Is sexual selection widespread across angiosperm species?

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10:00 S40 Open Symposium

Prague, 19th August 2022

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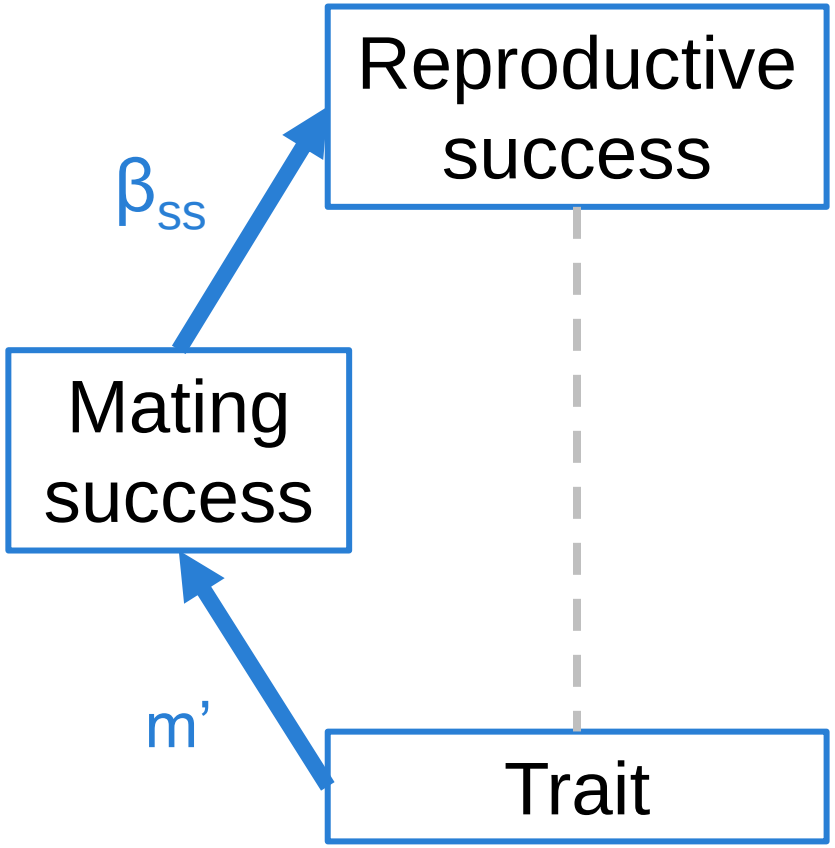
Sexual selection arises from competition *within a sex* for access to mates and fertilisations

Darwin 1871; Andersson 1994

Sexual selection arises from competition *within a sex* for access to mates and fertilisations



Darwin 1871; Andersson 1994; Arnold and Duvall 1994; Jones 2009

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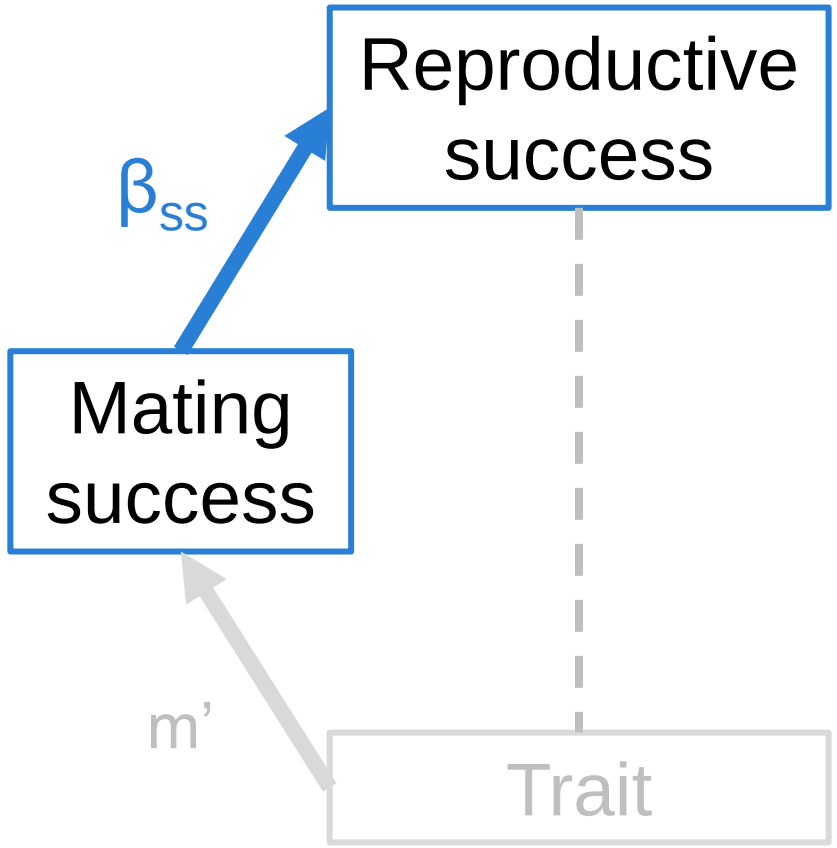

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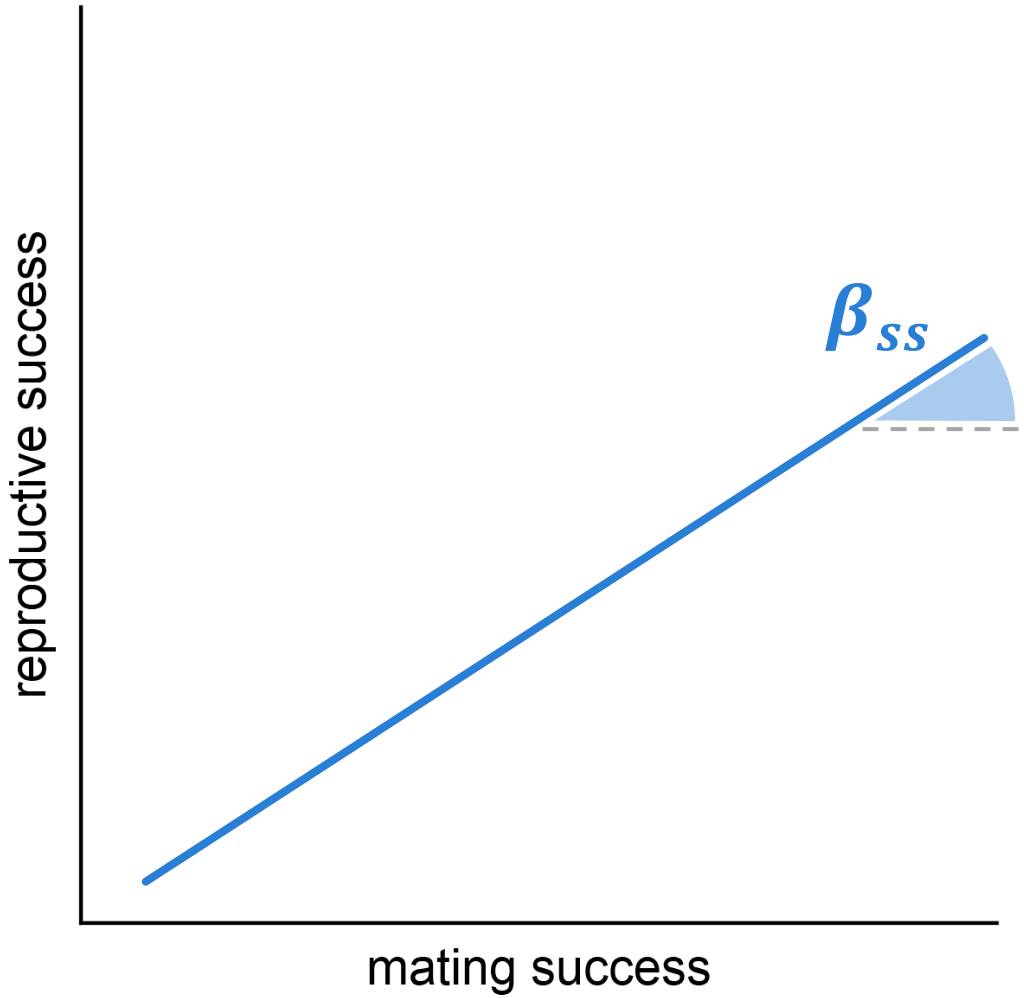
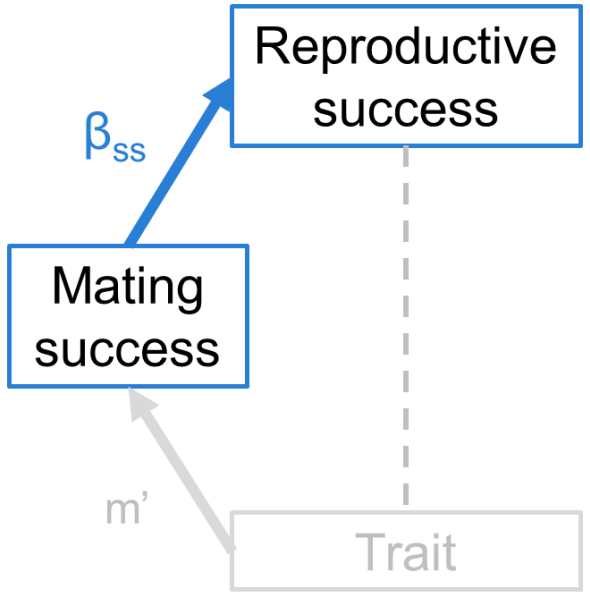
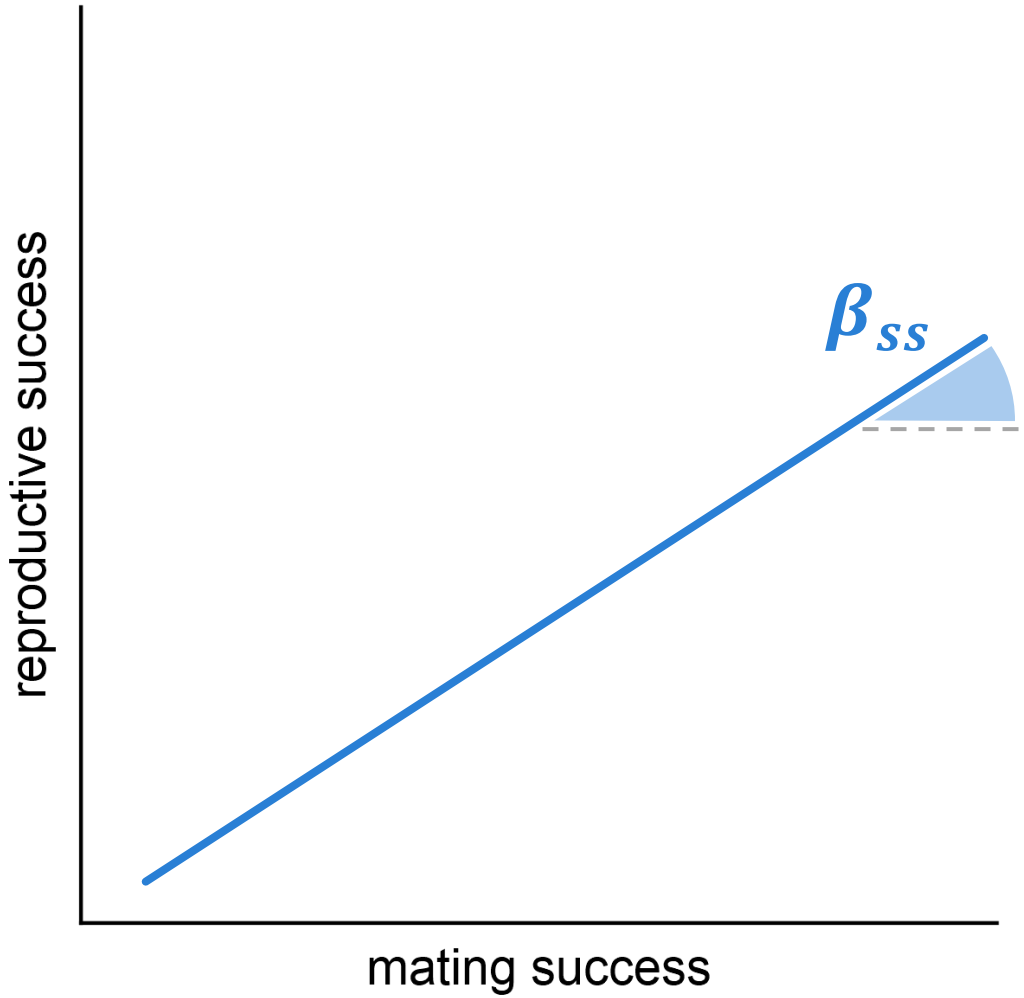
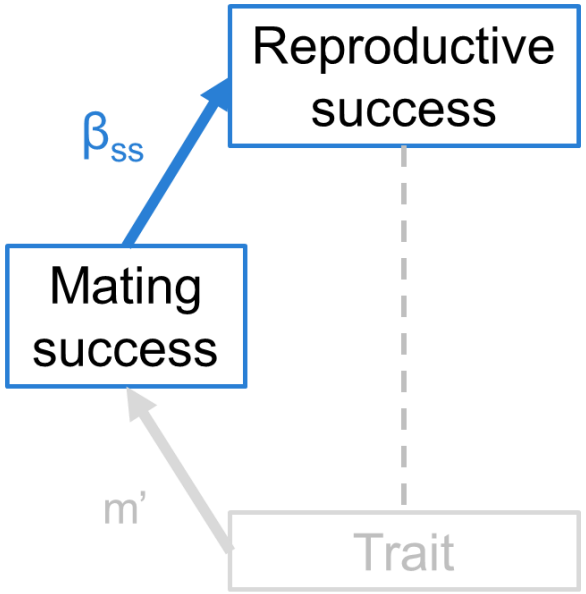

reproductive success
β_{ss}
mating success


Reproductive success
β_{ss}
Mating success
m'
Trait

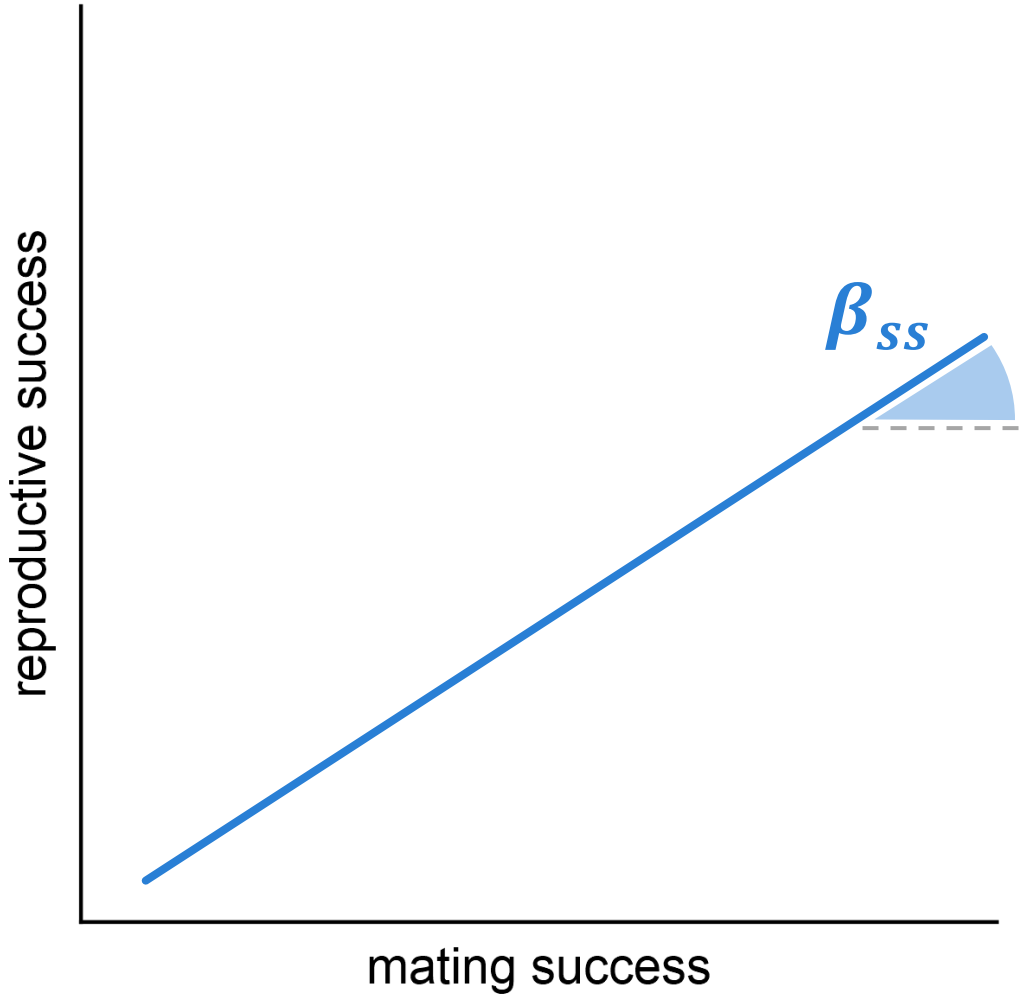
Bateman gradient





Bateman 1948; Arnold and Duvall 1994

Bateman gradient



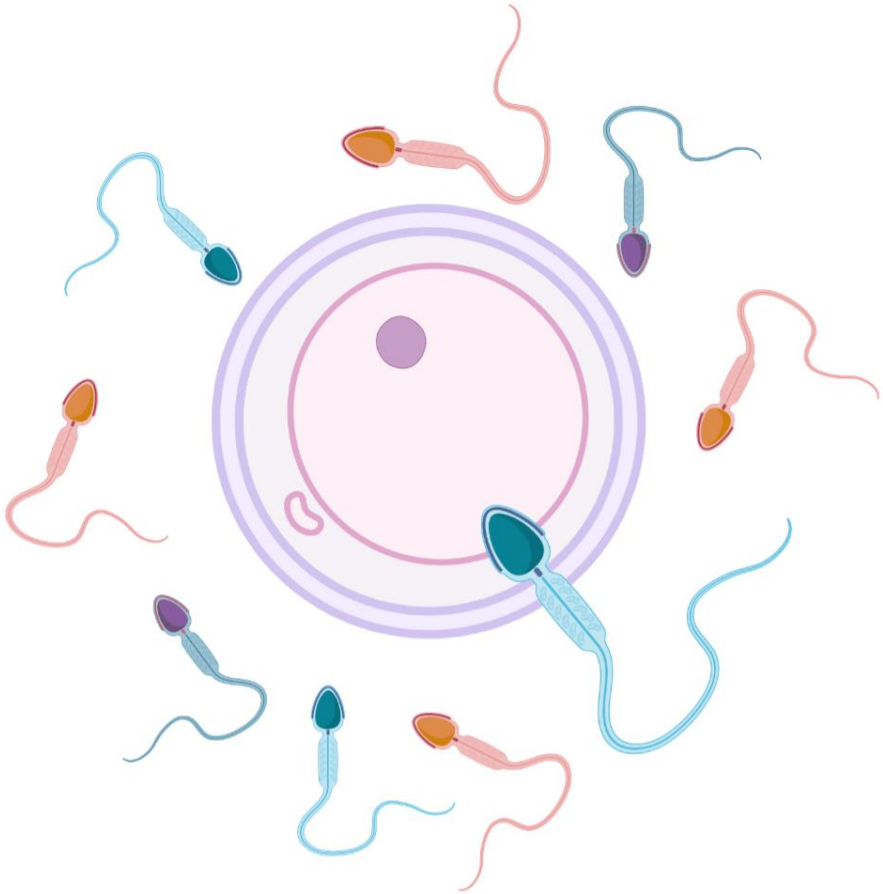
Magnitude of slope (β_{ss})
overall intensity of sexual selection

Bateman 1948; Arnold and Duvall 1994; Jones 2009; Anthes et al. 2017

Intra-male sexual selection is driven by

anisogamy

Bateman 1948; Arnold 1994; Kokko and Jennions 2003; Lehtonen 2022



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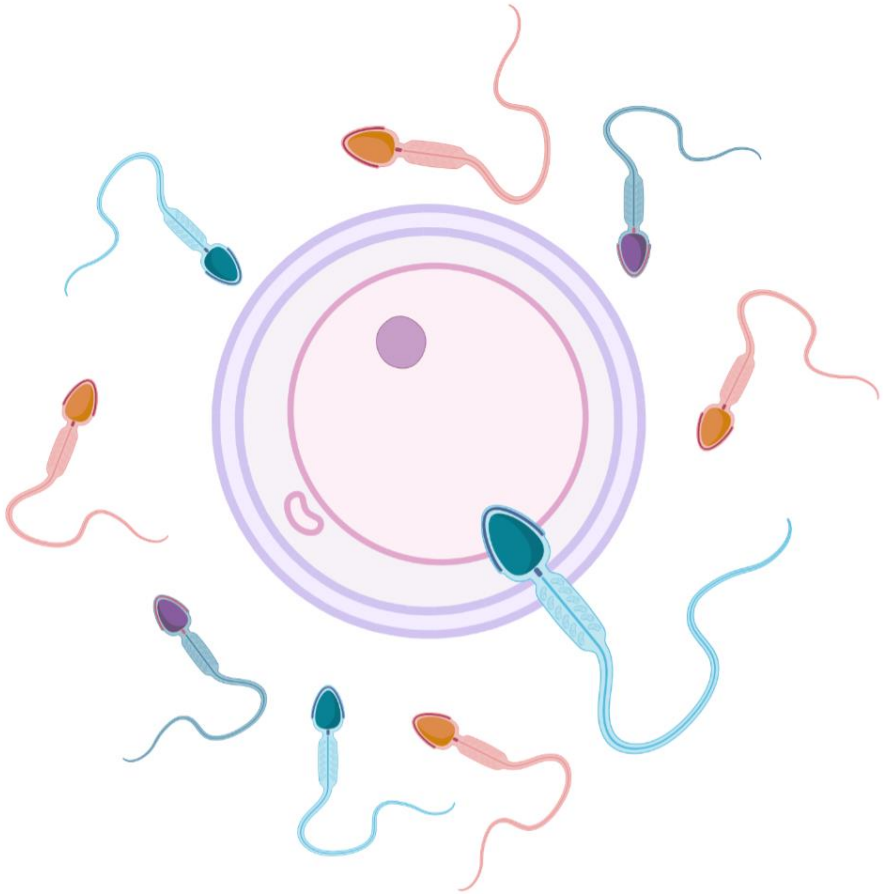

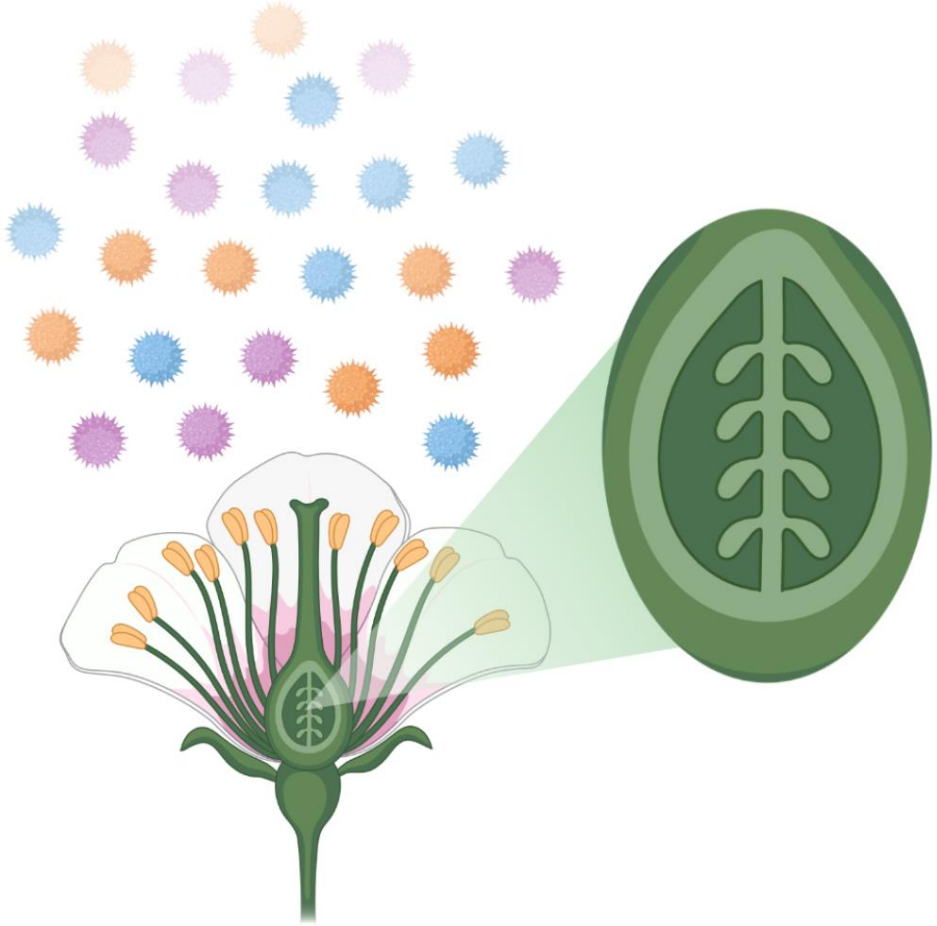

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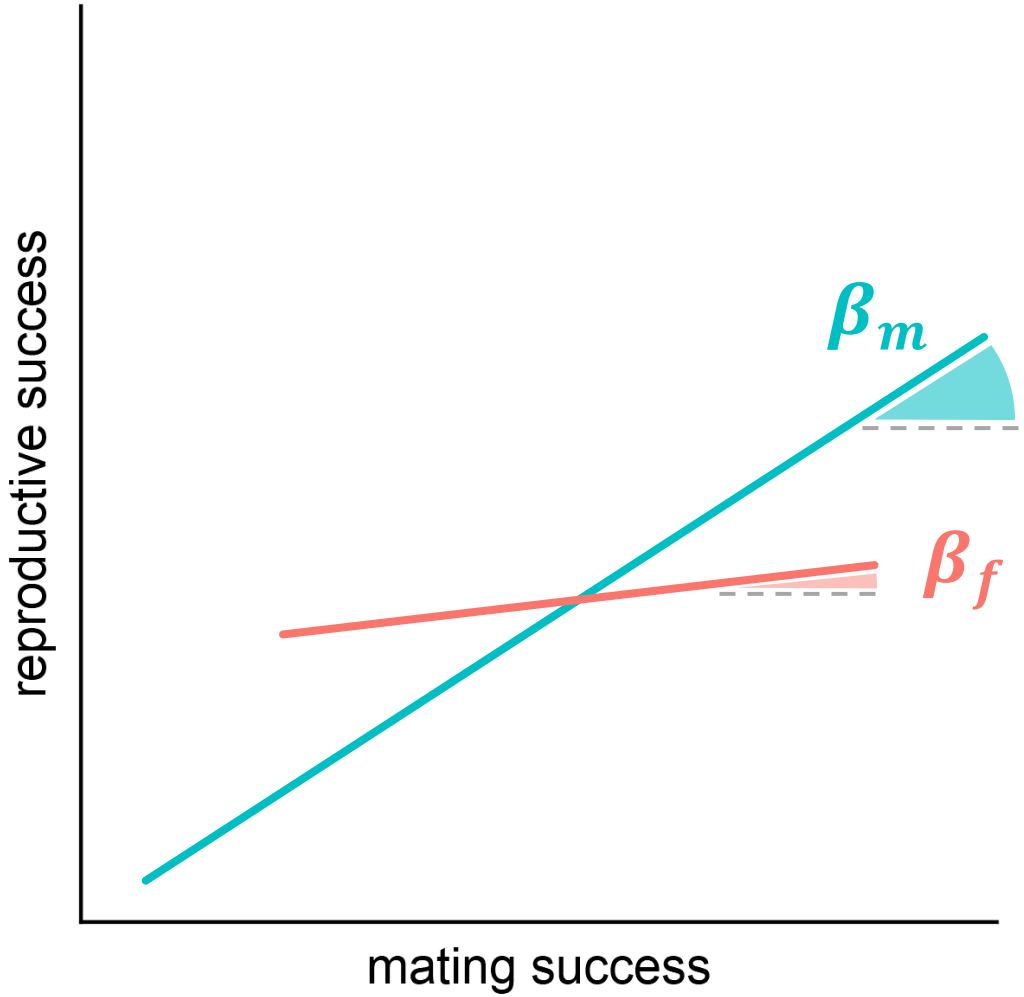
ESEB

Bateman gradient

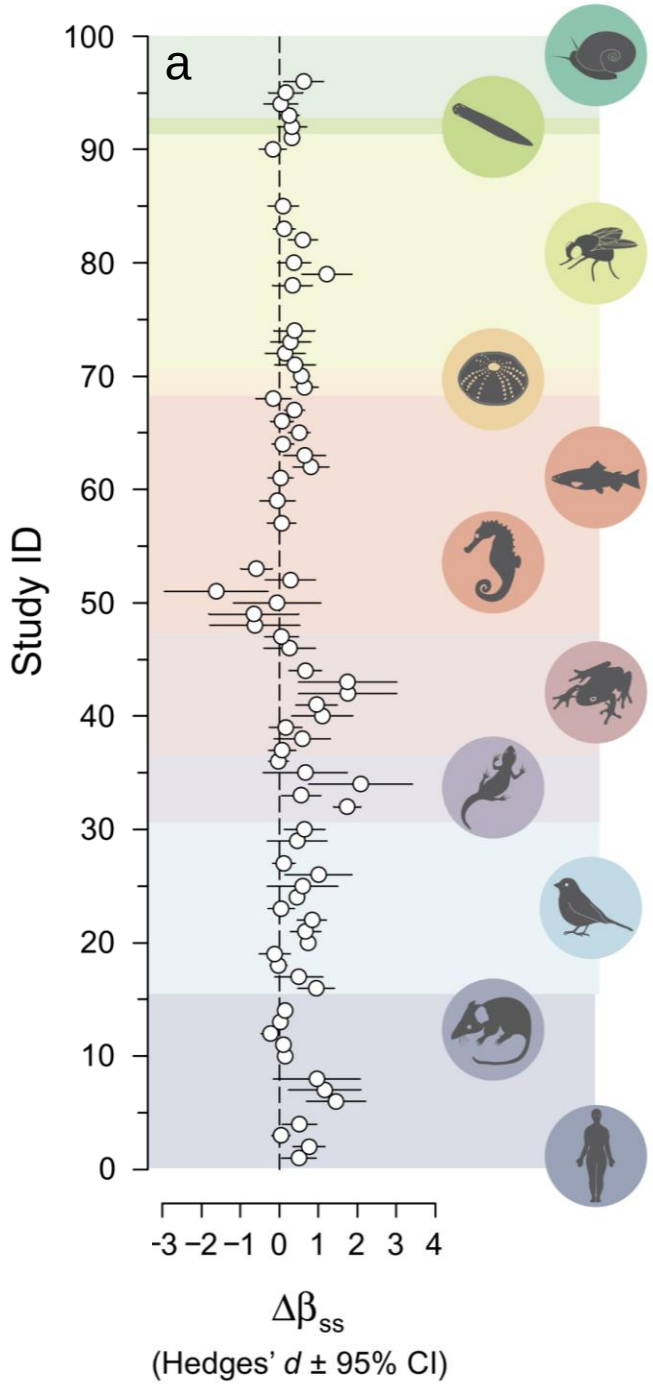


Magnitude of slope (β_{ss})
overall intensity of sexual selection

Sig. different slopes ($\beta_m \neq \beta_f$)
sex difference in sexual selection

Bateman 1948; Arnold and Duvall 1994; Jones 2009; Anthes et al. 2017

Bateman gradients are routinely estimated in animals...



[a]*Janicke et al. 2016*

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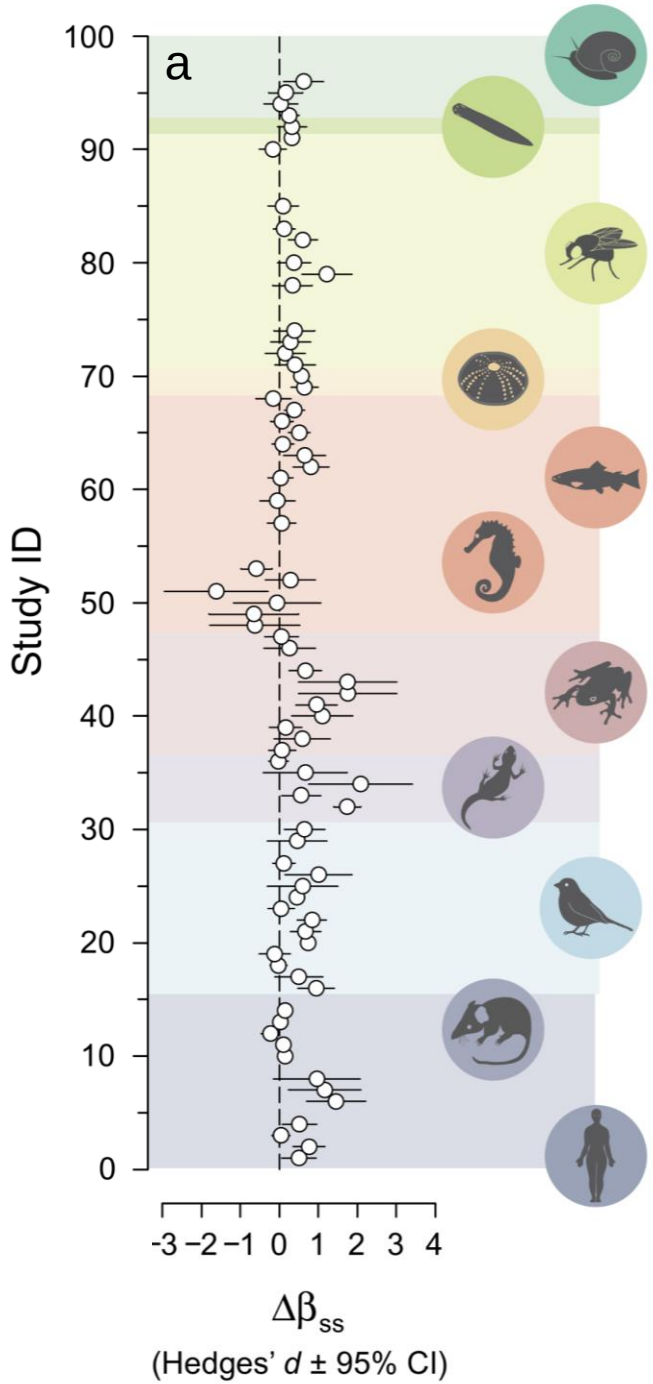


	β_{ss} estimates	Species
Animals	76[a]	66[a]

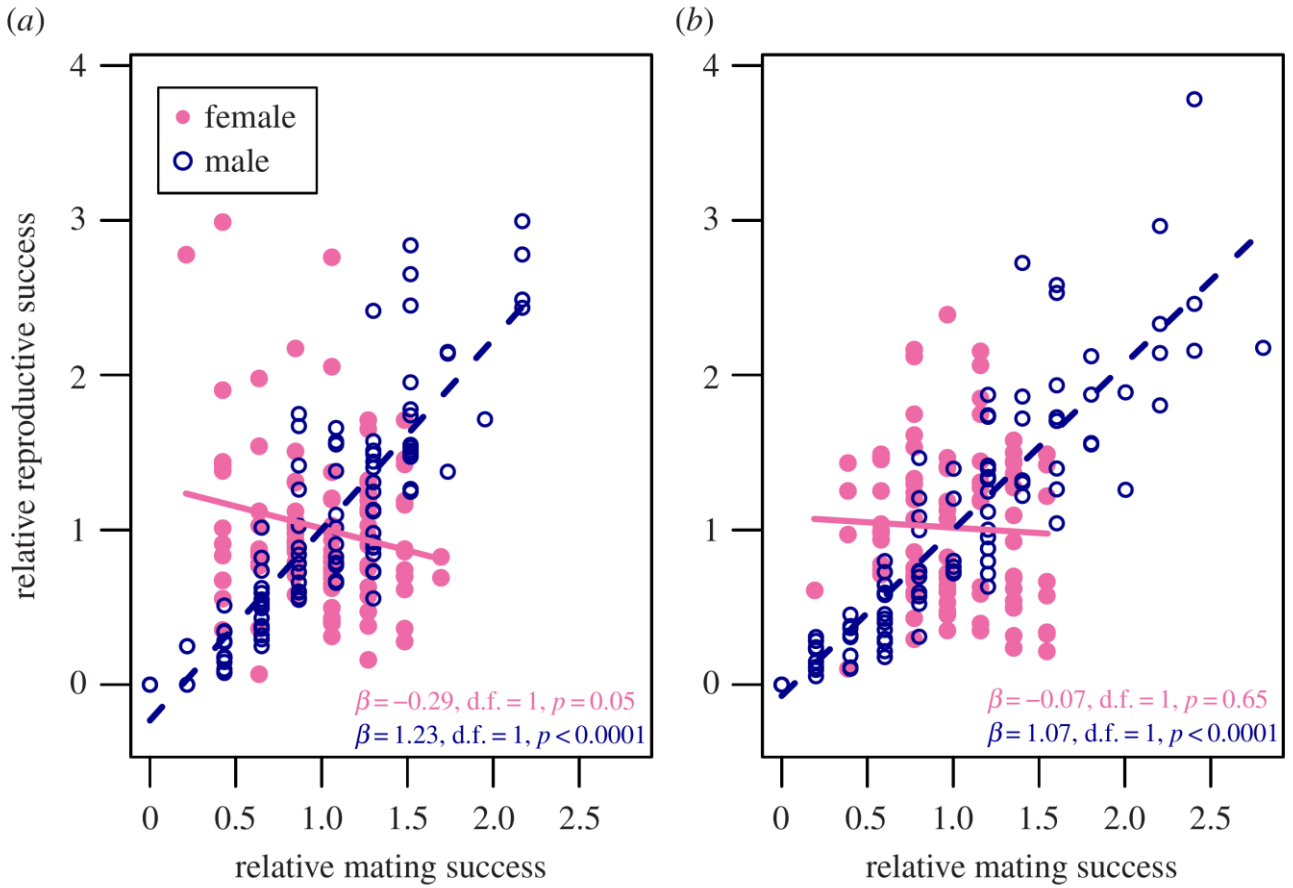
[a]*Janicke et al. 2016*

…But not in plants

	β_{ss} estimates	Species
Animals	76[a]	66[a]
Plants	3[b]	2[b]

[a] *Janicke et al. 2016*
[b] *Johnson and Shaw 2016; Tonnabel et al. 2019*

…But not in plants

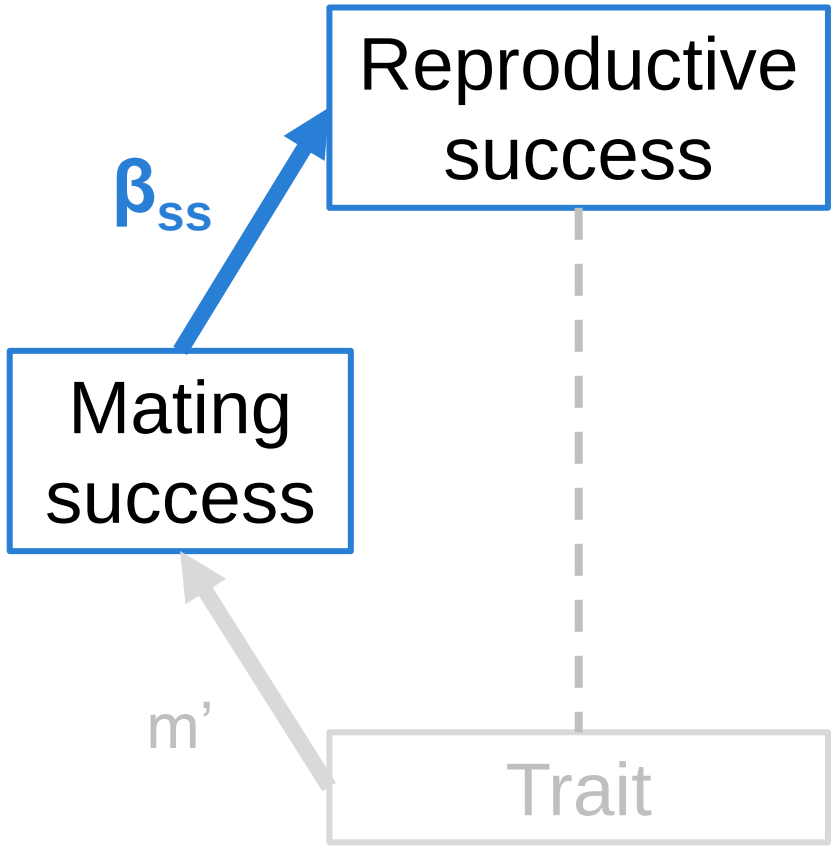


Mercurialis annua

Tonnabel et al. 2019

Are these results typical of

angiosperms in general?


Reproductive success
β_{ss}
Mating success
m'
Trait

Is sexual selection widespread

in angiosperm species?

Mating success

is rarely reported in plants

Data to estimate mating success is

often collected!

A hidden literature

Must feature
Parentage analysis to assign offspring to parents

Genetic mating success (gMS)

A hidden literature

Must feature
Parentage analysis to assign offspring to parents
Measure of female fitness (e.g. seed count)
High proportion of potential parents sampled

A hidden literature

Must feature	Must not feature
Parentage analysis to assign offspring to parents	Artificial pollination
Measure of female fitness (e.g. seed count)	Strong experimental manipulation (e.g. flower number)
High proportion of potential parents sampled	

A hidden literature

Must feature	Must not feature
Parentage analysis to assign offspring to parents	Artificial pollination
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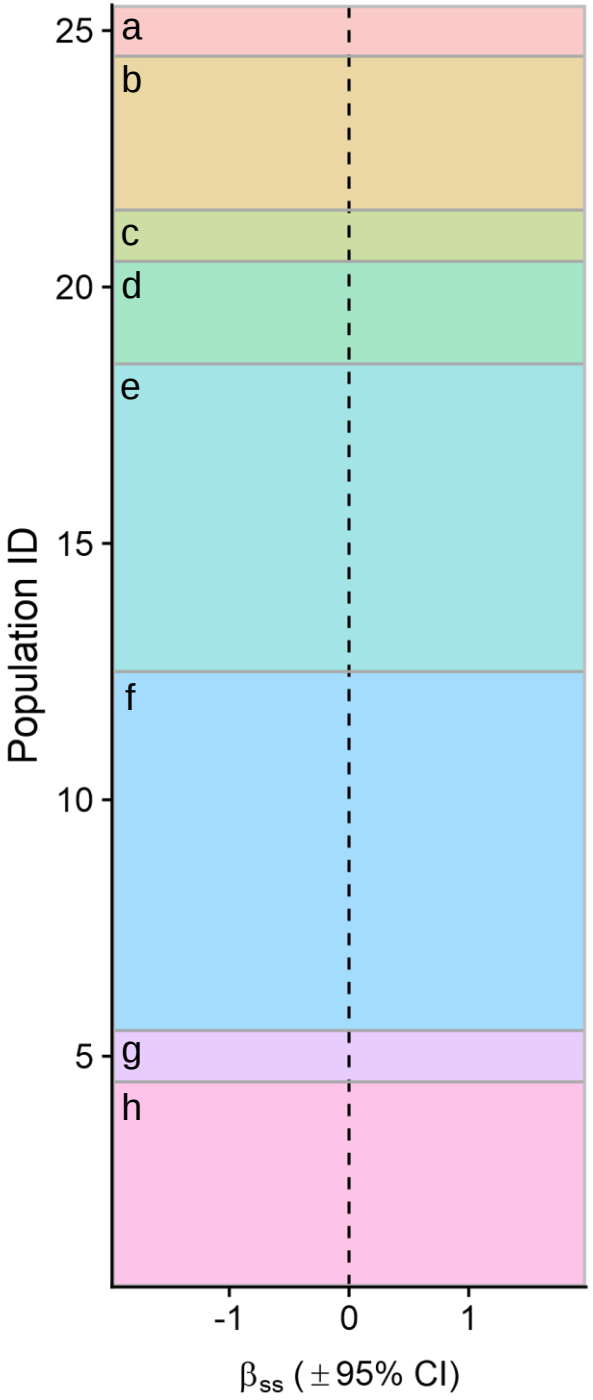
High proportion of potential parents sampled	

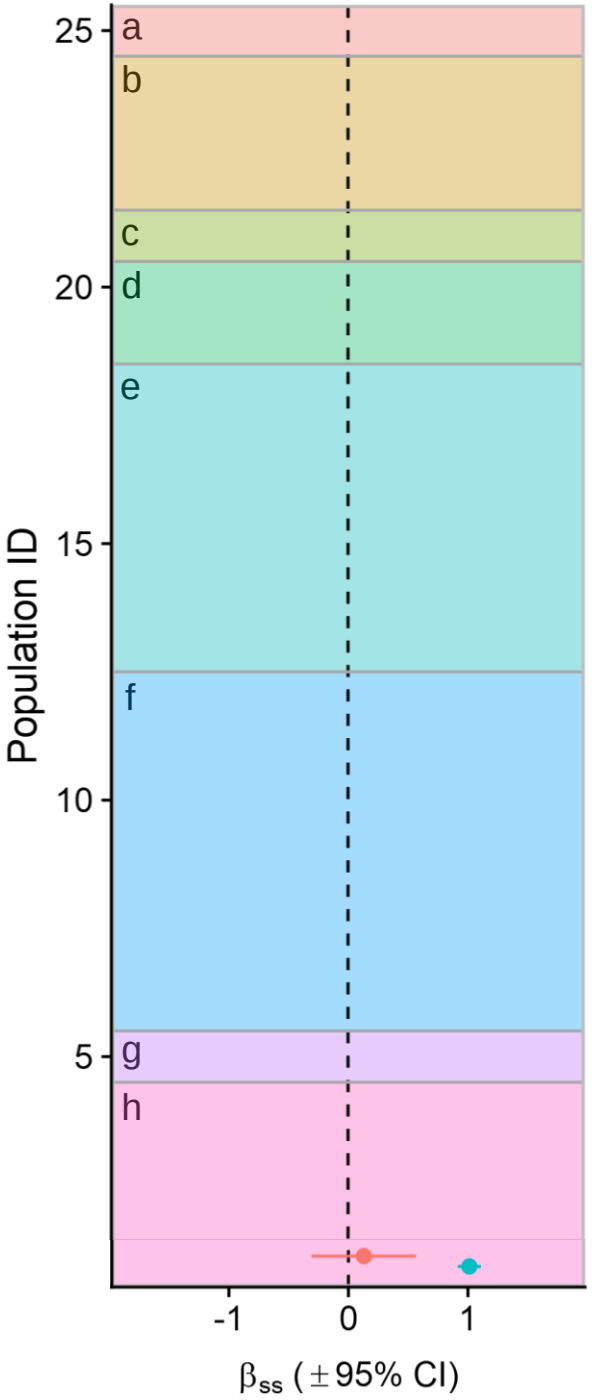
(plant OR angiosperm) AND (paternity OR parentage)



Ambrosia artemisiifolia a
Brassica rapa b
Leucadendron rubrum c
Mercurialis annua d
Narcissus papyraceus e
Raphanus raphanistrum f
Silene (latifolia × dioica) g
Silene stellata h

β_m β_f

ESEB



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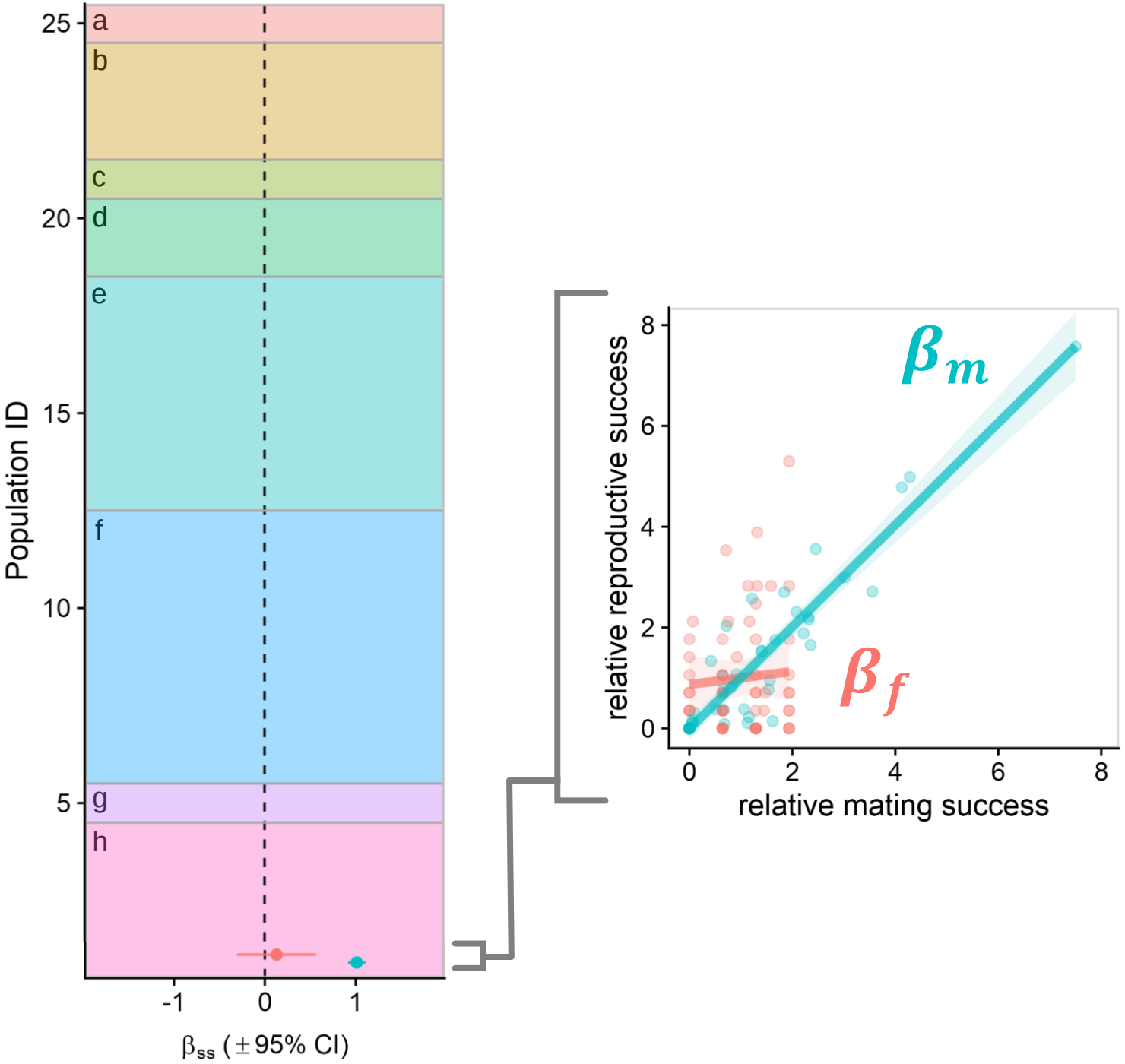

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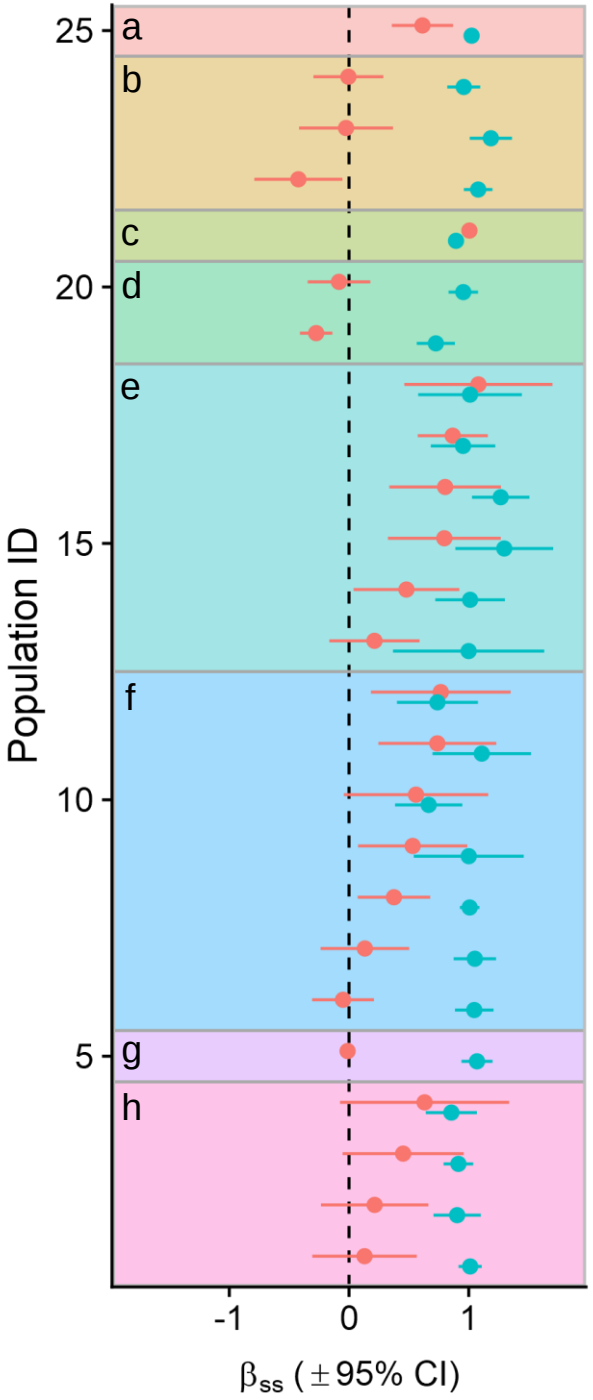

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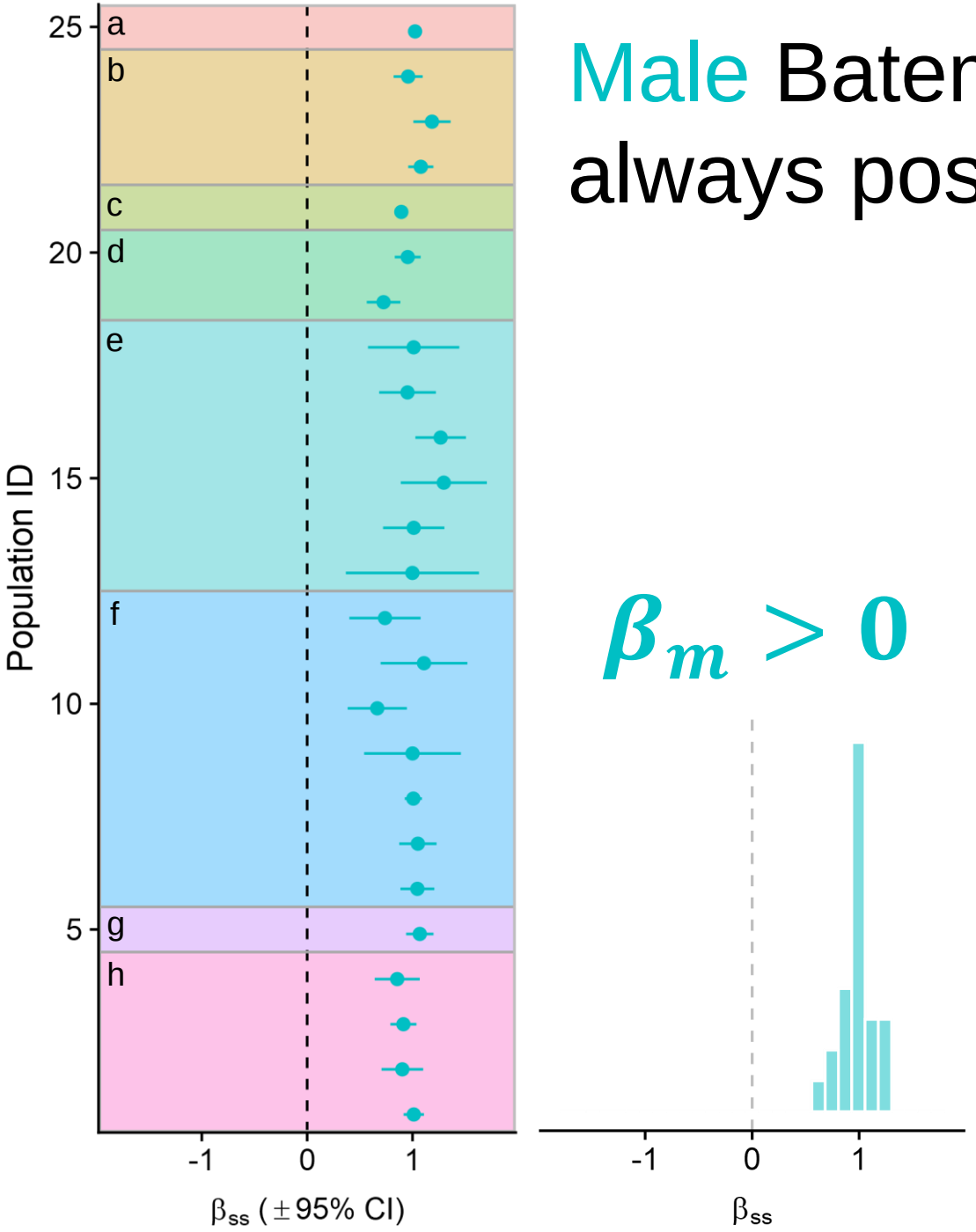
ESEB

Male Bateman gradients are always positive



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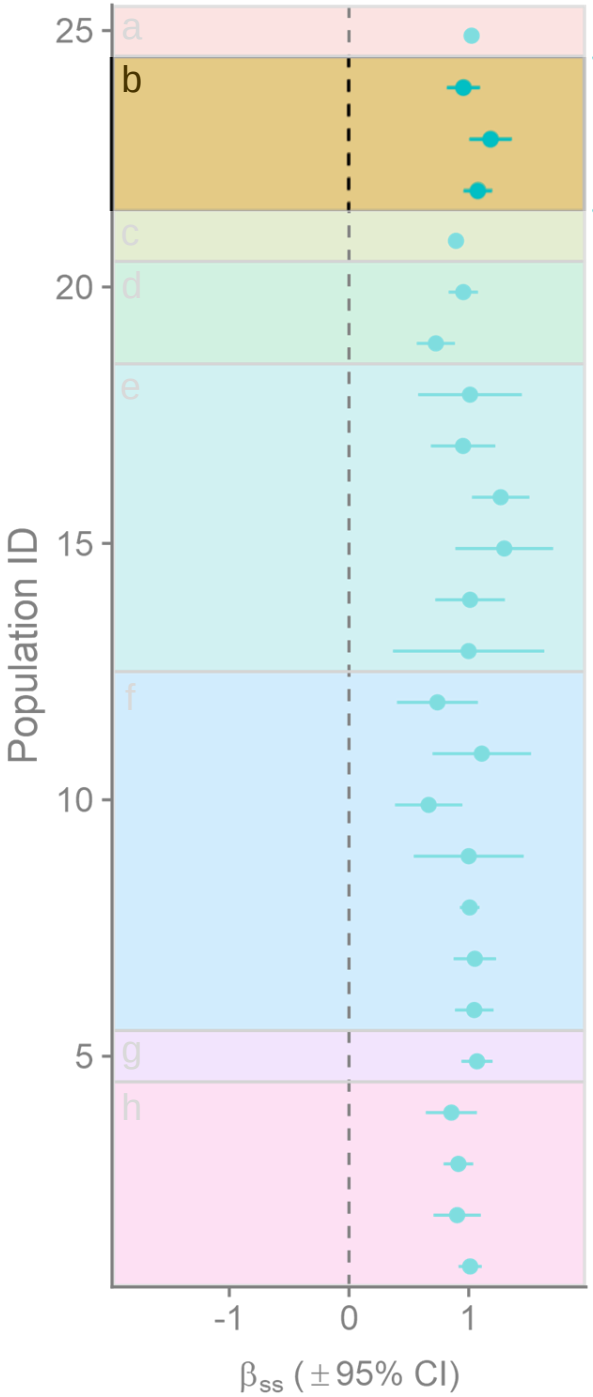
β_m β_f

ESEB

Male Bateman gradients show little variation within and between species



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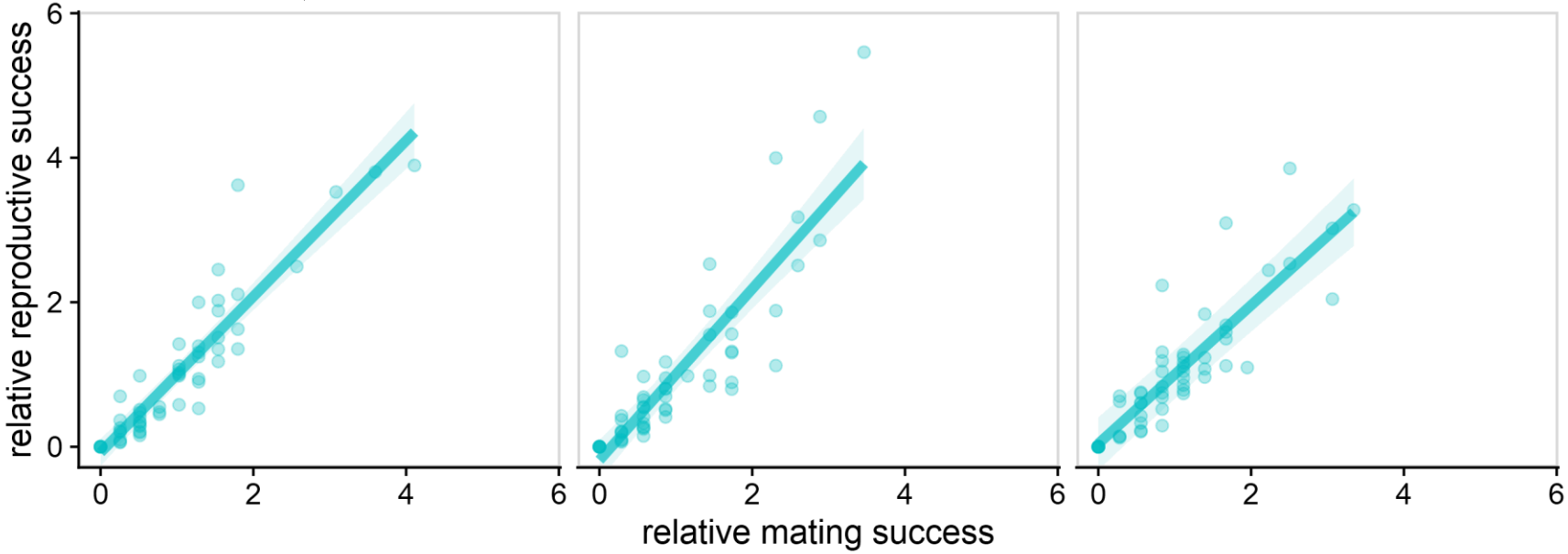
β_m β_f

$\beta_m = 1.08\ [0.96 - 1.20]$ $\beta_m = 1.18\ [1.00 - 1.36]$ $\beta_m = 0.96\ [0.82 - 1.10]$



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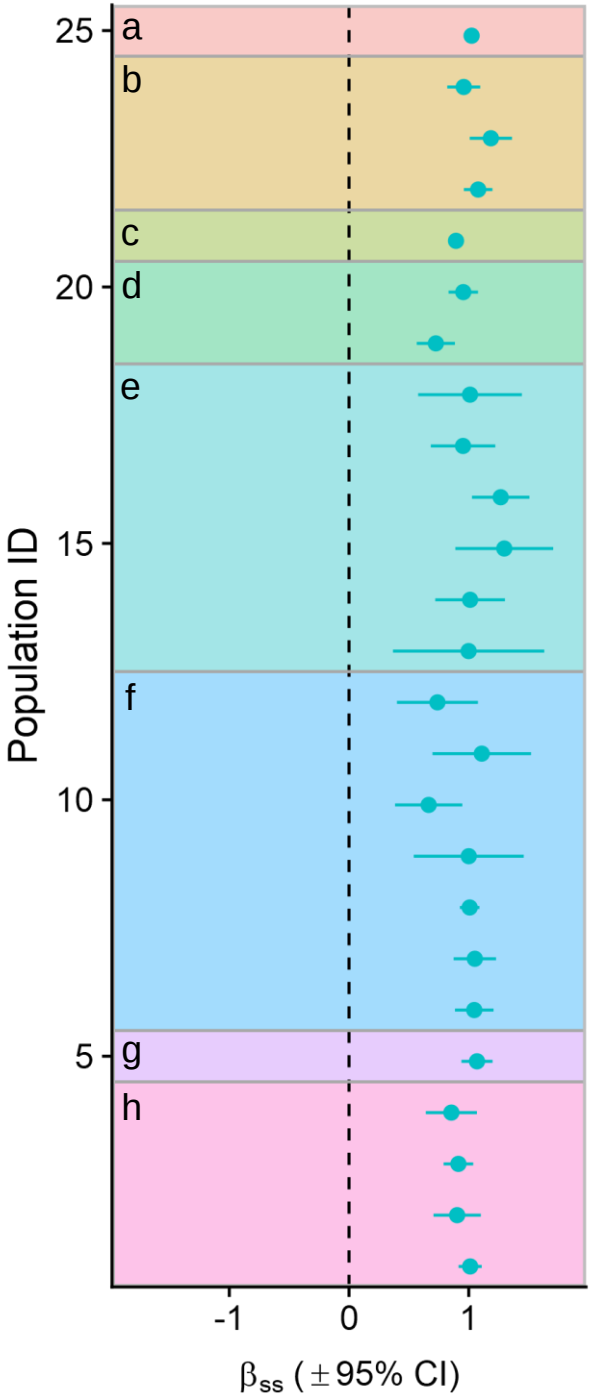
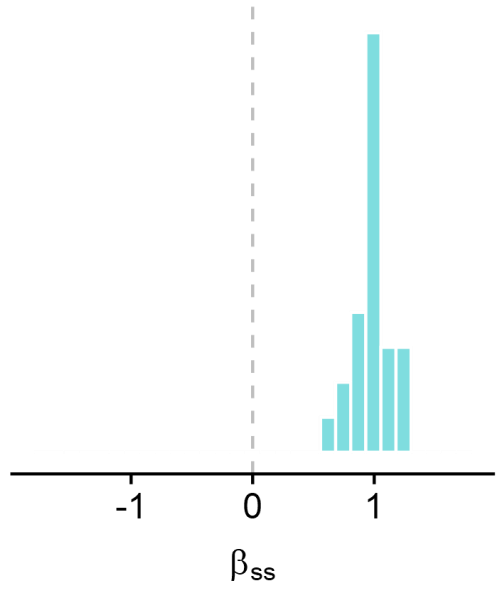


$\beta_m > 0$



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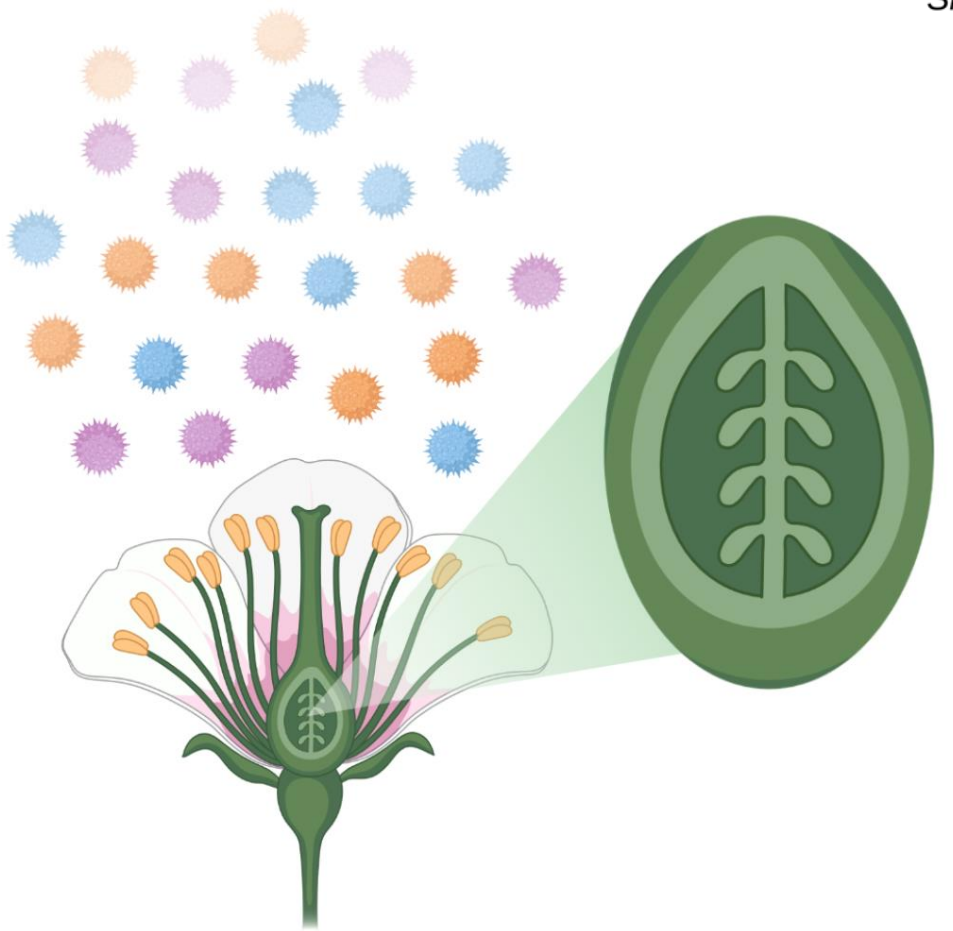

Male MS explains most of the variation in Male RS

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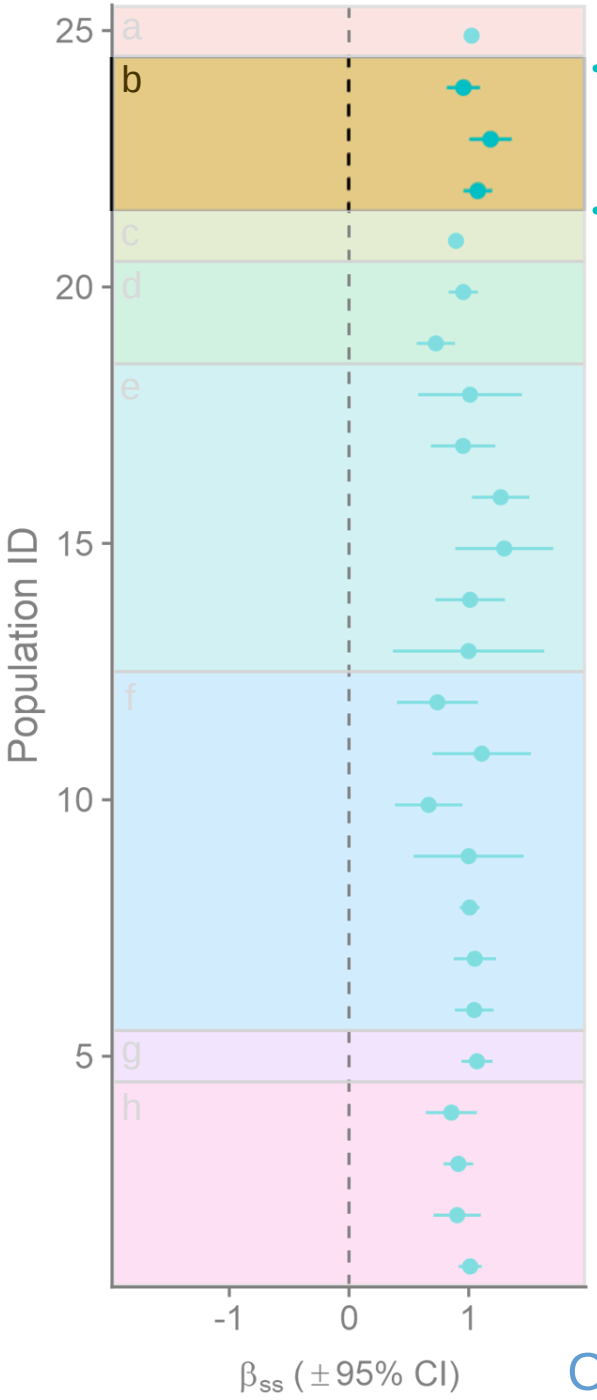
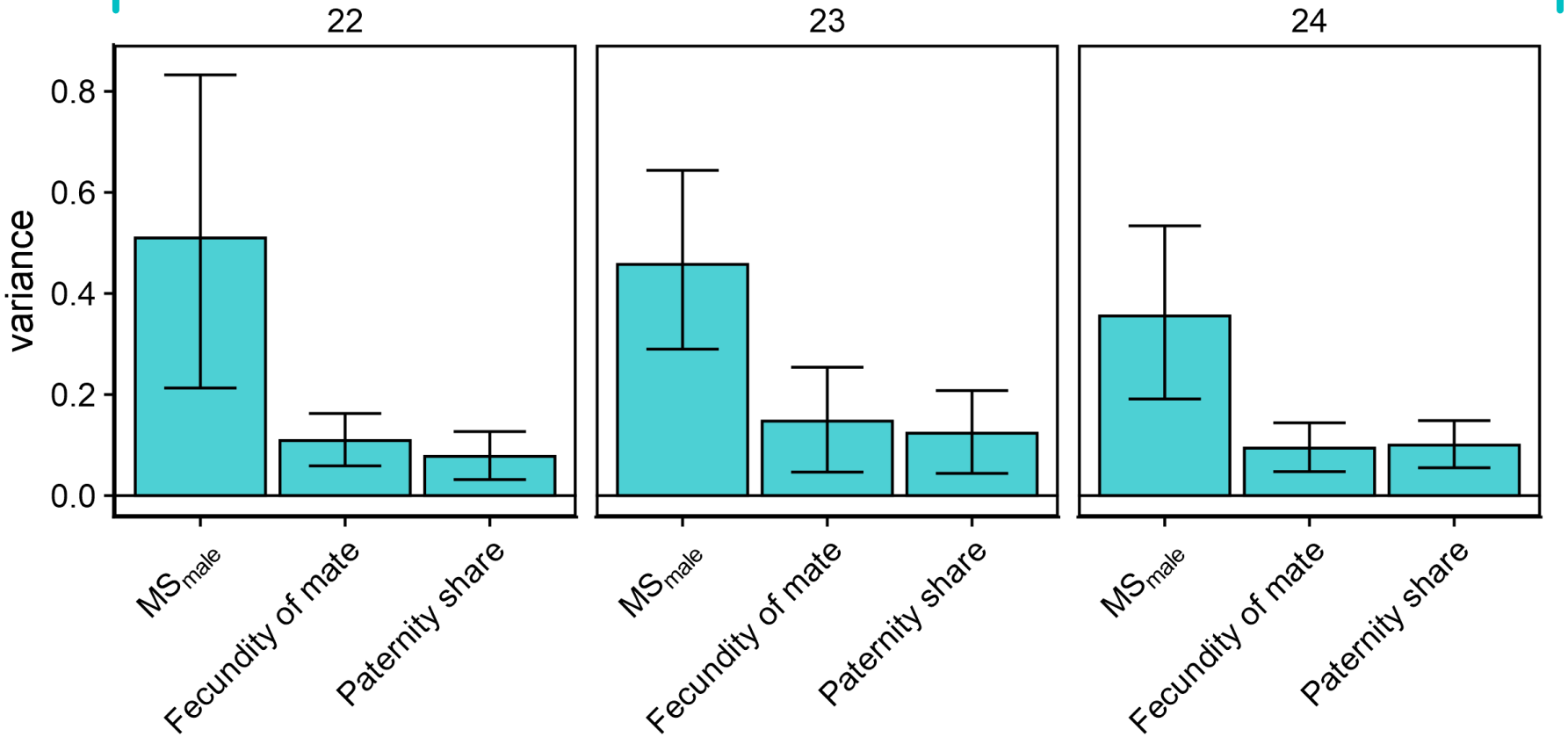


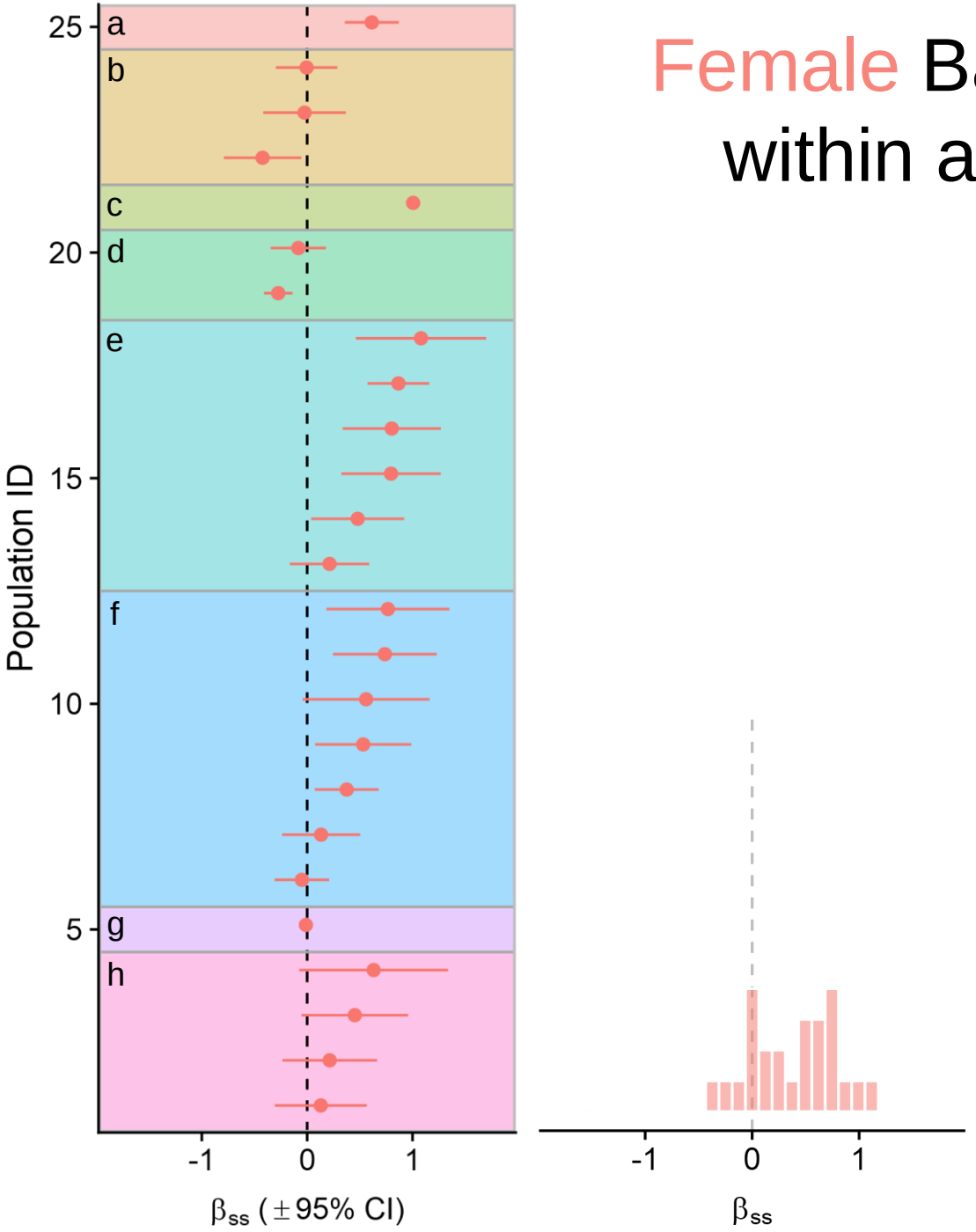
β_m β_f



Collet et al. 2012; Pélissié et al. 2014; Tonnabel et al. 2019

ESEB

Female Bateman gradients vary within and between species



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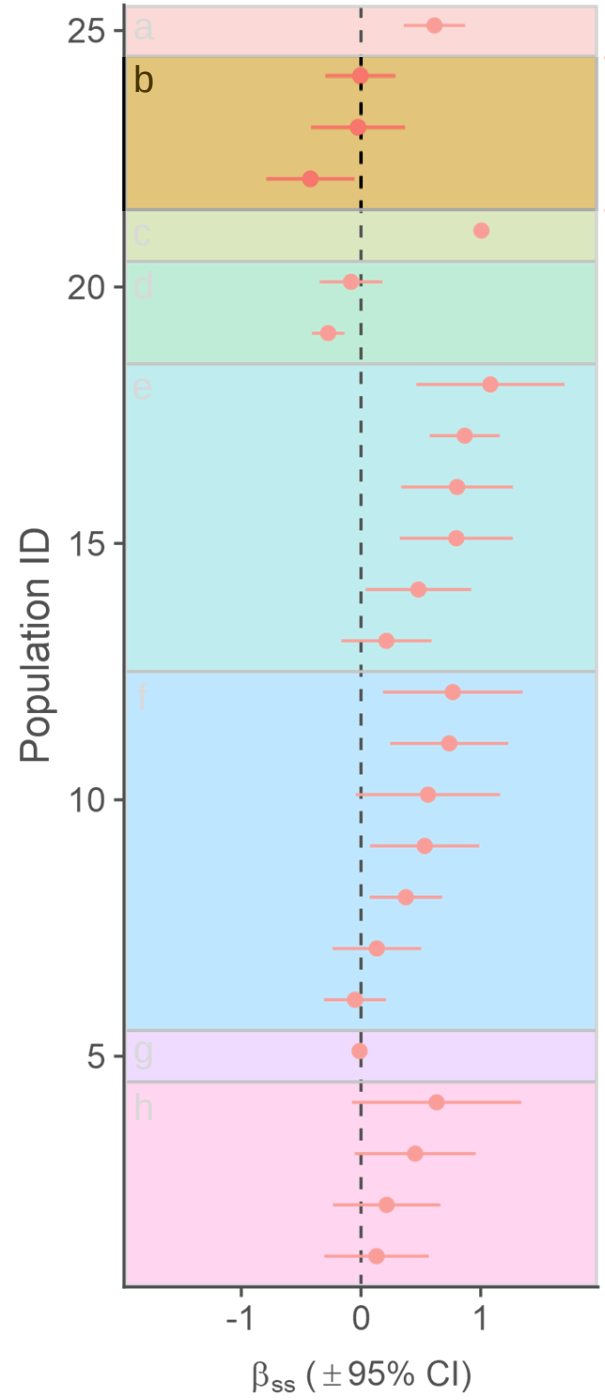

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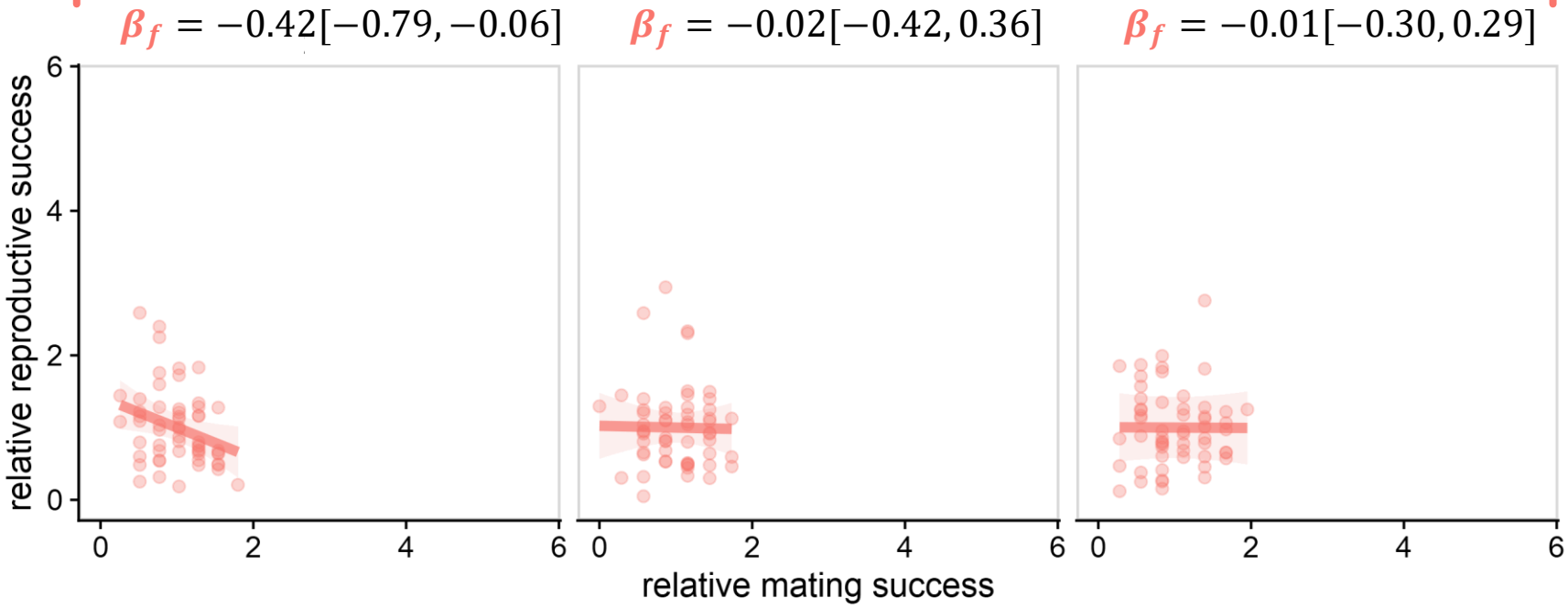

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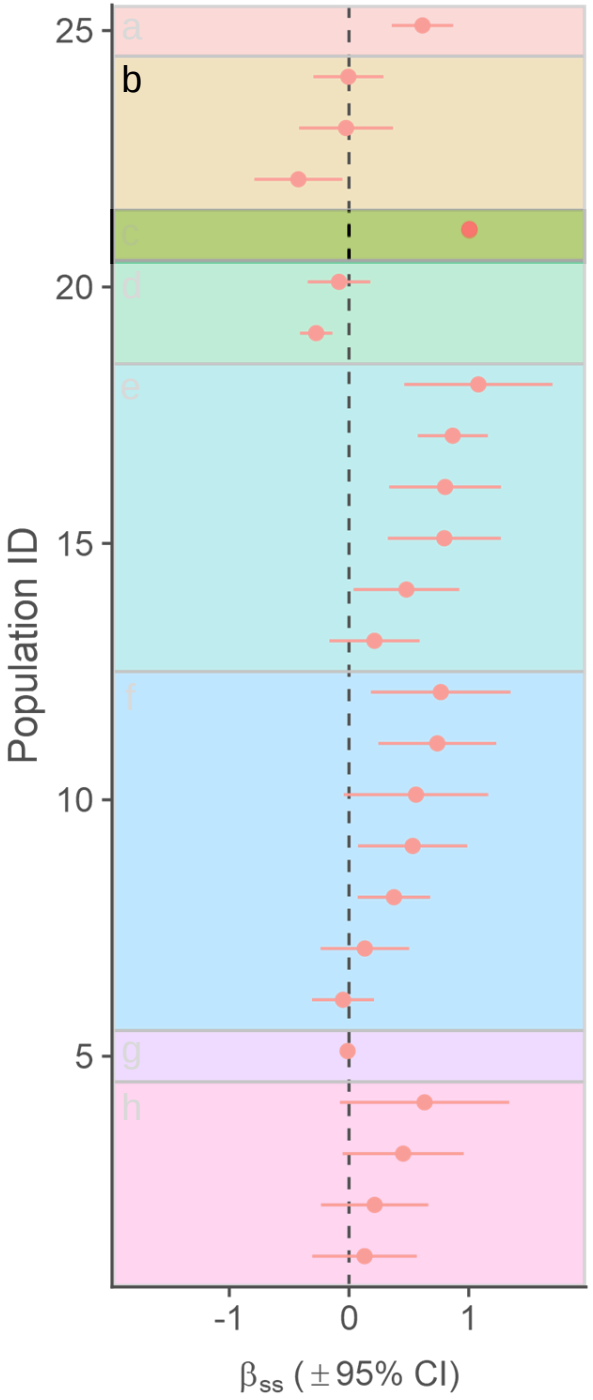

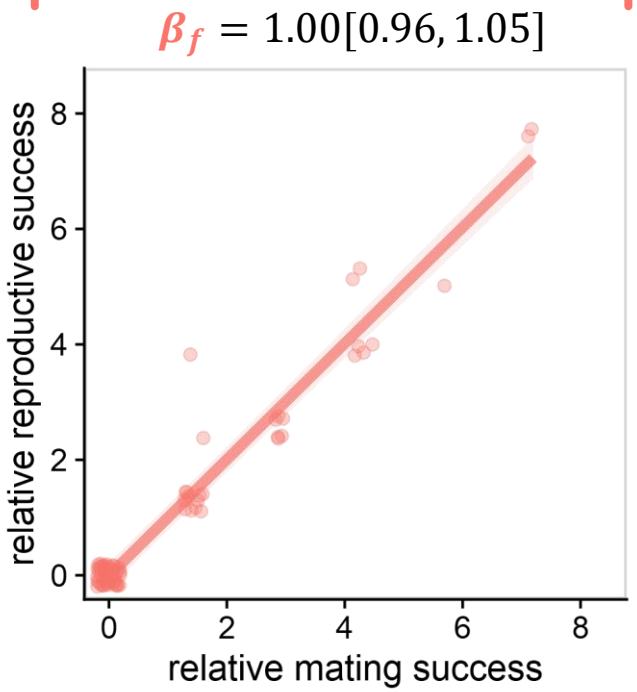

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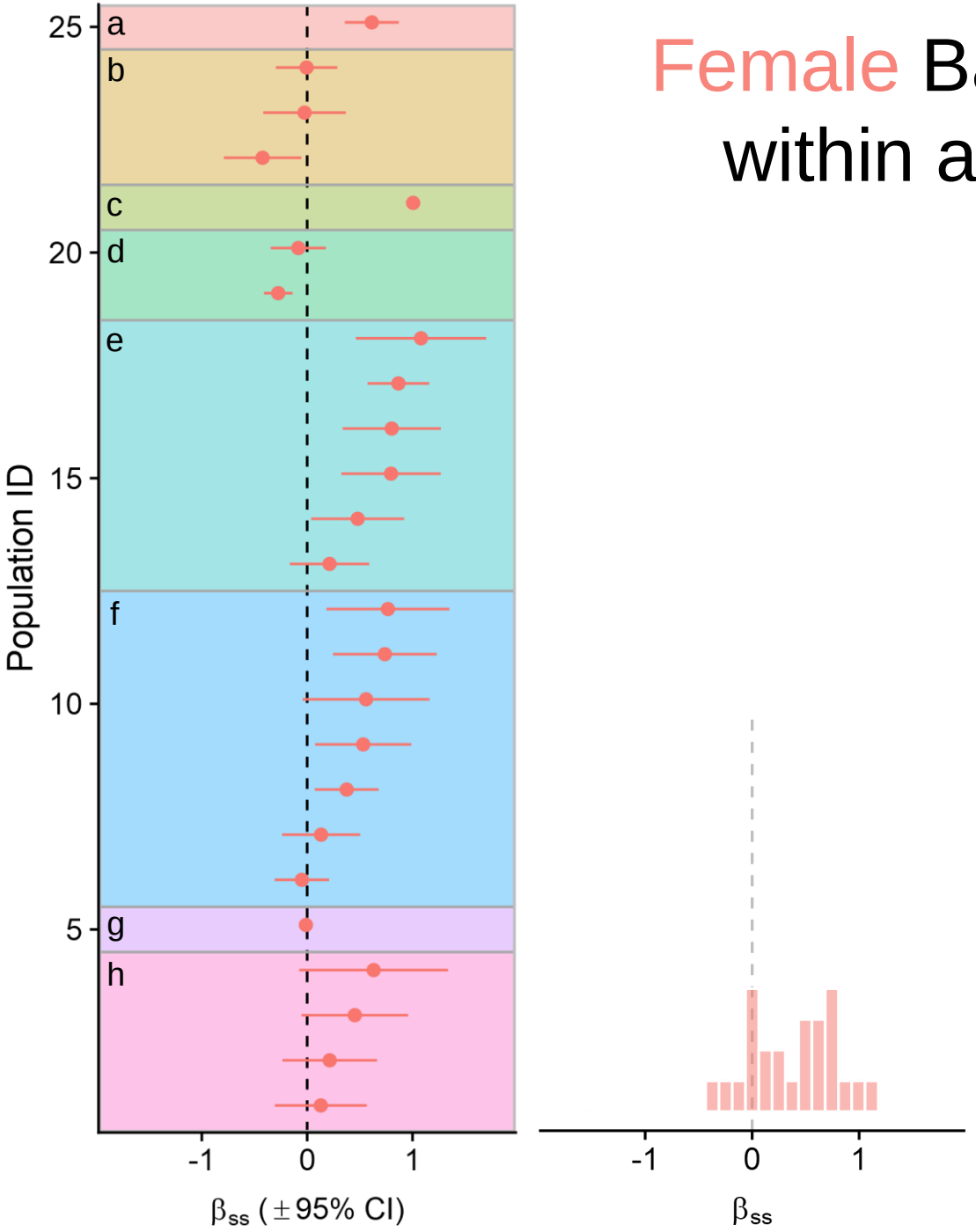

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Burd 1994; Pannell and Labouche 2013

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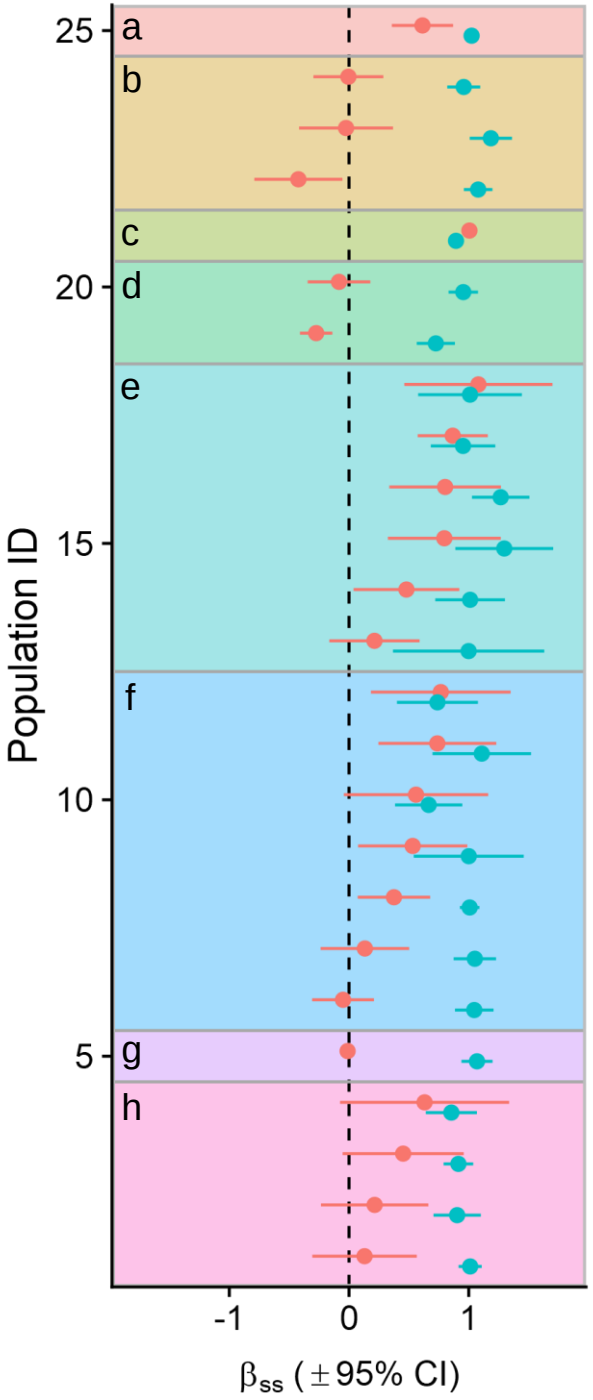
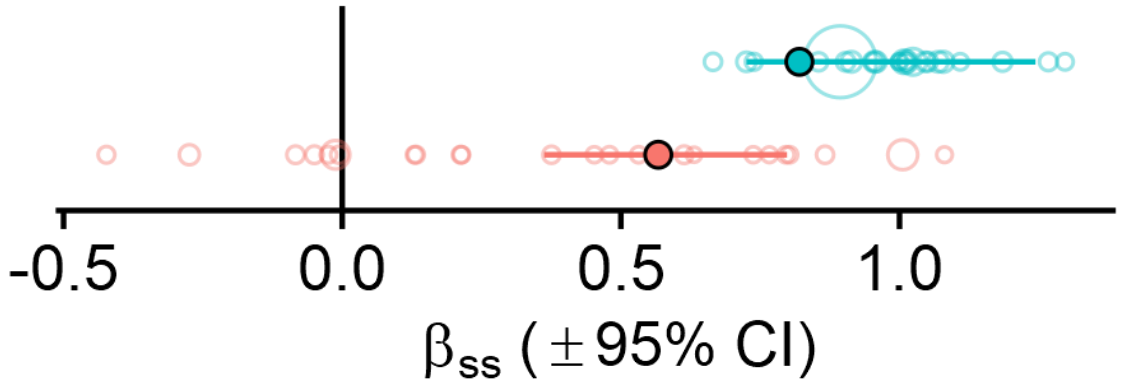
Male and very often Female Bateman gradients are positive





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β_m β_f

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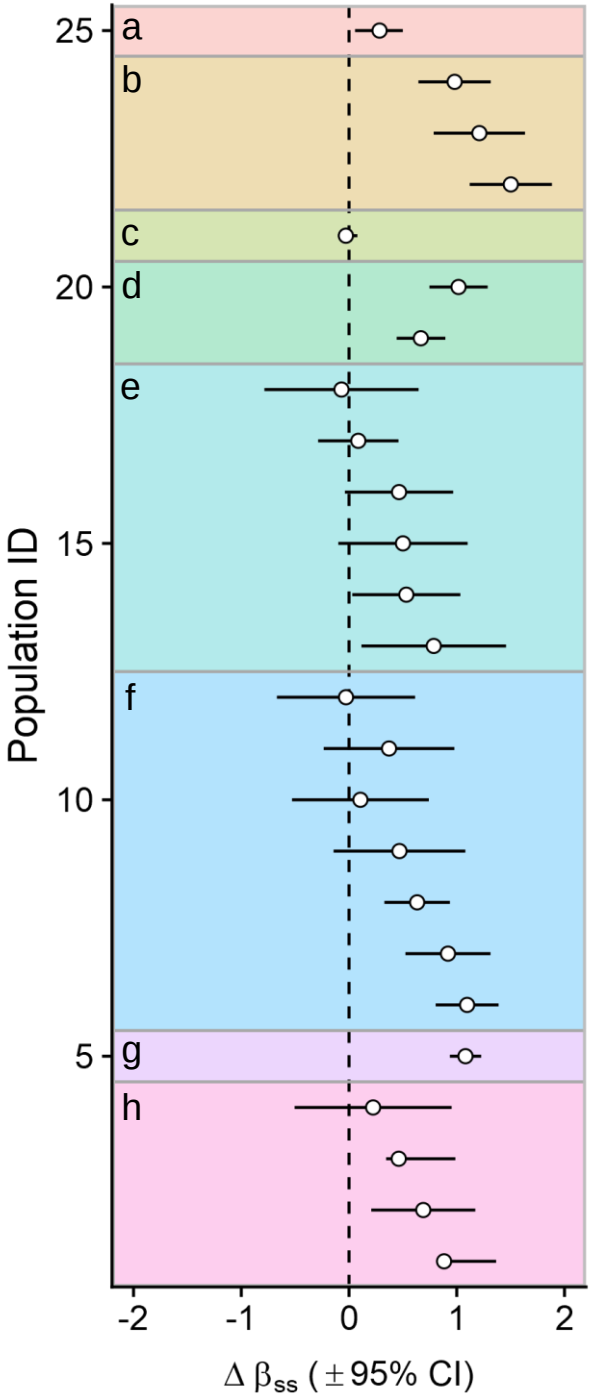

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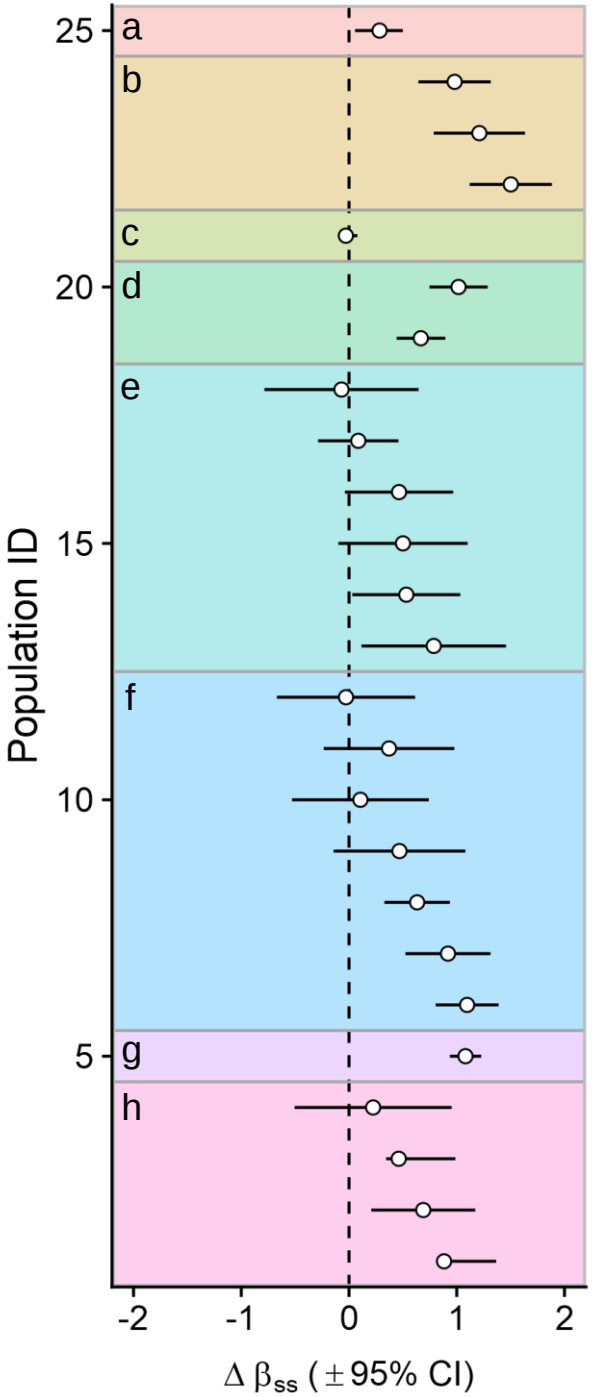

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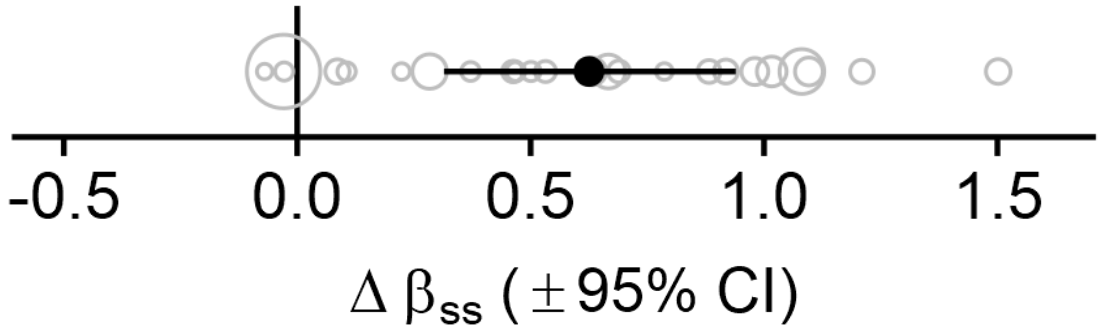
Male biased Bateman gradient estimates ($\beta_m > \beta_f$)



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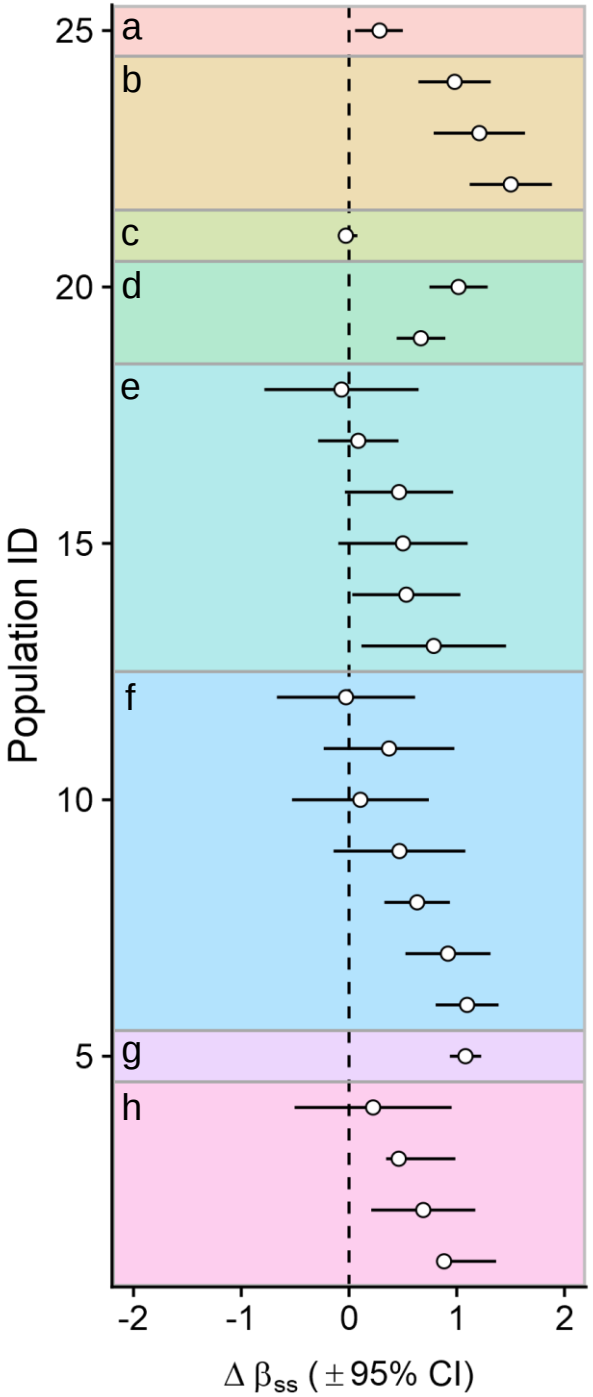

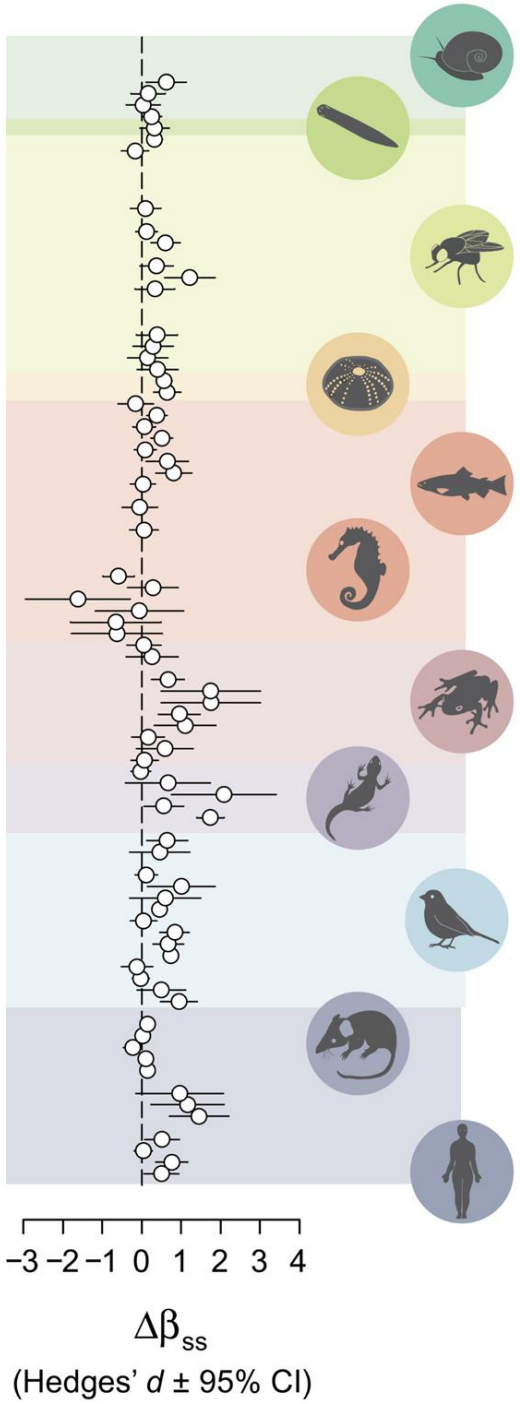

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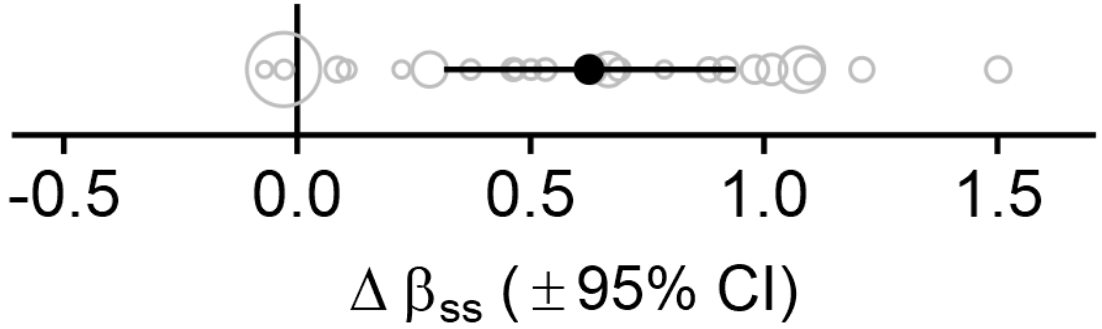

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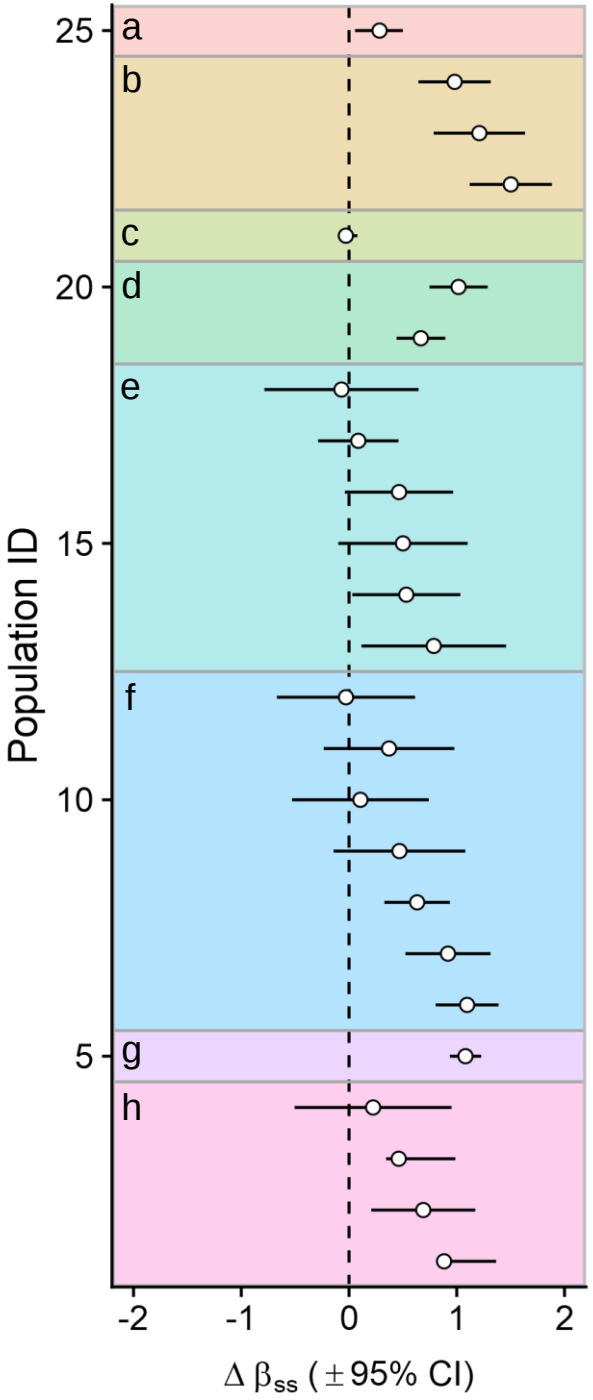
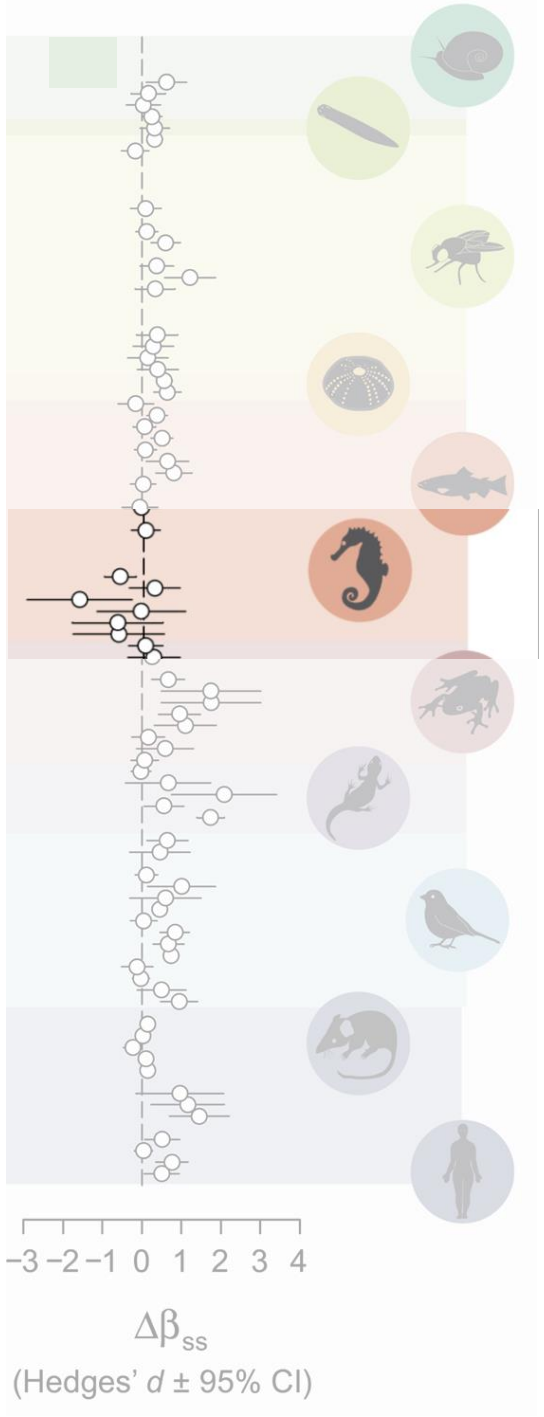
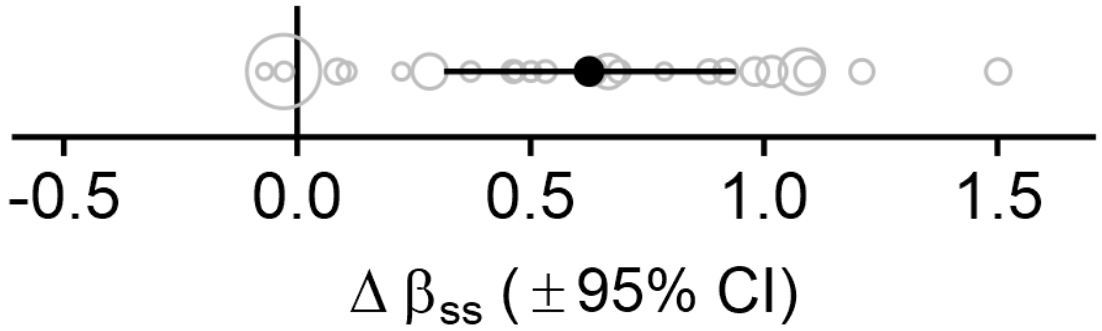




Ambrosia artemisiifolia a
Brassica rapa b
Leucadendron rubrum c
Mercurialis annua d
Narcissus papyraceus e
Raphanus raphanistrum f
Silene (latifolia × dioica) g
Silene stellata h

Male biased Bateman gradient estimates ($\beta_m > \beta_f$)



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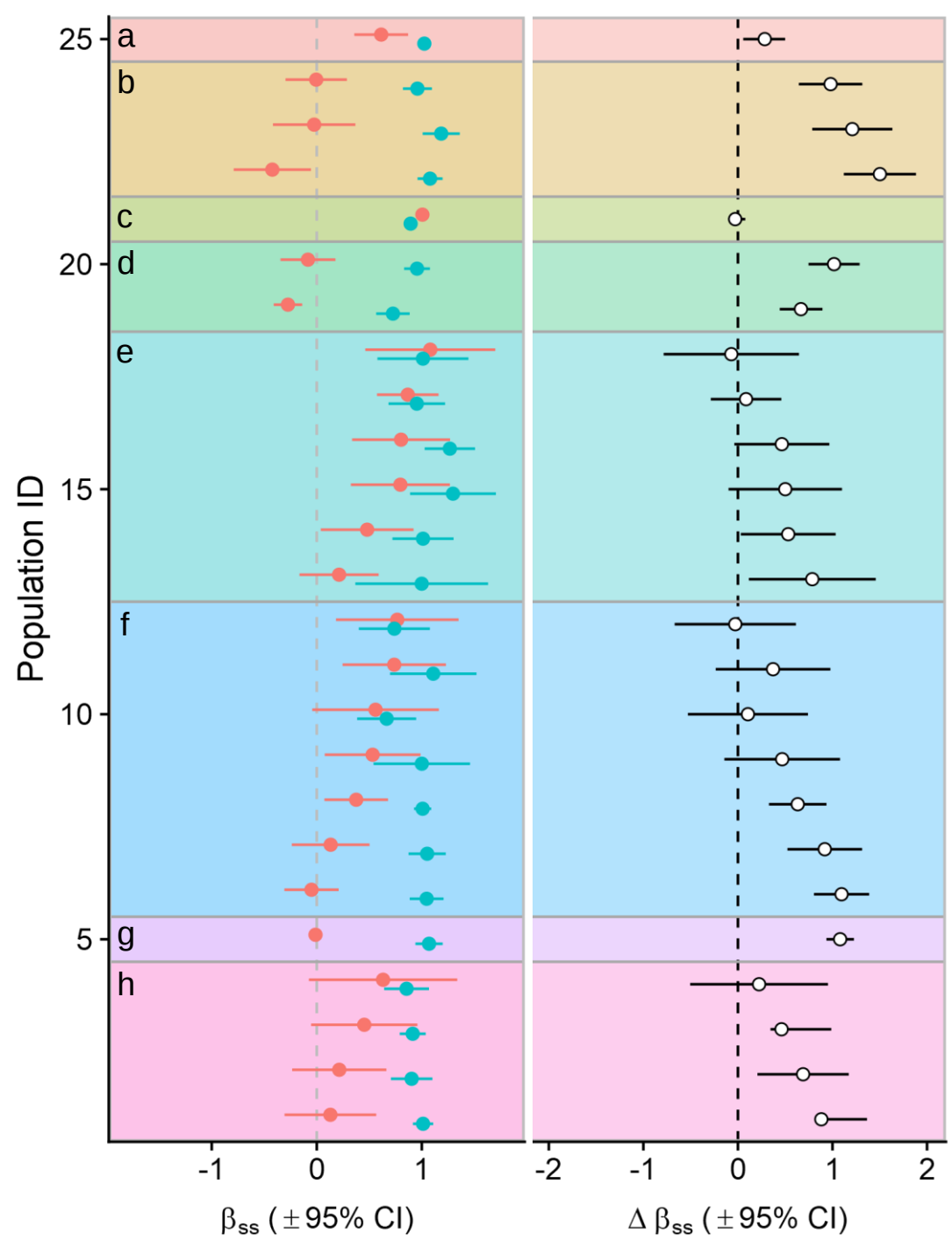

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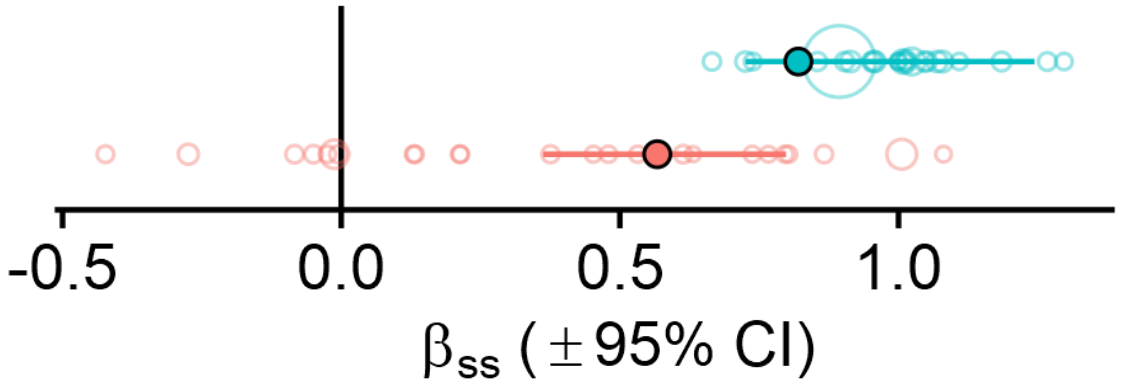

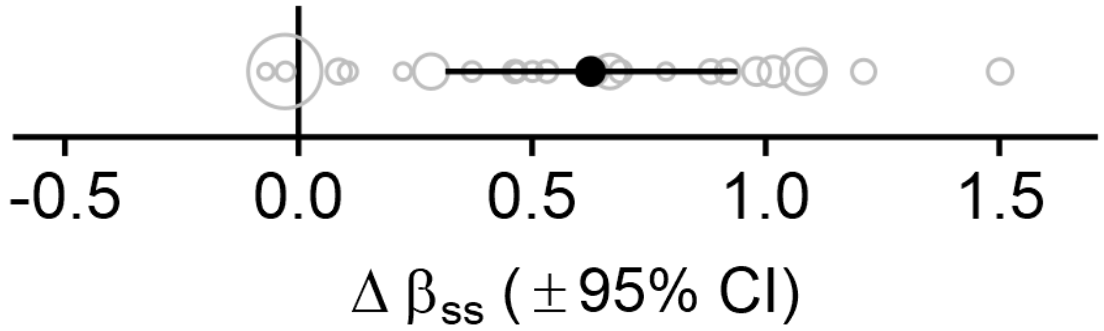

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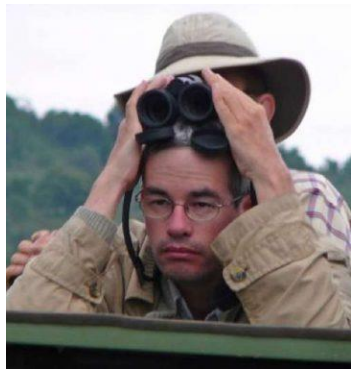
With thanks to

Jeanne Tonnabel



François Rousset

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Patrice David

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Jennifer Ison	Pablo Riba	Arthur Weis
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Institute of Evolutionary Science of Montpellier

Included studies

Austen and Weis 2016. Evolution

Nakahara et al. 2018. Ecol. Evol.

Simón-Porcar et al. 2015. Evolution

Tonnabel et al. 2019. Proc. Royal Soc. B

Tonnabel et al. 2021. Mol. Ecol.

Waterman et al. 2022. *In Prep*

Zhou et al. 2020. Evolution

Pannell. Unpublished data

WORK IN PROGRESS!

Call for studies!

Unpublished data!

✉ **iain.moodie@evobio.eu**

irmoodie

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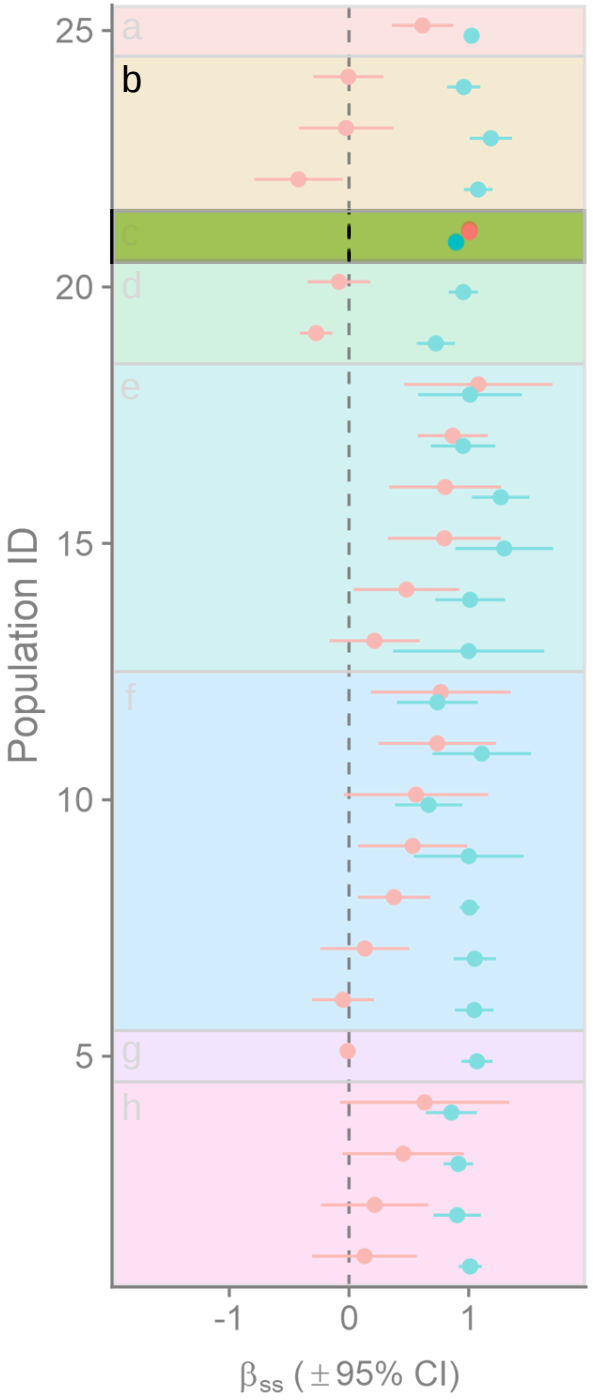

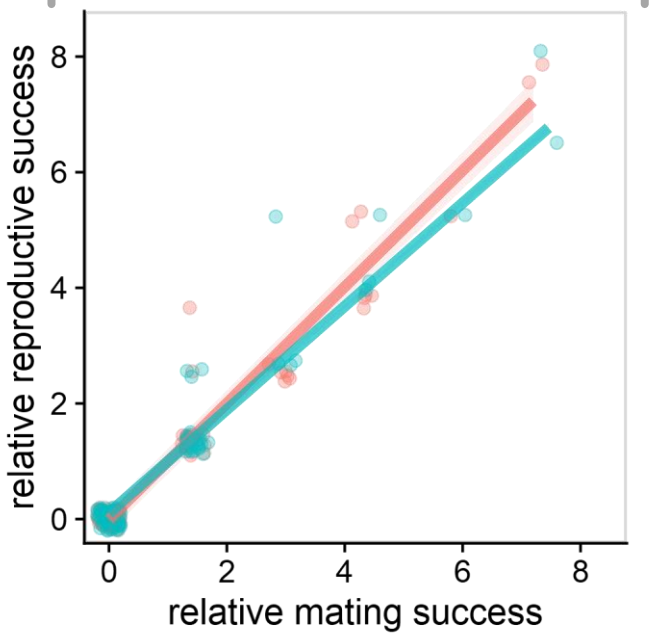

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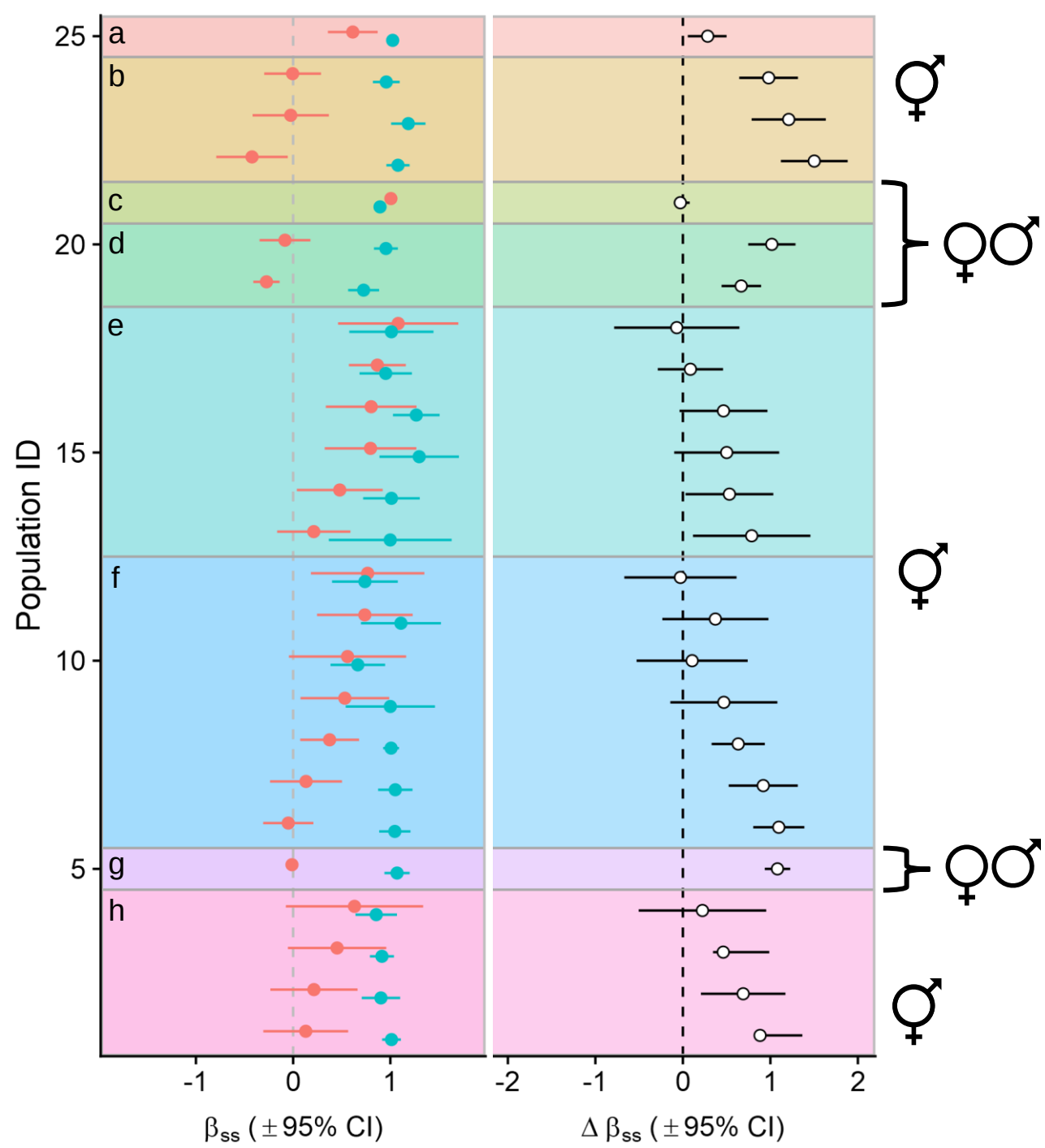
Barrett and Hough 2013



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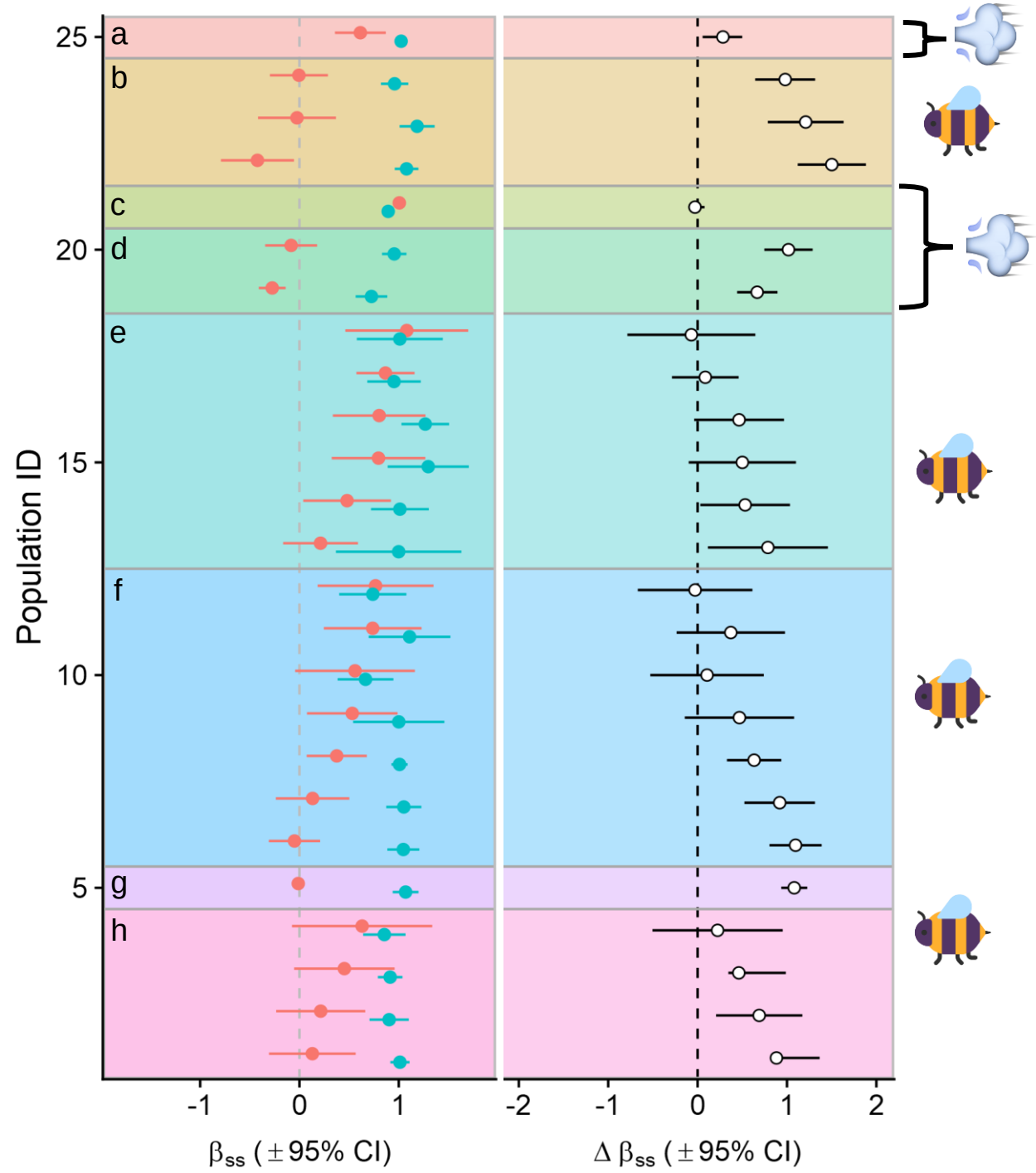

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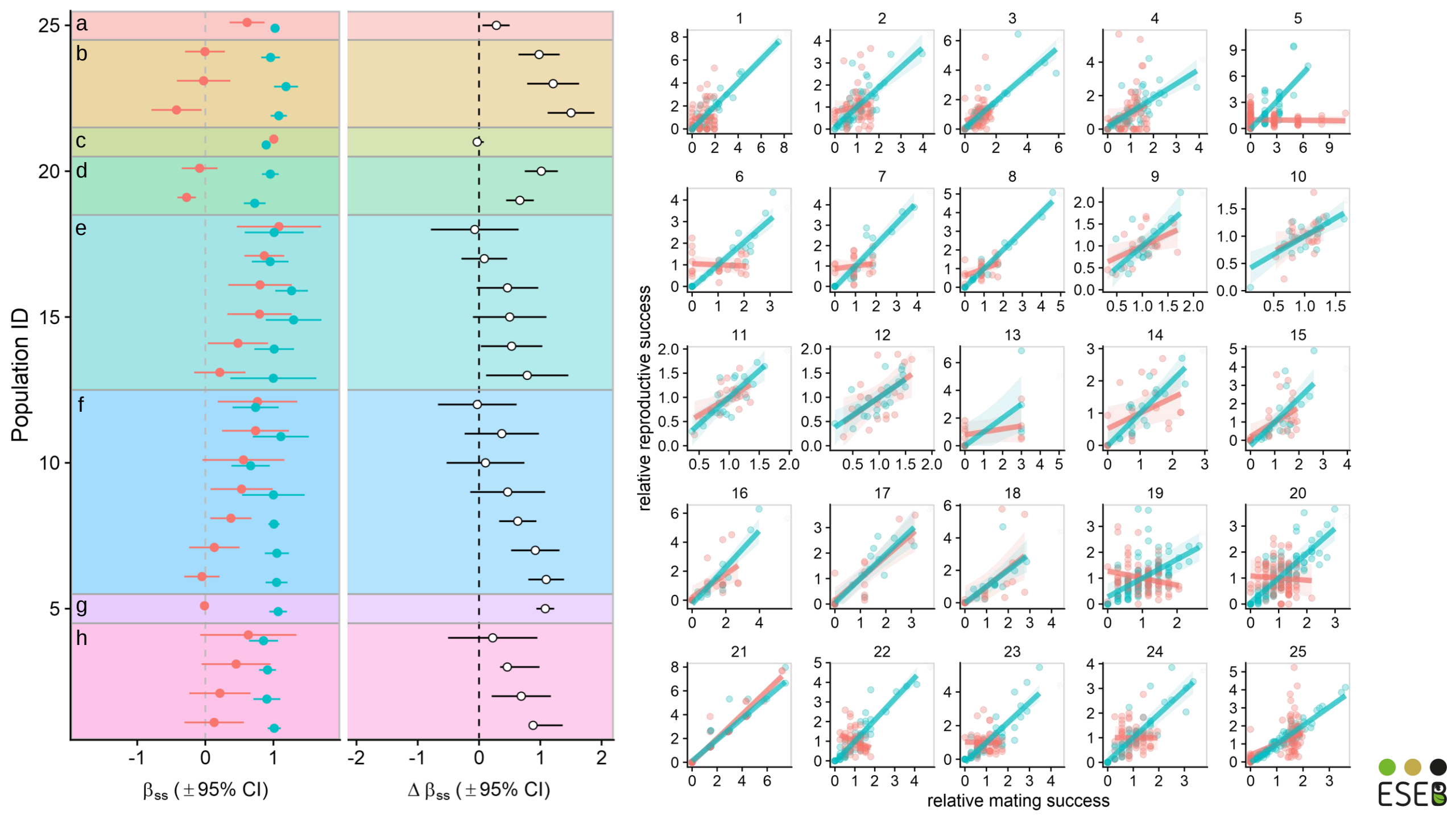
Population ID
a
b
c
d
e
f
g
h
25
20
15
10
5
-1
0
1
-2
-1
0
1
2
β_{ss} (±95% CI)
$\Delta\beta_{ss}$ (±95% CI)
relative reproductive success
relative mating success
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
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17
18
19
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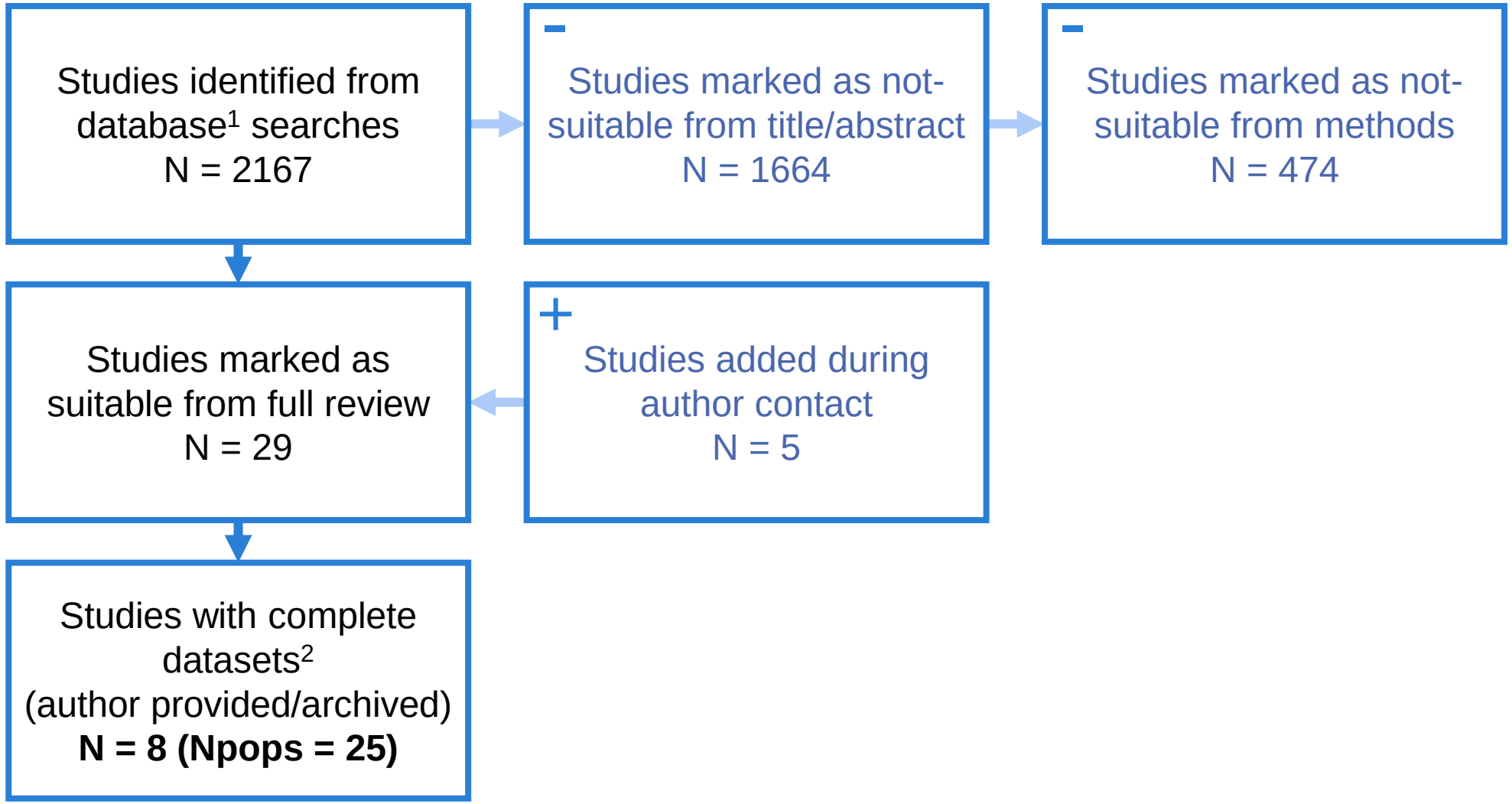
21
22
23
24
25



[1]Dryad, Zenodo & Web of Science (Core); [2]as of 1/8/2022