judiciary, and ensure enforcement at illegal killing hot-spots, with increased investment if required.

3.2.3 [Range States with hunting of turtle-doves, by 2020] Collect robust and accurate hunting bag data using standardised protocols, including on-the-spot reporting of harvested birds. For EU Member States, reporting of hunting bag data is introduced to the 2013-2018 Article 12 reporting format (Birds Directive). Report hunting bag statistics annually to the Turtle-dove Harvest Working Group. Calculate a yearly hunting bag statistic for each Range State, based on annual collections of hunting bag data.

3.4.1 [all Range States, by 2020] Carry out a survey of national hunting legislation across the flyway to understand best practices and identify Range States where legislation is poor or non-existent.

3.4.2 [Range States with hunting of turtle-doves, by 2020] Review/assess the turtle-dove Threat Status at the national level under IUCN criteria, taking into account the latest available information to ensure that the species' Red List status at the national, regional and global scale is used to inform national hunting legislation.

3.5.1 [all Range States, by 2020] Develop and implement legislation and raise awareness to prevent companies from advertising trips to countries with no or poorly-implemented hunting regulations for the purpose of hunting turtle-doves.

4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

4.5.1 [wintering Range States, by 2025] Promote early controlled burning of grassland and stubble in key areas to prevent wildfires that could destroy turtle-dove roosting or feeding sites.

5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.

5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG.

5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.

5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.

5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.

5.7.1 [Range States with no large existing conservation NGO, by end 2025] Increase capacity in small conservation NGOs and civil societies to carry out national conservation activities to support the conservation of the turtle-dove.

6.1.2 [EU Range States, by end 2018] Use the biannual meeting of the Expert Group on the Birds and Habitats Directives (NADEG) to discuss and inform on the progress/outputs of the implementation of the Action Plan.

6.3.1 [Range States with illegal killing, by 2020] Promote zero-tolerance of illegal killing of turtle-dove (and other birds).

6.4.1 [EU Member States and CMS parties, by 2020] In conjunction with CMS MIKT and BC TAP, undertake an advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund efforts to reduce illegal killing. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services.

7.1.1 [western Europe and African Range States, by 2020] Undertake studies to determine migration routes and key stopover/bottleneck areas in Western Europe, Eastern Europe and Central Asia.

7.2.2 [all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia, by 2020] Ensure that national monitoring schemes include turtle-dove specific surveys in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.

7.2.3 [all Range States in sub-Saharan Africa, by 2020] Develop targeted data collection on population size and trends of European turtle-dove populations in sub-Saharan Africa and collate information into a single database.

7.4.2 [all Range States, by 2020] Undertake tracking studies to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity.

7.4.3 [Range States in sub-Saharan Africa, by 2020] Conduct a Sahel-wide inventory of features that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests.

7.8.1 [all Range States, by 2020] Collect and analyse data on hunting tourism to develop more accurate estimates of yearly take.

7.9.1 [all Range States, by 2020] Collect and analyse data on illegal killing of turtle-doves to develop more accurate estimates of yearly take.

7.10.1 [all Range States, by 2025] Undertake research on the effects of disease (in particular, but not limited to, *Trichomonas gallinae*) and parasites on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures.

7.11.2 [all wintering and stopover Range States, by 2025] Assess the extent of use of pesticides and herbicides in key wintering and stopover locations and collate information on poisoning incidents.

7.16.1 [all Range States, by 2020] Include turtle-dove in National Biodiversity Strategy and Action Plans linked to the Convention on Biological Diversity to ensure regular national reporting, particularly for non-EU Range States not covered by Article 12 reporting.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

3 *Regional/District/Community Public Administration*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Regional/District/Community Public Administration is critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.4 [EU only, by 2020] Ensure that no measures that are detrimental to the turtle-dove, such as conversion of extensive grassland management and promotion of intensive land-use practices, are financed under the new Common Agricultural Policy framework.

1.2.5 [EU only, by 2020] Support and promote the maintenance of turtle-dove friendly management in High Nature Value farming systems within the turtle-dove's current or recent range.

High priority actions

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

4 *Managers/owners of: agricultural land, water resources, forest/woodland resources, military land, quarry/aggregate industry land*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Land managers are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

High priority actions

1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

5 *National/Regional/District agricultural associations*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

National/Regional/District agricultural associations are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

High priority actions

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

6 *Managers of Protected Areas*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Managers of Protected Areas are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

High priority actions

1.3.1 [breeding Range States, by 2025] Assess Important Bird Areas (IBAs/KBAs) and Natura 2000 sites with known or suspected presence of turtle-doves for their numbers. This applies in particular to EU Natura 2000 sites for which the Standard Data Form mention presence of the species. Turtle-dove numbers should continue to be monitored regularly.

1.3.2 [breeding Range States, by 2025] Existing Natura 2000 sites with ≥10 breeding pairs must be proposed as Special Protection Areas for turtle-dove. This action includes updating the Standard Data Form of each site and all the linked databases. The management authority for each site will ensure that the site management plan includes appropriate measures for turtle-dove conservation as recommended in the Species Action Plan.

1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

7 *Law enforcement agencies*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Law enforcement agencies are critical to the delivery of the following objectives:

2 – illegal killing in the European Union is eradicated and reduced elsewhere;
6 – stakeholder awareness is raised

Essential actions

2.1.1 [all Range States, with focus on areas of current poor information, such as the Middle East, Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

High priority actions

2.2.1 [all Range States with turtle-dove hunting, by end 2018] In conjunction with CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.

2.3.1 [EU Range States by 2020, other Range States by 2025] In the framework of the CMS MIKT and the Bern Convention, develop and deploy training to enhance enforcement of hunting laws in hot-spot areas, both for local enforcement officers and the judiciary, and ensure enforcement at illegal killing hot-spots, with increased investment if required.

6.3.1 [Range States with illegal killing, by 2020] Promote zero-tolerance of illegal killing of turtle-dove (and other birds).

6.4.1 [EU Member States and CMS parties, by 2020] In conjunction with CMS MIKT and BC TAP, undertake an advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund efforts to reduce illegal killing. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

8 *Hunting federations and associations*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Hunting federations and associations are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2 – illegal killing in the European Union is eradicated and reduced elsewhere;
3 – hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
6 – stakeholder awareness is raised;
7 – knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

2.1.1 [all Range States, with focus on areas of current poor information, such as the Middle East, Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

3.1.1 [Range States with hunting of turtle-doves, by mid-2018] Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed.

3.2.1 [Range States with hunting of turtle-doves, by 2020] Develop a robust adaptive harvest management modelling framework for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons, coordinated by an International Turtle-dove Sustainable Harvest Working Group.

3.2.2 [Range States with hunting of turtle-doves, by 2020] Based on recommendations emerging from the adaptive harvest modelling framework and other new knowledge on the impact of other threats, implement yearly planning and national and local hunting quotas and seasons.

3.3.1 [Range States with hunting of turtle-doves, by 2019] Implement a turtle-dove-specific Sustainable Hunting Initiative that would promote good hunting practice, especially at bottle-necks and large concentrations of the species.

7.1.2 [West and East Africa Range States, by 2020] Undertake studies to determine movements and habitat use of birds within their wintering grounds in Africa.

7.4.1 [all Range States, by 2020] Improve knowledge of turtle-dove habitat selection and dietary needs, and undertake regional comparisons of population changes to changes in the agricultural landscape.

7.5.1 [all Range States, by 2020] Put in place systematic programmes of data collection, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity.

High priority actions

1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

2.2.1 [all Range States with turtle-dove hunting, by end 2018] In conjunction with CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.

3.2.3 [Range States with hunting of turtle-doves, by 2020] Collect robust and accurate hunting bag data using standardised protocols, including on-the-spot reporting of harvested birds. For EU Member States, reporting of hunting bag data is introduced to the 2013-2018 Article 12 reporting format (Birds Directive). Report hunting bag statistics annually to the Turtle-dove Harvest Working Group. Calculate a yearly hunting bag statistic for each Range State, based on annual collections of hunting bag data.

3.2.4 [Range States with hunting of turtle-doves, by 2018] Ensure that national hunting legislation is consistent with turtle-dove harvest management measures based on the adaptive harvest modelling framework, that it excludes hunting during the breeding season and pre-nuptial migration, and that enforcement is carried out where infringements occur.

3.4.1 [all Range States, by 2020] Carry out a survey of national hunting legislation across the flyway to understand best practices and identify Range States where legislation is poor or non-existent.

3.4.2 [Range States with hunting of turtle-doves, by 2020] Review/assess the turtle-dove Threat Status at the national level under IUCN criteria, taking into account the latest available information to ensure that the species' Red List status at the national, regional and global scale is used to inform national hunting legislation.

4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.

5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG.

5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.

5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.

5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.

6.1.1 [all Range States, by end 2018] Develop a Communications Strategy to promote the implementation of the Action Plan, raise stakeholder and national authority awareness, and keep the Plan high on the political and economic agenda for national governments.

6.3.1 [Range States with illegal killing, by 2020] Promote zero-tolerance of illegal killing of turtle-dove (and other birds).

6.4.1 [EU Member States and CMS parties, by 2020] In conjunction with CMS MIKT and BC TAP, undertake an advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund efforts to reduce illegal killing. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services.

7.1.1 [western Europe and African Range States, by 2020] Undertake studies to determine migration routes and key stopover/bottleneck areas in Western Europe, Eastern Europe and Central Asia.

7.2.2 [all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia, by 2020] Ensure that national monitoring schemes include turtle-dove specific surveys in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.

7.2.3 [all Range States in sub-Saharan Africa, by 2020] Develop targeted data collection on population size and trends of European turtle-dove populations in sub-Saharan Africa and collate information into a single database.

7.4.2 [all Range States, by 2020] Undertake tracking studies to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity.

7.4.3 [Range States in sub-Saharan Africa, by 2020] Conduct a Sahel-wide inventory of features that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests.

7.8.1 [all Range States, by 2020] Collect and analyse data on hunting tourism to develop more accurate estimates of yearly take.

7.9.1 [all Range States, by 2020] Collect and analyse data on illegal killing of turtle-doves to develop more accurate estimates of yearly take.

7.10.1 [all Range States, by 2025] Undertake research on the effects of disease (in particular, but not limited to, *Trichomonas gallinae*) and parasites on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures.

7.11.2 [all wintering and stopover Range States, by 2025] Assess the extent of use of pesticides and herbicides in key wintering and stopover locations and collate information on poisoning incidents.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

9 *Local hunting departments and groups*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Local hunting departments and groups are critical to the delivery of the following objectives:
1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2 – illegal killing in the European Union is eradicated and reduced elsewhere;
3 – hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
6 – stakeholder awareness is raised;
7 – knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

2.1.1 [all Range States, with focus where poor information, eg the Middle East, Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

3.1.1 [Range States with hunting of turtle-doves, by mid-2018] Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed.

3.3.1 [Range States with hunting of turtle-doves, by 2019] Implement a turtle-dove-specific Sustainable Hunting Initiative that would promote good hunting practice, especially at bottle-necks and large concentrations.

7.1.2 [West and East Africa Range States, by 2020] Undertake studies to determine movements and habitat use of birds within their wintering grounds in Africa.
7.4.1 [all Range States, by 2020] Improve knowledge of turtle-dove habitat selection and dietary needs, and undertake regional comparisons of population changes to changes in the agricultural landscape.
7.5.1 [all Range States, by 2020] Put in place systematic programmes of data collection, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity.

High priority actions
2.2.1 [all Range States with turtle-dove hunting, by end 2018] With CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.
3.2.3 [Range States with hunting of turtle-doves, by 2020] Collect robust and accurate hunting bag data using standardised protocols, including on-the-spot reporting of harvested birds. For EU Member States, reporting of hunting bag data is introduced to the 2013-2018 Article 12 reporting format (Birds Directive). Report hunting bag statistics annually to the Turtle-dove Harvest Working Group. Calculate a yearly hunting bag statistic for each Range State, based on annual collections of hunting bag data.
3.2.4 [Range States with hunting of turtle-doves, by 2018] Ensure that national hunting legislation is consistent with turtle-dove harvest management measures based on the adaptive harvest modelling framework, that it excludes hunting during the breeding season and pre-nuptial migration, and that enforcement is carried out.
3.4.1 [all Range States, by 2020] Carry out a survey of national hunting legislation across the flyway to understand best practices and identify Range States where legislation is poor or non-existent.
4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.
5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.
5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG.
5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.
5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.
5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.
6.1.1 [all Range States, by end 2018] Develop a Communications Strategy to promote the implementation of the Action Plan, raise stakeholder and national authority awareness, and keep the Plan high on the political and economic agenda for national governments.
6.3.1 [Range States with illegal killing, by 2020] Promote zero-tolerance of illegal killing of turtle-dove and other species.
6.4.1 [EU Member States and CMS parties, by 2020] In conjunction with CMS MIKT and BC TAP, undertake an advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund efforts to reduce illegal killing. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services.
7.1.1 [western Europe and African Range States, by 2020] Undertake studies to determine migration routes and key stopover/bottleneck areas in Western Europe, Eastern Europe and Central Asia.
7.2.2 [all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia, by 2020] Ensure that national monitoring schemes include turtle-dove specific surveys in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.
7.2.3 [all Range States in sub-Saharan Africa, by 2020] Develop targeted data collection on population size and trends of turtle-dove populations in sub-Saharan Africa and collate information into a single database.
7.4.2 [all Range States, by 2020] Undertake tracking studies to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity.
7.4.3 [Range States in sub-Saharan Africa, by 2020] Conduct a Sahel-wide inventory of features that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests.
7.8.1 [all Range States, by 2020] Collect and analyse data on hunting tourism to develop more accurate estimates of yearly take.
7.9.1 [all Range States, by 2020] Collect and analyse data on illegal killing of turtle-doves to develop more accurate estimates of yearly take.
7.10.1 [all Range States, by 2025] Undertake research on the effects of disease (in particular, but not limited to, *Trichomonas gallinae*) and parasites on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

10 *Conservation NGOs*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:

- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Conservation NGOs are critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2 – illegal killing in the European Union is eradicated and reduced elsewhere;
3 – hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
6 – stakeholder awareness is raised;
7 – knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

2.1.1 [all Range States, with focus on areas of current poor information, such as the Middle East, Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

3.1.1 [Range States with hunting of turtle-doves, by mid-2018] Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed.

3.2.1 [Range States with hunting of turtle-doves, by 2020] Develop a robust adaptive harvest management modelling framework for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons, coordinated by an International Turtle-dove Sustainable Harvest Working Group.

3.2.2 [Range States with hunting of turtle-doves, by 2020] Based on recommendations emerging from the adaptive harvest modelling framework and other new knowledge on the impact of other threats, implement yearly planning and national and local hunting quotas and seasons.
5.5.1 [all Range States as they develop National Action Plans, by end 2019 and ongoing] Ensure that National Action Plans are coordinated with the overarching International Single Species Action Plan for European Turtle-dove.
7.1.2 [West and East Africa Range States, by 2020] Undertake studies to determine movements and habitat use of birds within their wintering grounds in Africa.
7.4.1 [all Range States, by 2020] Improve knowledge of turtle-dove habitat selection and dietary needs, and undertake regional comparisons of population changes to changes in the agricultural landscape.
7.5.1 [all Range States, by 2020] Put in place systematic programmes of data collection, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity.

High priority actions

1.3.1 [breeding Range States, by 2025] Assess Important Bird Areas (IBAs/KBAs) and Natura 2000 sites with known or suspected presence of turtle-doves for their numbers. This applies in particular to EU Natura 2000 sites for which the Standard Data Form mention presence of the species. Turtle-dove numbers should continue to be monitored regularly.
1.3.2 [breeding Range States, by 2025] Existing Natura 2000 sites with ≥10 breeding pairs must be proposed as Special Protection Areas for turtle-dove. This action includes updating the Standard Data Form of each site and all the linked databases. The management authority for each site will ensure that the site management plan includes appropriate measures for turtle-dove conservation as recommended in the Species Action Plan.
1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.
1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.
2.2.1 [all Range States with turtle-dove hunting, by end 2018] In conjunction with CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.
3.4.1 [all Range States, by 2020] Carry out a survey of national hunting legislation across the flyway to understand best practices and identify Range States where legislation is poor or non-existent.
3.4.2 [Range States with hunting of turtle-doves, by 2020] Review/assess the turtle-dove Threat Status at the national level under IUCN criteria, taking into account the latest available information to ensure that the species' Red List status at the national, regional and global scale is used to inform national hunting legislation.
4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).
4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.
4.3.1 [wintering Range States, by 2020] Inventory and evaluate small-scale local projects that benefit turtle-dove habitats (eg native tree-planting projects where local people are encouraged to contribute and later harvest the wood).
4.5.1 [wintering Range States, by 2025] Promote early controlled burning of grassland and stubble in key areas to prevent wildfires that could destroy turtle-dove roosting or feeding sites.
4.6.1 [wintering Range States, by 2025] Where wood is harvested in key areas, identify the reasons for harvesting (eg fuel). If the wood/wood product is exported, identify whether better regulations are required.
4.6.2 [wintering Range States, by 2025] Promote alternative fuel/cooking methods in key areas for turtle-doves to prevent loss of roosting sites due to fuel wood harvesting.
5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.
5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from all major Range States, and international experts, including a representative of the CMS AEMLWG.
5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.
5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.
5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.
5.7.1 [Range States with no large existing conservation NGO, by end 2025] Increase capacity in small conservation NGOs and civil societies to carry out national conservation activities to support the conservation of the turtle-dove.
6.1.1 [all Range States, by end 2018] Develop a Communications Strategy to promote the implementation of the Action Plan, raise stakeholder and national authority awareness, and keep the Plan high on the political and economic agenda for national governments.
6.4.1 [EU Member States and CMS parties, by 2020] In conjunction with CMS MIKT and BC TAP, undertake an advocacy campaign to promote enforcement of hunting legislation, to provide technical support, and to fund

efforts to reduce illegal killing. Promotion of zero-tolerance stance on illegal killing of turtle-doves to enforcement authorities/services.

7.1.1 [western Europe and African Range States, by 2020] Undertake studies to determine migration routes and key stopover/bottleneck areas in Western Europe, Eastern Europe and Central Asia.

7.2.2 [all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia, by 2020] Ensure that national monitoring schemes include turtle-dove specific surveys in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.

7.2.3 [all Range States in sub-Saharan Africa, by 2020] Develop targeted data collection on population size and trends of European turtle-dove populations in sub-Saharan Africa and collate information into a single database.

7.4.2 [all Range States, by 2020] Undertake tracking studies to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity.

7.4.3 [Range States in sub-Saharan Africa, by 2020] Conduct a Sahel-wide inventory of features that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests.

7.10.1 [all Range States, by 2025] Undertake research on the effects of disease (in particular, but not limited to, *Trichomonas gallinae*) and parasites on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures.

7.11.2 [all wintering and stopover Range States, by 2025] Assess the extent of use of pesticides and herbicides in key wintering and stopover locations and collate information on poisoning incidents.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

11 *Academic institutions/Research agencies*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Academic institutions/Research agencies are critical to the delivery of the following objectives:
1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
2 – illegal killing in the European Union is eradicated and reduced elsewhere;
3 – hunting across the range of the European turtle-dove is carried out at locally and internationally sustainable levels;
4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering;
5 – international co-operation is enhanced, through enabling sharing of information and expertise;
7 – knowledge gaps are filled, critically in areas that help increase the understanding of factors acting on the wintering grounds south of the Sahara, where information is very limited.

Essential actions

1.1.1 [EU only, by 2018] Put in place and further develop emergency feeding schemes to provide a short-term solution to food availability by 2018 (to be deployed over a wider area in the subsequent years).

1.2.1 [breeding Range States, by 2020] Develop National Conservation Strategies for turtle-doves that include technical specifications for agri-environment packages that will benefit turtle-doves, based on measures that increase abundance and accessibility of food, water and breeding habitat (see actions 1.2.1.1-1.2.1.6).

2.1.1 [all Range States, with focus on areas of current poor information, such as the Middle East, Africa, and some Mediterranean islands, by end 2018] Assess and report on the scale of illegal killing across the range of the turtle-dove, identify illegal killing hot-spots, why there is a lack of enforcement, and how this can be addressed.

3.1.1 [Range States with hunting of turtle-doves, by mid-2018] Implement a temporary hunting moratorium until an adaptive harvest management modelling framework (Action 3.2.1) is developed.

3.2.1 [Range States with hunting of turtle-doves, by 2020] Develop a robust adaptive harvest management modelling framework for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons, coordinated by an International Turtle-dove Sustainable Harvest Working Group.

3.2.2 [Range States with hunting of turtle-doves, by 2020] Based on recommendations emerging from the adaptive harvest modelling framework and other new knowledge on the impact of other threats, implement yearly planning and national and local hunting quotas and seasons.

7.1.2 [West and East Africa Range States, by 2020] Undertake studies to determine movements and habitat use of birds within their wintering grounds in Africa.

7.4.1 [all Range States, by 2020] Improve knowledge of turtle-dove habitat selection and dietary needs, and undertake regional comparisons of population changes to changes in the agricultural landscape.

7.5.1 [all Range States, by 2020] Put in place systematic programmes of data collection, focusing on annual survival (eg capture-mark-recapture), wing collection, and breeding productivity.

High priority actions

1.3.1 [breeding Range States, by 2025] Assess Important Bird Areas (IBAs/KBAs) and Natura 2000 sites with known or suspected presence of turtle-doves for their numbers. This applies in particular to EU Natura 2000 sites for which the Standard Data Form mention presence of the species. Turtle-dove numbers should continue to be monitored regularly.

1.3.2 [breeding Range States, by 2025] Existing Natura 2000 sites with ≥10 breeding pairs must be proposed as Special Protection Areas for turtle-dove. Includes updating the Standard Data Form of each site and all the linked databases. The management authority for each site will ensure that the site management plan includes appropriate measures for turtle-dove conservation as recommended in the Species Action Plan.

1.3.3 [breeding Range States, by 2025] Promote at the national level the inclusion of turtle-dove requirements into Protected Area Management Plans.

1.4.1 [breeding Range States, by 2020] Develop best practice and case studies of small-scale local projects that involve turtle-dove. Public authorities and micro-financing mechanisms to provide technical and financial support across the breeding range in order to encourage uptake.

2.2.1 [all Range States with turtle-dove hunting, by end 2018] With CMS MIKT and the Bern Convention, develop guidance on effective voluntary and state mechanisms for enforcing hunting regulations.

4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).

4.2.1 [wintering and key stopover Range States, by 2025] Develop, test and implement guidelines on managing turtle-dove habitats at passage and overwintering sites, with regional variation as required.

4.5.1 [wintering Range States, by 2025] Promote early controlled burning of grassland and stubble in key areas to prevent wildfires that could destroy turtle-dove roosting or feeding sites.

5.1.1 [all Range States, by end 2018] Create and maintain a regularly updated on-line workspace to share documents and data (including developing joint databases), with a discussion forum.

5.1.2 [all Range States, by end 2018] Convene a Working Group to support the implementation of the Action Plan, including via on-line activities, with representatives balanced between different parties and stakeholders. The Working Group will comprise designated representatives of national state authorities in charge of the implementation, national experts and conservation organisations invited by the state authorities from major Range States, and international experts, and representative of the CMS AEMLWG.

5.2.1 [all Range States, by end 2018] Convene an International Turtle-dove Study Group, linked to the MLSG, to promote research on turtle-dove breeding biology and on population and movement ecology (including tracking), exchange of information, and collaboration.

5.3.1 [all Range States by end 2018] Convene an International Turtle-dove Sustainable Harvest Working Group to collaborate on development of sustainable harvest models and practice.

5.4.1 [all Range States, by end 2019] Develop a set of agreed standards and methodologies across all Range States for collecting data (eg blood samples, productivity), tracking, and analyses.

5.7.1 [Range States with no large existing conservation NGO, by end 2025] Increase capacity in small conservation NGOs and civil societies to carry out national conservation activities to support the conservation of the turtle-dove.

7.1.1 [western Europe and African Range States, by 2020] Undertake studies to determine migration routes and key stopover/bottleneck areas in Western Europe, Eastern Europe and Central Asia.

7.2.2 [all Range States, but in particular those currently with poor population and trend estimates, especially Turkey, eastern Europe, and into Asia, by 2020] Ensure that national monitoring schemes include turtle-dove specific surveys in order to enable more robust estimates of national, regional and international population sizes and trends, and modelling of recent and potential changes.

7.2.3 [all Range States in sub-Saharan Africa, by 2020] Develop targeted data collection on population size and trends of European turtle-dove populations in sub-Saharan Africa and collate information into a single database.

7.4.2 [all Range States, by 2020] Undertake tracking studies to determine small-scale movements of birds within their breeding area in different habitats (forest, agricultural landscapes), and assess how they link with breeding productivity.

7.4.3 [Range States in sub-Saharan Africa, by 2020] Conduct a Sahel-wide inventory of features that contribute to good quality turtle-dove habitat, including roosting sites, wetlands and seasonally-flooded forests.

7.8.1 [all Range States, by 2020] Collect and analyse data on hunting tourism to develop more accurate estimates of yearly take.

7.9.1 [all Range States, by 2020] Collect and analyse data on illegal killing of turtle-doves to develop more accurate estimates of yearly take.

7.10.1 [all Range States, by 2025] Undertake research on the effects of disease (in particular, but not limited to, *Trichomonas gallinae*) and parasites on the mortality and fitness of turtle-doves, and whether or not there is a population-level effect. If appropriate, design and deliver mitigation measures.

7.11.2 [all wintering and stopover Range States, by 2025] Assess the extent of use of pesticides and herbicides in key wintering and stopover locations and collate information on poisoning incidents.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

12 *European Commission*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

The European Commission is critical to the delivery of the following objectives:

1 – good quality habitats, with available and accessible water and food, are maintained and increased on the breeding grounds;
6 – stakeholder awareness is raised.

Essential actions

1.2.2 [EU only, by 2020] Ensure that relevant measures identified in the National Conservation Strategies for turtle-dove, including turtle-dove agri-environment packages and "bespoke seed packages", are financed under the new Common Agricultural Policy framework, especially in the identified Priority Intervention Areas.

1.2.3 [breeding Range States, by 2020] Ensure that measures identified in the National Conservation Strategies for turtle-dove are also financed under other international, national, private funds, especially in the identified Priority Intervention Areas.

1.2.4 [EU only, by 2020] Ensure that no measures that are detrimental to the turtle-dove, such as conversion of extensive grassland management and promotion of intensive land-use practices, are financed under the new Common Agricultural Policy framework.

1.2.5 [EU only, by 2020] Support and promote the maintenance of turtle-dove friendly management in High Nature Value farming systems within the turtle-dove's current or recent range.

3.2.1 [Range States with hunting of turtle-doves, by 2020] Develop a robust adaptive harvest management modelling framework for the hunting of turtle-dove for each flyway, based on demographic and hunting data, and propose national and local hunting quotas and seasons, coordinated by an International Turtle-dove Sustainable Harvest Working Group.

High priority actions

6.1.2 [EU Range States, by end 2018] Use the biannual meeting of the Expert Group on the Birds and Habitats Directives (NADEG) to discuss and inform on the progress/outputs of the implementation of the Action Plan.

6.8.1 [EU Member States, by end 2018] European Commission includes the turtle-dove on the EU list of priority species, to enable access to funding (eg LIFE programme).

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

European Turtle-dove Action Plan Stakeholder Summary

13 *Development NGOs*

The European turtle-dove (*Streptopelia turtur*) breeds across most of Europe, except the extreme north; and within the European Union (EU), only Ireland and Sweden do not have breeding populations. The breeding range extends east into China, and south into northern Africa. Birds migrate to sub-Saharan Africa to overwinter, using at least three routes: through Iberia, via Italy and Malta, and across the Eastern Mediterranean. The latest breeding population estimate is 2.4 to 4.2 million birds within the EU, around 75% of the 2.9 to 5.6 million pairs in Europe. The global population is estimated as 13 to 48 million pairs, all but an unknown number in north-eastern China being within the scope of the African-Eurasian Migratory Landbirds Action Plan (AEMLAP).

The three **main threats** to the species are:
- habitat loss in both its breeding and wintering areas, linked to land use and land cover changes;
- illegal killing and trapping, particularly during spring migration and in the breeding season;
- unsustainable hunting levels.

The **goal** of the Action Plan is to restore the European turtle-dove to a favourable population status so it can be safely removed from the threatened categories of the IUCN Red List.

The **high level objective** is to halt the population decline of the European turtle-dove throughout most of its range, preparing the way for an increase in population sizes within each flyway during the period of the next version of the Action Plan.

With such a wide-ranging species as the European turtle-dove, due to local or regional specific circumstances (for instance the average size of agricultural holdings, local climatic and bio-geographic circumstances, legislation adopted etc), not all measures will be applicable to all Member States.

In the actions below, *recent range* refers to areas where the species is no longer found, but was present at some time within the 30 years prior to 2018 (ie since 1988).

Development NGOs are important to the delivery of the following objectives:

4 – good quantity and quality of suitable turtle-dove habitat, with available and accessible water and food, are maintained and increased at key sites for stopover and overwintering

High priority actions

4.1.1 [Range States in West and East Africa and southern Europe, by 2025] Assess water and food availability and persistence of water sources in Africa/southern Europe in areas known to be used by large numbers of turtle-doves (for example, through remote sensing and survey of known hot-spots).

4.3.1 [wintering Range States, by 2020] Inventory and evaluate small-scale local projects that benefit turtle-dove habitats (eg native tree-planting projects where local people are encouraged to contribute and later harvest the wood).

4.6.1 [wintering Range States, by 2025] Where wood is harvested in key areas, identify the reasons for harvesting (eg fuel). If the wood/wood product is exported, identify whether better regulations are required.

4.6.2 [wintering Range States, by 2025] Promote alternative fuel/cooking methods in key areas for turtle-doves to prevent loss of roosting sites due to fuel wood harvesting.

For further details, and actions that are of a Medium and Low priority, please see the full Framework for Action in Section 2 of the *International Single Species Action Plan for the Conservation of the European Turtle-dove (*Streptopelia turtur*) (2018-2028).*

Annex 1: BIOLOGICAL ASSESSMENT

Movements and lifecycle

Ringing data suggest that there are three main migratory flyways for turtle-dove: western, central and eastern European (Marx *et al* 2016). A very large proportion (62-94%) of birds breeding in France, Germany and the UK follow the western flyway, while 56% of birds breeding in the Czech Republic use the central flyway and 55% birds breeding in Hungary use the eastern flyway, with overlap between the central and eastern flyways (Figure 4).

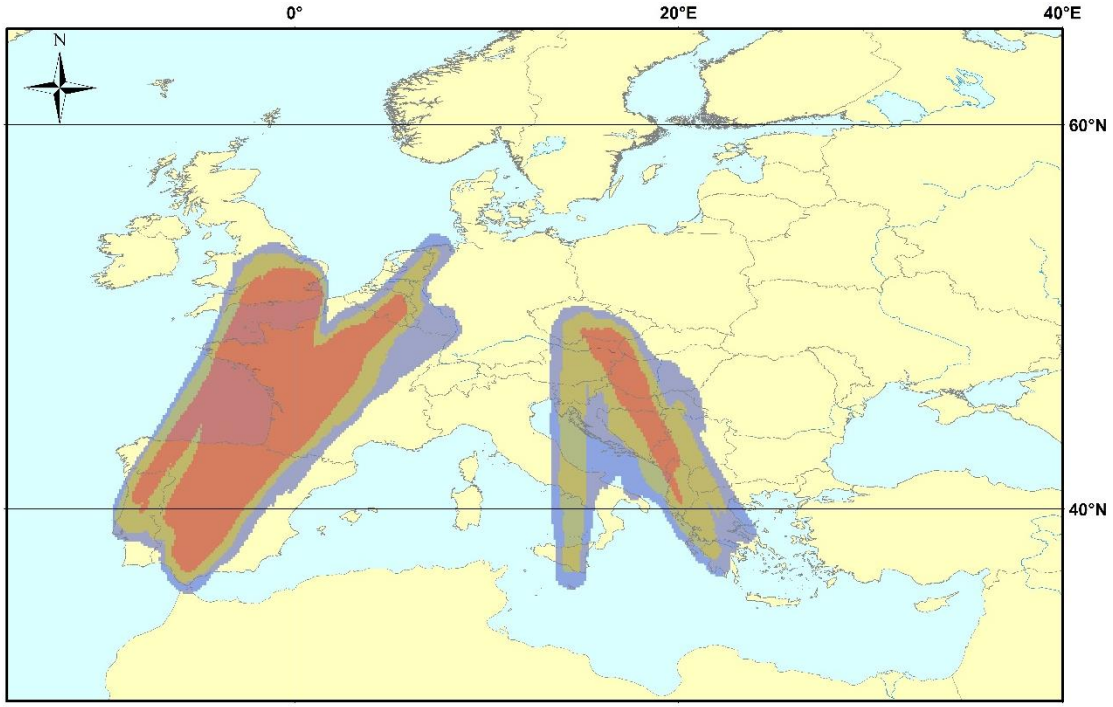


Figure 4. Flyways of turtle-doves from five different countries.

Czech Republic, France, Germany, Hungary and the UK (figure from Marx *et al* 2016). Line density kernels for 70% (red), 80% (yellow) and 90% (blue) of birds.

The post-breeding migration towards Africa starts by the end of July and reaches its most intensive period at the end of August/beginning of September, the last birds being observed at the beginning of October (Snow and Perrins 1998). The western migratory route is across the Iberian Peninsula and Morocco, while other routes pass through Italy, Malta, Tunisia, and through Greece, Egypt and the Middle-East (Cramp 1985, Rocha and Hidalgo de Trucios 2002a). In the east, some birds are observed migrating west of the Caucasus during daylight hours, possibly suggesting an important migration route (Batumi Raptor Count 2015). The wintering area is entirely in Africa, and stretches from the 10th parallel to the 20th parallel North and corresponds to the Sahel-Sudan zone.

The western European populations migrate via the south-west of France and the Iberian Peninsula, where they are joined by birds breeding in Portugal and Spain, cross Morocco and Mauritania, and finally winter in the savannahs of the western half of tropical Africa. Recent tagging and tracking studies have confirmed routes for western birds and shown that many use the south of Spain to make stopovers before arriving in North Africa and crossing the Sahara (Lormée *unpublished*, Lormée *et al* 2016, RSPB 2016). Senegal, The Gambia, Guinea Bissau, the north of Conakry (Guinea) and south-west Mali are considered to be the host countries for the greater part of these populations, but the species has also been recorded in many other African countries (southern Niger, Burkina Faso, northern Côte d'Ivoire, northern Ghana, northern Nigeria and northern Cameroon) (Carvalho and Dias 2001, 2003, Aebischer 2002). An analysis of migration routes of birds fitted with light-level geolocators in France found that the core wintering area covered western Mali, the Inner Niger Delta and the border of Mali and Mauritania, while some birds were found in northern Guinea, north-west Burkina Faso and Côte d'Ivoire. However, these results rely on data from geolocators that can sometimes be erroneous or less accurate than data derived from satellite tracking devices, so should be interpreted with caution (Eraud *et al* 2013). In 2000, an estimated 22,000 turtle-

doves were recorded at a site in south-east Mauritania, apparently roosting in a wadi lined with acacia (*Acacia sp*) adjacent to a lake (Joost Brouwer *pers comm*). In Senegal, turtle-doves arrive from late July to August-September (Zwarts *et al* 2009) and are generally found in the east along the Senegal River, where sufficiently large stands of *A. nilotica* and *A. sayel* remain intact (Chris Orsman *pers comm*). The first stops for the species in the Sahel region may be in the pastoral rather than the agricultural (cereal growing) zone (Joost Brouwer *pers comm*). In The Gambia, the species has been recorded in the dry season from September to May (Barlow *et al* 1997), while in Niger the species is scarce or absent even in suitable habitats (Zwarts *et al* 2009). There are very few records related to Niger on the West African Bird DataBase, and many of these consist of groups of dead birds (Giraudoux *et al* 1986, WABDaB 2016). In Cameroon, the species is found in October and November, and again in February and March (Zwarts *et al* 2009). Some individuals also winter in Morocco (Jarry 1994b), but rarely in Europe.

A more eastward migratory route, probably mainly from Central Europe, stretches over Italy, Malta, Cyprus, Tunisia and Libya, and birds may winter in Sudan, Ethiopia and Chad, possibly reaching as far west as Mali and Burkina Faso (Zwarts *et al* 2009). The turtle-dove is described as an abundant winter visitor to Sudan (Zwarts *et al* 2009). Bulgaria forms an important migratory crossroads with birds from a range of countries, including the Czech Republic, Hungary and Germany (Nankinov 1994). At the Batumi Raptor Count in Georgia, migrating turtle-doves numbering hundreds of individuals were observed passing through in September and October 2016, possibly suggesting an important migration route in the Caucasus (Batumi Raptor Count 2016, Raffael Ayé *pers comm*). An analysis of ringing recoveries found that turtle-doves recovered in Malta had been ringed in a range of European countries. The largest percentage came from Italy (c50%), followed by the Czech Republic (c25%), Tunisia, Hungary, Germany, Poland, France, Croatia and Austria (Raine 2007). Preliminary data from turtle-doves fitted with tracking devices in Malta found that in 2016 one bird spent the breeding season in Italy and the winter in Nigeria, before returning to Italy for the following breeding season. Three of four turtle-doves tagged in Malta in April 2017 spent the breeding season in Italy, Slovakia and around the border of Bulgaria, Romania, and Serbia respectively (Petra Quillfeldt *pers comm*). Contact was lost with the fourth bird over Gozo (Nicholas Barbara *pers comm*, Naturschutzbund Deutschland 2017).

Early studies with miniaturised light-level geolocators attached to birds confirmed that turtle-doves breeding in western Europe winter in west Africa, and may make movements of several hundreds of kilometres during the wintering season (Eraud *et al* 2013). This work also pointed to the possibility that the species undergoes a 'loop migration' whereby the post-breeding migration flyway is located further west than the northbound spring migration (Office National de la Chasse et de la Faune Sauvage 2017, Lormée *unpublished*). Evidence of staging in North Africa for several weeks after crossing the Sahara also indicates that environmental conditions in these staging areas may play a pivotal role in population dynamics, such as the quality and availability of staging posts in central Sahara. Tracking data have highlighted that birds use more limited areas for wintering than previously thought (Lormée *et al* 2016). Recent satellite tracking data from a bird tagged in the UK support the proposal that the species may be faithful to both its breeding and wintering grounds (RSPB 2016). This is backed up by data from a bird tagged in France in 2015, which returned to its site of capture for the second year in 2017, having spent both winters in the same part of The Gambia (Chris Orsman *pers comm*). In Croatia, two birds were recovered after three and five years respectively, from the the localities where they were ringed (Sanja Barišić *pers comm*).

Turtle-doves from central and eastern Europe seem to move south, possibly following a reverse loop migration, flying south-east in autumn, through the Balkans, Greece and European Turkey, and moving northwards in spring across the central Mediterranean (Spina and Volponi 2008). Within the Mediterranean region, the northward migration generally takes place between early April and mid-May with a peak in late April (Zwarts *et al* 2009). Those birds wintering south of The Gambia begin to move northwards from February heading towards northern Senegal (Zwarts *et al* 2009). The species congregates in the very north of the Sahel (prior to the Sahel droughts, numbers may have reached several millions in the Senegal Delta) where birds increase their body mass in order to be able to make what was originally considered to be a non-stop crossing of the Sahara, North Africa, the Mediterranean Sea and much of southern Europe (Zwarts *et al* 2009). However, new information from birds tagged in France suggests that during the northbound Sahara crossing the birds take short breaks and then stop for up to several weeks north of the Sahara before crossing the Mediterranean Sea (Eraud *et al* 2013, Lormée *unpublished)*. Sites in Morocco and western Algeria represent likely stopovers, and the species is known to use cereal crops on agricultural land in this region where it can improve its body condition prior to the crossing. The birds may have differing spring and autumn migration strategies, as typically more are recorded on the northward spring migration than in the autumn migration period, suggesting they may be flying at a lower altitude or flying during daylight hours more often in spring than in autumn (Zwarts *et al* 2009). Tracking research shows that most of the autumnal migration occurs at night (Lormée *et al* 2016).

Migratory movements of populations breeding in the eastern part of the range are poorly understood. Birds ringed on passage in Ukraine in August were found in the eastern Mediterranean by September (Dubois 2002). In autumn, several million individuals have been observed crossing a 100km wide area in the Bagdad region of Iraq (Dubois 2002). Birds that breed in or cross Croatia have been found in southern Italy and Malta (five recoveries in total). One juvenile was ringed on the 30th August in Croatia and found 19 days later on Lampedusa, Italy (Sanja Barišić *pers comm*). Similarly, the migratory patterns of the breeding population of *S. t. arenicola* are very poorly known, and it is not clear whether these individuals use the same wintering grounds as *S. t. turtur* (Hanane 2017).

During pre-breeding migration, the first observations of the species in Europe occur in late March and early April (Gargallo *et al* 2011), getting fully underway in late April. Towards the north of the range, migration reaches its peak during the first half of May and finishes mid-June. Data from the Iberian Peninsula suggest a late arrival to the breeding grounds, based on the 10-year trend for Portugal (Feith 2011, 2013) and the earlier autumn departure date (Montoya and Méson 1994, Montoya 2009). In Italy, the highest relative abundance based on birds ringed during return migration across the Mediterranean is at the beginning of May (Macchio *et al* 1999). A fast and significant increase in wing length of birds staging on Italian islands during their northbound migration across the Mediterranean is reported between the middle of April and the end of May, suggesting the passage of birds belonging to different geographical populations (Licheri and Spina 2005). Birds ringed in a range of countries, including Sweden, the Czech Republic, the western and southern Mediterranean and Tunisia, have been recovered in Italy (Spina and Volponi 2008). The central Mediterranean is crossed by birds heading towards Central and Eastern Europe, as confirmed by direct recoveries and recoveries during the breeding season of birds ringed on Italian islands. In the UK, evidence shows that the median annual spring arrival date has not altered (Newson *et al* 2016), but the median annual autumn departure date has become earlier by eight days, resulting in a shortening of the breeding season (Browne and Aebischer 2003a).

Figure 5 shows the breeding and pre-breeding migration periods for turtle-doves across the European Union. The beginning of pre-breeding migration is defined as running from the arrival of the first migrants, and breeding is defined as lasting from the occupation of breeding sites (or in France, the occupation of territories by singing males) until the full flight of young birds.

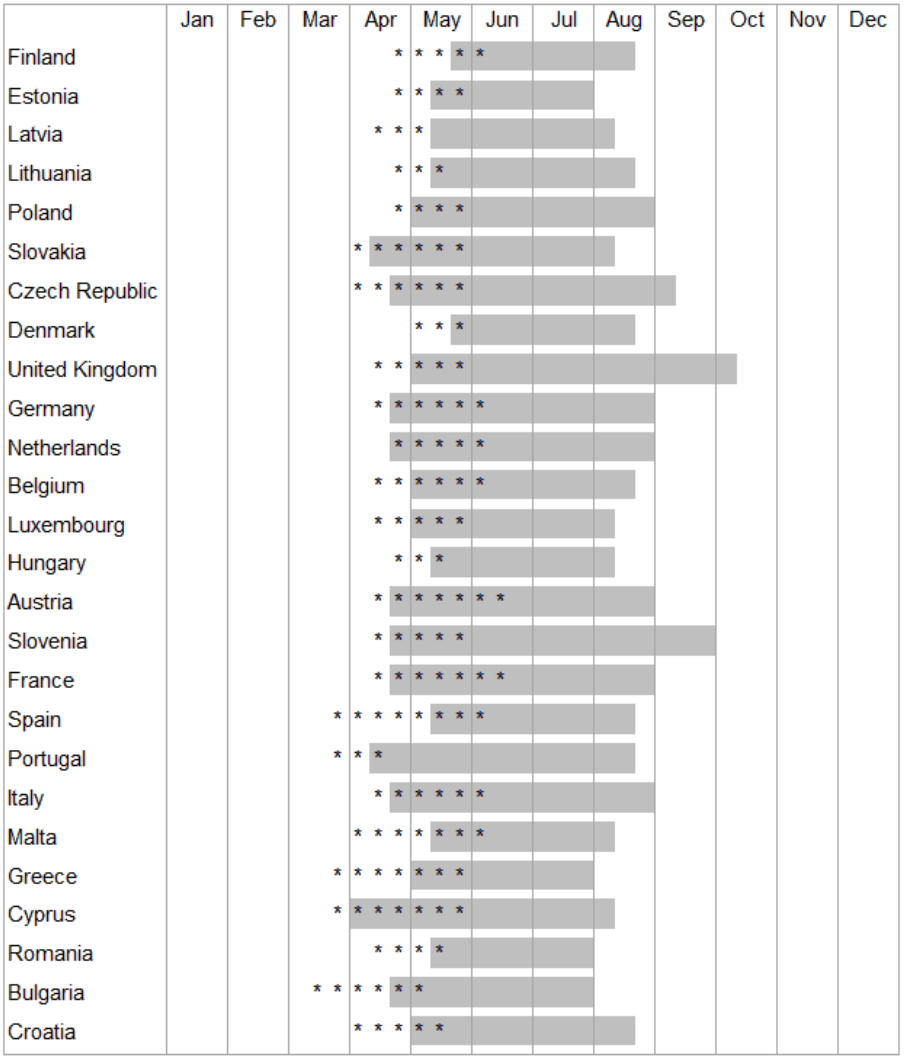


Figure 5. Breeding season (blocked) and pre-breeding migration (starred) of turtle-doves in EU Member States.

Ireland and Sweden not included, north to south order (based on European Union 2008). It is acknowledged that the breeding period data need to be updated in a systematic way to reflect changes in arrival and departure dates since 2008.

Habitat requirements

Generally, the turtle-dove nests in bushes/trees in landscapes with a rich, patchy habitat of open cultivated land for feeding, adjacent to wooded areas with trees and bushes in clumps (woods, copses, groves) or lines (riparian woodlands, hedges) and a nearby water supply.

In the Mediterranean region, the turtle-dove may use a range of habitat types including woodland and orchards (Dias *et al* 2013). In the Iberian Peninsula, birds appear to prefer olive (*Olea europaea*) trees and evergreen/holm oaks (*Quercus ilex*) (ICONA 1989) over intensive orchards (Purroy 1997). A study in northern Spain found that turtle-doves used forested habitats, riparian forests and evergreen oak patches, but that abundance decreased as tree cover increased (Sáenz de Buruaga *et al* 2012). Abundance was lower on open farmland, probably owing to a scarcity of nesting sites. Research in Portugal found that turtle-dove abundance was positively correlated with forest cover (particularly broadleaved forests and pine *Pinus sp* stands without woody understory), cover by permanent crops and the density of woody linear habitats (Dias *et al* 2013). In a study in forested areas in Spain, more wild seed species were found in the turtle-dove diet in contrast to previous studies performed in farmland (Gutiérrez-Galán and Alonso 2016). In these Mediterranean forested areas, *Echium plantagineum* and *Amaranthus deflexus* could be important seed sources. Herbaceous species whose seeds ripen earlier in the season are frequently the only food sources available in the first half of the breeding season, so may be an important food source for turtle-

doves (Gutiérrez-Galán and Alonso 2016). In north-eastern Greece, the species prefers breeding in forest stands with a high density of medium-sized pines (21-30 cm in diameter at chest height) and a high percentage of canopy closure in the intermediate tree layer; it also avoids forest stands with a high percentage of canopy cover of shrubs (Bakaloudis *et al* 2009). In Cyprus, the turtle-dove mainly breeds in wooded farmland with Turkish pine (*Pinus brutia*), olives, and almonds (*Prunus dulcis*) as the main nesting trees (Nicos Kassinis *unpublished*).

Further north, hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*), blackthorn (*Prunus spinosa*) and elder (*Sambucus nigra*) provide most nesting sites, with attractiveness increasing when associated with brambles (*Rubus sp*) and other climbing plants that reinforce the structure of vegetation for the construction and protection of the nest (Murton 1968, Aubineau and Boutin 1998, Browne and Aebischer 2004). In north-western Europe, patchy woodland and farmland with hedges and wood plots are the main habitats, and again open farmland provides few nesting sites, although bare and fallow land have a positive influence as feeding areas (van den Brink *et al* 1996, Dunn and Morris 2012), as do dehesa (a traditional Mediterranean silvo-pastoral system) with cereals in Iberia (Rocha and Hidalgo de Trucios 2002a). The small Danish population inhabits young coniferous plantations on sandy soils (Jesper Tofft *unpublished*), while in Estonia the species breeds mainly at forest edges close to farmland, and can also be found in forest clear-cuts (Jaanus Elts *pers comm*).

In the Baltic States, Belarus, Russia, and Ukraine, the species typically uses forest habitats composed of scattered pine forests or other coniferous trees in the north of the range and more deciduous forests in the south (Rouxel 2000). However, it avoids dense coniferous forests and mature timber. In Kazakhstan it is known to nest in desert habitats provided that trees or shrubs and water sources are present or nearby (Rouxel 2000).

In Morocco, the turtle-dove breeds in olive and orange (*Citrus sp*) orchards. Large areas of olive groves in Morocco are found in close proximity to irrigated areas with available water and cereal crops providing suitable foraging and nesting sites for the species (Hanane 2012a). However, a recent study found that the density of nests was 68% higher in orange than olive orchards (Hanane 2016a). Landscapes of fruit orchards, cereal crops and available water sources in North Africa represent favourable breeding and foraging habitat for the species (Hanane 2012b, Kafi *et al* 2015). Irrigated orchards in Morocco support large numbers of turtle-dove (~60,000 pairs in the Tadla area alone) (Hanane 2012b), while the importance of areas outside of irrigation is unknown (Hanane 2017).

The species also feeds on cultivated cereals, with seeds that remain on the ground post-harvest forming an important resource before migration (Dias and Fontoura 1996, Dubois 2002). Evidence suggests that a loss of agricultural weeds bare and fallow land may have had a negative impact on food availability for the species (Browne and Aebischer 2003b).

Suitable wintering habitat appears to be defined by an abundant food supply, available drinking water and large trees or patches of woodland. Where one of these three key factors is absent, the species will typically only use the habitat temporarily (Zwarts *et al* 2009). In winter, the amount of cereal seeds produced annually in the Mali-Senegal area has been suggested to be a significant predictor of survival rate (Eraud *et al* 2009) at least in the short term, although cereal production has increased in West Africa since the 1970s and turtle-dove populations have continued to decline (Raffael Ayé *pers comm*). Birds tend to use *Acacia sp* scrub as their major roosting sites and tracking has confirmed that a readily available water source, cultivated sorghum (*Sorghum sp*), millet (various varieties) and peanut (*Arachis hypogaea*) fields, or natural scrubby grassland may be important for the species (Eraud *et al* 2009, RSPB 2016). On the wintering grounds, the species is known to feed on a diverse range of grains including *Panicum laetum, Tribulus terrestris* and *Echinocloa colona* (Dubois 2002). In years with low rainfall, *T. terrestris* becomes more prevalent in the species' diet, but it is of low nutritional value (Dubois 2002, Zwarts *et al* 2009). Spilt rice grain (*Oryza sp*) in time of drought is also of vital importance. In Senegal, the species uses rice fields, where it feeds on grass seeds prior to harvest and spilt grains following harvest (Zwarts *et al* 2009). In Burkina Faso and Guinea Bissau, the species has been observed at wetland sites and rice fields and is known to roost in stands of *Acacia seyal* (Carvalho and Dias 2003, Zwarts *et al* 2009). Birds also forage extensively in fallow rice paddies as they can be very productive sites for *Panicum laetum* and other grass species (Chris Orsman *pers comm*). Burnt areas of grass within these fields have been particularly targeted as seeds are more readily accessible. In Chad, wetlands in Zakouma National Park appear to be important for the species late in the dry season either for wintering or as staging areas (Joost Brouwer and Leon Lamprecht *pers comm*). In both Nigeria and Mali, birds have been seen feeding on open treeless plains in the heat of the middle of the day, possibly a strategy either to avoid competition with other dove and pigeon species or to fatten up before the northward migration (Zwarts *et al* 2009), although in October-December in parts of the Sahel it is not excessively hot in the middle of the day, so turtle-doves may not be exposed

to extreme temperatures (Joost Brouwer *pers comm*). In The Gambia, the species has been recorded resting in the shrubs *Tamarix senegalensis* and *Mitragyna inermis* (Clive R Barlow *pers comm*), as well as in rice fields (Lamin Jobaate *pers comm*). In Senegal, birds have been recorded at rest in a range of tree species including *Acacia nilotica, Faidherbia albida, Mitragyna inermis, Combretum glutinosum, Diospyros mespiliformis, Mangifera indica* and *Adansonia digitata* (Chris Orsman *pers comm*). Selection appears to be dependent to some extent on season as presence of foliage is thought to be preferred for shade/crypsis.

Breakdown of turtle-dove habitat use across Europe

France/Portugal/Spain

In France, Portugal and Spain the species uses a mixture of habitats interspersed with agricultural land.

In France, the species is reported to use fragmented landscapes, forest edges, woodland, copses (small groups of trees) and hedges (Bacon 2012), particularly those in close proximity to grain crops, oilseed rape (*Brassica napus)* and sunflower (*Helianthus sp*) fields (Dubois *et al* 2008). It nests in shrubs, particularly thorny species such as hawthorn and blackthorn. The following plants have been identified as food sources for the species in France: *Vicia cracca, Galeopsis speciosa, Cirsium arvense, Ulmus laevis, Amaranthus retroflexus, Euphorbia virgata, Setaria glauca, Pinus sylvestris, Lycopsis arvensis, Fagopyrum sp, Reseda lutea, Silene vulgaris, and Echinochloa crus-galli* (Dubois 2002). Lormée (2013) identified woodland groves/thickets as the most important nesting habitat for the species (supporting 46.2% nests), followed by agricultural land (33% nests).

In Portugal, turtle-doves show a preference for forests and agricultural landscapes with trees (Dias *et al* 2013). Forested habitats are the main breeding habitat, pine forest with no shrub under-storey and small patches of forest in complex patchy landscapes being the most important for the species. In agricultural landscapes, permanent crops (such as orchards, traditional olive groves and oranges) are also used for breeding. Turtle-dove abundance is positively associated with forest cover (particularly broadleaved forests, and by pine stands without woody under-storeys), with permanent crops and with areas that have a high density of woody linear habitats (Dias *et al* 2013). The absence of a woody under-storey mostly results from management to reduce fire risk. Broadleaved forests are primarily stands dominated by oak (*Quercus sp*); permanent crops are mostly olive and other orchards; and woody linear habitats are mostly tree lines, hedgerows and riparian galleries, which are often associated with agricultural habitats. In the south (Algarve), the species is more abundant in typical 'barrocal' vegetation (a mixture of Mediterranean shrubs and trees). It nests in trees (pines, oaks and fruit trees) but also in woody shrubs with a complex array of branches (Dias 2016).

In Spain, a recent analysis of common bird monitoring data found that regional population declines were significantly related to trends in forest, sunflower cover, and pasture cover (SEO/BirdLife 2016a). Population declines were less strong in regions where the coverage of forests and sunflowers had increased and where pastures were more abundant. Important declines occurred where there was a high cover of forested habitats, as well as in agricultural areas. In the north of the country, forested areas were the principal breeding habitat for the turtle-dove population (Sáenz de Buruaga *et al* 2012). Linear riparian forests had the highest numbers of turtle-doves followed by patches of open evergreen oak forest interspersed with crops. Farmland played a secondary role in terms of breeding habitat. The species was widely distributed in the study area in the 1980s, but 15 years later, the range had been reduced to four sectors: coastal, central plain, transitional valleys and the Ebro valley plain. Persistence in these locations may be related to turtle-doves favouring warm, temperate climates at low altitudes, as the areas from which they disappeared were mountainous and at higher altitude. The highest reproductive densities of the species are found in central-southern Spain (Extremadura, Castilla La-Mancha and Andalucía) (Gregorio Rocha *pers comm*). At these latitudes the species mostly uses dehesa habitats (Rocha *et al* 2009). Dehesa is used for breeding and feeding by the local populations and as passage sites for birds on their southward migration through Spain (Rocha and Hidalgo de Trucios 2002a). Sáenz de Buruaga *et al* (2012) suggest that preserving and extending open woodland patches within farmland and riparian woodlands would be a positive conservation measure for the species, potentially increasing availability of nest sites. In Catalonia, the species shows a preference for the following habitats: irrigated orchards, non-irrigated orchards, vineyards, cereal crops, cork oak (*Quercus suber*), forests of pine or exotics, Scots pine (*Pinus sylvestris*) and Aleppo pine (*P. halepensis*) (ICO 2016). It avoids the following habitats: beaches, wetlands, suburbs, urban areas, irrigated arable crops, rocky areas, alpine and subalpine meadows, Mediterranean scrub, Mediterranean grassland, beech (*Fagus sp*) forests and riparian forests, oak, evergreen oak, fir (*Abies sp*), Scots pine and black pine (*P. nigra*).

In early August 2017, the species was observed nesting in a pitaya (*Hylocereus sp*) plantation. The nest was positioned low to the ground and the entire plantation was covered by a fine textile for shading so the birds had to fly under the shading to access their nest (Lara Moreno Zárate *pers comm*). This may be an indication that the species is more adaptable to new environments than previously thought.

Belgium/Denmark/Germany/Luxembourg/Netherlands/UK

The species appears to use a mixture of agricultural and wooded areas in this group of countries.

In Belgium, the species was recorded as nesting in woodland groves and edges, hedges, wet alder (*Alnus sp*) groves, scrubby dunes, young pine forests and larger plantations providing there is sufficient undergrowth (Devillers *et al* 1988). To a lesser extent, it has also been recorded breeding in large gardens, parks, and orchards.

In the Wetterau district of central Hessen, Germany, Quillfeldt *et al* (2014) re-surveyed sites where the species had been present 14 years previously. The study found that 31% retained turtle-doves. In the Taunusausläufern area, sites that retained turtle-doves had woody habitats and rich, less agricultural meadows. The species showed a preference for forested and grassland areas, and dense forested areas and mixed woodland were important for breeding. Grassland and forest meadows were important for foraging.

In the Netherlands, key breeding habitats for the species are younger polder forests (usually poplar, *Populus* sp), hawthorn hedges and streamside thickets (SOVON 2002). Arable land is important, particularly the edges which offer foraging resources in the form of weed seeds. The species shows a preference for arable land over grassland, and avoids very open areas.

In the UK, the species has been recorded using principally farmyards and break crops for foraging, and at these sites mainly feeding on the weed strip around fields and on stubbles after harvest (Browne and Aebischer 2003b). In the same study, the species did not use clover (*Trifolium* sp), ley or hay fields as it did in the late 1950s and early 1960s. Clover leys today are likely to contain far fewer weed species than previously. Similarly, a difference in diet was identified: in the 1950s/60s it consisted of more than 95% weed seeds, mainly fumitory (*Fumaria officinalis*), compared to just 40% weed seeds in the late 1990s. Nestling diet in the late 1990s constituted almost 70% seeds from cultivated plants (wheat *Triticum sp* and rape) and adult diet was 60% cultivated seeds. These figures contrast strongly with the 1950s/60s where seeds from cultivation made up just 23% and 5% respectively of nestling and adult diets. In eastern England, more than 75% of turtle-dove territories were associated with residential areas, scrub, and woodland, with hedge use much less often than expected, based on their occurrence (Mason and Macdonald 2000). The study also found that grass was a strongly-preferred land-use. On set-aside, pigeons (*Streptopelia sp* and *Columba sp*), appeared to be positively associated with bare ground during the breeding season, but the association was not statistically significant (Henderson and Evans 2000). Younger set-asides tended to have a mosaic of bare ground, straw, litter and vegetation cover. Pigeon abundance in summer was also found to be significantly higher on set-aside than on winter cereals, with highest abundances on rotational set-aside (Henderson *et al* 2000).

Estonia/Finland/Latvia/Lithuania

Habitat information is limited. However, in Latvia the species is known to use a mixture of agricultural and woodland habitats.

In Latvia, the species has been recorded nesting mainly near fields and meadows in small mixed and deciduous woods, at the edges and in shrubs and saplings (Priednieks *et al* 1989). The species was recorded at slightly higher densities in deciduous forests than in mixed forests dominated by pine trees (Rouxel 2000). Highest densities in Lithuania have been reported from mixed forests with fir trees, while the species was found at lower densities in small stands of urban and agricultural areas (Rouxel 2000).

Austria/Czech Republic/Hungary/Italy/Liechtenstein/Poland/Slovakia/Switzerland

Wooded areas are of importance in this group of countries. The density of turtle-doves in forest habitats was twice that in farmland in Hungary; however, habitat occupancy was higher on farmland than in forest. In Italy and Poland, woodland patches are important.

In Austria and the Czech Republic, the turtle-dove is considered a species of farmland (Reif *et al* 2006, Teufelbauer and Frühauf 2010). In the Czech Republic, turtle-doves use spruce (*Picea* sp) woods (1-1.1

pairs/10ha), deciduous forest (0.7-5 pairs/10ha), scattered and linear vegetation, such as a windbreaks, pond and river embankments, small woods, and hedgerows in the farmed landscape (0-9.9 pairs/10ha) and pine woods (0.2-13.2 pairs/10ha), with the species' density declining with altitude (in South-Bohemia in an area with altitude 500-1300m it was 12 times more abundant at an altitude of 500-600m than at 800-900m or higher, and it was absent above 1100m) (see review in Štastný *et al* 2006, Havlíček 2015).

In Hungary, the relative density of birds was 2.3 individuals/km^2 for wetlands (standard error 0.6), 8.7 individuals/km^2 for forests (s.e. 0.3), 4.1 individuals/km^2 for farmland (s.e. 0.2) and 3.4 individuals/km^2 for urban areas (s.e. 1.3). Habitat occupancy was 56.6% for farmland, 37.8% for forest, 4.0% for urban areas, and 1.6% for wetlands. (Szep *et al* 2012). At least 60,000 individuals were found roosting in an oak plantation in eastern Hungary in 1987 (Attila Bankovics *pers comm*).

In Italy, the species is described as using various types of open wooded areas (IUCN Comitato Italiano 2012). Its breeding habitat is cultivated areas with hedges and trees in proximity to watercourses. The highest densities were found in hilly areas where fields under cultivation (wheat and sunflowers) were interspersed with groves of locust (*Parkia biglobosa*), elm (*Ulnus sp*) and oak trees, as well as bramble hedges or in riverside habitats with natural vegetation (Meschini and Frugis 1993). The species was considered to be a forest species in an analysis of bird communities in central Italy and was not found in habitat fragments smaller than 10ha (Frank and Battisti 2005).

In Poland the species inhabits wooded areas: field copses, small woodland patches, plantations, parks, orchards, lines of trees, forest edges and suburban areas with trees (Sikora *et al* 2007). It shows a preference for younger deciduous or mixed stands with rich, dense under-storey vegetation.

Albania, Bosnia and Herzegovina, Croatia, Greece, Kosovo (UN Res 1244), The former Yugoslav Republic of Macedonia, Montenegro, Serbia, Slovenia

In Croatia, the turtle-dove is most abundant in sub-Mediterranean degraded forests, in Greece the species breeds in a range of habitats, and in Slovenia it inhabits a mosaic of agricultural landscapes.

In coastal Croatia, the species is most abundant in sub-Mediterranean degraded forests of oriental hornbeam (*Carpinus orientalis*) and downy oak (*Quercus pubescens*) (Rucner 1998). It is less numerous in eumediterranean degraded forests of holm oak and Aleppo pine. According to Rucner (1998) and unpublished data (Institute of Ornithology CASA, Vesna Tutiš *pers comm*) it is also numerous in riverine forests throughout the country. Fifty years ago, it was the second most abundant species in riverine forests of Eastern Croatia (Rucner and Rucner 1972). Quantitative data (based on 39 1-km-long transects conducted by the Institute of Ornithology CASA) for agricultural habitats in Northern Dalmatia show that turtle-dove densities are highest in traditional agricultural mosaics with low or moderate degrees of succession (13.8 individuals/km^2), lowest in intensive agriculture with or without linear tree groves (2.8 individuals/km^2), and medium in rocky pastures of moderate or pronounced succession (5 individuals/km^2).

In Slovenia, the species inhabits a mosaic of agricultural landscapes and woodland across much of the country up to 500m (Mihelič 2013, Denac and Kmecl 2014).

In north-eastern Greece, the species breeds in various habitats, including forests, agricultural land with hedgerows, and forest-grassland edges. Optimum breeding habitats are middle-aged conifer stands with low percentage understory cover (Bakaloudis *et al* 2009). In parts of central Greece, it breeds in high densities in hilly areas covered by shrubs and garigue (a low open scrubland with many evergreen shrubs, low trees, aromatic herbs, and bunchgrasses found in poor or dry soil in the Mediterranean region) (Dimitris Bakaloudis *pers comm*).

Armenia, Azerbaijan, Belarus, Bulgaria, Cyprus, Georgia, Moldova, Romania, Russia, Turkey, Ukraine

Woodland habitats appear to be of high importance for the species.

In Armenia, the species uses broadleaved woodland, open juniper woodland and forest plantations (Mamikon Ghasabayan *pers comm*). In Bulgaria, the species is found at the highest densities in forested areas or areas with a mosaic of trees and bushes near to open areas (Iankov 2007). Shifts in the availability of suitable feeding habitat for the species took place in the 2000s, caused by changes in the areas of cultivated and uncultivated agricultural land. Loss of nesting habitats is a limiting factor for the species in Bulgaria (Ministry of Environment and Water *pers comm*). In Cyprus, the species nests in pine forests and lightly wooded areas at all altitudes (Flint and Stewart 1992). In Moldova, the species nests in forests,

forest belts, and parks (Munteanu and Zubcov 2010). In Romania, the species nests in both the lowlands and uplands where it uses deciduous and coniferous forests respectively (Petrovici 2015). However, it shows a preference for lowland forests near farmland.

In the countries of the former USSR, the species was reported to use deciduous and mixed forests (less common in coniferous forest), forest steppes, steppes, desert zones, urban areas and river valleys (Flint *et al* 1984). In Kaliningrad, the optimal habitat for the species is deciduous forest and mixed stands with fir trees. In highly urbanized parts of Russia the species is found at much lower densities than in natural habitats. In central Russia, the species uses oak woodland adjacent to regularly-flooded areas, always preferring deciduous or mixed woodlands over pure coniferous stands, although it will use pine forests (Rouxel 2000). In the Ural Mountains it nests in deciduous forests and shrubs. In the south of European Russia (the steppe zone), the turtle-dove inhabits shelter belts, woodland sites and gardens among the cereal crops. It does not show a preference for any type of woodland and tree species for nesting, but prefers mosaic landscapes and avoids continuous forests (Belik 2005, 2014).

In Turkey, the species is described as a generally widespread and common summer visitor to wooded and agricultural areas (Kirwan *et al* 2008). It breeds in areas with trees, hedges and taller bushes, both in agricultural areas (including orchards and olive groves) and natural areas (including woodland and woodland edges).

Survival and productivity

As a general rule, two to three clutches of two eggs each are laid between May and July in northern parts of the species' range (Browne *et al* 2005). In Spain, the breeding season begins mid-April and lasts until the end of August (Rocha and Hidalgo de Trucios 2002a). In Portugal, data from 1993-2004 also show that in some regions breeding lasts until the last week of August (Dias 2016). In Cyprus, active nests are found from the beginning of May until August (Nicos Kassinis *unpublished*). In the south of Russia, the species typically lays one clutch per year while in northern Russia, Ukraine and Belarus it lays two (Rouxel 2000). In Kazakhstan it can have up to three clutches. In Morocco, the first birds arrive in the Tadla area (central Morocco) in the third week of March and egg laying begins in the first two weeks of April (Hanane 2011).

The turtle-dove is able to reproduce in its second calendar year, and the maximum lifespan for a bird in the wild is estimated as 20 years (Glutz von Blotzheim 1980). The average lifespan is two years and the annual survival rate is 50% (Robinson 2016). The maximum age recorded from ringing is 13 years and two months for a Dutch turtle-dove that was reported shot, followed by a bird from Great Britain and Ireland, shot at age >12 years and 11 months (Fransson *et al* 2010). Survival rates may show important variations from year to year (average apparent survival probability for birds in a French population was 0.51 ± 0.15 with values ranging from 0.29 ± 0.18 to 0.99 ± 0.002) (Eraud *et al* 2009). In the UK, the annual survival rate of adult turtle-doves was 0.62 during periods of stable population trends and 0.53 when trends were declining (Siriwardena *et al* 2000). For first-year birds, annual survival was 0.22 when trends were stable and 0.19 when trends were decreasing.

In Spain, the percentage of nests successfully producing young reaches 53% in Extremadura and 36-58% in the area of Madrid (Rocha and Hidalgo de Trucios 2002a). Breeding success in France is roughly estimated at an average of 53% with a range of 37-66% over the 2001 to 2015 period (ONCFS *pers comm*). In southern Portugal, nest success varied between 56% and 75% on game estates with predator control and residual human disturbance over the period 1993 to 1996 (Dias 2016). In the UK, nest success rate averages 53% during incubation and 65% during the nestling stage, so that only 35% of nests successfully produce young (Browne and Aebischer 2004).

Rocha and Hidalgo de Trucios (2002a) showed that annual productivity in Extremadura, Spain, can vary from two to three chicks per pair. Fontoura and Dias (1995) observed a rate of 2.71 young per pair in north-west Portugal. Data from Algarve, southern Portugal, varied between 1.68 and 2.14 young per pair (Dias 2016). Two to three nesting attempts per pair per year were recorded during the 1990s and early 2000s (Dias 2016). Browne and Aebischer (2004) reported that the number of nesting attempts undertaken by each pair per breeding season in the UK was significantly lower in the late 1990s compared to the early 1960s; this reduction being sufficient to explain the decline in population sizes. The annual production rate was an average of 2.1 chicks fledged per pair in the 1960s (Murton 1968) compared to an average of 1.3 chicks fledged per pair in the 1990s (Browne and Aebischer 2004). The reduction of food availability and reduced nesting habitat availability may be the underlying causes of this decrease in productivity (Browne and Aebischer 2005). In the UK, the breeding season has shortened by 12 days (Browne and Aebischer 2003a), the production per pair being 40-45% of the number of clutches and young compared to

productivity in the 1960s (Browne and Aebischer 2004). However, a recent study suggests improvement in reproductive output, but not to the levels seen in the 1960s (RSPB *unpublished data*).

In Morocco, turtle-dove clutch size is not affected by location, orchard type (orange or olive), laying period or nest position (Hanane 2016b). The number of chicks hatched and fledged per nest was greater in olive orchards compared to orange orchards, although a more recent study in the Tadla region of Morocco found no difference in nest survival rates between the two orchard types despite oranges being harvested in March-September, coinciding with the turtle-dove's breeding season (Hanane and Baamal 2011). Laying period in Morocco was also identified as a significant predictor of the number of chicks fledged per nest. More chicks fledged in the early period than in the late period. Possible reasons for this difference may lie in hunting activity, which takes place from early July to late August, disturbance by children during the summer holidays from June to September, and orange harvesting and tree pruning from the end of May to September (Hanane 2016b). In the Moroccan Haouz and Tadla irrigated zones, 41% of nests successfully fledged young (Hanane 2017). Over half of nest failures recorded in Morocco and Algeria have been attributed to desertion, possibly as a result of agricultural practices or human disturbance (Hanane 2017).

Dunn *et al* (2016a) used leg-ring radio-tag attachments to study post-fledging survival in the UK and its role in the dynamics of bird populations. Fledglings remained in close proximity to the nest for the first three weeks post-tagging, over half of the time within 20m from the nest. Movements were selectively within seed-rich habitats (semi-natural grassland, low-intensity grazing, fallow and quarries). Nestlings that were heavier and in better body condition at seven days old were more likely to survive for 30 days post-fledging, and nestling condition was strongly predicted by the proportion of available seed-rich habitat, highlighting the critical role that food availability plays in juvenile survival, both while being fed by adults and when recently fledged (Dunn *et al* 2016a).

The turtle-dove's spring/summer diet is mainly seeds, but tiny animals are also occasionally eaten (worms, molluscs, insects) (Cramp 1985). In rare cases they may also feed on berries (Rouxel 2000). They mainly feed on the ground and need to drink daily. In less-intensively farmed landscapes the turtle-dove's breeding season diet is primarily weed seeds (Murton 1968, Calladine *et al* 1997). In Mediterranean forest areas in southern Spain, wild plant seeds were found in 65.8% of turtle-dove digestive tracts analysed and the main wild seed species consumed each year varied annually (Guttiérez-Galán and Alonso 2016). Rocha and Hidalgo de Trucios (2002a) demonstrated the importance of weed-seeds for birds arriving at nesting sites, as well as an increased nesting success in herbicide-free areas.

In eastern Europe, wild plant seeds form the basis of the species' diet in spring, while cereal crops become more important later in the season (Rouxel 2000). In more intensively-farmed areas, modern agricultural methods have resulted in a decrease in the availability of arable plant seeds. These have largely been replaced in the diet by seeds of crops such as cereals, oilseed rape and sunflower. A study on turtle-dove summer diet in southern Portugal showed that young turtle-doves had a narrower dietary breadth than adults (Dias and Fontoura 1996). Young were strongly dependent on cultivated cereals and oilseeds that were provided as game crops. In the UK, Dunn *et al* (2016c) showed that nesting turtle-doves that were in better condition had a higher proportion in their diet of plant species that occur in human-provided food sources, such as game or garden bird seed mixes, suggesting that adults feeding nestlings may be reliant on these additional food resources in order to raise young successfully. Other studies from the UK, Portugal and Spain also showed the species feeding mainly at man-made sites, such as spilt grain, game and animal feed, and grain stores (Jiménez *et al* 1992, Dias and Fontoura 1996, Browne and Aebischer 2003a, Rocha and Quillfeldt 2015), with juveniles particularly attracted to sunflower seeds (Rocha and Hidalgo de Trucios 2001a). Rocha and Quillfeldt (2015) showed that turtle-doves are readily attracted to supplemental grain provided at feeding stations in Spain, and suggest that breeding success can be increased when the amount of food provided is sufficiently large and provided early in the breeding season.

These recent changes in diet probably reflect opportunistic foraging behaviour in highly anthropogenically modified landscapes. On most Spanish hunting estates, supplementary food is generally provided from 20 to 120 days prior to the start of the hunting season (Rocha and Quillfeldt 2015). The extra food is provided to encourage the birds to stay on the estate so that there are more present when the hunting season opens (Rocha and Hidalgo de Trucios 2001a). Preliminary results suggest that hunting pressure on these estates may be as much as a 26% take prior to migration (Gregorio Rocha *pers comm*). Set-aside and agri-environmental schemes provide a framework for the maintenance of seed-rich areas. In the UK, higher-tier agri-environmental scheme agreements occupied by turtle-dove had a tendency to contain greater areas of seed-rich options, but in most cases the vegetation became too overgrown to provide optimal foraging conditions (Walker and Morris 2016). Cluster pine (*Pinus pinaster*) seeds are also eaten during migration (Devort *et al* 1988).

Population size and trend

Estimates of population size are available for most countries in Europe and for some in Central Asia and Africa, with varying degrees of confidence, depending on the availability of censuses from sampling. See Table 2 for breeding population data by country and

Table 3 for passage/wintering data.

BirdLife International (2015) quotes 2.3 to 4.1 million pairs within the EU, comprising roughly 70% of the overall European population of 3.2 to 5.9 million pairs. Figures collected in Table 2 estimate 2.4 to 4.2 million birds within the EU, around 75% of Europe's 2.9 to 5.6 million pairs. Globally, according to the data compiled by BirdLife International (2016) the population can be estimated at 13 to 48 million pairs, the large spread in figures being due to a significant lack of reliable data in Central Asia, Russia and countries in the far east of the range.

In Europe as a whole, the population is estimated to be decreasing by 30-49% in 15.9 years (three generations) (BirdLife International 2015). Based on data from the Pan-European Common Bird Monitoring Scheme, the population has undergone a decline of 79% between 1980 and 2014, and the trend is classified as moderate (significant decline, but not more than 5% decline per year) (EBCC/RSPB/BirdLife/Statistics Netherlands 2016).

Table 2. Breeding population size and trend by country/territory.

Country/territory	Population (pairs)	Quality	Year(s) of population estimate	Short-term trend (%)	Direction	Quality	Reference
Albania	800-6,000	Poor (Suspected)	2002-2012	10-30	decreasing	Poor (Suspected)	BirdLife International (2015)
Algeria	10,000-30,000	Medium (Estimated)	2013	40-55	decreasing	Medium (Inferred)	Fadhila Kafi (PhD Thesis), Ettayib Bensaci (*pers comm*)
Andorra	unknown	-	-	unknown	unknown	-	-
Armenia	600-1,200	Medium (Estimated)	2002-2015	10-15	decreasing	Medium (Inferred)	BirdLife International (2015), Mamikon Ghasabyan (*pers comm*)
Austria	7,500-11,000	Good (Estimated)	2015	45-55	decreasing	Good (Estimated)	Dvorak (2017 *in prep*)
Azerbaijan	100,000-200,000	Medium (Inferred)	2000-2015	40-80	decreasing	Medium (Inferred)	Elchin Sultanov (*pers comm*)
Belarus	10,000-15,000	Medium (Estimated)	2013-2016	66-75	decreasing	Medium (Estimated)	Levy S, Gritchik V, Vorobei N, Kozulin A, Dombrovski V, Vintchevski A, Sakhvon V, Kuzmitski A and Yakubovich D (*pers comm*)
Belgium	3,000-4,500	Good (Estimated)	2000-2002	53	decreasing	Good (Estimated)	Vermeersch *et al* (2004)
Bosnia and Herzegovina	5,000-15,000	Poor (Suspected)	2010-2014	unknown	unknown	-	BirdLife International (2015)
Bulgaria	35,000-100,000	Medium (Estimated)	2010-2015	unknown	stable	Good (Observed)	Hristov 2015
Croatia	50,000-100,000	Poor (Suspected)	2000	unknown	unknown	-	European Union (2013), BirdLife International (2015)
Cyprus	3,000-10,000	Medium (Estimated)	2006-2012	0	stable	Medium (Estimated)	European Union (2013), BirdLife International (2015)
Czech Republic	50,000-100,000	Medium (Estimated)	2001-2003	unknown (over the period 1982-2014)	moderate decrease (over the period 1982-2014)	Good (Observed)	Šťastný *et al* 2006, ČSO/JPSP 2015
Denmark	100-150	Medium (Estimated)	2010-2011	0	stable	Medium (Estimated)	Nyegaard *et al* (2014)
Egypt	unknown	-	-	unknown	unknown	-	-
Estonia	150-300	Medium (Estimated)	2016-2017	30-40	decreasing	Good (Observed)	Jaanus Elts and Riho Marja *pers comm*, Elts *et al* (2013)
Finland	0-10	Medium (Estimated)	2014-2015	27-61	decreasing	Medium (Estimated)	BirdLife Finland (*unpublished data*)
France	396,985-481,007	Good (Estimated)	2009	44-48%	decreasing	Good (Estimated)	Bacon 2012, Issa and Muller (2015), Jiguet (2016), Cyril Eraud and Hervé Lormée (*pers comm*).
Georgia	present	Poor (Suspected)	unknown	unknown	unknown	-	BirdLife International (2015)
Germany	25,000-45,000	Good (Observed)	2005-2009	38-58	decreasing	Good (Observed)	European Union (2013), Gedeon *et al* (2014), BirdLife International (2015)
Greece	30,000-80,000	Medium (Inferred)	2000-2012	-5 / +5	stable	Medium (Inferred)	European Union (2013), BirdLife International (2015), Vlachos *et al* (2015)
Hungary	64,000-150,000	Medium (Estimated)	2000-2012	-18 / +13	stable	Medium (Estimated)	Szép *et al* (2012), BirdLife International (2015)
Israel	100,000	Medium (Inferred)	1980-2015	20-40	decreasing	Medium (Inferred)	Shirihai (1996), Perlman *et al* (2016), Yoav Perlman (*pers comm*)
Italy	150,000-300,000	Poor (Suspected)	2006	unknown	stable/unknown	Good (Observed)	Nardelli *et al* (2015), Rete Rurale Nazionale and LIPU (2015), MITO2000 (2016). Although the population for breeding turtle-dove in Italy is estimated to be stable by the

Country/territory	Population (pairs)	Quality	Year(s) of population estimate	Short-term trend (%)	Direction	Quality	Reference
							MITO2000 project (Rete Rurale Nazionale and LIPU 2015, MITO2000 2016), when this information was considered for the Reporting of the Birds Directive (Nardelli *et al* 2015), the Lega Italiana Protezione Uccelli and the Istituto Superiore per la Protezione e la Ricerca Ambientale decided to describe both the short- and long-term trends as unknown, due to insufficient data.
Jordan	unknown	-	-	unknown	unknown	-	-
Kosovo (UN Res 1244)	7,000-11,000	Medium (Estimated)	2009-2014	unknown	unknown	-	BirdLife International (2015)
Latvia	10,341-30,431	Medium (Estimated)	2008	88 (over the period 2005-2014)	decreasing	Medium (Estimated)	Auniņš (2015)
Lebanon	650-900	Good (Estimated)	2000-2015	3.6-5	decreasing	Medium (Estimated)	Ghassan Ramadan Jaradi (*pers comm*)
Libya	unknown	-	-	unknown	unknown	-	-
Liechtenstein	0-2	Poor (Suspected)	2009-2014	unknown	unknown	-	BirdLife International (2015)
Lithuania	4,000-7,000	Good (Estimated)	2012	5-10	decreasing	Medium (Estimated)	European Union (2013), BirdLife International (2015)
Luxembourg	150-200	Medium (Inferred)	2000-2012	0-20	decreasing	Medium (Inferred)	European Union (2013), BirdLife International (2015)
Macedonia, The former Yugoslav Republic of	20,000-60,000	Poor (Suspected)	2001-2012	0	stable	Poor (Suspected)	BirdLife International (2015)
Malta	0-14 (not confirmed)	Medium (Estimated)	2008	unknown	decreasing	Medium (Estimated)	Raine *et al* (2009), Sultana *et al* (2011), Wild Birds Regulation Unit (*pers comm*)
Moldova	3,000-3,500	Medium (Estimated)	2000-2010	0	stable	Medium (Estimated)	BirdLife International (2015)
Montenegro	10,000-15,000	Poor (Suspected)	2010-2015	unknown	decreasing	Poor (Suspected)	Montenegro EPA (2009)
Morocco	unknown (60,000 pairs for Tadla Region alone)	-	2014	unknown	unknown	-	Hanane and Besnard (2014)
Netherlands	1,200-1,400	Medium (Estimated)	2013-2015	27-55	decreasing	Good (Estimated)	European Union (2013), BirdLife International (2015), Ruud Foppen (*pers comm*)
Palestinian Territory	5,000-7,000 (individuals)	Medium (Estimated)	2013-2017	unknown	decreasing	Medium (Estimated)	Imad Atrash (*pers comm*)
Poland	25,000-49,000	Good (Estimated)	2008-2012	25-55	decreasing	Good (Estimated)	European Union (2013), BirdLife International (2015)
Portugal	10,000-50,000	Medium (Estimated)	2008-2012	39-59	decreasing	Medium (Estimated)	European Union (2013), BirdLife International (2015), Susana Dias (*pers comm*)
Romania	120,000-300,000	Good (Estimated)	2010-2013	0-20	fluctuating	Good (Estimated)	European Union (2013), BirdLife International (2015)
Russia (Europe)	7,000-15,000	Poor (Suspected)	2013-2016	>90	decreasing	Medium (Inferred)	Mischenko (2017)
Serbia	39,000-53,000	Medium (Estimated)	2008-2012	1-9	decreasing	Good (Estimated)	Puzović *et al* (2003); BirdLife International (2015)
Slovakia	15,000-30,000	Medium (Estimated)	2002	0	stable	Medium (Estimated)	European Union (2013), BirdLife International (2015)

Country/territory	Population (pairs)	Quality	Year(s) of population estimate	Short-term trend (%)	Direction	Quality	Reference
Slovenia	3,500-5,000	Good (Observed)	2002-2016	34-59	decreasing	Good (Observed)	Mihelič (2013), Kmecl and Figelj (2016)
Spain	1,370,000-2,285,000	Good (Estimated)	2004-2006	23 (over the period 1998-2015)	decreasing	Good (Estimated)	SEO/BirdLife (2016b)
Switzerland	1,000-2,500	Good (Observed)	1993-1996	20-40	decreasing	Good (Estimated)	Schmid *et al* (1998)
Syria	10,000-100,000	Poor (Suspected)	2010	50-75	decreasing	Medium (Inferred)	Nabegh Ghazal Asswad (*pers comm*)
Tunisia	unknown	-	-	unknown	unknown	-	-
Turkey	300,000-900,000	Medium (Inferred)	2016	10-30	decreasing	Medium (Inferred)	Zeynel Arslangündogdu (*pers comm*), BirdLife International (2004), www.kusbank.org
Ukraine	60,000-80,000	Medium (Estimated)	2000-2010	25-40	decreasing	Medium (Estimated)	Igor Gorban (*pers comm*)
United Kingdom	4,300 (3,200-5,400) territories	Medium (Estimated)	2014	88-93	decreasing	Good (Estimated)	European Union (2013), BirdLife International (2015), Walker and Morris (2016), Guy Anderson and Tony Morris (*pers comm*)

Note on United Kingdom: The population estimate is an **e**xtrapolation from the last formal breeding population estimate in the UK in 2009 (Musgrove *et al* 2013), using trend data (Harris *et al* 2017). The unit for the population estimate is territories, with the assumption that most territories equate to pairs. However, radio-tracking studies show that some calling males are not paired up.

The short-term trend is over the last 10 years (or three generations) but the period is not necessarily the same for all countries.
Good (Observed) - based on reliable or representative quantitative data derived from complete counts or comprehensive measurements.
Good (Estimated) - based on reliable or representative quantitative data derived from sampling or interpolation.
Medium (Estimated) - based on incomplete quantitative data derived from sampling or interpolation.
Medium (Inferred) - based on incomplete or poor quantitative data derived from indirect evidence.
Poor (Suspected) - based on no quantitative data, but estimates derived from circumstantial evidence

Table 3. Migrating and non-breeding populations by country/territory.

Good data on migrating and wintering numbers and trends for turtle-dove are generally lacking. This table collates known figures, but only represents a small part of the range (see Table 1).

Country/ territory	Season	Numbers (birds)	Quality	Years	Short-term trend (%)	Direction	Quality	Reference
Belarus	passage	-	-	-	-	decreasing	Good (Observed)	Levy S, Gritchik V, Vorobei N, Kozulin A, Dombrovski V, Vintchevski A, Sakhvon V, Kuzmitski A and Yakubovich D (*pers comm*)
Bulgaria	passage	-	-	-	-	decreasing	Poor (Suspected)	BSPB (*pers comm*)
Chad	non-breeding	>10,000 (see note)	Poor (Suspected)	2017	-	-	-	Leon Lamprecht (*pers comm*)
Finland	non-breeding	50-100	Medium (Inferred)	2010-2014	30-50	decreasing	Medium (Inferred)	BirdLife Finland (*unpublished data*)
France	birds passing through France during spring and autumn migration	-	-	-	-	decreasing	Medium (Inferred)	Hervé Lormée (*pers comm*)
The Gambia	wintering	max >1,000,000 in 1970s	Medium (Estimated)	1970-2016	65-75	fluctuating or decreasing	Medium (Inferred)	Gore (1980), WABSA (*pers comm*), Habitat Africa (*pers comm*), DPWM (*pers comm*), Barlow *et al* (1997)
Greece	passage	120,000-320,000	Poor (Suspected)	2010	10-25	decreasing	Poor (Suspected)	HOS (*pers comm*)
Lebanon	passage	15,000-18,000	Medium (Estimated)	2000-2015	95	decreasing	Medium (Estimated)	Ghassan Ramadan Jaradi (*pers comm*)
Mali	wintering	100,000-150,000	Good (Observed)	2008	-	increasing	Good (Observed)	Bouba Fofana (*unpublished*)

Country/ territory	Season	Numbers (birds)	Quality	Years	Short-term trend (%)	Direction	Quality	Reference
Malta	passage	**Spring**[6] 2011 (8/5-28/5) 18,057 2012 (9/4-26/5) 57,160 2013 (10/4-30/4) 42,521 2014 (10/4-30/4) 24,922 2015 (14/4-30/4) 25,006 2016 (10/4-30/4) 22,349 2017 (25/3-14/4) 7,539 **Autumn** 2014 (1/9-31/10) 7,956 2015 (1/9-31/10) 12,386 2016 (1/9-31/10) 6,868 2017 (1/9-31/10) 9,943	Good (Estimate)	2011-2017 (spring) 2014-2017 (autumn)	6.5	decreasing	Good (Estimated)	Wild Birds Regulation Unit (*pers comm*), Ecoserv 2011, 2012, 2013, 2014a, 2014b, 2015a, 2015b, 2016a, 2016b, 2017a, 2017b.
Mauritania	wintering	500-2,500	Poor (Suspected)	2015	-	decreasing	Poor (Suspected)	Djibril Diallo (*pers comm*)
Niger	wintering	>500	Poor (Suspected)	2006	-	-	-	WABDaB (2016)
Nigeria	wintering	tens of thousands (see note)	Poor (Suspected)	1980s	-	unknown	Poor (Suspected)	Phillip Hall (*pers comm*)
Senegal	wintering	>100,000	Medium (Estimated)	2017	-	fluctuating	Medium (inferred)	Malang Sarr (*pers comm*), Chris Orsman (*pers comm*)
Serbia	passage	-	-	2008-2013	-	decreasing	Medium (Estimated)	Puzović *et al* (2003)
Syria	passage	100,000-250,000	Medium (Inferred)	2010	60-90	fluctuating	Medium (Inferred)	Nabegh Ghazal Asswad (*pers comm*)
Ukraine	passage	300,000-500,000	Medium (Inferred)	2000-2010	25-30	decreasing	Medium (Inferred)	Igor Gorban (*pers comm*)

Note on Chad: turtle-doves have been reported from the wadis of Kharma and Achim in Chad, in small flocks on the move (20-100 birds in multiple groups) (Tim Wacher *pers comm*). An estimated 10,000 turtle-doves were observed drinking at a wetland in the north of Zakouma National Park in late April 2017 (Leon Lamprecht *pers comm*).

Note on Nigeria: in the 1980s there were thousands of wintering turtle-doves in the Jeribowl area to the east of Maiduguri, and there were tens of thousands wintering across to the north of Cameroon, especially around the Lake Chad shore areas.

See Table 2 for trend and quality categories.

[6] The periods of data collection do not necessarily span the entire migratory period of the species in spring or autumn.

Figure 6, Figure 7, Figure 8, Figure 9, Figure 10 and Figure 11 show the population trends of turtle-doves in 22 European countries collected by the Pan-European Common Bird Monitoring Scheme PECBMS (EBCC/RSPB/BirdLife/Statistics Netherlands 2016). Figure 12 and Figure 13 show the population trends over time experienced by turtle-doves in the western and central-eastern populations respectively, while Figure 14 shows all trends. Data for these figures were provided by national breeding bird surveys contributing to the Pan-European Common Bird Monitoring Scheme. In some cases, national coordinators may have chosen to present indices with a different base year; however, the trend of the index remains the same. Some range states may have additional population trend datasets to the PECBMS trends. We have used only the PECBMS data in these figures so that trends can be compared between range states.

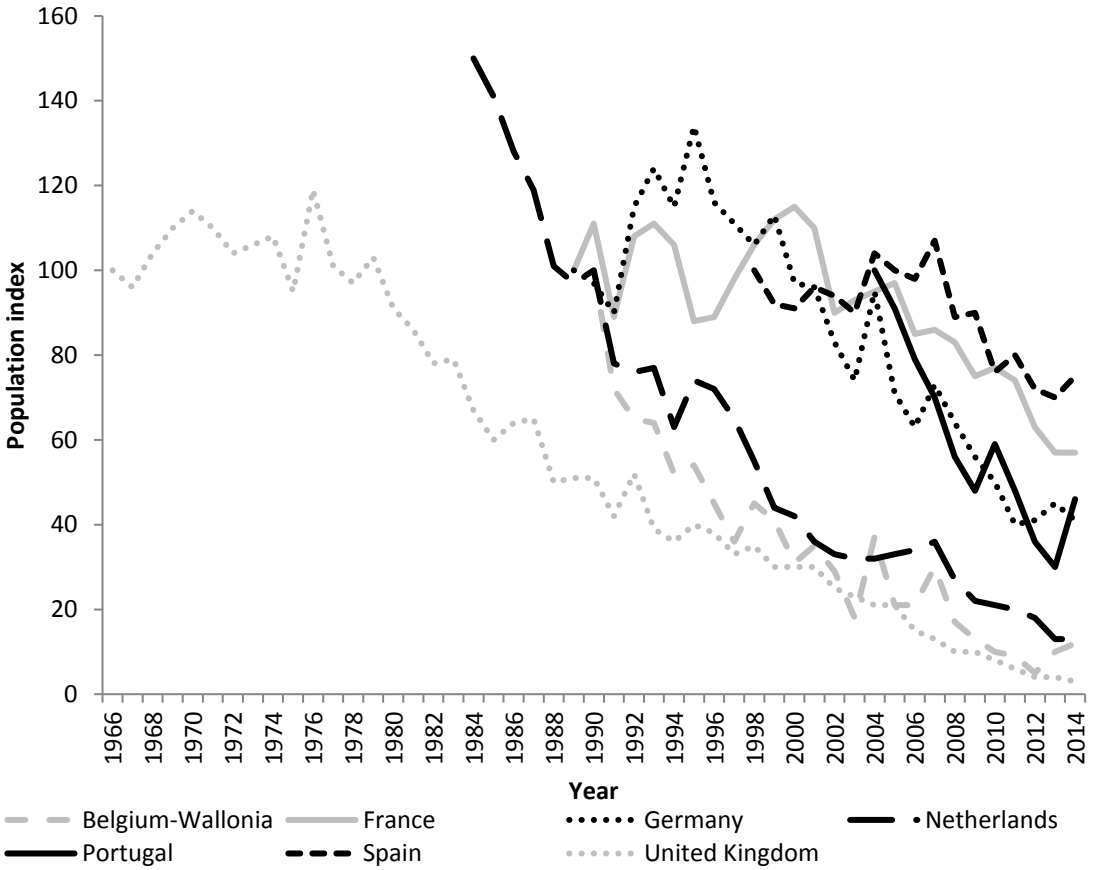


Figure 6. Pan-European Common Bird Monitoring Scheme population trend index for western Europe. EBCC/RSPB/BirdLife/Statistics Netherlands 2016.

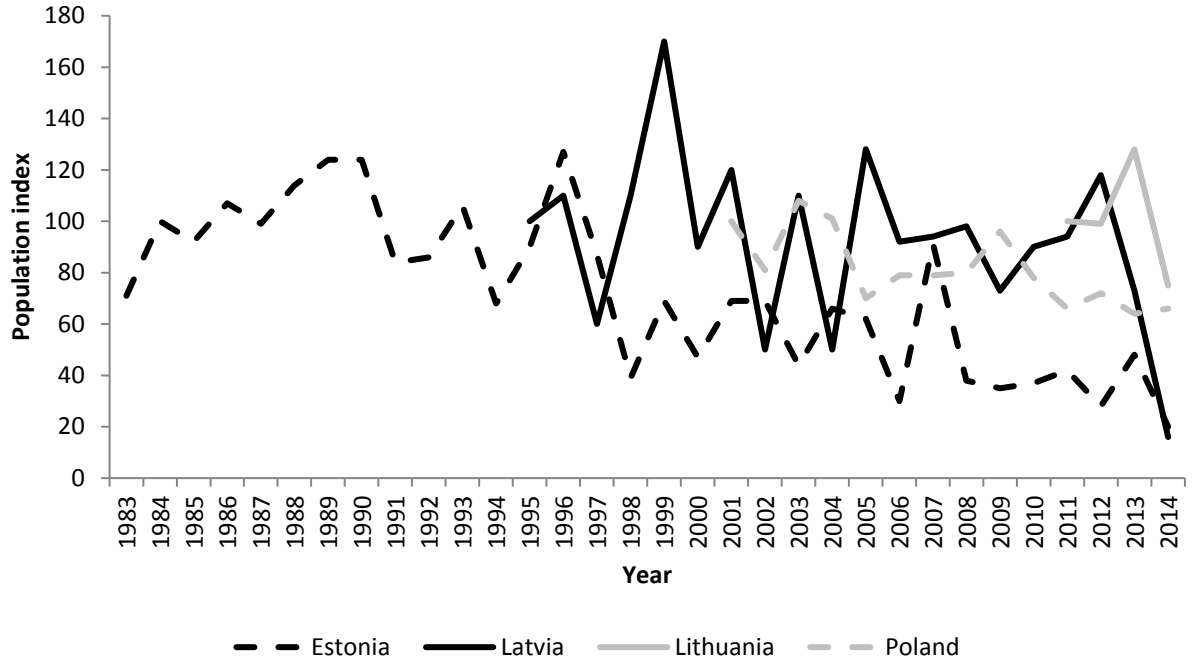


Figure 7. Pan-European Common Bird Monitoring Scheme population trend index for Estonia, Latvia, Lithuania and Poland.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016.

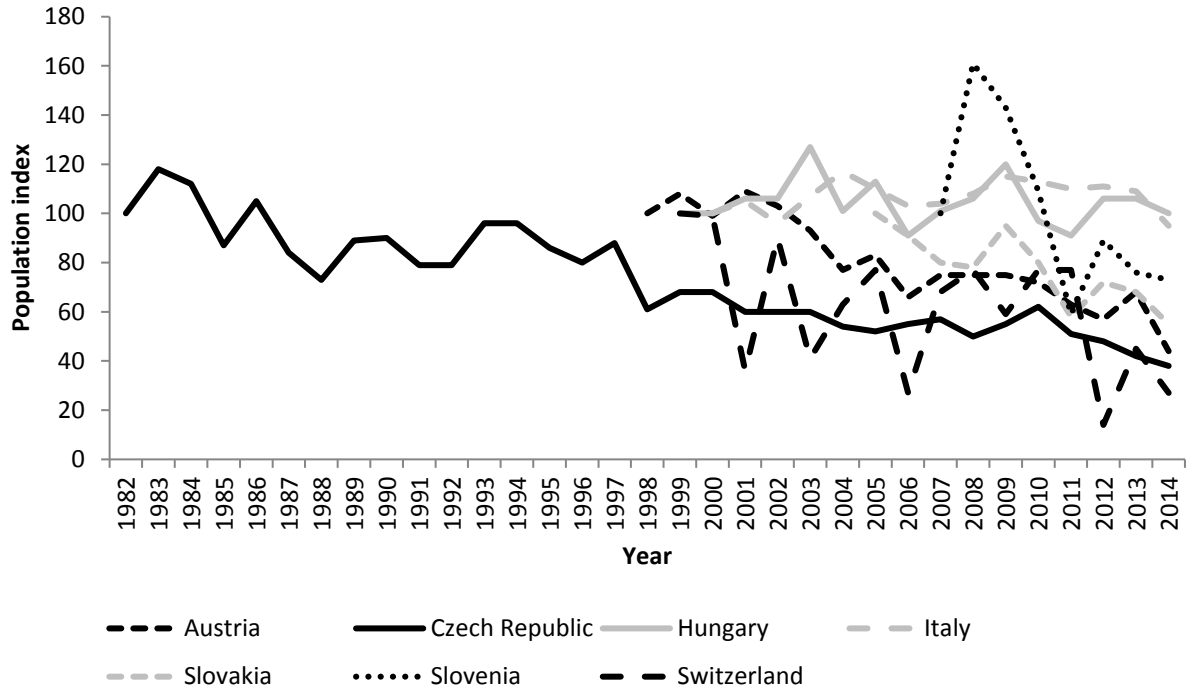


Figure 8. Pan-European Common Bird Monitoring Scheme population trend index for Austria, Czech Republic, Hungary, Italy, Slovakia, Slovenia and Switzerland.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016. 2007 was a pilot year for the data from Slovenia.

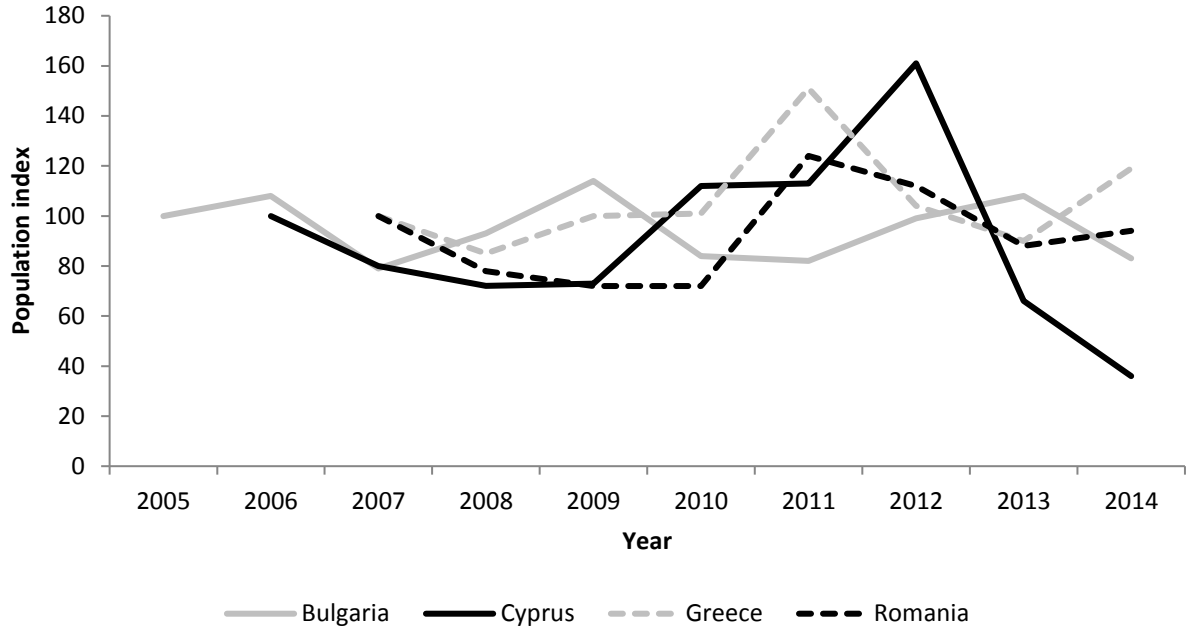


Figure 9. Pan-European Common Bird Monitoring Scheme population trend index for Bulgaria, Cyprus, Greece, and Romania.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016.

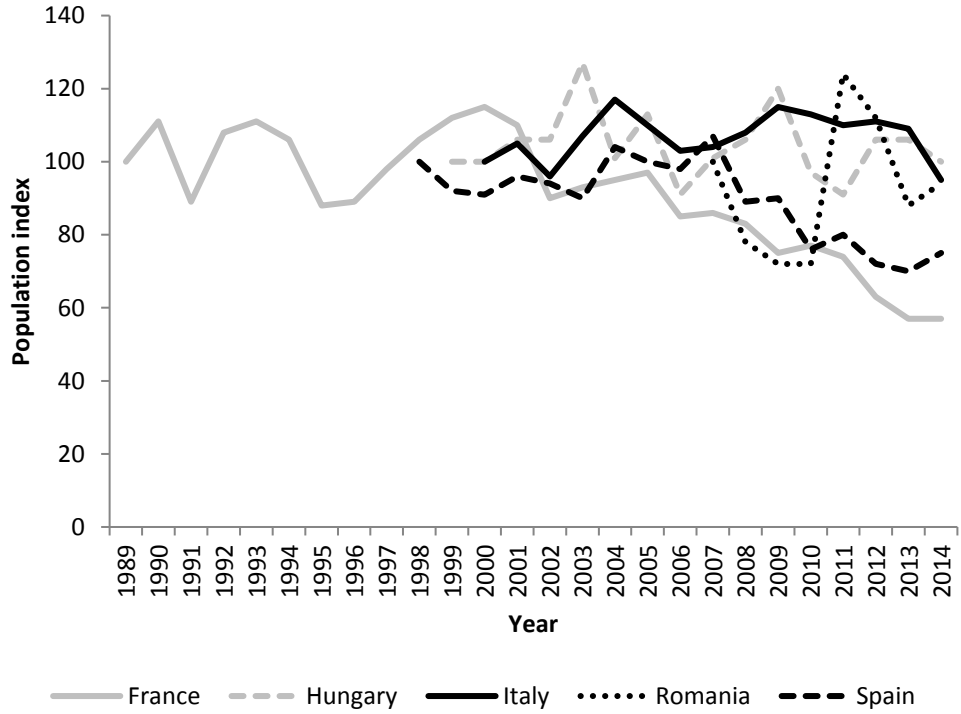


Figure 10. Pan-European Common Bird Monitoring Scheme population trend index for the five largest populations of turtle-doves contributing to the Pan-European Common Bird Monitoring Scheme.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016.

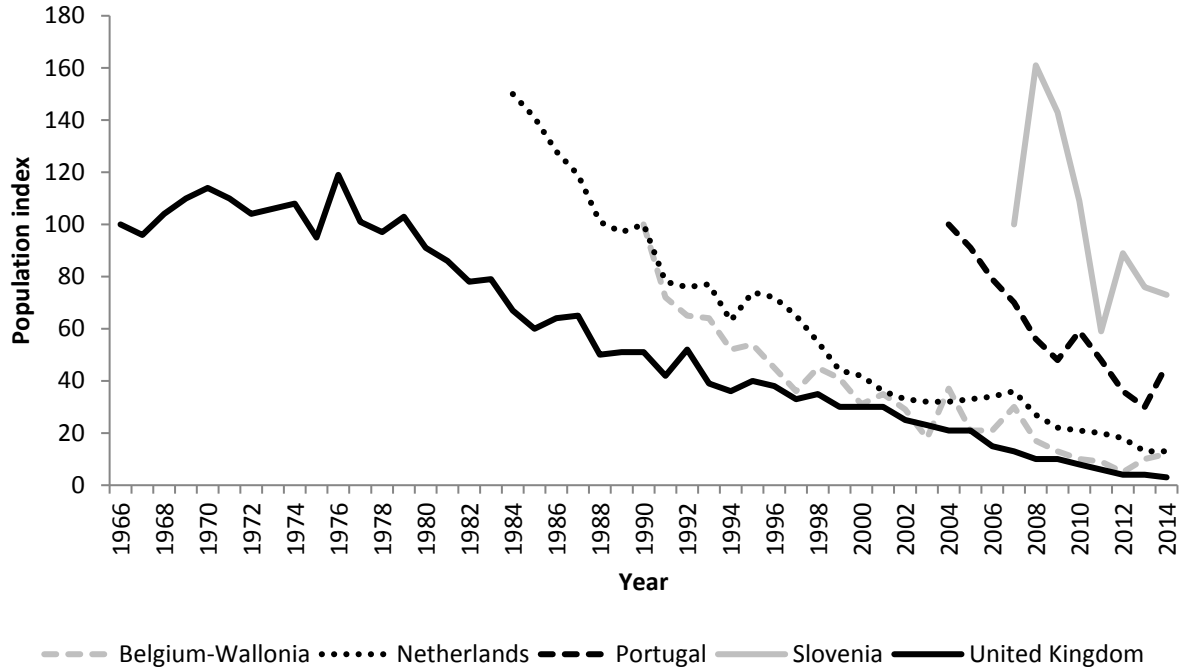


Figure 11. Pan-European Common Bird Monitoring Scheme population trend index for the five populations of turtle-dove showing the strongest declines.

Based on the multiplicative trend index contributing to the Pan-European Common Bird Monitoring Scheme (EBCC/RSPB/BirdLife/Statistics Netherlands 2016). 2007 was a pilot year for the data from Slovenia.

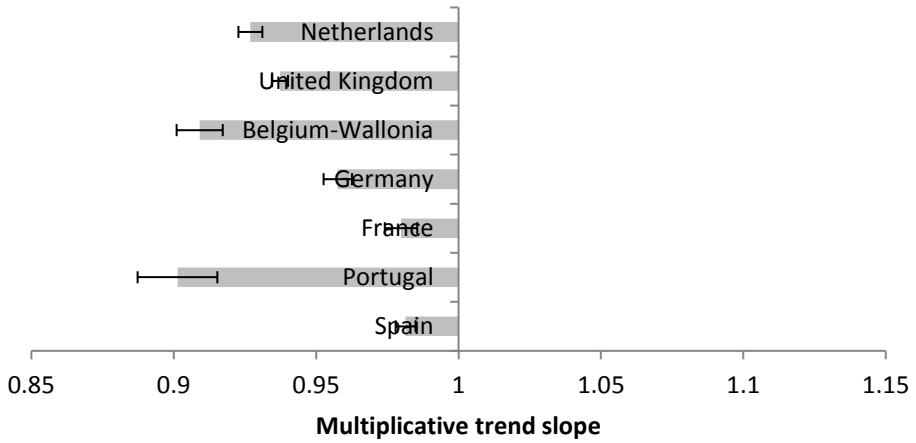


Figure 12. Pan-European Common Bird Monitoring Scheme population trend slope for turtle-doves in countries on the western flyway contributing to the Pan-European Common Bird Monitoring Scheme.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016. The countries are ordered from north (top) to south. Multiplicative trend over the time period (Belgium-Wallonia 1990-2014; France 1989-2014; Germany 1989-2014; Netherlands 1984-2014; Portugal 2004-2014; Spain 1998-2014; UK 1966-2014) reflects average percentage change per year, where for instance 1.08 means an 8% increase per year, 0.93 means 7% decline per year. >1 positive trend, <1 negative trend.

The PECBMS dataset is the only one available to enable representation of population trends across Europe in a comparable way (methodology and analysis). Other sources are available in Table 2, page 84, and there are limitations to the PECBMS data. For example, in France the number of bird count stations was low, biased in geographical location, and with variation in the number of count stations until 2001. STOC census data (2014), and ONCFS/FNC/FDC data (1996 to 2014) estimate that the decline is nearer to 48% (Cyril Eraud and Hervé Lormée *pers comm*).

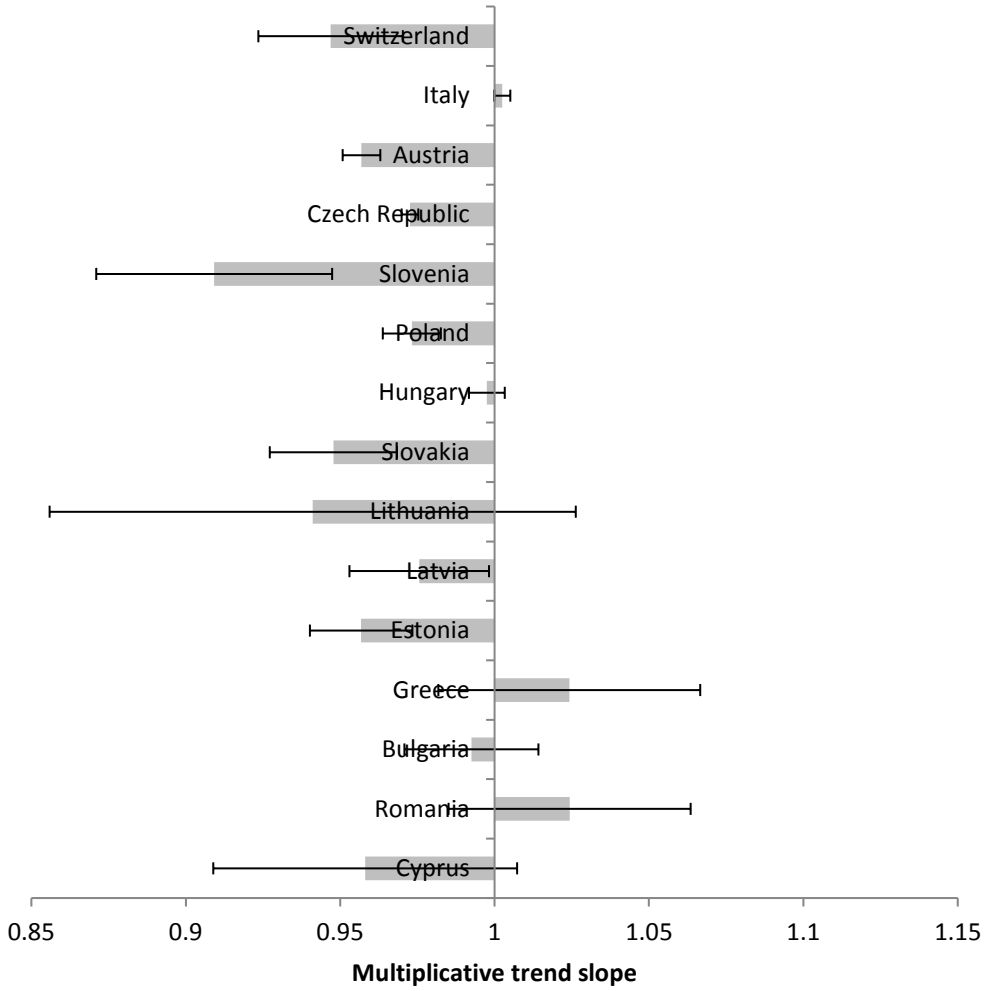


Figure 13. Pan-European Common Bird Monitoring Scheme population trend slope for turtle-doves in countries on the central-eastern flyway contributing to the Pan-European Common Bird Monitoring Scheme.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016. The countries are ordered east (top) to west. Multiplicative trend over time period (Austria 1998-2014; Bulgaria 2005-2014; Cyprus 2006-2014; Czech Republic 1982-2014; Estonia 1983-2014; Greece 2007-2014; Hungary 1999-2014; Italy 2000-2014; Latvia 1995-2014; Lithuania 2011-2014; Poland 2000-2014; Romania 2007-2014; Slovakia 2005-2014; Slovenia 2007-2014; Switzerland 1999-2014) reflects average percentage change per year, where for instance, 1.08 means an 8% increase per year, 0.93 means 7% decline per year. >1 positive trend, <1 negative trend. Where an error bar crosses the y-axis there is uncertainty over the trend direction.

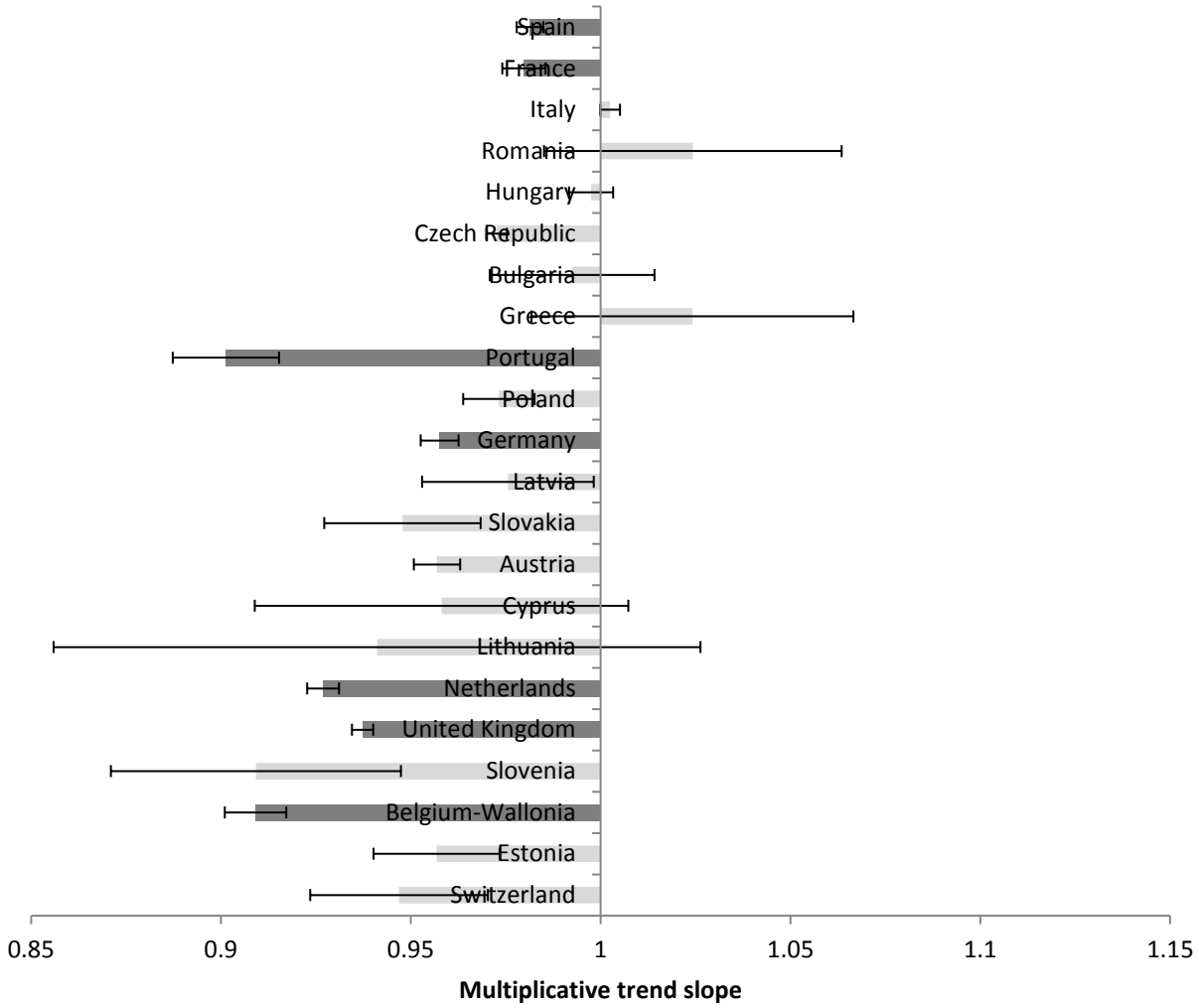


Figure 14. Pan-European Common Bird Monitoring Scheme population trend slope for turtle-doves in all countries submitting national data to the Pan-European Common Bird Monitoring Scheme.

EBCC/RSPB/BirdLife/Statistics Netherlands 2016. The countries are ordered by population size (largest population at the top). Countries from the western population are shaded in dark grey, countries from the central-eastern populations are shaded in light grey. Multiplicative trend over a time period considered, reflects average percentage change per year. >1 positive trend, <1 negative trend.

Outside of the European Union area, the formerly large population in European Russia has fallen by more than 80% since 2000, and by more than 90% since 1980 according to reports from the region (BirdLife International 2015, Mischenko 2017). Declines have been reported for the species in both the forest and steppe zones of European Russia (Alexander Mischenko *pers comm*). The species underwent a strong decline in the 1990s and 2000s in the forest zone, in Leningrad, Kirov, Kostroma and Novgorod regions (Golovan 2002, Sotnikov 2002, Ivanchev and Denis 2011, Mischenko 2015). At a monitoring plot in the Kostroma Region, turtle-doves were common in 1978-1980, with an average abundance in woodlands of two individuals per km^2. However, in 2008-2009 the species was completely absent (Preobrazhenskaya 2009). In many regions of the steppe zone of southern Russia there was a 20-40% decrease in the 1990s. In the Rostov and Volgograd regions and in the Dagestan Republic, populations decreased by approximately 50% or more over 10 years (Belik *et al* 2003). The breeding population in Stavropol Territory was assessed as 200,000 pairs in the 1980s, but only 3,500-4,500 individuals were estimated there based on a route census extrapolation at the beginning of the 21st century (Khohlov 1993, Bobenko 2010). The total population of turtle-doves in southern Russia at the beginning of the 21st century was estimated to be 100-300,000 pairs, while in the 2010s the population was estimated at just 1-2,000 pairs (Belik 2005, 2014). The overall population estimate for turtle-doves in European Russia decreased from 1-2.5 million pairs in 2000 (Mischenko 2004) to 7,000-15,000 pairs in 2016 (Mischenko 2017). The scale of the declines in the 1990s-2000s in both the steppe zone with strong farming and the forest zone with much lower intensity farming, points to factors outside the breeding range having a strong negative influence on the Russian population (Alexander Mischenko *pers comm*).

In Central Asia (Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) a very simple analysis of opportunistic observations of the species suggests that it has experienced a moderate or possibly strong decline over the past two to four decades (Raffael Ayé *unpublished*). In Uzbekistan the species has declined severely over the past 30 years (Roman Kashkarov *unpublished*). Declines have also been reported from parts of east and south-east Kazakhstan. For example the species is now rare, or even absent in the Manrak Mountains, where it was once common (Wassink and Oreel 2008).

A reduction in turtle-dove numbers on the wintering grounds has also been observed. Despite an increase in rice cultivation in northern Senegal, an important food resource for the species, declines have still been reported since the 1970s (Zwarts *et al* 2009). On the Inner Niger Delta in Mali, numbers of turtle-doves have dropped dramatically since the droughts of the 1980s from hundreds of thousands pre-drought conditions to just small flocks of at most several dozen over the period 1992-2007 (Zwarts *et al* 2009).

Breakdown of turtle-dove population trends across Europe

The information provided below was gathered through an informal literature review. It is designed to complement the information provided in Table 2, which should be regarded as the primary source of population trend data in this document.

France/Portugal/Spain

All three countries have reported long-term declines in turtle-doves. The Spanish population decreased at a rate approaching 23% between 1998 and 2015. In the European Red List of Birds, the long-term population trends were assessed as 20-30% decline for France and 20-40% decline for Portugal (BirdLife International 2015). In both France and Spain, some areas have experienced increasing or stable populations.

The turtle-dove in France underwent a decrease of 48% between 1989 and 2015, while in the last 10 years it decreased by 44% (Jiguet 2016). A strong population decrease was observed in 2008, probably explained by low temperatures and heavy rains (Roux *et al* 2011). A strong decline was detected in the 1970s-80s with an effective reduction of at least 50% in the following departments: Bretagne, Charente, Vendée, Centre, Île-de-France, Champagne, Rhône-Alpes, Midi-Pyrénées (Dubois *et al* 2008). Populations were stable or declines were weaker in: Normandie, Loir-et-Cher, Franche-Comté and Haute-Provence. Overall stability (or even a slight increase) followed in the 1990s, but with different trends across the regions. At a sub-national scale, three French regions experienced increases in the turtle-dove population index, namely Languedoc-Rousillon, Aquitaine and Poitou-Charentes (Roux *et al* 2011). All other regions experienced stable or downward trends. Declines appear strongest in those regions where the species was least abundant and the increases were in regions known to be strongholds for the species (Roux *et al* 2011). Overall it seems that the end of the breeding season in France is getting earlier, this shortening of the breeding season being similar to trends observed in the UK (Lormée 2013).

In Portugal, the species is distributed across the country with highest relative abundance in the far north, centre and far south (Equipa Atlas 2008). The core areas for the breeding population are mainly north of the Tagus River. Areas along the Guadiana valley and the lowlands of central/coastal areas near Lisbon are considered important for breeding and post-breeding populations (Dias *et al* 2013, Dias 2016). The species underwent a decline of 49% between 2004 and 2011 (Meirinho *et al* 2013). From 1994 to 2004 the decline was evaluated as moderate (annual rate -6.9 %). During this period, the highest declines were observed in those regions where the breeding population was concentrated. The long-term decline (1994-2011) was evaluated as moderate using the Pan-European Common Bird Monitoring Scheme as a common approach to analyse the data from two different monitoring schemes (Dias 2016).

In Spain, the species underwent a population decline of 23% between 1998 and 2015 (SEO/BirdLife 2016b). Following a slight increase in 2007, the population has since undergone a strong decline with the population index in 2015 the lowest recorded over the 1998-2015 period. At a sub-national scale the decline has been strongest in the *Eurosiberiana* biogeographic region (northern Spain) where the population trend over the period 1998-2015 was -70% (SEO/BirdLife 2016b). This was followed by the *Mediterránea Sur* biogeographic region (central, southern and eastern Spain) where the population decreased 29% between 1998 and 2015 and the *Mediterránea Norte* region (to the south of the *Eurosiberiana* area) where the decrease was 7% over the same period. In contrast to these declines, the population in Catalonia remained stable between 2002 and 2015 (ICO 2016). A new analysis shows an even stronger national decline of 40% between 1996 and 2016, including significant declines in ten regions: Pais Vasco, Galicia, Andalucia,

Catalunya, Castilla la Mancha, Castilla y León, Comunidad Valenciana, Madrid, Aragón and Extremadura (SEO/BirdLife 2016a). One region showed a significant increase (Navarra) and two regions showed no significant trends (Rioja and Murcia). In Navarra, the increase was due to a high number of observations in 2016 compared to previous years when the population was somewhat stable. Declines were most marked in Galicia and Pais Vasco.

Belgium/Denmark/Germany/Luxembourg/Netherlands/UK

In the northern part of the western flyway, populations are generally declining and in some areas the species has been lost. For example, it no longer uses urban parks for nesting in Belgium. Declines in Flanders have been most dramatic in agricultural regions, while in the Netherlands declines were strongest in woodland followed by agricultural areas, while the species remained generally stable in marsh habitats. In the UK, the species underwent a strong retraction from Wales, the south-west, Midlands and northern England, and is now absent from these regions.

The species was considered very common in the north and less common in the central and southern regions of Belgium according to the 1972 Atlas (Lippens and Wille 1972). In 1988, a decline was inferred due to an increase in changes to habitat: changes in grassland crops, and agricultural intensification, with associated loss of hedges, groves, country lanes, vegetated stream banks and other linear features in the farmed environment (Devillers *et al* 1988). While urban parks were previously used for nesting, in the 1988 Atlas these were no longer considered a breeding habitat. The population of turtle-dove in Flanders dropped by more than 70% in thirty years, with the species being lost from built-up areas as well as whole regions (Vermeersch *et al* 2004). The population declines have been most dramatic in important agricultural regions (Moyenne-Belgique and Condroz) but equally in Fagne and Lesse-et-Lomme. In Wallonie the species is currently in severe decline having undergone a loss of 70% in 30 years and is considered Vulnerable (Jacob *et al* 2010, Biodiversité Wallonie 2016).

The population trend for the Netherlands shows a marked decrease since 1990, with slight increases in 1996 and again in 2007 (Compendium voor de Leefomgeving 2016). The most recent data, as yet unpublished, collected between 2013 and 2015 as part of the Breeding Bird Atlas, suggest that the population has again declined (Ruud Foppen *pers comm*). The 1998-2000 Breeding Bird Atlas highlights that the population declined between the 1973-1985 period and 1998-2000 (retraction of breeding range in the lowlands and a 70-90% reduction in numbers in some populations) (SOVON 2002). Highest densities in the 1998-2000 period were found in the south-west of the country in polders (low-lying land reclaimed from the sea or a river and protected by dykes) in Lake Ijsselmeer, with the species generally absent from the north of the country. Declines were most prominent in Friesland, Zuidoost-Drenthe and West Nederland. The decline was strongest in deciduous woodland followed by farmland. The trend in marsh habitats remained relatively stable over the 1970-2000 period.

The species is a relatively new addition to the avifauna of Denmark, first appearing as a breeding species in 1918 (Fenger *et al* 2016). In the 1971-1974 Atlas the species was recorded as possibly or probably breeding. In the 1993-1996 Atlas the species was recorded breeding in Jutland. In Germany, the population generally increased between 1990 and 1995, and since then the overall trend has been declining (Dachverband Deutscher Avifaunisten 2016). Comparison of the distribution of the species in 1985 and 2005-2009 shows that it is generally similar between the two periods. It is mainly found in the lowlands of northern Germany and the northern and western uplands (Gedeon *et al* 2014). While there has been limited ringing of turtle-doves in Germany, it is thought that birds breeding in the west of the country migrate down through France and the Iberian peninsula, and birds breeding in the east of the country and Austria move down through Italy and Malta (Quillfeldt *et al* 2014).

The breeding population in Luxembourg is very small at just 150-200 pairs (Lorgé *et al* 2014). No population trend estimates are available, but the species was uplisted from Vulnerable in 2010 (Lorgé and Biver 2010) to Endangered in 2014 (Lorgé *et al* 2014).

In the UK, the population underwent a decline of 94% between 1995 and 2015 (Harris *et al* 2017). Regionally the species declined by 92% in the east of England (Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk, Suffolk) and 94% in the south east of England (Berkshire, Buckinghamshire, Hampshire, Isle of Wight, Kent, Oxfordshire, Surrey, Sussex). The range of the species in the UK retracted between the 1968-1972 and 2008-2011 Atlases (BTO 2016). The species remains in the east and south-east of England, but has generally been lost from the south-west, Wales, Midlands and northern England. Based on the current rate of decline turtle-doves may be lost as breeding birds in the UK by 2021 (Dunn and Morris 2012).

Estonia/Finland/Latvia/Lithuania

Countries around the Baltic Sea have generally experienced a decline in turtle-dove numbers or range. The decline in Latvia between 1995 and 2014 was very strong, and the Lithuanian population declined at an average rate of about 13% per year between 1994 and 2013.

The turtle-dove population in Estonia fluctuated greatly over the period 1983-2010 (Kuresoo *et al* 2011). The species increased between the 1970s and 1990s (Rouxel 2000) but exhibited a sharp decline in 1996-1998. In the early 2000s, the species dropped to 1983 levels or below (Kuresoo *et al* 2011).

In Finland, comparison of the 1974-1979, 1986-1989 and 2006-2010 Breeding Atlases shows that there are fewer records of the species in the most recent Atlas than in previous versions (Valkama *et al* 2011). The species is found mainly in the south-east of the country where it breeds in agricultural areas. It was first recorded breeding in Finland in 1979, and the population size was estimated at 70 pairs in 1980-1990, but is now estimated as five pairs. The number of atlas squares in which the species was recorded dropped from 130 in the 1970s, 90 in the 1980s, to 30 in the 2000s. If the decline continues, the turtle-dove will be lost as a breeding species. The population decline in Finland is thought to be related to broader declines across Europe.

According to the first 10 years of data collected as part of the Latvian Common Bird Monitoring Scheme, the population of turtle-doves decreased 87.9% between 2005 and 2014 (Auniņš 2015). The trend between 1995 and 2014 was -82.0%. The average annual trend was estimated at -9.7 to -2.5%. The species is distributed across Latvia with slightly more records in the south than north of the country (Kerus 2005). In the past, the species was described as most common in the east of the country, but always at low densities (Rouxel 2000). The range of turtle-doves expanded northwards from the 1930s until at least the 1960s.

In Lithuania the turtle-dove is a widespread species, but the population abundance index for turtle-doves between 1994 and 2013 was 0.87 (standard error 0.03) signalling a statistically significant average rate of decline of roughly 13% per year (Lietuvos Ornitologų Draugija 2013). The species also declined between 1970 and 1990 (Kurlavičius 2006).

Austria/Czech Republic/Hungary/Italy/Poland/Slovakia/Switzerland

An overall population trend for this region is unclear. Several countries have reported stable populations (Italy and Hungary) while other national trends are decreasing (Austria, Czech Republic and Poland).

In Austria over the period 2010-2015, the turtle-dove underwent a strong decline of 40% (annual decline of 9.8%) (Teufelbauer and Seaman 2016). Between 1998 and 2015, the species declined 54% overall, with an annual decline of 4.7%. The species is mainly found in the east of the country (Dvorak *et al* 1993).

Considered as a species of farmland in the Czech Republic, the population is undergoing a slight decrease (ČSO/JPSP 2015). Over the period 1982-2005, the species had an average annual population change of -2.81% (lower limit of confidence interval 0.96, upper limit 0.98) which was considered a moderate decline (Reif *et al* 2006). Comparison between the 1973-1977 and 1985-1989 Breeding Atlas shows that the number of squares occupied by the species remained similar in both periods (Štastný *et al* 1997). The 2001-2003 Breeding Bird Atlas data show that quadrat occupancy did not dropped below 90% on any mapping occasion (Štastný *et al* 2006). The preliminary results from the 2014-2017 Breeding Atlas (ČSO and ČZU 2017) show a moderate decrease in the number of occupied squares and a reduction in the number of squares where breeding has been confirmed, which may indicate a recent population decline.

In Slovakia, the population trend for turtle-doves is unclear. Although the trends for 2000-2012 and 1980-2012 were reported to be stable in the European Red List of Birds (BirdLife International 2015), analysis of Common Bird Monitoring data for the period 2005-2009 shows that the trend classification was uncertain with a negative tendency (Slabeyová *et al* 2009). The average annual population change during 2005-2009 was -3.22% (confidence intervals of 0.86-1.07). The species breeds mainly in the lowlands and is found in high numbers in the south of the country (eg in the Podunajsko region with records of 1.3-3.2 breeding pairs/10ha in windbreaks) (Danko *et al* 2002).

In Hungary, the population is estimated to be stable, with an annual trend of -0.26% (Mindennapi Madaraink Monitoringja 2016).

Although the population for breeding turtle-doves in Italy is estimated to be stable by the MITO2000 project (Rete Rurale Nazionale and LIPU 2015, MITO2000 2016), when this information was considered for the

Reporting of the Birds Directive (Nardelli *et al* 2015), the Lega Italiana Protezione Uccelli and the Istituto Superiore per la Protezione e la Ricerca Ambientale decided to describe both the short- and long-term trends as unknown, due to insufficient data. According to the 1983-1987 Breeding Bird Atlas (Meschini and Frugis 1993), and Brichetti and Fracasso (2006), the species was distributed along the entire Italian peninsula with small exceptions in the far north (Alps) and south, where the species was either not present or present in small numbers.

In Poland, the species underwent a moderate decline between 2000 and 2017 (Monitoring Ptaków Polski 2017). The population index in 2017 was 0.5 compared to 1 in 2000. The 1985-2004 Breeding Bird Atlas describes the species as very widespread (Sikora *et al* 2007). In the 19th century it was the most common dove species in Poland, but numbers have declined since then. It has also become less widespread (the distribution index in 2017 was 0.06 compared to 0.15 in 2000) (Jakub Milczarek *pers comm*).

The population in Switzerland fluctuated over the period 1990-2015, with the species generally in decline since about 1996, with a sharp decline exhibited in 2008 (Vogelwarte 2016b). However, from 1985 to the late 1990s the population increased (Schmid *et al* 2001). Analysis of three Atlas publications in Switzerland (1950-1959, 1972-1976 and 1993-1996) shows that the distribution of turtle-dove remained generally similar over the whole period, with some losses in central Switzerland between the 1972-1976 Atlas and the 1993-1996 Atlas. In the 1950s, the turtle-dove's range was patchy, being found in areas with a mild climate in the west and south of the country. Numbers increased after the mid-1950s, particularly in the Plaine de l'Orbe in the Vaud canton as well as on the Rhône plain. In the 1993-1996 Atlas, breeding was more irregular in eastern Switzerland with a slight negative trend (Schmid *et al* 2001).

Albania, Bosnia and Herzegovina, Croatia, Greece, Kosovo (UN Res 1244), The former Yugoslav Republic of Macedonia, Montenegro, Serbia, Slovenia

Information on the population trend or distribution of the species in this group of countries is limited. The species has undergone a steep decline in Slovenia, but is considered Least Concern in Romania. In Greece it is a widespread breeding bird, but much commoner on passage, particularly during the spring when large numbers of birds stage on the Greek islands.

The turtle-dove maintains high breeding densities in central Greece (Thessaly), and most of its breeding population in north-eastern Greece (Evros region) shows a stable and/or low (±5) declining trend during the last 15 years (Dimitris Bakaloudis *pers comm*). It is reported to breed over much of the Greek mainland, being widespread and common in Macedonia and Thrace, but more thinly distributed farther south (Handrinos and Akriotis 1997). In the Peloponnese, widespread in small populations in suitable habitats. The species nests up to an altitude of 1500m. It largely prefers pine trees and olive groves with old growth trees (above 5m height) (Christos Barboutis *pers comm*). The species is much commoner on passage in Greece, particularly during spring migration. It moves on a broad front, but large numbers can be found along the coast, particularly in western Greece. In spring, birds pass through Zakynthos, Kefallinia and the Strofades, the first landing site after crossing the Mediterranean from more southerly wintering areas. Large numbers of birds have been recorded stopping on or passing over the Strofades in spring: an estimated 5,000 birds recorded on the main island in 1995 and a further 5,000 passing over (Handrinos and Akriotis 1997).

In Slovenia, the population underwent a steep decline with a multiplicative annual slope of 0.90 over the period 2008-2016 (Kmecl and Figelj 2016). However, in the 1995 Breeding Bird Atlas the species was described as common with a stable trend (Geister 1995). It is most common in the east of the country, especially Dolenjska, Bela Krajina, Kozjansko, and Prekmurje. It is also common in the south-western part of the country, especially in the Slovene part of Istria (Mihelič 2013).

No population trend is available for Albania, Bosnia and Herzegovina, Croatia, Kosovo (UN Res 1244), The former Yugoslav Republic of Macedonia, Montenegro, or Serbia. However, it is considered Least Concern on the national Red List for Croatia (Tutiš *et al* 2013).

Armenia, Azerbaijan, Belarus, Bulgaria, Cyprus, Georgia, Moldova, Romania, Russia, Turkey, Ukraine

The overall picture for this region is unclear. The population in Bulgaria was stable from 2005 to 2015. Good information is lacking for a number of countries (Armenia, Azerbaijan, Belarus, Georgia, Russia and Ukraine) while the trend is uncertain for Cyprus. The Turkish population is apparently in decline while numbers in Moldova and Romania have increased.

The population trend for the species in Bulgaria over the period 2005-2015 was stable (Hristov 2015), and the species has a broad distribution across the country (Iankov 2007). Historically, the species was described as widely distributed at the end of the 19th century, in the first half of the 20th and at the middle of the 20th century. During the second half of the 20th century, the distribution was similar to that of the first half, but it is likely that there were some reductions in occupied territories in higher mountain areas. In terms of the national population trend, there is some evidence (based on the frequency of sightings) that the species may have decreased slightly over the period 1970-1990. However, the lack of data collected through coordinated national census work means that it is not possible to confirm this (Iankov 2007).

In Cyprus, the overall trend for the species over the period 2006-2015 was uncertain with the population exhibiting increases, decreases, and periods of stability over the 10 year period (Hellicar 2016). The trend for the species in farmland and forest habitats was equally uncertain.

The species is considered common in Moldova and in recent years the population has increased (Munteanu and Zubcov 2010). An ongoing monitoring programme is underway and will be completed in 2018, which will allow the population trend to be updated (Vitalie Grimalschi *pers comm*).

In Romania, the turtle-dove is described as present throughout the country, and the 2002 Breeding Bird Atlas states that the species underwent sharp declines in recent decades (Munteanu 2002). Post-1950, the species underwent continuous declines and is now less numerous in large wooded areas than in the first half of the 20th century (Munteanu 2009). Nesting birds in parks and cities were lost in the 1940s-50s due to the species being outcompeted by the collared dove at least in Transylvania and Banat (Munteanu 2009). However, the population of turtle-doves is currently increasing (Petrovici 2015).

In Turkey, the population is apparently in decline (Kirwan *et al* 2008). It is more common in the west of Turkey and localised in East Anatolia. The species is widespread on passage and can be found in large numbers. It is reported to be abundant on passage through the eastern third of the country, particularly the extreme north-east. There is no evidence of large-scale passage movements at the Bosphorus.

In the north of the Caucasus, the species is described as common. However, it does not breed in large numbers (Rouxel 2000).

The overall population estimate for turtle-doves in European Russia decreased from 1-2.5 million pairs in 2000 (Mischenko 2004) to 7,000-15,000 pairs in 2016 (Mischenko 2017). Fluctuations were recorded in the Kaliningrad population and a decline was detected in the 1930s. However, by the late 1990s it was thought to have stabilised (Rouxel 2000). Karelia represents the northern limit of the species' distribution in north-west Russia (Rouxel 2000). Production of a European Russian Breeding Atlas is currently underway (Luomus 2016) using data collected from 2005 to 2017 (Zoological Museum of Moscow University 2016), and so more information on the species in Russia will become available.

In the west of Ukraine, declines of around 20-50% were recorded in the late 1990s (Rouxel 2000). Work is underway to collect data on bird distribution and abundance for the second European Breeding Bird Atlas (Gorban 2016) and more information on the species in Ukraine will be available..

The species is described as uncommon in Armenia (Adamian and Klem 1997). It is not present in all suitable habitats in Crimea and is rare in the west of Ukraine, but is noted as a common breeder in the north of the Azov Sea (Rouxel 2000). It is common in Belarus (Rouxel 2000). Azerbaijan holds about 7% of the European breeding population (BirdLife International 2015) and it is a very common nesting species and migrant (Patrikeev 2004), although quantitative trend information is unavailable.

Annex 2: PROBLEM ANALYSIS

General overview

Relative importance of threats is hard to determine, as empirical data on the likely drivers of decline are limited for a large number of Range States. However, questionnaires for the development of the Species Status Report (Fisher *et al* 2016a), expert opinion at the two workshops, and comments on multiple draft documents have shown general agreement that the main threat for the turtle-dove is loss of food, water and/or habitat (nesting habitat during breeding season or roosting habitat during winter), brought about through habitat loss or modification. This was assessed as a Critical threat (causing or likely to cause very rapid declines, >30% over 10 years) on the breeding grounds, and High (causing or likely to cause rapid declines, 20-30% over 10 years) for passage/wintering grounds. Evaluation of the threats at the workshops was based on three criteria: the proportion of the population exposed to the threat, the impact of that threat on that part of the population exposed to it, and the timing (happening now, soon, or in the future).

Illegal killing was also assessed as Critical at the workshops, with possibly large numbers of birds being killed or taken each year, and scarce information available for many Range States. Unsustainable hunting pressure on turtle-doves, especially with rapidly decreasing national populations across much of its range, was ranked as High, with little information about its impact at the overall flyway level.

Additional threats were identified, such as disease, pesticide use, and competition, but either knowledge is limited, or the degree of impact is considered to be small or unknown (with lack of compelling evidence to warrant action) compared to habitat change, illegal killing, and hunting.

While it is acknowledged that there is disagreement among some stakeholders as to the exact grading of some threats (eg Critical vs High), the purpose of determining relative importance is to target action. It is clear that some threats are far less significant than others, and that – regardless of exact ranking – the following issues are the most significant and must be addressed *concurrently*:

- Loss of good habitat for breeding (habitat, food and water)
- Loss of good habitat for passage/wintering (habitat, food and water)
- Illegal killing
- Unsustainable hunting.

Habitat loss/modification

In Europe, changes in habitat have been linked to the falling breeding numbers in most countries. Turtle-doves nest in bushes/trees in mosaic habitats, where undergrowth is not too thick and food is plentiful. Since the 1960s, mechanisation, land reform, and intensification have led to a reduction in hedgerows and margins across Europe (eg Barr and Gillespie 2000), although the transformation in central and eastern States has been less, perhaps accounting for stable populations or slower declines.

Rocha and Hidalgo de Trucios (2002a) showed that the decline of turtle-dove populations in Extremadura, Spain could be directly linked to the decrease in the agricultural area of cereals over previous decades, and that the density of nests is 3.5 times less in areas where herbicides are used than in areas without herbicides. In Spain, habitat degradation due to loss of hedgerows, riparian forests and the landscape mosaic, increasing use of herbicides leading to loss of weeds, intensification of olive groves, reduction in the area of sunflower crops (leading to loss of food), loss of poplars to cropland, and increasing area of conifer plantations were all listed as threats in the 2004 Red List of Birds of Spain (Madroño *et al* 2004). In addition, in Portugal habitat loss and degradation due to replacement of traditional orchards by intensive irrigated orchards, large wildfires, reduction in the number of conifer patches and forest management neglect, particularly in the interior of the country, can also be considered relevant threats (Dias 2016).

In Greece, abandonment of mountainous and rural areas and the subsequent decrease of cropland and afforestation of these areas are believed to have created unfavourable habitats for the species. Moreover, significant changes in agriculture, including diversification and intensification of traditional crops such as cereals and legumes, have altered the landscape. The intensification of olive farming (Super High Density Olive Farming) is expected to expand significantly in the future, which could result in a loss of important foraging and nesting sites, especially in southern Greece and Crete (Christos Barboutis *pers comm*).

In Cyprus, abandonment of small-scale agriculture in mountainous and rural areas and changes in cultivated crops are believed to threaten the turtle-dove population (Nicos Kassinis *unpublished*). Of key concern is suitable crop availability, particularly the traditional crop varieties that are important food sources for turtle-doves, such as legumes (*Fabaceae*), vetches (*Vicia sp*) and sesame (*Sesamum indicum*) (Panicos Panayides *pers comm*). Many of these crop varieties have largely decreased over the years throughout Europe. In Cyprus, cultivated legumes decreased by 50.3% between 1960 and 1994, and more specialised nutritious crops like vetches, chickling vetches (*Lathyrus sp*), and sesame decreased by 84-94% over the same period (Panayides 2005). Habitat loss owing to urban expansion is also a problem. The land taken up by urban centres increased fourfold between 1963 and 1993, while suburbanisation with scattered housing affects even more land. Habitat fragmentation by road construction increased from an average of 0.64km length of road/km^2 in 1960 to 1.9km of road length/km^2 in 1999 (Panayides 2005).

In the wider Mediterranean region, lack of management in conifer plantations results in the rapid development of dense under-storey vegetation, rendering these habitats unsuitable for turtle-doves (Dias *et al* 2013). In Bulgaria, the intensification of agriculture, particularly the large-scale removal of mature scrub and field margins driven by Rural Development Programme subsidies, may have had a strong negative impact on turtle-doves. Conversion of large areas of abandoned, low productivity farmland to more intensive production also poses a threat. However, the species remains quite abundant in these areas and specific surveys would be needed to estimate the real impact on the population. The Bulgarian Common Bird Monitoring scheme would not be able to detect any impacts until it is possibly too late to counteract declines.

In Central Europe, land abandonment and agricultural intensification are both issues. Lack of early-season wild seeds is of concern for some countries, and intensification may mean that seeds are not available, as they are buried in the soil. In Croatia, land abandonment in Mediterranean regions results in transformation of traditional low-intensive agricultural habitats into *maquis*, a shrubby, mostly evergreen vegetation with a low amount of herbaceous undergrowth. Presumably the food availability is lower in *maquis* as the breeding densities in *maquis* are lower than in agricultural habitats with less pronounced succession (Sanja Barišić *pers comm*, Vesna Tutiš *pers comm*). Abandonment also prevents the birds from accessing seeds on the ground: a large issue in Croatia, but probably not such a priority for Hungary where changes are occurring in the early season (Sanja Barišić *pers comm*, Béla Tokody *pers comm*, Vesna Tutiš *pers comm*). Food availability is likely to reduce in the future, and is extremely variable across the region. For example, in Croatia agricultural intensification in some areas is predicted to have a significant impact on the turtle-dove population in the future as current rural development plans in the Mediterranean region envision transformation of pastures or arable land currently used for cereal production into irrigated farmlands (orchards, olive groves, vineyards or for vegetable production), which would be suboptimal breeding habitat for the turtle-dove (Sanja Barišić *pers comm*, Vesna Tutiš *pers comm*).

In Flanders, Belgium where the population decreased by at least 70% between the 1970s and 2000-2002, factors on the breeding grounds contributing to the decline were identified as agricultural intensification and a loss of copses, hedgerows and mature woodlands, as well as declines in the number of seed-producing herbs (Vermeersch *et al* 2004). In Wallonia, the drivers behind the declines lie in agricultural intensification (Jacob *et al* 2010). Factors include changes that have reduced available food sources: increasing pesticide applications, concreting of rural tracks, and loss of weed-rich field margins. In the Netherlands, activities contributing to population declines include the degradation of breeding habitat, such as replacement of cereals by green maize (*Zea mays*) and the use of herbicides (SOVON 2002). Similarly in Switzerland and France, habitat loss, pesticide use and agricultural intensification have been identified as threats (Schmid *et al* 2001, Issa and Boutin 2015), leading also to hedgerow and woodlot destruction. It is not known whether the introduction of ecological compensation measures have benefited the species (Schmid *et al* 2001). In Slovenia, the main threat is the agricultural intensification that has caused the loss of mosaic fields, fallow land and hedges (Kmecl and Figelj 2016). In Romania, deforestation and removal of tall shrubs (nesting habitat), modification, fragmentation and loss of habitat, increased herbicide use (loss of weeds) and possible ingestion of grain treated with rodenticide have all been identified as threats on the breeding grounds (Munteanu 2009, Petrovici 2015). Important conservation actions identified for the species in Romania include a number related to habitat/loss modification: preventing urban developments in important forest habitats and preventing deforestation; ensuring forestry operations are carried out at times that minimise disturbance to the species; maintaining and increasing the area of native forest; maintaining and increasing a mosaic of habitats at the landscape scale; and connecting existing habitats (Petrovici 2015). Removal of alluvial forests and margins is considered a localised problem in Central Europe, for example in Slovakia and Croatia (Sanja Barišić *pers comm*, Ivana Czocherova *pers comm*, Vesna Tutiš *pers comm)*.

In the UK, reductions in habitat area and food availability have been suggested as causes for population declines (Hodge *et al* 2006). Changes to the farmed environment appear to have had a strong impact on the turtle-dove. Woodland habitats were found to support 6.5 times more turtle-dove territories than farmland in the UK (Browne *et al* 2004). Farmland habitat diversity decreased due to simplifications in crop rotations and loss of non-arable habitats. Between the 1960s and 1980s, farmland plots lost hedgerows, scrub and woodland, but after the mid-1980s the measure of 'hedginess' increased. Habitat diversity increased in woodland plots as vegetation clearance increased the number of habitats found within the woodland group, causing a small decrease in the amount of available nesting habitat. In the UK, turtle-dove territories were more likely to be retained and were more abundant in locations with a greater area of established scrub and more hedgerows (Dunn and Morris 2012). Turtle-dove diet changed between the 1950s/60s and late 1990s, with far fewer weed seeds now present in the species' diet both as nestlings and as adults. The species' favoured feeding sites in the 1950s/60s consisted of hayfields, clover leys and haystooks, whereas in the late 1990s the species was not recorded on these habitats at all, mostly because these habitats have almost entirely disappeared (Browne and Aebischer 2003b). Naturally regenerated fallow rotational set-aside in the summer was found to have a small benefit to turtle-doves, compared to conventional farmed arable land, whereas set-aside sown with crops for wild birds and long-term set-aside more than two years old or younger set-aside sown with a grass mix did not benefit the species (Hodge *et al* 2006).

Set-aside created under the Single Payment Scheme (introduced in 2005) was predicted to make no difference in terms of biodiversity benefit to turtle-doves compared to set-aside under the Arable Area Payment Scheme. However, reversion of set-aside land under the Single Payment Scheme to arable was predicted to have a small negative impact on turtle-doves (Hodge *et al* 2006). In 2008, around eight million hectares of former set-aside land re-entered mainstream agricultural production when set-aside policy in the EU was abolished (Allen *et al* 2014). Agri-environment measures have been introduced in the UK with the aim of improving foraging and nesting habitat for turtle-doves. One option under Environmental Stewardship - arable margin management (creating grass margins) - was shown to be positively associated with turtle-dove population growth rates (Baker *et al* 2012). However, options under Higher Level Stewardship failed to affect abundance of turtle-doves on surveyed farms (Bright *et al* 2015). The Operation Turtle-dove partnership in the UK has developed a Turtle-dove Package (Annex 3: JUSTIFICATION OF CONSERVATION / MANAGEMENT OBJECTIVES, page 104), which consists of a suite of options designed to support the needs of breeding turtle-doves. The measures include accessible seed-rich foraging habitat close to suitably managed scrub and hedgerows providing safe nesting habitat. Initial survey work suggests that one to two years after implementation there was some evidence that turtle-dove occupancy and abundance were positively associated with agreements containing some foraging habitat (Walker and Morris 2016). However, in most cases the conditions for foraging were not optimal.

Reduced water availability has been suggested as a problem for the species both on the breeding and passage/wintering grounds, although the scientific evidence for this is limited. It is not clear whether there has been a significant reduction in water supply on the breeding grounds, particularly with the expansion of irrigated agriculture, but water does appear to play a role in site selection for turtle-dove. In the UK, areas that retain turtle-doves have water supplies (Tony Morris *pers comm*). In Spain, there is a correlation between turtle-dove productivity and presence of water, and turtle-doves avoid breeding in areas without water supplies (Rocha and Hidalgo de Trucios 2002a). Intensive dam construction in Cyprus is affecting ecosystems by altering water flow and exacerbating drying of natural springs during hot weather (Panayides 2005), and this may impact availability to turtle-doves.

A reduction in the number of nesting locations may also be affecting the species. Although the area of forest habitats may be increasing across Europe, quality of nesting habitat may be decreasing. A study in the west of France found that in areas where hedgerows had been cut on both sides, the number of singing male turtle-doves has reduced (Hervé Lormée *pers comm*). In Armenia, illegal logging in broadleaved woodlands threatens the species (Mamikon Ghasabyan *pers comm*).

In European Russia, the turtle-dove breeds in the forest and steppe zones. Large-scale abandonment of farmland, primarily cereals and grasslands, and their overgrowth by tall dense weeds, bushes and young forest is an important negative factor in turtle-dove breeding habitat within the forest zone, leading to a loss of feeding habitat (Alexander Mischenko *pers comm*). Abandonment began in the early 1990s and continues today. Huge areas of farmland have been abandoned, up to 80% of the total farmland area in some regions (Ljuri *et al* 2010). This loss of feeding habitat is aggravated by spring fires over large areas. In contrast, in southern Russia (the former steppe), agricultural intensification is taking place. Cereal crops are the dominant agricultural land-use and receive heavy pesticide treatments, including dispersal of pesticides via light aircraft (Alexander Mischenko *pers comm*).

In West Africa, increasing human populations caused significant changes to the natural environment with increased cultivation of the Sahel and Sudan zone, overgrazing and cutting of trees, notably in Senegal and The Gambia, at least in the latter decades of the 20th century (Jarry 1994b). Wood cutting at turtle-dove roost sites in south-east Senegal has been recorded (Malang Sarr *pers comm*). Such modification of habitats probably led to the disappearance or deterioration of important roosting sites, but may also have had an impact on the feeding opportunities for wintering turtle-doves. Morel and Morel (1979) reported 450,000 turtle-doves roosting at a site in March (year unclear) near the town of Richard Toll, Senegal. Recent visits to this area have found no stands of trees capable of holding such large numbers (Chris Orsman *pers comm*). Isolated wetlands in Niger are under pressure from a range of human activities including livestock grazing, hunting and agriculture that can result in loss of trees, trampling of vegetation by grazing animals and disturbance (Brouwer 2014). Such human pressure around isolated wetlands will increase into the future. Following the Sahel droughts of 1968-1997, the region experienced a very rapid loss of natural non-forest vegetation through increased agricultural activity (Walther 2016). The diversity, abundance and distribution of woody plant species declined strongly post-drought, brought about by a number of factors: overharvesting of woody material (for timber, firewood and livestock feed); overgrazing; intensification of agriculture leading to a decline in rotational cropping, fallows and semi-natural habitats; increased fire frequency; and replacement of natural habitats with forest monocultures or invasive species (Walther 2016). The soil was also subject to wind and water erosion. A large literature review suggests that the rapid conversion of the Sahel to a human-dominated landscape is likely to have been the most important long-term cause of population declines in migratory species in the Sahel region (Walther 2016), but how this affects turtle-doves is not known.

Additional habitat-related threats have been identified as: the increased use of plastic and other covering in fields in Switzerland (Raffael Ayé *pers comm*); rapid ploughing and re-cropping of cereal fields after harvest, leading to poor availability of grains and weeds in France (Hervé Lormée *pers comm*); monocultures, loss of meadow to arable land, and urbanisation of agricultural habitats in Lithuania (Liutauras Raudonikis *pers comm*) and in Portugal, particularly in the coastal regions (Susana Dias *pers comm*); reseeding of grassland and intensive grassland management, increased use of pesticides, and high predator densities in Estonia (Jaanus Elts *pers comm*); changes in crop rotation and uncontrolled forest cutting in Ukraine (Tetiana Kuzmenko *pers comm*); and the decline of wooded semi-natural pastures because of under-grazing in Turkey (Itri Levent Erkol *pers comm*). In the Mediterranean region, increasing frequency and intensity of wildfires may threaten suitable habitat (conifer plantations with low cover of under-storey shrubs) (Dias *et al* 2013).

Illegal killing

In the context of this Action Plan, illegal killing is defined as catching, trapping and/or killing outside of the law (eg using illegal methods, killing out of the hunting season).

Estimates of turtle-dove mortality due to illegal activities have proved complex and challenging to develop. In most countries, verifiable numbers are lacking or data on officially disclosed cases of illegal killing are limited. Brochet *et al* (2016) estimate the number of turtle-doves killed illegally in the Mediterranean at 602,599 individuals annually (336,014-869,183), although these figures are based on an extrapolation from a poaching hot-spot that may not be fully representative of the wider region. Libya, Syria and Greece were where the largest number of birds were killed each year. Turtle-doves are traded legally in significant numbers (for example, as a hunting trophy), but they are also traded illegally in large numbers in Europe (TRAFFIC 2008). Illegal killing of birds is prevalent on the Ionian Islands of Greece, with an estimated 69,000 turtle-doves illegally shot every spring (LIPU/SEO/HOS 2015), although this figure is disputed. Efforts of local authorities and game wardens in some areas have reduced hunting take to zero, for example in Strofadia (Hellenic Hunters' Confederation, *pers comm*). The species is illegally killed in Egypt during autumn migration, where an estimated 34,534 turtle-doves are caught annually along the North Sinai coastline (Eason *et al* 2016). Some of these birds may be sold in local markets. Observations of trapping activities along the eastern coast of the Red Sea in Saudi Arabia in the early-mid 1980s estimated that 100,000 turtle-doves (subspecies *arenicola*) were caught alive every year at three trapping stations and sold at markets or eaten locally as a delicacy (Büttiker 1988).

In Cyprus, hunters illegally put down food to attract wood pigeons (*Columba palumbus*) and turtle-doves, which are then shot in large numbers. As it has not been possible to control this practice to-date, the legalisation of the practice of 'feeding' (τάϊσμα/taisma) has been tabled by the Game and Fauna Service under the proposed amendment of the Hunting Law (Protection and Management of Wild Birds and Game Law N152(I)/2003). Instead of remaining an illegal activity, negative effects would be mitigated by increasing the geographic spread and reducing the proportion of the populations affected at each site.

However, BirdLife Cyprus opposes this legalisation (BirdLife Cyprus 2016). An amendment to the Republican Game and Wild Birds Law in 2017 allows persons with a game licence to take cooked, lawfully killed, game in small quantities (defined in the Law) to restaurants for their own consumption. Turtle-doves (up to 10 per person) are included in the schedule of permitted species.

Work is underway to implement the Tunis Action Plan 2013-2020 for the eradication of illegal killing, trapping and trade of wild birds (Golovkin 2016), and there are some national initiatives. For example, the Italian Ministry of the Environment is in the process of finalising a National Action Plan on Illegal Killing, Trapping and Trade of Wild Birds, which will be a step towards reducing illegal harvesting both during and outside the formal hunting season. However, there is little information from large areas of the species' range, and expert opinion is that illegal take is having a critical impact on the population size of turtle-doves in some regions.

Hunting

Hunting of turtle-doves is permitted in ten EU Member States (Austria, Bulgaria, Cyprus, France, Greece, Italy, Malta, Portugal, Romania and Spain) by Article 7 in relation to Annex II/part B of the Birds Directive. In these countries, hunting is regulated by national legislation, although each Member State must ensure that the hunting of turtle-doves does not jeopardise conservation efforts in their distribution area, complies with the principles of wise use and ecologically balanced control of the species, and takes place outside the pre-nuptial migration (spring) and breeding periods. However, the hunting season overlaps with the breeding season in Austria and, to a less extent, in France and Spain (see

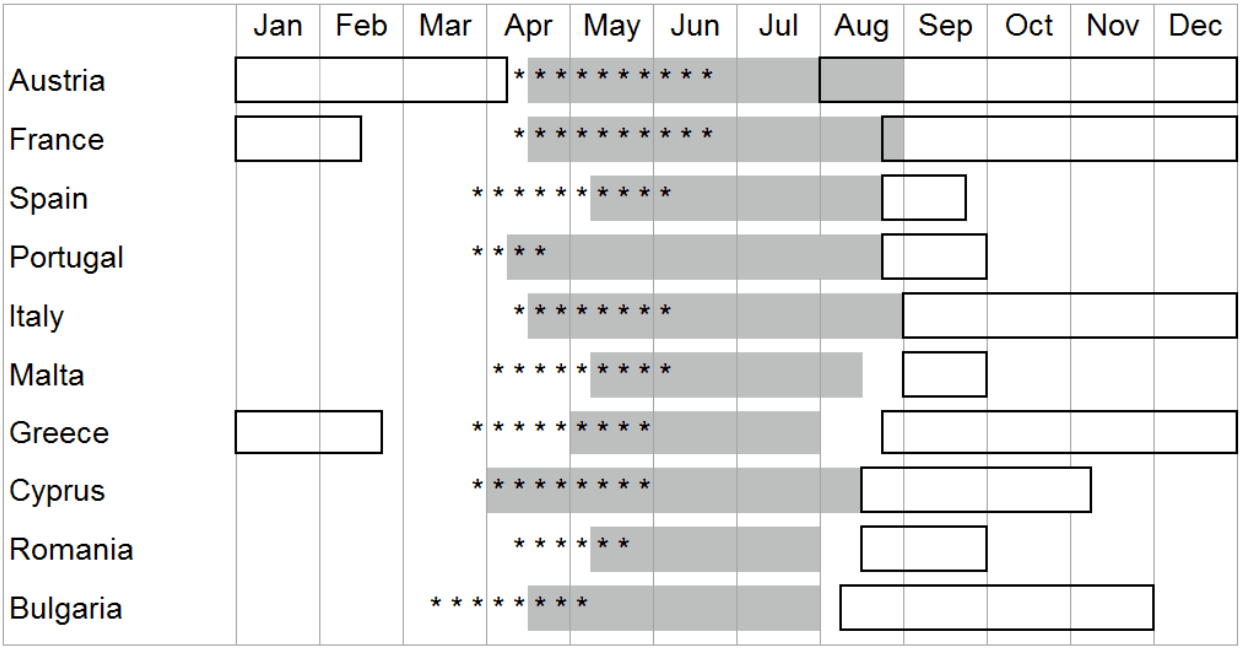


Figure 15). Up until May 2016, Malta allowed spring hunting of the turtle-dove via the application of Article 9 (1) c of the Birds Directive. Following declaration of a moratorium on spring hunting of the turtle-dove, in 2017 Malta only permitted a limited spring hunting derogation for quail, while any shooting of the turtle-dove was strictly prohibited.

The hunting pressure on the species has been described as generally high by multiple authors (eg between two and four million birds shot annually, Boutin *et al* 2001, Hirschfeld and Heyd 2005), but there are disagreements about the accuracy of estimates for various countries. Data on hunting bags, particularly where self-reported and not necessarily verified, may be subject to both under- and over-estimation but it is not known to what degree. Some populations may have to cross several countries where the species is huntable before reaching their breeding/passage/wintering grounds, leading to an effectively extended hunting period.

Table 4 shows the available data on hunting bag statistics provided by the European Federation of Associations for Hunting and Conservation (FACE) and others.

Table 4. Turtle-dove bag numbers and protection/hunting details across range states within Europe, Central Asia and Africa.

Countries are only included where information is available, and as methods of collection and analysis differ, numbers are not directly comparable.

Country	Birds bagged	Protection/hunting details
Albania		Complete ban (Brochet *et al* 2016, Birdlife International 2014a).
Algeria		Complete ban (Brochet *et al* 2016).
Armenia		Until 2015, it was permitted to shoot pigeons without specifying the species, with a limit of 10,000 during the hunting season (from 23 August to 31 January). Limit of five individuals per one day of hunting per hunter. As of 2016, turtle-dove hunting is forbidden (Mamikon Ghasabyan *pers comm*).
Austria	<7,800 *annually*	Covered by EU Birds Directive. Seasons differ between regions: 31 Jul to 31 Oct Burgenland, 15 Sep to 31 Jan Niederösterreich, 1 Sep to 10 Apr Wien. Burgenland and Lower Austria hold about 95% of the national turtle-dove population (Zentralstelle Österreichischer Landesjagdverbände *pers comm*).
Azerbaijan	unknown	No regulation.
Belarus		Protected from killing.
Belgium		Covered by EU Birds Directive. No hunting.
Bosnia and Herzegovina	unknown	Federation of Bosnia and Herzegovina season from 1 Aug to 31 Dec, and Republika Srpska 1 Aug to 31 Jan (BirdLife International 2014b).
Bulgaria	145,672 *2014-15*	Covered by EU Birds Directive. Second Saturday in Aug to 30th Nov; hunting is only allowed on Saturdays, Sundays and official holidays (6 and 22 Sept) (Rules for Application of the Hunting and Wildlife Protection Act, Article 69, Paragraph 1) (Ministry of Environment and Water *pers comm*); daily limit of 10 per Bulgarian hunter, and 30 for organised hunting tourism. Hunting statistics are collected by the Executive Forest Agency (Union of Hunters and Anglers of Bulgaria *pers comm*). No violations related to the shooting of turtle-dove were found during 2014-2017 (Ministry of Environment and Water *pers comm*).
Croatia		Covered by EU Birds Directive. No hunting.
Cyprus	44,578 *2010-11* 55,571 *2012-13* 67,141 *2014-15* 20,215 *2015-16*	Covered by EU Birds Directive. Sundays and Wednesdays only from mid-Aug to early Nov; in some areas (mainly coastal, where migrant birds are located) daily hunting is allowed during this period (BirdLife Cyprus *pers comm*, Game and Fauna Service 2016).
Czech Republic		Covered by EU Birds Directive. No hunting.
Denmark		Covered by EU Birds Directive. Hunting of turtle-doves is illegal in Denmark, and the collared-dove season now takes place from 1 Nov to 31 Dec to ensure that there are no cases of misidentification of the species (Timme Nyegaard *pers comm*).
Egypt	unknown	2014/2015 season 15 Nov to 31 Mar (BirdLife International 2014c).
Estonia		Covered by EU Birds Directive. No hunting.
Finland		Covered by EU Birds Directive. No hunting.
France	91,704 *2013-14*	Covered by EU Birds Directive. From the last Saturday in Aug to the second week of Feb. Two Départements apply a bag limit: Deux-Sèvres (5 per day, reduced to 3 per day in 2017), and Charente Maritime (10 per day). Data provided from Enquête Nationale sur les Tableaux de Chasse à Tir (Aubry *et al* 2016), the ONCFS, and Fédération Nationale des Chasseurs (2016). Bag size for combined turtle-dove and collared dove in 1974 was estimated at 1,382,000 (+/- 47%) (Chambolle 1986), in 1983-1984 the combined total was 583,000 (557-609,000) excluding hunting in May along the Atlantic flyway (Chambolle 1986), in 1998-1999 bag size for turtle-dove only was estimated at 189,300 (+/- 14,000) (Boutin and Tesson 2000), and in 2007-2008 bag size for turtle-dove was 60-75,000 (Arnauduc *et al* 2011). Current bag is estimated 45,618-137,789 (Aubry *et al* 2016). The FNC maintains a dossier on the actions that hunters have taken to benefit turtle-doves on the breeding grounds (Jean-Pierre Arnauduc *pers comm*).
Germany		Covered by EU Birds Directive. Under EU law, turtle-doves are not huntable in Germany. However, in the Federal Hunting Law of Germany 1952, all wild species of pigeons and doves are classed as huntable species, while Federal regulation on hunting seasons 1977 stipulates

Country	Birds bagged	Protection/hunting details
		open hunting seasons for only two species of pigeons and dove, not including the turtle-dove. Nationally the turtle-dove in Germany is formally a huntable species, but has no open hunting season. In addition, regional hunting legislation supersedes Federal legislation if it is newer, which is the case in several regions (Länder). However, in none of these does the turtle-dove have an open season.
Georgia	unknown	Annual bag between 1966 and 1970 was estimated to be 19-60,000 birds (Rouxel 2000). The season runs from 15 Aug to 15 Feb, with a limit of 10 turtle-doves per hunter per day (Agenda.ge 2015).
Greece	273,700 - 492,800 *annually (13 year average to 2017)*	Covered by EU Birds Directive. Season 20 Aug to 14 Sep within "passage zones of migrating birds" (less than 15% of the overall permitted hunting areas). Season 15th Sep to 20th Feb for licensed hunters with shotguns, during daylight hours, and in all areas apart from those designated as No Hunting Areas. Daily limit of 12 turtle-doves per hunter. The season and the quota system are officially approved each year by the Government, after a report provided and compiled by Greek Universities from data derived from programmes that have been launched by the Hunter's Confederation through an open public tendering procedure (Hellenic Hunters' Confederation *pers comm*).
Guinea-Bissau	unknown	Hunting of turtle-doves at their roost sites and drinking pools is commonplace and is facilitated by European travel agencies (Tucker 1996, Carvalho and Dias 2003, Zwarts *et al* 2009, Raffael Ayé *pers comm*).
Hungary		Covered by EU Birds Directive, and nationally protected since 1971. Not hunted.
Israel	unknown	Protected. Fewer than 1,000 hunters and decreasing; the turtle-dove is not a popular quarry species. Season 1 Sep to 31 Jan with no bag limit (BirdLife International 2014d).
Italy	250-350,000 *annually*	Covered by the EU Birds Directive. In many regions the turtle-dove season runs from 1 Sep and is only allowed for one to five fixed days (three in many regions), until the third Sunday of Sep when the regular season starts until 31 Dec. Other regions allow three fixed days, with a season of 1 to 31 October. Most regions now close the turtle-dove hunting season on 31 Oct. Regional Governments apply daily and seasonal bag limits. (Sorrenti and Tramontana 2016, Michele Sorrenti *pers comm*). Bag data are reported at the end of each day, but are acknowledged to be underestimates, potentially with only a third of hunted birds counted (LIPU *pers comm*). Sardegna, Calabria, Basilicata and Molise are not included in the hunting bag statistics, although hunting of turtle-doves does take place in these regions (LIPU *pers comm*).
Jordan	unknown	Season 1 Jul to 30 Nov, with a limit of 20 turtle-doves per hunter per trip (Namrouqa 2016).
Kosovo (UN Res 1244)	unknown	Season 1 Sep to 30 Nov (UNMIK/IPVQ 2007).
Latvia		Covered by EU Birds Directive. No hunting.
Lebanon		Complete ban (Brochet *et al* 2016, BirdLife International 2014e).
Libya	unknown	No regulations (BirdLife International 2014f).
Liechtenstein		Not on the national list of huntable species (Liechtensteinisches Landesgesetzblatt 2003).
Lithuania		Covered by EU Birds Directive. Not hunted.
Luxembourg		Covered by EU Birds Directive. Not hunted.
Macedonia, The former Yugoslav Republic of	unknown	1 Aug to 30 Mar (Michele Sorrenti *pers comm*).
Mali	unknown	Hunting of turtle-doves at their roost sites and drinking pools is commonplace and is facilitated by European travel agencies (Tucker 1996, Carvalho and Dias 2003, Zwarts *et al* 2009, Raffael Ayé *pers comm*). Unprotected. National decree sets rates of royalties and taxes for the exploitation of wildlife in State-owned areas, and sets season dates yearly.
Malta	2,014 *spring 2015* 3,695 *autumn 2015*	Covered by EU Birds Directive. Autumn hunting seasons opened via Conservation of Wild Birds' Regulations, while spring hunting seasons opened via application of Article 9(1)c derogation of the Birds Directive. Spring hunting seasons did not open in 2008 and 2009 due to a European Court of Justice interim court injunction, and in spring 2017 due to a government imposed moratorium. Previous seasons: spring 2015 14 to 27 Apr; autumn 2015 1 Sep to 31 Jan; spring 2016 17 to 30 Apr; autumn 2016 1 to 30 Sep. Season reduced in 2016 to Sep only, from 2 hours before sunrise to 2 hours after sunset, on weekdays and Saturdays; on Sundays and Public

Country	Birds bagged	Protection/hunting details
	1,284 *spring 2016* 123 *autumn 2016*	Holidays, hunting stops at 1pm. On weekdays between 15 and 30 Sep hunting after 7pm is not allowed. Licensed hunters are required to report birds caught to a telephone reporting system before leaving the hunting area. Hunters can only take species listed in their licence category. Spring hunting derogation law allows for a maximum of 3 weeks in Apr with a maximum quota of 11,000. Following declaration of a moratorium on spring hunting of the turtle-dove, in 2017 Malta only permitted a limited spring hunting derogation for quail, while any shooting of the turtle-dove was strictly prohibited. Under Maltese law, any illegal targeting of this species in spring is subject to, on a first conviction: up to €5,000 fine, confiscation of *corpus delicti*, between two and five years' suspension of hunting/firearm licences, and, at the Courts' discretion, community service. On a second or subsequent conviction the penalties increase up to €10,000 fine and/or not less than six months' but not more than two years' imprisonment, confiscation of *corpus delicti*, permanent revocation of licences, and, at the Courts' discretion, community service. The autumn hunting season with the latest law allows for turtle-doves to be hunted from 1 to 30 Sep, up to a 7,000 quota. (Wild Birds Regulation Unit *pers comm*, WBRU 2015, WBRU 2016). Hunting in the spring of 2008 and 2009 was completely prohibited. Following the judgment of the Court of Justice of the European Union (CJEU) in Case C-76/08 Commission vs. Malta of 10 Sep 2009, Malta applied derogations for limited hunting of the species in spring under strictly supervised conditions from 2010 to 2016. The conditions are stipulated in the Conservation of Wild Birds Regulations *Framework for allowing a derogation opening a spring hunting season for turtle-dove and quail, S.L. 549.57* (Government of Malta 2010) which establishes the parameters for the application of a derogation, including provisions related to individual, seasonal and national bag limits, obligations concerning enforcement, reporting requirements and other conditions. The Framework Regulations dictate that a spring hunting season for this species will not open if the previous autumn hunting bag exceeds 21,000 specimens. This Regulation also specifies that the maximum bag limit for a spring hunting derogation may be fully allowed in cases when the number of turtle-doves hunted in the previous autumn season does not exceed 10,000, provided further that the maximum bag limit for a spring hunting derogation should be reduced by inverse proportion to the number of birds hunted in excess of 10,000 in the previous autumn season. Bag statistics and detailed information on each year's special licensing process and enforcement are published annually, although NGOs such as BirdLife Malta contest the numbers quoted.
Mauritania	unknown	*Streptopelia sp* partially protected (Journal Officiel de la République Islamique de Mauritanie 1997), but hunting does take place (Sheehan *et al* 2014).
Moldova	unknown	The Republic of Moldova Government Decision no. 963 of 08.08.2016 made hunting for migratory birds (including turtle-doves) forbidden during 2016-2017 (Vitalie Grimalschi *pers comm*).
Montenegro	unknown	Not protected. Hunting season from 1 Aug to 31 Dec (BirdLife International 2014g).
Morocco	31,682 *2013*	Season Jun/Jul to Aug (BirdLife International 2014h). In the Tadla region of Morocco, about 2% of the breeding population was harvested in 2013 (Hanane and Besnard 2014). Hunting is mainly of *S. t. arenicola* (El Mastour 1988) and hunting ends by the 25 Aug, so many of the European-breeding birds are unlikely to be affected by hunting in Morocco (M Denny *unpublished*).
Netherlands		Covered by EU Birds Directive. Not hunted.
Niger	unknown	Hunting takes place (Brouwer 2014).
Palestinian Territory	unknown	Legislation based on Jordanian Environmental Law (BirdLife International 2014i), but status unclear.
Poland		Covered by EU legislation. Not hunted.
Portugal	109,815 *2013-14*	Covered by EU Birds Directive. Since 2012, hunted from the third Sunday in Aug to 30 Sep. The daily bag limit was reduced from eight to six birds in 2015, reducing further to five in 2017 and four in 2018. Available bag statistics 1989-2011, covering c90% of the country show a 0.4% annual decrease (ICNF *unpublished data*, Susana Dias *pers comm*). The number of birds shot was c200,000 in 2009/2010, dropping to c120,000 birds in the last three hunting seasons (2014-2016). The number of birds shot has decreased from c11.2 birds shot/100ha in 1996/1997 to 3.4/100 ha in 2014/2015 (Gonçalo Lopes *pers comm;* Breeding Monitoring Scheme 1994-2004; hunting statistics for game estates 1989 onwards; past and current National Breeding Birds Atlas).
Romania	30,000 max *annually*	Covered by EU Birds Directive. Annual quota approved each year by the Government. The seasons starts on the 15 Aug. At the recent request of the Government, the end of the hunting period was shortened from 18 Feb to 30 Sep. An estimated 30,000 individuals are taken yearly (Michele Sorrenti *pers comm*).

Country	Birds bagged	Protection/hunting details
Russian Federation (European)	unknown	Imminent protected by inclusion in the Red Data Book of the Russian Federation; hunting of turtle-dove will be prohibited for at least 10 years, with serious penalties for illegal killing (Alexander Mischenko *pers comm*, Evgeny Syroechkovskiy *pers comm*). Generally, hunting in north-west Russia takes low numbers (Rouxel 2000).
Senegal	unknown	Hunting of turtle-doves at their roost sites and drinking pools is commonplace and is facilitated by European travel agencies (Tucker 1996, Carvalho and Dias 2003, Zwarts *et al* 2009, Raffael Ayé *pers comm*). Although hunting anecdotally appears to be widespread, there is no information on the numbers taken or its impact on the population (Chris Orsman *pers comm*).
Serbia	unknown	Hunting ban in place from Oct 2015 to Mar 2017 due to public pressure. Generally, the season is 1 Aug to 30 Sep (BirdLife International 2014j, Institute for Nature Conservation of Serbia 2015).
Slovakia		Covered by EU Birds Directive. Not hunted.
Slovenia		Covered by EU Birds Directive. Not hunted.
Spain	436,807-805,643 *annually (not all provinces submit data every year so actual numbers may be higher)*	Covered by EU Birds Directive. Generally the season is 15 Aug to 21 Sep but varies between regions. Thursday, Saturday and Sunday only (MAPAMA 2016). More than 75% of the turtle-dove bag in Spain comes from the following regions: Andalucía, Castilla-La Mancha, Castilla y León, and Extremadura (Gregorio Rocha *pers comm*). Hunting bag data are of poor quality in Spain because daily bags are rarely recorded, which makes annual totals difficult to calculate, and poor interregional organisation leading to some regional bag totals being omitted from the annual totals (Gregorio Rocha *pers comm*).
Switzerland		Not included on the list of huntable species (Le Conseil Federal 2014). Protection covers nest destruction.
Syria	unknown	It is permitted to shoot pigeons and doves according to the current hunting law. However, there is currently a ban on all hunting (BirdLife International 2014k). The species is included on the Game Species List with a bag limit of 20 birds/hunting trip according to a new law (expected to be issued in 2018) with open season from 1 Sep to 31 Jan.
The Gambia	unknown	Covered by the Biodiversity Wildlife Act 2003, National Biodiversity Strategy and Action Plan 2015 and international obligations. Commercial hunting Jan to Apr; subsistence hunting Jan to Aug; other hunting banned. Protection covers disturbance.
Tunisia	unknown	"Doves" hunted from mid-Jul to early Sep (BirdLife International 2014l, Kafi *et al* 2015).
Turkey	unknown	Season 23 Aug to 18 Jan (BirdLife International 2014m)
Ukraine	unknown	Season 15 Aug to 30 Sep; "pigeons" except stock dove (*Columba oenas*) are huntable from Aug to Dec (Ukrainian Hunting and Fishing Association *undated*). Each hunter can shoot up to 10 “pigeons” (excluding stock dove) per day of the hunting season (Ministry of Environmental Protection of Ukraine 2017). The number of turtle-doves taken could be as high as 218,000 birds (Rouxel 2000).
United Kingdom		Covered by EU Birds Directive. Not hunted.
Total EU bag	**Estimated 1,425,102 to 2,245,166 minimum.**	

According to Jarry (1994b) and Hill (1992), the turtle-dove is the EU quarry species likely to be worst affected by hunting as it has particularly low survival and productivity, although the extent to which hunting poses a threat has not been quantified and hunting pressure has changed over time (Hill 1992, Tucker 1996). In general, estimates of population sizes and bag data in most EU States exist, although care must be taken in the interpretation of data. There is a lack of up-to-date information on the sustainability of turtle-dove hunting at a flyway level. Existing hunting quotas are not based on sustainable harvest levels at a regional or national level, and control over current quotas is challenged by some NGOs. The monitoring and enforcement of hunting restrictions as well as the collection of reliable harvest data also presents a challenge in some regions.

Based on a modelling analysis, Hill (1992) recommended that hunting losses in Europe should be reduced to 5-15% of the post-breeding population if overall populations were to be self-sustaining. However, the impact of hunting in terms of population dynamics has not been assessed, and without an assessment of harvest sustainability at the flyway level, the full impact of hunting activity remains unknown. This is starting to be addressed through sustainable harvest modelling (page 121).

A series of studies from Spain indicate that excessive hunting pressure, particularly on fledglings, as well as an early start to the hunting season may have aggravated and, in some cases, accelerated the species' decline in combination with other factors (Hidalgo de Trucios and Rocha 2001a, b, 2005, Hidalgo de Trucios 2007). However, owing to breeding site fidelity, management actions can be carried out on hunting estates in Spain to benefit the local breeding population (Hidalgo de Trucios and Rocha 2002, 2003). A PhD study currently underway seeks to provide better understanding of the numbers of turtle-doves hunted in Iberia, their geographical area of origin and the motivations of the hunters (Lara Moreno Zárate *in prep*). In Portugal, suggested conservation actions for the species have been identified as: better game management, protecting the most important habitats and ultimately suspension of hunting (Meirinho *et al* 2013), as well as more detailed suggestions included in Dias (2016). In Romania, the cessation of hunting and poaching has been identified as an important action to consider for the conservation of the species (Petrovici 2015). The idea of a temporary moratorium on hunting has been put forward by several authors in Spain (eg Balmori in Madroño *et al* 2004, Purroy 1997, Rocha and Hidalgo de Trucios 2001a) as an effective measure to stop population declines. The Spanish Red List proposes a five-year moratorium that should be accompanied by a set of measures on habitat management in order to favour the recovery of turtle-dove populations (Balmori 2004).

In Spain, there has been a reduction in the average number of hunting days in the partial closed game season (Hidalgo de Trucios and Rocha 2002, 2003). According to Rocha and Hidalgo de Trucios (2002a) and Dias (2016), a delay in the beginning of the hunting period would be beneficial to the species, not only because it would avoid hunting when some pairs are still breeding, but also because it would allow a longer development period for the chicks and a higher probability of survival. Gregorio Rocha (*pers comm*) was able to verify that the pre-migratory movements of around 25% of birds present in feeding areas on hunting preserves in Spain begin in mid-August. With a delay in the start of the hunting season until the end of August, these birds will have moved away before they can be hunted (Gregorio Rocha *pers comm*).

In some states, the hunting period still overlaps the breeding season (see 98). The Red List Book of Wild Birds in Spain (Balmori 2004) identifies the overlap between the beginning of the hunting season and the end of the breeding season as one of the causes of decline of the population in that country, and recommends delaying the onset of the open season for hunting as a conservation measure. Recent observations (2017) found birds still brooding young chicks in a pitaya plantation only two weeks before the onset of the hunting season (Lara Moreno Zárate *pers comm*).

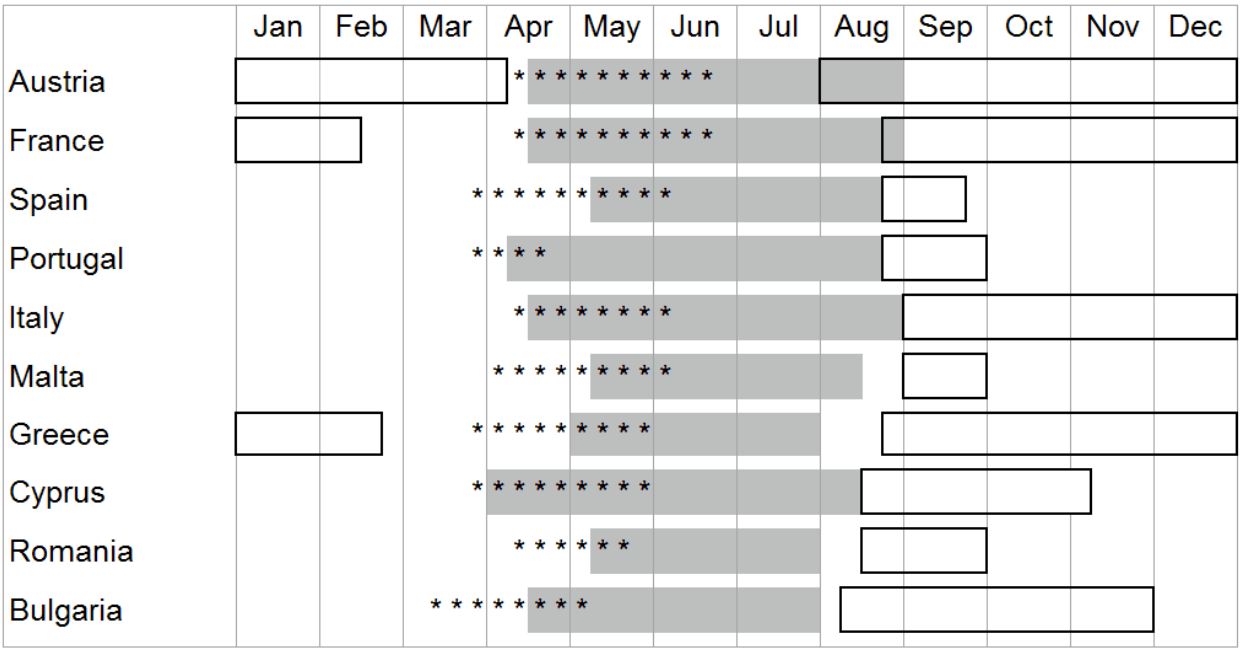


Figure 15. Overlap of hunting season (outlined) with breeding period (shaded) for the turtle-dove in European Union Member States.

Based on European Union 2008, ordered north to south, for those States allowing a turtle-dove season. Hunting may only be allowed on certain days within the hunting seasons outlined above. For detailed information on each of the national hunting seasons, see Table 4. In France, the hunting season and turtle-dove breeding period only overlap in certain Departments, but not across the whole territory. It is acknowledged that these data need to be updated in a systematic way to reflect changes in arrival and departure dates since 2008.

In May 2016, following reclassification of the conservation status of turtle-doves to Vulnerable at global level and Near Threatened at EU level, the Maltese government enacted a moratorium on the future spring hunting of the turtle-dove, which will remain in force until such time that maintenance of the EU population of turtle-doves at a satisfactory level is scientifically ascertained at EU level. No spring hunting season on turtle-doves was subsequently allowed in April 2017.

Outside of Europe, information on hunting bags becomes scarce. In Africa, the turtle-dove is subject to hunting on both the wintering grounds and on migration (Barlow *et al* 1997), and the combined effect of direct mortality and disturbance at roosts during the crucial pre-migration period when the birds must substantially increase their body mass is likely to affect survival (Zwarts *et al* 2009). Hunting outside of the EU is not in alignment with the EU Birds Directive.

Hunting tourism also remains an unquantified problem. Agencies offer turtle-dove hunting during the summer in some parts of Europe, such as in Bulgaria (mid-August to end-September, quota for tourist hunters of 30 birds/day [Michele Sorrenti *pers comm*]) and The former Yugoslav Republic of Macedonia (no quota, with a hunting season from mid-August to the end of September) (Favia Srl 2017). The impact of hunting tourism needs to be better understood and quantified. A basic internet search found turtle-dove hunting trips were offered in Bulgaria, Burkina Faso, Egypt, The Gambia, Greece, Guinea Bissau, The former Yugoslav Republic of Macedonia, Mali, Montenegro, Morocco, Romania, Tunisia, Turkey, Senegal and Spain.

According to Zwarts *et al* (2009), shooting turtle-doves at roosts and drinking pools is common practice in Senegal and Mali, and is facilitated by European travel agencies specialising in shooting forays that guarantee daily bags. The success rate of such shooting parties in terms of birds killed is not known. However, the disturbance alone could be having negative impacts on the birds, reducing the amount of time that they can spend fattening up. The impacts of such shooting events may be particularly strong when woodlots are relatively scarce, making roosting sites scarcer and increasing the number of birds affected.

Hunting organisations also carry out activities that are beneficial to the turtle-dove, such as restoring hedges and woodland, clearing springs, providing food directly, planting set-aside crops, voluntarily policing hunting activity, and limiting birds taken. Research by Rocha and Quillfeldt (2015) shows that hunting estates in south-west Spain, where food supplementation takes place, have higher young/adult ratios than control ones (estimated in the second half of August, prior to the opening of the hunting season).

Other threats

A number of additional threats to turtle-doves have been identified, but for these, either the impact is considered to be small or the degree of impact is unknown and further research is needed. In addition to those listed below, there may be mortality associated with collision with wind energy installations as well as electrocution and impact with power lines. It is possible that predation may be affecting the species (Hanane 2016b), and plastic pollution could pose a threat, as a study in Mediterranean forest areas in southern Spain found plastic granules in 3.8% of turtle-dove digestive tracts analysed (Guttiérez-Galàn and Alonso 2016).

Pesticides and agricultural chemicals

Increased use of pesticides and herbicides has the potential to threaten the species both directly and indirectly: direct poisoning through ingestion of agricultural chemicals, and indirectly by reducing the availability of weed seeds. There is no direct evidence to suggest that pesticides have been responsible for declines in turtle-dove, but avian species are known to be negatively affected with effects ranging from reduced reproductive success and immune response to mortality (Mineau and Palmer 2013). Granivorous birds may be susceptible to feeding on seeds treated with pesticides (Goulson 2013). For instance, red-legged partridges (*Alectoris rufa*) are known to be susceptible to at least three pesticides, with birds experiencing sub-lethal and lethal effects when fed wheat seed dressed in the substances (Lopez-Antia *et al* 2013). Feral pigeons (*Columba livia*) are also known to be susceptible to at least two pesticides and it has been calculated that a grey partridge (*Perdix perdix*) would have to feed on just six beet seeds treated with 0.9 mg of imidacloprid to have a 50% chance of being killed by the dose (Gibbons *et al* 2015). Chemical treatment of forest massifs against insects may be negatively affecting the species in Armenia (Mamikon Ghasabyan *pers comm*).

In Niger, many of the records of turtle-doves are from groups of dead birds. It is possible that some of these birds were accidentally poisoned by agricultural treatments such as anti-parasite chemicals for livestock or by herbicides (Joost Brouwer *pers comm*). Irrigated farmland in the northern part of the Senegal River Valley is subject to high pesticide and fertilizer use, and coincides with large turtle-dove roosts in acacia vegetation (Malang Sarr *pers comm*). Granular pesticides that are toxic to avifauna are still used in parts of Africa, including the Sahel (Wim Mullié *pers comm*). Birds that feed on grain or grit may accidentally ingest these granules which could lead to cases of poisoning. In the case of ingestion of toxic chemicals, the cause may not be obvious to those discovering the cases of mortality (Wim Mullié *pers comm*). However, for turtle-doves to be affected by sprayed chemicals used to control Quelea (*Quelea quelea*), they would probably have to fly through a cloud of pesticide in order to accumulate a high enough dose, or for the entire roost to be sprayed. Spraying such chemicals involves expensive equipment, so this activity is likely to be quite limited. Intake of veterinary drugs and subsequent poisoning is likely to be similarly limited (Wim Mullié *pers comm*).

For turtle-doves breeding in the steppe zone of European Russia, dominated by intensive arable land (cereals, sunflower, sugar beet *Beta vulgaris* etc), a significant increase in farming intensity took place in the 2010s. The main threats are increased use of pesticides and poisoning by seeds treated with fungicides and pesticides. Spraying of pesticides from light aircraft takes place in some areas and air-sprayed pesticides are disseminated by wind and can settle in shelter belts, the main nesting habitat of the turtle-dove in this area.

In the UK, increased use of herbicides and pesticides has reduced weed abundance and diversity within agricultural areas and it is likely that weed seed availability has been greatly reduced compared to the middle of the 20th century (Browne and Aebischer 2003b). A shift in the species' diet from predominantly weed seeds to cultivated crop seeds may, in part, reflect the loss of weeds from the agricultural landscape. However, an increase in the use of agricultural chemicals coincided with a number of other widespread changes to the farmed environment, including changes in sowing dates and tillage methods and an

increase in inorganic fertiliser use. It is therefore difficult to disentangle the individual effects that these changes may have had. In Romania, reducing the use of insecticides and herbicides, and/or ensuring that they are applied outside the breeding season, are likely to be important conservation actions for the species (Petrovici 2015). The loss of ruderal plants owing to the use of herbicides, particularly early in the breeding season, may also have affected the species in parts of Spain (Hidalgo de Trucios and Rocha 2005, Hidalgo de Trucios 2007).

Drought and climate change

Climate conditions (particularly drought) in wintering areas as well as across critical staging posts in Central Sahara can lead to an abnormally high mortality rate. In the 1970s and 1980s, the Sahelian regions of western Africa, which make up the principal wintering areas for western European populations of turtle-doves, were hit by long periods of drought, annual rainfall only very infrequently going above the annual average and very often remaining well below (Jarry 1994b). In the north of the Sahel, the rainy season is shortest (May/Jul-Aug/Oct), so in general food and water will disappear there first (Joost Brouwer *pers comm*). However, in the past, changes in turtle-dove abundance in the UK did not show any significant correlation with severe drought years in the Sahel wintering grounds (Marchant *et al* 1990). Moreover, several species which are known to be affected by drought in the Sahel (common whitethroat *Sylvia communis* and sedge warbler *Acrocephalus schoenobaenus*) showed strong population increases during the 1990s coinciding with increasingly favourable rainfall conditions there (Marchant *et al* 1990). High annual survival of birds in a population in France matched years of high cereal production in the Sahel (Eraud *et al* 2009). Cereal production is often negatively linked to droughts. However, the same study found no relationship between rain index and adult survival. Similarly, rainfall in the arid Sahel region of West Africa was shown to have a significant impact on the population trend of UK breeding turtle-doves, with arid zone rainfall associated with a positive population change in the species. However, the percent of deviance explained by rainfall in the model examining inter-annual percentage change in abundance index was low, at 4% (Ockenden *et al* 2014).

According to species distribution models produced by Huntley *et al* (2007), the simulated future (late 21st century) potential distribution of the species entails a northward spread into Ireland, Scotland and Scandinavia, as well as to Madeira and most of the Azores and into the Alpine region (excluding the Scandinavian mountains), with no range contraction simulated for southern Europe. While the overall effects of climate change are poorly understood, recent data from a satellite-tracked bird showed that weather events, such as sandstorms, might have carry-over effects that affect productivity, such as birds being delayed in their return to the breeding grounds (RSPB 2016). In Niger, the end of the rainy season falls during the turtle-dove's southward migration to the wintering grounds (Kusserow and Brouwer 2011). However, by March-April the weather conditions are hotter and drier, with migratory species, including turtle-doves, recorded visiting gardens in search of water (Kusserow and Brouwer 2011). The depletion of ancient underground water aquifers (particularly in Libya) due to over-abstraction has led to habitat decline in Saharan oases that act as critical staging posts along migratory routes.

Local weather conditions may also affect the species. In Greece, very low breeding densities were recorded during 2015, due to bad weather conditions during May and June (high rainfall) compared to 2016 (Dimitris Bakaloudis *pers comm*). In Cyprus, several thousand birds were found dead on the Paphos/Akamas coast following two days of severe storms in 1976 (Flint and Stewart 1992).

Competition with collared doves

The collared dove has expanded its range throughout the Western Palearctic over the past few decades (Rocha and Hidalgo de Trucios 2000, 2002b). This species is mainly found in the vicinity of urban areas, especially in parks, avenues and other wooded areas. Its presence is usually linked to human activities, and it is often common around agriculture infrastructure (barns, farms, livestock silos) where food is available. In central Spain (notably Extremadura) and in several parts of France where both species of dove occur, collared doves appear to compete with turtle-doves in some locations. Overlap between collared doves and turtle-doves has been found in meadow (*dehesa*) habitats in central, southern and western parts of the Iberian Peninsula (Rocha and Hidalgo de Trucios 1998, 2000, 2001b, 2002b, 2004a and 2004b). When comparing the presence/absence in places where both species could exist, Rocha and Hidalgo de Trucios (2000) observed an exclusion relationship between the two. Furthermore, the analysis of densities of both species in the same places showed that turtle-dove densities decreased at the same time as collared dove densities increased. The same is true for Portugal (Dias 2016). The collared dove benefits from advantages such as its sedentary and territorial character, larger size and aggressiveness

(Fletcher 1979), and a high reproductive success - several clutches per year, with 66% success, versus fewer clutches and 35% success for the turtle-dove (Browne and Aebischer 2004). However, correlation does not necessarily mean causation and in eastern Europe, where collared doves have been present for longer than in western Europe, turtle-dove populations have not decreased to such an extent. In Hungary, the collared dove nests near human settlements while the turtle-dove uses forest edge, woodland and shrub away from human habitation (Hadarics and Zalai 2008); but in Romania, competition with collared doves has caused turtle-doves to be lost from parks and cities at least in Transylvania and Banat (Munteanu 2009).

It is possible that the role of potential competition between turtle-dove and collared-doves varies from one country to another. Unpublished data from the UK (Dunn *et al* 2016c *under review*) show significant dietary overlap between all four UK farmland columbid species, and while the lowest overlap was between turtle-doves and collared doves, it was still significant. There is the possibility of indirect competition between the species, but sufficient disparity between their ecology, food and habitat requirements limits effects, and anecdotal observations indicate little, if any, direct competition in the form of aggressive behaviours, nest site limitations etc (Tony Morris *pers comm*). The level of abundance of the resources for which the species overlap must also be taken into account (Cyril Eraud *pers comm*).

In Morocco, a recent expansion of laughing doves means that the range of turtle-doves and laughing doves now overlap. While both species have slightly different nesting preferences, further work is needed to understand the extent of competition (Hanane 2015). Wood pigeons and turtle-doves have also been shown to have different nesting preferences in *Tetraclinis articulata* woodland in Morocco, with wood pigeons selecting taller and larger diameter trees for nesting, compared to turtle-doves (Hanane and Yassin 2017).

Disease

The unicellular parasite, *Trichomonas gallinae*, is a pathogen in wild birds, linked to recent declines in finch (Fringillidae) populations across Europe (Robinson *et al* 2010). Globally, the main hosts for this parasite are species of *Columbidae* (doves and pigeons). Recent work has shown that almost all wild turtle-doves sampled (in France, the UK, Burkina Faso and Senegal) were infected, whether showing clinical signs or not, and that lesions can cause mortality in both adults and nestlings through subsequent starvation and/or suffocation (Lennon *et al* 2013, Stockdale *et al* 2015, Dunn *et al* 2016b). In the UK, a single strain has accounted for all known *T. gallinae* mortality in turtle-doves. This strain is the same as that found in European greenfinch (*Chloris chloris*), and is known to have population-level effects. Wild birds are more likely to be infected where supplementary food is provided for game birds. There is also the possibility of cross-infection from collared doves at foraging sites. The implications (alone or in combination with other threats) for turtle-dove populations are unclear. An analysis of turtle-doves from Germany, Spain, Italy and Malta found that the birds had a high infection status of *Trichomonas* (67%) and if frozen tissue samples (which were analysed differently) were removed from the sample size, infection status was 93% (similar to that previously observed from a sample of UK birds) (Marx *et al* 2017). However, the same study, which considered multiple Columbid species, found that only stock doves and collared doves showed infections by potentially pathogenic and often lethal lineages of *Trichomonas*. It is likely that turtle-doves elsewhere in Europe (outside the western and central flyways that have been sampled) are also infected with *Trichomonas*. However, sampling from eastern Europe is needed to confirm this theory (Marx *et al* 2017). Shared feeding and watering sites potentially facilitate the spread of the disease. In the UK, blood parasite prevalence in nestling (up to seven days old) turtle-doves was 30% out of a sample of 33 turtle-dove nestlings. This prevalence did not differ significantly from nestlings of stock doves or wood pigeons (Dunn *et al* 2017).

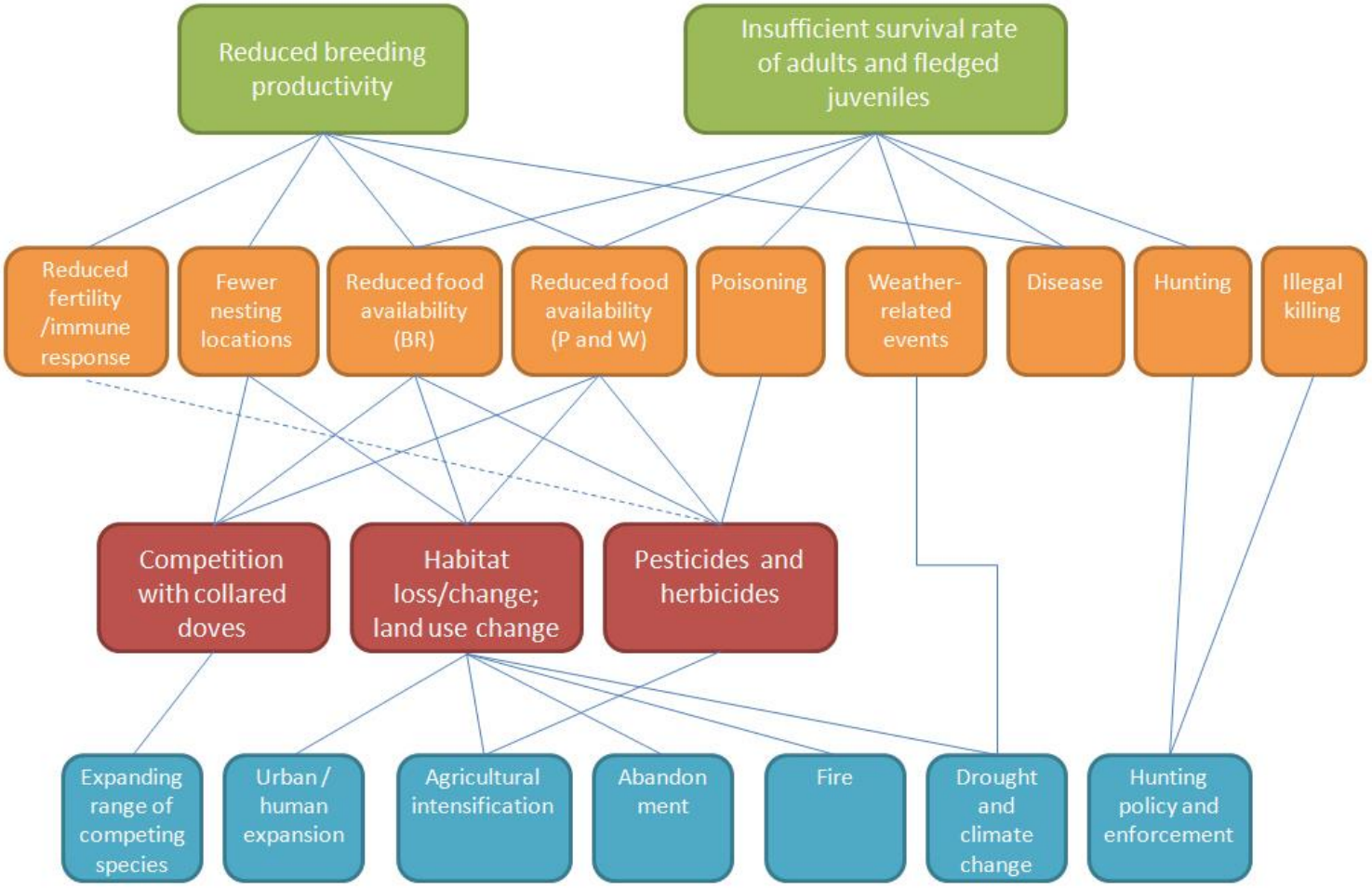
Genetic contamination

Genetic contamination as a result of poorly-managed captive breeding and release programmes poses a potential risk to the species. If such programmes are not carried out according to IUCN Guidelines for Reintroductions and Other Conservation Translocations then genetic contamination of the wild population could be a serious risk (Nicholas Barbara, *pers comm*).

Lead shot

As with many granivorous bird species the turtle-dove may be exposed to the risk of ingesting spent lead pellets. In the USA, high ingestion rates have been reported for the mourning dove (*Zenaida macroura*) in areas where hunting activity is very intense (Shulz *et al* 2006), and there are cases of ingestion by wood pigeons and rock pigeons (*Columba* livia) (Fisher *et al* 2006). However, no reports of mortality owing to lead ingestion have been made and the rate of lead ingestion could be low, as fields where the species feeds are ploughed annually.

Problem tree



Annex 3: JUSTIFICATION OF CONSERVATION / MANAGEMENT OBJECTIVES

This Annex is included to provide a basis for the development of national/regional-specific solutions for creation and management of habitats that are beneficial to European Turtle-doves. As conditions and habitats differ across the species' range, locally appropriate solutions will need to be developed as part of the Framework for Action.

Habitat Creation and Management for Turtle-doves on the European Breeding Grounds: case studies of option research, development and deployment from the UK

Tony Morris, RSPB

Studies in the UK have shown that European turtle-doves have shorter breeding seasons (by 12 days) and only produce one-third to a half of the number of clutches and young per pair than they did in the 1960s (Browne and Aebischer 2003a; 2004). This is almost certainly linked to a shortage of food, particularly during the first part of the breeding season, before the seeds from arable crops become available (Browne and Aebischer 2003b). It is also likely to be the reason that birds have been recorded travelling long distances to find food and for the number of recent records of use of garden bird feeding stations (Browne and Aebischer 2003a, RSPB *unpublished data*). This has led to a truncation of the breeding season, with an earlier departure date in autumn, so that pairs now average 1.5-2.1 clutches per season, as opposed to 3 in the 1960s. This has significantly reduced the number of chicks fledged per pair per breeding season, from 2.1 in the 1960s to 1.3 in the late 1990s (Browne and Aebischer 2004). This change alone largely accounts for the observed decline in the UK breeding population, and therefore the underlying cause is primarily changes in farming practices, especially those which have reduced the abundance and diversity of arable flora, such as the increased use of agro-chemicals and the switch from spring to autumn-sowing of crops.

English case studies on Agri-environment Option research, development, and deployment (via Agri-environment Schemes) illustrate some of the management techniques that may provide suitable nesting and foraging habitat. Since 2015, a package of Agri-environment Options for turtle-doves has been available in the *Higher Tier* of the Countryside Stewardship Scheme to qualifying landowners/managers in England. Some of these require further development to optimise their potential, but nevertheless they provide case studies into some of the pitfalls of habitat creation. Other habitat types of potential value (eg flower-rich low-input grasslands) require research and development before there is confidence in their value to turtle-doves. In all cases, the techniques have only been trialled (and in some cases rolled out) in England, and further development is needed to determine what forms of habitat management are most appropriate to different areas of Europe. These may vary considerably; for example due to the factors limiting the population, local differences in vegetation, soil, climatic conditions and land management practices that determine suitability and practicality, and policy mechanisms that affect the ability to deploy measures.

Nesting Habitat

Turtle-doves select areas of scrub or hedgerows at least 4m wide and at least 3m tall, especially those containing standard trees, for song posts and nest placement (Figure 16). Scrubby edges to banks, watercourses, reservoirs, gravel pits and ponds appear to be particularly selected, although it is unclear whether these wet-edge habitats are favoured solely because they provide good, overgrown nesting habitat (because they are difficult to access to cut and remove wooded vegetation), or because they also provide additional resources - most likely drinking water (Dunn and Morris 2012).

In the UK, many species of tree or shrub are used as nest sites, but there is some evidence of selection for thorny shrubs such as *Crataegus* and *Prunus spp*, often covered with climbers such as *Rosaceae*, *Rubus*, *Hedera* and *Caprifoliaceae spp*. RSPB research (2011-14) indicates a narrower range of nesting habitats than reported in previous studies such as Browne and Aebischer (2003b), which detailed use of habitats including coniferous trees, old orchards and shorter, frequently-cut hedgerows. This narrowing of

the range of nesting habitats may reflect a relaxation of density-dependent pressures as the turtle-dove population declines, leading to the abandonment of more marginal habitats and greater selection of "preferred" habitats types that are no longer limited.

Figure 16. A typical hedgerow and patch of scrub used by turtle-doves for songposts and nesting.

Nesting habitat alone is thought unlikely to be limiting the population, as nesting areas previously utilised by turtle-doves where habitat has not altered are no longer used due to a reduced density of breeding birds (Dunn and Morris 2012). However, lack of suitable nesting habitat may be important at a local scale, and a combination of nesting and foraging habitat together in close proximity is known to be important for recently fledged young.

Table 5 summarises the nesting habitat requirements of turtle-doves and how these can be met by the Countryside Stewardship Agri-environment Options tailored for turtle-doves. Depending on the character of the hedgerows, landowners are advised to consider allowing hedges to reach and then maintain a minimum height of 3m and a minimum width of 4m for at least some of the hedgerows where turtle-doves are likely to breed as part of option *BE3 Management of Hedgerows.* As scrub typically matures in 15 years, it is recommended to cut one fifteenth of the scrub every year or one fifth every third year when using Countryside Stewardship options WD7 and WD8, to restore and maintain a varied age structure, including mature areas suitable for nesting.

Table 5. Nesting habitat requirements of turtle-doves and how these can be met by Countryside Stewardship Agri-environment Options.

Resource requirement	*Minimum quantity (per 100ha of farmed land)*	*Relevant Countryside Stewardship Options*
Wide hedgerows or areas of scrub, at least 3m tall, especially those with thorny shrubs and climbers. *A pond or other source of accessible water on the holding or nearby also benefits turtle-doves.*	500m–2000m	BE3 Management of Hedgerows. WD7 Management of Successional Areas and Scrub. WD8 Creation of Successional Areas and Scrub.

An evaluation of 20 Higher-tier Agri-environment Agreements with a pilot version of a package of measures for turtle-dove, which included both nesting and foraging habitats on the same site, showed that 58% of evaluated sections of tall hedges and scrub potentially provided suitable nesting habitat for turtle-doves: sections were at least 3m tall, at least 4m wide and had climbing plants present for nest concealment (Walker and Morris 2016).

Foraging Habitat

The turtle-dove is an obligate granivore (it only eats seeds, although very small amounts of green plant material and invertebrates such as snails have occasional been recorded in the diet). In the UK, *Fumaria sp* historically formed the mainstay of its diet, with seeds of other plants associated with arable fields (such as *Stellaria media*, *Anagallis arvensis*, *Geraniaceae*, *Amaranthaceae* and *Poa*) also being common. Before widespread agricultural intensification, seeds of *Trifolium spp* were also commonly taken from short-term

rotational grass and legume leys. However, in recent decades, the seeds of arable crops (especially cereals and brassicas such as oilseed rape) have become an especially important part of the diet later in the breeding season. A recent dietary study based on molecular techniques confirmed the importance of both natural and anthropogenic food sources (including, for the first time, seeds originating from garden/game bird feeders). Adult birds have been recorded travelling considerable distances, sometimes as far as 10km, from their breeding territories to exploit locally abundant food supplies, such as spilt grain and weed-rich fields.

Turtle-doves obtain most of their food from the ground, and providing a sparse, patchy sward that enables the birds to detect and access the seeds is very important for this species. Typical characteristics of foraging locations show mean vegetation height <20cm and mean bare soil forms 60% of ground cover (Browne and Aebischer 2003b, Dunn *et al* 2015). Territories are more likely to be lost from areas with less bare ground and fallow (Dunn and Morris 2012), traditionally habitats rich in accessible arable plant seed.

Creation and management of marginal strips/plots of early-seeding plants that retain an open structure from mid-April into late summer provide good foraging habitat for turtle-doves. In Countryside Stewardship, these can be created in two main ways (Table 6).

Table 6. Summary of the foraging habitat requirements of turtle-doves and how these can be met by Countryside Stewardship Agri-environment Options tailored for turtle-doves.

Resource requirement	*Minimum quantity (per 100 ha of farmed land)*	*Relevant Countryside Stewardship Options*
Marginal strips or plots with early-seeding plants that retain openness from mid-April to July, to allow birds to access the seeds, ideally situated within 300m of suitable nesting habitat.	2-3 ha	*Ideally, a combination of:* AB1 Nectar Flower Mix with SP9 Threatened Species Supplement. AB11 Cultivated Areas for Arable Plants.

Sown plant mixes

A tailored management option has been devised by an RSPB/Natural England project aimed at providing optimal foraging conditions for turtle-doves: early-seeding plants known to be important in the diet within a sparse sward that enables the birds to have access to the seeds on the ground. Two hectares of the plant mix was sown on each of eight sites (six of which ran concurrently) to test the suitability of seed production and accessibility over two-year periods. The sown mix was based on plant species known to be present in turtle-dove diet historically, and was designed to deliver a phenology of different seeds across most of the breeding season from May until September. The research trials found that the sown plots provided plentiful seed, but that ground became too overgrown by mid-summer (especially in the second year) to allow turtle-doves access (Dunn *et al* 2015). Further management was included to keep the sown mix more open, and has been adopted in the Countryside Stewardship option.

Sown seed mixes for turtle-doves in Countryside Stewardship are delivered by a modified version of AB1 Nectar Flower Mix, with the additional costs associated with establishing and managing a modified seed mix specifically for turtle-doves met by the payment of a SP9 Threatened Species Supplement, an additional £120/ha per annum. To tailor this option for turtle-doves, specific management must be applied to the AB1 Nectar Flower Mix:

- establish a seed mixture of 25% (by weight) *Vicia sativa* (variety “early English”), 20% *Lotus corniculatus*, 20% *Trifolium repens*, 20% *Medicago lupulina*, 10% *Trifolium pratense* and 5% *Fumaria officinalis* at a seed rate of 10–15kg/ha;
- establish in blocks and/or strips between 1 August and 15 October;
- rotationally cut 50% of the plot area each year between 15 June and 7 July; do not cut the same area in successive years;
- cut the whole area between 1 September and 30 September, removing cuttings to avoid patches of dead material developing;
- mixes may need to be re-sown every two years.

Experience from the RSPB/Natural England research project suggests that undertaking these additional management prescriptions is vital to achieve successful establishment and maintenance of suitable conditions for foraging birds during the lifetime of the Countryside Stewardship Agri-environment

Agreement. Each plot has to maintain seed production through the season as well as maintain an open and accessible structure with a minimum of 30-50% bare ground (Figure 17), which can be a difficult balance to achieve. This is very different from the desired structure of a standard nectar mix plot for pollinating insects. Visiting the plots regularly through the season (and especially in early spring) to determine whether both seed and bare/sparsely vegetated ground are present is highly desirable.

Figure 17. A well-managed AB1 Nectar Flower Mix with SP9 Threatened Species Supplement, delivering turtle-dove foraging habitat, with open structure and large amounts of bare ground.

There are indications from the evaluation of 20 Agri-environment Agreements with a pilot version of the turtle-dove package that this composition of seed mix may still not be optimal despite some amendments to the management, as 69% of evaluated plots were deemed to contain insufficient suitable seed or access for turtle-doves (Walker and Morris 2016). In part, this is likely to have been due to the tall, dense structure of modern leguminous cultivars (designed primarily to maximise forage delivery for livestock) coupled with the highly fertile nature of arable fields, which routinely received high input of inorganic nitrogen fertiliser when commercially cropped. The RSPB plans to investigate alternative sown seed mixes further, for example with lower sowing rates/reduced clover content/revised species components, but such evaluations will not take place before 2018 at the earliest. However, Walker and Morris (2016) did find a marginally significant tendency for turtle-dove abundance to increase with increasing area of AB1 Nectar Flower Mix with SP9 Threatened Species Supplement on the 20 turtle-dove package pilot sites.

Care needs to be taken when deploying plots of sown seed mixes on holdings where there is evidence of or a high likelihood that rare arable plants and/or a high quality (diverse) arable plant assemblage is present. In these situations, locating cultivated plots on the sensitive parts of the holding or on field margins (the first 12m from the field boundary), while employing sown plots elsewhere, may provide a better option. Furthermore, cultivated plots may provide a better option if there are already populations of *Fumaria officinalis* or other species of small-seeded arable plants present on the holding. Plots should be located on level ground and not adjacent to watercourses, to minimise the risks of soil loss and run-off.

Cultivated areas

No study has specifically evaluated the benefit of cultivated, uncropped areas in providing a source of naturally-regenerating seed for turtle-doves. However, the Browne and Aebischer (2003b) study of foraging locations from radio-tagged birds, plus anecdotal casual observations, suggest that if managed in the correct way and in the presence of an abundant and diverse seed bank (most likely on lighter sandy or chalky soils or in areas with a shorter, less-intensive history of crop production), cultivated, uncropped

areas can provide abundant, accessible sources of seed from arable species known to be present in turtle-dove diet.

In England, Agri-environment Schemes have long contained management options that provide for the annual cultivation of uncropped areas for arable plant communities, or ground-nesting birds such as Eurasian stone curlew (*Burhinus oedicnemus*) and northern lapwing (*Vanellus vanellus*). In Countryside Stewardship, option AB11 provides for the creation of cultivated but uncropped areas for arable plants. Typically, these are field margins, but they can also be plots in the field centre, and they are easiest to manage and provide the greatest range of seeds suitable for turtle-doves on sites with lighter soils, which tend to have the most species-rich seed banks and lesser populations of difficult to control weeds not commonly found in the turtle-dove diet, such as *Alopecurus myosuroides*. This option works best for turtle-doves when autumn-cultivated, to allow time for regenerating plants to set seed, and placed in areas with lower soil fertility and with as few pernicious weeds as possible. On heavy soils, a two-stage cultivation programme, incorporating an autumn cultivation followed by an application of a non-selective herbicide prior to a secondary cultivation completed in early spring, can deliver weed-rich habitat with minimised pernicious weeds. Where appropriate, combining both spring and autumn-cultivated AB11 plots on the same agreement/field and, ideally, in combination with an AB1/SP9 plot, will increase the diversity and resilience of seed food provided to the turtle-doves. The desired outcome is a plot containing arable flora such as *Fumaria officinalis*, *Stellaria media* and *Anagallis arvensis* with an open structure that allows foraging turtle-doves access to seeds on the ground (Figure 18).

Figure 18. A well-managed uncropped AB11 plot delivering suitable foraging habitat for turtle-doves.

If undesirable weeds such as black-grass *Alopecurus myosuroides* start to build up, the timing and depth of cultivation can be changed to break the life cycle of the weeds, or the plot can be rotated around different edges of the same field. Alternatively, the following herbicide control options can be considered. Where rare arable plants are present but the perennial weed burden is having an impact on the growth, the use of a non-selective herbicide in September will control the perennial species with minimal damage to the rare annual species, which will have largely seeded by the autumn. Where rare arable plants are not present, applying a non-selective herbicide to control grass weeds such as *A. myosuroides* following an autumn cultivation and prior to a secondary cultivation pass can be considered to help maintain an acceptable level of weed control, without jeopardising the delivery of the outcome of seed-rich, open foraging habitat for turtle-doves. This should only be carried out if there are high levels of undesirable weeds, adopting a three-stage approach: (1) cultivate the option area between 1 August and 1 November each year to stimulate a flush of autumn-germinating weeds such as black-grass (up to two passes with primary and secondary cultivation implements can be completed); (2) spray off the resultant weed flush by 15 February using a non-selective herbicide; and (3) complete a final cultivation to achieve a firm, fine tilth (preparation of surface soil) by 15 March; this final cultivation is intended to generate a flush of spring germinating annual plants which are taken by many farmland birds; do not disturb fallow areas until 31 August.

Implementing management of nesting and foraging habitats on a single site

Agri-environment Schemes are the main mechanism for delivering the sympathetic management of farmland for turtle-doves in the UK. Previous Agri-environment Schemes have failed to halt declines at

regional or national levels, while evaluations of the Entry and Higher Levels of Environmental Stewardship in England detected no relationship between the presence or extent of agri-environment and trends in turtle-dove abundance (Baker *et al* 2012, Bright *et al* 2015). At least in part, this may be due to the lack of suitable options (particularly for foraging habitat) in the schemes. In view of the ongoing steep decline, a species recovery initiative *Operation Turtle-dove* (http://operationturtledove.org) was set up by the RSPB, Conservation Grade, Pensthorpe Trust and Natural England to carry out a range of targeted actions, including promotion of turtle-dove-friendly land management to farmers through Agri-environment Schemes.

Forming the basis of effective land management was the need to develop a package of measures that provided all of the ecological requirements of the species during the breeding season on a single agreement (site) in sufficient quantity and in appropriate locations. Although adult turtle-doves can forage and move between nest sites over distances of several kilometres, this is likely to entail a high energetic cost. During the first three weeks post-fledging, juveniles spend more than half their time within *c*20m of the nest site (with 95% of foraging trips within 329m of the nest), where they select seed-rich habitat. Fledglings that were heavier and in better body condition at seven days old were more likely to survive for 30 days post-fledging, and the proportion of available seed-rich habitat was a strong predictor of nestling weight and condition at seven days old (Dunn *et al* 2016a). Therefore, providing both nesting and foraging requirements on a single site is likely to be highly advantageous for the species. Providing a range of different foraging habitats (sown and natural-regeneration from cultivation) within the same agreement can provide a more diverse and resilient supply of accessible seed food.

Between 2013 and 2015, the types of turtle-dove-friendly nesting and foraging habitats outlined previously, plus other possibly suitable agri-environment measures, were rolled out in combination in a pilot project to test the efficacy of a “turtle-doves package”. Pilot turtle-dove package agreements were set up on a number of Higher Level Stewardship (HLS) sites in Eastern England with recent records of turtle-doves nearby. HLS was the higher tier of the Environmental Stewardship Agri-environment Scheme available (on a competitive basis) to farmers in England from 2006 until the end of 2015. Twenty HLS agreements with packages of turtle-dove-friendly management were surveyed in summer 2015 and found to have a turtle-dove occupancy rate of 45% (corrected to 64.3%, when controlling for the 70% detection rate of the survey methodology), against the backdrop of an ongoing steep decline in the species, and the fact that most management had only been implemented for one to two years. 58% of evaluated sections of tall hedges and scrub provided potentially suitable nesting sites, but only 31% of evaluated foraging habitat was considered suitable, the most common reason for unsuitability being a lack of bare ground. Despite the suboptimal delivery of access to seed on the ground, there was a marginally significant tendency for turtle-dove abundance to increase with increasing area of nectar flower mix with threatened species supplement, on the agreements. 80% of the evaluated turtle-dove package agreements succeeded in providing some potential nesting and foraging habitat in very close proximity (<150m), although this fell to 45% of agreements when only highly suitable nesting and foraging habitat were considered (Walker and Morris 2016).

From the start of 2016, a new Agri-environment Scheme, Countryside Stewardship, was introduced on a competitive basis to landowners and land managers in England. The higher tier of Countryside Stewardship contains provision for a package of bespoke habitat management for turtle-doves, which can be taken up by agreement holders with recent records of turtle-dove nearby. The more complex, species-specific management is underpinned by the SP9 Threatened Species Supplement, whereby the agreement holder is fully compensated for the cost of establishing and maintaining the habitat in suitable condition. The range of options and managements is similar to those outlined previously but has been guided by the experience gained within the HLS pilot and recent land management option trials by the RSPB/Natural England, to provide advice on developing a Higher Tier Countryside Stewardship agreement that will successfully deliver for turtle-doves.

A successful Countryside Stewardship agreement for turtle-doves requires a combination of options to be deployed to deliver both its nesting and seed-rich foraging requirements in close proximity (within 300m). In addition, in most situations, ideal foraging habitat can best be provided by deploying plots of a modified version of option AB1 Nectar Flower Mix, requiring a specified seed mix and additional management (funded by the SP9 Threatened Species Supplement), ideally in combination with option AB11 Cultivated Areas for Arable Plants. Options beneficial to turtle-doves can be deployed anywhere where there is a reasonable level of certainty that the species is holding territory (based on the national Bird Atlas data (Balmer *et al* 2013) and local information). This will most easily be deployed as part of the Higher Tier Wild Pollinator and Farm Wildlife Package and the options detailed here can count towards the minimum quantities required for the relevant resources. However, it is recommended that the modified AB1/SP9 combined option should be targeted on those holdings where there is good evidence of birds being present,

and where the agreement holder both understands and is committed to undertaking the additional management that is required.

Other potentially useful habitat types

The evaluation of the pilot HLS turtle-dove package sites found no evidence of positive associations between turtle-dove occupancy/abundance and any other evaluated habitat or Agri-environment Option type with the exception of HK15 (Maintenance of Grassland for Target Features). These "target features" do not include providing foraging habitat for turtle-doves, and following discussions with Natural England Advisors it was concluded that any benefits of HK15 were likely to have arisen from local soil conditions in the study areas (light, sandy soils that produce naturally short grass swards) rather than management of the option *per se*. Therefore, grassland management options have not been included in the Countryside Stewardship turtle-dove package. However, it is likely that short, patchy, and flower-rich grassland with no/low amounts of herbicide and nitrogen fertiliser applications did provide, and may continue to provide, good quality semi-natural foraging habitat. More research is needed to determine the exact specifications to optimise delivery for turtle-doves.

It is also probable that grass and wild flower mixes often sown on the edge of amenity recreation and reclaimed quarry and mining sites may provide suitable habitat with some minimal management, such as rotational mowing. The RSPB and the aggregates company CEMEX are currently exploring the possibility of introducing such habitat on areas of quarried land once extraction of minerals has ceased. A possible seed mix for the CEMEX sites, which has yet to be tested, is as follows:

%	species
0.5	*Achillea millefolium*
1	*Centaurea nigra*
1.5	*Galium verum*
1.5	*Leucanthemum vulgare*
1	*Lotus corniculatus*
3	*Plantago lanceolata*
0.6	*Primula veris*
3	*Ranunculus acris*
1.5	*Rhinanthus minor*
1.5	*Rumex acetosa*
0.1	*Lychnis flos-cuculi*
0.3	*Trifolium pratense* (var wild red)
1	*Vicia cracca*
10	*Agrostis capillaris* *
2	*Alopecurus pratensis* *
1	*Anthoxanthum odoratum* *
1	*Briza media* *
36	*Cynosurus cristatus* *
24	*Festuca rubra rubra litoralis* *
2	*Hordeum brachyantherum* *
4	*Phleum bertolonii* *

* % of these grasses may be reduced in favour of the addition of *Medicago lupulina*.

In the early 1960s, turtle-doves in eastern England commonly foraged for the seeds of *Trifolium spp*, grasses and other arable plants in grass/clover leys, which were used as breaks between arable crops. This habitat has become rare in arable farmland; it has long since disappeared from the original study sites, along with turtle-doves. However, as there is now a trend towards greater use of traditional methods to achieve better control of grass weeds and improved soil fertility and structure on arable land, it is possible that this habitat will once again become more widespread in NW Europe, while the use of temporary, species-rich leys is still more widespread in other areas of Europe. However, the use of less diverse species mixes, modern varieties of legume with taller and denser vegetation structure, more frequent cutting/grazing, and high residual fertility from long-term use of inorganic nitrogen fertilisers may mean that modern leys are less suitable as foraging habitats, and research is needed to test the value of present-day leys for turtle-doves.

Guidance on developing a Countryside Stewardship agreement for farmland birds in general, through the Wild Pollinator & Farm Wildlife Packages can be found at https://www.gov.uk/government/publications/countryside-stewardship-farm-wildlife-package (last accessed 7 February 2018).

Sample Countryside Stewardship Management Plan for SP9 Threatened Species Supplement

Agreement reference	
Agreement holder	
Target species	Turtle-dove
Option(s) covered by this management plan	AB1 Nectar Flower Mix + SP9 Threatened Species Supplement
Field location(s) and plot size (ha)	

Introduction

This management plan provides tailored guidance and management prescriptions that will enable to you to deliver the bespoke turtle-dove seed mix successfully as part of your Countryside Stewardship Higher Tier Agreement.

The bespoke guidance and prescriptions in this plan only apply to those AB1 Nectar Flower Mix plots being managed specifically for turtle-doves with the SP9 Threatened Species Supplement. All other AB1 plots in your agreement should be managed according to the standard prescriptions.

Outcome of management

The management detailed in this plan seeks to provide ideal foraging conditions for turtle-doves: plots sown with early-seeding plants that retain an open structure from mid-April to July, allowing birds to access the seeds on the ground, located within 300m of suitable nesting habitat (tall, dense hedgerows or stands of scrub). It is recognised that maintaining both seed production and an open structure throughout the season can be a difficult balance to achieve, and is very different to a standard nectar mix plot. The following image shows the structure that needs to be achieved to be suitable for foraging turtle-doves.

Step-by-step guide

The following is a step-by-step guide to establishing and managing these areas during the course of your five-year agreement.

Step 1: establishing the plot in Year 1 (and Year 3) of your agreement

Plot size

The plot should be at least 6m wide and a maximum area of 1ha.

Plot location

The plot should be positioned on level ground, close to suitable turtle-dove nesting habitat (within 300m), or near to farm ponds or other wetland features, but not adjacent to watercourses (to minimise the risks of soil loss and run-off into watercourses). Sheltered, south-facing locations will generally be best. Areas with low soil fertility can be used, but avoid waterlogged and completely shaded locations.

Care should be taken to avoid putting this option in locations known to support rare arable plant species such as corn marigold, cornflower, night-flowering catchfly and shepherd's needle.

What to sow

The following seed mix (% by weight) must be sown at a seed rate of 10–15 kg/ha:

- early English common vetch (25%)
- birdsfoot trefoil (20%),
- early white clover (20%)
- black medick (20%)
- early red clover (10%)
- common fumitory (5%)

On heavier soils, and where there are likely to be problems with pernicious weeds, a sowing rate of up to 15 kg/ha is recommended. On lighter soils, a sowing rate of 10 kg/ha is more likely to provide a more varied vegetation structure.

When to sow

Sow from late August to mid-September wherever possible (ground conditions permitting) to ensure establishment before the winter dormancy period and any harsh weather. Later sowings, up to 15 October, can be considered in localities where severe/early frosts are less common and the winters are generally milder.

How to sow

The seed mix should be broadcast into a firm, fine seedbed and then rolled.

Step 2: management of plot in Year 2

(a) Early spring inspection and scarification

It is vital that there is sufficient bare earth within the plot when the turtle-doves arrive on the breeding grounds. Inspect the plot by early April to ensure that the vegetation is generally <12cm in height and covers <50% of the ground. If the vegetation generally exceeds this height and cover, scarify half of the plot by 15 April.

(b) Summer cut and scarification

Cut 50% of the plot to a height of 10cm between 15 June and 7 July. To extend the use as a foraging habitat by turtle-doves, those plots where the vegetation uniformly exceeds 12cm in height and covers >50% of the ground should be scarified to a depth of 2–3cm immediately after cutting.

The width of the scarification should be determined by the dimensions of the plot. For example, a 6m margin should have half topped (3m-wide cut), while a plot of 0.5ha should have 6m scarified strips distributed evenly across the plot, to provide the level of sward diversity (including bare ground) required by foraging birds.

(c) Autumn cut/scarification

In order to prevent the vegetation cover becoming too dense, and to encourage autumn germination of seed-producing plants, it is vital that any dense vegetation be cut/flailed and removed; and then the whole of the plots should be scarified to a depth of 2–3cm.

Scarification or shallow cultivation can be undertaken by a range of suitable equipment such as a power harrow, set of discs or tines, or other implements appropriate to site conditions.

Step 3: management of plot in Year 3

Repeat 2a and 2b to maintain the suitability of the plot for foraging turtle-doves.

Step 4: re-establish the plot in Year 3

After the summer cut/scarification, allow plants to re-grow and flower for a minimum of four weeks before repeating step 1 to re-establish the plot. To do this, you can either re-sow the seed mix in the same location or bring that land back into the normal arable rotation and move the plot a new suitable location.

Step 5: management of the plot in Years 4 and 5

Repeat 2a, 2b and 2c in Year 4 of your agreement, and 2b and 2c in Year 5.

Habitat Creation and Management for Turtle-doves on the European Breeding Grounds: prescriptions elsewhere in breeding Range States.

Development of detailed prescriptions that are tailored to national/local circumstances is urgently required across the European Union and other breeding Range States.

Keenleyside *et al* (2006) reported on the development of agri-environment measures in new EU member states (Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) and suggested that in more intensively farmed areas, mainly in the lowlands, turtle-dove and a suite of other species could benefit from: potato growing in three-year rotational fallow; citrus/vines being ploughed instead of using herbicides; crop rotation of cereals; and, on all arable land, no ploughing of green manure crops or for weed control in spring/early summer. The report also suggested that in the uplands (low intensity carob and almond groves, vineyards with dry-stone walls) the following may benefit turtle-doves and other species: maintenance of traditional trees (carobs/almonds); maintenance of traditional bushes; clearing of scrub from abandoned farmland; maintenance of dry-stone walls. Orchard management techniques that could benefit turtle-dove and other farmland species were identified as: maintenance of old orchards with high trees; grassy spaces between lines of grapes cultivated on poles; areas of natural regeneration; no chemical weed control until July.

Annex 4: PRELIMINARY MODELLING ASSESSMENT OF THE IMPACT OF HUNTING OF EUROPEAN TURTLE-DOVE ON THE WESTERN FLYWAY

Estimating hunting sustainability of turtle-doves using the western flyway: a first approach based on the use of demographic invariants

Hervé LORMÉE[1], Lara MORENO[2], Carles CARBONERAS[3], Will PEACH[3], Christophe BARBRAUD[4] and Cyril ERAUD[1].

[1]Office National de la Chasse et de la Faune Sauvage, 79360 Villiers en Bois, France.
[2]Instituto de Investigación en Recursos Cinegéticos, Ronda de Toledo s/n, 13005 Ciudad Real, Spain.
[3]RSPB, The Lodge, Sandy, Bedfordshire SG19 2DL, UK.
[4]Centre d'Etudes Biologiques de Chizé, UMR 7372 Centre National de la Recherche Scientifique, Université La Rochelle, 79360 Villiers en Bois, France.

The main objective of this approach is to estimate a maximum harvestable population of turtle-doves that use the western flyway (P), based on the methodology proposed by Niel and Lebreton (2005) and to compare the estimated values of P though a range of scenarios with the most recent estimate of hunting bags for the western flyway.

Area of analysis

Marx *et al* (2016) was used to assign countries to the western or central flyway. No information was available for Switzerland, but it has been included in the western flyway. Italy falls within the central flyway according to Marx *et al* (2016), and for the initial analysis, it was not included. Population sizes can be found in Table 2 as the basis for Table 7.

Table 7. Base data for sustainable hunting model analyses.

Country	Pop size (pairs) min	Pop size (pairs) max	Year(s) of estimate	Year of reference (1)	Multiplic-ative trend slope (2)	Multiplic-ative trend slope period (3)	Time elapsed (in years) between year of reference and 2013 (4)	[multiplicative trend slope] time elapsed (5)	Pop size in 2013 (pairs) min (6)	Pop size in 2013 (pairs) max (6)
Belgium	3,000	4,500	2000-2002	2001	0.9091	90-14	12	0.3187	956	1434
Denmark	100	150	2010-2011	2011	1		2	1.0000	100	150
France	396,985	481,007	2009	2009	0.9798	89-14	4	0.9216	365868	443303
Germany	25,000	45,000	2005-2009	2007	0.9576	89-14	6	0.7711	19277	34699
Italy	150,000	300,000	2006	2006	1.0025	00-14	7	1.0176	152645	305290
Netherlands	1,200	1,400	2013-2015	2014	0.9269	84-14	-1	0.92693	1295	1510
Portugal	10,000	50,000	2008-2012	2010	0.9013	1984-14	3	0.7322	7322	36608
Spain	1,370,000	2,285,000	2004-2006	2005	0.9814	98-14	8	0.8605	1178933	1966322
Switzerland	1,000	2,500	1993-1996	1995	0.9469	99-14	18	0.3745	375	936
UK	3,220	5,460	-2014	2014	0.9373	66-14	-1	0.9373	3435	5825

(1) the median year within the period over which the population size was estimated
(2) as given in Figure 12, Figure 13, and Figure 14
(3) period over which the slope was calculated (given in legends of Figure 12, Figure 13, and Figure 14)
(4) time elapsed (in years) between median year and 2013
(5) rate of change in population size during the period of concern, calculated as: multiplicative slope$^{[number\ of\ years\ elapsed]}$
(6) population size in 2013, calculated as: initial population size × rate of change

Escandell (2011) and Spina and Volponi (2008) present recovery maps in which it appears that some birds ringed in islands located east of Spain (for example, the Balearic Islands and Colombretes) are recovered

in Italy during spring migration, and some birds ringed in Italy are recovered in western Europe (France, Spain, Portugal), although it is not known if ringing occurred during the breeding period and/or during migration. These observations suggest that at least a part of the Italian population may use the western flyway during both spring and autumn migrations, so making those birds available for hunting on the western flyway.

In a second scenario, Italy was partly included by adding the area located north of a line from La Spezia to Bologna (alpine chain excluded), as most of the recoveries located in western Europe of doves ringed in Italy were from this area. No data are available on the percentage of the Italian turtle-dove breeding population in this region. As it accounts for 21% of the national area, this same ratio was used.

Based on the Migration Atlas, Spina and Volponi (2008), a hypothesis was used that among all birds ringed and recovered in Italy, those recovered in the northern part of the country were more likely to contribute to the hunting bag associated with the western flyway. Using this hypothesis, and as the vast majority of recoveries in Italy are obtained through hunting, a rough calculation based on the map showing national recoveries showed 19 recoveries out of 102 above the Spezia-Bologna line, leading to an estimate of 18.6% of the national hunting bag.

Method

The aim was to estimate the maximum harvestable population allowed by population growth.

It can be estimated as: $\mathbf{P = Nb(\lambda_{max} - 1)}$

P - potential maximum harvestable population fraction.

N - total population size, before the hunting season starts. Total population size includes adults and juveniles produced in the relevant year. To estimate the 2013 adult population size, the most recent estimates available for turtle-dove population size in each of the countries were corrected by the yearly multiplicative trend slope. To estimate the juvenile population size, the breeding population (in pairs; all adults were considered to breed, which may not be the case) was multiplied by a productivity estimate (number of flying juveniles produced per pair per year). Two different estimates were used as lower and upper intervals: 1.3 (calculated in the 1990s in the UK by Browne and Aebischer 2004) and 2.71 (calculated in Portugal by Fontoura and Dias 1995).

b - correction factor accounting for the effect of density on demographic performance. Initially, Wade (1998) recommended setting **b** at the default value of 0.5. However, more recently, Dillingham and Fletcher (2008) suggested that, without further information, it may be reasonable to use a value of 0.1 for threatened or endangered species (0.5 for Least Concern species). 0.1 is used in this model.

λ_{max} - maximal growth rate.

λ_{max} is estimated following Niel and Lebreton (2005) by solving numerically:

$$\lambda_{max} = \exp([a + So/(\lambda_{max} - So)]^{-1})$$

a - average age at first reproduction. In the absence of published data, it was considered that 100% of birds first breed at one year.

So - adult survival rate. Estimates of survival rates are available for France and the UK.

For France, apparent adult survival rates came from a study at the CMR station located on Oléron Island (France, south-west) and monitored since 1998. The model accounted for transience effect on survival (due to permanent emigration), considering a distinct survival rate for transient and resident individuals. Both these survival rates could vary between years but recapture probability **p** held constant (model **ϕtp**). An average value of **So** for resident individuals was used with Mark software ("Output/Specific model output/Variance components/Real parameter estimates"), set to **So** = 0.593.

As apparent survival rate is likely to underestimate true survival, an alternative approach was also applied by using the averaged upper 95% interval confidence of resident survival rates obtained through the same model (from 1998 to 2016). From this, **So** = 0.748.

For the UK, survival estimates found in Siriwardena *et al* (2000) were used, obtained through ring recoveries data (and so being a more realistic representation of true survival rate). Two adult survival rates were given, one when the population was considered as stable, **So** = 0.623, and one when the population was declining, and set to 52.5%. As an intermediate approach compared to France, the value of **So** = 0.623 was used.

The potential maximum harvestable population fraction (P) according to different group of hypotheses were estimated. In the first group of scenarios, Italy was not included, while in the second "Italian" group, data were included as previously described. In each group, productivity and adult survival could have different values. There were six different scenarios in each group Figure 19**Error! Reference source not found.**.

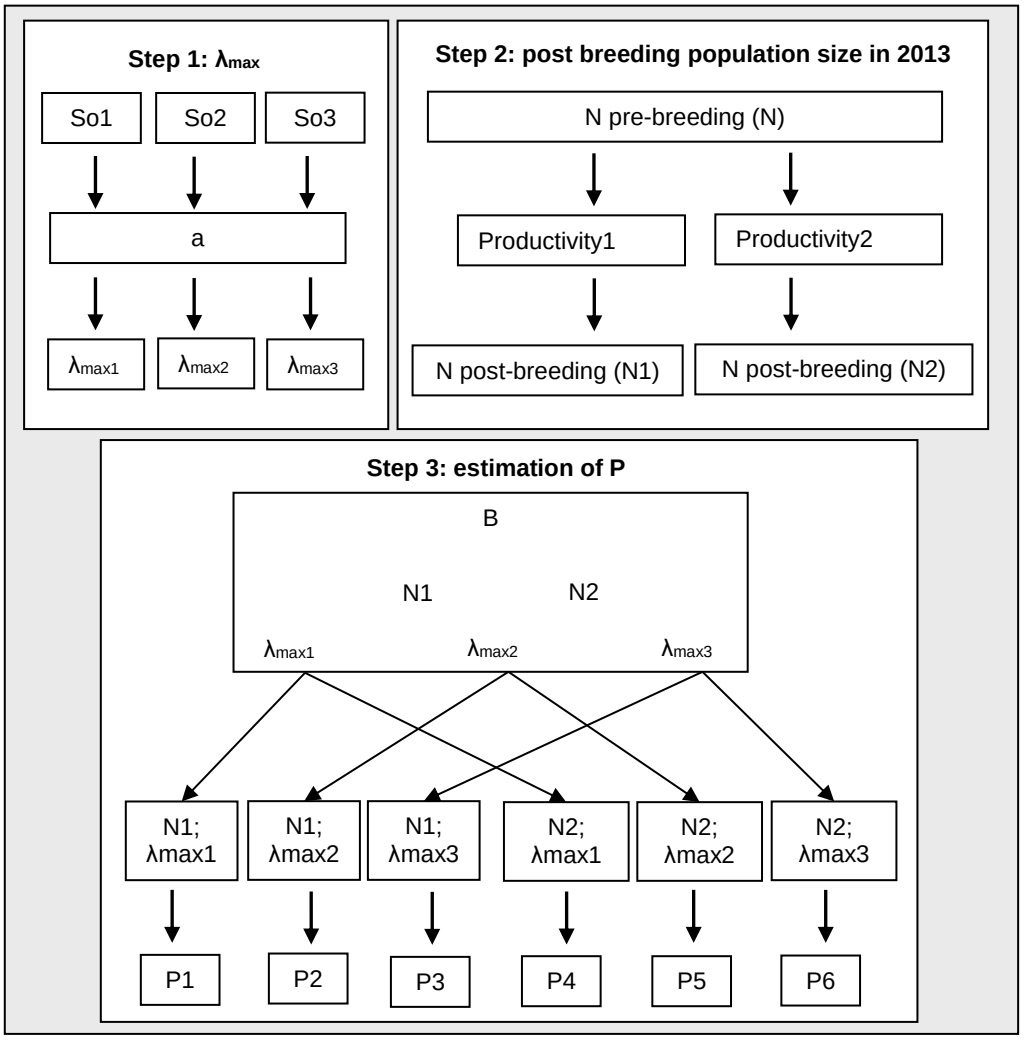


Figure 19. Three steps to estimate the Potential maximum harvestable population fraction (P).

Three values are used for survival S and hence λ_{max}, two values are used for productivity, leading to six different scenarios. Other parameters remain constant (a: age at 1st breeding, b: correction factor).

P1 is the potential maximum harvestable population fraction that could be performed in conditions that are the most conservative for turtle-dove populations (lowest λ_{max}, post-breeding population calculated with the lowest productivity value). P6 gives the potential maximum harvestable population fraction that could be performed in conditions that are the least conservative for turtle-dove populations (highest λ_{max}, post-breeding population calculated with the highest productivity value).

Results

Estimates of population size from western flyway potentially targeted by hunting:

Group 1: Italy not included in population size

Using the information in Table 7, the adult population size N in 2013 = 1,577,560-2,490,789 breeding pairs × 2 = 3,155,119-4,981,577 birds.

• Hypothesis 1: post-breeding population N1 (productivity rate = 1.3)

Applying a productivity rate of 1.3 would lead to a juvenile population of 2,050,827-3,238,025.

The total population before hunting, calculated as twice the number of breeding pairs plus the number of juveniles produced = N + N1 = 5,205,947-8,219,602 birds.

• Hypothesis 2: post-breeding population N2 (productivity rate = 2.71)

Applying a productivity rate of 2.71 would lead to a juvenile population of 4,275,187-6,750,037.

The total population before hunting, calculated as twice the number of breeding pairs plus the number of juveniles produced = N + N2 = 7,430,306-11,731,614 birds.

Group 2: Italy partially included in population size

21% of the Italian population in 2013 = 32,055-64,111 pairs.

The adult population size N in 2013 = 1,609,615-2,554,899 breeding pairs × 2 = 3,219,230-5,109,799 birds.

• Hypothesis 1: post-breeding population N1 (productivity rate = 1.3)

Applying a productivity rate of 1.3 would lead to a juvenile population of 2,092,499-3,321,369.

The total population before hunting, calculated as twice the number of breeding pairs plus the number of juveniles produced = N + N1 = 5,311,729-8,431,168 birds.

• Hypothesis 2: post-breeding population N2 (productivity rate = 2.71)

Applying a productivity rate of 2.71 would lead to a juvenile population of 4,362,057-6,923,777.

The total population before hunting, calculated as twice the number of breeding pairs plus the number of juveniles produced = N + N2 = 7,581,287-12,033,576 birds.

Estimates of λ_{max}

For **So =** 0.748, λ_{max1} = 1.79
For **So =** 0.623, λ_{max2} = 1.98
For **So =** 0.593, λ_{max3} = 2.03

Calculation of P

Group 1: Italy excluded
• Hypothesis 1: post-breeding population N1 (productivity rate = 1.3)

λ_{max1} (1.79), P = 411,270-649,349
λ_{max2} (1.98), P = 510,183-805,521
λ_{max3} (2.03), P = 536,213-846,619

• Hypothesis 2: post-breeding population N2 (productivity rate = 2.71)

λ_{max1} (1.79), P = 586,994-926,798
λ_{max2} (1.98), P = 728,170-1,149,698
λ_{max3} (2.03), P = 765,322-1,208,356

Group 2: Italy partially included
• *Hypothesis 1: post-breeding population N1 (productivity rate = 1.3)*

λ_{max1} (1.79), P = 419,627-666,062
λ_{max2} (1.98), P = 520,549-826,254
λ_{max3} (2.03), P = 547,108-868,410

• *Hypothesis 2: post-breeding population N2 (productivity rate = 2.71)*

λ_{max1} (1.79), P = 598,922-950,653
λ_{max2} (1.98), P = 742,966-1,179,290
λ_{max3} (2.03), P = 780,873-1,239,458

Estimation of European hunting bag obtained for turtle-doves using the western flyway

According to Table 4, the number of birds bagged is:

France	91,704 (2013-2014 hunting season; Aubry *et al* 2016)
Italy	305,590 (annual mean; 2004-2014 period; Sorenti and Tramontana 2016)
Portugal	110,624 (2013-2014 hunting season; Lara Moreno Zárate *pers comm*)
Spain	824,369 (2013-2014 hunting season; Moreno *et al* 2017)

Total (without Italy)	1,026,697
Total (with 18.6% Italy)	1,083,537

A comparison between P and the number of birds effectively bagged shows if the number of birds taken exceeds P or falls below it (Table 8).

Table 8. Comparison of different scenarios leading to estimates of P and the hunting bag estimate for the western flyway.

Group	Productivity	λ_{max}	P range	Ratio (%) (hunting bag/P)*100	Scenario Number
Italy excluded	Low	$\lambda_{max}1$	[411 270 – 649 349]	[249.6 – 158.1]	1
		λ_{max} 2	[510 183 – 805 521]	[201.2 – 127.5]	2
		λ_{max} 3	[536 213 – 846 619]	[191.5 – 121.3]	3
	High	$\lambda_{max}1$	[586 994 – 926 798]	[174.9 – 110.8]	4
		λ_{max} 2	[728 170 – 1 149 698]	[141.0 – 89.3]	5
		λ_{max} 3	[765 322 – 1 208 356]	[134.2 – 85.0]	6
Italy partially included	Low	$\lambda_{max}1$	[419 627 – 666 062]	[258.2 – 162.7]	7
		λ_{max} 2	[520 549 – 826 254]	[208.2 – 131.1]	8
		λ_{max} 3	[547 108 – 868 410]	[198.0 – 124.8]	9
	High	$\lambda_{max}1$	[598 922 – 950 653]	[180.9 – 114.0]	10
		λ_{max} 2	[742 966 – 1 179 290]	[145.8 – 91.9]	11
		λ_{max} 3	[780 873 – 1 239 458]	[138.8 – 87.4]	12

In all scenarios, hunting take is lower than P only when considering the upper interval values for P. It is never the case when considering the lower interval values. For eight out of 12 scenarios, the hunting bag dramatically exceeds the value of P (249.6% to 114%, scenarios 1 to 4 and 7 to 10). The only cases in which hunting take falls below P are scenarios where productivity reaches its maximum value, and λ_{max} is intermediate or very high. In those cases where the hunting take is below P, the difference is lower than

15% (85% to 91.9%) Both of these last scenarios (6 and 12) had λ_{max} set to its maximum value (2.03), which is likely not to be realistic for a species such as the turtle-dove. Consequently, hunting take would be lower than P only for scenarios 5 and 11, such difference being always below 10.7% (89.3% and 91.9%).

It appears, therefore, that the number of birds hunted within the western flyway is higher than the turtle-dove population is able to sustain (whether Italy is included or not).

This conclusion is further supported by additional information:
- the maximal growth rates calculated through national monitoring schemes are notably weaker than λ_{max} calculated through the use of demographic invariants (Spain 1.3139, 21 years data; France 1.2134, 26 years data; UK 1.2525, 49 years data (Will Peach *pers comm*)); it should be noted that λ_{max} obtained through national schemes already includes additive mortality related to hunting;
- this analysis has not taken into account the number of turtle-doves killed by hunters in Africa while overwintering, and so the overall hunting bag size could be substantially higher.

Annex 5: REFERENCES

ADAMIAN MS and KLEM D (1997) *A Field Guide to Birds of Armenia*. American University of Armenia, Yerevan.

AEBISCHER NJ (2002) Turtle-dove *Streptopelia turtur*. In: WERNHAM CV, TOMS MP, MARCHANT JH, CLARK JA, SIRIWADERNA GM and BAILLIE SR (eds) *The Migration Atlas: movements of the Birds of Britain and Ireland*. T & AD Poyser, London. pp 420-422.

AGENDA.GE (2015) *Georgia's bird hunting season begins tomorrow.* http://agenda.ge/news/40710/eng (last accessed 7 February 2018)

ALLEN B, KRETSCHMER B, BALDOCK D, MENADUE H, NANNI S and TUCKER G (2014) *Space for energy crops – assessing the potential contribution to Europe's energy future*. Report produced for BirdLife Europe, European Environmental Bureau and Transport and Environment. IEEP, London.

ARNAUDUC J-P, ANSTETT L and BOOS M (2011) Les prélèvements de colombidés par la chasse en France. *Faune Sauvage* 293: 45-49.

AUBINEAU J and BOUTIN JM (1998) L'impact des modalités de gestion du maillage bocager sur les colombidés nicheurs dans l'ouest de la France. *Gibier Faune Sauvage* 15(1): 55-63.

AUBRY P, ANSTETT L, FERRAND Y, REITZ F, KLEIN F, RUETTE S, SARASA M, ARNAUDUC J-P and MIGOT P (2016) Enquête nationale sur les tableaux de chasse à tir. Saison 2013-2014 Résultats nationaux. *Faune Sauvage* 310 (supplement Jan-Mar 2016): 1-8.

AUNIŅŠ A (2015) *Latvijas ligzdojošo putnu uzskaites: parasto putnu skaita pārmaiņas 2005–2014*. Putni dabā 2015/1.

BACON L (2012) *Estimation de la taille de la population de tourterelle des bois nicheuse en France*. Master1 IEGB, Université Montpellier, Montpellier.

BAKALOUDIS DE, VLACHOS CG, CHATZINIKOS E, BONTZORLOS V and PAPAKOSTA M (2009) Breeding habitat preferences of the turtle-dove (*Streptopelia turtur*) in the Dadia-Soufli National Park and its implications for management. *European Journal of Wildlife Research* 55: 597-602.

BAKER DJ, FREEMAN SN, GRICE PV and SIRIWARDENA GM (2012) Landscape-scale responses of birds to agri-environment management: a test of the English Environmental Stewardship scheme. *Journal of Applied Ecology* 49(4): 871-882.

BALMER DE, GILLINGS S, CAFFREY BJ, SWANN RL, DOWNIE IS and FULLER RJ (2013) *Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland*. BTO Books, Thetford.

BALMORI A (2004) Tórtola Común *Streptopelia turtur*. In: MADROÑO A, GONZÁLEZ A and ATIENZA JC (eds) *Libro Rojo de las aves de España*. Dirección General para la Biodiversidad. SEO/BirdLife, Madrid. pp 281–285.

BAPTISTA LF, TRAIL PW, HORBLIT HM, BOESMAN P, SHARPE CJ and KIRWAN GM (2018) European Turtle-dove (*Streptopelia turtur*). In: del HOYO J, ELLIOTT A, SARGATAL J, CHRISTIE DA and de JUANA E (eds) *Handbook of the Birds of the World*. Lynx Edicions, Barcelona. https://www.hbw.com/node/54149 (last accessed 14 March 2018)

BARR CJ and GILLESPIE MK (2000) Estimating hedgerow length and pattern characteristics in Great Britain using Countryside Survey data. *Journal of Environmental Management* 60: 23-32.

BARLOW C, WACHER T and DISLEY T (1997) *A Field Guide to Birds of The Gambia and Senegal*. Pica Press, Robertsbridge.

BATUMI RAPTOR COUNT (2015 onwards) http://www.batumiraptorcount.org/raptor-migration/migration-count-data (last accessed 7 February 2018).

BELIK VP (2005) Cadastre of breeding avifauna of South Russia. *Strepet* 3 (1-2): 5-37. [In Russian]

BELIK VP (2014) Woodpigeon and turtle-dove in the steppes of Don basin. *Caucasian Ornithological Bulletin 5*: 14-42. [In Russian]

BELIK VP, POLIVANOV VM, TILBA PA, DZHAMIRZOEV GS, MUZAEV VM, BUKREEVA OM, RUSANOV GM, REUTSKIY ND, MOSEJKIN VN, CHERNOBAY VF, KHOKHLOV AN, IL'YKH MP, MNATSEKANOV RA and KOMAROVA YU E (2003) Recent population trends of breeding birds in the Southern Russia. *Strepet* 1: 10-30. [In Russian]

van BEUSEKOM R, HUIGEN P, HUSTINGS F, DE PATER K and THISSEN J (eds) (2005) *Rode lijst van de Nederlandse broedvogels*. Tirion Uitgevers BV, Baarn.

BIODIVERSITE WALLONIE (2016) *Tourterelle des bois (*Streptopelia turtur*)* http://biodiversite.wallonie.be/fr/streptopelia-turtur.html?IDD=50334168&IDC=310 (last accessed 7 February 2018)

BIRDLIFE CYPRUS (2016) *BirdLife Cyprus note regarding the consultation on the proposed amendments to the Protection and Management of Wild Birds and Game Law N.152(I)/2003* [Letter written September 2, 2016 to Head of the Game and Fauna Service, Mr Pantelis Hadjiyerou].

BIRDLIFE INTERNATIONAL (2004) *Birds in Europe: population estimates, trends and conservation status*. *BirdLife Conservation series 12*. BirdLife International, Cambridge.

BIRDLIFE INTERNATIONAL (2014a) *Summary of National Hunting Regulations: Albania.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Albania.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014b) *Summary of National Hunting Regulations: Bosnia-Herzegovina.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Bosnia.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014c) *Summary of National Hunting Regulations: Egypt.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Egypt.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014d) *Summary of National Hunting Regulations: Israel.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Israel.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014e) *Summary of National Hunting Regulations: Lebanon.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Lebanon.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014f) *Summary of National Hunting Regulations: Libya.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Libya.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014g) *Summary of National Hunting Regulations: Montenegro.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Montenegro.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014h) *Summary of National Hunting Regulations: Morocco.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Morocco.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014i) *Summary of National Hunting Regulations: Palestine.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Palestine.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014j) *Summary of National Hunting Regulations: Serbia.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Serbia.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014k) *Summary of National Hunting Regulations: Syria.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Syria.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014l) *Summary of National Hunting Regulations: Tunisia.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Tunisia.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2014m) *Summary of National Hunting Regulations: Turkey.* http://datazone.birdlife.org/userfiles/file/hunting/HuntingRegulations_Turkey.pdf (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2015) *Streptopelia turtur. European Red List of Birds*. Office for Official Publications of the European Communities, Luxembourg. http://www.iucnredlist.org/details/22690419/1 (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2016) *Data Zone factsheet for Turtle-dove* Streptopelia turtur. http://www.birdlife.org/datazone/species/factsheet/22690419 (last accessed 7 February 2018).

BIRDLIFE INTERNATIONAL (2017) *European birds of conservation concern: populations, trends and national responsibilities.* BirdLife International, Cambridge, UK.

BOBENKO OA (2010) Recent numbers of pigeons and doves in the Stavropol Territory. Ornithology in the North Eurasia. *Materials of XIII International Ornithological Conference*, Orenburg: 62. [In Russian]

BOUTIN JM (2001) Elements for a Turtle-dove (*Streptopelia turtur*) management plan. *Game and Wildlife Science* 18: 87-112.

BOUTIN JM, BARBIER L and ROUX D (2001) Suivi des effectifs nicheurs d'Alaudidés, Colombidés et Turdidés en France: le programme ACT. *Alauda* 69(1): 53-61.

BOUTIN JM and TESSON JL (2000) La tourterelle des bois et la tourterelle turque. In: *Enquête nationale sur les tableaux de chasse à tir – Saison 1998/1999*. *Faune Sauvage Cahiers Techniques* 251. pp 70-81.

BRICHETTI P and FRACASSO G (2006) *Ornitologia italiana. Vol. 3 – Stercorariidae-Caprimulgidae*. Alberto Perdisa Editore, Bologna.

BRIGHT JA, MORRIS AJ, FIELD RH, COOKE AI, GRICE PV, WALKER LK, FERN J and PEACH WJ (2015) Higher-tier Agri-Environment Scheme enhances breeding densities of some priority farmland birds in England. *Agriculture, Ecosystems and Environment* 203: 69-79.

van den BRINK H, van DIJK A, van OS B, and VENEMA P (1996) *Broedvogels van Drenthe*. Van Gorcum, Assen.

BROCHET A-L, van den BOSSCHE W, JBOUR S, NDANG'ANG'A PK, JONES VR, ABDOU WALI, AL-HMOUD AR, ASSWAD NG, ATIENZA JC, ATRASH I, BARBARA N, BENSUSAN K, BINO T, CELADA C, CHERKAOUI SI, COSTA J, DECEUNINCK B, ETAYEB KS, FELTRUP-AZAFZAF C, FIGELJ J, GUSTIN M, KMECL P, KOCEVSKI V, KORBETI M, KOTROŠAN D, MULA LAGUNA J, LATTUADA M, LEITÃO D, LOPES P, LÓPEZ-JIMÉNEZ N, LUCIĆ V, MICOL T, MOALI A, PERLMAN Y, PILUDU N, PORTOLOU D, PUTILIN K, QUAINTENNE G, RAMADAN-JARADI G, RUŽIĆ M, SANDOR A, SARAJLI N, SAVELJIĆ D, SHELDON RD, SHIALIS T, TSIOPELAS N, VARGAS F, THOMPSON C, BRUNNER A, GRIMMETT R and BUTCHART SHM (2016) Preliminary assessment of the scope and scale of illegal killing and taking of birds in the Mediterranean, *Bird Conservation International* 26(1): 1–28.

BROUWER J (2014) Are the Most Valuable Resources in Dryland Areas Isolated Wetlands? *Planet@Risk* 2(1): 47-56.

BROWNE SJ and AEBISCHER N (2003a) Temporal changes in the migration phenology of turtle-doves *Streptopelia turtur* in Britain, based on sightings from coastal bird observatories. *Journal of Avian Biology* 34 (1): 65-71.

BROWNE SJ and AEBISCHER N (2003b) Habitat use, foraging ecology and diet of Turtle-doves *Streptopelia turtur* in Britain. *Ibis* 145: 572-582.

BROWNE SJ and AEBISCHER N (2004) Temporal changes in the breeding ecology of European Turtle-doves *Streptopelia turtur* in Britain, and implications for conservation. *Ibis* 146: 125-137.

BROWNE SJ and AEBISCHER N (2005) Studies of West Palearctic birds: Turtle-dove. *British Birds* 98: 58-72.

BROWNE SJ, AEBISCHER N and CRICK H (2005) Breeding ecology of Turtle-doves *Streptopelia turtur* in Britain during the period 1941-2000: an analysis of BTO nest records cards. *Bird Study* 52: 1-9.

BROWNE SJ, AEBISCHER NJ, YFANTIS G and MARCHANT JH (2004) Habitat availability and use by Turtle-doves *Streptopelia turtur* between 1965 and 1995: an analysis of Common Birds Census data. *Bird Study* 51, 1-11.

BTO (2016) *Bird Atlas Mapstore*. http://app.bto.org/mapstore/StoreServlet?id=272 (last accessed 7 February 2018).

BÜTTIKER W (1988) Trapping of Turtle Doves (*Streptopelia turtur* Linnaeus, 1758) in Saudi Arabia. In: BÜTTIKER W and KRUPP F (eds) *Fauna of Saudi Arabia Volume 9*. National Commission for Wildlife Conservation and Development Riyadh, Saudi Arabia and Pro Entomologia c/o Natural History Museum, Basle, Switzerland. pp 12-18.

CABRAL MJ, ALMEIDA J, ALMEIDA PR, DELLINGER T, FERRAND DE ALMEIDA N, OLIVEIRA ME, PALMEIRIM JM, QUEIROZ AL, ROGADO L and SANTOS REIS M (eds) (2005) *Livro Vermelho dos Vertebrados de Portugal*. Peixes Dulciaquícolas e Migradores, Anfíbios, Répteis, Aves e Mamíferos. Instituto da Conservação da Natureza, Lisbon. 660pp.

CALDERÓN L, CAMPAGNA L, WILKE T, LORMEE H, ERAUD C, DUNN JC, ROCHA G, ZEHTINDJIEV P, BAKALOUDIS DE, METZGER B, CECERE JG, MARX M and QUILLFELDT P (2016) Genomic evidence of demographic fluctuations and lack of genetic structure across flyways in a long distance migrant, the European turtle-dove. *BMC Evolutionary Biology* 16(237): 1-11.

CALLADINE JR, BUNER F and AEBISCHER NJ (1997) *The summer ecology and habitat use of the Turtle-dove. A pilot study*. English Nature Research Reports 219. English Nature, Peterborough.

CARVALHO M and DIAS S (2001) Análise dos quadros de caça de columbídeos na região de Cape (Guiné-Bissau) – contributo para a sua gestão cinegética. In *Livro de resumos do III Congresso Ornitologia da Sociedade Portuguesa para o Estudo das Aves*. SPEA, Castelo Branco. pp 23.

CARVALHO M and DIAS S (2003) *Game* Columbidae *in Guinea- Bissau*. XXVIth Congress of the International Union of Game Biologists "Integrating Wildlife with People". Braga, Portugal. Abstract book 67.

CHAMBOLLE P (1986) Prélèvement cynégétique de tourterelles en France, saison 1983-84. *Bulletin Mensuel de l'ONC* 108: 50-53.

CMS (2017) *National Report of Parties on the Implementation of the Convention on the Conservation of Migratory Species of Wild Animals – Italy*. http://www.cms.int/sites/default/files/document/cms_cop12_nr_ita_e.pdf (last accessed 7 February 2018).

COMPENDIUM VOOR DE LEEFOMGEVING (2016) *Vogels van het boerenland, 1990-2014*. http://www.clo.nl/indicatoren/nl1479-vogels-van-het-boerenland?i=4-27 (last accessed 7 February 2018).

LE CONSEIL FEDERAL (2014) *Loi fédérale sur la chasse et la protection des mammifères et oiseaux sauvages.* https://www.admin.ch/opc/fr/classified-compilation/19860156/index.html#a5 (last accessed 7 February 2018).

CRAMP S (1985) *Handbook of the birds of Europe, the Middle East and North Africa*. *Volume IV, Terns to Woodpeckers.* Oxford University Press, Oxford. pp353-363.

ČSO/JPSP (2015) *Indexy a trendy 2015 - Hrdlička divoká (*Streptopelia turtur*)*. http://jpsp.birds.cz/vysledky.php?taxon=605 (last accessed 7 February 2018).

ČSO and ČZU (2017) *Atlas hnízdního rozšíření ptáků ČR 2014–2017*. http://birds.cz/avif/atlas_sq_alloc.php (last accessed 7 February 2018).

DACHVERBAND DEUTSCHER AVIFAUNISTEN (2016) *Bestandsentwicklung, Verbreitung und jahreszeitliches Auftreten von Brut- und Rastvögeln in Deutschland*. Dachverband Deutscher Avifaunisten, Münster.

DANKO Z, DAROLOVÁ A and KRIŠTÍN A (2002) *Rozšírenie vtákov na Slovensku – Birds Distribution in Slovakia*. Vydavatel'stvo Slovenskej akadémie vied, Bratislava.

DENAC K and KMECL P (2014) *Ptice Goričkega*. DOPPS, Ljubljana.

DEVILLERS P, ROGGEMAN W, TRICOT J, DEL MARMOL P, KERWIJN C, JACOB J-P and ANSELIN A (1988) *Atlas des oiseaux nicheurs de Belgique*. Institut Royal des Sciences Naturelles de Belgique, Bruxelles.

DEVORT M, TROLLIET B and VEIGA J (1988) Sur la migration postnuptiale de la tourterelle des bois en Gironde. *Gibier Faune Sauvage* 5: 61-70.

DEVOS K, ANSELIN A, DRIESSENS G, HERREMANS M, ONKELINX T, SPANOGHE G, STIENEN E, T'JOLLYN F, VERMEERSCH G and MAES D (2016) The IUCN Red List of Breeding Birds in Flanders, Northern Belgium, *Natuur Oriolus* 82(4): 109-122.

DIAS (2016) *Critérios para a gestão sustentável das populações de rola-brava [Streptopelia turtur (L.)] em Portugal. Padrões de abundância, reprodução e pressão cinegética*. PhD Thesis. Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon.

DIAS S and **FONTOURA P** (**1996)** A alimentação estival da rola-brava no sul de Portugal. Actas do II Congresso Ibérico de Ciências Cinegéticas. *Revista Florestal* 9(1): 227-241.

DIAS S, MOREIRA F, BEJA P, CARVALHO M, GORDINHO L, REINO L, OLIVEIRA V and REGO F (2013) Landscape effects on large-scale abundance patterns of turtle-doves *Streptopelia turtur* in Portugal. *European Journal of Wildlife Resources* 59: 531-541.

DILLINGHAM PW and FLETCHER D (2008) Estimating the ability of birds to sustain additional human-caused mortalities using a simple decision rule and allometric relationships. *Biological Conservation* 141(7): 1783-1792.

DUBOIS C (2002) *Contribution à l'étude de la tourterelle des bois (*Streptopelia turtur*): Biologie, Zoologie, Chasse*. Thèse pour obtenir le grade de Docteur Vétérinaire. Ecole Nationale Vétérinaire, Toulouse.

DUBOIS PJ, LE MARECHAL P, OLIOSO G and YESOU P (2008) *Nouvel inventaire des oiseaux de France*. Delachaux et Niestlé, Paris.

DUNN JC and MORRIS AJ (2012) Which features of UK farmland are important in retaining territories of the rapidly declining Turtle-dove *Streptopelia turtur*? *Bird Study* 59(4): 394-402.

DUNN JC, MORRIS AJ and GRICE PV (2015) Testing bespoke management of foraging habitat for European Turtle Doves *Streptopelia turtur*. *Journal of Nature Conservation* 25: 23-34.

DUNN JC, MORRIS AJ and GRICE PV (2016a) Post-fledging habitat selection in a rapidly declining farmland bird, the European Turtle-dove *Streptopelia turtur*. *Bird Conservation International*, available on CJO 2016 doi:10.1017/S0959270916000022.

DUNN JC, STOCKDALE JE, McCUBBIN A, THOMAS RC, GOODMAN SJ, GRICE PV, MORRIS AJ, HAMER KC and SYMONDSON WOC (2016b) Non-cultured faecal and gastrointestinal seed samples fail to detect Trichomonad infection in clinically and sub-clinically infected columbid birds. *Conservation Genetic Resources* 8: 97–99.

DUNN JC, STOCKDALE JE, MOORHOUSE-GANN RJ, McCUBBIN A, HIPPERSON H, MORRIS AJ, GRICE PV and SYMONDSON WOC (2016c) Molecular analysis of dietary overlap between UK columbids and associations between diet and body condition in the rapidly declining European turtle-dove *Streptopelia turtur*. RSPB, Sandy (under review).

DUNN JC, STOCKDALE JE, BRADFORD EL, MCCUBBIN A, MORRIS AJ, GRICE PV, GOODMAN SJ and HAMER KC (2017) High rates of infection by blood parasites during the nestling phase in UK Columbids with notes on ecological associations. *Parasitology* 144: 622-628.

DVORAK M (2017) Population estimates of Austrian breeding birds. *Egretta* 55, in preparation.

DVORAK M, RANNER A and BERG H-M (1993) *Atlas der Brutvögel Österreichs*. Ergebnisse der Brutvogelkartierung 1981-1985 der Österreichischen Gesellschaft für Vogelkunde. Herausgegeben vom Umweltbundesamt; Bundesministerium für Umwelt, Jugend und Familie, Vienna.

EASON P, RABIA B and ATTUM O (2016) Hunting of migratory birds in North Sinai, Egypt. *Bird Conservation International* 26: 39-51.

EATON M, AEBISCHER N, BROWN A, HEARN R, LOCK L, MUSGROVE A, NOBLE D, STROUD D and GREGORY R (2015) Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds* 108: 708-746.

EBCC/RSPB/BIRDLIFE/STATISTICS NETHERLANDS (2016) *Pan-European Common Bird Monitoring Scheme - Trends of common birds in Europe, 2016 update*. European Bird Census Council, Czech Republic.

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*. http://msdec.gov.mt/en/Documents/Downloads/WBRU/Bird%20Survey%20Report%202011.pdf (last accessed 20 March 2018).

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*. Ecoserv Report Reference: 099-12. http://msdec.gov.mt/en/Documents/Downloads/WBRU/Annex%202%20-%20Migration%20study%20report.pdf (last accessed 20 March 2018).

ECOSERV (2013) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2013.* Ecoserv Report Reference: 058-13 http://msdec.gov.mt/en/Documents/Downloads/WBRU/WBRU%20-%206B.%20Reports%20and%20Statistics%20(Report%201B).pdf (last accessed 20 March 2018)

ECOSERV (2014a) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2014*. Ecoserv Report Reference: 036-14. http://msdec.gov.mt/en/Document%20Repository/WBRU/Annex%20III%20Bird%20Survey%20Report%202014.pdf (last accessed 20 March 2018).

ECOSERV (2014b) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2014.* Ecoserv Report Reference: 110-14. http://msdec.gov.mt/en/Documents/Downloads/WBRU/spring%20hunting%202015/Annex%20I_Autumn%202014%20migration%20survey%20report.pdf (last accessed 20 March 2018).

ECOSERV (2015a) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2015.* Ecoserv Report Reference: 112-15. http://msdec.gov.mt/en/Documents/Downloads/WBRU/spring%20hunting%202015/Annex%20IV_Spring%202015%20migration%20study%20report.pdf (last accessed 20 March 2018).

ECOSERV (2015b) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2015*. Ecoserv Report Reference: 206-15. http://msdec.gov.mt/en/Document%20Repository/WBRU/MSDEC_TurtleDove-Quail_Autumn2015.pdf (last accessed 20 March 2018).

ECOSERV (2016a) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in April 2016.* Ecoserv Report Reference: 036-16. http://msdec.gov.mt/en/Documents/Downloads/WBRU/2016/Annex%20IV_2016%20Spring%20Migration%20Study%209-6.pdf (last accessed 20 March 2018).

ECOSERV (2016b) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2016*. Ecoserv Report Reference: 122-16.

https://msdec.gov.mt/en/Document%20Repository/WBRU/2017/springHuntingDerogations/Annex%20I-%20Migration%20Study%20of%20Turtle%20Dove%20and%20Quail%20in%20autumn%202016.pdf (last accessed 20 March 2018).

ECOSERV (2017a) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made in March – April 2017*. Ecoserv Report Reference: 051-17. https://msdec.gov.mt/en/Document%20Repository/WBRU/2017/springHuntingDerogations/Annex%20IV%20-%20Spring%202017%20migration%20study%20report.pdf (last accessed 20 March 2018).

ECOSERV (2017b) *Report on a survey of the influx of migratory Common Quail and Turtle Dove over the Maltese Islands, made during September and October 2017.* Ecoserv Report Reference: 113-17. http://msdec.gov.mt/en/Document%20Repository/WBRU/2018/otherReports/MSDEC_Survey%20of%20Influx%20Turtle%20Dove.pdf (last accessed 20 March 2018).

EIONET (2017) *Population status and trends at the EU and Member State levels* – Streptopelia turtur. European Topic Centre on Biological Diversity. http://bd.eionet.europa.eu/article12/summary?period=1&subject=A210 (last accessed 7 February 2018).

EL MASTOUR A (1988) La tourterelle des bois (*Streptopelia turtur*), biologie, écologie et législation de la chasse au Maroc. *Bulletin Mensuel* 127: 43-45.

ELTS J, LEITO A, LEIVITS A, LUIGUJÕE L, MÄGI E, NELLIS R, NELLIS R, OTS M and PEHLAK H (2013) Status and numbers of Estonian birds, 2008–2012. *Hirundo* 26(2): 80−112.

EQUIPA ATLAS (2008) *Atlas das Aves Nidificantes em Portugal (1999-2005)*. Instituto da Conservação da Natureza e da Biodiversividade, Sociedade Portuguesa para o Estudo das Aves, Lisbon.

ERAUD C, BOUTIN J-M, RIVIÈRE M, BRUN J, BARBRAUD C and LORMÉE H (2009) Survival of Turtle-doves *Streptopelia turtur* in relation to western Africa environmental conditions. *Ibis* 151: 186-190.

ERAUD C, RIVIÈRE M, LORMÉE H, FOX JW, DUCAMP J-J and BOUTIN J-M (2013) Migration routes and staging areas of trans-Saharan turtle-doves appraised from light-level geolocators. *PLoS ONE* 8(3): e59396. doi:10.1371/journal.pone.0059396.

ESCANDELL R (2011) The turtle dove. In: *Spring migration in the western Mediterranean and NW Africa: the results of 16 years of the Piccole Isoleproject*. *Monografias del museu de ciencias naturals 6*. pp 31-37.

EUROPEAN COMMISSION (2014) *Key concepts of Article 7(4) of Directive 79/409/EEC: Version 2014. Period of reproduction and prenuptial migration of Annex II bird species in the 28 EU Member States*. http://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/docs/reprod_intro.pdf (last accessed 7 February 2018).

EUROPEAN UNION (2008) *Period of reproduction and prenuptial migration of Annex II bird species in the EU*. http://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/docs/reprod_68-73_en.pdf (last accessed 7 February 2018).

EUROPEAN UNION (2013) *National reporting under Article 12 of the Birds Directive.* http://bd.eionet.europa.eu/article12/ (last accessed 7 February 2018).

FAVIA SRL (2017) *Small game - turtle-dove hunting*. http://www.faviaviaggi.com/offers/small-game/animal/turtle-doves-15/?view=1#prettyPhoto (last accessed 7 February 2018).

FÉDÉRATION NATIONALE DES CHASSEURS (2016) *Conservation des habitats de la Tourterelle des bois (*Streptopelia turtur*) par les chasseurs français*. Fédération Nationale des Chasseurs (FNC).

FEITH H (2011) *Projecto Chegadas - Relatório 2011*. Sociedade Portuguesa para o Estudo das Aves, Lisbon.

FEITH H (2013) *Projecto Chegadas - Relatório 2012*. Sociedade Portuguesa para o Estudo das Aves, Lisbon.

FENGER M, NYEGAARD T and JØRGENSEN MF (2016) *Overvågning af de almindelige fuglearter i Danmark 1975-2015*. Årsrapport for Punkttællingsprogrammet. Dansk Ornitologisk Forening, Copenhagen.

FISHER IJ, PAIN DJ and THOMAS VG (2006) A review of lead poisoning from ammunition sources in terrestrial birds. *Biological Conservation* 131: 421-432.

FISHER IJ, ASHPOLE JE, PROUD T and MARSH M (compilers) (2016a) *Status Report for the European Turtle-dove* (Streptopelia turtur). Report of Actions A6, 8, 9 and 10 under the framework of Project LIFE EuroSAP (LIFE14 PRE UK 002). RSPB, Sandy (unpublished report).

FISHER IJ, PROUD T and ASHPOLE JE (compilers) (2016b) *Review of the EU European Turtle-dove (*Streptopelia turtur*, subspecies* turtur*) Management Plan*. Report of Action A3 under the framework of the Project LIFE EuroSAP (LIFE14 PRE UK 002). RSPB, Sandy (unpublished report).

FLETCHER MR (1979) Aggression by Collared Doves *Streptopelia decaocto* to Turtle-doves *Streptopelia turtur*. *British Birds* 72(7): 346.

FLINT VE, BOEHME RL, KOSTIN YV and KUZNETSOV AA (1984) *A Field Guide to the Birds of the USSR – Including Eastern Europe and Central Asia*. Princeton University Press, Princeton.

FLINT PR and STEWART PF (1992) *The Birds of Cyprus – An annotated check-list*. BOU Check-list 6 (Second Edition). BOU, Tring.

FONTOURA AP and DIAS S (1995) Productivity of the turtle-dove (*Streptopelia turtur*) in the northwest of Portugal. In: BOTEV N (ed) *Procedures of the International Union of Game Biologists XXII Congress: Game and man.* Sofia, Bulgaria 4-8 September 1995 (1996). pp 1-6.

FRANK B and BATTISTI C (2005) Area effect on bird communities, guilds and species in a highly fragmented forest landscape of Central Italy. *Italian Journal of Zoology* 72(4): 297-304.

FRANSSON T, KOLEHMAINEN T, KROON C, JANSSON L and WENNINGER T (2010) *EURING list of longevity records for European birds*. http://www.euring.org/data-and-codes/longevity-list?page=3 (last accessed 7 February 2018).

GALLO-ORSI U (ed) (2001) *Saving Europe's most threatened birds: progress in implementing European Species Action Plans*. BirdLife International, Wageningen.

GAME AND FAUNA SERVICE (2016) *Results of Hunting Bag Statistics Survey 2015-2016*. Ministry of Interior, Nicosia, Cyprus. http://www.moi.gov.cy/moi/wildlife/wildlife_new.nsf/web23_gr/web23_gr (last accessed 7 February 2018).

GARGALLO G, BARRIOCANAL C, CASTANY J, CLARABUCH O, ESCANDELL R, LOPEZ-IBORRA G, RGUIBI-IDRISSI H, ROBSON D and SUAREZ M (2011) *Spring migration in the western Mediterranean and NW Africa: the results of 16 years of the Piccole Isole project*. Monografies del Museu de Ciències Naturals 6, Barcelona.

GEDEON K, GRÜNEBERG C, MITSCHKE A, SUDFELDT C, EIKHORST W, FISCHER S, FLADE M, FRICK S, GEIERSBERGER I, KOOP B, KRAMER M, KRÜGER T, ROTH N, RYSLAVY T, STÜBING S, SUDMANN SR, STEFFENS R, VÖKLER F and WITT K (2014) *Atlas Deutscher Brutvogelarten/Atlas of German Breeding Birds*. Stiftung Vogelmonitoring Deutschland and Dachverband Deutscher Avifaunisten, Münster.

GEISTER I (1995) *Ornitološki Atlas Slovenije – Razširjenost gnezdilk*. DZS, Ljubljana.

GEROUDET (1983) *Limicoles, Gangas et Pigeons d'Europe. Volume 2.* Delachaux et Niestlé, Neuchâtel.

GIBBONS D, MORRISSEY C and MINEAU P (2015) A review of the direct and indirect effects of neonicotinoids and fipronil on vertebrate wildlife. *Environmental Science and Pollution Research* 22(1): 103-118.

GIRAUDOUX P, DEGAUQUIER R, JONES PJ, WEIGEL J and ISENMANN P (1986) Avifaune du Niger: État des connaissances en 1986. *Malimbus* 10: 1-140.

GOVERNMENT OF MALTA (2010) S.L.549.57 *Framework for Allowing a Derogation Opening a Spring Hunting Season for Turtle Dove and Quail Regulations.* https://eracms.gov.mt/en/Pages/S-L-549-57-Framework-for-Allowing-a-Derogation-Opening-a-Spring-Hunting-Season-for-Turtle-Dove-and-Quail-Regulations.aspx (last accessed 7 February 2018).

GORE MEJ (1980) Millions of turtle-doves. *Malimbus* 2: 78.

GLUTZ VON BLOTZHEIM UM (1980) *Handbuch der Vögel Mitteleuropas*. Akademische Verlagsgesellschaft, Wiesbaden.

GOLOVAN VI (2002) Turtle-dove. In: NOSKOV GA. (Editor-in-Chief). *Red Data Book of nature of the Leningrad Region*. Vol 3 Animals. World & Family, St Petersburg. pp401-402. [In Russian]

GOLOVKIN S (2016) *Update on Recommendation No. 164 (2013) of the Bern Convention Standing Committee on the implementation of the Tunis Action Plan 2013-2020 for the eradication of illegal killing, trapping and trade of wild birds. Outcomes of the 3rd Meeting of Special Focal Points for Illegal Killing of Birds, 14-15 April 2016, Tirana.* http://www.cms.int/sites/default/files/document/Update%20from%20Bern%20Convention%20-%20Mr.%20Sergey%20Golovkin.pdf (last accessed 7 February 2018).

GORBAN I (2016) *Ukraine – contribution to EBBA2 and a path towards modern European bird monitoring. European Breeding Bird Atlas*. http://www.ebba2.info/2016/03/17/ukraine-contribution-to-ebba2-and-a-path-towards-modern-european-bird-monitoring/ (last accessed 7 February 2018).

GOULSON D (2013) An overview of the environmental risks posed by neonicotinoid insecticides. *Journal of Applied Ecology* 50(4): 977-987.

GRELL MB, HELDBJERG H, RASMUSSEN B, STABELL M, TOFFT J and VIKSTRØM T (eds) (2004) Truede og sjældne ynglefugle I Danmark 2003. *DOFT (Journal of the Danish Ornithological Society)* 98: 77.

GRÜNEBERG C, BAUER H-G, HAUPT H, HÜPPOP O, RYSLAVY T and SÜDBECK P (2015) Rote Liste der Brutvögel Deutschlands, 5.Fassung, 30. November 2015. *Berichte zum Vogelschutz* 52: 19-67.

GUTIÉRREZ-GALÁN A and ALONSO C (2016) European Turtle-dove *Streptopelia turtur* diet composition in Southern Spain: the role of wild seeds in Mediterranean forest areas. *Bird Study* 63(4): 490-499.

HADARICS T and ZALAI T (2008) *Magyarország madarainak névjegyzéke. An annotated list of the birds of Hungary*. Magyar Madártani és Természetvédelmi Egyesület, Budapest.

HANANE S (2011) La reproduction de la tourterelle des bois dans les vergers de Tadla (Maroc central). *Faune sauvage* 293: 30-31.

HANANE S (2012a) Do age and type of plantings affect turtle-dove *Streptopelia turtur* nest placement in olive agro-ecosystems? *Ethology, Ecology and Evolution* 24: 284-293.

HANANE S (2012b) Les périmètres irrigués du Maroc: une aubaine pour deux espèces d'oiseaux migrateurs, la tourterelle des bois (*Streptopelia turtur*) et la caille des blés (*Coturnix coturnix*). *Revue d'Ecologie* 67: 3-11.

HANANE S (2015) Nest-niche differentiation in two sympatric *Streptopelia* species from a North African agricultural area: the role of human presence. *Ecological Research* 30(4): 573-580.

HANANE S (2016a) Effects of orchard type and breeding period on Turtle-dove nest density in irrigated agroecosystems. *Bird Study 63(1)*: 1-5.

HANANE S (2016b) Effects of location, orchard type, laying period and nest position on the reproductive performance of Turtle-doves (*Streptopelia turtur*) on intensively cultivated farmland. *Avian Research* 7(4): 1-11.

HANANE S (2017) The European Turtle-dove *Streptopelia turtur* in northwest Africa: A review of current knowledge and priorities for future research. *Ardeola* 64(2): 273-287.

HANANE S and BAAMAL L (2011) Are Moroccan fruit orchards suitable breeding habitats for Turtle-doves *Streptopelia turtur*? *Bird Study* 58: 57-67.

HANANE S and BESNARD A (2014) Are nest-detection probability methods relevant for estimating turtle-dove breeding populations? A case study in Moroccan agroecosystems. *European Journal of Wildlife Research* 60: 673-680.

HANANE S and YASSIN M (2017) Nest-niche differentiation in two sympatric columbid species from a Mediterranean *Tetraclinis* woodland: considerations for forest management. *Acta Oecologica* 78: 47-52.

HANDRINOS G and AKRIOTIS T (1997) *The Birds of Greece*. Christopher Helm, London.

HARRIS SJ, MASSIMINO D, GILLINGS S, EATON MA, NOBLE DG, BALMER DE, PROCTER D and PEARCE-HIGGINS JW (2017) *The Breeding Bird Survey 2016. BTO Research Report 700*. British Trust for Ornithology, Thetford.
HAVLIČEK J (2015) Hrdlička divoká *Streptopelia turtur*: Výskyt v jižních Čechách. In: Kloubec B, Hora J and Šťastný K (eds). *Ptáci jižních Čech*. Jihočeský kraj. pp262-263.

HELLICAR M (2016) *Status of Common Birds in Cyprus, 2015. Ten years of the BirdLife Cyprus Common Birds Monitoring* Scheme *(CBMS) 2006-2015: Population trends and population size estimates for Cyprus common breeding birds*. BirdLife Cyprus, Nicosia.

HENDERSON IG, COOPER J, FULLER RJ and VICKERY J (2000) The relative abundance of birds on set-aside and neighbouring fields in summer. *Journal of Applied Ecology* 37: 335-347.

HENDERSON IG and EVANS AD (2000) Responses of farmland birds to set-aside and its management. In AEBISCHER NJ, EVANS AD, GRICE PV and VICKERY JA, *Ecology and Conservation of Lowland Farmland Birds*, pp 339-422. British Ornithologists' Union, Tring.

HIDALGO DE TRUCIOS SJ & ROCHA CAMARERO G (2001a) Status de la Tourterelle des bois *Streptopelia turtur* en Estrémadura (Espagne). Incidence sur la chasse. *Faune Sauvage* 253: 82-85.

HIDALGO DE TRUCIOS SJ and ROCHA CAMARERO G (2001b) Valoración de la presión cinegética sobre la Tórtola Común en Extremadura. *Naturzale* 16: 157-171.

HIDALGO DE TRUCIOS SJ and ROCHA CAMARERO G (2002) ¿Qué está pasando en realidad con la Tórtola Común? *Euskonews & Media* 184: 18-25.

HIDALGO DE TRUCIOS SJ and ROCHA CAMARERO G (2003) La Caza de la Tórtola Común como actividad sostenible. In: *Conservación, explotación y comercialización de los espacios cinegéticos*. Editado por el Centro de Desarrollo Rural Campiña Sur, Badajoz. pp135-149.

HIDALGO DE TRUCIOS SJ and ROCHA CAMARERO G (2005) Revisión del Status de la Tórtola Común *Streptopelia turtur* en Extremadura, implicaciones en su Conservación. In: LÓPEZ CABALLERO JM (ed) *Conservación de la naturaleza en Extremadura.* Publica Consejería de Agricultura y Medio Ambiente, Junta de Extremadura, Mérida. pp 427-433.

HIDALGO DE TRUCIOS SJ (2007) Capítulo 6. Certificación de Calidad Cinegética en Áreas Agrícolas y Esteparias. In: CARRANZA J and VARGAS JM (eds) *Criterios para la Certificación de la Calidad Cinegética en España.* Universidad Extremadura, Servicio de Publicaciones, Cáceres. pp 45-51.

HILL D (1992) *Assessment of the population dynamics of Turtle-dove in EC countries*. Report DGXI: 12, Brussels.

HIRSCHFELD A and HEYD A (2005) Mortality of migratory birds caused by hunting in Europe: bag statistics and proposals for the conservation of birds and animal welfare. *Berichte zum Vogelschutz* 42: 47-74

HODGE I, READER M, REVOREDO C, CRABTREE R, TUCKER G and KING T (2006) *Project to assess future options for set-aside – Final Report for the Department for Environment, Food and Rural Affairs*. University of Cambridge, Department of Land Economy, Cambridge.

HRISTOV I (2015) Common birds in Bulgaria: trends for the period 2005-2015. Bulgarian Society for the Protection of Birds. *Conservation series. Book 32.* BSPB, Sofia.

HUNTLEY B, GREEN RE, COLLINGHAM YC and WILLIS SG (2007) *A climatic atlas of European breeding birds*. Durham University, RSPB and Lynx Edicions. Durham, Sandy and Barcelona.

IANKOV P (2007) *Atlas of Breeding Birds in Bulgaria*. Bulgarian Society for the Protection of Birds, Conservation Series 10. BSPB, Sofia.

ICO (2016) *SIOC: servidor d'informació ornitològica de Catalunya*. ICO, Barcelona.

ICONA (1989) *Determination del status de la tortola comun* Streptopelia turtur*. Final Report.* Instituto Nacional para la Conservación de la Naturaleza, Servicio de Vida Silvestre, Madrid.

INSTITUTE FOR NATURE CONSERVATION OF SERBIA (2015) *A grey partridge and turtle-dove hunting ban in Serbia.* http://www.zzps.rs/novo/index.php?jezik=_en&strana=vest&n=282 (last accessed 7 February 2018).

ISSA N and MULLER Y (2015) *Atlas des oiseaux de France métropolitaine, nidification et présence hivernale*. LPO, SEOF and MNHN, Delachaux and Niestlé, Paris.

ISSA N and BOUTIN J-M (2015) Tourterelle des bois *Streptopelia turtur*. In: MULLER Y and ISSA N (coordinators) *Atlas des oiseaux de France métropolitaine, nidification et présence hivernale*. LPO, SEOF and MNHN, Delachaux and Niestlé, Paris.

IUCN COMITATO ITALIANO (2012) *Streptopelia turtur*. http://www.iucn.it/scheda.php?id=1425556678 (last accessed 7 February 2018).

IVANCHEV VP and DENIS LS (2011) Turtle-dove. In: IVANCHEV VP and KAZAKOVA MV (eds). *Red Data Book of Ryazan Region*. NP Golos Gubernii, Ryazan: 109. [In Russian]

JACOB J-P, DEHEM C, BURNEL A, DAMBIERMONT J-L, FASOL M, KINET T, van der ELST D and PAQUET J-Y (2010) *Atlas des oiseaux nicheurs de Wallonie 2001-2007. Serie Faune-Flore-Habitats 5. Gembloux.* Publication d'Aves et du Departement de l'Etude du Milieu Naturel et Agricole, Wallonie.

JARRY G (1994a) *Streptopelia turtur*. In YEATMAN-BERTHELOT D and JARRY G (eds) *Nouvel atlas des oiseaux nicheurs de France, 1985-1989*. Société Ornithologique de France, Paris.

JARRY G (1994b) Turtle dove *Streptopelia turtur*. In: SOCHA CM (ed) *Birds in Europe: their conservation status*. Conservation Series 3, BirdLife International, Cambridge. pp 320-321.

JIGUET F (2016) *Les résultats nationaux du programme STOC de 1989 à 2015*. http://vigienature.mnhn.fr/page/tourterelle-des-bois (last accessed 7 February 2018).

JIMÉNEZ R, HODAR J Á and CAMACHO I (1992) La alimentación de la tortola comun (*Streptopelia turtur*) en el sur de Espana. *Gibier Faune Sauvage* 9: 119-126.

JOURNAL OFFICIEL DE LA REPUBLIQUE ISLAMIQUE DE MAURITANIE (1997) Loi N° 97- 006 du 20 janvier 1997 abrogeant et remplacant la loi n° 75-003 du 15 janvier 1975 portant code de la chasse et de la protection de la nature. *Journal Officiel de la République Islamique de Mauritanie* 896: 155-161.

KAFI F, HANANE S, BENSOUILAH T, ZERAOULA A, BRAHMIA H and HOUHAMDI M (2015) Les facteurs determinant le succès de la reproduction des tourterelles des bois (*Streptopelia turtur*) dans un milieu agricole Nord-Africain. *Revue d'Ecologie (Terre et Vie)* 70(3): 271-279.

KEENLEYSIDE C, ELTS J, FIGECZKY G, FIŠER B, GALVÁNEK D, HELLICAR M, IRŠA L, JOBDA M, KOORBERG P, KOUNNAMAS C, KURLAVIČIUS P, MADERIĖ B, MEDVED A, METERA D, PEZOLD T, PRIEDNIEKS J, RAČINSKIS E, RAUDONIKIS L, SZILVÁCSKU Z, VAIČIŪNAITĖ R and ZÁMECNÍK V (2006) *Farmland birds and agri-environment schemes in New Member States – A report for the Royal Society for the Protection of Birds*. RSPB, Sandy.

KERUS V (2005) *Latvijas ligzdojošo putnu atlants*. Latvijas Ornitoloģijas biedrība, Riga.

KHOHLOV AN (1993) *Fauna of the Stavropol Territory.* Stavropol Institute of Education Development, Stavropol. [In Russian]

KIRWAN GM, BOYLA K, CASTELL P, DEMIRCI B, ÖZEN M, WELCH H and MARLOW T (2008) *The Birds of Turkey*. Christopher Helm, London.

KMECL P and FIGELJ J (2016) *Monitoring of common bird species for the determination of the Slovenian index of farmland birds report for the year 2016*. DOPPS, Ljubljana. [In Slovenian]

KURESOO A, PEHLAK H and NELLIS R (2011) Population trends of common birds in Estonia in 1983-2010. *Estonian Journal of Ecology* 60(2): 88-110.

KURLAVIČIUS P (2006) *Lietuvos Perinčių Paukščių Atlasas*. Lututė, Kaunas.

KUSSEROW D and BROUWER J (2011) Europe-bound migratory passerines, heat-struck in Niger before they cross the Sahara. *West African Bird DataBase*.

LEGAKIS A and MARAGKOU P (2009) *The Red Data Book of Threatened Animals in Greece*. Hellenic Zoological Society, Athens.

LENNON RJ, DUNN JC, STOCKDALE JE, GOODMAN SJ, MORRIS AJ and HAMER KC (2013) Trichomonad parasite infection in four species of Columbidae in the UK. *Parasitology* 140: 1368-1376.

LEOPOLD A (1953) On a Monument to the Pigeon, In *A Sand County Almanac.* Oxford University Press, Oxford.

LICHERI D and SPINA F (2005) Biodiversità dell'avifauna italiana: variabilità morfologica nei non-Passeriformi. *Biologia e Conservazione della Fauna* 114: 1-192.

LIECHTENSTEINISCHES LANDESGESETZBLATT (2003) *Verordnung vom 30. September 2003 über die Hege des Wildes, die Abschussplanung, - durchführung und - kontrolle sowie die Kostenregelung von Massnahmen der Wildschadenverhü- tung (Hegeverordnung; HegeV).* https://www.gesetze.li/lilexprod/ifshowpdf.jsp?lgblid=2003198000&version=3&signed=n&tablesel=0 (last accessed 7 February 2018).

LIETUVOS ORNITOLOGŲ DRAUGIJA (2013) *Paukščių populiacijų gausos pokyčiai Lietuvoje*. http://www.virtualusprocesai.lt/ipgs/view.php?kat_id=2 (last accessed 7 February 2018)

LIPPENS CL and WILLE H (1972) *Atlas des oiseaux de Belgique et d'Europe occidentale*. Editions Lannoo, Tielt.

LIPU/SEO/HOS (2015) *Leaving is Living – Layman's Report LIFE Project "A Safe Haven for Wild Birds" (LIFE INF IT 253)*. Lega Italiana Protezione Uccelli, SEO/BirdLife, Hellenic Ornithological Society, J Walter Thompson Worldwide.

LJURI DI, GORYACHKIN SV, KARAVAEVA NA, DENISENKO EA and NEFEDOVA TG (2010) Dynamics of agricultural lands in Russia in the 20th century and post-farming recovery of vegetation and soils. *GEOS*, Moscow. [In Russian]

LOPEZ-ANTIA A, ORTIZ-SANTALIESTRA ME, MOUGEOT F and MATEO R (2013) Experimental exposure of red-legged partridges (*Alectoris rufa*) to seeds coated with imidacloprid, thiram and difenoconazole. *Ecotoxicology* 22(1): 125-138.

LORGÉ P and BIVER G (2010) Die Rote Liste der Brutvögel Luxemburgs – 2009. *Regulus Wissenschaftliche Berichte* 25, 67-72.

LORGÉ P, BASTIAN M and KLEIN K (2014) Die Rote Liste der Brutvögel Luxemburgs 2014. *Regulus Wissenschaftliche Berichte* 30: 58-65.

LORMÉE H (2013) *Programme d'études Colombidés – Bilan de la campagne 2012*. Office National de la Chasse et de la Faune Sauvage, Villiers-en-Bois.

LORMÉE H, BOUTIN J-M, PINAUD D, BIDAULT H and ERAUD C (2016) Turtle-dove *Streptopelia turtur* migration routes and wintering areas revealed using satellite telemetry. *Bird Study* DOI: 10.1080/00063657.2016.1185086.

LUOMUS (2016) *Russian Bird Atlas 2005-2017*. http://www.luomus.fi/fi/venajan-lintuatlas-2005-2017 (last accessed 7 February 2018).

LUTZ M and JENSEN FP (2007) *Management Plan for turtle-dove (*Streptopelia turtur*) 2007-2009*. European Commission, Technical Report 007-2007. Office for Official Publications of the European Commission, Luxembourg.

MACCHIO S, MESSINEO A, LICHERI D and SPINA F (1999) Atlante della distribuzione geografica e stagionale degli uccelli inanellati in Italia negli anni 1980-1994. *Biologia e Conservazione della Fauna* 103: 1-276.

MADROÑO A, GONZALEZ C and ATIENZA JC (2004) *Libro Rojo de las Aves de España. Dirección General para la Biodiversidad*. SEO/BirdLife, Madrid.

MAPAMA (2016) *Estadística Anual de Caza.* Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, Madrid.

MARCHANT JH, HUDSON R, CARTER SP and WITTINGTON P (1990) *Population trends in British breeding birds*. British Trust for Ornithology, Thetford.

MARX M, KORNER-NIEVERGELT F and QUILLFELDT P (2016) Analysis of ring recoveries of European Turtle-doves *Streptopelia turtur* - flyways, migration timing and origin areas of hunted birds. *Acta Ornithologica* 51(1): 55-70.

MARX M, REINER G, WILLEMS H, ROCHA G, HILLERICH K, MASELLO JF, MAYR SL, MOUSSA S, DUNN JC, THOMAS RC, GOODMAN SJ, HAMER KC, METZGER B, CECERE JG, SPINA F, KOSCHKAR S, CALDERÓN L, ROMEIKE T and QUILLFELDT P (2017) High prevalence of *Trichomonas gallinae* in wild columbids across western and southern Europe. *Parasites & Vectors* 10: 242.

MASON CF and MACDONALD SM (2000) Influence of landscape and land-use on the distribution of breeding birds in farmland in eastern England. *Journal of Zoology* 251: 339-348.

MAYROSE A, VINE G, LABINGER Z, STEINITZ O, HATSOFE O, HAVIV E, PERLMAN Y, ALON D and LEADER N (2017) *Israeli Red Book of Birds*. Society for the Protection of Nature in Israel and Nature and Parks Authority. http://aves.redlist.parks.org.il (last accessed 7 February 2018).

MEIRINHO A, LEAL A, MARQUES AT, FAGUNDES AI, SAMPAIO H, COSTA J and LEITAO D (2013) *O estado das aves comuns em Portugal 2011: relatório do projeto Censo de Aves Comuns*. Sociedade Portuguesa para o Estudo das Aves, Lisbon.

MESCHINI E and FRUGIS S (1993) Atlante degli uccelli nidificanti in Italia. *Supplemento alle Ricerche di Biologia della Selvaggina* XX: 1-344.

MIHELIČ T (2013) *Web base NOAGS*. http://www.ptice.si/atlas (last accessed 7 February 2018).

MINDENNAPI MADARAINK MONITORINGJA (2016) *MMM database*. http://mmm.mme.hu/charts/trends (last accessed 7 February 2018).

MINEAU P and PALMER C (2013) *The Impact of the Nation's Most Widely Used Insecticides on Birds.* American Bird Conservancy, The Plains. pp 1-97.

MINISTRY OF ENVIRONMENTAL PROTECTION OF UKRAINE (2017) *On the establishment of the Norms for shooting of other hunting animals belonging to the state hunting fund during hunting season of 2017/2018.* http://zakon2.rada.gov.ua/laws/show/en/z0868-17 (last accessed 7 February 2018).

MISCHENKO AL (2004) *Estimation of numbers and trends for birds of the European part of Russia (Birds in Europe-II).* RBCU, Moscow. [In Russian]

MISCHENKO AL (2015) Turtle-dove. In: VETKIN YU V, GELTMAN DV, LITVINOVA EM, KONECHNAYA GY and MISCHENKO AL (eds) *Red Data Book of Novgorod Region*. Diton, St Petersburg. p 128. [In Russian]

MISCHENKO AL (ed) (2017) *Estimation of numbers and trends for birds of the European part of Russia (European Red List of Birds)*. Birds Russia, Moscow.

MITO2000 (2016) *Specie agricole. Monitoraggio Italiano Ornitologico*. Milan.

MONITORING PTAKOW POLSKI (2017) *Streptopelia turtur*. http://monitoringptakow.gios.gov.pl/database (last accessed 7 February 2018).

MONTENEGRO EPA (2009) *Katastar of hunting areas in Montenegro*. Montenegro EPA, Podgorica.

MONTOYA JM (2009) *Media veda.Codorniz, Tórtola y Palomas*. Editorial Solitário, Madrid.

MONTOYA JM and MÉSON M (1994) *La tortola y la Codorniz en España. Estado actual de estas especies cinegéticas*. Federación Española de Caza.

MOREL GJ and MOREL M-Y (1979) La tourterelle des bois dans l'extreme Ouest-Africain. *Malimbus*, 1: 66-67.

MORENO L, PEACH W and ARROYO B (2017) Do hunting bag changes match the population trends of Turtle Dove? The case of Spain. In: BRO E and GUILLEMAIN M (eds) *33rd IUGB Congress & 14th Perdix Symposium abstract book*. ONCFS, Paris. pp. 280

MUNTEANU D (2002) *Atlasul păsărilor clocitoare din România – Ediţia II*. Societatea Ornitologică Română, Cluj-Napoca.

MUNTEANU D (2009) *Păsări rare, vulnerabile şi periclitate în România*. Editura Alma Mater, Cluj-Napoca.

MUNTEANU A and ZUBCOV N (2010) *Atlasul păsărilor clocitoare din Republica Moldova.* Institutul de Zoologie al Academiei de Ştiinţe a Moldovei Societatea Ornitologică din Republica Moldova, Chişinău.

MURTON R K (1968) Breeding, migration and survival of Turtle-doves. *British Birds* 61(5): 193-212.

MUSGROVE A, AEBISCHER N, EATON M, HEARN R, NEWSON S, NOBLE D, PARSONS M, RISELY K and STROUD D (2013) Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106: 64-100.

THE N2K GROUP (2014) *Implementation review for 13 Management Plans for birds*. Prepared for the European Commission, Directorate General Environment, B3 Unit in the framework of the Service Contract N° 070307/2012/635359/SER/B2.

NAMROUQA H (2016) Nature society says hunting turtle-doves prohibited. *The Jordan Times* 05/07/2016. http://www.jordantimes.com/news/local/nature-society-says-hunting-turtle-doves-prohibited (last accessed 7 February 2018).

NANKINOV D (1994) Migrations of the turtle dove (*Streptopelia turtur*) in Bulgaria: a review. *Gibier Faune Sauvage* 11: 249-261.

NARDELLI R, ANDREOTTI A, BIANCHI E, BRAMBILLA M, BRECCIAROLI B, CELADA C, DUPRÉ E, GUSTIN M, LONGONI V, PIRRELLO S, SPINA F, VOLPONI S and SERRA I (2015) *Rapporto sull'applicazione della Direttiva 147/2009/CE in Italia: dimensione, distribuzione e trend delle popolazioni di uccelli (2008-2012). Report Series 219.* European Commission, ISPRA.

NATURSCHUTZBUND DEUTSCHLAND (2017) Besenderung der Turteltauben auf Malta. *Zugvögel auf Reisen*. https://blogs.nabu.de/zugvoegel/turteltauben/2017/08/besenderung-turteltauben-malta/ (last accessed 7 February 2018).

NEWSON SE, MORAN NJ, MUSGROVE AJ, PEARCE-HIGGINS JW, GILLINGS S, ATKINSON PW, MILLER R, GRANTHAM MJ and BAILLIE SR (2016) Long-term changes in the migration phenology of UK breeding birds detected by large-scale citizen science recording schemes. *Ibis* 158(3): 481-495.

NIEL C and LEBRETON JD (2005) Using demographic invariants to detect overharvested bird populations from incomplete data. *Conservation Biology* 19(3) : 826–835.

NYEGAARD T, MELTOFTE H, TOFFT J and GRELL M (2014) Truede og sjældne ynglefugle i Danmark 1998-2012. *DOFT (Journal of the Danish Ornithological Society)* 108: 1-144.

OCKENDON N, JOHNSTON A and BAILLIE SR (2014) Rainfall on wintering grounds affects population change in many species of Afro-Palaearctic migrants. *Journal of Ornithology* 155(4): 905-917.

OFFICE NATIONAL DE LA CHASSE ET DE LA FAUNE SAUVAGE (2017) *La tourterelle des bois*. http://turtledoveresearch.com/fr/. (last accessed 7 February 2018)

PANAYIDES P (2005) Six aspects of land use and development activity that result in adverse effects to Cypriot wildlife resources. *Proceedings of the XXVth International Congress of the International Union of Game Biologists – IUGB and the IXth International Symposium Perdix* 2: 182-196.

PAQUET J-V and JACOB J-P (2010) Liste rouge 2010 des oiseaux nicheurs. In Jacob J-P, Dehem C, Burnel A, Dambiermont J-L, Fasol M, Kinet T, van der Elst D and Paquet J-Y (2010) *Atlas des oiseaux nicheurs de Wallonie: 2001-2007*, Série 'Faune – Flore – Habitats' 5, Aves et Région Wallone, Gembloux. pp80-95.

PARSLOW JLF (1967) Changes in status among breeding birds in Britain and Ireland. *British Birds* 60: 177-202.

PATRIKEEV M (2004) *The Birds of Azerbaijan 1999-2003 Edition*. Pensoft Publishers, Sofia-Moscow.

PERLMAN Y, HAVIV E, MAYROSE A, LABINGER Z, KIAT Y, VINE G, STEINITZ O and ALON D (2016) *European Turtle-dove (*Streptopelia turtur*) in Israel – status and trends, May 2016*. Unpublished.

PETROVICI M (2015) *Atlas al speciilor de păsări de interes comunitar din România*. Societatea Ornitologică Română/BirdLife International și Asociația pentru Protecția Păsărilor și a Naturii *Grupul Milvus*, Bucharest.

PREOBRAZHENSKAYA ES (2009) Numbers of some rare bird species in Unzha taiga and their changes in 1978-2009. *Rare bird species of Non-Chernozem Centre of Russia. Proc. of IVth Conference*. Moscow. pp 43-49. [In Russian]

PRIEDNIEKS J, STRAZDS M, STRAZDS A and PETRINS A (1989) *Latvijas Ligzdojošo Putnu Atlants 1980-1984*. Rīga Zinātne, Riga.

PURROY F (1997) *Atlas de las aves de España (1975/1995*). SEO/LYNX Edicions, Barcelona.

PUZOVIĆ S, SIMIC D, SAVELJIĆ D, GERGELJ J, TUCAKOV M, STONJNIĆ N, HULO I, HAM I, VIZI O, SCIBAN M, RUZIC M, VUCANOVIC M and JOVANOVIC T (2003) Birds of Serbia and Montenegro - size of nesting populations and trends: 1990-2002. *Ciconia* 12: 36-120.

QUILLFELDT P, KLEEMAN L and MARX M (2014) Hessen, Deutschland, Europa: Turteltauben im Fokus. *Der Falke* 61 (2): 32-33.

RAINE AF (2007) *The international impact of hunting and trapping in the Maltese islands*. BirdLife Malta, Valleta.

RAINE A, SULTANA J and GILLINGS S (2009) *Malta Breeding Bird Atlas 2008*. BirdLife Malta, Valleta.

REIF J, VOŘÍŠEK P, ŠTASTNÝ K and BEJČEK V (2006) Trendy početnosti ptáků v České republice v letech 1982–2005. *Sylvia* 42: 22-37.

RETE RURALE NAZIONALE and LIPU (2015) *Uccelli comuni in Italia. Aggiornamento degli andamenti di popolazione e del Farmland Bird Index per la Rete Rurale Nazionale dal 2000 al 2014.* http://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15032 (last accessed 7 February 2018.

ROBINSON RA (2016) *BirdFacts: profiles of birds occurring in Britain & Ireland (BTO Research Report 407).* BTO, Thetford. https://app.bto.org/birdfacts/results/bob6870.htm (last accessed 7 February 2018).

ROBINSON RA, LAWSON B, TOMS MP, PECK KM, KIRKWOOD JK, CHANTRY J, CLATWORTHY IR, EVANS AD, HUGHES LA, HUTCHINSON OC, JOHN SK, PENNYCOTT TW, PERKINS MW, ROWLEY PS, SIMPSON VR, TYLER KM and CUNNINGHAM AA (2010) Emerging infectious disease leads to rapid population declines of common British birds. *PLoS ONE* 5 (8) DOI: 10.1371/journal.pone.0012215.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (1998) Distribución y abundancia de la Tórtola Turca *Streptopelia decaocto* en Extremadura (SO de España). http://www.ornitologia.org/mm/file/15_01.pdf (last accessed 2 October 2018).

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (2000) *Ecología de la tórtola turca (*Streptopelia decaocto*)*. Servicio de Publicaciones de la Universidad de Extremadura, Cáceres.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS S J (2001a) Incidencia del uso de reclamos alimenticios sobre la *tórtola comùn.* Biologia y gestion de columbidos silvestres. II Cologuio Internacional – 14-15 Deciembre 2000 – Donostia-San Sebastian. Naturzale. Cuadernos de Ciencias Naturales 16 : 147-155.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (2001b) La Tourterelle Turque *Streptopelia decaocto* en Estrémadure, en Espagne: sa distribution, son expansion et son incidence sur la Tourterelle des bois. *Faune Sauvage* 253: 66-68.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS S J (2002a) *La tórtola común (*Streptopelia turtur*). Análisis de los factores que afectan a su status.* Servicio de Publicaciones de la Universidad de Extremadura, Cáceres.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (2002b) Examining the spread of the Collared Dove in Europe. Colonization patterns in the west of the Iberian Peninsula. *Bird Study* 489: 11-16.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (2004a) La Investigación científica al servicio de una gestión eficaz: el ejemplo de los estudios sobre la Tórtola Común en Extremadura. *Foresta* 27: 76-81.

ROCHA CAMARERO G and HIDALGO DE TRUCIOS SJ (2004b) La Tórtola Turca, ¿especie cazable?. In: CENTRO de DESARROLLO RURAL CAMPIÑA SUR (ed) *Gestion cinegética y desarrollo rural*. Badajoz. pp143-152.

ROCHA G, MERCHÁN T and HIDALGO DE TRUCIOS SJ (2009) Gestión de la tórtola común y la paloma torcaz. In: SÁENZ de BURUAGA M and CARRANZA J: *Gestión cinegética en los ecosistemas mediterráneos.* Consejería de Medio Ambiente. Junta de Andalucía (1): 266-297.

ROCHA G and QUILLFELDT P (2015) Effect of supplementary food on age ratios of European turtle-doves (*Streptopelia turtur* L.). *Animal Biodiversity and Conservation* 38(1): 11–21.

ROUX D, LORMÉE H, ERAUD C and BOUTIN J-M (2011) Les populations de colombidés nichant et hivernant en France : tendances d'évolution des espèces les plus communes. *Faune Sauvage* 293: 4.

ROUXEL R (2000) Turtle-dove (*Streptopelia turtur*): A review of bibliographical data from the eastern Europe. *OMPO Newsletter* 22: 5-18.

RSPB (2016) *What we've learnt from Titan the satellite tagged turtle-dove*. http://www.rspb.org.uk/community/ourwork/b/biodiversity/archive/2016/08/30/what-we-ve-learnt-from-titan-the-satellite-tagged-turtle-dove.aspx (last accessed 7 February 2018).

RUCNER D (1998) *Ptice hrvatske obale Jadrana*. Hrvatski prirodoslovni muzej, Ministarstvo razvitka i obnove, Zagreb.

RUCNER D and RUCNER R (1972) Prilog poznavanju napučenosti ptica u biotopima Baranje. *Larus* 24: 31-64.

SÁENZ DE BURUAGA M, ONRUBIA A, FERNANDEZ-GARCÍA JM, CAMPOS MA, CANALES F and UNAMUNO JM (2012) Breeding habitat use and conservation status of the turtle-dove *Streptopelia turtur* in northern Spain. *Ardeola* 59(2): 291-300.

SCHMID H, LUDER R, NAEF-DAENZER B, GRAF R and ZBINDEN N (1998) *Schweizer Brutvogelatlas*. Schweizerische Vogelwarte, Sempach.

SCHMID H, BURKHARDT M, KELLER V, KNAUS P, VOLET B and ZBINDEN N (2001) *Die Entwicklung der Vogelwelt in der Schweiz. Avifauna Report Sempach*. Schweizersische Vogelwarte, Sempach.

SCHULZ J, PADDING P and MILLSPAUGH J (2006) Will mourning dove crippling rates increase with nontoxic-shot regulations? *Wildlife Society Bulletin* 34(3): 861-865.

SEO/BIRDLIFE (2016a) *Analysis of environmental correlates of Turtle-dove* Streptopelia turtur *abundance in Spain using data from SACRE*. SEO/Birdlife, Madrid.

SEO/BIRDLIFE (2016b) *Programas de Seguimiento y grupos de trabajo de SEO/BirdLife 2015*. SEO/BirdLife, Madrid.

SHARROCK JTR (1976) *The atlas of breeding birds in Britain and Ireland*. British Trust for Ornithology, Thetford.

SHEEHAN DK, WOTTON S, DUNN JC and MORRIS TJ (2014) Ähnliches Schicksal: Wandertaube damals – Turteltaube heute. *Der Falke* 61(2): 28-31.

SHIRIHAI H (1996) *The Birds of Israel*. Academic Press, London.

SIKORA A, ROHDE Z, GROMADZKI M, NEUBAUER G and CHYLARECKI P (2007) *Atlas rozmieszczenia ptaków lęgowych Polski 1985-2004 – The atlas of breeding birds in Poland 1985-2004*. Bogucki Wydawnictwo Naukowe, Poznań.

SIRIWARDENA GM, BAILLIE SR, CRICK HQP, WILSON JD and GATES S (2000) The demography of lowland farmland birds. In: *Ecology and Conservation of Lowland Farmland Birds. Procedings of the 1999 BOU Species Conference.* BTO, Thetford. pp 117-133.

SLABEYOVÁ K, RIDZOŇ J and KROPIL R (2009) Trendy početnosti bežných druhov vtákov na Slovensku v rokoch 2005–2009. *Tichodroma* 21: 1-13.

SNOW DW and PERRINS CM (1998) *The Birds of the Western Palearctic. Concise Edition Vol. 1 Non-passerines.* Oxford University Press, Oxford. pp 856-859.

SORRENTI M and TRAMONTANA D (2016) *Estimate of turtle-dove* Streptopelia turtur *harvest in Italy*. Federazione Italiana della Caccia – Ufficio Avifauna Migratoria, Rome.

SOTNIKOV VN (2002) *Birds of Kirov Region and adjacent territories. Non-passeriformes. Vol. 2 (2).* Triada-S, Kirov. [in Russian]

SOVON (2002) *Atlas van de Nederlandse broedvogels 1998-2000*. Verspreiding, aantallen, verandering (Nederlandse Fauna 5). Nationaal Natuurhistorisch Museum Naturalis, KNNV Uitgeverij and EIS-Nederland, Leiden.

SPINA F and VOLPONI S (2008) La tortola selvatica (*Streptopelia turtur*). In: *Atlante della migrazione degli Uccelli in Italia. 1. Non-Passeriformi*. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Istituto Superiore per la Protezione e la Ricera Ambientale (ISPRA), Tipografia SCR, Roma.

STANBURY A, BROWN A, EATON M, AEBISCHER N, GILLINGS S, HEARN R, NOBLE D, STROUD D and GREGORY R (2017) The risk of extinction for birds in Great Britain. *British Birds* 110: 502-517.

ŠTASTNÝ K, BEJČEK V and HUDEC K (1997) *Atlas hnízdního rozšíření ptáků v České republice 1985-1989*. Nakladatelství a vydavatelství, Prague.

ŠTASTNÝ K, BEJČEK V and HUDEC K (2006) *Atlas hnízdního rozšíření ptáků v České republice 2001-2003*. Aventinum, Prague.

ŠTASTNÝ K, BEJČEK V and NĚMEC M (2017) *The Red List of birds of the Czech Republic. Příroda* 34: 107-154.

STOCKDALE JE, DUNN JE, GOODMAN SJ, MORRIS AJ, SHEEHAN DK, GRICE PV and HAMER KC (2015) The protozoan parasite *Trichomonas gallinae* causes adult and nestling mortality in a declining population of European Turtle-doves, *Streptopelia turtur*. *Parasitology* 142(3): 490-498.

SULTANA J, BORG JJ, GAUCI C and FALZO V (2011) *The Breeding Birds of Malta*. BirdLife Malta, Ta' Xbiex.

SZÉP T, NAGY K, NAGY ZS and HALMOS G (2012) Population trends of common breeding and wintering birds in Hungary, decline of long-distance migrant and farmland birds during 1999-2012. *Ornis Hungarica* 20(2): 13-63.

TEUFELBAUER N and FRÜHAUF J (2016) Developing a national Farmland Bird Index for Austria, *Bird Census News* 23(1-2): 87-97.

TEUFELBAUER N and SEAMAN B (2016) *Monitoring der Brutvögel Österreichs Bericht über die Saison 2015*. BirdLife Österreich, Vienna.

TIAINEN J, MIKKOLA-ROOS M, BELOW A, JUKARAINEN A, LEHIKOINEN A, LEHTINIEMI T, PESSA J, RAJASÄRKKÄ A, RINTALA J, SIRKIÄ P and VALKAMA J (2016) *Suomen lintujen uhanalaisuus 2015/The 2015 Red List of Finnish Bird species.* Ympäristöministeriö & Suomen ympäristökeskus, Helsinki.

TRAFFIC (2008) *The illegal trade in wild birds for food through South-east and Central Europe.* http://www.trafficj.org/publication/08_Illigal_trade_in_wild_birds.pdf (last accessed 7 February 2018).

TUCKER GM (1996) *Investigation on the conservation measures taken by member states for bird species of annex II of the council directive 79/409/EEC which have an unfavourable conservation status*. Ecoscope Applied Ecologists, Final report for European Commission DG XI. pp 170-175.

TUTIŠ V, KRALJ J, RADOVIĆ D, ĆIKOVIĆ D and BARIŠIĆ S (2013) *Crvena knjiga ugroženih ptica Hrvatske.* Ministarstvo zaštite okoliša i prirode i Državni zavod za zaštitu prirode, Zagreb.

UICN FRANCE, MNHN, LPO, SEOF and ONCFS (2016) *La liste rouge des espèces menacées en France - Chapitre Oiseaux de France métropolitaine*. Paris, France.

UKRAINIAN HUNTING AND FISHING ASSOCIATION (undated) *Legislation on hunting/fishing – Law of Ukraine.* http://uoor.com.ua/eng/legislation/about_hunting. (last accessed on 7 February 2018).

UNMIK/IPVQ (2007) *Administrative Instruction MA – No. 11/2007 Concerning the Hunting Season*. http://www.mbpzhr-ks.net/repository/docs/676345_AIMA-Nr._11-20007_eng.doc (last accessed 7 February 2018).

VALKAMA J, VEPSÄLÄINEN V and LEHIKOINEN A (2011) The Third Finnish Breeding Bird Atlas. Finnish Museum of Natural History and Ministry of Environment. http://atlas3.lintuatlas.fi/english (last accessed 7 February 2018).

VERMEERSCH G, ANSELIN A, DEVOS K, HERREMANS M, STEVENS J, GABRIËLS J, and van de KRIEKEN B (2004) *Atlas van de Vlaamse Broedvogels 2000-2002*. Instituut voor Natuur - en Bosonderzoek, Anderlecht.

VLACHOS C, BRAZIOTIS S, BONTZORLOS V, CHATZINIKOS E, KIOUSIS D, DEDOUSOPOULOU E, KASABALIS D, BIRTSAS P, XENOS A, STEFANOU L, GASIOS A, MELIKOKI K, VLACHAKI D and KONTOS K (Coordinators) (2015). *National report of Article 12 of the Birds Directive 2009/147/EU of Study 9 Monitoring and Evaluation of Bird Species Conservation Status in Greece*. Ministry of Environment, Energy and Climate Change, Athens

VOGELWARTE (2016a) *European Turtle-dove Streptopelia turtur- Birds of Switzerland.* http://www.vogelwarte.ch/en/birds/birds-of-switzerland/european-turtle-dove.html (last accessed 7 February 2018).

VOGELWARTE (2016b) *Breeding population indices for 174 native, regularly breeding species 1990–2015*. http://www.vogelwarte.ch/en/projects/population-trends/state-of-birds/breeding-birds/ (last accessed 7 February 2018).

WABDaB (2016) *European Turtle-dove*. The contributors to the bilingual West African Bird DataBase (www.wabdab.org), managed by Ulf Leidén, Joost Brouwer and Tim Wacher.

WADE PR (1998) Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Marine Mammal Science* 14: 1-37.

WALKER LK and MORRIS AJ (2016) *Evaluating Turtle-dove HLS Package*. Report to Natural England Work Package Number ECM6924.

WALTHER BA (2016) A review of recent ecological changes in the Sahel, with particular reference to land-use change, plants, birds and mammals. *African Journal of Ecology* 54: 268-280.

WASSINK A and OREEL GJ (2008) Birds of Kazakhstan: new and interesting data. *Dutch Birding* 30(2): 93-100.

WBRU (2015) *Report on the Outcome of the 2015 Spring Hunting Season in Malta*. https://msdeccms.gov.mt/en/Documents/Downloads/WBRU/spring%20hunting%202015/SH%202015%20derogation%20report.pdf (last accessed 7 February 2018).

WBRU (2016) *Report on the Outcome of the 2016 Spring Hunting Season in Malta.* https://msdeccms.gov.mt/en/Documents/Downloads/WBRU/2016/SH%20derogation%20report%202016%209-6.pdf (last accessed 7 February 2018).

ZOOLOGICAL MUSEUM OF MOSCOW UNIVERSITY (2016) *Breeding bird atlas of European Russia*. Zoological Museum of Moscow University. http://zmmu.msu.ru/en/about-muzeum/divisions/division-of-the-scientific-public-oriented-projects/breeding-bird-atlas-of-european-russia (last accessed 7 February 2018).

ZWARTS L, BIJLSMA RG, van der KAMP J and WYMENGA E (2009) *Living on the Edge: wetlands and birds in a changing Sahel*. KNNV Publishing, Zeist.

Annex 7: LIST OF ACRONYMS/ABBREVIATIONS

AAO – Association Les Amis des Oiseaux (BirdLife Tunisia)
AEMLAP – African-Eurasian Migratory Landbirds Action Plan
AEMLWG – African-Eurasian Migratory Landbirds Working Group
AEWA - The Agreement on the Conservation of African-Eurasian Migratory Waterbirds
AMCFE – Association Malienne pour la Conservation de la Faune et de l'Environnment
ANAO – Algerian National Association of Ornithology
AOS – Azerbaijan Ornithological Society (BirdLife Azerbaijan)
APB – Ахова птушак Бацькаўшчыны (АПБ) (BirdLife Belarus)
BC TAP – Bern Convention Tunis Action Plan
BIOM – Association BIOM (BirdLife Croatia)
BSPB – Bulgarian Society for the Protection of Birds (BirdLife Bulgaria)
BTO – British Trust for Ornithology
CASA – Croatian Academy of Sciences and Arts
CAP – European Union Common Agricultural Policy
CBD – The Convention on Biological Diversity
CEABN/InBIO – Centro de Ecologia Aplicada "Prof. Baeta Neves"/Research Network in Biodiversity and Evolutionary Biology (Portugal)
CIBIO/InBIO – Centro de Investigacão em Biodiversidade e Recursos Genéticos/Research Network in Biodiversity and Evolutionary Biology (Portugal)
CITES – Convention on the International Trade of Endangered Species of Wild Flora and Fauna
CMS – Convention on Migratory Species
CMS MIKT – Intergovernmental Task Force on Illegal Killing, Taking and Trade of Migratory Birds in the Mediterranean
ČSO – Česká společnost ornitologická/Czech Society for Ornithology (BirdLife Czech Republic)
DOF – Dansk Ornitologisk Forening (BirdLife Denmark)
DOPPS – Društvo za Opazovanje in Proučevanje Ptic Slovenije (BirdLife Slovenia)
EIA – Environmental Impact Assessment
ENEC – European Network against Environmental Crime
EOS – Estonian Ornithological Society (BirdLife Estonia)
EU – European Union
EU COST – European Cooperation in Science and Technology
EURING – The European Union for Bird Ringing
FACE – The European Federation of Associations for Hunting and Conservation
FAO – Food and Agriculture Organization of the United Nations
FDC – la Fédération Départementale des Chasseurs (France)
FNC – la Fédération Nationale des Chasseurs (France)
GCT – The Game Conservancy Trust (United Kingdom)
GREPOM – Groupe de Recherche pour la Protection des Oiseaux au Maroc (BirdLife Morocco)
HOS – Hellenic Ornithological Society (BirdLife Greece)
IBA – Important Bird Area
IMPEL – European Union Network for the Implementation and Enforcement of Environmental Law
ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale (Italy)
IUCN – International Union for Conservation of Nature
JPSP – Jednotného programu sčítání ptáků
KBA – Key Biodiversity Area
LIPU – Lega Italiana Protezione Uccelli (BirdLife Italy)
LOD – Lietuvos Ornitologų Draugija (BirdLife Lithuania)
LPO – Ligue pour la Protection des Oiseaux (BirdLife France)
MITO2000 – Monitoraggio ITaliano Ornitologico
MLSG – Migrant Landbird Study Group
MME – Magyar Madártani és Természetvédelmi Egyesület (BirdLife Hungary)
MNHN – Muséum National d'Histoire Naturelle (France)
NGO – Non-governmental Organisation
NABU – Nature and Biodiversity Conservation Union (BirdLife Germany)
NADEG – EU Expert Group on the Birds and Habitats Directives
OMPO – Migratory Birds of the Western Palearctic
ONCFS – Office National de la Chasse et de la Faune Sauvage (France)
OTOP – Ogólnopolskie Towarzystwo Ochrony Ptaków (BirdLife Poland)
PECBMS – Pan-European Common Bird Monitoring Scheme
Ramsar – The Convention on Wetlands
RSCN – Royal Society for the Conservation of Nature (BirdLife Jordan)
RSPB – Royal Society for the Protection of Birds (BirdLife United Kingdom)
SEO – Sociedad Española de Ornitología (BirdLife Spain)
SEOF – Société d'Etudes Ornithologiques de France

SOR – Societatea Ornitologică Română (BirdLife Romania)
SOS – Slovakian Ornithological Society (BirdLife Slovakia)
SOVON – Sovon Vogelonderzoek Nederland
SPA – Special Protection Area
SPEA – Sociedade Portuguesa para o Estudo das Aves (BirdLife Portugal)
SPNI – Society for the Protection of Nature in Israel (BirdLife Israel)
SPNL – Society for the Protection of Nature in Lebanon (BirdLife Lebanon)
SSCW – Syrian Society for Conservation of Wildlife (BirdLife Syria)
STOC – Suivi Temporel des Oiseaux Communs (France)
UNCCD – United Nations Convention to Combat Desertification
UNDP – United Nations Development Programme
USPB – Ukrainian Society for the Protection of Birds (BirdLife Ukraine)
WABDaB – West African Bird Database
WABSA – West African Bird Study Association
WBRU – Wild Birds Regulation Unit, Government of Malta

Annex 8: EUROPEAN MEMBER STATE CODES

AT	Austria	Österreich	Republic of Austria
BE	Belgium	Belgique/België	Kingdom of Belgium
BG	Bulgaria	България	Republic of Bulgaria
CY	Cyprus	Κύπρος	Republic of Cyprus
CZ	Czech Republic	Česká Republika	Czech Republic
DE	Germany	Deutschland	Federal Republic of Germany
DK	Denmark	Danmark	Kingdom of Denmark
EE	Estonia	Eesti	Republic of Estonia
EL	Greece	Ελλάδα	Hellenic Republic
ES	Spain	España	Kingdom of Spain
FI	Finland	Suomi/Finland	Republic of Finland
FR	France	France	French Republic
HR	Croatia	Hrvatska	Republic of Croatia
HU	Hungary	Magyarország	Hungary
IE	Ireland	Éire/Ireland	Ireland
IT	Italy	Italia	Italian Republic
LT	Lithuania	Lietuva	Republic of Lithuania
LU	Luxembourg	Luxembourg	Grand Duchy of Luxembourg
LV	Latvia	Latvija	Republic of Latvia
MT	Malta	Malta	Republic of Malta
NL	Netherlands	Nederland	Kingdom of the Netherlands
PL	Poland	Polska	Republic of Poland
PT	Portugal	Portugal	Portuguese Republic
RO	Romania	România	Romania
SE	Sweden	Sverige	Kingdom of Sweden
SI	Slovenia	Slovenija	Republic of Slovenia
SK	Slovakia	Slovensko	Slovak Republic
UK	United Kingdom	United Kingdom	United Kingdom of Great Britain and Northern Ireland