

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

NYCounterPOPd

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Software Information

Overview of the NYCounterPOPd software application

We integrated veterinary data on lead toxicosis in breeding adult bald eagles from New York State, USA with current population dynamics to create a comparative software application that is used to explore the differences in population dynamics that arise in the presence and absence of lead contaminants.

This NYCounterPOPd interactive application allows the user to view and compare the algorithm-predicted asymptotic and transient population properties for male and female bald eagles in the NY, USA between 1990-2018. Comparisons include three scenarios: (1) current (leaded) scenarios (“NY, USA”), (2) hypothetical scenarios with the removal of lead poisoning (“Exper.I”), and (3) hypothetical scenarios with the removal of Pb exposure (“Exper.II”). 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 NYCounterPOPd Software User Tutorial

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

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

Step 2: Inside the folder, you will find several presaved .txt files:

“BestAlgorithmPredictedModelsNY.txt”,
 “BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_A.txt”,
 “BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_C.txt”,
 “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.

Step 5: Install the appropriate R packages (see below).

Step 6: Open the NY_FemaleCounterPOPd.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_FemaleCounterPOPd software application.

NOTE: The above 8-step process requires the use of all the presaved files that are listed in Step 2. However, you may generate the files yourself using the algorithms. For example, the “...NY.txt” files are attained from the NYEaglePOPd software (“Algorithm NY.R”; included here for convenience), while the “...COUNTERFACTUAL_PAIN_A.txt” and “...COUNTERFACTUAL_PAIN_C.txt” files are attained from the “NY_Algorithm Exper.I.R” and “NY_Algorithm Exper.II.R” software files. 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, will not go to sleep, and 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 app for male bald eagles:

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

Step 2: Inside the folder, you will find several presaved .txt files:

“BestAlgorithmPredictedModelsNY.txt”,
“BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_A.txt”,
“BestAlgorithmPredictedModelsCOUNTERFACTUAL_PAIN_C.txt”,
“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.

Step 5: Install the appropriate R packages (see below).

Step 6: Open the NY_MaleCounterPOPd.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_MaleCounterPOPd software application.

NOTE: The above 8-step process requires the use of all the presaved files that are listed in Step 2. However, you may generate the files yourself using the algorithms. For example, the “...NY.txt” files are attained from the NYEaglePOPd software (“NY_Algorithm NY.R”; included here for convenience), while the “...COUNTERFACTUAL_PAIN_A.txt” and “...COUNTERFACTUAL_PAIN_C.txt” files are attained from the “NY_Algorithm Exper.I.R” and “NY_Algorithm Exper.II.R” software files. 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, will not go to sleep, and 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 NYCounterPOPd validation script

This validation bundle includes software to verify the use of the algorithm under modeling assumptions. Specifically, the computer selects a randomly generated configuration of matrix elements, then projects an adult time series. 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 parameter. 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 NYCounterPOPd validation script

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

Step 2: Install the appropriate R packages (see below).

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

Technical details

This app was written under R version 4.0.2 (2020-06-22) --"Taking Off Again"Copyright (C) 2020 The R Foundation for Statistical Computing Platform: x86_64-w64-mingw32/x64 (64-bit) and requires R packages: “devtools (Version 2.3.2)”, “shinyBS (Version 0.61)”, “shiny (Version 1.3.2)”, “rgl (Version 0.100.26)”, “popdemo (Version 1.3-0)”, “FSA (Version 0.8.25)” and “rmarkdown (Version 1.14)”.

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Citations

The citation for this package is:

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Changes to this submission

2020-10-27. Changes made include: (1) the alteration from the terms “acute” or “A” to “Exper.I” and “chronic” or “C” to “Exper.II” in the code and readme files, (2) the correction of typos in the narratives, and (3) the alteration of the code and readme to include R and package versioning information.

2022-01-04. Changes made include (1) the correction of remaining A and C to “Exper.I” and “Exper.II” in locations that were missed on 10.27.2020, and (2) the organization of all boxplots to have data displayed (from left to right) as “Northeast”, “Exper.I”, and “Exper.II”.