Documentation for the Great and Blue Tit database at University of Antwerp

Excerpt for Peerdsbos plot B (1979-present)

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This document is an excerpt from the full documentation for analysis and interpretation of the long-term population and behavioural data collected in nestbox studies on Great Tits *Parus major* and Blue Tits *Cyanistes caeruleus* at the University of Antwerp. The document contains generic sections across all study areas, and a section specific for Peerdsbos plot B ("Boswachter").

The main aim of this document is to advise future users of the data on the nature of the study systems and data collection, the strengths and limitations of the data, and important caveats such as missing or incomplete information, or data that may be affected by experimental procedures. Key points for data users to consider are given below in general terms, and again with each of the main study areas.

The document contains full descriptions of all study areas and study periods, any changes that occurred in the study plots such as changes in nestbox setup, the basic data collection protocol, and descriptions of additional datasets that are available such as environmental data, behavioural tests, or parasite data. It also contains an overview of experiments conducted during the study with comments on the extent to which these experiments may have affected the data.

1. Introduction

General key points for using the database

The database contains data from **multiple study areas, most of these having a complex history**, covering different time periods and most often subdivided in multiple plots that also may differ in study period. Also, nestbox numbers and/or types have changed over time in many plots, sometimes as part of an experimental design, sometimes for more practical reasons.

Before analyzing the data, **users should verify that the selection of plots and time periods fits their purpose and research questions.** For construction of pedigrees or assessment of bird origins all data may be used, but for most analyses care will have to be taken to select plots and time periods with systematic monitoring. Of particular importance are the (changes in) nestbox densities, but also the combination of nestboxes with large and/or small entrances (LE or SE throughout the document). For any analysis, keep in mind that **nestbox density has often been high** in comparison with other studies (often around 10 boxes per ha, sometimes up to 15 per ha) and that the main study areas have through most of their history had a mixture of large and small entrances.

In general, **the most useful study areas and plots for long-term analyses are plot B in the Peerdsbos study area, most of the Boshoek study area, and plot HP in the Ghent study area** (see further comments in the respective sections; note that plots B and HP have often been referred to as "Peerdsbos" or "Ghent" in general). However, for particular investigations focusing on for example urbanization or density effects, the other plots studied for shorter time periods may also be particularly interesting. **The Boshoek study area is particularly interesting for analyses on natural selection, population structure and quantitative genetics** because of the high recapture rates and local recruitment resulting in deeper pedigrees and more accurate fitness estimates than other study areas.

The dataset is fully annotated with codes for additional manipulations or experiments at bird or nest level (such as cross-fostering, personality tests…). These are fully documented, and can be used to evaluate the inclusion of specific records in analyses. This document also provides full information on additional data available (such as vegetation, budburst, personality data, parasites…).

Note that while most of the baseline breeding and ringing data are available in standardized format through SPI-Birds, many of these additional data are not and should be requested directly from the data owner(s).

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1.1. General introduction

This document gives an overview of the nestbox study areas and data collected on Great and Blue Tits under supervision of André Dhondt and Erik Matthysen at the University of Antwerp, since 1979.

The document deals with all data collected on birds (including behavioural data, samples…), as well as other data collected in the framework of the bird research, such as vegetation data or parasites. The document only refers to Great Tit *Parus major* and Blue Tit *Cyanistes caeruleus* which make up more than 95% of all breeding records; the only other regular breeding species is the Nuthatch *Sitta europaea*, and even though these nests and captures are recorded in the database, the nests have not been monitored to the same level of detail, and presumably less than half of the breeding pairs use the nestboxes.

Section 2 describes all study areas with particular reference to (changes in) study plot extent, nestbox setup, or detail of data collection that may have important implications for the use of the data. **Overall the document makes a distinction between "study areas" and "plots" that are smaller-scale entities within a study area.** Study areas are to some extent distinct geographic entities, but they may also reflect the history and organization of the research over the decades; thus there is a wide diversity in the size of study areas, number of plots per study area, distances between plots etc. In some cases there are large differences between plot characteristics in the same study area as well as in the period and level of detail of data collection. **For that reason, information is typically provided at plot level rather than at study area level.** Importantly, study areas cannot be simply treated as "populations" and plots within study areas as "subpopulations", given the large variation in plot sizes and distances among plots, as well as the sometimes arbitrary subdivision of plots.

For each study area we give a brief overview in Section 2 on major **additional datasets** that have been collected at plot level (e.g. vegetation data, tree budburst) or at individual bird or nest level (e.g. radiotracking data, personality scores, parasites, etc.). Additional data are only mentioned insofar as the data themselves are still available, or at least the individuals or nests that were involved can be identified. Also, additional data are included only if they cannot be directly derived from the capture and breeding data (examples are divorce rates or dispersal distances).

Note that throughout the document, if not explicitly stated otherwise, "year" always refers to the breeding season. For instance, when it is stated "boxes were added in year N" this means that boxes were added sometime between breeding seasons of years N-1 and N (often in the autumn or early winter).

1.2. Brief historical overview

The study on Great and Blue Tit populations originated with the first nestbox research project in Ghent under the direction of Jan Hublé, which was later taken over by his student André Dhondt. **The main data collection in Ghent was from 1959 to 1987**, including many different plots in and around the city of Ghent. One study area (Hutsepot - HP)) continues to this day through volunteer efforts of Jenny De Laet. The focus of this research was initially on territorial behaviour and population regulation, and later on mechanisms of intra- and interspecific competition (Dhondt and Hublé 1968, Dhondt 1977).

The main data collection in Antwerp started in 1979 under the direction of André Dhondt in the Peerdsbos area with a particular focus on intra- and interspecific competition. The main study lasted for 15 years until 1993. Similar to Ghent, **one plot (Boswachter (B)) continues to this day**. A particular feature of the study on competition in both Antwerp and Ghent was to install plots with different combinations of boxes with large and small entrance sizes, the small ones only accessible to Blue Tits. As a consequence, the mix of boxes with large and small entrances was also applied in other study areas even though these were not initiated with a particular focus on competition. Many behavioural studies were initiated in the Antwerp plots

including territoriality, singing behaviour and mating strategies (Dhondt and Schillemans 1983, Lambrechts and Dhondt 1988, Kempenaers et al. 1992). Overviews of the competition experiments in both Ghent and Antwerp can be found in (Dhondt and Adriaensen 1999, Dhondt 2010, 2012, 2023).

Starting in 1994 the main focus of the project shifted to a new study area "Boshoek" under the supervision of Erik Matthysen. This area consists of many small plots separated by open space, mostly agricultural land. The initial focus was to study forest fragmentation and dispersal (Nour et al. 1998, Matthysen, Adriaensen and Dhondt 2001, Korsten et al. 2013, Vardakis et al. 2015), while in later years a lot of research was done on parasites and infections (Heylen et al. 2013, Teyssier et al. 2018). Over the years many studies involved some degree of experimental manipulation of individuals or nests (radiotracking, feeders, cross-fostering, parasitism). Starting in 2016 multiple changes have been made to nestbox types (entrance) and numbers, potentially compromising the value for particular long-term analyses.

In all areas, data were collected largely through the same protocol (see below for a brief summary), and were entered into a single database with an extensive series of data quality checks developed by André Dhondt and Frank Adriaensen. **In particular, the protocols in Peerdsbos and Boshoek have remained highly standardized** throughout the study period**. Throughout the project data collection was highly similar for Great Tits and Blue Tits**, even though the former species has been more often used for additional data collection.

Starting in the 1990s, data from the long-term study plots have been increasingly used as part of multi-population studies on climate change, spatial population synchrony, and other topics. These were mostly data from plots B and HP, in publications often referred as "Peerdsbos" and "Ghent" respectively, but more recently also data from Boshoek.

1.3. Nestboxes

From the onset of the study in 1959 boxes have had standard dimensions (initially referred to as "the Wageningen type") which have remained virtually unchanged through the project. All boxes are made of wood of ca 15mm thickness, with inner dimensions: 235mm (top to bottom), 9mm (width) and 115mm (front to back wall) (Figure 1). A circular opening of ca 32mm diameter is situated about 35mm below the top of the front wall. Boxes are covered with a wooden top lid reinforced with metal that extends 15 to 25mm beyond the outside of the box (except at the back). Boxes are attached to a narrow wooden board at the back (ca 400x20x50mm) which is fixed to the tree with nylon rope.

Figure 1. Different views of a standard nestbox. This particular box was installed at the onset of the Peerdsbos study in 1979 and survived more than 30 years in the field. Note however that while initial boxes were painted red, after a few years we switched to green for the remainder of the study.

Boxes were almost always attached to large trees except in the Speedy study area where they were sometimes attached to walls. Boxes were placed either low (ca 1m to 1,5m) in areas with low visitor pressure, or high (ca 2,5m) in areas where disturbance or damage was judged to be more of a risk.

In a number of cases, boxes had to be moved to a different tree if the initial one fell down or was removed. This became a particular problem in plot B because of severe tree mortality in the decades after 2000. Therefore, nest records of the same nestbox may have different coordinates in different years.

While all boxes had a 32mm opening, often a metal plate with a 26mm opening was slid over the entrance, such that the box was (with very rare exceptions) only accessible to Blue Tits. **Boxes with and without metal plates are referred to as large entrances (LE) and small entrances (SE).** Most areas either had only LE or a 2:1 mixture of LE and SE, only two plots had only (or mostly) SE. In case of a 2:1 mixture, SE were regularly spaced throughout the plot.

1.4. Summary of data collection protocol

This description is based on the standard practice of data collection in the Peerdsbos and Boshoek study areas from 1979 to present. This protocol is largely identical to the one used in the Ghent study started in 1959. “Researcher” here refers to anyone participating in nestbox checks and ringing. A fairly detailed methodology for breeding data collection was published in (Matthysen, Adriaensen and Dhondt 2011). Full details on all recorded data and coding are available in the internal PARUS.DOC document.

1.4.1. Breeding season

Basic organization: Throughout the breeding season, all researchers have access to a working database with daily updated information on all nestboxes in the study. Formerly this database was kept on paper, since 2014 the database is maintained and accessed through the Parus App, a dedicated software application for data entry developed for the nestbox project. Typically, the database is consulted on a daily basis to allocate nestbox checks and ringing tasks to individual researchers (except the HP plot in Ghent where fieldwork is organized separately and data are submitted to the database after the season). Data are entered as nest visits which are after the breeding season compiled on nest cards (paper cards until 2013, digital cards since 2014 except for the HP plot). Summary data from these nest cards are then entered into

the final database. Thus, derived data such as laying date or brood type (first, second, replacement…) are only assigned after the end of the breeding season.

General nest check schedule: Nestboxes are controlled weekly from the time the first egg can be expected in the latter half of March. When a nest is found with hatched young, the age is recorded and extrapolated to the time when parents need to be caught and ringed (at nestling day 8) or nestlings are ringed (day 15). When the first nests reach day 8 of nestling age, the weekly control schedule changes to a nestbox-based schedule whereby boxes are visited based on what needs to be done. Intermittently, nests where young have not yet hatched are visited to update their status. Importantly, the date of ringing parents and nestlings is based on developmental age (i.e. stage of plumage development of nestlings) rather than exact age (see below). Approximately 4 weeks after the last full nestbox check, usually when the majority of first brood parents have been ringed, all boxes are checked again to identify any second broods which are then similary entered in the temporary database. At the end of the season, all boxes are checked once more. In autumn or winter the main study areas are usually checked for maintenance or replacement of nestboxes.

***Checking nests*:** Basic data recorded at every visit include the presence of nest material, stage of nest building, number of eggs and incubation status, identity of parents when caught or observed on the nest, number and (estimated) age of young, number of unhatched eggs and dead young, and the date of removal of nest material (after nests fledged or failed). When a female is found on the eggs, the bird is gently prodded with a twig or pencil to facilitate inspection of the legs for colour rings, and if possible checking for recently hatched young. At any sign of anxiety the female is left alone to avoid her leaving the nest. Females are never taken from eggs in routine controls, except when the hatching of eggs is long overdue and the brood is considered as lost.

***Scoring nestling age**:* This is based on plumage development. Importantly, the day of hatching is counted as day 0 and not day 1. Thus, day 8 corresponds to eight days after the young hatched. Since the exact date of hatching is unknown, and since plumage development shows some variation among nests, the estimated age is recorded at every nestbox visit and if necessary updated in the temporary database. Thus in a slow-developing brood the time of ringing parents and nestlings would be postponed, usually by no more than 1 or 2 days at most. Similarly, ringing dates would be advanced in broods that develop more rapidly than expected, or where nestling age was underestimated on the first check.

General ringing procedure: In principle, birds in the main study populations receive an individual metal ring issued by the Belgian Ringing Scheme, and three (sometimes two) colour rings. Nestlings are usually only given a metal ring. Upon first capture as fullgrown bird, birds receive a metal ring (if not yet ringed as nestling) and colour-rings. At this time a sample of body feathes is also routinely taken as source of DNA (since 1998). Colour-ring combinations are unique within a study area; in Great Tits they are unique within each sex, in Blue Tits they are unique within the species. Standard data taken at most captures in the main study areas are: sex, age, wing length, tarsus length and body mass, as well as location (with spatial coordinates), capture method, observer, date and time (more information in PARUS.DOC). Section 4.1 gives additional information on measurements that were not part of the standard procedure (such as bill length and depth, tarsus asymmetry). Note that in 2000 the project switched to a new method of measuring tarsus length; from 2000 to 2015 old and new methods were combined, and after 2015 only the new method was used.

Trapping and ringing parents: In principle, parents are trapped on the nest when nestlings are 8 days old. Occasionally parents are already trapped on day 7 but only when nestlings appear in good condition and weather is favourable, or trapping is postponed because of constraints in the fieldwork schedule. Simple metal wire traps are placed on the inside of the nestbox front, often allowing to trap both male and female within an hour. If one or both parents are not trapped, new attempts are made on the following day(s). Note that these failed attempts are not explicitly recorded in the database, thus there is no record of trapping effort. Standard ringing and measuring apply as above. After capture birds are released

immediately near the nestbox or in the general vicinity of their territory. Very occasionally, birds that were present but very reluctant to enter the nestbox with a trap, have been caught with a mistnet in front of the nestbox (this is not recorded in the database as different from the use of traps). Also occasionally, females that were not caught in the daytime have been captured when roosting with the nestlings in the evening. Again this is not recorded in the database as such, but would be evident from the time of capture. In some cases parents that were not caught but present near the nestbox, were identified by their colour rings. This information is included in the database but not recorded as a capture.

Ringing and measuring nestlings: Nestlings are in principle ringed on day 15, but regularly also on day 14 depending on the fieldwork schedule, given that nestling mass tends to level off after 13-14 days of age (Barba, Gil-Delgado and Monros 1993). If due to unforeseen circumstances ringing happens on day 16, extra care is taken to avoid premature fledging by blocking the nest entrance until young have calmed down. In some years and study areas standard individual measures were taken (Table 1). In other cases only the total brood mass has been recorded. Brood age (days after hatching) is recorded in all cases, based on plumage development, and individual nestlings deviating in development age are also recorded.

Removing nest material*:* When ringing young at day 15, the nest is inspected for any unhatched eggs and dead young; these are recorded and removed from the nest. At the first nest inspection after the young fledged, nest material is removed, and any additional unhatched eggs or young are also recorded.

Table 1. Overview of years when nestlings were individually measured at day 15 in most or all nests. In Boshoek, smaller numbers of nests were individually measured in several additional years for Great Tits, and a few years for Blue Tit. Note that for the Ghent data prior to 2001, some individual measurements may exist but are not yet digitally available.

Study area	Plot	Species	Years with individual measurements
Boshoek	All	Great tit	1996-1998; 2000-2002; 2006-2008; 2012-2014
Ghent	HP	Great tit, Blue Tit	2001-2020
Peerdsbos	B	Great tit, Blue Tit	1979-1994; 1996
Peerdsbos	C	Great tit, Blue Tit	1979-1993
Peerdsbos	L	Great tit, Blue Tit	1980-1988
Peerdsbos	T	Great tit, Blue Tit	1979-1993
Speedy	All	Great tit, Blue Tit	2014-2015

1.4.2. Roosting checks

Depending on the study area and time period, routine nestbox checks have been carried out after dusk in autumn and winter**.** In the early Peerdsbos study period and in some years of Boshoek, controls were done every winter month (4-5 times per year). Since 2001 this was at most twice per winter, and since 2015 only in plot B (

Table 2). Usually all nestboxes in a study plot were checked on the same evening (or multiple successive evenings). All birds were identified, (if needed) ringed and measured (tarsus length, wing length, weight) in the field and immediately returned to their nestbox. On rare occasions, birds were transported to the laboratory for additional data collection or personality tests, and returned to the field the following morning.

Table 2. Overview of standard night controls in the main study areas: number of roost controls per winter period, and months. Note that occasionally controls were canceled because of weather conditions. Start years refer to Nov/Dec, end years refer to Jan/Feb/March.

Study area	Plot	Period	Number	Months
Peerdsbos	T	1979-1993	5	Nov, Dec, Jan, Feb, Mar
Peerdsbos	L	1980-1988	5	Nov, Dec, Jan, Feb, Mar
Peerdsbos	K	1997-2015	2	Nov/Dec, Jan/Feb
Peerdsbos	C	1980-1989	2	Nov/Dec, Jan/Feb/Mar
Peerdsbos	C	1989-1993	4	Nov, Dec, Jan, Feb
Peerdsbos	C	1993-1996	2	Nov/Dec, Jan/Feb
Peerdsbos	B	1979-1994	5	Nov, Dec, Jan, Feb, Mar
Peerdsbos	B	199-2025	2	Nov/Dec, Jan/Feb
Boshoek	All	1993-1996	2	Nov/Dec, Jan/Feb
Boshoek	All	1996-2001	4	Nov, Dec, Jan, Feb
Boshoek	All	2001-2015	2	Nov/Dec, Jan/Feb

1.4.3. Other capture data

At no time has there been a standardized capture effort outside the breeding season in any of the study areas. Captures outside the breeding season have always been done in the framework of specific projects. Most of these captures were done with mistnets at temporary feeding stations that were operated for week or perhaps months. At all times, Great and Blue Tits caught outside the breeding season inside the study area were ringed, colour-ringed, and measured (at least tarsus, wing, weight).

2.The Peerdsbos study area

Key points for using the Peerdsbos study area

The only true long-term plot is Plot B ("Boswachter") which has been monitored consistently from 1979 to present, but with a major reduction in nestboxes from 1996 to 1997. Highly detailed data on tree species composition are available from the 2000s, as well as some data on lower vegetation and on tree budburst. In the years 2025-2026 many nests suffered predation by pine marten which may render some of the data less useful.

In the period 1979-1993, plots B, C and T were also monitored consistently but with different combinations of large and small entrance nestboxes. In plot T these were changed over three five-year periods. Plot L was used as an additional comparison plot but only until 1988. Due to the nestbox setup, plot C has few data on Great Tits but mostly on Blue Tits.

Other than nestbox manipulations at plot level, few experiments have been conducted that would affect individual-level data.

Since plot sizes are relatively small and plots (except C) are part of a larger forest, and despite the high capture rates of breeders, local recruitment is relatively low and pedigrees are not very deep.

2.1. General overview and history

The Peerdsbos study area in Brasschaat-Schoten contains several small plots (7 to 12 ha), some of them directly adjacent, within the larger Peerdsbos forest, plus one isolated plot (C) that lies to the south of this forest (Figure 2, Figure 3). The Peerdsbos forest is a 150-ha mixed forest dominated by common oak (*Quercus robur*, referred to as "oak" throughout this document) and beech *Fagus sylvatica* with some small conifer stands, and is adjacent to the municipal park of Brasschaat which contains similar forest stands. The total forested contiguous area is about 300ha. The plots are mostly on sandy soil (sand or loamy sand), with a smaller part on clay. The natural forest type would probably be best classified as T1E acidophilous oak-birch woodland under the EUNIS classification, but most stands originated as plantations.

The Peerdsbos study started in 1979 as part of a **large-scale experiment on interspecific competition**, in combination with a number of plots in the Ghent study area undergoing similar treatments. Four plots were included with different nestbox treatments (combinations of LE and SE[1]), whereby in one plot (T) the treatments were changed every five years. **After a 15-year period, only plot B remained for standardized data collection.** Two plots (T and B) were inside the actual Peerdsbos forest, separated from each other by ca 550m of forest. Plot L was part of the same wooded area but belonged to a private estate directly adjacent to plot T to the south. Plot C was situated outside the Peerdsbos forest, in a private estate mostly surrounded by residential areas a little over 2km to the south of the other plots. In between plots T and B an additional plot (K) was installed that contained varying numbers of nestboxes over the years, and was never considered part of the standardized long-term data collection. In addition, the Peerdsbos study area has contained additional small plots with nestboxes for only a short span of years and for specific projects only (TS, MP) (Figure 3). Overall, study plots and their surrounding land use have remained very similar during their respective study periods.

[1] Large entrance and small entrance

Since plots are relatively small and (except C) not physically isolated from other forest where both tit species breed in natural cavities, **local recruitment at plot level and even for the area as a whole is relatively low** (Matthysen, Adriaensen and Dhondt 2001) and therefore pedigrees will be relatively shallow, especially compared to Boshoek.

Table 3 gives an overview of the different plots. Population sizes are shown for all plots in Appendix 1. Capture rates of breeding birds were generally high for both species, especially in the initial 15 years (around 85% for both species and sexes combined) but dropped somewhat in the later period (Appendix 2).

Table 3. Overview of the main plots in the Peerdsbos study area. Years refer to breeding seasons.

Name	Size (ha)	Nest boxes	Years	General description	Nestbox entrances	Nestbox height
List (L)	7,5	53	1980-1988	Wooded part of private estate	All LE	Low
Tennis (T)	12,5	80-180	1979-1993	Mixed deciduous	Different treatments	High
Boswachter (B)	11,7	118-177	1979-	Mixed deciduous	LE and SE	High
Kontrole (K)	12,7	18-97	1980-	Mixed deciduous	LE and SE	High
Calixberg (C)	17	90-150	1979-1999	Partly wooded private estate	Mostly SE only	Low
Tuinen Schoten (TS)	n/a	24	2000-2004	Mixed deciduous	LE and SE	High
Melkerij Parking (MP)	n/a	24	2000-2015	Mixed deciduous	LE and SE	High

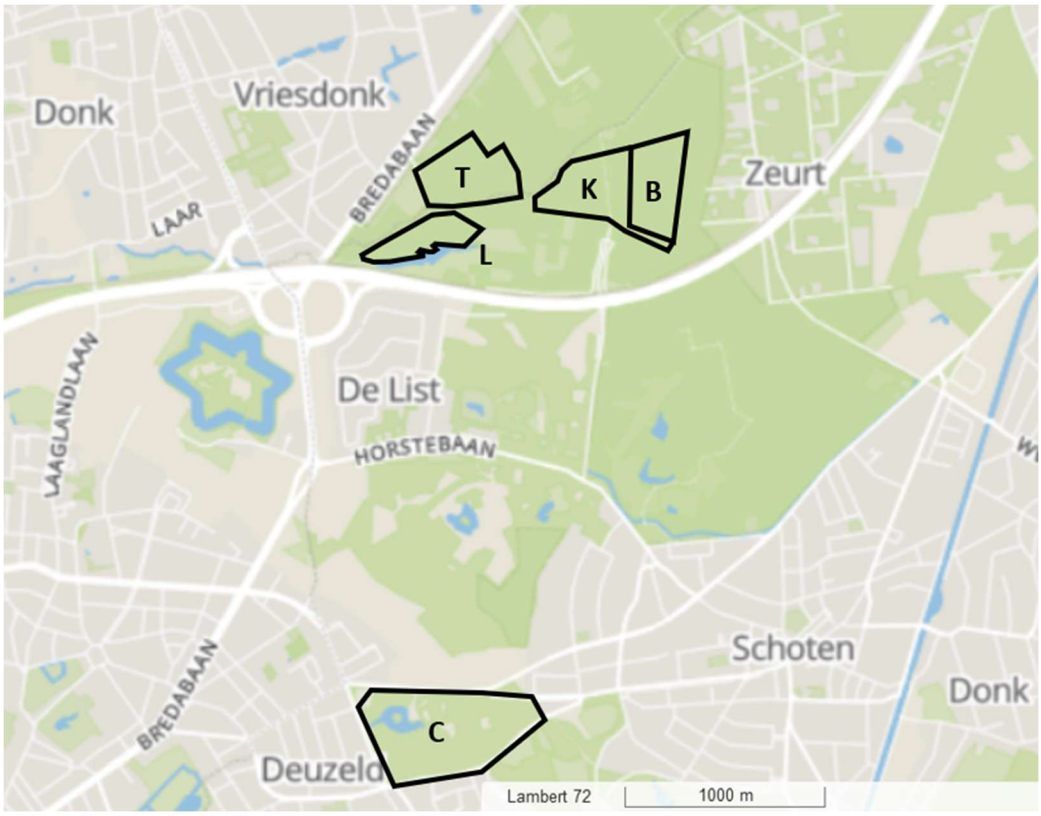


Figure 2. Overview of "Peerdsbos" plots, including plot C which lies outside the actual Peerdsbos forest. See Fig D for a more detailed overview of plots L, T, K and B.

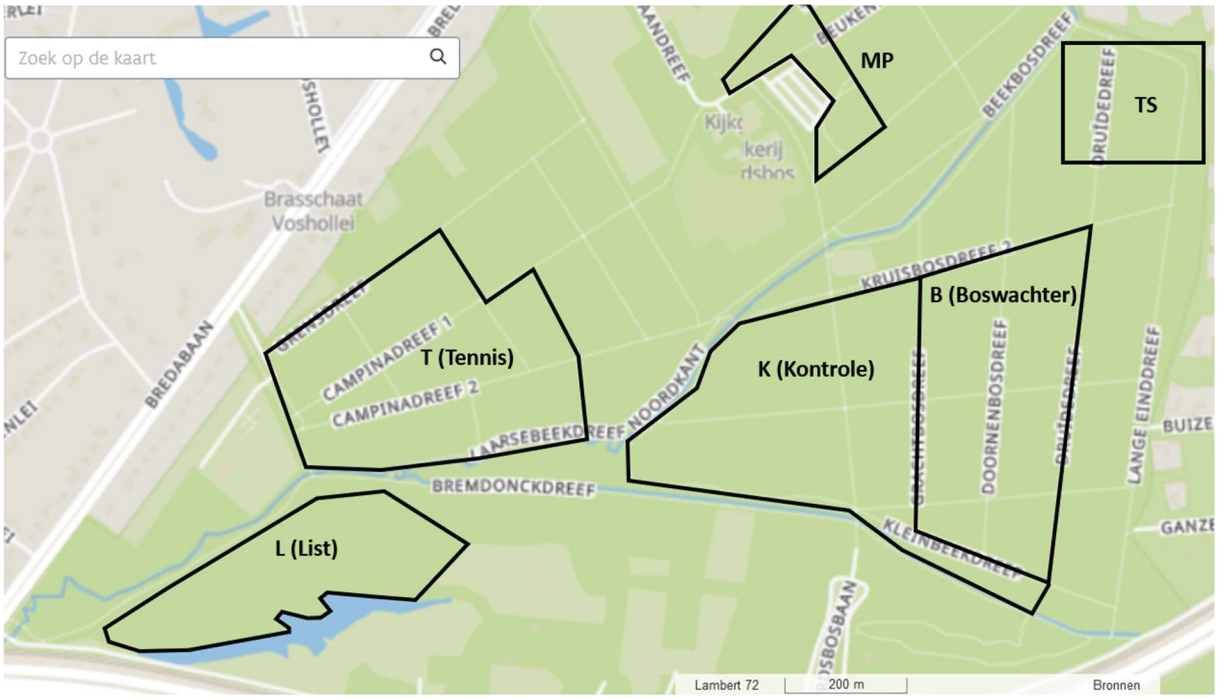


Figure 3. Detailed overview of Peerdsbos plots, including plots MP and TS. The outline of TS is only an approximation.

2.2. Study plots in Peerdsbos

Plot B ("Boswachter") is a 11,7 ha plot dominated by old oak and beech trees and crossed by oak lanes. It is bordered by similar forest on all sides except pine stands to the north. It started in 1979 with 118 nestboxes equally divided over large (LE) and small (SE) entrances[2]. By the breeding season of 1980, 59 additional LE boxes labelled "A" were added, thus effectively creating a 2:1 ratio of LE and SE boxes. **Starting with 1997 the nestbox density was reduced again** to the original 118 by removing the "A" boxes (Table 4). The 2:1 ratio of LE and SE was maintained however, by changing the entrance size of some of the boxes[3]. The rationale was to make this plot comparable to the then recently installed Boshoek area with a similar nestbox density of 9 boxes per hectare.

Since plot B was always considered a long-term reference plot, no major experiments were conducted here. In recent decades there has been substantial mortality of oak trees, not only reducing the dominance of living oak versus beech trees but also creating gaps in the original closed-canopy stand (see 3.1.1 on available data). Due to increasing pine marten predation in the 2020s, wooden blocks were attached to the front of all nestboxes in plot B (and in the adjoining plot K) in early 2023, extending the entrance tunnel by 4cm. In the winter of 2025-26 after another season with high predation rates, tunnels were extended with another 4cm in half of the boxes, but predation continued. Thus, in late 2026 all boxes are equipped with a metal "marten protection basket". Key references to this study plot are (Dhondt 1987a, Matthysen, Adriaensen and Dhondt 2011, Matthysen et al. 2021).

Plot K ("Kontrole") is similar in vegetation to plots T and especially B and surrounded by the Peerdsbos forest on all sides. It had different sizes and nestbox configurations over the years, but was never considered one of the regular study plots, but rather as a source of additional ringed birds and/or an area that could be used for experimental manipulations. From 1980 18 nestboxes were available in the centre of the plot but these were not open in winter (Dhondt 1987b). From 1988 29 additional LE boxes were present. From 1994 to 1996 no boxes were monitored. From 1997 onwards the entire plot was covered with 123 nestboxes. In 2001, boxes 92 to 117 were closed as part of the METABIRD project. In addition the western part has been used from 2015 to 2019 by a different project not included in the database ("Peerdsbos West"). Briefly, the only part of the K dataset that would be suitable for any analysis are the boxes 1-49 in the period since 1997, since these were not used for experiments and nests were monitored at least for ringing young, although capture rate of parents has been variable.

Table 4. Overview of nestbox treatments per year in the main plots of the Peerdsbos area. LE and SE refer to large- and small-entrance boxes. Years always refer to breeding seasons when the boxes were in use. Note that plot T contained 15 additional LE boxes for Nuthatches in 1984 only. Also note that the 17 ha for plot C only refer to the wooded part (total is 31 ha).

Code	Plot name	Size (ha)	LE	SE	Total	Start	end
B	Boswachter	11,95	59	59	118	1979	1979
B	Boswachter	11,95	118	59	177	1980	1996
B	Boswachter	11,95	79	39	118	1997	
C	Calixberg	17	10	90	100	1979	1993
C	Calixberg	17	100	50	150	1994	1996
C	Calixberg	17	34	17	100	1997	1999

[2] LE were initially the odd numbers from 1-61, the even numbers from 64-78, and the odd numbers 79-117; SE were even numbers 2-62, odd numbers 63-77, and even numbers 80-118

[3] SE were from 1997 onwards: boxes 3, 6, 9, 12, 15, 20, 22, 24, 28, 30, 32, 37, 39, 41, 44, 46, 50, 53, 57, 59, 61, 63, 66, 70, 73, 75, 78, 84, 86, 88, 91, 94, 96, 99, 102, 104, 107, 109, 116, 118

L	List	7,5	53	0	53	1980	1988
T	Tennis	12,74	80	0	80	1979	1980
T	Tennis	12,74	120	0	120	1981	1983
T	Tennis	12,74	0	120	120	1984	1988
T	Tennis	12,74	120	60	180	1989	1993

2.3. Additional data collected

Vegetation in plot B: In 1986, vegetation surveys were conducted around all 177 nestboxes in plot B (tree species and sizes within 10m, herb and shrub coverage). In 2010 and again in 2017, all trees in plot B (including the lanes with oak trees surrounding the plot) were mapped, measured and their live/dead status recorded (Table 5). All information and tree maps are available in (Matthysen et al. 2021).

Table 5. Summary of tree composition in plot B based on a full tree survey in 2010, taken from Table S1 in (Matthysen et al. 2021).

Species	N	%	meanDBH	maxDBH	% dead
pedunculate oak *Quercus robur*	1146	73.5	56.7	122	9.7
beech Fagus sylvatica	263	16.9	60.4	139	0.8
red oak Quercus rubra	42	2.7	43.7	74	0.0
silver birch Betula pendula	31	2.0	36.7	53	6.4
black alder Alnus glutinosa	21	1.3	28.8	51	0.0
hornbeam Carpinus betulus	12	0.8	30.9	44	0.0
Norway spruce *Picea abies*	11	0.7	62.0	107	0.0
larch Larix decidua	11	0.7	51.6	72	0.1

Budburst data in plot B: budburst scores were collected in 2010 from all individual trees in the plot by repeated visits. In 2009, 2017 and 2024 budburst was also scored for nestbox trees (or a selection of them), usually during a single visit. Starting in 2026, a subset of oak and beech trees were monitored as part of a tree phenology project. For details see (Matthysen et al. 2021).

Roosting birds: Roost controls have been conducted every winter from the autumn of 1979 to early 2025. In the first half of the study period until 1996, all plots (except K) were checked once each month from November to February for roosting birds. In the latter period this was reduced to two visits per winter, in plots K and B, and after 2015 only in plot B. Note that regular roost checks are coded specifically in the capture database to distinguish them from ad hoc captures of roosting birds.

Moult data: in the early 1980s flight feather moult of adult birds was regularly scored in summer, mostly on Great Tits. From 2021 to 2023, targeted mistnet captures were done to obtain moult scores in July and August in plots B and K. Sample sizes vary between 30 and 50 birds for 1980-1982 and 2021-2023.

2.4. Major experiments

none

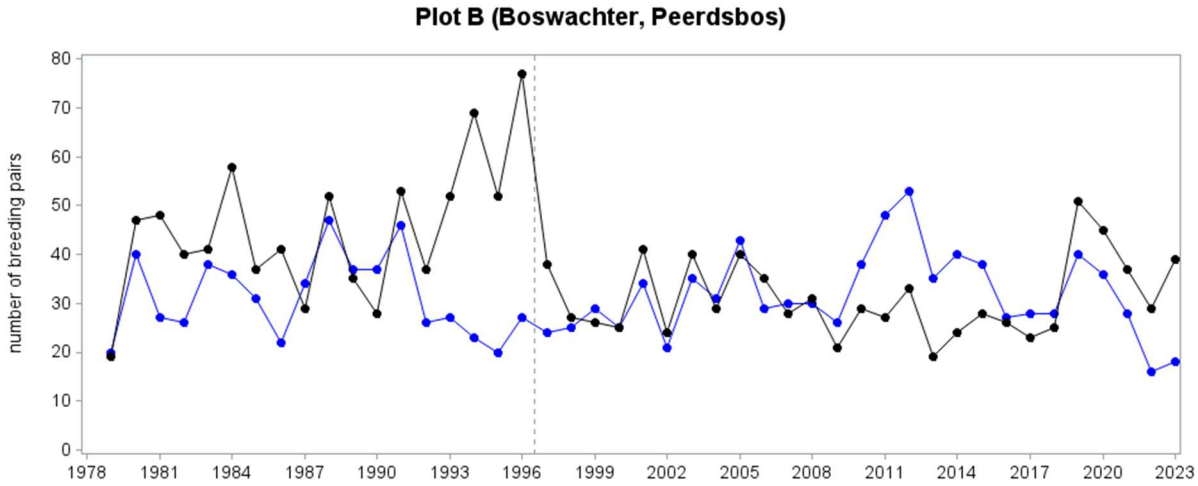
2.5. Relation of plot B with other datasets

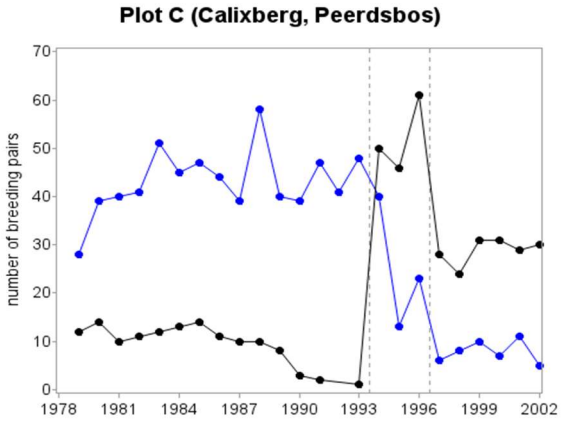
There is hardly any exchange of birds between the Peerdsbos and any of the other study areas. However, many of the breeders in plot B were ringed in one of the other plots. For example, 36% of all breeders (Great and Blue Tit combined) were ringed as nestling in another plot within Peerdsbos. Of those 23% were born in plot K, adjacent to plot B, and the remaining 13% scattered over the other plots. Thus, in order to maximize pedigree depth, or to maximize information on the origin of breeding birds, data from the other plots can be included. However, since the other plots were very uneven in their coverage over time, care must be taken to avoid any biases.

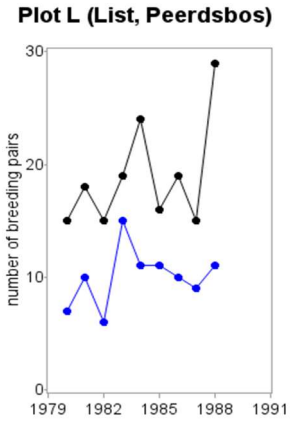
For particular long-term analyses such as on phenology, one could consider to boost sample sizes by including data from plot K, in particular the stands immediately adjacent to plot B which are very similar in vegetation. Again, care must be taken to avoid any biases. For this purpose we recommend to consult the full documentation on the Peerdsbos study, and/or to contact us directly to discuss the value of the data.

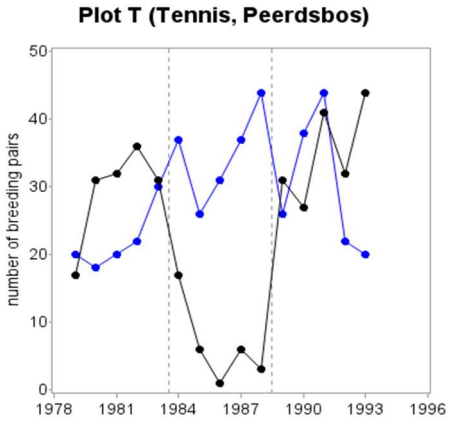
Appendix 1. Population sizes in the main Peerdsbos plots

Black and blue data points correspond to Great and Blue Tits, respectively. Note that breeding pair numbers include late broods of so-called intruder pairs (coded in the database as brood type 9) (Dhondt and Schillemans 1983). Dashed lines represent changes in nestbox setup (see Table C) (generated by SAS procedure **popsizes.sas**).



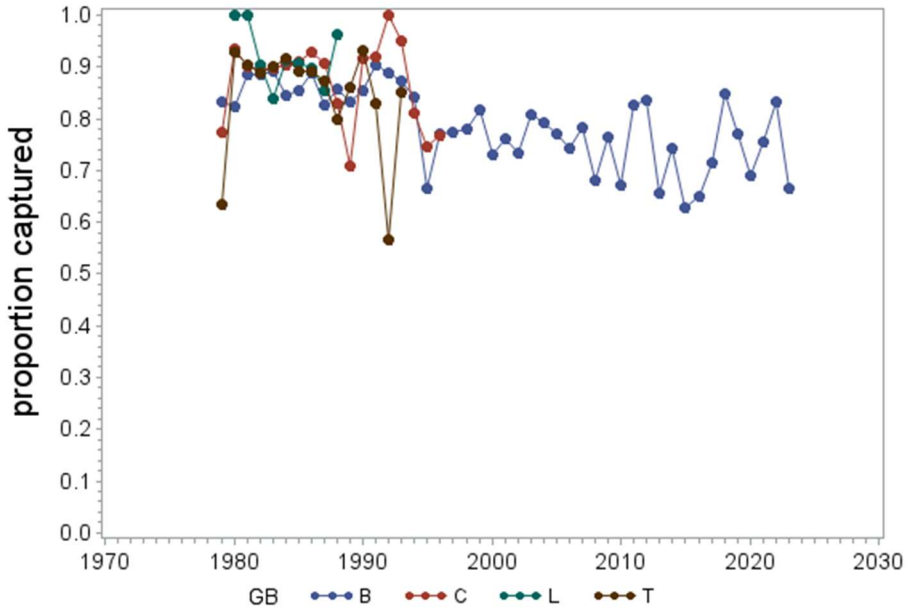




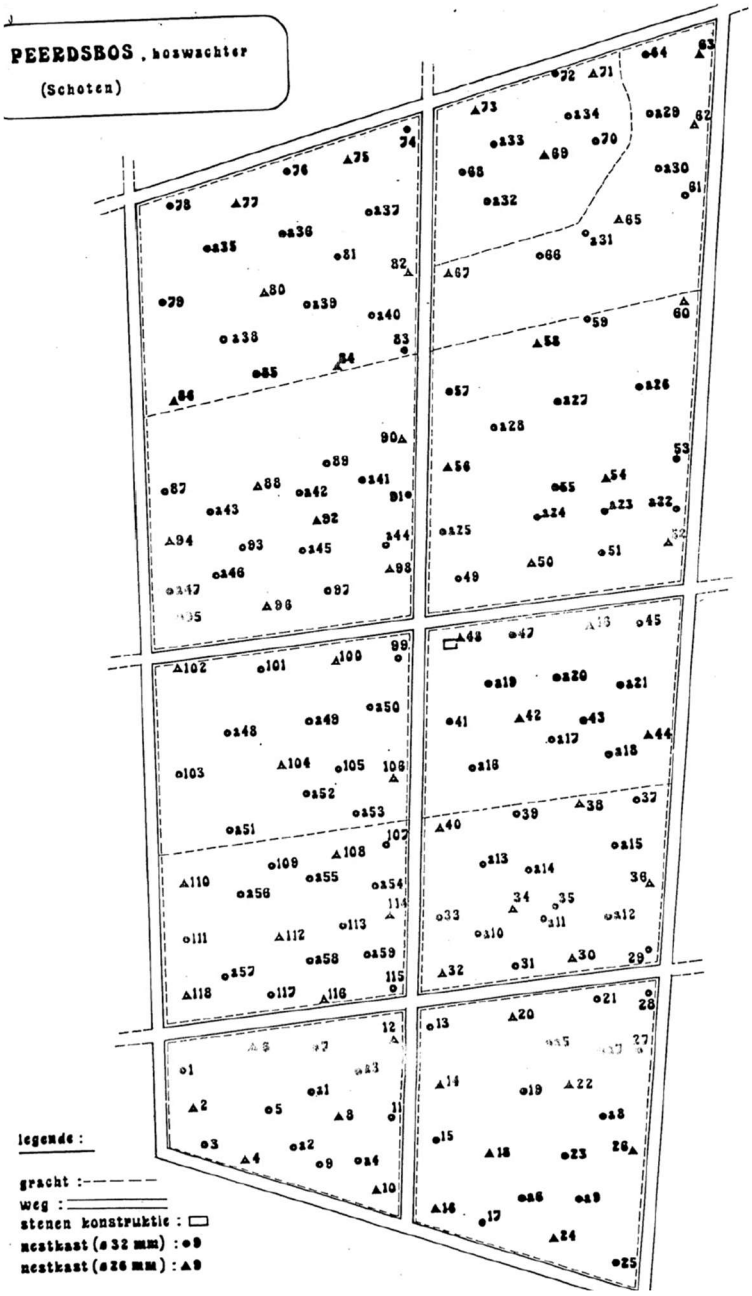


Appendix 2. Capture rates of breeding birds in Peerdsbos plots

Capture rates are combined for both sexes and species per year, for broods of type 1 and 9 (plots generated by SAS procedure **propcaptured.sas**). Note that these are capture rates over all initiated first broods, including early failed nests, thus capture rates of parents actually feeding young are much higher.



Appendix 3. Nestbox map of plot B



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