

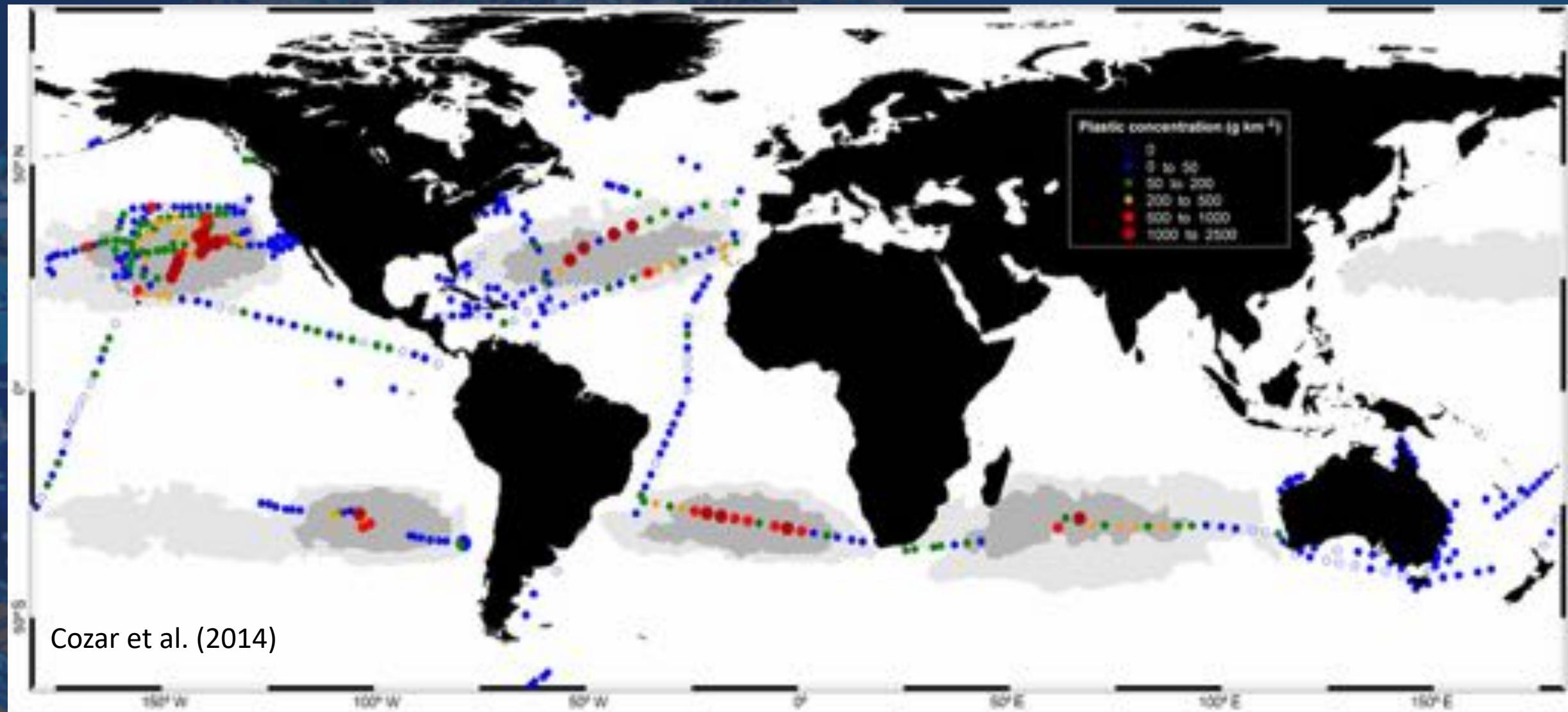
# Artificial ecosystem selection for marine polymer degradation

**Robyn Wright**

**Supervisors:** Joseph Christie-Oleza  
and Matt Gibson



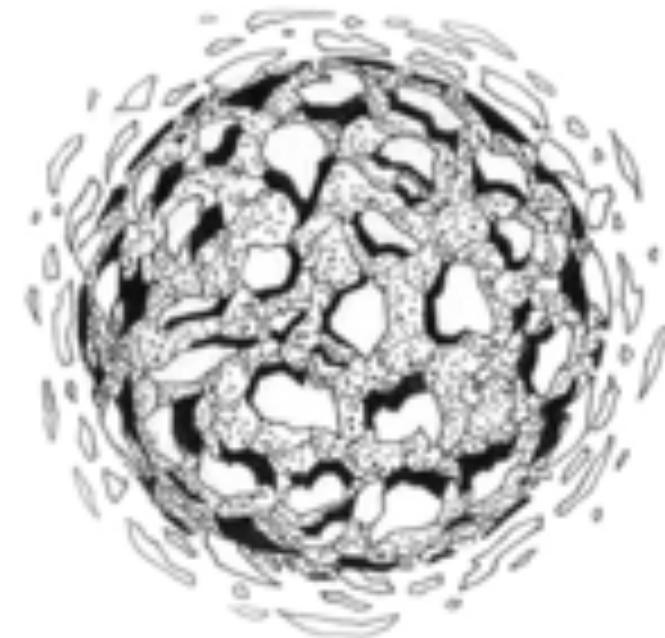
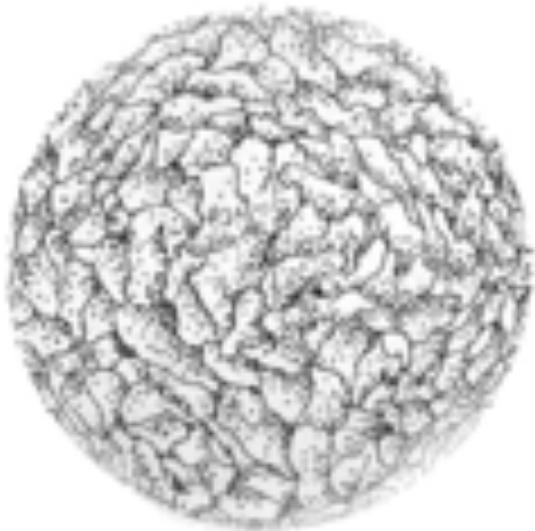
**@RobynJWright**



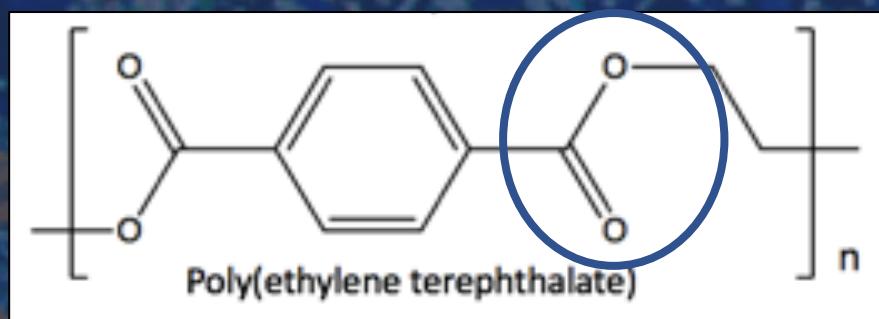
Cozar et al. (2014)

# The problem...

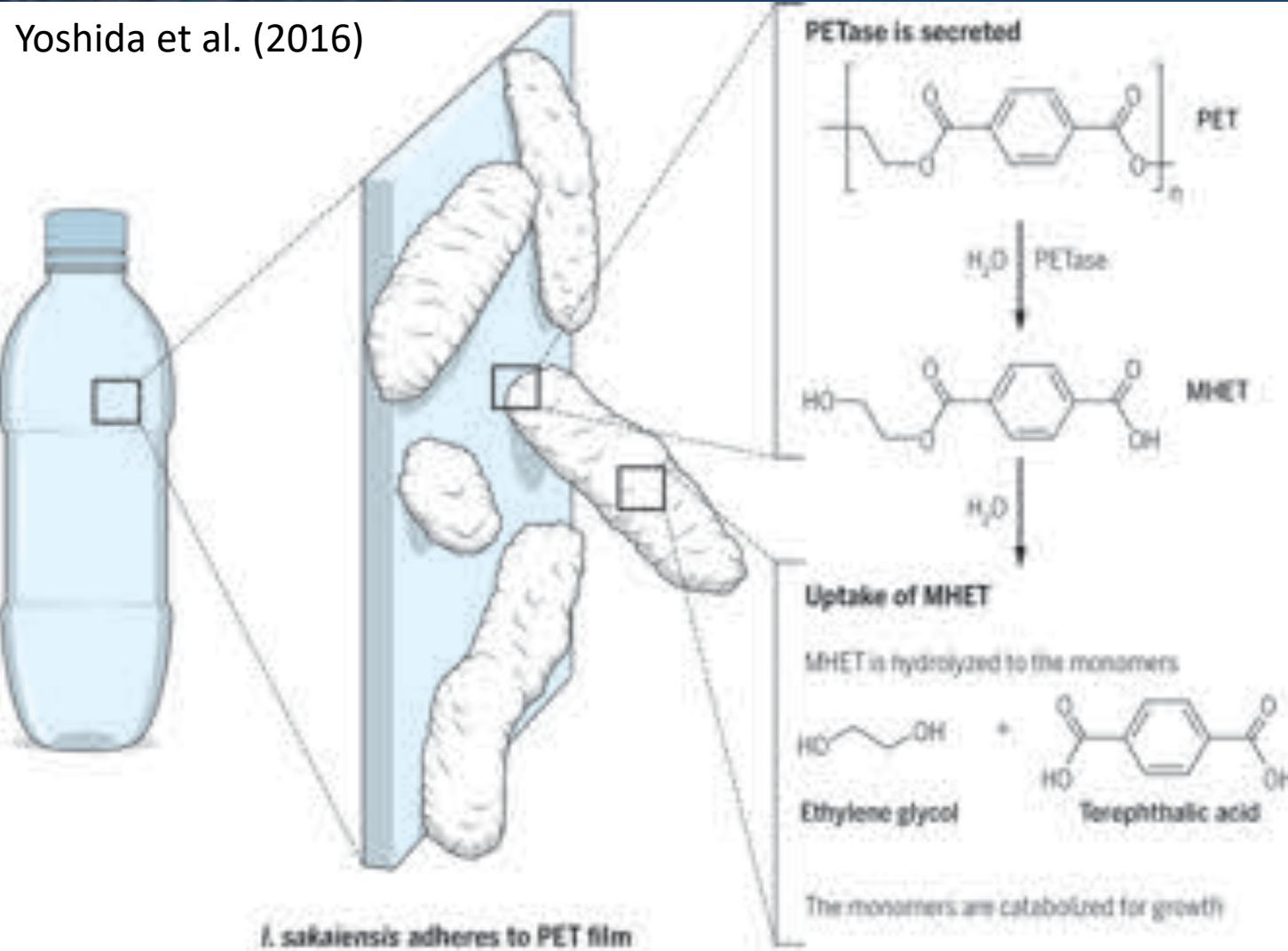
Andrade (2017)



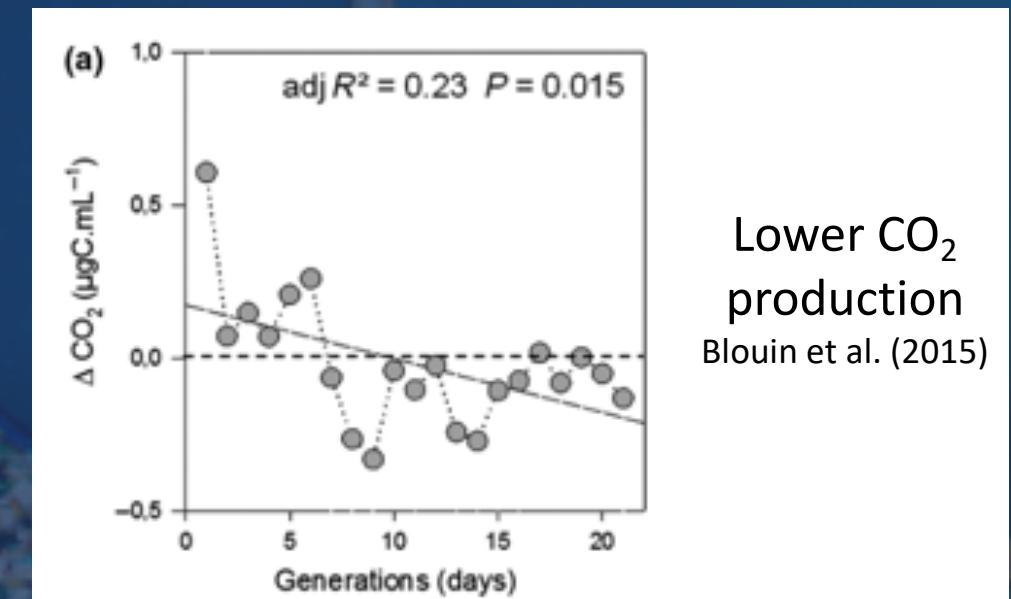
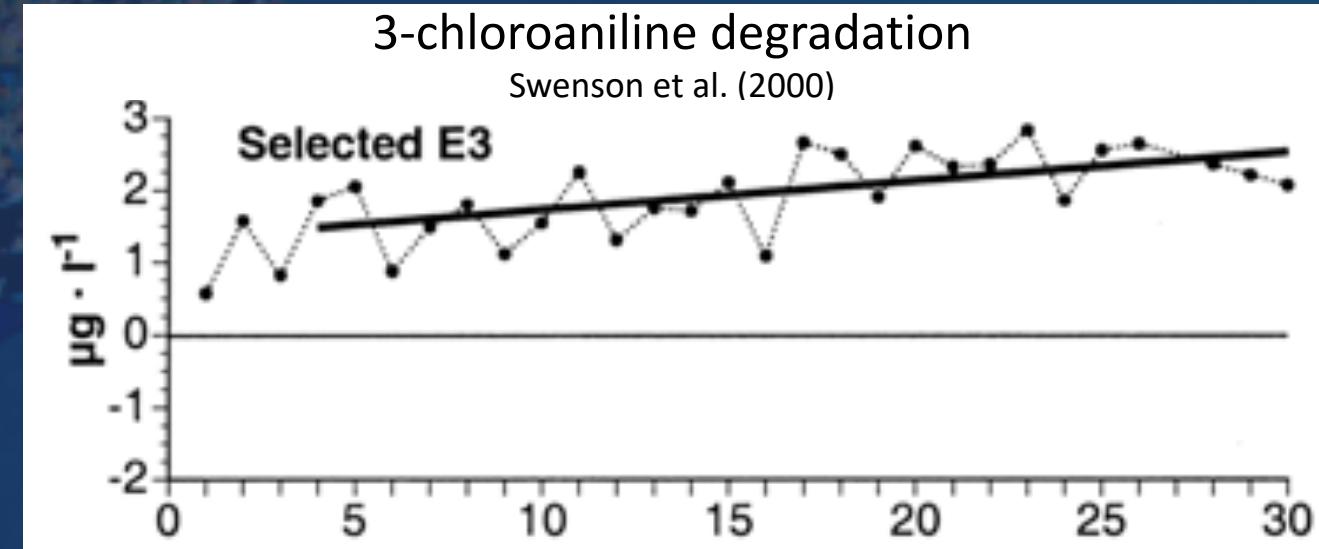
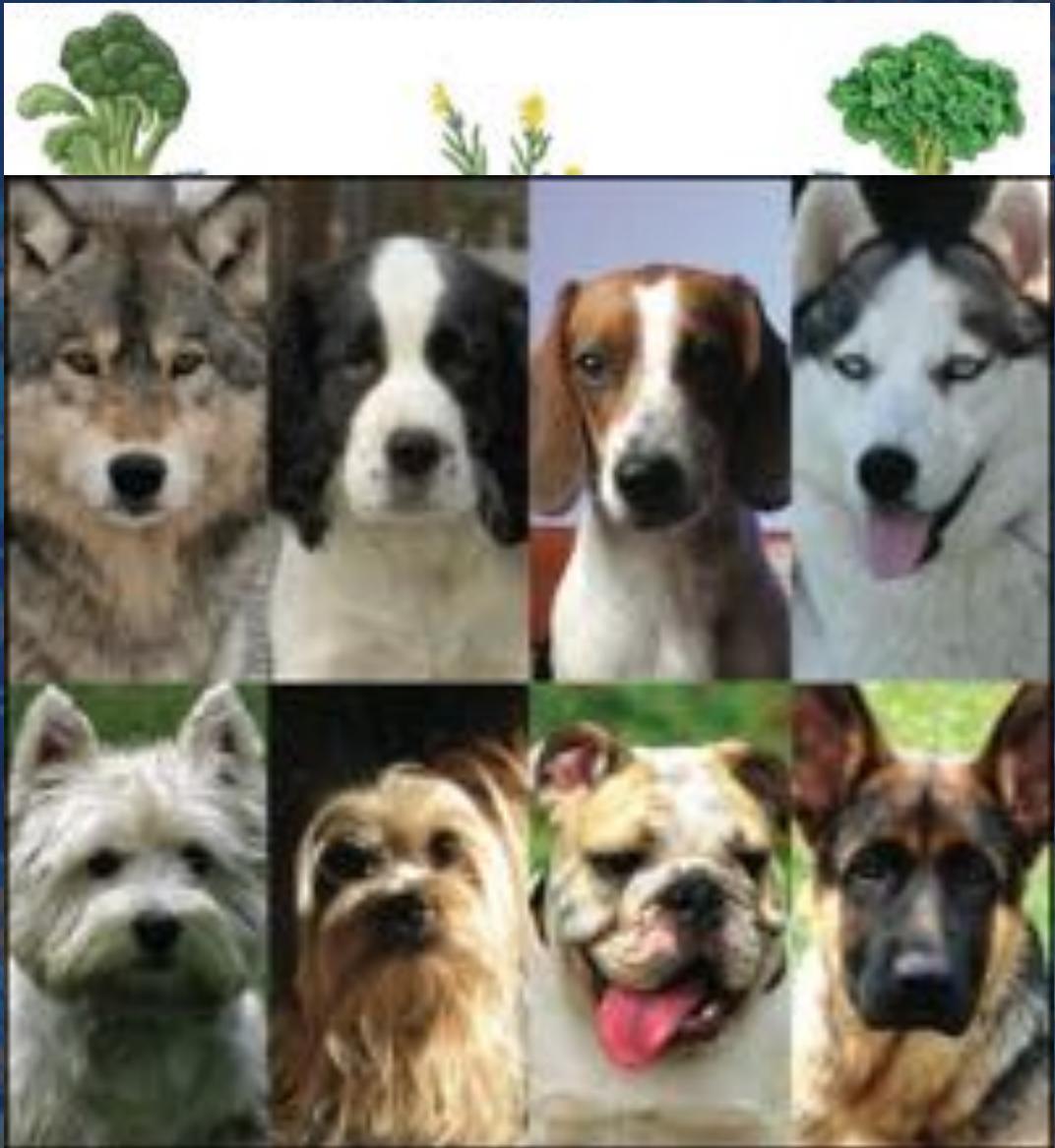
# PET



Yoshida et al. (2016)



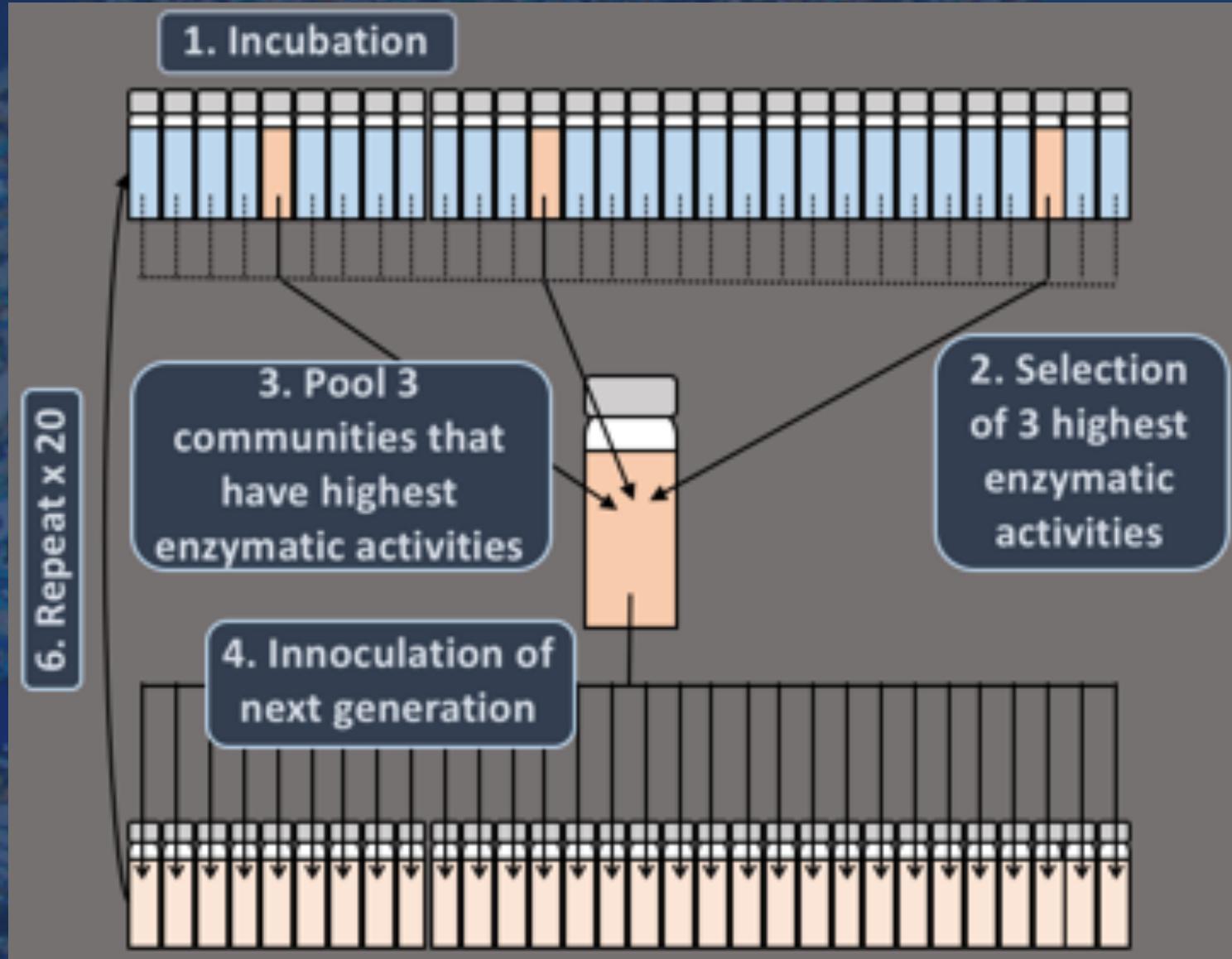
# Community artificial selection



# Chitin



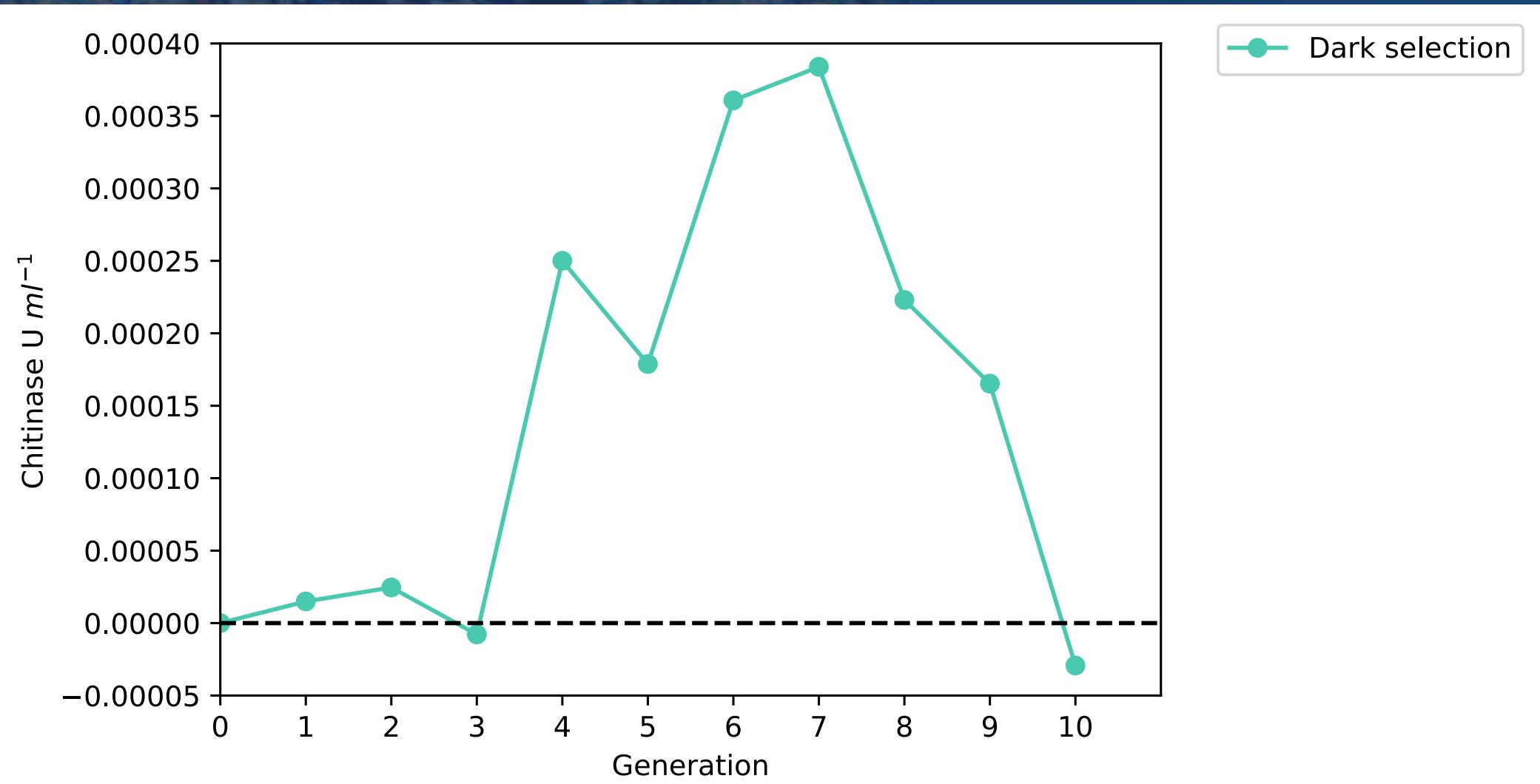
# What do I mean by artificial selection?



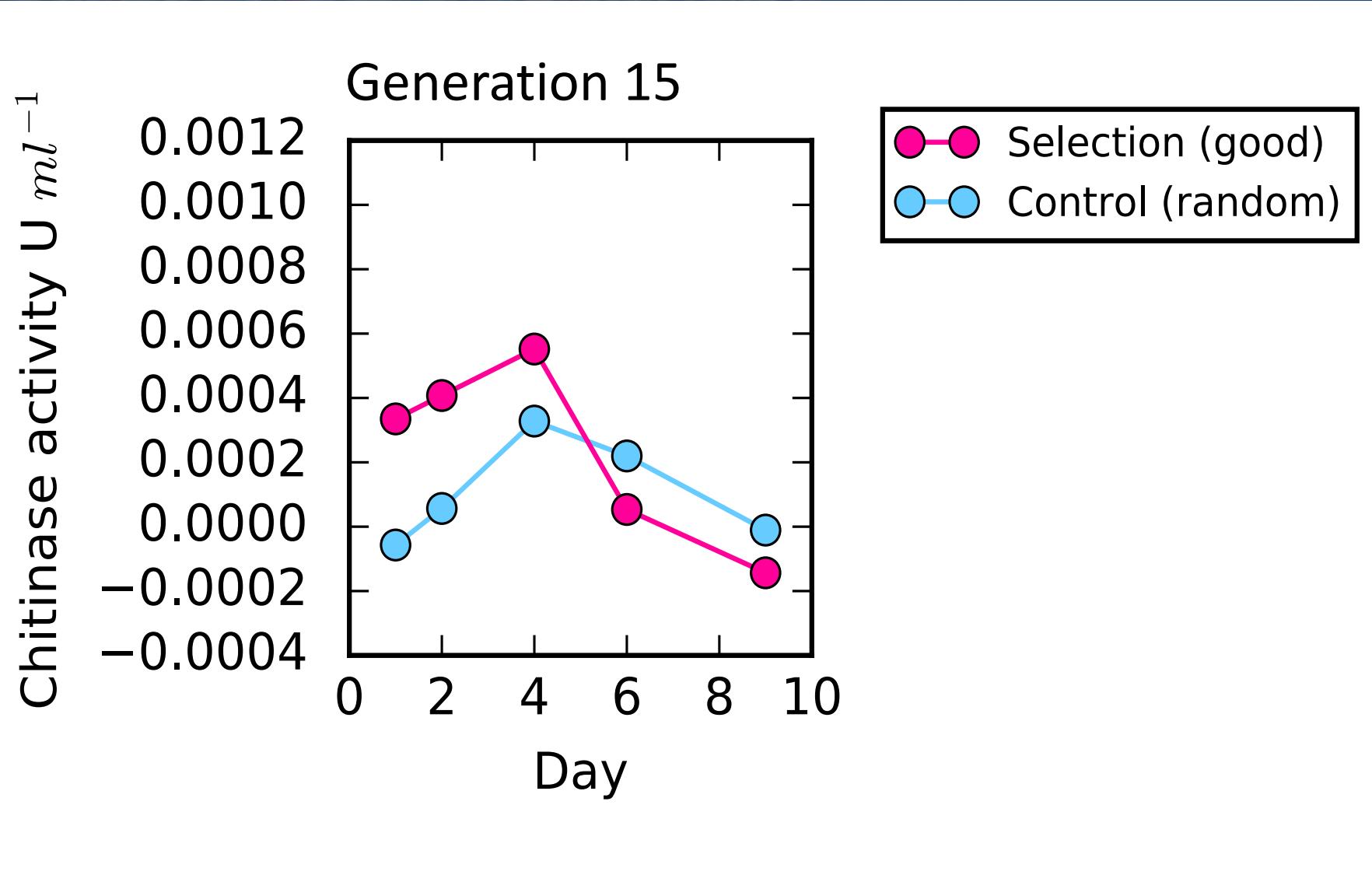
**Treatment 1:** *selection of 3 best communities*

**Treatment 2 (control):** *selection of 3 random communities*

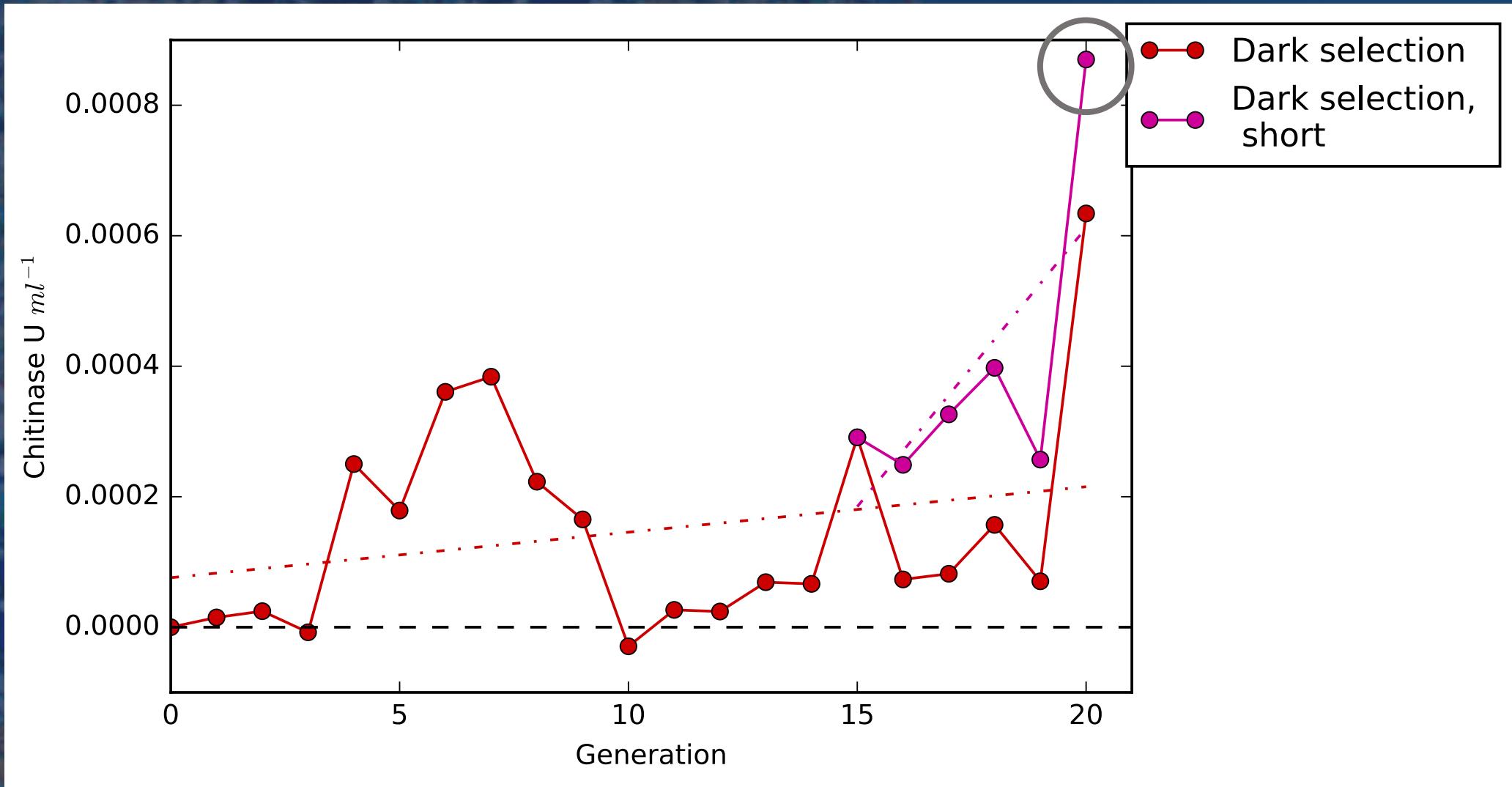
# Results



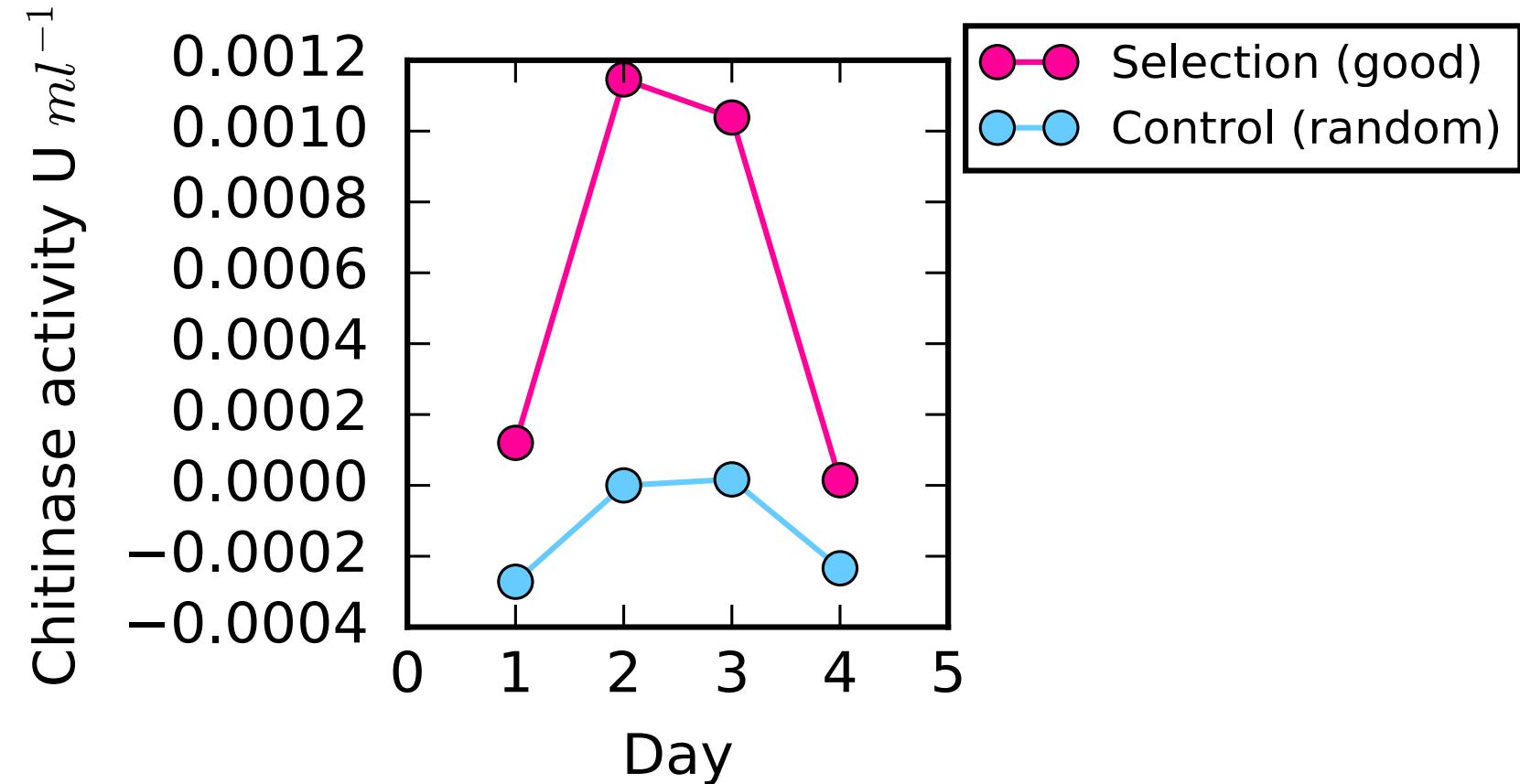
# Why was the selection not working as expected?



# After shortening incubation time

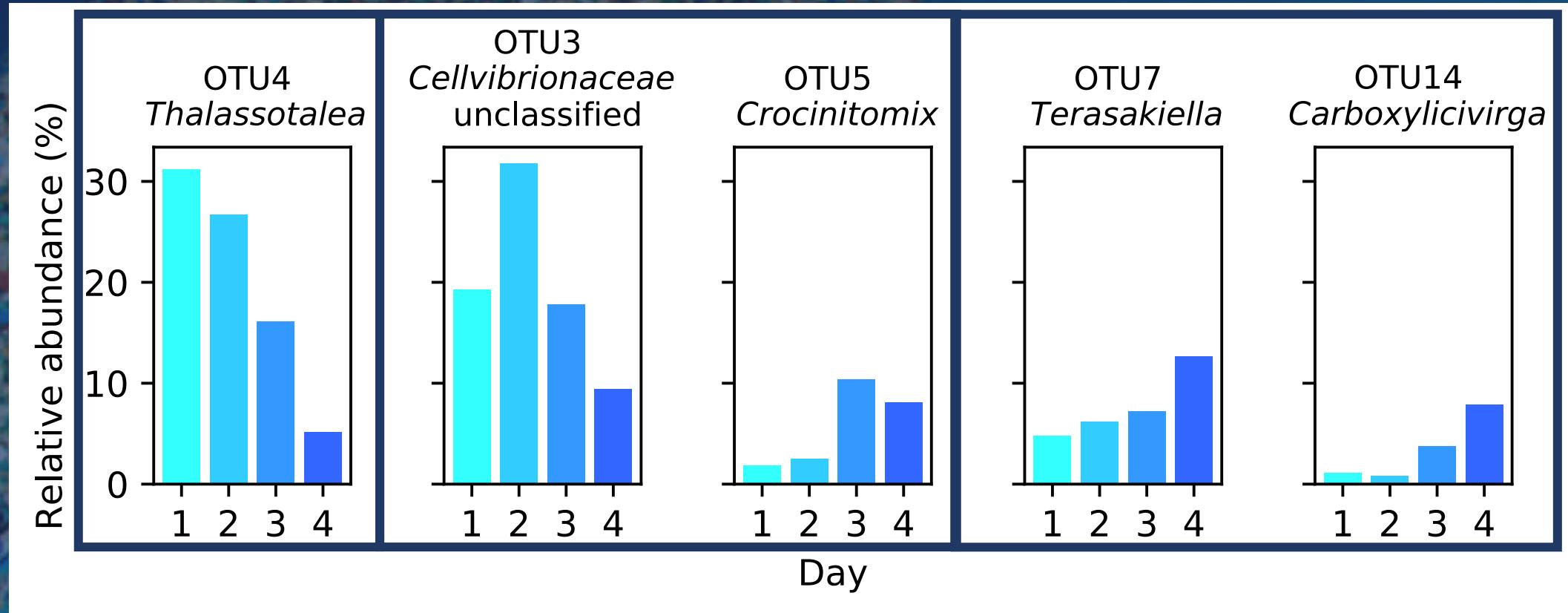


# Generation 20



Optimal incubation reduced to 2 days (from 4 days).

# Why was the selection not working?



***Thalassotalea*** – some are rapid primary colonisers of marine particles

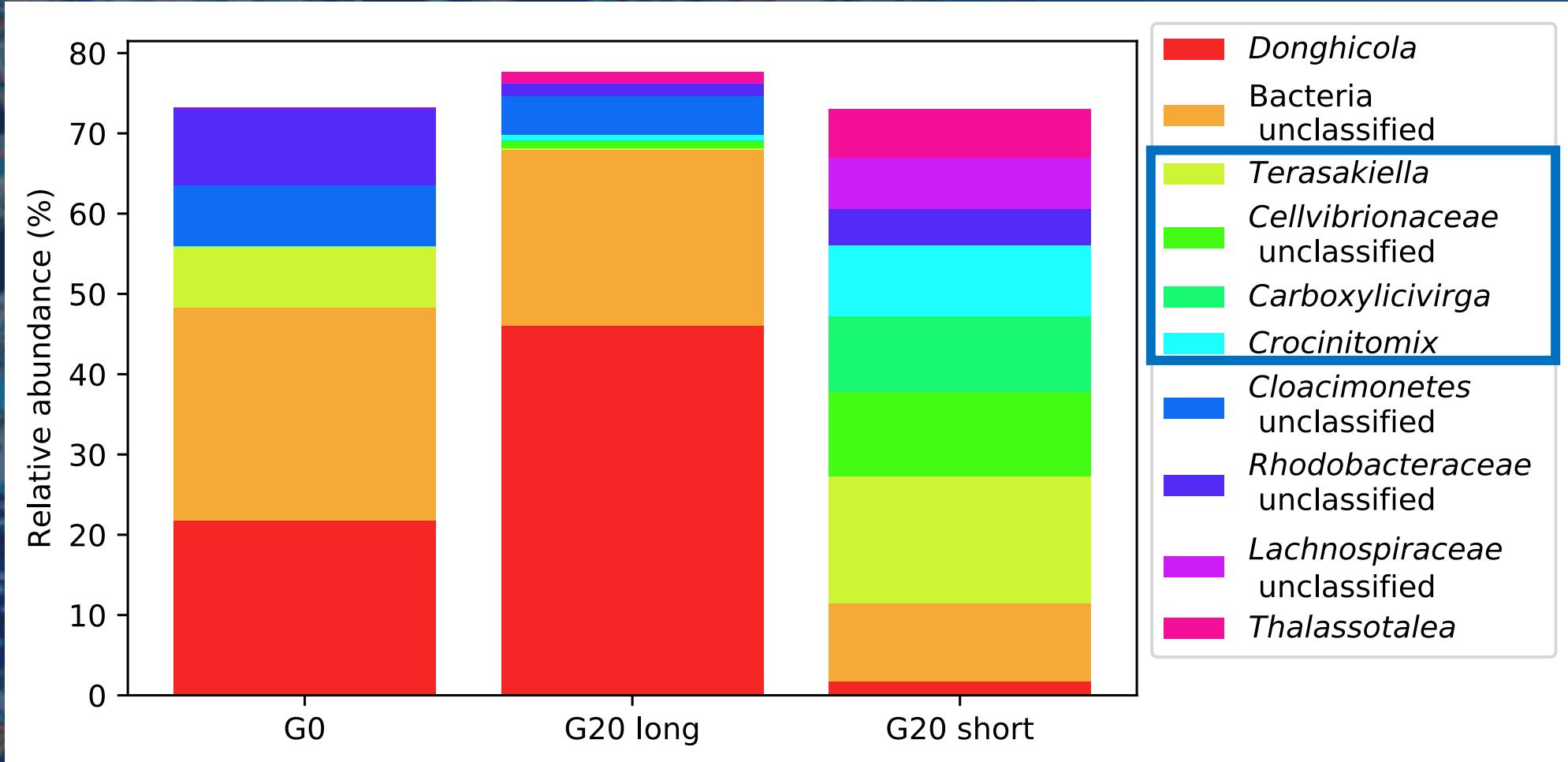
***Cellvibrionaceae*** – members of this family are capable of chitin degradation

***Crocinitomix*** – capable of producing chitinases sediment

***Terasakiella*** – previously isolated from shellfish, I have shown to produce chitinases

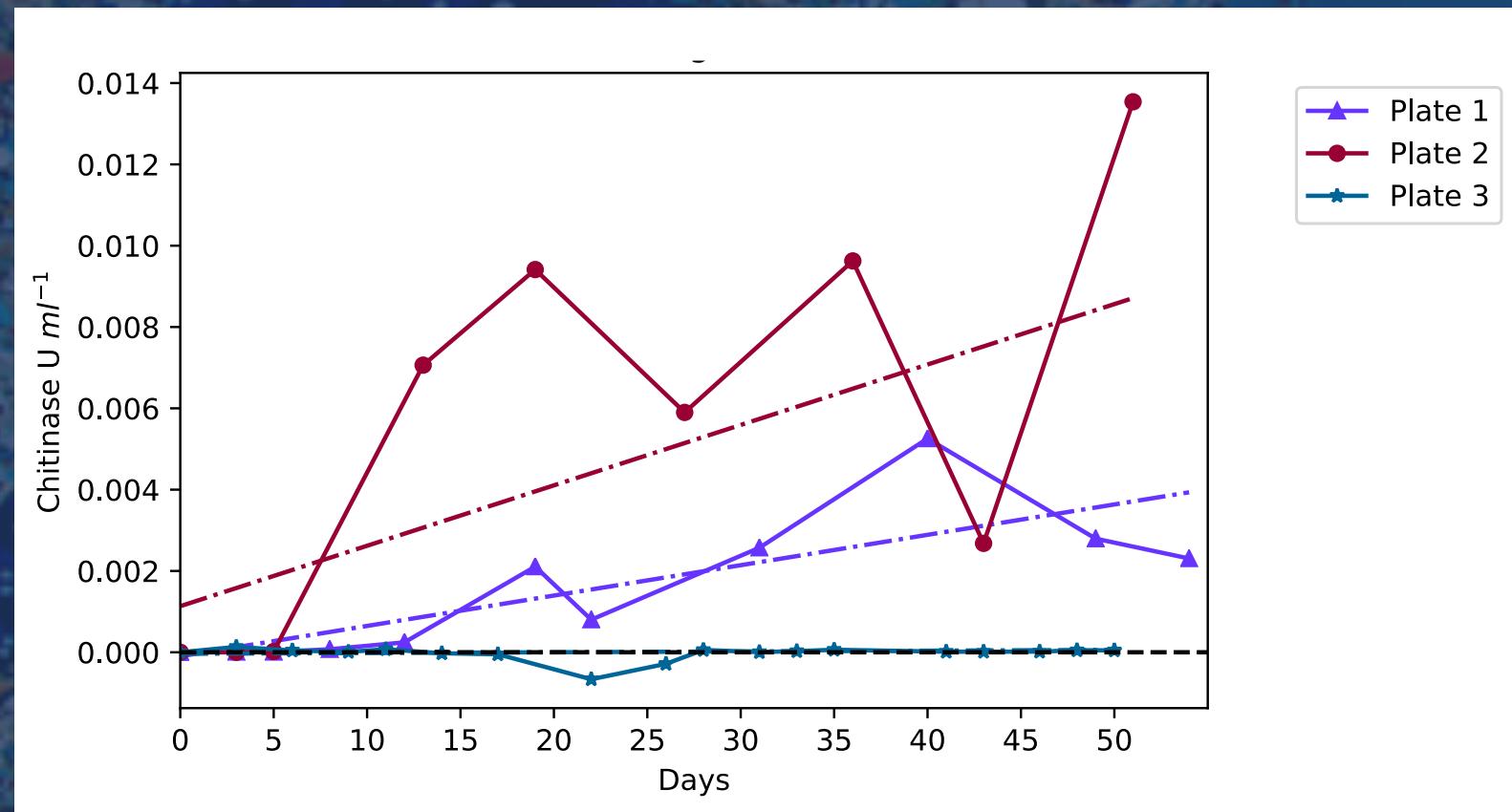
***Carboxylicivirga*** – isolated from marine

# How did the community change?

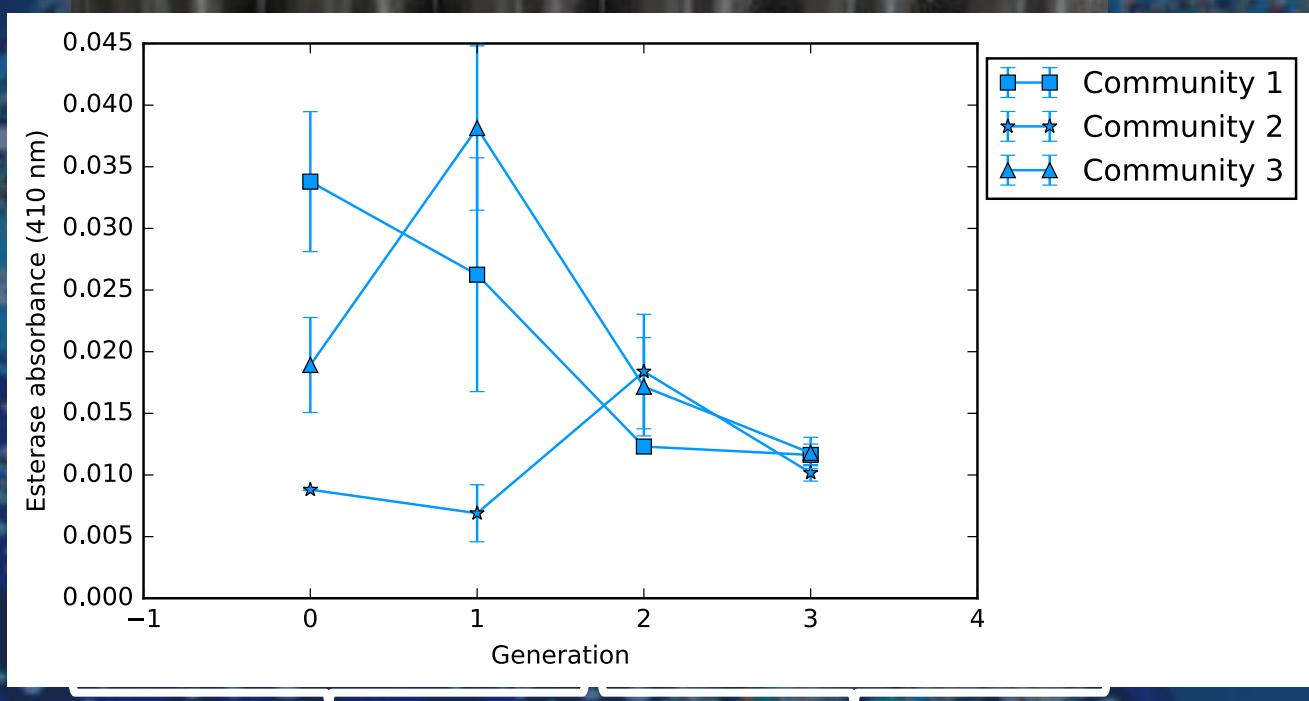


# Artificial selection 2

- Test for optimal incubation time at each generation
- Only start next generation after peak in activity has occurred

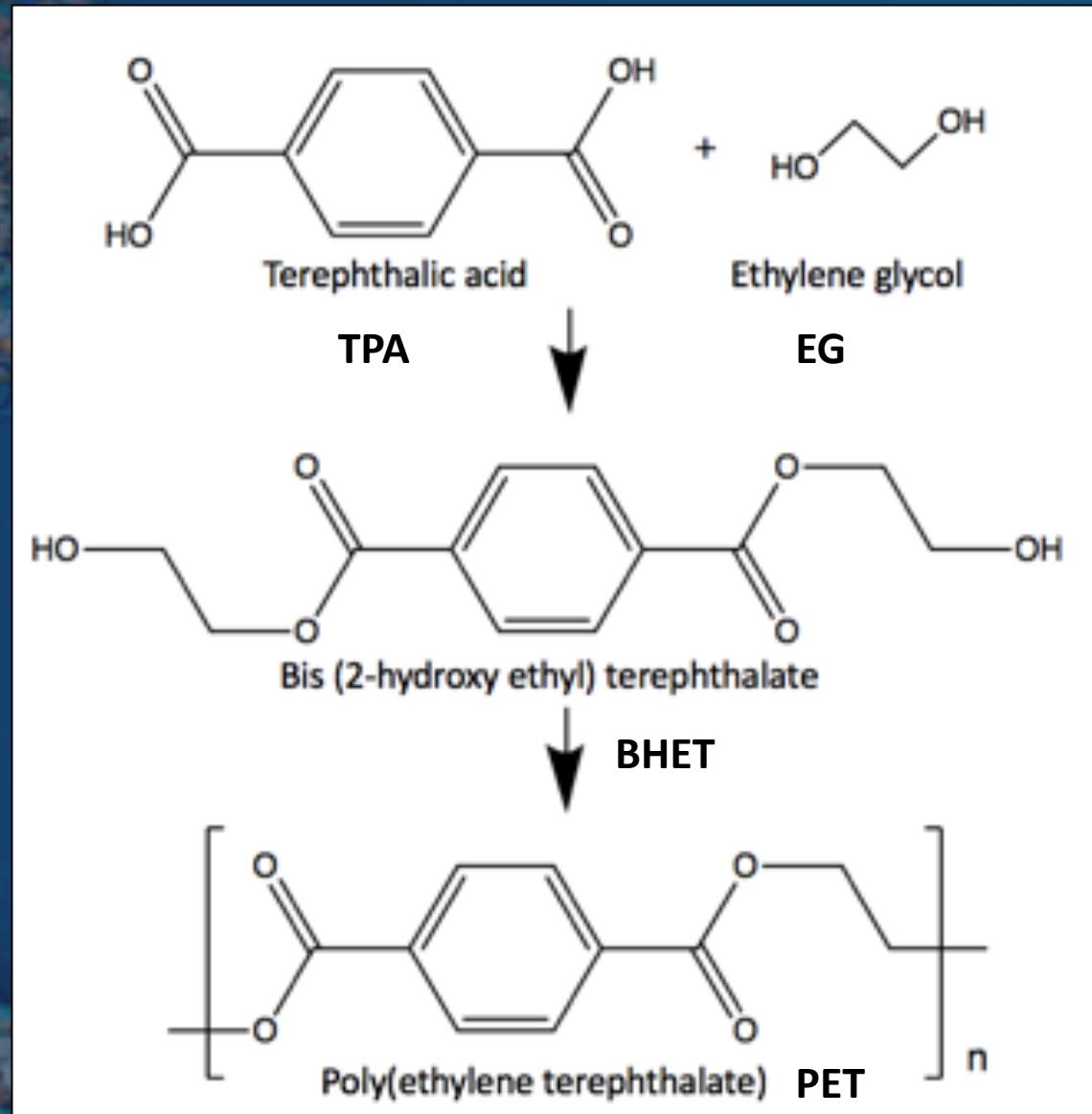


# What about PET?



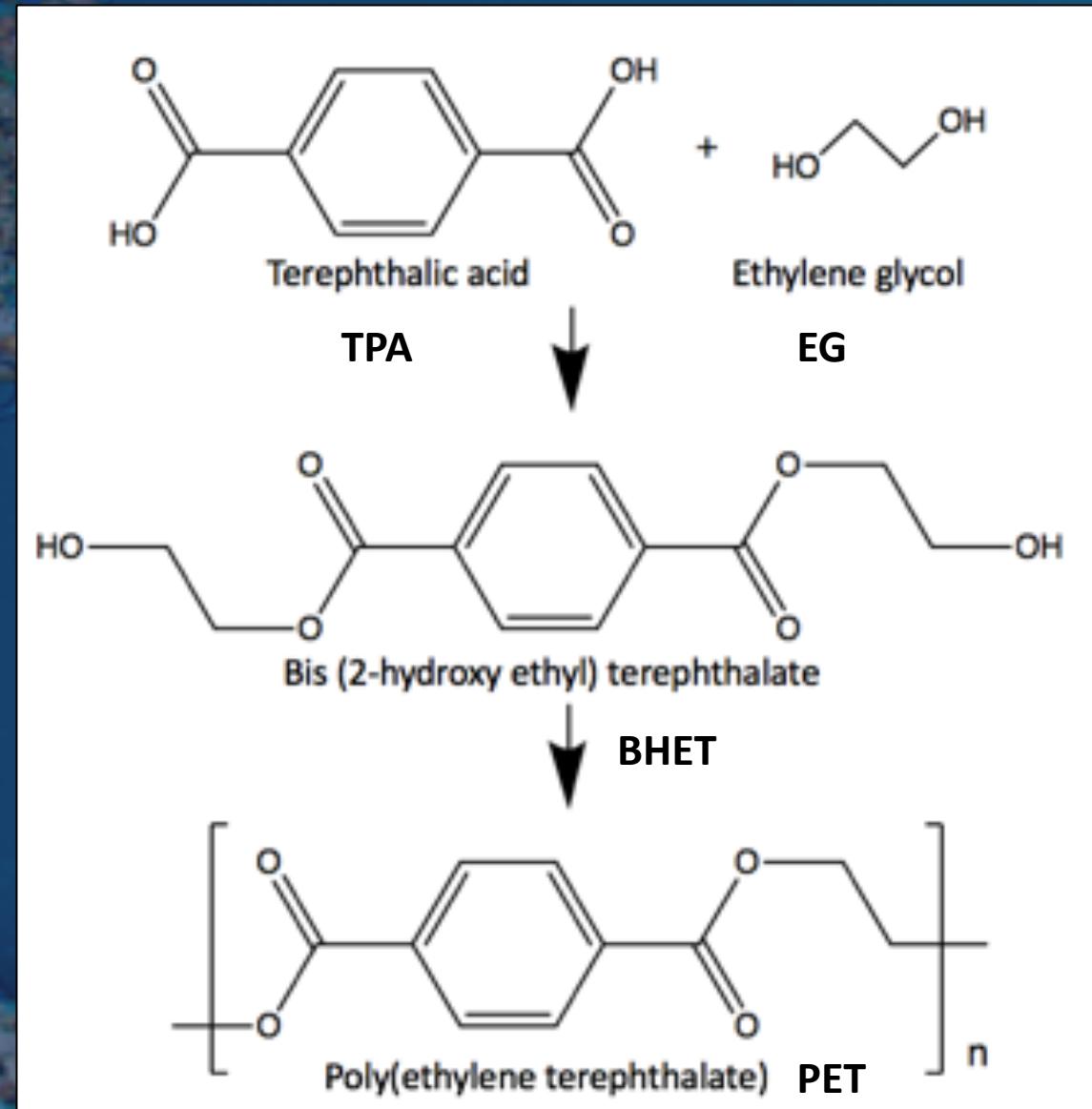
Control (random selection)

Good selection



# What about PET?

- Major problems:
  - Time to grow
  - Determination of degradation ability
- How to overcome this?
  - Addition of TPA and EG 
  - Addition of BHET 
- Why didn't this work?
- What now?
  - Enrichments with BHET
  - Testing of isolates with low crystallinity PET
  - Re-start artificial selection



# Summary

- **Chitin proof of concept:**
  - Can select for higher chitinase activity
  - Must test for optimal incubation time
  - We can make the selection much quicker than initially thought
- **PET:**
  - Artificial selection using monomers EG, TPA and BHET
  - Need better methods for looking at degradation of PET
  - BHET isolates



# Acknowledgements

## Supervisors:

Joseph Christie-Oleza

Matt Gibson

## Christie-Oleza (and Scanlan) groups

### Plastics group:

Gabriel Erni-Cassola

Vinko Zadjelevic

## Gibson group



A large pile of colorful plastic waste floating in the ocean.

# Thanks for listening!

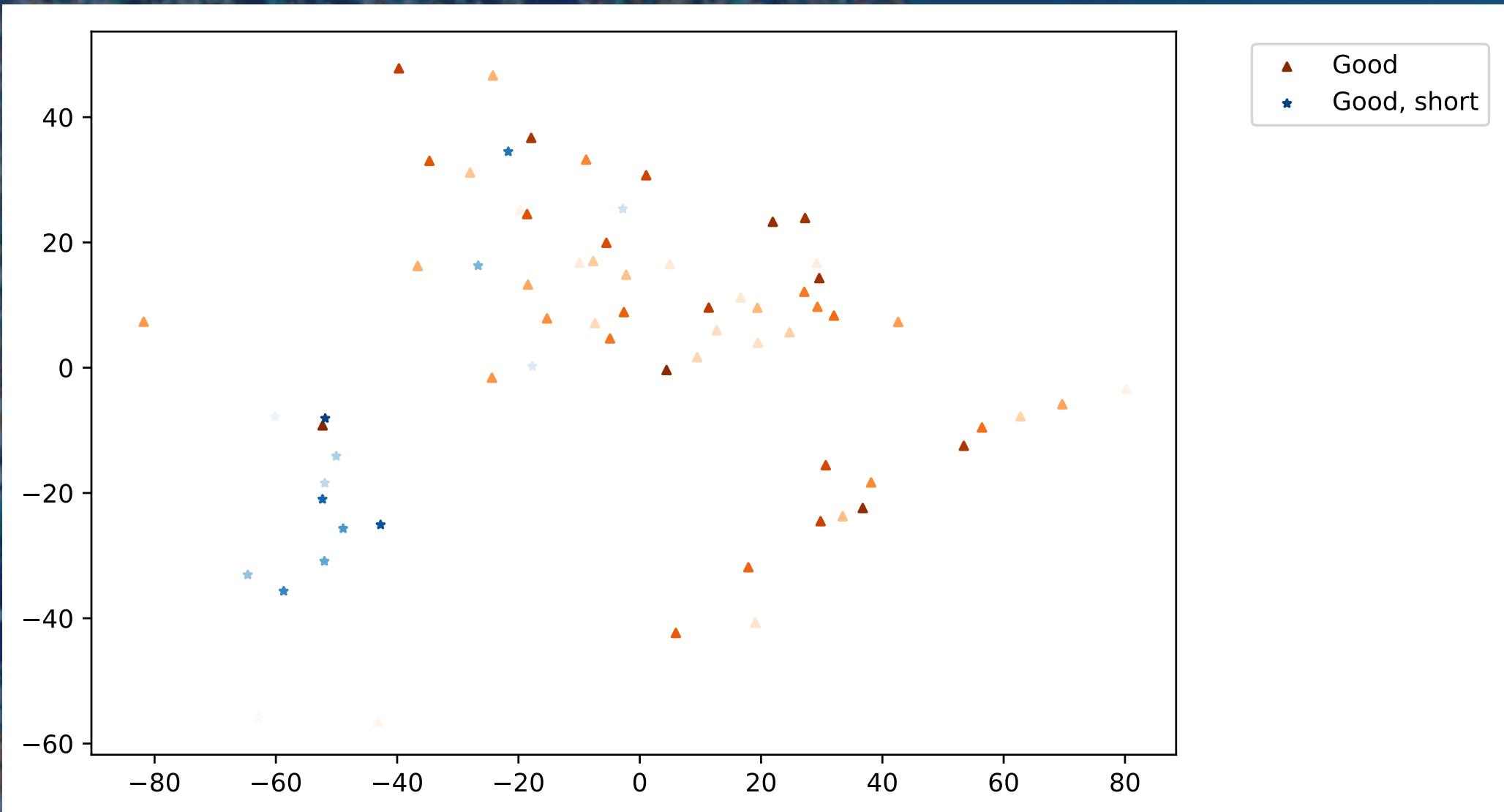


@RobynJWright



@JCO\_lab

# NMDS – family



# BHET degrading isolates

- *Thioclava dalianensis* (99% identity)
  - Alphaproteobacteria
  - Previously shown to be capable of degrading crude oil
  - Showed almost 50% degradation in 20 days <sup>1</sup>
- *Bacillus aquimaris* (99% identity)
  - Firmicutes
  - Bacteria with 99% identity shown to be enriched in a low molecular weight polyethylene-degrading consortia <sup>2</sup>
  - Closely related strains have been shown to degrade alkanes <sup>3</sup>

<sup>1</sup> Wang et al. (2014) Change of bacterial community in oil-polluted soil after enrichment cultivation with low-molecular-weight polyethylene

<sup>2</sup> Jin & Kim (2017) Change of bacterial community in oil-polluted soil after enrichment cultivation with low-molecular-weight polyethylene

<sup>3</sup> Olajire & Essien (2014) Aerobic Degradation of Petroleum Components by Microbial Consortia