Teórica 11:
Ecología y actividades humanas

Teórica 11: Esquema conceptual

- Cosecha de poblaciones (cap. 15 de Krebs)
- Control de plagas (cap. 16)
- Biología de la conservación (cap. 17)
- Cambio climático (cap. 25)
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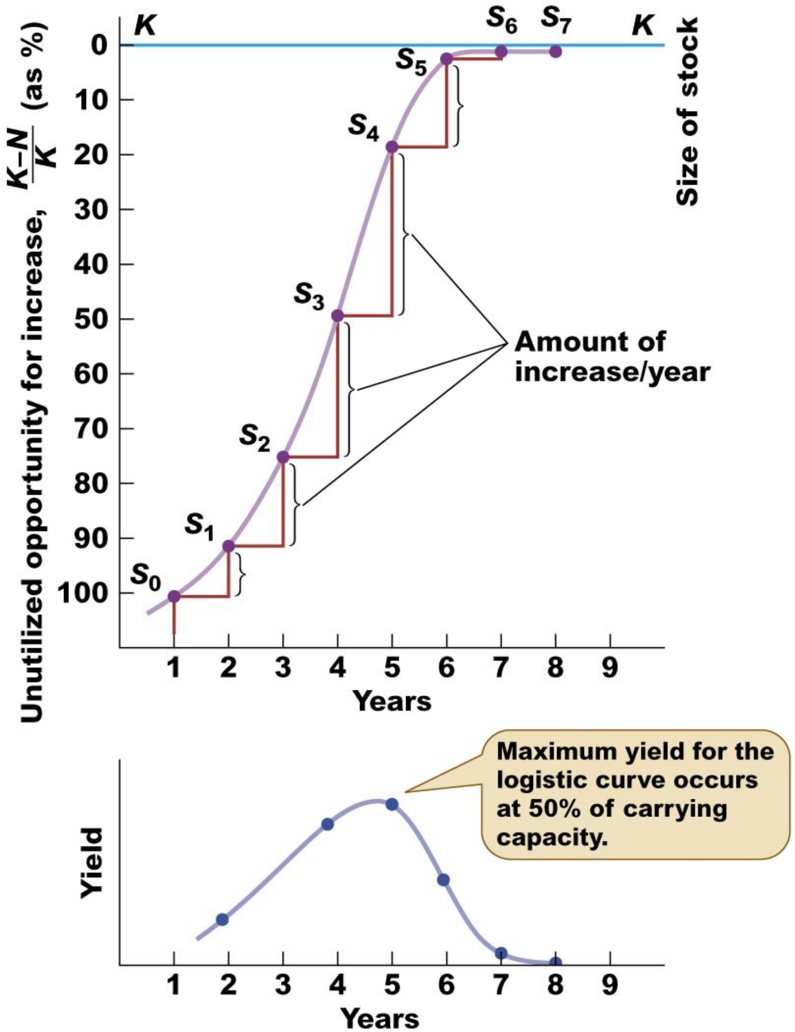
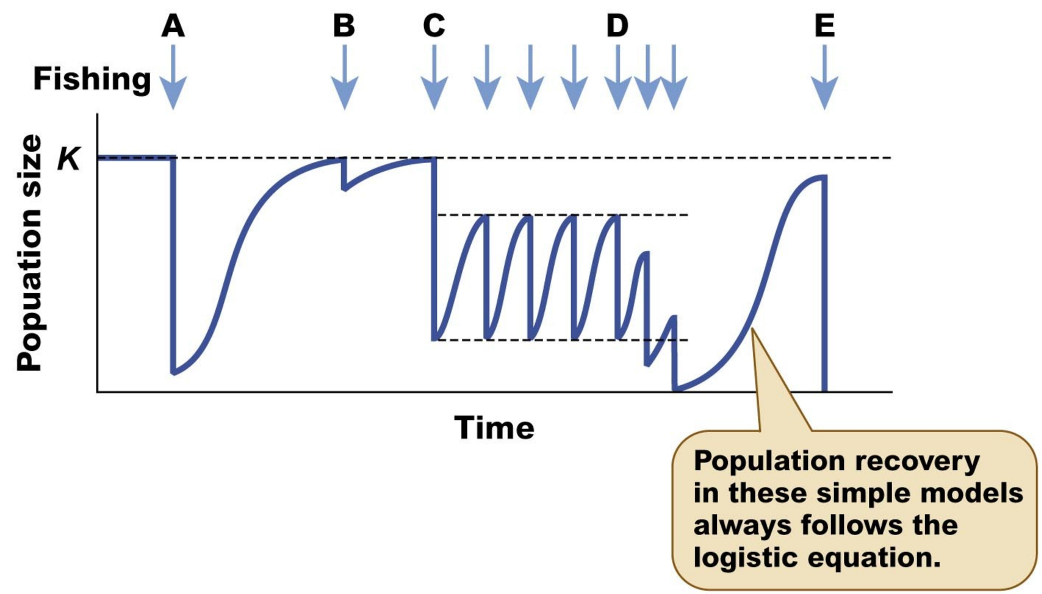
Bacalao del atlántico (*Gadus morhua*)

Quebracho colorado
(*Schinopsis balansae*)

Mamut lanudo (*Mammuthus primigenius*)

Modelo logístico con cosecha





Modelo logístico con cosecha

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right) - qEN$$

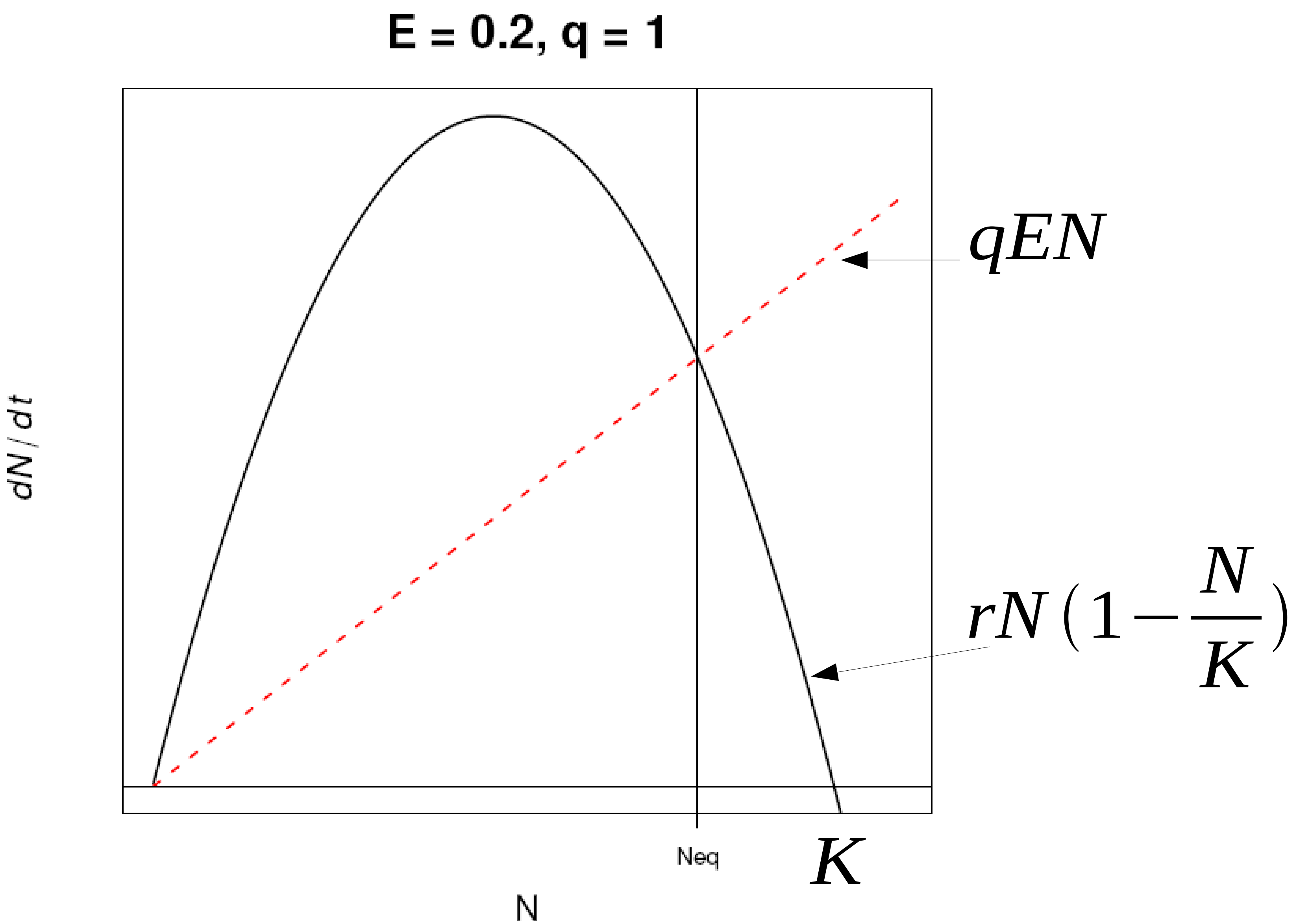
q: capturabilidad

E: esfuerzo de captura

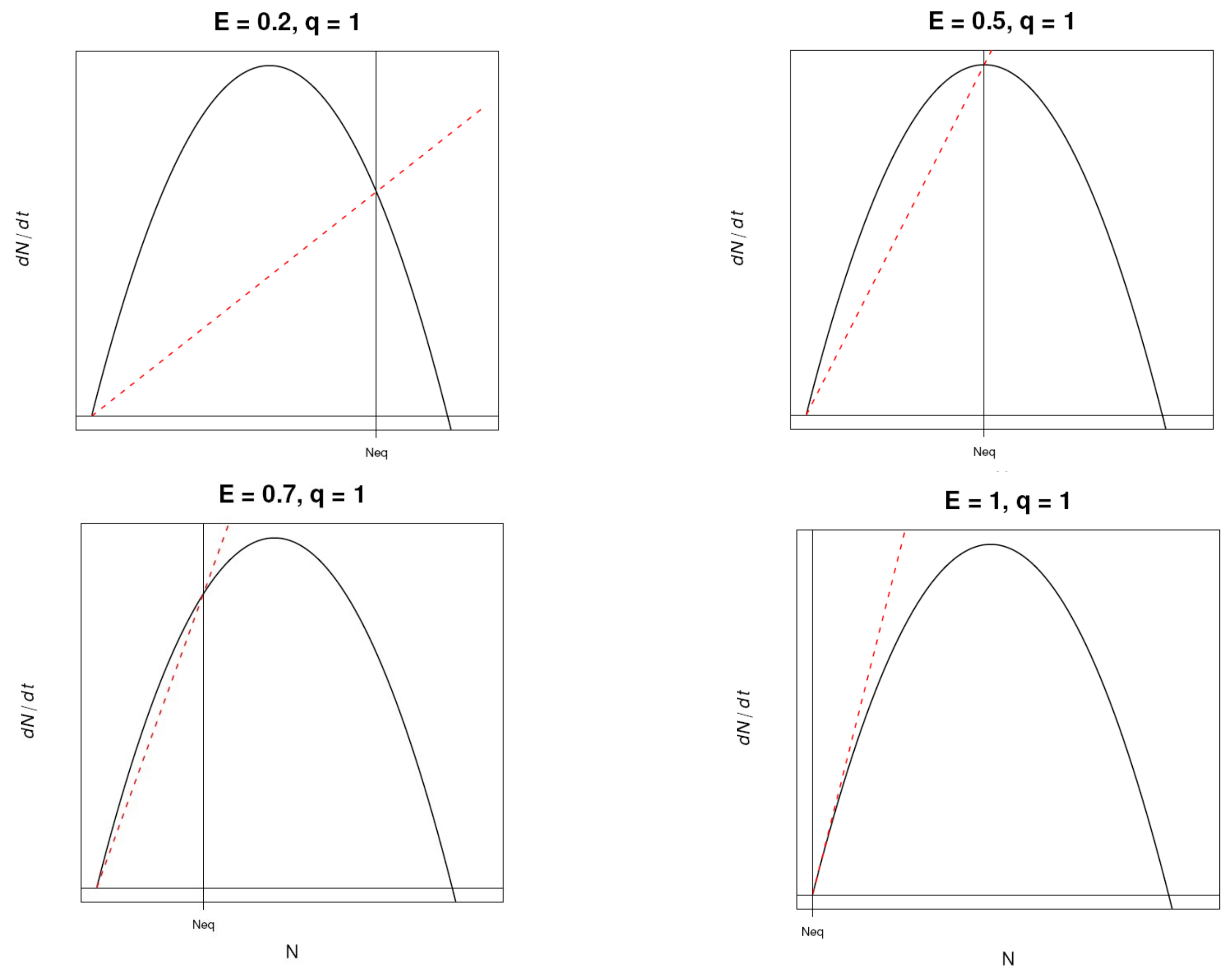
En el equilibrio:

$$\frac{dN}{dt} = 0,\ rN\left(1 - \frac{N}{K}\right) = qEN$$

Modelo logístico con cosecha



Modelo logístico con cosecha



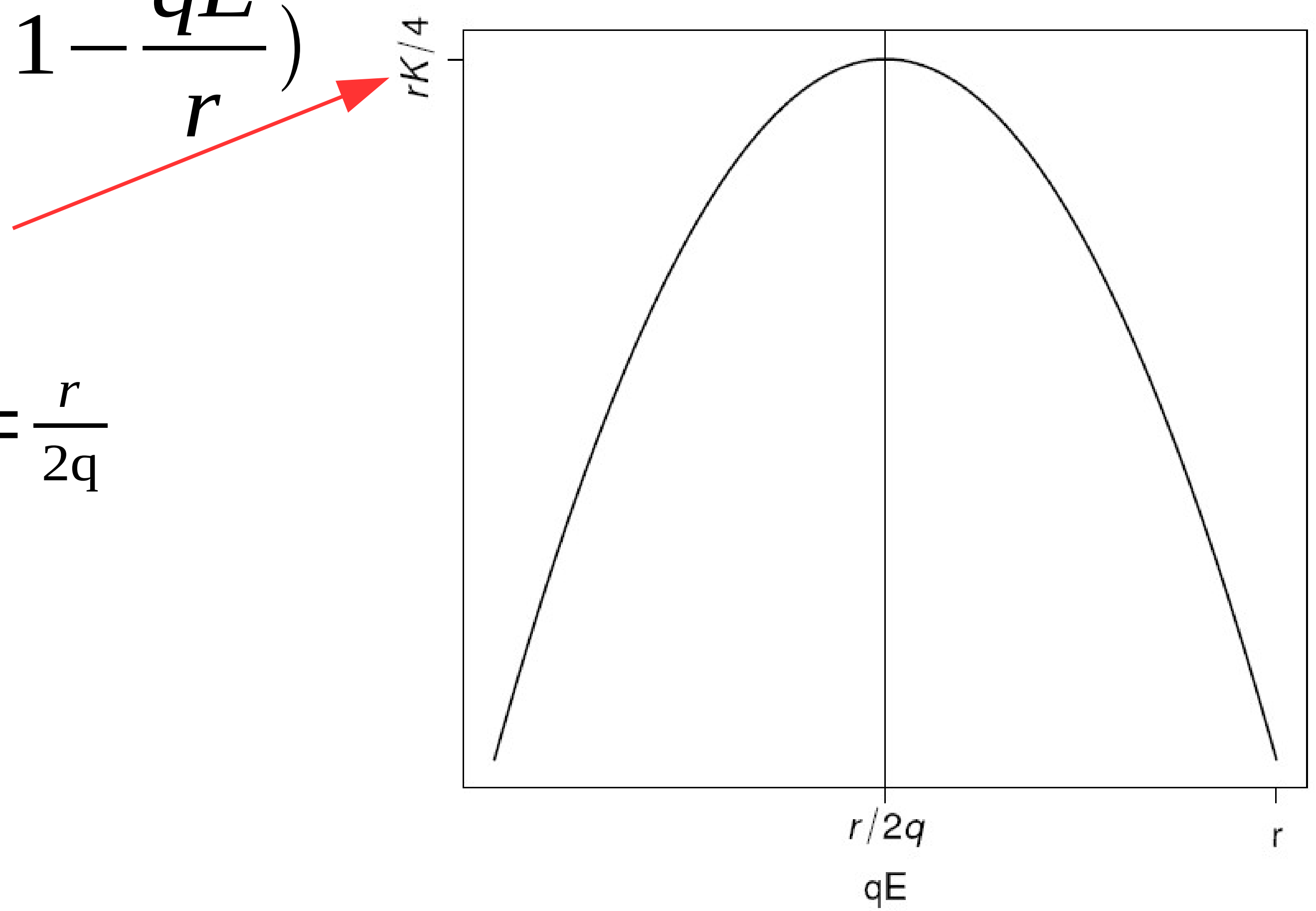
Modelo logístico con cosecha

Rendimiento máximo sostenible (maximum sustainable yield):

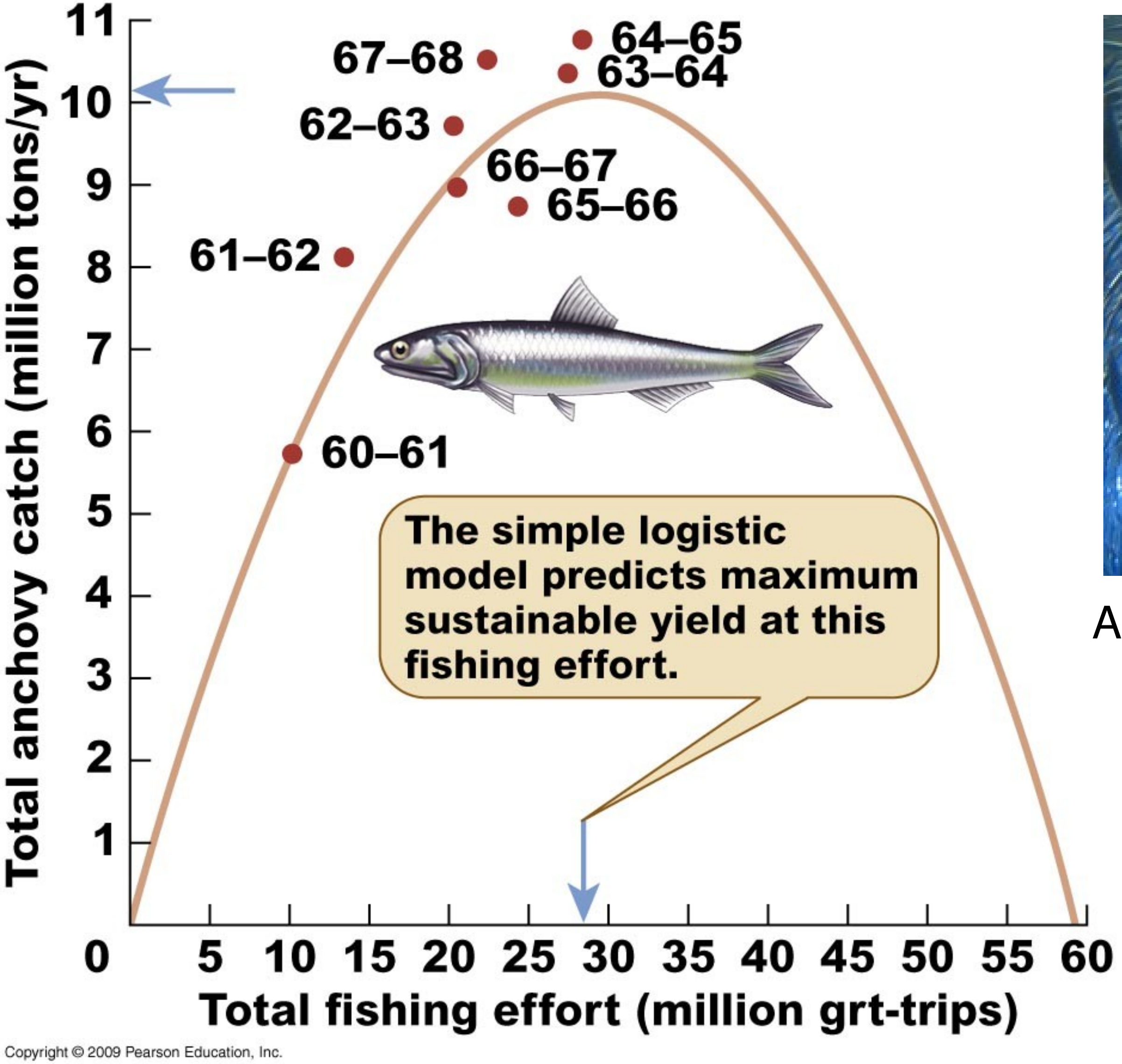
$$Y = qEK\left(1 - \frac{qE}{r}\right)$$

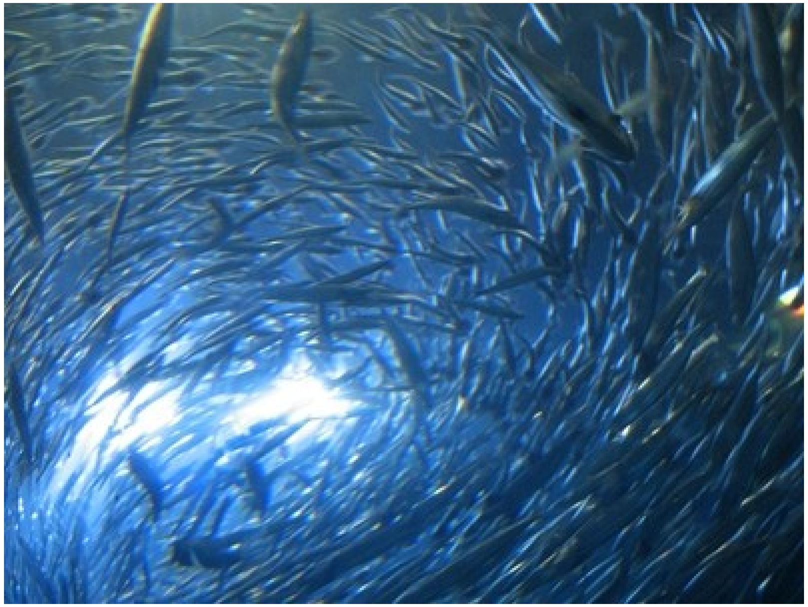
$$Y_{max} = \frac{rK}{4}$$

$$E(Y_{max}) = \frac{r}{2q}$$



Ejemplo: La anchoveta peruana





Anchoveta peruana (*Engraulis ringens*)

Ejemplo: La anchoveta peruana

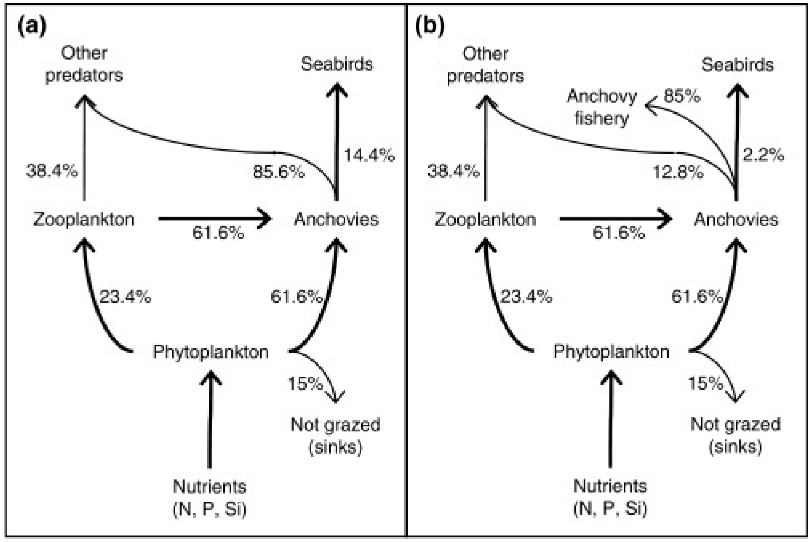
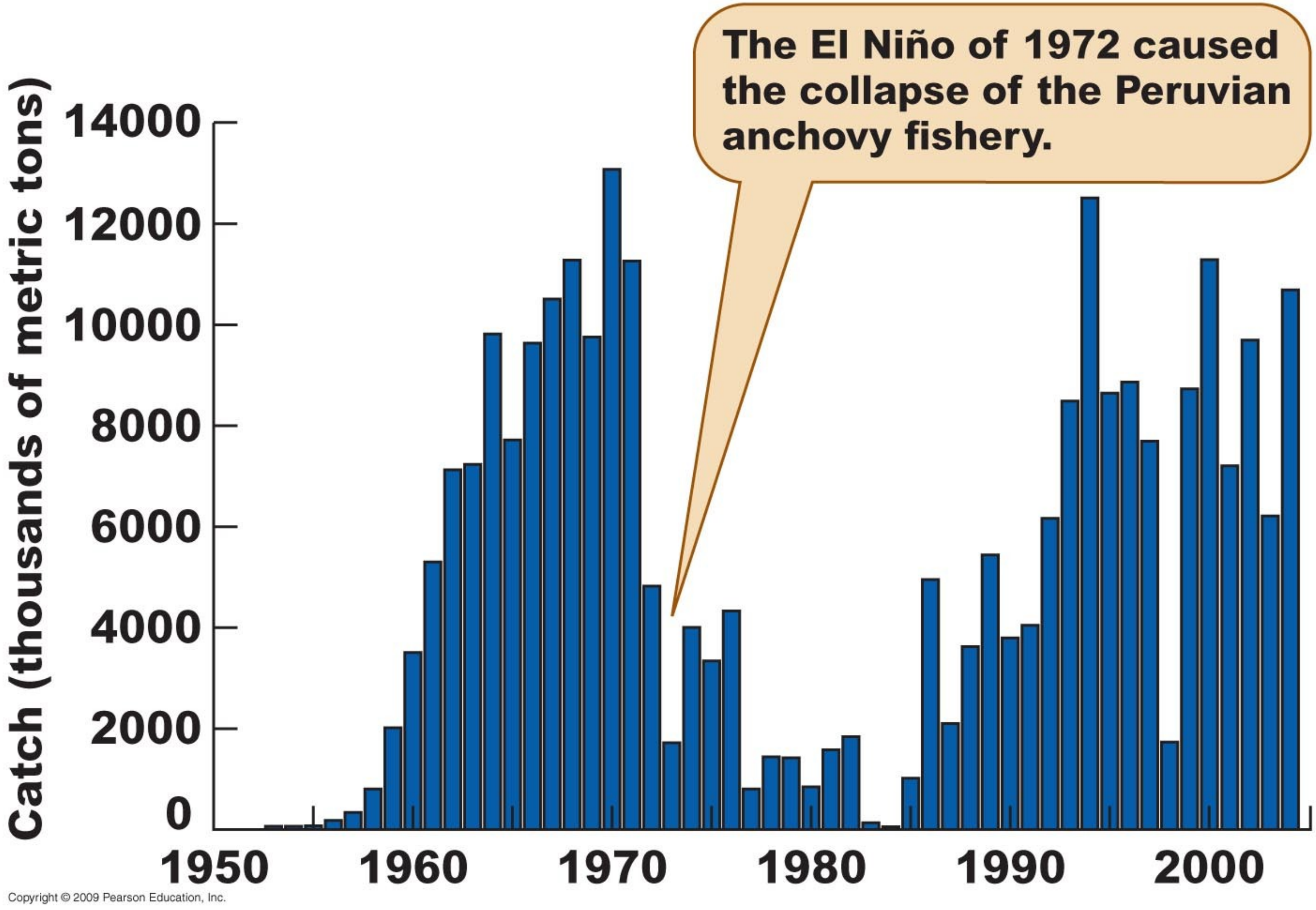


Figure 5. Schematic representation of the food web in the Peruvian upwelling system without (a) and with (b) the industrial fishery for anchovies included in the model. The numbers correspond to the proportion of productivity available at one trophic level consumed by the next trophic level at any given time.

Fuente: Jahncke et al. (2004) Fisheries Oceanography 13: 208-233

Ejemplo: La anchoveta peruana



Pesca y sobreexplotación

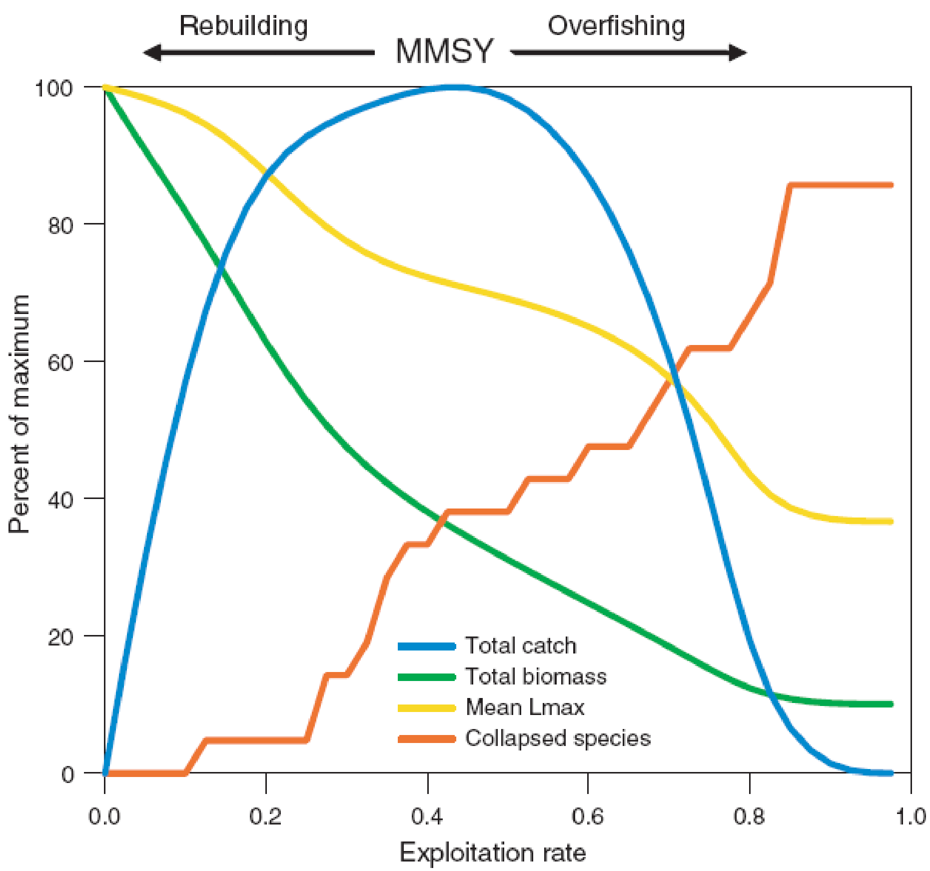


Fig. 2. Effects of increasing exploitation rate on a model fish community. Exploitation rate is the proportion of available fish biomass caught in each year. Mean L_{max} refers to the average maximum length that species in the community can attain. Collapsed species are those for which stock biomass has declined to less than 10% of their unfished biomass. This size-structured model was parameterized for 19 target and 2 nontarget species in the Georges Bank fish community (*13*). It includes size-dependent growth, maturation, predation, and fishing. Rebuilding can occur to the left, overfishing to the right, of the point of maximum catch. Three key objectives that inform current management are highlighted: biodiversity is maintained at low exploitation rate, maximum catch is maintained at intermediate exploitation rate, and high employment is often maintained at intermediate to high exploitation rate, because of the high fishing effort required.

Fuente: Worm et al. (2009) Science 325: 578-585

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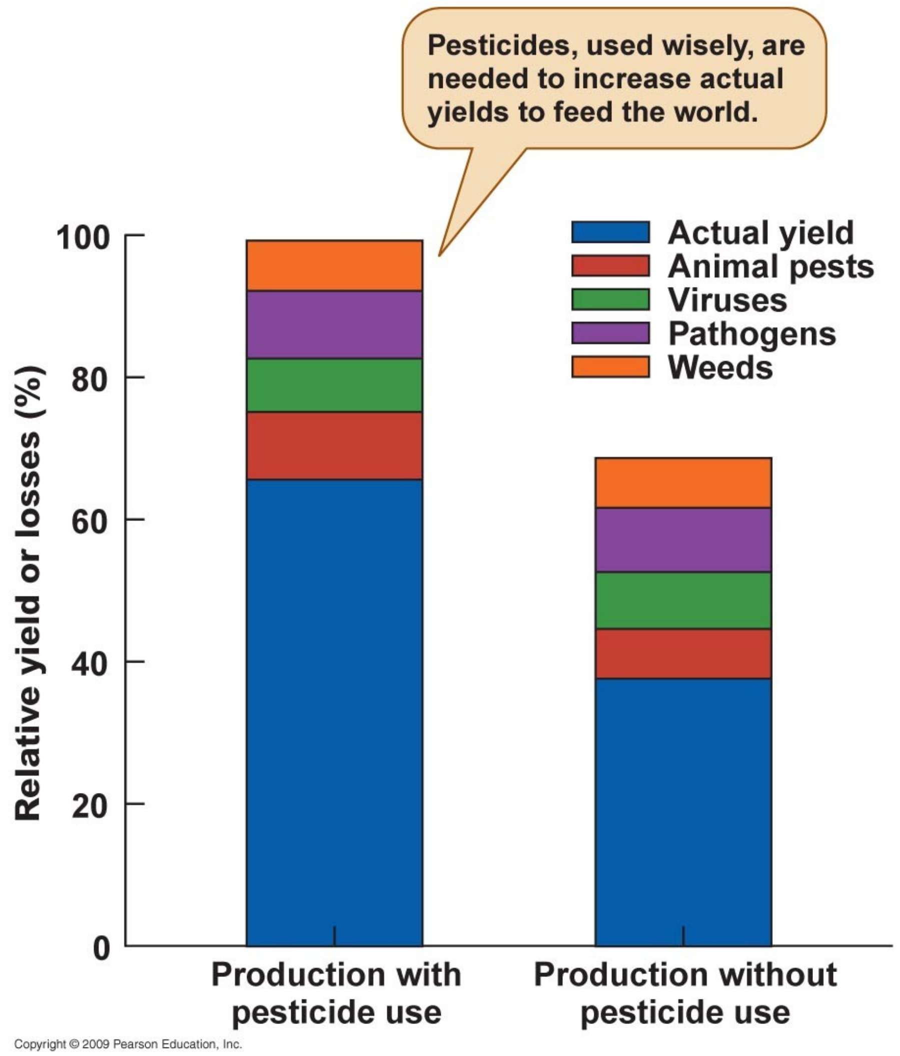
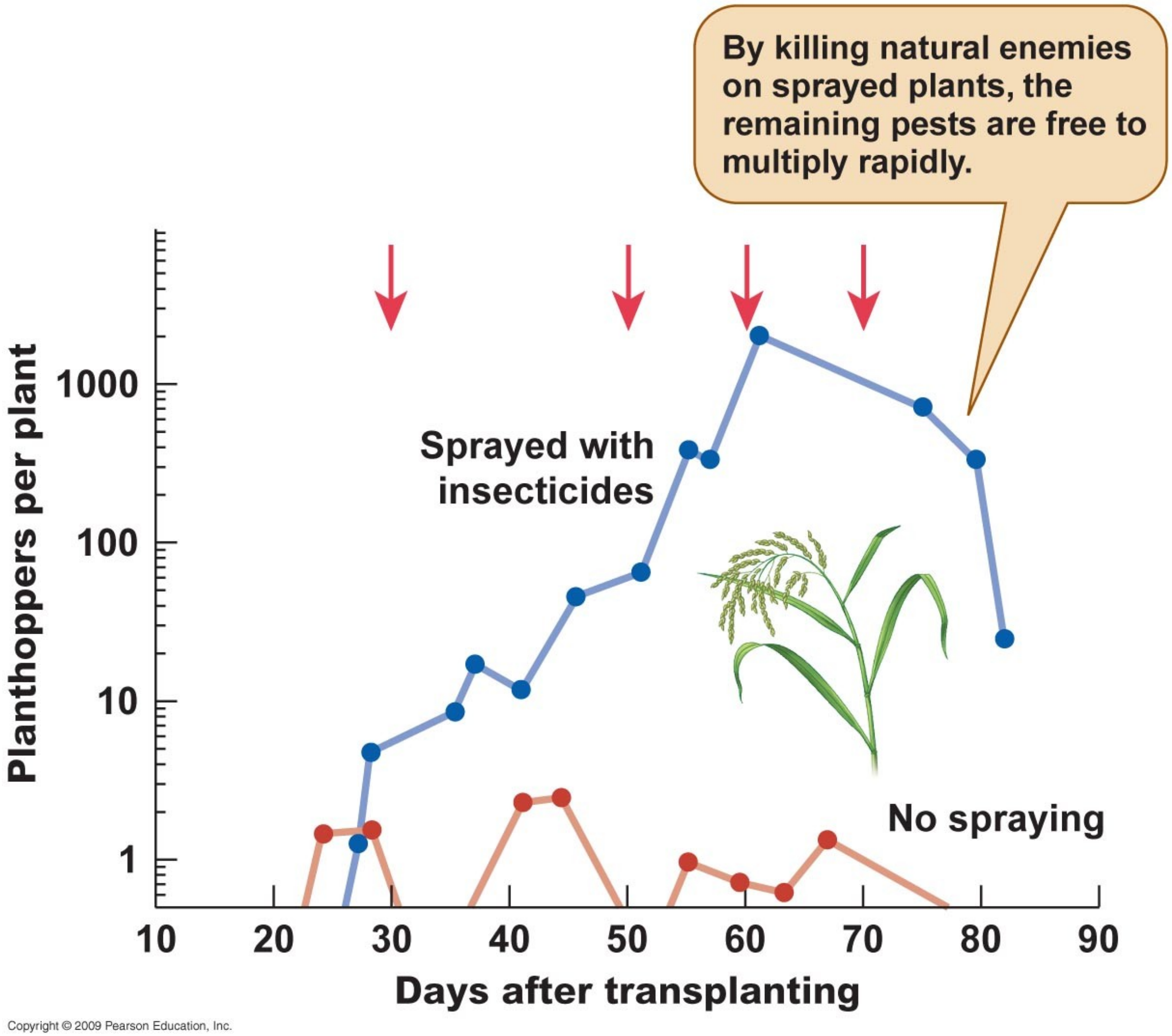
Tipos de control de plagas

- Natural: Exposición a depredadores, parásitos y competidores naturales
- Pesticidas: Tratamiento con herbicidas, fungicidas, insecticidas y otros químicos
- Agrícola: Rotación de cultivos, manejo de bordes, etc.
- Biológico: Exposición a enemigos introducidos
- Integrado: Integración de las cuatro estrategias

El uso de pesticidas puede ayudar...



...pero no siempre



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Especial Malezas

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Lo importante, según **Martín Marzetti**, REM –Aapresid.

"Las soluciones ya no vienen en un bidón".

"Todo esto nos obliga a volver al lote. Como se nos acabaron las soluciones fáciles, hace falta mucho más conocimiento por hectárea".

"Las tecnologías ya no serán la solución principal, sino una ayuda para resolver el problema junto al resto de las prácticas culturales".

El problema

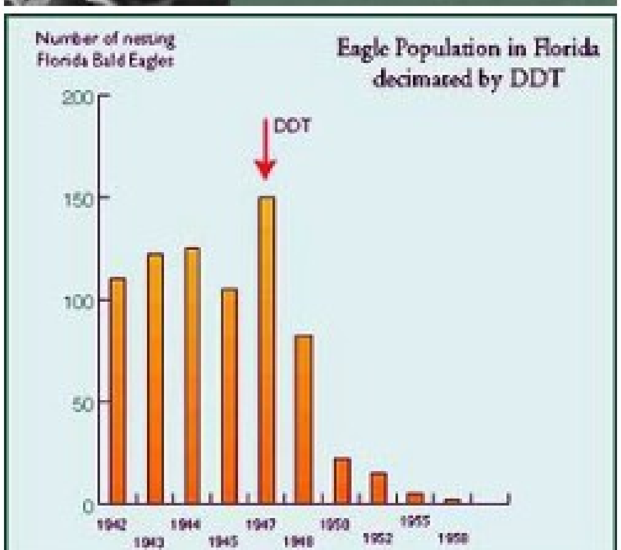
Con las malezas difíciles, se acabaron las recetas

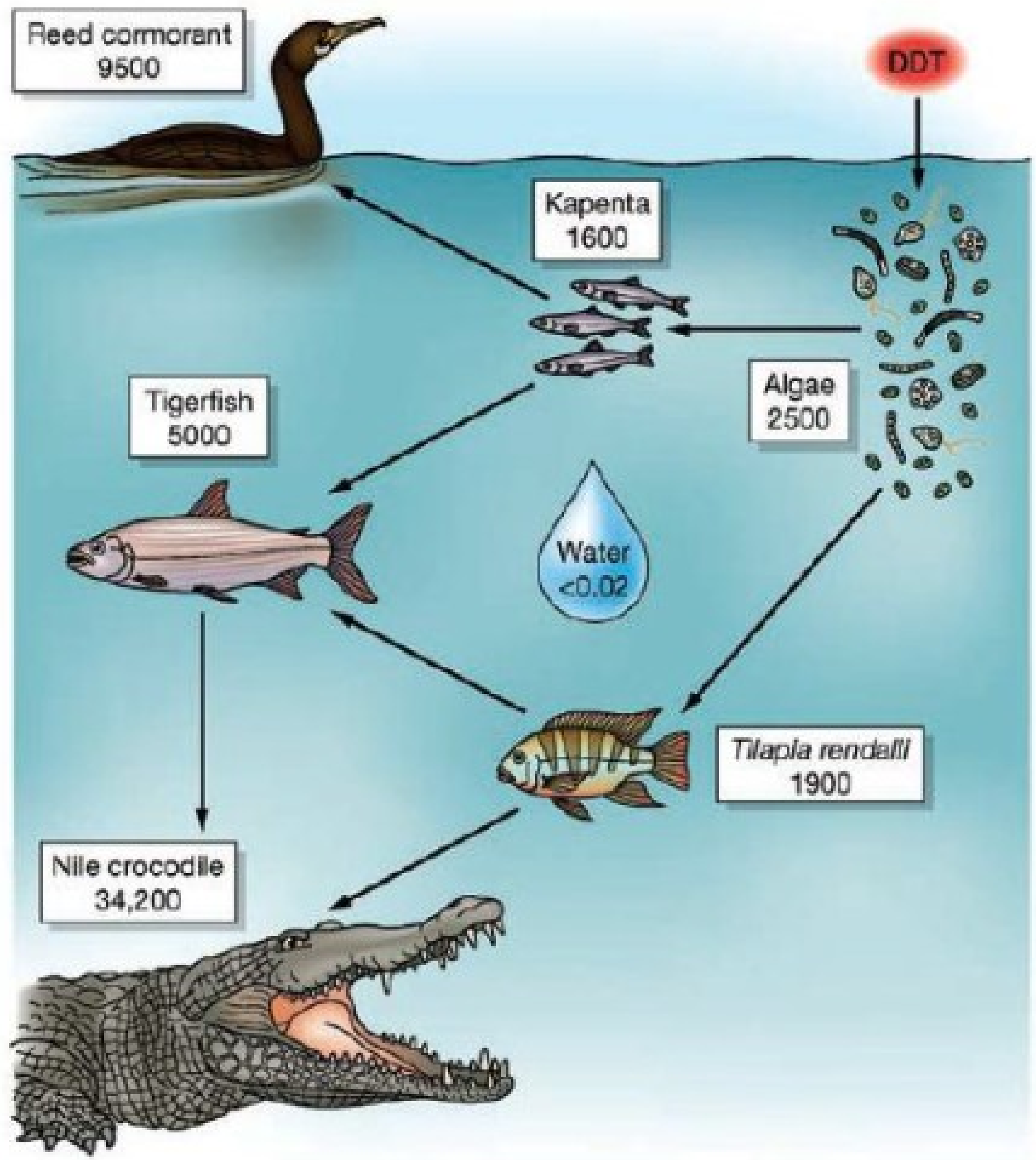
La expansión de las malezas resistentes y tolerantes exige un replanteo de las prácticas agrícolas actuales. Por qué la tecnología ya no podrá ir por delante del conocimiento.

Hace 9 años se descubría en la Argentina la presencia de la primera maleza resistente a glifosato, el sorgo de Alepo. Ese fue el comienzo de una ola que llega hasta la actualidad y amenaza con transmutarse en un tsunami en caso de que no se implementen las soluciones a tiempo. La Red de conocimiento en Malezas Resistentes (REM) de la Asociación Argentina de Productores en Siembra Directa (Aapresid) consigna la existencia en el país de 16 biotipos –pertenecientes a 12 especies distintas– resistentes a herbicidas de 3 diferentes

…y tiene consecuencias no deseadas

…y tiene consecuencias no deseadas



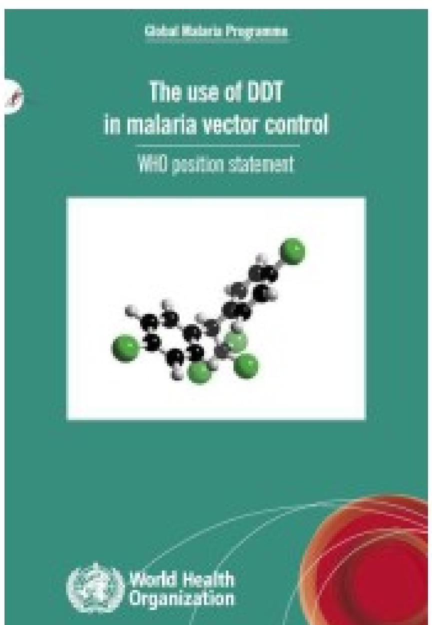


Pero no siempre es tan sencillo...

NEWS FEATURE

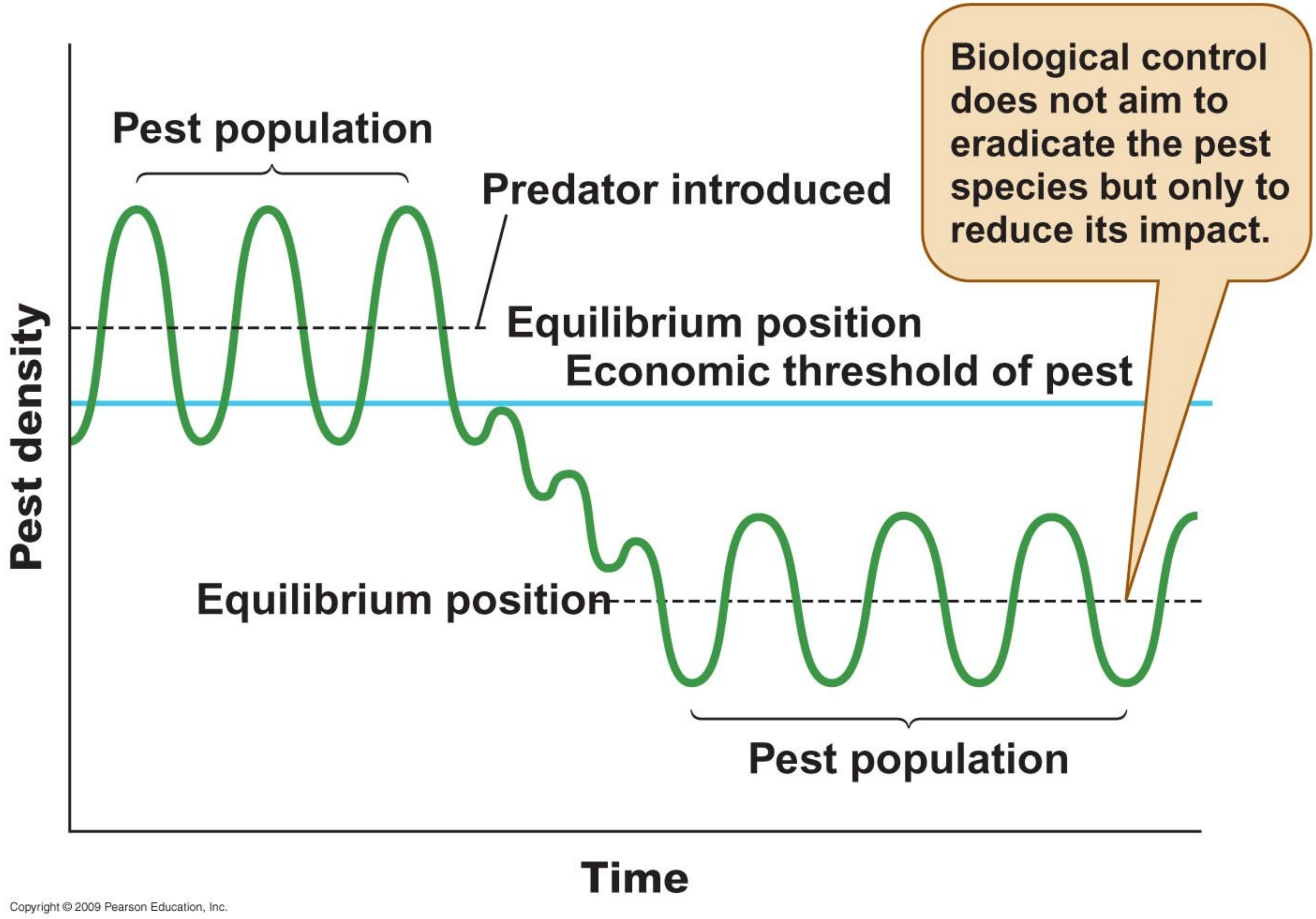
DDT returns

The most infamous pesticide in history is also the most effective weapon against malaria. Ready or not, DDT is on its way back to Africa. Apoorva Mandavilli reports.



Big impact: Small amounts of DDT sprayed on walls can help control malaria.

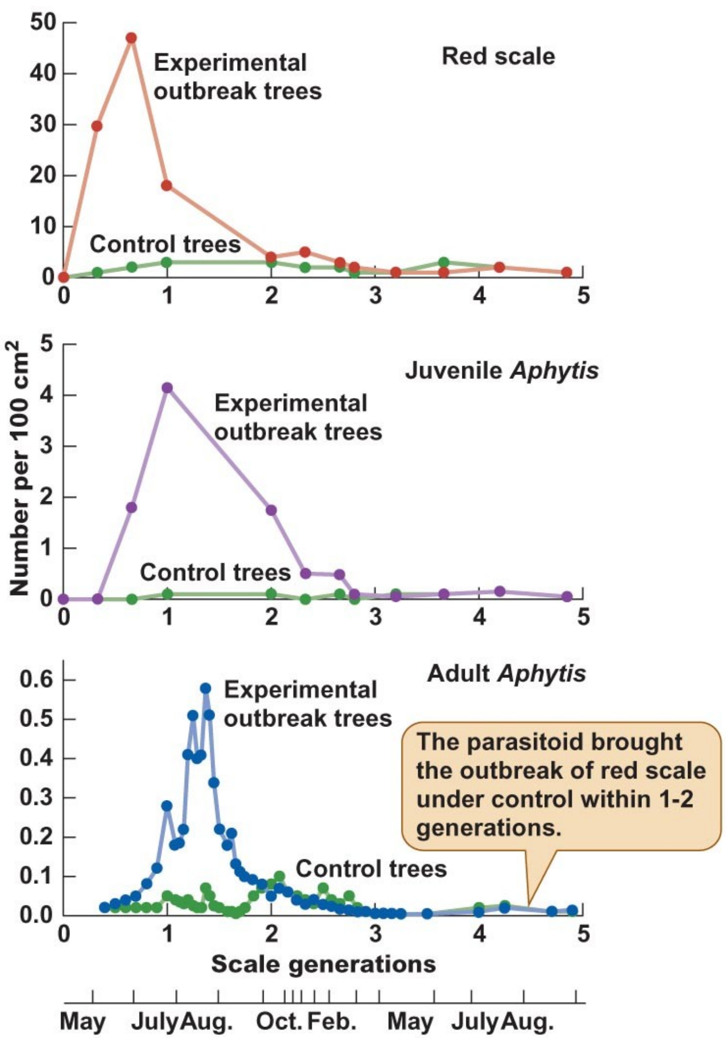
Control biológico clásico



Características ideales de un agente de control biológico

- Alta especificidad de hospedador o presa
- Alta sincronización fenológica con la plaga
- Alta tasa intrínseca de crecimiento (*r*)
- Capacidad de sobrevivir con baja abundancia del hospedador o la presa (plaga)
- Alta capacidad de búsqueda del hospedador o la presa

Ejemplo de control biológico



Aonidiella aurantii

Aphytis melinus

Éxito (y fracaso) del control biológico

Table 16.3 Summary of the success of biological control efforts against insect and arachnid pests throughout the world.

			Established efforts	
Category	No. of attempts	Established (%)	Partial or complete successes (%)	Complete successes (%)
Total*	2295	34	58	16
By order of insects introduced				
Homoptera	819	43	80	30
Diptera	258	37	31	0
Hymenoptera	105	34	56	0
Lepidoptera	628	27	48	6
Coleoptera	364	23	36	4
By demographic origin of pest				
Exotic pests	2163	34	60	17
Native pests	132	25	29	6
By geographic isolation				
Islands	827	40	60	14
Continents	1468	30	56	17
By habitat stability				
Unstable habitats (vegetable and field crops)	640	28	43	3
Intermediate (orchards)	916	32	72	30
Stable habitats (forests, rangelands)	535	36	47	8

*Not all minor orders of introduced insects are listed here.

SOURCE: Data compiled by Hall and Ehler (1979) and Hall et al. (1980).

Riesgos del control biológico

Mangosta (*Herpestes auropunctatus*)

Caracol africano gigante (*Achatina fulica*)

Riesgos del control biológico

Biological Invasions **6:** 151–159, 2004.

Biological control not on target

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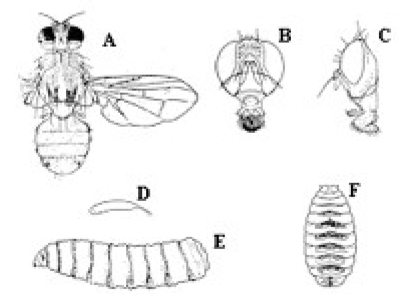
Key words: biological control, non-target effects, parasitoids, predators

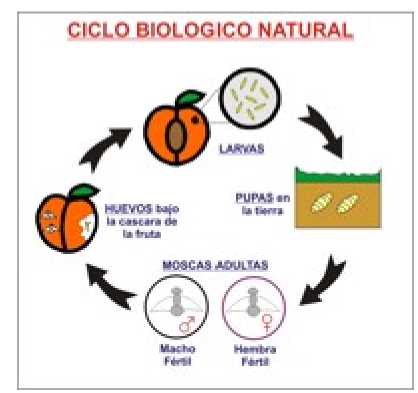
Abstract

Non-target effects of exotic biological control agents, parasitoids and predators, released worldwide to control insect pests, are becoming more apparent. This paper summarizes previously recorded information on the diet breadth of natural enemies released to control insect pests worldwide. It also summarizes the diet breadth of native parasitic hymenoptera in North America to determine whether the diet breadths of native and exotic parasitoids differ. Of released biocontrol agents, 48% were recorded as generalists (attacking more than one genus of host) and another 29.2% attacked more than one species in a genus. Only 22.5% were recorded as specialists on the target pests. This suggests that many natural enemies released in biocontrol programs against insect pests have broad diets and that non-target effects are likely. Data from native hymenoptera in North America also show that many species attack multiple host genera and species, with an average of 5.8 genera and 7.3 species attacked, indicating broad agreement with data from biological control releases.

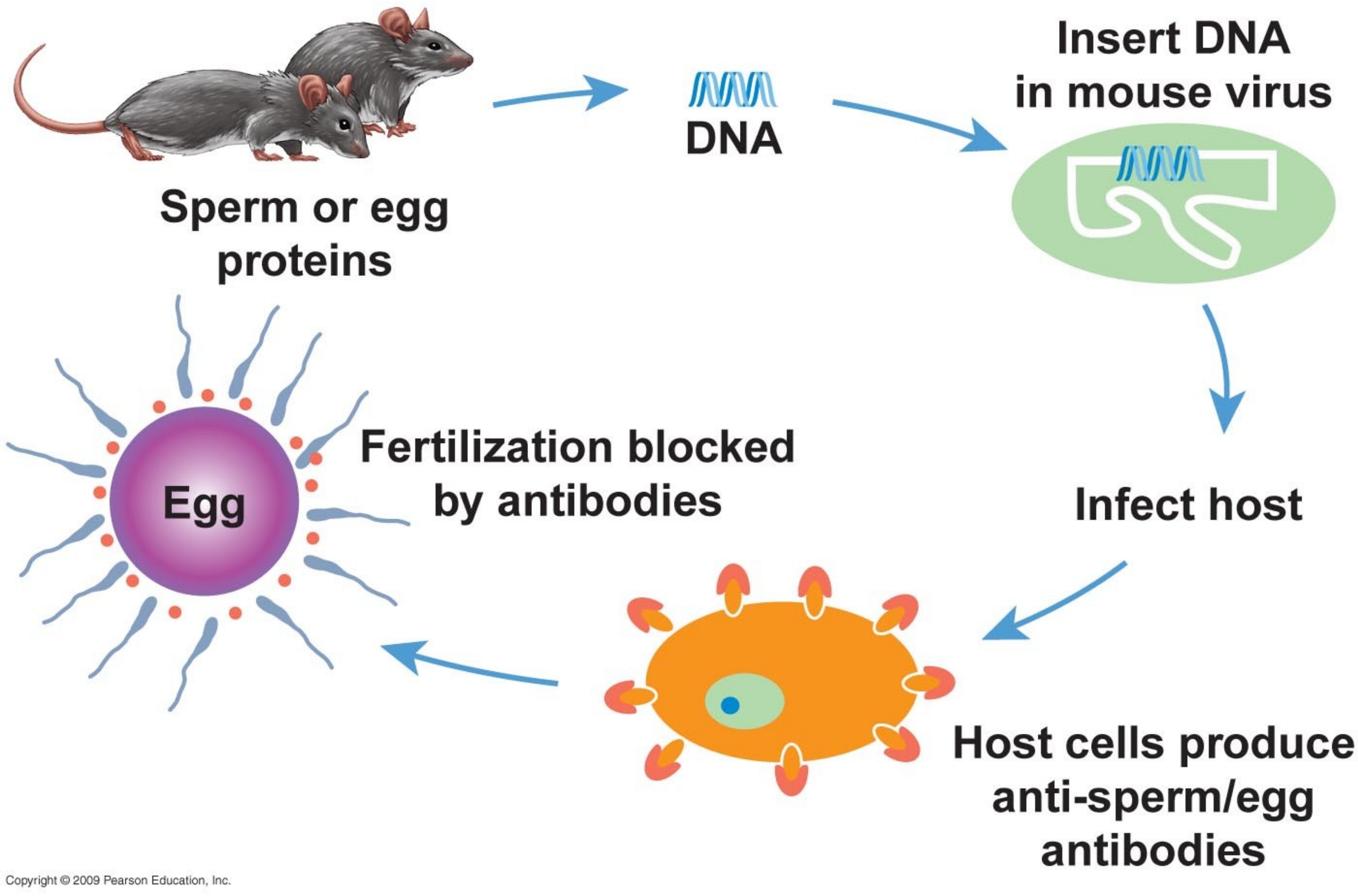
Control genético de plagas



Pepper maggot. A-C, Adult. B, C, Front and side view of head. D, Egg. E, Maggot. F, Puparium.



Inmunoanticoncepción



Control cultural

(a)

(b)

Control cultural

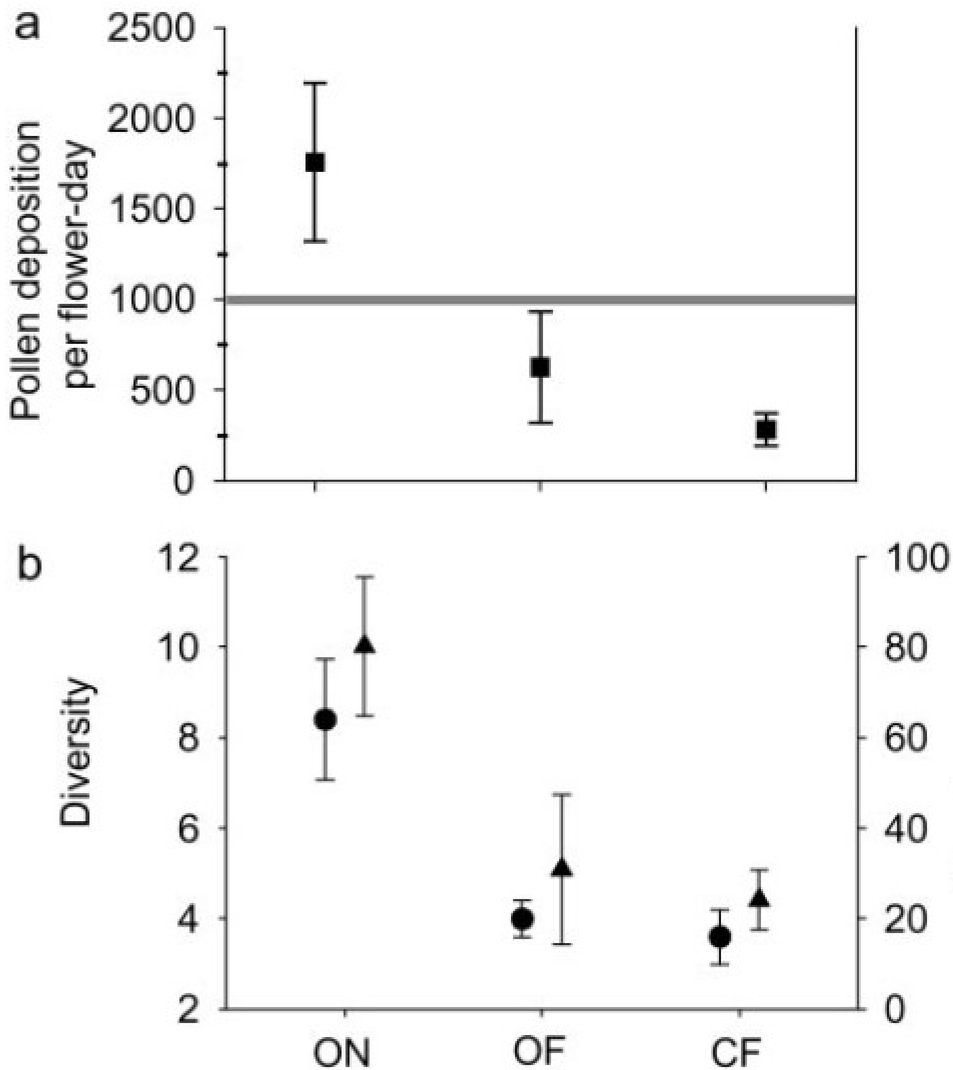
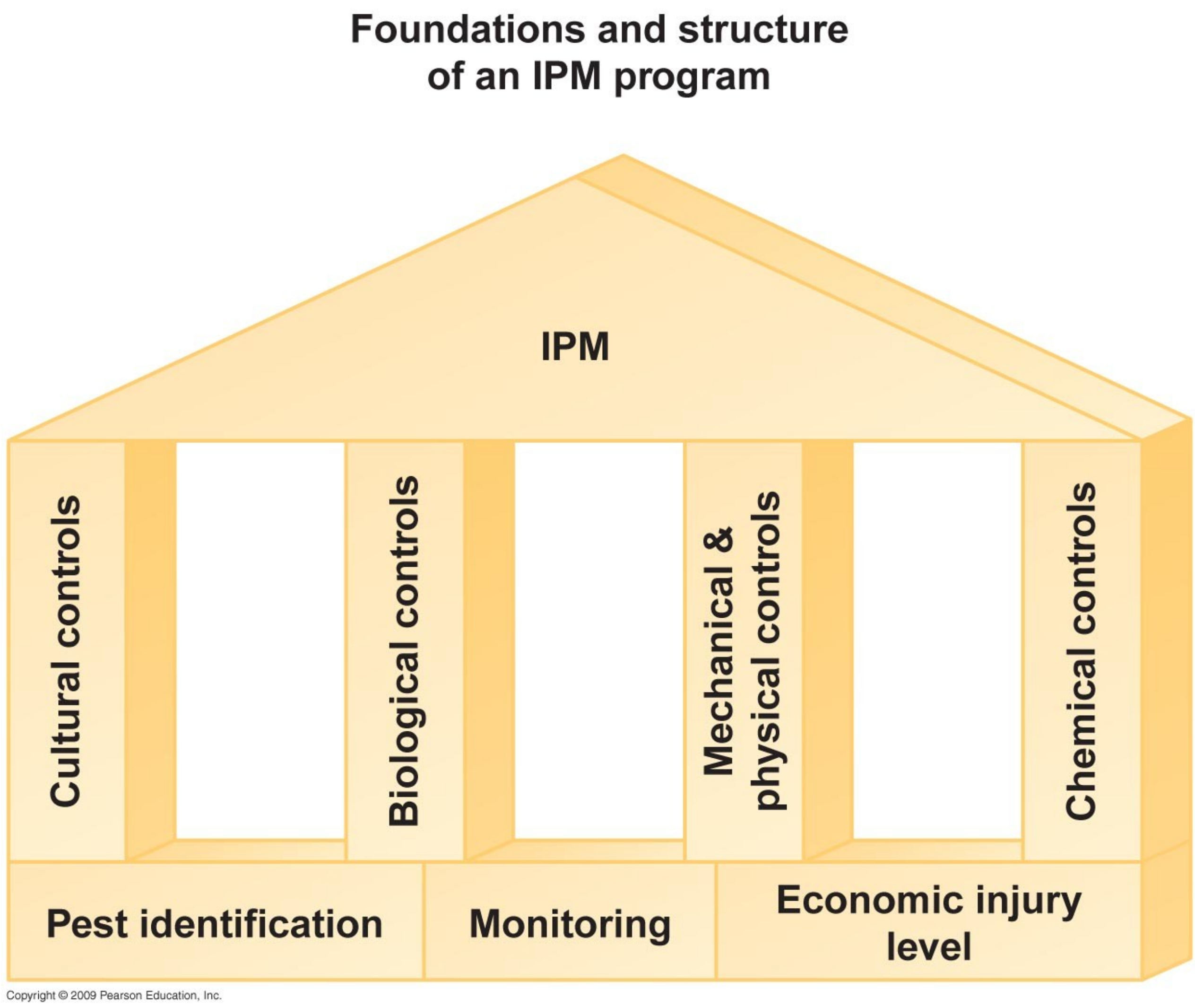


Fig. 1. (*a*) Total estimated pollen deposition by native bees ± SE in 2001 on ON, OF, and CF farms. The gray line indicates pollen deposition for production of marketable fruit. (*b*) Native bee diversity (circles) and abundance (triangles) ± SE in 2001.

ON: Cultivo orgánico de melón cerca de vegetación natural (organic near)
OF: Cultivo orgánico de melón lejos de vegetación natural (organic far)
CF: Cultivo convencional de melón lejos de vegetación natural (convetional far)

Fuente: Kremen et al. (2002)
PNAS 99: 16812-16816

Control integrado



Teórica 22: Esquema conceptual

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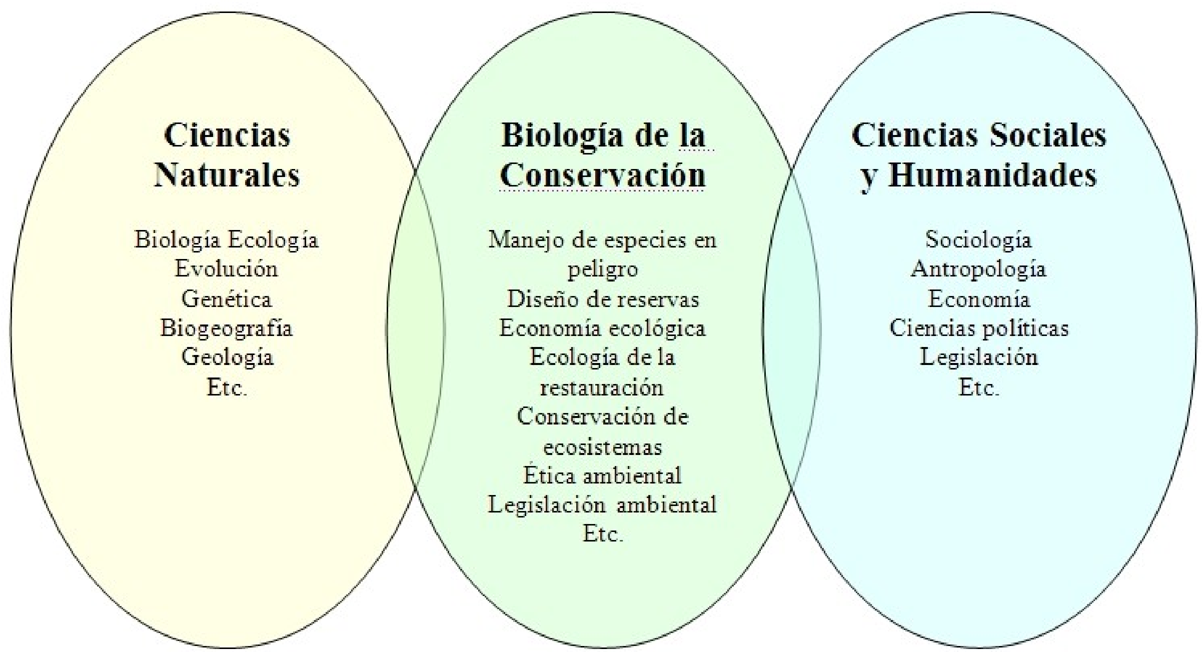
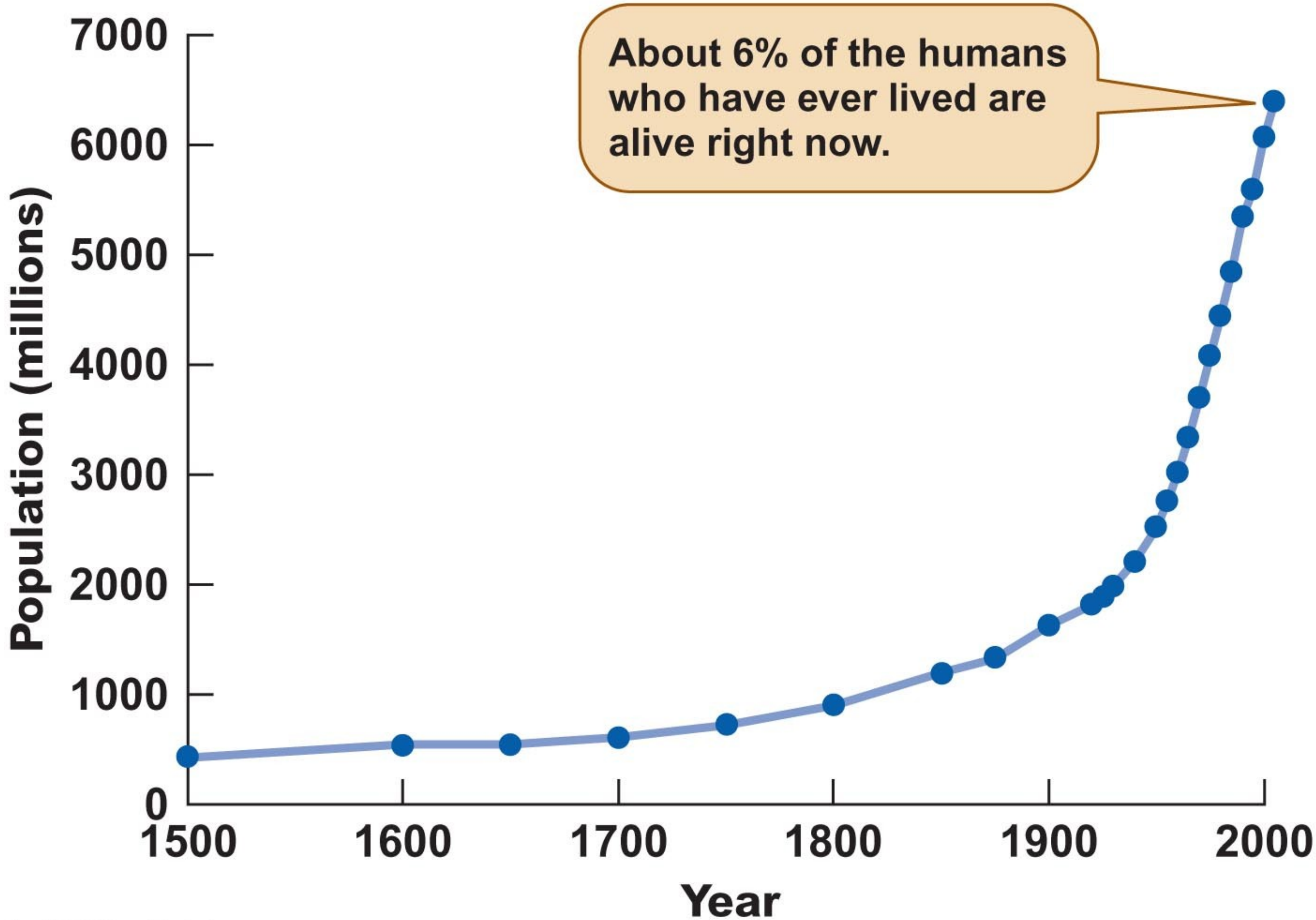
¿Qué es la biología de la conservación?

Es una **disciplina científica** de reciente aparición que aplica **principios multidisciplinarios** dirigidos al **mantenimiento de la diversidad biológica** del planeta.



La biología de la conservación integra disciplinas de los campos de las ciencias naturales, las ciencias sociales y las humanidades (Modificado a partir de Groom *et al*., 2006)

Crecimiento de la población humana en el mundo



Tasas de extinción

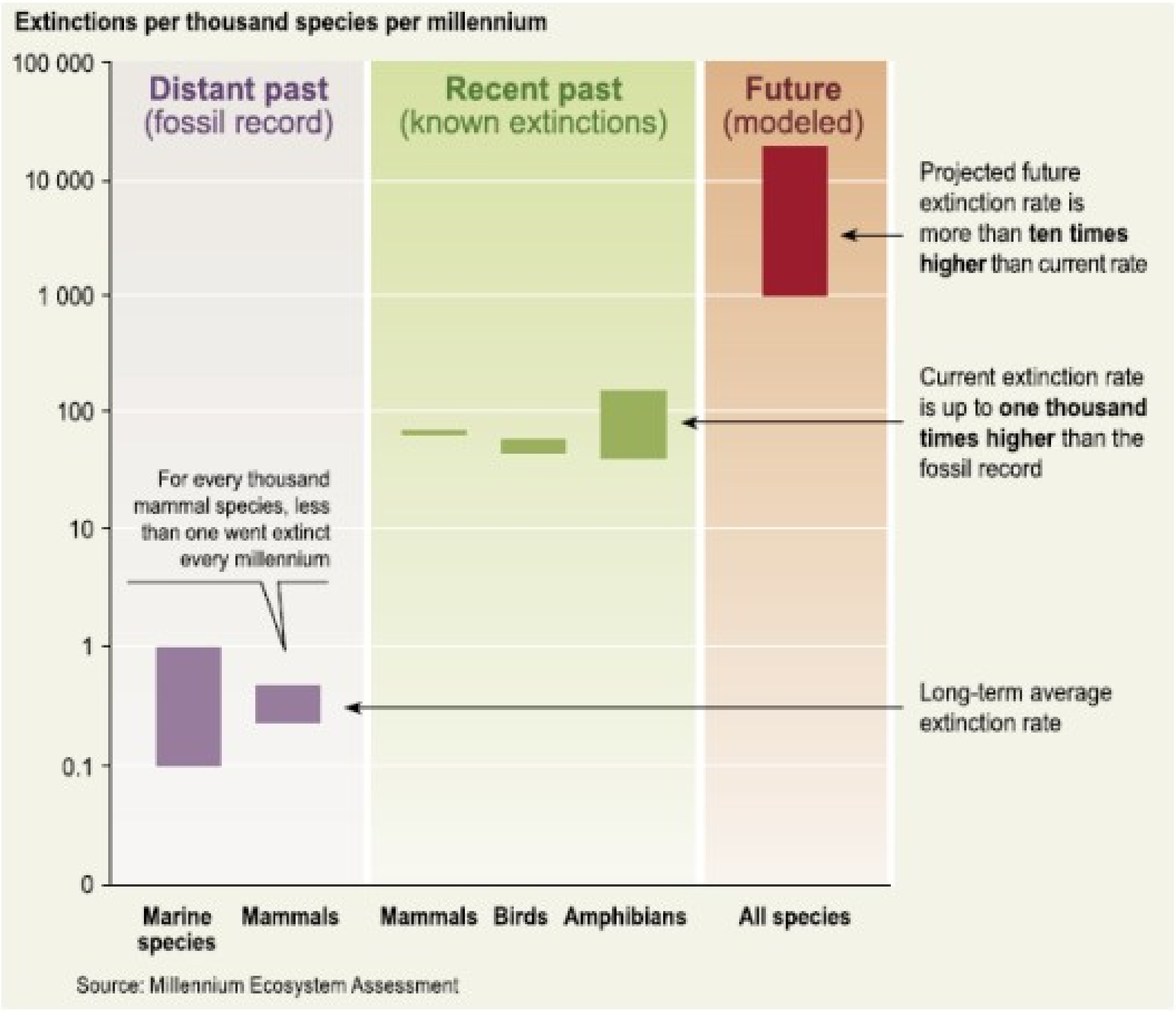


TABLE 3.2 *Number of Globally Threatened Species by Taxon*

	Described species	Evaluated species	Threatened species	Percent of described species threatened	Percent of evaluated species threatened
Vertebrates					
Mammals	5416	4853	1101	20	23
Birds	9917	9917	1213	12	12
Reptiles	8163	499	304	4	61
Amphibians	5743	5743	1856	32	32
Fish	28,600	1721	800	3	46
Invertebrates					
Insects	950,000	771	559	0.1	73
Molluscs	70,000	2163	974	1	45
Crustaceans	40,000	498	429	1	86
Others	130,200	55	30	0.02	55
Plants					
Mosses	15,000	93	80	0.5	86
Ferns	13,025	210	140	1	67
Gymnosperms	980	907	305	31	34
Dicotyledons	199,350	9473	7025	4	74
Monocotyledons	59,300	1141	771	1	68
Lichens	10,000	2	2	0.02	100
Total	1,545,594	38,046	15,503	1	41

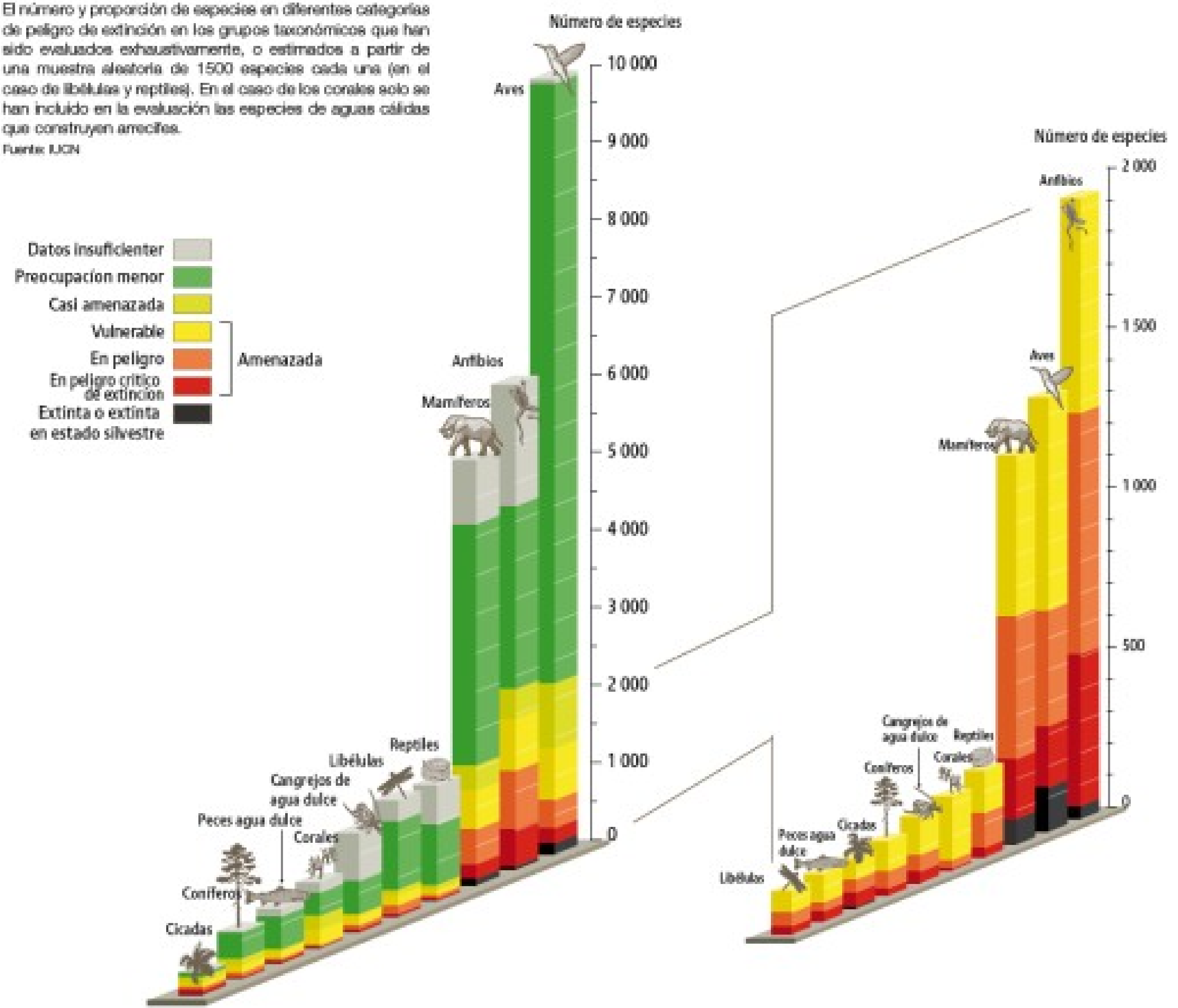
Note: A "threatened species" includes any species designated as CR, EN, or VU by the IUCN Red List.

Source: Modified from IUCN 2004.

FIGURA 4 Situación de amenaza de especies de grupos taxonómicos exhaustivamente evaluados

El número y proporción de especies en diferentes categorías de peligro de extinción en los grupos taxonómicos que han sido evaluados exhaustivamente, o estimados a partir de una muestra aleatoria de 1500 especies cada una (en el caso de libélulas y reptiles). En el caso de los corales solo se han incluido en la evaluación las especies de aguas cálidas que construyen arrecifes.

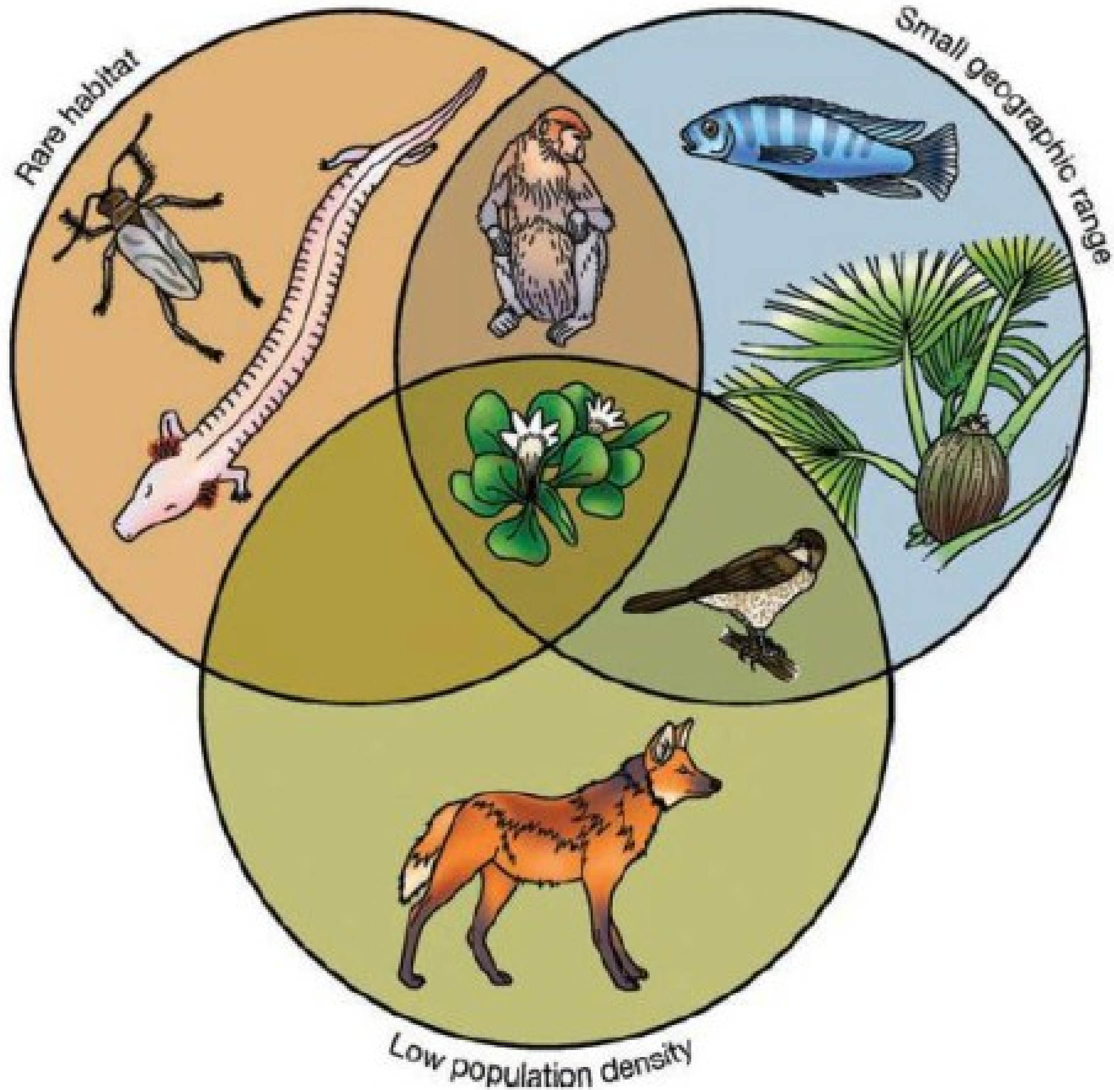
Fuente: IUCN



Fuente: Secretaría del Convenio sobre la Diversidad Biológica (2010) Perspectiva Mundial sobre la Diversidad Biológica 3. Montreal

¿Qué hace a algunas especies más vulnerables a la extinción?

Las especies raras tienen mayor chance de extinguirse



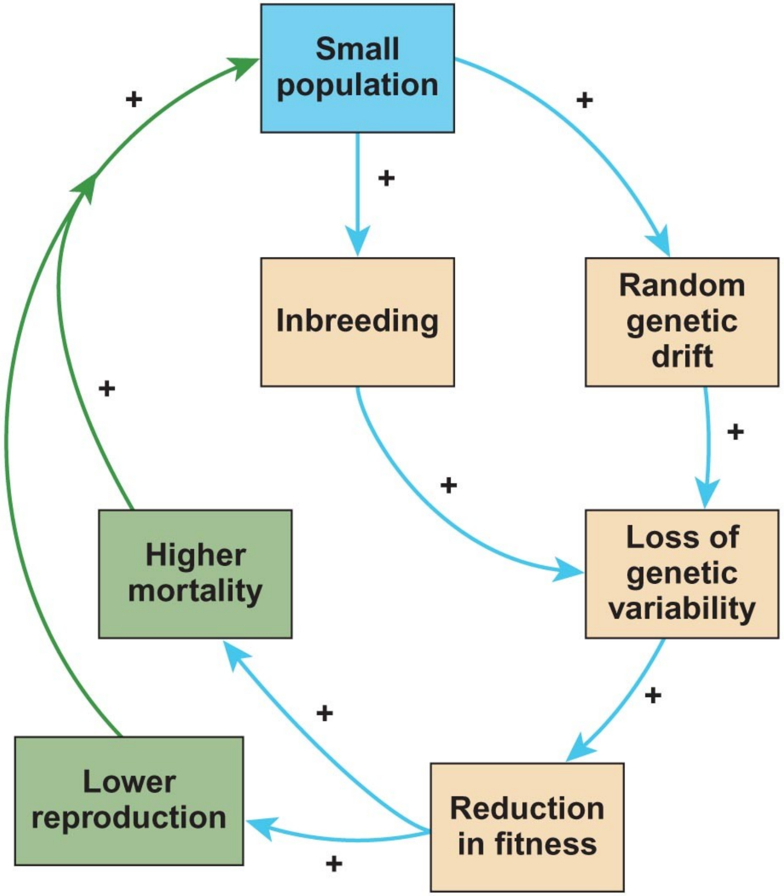
Tipos de rareza

Table 17.1 A classification of rare species based on three characteristics: geographic range, habitat specificity, and local population size.

	Geographic range			
	Large		**Small**	
	Habitat specificity			
Population size	**Wide**	**Narrow**	**Wide**	**Narrow**
Large, dominant somewhere	Locally abundant over a large range in several habitats	Locally abundant over a large range in a specific habitat	Locally abundant in several habitats but restricted geographically	Locally abundant in a specific habitat but restricted geographically
Small, nondominant	Constantly sparse over a large range and in several habitats	Constantly sparse in a specific habitat but over a large range	Constantly sparse and geographically restricted in several habitats	Constantly sparse and geographically restricted in a specific habitat

SOURCE: Modified after Rabinowitz (1981).

El “vórtice de extinción” en poblaciones pequeñas



Las poblaciones pequeñas están sujetas a tres tipos de estocasticidad:

- Genética
- Demográfica
- Ambiental

Causas de amenaza y extinción

Figure 4. *Four major threats to biodiversity. (a) Habitat loss is the leading threat to biodiversity (Wilcove* et al. *1998; Lawler* et al. *2002). (b) Exotic species, such as purple loosestrife, often out-compete native species for critical resources. (c) Over-exploitation is the leading threat to marine species (Kappel 2005). (d) Climate change poses substantial threats to many ecological systems (Parmesan and Yohe 2003).*

Fuente: Lawler et al. (2006) Front. Ecol. Environm. 4: 473-480

Causas de amenaza y extinción

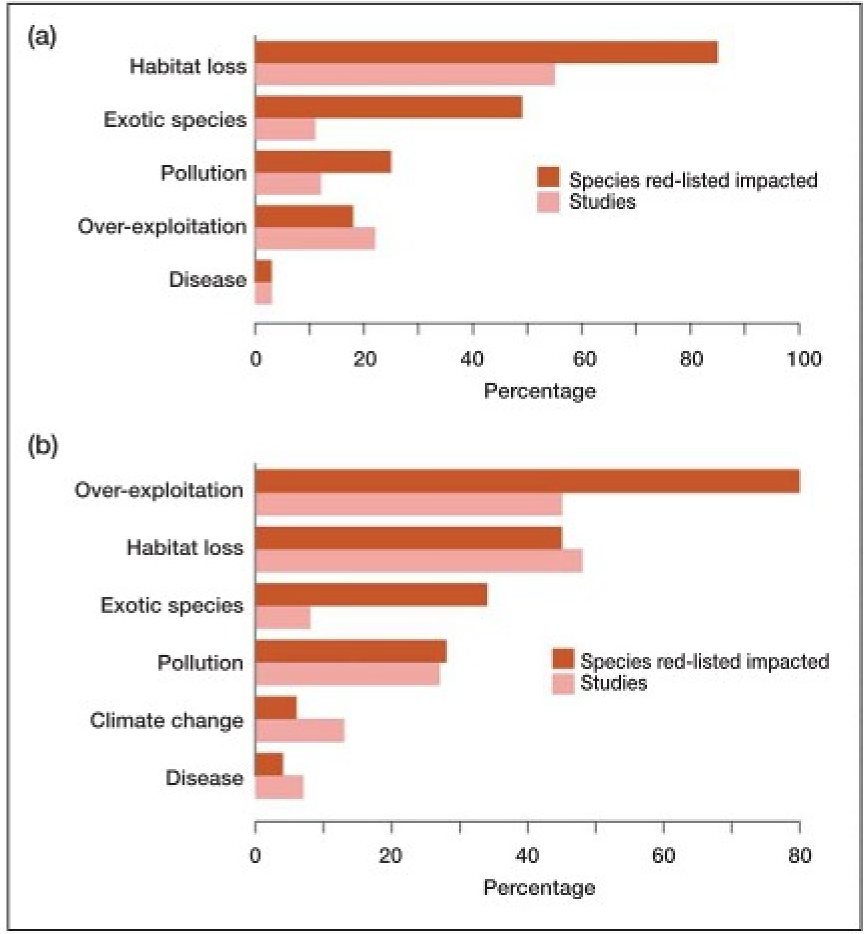


Figure 5. *A comparison of the prevalence of different risks to biodiversity and the degree to which they are reported in the literature, (a) in all systems and (b) in marine systems. The prevalence of threats to species in all systems was derived from Wilcove et al. (1998). The prevalence of threats to marine systems was taken from Kappel (2005).*

Fuente: Lawler et al. (2006) Front. Ecol. Environm. 4: 473-480

Causas de amenaza y extinción

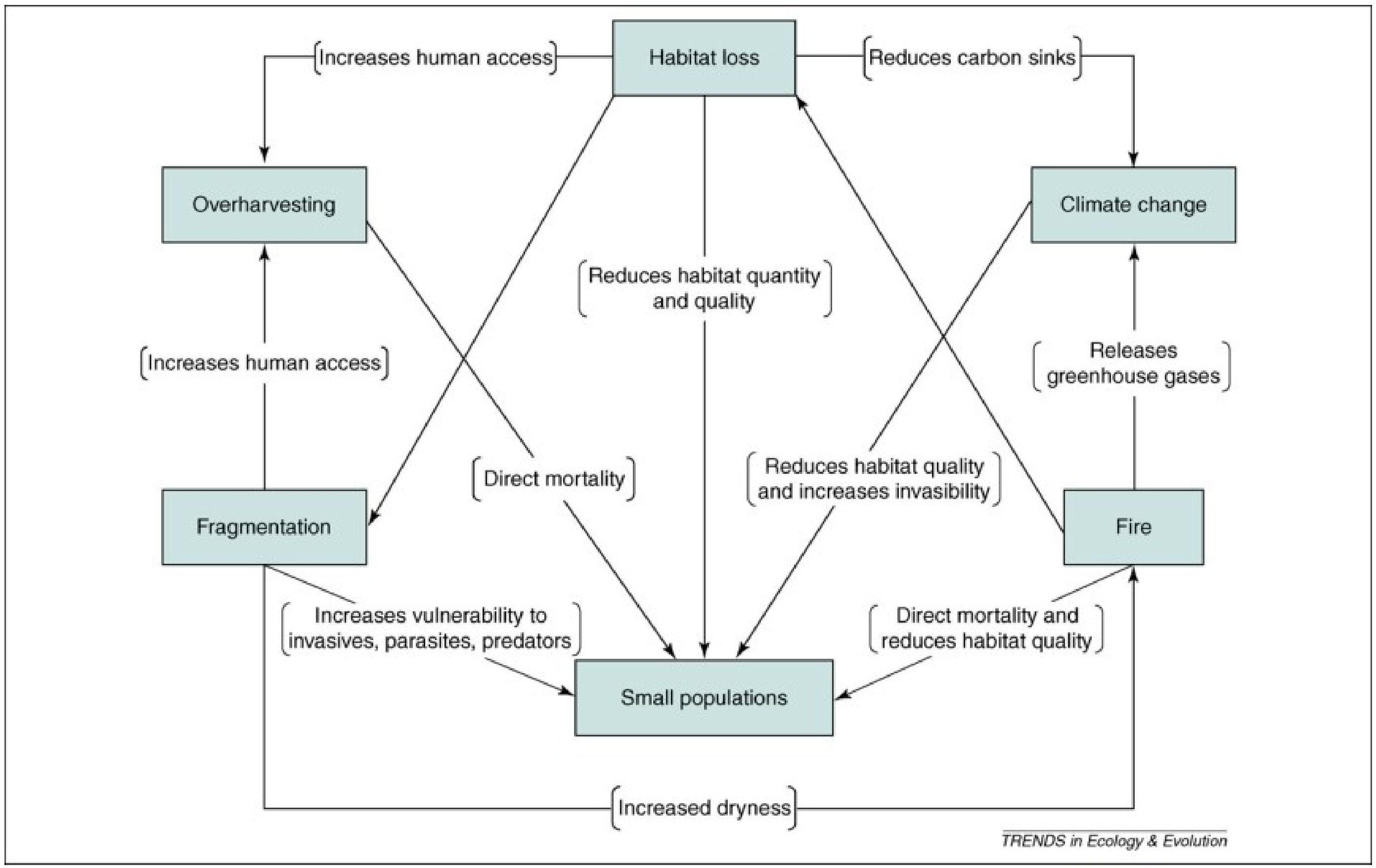


Figure 3. An example of the synergistic feedbacks which threaten species in disturbed tropical rain forests [1,20,28,55].

Fuente: Brook et al. (2008) TREE 23: 453-460

Destrucción del hábitat

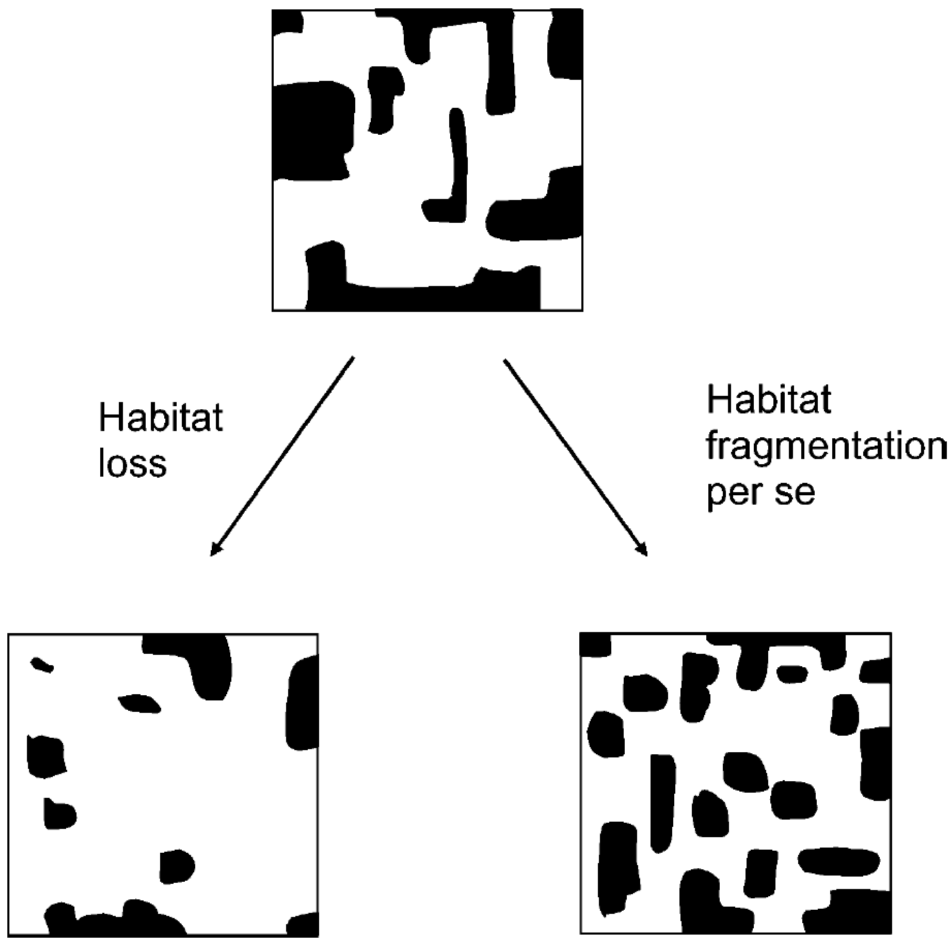


Figure 5 Both habitat loss and habitat fragmentation per se (independent of habitat loss) result in smaller patches. Therefore, patch size itself is ambiguous as a measure of either habitat amount or habitat fragmentation per se. Note also that habitat fragmentation per se leads to reduced patch isolation.

Destrucción del hábitat

Valle de Uco, Provincia de Mendoza

Destrucción del hábitat

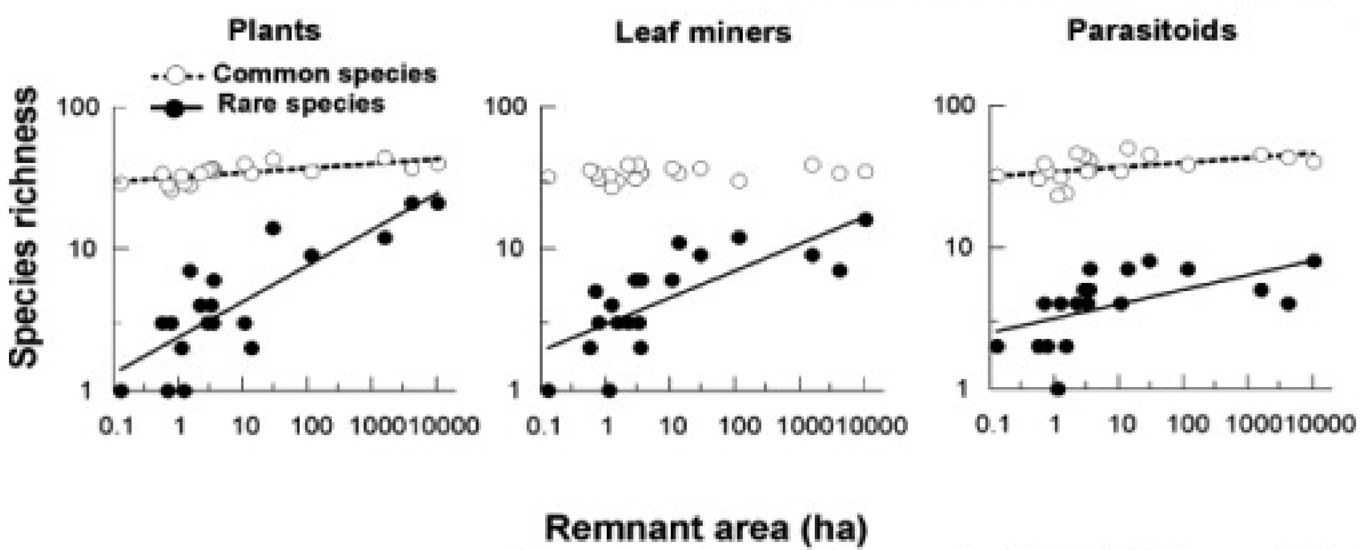
TABLE 19.3 Changes associated with habitat fragmentation and their possible effects on population dynamics.

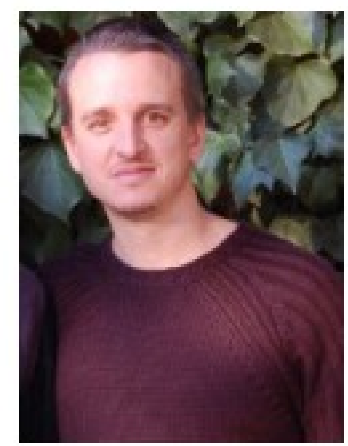
	Habitat change	*Consequences for population dynamics*
Population-level effects	Reduced connectivity, insularization, increased interfragment distance Reduced fragment size, reduced total area	Directly affects dispersal and reduces the immigration rate Directly affects population size and increases the extinction rate
Landscape or community-level effects	Reduced interior-edge ratio Reduced habitat heterogeneity within fragments Increased habitat heterogeneity in surrounding matrix Loss of keystone species from the habitat	Indirectly affects mortality and production through increased pressure from predators, competitors, parasites, and disease Indirectly affects population size through reduced carrying capacity within the fragment Indirectly affects mortality and production through increased carrying capacity of predators, competitors, etc. in the surrounding matrix Indirect effect through disruption of mutualistic guilds or food webs

Source: From Rolstad (1991).

Destrucción del hábitat

Plantas, minadores y parasitoides en fragmentos de Chaco Serrano, Córdoba





Luciano Cagnolo

Fuente: Cagnolo et al. (2009) Cons. Biol. 23: 1167-1175

Destrucción del hábitat

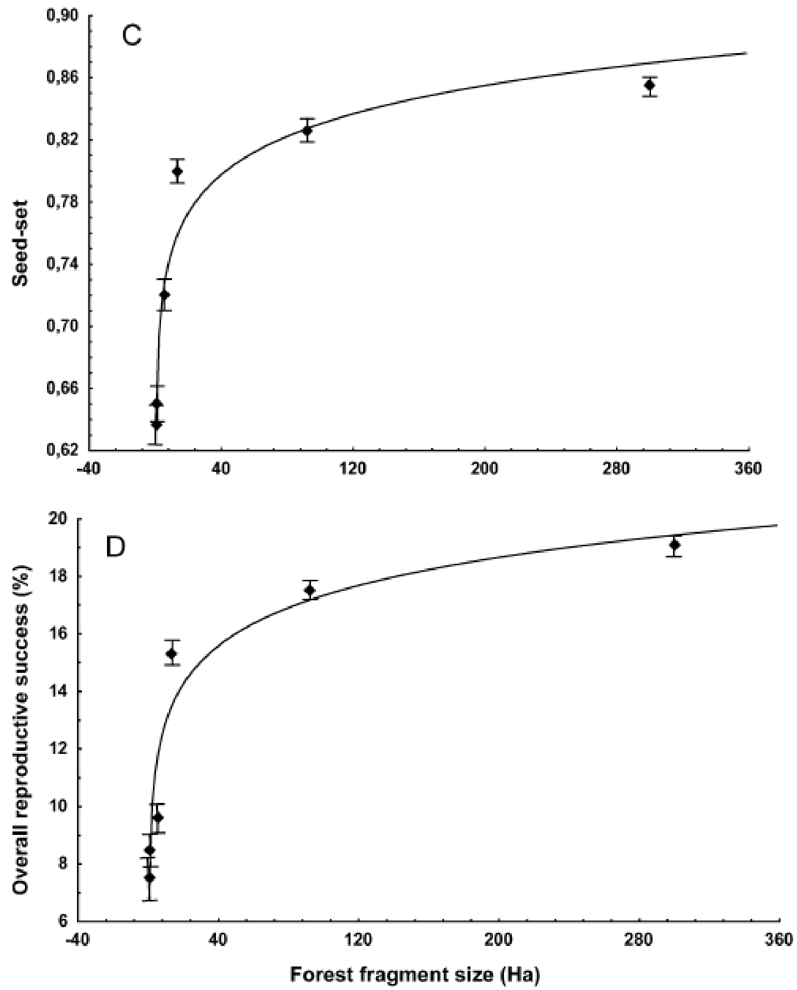


Fig. 1 Relationships between forest fragment size and mean (±1 SE) pollen loads (**A**), pollen tubes (**B**), seed-set (**C**), and overall reproductive success (**D**). Logarithmic fit significant at $P < 0.05$

Fuente: Aguilar & Galetto (2004) Oecol. 138: 513-520

Destrucción del hábitat

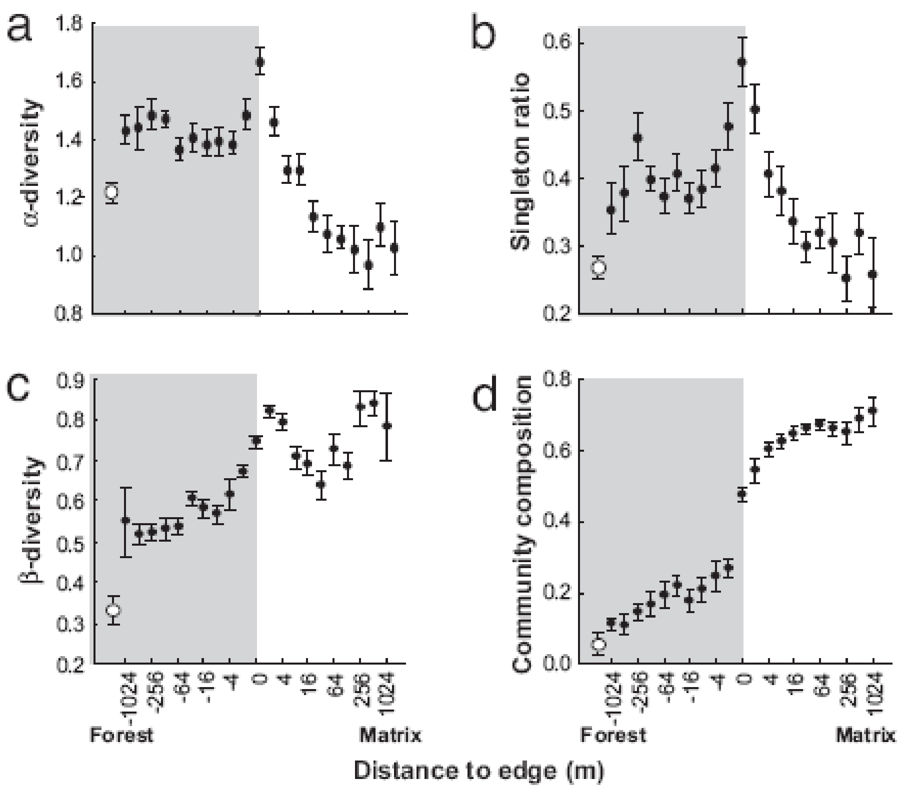
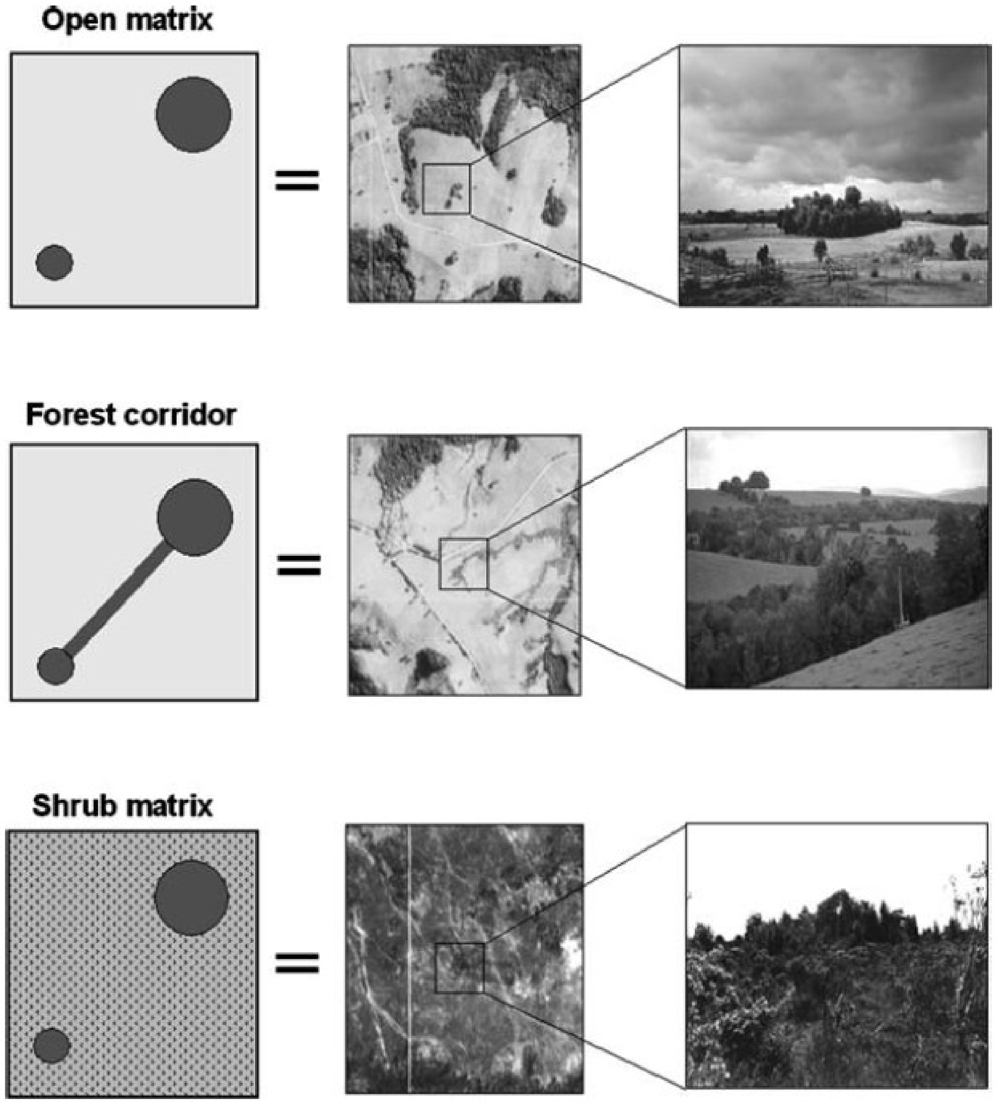


Fig. 3. Changes in beetle community structure and diversity with respect to distance to forest edges in New Zealand. (*a*) α-Diversity represented by $\log_{10}$-transformed Fisher's α. (*b*) Singleton ratio (proportion of total abundance made up of species represented by a single individual, as determined by a randomization test that standardized for variation in sample size; *SI Appendix*). (*c*) β-Diversity as represented by a modified Jaccard similarity index that takes into account the number of unrecorded species pairs and is robust to variation in sample size (values indicate the proportional turnover of beetle species between sites within each distance category, with low values indicating a high proportion of shared species between sites; *SI Appendix*). (*d*) Community composition represented by ordination scores from axis 1 of a partial detrended correspondence analysis controlling for the potential confounding effect of fragment area on edge response (sites with similar values have similar beetle communities). Values in all panels are mean ± 1 SE. The open symbols represent the values for five sites in the deep forest control that were all separated by >500 m. Negative edge values are in the forest (shaded area), and positive values are in the surrounding grassland matrix.

Fuente: Ewers & Didham (2008) PNAS 105: 5426-5429

Destrucción del hábitat



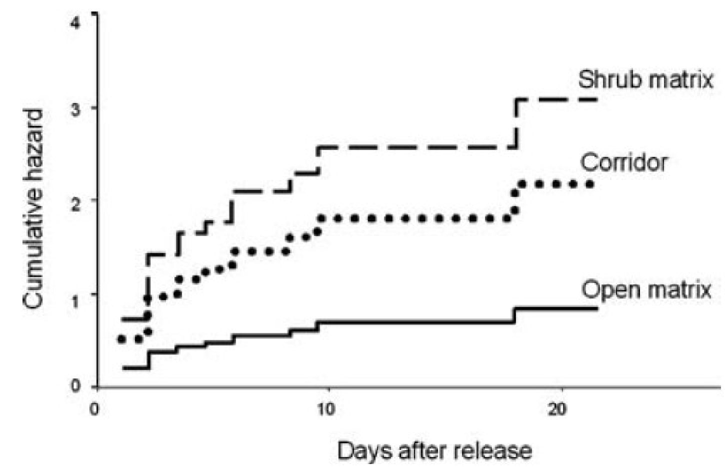


Figure 2. Hazard function showing likelihood (not scaled to 100 because of censored data) of dispersal by translocated Chucaos from release patches as a function of time (days).

Fuente: Castellón & Sieving (2006) Cons. Biol. 20: 135-145

Destrucción del hábitat

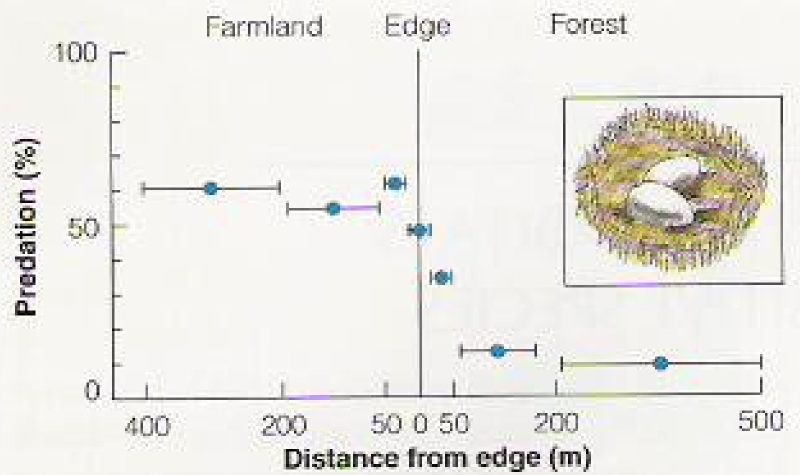


FIGURE 19.9
Predation rate on artifical bird nests containing two brown chicken eggs in relation to distance from the farmland forest edge in central Sweden, 1984–1986. Each point is based on 13 to 30 nests. Generalist predators such as red foxes do not seem to go more than 50 m into these coniferous forest patches (From Andrén and Angelstam 1988.)

Sobreexplotación

Acopio de madera de algarrobo dulce (Prosopis flexuosa),
Estación del ferrocarril, Chepes, La Rioja, 1916

Sobreexplotación

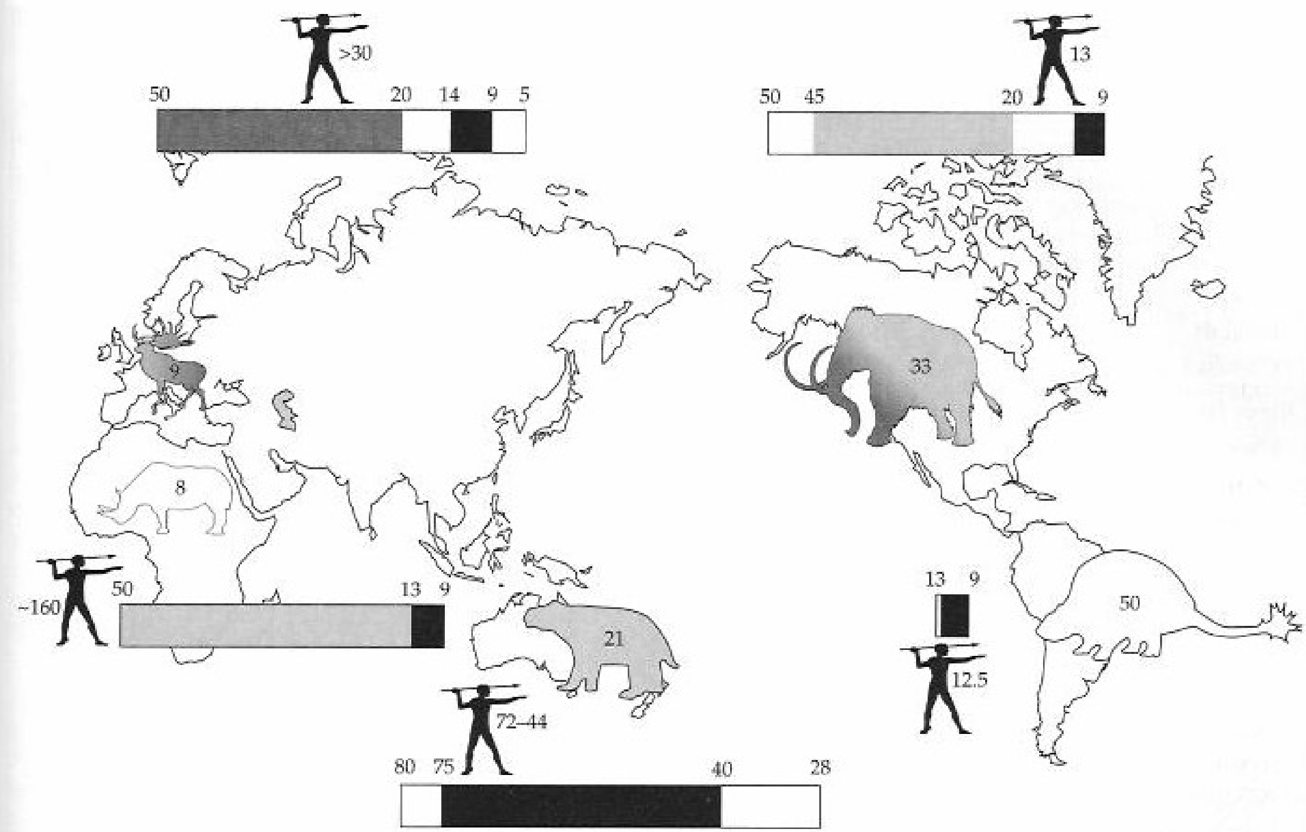


Figure 3.4 Mammalian megafaunal genera (species > 44 kg) went extinct soon after human migrations into North America, Australia, South America, and Europe. Numbers in mammal icons represent the total number of genera that went extinct and the shading indicates cause of extinction; see inset legend. Bars indicate the period of extinction (in kya), and shading indicates the magnitude of extinctions during that time; Black = many, dark gray = some, light gray = few, white = one or none. Numbers next to human icons indicate when humans arrived to the continent. Rapid climate warming (occurring from 14–10 kya) contributed to extinction in many cases, particularly in Eurasia and South America. In South America climate change and the arrival of humans entirely coincided with an extinction spasm of 50 genera. (Modified from Barnosky et al. 2004.)

Sobreexplotación

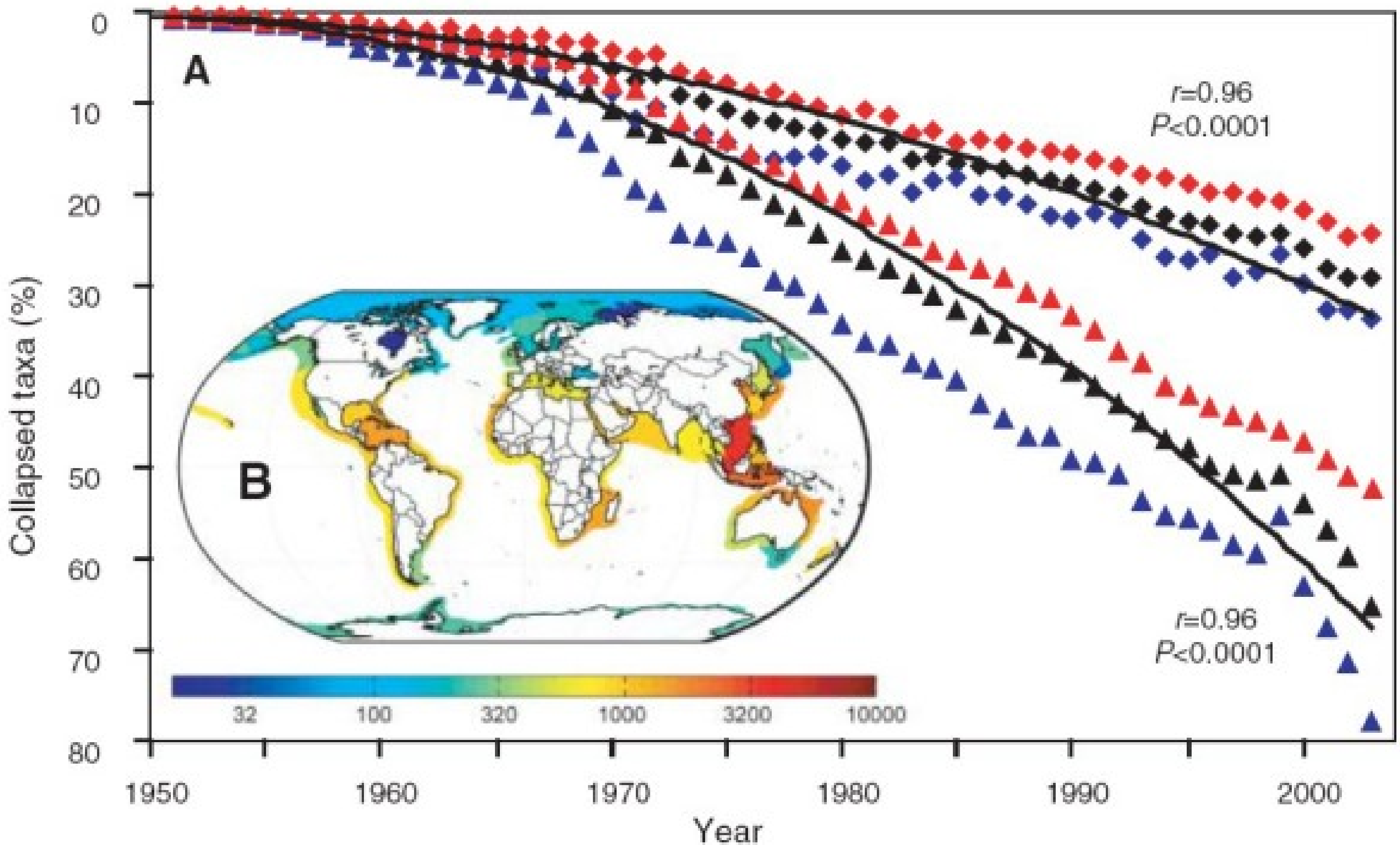


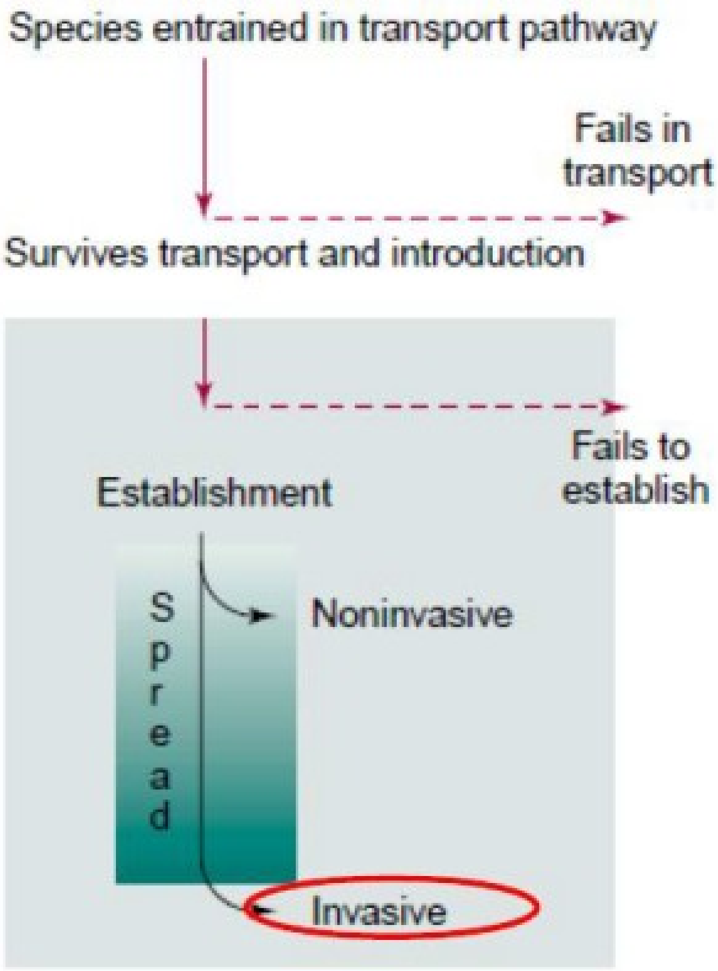
Fig. 3. Global loss of species from LMEs. (**A**) Trajectories of collapsed fish and invertebrate taxa over the past 50 years (diamonds, collapses by year; triangles, cumulative collapses). Data are shown for all (black), species-poor (<500 species, blue), and species-rich (>500 species, red) LMEs. Regression lines are best-fit power models corrected for temporal autocorrelation. (**B**) Map of all 64 LMEs, color-coded according to their total fish species richness. (**C**) Proportion of collapsed fish and invertebrate taxa, (**D**)

Fuente: Worm et al. (2006) Science 314: 787-790

Charles Elton (1900-1991)

Invasión de especies

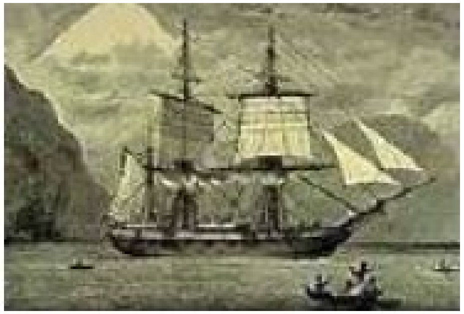
La invasión ocurre cuando una nueva especie es introducida en un ecosistema fuera de su rango natural.



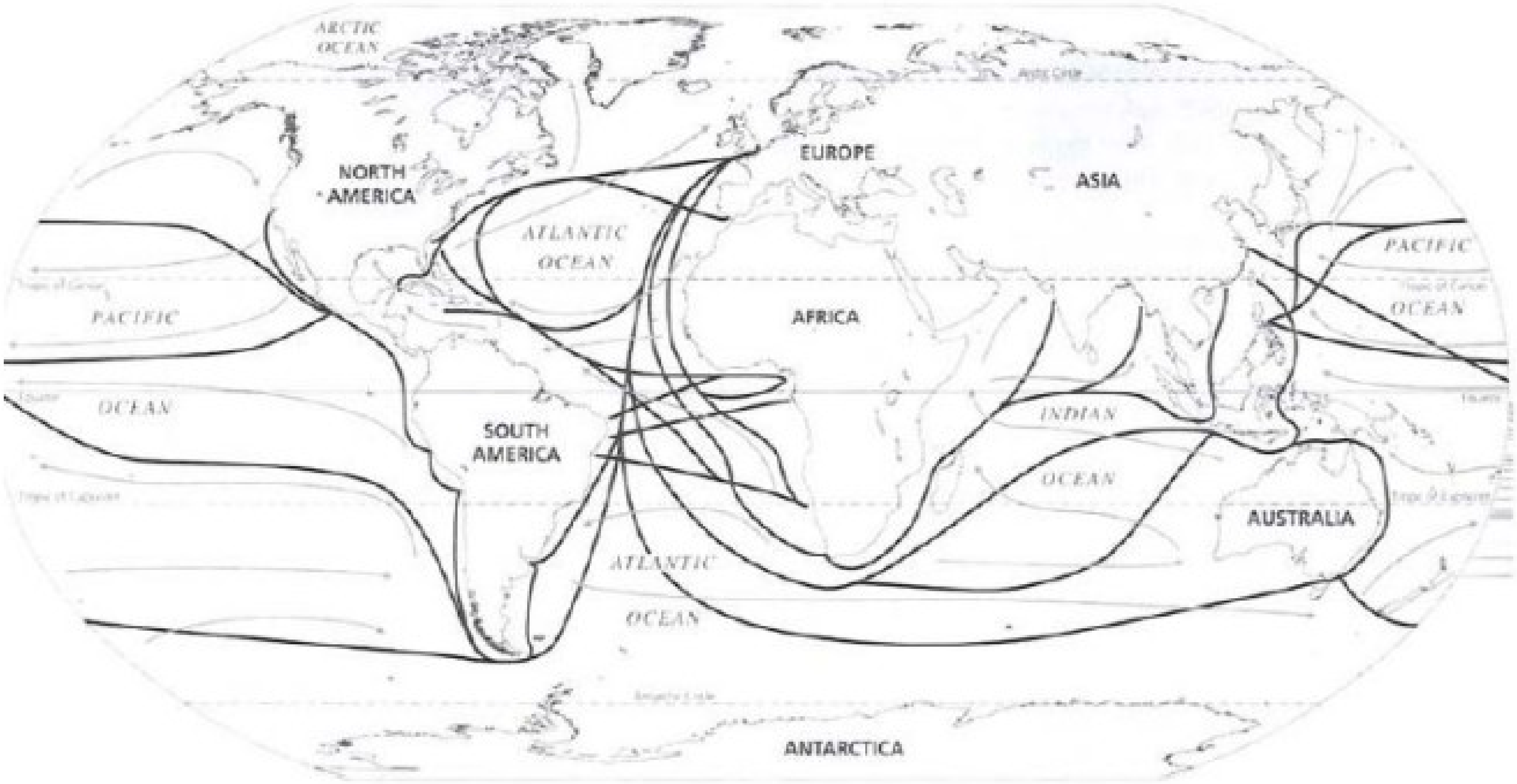
La introducción inicial debe producirse a través de una barrera que sería insuperable naturalmente;

Establecimiento y expansión poblacional

Invasión de especies

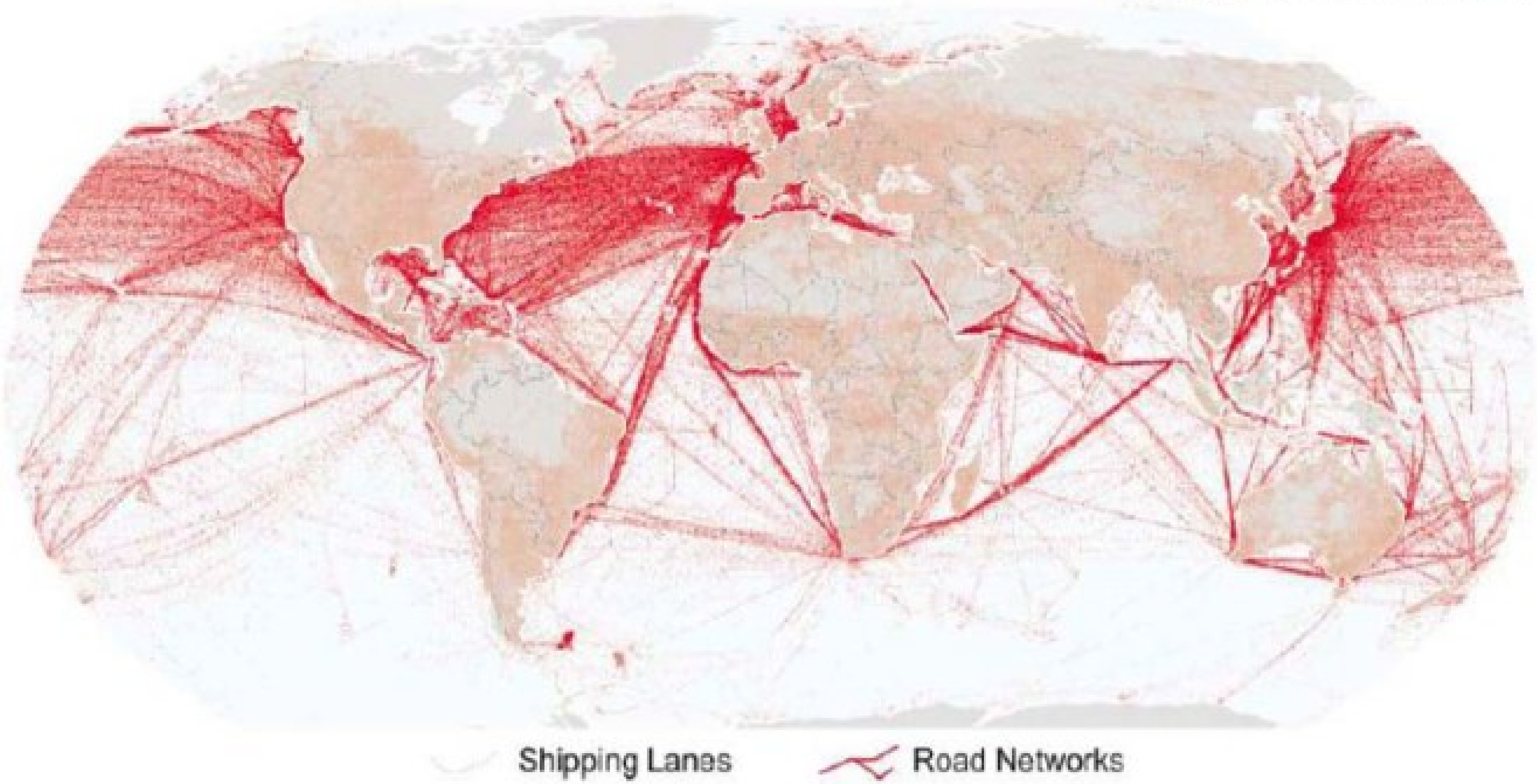


Principales rutas de navegación, siglos XVI - XVII



Invasión de especies

Rutas de navegación (Kareiva et al. 2007)



Invasiones biológicas

Table 1. Numbers of native and exotic terrestrial and freshwater species for several taxa in Argentina and Chile.

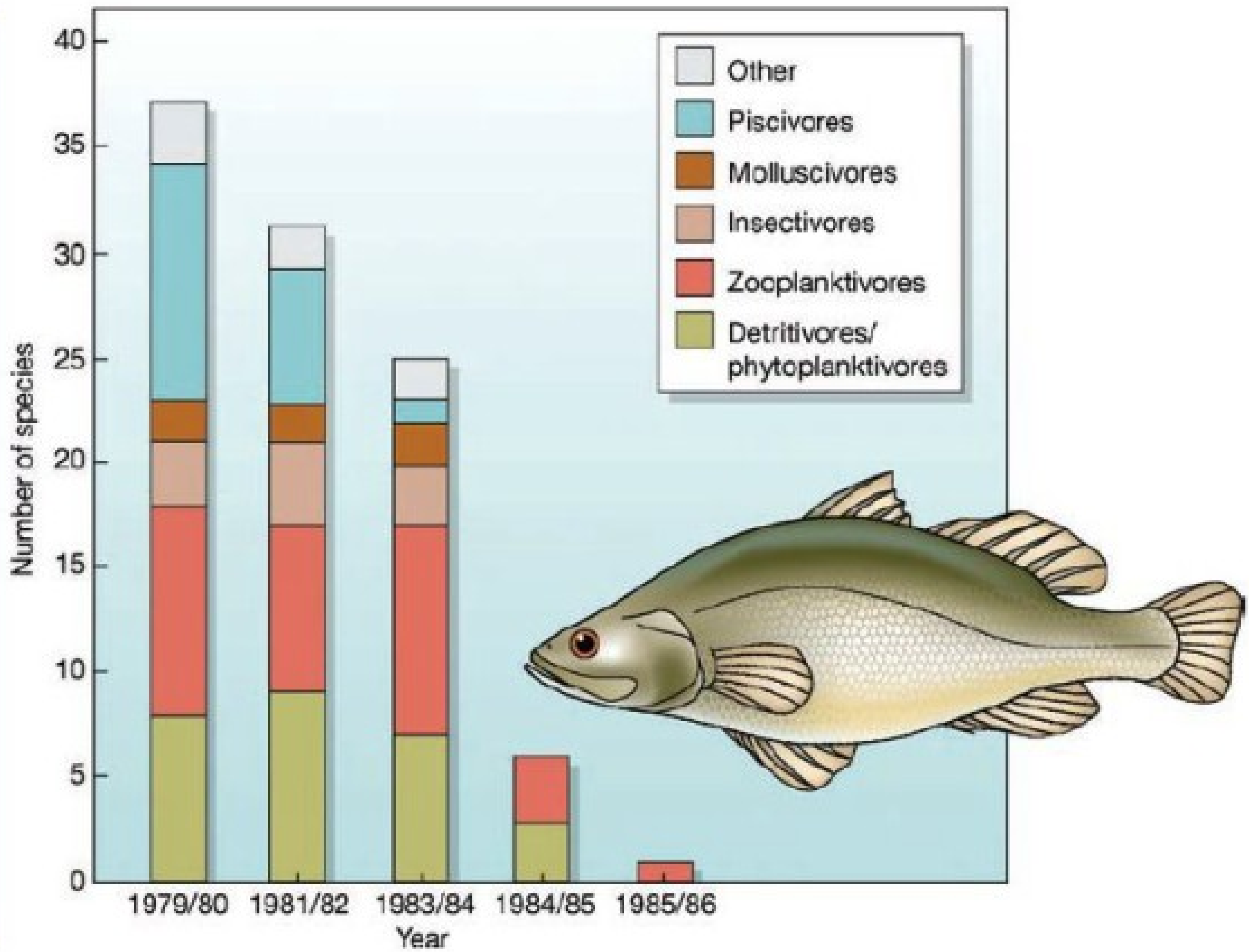
Environment	Taxon	Region	Natives	Exotic[a]	% exotic	Source[b]
Terrestrial	Plants	Chile	4681	690	12.8	1, 2
		Islas Juan Fernández, Chile	209	232	52.6	3
		Central Chile	2395	507	17.5	2
		Tierra del Fuego (Arg. and Chile)	545	128	19.0	2
		Buenos Aires Province (Arg.)	1326	404	23.4	5
		Sierra de San Javier, Tucumán (Arg.)[c]	79	15	16.0	6, 7
	Amphibians	Pampa-Monte (Arg.)	83	0	0	8, 9
		Patagonian steppe	10	0	0	8, 9
		Chile	42	1	2.3	10
	Reptiles	Argentina	—[d]	1	—[d]	9
		Chile	89	6	6.3	10
	Birds	Argentina	951	11	1.1	9, 11
		Chile	380	5	1.3	10
	Mammals	Argentina	300	19	6.0	9, 12
		Chile	147	15	9.3	10
	Aphids	Chile	31	104	77.0	13
	Bees	Chile	348	2	0.6	14
	Oligochaetes	Sierras Chicas, Córdoba (Arg.)	5	12	70.6	15
	Mollusks	Chile	132	9	6.4	16
Freshwater	Bivalves	Río de la Plata	23	3	11.5	17
	Mollusks	Chile	83	0	0.0	16
	Fish	Argentine Patagonia	20	10	33.3	18
		Río Tercero, Córdoba (Arg.)	29	4	12.1	19

[a]For marine groups, the number of cryptogenic species is also given between parentheses. [b]Data sources: (1) Marticorena and Quezada (1985); (2) Arroyo et al. (2000); (3) Greimler et al. (this issue); (4) Rapoport and Brion (1991); (5) Söyrinki (1991); (6) Morales (1995); (7) Grau and Aragón (2000); (8) Duellman (1999); (9) Navas (1987); (10) Jaksic (1998); (11) Narosky and Yzurieta (1987); (12) Olrog and Lucero (1980); (13) Fuentes-Contreras et al. (1997); (14) Toro (1986); (15) Mischis (1999); (16) Valdovinos-Zarges (1999); (17) Darrigran (1995); (18) Pascual et al. (this issue); (19) Haro et al. (1996). [c]Only trees were included. [d]No data available.

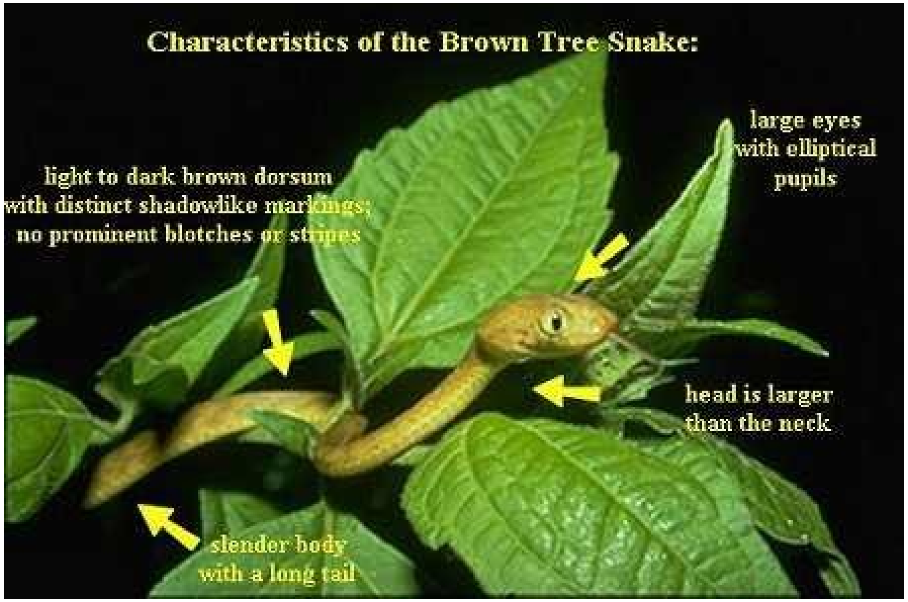
Fuente: Vázquez & Aragón (2002) Biol. Inv. 4: 1-5

Invasiones biológicas

Figure 10.7 The introduction of Nile perch to Lake Victoria led to the extirpation of over 200 species of fish and significant changes in the lake's food web. (Redrawn by permission from Witte et al. 1992b.)

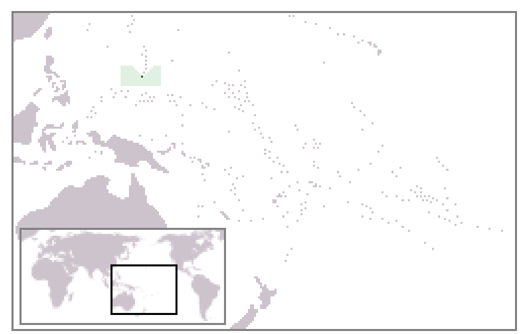


Invasiones biológicas



Serpiente arborícola marrón
(*Boiga irregularis*)

- De las 18 especies de aves nativas de Guam, 9 se extinguieron por la depredación de *B. irregularis*, y el resto están seriamente amenazadas

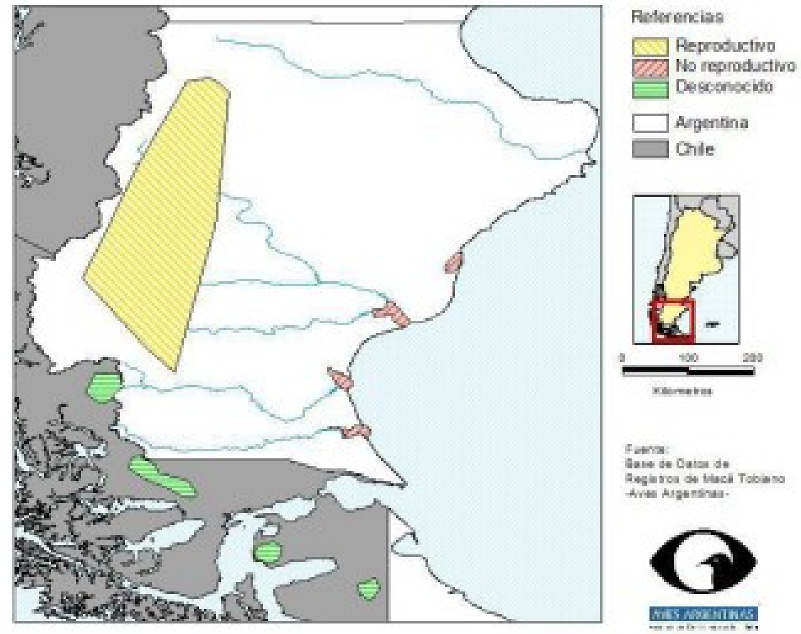


Fuente: Fritts & Rodda (1998) Ann. Rev. Ecol. Syst. 29: 113-140

Invasiones biológicas

Macá tobiano (*Podiceps gallardoi*)

Distribución geográfica del Macá Tobiano *(Podiceps gallardoi)*



Cadenas de extinción

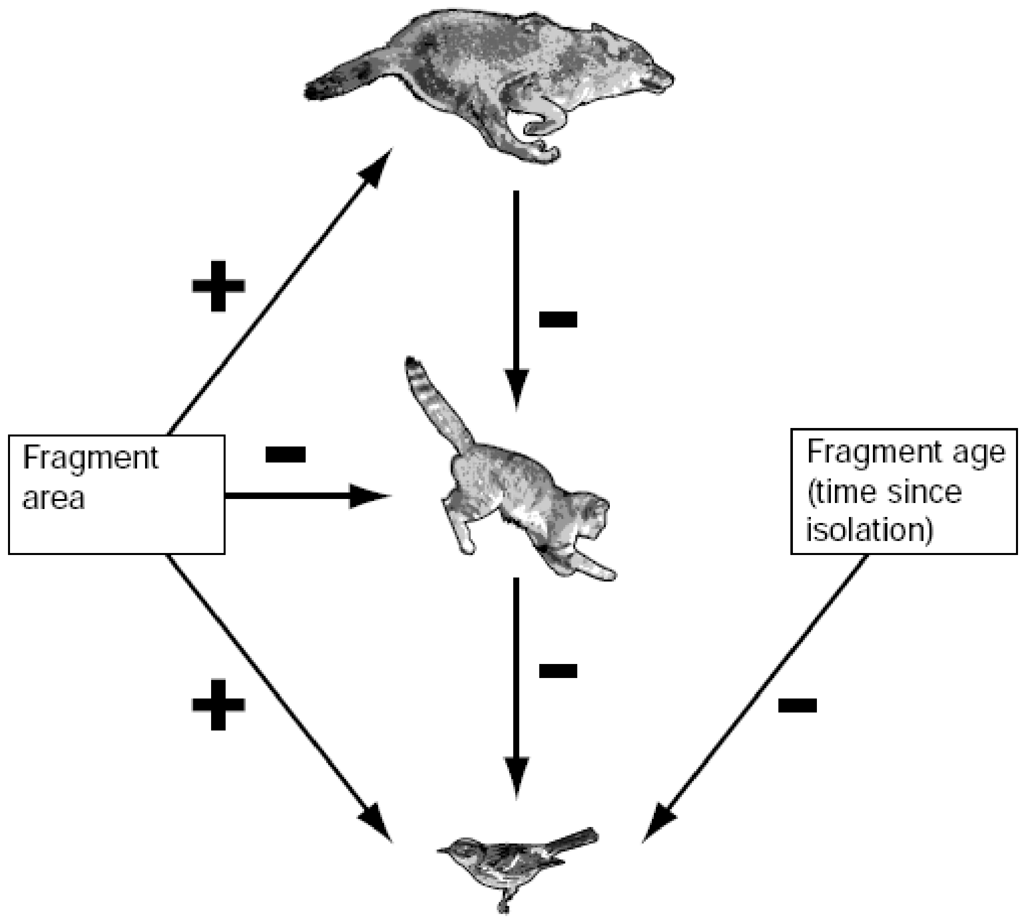


Figure 1 Model of the combined effects of trophic cascades and island biogeographical processes on top predators (for example, coyote), mesopredators (domestic cat) and prey (scrub-breeding birds) in a fragmented system. Direction of the interaction is indicated with a plus or minus.

Fuente: Crooks & Soulé (1999) Nature 400: 563-566

Contaminación

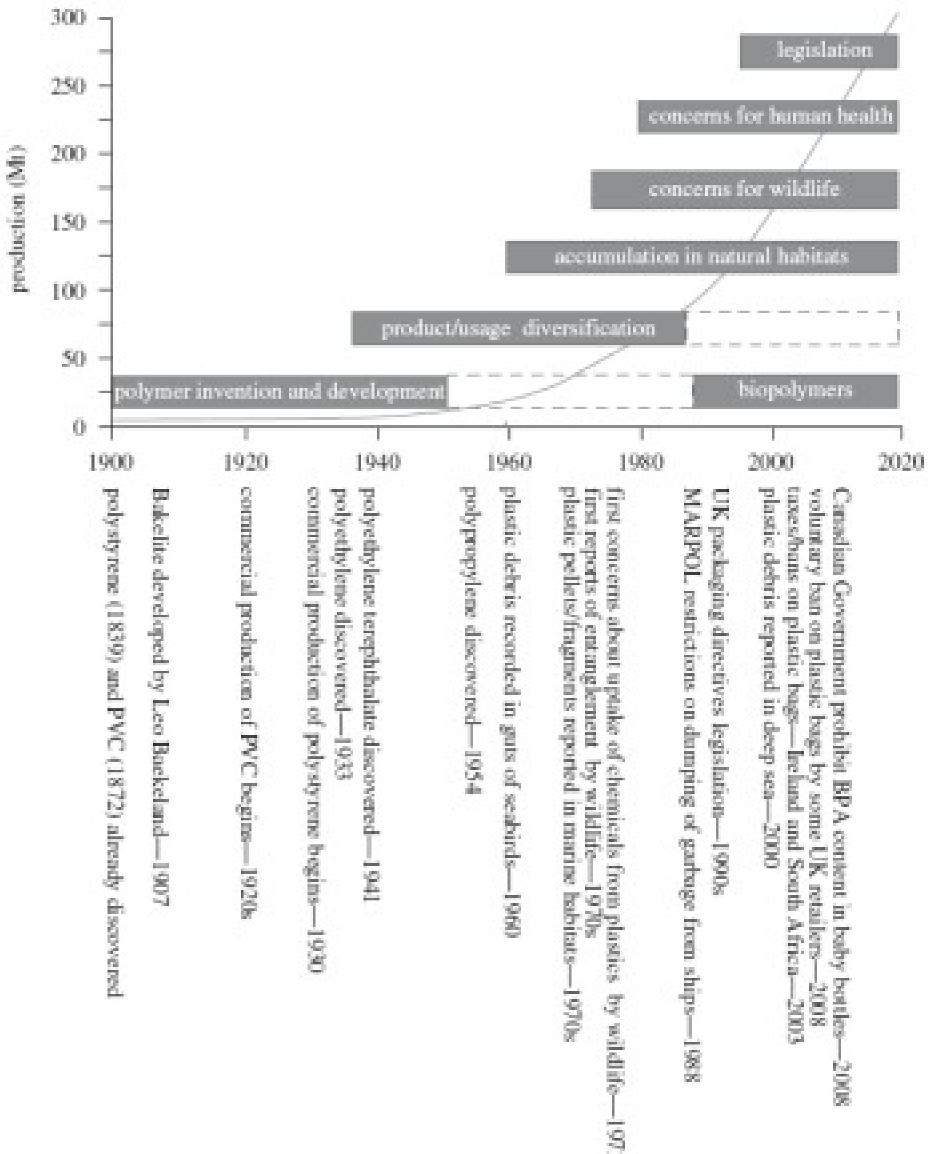


Figure 1. Summary illustrating historical stages in the development, production and use of plastics together with associated concerns and legislative measures (numerous sources). Solid red line shows plastic production in millions of tonnes (Mt). Reproduced with permission from APME (2006). BPA, bisphenol A; PVC, polyvinyl chloride.

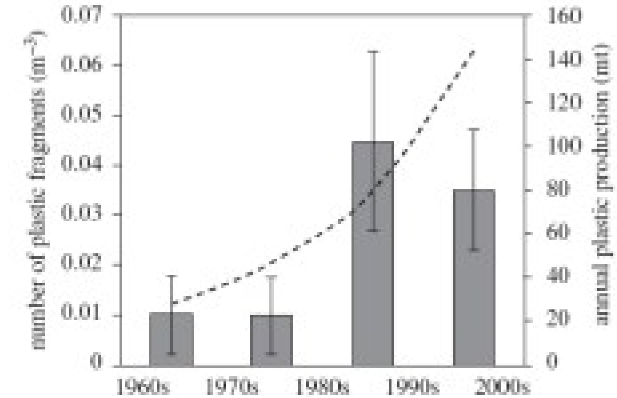


Figure 8. Microscopic plastic in surface waters, collected with continuous plankton recorder, revealed a significant increase in abundance when samples from the 1960s and 1970s were compared with the 1980s and 1990s ($F_{3,3} = 14.42$, $p < 0.05$). Global production of plastic overlain for comparison (APME 2006). Grey boxes, number of plastic fibres (m^{-3}); dashed line, plastic produced per year (million tonnes). (Reproduced with permission from Thompson *et al.* 2004.)

Figure 1. Debris (mainly plastic) collected during an annual beach clean at Mason Bay, South Island, New Zealand.

Fuente: Thompson et al., Barnes et al., Gregory (2009) Ph. Trans. R. Soc. B 364: 1985-

Contaminación

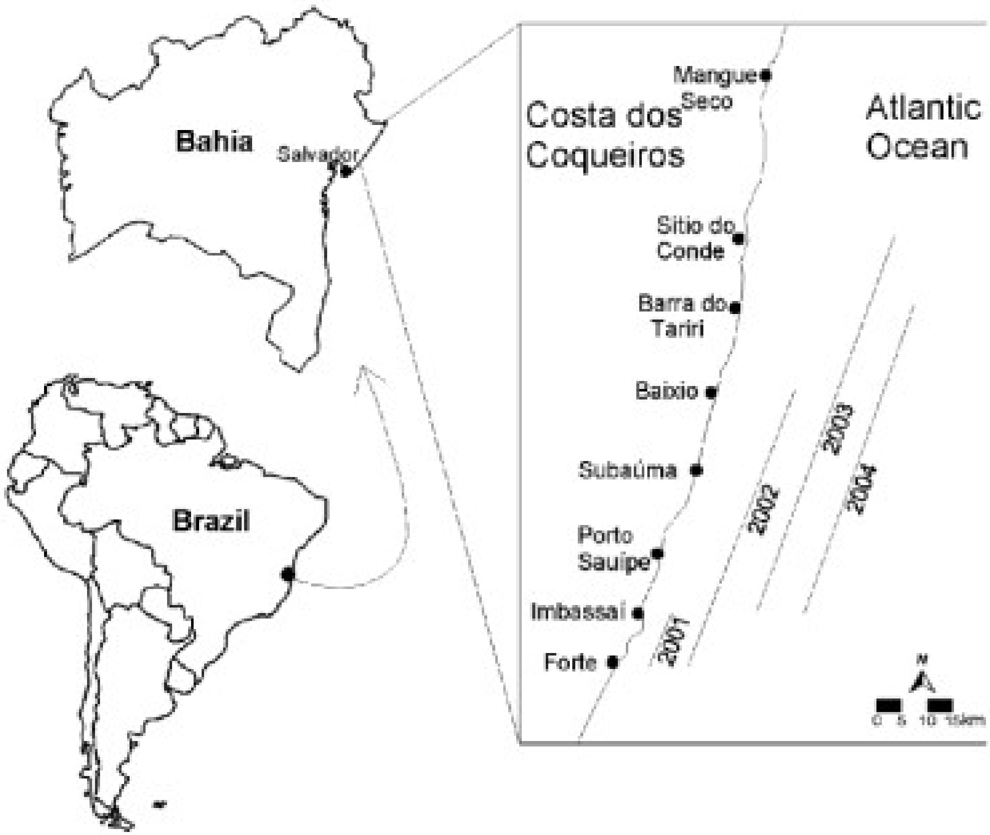


Fig. 1. Map of the study area and beach sectors sampled between 2001 and 2004.

Table 2
Percentage of original content of containers found on Costa dos Coqueiros beaches

Product	2001	2002	2003	2004	Total
Mineral water	22.3	37.9	30.5	38.2	35.3
Milk/juice	21.3	11.2	13.8	11.3	12.4
Cosmetics/toiletries	13.8	10.5	8.6	8.1	9.4
Household cleaners	16.0	10.7	14.2	9.9	11.6
Food	11.7	12.2	11.5	14.6	12.8
Insecticides	8.5	1.6	4.4	1.8	2.7
Soft drinks	3.2	4.9	6.9	6.7	5.9
Alcoholic drinks	0.0	1.2	2.9	1.3	1.6
Drugs	0.0	1.0	1.0	1.9	1.2
Lubricating oil	1.1	0.0	3.4	2.9	1.9
Others/not identified	2.1	8.6	2.7	3.3	5.1
Total	100	100	100	100	100

Table 3
Percentage of country of origin of containers found on Costa dos Coqueiros beaches

Country	2001	2002	2003	2004	Total
USA	10.6	13.7	14.8	8.6	12.2
Italy	3.2	9.6	3.8	9.2	7.6
South Africa	9.6	6.2	5.2	7.2	6.4
Argentina	5.3	4.2	5.2	8.9	6.0
Germany	8.5	5.9	5.7	4.6	5.6
United Kingdom	6.4	4.4	5.9	3.5	4.6
Taiwan	4.3	7.3	2.1	2.9	4.4
Singapore	0.0	1.4	5.7	5.1	3.6
Spain	4.3	4.0	3.6	3.0	3.6
Malaysia	3.2	2.9	1.9	4.5	3.1
Others	38.3	33.7	38.9	33.3	35.2
Unidentified	6.4	6.8	7.1	9.2	7.6
Total	100	100	100	100	100

Fuente: Santos et al. (2005) Mar. Poll. Bull. 50: 778-786

Contaminación

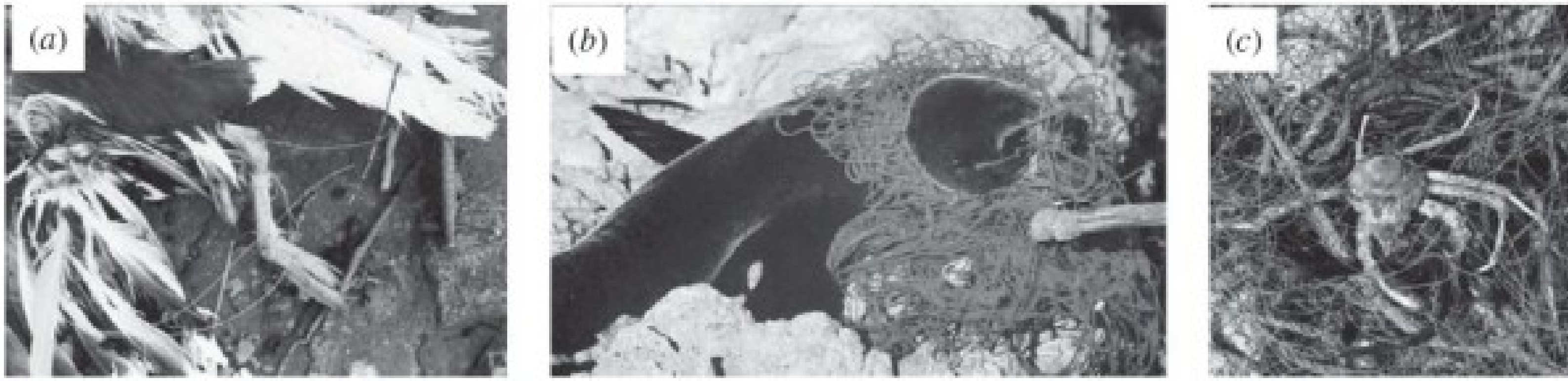


Figure 2. Examples of entanglement from New Zealand that draw immediate public sympathy and anger: (*a*) Karoro (southern black-backed gull, *Larus dominicanus*) caught and hooked in nylon filament fishing line; (*b*) a New Zealand fur seal trapped in discarded netting and (*c*) Ghost fishing—derelict fishing gear dredged from >100 m on the Otago shelf.

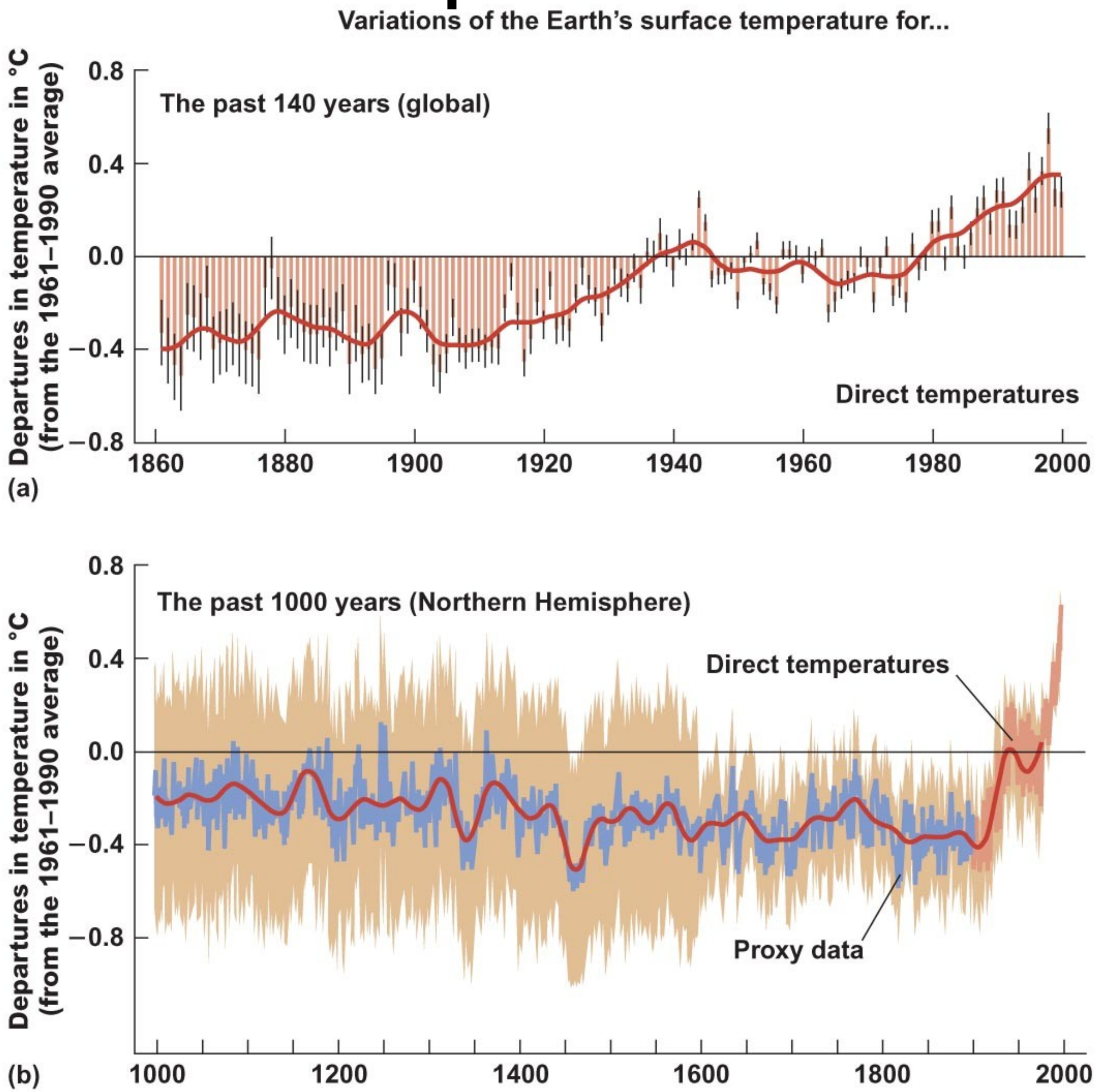
Figure 3. Examples of ingestion: (*a*) Laysan Albatross (*Phoebastria immutabilis*, at Kure Atoll, Courtesy of AMRF); (*b*) plastic from the stomach of a young Minke whale (*Balaenoptera acutorostrata*) that had been washed ashore dead in France (Courtesy of G. Mauger & F. Kerleau, Groupe d'Études de Cétacés du Cotentin GECC) and (*c*) stranded sea turtle disgorging an inflated plastic bag. One infers that it has been mistaken for an edible jellyfish (medusoid).

Fuente: Gregory (2009) Phil. Trans. R. Soc. B 364: 2013-2025

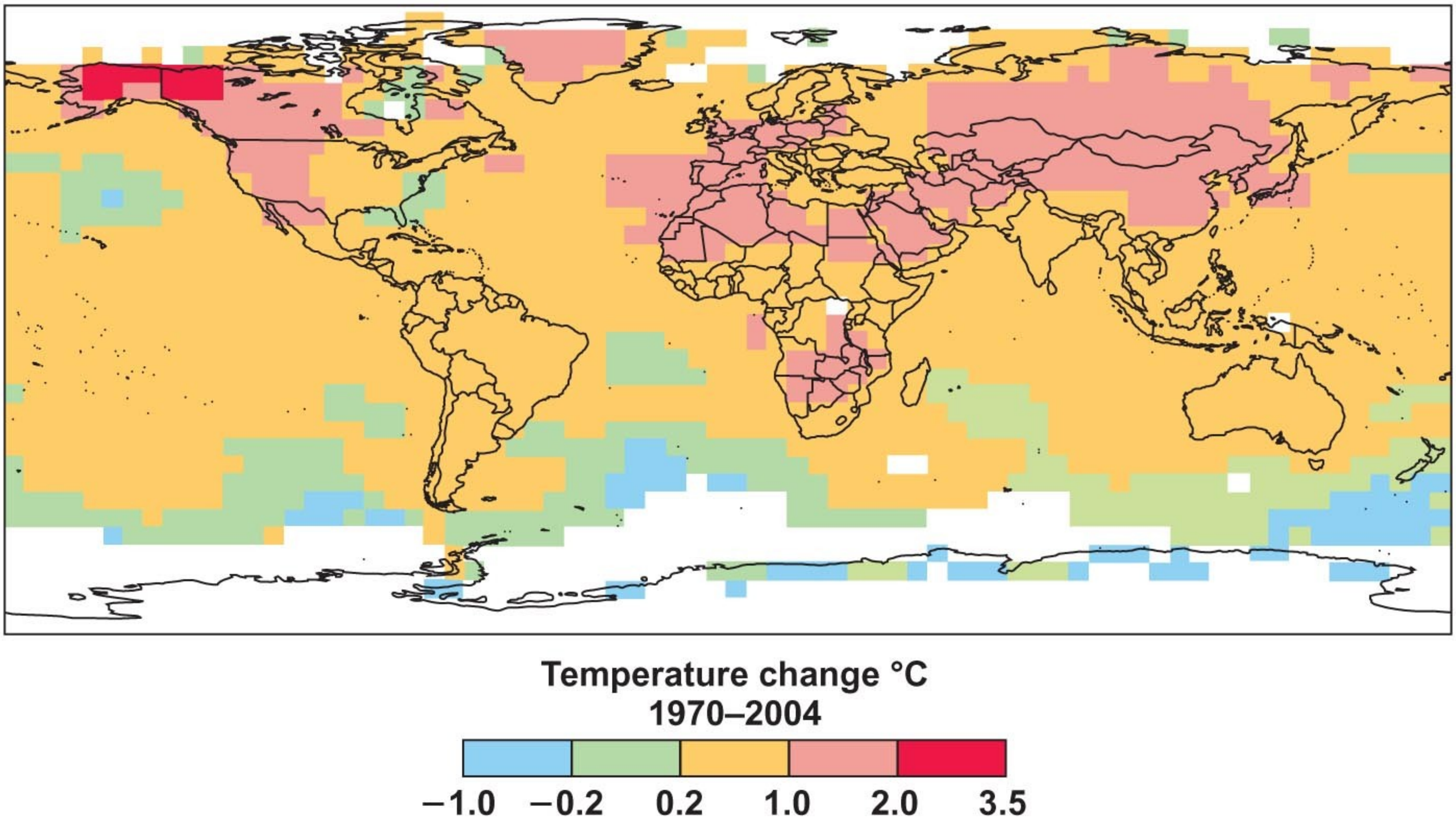
Teórica 22: Esquema conceptual

- Cosecha de poblaciones (cap. 15 de Krebs)
- Control de plagas (cap. 16)
- Biología de la conservación (cap. 17)
- Cambio climático (cap. 25)
- Salud ecosistémica e impacto humano (cap. 26)

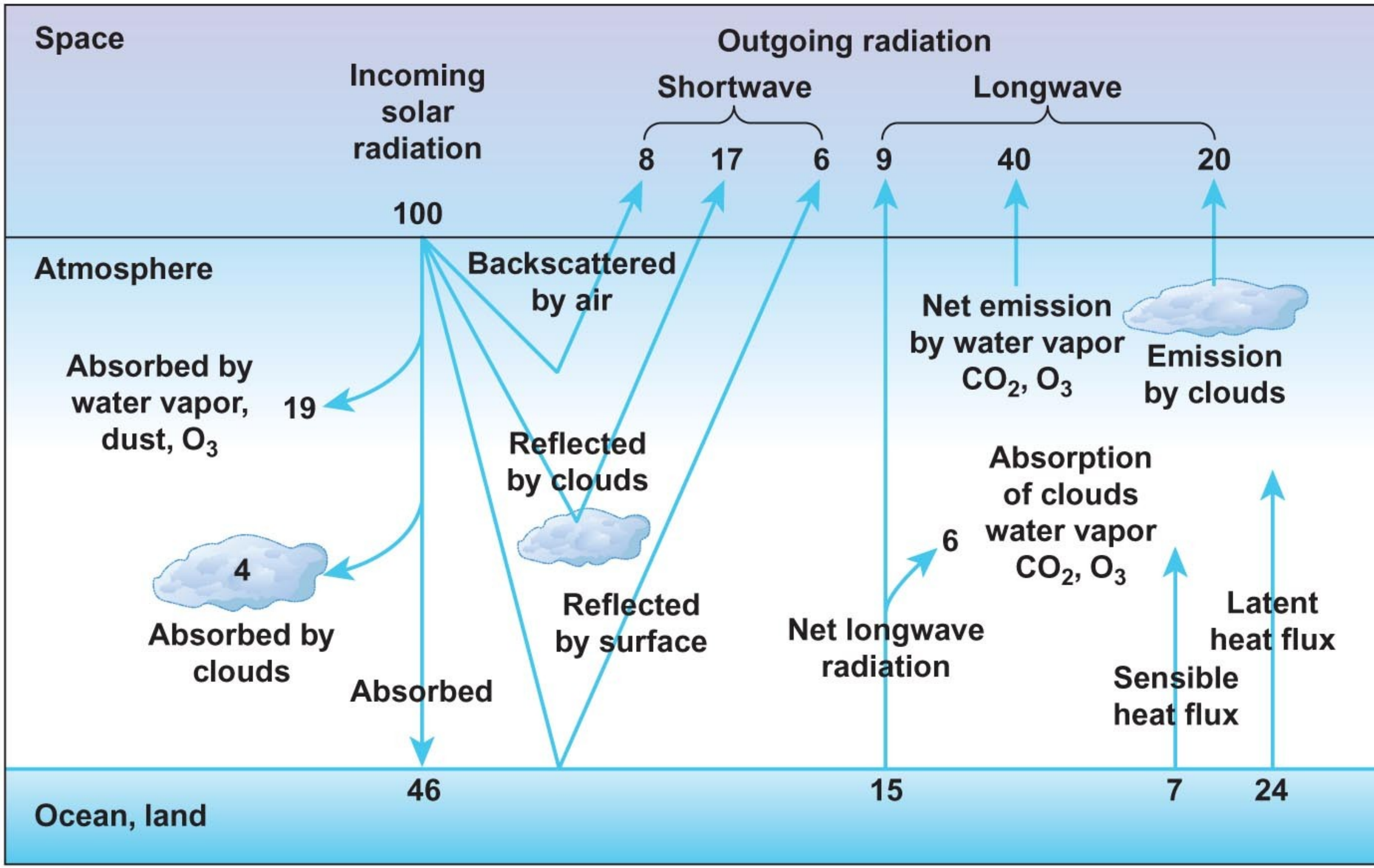
Variación histórica de la temperatura



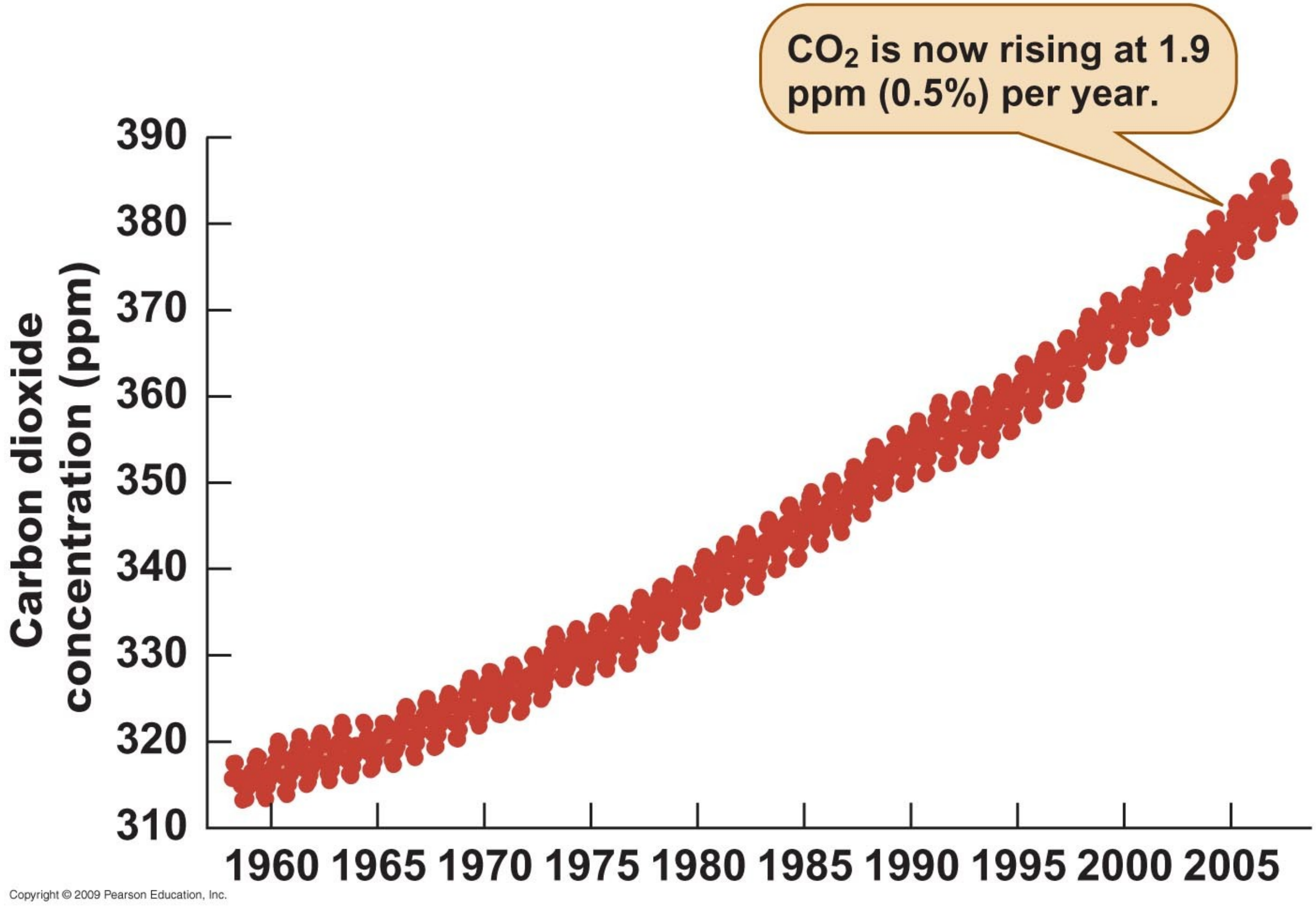
Cambio en la temperatura en distintas regiones



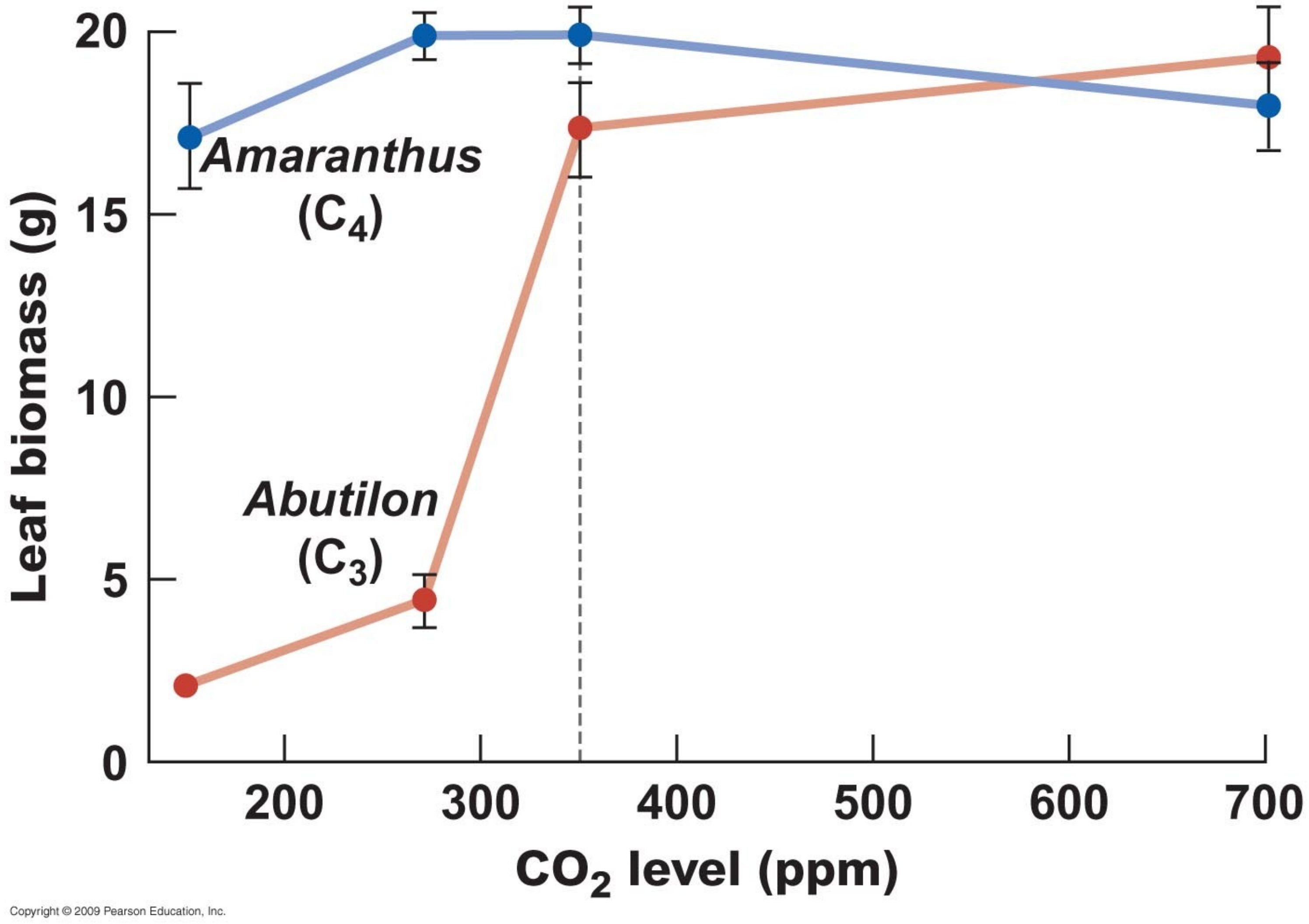
Explicación del aumento de la temperatura: efecto invernadero



Aumento del CO_2



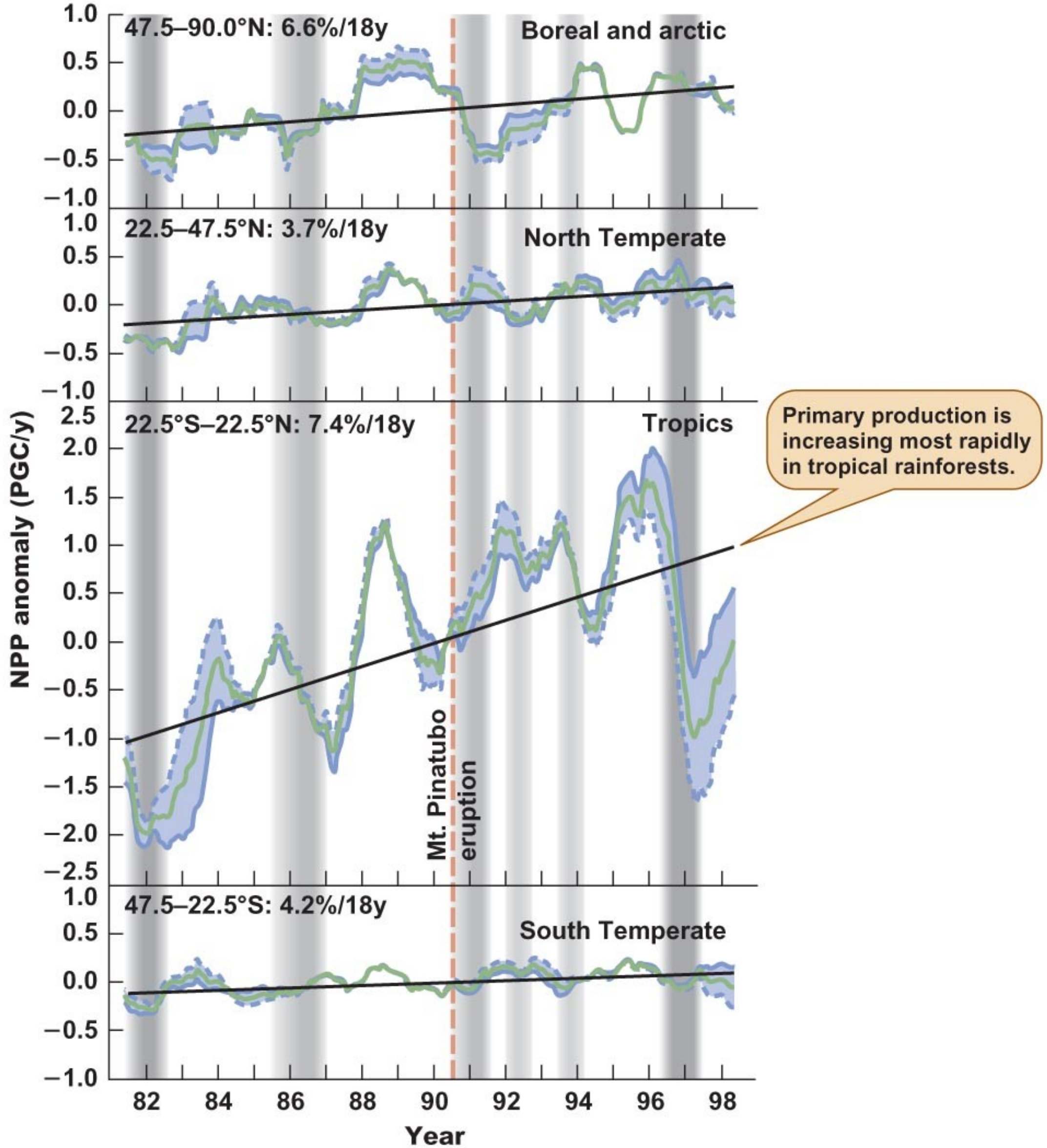
Efecto del CO_2 sobre las plantas



Efecto del CO_2 sobre las plantas

(a) (b)

Efecto del CO_2 sobre las plantas



Efecto del cambio climático sobre las interacciones

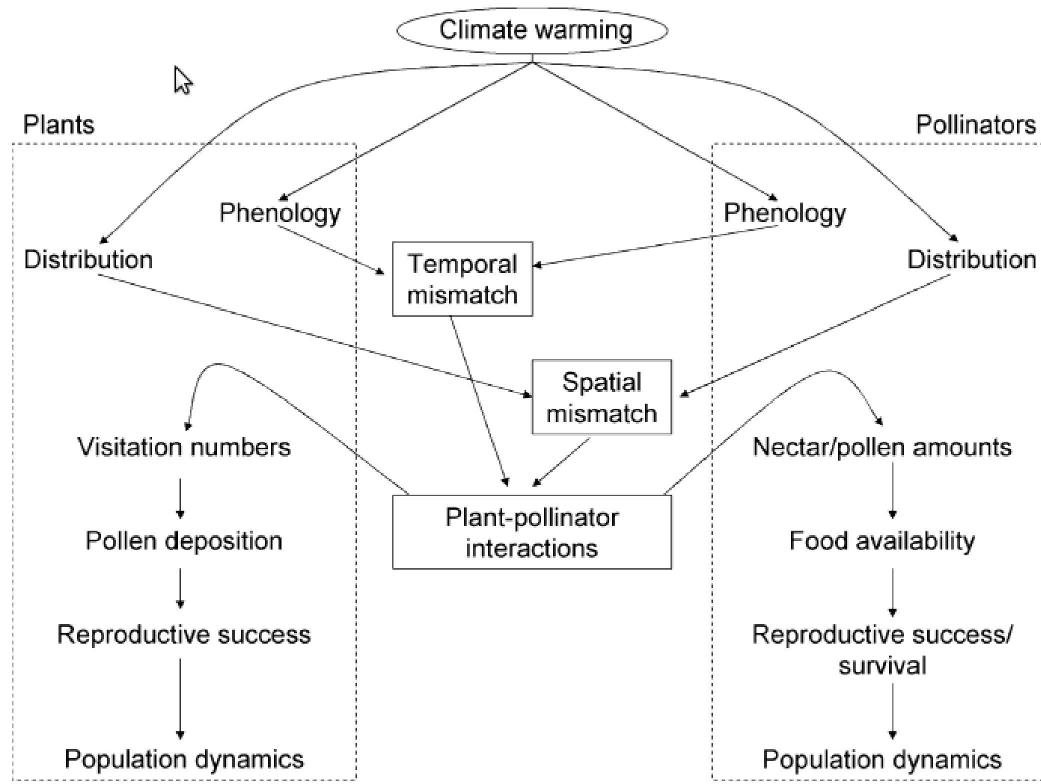


Figure 1 Framework showing how climate warming may affect the phenology and, distribution of plants (left panel) and pollinators (right panel) and thereby creating temporal or spatial mismatches in plant-pollinator interactions. In the lower half of the panels we show how and by which key factors the demography of the mutualistic partners are likely to be affected. The pathway until the mismatches is largely known, whereas the mismatches and the subsequent effects are still mostly unknown and requires additional research.

Fuente: Hegland et al. (2009) Ecol. Lett. 12: 184-195

Teórica 22: Esquema conceptual

- Cosecha de poblaciones (cap. 15 de Krebs)
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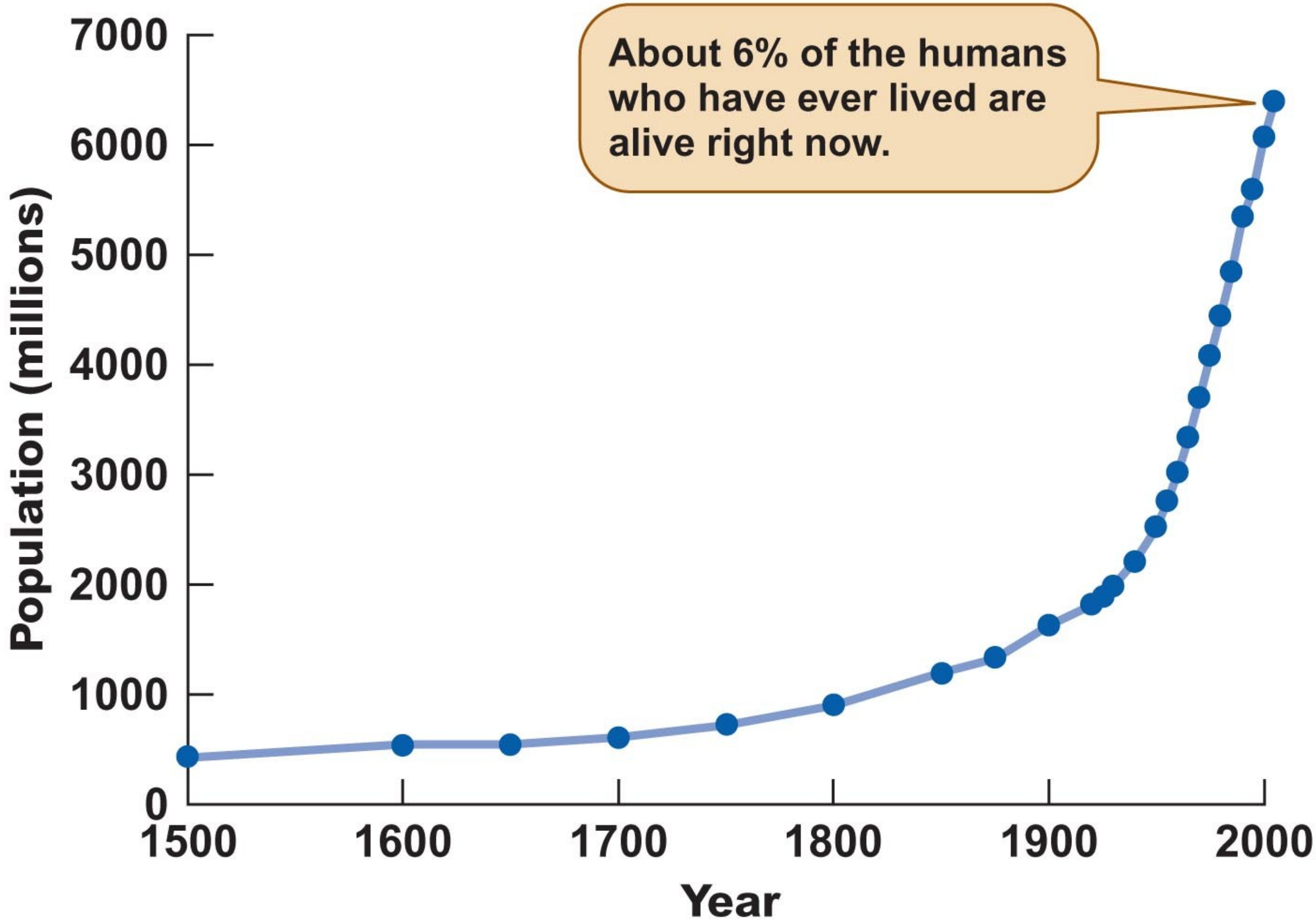
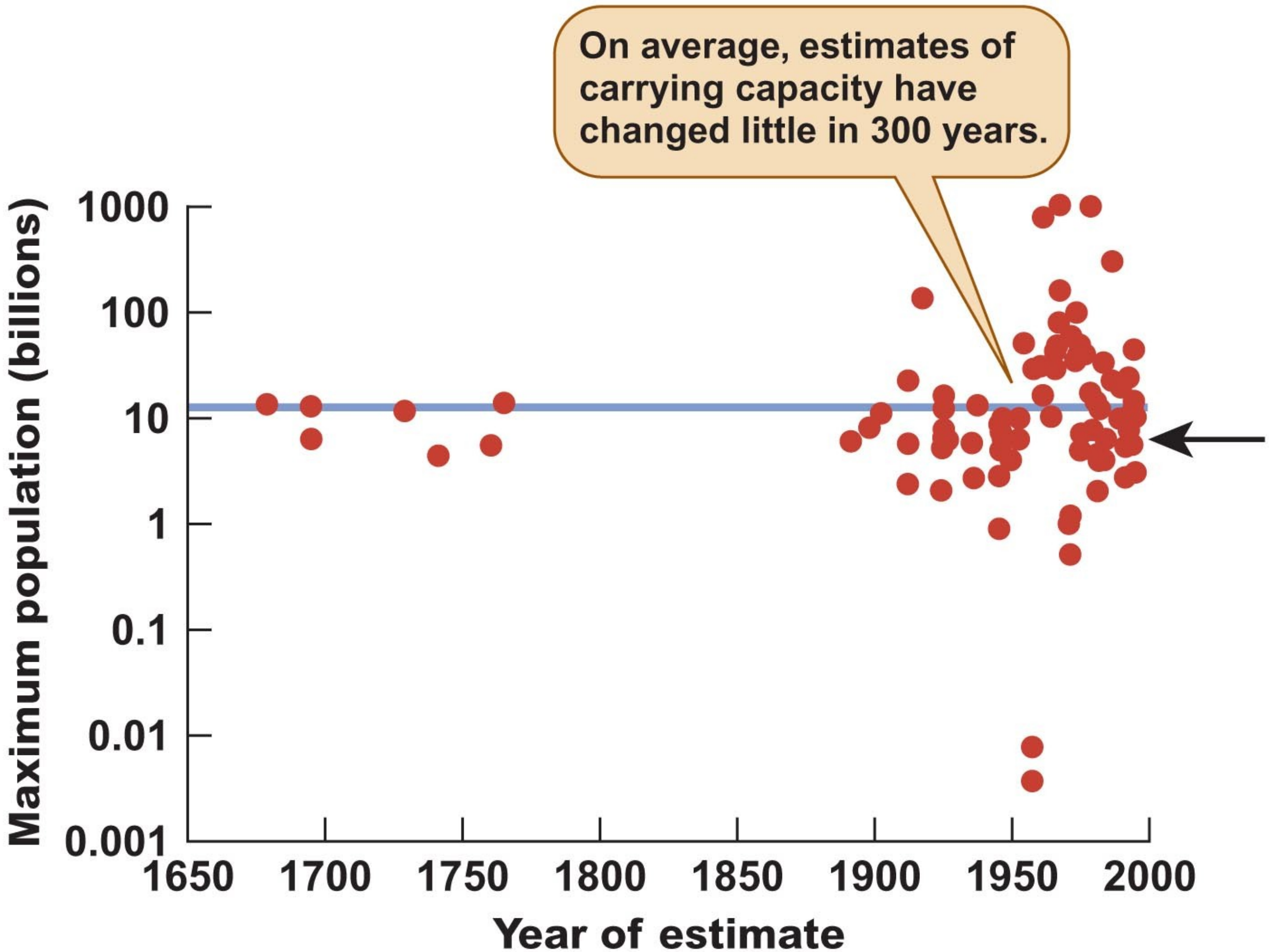
- Biología de la conservación (cap. 17)
- Cambio climático (cap. 25)
- Salud ecosistémica e impacto humano (cap. 26)

Crecimiento de la población humana en el mundo



Capacidad de carga de la tierra



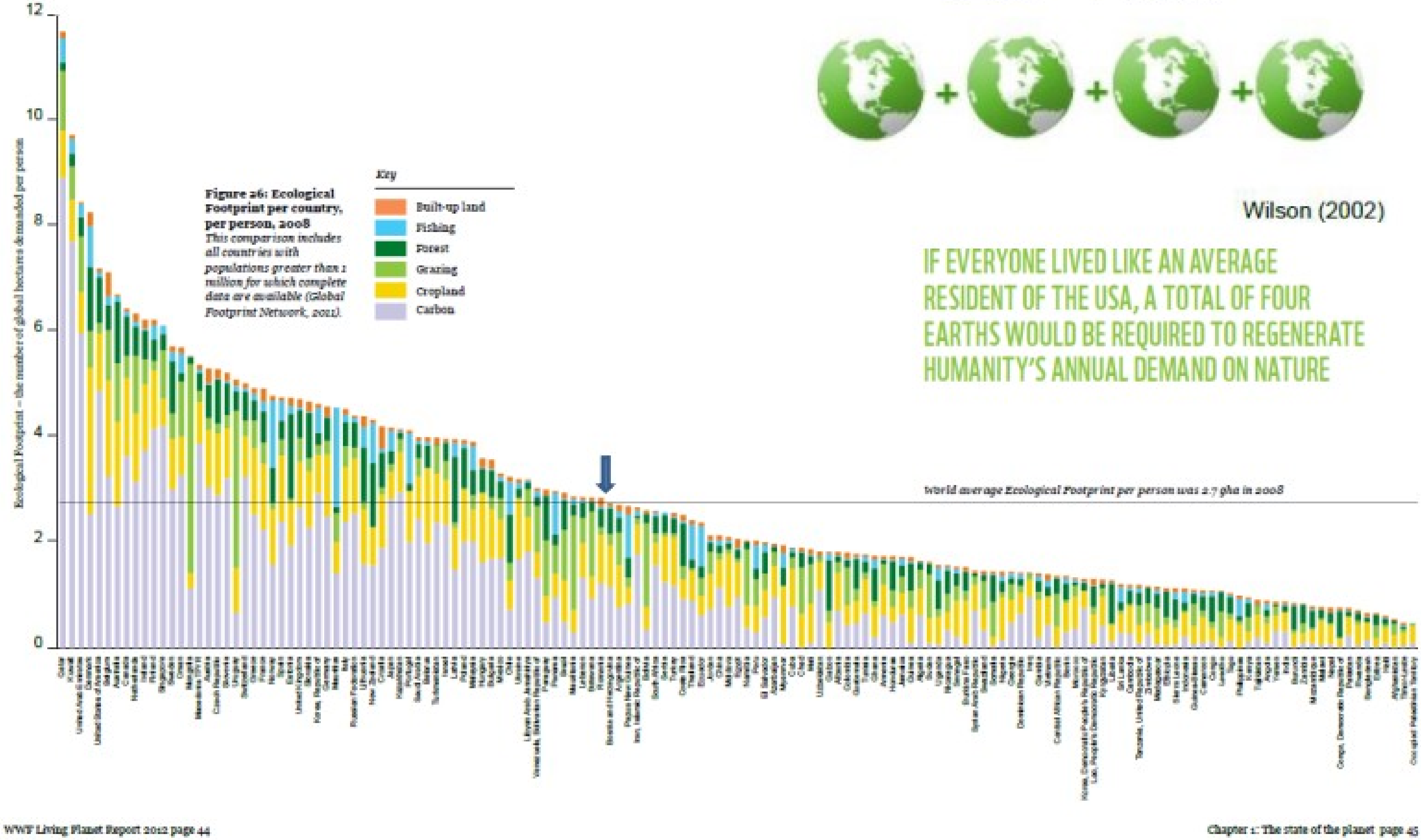
Huella ecológica

Huella ecológica

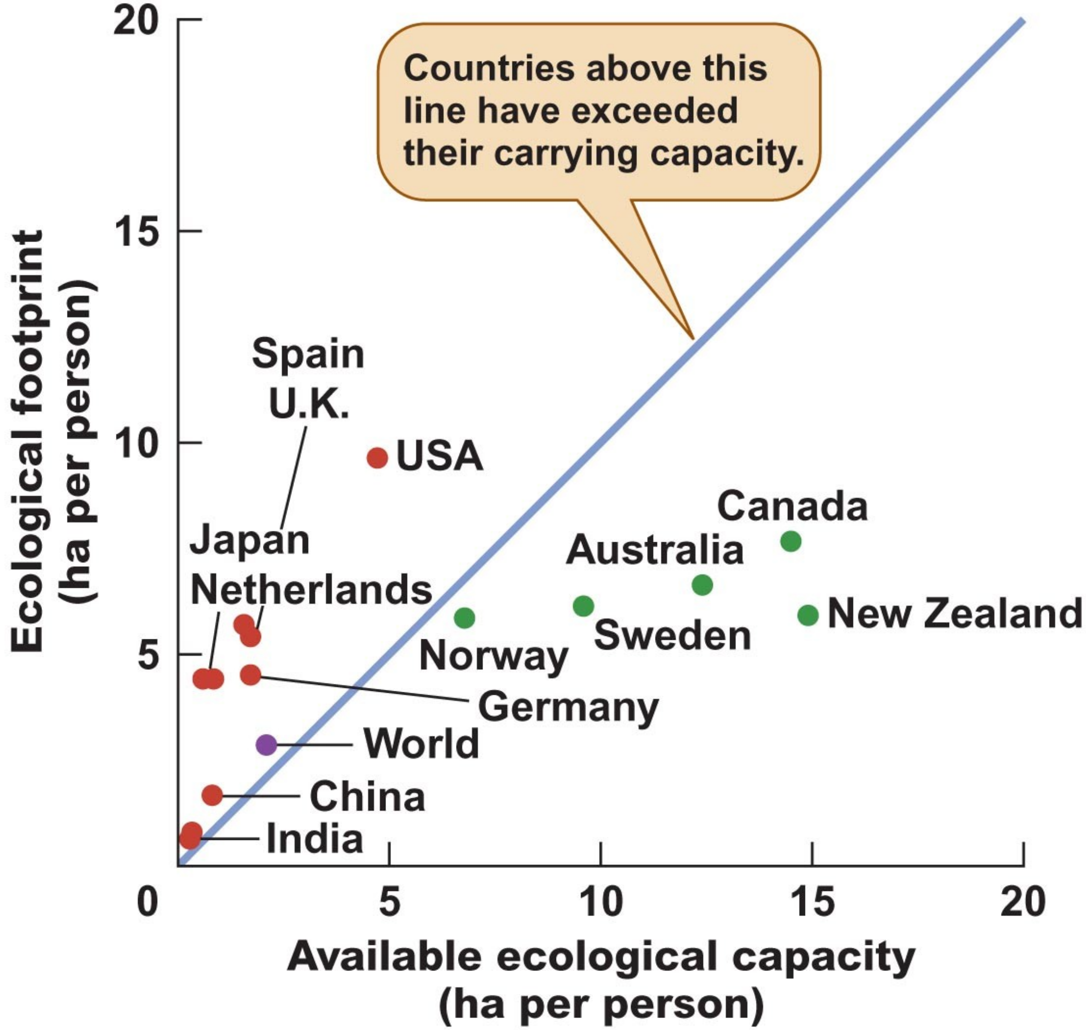
EEUU = 4 Tierras

Wilson (2002)

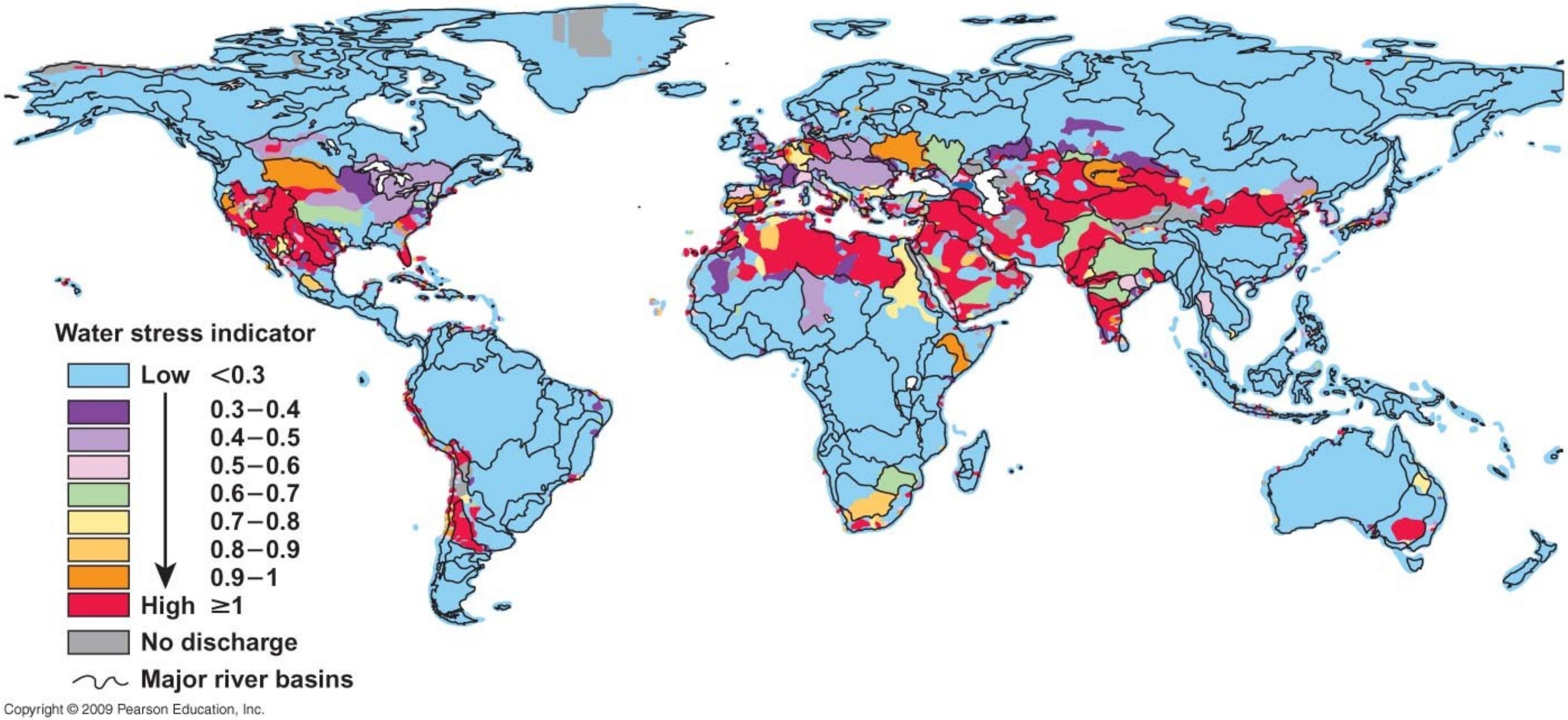
IF EVERYONE LIVED LIKE AN AVERAGE RESIDENT OF THE USA, A TOTAL OF FOUR EARTHS WOULD BE REQUIRED TO REGENERATE HUMANITY'S ANNUAL DEMAND ON NATURE



Huella ecológica



Uso del agua



Water stress indicator
Low <0.3
0.3–0.4
0.4–0.5
0.5–0.6
0.6–0.7
0.7–0.8
0.8–0.9
0.9–1
High ≥1
No discharge
Major river basins
Copyright © 2009 Pearson Education, Inc.

Uso del agua

Ciudad del Cabo, a tres meses del 'día cero'

Por primera vez una gran ciudad del mundo amenaza con dejar de suministrar agua

EL PAÍS

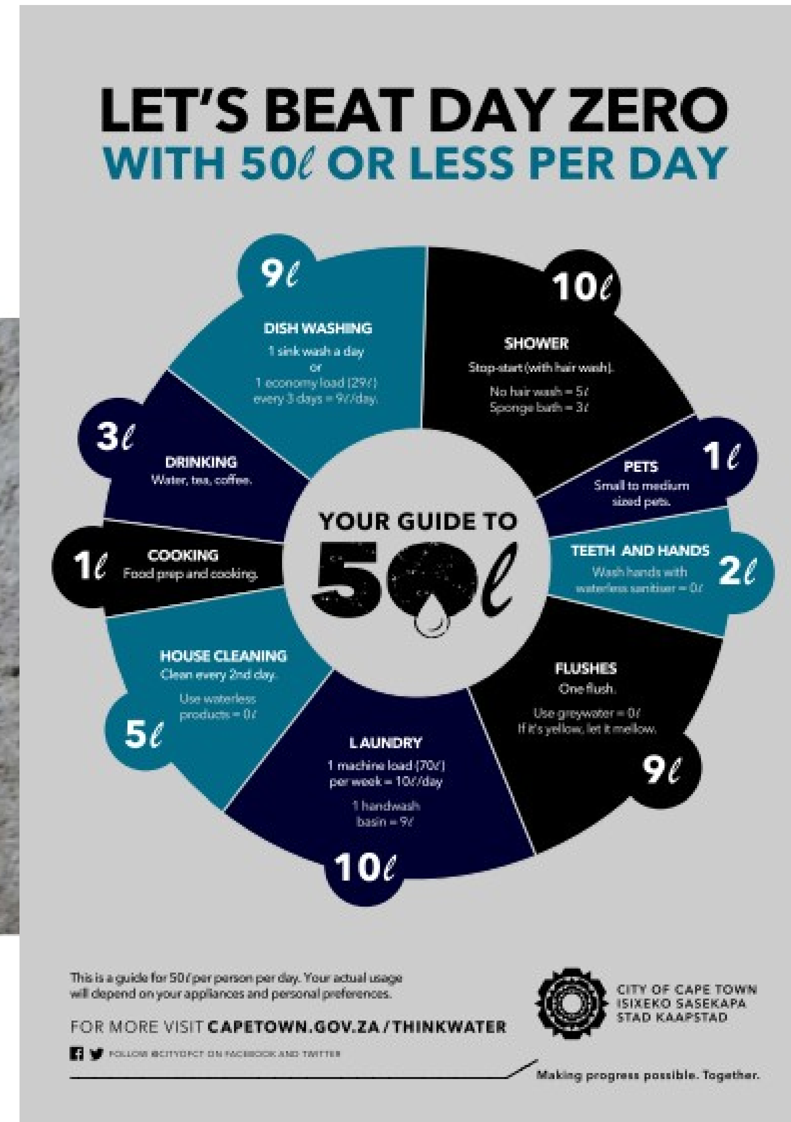
Madrid - 22 ENE 2018 - 16:07 CET

The Guardian

International edition

How Cape Town was saved from running out of water

Reusing shower water, limiting toilet flushing and night-time irrigation were among measures that saved South Africa's second city from running dry



Uso del agua

From The Times

October 21, 2009

Yemen could become first nation to run out of water

Judith Evans in Yemen

One type of vehicle is always within sight on Yemen's roads: the water truck.

The brightly co
Kalashnikov-wi
and cross dese
precious than p
can afford, with
off. Others mus
off thirst.

Yemen is set to
water, providing
populations tha
growth outstrip

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leave other are

ELPAÍS.com | Versión para imprimir | Imprimir

Yemen se queda sin agua

Cada habitante sólo dispone de 125 metros cúbicos anuales, frente a los 2.500 de media mundial - El ritmo de consumo supera al de reposición

ÁNGELES ESPINOSA

A medida que uno
que ocupan no sólo
aquí", explica Moh

Ni hasta allí, ni has
suministro sólo se p
Saná de aquí a 202

El Banco Mundial
125 metros cúbicos
el norte de África.
allá de que el abast
ciudades.

The Washington Times

Yemen's capital running out of water

21 Comments and 0 Reactions | Tweet | Share | Print | Email | More

Like

By

-

The Washington Times

5:45 a.m., Sunday, Novembe

SAN'A, Yemen | Five years ag

He grew onions, garlic and o
day.

Now, a slight breeze blows b
yellow bottle of cooking oil p
drives a motorcycle taxi and

"I just make enough for daily

Water shortages can be felt i
water trucks crisscross the c
cannot send women and chil

With well levels dropping as
specialists predict that San'a
groundwater. The shortages
is already fighting two insurg

SciDev.Net Science and Development Network
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NEWS

Yemen's capital 'will run out of water by 2025'

Omar Naje
22 October 2010 | EN

Water resources in Sana'a will dry out by 2025
Flickr/eesti

[SANA'A, YEMEN] Water shortages in Yemen will squeeze agriculture to such an extent that 750,000 jobs could disappear and incomes could drop by a quarter within a decade, according to a report.

Poor water management and the enormous consumption of water for the farming of the popular stimulant khat are blamed for the predicted water shortages, which experts say could lead to the capital Sana'a running out of water by around 2025.

The report was produced by McKinsey&Company, an international management consulting firm, which was charged by the Yemeni government with identifying ten governmental priorities for the next decade. A preliminary draft of the report was released last month (24 September).

Yemen has no rivers, so the main sources of water are groundwater and rain. The study warns that almost 90 per cent of the country's available freshwater is used for agriculture.