The Surprising Inefficiency of Dwarf Satellite Quenching

Coral Wheeler
UC Irvine

Collaborators:
John Phillips (UCI)
Sean Fillingham (UCI)
James Bullock (UCI)
Mike Cooper (UCI)
Mike Boylan-Kolchin (Maryland)
Erik Tollerud (Yale)

11th Potsdam Dwarf Thinkshop
August 26th, 2014

Shutting down of star formation in galaxies caused by their environment

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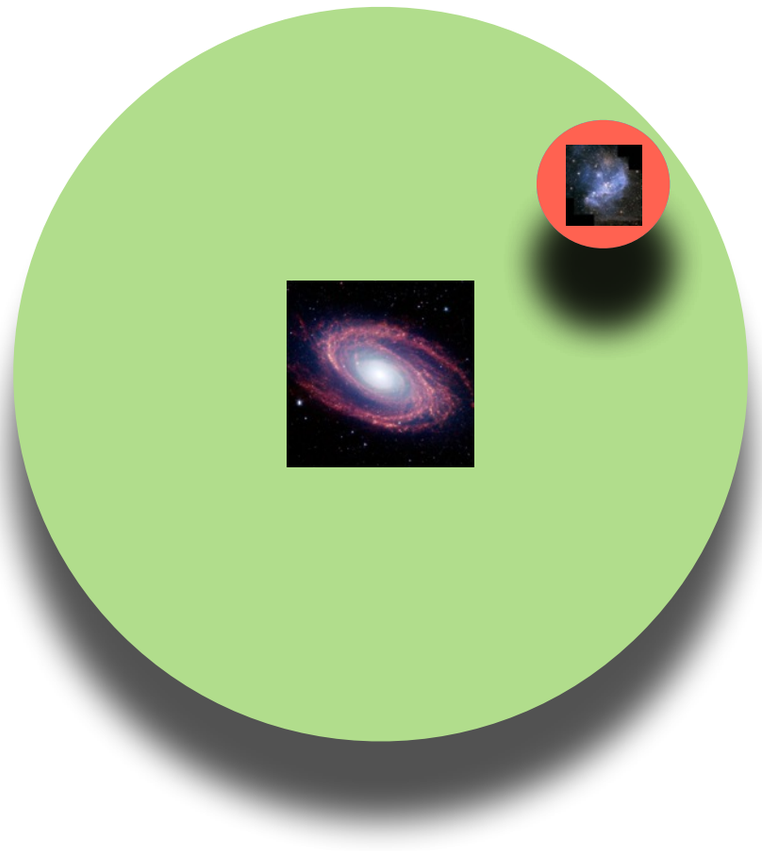
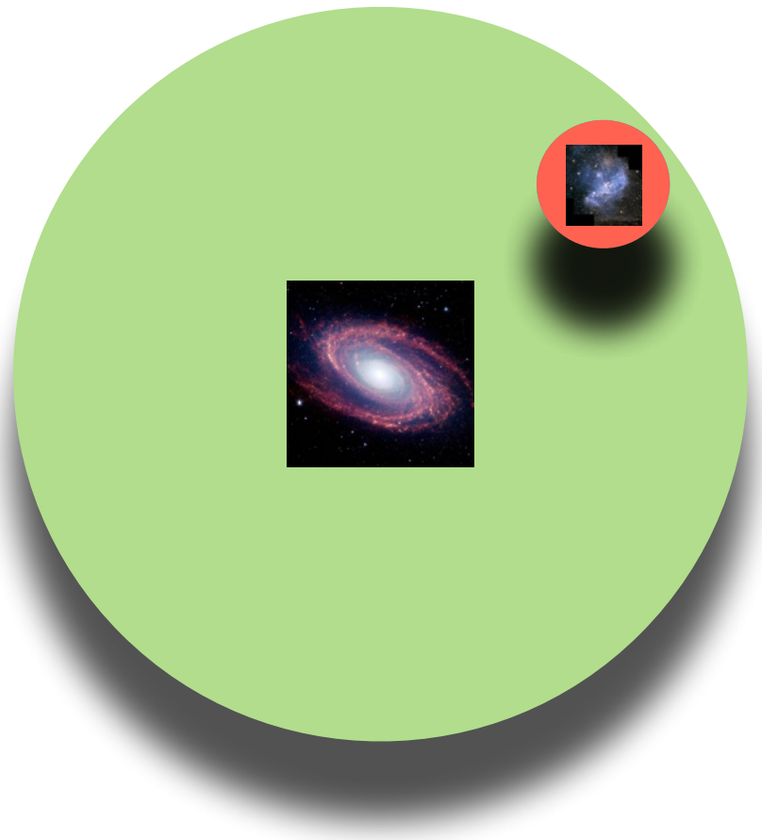


Shutting down of star formation in galaxies caused by their environment

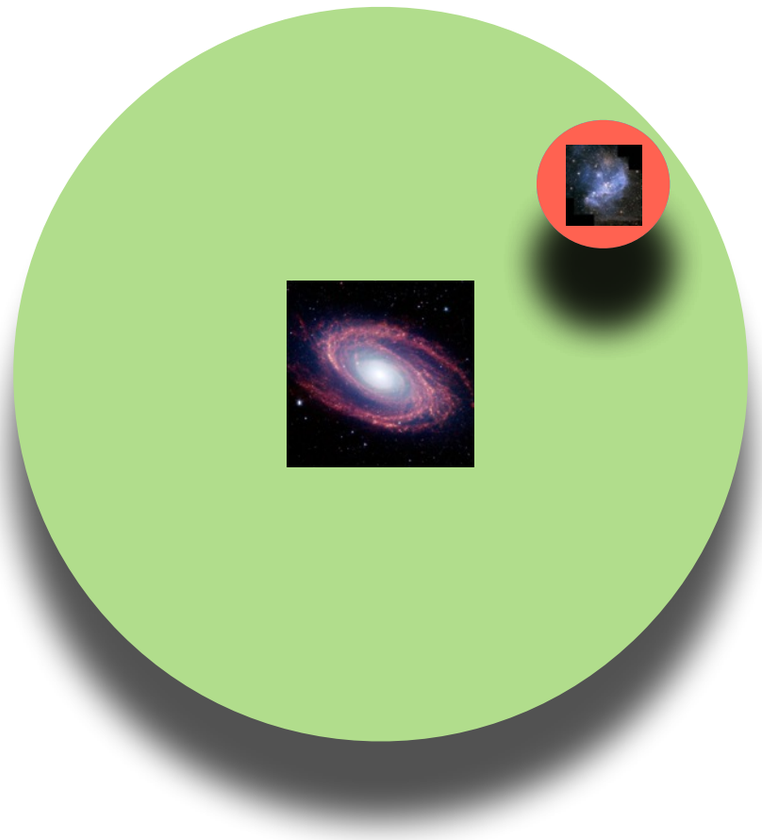
How efficient?



Shutting down of star formation in galaxies caused by their environment

How fast?

How efficient?



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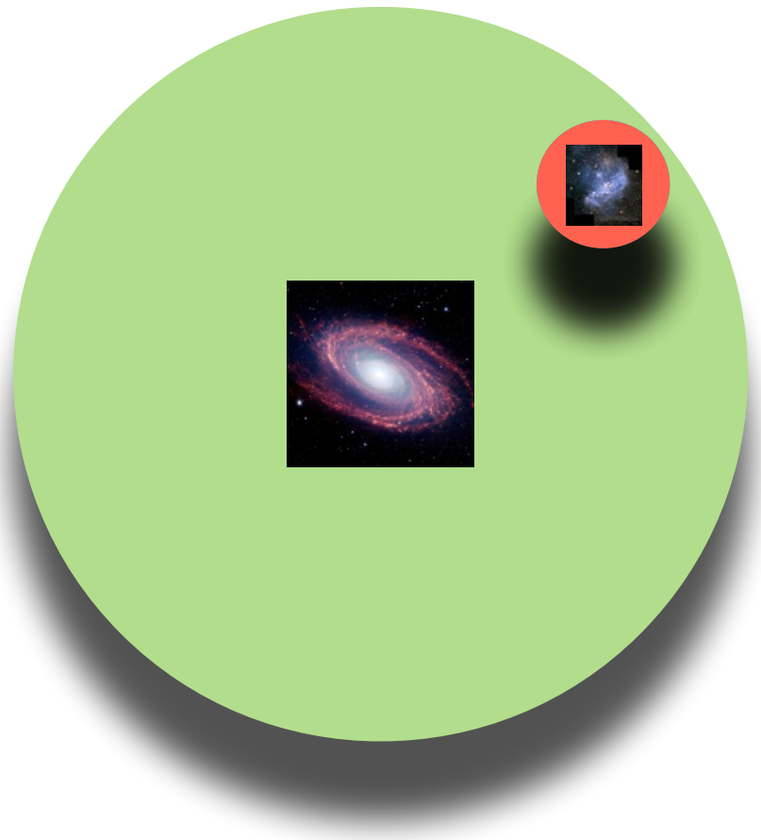


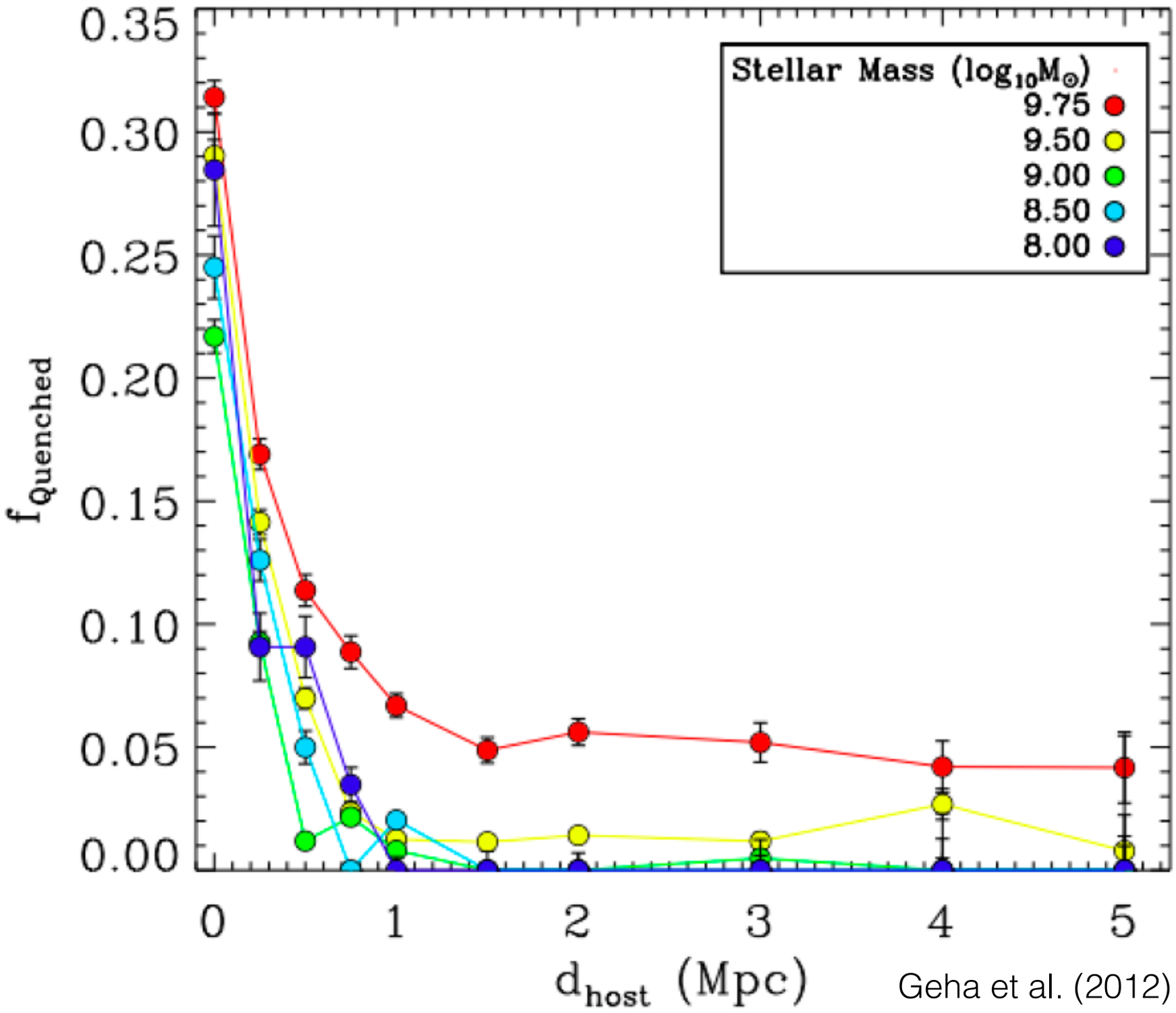
What situations?

Compare SDSS data to MSII to develop single parameter quenching models

York et al. (2000)

Boylan-Kolchin et al. (2009)

Low mass galaxies do not quench in the field!



Geha et al. (2012)

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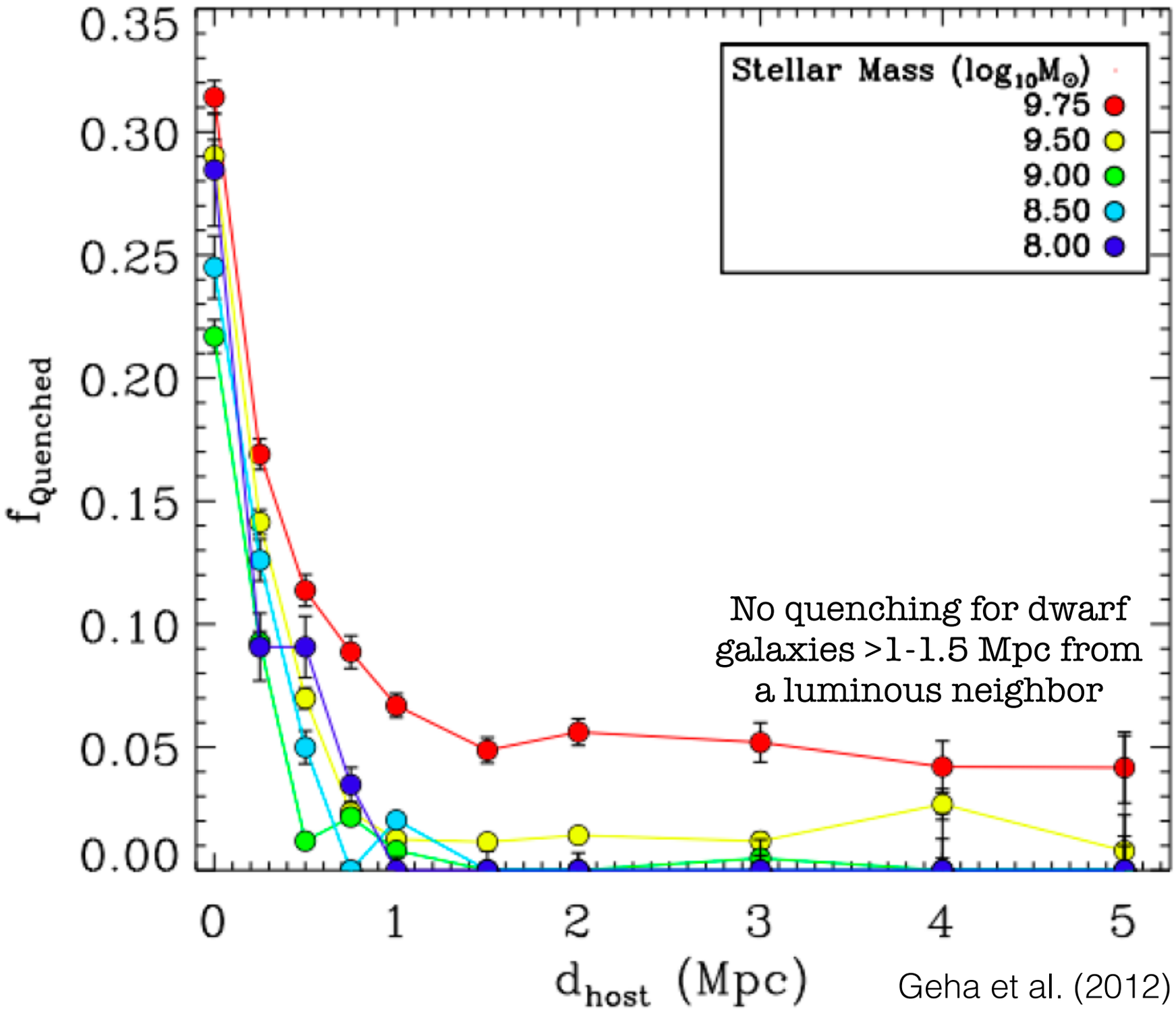

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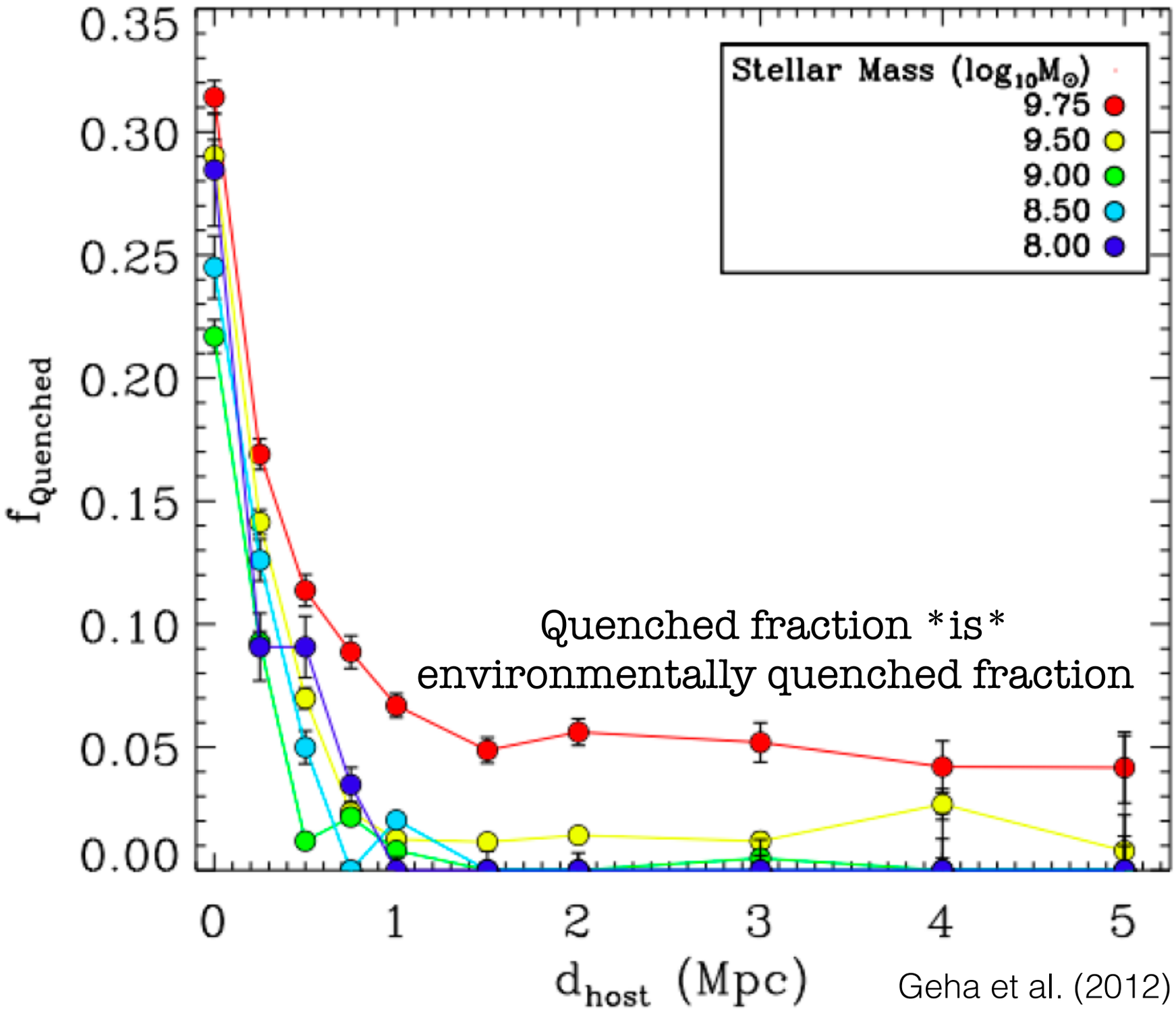

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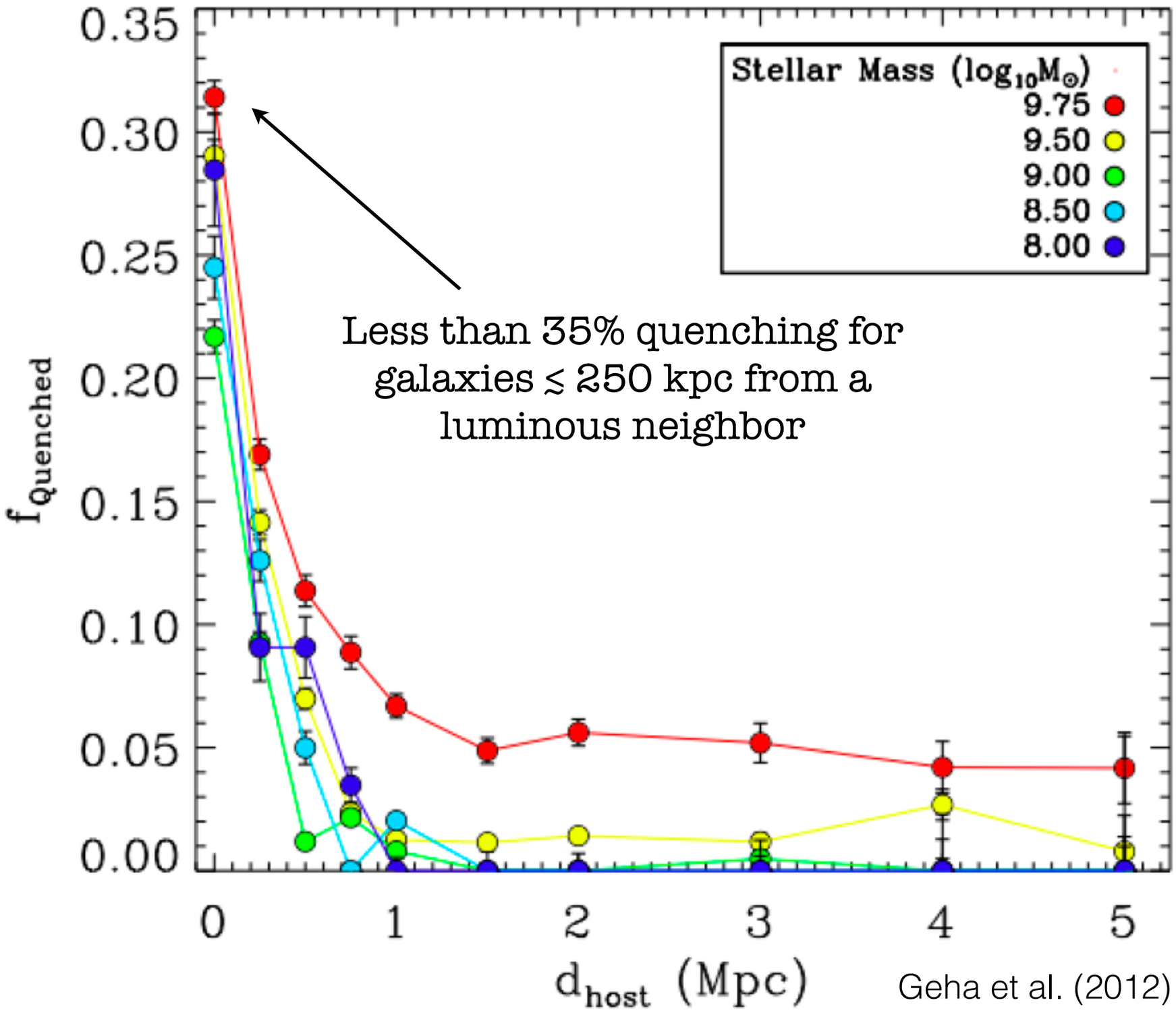

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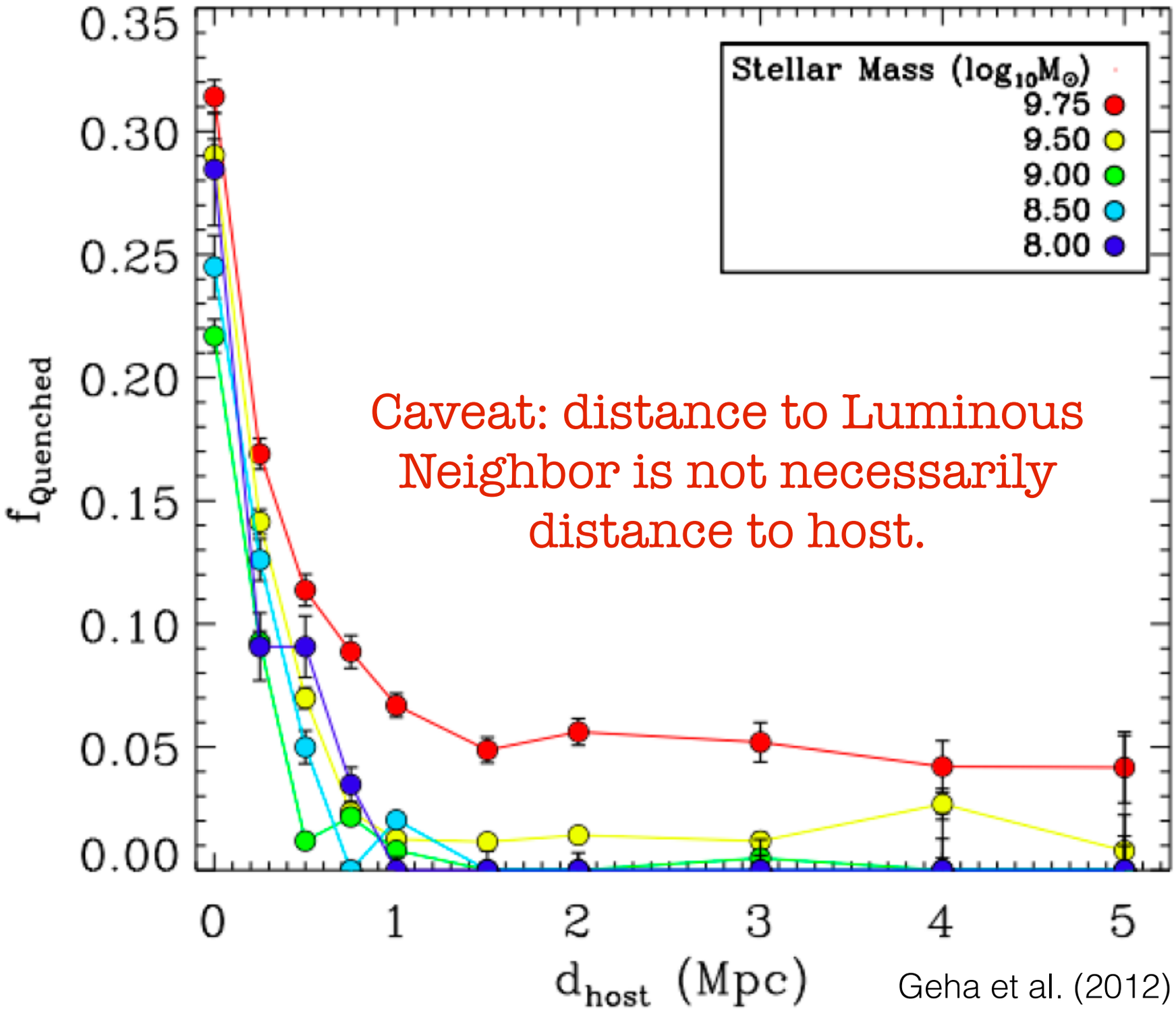

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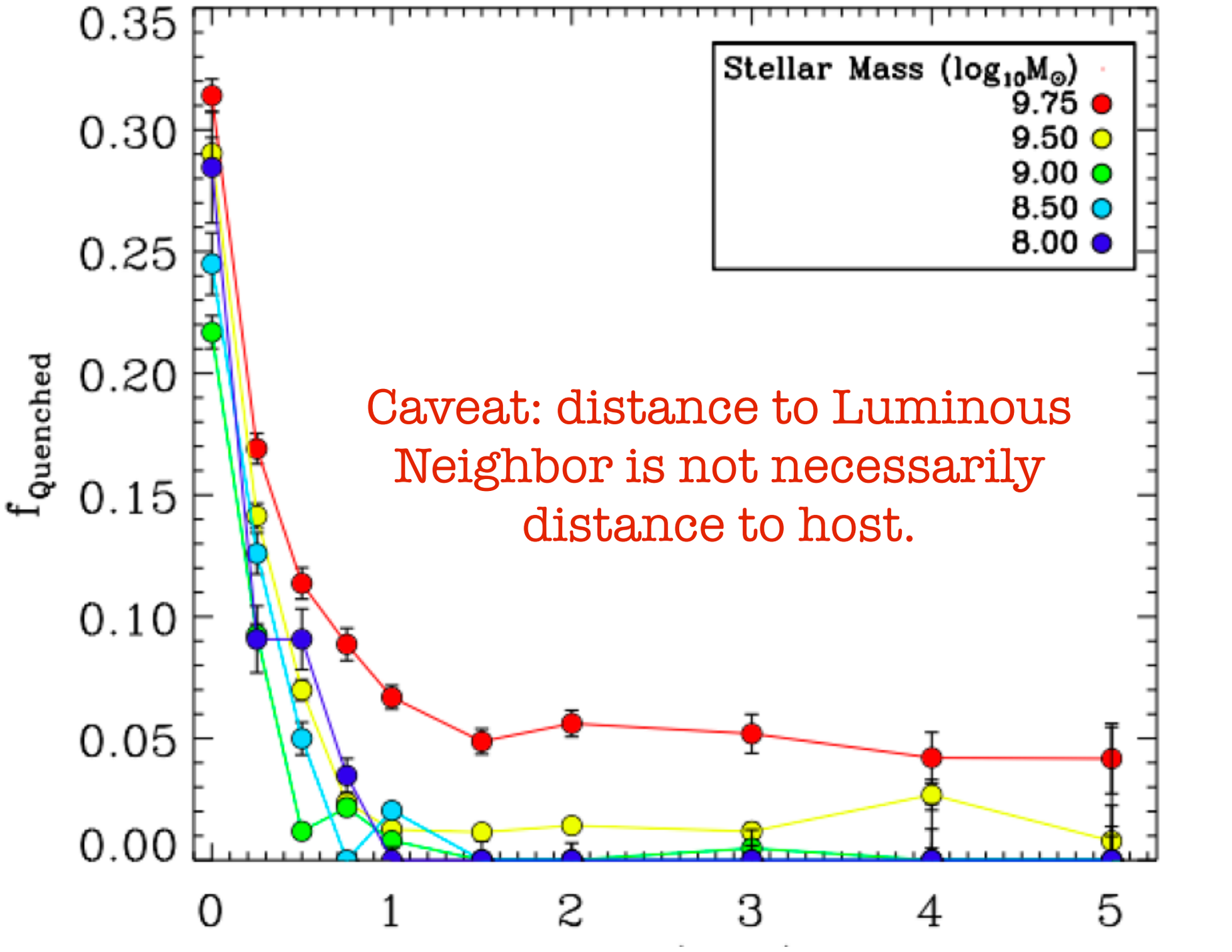
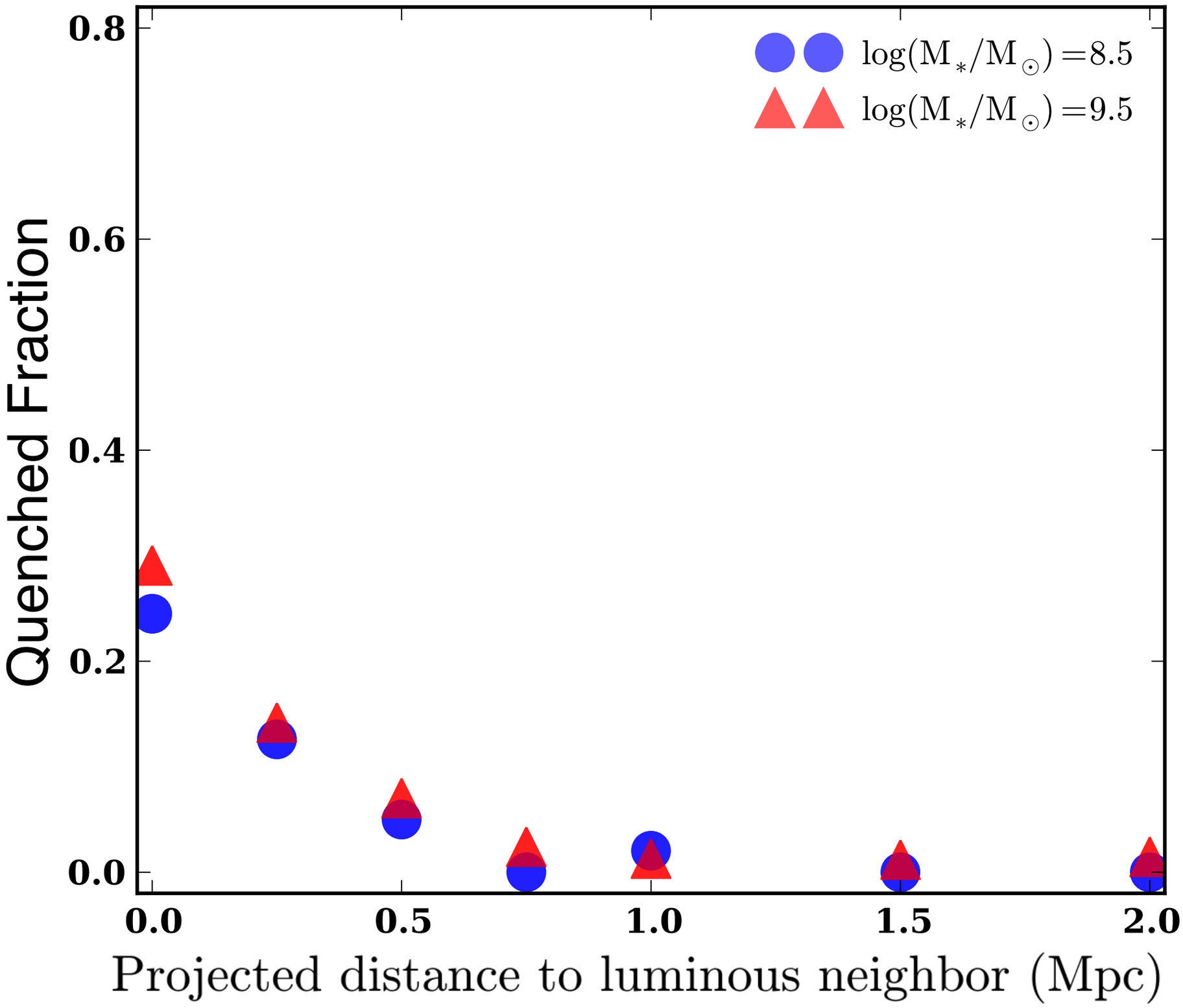
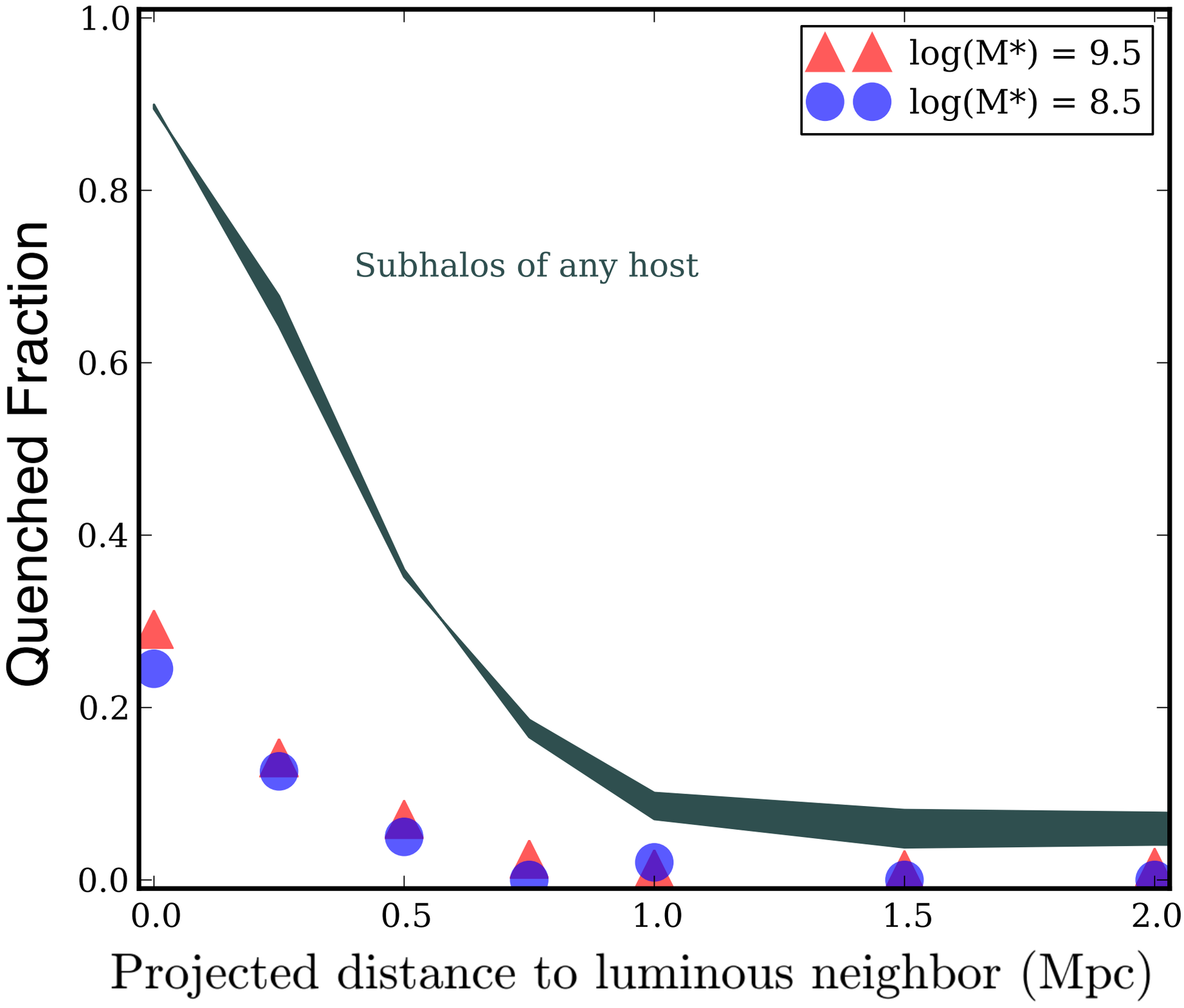


One-Parameter Quenching Models



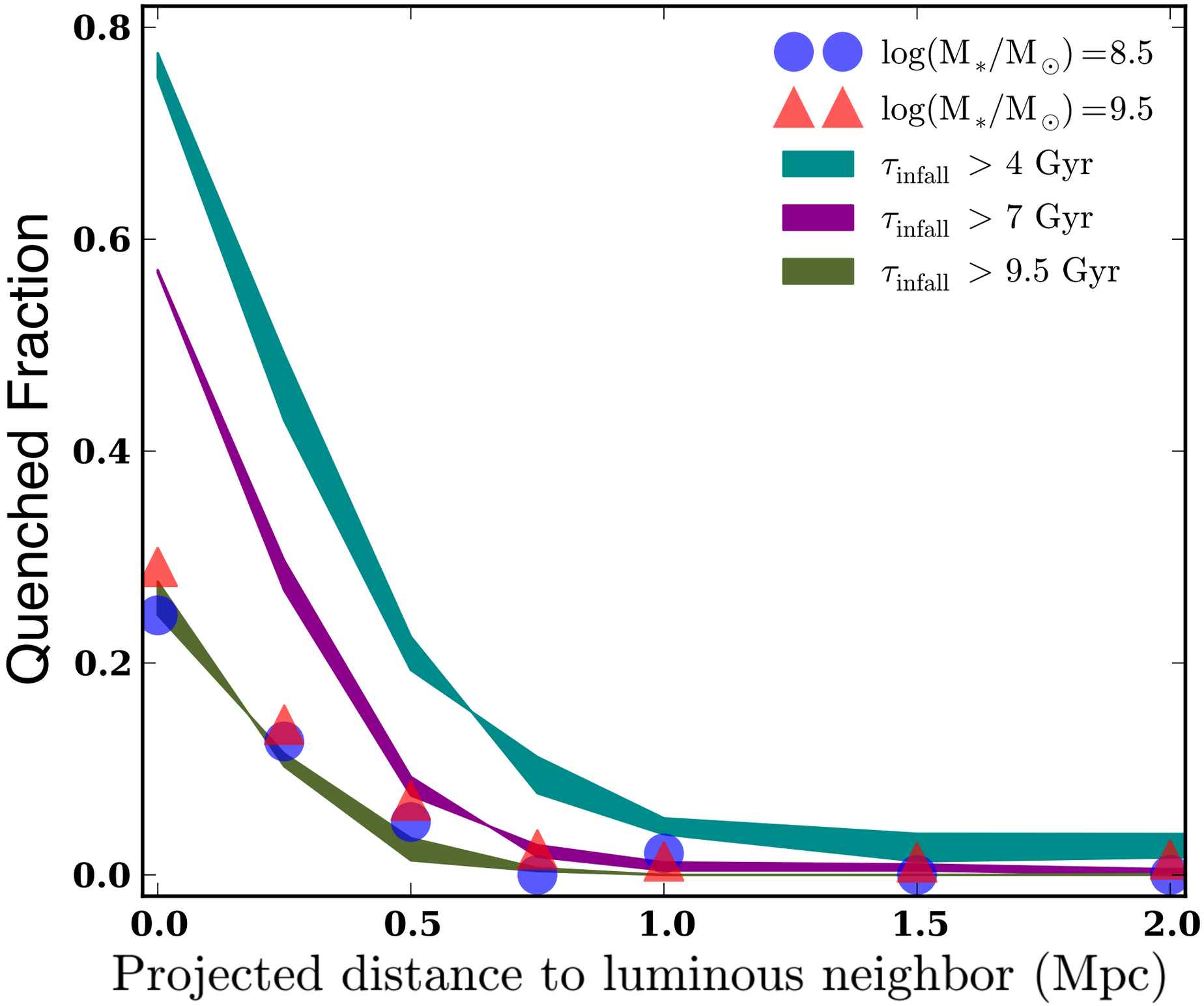
One-Parameter Quenching Models

Infall Model Wheeler et al. (2014)

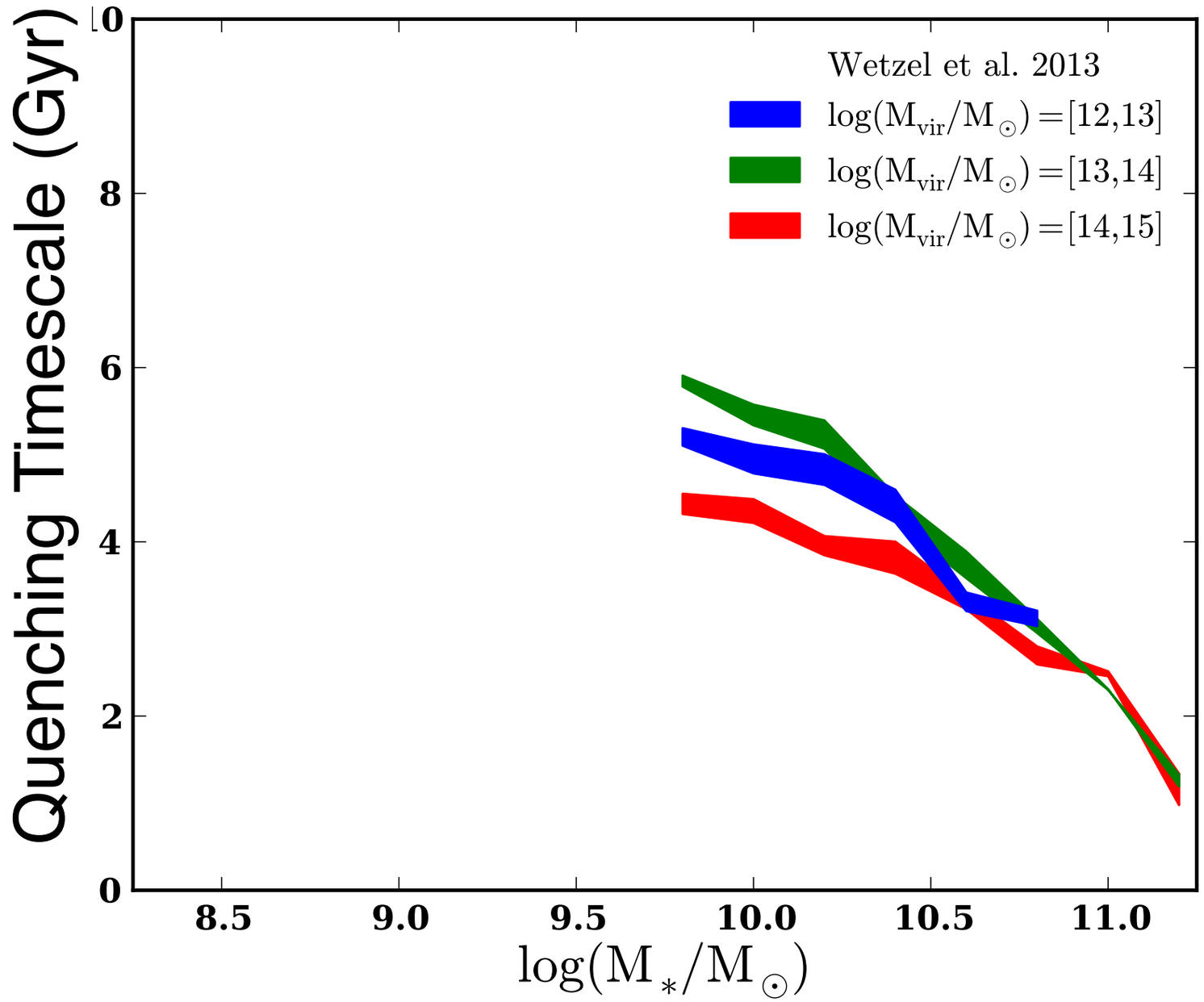


One-Parameter Quenching Models

Infall Time Model Wheeler et al. (2014)



Quenching timescales increase with decreasing satellite mass



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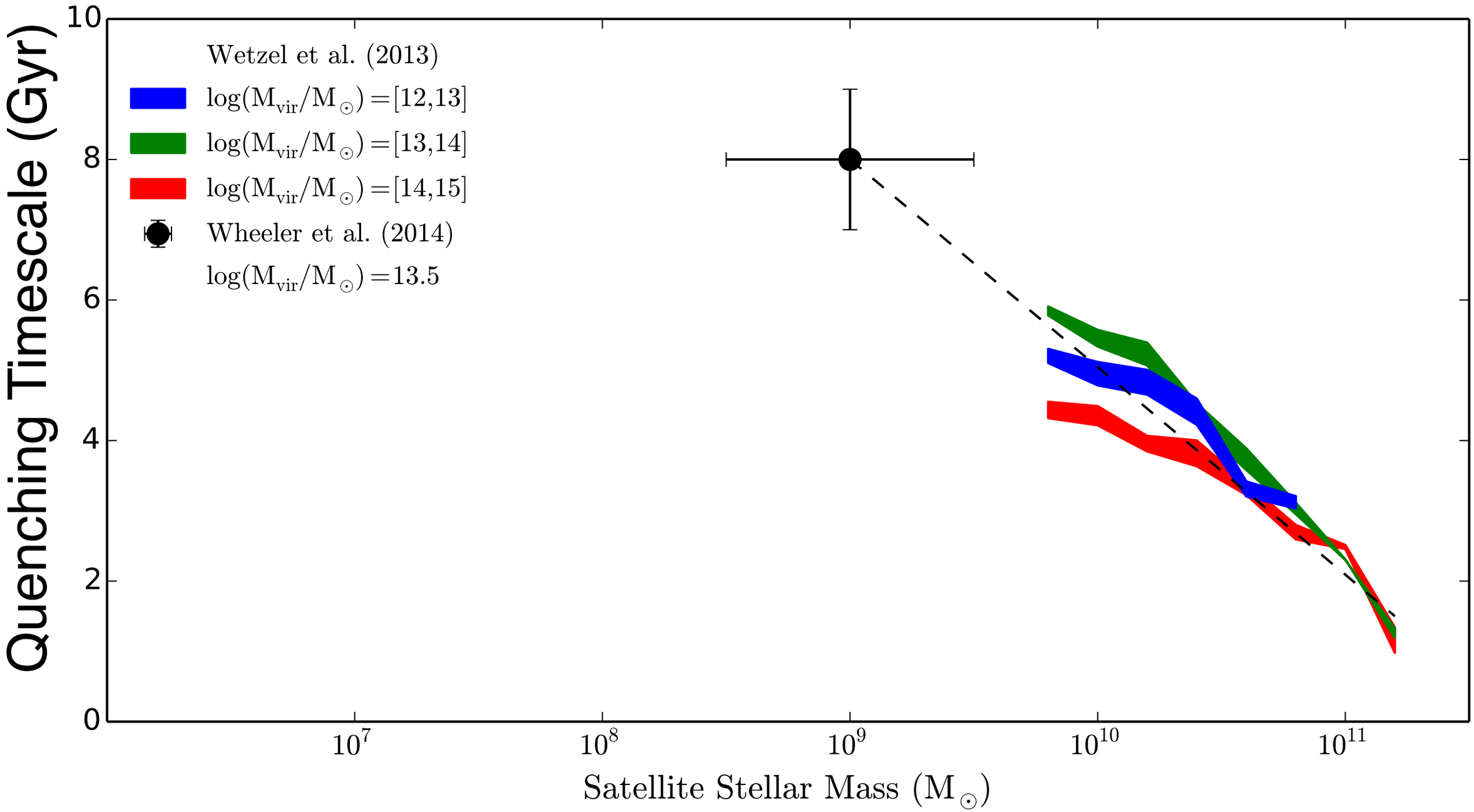
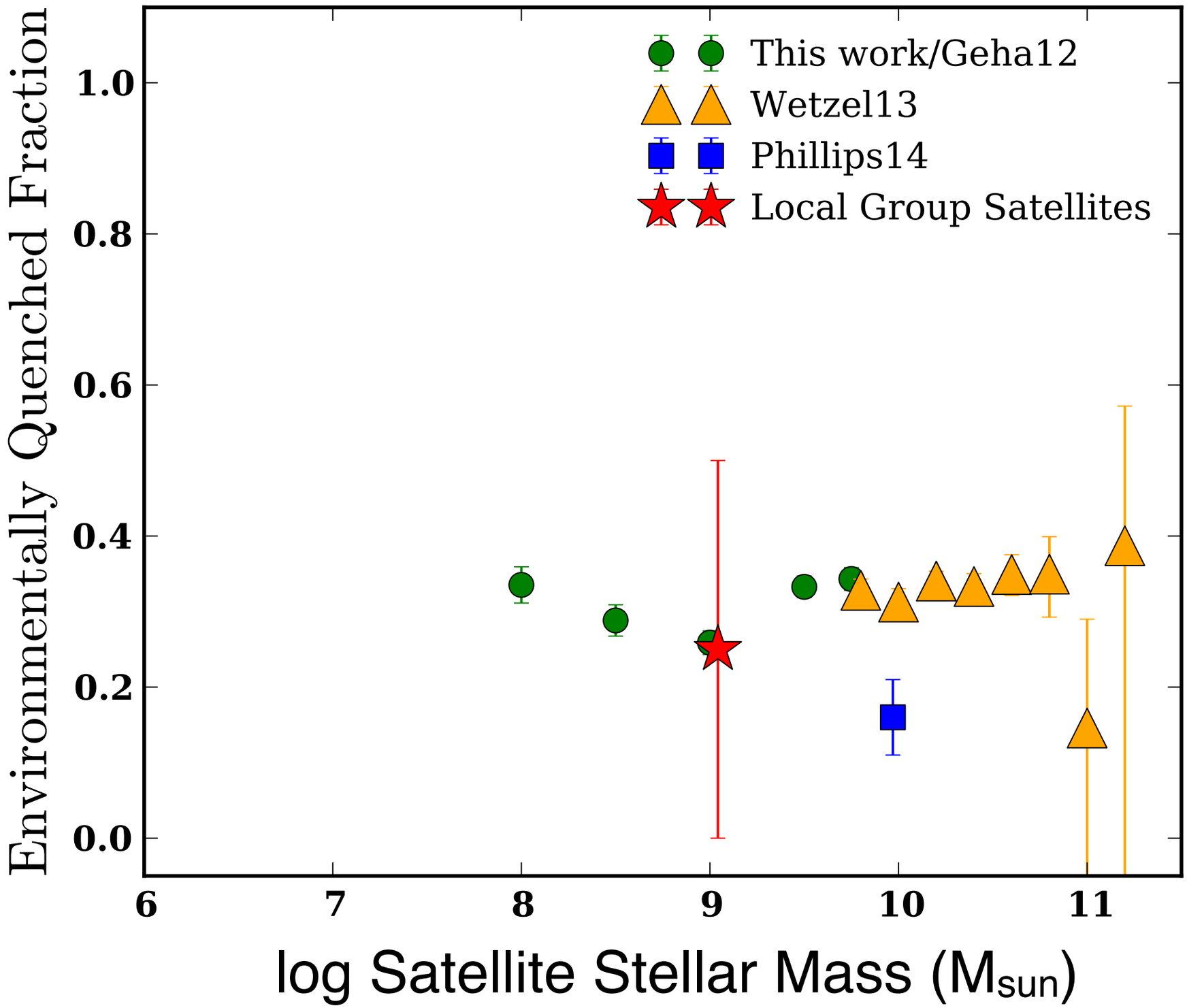


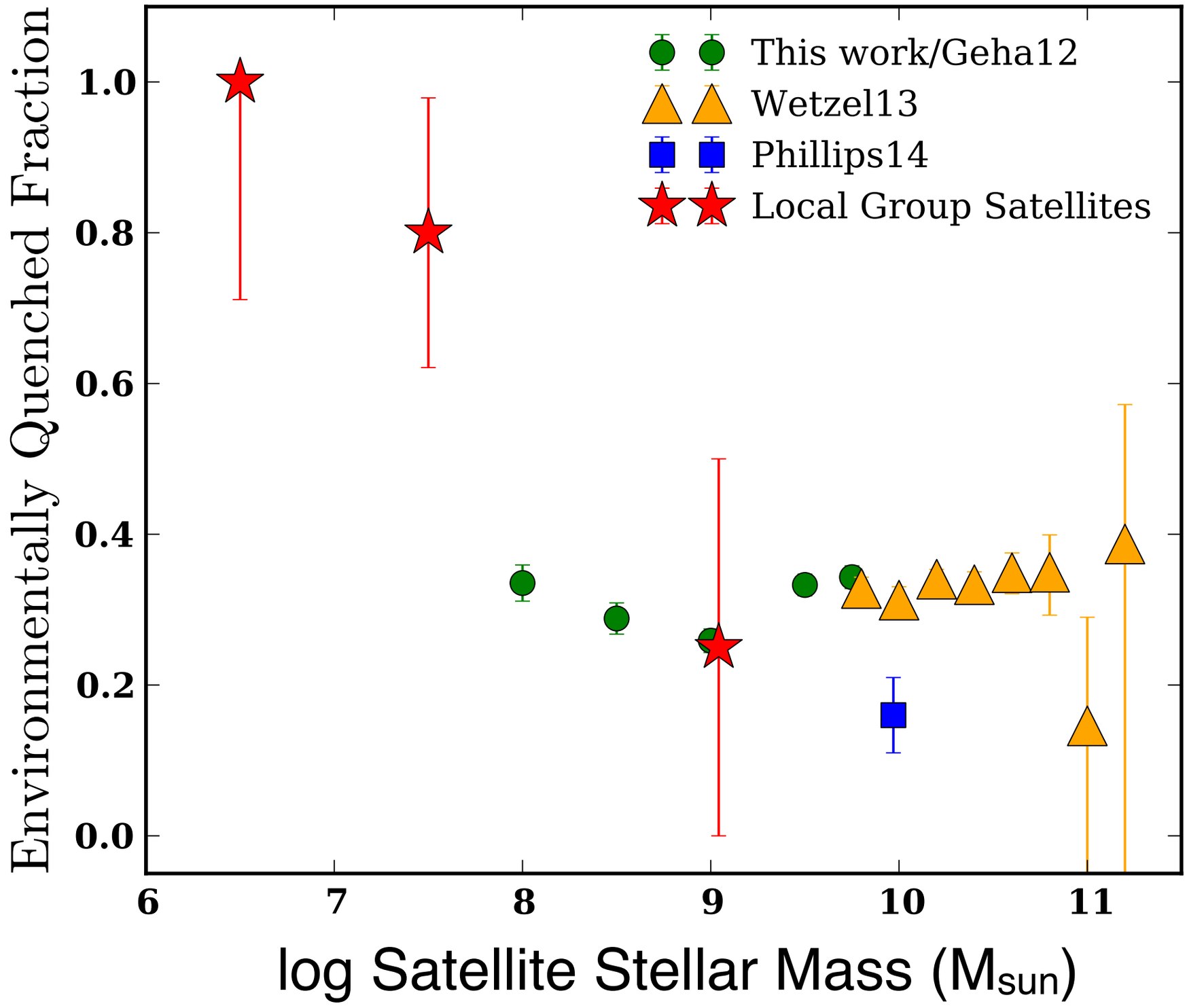
Environmentally quenched fraction largely independent of satellite stellar mass …

Wheeler et al. (2014)



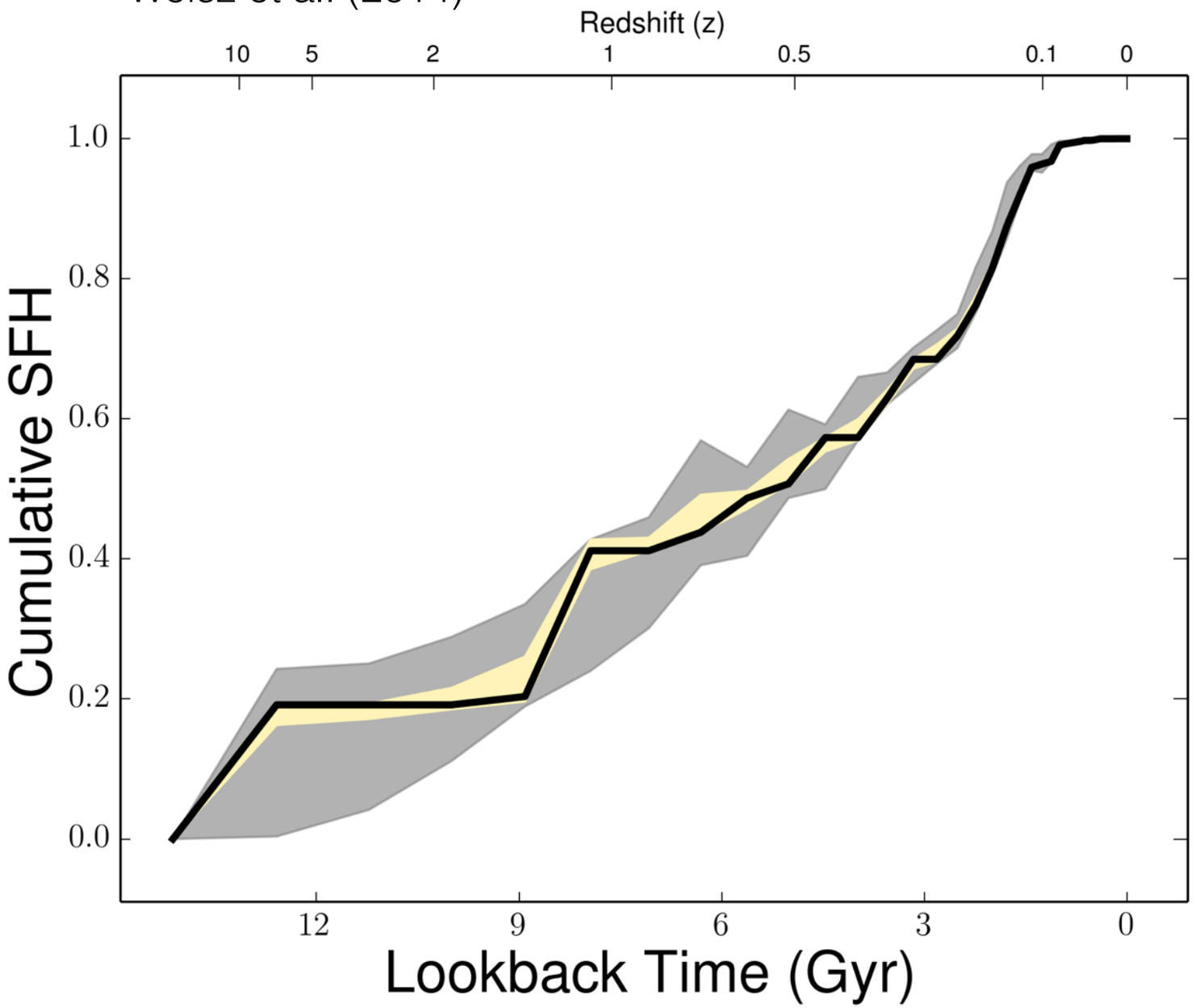
… but only to a point. At low mass, quenching efficiency spikes

Wheeler et al. (2014)



Star-Formation Truncation in Leo I

Weisz et al. (2014)



HST proper motion of Leo I:
(Sohn et al. 2013; Boylan-Kolchin et al. 2013)

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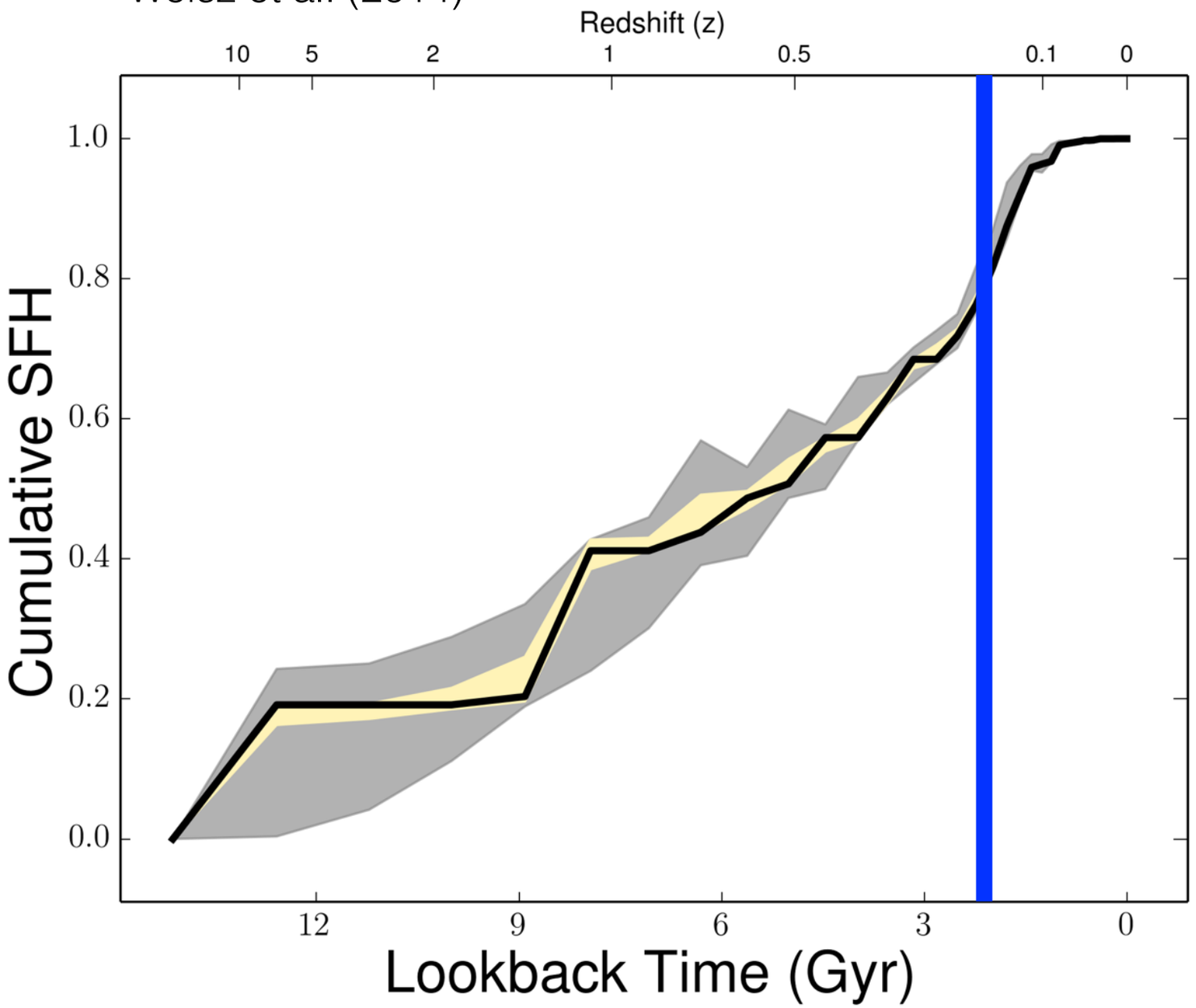

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First R_{vir} crossing:
2.3 Gyr

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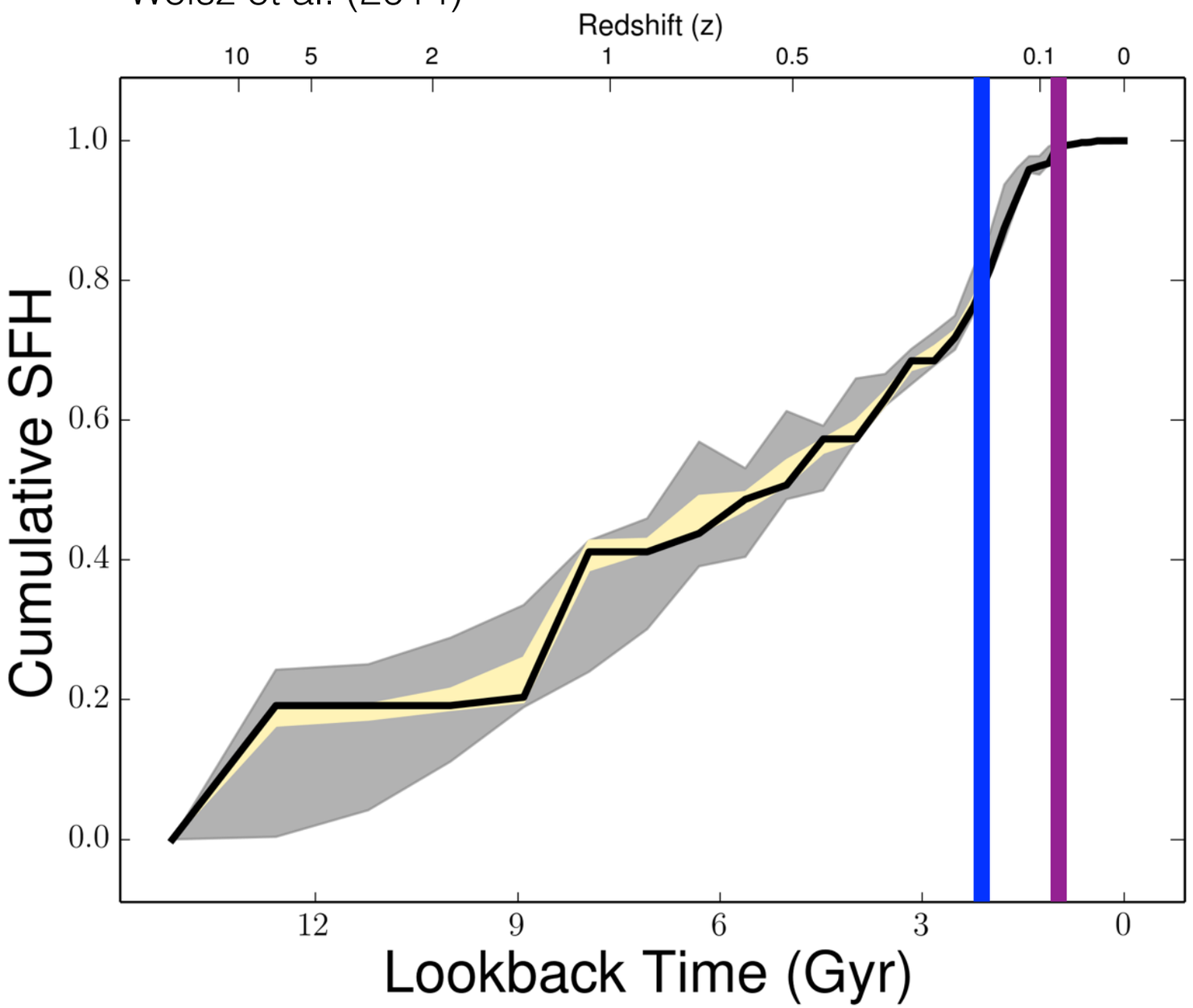

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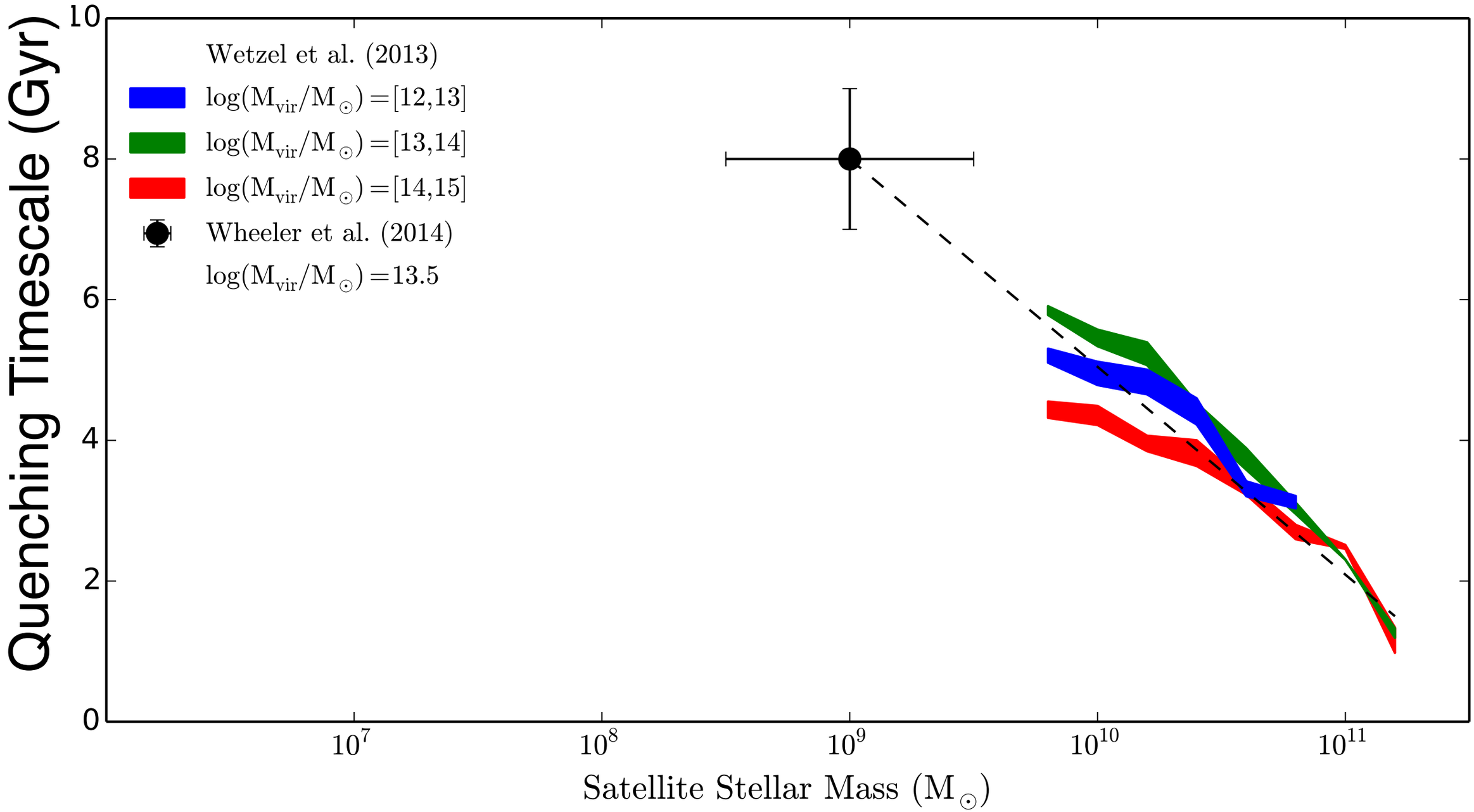
First R_{vir} crossing:
2.3 Gyr

First pericenter:
1 Gyr

Preliminary results suggest a critical satellite stellar mass for quenching



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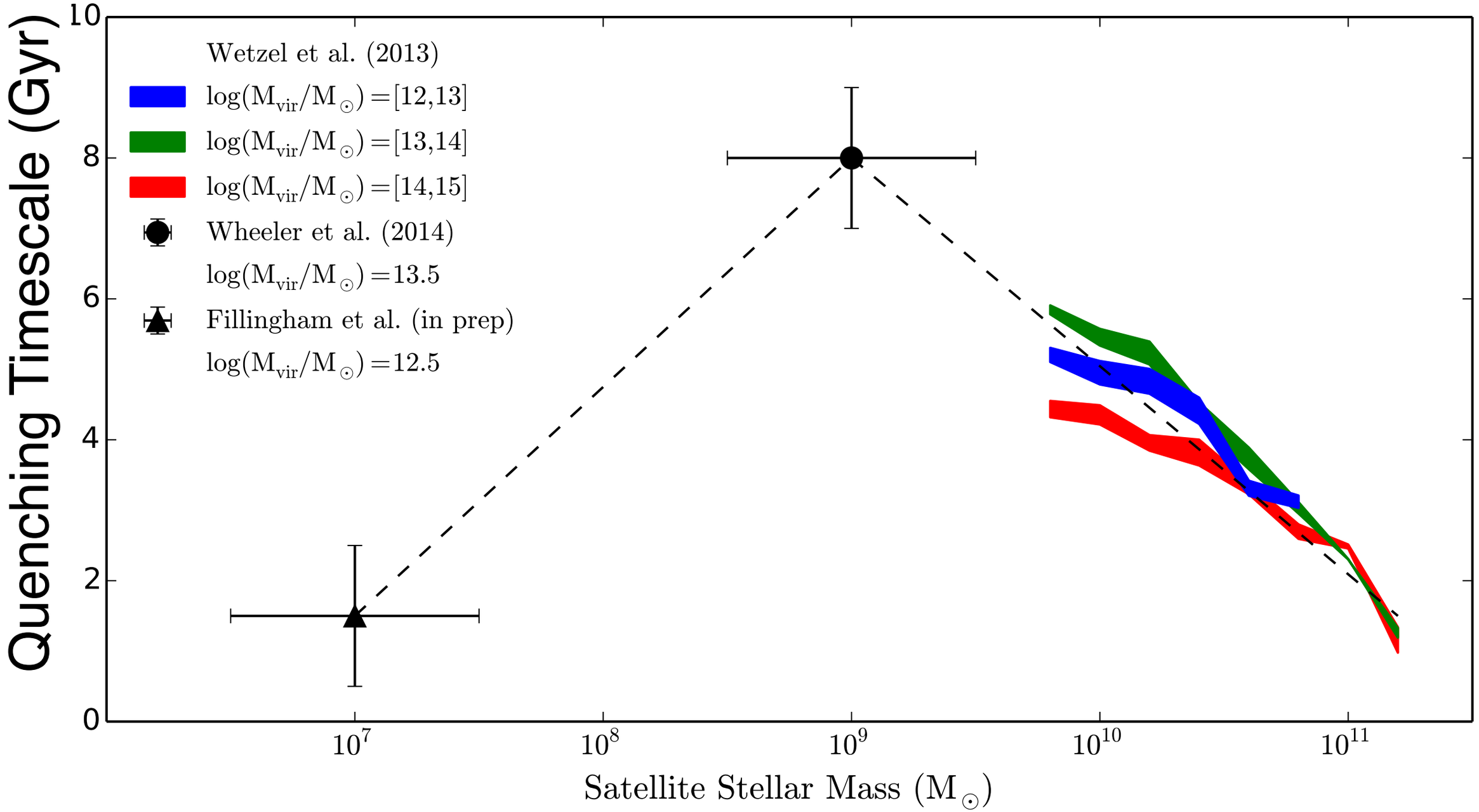
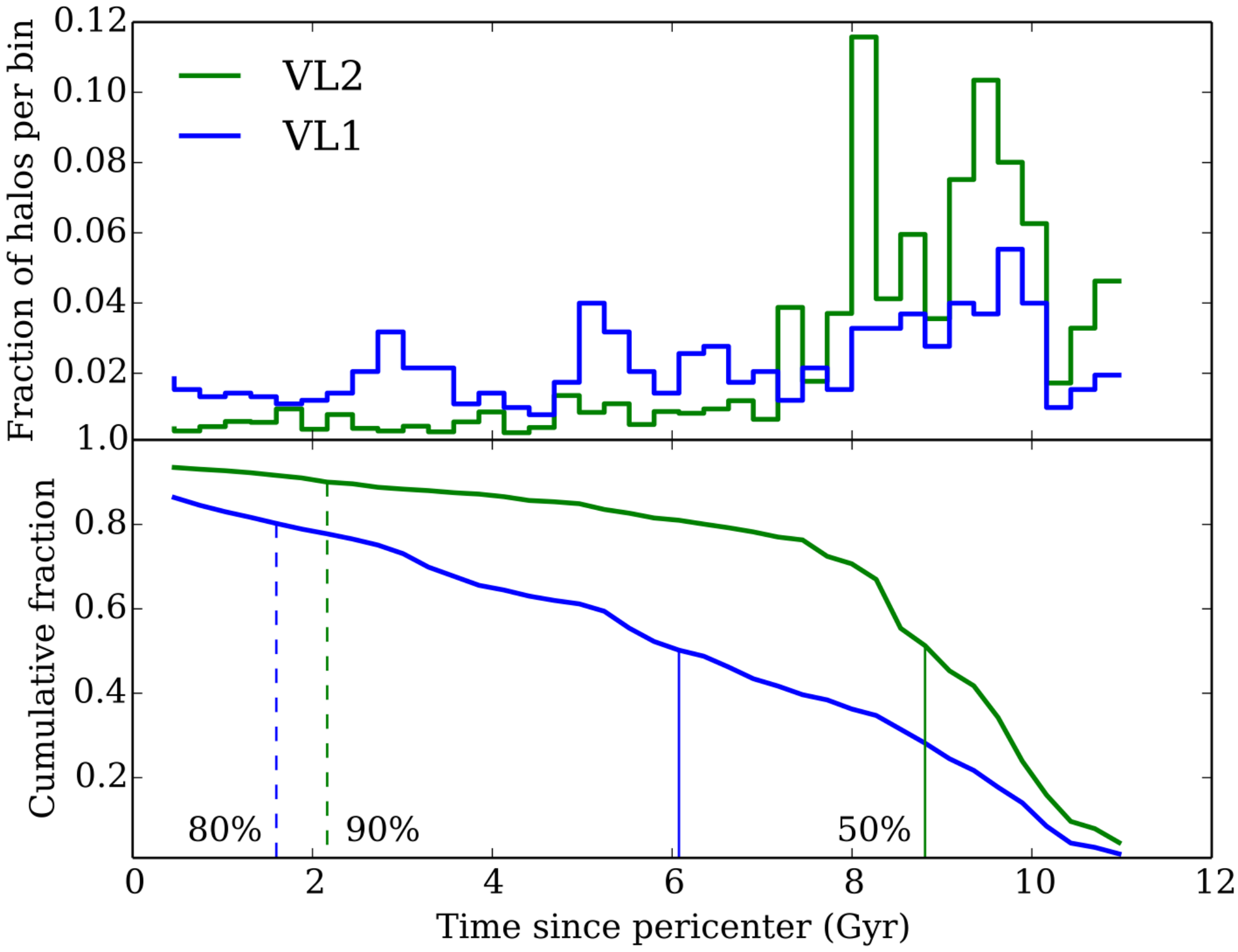


Similar Conclusion Using Via Lactea

Slater and Bell (2014)



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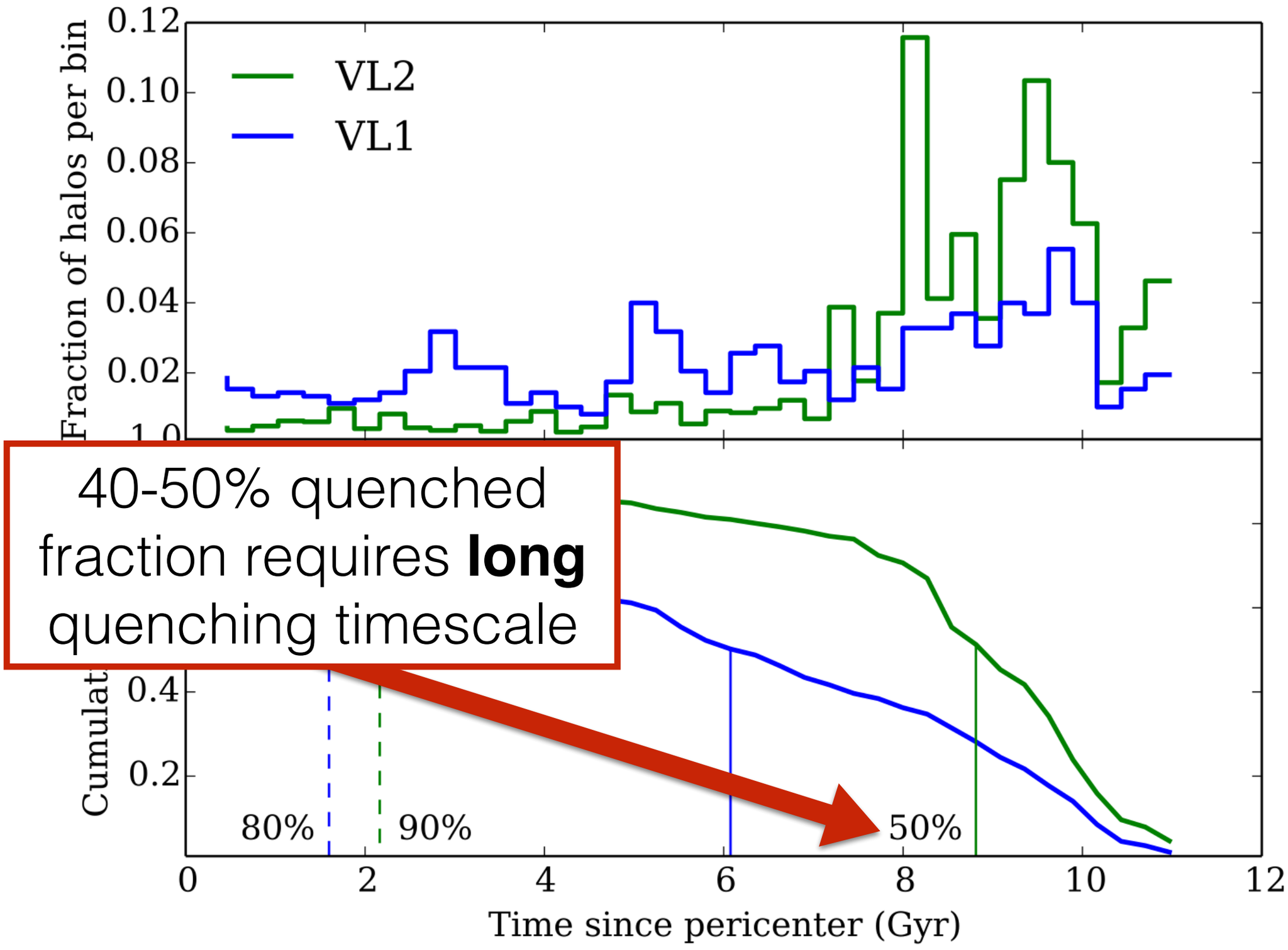

40-50% quenched fraction requires **long** quenching timescale

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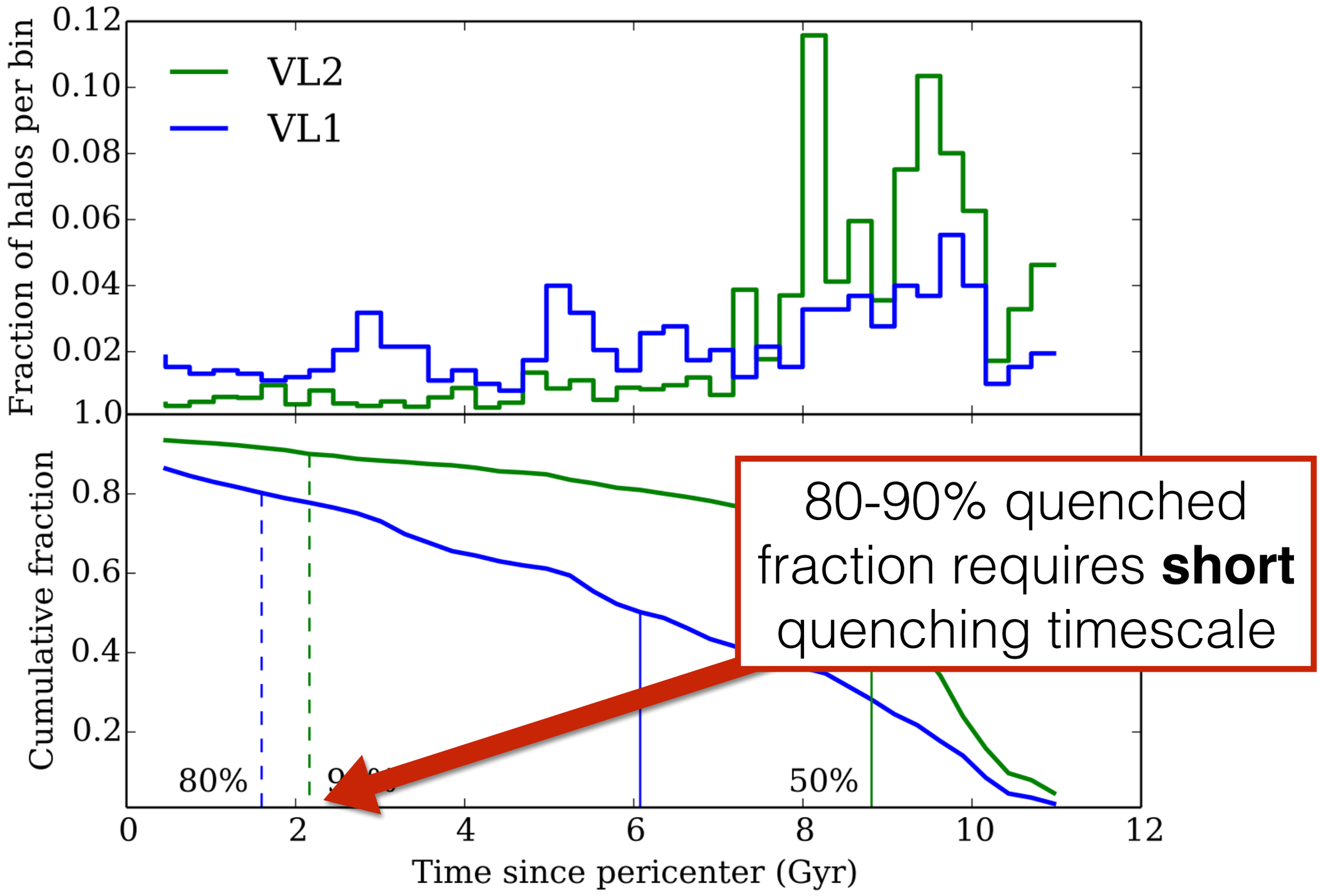

80-90% quenched fraction requires **short** quenching timescale

Conclusions

- Dwarf satellites ($10^{8.5}$-$10^{9.5}$ M_{sun}) not quenched immediately at the virial radius
- If infall time alone determines quenching, sats of $M^* \sim 10^9$ M_{sun} only quenched after 9.5 Gyr
- Ubiquitous quenching of low mass LG sats suggest a critical satellite stellar mass for quenching (~10^8 M_{sun}?)

Thank You!