

Teias tróficas e mutualismos

1. O que são teias tróficas?
2. Efeitos indiretos e cascatas tróficas
3. Estrutura e estabilidade em teias tróficas
4. E os mutualismos?
5. Resumo
6. Sugestão de leitura

Ao final da aula, nós deveremos saber como:

1. A estrutura influencia na propagação de efeitos indiretos
2. Estabilidade e complexidade estão relacionadas
3. Como mutualismos influenciam a fragilidade de comunidades ecológicas

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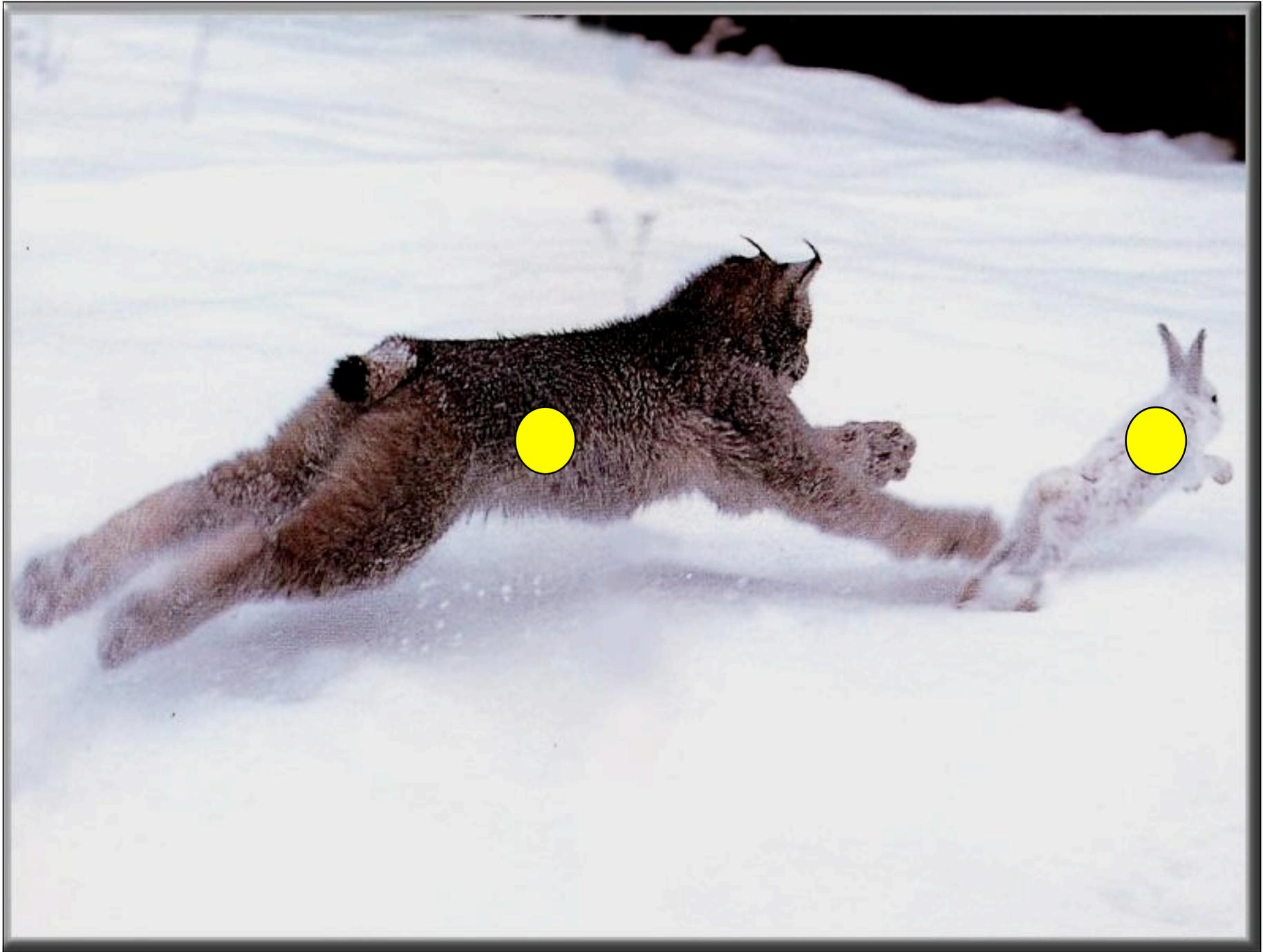


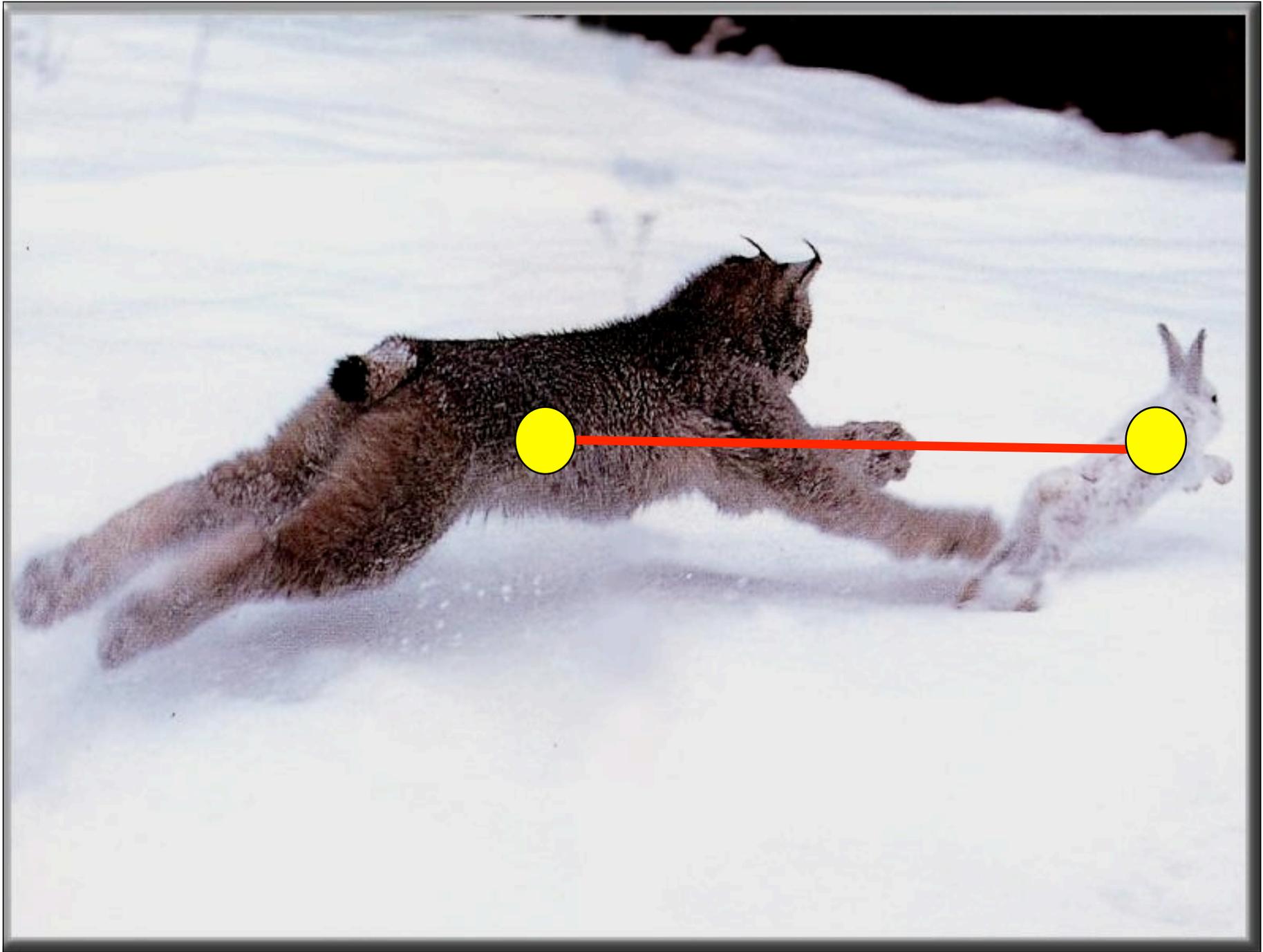


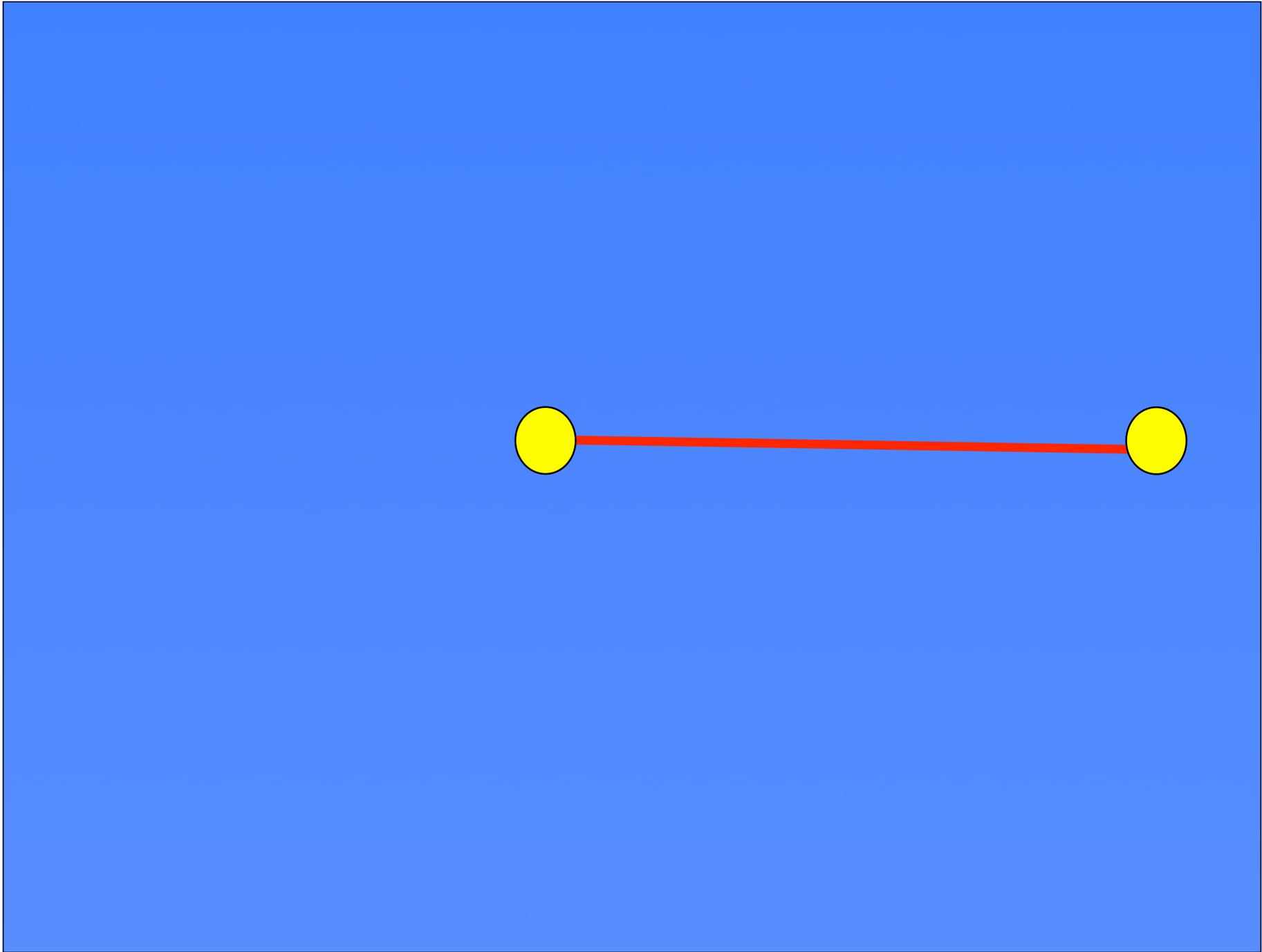
I am tempted to give one more instance showing how plants and animals, most remote in the scale of nature, are bound together by a web of complex relations

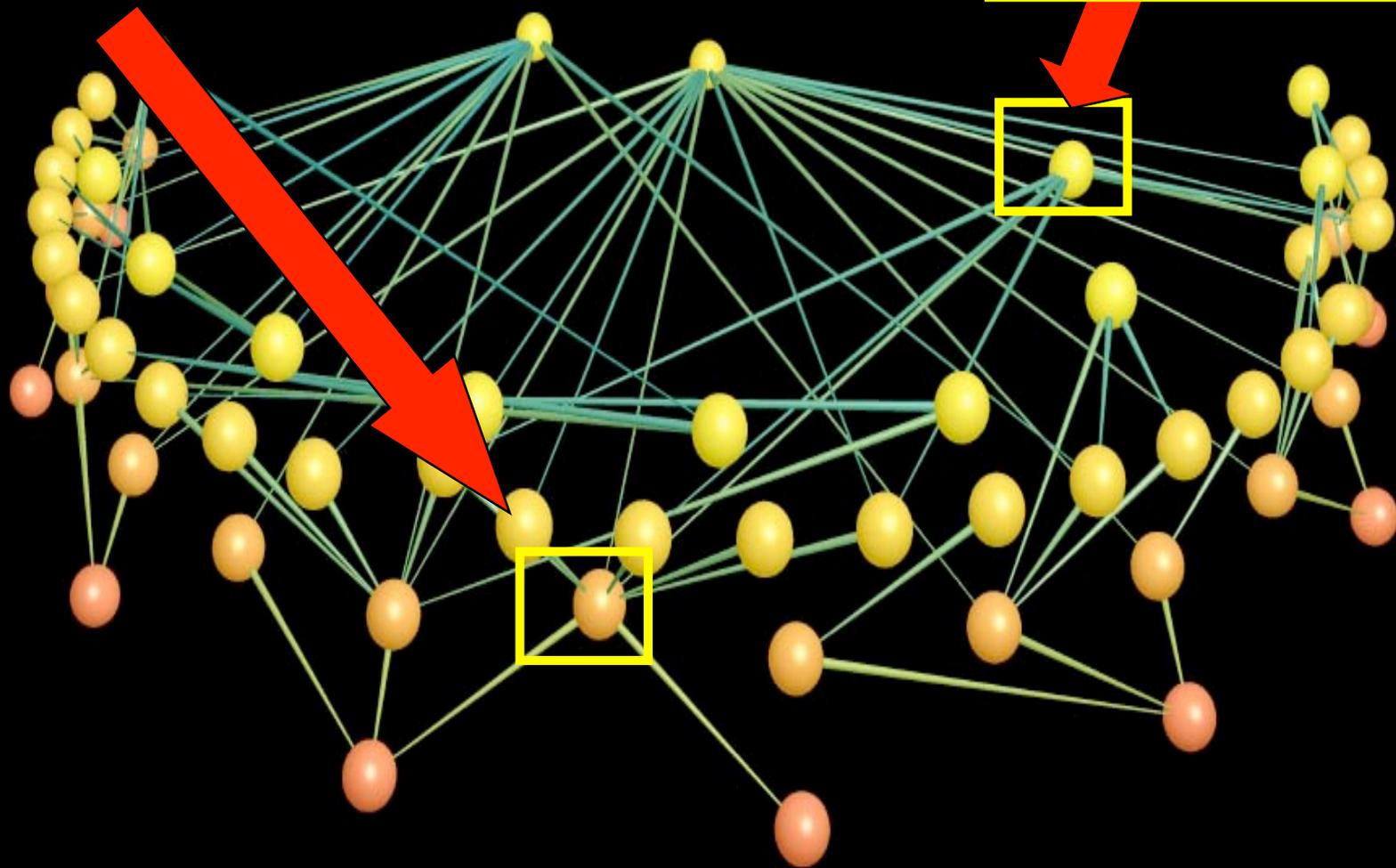












Teia trófica: Definição

1. Teia trófica: é uma rede formada pelas interações tróficas entre diferentes espécies

Como montar uma rede?





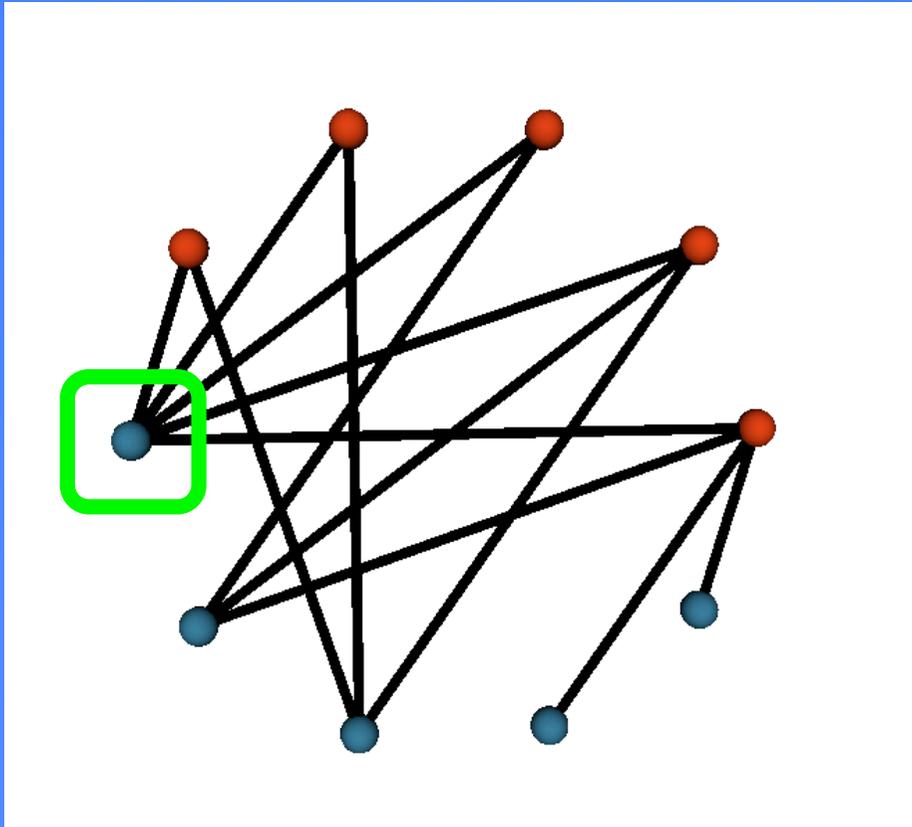


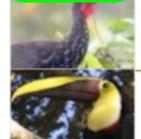
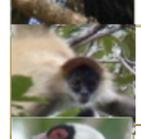
					
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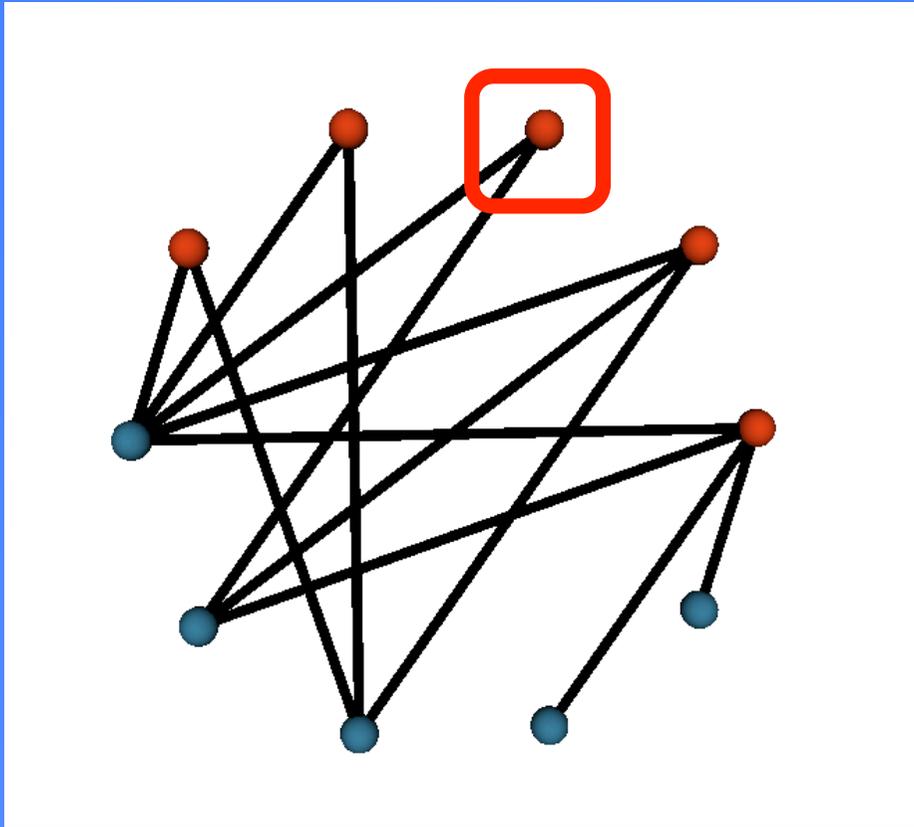
					
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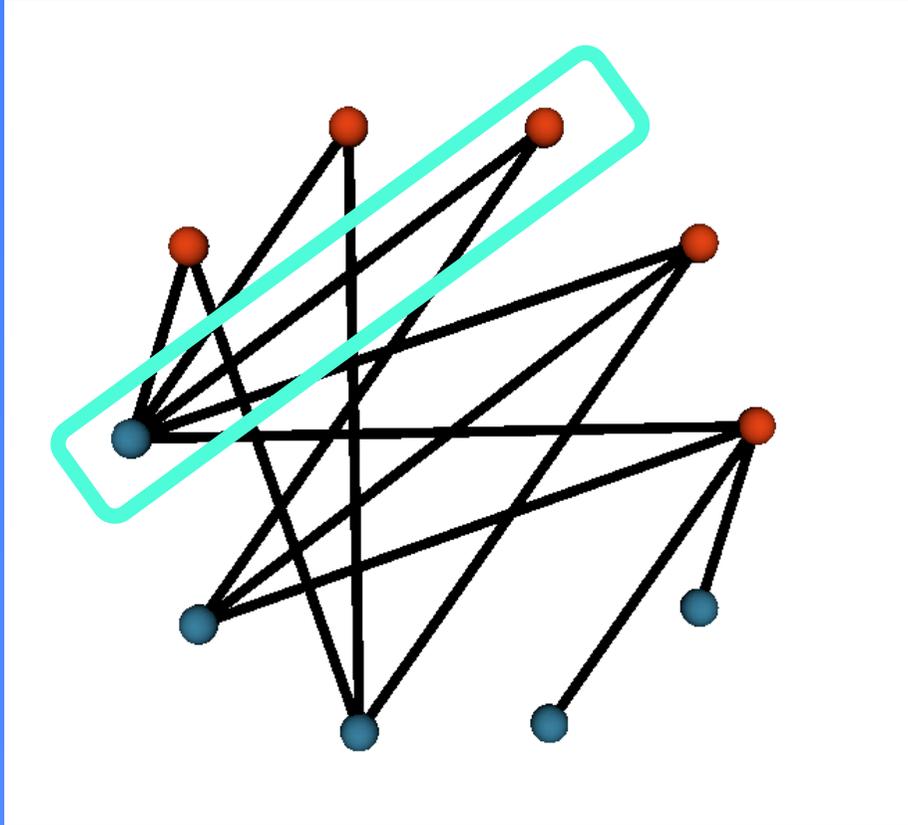
					
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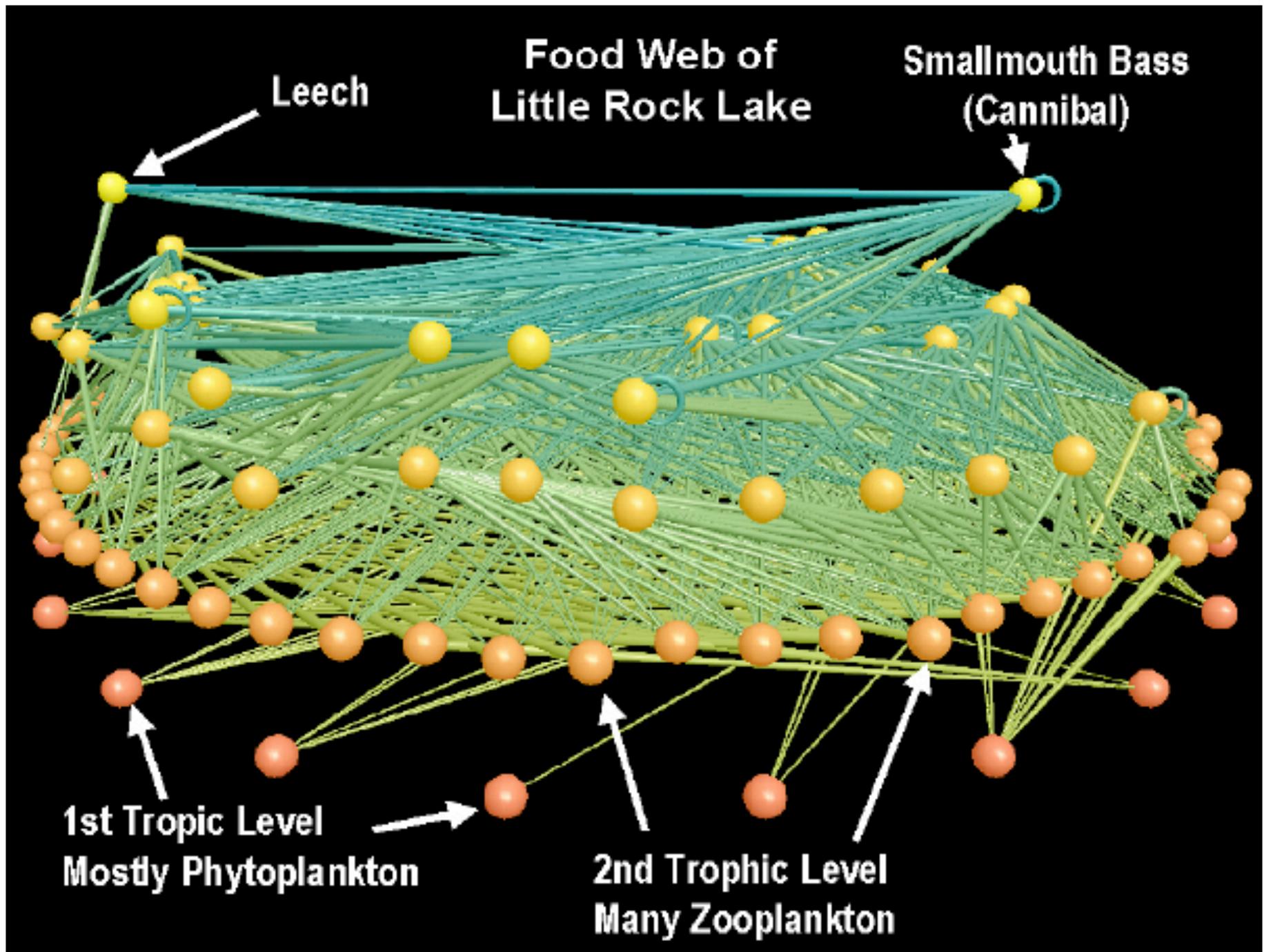
					
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	1	0	0	0	0



					
	1	1	1	1	1
	1	1	1	0	0
	0	1	0	1	1
	1	0	0	0	0
	1	0	0	0	0



					
	1	1	1	1	1
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	0	1	0	1	1
	1	0	0	0	0
	1	0	0	0	0



Teias tróficas

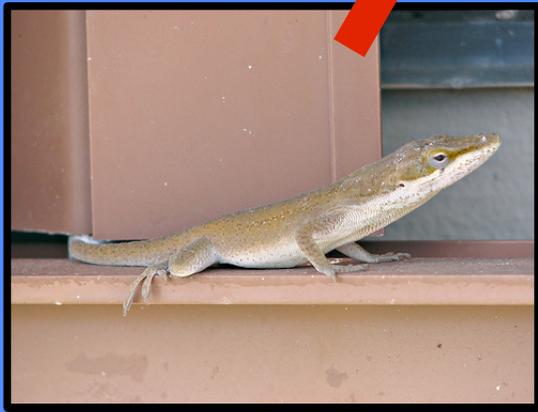
1. O que são teias tróficas?
- 2. Efeitos indiretos e cascatas tróficas**
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Efeito indireto: definição

1. Efeito indireto é uma mudança na abundância de uma espécie causada por uma espécie que não interage diretamente com ela



+



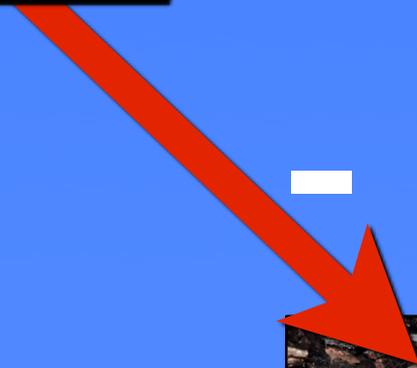
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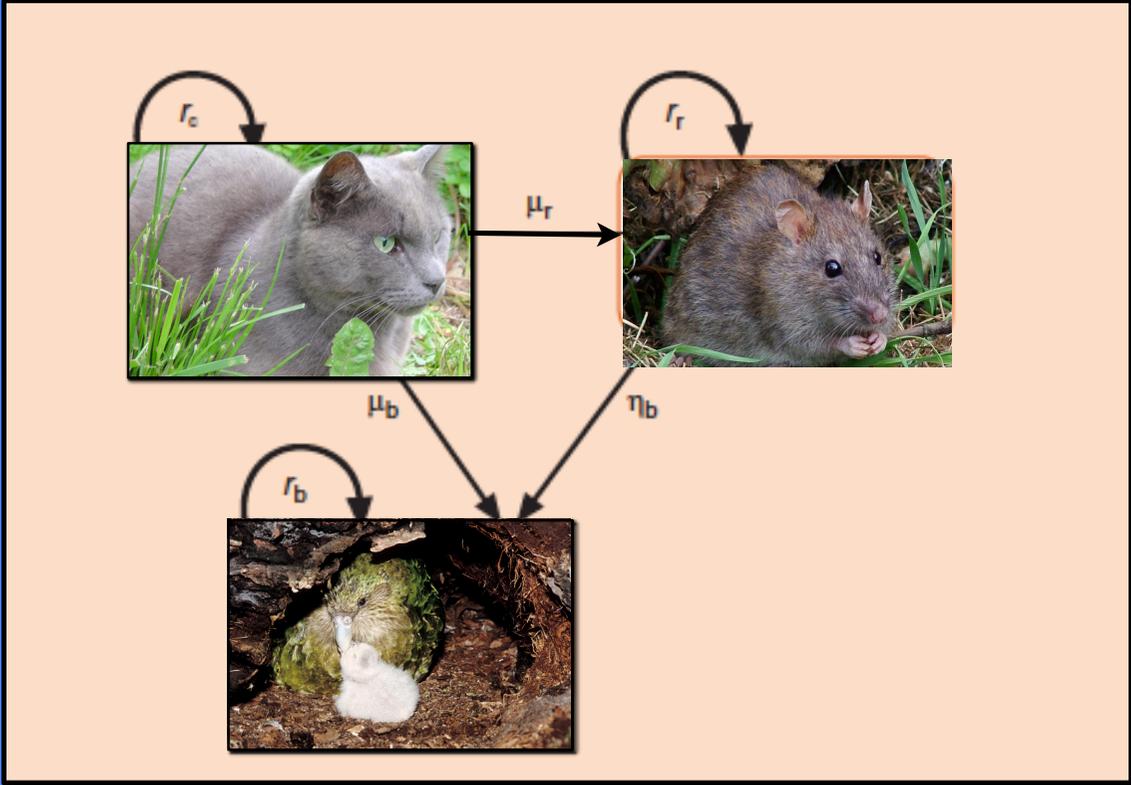
Efeito indireto



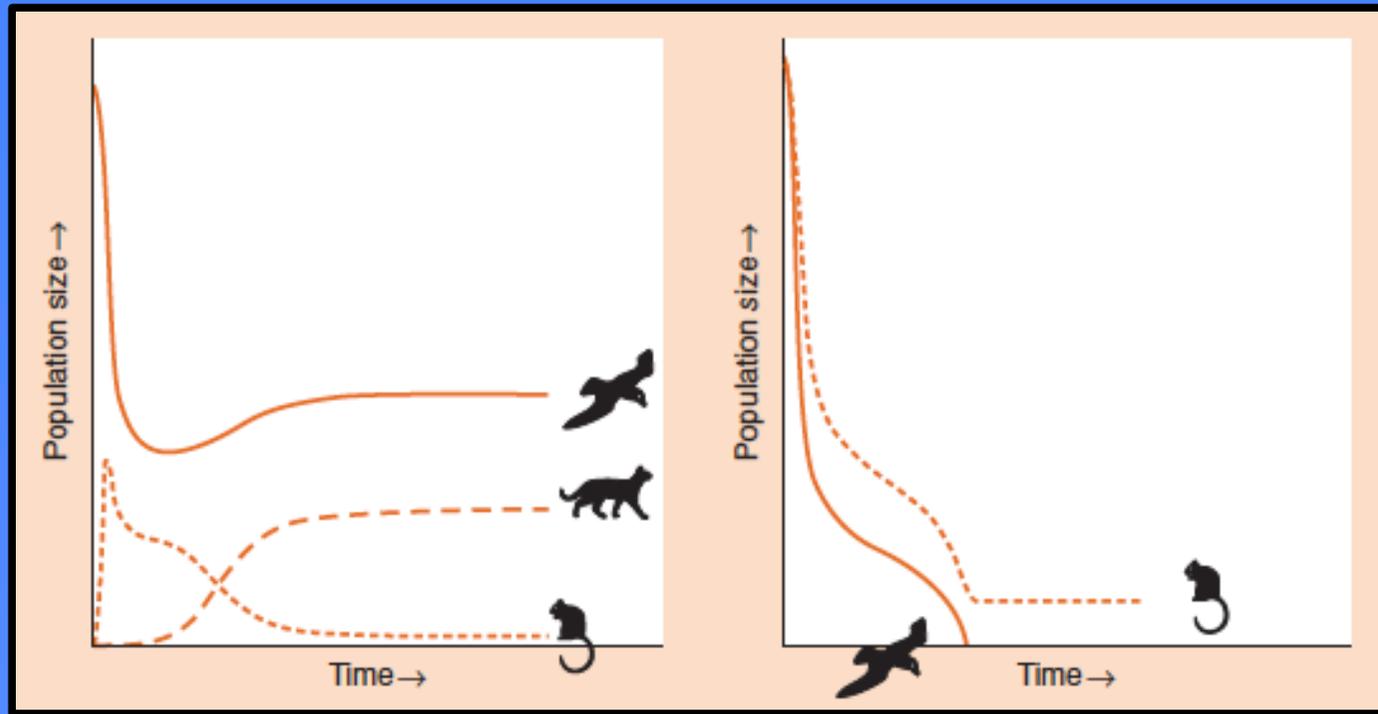




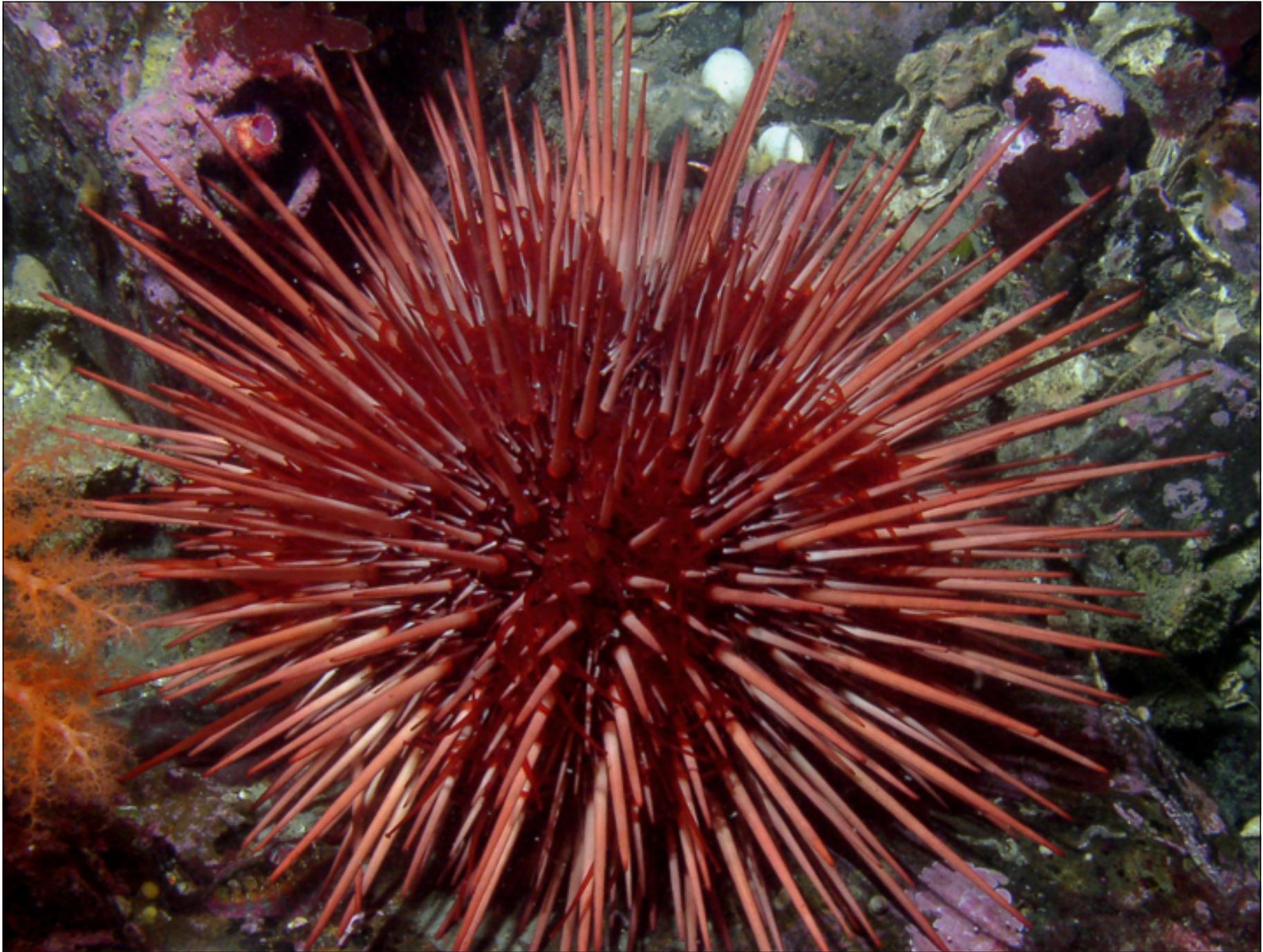




Efeitos inesperados



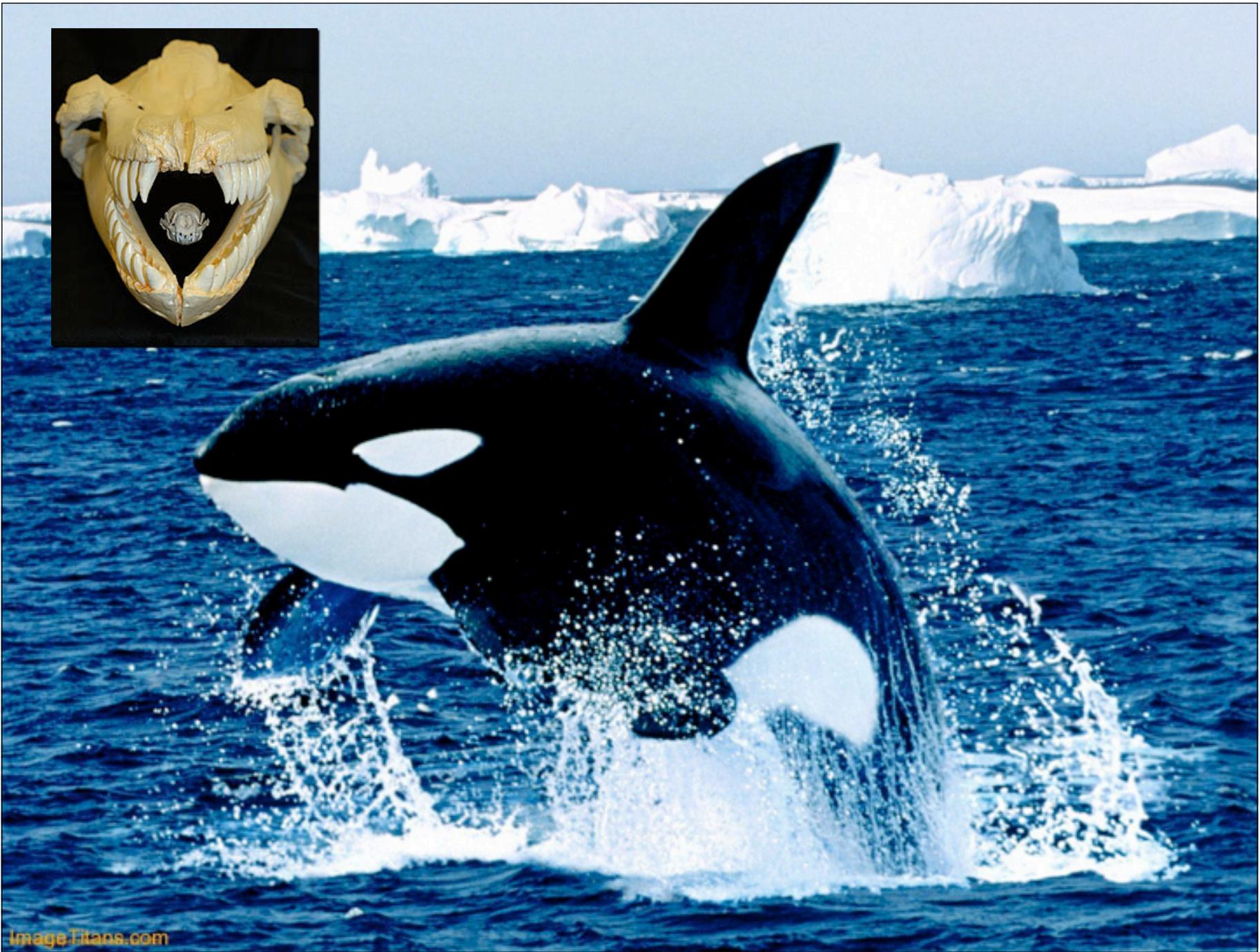


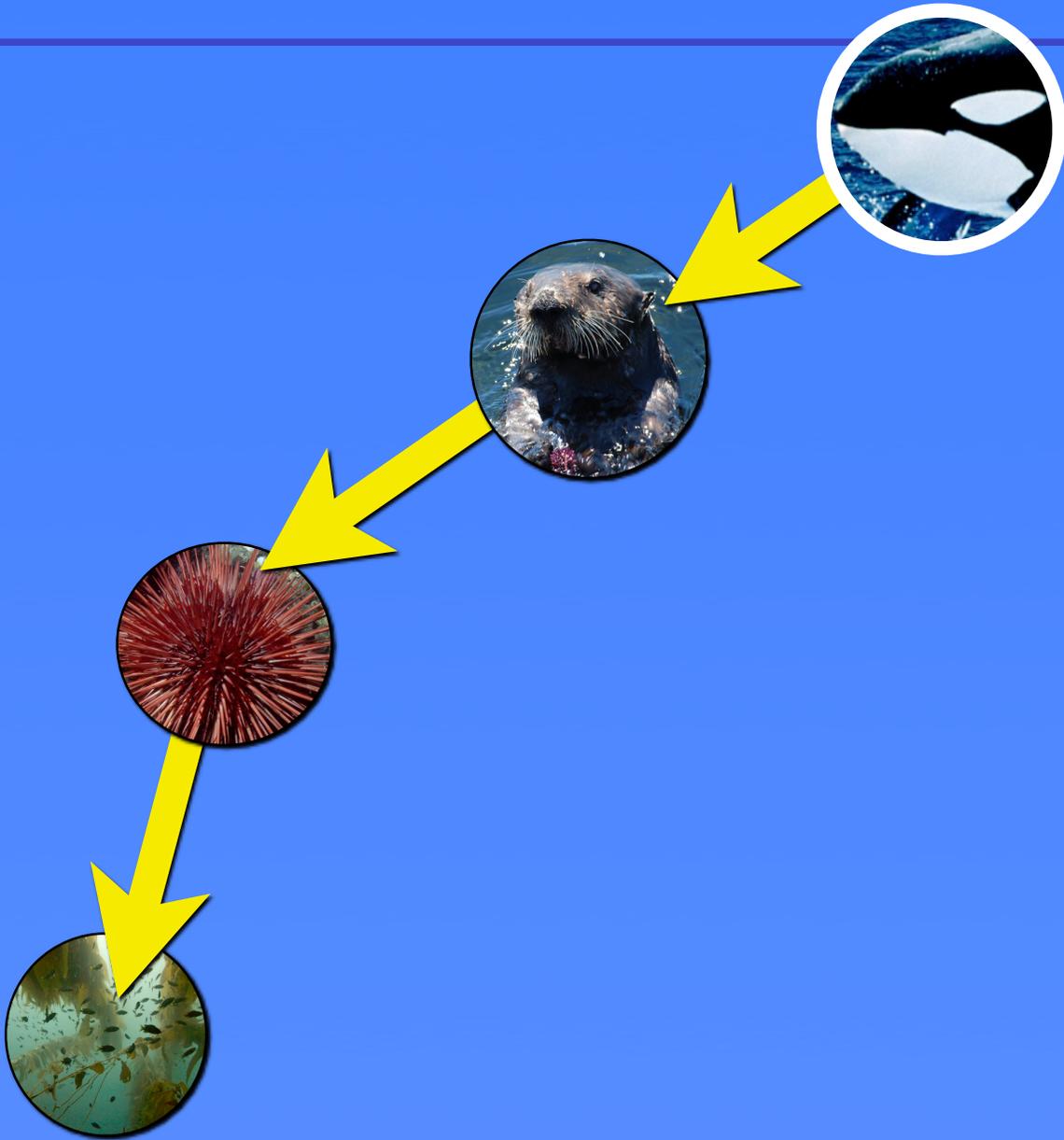


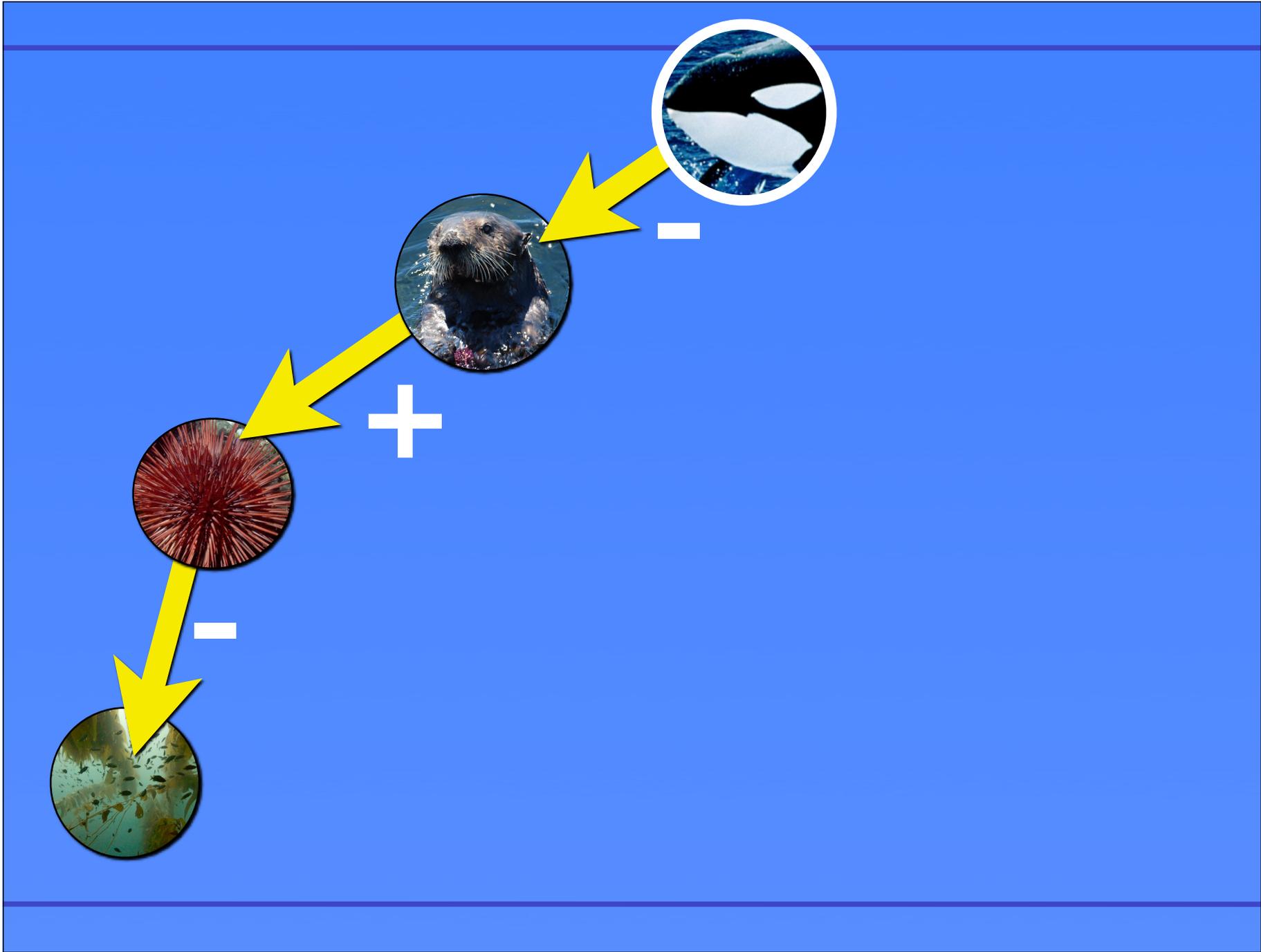
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Cascata trófica

Cascata trófica: definição

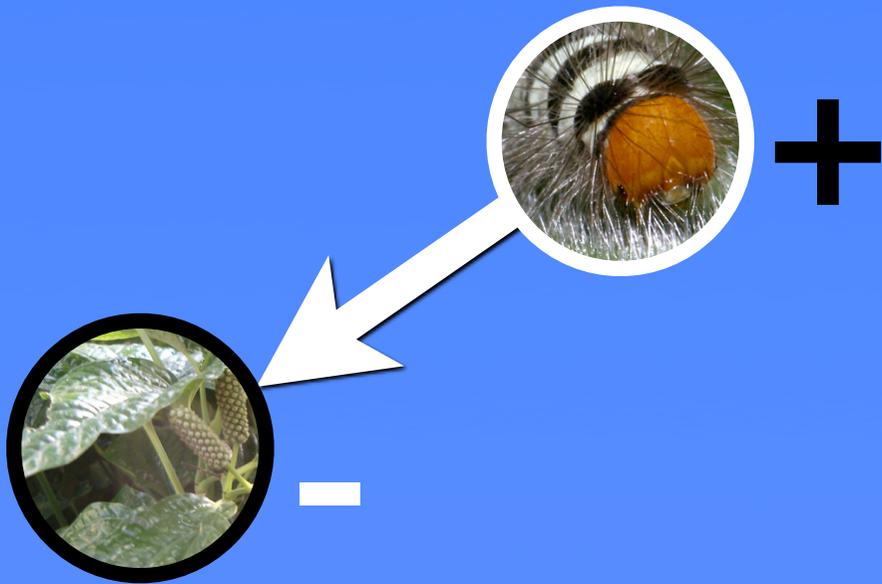
1. Cascata trófica é uma mudança causada por uma espécie em uma teia trófica que tem efeitos alternados em diferentes níveis tróficos



Cascata trófica

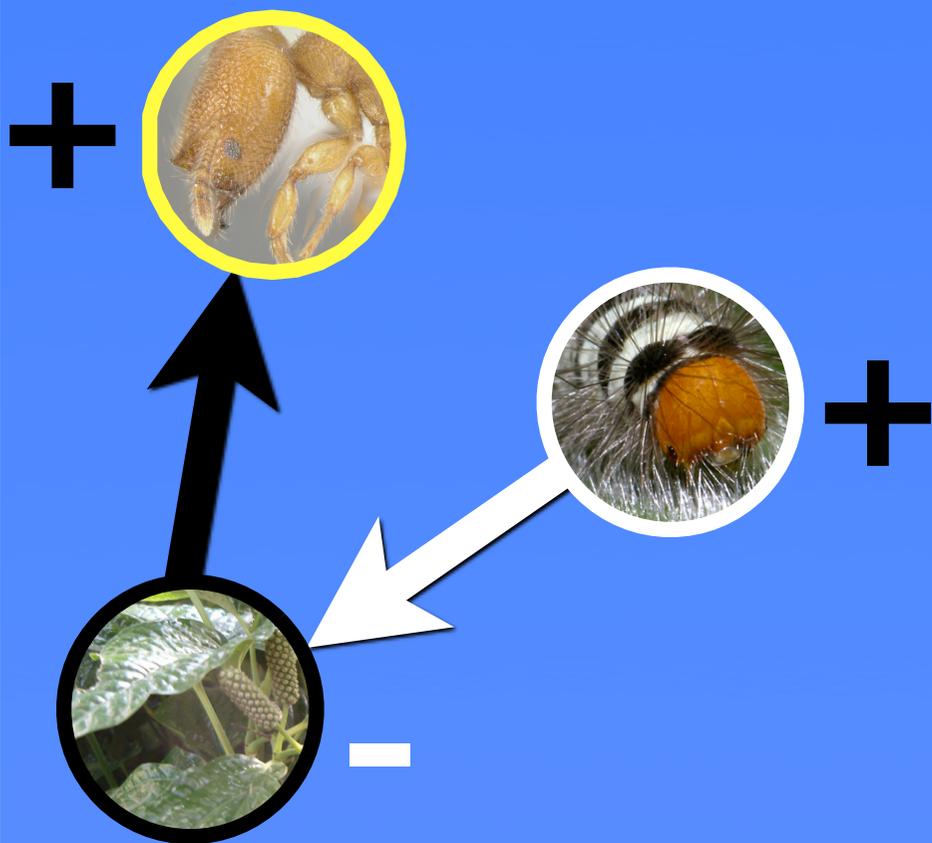


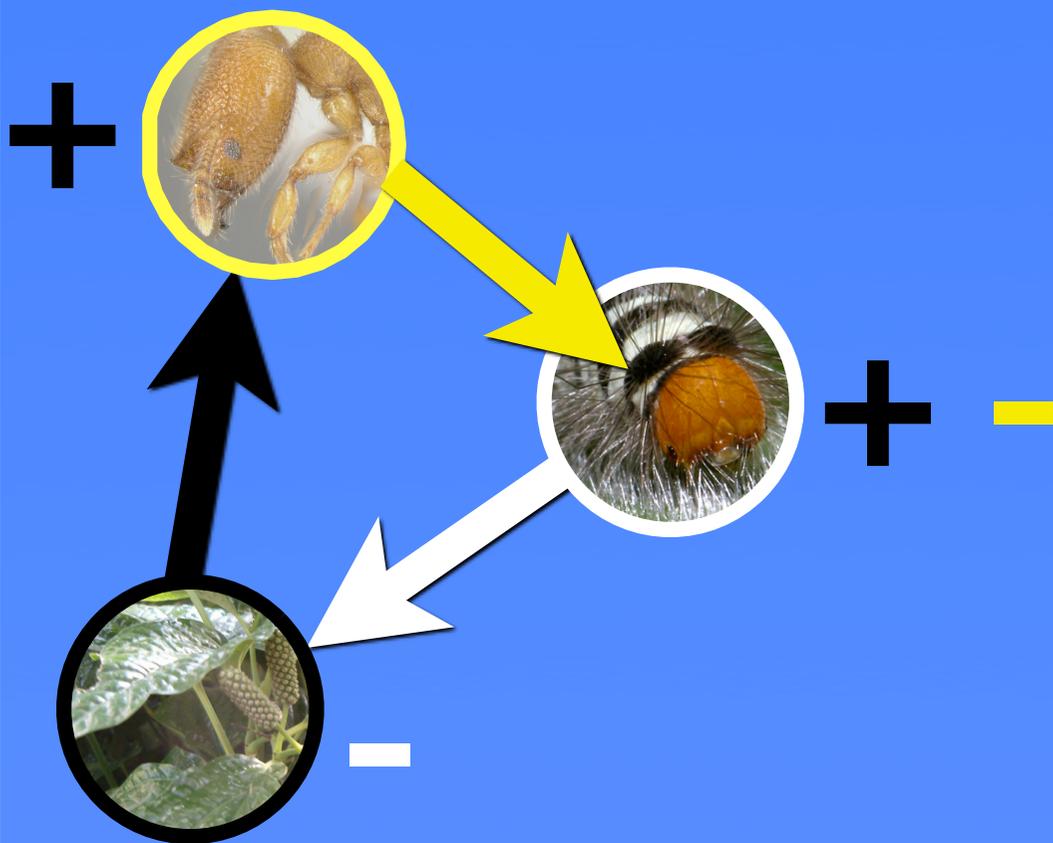


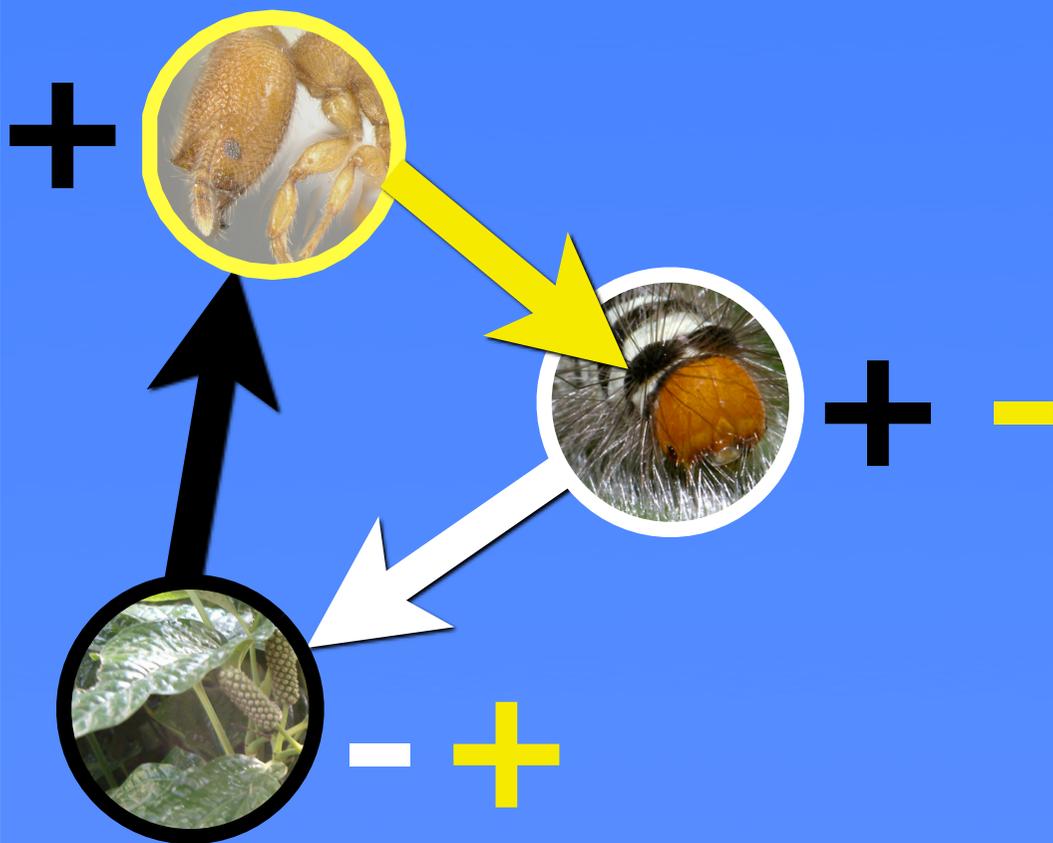




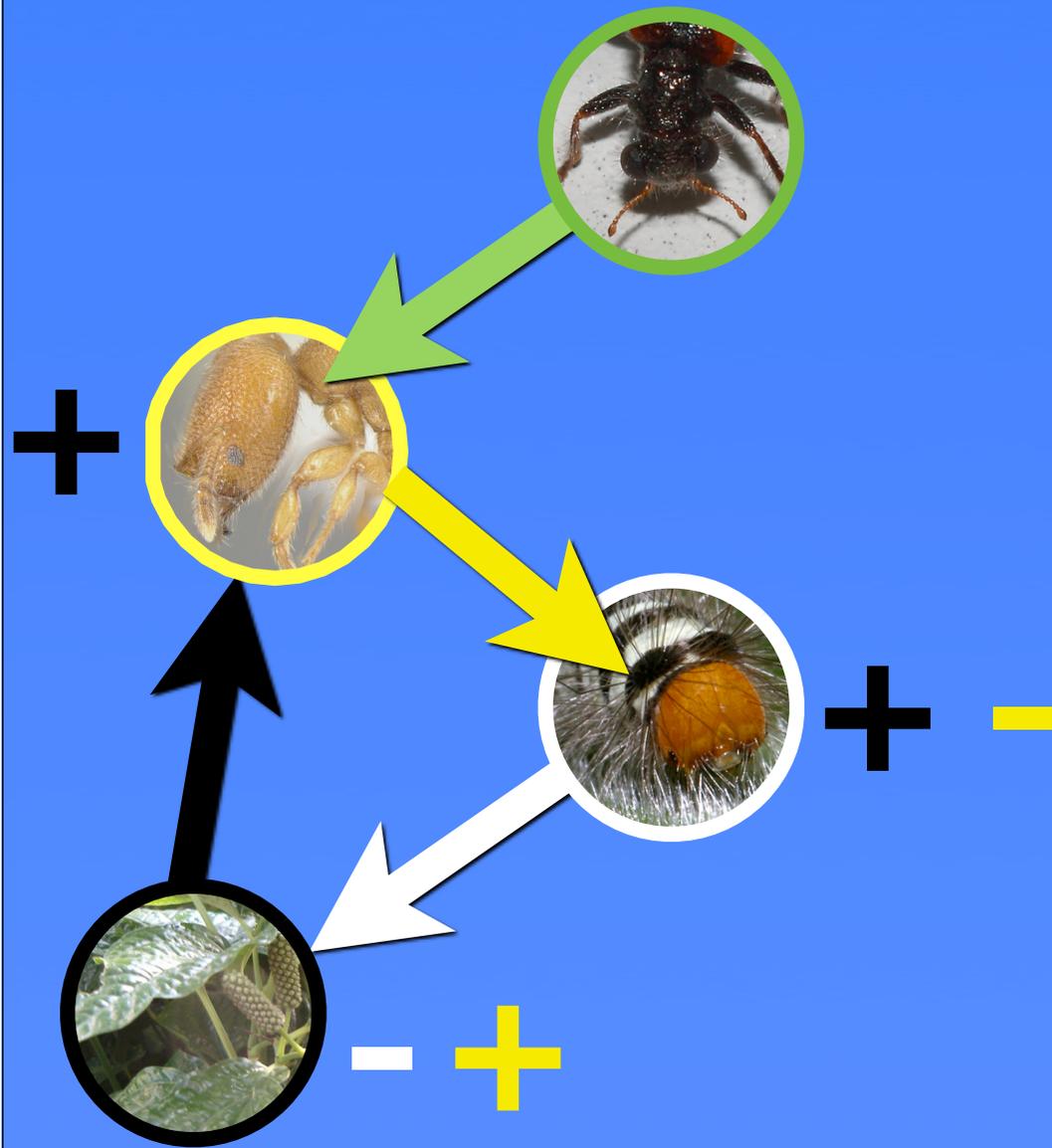
INBIOCRI001281880. Costa Rica. Image by C. Richart Mar'03.







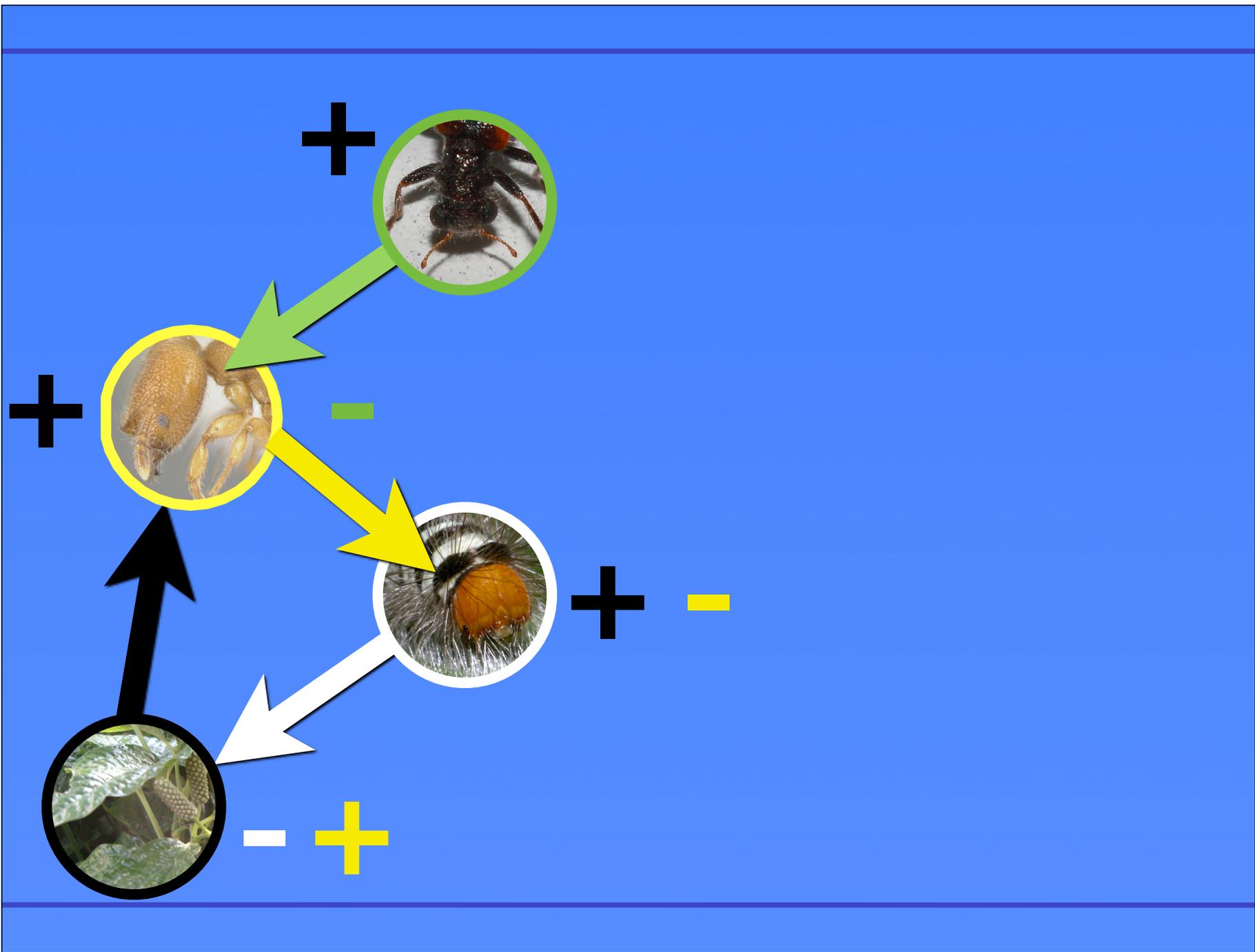


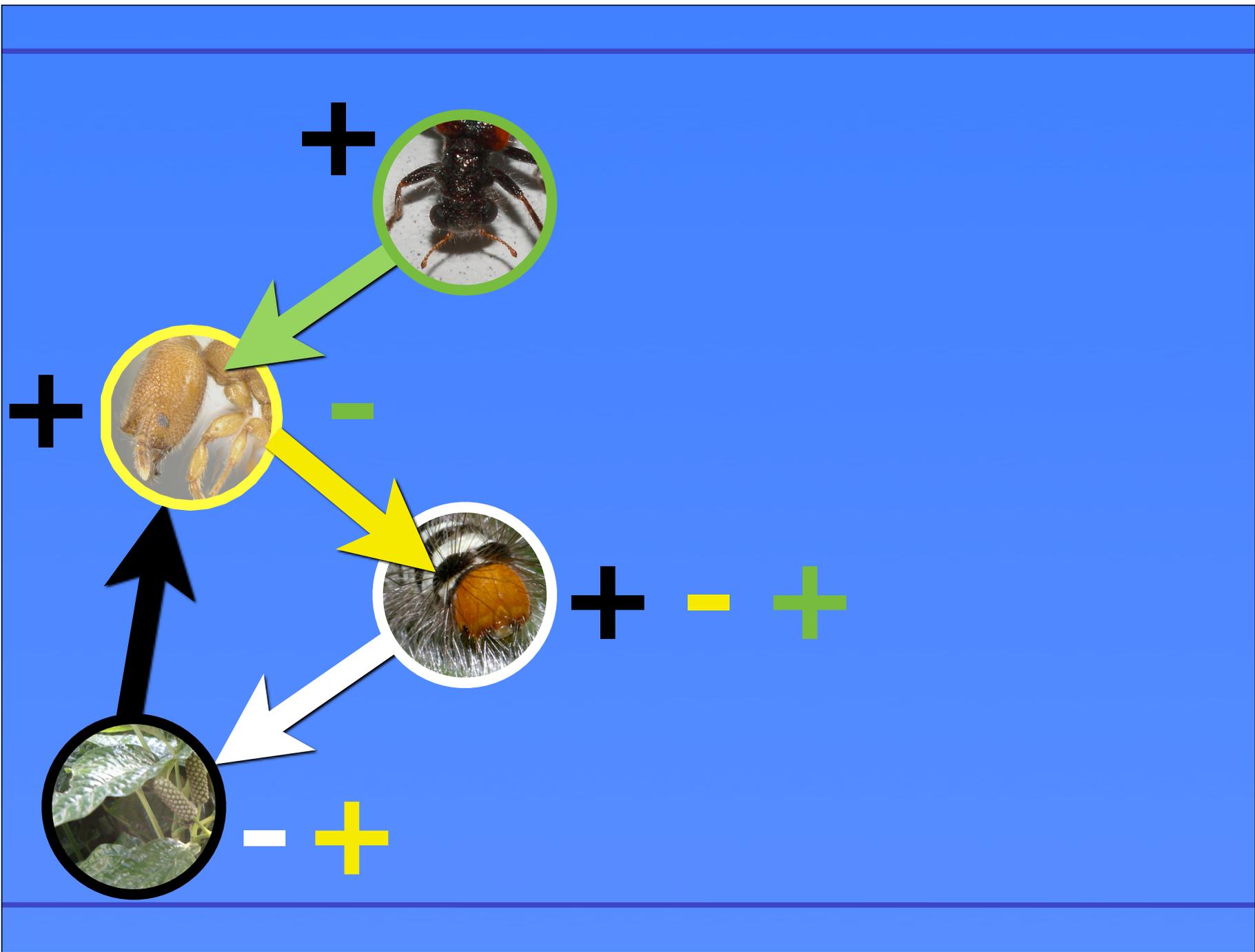


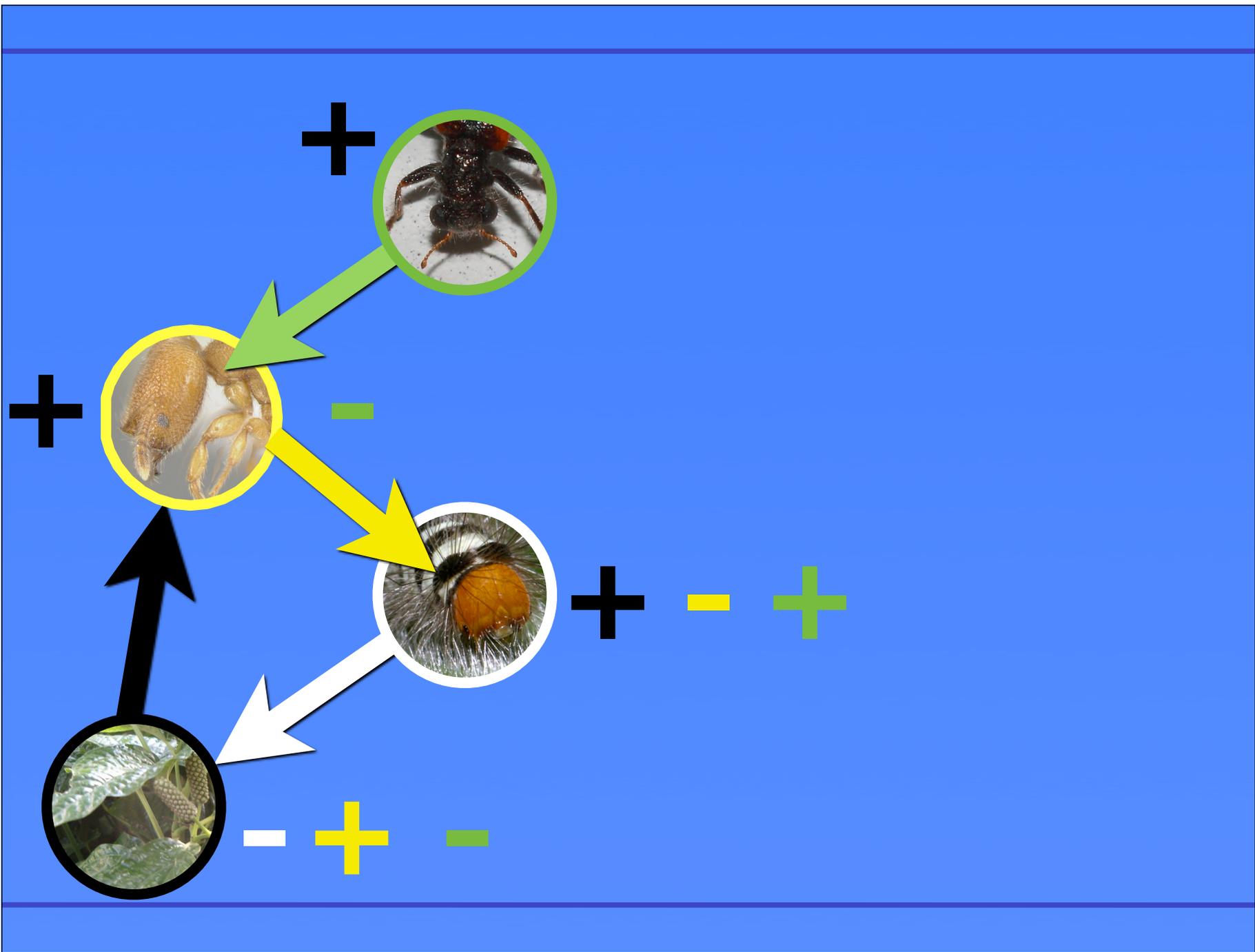


Cascata trófica?

Não é alternado!



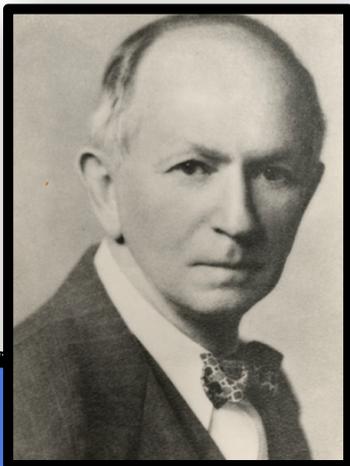




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$$\frac{dN_i}{dt} = \Phi(N_1, \dots, N_S)$$



Estabilidade

1. Estabilidade no tempo

2. Dois componentes:

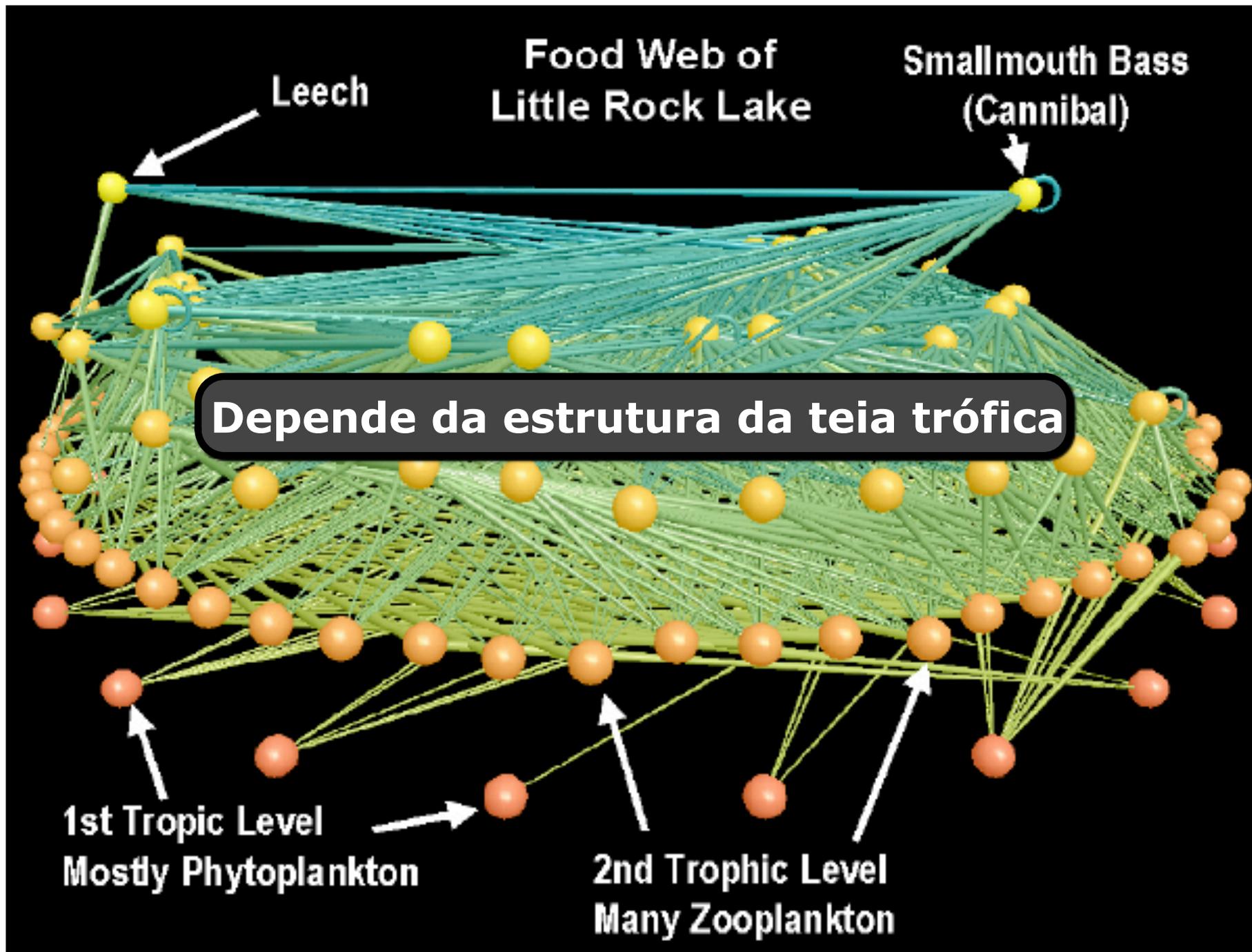
Resiliência: quão rápido a comunidade retorna ao equilíbrio

Resistência: quão difícil é para a comunidade sair do equilíbrio



Comunidades diversas são estáveis?





Food Web of Little Rock Lake

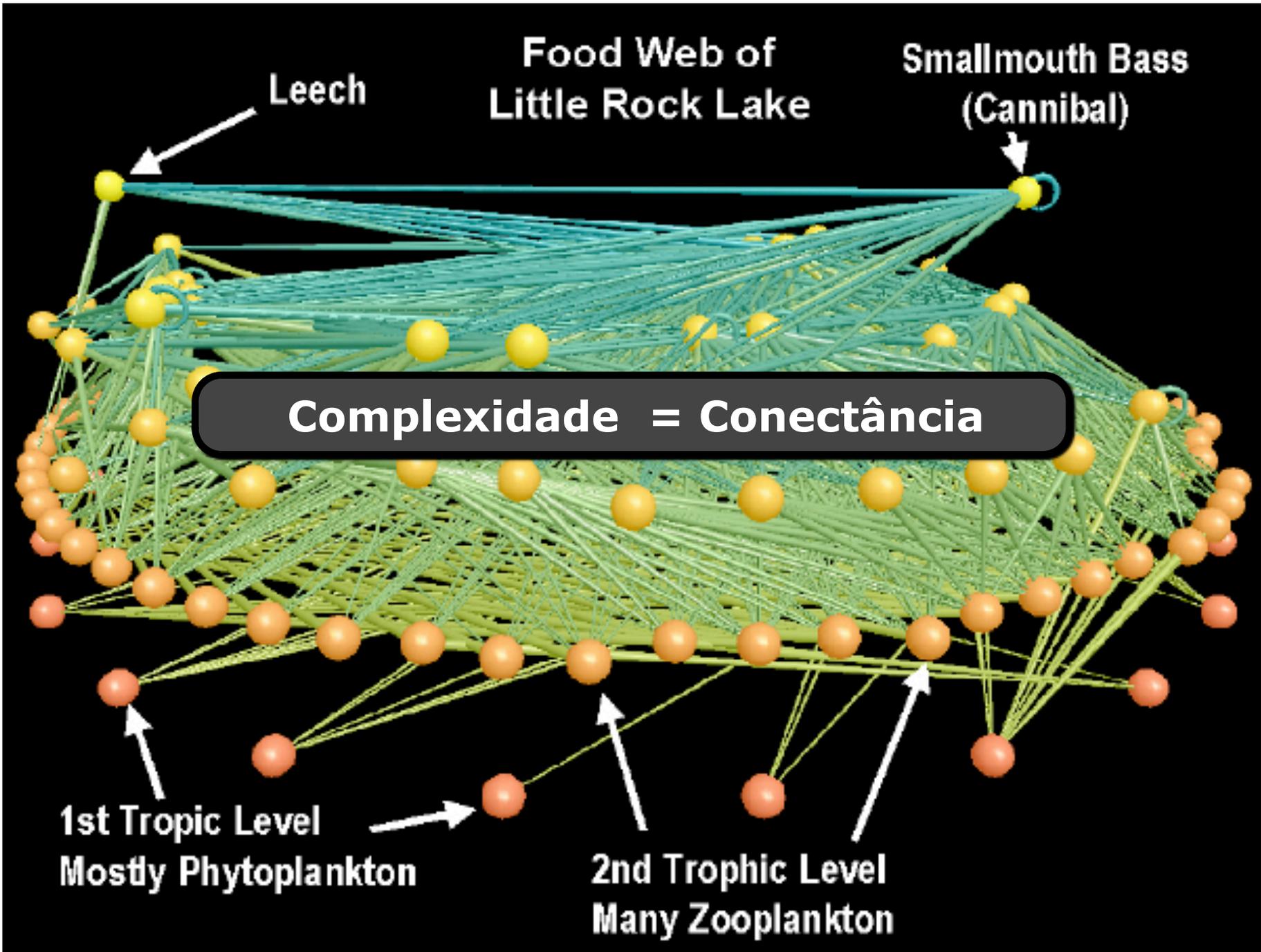
Smallmouth Bass (Cannibal)

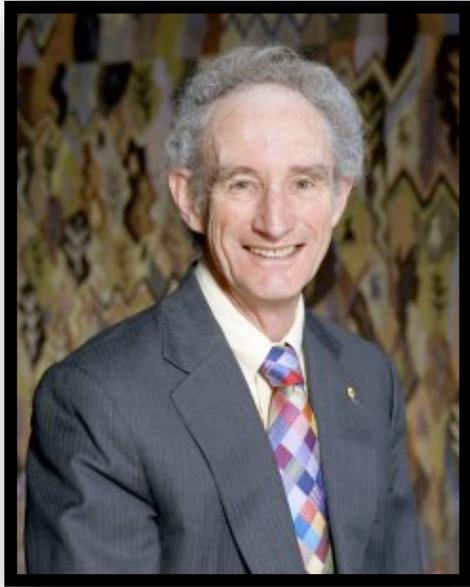
Leech

Complexidade = Conectância

1st Trophic Level
Mostly Phytoplankton

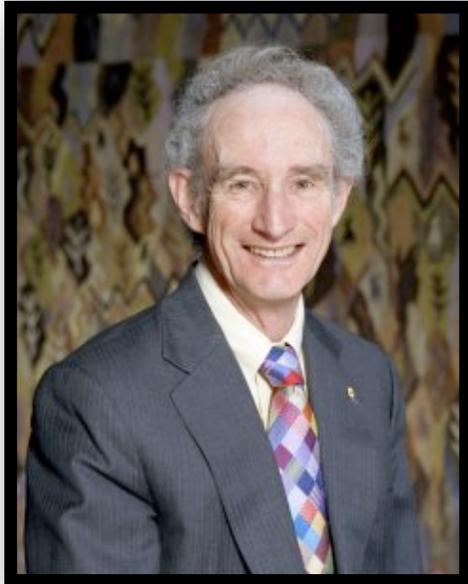
2nd Trophic Level
Many Zooplankton



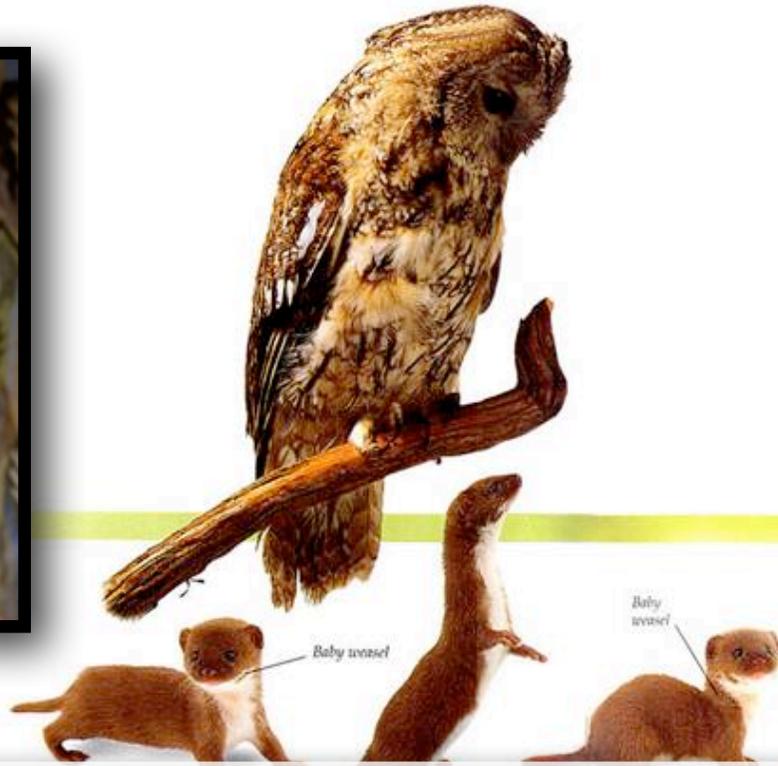


R. May - 1972



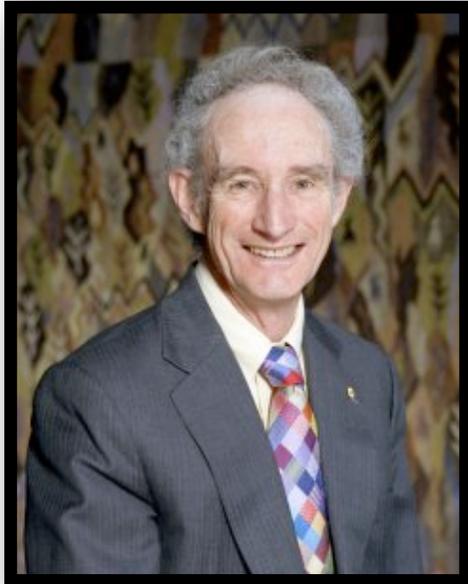


R. May - 1972



**Conectância =
Interações observadas / interações possíveis**





R. May - 1972



Conectância (complexidade) =
Interações observadas / **interações possíveis**



Food Web of Little Rock Lake

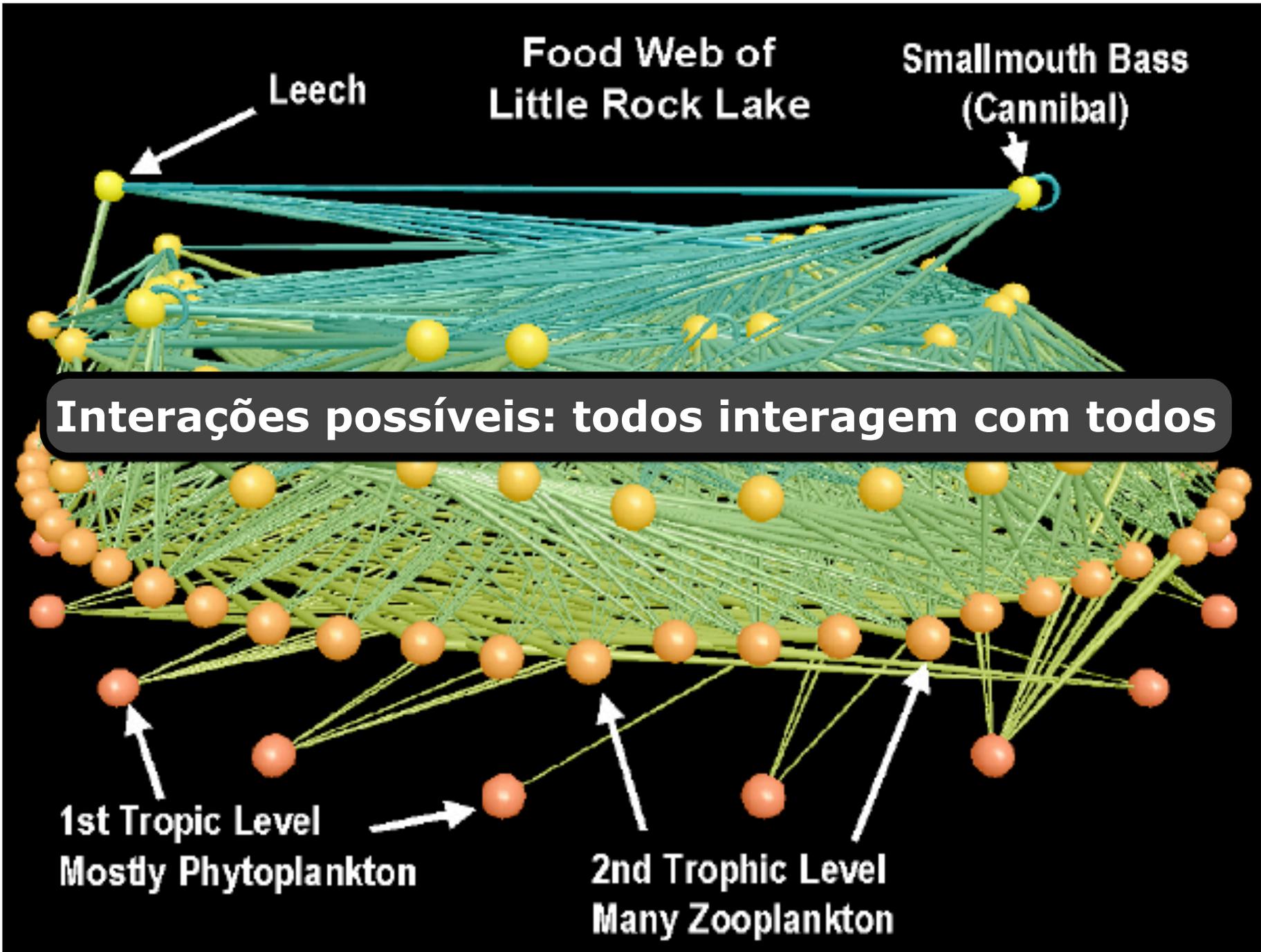
Leech

Smallmouth Bass (Cannibal)

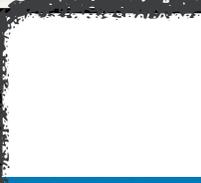
Interações possíveis: todos interagem com todos

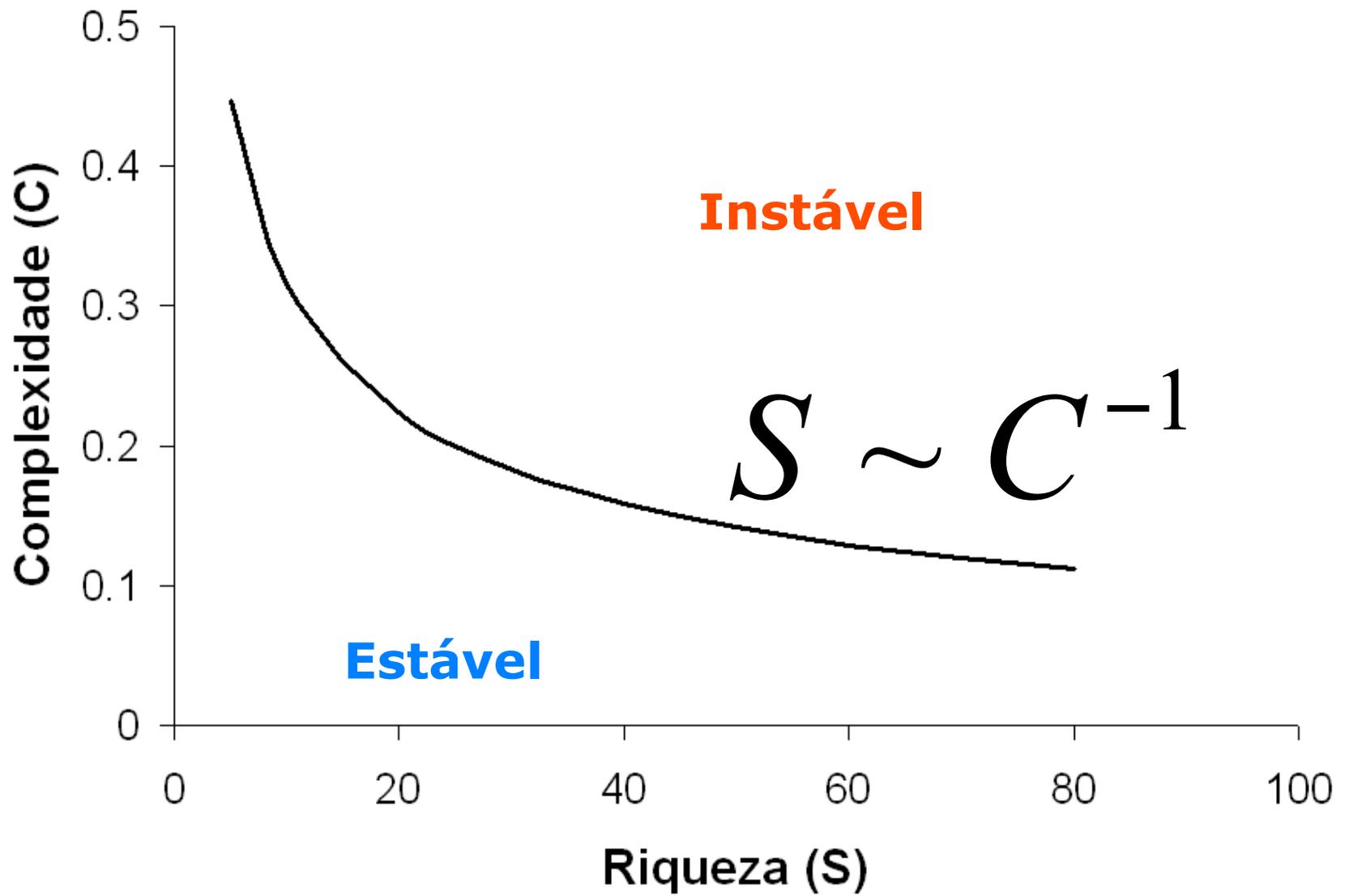
1st Trophic Level
Mostly Phytoplankton

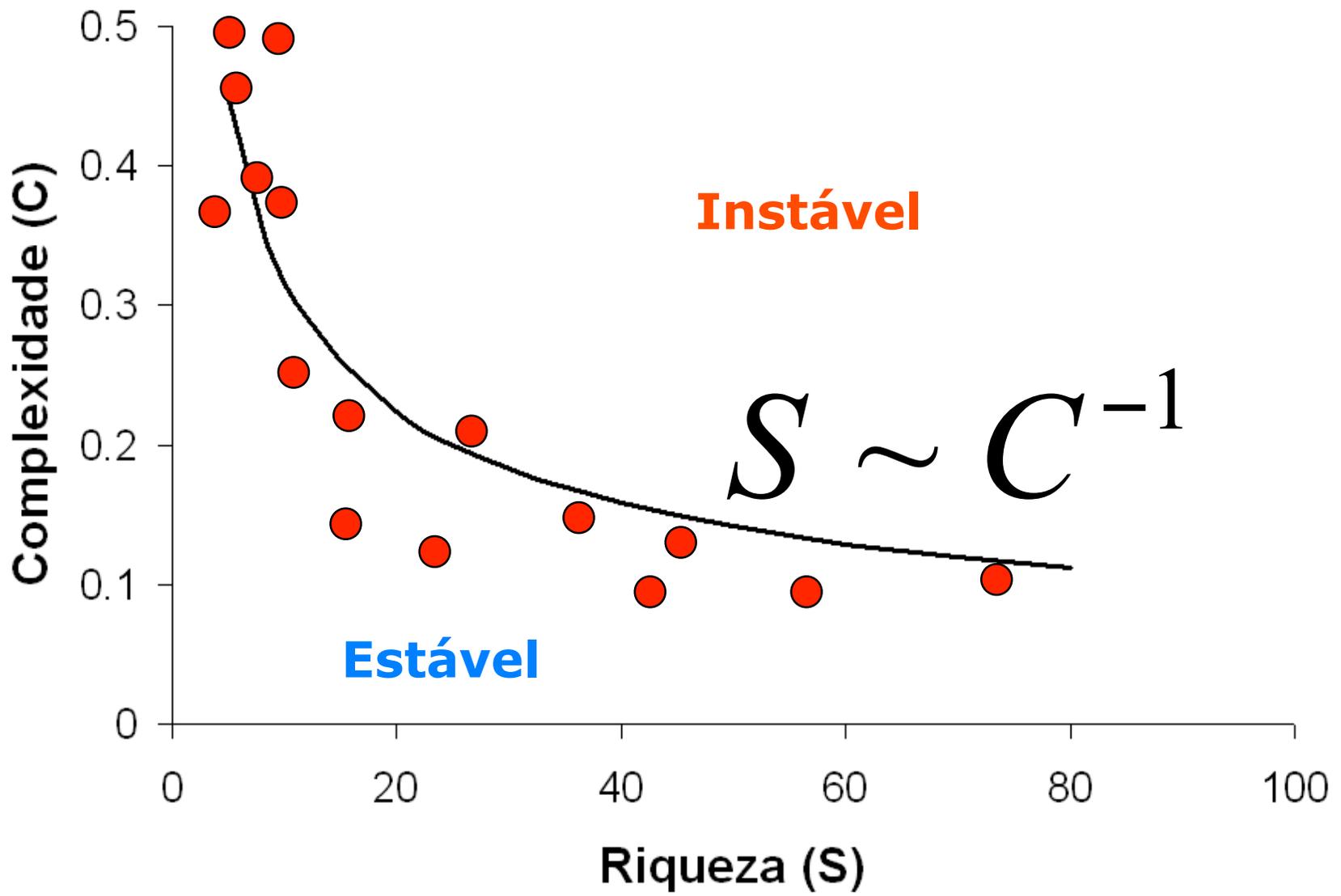
2nd Trophic Level
Many Zooplankton



A Matriz Comunitária

					
	-	+	+	-	0
	+	-	+	0	0
	-	-	-	+	0
	+	0	+	-	+
	0	0	0	-	-





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Mutualismo é:
uma interação que aumenta a aptidão de **indivíduos** de espécies
diferentes





O que é importante?

(< 1990)

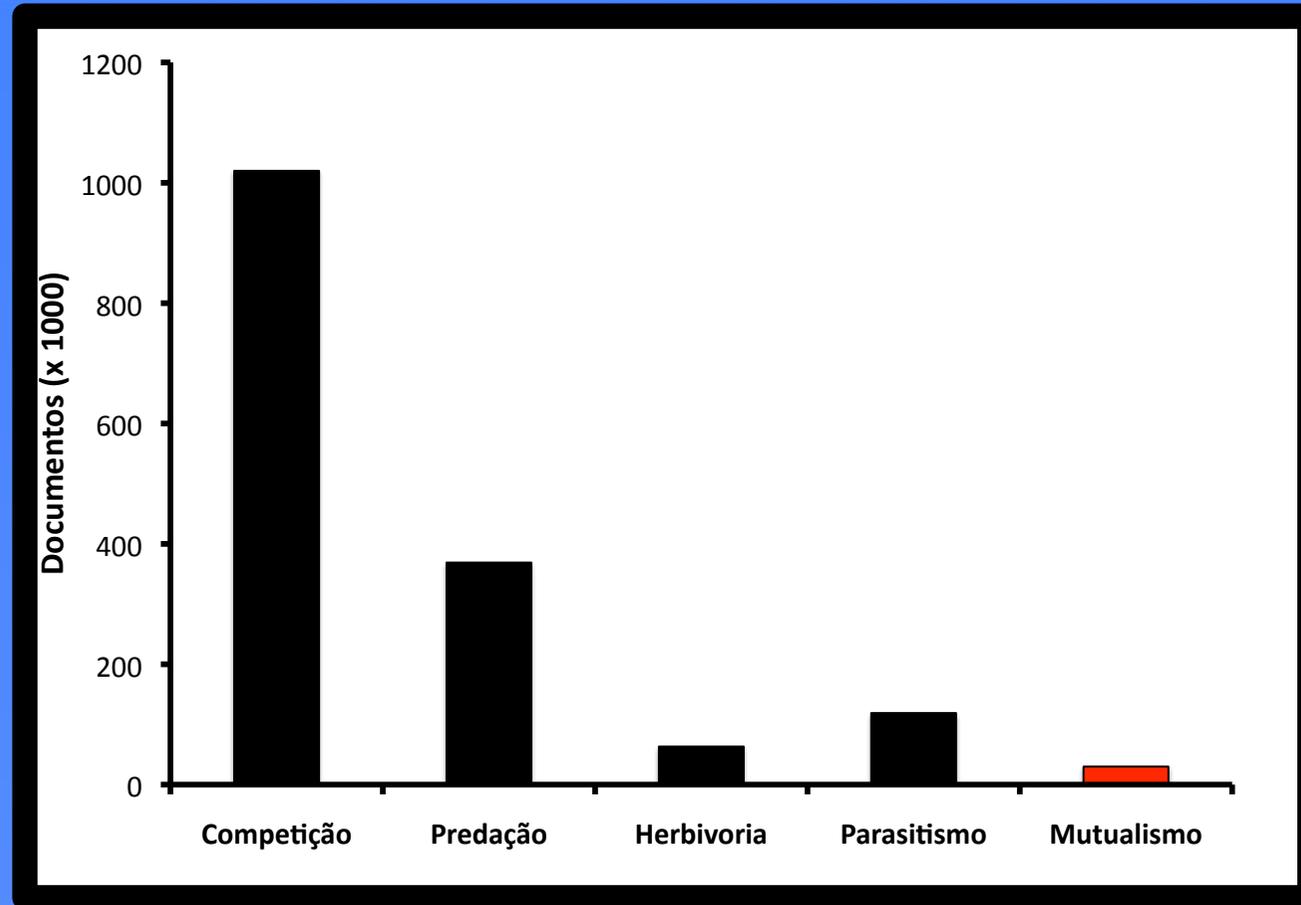
Table 1. The impressions given to students regarding the importance of the three major ecological interactions in the biosphere, as assessed by the number of pages on the topic referred to in the index of current textbooks on introductory ecology.

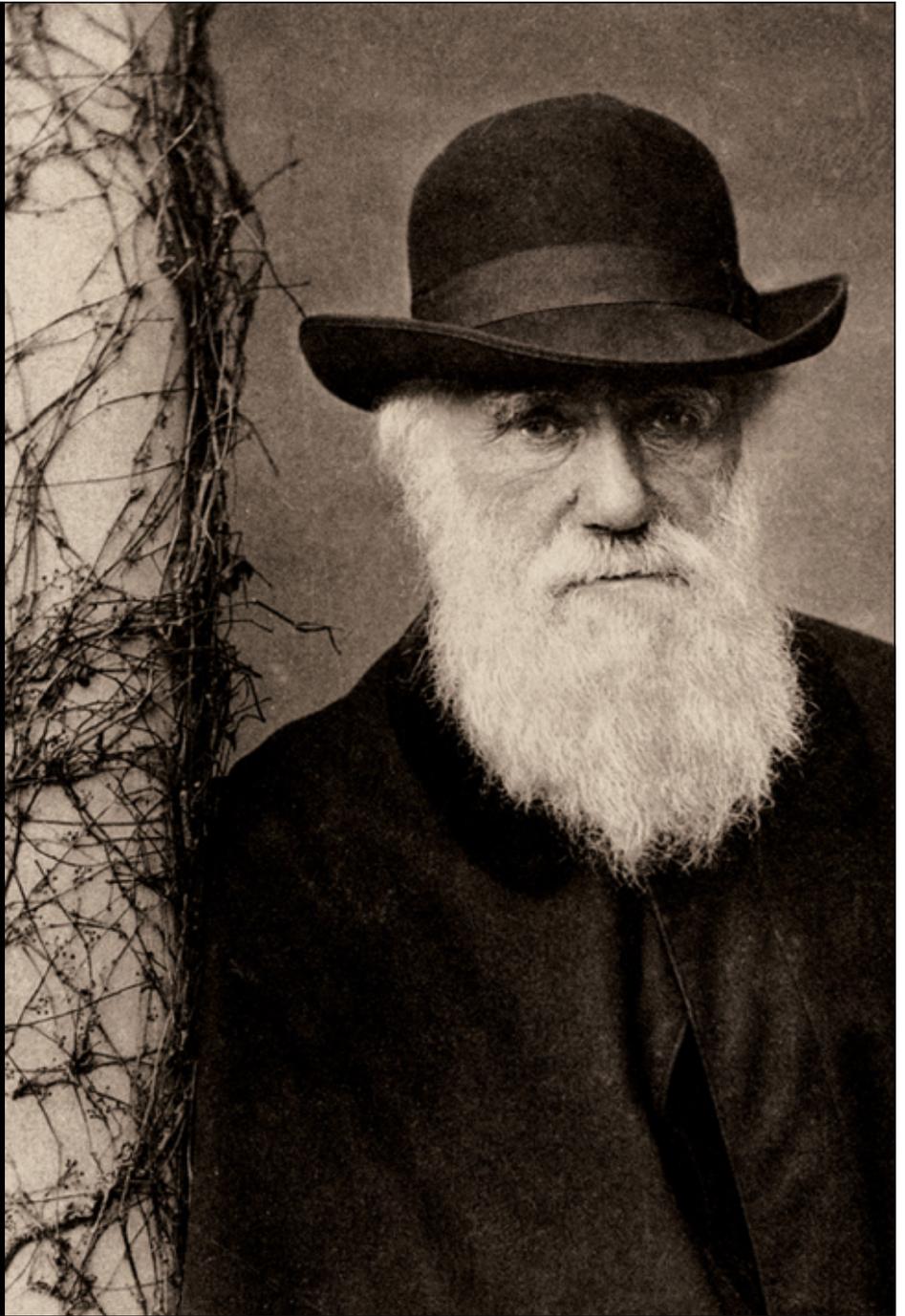
Textbook	Mutualism	Competition	Predation
Colinvaux (1986)	1	33	70
Collier et al. (1973)	0 (1)*	45	30
Hutchinson (1978)	0 (9)	59	6
Krebs (1978)	3	50	32
Lederer (1984)	5	21	4
McNaughton and Wolf (1979)	20	77	71
Odum (1983)	15	17	15
Pianka (1983)	3	74	41
Ricklefs (1979)	3	38	30
Ricklefs (1983)	2	11	14
Smith (1986)	2† (1)	19	24
Whittaker (1975)	5 (9)	18	22

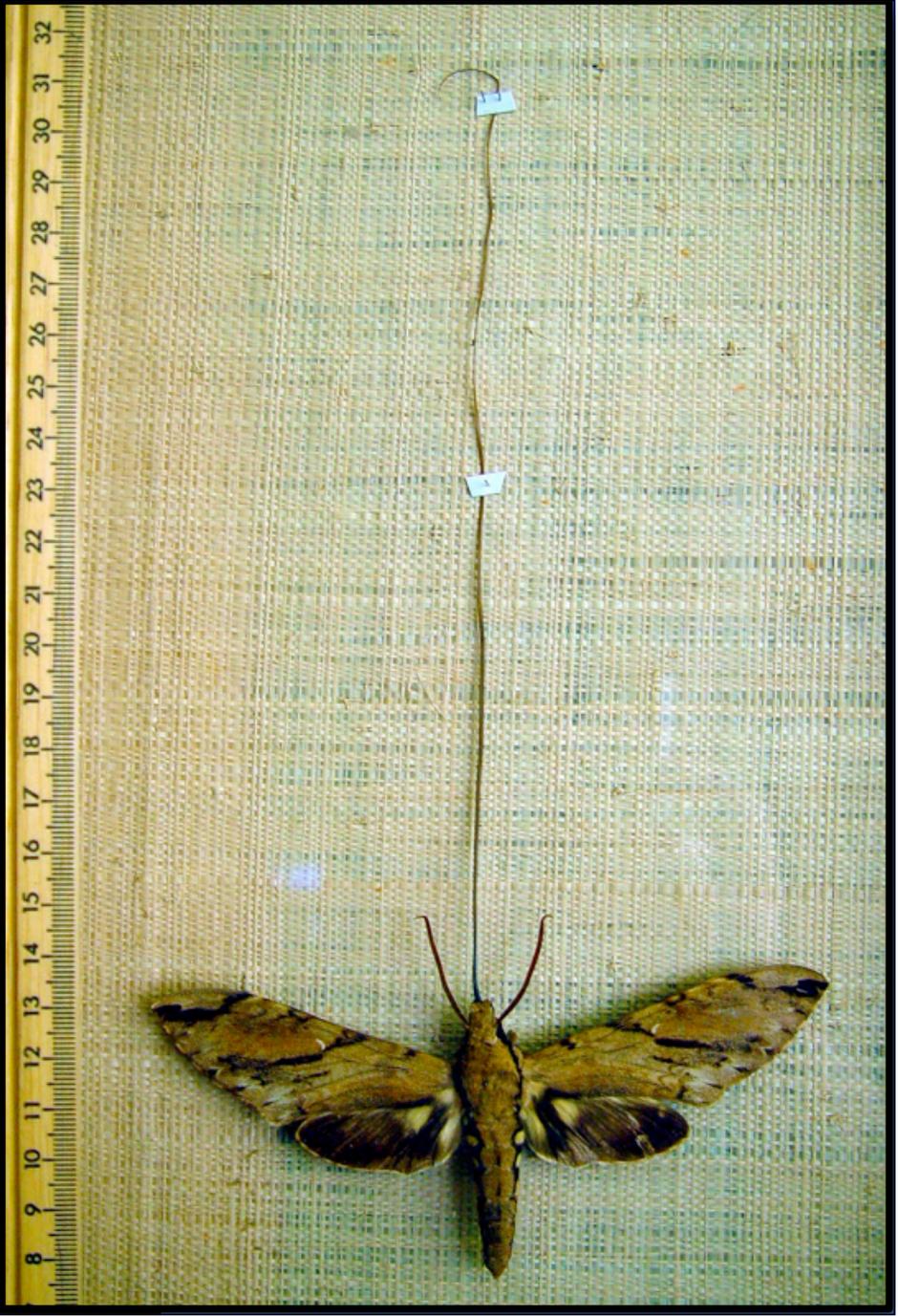
* Number in brackets is symbiosis, which some authors appear to equate with mutualism.

† Mutualism not in index, but present in text.

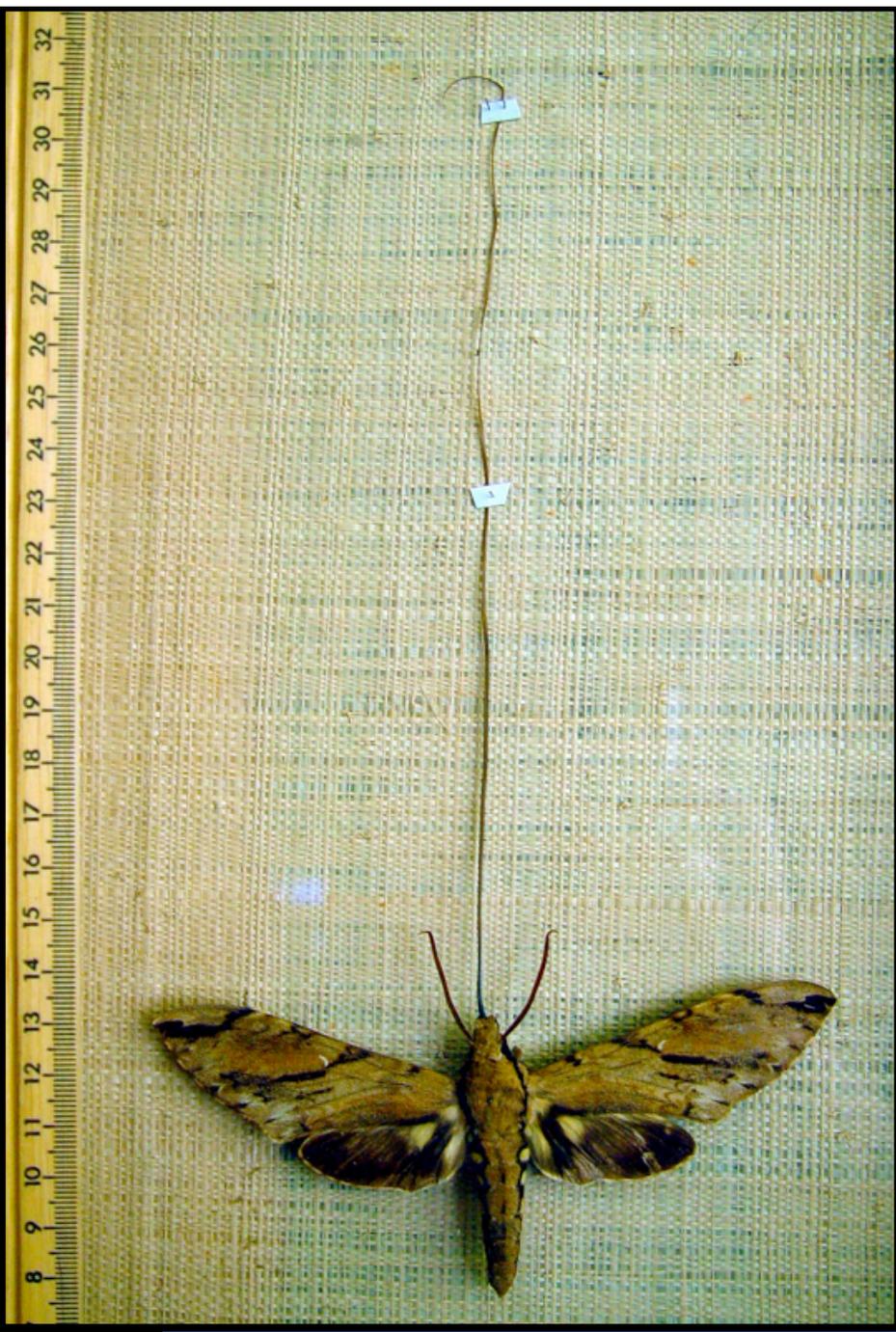
2011









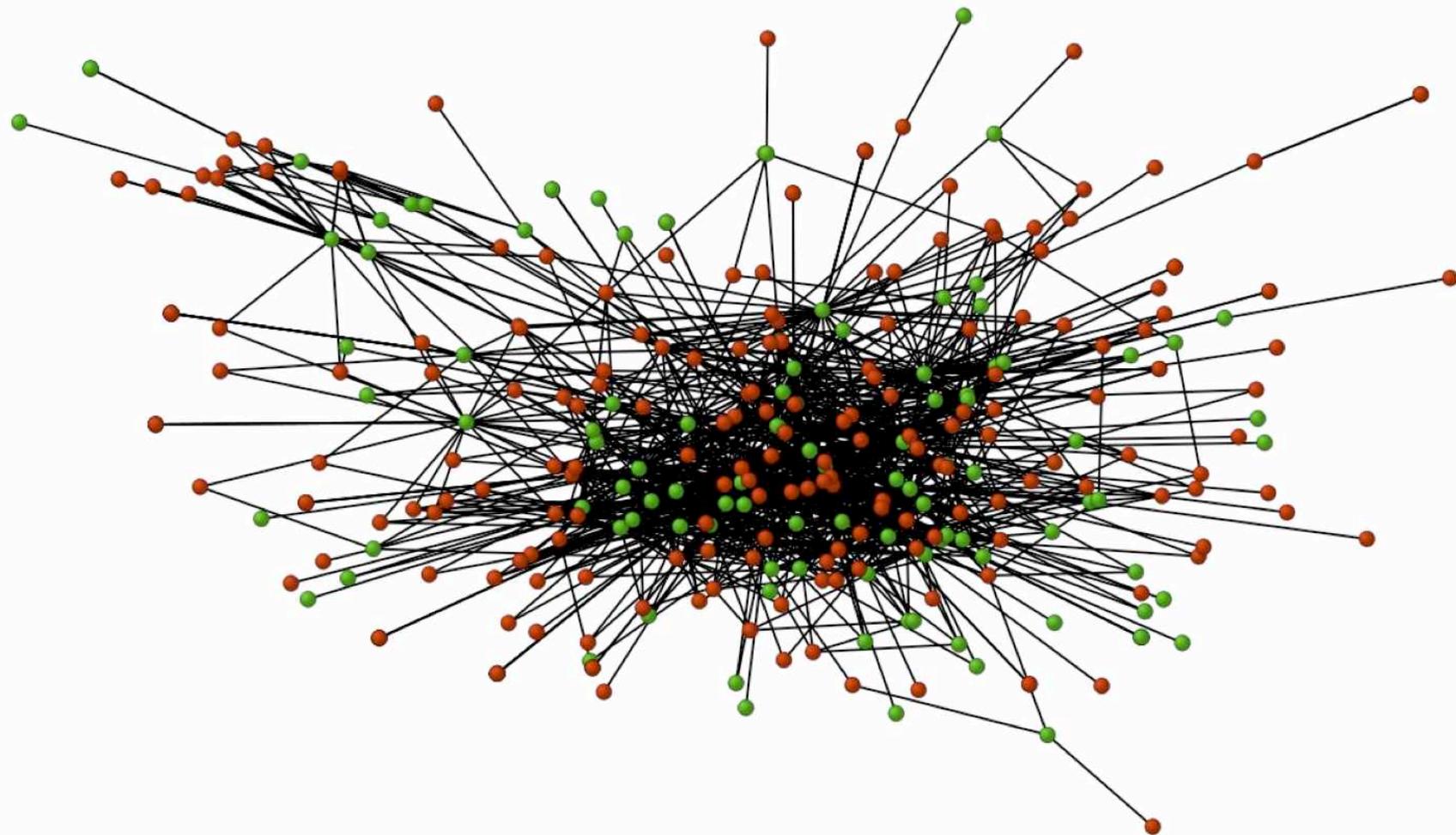








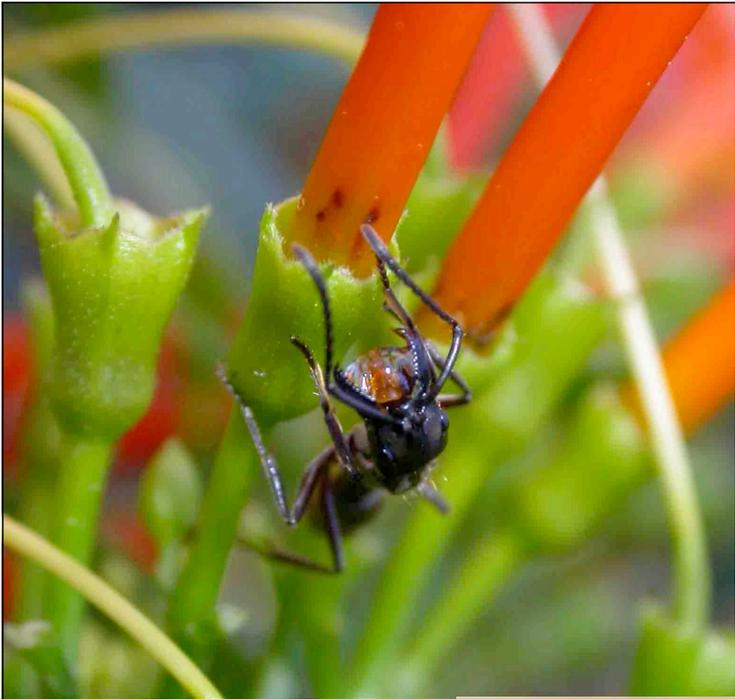
Edson Endrigo



Redes mutualísticas



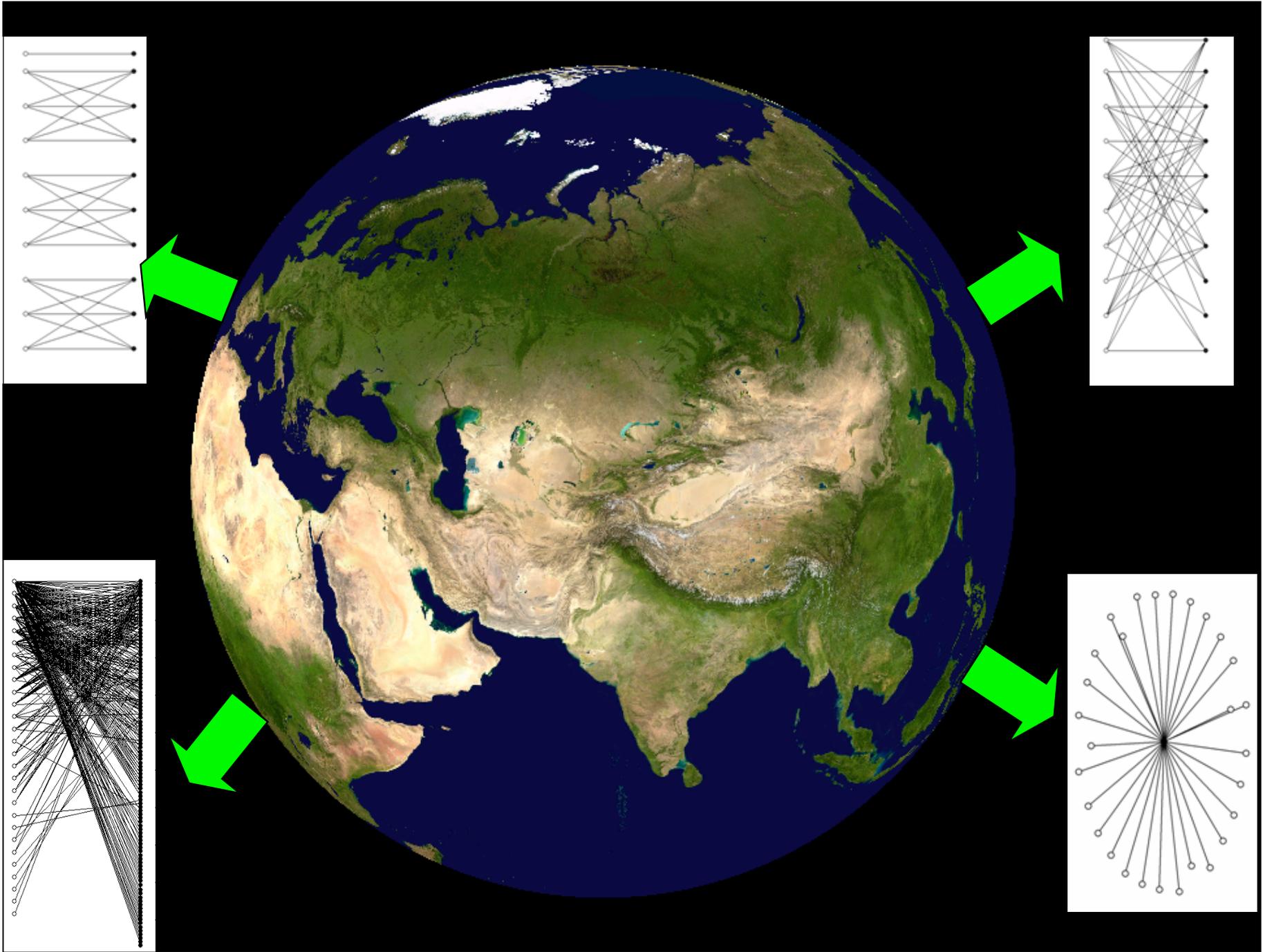


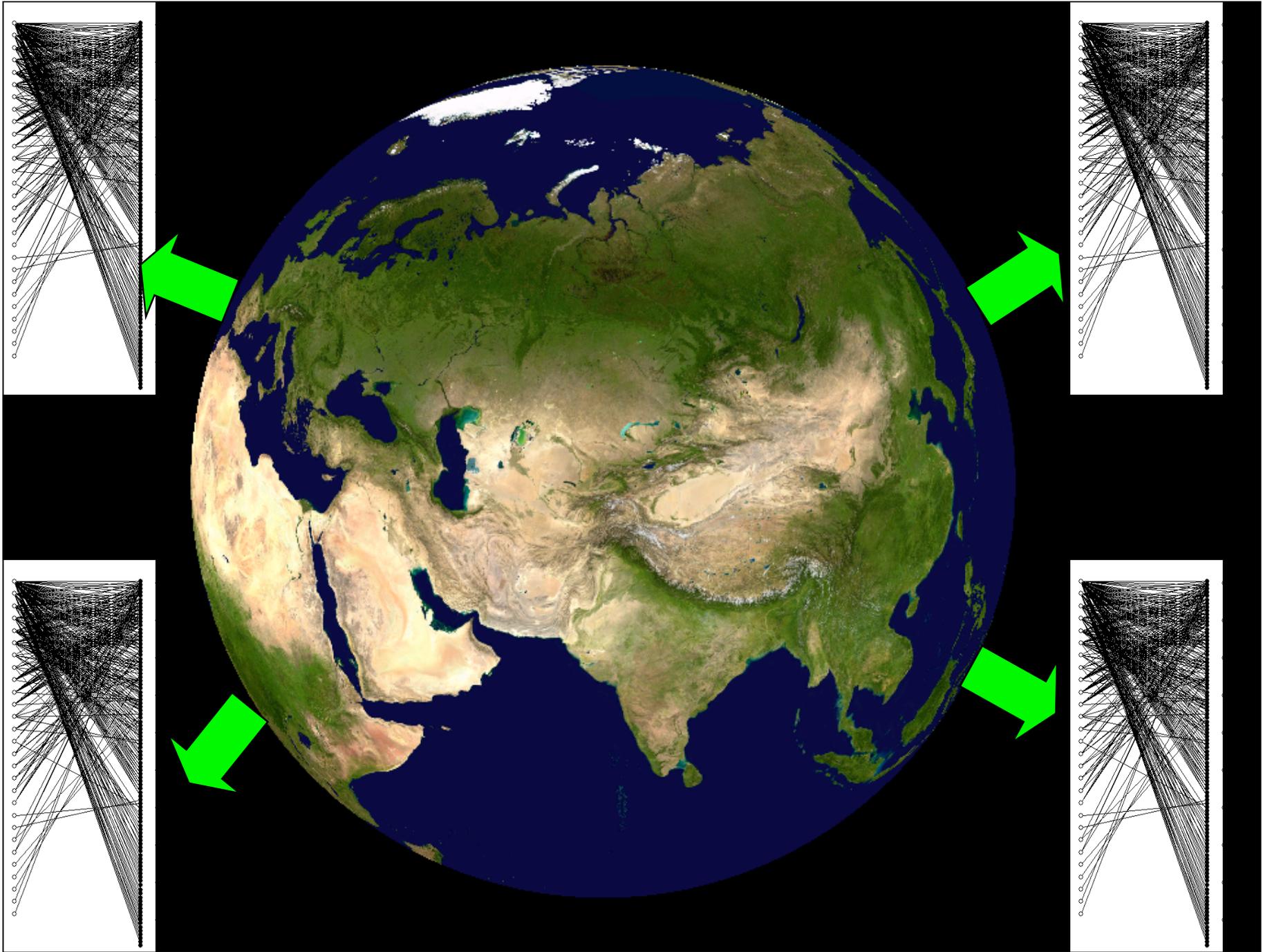




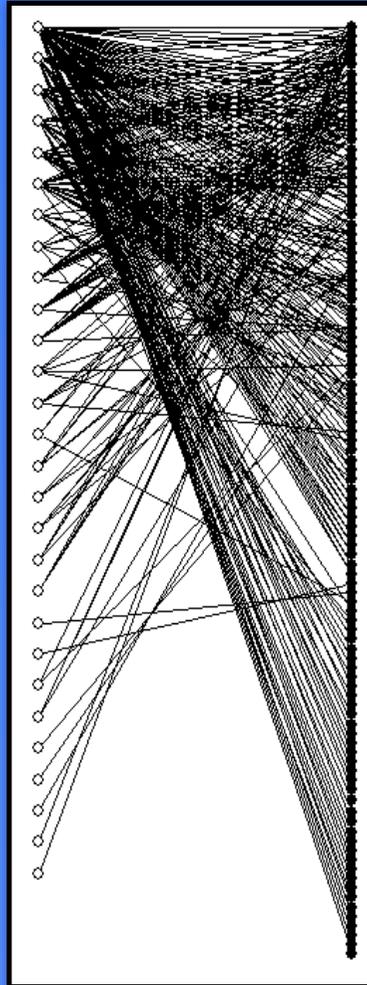




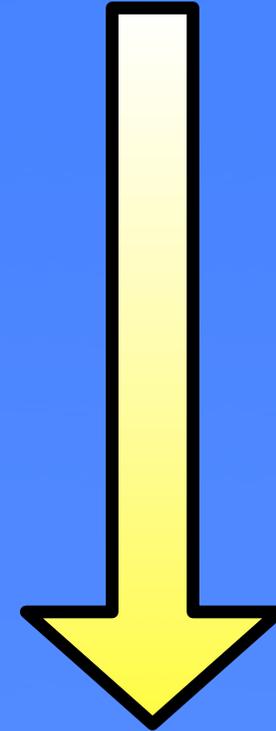




Aninhamento

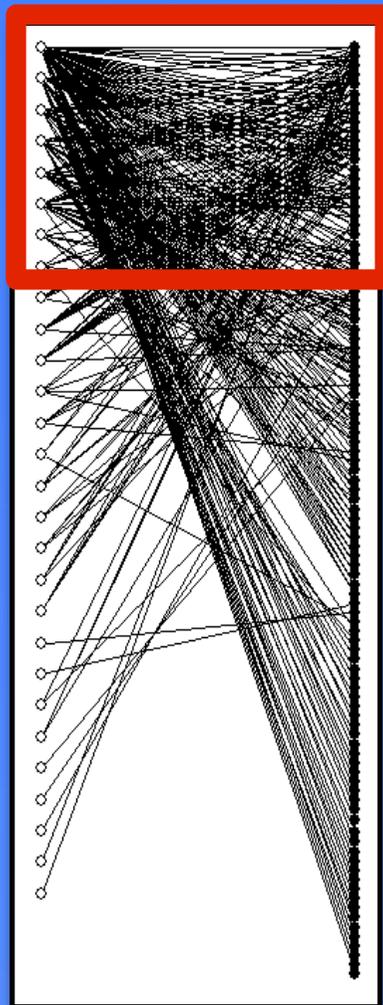


Generalistas



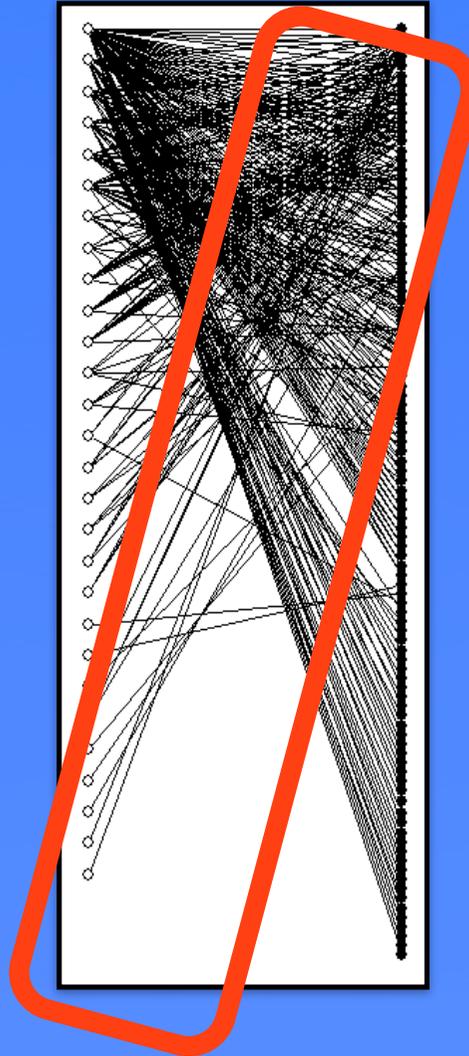
Especialistas

Aninhamento



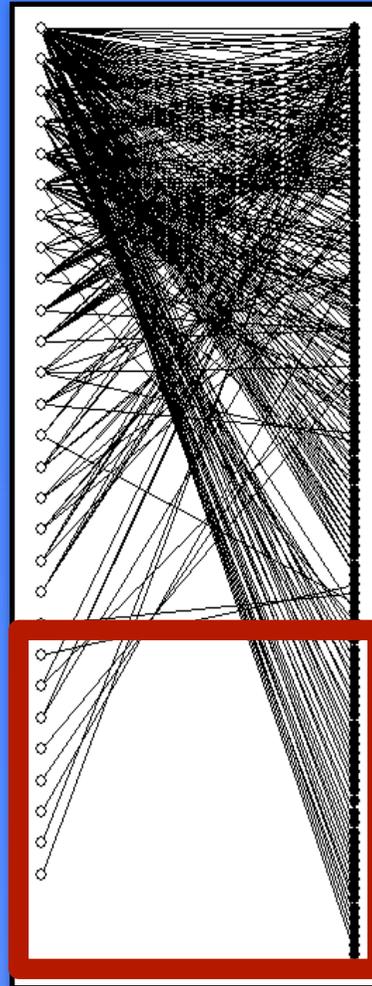
**Núcleo de
generalistas**

Aninhamento



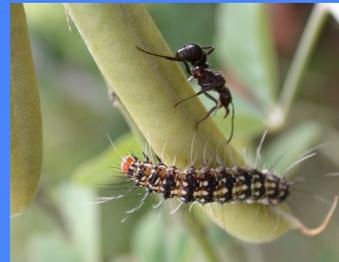
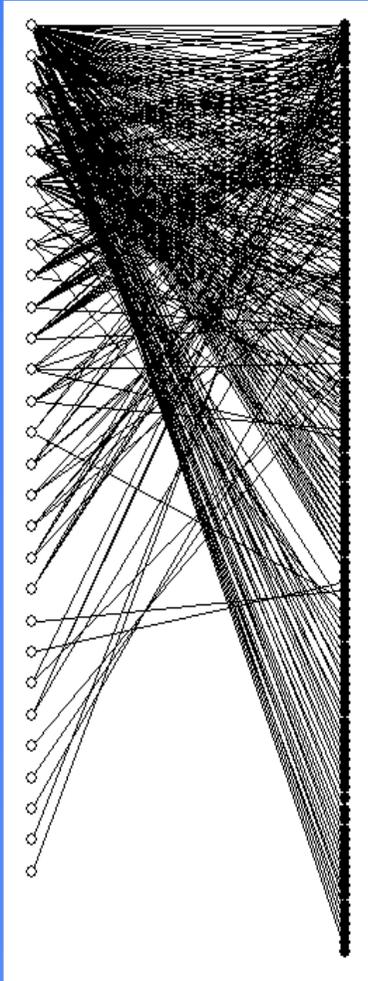
Assimetrias

Aninhamento

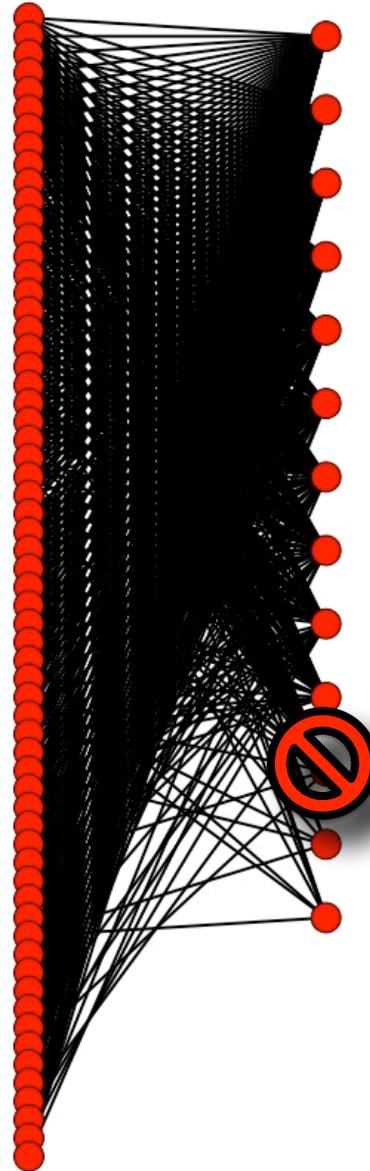


Sem interação entre especialistas

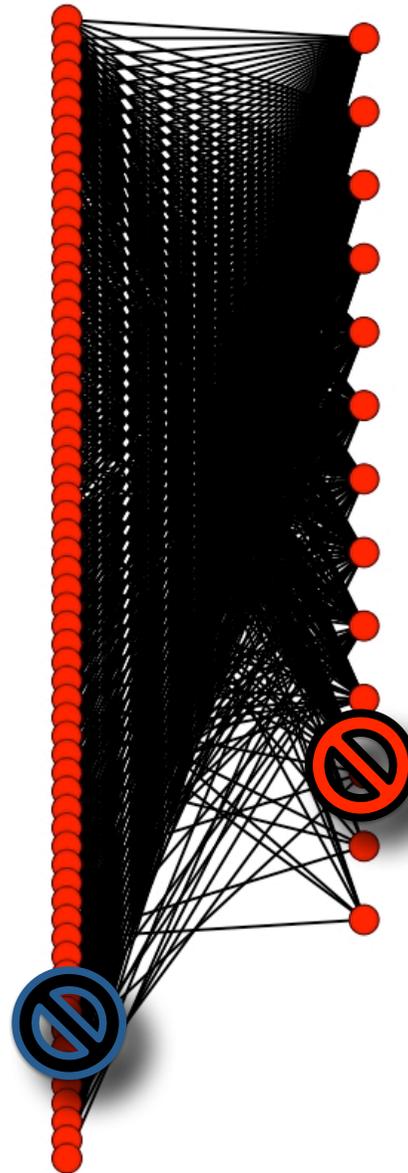
Aninhamento



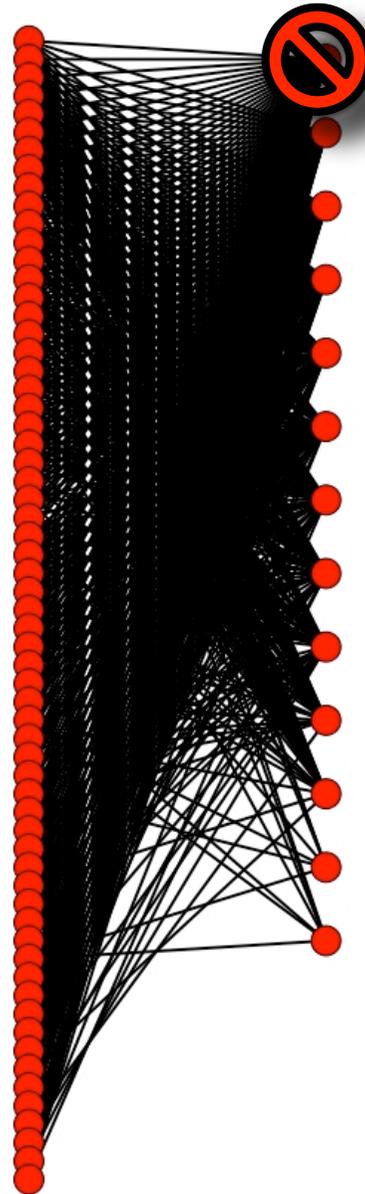
Robusta a extinções aleatórias



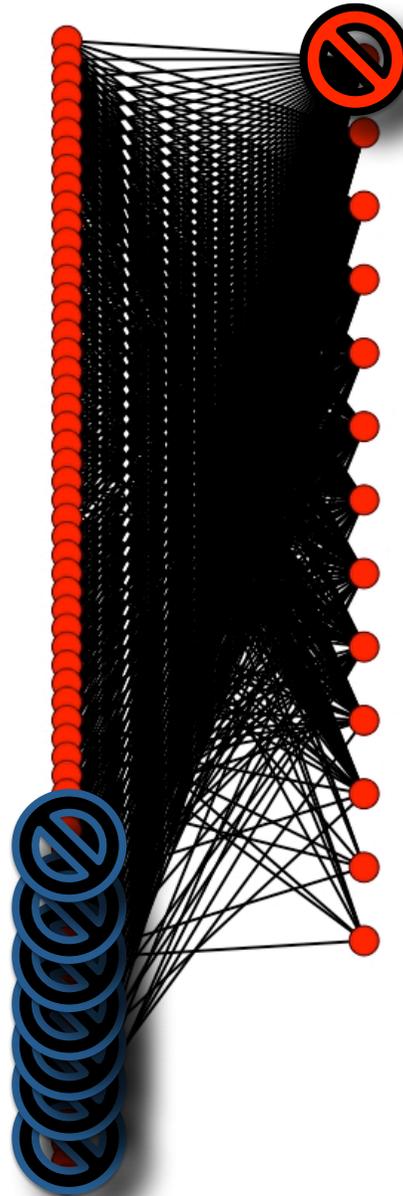
Robusta a extinções aleatórias



Frágil a extinções de espécies generalistas



Frágil a extinções de espécies generalistas



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Interações



Teias tróficas



Estrutura

Interações



Teias tróficas



Estrutura



Efeitos indiretos

Cascatas tróficas

Interações



Teias tróficas



Estrutura



Efeitos indiretos

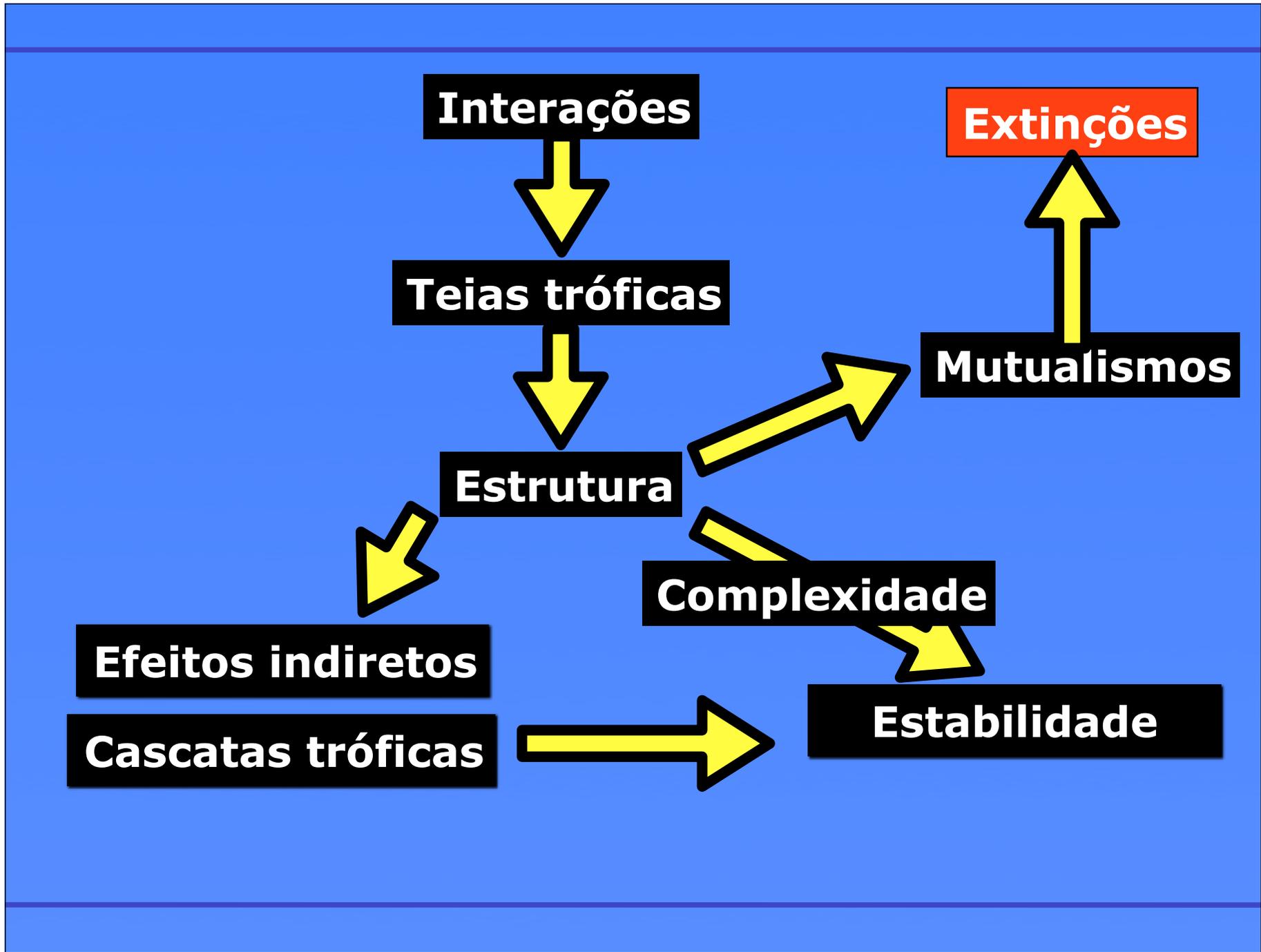
Cascatas tróficas

Complexidade



Estabilidade





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Para saber mais:

- 1. Bascompte. 2009. Disentangling the Web of Life. Science 325: 416 - 419**
- 2. Estes et al. 2011. Trophic Downgrading of Planet Earth. Science 333: 301 - 306**