



# Fish Pathology

presentation for

## CA DFG Fish Hatcheries



# Outline

1. Fish Lab (who we are, what we do)
2. Fish Health at Hatcheries
3. Some Common Pathogens
4. Treating Fish Diseases

# CA DFG Fish Health Laboratory

*Freshwater- All Trout and Salmon Hatcheries*

- Joe Maret, DVM, Senior Pathologist
- Mark Clifford, Ph.D., Associate Pathologist
- Tresa Veek, Associate Pathologist
- Mark Adkison, Ph.D., Senior Pathologist (Sup)
- Garry Kelley, Ph.D., Associate Pathologist
- Kavery Mukkatira, Laboratory Technician II





# We Provide Fish Health Services for:

- California State Fish Hatcheries
- California Private Fish Farms
- California Wild Fish



# What We Do

- Diagnose Fish Diseases, Recommend Therapy
- Inspect CA Fish for Disease and Health Status
- Monitor Spawning Fish for Pathogens
- Inspect Fish for In-State movement
- Confirm Fish Disease Certifications from other States
- Inspect Fish Imported from Other States
- Survey Wild Fish for Diseases
- Provide Scientific Support for Experiments, Feed Studies, Nutrition etc.





## There Are *Many* Types of Fish Diseases-

Infectious  
Environmental  
Nutritional  
Genetic  
Traumatic  
etc.



## We Deal Mostly with **Infectious Diseases-**

Bacterial  
Fungal  
Parasitic  
Viral





# Fish Health At Hatcheries

## Outline

- 1) Fish Stress and Fish Diseases
- 2) Hatchery Staff are the first line of defense
- 3) What to look for in sick fish (signs of disease or stress)
- 4) How to avoid disease episodes
- 5) Diagnostic visit



Pathogens are always present, but only cause disease in times of stress.

Stressors Include:

- High density
- High temperatures
- Low oxygen
- Spawning
- Uneaten food and feces
- Spawning/Sexual Maturity
- Fin clipping
- Inventory
- Grading
- Being chased (predators etc.)
- Smoltification etc.



# Three Factors of Fish Infectious Disease:



Host (the Fish)



Pathogen

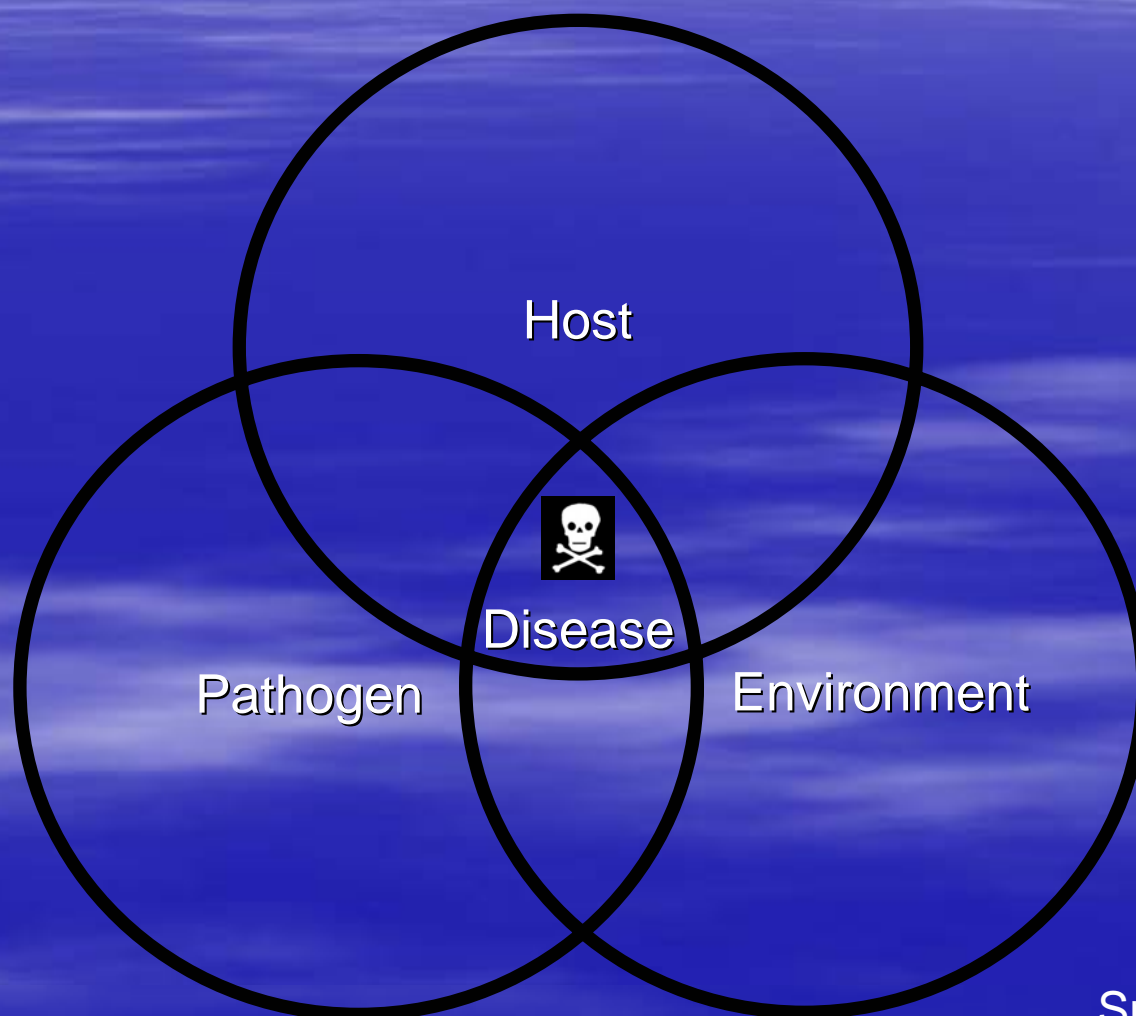


Environment  
(temp, oxygen, etc.)





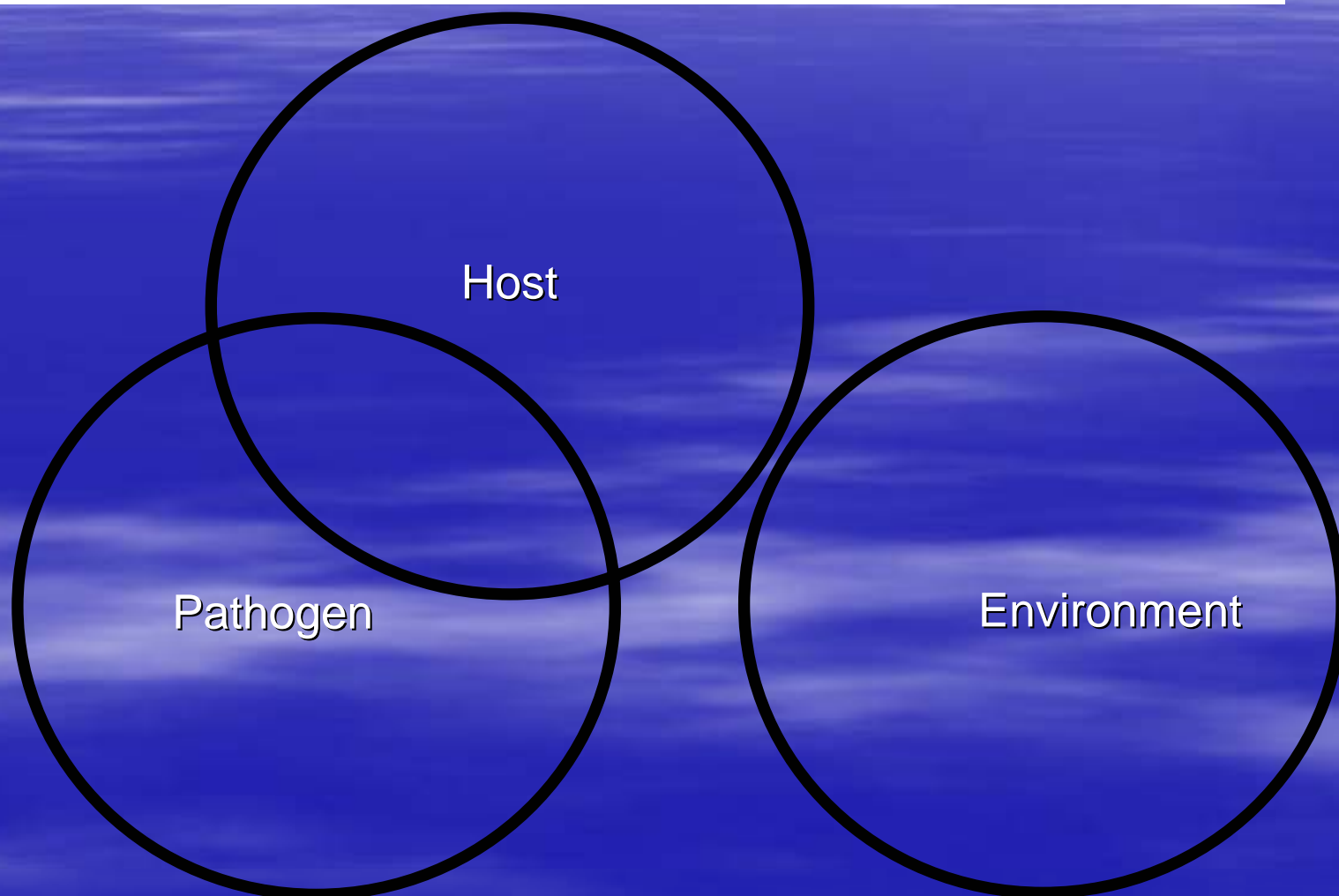
# A Perfect Disease Episode



Sneizko Diagram



# Disease Avoided: Good Environment





# Hatchery Staff: The First Line of Defense Against Fish Disease



Person FEEDING FISH may be most able to recognize sick fish, increased mortality, less feeding etc.



# Signs of Fish Diseases

## Behavioral

- Flashing
- Going off feed
- Listlessness (lazy swimming)
- Riding High
- Piping (breathing at surface)
- Swimming at sides
- Swimming in circles
- Sticking to screens (duh!)

## External

- Darkening
- Increased Mucus
- Hemorrhaging (bleeding)
- Popeye (exophthalmia)
- Ulceration (open sores)
- Deformities
- Abdominal Swelling
- Flared Opercula

# How to Limit or Avoid Fish Disease Episodes:

- ✓ Keep raceways clean
- ✓ Provide an ample supply of good water
- ✓ Avoid crowding & high densities
- ✓ Keep stress to a minimum
- ✓ Do not over or under feed
- ✓ Biosecurity- do not transfer infected material (nets etc.)  
from place to place.
- ✓ Disinfect nets, buckets etc. with PVP Iodine
- ✓ Report increased mortality, keep good written records
- ✓ Remove dead fish to prevent spreading disease



# Diagnostic Visit

## When to Call the Fish Health Lab:

- Fish need to be examined, inspected, certified, diagnosed etc.
- Losses are higher than normal or are unacceptable
- Fish are exhibiting external or behavioral signs of disease
- Losses are slowly but steadily climbing and remaining elevated

If there is any question, call us and we will come take a look.

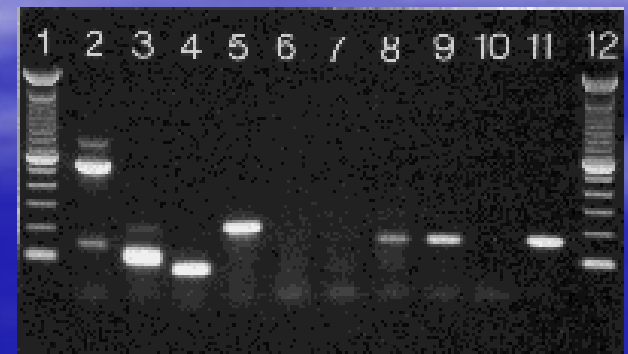
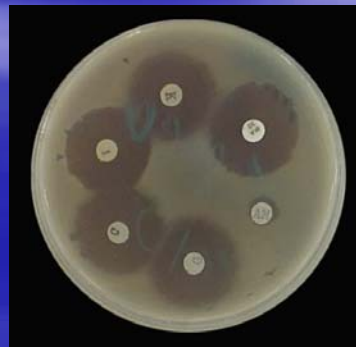
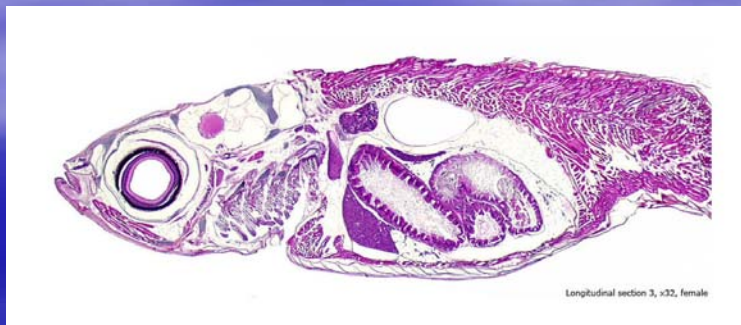
# Diagnostic Visit

## **Info provided by you assists diagnosis:**

1. Number of fish dying per day & total amount of fish in pond or trough.
2. How long have you been experiencing losses?
3. Change in fish behavior or appearance?
4. Water temperature. Any recent changes?
5. Any change in feed, feeding behavior, feeding practices etc.
6. Any recent stress events (fin clipping, grading, pond cleaning etc.)
7. Any change in water quality/clarity?
8. What is the current flow rate/volume? Has it changed?!

# What we do when we get there:

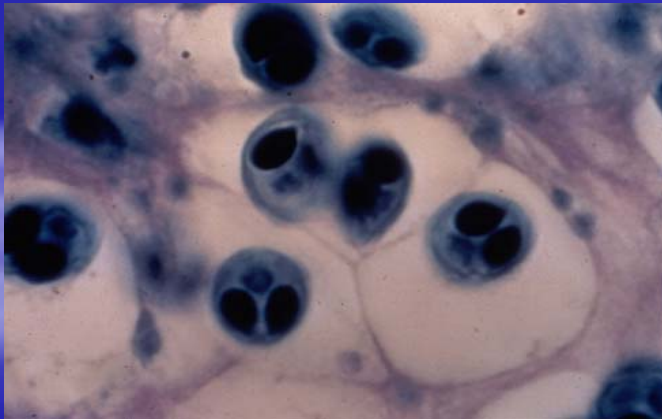
- ✓ Observe sick fish for behavioral signs of disease.
- ✓ Get a record of recent losses and total amount of fish in pond.
- ✓ Examine skin and gills of sick fish for sores, then euthanize sick fish.
- ✓ Microscopes- look for bacteria, parasites, fungi (etc.) on skin and gill scrapes
- ✓ Open fish and observe internal organs for size, shape color,
- ✓ Use microscopes to look for parasites, bacteria (etc.) in internal organs.
- ✓ Organs examined are chosen with respect to most likely pathogen, but often include spleen, kidney, brain, intestines etc.
- ✓ Some cases require bacterial cultures to be taken for identification and possible drug resistance. Other times samples are taken for PCR, Histology, virology etc.





# Pathogens

1. A list of pathogens that occur in trout and salmon
2. Pathogens defined, with examples of some found at DFG hatcheries



## Some Trout and Salmon Pathogens

### ■ Bacteria

- Columnaris (*Flavobacterium columnare*)
- Cold Water Disease (*Flavobacterium psychrophilum*)
- Bacterial Gill Disease (*Flavobacterium branchiophilum*)
- Furunculosis (*Aeromonas salmonicida*)
- Bacterial Kidney Disease (*Renibacterium salmoninarum*)
- General Septicemia (*Aeromonas/Pseudomonas* species)
- Enteric Red Mouth (*Yersinia ruckeri*)

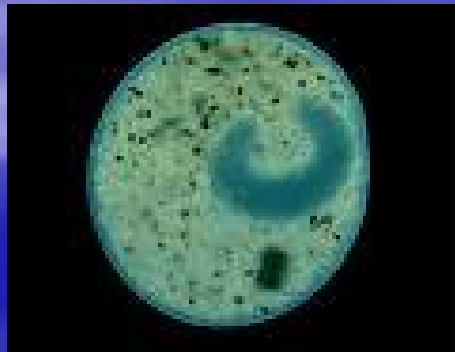
### ■ Viruses

- Infectious Hematopoietic Necrosis Virus (IHNV)
- Infectious Pancreatic Necrosis Virus (IPNV)
- Viral Hemorrhagic Septicemia (VHS)
- Cutthroat Trout Virus (CTV)

# Some Trout and Salmon Pathogens

## Parasitic-External

- Costia (*Ichthyobodo necator*)
- Gyrodactylus species
- Ich (*Ichthyophthirius multifiliis*)
- Trichodina
- Chilodonella
- Epistylis
- Ambiphrya
- Anchor worm (*Lernaea* spp.)
- Saprolegnia (Fungus)



## Parasitic-Internal

- Gill Fluke (*Sanguinicola* species)
- Whirling Disease (*Myxobolus cerebralis*)
- Hexamita
- Ceratomyxa shasta
- Parvicapsula minibicornis
- Loma
- PKD (*Tetracapsuloides bryosalmonae*)
- Nucleospora salmonis
- Nanophyetus salmonicola (*Neorickettsia helminthoeca*- salmon poisoning of dogs)





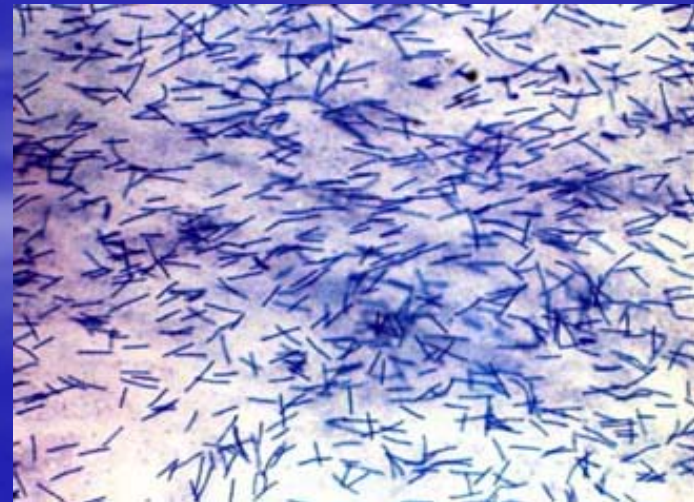
# Pathogens of Trout and Salmon at DFG Hatcheries:

## BACTERIA

### Columnaris (*Flavobacterium columnare*)

peduncle disease, saddleback, fin rot, cotton wool disease etc.

- Disease occurs generally at warmer temperatures (above 60°F).
- Often see yellowish pigment on skin and/or gill lesions.
- Always present in water and soil, enters fish through breaks in skin or at gills



# Pathogens of Trout and Salmon at DFG Hatcheries:

## BACTERIA

**Cold water disease (*Flavobacterium psychrophilum*)**  
peduncle disease, etc.

- Disease Occurs at cooler temperatures (<62°F, some overlap with Columnaris).
- Survivors of infection often grow to be deformed (lordosis, scoliosis)
- Can be external (skin and gills) or systemic (spleen, brain tissue etc.)
- Can be spread from adults to eggs (proper PVP Iodine treatment kills bacteria on eggs and reduces amount of sick fry and fingerlings!)



## Common Pathogens of Trout and Salmon at DFG Hatcheries:

# PARASITES

**Ich (*Ichthyophthirius multifiliis*)- white spot disease, salt & pepper disease etc.**  
**Irritating protozoan on skin and gills**

- Fish “flash”, jump and produce extra mucous to rid parasite
- Causes epithelial erosion and ulceration (secondary bacterial infections too)
- Complex life cycle makes treatment difficult

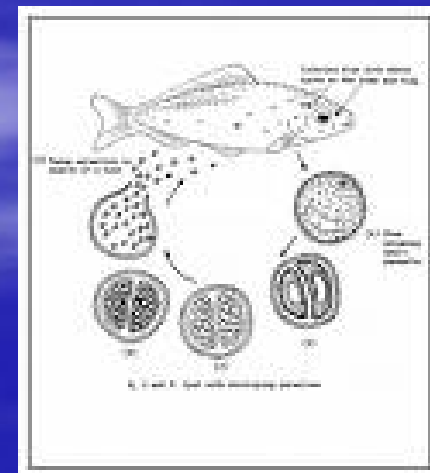
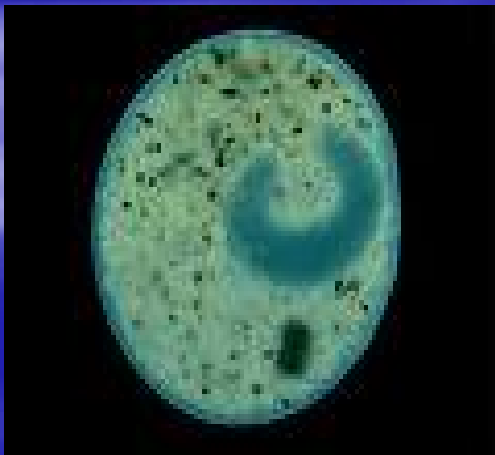
## •Water temperature & Required Treatment Interval

75° and higher -Treat every day.

65° to 74° -Treat every other day.

55° to 64° -Skip 2 days between treatments.

45° to 54° -Skip 3 or 4 days between treatments.





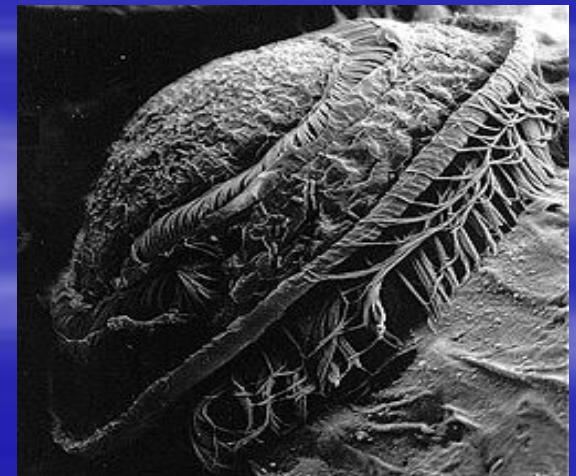
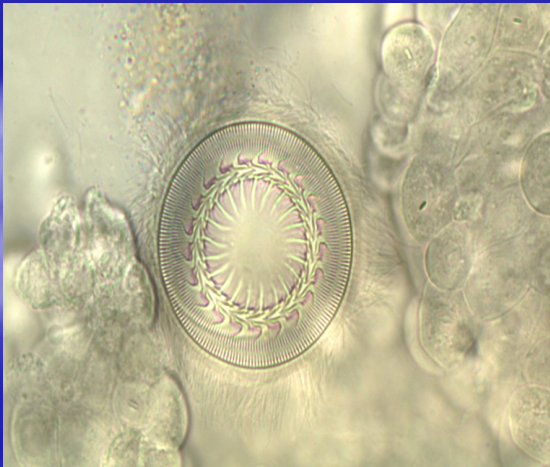
## Common Pathogens of Trout and Salmon at DFG Hatcheries :

### PARASITES

*Example:*

Trichodina- irritating protozoan on skin and gills.

- Fish “flash” to scrape off the parasite
- Low numbers on fish are inconsequential
- Often a sign of poor water quality
- Rasping mouth parts feed on fish, open lesions can lead to bacterial infections.



# Common Pathogens of Trout and Salmon at DFG Hatcheries (continued):

## VIRUSES

### *Example:*

#### Infectious Hematopoietic Necrosis Virus (IHNV)

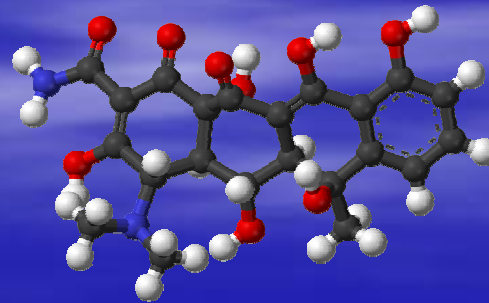
- Lethal virus for which there is no effective treatment
- Environmentally and economically important disease
- IHNV replicates in hematopoietic (blood forming) tissues like kidney and spleen.
- Fish die of anemia or kidney failure
- A significant source of mortality in both wild and hatchery populations





# Treatments

1. Chemicals
2. Antibiotics
3. Vaccines
4. Application Methods
5. Water Quality and FDA Restrictions





# Chemicals



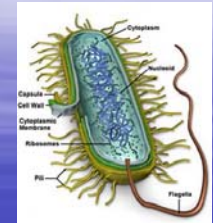
- Salt (Sodium Chloride)
- Copper Sulfate
- Formalin
- Hydrogen Peroxide
- Potassium Permanganate
- PVP Iodine
- Acetic Acid
- Chloramine T



*Recommendation required for all chemical treatments except salt*

- Chemicals used appropriately
  - Effective and lawful treatment
  - Different modes of action = different uses
- Chemicals used incorrectly
  - Extremely dangerous (lethal) to staff
  - Ineffective (too little chemical)
  - Negative effective on fish and wildlife
  - Result in fines and/or lawsuits (Water Quality Board)

# Antibiotics



- Oxytetracycline Hydrochloride (TM)
- Penicillin G Potassium
- Florfenicol (Aquaflor)
- Amoxicillin Trihydrate
- Erythromycin
- Romet (Sulfadimethoxine-ormetoprim)

- **Recommendation and/or Prescription Required.**
- **Improper use can result in drug-resistant bacteria = now what?**
- **Improper use of antibiotics include:**
  - Too little
  - Too much
  - Too often
  - Not long enough

**As in human medicine, follow prescriptions exactly as written!**

# Vaccines

- Prepares fish immune system to fight pathogen
- Very effective in some cases
- Often requires individual fish to be injected (rarely feasible)

Vaccines are used by DFG hatcheries to fight :

- ✓ Enteric Redmouth (*Yersinia ruckeri*)
- ✓ *Vibrio* species. (for fish going to salt water)
- ✓ Bacterial Kidney Disease (BKD, *Renibacterium salmoninarum*)





# Application Methods

- California Flush (a “bolus” or “pulse” treatment)
- Constant drip (peristaltic pump or regulated flow)
- Medicated bath
- Medicated feed
- Injection (rare)

In ALL the above cases, there is **critical** information needed to successfully treat the fish. These *may* include some or all of the following:

- Accurate flow rate or water volume (most important)
- Amount of fish (accurate weight or numbers or both)
- Water Temperature
- Recent Treatments
- Water hardness

We are trained and willing to help you make these calculations!



# Fewer Options

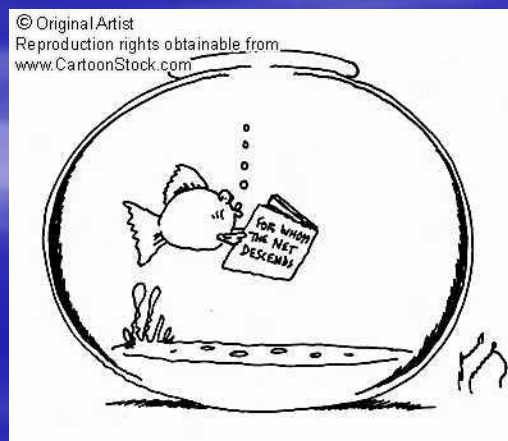
- Water quality regulations are becoming more stringent, reducing the number of treatment options available, or the amount of therapeutic agent that can be used.
- The US Food and Drug Administration strictly regulates the use of antibiotics.
- In the coming future, increased fish production may result in increased incidence or severity of infectious disease at CA DFG hatcheries.
- It is imperative that we do our best to prevent disease before it occurs and to treat fish accurately when pathogens are found.
- We won't be able to prevent all disease episodes, but we can limit the effect infectious disease has on our budgets, workload, and fish production.



# SUMMARY

We have discussed:

- ✓ Duties and Services of Fish Health Lab
- ✓ Hatchery Staff as the First Line of Defense Against Fish Disease
- ✓ Signs of Disease, How to Prevent Disease, When to Report Disease
- ✓ Some Pathogens Seen in California Trout and Salmon
- ✓ Options for Treating and Preventing Fish Diseases
- ✓ Benefits of Avoiding Fish Disease (Time, Money, Resources, Inventory)







**Thanks to ALL hatchery staff working to raise healthy fish for our State.**



THE END

