Aquatic Systems and Environmental Health

AQUATIC BIRDS: ENVIRONMENTAL HEALTH ISSUES

Marilyn G. Spalding, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine, University of Florida, Gainesville, Florida

Aquatic birds and habitat usage

- Loons and grebes
- Tubenoses
- Pelicaniformes
- Anhingas and cormorants
- Wading birds
- Swans and geese
- Ducks
- Raptors
- Cranes
- Shorebirds
- Terns
- Alcids
- Kingfishers
- Dippers

- Stand on it
- Stand in it
- Float on it
- Dive in it
- Corral food in it
- Walk under it
- Stab food in it
- Filter food from it
- Swim after food in it
- Bait food in it
- Build floating nests on it
- Bathe in it
- Defecate in it
- Drink it


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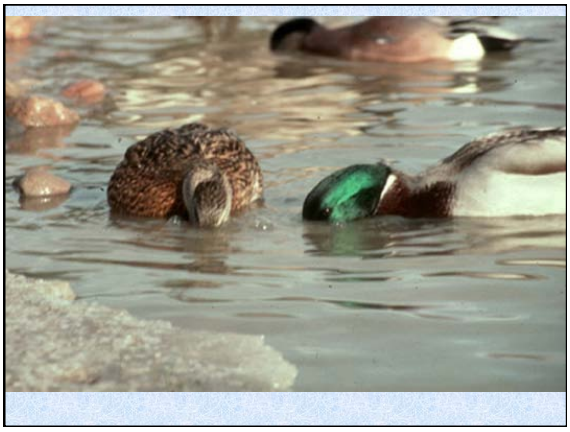
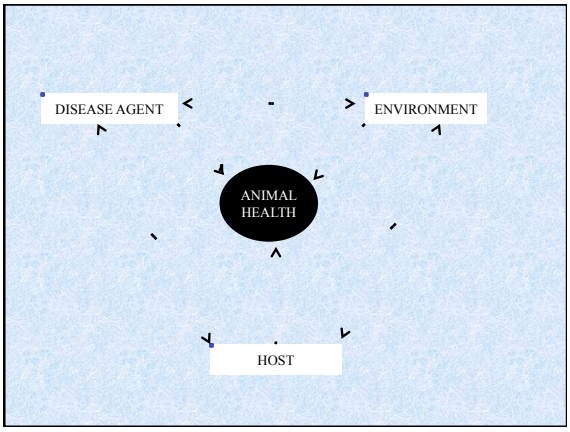
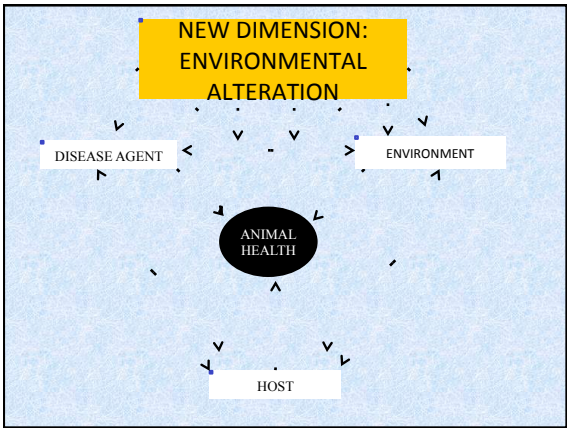



A. Long, First Light Productions





How we alter habitat

- Nutrient pollution
- Toxins
- Artificial food
- Translocation of disease agent
- Translocation of host
- Artificial species contact
- Habitat loss
- Structural hazards
- Climate change

Habitat alteration:New niches for waterbird diseases

- Toxins
- Nutrients
- Artificial food
- Translocation of disease agent
- Translocation of host
- Artificial species contact
- Habitat alteration/loss
- Structural hazards
- Climate change

- Mortality/morbidity
- Biotoxins
- Immune suppression
- Nutritional deficits
- Attractive nuisance
- Naïve immune system
- Crowding
- Aggression
- Increased transmission environment
- Inadequate neuroendocrine stimulation
- Trauma
- Antibiotic resistance
- Disease agent pathogenicity

Habitat alteration: pathways for injury

- Toxins
- Nutrients
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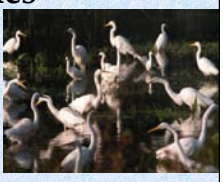
Contaminants in water

- Nutrients
- Methyl Mercury
- Chlorinated hydrocarbons, PCB,s, Dioxins,
- Sodium chloride
- Antibiotics
- Estrogen

Current Mercury Exposure in Everglades



- ↓ PCV
- ↓ Lymphoid tissue
- ↓ Appetite/ Motivation to hunt
- ↓ Weight
- Changes in tissue enzymes
- Thermoregulation change
- Lethargy
- Decreased immune function

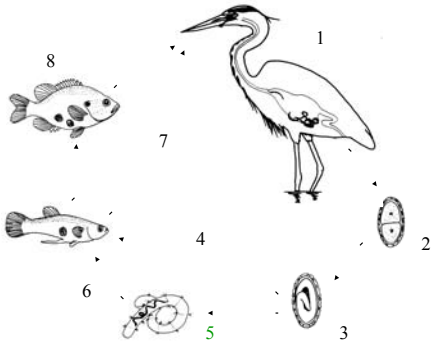
Nutrient contaminants

- Eustrongylidosis, and other parasites, attractive nuisance (increase productivity)
- Biotoxins? – red tide, botulism

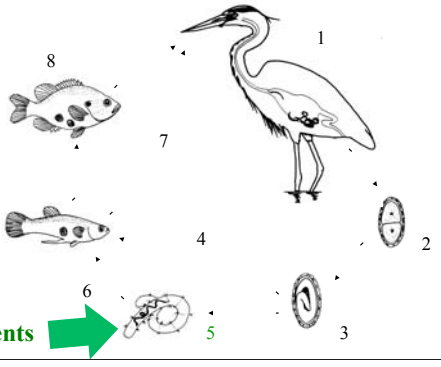
Eustrongylidosis

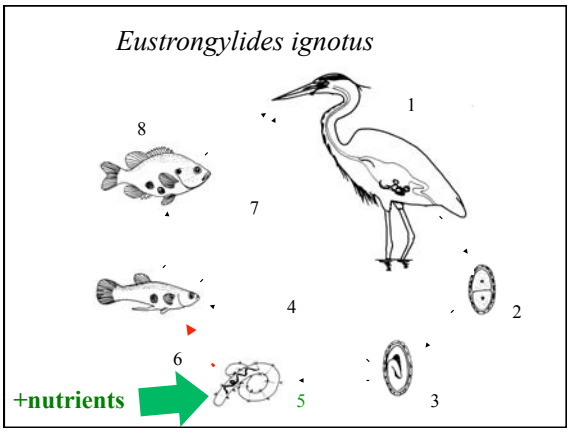
- Nematode parasite of herons and cormorants
- Complex life cycle

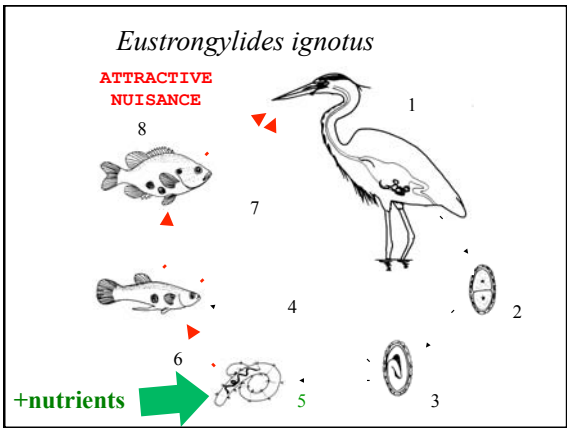
Eustrongylides ignotus

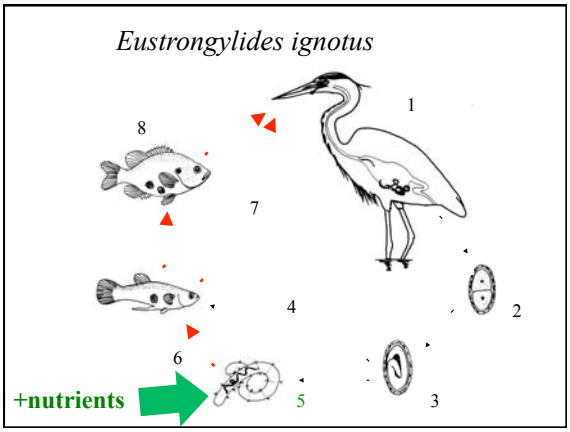


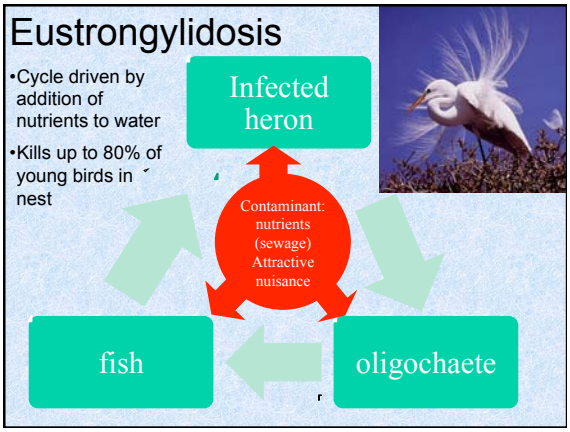
Eustrongylides ignotus







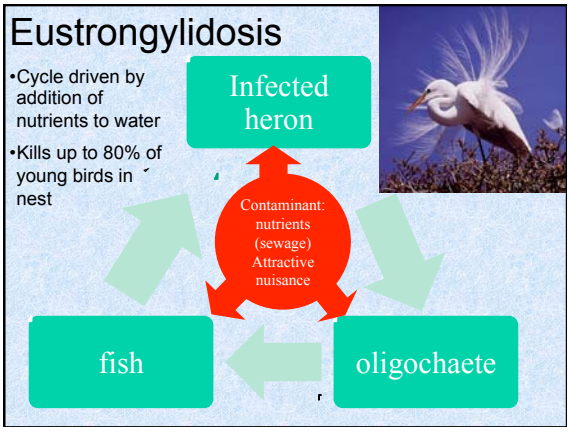




Attractive nusiance

- Abundant food resources- due to nutrient pollution, agricultural waste, human waste disposal into environment
- No warning label!!!

Parasites,
Toxins
Infectious diseases
Abnormal foods
Novel species exposure
Structural hazards

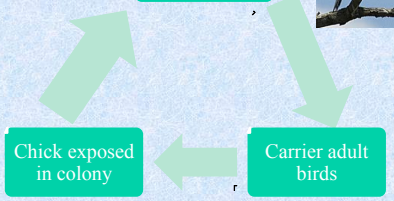


Infectious Diseases

- Fecal contamination, *Escherichia coli, Campylobacter, Salmonella, Shigella*
- Avian cholera
- Salmonellosis
- Newcastle Disease – aquaculture/cormorants
- Avian influenza
  - Most benign, HPAI

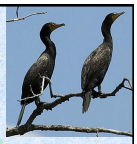
Newcastle disease

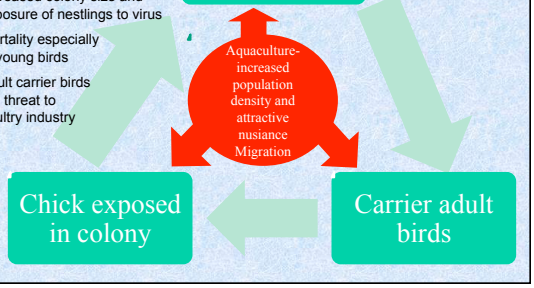
- Highly contagious viral enteric or neurologic disease
- Transmission by aerosol or fecal ingestion
- Transported by carrier birds
- Causes reduced egg production to rapid death



Newcastle disease virus

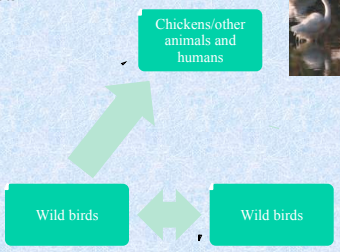
- Access to abundant food (catfish and crayfish aquaculture) in gulf states increases population size
- Increased colony size and exposure of nestlings to virus
- Mortality especially of young birds
- Adult carrier birds are threat to poultry industry





Avian influenza A

- Waterbirds are natural reservoirs. Asymptomatic birds are frequently infected with multiple strains of virus.
- Transmission fecal oral/contamination of water



High pathogenic avian influenza

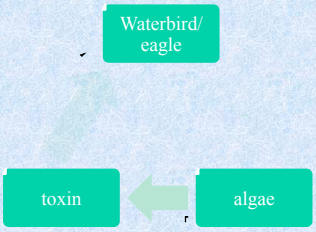
- High pathogenic avian influenza (rare) may be transmitted to wild birds by contact with domestic ducks and chickens and their waste and vise versa
- Spread by chicken products and/or wild bird migration
- Fatal disease in wild birds, chickens, waterbirds, mammals, and humans
- Attractive nusiance is waste grain and nutrient pollution

Biotoxins

- Avian vacuolar myelinopathy?
- Botulism
- Red tide – nutrient pollution????
- Domoic acid
- Other harmful algal biotoxins (HABs)
- Mycotoxins

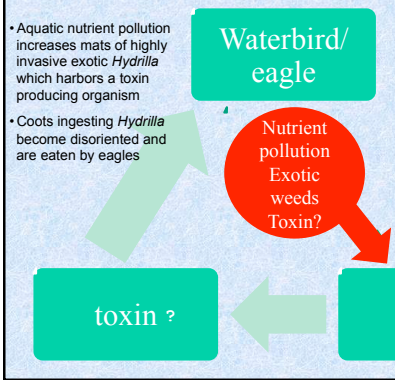
Biotoxin: Avian vacuolar myelinopathy (AVM)

- Unidentified toxin biotoxin produces disorientation and brain lesions in coots and eagles at certain lakes in the southeast
- Recent "emerging" disease



Avian vacuolar myelinopathy (AVM)

- Aquatic nutrient pollution increases mats of highly invasive exotic *Hydrilla* which harbors a toxin producing organism
- Coots ingesting *Hydrilla* become disoriented and are eaten by eagles



Translocation of pathogen/host

- West Nile Virus
- Malaria
- Avian influenza

Translocation: West Nile Virus

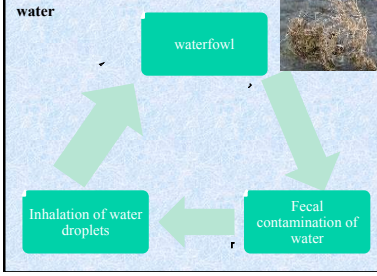
- Example of translocation of a disease
- Common in Eurasia with occasional outbreaks, rare bird mortality
- Transmitted by mosquitoes
- Entered North America for first time in 1999 causing over 500 human deaths
- Extensive mortality in some bird species especially Corvids and hawks
- With time, immunity develops, similar to Europe

Wetland loss – crowding

- Increased exposure to sick birds
  - i.e., avian cholera
- Exposure to novel species (and their diseases)
- Increase chance of dead bird leading to a botulism epizootic
- Decrease in water quality
  - Fecal contamination – clostridium, salmonella

Avian cholera

- **Very rapidly reproducing bacteria: *Pasteurella multocida***
- **Fecal contamination of water which is aerosolized when birds take off from water**

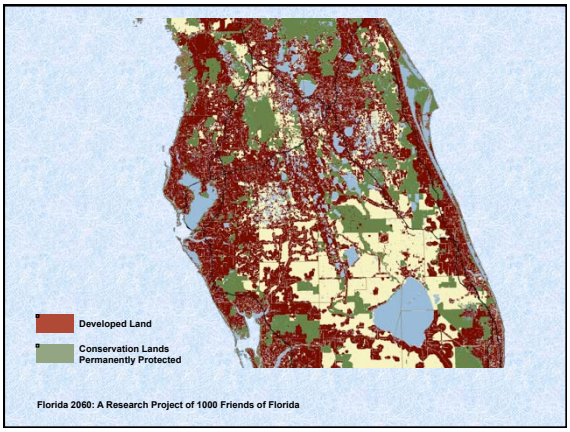


Avian cholera

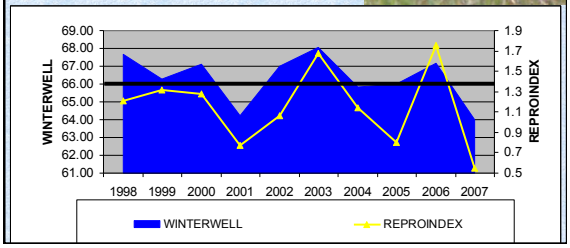
- Access to waste grain increases population size
- Immune suppression may be associated with Vit A deficient corn diet
- Fewer wetlands available further increases density
- Fecal contamination of wetlands
- Rapid death of 10,000's of birds every year

Wetland loss: development, drainage, drought

- Decreased quality habitat for foraging and nesting
- Forces use of marginal habitats with associated danger
  - increase hazards, especially boats
- Increases territorial competition
  - Increases adult and chick mortality
  - Increased exposure to terrestrial predators
  - Decreases pair "experience level"



Whooping crane reproduction in Florida: Sustainable vs Unsustainable



Emerging disease?
Or new opportunities for diseases to emerge?

- **Crowding & species mixing** from wetland loss, development, drainage, drought
- **Population expansion and inadequate nutrition** from monoculture/ agriculture, and aquaculture food availability
- **Attractive nuisance**: Pathogen exposure and nutrient pollution from human and animal waste
- **Translocation** of host and disease agents
- **Toxins** – physiologic change and immune suppression