Virginia Aquaculture and the Role of the Veterinarian

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Virginia Veterinary Medical Association
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WHAT IS AQUACULTURE?

- Cultivation of aquatic plants and animals for the purposes of:
  - Consumption
  - Conservation
  - Recreation
  - Display
GLOBAL AQUACULTURE PRODUCTION

- 106 million tonnes of aquatic plants and animals farmed globally
  - Farm gate value of $163 billion dollars
  - Average annual growth rate of 6%

50% of seafood consumed globally is farmed
2015 Aquaculture Production Highlights

U.S. marine aquaculture is growing 1% per year (2010-2015)

Marine and Freshwater National Totals

U.S. Value

$1.4 billion dollars

21% of total U.S. seafood production & fishery products by value

U.S. Production

627 million pounds

16th in global aquaculture production

Marine Species Totals

Oysters

$173 million
35 million pounds

Clams

$112 million
9 million pounds

Salmon

$88 million
48 million pounds

Shrimp

$11 million
4 million pounds

Mussels

$10 million
0.7 million pounds

Regional Marine Totals

Pacific 36% by value

Atlantic 41% by value

Gulf of Mexico 23% by value
Virginia Aquaculture

- Ranked 10\textsuperscript{th} in Domestic Aquaculture Production
- Approximately 120 farms in business
- Production dominated by
  - Shellfish: oysters and clams
  - Tilapia
  - Trout
- Total Sales: >$55 million annually
DGIF and Aquaculture

- Operate 9 fish hatcheries within the Commonwealth

- Five coldwater hatcheries:
  - Produce and Stock over 1 million trout per year

- Four warmwater hatcheries
  - Produce and stock: striped bass, walleye, muskellunge, sunfish etc.
OPTIMIZING FISH HEALTH AND WELFARE

- Use of high quality, nutritionally complete diets
- Incorporation of biosecure protocols and regular fish health sampling
- Thorough understanding of fish biology and interaction with environment
Feed 100 g

Ion Exchange

Oxygen (O₂) 25 g
Carbon Dioxide (CO₂) 35 g
Ammonia (NH₃) 3 g

Solids
- Suspended 5 g
- Soluble 5 g
Role of Veterinarians in Aquaculture

- Aquaculture continually seeking to optimize production

- Veterinarian’s role in production optimization:
  - Monitor for emergence of novel pathogens
  - Assist with biosecurity plan development
  - Coordinate sample submission/perform diagnostics for morbidity/mortality events
  - Prescribe appropriate treatments* and preventative measures

* VFD required for all antibiotic treatments starting December 2016
AQUATIC VETERINARIANS IN VIRGINIA

- American Association of Fish Veterinarians
  - 2 aquatic veterinarians listed
    - 1 USDA Vet
    - 1 Virginia Tech Professor

- AquaVetMed
  - 18 aquatic veterinarians listed
    - 3 not in Virginia, 6 unknown status, 2 university professors, 6 exotic animal vets but no mention of aquatic medicine
    - 1 confirmed aquatic vet
ROLE OF VETERINARIANS IN AQUACULTURE

- VFD = game changer
  - No antibiotics can be used without veterinary oversight
    - Romet and Terramycin could previously be used legally without a VFD or prescription
  - Ensures proper and judicious use of drugs

- Opens the door for additional veterinary cooperation and oversight in aquaculture
1. IMPORTS AND EXPORTS

- Fish imports are regulated by either the State Agriculture or State Wildlife Resources Department
  - Regulations vary widely

- Check with recipient state when working with a producer to export fish
  - Virginia: no paperwork or notifications
  - Ohio: Fish health inspection and testing report for salmonids
    - 7 pathogens to be tested for, fish health inspector or vet must perform inspection
  - Utah: only accepts fish imports from “approved facilities”
    - “Approved facilities” submit annual fish health testing reports to Dept. of Ag.
2. LABORATORY SUBMISSIONS

- No accreditation system specific to Aquatic Animal Health Diagnostic Laboratories
  - University Veterinary Diagnostic Labs
    - Arizona, Georgia, Louisiana, Oregon, Nebraska, Texas, Washington, Wisconsin
  - State Agriculture Labs
    - Hawaii, Maryland, New Jersey, North Carolina
  - Private Labs
    - Fish Vet Group (Maine), Kennebec River Biosciences (Maine), Phoenix Central Laboratory for Veterinarians (Washington), IDEXX RADIL Aquatic Diagnostics (Missouri)
3. **Facility Inspections**

- **Goal** = standardize approach to diagnostics, facilitate health inspection certification for trade
- Both require that inspection be performed by fish health inspector or accredited veterinarian

- **OIE**
  - 150 fish total from the facility, twice per year

- **American Fisheries Society Blue Book**
  - 60 fish from each lot, once per year
4. Preventative Medicine

- Commercial vaccines
  - Immersion dips and injectables
  - Furunculosis, Bacterial Kidney Disease, Infectious Salmon Anemia Virus, Enteric Redmouth Disease, Columnaris, Vibriosis, Enteric Septicemia of Catfish

- Autogenous vaccines
  - Kennebec, Fish Vet Group

- Biosecurity plans/audits
  - Foot baths, disinfection protocols, egg disinfection, egg versus fish transfers
5. Treatment Protocols

- Veterinary Feed Directive - December 2016
  - Eliminate use of antibiotics for production purposes
  - Increase veterinary oversight to ensure appropriate and judicious use
  - Extralabel use of medicated feed in minor species
    - Compliance Policy Guide, Sec. 615.115, Extralabel Use of Medicated Feeds for Minor Species
    - VFD + separate written recommendation that includes:
      - Diagnosis, drug selection, dose, duration, withdrawal period

- Veterinary prescriptions

- Veterinary-Client-Patient Relationship
  - Visit producer at least once per year
DRUGS AND DISINFECTANTS USED IN AQUACULTURE

- Veterinary Feed Directive required
  - Aquaflor, Romet, Terramycin
- Veterinary prescription required
  - Chorulon, Pennox 343
- No veterinary oversight required
  - Hydrogen peroxide, Formalin, Halamid, Tricaine-S (MS-222)
Drug Use in Fishes

- Only drugs recognized by FDA to be safe or effective for a specific intended purpose can legally be used on fish
  - FDA has concluded that drug:
    - Achieves stated claim
    - Safe to target fish
    - Safe to humans who might consume treated fish
    - Safe to environment

- Illegal to use:
  - Unapproved drugs for any purpose
  - Approved drugs in a manner other than specific on label unless under investigational new animal drug (INAD) or extra-label prescription issued by veterinarian
Human Chorionic Gonadotropin

Approved intended use: spawning aid in brood fish

Approved dose range:
- 50 to 510 IU/pound for males
- 67 to 1816 IU/pound for females

No withdrawal period

Requires veterinary prescription
## Label Information

<table>
<thead>
<tr>
<th>CHORIONIC GONADOTROPIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product name &amp; supplier</td>
</tr>
<tr>
<td>CHORULON&lt;sup&gt;®&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intervet Inc. 1-800-441-8272</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Aquaflor® Veterinary Feed Directive (Florfenicol)

#### Client: ____________________________  Veterinarian: ____________________________________

**Home or Business Address** ___________________________________________________________

__________________________

**Address:** ____________________________________________________________

__________________________

**Phone:** ____________________________  **Phone:** ____________________________

**Approximate Number of Animals:**
**Animal Location:**

**Indications:** Circle the row with the treated species and indication, and initial the corresponding box.

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Indication</th>
<th>Florfenicol (mg/kg body weight/day)</th>
<th>Florfenicol (grams/ton)</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater-reared salmonids</td>
<td>For the control of mortality due to furunculosis associated with <em>Aeromonas salmonicida.</em></td>
<td>10 – 15</td>
<td>182 – 2,724</td>
<td></td>
</tr>
<tr>
<td></td>
<td>For the control of mortality due to coldwater disease associated with <em>Flavobacterium psychrophilum.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater-reared finfish</td>
<td>For the control of mortality due to columnaris disease associated with <em>Flavobacterium columnare.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catfish</td>
<td>For the control of mortality due to enteric septicemia of catfish associated with <em>Edwardsiella ictaluri.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater-reared warmwater finfish</td>
<td>For the control of mortality due to streptococcal septicemia associated with <em>Streptococcus iniae.</em></td>
<td>15</td>
<td>273 – 2,724</td>
<td></td>
</tr>
</tbody>
</table>
### VFD Example - Aquaflor

**Feeding Rate:** % Biomass

**Feeding Duration:** Feed as the sole ration for 10 consecutive days.

<table>
<thead>
<tr>
<th>Feeding Rate</th>
<th>Florfenicol Concentration in Feed</th>
<th>Amount of Aquaflor® (florfenicol) per Ton of Feed</th>
<th>Biomass of Fish Medicated per Ton of Feed per 10-day Treatment Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Biomass</td>
<td>Grams/Ton</td>
<td>lbs</td>
<td>lbs</td>
</tr>
<tr>
<td>0.5</td>
<td>1,816</td>
<td>8.00</td>
<td>40,000</td>
</tr>
<tr>
<td>1.0</td>
<td>908</td>
<td>4.00</td>
<td>20,000</td>
</tr>
<tr>
<td>2.0</td>
<td>454</td>
<td>2.00</td>
<td>10,000</td>
</tr>
<tr>
<td>3.0</td>
<td>300</td>
<td>1.32</td>
<td>6,666</td>
</tr>
<tr>
<td>5.0</td>
<td>182</td>
<td>0.80</td>
<td>4,000</td>
</tr>
</tbody>
</table>

**Special Instructions:**

Use of feed containing this veterinary feed directive (VFD) drug in a manner other than as directed on the labeling (extralabel use) is not permitted.

This VFD only authorizes the use of the VFD drug cited in this order and is not intended to authorize the use of such drug in combination with any other animal drugs.

**Caution:** Feed containing Aquaflor® (florfenicol) shall not be fed to fish for more than 10 days. Following 10 days administration, fish should be reevaluated by a licensed veterinarian before starting another course of therapy. The expiration date for VFD Aquaflor® (florfenicol) must not exceed 6 months from the date of issuance. VFD for Aquaflor® (florfenicol) shall not be refilled.

Not for use in animals intended for breeding purposes. The effects of florfenicol on reproductive performance have not been determined. Toxicity studies in dogs, rats, and mice have associated the use of florfenicol with testicular degeneration and atrophy. For calves, a dose-related decrease in hematopoietic/lymphopoietic tissue may occur. The time required for the hematopoietic/lymphopoietic tissues to regenerate was not evaluated.

Sunburn, skin lesions, and skin sloughing have been reported in salmonids treated with florfenicol. Not all adverse drug events are reported to FDA CVM. It is not always possible to reliably estimate the adverse event incidence or to establish a causal relationship to product exposure using this data alone.

Before using this drug for the first time, you must inform the appropriate National Pollutant Discharge Elimination System (NPDES) permitting authority of your intentions and of the following information. Acute and chronic water quality benchmarks for the protection of freshwater aquatic life have been derived by FDA for florfenicol following EPA guidance for calculating Tier II water quality criteria for the Great Lakes System (40 CFR 132, App. A). The acute benchmark value (Secondary Maximum Concentration) is 20.6 mg/L (equivalent to one-half of the Secondary Acute Value). The chronic benchmark value (Secondary Continuous Concentration) is 0.23 mg/L (equivalent to the Final Plant Value). The NPDES authority may require an NPDES permit before you can discharge Aquaflor®. The water quality benchmark concentrations are not discharge limits, but may be used by the NPDES authority to derive such limits for the permit.

Additional environmental information on Aquaflor® and the benchmark values are available in an environmental assessment posted at...
INVESTIGATIONAL NEW ANIMAL DRUGS (INADs)

- Legal mechanism to use unapproved animal drugs for a particular use
AADAP Program

- Aquatic Animal Drug Approval Partnership Program
  - USFWS National Fish Hatchery System
- Established in 1994/2003 by FDA
- Goal: Work to obtain FDA-approval for new animal drugs for fishes
  - INAD program collects data and submits to FDA
  - FDA analyzes data and classifies drugs
CURRENT INADs

- Common carp pituitary, luteinizing hormone releasing (LHRHa) hormone, salmon gonadotropin releasing hormone analogue (sGnRHa)
  - Spawning agents
- 17α-methyl testosterone
  - Produce >90% phenotypic male fish
- SE-MARK (calcein)
  - Skeletal marking
- Aqui-S (eugenol)
  - Anesthetic/sedative

Subset of INADs listed above – 15 drugs total
COMMONLY DIAGNOSED FISH DISEASES

- Bacterial Gill Disease
  - Filamentous bacteria, Halamid (disinfectant)
- Coldwater Disease
  - Flavaobacterium psychrophilum, antibiotic-medicated feed
- Furunculosis
  - Aeromonas salmonicida, antibiotic-medicated feed
- Enteric Redmouth Disease
  - Yersinia ruckerii, antibiotic-medicated feed
- Gyros
  - Gyrodactylus spp., Formalin (disinfectant)
- Ich
  - Ichthyophthirius multifiliis, Formalin (disinfectant)
- Whirling Disease
  - Myxobolus cerebralis, disinfection and husbandry/management changes
Emerging/Novel Fish Pathogens in SE

- Viral Hemorrhagic Septicemia Virus
- Infectious Hematopoietic Necrosis Virus
- Infectious Salmon Anemia Virus
- Spring Viremia of Carp Virus
- Proliferative Kidney Disease
Fish Culture Best Management Practices

Fish rearing/husbandry practices that strive to ensure optimal animal health, growth and production, and economic performance

Goal of BMPS = achieve optimal production efficiency, not just optimal production

Dependent upon proper and judicious use of drugs

Potential for enhancement with veterinary oversight

Increased veterinary involvement in Virginia aquaculture will benefit facility production and industry overall
AQUATIC ANIMAL HEALTH TRAINING OPPORTUNITIES

- World Aquatic Veterinary Medical Association
  - CertAqV Program
  - WebCEPD Program – web-based
- Aquavet I, II, and III
  - Cornell University, Rhode Island
- Aquatic Animal Health Distance Learning
  - University of Florida, web-based
- SeaVet Clinical Training
  - University of Florida, 9-day course
Questions?