



# Avian Disease at the Salton Sea

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# \* Salton Sea disease history

1933 “hundreds of thousands” of ducks dead

This event brought wildlife disease investigators to the Sea

- Investigation implicated avian botulism
- Prior events (1917, 1926-1931) also discovered
- Subsequent events noted (1934, 1939)

*“I am convinced that one of the most valuable features of the improvement works on the Salton Sea Refuge will be those that will curb botulism and thus save many waterfowl. Without adequate provisions for disease control, an enlarged refuge might become simply an aggravated death trap.”*

*E.R. Kalmbach - 1934*

# \* Salton Sea disease history

**1940-1949** very little record of avian disease

- Refuge annual narratives only mention a few small cases
- 1942 - event raised attention but no numbers kept
- 1947 - mortality of eared grebes noted

**1950-1959** better documentation, low occurrence

- Refuge annual narratives include annual tally of affected species

**1960-1969** continued low occurrence

- 1962-1964 avian botulism events ~6,000 birds annually

# \* Salton Sea disease history

**1970-1979** increased surveillance and disease response

- 1972, 1974, 1975 avian botulism events
- 1974 - first documented pesticide poisoning
- 1978 - first documented avian cholera ~9,000 birds

**1980-1989** standardized surveillance begins

- National Wildlife Health Center actively participates
- Disease monitoring transects established
- Low occurrence of botulism or cholera
- Eared grebe mortality 1989 - 40,000 dead

# \* Salton Sea disease history

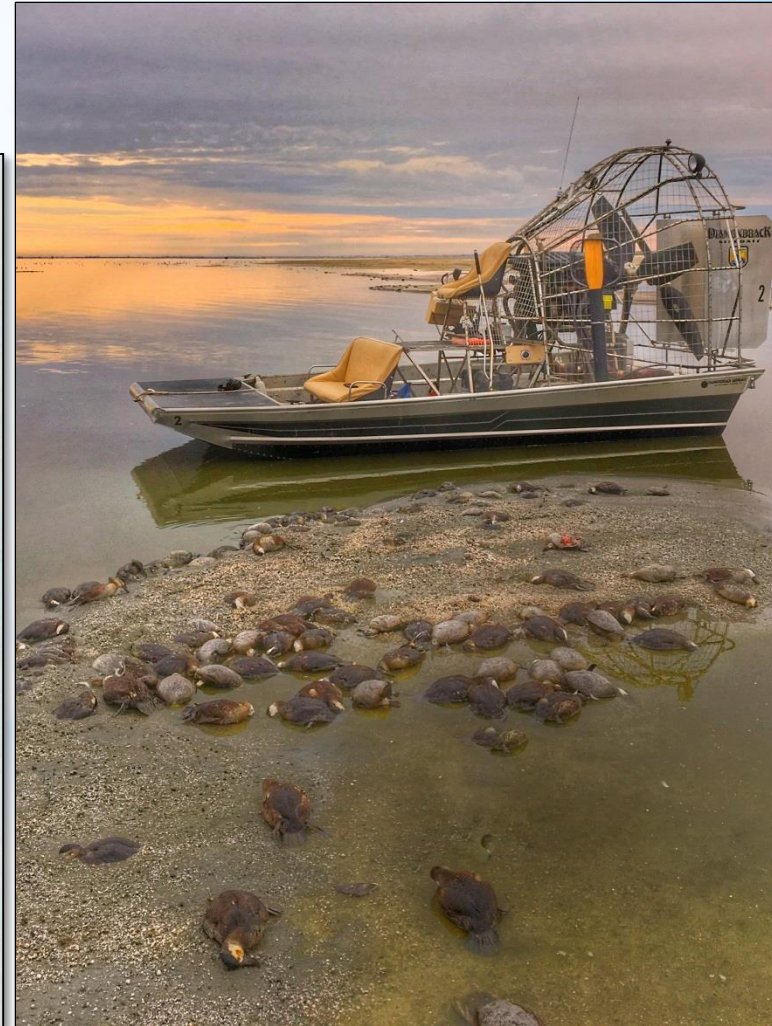
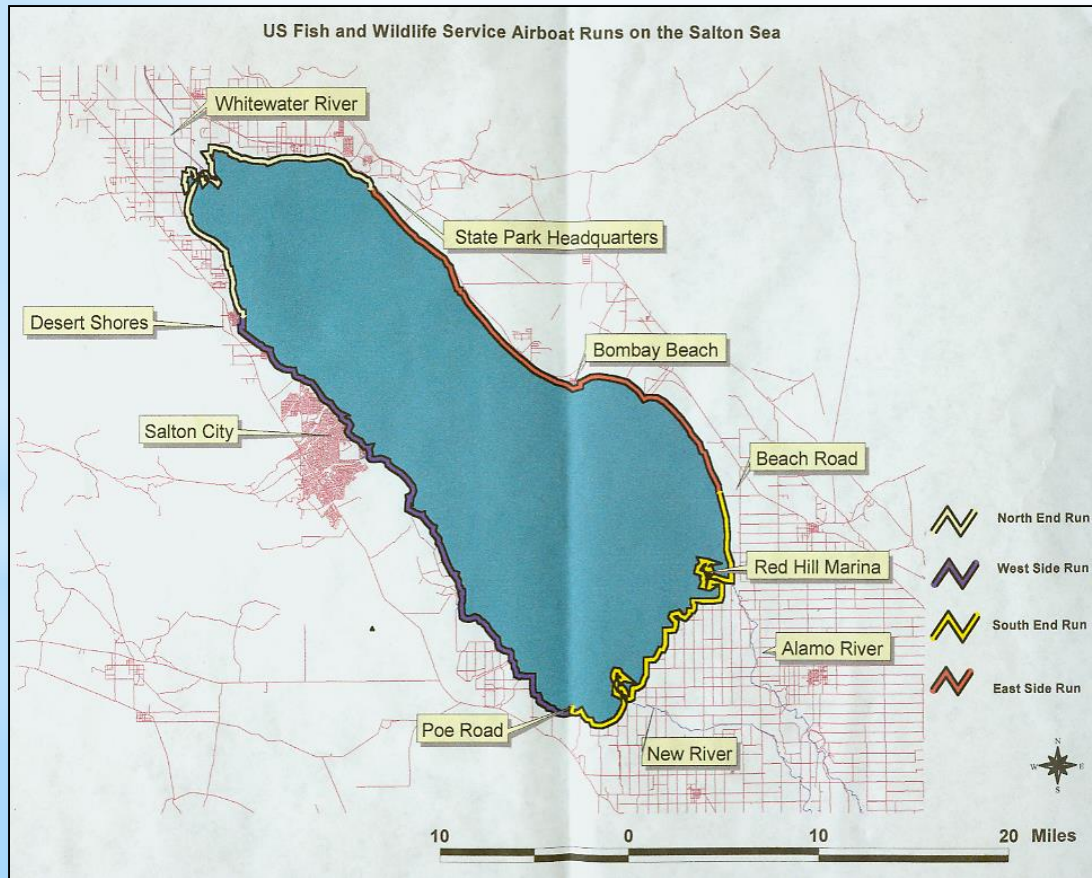
1990-1999 disease events escalate

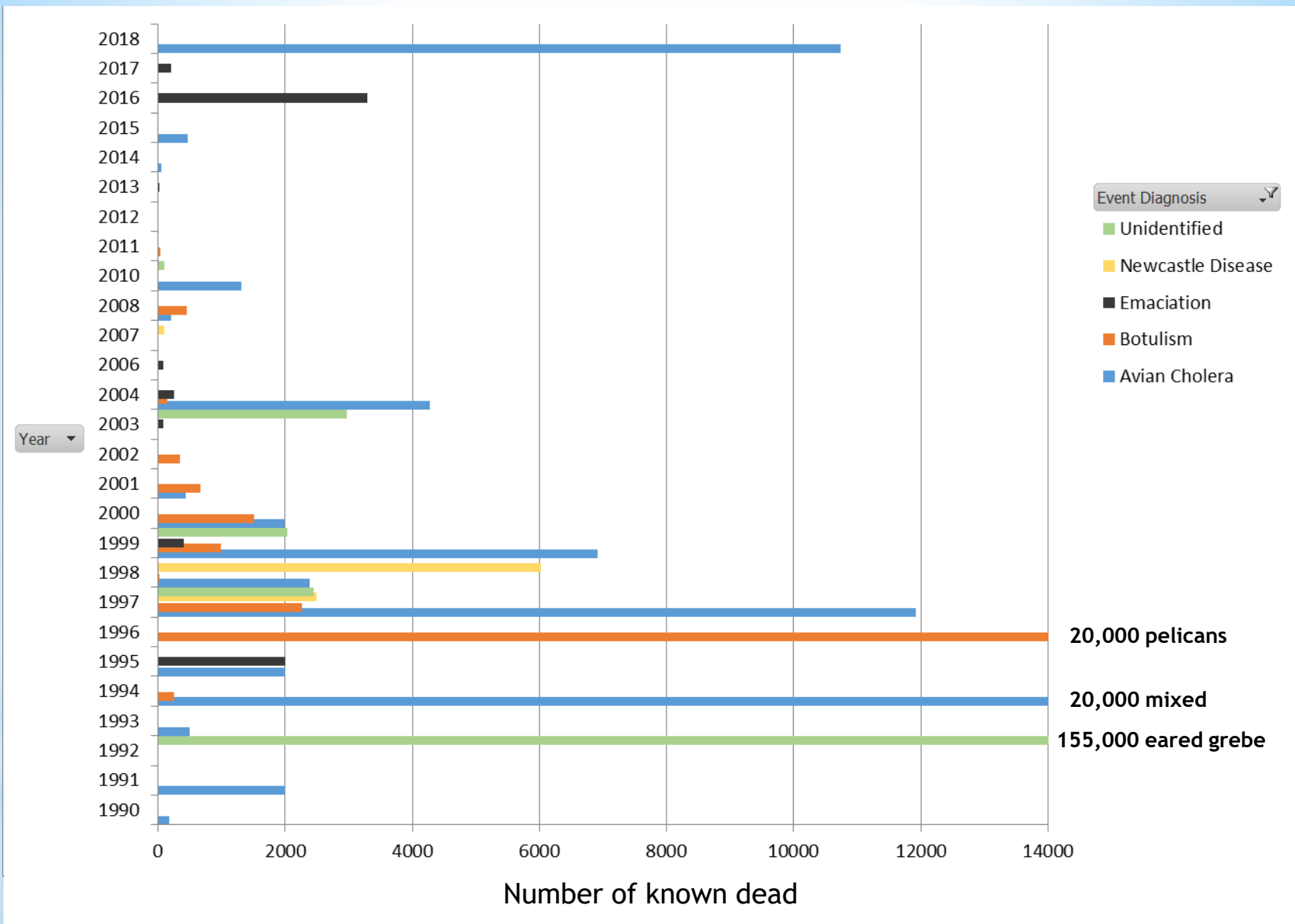
- Avian disease mortality documented annually
- 1992 - 155,000 eared grebe (undetermined)  
45,000 ruddy duck (cholera)
- 1994 - 20,000 eared grebe (undetermined)
- 1996 - 20,000 mostly pelicans (botulism)
- 1997 - 8,000 ruddy duck (cholera)
- 2,500 cormorant (Newcastle disease)
- 1998 - 6,000 cormorant (Newcastle disease)
- 1999 - 7,000 ruddy duck (cholera)

# Wildlife Disease Surveillance Program

1999 MOU established program

Early detection and rapid response





# The microbe is nothing: the terrain everything

*~ Louis Pasteur*

Many diseases are ubiquitous and exposure happens quite frequently

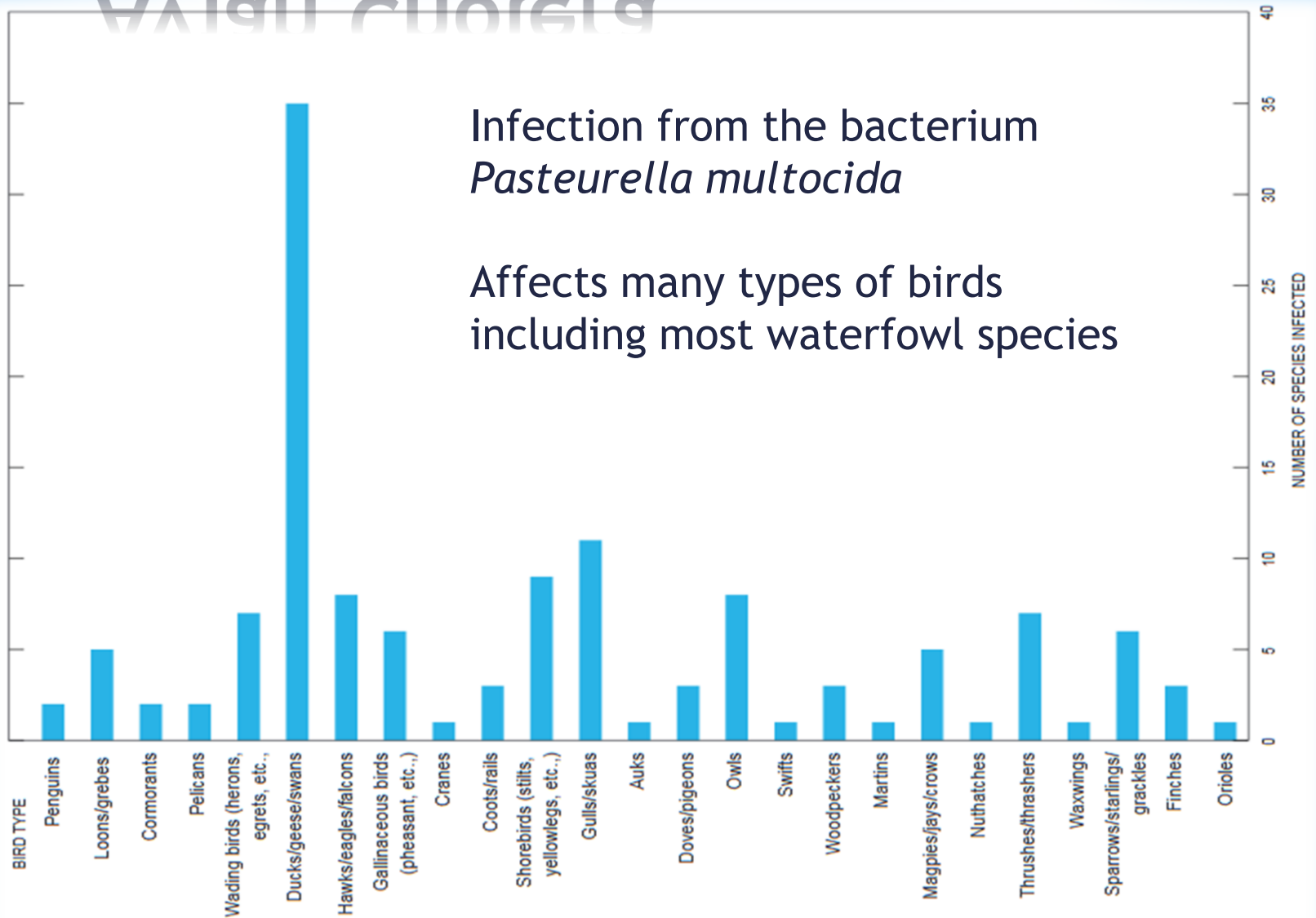
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What are the factors that turn exposure into an outbreak





# \* Avian Cholera

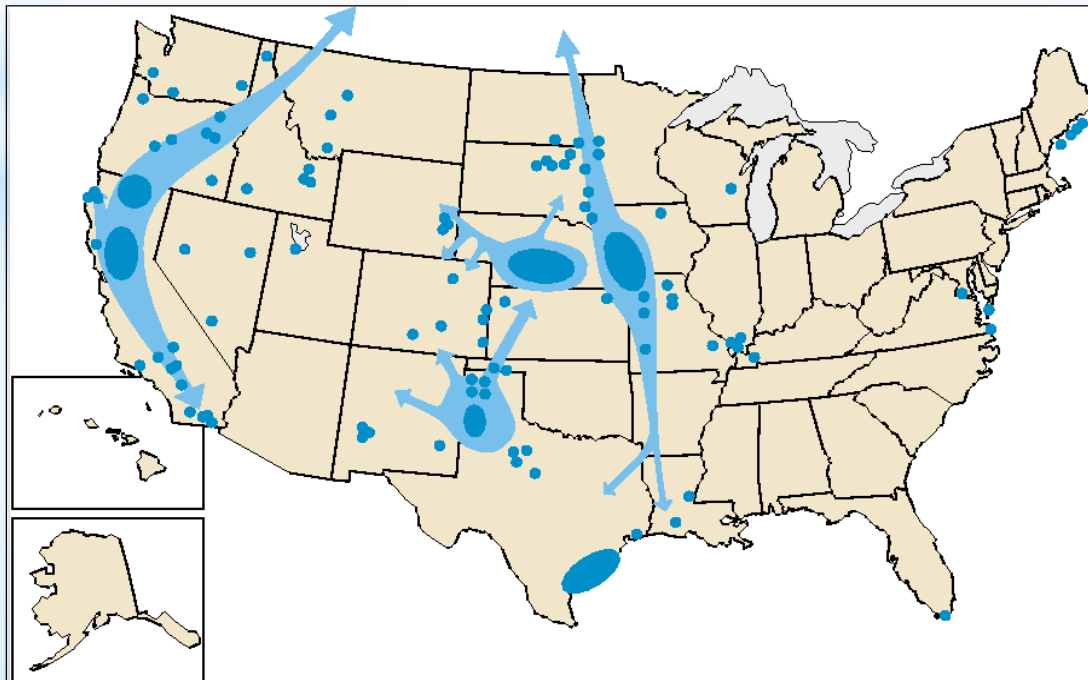


# \* Avian Cholera - history

First detected in North America 1880s - TX and CA

Not noted in free-ranging waterbirds until 1944

Expanded geographically along flyways post 1970



# \* Avian Cholera



Chronically infected birds serve as carriers

- Snow geese documented carriers
- Most commonly spread bird-to-bird
- Results from exposure through respiratory mucus membranes

Acutely infected birds succumb within 48 hours

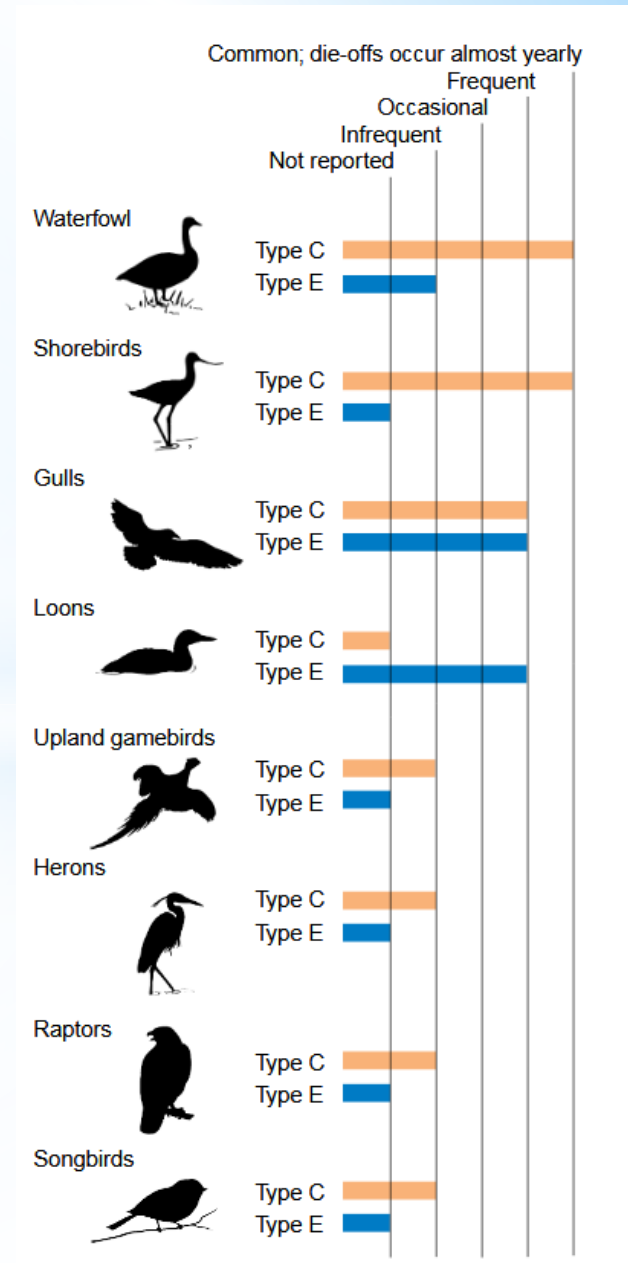
Sites remain contaminated for two weeks

# \* Avian Botulism

Toxin from the bacterium  
*Clostridium botulinum*

Spores reside in wetland  
soils and animal tissues

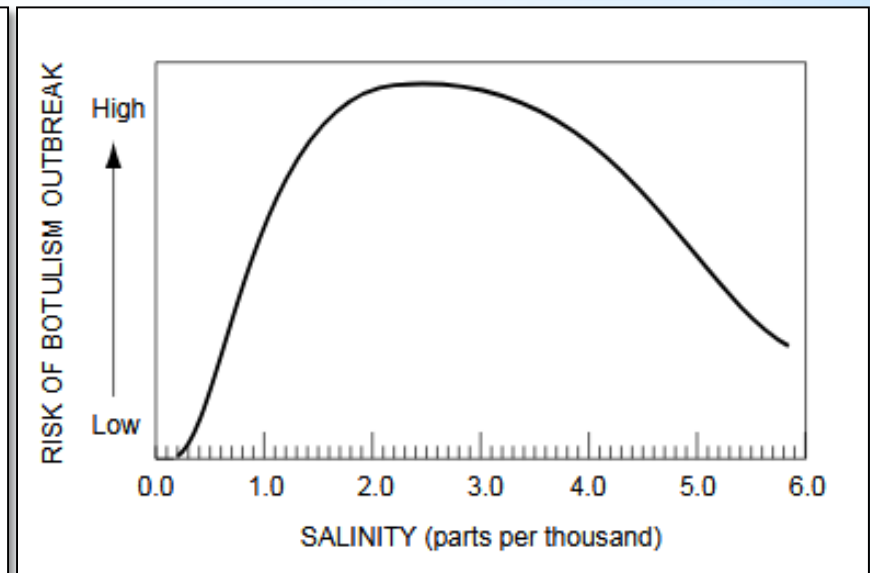
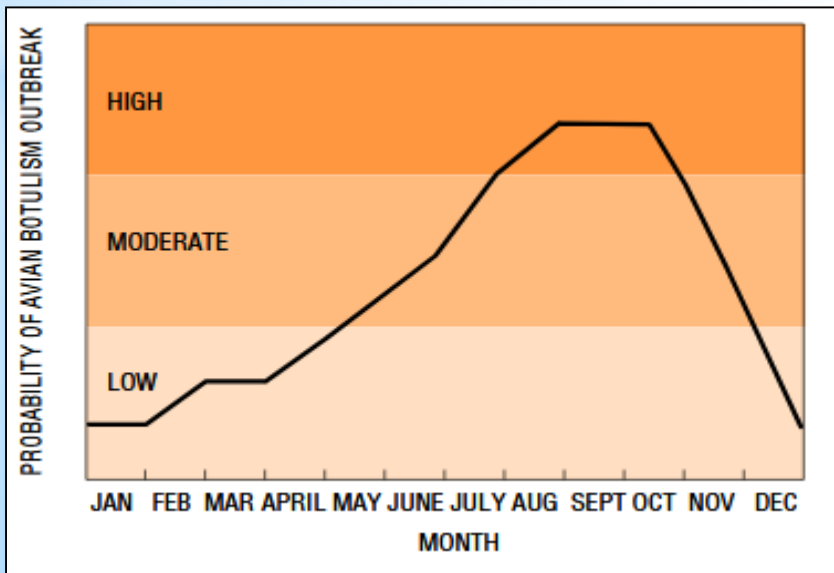
- 7 distinct toxins have been recognized (A-G)
- Type C and Type E affect wild birds



# \* Avian Botulism

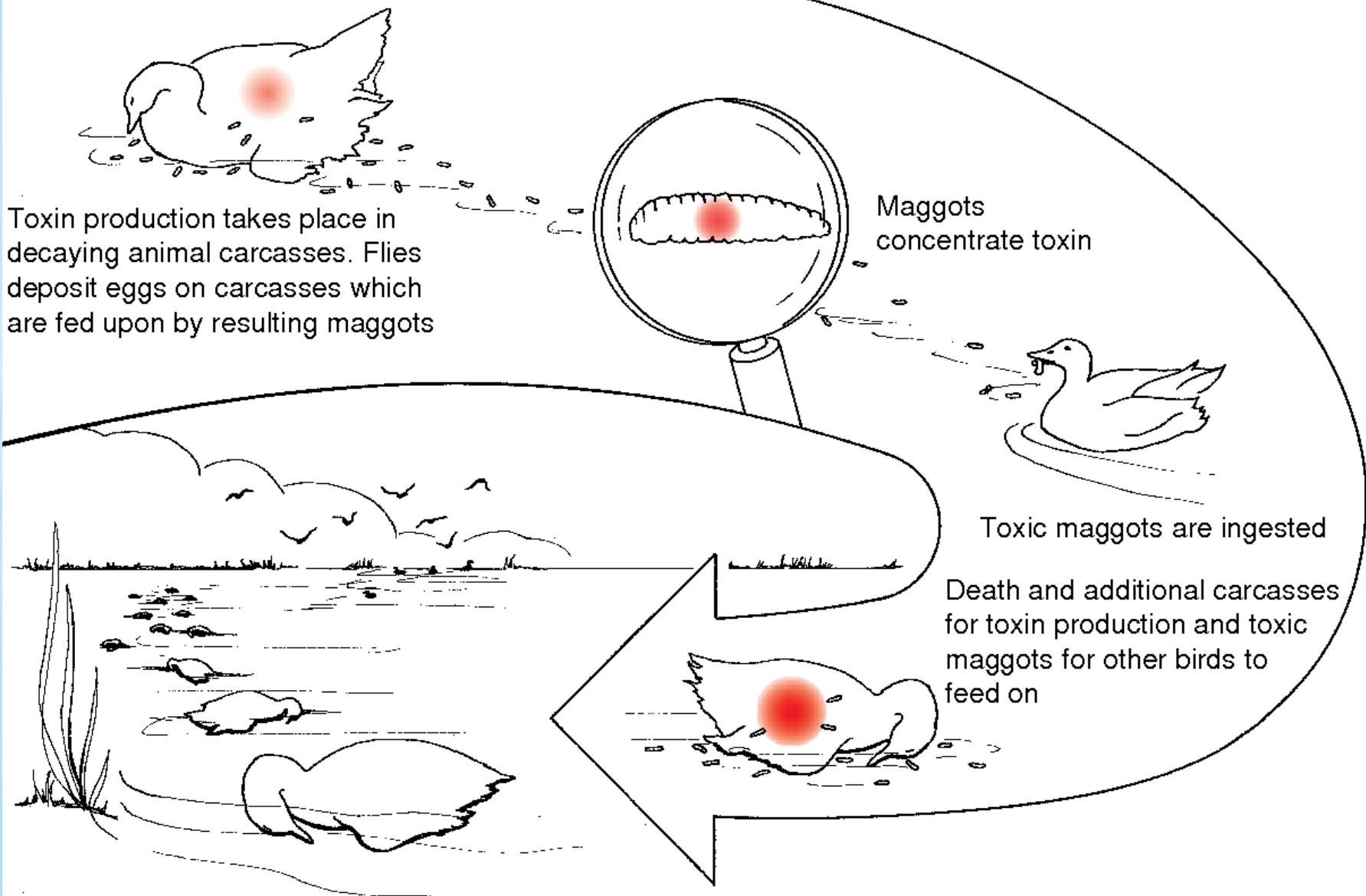
Requirements for spore germination

- anoxic conditions - organic decomposition
- a protein source for energy
- Temperature dependent 60°F - 90°F



# Carcass-maggot cycle of avian botulism

60 – 92 °F



# \* Avian Botulism

Outbreaks in breeding grounds and along flyway where birds congregate can be very large



Location	Year	Estimated loss
Utah and California	1910	"Millions"
Lake Malheur, Oregon	1925	100,000
Great Salt Lake, Utah	1929	100,000– 300,000
Tulare Basin, California	1941	250,000
Western United States	1952	4–5 million
Montana	1978	50,000
Montana	1979	100,000
Great Salt Lake, Utah	1980	110,000
Canada (Alberta)	1995	100,000
Canada (Manitoba)	1996	117,000
Canada (Saskatchewan)	1997	1 million
Great Salt Lake, Utah	1997	514,000

# \* Newcastle Disease

- Highly contagious viral disease of poultry.
- Very few cases documented in wild birds prior to 1990 despite over 230 species known to be susceptible.
- All outbreaks in wild birds have been in breeding colonies of double-crested cormorants.
- Three events at the Salton Sea 1997, 1998, 2007





The microbe is nothing:  
the terrain everything

~ Louis Pasteur

Migration Factors:

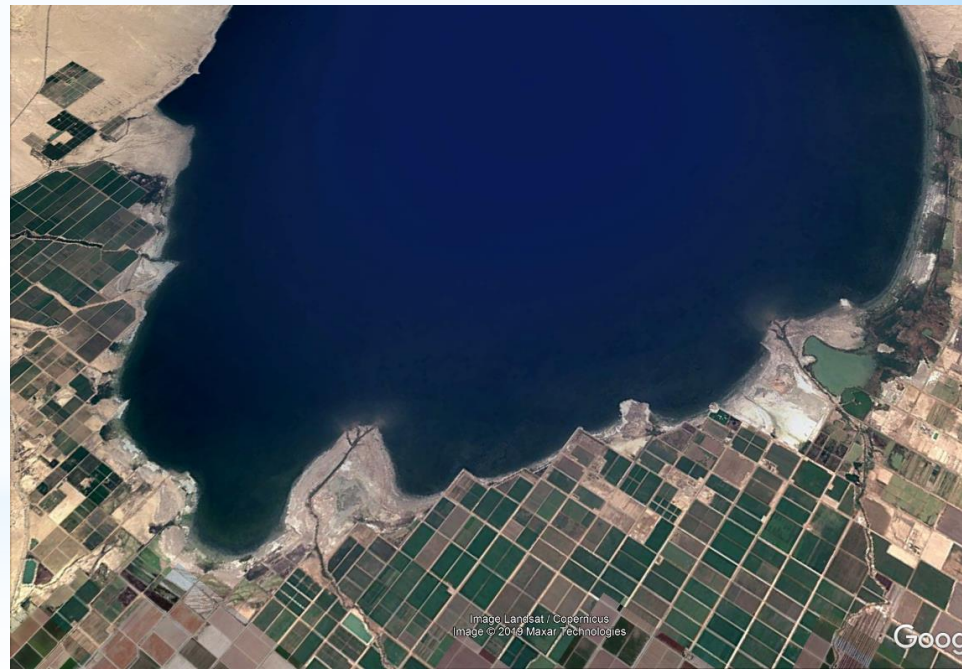
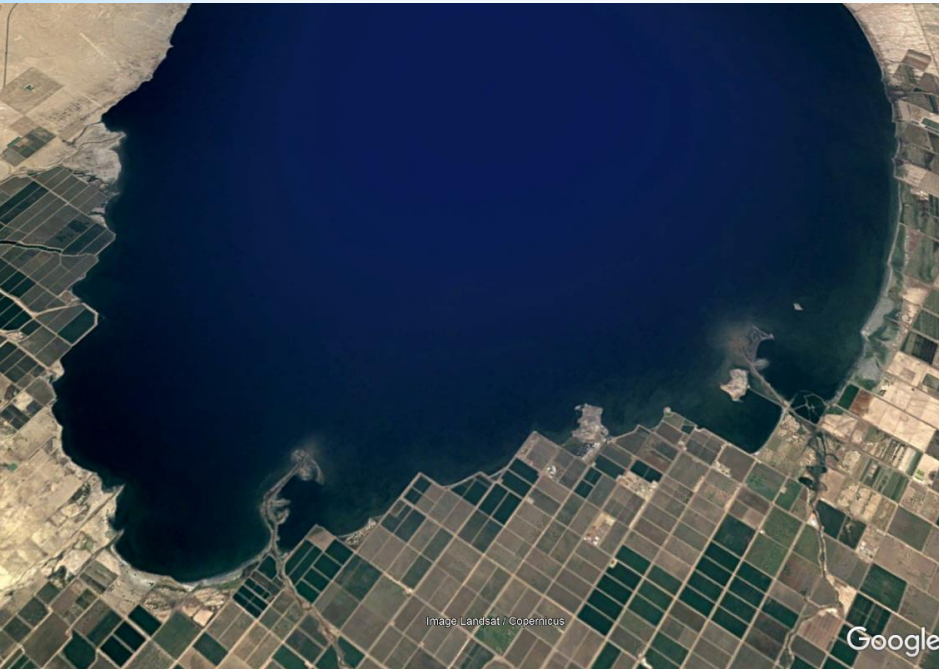
Flyway level  
Species level  
Individual level



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## Changing Factors: Use of the changing Sea



# SSMP design features to consider

- Spread birds out as much as possible.
- Design for or against certain species.
- Provide access for disease monitoring and response.
- Create diverse and productive habitats.

Productive to elevate health of migratory birds.

Diverse to buffer against loss of any one food resource.