# Instructions and Codes for in formatting MAPS data in Microsoft Access

Raw files from MAPS records were first formatted in Microsoft Access before brought into R for mark-recapture and fecundity analyses. The work done in Access include, 1) merging multiple files into one, 2) flag individuals that were identified as multiple different species, 3) identifying juveniles and adults, 4) calculate effort, 5) detect movements amongst stations for each species, and 5) determine the time periods for the analyses based on the number of captures each year. The dataset made available is the product of this data formatting.

# How to establish database connection to Access?

You need to create an ODBC driver on your PC to connect to Access from R. If you have a Mac and run Access on parallels you need to maintain a local copy as connecting to the network proxy is not allowed.

1. From control panel find administrative tools or in the search type ODBC which brings up the ODBC Data Source Administrator
2. Click on ‘Add’
3. Select ‘Microsoft Access Driver (\*.mdb)’
4. Click on ‘Finish’
5. Name your datasource
6. Click on ‘Select’ to navigate to your \*.mdb file

**Note:** In some computers, a 32-bit version of R is required to use this database.

# How to merge band and effort data into one file?

MAPS records were received as .dbf files. Multiple .dbf files exist for band and effort data.

1. Import .dbf files into Access
   1. Open Access and under the tab ‘External Data’ click on ‘more’ and ‘dBase file’
   2. Navigate to the directory where .dbf files are stored.
   3. Import the .dbf files. Files are imported as new tables into Access with the same name as the raw .dbf file.
2. Merge the files into one band data and one effort table in Access.
   1. Create a table ‘MAPSBAND’ for band data
   2. # Insert band data. Repeat until you insert all existing band data tables.

*INSERT into MAPSBAND*

*SELECT \**

*FROM NAS1BAND*  # name of one band data file from MAPS

* 1. Create a table ‘MAPSEF’ for effort data
  2. # Insert effort data. Repeat until you insert all existing effort data tables.

*INSERT into MAPSEF*

*SELECT \**

*FROM NAS1EF* # name of one effort data file from MAPS

1. Create a final band data table (‘finalMAPSBAND’)
   1. # Remove multiple entries by month

*SELECT distinct band, year(date) as CaptureYear, month(date) as month, spec, loc, station, age, CP, BP, "" as Agegroup, 0 as ActualAge, 0 as BirthYear, 0 as dupeSpec, 0 as recap*

*INTO finalMAPSBAND*

*FROM MAPSBAND*

*WHERE band <> '' AND sex <> ''*

* 1. # Collect IDs with at least one recapture

*SELECT band, count(\*)*

*INTO tmpids2*

*FROM finalMAPSBAND*

*WHERE dupeSpec = 0*

*GROUP BY band*

*HAVING count(\*) > 1*

*UPDATE finalMAPSBAND*

*INNER JOIN tmpids2 ON tmpids2.band=finalMAPSBAND.band*

*SET recap = 1*

# How to flag individuals identified as multiple species?

In some cases, individuals with the same band ID were identified and recorded as different species. To avoid errors, these individuals were removed from the analysis.

1. # Flag individuals recorded with different species
2. # Find individuals identified as different species

*SELECT distinct band, spec*

*INTO dupeSpec\_test*

*FROM finalmapsband*

1. # Select bands with more than 1 species ID

*SELECT band, count(\*)*

*INTO dupeSpec*

*FROM dupeSpec\_test*

*GROUP BY band*

*HAVING count(\*)>1*

1. # Manually, double-check individuals recorded with multiple different species

*SELECT \**

*FROM dupeSpec\_test*

*WHERE band in (*

*“6590”,*

*“118012977”,*

*“168112125”,*

*“187147005”,*

*“243002488”)* # Only some example IDs are presented here.

1. # Flag individuals recorded with 2 different species

*UPDATE finalMAPSBAND*

*INNER JOIN dupeSpec ON dupeSpec.band=finalMAPSBAND.band*

*SET dupeSpec = 1*

# How to set age group into juveniles and adults?

Here, we defined hatching-year birds and local young birds that are incapable of sustained flight as juveniles. All other categories under class ‘AGE’ were defined as adults. [See ‘Code Definitions of MAPS Banding Data for detailed information.]

1. # Set agegroup (Juvenile vs. Adult)

*UPDATE finalMAPSBAND*

*SET agegroup = 'J'*

*WHERE age in ('2','4')*

1. # Assumption: age=0 (indeterminable age) is an Adult

*UPDATE finalMAPSBAND*

*SET agegroup = 'A'*

*WHERE age not in ('2','4')*

# How to set birth year and actual age for juveniles?

1. # Set birth year for individuals captured as juveniles

*UPDATE finalMAPSBAND*

*SET birthyear=captureyear*

*WHERE agegroup='J'*

1. *SELECT band, birthyear*

*INTO tmp3*

*FROM finalMAPSBAND*

*WHERE birthyear<> 0*

1. *UPDATE finalMAPSBAND*

*INNER JOIN tmp3 ON tmp3.band=finalMAPSBAND.band*

*SET finalMAPSBAND.birthyear=tmp3.birthyear*

1. # Set actual age for individuals captured as Juveniles

*SELECT band, birthyear, captureyear, captureyear-birthyear, IIF( birthyear<>0, captureyear-birthyear, -1) as result*

*INTO tmp4*

*FROM finalMAPSBAND*

1. *UPDATE finalMAPSBAND*

*INNER JOIN tmp4 ON tmp4.band=finalMAPSBAND.band and tmp4.captureyear=finalMAPSBAND.captureyear*

*SET finalMAPSBAND.actualage=tmp4.result*

# How to calculate capture effort?

Effort is defined as the total number of days of mist-netting in a given month. It is important for estimating capture probability which is later used to estimate fecundity.

1. # Calculate the total number of days of mist-netting

*SELECT loc, year(date) as year, month(date) as month, round(sum(cint(length)\*((Cint(mid(end,1,2))\*60+Cint(mid(end,3))\*10) - (Cint(mid(start,1,2))\*60+Cint(mid(start,3))\*10) ))/1440,2) as effort*

*FROM mapsef*

*GROUP BY loc, year(date), month(date)*

**Note:**

One unit of mist-net length represents one 12-m mist-net.

In MAPS, the starting and finishing times of mist-netting are recorded in the following format, eg. 104 -> 10:40am, eg. 085 -> 8:50am

# How to find bands with multiple stations?

In order to determine which movement model to use in mark-recapture analysis, one can look at how many individuals are found at different locations/stations throughout the course of MAPS recordings. Here, we assumed ‘no movement’ model because only a few movements were observed between stations throughout the time course of our MAPS dataset.

1. # First, select stations for each species

*SELECT distinct band, station*

*INTO tmpdupes*

*FROM finalmapsband*

*WHERE spec in (”NOCA”)* # Use different 4 letter alpha code for different species

1. # Count the number of captures for each unique ID in different stations
2. *SELECT tmpdupes.band, Count(\*) AS count*

*INTO tmpdupes2*

*FROM tmpdupes*

*GROUP BY tmpdupes.[band]*

*HAVING (((Count(\*))>1))*

1. *SELECT \**

*FROM tmpdupes2*

1. # Display individuals that appear in different stations

*SELECT b.band, b.station*

*FROM tmpdupes2 a, tmpdupes b*

*WHERE a.band=b.band*

1. # Stations where a bird moved from 1 station to another
2. *SELECT DISTINCT b.station*

*INTO tmpstations*

*FROM tmpdupes2 a, tmpdupes b*

*WHERE a.band=b.band*

1. *SELECT \**

*FROM tmpstations*

# How to get distinct locations for each species?

In our analyses, we defined each location as a separate biological population because of the rare movement observations amongst MAPS locations for all species modeled. Therefore, the list of locations is used to group individuals into populations in the later mark-recapture analyses.

1. *# Select distinct location for each species*

*SELECT distinct loc*

*FROM finalMAPSBAND*

*WHERE spec in ('BCCH',’CACH', 'COYE', 'GRCA',’HOWA’,'NOCA', 'WEVI','WOTH','YBCH')*

# How to determine the starting and end year for each species?

Based on the number of captures, we discarded some years in which there were only a few captures. Years with fewer than 10 bird captures were removed from the analysis.

1. # Count the number of capture each year for a give species

*SELECT captureyear, count(\*)*

*FROM finalmapsband*

*WHERE spec in ('NOCA')* # Use different 4 letter alpha code for different species

*GROUP BY captureyear*