

-----Readme file -----

NYClosedCounterPOPd

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Software Information

Overview of the NYClosedCounterPOPd software application

We integrated veterinary data on lead toxicosis with baseline population dynamics in NY to explore the differences in population dynamics that arise in the presence and absence of lead toxins in hypothetically closed bald eagle populations. Comparisons include: (1) current (leaded) scenario (“NY”), (2) a hypothetical scenario with the removal of Pb poisoning (“A”), and (3) a hypothetical scenario with the removal of Pb exposure (“C”). Comparative demographic properties include:

- 1) Life table
- 2) Predicted annual abundances
- 3) Predicted bi-annual abundances
- 4) Predicted bi-annual hatchling abundances
- 5) Predicted bi-annual immature and non-breeding adult abundances
- 6) Predicted bi-annual breeding adult abundances
- 7) Predicted abundances during the breeding period

- 8) Predicted abundances during the non-breeding period
- 9) Migration and dispersal
- 10) Asymptotic growth rates
- 11) Survival rates
- 12) Stable stage distribution
- 13) Reproductive value
- 14) Sensitivities
- 15) Elasticities
- 16) Damping ratio and convergence time
- 17) Cumulative growth
- 18) Stochastic growth rate
- 19) Transient growth rate
- 20) Harmonic vs. arithmetic mean abundances
- 21) Loss of genetic diversity
- 22) Population inertia
- 23) Reactivity
- 24) Maximum amplification
- 25) Maximum attenuation

Interactive NYClosedCounterPOPd Software User Tutorial

Preparing and running the software for female and male bald eagles:

Step 1: Download the “NYClosedCounterPOPd for Females” folder.

Step 2: Inside the folder, you will find four .R files and several pre-saved .txt files:

“BestAlgorithmPredictedModelsNY”,
 “BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_A”,
 “BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_C”,
 “NEW_AA_NY”,
 “NEW_AA_COUNTERFACTUAL_PAIN_A”,
 “NEW_AA_COUNTERFACTUAL_PAIN_C”,
 “NEW_PA_NY”,
 “NEW_PA_COUNTERFACTUAL_PAIN_A”,
 “NEW_PA_COUNTERFACTUAL_PAIN_C”,
 “NEW_SA_NY”,
 “NEW_SA_COUNTERFACTUAL_PAIN_A”,
 “NEW_SA_COUNTERFACTUAL_PAIN_C”,
 “NEW_PS_NY”,
 “NEW_PS_COUNTERFACTUAL_PAIN_A”,
 “NEW_PS_COUNTERFACTUAL_PAIN_C”,
 “NEW_Adults_January_NY”,
 “NEW_Adults_January_COUNTERFACTUAL_PAIN_A”,
 “NEW_Adults_January_COUNTERFACTUAL_PAIN_C”,
 “NEW_Adults_June_NY”,
 “NEW_Adults_June_COUNTERFACTUAL_PAIN_A”,
 “NEW_Adults_June_COUNTERFACTUAL_PAIN_C”,
 “NEW_Subadults_January_NY”,

“NEW_Subadults_January_COUNTERFACTUAL_PAIN_A”,
“NEW_Subadults_January_COUNTERFACTUAL_PAIN_C”,
“NEW_Subadults_June_NY”,
“NEW_Subadults_June_COUNTERFACTUAL_PAIN_A”,
“NEW_Subadults_June_COUNTERFACTUAL_PAIN_C”,
“NEW_Juveniles_June_NY”,
“NEW_Juveniles_June_COUNTERFACTUAL_PAIN_A”,
“NEW_Juveniles_June_COUNTERFACTUAL_PAIN_C”,
“NEW_AdultsAbsorbPercent_NY”,
“NEW_AdultsAbsorbPercent_COUNTERFACTUAL_PAIN_A”,
“NEW_AdultsAbsorbPercent_COUNTERFACTUAL_PAIN_C”,
“NEW_AdultsPurgePercent_NY”,
“NEW_AdultsPurgePercent_COUNTERFACTUAL_PAIN_A”,
“NEW_AdultsPurgePercent_COUNTERFACTUAL_PAIN_C”,
“NEW_SubadultsAbsorbPercent_NY”,
“NEW_SubadultsAbsorbPercent_COUNTERFACTUAL_PAIN_A”,
“NEW_SubadultsAbsorbPercent_COUNTERFACTUAL_PAIN_C”,
“NEW_SubadultsPurgePercent_NY”,
“NEW_SubadultsPurgePercent_COUNTERFACTUAL_PAIN_A”,
“NEW_SubadultsPurgePercent_COUNTERFACTUAL_PAIN_C”,
“NEW_TIMESERIES_NY”,
“NEW_TIMESERIES_COUNTERFACTUAL_PAIN_A”,
“NEW_TIMESERIES_COUNTERFACTUAL_PAIN_C”,

Step 3: Save these text files in a specific location on your computer.

Step 4: Open R Studio.

Step 5: In R Studio, install six packages: “shinyBS”, “popdemo”, “shiny”, “rgl”, “FSA”, and “rmarkdown”. To install a package, type `install.packages(“shinyBS”)` into your R console and run the line. Repeat this command with the other packages.

Step 6: Open the `NY_FemaleClosedCounterPOPd.R` file in R studio and set the working directory to the location where you saved the .txt files in Step 3.

Step 7: Click “Run All”.

Step 8: Begin interacting with the `NY_FemaleClosedCounterPOPd` software application.

NOTE: The above 8-step process requires the use of all the pre-saved files that are listed in Step 2. However, you may generate the .txt files yourself using the three algorithm files. The “...NY.txt” files are generated using “`NY_Algorithm NY.R`”, the “...`COUNTERFACTUAL_PAIN_A.txt`” are generated using “`NY_Algorithm Hypothetical Trajectory A.R`” and the “...`COUNTERFACTUAL_PAIN_C.txt`” files are generated using the “`NY_Algorithm Hypothetical Trajectory C.R`” file. If you wish to modify and run your altered algorithms on your own machine (to overwrite the .txt files with new versions):

Step i. Conduct Step 2-3 (above),

Step ii. Open the appropriate “`NY_Algorithm...R`” file in R,

Step iii. Set the working directory to the folder in Step i.

Step iv. Select “Run all”. ***Beware, the runtime of the unmodified algorithms is a minimum of 6 hours, so ensure your computer is plugged in and will not go to sleep, and then turn off your screen to save the backlight from burnout.*** The algorithm will run and automatically save the new .txt files into the folder that you specified in Step iii.

Running the NYClosedCounterPOPd app for male bald eagles:

Step 1: Download the “NYClosedCounterPOPd for Males” folder.

Step 2: Inside the folder, you will find four .R files and several pre-saved .txt files:

“BestAlgorithmPredictedModelsNY”,
“BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_A”,
“BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_C”,
“NEW_AA_NY”,
“NEW_AA_COUNTERFACTUAL_PAIN_A”,
“NEW_AA_COUNTERFACTUAL_PAIN_C”,
“NEW_PA_NY”,
“NEW_PA_COUNTERFACTUAL_PAIN_A”,
“NEW_PA_COUNTERFACTUAL_PAIN_C”,
“NEW_SA_NY”,
“NEW_SA_COUNTERFACTUAL_PAIN_A”,
“NEW_SA_COUNTERFACTUAL_PAIN_C”,
“NEW_PS_NY”,
“NEW_PS_COUNTERFACTUAL_PAIN_A”,
“NEW_PS_COUNTERFACTUAL_PAIN_C”,
“NEW_Adults_January_NY”,
“NEW_Adults_January_COUNTERFACTUAL_PAIN_A”,
“NEW_Adults_January_COUNTERFACTUAL_PAIN_C”,
“NEW_Adults_June_NY”,
“NEW_Adults_June_COUNTERFACTUAL_PAIN_A”,
“NEW_Adults_June_COUNTERFACTUAL_PAIN_C”,
“NEW_Subadults_January_NY”,
“NEW_Subadults_January_COUNTERFACTUAL_PAIN_A”,
“NEW_Subadults_January_COUNTERFACTUAL_PAIN_C”,
“NEW_Subadults_June_NY”,
“NEW_Subadults_June_COUNTERFACTUAL_PAIN_A”,
“NEW_Subadults_June_COUNTERFACTUAL_PAIN_C”,
“NEW_Juveniles_June_NY”,
“NEW_Juveniles_June_COUNTERFACTUAL_PAIN_A”,
“NEW_Juveniles_June_COUNTERFACTUAL_PAIN_C”,
“NEW_AdultsAbsorbPercent_NY”,
“NEW_AdultsAbsorbPercent_COUNTERFACTUAL_PAIN_A”,
“NEW_AdultsAbsorbPercent_COUNTERFACTUAL_PAIN_C”,
“NEW_AdultsPurgePercent_NY”,
“NEW_AdultsPurgePercent_COUNTERFACTUAL_PAIN_A”,
“NEW_AdultsPurgePercent_COUNTERFACTUAL_PAIN_C”,
“NEW_SubadultsAbsorbPercent_NY”,

“NEW_SubadultsAbsorbPercent_COUNTERFACTUAL_PAIN_A”,
“NEW_SubadultsAbsorbPercent_COUNTERFACTUAL_PAIN_C”,
“NEW_SubadultsPurgePercent_NY”,
“NEW_SubadultsPurgePercent_COUNTERFACTUAL_PAIN_A”,
“NEW_SubadultsPurgePercent_COUNTERFACTUAL_PAIN_C”,
“NEW_TIMESERIES_NY”,
“NEW_TIMESERIES_COUNTERFACTUAL_PAIN_A”,
“NEW_TIMESERIES_COUNTERFACTUAL_PAIN_C”,

Step 3: Save these text files in a specific location on your computer.

Step 4: Open R Studio.

Step 5: In R Studio, install six packages: “shinyBS”, “shiny”, “popdemo”, “rgl”, “FSA”, and “rmarkdown”. To install a package, type `install.packages(“shinyBS”)` into your R console and run the line. Repeat this command with the other packages.

Step 6: Open the NY_MaleClosedCounterPOPd.R file in R studio and set the working directory to the location where you saved the .txt files.

Step 7: Click “Run All”.

Step 8: Begin interacting with the NY_MaleClosedCounterPOPd software application.

NOTE: The above 8-step process requires the use of all the pre-saved files that are listed in Step 2. However, you may generate the .txt files yourself using the three algorithm files. The “...NY.txt” files are generated using “NY_Algorithm NY.R”, the “...COUNTERFACTUAL_PAIN_A.txt” are generated using “NY_Algorithm Hypothetical Trajectory A.R” and the “...COUNTERFACTUAL_PAIN_C.txt” files are generated using the “NY_Algorithm Hypothetical Trajectory C.R” file. If you wish to modify and run the altered algorithms on your own machine (to overwrite the .txt files with new versions):

Step i. Conduct Step 2-3 (above),

Step ii. Open the appropriate “NY_Algorithm...R” file in R,

Step iii. Set the working directory to the folder in Step i.

Step iv. Select “Run all”. ***Beware, the runtime of the unmodified algorithms is a minimum of 6 hours, so ensure your computer is plugged in and will not go to sleep, and then turn off your screen to save the backlight from burnout.*** The algorithm will run and automatically save the new .txt files into the folder that you specified in Step iii.

Overview of the NYClosedCounterPOPd validation bundle

This validation bundle includes software to verify the use of the algorithm when the system is assumed to be closed to incoming or outgoing dispersal. The computer selects a randomly generated configuration of matrix elements, then projects an adult time series using those elements. The algorithm then uses that time series to estimate all the underlying parameters. The software then overlays the algorithm predictions onto the “true” underlying random parameters. If the algorithm catches the true value of the parameter within its range, it is said to have “successful predictive performance.”

Preparing and running the NYClosedCounterPOPd software

Step 1: Download the “NY_ClosedCounterPOPd_Validation.R” software.

Step 2: Install the package “popdemo”. To install a package, type `install.packages(“popdemo”)` into your console and run the line.

Step 3: Click “Run All”. The software will automatically overlay the algorithm predictions for each of the demographic parameters found in NY_ClosedCounterPOPd.

Note: One can check different random trajectories by selecting a different starting seed, or by modifying the values of the “true parameters”.

Technical details

The NYClosedCounterPOPd software was written under R Studio Version 3.5.3 (2019-03-11) – “Great Truth” © 2019 RStudio, Inc. requires six R Shiny packages: “shinyBS”, “shiny”, “rgl”, “FSA”, “popdemo”, and “rmarkdown”. The NYClosedCounterPOPd validation software was written under R Studio Version 1.1.463 – © 2009-2018 RStudio, Inc., and requires one package: “popdemo”.

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Citations

Connelly, P, Hanley, B, Bunting, E, & Schuler, K. 2020. NYClosedCounterPOPd Web Interactive: Software to investigate the population scale impacts of lead in New York State from 1990-2018. [Software]. Cornell University Library eCommons Repository. <https://doi.org/10.7298/ewr7-xj09>