

Non-genetic mechanisms of coral response to global change: preliminary epigenetic analyses in corals impacted by hurricanes Irma and Maria in Puerto Rico

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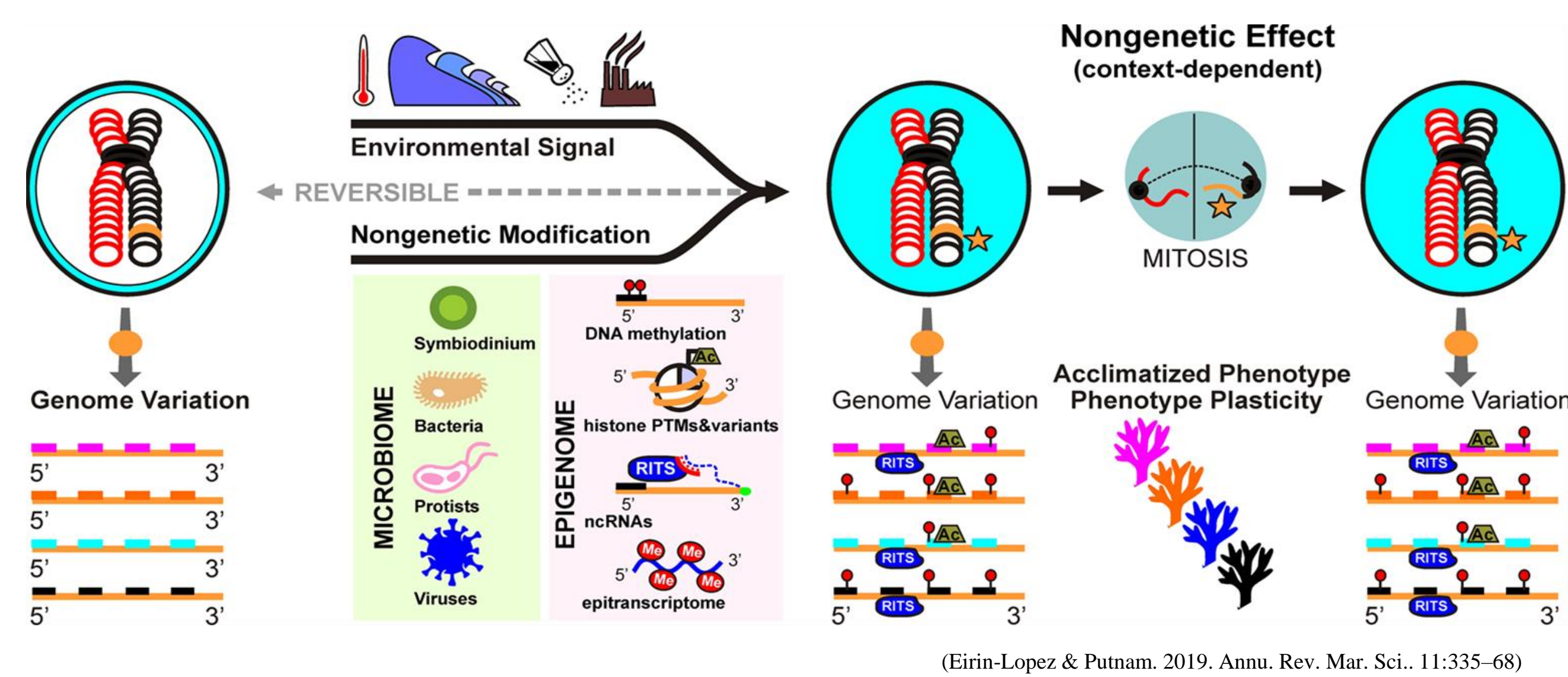


Background

One of the many effects of climate change is an increase in the frequency and intensity of extreme weather events.

Coral reef recovery after these events is hampered due to the cumulative impact that storms have with other stressors currently affecting these ecosystems.

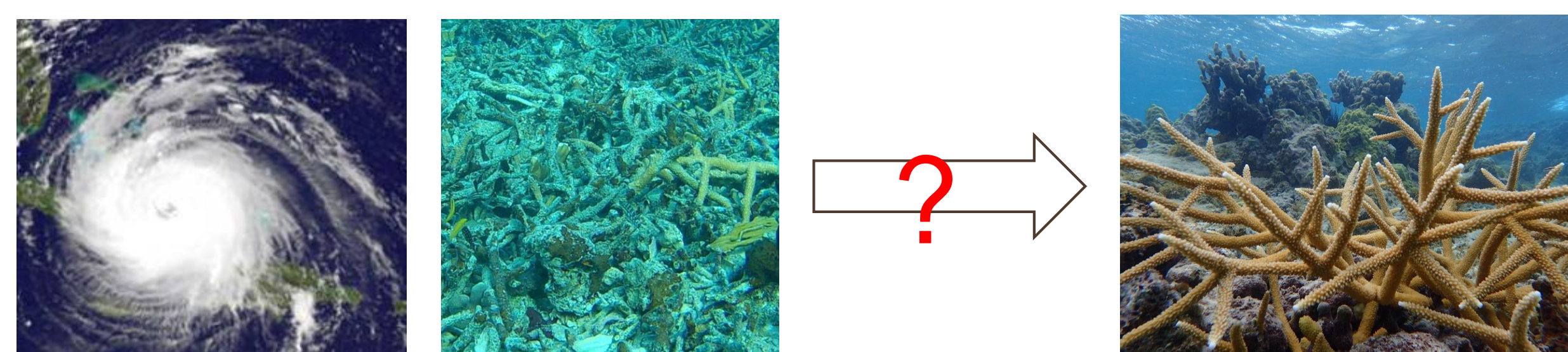
Coral capacity to acclimate and cope with rapidly changing environment rely on a combination of genetic and non-genetic mechanisms



The role of non-genetic mechanisms during environmental responses in ecologically and environmentally relevant organisms is still unknown.

Specially, it is not clear how genetic (i.e., genotype) and non-genetic mechanisms (i.e., epigenome, microbiome) interact promoting acclimatory capacity.

How coral existing genetic variation interacts with acquired environmental modifications during recovery from extreme climatic events?



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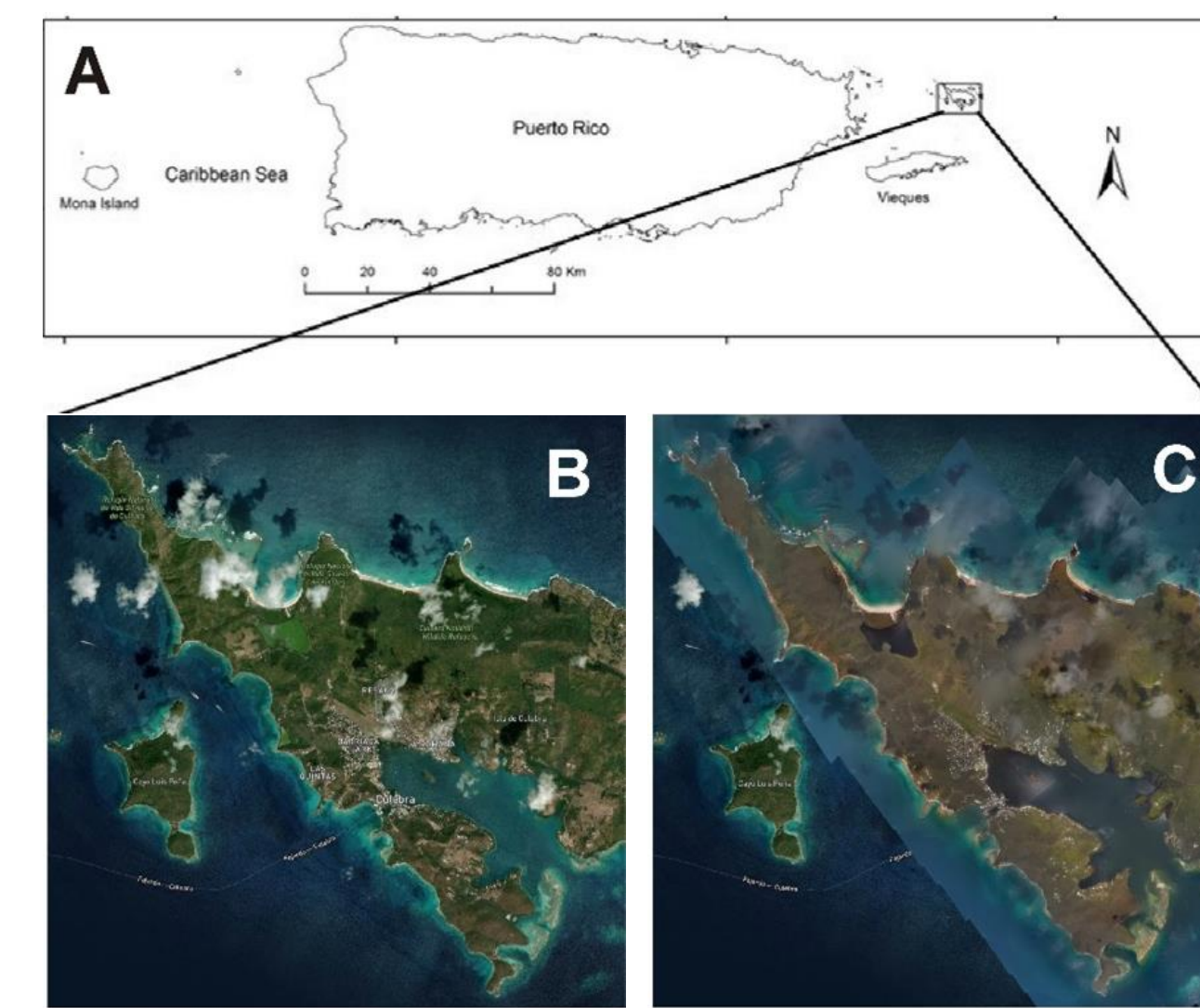


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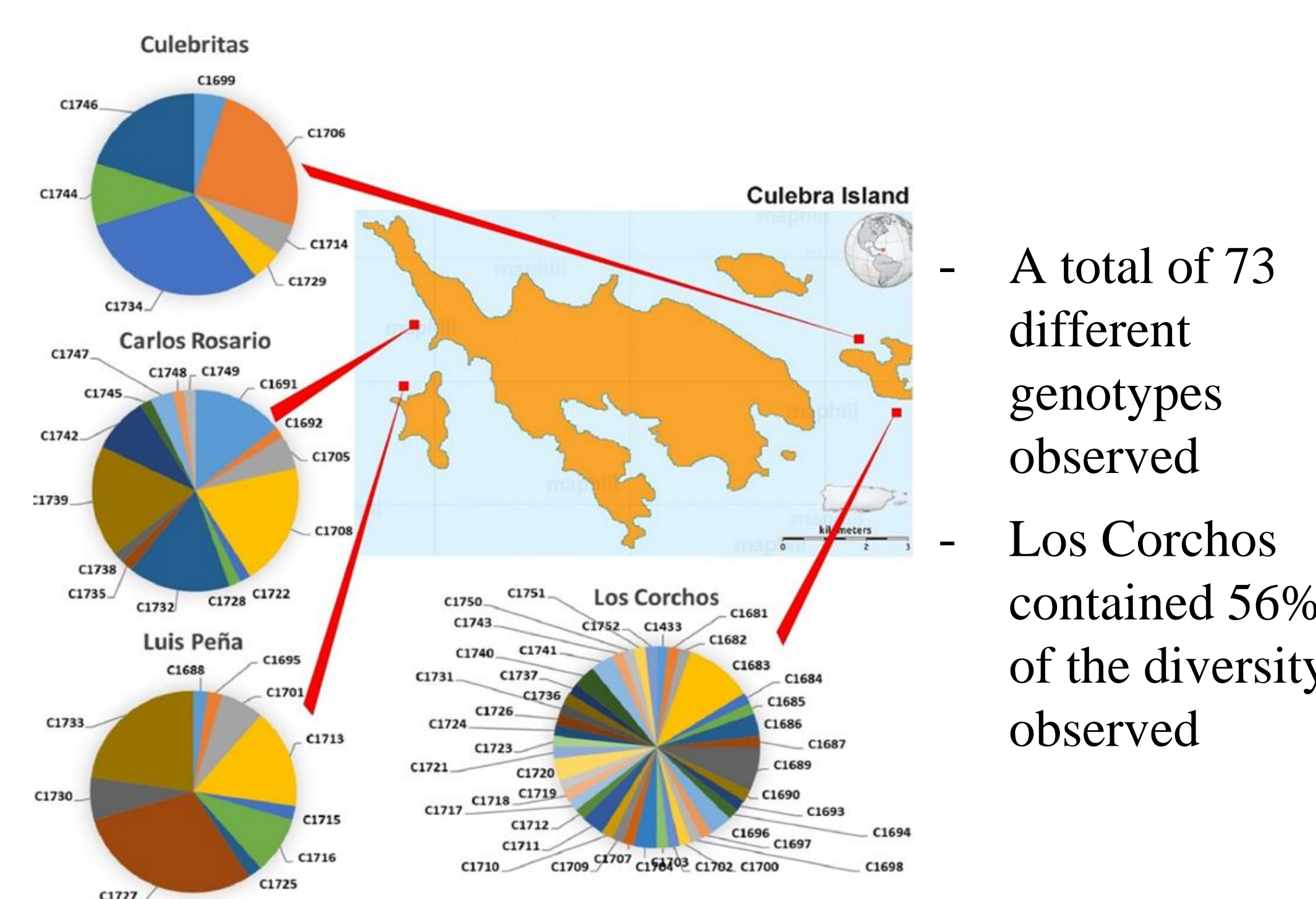
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Approach

Culebra Island, PR suffered the direct impact of back to back Cat5 hurricanes in less than a month (Irma & Maria), making it a perfect natural laboratory to evaluate coral recovery.

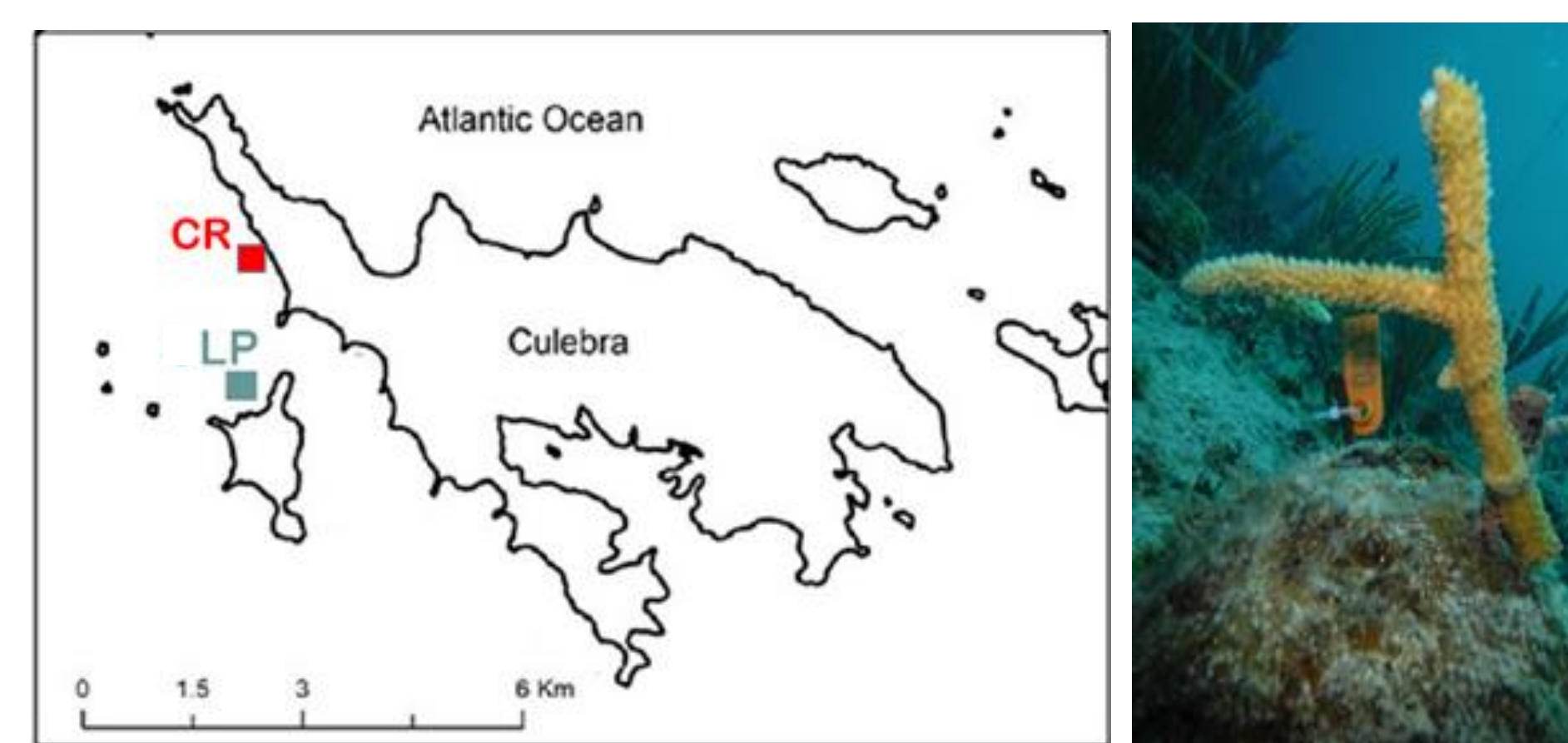


Over 200 fragments of Staghorn coral (*Acropora cervicornis*) were rescued from 4 reefs and genotyped using 6 microsatellite loci (Baums et al. 2005)*



- A total of 73 different genotypes observed
 - Los Corchos contained 56% of the diversity observed

Coral were immediately outplanted in two reefs (LP&CR) and at 2 depth (5 & 15 m) (4 sites, N = 400)



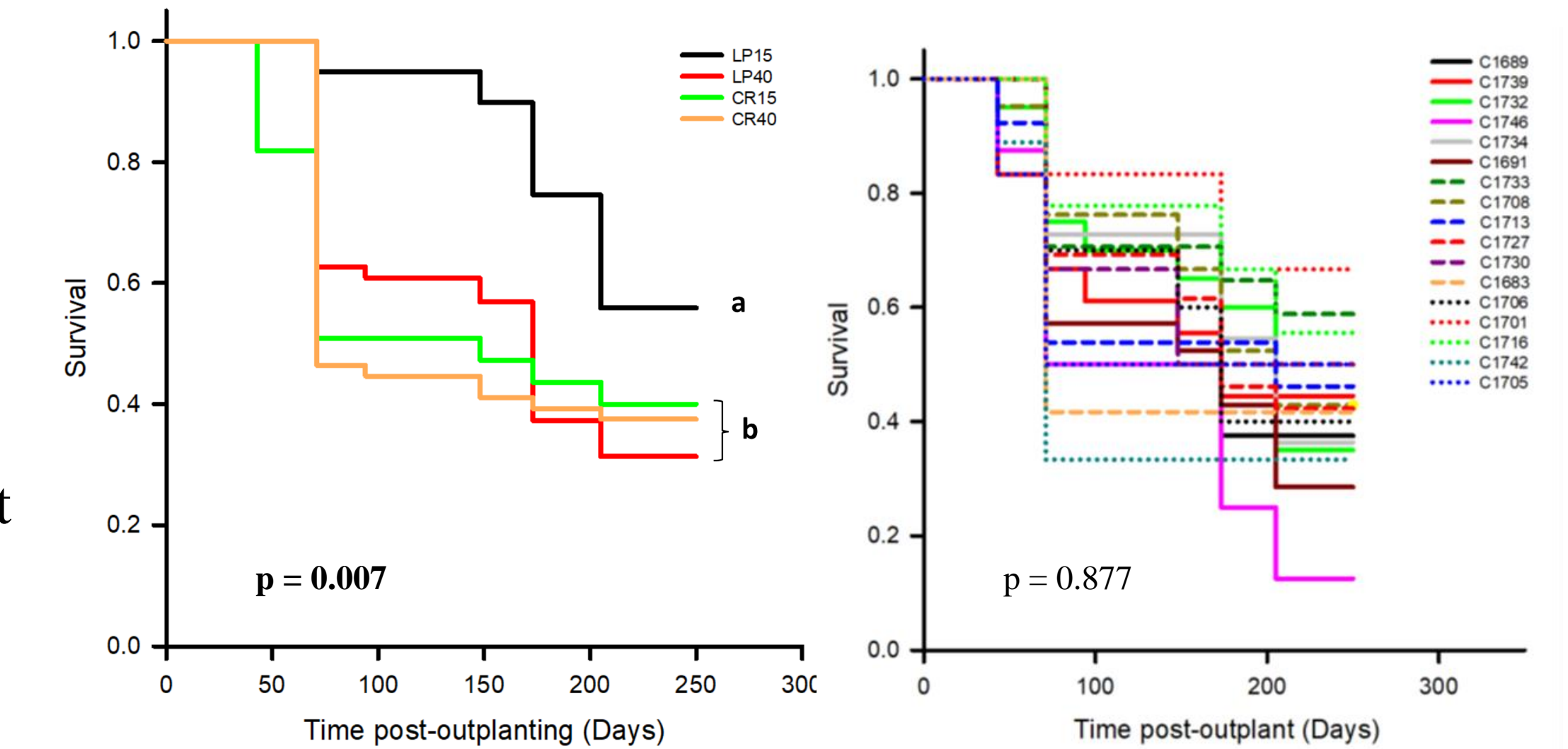
- Every month
- Survival
 - Photosynthesis (PAM)
 - Abiotic parameters
- Every three months
- Growth
 - Tissue samples



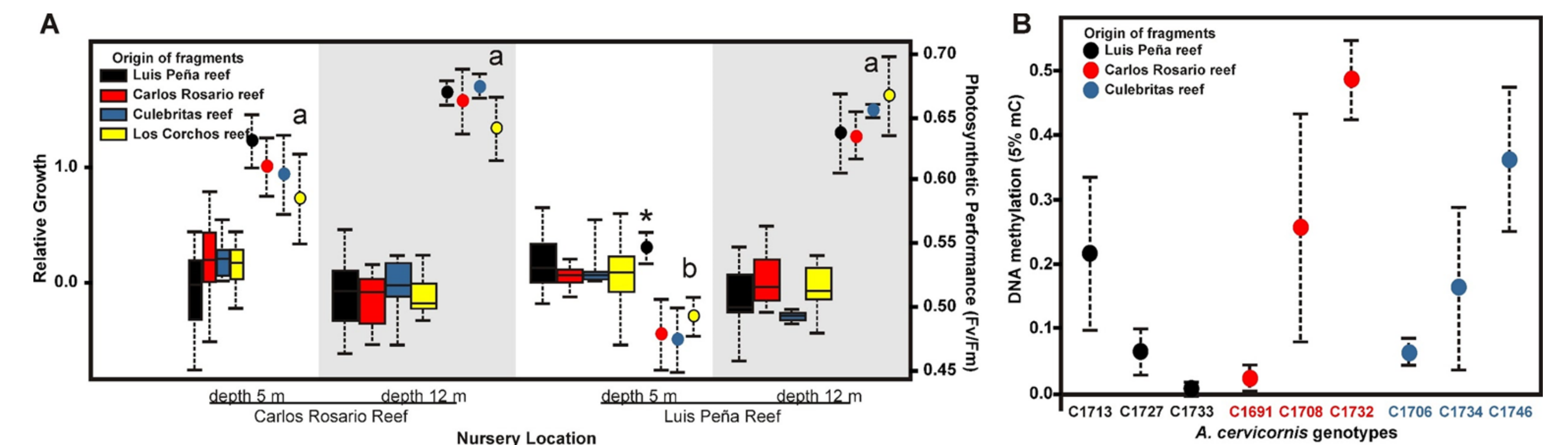
Genetic
Epigenetic
Microbiome
Physiology

Results

After the first six months of the experiment we observed overall survival of around 56% of the outplants. Kaplan-Meier curves (on the right) showed a high variability between genotypes but no significant differences, being significantly dependent on outplant site.

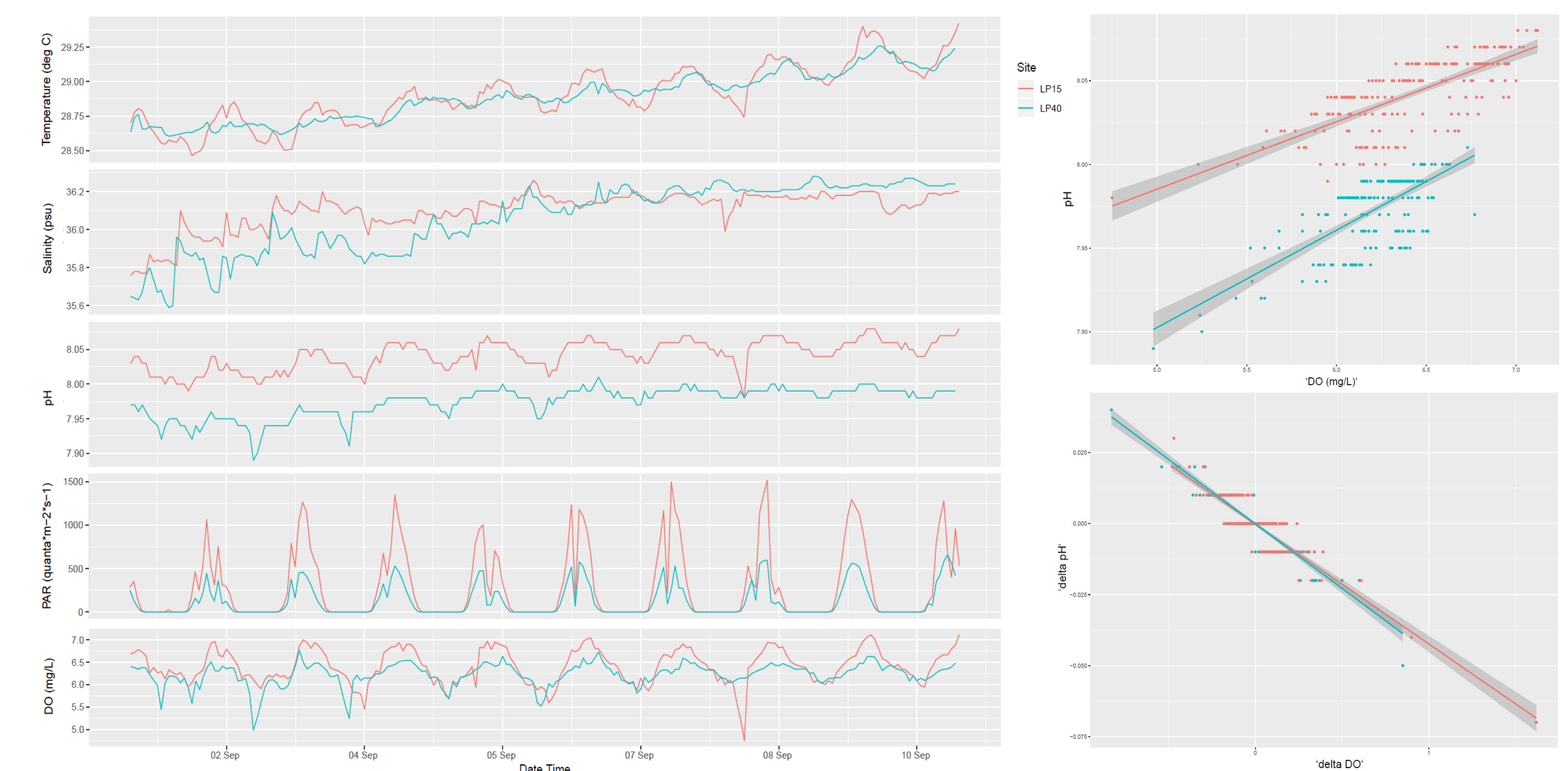


In terms of growth, the analysis of the first three months showed positive growth (no tissue lost) in most outplants. No differences were observed between outplant sites (see below, A). PAM fluorometry results indicate significantly lower photosynthetic efficiencies in LP15 (see below, B). Interestingly, locally collected corals within this site showed a higher efficiency.



Global methylation (see above B) of fragments right after initial collection indicate differences between genotypes being more marked than between sites, indicating a role of genotype in the epigenetic landscape.

Abiotic parameters (below left panels) show clear differences between depths as: higher variability of temperature, increased pH, PAR and DO in LP15. Remarkably, LP15 showed an increased buffering capacity (pH/DO plot, below right) potentially constituting better conditions for calcification.



These preliminary results hint a relationship between particular genotypes and specific epigenetic regulatory responses, evidencing complex physiological responses to different environmental conditions. The complete set of results (expected upon completion of this project) will allow to clarify the nature of the interaction between epigenome, microbiome and genome during responses to different environmental conditions.

* Baums, I. B., C. R. Hughes, M. E. Hellberg (2005) Mendelian microsatellite loci for the Caribbean coral *Acropora palmata*. *Mar Ecol Prog Ser* 288: 115–127