

Main Points

1) Homo sapiens as just another mammal

- metabolism, allometry, and life histories revisited
- the production of extra-metabolic energy
- energy consumption as a predictor of life histories

2) The appealing oxymoron of sustainable development

- wealth as a predictor of energy consumption
- the Malthusian-Darwinian dynamic, failed societies, and alternatives to technological bail-outs
- commons tragedies and selfish genes
- the silver lining!

3) Two recent success stories in wildlife conservation

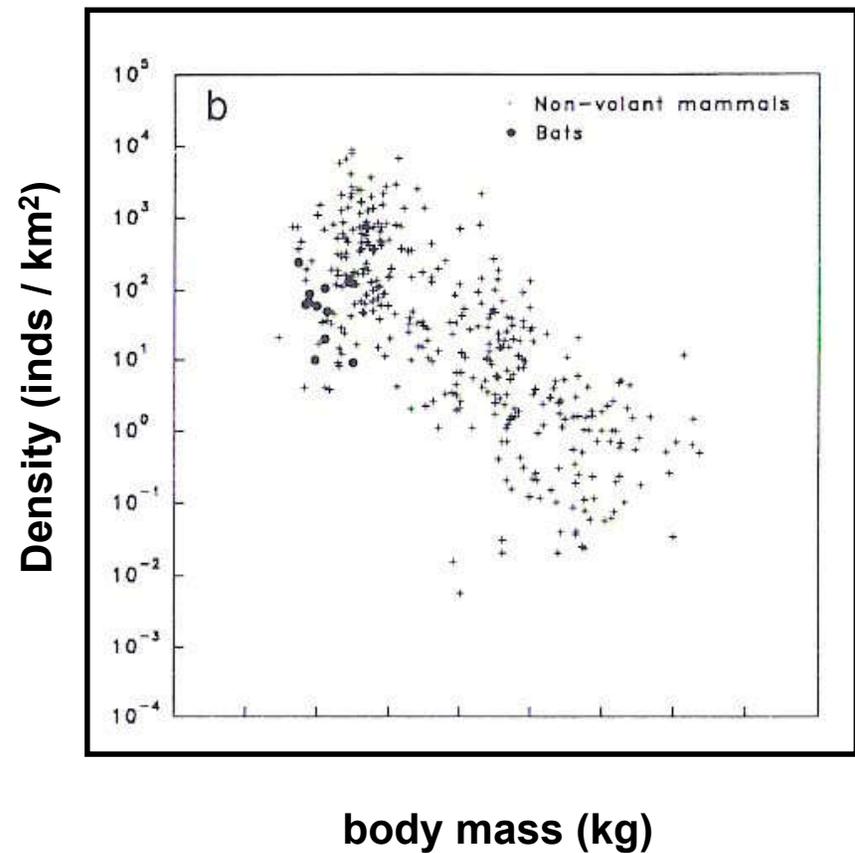
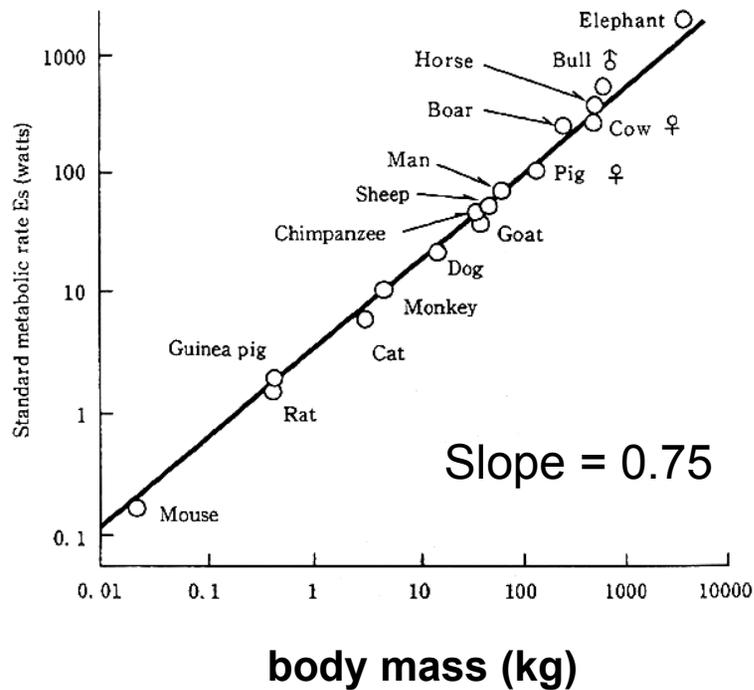
4) Some recommended reading

5) Optional final is Tuesday 19 Dec 1015am in this room (please email Jake if you're planning to take it)

6) Fill out online evaluations for extra credit!

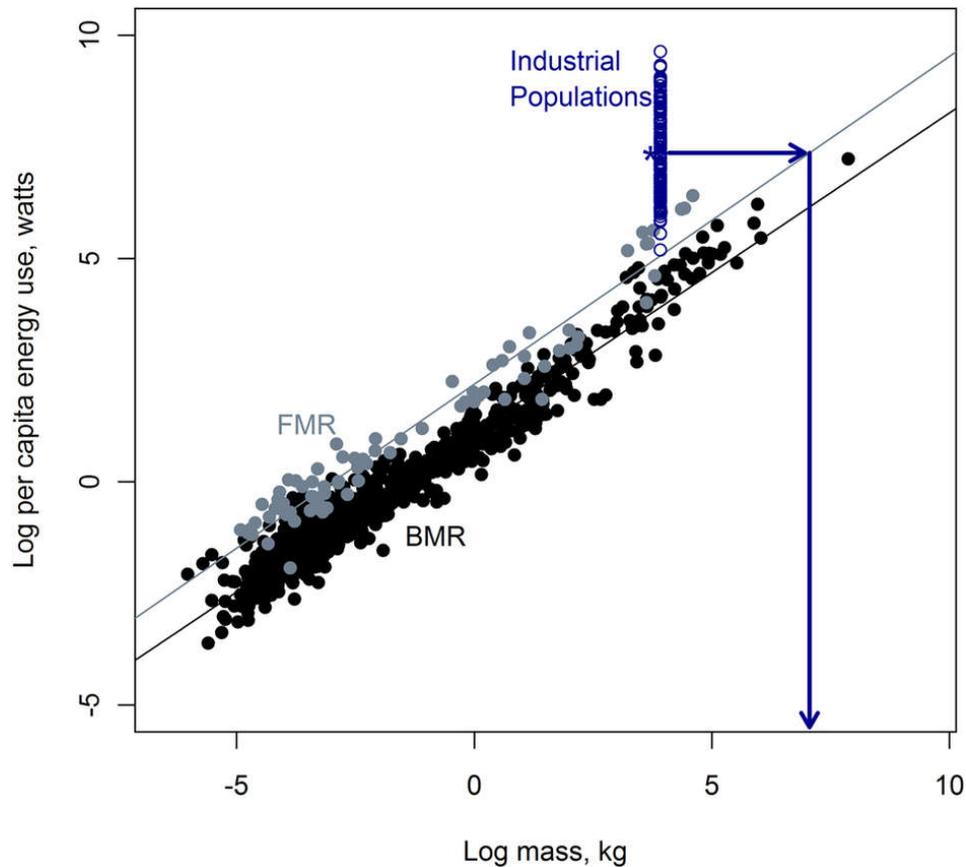
Metabolism and body size

- Energy equivalence occurs because two allometries—body mass and metabolic rate, and body mass and population density—cancel out



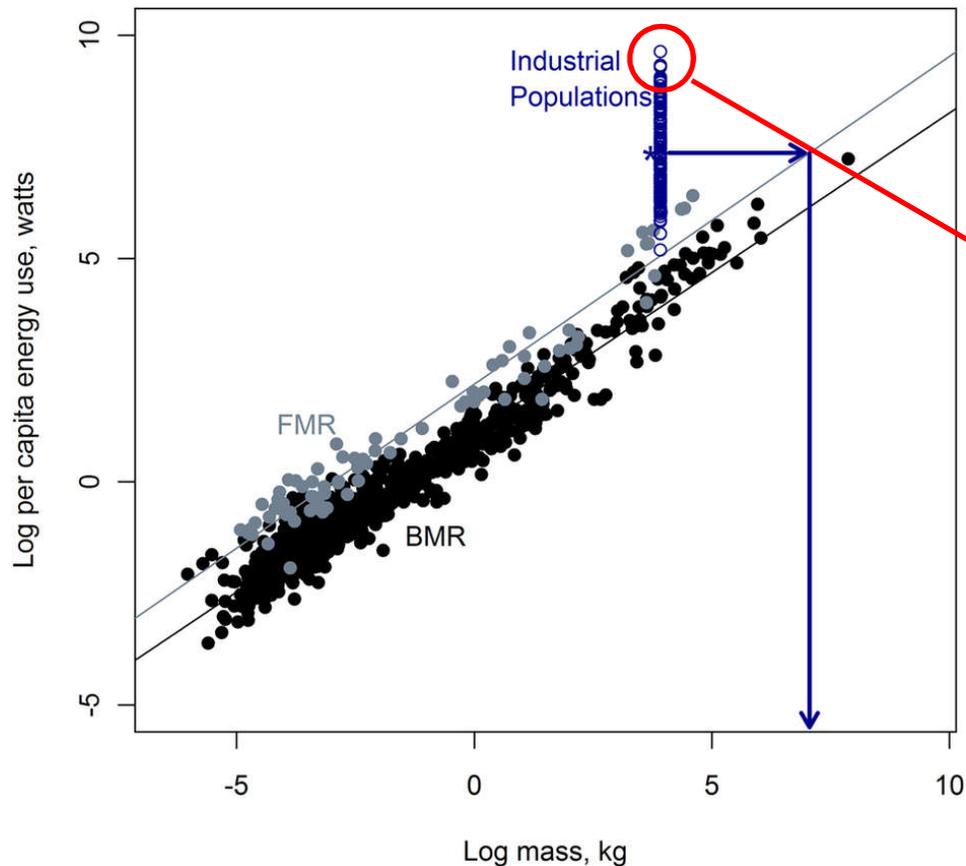
Metabolism and body size

- **Median energy consumption of industrialized H. sapiens is roughly 10x the expectation for a non-human mammal of the same size**



Metabolism and body size

- **Magnitude and pace of this increase is unprecedented, because it occurred without an increase in human body mass**



two sperm whales (92,500 kg)

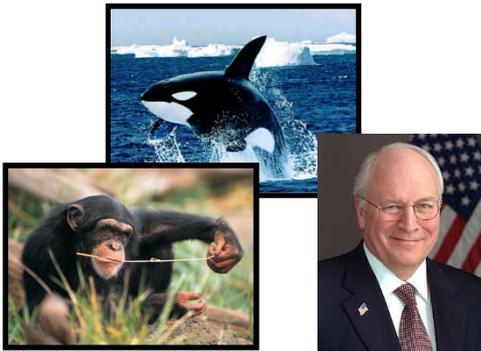


Metabolism fuels life history and demography

- r selection = selection for high growth rates, low adult survival, large litter sizes, minimal parental care
- K selection = selection for low growth rates, high adult survival, low litter sizes, slow development/long maturation leads, prolonged parental care

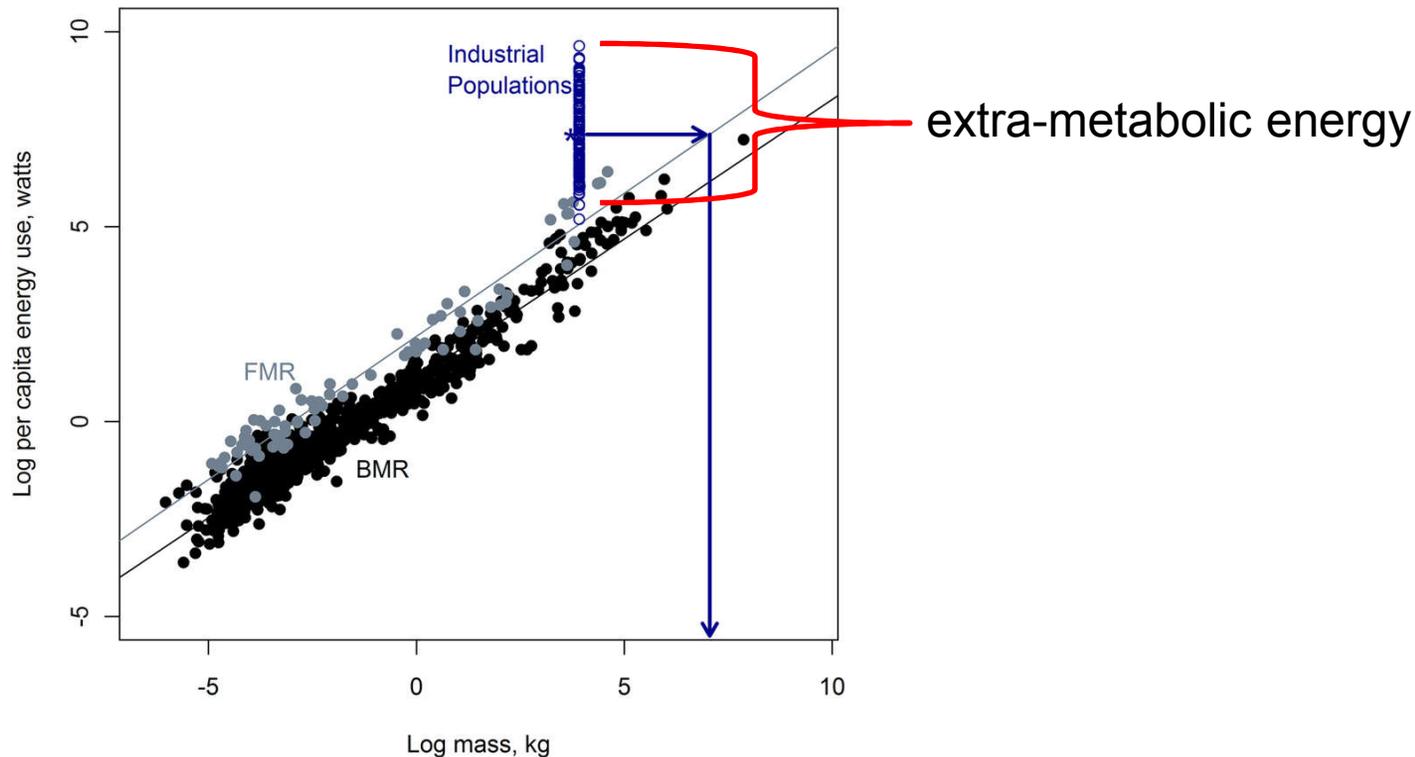
K

r



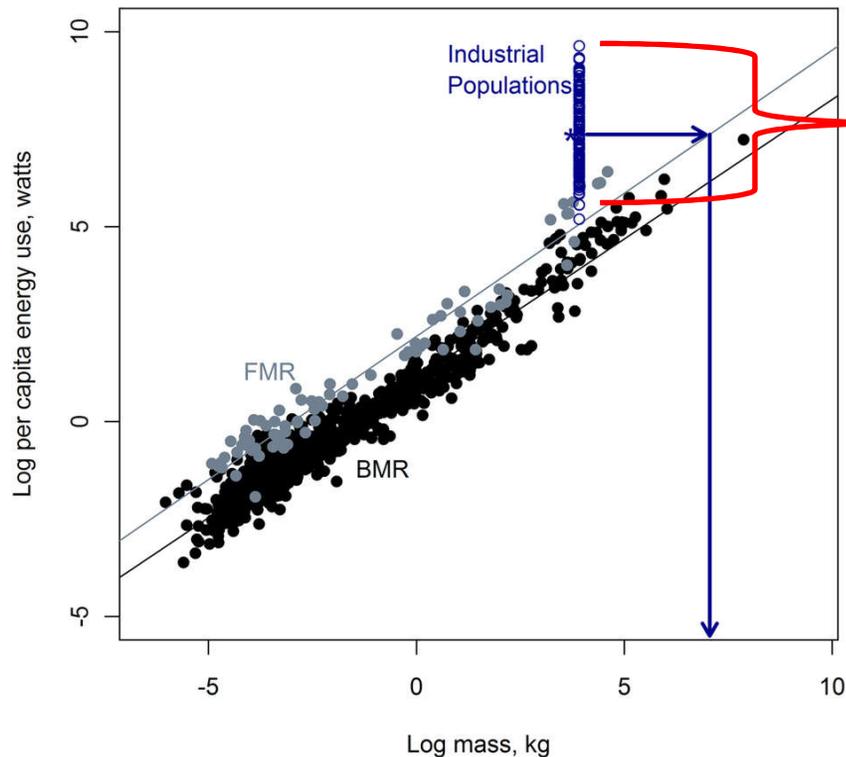
Metabolism fuels life history and demography

- for non-human mammals, energy use approximates caloric intake and digestion (i.e., metabolism)

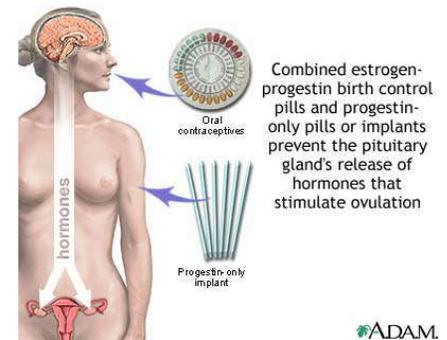


Metabolism fuels life history and demography

- for non-human mammals, energy use approximates caloric intake and digestion (i.e., metabolism)
- industrial environments provide goods and services that alter demography without changing metabolism (i.e., extra-metabolic energy)

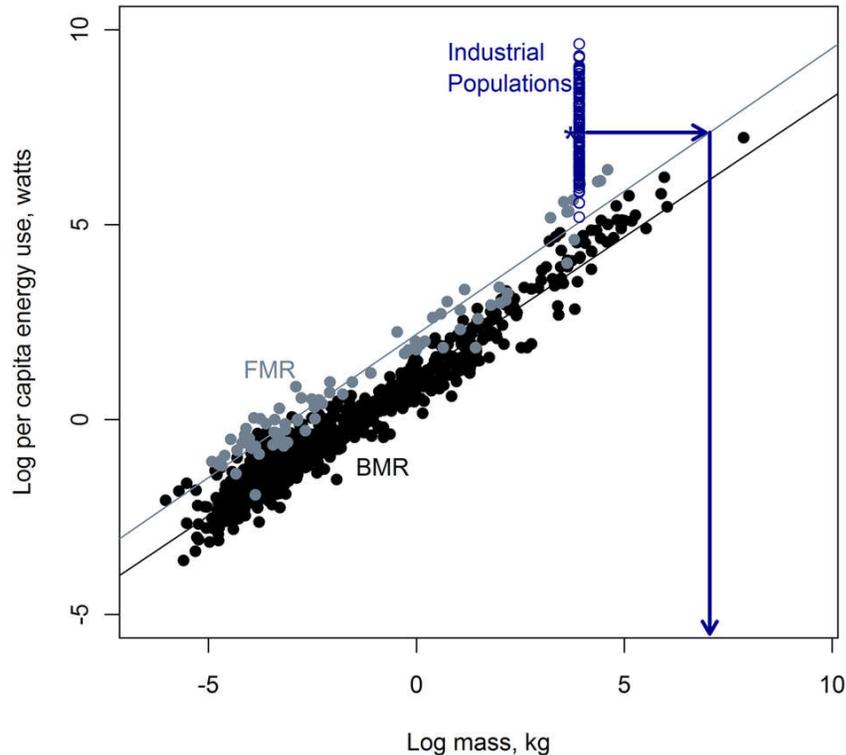


extra-metabolic energy



Body size, wealth, and life histories

- energy use a function of body size for non-human mammals, so demographics and life histories are constrained by body size in non-human mammals



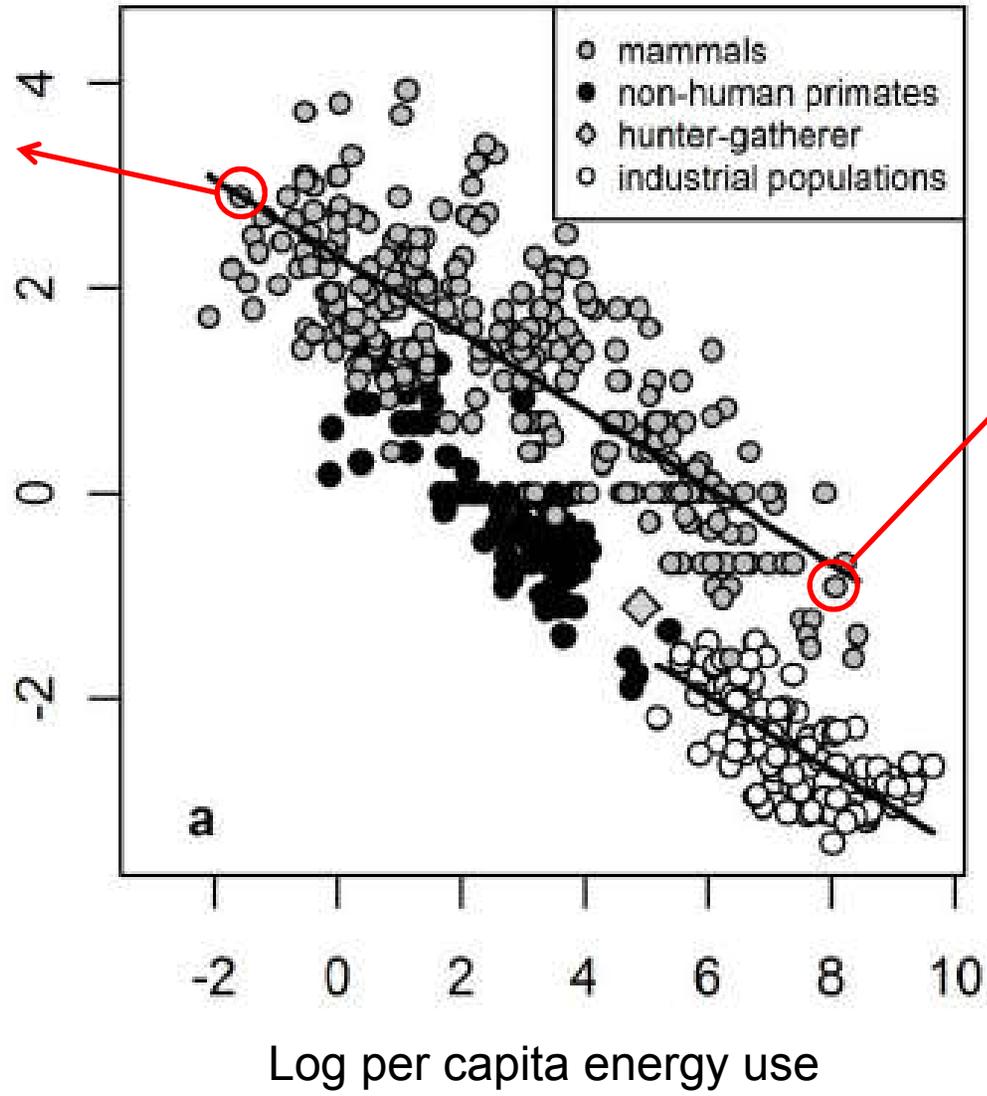
Body size, wealth, and life histories

- any trait that scales with body size can be expressed as a function of energy use
- for humans, can energy use (both metabolic and extra-metabolic) predict life history variables?



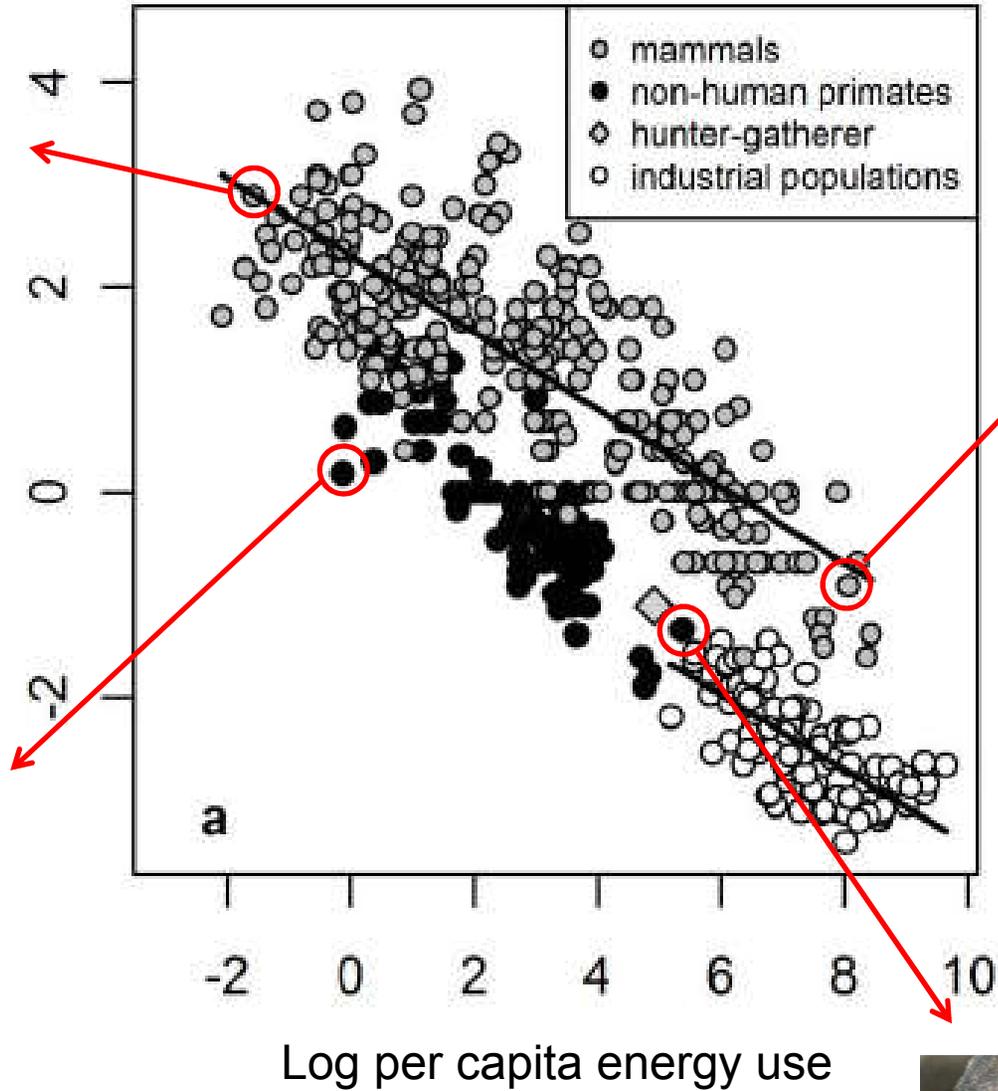


Log births per year



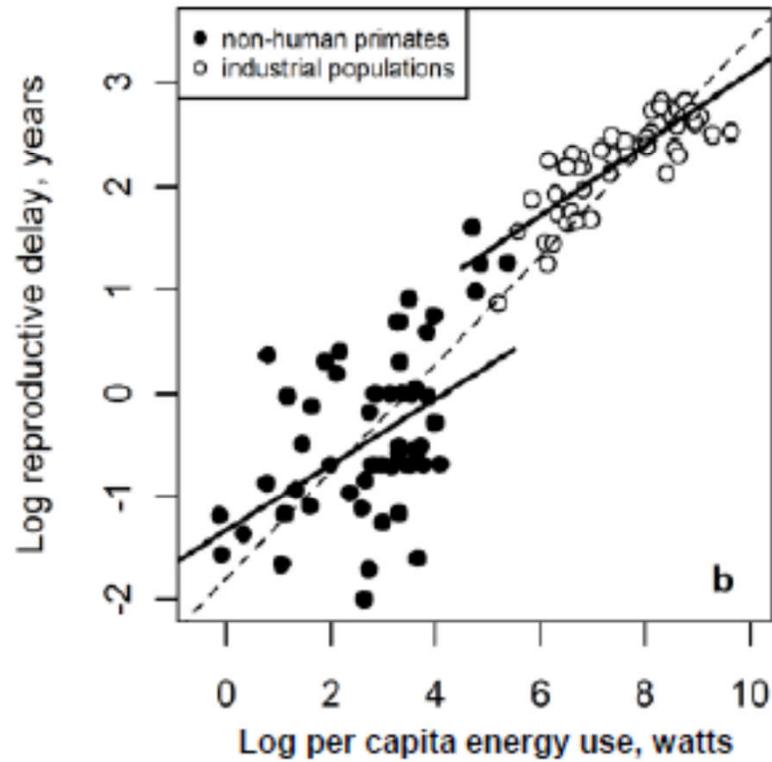
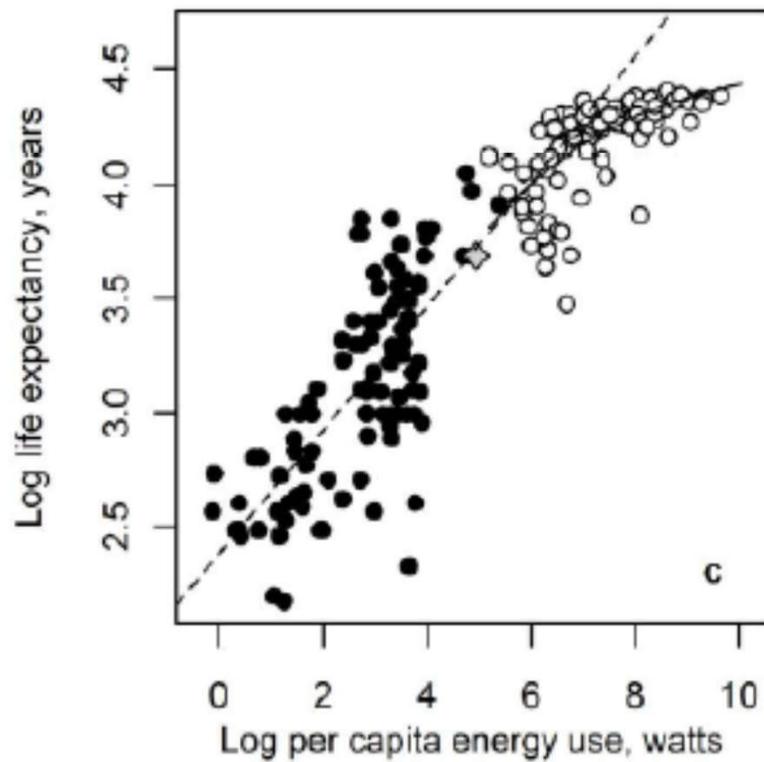


Log births per year

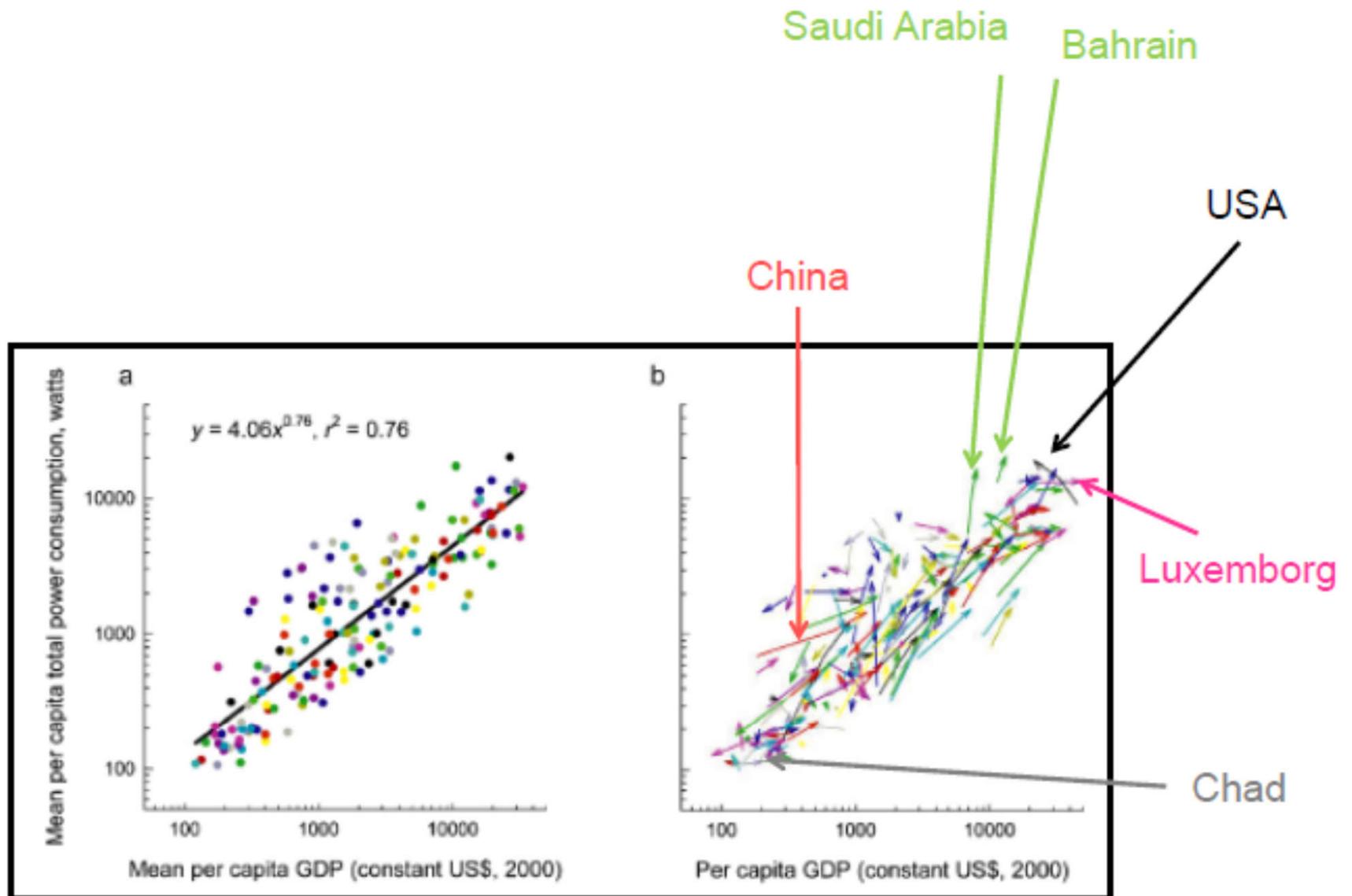


Body size, wealth, and life histories

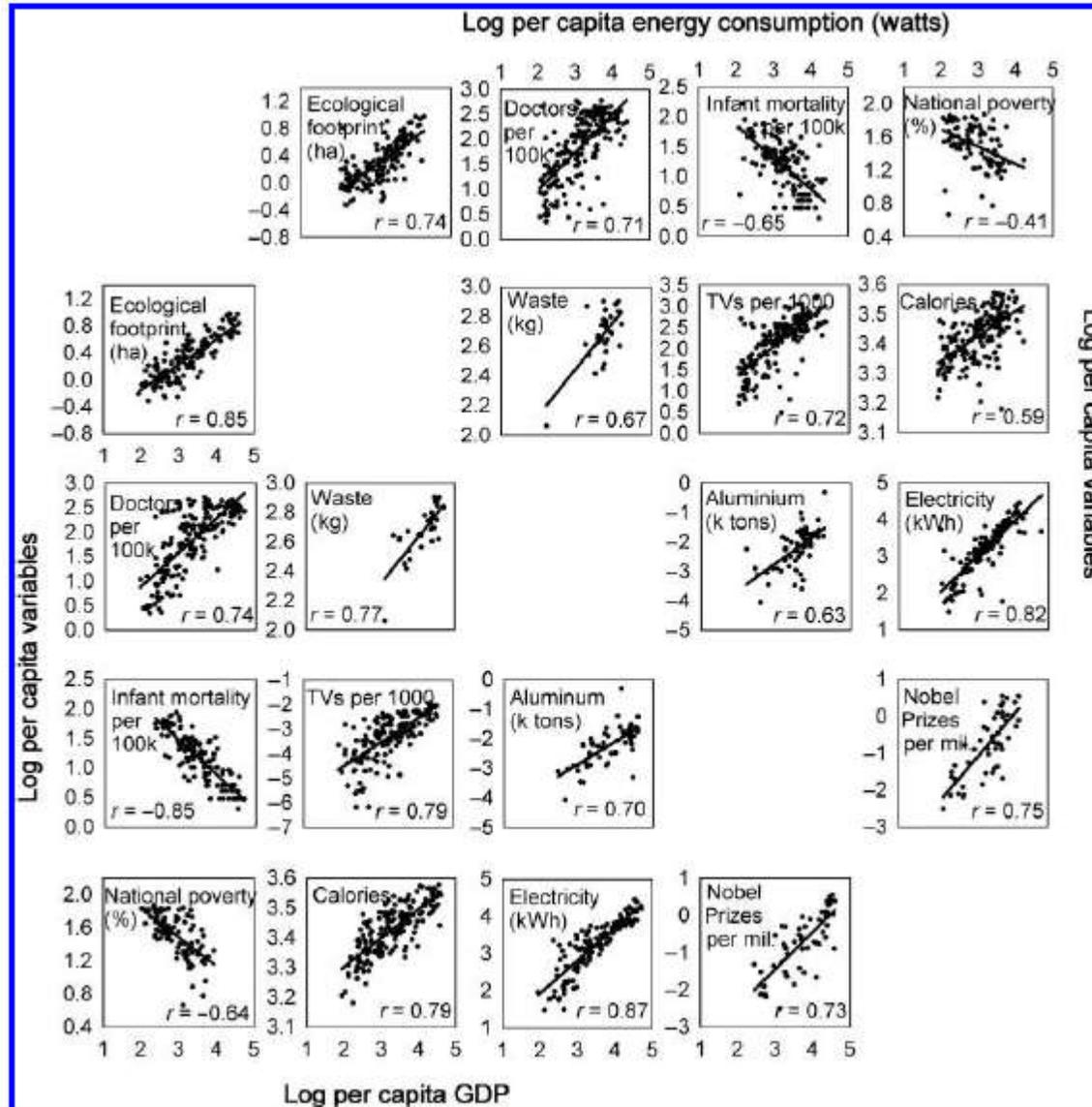
- life expectancy and reproductive delay are strongly related to energy use



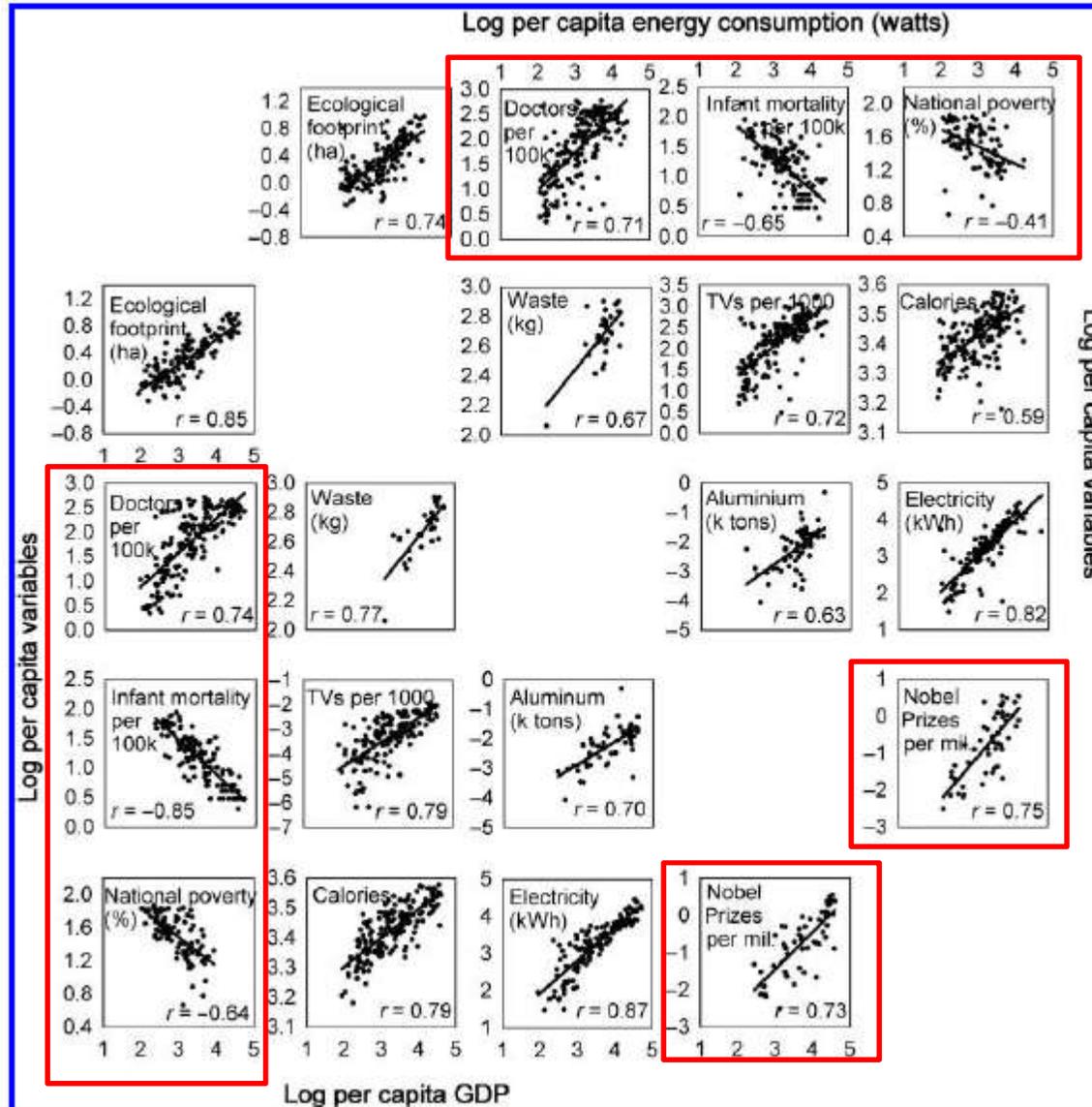
Body size, wealth, and life histories



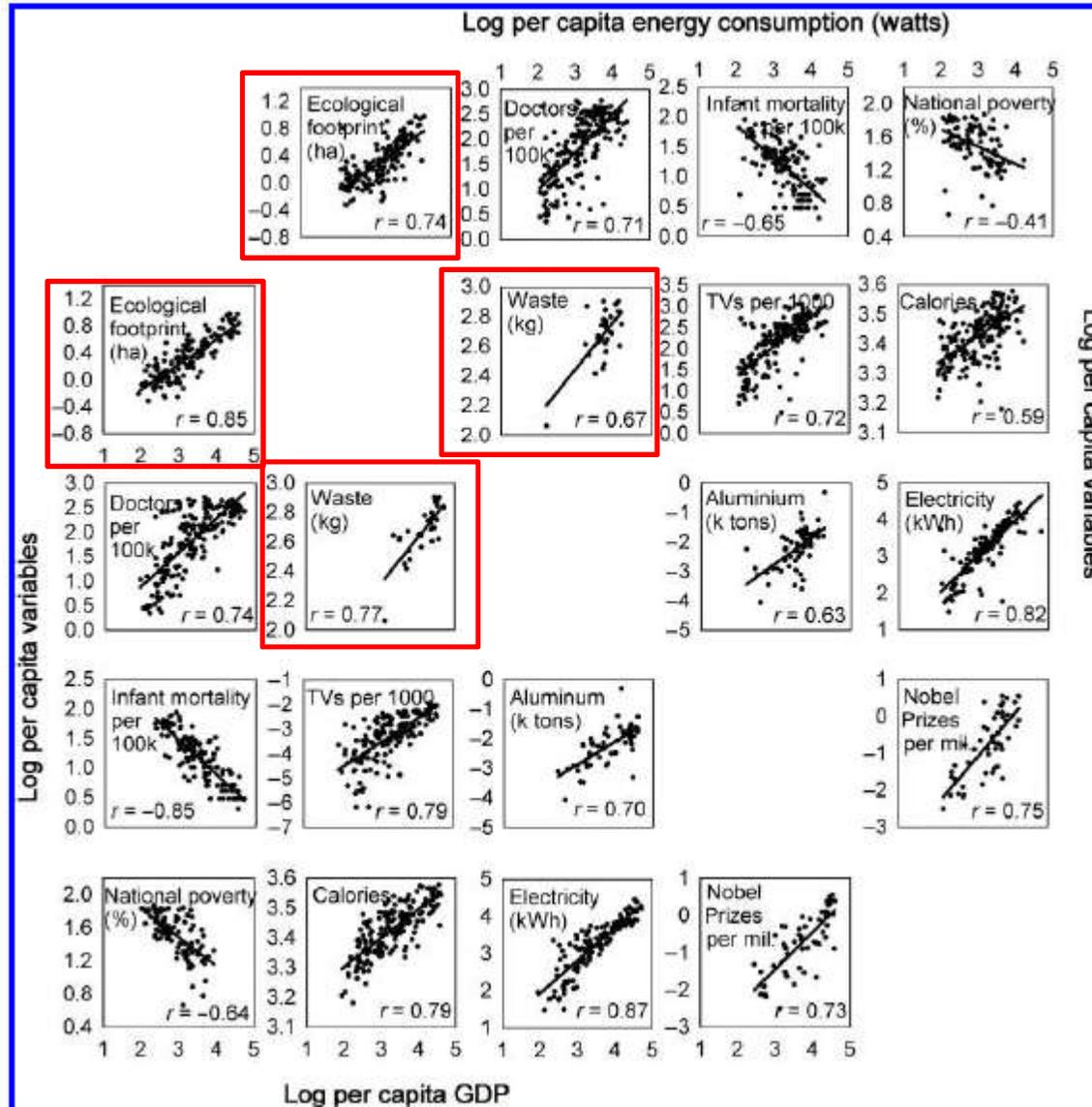
Body size, wealth, and life histories



Body size, wealth, and life histories

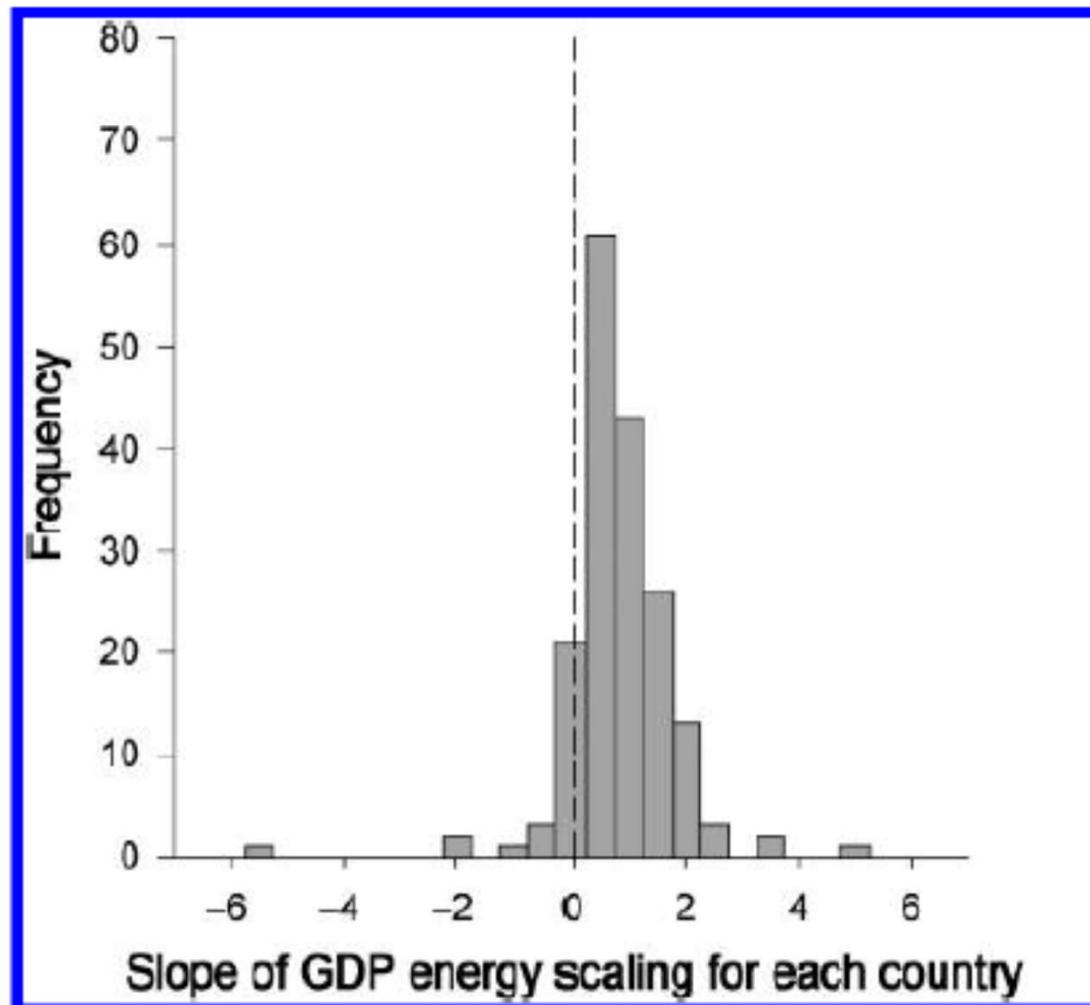


Body size, wealth, and life histories



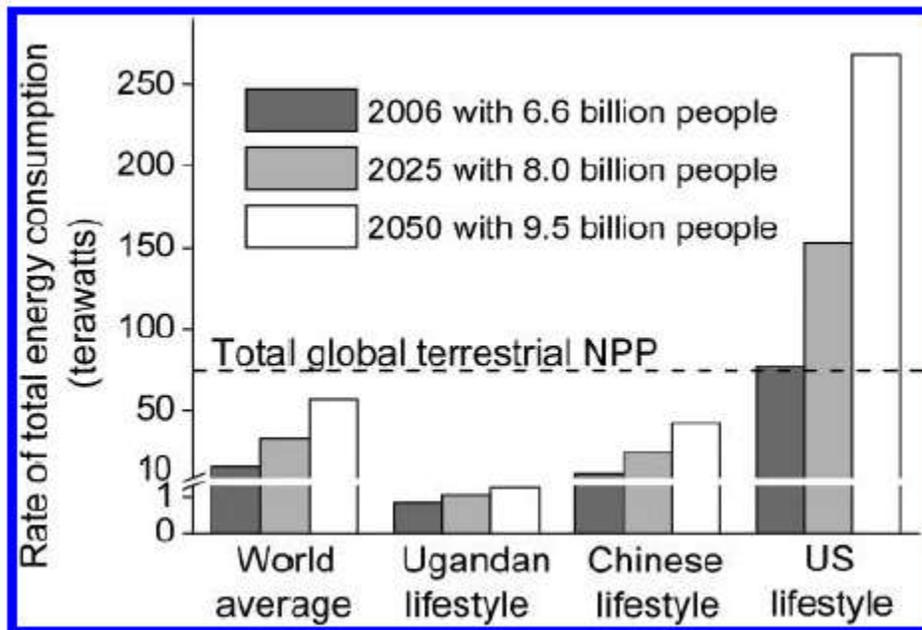
Energetic limitations to economic growth

- standards of living (as indexed by GDP) are increasing through time



Energetic limitations to economic growth

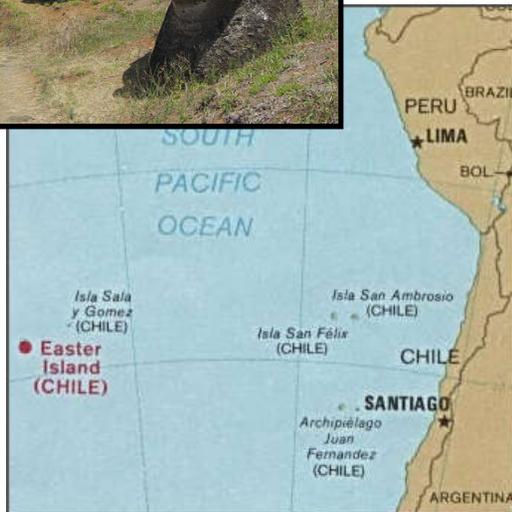
- **H. sapiens** is projected (conservatively) to reach a global population size of 9-10 billion people by 2050
- Three scenarios through which additional economic growth can be maintained given this



1) Technological bail-outs

1) Technological bail-outs

Easter Island, Societal collapse ~1870



Cambodian Angkor, Societal collapse ~1400



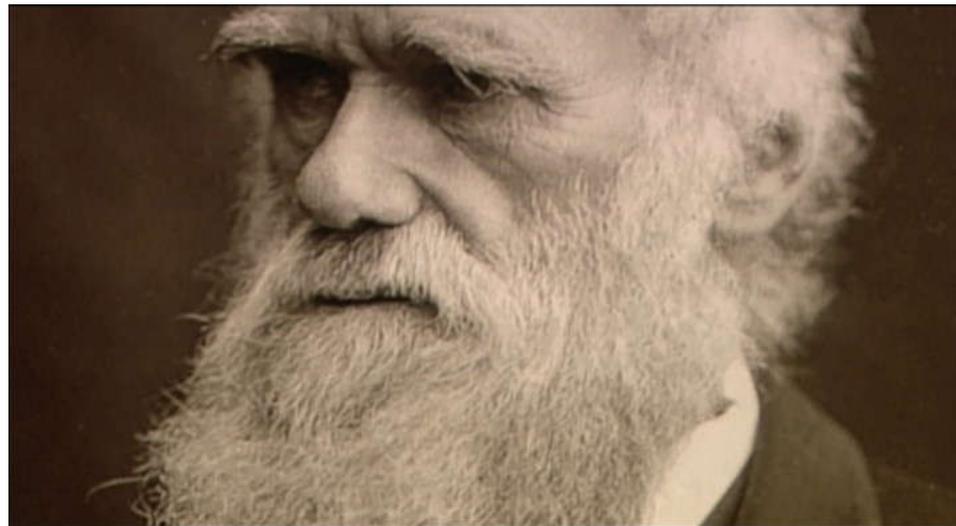
Yucatan Mayans Societal collapse ~1600



2) Voluntary reduction in population size

Malthusian-Darwinian dynamic has created powerful tendencies for humans to reproduce and acquire wealth to enhance fitness and personal status.

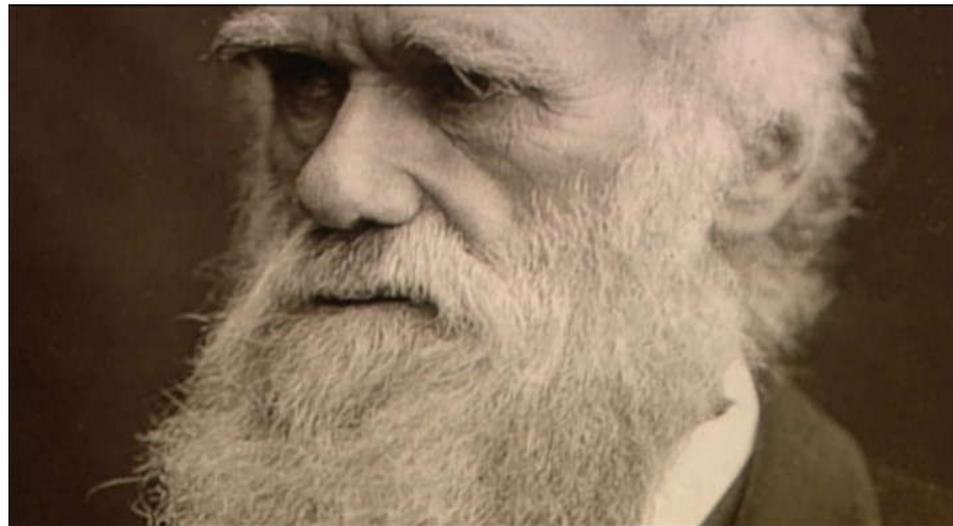
Malthus distinguished between preventative and positive checks to population growth (and resource consumption)



3) Voluntary reduction in energy use

Malthusian-Darwinian dynamic has created powerful tendencies for humans to reproduce and acquire wealth to enhance fitness and personal status.

Malthus distinguished between preventative and positive checks to population growth (and resource consumption)



Tragedy of the Commons = depletion of a shared resource by individuals that act in their own self-interests, despite their understanding that depleting the common resource is contrary to the group's long-term interests

Tragedy of the Commons = depletion of a shared resource by individuals that act in their own self-interests, despite their understanding that depleting the common resource is contrary to the group's long-term interests

BLM land, central ID; common resource = grass



Tragedy of the Commons = depletion of a shared resource by individuals that act in their own self-interests, despite their understanding that depleting the common resource is contrary to the group's long-term interests

**Jonah Field, western WY;
common resource = air quality, wildlife**



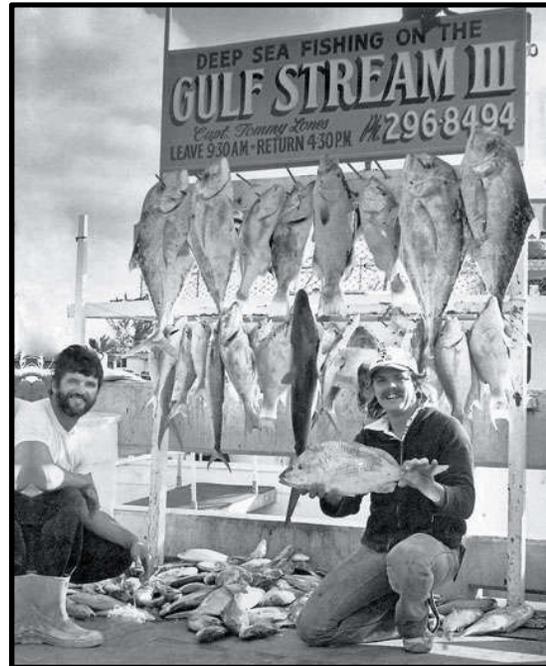
Tragedy of the Commons = depletion of a shared resource by individuals that act in their own self-interests, despite their understanding that depleting the common resource is contrary to the group's long-term interests

**Florida keys;
common resource = sport fish**

1983

1957

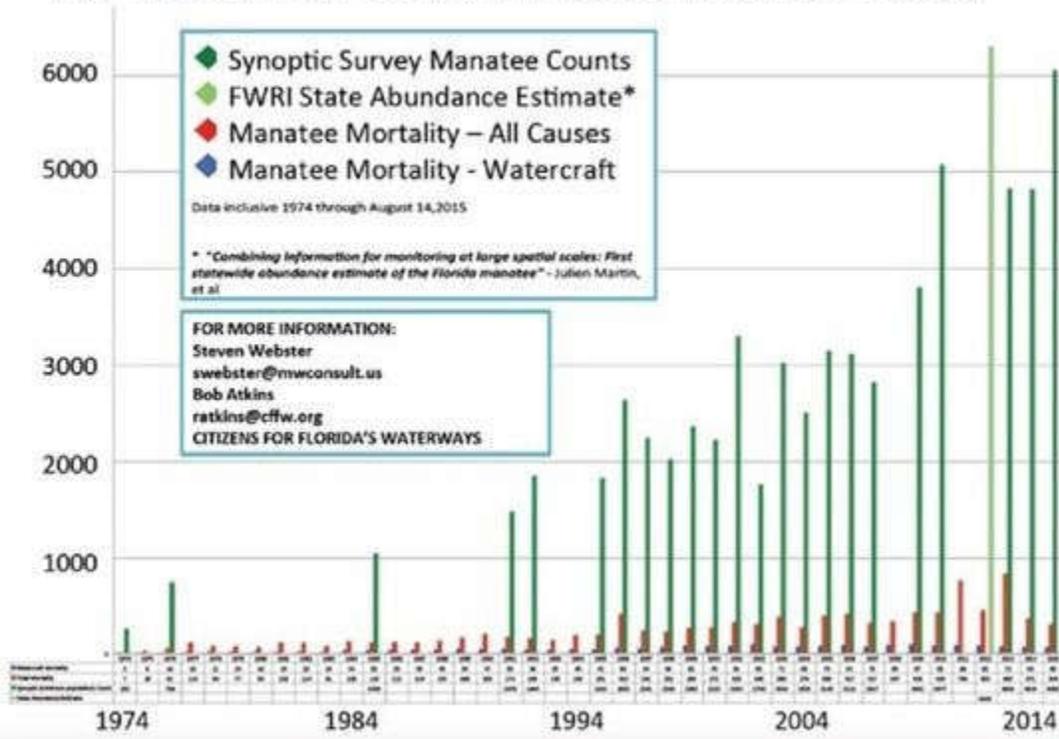
2007



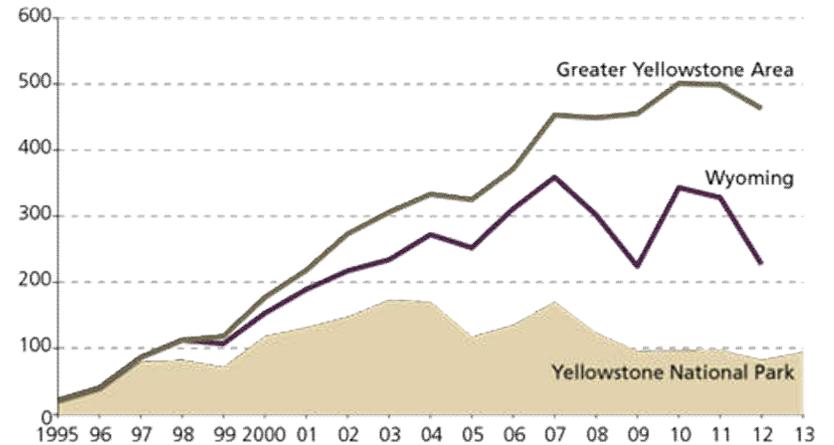
Success story #1: In the past year, West Indian manatees have been downgraded from endangered to threatened



40 Years of Observations and Data



Success story #2: In the past six months, the U.S. Court of Appeals upheld the USFWS 2012 decision to let Wyoming manage its wolves



Wyoming Wolves Can Now Be Hunted, But Only In Certain Areas

By MAGGIE MULLEN • 16 HOURS AGO

PROGRAM: Natural Resources & Energy

Tweet Share Google+ Email

CREDIT: GARY HAMMER - US FISH AND WILDLIFE SERVICE

Wyoming's management plan for wolves is back in effect, after a recent ruling by the U.S. Court of Appeals reaffirmed the U.S. Fish and Wildlife Service's 2012 decision to delist wolves.

Under Wyoming law, wolves fall under a dual-classification system. The first is as trophy game for those wolves living in the northwestern corner of the state. That's where most of them live and where the most suitable habitat is. Wyoming Game and Fish Department's Renny MacKay said in that area, they receive extra protections.

"And that means you need to have a license if you are to hunt a wolf in that part of the state, and there is not a hunting season in place at this time," said MacKay.

If the Wyoming Game and Fish Commission approves a hunting season, that will begin this October, after a public input period.

But MacKay said wolves everywhere else in the state are considered predators, so they can be hunted right now. If hunters do kill a wolf, MacKay said they must

