COM(P)ADRE News

Quarterly newsletter for **COMPADRE** and **COMADRE**

FALL 2020

FROM THE COORDINATOR

I first sat down at this desk as the Research Coordinator for COM(P)ADRE on January 2nd, 2020. Reflecting on the year that's nearly behind us, I find myself wondering where the months have gone—yet remembering how long each of them seemed to linger. This has been a year of challenges and hardships for many, and if you're reading this, I hope you'll join me in wishing for better days for us all in the year ahead.

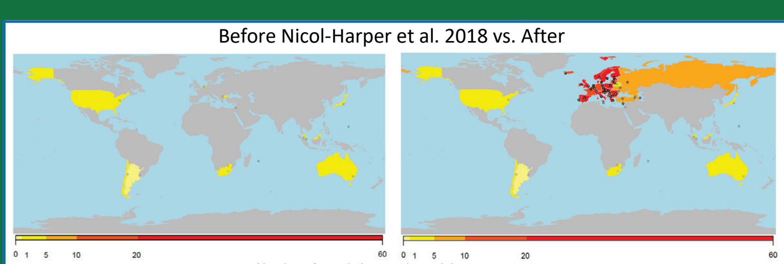
As we wrap up the last few days of fall and head into winter and this year's end, I couldn't be more proud of the team at COM(P)ADRE for all the amazing work they've done despite how unpredictable this year has been. The COMPADRE and COMADRE databases continue to grow and improve, new website features have made these data more accessible than ever, and we continue to brainstorm new ways of engaging our users and facilitating the study of local to global ecological questions.

From all of us at COM(P)ADRE, best wishes to you and yours this holiday season, and here's to another year of demography!

Chelsea C. Thomas, Research Coordinator

Over 1,100 human matrices added to COMADRE!

Details for this exciting new addition on Page 4!



(Photo: Chelsea C. Thomas, Lincoln Park Zoo)

MAJOR FEATURE UPDATES!

The COM(P)ADRE website has had two major feature updates since spring! We've added an education section for tutorials, workshops, exercises, and helpful information, as well as a new portal for users to add their own data to the databases! Find more details about these exciting developments below!

Have a knack for plant and animal photography? We'd love to showcase your photos in the newsletter! Contact news@compadre-db.org for details.

NEW WEBSITE FEATURE

Add your matrix data to COMPADRE and COMADRE!

We are incredibly excited to announce our **biggest website feature update of the year**! The latest update for the COM(P)ADRE website includes a data digitization portal for public users!

As the COMPADRE and COMADRE databases continue to grow, our dedicated digitization team is currently intaking more data than we're able to digitize, which leaves authors waiting longer for their data to appear in the database and our users waiting for new data to explore!

Starting now, authors and their teams can digitize their own matrices and metadata into the COMPADRE and COMADRE databases using our new, streamlined data entry portal. This new public user portal follows the same protocol our digitization team uses for adding new data to the database, and once data has been digitized by an author or member of the author's team, it's submitted directly to our data reviewers and released to the database as soon as we verify the web forms are complete.

Ready to get started?

Authors interested in contributing their data can find an overview of the digitization and approval process on our new Contribute Data page, and a comprehensive guide to the digitization protocol with definitions and examples can be found here.

Going forward, our data review team will prioritize author submissions, so your data will be processed and added to the next COMPADRE or COMADRE release as soon as possible. Our goal at COM(P)ADRE is to facilitate large-scale investigation of timely and important ecological and evolutionary questions, and our online data entry portal is designed to make author contribution to this goal straightforward and simple.

It's our hope that this new feature—along with all the other work we're implementing and improving this year—continues to improve your user experience and make COMPADRE and COMADRE more accessible than ever!

ANNOUNCEMENT

New database versions and updated release schedule!

Starting in fall 2020, we are releasing new database versions once per quarter throughout the calendar year. This new schedule gives our digitization team more time to digitize, verify, and release new data between versions, allowing for more robust error checking and minimizing redundant version releases. Our 2021 release schedule follows.

January 15, 2021
April 15, 2021
July 15, 2021
October 15, 2021

We may also release new versions outside of this schedule in the event of major database updates like our recent human data addition from University of Southampton (see details below)!

As always, you can keep up with the latest news on COMPADRE and COMADRE at our blog, ResearchGate project log, and social media!

Download COMPADRE 6.20.11.1
Download COMADRE 4.20.11.1

Explore data. Find resources. Connect with us.

The COM(P)ADRE website has been updated! Read about our latest updates in this newsletter.

compadre-db.org

NEW WEBSITE FEATURE

Single matrix CSV downloads

Need data from a few matrices but don't want to download and subset the entire database? Or maybe you'd like to use some example data for a class project or tutoring session? Single matrices can now be downloaded as stand-alone .CSV files! Each file comes with all the associated metadata for that matrix, so no need to download the entire database. Look for the download button in each matrix!

Download Matrix and Metadata

FEATURED COM(P)ADRE USER

Alex Nicol-Harper

Alex is a 3rd year PhD student at the University of Southampton in collaboration with the Wildfowl & Wetlands Trust, supervised by Tom Ezard (a member of the COMPADRE Core Committee), Patrick Doncaster, Geoff Hilton and Kevin Wood. With a background in biology (Natural Sciences at the University of Cambridge) and conservation (MSc Biodiversity, Conservation & Management at the University of Oxford), Alex took a slight detour to become a Research Technician on Tom's Wellcome Trust-funded human population project in 2016. The resulting paper, and its component matrices, are described elsewhere in this newsletter.

Alex and Tom then devised a PhD project combining their interests and contacts across matrix population modelling, marine biology, conservation, and ornithology. The resulting project involves the use of population modelling to inform conservation, with the common eider (*Somateria mollissima*) as a primary study species. The first publication, in prep, uses a meta-analysis of this seaduck's vital rates, along with matrix element elasticities, to answer the question: 'Are we collecting the most useful ecological data for population management?'. The underlying matrices build on those developed at a NERC Advanced Training Short Course in Oxford in January 2019, hosted by Rob Salguero-Gómez (Core Committee), with colleagues including Dylan Childs (Science Committee) and Pol Capdevila (Compadrino).

More recently Alex has joined a collaborative project which uses Bayesian modelling techniques to compare life history patterns across multiple animal species along the slow-fast continuum, where her role involves analysing a dataset for the black-browed albatross (*Thalassarche melanophris*), with the help of Stephanie Jenouvrier and Rémi Fay.

Another important component of the PhD has been public engagement. With support from the Public Engagement with Research unit at the University of Southampton, Alex created a table-top matrix population model game (pictured), which she's presented to children at science festivals, as well as fellow scientists at conferences! If you are interested, please follow along with the project on Twitter @alexnicolharper #TheNotSoCommonEider.

FEATURED TEAM MEMBER

Austin Sisson

Austin is a software developer with Zier Niemann Consulting—the firm that designed, tests, and maintains the COM(P)ADRE website. He received a BS in History from Indiana State University in 2013 and has been in software development since 2015. Austin has been a part of the COM(P)ADRE project since 2017. His area of expertise for the project is website and database design and development, and many of the websites features—including the latest features described in this newsletter—were designed and implemented by Austin! Our team works closely with Austin and the folks at Zier Niemann to plan, create, and test new website and database features to make COMPADRE and COMADRE the incredible resources that they are, so if you're enjoying the newest features at compadre-db.org, know Austin helped to make it happen!

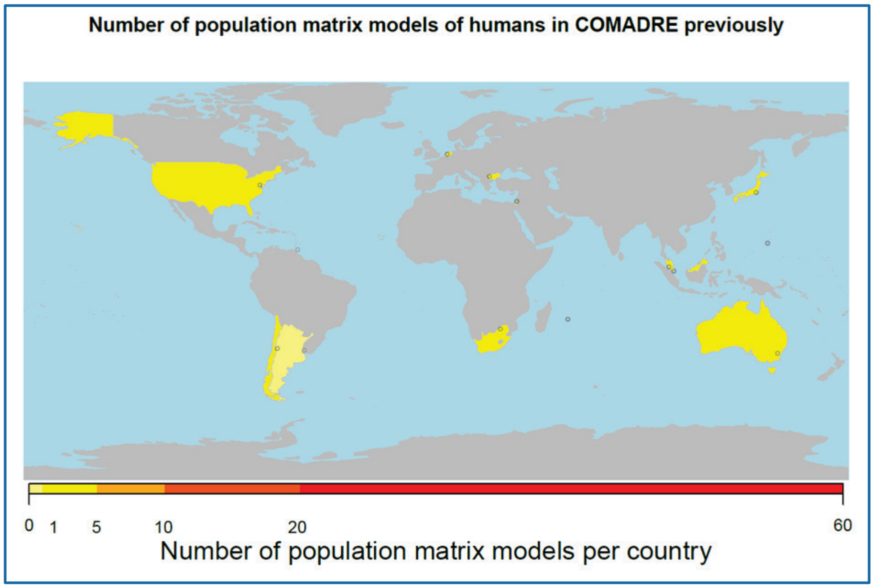
After we wrap up the last major additions to the website at the end of 2020, Austin and company will continue troubleshooting and maintaining website functionality into 2021. When he isn't saving us from the occasional bug in the code, Austin enjoys hiking the mountains and high deserts of southern Colorado. From all of us on the demography side of COM(P)ADRE, thank you for everything you do Austin!

FEATURE

Large human data addition to COMADRE

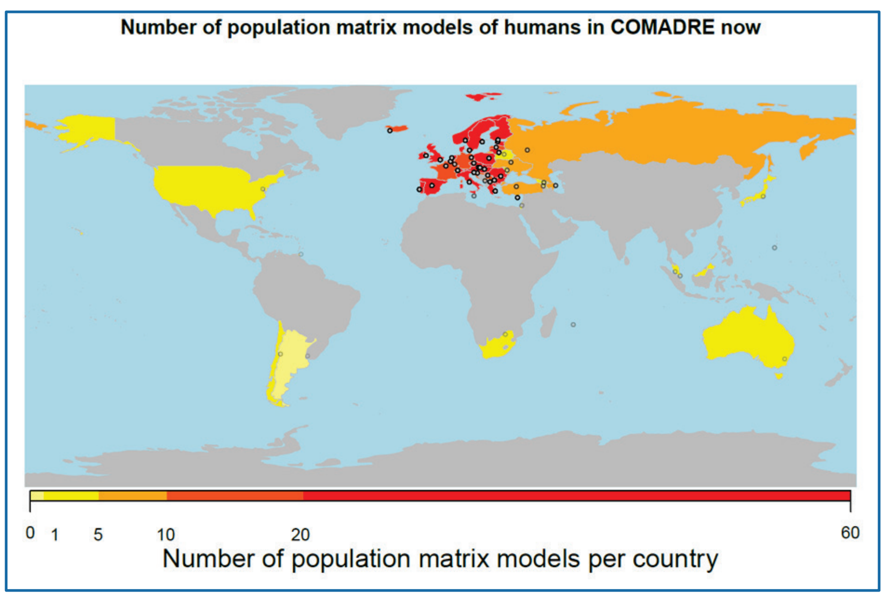
by Alex Nicol-Harper

COMADRE contains population matrix models for a wide range of species, but until now had relatively few pertaining to a particularly widespread and important animal: *Homo sapiens*. Prior to the most recent update, the database held 26 human matrices, from 14 countries across 6 continents – not a bad geographical range, but temporally representing only 20 years from 1965. These matrices correspond to a subset of those presented in Keyfitz & Flieger's (1990) atlas: '*World Population Growth and Aging: Demographic Trends in the Late Twentieth Century*' – which, along with the two preceding volumes, has been fully digitised as part of a CPC project [http://pyramids.cpc.ac.uk/app/].



The new COMADRE update will include a further 1,120 human matrices, developed in our paper '*Inferring transient dynamics of human populations from matrix non-normality*' (linked below) We used Eurostat (linked below) data to add a further 40 European countries to the previously represented Bulgaria and Netherlands, and more than doubled the temporal range, with 6 countries each providing 55 consecutive years of data from 1960 to 2014. To correspond to Keyfitz & Flieger, we used female-specific data and aggregated into 5-year age bins, but went all the way to '85 years and older' as opposed to truncating after menopause. Countries with small populations (Andorra, Liechtenstein, San Marino) were excluded since many of their age groups regularly experienced zero deaths over 5 year periods.

Publication: [https://esj-journals.onlinelibrary.wiley.com/doi/pdf/10.1007/s10144-018-0620-y].
Eurostat: [https://ec.europa.eu/eurostat/web/population/overview]



The aim of our paper was to develop a measure of matrix susceptibility to transient dynamics: deviations from the asymptotic trajectory are triggered by unstable age structures, but do particular vital rate combinations enhance this effect? We showed that measures of matrix non-normality, a quantity used in linear algebra, correlate well with traditional indices of transient dynamics from the ecological literature. And those transient indices, when applied to the human populations of Europe, illustrate some interesting phenomena. They peak around the millennium, in contrast to asymptotic growth rates, which declined across the period and remained below 1 from circa 1995 (Fig. 3a). This provides evidence for a current 'second demographic transition' (van Daalen and Caswell 2015), with fertility dropping below the level required for replacement in the long-term. Nevertheless, applying these vital rates to the population structures found in Europe over this period almost always resulted in immediate population growth (reactivity >1; Fig. 3c) and boosts to asymptotic population size relative to stable population structure (inertia >1; Fig. 3d). Unstable age structures and variable vital rate regimes were likely due to changes across Europe during this time: not only the repercussions of demographic transition (Blue and Espenshade 2011), but as a result of political upheavals (such as the reunification of Germany in 1989 – see Goldstein & Kreyenfeld, 2010 – and the Yugoslavian conflict 1991-'99) and ever-present migration (Espenshade and Tannen 2015, and the unpublished EU study therein).

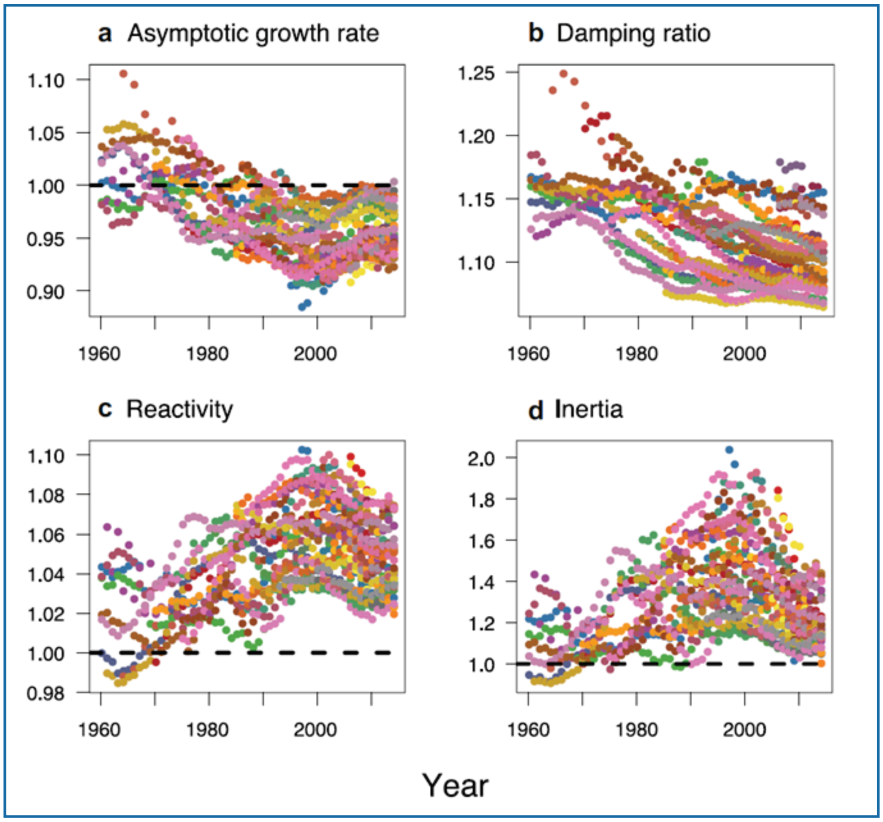


Fig. 3 Ecological measures of population dynamics over time. Points are coloured by country. Asymptotic growth rate is the dominant eigenvalue, with the dashed line showing $\lambda_1 = 1$ i.e., no population change—above the line is population growth; below, decline. For definitions of the other measures, refer to "Methods". For reactivity and inertia, the dashed lines divide the plot into transient growth (> 1) and decline (< 1)

While those explanations delve deep into human demography and socioeconomics, ultimately Homo sapiens is just another (particularly well-studied) animal. In that light:

"*It remains to be seen how the three non-normality metrics perform across other systems and stage structures, and whether their interrelationships with population dynamic indices remain consistent. Comparative studies using the COMPADRE and COMADRE demographic databases (Salguero-Gómez et al. 2015, 2016) could prove particularly insightful here.*" (p. 193)

Unfortunately, to (badly) paraphrase Game of Thrones, now our grant has ended. Could you apply our non-normality metrics to matrices from the COMADRE and COMPADRE databases? Please get in touch!

Blue, L. & Espenshade, T.J. (2011) Population momentum across the demographic transition. *Population and Development Review*, 37, 721–747.

Espenshade, T.J. & Tannen, J.B.C. (2015) Population dynamics: Momentum of population growth. In J.D. Wright (Ed.) *International encyclopedia of the social and behavioural sciences*, vol 18, 2nd edn. (pp. 572–578). Amsterdam, Netherlands: Elsevier.

Goldstein, J.R., & Kreyenfeld, M. (2010) East Germany Overtakes West Germany: Recent Trends in Order-Specific Fertility Dynamics. MPIDR WORKING PAPER WP 2010-033 NOVEMBER 2010 https://bit.ly/2GeBo5Q Accessed October 2020.

Keyfitz, N. & Flieger, W. (1990) *World population growth and aging: demographic trends in the late twentieth century*. Chicago, USA: University of Chicago Press.

Salguero-Gómez, R. et al. (2015) The compadre Plant Matrix Database: an open online repository for plant demography. *Journal of Ecology* 103:202–218

Salguero-Gómez, R. et al. (2016) COMADRE: a global data base of animal demography. *Journal of Animal Ecology*, 85, 371–384.

van Daalen, S. & Caswell, H. (2015) Lifetime reproduction and the second demographic transition: stochasticity and individual variation. *Demographic Research*, 33, 561–588

COM(P)ADRE publications since the last newsletter

Janovský Z, Herben T (2020) Reaching similar goals by different means - Differences in life-history strategies of clonal and non-clonal plants. *Perspect Plant Ecol Evol Syst* 44:125534 https://doi.org/10.1016/j.ppees.2020.125534

Abstract: Clonality is a largely underexplored plant life-history trait with possibly profound effects on plant demography. Clonal growth constitutes an alternative reproductive pathway, which should provide clonal species with an advantage over non-clonal ones under disturbance regimes unfavourable to regeneration from seeds.

We investigated how clonal and non-clonal species differ in their life histories (other than clonality) and how this relates to disturbance regimes where the studied species occur. Further, we focused on the contribution of clonality to fluctuations in the populations of species and the importance of clonality for the life cycle of a species in relation to its other life-history characteristics. We achieved this through phylogenetically informed analyses of the matrix population models available from the COMPADRE database coupled with information on species clonality from the CLO-PLA database.

The phylogenetic principal component analysis revealed that plant life-history characteristics could be aligned along two gradients. The gradient of generation time and individual turnover in populations was more important and corresponded to the frequency of habitat disturbance. Clonal species on average had populations with lower overall rates of individual turnover and disturbance frequencies. The second gradient was correlated with disturbance severity and plant ability to regenerate after the loss of biomass. The importance of clonal growth for the life cycle of a clonal species increased with more severe disturbance events. The fluctuation of population growth rates depended on the life-history characteristics of a species but not on clonality. The net effect of clonal growth on the fluctuations of the populations of a species was positive.

In general, clonality seems to provide an important alternative for adjusting plant life history to the disturbance regime and other site conditions allowing a plant to circumvent its morphological or developmental constraints. Clonal growth turned out to be mainly a mechanism that enables population expansion under favourable conditions rather than a mechanism that buffers the effects of adverse conditions.

Takada T, Kawai Y (2020) An analysis of elasticity vector distribution specific to semelparous species using randomly generated population projection matrices and the COMPADRE Plant Matrix Database. *Ecol Modell* 431:109125 https://doi.org/10.1016/j.ecolmodel.2020.109125

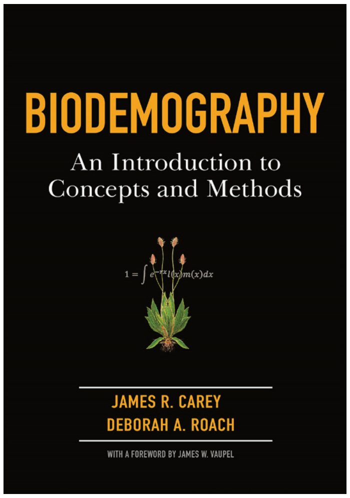
Abstract: The elasticity of population growth rate lambda is a notable statistic in population projection matrix models and has been used by many empirical researchers. Silvertown and his collaborators published a paper in 1996 in which they mapped elasticity vectors of stasis, growth and fecundity for 84 plant species in a ternary plot and reported that the elasticity vector distribution of semelparous species (10 species) was located in the upper-left region of the ternary plot. To understand and clarify why the elasticity vectors of semelparous species were distributed in the upper-left region, we conducted three analyses. First, we used 68 matrices of semelparous species populations in the COMPADRE Plant Matrix Database and plotted their elasticity vectors in the ternary plot. Second, we constructed randomly generated population projection matrices for three archetypes, where several biological assumptions were made, and obtained their elasticity vector distributions. We showed that the high fecundity and/or immediate death after reproduction shifted the elasticity vector distribution to the upper-left region of the plot. Third, we examined the evolutionary change in the distribution using a population projection matrix model in which the trade-off between fecundity and adult survival was

incorporated. The evolutionary trajectory derived from the trade-off model showed that the evolutionary consequence of semelparity was located in the upper-left more than was that of iteroparity in the ternary plot. Synthesizing the results derived from the three analyses, we concluded that the distinctive distribution of the elasticity vectors of semelparous species is the outcome of natural selection under the trade-off with low convexity, and the outcome of the resultant big-bang reproduction and immediate death after reproduction.

RECENT PUBLICATIONS

Book Reviews

Biodemography: An Introduction to Concepts and Methods by J. R. Carey and D. A. Roach. Princeton University Press, Princeton, NJ. 2020. 480 pgs. ISBN: 9780691129006



The book "Biodemography", recently published and authored by James Carey and Debbie Roach, is a must-have piece for anyone interested in the applications of demography to species across the tree of life. *Biodemography* is an essential resource for demographers, epidemiologists, gerontologists, and health professionals as well as ecologists, population biologists, entomologists, and conservation biologists. This accessible and innovative book is also ideal for the classroom. There is quite a lot of discussion in this book about matrix population models. If you are using COMPADRE and/or COMADRE, we strongly recommend you check it out!

Rob Salguero-Gómez, *Dept. of Zoology, University of Oxford*

Did we miss you?

We're proud of the amazing work our users are doing with COMPADRE and COMADRE. If we missed your publication or presentation, please reach out to news@compadre-db.org to be featured in our upcoming newsletter!

ANNOUNCEMENT

Upcoming COM(P)ADRE website feature

Earlier this year, we announced that planned workshops for 2020 would be cancelled. As we continue to monitor the COVID-19 pandemic and think about best practices for interacting with our users, we believe hosting in-person workshops is not the answer.

Our team is currently brainstorming creative ways to make workshop content available to all as well as provide direct learning experiences for users to learn the ins and outs of COMPADRE and COMADRE while interacting with our team in real time. We hope to provide some form of digital workshop—either as an all-day seminar or a week-long COM(P)ADRE "boot camp" in summer 2021. Look out for more details in our winter and spring newsletters!

In the meantime, we are creating a new section of the website just for tutorials, exercises, and general education materials. Check out the COM(P)ADRE Learn feature at compadre-db.org today! Our website team will be adding new material to this section through spring 2021, and we welcome user content requests. If there are specific tutorials you'd be interested in seeing, feel free to let us know! We're working hard to provide the best learning experience possible!

(Photo: Chelsea C. Thomas, Lincoln Park Zoo)

LINCOLN PARK ZOO
FOR WILDLIFE. FOR ALL.

(Photo: Chelsea C. Thomas, Lincoln Park Zoo)

Doing cool stuff with COM(P)ADRE?

We'd love to promote your projects in the newsletter!

Let us know what you're up to at news@compadre-db.org