QUILLOW BIRD MONITORING INFORMATION SYSTEM

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Overview

- This database project deals with breeding bird data coming from a long term monitoring project in the Quillow river catchment area in North East Brandenburg.
- The monitoring was performed in two different periods from 1999 – 2002 and from 2013 – 2015.
- The monitoring project was performed under the leadership of the Leibniz Center for Land Use Research (ZALF) Müncheberg, Institute for Land Use Systems (Dr. M. Glemnitz, Dr. U. Stachow) in cooperation with the University for Sustainable Development (HNEE) (Prof. Dr. A. Schultz)

Overview-The final objective

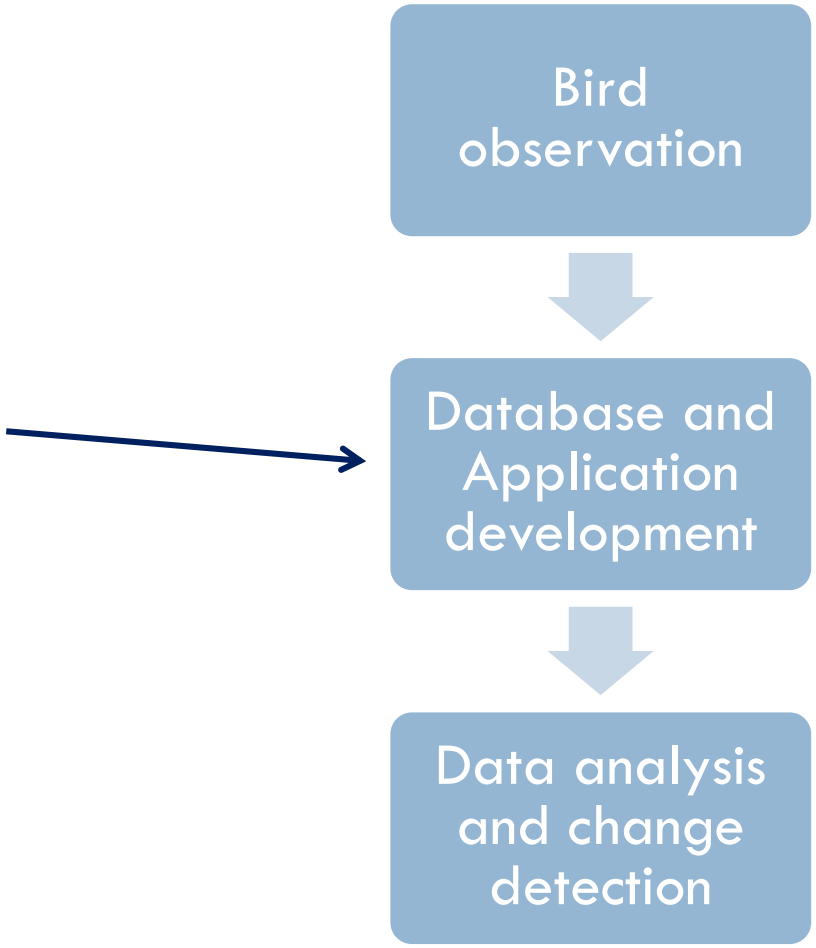
- The overall objective of the underlying bird monitoring project is to derive and test biodiversity indicators based on breeding bird occurences in order to :
  - describe states and trends in biodiversity development in the considered landscape
  - derive relationships between the occurence of breeding birds and landscape structure
  - analyze potential reasons for observed changes, e.g. due to land use changes

Overview –The current need

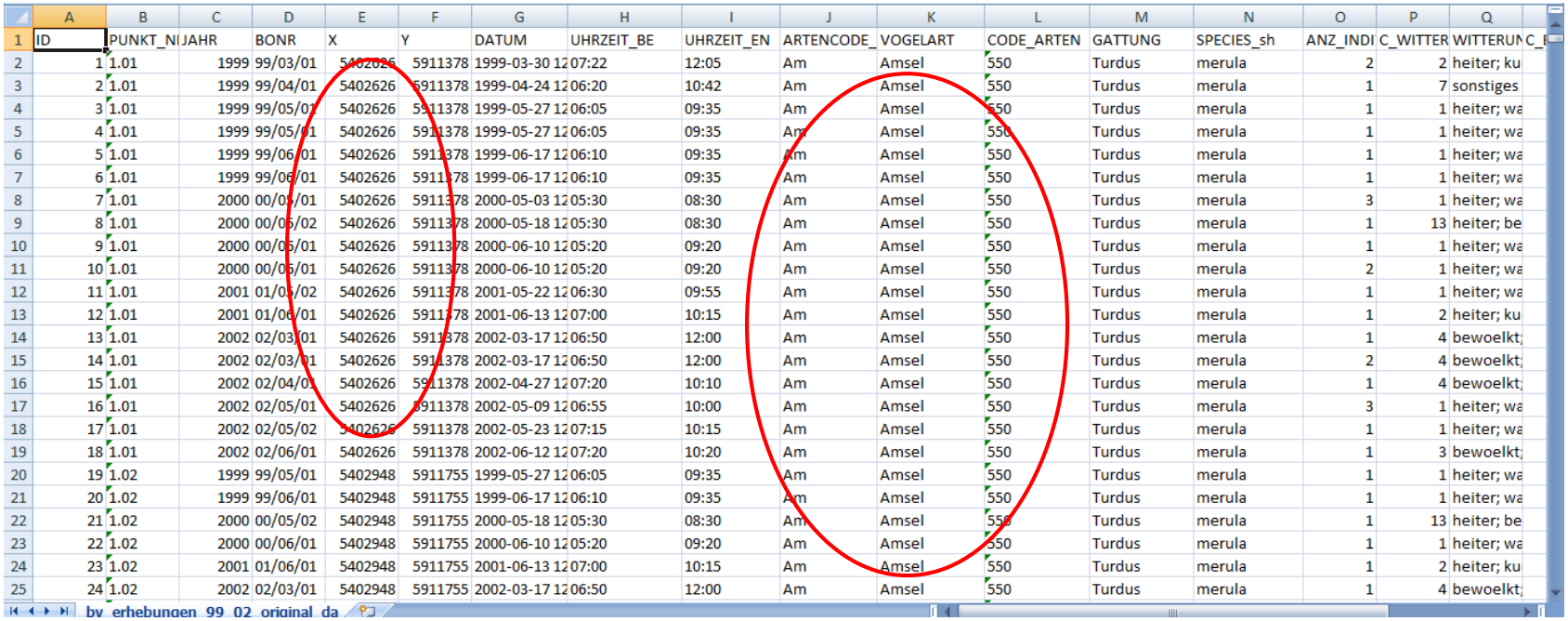
- The bird occurrence data were listed in an acquisition sheet resulting in more than 20000 records , each record containing 22 values.

- This project aims to develop a database for bird monitoring data and a desktop application for further analysis .

Overview- the big picture



Overview- Acquisition sheet



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	ID	PUNKT_NI	JAHR	BONR	X	Y	DATUM	UHRZEIT_BE	UHRZEIT_EN	ARTENCODE_	VOGELART	CODE_ARTEN	GATTUNG	SPECIES_sh	ANZ_INDI	C_WITTER	WITTERUN
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3	2	1.01	1999	99/04/01	5402626	5911378	1999-04-24 12	06:20	10:42	Am	Amsel	550	Turdus	merula	1	7	sonstiges
4	3	1.01	1999	99/05/01	5402626	5911378	1999-05-27 12	06:05	09:35	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
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6	5	1.01	1999	99/06/01	5402626	5911378	1999-06-17 12	06:10	09:35	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
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8	7	1.01	2000	00/05/01	5402626	5911378	2000-05-03 12	05:30	08:30	Am	Amsel	550	Turdus	merula	3	1	heiter; wa
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10	9	1.01	2000	00/06/01	5402626	5911378	2000-06-10 12	05:20	09:20	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
11	10	1.01	2000	00/06/01	5402626	5911378	2000-06-10 12	05:20	09:20	Am	Amsel	550	Turdus	merula	2	1	heiter; wa
12	11	1.01	2001	01/05/02	5402626	5911378	2001-05-22 12	06:30	09:55	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
13	12	1.01	2001	01/06/01	5402626	5911378	2001-06-13 12	07:00	10:15	Am	Amsel	550	Turdus	merula	1	2	heiter; ku
14	13	1.01	2002	02/03/01	5402626	5911378	2002-03-17 12	06:50	12:00	Am	Amsel	550	Turdus	merula	1	4	bewoelkt;
15	14	1.01	2002	02/03/01	5402626	5911378	2002-03-17 12	06:50	12:00	Am	Amsel	550	Turdus	merula	2	4	bewoelkt;
16	15	1.01	2002	02/04/01	5402626	5911378	2002-04-27 12	07:20	10:10	Am	Amsel	550	Turdus	merula	1	4	bewoelkt;
17	16	1.01	2002	02/05/01	5402626	5911378	2002-05-09 12	06:55	10:00	Am	Amsel	550	Turdus	merula	3	1	heiter; wa
18	17	1.01	2002	02/05/02	5402626	5911378	2002-05-23 12	07:15	10:15	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
19	18	1.01	2002	02/06/01	5402626	5911378	2002-06-12 12	07:20	10:20	Am	Amsel	550	Turdus	merula	1	3	bewoelkt;
20	19	1.02	1999	99/05/01	5402948	5911755	1999-05-27 12	06:05	09:35	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
21	20	1.02	1999	99/06/01	5402948	5911755	1999-06-17 12	06:10	09:35	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
22	21	1.02	2000	00/05/02	5402948	5911755	2000-05-18 12	05:30	08:30	Am	Amsel	550	Turdus	merula	1	13	heiter; be
23	22	1.02	2000	00/06/01	5402948	5911755	2000-06-10 12	05:20	09:20	Am	Amsel	550	Turdus	merula	1	1	heiter; wa
24	23	1.02	2001	01/06/01	5402948	5911755	2001-06-13 12	07:00	10:15	Am	Amsel	550	Turdus	merula	1	2	heiter; ku
25	24	1.02	2002	02/03/01	5402948	5911755	2002-03-17 12	06:50	12:00	Am	Amsel	550	Turdus	merula	1	4	bewoelkt;

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Goals

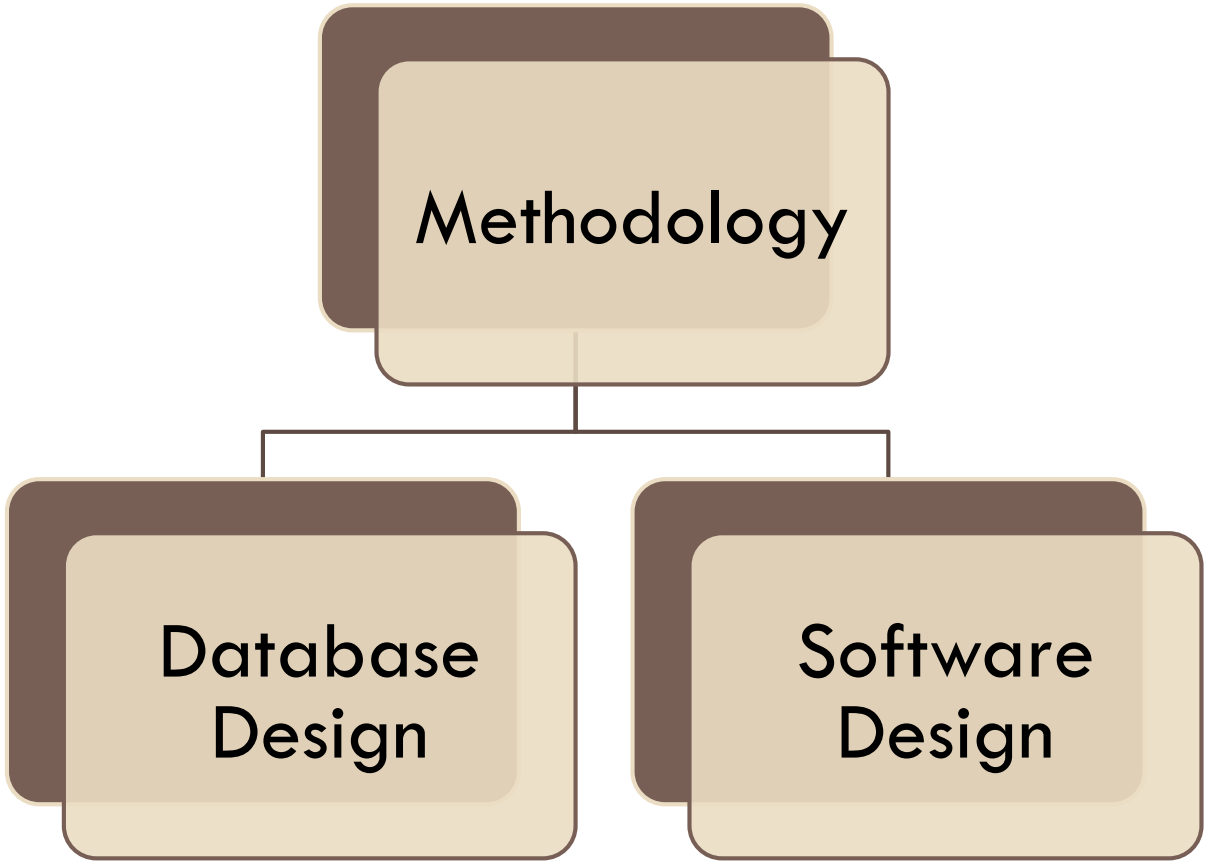
- Reliable storage of data
- Efficient data operations for future analysis
- User-friendly desktop application.

Motivations

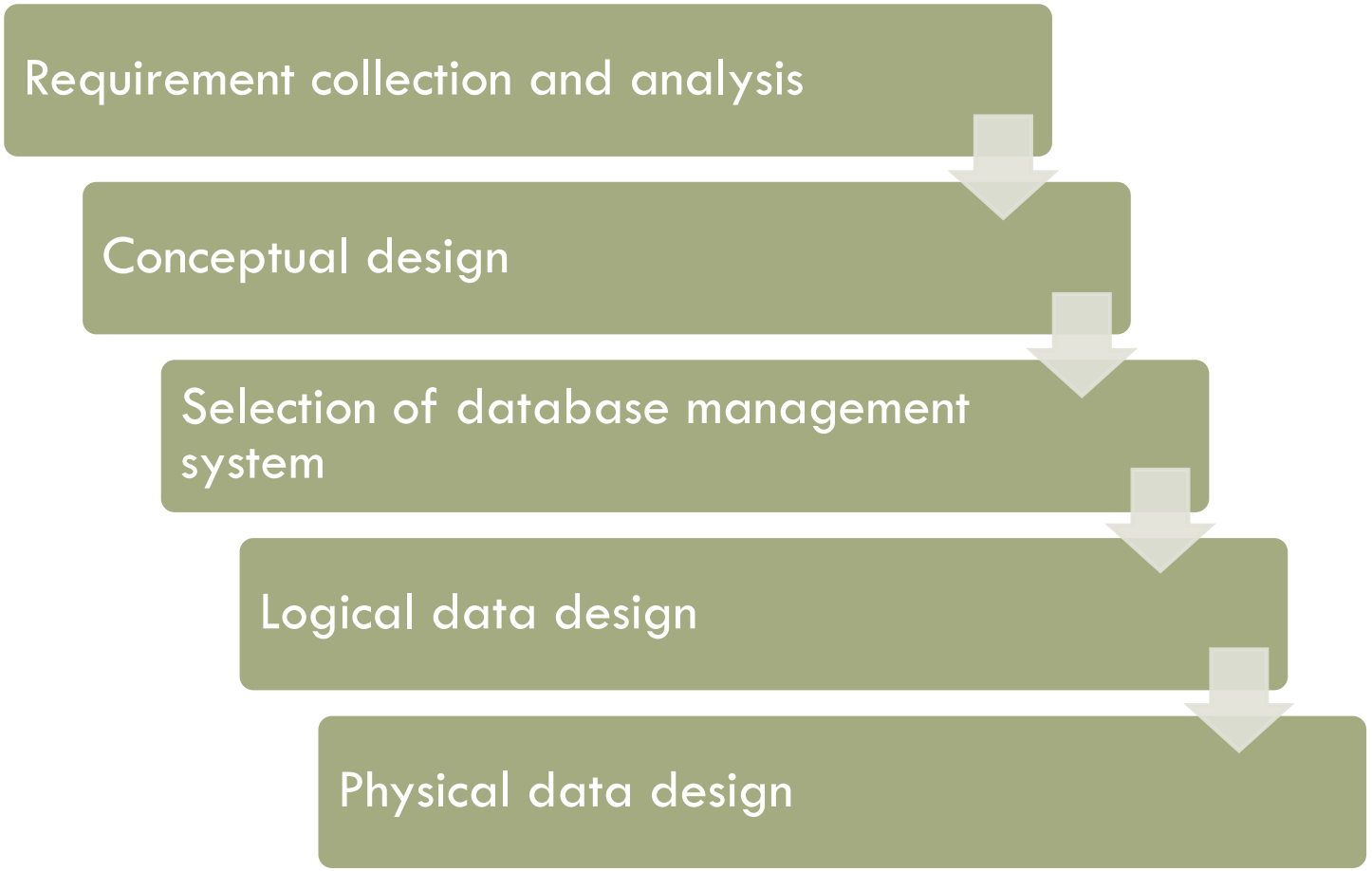
- Organize the data in a better way to easily answer data questions .
- Some ready-to-see reports may answer some commonly raised queries by users(scientists and others)
- A desktop application can help inserting new observation data, retrieve them and finally help further data analysis.

Research Methodology

This presentation discusses only this part



Research Methodology ~ **database design**



Research Methodology ~ database design ~ **Requirement collection and Analysis**

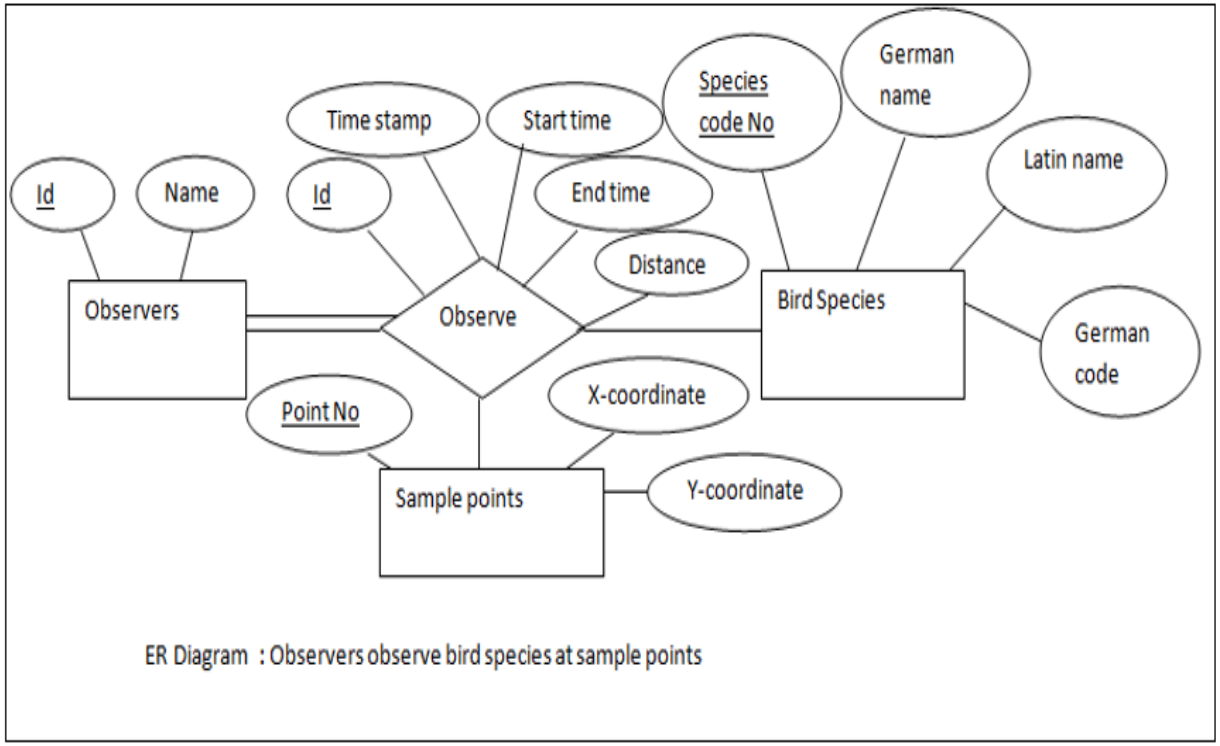
- Who may require data and in which format.
- Which data may be required most often.
- Which data may be not required and thus eligible for elimination.

Research Methodology ~ database design ~ **Conceptual design**

- Entity- relationship diagram
- Different entities and their relationships are to identified.
- Entity-relationship diagram is not specific to any database model(relation ,hierarchical etc)
- It is possible to navigate to another database model.

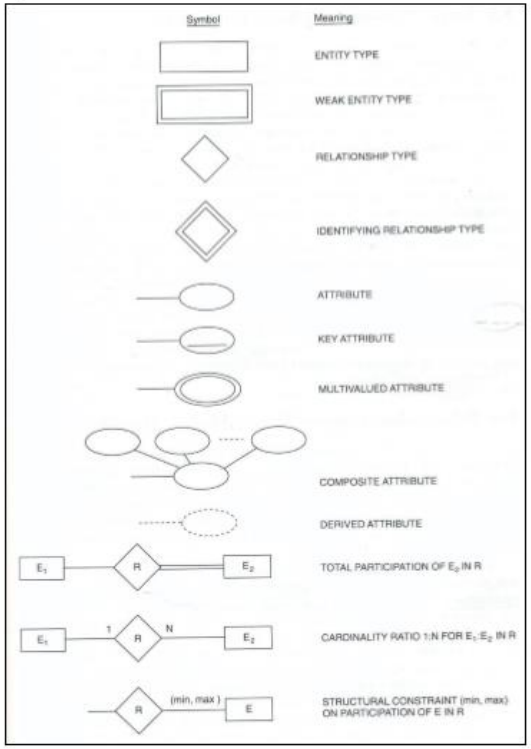
Research Methodology ~ database design ~ **Conceptual design**

Conceptual Design - entity relationship diagram



ER Diagram : Observers observe bird species at sample points

Conceptual Design Symbols



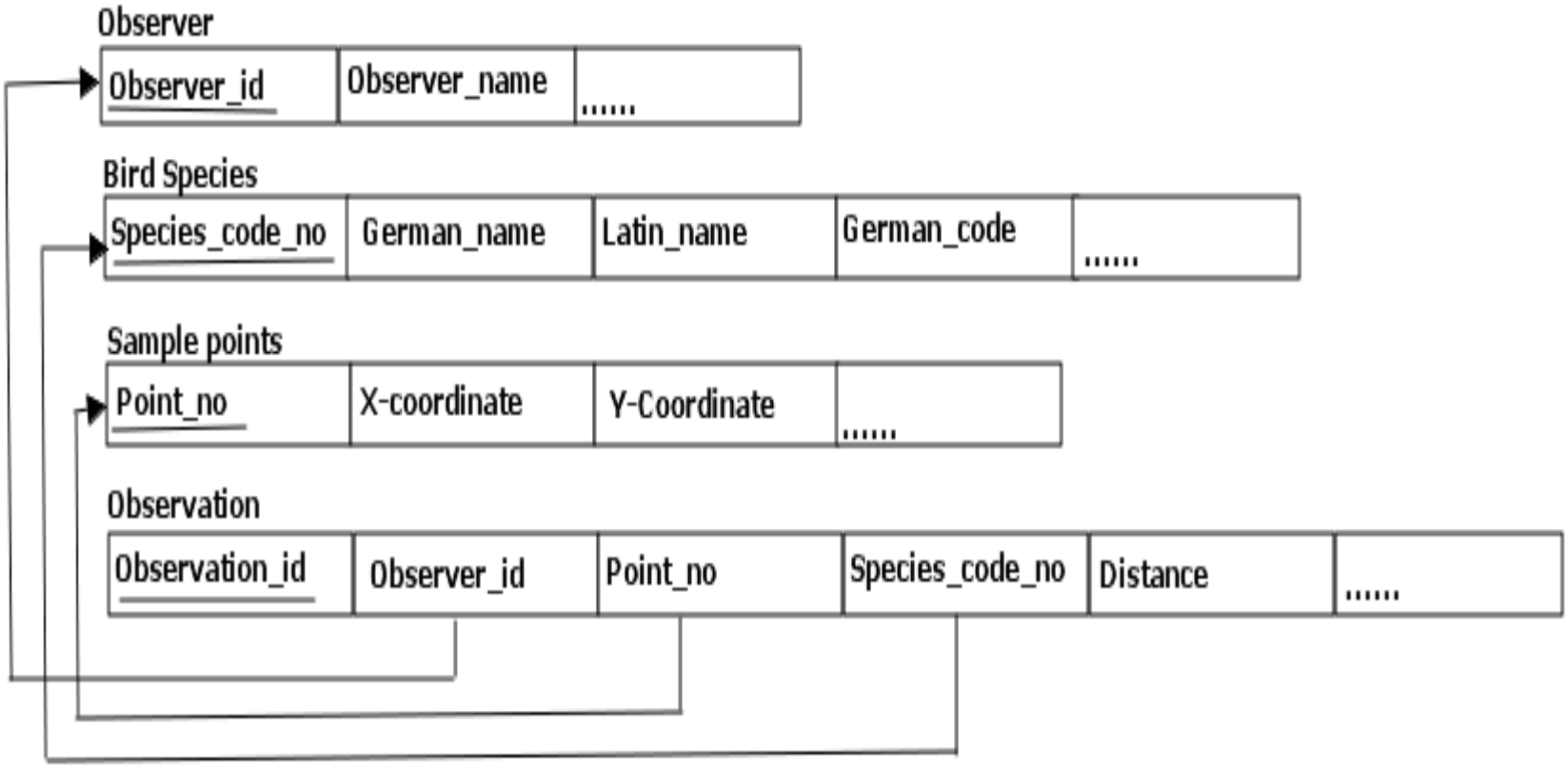
Research Methodology ~ database design ~ **Selection of DBMS**

- Selection of data model.
- Requirements were to consider users with minimal software knowledge.
- Possible to migrate to more powerful DBMS.

Research Methodology ~ database design ~ **Logical data design**

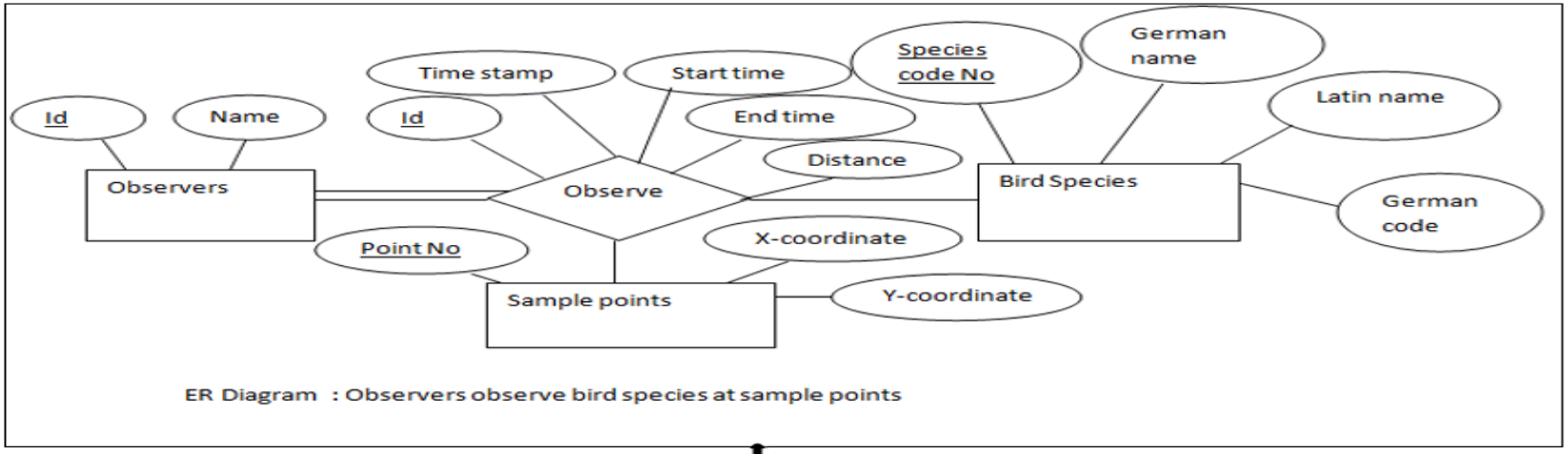
- Logical table formation.
- Specific to relational database.
- A pen and paper method, can also be done using special software.

Research Methodology ~ database design ~ **Logical data design**



Research Methodology ~ database design ~ **Logical design (Mapping)**

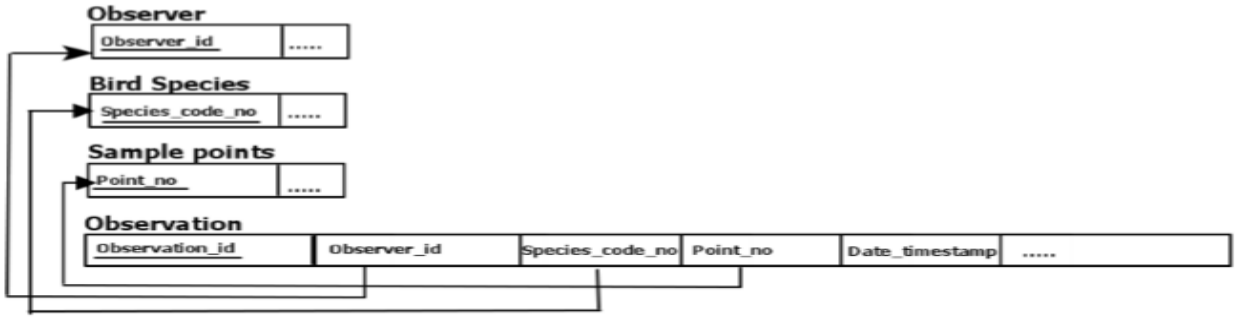
Conceptual Design – entity relationship diagram



ER Diagram : Observers observe bird species at sample points

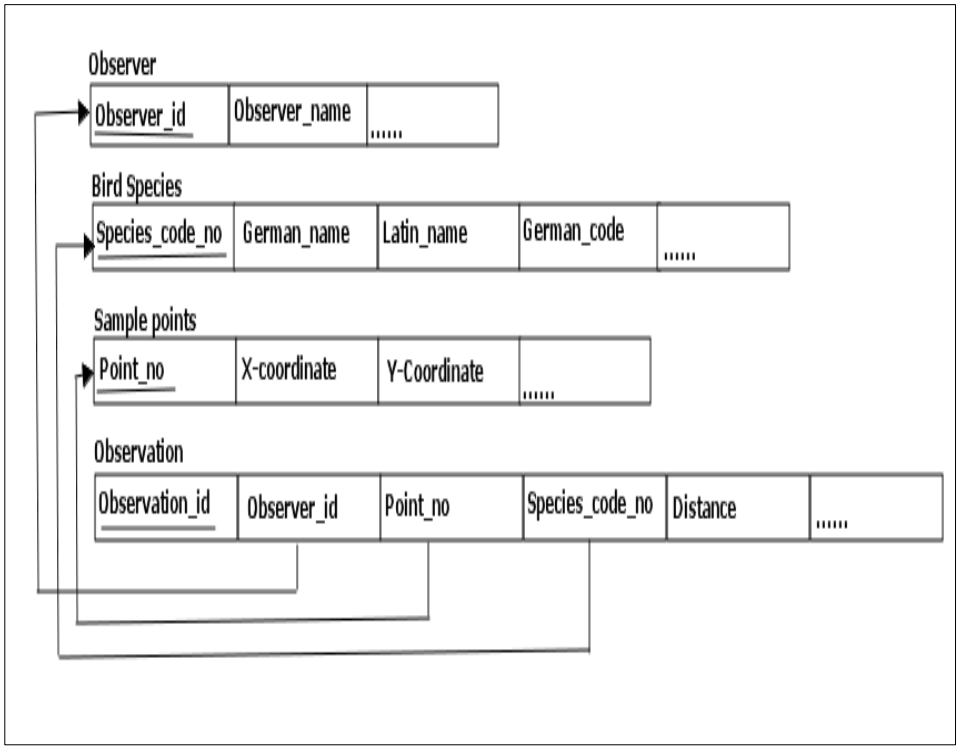
Mapped to

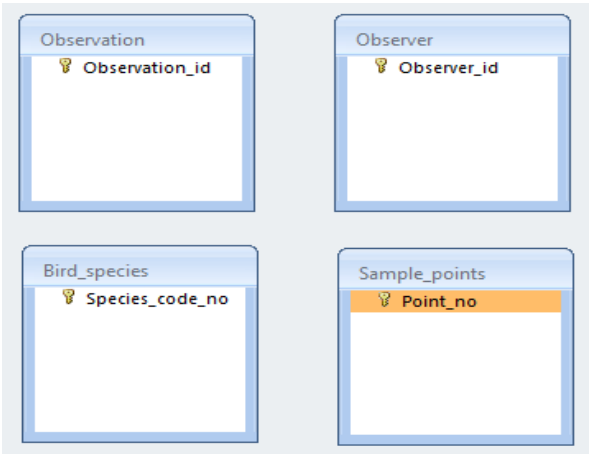
Logical Design – database schema



Research Methodology ~ database design ~ **Physical data design 1**

- Initial table creation by realizing the schema(logical design)



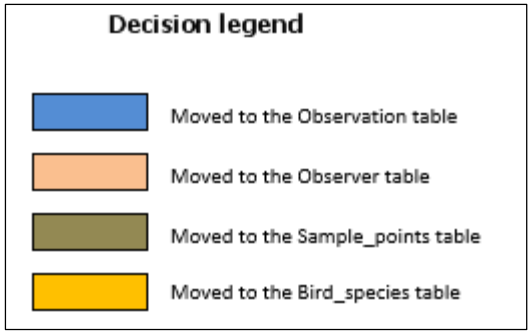


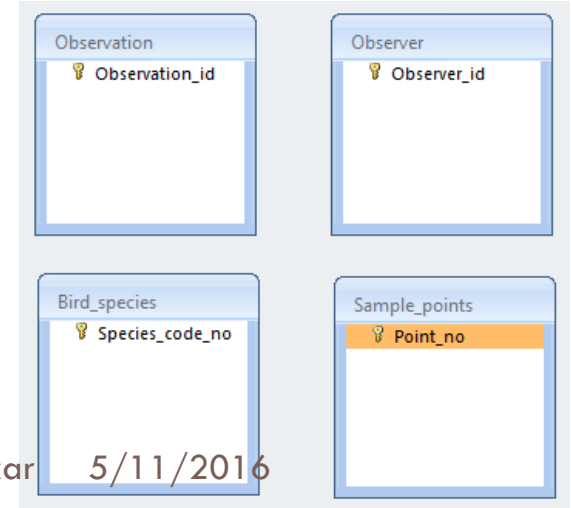
Research Methodology ~ database design ~ **Physical data design**

- Step 1: Actual relation formation(table creation)

Columns from acquisition sheet

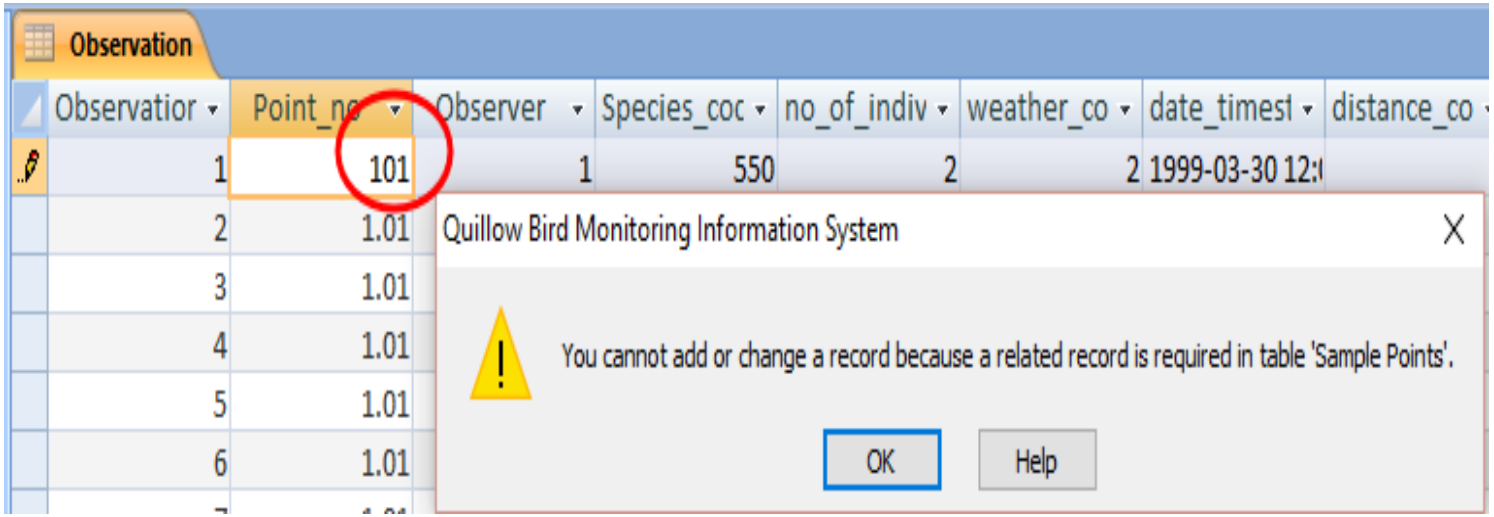
Column name(German)	Column name(English) and explanation
ID	An identification no of every observation
PUNKT_NR	Point number – sample point number
JAHR	Year of observation
BONR	Date
X	X coordinate of the point
Y	Y coordinate of the point
DATUM	Date timestamp
UHRZEIT_BE	Starting time of the particular observation
UHRZEIT_EN	Starting time of the particular observation
ARTENCODE_	Species code in German
VOGELART	Species name in German
CODE_ARTEN	Species code number
GATTUNG	Genus in Latin
SPECIES_sh	Species name in Latin
ANZ_INDIVI	Number of individuals observed
C_WITTERUN	Weather code
WITTERUNG	weather
C_ENTFERNU	Distance coding
ENTFERNUNG	Distance
BEOBACHTER	Observer
Species	Genus and species in Latin





Research Methodology ~ database design ~ **Physical data design**

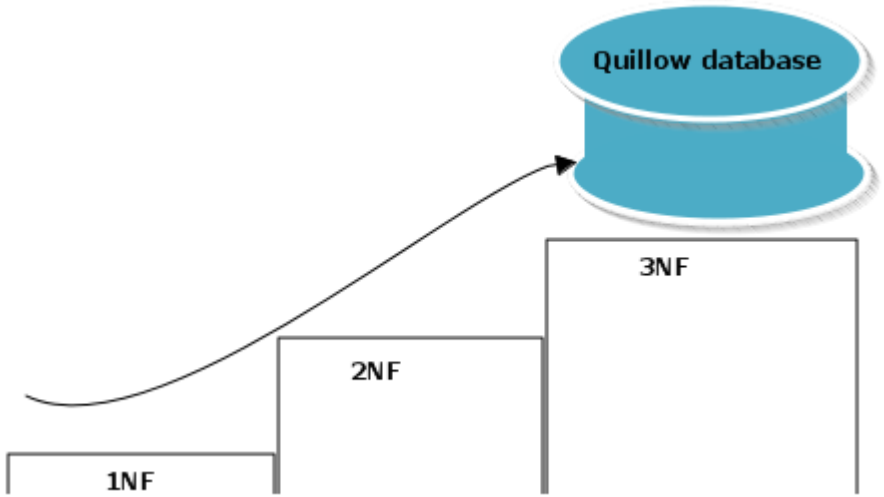
- Anomalies – leads to inconsistency of data
- Insertion , update, deletion anomaly



Research Methodology ~ database design ~ **Physical data design**

- Normalization -Normalization of data can be considered a process of analyzing the given relation schemas based on their FDs and primary keys to achieve the desirable properties of (1) minimizing redundancy and (2) minimizing the insertion, deletion, and update anomalies.
- This project aims to keep the database in the third normal form.

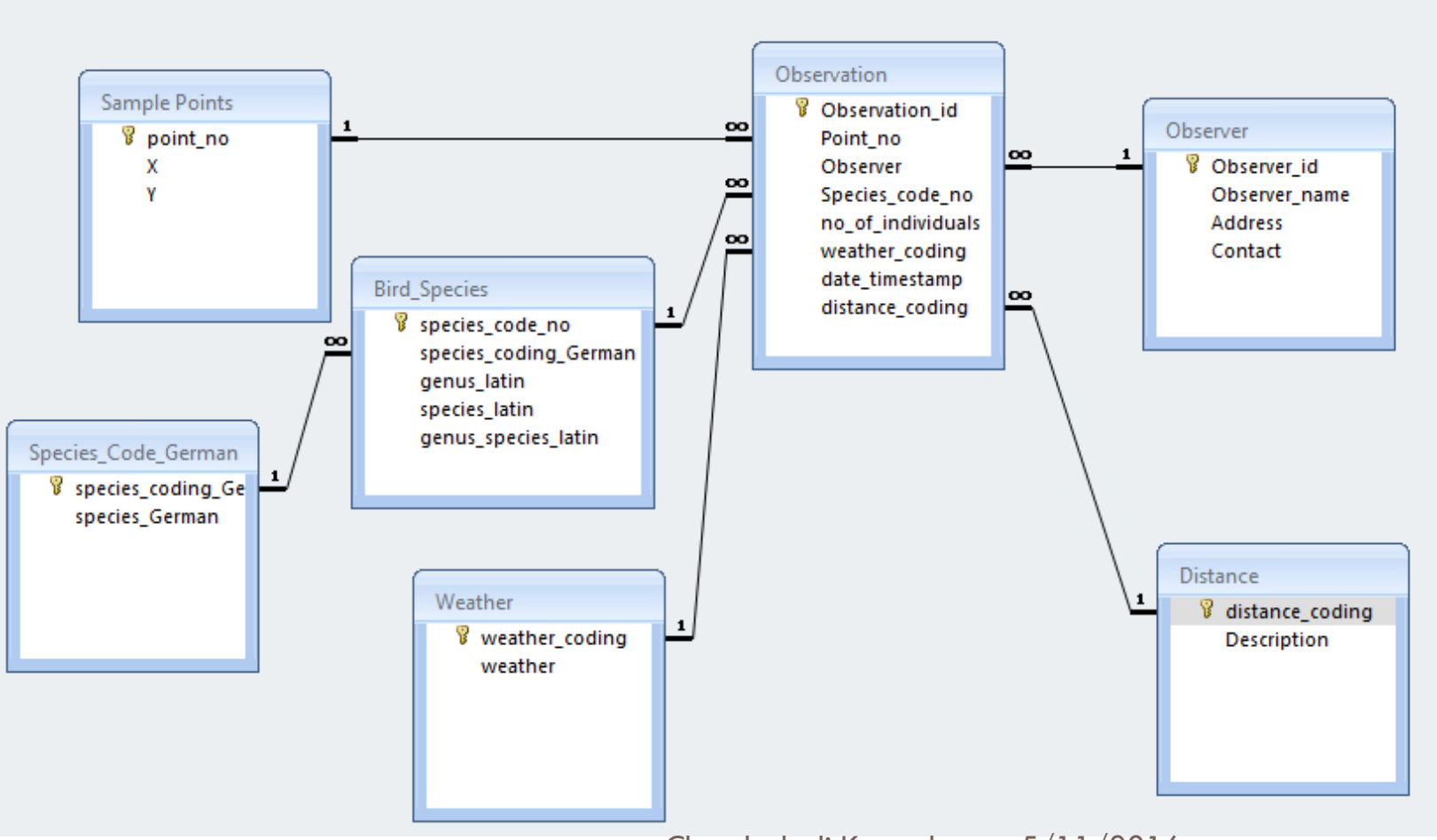
Research Methodology ~ database design ~ **Physical data design**



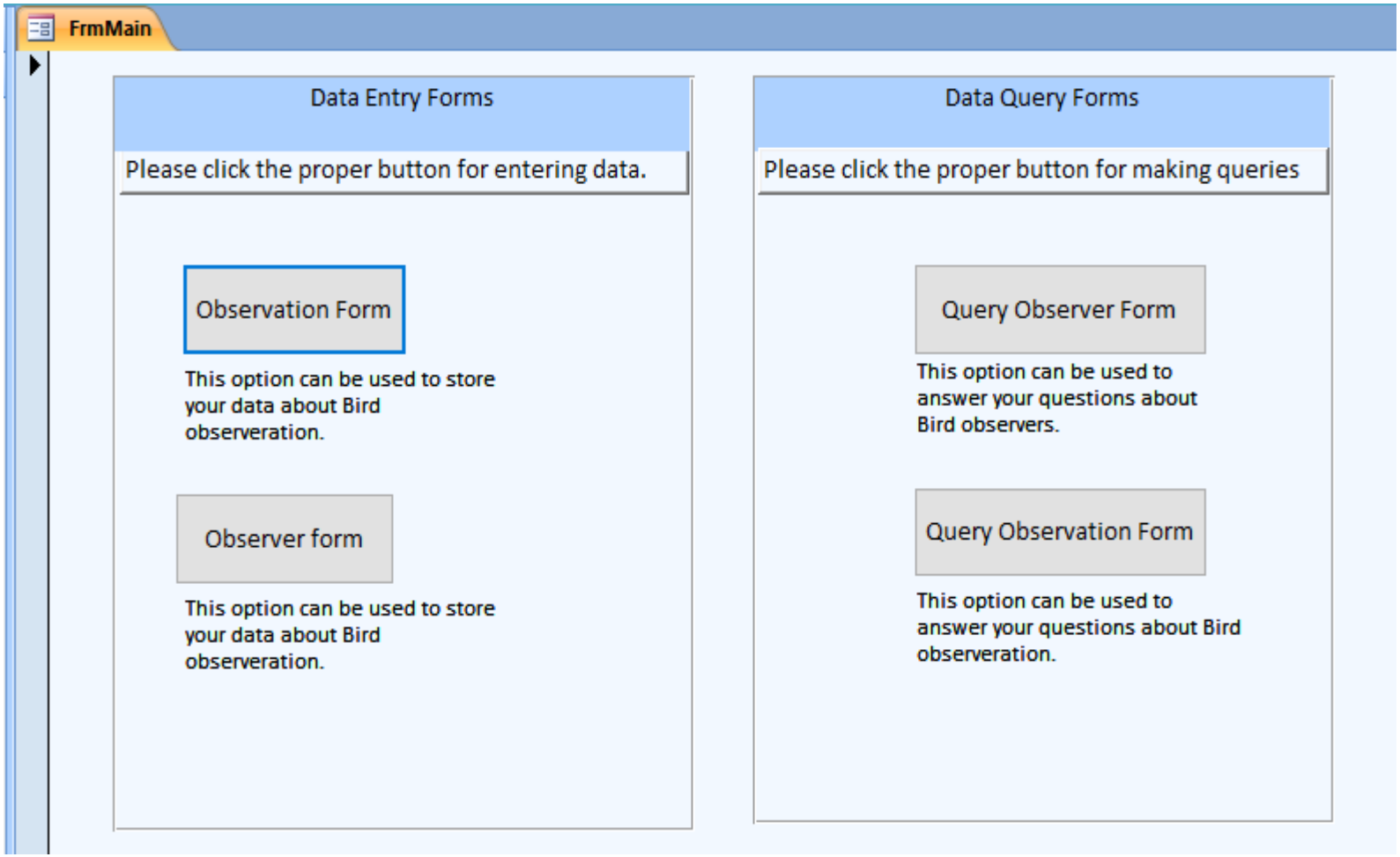
Research Result

- A well-designed (satisfies ACID properties) database with minimal redundancy .
- A desktop application that is based on the database.

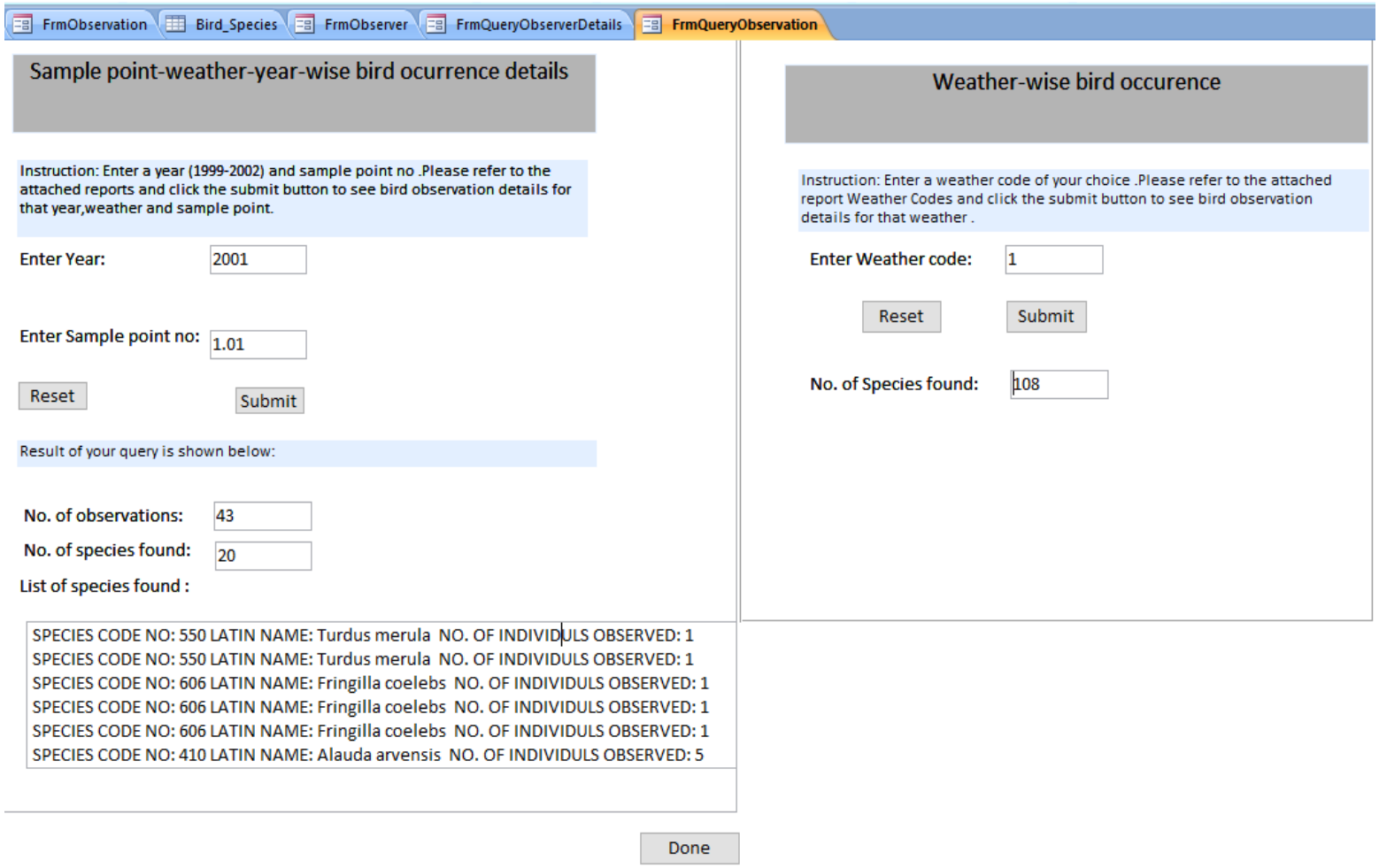
Research Result - Database



Research Result –Application program



Research Result –Application program



Concluding remarks and future scope

- Both the database and application program can be extended for better features.
- The application program is being modified to generate input for statistical analysis.

References

- Database concepts – Navathe 2000
- A Relational Model of Data for large shared database – E F Codd
- “Landscape-related analysis of breeding bird monitoring data in the case study area Quillow”- Friederike Borges

Thank you for your attention

Questions are welcome

Appendix-1

Results:

The result of normalization is shown below:

Table 3: Relations after normalization process

Old Relation [attributes names are inside paranthesis ; Underlined attributes are key (Prime) attributes]	**Functional Dependencies**	**New Relations after decomposition**	**Functional Dependencies**	**Comment**
Bird Species (species_code_no, species_coding_German, species_German, genus_latin, species_latin, genus_species_latin)	species_code_no→ species_coding_German species_code_no→ genus_latin species_code_no→ species_latin species_code_no→ genus_species_latin species_coding_German → species_German	**Bird_Species** (species_code_no, species_coding_German genus_latin, species_latin, genus_species_latin) **Species_Code_German** (species_coding_German, species_German)	**Relation** / **Functional Dependencies** **Bird_Species**: species_code_no→ species_coding_German; species_code_no→ genus_latin; species_code_no→ species_latin; species_code_no→ genus_species_latin **Species_Code_German**: species_coding_German →species_German	All relations are in 3NF now

Appendix-2

Screenshot 6 –Null value handling

```
TxtAddress.SetFocus
If IsNull(rst.Fields(2).Value) Then
TxtAddress.SetFocus
TxtAddress.Text = "Not Available"
ElseIf (Not IsNull(rst.Fields(2).Value)) Then
TxtAddress.SetFocus
TxtAddress.Text = rst.Fields(2)
End If
```

Screenshot 6- Exception handling

```
'the error handler
Error_MayCauseAnError:

    If Err.Number = 3021 Then
       MsgBox ("Sorry! Please enter a valid id for which we have an existing record !")
    ElseIf Err.Number <> 0 Then
       MsgBox ("Some error occured." & "Error number: " & Err.Number & ". Error description: " & Err.Description)
    End If
```

Screenshot 7 – Data insertion into table

```
Private Sub BtnAdd_Click()
'add data to the table
CurrentDb.Execute " INSERT INTO Observer(Observer_id,Observer_name,Address,Contact) " & _
" VALUES(" & CInt(Me.TxtObsvr_Id) & ",'" & Me.TxtObsvr_Name & "','" & Me.TxtObsrvr_Address & "','" & Me.TxtObsrvr_Contact & "')"
```