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**Wildlife Division Database**

**and Research Interface**

A Partnership Project of the Grand Canyon National Park and

Northern Arizona University’s Landsward Institute

Final Report

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# **TABLE OF CONTENTS**

1. Executive Summary 3
2. Project Description 4
3. Methods 4
4. Results 5
5. Project-specific Functional Requirements 5
6. Entity/Relationship Diagrams 9
7. Metadata 23

# **EXECUTIVE SUMMARY**

The primary objective of this project is to provide Grand Canyon National Park (GRCA) with design, programming, and development assistance in order to produce a SQL Server hosted Wildlife Database module, and an intranet web application to facilitate data management, data entry, and reporting of information related to the program at Grand Canyon National Park.

The first phase of this project involved gathering and compilation of the requirements for the database module and web application. Upon consultation of the Wildlife Division Staff as well as review of the wildlife records, it became clear that although intern Abraham Henn had considerable knowledge and experience with the wildlife research and data collection methods, a more extensive knowledge of database design and programming was necessary to realize a formal database schema. This was when Dr Li and her intern team were asked to take over the project at the beginning of the fall semester of 2010.

After meeting with GIS Coordinator Mark Nebel and Wildlife Biologist Tim Bowden, it was decided that the core functional requirements of the system were: searching, editing, and entering data, as well as a cross-project location search component and a file management system. After analyzing the wildlife data records, the software development team agreed that due to the inherent disparities across the project data sets, that the database should be organized as a set of mini-databases separated by project. Effectively, this design approach was adopted in order to provide data querying, entering, and editing functions within specific subprojects, and to provide a separation of concerns across the wildlife project set. It was also agreed that Tim Bowden was to meet with the wildlife project leaders and acquire from each a set of metadata that was to provide a listing of the required, valid, and searchable fields for each of the subprojects in order to generate a set of constraints to guide the development of the web-based application.

It also became clear that although core requirements of the system had been established, many of the lower-level requirements were still unclear. As a result, the software development team decided to adopt an agile development approach, which involved deriving a subset of functional requirements, submitting them to the client for approval, developing the subset of functionality, and then obtaining feedback from the client. It is due to this development approach and the fact that not all of the final datasets have been provided from the client, that the design of the database did not meet the initial timeline. At the time of publication of this report, most of the datasets were provided, and a general convention for designing the database around the aforementioned datasets was established. Documentation for the design of the database that has been realized to this point is provided in section 6 of this report.

Programming of the database and web application falls under the scope of a separate task agreement with Northern Arizona University and will be presented in the final report required under that agreement.

# **PROJECT DESCRIPTION**

The goal of this project was to consult with the Grand Canyon National Park’s Wildlife Division to: 1) locate, compile, catalog and prioritize archival data related to the wildlife program at Grand Canyon National Park; 2) identify common elements across the datasets; and 3) develop a database schema including recommendations for fields, tables and relationships. This task involved collaboration with the NAU database programmer (Dan Li) and her intern team working under a separate but related Task Agreement with the Park. The result of this project is a conceptual design of a web-based user interface for Grand Canyon National Park’s Wildlife Division staff which will be further developed and programmed under a separate agreement.

# **methods**

**3.1 Phase 1 – Initial requirements analysis**

The project team consulted with Wildlife Division staff to obtain the requirements and functions of the database, reviewed existing wildlife datasets and files and made recommendations regarding possible database relationships. This was the basis for programming of the final application.

Mid-project, it became clear that although the initial intern had a thorough understanding of natural resources and wildlife research and data along with a conceptual understanding of databases, more in-depth knowledge of database structure was needed to successfully produce recommendation for the database schema. At this point, the computer science interns hired for the follow-on programming phase of this project were brought in to assist in development of the schema. The initial intern oriented two computer science interns in summer 2010 to continue the project and remained available on an as-needed basis for facilitation and consultation. A third intern joined the team in spring 2011 to complete the project.

**3.2 Phase 2 – Functional requirements analysis**

During this phase, the computer science interns met with Tim Bowden and Mark Nebel to further reify the functional requirements associated with the programming of the database and web-based application. The Wildlife Division staff provided the software development team with a CD containing the data around which the database and web application was to be programmed. This enabled the software development team to do a thorough analysis of the data and to make recommendations for the design of the database and the web application.

Due to the fact that the functional requirements of the project were not clear to either team, it was decided by the software team that an agile development approach was to be adopted. This kind of development process is characterized by gathering requirements specific to a given part of the project, developing the associated functionality, and then submitting it to the client in order to obtain valuable feedback. The software development team also organized several meetings amongst team members to delegate development tasks. It was decided that Jeff Burk would be responsible for the web development, and Owain Moss would handle the design and programming of the database.

# **results**

**4.1 Phase 1 – Initial requirements analysis**

In the first months of the project, the initial intern was able to meet once with all of the wildlife staff and twice with the designated wildlife staff representative. Following these meetings, the intern created a short document outlining some general requirements and functions for the database application.

**4.2 Phase 2 – Functional requirements analysis**

After meeting with Tim Bowden and Mark Nebel, it was decided that the core functionality of the database module and web application was to be centered on searching, editing, and entering data, as well as a cross-project location search component and a file management system. It was proposed that the file management system was to facilitate organization of compliance files, permits, consultation and proposal documents, as well as general reports, GIS files, and safety documents. As far as the subset of functionality associated with wildlife project data, it was further decided that this functionality of the database module and web-based application was going to be organized according to specific projects instead of in a cross-project manner. This was due to the inherent disparities across the wildlife data. A detailed listing of general project requirements is provided in section 5.

Tim Bowden agreed to meet with the project leaders in order to obtain a set of metadata for each subproject, which would effectively provide a listing of the required/searchable fields in addition to valid entries for each data set. This metadata was provided for the Mexican spotted owl, Northern goshawk, California condor, point counts, Southwestern willow flycatcher, Brown-headed cowbird, puma, and Bighorn sheep projects. A listing of this metadata is provided in section 7 of this report.

**5. PROJECT-SPECIFIC FUNCTIONAL REQUIREMENTS**

For each project component, a set of functional requirements was realized that outlined in detail the specific functionality that was to be provided by the software development team. Each project was separated into two categories of data and files – long term monitoring and past projects. A general listing of these functional requirements is provided below.

**5.1 Long term monitoring**

5.1.1 User:

5.1.1.1 User will be able to login to the user interface with username and password

5.1.1.2 User will be able to select the project type and then the specific subproject from a list of   
 species

5.1.1.3 User will be able to select “Long Term Monitoring”

5.1.1.4 User will be able to choose to upload a file

2.1.1.4.1 User will be able to designate the specific kind of file to upload (e.g. Long Term

Monitoring/Inventory or Long Term Monitoring/MSO\_Compliance

5.1.1.4.2 User will be able to specify the file extension of the file to be uploaded

(This assures valid user input)

5.1.1.4.3 User will be able to see a list of files in the current directory before and after

uploading (These files should be listed as hyperlinks so the user can download)

5.1.1.4.4 User will be required to enter metadata for the file such as author and keywords

5.1.1.5 User will be able to choose to download a file

5.1.1.5.1 User will be able to specify what kind of file to download (e.g. Long Term

Monitoring/Inventory or Long Term Monitoring/Inventory/MSO\_Compliance)

5.1.1.5.2 User will be able to view all files in the user specified directory/table

5.1.1.5.3 User will be able to select the file to download by clicking on it

5.1.1.6 User will be able to choose to delete a file

5.1.1.6.1 User will be able to specify what kind of file to delete (e.g. Long Term

Monitoring/Inventory or Long Term Monitoring/Inventory/MSO\_Compliance)

5.1.1.6.2 User will be able to view a list of files in the user specified directory/table

5.1.1.6.3 User will be able to select the file to download from aforementioned list

5.1.1.6.4 User must confirm their choice of file to delete

5.1.1.7 User will be able to edit an existing file

5.1.1.7.1 User will be able to download the file they want to edit (see 1.1.5) so they can make

the necessary changes

5.1.1.7.2 User will be able to specify what kind of file to upload (e.g. Long Term

Monitoring/Inventory or Long Term Monitoring/Inventory/MSO\_Compliance)

5.1.1.7.3 User will be able to specify the file extension of the file to be uploaded (This

assures valid user input)

5.1.1.7.4 The system will check whether the file to be uploaded is a replacement of an

existing file

5.1.1.7.5 The system will notify the user that the file to be uploaded will replace an existing

file

5.1.1.7.6 User will be required to enter metadata for the file such as author, keywords, title,

date, and last person to modify

5.1.1.7.7 The system will keep a history of changes

5.1.1.8 User will be able to choose to search for files

5.1.1.8.1 User will be able to specify what type of file to search for (e.g. Long Term

Monitoring/Inventory Compliance) and then view a list of files of the specified

type

5.1.1.8.2 User will also be able to specify search criteria such as author or keywords and

view a listing of files that fit the search criteria

5.1.1.9 User will be able to choose to view data entries from data menu

2.1.1.9.1 User will be able to specify the type of results to view from a list

5.1.1.9.2 User will be able to search data collection results by all related fields

5.1.1.9.3 User will be able to specify a range of coordinates and search data entries that fall   
 within the user specified range

5.1.1.10 User will be able to choose to enter data from data menu

2.1.1.10.1 User will be able to specify the type of data to enter from a list

5.1.1.10.2 User will be presented with a form for data entry

5.1.1.10.3 User will be able to choose to “Enter Data” once they have filled out the form

5.1.1.10.4 User will be able to view the new data set upon entry

5.1.1.11 User will be able to choose to edit an existing data entry

5.1.1.11.1 User will be able to view relevant data entries

5.1.1.11.2 User will be able to choose to edit the an existing data entry by clicking on an edit   
 link

5.1.1.11.3 User will be presented with a form for data modification

5.1.1.11.4 User will be able to save the modified data entry

5.1.1.11.5 User will be able to view the modified data entry

5.1.1.11.6 User will be able to delete an existing data entry by clicking on a delete link

**5.2 Past Projects:**

5.2.1 User

5.2.1.1 Once on the Project page, the user will be able to select “Past Projects” from a list of choices

5.2.1.2 User will be able to choose to upload a file

5.2.1.2.1 User will be able to designate the specific kind of file to upload (e.g. Past

Projects/Habitat\_Definitions/Critical\_Habitat)

5.2.1.2.2 User will be able to specify the file extension of the file to be uploaded (This

assures valid user input)

5.2.1.2.3 User will be able to see a list of files in the current directory before and after

uploading (These files should be listed as hyperlinks so the user can download)

5.2.1.2.4 User will be required to enter metadata for the file such as author and keywords

5.2.1.3 User will be able to choose to download a file

5.2.1.3.1 User will be able to specify what kind of file to download (e.g. Past

Projects/Habitat\_Definitions/Critical\_Habitat)

5.2.1.3.2 User will be able to view all files in the user specified directory/table

5.2.1.3.3 User will be able to select the file to download by clicking on it

5.2.1.4 User will be able to choose to delete a file

5.2.1.4.1 User will be able to specify what kind of file to delete (e.g. Past

Projects/Habitat\_Definitions/Critical\_Habitat)

5.2.1.4.2 User will be able to view a list of files in the user specified directory/table

5.2.1.4.3 User will be able to select the file to download from aforementioned list

5.2.1.4.4 User must confirm their choice of file to delete

5.2.1.5 User will be able to edit an existing file

5.2.1.5.1 User will be able to download the file they want to edit so they can make   
 the necessary changes

5.2.1.5.2 User will be able to specify what kind of file to upload (e.g. Past

Projects/Habitat\_Definitions/Critical\_Habitat)

5.2.1.5.3 User will be able to specify the file extension of the file to be uploaded (This

assures valid user input)

5.2.1.5.4 The system will check whether the file to be uploaded is a replacement of an

existing file

5.2.1.5.5 The system will notify the user that the file to be uploaded will replace an existing

file

5.2.1.5.6 User will be required to enter metadata for the file such as author, keywords, title,   
 date, and last person to modify

5.2.1.5.7 The system will keep a history of changes

5.2.1.6 User will be able to choose to search for files

5.2.1.6.1 User will be able to specify what type of file to search for (e.g. Past

Projects/Habitat\_Definitions/Critical\_Habitat) and then view a list of files of the

specified type

5.2.1.6.2 User will also be able to specify search criteria such as author or keywords and

view a listing of files that fit the search criteria

5.2.1.7 User will be able to choose to add a directory to the current existing structure

5.2.1.7.1 User will be able to specify the location of the new directory

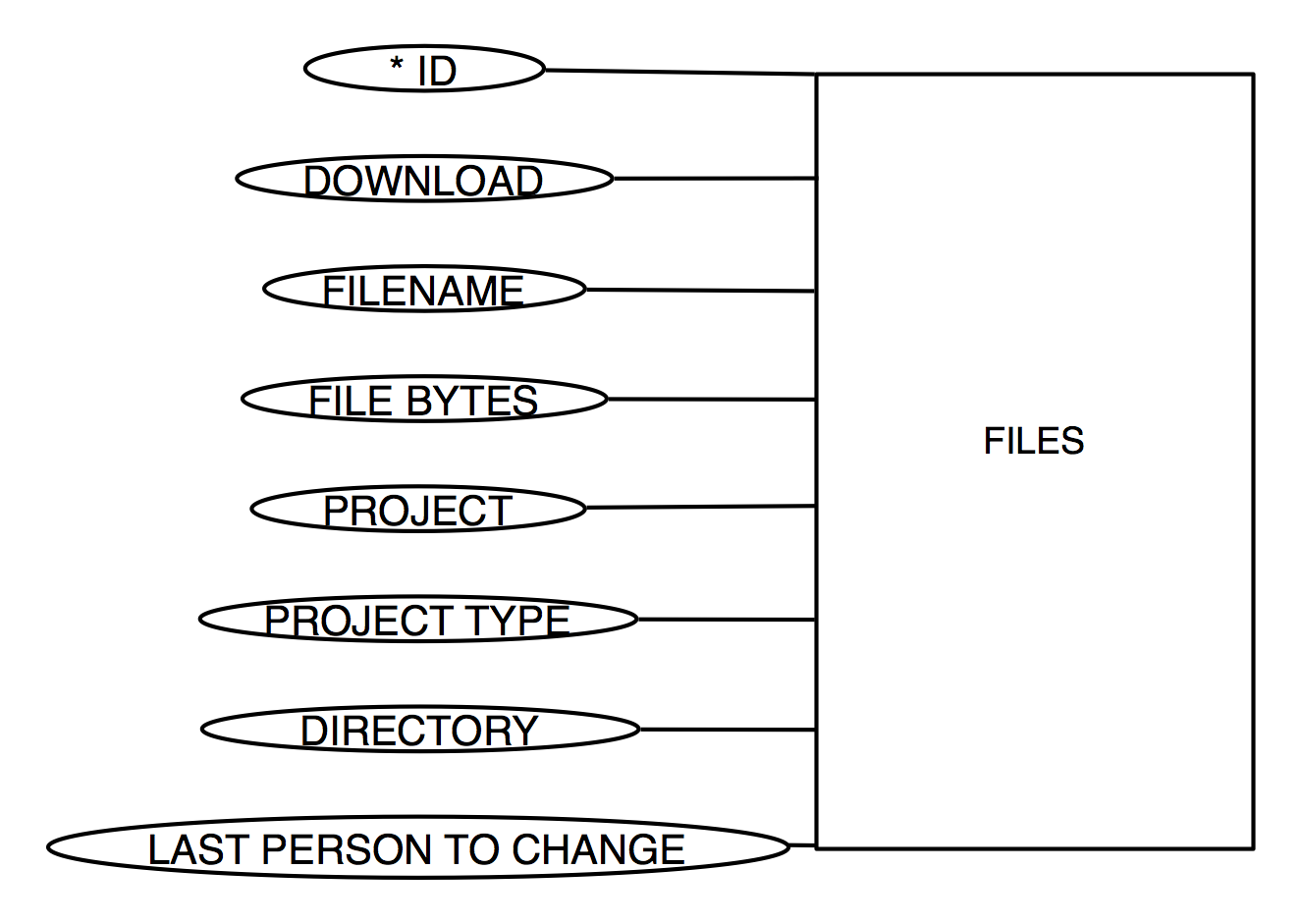
5.2.1.7.2 User will be able to view the new directory and add and remove contents within the

directory

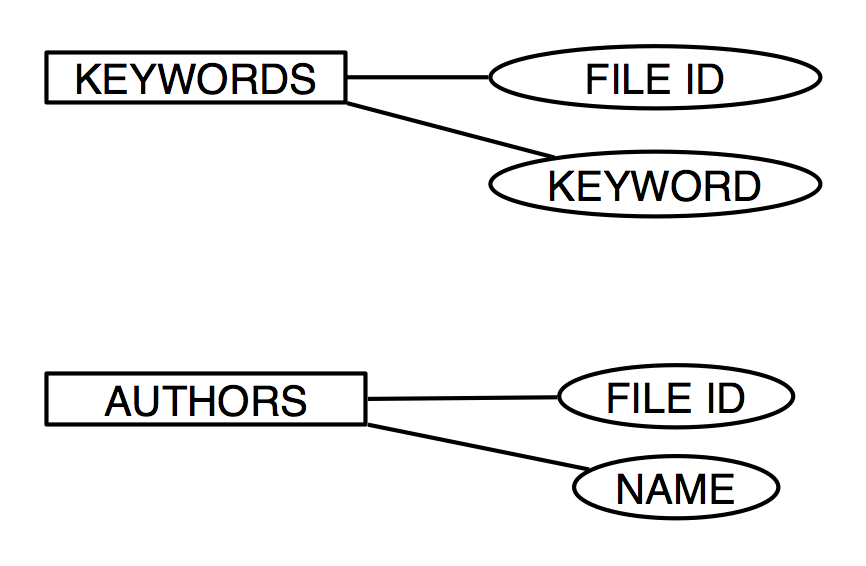
**6. ENTITY/RELATIONSHIP DIAGRAMS**

In order to realize and document an architectural design for the database module, a set of entity-relationship diagrams were created. These diagrams reveal the tables in the database and the fields associated with each. The majority of these E/R diagrams is listed according to project name and subproject designation. Any general tables are listed according to their general designation.

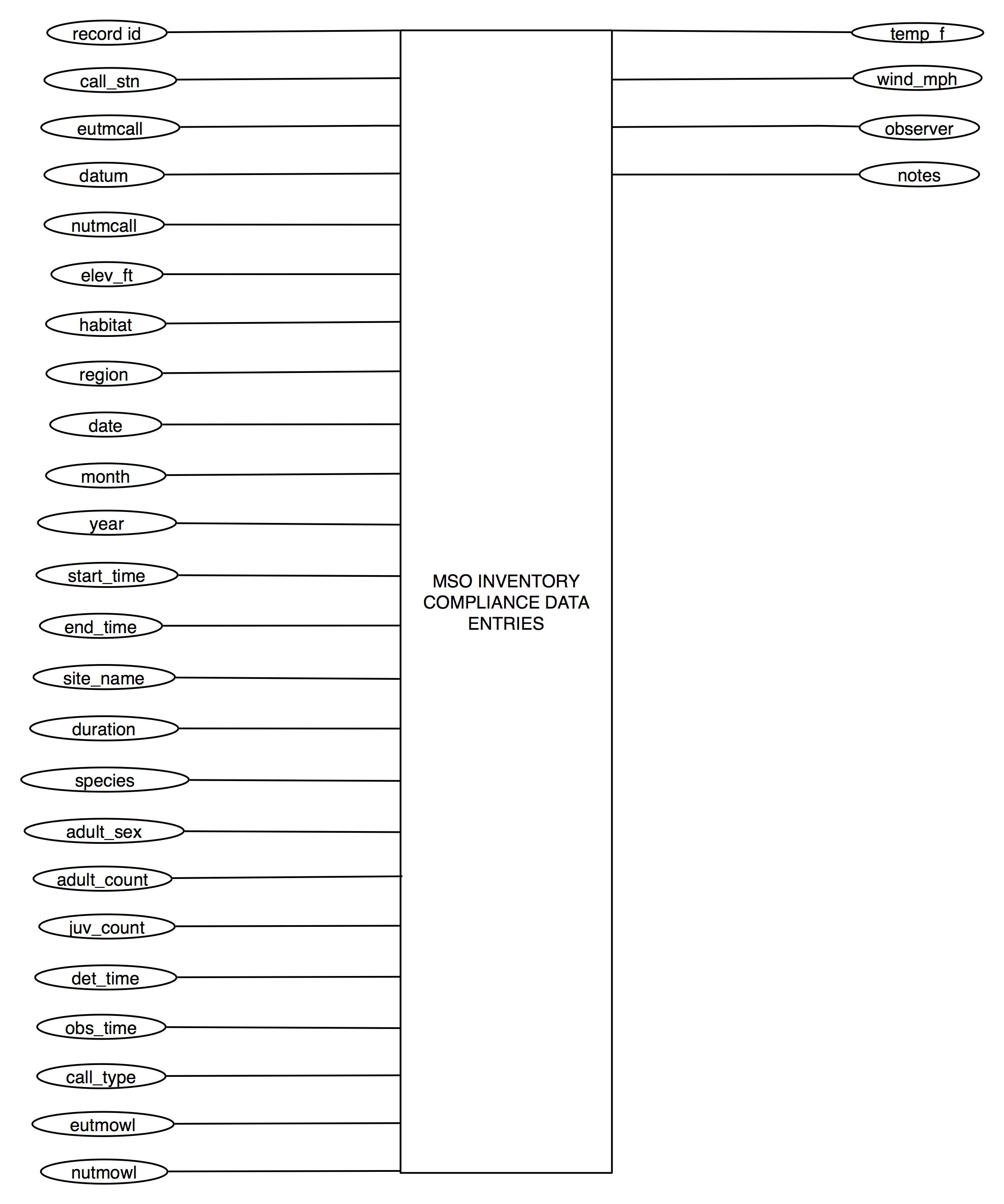
6.1 Files



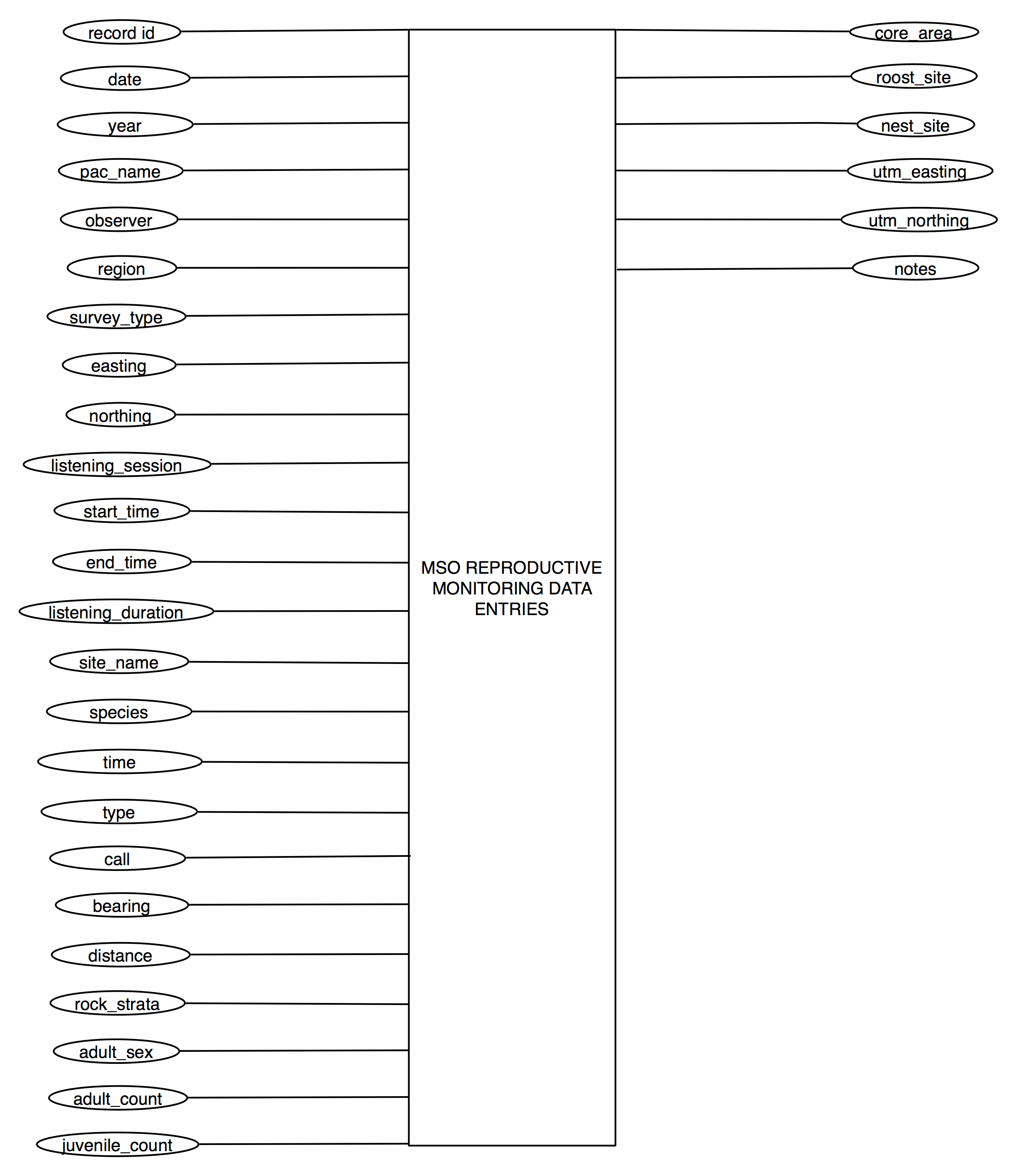
6.2 Authors and Keywords



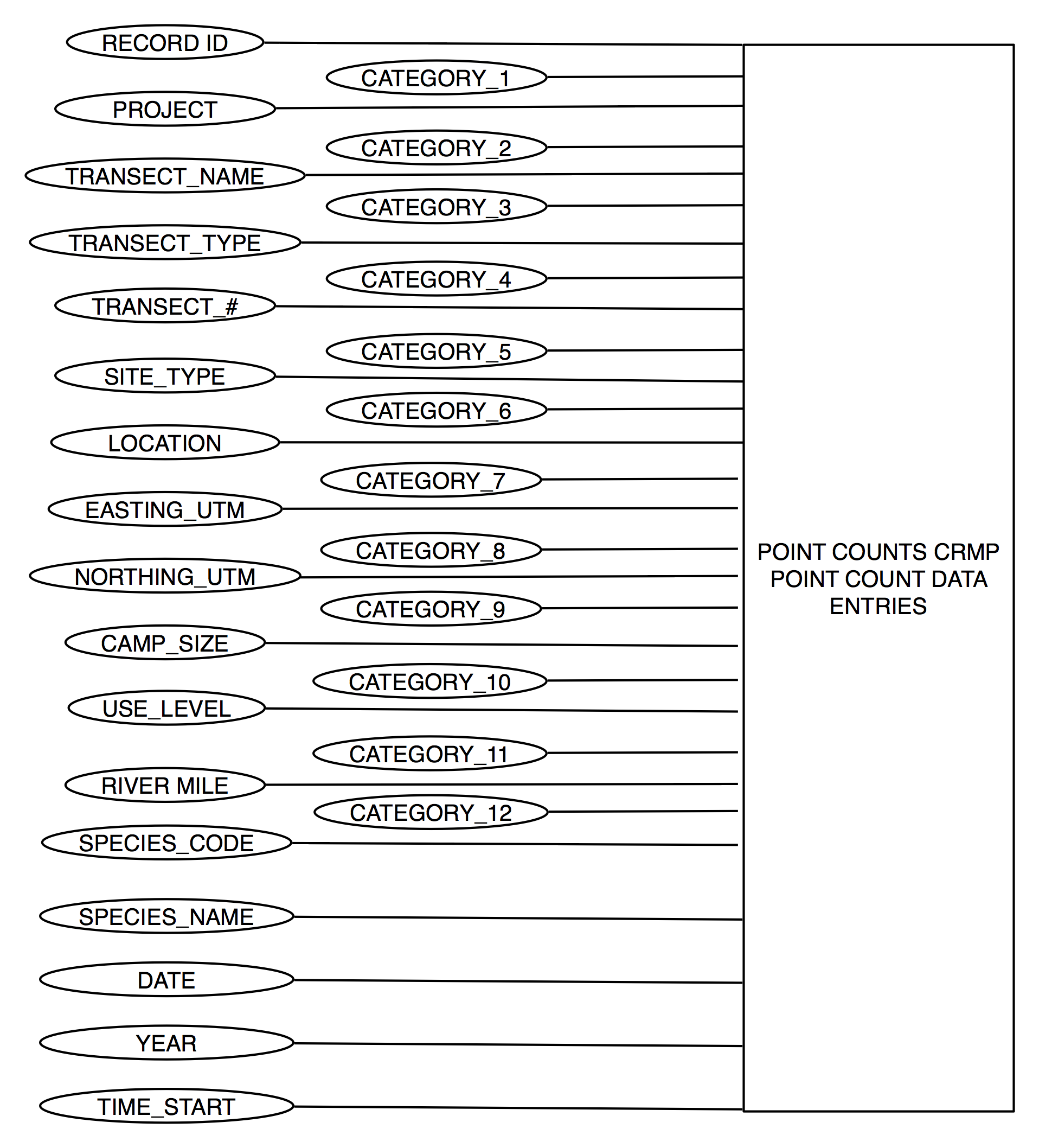
6.3.1 MSO – Long Term Monitoring/Inventory Compliance



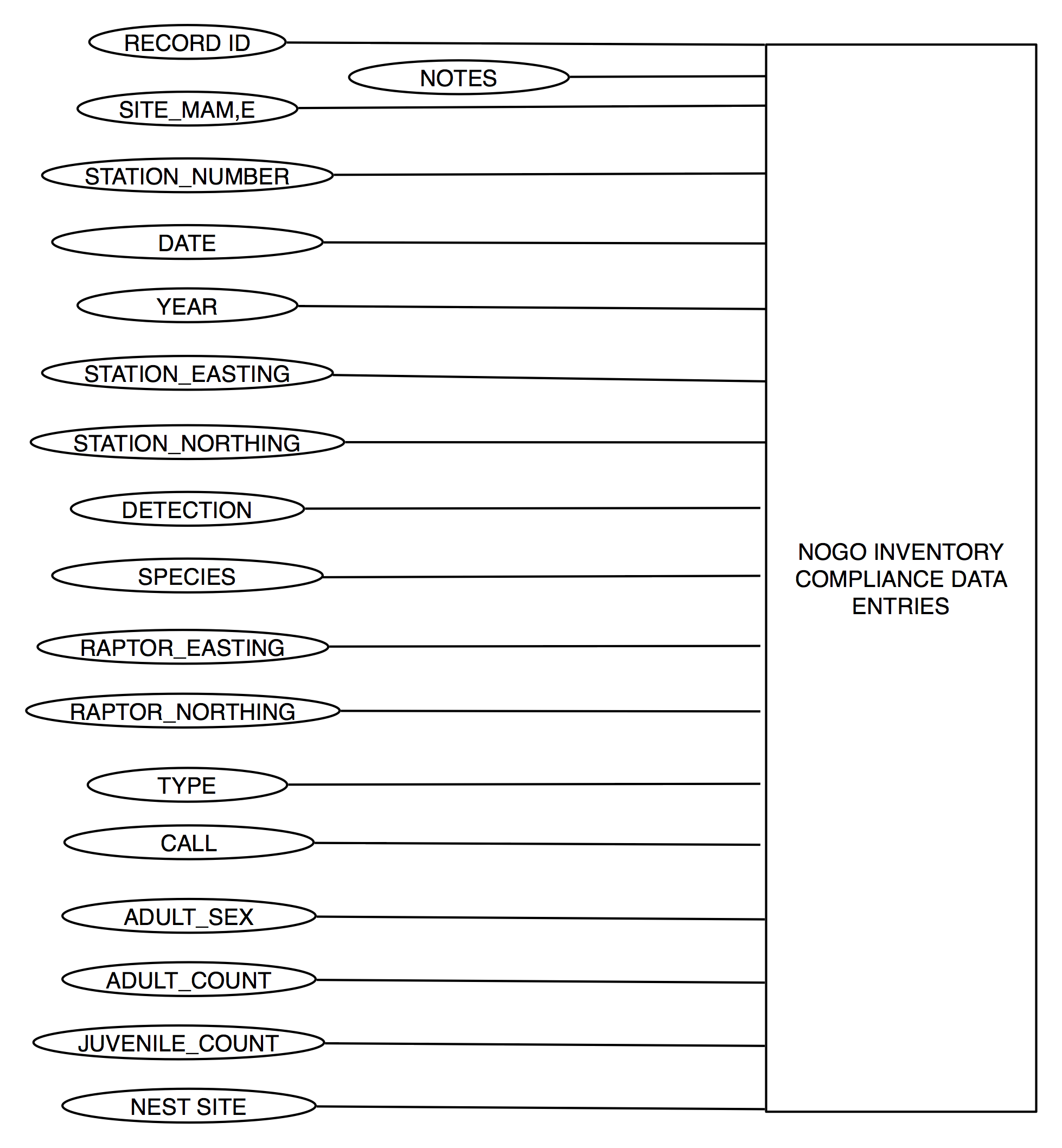
6.3.2 MSO – Long Term Monitoring/Reproductive Monitoring



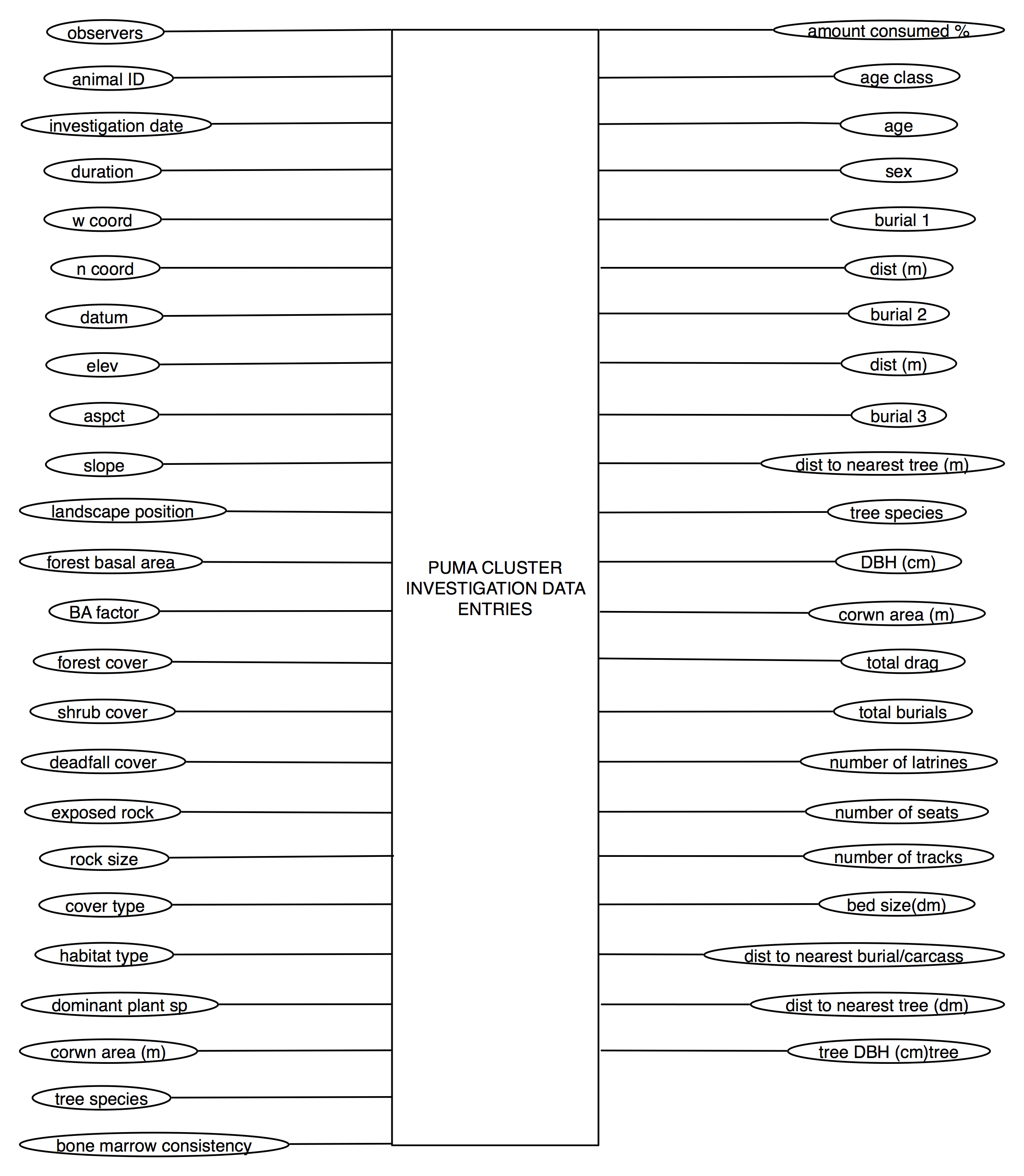
6.4.1 Point Counts – Long Term Monitoring/CRMP Point Count



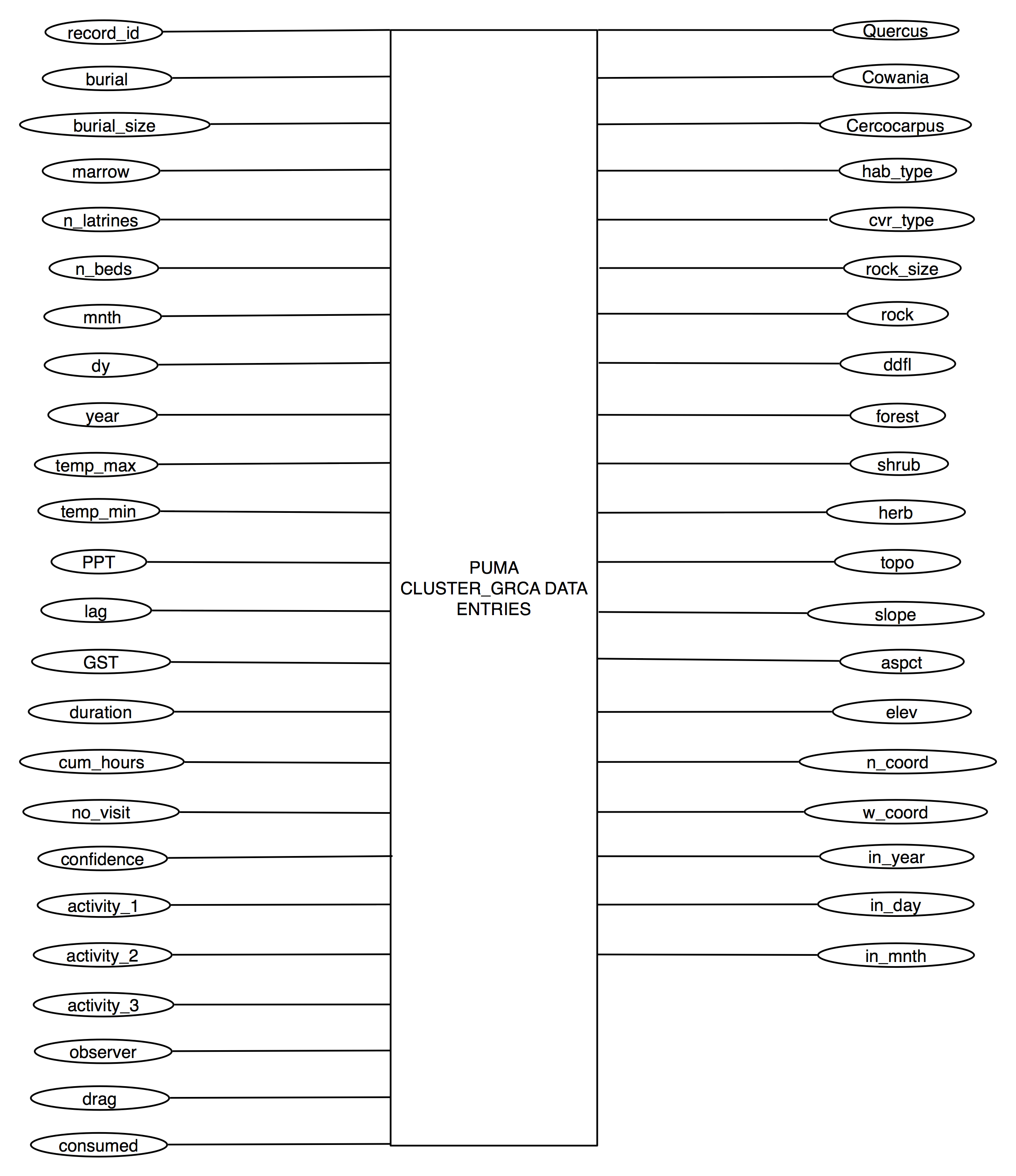
6.5.1 Northern Goshawk – Long Term Monitoring/Inventory Compliance



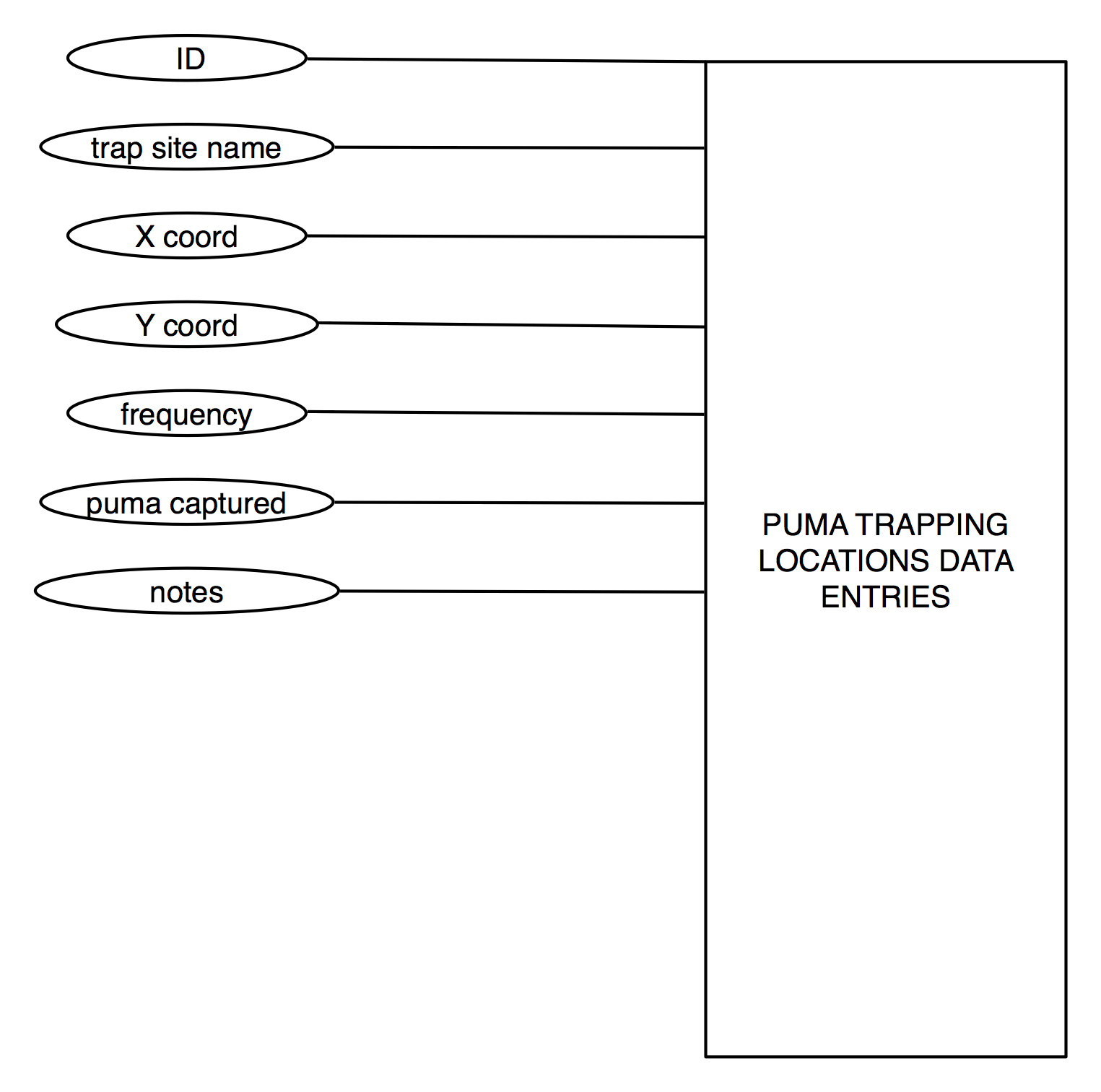
6.6.1 Puma – Long Term Monitoring/Cluster Investigation



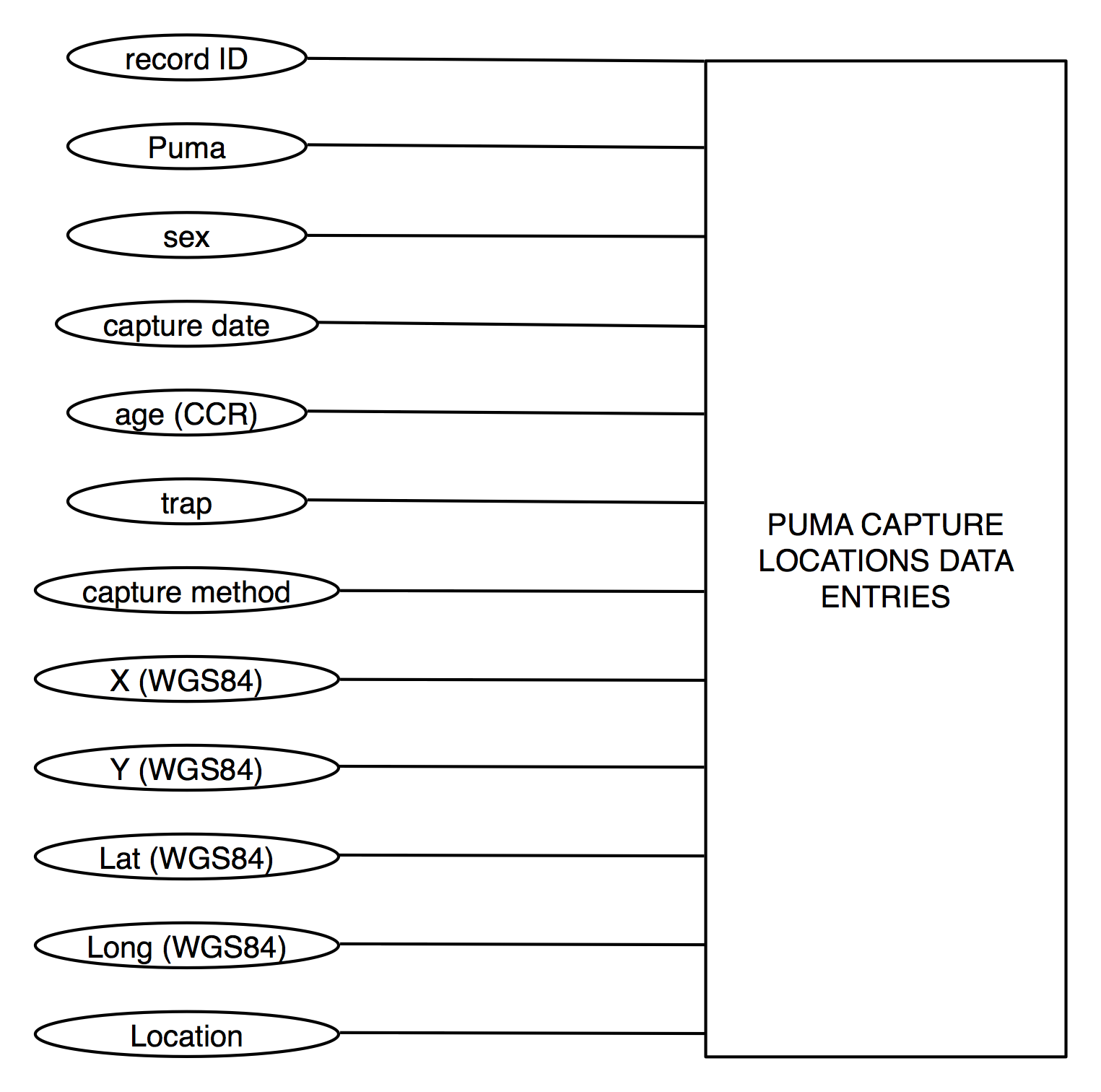
6.6.2 Puma – Long Term Monitoring/Clusters GRCA



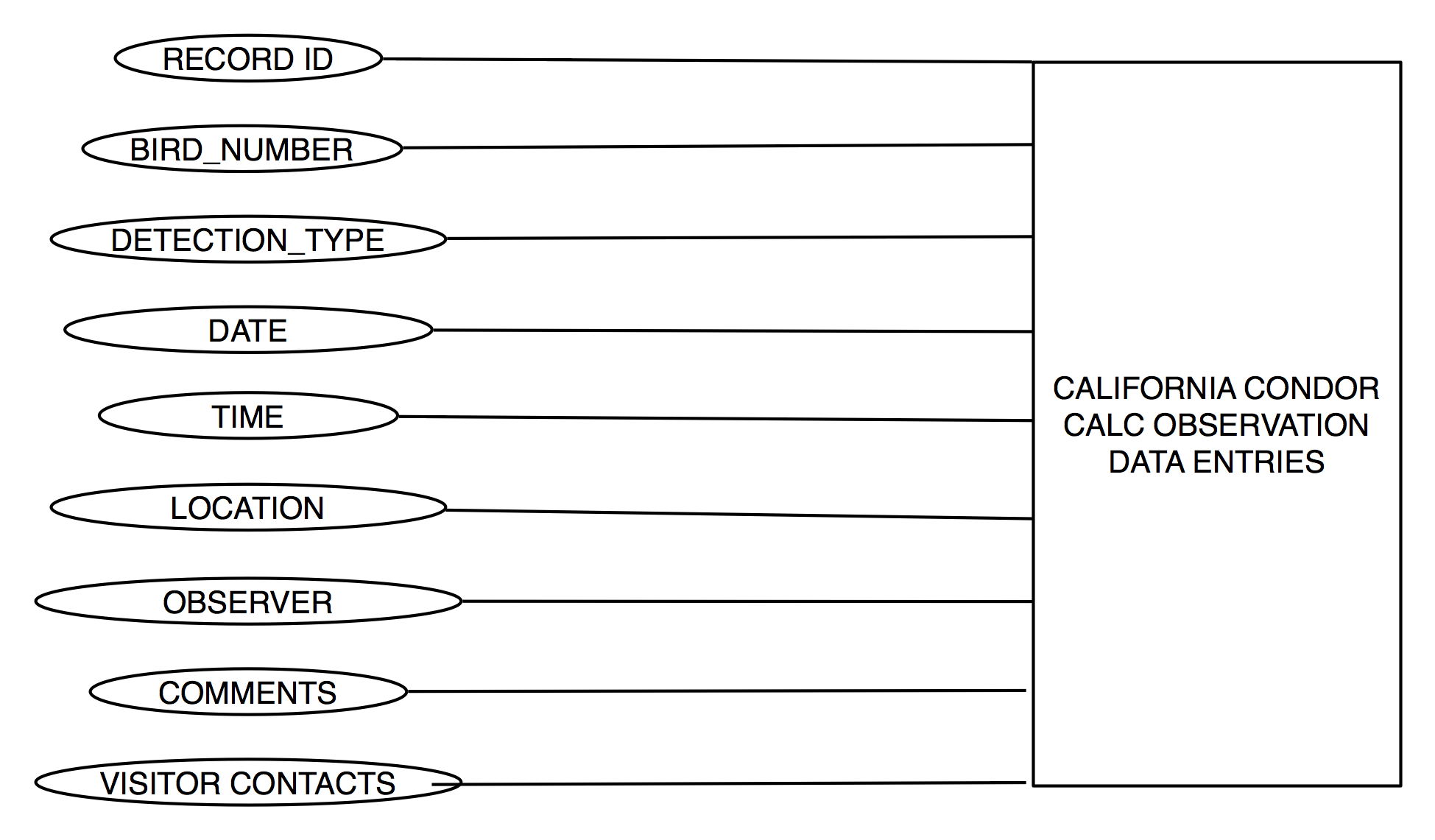
6.6.3 Puma – Long Term Monitoring/Trapping Locations



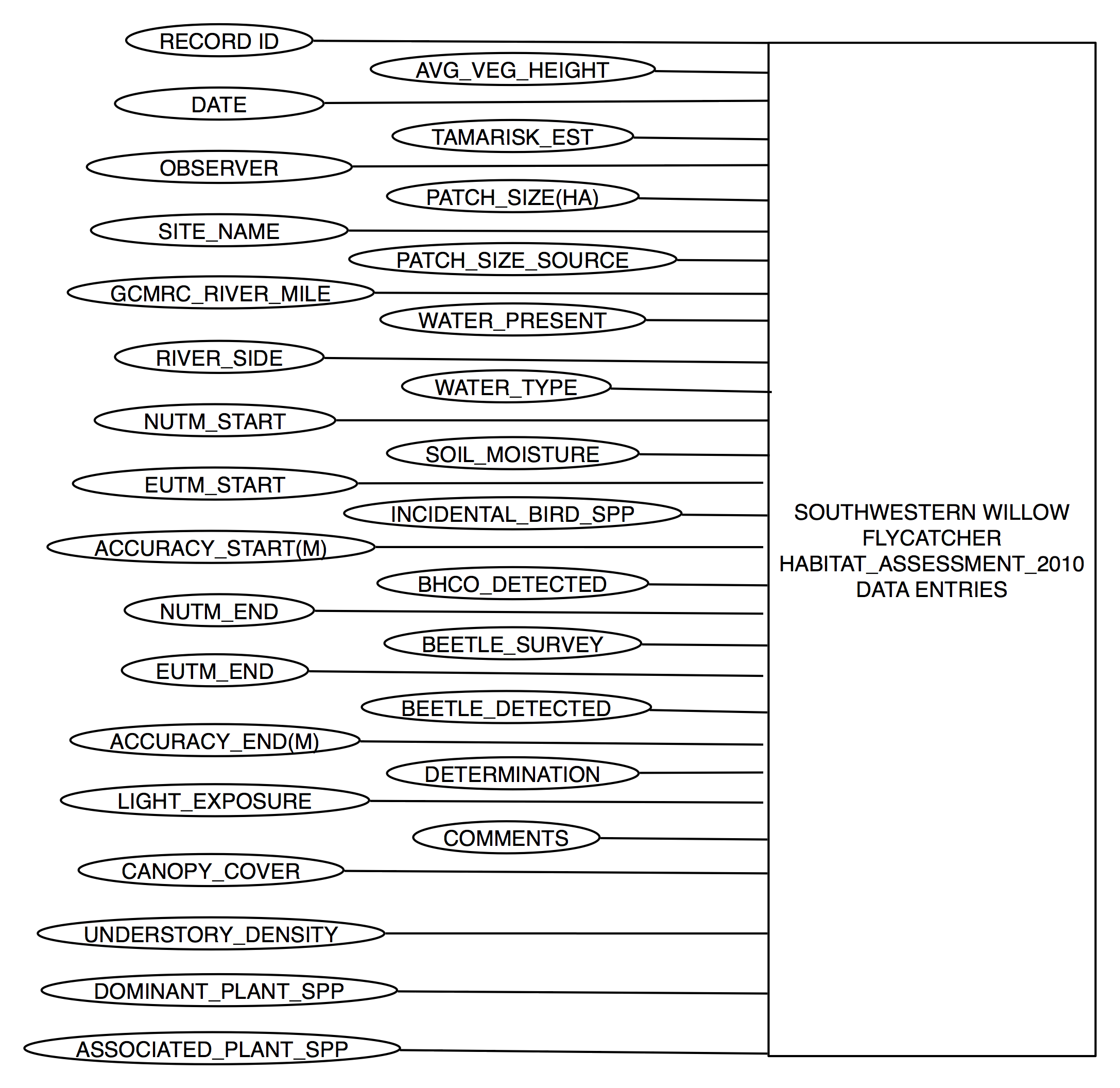
6.6.4 Puma – Long Term Monitoring/Capture Locations



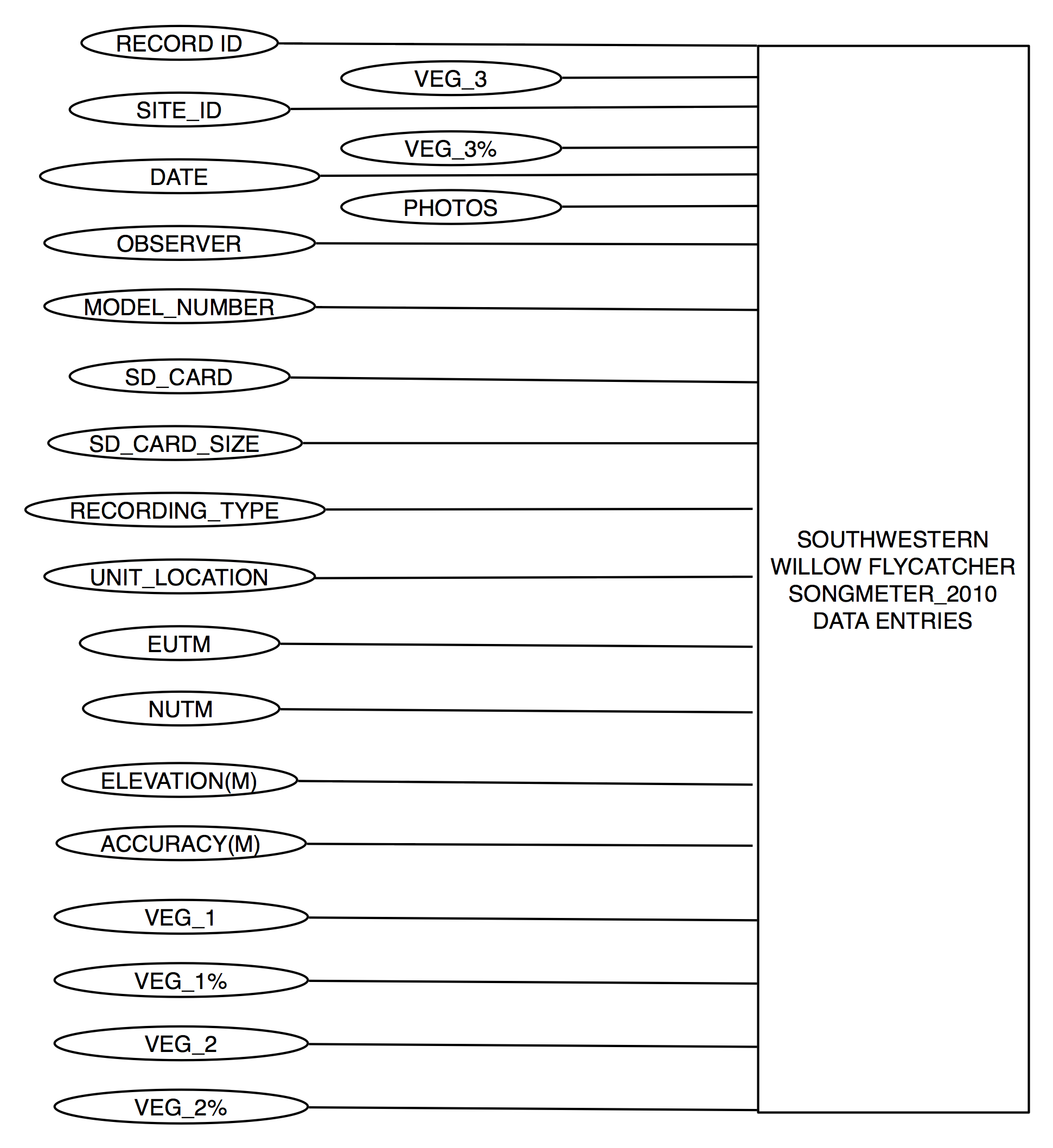
6.7.1 California Condor – Long Term Monitoring/Calc Observation



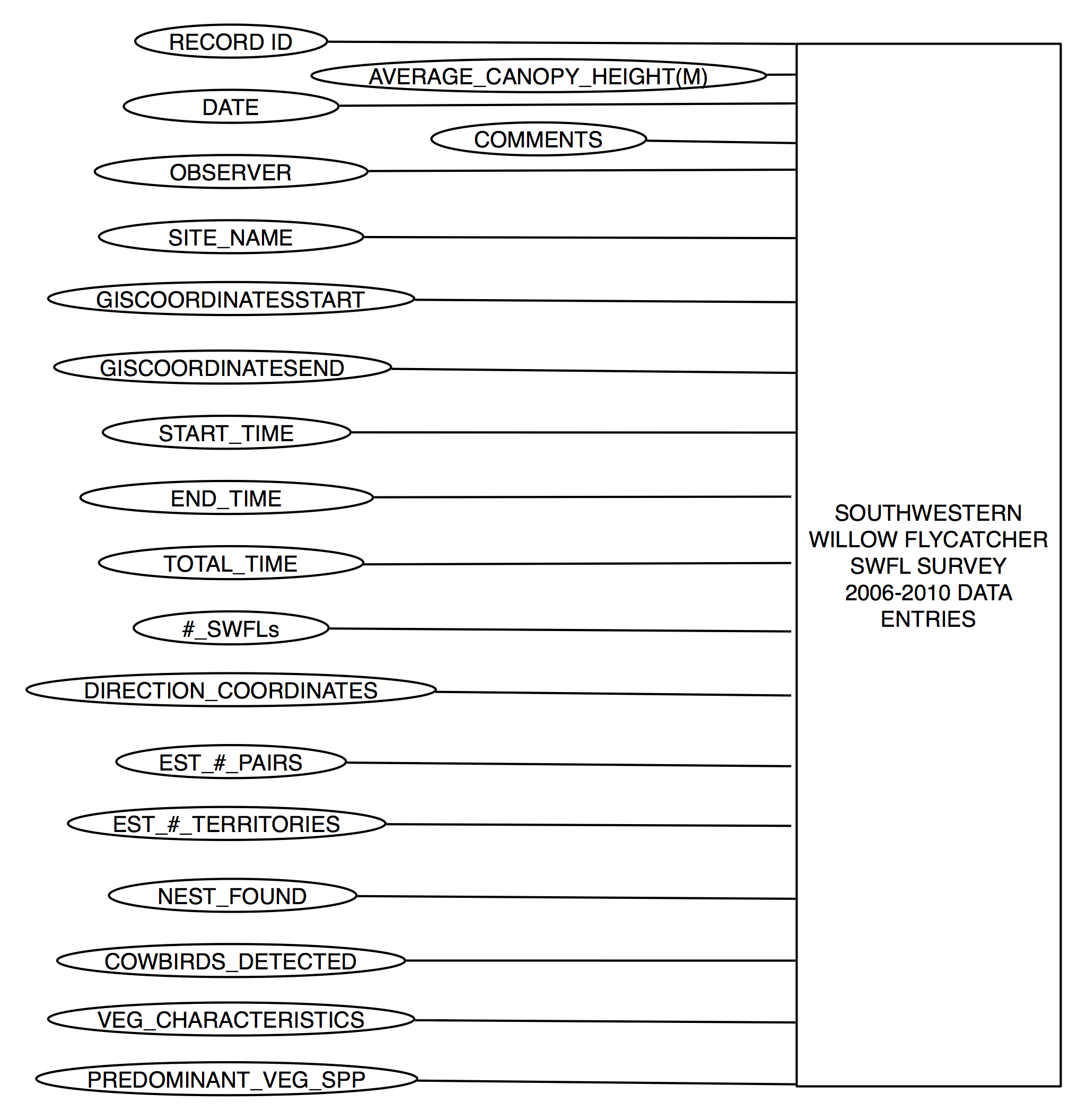
6.8.1 Southwestern Willow Flycatcher – Long Term Monitoring/Habitat Assessment



6.8.2 Southwestern Willow Flycatcher – Long Term Monitoring/Songmeter 2010



6.8.3 Southwestern Willow Flycatcher – Long Term Monitoring/SWFL Survey 2006-2010



**7. METADATA**

Metadata was provided by Tim Bowden for each subproject that provides a listing of all required and searchable fields, as well as the constraints for valid entries. Listed below are these metadata files, which are listed according to project and the given subproject.

7.1 Mexican Spotted Owl Metadata

|  |  |  |  |
| --- | --- | --- | --- |
| ***Updated\_MSO\_Database\_2007.mdb*** | | | ***MSO\_Inv&Comp\_Data\_Form.xls*** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| SITE\_NAME | Y | Text | Dynamic DDM or create new site |
| CALL\_STN | N | Integer: 1:999 | DDM\*: user input or NA=999 |
| REGION | Y | Text | DDM: PLATEAU, RIM, or CANYON |
| DATUM | N | Text | DDM: 12 S NAD83 |
| EUTMCALL | Y | Integer: 6 digits | User input; must = 6 digits |
| NUTMCALL | Y | Integer: 7 digits | User input; must = 7 digits |
| ELEV\_FT | N | Integer: 1:10,000 | User input |
| HABITAT | Y | Text | DDM: DS, PJ, PP, MC, or SF |
| DATE | Y | Date: mm/dd/yyyy | User input |
| MONTH | Y | Text | DDM: January – December |
| YEAR | Y | Integer: 4 digits | User input |
| START\_TIME | N | Time: hh:mm | User input |
| END\_TIME | N | Time: hh:mm | User input |
| DURATION | N | Time: hh:mm | Auto Calculation = END\_TIME – START \_TIME |
| SPECIES | Y | Text: 4 letters | DDM: STOC, BUVI, GLGN, AEAC, OTFL, ASOT, ASFL |
| ADULT\_SEX | N | Text | DDM: M, F, MF, MFM, or User input |
| ADULT\_COUNT | N | Integer: 0:9 | User input |
| JUV\_COUNT | N | Integer: 0:9 | User input |
| DET\_TIME | N | Time: hh:mm | User input |
| OBS\_TYPE | Y | Text | DDM: H, V, or B |
| CALL\_TYPE | Y | Text | DDM: T, C, B, PD, J |
| EUTMOWL | Y | Integer: 6 digits | User input; must = 6 digits |
| NUTMOWL | Y | Integer: 7 digits | User input; must = 7 digits |
| TEMP\_F | N | Integer | User input |
| WIND\_MPH | N | Integer | User input |
| OBSERVER | N | Text | User input |
| NOTES | N | Text | User input |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ***MSO\_Reproductive\_Monitoring\_Table.xls*** | | | ***MSO\_Reproductive\_Monitoring\_Form.xls*** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| DATE | Y | Date: mm/dd/yyyy | User input |
| YEAR | Y | Date: yyyy | User input |
| PAC NAME | Y | Text | Dynamic DDM: See PAC\_Name\_List  or Create New |
| OBSERVER | N | Text | User input |
| REGION | Y | Text | DDM: Rim, Canyon |
| SURVEY\_TYPE | Y | Text | DDM: Core Visit, Dish |
| EASTING | Y | Integer 6 digits | User input, must = 6 digits |
| NORTHING | Y | Integer 7 digits | User input, must = 7 digits |
| LISTENING SESSION | Y | Text | DDM: Dusk, Midnight, Dawn |
| START\_TIME | Y | hh:mm | User input |
| END\_TIME | Y | hh:mm | User input |
| LISTENING\_DURATION | Y | hh:mm | User input |
| SPECIES | Y | Text: 4 Letters | DDM: STOC, BUVI, GLGN, AEAC, OTFL, ASOT, ASFL, WIND |
| TIME | Y | hh:mm | User input |
| TYPE | Y | Text | DDM: Heard only, Visual only, Both |
| CALL | Y | Text: | DDM: T, C, B, PD, J |
| BEARING | N | Integer: 0:364 | User input |
| DISTANCE | N | Integer: 1:3000 | User input |
| ROCK\_STRATA | Y | Text | DDM: MUAV,MUAV/REDWALL, REDWALL, SUPAI, HERMIT, COCONINO, TOROWEAP, KAIBAB |
| ADULT\_SEX | Y | Text | DDM: M, F, MF, Unknown, User Input |
| ADULT\_COUNT | Y | Integer: 1:9 | User input |
| JUVENILE\_COUNT | Y | Integer: 0:9 | User input |
| CORE AREA | Y | Text | DDM: Y, N, U |
| ROOST SITE | Y | Text | DDM: Y, N, U |
| NEST SITE | Y | Text | DDM: Y, N, U |
| UTM\_EASTING | Y | Integer: 6 Digits | User input, must = 6 digits |
| UTM\_NORTHING | Y | Integer: 7 Digits | User input, must = 7 digits |
| NOTES | N | Text | User input |
|  |  |  |  |

7.2 Point Count Metadata

|  |  |  |  |
| --- | --- | --- | --- |
| ***CRMP\_Point\_Count\_Data*** | | | ***CRMP\_Point\_Count\_Form.xls*** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| PROJECT | Y | Text | DDM: CRMP |
| TRANSECT\_NAME | Y | Text | DDM: See list of Names |
| TRANSECT\_TYPE | Y | Text | DDM: E, F, G, H |
| TRANSECT\_# | Y | Integer: 1:2 | DDM: 1, 2 |
| SITE\_TYPE | Y | Text | DDM: Camp, Control |
| LOCATION | Y | Text | DDM: NHWZ, OHWZ |
| EASTING\_UTM | Y | Integer: 6 Digits | User Input: 6 Digits |
| NORTHING\_UTM | Y | Integer: 7 Digits | User Input: 7 Digits |
| CAMP\_SIZE | Y | Text | DDM: S, M, L |
| USE\_LEVEL | Y | Text | DDM: L, M, H, NA |
| RIVER MILE | Y | Integer: 1.0 : 300.0 | User Input |
| SPECIES\_CODE | Y | Text | DDM: See list of Codes |
| SPECIES\_NAME | Y | Text | DDM: See list of Names |
| CATEGORY\_1 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_2 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_3 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_4 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_5 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_6 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_7 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_8 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_9 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_10 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_11 | Y | Integer:0:100 | DDM: 1:100 |
| CATEGORY\_12 | Y | Integer:0:100 | DDM: 1:100 |
| DATE | Y | Date: mm/dd/yyyy | User Input: mm/dd/yyyy |
| YEAR | Y | Integer: 4 Digits | User Input |
| TIME\_START | Y | Time: hh:mm | User Input: hh:mm |
|  |  |  |  |

7.3 Northern Goshawk Metadata

|  |  |  |  |
| --- | --- | --- | --- |
| ***Goshawk\_Survey\_Table.xls*** | | | ***Goshawk\_Survey\_Form.xls*** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| SITE\_NAME | Y | Text | DDM: Populate from: Unit\_Name\_List.xls or Create New |
| STATION\_NUMBER | Y | Interger: 1:200 | User Input |
| DATE | Y | Date: mm/dd/yyyy | User input |
| YEAR | Y | Date: yyyy | User input |
| TIME | Y | hh:mm | User input |
| STATION\_EASTING | Y | Integer 6 digits | User input, must = 6 digits |
| STATION\_NORTHING | Y | Integer 7 digits | User input, must = 7 digits |
| DETECTION | Y | Text | DDM: Y,N |
| SPECEIS | Y | Text: 4 Letters | DDM: ACGE, ACCO, ACST, BUJA, FAPE |
| RAPTOR\_EASTING | Y | Integer 6 digits | User input, must = 6 digits |
| RAPTOR\_NORTHING | Y | Integer 7 digits | User input, must = 7 digits |
| TYPE | Y | Text | DDM: Heard only, Visual only, Both |
| CALL | Y | Text: | DDM: A, W, BE, BE/A, NA |
| ADULT\_SEX | Y | Text | DDM: M, F, P, U, NA |
| ADULT\_COUNT | Y | Integer: 0:9 | User input |
| JUVENILE\_COUNT | Y | Integer: 0:9 | User input |
| NEST SITE | Y | Text | DDM: Y, N |
| NOTES | N | Text | User input |
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7.4 Puma Metadata

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| --- | --- | --- | --- |
| ***Cluster Investigation\_Form.xls*** | | | |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| observers | Y | Text: | User input |
| animal ID | Y | Text, Integer: 2 | User input |
| investigation date | Y | Integer: 6 | User input |
| duration | Y | Integer: 1:3 | User input |
| w coord (utm) | Y | Integer: 7 | User input |
| n coord (utm) | Y | Integer: 6 | User input |
| datum | Y | Text | User input |
| elev | Y | Integer: 1:4 | User input |
| aspct | Y | Integer: 3 | User input |
| slope | Y | Integer: 3 | User input |
| landscape position | Y | Text | DDM: BNCH, BTM, FLAT, LS, MS, US, RDG |
| forest basal area | Y | Integer: 1:2 | User input |
| BA factor | Y | Integer: 2 | DDM: 5,10,20,40 |
| forest cover | N | Integer: 3 | User input |
| shrub cover | Y | Integer: 3 | User input |
| deadfall cover | Y | Integer: 3 | DDM: M, F, MF, Unknown, User Input |
| exposed rock | Y | Integer: 3 | User input |
| rock size | Y | Text | DDM: G, C, SB, MB, LB |
| cover type | Y | Text | DDM: DF, DW, F, W, FW, G, OF, OW, S |
| habitat type | Y | Text, Integer: 2 | User input |
| dominant plant sp | Y | Text: 4 | User input |
| species | Y | Text | User input |
| sex | Y | Text | User input |
| age | Y | Integer: 1:2 | User input |
| age class | Y | Text | User input |
| amount consumed (%) | Y | Integer: 1:3 | User input |
| bone marrow consistency | Y | Text | User input |
| burial 1 | Y | Integer: 1:2 x 1:2 | User input |
| dist (m) | Y | Integer: 1:2 | User input |
| burial 2 | Y | Integer: 1:2 x 1:2 | User input |
| dist (m) | Y | Integer: 1:2 | User input |
| burial 3 | Y | Integer: 1:2 x 1:2 | User input |
| dist to nearest tree (m) | Y | Integer: 1:2 | User input |
| tree species | Y | Text | User input |
| DBH (cm) | Y | Integer: 1:2 | User input |
| crown area (m) | Y | Integer: 1:2 x 1:2 | User input |
| total drag | Y | Integer: 1:3 | User input |
| total burials | Y | Integer: 1:2 | User input |
| number of latrines | Y | Integer: 1:2 | User input |
| number of scats | Y | Integer: 1:2 | User input |
| number of tracks | Y | Integer: 1:2 | User input |
| bed size (dm) | Y | Integer: 1:2 x 1:2 | User input |
| dist to nearest burial/carcass | Y | Integer: 1:2 | User input |
| dist to nearest tree (dm) | Y | Integer: 1:2 | User input |
| tree species | Y | Text | User input |
| tree DBH (cm)tree | Y | Integer: 1:2 | User input |
| crown area (m) | Y | Integer: 1:2 x 1:2 | User input |
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| ***Clusters\_GRCA\_Table.xls*** | | | ***Cluster Investigation\_Form.xls*** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| ID | N | Text,Integer: 1:3 | User input |
| mnth | Y | Integer: 2 | User input |
| dy | Y | Integer: 2 | User input |
| year | Y | Integer: 4 | User input |
| temp max | Y | Integer: 1:3 | User input |
| temp min | Y | Integer: 1:3 | User input |
| PPT | Y | Integer: 1:4 | User input |
| lag | Y | Integer 1:5 | User input |
| GST | Y | Integer: 4 | User input |
| duration | Y | Integer: 1:3 | User input |
| cum hours | Y | Integer: 1:3 | User input |
| no visit | Y | Integer: 1:2 | User input |
| confidence | Y | Integer: 1:3 | User input |
| activity1 | Y | Integer: 0-99 | User input |
| activity2 | Y | Integer: 0-99 | User input |
| activity3 | Y | Integer: 0-99 | User input |
| observer | Y | Text: | User input |
| in mnth | Y | Integer: 2 | User input |
| in day | Y | Integer: 2 | User input |
| in year | Y | Integer: 4 | User input |
| w coord | N | Integer: 1:8 | User input |
| n coord | N | Integer: 1:9 | User input |
| elev | Y | Integer: 1:4 | User input |
| aspct | Y | Integer: 3 | User input |
| slope | Y | Integer: 3 | User input |
| topo | Y | Text | DDM: BNCH, BTM, FLAT, LS, MS, US, RDG |
| herb | Y | Integer: 3 | User input |
| shrub | Y | Integer: 3 | User input |
| forest | N | Integer: 3 | User input |
| ddfll | Y | Integer: 3 | DDM: M, F, MF, Unknown, User Input |
| rock | Y | Integer: 3 | User input |
| rock size | Y | Text | DDM: G, C, SB, MB, LB |
| cvr type | Y | Text | DDM: DF, DW, F, W, FW, G, OF, OW, S |
| hab type | Y | Text, Integer: 1:2 | User input |
| Cercocarpus | Y | Integer: 0 or 1 | User input |
| Cowania | Y | Integer: 0 or 1 | User input |
| Quercus | Y | Integer: 0 or 1 | User input |
| consumed | Y | Integer: 1:3 | User input |
| drag | Y | Integer: 1:3 | User input |
| burial | Y | Integer: 0 or 1 | User input |
| burial size | Y | Integer: 3 | User input |
| marrow | Y | Integer: 1-9 | User input |
| n latrines | Y | Integer: 1:10 | User input |
| n beds | Y | Integer: 1:10 | User input |
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| ***Puma Capture Locations\_Table.xls*** | | | |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| Puma | Y | Text; Integer: 1:3 | User input |
| sex | Y | Text:M,F | DDM: M,F |
| wgt | Y | Integer: 2 | User input |
| capture date | Y | Date: mm/dd/yyyy | User input |
| age (CCR) | Y | Integer: 1:3 | User input |
| trap | Y | Text | User input |
| capture method | Y | Text | DDM: snare, hounds, cage |
| X (WGS84) | N | Integer: 6 | DDM: 6 digits |
| Y (WGS84) | N | Integer: 7 | DDM: 7 digits |
| Lat (WGS84) | N | Integer: 1:10 | User input |
| Long (WGS84) | N | Integer: 1:10 | User input |
| Location | Y | Text | User input |
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| ***Clusters\_GRCA\_Table.xls*** | | | |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Entry Type** |
| ID | Y | Integer: 1:3 | User input |
| trap site name | Y | Text | User input |
| X coord | N | Integer: 6 | DDM: 6 digits |
| Y coord | N | Integer: 7 | DDM: 7 digits |
| frequency | Y | Integer: 1:8 | User input |
| puma captured | Y | Text | User input |
| notes | Y | Text | User input |
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7.5 California Condor Metadata

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| **CALC\_Observation\_Table.mdb** | | |  |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| BIRD\_NUMBER | Y | Text | User input |
| DETECTION\_TYPE | N | Text | DDM: Signal; Visual; Both; None |
| DATE | Y | Date: mm/dd/yyyy | User input |
| TIME | N | Time: hh:mm | User input |
| LOCATION | Y | Text | DDM: Village Cove; South Rim; Yaki; Trail View; Desert View; Hopi; Navajo; Yavapai; Grandview; Lipan; Mohave; Hermit; Pima; Abyss; Powell; Maricopa; Church Rocks; Roger's Roost; Mather; Shoshone; Moran; Phantom; Clear Creek; Utah Flats; TipOff |
| OBSERVER | Y | Text | User input |
| COMMENTS | Y | Text | User input |
| VISITOR CONTACTS | N | Text | User input |
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7.6 Southwestern Willow Flycatcher Metadata

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| **Habitat\_Assessment\_2010\_Table.mdb** | | | **Habitat\_Assessment\_2010\_Form.doc** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| DATE | Y | Date: mm/dd/yyyy | User input |
| OBSERVER | N | Text | Dynamic DDM or create new observer |
| SITE\_NAME | Y | Text | User input |
| GCMRC\_RIVER\_MILE | Y | Text | User input |
| RIVER\_SIDE | N | Text | DDM: Left; Right |
| NUTM\_START | Y | Integer: 6 digits | User input; must = 6 digits |
| EUTM\_START | Y | Integer: 7 digits | User input; must = 7 digits |
| ACCURACY\_START(M) | N | Integer | User input |
| NUTM\_END | Y | Integer: 6 digits | User input; must = 6 digits |
| EUTM\_END | Y | Integer: 7 digits | User input; must = 7 digits |
| ACCURACY\_END(M) | N | Text | User input |
| LIGHT\_EXPOSURE | N | Text | DDM: Full Sun; Partial Sun; Full Shade |
| CANOPY\_COVER | Y | Text | DDM: Sparse; Low; Moderate; High |
| UNDERSTORY\_DENSITY | Y | Text | DDM: Sparse; Low; Moderate; High |
| UNDERSTORY\_COMPOSITION | N | Text | DDM: Live Foliage; Dead Branches; Both |
| DOMINANT\_PLANT\_SPP | N | Text | User input |
| ASSOCIATED\_PLANT\_SPP | N | Text | User input |
| AVG\_VEG\_HEIGHT | N | Text | User input |
| TAMARISK\_EST | Y | Text | DDM: Sparse; Low; Moderate; High |
| PATCH\_SIZE(HA) | Y | Text | User input |
| PATCH\_SIZE\_SOURCE | N | Text | DDM: Aerial Photo; Field Estimate |
| WATER\_PRESENT | N | YES/NO | User input |
| WATER\_TYPE | Y | Text | DDM: Seep; Spring; Stream; Pothole; River |
| SOIL\_MOISTURE | Y | Text | DDM: Dry; Moist; Saturated; Standing Water |
| INCIDENTAL\_BIRD\_SPP | N | Text | User input |
| BHCO\_DETECTED | Y | YES/NO | User input |
| BEETLE\_SURVEY | N | YES/NO | User input |
| BEETLE\_DETECTED | Y | YES/NO | User input |
| DETERMINATION | Y | Text | DDM: Suitable; Potential; Unsuitable |
| COMMENTS | N | Text | User input |
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| **Songmeter\_2010\_Table.mdb** | | | **Songmeter\_2010\_Form.xls** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| SITE\_ID | Y | Text | User input |
| DATE | Y | mm/dd/year | User input |
| OBSERVER | N | Text | User input |
| MODEL\_NUMBER | N | Integer | User input |
| SD\_CARD | N | Integer | User input |
| SD\_CARD\_SIZE | N | Text | DDM: 16 GB; 32GB |
| RECORDING\_TYPE | N | Text | DDM: Stereo; Mono-R; Mono-L |
| UNIT\_LOCATION | N | Text | User input |
| EUTM | Y | Integer: 6 digits | User input; must = 6 digits |
| NUTM | Y | Integer: 7 digits | User input; must = 7 digits |
| ELEVATION(M) | N | Text | User input |
| ACCURACY(M) | N | Text | User input |
| VEG\_1 | N | Text | User input |
| VEG\_1\_% | N | Text | User input |
| VEG\_2 | N | Text | User input |
| VEG\_2\_% | N | Text | User input |
| VEG\_3 | N | Text | User input |
| VEG\_3% | N | Text | User input |
| PHOTOS | N | Text | User input |

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| **SWFL\_Survey\_2006-2010\_Table.mdb** | | | **Survey\_2010\_Form.xls** |
| **Field** | **Searchable (Y/N)** | **Valid Entries** | **Enter Data** |
| RECORD\_ID | N | Integer: 1:10,000 | Automatic sequential number |
| DATE | Y | Date: mm/dd/yyyy | User input |
| OBSERVER | N | Text | Dynamic DDM or create new observer |
| SITE\_NAME | Y | Text | Dynamic DDM or create new site |
| GISCOORDINATESSTART | Y | Text | User input |
| GISCOORDINATESEND | Y | Text | User input |
| START\_TIME | N | Time: hh:mm | User input |
| END\_TIME | N | Time: hh:mm | User input |
| TOTAL\_TIME | N | Time: hh:mm | Auto Calculation = END\_TIME – START \_TIME |
| #\_SWFLs | Y | Integer: 1:10,000 | User input |
| DETECTION\_COORDINATES | Y | Text | User input |
| EST\_#\_PAIRS | N | Text | User input |
| EST\_#\_TERRITORIES | N | Text | User input |
| NEST\_FOUND | Y | YES/NO | User input |
| COWBIRDS\_DETECTED | Y | YES/NO | User input |
| VEG\_CHARACTERISTICS | N | Text | DDM: entirely or almost entirely, >90%native; mostly native, 50-90% native; mostly exotic, 50-90% exotic; entirely or almost entirely, >90% exotic |
| PREDOMINANT\_VEG\_SPP | N | Text | User input |
| AVERAGE\_CANOPY\_HEIGHT(M) | N | Text | User input |
| COMMENTS | N | Text | User input |
|  |  |  |  |