

Chpt. 8: Overexploitation

What is exploitation (harvesting)?

Why do we exploit *(think back to those utilitarian needs)*?

What are our motivations *(Maslow and Adam Smith might come in handy here)*?

Tragedy of the Commons

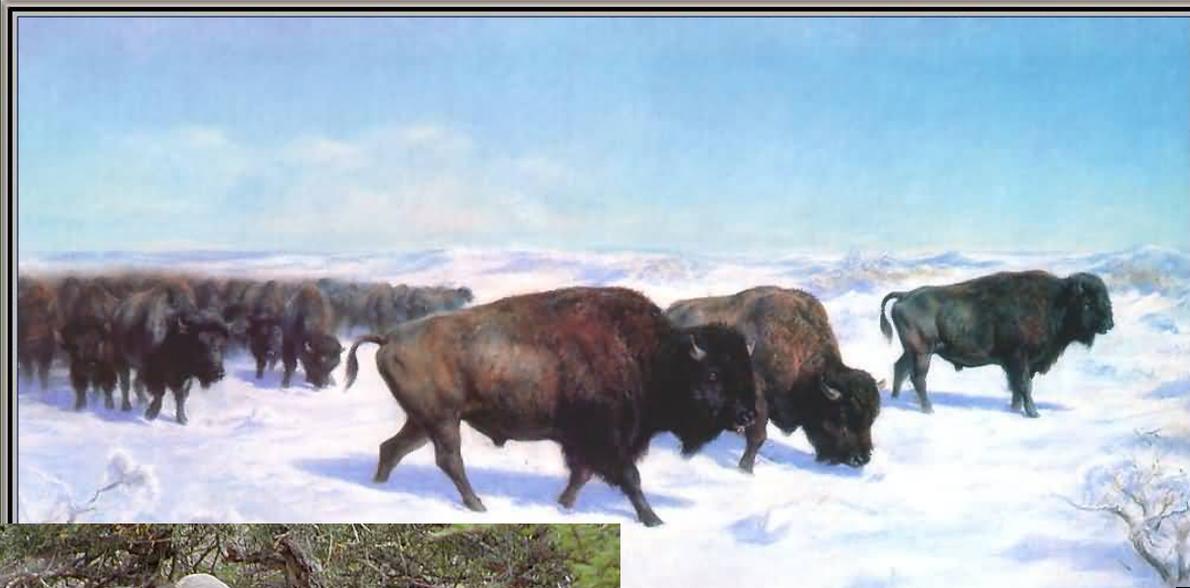
"Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons." (Hardin, 1968)

Overexploitation

2nd biggest threat to terrestrial biodiversity

3rd biggest threat to freshwater fish
extinctions

Classic Examples of Single-Species Overexploitation





In 1902, the auctions at the London Commercial Sales Room sold 1,608 packages of herons' plumes weighing about 30 ounces each. Four herons were needed to make one ounce of plumes; therefore, the sales from this one source alone required 192,960 herons killed.

Impacts of Exploitation: Target Species

TROPICAL SYSTEMS:

Timber Extraction – frontier expansion/infrastructure development, expanding subsistence farming, expanding industrial agriculture; globally around 14 million acres/year logged, 25% of all production

(Importance of endozoochorous trees (90% of all tropical trees) and native dispersers)

Subsistence Hunting – aborigines, rural, and urban communities

Non-timber Forest Products – examples?



Illegal logging and Gibson guitar controversy

<http://www.bbc.co.uk/news/magazine-15268169>

Also refer to the illegal logging section of the Lacey Act in Invasive Species notes

TABLE 10.1 Major Targeted Groups of the Worldwide Trade in Wildlife

Group	Number traded each year ^a	Comments
Primates	40,000	Mostly used for biomedical research; also for pets, zoos, circuses, and private collections.
Birds	4 million	Zoos and pets. Mostly perching birds, but also legal and illegal trade of about 80,000 parrots.
Reptiles	640,000	Zoos and pets. Also 10–15 million raw skins. Reptiles are used in some 50 million manufactured products (mainly from the wild but increasingly from farms).
Ornamental fish	350 million	Most saltwater tropical fish come from the wild and may be caught by illegal methods that damage other wildlife and the surrounding coral reef.
Reef corals	1000–2000 tons	Reefs are being destructively mined to provide aquarium decor and coral jewelry.
Orchids	9–10 million	Approximately 10% of the international trade comes from the wild, sometimes deliberately mislabeled to avoid regulation.
Cacti	7–8 million	Approximately 15% of traded cacti come from the wild, with smuggling a major problem.

Source: Data from WRI 2005 and Karesh 2005.

^aWith the exception of reef corals, refers to number of individuals.

Impacts of Exploitation: Target Species

TEMPERATE SYSTEMS:

Timber Extraction – widespread, most of global production, sustainability somewhat increased by modern forestry practices

(boreal forests particularly threatened; important non-commercial components)

Subsistence Hunting – increasingly rare, but recreational hunting has large impacts

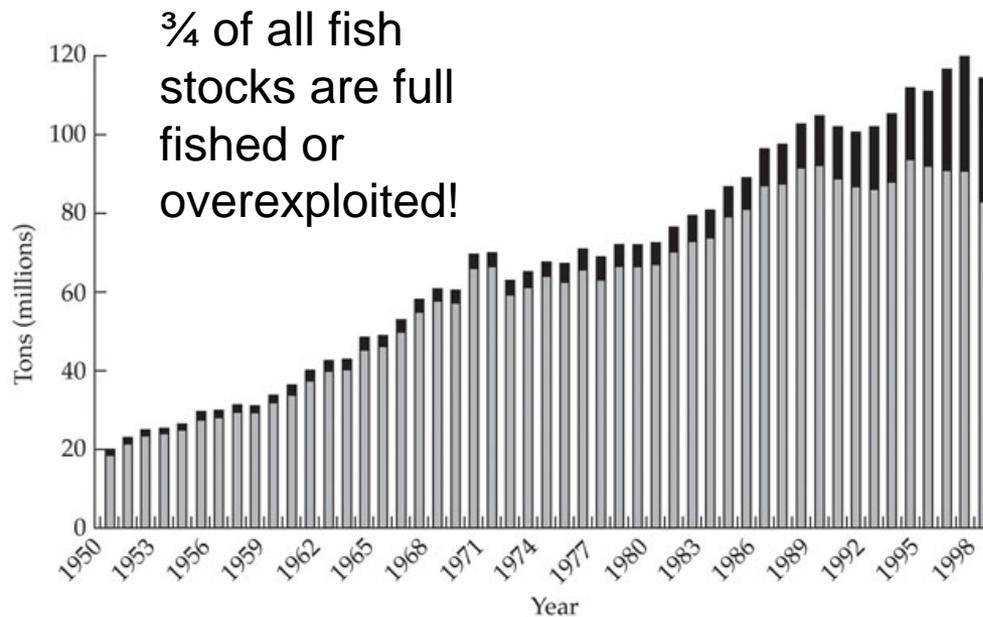
Non-timber Forest Products – what are some examples from KY? Below might be a good hint. <http://www.youtube.com/watch?v=u3CxPUr6cy4>



Now compare exploitation between these two general terrestrial types of systems.

Impacts of Exploitation: Target Species

AQUATIC SYSTEMS:



Note: The Y axis is Tons of fish harvested

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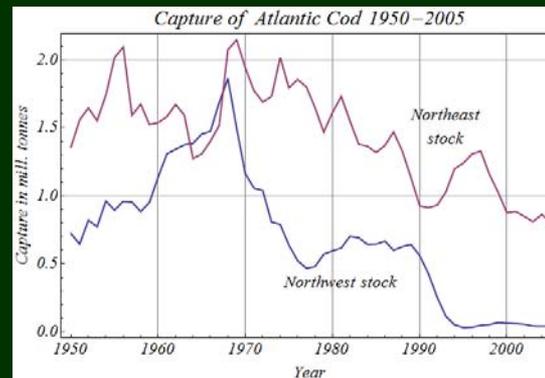
Fish most vulnerable or easiest to exploit:

- live in shallow water
- high capture susceptibility
- low reproductive rates
- site congregationists (schooling behavior)

Atlantic Cod



- In U.S. waters ranges from Maine to North Carolina
- Overfishing led to major pop collapse in 1990s
 - Numbers down
 - Individual size down (also refer to the “Shrink to Fit” article on overexploitation and size trends for many species)
 - (as w/ many species of fish we’re culling the biggest/prime individuals)
- Major restrictions on harvest have led to stabilization and some population increase in recent years



http://www.nmfs.noaa.gov/fishwatch/species/atlantic_cod.htm (NMFS gov website on cod)

<http://www.youtube.com/watch?NR=1&v=WJeLwrgstmq> (Impacts of Cod fisheries loss on human communities)

Elephants and Ivory Trade

Elephants killed for tusks made of ivory that is raw material for carvings, other art, and decorative ornamentation (e.g. ivory keys on older pianos)

Elephants are ecosystem engineers; why might their loss create major impacts in African ecosystems? What life history attributes do elephants have that make them vulnerable to overexploitation?



<http://www.youtube.com/watch?v=3PkRtXXImVA> (Elephants and Ivory News Clip)





Sharks



- Sharks are an ancient (~400 million years old), apex oceanic predator of immense importance to the ecosystem
 - See <http://www.youtube.com/watch?v=yzlqXMateRE&feature=relmfu> (Loss of Sharks from Ecosystem Perspective) and **READ the Myers et al. Science paper**. Understand how loss of sharks impacts places like the Chesapeake Bay and other coastal areas.
- ~73 million sharks are harvested each year, deliberately they are caught in “finned”; their fins are cut off and used to make shark fin soup, sold primarily in Asian markets; other sharks perish as bycatch (non-target organisms caught in nets)
- <http://www.youtube.com/watch?v=Uo8K1-BVtNw> (About shark finning in general from South African reporter)
- <http://www.youtube.com/watch?v=C2UKgLsOhRM> (Awareness is growing in East Asia that shark overharvest is a major problem and measures need to be taken)
- As a result of overexploitation, about 1/3 of all sharks (~60+ species) are on the IUCN **Red List**

Legal Measures to Protect Sharks

- **Shark Conservation Act of 2010** - Prohibits any person from cutting the fins of a shark at sea and from possessing, transferring and landing shark fins (including the tail) that are not "naturally attached to the corresponding carcass". In addition it prohibits any person from landing a shark carcass without its corresponding fins being "naturally attached".
- The European Union, Chile, and also have bans on shark finning and harvest of some species, but there are many loopholes in these laws.
- California bans selling of shark fin soup (Sept 2011)
- http://blogs.sfweekly.com/foodie/2011/10/sharks_fin_soup_banned_done_k_a.php
- <http://www.sharkalliance.org> (Lots of good info here on efforts to protect sharks)

Bushmeat Trade

- Major crisis particularly in Africa, but also in many parts of Asia, and to a lesser degree, South America.
- Catalyzed by
 - road creation and increased auto access on existing roads
 - modern firearm proliferation
 - local loss of traditional protein sources
 - illegal and legal logging and other forms of habitat loss and fragmentation
- To Satisfy market for:
 - Local and exported food
 - Local and exported medicinal uses
 - Fur trade
 - Other trade in animal parts (e.g. horns, teeth, skulls, etc.)
- <http://www.bushmeat.org/>
- <http://www.rhinoconservation.org/2011/07/25/fuss-over-antique-rhinoceros-horn-cups-fails-to-mention-loss-of-life/>

Convention on International Trade in Endangered Species of Wild Flora and Fauna (**CITES**) (1973)

- Prohibits importing, exporting, wildlife or plants, their parts or derivatives, of certain species unless permitted to do so by both the importing and exporting country



Some Impacts of Exploitation: Non-target Species

- Trophic Cascades
- Loss of Seed-dispersal Effects
- Increased forest flammability
- Indirect killing of other species

Can you think of others?

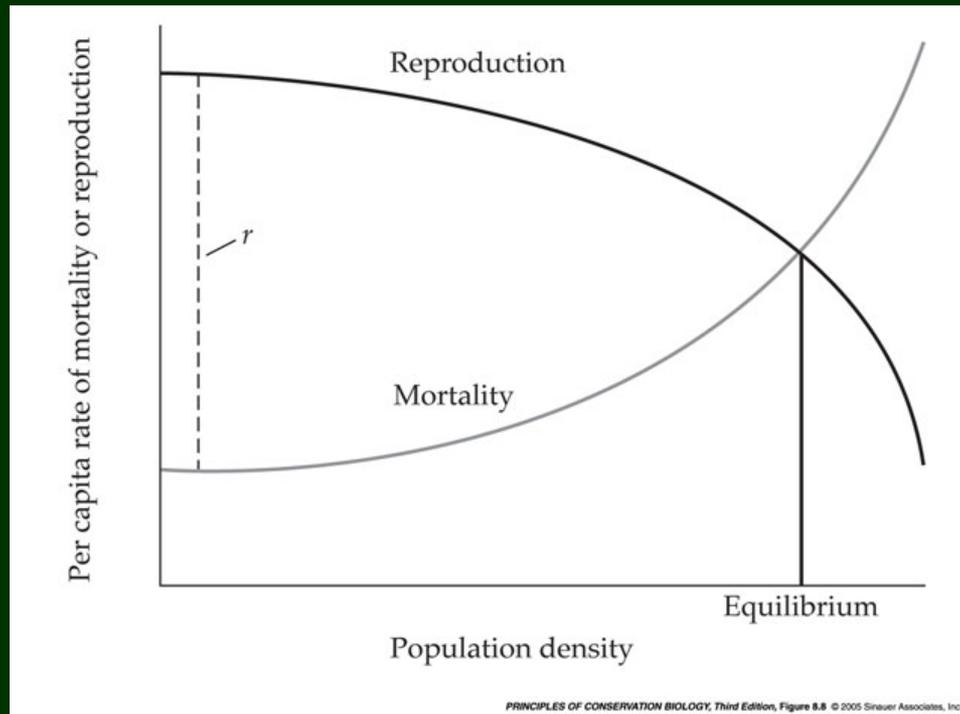
Species Vulnerability to Overexploitation

- *What are some traits that make a species vulnerable to overexploitation?*
 - Congregate, or herd forming
 - Highly visible to humans
 - Lack fear of humans (“naïve prey”)
 - Low reproductive rate
 - High human demand for products
 - Live in accessible or areas of high human population density

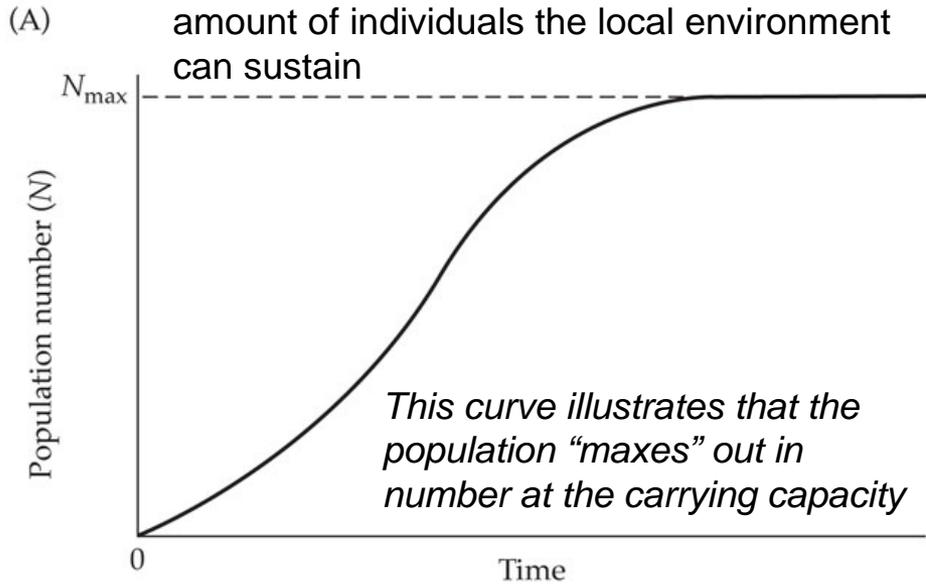
Biological Theory on *Sustainable* Exploitation

Sustainable Exploitation

- Biological pops. are renewable, thus they can be sustainably exploited
- Species have wide-range of responses to exploitation
- A density dependent growth pattern is characterized by increasing mortality and decreasing reproduction as the population grows and the number of individuals/area (density) increases. *What might be responsible for this phenomenon?*

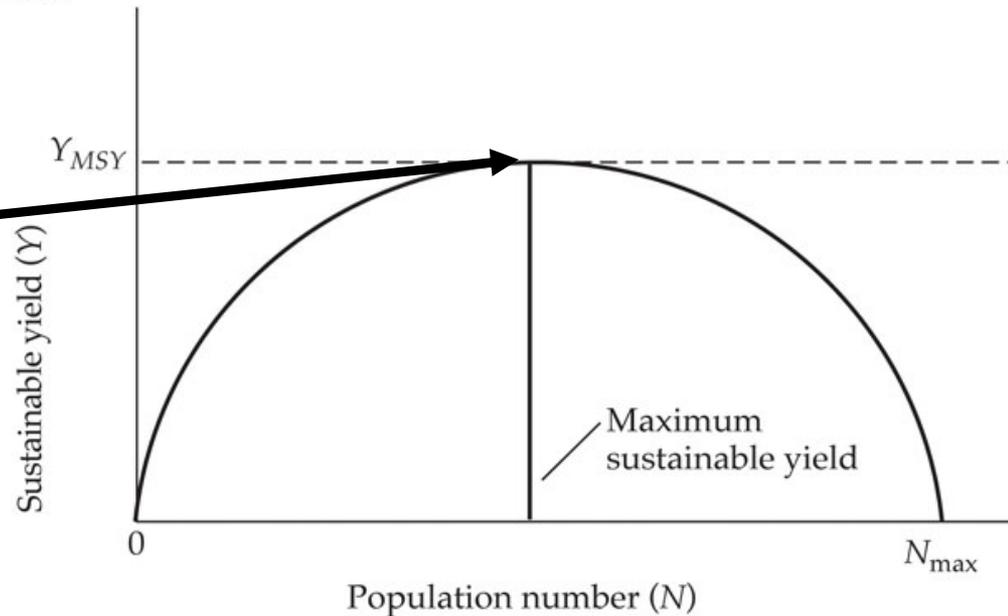


Nmax or Carrying capacity – the maximum amount of individuals the local environment can sustain



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Maximum Sustainable Yield = the greatest amount of a resource that can be harvested each year and replaced by population growth. Point at which population is at a size that it can grow most rapidly (in many cases) *Note: this is typically at $\frac{1}{2} N_{\max}$*



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Tragedy of the Commons Positive Feedback Loop

