

QUICK DESK REFERENCE GUIDE TO:

Second Edition: April 2015

Approved Drugs for Use in Aquaculture

Developed by:

U.S. Fish & Wildlife Service's Aquatic Animal Drug Approval Partnership Program

American Fisheries Society's Fish Culture and Fish Health Sections

**Association of Fish & Wildlife Agencies - Fisheries and Water Resources Policy Committee's
Drug Approval Working Group**



APPROVED DRUGS FOR USE IN AQUACULTURE

The legal and judicious use of U.S. Food and Drug Administration (FDA) approved aquaculture drugs can be challenging considering that a variety of approved products are available, each with specific permitted treatment regimens. This situation can, at times, be further complicated as new drugs are approved or new claims are added to existing approved drugs. To assist aquaculturists and other fisheries professionals, the U.S. Fish and Wildlife Service's Aquatic Animal Drug Approval Partnership (AADAP) program, the American Fisheries Society's Fish Culture and Fish Health Sections, and the Association of Fish and Wildlife Agencies - Fisheries and Water Resources Policy Committee's Drug Approval Working Group have prepared this "Quick Desk Reference Guide to Approved Drugs for Use in Aquaculture."

This desk reference guide complements a previously released poster version. Like the poster, the desk reference guide provides up-to-date information about all FDA-approved aquaculture drugs, including trade names, approved uses, allowable treatment regimens, and supplier contact information. Its format is suitable for use in hatchery and laboratory settings, as well as in the office, classroom, or in the field. Like the poster, the desk reference guide will be periodically updated as new and/or expanded uses of aquaculture drugs are approved by FDA.

In this desk reference guide, example treatment scenarios and suggested treatment calculations are provided for each drug. The suggested treatment calculations are provided simply as examples for your consideration, as we recognize there is typically more than one way to calculate the correct amount of an aquaculture drug needed for a given treatment scenario. ***As always, please refer to the product label when using any drug or chemical.*** If a drug or chemical is being used for the first time, you should consider testing the treatment on a small sample of the population. If you still have questions after reading the product label, please contact the manufacturer.

Request additional Quick Desk Reference Guides at: <http://www.fws.gov/fisheries/aadap/home.htm>

APPROVED DRUGS FOR USE IN AQUACULTURE

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CHORIONIC GONADOTROPIN

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
CHORULON® Merck Animal Health 1-800-521-5767	Male and female brood finfish	Aid in improving spawning function	<ul style="list-style-type: none">• Males: 50 - 510 IU¹ chorionic gonadotropin/lb• Females: 67 - 1,816 IU chorionic gonadotropin/lb	<ul style="list-style-type: none">• Intramuscular injection• When reconstituted with the accompanying sterile diluent, each 10 mL vial contains 10,000 IU chorionic gonadotropin (i.e., 1,000 IU/mL)• Inject up to three doses, the total dosage not to exceed 25,000 IU in fish intended for human consumption• Depending on body weight and dose administered, it may be necessary to divide the dose between two or more injection sites to avoid injecting a large volume at a single site• Prescription product restricted to use by or on the order of a licensed veterinarian• 0-day withdrawal time

¹ IU = International Units

EXAMPLE TREATMENT SCENARIO AND SUGGESTED CHORULON[®] TREATMENT CALCULATIONS*

Injection Treatment

Example: Your resource management objectives include the production of hybrid striped bass fingerlings for stock enhancement, and require the use of Chorulon[®] to induce ovulation in female striped bass. Previous experience with striped bass suggests that only one injection will be needed, and that female striped bass require a dose of 250 International Units (IU) chorionic gonadotropin/lb. Your first female weighs 20 lb. How many IU of chorionic gonadotropin should you inject? How much Chorulon[®] (mL) should you inject?

Additional information: 1 mL of reconstituted Chorulon[®] contains 1,000 IU of chorionic gonadotropin

Calculations:

$$\begin{aligned} \text{IU to inject} &= [\text{weight of fish (lb)} \times \text{dose (IU/lb)}] \\ &= 20 \times 250 \\ &= \mathbf{5,000 \text{ IU}} \end{aligned}$$
$$\begin{aligned} \text{Chorulon}^{\text{®}} \text{ (mL) to inject} &= [\text{IU required/fish} \div 1,000 \text{ IU/mL}] \\ &= 5,000 \div 1,000 \\ &= \mathbf{5 \text{ mL of reconstituted Chorulon}^{\text{®}}} \end{aligned}$$

*Always refer to and follow all label instructions

FORMALIN - EXTERNAL PARASITES

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
<p>PARASITE-S Western Chemical, Inc. 1-800-283-5292</p>	All finfish	Control of external protozoa (species of the genera <i>Chilodonella</i> , <i>Costia</i> , <i>Epistylis</i> , <i>Scyphidia</i> , <i>Ichthyophthirius</i> , and <i>Trichodina</i>)	<ul style="list-style-type: none"> • Salmonids (salmon & trout) in tanks and raceways: <ul style="list-style-type: none"> • Above 50°F: up to 170 µL/L for up to 1 hr • Below 50°F: up to 250 µL/L for up to 1 hr • All other finfish up to 250 µL/L for up to 1 hr • Earthen ponds: 15 - 25 µL/L indefinitely 	<ul style="list-style-type: none"> • Do not subject to temperatures below 40°F (4.4°C) • Do not apply when 1) water is warmer than 80°F (27°C), 2) there is a heavy phytoplankton bloom, or 3) dissolved oxygen is less than 5 mg/L • Ponds may be retreated in 5 to 10 days if needed • Do not treat ponds containing striped bass • Test on a small number of fish from each lot to check for any unusual sensitivity to formalin before proceeding • 0-day withdrawal time
<p>FORMALIN-F Natchez Animal Supply Co. 1-800-647-6760</p>		and		
<p>FORMACIDE-B B.L. Mitchell, Inc. 1-800-817-5808</p>		monogenetic trematodes (species of the genera <i>Cleidodiscus</i> , <i>Dactylogyrus</i> , and <i>Gyrodactylus</i>)		

FORMALIN - EXTERNAL PARASITES (SHRIMP)

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
<p>PARASITE-S Western Chemical, Inc. 1-800-283-5292</p>	<p>Penaeid shrimp</p>	<p>Control protozoan parasites (species of the genera <i>Bodo</i>, <i>Epistylis</i>, and <i>Zoothamnium</i>)</p>	<ul style="list-style-type: none"> Tanks and raceways: 50 - 100 µL/L for up to 4 hrs daily Earthen ponds: 25 µL/L as single treatment 	<ul style="list-style-type: none"> Do not subject to temperatures below 40°F (4.4C) Do not apply when 1) water is warmer than 80°F (27°C), 2) there is a heavy phytoplankton bloom, or 3) dissolved oxygen is less than 5 mg/L Ponds may be retreated in 5 to 10 days if needed Test on a small number of shrimp from each lot to check for any unusual sensitivity to formalin before proceeding 0-day withdrawal time
<p>FORMALIN-F Natchez Animal Supply Co. 1-800-647-6760</p>				
<p>FORMACIDE-B B.L. Mitchell, Inc. 1-800-817-5808</p>				

FORMALIN - FUNGUS

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
<p>PARASITE-S Western Chemical, Inc. 1-800-283-5292</p>				
<p>FORMALIN-F Natchez Animal Supply Co. 1-800-647-6760</p>	All finfish eggs	Control fungi of the family Saprolegniaceae	<ul style="list-style-type: none"> All finfish eggs: 1,000 - 2,000 µL/L for 15 min Species of the order Acipenseriformes: up to 1,500 µL/L for 15 min 	<ul style="list-style-type: none"> Do not subject to temperatures below 40°F (4.4C) Preliminary testing on a small number of eggs is recommended before treating an entire lot 0-day withdrawal time
<p>FORMACIDE-B B.L. Mitchell, Inc. 1-800-817-5808</p>				

EXAMPLE TREATMENT SCENARIO AND SUGGESTED FORMALIN TREATMENT CALCULATIONS*

Static Bath Treatment

Example: You have a raceway containing a relatively low density of rainbow trout diagnosed with a *Costia sp.* infestation. The raceway measures 60 ft x 6 ft, with a water depth of 3 ft. Management has prescribed a treatment regimen of 170 µL/L formalin for 1 hour, and has determined that stocking density is low enough to allow for a static bath treatment. How much formalin (mL) must be added to the raceway to achieve the prescribed treatment concentration?

Additional information: Formalin is considered 100% active ingredient, for it is a saturated aqueous solution of formaldehyde gas
The specific gravity (SG) of formalin = 1.08
Gallons per cubic foot = 7.48
Conversion Factor (CF) to convert gallons to milliliters = 0.003785

Calculations:

$$\begin{aligned} \text{Volume of water (gal) in raceway} &= [\text{length (ft)} \times \text{width (ft)} \times \text{depth (ft)} \times 7.48 \text{ gal/ft}^3] \\ &= 60 \times 6 \times 3 \times 7.48 \\ &= 8,078 \text{ gallons} \end{aligned}$$
$$\begin{aligned} \text{Amount of formalin (mL) to add to raceway} &= [\text{water volume (gal)} \times \text{treatment concentration (}\mu\text{L/L)} \times \text{CF} \div \text{SG}] \\ &= 8,078 \times 170 \times 0.003785 \div 1.08 \\ &= \mathbf{4,813 \text{ mL}} \end{aligned}$$

*Always refer to and follow all label instructions

EXAMPLE TREATMENT SCENARIO AND SUGGESTED FORMALIN TREATMENT CALCULATIONS*

Charged Flow-through Treatment

Example: You have a raceway containing a moderately high density of rainbow trout diagnosed with a *Costia* sp. infestation. The raceway measures 60 ft x 6 ft, with a water depth of 3 ft. Water flow into the raceway is 100 gpm. Management has prescribed a treatment regimen of 170 µL/L formalin for 1 hour, and has determined that stocking density is such that a charged flow-through treatment is recommended. How much formalin (mL) must be added to “charge” the raceway to the prescribed treatment concentration? How much formalin (mL) must be “metered” into the raceway inflow over the course of the 1 hour treatment duration to maintain the prescribed treatment concentration?

Additional information: Formalin is considered 100% active ingredient, for it is a saturated aqueous solution of formaldehyde gas
The specific gravity (SG) of formalin = 1.08
Gallons per cubic foot = 7.48
Conversion Factor (CF) to convert gallons to milliliters = 0.003785

Calculations:

Volume of water (gal) in raceway = [length (ft) × width (ft) × depth (ft) × 7.48 gal/ft³]
= 60 × 6 × 3 × 7.48
= 8,078 gallons

Formalin (mL) to “charge” raceway = [water volume (gal) × treatment concentration (µL/L) × CF ÷ SG]
= 8,078 × 170 × 0.003785 ÷ 1.08
= **4,813 mL**

Formalin (mL) “metered” into raceway = [water flow (gpm) × treatment duration (min) × treatment concentration (µL/L) × CF ÷ SG]
= 100 × 60 × 170 × 0.003785 ÷ 1.08
= **3,575 mL**

*Always refer to and follow all label instructions

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AADAP

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HYDROGEN PEROXIDE - EXTERNAL BACTERIA

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
	Freshwater-reared salmonids	Control of mortality due to bacterial gill disease associated with <i>Flavobacterium branchiophilum</i>	<ul style="list-style-type: none"> • 100 mg/L for 30 min or 50 - 100 mg/L for 60 min once daily on alternate days for 3 treatments 	<ul style="list-style-type: none"> • Preliminary testing on a small number of fish is recommended before treating an entire lot • 0-day withdrawal time
35% PEROX-AID® Western Chemical, Inc. 1-800-283-5292	Freshwater-reared coolwater finfish and channel catfish	Control of mortality due to external columnaris disease associated with <i>F. columnare</i>	<ul style="list-style-type: none"> • <u>Fingerlings and adults:</u> 50 - 75 mg/L for 60 min once daily on alternate days for 3 treatments • <u>Fry:</u> 50 mg/L for 60 min once daily on alternate days for 3 treatments 	<ul style="list-style-type: none"> • Preliminary testing on a small number of fish is recommended before treating an entire lot • Should not be used to treat northern pike, paddlefish, or pallid sturgeon fry • Use with caution on walleye • 0-day withdrawal time

HYDROGEN PEROXIDE - FUNGUS

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
35% PEROX-AID® Western Chemical, Inc. 1-800-283-5292	Freshwater-reared finfish eggs	Control of mortality due to saprolegniasis	<ul style="list-style-type: none"> • Coldwater and coolwater: 500 - 1,000 mg/L for 15 min in a continuous flow system once daily on consecutive or alternate days until hatch • Warmwater: 750 - 1,000 mg/L for 15 min in a continuous flow system once daily on consecutive or alternate days until hatch 	<ul style="list-style-type: none"> • Preliminary testing on a small number of eggs is recommended before treating an entire lot • 0-day withdrawal time

EXAMPLE TREATMENT SCENARIO AND SUGGESTED 35% PEROX-AID® TREATMENT CALCULATIONS*

Static Bath Treatment

Example: You have a 6 ft diameter circular tank (water depth of 3 ft) containing a relatively low density of yellow perch fingerlings that have been diagnosed with external columnaris. Management has prescribed a treatment regimen of 50 mg/L hydrogen peroxide for 1 hour, and has determined that stocking density is low enough to allow for a static bath treatment. How much hydrogen peroxide (mL) must be added to the tank to achieve the prescribed treatment concentration?

Additional information: The volume of a circular tank (cylinder) is determined by the equation: $\text{Volume} = \pi r^2 h$. Note: $\pi = 3.14$; r = radius; and h = height (or depth)
35% PEROX-AID® contains 35% hydrogen peroxide as the active ingredient (%AI). Note: %AI expressed as 0.35 for calculation purposes
Gallons per cubic foot = 7.48
The specific gravity (SG) of 35% PEROX-AID® = 1.132
Conversion Factor (CF) to convert gallons to milliliters = 0.003785

Calculations:

$$\begin{aligned} \text{Volume of water (gal) in tank} &= [3.14 \times \text{tank radius (ft)}^2 \times \text{water depth (ft)} \times 7.48 \text{ gal/ft}^3] \\ &= 3.14 \times 3^2 \times 3 \times 7.48 \\ &= 634 \text{ gallons} \\ \\ \text{35\% PEROX-AID}^\circ \text{ (mL) to add to tank} &= [\text{water volume (gal)} \times \text{treatment concentration (mg/L)} \div \% \text{ active ingredient} \times \text{CF} \div \text{SG}] \\ &= 634 \times 50 \div 0.35 \times 0.003785 \div 1.132 \\ &= \mathbf{303 \text{ mL}} \end{aligned}$$

*Always refer to and follow all label instructions

EXAMPLE TREATMENT SCENARIO AND SUGGESTED 35% PEROX-AID® TREATMENT CALCULATIONS*

Charged Flow-Through Treatment

Example: You have a 6 ft diameter circular tank (water depth of 3 ft) containing a moderately high density of yellow perch fingerlings that have been diagnosed with external columnaris. Water flow into the tank is 10 gpm. Management has prescribed a treatment regimen of 50 mg/L hydrogen peroxide for 1 hour, and has determined that stocking density is such that a charged flow-through treatment is recommended. How much 35% PEROX-AID® (mL) must be added to “charge” the raceway to the prescribed treatment concentration? How much 35% PEROX-AID® (mL) must be “metered” into the tank inflow uniformly over the course of the 1 hour treatment duration to maintain the prescribed treatment concentration?

Additional information: The volume of a circular tank (cylinder) is determined by the equation: $\text{Volume} = \pi r^2 h$. Note: $\pi = 3.14$; r = radius; and h = height (or depth)
 35% PEROX-AID® contains 35% hydrogen peroxide as the active ingredient (%AI). Note: %AI expressed as 0.35 for calculation purposes
 Gallons per cubic foot = 7.48
 The specific gravity (SG) of 35% PEROX-AID® = 1.132
 Conversion Factor (CF) to convert gallons to milliliters = 0.003785

Calculations: Volume of water (gal) in tank = $[3.14 \times \text{tank radius (ft)}^2 \times \text{water depth (ft)} \times 7.48 \text{ gal/ft}^3]$
 = $3.14 \times 3^2 \times 3 \times 7.48$
 = 634 gallons

35% PEROX-AID® (mL) to “charge” tank = $[\text{water volume (gal)} \times \text{treatment concentration (mg/L)} \div \% \text{ active ingredient} \times \text{CF} \div \text{SG}]$
 = $634 \times 50 \div 0.35 \times 0.003785 \div 1.132$
 = **303 mL**

35% PEROX-AID® (mL) “metered” into tank = $[\text{water flow (gpm)} \times \text{treatment duration (min)} \times \text{treatment concentration (mg/L)} \div \% \text{AI} \times \text{CF} \div \text{SG}]$
 = $10 \times 60 \times 50 \div 0.35 \times 0.003785 \div 1.132$
 = **287 mL**

*Always refer to and follow all label instructions

CHLORAMINE-T - EXTERNAL BACTERIA

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
Halamid® Aqua Western Chemical, Inc. 1-800-283-5292	Freshwater-reared salmonids	Control of mortality due to bacterial gill disease associated with <i>Flavobacterium</i> spp.	<ul style="list-style-type: none"> 12 - 20 mg/L for 60 min once daily on consecutive or alternate days for 3 treatments 	<ul style="list-style-type: none"> Preliminary testing on a small number of fish is recommended before treating an entire lot If used in recirculating system, bypass biofilter during treatment and flushing 0-day withdrawal time
	Walleye	Control of mortality due to external columnaris disease associated with <i>F. columnare</i>	<ul style="list-style-type: none"> 10 - 20 mg/L for 60 min once daily on consecutive or alternate days for 3 treatments 	<ul style="list-style-type: none"> Preliminary testing on a small number of fish is recommended before treating an entire lot Walleye fingerlings may be more sensitive than walleye fry If used in recirculating system, bypass biofilter during treatment and flushing 0-day withdrawal time
Freshwater-reared warmwater finfish		<ul style="list-style-type: none"> 20 mg/L for 60 min once daily on consecutive or alternate days for 3 treatments 		

EXAMPLE TREATMENT SCENARIO AND SUGGESTED HALAMID® AQUA TREATMENT CALCULATIONS*

Static Bath Treatment

Example: You have a rectangular rearing tank containing a relatively low density of cutthroat trout fingerlings that have been diagnosed with bacterial gill disease. The tank measures 15 ft × 3 ft, with a water depth of 2.5 ft. Management has prescribed a treatment regimen of 12 mg/L chloramine-T for 1 hour, and has determined that rearing density is low enough to allow for a static bath treatment. How much chloramine-T (g) must be added to the tank to achieve the prescribed treatment concentration?

Additional information: Chloramine-T is considered 100% active ingredient
Gallons per cubic foot = 7.48
Conversion Factor (CF) to convert gallons to grams = 0.003785

Calculations:

$$\begin{aligned} \text{Volume of water (gal) in tank} &= [\text{length (ft)} \times \text{width (ft)} \times \text{water depth (ft)} \times 7.48 \text{ gal/ft}^3] \\ &= 15 \times 3 \times 2.5 \times 7.48 \\ &= 842 \text{ gallons} \end{aligned}$$
$$\begin{aligned} \text{Halamid® Aqua (g) to add to tank} &= [\text{water volume (gal)} \times \text{treatment concentration (mg/L)} \times \text{CF}] \\ &= 842 \times 12 \times 0.003785 \\ &= \mathbf{38.2 \text{ g}} \end{aligned}$$

*Always refer to and follow all label instructions

EXAMPLE TREATMENT SCENARIO AND SUGGESTED HALAMID® AQUA TREATMENT CALCULATIONS*

Charged Flow-Through Treatment

Example: You have a rectangular rearing tank containing a moderately high density of cutthroat trout fingerlings that have been diagnosed with bacterial gill disease. The tank measures 15 ft × 3 ft, with a water depth of 2.5 ft. Water flow into the tank is 20 gpm. Management has prescribed a treatment regimen of 12 mg/L chloramine-T for 1 hour, and has determined that stocking density is such that a charged flow-through treatment is recommended. How much Halamid® Aqua (g) must be added to “charge” the tank to the prescribed treatment concentration? How much Halamid® Aqua (g) must be “metered” into the tank inflow uniformly over the course of the 1 hour treatment duration to maintain the prescribed treatment concentration?

Additional information: Chloramine-T is considered 100% active ingredient
 Gallons per cubic foot = 7.48
 Conversion Factor (CF) to convert gallons to grams = 0.003785

Calculations: Volume of water (gal) in tank = [length (ft) × width (ft) × water depth (ft) × 7.48 gal/ft³]
 = 15 × 3 × 2.5 × 7.48
 = 842 gallons

Halamid® Aqua (g) to “charge” tank = [water volume (gal) × treatment concentration (mg/L) × CF]
 = 842 × 12 × 0.003785
 = **38.2 g**

Halamid® Aqua (g) “metered” into tank = [water flow (gpm) × treatment duration (min) × treatment concentration (mg/L) × CF]
 = 20 × 60 × 12 × 0.003785
 = **54.5 g**

*Always refer to and follow all label instructions

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OXYTETRACYCLINE HYDROCHLORIDE - SKELETAL MARKING

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
<p>PENNOX[®] 343 Pharmgate Animal Health 1-800-320-8303</p> <p>Oxytetracycline HCl Soluble Powder-343¹ IVX Animal Health 1-800-759-3664</p> <p>TERRAMYCIN-343¹ Aquatic Health Resources 1-877-280-2858</p>	Finfish fry and fingerlings	Mark skeletal tissue	<ul style="list-style-type: none"> • 200 - 700 mg oxytetracycline hydrochloride/L of water for 2 - 6 hr 	<ul style="list-style-type: none"> • None
<p>TETROXY[®] Aquatic Soluble Powder² Bimeda 1-888-524-6332</p>	Finfish fry and fingerlings	Mark skeletal tissue	<ul style="list-style-type: none"> • 200 - 700 mg oxytetracycline hydrochloride (buffered)/L of water for 2 - 6 hr 	<ul style="list-style-type: none"> • None

¹ Product is currently not available; future status unknown

² Product can be difficult to administer except in water with high natural buffering capacity

EXAMPLE TREATMENT SCENARIO AND SUGGESTED OXYTETRACYCLINE HYDROCHLORIDE SKELETAL-MARKING TREATMENT CALCULATIONS*

Static Bath Treatment:

Example: Your resource management objectives include the production of 10,000,000 walleye fry for stock enhancement, and require all fry be skeletal marked for later identification in the field. Management has prescribed a treatment regimen of 700 mg/L oxytetracycline hydrochloride (OTC) for 6 hours. Since your hatchery water has low natural buffering capacity, management has recommended treatment with Pennox 343[®] Soluble Powder. Fry will be marked in 3 ft × 10 ft rectangular tanks, with a water depth of 2 ft. Supplemental aeration will be provided to each treatment tank. How much Pennox[®] 343 Soluble Powder (g) needs to be added to each treatment tank?

Additional information: Pennox 343[®] Soluble Powder contains 75.6% OTC as the active ingredient (%AI) Note: %AI expressed as 0.756 for calculation purposes
Gallons per cubic foot = 7.48
Conversion Factor (CF) to convert gallons to grams = 0.003785

Calculations:

$$\begin{aligned} \text{Volume of water (gal) in treatment tanks} &= [\text{length (ft)} \times \text{width (ft)} \times \text{depth (ft)} \times 7.48 \text{ gal/ft}^3] \\ &= 3 \times 10 \times 2 \times 7.48 \\ &= 449 \text{ gallons} \end{aligned}$$
$$\begin{aligned} \text{Amount of PENNOX}^{\text{®}} \text{ 343 Soluble Powder (g) to add to each tank} &= [\text{water volume (gal)} \times \text{treatment concentration (mg/L)} \div \%AI \times CF] \\ &= 449 \times 700 \div 0.756 \times 0.003785 \\ &= \mathbf{1,574 \text{ g}} \end{aligned}$$

*Always refer to and follow all label instructions

TRICAINЕ METHANESULFONATE

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
<p>TRICAINЕ-S Western Chemical, Inc. 1-800-283-5292</p>	<p>Fish (of the families Ictaluridae, Salmonidae, Esocidae, and Percidae), aquatic amphibians, and other aquatic poikilotherms</p>	<p>Temporary immobilization</p>	<ul style="list-style-type: none"> • Fish: 15 - 330 mg/L • Other poikilotherms: 1:1,000 - 1:20,000 	<ul style="list-style-type: none"> • Crystalline powder to be mixed in water • Treatment dose depends upon desired degree of anesthesia, species, life stage, water temperature, and water hardness • Preliminary testing on a small number of fish is recommended • 21-day withdrawal time (fish) • Laboratory or hatchery use only in other poikilotherms • Water temperature over 50°F (10°C)

EXAMPLE TREATMENT SCENARIO AND SUGGESTED TRICAIN METHANESULFONATE TREATMENT CALCULATIONS*

Static Bath Treatment

Example: Your resource management objectives include the production of 200,000 fin-clipped rainbow trout for stock enhancement. Management has prescribed the use of tricaine methanesulfonate (MS-222) at a treatment concentration of 80 mg/L to sedate fish prior to fin-clipping. Fish will be sedated in small lots utilizing “knockout” tubs containing 1.5 gallons of water. How much MS-222 (g) needs to be added to each knockout tub?

Additional information: MS-222 is considered to be 100% active ingredient
Conversion Factor (CF) to convert gallons to grams = 0.003785

Calculations: **Amount of MS-222 to add to each knockout tub** = [water volume (gal) × treatment concentration (mg/L) × CF]
= 1.5 × 80 × 0.003785
= **0.45 g**

*Always refer to and follow label instructions

FLORFENICOL

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
AQUAFLO[®] (Florfenicol) Merck Animal Health 1-800-521-5767	Freshwater-reared salmonids	Control of mortality due to furunculosis associated with <i>Aeromonas salmonicida</i>	<ul style="list-style-type: none"> • 10 - 15 mg florfenicol/kg fish per day for 10 consecutive days 	<ul style="list-style-type: none"> • Veterinary Feed Directive (VFD) drug • 15-day withdrawal time
		Control of mortality due to coldwater disease associated with <i>Flavobacterium psychrophilum</i>		
	Freshwater-reared finfish	Control of mortality due to columnaris disease associated with <i>Flavobacterium columnare</i>	<ul style="list-style-type: none"> • 10 - 15 mg florfenicol/kg fish per day for 10 consecutive days 	<ul style="list-style-type: none"> • VFD drug • 15-day withdrawal time
	Catfish	Control of mortality due to enteric septicemia associated with <i>Edwardsiella ictaluri</i>	<ul style="list-style-type: none"> • 10 - 15 mg florfenicol/kg fish per day for 10 consecutive days 	<ul style="list-style-type: none"> • VFD drug • 15-day withdrawal time
	Freshwater-reared warmwater finfish	Control of mortality due to streptococcal septicemia associated with <i>Streptococcus iniae</i>	<ul style="list-style-type: none"> • 15 mg florfenicol/kg fish per day for 10 consecutive days 	<ul style="list-style-type: none"> • VFD drug • 15-day withdrawal time

EXAMPLE TREATMENT SCENARIO AND SUGGESTED AQUAFLO[®] TREATMENT CALCULATIONS*

Example:

Your facility has a raceway containing 10,000 lb of coho salmon smolts that have been diagnosed with bacterial coldwater disease. The causative pathogen has been confirmed to be sensitive to florfenicol. The fish are being fed at a feed rate of 2% body weight per day. Your veterinarian has prescribed treatment with Aquaflor[®] at **10 mg florfenicol/kg fish per day** for 10 days. How many pounds of Aquaflor[®] medicated-feed will be needed for the treatment? How much Aquaflor[®] (g) will be needed to prepare the medicated-feed?

Additional information:

- Aquaflor[®] is a Veterinary Feed Directive (VFD) drug that can only be used in the context of a valid veterinarian-client-patient relationship.
- With respect to certain treatment calculations, the likelihood of obtaining accurate and consistent results can be greatly enhanced by the use of a simple “cheat sheet.” The table provided below is based on fish feed rate (expressed as % body weight per day), and for each given feed rate provides the amount of Aquaflor[®] (in g/lb of feed, g/kg of feed, and lb/ton of feed) that needs to be incorporated into medicated-feed to achieve a target dose of **10 mg florfenicol/kg fish per day**. Note: Read down columns.

Feed Rate (% body weight per day)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	10.0
Aquaflor [®] (g/lb of feed)	1.8144	0.9072	0.6048	<u>0.4536</u>	0.3629	0.3024	0.2592	0.2268	0.2016	0.1814	0.0907
Aquaflor [®] (g/kg of feed)	4.00	2.00	1.33	1.00	0.80	0.67	0.57	0.50	0.44	0.40	0.20
Aquaflor [®] (lb/ton of feed) ¹	8.00	4.00	2.67	2.00	1.60	1.32	1.14	1.00	0.89	0.80	0.40

¹ Values in this row (i.e., lb/ton of feed) are the same as values presented in the table contained in the official VFD Form that must be used when ordering medicated feed.

Calculations:

$$\begin{aligned} \text{Aquaflor}^{\text{®}} \text{ medicated-feed (lb) needed} &= [\text{total weight of fish (lb)} \times \text{feed rate (\% BW per day)} \times \text{number of treatment days}] \\ &= 10,000 \times 0.02 \times 10 \\ &= \mathbf{2,000 \text{ lb}} \end{aligned}$$

$$\begin{aligned} \text{Aquaflor}^{\text{®}} \text{ (g) needed to prepare medicated-feed} &= [\text{total feed weight (lb)} \times \text{Aquaflor}^{\text{®}} \text{ (g) per lb of feed}] \\ &= 2,000 \times 0.4536 \\ &= \mathbf{907 \text{ g}} \end{aligned}$$

Note: See page 10-1 for formula to assist in Aquaflor[®] medicated-feed treatment calculations

***Always refer to and follow all label instructions**

EXAMPLE TREATMENT SCENARIO AND SUGGESTED AQUAFLO[®] TREATMENT CALCULATIONS*

Example:

Your facility has a raceway containing 10,000 lb of coho salmon smolts that have been diagnosed with bacterial coldwater disease. The causative pathogen has been confirmed to be sensitive to florfenicol. The fish are being fed at a feed rate of 2% body weight per day. Your veterinarian has prescribed treatment with Aquaflor[®] at **15 mg florfenicol/kg fish per day** for 10 days. How many pounds of Aquaflor[®] medicated-feed will be needed for the treatment? How much Aquaflor[®] (g) will be needed to prepare the medicated-feed?

Additional information:

- Aquaflor[®] is a Veterinary Feed Directive (VFD) drug that can only be used in the context of a valid veterinarian-client-patient relationship.
- With respect to certain treatment calculations, the likelihood of obtaining accurate and consistent results can be greatly enhanced by the use of a simple “cheat sheet.” The table provided below is based on fish feed rate (expressed as % body weight per day), and for each given feed rate provides the amount of Aquaflor[®] (in g/lb of feed, g/kg of feed, and lb/ton of feed) that needs to be incorporated into medicated-feed to achieve a target dose of **15 mg florfenicol/kg fish per day**. Note: Read down columns.

Feed Rate (% body weight per day)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	10.0
Aquaflor [®] (g/lb of feed)	2.7216	1.3608	0.9072	<u>0.6804</u>	0.5443	0.4536	0.3888	0.3402	0.3024	0.2722	0.1361
Aquaflor [®] (g/kg of feed)	6.00	3.00	2.00	1.50	1.20	1.00	0.86	0.75	0.67	0.60	0.30
Aquaflor [®] (lb/ton of feed) ¹	12.00	6.00	4.00	3.00	2.40	1.98	1.71	1.50	1.33	1.20	0.60

¹ Values in this row (i.e., lb/ton of feed) are the same as values presented in the table contained in the official VFD Form that must be used when ordering medicated feed.

Calculations:

$$\begin{aligned} \text{Aquaflor}^{\text{®}} \text{ medicated-feed (lb) needed} &= [\text{total weight of fish (lb)} \times \text{feed rate (\% BW per day)} \times \text{number of treatment days}] \\ &= 10,000 \times 0.02 \times 10 \\ &= \mathbf{2,000 \text{ lb}} \end{aligned}$$

$$\begin{aligned} \text{Aquaflor}^{\text{®}} \text{ (g) needed to prepare medicated-feed} &= [\text{total feed weight (lb)} \times \text{Aquaflor}^{\text{®}} \text{ (g) per lb of feed}] \\ &= 2,000 \times 0.6804 \\ &= \mathbf{1,361 \text{ g}} \end{aligned}$$

Note: See page 10-1 for formula to assist in Aquaflor[®] medicated-feed treatment calculations

***Always refer to and follow all label instructions**

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AADAP

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OXYTETRACYCLINE DIHYDRATE - BACTERIAL DISEASES

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
TERRAMYCIN® 200 for Fish Phibro Animal Health 1-888-475-7355	Catfish	Control of bacterial hemorrhagic septicemia (<i>Aeromonas liquefaciens</i>) and pseudomonas disease (<i>Pseudomonas</i> spp.)	<ul style="list-style-type: none"> • 2.5 - 3.75 g OTC¹/100 lb fish per day for 10 days 	<ul style="list-style-type: none"> • Water temperature not below 62°F (16.7°C) • 21-day withdrawal time
	Lobster	Control of gaffkemia (<i>Aerococcus viridians</i>)	<ul style="list-style-type: none"> • 1 g OTC/lb medicated feed for 5 days 	<ul style="list-style-type: none"> • In feed as sole ration • 30-day withdrawal time

¹ Oxytetracycline dihydrate

OXYTETRACYCLINE DIHYDRATE - BACTERIAL DISEASES

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
TERRAMYCIN® 200 for Fish Phibro Animal Health 1-888-475-7355	Salmonids	Control of ulcer disease (<i>Hemophilus piscium</i>), furunculosis (<i>Aeromonas salmonicida</i>), bacterial hemorrhagic septicemia (<i>A. liquefaciens</i>), and pseudomonas disease (<i>Pseudomonas</i> spp.)	<ul style="list-style-type: none"> • 2.5 - 3.75 g OTC¹/100 lb fish per day for 10 days 	<ul style="list-style-type: none"> • 21-day withdrawal time • No temperature restrictions on use
	Freshwater-reared salmonids	Control of mortality due to coldwater disease caused by <i>Flavobacterium psychrophilum</i>	<ul style="list-style-type: none"> • 3.75 g OTC/100 lb fish per day for 10 days 	<ul style="list-style-type: none"> • 21-day withdrawal time • No temperature restrictions on use
	All freshwater-reared <i>Oncorhynchus mykiss</i>	Control of mortality due to columnaris disease (<i>F. columnare</i>)	<ul style="list-style-type: none"> • 3.75 g OTC/100 lb fish per day for 10 days 	<ul style="list-style-type: none"> • 21-day withdrawal time • No temperature restrictions on use

¹ Oxytetracycline dihydrate

OXYTETRACYCLINE DIHYDRATE - SKELETAL MARKING

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
TERRAMYCIN[®] 200 for Fish Phibro Animal Health 1-888-475-7355	Pacific salmon	Mark skeletal tissue	<ul style="list-style-type: none"> 11.35 g OTC¹/100 lb fish per day for 4 days 	<ul style="list-style-type: none"> Salmon not over 30 g body weight In feed as sole ration 7-day withdrawal time

¹ Oxytetracycline dihydrate

EXAMPLE TREATMENT SCENARIO AND SUGGESTED TERRAMYCIN® 200 FOR FISH TREATMENT CALCULATIONS*

Example: Your facility has a raceway containing 2,000 lb of fingerling cutthroat trout that have been diagnosed with bacterial coldwater disease. The causative pathogen has been confirmed to be sensitive to oxytetracycline (OTC). The fish are being fed at a feed rate of 3% body weight per day. Your fish health biologist has recommended treatment with Terramycin® 200 for Fish (TM200) at 3.75 g OTC/100 lb fish per day for 10 days. What %TM200 in feed should you order? At what feed rate should the TM200 medicated-feed be fed? How many pounds of TM200 medicated-feed will be needed for the treatment?

- Additional information:**
- Most feed manufacturers only offer (prepare) TM200 medicated-feed at specific, pre-determined levels of %TM200 in feed. As a result, accurate dosing as per label instructions requires the use of only specified feed rates (or feed rate ranges if dose is a range) for each level of %TM200 in feed. The take-home message is that culturists must often adjust “preferred feed rate” to meet treatment objectives and label use-guidelines; most notably when the treatment dose is a specific value (e.g., 3.75 g OTC/100 lb fish per day). Also note that if feed rate must be adjusted, it should always be adjusted to a value less than preferred to ensure fish consume all medicated-feed. If desirable, non-medicated feed can be fed to fish after medicated-feed each day to achieve preferred feed rate.
 - The table provided below is based on the most commonly prepared %TM200 levels in feed, and for each given %TM200 level, provides the appropriate feed rate (or feed rate range) that should be use to achieve a target dose of 2.5 g, 3.75 g, or 2.5 – 3.75 g OTC/100 lb fish per day. Note: Read down columns.

% TM200 in Feed	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Feed rate (% BW per day) at 2.5 g OTC/100 lb fish	2.5	1.25	0.83	0.62	0.5	0.42	0.36	0.31
Feed rate (% BW per day) at 3.75 g OTC/100 lb fish	3.75	<u>1.87</u>	1.25	0.94	0.75	0.62	0.54	0.47
Feed rate (% BW per day) at 2.5 - 3.75 g OTC/100 lb fish	2.5 - 3.75	1.25 - 1.87	0.83 - 1.25	0.62 - 0.94	0.5 - 0.75	0.42 - 0.62	0.36 - 0.54	0.31 - 0.47

Calculations:

%TM200 in feed to order (suggested) = 1% TM200

Feed rate (TM200 medicated-feed) = 1.87% body weight per day¹

TM200 medicated-feed (lb) needed = [total weight of fish (lb) × feed rate (%BW per day) × number of treatment days]
 = 2,000 × 0.0187 × 10
 = **374 lb**

¹ To achieve preferred feed rate, non-medicated feed can be fed at 1.13% BW each day after medicated-feed has been fed; 1.87% + 1.13% = 3.0%

SULFADIMETHOXINE & ORMETOPRIM

Product Name & Supplier	Species	Indication	Dosing	Limitations & Comments
ROMET® 30 Aquatic Health Resources 1-877-280-2858	Salmonids	Control of furunculosis caused by <i>Aeromonas Salmonicida</i>	<ul style="list-style-type: none"> • 50 mg/kg fish per day for 5 days 	<ul style="list-style-type: none"> • In feed • 42-day withdrawal time
ROMET® TC Aquatic Health Resources 1-877-280-2858	Catfish	Control of enteric septicemia caused by <i>Edwardsiella ictaluri</i>	<ul style="list-style-type: none"> • 50 mg/kg fish per day for 5 days 	<ul style="list-style-type: none"> • In feed • 3-day withdrawal time

EXAMPLE TREATMENT SCENARIO AND SUGGESTED ROMET® 30 TREATMENT CALCULATIONS*

Example: Your facility has a raceway containing 4,000 lb of juvenile lake trout that have been diagnosed with furunculosis. The causative pathogen has been confirmed to be sensitive to Romet® 30. The fish are being fed at a feed rate of 2% body weight per day. Your fish health biologist has recommended treatment with Romet® 30 at 50 mg/kg fish per day for 5 days. How many pounds of Romet® 30 medicated-feed will be needed for the treatment? How much Romet® 30 (g) will be needed to prepare the medicated-feed?

- Additional information:**
- Romet® 30 is a dry medicated premix, and is available as an over-the-counter product. Romet® 30 medicated-feed may be purchased from a licensed feed mill, or may be prepared on-site by top-dressing standard ration.
 - With respect to certain treatment calculations, the likelihood of obtaining accurate and consistent results can be greatly enhanced by the use of a simple “cheat sheet.” The table provided below is based on fish feed rate (expressed as % body weight per day), and for each given feed rate provides the amount of Romet® 30 (in g/lb of feed, g/kg of feed, and lb/ton of feed) that needs to be incorporated into medicated-feed to achieve a target dose of 50 mg Romet® 30/kg fish per day. Note: Read down columns.

Feed Rate (% body weight per day)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	10.0
Romet® 30 (g/lb of feed)	15.12	7.56	5.04	3.78	3.02	2.52	2.16	1.89	1.68	1.51	0.76
Romet® 30 (g/kg of feed)	33.33	16.67	11.11	8.33	6.67	5.56	4.76	4.17	3.70	3.33	1.67
Romet® 30 (lb/ton of feed) ¹	66.67	33.33	22.22	16.67	13.33	11.11	9.52	8.33	7.41	6.67	3.33

¹ Values in this row (i.e., lb per ton) are similar to values presented on the drug label.

Calculations:

Romet® 30 medicated-feed (lb) needed = [total weight of fish (lb) × feed rate (%BW per day) × number of treatment days]
 = 4,000 × 0.02 × 5
 = **400 lb**

Romet® 30 (g) needed to prepare medicated feed = [total feed weight (lb) × Romet® 30 (g) per lb of feed]
 = 400 × 3.78
 = **1,512 g**

Note: See page 10-1 for formula to assist in Romet® 30 medicated-feed treatment calculations

*Always refer to and follow label instructions

EXAMPLE TREATMENT SCENARIO AND SUGGESTED ROMET® TC TREATMENT CALCULATIONS*

Example: Your facility has a raceway containing 4,000 lb of juvenile lake trout that have been diagnosed with furunculosis. The causative pathogen has been confirmed to be sensitive to Romet® TC. The fish are being fed at a feed rate of 2% body weight per day. Your fish health biologist has recommended treatment with Romet® TC at 50 mg/kg fish per day for 5 days. How many pounds of Romet® TC medicated-feed will be needed for the treatment? How much Romet® TC (g) will be needed to prepare the medicated-feed?

Additional information:

- Romet® TC is a medicated premix that is added to water and then “top-coated” on feed. Romet® TC is available as an over-the-counter product, and is intended for “on-site” top-coating of standard ration.
- With respect to certain treatment calculations, the likelihood of obtaining accurate and consistent results can be greatly enhanced by the use of a simple “cheat sheet.” The table provided below is based on fish feed rate (expressed as % body weight per day), and for each given feed rate provides the amount of Romet® TC (in g/lb of feed, g/kg of feed, and lb/ton of feed) that needs to be incorporated into medicated-feed to achieve a target dose of 50 mg Romet® TC/kg fish per day. Note: Read down columns.

Feed Rate (% body weight per day)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	10.0
Romet® TC (g/lb of feed)	22.68	11.34	7.56	5.67	4.54	3.78	3.24	2.83	2.52	2.27	1.13
Romet® TC (g)/kg of feed)	50.00	25.00	16.67	12.50	10.00	8.33	7.14	6.25	5.56	5.00	2.50
Romet® TC (lb/ton of feed) ¹	100.00	50.00	33.33	25.00	20.00	16.67	14.29	12.50	11.11	10.00	5.00

¹ Values in this row (i.e., lb per ton) are similar to values presented on the drug label.

Calculations:

$$\begin{aligned} \text{Romet® TC medicated-feed (lb) needed} &= [\text{total weight of fish (lb)} \times \text{feed rate (\%BW per day)} \times \text{number of treatment days}] \\ &= 4,000 \times 0.02 \times 5 \\ &= \mathbf{400 \text{ lb}} \end{aligned}$$

$$\begin{aligned} \text{Romet® TC (g) needed to prepare medicated feed} &= [\text{total feed weight (lb)} \times \text{Romet® TC (g) per lb of feed}] \\ &= 400 \times 5.67 \\ &= \mathbf{2,268 \text{ g}} \end{aligned}$$

Note: See page 10-1 for formula to assist in Romet® TC medicated-feed treatment calculations

*Always refer to and follow label instructions

FORMULAE TO ASSIST IN MEDICATED-FEED TREATMENT CALCULATIONS

The following formulae (equations) provide a simple means of calculating either 1) the feed rate (percent body weight to feed each day), or 2) the percent drug premix incorporated into feed. As presented, the formulae are arranged to solve for feed rate (% BW per day). However, as in the case of any algebraic formulae, each formula can be rearranged to solve for any other variable.

Medicated Feed Type	Formula	Footnotes
<p>Terramycin® 200 for Fish (TM200)</p>	<p>Feed Rate (% BW per day) = $\frac{22.03^{[1]} \times \text{Treatment dose (g OTC/100 lb fish)}}{\% \text{ TM200 in feed}^{[2]} \times 44.1^{[3]}}$</p>	<p>¹ Algebraic conversion factor (constant) ² e.g., 2% TM200 = 2; 2% TM200 ≠ 0.02 ³ % OTC in TM200 (constant)</p>
<p><u>Note:</u> Most feed mills will sell TM200-medicated feed labeled at 1%, 2%, 3%, or 4% TM200 in the feed. However, some feed mills will sell TM200-medicated feed labeled at 2g, 4g, 6 g, or 8g OTC/lb feed. For the TM200 calculations performed above, please note that 2 g OTC/lb feed = 1% TM200, 4 g OTC/lb feed = 2% TM200, 6 g OTC/lb feed = 3% TM200, and 8 g OTC/lb feed = 4% TM200.</p>		
<p>Aquaflor®, Romet® 30 and Romet® TC^[1]</p>	<p>Feed Rate (% BW per day) = $\frac{\text{Treatment dose (mg active ingredient/kg fish)}}{\% \text{ drug premix in feed}^{[2]} \times \% \text{ active ingredient in premix}^{[3]}}$</p>	<p>¹ Aquaflor® is 50% active ingredient Romet® 30 is 30% active ingredient Romet® TC is 20% active ingredient ² e.g., 2% premix = 2; 2% premix ≠ 0.02 ³ e.g., 50% active = 50; 50% active ≠ 0.50</p>
<p><u>Note:</u> This formula also applies to future FDA-approved medicated feed products where treatment dose is expressed as mg/kg fish. If treatment dose is expressed as µg/kg fish, simply divide by 1,000. If treatment dose is expressed as g/kg fish, simply multiply by 1,000.</p>		

Please Note:

ADDITIONAL DRUG-USE GUIDANCE

Please Note:

- **Product Labels:** Each product's label should be considered the definitive source of specific instructions for product use. *Always refer to the product label before initiating treatment.*
- **Veterinary Feed Directive (VFD) Drugs (e.g., Aquaflor®):** VFD drugs are a certain subset of drugs that are intended for use in animal feeds. The use of VFD drugs is permitted only under the professional supervision of a licensed veterinarian in the context of a valid veterinarian-client-patient relationship. VFD drugs cannot be used under extra-label drug use provisions.
- **Prescription Drugs (e.g., Chorulon®):** Prescription drugs are drugs that may be used only by, or on the order of, a licensed veterinarian in the context of a valid veterinarian-client-patient relationship.
- **Extra-label Drug Use:** The actual or intended use of an FDA-approved drug in a manner that is not in accordance with the approved label directions. Extra-label drug use is permitted only by, or on the order of, a licensed veterinarian when a valid veterinarian-client-patient relationship exists.
- **Calculations:** The treatment calculations provided in this Desk Reference are intended to serve as an example of one method to correctly determine the amount of a drug needed for use in a specific treatment situation. Regardless of how you may choose to calculate the amount of drug needed for treatment, always refer to and follow all product label instructions.
- **Additional Information:** Additional information regarding approved drug use, including a variety of drug use related guidance documents, can be found by visiting the FDA (<http://www.fda.gov/AnimalVeterinary/default.htm>) and AADAP (<http://www.fws.gov/fisheries/aadap/home.htm>) websites.
- **Disclaimer:** *Use of a product name does not indicate endorsement by the U.S. Fish and Wildlife Service, the American Fisheries Society, or the Association of Fish and Wildlife Agencies.*

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Approved Drugs for Use in Aquaculture

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