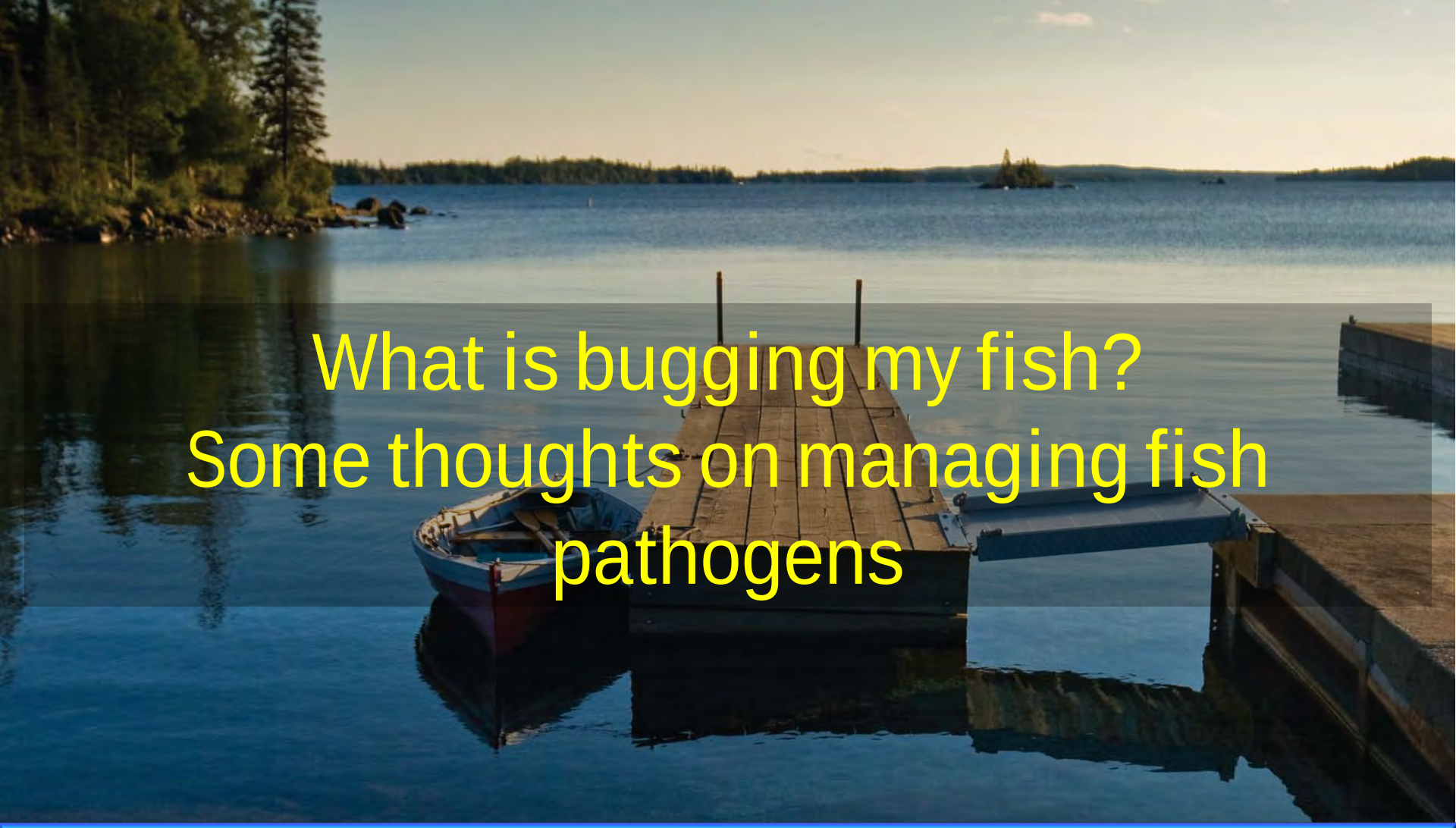


What is bugging my fish? Some thoughts on managing fish pathogens

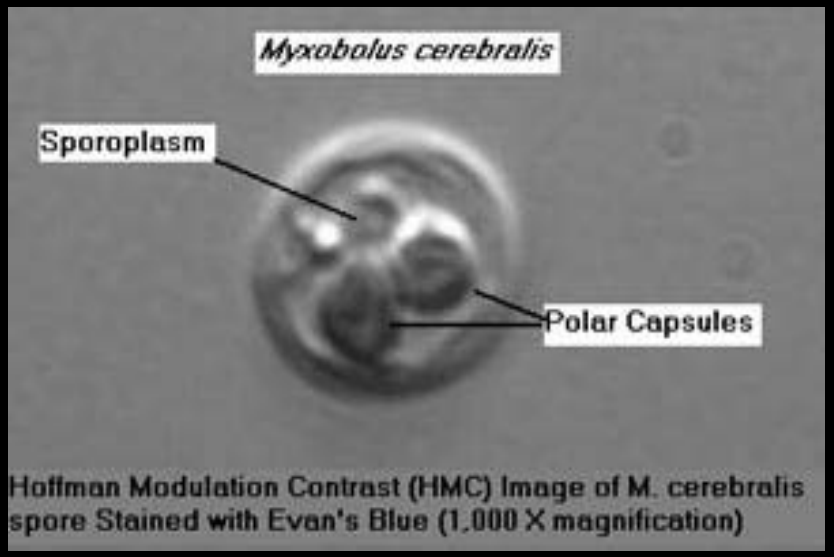
Department of Natural Resources
Gary E. Whelan

Why Care?

Annual Mortality =

+

Fish Pathogens and Disease



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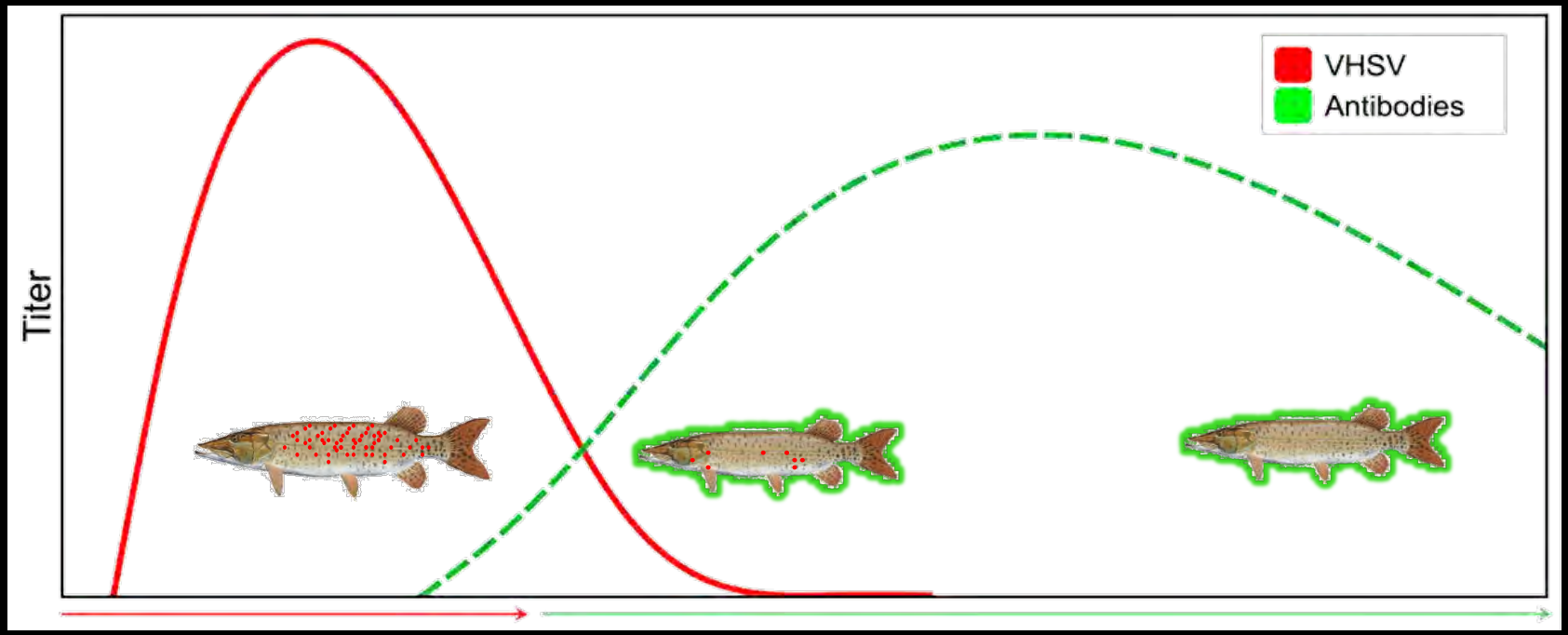
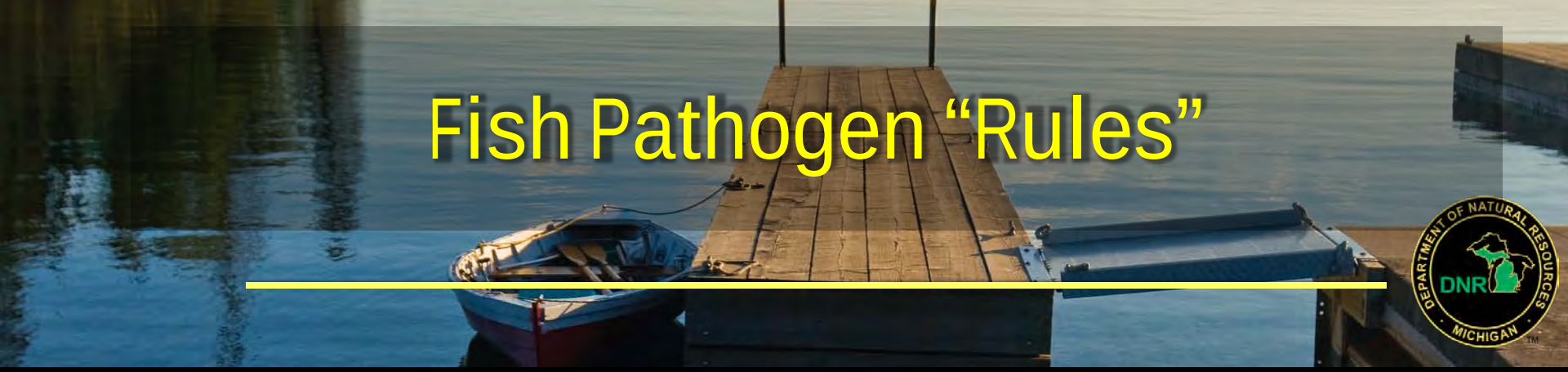
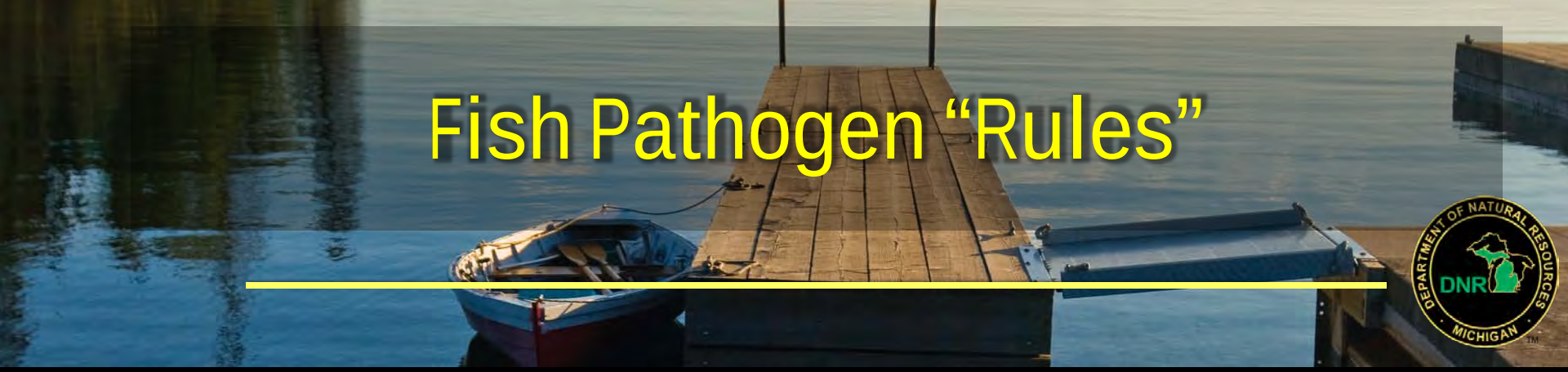
Disease Progression





Fish Pathogen "Rules"

- **Fish diseases issues are heavily regulated nationally and internationally**
  - Aquaculture driven
- **Water is a very good medium for transmission**
  - Constant movement of pathogens
  - Must manage acquired pathogens forever
- **Nearly none of the virus and bacteria are human pathogens**
  - Humans are too hot for replication of viruses and bacteria
  - Many parasites "can" use humans as intermediate hosts
- **Key pathogen groups require different strategies – Sampling and treatment**
  - Viruses
  - Bacteria
  - Parasites
  - Fungal
- **Make sure you really know you have the pathogen**
  - Confirm, confirm, confirm.....



Fish Pathogen "Rules"

- Poor knowledge base of baseline in wild
  - Understand disease ecology and progression
- Most wild epizootics are the result of ecosystem stress
- Fish stocking is one of the three legs of the management chair
  - Raise large numbers of fish – Disease management is critical
  - Herd Immunity
    - Use hatchery fish to break transmission
    - **Change natural mortality**
- Control vectors of transmission
- Fish pathogen expertise and control is organized
  - GLFC – Great Lakes Fish Health Committee
  - NE and NW Fish Health Committees

Fish Disease Transmission Relative Risk Factors

- Anglers
  - Bait
    - Preserved bait
      - Very low to zero risk
    - Frozen Bait
      - Short and long distance
      - Low risk – Bacteria and some parasites
      - High risk – Viruses - depending on storage time
    - Live Bait
      - Short and long distance
      - Very high risk for all pathogens

Disease Transmission Relative Risk Factors

- Anglers
  - Equipment
    - Short and long distance
    - Depends on disinfection and pathogen
  - Private and angler fish stocking
    - Short and long distance
    - Depends on testing and biosecurity
      - Most private facilities are not a vector
      - Angler stocking is a large issue
  - Bilge and live well water in recreational boats
    - Short and long distance
    - Low risk but high frequency – Low amounts and needs perfect timing

Disease Transmission Relative Risk Factors

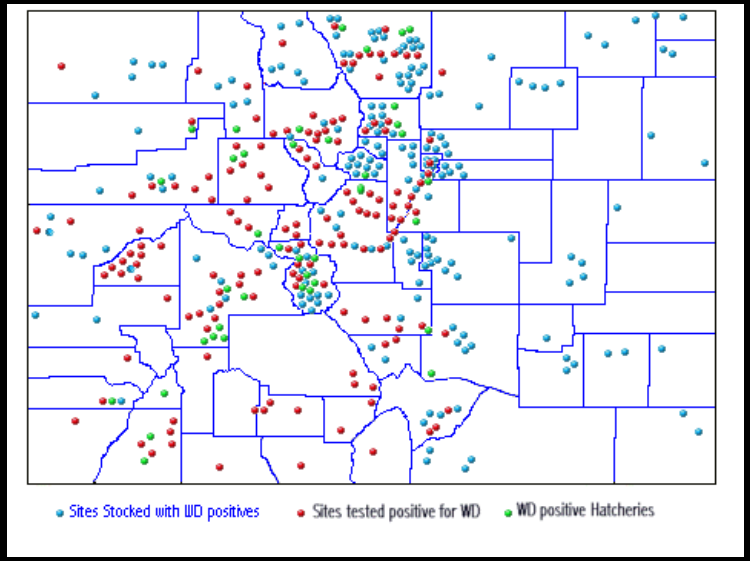
- Riparians
  - Weed harvesting
    - Short and long distance
    - Medium to High Risk depending on biosecurity
- Dredging
  - Usually short distance
  - Depends on biosecurity

Disease Transmission Relative Risk Factors

- Commercial Shipping
  - Individual events have low probability but high frequency and volume activity with great potential effects
    - Short and long distance
    - Generally high volumes – 1 to 10 million gallons
    - Availability of enough viable pathogen at intake
    - Transportation viable
    - Available hosts at discharge
    - Dilution effects on enough viable pathogens at discharge

Disease Transmission Relative Risk Factors

- Resource Management Actions
  - Fish Stocking (State and Federal fish)
    - Short and long distance
    - Very low risk
    - Disinfect all eggs and inspect all fish
  - Movement of equipment
    - Short and long distance
    - Very low risk
    - Biosecurity



CO Whirling Disease Example

Disease Transmission Relative Risk Factors

- Fish migrations
  - Short and long distances possible
  - No stated evidence in literature – Sea Lice?
  - Generally low risk
- Fish eating birds and mammals
  - Depends on pathogen life cycle and residence time
  - Likely short distance
  - Risk - Variable
    - Low to Medium for viruses and bacteria
    - High for many parasites

Key Fish Pathogens

- Not all pathogens are equal
- Key wild pathogens
  - Viral Hemorrhagic Septicemia virus (VHS)
  - *Renibacterium salmoninarum* - Bacterial Kidney Disease
  - *Myxobolus cerebralis* (whirling disease)
  - Largemouth Bass Virus (LMBv)
  - Koi herpesvirus (KHV)
  - Spring Viraemia of Carp Virus (SVC)
- Key hatchery pathogens
  - *Aeromonids*
    - *Aeromonas salmonicida* (Furunculosis)
  - Flavobacterium
  - Infectious Salmon Anemia virus (ISA)
  - Infectious Haematopoietic Necrosis (IHN)

GLFHC Disease Transmission Risk Assessment Tool

Factor	Score Range * Weight	Total Possible Score-650
Prevalence in Source	(0 – 5) * 10	50
Transmission	(1-5) * 10	50
Prevalence in Receiving	(1-10) * 5	50
Regional Distribution	(1-3) * 10	30
Number of Vectors	(1-8+) * 10	70
Intro Increases Pathogen	(0-5) * 5	25
Disease Spread to Others	(0-5) * 10 + (0-5) * 10	100
Wild Stock Epizootic	(1-5) * 20	100
Test Method Confidence	(1-7) * 5	35
Health History of Source	(1-5) * 5	25
Health History of Receiving	(1-5) * 5	25
System Health History	(1-5) * 5	25
Surveillance History	(1-7) * 10	70

GLFHC Disease Transmission Risk Assessment Tool

- Scoring and Recommendations

Score	Risk	Recommendation
Less Than 360	Low	Unrestricted movement
370 - 569	Medium	Okay for positive waters
Greater Than 570	High	No movement

Questions
or
Comments

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Bacterial Kidney Disease Adventure Chronology

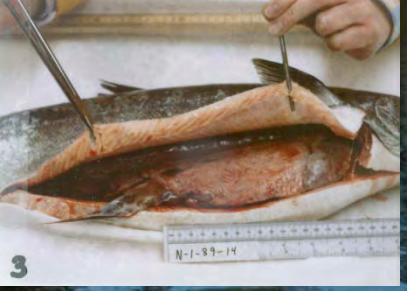
- 1955 – First reported in MI
- 1961 – BKD not likely to be spread by stocking
- 1967 – First mortalities of COS in Lake MI
  - Prevalence between 37.5 to 50% with dead salmon on beaches including CHS and Kokanee Salmon
- 1970 – Biosecurity measures started
    - Eliminating infected stocks, move away from open water sources

Bacterial Kidney Disease Adventure Chronology

- 1984 and 1985 – Small salmon noted at weirs
- 1986 and 1987 – Dead CHS in Lake MI
- 1988 – 10,000 to 20,000 CHS washed ashore in Lake MI with BKD detected (100% prevalence)
- 1989 – CHS mortality continues
  - BKD found in CHS smolts
  - Broodstock culling and “disease-free” eggs brought in from NY
  - **Mass Panic in Agency**

Bacterial Kidney Disease Adventure Chronology

- 1990-1991
  - Culling and water hardening in Erythromycin
  - CHS and COS broodstock BKD prevalence 100%
  - All production conducted with disease-free CHS eggs
  - Treating sick fish with Erythromycin feeds
- 1992-1994
  - WLSFH ATS develop BKD - 50,000K destroyed
  - Multiple phenotypes of BKD indentified
  - Reduced rations implicated as a stressor agent
  - Improved culling initiated using clinical signs and FELISA
  - Direct mortalities subside



Bacterial Kidney Disease Adventure Chronology

- 1995-1999
  - Culling extended to all feral salmonid broodstocks
  - Salmon stocking reduced to 4.5 million
  - Salmon mortalities very low but in a broad range of hosts
- 2000-2002
  - BKD found in BKT from MSFH water source – 50K yearlings destroyed - $50,000 loss (25%)
  - Changes
    - COS losses at PRSFH 12% to 4% (1992-1998) - $160,000 savings
    - BKD dropped in CHS and COS from 15% to 3% (1991-1999)
  - BKD found in 51 of 67 streams sampled

Bacterial Kidney Disease
Adventure Chronology

- 2002 to today – Increased biosecurity measures
  - Stress Reduction
    - Decreased rearing densities
    - Installed raceway covers
    - Improved water quality
  - Broodstock development
    - Pre-test donor populations
    - Testing individual pairs – culling most positive
    - Bringing new broodstocks to quarantine or isolation facilities
    - Increasing testing and vaccination of new broodstocks
  - Example of improvement - MSFH
    - BKT from >80% (>50% high) to 0% prevalence

Bacterial Kidney Disease Adventure Chronology

- 2002 to today – Increased biosecurity measures
  - Improved culling using “real time” ELISA
    - Increased testing during egg takes
  - Increased hygiene at hatcheries
    - Immediate removal of dead fish
    - Treatment of BKD positive fish
    - Increased cleaning and disinfection
    - UV disinfection
  - Water hardening of eggs in erythromycin