

Wildlife Interaction

Endangered Species Act- Molly

Bt Corn and Monarch Butterflies- Karin

Salmon Farming- Jake

Buffalo in Yellowstone- Rae

Chronic Wasting Disease and Elk Farming-
Molly

Wolf Reintroduction- John



Endangered Species Act

The Background:

- 1966: Congress passes the *Endangered Species Preservation Act*
 - ✓ authorized a list of endangered domestic fish and wildlife, allowed the Fish & Wildlife Service to buy habitat for listed species
 - ✓ directed federal land agencies to preserve endangered species habitat on their lands "insofar as is practicable and consistent with their primary purpose"
- 1973: With the support of the Nixon administration, Congress almost unanimously passes a completely rewritten Endangered Species Act.



The 1973 law...

- distinguishes threatened from endangered species
- allows listing of a species that is in danger in just part of its range
- allows listing of plants and invertebrates
- authorizes unlimited funds for species protection
- makes it illegal to kill, harm, or otherwise "take" a listed species



Managers of the Act:



- Fish and Wildlife Service

Department of Interior

- National Oceanic and Atmospheric Administration (NOAA) Fisheries

Department of Commerce

Threatened:

- A “threatened” species is one that is likely to become endangered in the foreseeable future.



Endangered:

- An “endangered” species is one that is in danger of extinction throughout all or a significant portion of its range.

Critical Habitats:

- Habitat loss is the primary threat to most imperiled species
- ESA designates specific areas as protected "critical habitat" zones
- Critical habitats are required to contain "all areas essential to the conservation" of the target species, private or public
- Federal agencies are prohibited from enacting, funding, or authorizing actions which "adversely modify" critical habitats
- Large-scale development, logging and mining projects on private and state land typically require a federal permit and thus become subject to critical habitat regulations. Most provisions of the ESA revolve around preventing extinction. Critical habitat is one of the few that focuses on recovery: Species with critical habitat are twice as likely to be recovering as species without critical habitat.

What does this mean for agriculture?

- Large-scale development, logging and mining projects, and grazing on private and state land typically require a federal permit and thus become subject to critical habitat regulations.



The ESA at 30:

Produced by EarthJustice, 2003:

- <http://www.youtube.com/watch?v=9tFN1y2sTx4>



Listed as Threatened or Endangered

- Animals, including all mammals, birds, reptiles, amphibians, fish, and invertebrates:

1175

- Plants, including deciduous trees, conifers, flowering plants, ferns, and lichens:

747

Candidates for Listing

- Native plants and animals to America that could be listed, and are closely studied:

278



Proposed for Listing:

- Polar Bear, *Ursus maritimus*
- Coho Salmon, *Oncorhynchus kisutch*
- Gray Wolf, *Canis lupus*



Colorado

- 32 species listed
(19 animals, 13 plants)
- Including grizzly, greenback cutthroat trout,
Canada lynx
- Success story:
Peregrine falcon

De-listed in 1994

Local populations: Falls Creek

Chimney Rock



The ESA at 30:

Produced by EarthJustice, 2003:

- <http://www.youtube.com/watch?v=9tFN1y2sTx4>

More information:

Fish and Wildlife Service:

- <http://www.fws.gov/endangered/>



**Bt-corn and
Monarch Butterflies**

What is Bt-corn?

- a GMO (genetically modified organism)
- The additional genetic material in Bt-corn is *Bacillus thuringiensis*.
- It produces a protein that kills Lepidoptera larvae, aka European corn borer.
- It is an alternative to spraying pesticides to control the European and southwest corn borer.
- Safe for human consumption.



Monarch Butterflies

- Also known as “milkweed butterflies” because milkweed is the only plant that they feed on.
- Female monarchs lay their eggs on the underside of the milkweed leaves.
- The eggs hatch 3-12 days later.
- The larvae then feed on the milkweed for 2 weeks while developing into a caterpillar.



Why Milkweed?

- Caterpillars feed exclusively on milkweed because it provides them protection from predators.
- Milkweed contains cardenolides which are toxic to predators.
- The caterpillars incorporate this toxin into their body tissues, which protects them undesirable to predators.
- Milkweed grows best along the edges of cornfields.



*Monarch Larva (Danaus Plexippus)
Gayle Edwards, Lee County Master Gardener*

Cornell Study

- Published in the May 1999 issue of the *Nature* journal by John E. Losey.
- Concluded that Bt-corn has no effect on most “nontarget” organisms, like honeybees or ladybugs.
- The problem is the pollen it produces that contains crystalline endotoxin from the bacterium genes.

Cornell Study

- This pollen is then scattered by the wind, landing on many plants, including milkweed.
- Milkweed is very common around corn fields and is the only source of food for Monarch caterpillars.
- They conducted a lab test to discover more.

Lab Results

- Caterpillars eating milkweed with Bt-corn pollen:
 - Ate less
 - Grew more slowly
 - Had a much higher mortality rate (nearly 50%)
- Caterpillars eating milkweed without Bt-corn pollen:
 - Ate more
 - Grew quickly
 - All survived the study

Bt-corn Pollen

- The toxin in the pollen works its way down into the gut of the caterpillar.
- It then binds itself to the inside of the gut.
- This changes the gut wall from a protective layer to an open sieve.
- The pathogens usually held captive in the gut then spread to other parts of the body, quickly killing the caterpillar.



Monarch Migration Patterns

- They spend the winter in Mexico
- In the spring they begin to migrate north
- The first generation crosses into the Gulf Coast states (like Texas and Florida)
- By late May the second generation heads north into the Midwest Corn Belt
- This means they are feeding on the milkweed during the same time that the corn is shedding pollen

Response of Scientific Community

- 29 scientists in the U.S. and Canada in 1999 and 2000 conducted laboratory and field studies
- On October 9, 2001 the *Proceedings of the National Academy of Sciences* published 6 studies related to this topic

Questions Asked

- 1. What is the potential for toxicity for a particular species?
- 2. What is the likelihood of exposure to the toxicant?

Pollen Exposure

- Looked at the 4 most common areas to find Bt-corn and Monarch larvae in the same place at the same time based on migration patterns.
- Ontario: 62%
- Minnesota/Wisconsin: 40%
- Maryland: 20%
- Iowa: 15%

Pollen Effects

- Monarch caterpillars must be exposed to at least 1000 pollen grains/cm² to have a toxic effect
- 95% of all leaves sampled had less than 600 grains/cm²

Average Pollen Density Levels on Milkweed (cm²)

- Inside a corn field: 170.6
 - 0 m from edge: 63.1
 - 1 m from edge: 35.4
 - 2 m from edge: 14.2
 - 4-5 m from edge: 8.1
-
- These levels are obviously not enough to cause damage to Monarch Caterpillars.

Their Conclusion

- The potential risk to monarch butterfly populations from *Bt*-corn pollen is negligible.
- This study shows us how important it is to have all the scientific facts before rushing to conclusions.

References Used

- http://www.ars.usda.gov/sites/monarch/sect2_1.html

- <http://www.news.cornell.edu/releases/May99/Butterflies.bpf.html>
Ballard, Jacob C. (JCBALLARD); Cox, Karin M. (KMCOX); Lyons, Jarad R. (JRLYONS); V

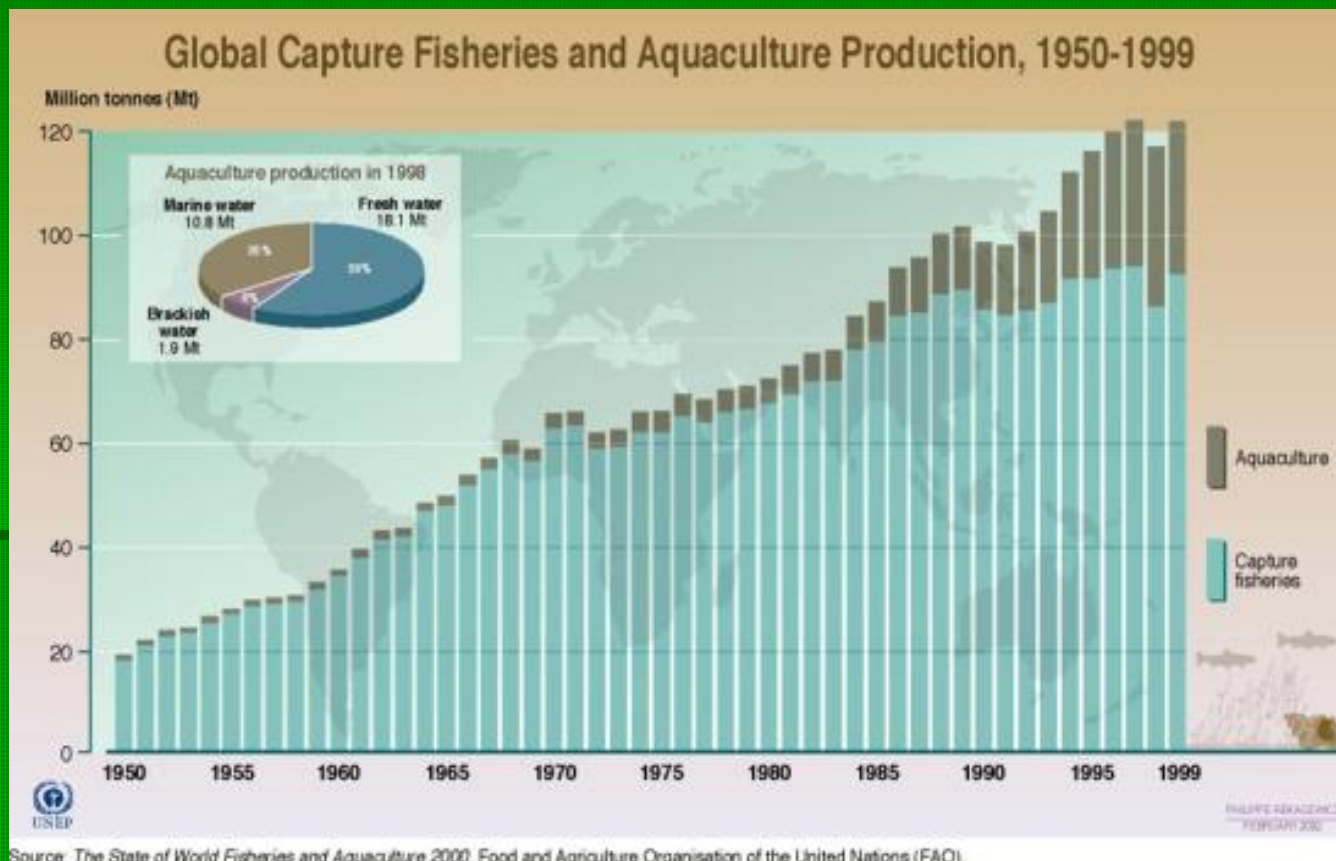
- <http://www.uky.edu/Ag/Entomology/entfacts/fldcrops/ef130.htm>

- http://www.kidzone.ws/animals/monarch_butterfly.htm

Wild Life Interactions with Aquaculture

- Aquaculture: is the production of aquatic animals and plants under controlled conditions for all or part of their lifecycle (usda.gov).
- Largest sectors in the U.S.
 - Shrimp and Mollusk farming
 - Catfish farming 1,370 farms worth \$450,710,000
 - Salmon and Trout farming 561 farms worth \$72,457,000 in total sale (USDA census 1998)
 - Between 1980 and 1998, the value of U.S. aquaculture production rose over 400 percent. The 1998 Census of Aquaculture reported farm-level sales of \$972 million.

Global Aquaculture Production

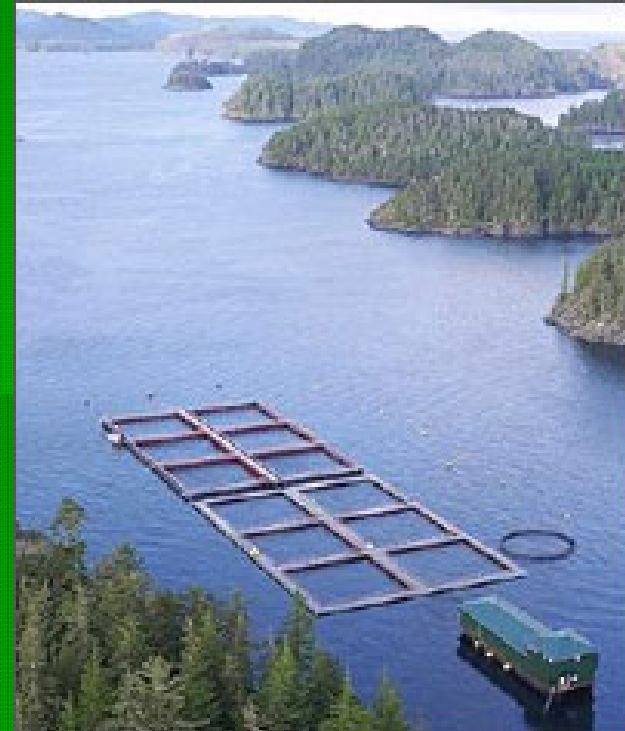


Types of Aquaculture System

- Extensive (pond) aquaculture
 - Has low oxygen content, good for pelagic species. Ex. Catfish
- Intensive (closed-circulation) aquaculture
 - Uses recirculated filtered water, has high Oxygen Content. Ex. Trout
- Cage system
 - use synthetic fiber cages in existing water resources. Ex. Salmon

Examples of Cage System

Salmon Farming in the Ocean



Extensive Pond Aquaculture

- Catfish farming



Intensive (closed-circulation) aquaculture

- Trout Farms. Ex. Of Runways



Effects of Predation by Birds

- Aquacultured fish are kept at capacity
- Fish Harassed by birds do not feed properly, and are subject to stress related disease. (ABP) Stress related diseases are usually fungal.
- Since weaker fish are usually predated upon first, farmer may not notice problems in time to administer treatment. Can result in complete loss of live stock.
- Birds can be intermediate or definitive hosts to parasites, such as: cestodes, nematodes, trematodes.
 - Parasites can cause deformities to numerous parts of the fish.
 - Parasites can prevent the ability to gain weight.
 - Leaves them more susceptible to infections and viruses.

Effects of Predation by Birds

- Open aquaculture systems are susceptible to bird predation.
- In Europe, Birds have been implicated as a vector for transmission of three fish viruses from aquaculture, to wild populations.
 - Spring Viraemia of Carp (SVC)
 - Viral Haemorrhagic Septicemia (VHS)
 - Infectious Pancreatic Necrosis (IPN)
 - Birds can carry bacterial pathogens in their gut and on their feet.
 - Price, I.M. Nickum, J.G. (1995). Aquaculture and Birds: The Context for Controversy. Colonial Waterbirds, vol. 18, pp.33-45
- Aquaculture can have a significant impact on changes in bird distribution, and migration patterns.

Salmon Farming and Salmon Interaction

- Large salmon projects have resulted in significant ecological interactions that have tended to reduce-genetic diversity and have resulted in the replacement of wild salmon by hatchery fish.
 - Low Genetic Diversity leads to higher genetic loads, and expressed genes that are not normally expressed. Higher mutation rate.
 - hatcheries produce domesticated salmon, which are selected on the basis of traits that were beneficial for survival in the hatchery itself. Such selection increases fitness in the hatchery, but often decreases fitness in the natural environment. (Campton, D. E. 1995. Genetic effects of hatchery fish on wild populations of Pacific salmon and steelhead: What do we really know? *American Fisheries Society Symposium* 15: 337-353, Bethesda, MD)

Salmon Farming and Salmon Interaction

- Fish native to a watershed with endemic parasites may develop resistance to them; fish not native may be very vulnerable. They do not coevolve with parasites.
- Ocean productivity periods fluctuate broadly within cycles. Hatchery production, tends to operate on fixed production schedules. The result is that fixed levels of production come into conflict with varying levels of ocean productivity.
- http://www.wildsalmoncenter.org/hatchery_factsheet.php

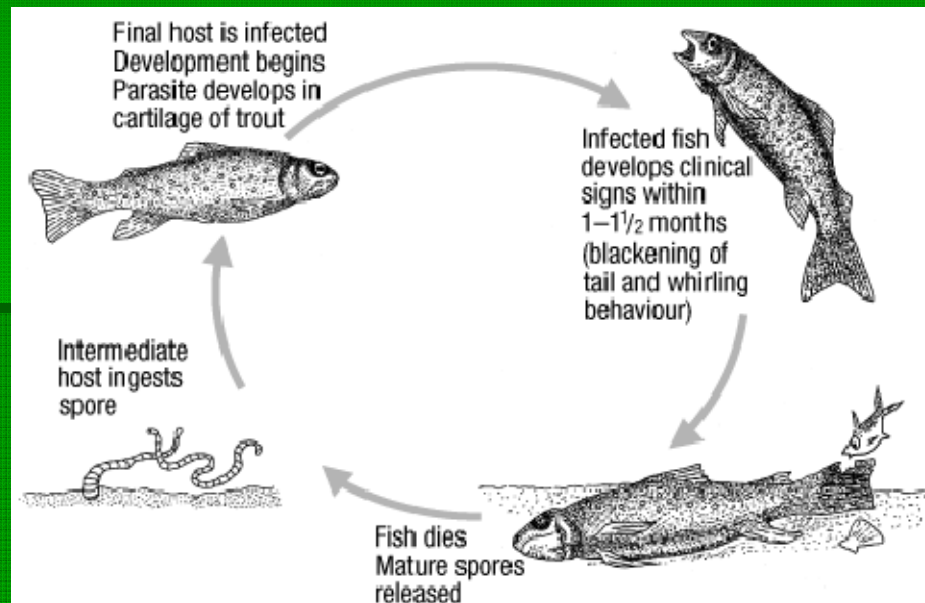
Whirling disease

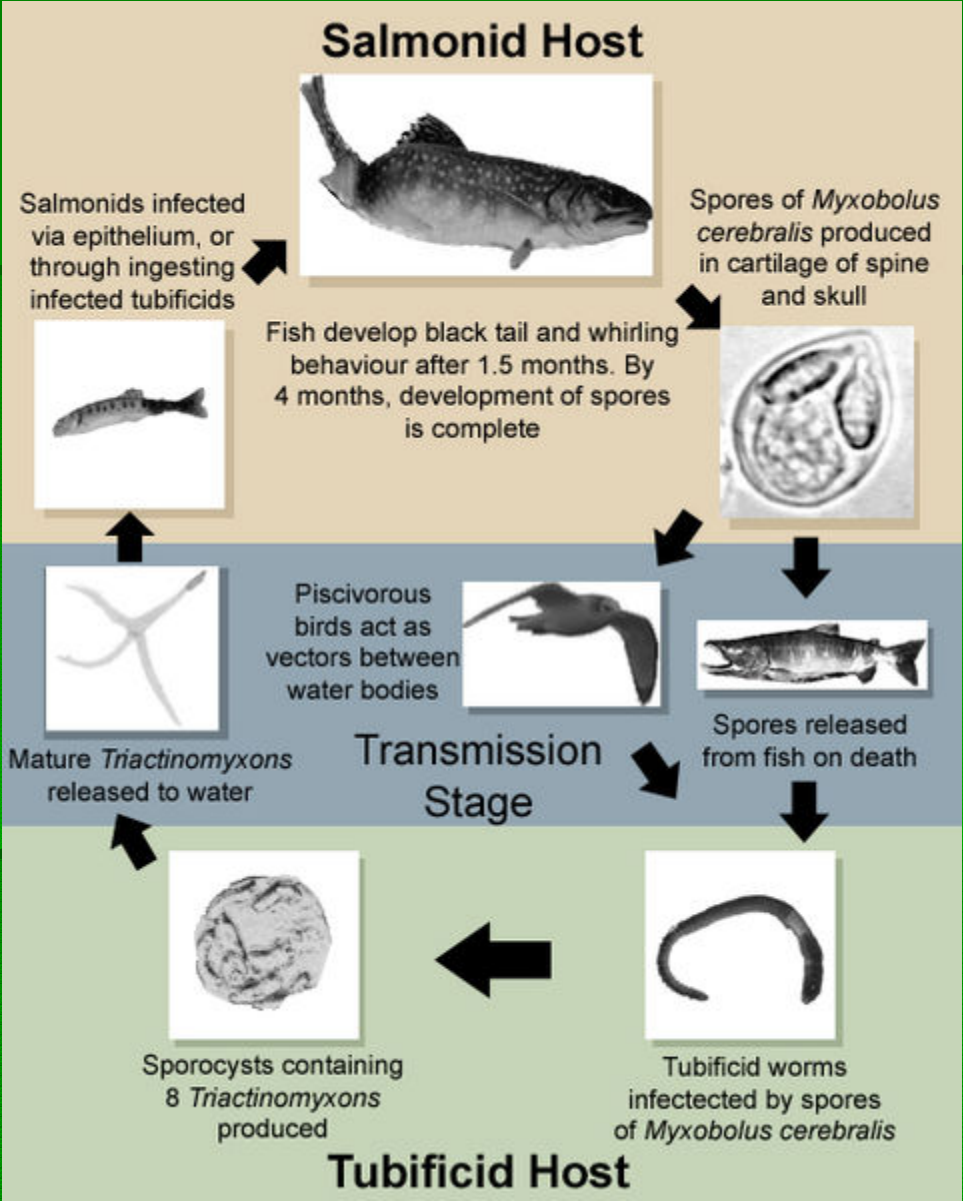
- Parasite, Scientific name: *Myxobolus cerebralis*
- Introduced in the 1950's from Europe.
- *Myxobolus cerebralis* is a parasite that penetrates the head and spinal cartilage of fingerling trout where it multiplies very rapidly, putting pressure on the organ of equilibrium. This causes the fish to swim erratically (whirl), and have difficulty feeding and avoiding predators.
- *M. cerebralis* is a spore, and needs an intermediate host, which is a tubifex worm. This worm is found in natural ecosystems through out Colorado and the U.S.
- Removing tubifex worms from a hatchery will eradicate *M. Cerebralis*.

Whirling Disease

- The life cycle of *M. cerebrali*

<http://www.whirling-disease.org>

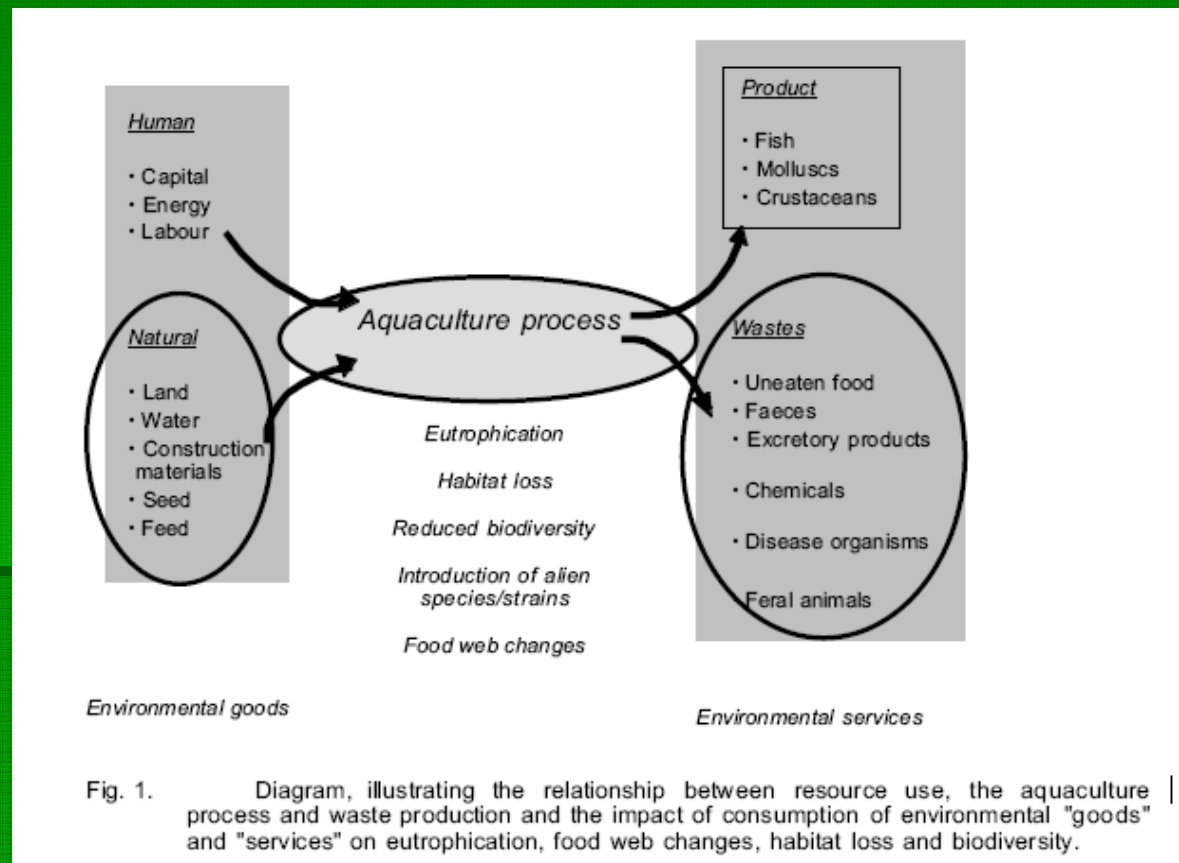




Whirling Disease

- How to remove *M. cerebrali* from Hatchery.
- Use Concrete runways to raise hatchlings instead of mud based runways. Remove what tubifex worms need to survive.
- Use filtered water, not water directly from river, lake or ground water.
- To save money, adult fish can still be raised in mud based runways, as *M.cerebrali* does not affect fish over the size of 6 inches.

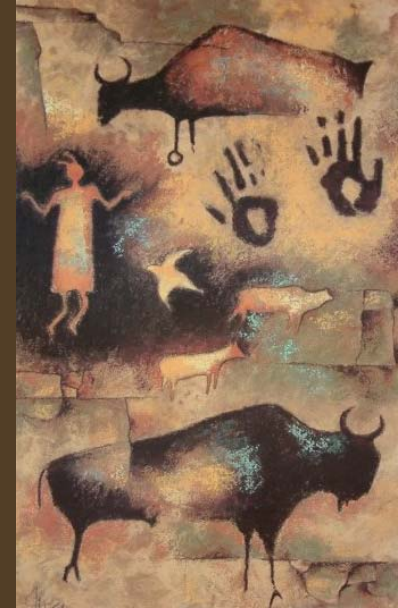
Aquaculture Process



Buffalo in Yellowstone

- History

- Symbol of America
- Cattle dominance in West
- Government interactions



Yellowstone

Safe place

Wild vs. Domesticated
-Pure lines



History

- Yellowstone Buffalo
Preservation Act

Montana

- Lower altitude
- Hunting license
- Cattle interaction



Disease

- Brucellosis
- Wyoming



Solutions

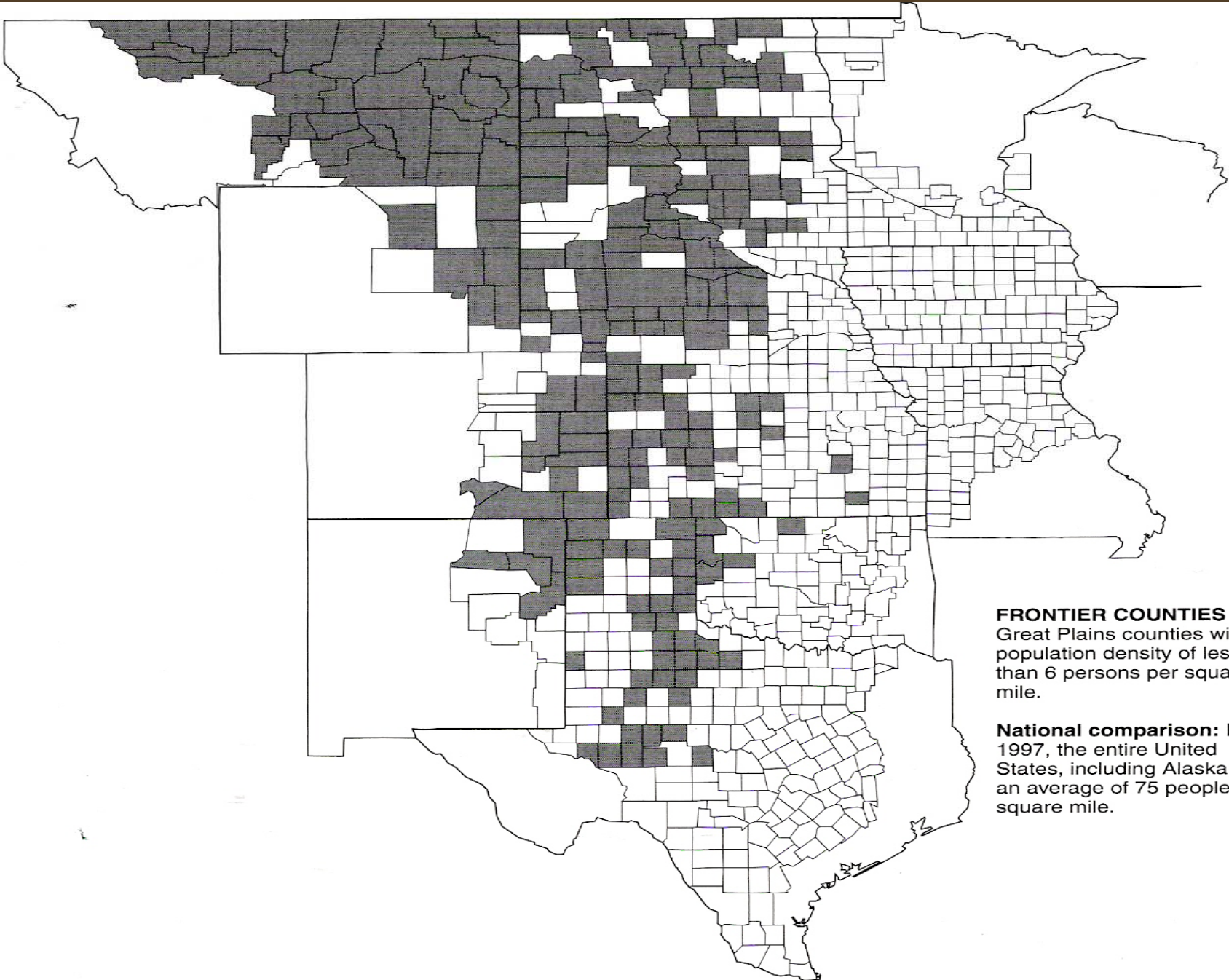
Vaccinations



Y2Y Conservation Initiative



Buffalo Commons



FRONTIER COUNTIES
Great Plains counties with a population density of less than 6 persons per square mile.

National comparison: In 1997, the entire United States, including Alaska, had an average of 75 people per square mile.



William Campbell, USFWS

Wolf Reintroduction: Pro's

John Sedlak

Where Have Wolves Been Reintroduced in The US?

- **Today, wolves have been reintroduced into forested regions of Minnesota, Michigan and Wisconsin, and parts of the northern Rockies. Studies of wolf-prey relationships in the Yellowstone ecosystem in Wyoming indicate that wolves have helped restore degraded habitat and streams by reducing an overabundant population of elk**



Pro's

- **“Wolf Tourism” Wolves (in the YNP and other areas) will increase tourism, and add more money to local economies**
- **Wolf watchers boost tourism in the Yellowstone region at least \$20 million annually based on some conservative estimates**



Pro's

- **Healthy wolf populations help to control populations of deer and elk that can have considerable negative economic and ecological impacts.**
- **Wolves eat elk and elk eat aspen, the lack of the wolves actually led to the decimation of aspen in YNP.**
- **Since the wolves have been reintroduced, some of the woody species have begun to return**



Pro's

- **Willow re-growth creates opportunities for increased biodiversity in a number of ways:**
 1. **Taller willows provide more food for beavers. Since the willow has reappeared, Yellowstone's northern range has gone from one beaver colony to at least eight beaver colonies.**
 2. **Taller willows and more extensive willow species also provide better habitat for certain bird species**
 3. **Willow growth also provides for stream-bank protection, decreased erosion, and additional shade on the water, which is good for trout.**



Pro's

- In the absence of wolves there weren't many carcasses of large ungulates like deer, elk, and bison between December and February. If the ground is frozen what's left for a raven, eagle, or wolverine to eat without wolf kills on the ground?
- A study by Yellowstone biologist Daniel Stahler revealed that before wolves had been returned to the park, an average of four ravens scavenged an individual elk carcass, but after wolf reintroduction, each carcass averaged 29 ravens, and some drew as many as 135, prompting wildlife biologists to wonder how ravens ever survived without wolves.



Pro's

- **Wolves have the ability to return the landscape back to its natural balance.**
- **But in spite of Yellowstone's and other wolf reintroduction areas success, many people in this country and around the world still view wolves in the same light as they were 100 years ago, when the animals were first removed to make way for farms and ranches.**



What Now?

- **US wildlife authorities will remove wolves from the endangered species list in three states and want to de-list the animals in three more regions, paving the way for hunting the creatures for the first time in decades.**
- **US Fish and Wildlife Service director H. Dale Hall said the decision was made because the wolves had been successfully re-populated.**

