

Amphibians, Reptiles, and Humans

We'll look at human - herp interactions first, and then concentrate on conservation biology.

I. Human herp interactions:

Amphibians and reptiles have lots of interactions with humans (more than most people would guess).

A. Economics:

Some are used as food (frogs, turtles, others in other parts of the world).

Traditional medicine

But also here - an early pregnancy test used female frogs (inject with urine, frog would expel eggs)

Pet trade - obvious (we'll say more about this under conservation).

Research - used in all kinds of research (embryology, endocrinology, others; early cloning attempts done on frogs).

Snake and other venoms have led to several new medications.

Antivenom - prepared by injecting horse with venom in increasing dosages.

antibodies are harvested (can cause problems in people with horse allergies)

Fish bait.

Many reptiles are important in controlling pests (mice, rats, etc.)

(Many farmers have no problem with snakes (unless venomous)).

Turtles and tadpoles can keep algae in ponds in check

Act as intermediate hosts for some human diseases (tapeworms, some viruses, salmonella, etc.)

Poisonous skin secretions used for darts/arrows

Amphibians are often used as ecological indicators

But reptiles are also affected (*Regina* feed on crayfish, if crayfish disappear, *Regina* disappears (populations have crashed)).

Superstitions, quack medications, etc.

(Also silly legends like "hoop snakes" or "milk snakes" ("Speckled band" - Sherlock Holmes story)

Oils used in cosmetics.

Entertainment - zoos, croc hunter

(The “crocodile hunter” was a bit of an idiot).

Crocodile attacks - humans/livestock

Snake bite - important cause of human mortality

(anywhere between 10,000 and 100,000 mortalities (hard to know)).

II. Conservation (a lot of the following applies to many organisms, not just herps).

1) Human population growth.

This is the problem that underlies most other problems.

We are currently at over 7 billion people, and projected to reach over 9 billion by 2050.

(incidentally, carrying capacity for the planet is thought to be between 10 and 15 billion).

Growth is not evenly distributed; developing countries generally have much higher growth rates.

However, it is not fair to put all the blame on developing countries:

Rich countries use way more resources than we should, and that, too, is causing a massive problem.

2) Habitat modification/destruction.

Habitats are being destroyed all over:

Urbanization - GMU is a good example.

Or New Jersey, which has essentially run out of room to build more houses.

Deforestation - tropical rain forests are particularly affected, but temperate forests are also impacted (Canada has the highest annual rate of deforestation).

Desertification - sub Saharan Africa is particularly hard hit by this.

Loss of wetlands - draining swamps and marshes (they were once considered “useless”)

Corps of Engineers have destroyed many wetlands with dams for flood control.

3) Overexploitation.

Overusing species either through harvesting, poaching, or other reasons.

Sea turtles - eggs, meat

Red eared sliders, box turtles (eaten in Japan)

Pet trade has decimated some species of herps - many people want exotic species as pets.

Crocodile hides

Alligators were once highly endangered - now almost a pest in places.

Turtles (particularly box turtles in the U.S.) - smashed by cars

(populations may crash if roads built through woods).

Rattlesnake roundups.

One of the most egregious examples of stupidity and needless killing of snakes as “entertainment”.

Reminiscent of the “shoot-offs” that contributed to the extinction of the passenger pigeon.

4) Introduced species.

Species that flourish where they're not supposed to be:

Bullfrogs in Italy (as well as Japan, some Caribbean Islands)

Geckos and Anoles in U.S.

Cane toads in Florida, Hawaii, Australia

Cause deaths to dogs who chew on them

Have decreased populations of native herps in Australia

(including, surprisingly, *Crocodylus johnstoni*)

Caimans in Florida

Red eareds in Germany

Pythons in Florida

Have massively disrupted the environment:

Lots of native mammals and birds have crashed

Raccoons, opossums, rabbits, deer, and bobcats have been found in stomach contents of pythons.

Ramphotiphlops (Flower pot snake)

Some more examples introduced species in Florida can be seen at:

<http://myfwc.com/wildlifehabitats/nonnatives/reptiles/>

(lists over 41 lizards found in Florida, about half of which are “established”)

(Also lists other animals (mammals, birds, etc.) if you're interested)

5) Environmental factors

Pollution and other factors that cause problems for herps.

Light pollution - already mentioned this

Causes problems for baby turtles and other herps that use light for navigation.

Noise pollution - some evidence that noise pollution is affecting frog populations.

Ozone - some evidence that increased UV adversely affects amphibian eggs.

(Some of this may have been overstated)

Pesticides - cause increased mortality in tadpoles. Also linked to increased rate of deformities.

Acid rain - thought to affect amphibian populations, particularly juvenile stages.

Also thought to impact crayfish (*Regina*)

Carbon dioxide

There is evidence that ranges of many species are shifting.

Golden toad may have gone extinct (?) due to changes in climate in the cloud forests where it lived.

Some speculation that increased cover has also promoted the growth and spread of the fungus (*Chytridiomycosis*).

Some lizards are also thought to be threatened by global warming.

Viviparity is thought to be an adaptation to colder temperatures in some species.

6) Diseases

We already discussed some of this, but now we're specifically interested in the effect of the fungus *Chytridiomycosis*.

Some of this is still speculative:

Was fungus spread by humans (e.g., by amphibian transports (Africa clawed frogs))?

Has it always been around but recently become more virulent?

Causes convulsions, changes in behavior, damage to skin, occasional hemorrhages

Regardless of where it “originated”, it is thought that it is having a serious impact on amphibian populations world wide.

(Some research seems to indicate that this may be overstated??)

Affects different amphibians differently - in some it can cause 100% mortality, in others the numbers may be lower (in some it may simply be “carried”).

Of course, other diseases also affect herps (as discussed previously).

III) Conservation measures:

1. First some definitions and explanations:

The status of organisms.

First, let’s discuss some of the major organizations (this is only a partial list) out there:

IUCN. The “International Union Probably for the Conservation of Nature and natural resources:

Arguably the most important of the bunch.

The IUCN collects and maintains information about species from around the world and lists them in to one of several categories if it is judged (by scientists working in the field) that there is some concern about the species.

It attempts to be apolitical (though by it’s very nature it is conservation oriented).

Many governments pay close attention to the lists provided by the IUCN.

Categories are as follows (from the IUCN web site, though abbreviated somewhat):

EXTINCT (EX) A taxon is Extinct when there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD (EW) A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range.

The following three categories are all considered “THREATENED”:

CRITICALLY ENDANGERED (CR) A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an **extremely high** risk of extinction in the wild.

ENDANGERED (EN) similar to above, but is considered to be facing a **very high** risk of extinction in the wild.

VULNERABLE (VU) similar to above, but is considered to be facing a

high risk of extinction in the wild.

NEAR THREATENED (NT) A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC) A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD) A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

NOT EVALUATED (NE) A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

A comment about the criteria for listing in one of the threatened categories:

These vary depending on the category, but include five major criteria:

- reduction in population size
- reduction in range
- small population of very few individuals and indications of continued decline.
- very small (smaller than above) population size.
- results of analysis indicating that the species faces extinction soon.

If a species meets any of the 5 criteria it is listed. Depending on the stringency of these criteria, it is listed in one of the three threatened categories.

For a more detailed breakdown, see the IUCN web page (although this can be hard to find).

CITES. “Convention on International Trade in Endangered Species of Wild Fauna and Flora”

Member states are expected to enact laws that govern the trade of wildlife products as listed by CITES (or better, each nation has to enact laws that are in compliance with CITES).

CITES regulates the trade in wildlife based on three “appendices” (quoting directly from the CITES web page):

Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.

Examples include elephants (most), many whales, cheetahs.

Appendix II includes species not necessarily threatened with extinction, but in

which trade must be controlled in order to avoid utilization incompatible with their survival.

Examples include whales not listed under Appendix I, and some populations of both elephant and cheetahs (organisms may be listed in different Appendices depending on region).

Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

Examples include deer (same species as around here(!), but in Guatemala) and various Gazelles (e.g. *Gazella dorcas*) in Tunisia (presumably very rare there, though the species overall is declining (listed as vulnerable by the IUCN)).

Countries are expected to adhere to the listings in CITES

Through a rather complicated process of scientific input and voting by members (& regions) species are placed on various Appendices. The details are available on the web site (www.cites.org).

On occasion, this can have a major impact on a species, for example when all trade in elephants or elephant products was stopped.

CITES now includes 179 parties (i.e. countries).

On the national level (U.S.):

Fish and Wildlife Organization - administers the endangered species act and is charged with protecting national species. Their listings may or may not be in accordance with CITES* or the IUCN. Incidentally, they have 27 different categories for listings (talk about bureaucracy!).

They also cooperate with international organizations (e.g. CITES).

* the U.S. is a member of CITES, so this presumably means that we follow CITES rules and regulations, but may have more stringent protections in some cases (several other countries may also have more stringent protections than that provided by CITES).

Animals are listed as threatened or endangered after scientific review. Since this includes several political personnel, the process can generate controversy (it's only fair to say that CITES generates a fair amount of controversy as well).

2) So what can be done?

There are lots of examples:

a) Legislation

Legislation can help tremendously (protections for tuataras, sea turtles, etc.)

Only works if there is a healthy respect for law enforcement.

b) Controlling predators

Can be effective - removing rats (difficult, but possible) has helped several species to recover (some populations of tuatara).

Australia is working feverishly to reduce cane toad populations (have caused massive reduction in herp diversity).

Generally, the problem is introduced predators.

c) Manage wild areas to help populations:

Build ponds, provide shelter, etc.

Some ponds at Mason Neck were purpose built.

Setting up wetlands.

d) Setting up reserves:

These can keep people out, restrict development, etc.

Problem is that many reserves are "islands"

Buffer zones and migration corridors are needed!

e) Zoos

Removing animals from the wild to try to breed/maintain them in captivity.

Can work well (in captivity, at least).

National zoo is breeding such species as Komodo dragons, Chinese alligators and Madagascar radiated tortoises (part of the reason it's endangered is due to the pet trade).

Problem is that the objective is to eventually return them to the wild:

What wild areas??

f) Others:

Sea turtles - raised in captivity for some years to increase survival chances.

Corridors under roads (or over roads).

g) Studying the animal

This is the single most important thing someone can do. None of the other techniques will be terribly effective if we don't know anything about the life history/biology of the animal.

- what food does it need?
- what temperatures does it like?
- what environmental conditions does it need?
- what predators exist.
- how does it reproduce?
- etc.

For example - suppose we set up a reserve to protect Merten's water monitor (*Varanus mertensi*), but ignore the fact that the reserve we set up has a large population of cane toads.

End result - the reserve is no good at all!

h) Education

Almost as important is education:

- why are rattlesnakes important? Why do we want to “save” them?
 - need to change people's attitude towards “unlovable” species.
 - perhaps stress the fact that they control pest species.
- most people don't even know how bad off many populations are.

IV) Finally, a bit about why we want to conserve and some history:

John Muir - helped people realize the importance of nature.

He was particularly inspired by God's handiwork, and considered nature "God's temple", which shouldn't be despoiled by economics.

His writings helped influence many people, and in later years he went on to help found the Sierra Club, the first organization dedicated to using and preserving nature.

His view of nature makes conservation very important.

Gifford Pinchot - had a rather different view of things.

Nature needs to be conserved so that future generations can still "exploit" nature.

This does require, however, very careful management of resources. After all, these resources should be around for the longest time possible to serve as many people as possible.

As such he was responsible for the restoration of many lands that had been clear-cut or otherwise damaged.

Aldo Leopold - brought ecology into all this.

He realized the importance of individual species, and their connections to other species.

Wilderness should be preserved intact since many things are interconnected. A direct argument is made to biodiversity.

Helped organize the Wilderness Society, co-founded the Wildlife society.

"A Sand Country Almanac", is probably his most famous book.

Together, they gave us three "reasons" for conservation:

- 1) For the sake of nature - an aesthetic argument.
- 2) For the sake of sustainability - resources should be around for future generations.
- 3) For the sake of ecology - everything is interconnected.

Of course there are many others: Rachel Carson, Ansel Adams, Henry David Thoreau, John Audobon, Jacques Cousteau, etc.

But finally, let's mention Teddy Roosevelt.

Avid outdoorsman & hunter (traveled all over the world, camping, hunting, and enjoying the outdoors).

Was strongly influenced by Pinchot (a good friend). Also influenced by Muir.

Expanded the U.S. forest service (increased national forest system by 400%), set up the national refuge system, set up the first Governor's conference dedicated to conservation issues, used the 1906 Antiquities act to set up National Monuments (including the Grand Canyon), and generally set a high standard for future presidents to follow (not all did, of course).

[Oh, yes - he was, of course, also partly responsible for Teddy Bears!]