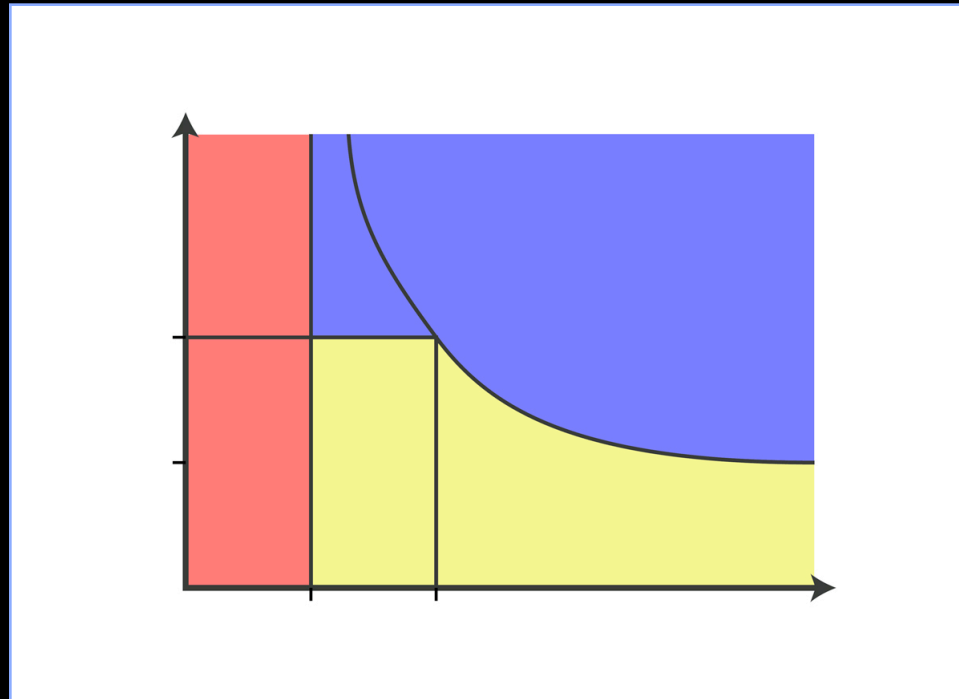


# Predators vs. Parasites:

A Consumer-Resource Distinction  
due to Ecological Exclusion?



Lev R. Ginzburg, Christopher X J. Jensen, and Roberta L. Harnett

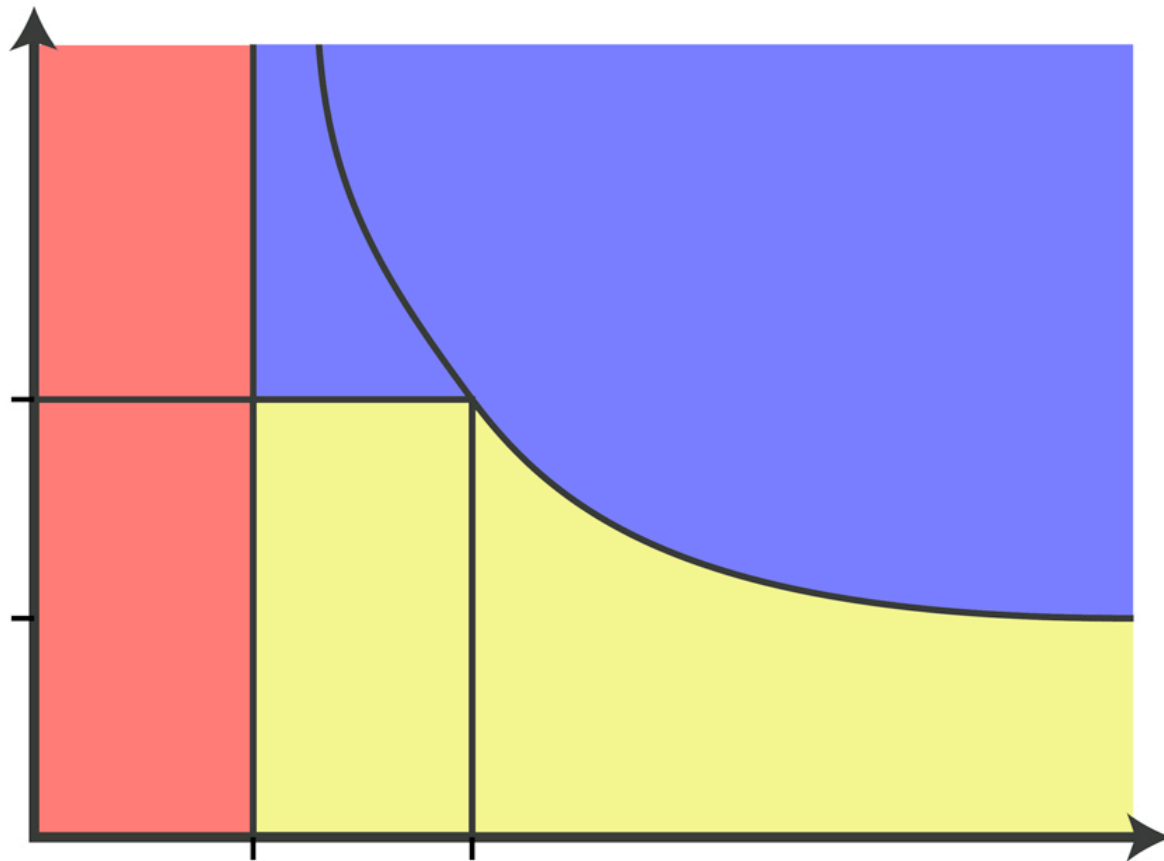
# What is the Distinction between Predators and Parasites?

- Predators kill their prey (preventing future reproduction), parasites do not kill their host.
- Predators consume their entire prey, parasites consume only part of their host.
- Parasites spend the entirety of each life stage on a particular host, whereas predators do not.
- Predators are “bigger” than their prey, whereas parasites are “smaller” than their hosts.

**Is there an ecological distinction between parasites and predators, or is our characterization purely linguistic?**

**Do evolutionary processes drive an ecological distinction?**

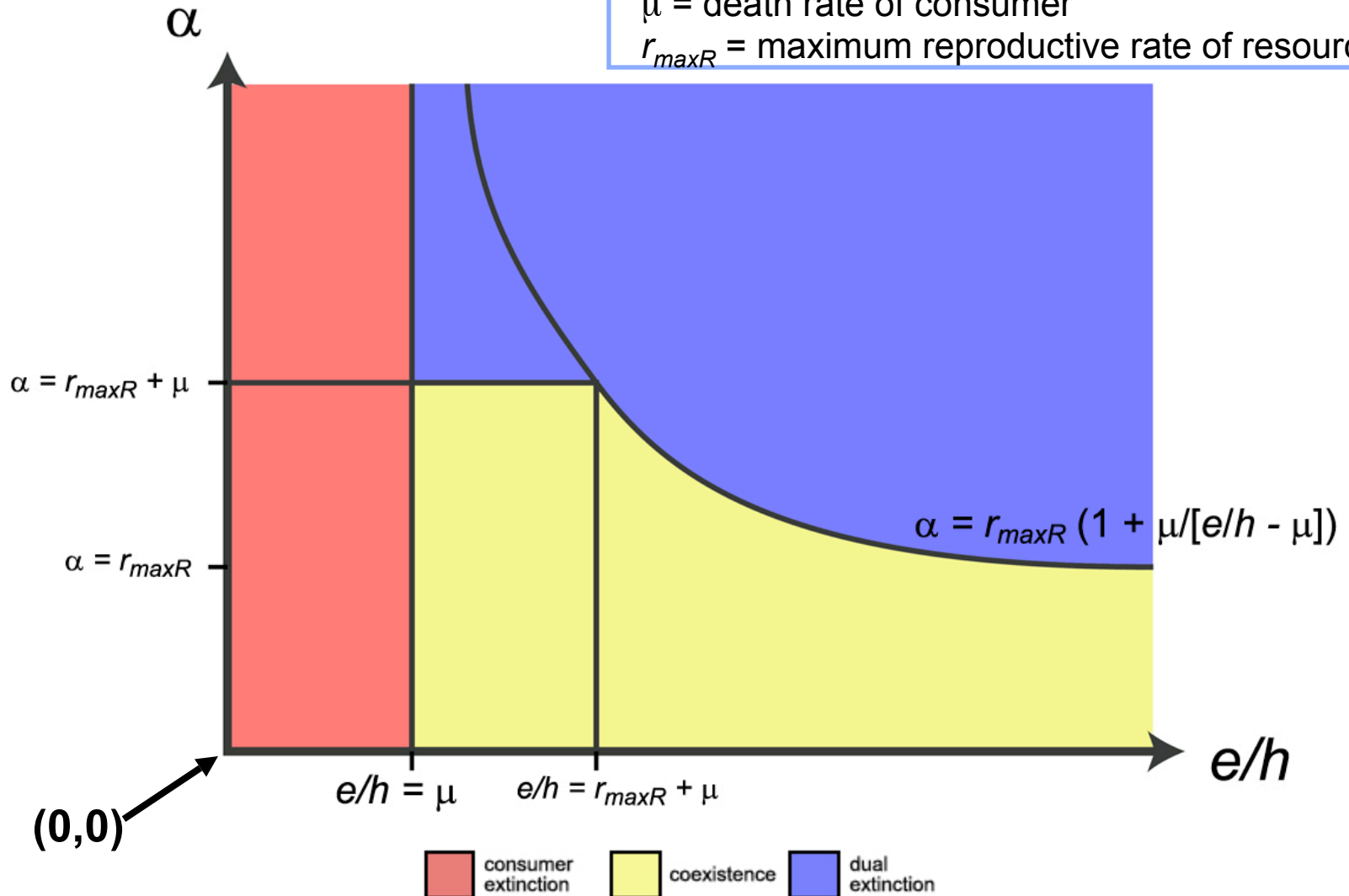
## BKA Parameter Space:



 consumer extinction    coexistence    dual extinction

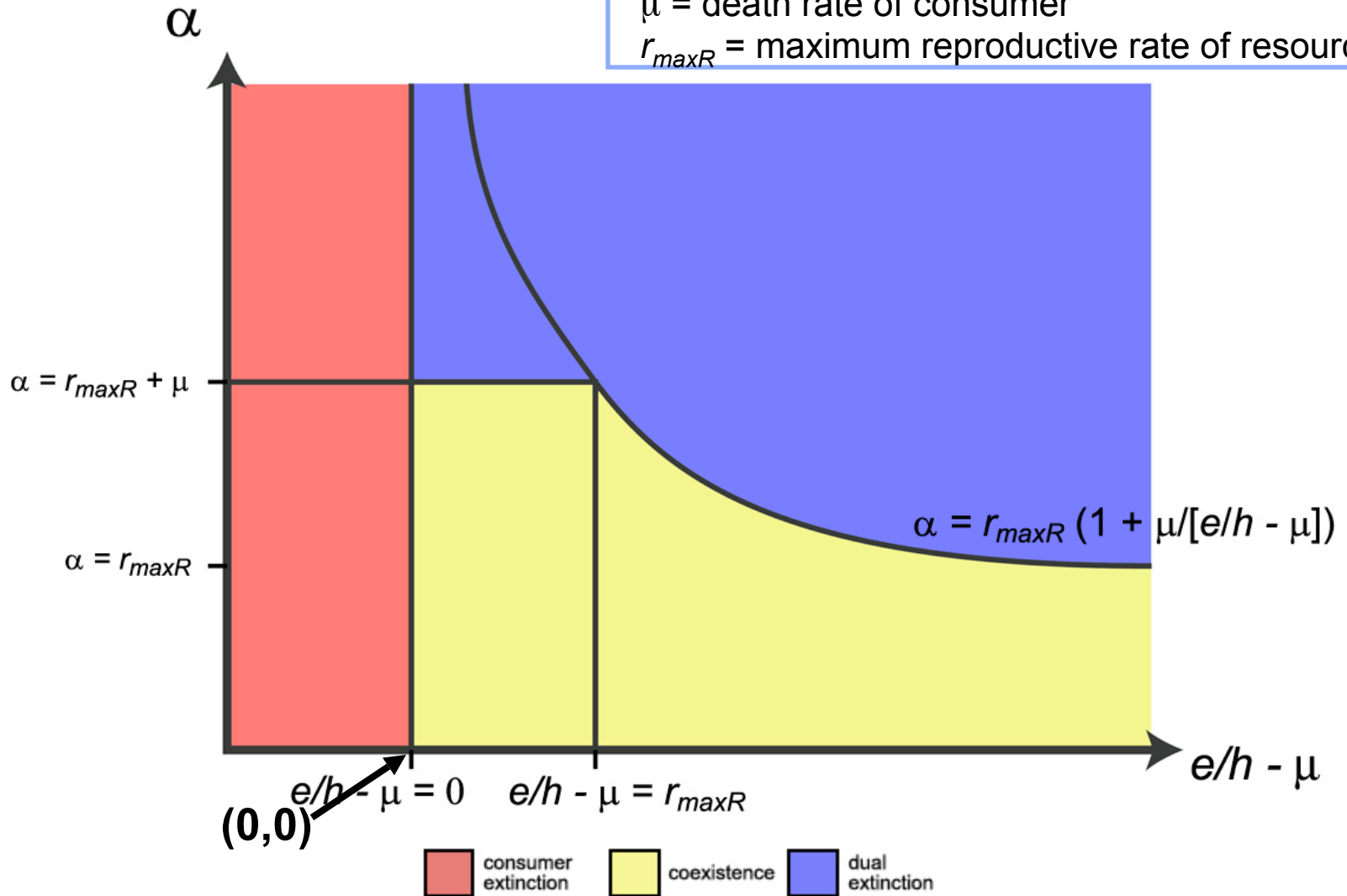
## BKA Parameter Space:

$\alpha$  = capture efficiency of consumer  
 $e$  = conversion efficiency of consumer  
 $h$  = handling time of consumer  
 $\mu$  = death rate of consumer  
 $r_{maxR}$  = maximum reproductive rate of resource



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**What is the maximum  
net reproductive rate of  
the consumer?**

Maximum Consumption Rate =  $1/h$

Maximum Reproductive Rate =  $e/h$

Max. Net Reproduction =  $e/h - \mu$

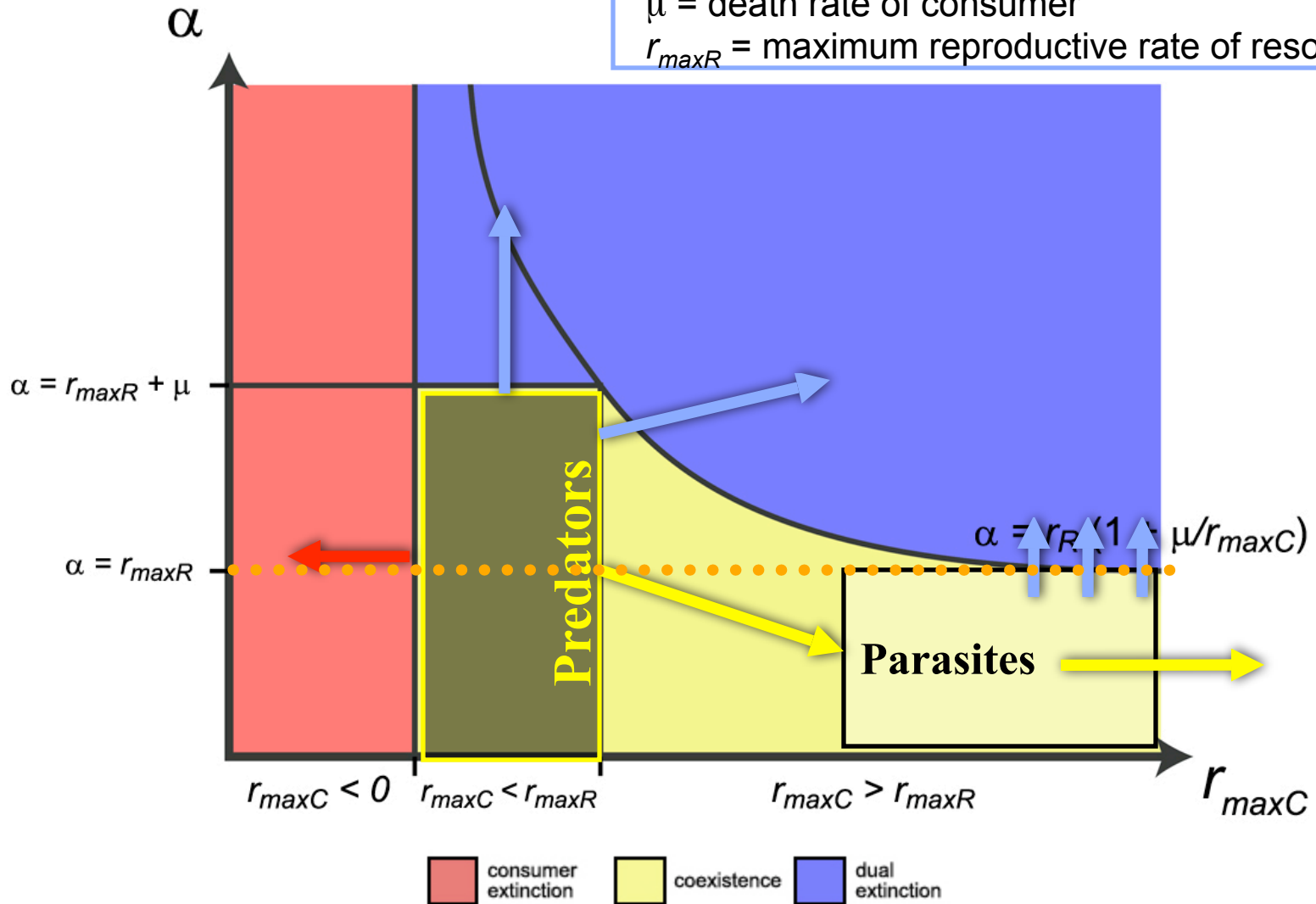
$$r_{maxC} =$$

$$(e/h - \mu)$$



## BKA Parameter Space:

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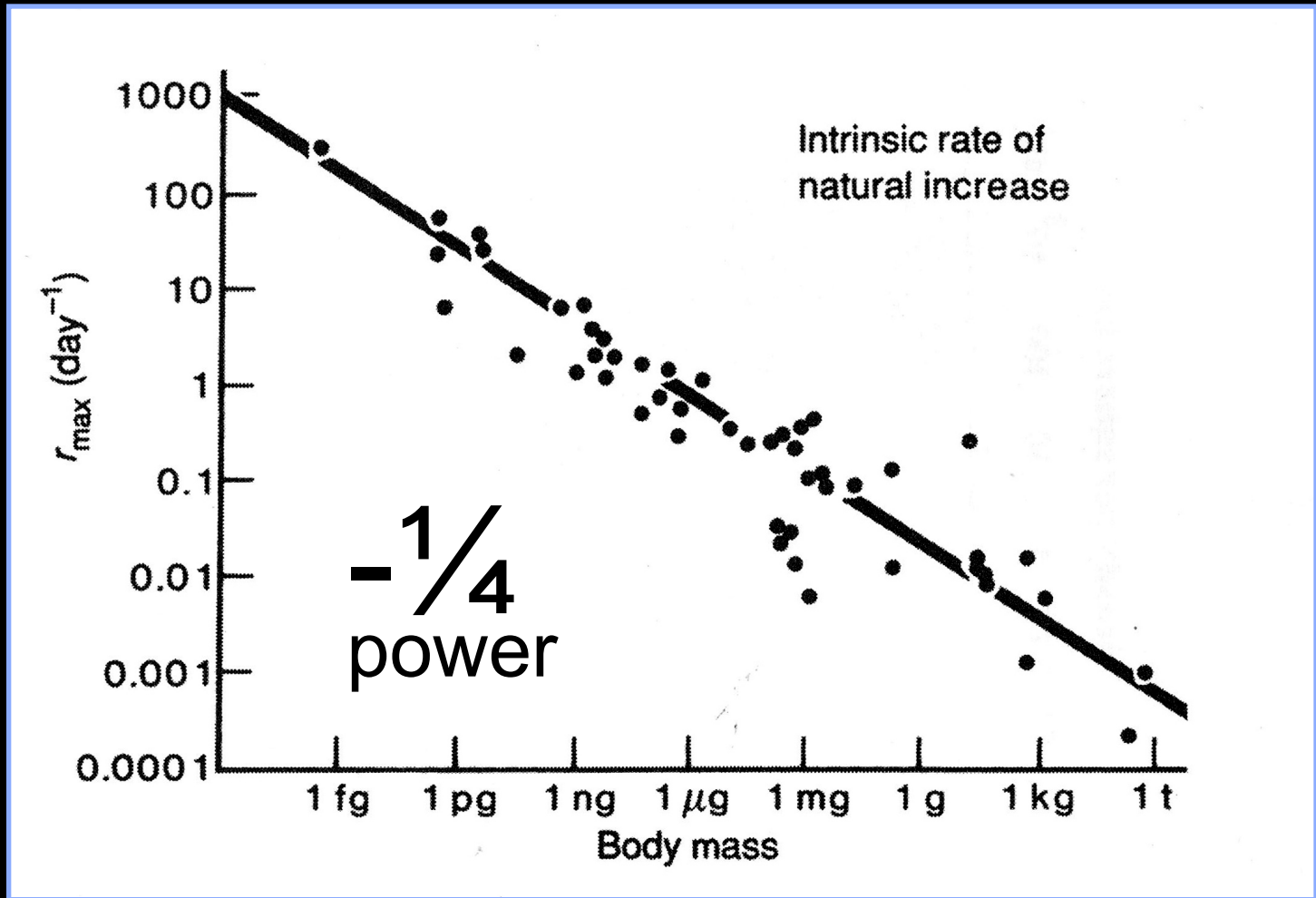
# Data that we do have:

Body Size Ratios for consumer-resource pairs, labeled as:

1. Predator (n= 15419)
2. Parasitoid (n= 215)
3. Parasite (n= 47)
4. Pathogen (n= 3)

(Source: Brose *et al.* 2005, Ecology 86:2545)

# Net Reproductive Rate is Allometrically Scaled:



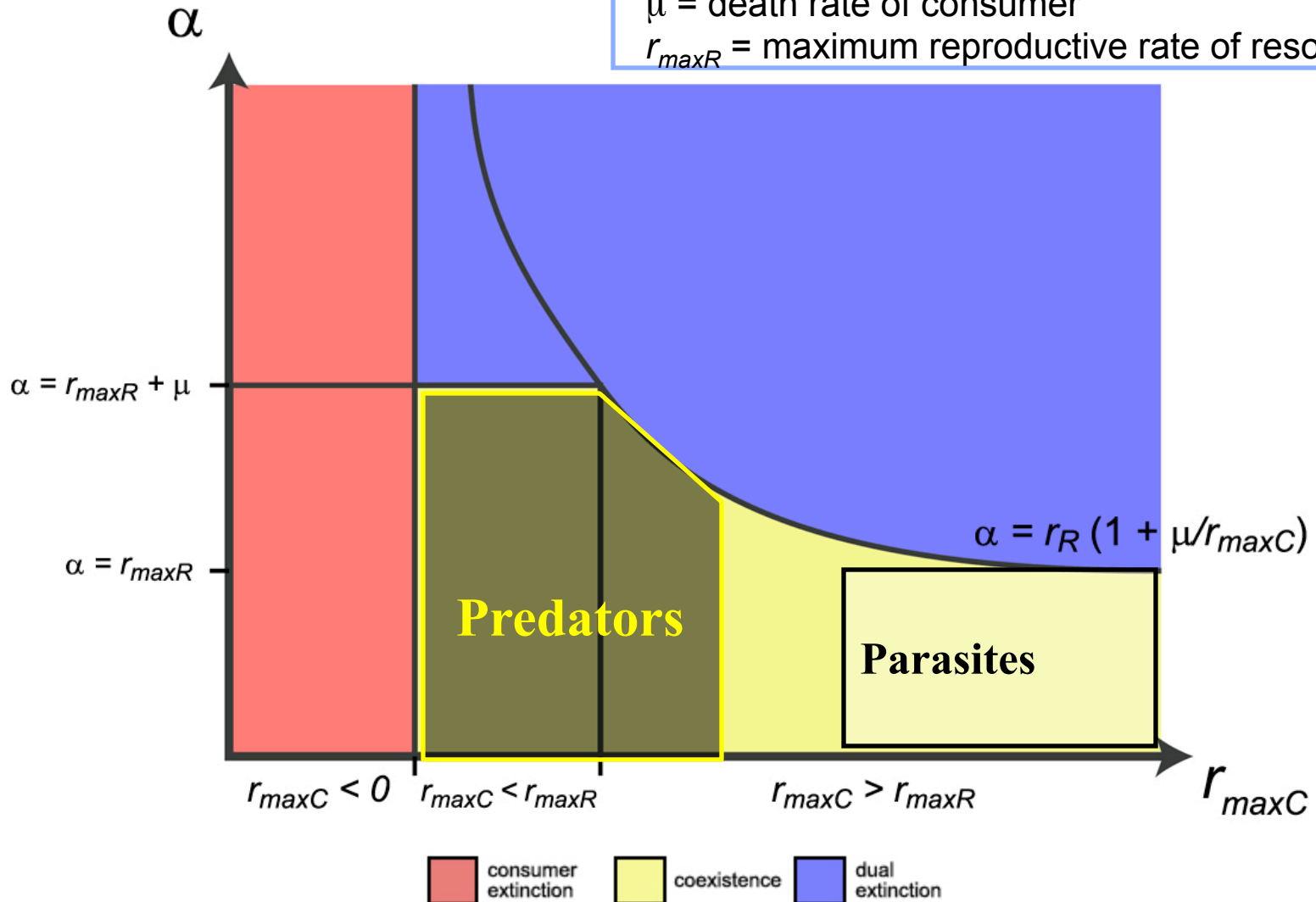
# A Comparison of Definitions:

(net reproductive rate inferred from body size)

|            | Our "Predator"<br>( $r_C \leq r_R$ ) | Our "Parasite"<br>( $r_C > r_R$ ) |
|------------|--------------------------------------|-----------------------------------|
| Predator   | 78.3%                                | 21.7%                             |
| Parasitoid | 38.6%                                | 61.4%                             |
| Parasite   | 0.0%                                 | 100.0%                            |
| Pathogen   | 0.0%                                 | 100.0%                            |

## BKA Parameter Space:

$\alpha$  = capture efficiency of consumer  
 $e$  = conversion efficiency of consumer  
 $h$  = handling time of consumer  
 $\mu$  = death rate of consumer  
 $r_{maxR}$  = maximum reproductive rate of resource



## **Substantiating this distinction between predators and parasites:**

- Actual maximum net reproductive rates for consumer resource pairs would yield more direct insights
- We need more data on parasites/pathogens and their hosts
- Key prediction is a limitation on consumption efficiency: this data would allow for falsification of this hypothesis

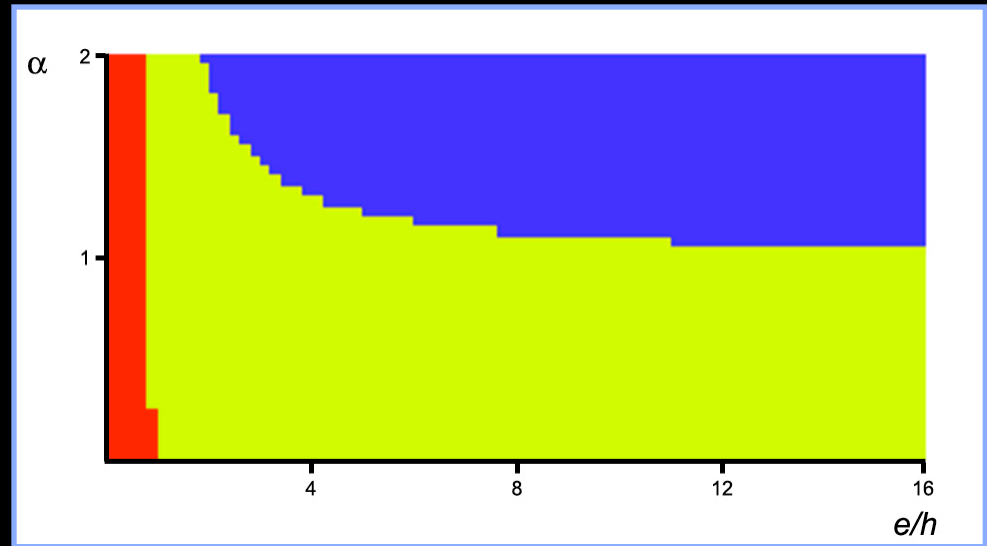
# Acknowledgements:

Roger Arditi and Dan Stoebel provided insightful comments on earlier versions of this presentation

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# Is this theory robust to functional response form?

Ratio Dependent:



Prey Dependent:

