

Physiological performances of Southern Ocean key species

Southern Ocean

- Strong endemism
- Strong adaptations
 - Stenotherms
 - Low growth rates
 - Adaptation to ice during winters



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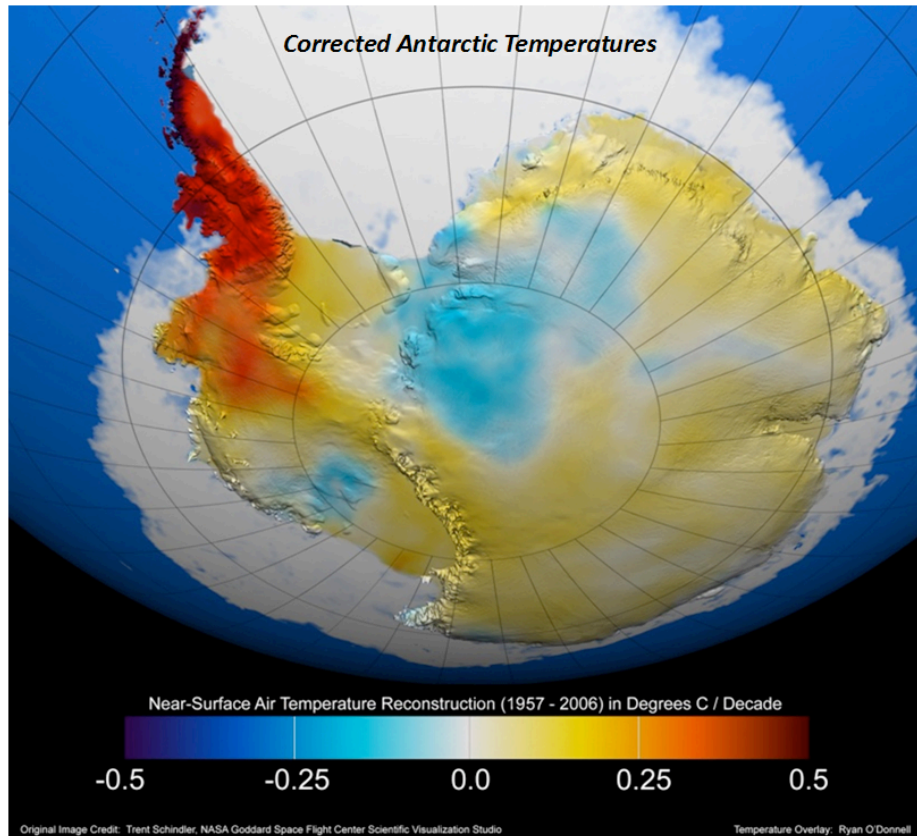


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Southern Ocean

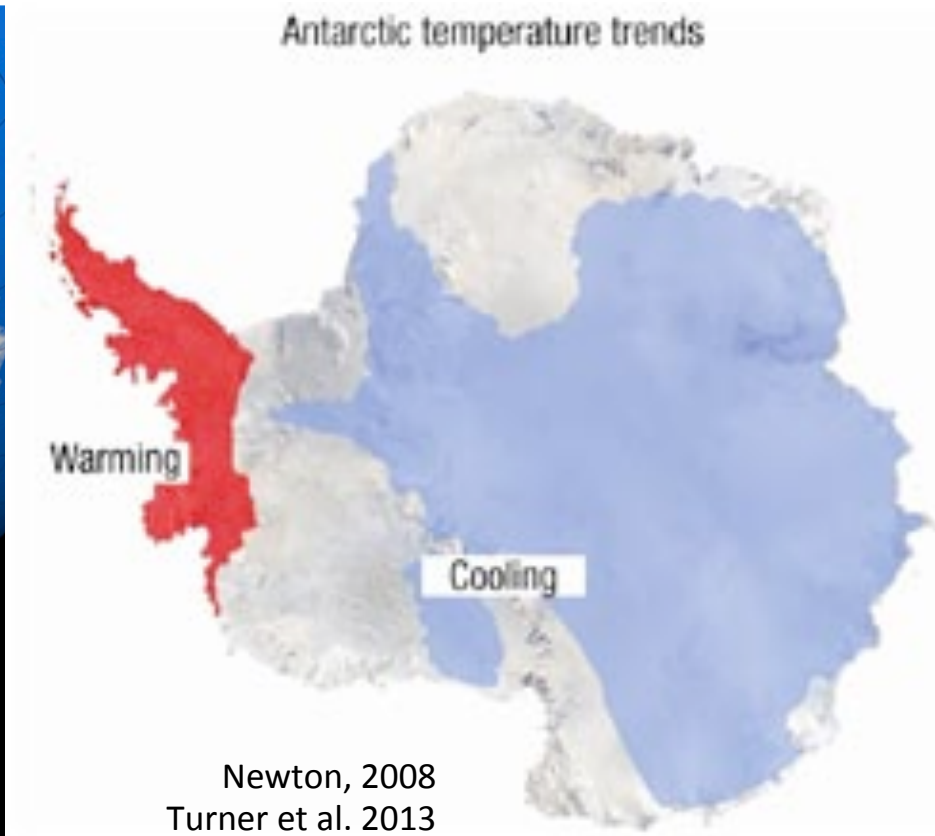
→ Facing global changes

Past surface T° changes 1957-2006



(NASA , O'Connel et al. 2010)

Future predictions



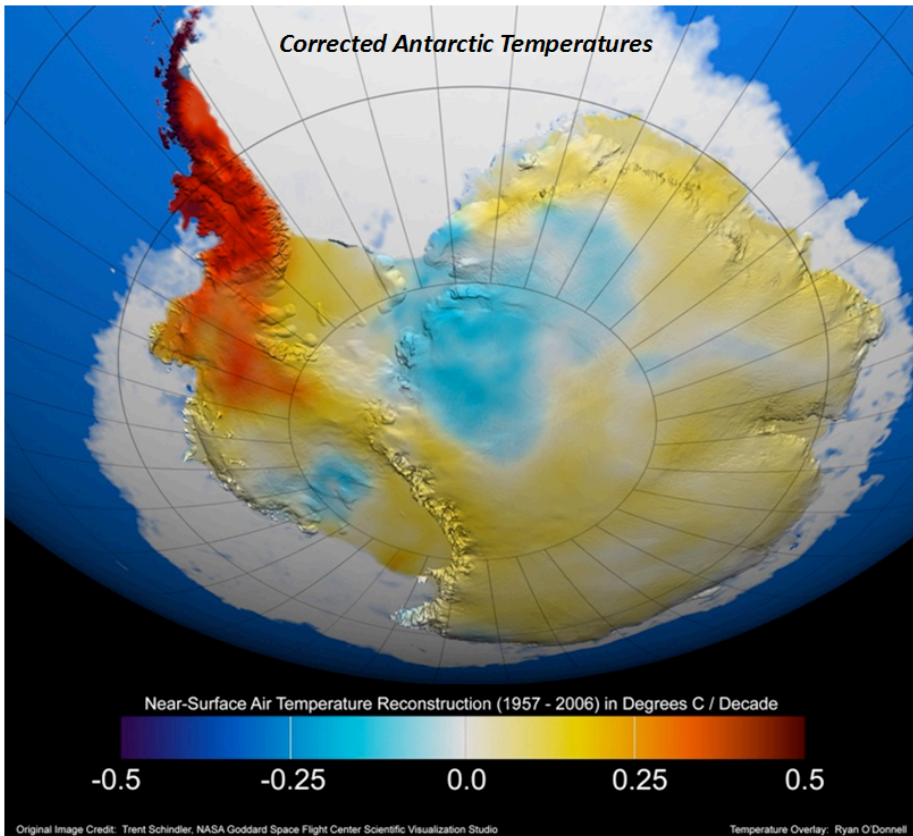
Newton, 2008
Turner et al. 2013
Schram et al. 2015

Southern Ocean

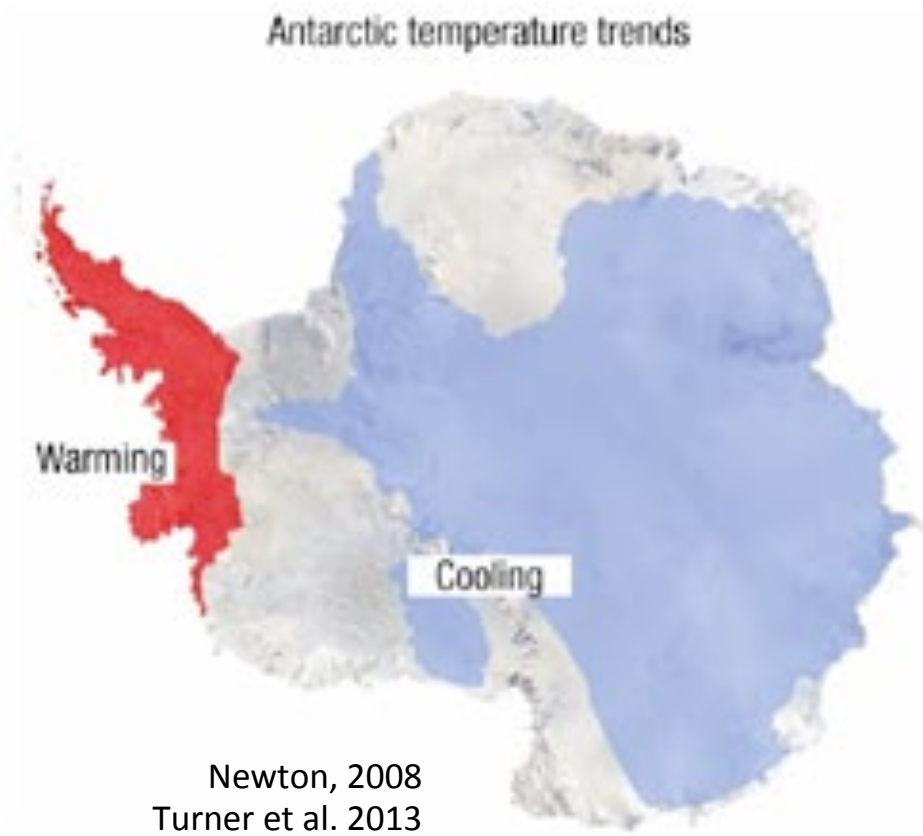
How sensitive are the communities to these upcoming changes ?

Past surface T° changes 1957-2006

Future predictions



(NASA , O'Connel et al. 2010)



Newton, 2008
Turner et al. 2013
Schram et al. 2015

Southern Ocean

→ Difficulties to access and work



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Southern Ocean

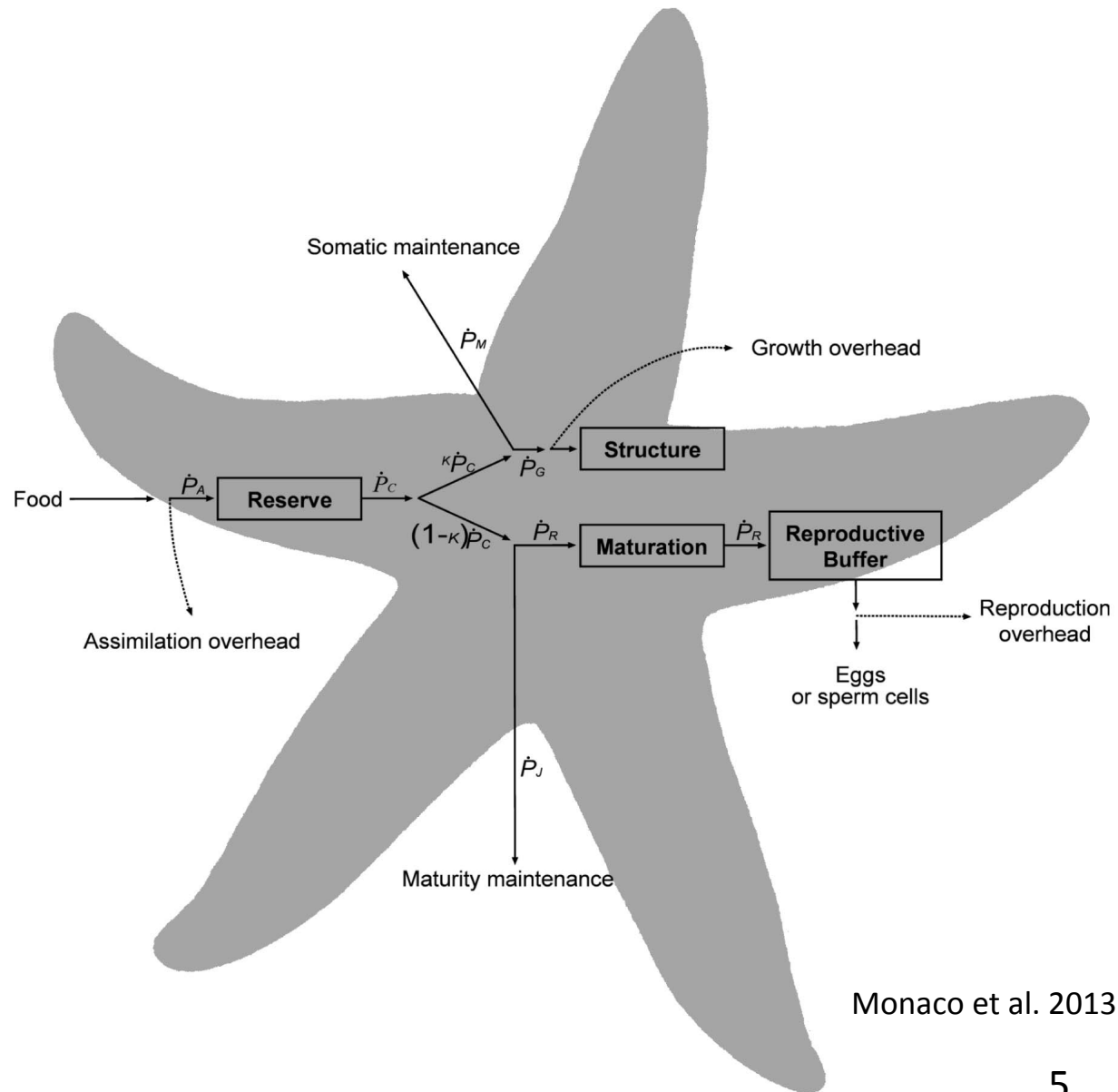
- Experiments : technical constraints
- Slow growth rates



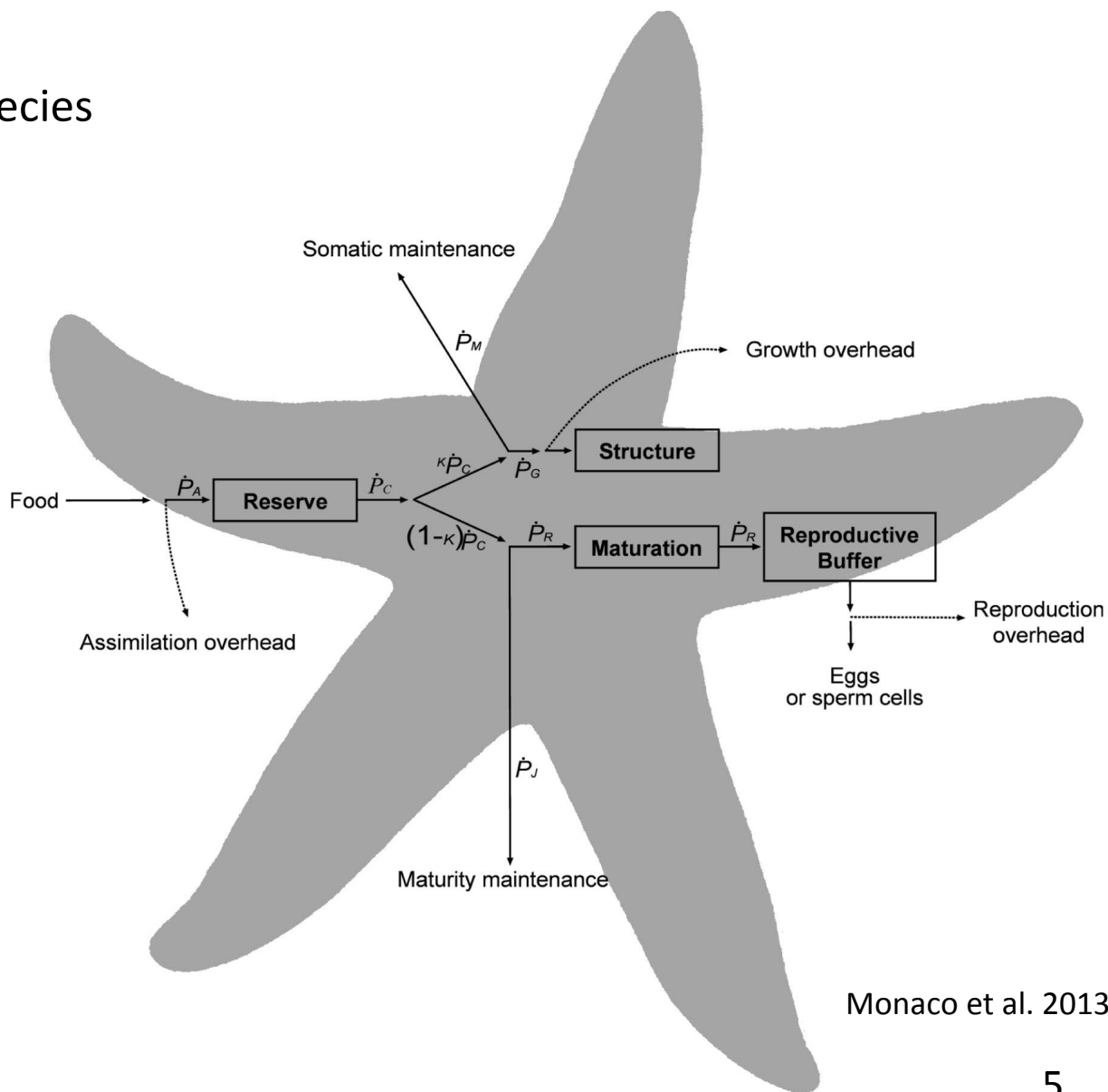
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- DEB models of 4 benthic species





Nacella concinna
(Guillaumot, Agüera 2017, unpublished)



Laternula elliptica
(Agüera et al. 2017, submitted)



Sterechinus neumayeri
(Stainthorp, Agüera 2017, unpublished)



Odontaster validus
(Agüera et al. 2015)



Realized on subtidal species, need to be fine tuned with intertidal data

Nacella concinna

(Guillaumot, Agüera 2017, unpublished)



DEB model + trait history

Laternula elliptica

(Agüera et al. 2017, submitted)



On going, being fine-tuned

Sterechinus neumayeri

(Stainthorp, Agüera 2017, unpublished)



DEB model + trait history

Odontaster validus

(Agüera et al. 2015)



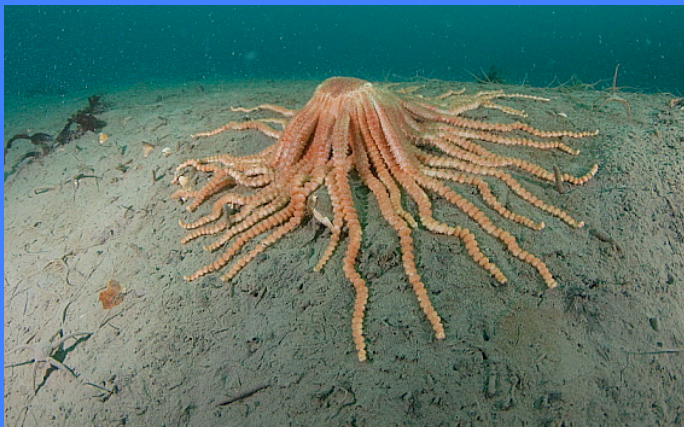
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Notothenia coriiceps
Notothenia rossii



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Ophionotus victoriae



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Labidiaster annulatus



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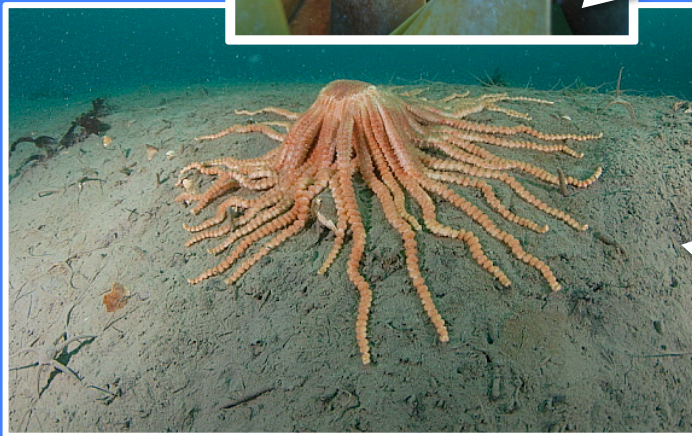
Aequiyoldia eightsii



© Fish



Notothen
Nototh



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Labidiaster annulatus



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Ophionotus victoriae



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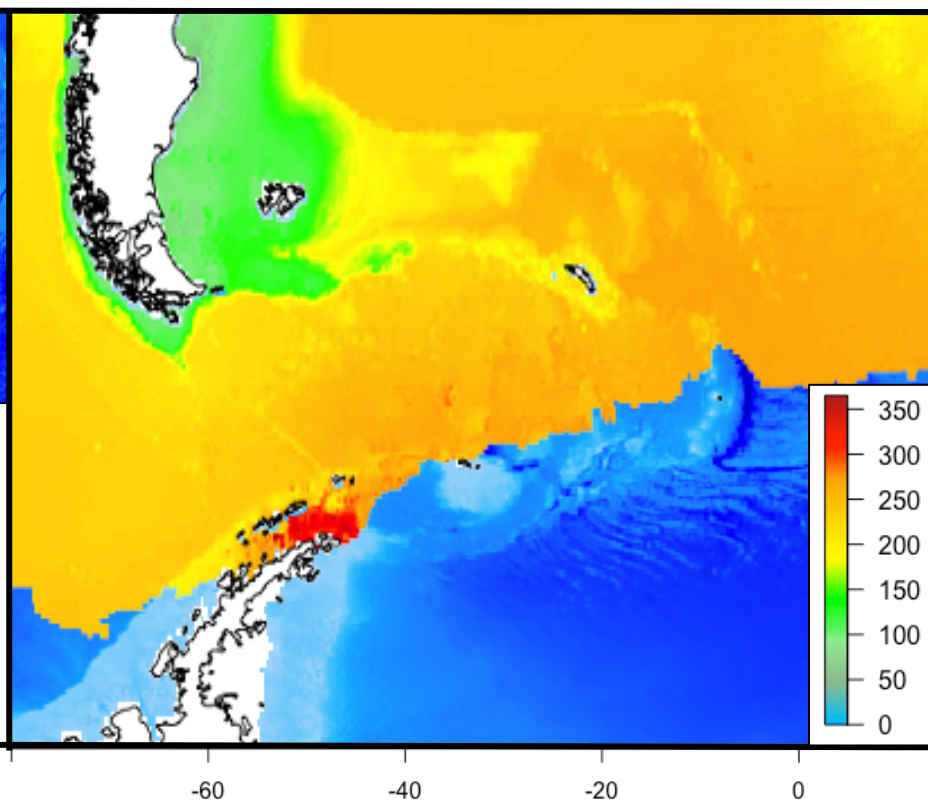
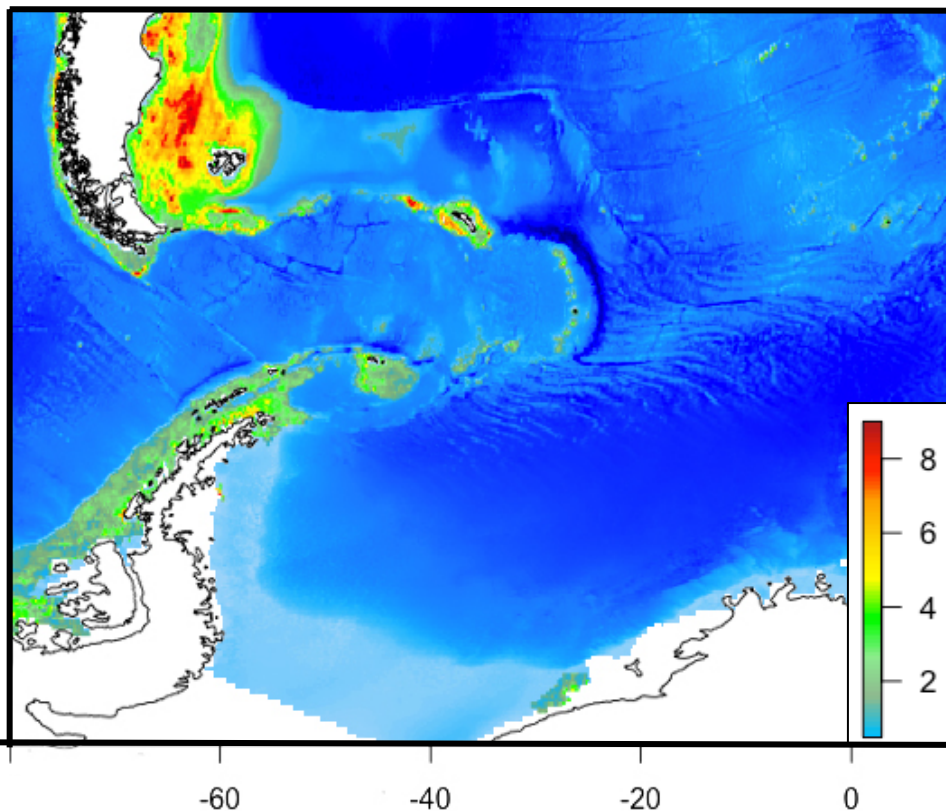
Aequiyoldia eightsii

Mechanistic distribution models

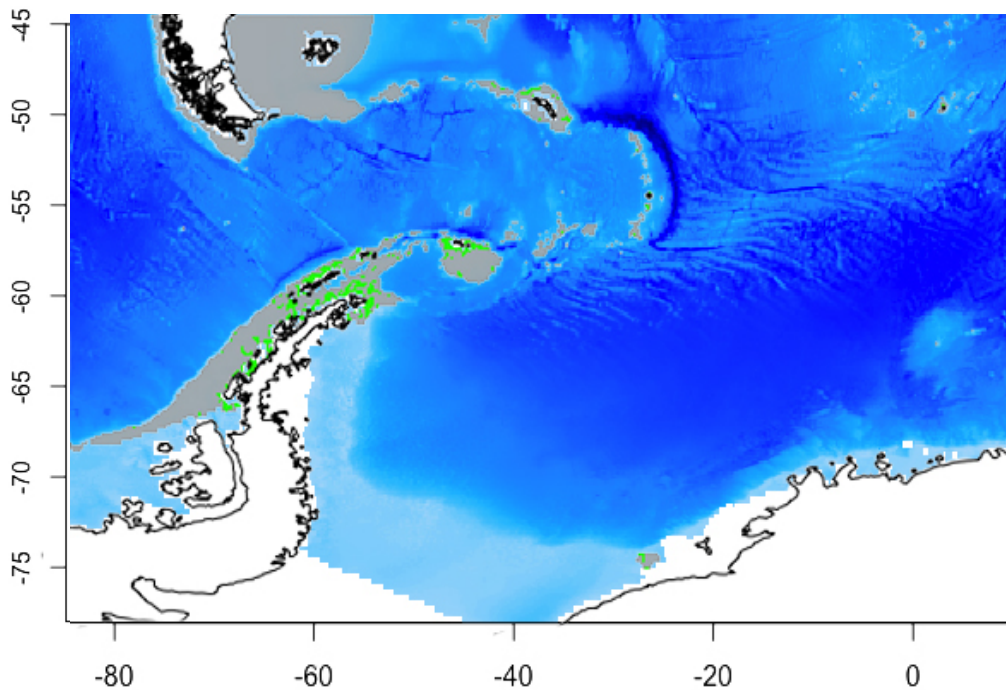


Maximum size (cm)

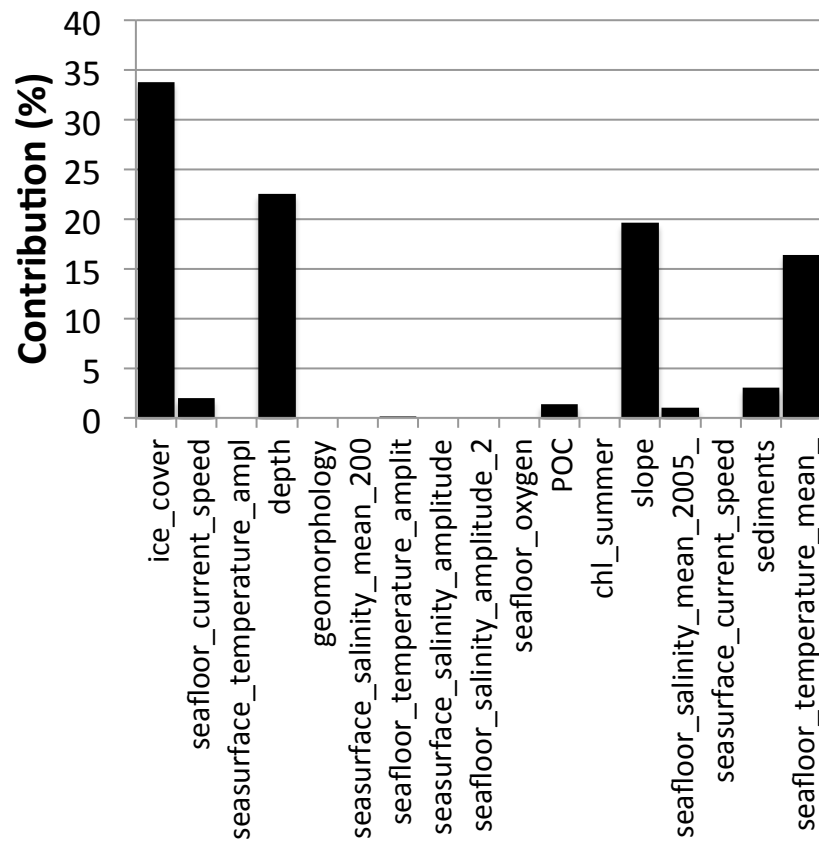
Age at metamorphosis (days)



Mechanistic distribution models
vs. **Species Distribution Models**



NON suitable area
 Suitable area





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Nacella concinna
(Guillaumot, Agüera 2017, unpublished)



© oikonos

Laternula elliptica
(Agüera et al. 2017, submitted)



Sterechinus neumayeri
(Stainthorp, Agüera 2017, unpublished)



Odontaster validus
(Agüera et al. 2015)

Comparison with related species within taxonomic group



Nacella concinna
(Guillaumot, Agüera 2017, unpublished)



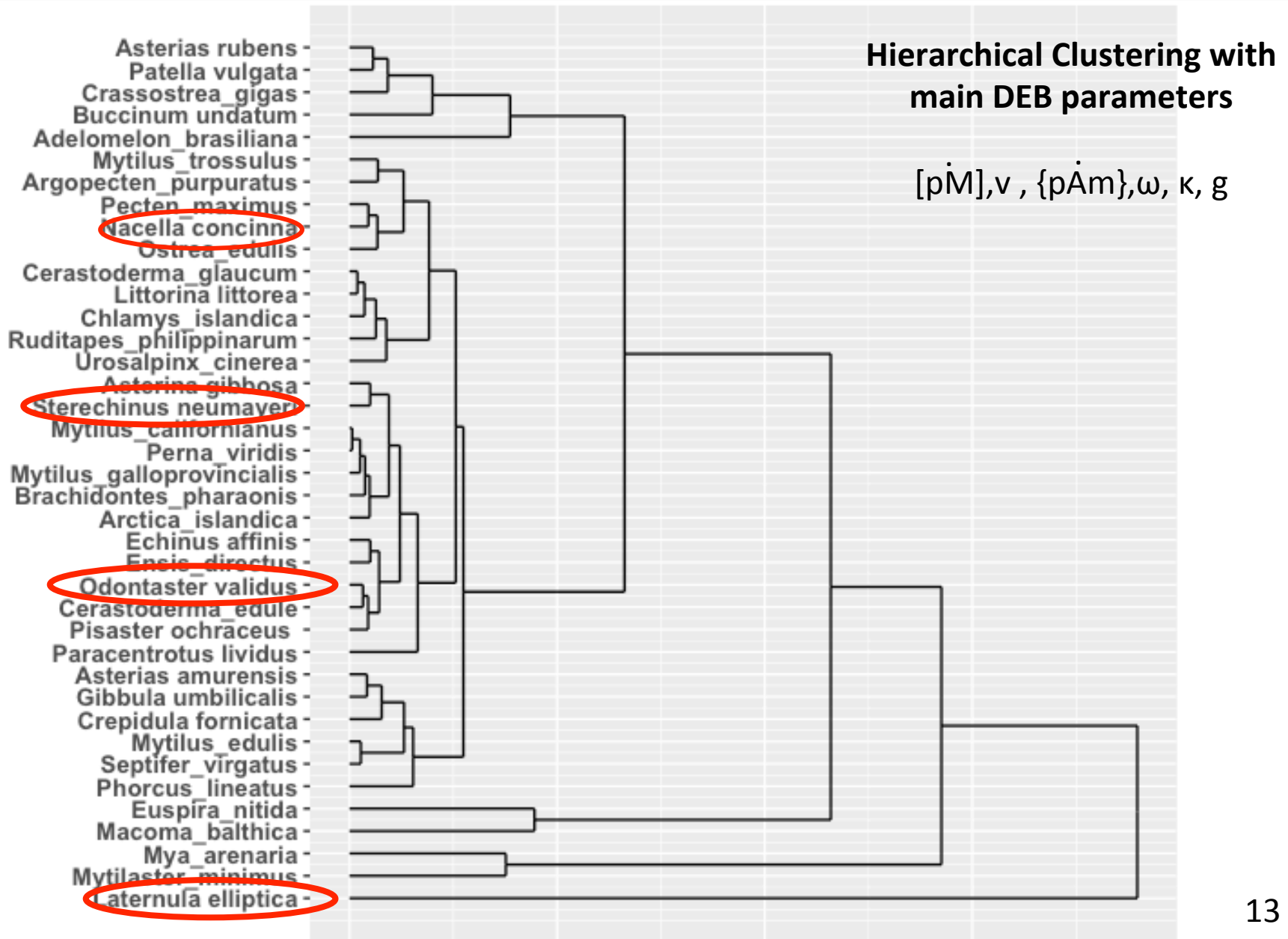
Laternula elliptica
(Agüera et al. 2017, submitted)



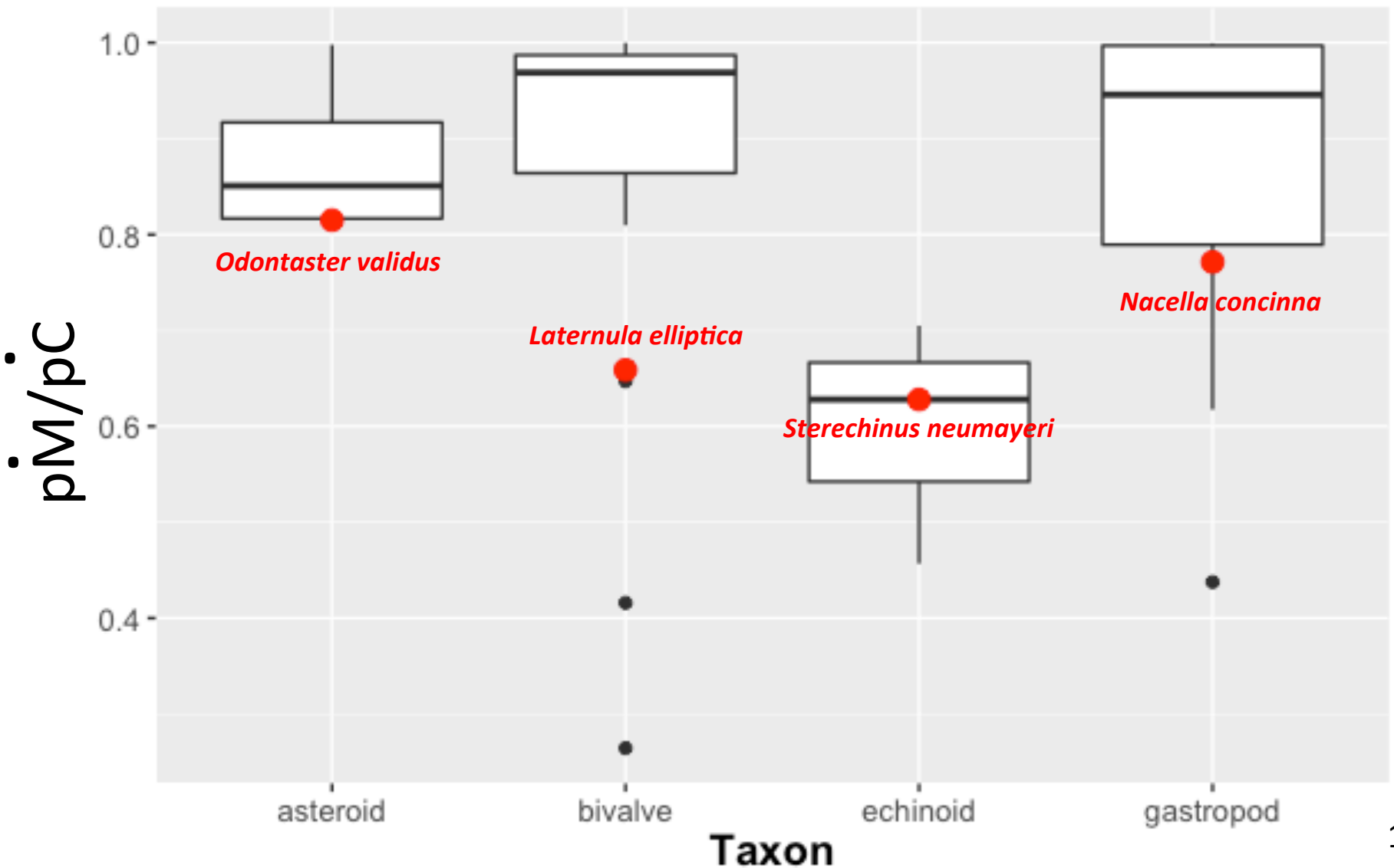
Sterechinus neumayeri
(Stainthorp, Agüera 2017, unpublished)



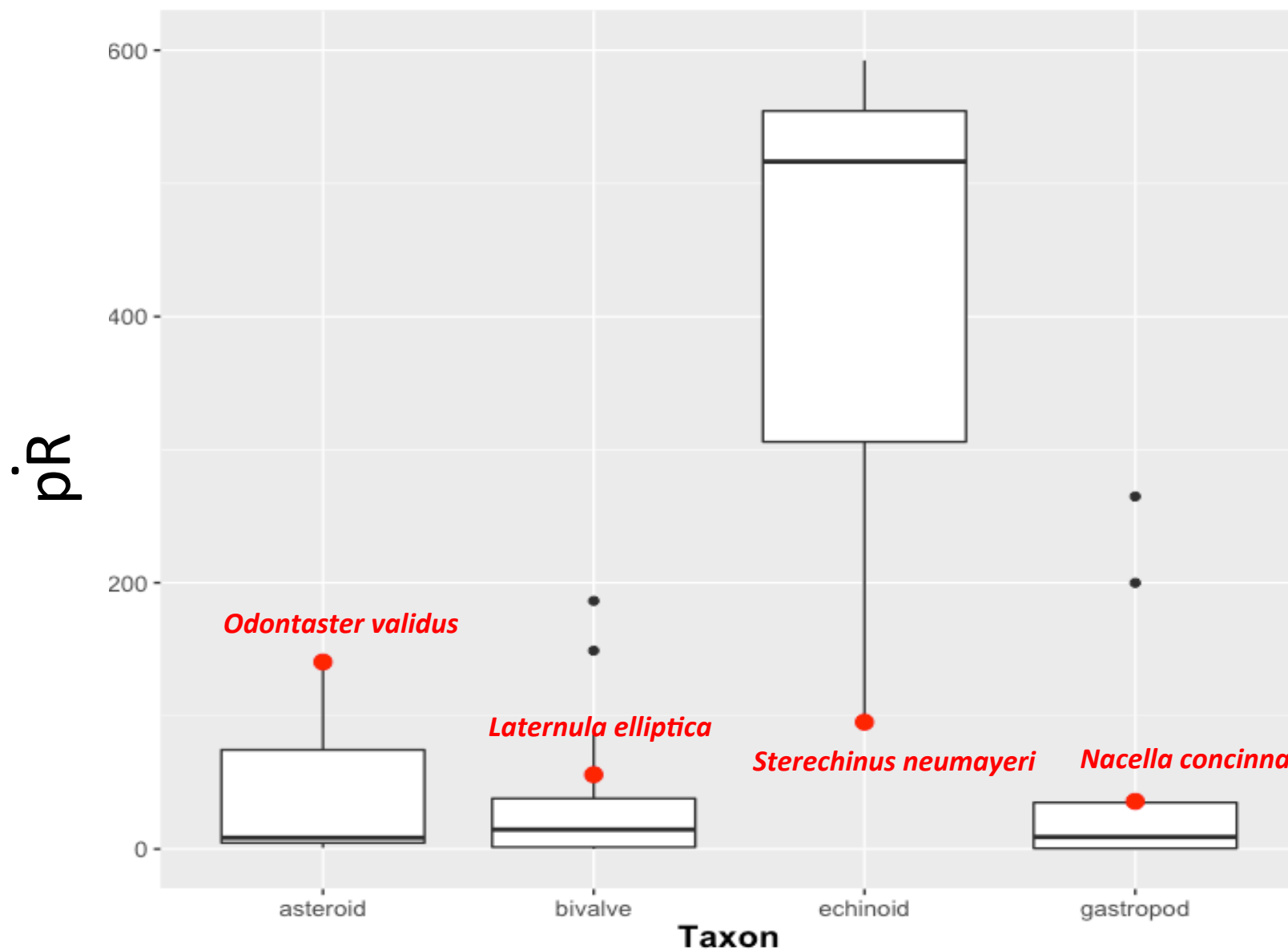
Odontaster validus
(Agüera et al. 2015)

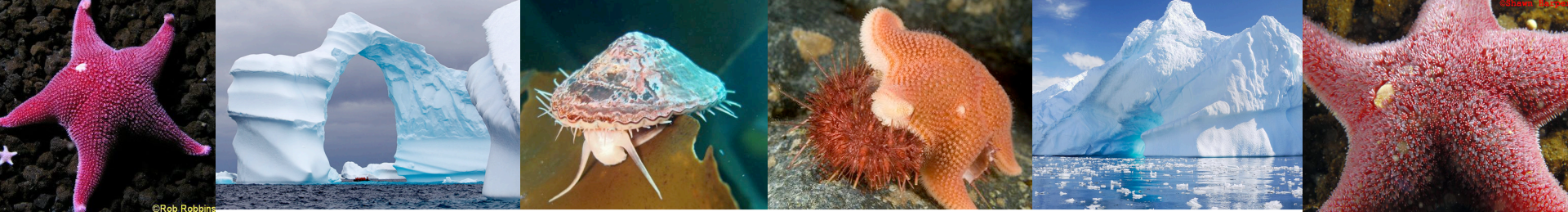


Comparison with parameters of other species



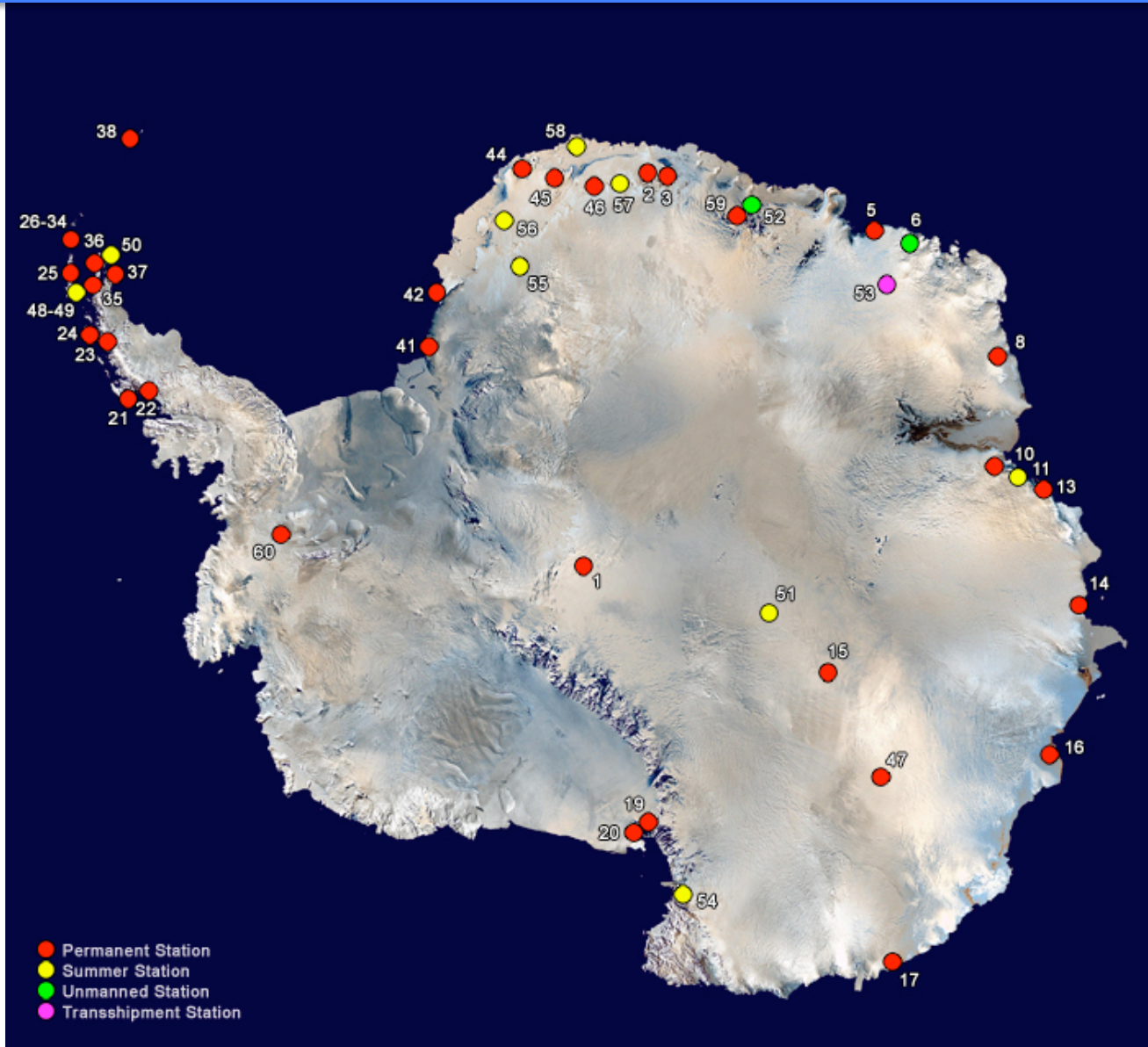
Comparison with parameters of other species





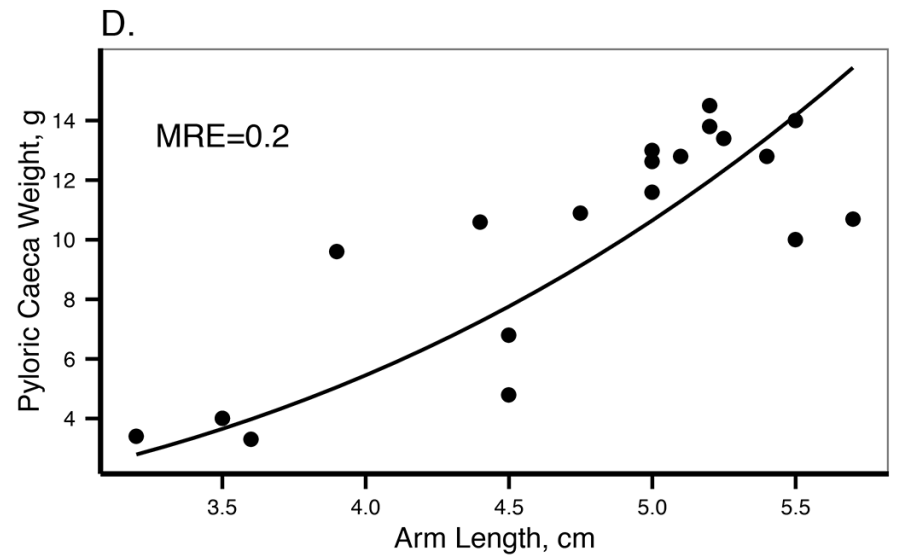
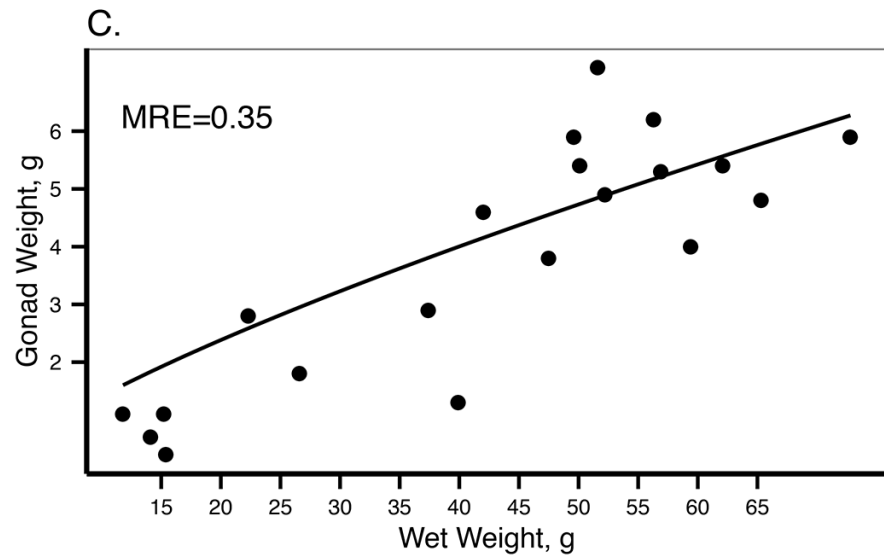
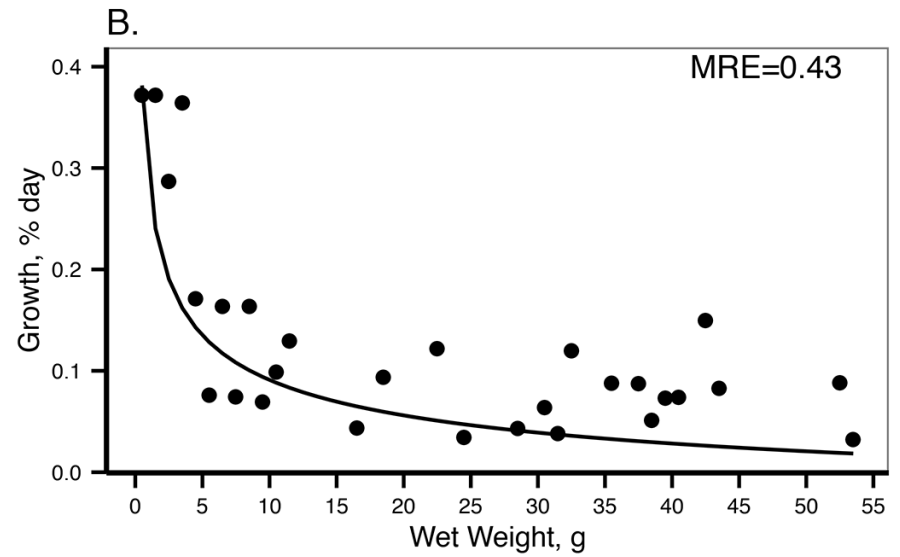
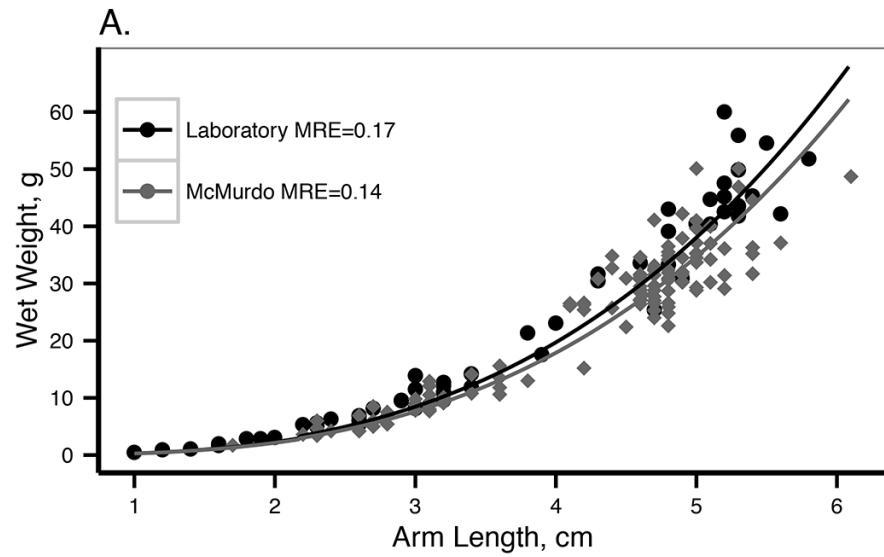
Thanks for your attention !

→ Stations



Satellite Image Map of Antarctica

Using Advanced Very High Resolution Radiometer (AVHRR) from the United States Geological Survey's Mini Image Processing System (USGS/MIPS)



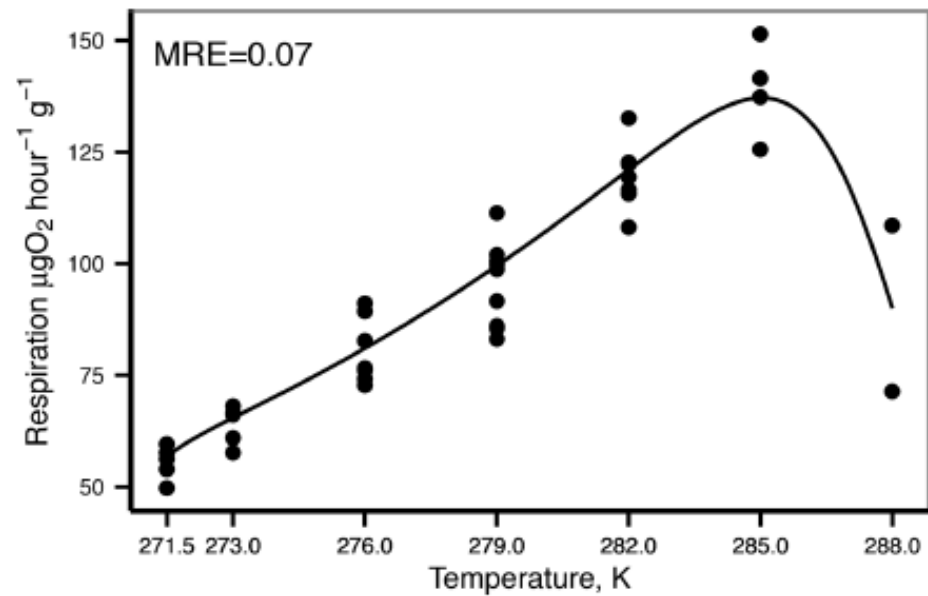
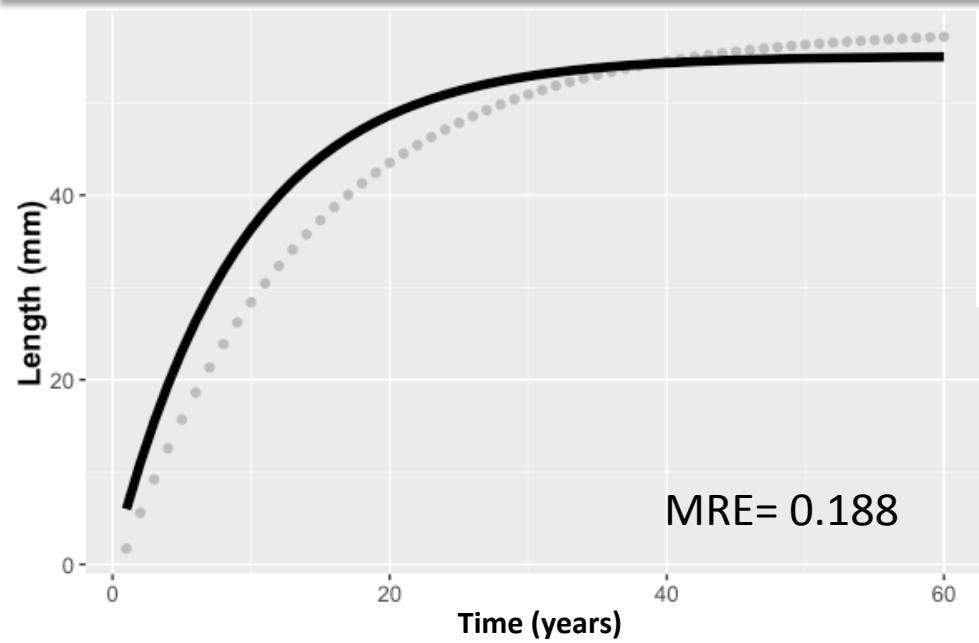
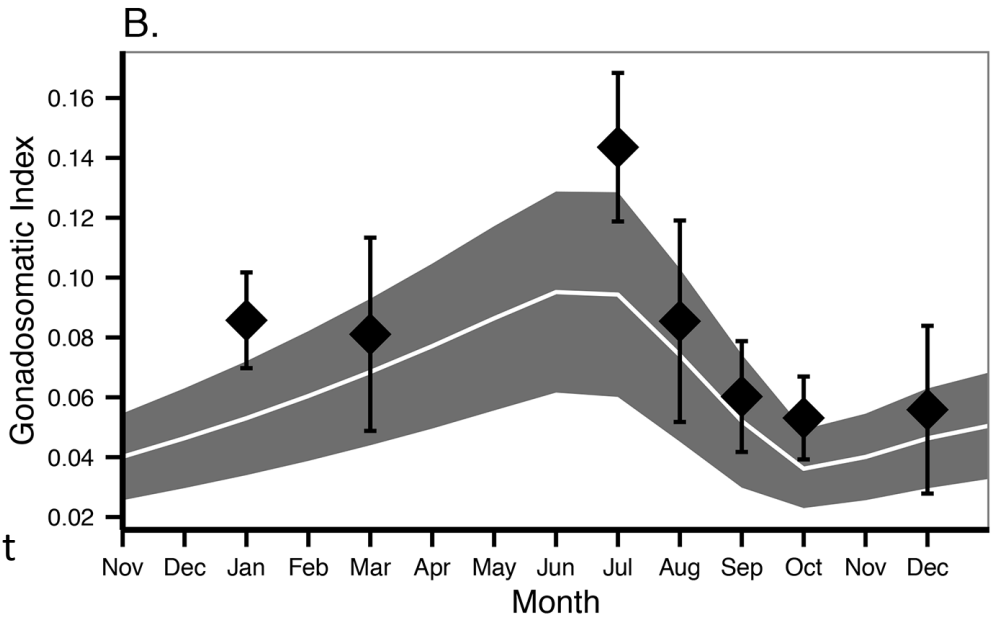
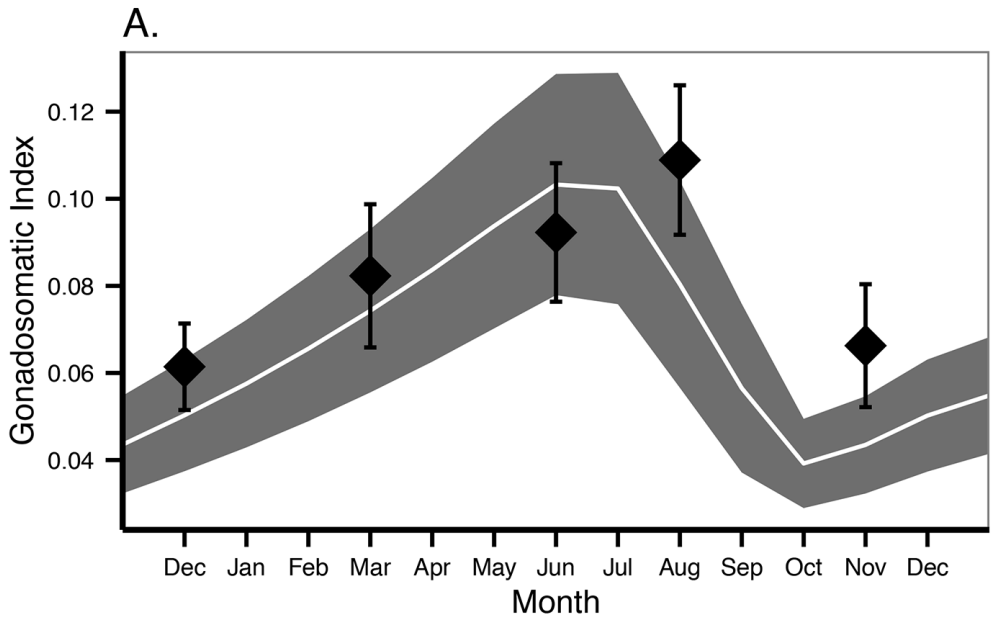
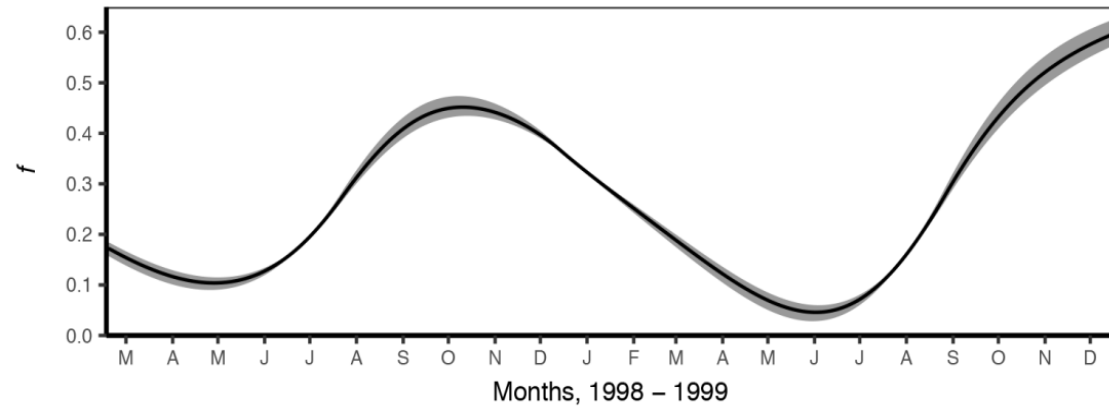


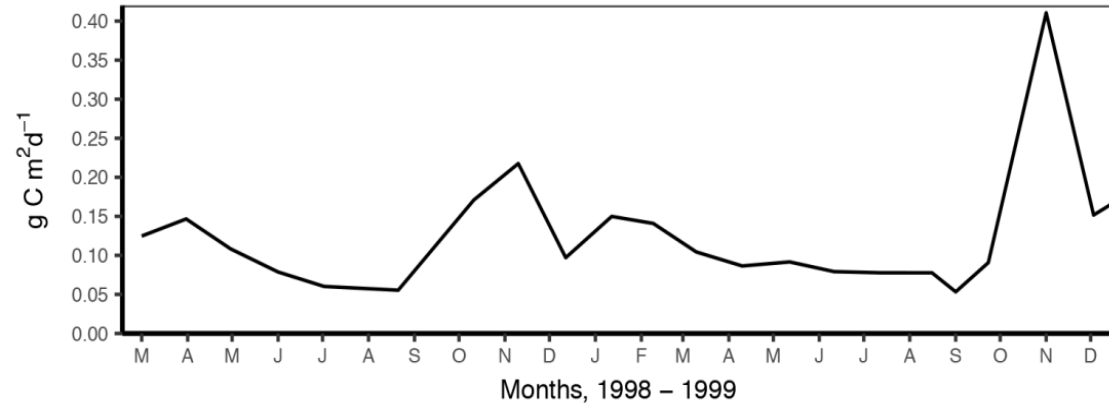
Fig 10. Gonadosomatic Index (GSI). A. Animals kept in the laboratory and fed ad libitum. B. Animals at the food level estimated for McMurdo. Points are mean and 95% confidence interval of laboratory and field observations respectively [25]. Line (mean) and shaded areas (95% confidence interval) are DEB model output applying the reproduction buffer handling rules to a 100 individuals with the same mean weight and SD than the ones used in the observations.



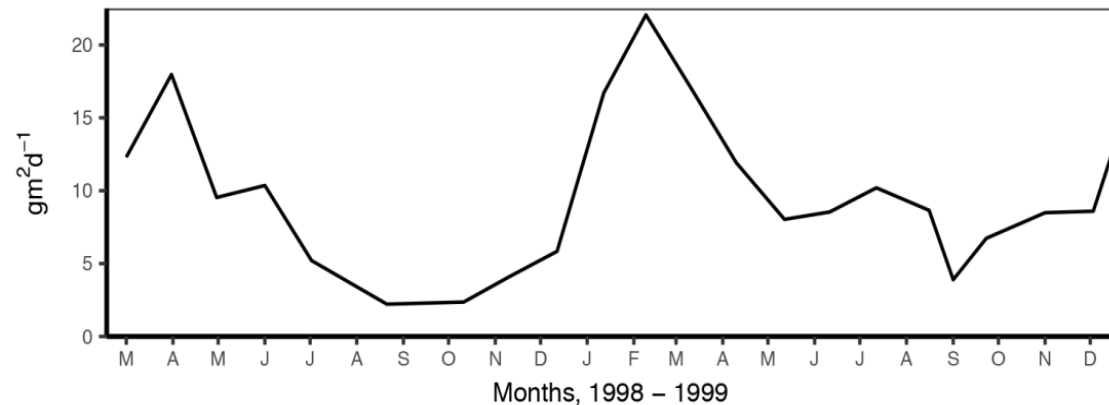
A. Scaled functional response

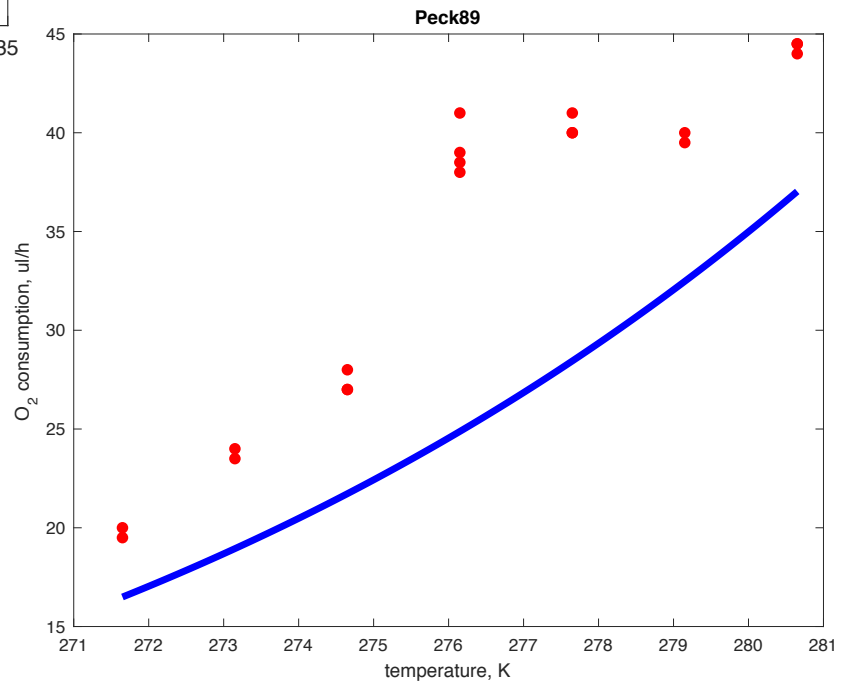
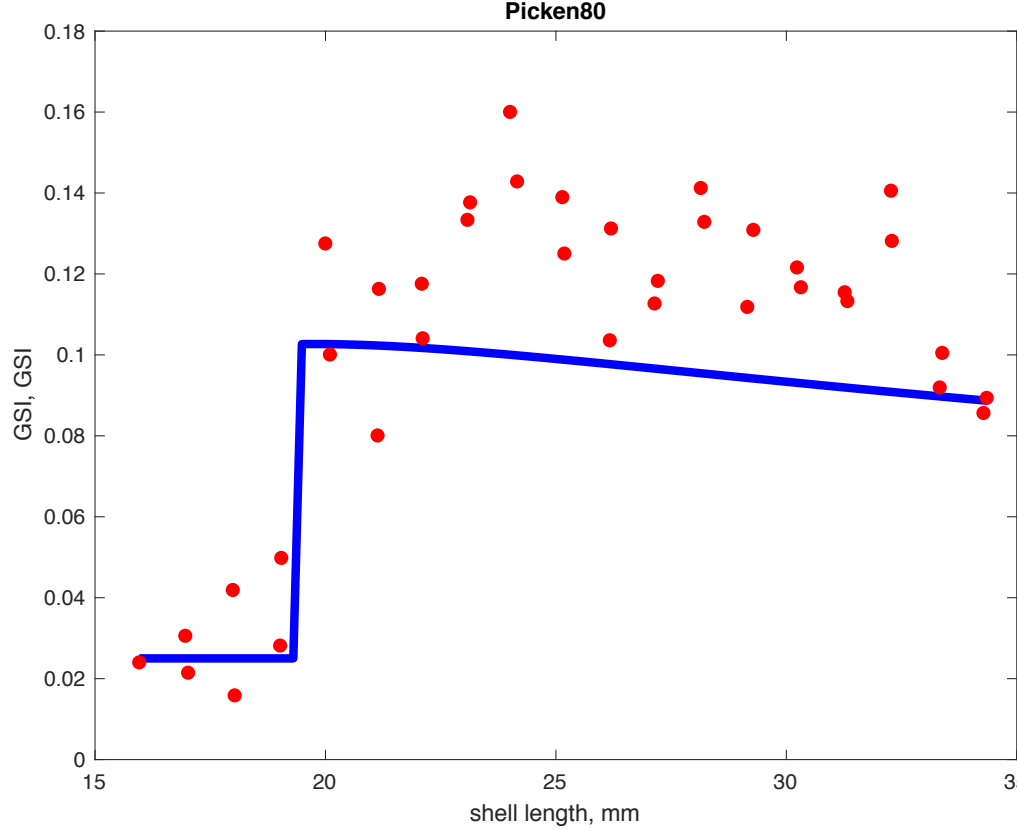


B. Particulate Organic Carbon flux



D. Lithogenic Particle flux





Antarctic species
Nacella concinna



At 20°C
=> pR = 10 000 eggs.year⁻¹

At 10°C
=> pR = 20 000 eggs.year⁻¹

Temperate species
Patella vulgata



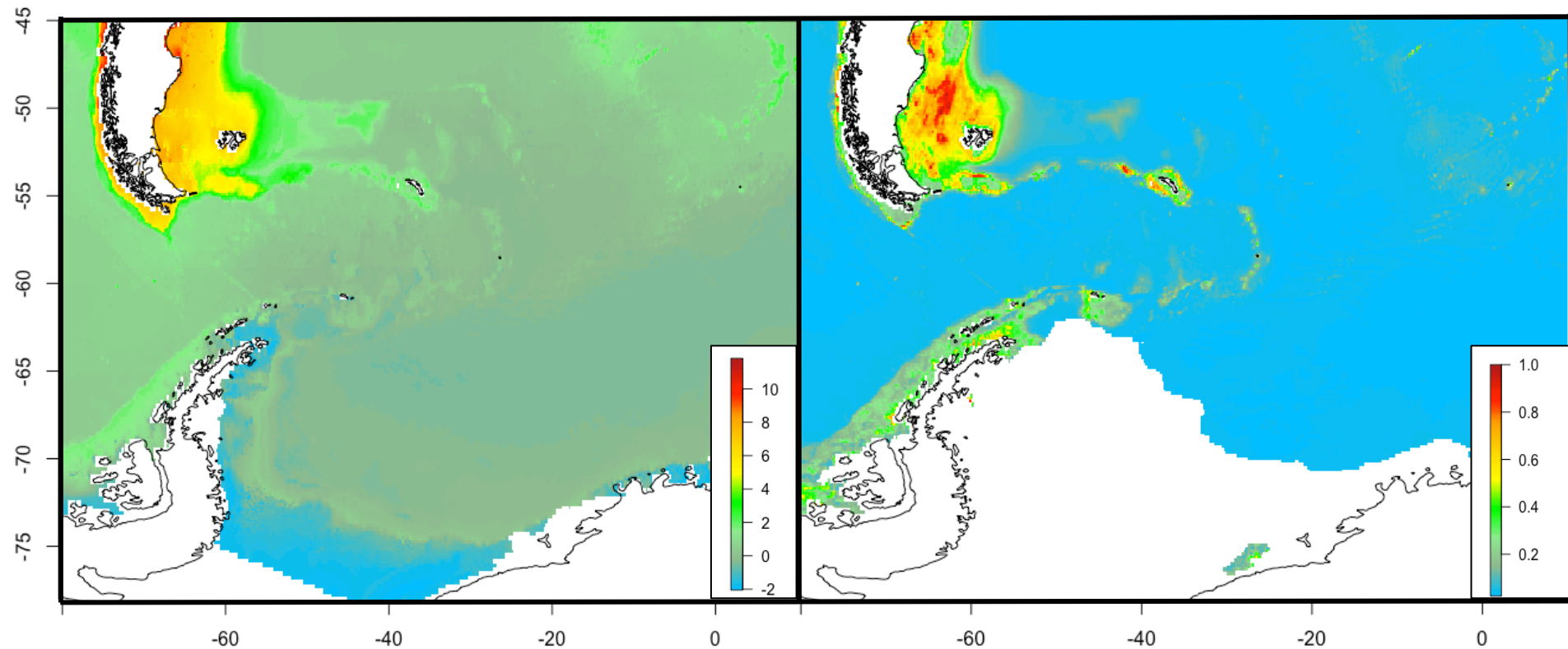
At 20°C
=> pR = 30 000 eggs.year⁻¹

At 10°C
=> pR = 1 000 eggs.year⁻¹

Proxy temperatures and functional response:

Floor T° (°C)
Annual mean, 2005-2012 (WOCE)

Particulate Organic Carbon export (gC.m⁻².d⁻¹)
Annual mean, 2003-2015



(Lutz et al. 2007, Woolley et al. 2016, Guillaumot et al. 2017)