Does an extreme solitary animal have a Social Network?

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Introduction

- The social structure of species has been described by means of social networks.
- A social network can monitor potential for parasites transmission between individuals[1].
- It is known that some solitary species use a "time – lag" social network[2].
- Social networks have not been studied in extreme solitary species, such as the Sinai chameleon *(Chamaeleo chamaeleon musae)*[3,4].
- Sinai chameleon population was previously shown to be demographically split between odd and even years, due to a combination of annual life cycle and egg incubation time (see Fig 1).
- This study is the first step in understanding the potential for transfer of microorganisms in extreme solitary species.

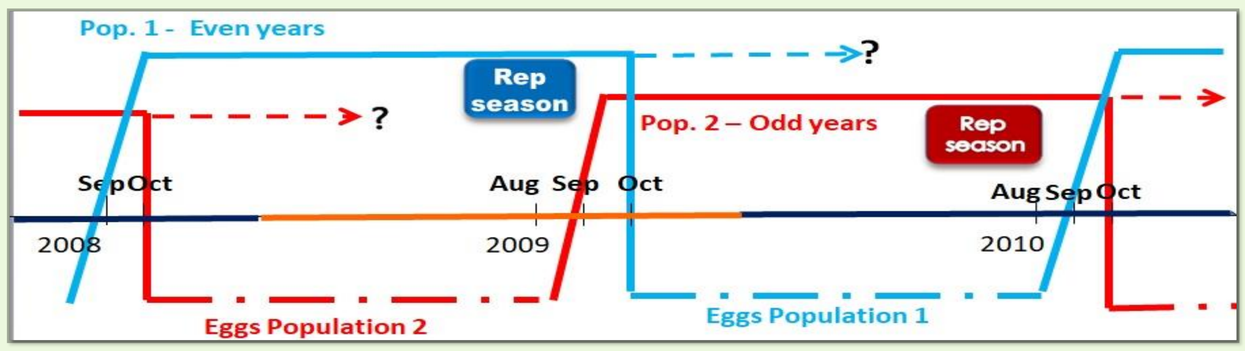


Fig. 1: Graphic representation of separate parallel populations of Sianai chameleon.

Objectives

To examine the hypothesis that even in an extreme type of solitary reptile without permanent burrows, a social network can be identified by analyzing the locations of the individuals.

Methods

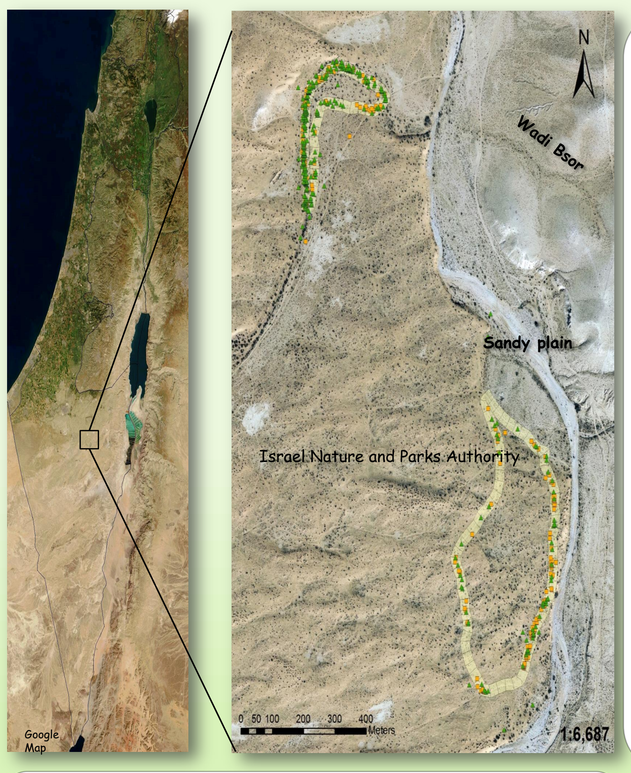
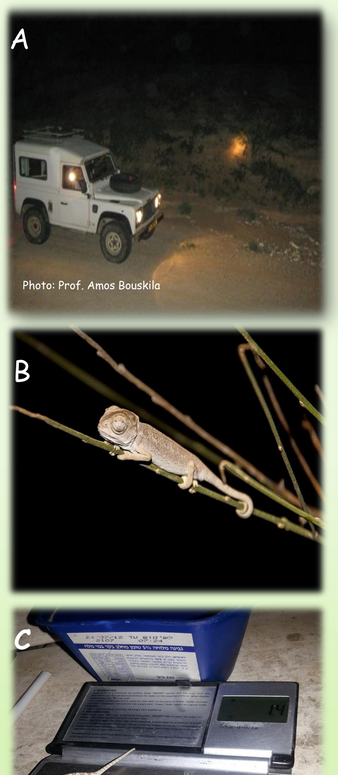
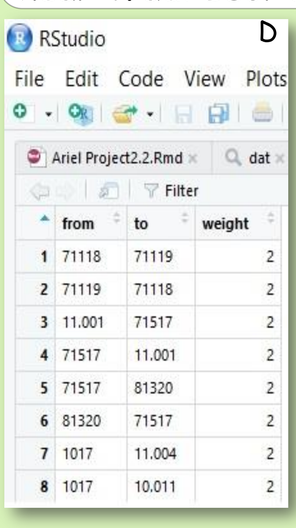


Fig. 3: We conduct night surveys each month at two fixed routes near Wadi Bsor since 2009.

Fig. 2: We detect sleeping chameleons with spotlights. (A)(B) We record data, including Body mass, and location (by GPS). (C) Sleeping sites reflect activity location during the day.





	from	to	weight
1	71118	71119	2
2	71119	71118	2
3	11.001	71517	2
4	71517	11.001	2
5	71517	81320	2
6	81320	71517	2
7	1017	11.004	2
8	1017	10.011	2

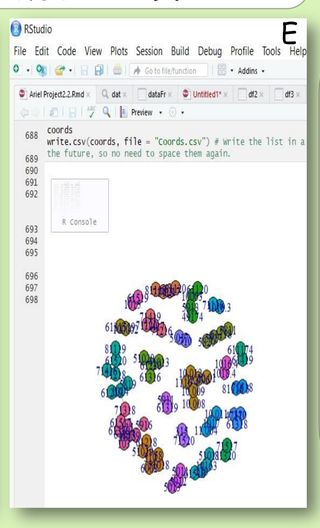


Fig. 4: With the use of *R* language:
1. based on the package *geosphere*, we calculated distance between capture points of all individuals in each year between 2012 - 2017 (D).
2. Based on the encounters number we used the *igraph* package to construct the "Time - Lag" social networks (E).

Results

- We represent 1,984 encounters in six yearly social networks.
- Few differences in means between odd and even years.

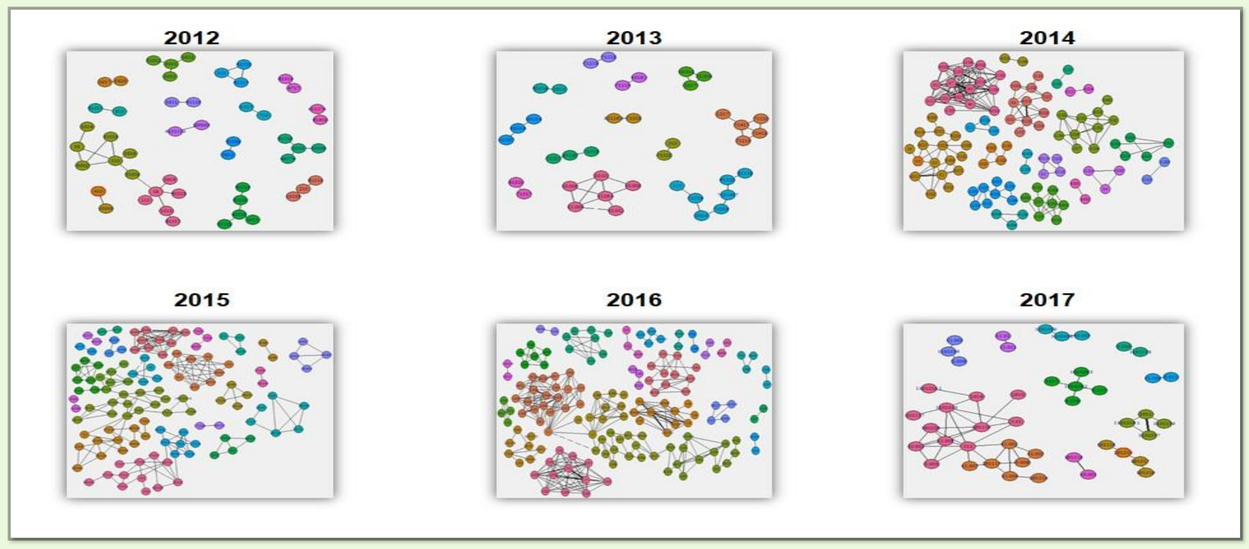
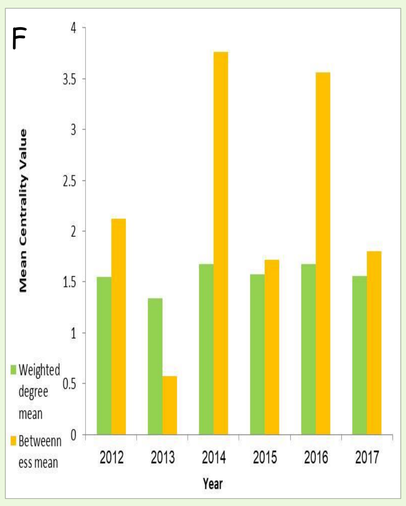
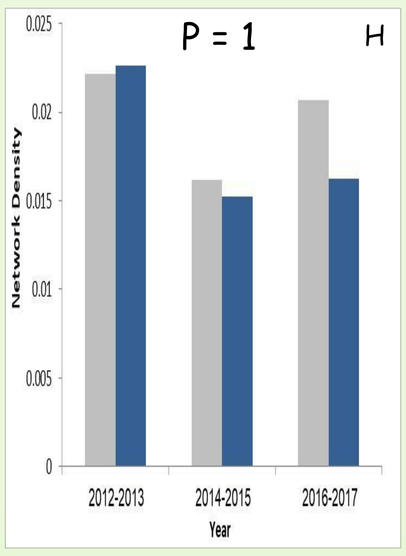


Fig. 5: the Sinai chameleon "time – lag" social networks between 2012 – 2017.



G	Weighted degree mean	Betweenness Mean
Odd	1.49	1.36
Even	1.63	3.14
P-value	<0.001	<0.05



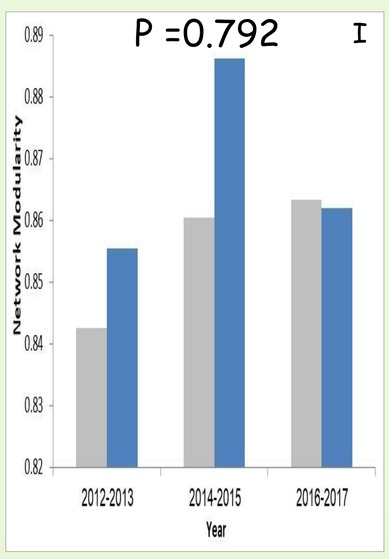


Fig. 6: **Differences in means between years (calculated with resampling methods).** Means of weighted degree & betweenness (F). Weighted degree and betweenness are **significantly different** in social networks of odd and even years (G). Density and modularity measures, are **not** different in the social networks between odd and even years (H)(I).

Discussion

- Even in the extreme solitary Sinai chameleon time-lag social networks are seen.
- First time that the subject has been examined in an extreme solitary species that has no permanent burrows.
- The encounters between individuals in the social network can lead to transmission of microorganisms and affect the fitness of individual (gut microorganisms in animals play an important role in many processes that affect fitness, e.g., physiology, immunity and behavior)[5] .
- There are differences between populations in even and odd years.
- Understanding the viability of microorganisms in the field is very important for better understanding of transmission among reptiles.
- More research is needed, but the theoretical foundation is ready to collect field data.

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