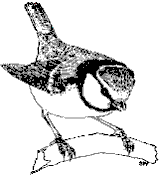
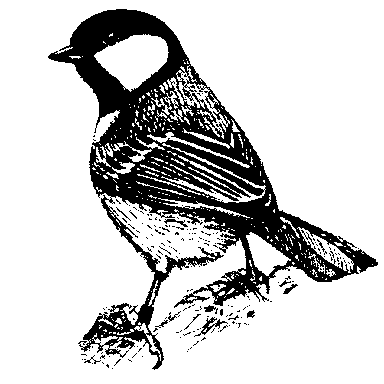


**University of Antwerp**

**Evolutionary Ecology Group**





**PARUS:**

**The Antwerp  
  
 Tit database**

Special version OCT 2018

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## Introduction

Since 1994 the long-term data on Great Tits (PM) and Blue Tits (PC) are collected and managed as a relational database in SAS. Data input, data control, data selection and data analysis all can be done within the SAS programming language. Very powerful data manipulation and data selection is possible using SQL-statements and SAS data-step procedures. Up until 2014 data are entered from notebooks into the computer and later edited using SAS FSEDIT screens. Starting breeding season 2014 taking notes in the field and data entry are done using the application ParusData on tablets and computers. Since then also the fieldwork is managed by ParusData and all data collected in the field are readily available in digital format from the server collecting all the data. Data files coming from the server are subjected to a first round of quality control, after which a couple of SAS procedures prepare the data to enter the standard procedures for adding the data to the main database, described in this document. More details on working of and with ParusData can be found in a separate document. This new approached had some (limited) consequences for the main database (e.g. formats of some fields were changed).

All data files are stored in an EVO-ECO file exchange unit at the central UA servers.

The database also holds the historic data from the tit research in Ghent, including the still running Hutsepot study area. The Ghent data are stored in separate data files.

The organization of the database tables is based on a mix of optimization of resources in terms of storage space, and flexibility and speed of data retrieval. Because of this some redundancy is allowed for in the tables.

This document gives an overview of

* Tables: an overview of all tables in the database and their relationships
* Coding: an overview of definitions and coding of all fields, per table
* Study areas: overview of the study sites, areas, habitat, nestbox composition.

The following chapters are organized per data type: captures, nests, standard data. After description of the main tables, a number of extra tables are also described in detail.

Naming conventions in text and file names:

* PM: Great tit, koolmees, *Parus major*
* PC: Bue tit, pimpelmees, *Parus caeruleus*, now *Cyanistes caeruleus*
* & is blank field
* n is a number

## Overview of tables

### Database structure

Figure 2 and table 1 give overviews of the database files and structure for the main database.

RN

**Brood data:**

**BR**

**Nestbox data:**

**Box**

**Plot data:**

**plot**

NN

**Standardized data:**

**ind**

**Capture data:   
VG**

RN

GB+PL

GB+PL

### Overview of tables and table names

|  |  |
| --- | --- |
| **SAS table** | **contents** |
|  | **Brood data** |
| **Br** | Main data file Antwerp Blue Tit (PC) and Great Tits |
| **Brgent** | Main data file Ghent data |
|  | **Capture data** |
| **Vg** | Main data file Antwerp PC and PM captures |
| **Vggent** | Main data file Ghent data |
|  | **Standardized data** |
| **Ind** | Main data file for Antwerp standardized data per individual |
|  | **Extra data files** |
| **Plot** | Most recent data on study plots |
| **Box** | Most recent data on nestboxes and other locations |

## Capture data (table VG)

All capture data, i.e. all occasion in which a bird is handled or its location and status as recorded by electronic devices (e.g. radio-transmitter, pit-tag, …), are collected in this group of tables, one record per event. Also every chick ringed in the nest is a separate capture record.

### Capture table structure

# Variable Type Len Format Informat Label

1 SOORT Char 3

2 RN Char 8 $8. $8. rn

3 NRN Char 1

4 KLR Char 4

5 NKLR Char 1

6 TAGTY Char 2

7 TAG Char 10

8 NTAG Char 1

9 NN Num 8 8.

10 GS Char 2

11 VD Num 8 DDMMYY8. DDMMYY8.

12 LT Num 8 2.

13 GB Char 10 $10.

14 PL Char 20 $20.

15 VW Char 2

16 ME Char 2

17 VLL Num 8 5.1

18 GEW Num 8 5.1

19 UUR Num 8 5.2

20 TA Num 8 5.2

21 BL Num 8 5.2

22 BH Num 8 5.2

23 DMVL Char 1

24 BLOED Char 1

25 RUI Char 10

26 COMM Char 50 $50.

27 RECNUM Num 8

28 SPLIT Char 2 $2.

29 TANEW Num 8 5.2

30 COORX Num 8 13.6

31 COORY Num 8 13.6

32 SA Char 2

33 TEEK Num 8

34 exp Char 8

35 klr\_old Char 4 $4.

36 gbpl Char 30

### Capture table coding

The chapters on coding contain all the details on the contents (and definitions) and the coding of all fields in the relevant tables. In principle the contents of all text fields are in capitals. Exceptions are explicitly mentioned.

**SOORT:** soort, species code

* The species is coded by a 2 letter (pm for Great tit, pc for Blue tit, lower case!)

**RN:** ringnummer, number on the official metal ring

* This field has to be filled in. If no ring number in know, a virtual code is sometimes used (always starting with a letter).
* This field is the only field that may be corrected during post processing, because it is the crucial ID field for the individual. All other fields, in principle, remain as noted in the note books/ParusData, even if it obviously not correct. Parus.IND takes care of wrongly noted observations.

**NRN:** Code for newly placed metal ring

* **\*** newly placed metal ring of UA series
* **V** metal ring removed and replaced by new metal ring (extremely rare event)
* **2** second metal ring placed next to a metal ring already present (mistake!)
* **&** metal ring already present at capture

**KLR**: Kleurring, colour ring combination observed or placed

* Colour ring code are read top left, bottom left – top right, bottom right
* X (no ring) always on top
* 4 letter codes from AAXM tot ZZZM
* Split rings (two colours on one ring, on top of each other): code ’S’, in combination with colour combination in field SPLIT (see below).

**NKLR:** nieuwe kleurring, new color ring combination placed on bird

* \* new combination is applied, and no previous colour ring(s) were present (metal only, is NOT regarded as a colour ring combination)
* V if existing combination was replaced by a new combination

**TAGTY:** tagtype, type of extra marking (not metal ring and/or colour rings)

* P Passive integrated transponder (Pittag) placed (injected or ring)
* V streamer attached to leg(s)
* T streamer attached to wing(s)
* Painted parts of the boby:
  + W cheak(s)
  + B breast (one or two sides)
  + K throat

**TAG:** tagcode,

* Colour code of extra markings,
* or code of the pittag (char(10)).

**NTAG:** nieuwe tag, new tag

* \* in case of a newly placed tag

**NN:** nest nummer, nest number

* A unique ID number for every nest in the BR data files. Coded as one figure composed of 4 figures of the year followed by 4 figures to make it a unique number (see BR).

**GS:** geslacht, sex as noted in the note book

* M noted as male
* W noted as female
* M? noted as probably male (default for all blue tits captured outside breeding season)
* W? noted as probably female (default for all blue tits captured outside breeding season )
* ? sex unknown or not noted

**VD:** vangdatum, capture date

* Format DD/MM/YY

**LT:** Leeftijd, age as noted in the notebook

* 10-19 is coding for the age of nestlings (developmental age in days). For discussion on developmental age see below
* 1-5 is a coding for the age of full grown individuals (calendar years)
  + 1 first calendar year
  + 2 second calendar year
  + 3 older than first calendar year (adult bird in period after the breading season up until end of the year)
  + 4 older than second calendar year (adult birds in first part of the year)
  + 5 full grown, no age known

**GB:** Gebied, study plot

* Because of the high number of different plots, we used a letter code to identify the plots, making it easier to follow which plot is meant.

**PL:** plaats, place: nestbox or other location code.

* Nestbox number: nestboxes are numbered per plot, so only GBPL makes a unique nestbox ID!
* Locations outside the study plots have a unique letter code
* All captures have coordinates in Lambert72
* All GB-PL combinations should be in Parus.box

**VW:** vangwijze, capture mode

* + DG found dead
  + FU semi-automatic cage trap (fuik)
  + GE visual observation of tag
  + MN mistnet capture
  + ON captured attending a nest
  + NO second time an individual was capture on the same nest
  + P pullus, nestling, chick
  + PP measurements of nestlings on other days than the last day (in principle day 15)
  + SK semi-automatic cage trap (slagkooi)
  + SL roosting during routine standardized night control session
  + LS roosting any night outside the routine night checks

**ME:** meter, ID of observer taking the measurements

**VLL:** vleugellengte , wing length in mm as noted in the notebook

**GEW:** gewicht, body mass in grams as noted in the notebook

* In recent years in many nests all chicks were weighed as a group, and no individual measurements were taken. If chicks mass is only taken in group, no weight (GEW) is entered in the individual capture records. Average weight is only entered in the breeding record (GG, see below), but not in the capture records of the individual chicks (all chicks equal).

**UUR:** weeguur, time of weighing in decimal hours

**TA:** tarsuslengte, “ short” tarsus length as measured from the start of tit research in Antwerp (see  
 below in IND section (5) for more info)

**BL:** beklengte, length of beak (has only been measured in some years)

**BH:** bekhoogte, height of beak (has only been measured in some years)

**DMVL:** duimvleugel, moulting status of alula

* + N moulted/new
  + O un-moulted/old

**BLOED:** DNA-staal en/of foto van borststreep, DNA sample and/or photo of breast stripe taken

* + B blood sample in freezer or storage medium
  + P dry body feathers
  + S tale feathers
  + F photo of breast stripe
  + A P+S
  + Q P+F

**RUI:** volledige rui-score, complete moulting score, rarely noted

**COMM:** commentaar, non-systematic remarks.

**RECNUM:** recordnummer, unique record number for each data line.

**SPLIT:** splitring code, two letter code for split ring colours (not used in recent years in Antwerp)

* Only if KLR contains ‘S’
* top+bottom

**TANEW**: nieuwe tarsusmaat, new tarsus measurement: long tarsus , from heel to top of bended   
 toes). More details on different ways of measuring tarsus length: see below in IND  
 section 5.

**COORX:** x-coordinaat, X coordinate place of capture (Lambert72)

**COORY:** y-coordinaat, Y coordinate place of capture (Lambert72)

**SA:** studie gebied, study area.

* In many cases study plots are aggregated in wider study areas, which form functional units
  + **FR** Fragments in Boshoek (Boechout-Lier-Hove-Lint)
  + **PB** Peerdsbos+Calixbergen
  + **KA** Katelijne (VLINA and Metabird projects)
  + **U** Univerity campus sites (CDE as well as CGB)
  + **WV** studiegebieden Metabird West- en Oost-Vlaanderen
  + **GE** Ghent
  + **SP** SPEEDY plot scattered across Flanders and Brussels

**TEEK:** teken, number of tick observed on (head of) bird

* + **& No observation done**
  + **n** checked and number of ticks counted
  + **0** checked and counted but no ticks found!

**EXP**: experiment code, code for experimental treatment if any

**KLR\_OLD**: Oude kleurring, old colour ring combination, replaced code in case of NKLR=V

* Coding equal to KLR
* In case of S in KLR\_OLD, split combination in COMM(S=X/Y)

**GBPL**: concatenate( gb, pl) = unique location code. Not all gbpl in VG or BR have a record in   
 BOX. One time observations have coordinates in VG/BR bur have no entry in BOX.

#### Colour ring coding

The colour rings we use are made in the U.K.by Hughes Ltd. (Tel: 0044 181 979 1366, Fax: 0044 181 979 5872). <http://www.ringco.co.uk>

We read our colour ring codes from top left to bottom right. Beware! The left side is the left side of the bird, seen from the position of the bird, exactly the same as the way we know which is our left or right leg. So, MBWR means Metal on top of Blue on the left side and White on top of Red.

When taking notes on colour rings note missing rings with an 'X'. This will exclude any doubts about missing rings later on (since ParusData, this is required). Since a single colour ring is always at the bottom, the X always comes first. So, XM-BG, means left only a Metal band, right Blue on top of Green.

The colours and combinations we use:

* Nowadays all colour rings have one single colour. We don’t use split rings anymore. Split rings are still in use in Ghent.
* In principle all full grown birds get a complete 4 ring combination: 1 metal ring and 3 colour rings. The metal band (M) is always part of the combination.
* Nestlings may receive a nest combination using one or two colour rings, not three. All chicks in the nest have the same combination.
* In case a colour ring is present, but replaced for another combination: always note the old combination: KLR\_OLD
* Pittag rings also have a colour, which is noted by a number.
  + O oranje, orange
  + B blauw, dark blue
  + W wit, white
  + R rood, red
  + S split ring (see field SPLIT)
  + X geen ring, no ring
  + Y geel, yellow
  + M metal, metal
  + Z zwart, black
  + G groen, green
  + P paars, mauve/purple
  + F fuchsia, pink
  + 2 pittag ring yellow
  + 3 pittag ring red
  + 4 pittag ring grey
  + 5 pittag ring cyan
  + 6 pittag ring black
  + 7 pittag ring white

#### Observer codes

For most recent version of the full list see Parus.meter.

#### Plot codes

For most recent version of the list of plot codes see Parus.plot.

#### Codes for roosting birds

The coding of VW for controls on roosting birds was completely revised in 2009, in order to be able to quickly make the difference between the routine controls and other controls on roosting birds.

* SL: roosting birds during routine night control. A routine night control is a control in which all nestboxes in all plots in one SA are checked during in a short period of time (mostly 1-3 days). Efforts are made to avoid it, but sometimes weather circumstances force team to check sub-parts of one plot in more than one night.
* LS: roosting birds found outside the controls indicated as routine controls (SL).
* In the first years of the work in PB sometimes more than one full night control was done in the same month. In those cases only one of those controls was marked as SL. Selection was made based on the shortest period in which the full control was done.
* Some small plots, which were used in a limited number of years, or regularly changed set-up (K, ME, TS, …) are not used in the marking of routine controls, unless there is a relatively long continuous period with night controls and no changes (eg. K from 1997, T before 1994, …).
* Occasional night controls in October or April are not indicated with SL. However, March controls in PB are indicated as SL.
* Night controls in all other SA (U, KA, TF) are coded as LS

## Breeding data (Table BR)

Tables for breeding data hold one record per observed breeding attempt. A breeding attempt is defined as any nest in which at least one egg was laid. Attempts stopped during the nest building phase are not included in the database! Up until breeding season 2013, these data are only available on the handwritten nest cards, and not entered in the database. Starting breeding season 2014 all nest observation data are collected using ParusData, and all raw nest observation are stored in SAS data files PARUS.CARDSyyyy. All observations in a nest card, are interpreted, as far as possible, first by a couple of SAS procedures, after which this translation from the raw nest observations is checked manually for every nest..

### Breeding table structure

# Variable Type Len Format Informat

1 NN Num 8 8.

2 SOORT Char 3

3 GB Char 10 $10.

4 PL Char 20 $20.

5 LD Num 8 DDMMYY8. DDMMYY8.

6 JAE Char 1

7 AE Num 8 2.

8 AEN Num 8 2.

9 NP Num 8 2.

10 PD Num 8 2.

11 PU Num 8 2.

12 LO Num 8 1.

13 TY Num 8 2.

14 AW Char 2

15 WD Num 8 DDMMYY8. DDMMYY8.

16 WU Num 8 5.2

17 ME Char 2

18 GN Num 8 2.

19 GT Num 8 5.2

20 GG Num 8 5.2

21 CON Num 8 5.2

22 SA Char 2 $2.

23 NNN1 Num 8

24 NNN2 Num 8

25 NNN3 Num 8

26 NNBI Num 8

27 NNTRI Num 8

28 VERL Char 2

29 exp Char 8

30 coorx Num 8

31 coory Num 8

32 comm Char 75 $75.

33 year Num 8

34 gbpl Char 30

### Breeding table: coding of fields

For the coding of follow-up nests within the same breeding season (fields NNNx) interpretation of events is always seen from the point of females. This does not mean that the females are actually captured at all different attempts. For a limited number of nests it is even possible that neither of the parents were actually captured at the nest (especially in nests which were abandoned in early nest stages). Decisions on the parents of those nests are based on other criteria such as timing etc. On the contrary the two fields coding for polygyny (NNBI, NNTRI), they are seen from the point of view of the males. Data in NNBI and NNTRI (nest numbers) are reciprocally entered for the two nests involved of the bigamous male. A search on NNBI will return the right number of nests involved, but double the number of cases of bigamy. This is not so for NNN, in which only the number of the other nest is entered in the relevant field. For a second brood 333 of a follow-up nest 222 after a failed first brood 111, this should give for the first brood NN111, NNN2222 and NNN3 333; while for the last brood this should be NN333, NNN1111, NNN2222.

Nests holding chicks from two species (great+bleu; blue+great, Sitta+great, …) are difficult to handle in the database. Since 2004 we standardize the way we handle and note such events.

* Parents attending the nest determine the species of the nest
* Extra chicks, not of the species of the parents, are NOT included in the numbers for nestlings in 1the nest (NP, PD, PU and GN), nor in the average measurements of the chicks.
* Given the rarity of such events, they are treated as real exceptions, needing some manual handling while adding the data. The number of chicks in BR (PU) and of records of banded chicks for that nest in VG will not match and produce warning outputs. An extra procedure at the end of addition of the data checks for the presence of multi-species nests, and allows for adjusting the data accordingly.
* It is important to enter the comments field in the right way and as standardized as possible! It should be noted as “+n PULPC”
* Observers should be told that if all chick are weighed together, this should be done separately for each species!

**NN**: nest number, see VG

**SOORT:** species, see VG

**GB:** plot, see VG

**PL:** nestbox, see VG

**LD:** laying date/date of first egg, see VD in VG.

* Day of first egg is back-calculated based on the number of eggs found during the first routine control which observed egg(s) in the nest. It is assumed that every morning one egg in laid. Data are checked for laying interruptions and/or extra eggs laid.
* If no observation of the nest at the egg stage are available, and also nesling age is nit entirely known, LD can be blank.

**JAE:** juist aantal eieren geteld. Number of eggs exactly counted

* + J exact count
  + N no 100% exact count (only counted with female brooding the eggs)

**AE:** aantal eieren geteld, number of eggs counted

**AEN:** aantal eieren gevonden na uitvliegen, number of unhatched eggs

**NP:** total aantal pulli in nest, calculated total number of hatched chicks: NP=AE-AEN

**PD:** pulli dood, number of chicks actually found dead in the nest

**PU:** pulli uitgevlogen, number of chicks fledged

**LO:** legonderbreking, number of days of laying interruption, based on one egg per day

**TY:** type broedsel, type of brood

|  |  |
| --- | --- |
| **0** | **Female breeding on nest with 0 eggs** |
| **1** | **First brood:** first nest of a known female in a given year |
| **2** | **Second brood**: Second nest of a known female in a given year. Identity of female/parents known AND at least one chick fledged successfully in first clutch. |
| **3** | **Replacement clutch**: Second nest of known female AND no chicks in first nest (nest abandoned before hatching). |
| **4** | **Replacement clutch**: Second nest of known female (see 4) AND chicks in first nest (nest abandoned after hatching). |
| **5** | **Replacement clutch**: Late nest but no female/parents known from a first nest AND one or more nests (with unknown parents) known to have failed in the vicinity with a timing which could comply with the timing of the start of the current nest. Relatively late nests, but not taken as strict as in 9. |
| **6** | **Third brood**: Third nest of a known female in a given year. Identity of female/parents known AND at least one chick fledged successfully in first and second clutch. |
| **7** | **Third brood**: Third nest of a known female in a given year. Identity of female/parents known AND at least one chick fledged successfully in first OR second clutch. |
| **8** | **Second replacement clutch**: Third nest of a known female in a given year. Identity of female/parents known AND no chicks fledged successfully in first NOR second clutch. |
| **9** | **Extra pair/Late first brood:** Nest for which no first nest/parents/female is known AND no nest failures with acceptable timing could be indicated in the vicinity (thus, no replacement clutch). First egg date at least 10 days later than last documented genuine first brood (thus, no ordinary first brood). |

**RM:** ringman, father attending the nest, see RN in VG

* In most cases parents are captured in the nestbox while feeding chicks of 8 days old. In some cases birds are identified by other means (visual, mistnetting, pittag, …).
* For every parent there is also a full capture record (VW= ON) in VG.

**RW:** ringvrouw, mother attending the nest, see RN in VG

**DATA on CHICKS**

**WD:** weegdatum jongen, day of weighing of the chicks, see VD in VG

* WD has to be equal to VD of the chicks (VW=P) in VG!

**WU** time of weighting, see VG

**ME** observer measuring chicks

**GN:** number of chicks measured (beware of nests with more than one species in the nest)

**GT:** average tarsus length at fledging (15 days of developmental age)

**GG:** average body mass at fledging

**CON:** average body condition of chicks as (GG / GT)

**SA:** Study area, see VG.

**NNN1:** NN of the first nest of the female of which this is a second brood or a follow-up clutch

**NNN2:** NN the second nest of a female of which this is the first brood

**NNN3:** NN of third nest (second follow-up nest) of the female of this nest. If NNN3 if entered  
 also NNN1 and NNN2 should have a NN

**NNBI:** NN of the other nest of a bigamous male (see also above)

**NNTRI:** NN of the third nest of a trigamous male. NNBI should also have a NN

**VERL:** stage at which a nest was abandoned

* + D egg(s) covert, nest abandoned during egg laying
  + B egg(s) brooded. Female seen brooding or eggs noted as ‘warm’
  + K eggs cold: nest abandoned without brooding or before the eggs could be found as ‘warm’
  + P chicks present, but no age of chicks noted
  + W egg on very little of no nest material
  + 1-8: age of dead chicks, if known
  + Second part of two-letter code: potential reason of disturbance
  + I: insect eg wasps
  + M: human
  + V: bird eg woodpecker
  + Z: mammal eg weasel

**EXP:** experiment, see VG

**COORX:** coordinates, see VG

**COORY:** coordinates, see VG

**COMM:** commentaar, comments

* See above for codes if chicks of more than one species are present in the nest
* In this column only occasional remarks should be added. More structural comments should go to a separate field!

**YEAR:** breeding season (in some years there is no laydate, and no dat the nestlings were ringed).

**GBPL:** concatenate(gb, pl) = unique location code.

## Standardized data (table IND)

Parus.IND has one record per individual present in VG. In this data file all data on each individual are represented as accurate as possible. Colour ring combinations are sometimes replaced by new combinations. In order to be able to see which colour ring combination an individual was wearing in what period in time a rather elaborate coding is included, giving every combination used on the individual and the date this combination was placed on the bird.

### Data summerizing

Since data records are in principle entered and kept as noted in the note books, those data records are not the most reliable source of information on the exact data of each individual (if captured more than once). To overcome this problem parus.IND was created. This table holds, for each individual ever captured (all species included), the most accurate information based on all data available on the individual.

* SOORT, MODE, GB, VD are copied from VG
* AGE: noted as year of birth (GBJ+CGJ)
* RN: checked based on all available data using the adding procedures
* SEX: based on all observations, sometimes including genotyping (absolute priority). Priority of captures ON; for birds never captured ON compared to data at first capture.
* KLR is checked extensively during addition of data to the main database, because unlikely things with KLR often indicate errors in RN, which should certainly be corrected!
* Measurements are represented by the median of all observation of that individual, corrected for observer bias (see separate document).

### Tarsus length

Since 2001, there are two tarsus measurements, the old tarsus (TA: heel to the last complete scale on the tarsus, prone to observation errors) and new tarsus (TANEW: heel to the top of the bended toes, less prone to observation errors). In 2015 we decided, after extensive exploratory and analysis work by Michalis Vardakis, to develop a new automated and straightforward correction system, resulting in corrected measures for both tarsus measures, but also one universal tarsus measure TARSUS, preferably only based on actual TANEW data, but for individuals without TANEW data, a converted measure based on their TA data. TARSUS is the new standard tarsus measure in parus.IND.

After new data are added each year, TARSUS of all individuals in IND are recalculated, based on all available data, including the most recent ones. This also means that TARSUS of older individual may still change marginally, because correction factors for the observers involved may change slightly.

#### Workflow TARSUS

Calculation done for PM and PC separately.

Type of calculation is stored with TARSUS value (tar\_ty=TANEW or CAL).

##### Correction for observer bias TANEW

* + Eliminate extreme values of TANEW from the basic data file:
    - PM: tanew gt **17.5** and tanew lt **22.0**
    - PC: tanew gt **15.2** and tanew lt **18.2**
  + Only individuals with at least 2 valid measurements
  + Only individual from main study areas (sa=FR+TF+PB)
  + Calculate observer estimates using a mixed model (model TANEW = me / solution; random rn;)
  + Calculate cTANEW as ctanew=tanew-estnt (invalid values are excluded)
  + Calculate med(cTANEW) as TARSUS

##### Correction for observer bias TA

* + Similar to TANEW above
  + Valid data range:
    - PM: ta gt 15.5 and ta lt 20.2
    - PC: ta gt **13.0** and ta lt **16.6**
  + cta=ta-estta
  + calculate med(cTA)

##### Extrapolate missing cTANEW from cTA

* + glm: model ctanew\_med = cta\_med / intercept
  + ctn\_conv = cta\_med\*estim + interc
  + calculated med(ctn\_conv) as TARSUS for individuals without TANW measures.

#### MEASURING TARSUS IN GREAT TITS ACROSS EUROPE

Several methods for measuring TARSUS in tits are in use over Europe. Some groups changed method in the course of the years. So did we in Antwerp.

**Svensson:**

****

**Oxford:**

Minimum versus Maximum tarsus measurement method



**Antwerp:**

**Until recently we used two parallel tarsus measures: the “short” one (TA) we have used traditionally since André started the project (TL measured to the “last complete scale”) and the “long” one (TANEW) that measures the full tarsus by bending the foot (in Svensson’s identification guide these are the “standard” and “alternative” measures). Now we only use the last method (which appears more reliable anyway).**

**NIOO:**

Measure with a vernier calliper from the notch on the back of the intertarsal joint (the small protroberescence (lump) at the ankle-joint) to the upper edge of the last undivided scale before the toes diverge, which is the scale that bends slightly when the toes are bowed. On the larger birds, and sometimes on smaller birds too, the scales at the lower end of the tarsus can appear as a mixture of complete ones and divided (due to natural variation or deformities). Therefore, the toes are bend back approximately 90 degrees to the tarsus and measured to this point.

For a right handed person (for left handed, reverse left and right hands);

1. Take the bird in your left hand, lying on its back, with the neck between your index and middle fingers.

2. Hold the right tarsus between your left thumb and index-finger, fold the toes downwards with your right hand and trap them between your left thumb and index-finger.

3. Make the measurement (Fig. below) and read the calliper to 0.1mm. Verify this with an experienced tarsus measurer and be careful with the sharp edges of the callipers.



**In conclusion:**

NIOO method = Oxford Minimum (S) = Antwerp “long” = Svensson ‘alternative’

Antwerp “short” = Svensson ‘standard’

Oxford Maximum (M) is a third method

So far there are thus three methods, which we will refer to as Svensson’s Standard Method (‘S’), Svensson’s Alternative Method (‘A’) and Oxford Maximum Method (‘O’). If other methods are used please let us know and we will include these in this overview.

**Conversion:**

Svensson ‘alternative’ = 6.158 + 0.777 \* Svensson ‘standard’ (Adriaensen unpubl)

Svensson ‘alternative’ = 3.64549 + 0.72005 \* Oxford Maximum (Gienapp & Cole unpubl)

### Wing length

The reasoning is largely similar to the one for TARSUS above, but more complex, due to seasonal effects on wing length. See SA procedure Workflow WING

##### Removal of extreme values

* + Extreme low/high values are removed is value is above threshold, and multiple measurements have a difference of at least 5 mm, to avoid removing some individuals with repeatedly measured very high wing lengths.
    - PM: reomove if raw value vll lt 69 or gt 82
    - PC: vll gt 71

##### Correction factor for season + age + me

* + One mixed model is used to calculate estimates for all factors:
    - model vll = per age me/ solution; random rn
  + corrected wing length cvll = vll - per\_est - age\_est - me\_est
  + standard wing length cvll\_med = med(cvll)

### Standard data table structure

# Variable Type Len Format Informat Label

1 soort Char 3

2 rn Char 8 $8. $8. rn

3 sex Num 8 1.

4 gbj Num 8 4.

5 cgj Char 1

6 mode Char 2 $2.

7 gb Char 10 $10.

8 vd Num 8 DDMMYY. DATE.

9 nrn Char 1 $1.

10 n Num 8 2.

11 pit Char 10 $10.

12 pitdate Num 8 DDMMYY8.

13 klr1 Char 4 $4.

14 klr1date Num 8 DDMMYY8. DDMMYY8.

15 klr2 Char 4 $4.

16 klr2date Num 8 DDMMYY8. DDMMYY8.

17 klr3 Char 4 $4.

18 klr3date Num 8 DDMMYY8. DDMMYY8.

19 klr4 Char 4 $4.

20 klr4date Num 8 DDMMYY8. DDMMYY8.

21 molsex Num 8 molsex

22 vll\_med Num 8

23 vll\_n Num 8

24 cta\_med Num 8 cta\_med

25 cta\_n Num 8 cta\_n

26 ctanew\_med Num 8 ctanew\_med

27 ctanew\_n Num 8 ctanew\_n

28 tarsus\_n Num 8

29 tarsus\_med Num 8

30 tarsus\_ty Char 5 $5.

### Standard data coding

**SOORT:** soort, species (see VG).

**RN:** ringnummer, ringnumber (see VG), this is the unique identifier in this table

**SEX:** geslacht, sex

* **1** certainly male
* **2** certainly female
* **3** probably male
* **4** probably female
* **&, 5** unknown

**GBJ:** geboortejaar, year of birth (4 digits)

**CGJ:** code geboortejaar, code year of birth

**&** year of birth known exactly

**+** year of birth not known exactly (maximum year of birth)

**?** year of birth unknown, not noted

**MODE:** mode of capture.

**?**: ringed by other ringer as fullgrown

**BG:** ringed by other ringer on the nest

**ON:** ringed by UA on the nest while feeding chicks

**P:** ringed by UA as chick

**VL:** ringed by UA as fullgrown

**XX:** ringed as fullgrown abroad ( in VG: GBXX)

**GB:** plot code first capture

**VD:** date of first capture

**NRN:** **\*** if metal ring was ever changed for another one (ie. New ID)

**N:** total number of records in VG

**PIT:** pittagcode if ever applied to the individual. In case of replacing of the pittag because the   
 first one was lost/broken, the last known tag code is entered

**PITDATE:** date of placing of the pittag

**KLR1:** first colour ring combination (in VG record with NKLRr’\*’)

**KLR1DATE**: date first colour ring combination was placed

**KLR2:** second combination placed (in VG first time NKLR’V’)

**KLR2DATE:** date second combination placed

**KLR3:** third colour ring combination on the same individual (second record with NKLR’V’)

**KLR3DATE: date** third colour ring combination was placed

**KLR4:** Forth colour ring combination on the same individual (third record with NKLR’V’), dd.   
 Feb 2009 klr4 was never applied yet

**KLR4DATE:** date forth colour ring combination was placed

**MOL\_SEX:** Molecular sex

In 2007 en 2008 128 GT were captured in early summer in Boshoek. These birds were sexed based on DNA. In 5 birds this was not successful.

MINPIT:

**VLL\_MED**: **:** median wing length after correction for the observer, season and age of the bird (based on model above). Wing length is back-calculated to first winter size.

**VLL\_N:** number of observations available

**CTA\_MED:** median ‘old’ or ‘short’ tarsus length (type 1) after correction for the observer, based   
 on all observations of this type only.

**CTA\_N:** number of observations available

**CTANEW\_MED:** median ‘new’ or ‘long’ tarsus length (type 1) after correction for the   
 observer, based on all observations of this type only.

**CTANEW\_N:** number of observations available

**TARSUS\_MED:** standardized ‘long’ tarsus measure, if available based on TANEW   
 measurements, if not available based on conversion of TA measurements

**TARSUS\_N:** number of observations available

**TARSUS\_TY:** (CAL=calculated based on TA values, TANEW=TANEW data only).

## Nestbox table

Parus.BOX gives an overview of information on nestboxes and other capture locations. Most importantly it gives the most recent and most accurate coordinates of the location (in Lambert72 coordinates, the standard Flemish coordinate system, unit = 1 m). Based on this location file, coordinates are added to each capture and breeding record. Since 2011 it is checked that no locations are entered in BR of VG for which no coordinates are known. For occasional locations the coordinates can be entered directly in the capture or breeding record. For more standardized locations (capture sites, houses or nestboxes) the coordinates are stored in BOX. However, in ParusData, no data can be entered without a unique location code. If necessary this can be generated in the app, where there is also room for the coordinates of the location which may be collected from the internal GPS (in lat long). Individual records in BR and VG have all their own coordinates as coordinates of a nestbox might change slightly over time (eg when a tree with a nestbox disappears, and the box is moved to the next tree).

#### Nestbox table structure

# Variable Type Len Format Informat Label

1 GBPL Char 10 $10. $10. GBPL

2 YEARFIRST Num 8 YEARFIRST

3 YEARLAST Num 8 YEARLAST

4 X Num 8 X

5 Y Num 8 Y

6 PL Char 10 $10. $10. PL

7 GB Char 7 $7. $7. GB

8 SA Char 2 $2. $2. SA

9 TYPE Char 3 $3. $3. TYPE

10 Y\_deg Num 8 Y\_deg

11 X\_deg Num 8 X\_deg

#### Nestbox table coding

**GBPL:** concatenate(gb,pl)

**YEARFIRST:** first breeding season active

**YEARLAST:** last breeding season active

**X:** longitude in Lambert72 (units in meter, Belgian projection).

**Y:** latitude in Lambert72 (units in meter).

**PL:** nestbox number or place code (see VG)

**GB:** plot code

**SA**: study area (se SA in VG table)

**TYPE**: nestkasttype

**pc**: standard ‘Wagening’ nestbox, 26 mm entrance, blue tit only

**pm**: standard ‘Wagening’ nestbox, 32 mm entrance

**cb**: nestbox type for Tree Creeper

**FPT:** feeder in pittag network

**PMO:** vertical tube designed fot marsh tits (but never with marsh tits)

**&:** all other locations, and nest sites (lettre boxes, natural cavities, mistnet sites, …)

**Y-deg:** latitude in decimal degrees

**X-deg;** longitude in decimal degrees

## Plot table

Data on the respective study plots are stored in Parus.PLOT2: area, coordinates, municipality, etc.

#### Plot table structure

# Variable Type Len Format Informat Label

1 GB Char 3 $3. $3. GB

2 SA Char 2 $2. $2. SA

3 PERI Num 8 PERI

4 AREA Num 8 AREA

5 FIRSTY Num 8 FIRSTY

6 LASTY Num 8 LASTY

7 COORX Num 8 COORX

8 COORY Num 8 COORY

9 LAT Char 13 $13. $13. LAT

10 LONG Char 12 $12. $12. LONG

11 NAAM Char 19 $19. $19. NAAM

12 DEELGEM Char 22 $22. $22. DEELGEM

#### Plot table coding

**GB:** plot code

**SA:** Study area

**PERI:** perimeter (m) if known

**AREA:** area in hectares.

**FIRSTY:** First breeding season with boxes.

**LASTY:** Last years with boxes

**COORX:** Lambert72 coordinate of center of gravity of plot

**COORY**: Lambert72 coordinate of center of gravity of plot

**LAT:** Latitude of center of gravity of plot

**LONG**: Longitude of center of gravity of plot

**NAAM**: (Dutch) name of plot

**DEELGEM**: municipality in which plot is situated.

#### Plot history

The table below gives an overview of all nestbox set-ups, areas, etc. of all study plots included in the main study areas, in Ghent as well as in Antwerp. This table was last updated in 2010. This information is currently not in the Plot table, but the plot table could to contain one line per plot-period instead of just one line per plot.

* CODE: plot code
* GEBIED: name of plot
* OPP: area (ha)
* HAB: habitat (1 = oak dominated forest, 2 = park, 3 = other)
* PER: period (chronologic)
* N32: number of boxes with 32 mm entrance
* N26: number of boxes with 26 mm entrance
* BJ: first breeding season
* EJ: last breeding season

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **gebied** | **opp** | **hab** | **per** | **N32** | **N26** | **bj** | **ej** |
|  |  |  |  |  |  |  |  |  |
| B | Boswachter | 11.70 | 1 | 1 | 59 | 59 | 79 | 79 |
| B | Boswachter | 11.70 | 1 | 2 | 118 | 59 | 80 | 95 |
| B | Boswachter | 11.70 | 1 | 3 | 79 | 39 | 96 | 99 |
| BW | Boshoek West | 3.0 | 3 | 1 | 12 | 6+4 | 01 |  |
| C | Calixberg | 17.00 | 2 | 1 | 10 | 90 | 79 | 93 |
| C | Calixberg | 17.00 | 2 | 2 | 100 | 50 | 94 | 96 |
| C | Calixberg | 17.00 | 2 | 3 | 50 | 50 | 97 | 99 |
| CI | Citadelpark | 20.00 | 2 | 1 | 49 | 0 | 59 | 79 |
| CO | COO | 20.00 | 3 | 1 | 67 | 0 | 61 | 61 |
| CO | COO | 20.00 | 3 | 2 | 104 | 0 | 62 | 62 |
| CO | COO | 20.00 | 3 | 3 | 119 | 0 | 63 | 68 |
| CO | COO | 30.00 | 3 | 4 | 136 | 0 | 69 | 79 |
| CO | COO | 20.00 | 3 | 5 | 92 | 0 | 80 | 85 |
| DN | Dreef Notaris | 0.25 | 1 | 1 | 8 | 4 | 94 |  |
| GT | Gontrode | 18.00 | 1 | 1 | 108 | 0 | 72 | 76 |
| GT | Gontrode | 18.00 | 1 | 2 | 11 | 97 | 77 | 82 |
| GT | Gontrode | 18.00 | 1 | 3 | 108 | 0 | 83 | 84 |
| HM | Hoogbos Midden | 0.76 | 1 | 1 | 4 | 2 | 94 |  |
| HN | Hoogbos Noord | 2.81 | 1 | 1 | 15 | 8 | 94 |  |
| HP | Hutsepot | 30.00 | 3 | 1 | 184 | 0 | 64 | 79 |
| HP | Hutsepot | 30.00 | 3 | 2 | 184 | 0 | 80 | 86 |
| KB | Kapellekensbos | 10.01 | 1 | 1 | 60 | 30 | 94 | 99 |
| KL | Klein Lachenen | 1.57 | 1 | 1 | 10 | 5 | 94 |  |
| K | Kontrole | 4.00 | 1 | 1 | 9 | 9 | 80 | 87 |
| K | Kontrole | 12.70 | 1 | 2 | 38 | 9 | 88 | 93 |
| K | Kontrole | 1 | 3 | 123 | 0 | 97 | 99 |  |
| LO | Lachenen Oost | 6.18 | 1 | 1 | 38 | 20 | 94 |  |
| LW | Lachenen West | 1.02 | 1 | 1 | 6 | 4 | 94 |  |
| LS | Liersesteenweg | 0.49 | 1 | 1 | 3 | 2 | 94 | 99 |
| L | List | 7.50 | 2 | 1 | 53 | 0 | 80 | 88 |
| MA | Maaltepark | 10.00 | 2 | 1 | 34 | 0 | 59 | 59 |
| MA | Maaltepark | 10.00 | 2 | 2 | 44 | 0 | 60 | 61 |
| MA | Maaltepark | 10.00 | 2 | 3 | 74 | 0 | 62 | 62 |
| MA | Maaltepark | 10.00 | 2 | 4 | 79 | 0 | 63 | 78 |
| MA | Maaltepark | 10.00 | 2 | 5 | 79 | 26 | 79 | 86 |
| MM | Maria-Middelares | 10.00 | 2 | 1 | 56 | 0 | 64 | 81 |
| SE | Seminarie | 7.00 | 2 | 1 | 58 | 0 | 67 | 79 |
| SO | Soenen | 8.00 | 2 | 1 | 89 | 0 | 67 | 77 |
| SO | Soenen | 8.00 | 2 | 2 | 9 | 80 | 78 | 78 |
| SO | Soenen | 8.00 | 2 | 3 | 89 | 0 | 79 | 86 |
| SA | Stad A | 5.00 | 2 | 1 | 42 | 0 | 69 |  |
| SI | Stad I | 10.00 | 2 | 1 | 37 | 0 | 59 |  |
| T | Tennis | 12.50 | 3 | 1 | 80 | 0 | 79 | 79 |
| T | Tennis | 12.50 | 3 | 2 | 120 | 0 | 80 | 83 |
| T | Tennis | 12.50 | 3 | 3 | 17 | 120 | 84 | 84 |
| T | Tennis | 12.50 | 3 | 4 | 0 | 120 | 85 | 88 |
| T | Tennis | 12.50 | 3 | 5 | 120 | 60 | 89 | 93 |
| TU | Turk | 11.05 | 3 | 1 | 44 | 21 | 96 | 99 |
| TF | Tussen fragmenten |  | 2 | 1 | 97 | 99 |  |  |
| VS | Vinkenstraat | 1.25 | 1 | 1 | 8 | 4 | 94 | 99 |
| ZN | Zevenbergen Noord | 1.53 | 1 | 1 | 10 | 5 | 94 |  |
| ZW | Zevenbergen West | 0.41 | 1 | 1 | 4 | 2 | 94 |  |
| ZZ | Zevenbergen Zuid | 11.10 | 1 | 1 | 64 | 32 | 94 |  |
| ZE | Zevergem | 13.00 | 1 | 1 | 41 | 0 | 59 | 60 |
| ZE | Zevergem | 13.00 | 1 | 2 | 79 | 0 | 61 | 63 |
| ZE | Zevergem | 16.00 | 1 | 3 | 97 | 0 | 64 | 87 |