



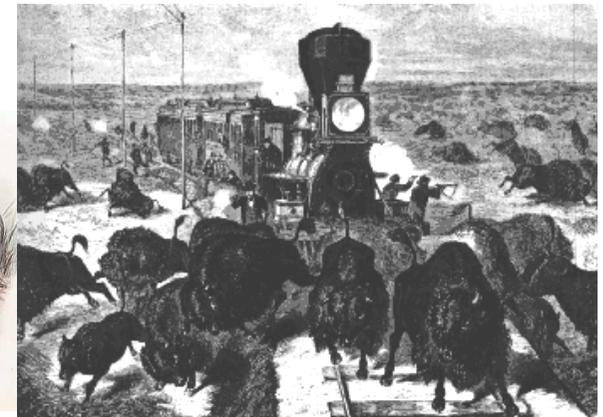
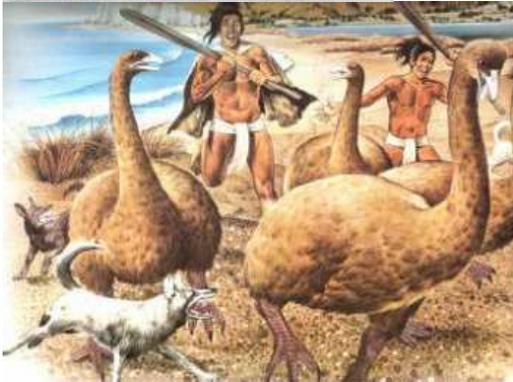
Nature Conservation

(semester course)

Threat by Hunting

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Which species are under threat?

Characteristic traits of particularly endangered species (1)

- very small range
 - birds restricted to one or few oceanic islands
 - fish restricted to a single lake (pool!) or a single river system
- with a single or a small number of populations
- with small populations / low density
 - large predators
 - highly specialized species
- requiring a large home range
- of large body size (the largest within its taxonomic group)
- with slow population growth (K-strategists)
- lacking effective mechanisms of dispersal (e.g. unable to fly)

Which species are under threat?

Characteristic traits of particularly endangered species (2)

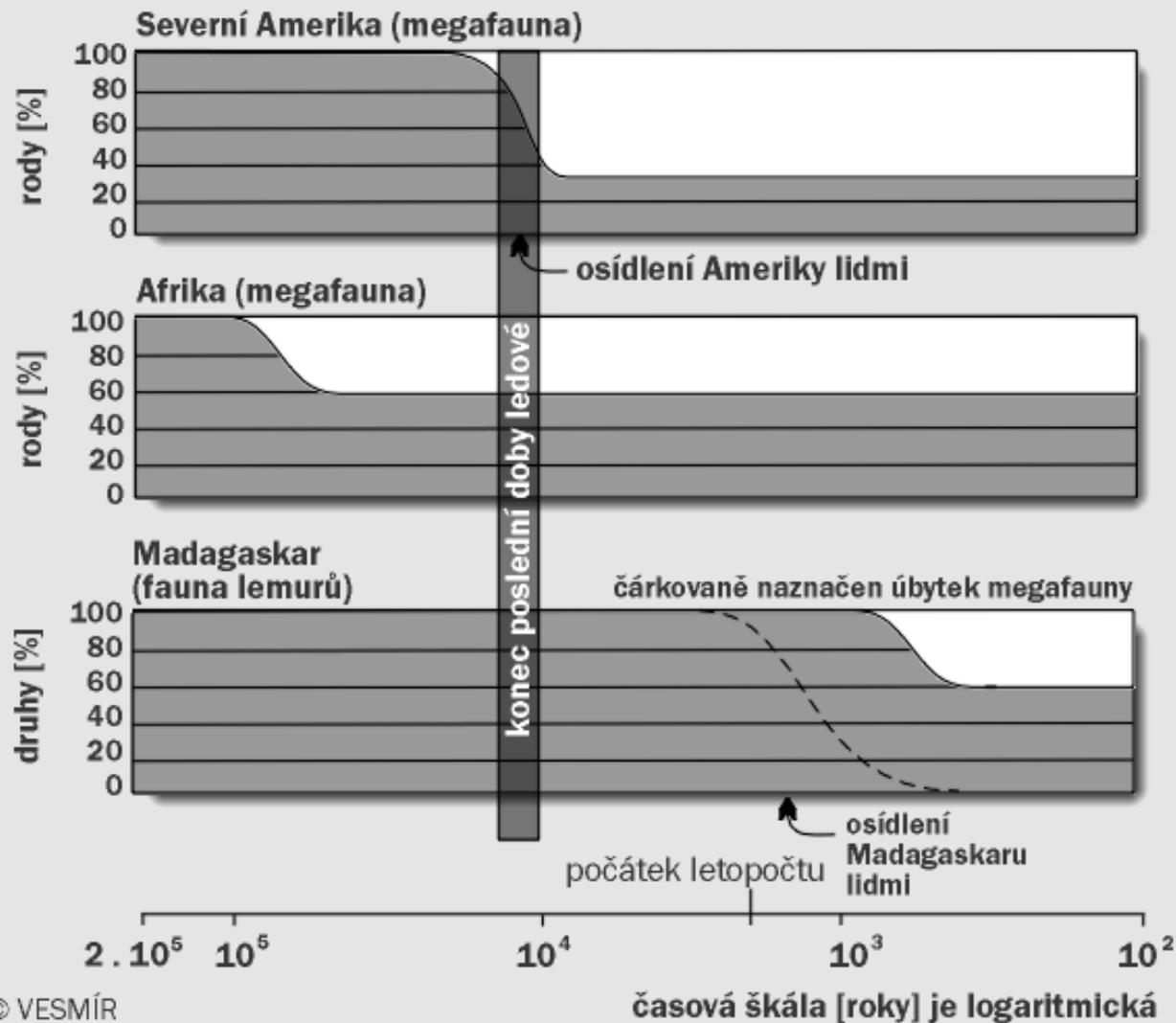
- living in stable environments (e.g. in tropical primeval forests, in cavities of ancient trees)
- migratory species
- living permanently or temporarily in groups
 - herds of hoofed animals (bison, wild horse, onager, kulan)
 - bats (caves),
 - migratory birds (e.g. passenger pigeon),
 - birds breeding in colonies,
 - fish (salmon),
 - sea turtles (laying eggs),...
- hunted or collected by man

Threat to species by hunting

North
America
(megafauna;
genera in %)

Africa
(megafauna;
genera in %)

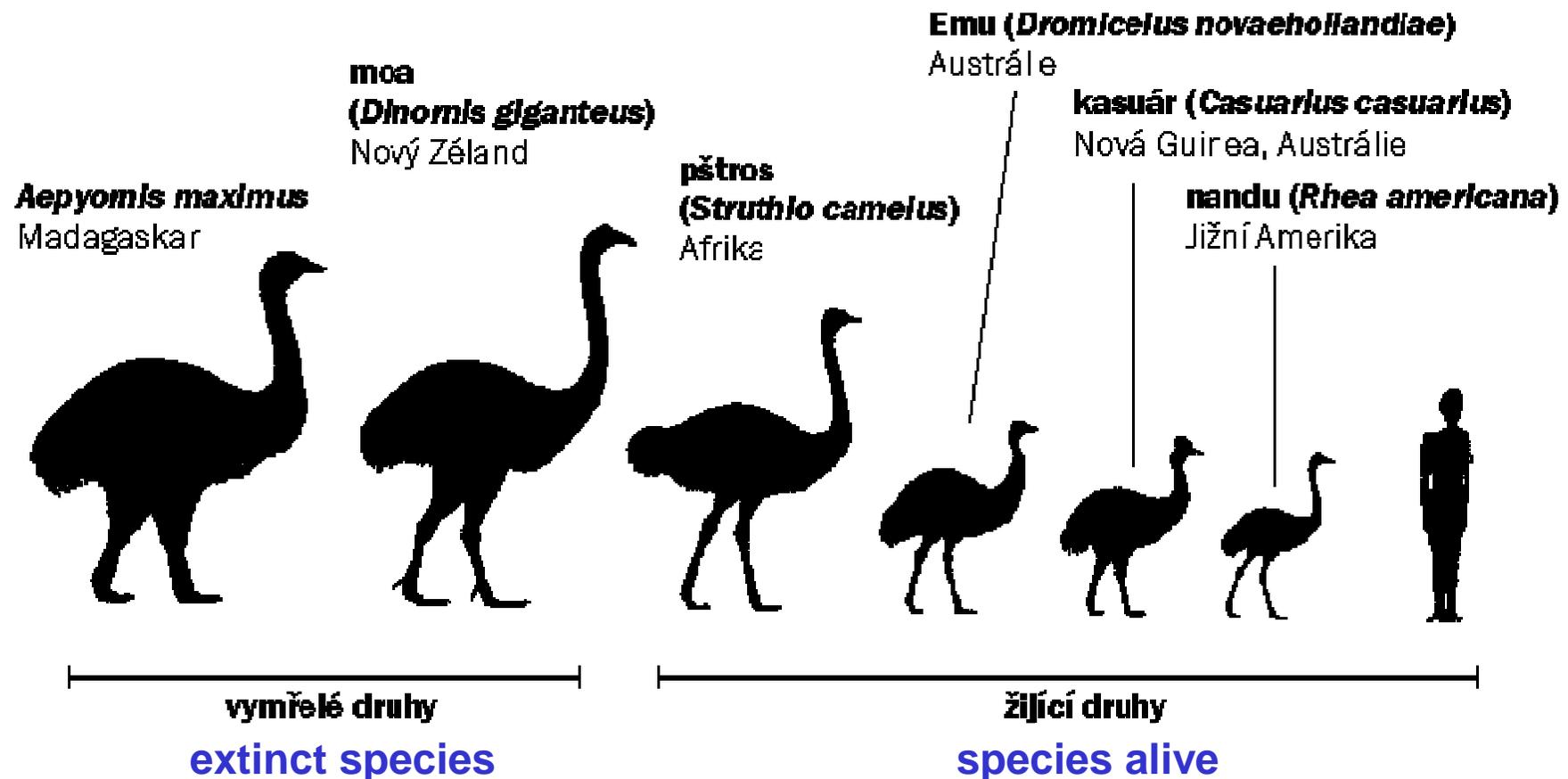
Madagascar
(lemures;
species in %)



Decline of megafauna or lemures in dependence on the arrival of humans

Threat to species by hunting

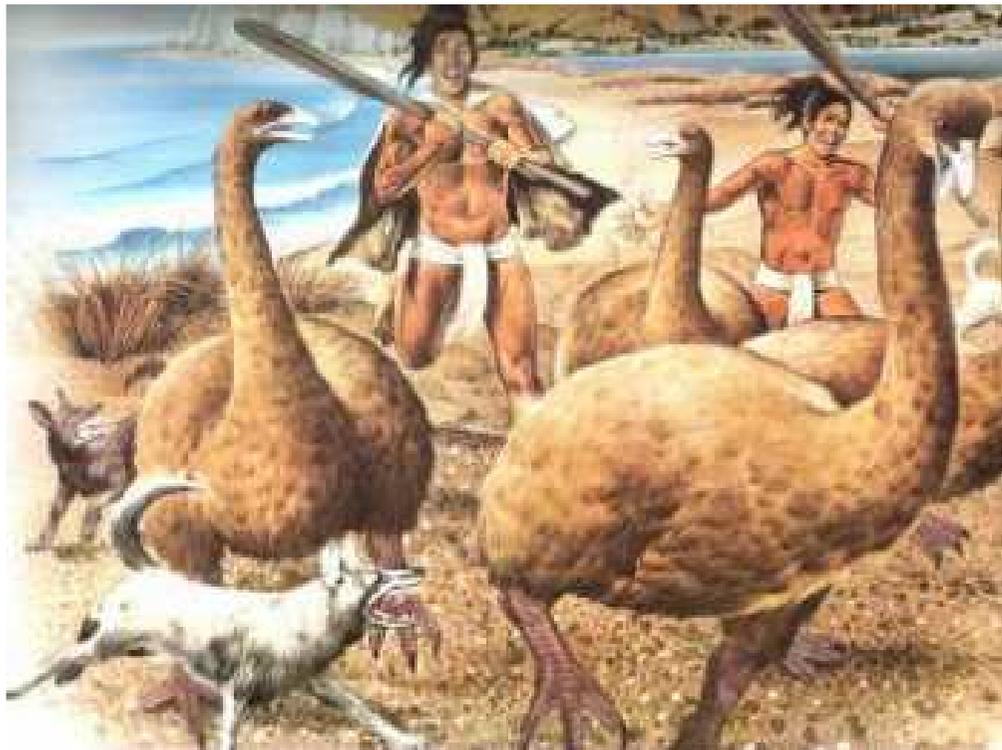
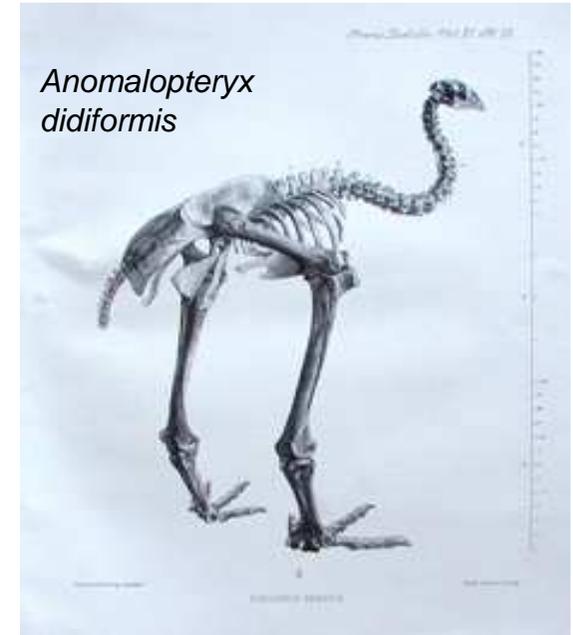
Comparison of the size of extinct birds, Aepyornitids (elephant birds) and Moas in comparison with other birds incapable of flight and man



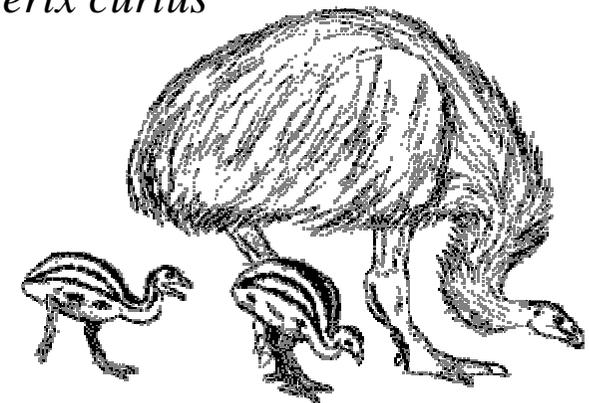
Threat to species by hunting

The Moa Birds (Diornithiformes)

- New Zealand
- about 10 species (2 families)
- mostly woodland species
- from 20 kg up to over 230 kg (2 m at the withers)
- last one killed in 1785?



Euryapterix curtus



Threat to species by hunting

The Haast's eagle (*Harpogornis moorei*)

- New Zealand
- females up to 13 kg, wing spread 3 m
- youngest bones ca 500 years old

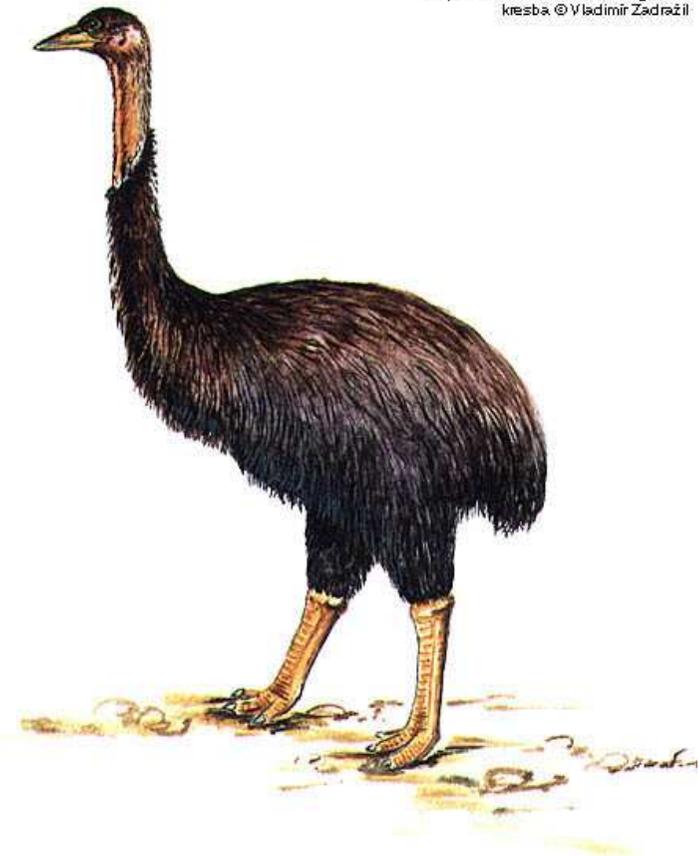


Threat to species by hunting

The Elephant birds (Aepyornitidae)

- Madagascar
- at least 7 species (2 genera)
- up to 400 (500?) kg (height 3 m)
- last one died in 1649?
- contribution of hunting and climatic change (drought) to extinction?

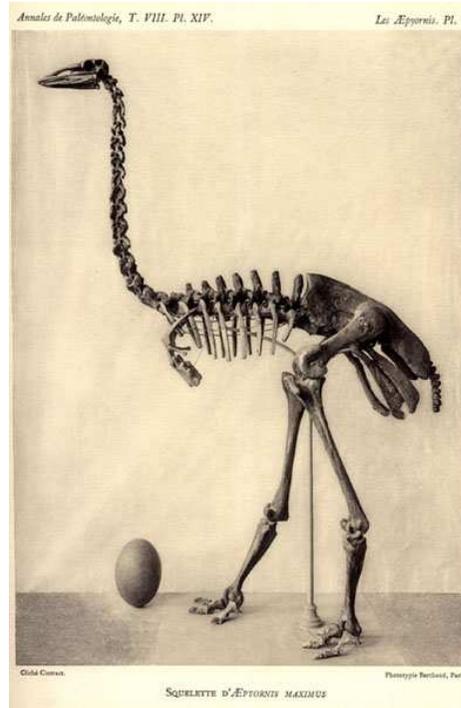
<http://vesmir.kav.cas.cz/Madagaskar>
kresba © Vladimír Zadražil



Threat to species by hunting

The Elephant birds (Aepyornitidae)

- eggs: volume 10 l, length 35 cm



Threat to species by hunting

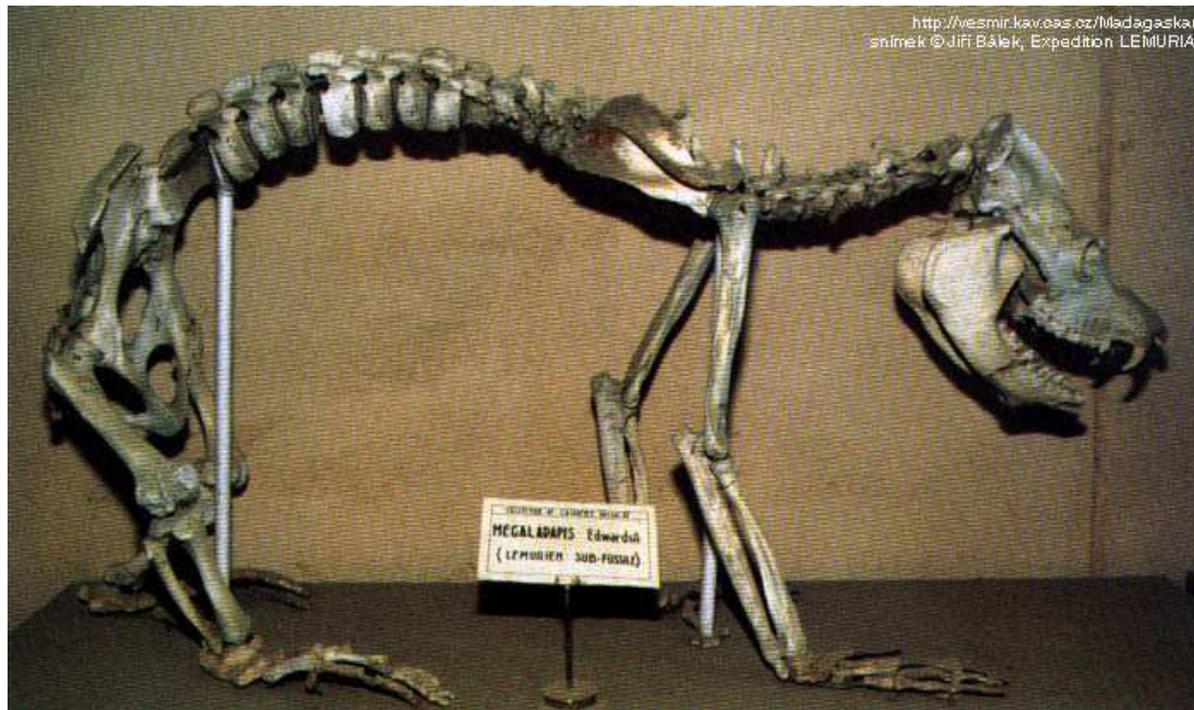
The lemur *Megaladapsis edwardsi*

- Madagascar
- the largest lemur – gorilla-sized (the genus included another two large species, in total some 17 “giant” lemur species got extinct)
- woodland species
- 600 years before present still alive
- contribution of hunting, clearing of forests and climate change to extinction?



Threat to species by hunting

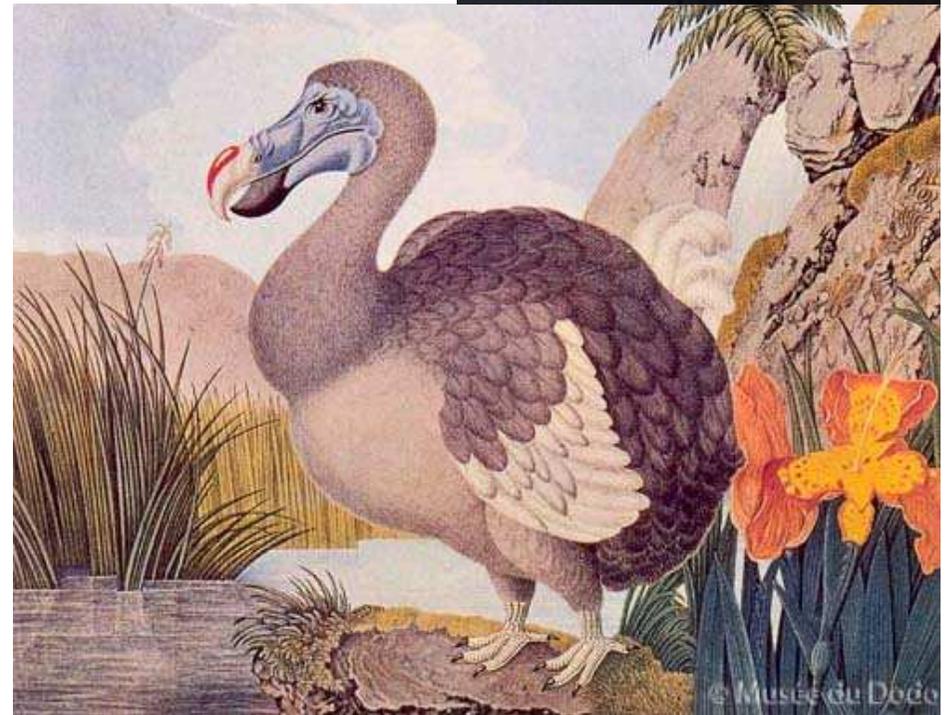
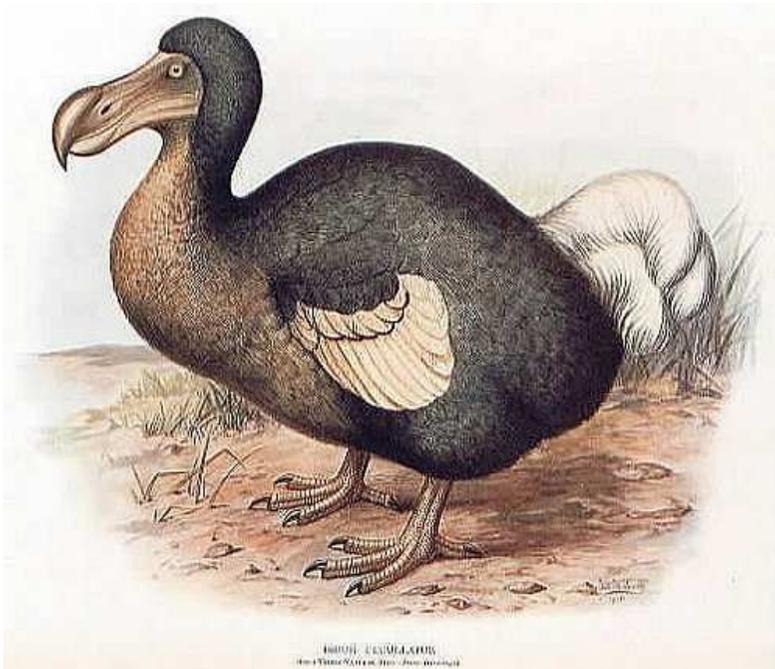
The lemur *Megaladapsis edwardsi*



Threat to species by hunting

The Dodo (*Raphus cucullatus*)

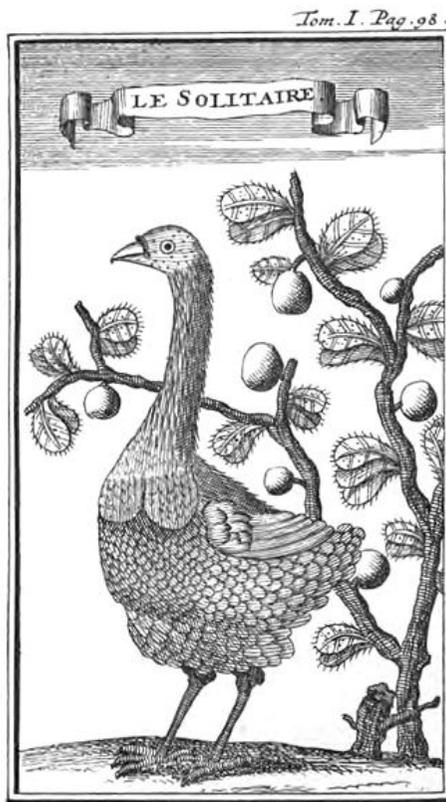
- The Isle of Mauritius (Indian Ocean)
- extinction due to hunting by man and introduced animals - cats, pigs and macaques
- first landing of seafarers in 1507
- colonisation of the island in 1644
- last birds observed in 1662, survival until 1681?



Threat to species by hunting

The Rodriguez Solitaire (*Pezohaps solitaria*)

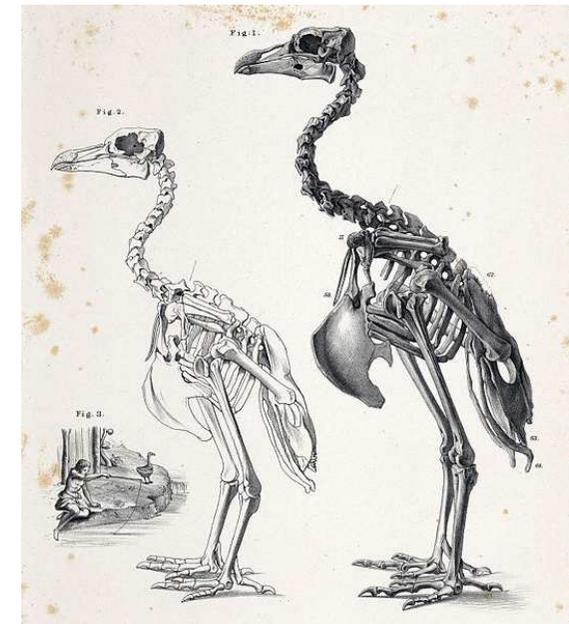
- Rodriguez Island (Indian Ocean)
- discovered in 1691, in 1730 common, in 1755 very rare, in 1761 not found
- hunted to extinction by man and introduced cats



Only drawing by a person that actually saw the bird alive (François Leguat, 1708)



Reconstruction according to Leguat's description (Frederick William Frohawk)



Skeleton of female and male

Threat to species by hunting

The Réunion ibis (*Threskiornis solitarius* = *Borbonibis latipes*)

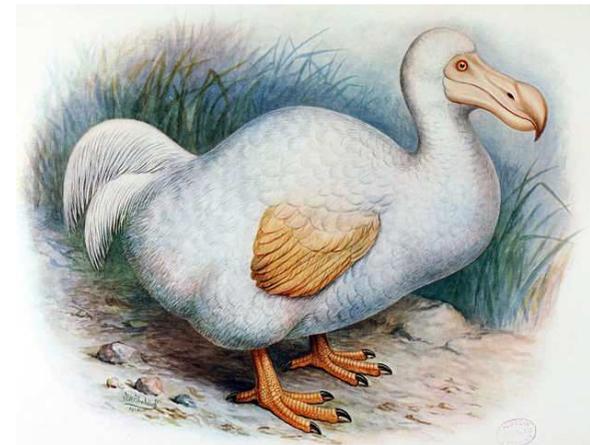
- Réunion Island (Indian Ocean)
- Discovered in 1613, last one died in 1791
- Real appearance?! Systematic position?!
- For long referred to as the Réunion solitaire (*Raphus solitarius*)“, a dodo-like species that probably never existed!



It might have looked like this: Hypothetical restoration based on contemporary descriptions, subfossil remains, and extant relatives (Wikipedia).



Misleading image (short beak!):
Frohawk's 1907 restoration of the Réunion solitaire, based on
Sieur Dubois' description

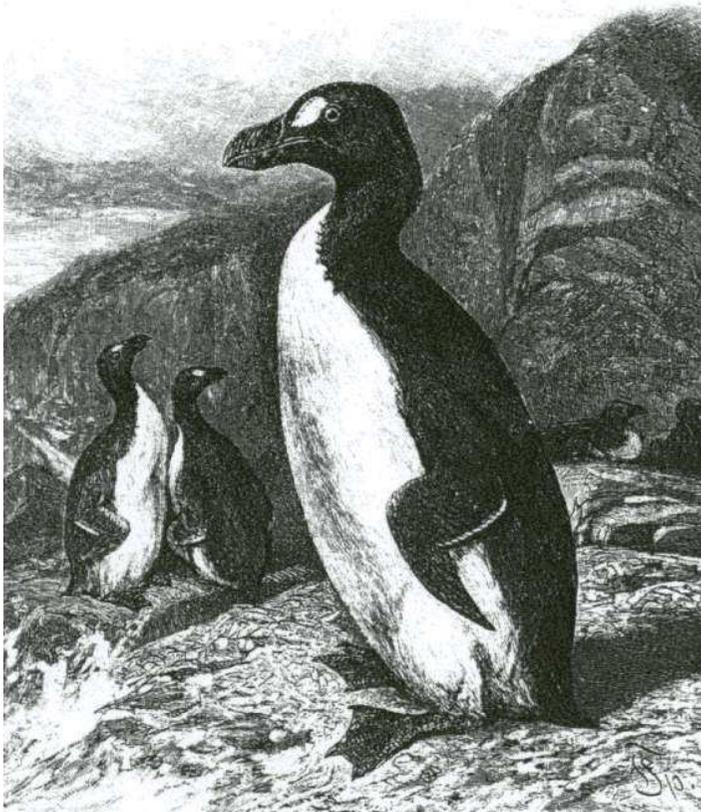


It certainly did not look like this, but
was often depicted as a white dodo!
Here Frederick William Frohawk's 1907
restoration of the Réunion solitaire,
adapted from Withoos' white dodo.

Threat to species by hunting

The Great Auk (*Pinguinus impennis*)

- The largest auk (5 kg, height 75-92 cm)
- Originally occurring on the coasts and islands of the Northern Atlantic
- Massive hunting and egg collecting
- The birds served not only for food of the inhabitants of the coast and sailors but also as fishing bait and fuel (much fat), later as a source of down feathers in high demand



Threat to species by hunting

The Great Auk (*Pinguinus impennis*)

- Before the end of the 13th century extinct on the Norwegian mainland
- Dramatic population decline at the end of the 16th century
- in N. America eradicated at the end of 18th century (last population on Funk Island off the coast of Newfoundland ceased to exist between 1785 and 1800)
- 1808 eradicated on the Faroer Islands
- 1812 eradicated on the Orkney Islands
- 1813 eradicated on the British Isles
- 1815 eradicated in Greenland
- 1821 eradicated on the Hebrides
- 1830 Geirfuglakor island with last breeding colony submerged due to volcanic activity
- 1835 a colony of surviving birds (less than 50) discovered close-by on Eldey Island
- 1840 one bird killed on the isle Stac an Armin (St. Kilda Archipelago, Outer Hebrides)
- 1844 last nesting pair on Eldey Island beaten to death, egg destroyed
- 1852 one bird reported off the coast of Newfoundland – last sighting ever reported
- **in the last decades the demand of museums and private collectors for skins and eggs contributed substantially to the eradication of the species**



Threat to species by hunting

The Labrador Duck (*Camptorhynchus labradorius*)

- occurring along the northern part of the North American Atlantic coast (Labrador)
- egg collecting and hunting by man (meat, down feathers)
- antropogennic decrease of mollusc populations in its wintering grounds
- last bird killed in r. 1875



Threat to species by hunting

The Short-tailed Albatross (*Phoebastria [=Diomedea] albatrus*)

- original range: Bonin (Izu) archipelago and Ryuku (Japan), Taiwan, islands close to Chinese coast, Pacific coast of North America
- at the end of the 19th cent. population of ca. 5 million (on Bonin = Izu)
- intensive hunting for feathers (pens, feather beds)
- 1939: 30-50 birds on Torishima island, last nesting pairs disappeared concurrently with the se prohibition of hunting
- 1949: declared extinct (however, juveniles survived at the open sea)
- 1954: return of 25 birds to Torishima, at least 6 pairs, first eggs
- 2008: 1922 birds (ca 426 pairs) on Torishima, 442 birds on Minami-kojima (Senkaku archipelago)



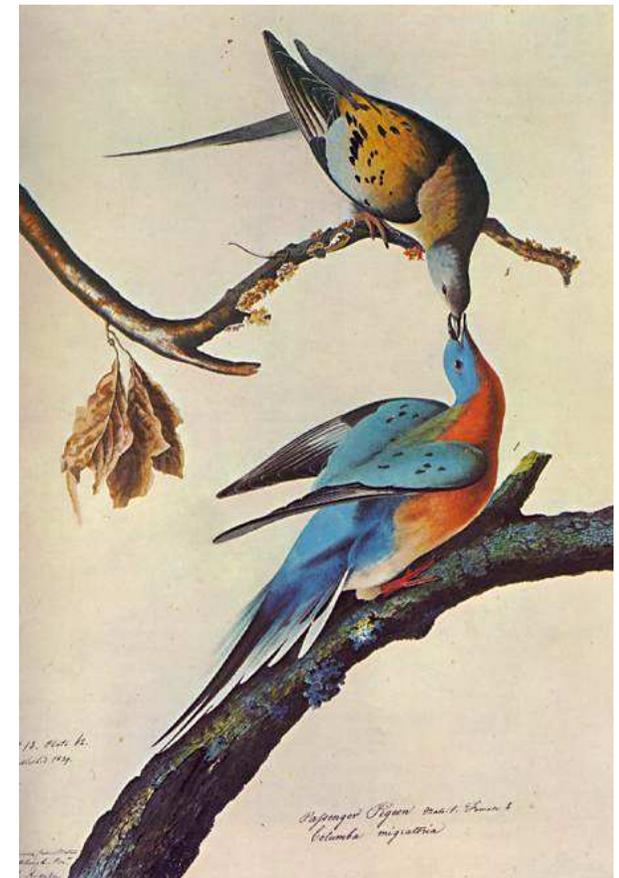
Threat to species by hunting

The Passenger Pigeon (*Ectopistes migratorius*)

- original range in North America east of the Rocky Mountains
- original population size ca 2 million
- in the 2nd half of the 19th century decline of population due to massive hunting, total protection declared
- last individual died in 1914 (Cincinnati Zoo)



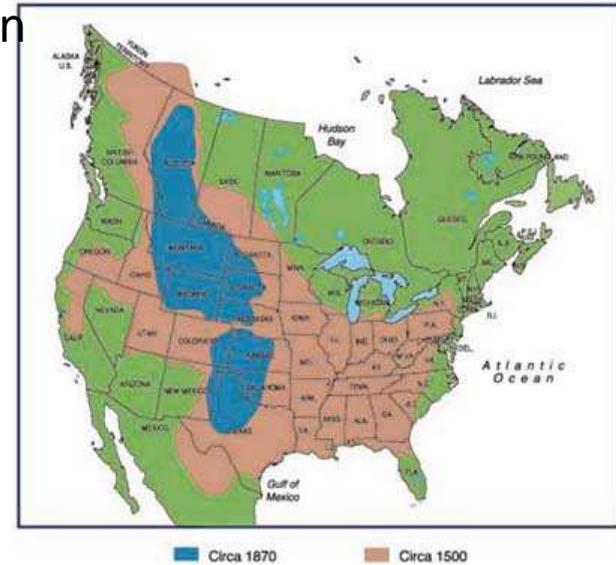
Distribution area: nesting red, wintering orange



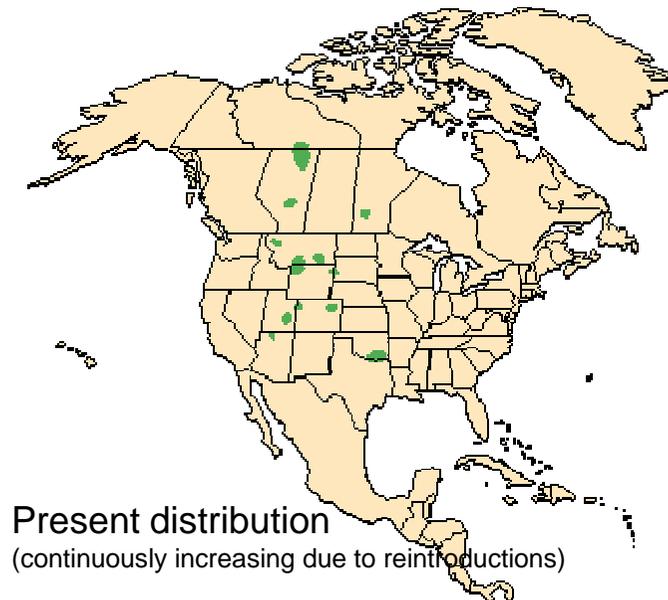
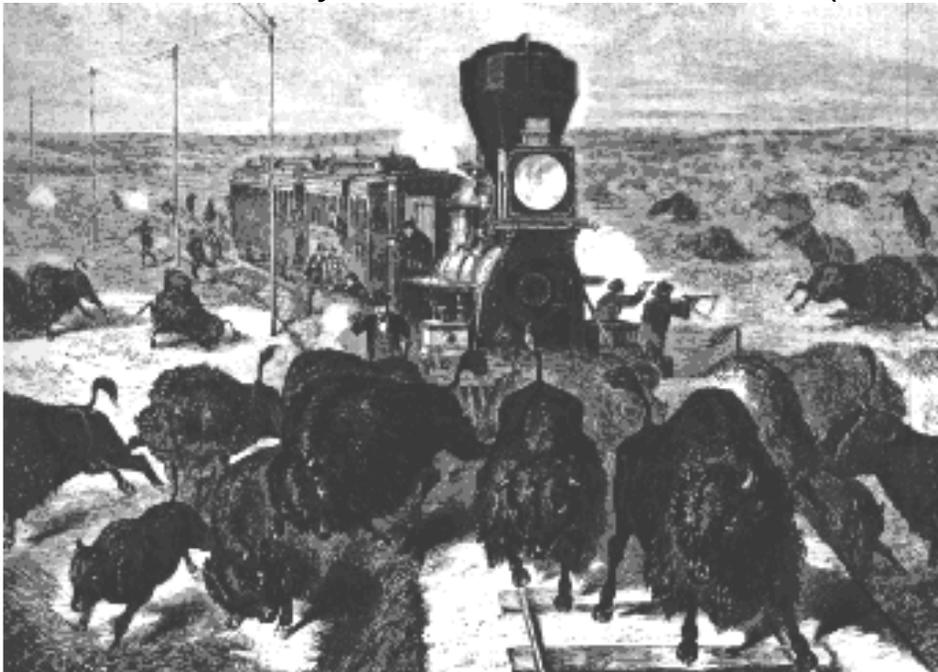
Threat to species by hunting

The American Bison (*Bison bison*)

- population size before arrival of Europeans ca 60 million (still valid in ca 1800)
- mass killing since the 18th century
- in 1832 exterminated east of the Mississippi
- in 1870 exterminated in the Southern Plains
- in 1870-1875 2.5 million animals shot per year
- in 1889 only 1091 individuals alive (635 in the wild)



(Pre-)Historic distribution of the bison



Present distribution
(continuously increasing due to reintroductions)

Threat to species by hunting

The American Bison (*Bison bison*)

The plains indians were totally dependent on bison (after the expansion of horse keeping and the corresponding cultural changes)



Bizon (*Bison bison*)

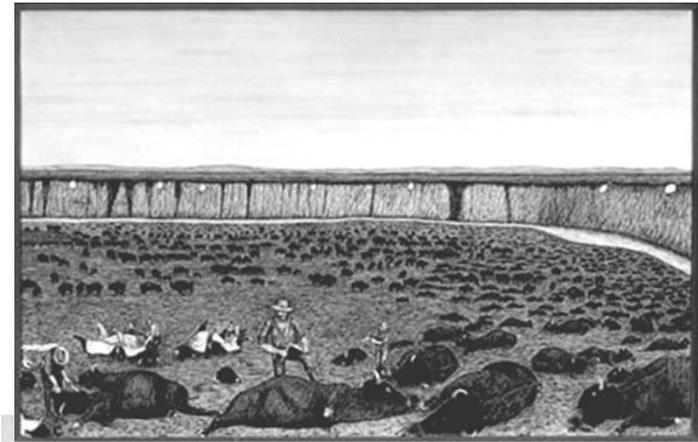


The famous buffalo hunter
William F. Cody alias
Buffalo Bill

- The construction of the transcontinental railway contributed substantially to the almost total extermination of bison.

- The hides were processed on a large scale, the skinned corpses were left behind.

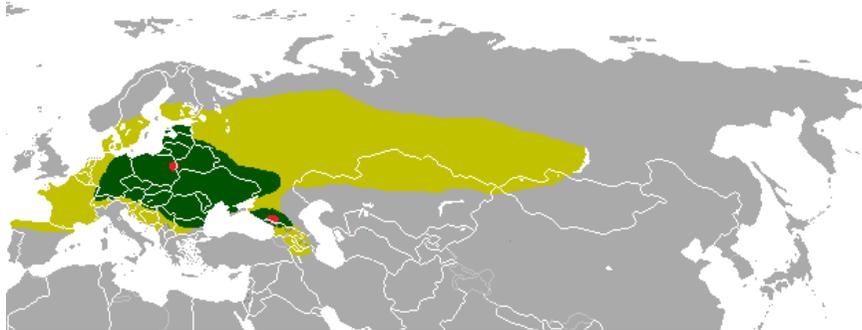
- The last utilization was the collecting of bones (e.g. for fertilizer production).



Threat to species by hunting

The Wisent or European Bison (*Bison bonasus*)

Original distribution: Euroasia



Reconstruction of distribution area in the Holocene (light green) and high middle ages (dark green); last endemic populations in red



Three subspecies:

- The European / Lowland Bison (*B. b. bonasus*) – today ca. 1000 animals, ca. 70 % „in the wild“
- The Caucasian Bison (*B. b. caucasus*) , pure-blood subspecies extinct, a breed of hybrids with the lowland subspecies with some genes of the American Bison (*B. bison*) has survived
- The Carpathian bison (*B. b. hungarorum*), extinct around 1790 (the last one perhaps killed as early as 1762 in the Rodna mountains (presently in northern Romania), valid subspecies?

Threat to species by hunting

Bison bonasus (bonasus)

- 1 AD - ranging from the British Isles to Siberia and the Caucasus (there are doubts about the western border of the distribution area, in the Caucasus represented by another subspecies, i.e. *B. b. caucasus*)
- 7th cent. - in the West still present in the Vosges mountains
- 1100 - 1500 - exterminated in the British Isles, Apennine Peninsula and Sweden
- 11th cent. - still present in northern Switzerland
- until 16th cent. - still present in Brandenburg
- until 18th cent. - in Poland / Eastern Prussia and Transilvania
- early 19th cent. - last lowland wisents living in the Białowieża Forest (formerly the Polish king's, then the Russian tsar's hunting reserve)
- 1850 - ca 1920 - decline and extinction of the lowland subspecies population in the wild : 1850 - 1500 individuals; 1910 - 600 ind.
- 1923 - The international Society for the Protection of the European Bison founded in Berlin, 54 (56?) specimens in captivity, of those 12 able to reproduce
- 2006 - 3200 pure-blood wisents in the breed registry, including also the lowland-Caucasus line (of those ca 60% "in the wild")

Threat to species by hunting

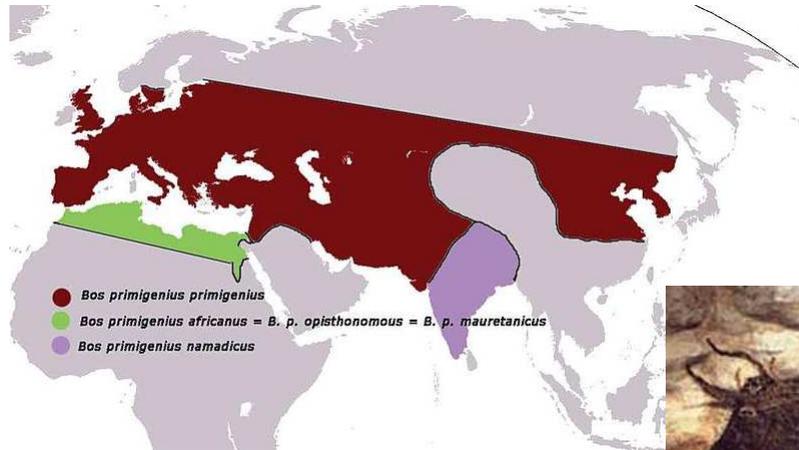
The Causacian Wisent (*Bison bonasus caucasicus*)

- 1831 - population of the Caucasian subspecies discovered in the north-western Caucasus (S)
- ca 1860 - 2000 individuals
- 1914 - 800 individuals
- 1917 - 500-600 individuals
- 1921 - 50 individuals (fast declined due to hoof and mouth disease, anthrax, poaching and excesses of Soviet revolutionaries)
- 1924 - reserve established
- 1927 - last three pure-blood individuals killed
- 2002 - ca 2200 hybrids of the Caucasian and lowland subspecies, most of those also with genes of the American Bison (all genes of the Caucasian subspecies come from a single bull held in captivity, which died in 1925)

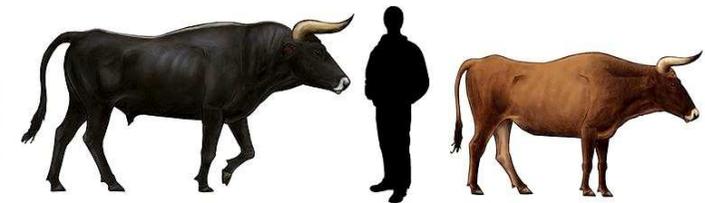
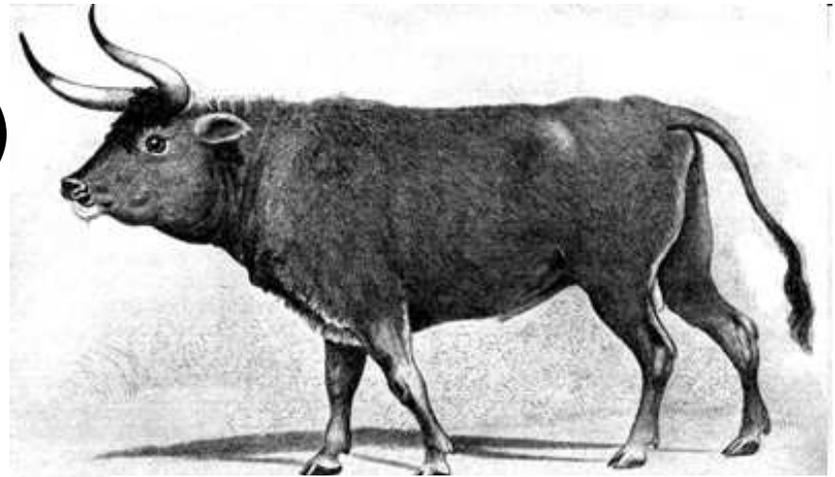


Threat to species by hunting

The Aurochs (*Bos primigenius*)



Reconstruction of original range



Reconstruction of bull and cow

Several subspecies:

- *B. p. primigenius* – ancestor of taurine or European cattle (*B. taurus*)
- *B. p. namadicus* (India) – ancestor of the Indian cattle - the zebu

- Size at the withers up to 185 cm in bulls (1000 kg), 150 cm in cows
- Domestication from 6500 B.C. onwards
- The wild form became extinct in Asia in antiquity, in western and central Europe between the 12th and 14th century (after large-scale forest clearing between the 9th and 11th century)

Threat to species by hunting

The Auerochs (*Bos primigenius*)

after 1300 BC – not present (exterminated?) in the British Isles

after 400 BC – not present (exterminated?) in the Netherlands

ca 1 AD

- exterminated in northern Italy (30 BC still hunted there)
- exterminated in Jutland (mainland Denmark)

800 AD

- still present in France

1000 AD

- still present in Switzerland

ca 1250

- exterminated in Hungary (Pannonian Plain)

12th or 13th cent.

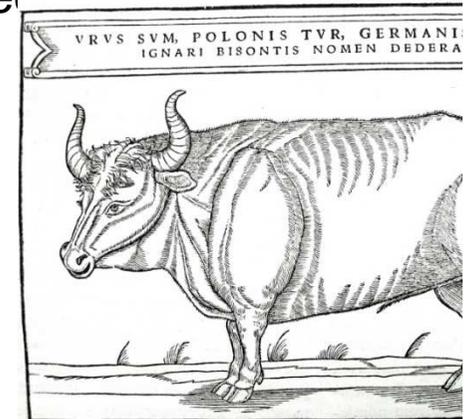
- exterminated in Russia

1406 and 1408

- last reliable records from Germany

1476

- last two herds of wild aurochs become the property of the Polish king (received from the Duke of Mazovia)



Threat to species by hunting

The Aurochs (*Bos primigenius*)

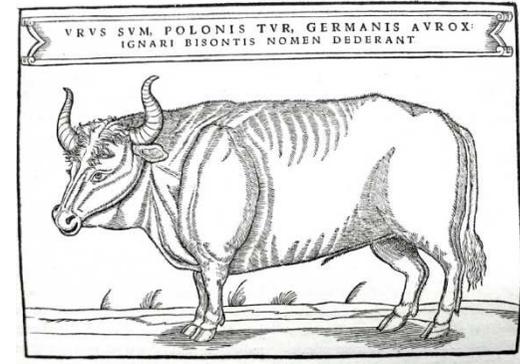
Last population in the Jaktorow royal hunting enclosure
(south of Warsaw):

1564 - 38 individuals (8 bulls, 22 cows, 3 immatures, 5 calves)

1566 – 24 individuals remaining

1602 - 4 individuals (3 bulls, 1 cow)

1620 – last individual (cow) – died in 1627



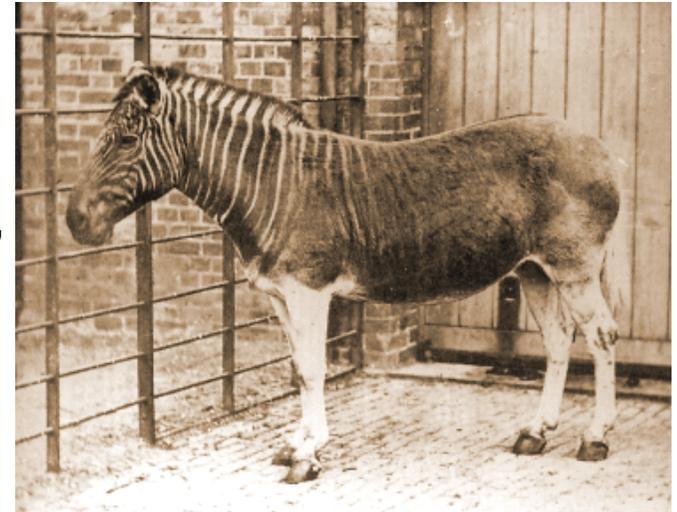
An attempt to get the original Aurochs back by cross-breeding of several primitive races of domestic cattle was undertaken in 1920-1940 (the Heck brothers, Zoos in Munich and Berlin) - today some 2000 individuals of an stabilized breed exist in various zoological gardens and game enclosures. The bulls reach „only“ 150 cm at the withers.



Threat to species by hunting

The Quagga (*Equus q. quagga*)

- southern subspecies of *E. quagga*
- orig. range NW to the Oranje river, NE to the Vaal river, SE to Great Kei River
- massive hunting by white settlers (for meat and hides, as competitors of domestic animals on range-land)
- last live individuals captured in 1870



Plains Zebra
(*E. quagga burchellii*)



Mountain Zebra
(*E. zebra*)

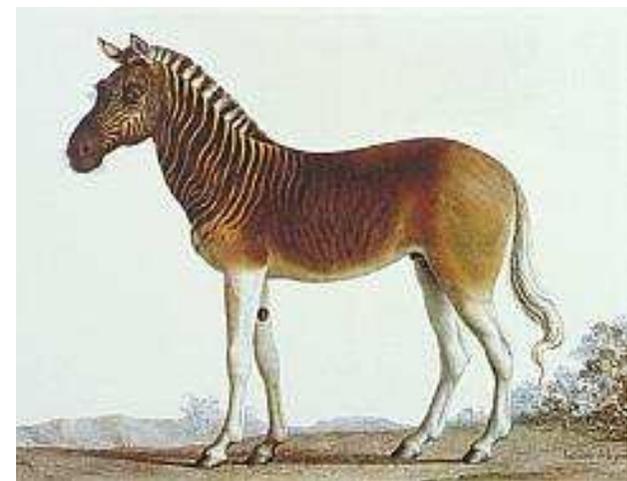


Grevy's Zebra
(*E. grevyi*)

Threat to species by hunting

Zebra kvaga (*Equus q. quagga*)

- last animal shot in the wild in 1878
- last animal died in captivity in 1883 (Amsterdam Zoo)
- only later it became clear that this had been the last

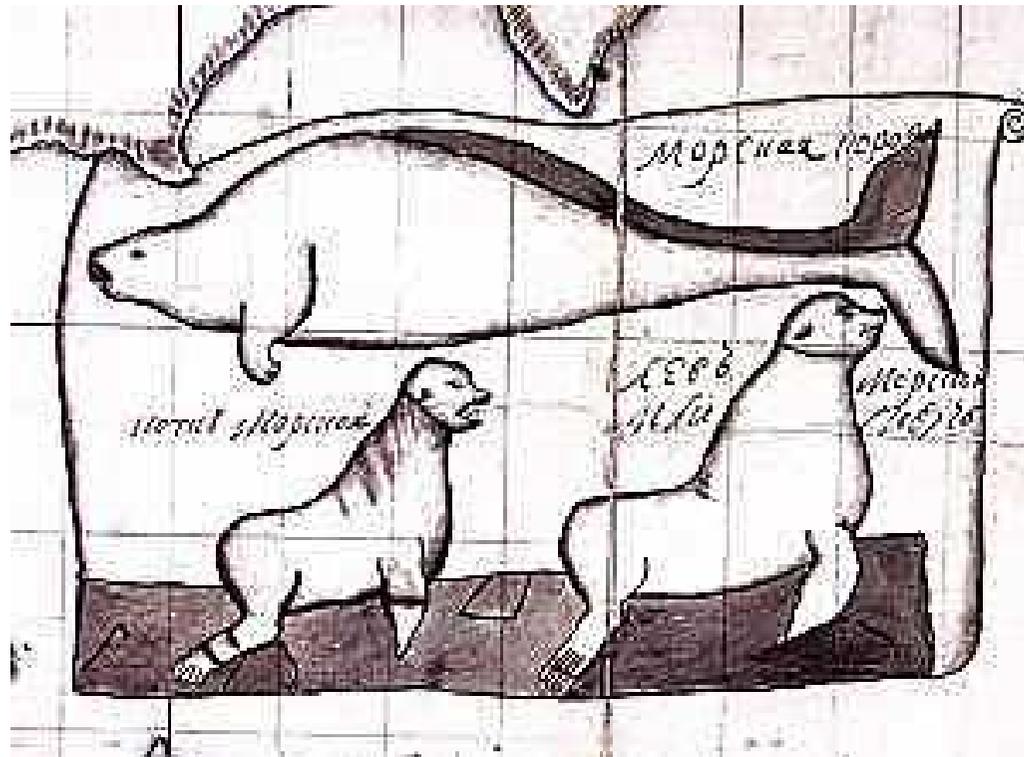


Since 1987 there is a project attempting to obtain zebras of quagga phenotype by breeding selected individuals of the adjacent subspecies captured in Namibia (apparently carrying genes of the nominate subspecies).

Threat to species by hunting

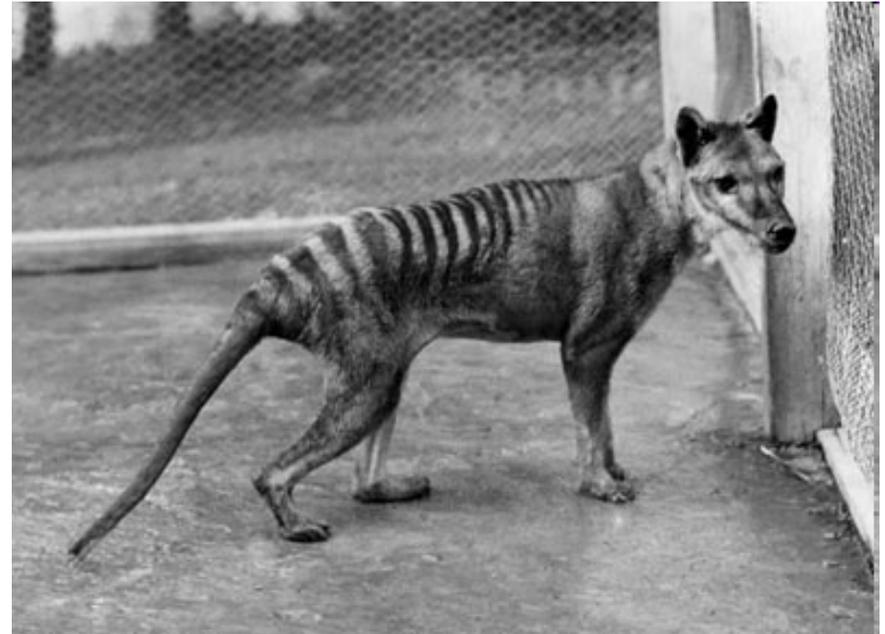
Steller's Sea Cow (*Hydrodamalis gigas*)

- up to 9 m long, up to 6 tonnes body mass
- discovered in 1741 on a single island in the Bering Sea (formerly also present on the Kamtchatka peninsula – eradicated by tribesman)
- eradicated by sailors within 27 years – in 1768 (scientific description 12 years hereafter)



Threat to species by hunting

The Tasmanian Wolf or Tiger (*Thylacinus cynocephalus*)



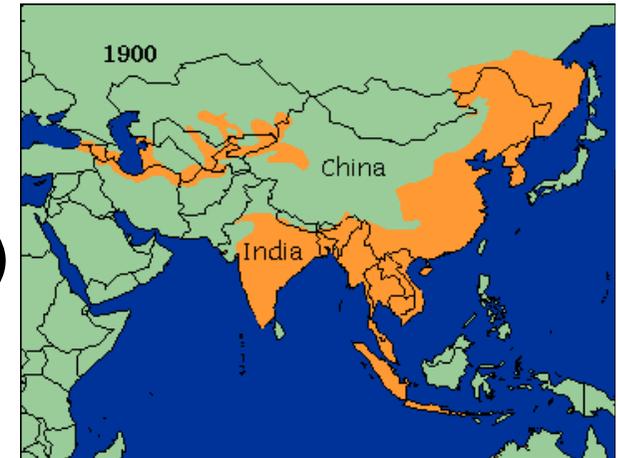
- original range included Australia and New Guinea (erradicated by the aborigines and by competition of dogs and the ferralized dingo)
- at the time of the colonization by Europeans only occurring (demonstrable) in Tasmania
- from 1830 to 1909 bounty was paid for killed thylacines (said to attack sheep)
- from 1888 to 1909 2184 bounties were paid (minimal number of killed individuals)
- last known shot in the wild in 1933
- in 1936 the last individual died in Hobart Zoo, absolute protection of the species was decreed in the very same year

Threat to species by hunting

Three subspecies of the tiger: *Panthera tigris* *virgata*, *P. t. balica*, *P. t. sondaica*

The Caspian Tiger (*Panthera tigris virgata*)

- the 2nd largest subspecies
- orig. range: Turkey - N. Iraq – Iran – Azerbaijan, Russian Central Asia, Turkmenistan, Uzbekistan, Afghanistan, Mongolia
- intensive hunting incl. a campaign of the Russian army at the Caspian Sea in the early 20th century
- last(?) shot in 1959 (Iran?, Iraq?) or as late as 1970 (Turkey) or 1997 in northern Afghanistan?



Tiger distribution area in 1900



Threat to species by hunting

The Bali Tiger (*Panthera tigris balica*)

- subspecies of smallest body-size, only on the island of Bali (rather small population)
- last kill in 1937
- reports on sightings up to 1952 (questionable ones from 1970 and 1972)



The Java Tiger (*Panthera tigris sondaica*)

- only on the island of Java, in the early 19th century very abundant
- in 1940 only in mountainous areas – decline due to hunting, poisoning, deforestation
- 20-25 individuals remaining
- 1979: last footprints found (max. 3 ind.)



Java

Threat to species by hunting

Large Carnivores in Europe

- were also on the brink of extinction, today their populations remain mostly small but are rising in many areas due to their protection and reintroductions.



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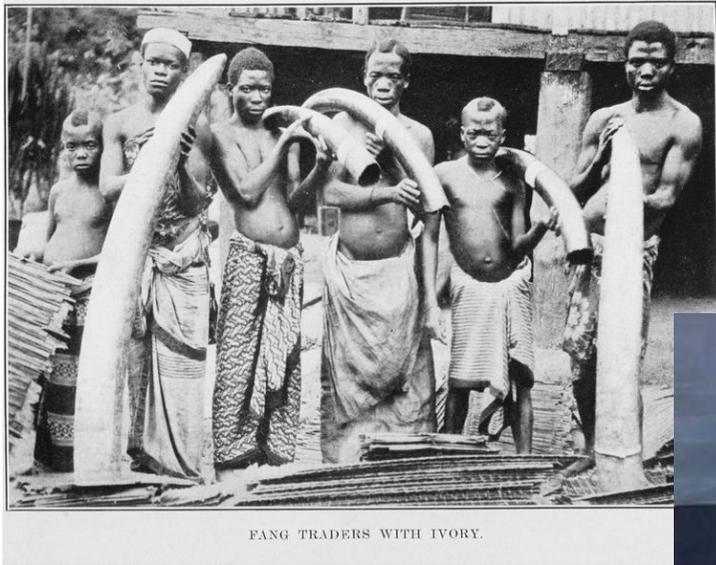
Threat to species by hunting

Current problems of threats to species by hunting or collecting: poaching and international trade

- trading with ivory (elephant, mammoth (subfossil), narwhal, walrus, and hippopotamus tusks/teeth; raw material for artistic objects)
- trading with rhinoceros horns, bones and other body parts of tigers and other objects used in traditional medicine (in particular Chinese)
- capturing or collecting (e.g. eggs, marine molluscs, but also plants such as cacti and orchids) for sale to zoological and botanical gardens, at present mostly to private keepers, breeders (falconers, parrot breeders, etc.) or collectors.
- hunting for subsistence and trade („bushmeat“) in developing countries
- too intensive use of wild populations by fishing, hunting or similar activities by “developed” countries, often based on international agreements but also on the brink of illegality (e.g. whaling).

Threat to species by hunting

Ivory Trade



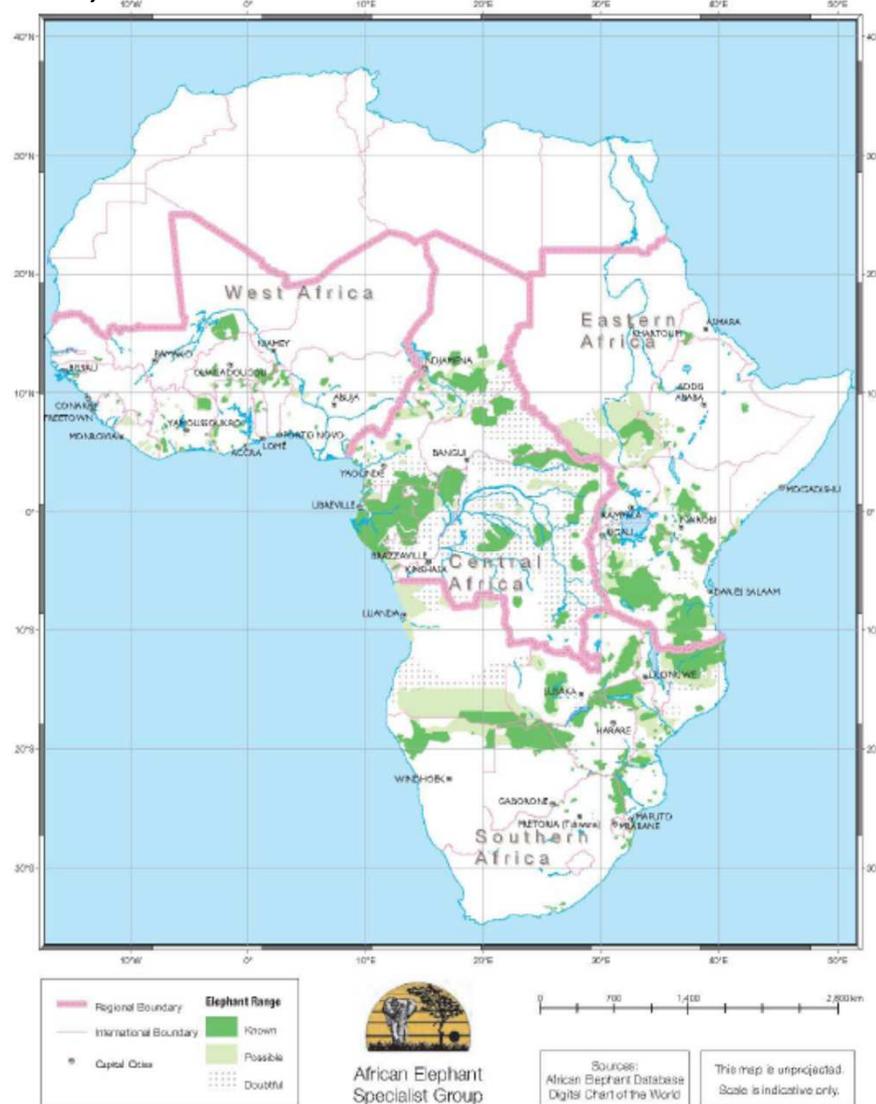
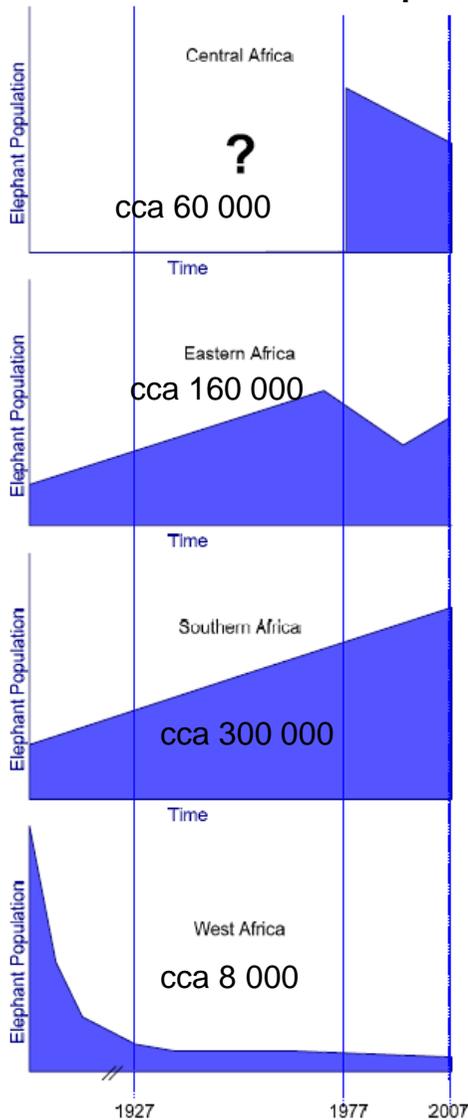
Threat to species by hunting

CITES and the ivory trade

- 1975** Convention on the International Trade in Endangered Species of Wild Fauna and Flora):
The African Elephant listed in Annex II (allowing monitored international trade with ivory and other products); The Asian Elephant listed in Annex I (not allowing trade with ivory or any other products).
- 1989** (valid from 1990) CITES transferrs all African Elephant populations from Annex II (threatened) to Annex I (endangered)
- 1997** CITES (COP 10) transfers populations in Botswana, Namibia and Zimbabwe to Annex II, to allow an one-time sale of ivory stocks (done in 1999).
- 2000** The Republic of South Africa, Namibia, Botswana and Zimbabwe withdrew their applications for a permit of trading with ivory, which they had filed earlier. Kenia a India withdrew their applications to transfer the elephant populations of other countries from Annex II back to Annex I. Southafrican population transferred from Annex I to Annex II.
- 2002** The Republic of South Africa, Namibia, Botswana and Zimbabwe asked for the permit to sell their existing ivory stocks and to receive annual quota for the sales of elephant tusks. Zambia did not ask for annual quota but for a permit to sell existing stocks only.
- 2006** CITES put aside the requests of South Africa, Namibia and Botswana to sell their ivory stocks.
- 2007** African Elephant populations in South Africa, Namibia, Botswana and Zimbabwe transferred to Annex II. This allows non-commercial trophy hunting, trade with live individuals (restricted by given rules), trade in skins, hair, leather products, limited trade with ivory products under compliance with explicit rules, trade with registred raw ivory (tusks and their parts) from state-owned stocks (except ivory that had been confiscated or of unknown origin) to checked buyers (max. one sale to one buyer), in a one-time transaction – followed by a 9-year moratorium on further sales .

Threat to species by hunting

The African Elephant (*Loxodonta africana*)



The development of regional populations of the African Elephant from 1900 and estimates of present regional population sizes

Present (2007) distribution of the African Elephant
 Total population ca 550 000 (2007)

Threat to species by hunting

The Asian Elephant (*Elephas maximus*)

Number of elephants poached in India in 1991-2001

Reported cases of elephant poaching in India

States	Number of cases									
	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001
Andhra	2	3	1	1	-	-	-	-	-	-
Arunachal	-	-	-	-	1	1	-	-	-	2
Assam	5	7	12	3	6	4	6	2	4	6
Bihar/Jharkhand	-	-	-	-	1	2	3	-	2	2
Karnataka	14	16	15	4	10	18	15	27	21	19
Kerala	23	10	6	4	9	8	6	4	1	3
Meghalaya	-	-	1	1	10	5	4	2	2	1
Mizoram	-	-	-	-	-	-	-	-	1	-
Nagaland	2	3	3	1	5	5	1	-	-	-
Orissa	11	15	13	23	20	14	13	14	9	11
Tamil Nadu	10	4	2	4	7	15	12	12	7	7
U.P./Uttaranchal	-	-	-	-	2	-	-	1	-	6
W. Bengal	-	1	2	6	4	-	-	4	14	3
Total	67	59	55	47	75	72	60	66	61	60



Foto: Bodenseemann

Wild Elephants in India (2001)

Region/ State	Population
North-East :	
Arunachal	1607
Assam	5312
Meghalaya	1840
Nagaland	147
Mizoram	28
Manipur	10-15
Tripura	30-50
West Bengal (North)	292
Total for North-East	9266-9261
East :	
West Bengal (South)	35
Jharkhand and Bihar	618
Orissa	1827
Total for East	2480
North :	
Uttaranchal	1507
Uttar Pradesh	70-100
Total for North	1577-1607
South :	
Tamil Nadu	2971
Karnataka	6088
Kerala	5737
Andhra Pradesh	73
Total for South	14869
Islands:	
Andaman and Nicobar	40-70
Grand Total	28232-28317

Estimates of elephant population in the world

Country	Estimated numbers	
	Min.	Max.
Bangladesh	200	250
Bhutan	60	150
Borneo		
(Sabah and Kalimantan)	750	1000
Cambodia	2000	2000 (?)
China	250	350
India	20000	24000
Indonesia		
(excl. Kalimantan, i.e. Sumatra)	2500	4500 (?)
Laos	2000	4000 (?)
Myanmar		
(formerly Burma)	5000	6000
Peninsular Malaysia (excl. Sabah)	800	1000
Nepal	50	85
Sri Lanka	2500	3000
Thailand	2000	2000 (?)
Vietnam	250	400
Total	38360	48735

Source : WWF-International and IUCN's Asian Elephant Specialist Group, 1996).

Asian Elephant population world-wide
(estimate, 1996) and in India (1991-2001)

Threat to species by hunting

Rhinoceroses – victims to superstition about the healing power of their horns

Population estimates for rhinos living in the wild in Africa as of Dec. 2007



White Rhinoceros (*Ceratotherium simum*)

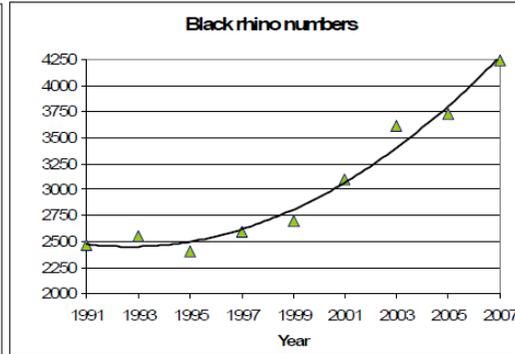
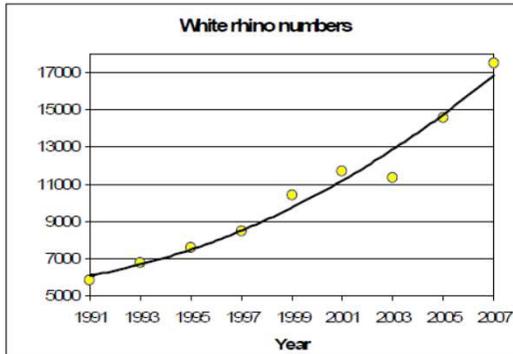
Black Rhinoceros (*Diceros bicornis*)

In 2010 scientific evidence was presented, indicating that the northern subspecies, Cotton's, deserves the status of an independent species.

Species	White rhino				Black rhino					
	Subspecies	<i>C.s.cottoni</i>	<i>C.s.simum</i>	Total	Trend since 2005	<i>D.b.bicornis</i>	<i>D.b.michaeli</i>	<i>D.b.minor</i>	Total	Trend since 2005
		(northern)	(southern)			(south-western)	(eastern)	(southern-central)		
Botswana			106	106	Up			7	7	Stable
DR Congo		4		4	Stable?					
Kenya			303	303	Up		577		577	Up
Malawi								16	16	Up
Mozambique			9	9	?			?	?	?
Namibia			370	370	Up	1,435			1,435	Up
Rwanda							1		1	Stable
South Africa			16,273	16,273	Up	113	54	1,321	1,488	Up
Swaziland			89	89	Up			18	18	Up
Tanzania							67	56	123	Up
Uganda			6	6	New					
Zambia			1	1	Down			16	16	Stable+Intro
Zimbabwe			313	313	Stable			546	546	Down
Totals		4?	17,470	17,475	Up	1,550	700	1,980	4,230	Up

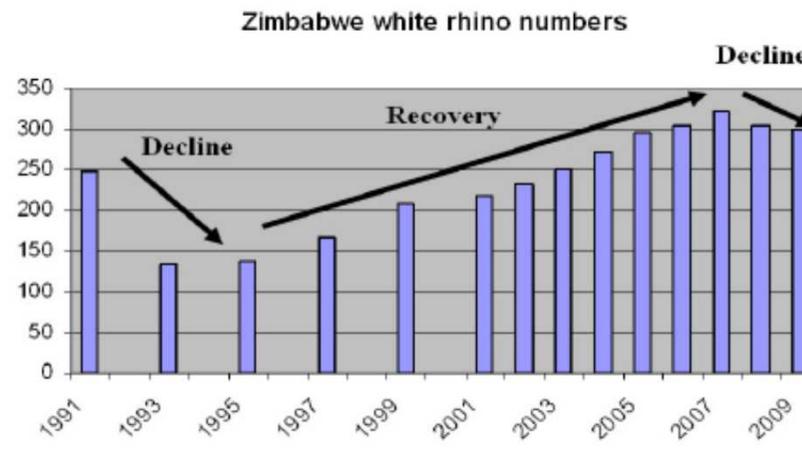
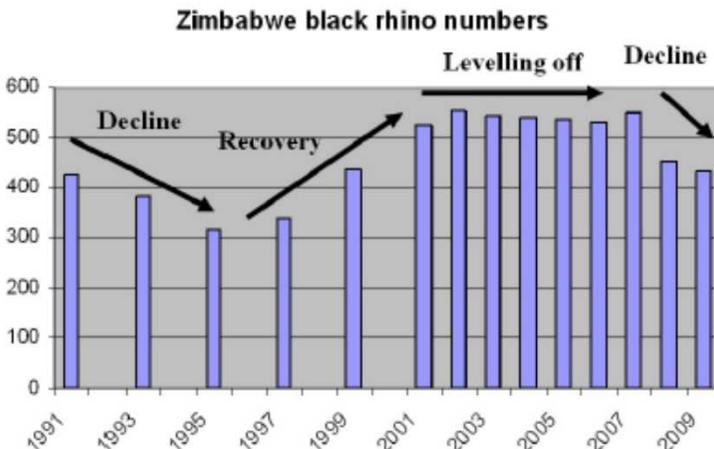
Threat to species by hunting

Rhinoceroses – victims to superstition about the healing power of their horns



Thanks to strict protection the populations of African rhinos grew in the last decades (the population of the Southern Wide Rhinoceros increased from 20-50 animals in 1885 to ca 20 000; the population of the Black Rhino had dramatically decreased from ca 300 000 in 1950 dramatically poklesla, but even here an increase to ca 5 000 was reached). However a dramatic breaking point was reached in 2007.

Poaching victim

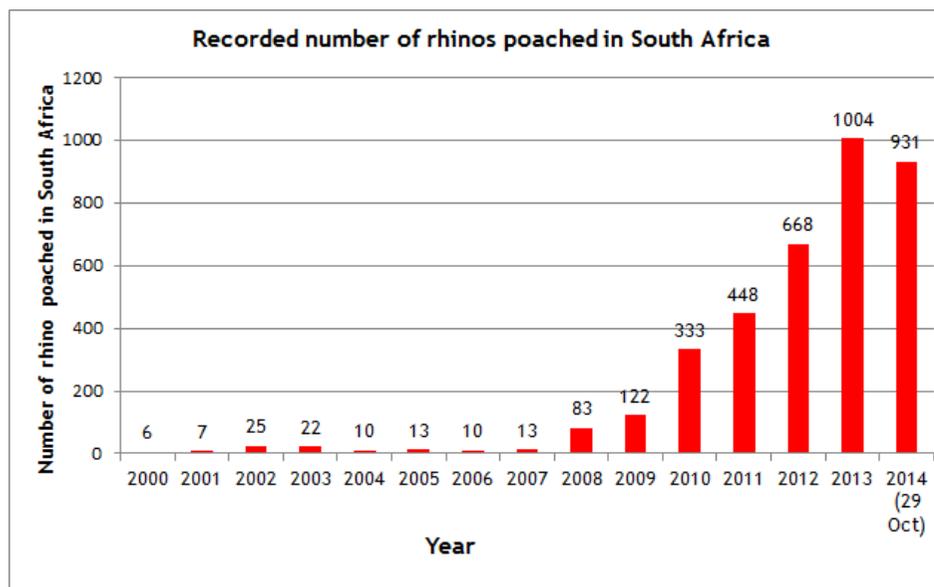


Development of rhino populations in Zimbabwe reflects poaching intensity

The demand for rhino horns on the black market – mainly in China and further South Asian countries (use in traditional Chinese medicine) and in Yemen (used for handles of traditional daggers) – started to rise steeply, once the superstitious belief that they presented effective medicine against cancer spread in Vietnam. Since then the price of rhino horn has increased manifold (35 USD / kg in 1975, 65 000 USD / kg in 2004) .

Threat to species by hunting

Rhinoceroses – victims to superstition about the healing power of their horns



Minimal numbers of rhinos poached in Africa
(2006 – Feb. 2013)

dle údajů AfRSG, TRAFFIC a CITES Rhino Working Group

Country	2006	2007	2008	2009	2010	2011	2012	2013 to 20 Feb	Country Totals	2012 poaching as % of 2012 popn estimates
Botswana	0	0	0	0	0	0	2	0	2	1.03%
DR Congo	0	0	2	2	0	0	0	0	4	
Kenya	3	1	6	21	22	25	29	5	112	2.83%
Malawi	0	0	0	0	0	0	2	0	2	7.69%
Mozambique	0	9	5	15	16	10	12	?	67	1200.00%
Namibia	0	0	0	2	2	0	1	0	5	0.04%
South Africa	36	13	83	122	333	448	668	102	1805	3.19%
Swaziland	0	0	0	0	0	2	0	0	2	0.00%
Tanzania	0	0	2	0	1	0	2	0	5	1.57%
Uganda	0	0	0	0	0	0	0	0	0	0.00%
Zambia	0	1	0	0	0	0	0	0	1	0.00%
Zimbabwe	21	38	164	39	52	35	29	4	382	4.11%
Total	60	62	262	201	426	520	745	111	2387	2.93%
Poached/day	0.16	0.17	0.72	0.55	1.17	1.42	2.04	2.18		
Projected							794			

Numbers of rhinos poached in South Africa (2000 – Oct. 2014)

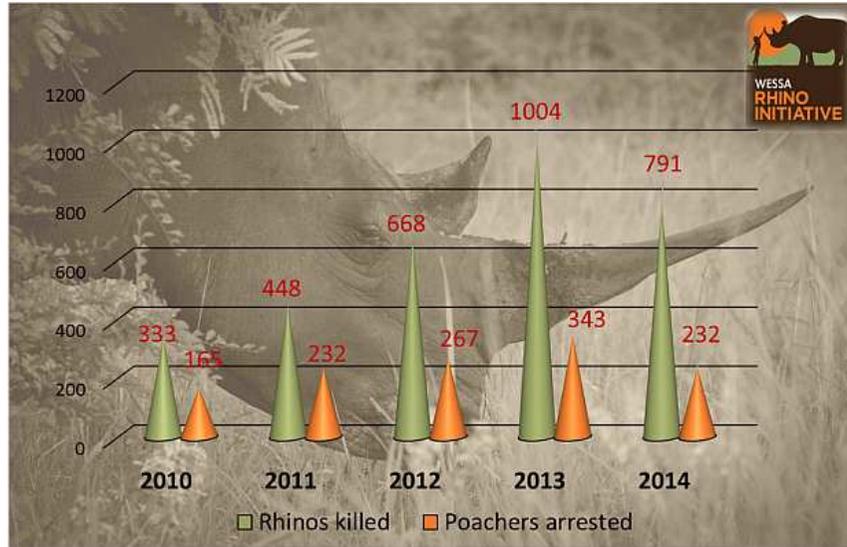
Numbers of rhinos poached in Africa (2006–2009) broken down to countries and way of killing

98% of all African rhinos now live in four countries in southern Africa: South Africa, Namibia, Zimbabwe and Botswana.

The Czech Republic plays an important role in the illegal trade with rhino horns (large vietnamese community, feigned trophy hunting by Czech citizens, theft of horns from exhibitions, stepping stone on the way to Asia).

Country	All Rhinoceros 2006-2009				Total
	Illegal Killing				
	Shot	Snared	Speared, Stabbed, Poisoned	Unknown but presumed poached	
Botswana	0	0	0	0	0
DR Congo	0	0	0	1	1
Kenya	16	1	0	0	17
Malawi	0	0	0	0	0
Mozambique	5	0	0	0	5
Namibia	0	0	0	0	0
South Africa	152	2	1	55	210
Swaziland	0	0	0	0	0
Tanzania	0	0	0	1	1
Uganda	0	0	0	0	0
Zambia	1	0	0	0	1
Zimbabwe	149	6	4	76	235
Grand Total	323	9	5	133	470

Threat to species by hunting



Rising numbers of poached rhinos and arrested poachers in South Africa from 2010 to Sept. 2014.

In the Republic of South Africa, paid trophy hunting of rhinoceroses is still legal, usually in private game reserves (ca 23% of rhinos in South Africa have private owners). According to official sources legal trophy hunting makes up for 100-160 rhinos killed per year. The export of private trophies, however, serves as a disguise for their further trade and for the trade of poached horns. In the meantime South Africa has prohibited trophy hunting by citizens of Vietnam and Czechia!

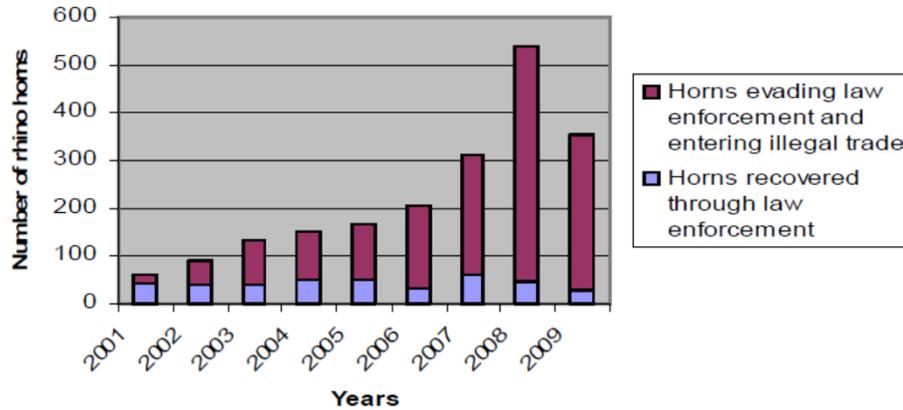


One measure to protect rhinos against poachers is the careful removal of their horns. However, to prevent injury, the ceratin base of the horn (which is growing into the bone), has to be left intact. Even this remaining part attracts poachers as the price per kg horn is very high.

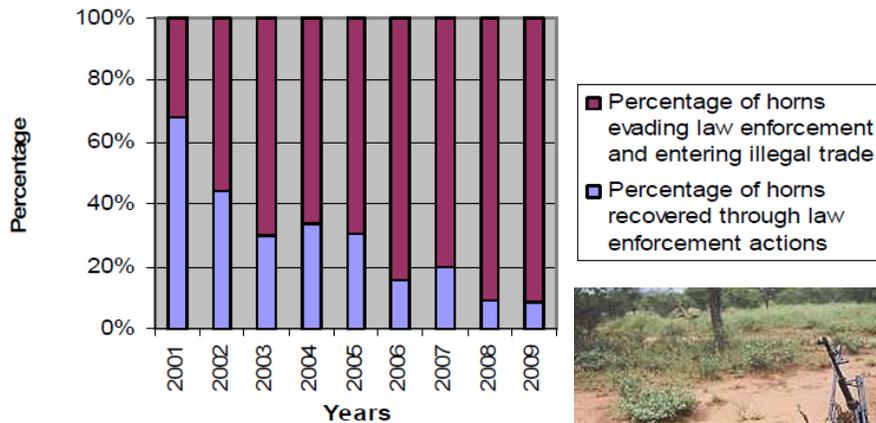
Threat to species by hunting

Rhinoceroses – victims to superstition about the healing power of their horns

Rhino horns on the black market in Africa



Percentages of horns entering the illegal trade, and confiscated by security forces in Africa.



The fight against the well-organized and armed groups of poachers is dangerous and requires sufficient numbers of well-trained and equipped rangers.



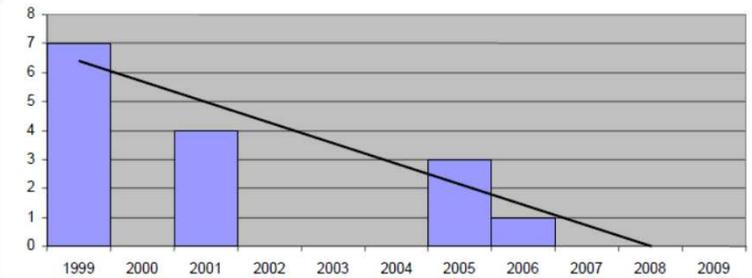
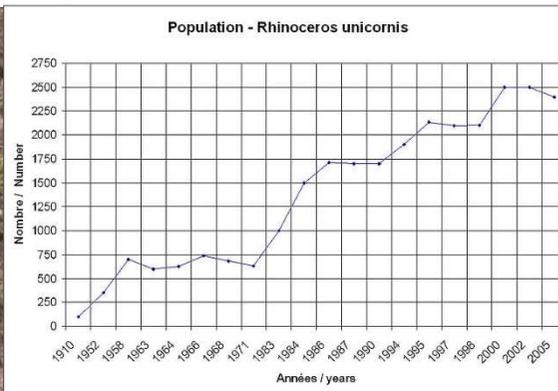
Threat to species by hunting

Rhinoceroses – victims to superstition about the healing power of their horns

Estimate of Asian rhino populations in the wild as of Sept. 2009 (trends since 2007)



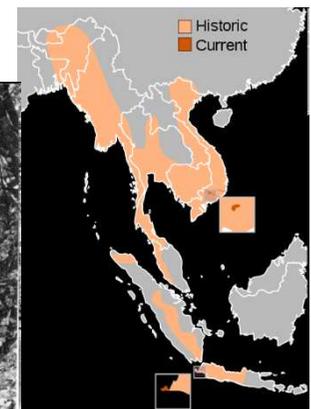
Species	Greater One Horned		Lesser One Horned				Sumatran			
	Subspecies	Trend	Subspecies	Subspecies	Total	Trend	Subspecies	Subspecies	Total	Trend
India	<i>R.unicornis</i>	Up								
Nepal	<i>R.unicornis</i>	Stable/Up?								
Pakistan	<i>R.unicornis</i>	Unknown								
Indonesia			<i>R.s.ondaicus</i>	<i>R.s.annsmiticus</i>			<i>D.s.sumatrensis</i>	<i>D.s.harrissoni</i>		
Malaysia										
VietNam										
Total	2,800	Up	38-44	0-5	38-49	Stable/Down?	140-200?	20-30	160-300?	Down



Number of photo trap records of Lesser One Horned (= Javan) Rhinoceros in Vietnam

Greater One Horned (= Indian) Rhino population development (1910-2005)

On the 24th October 2011 the WWF announced that the last Lesser One Horned Rhinoceros in Vietnam had been poached.



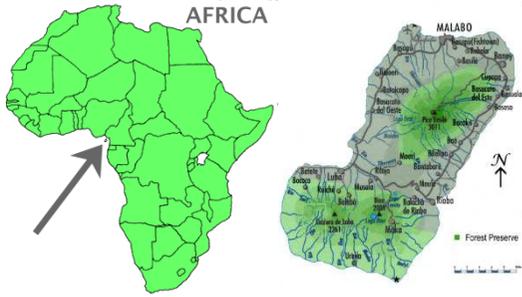
Threat to species by hunting

In many developing (poor!) countries, wild animals are hunted, often illegally, as an supplementary or even main source of food (proteins!) – so-called „bushmeat“ (in Africa) – however, this meat reaches increasingly also the European market!
Apes are among the hunting game.



Threat to species by hunting

Example: Bioko Island (Equatorial Guinea): what ends on the market and eventually in the kitchen!



Threat to species by hunting



The sale of animals, their parts or products made of them as souvenirs or collector items can lead to dramatic decline in populations.

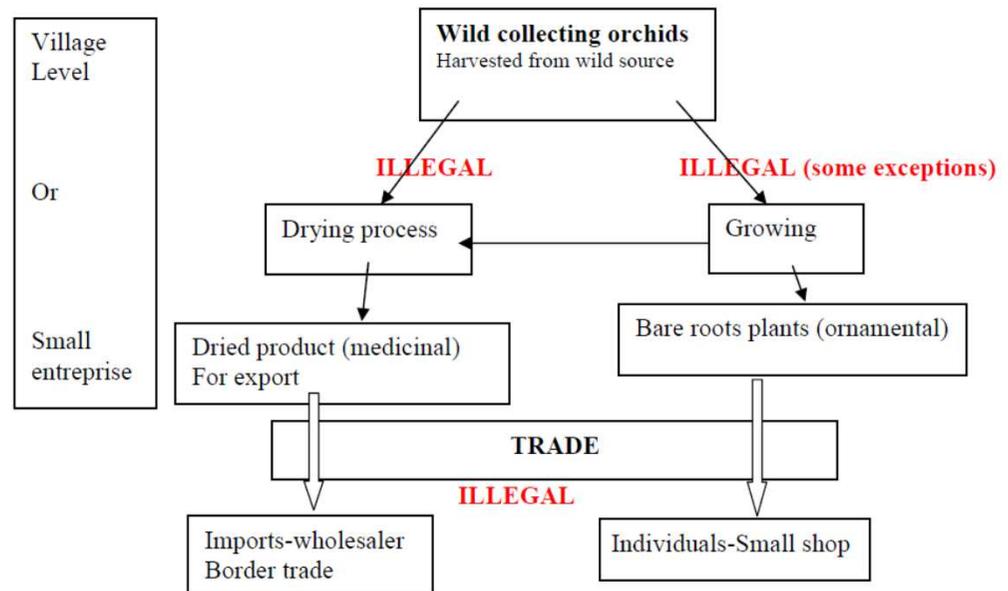


Legal trophy hunting (“sport”) can provide substantial funding for national or private reserves, and thus co-fund nature conservation. However, the longing for trophies can also lead to illegal hunting, corruption etc. The existence of legal products obtained from animals killed for trophy makes it easier to trade with such products obtained illegally.

Threat to species by hunting

Trade with wild-growing orchids seriously threatens many species

Declared orchid trade in Laos 2007				
Specie	Province	Quantity Kg	Plants equivalent	Value in USD
Dendrobium spé	All around country	10700	10000	160500
Paphiopedilum spé	All around country	1250	2000	68750
Anoectochilus	North	160	2000	16000
Arachnis & Aerides spé	South	10000	6000	60000
Dendrobium officinale	All around country	3500	3200	52500
TOTAL		25610	23200	305250



The orchid trade in Laos

Threat to species by hunting

Whaling – most populations of large species decreased dramatically

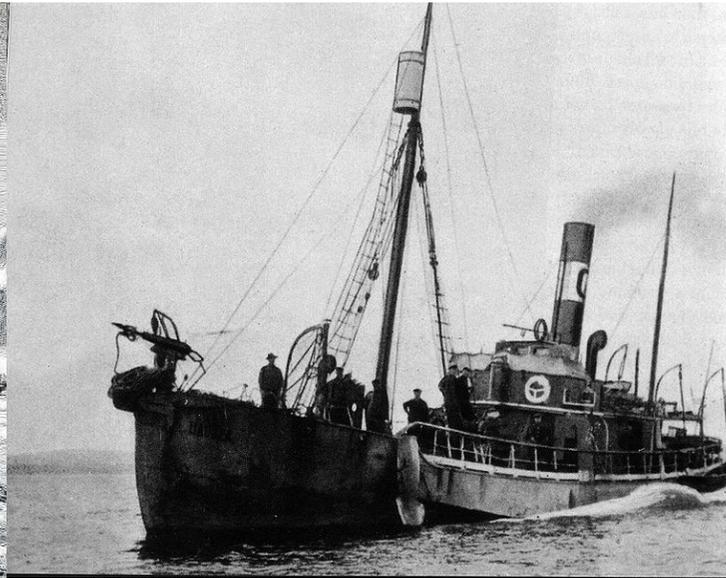


Photo: Stan Shebs



Nowadays mostly subsistence hunting by indigenous peoples is permitted (above Eskimoes or Inuit in Greenland)



Photo: Zenwort

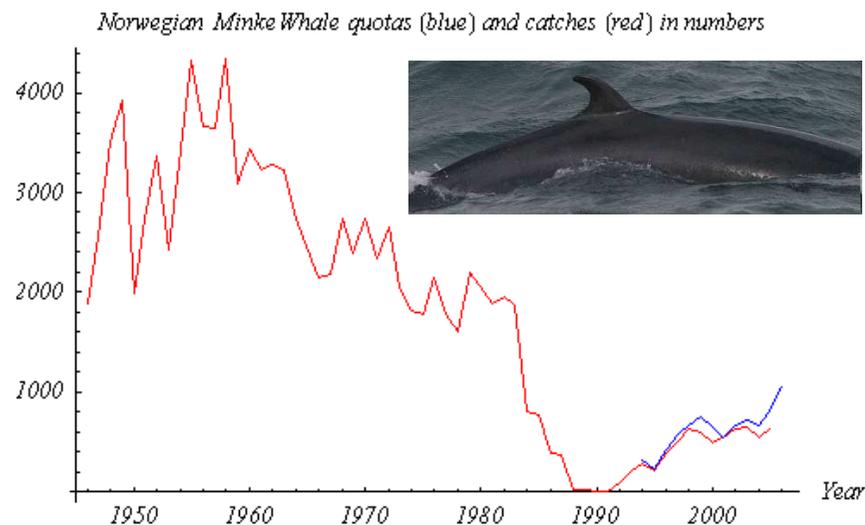
Whale meat in a grocery shop in Japan, where Whaling is still done for “research purposes”

Threat to species by hunting

Assesment of the impact of human hunting on whale populations

Species	Natural population size (pre-hunting estimates)	Present population (estimates of the number of individuals)
Baleen whales		
Blue whale	200 000	9 000
Common minke whale	140 000	850 000
Sei whale	100 000	55 000
Fin whale	475 000	123 000
Grey whale	23 000	21 000
Bowhead whale	56 000	8 200
Humpback whale	150 000	25 000
North Atlantic right whale	?	1 300
Southern right whale	100 000	1 500
Toothed whales		
Beluga	?	50 000
Narwhal	?	35 000
Sperm whale	2 400 000	1 950 000

Threat to species by hunting



Numbers of Minke whale (*Balaenoptera acurostrata*) catches by Norwegian whalers (red) and quotas of allowed catches (blue)



Catch of Atlantic white-sided dolphin (*Lagenorhynchus acutus*) na the island of Hvalba (Faroe Islands, 26. Aug. 2006)

Threat to species by hunting

Hunting, fishing, harvesting:
about the use of populations
Living / growing in the wild



Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

Table 16.6 Effects produced in populations of the blowfly *Lucilia cuprina* by the destruction of different constant percentages of emerging adults. (After Nicholson 1954b.)

Exploitation rate of emerging adults	Pupae produced per day (a)	Adults emerged per day (b)	Mean adult population (c)	Mean birth rate (per individual per day) (a/c)	Natural adult deaths per day	Adults destroyed per day (d)	Accessions of adults per day (e = b - d)	Mean adult life-span (days) (c/e)
0%	624	573	2520	0.25	573	0	573	4.4
50%	782	712	2335	0.33	356	356	356	6.6
75%	948	878	1588	0.60	220	658	229	7.2
90%	1361	1260	878	1.55	125	1134	126	7.0

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

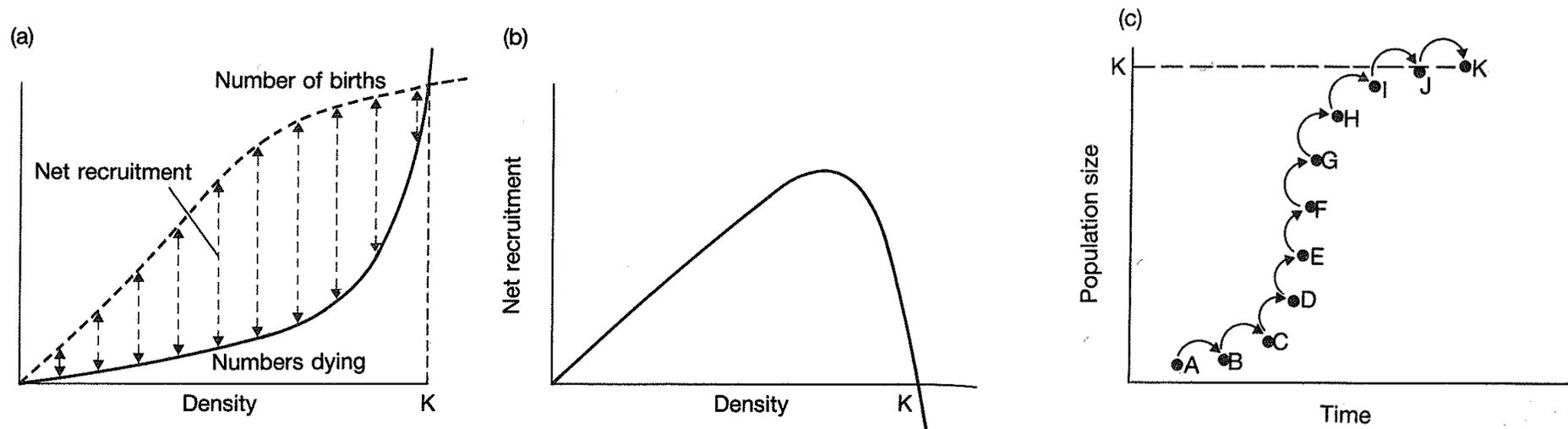


Figure 6.7. Some general aspects of intraspecific competition. (a) Density-dependent effects on the numbers dying and the number of births in a population: net recruitment is 'births minus deaths'. Hence, as shown in (b), the density-dependent effect of intraspecific competition on net recruitment is a humped or 'n'-shaped curve. (c) A population increasing in size under the influence of the relationships in (a) and (b). Each arrow represents the change in size of the population over one interval of time. Change (i.e. net recruitment) is small when density is low (i.e. at small population sizes: A to B, B to C) and is small close to the carrying capacity (I to J, J to K), but is large at intermediate densities (E to F). The result is an 'S'-shaped or sigmoidal pattern of population increase, approaching the carrying capacity.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

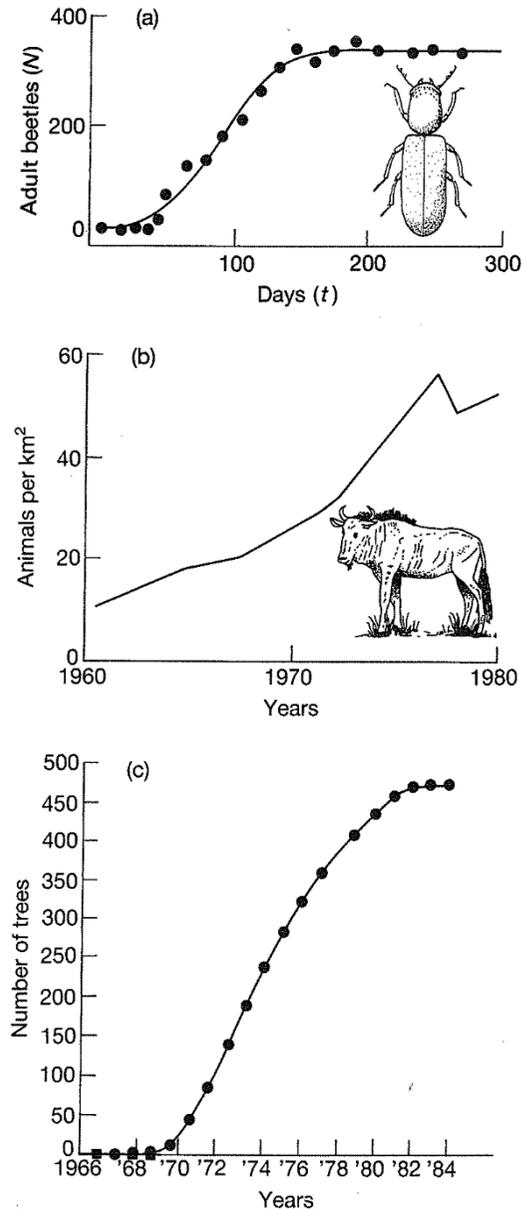


Figure 6.9. Real examples of an 'S'-shaped population increase. (a) The beetle *Rhizopertha dominica* in 10 g of wheat grains replenished each week. (After Crombie, 1945.) (b) The population of wildebeest, *Connochaetes taurinus*, of the Serengeti region of Tanzania and Kenya seems to be levelling off after rising from a low density caused by the disease rinderpest. (After Sinclair & Norton-Griffiths, 1982. From Deshmukh, 1986.) (c) The population of the willow tree, *Salix cinerea*, in an area of land after myxamatosis had effectively prevented rabbit grazing. (After Alliende & Harper, 1989.)

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

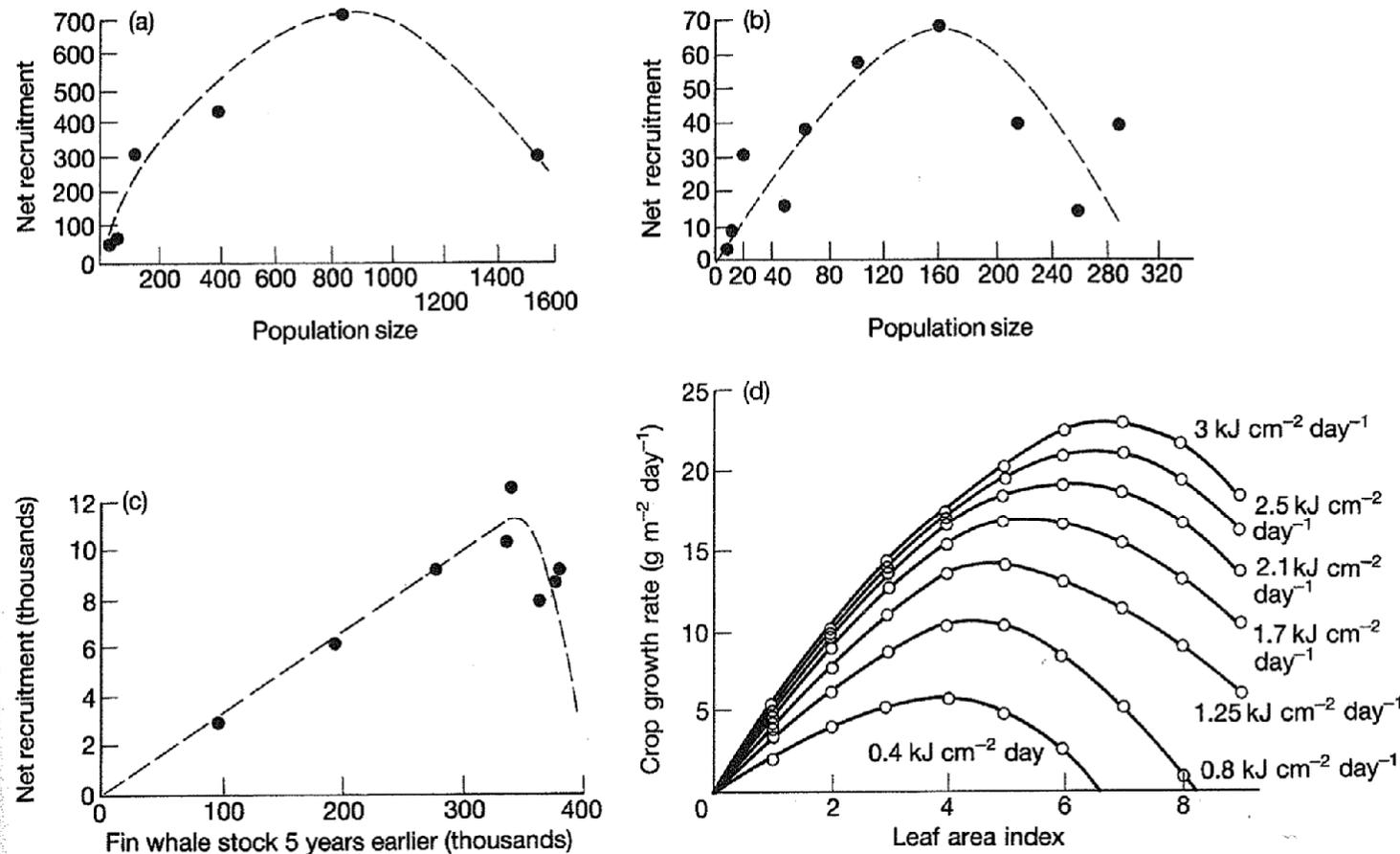


Figure 6.8. Some 'n'-shaped net recruitment curves, drawn by eye through the data points shown. (a) The ring-necked pheasant on Protection Island following its introduction in 1937. (Data from Einarsen, 1945.) (b) An experimental population of the fruit-fly *Drosophila melanogaster*. (Data from Pearl, 1927.) (c) Estimates

for the stock of Antarctic fin whales. (After Allen, 1972.) (d) The relationship between crop growth rate of subterranean clover (*Trifolium subterraneum*) and leaf area index (LAI) at various intensities of radiation. Note that the leaf area index at which crop growth rate is maximal depends on the light intensity. (After Black, 1963.)

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

To reach a maximal yield while not damaging the population we have to keep population size at N_m .

h_m is the highest yield that the population is able to support by its own increment = **maximum sustainable yield (MSY)**

Net recruitment (increment) curve of a hypothetical population

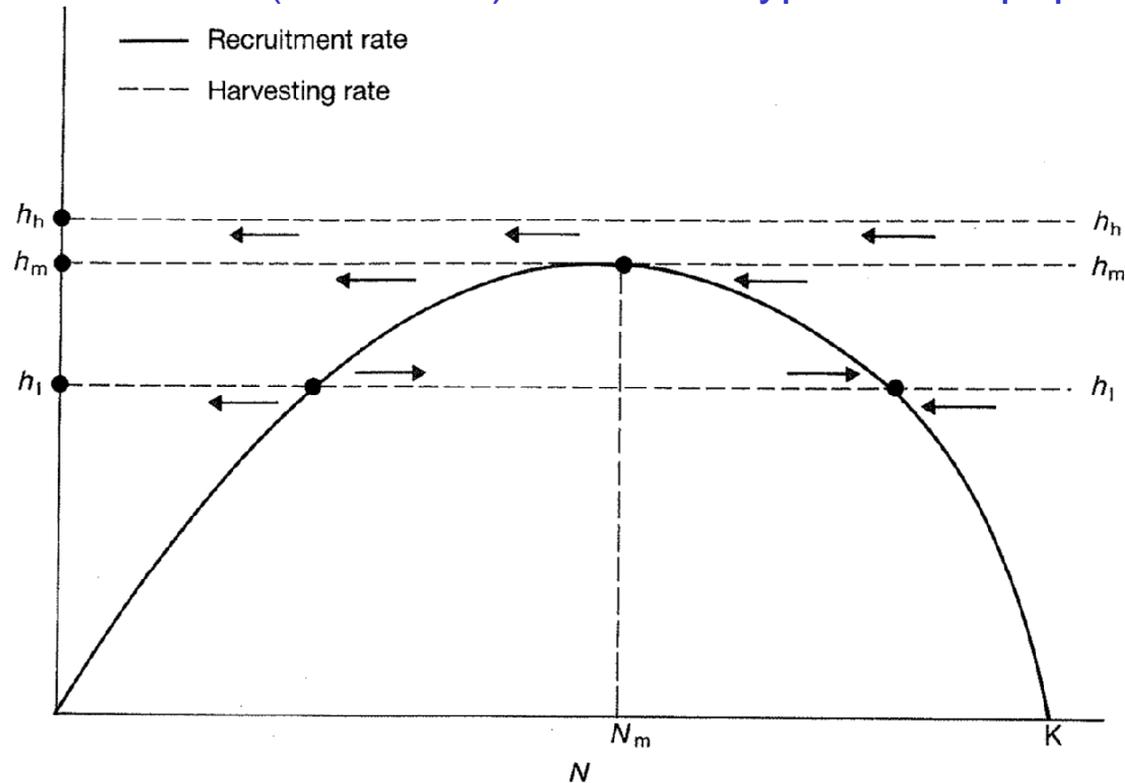


Figure 16.11. Fixed-quota harvesting. The figure shows a single recruitment curve (solid line) and three fixed-quota harvesting curves (broken lines); high quota (h_h), medium quota (h_m) and low quota (h_l). Arrows in the figure refer to changes to be expected in abundance under the influence of the harvesting rate to which the arrows are closest. Dots (•) are equilibria. At h_h the only 'equilibrium' is when the population is driven to extinction. At h_l there is a stable equilibrium at a relatively high density, and also an unstable break-point at a relatively low density. The maximum sustainable yield is obtained at h_m because it just touches the peak of the recruitment curve (at a density N_m): populations greater than N_m are reduced to N_m , but populations smaller than N_m are driven to extinction.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

The highest frequency of harvesting at a medium population density

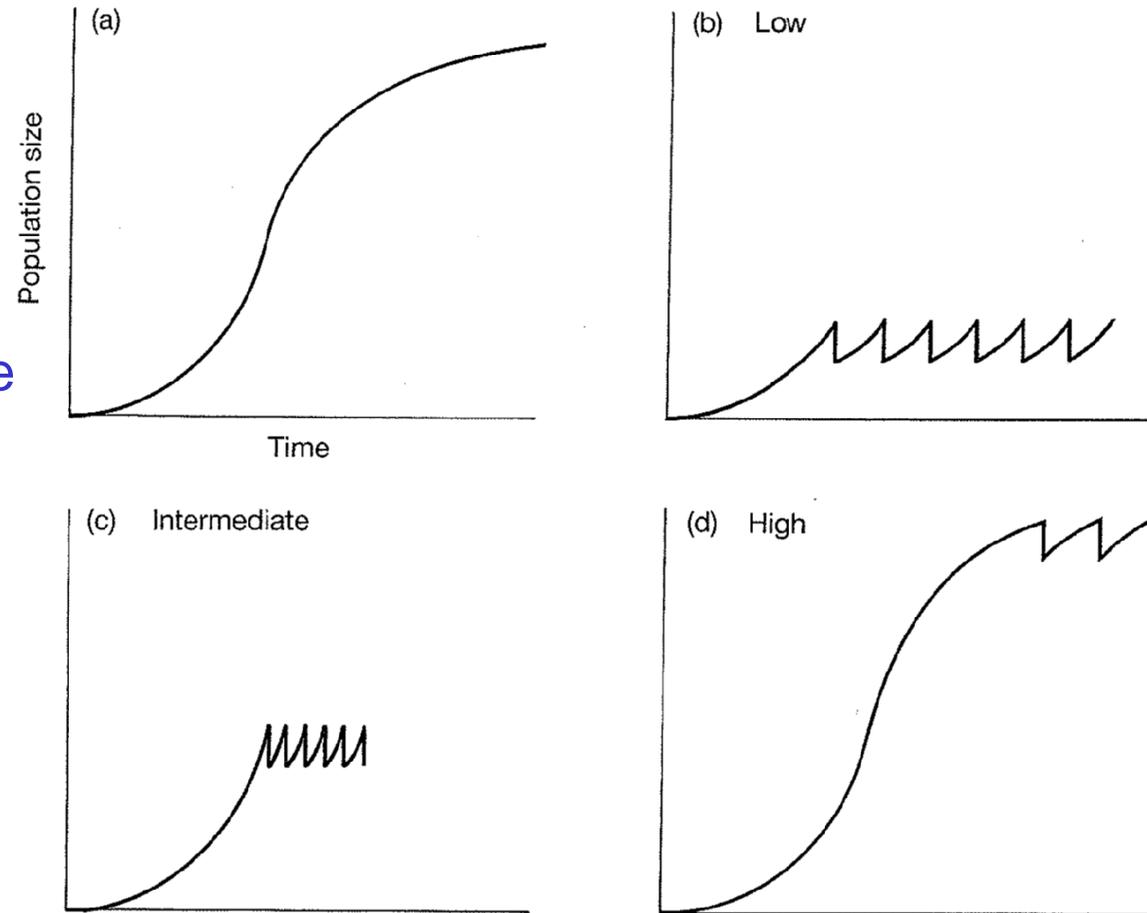


Figure 16.12. For a population exhibiting 'S'-shape growth in size (a), at what density can a harvest of a given size (the vertical lines in (b), (c) and (d)) be taken most frequently? The answer is 'at an intermediate density', shown in (c). At both low (b) and high (d) densities, the rate of growth and thus the frequency of harvest is lower.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

The MSY approach was used by the International Whaling Commission to set fixed annual whaling quota in 1949-1960.

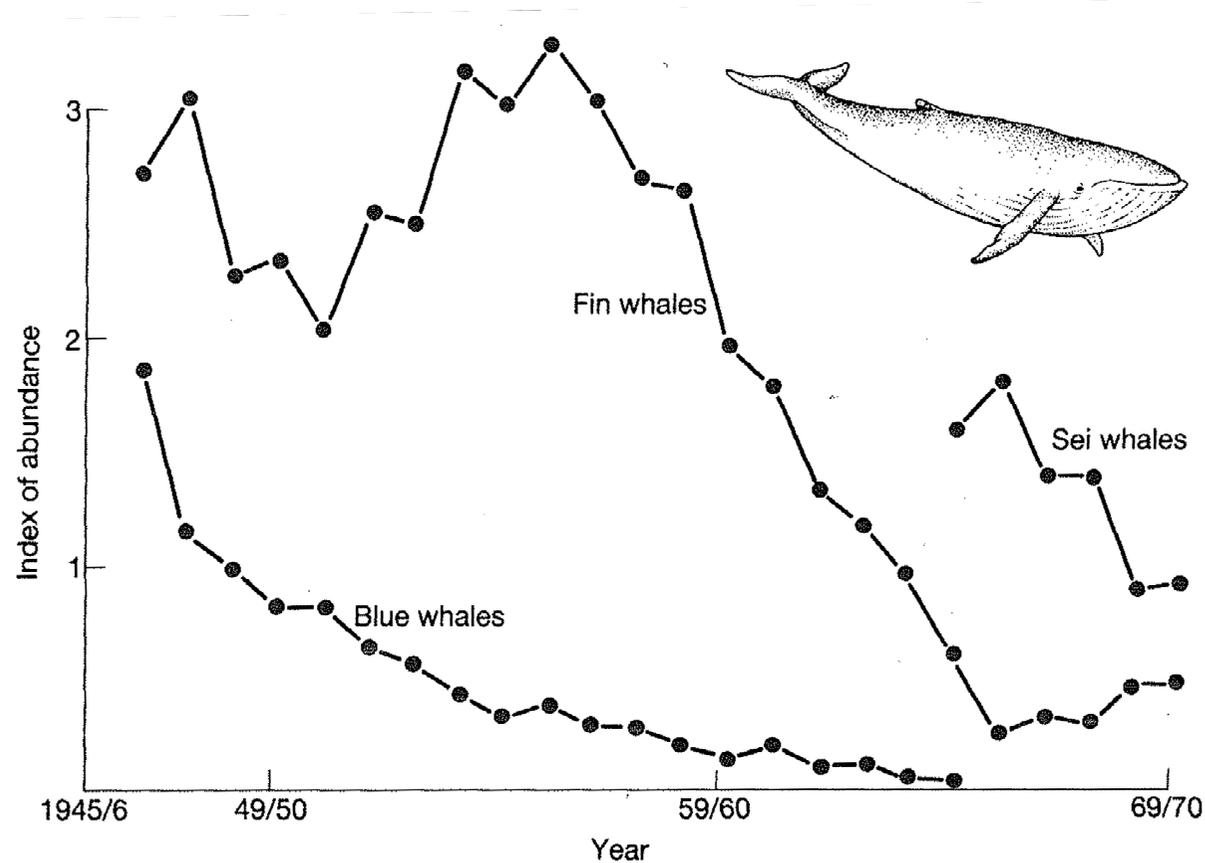


Figure 16.13. The declines in the abundance of Antarctic baleen whales under the influence of human harvesting. (After Gulland, 1971.)

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

An alternative to fixed quota is the regulation of harvesting effort.

$$h = g * E * N$$

h = yield from a harvest

g = harvesting efficiency

E = level of harvesting effort

N = population size



Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

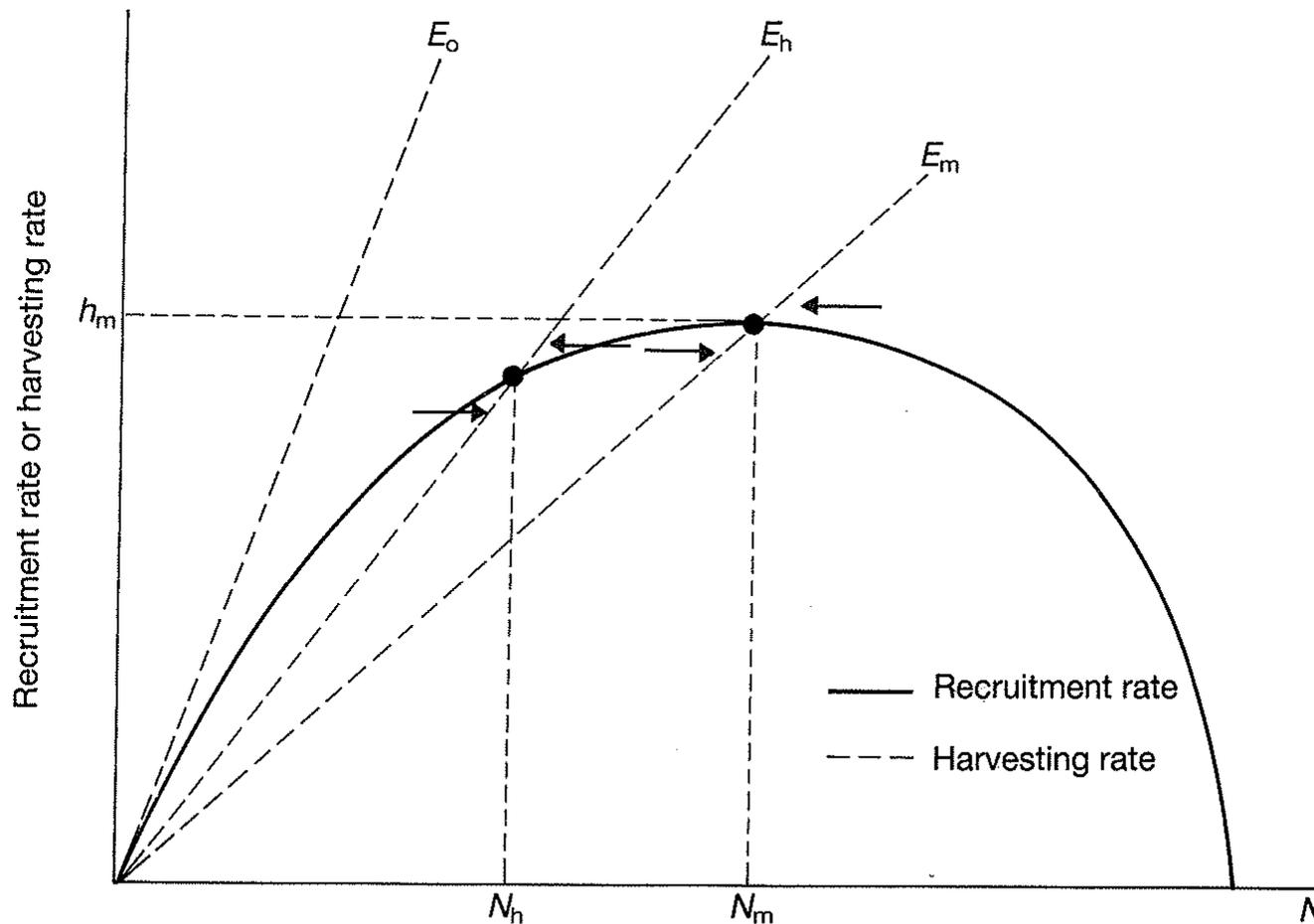


Figure 16.14. Constant-effort harvesting. Curves, arrows and dots as in Figure 16.11. The maximum sustainable yield is obtained with an effort of E_m , leading to a stable equilibrium at a density of N_m with a yield of h_m . At a somewhat higher effort (E_h), the equilibrium density and the yield are both lower than with E_m but the equilibrium is still stable. Only at a much higher effort (E_o) is the population driven to extinction.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

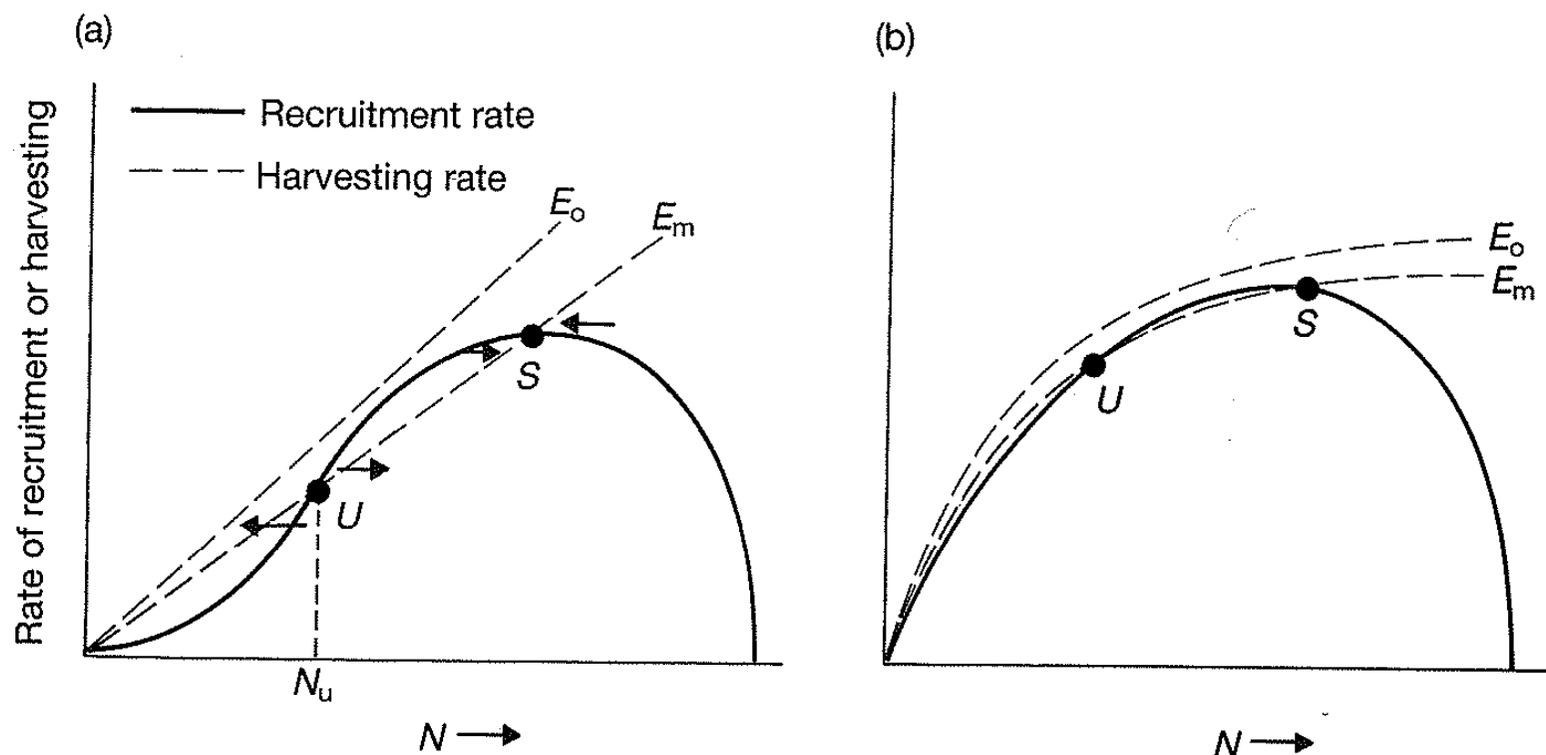


Figure 16.15. Multiple equilibria in harvesting. (a) When recruitment rate is particularly low at low densities, the harvesting effort giving the maximum sustainable yield (E_m) has not only a stable equilibrium (S) but also an unstable break-point (U) at a density below which the population declines to extinction. The population can also be driven to extinction by harvesting efforts (E_o) not much greater than E_m . (b) When harvesting efficiency declines at high densities, comments similar to those in (a) are appropriate.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

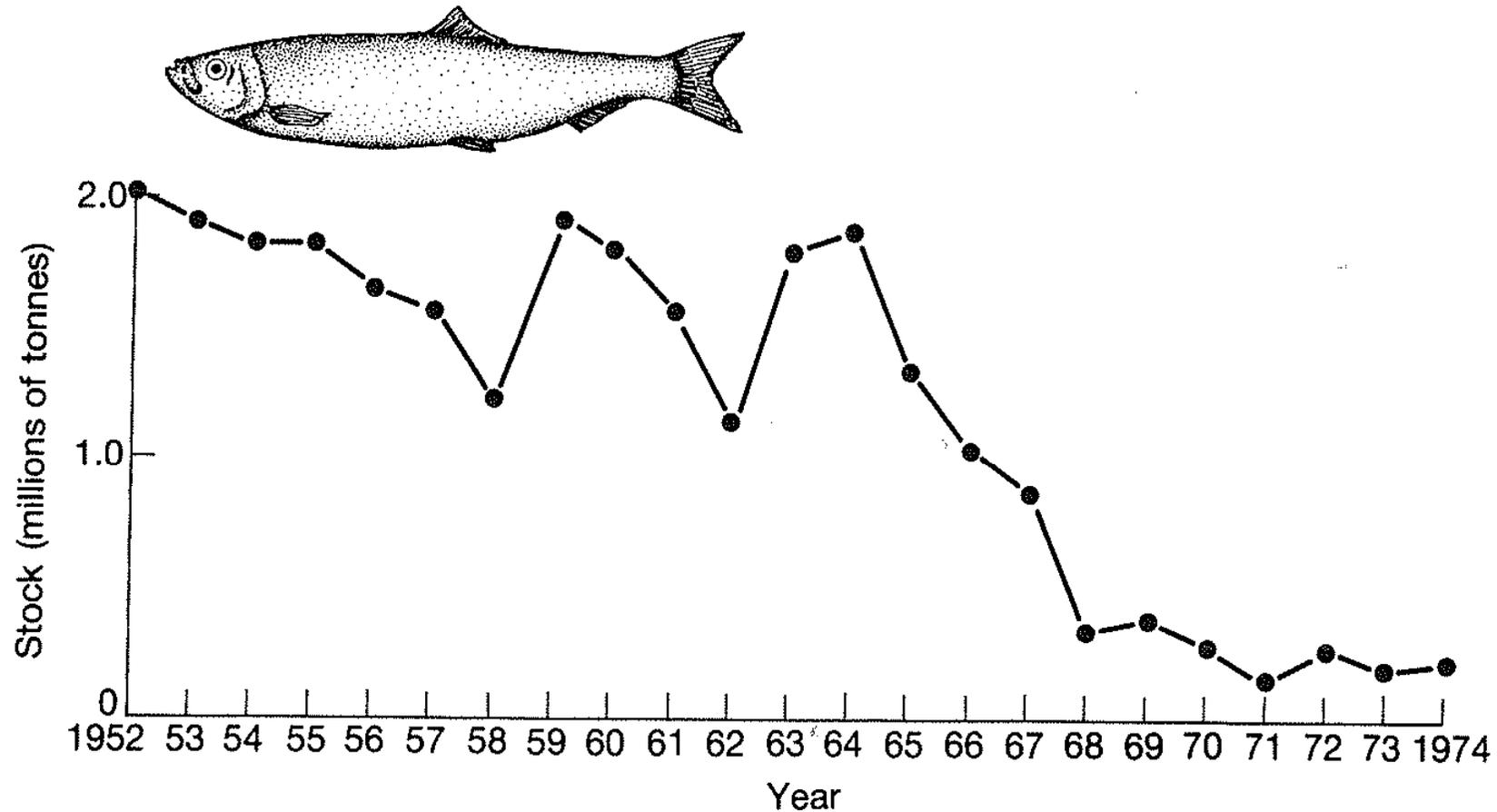


Figure 16.16. The decline in the stock of North Sea herring (measured in millions of tonnes). (After Iles, 1981.)

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

Surplus Yield Models
(all introduced above)

Alternative approach (more complicated):

Dynamic Pool Models

(the very first one formulated in 1957)

Available data on the population (empirical and theoretical) are arranged in such a way to reflect the dynamics of a structured population.

Recommendation for the practise includes not only harvesting effort but also its break down to the individual age classes.

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

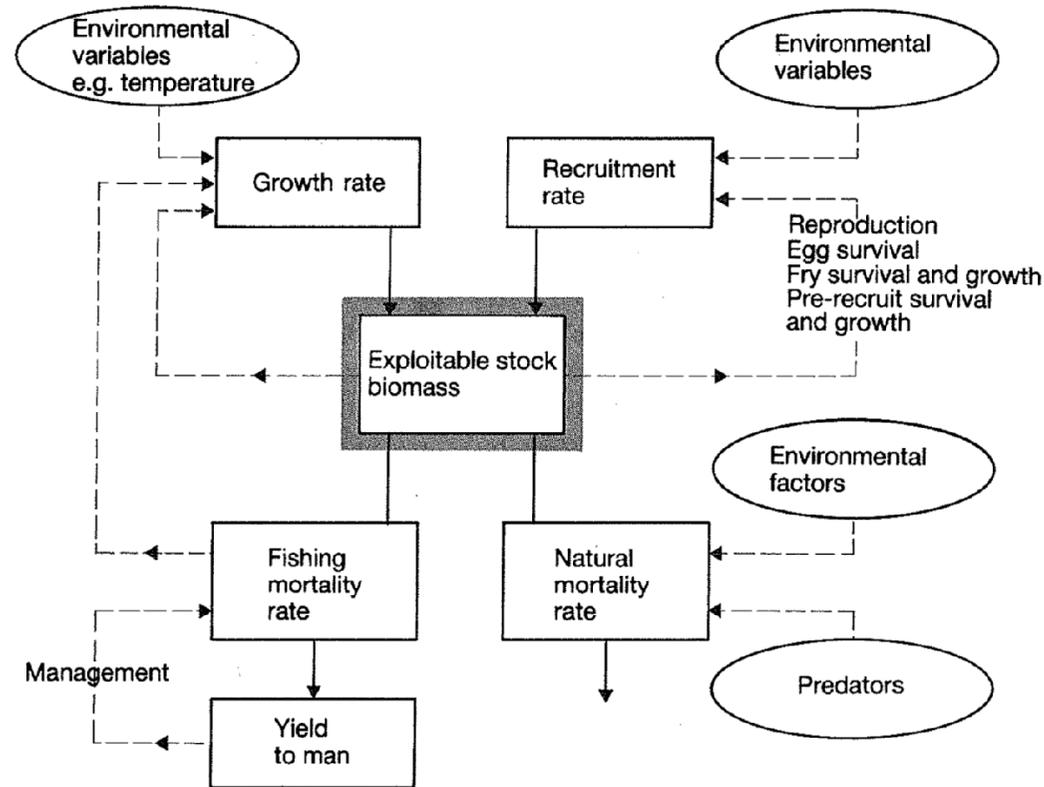
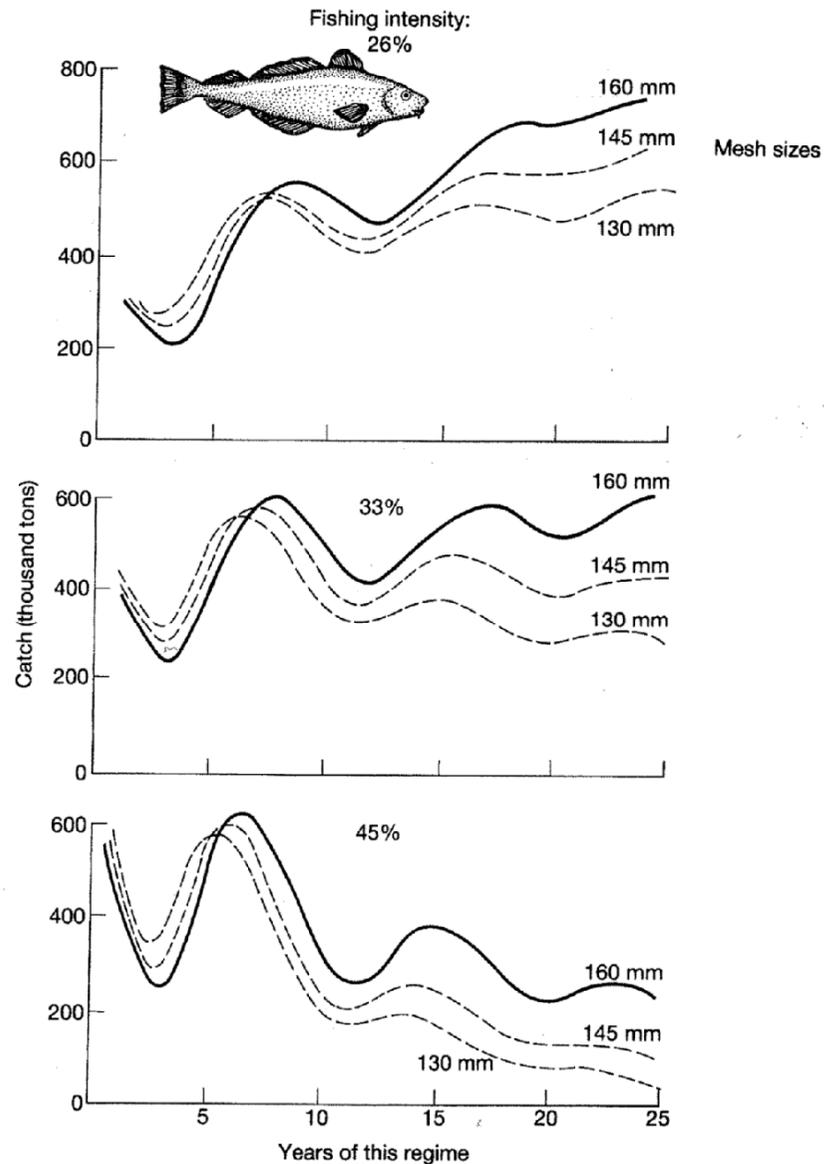


Figure 16.17. The dynamic pool approach to fishery harvesting and management, illustrated as a flow diagram. There are four main 'sub-models': the growth rate of individuals and the recruitment rate into the population (which add to the exploitable biomass), and the natural mortality rate and the fishing mortality rate (which deplete the exploitable biomass). Solid lines and arrows refer to changes in biomass under the influence of these sub-models. Dashed lines and arrows refer to influences either of one sub-model on another, or of the level of biomass on a sub-model, or of environmental factors on a sub-model. Each of the sub-models can itself be broken down into more complex and realistic systems. Yield to man is estimated under various regimes characterized by particular values inserted into the sub-models. These values may be derived theoretically (in which case they are 'assumptions') or from field data. (After Pitcher & Hart, 1982).

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild



Garrod and Jones made at the the turn of the 1970s a **dynamic pool model** for the northernmost part of the **cod** population in the Atlantic ocean – the subpopulation in Norwegian Arctica:

- They assessed the age class structure in the late 1960s.
- They forecasted the medium-term effect of various fishing intensities and mesh sizes in the trawl nets on the catch.
- The temporary peak after five years was the effect of the large year-class hatched in 1969.
- Recommendation: low intensity fishing using a large mesh size (let the fish grow and reproduce for a longer time).

Figure 16.18. Garrod and Jones's (1974) predictions for the Arctic cod stock under three fishing intensities and with three different mesh sizes. (After Pitcher & Hart, 1982.)

Threat to species by hunting

Hunting, fishing, harvesting: about the use of populations living / growing in the wild

What happened with the recommendations given by Garrod and Jonese?

- The **mesh size was not modified before 1979** when it was increased from **120 mm to 125 mm** (according to Garrod and Jonese **already the use of a mesh size of 130 mm led to an overexploitation** of the population!).
- Cod fishing intensity never dropped below 45% (in the late 1970s annual catches of 900 000 tonnes were taken).

At the end of the 1980s the subpopulation of cod in Norwegian Arctica was seriously depleted – similarly as all other cod stocks in the North Atlantic.

For more details see Chapter 15 in Begon et al. (2006): Ecology: from individuals to ecosystems. 4th ed. Blackwell Publishing Ltd.