Wildlife Management & Disease

A. Wildlife Disease Categories and Definitions

- **infectious**
- **parasitic**
- **toxic**
- **physiological**
- **nutritional**
- **congential**

epizootiology – The study of disease ecology, addresses "how" and "why" of diseases.

enzootic – The chronic level of disease frequency, that is a low but constant occurrence of a disease in a population.

epizootic – An outbreak of a disease. Large numbers die within a short period of time.

B. Why wildlife managers should address disease issues?

4 reasons

1. Domestic or wild animals may serve as reservoirs or vectors for pathogens that affect each other or humans.

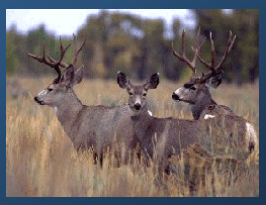
Reservoir – pool represented by animal population where pathogen may be harbored as a source of infection for other populations.

Vector – an organism that transmits the disease within and between populations.

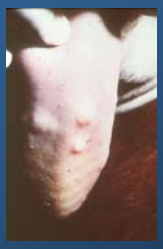
Foot and Mouth Disease

1924 – Stanislaus National Forest

22,000 Mule Deer slaughtered when disease appeared in CA livestock.

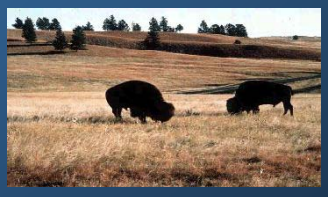


FMD – highly infectious viral disease



Brucellosis

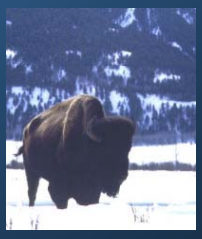
Suspected that bison in Yellowstone Park serve as reservoir for bacterial disease.



1996 summer herd – 3500

1996 winter many moved out of park

1997 spring herd - 1300



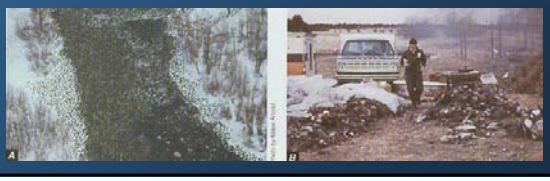
McCorquodale and DiGiacomo 1985. J. Wildl. Disease 21:351.

2. With habitat loss, wildlife populations become more concentrated.

Severity of disease may be density-dependent

Missouri – winter epizootic of avian cholera caused massive mortality.

Bacterial infection results in death 6 – 48 hrs. after exposure.



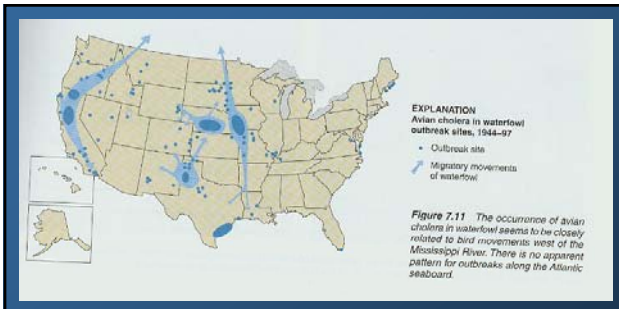


Figure 7.11 The occurrence of avian cholera in waterfowl seems to be closely related to bird movements west of the Mississippi River. There is no apparent pattern for outbreaks along the Atlantic seaboard.

3. Disease may cause serious losses in already small populations of endangered species.

- Insect-borne virus killed 7 of 39 Whooping Cranes
- West Nile virus killed 1 Humboldt Penguin at Philadelphia Zoo
- Canine parvovirus found in Isle Royale wolf pack
- Canine distemper decimated most of Black-footed Ferret colony (59→ 6)

Bald Eagles

AVM

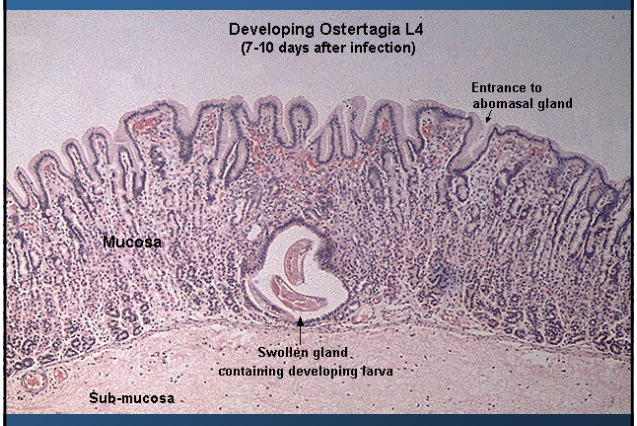
Avian vacuolar myelinopathy

1995 – 29 Bald Eagles died mysteriously

1997 – 26 died

1998 – 2000 – 86 died

4. Diseases are part of whole spectrum of issues facing wildlife managers.

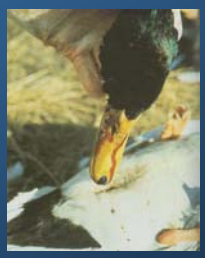


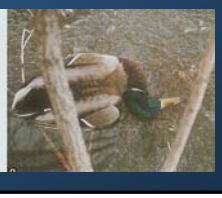
Caribou in Newfoundland

50% calves dying from abscesses on necks

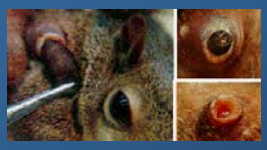
Public may become passionately involved

Venice, CA – outbreak of DVE (duck plague)





C. What management actions can be taken?



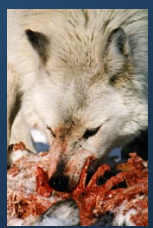
Squirrels and Botflies

Rabbits and tularemia

Days	Rate of tularemia per 100,000 humans
After opening of season	
30 – 39	14.1
20 – 29	14. 2
10 – 19	11.1
0 – 9	4.3
Before opening of season	
0 – 9	1.0
10 – 19	0.4

Yeatter and Thompson 1952

Predation can interact with disease to affect populations.



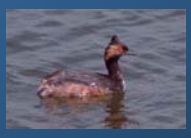
Diseased prey **<u>can</u>** be more vulnerable to predators.

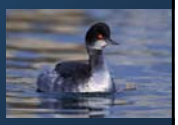
The Salt Lake Tribune

Cholera killing off migrating bird life Great Salt Lake: Grebes die by the thousands, but there is little danger seen for humans

By Greg Lavine

The Salt Lake Tribune 11/06/2004





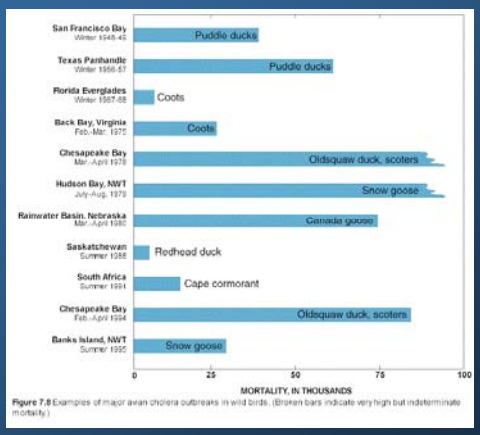


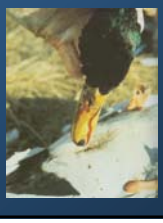
Figure 7.8 Examples of major avian cholera outbreaks in wild birds. (Broken bars indicate very high but indeterminate mortality.)

Avian cholera is a contagious disease resulting from infection by the bacterium *Pasteurella multocida*

- can result in bird deaths 6–12 hours after exposure,
- Infection generally results when *P. multocida* enters the tissues of birds through the mucous membranes of the pharynx or upper air passages, also through the membranes of the eye or through cuts and abrasions in the skin.

• Environmental contamination from diseased birds is a primary source for infection

• Wetlands can be contaminated by the body discharges of diseased birds (as much as 15 mls of nasal discharge containing massive numbers of *P. multocida* have been collected from a single snow goose)



• bird-bird contact

• ingestion 

• aerosol 

• insects

• animal bites 

• fomites 

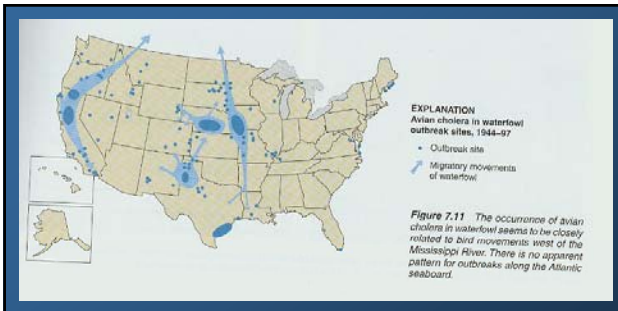


Figure 7.11 The occurrence of avian cholera in waterfowl seems to be closely related to bird movements west of the Mississippi River. There is no apparent pattern for outbreaks along the Atlantic seaboard.

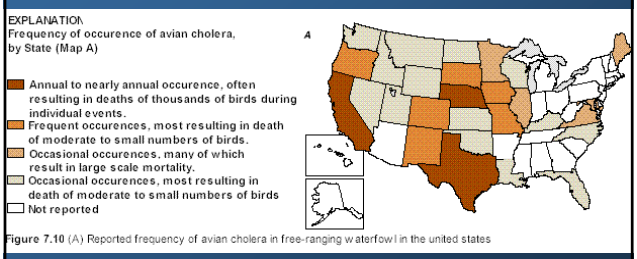
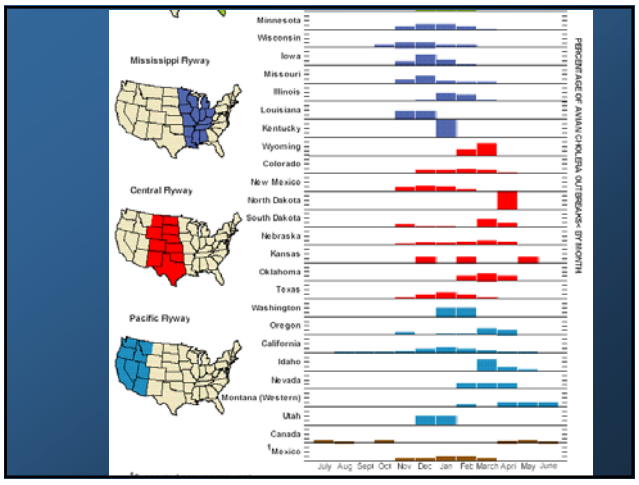


Figure 7.10 (A) Reported frequency of avian cholera in free-ranging waterfowl in the united states



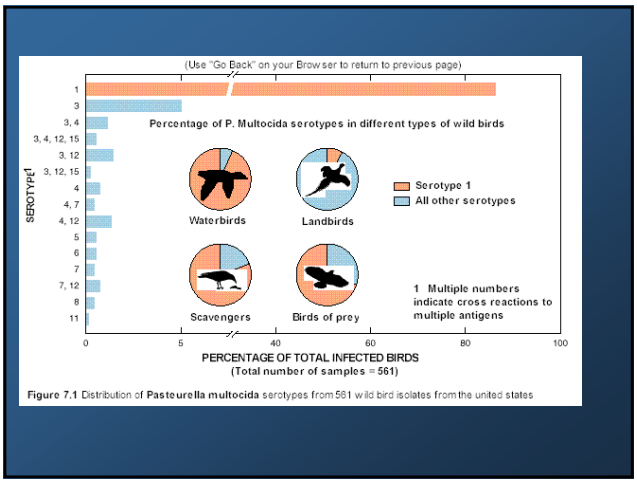


Figure 7.1 Distribution of **Pasteurella multocida** serotypes from 561 wild bird isolates from the united states

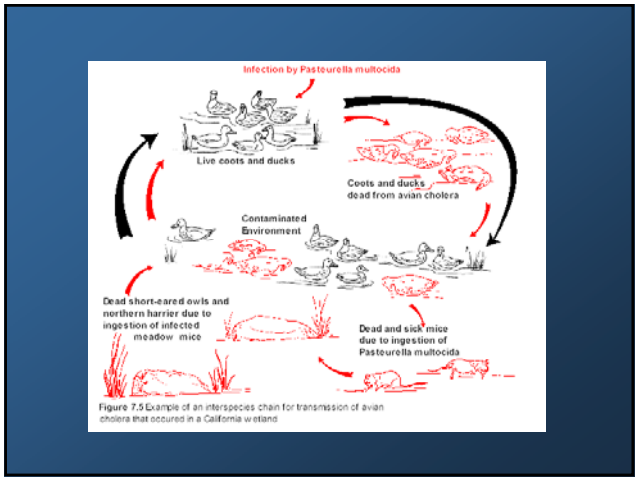
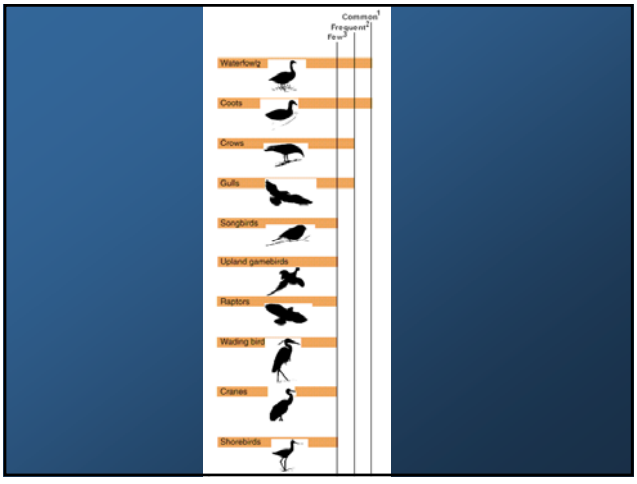


Figure 7.5 Example of an interspecies chain for transmission of avian cholera that occured in a California wetland



Management Guidelines

• early detection important

• carcass collection and incineration (standard procedures) collect bill-up, double-bag

• hazing

• drain wetlands

Disease can affect behavior

Consume more prey infected with parasites than nonparasitized prey

Implications

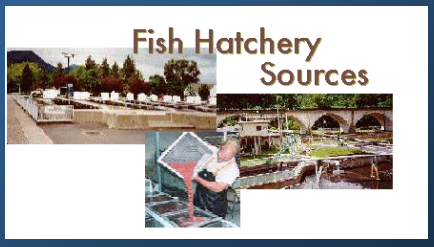
1. Prey consist of 2 populations (parasitized and not parasitized) – predation rates may vary.
2. Some species of prey may be uncommon in predator diets but predator may still become infected.
3. Parasites that increases vulnerability of prey likely influences diet of predator (may dominate diet in one community)

4. Evolutionary benefit of parasite to increase vulnerability of intermediate host.

Are the effects of disease underestimated?

- examination of carcasses – likely underestimates importance
- Parasitism may increase vulnerability to predation

Management practices can be conducive to epizootics



II. Habitat and Disease

A. Historical Perspective

Pathogens regarded passively by managers

Little could be accomplished – regrettable but unmanageable.

As knowledge increased attitudes changed

Control measures initiated to stem epizootics

(proper disposal of dead animals)

Last phase of disease management – prevention still remains elusive.

Experts now believe habitat conditions influence the course of many wildlife diseases.

Pathogens not likely to be eradicated but severity and frequency may be limited.

Problem – epizootiology of many diseases unclear.

B. Case Study – Avian botulism

Linked to habitat conditions since late 1800's.

Accounts for 100,000 + deaths during outbreaks.

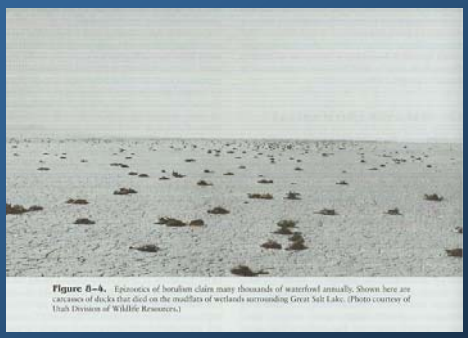


Figure 8–4. Epizootics of botulism claim many thousands of waterfowl annually. Shown here are carcasses of ducks that died on the mudflats of wetlands surrounding Great Salt Lake. (Photo courtesy of Utah Division of Wildlife Resources.)

1st hypothesis – caused by mineral components in water "alkali poisoning"

Identified bacteria producing toxin

Clostridium botulinum type C

Type of food poisoning

2nd hypothesis – Sludge-bed hypothesis

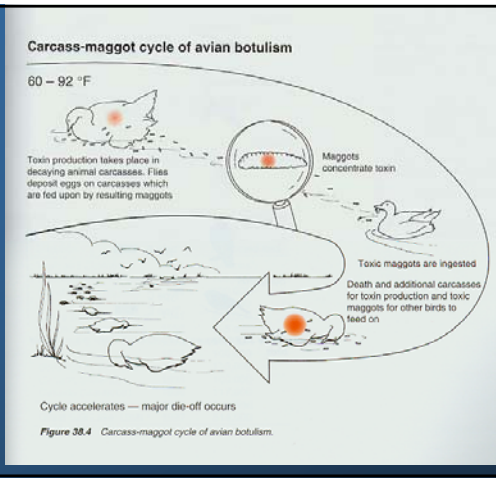
dead organic matter + shallow water + high temps + alkaline environment promoted disease.

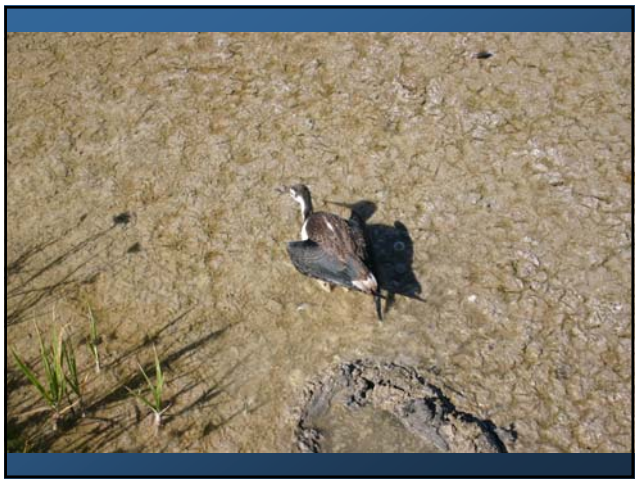
Bell et al. (1955) alternative hypothesis – "microenvironment concept"

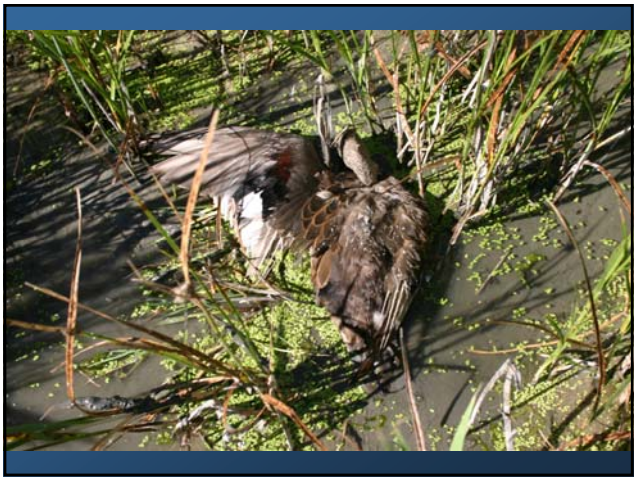
Wetland invertebrates prime transmitters of toxin to waterbirds

Bacteria produce environment in carcasses of aquatic invertebrates.

When water recedes – invertebrates die – bacteria flourish on medium rather than soil - invertebrates ingested – waterbird mortality







Management guidelines

Water levels should remain constant during botulism season

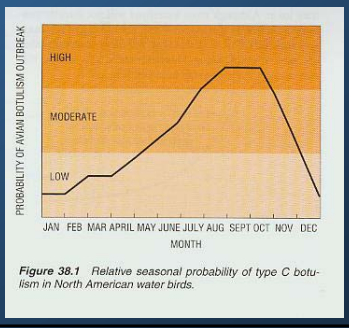


Figure 38.1 Relative seasonal probability of type C botulism in North American water birds.

Shallow edges prime sites for toxin production

Concentrate water into 1 –2 large units.

Reflooding areas should not be done in summer

Summer drawdowns should be avoided

Prompt removal of carcasses necessary

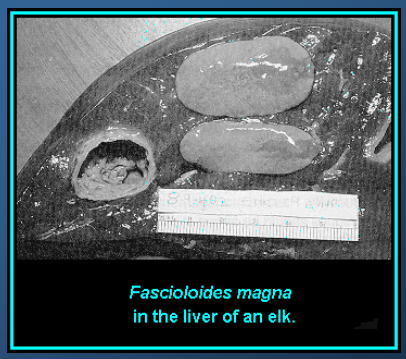
C. Soils, Land Use and Disease

Relationship indirect

e.g.

Large liver fluke (*Fascioloides magna*)

infects liver of White-tailed Deer



Fascioloides magna
in the liver of an elk.

In deer – causes little damage

In cattle – produces significant damage

Deer and elk serve as reservoir for parasite

Requires intermediate hosts

Texas – *Lymnaea bulimoides* sole intermediate host.

Requires shallow surface water to complete life cycle

Survey for snail indicated absent on sandy soils but all transects in heavy clay soil contained snail.

Translates to degree of helminth infection.

Cattle grazing pastures with heavy clay soils

likely to be affected.

Wallowing species can exacerbate fluke infections

Feral hogs – create depressions that hold water.

Little management is possible – other than treating cattle in areas prone to fluke infections.

Sandy ranges – don't develop artificial water sources,

if using windmills – confine water to troughs that are periodically treated with mulluscicides

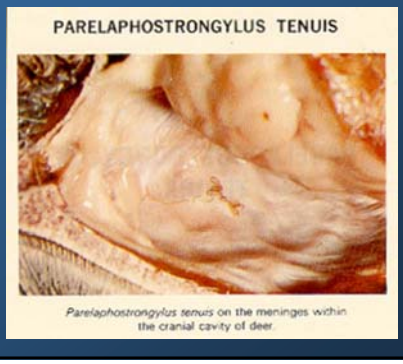
Fencing ?

Land use change also has increased contact between spp with differential responses to parasitic disease.

prior to 1900's little contact in N. Minnesota

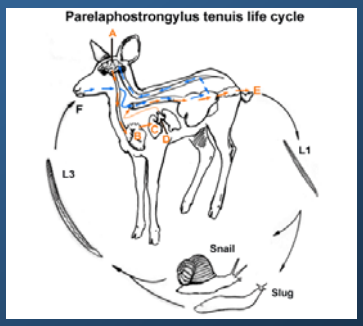
Logging, homesteading, burning created favorable habitats for deer into moose range.

Moose populations declined – meningeal parasites carried by deer.



Parelaphostrongylus tenuis on the meninges within the cranial cavity of deer.

Nematode – snails serve as intermediate host.



Deer - little to no damage

Moose – damage CNS, causing paralysis and death (“blind staggers” or “moose sickness”)

Parasite plays regulatory role where ranges overlap.

Small moose populations where large deer populations.

Recommendation – deer populations kept minimal levels in areas managed for moose.

Reintroductions of moose– weighed in light of current deer densities.

1985 & 1987 – 59 moose released in upper Michigan.

Release site had low density of deer (2-3 per km^2)

P. tenuis infection killed ~ 25% of moose

but 1994 population = 200

Snow depth can be important in reducing transmission of disease.

Habitats can be “improved” to point where diseases may be enhanced.

e.g. Grazing animals in Africa

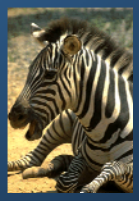
Pits left after roads were graveled - filled with water.

Attracted wildlife – additional boreholes made to hold animals near tourists.

Result – epizootic of anthrax (*Bacillus anthrax*)

Permanent water concentrated animals – degraded range conditions – weakened animals

– stress and permanent source of infection overcame natural immunity of disease in Zebras



III. Diseases and Populations

A. Do diseases regulate populations?

Difficulties (many interacting effects)

- predation
- weather
- competition

Epizootics easily documented, but do they actually regulate populations?

Diseases can operate in a density-dependent fashion but separating other factors is difficult.

Density-dependent responses of disease may explain population cycles.

Red Grouse and parasitic nematodes

Dense Grouse population

↓

Greater proportion infected heather tips

↓

Intensity of infection rises --- increased mortality

David Lack –

Number of grouse in relation to food supply.

Nematode lethal only to those already weakened by starvation.

Extent of nonhunting mortality largely unknown but disease may be responsible for majority.

Estimated

Nonhunting losses of waterfowl > legal harvest (x2)

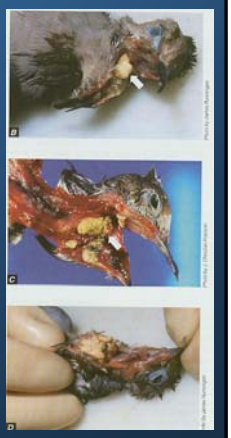
Life table studies of Mourning Doves

Mortality rates = sites hunted vs not hunted

Hunting compensatory to other types of mortality

Trichomoniasis

Trichomonas gallinae



Alabama outbreak curtailed reproduction

Juveniles made up < 10% of population