

# Occurrence Rates as Inputs to Yield Models

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# Demographics

$$\eta_{EARTH} = \frac{N_{measured}}{N_{detectable}}, \text{ where}$$

$$N_{detectable} = \sum_i P_{i,geo} P_{i,SNR}$$

$N_{measured}$ : the number of real Earth-like planets in the Kepler sample (i.e. understanding the **reliability**)

$N_{detectable}$ : the number of stars around which the Kepler pipeline would have detected such planets (i.e. understanding the **completeness**)

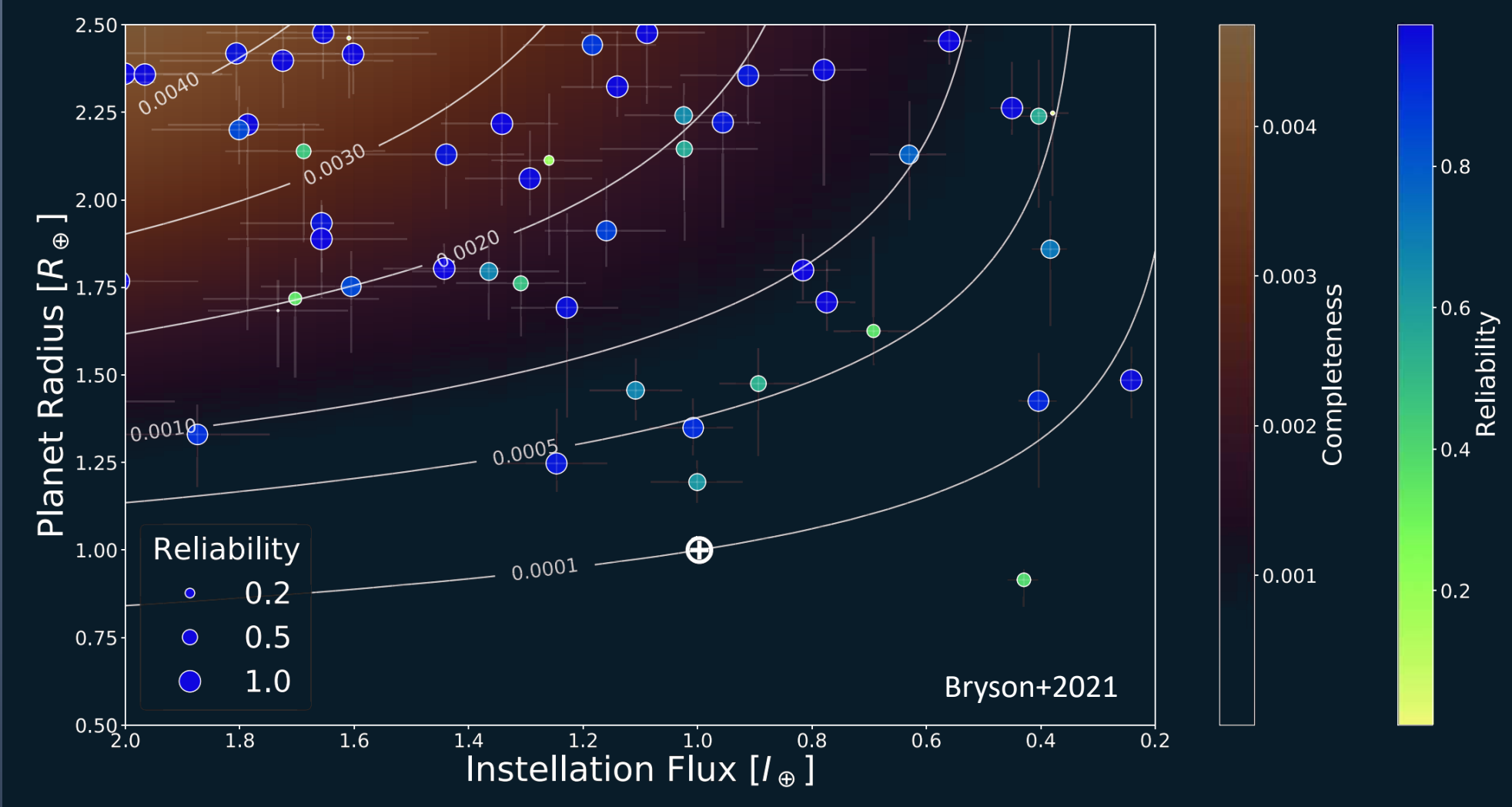
1. Uniform stellar catalogue – well understood selection biases
2. Uniform, automated planet candidate catalogue
3. Understanding of completeness and reliability of candidates

$$\eta_{\oplus}$$

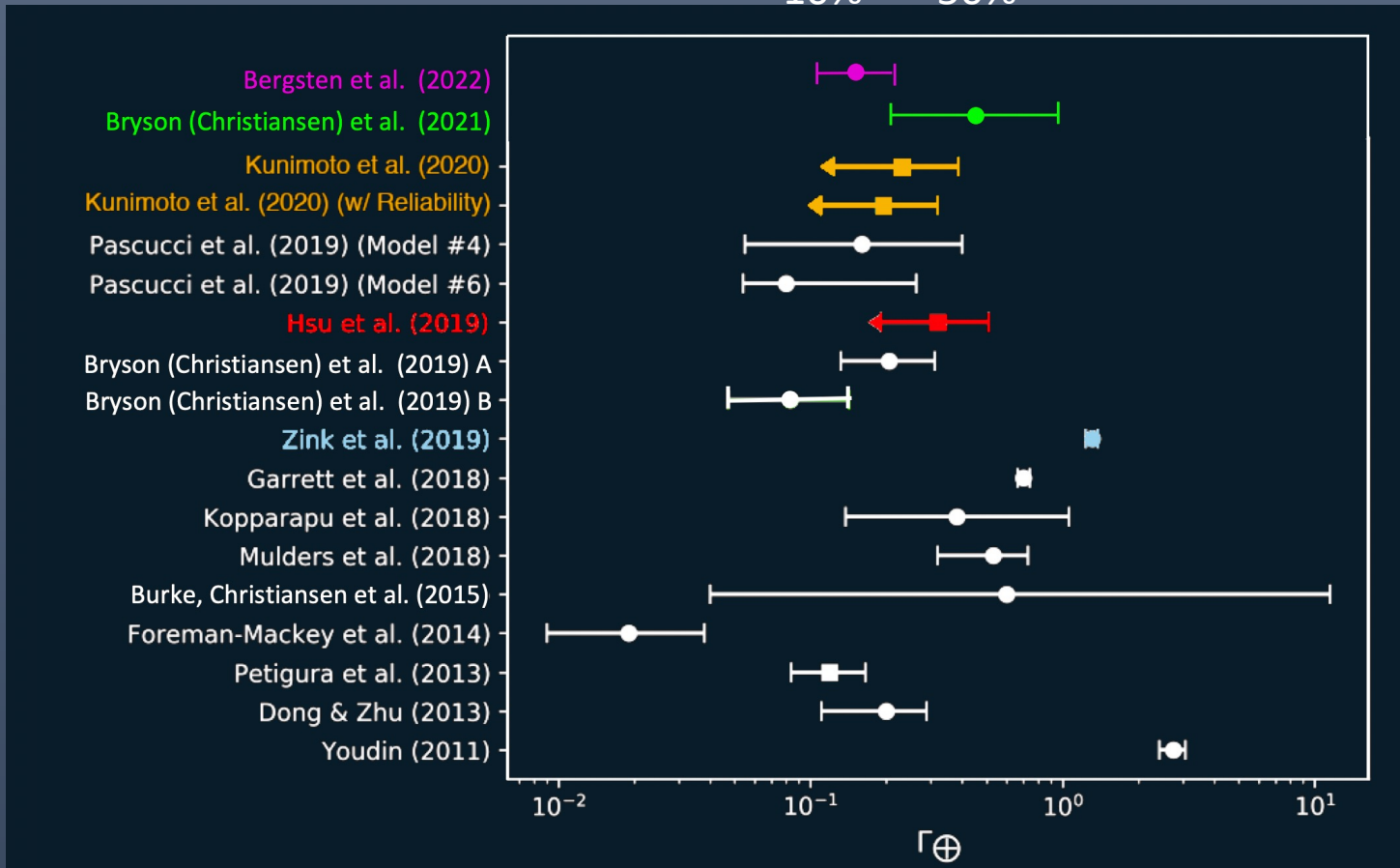
the frequency of

- (i) Earth-like planets
- (ii) in the habitable zones
- (iii) Of Sun-like stars

# Kepler planet sample



# Current best estimates



Modified from Hsu+2019

## Major recent advances

- Gaia stellar parameters
- Inclusion of reliability
- Exploration of the impact of extrapolating from short-period populations
- Independent pipelines
- Investigation of different methodologies

## Still missing

- Treatment of stellar multiplicity
- Treatment of planet multiplicity

# Why is $\eta_{\oplus}$ so important?

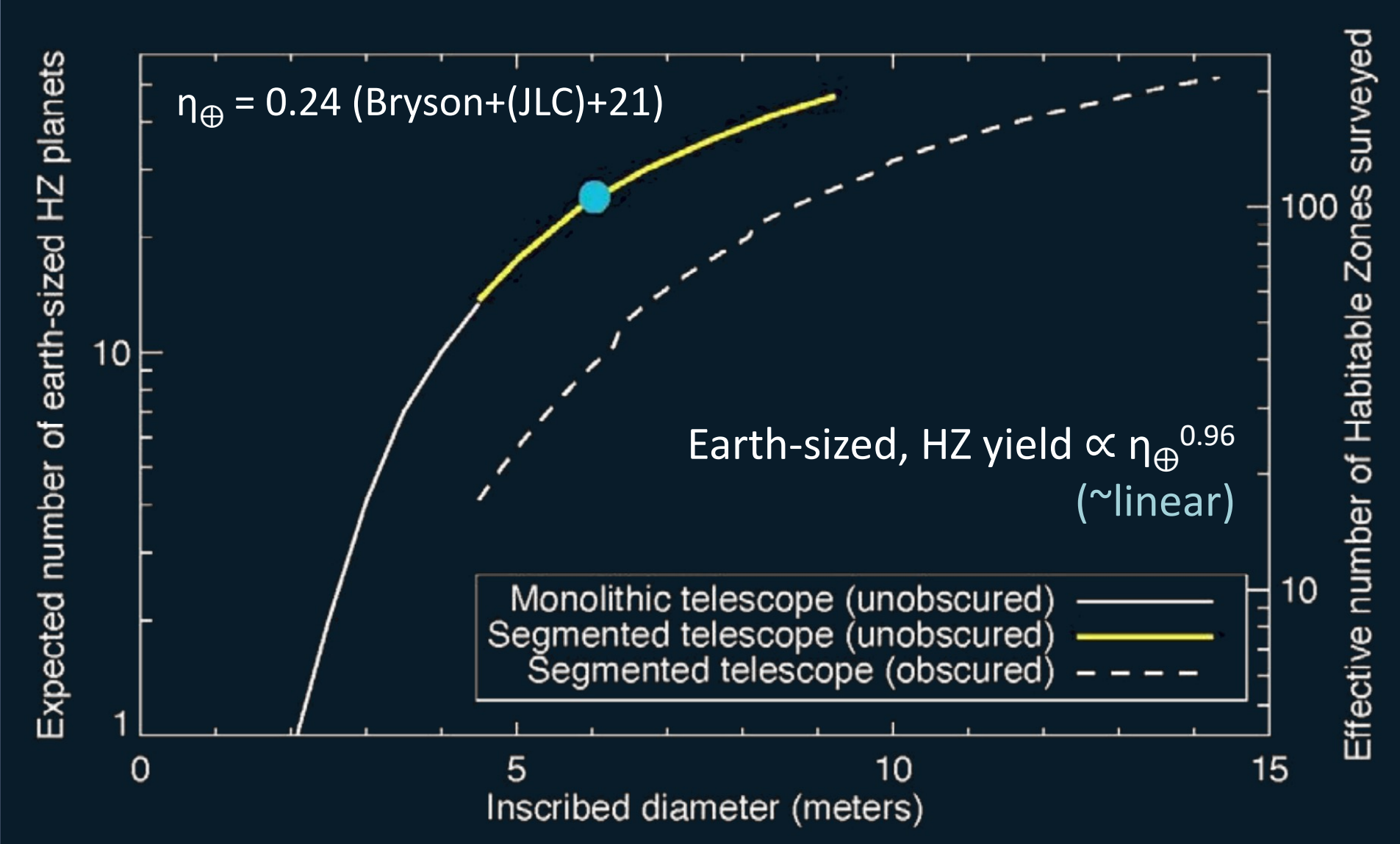


Figure 7.6, Astro2020 Decadal Survey