

Learning takes time: Biotic resistance by native herbivores increases through the invasion process. Jorge Santamaría, Raúl Golo, Jana Verdura, Fiona Tomas, Enric Ballesteros, Teresa Alcoverro, Rohan Arthur, Emma Cebrian. 2022

SUPPLEMENTARY TABLES

Table S1. ANOVA summary for the Generalized Linear Model fitted to the data on the presence of *Caulerpa cylindracea* in *Sarpa salpa* pellets.

Dependent variable	Predictor	Chisq	Df	Pr(<Chisq)
<i>Caulerpa</i> presence	Time since invasion	7.84	1	<0.01*
	<i>Caulerpa</i> abundance	41.77	1	<0.001*
	Time since invasion x <i>Caulerpa</i> abundance	8.37	1	<0.01*

The presence of *Caulerpa cylindracea* in the fish pellets was modeled as a function of the time since the invasion, the abundance of the invader in the community and the interaction between both terms. The asterisk (*) and the text in bold denote the significant p-values.

Table S2. Effect of A) time since invasion and B) *Caulerpa cylindracea* abundance on the presence of *Caulerpa cylindracea* in the fish pellets.

A)

Dependent variable	Time since invasion	Comparison	z ratio	p-value
<i>Caulerpa</i> presence	Old	High - Low	5.67	<0.001*
	Recent	High - Low	2.08	0.04*

B)

Dependent variable	<i>Caulerpa</i> abundance	Comparison	z ratio	p-value
<i>Caulerpa</i> presence	High	Old - Recent	3.72	<0.001*
	Low	Old - Recent	0.93	0.35

Tukey tests were applied to the fitted GLM to compare the presence of *Caulerpa cylindracea* in the fish pellets between different exposure times at each level of invader abundance (upper table) and between different abundances at each level of exposure time (lower table). The asterisk (*) and the text in bold indicate that the p-value is significant.

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Table S3. ANOVA summary for the Generalized Linear Model fitted to the data on the proportion of *Caulerpa cylindracea* found in *Sarpa salpa* pellets.

Dependent variable	Predictor	Chisq	Df	Pr(<Chisq)
<i>Caulerpa</i> proportion	Time since invasion	343.71	1	<0.001*
	<i>Caulerpa</i> abundance	1264.82	1	<0.001*
	Time since invasion x <i>Caulerpa</i> abundance	198.09	1	<0.001*

The proportion of *Caulerpa cylindracea* in the fish pellets was modeled as a function of the time since the invasion, the abundance of the invader in the community and the interaction between both terms. The asterisk (*) and the text in bold denote the significant p-values.

Table S4. Effect of A) time since invasion and B) *Caulerpa cylindracea* abundance on the proportion of *Caulerpa cylindracea* found in the fish pellets.

A)

Dependent variable	Time since invasion	Comparison	z ratio	p-value
<i>Caulerpa</i> proportion	Old	High - Low	28.56	<0.001*
	Recent	High - Low	5.23	<0.001*

B)

Dependent variable	<i>Caulerpa</i> abundance	Comparison	z ratio	p-value
<i>Caulerpa</i> proportion	High	Old - Recent	17.92	<0.001*
	Low	Old - Recent	1.03	0.30

Tukey tests were applied to the fitted GLM to compare the proportion of *Caulerpa cylindracea* in the fish pellets between different exposure times at each level of invader abundance (upper table) and between different abundances at each level of exposure time (lower table). The asterisk (*) and the text in bold indicate that the p-value is significant.

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Table S5. Mean Ivlev's Electivity Index values $\pm$ S.E., as a measure of the electivity of the herbivorous fish *Sarpa salpa* towards the invasive alga *Caulerpa cylindracea*. Ivlev Indexes were calculated for three different years at two locations with contrasting exposure times to the invader: Cabrera (first detection in 2003) and Roses (first detection in 2016).

Location	Year	Ivlev Index
Cabrera	2007	-0.181 $\pm$ 0.05
	2008	-0.151 $\pm$ 0.05
	2020	0.085 $\pm$ 0.06
Roses	2018	-0.877 $\pm$ 0.04
	2019	-0.533 $\pm$ 0.10
	2020	-0.455 $\pm$ 0.13

Index values approaching -1 indicate that the food item is avoided, whereas values approaching 1 indicate that the species exclusively targets that item.

Table S6. Kruskal-Wallis test applied to the Ivlev's Electivity data for different sampling years and at each location.

Location	Dependent variable	Predictor	K-W Chisq	Df	p-value
Cabrera	Ivlev Index	Year	15.94	2	<0.001*
Roses	Ivlev Index	Year	2.04	2	0.36

The Ivlev's Electivity Indexes of *Sarpa salpa* towards *Caulerpa cylindracea* were analyzed as a function of sampling year. The asterisk (*) and the text in bold denote the significant p-values.

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Table S7. Effect of sampling year on the Ivlev's Electivity Index of *Sarpa salpa* towards *Caulerpa cylindracea*.

Location	Comparison	Z	p-value adjusted
Cabrera	2007-2008	-0.44	0.66
	2007-2020	-3.75	<0.001*
	2008-2020	-3.38	0.001*

Dunn tests were applied to the Kruskal-Wallis test to compare the Ivlev's Electivity Index of *Sarpa salpa* towards *Caulerpa cylindracea*, between sampling years at Cabrera. P-values were adjusted with the Benjamini-Hochberg method. The asterisk (*) and the text in bold indicate that the *p*-value is significant.

Table S8. Temporal and numerical characteristics of the locations studied and sampled for this study in relation to the invasion of *Caulerpa cylindracea*.

Region	Location	Year of detection	Year of experiment	Years invaded	Time since invasion	Abundance	Abundance in site
Menorca	Illa del Aire	2006	2018	12	Old	58	High
	Porros	2010	2018	8	Old	54	High
	Sa Mola	2012	2018	6	Old	18	Low
	Sa Llosa	2014	2018	4	Recent	1	Low
Catalonia	Sant Francesc	2013	2019	6	Old	1	Low
	Roses 2020	2016	2020	4	Recent	5	Low
	Roses 2019	2016	2019	3	Recent	7	Low
	Roses 2018	2016	2018	2	Recent	45	High
	Ses Negres	2017	2019	2	Recent	9	Low
Cabrera Archipelago	Cabrera	2003	2020	17	Old	28	Low
	Cabrera	2003	2008	5	Recent	55	High
	Cabrera	2003	2007	4	Recent	62	High

SUPPLEMENTARY FIGURES

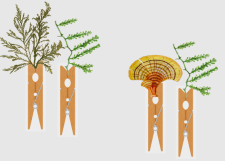
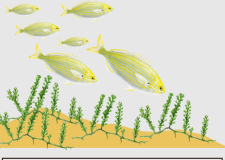
Variable of Interest	Locations Type of Assessment	Old-High		Old-Low			Recent-High			Recent-Low			
		Illa del Aire	Porros	Cabrera (2020)	Sa Mola	Sant Francesc	Cabrera (2007)	Cabrera (2008)	Roses (2018)	Sa Llosa	Roses (2020)	Roses (2019)	Ses Negres
Preference	 Pair-choice Experiment	✓	✓	✗	✓	✓	✗	✗	✓	✓	✗	✓	✓
Incidence on Herbivore		✓	✓	✗	✓	✓	✗	✗	✓	✓	✗	✓	✓
Per capita consumption	 Content in pellets	✓	✓	✗	✓	✓	✗	✗	✓	✓	✗	✓	✓
Electivity	 Ivlev's Electivity Index	✗	✗	✓	✗	✗	✓	✓	✓	✗	✓	✓	✗

Figure S1. Schematic representation of the different methodologies used in this study. These methodologies were used to assess the predator-prey interaction between the native herbivore *Sarpa salpa* and the invasive alga *Caulerpa cylindracea* in different locations characterized by contrasting exposures times and abundances of the invader in the community. The green tick indicates that the assessment was performed in that location, whereas the red cross indicates that the assessment was not performed in that location.