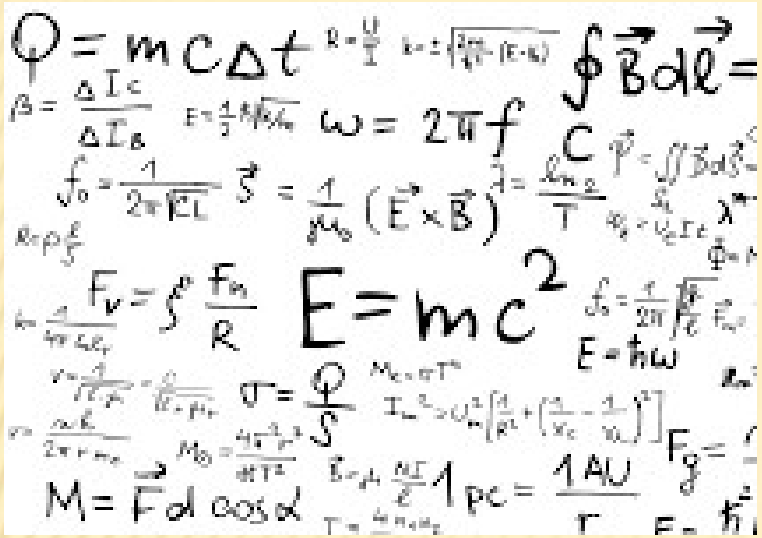
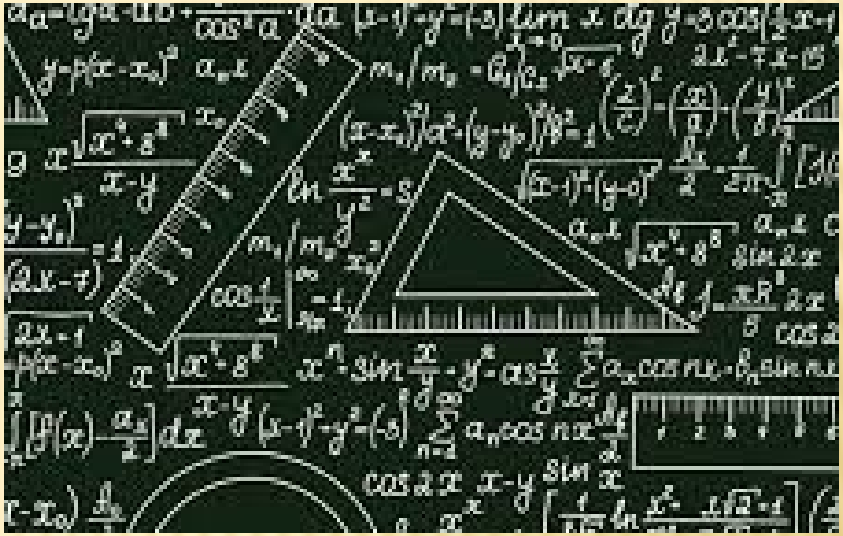




B. Samraoui, D. Phil.

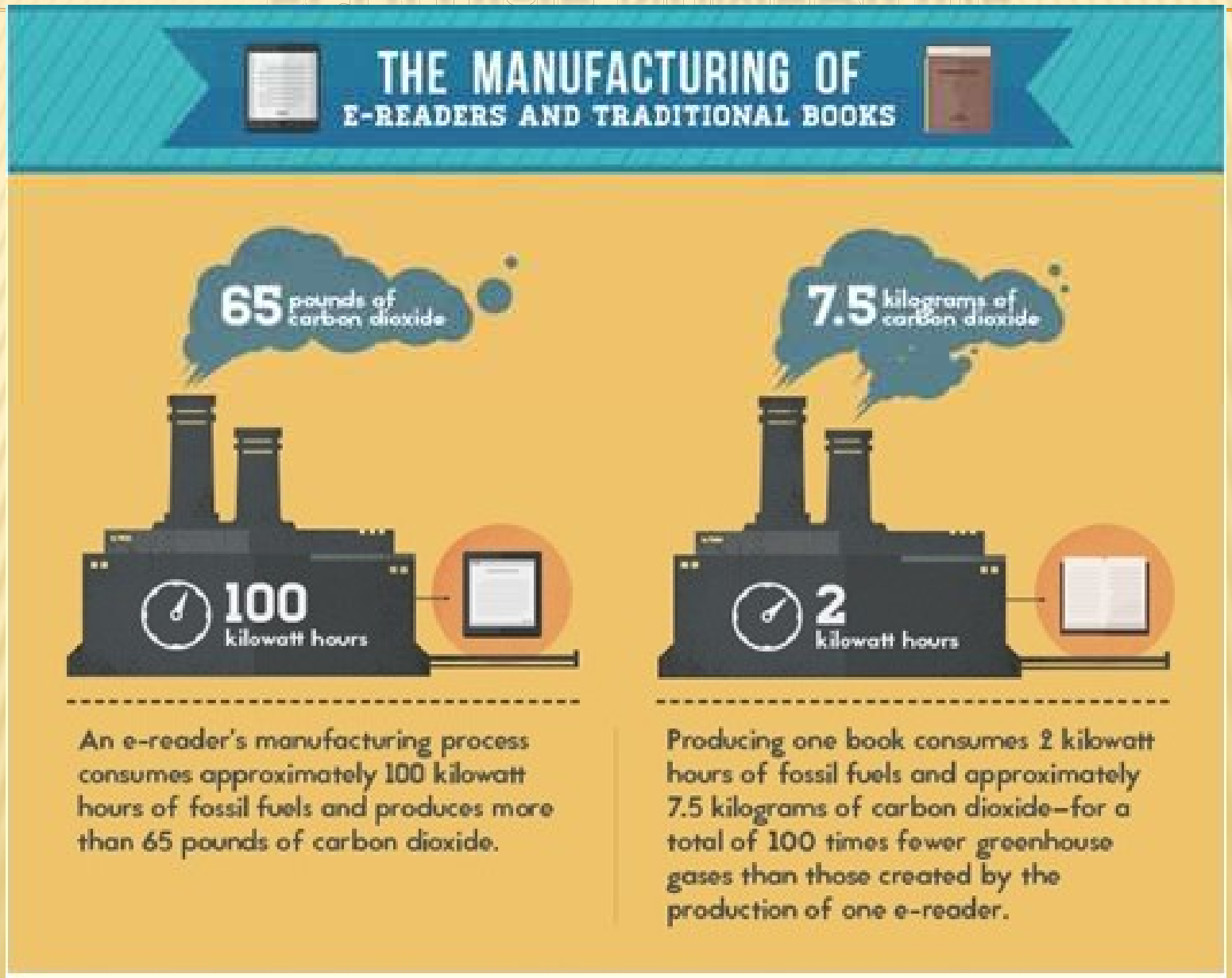
University of Annaba

ECOLOGIE NUMÉRIQUE ET MODÉLISATION

ECOLOGISTE/ECOLOGUE/ECOLOGIST/ENVIRONMENTALIST

ENVIRONNEMENT NUMÉRIQUE

ECOLOGIE NUMÉRIQUE



ECOLOGIE NUMÉRIQUE

PLAN DU COURS

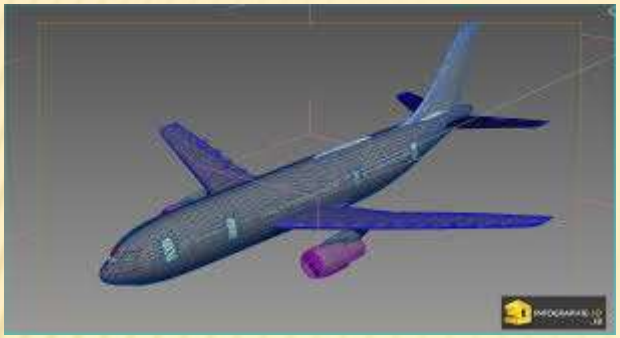
- 1) Mesures de la diversité écologique
- 2) Introduction à R
- 3) Exploration des données et modélisation

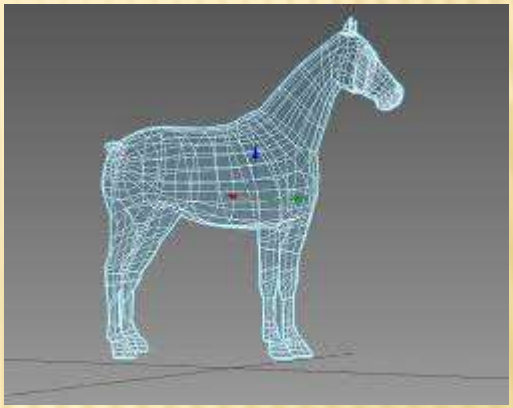
Triple learning curve!

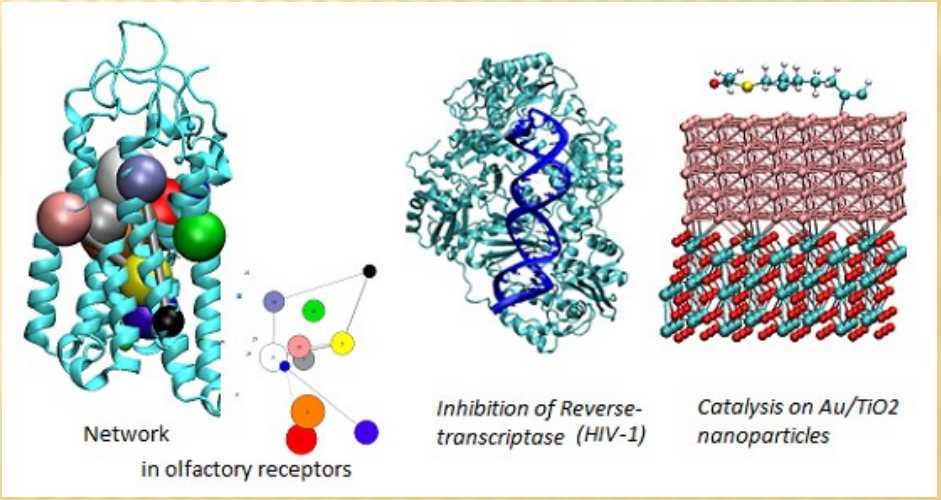
GALILEO GALILEI

« La philosophie est écrite dans cet immense livre qui se tient toujours ouvert devant nos yeux, je veux dire l'univers, mais on ne peut le comprendre si l'on ne s'applique d'abord à en comprendre la langue et à connaitre les caractères dans lesquels il est écrit. Il est écrit en langue mathématique, et ses caractères sont des triangles, des cercles et autres figures géométriques, sans le moyen desquels il est humainement impossible d'en comprendre un mot. »

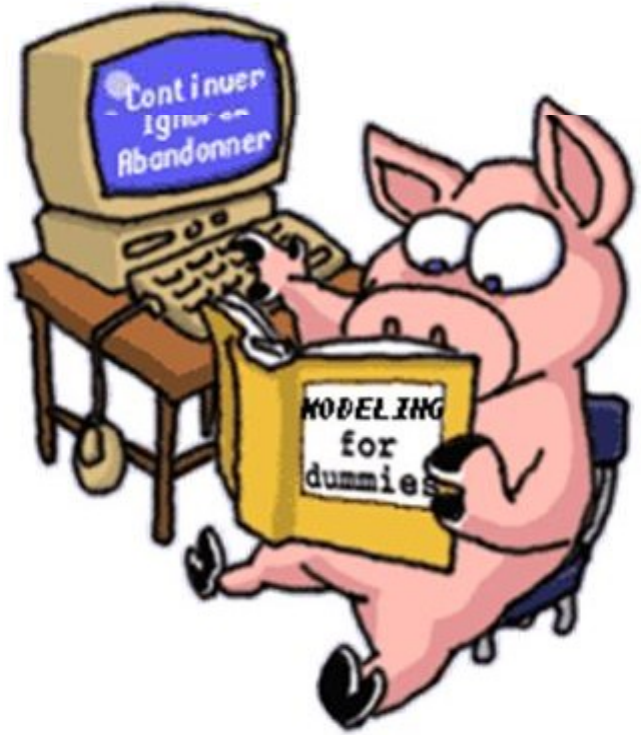
MODÉLISATION







Bon, j'ai mon modèle 3D, et maintenant, j'en fait quoi ?



TESTS DES MODÈLES

"All models are wrong, but some are useful“ George Box

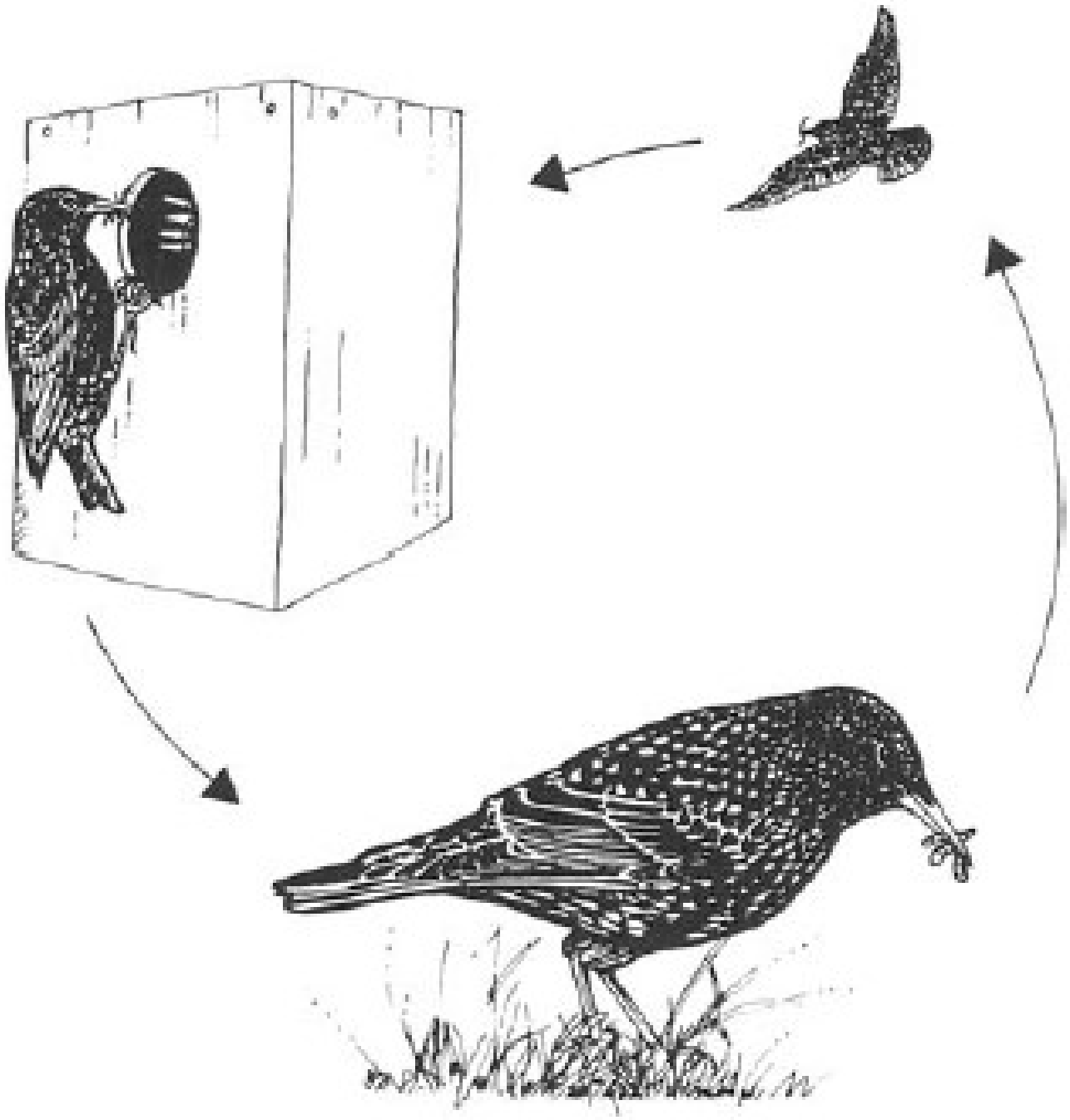
BIG DATA AND DATA SCIENCE

DECISIONS ECONOMIQUES

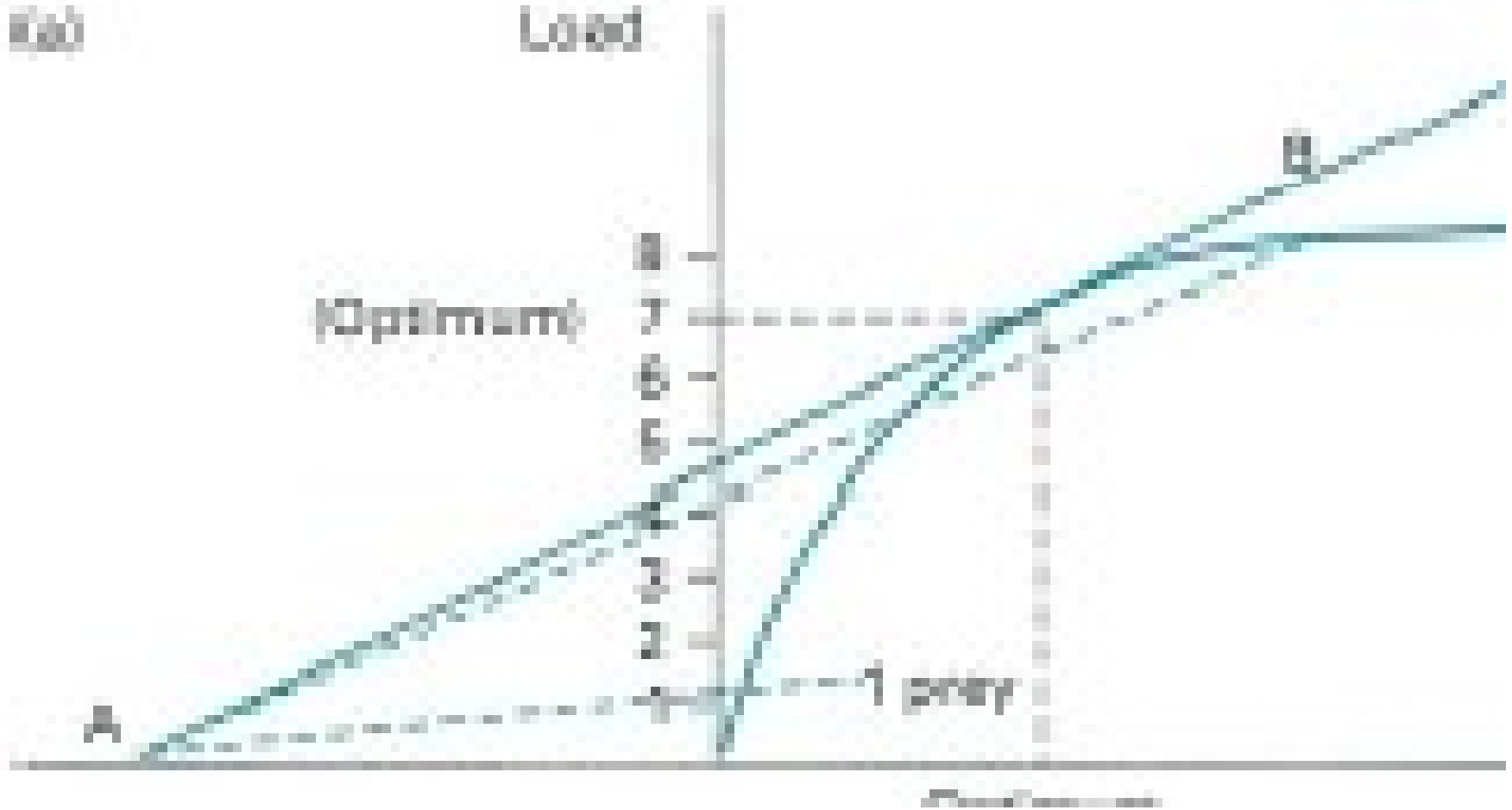
- Un étourneau nourrit ses poussins de larves de tipules. Un parent doit faire près de 400 aller et retour chaque jour durant le pic de croissance.

Combien de larves de tipules un parent doit-il porter à chaque voyage?

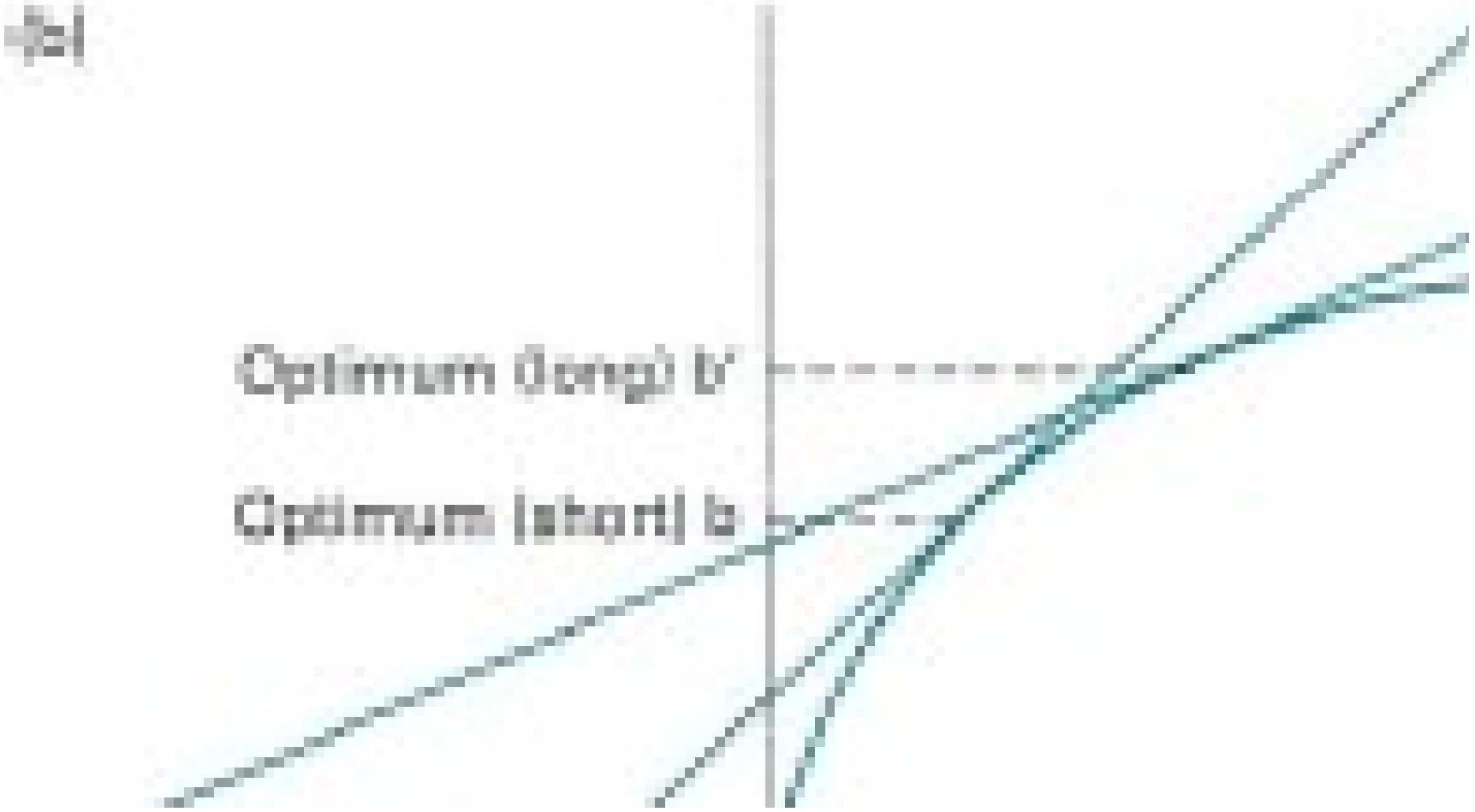
Le problème de l’étourneau est de déterminer le moment où il abandonne sa quête.



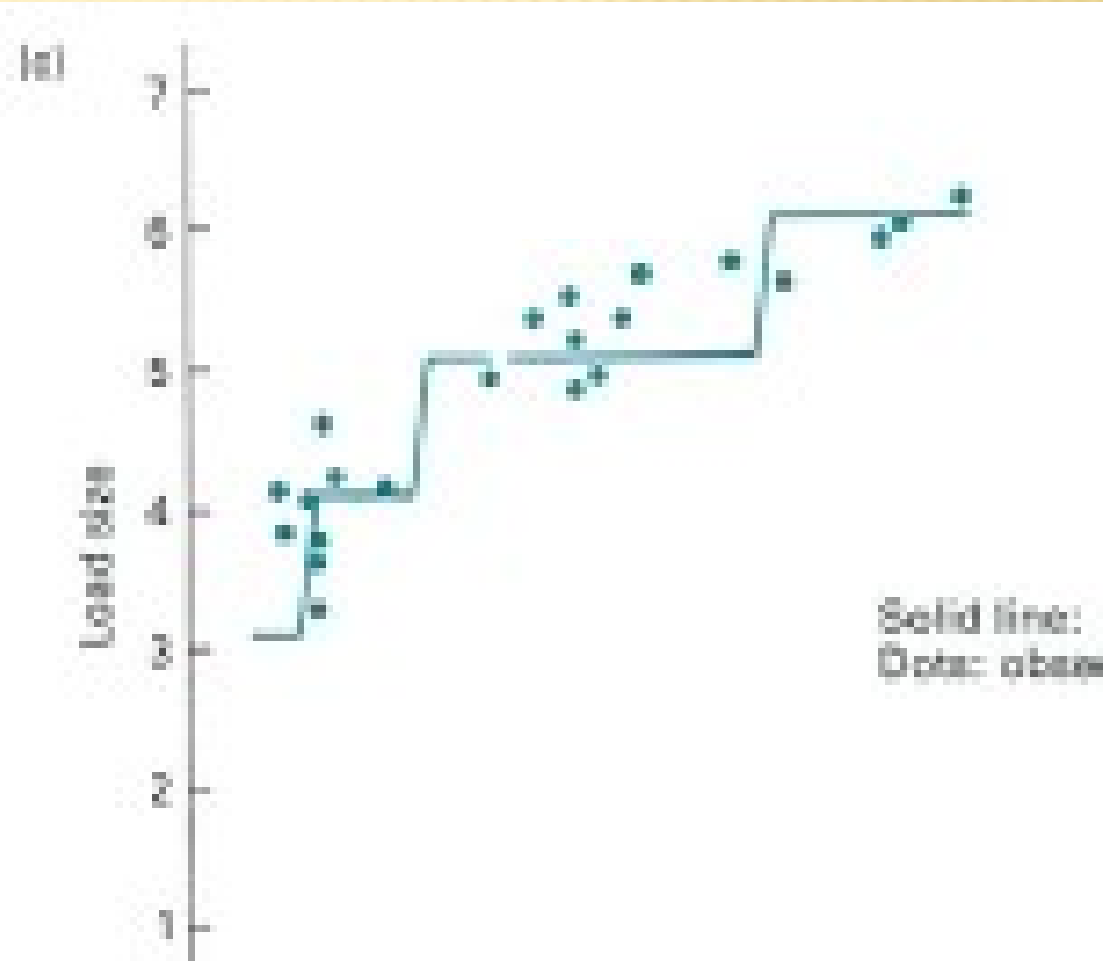
Loading curve



Marginal value theorem (Charnov, 1976)



Kacelnik (1984)

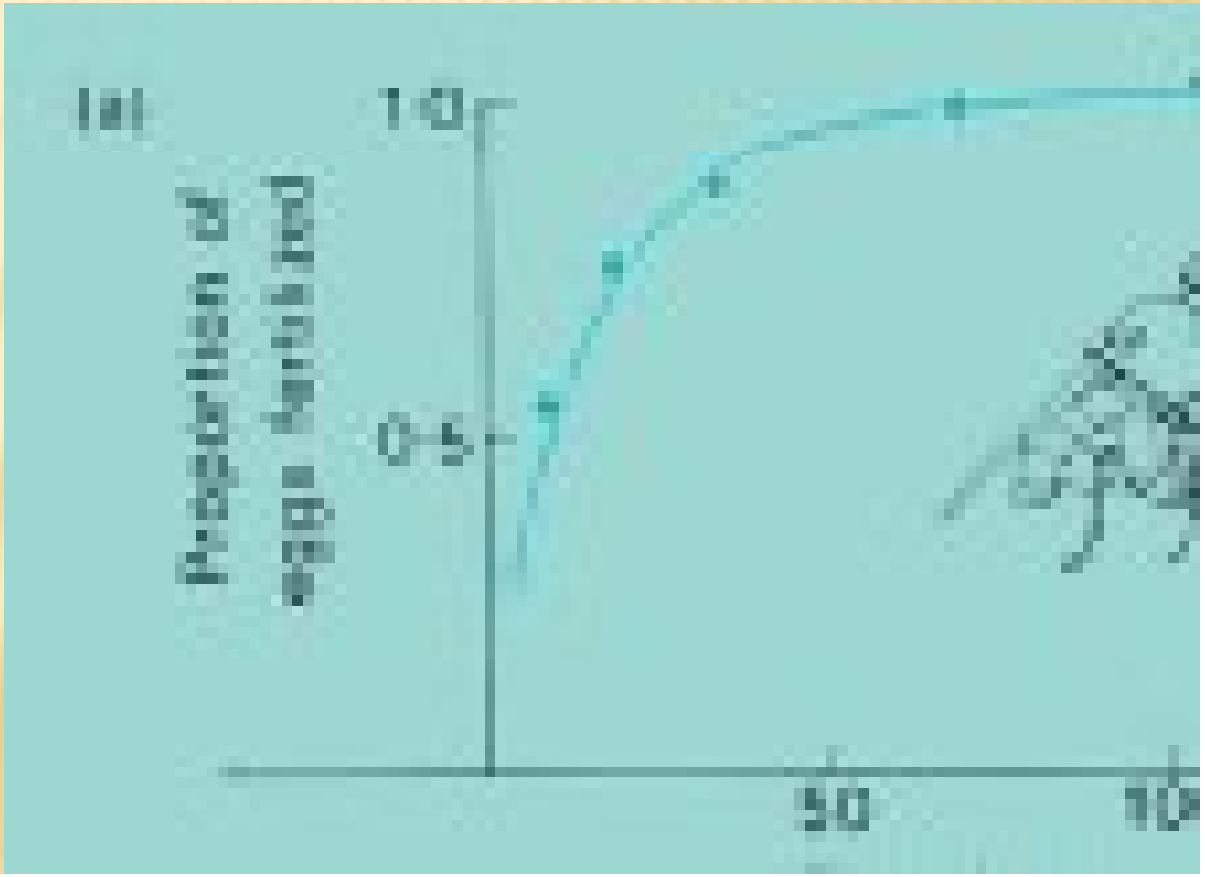


Decisions de reproduction analysées avec le même modèle.

Geoff Parker (1978): *Scatophaga stercoraria*

Recherche de partenaires sexuels chez la mouche à bouse

Combien de temps va-t-il passer en copulation?

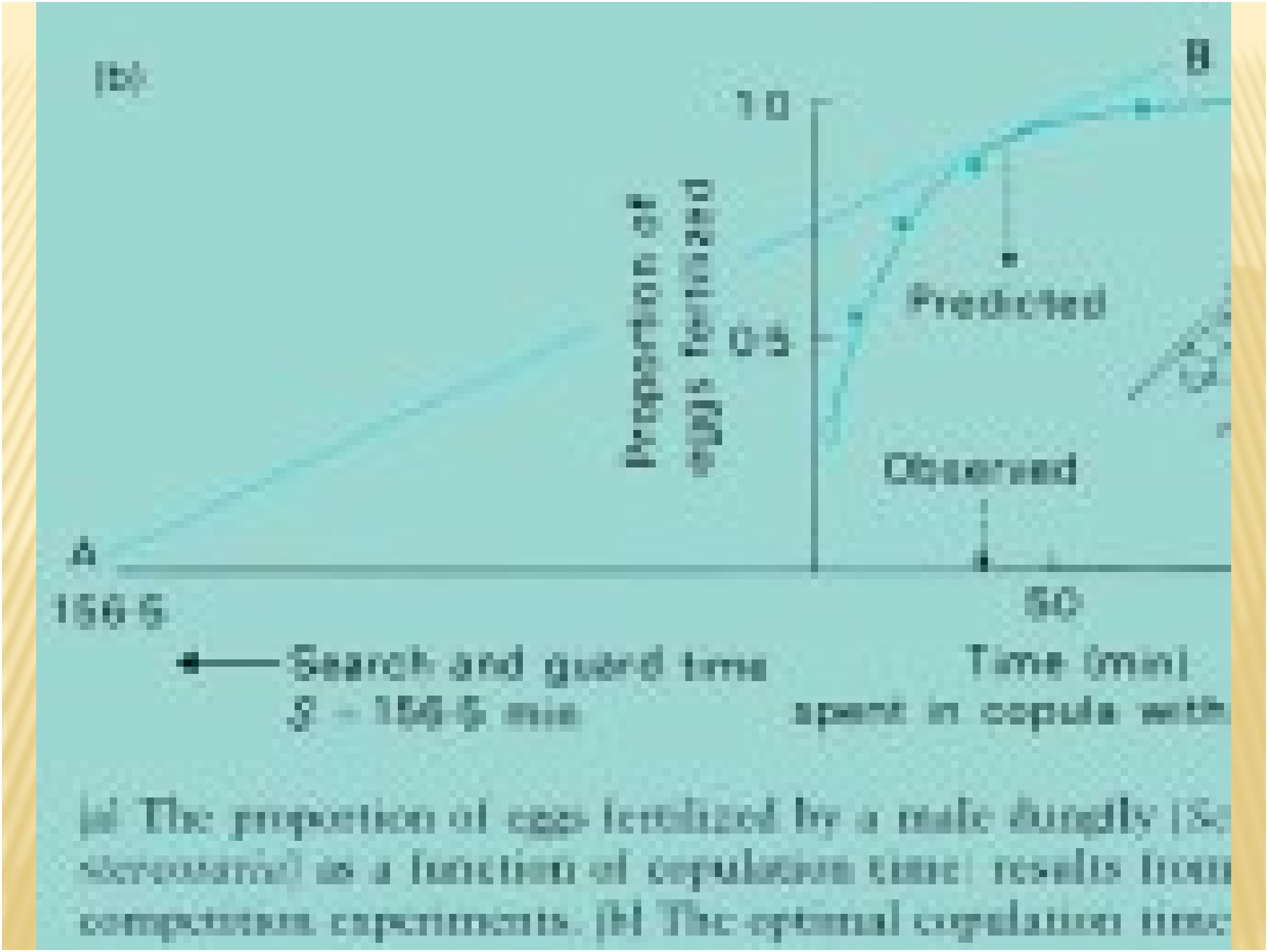


1)Les mâles entrent en compétition pour l'accès aux femelles qui visitent les bouses de vaches pour y pondre leurs œufs.

2)Quand un 2ième mâle copule avec la même femelle, il a l'opportunité de féconder la plupart des œufs.

Parker (1978) montra cela en irradiant les mâles avec du **Cobalt 60** qui stérilise les mâles mais qui n'affecte pas l'activité des spermatozoïdes.

Il montra que plus la copulation est longue, plus le nombre d'œufs fécondé est élevé mais que le bénéfice d'une plus longue copulation diminue avec le temps.

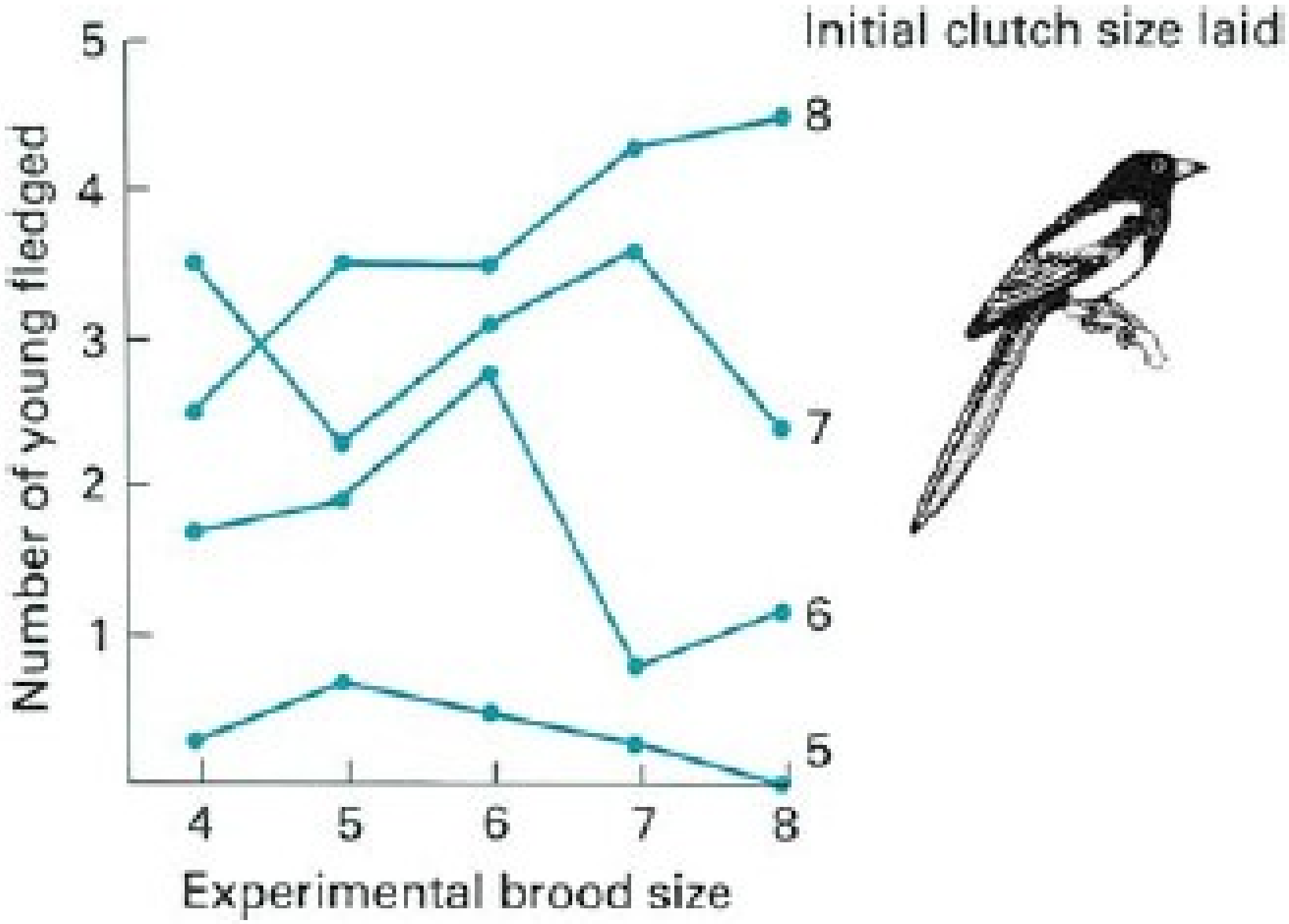


(a) The proportion of eggs fertilized by a male dungfly (Sc
scrotaria) as a function of copulation time: results from
competition experiments. (b) The optimal copulation time

DÉCISIONS

- Il y a un coût associé avec les copulations de longue durée: les mâles perdent l'opportunité d'aller rencontrer d'autres femelles.

Temps optimal de copulation: 41 mn (~ 80% des œufs fécondés)


Initial clutch size laid
Number of young fledged
5
4
3
2
1
8
7
6
5
4
5
6
7
8
Experimental brood size

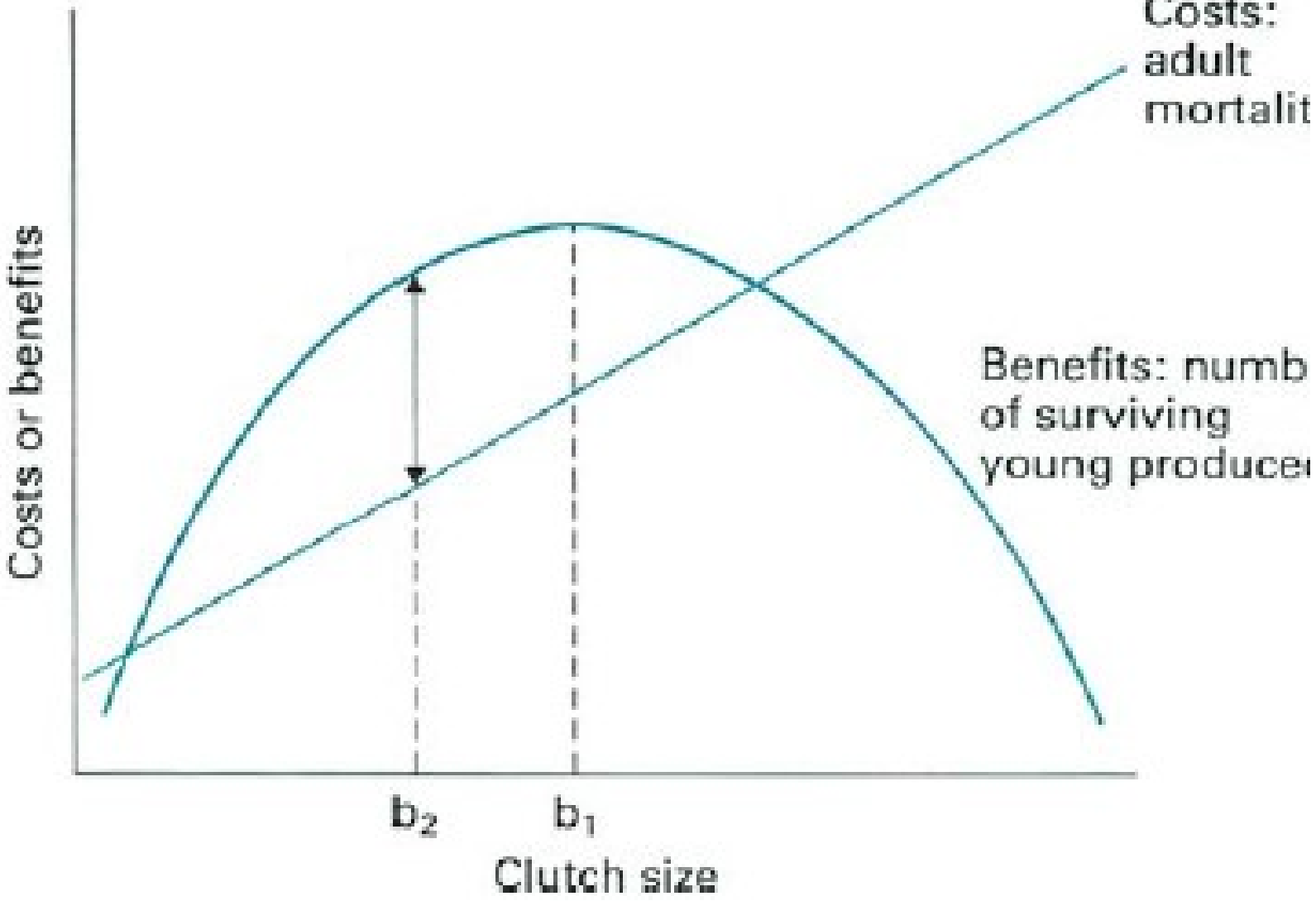
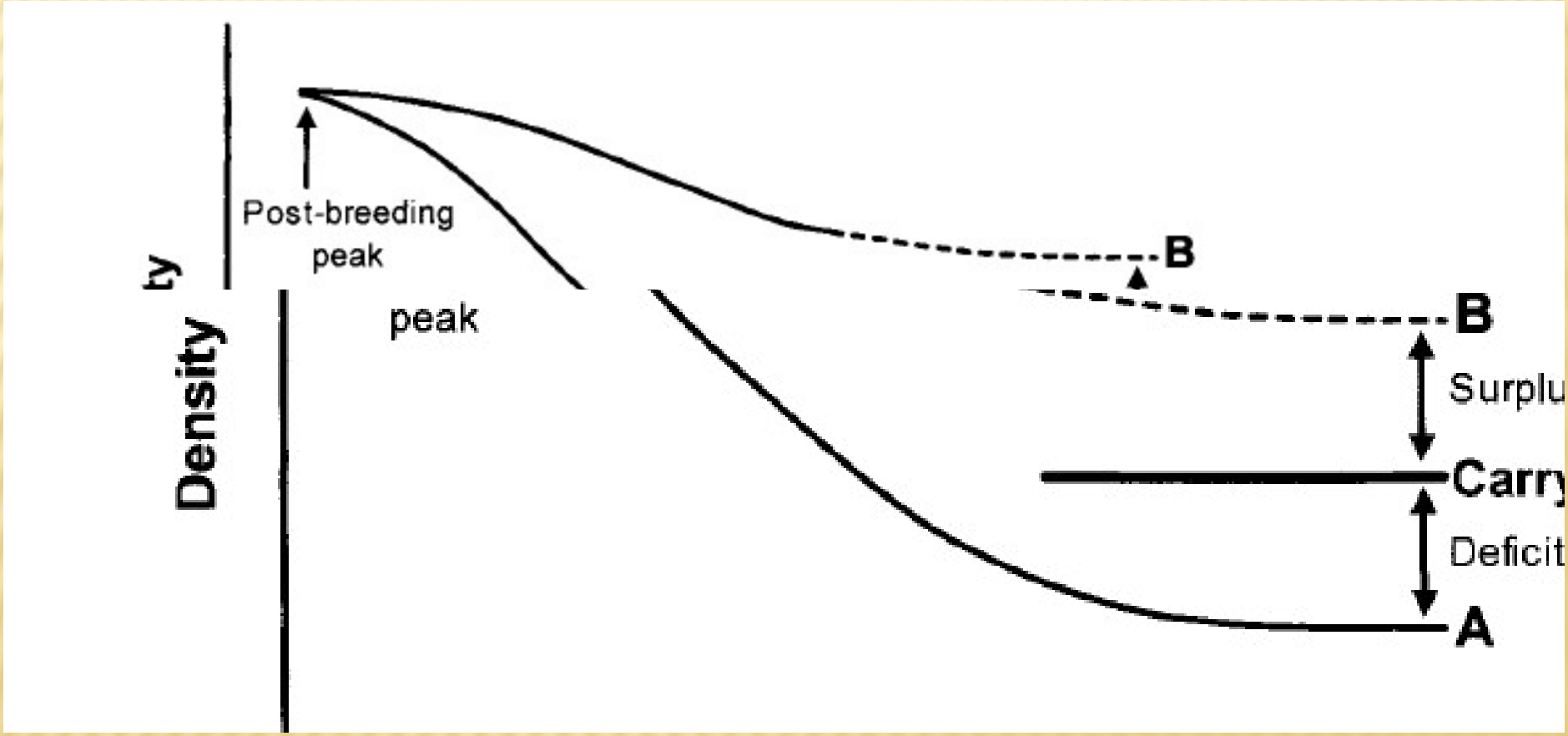
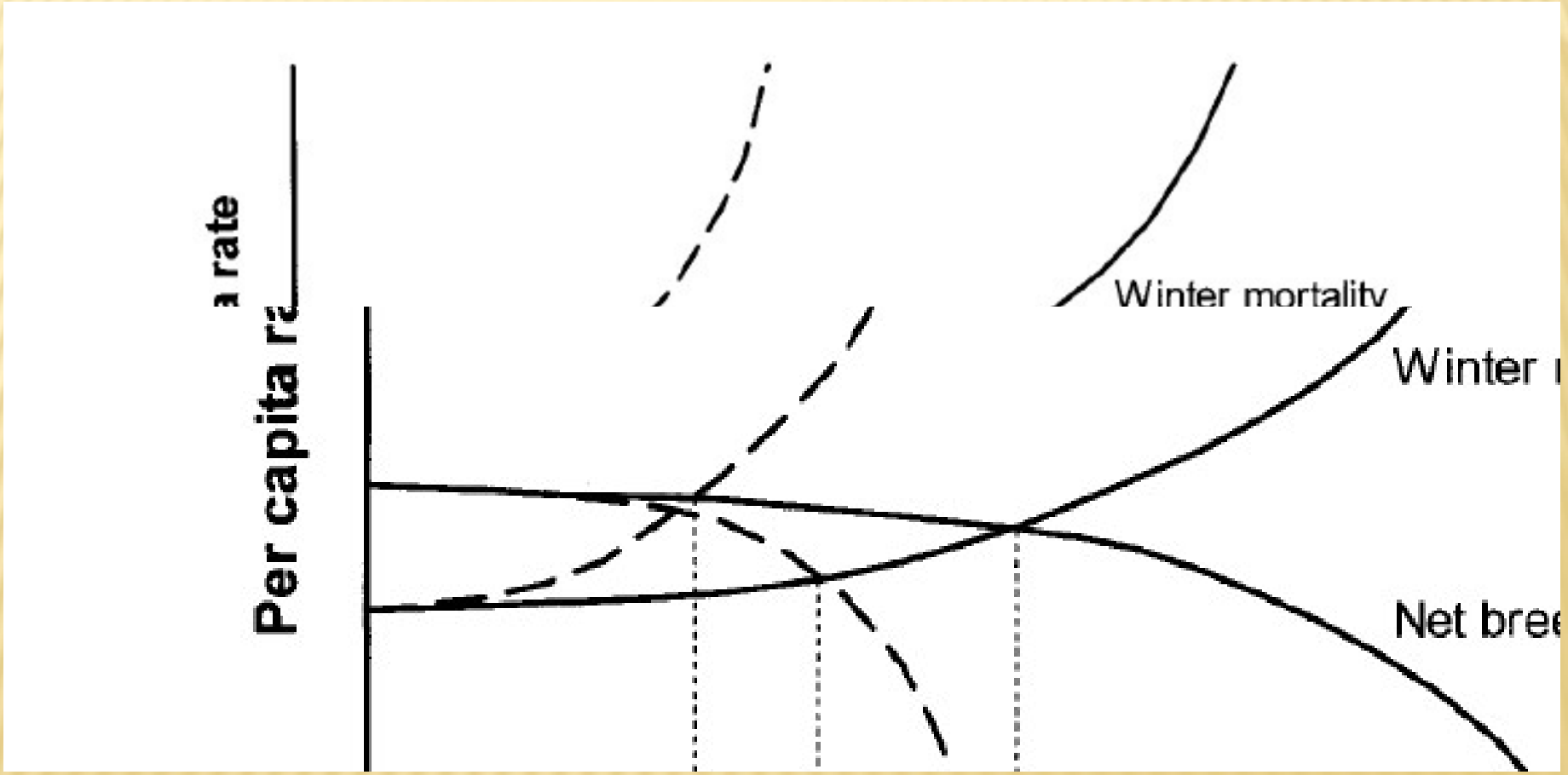


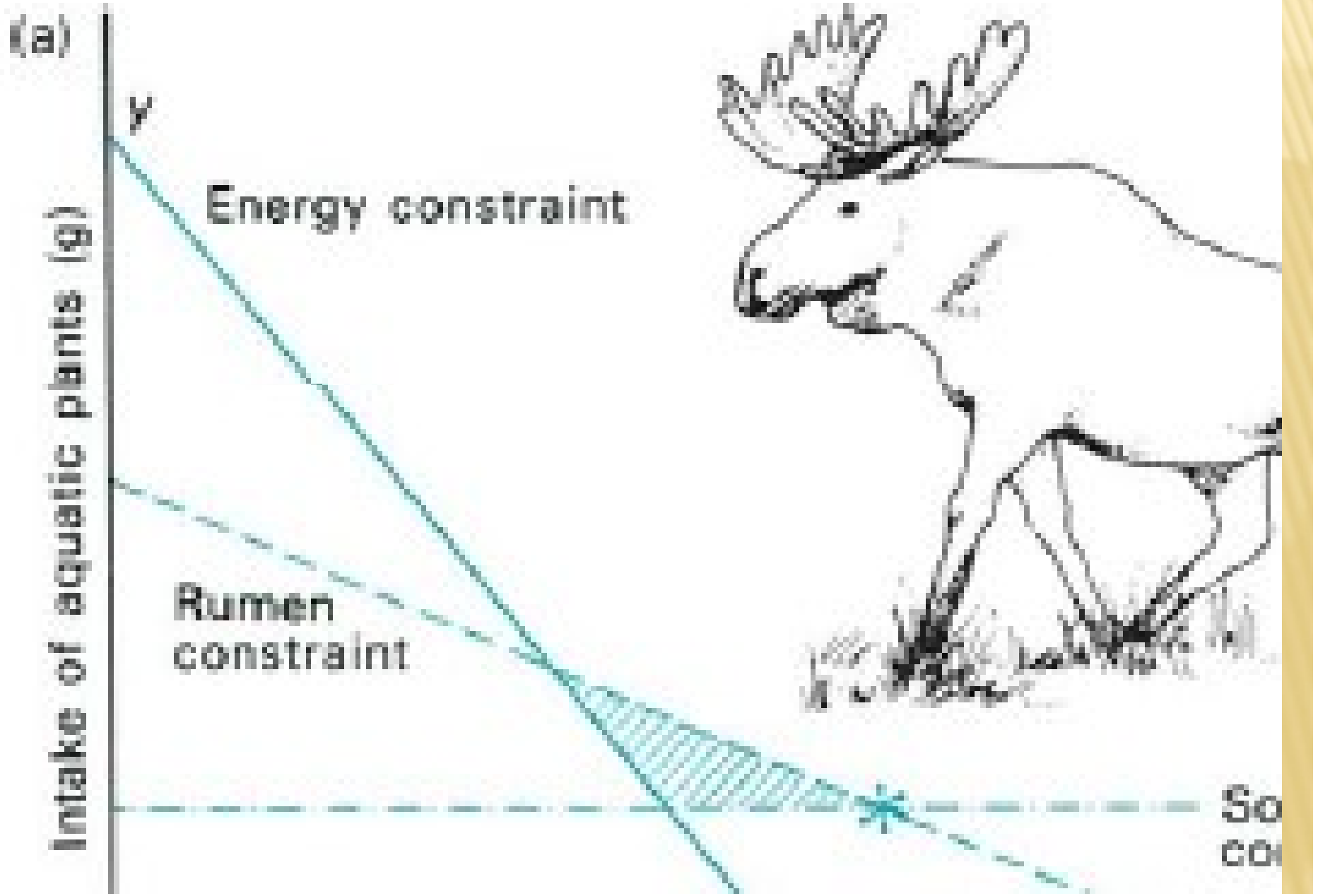
Fig. 1.6 The influence of adult mortality on the optimal clutc number of young produced versus clutch size follows a curve, with b_1 being the clutch size which maximizes the number o

CARRYING CAPACITY



PERTE DE MILIEUX




(a)
Intake of aquatic plants (g)
Energy constraint
Rumen constraint

CAS DE LA CIGOGNE BLANCHE

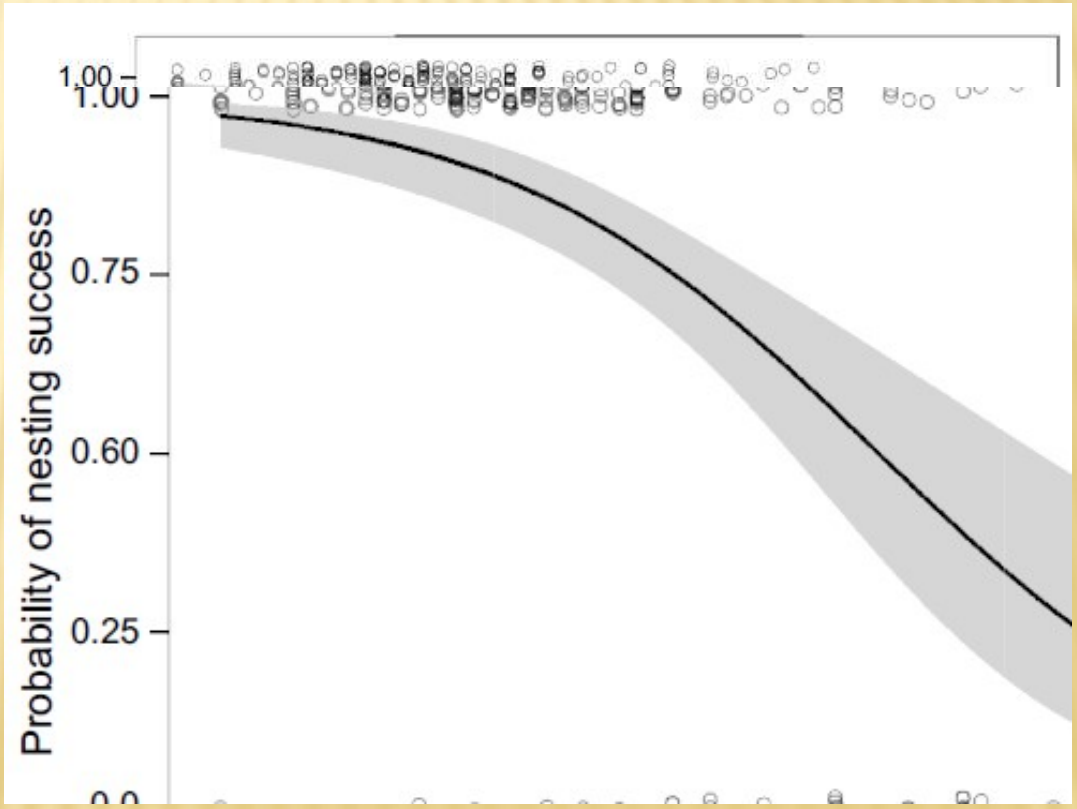
- Début de l'étude en 2011
- Une centaine de nids
- Nombre qui a doublé en 2014)
- Suivi de la dynamique (date de ponte, réussite, etc.)
- Baguage de poussins (120-150 p/an) depuis 2011

ETUDE PRÉLIMINAIRE (2011-2012)

ACTA ORNITHOLOGICA
Vol. 50 (2015) No. 2

Is a core-periphery gradient a determinant factor of breeding performance in the colonially breeding White Storks *Ciconia ciconia*?

Mohammed BOURIACH[1], Farrah SAMRAOUI[1], Ramzi SOUILAH[1], Imen HOUMA[1], Imen RAZKALLAH[1], Ahmed H. ALFARHAN[2] & Boudjéma SAMRAOUI[1,2,*]



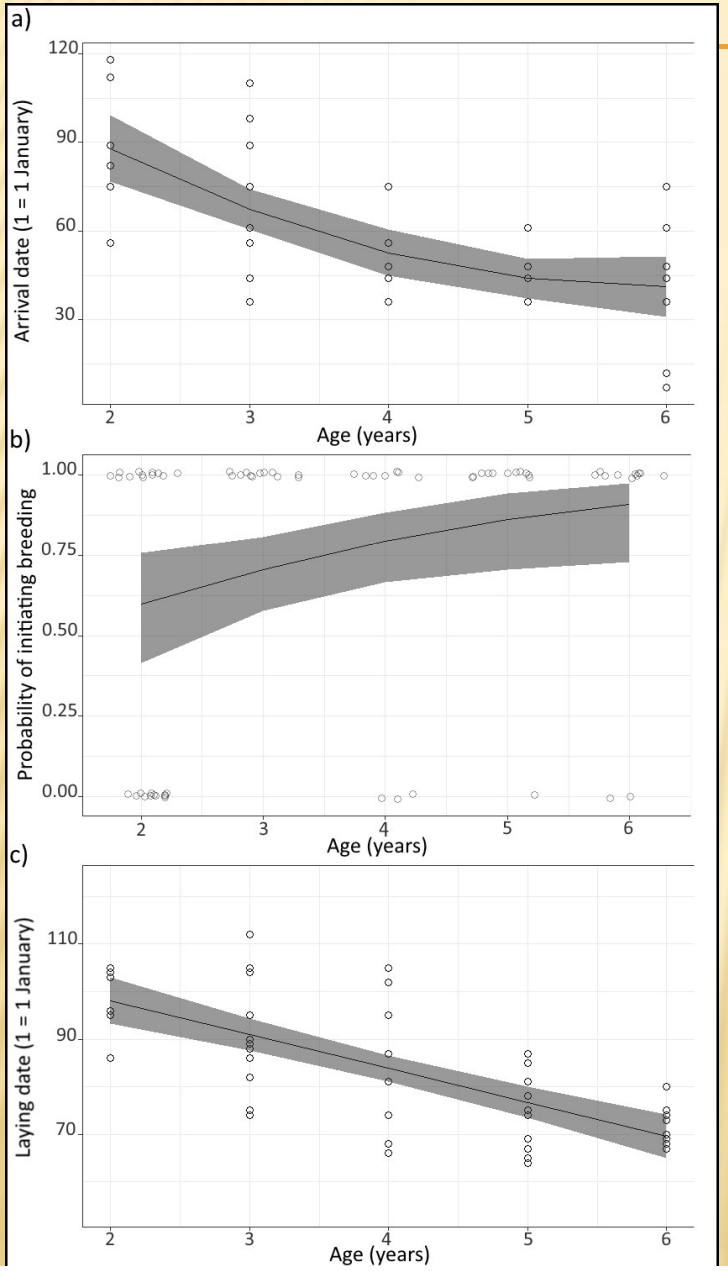
PUBLICATION: Belabed et al. (2019)

The early bird catches the worm: age-specific arrival time influences reproductive performance in the White Stork *Ciconia ciconia*

Bourhane-Eddine Belabed, Mohammed Athamnia, Laïd Toua
Samraoui, Abdennour Boucheker & Boudjéma Samraoui

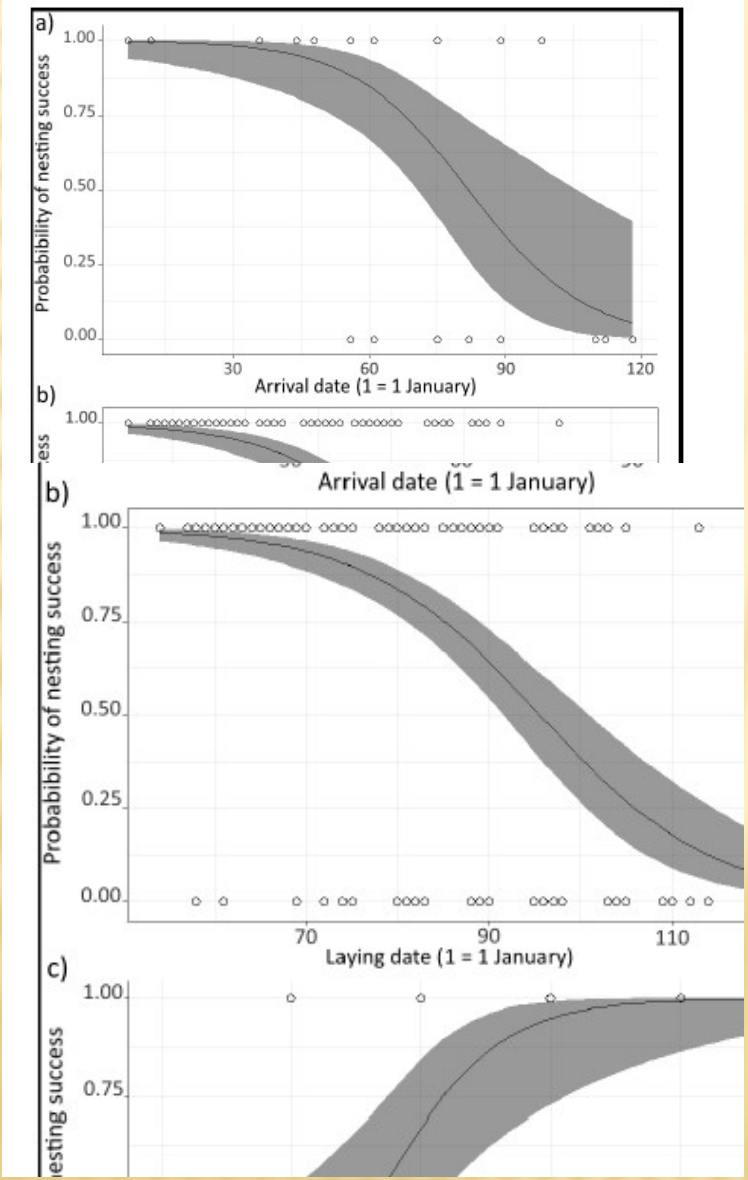
To cite this article: Bourhane-Eddine Belabed, Mohammed Athamnia, Laïd T
Samraoui, Abdennour Boucheker & Boudjéma Samraoui (2019) The early birc

2017



- Tranche d'âge: 2-6 ans
- Effet de l'âge sur les paramètres de la reproduction

ETUDE DE 2017



- Critique: Basée sur une seule année (dates d'arrivée)

POURQUOI UNE MESURE DE LA BIODIVERSITÉ?

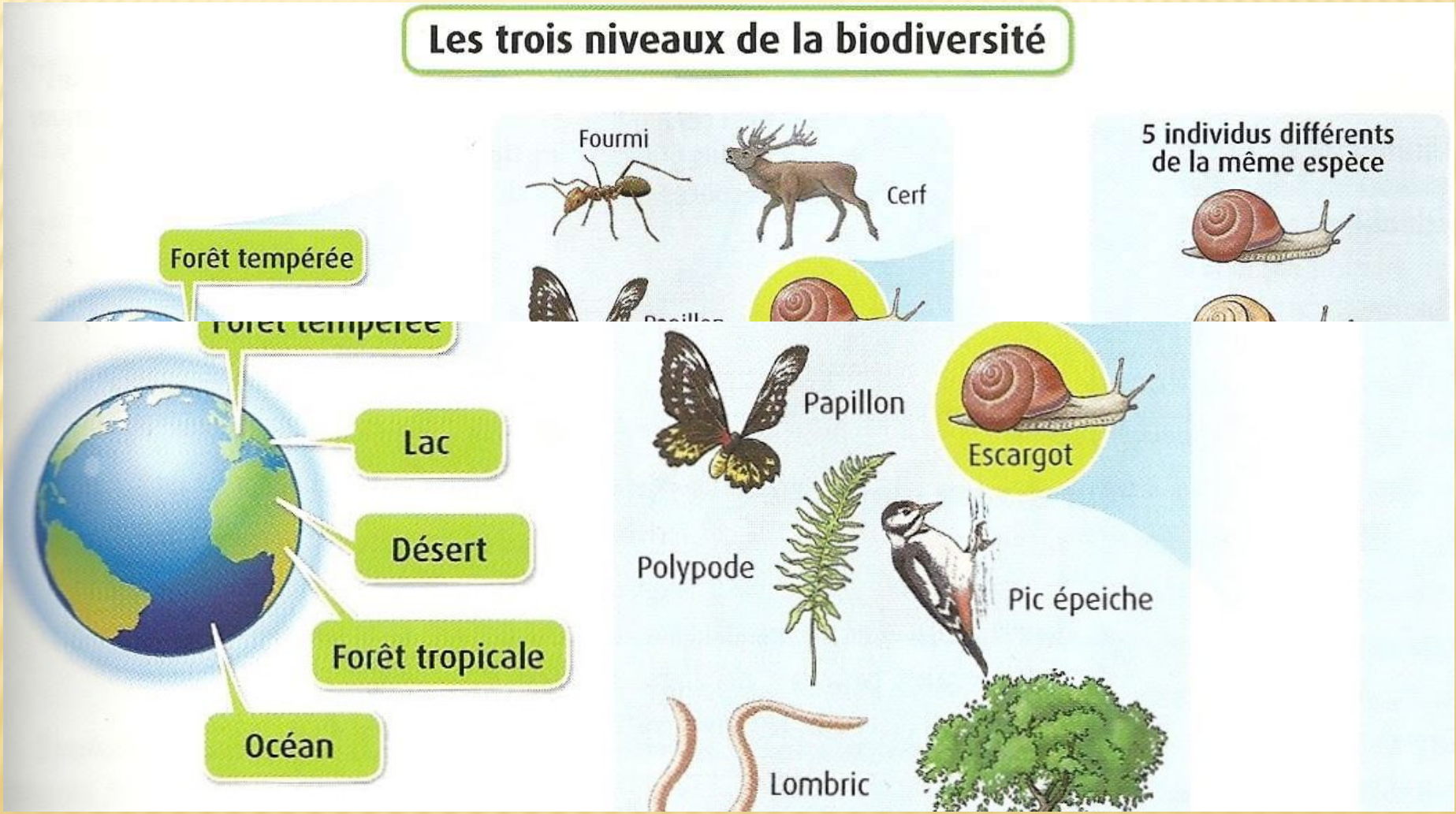
Ecologie des peuplements

MESURES DE LA BIODIVERSITÉ

3 raisons:

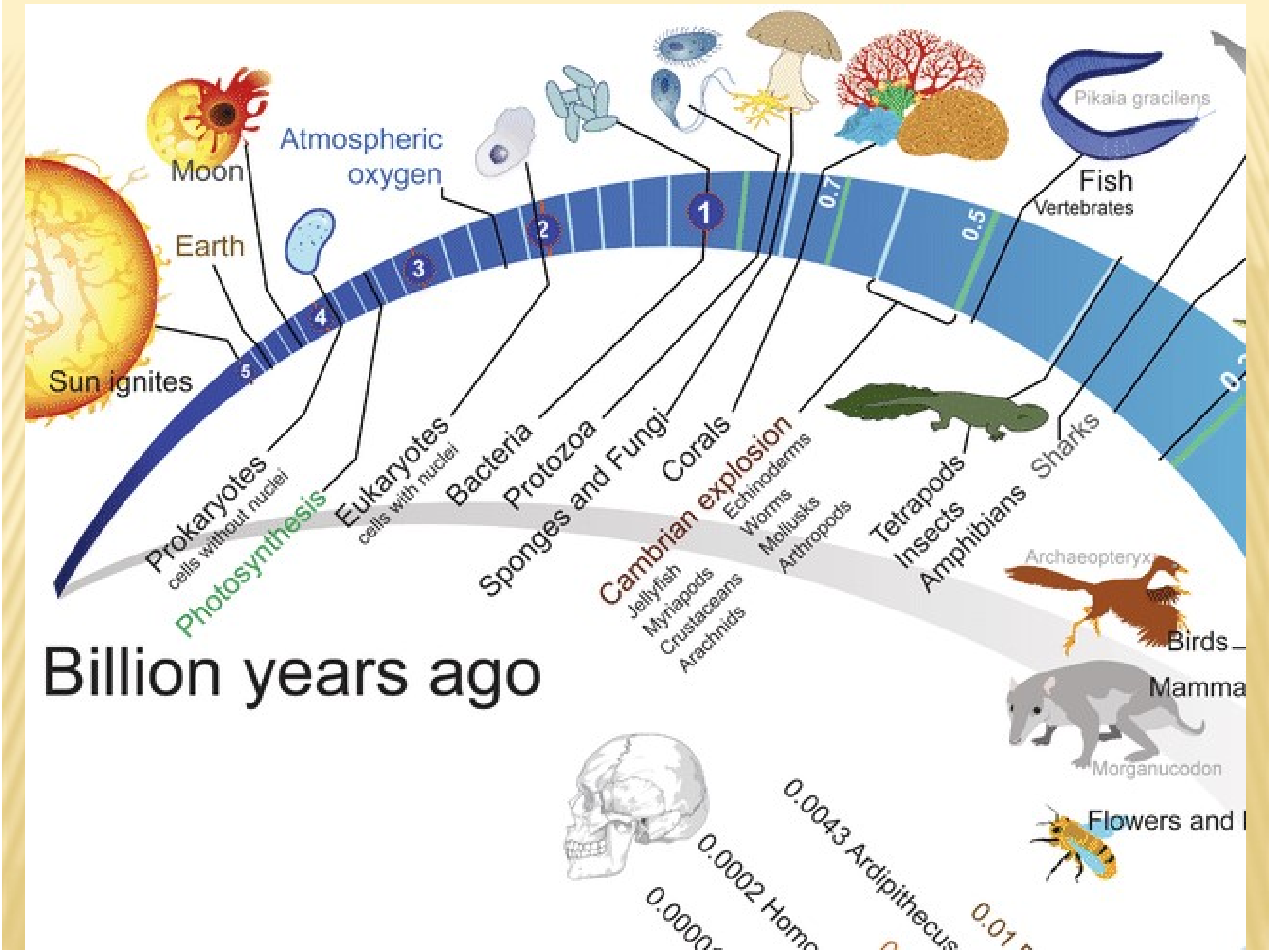
1) La diversité est un thème central à l'écologie (variation spatio-temporelle de la biodiversité)
2) Indicateurs de la bonne santé des écosystèmes
3) Les mesures de la biodiversité génèrent un débat vif et persistant. Tout comme la notion d'espèce, on est même arrivé à la notion de « non-concept ».

DIVERSITÉ BIOLOGIQUE



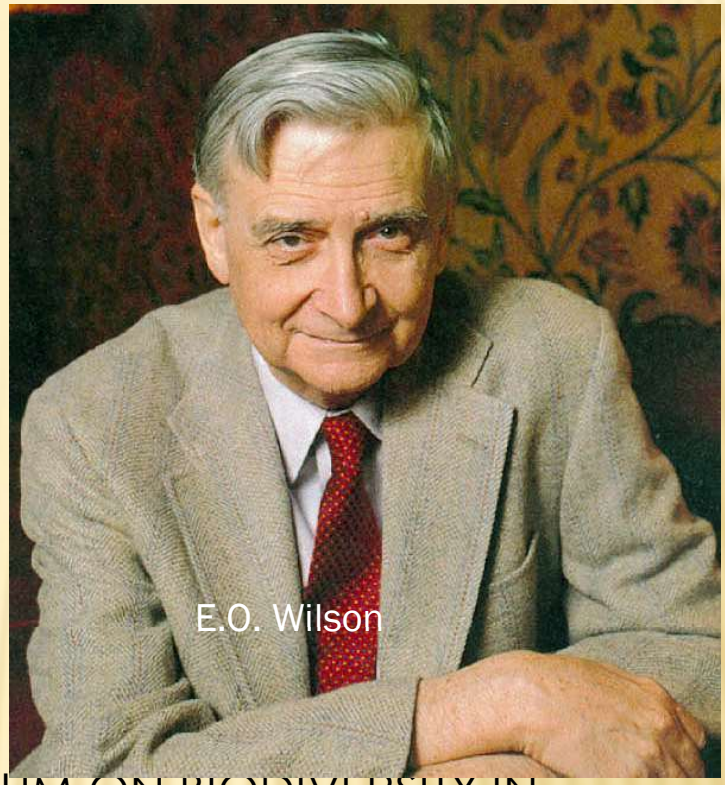
One « peculiar » planete

The living planet



Billion years ago

THE ORIGIN


E.O. Wilson

IN1986, DURING A NATIONAL FORUM ON BIODIVERSITY IN WASHINGTON

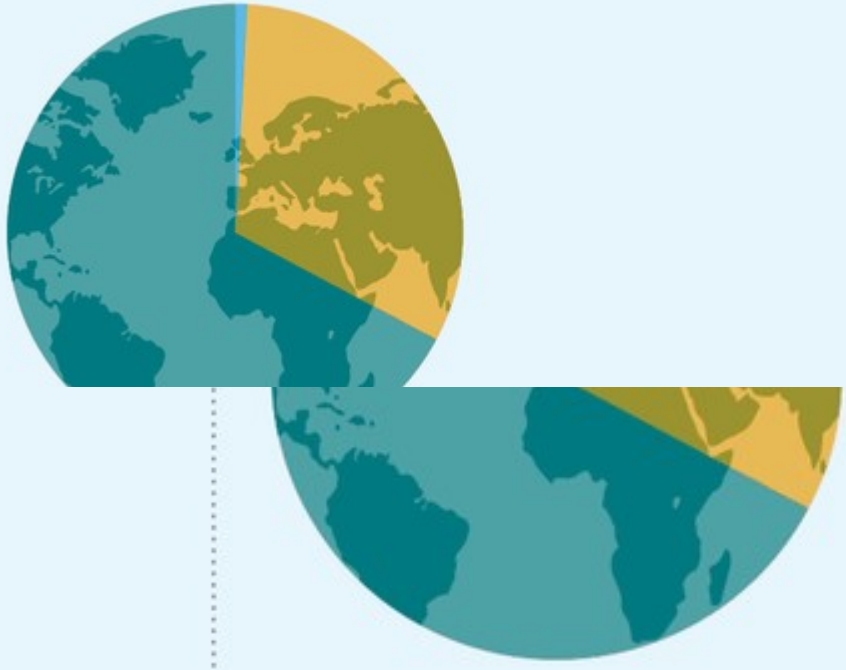
A CONTRACTION OF « BIOLOGICAL DIVERSITY »

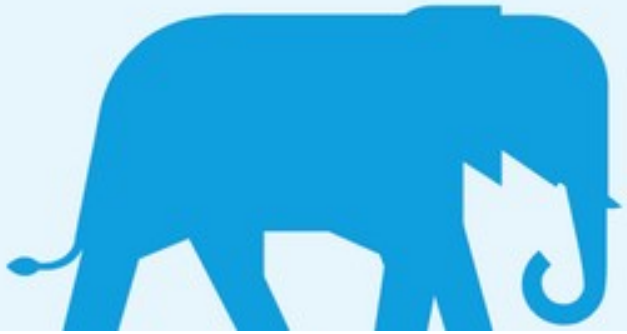
WEIGHT OF VERTEBRATE LAND ANIMALS

10,000 YEARS AGO

10,00

TODAY





INSECTS

Received: 1 March 2019 | Revised: 19 March 2019 | Accepted: 21 March 2019
DOI: 10.1002/ece3.5153

COMMENTARY

WILEY Ecology and Evolution

Worldwide insect declines: An important message, but interpret with caution

Benno I. Simmons[1] | Andrew Balmford[1] | Andrew J. Bladon[2] | Alec P. Christie[1] | Adriana De Palma[3] | Lynn V. Dicks[4] | Juan Gallego-Zamorano[5] | Alison Johnston[1,6] | Philip A. Martin[1] | Andy Purvis[3] | Ricardo Rocha[1] | Hannah S. Wauchope[1] | Claire F. R. Wordley[1] | Thomas A. Worthington[1] | Tom Finch[1,7]

Annals of App

EDITORIAL

"Ecological Armageddon" – more evidence for the decline in insect numbers

S R Leather

Biological Conservation

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

ELSEVIER

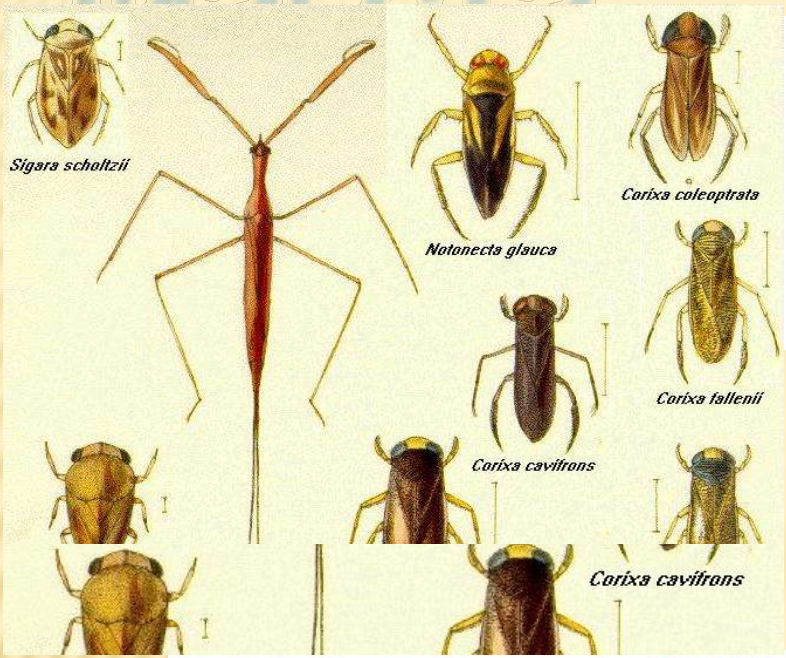
Review

41%

OF INS

SPEC

INSECTS



PLOS ONE | TENTH ANNIVERSARY

More than 75 percent decline over 27 years in total flying insect biomass in protected areas

Caspar A. Hallmann , Martin Sorg, Eelke Jongejans, Henk Siepel, Nick Hofland, Heinz Schwan, Werner Stenmans, Andreas Müller, Hubert Sumser, Thomas Hörren, Dave Goulson, Hans de Kroon

Entomology, Ornithology & Herpetology: Current Research

Bidau, Entomol Ornithol Herpetol 2018, 7:1
DOI: 10.4172/2161-0983.1000e130

Editorial Open Access

Editorial

Doomsday for Insects? The Alarming Decline of Insect Popu

Journal of Insect Conservation (2019) 23:475–488
https://doi.org/10.1007/s10841-019-00133-1

ORIGINAL PAPER

Anthropogenic stressors are driving a steep decline of diversity in dune ponds in north-eastern Algeria

COMMUNITY CHANGES

VIE ET MILIEU - LIFE AND ENVIRONMENT, 2019, 69 (1): 25-33

THE TIMES THEY ARE A CHANGIN': IMPACT OF LAND-USE SHIFT AND CLIMATE WARMING ON THE ODONATE COMMUNITY OF A MEDITERRANEAN STREAM OVER A 25-YEAR PERIOD

F. MORGHAD[1,2], F. SAMRAOUI[2], L. TOUATI[3], B. SAMRAOUI[1,2]*

diversity

Article

Trends in Population Size of Rare Plant Spe Alpine Habitats of the Ukrainian Carpathia Climate Change

AMPHIBIANS

More than 70% of the world's amphibian species are in decline!

EcoHealth 4, 125–134, 2007
DOI: 10.1007/s10393-007-0093-5

ECOHEALTH

Spread of Chytridiomycosis Has Caused the Rapid Global Decline and Extinction of Frogs

Lee Francis Skerratt,[1] Lee Berger,[2] Richard Speare,[2] Scott Cashins,[3] Keith Raymond M

Journal of Herpetology, Vol. 41, No. 3, pp. 483–491, 2007

Amphibian Decline or Extinction? Current Declines Dwa Extinction Rate

ABSTRACT.—Amphibian declines and extinctions are critical concerns of biologists a estimated current rate of amphibian extinction is known, but how it compares to the ba extinction rate from the fossil record has not been well studied. I compared current rates with their reported background extinction rates using standard and fuzzy arithmet suggest that the current extinction rate of amphibians could be 211 times the ba extinction rate. If current estimates of amphibian species in imminent danger of extin these calculations, then the current amphibian extinction rate may range from 25,

OWN STUDY

A PRECIPITOUS DECLINE OF THE ALGERIAN NEWT *PLEURODELES POIRETI* GERVAIS, 1835 AND OTHER CHANGES IN THE STATUS OF AMPHIBIANS OF NUMIDIA, NORTH-EASTERN ALGERIA

Boudjéma SAMRAOUI[1,2,*], Farrah SAMRAOUI[1], Nouara BENSLIMANE[1], Ahmed ALFARHAN[2] & Khaled A.S. AL-RASHEID[2]

REPTILES

The IUCN Red List, considers some 664 species of reptiles—representing more than 20 percent of known reptile species worldwide—as endangered or facing extinction.

Todd BD, Willson JD, Gibbons JW. 2010. The global status of reptiles and causes of their decline.
pp 47-67 In Ecotoxicology of Amphibians and Reptiles, Second Edition. Sparli
Krest S (Eds). CRC Press, Pensacola, FL, USA.

3 The Global Status of Re
and Causes of Their De

Reptiles have been considered by some to be of "minor importance," and thei
been suggested to "not make much difference one way or the other" (Zim and Sn
himself described reptiles in his 1758 Systema Naturae as "foul and loathsome
rent because of their cold body … fierce aspect … and squalid habitation." Tha
ments are increasingly outdated as scientists reveal the significant roles that re

REPTILES

- The Global Decline of Reptiles, Déjà Vu Amphibians: Reptile species are declining on a global scale. Six significant threats to reptile populations are habitat loss and degradation, introduced invasive species, environmental pollution, disease, unsustainable use, and global climate change
- J. Whitfield Gibbons, David E. Scott, Travis J. Ryan, Kurt A. Buhlmann, Tracey D. Tuberville, Brian S. Metts, Judith L. Greene, Tony Mills, Yale Leiden, Sean Poppy ...
- *BioScience*, Volume 50, Issue 8, August 2000, Pages 653–666,

MAMMALS

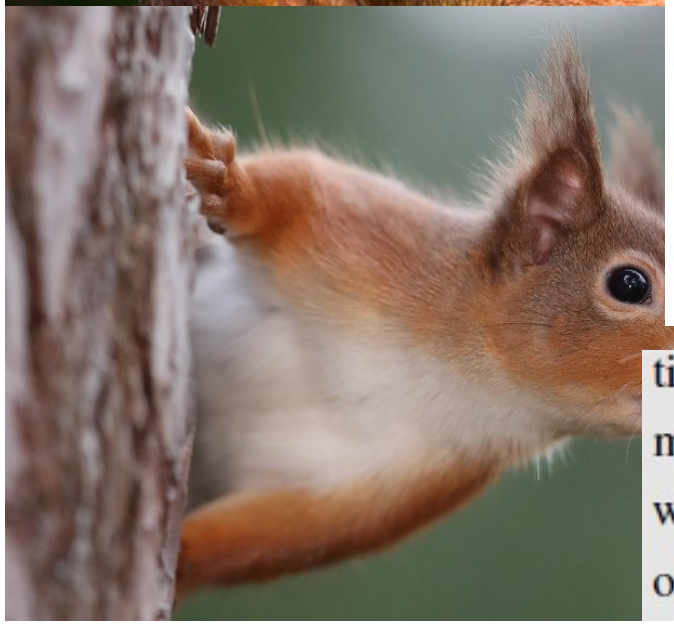
Ongoing unraveling of a continental fauna: Decline and extinction of Australian mammals since European settlement

John C. Z. Woinarski[a,b,1], Andrew A. Burbidge[c], and Peter L. Harrison[d]

Mammal Population Losses and the Extinction Crisis

Gerardo Ceballos[1] and Paul R. Ehrlich[2]

3 MAY 2002 VOL 296 SCIENCE www.scien



LETTER WILEY Conse

Are we eating the world's megafauna to extinction?

William J. Ripple[1] | Christopher Wolf[1] | Thomas M. Newsome[1,2] | Matthev

tiles. We identified a total of 362 extant megafauna species. We fou
megafauna species with sufficient information are decreasing and 59%
with extinction. Surprisingly, direct harvesting of megafauna for hum
of meat or body parts is the largest individual threat to each of th

A TALE OF TWO RHINOS…

- Sudan: the last male northern White Rhino

- Iman: Malaysia's last Sumatran Rhino

BIRDS

IBIS 137: S105–S111

Habitat fragmentation and population extinction of birds

DANIEL SIMBERLOFF

Ecosystem consequences of bird declines

Çağan H. Şekercioğlu*, Gretchen C. Daily, and Paul R. Ehrlich

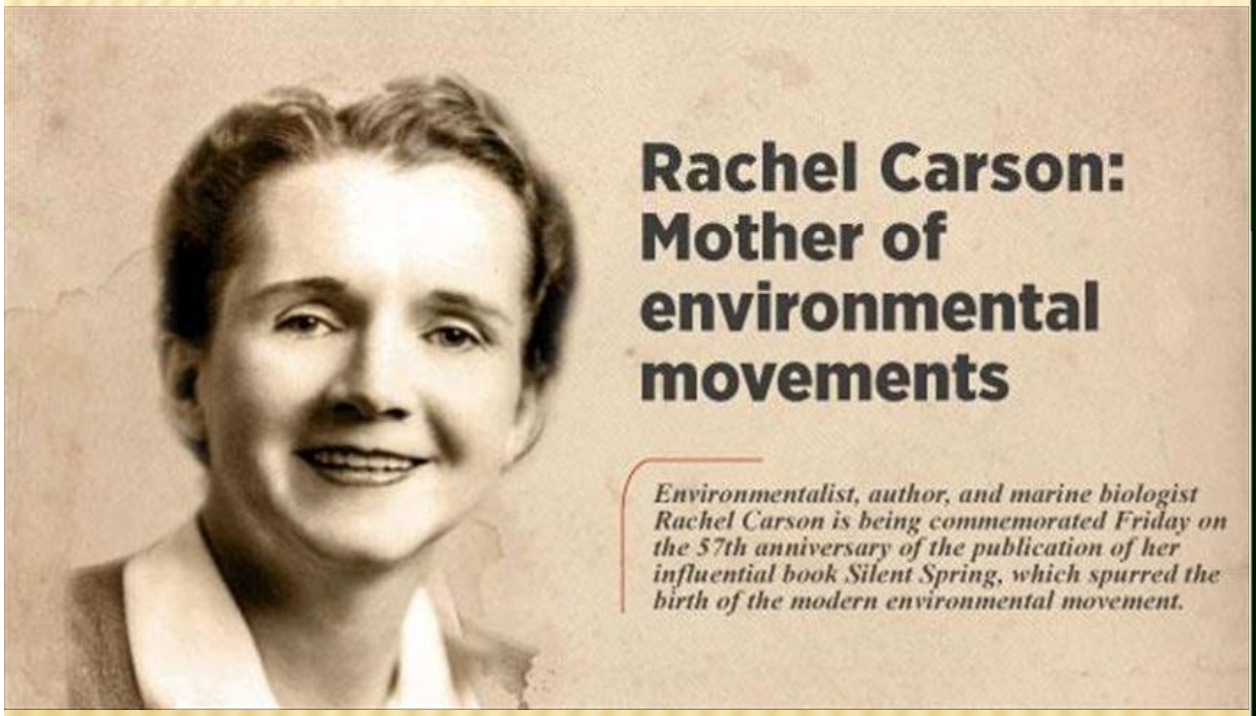
18042–18047 | PNAS | December 28, 2004 | vol. 101 | no. 52

More than 1300 species of birds around the world – one in eight – are threatened with extinction.

Even familiar birds at risk of extinction, new study finds

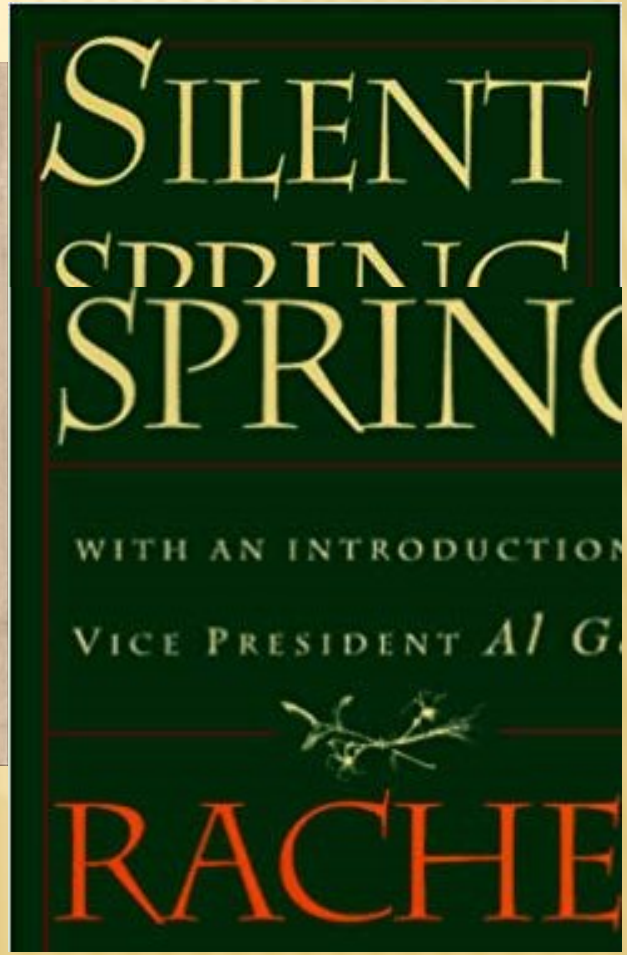
The 1,300 Bird Species Facing Extinction Signal Threats to Human Health
Climate change and chemicals like pesticides are driving the crisis.

A NEW SILENT SPRING?



Rachel Carson: Mother of environmental movements

Environmentalist, author, and marine biologist Rachel Carson is being commemorated Friday on the 57th anniversary of the publication of her influential book Silent Spring, which spurred the birth of the modern environmental movement.



FISH

Marine Fish Population Collapses: Consequences for Recovery and Extinction Risk

JE *April 2004 / Vol. 54 No. 4* • BioScience 297 S

AUGUST 2010

How do large sharks shape marine communities?

GLOBAL CONSEQUENCES

GLOBAL CONSEQUENCE

OF SHARK DECLINES

Extinctions of North Americar During the Past Centur

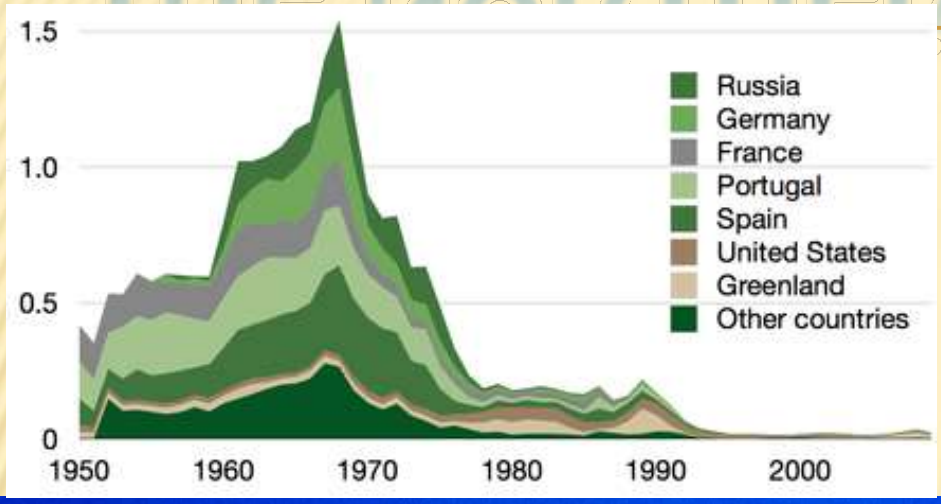
Fisheries, Vol. 14, N

The destruction of an endemic species flock: quant on the decline of the haplochromine cichlids of Lal

Frans Witte,[1] Tijs Goldschmidt,[1] Jan Wanink,[1] Martien van Oijen,[2] Kees Goudswaard Niels Bouton[1]

Environmental Biology of Fishes **34**: 1–

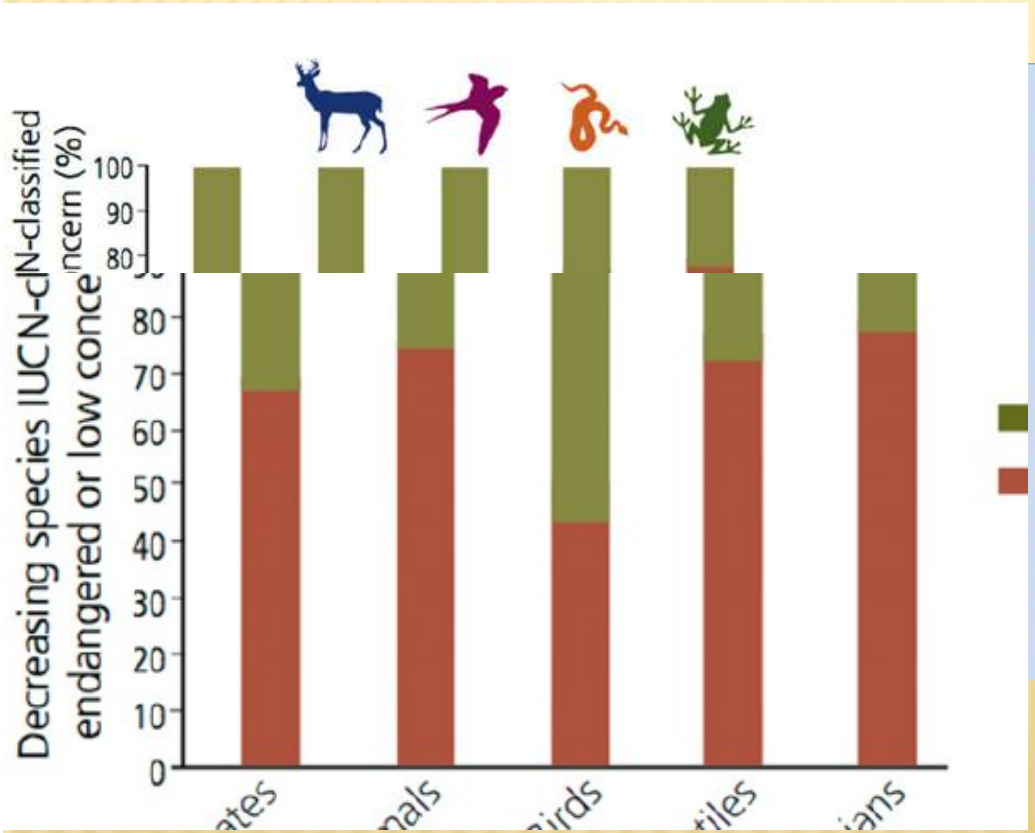
THE NORTHERN COD



- In 1497, an explorer from England, John Cabot, discovered a New Found Land. Offshore, he found the sea "swarming with fish — which can be taken not only with nets, but in baskets let down with a stone". Before long, he was followed to the "Grand Banks" by other fishermen from Europe. The English began to dry their catch on the land, and so began the unique settlement of Newfoundland.

- In the summer of 1993, The Northern Cod biomass fell to 1% of earlier levels. This collapse led to a moratorium on the Northern Cod fishery which shaped the lives and communities of eastern Canada for 500 years.

AN IMPORTANT TAKE-HOME MESSAGE



Significance

The strong focus on species extinctions, a critical aspect of the contemporary pulse of biological extinction, leads to a common misimpression that Earth's biota is not immediately threatened,

misimpression that Earth's biota is not immediately
just slowly entering an episode of major biodiversi
view overlooks the current trends of population d
extinctions. Using a sample of 27,600 terrestrial ver
cies, and a more detailed analysis of 177 mammal
show the extremely high degree of population dec
brates, even in common "species of low concern."
population sizes and range shrinkages amount to
anthropogenic erosion of biodiversity and of the

CONCLUSION: WHY A SIXTH MASS EXTINCTION?

- Welcome to the Anthropocene!

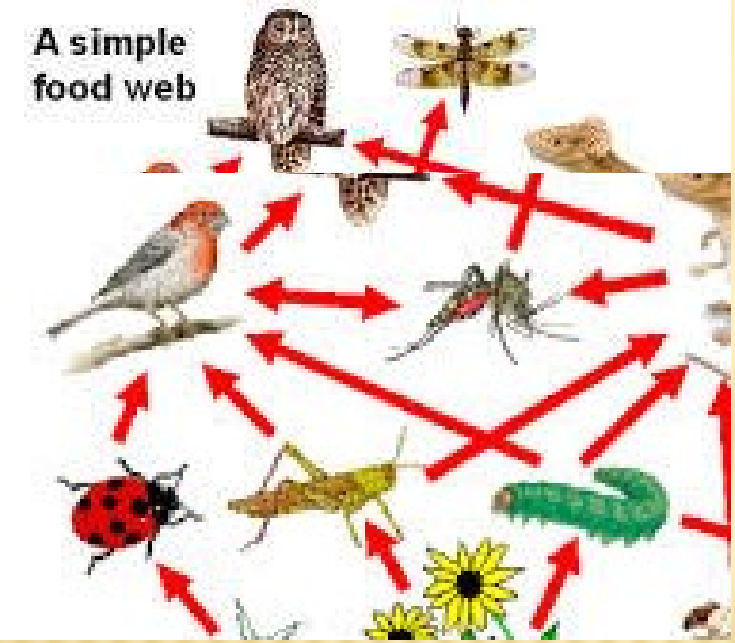
- Species are becoming extinct 100 times faster than they would without human impacts.
- Populations of wild animals have more than halved since 1970, while the human population has doubled.
- Only five times before in our planet's history have so many species and so much biodiversity been lost so quickly.

DIFFICULTÉS DE LA NOTION DE DIVERSITÉ

- Pourquoi c'est si difficile?
- La diversité est composé de 2 éléments: La varieté et l'abondance.

Species	*Sampling sites*									
	STA	*STB*	*STC*	*STD*	*STE*	*STF*	*STG*	*STH*	*STI*	*STJ*
SPP1	0	10	0	75	0	0	80	0	70	0
SPP2	99	0	25	0	50	35	0	20	10	54
SPP3	0	0	0	0	0	0	0	35	0	0
SPP4	0	0	15	40	10	68	20	0	50	45
SPP5	0	0	35	10	35	55	6	10	25	35
SPP6	75	0	0	0	35	0	0	95	0	0
SPP7	0	35	0	0	0	0	100	0	0	0
SPP8	22	0	10	0	76	0	0	45	0	25
SPP9	0	45	0	0	0	0	0	0	0	0
SPP10	0	2	10	60	0	33	55	0	80	0
Richness	3	4	5	4	5	4	5	5	5	4
Abundance	196	92	95	185	206	191	261	205	235	159

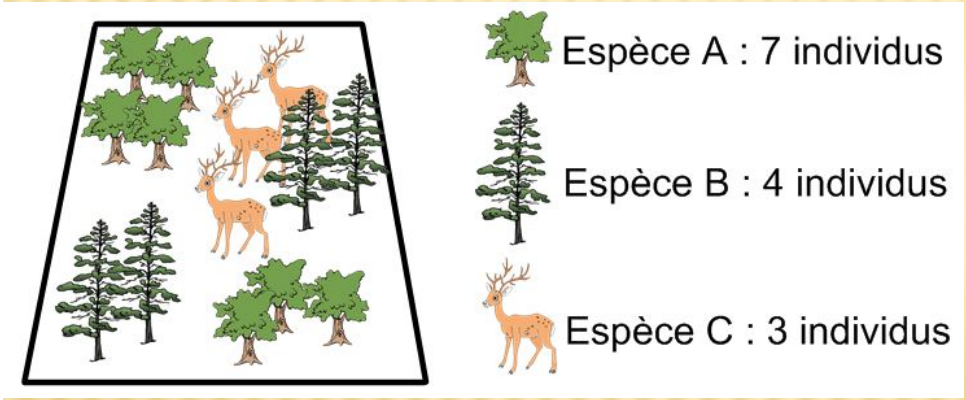
L'IMPORTANCE DES MESURES



- La diversité est au coeur de nombreuses questions de l'écologie théorique et appliquée:
- Pourquoi y-a-t-il un gradient latitudinal de la diversité biologique?
- Association diversité et superficie
- Le débat Diversité-Stabilité

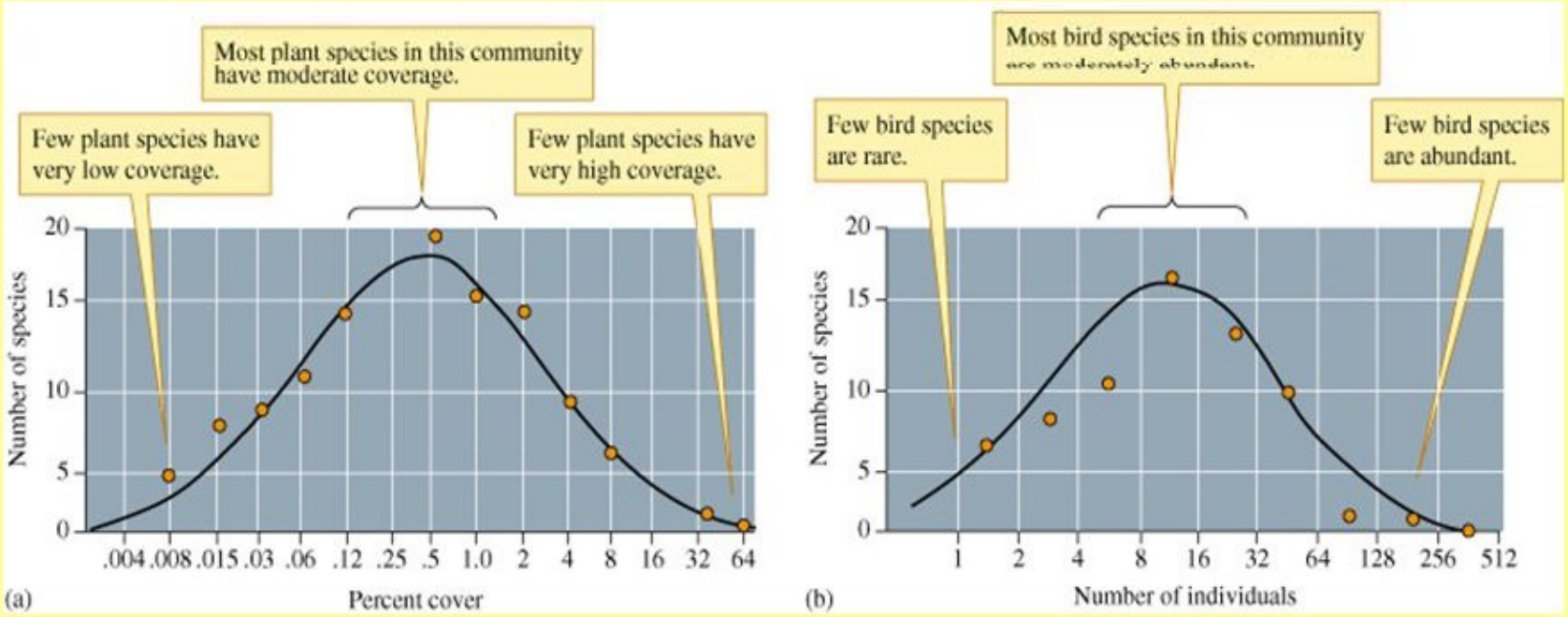
ABONDANCE

- Nombre d'espèces (Richesse spécifique)
- Abondance relative des espèces
- La majorité des espèces sont rares alors qu'un nombre modéré est commun et le reste des espèces très abondantes.



Lognormal Distribution

- *Preston* graphed abundance of species in collections as frequency distributions.
  - Lognormal Distributions
    - Bell-shaped curves.



UNE VARIÉTÉ DE DISTRIBUTIONS D'ABONDANCE

- Série géométrique
  - Log series
- Log normal
- Broken stick

Comment expliquer cela?

IMPORTANCE DE LA RELATION ESPÈCE-ABONDANCE

- Log normal: Un artéfact mathématique?
- Monitoring environnemental: peuplements stressés (pollués) sont caractérisés par un changement de l'abondance des espèces qui change de la distribution log normal à la série géométrique.
- Notion de structure des peuplements