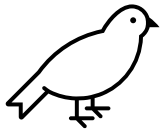
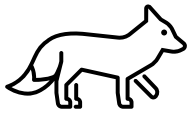


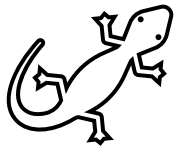
× 10

× 5

× 3



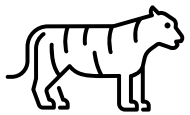
× 2



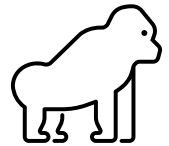
× 5

× 5

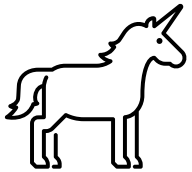
× 4



× 3

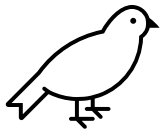


× 2



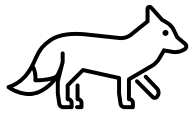
× 1

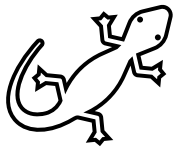
Richness?

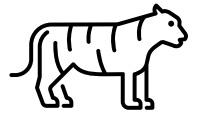
 × 10

 × 3

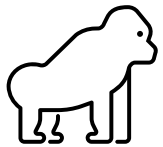
 × 5

 × 2

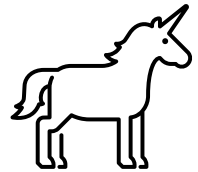
 × 5

 × 3

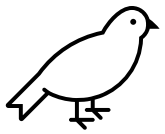
 × 5

 × 2

 × 4

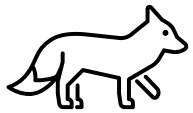
 × 1

Richness?

 × 10

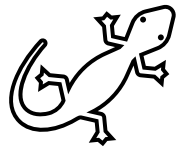
 × 3

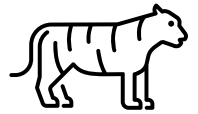
 × 5

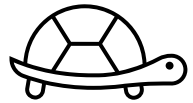
 × 2

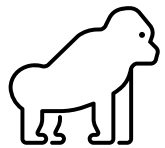
4 unique species

species richness = 4

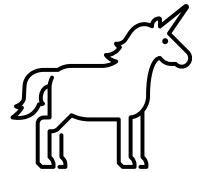
 × 5

 × 3

 × 5

 × 2

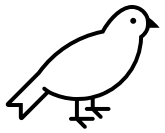
 × 4

 × 1

6 unique species

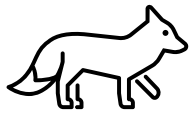
species richness = 6

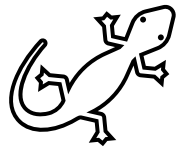
Abundance?

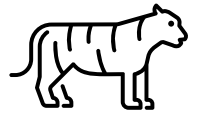
 × 10

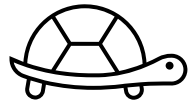
 × 3

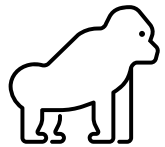
 × 5

 × 2

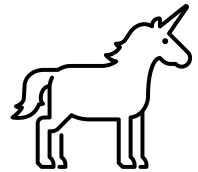
 × 5

 × 3

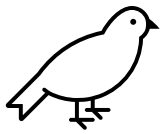
 × 5

 × 2

 × 4

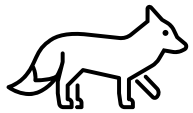
 × 1

Abundance?

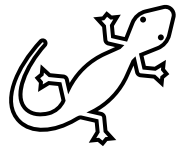
 × 10

 × 3

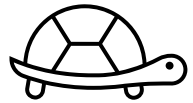
 × 5

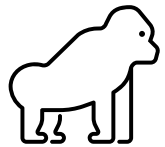
 × 2

(10, 3, 5, 2)

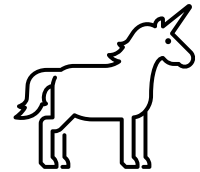
 × 5

 × 3

 × 5

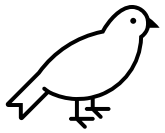
 × 2

 × 4

 × 1

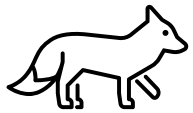
(5, 3, 5, 2, 4, 1)

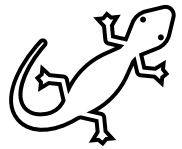
Octaves?

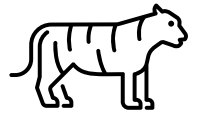
 × 10

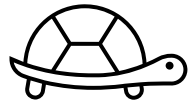
 × 3

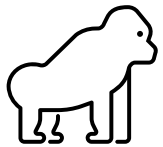
 × 5

 × 2

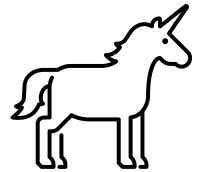
 × 5

 × 3

 × 5

 × 2

 × 4

 × 1

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1			
2			
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1		
2			
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	
2			
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2			
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2		
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	2, 3
3			
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	2, 3
3	4	8	4, 5, 6, 7
4			
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	2, 3
3	4	8	4, 5, 6, 7
4	8	16	8, 9, 10, 11, 12, 13, 14, 15
5			
6			
7			

Octaves?

- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	2, 3
3	4	8	4, 5, 6, 7
4	8	16	8, 9, 10, 11, 12, 13, 14, 15
5	16	32	16, 17, …, 31
6	32	64	32, 33, …, 63
7	64	128	64, 64, …, 127

Octaves?

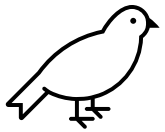
- A **species** is in octave n if the abundance a of that species satisfies:

  $2^{n-1} \leq a < 2^n$

  i.e., $a \geq 2^{n-1}$ AND $a < 2^n$

Octave class	$a \geq 2^{n-1}$	$a < 2^n$	Possible abundances a
1	1	2	1
2	2	4	2 – 3
3	4	8	4 – 7
4	8	16	8 – 15
5	16	32	16 – 31
6	32	64	32 – 63
7	64	128	64 – 127

Octaves?

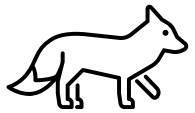
 $\times 10$

 $\times 3$

$2^3 \leq a < 2^4$

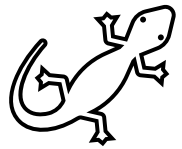
$\Rightarrow n = 4$

 $\times 5$

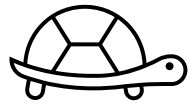
 $\times 2$

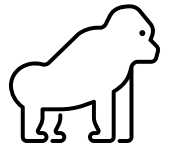
$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 5$

 $\times 3$

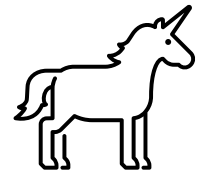
 $\times 5$

 $\times 2$

$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

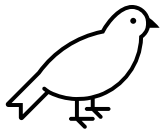
 $\times 4$

 $\times 1$

$2^0 \leq a < 2^1$

$\Rightarrow n = 1$

Octaves?

 $\times 10$

$2^3 \leq a < 2^4$

$\Rightarrow n = 4$

 $\times 3$

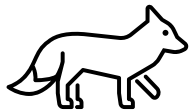
$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

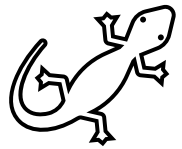
$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 2$

$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

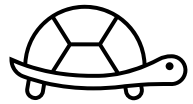
$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 3$

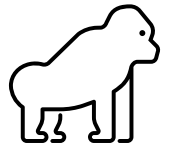
$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 2$

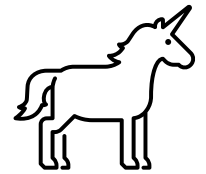
$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 4$

$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 1$

$2^0 \leq a < 2^1$

$\Rightarrow n = 1$

Octaves?

 $\times 10$

$2^3 \leq a < 2^4$

$\Rightarrow n = 4$

 $\times 3$

$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

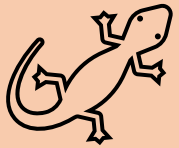
$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 2$

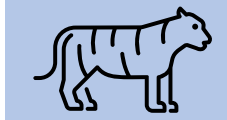
$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 3$

$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 5$

$2^2 \leq a < 2^3$

$\Rightarrow n = 3$

 $\times 2$

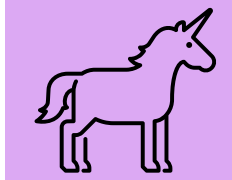
$2^1 \leq a < 2^2$

$\Rightarrow n = 2$

 $\times 4$

$2^2 \leq a < 2^3$

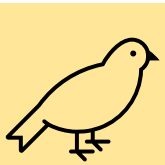
$\Rightarrow n = 3$

 $\times 1$

$2^0 \leq a < 2^1$

$\Rightarrow n = 1$

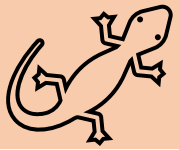
Octaves?

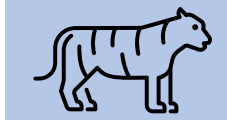
 × 10

 × 3

 × 5

 × 2

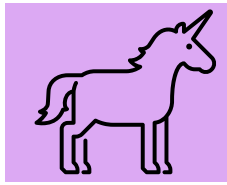
 × 5

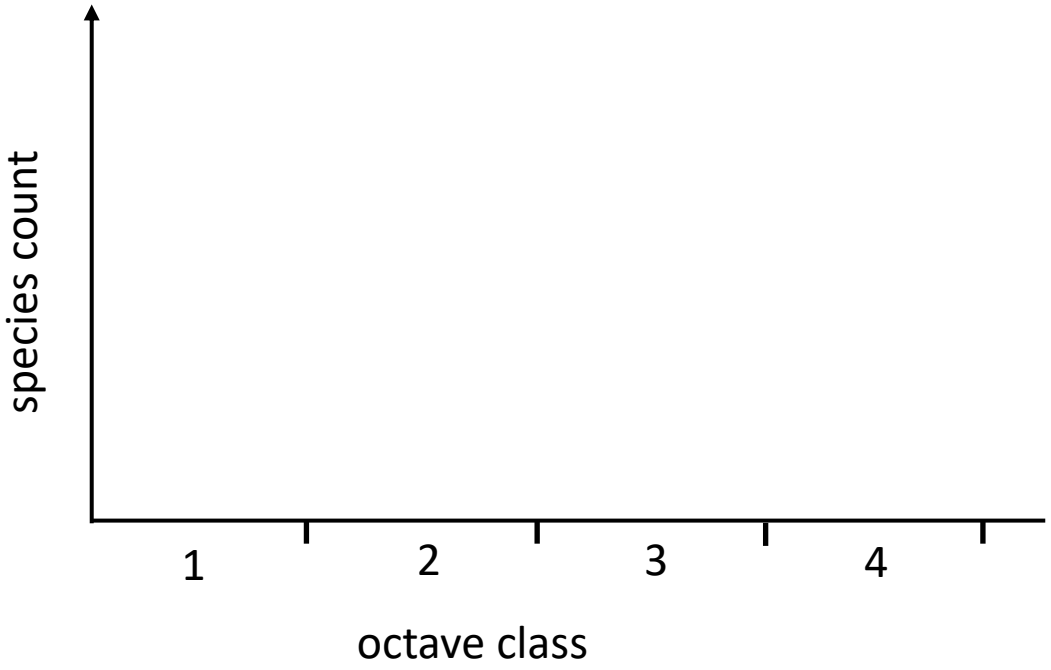
 × 3

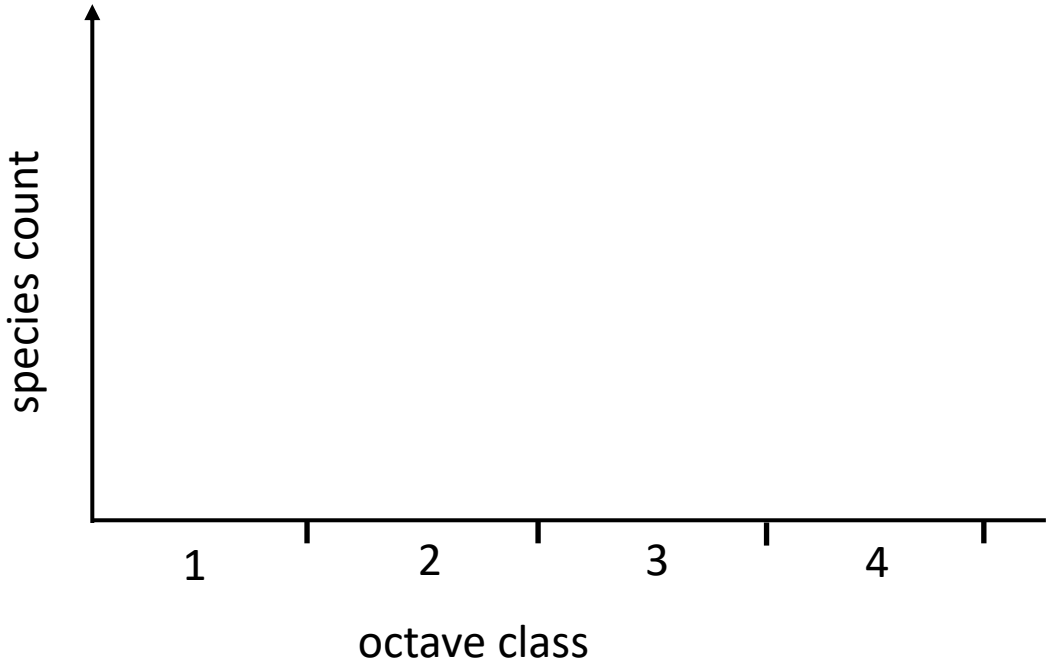
 × 5

 × 2

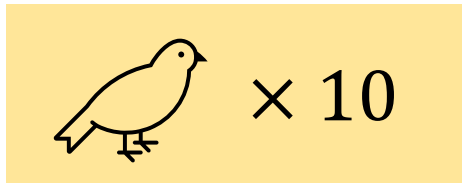
 × 4

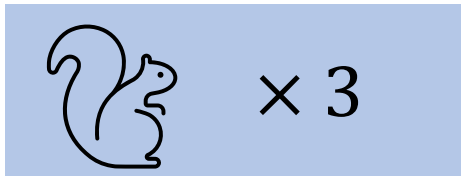
 × 1

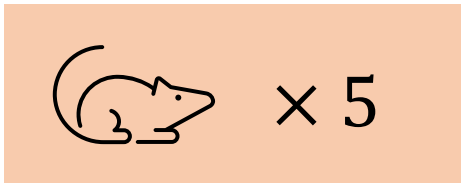


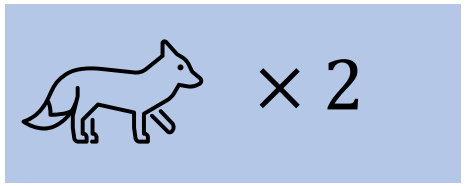


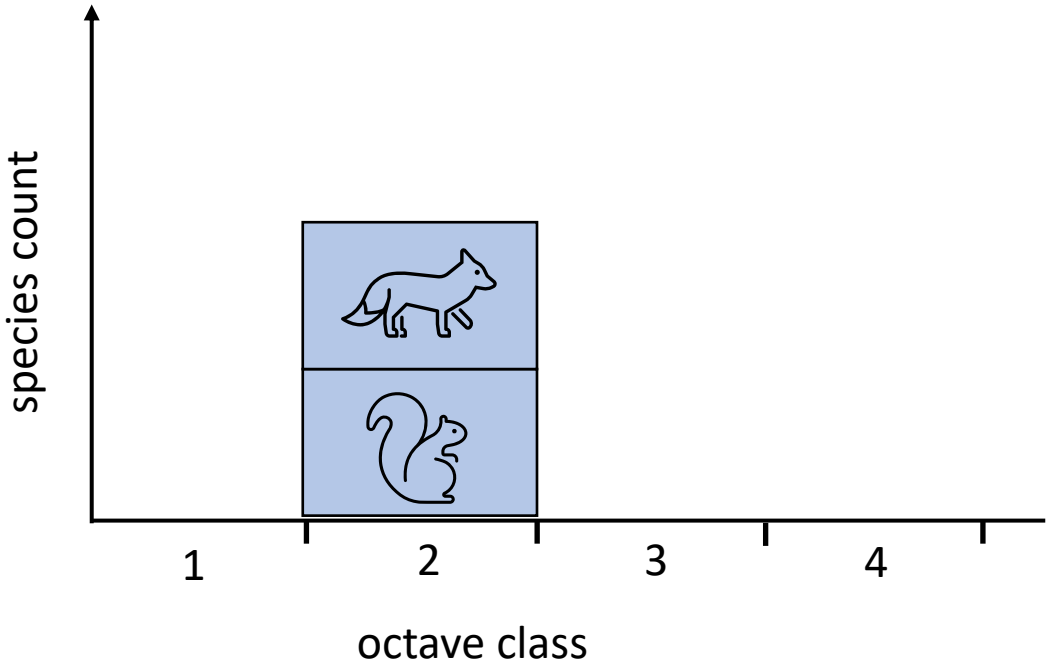
Octaves?

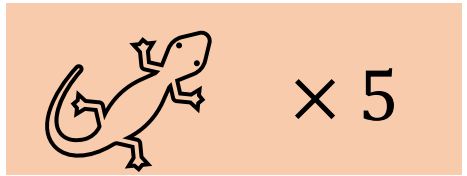

× 10

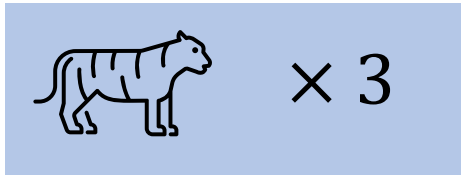

× 3

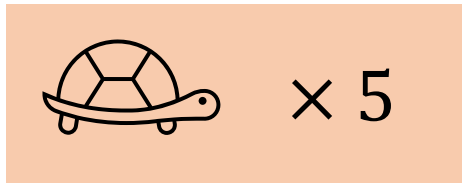

× 5

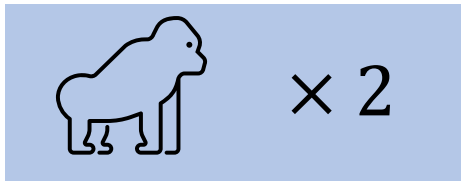

× 2

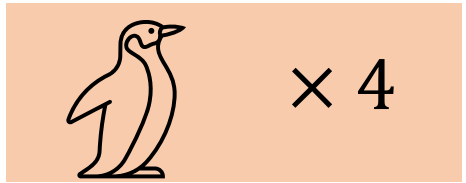

species count
1
2
3
4
octave class

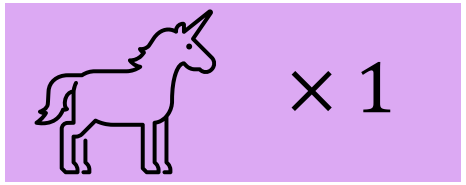

× 5

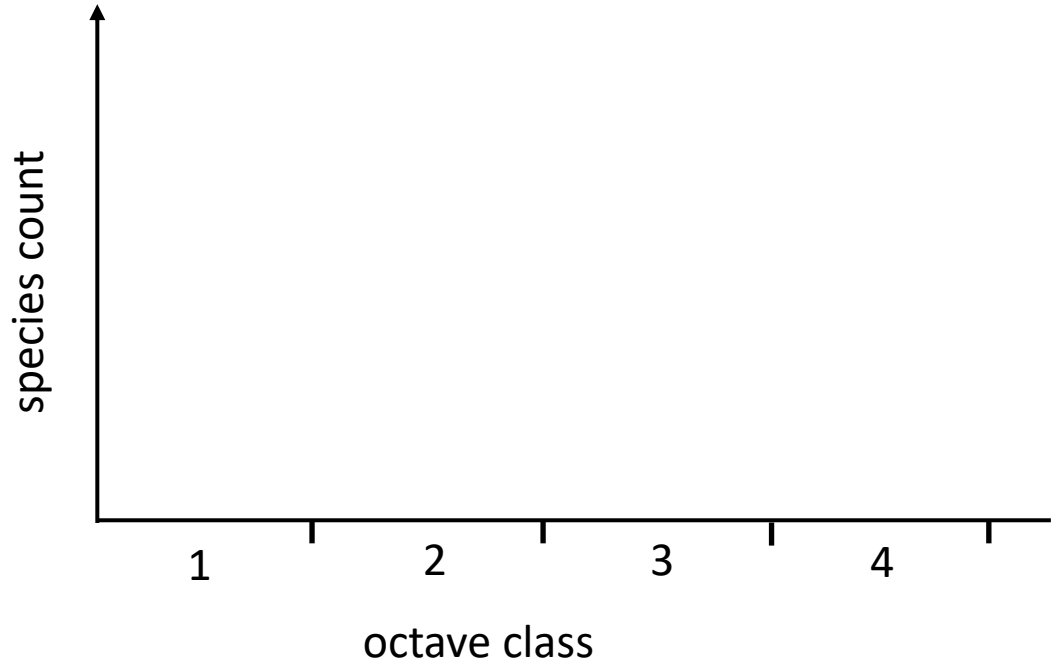

× 3


× 5

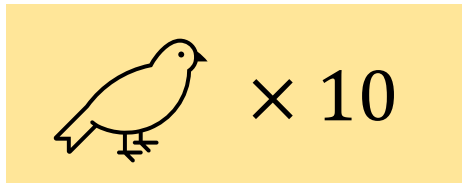

× 2

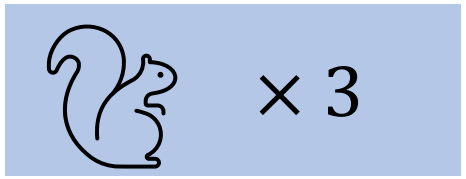

× 4

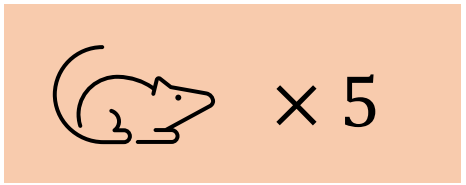

× 1

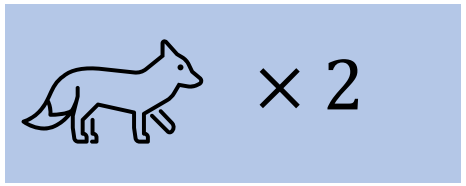

species count
1
2
3
4
octave class

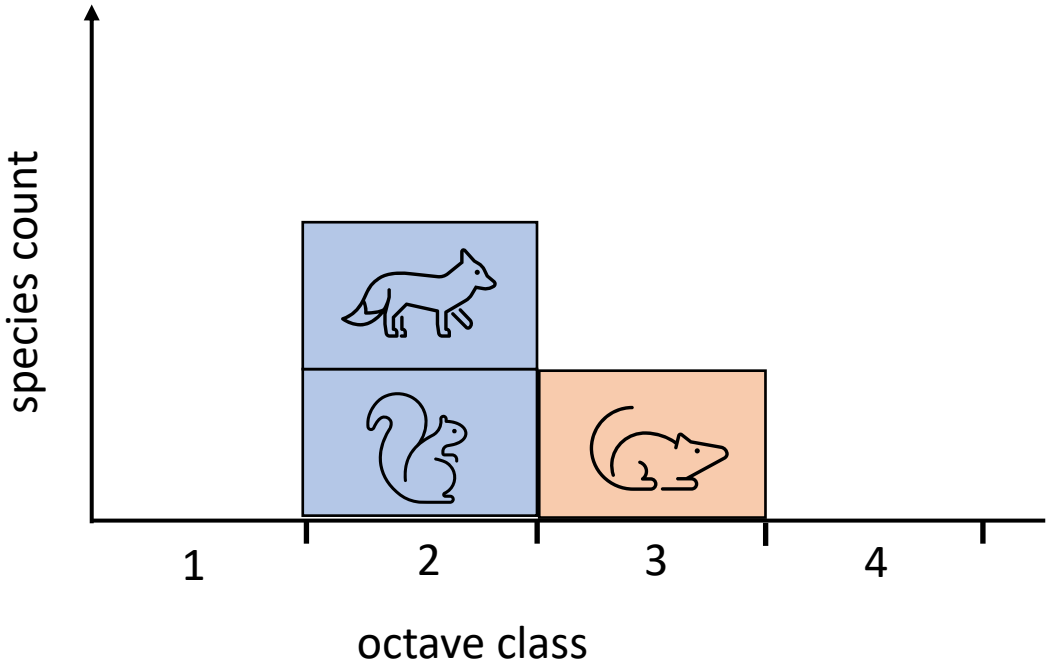
Octaves?

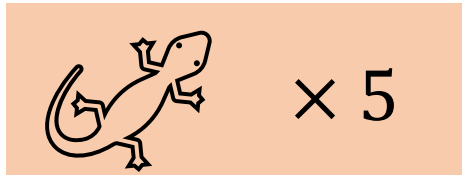

× 10

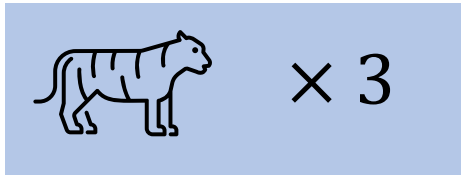

× 3

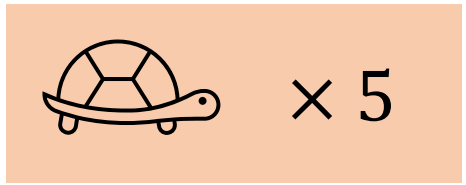

× 5

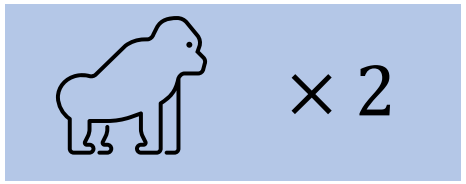

× 2

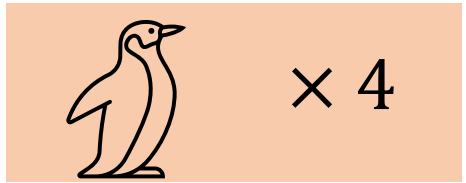

species count
1
2
3
4
octave class

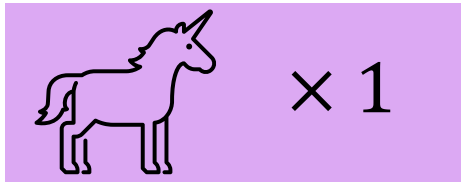

× 5

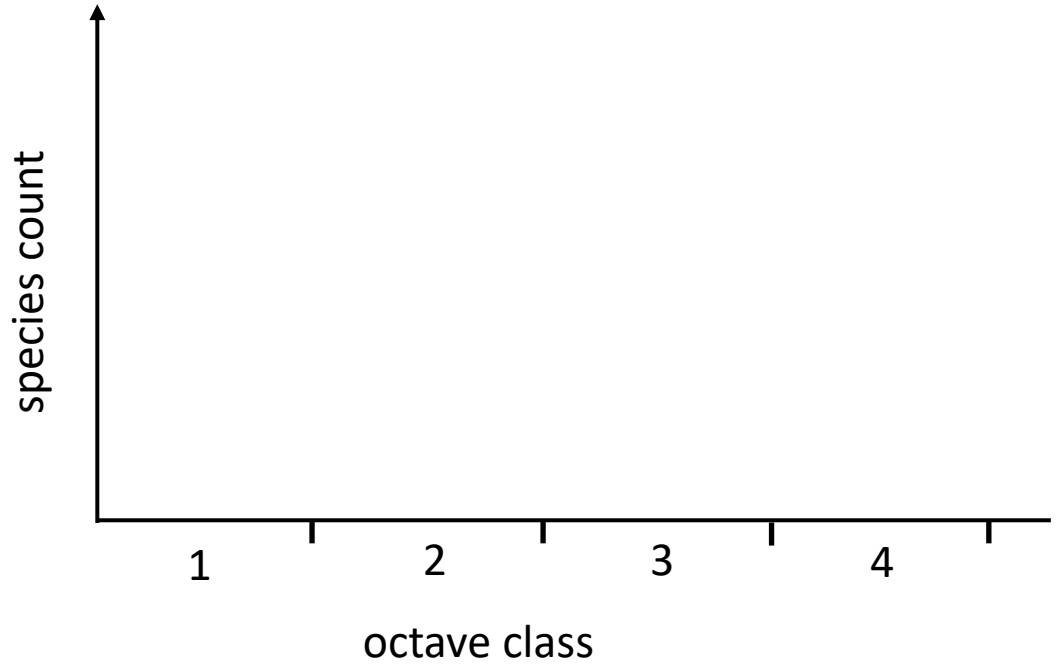

× 3


× 5

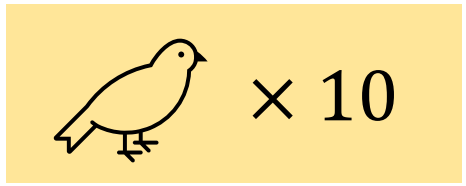

× 2

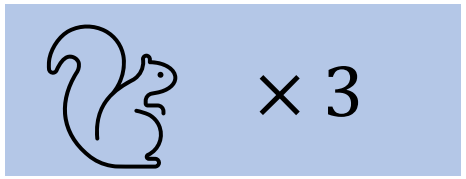

× 4

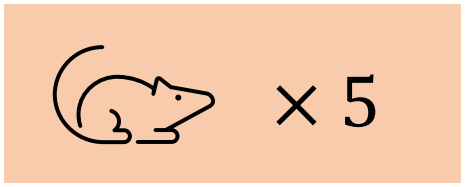

× 1

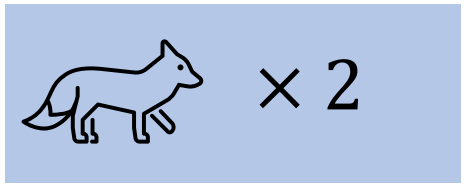

species count
1
2
3
4
octave class

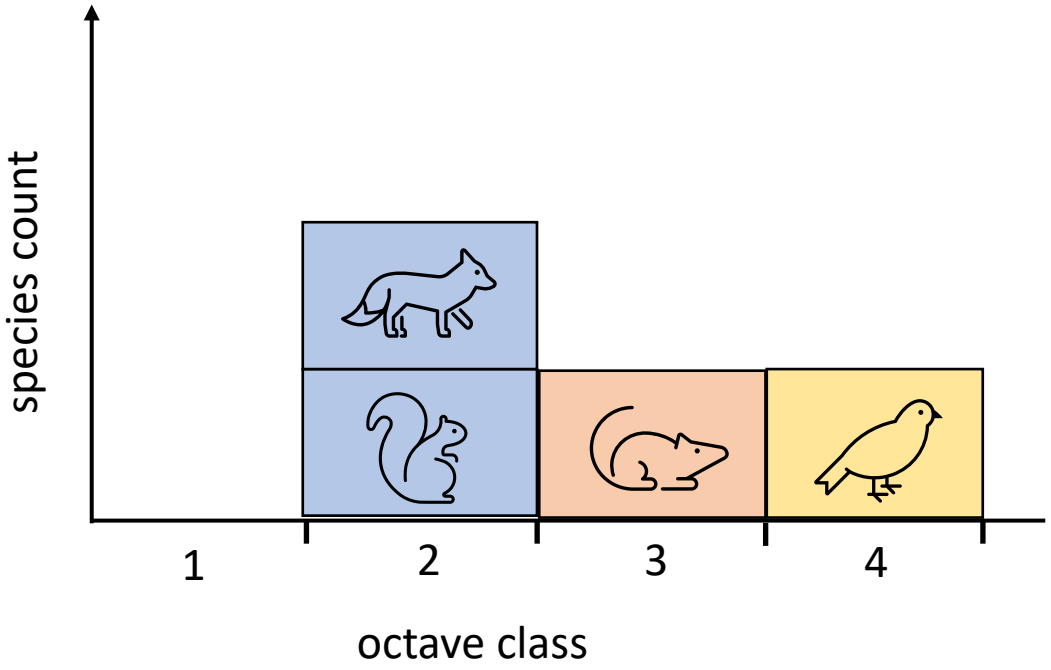
Octaves?

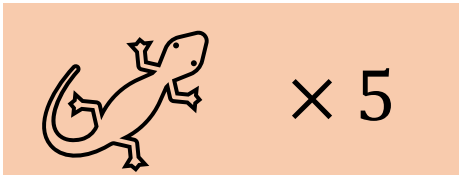

× 10

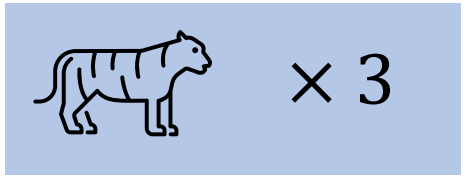

× 3

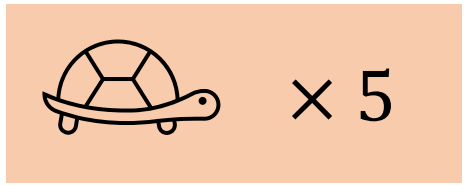

× 5

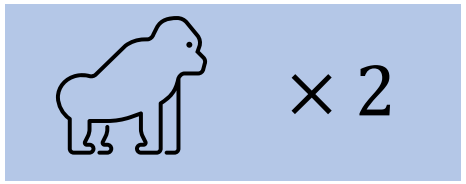

× 2

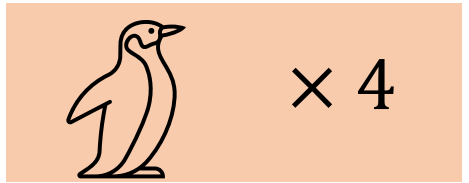

species count
1
2
3
4
octave class

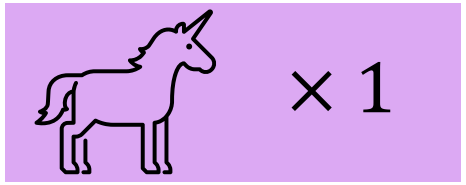

× 5

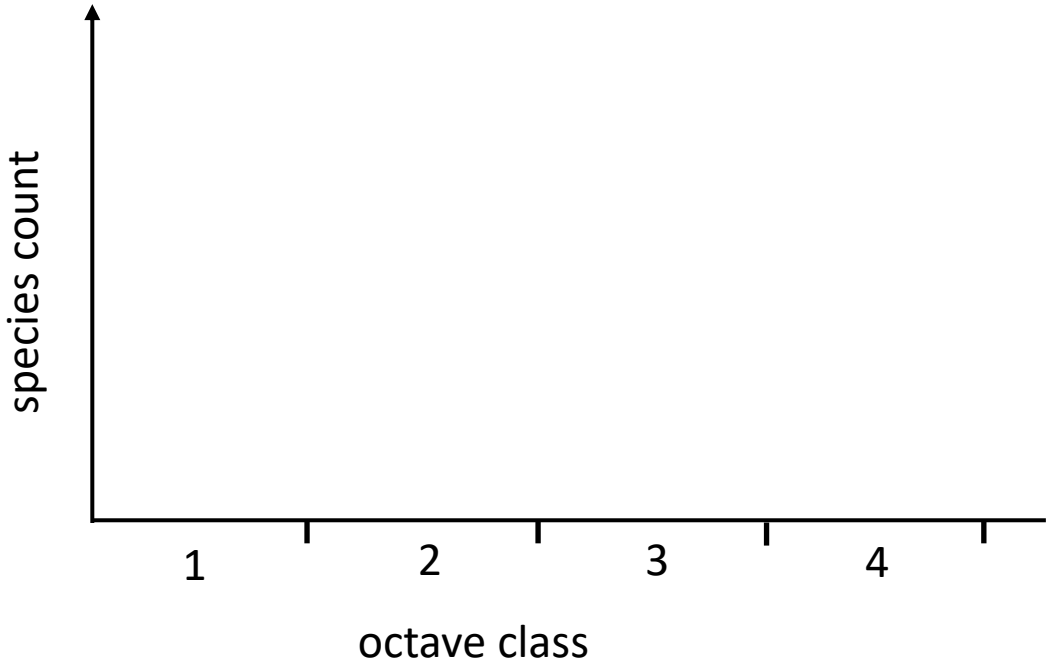

× 3


× 5

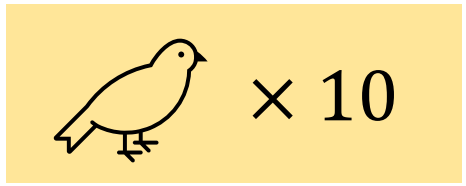

× 2

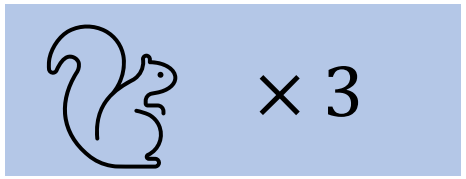

× 4

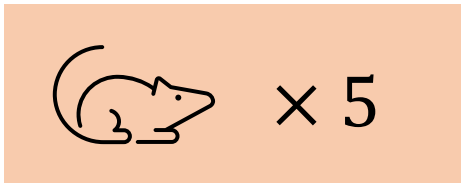

× 1

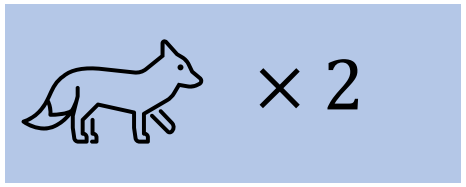

species count
1
2
3
4
octave class

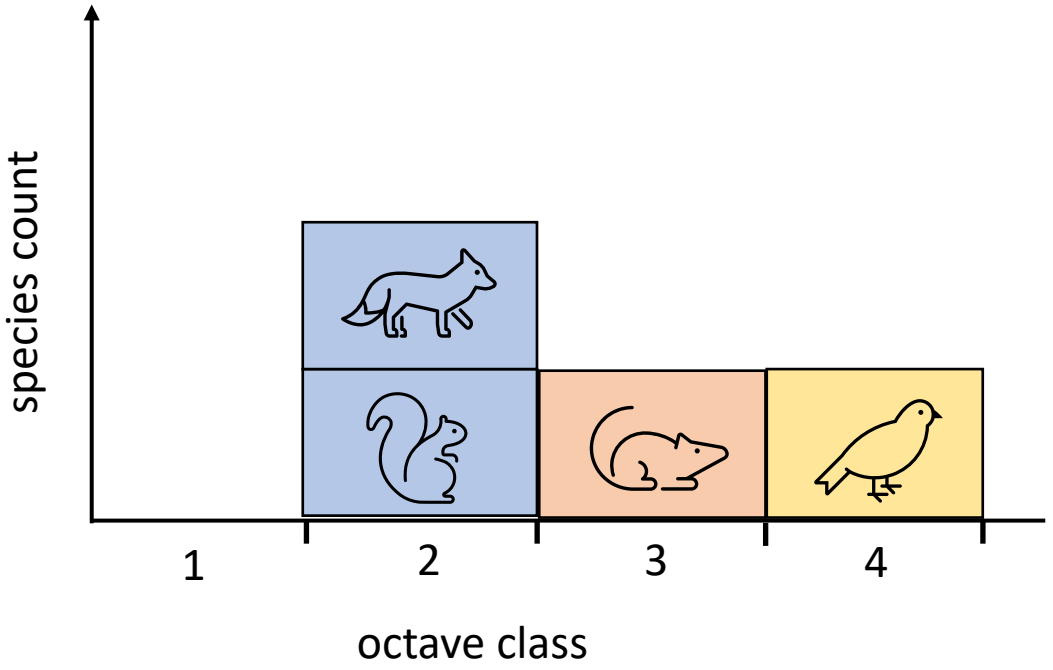
Octaves?

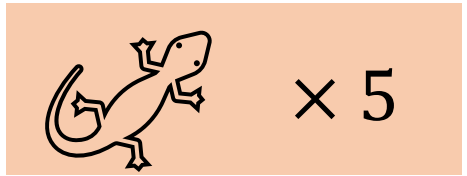

× 10

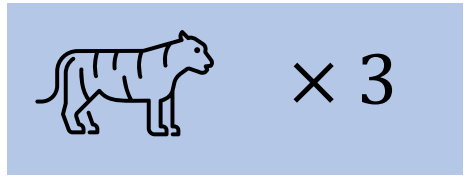

× 3

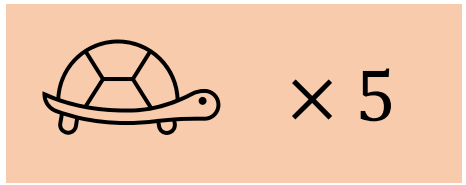

× 5

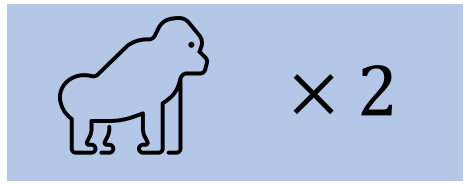

× 2

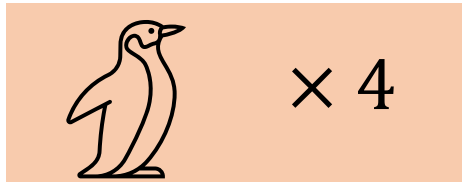

species count
1
2
3
4
octave class

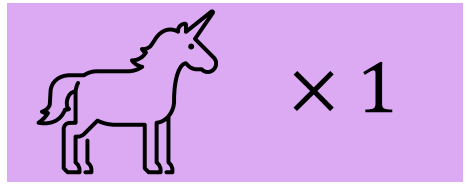

× 5

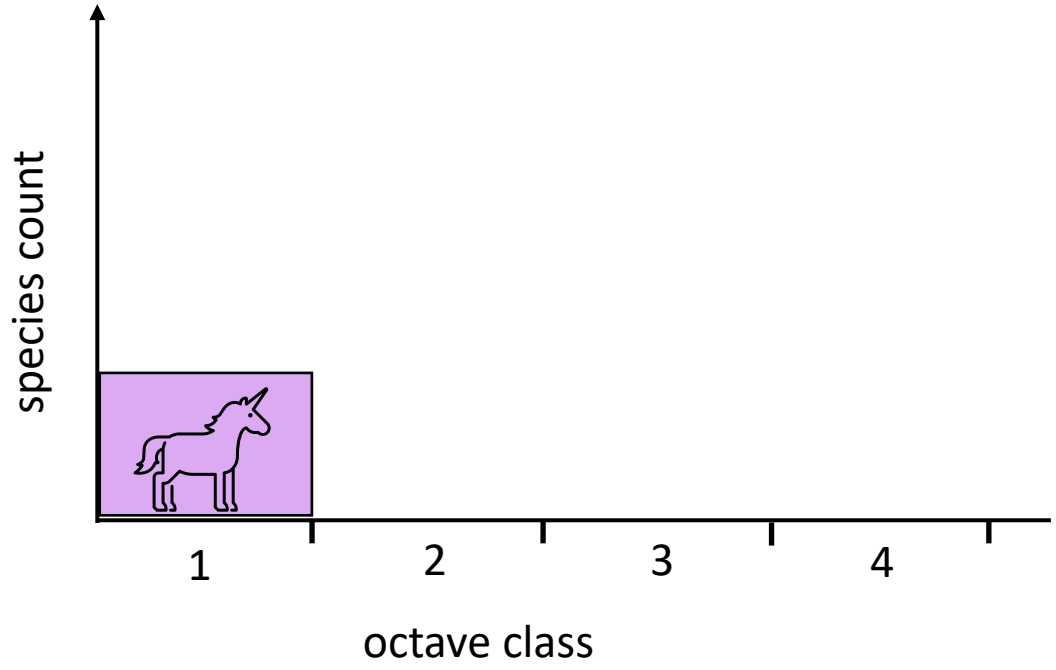

× 3


× 5

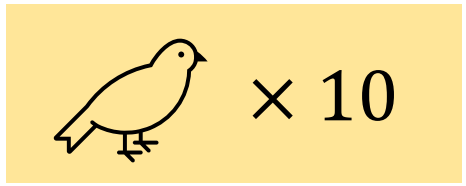

× 2

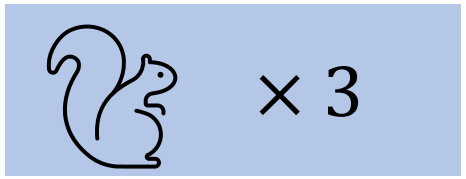

× 4

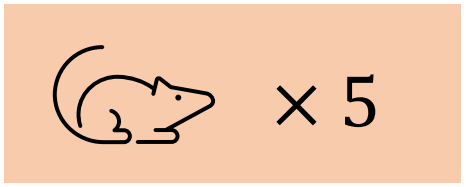

× 1

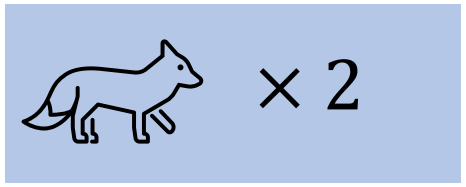

species count
1
2
3
4
octave class

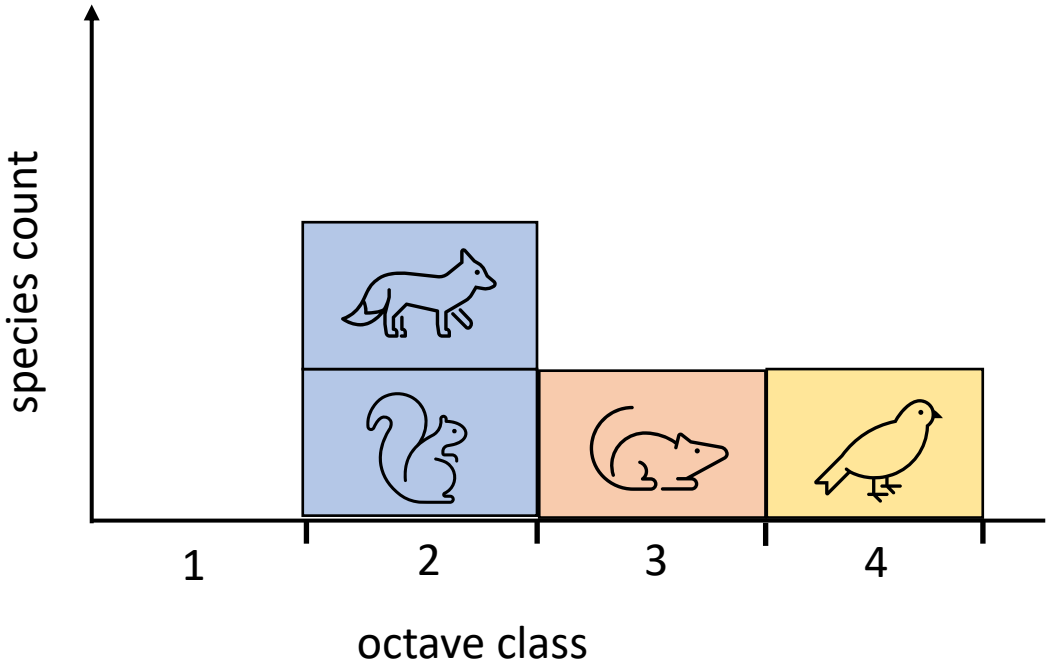
Octaves?

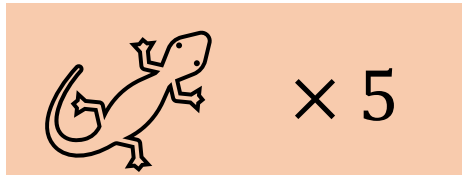

× 10

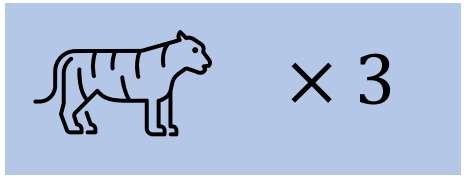

× 3

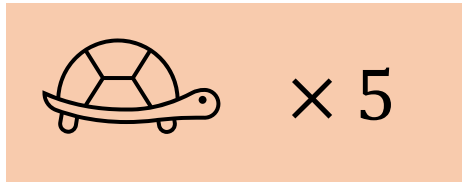

× 5

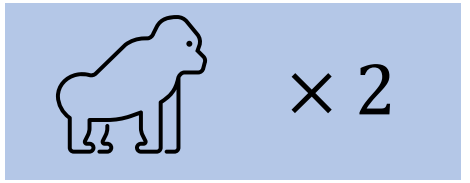

× 2

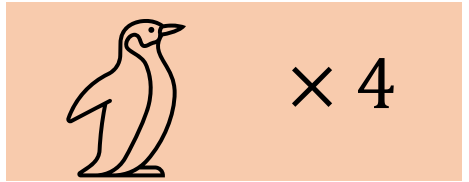

species count
1
2
3
4
octave class

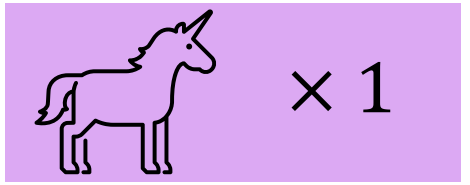

× 5

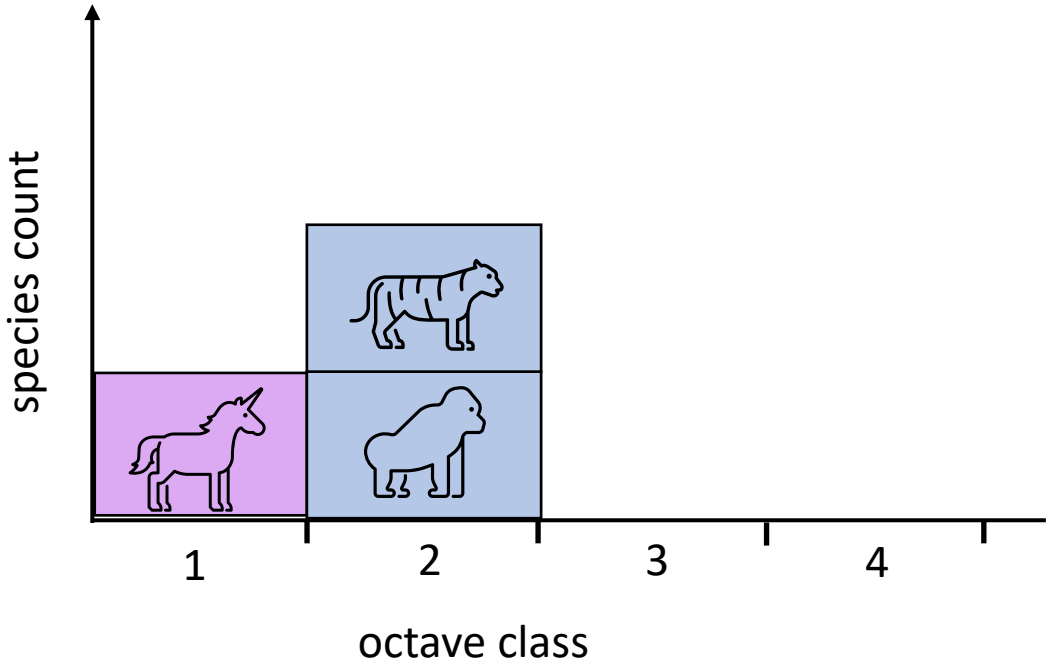

× 3


× 5

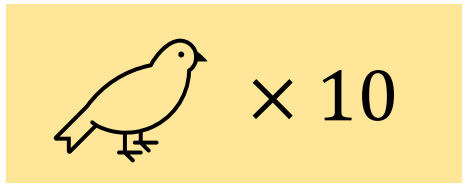

× 2

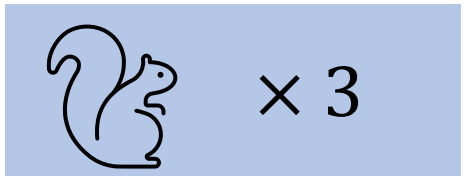

× 4

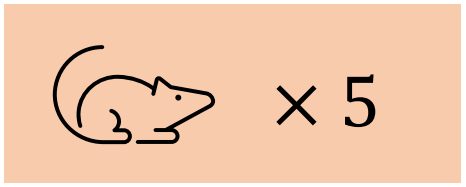

× 1

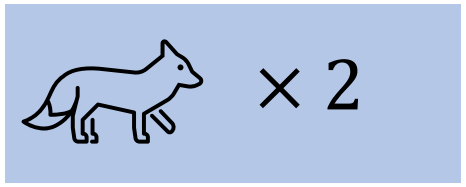

species count
1
2
3
4
octave class

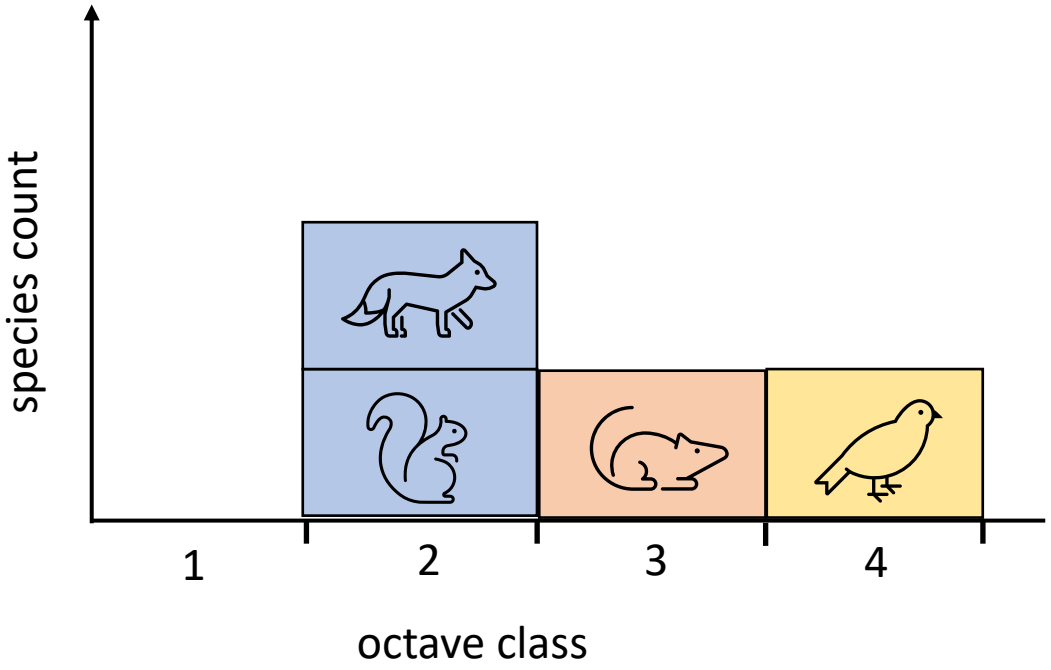
Octaves?

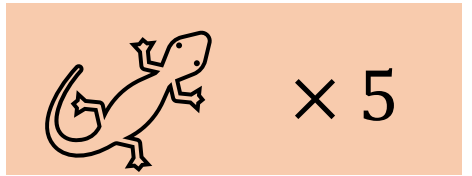

× 10

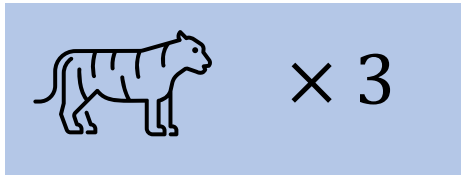

× 3

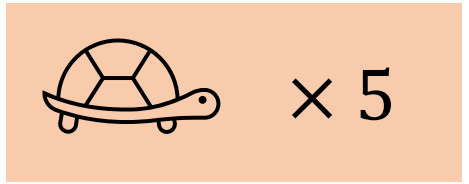

× 5

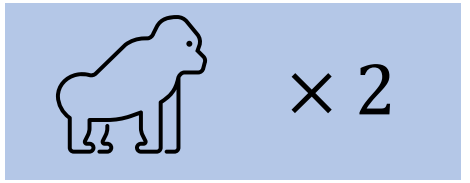

× 2

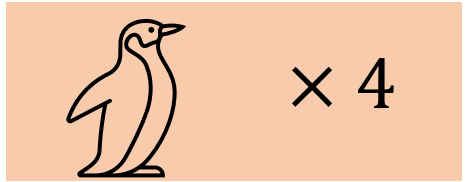

species count
1
2
3
4
octave class

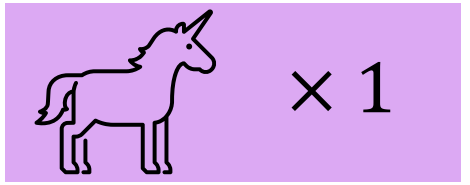

× 5

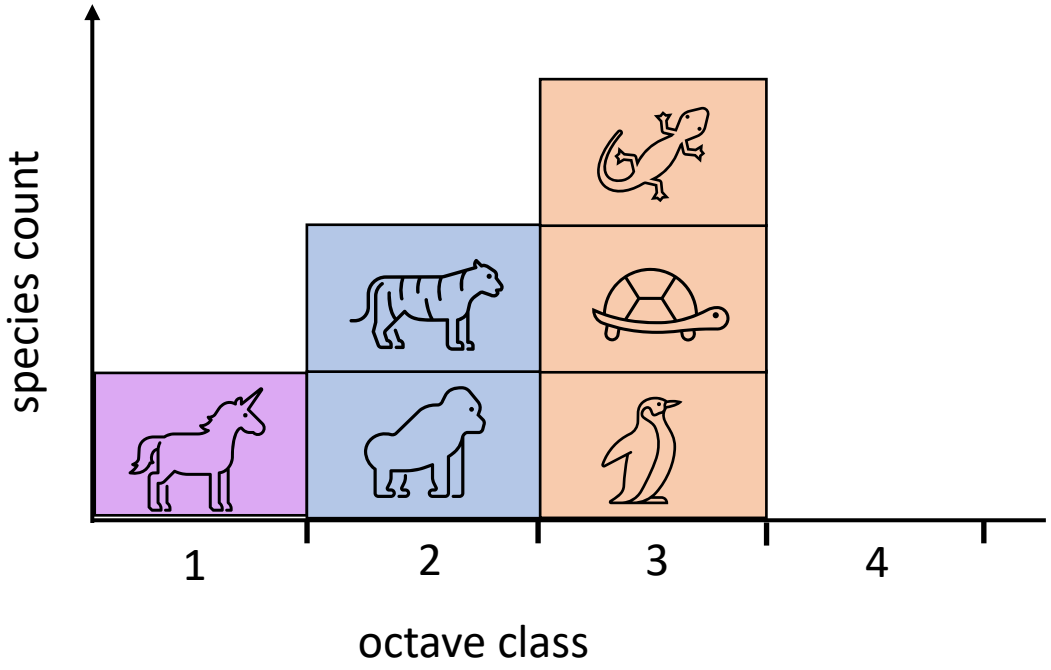

× 3


× 5

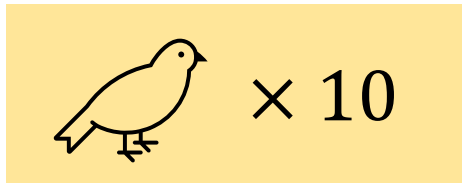

× 2

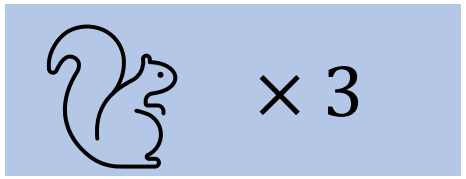

× 4

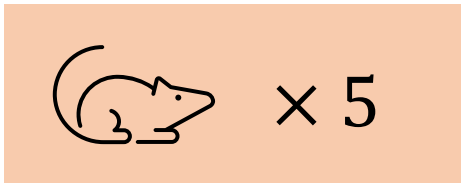

× 1

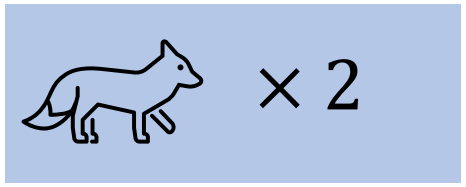

species count
1
2
3
4
octave class

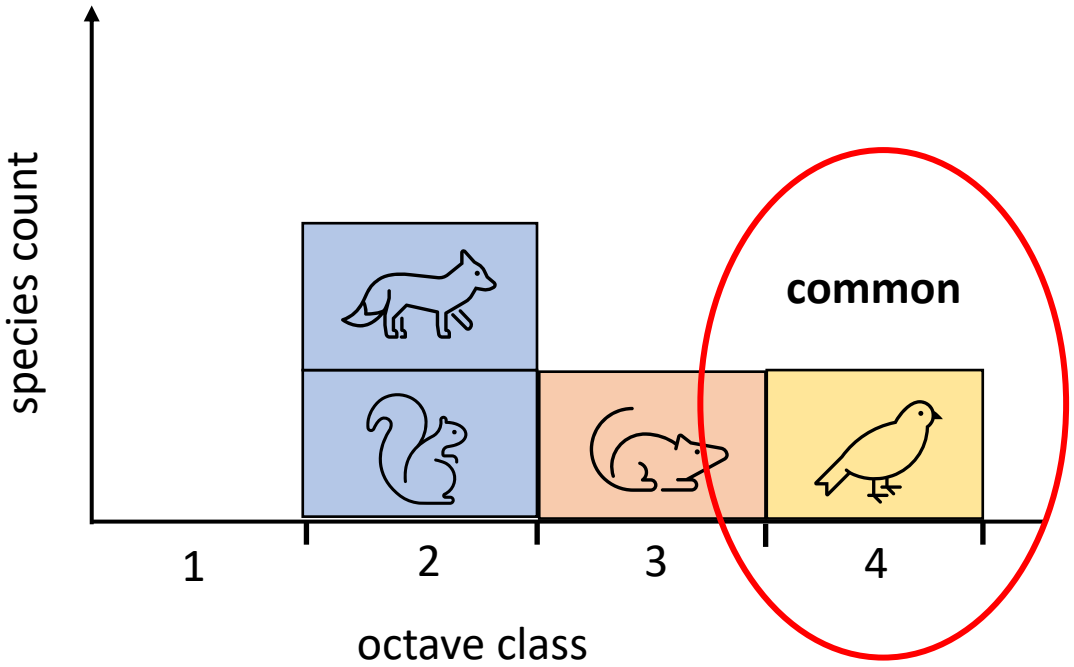
Octaves?

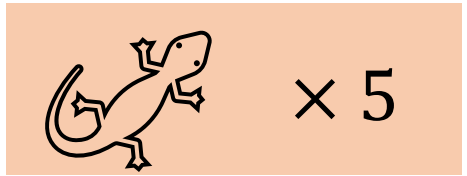

× 10

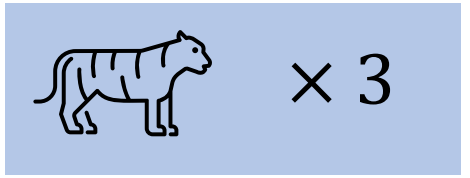

× 3

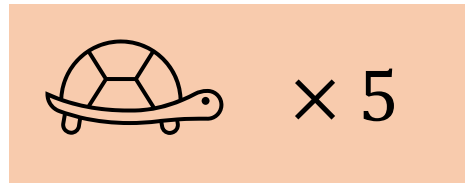

× 5

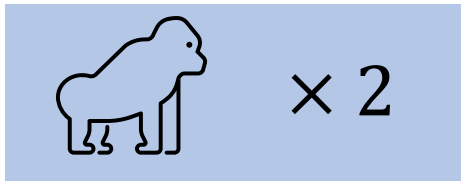

× 2

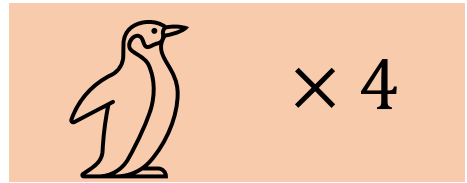

species count
common
1
2
3
4
octave class

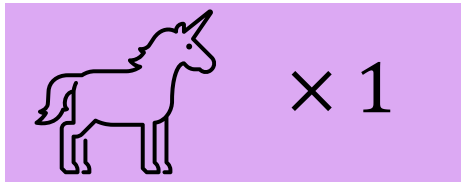

× 5

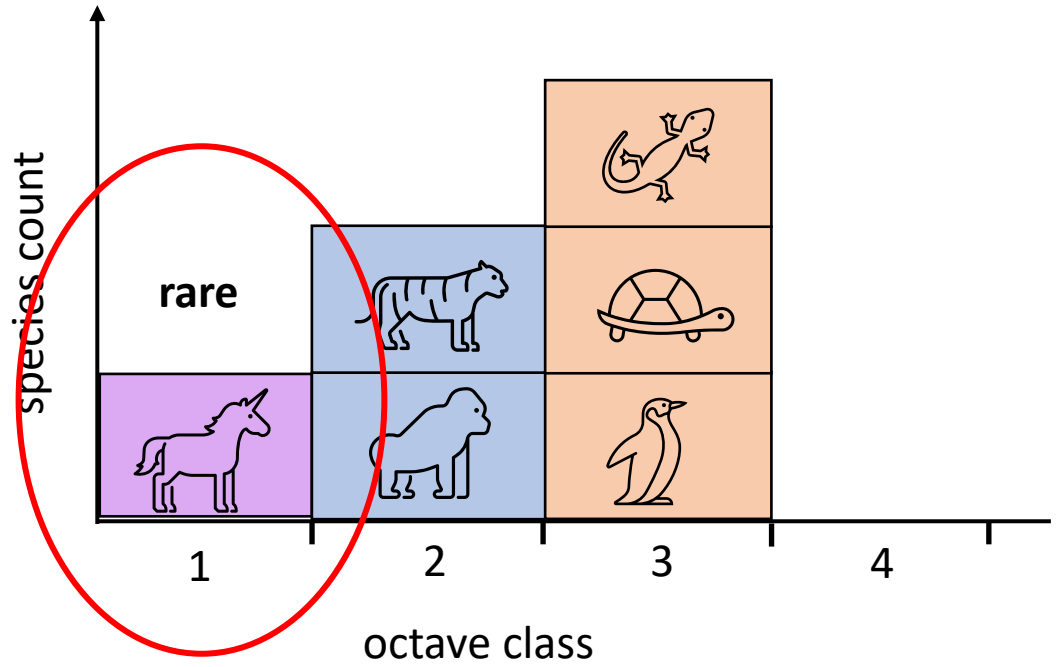

× 3


× 5


× 2


× 4


× 1


species count
rare
1
2
3
4
octave class