

Glossary

Speedgoat

2023-11-08

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Chapter 1

Introduction

This manual is a support document for SpeedGoat Software, which was created to streamline the process of running population models including IPM, Sightability, and Survival, as well as a framework for uploading survey data. You may notice that some of the tools that are documented here are not available on your version of the software. This is because your agency may not be using all of the tools that Speedgoat has to offer. Also, please note that each agency may collect and use different data, so your agency will have separate data and model documentation that walks through agency specific data processing steps and custom models.

At the top right of your page is a help toolbar. From left to right, the question mark brings you to the Speedgoat homepage, the little bug icon allows you to send a bug report to the speedgoat team, the lightbulb icon allows you to send the team an idea you have for a new feature, the broadcast symbol is a link to the speedgoat blog, and the lifering gives direct contact information for Josh and Paul.



Each tool has its own chapter, which includes an Overview, a Walkthrough, and a Reference page for each separate section within the tools. The Overview gives a general description of what a tool is and how it works, as well as hypothetical use cases for the tool. The Walkthrough is a step-by-step guide which explains how to load data and generate analyses with each tool. The Reference page gives a more detailed explanation of each page, as well as how to navigate the various menus.

Words that are green and bold can be found in our glossary section at the end of the book, and words that are blue and bold denote icon labels.

This manual was created by Speedgoat using bookdown.

Feedback and suggestions for improving the user manual are welcome at wyatt.nielsen@speedgoat.io.

To get started with SpeedGoat Software, visit the Speedgoat homepage and select your agency from the login menu.



Chapter 2

IPM

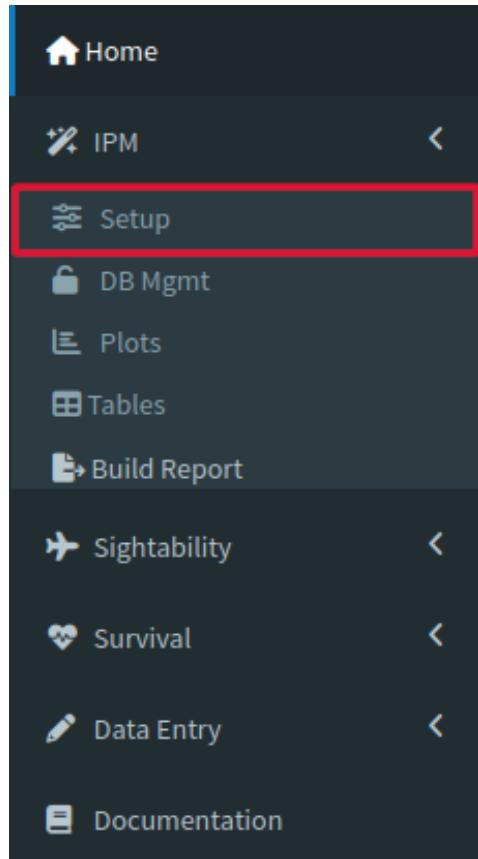
An Integrated Population Model(IPM), jointly analyzes data on population size and demographic parameters. Data collected in the field inform the demographic parameters in the model and unifying the analyses of multiple sources of data. Field data in the IPM database may come from the outputs from survival models and sightability models run in the PopR website, analysis done by a specific agencies, and/or agency specific databases. The IPM analyzes populations at the DAU level.

2.1 Walkthrough

Using the IPM tool can be split into two major processes: preparing data and reviewing outputs.

2.1.1 Preparing Data

Click on the Setup tab, the first dropdown under the IPM tool menu.



On the top left of the page should be a window labeled Overview, and this is where you determine the data that you run through the IPM. Select the database you want to retrieve the data from, then make sure you choose your Species, DAU, Unit, and Weather before you click Fetch Harvest Data on the bottom right of the Overview window to retrieve the specific data you requested.

1) Overview 2) Structure 3) Harvest 4) Run 

Species

Mule Deer ▾

DAU

MD_Bannock ▾

Unit

All ▾

IPM Database

elk_ipm_db.RData ▾

Future Weather

Average ▾

 Refresh DB Choices  Fetch Harvest Data

[Download IPM Data](#)

Once the data is loaded, you should get a popup dialog letting you know that the process was successful. It will also prompt you to proceed to the Structure tab.

The Structure tab allows you to select the model structure used in the analysis. For some agencies, the use of population reconstruction or other structural components may be available as structural options. The primary set-up options are to define whether your survival and reproduction will vary annually or be constant. The defaults were chosen to be well-suited to the specific species selected, so most of the time clicking “Default Structure” is a good start for your analysis. The inputs that appear when the tool is opened may not revert to the species specific defaults so clicking on “Default Structure”, will make sure you have selected the defaults before you move on to Harvest.

1) Overview 2) Structure 3) Harvest 4) Run 

Use Population Reconstruction?

TRUE

Reproduction

Time Varying

Juvenile Survival

Time Varying

Adult Survival

Constant

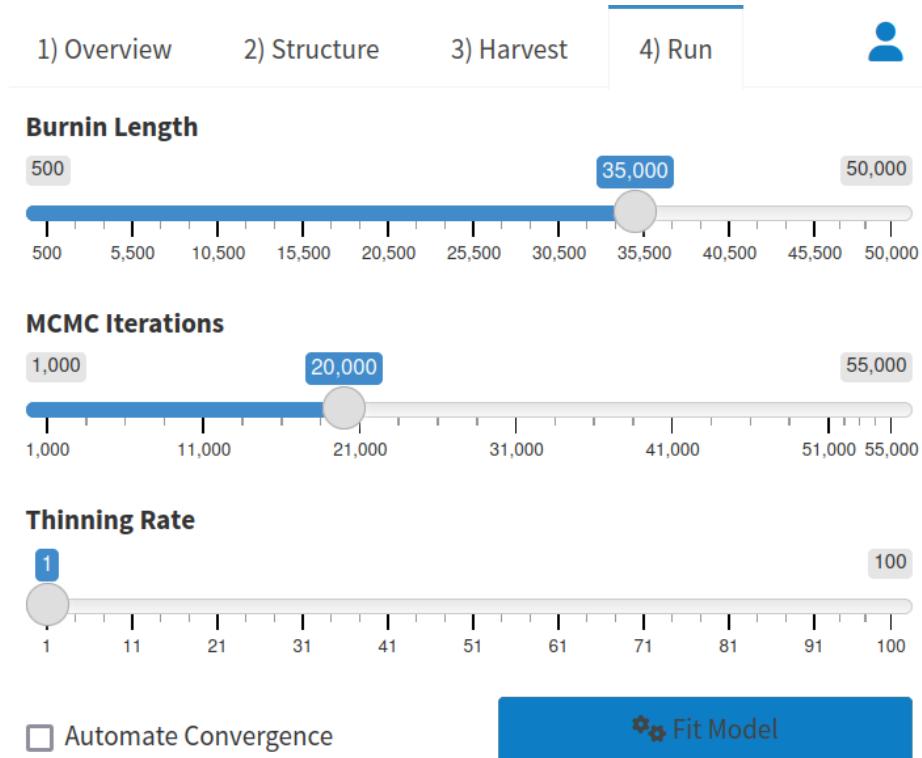
 Default Structure

After you select your Structure, you can move on to the Harvest Tab. Decide your effort variable and the years that you will be conducting your analysis, then look at the given information for the years that will be forecast. You can change the Harvest by double clicking the numbers and typing in new entries.

The screenshot shows the 'Harvest' tab of a software application. At the top, there are four tabs: '1) Overview', '2) Structure', '3) Harvest' (which is selected), and '4) Run'. To the right of the tabs is a user icon. Below the tabs, there are two sections: 'Analysis Years' and 'Effort Variable'. The 'Analysis Years' section has a slider with markers for 1998, 2007 (selected), and 2023. The 'Effort Variable' section shows 'Hunters' selected from a dropdown menu. Below these sections is a table with the following data:

Year	Species	Unit	DAU	Sex	Age	Ha
2022	Mule Deer	MD_Bannock	F	A		
2022	Mule Deer	MD_Bannock	M	A		
2023	Mule Deer	MD_Bannock	F	A		
2023	Mule Deer	MD_Bannock	M	A		

Our next step is the Run tab, which again already has a decent set of default values loaded. Adjust your Burnin Length, MCMC Iterations, and Thinning Rate. Decide whether you would like to Automate Convergence (This may increase the time it takes to run the model).

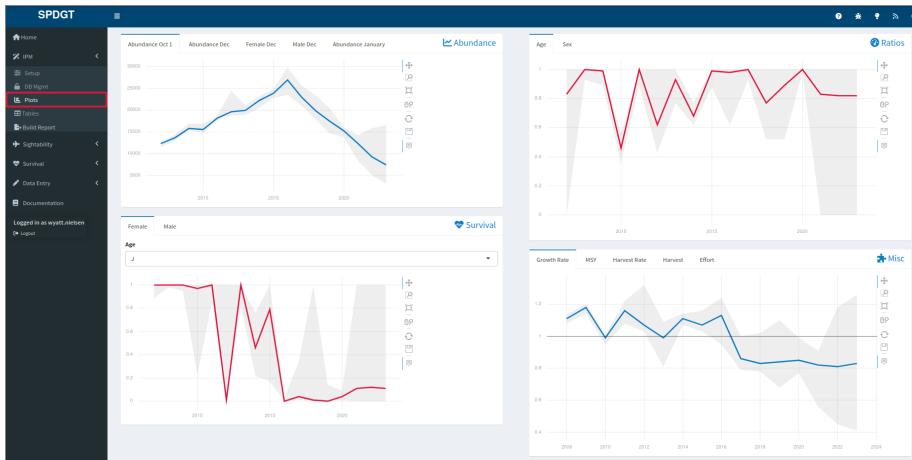


Once you are satisfied with all of the inputs outlined above, click Fit Model to begin analysis. This should take some time, but you will get a dialog box letting you know when the process is complete

2.1.2 Reviewing Outputs

(NOTE: This section will only work if you completed the steps above to prepare your data and fit your model beforehand.)

To look at the model output, wait until the model that you initiated in the setup tab has finished running, then go ahead and click the Plots tab on the IPM dropdown menu to check the results. Hovering your mouse over a point on a plot will give you the parameter, year, age, sex, control limits, and mean associated with the dataset that created the data point. These plots also contain the analogous data from the IPM inputs, so you can compare the model output with the data that was provided as inputs to the model.



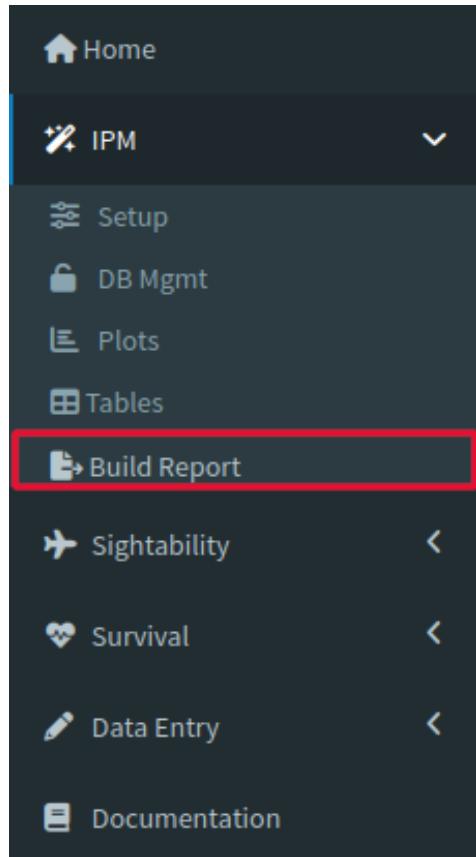
You can also check the model output by clicking the Tables tab right below the Plots one on the IPM dropdown. Rhat values greater than 1.1 are highlighted in red, which means the model may not have converged and should be run again after modifying the settings on the Run tab in the Setup tool. The first ten entries that appear when you open the table tab are not the only outputs of the model. You will notice that you may navigate the pages with the list to the bottom right, or you may increase the number of entries visible at the top left of the page, using the Show (10) Entries dropdown.

The figure shows the SPDGT software interface with the Tables tab selected. The table displays the following data:

Parameter	DAU	Year	Age	Sex	Mean	SD	LCL	UCL	Rhat	Rhat_UCL
Harvest Rate	All	2007	All	All	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2008	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2009	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2010	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2011	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2012	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2013	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2014	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2015	Y	F	0	0	0	0	0	0
Harvest Rate	MD_Barnrock	2016	Y	F	0	0	0	0	0	0

Showing 1 to 10 of 646 entries

As a final step to get more diagnostic information, use the Build Report tool.



Simply click on the tool and then click the download prompt on the popup window. The resulting document contains interactive plots as well as model specifications and fit.

Download Report

Choose Report Type

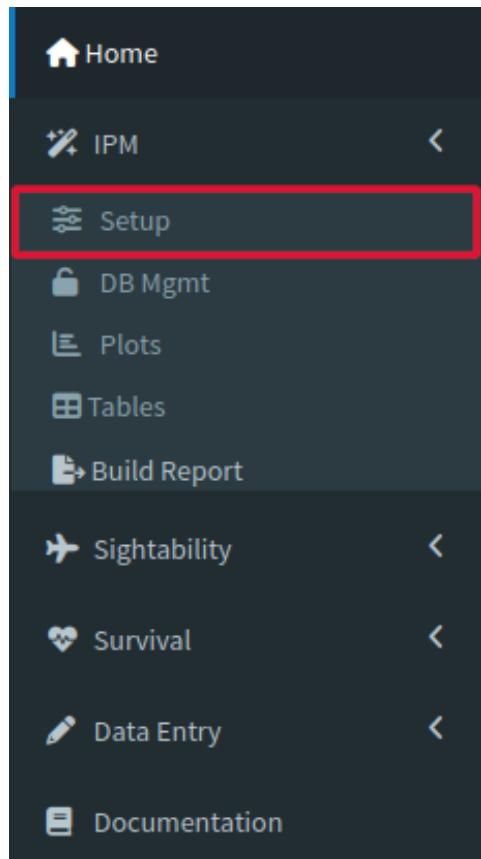
Analysis Report

 Download

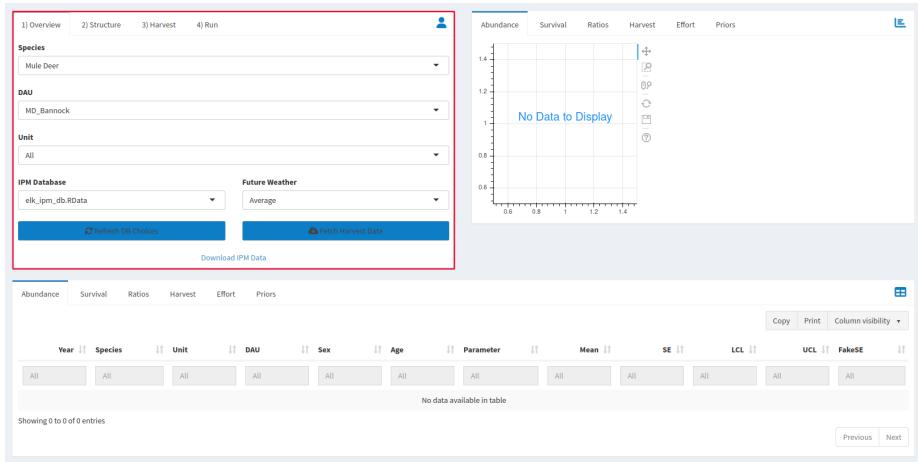
[Dismiss](#)

2.2 Reference

2.2.1 Setup



The main purpose of the Setup tab is to load and preview data that will be used for later analysis, and we will spend more time describing each element in detail. The window on the top left of the page has several tabs related to data preparation labeled Overview, Structure, Harvest, and Run.



The Overview tab helps you find the data you will be loading for your IPM. Make sure that you are pulling from the correct database! Also, the Future Weather dropdown allows you to consider weather in your IPM analysis. Average assumes mean observed weather conditions, Good assumes upper 95% quantile of observed weather, and Bad assumes lower 5% quantile of observed weather. You may also choose not to include weather in your analysis. All of these values were developed from the dissertation of Mark Hurley.

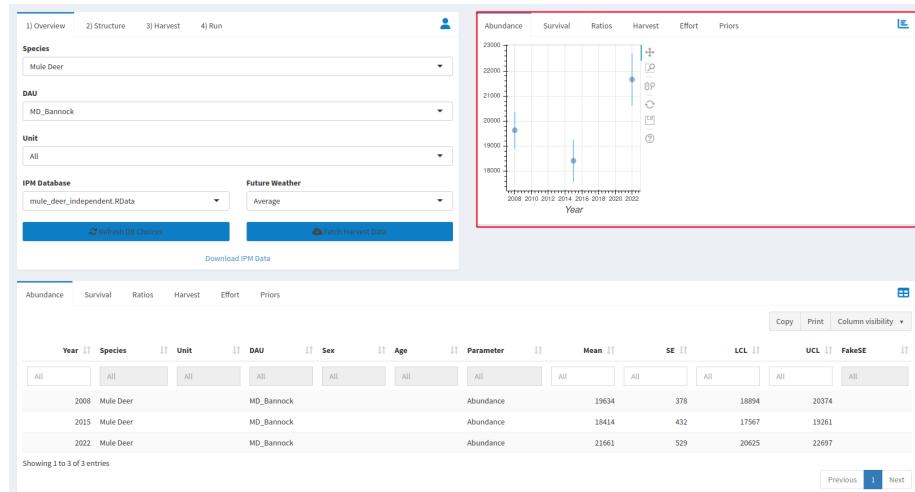
The Structure tab gives our model some information about assumptions. Population reconstruction is the process of estimating past abundance using a combination of known harvest data and estimated natural mortality rates. If you know when an animal died AND how old it was when it died, then you also know when it was alive. Using this “back-tracking” can create an abundance estimate for past years even if one was not carried out.

The Harvest tab gives our model some important context on harvest metrics. The slider at the top tells our model which years are being analyzed. The effort variable allows us to choose whether effort is determined by the number of days in the field or the number of hunters themselves. It also gives more context to our harvest numbers and helps us tease apart the relationship that hunter effectiveness and raw number of hunters had on the harvest that year. You may also give hypothetical harvest numbers for our model to consider so you may estimate the effects of management decisions on rates like survival and abundance.

The Run tab gives direction to our actual modeling process. The given settings control how we deal with the many thousands of times the model must run to calibrate itself. Adjust your Burnin Length, MCMC Iterations and Thinning Rate. The bottom of the window gives an option for Automating Convergence as well. You may adjust any of these factors, but the defaults are appropriate for a wide variety of situations.

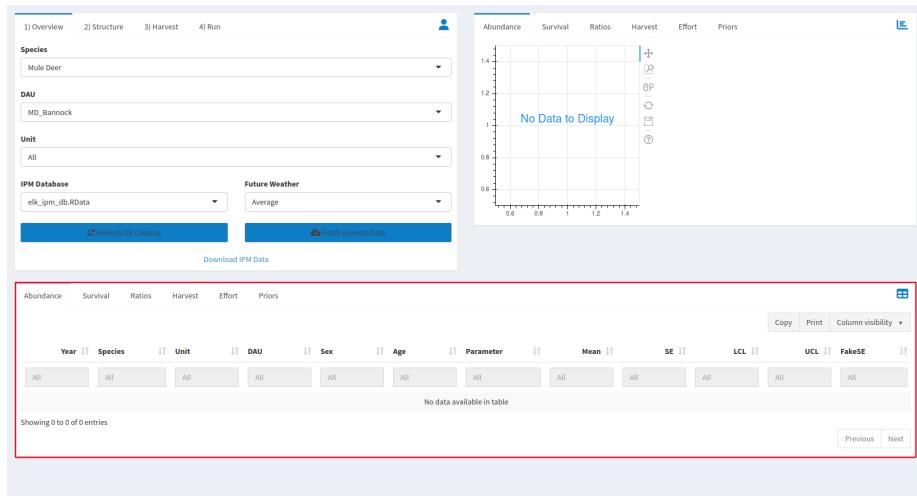
The window on the top right of the page is for previewing and exploring the

data that will create your analysis. Keep in mind that at this stage you are looking at the model input rather than the output, which is located in Plots and Tables. You can view Abundance, Survival, Sex Ratios, Harvest numbers, and Hunter Effort, as well as our Prior distribution for population parameters. A priors distribution gives a range of possible values for each of the factors that are considered by the IPM such as recruitment, survival, and mortality and then the likelihood of each value. This allows the model to consider historical data, but does not give too much power to outlier values. Just because a deer population lost 90% of their population in one year historically does not necessarily mean that it is likely to happen again in future years, but it should not be completely ignored either.

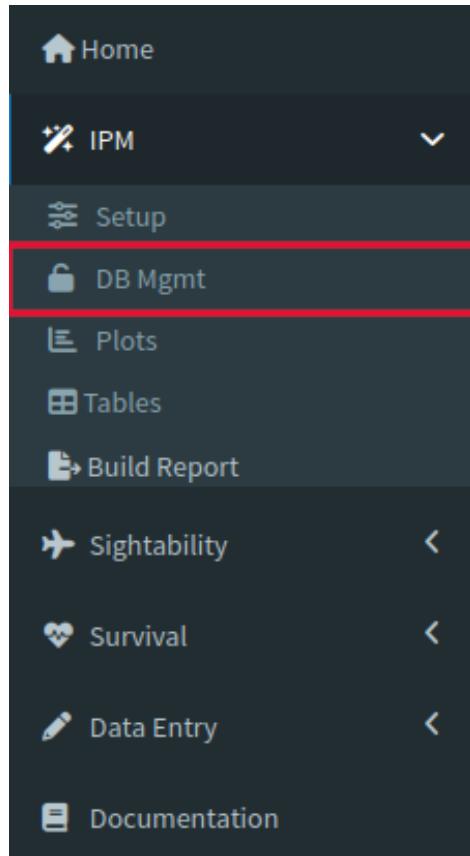


You can explore your graphs in this section with the pan and two zoom features on the side of each graph. Click the reset button to return to the original view. If any of these tabs are blank, it means that the dataset you picked does not have the relevant data to populate it.

The table at the bottom of the page gives another way to preview the data you loaded in the Overview tab. Use the blank column headers to look through your data with their keyword search function. You can page through your data with the previous and next buttons at the bottom of the page.



2.2.2 Database Management



The DB Mgmt tab creates, deletes and edits databases. The tools may be minimized, but to open them for use just click on the plus sign on the right side of the box containing the tool. Press it again to minimize it. Note that because databases are shared between users, edits here will change databases for EVERYONE. Data losses and changes will be permanent if you do not back up your data. You can also use the Create window to make a new database. NOTE: for some users this feature is only available for administrators and you may need to contact your administrator to create a new database or delete or edit an existing entry.

When using the Create window you can paste data from a spreadsheet app like Excel. You can also start off with data from any existing database, which you can select under the Historic Data box. Once the data is loaded, you can filter the entries by using the blank box at the top of each column as a keyword search bar. Make sure to give your new database a name, and then click the create database button to add a database to the Speedgoat server! You can also use the download tool to get the data you have loaded into our servers as a .csv.

The screenshot shows the 'Create' tool interface. At the top, there's a header with a 'Create' button and a note: 'Use this tool to create an empty database that you can populate using PopR'. Below this is a section for 'Enter Filename' with a text input field containing 'my_ipm_db'. To the right is a 'Historic Data' section with a table header and several dropdown filters for 'Year', 'Species', 'Unit', 'DAU', 'Sex', 'Age', 'Parameter', 'Mean', 'SE', 'Tau', 'LCL', 'UCL', and 'FakeSE', all set to 'All'. A message below the table says 'No data available in table'. At the bottom, it shows 'Showing 0 to 0 of 0 entries' with 'Previous' and 'Next' buttons.

The Delete DB tool will delete the database you select from the server. Deleting it here will delete it for everyone, so make sure that your data is backed up and that nobody is still working on a database before you delete it.

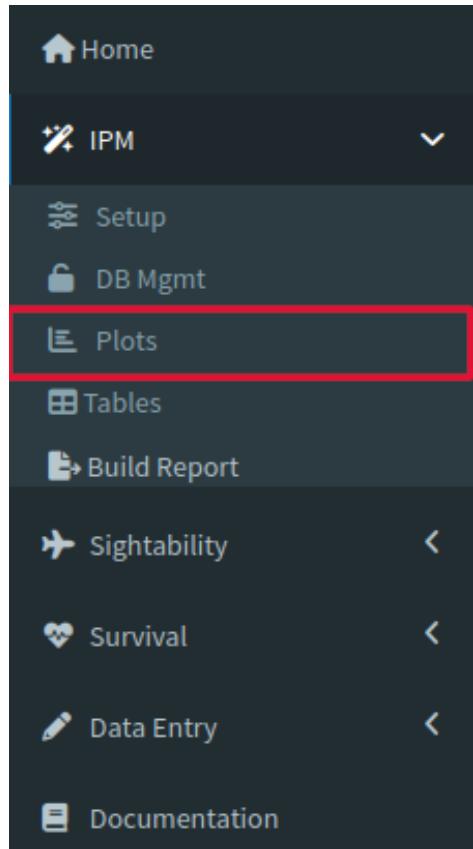
The screenshot shows the 'Delete' tool interface. It has a 'Create' button at the top left. Below it is a 'Delete' section with a dropdown menu titled 'Select DB to Delete' containing 'etk_ipm_db.RData'. To the right is a large empty area with a 'Delete DB' button. At the bottom, there's an 'Edit' section with a 'Save Changes' button.

The Edit tool allows you to add and delete rows of data from the database selected in the menu at the top of the tool. None of the edits you make will be applied until the Save Changes button is clicked, but once that button is clicked changes will be applied for everyone that uses that database.

Year	Species	Unit	DAU	Sex	Age	Parameter	Mean	SE	LCL	UCL	FalseE	Tau
All	All	All	All	All	All	All	All	All	All	All	All	All
1992	Elk		EDK_29_37A		Y	Abundance	511.000	16.410	478.84	543.16	false	
1992	Elk		EDK_29_37A	F	A	Abundance	927.000	24.920	878.16	975.84	false	
1992	Elk		EDK_29_37A	M	A	Abundance	202.000	21.280	160.29	243.71	false	
1992	Elk		EDK_29_37A	M	S	Abundance	134.000	16.410	101.84	166.16	false	
1992	Elk		EDK_29_37A	M	J	Abundance	179.000	10.330	158.75	199.25	false	
1994	Elk		EDK_29_37A		Y	Abundance	492.000	38.300	416.93	567.07	false	
1994	Elk		EDK_29_37A	F	A	Abundance	1,271.000	91.190	1092.27	1449.73	false	
1994	Elk		EDK_29_37A	M	A	Abundance	156.000	32.220	92.85	219.15	false	

Showing 1 to 9 of 2,246 entries

2.2.3 Plots



The plots page displays the outputs of the IPM. Use the zoom and pan tools to change your view of the graph, and use the reset button to return to your original view.

Though there are only four windows to display data, each of these windows can be changed by selecting the options across the top. Pictured are the options given for the Abundance window, which allows us to explore abundance during different times of year, as well as separating measurements by sex.



The ratios window allows us to break down the demographics that make up our study population, either by age or sex. This tab may also contain an age distribution plot that breaks down either proportion of the population or counts of the population by age. This plot is generated based on the expectation that the current population is broken down into ages based on the current survival rate of the specified age and sex class and may not be an accurate representation of the population age structure.



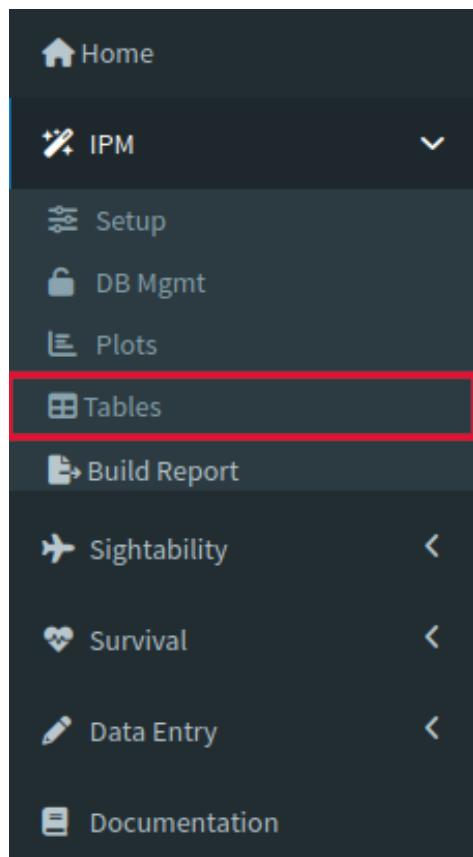
The survival window displays survival through the years for both males and females. Within each sex's tab, you can also select the age group of the animal to compare rates between adults and juveniles.



The Misc window contains many rates that are useful for understanding a population. Growth rate tracks how a population grows as a proportion of the population of the year before. For example, if a population of 100 animals grows by 50 in one year, the growth rate would be 0.5. MSY allows you to select which vital rate will be displayed on your y-axis. Lambda measures growth year by year, recruitment measures population growth, but specifically how many juveniles became adults in a population and how many adults immigrate into a population. Harvest and Harvest rate are often confused, but mean slightly different things. Harvest is the number of animals whose cause of death would be hunter-related, where harvest rate is the proportion of the population that was harvested. Effort measures how hunters put pressure on a population, and is either measured by the number of hunters on the landscape or how many cumulative days that hunters spent in the field. Note: these plots may be customized depending on your agencies needs, so the plots you see may not be the same as the ones pictured here.

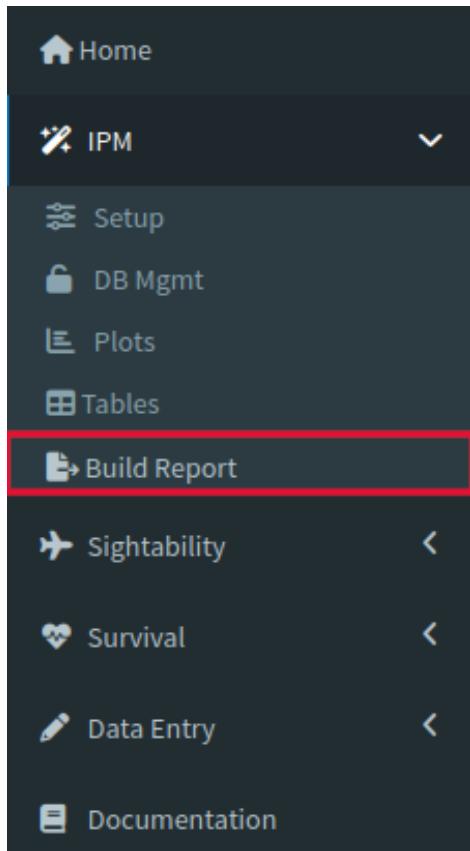


2.2.4 Tables



On the Tables page you can download and edit the data you are using for analysis. You can download your data here as well, but note that you will only download the data being displayed to you. By default, the table only shows the first ten entries of your dataset, so if you would like to download your data here make sure you change the dropdown at the top of the window from Show 10 entries to Show All entries.

2.2.5 Build Report



The Build Report tool gives a summary of the analysis conducted, while keeping relevant information like model settings for future comparisons.

Chapter 3

Sightability

Sightability models estimate abundance in a unit by combining the number of animals that we have seen in aerial surveys with an estimated number of animals that we have NOT seen using detection probability models. These detection models consider ground vegetation, the animal's activity, snow cover, and the size of the group of animals to determine the likelihood that an animal is seen with the interference of these variables.

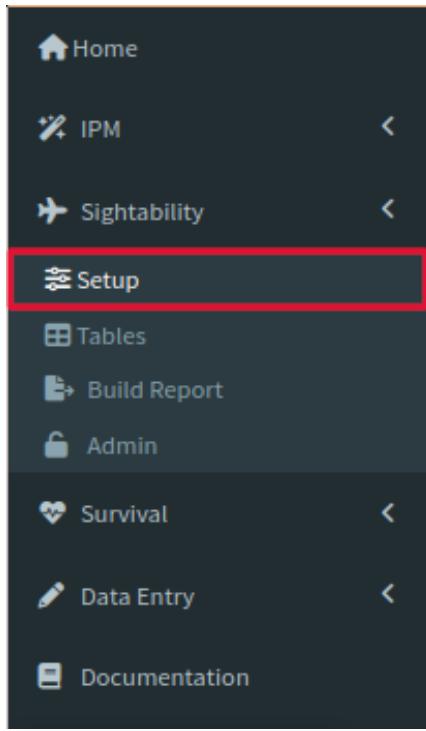
Stratum are used to organize habitat subunits by how well they would work as habitat for the animal being surveyed. The “high” strata group represents subunits that contain the best habitat, “low” is the group that has the worst habitats, and “medium” falls in between. Subunits are determined by previous observations from biologists and snow cover.

3.1 Walkthrough

Using the Sightability tool can be split into two major processes: preparing data and reviewing outputs.

3.1.1 Preparing Data

To prepare the data, navigate to the Setup tab under the Sightability dropdown.



Within the setup section, the User Inputs window decides which survey data you will load. Select your Species, DAU, Survey Type (Composition or Sightability-Abundance), Year, Analysis Focus, and Aircraft/Model. The data preview on the right side of the page will update as you adjust your settings. Check it as you make your choices in the User Inputs window, but you do not have to modify it any further.

User Inputs

Species

Mule Deer

Analysis DAU

Bannock

Survey Type

Composition

Year

2021-2022

Analysis Focus

Area

Aircraft/Model

Mule Deer

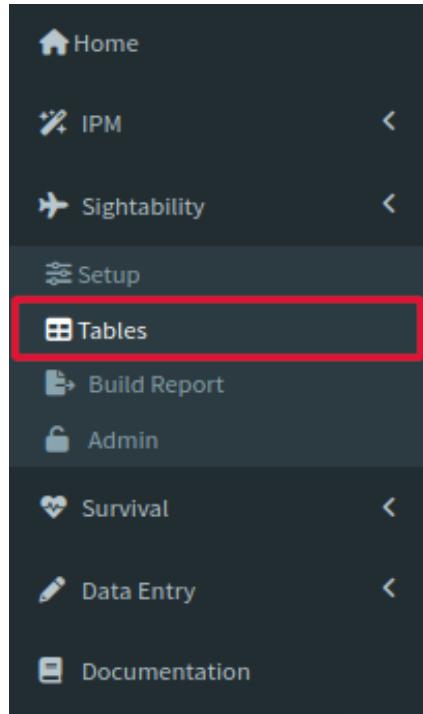
 Fit Model

Sampling	Count Data	Map	Issues		
DAU	Bio Year	Stratum	Subunits Available	Subunits Sampled	Prop Sampled
Bannock	2022	High	30	0	0
Bannock	2022	Other	737	31	0.042

Once you are satisfied with your choices in the User Input window, go ahead and click Fit Model. You will get a dialog box letting you know when the tool ran successfully.

3.1.2 Reviewing Outputs

Now that your data has been prepared you can go to the Tables tab, which is where you can view the output of your model.

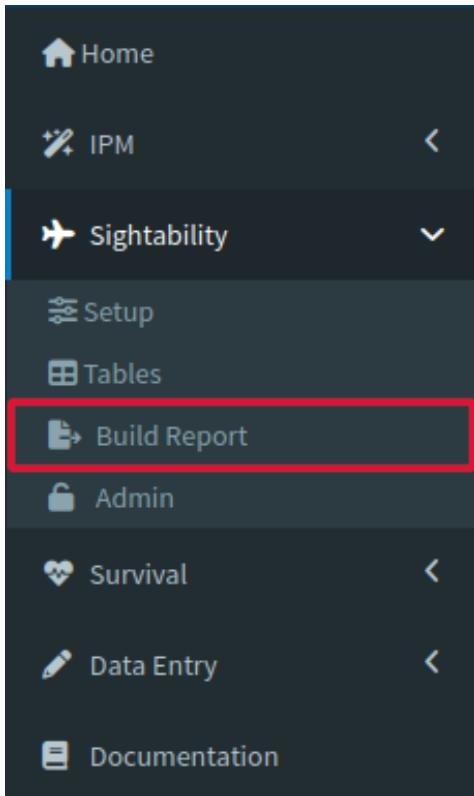


Navigate with the tabs along the top of the screen to check your estimates, survey design, detection, and covariates. You can also download your detection and estimation results as .csv files with Download at the bottom of the table.

Species	Survey Type	DAU	Bio Year	Demographic	Raw Count	i Estimate	Inflation			Variance			Model	Total
							LCL	UCL	Sightability	Sampling	Sightability	Sampling		
Mule Deer	Composition	Bannock	2021 - 2022	Total	1752.00	2115.82	1830.31	2401.33	1.21	1.00	0.000	4590.682	16628.896	21219.577
Mule Deer	Composition	Bannock	2021 - 2022	Does	967.00	1151.00	1006.64	1295.36	1.19	1.00	0.000	1229.046	4195.407	5424.452
Mule Deer	Composition	Bannock	2021 - 2022	Fawns	598.00	722.16	623.27	821.04	1.21	1.00	0.000	666.750	1878.816	2545.366
Mule Deer	Composition	Bannock	2021 - 2022	Total Bucks	187.00	242.66	188.28	297.04	1.30	1.00	0.000	320.523	449.229	769.752
Mule Deer	Composition	Bannock	2021 - 2022	Two Pts	140.00	185.76	140.18	231.36	1.33	1.00	0.000	242.247	299.033	541.280
Mule Deer	Composition	Bannock	2021 - 2022	Three Pts	34.00	38.27	31.84	44.70	1.13	1.00	0.000	7.165	3.400	10.765
Mule Deer	Composition	Bannock	2021 - 2022	Four Pts	13.00	18.63	5.06	32.19	1.43	1.00	0.000	40.017	7.852	47.869
Mule Deer	Composition	Bannock	2021 - 2022	YF Ratio	0.62	0.63	0.60	0.65						0.000
Mule Deer	Composition	Bannock	2021 - 2022	MF Ratio	0.19	0.21	0.18	0.24						0.000
Mule Deer	Composition	Bannock	2021 - 2022	Unclassified	0.00	0.00	0.00	0.00				0.000	0.000	0.000

[Download](#)

To get a more detailed report of your model that includes the information in the Tables tab while keeping track of things like model settings, click the Build Report tab under Sightability. A prompt will appear asking you to download the report as an html file.



Download Report

Choose Report

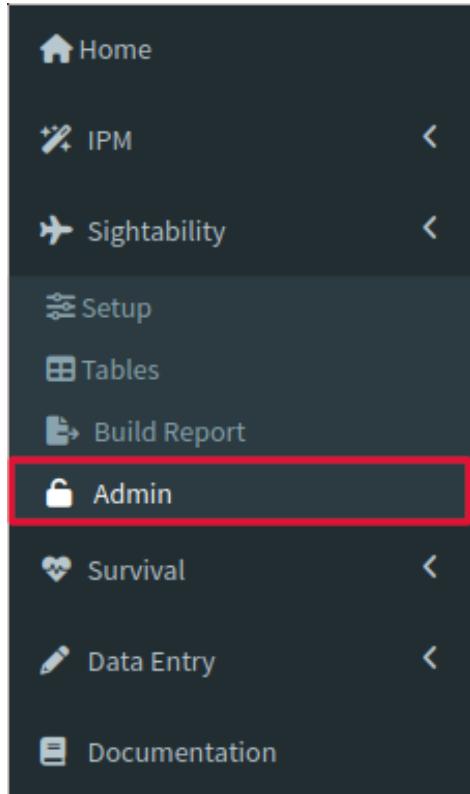
Type

Analysis Report

 Download

[Dismiss](#)

If you would like to upload the results of your model to an IPM database, you can click on the Admin tab.



Edits here will change databases for everyone. You can select the database that you want to upload your data to, as well as review the information that you will be uploading. Press Update DB to add your selected results to a shared database.

IPM Data

Use the input below to select a database. This is the database to which estimates will be added. If you want to create a new database use the Admin page within the IPM tab.

Add data to:
elk_ipm_db.RData

Estimates

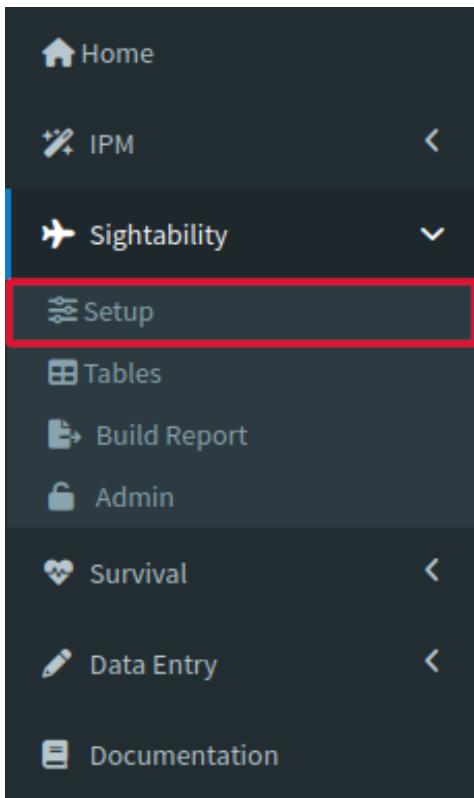
Verify that the abundance estimate in the table below is reasonable and then click Update DB to add the estimates to the IPM database.

Year	Species	Unit	DAU	Sex	Age	Parameter	Mean	SE	LCL	UCL
2022	Mule Deer	Bannock				YRatio	61.84	1.37	59.16	64.52
2022	Mule Deer	Bannock				MRatio	19.34	1.53	16.35	22.33

Update DB

3.2 Reference

3.2.1 Setup



The setup tab is used to select which DAU will be run through our model.

Surveys will only appear in the preview window if they are a perfect match to all of the dropdown menus, so make sure to double check that you did not accidentally leave one of them as default if the survey you are looking for refuses to appear in the preview window.

The screenshot shows the Speedgoat software interface. On the left, the 'User Inputs' tab is active, displaying various dropdown menus for survey parameters: Species (Mule Deer), Analysis DAU (Bannock), Survey Type (Composition), Year (2021-2022), Analysis Focus (Area), and Aircraft/Model (Mule Deer). On the right, the 'Count Data' tab is active, showing a table with data for the Bannock DAU. The table includes columns for DAU, Bio Year, Stratum, Subunits Available, Subunits Sampled, and Prop Sampled. The data shows two rows: one for High stratum with 30 available and 0 sampled, and another for Other stratum with 737 available, 31 sampled, and a proportion of 0.042.

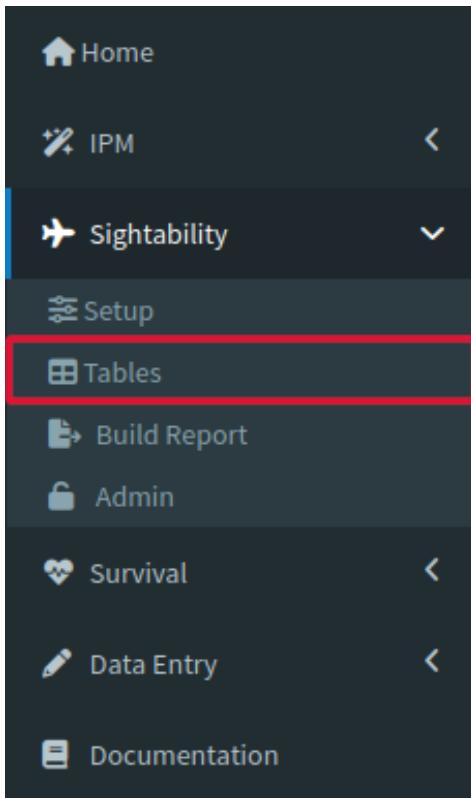
DAU	Bio Year	Stratum	Subunits Available	Subunits Sampled	Prop Sampled
Bannock	2022	High	30	0	0
Bannock	2022	Other	737	31	0.042

The User Inputs tab on the left side of the screen allows you to specify which data we will be analyzing. The species dropdown allows to choose whether you are selecting elk surveys or mule deer surveys. The Analysis DAU dropdown selects which data analysis unit we will be analyzing. All DAU are included as options for a survey, but this does not necessarily mean that surveys from all of them have been uploaded to the speedgoat database. If nothing appears in the preview window on the right side of the screen when you select a DAU, then it means there is no data available. The Survey Type dropdown includes both composition and sightability-abundance surveys. The year tab refers to which biological year the survey was carried out on. The Analysis Focus dropdown determines what scale the analysis will be carried out within the DAU you selected. It works best if the analysis is carried out at the same scale that data is collected. Aircraft/Model is more helpful with elk studies than mule deer studies, but it is helpful to know which aircraft flew your surveys no matter what.

The screenshot shows two main sections. On the left is a 'User Inputs' panel with dropdown menus for Species (Mule Deer), Analysis DAU (Bannock), Survey Type (Composition), Year (2021-2022), Analysis Focus (Area), Aircraft/Model (Mule Deer), and a 'Run Model' button at the bottom. On the right is a 'Sampling' table with columns for DAU, Bio Year, Stratum, Subunits Available, Subunits Sampled, and Prop Sampled. The data shows two rows for Bannock: one for High stratum with 30 available and 0 sampled, and one for Other stratum with 737 available and 31 sampled, resulting in a prop sample of 0.042.

DAU	Bio Year	Stratum	Subunits Available	Subunits Sampled	Prop Sampled
Bannock	2022	High	30	0	0
Bannock	2022	Other	737	31	0.042

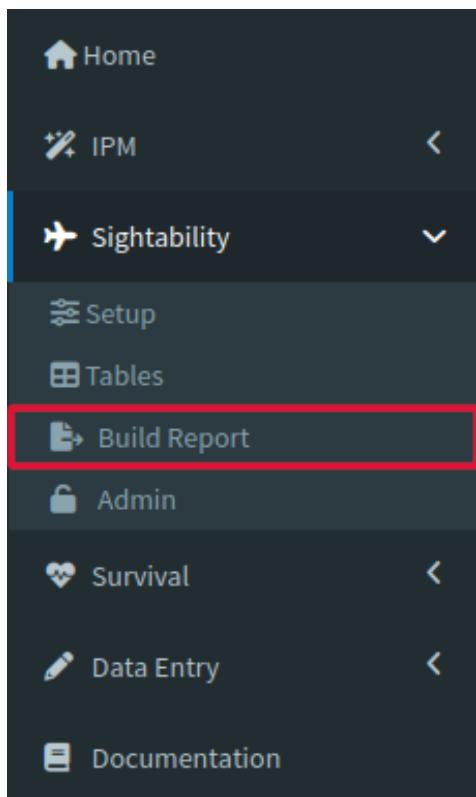
3.2.2 Tables



The Tables tab allows you to look at the output of your model run from Setup.

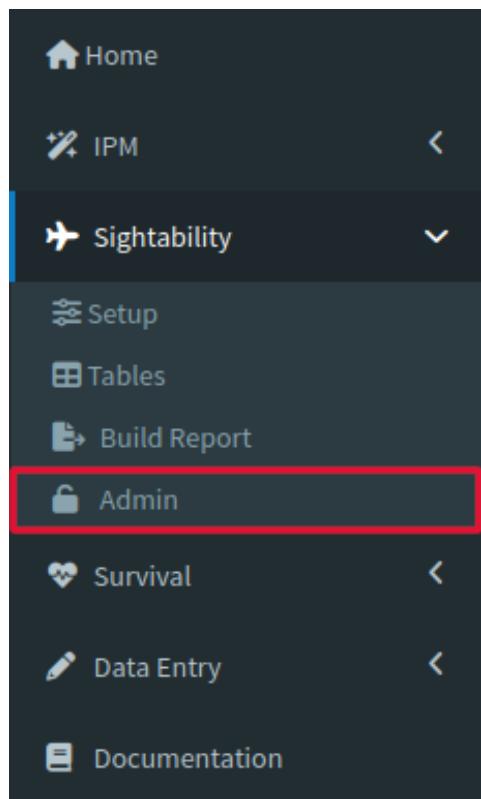
The Estimates tab displays model outputs based on your survey information, including abundance estimates for all age and sex demographics as well as Male:Female and Young:Female ratio. You can search each row with the blank box at the top. The Survey Design tab gives model settings for reference, as well as the proportion of subunits sampled and the abundance estimate for the area that you selected in Setup. The Detection tab gives raw survey info that the model used for its estimates. Notice that the page of data being displayed is only one of many pages which you can navigate with the page list on the bottom right of the window. Use the download button at the bottom of the Estimates and Detections tabs to download those results as a .csv. The covariates tab gives you a glimpse into how our models work by showing the covariate options, their model values, and their beta. This is not a table of outputs, but rather an insight as to how our model interprets the data you put into it. For example, while it would be tempting to spend precious time on a survey flight determining a specific snowcover percentage, a look at the covariates tab will tell you that snowcover is actually a categorical variable. Specifically, snowcover has three categories (1%-20%, 21%-79%, 80%-100%), which means that finding an exact percentage is a waste of time, since all values within the discrete categories will be treated the same. The reason you cannot see the 80-100% category on the covariates page is because of how our model interprets snowfall. Instead of three separate categories, all categories are in terms of the 80%-100% one. Our model does not think of the 1%-20% and 21-79% categories as independent, but as (80%-100% category) - (some value). 80%-100% is the default category, and default values are not displayed in the table.

3.2.3 Build Report



The Build Report tab prints your model outputs from the tables tab and saves model settings. Clicking the Build Report button will open a popup menu, click the download button to download the file to your machine as an HTML file.

3.2.4 Admin



The Admin tab is used to upload the results of your model to your database of choice. The bottom window can be used to preview the data that you plan to upload, so make sure you are comfortable with your results before you upload them to the public database. Data you upload will be incorporated into everyone else's model runs.

IPM Data

Use the input below to select a database. This is the database to which estimates will be added. If you want to create a new database use the Admin page within the IPM tab.

Add data to:

elk_ipm_db.RData

Estimates

Verify that the abundance estimate in the table below is reasonable and then click Update DB to add the estimates to the IPM database.

Year	Species	Unit	DAU	Sex	Age	Parameter	Mean	SE	LCL	UCL
2022	Mule Deer	Bannock				VFRatio	61.84	1.37	59.16	64.52
2022	Mule Deer	Bannock				MFRatio	19.34	1.53	16.35	22.33

Update DB

Chapter 4

Survival

Survival is something often calculated in a classroom setting, but the practicalities of calculating it in the real world can make things very tricky. Small sample sizes that can be found in collar studies can present a few problems, even if everything goes to plan. For example, if a collar study is composed of 4 animals, 3 of them may die (maybe it was deer opener). However, our Kaplan Meier model is telling us that 75% of our deer are dead! Is survival for that year really 0.25? Unless you know of some catastrophe this is very unlikely. Our five deer study poses another problem, which is that the hypothetical 0.2 we produced earlier is one of only 5 possible survival rates that can come from this population!(0, 0.25, 0.5 ,0.75, 1) If true survival is 0.66, then we have a problem because there is no possible way to get that output from our model. All of this is assuming that things go to plan, things like:

- All deer were collared at the same time
- All dead deer were found with their collar
- All collars worked for the duration of the study

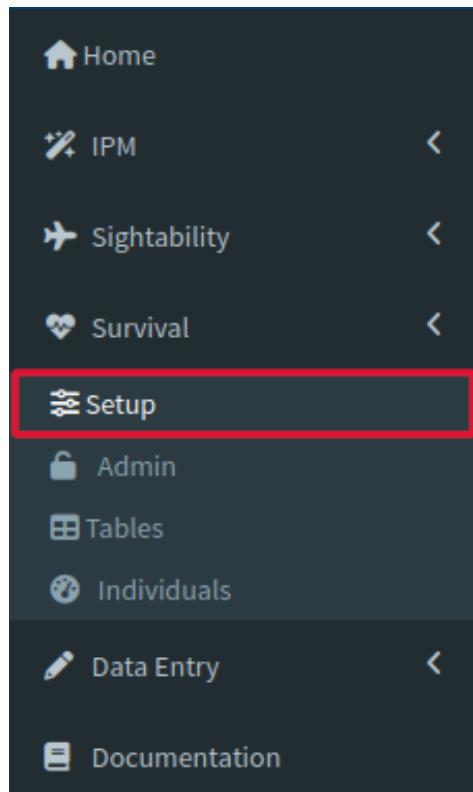
Things often do not go to plan, and so more complicated models need to be created to account for the reality of survival studies. Our models can consider mortality and survival data from the entire state/province as well as information from your particular DAU of interest. If there is sufficient data for your target DAU the model will use that information, but in the case that there isn't enough, the model can dip into a state-wide database that includes all capture and mortality data for the month in order to fill in gaps. Keep this in mind when your data is scarce, as the less data you have the closer your estimate will come to the state average.

4.1 Walkthrough

Using the Survival tool can be split into three major processes: preparing data, reviewing outputs, and uploading data.

4.1.1 Preparing Data

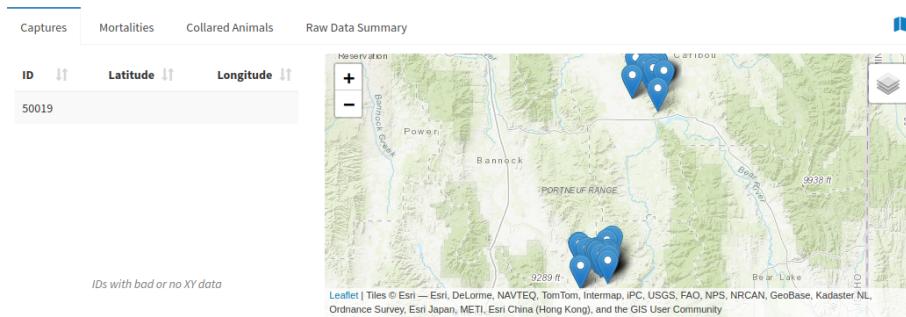
The first step is to obtain your data. Click Setup under the Survival dropdown.



You will notice a window at the top left of the page labeled Overview, and this is where you will decide the species and DAU that we will be analyzing. Once you have made your selections, click Download Data at the bottom of the window.

The screenshot shows the 'Overview' tab selected. It has two dropdown menus: 'Species' set to 'Elk' and 'DAU' set to 'Elk_Bannock'. Below these is a large blue button labeled 'Download Data' with a download icon.

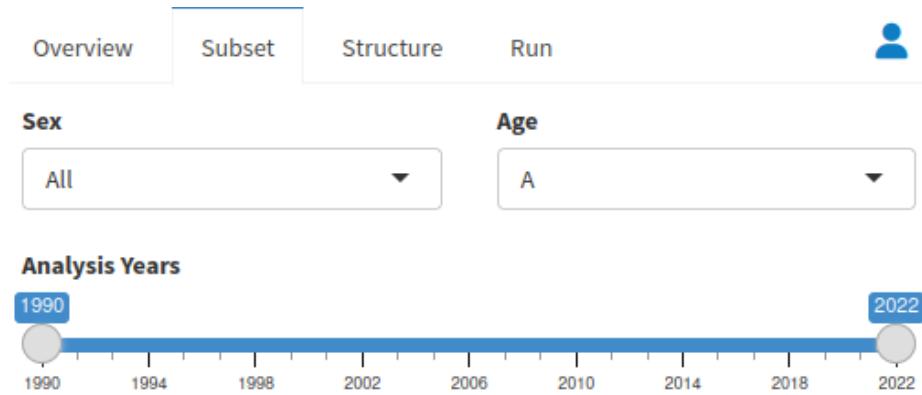
Now that your data is loaded, feel free to look it over using the windows to the right of and below the Overview window.



The screenshot shows the 'Raw Data' tab. At the top, there are tabs for 'Captures', 'Monitoring', 'Mortalities', 'Encounter Histories', and 'Raw Data'. Below the tabs is a search bar with 'Show 10 entries'. The main area is a table with columns: ID, Region, DAU, Unit, CapAge, Sex, Species, First, FirstCol, StudyStart, Latitude, and Longitude. The table contains 10 rows of data. At the bottom, a note says 'Showing 1 to 10 of 49 entries' and a navigation bar shows pages 1 through 5.

ID	Region	DAU	Unit	CapAge	Sex	Species	First	FirstCol	StudyStart	Latitude	Longitude
19185	5	Elk_Bannock	72	J	F	Elk	2019-01-20	158	2005-12-15	42.69757	-111.78051
19191	5	Elk_Bannock	72	J	F	Elk	2019-01-20	158	2005-12-15	42.69594	-111.78205
200199	5	Elk_Bannock	72	J	F	Elk	2019-12-31	169	2005-12-15	42.71335	-111.71669
4354	5	Elk_Bannock	72	A	F	Elk	2006-01-17	2	2005-12-15	42.72964	-111.70502
4355	5	Elk_Bannock	72	A	F	Elk	2006-01-17	2	2005-12-15	42.72964	-111.70502
4356	5	Elk_Bannock	72	A	F	Elk	2006-04-07	4	2005-12-15	42.72349	-111.72485
4357	5	Elk_Bannock	72	A	M	Elk	2006-04-07	4	2005-12-15	42.70569	-111.68426
4358	5	Elk_Bannock	72	A	M	Elk	2006-04-07	4	2005-12-15	42.73779	-111.77214
4359	5	Elk_Bannock	72	A	M	Elk	2006-01-16	2	2005-12-15	42.72964	-111.70502
4360	5	Elk_Bannock	72	A	F	Elk	2006-01-16	2	2005-12-15	42.72964	-111.70502

Once you have looked over your data, we can move on to the next step by navigating to the Subset tab next to the Overview one. Select the sex and age of the animals you will be analyzing, as well as the years your analysis will take place.

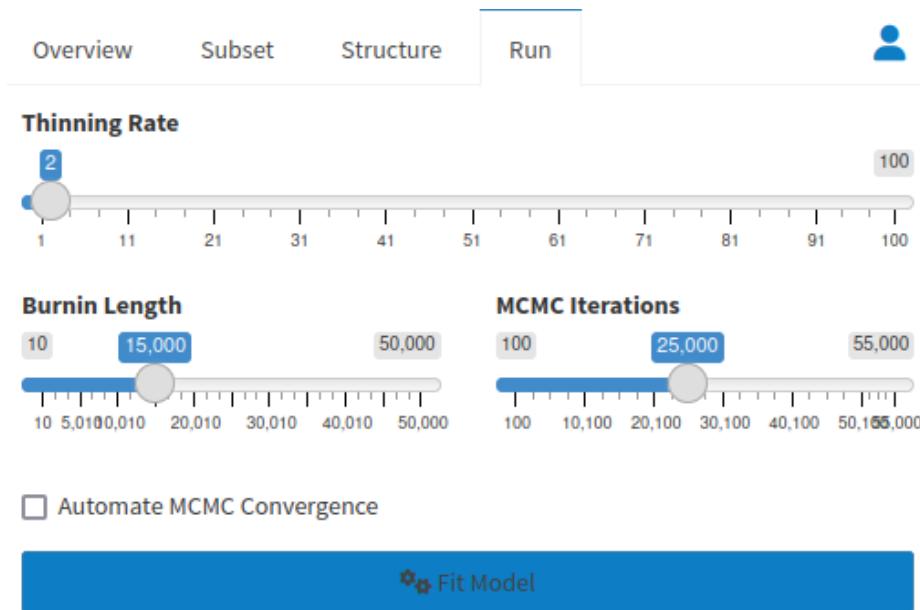


We will next move on to the Structure window, where we will determine our model type, as well as our variances for sex, time, and space. We can also choose to censor harvest mortalities.

The figure shows the 'Structure' tab of a software interface. At the top, there are four tabs: 'Overview', 'Subset', 'Structure' (which is selected and highlighted in blue), and 'Run'. To the right of the tabs is a user icon. Below the tabs, there are several dropdown menus and settings: 'Model Type' set to 'Known Fate', 'Covariates' set to 'None', 'Model sexes as' set to 'Same', 'Model time as' set to 'Constant', and 'Model space as' set to 'Constant'.

Once you have made your choices, you can move on to the Run tab. Under

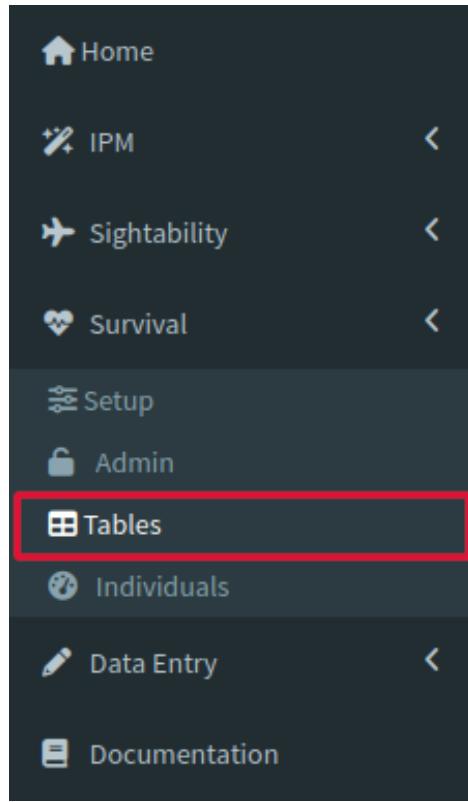
the run tab, decide your Burnin Length, MCMC Iterations, and Thinning Rate, then decide whether or not you would like to Automate Convergence. We have provided a set of defaults that are well suited for a variety of situations, but feel free to modify the values to better fit your situation.



When you are done, click Fit Model to run the analysis. You will get a dialog box when the process is done.

4.1.2 Reviewing Outputs

Once your model is finished running, you can view the results in the Tables tab.



Note that the first ten entries that appear when you open this page are only a small fraction of the total. Use the page list on the bottom right to see more pages of data or use Show (10) Entries on the top left to make more entries appear on each page.

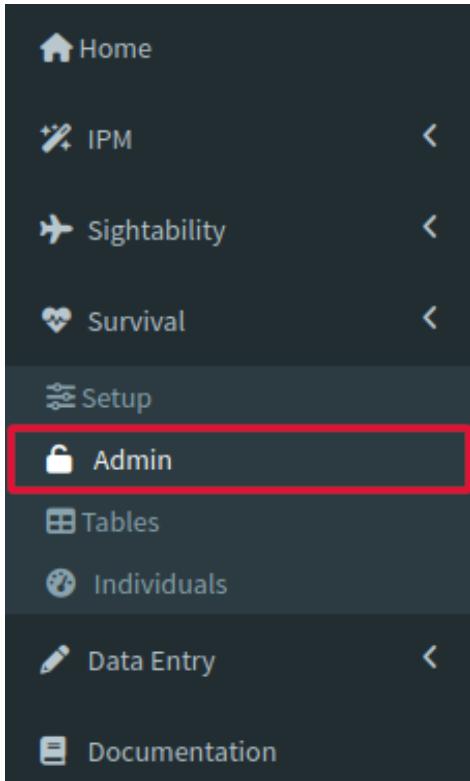
Tables										Show 10 entries	Copy	Print	Download	
Species	Year	DAU	Sex	Age	Parameter	Month	Mean	SD	LCL	UCL				
All	All	All	All	All	All	All	All	All	All	All	All	All	All	All
Elk	2006	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2007	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2008	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2009	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2010	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2011	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2012	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2013	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2014	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				
Elk	2015	Elk_Bannock	F	A	Survival		0.84	0.03	0.78	0.89				

Showing 1 to 10 of 209 entries

Previous [1] 2 3 4 5 ... 21 Next

4.1.3 Uploading Data

If you're feeling confident about your results, you can add them to an IPM database using the Admin tab, but understand that edits you make here will edit the database for everyone, which is why we ask that you're confident about your results before you add them.



The IPM Data window allows you to select which database will receive your data, and the Estimates tab allows you to review the data that you will be adding to the database. Update DB will upload your data when you are ready.

IPM Data
Use the input below to select a database. This is the database to which estimates will be added. If you want to create a new database use the Admin page within the IPM tab.

Add data to:
`elk_ipm_db.RData`

Estimates
Verify that the estimates in the table below are reasonable and then click Update DB to add the estimates to the IPM database. This will replace or update existing values. Changes are made instantly. For estimates to be useful for the IPM check that Year, Species, DAU, Sex, Age, Parameter, Mean and SE have values. If one of these values is blank the IPM will not be able to use the estimates.

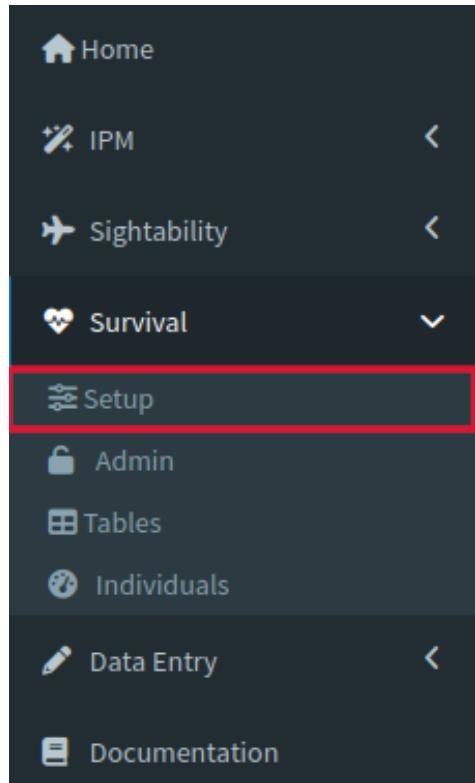
Show	10	v	entries											Copy	Print	Download
Year	Species	Unit	DAU	Sex	Age	Parameter	Mean	SE	All	All	All	All	All	All	All	
All	All	All	All	All	All	All	All	All	All	All	All	All	All	All	All	
2006	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2007	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2008	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2009	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2010	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2011	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2012	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2013	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2014	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									
2015	Elk	Elk_Bannock	F	A	Survival	0.840	0.028									

Showing 1 to 10 of 16 entries

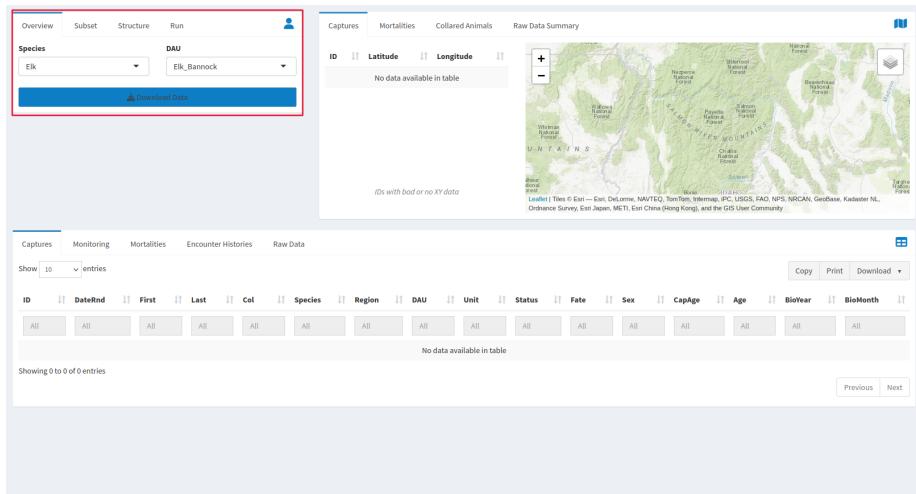
Update DB Previous 1 2 Next

4.2 Reference

4.2.1 Setup



The window on the top left determines how your model is going to be run.



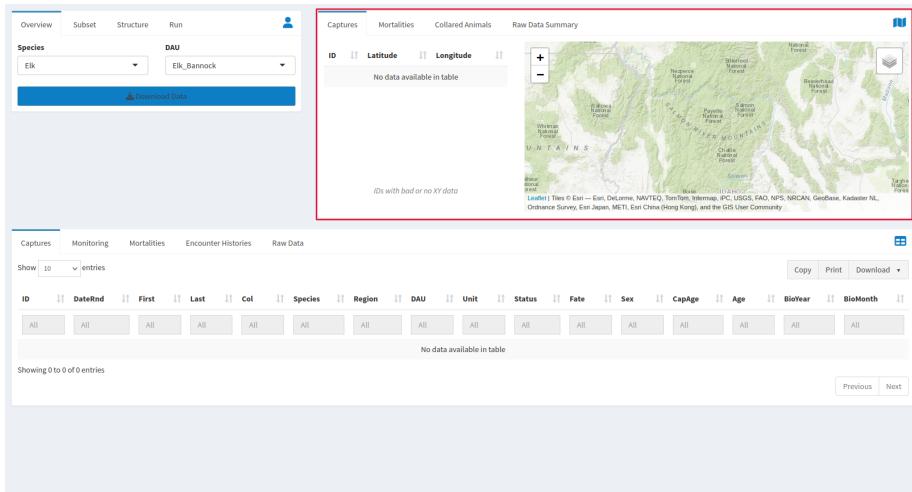
The Overview tab is where you select and download the data that you will be modeling for survival by species of animal and DAU that the data was collected in. The only way to preview the data before modeling is to download it, and you will have to redownload if you want to change the species or DAU before you run the model. If data is pulled from your agencies database via an API, the data must be modified at the source. PopR only loads the data temporarily using an API, and so cannot modify it. The Subset tab lets you decide which sections of your elk or mule deer population will be included in your output, and over what period of time. The default inputs are Sex:All, Age:A.

In the Structure tab, we get to make some decisions about our model. The Default inputs work well for a variety of situations and you should keep them if you plan on putting the results of this model into an IPM dataset. They are: Model Type: Known Fate, Covariates: None, Censor Fate(s): None, Model sexes as: Same, Model time as: Constant, Model space as: Constant. Use the known fate model if you know when every animal died in your study, but the multi-state model can make estimates even if you censored animals. You can also select which covariates will be included in your analysis here. Censor fate allows you to remove animals from your analysis who were harvested by hunters. Simply click the Harvest option. Model Sexes can get survival metrics of both males and females separately by setting it to Different. You can model both time and space as both constant and monthly.

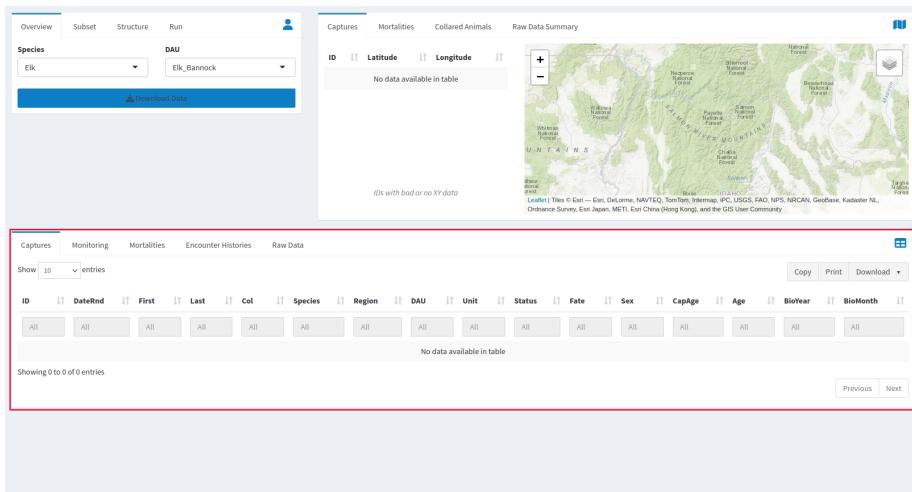
The Run tab gives direction to our actual modeling process. The given settings control how we deal with the many thousands of times the model must run to calibrate itself. Adjust your Burnin Length, MCMC Iterations and Thinning Rate. The bottom of the window gives an option for Automating Convergence as well. You may adjust any of these factors, but the defaults are appropriate for a wide variety of situations.

Use the window at the top right of the page to check for data issues. The

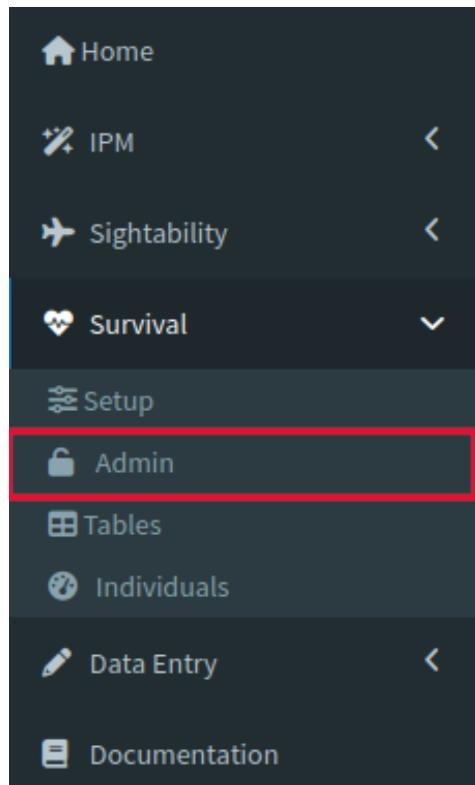
window to the top right is very useful for troubleshooting. The capture tab displays the ID of an animal that has bad or no XY data in the capture tab at the bottom of the page. The Mortalities tab displays Mortality data whose XY data needs fixing as well. To get a better idea of which points are causing a problem, points can be clicked on the map to get their IDs as well.



The window at the bottom of the page works as a preview for data that is gathered by the download data button. All of the tables can be downloaded with the corresponding button, but only data that is displayed will be downloaded, so make sure Show (10) Entries is changed to “All” if you would like to get your entire output in one .csv. All of the tables can be searched using the empty slots at the top of each column. Searching the ID column can be very helpful for finding data that is also displayed in the window that shows entries with damaged xy data.



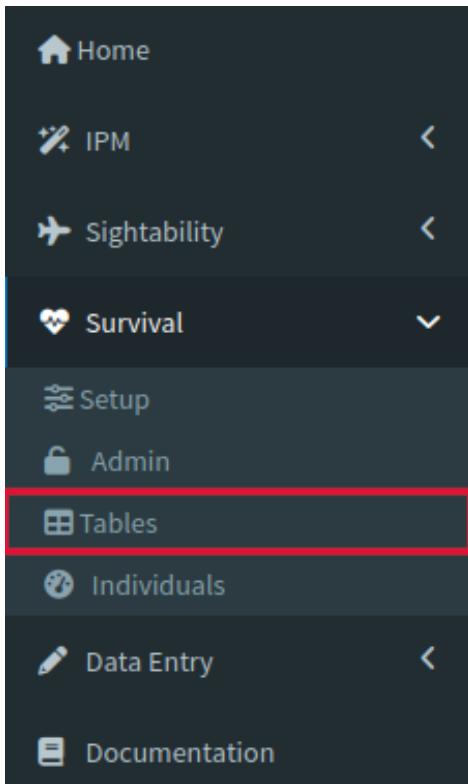
4.2.2 Admin



The Admin tab is a straightforward page used to upload the results of your model to your database of choice. The bottom window can be used to preview the data that you plan to upload, so make sure you are comfortable with your results before you upload them to the public database. Data you upload will be incorporated into everyone else's model runs, so be careful.

The screenshot shows the 'IPM Data' interface. At the top, there is a message: 'Use the input below to select a database. This is the database to which estimates will be added. If you want to create a new database use the Admin page within the IPM tab.' Below this is a dropdown menu labeled 'Add data to:' containing 'elk_ipm_db.RData'. A red box highlights the 'Estimates' section, which contains a message: 'Verify that the estimates in the table below are reasonable and then click Update DB to add the estimates to the IPM database. This will replace or update existing values. Changes are made instantly. For estimates to be useful for the IPM check that Year, Species, DAU, Sex, Age, Parameter, Mean and SE have values. If one of these values is blank the IPM will not be able to use the estimates.' At the bottom of this section is a button labeled 'Update DB'.

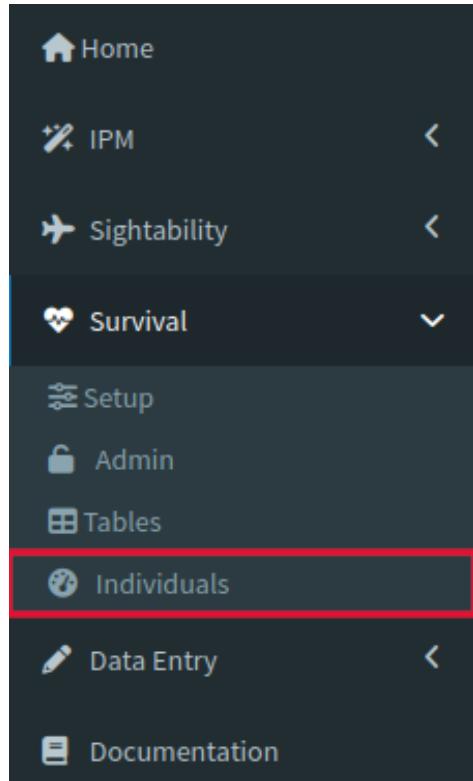
4.2.3 Tables



Once your model is finished running, you can view the results in the Tables tab.

Note that the first ten entries that appear when you open this page are only a small fraction of the total. Use the page list on the bottom right to see more pages of data or use the dropdown menu on the top left to make more entries appear on each page.

4.2.4 Individuals



If the window in the setup tab shows that there may be problems with XY data in capture and mortalities, this is the place to go. After selecting your individual of interest at the top of the page, the bottom two windows show all data available about that particular animal.

4.2. REFERENCE

Individual Record

When model fitting failures occur a common cause is the data. This tool allows the user to see the raw data, as received from the database, and compare it to the data formatted for input to the model. To begin using the tool load data using the Setup tab at left and then return to this tab and subset to individual of interest. The table on the left (i.e. Raw) shows the data as returned from the database while the table on the right shows data after processed and formatted for analysis.

Raw	Raw Minimized	Copy	Print	Download																																																																																																														
<table border="1"><thead><tr><th>Animal_ID</th><th>GamID</th><th>GMU</th><th>Sex</th><th>Age_Class</th><th>Capture_Date</th><th>Date</th><th>FateDate</th><th>Cr</th></tr></thead><tbody><tr><td>All</td><td>All</td><td>All</td><td>All</td><td>All</td><td>All</td><td>-</td><td>All</td><td></td></tr><tr><td>19182</td><td>4</td><td>72</td><td>Female</td><td>Calf</td><td>1/20/2019</td><td>2/28/2019</td><td>4/14/2019</td><td></td></tr><tr><td>19182</td><td>4</td><td>72</td><td>Female</td><td>Calf</td><td>1/20/2019</td><td>1/31/2019</td><td>4/14/2019</td><td></td></tr><tr><td>19182</td><td>4</td><td>72</td><td>Female</td><td>Calf</td><td>1/20/2019</td><td>3/31/2019</td><td>4/14/2019</td><td></td></tr><tr><td>19182</td><td>4</td><td>72</td><td>Female</td><td>Calf</td><td>1/20/2019</td><td>1/27/2019</td><td>4/14/2019</td><td></td></tr><tr><td>19182</td><td>4</td><td>72</td><td>Female</td><td>Calf</td><td>1/20/2019</td><td>2/6/2019</td><td>4/14/2019</td><td></td></tr></tbody></table>	Animal_ID	GamID	GMU	Sex	Age_Class	Capture_Date	Date	FateDate	Cr	All	All	All	All	All	All	-	All		19182	4	72	Female	Calf	1/20/2019	2/28/2019	4/14/2019		19182	4	72	Female	Calf	1/20/2019	1/31/2019	4/14/2019		19182	4	72	Female	Calf	1/20/2019	3/31/2019	4/14/2019		19182	4	72	Female	Calf	1/20/2019	1/27/2019	4/14/2019		19182	4	72	Female	Calf	1/20/2019	2/6/2019	4/14/2019		<table border="1"><thead><tr><th>ID</th><th>DateRnd</th><th>First</th><th>Last</th><th>Col</th><th>Species</th><th>Region</th><th>DAU</th><th>Unit</th><th>s</th></tr></thead><tbody><tr><td>All</td><td>A</td><td>A</td><td></td><td>AI</td><td>A</td><td>All</td><td></td><td></td><td></td></tr><tr><td>19182</td><td>2019-02-15</td><td>2019-01-20</td><td>2019-04-14</td><td>158</td><td>Elk</td><td>S</td><td>Elk_Bannock</td><td>72</td><td></td></tr><tr><td>19182</td><td>2019-03-15</td><td>2019-01-20</td><td>2019-04-14</td><td>159</td><td>Elk</td><td>S</td><td>Elk_Bannock</td><td>72</td><td></td></tr><tr><td>19182</td><td>2019-04-15</td><td>2019-01-20</td><td>2019-04-14</td><td>160</td><td>Elk</td><td>S</td><td>Elk_Bannock</td><td>72</td><td></td></tr></tbody></table>	ID	DateRnd	First	Last	Col	Species	Region	DAU	Unit	s	All	A	A		AI	A	All				19182	2019-02-15	2019-01-20	2019-04-14	158	Elk	S	Elk_Bannock	72		19182	2019-03-15	2019-01-20	2019-04-14	159	Elk	S	Elk_Bannock	72		19182	2019-04-15	2019-01-20	2019-04-14	160	Elk	S	Elk_Bannock	72	
Animal_ID	GamID	GMU	Sex	Age_Class	Capture_Date	Date	FateDate	Cr																																																																																																										
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ID	DateRnd	First	Last	Col	Species	Region	DAU	Unit	s																																																																																																									
All	A	A		AI	A	All																																																																																																												
19182	2019-02-15	2019-01-20	2019-04-14	158	Elk	S	Elk_Bannock	72																																																																																																										
19182	2019-03-15	2019-01-20	2019-04-14	159	Elk	S	Elk_Bannock	72																																																																																																										
19182	2019-04-15	2019-01-20	2019-04-14	160	Elk	S	Elk_Bannock	72																																																																																																										
Showing 1 to 5 of 5 entries	Showing 1 to 3 of 3 entries																																																																																																																	

Raw data, is on the left. The two tabs in this window are Raw and Raw minimized, which removes some of the columns from the Raw tab to make it easier to navigate. The empty box at the top of each column is a keyword search.

Data formatted by speedgoat for our model is on the right. There are many columns, so make sure to scroll horizontally to make sure you see them all. The empty text box at the top of each column allows you to do a keyword search.

Individual Record

When model fitting failures occur a common cause is the data. This tool allows the user to see the raw data, as received from the database, and compare it to the data formatted for input to the model. To begin using the tool load data using the Setup tab at left and then return to this tab and subset to individual of interest. The table on the left (i.e. Raw) shows the data as returned from the database while the table on the right shows data after processed and formatted for analysis.

Raw	Raw Minimized	Encounter Histories	Capture	Mortality																																																																																																														
<p>Copy Print Download ▾</p> <table border="1"> <thead> <tr> <th>Animal_ID</th> <th>GameID</th> <th>GMU</th> <th>Sex</th> <th>Age_Class</th> <th>Capture_Date</th> <th>Date</th> <th>FateDate</th> <th>Cr</th> </tr> </thead> <tbody> <tr> <td>All</td> <td>All</td> <td>All</td> <td>All</td> <td>All</td> <td>All</td> <td>-</td> <td>All</td> <td></td> </tr> <tr> <td>19182</td> <td>4</td> <td>T2</td> <td>Female</td> <td>Calf</td> <td>1/20/2019</td> <td>2/26/2019</td> <td>4/14/2019</td> <td></td> </tr> <tr> <td>19182</td> <td>4</td> <td>T2</td> <td>Female</td> <td>Calf</td> <td>1/20/2019</td> <td>1/30/2019</td> <td>4/14/2019</td> <td></td> </tr> <tr> <td>19182</td> <td>4</td> <td>T2</td> <td>Female</td> <td>Calf</td> <td>1/20/2019</td> <td>3/31/2019</td> <td>4/14/2019</td> <td></td> </tr> <tr> <td>19182</td> <td>4</td> <td>T2</td> <td>Female</td> <td>Calf</td> <td>1/20/2019</td> <td>1/27/2019</td> <td>4/14/2019</td> <td></td> </tr> <tr> <td>19182</td> <td>4</td> <td>T2</td> <td>Female</td> <td>Calf</td> <td>1/20/2019</td> <td>2/6/2019</td> <td>4/14/2019</td> <td></td> </tr> </tbody> </table> <p>Showing 1 to 5 of 5 entries</p>	Animal_ID	GameID	GMU	Sex	Age_Class	Capture_Date	Date	FateDate	Cr	All	All	All	All	All	All	-	All		19182	4	T2	Female	Calf	1/20/2019	2/26/2019	4/14/2019		19182	4	T2	Female	Calf	1/20/2019	1/30/2019	4/14/2019		19182	4	T2	Female	Calf	1/20/2019	3/31/2019	4/14/2019		19182	4	T2	Female	Calf	1/20/2019	1/27/2019	4/14/2019		19182	4	T2	Female	Calf	1/20/2019	2/6/2019	4/14/2019		<p>Copy Print Download ▾</p> <table border="1"> <thead> <tr> <th>ID</th> <th>DateRnd</th> <th>First</th> <th>Last</th> <th>Col</th> <th>Species</th> <th>Region</th> <th>DAU</th> <th>Unit</th> <th>S</th> </tr> </thead> <tbody> <tr> <td>All</td> <td>A</td> <td>A</td> <td>A</td> <td>AI</td> <td>A</td> <td>A</td> <td>All</td> <td></td> <td></td> </tr> <tr> <td>19182</td> <td>2019-02-15</td> <td>2019-01-20</td> <td>2019-04-14</td> <td>158</td> <td>Elk</td> <td>S</td> <td>Elk_Banrock</td> <td>T2</td> <td></td> </tr> <tr> <td>19182</td> <td>2019-03-15</td> <td>2019-01-20</td> <td>2019-04-14</td> <td>159</td> <td>Elk</td> <td>S</td> <td>Elk_Banrock</td> <td>T2</td> <td></td> </tr> <tr> <td>19182</td> <td>2019-04-15</td> <td>2019-01-20</td> <td>2019-04-14</td> <td>160</td> <td>Elk</td> <td>S</td> <td>Elk_Banrock</td> <td>T2</td> <td></td> </tr> </tbody> </table> <p>Showing 1 to 3 of 3 entries</p>	ID	DateRnd	First	Last	Col	Species	Region	DAU	Unit	S	All	A	A	A	AI	A	A	All			19182	2019-02-15	2019-01-20	2019-04-14	158	Elk	S	Elk_Banrock	T2		19182	2019-03-15	2019-01-20	2019-04-14	159	Elk	S	Elk_Banrock	T2		19182	2019-04-15	2019-01-20	2019-04-14	160	Elk	S	Elk_Banrock	T2	
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Chapter 5

Data Entry

This tool handles/organizes the information that makes all of the other tools work. More specifically, the data entry tool allows you to design sightability and composition surveys for a DAU and then enter/upload the results to the speedgoat database. Remember that the surveys you create and edit are the same ones that everyone on your team has access to, so any edit you make will change the data that EVERYONE is using for analysis.

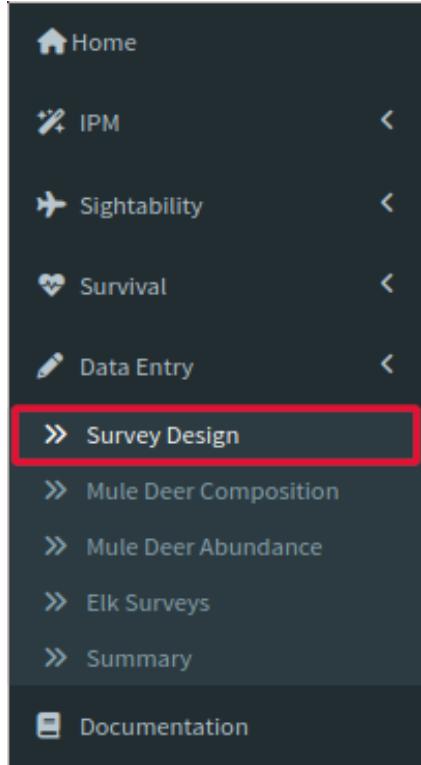
5.1 Walkthrough

The data entry tool can be broken into two sections: creating a survey and then filling it with data.

5.1.1 Creating a Survey

You can use the data entry tab to design aerial surveys and then populate them with data, which can then be used to inform our survival, sightability, and IPM tools.

To begin designing a survey click the Survey Design tab.



When you click the page, a popup window labeled Survey Design Setup should appear, prompting you for your survey species, DAU, survey type (composition or sightability-abundance)), and survey year.

Survey Design Setup

Welcome! Before we can build a survey we need to gather some information.

Species

Mule Deer ▾

DAU

Bannock ▾

Survey Type

Composition ▾

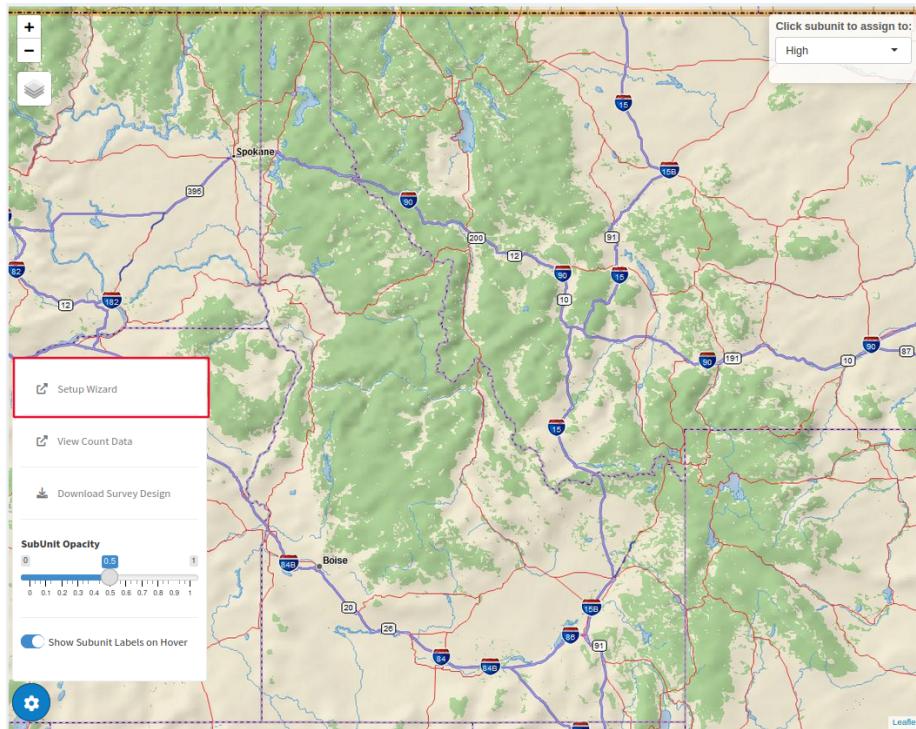
Survey Year

2021-2022 ▾

Close

Next ➞

If this window does not pop up click the gear icon on the bottom left of the page and select Setup Wizard.



Once you have made your choices, a second window will appear asking you whether you would like to import strata from a past survey or start from scratch.

Survey Design Setup

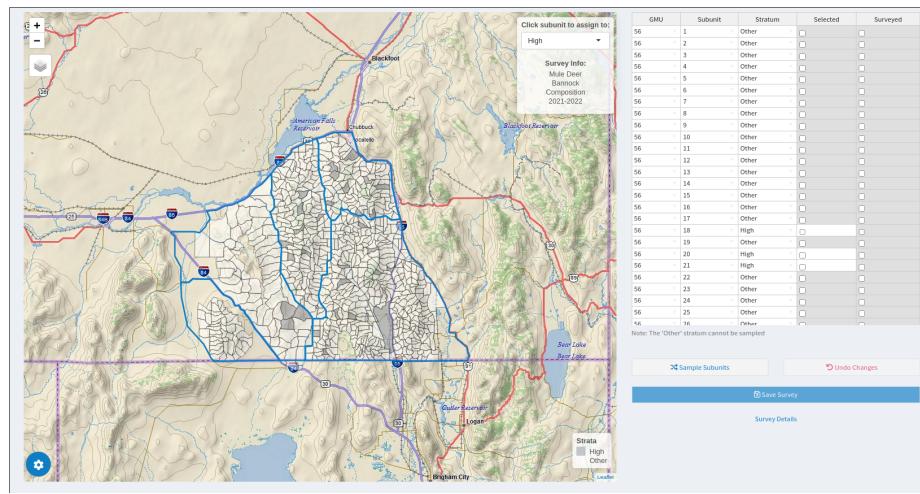
After you click on Finish you will see a map and a table. To assign a subunit to a stratum first select the stratum using the dropdown (top-right) and then click on the subunit.

If you want to return to this wizard or change to a different survey click the gear symbol in the bottom-left of the map and select Setup Wizard.

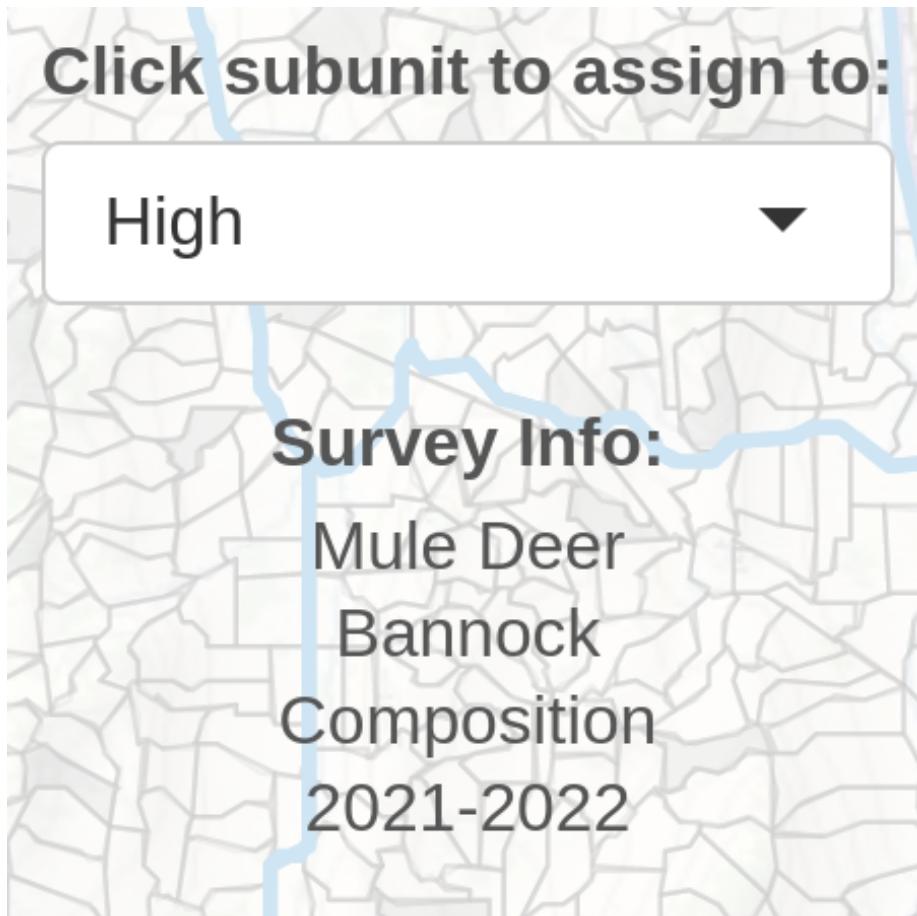
◀ Back

Finish

Either way, clicking Finish on this second window will close the popup and leave you with a map and a table. The map and the table both act as options to assign subunits to different strata, which is the next step in the process.



To use the map, choose which strata you would like to assign to the subunits with the small window labeled Click Subunit to Assign to: and then once your strata is selected, all subunits you click on the map will be assigned to that strata.



You can also assign subunits to different strata by using the table to manually change the Stratum column from Other to whichever is appropriate for your experiment. Note that any subunit left in the Other strata will not be sampled.

GMU	Subunit	Stratum	Selected	Surveyed
56	1	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	2	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	3	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	4	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	5	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	6	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	7	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	8	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	9	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	10	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	11	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	12	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	13	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	14	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	15	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	16	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	17	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	18	High	<input type="checkbox"/>	<input type="checkbox"/>
56	19	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	20	High	<input type="checkbox"/>	<input type="checkbox"/>
56	21	High	<input type="checkbox"/>	<input type="checkbox"/>
56	22	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	23	Other	<input type="checkbox"/>	<input type="checkbox"/>

After you have selected the subunits you plan to fly, click Sample Subunits to decide the time to fly each subunit, the proportion of the High strata that will be sampled, and whether you will sample randomly or using GRTS.

GMU	Subunit	Stratum	Selected	Surveyed
56	1	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	2	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	3	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	4	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	5	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	6	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	7	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	8	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	9	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	10	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	11	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	12	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	13	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	14	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	15	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	16	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	17	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	18	High	<input type="checkbox"/>	<input type="checkbox"/>
56	19	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	20	High	<input type="checkbox"/>	<input type="checkbox"/>
56	21	High	<input type="checkbox"/>	<input type="checkbox"/>
56	22	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	23	Other	<input type="checkbox"/>	<input type="checkbox"/>

Note: The 'Other' stratum cannot be sampled

 Sample Subunits

 Undo Changes

 Save Survey

Survey Details

Random Sampling by Stratum

Time to fly one subunit (hours)

1



Proportion of High to Sample

0.5



Sampling method

Random



Stratum	Subunits in Stratum	Proportion to Fly	Subunits to Fly	Flight Time (H)
High	30	0.5	15	15
Other	737	0	0	0

Note: The 'Other' stratum cannot be sampled. Any subunits marked as flown will be reset when a new sample is created.

Sample

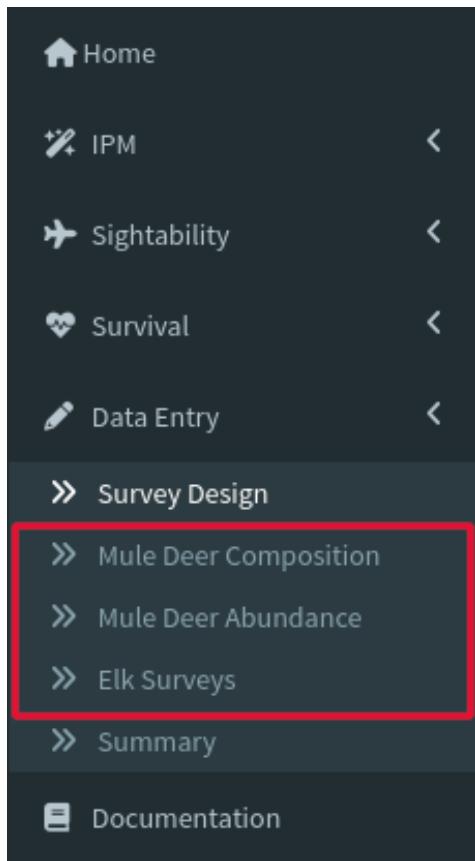
Close

When you are satisfied with the survey you have designed, Click Save Survey to save your edits.

When your survey is actually flown, return to the survey and check the Surveyed box to signal which subunits (of the units selected to be part of the survey earlier) have actually been flown. Click Save Survey to save your edits.

5.1.2 Populating the Survey

Now that you have generated at least one survey, it is time to learn about the Mule Deer Composition, Mule Deer Abundance, and Elk Surveys tabs under the Data Entry dropdown, which are all used to populate surveys created in the Survey Design tab.



It is important to understand that data added here will modify the surveys for everyone, so make sure you are comfortable with this information being used for analysis if you add it here.

All three of these tools use the same framework for data entry. To make sure you're adding info to the right survey you can either enter the relevant info in the upper window or use click here the top of the page, which allows you to hunt for your survey manually.

Enter new data below, or [click here](#) to edit existing data.

New	Tach Start:	Tach End:	Temp:	Wind:
GMU:				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
Flight:	Aircraft:		Pilot:	Observers:
Observations				
Deer <hr/> Other Species				

When you have selected your survey, you can add data manually one entry at a time, which is done by clicking any of the dropdown arrows in the cells of the Observations table. If you already have a spreadsheet prepared, you can also copy and paste that information right into the table.

Observations

Deer

Save Discard

Subunit	Total Deer	Doe's	Fawns	2 Points	3 Points	4+ Points	Unclassified	Activity	Snow %	Screen %	Screen Type	Veg Type	Waypoint	Latitude	Longitude	Notes
1 21	4	3	1	0	0	0	0	0 2 Standing	0	0 1 Grassland/Open	614	45.4090000	-114.0077000			
2 21	3	3	0	0	0	0	0	0 2 Standing	0	0 1 Grassland/Open	615	45.4216000	-114.0198000			
3 21	4	4	0	0	0	0	0	0 2 Moving	0	0 1 Grassland/Open	617	45.4100000	-114.0120000			
4 21	4	3	1	0	0	0	0	0 2 Standing	0	0 1 Grassland/Open	618	45.4241000	-114.0121000			
5 21	3	3	2	0	0	0	0	0 3 Moving	0	0 1 Grassland/Open	619	45.4250000	-114.0232000			
6 21	4	3	1	0	0	0	0	0 2 Standing	0	0 1 Grassland/Open	622	45.4301000	-114.0275000			
7 21	5	4	1	0	0	0	0	0 3 Moving	0	0 1 Grassland/Open	622	45.4301000	-114.0275000			
8 21	3	2	1	0	0	0	0	0 3 Moving	0	0 1 Grassland/Open	622	45.4301000	-114.0275000			
9 21	4	4	0	0	0	0	0	0 3 Moving	0	0 1 Grassland/Open	623	45.4301000	-114.0323000			
10 21	5	3	1	0	0	0	1	0 2 Bedded	0	0 1 Grassland/Open	624	45.4311000	-114.0328000			
11 21	3	1	2	0	0	0	0	0 2 Bedded	80	30 5 Conifer	624	45.4300000	-114.0360000			
12 21	1	0	0	0	0	1	0	0 2 Standing	25	25 5 Conifer	625	45.4344000	-114.0417000			
13 21	11	7	4	0	0	0	0	0 2 Standing	25	50 5 Conifer	626	45.4350000	-114.0396000			
14 21	1	0	0	0	0	1	0	0 2 Standing	0	25 5 Conifer	627	45.4339000	-114.0384000			
15 21	4	0	4	0	0	0	0	0 2 Standing	0	0 1 Grassland/Open	628	45.4341000	-114.0384000			
16 21	3	1	2	0	0	0	0	0 2 Standing	20	20 5 Conifer	629	45.4320000	-114.0402000			
17 21	8	4	4	0	0	0	0	0 2 Standing	10	10 5 Conifer	630	45.4327000	-114.0233000			
18 21	4	2	1	1	0	0	0	0 2 Standing	0	0 1 Grassland/Open	631	45.4322000	-114.0272000			
19 21	1	1	0	0	0	0	0	0 2 Standing	10	10 5 Conifer	632	45.4309000	-114.0241000			
20 21	2	0	2	0	0	0	0	0 2 Standing	25	25 5 Conifer	633	45.4326000	-114.0210000			
21 21	9	5	3	1	0	0	0	0 2 Standing	40	50 5 Conifer	634	45.4310000	-114.0210000			
22 21	6	3	0	0	0	0	0	0 2 Standing	75	60 5 Conifer	635	45.4300000	-114.0211000			
23 21	3	1	2	0	0	0	0	0 2 Standing	40	40 5 Conifer	636	45.4310000	-114.0313000			
24 21	3	1	2	0	0	0	0	0 1 Bedded	75	50 5 Conifer	637	45.4410000	-114.0695000			
25 21	7	4	2	1	0	0	0	0 2 Standing	60	40 5 Conifer	638	45.4410000	-114.0505000			
26 21	4	2	2	0	0	0	0	0 2 Standing	75	50 5 Conifer	639	45.4430000	-114.0474000			
27 21	5	1	0	2	2	0	0	0 2 Standing	75	60 5 Conifer	640	45.4429000	-114.0473000			
28 21	3	2	0	0	0	0	0	0 2 Standing	75	70 5 Conifer	641	45.4410000	-114.0474000			
29 21	1	0	0	0	0	0	0	0 2 Standing	90	50 5 Conifer	642	45.4461000	-114.0641000			
30 21	1	0	0	0	0	1	0	0 2 Standing	100	50 5 Conifer	643	45.4400000	-114.0596000			
31 21	8	2	3	1	1	0	1	0 2 Standing	100	75 5 Conifer	644	45.4452000	-114.0513000			
32 21	4	2	2	0	0	0	0	0 2 Bedded	100	10 5 Conifer	645	45.4399000	-114.0433000			
33 21	22	12	7	3	0	0	0	0 2 Standing	50	10 5 Conifer	646	45.4183000	-114.0354000			
34 21	1	1	0	0	0	0	0	0 2 Standing	75	30 5 Conifer	647	45.4166000	-114.0302000			

While you make these edits, the area that normally displays Add GPS Data and Totals changes to Save and Discard. Either accept your changes and save them to your database with Save or revert any changes with Discard and the original options will reappear.

5.1. WALKTHROUGH

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Observations																	
Deer																	
Subunit	Total Deer	Does	Fawns	2 Points	3 Points	4+ Points	Unclassified	Activity	Snow %	Screen %	Screen Type	Veg Type	Waypoint	Latitude	Longitude	Notes	
1 21	4	3	1	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	614	45.400000	-114.0037000			
2 21	3	3	0	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	615	45.410000	-114.0100000			
3 21	4	4	0	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	615	45.410000	-114.0052000			
4 21	4	3	1	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	618	45.424000	-114.0171000			
5 21	3	2	2	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	619	45.428000	-114.0230000			
6 21	4	3	1	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	622	45.430000	-114.0275000			
7 21	5	4	1	1	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	622	45.430000	-114.0275000			
8 21	2	2	1	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	622	45.430000	-114.0275000			
9 21	4	4	0	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	623	45.431000	-114.0320000			
10 21	5	3	1	0	0	0	1	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	623	45.431000	-114.0320000			
11 21	3	1	2	0	0	0	0	0 1) Bedded	80	30 5) Conifer	1) Grassland/Open	624	45.430000	-114.0390000			
12 21	1	0	0	0	0	0	1	0 2) Standing	25	25 5) Conifer	1) Grassland/Open	625	45.444000	-114.0437000			
13 21	11	7	4	0	0	0	0	0 2) Standing	25	50 5) Conifer	1) Grassland/Open	626	45.450000	-114.0396000			
14 21	1	0	0	0	0	0	1	0 2) Standing	25	50 5) Conifer	1) Grassland/Open	627	45.451000	-114.0396000			
15 21	4	0	4	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	628	45.454000	-114.0349000			
16 21	3	1	2	0	0	0	0	0 2) Standing	20	25 5) Conifer	1) Grassland/Open	629	45.453000	-114.0290000			
17 21	8	4	4	0	0	0	0	0 2) Standing	10	10 5) Conifer	1) Grassland/Open	630	45.452700	-114.0250000			
18 21	4	2	1	1	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	631	45.452200	-114.0227000			
19 21	1	1	0	0	0	0	0	0 2) Standing	10	10 5) Conifer	1) Grassland/Open	632	45.452200	-114.0227000			
20 21	2	2	2	0	0	0	0	0 2) Standing	25	50 5) Conifer	1) Grassland/Open	633	45.452000	-114.0231000			
21 21	9	5	3	1	0	0	0	0 2) Standing	40	55 5) Conifer	5) Conifer	634	45.450000	-114.0200000			
22 21	6	3	3	0	0	0	0	0 2) Standing	75	60 5) Conifer	5) Conifer	635	45.456000	-114.0231000			
23 21	3	1	2	0	0	0	0	0 2) Standing	40	40 5) Conifer	1) Grassland/Open	636	45.455200	-114.0313000			
24 21	3	1	2	0	0	0	0	0 1) Bedded	75	50 5) Conifer	5) Conifer	637	45.451000	-114.0495000			
25 21	7	4	2	1	0	0	0	0 2) Standing	60	40 5) Conifer	1) Grassland/Open	638	45.451000	-114.0495000			
26 21	4	2	2	0	0	0	0	0 2) Standing	60	40 5) Conifer	5) Conifer	639	45.453000	-114.0414000			
27 21	5	3	0	2	2	0	0	0 2) Standing	75	60 5) Conifer	5) Conifer	640	45.452900	-114.0473000			
28 21	5	3	2	0	0	0	0	0 1) Bedded	75	60 5) Conifer	5) Conifer	641	45.452000	-114.0363000			
29 21	1	1	0	0	0	0	0	0 2) Standing	90	50 5) Conifer	5) Conifer	642	45.464000	-114.0441000			
30 21	1	0	0	0	0	0	1	0 2) Standing	100	50 5) Conifer	5) Conifer	643	45.464000	-114.0595000			
31 21	8	2	3	1	1	0	0	0 2) Standing	100	75 5) Conifer	5) Conifer	644	45.450000	-114.0445000			
32 21	4	2	2	0	0	0	0	0 1) Bedded	100	50 5) Conifer	5) Conifer	645	45.459000	-114.0445000			
33 21	22	12	7	3	0	0	0	0 1) Bedded	50	10 5) Conifer	1) Grassland/Open	646	45.451000	-114.0350000			
34 21	-	1	1	0	0	0	0	0 2) Standing	75	30 5) Conifer	1) Grassland/Open	647	45.418000	-114.0302000			

You can add latitude and longitude information to the database with Add GPS Data on the right side of the page, which will be visible as long as you do not have any unsaved edits to your Observations table. Follow the instructions of the popup window that appears for final import instructions.

Observations																	
Deer																	
Subunit	Total Deer	Does	Fawns	2 Points	3 Points	4+ Points	Unclassified	Activity	Snow %	Screen %	Screen Type	Veg Type	Waypoint	Latitude	Longitude	Notes	
1 21	4	3	1	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	614	45.400000	-114.0037000			
2 21	3	3	0	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	615	45.416000	-114.0190000			
3 21	4	4	0	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	617	45.418000	-114.0052000			
4 21	4	3	1	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	618	45.443000	-114.0171000			
5 21	3	1	2	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	619	45.451000	-114.0230000			
6 21	4	2	2	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	620	45.461000	-114.0270000			
7 21	5	4	1	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	622	45.461000	-114.0270000			
8 21	3	2	1	0	0	0	0	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	622	45.461000	-114.0270000			
9 21	2	4	0	0	0	0	0	0 1) Bedded	0	0 1) Grassland/Open	1) Grassland/Open	623	45.461100	-114.0320000			
10 21	5	3	1	0	0	0	1	0 3) Moving	0	0 1) Grassland/Open	1) Grassland/Open	623	45.461100	-114.0320000			
11 21	3	1	2	0	0	0	0	0 1) Bedded	80	30 5) Conifer	1) Grassland/Open	624	45.464000	-114.0441000			
12 21	1	0	0	0	0	0	1	0 2) Standing	25	25 5) Conifer	1) Grassland/Open	625	45.464000	-114.0441000			
13 21	11	7	4	0	0	0	0	0 2) Standing	25	50 5) Conifer	1) Grassland/Open	626	45.465000	-114.0390000			
14 21	1	0	0	0	0	0	1	0 2) Standing	25	50 5) Conifer	5) Conifer	627	45.463000	-114.0394000			
15 21	4	0	4	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	628	45.453000	-114.0334000			
16 21	3	1	2	0	0	0	0	0 2) Standing	20	25 5) Conifer	1) Grassland/Open	629	45.453200	-114.0260000			
17 21	8	4	4	0	0	0	0	0 2) Standing	30	10 5) Conifer	1) Grassland/Open	630	45.461000	-114.0227000			
18 21	4	2	2	0	0	0	0	0 2) Standing	0	0 1) Grassland/Open	1) Grassland/Open	631	45.462000	-114.0227000			
19 21	1	1	0	0	0	0	0	0 2) Standing	10	10 5) Conifer	1) Grassland/Open	632	45.462000	-114.0243000			
20 21	2	0	2	0	0	0	0	0 2) Standing	25	25 5) Conifer	1) Grassland/Open	633	45.462000	-114.0203000			
21 21	9	5	3	1	0	0	0	0 2) Standing	40	55 5) Conifer	5) Conifer	634	45.456000	-114.0260000			
22 21	6	3	3	0	0	0	0	0 2) Standing	75	60 5) Conifer	5) Conifer	635	45.456000	-114.0281000			
23 21	3	2	2	0	0	0	0	0 2) Standing	40	50 5) Conifer	1) Grassland/Open	636	45.441000	-114.0494000			
24 21	3	1	2	0	0	0	0	0 1) Bedded	75	50 5) Conifer	5) Conifer	637	45.441000	-114.0494000			
25 21	7	4	2	1	0	0	0	0 2) Standing	60	40 5) Conifer	1) Grassland/Open	638	45.441900	-114.0500000			
26 21	4	2	2	0	0	0	0	0 2) Standing	75	50 5) Conifer	5) Conifer	639	45.443000	-114.0474000			
27 21	5	1	0	2	2	0	0	0 2) Standing	75	60 5) Conifer	5) Conifer	640	45.442000	-114.0473000			
28 21	5	3	2	0	0	0	0	0 1) Bedded	75	60 5) Conifer	5) Conifer	641	45.442000	-114.0363000			
29 21	1	0	0	0	0	0	0	0 2) Standing	40	50 5) Conifer	1) Grassland/Open	642	45.444000	-114.0409000			
30 21	1	0	0	0	0	0	0	0 2) Standing	100	50 5) Conifer	5) Conifer	643	45.444000	-114.0256000			
31 21	8	2	3	1	1	0	0	0 2) Standing	100	75 5) Conifer	5) Conifer	644	45.452000	-114.0533000			
32 21	4	2	2	0	0	0	0	0 2) Standing	100	50 5) Conifer	5) Conifer	645	45.459000	-114.0483000			
33 21	22	12	7	3	0	0	0	0 1) Bedded	50	10 5) Conifer	1) Grassland/Open	646	45.4181000	-114.0354000			
34 21	-	1	1	0	0	0	0	0 2) Standing	75	30 5) Conifer	1) Grassland/Open	647	45.4186000	-114.0302000			

When you are finished, make sure you click Save to make your changes permanent. Attached Files allows you to add files like maps and raw data for future reference and redundancy.

Mule Deer Composition Survey Data

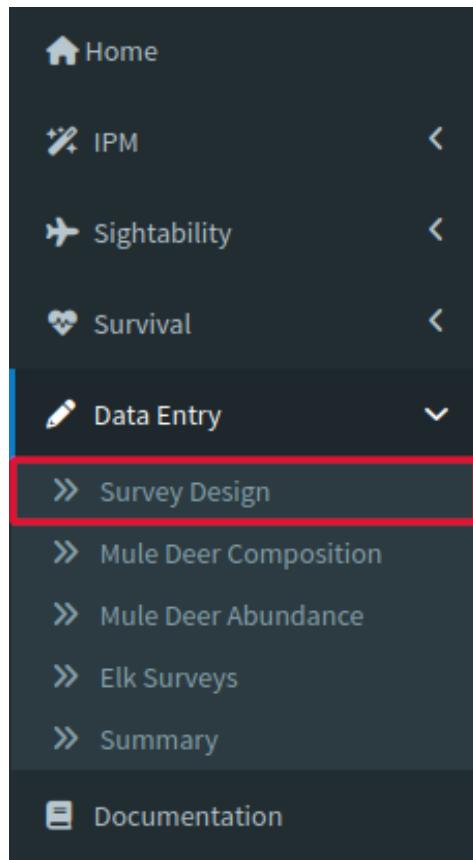
[Click here](#) to change to a different survey.

21 - 12/09/2014

GMU:	Tach Start:	Tach End:	Temp:	Wind:
21				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
12/9/2014				
Flight:	Aircraft:	Pilot:	Observers:	
(Imported from PopR)	Nothing selected			

5.2 Reference

5.2.1 Survey Design



Though someone with intimate knowledge of an area can bring a survey team to an area where there are a relatively high abundance of deer, surveys that return very low abundance are important as well in order to fully inform the model. The model assumes density to be constant, so if you only fly subunits where you

know there are a lot of animals, that amount of animals will be extrapolated to your entire DAU and can lead to overestimation, since it is now represented by only its busiest areas. If you want to track how many subunits are going to be included in your analysis, click Survey Details below the subunit selector table. This menu will remind you of your model settings while showing how many subunits have been selected for survey and how many have actually been surveyed.

GMU	Subunit	Stratum	Selected	Surveyed
56	1	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	2	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	3	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	4	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	5	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	6	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	7	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	8	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	9	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	10	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	11	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	12	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	13	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	14	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	15	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	16	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	17	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	18	High	<input type="checkbox"/>	<input type="checkbox"/>
56	19	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	20	High	<input type="checkbox"/>	<input type="checkbox"/>
56	21	High	<input type="checkbox"/>	<input type="checkbox"/>
56	22	Other	<input type="checkbox"/>	<input type="checkbox"/>
56	23	Other	<input type="checkbox"/>	<input type="checkbox"/>

Note: The 'Other' stratum cannot be sampled

Sample Subunits

Undo Changes

Save Survey

Survey Details

Make sure you stick to your predetermined selections if you want the model to return relevant information, since it is expecting data from these areas and these and these areas only. If the survey design menu does not pop up when you open the tool, then click the gear button on the bottom left of the page and select Setup Wizard from the options in the popup menu.

5.2.2 Mule Deer Composition



This software can only use data from aerial surveys. There is an option to select the aircraft that was flown for the survey which is considered for elk sightability surveys but NOT mule deer surveys, so it's best to just leave that box as "Nothing Selected". You can either begin entering survey data manually in the window labelled New, which will begin adding your data to a new survey, or you can edit surveys that you have already created with the link above the table labeled "click here". The Attached Files button Allows you to add files that you would like to be kept with your observations such as a reference map.

Enter new data below, or [click here](#) to edit existing data.

New				
GMU:	Tach Start:	Tach End:	Temp:	Wind:
nothing selected				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
Flight:	Aircraft:	Pilot:	Observers:	
	Nothing selected			

Observations

- [Deer](#)
- [Other Species](#)

The Observations window allows you to view and alter your data. The Add GPS Data button on the right side of the window allows you to easily import latitude and longitude from .csv files, and the Totals button brings up a window summarizing your data.

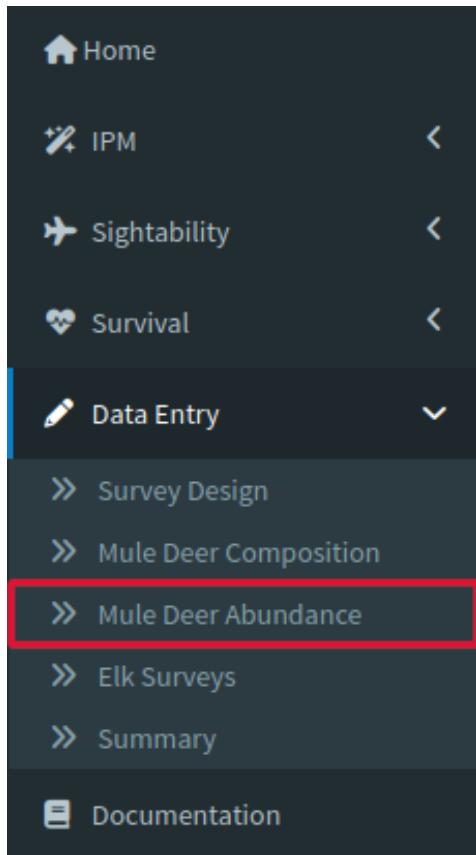
Enter new data below, or [click here](#) to edit existing data.

New				
GMU:	Tach Start:	Tach End:	Temp:	Wind:
nothing selected				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
Flight:	Aircraft:	Pilot:	Observers:	
	Nothing selected			

Observations

- [Deer](#)
- [Other Species](#)

5.2.3 Mule deer Abundance



This software can only use data from aerial surveys. There is an option to select the aircraft that was flown for the survey which is considered for elk sightability surveys but NOT mule deer surveys, so it's best to just leave that box as "Nothing Selected". You can either begin entering survey data manually in the window labelled New, which will begin adding your data to a new survey, or you can edit surveys that you have already created with the link above the table labeled "click here". The Attached Files button Allows you to add files that you would like to be kept with your observations such as a reference map.

Enter new data below, or [click here](#) to edit existing data.

New				
GMU:	Tach Start:	Tach End:	Temp:	Wind:
nothing selected				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
Flight:	Aircraft:	Pilot:	Observers:	
	Nothing selected			

Observations

- [Deer](#)
- [Other Species](#)

The Observations window allows you to view and alter your data. The Add GPS Data button on the right side of the window allows you to easily import latitude and longitude from .csv files, and the Totals button brings up a window summarizing your data.

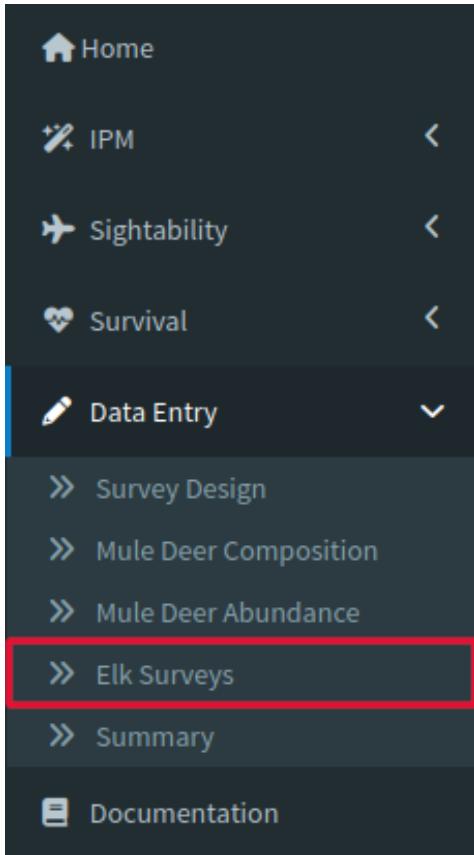
Enter new data below, or [click here](#) to edit existing data.

New				
GMU:	Tach Start:	Tach End:	Temp:	Wind:
nothing selected				
Date:	Clock Start:	Clock End:	Clouds:	Precip:
Flight:	Aircraft:	Pilot:	Observers:	
	Nothing selected			

Observations

- [Deer](#)
- [Other Species](#)

5.2.4 Elk Surveys



Like the mule deer survey tools, this software can only use data from aerial surveys. Elk sightability models are different than the mule deer ones since they incorporate the make of the survey plane in the model. Either enter data from your survey directly to begin adding data to a new survey or by clicking the “Click Here” under the page header. The Attached Files button Allows you to add files that you would like to be kept with your observations such as a reference map.

Enter new data below, or [click here](#) to edit existing data.

New

GMU:	nothing selected	Tach Start:		Tach End:		Temp:		Wind:	
Date:		Clock Start:		Clock End:		Clouds:		Precip:	
Flight:		Aircraft:	Nothing selected	Pilot:		Observers:			

Observations

Elk

Other Species

The Observations window allows you to view and alter your data. The Add GPS Data button on the right side of the window allows you to easily import latitude and longitude from .csv files, and the Totals button brings up a window summarizing your data.

Enter new data below, or [click here](#) to edit existing data.

New

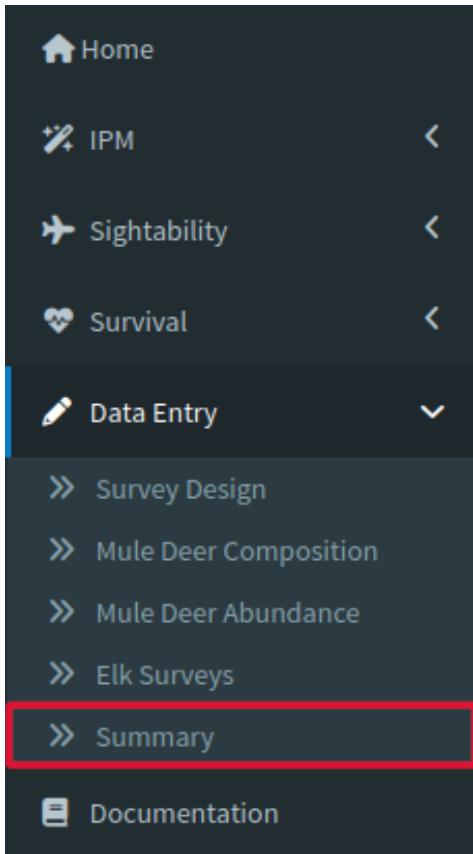
GMU:	nothing selected	Tach Start:		Tach End:		Temp:		Wind:	
Date:		Clock Start:		Clock End:		Clouds:		Precip:	
Flight:		Aircraft:	Nothing selected	Pilot:		Observers:			

Observations

Elk

Other Species

5.2.5 Summary



Be aware that the surveys displayed in the table when you first open the tool are not all of the data available, use the page navigation at the bottom right of the window to see more. If you are looking for a particular survey or location, the blank boxes at the top of every column can be used to search all entries. Just type something in the box and it will automatically find entries in the column that match what you type. This section is great for reviewing/checking raw data since you can download any of the survey data as a .csv.

Chapter 6

Glossary

Abundance The number of animals in a particular area.

Age Ratio Also called the fawn doe ratio or calf cow ratio, this measures the proportion of females that have young. A population of deer with an age ratio of 0.75 means than each cow has a 75% chance of having a calf.

Aircraft/Model Elk sightability models include considerations for the craft that was actually flown to collect the survey.

Analysis Focus This option determines the base geographical unit of your analysis. Game Management is carried out at many spatial scales, the broadest of which being Data Analysis Units (DAUs) which are comprised of several smaller Game Management Units (GMU), which are themselves composed of subunits. subunits are organized into categories based on animal abundance (Low, Medium, High, Other) which are called Strata and help with organization of subunits.

In the sightability tool on the website, “Area” refers to DAUs, or Data Analysis Units and a “Unit” specifically refers to a GMU, or Game Management unit.

When you are using the tool, remember that each spatial scale is calculated with different factors in mind, so it is VERY IMPORTANT that the scale at which the surveys are collected and the scale at which the analysis is carried out are the same. For example, if a survey was flown to cover an entire GMU without consideration for individual subunits, then it would be inappropriate to run an analysis with subunit as your analysis focus.

Automate Convergence Automating convergence will ensure that your model will run enough Burnin Length and MCMC iterations for a sound estimate and error distribution. This may greatly increase the amount of time needed to run your model.

Beta The strength of each variable in the model itself. Categorical variables are represented by a range of binned values, but for the model to create an output it must be converted to a numerical value that modifies the default value. For example, the VegClass covariate changes how easy it is to see an animal. VegClasses differ in the amount that they can obscure vision, but you will notice the classes that obscure visions the most have a negative beta value, which tells us that they have a negative impact on our probability to see an animal.

Burnin Length Burnin Length helps us focus our model. When the MCMC model begins running, it checks possible outputs of the model and begins sampling them to determine the probability that they will represent our data. The model uses past sampled points to try and get an idea of where the highest probabilities are, but when the model first begins running it does not have the luxury of these reference points. This sets up the model's first few samples to be more randomly chosen than any part of the process, meaning that the beginning samples are less likely to be on high probability outputs. Burnin Length helps us get around this by deleting the first runs of the MCMC model after it's done running.

Composition Survey A sightability survey which focuses on sex ratios

DAU (Data Analysis Unit) Data Analysis Units separate each state or province into distinct management areas for each species. Each one has a specific name and is further divided into subunits, which allow even more specificity.

GRTS (Generalized Random Tesselation Stratified) GRTS decides where to sample during geographic surveys by ensuring that the locations are both randomly placed and evenly spaced. This helps avoid bias while making sure that no parts of the study area are undersampled.

Hunter Effort A metric to measure hunting pressure on game animals. It is either measured by the total number of hunters in the field over the course of a season or the total number of days spent hunting over the course of a season by all hunters.

MCMC Iterations MCMC iterations are simply a measure of how many different times the model will test the probability of different model outputs. More sampling allows the model to consider more options and therefore can increase the chance that the model will find the outputs with the highest likelihoods, but it also may not be necessary and will make the tool take longer to run.

Model Value The numerical value that the model assigns to different covariates. In the User Interface, different covariates have helpful labels like “Snow Cover”, but in actual programming language this would make code unnecessarily long and complicated, so the computer stores them as simple numerical values instead.

Sex Ratio In a group of animals the sex ratio allows us to compare what proportion of that group is male and female. Management agencies will manipulate the balance between these two groups for different purposes, like tipping the scales toward females to encourage population growth or toward males to encourage trophy animals. Sometimes the ratio is given numerically, where a 1 means there are an equal number of males and females, greater than 1 means more males than females, and less than 1 means more females than males.

Sightability-Abundance Survey A sightability survey which focuses on abundance

Species In our tools, a box labeled ‘species’ determines the type of animal(s) that you would like to include in your analysis or plot. The species included for each tool are those chosen by the customer for management purposes, so common names will be used.

Stratum Stratum are used to organize habitat subunits by how well they would work as habitat for the animal being surveyed. The “high” strata group represents subunits that contain the best habitat, “low” is the group that has the worst habitats, and “medium” falls in between. Subunits are determined by previous observations from biologists and snow cover.

Survival The probability that an animal will stay alive for a human-selected period of time. For example, if yearly survival for does in a management unit is calculated to be 0.6 for the year 2008, then that means that 60% of the does in that unit that were alive at the beginning of the year were alive at the end of the year.

Thinning Rate Thinning rate helps us save memory by deleting entries from the model's stored runs. We can think of this as a sort of browser history for the model, showing us how it got its answer. In this case there are literally tens of thousands of steps, so deleting a small (or large) proportion of that history and using what is left still gives us an idea of the model's actions without taking up nearly as much memory. The slider is the percentage of model iterations that will be deleted once the modeling process is complete.

Unit Another name for a GMU, or Game Management Unit, which is a subdivision of a state or province with its own unique hunting and game regulations.

Year The year tab refers to which Biological year the survey was carried out on. Years are referred to as "2016-2017" rather than just one year because surveys are generally carried out between late fall and early spring, which straddles new year's. This makes more sense to keep related surveys together because two surveys may be flown only three weeks apart but still be lumped into separate years. If you are having trouble finding your survey, make sure you select the right time range, since a survey flown in 2016 could be in the 2015-2016 group OR the 2016-2017 group.