

# **Fishing down functional groups: Transition between urchins and fishes affects algal dynamics on Kenyan reefs**



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**Rhodes University, Grahamstown South Africa  
Wildlife Conservation Society, Bronx USA**

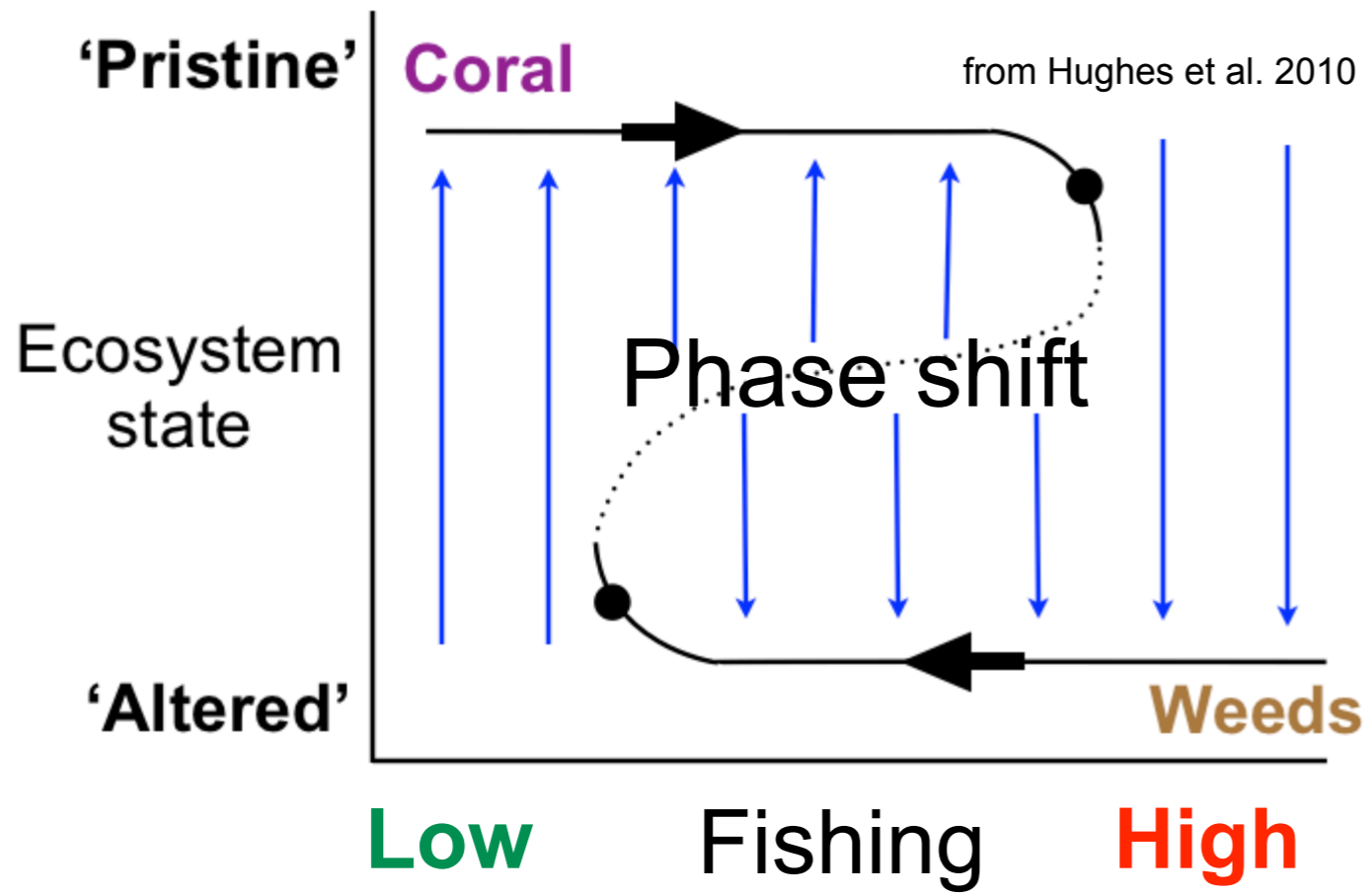




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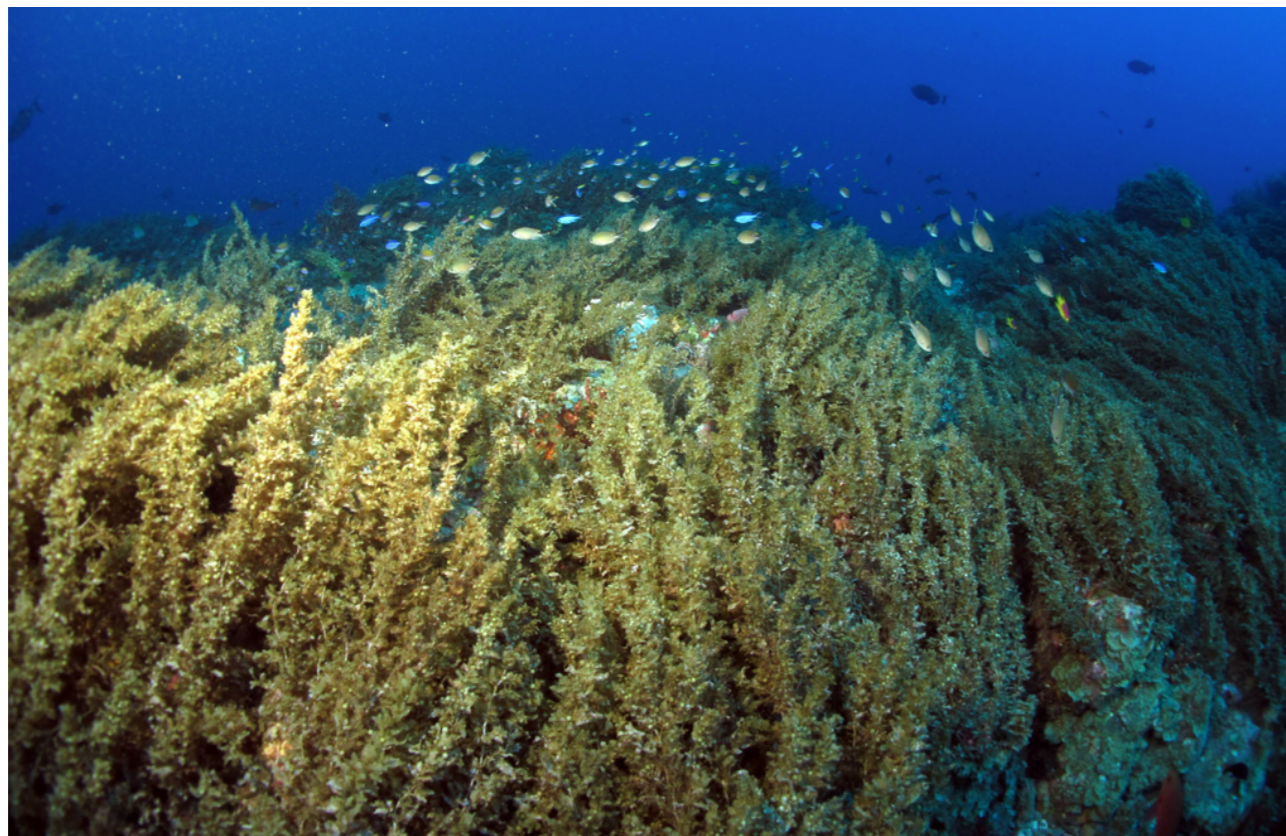
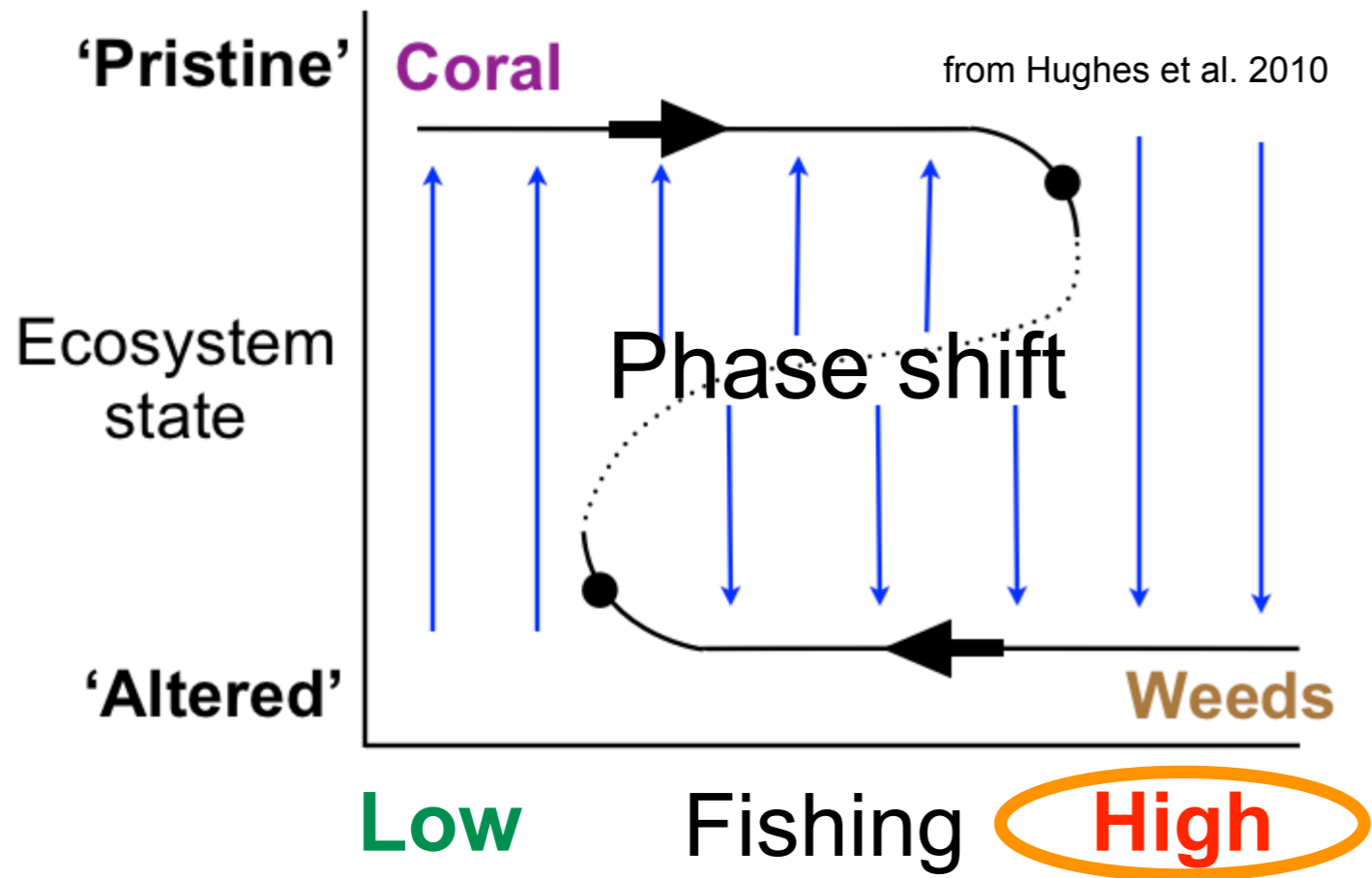




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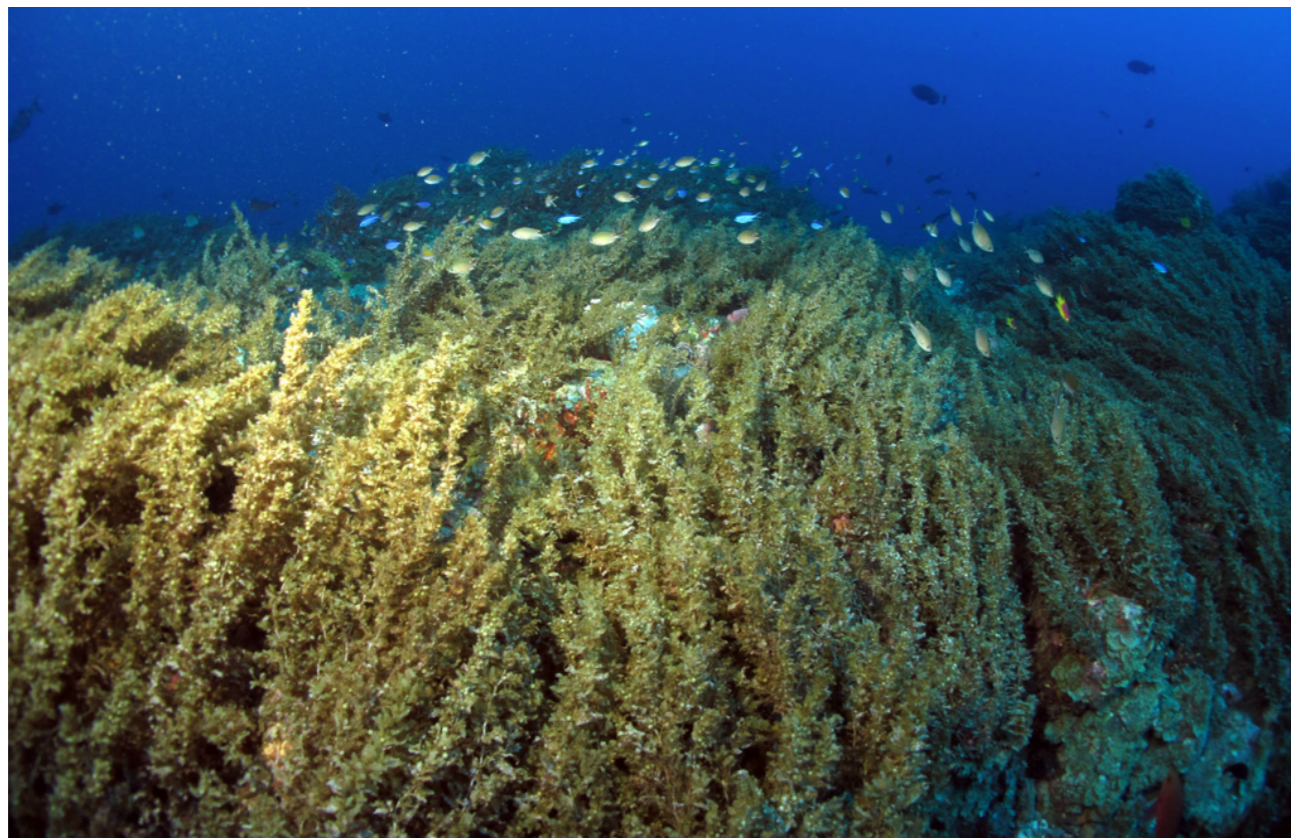
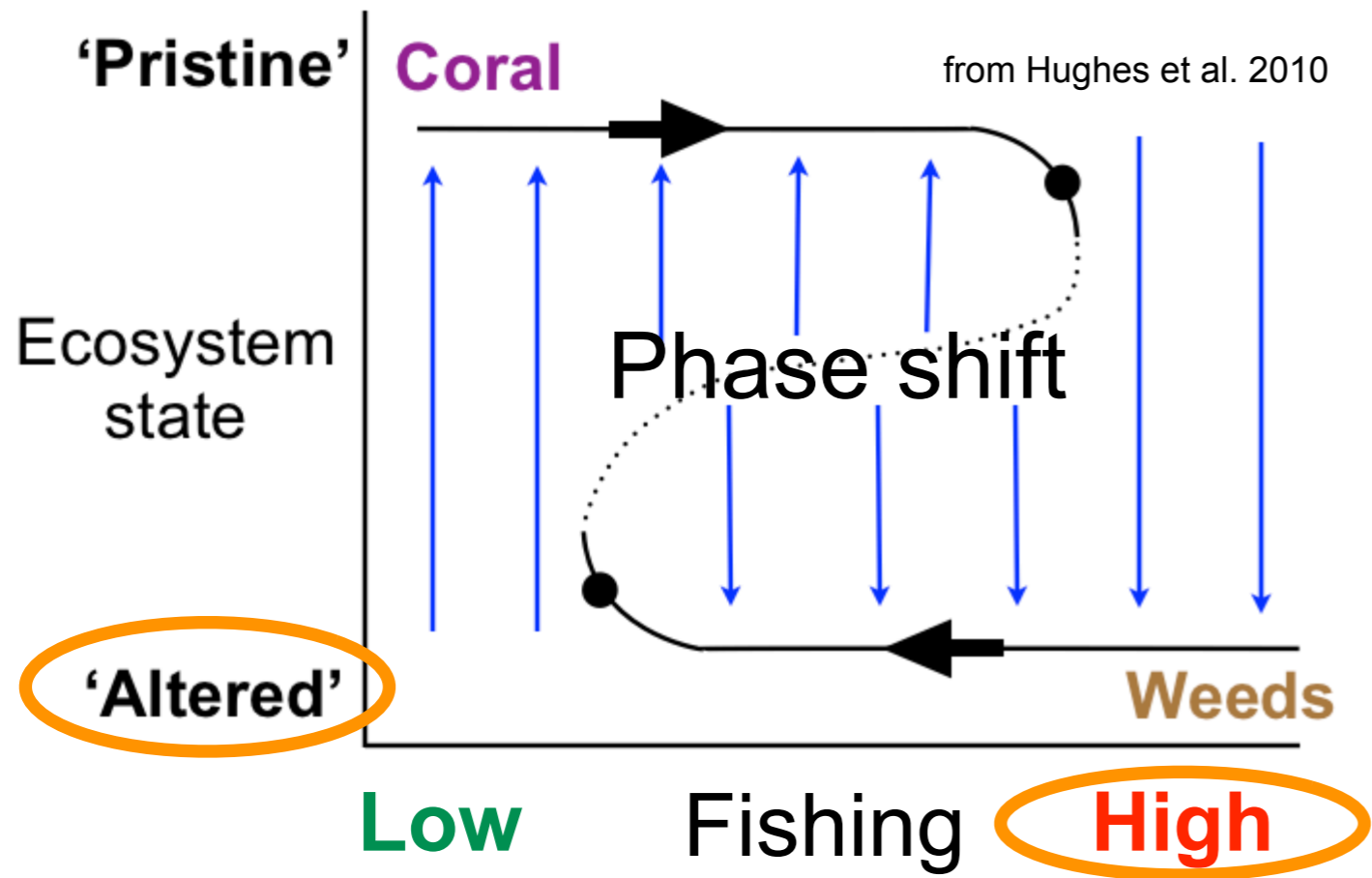




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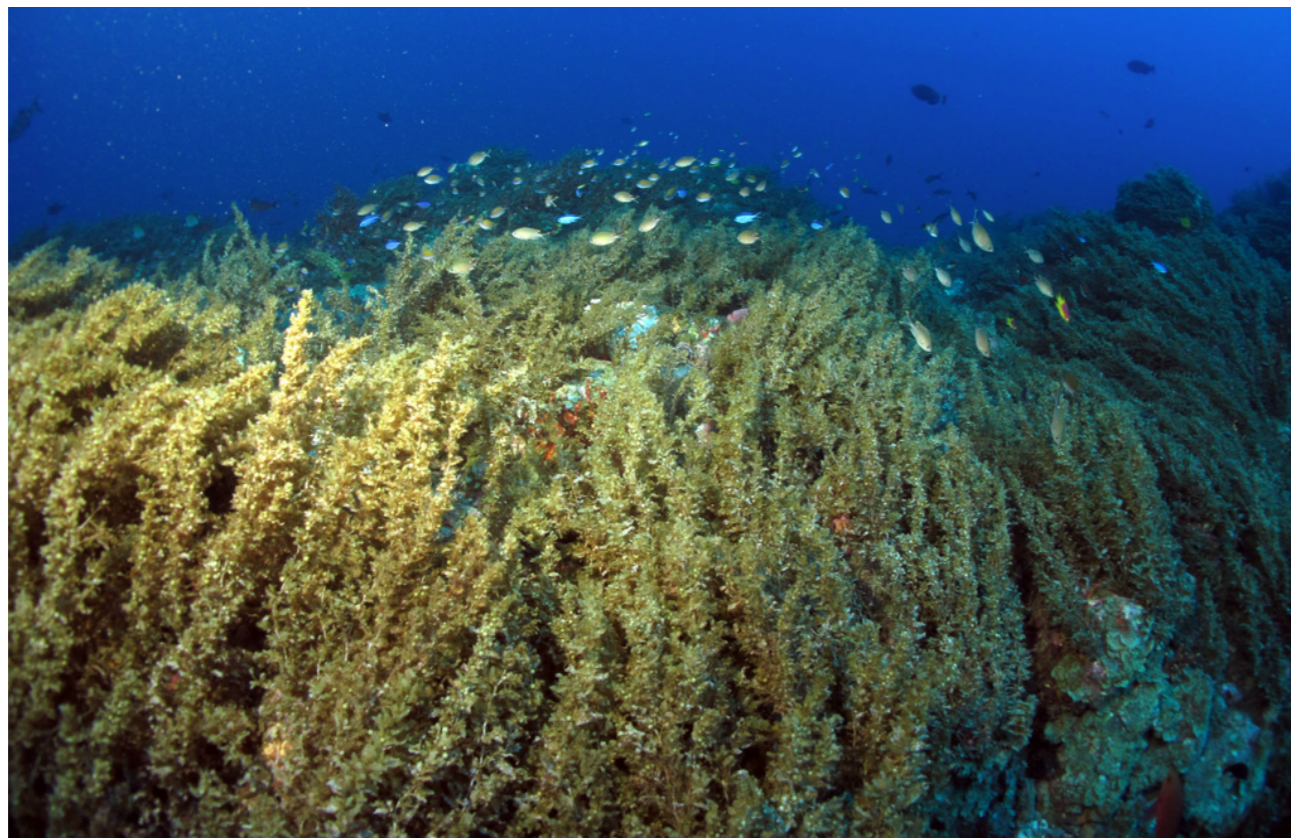
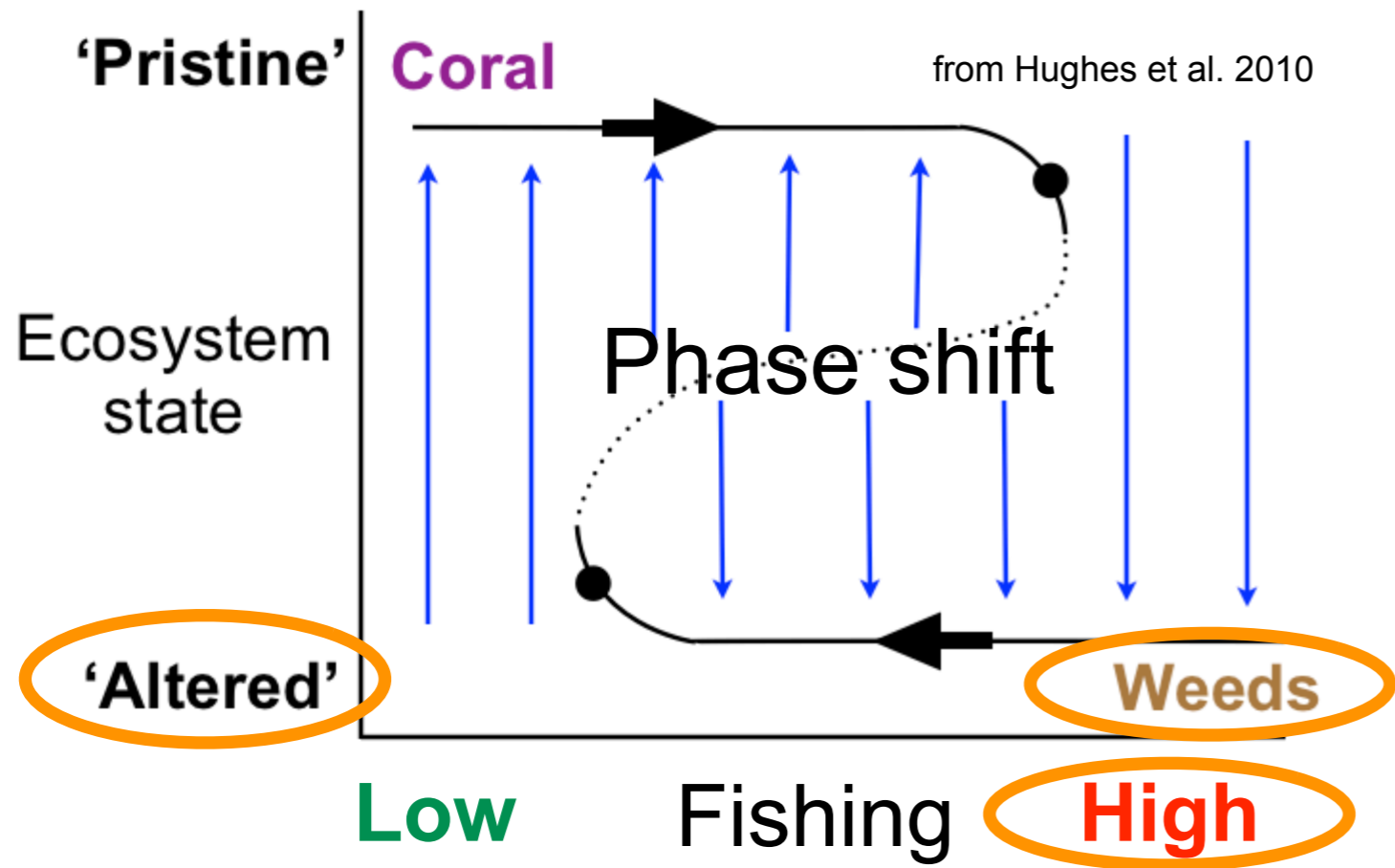




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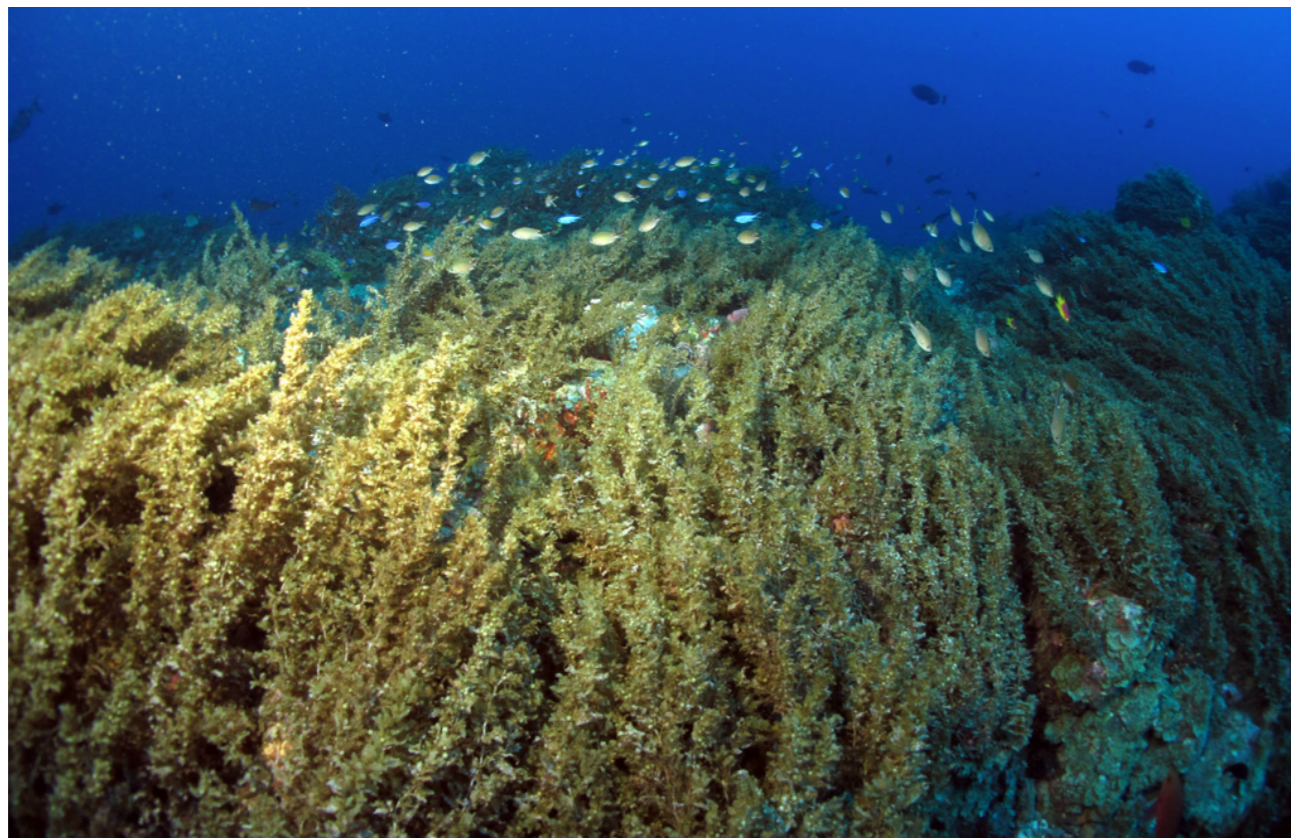
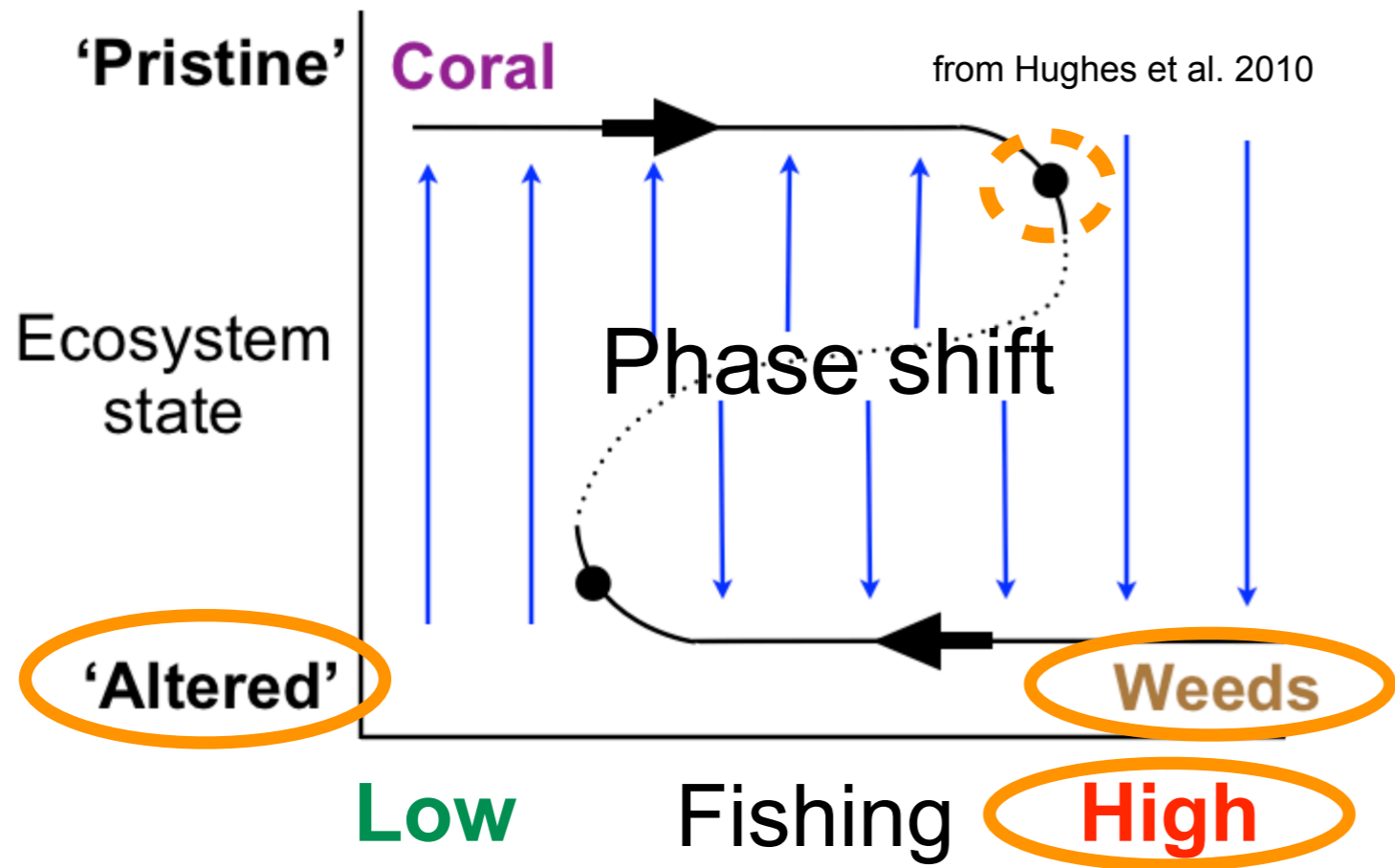




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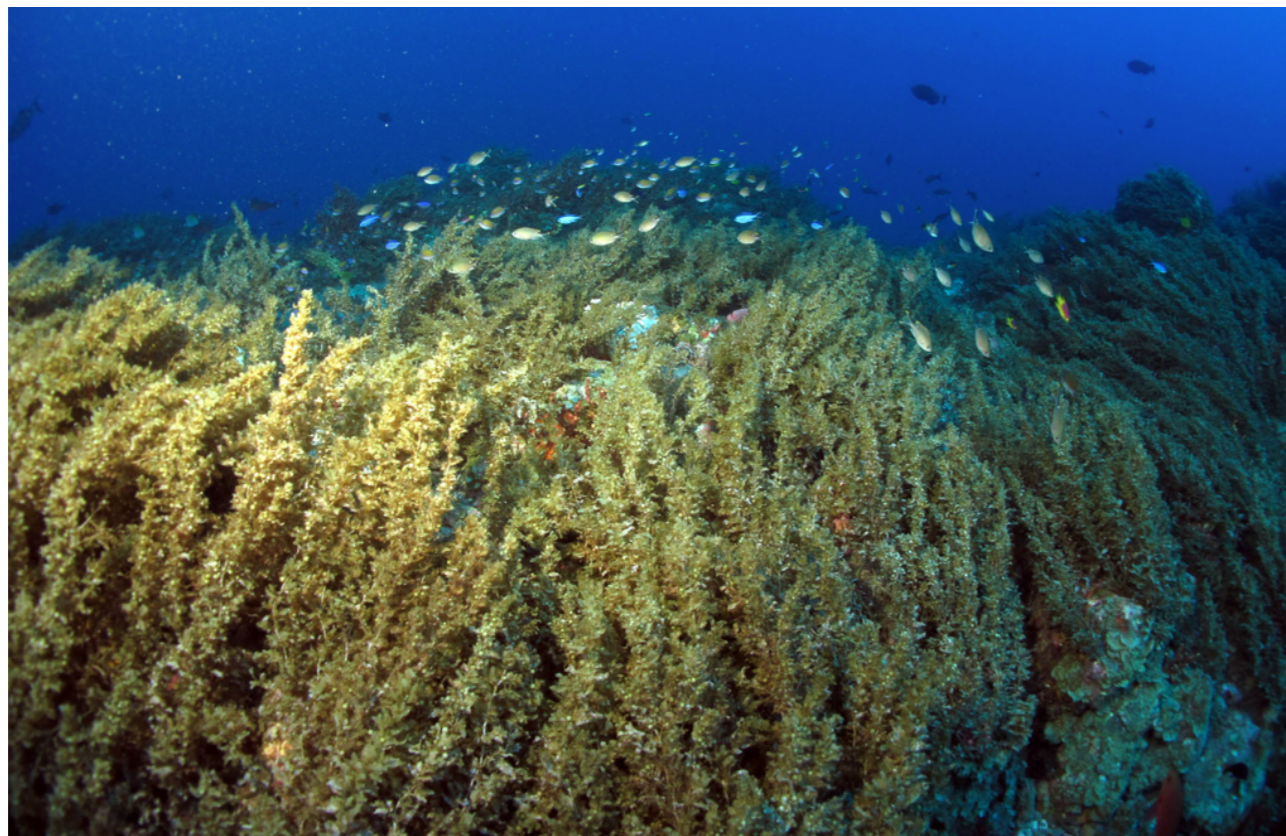
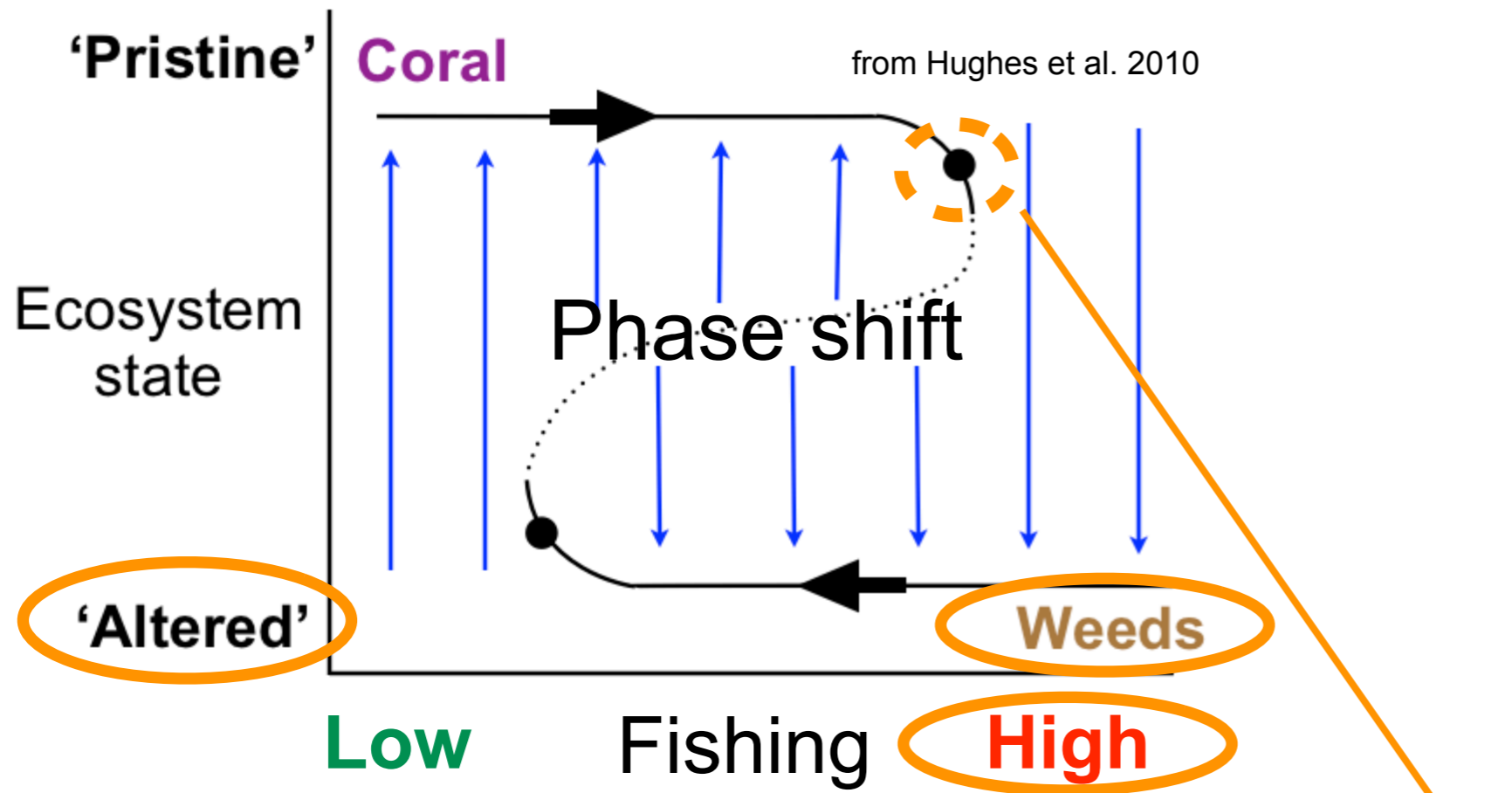




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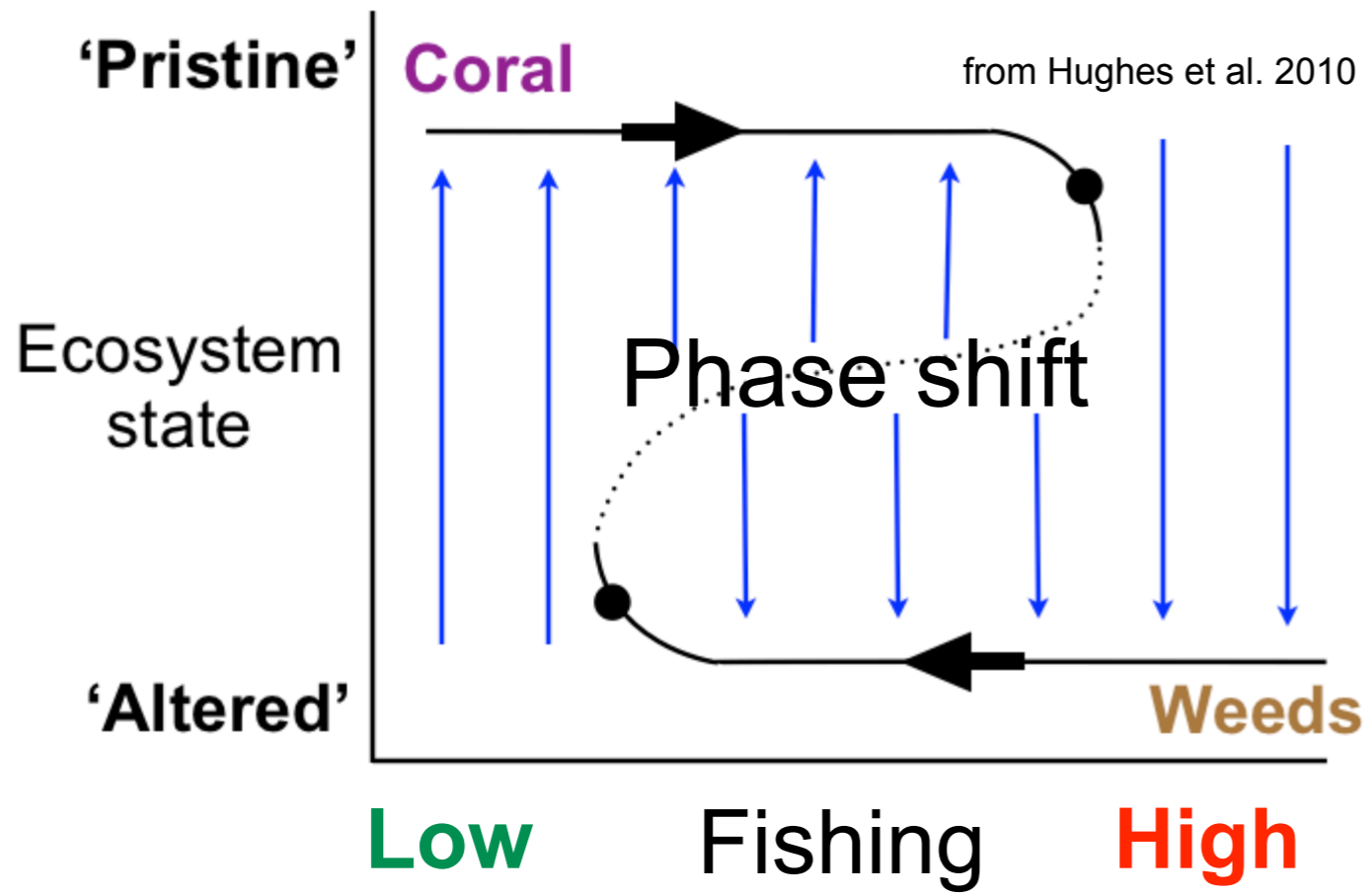




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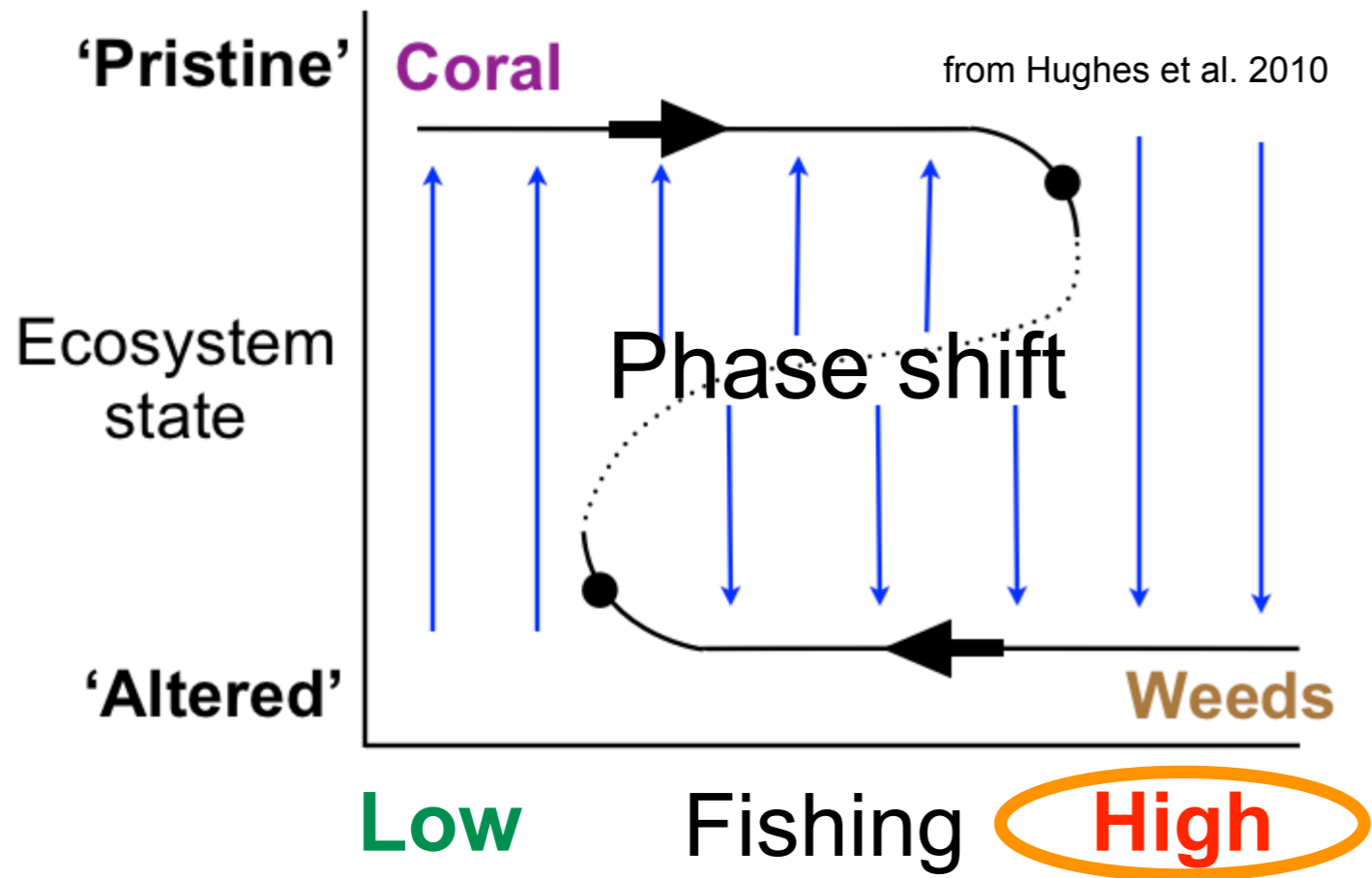




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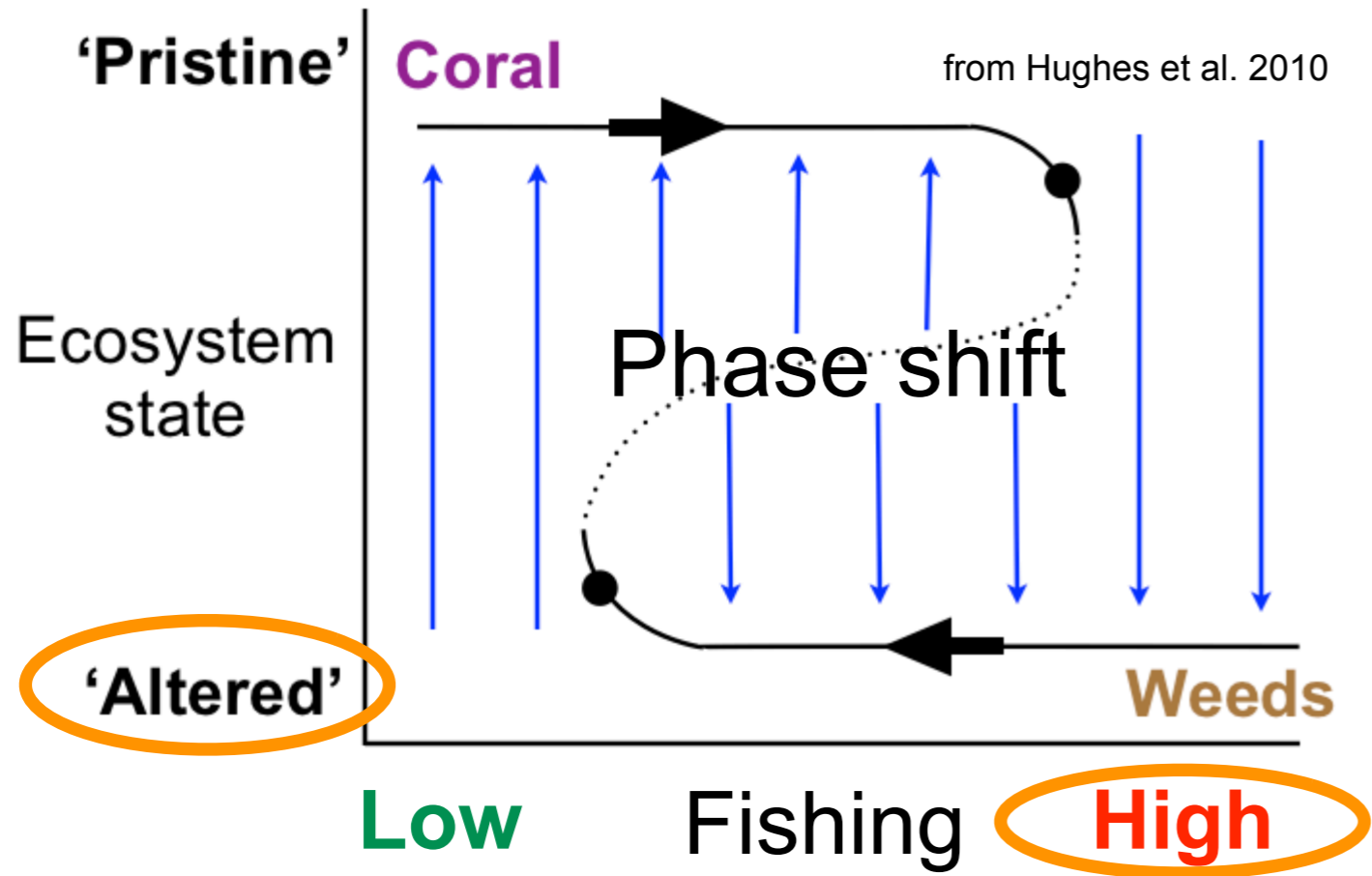




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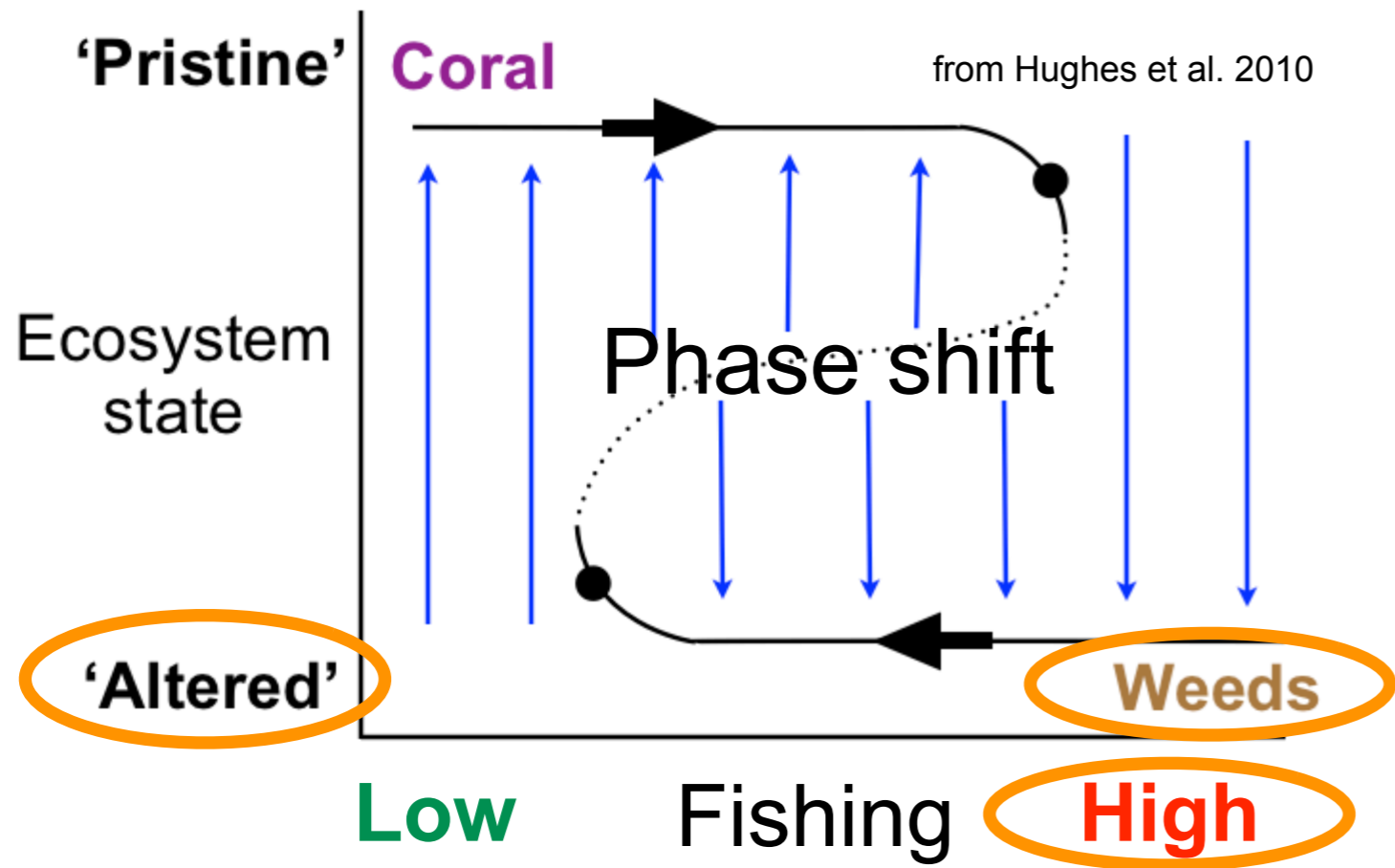




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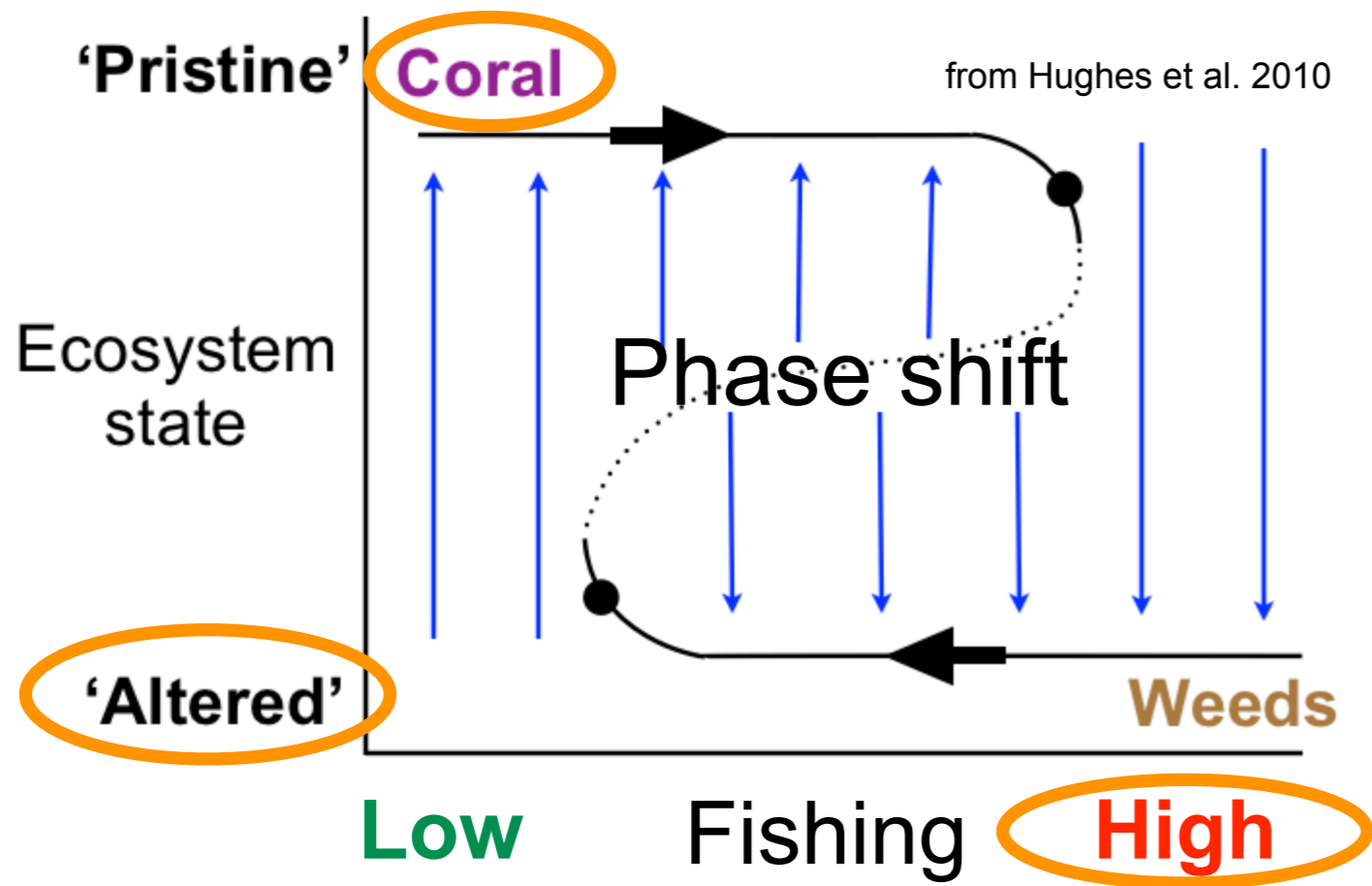




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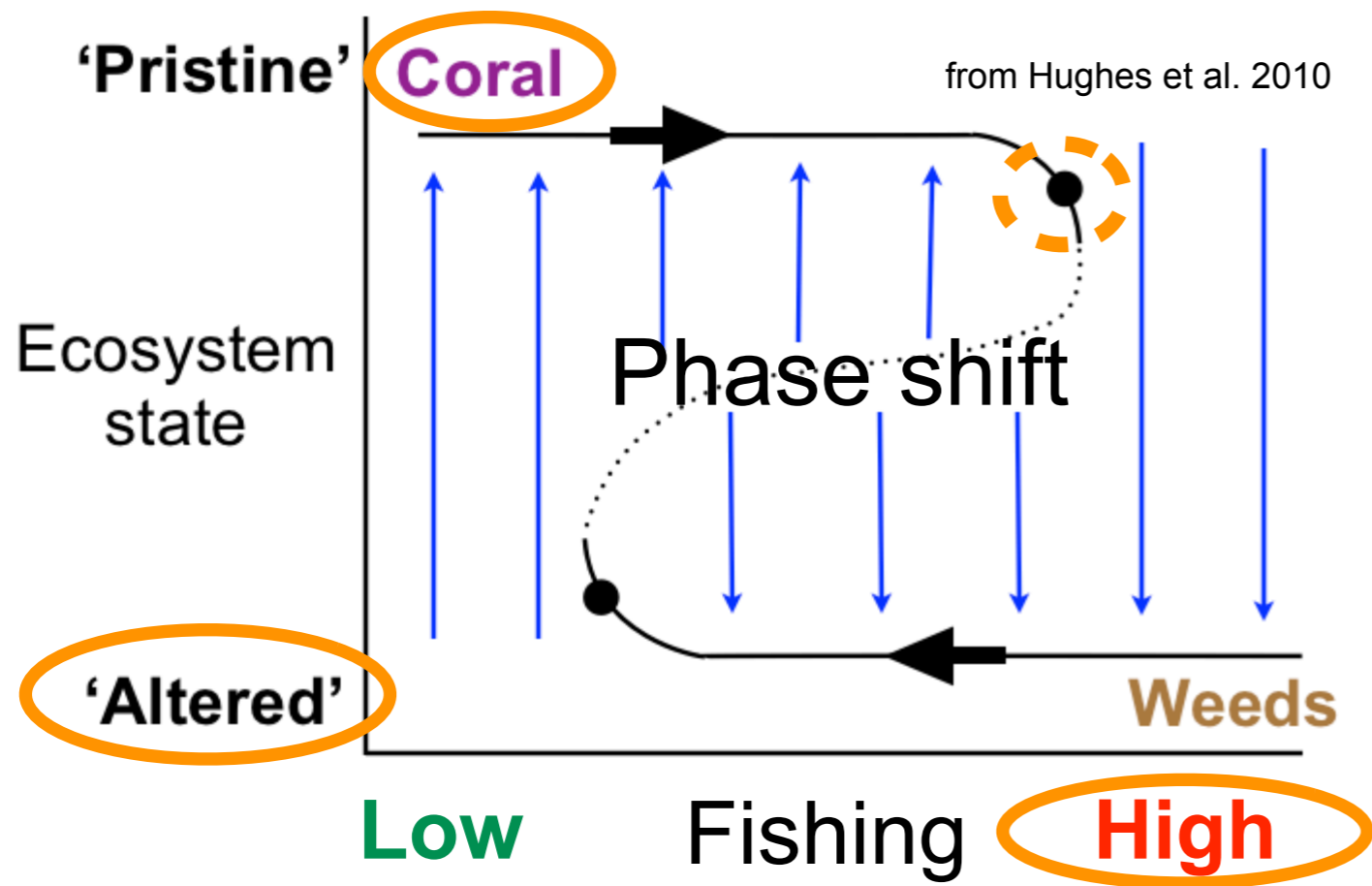




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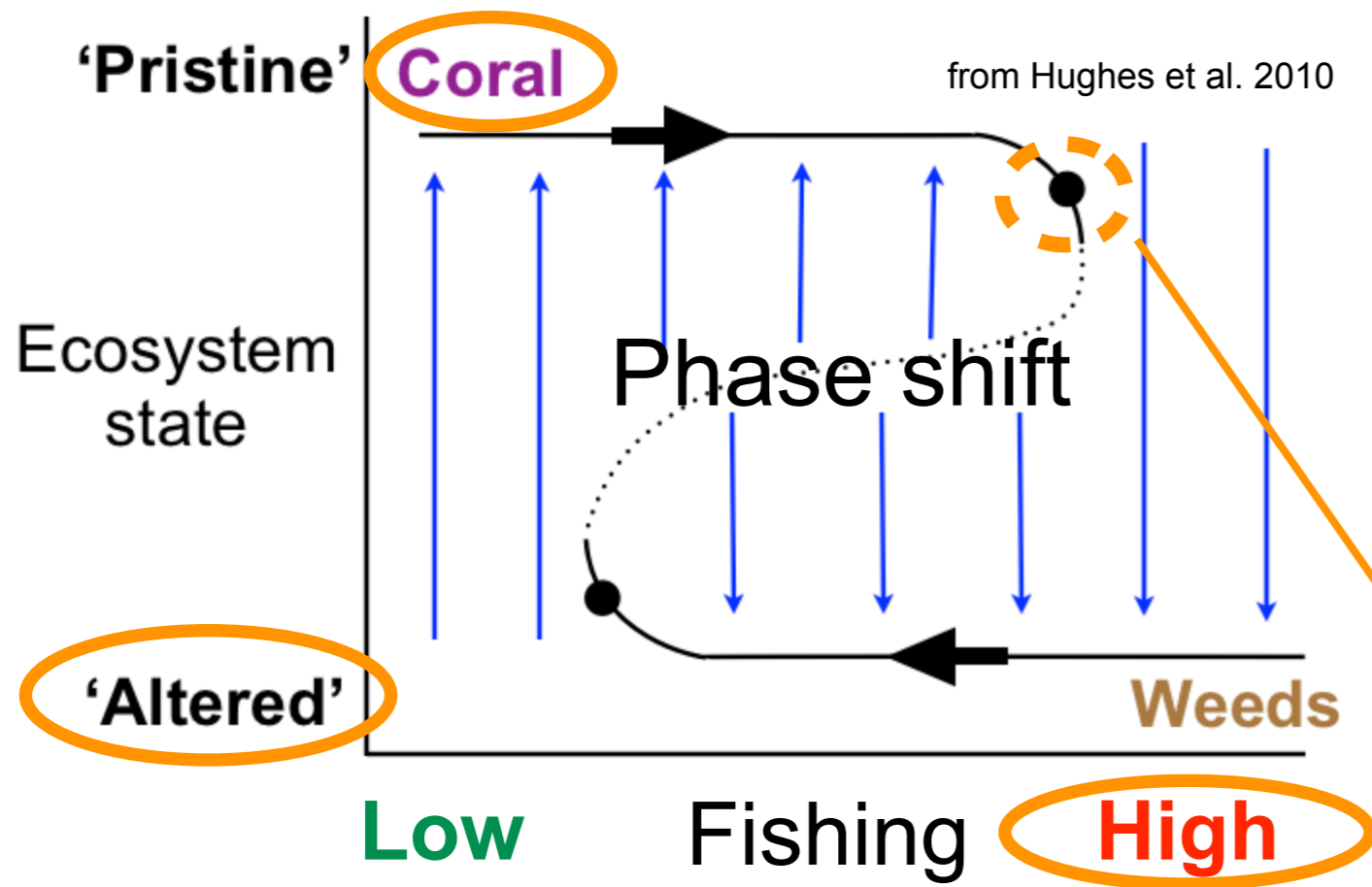




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**Where are Kenyan reefs most vulnerable to phase shifts?**



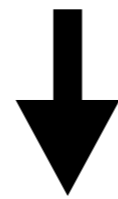
Where are Kenyan reefs most vulnerable to phase shifts?

**How does the transition between urchins and fishes affect algal dynamics?**



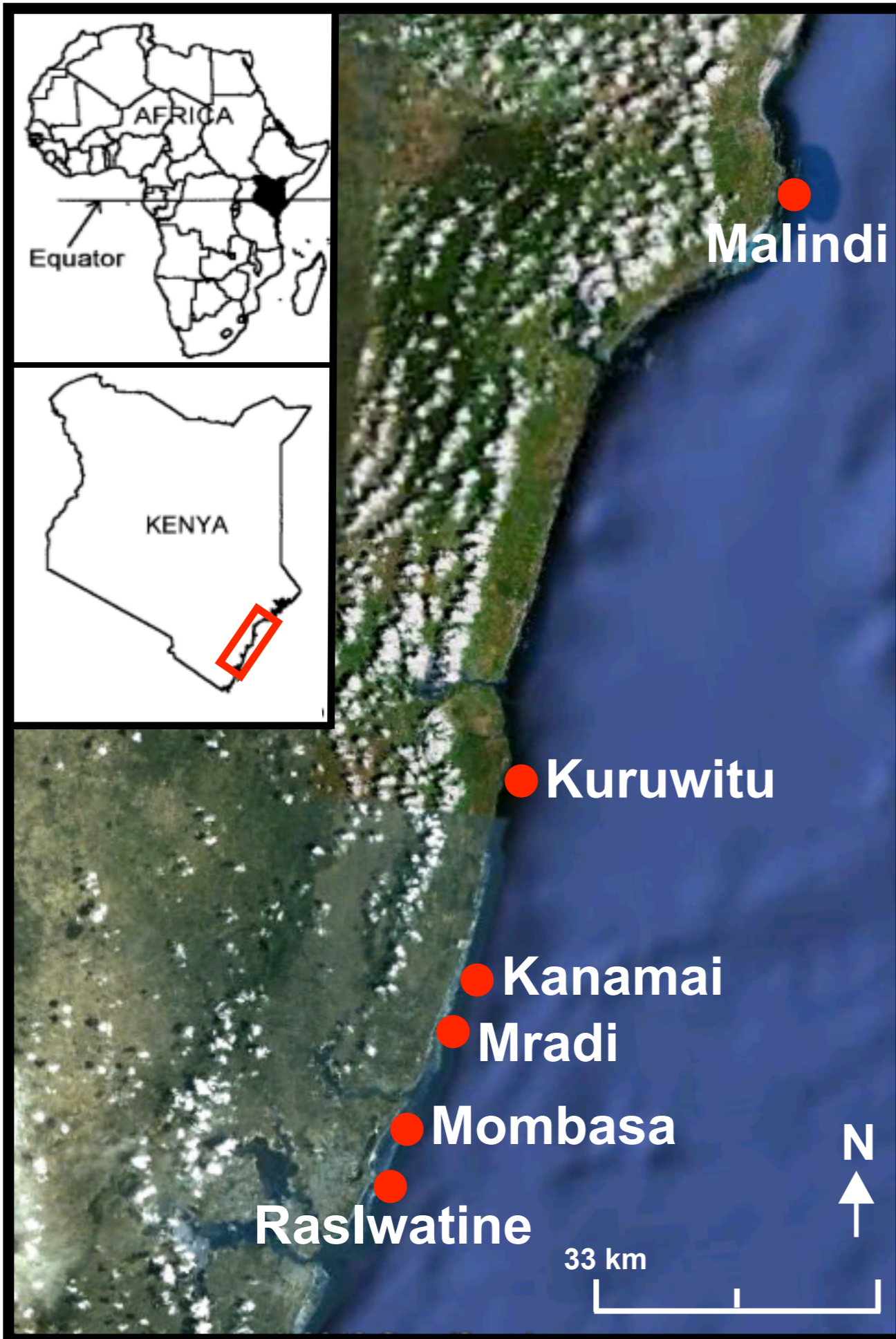
Where are Kenyan reefs most vulnerable to phase shifts?

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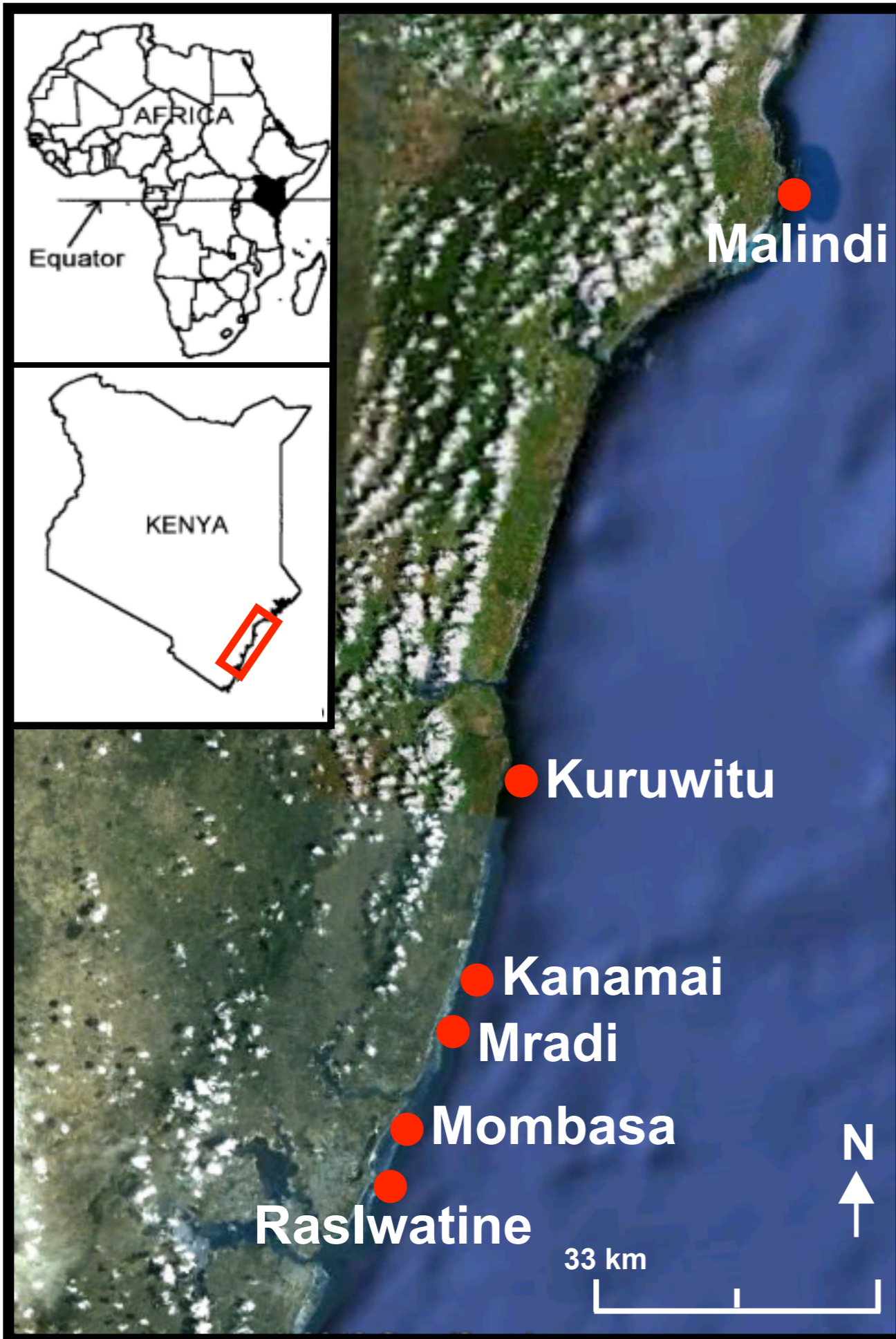
**Who is responsible?**





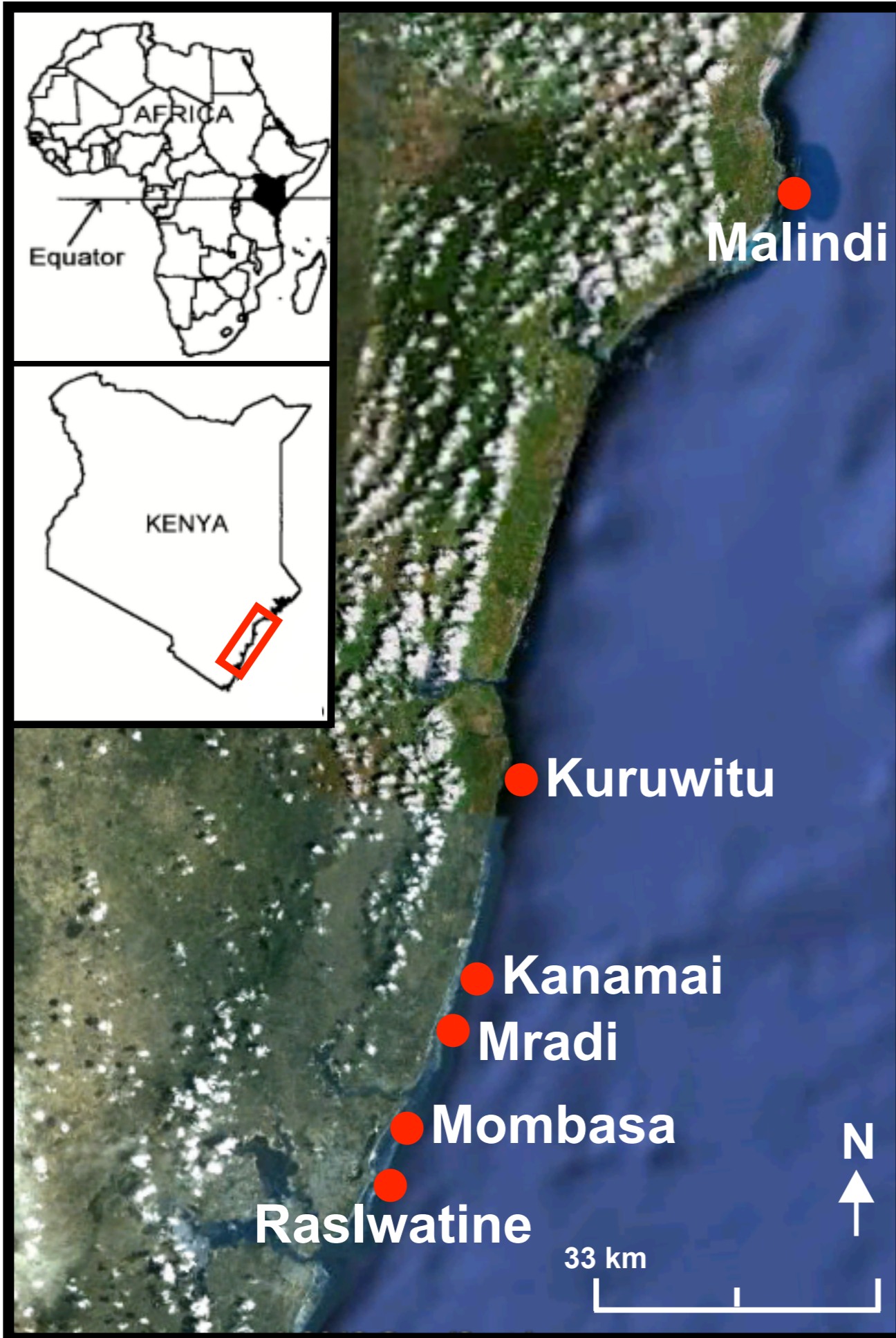
Gradient of:  
**Urchin biomass**  
&  
**Total fish biomass**



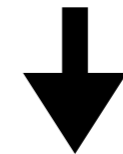


Gradient of:  
**Urchin biomass**  
&  
**Total fish biomass**  
↓  
Herbivore biomass

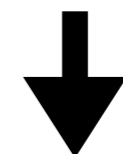




Gradient of:  
**Urchin biomass**  
&  
**Total fish biomass**



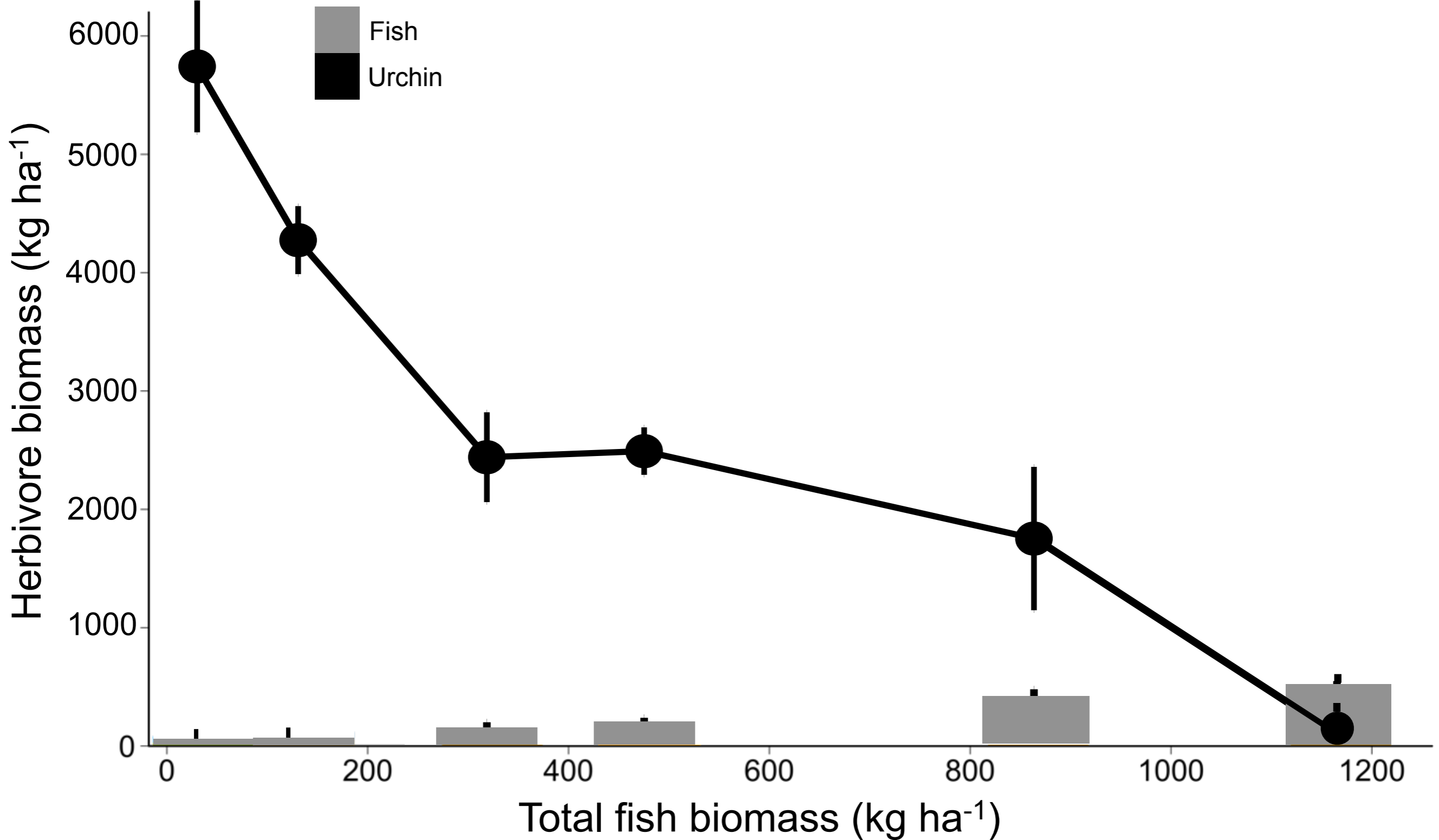
Herbivore biomass



**Scraper**  
**Browser**  
**Grazer**  
**Detritivore**

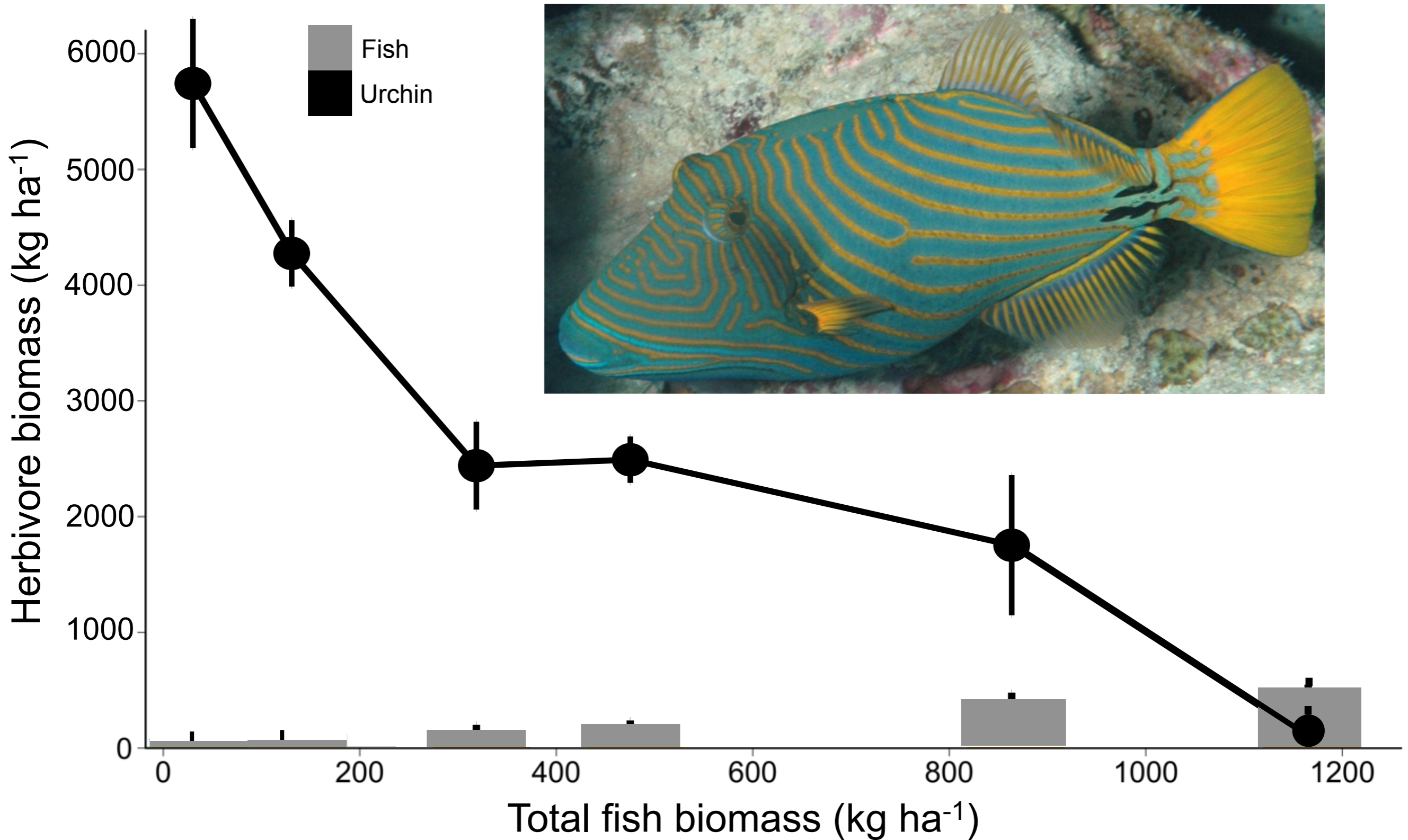


# Urchins are the dominant herbivore

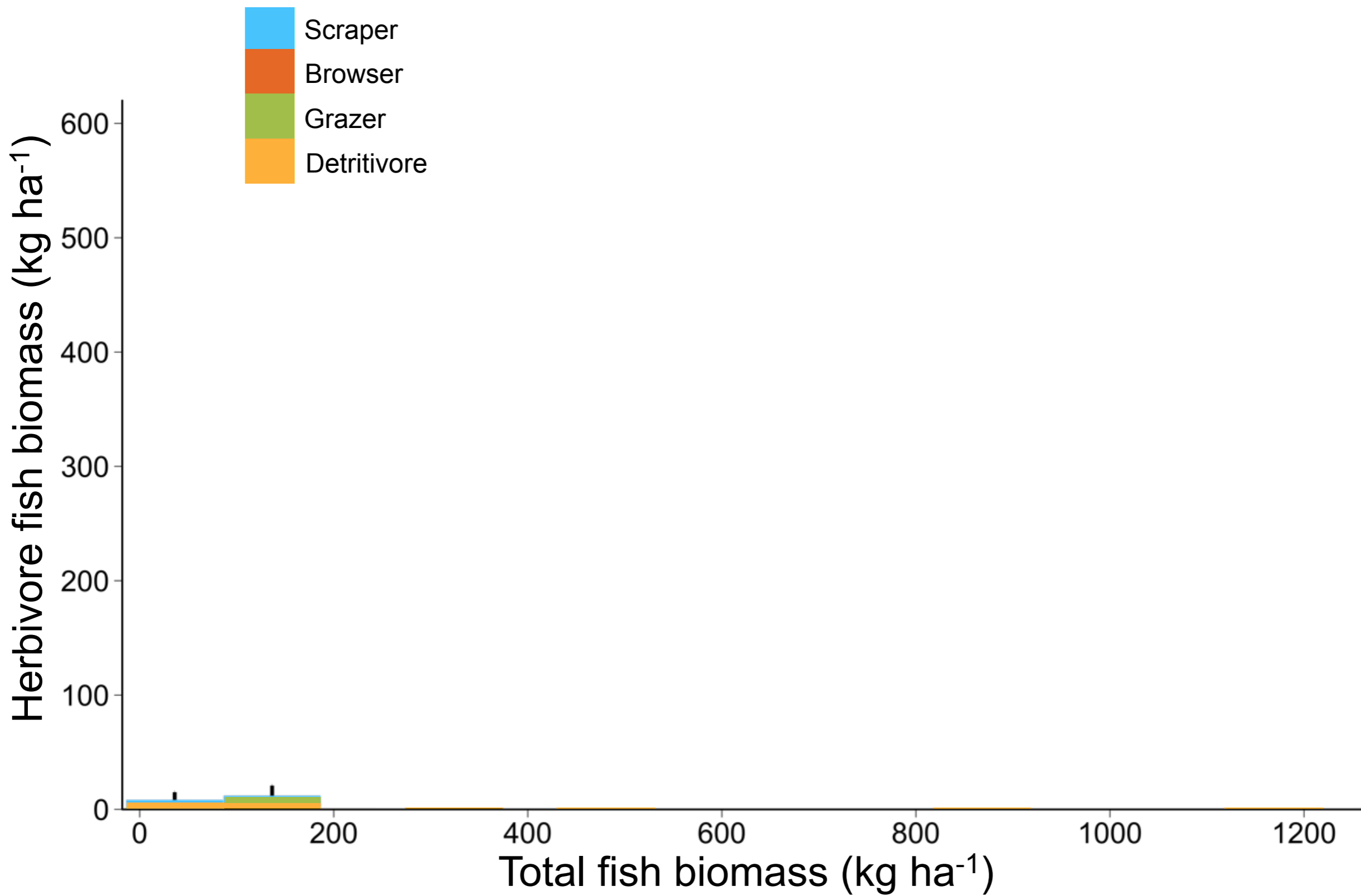




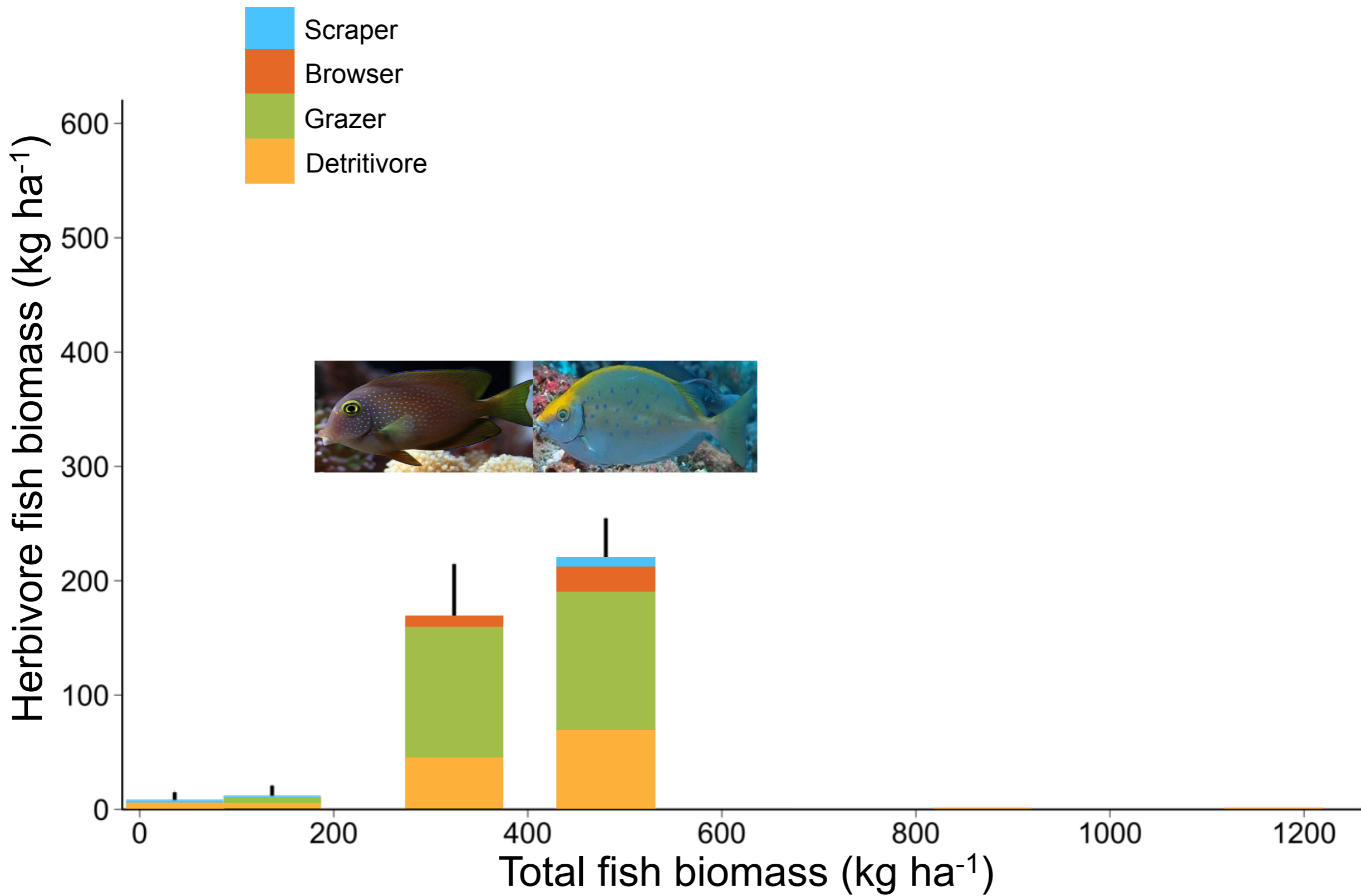
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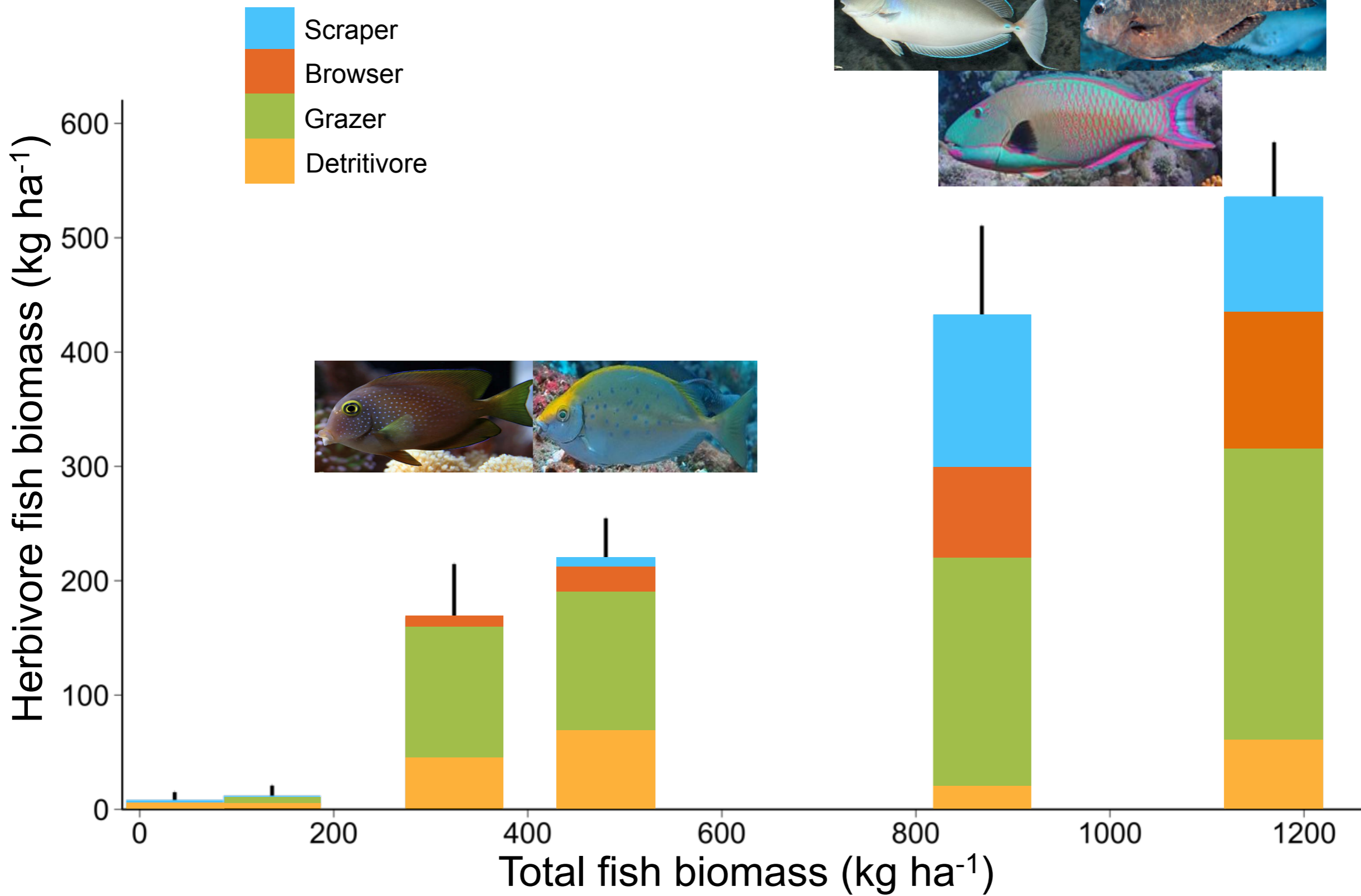




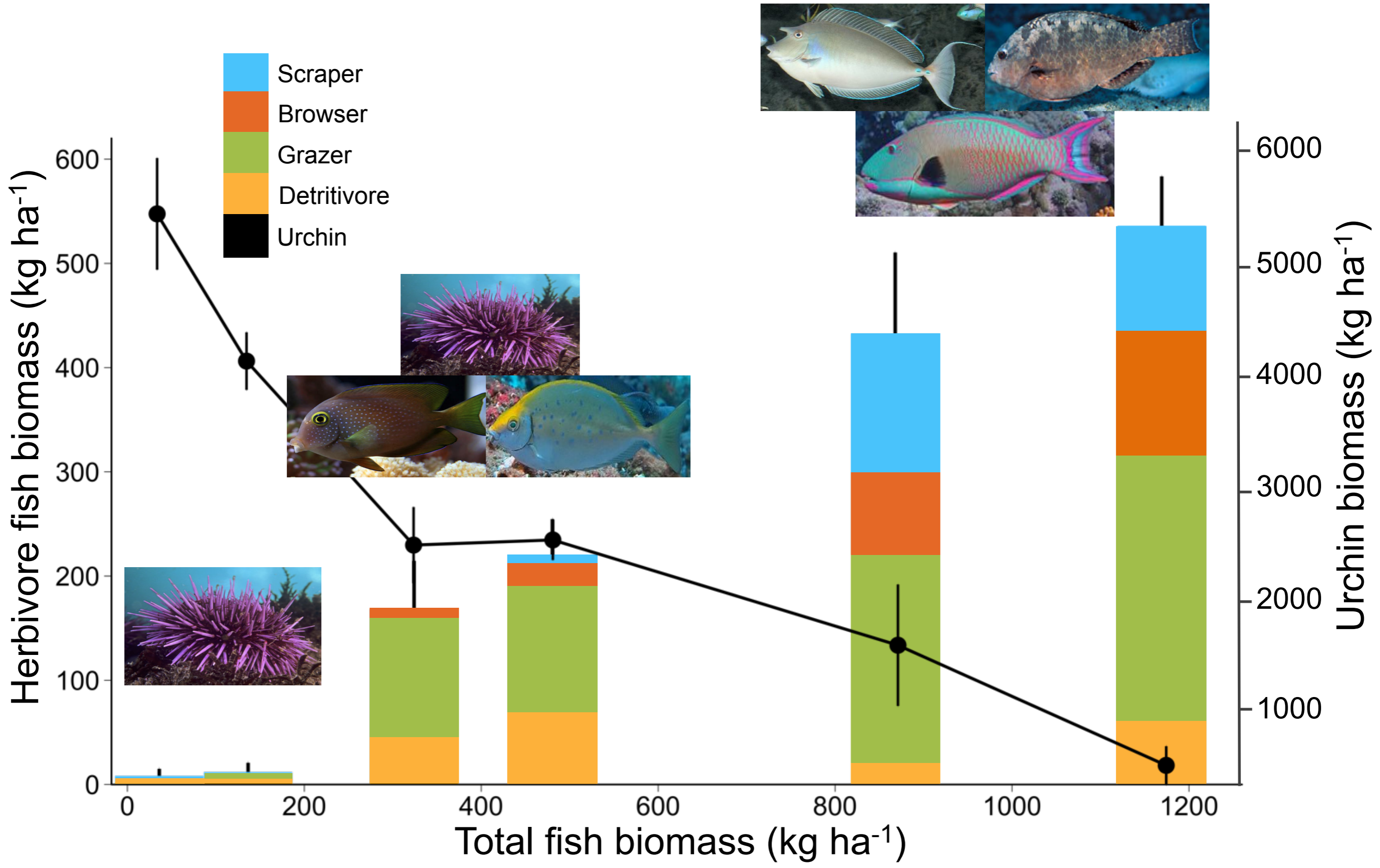




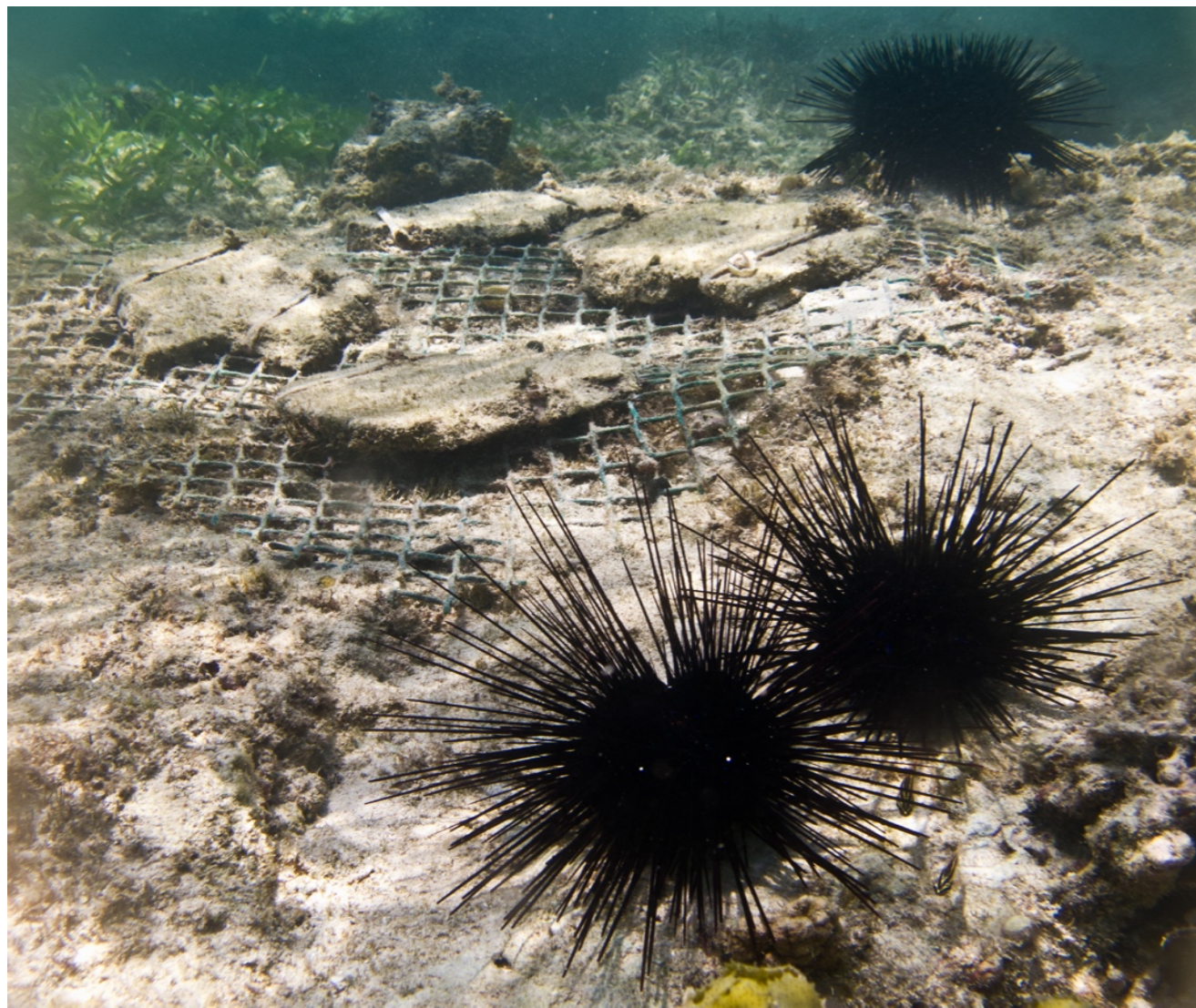
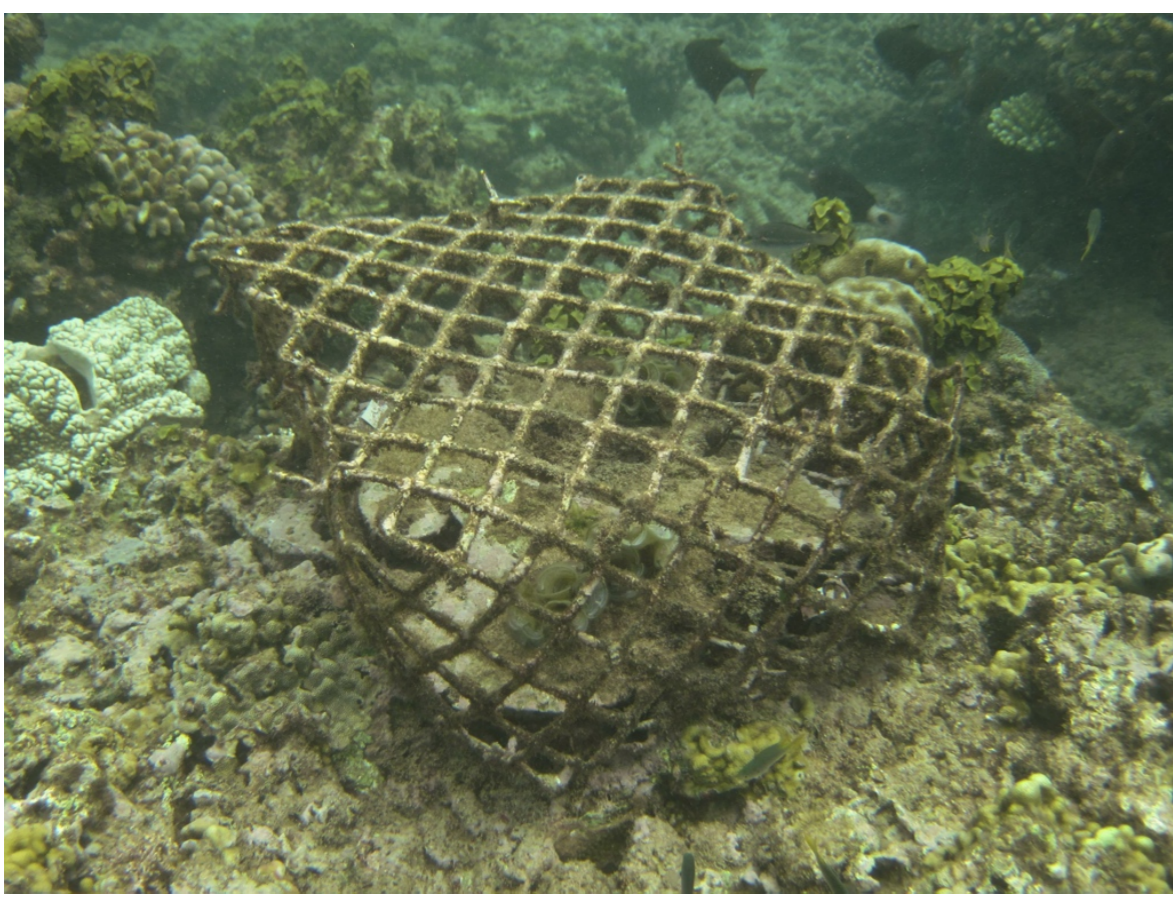






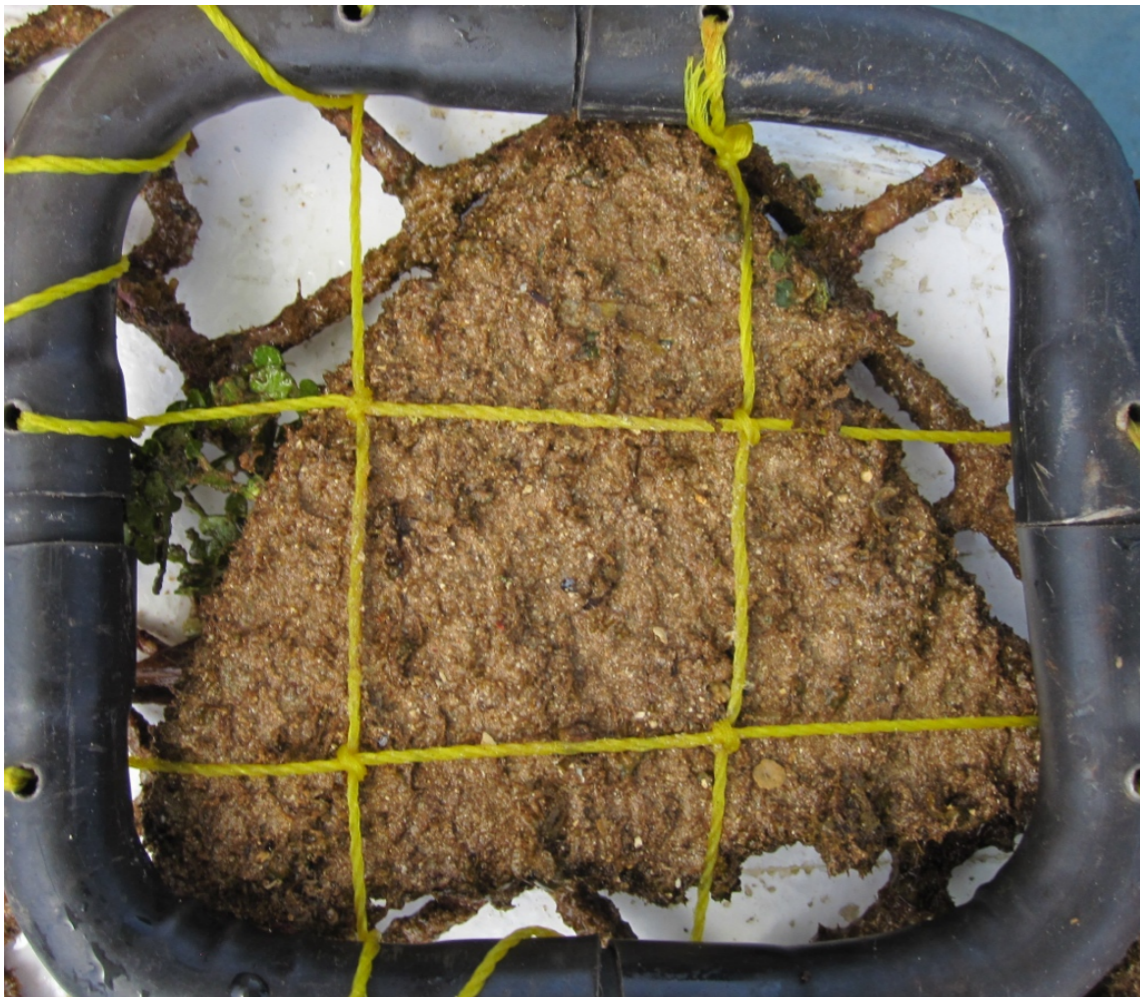






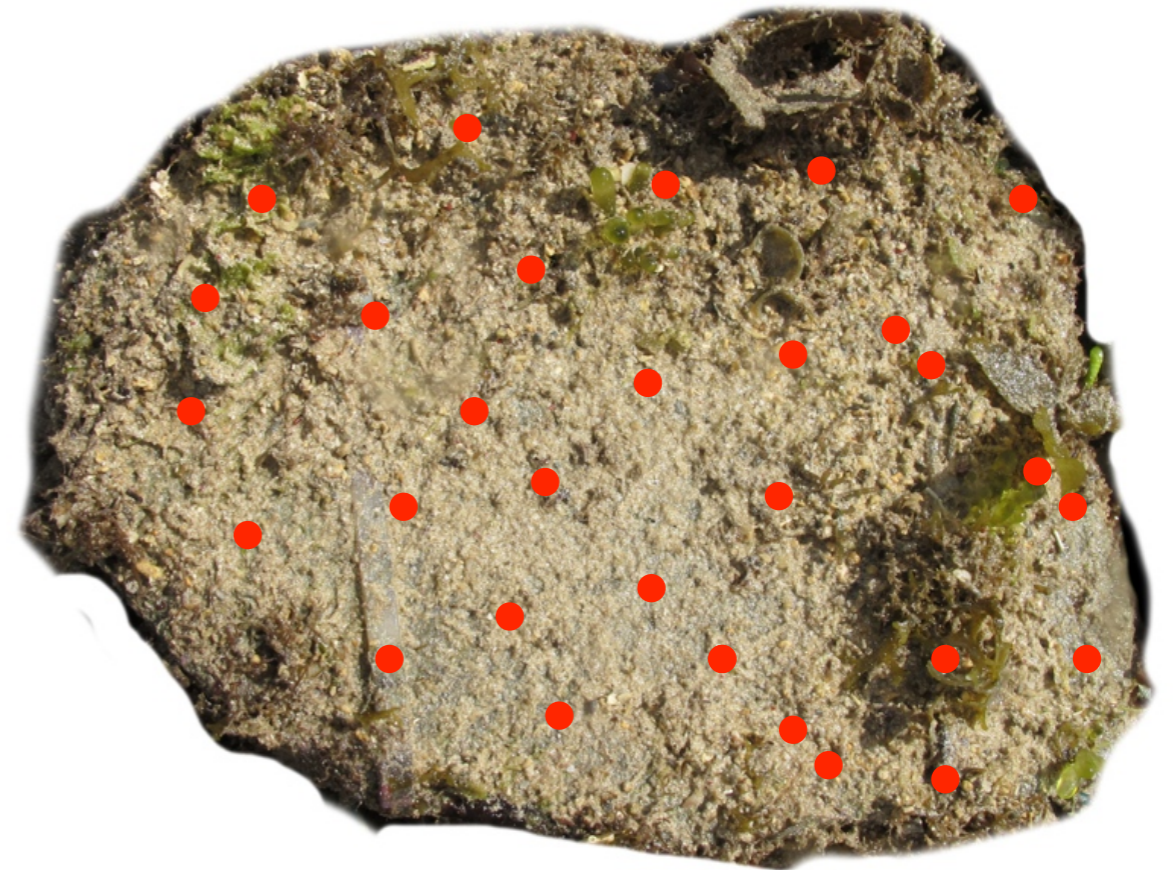


# Organic weight



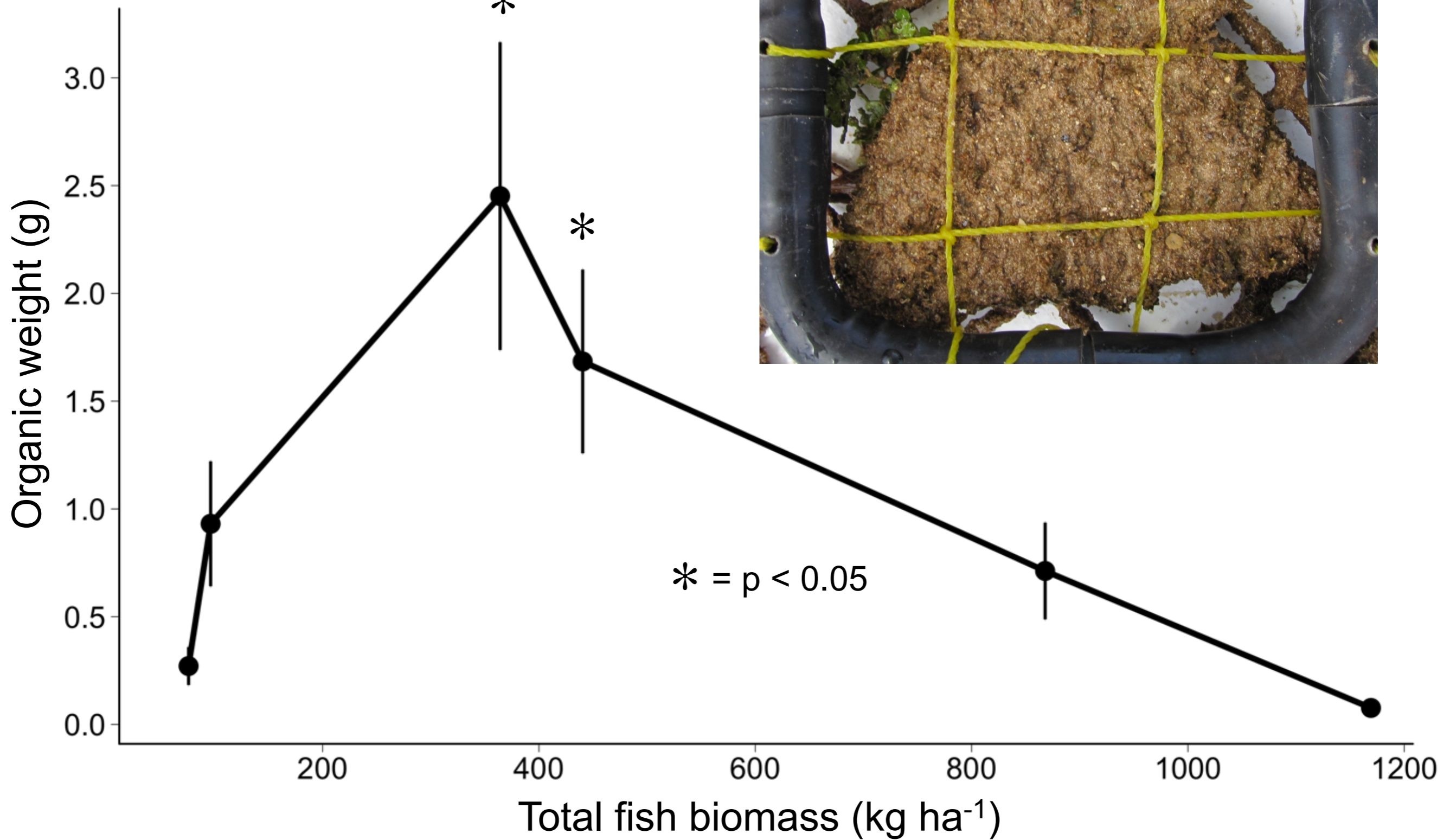
5 x 5 cm  
dry, decalcified wt

# Percent cover

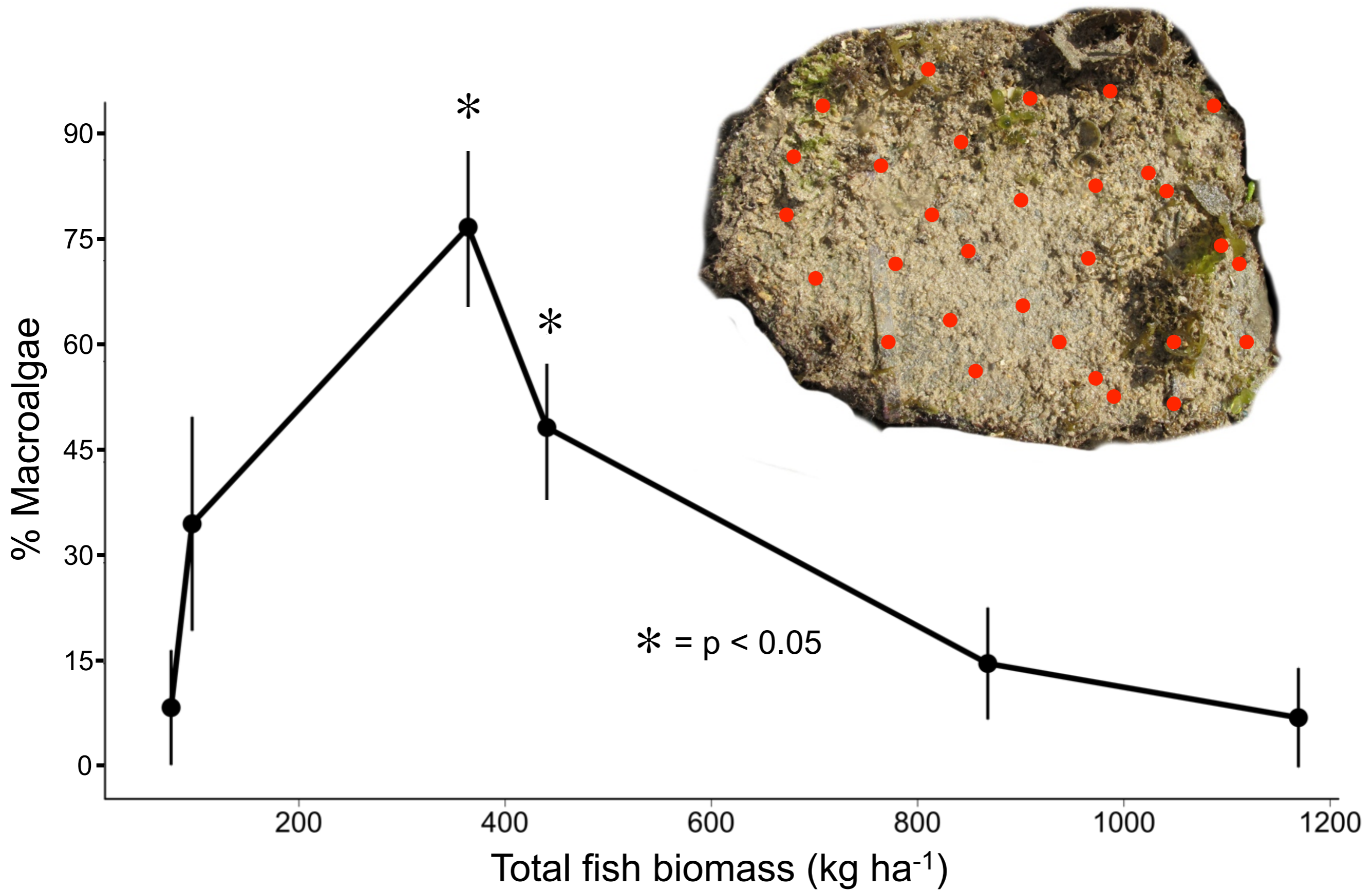


point-intercept  
50 random points  
genus-level id

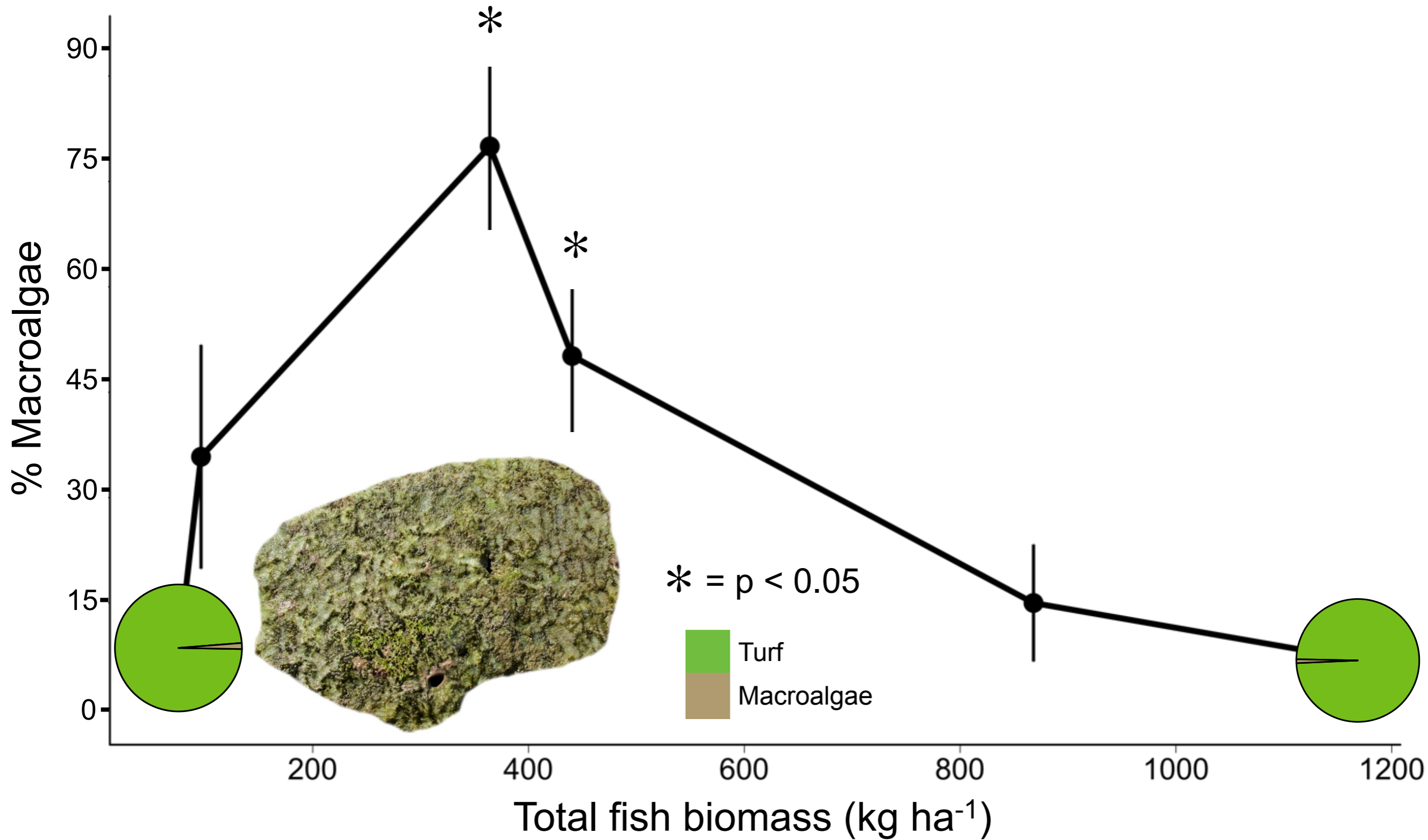




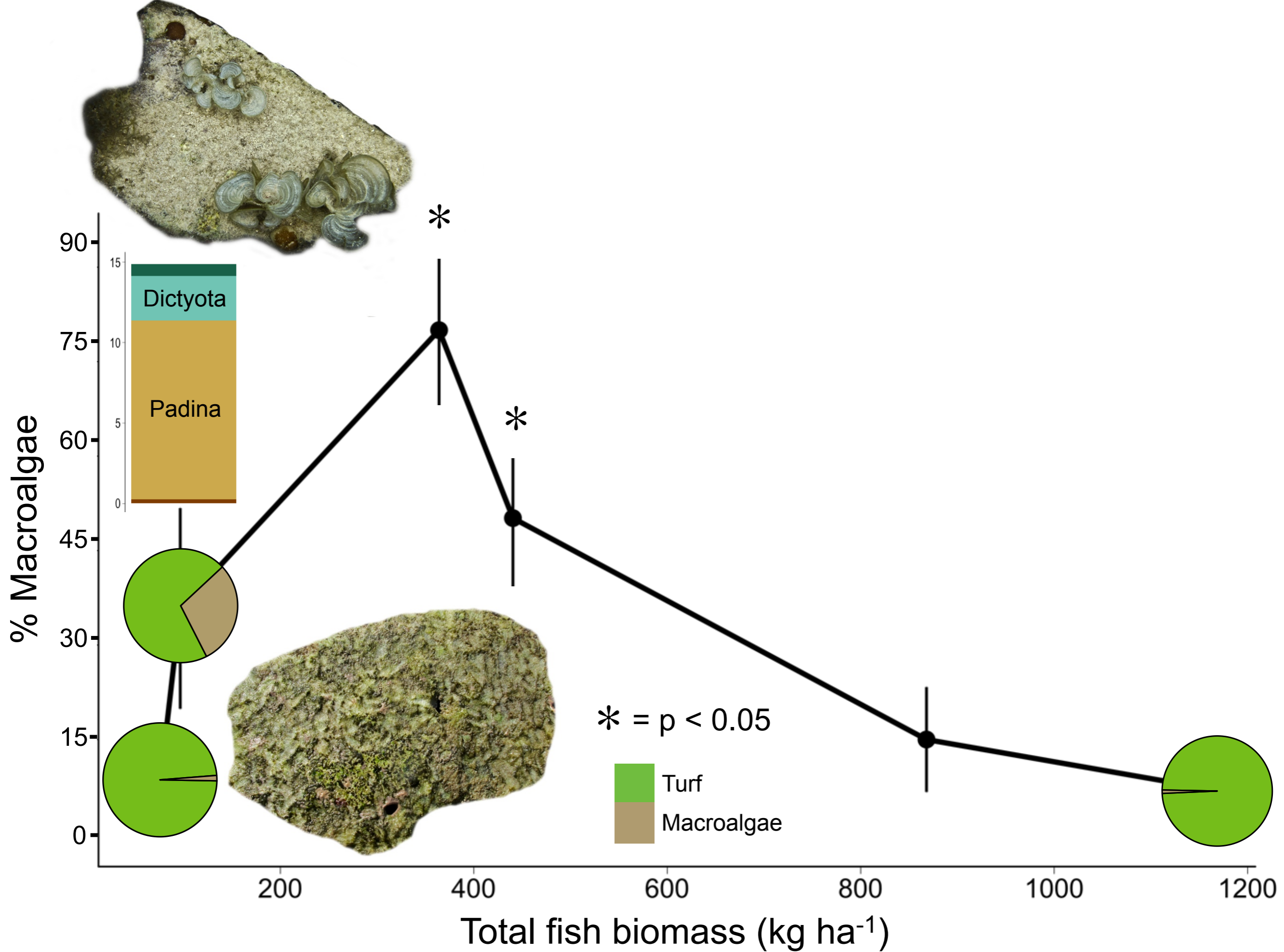




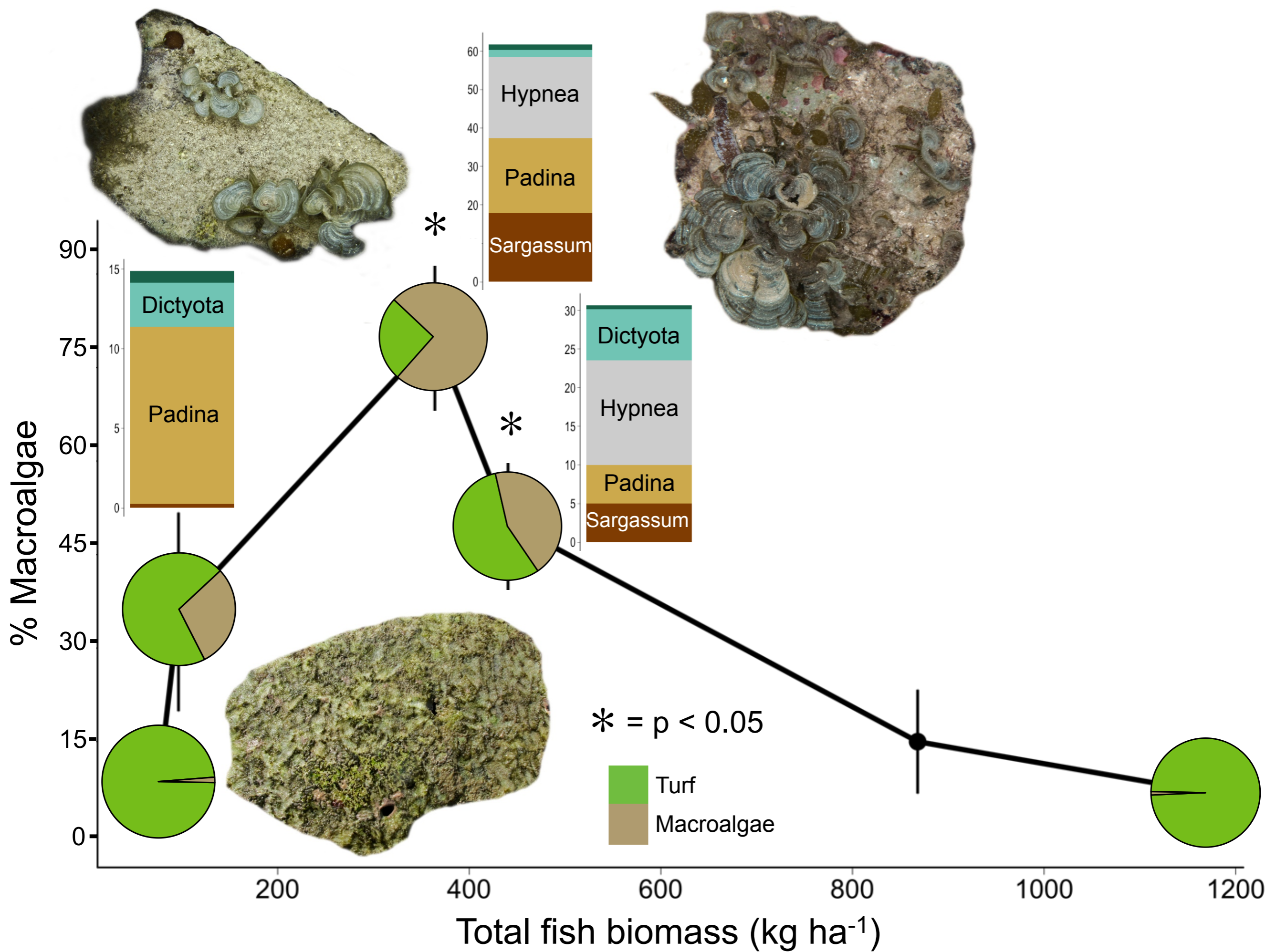




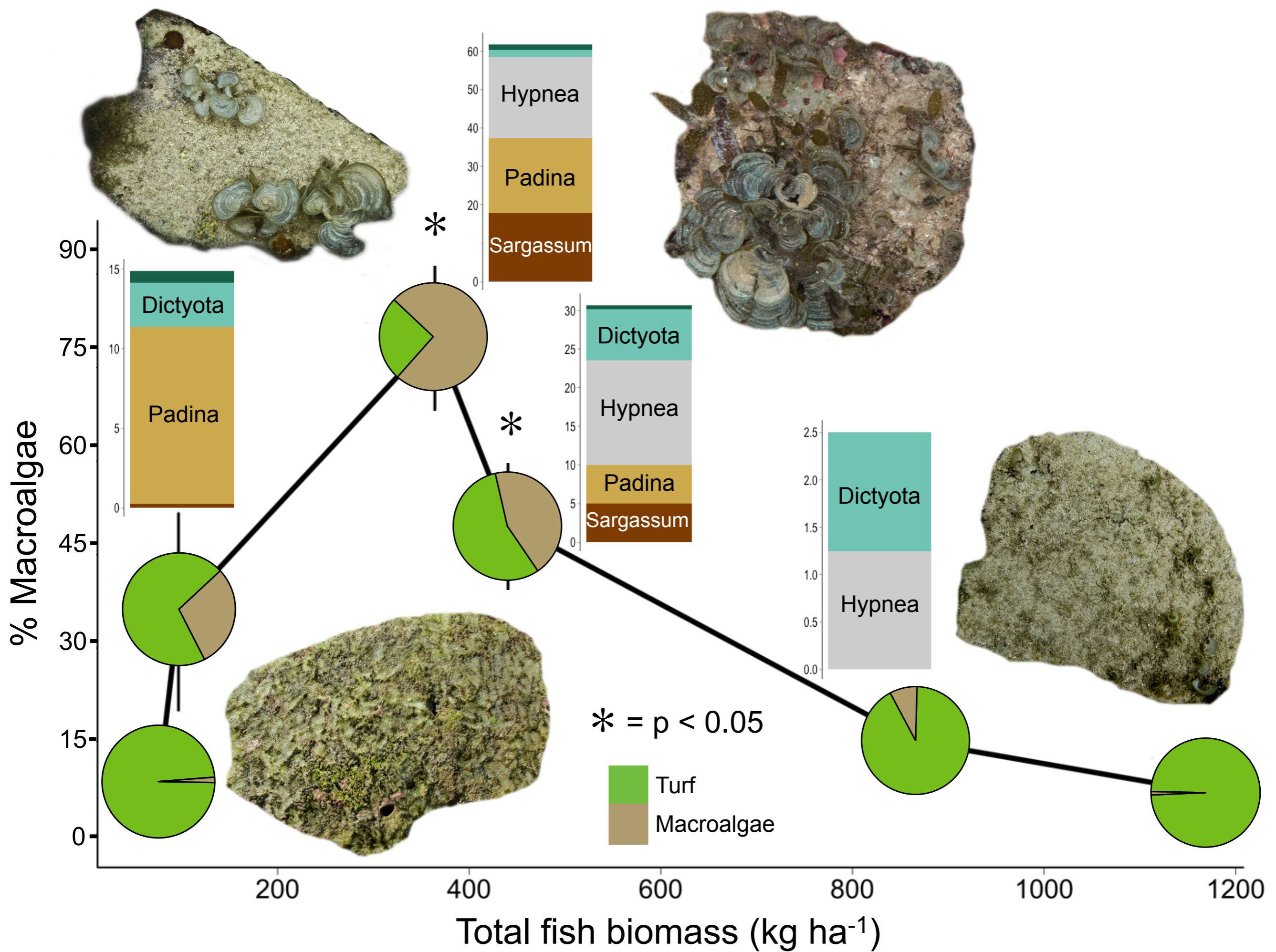




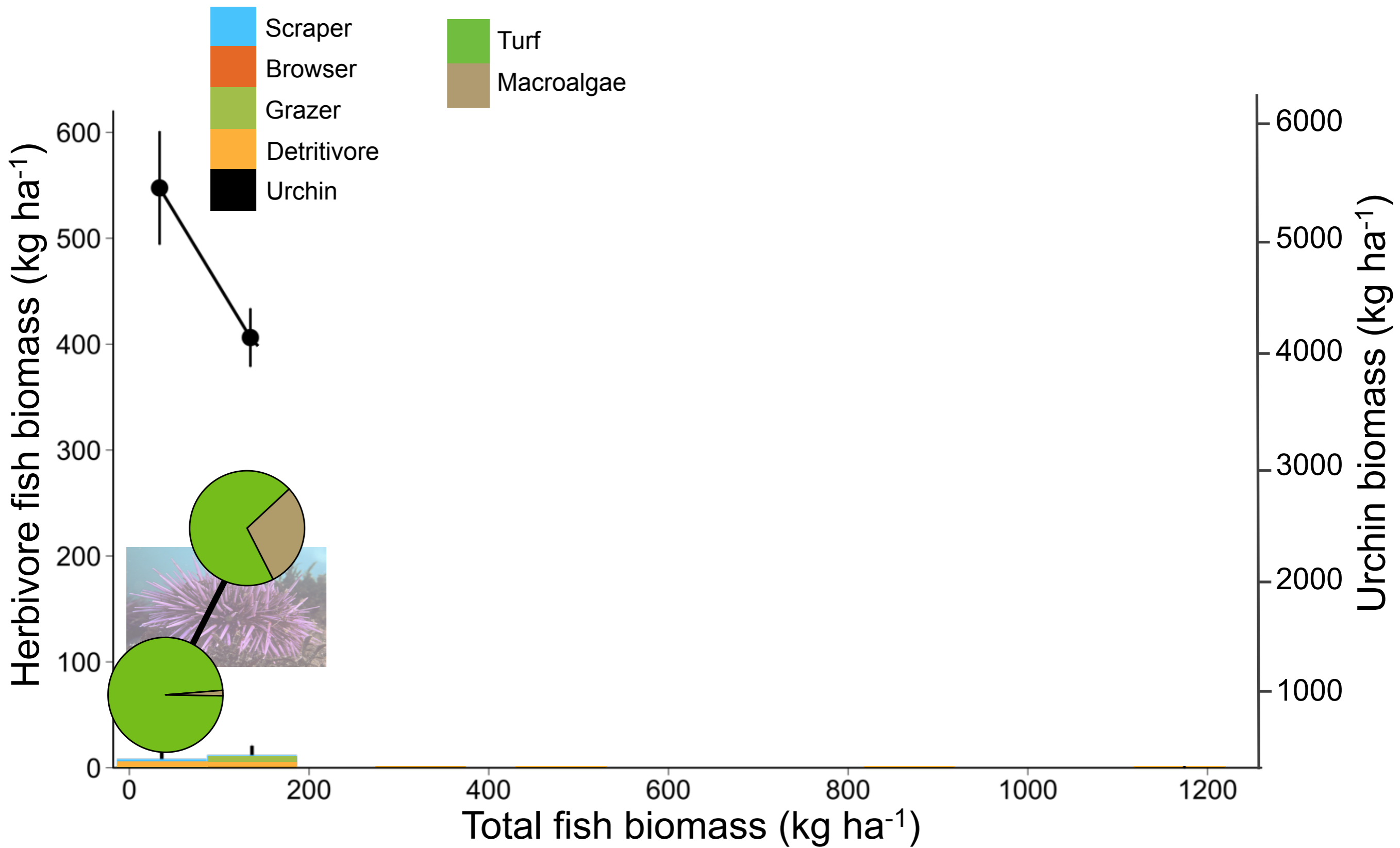




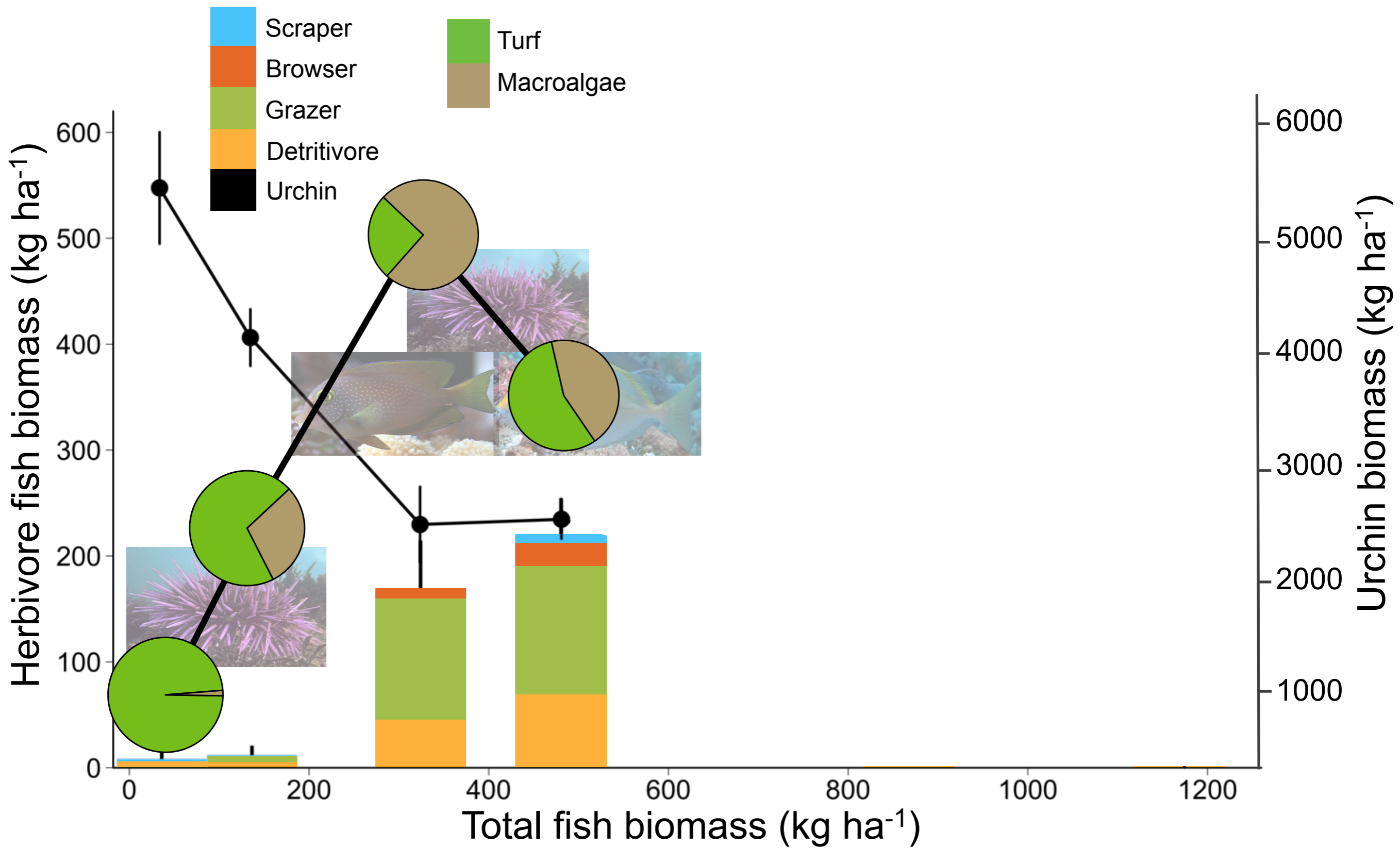




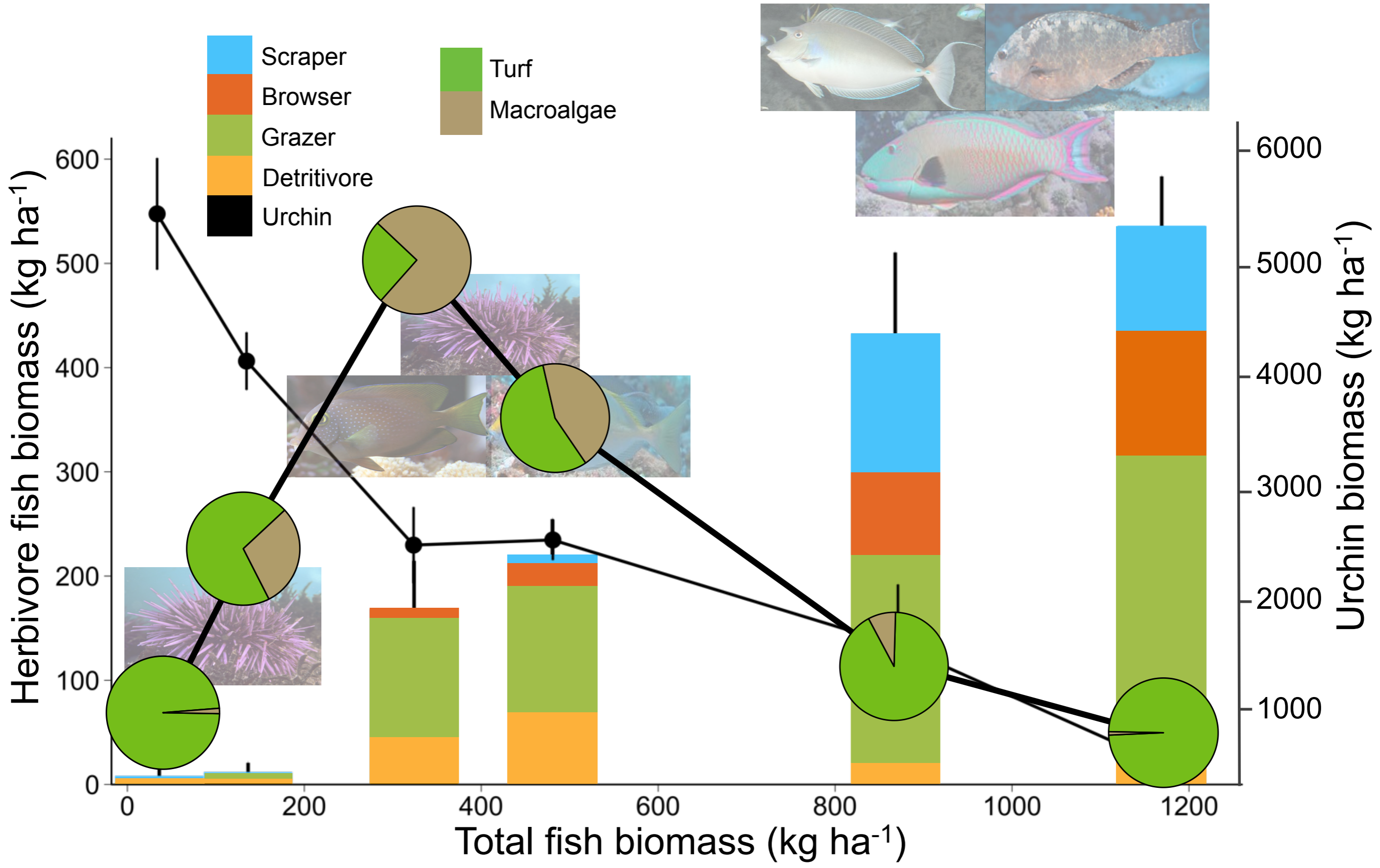














# Conclusions

**Total fish  
biomass**

**Herbivore**

**Algae**

**Reef**



# Conclusions

**Total fish biomass**

**Low**

**Herbivore**



**Algae**



**Reef**





# Conclusions

**Total fish biomass**

**Low**

**Intermediate**

**Herbivore**



**Algae**



**Reef**





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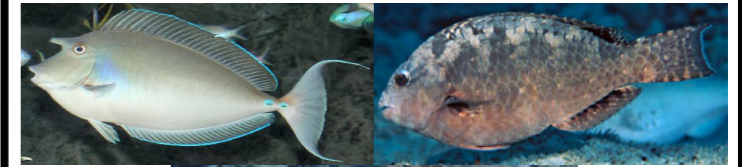
**Total fish biomass**

**Low**

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**Algae**



**Reef**





# Conclusions

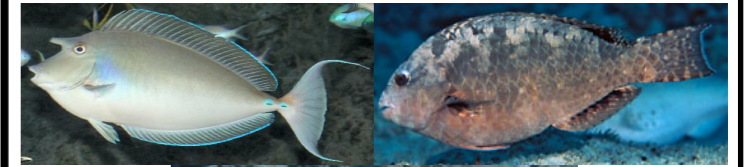
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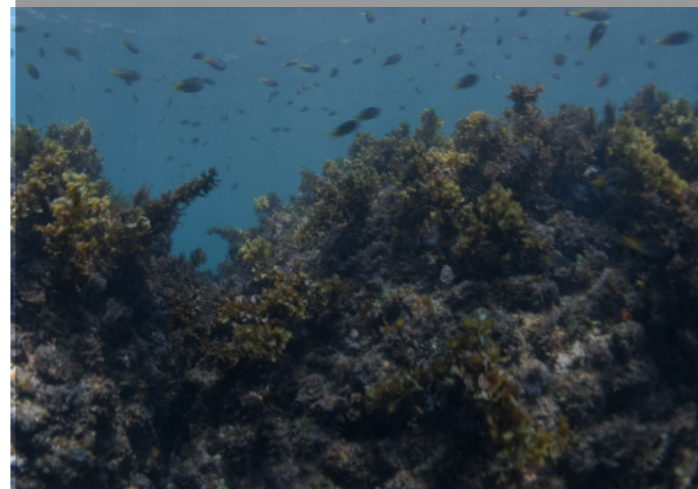
**Algae**



**DANGER ZONE**



**Reef**





# Conclusions

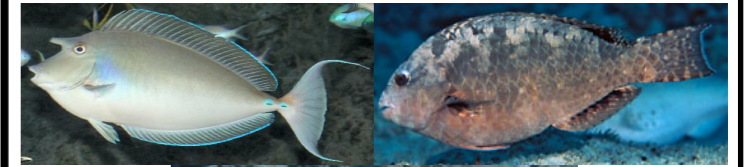
**Total fish biomass**

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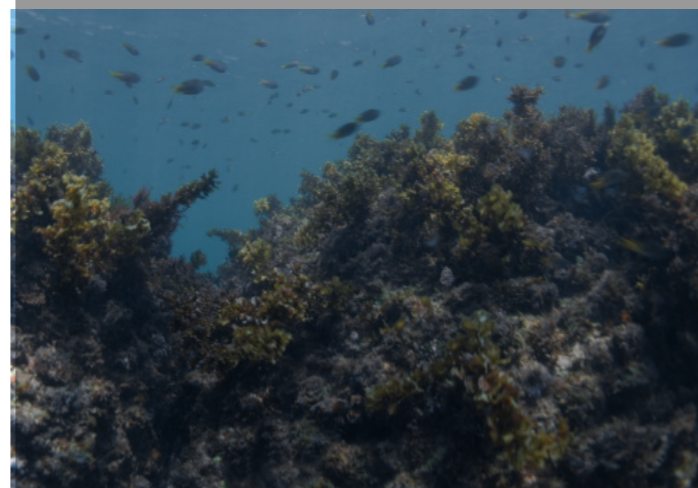
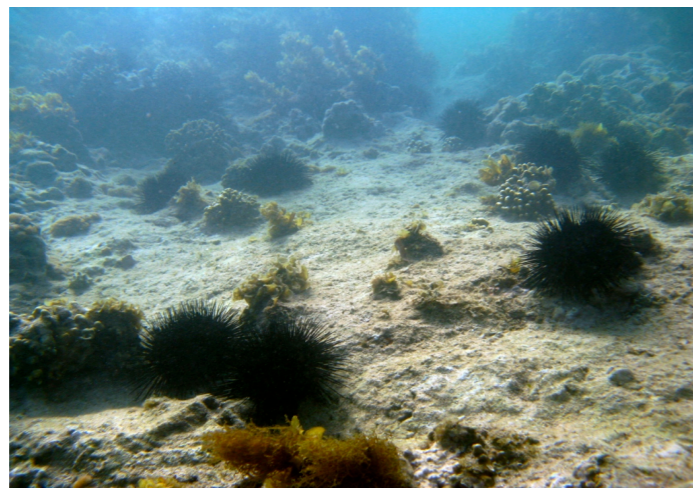


**DANGER ZONE**

**Algae**



**Reef**

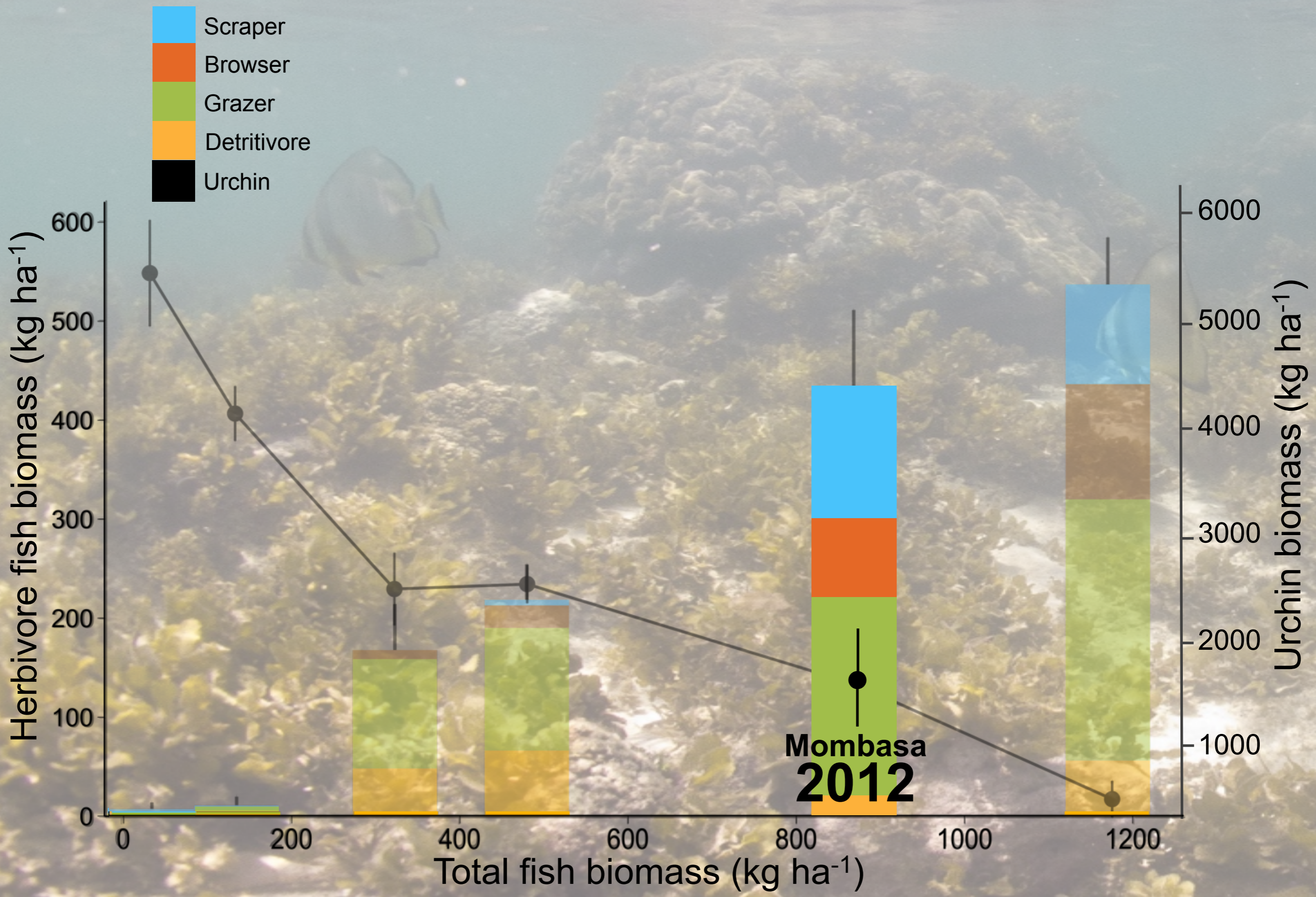




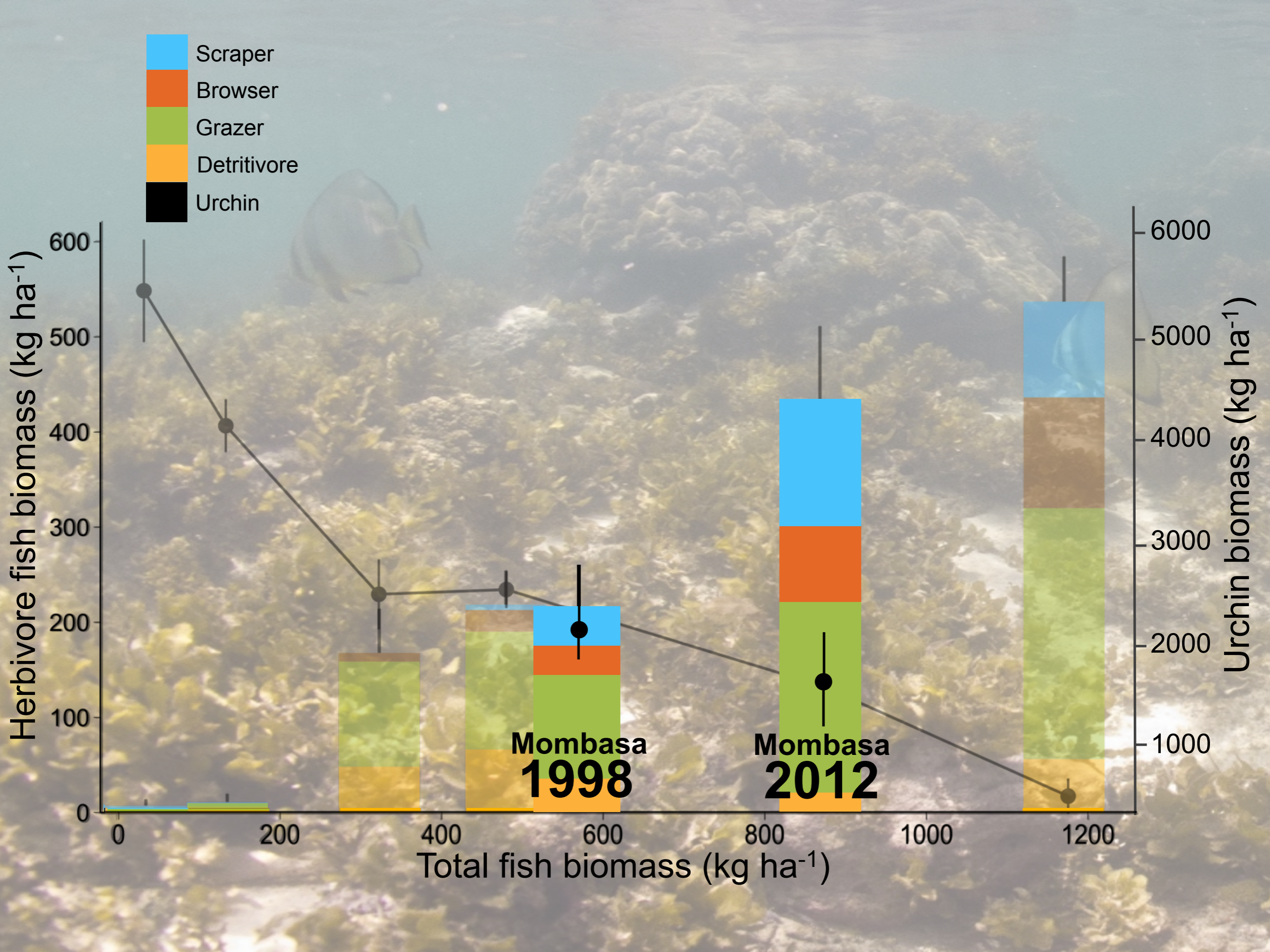
# Mombasa Marine Park 2012







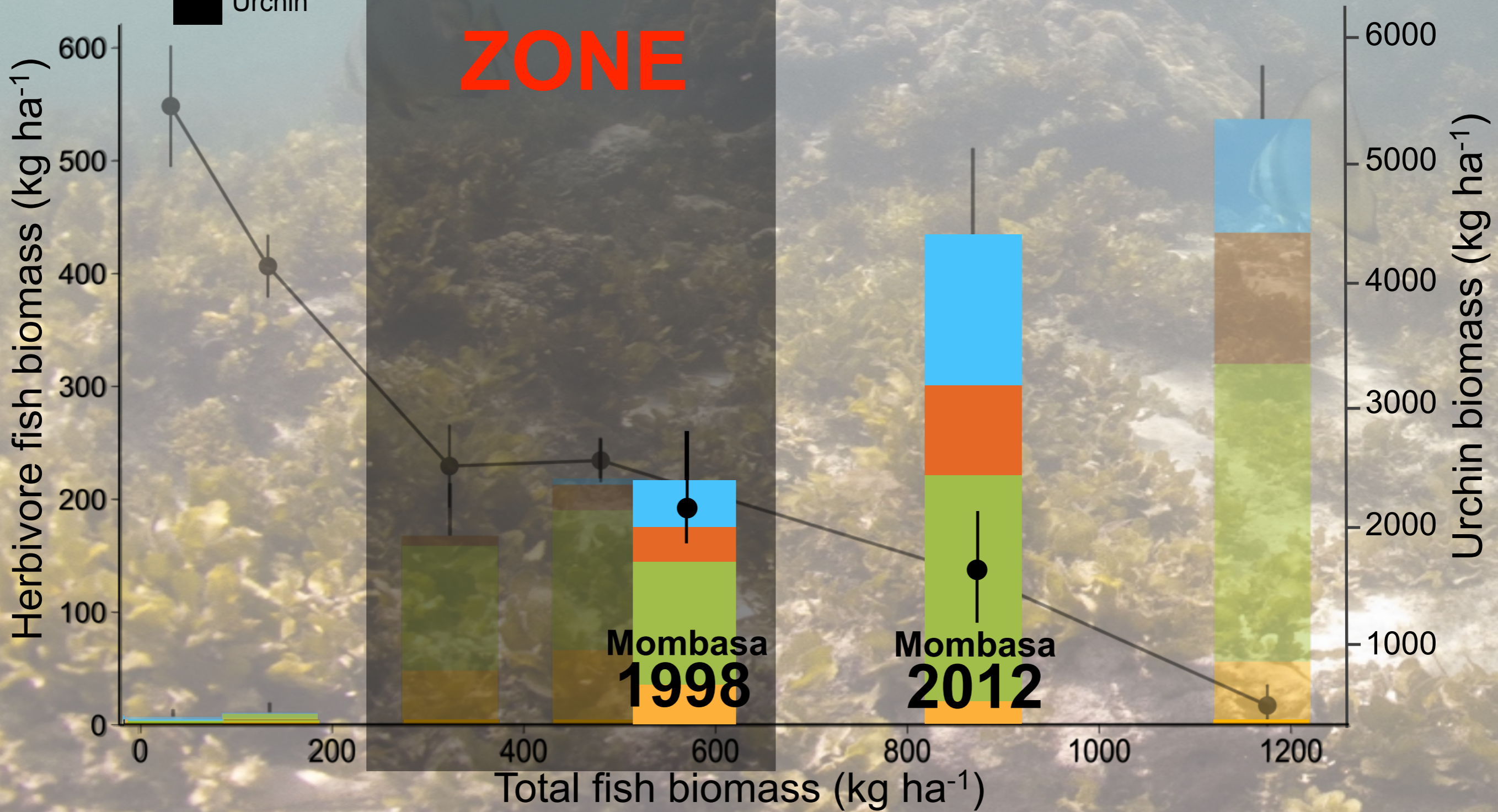




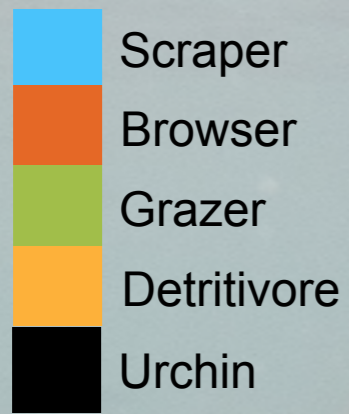




**DANGER  
ZONE**

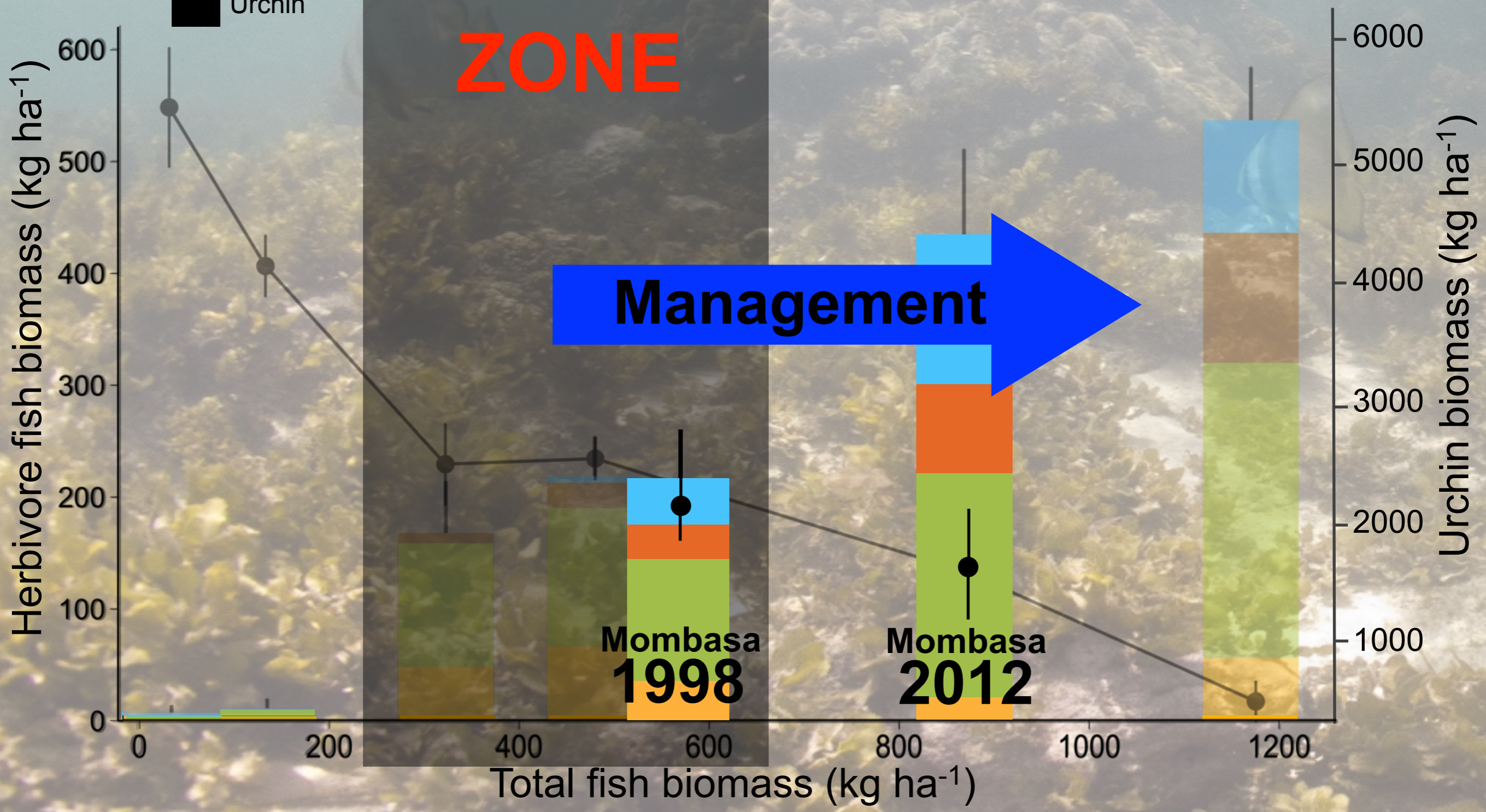






**DANGER  
ZONE**

**Management**





# Summary

High biomass of fish **OR**  
urchins do a good job as  
grazers





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High biomass of fish **OR**  
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Intermediate biomass of fish  
**AND** urchins provides  
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# Summary

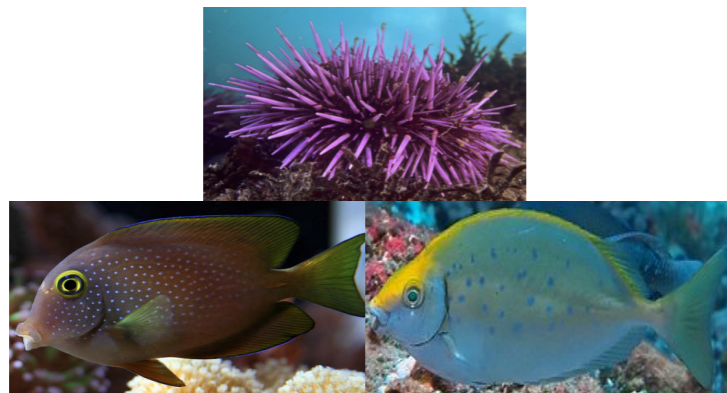
High biomass of fish **OR** urchins do a good job as grazers



Kenyan reefs most vulnerable to phase shifts during these transitional stages and not necessarily at low fish biomass



Intermediate biomass of fish **AND** urchins provides opportunity for macroalgae to develop





# Acknowledgments

**Tim McClanahan**  
**Christopher McQuaid**  
**Nyawira Muthiga**  
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**Rodgers Charo**



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Kenya Marine Fisheries Research Institute,  
Kenya Wildlife Service



The Andrew W. Mellon Foundation



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