BIOGEOGRAPHIC PATTERNS ESTIMATION

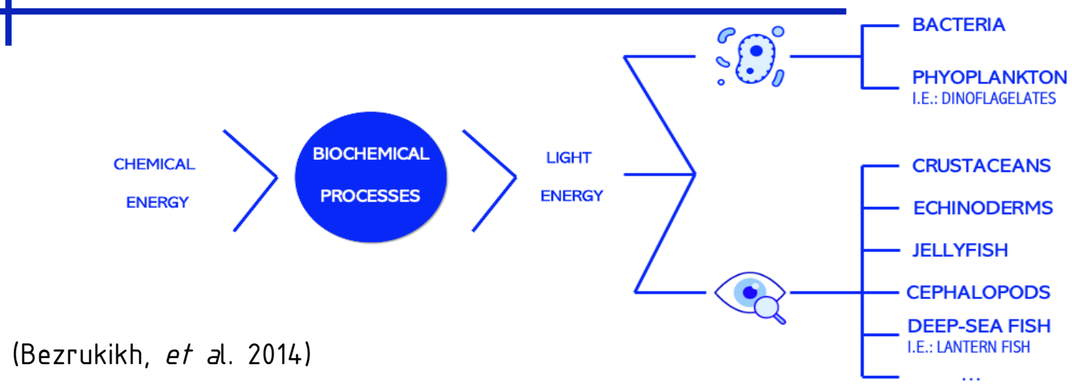
EXPLAINING THE MARINE BIOLUMINESCENCE IN COSTA RICA

Rebeca Rojas-Alfaro,[1] Steve Stephens-Cardenas,[2,3] Enzo Escobar-Méndez,[2] Yarenis Villalobos-Abella [2]

1 University of Costa Rica, Research Center for Microscopic Structures.
2 Latin University of Costa Rica, School of Biological Sciences.
3 University of Andes, School of Biological Sciences, Colombia.

rebeca.rojas.alfaro@gmail.com / mariarebeca.rojas@ucr.ac.cr

BACKGROUND & OBJECTIVES



(Bezrukikh, *et al*. 2014)

Fig. 1. What is bioluminescence? Where can you see it?

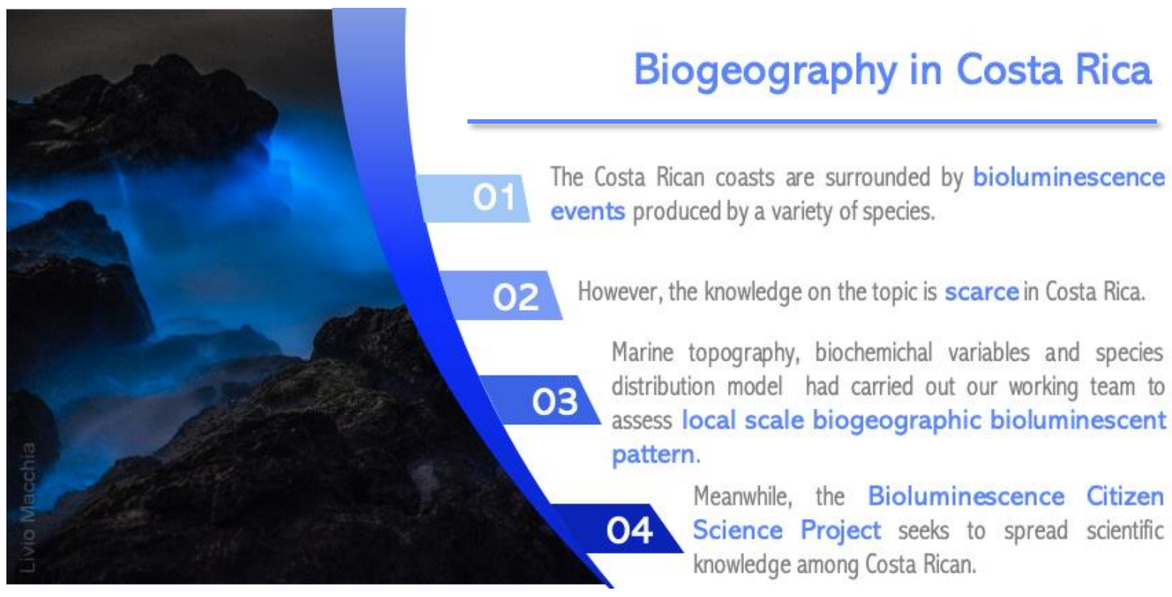


Fig.2. Biogeography ins and outs in Costa Rica. Here's a photo taken by Mr. Livio Macchia in Puntarenas, Costa Rica in 2019.

METHODS

1 OPEN SURVEY — Bioluminescent events locations where collected thanks to citizens through an open survey on the BIOLUMI platform.

2 DATA ORGANISATION — Then, the data were reviewed and re-organised by the working team in order to avoid some errors.

3 PCA ANALYSIS — It was useful to reduce the number of variables to analyse amongst the survey. It helped us assess differences between Pacific/Caribbean coast and mainland/island defining conditions.

4 PREDICTOR VARIABLES — In order to collect these variables, we use two tools according the kind of data we are working with: MARSPEC and BIO-ORACLE.

5 CLOSEST MATCHING MODEL — Last but not least, we set on the MAXENT software 50 replicate models with randomized data partitions. The final consensus was found by eliminating all the models with more than 1 deviation of the general AUC (Area Under the Curve).

Fig.3. Our methodology.

(Phillips & Dudík, 2008)

More than 180 data were collected → BIOLUMI PLATEFORM → Form: It is an online form available in www.biolumicostarica.weebly.com

17 biogeographical data were collected → MARSPEC → Software: It is a set climatic and geophysical spatial data layers for the world ocean.

11 biochemical data were collected → BIO-ORACLE → Software: It is a set combining marine biodiversity associated with sea surface and epibenthic habitats.

RESULTS

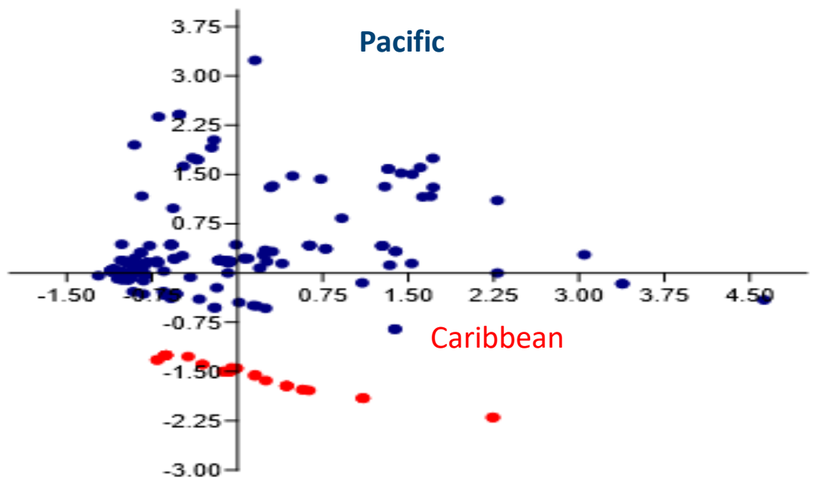


Fig.5. PCA analysis of data Pacific and Caribbean of bioluminescence data, Costa Rica. (AUC =0,99)

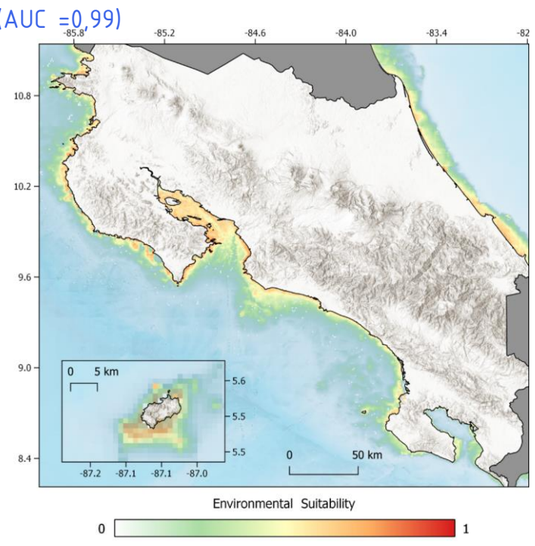


Fig.6. Costa Rica map showing the most environmental suitability places for bioluminescence events thanks to the highly accurate final consensus models found (AUC =0,99)

≠ In the Pacific and the Caribbean coasts both bioluminescence events and model contributions made by environmental predictors are different.

= In coastal areas and in oceanic.

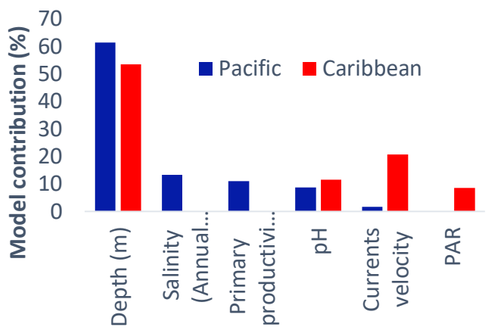
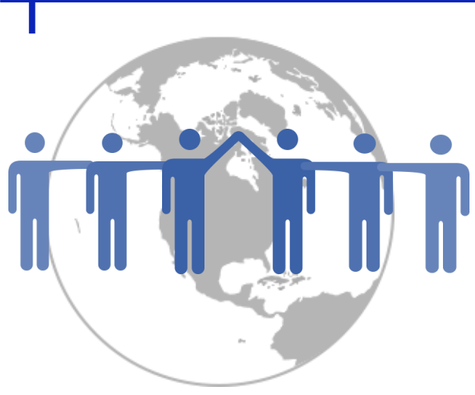


Fig.7. Differences between the Pacific and the Caribbean coasts.

DISCUSSION



Our working team believed it is a winning combo to involve citizens in its study. Indeed, it gives us the opportunity to improve our understanding of biological phenomena. Meanwhile, it's improving sustainable behavior amongst citizens by improving their comprehension on environmental variables. Finally, our model provide a baseline for designing research strategies which represents a major step in bioluminescent research.

REFERENCES

Bezrukikh, A., Esimbekova, E., Nemtseva, E., Kratasyuk, V., & Shimomura, O. (2014). Gelatin and starch as stabilizers of the coupled enzyme system of luminous bacteria NADH: FMN-oxidoreductase-luciferase. *Analytical and bioanalytical chemistry*, *406*(23), 5743-5747.

Phillips, S. J., & Dudík, M. (2008). Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. *Ecography*, *31*(2), 161-175.

Code a for FB page of the bioluminescence project