

## Oxytetracycline Medicated Feed Clinical Field Trials - INAD 9332

### **1999 Annual Summary Report on the Use of Oxytetracycline Medicated Feed in Field Efficacy Trials**

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#### **Summary**

Oxytetracycline as a feed additive (OTF) was used at 32 state fish hatcheries, 1 tribal hatchery, and 9 private hatcheries during 1999 to evaluate its efficacy to control mortality caused by bacterial coldwater disease, columnaris, systemic flavobacteriosis, bacterial kidney disease, myxobacteriosis, streptococcus, general systemic bacterial infection, gram negative bacteria, and withering syndrome caused by Rickettsia-like prokaryote (RLP) in a variety of salmonid and non-salmonid species. OTF has been approved for use in aquaculture by the U.S. Food and Drug Administration (FDA). However, the current label limits drug use to the control of only specific bacterial diseases of specific fish species at water temperatures not below 48.2° F (9° C). Label guidelines do not permit the use of oxytetracycline for the control of bacterial coldwater disease, columnaris, enteric redmouth, bacterial kidney disease, or vibriosis. To accommodate the needs of aquaculture and to collect pivotal and ancillary clinical field data on OTF for the control of these diseases, the FDA has authorized the use of this compound under Compassionate Investigational New Animal Drug (INAD) Exemption #9332. In 1999, OTF was administered under INAD #9332 in 127 disease control/prevention trials and involved approximately 36.9 million fish. Standard treatment regimes included the use of OTF at 2.5 - 3.75 g/100 lbs fish/day for 10 - 21 days; and 10.0 g/100 lbs fish/day for 10 - 16 days. In a few select trials fish were fed oxytetracycline medicated feed at 2.0 - 2.28 g/100 lbs fish/day for 10 - 11 days, 3.98 - 9.95 g/100 lbs fish/day for 2 - 14 days, and 12.3 - 54.0 g/100 lbs fish/day for 14 days. Approximately 70% of trials appeared efficacious, 9% appeared ineffective, and 21% were characterized as inconclusive.

## Introduction

The current label for OTF use in aquaculture limits use to the control of furunculosis in salmonids caused by *Aeromonas salmonicida*, and the control of bacterial hemorrhagic septicemia in salmonids and catfish caused by *A. hydrophila* or *Pseudomonas sp.*. Oxytetracycline medicated feed has been shown to be highly effective in controlling these diseases, especially when predisposing environmental stresses are reduced at the time of treatment (Warren 1991). Furthermore, the current FDA approved label for OTF limits dosage to a range of 2.5 - 3.75 grams of active drug per 100 pounds of fish per day for 10 days, and limits use to water temperatures "not below 48.2° F (9° C)". These label restrictions severely limit the overall utility of approved OTF use in aquaculture.

Fish culturists have also reported that OTF treatment is a useful tool for the control of bacterial cold water disease (CWD) and columnaris in salmonids. These two diseases, collectively termed "flexibacteriosis" are caused by *Flexibacter psychrophilus* and *F. columnaris*. Enteric redmouth caused by *Yersinia ruckeri*, vibriosis caused by various members of the genus *Vibrio*, and other less common bacterial diseases of fish also have been found to be responsive to OTF therapy. However, none of these latter uses are approved by the FDA.

## Purpose of Report

The primary purpose of this report is to summarize the results of calendar year 1999 (CY 99) supplemental OTF field efficacy studies. However, it is also expected data from these studies will be used to enhance the existing OTF database that has been established from previous years studies for the purpose of expanding and/or extending the approved label for OTF.

## Facilities, Materials, and Treatment Procedures

### 1. Facilities

A total of 32 state fish hatcheries, 1 tribal hatchery, and 9 private hatcheries (42 total facilities) used OTF to control mortality caused by CWD, columnaris, systemic flavobacteriosis, bacterial kidney disease, myxobacteriosis, streptococcus, general systemic bacterial infection, gram negative bacteria, and RLP.

### 2. OTF used in trials

The OTF used in these trials was either Terramycin 100 or Terramycin 100D, both of which contained 100 g active oxytetracycline quaternary salt per pound of premix. All Terramycin 100/100D was supplied by Pfizer, Inc., 1107 South 291

Highway, Lee's Summit, MO. However, oxytetracycline medicated feed was supplied by several different fish feed manufacturers.

### **3. Drug dosages and duration**

As described in the Study Protocol for INAD #9332, Investigators were allowed to use OTF either within the current label range of 2.5 - 3.75 grams of active drug per 100 lbs of fish per day for 10 - 21 days (~37% of studies), or at 10.0 grams of active drug per 100 lbs of fish per day for 10 - 16 days (~35% of studies). However, a number of trials (~28%) deviated from the protocol during CY 99. In these trials, fish were fed at rates of 2.0 - 54.0 grams of active drug per drug/100 lbs fish/day for periods of time ranging from 2 - 15 days.

## **Fish Species and Fish Diseases Involved in 1999 Trials**

### **1. Species of fish treated**

Six salmonid species and 7 non-salmonid species were treated during CY 99. Species treated included rainbow and steelhead trout (*Oncorhynchus mykiss*); coho salmon (*O. kisutch*); spring chinook salmon (*O. tshawytscha*); sockeye salmon (*O. nerka*), cutthroat trout (*O. clarki*), smallmouth bass (*M. dolomieu*), largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), white sturgeon (*Acipenser transmontanus*), white seabass (*Atractoscion nobilis*), hybrid striped bass (white bass x striped bass), black crappie (*Pomoxis nigromaculatus*), and red abalone (*Haliotis rufescens*).

### **2. Diseases treated**

The disease treated most frequently during CY 99 was bacterial coldwater disease. Other diseases treated were columnaris, systemic flavobacteriosis, bacterial kidney disease, myxobacteriosis, streptococcus, general systemic bacterial infection, gram negative bacteria, and RLP.

## **Data Collected**

### **1. Pathologist's reports**

Fish health pathology reports include: 1) a description of how the identity of disease agent(s) was verified; 2) disease identification records that confirm the presence of the disease agent; and 3) the name and title of the individual performing the diagnosis. Additionally, pathology reports often provide documentation that there were no secondary infections or infestations caused by unrelated disease agents in a population of test fish. Pathology reports provide

essential information if efforts are to expand/extend an existing approved label. Approximately 35% of CY 99 trials included pathologist's reports.

## **2. Mortality data**

As stated in the Study Protocol, mortality data was to be collected 5 days prior to treatment, during the treatment period, and for at least 20 days post-treatment. Investigators were strongly encouraged to collect mortality data on a daily basis. However, daily collection of mortality data was not always possible. At production facilities that are understaffed, the collection and enumeration of mortalities can not always be conducted on a daily basis. Therefore, in some cases, mortalities were collected, counted, and recorded only once/twice per week.

### **Discussion of Study Results:**

**1. General observations on the efficacy of OTF for the control of bacterial diseases of salmonids** (Note: A summary of all OTF studies conducted during CY 99 under INAD #9332 is presented in Table 1.)

**A. Efficacy at 2.0 - 2.28 g/100 lbs fish/day for 10 days at water temperatures above 48.2° F**

OTF was used at 2.0 - 2.28 g/100 lbs of fish for 10 days in 1 trial (Table 2). This trial appeared efficacious in controlling mortality caused by CWD in rainbow trout.

**B. Efficacy at 2.0 - 2.28 g/100 lbs fish/day for 11 days at water temperatures below 48.2° F**

OTF was used at 2.0 - 2.28 g/100 lbs of fish for 11 days in 1 trial (Table 4). This trial appeared inconclusive in controlling mortality caused by CWD in cutthroat trout.

**C. Efficacy at 2.5 - 3.75 g/100 lbs fish/day for 10 - 21 days at water temperatures above 48.2° F**

OTF was used at 2.5 - 3.75 g/100 lbs of fish for 10 - 21 days in 37 trials (Tables 2 - 4). OTF treatment appeared efficacious in 26 trials in controlling mortality caused by CWD, columnaris, systemic flavobacteriosis, gram negative bacteria, general systemic bacterial infection, and RLP. Fish species treated included cutthroat trout, rainbow trout, black crappie, white seabass, white sturgeon, and red abalone. OTF treatment did not appear efficacious in 4 trials, and treatment results were characterized as inconclusive in 7 trials.

**D. Efficacy at 2.5 - 3.75 g/100 lbs fish/day for 10 - 11 days at water temperatures below 48.2° F**

OTF was used at 2.5 - 3.75 g/100 lbs of fish for 10 - 11 days in 10 trials (Tables 2 & 4). OTF treatment appeared efficacious in 8 trials in controlling mortality caused by CWD. Fish species treated included coho salmon, cutthroat trout, rainbow trout, and steelhead trout. OTF treatment results were characterized as inconclusive in 2 trials of spring chinook salmon and coho salmon.

**E. Efficacy at 3.98 - 9.95 g/100 lbs fish/day for 2 -15 days at water temperatures above 48.2° F**

OTF was used at 3.98 - 9.95 g/100 lbs of fish for 2 - 15 days in 21 trials (Tables 2 - 4). OTF treatment appeared efficacious in 12 trials in controlling mortality caused by CWD, systemic flavobacteriosis, columnaris, streptococcus, and RLP. Fish species treated included coho salmon, cutthroat trout, rainbow trout, hybrid striped bass, and red abalone. OTF treatment did not appear efficacious in 1 trial of rainbow trout, and treatment results were characterized as inconclusive in 8 trials involving channel catfish, largemouth bass, rainbow trout, and white seabass.

**F. Efficacy at 3.98 - 9.95 g/100 lbs fish/day for 9 - 14 days at water temperatures below 48.2° F**

OTF was used at 3.98 - 9.95 g/100 lbs of fish for 9 - 14 days in 3 trials (Table 2). OTF treatment appeared efficacious in all 3 trials in controlling mortality caused by CWD. Fish species treated included cutthroat trout, rainbow trout, and steelhead trout.

**G. Efficacy at 10.0g/100lbs fish/day for 10 - 16 days at water temperatures above 48.2°F**

OTF was used at 10.0 g/100lbs fish/day for 10 - 16 days in 34 trials (Tables 2 - 4). OTF treatment appeared efficacious in 21 trials in controlling mortality caused by CWD, bacterial kidney disease, and RLP. Fish species treated included coho salmon, cutthroat trout, rainbow trout, spring chinook salmon, steelhead trout, and red abalone. OTF treatment did not appear efficacious in 6 trials, and were characterized as inconclusive in 7 trials.

**H. Efficacy at 10.0 g/100 lbs fish/day for 10 - 15 days at water temperatures below 48.2° F**

OTF was used at 10.0 g/100 lbs of fish for 10 - 15 days in 11 trials (Tables 2 - 4). OTF treatment appeared efficacious in 8 trials in controlling mortality

caused by CWD in coho salmon and sockeye salmon. OTF treatment did not appear to be efficacious in 1 trial of coho salmon, and were characterized as inconclusive in 2 trials involving coho salmon and spring chinook salmon.

**I. Efficacy at 12.3 - 54.0 g/100 lbs fish/day for 14 days at water temperatures above 48.2° F**

OTF was used at 12.3 - 54.0 g/100 lbs of fish for 14 days in 9 trials (Table 2). OTF treatment appeared efficacious in all 9 trials in controlling mortality caused by CWD, and columnaris in cutthroat trout and spring chinook salmon. The Investigator at Washoe Park Trout Hatchery noted that the dosage levels appeared higher than allowed due to feeding “by eye” and the nature of feeding swim-up cutthroat (some of these factors were inefficient feeding, poor conversion, wide confidence intervals of size, lot weight, etc.).

**2. Observed Toxicity**

No toxicity or adverse effects relating to OTF treatment were reported.

**Summary of Study Results**

Oxytetracycline medicated feed was used at dosages ranging from 2.0 - 54.0 g/100lbs fish per day. Treatment duration ranged from 2 - 21 days. Thirteen different species of fish and one species of abalone were treated with OTF, and trials involved approximately 36.9 million fish. Treated fish ranged in size from 0.75 - 12.7 in. Water temperature during treatment ranged from 39.2 - 82.4 °F, with a mean treatment temperature of 55.2 °F. Approximately 70% of trials appeared efficacious, 9% appeared ineffective, and 21% were characterized as inconclusive. Ten trials involved the use of control fish and ~35% of trials included pathologist’s reports. Overall, OTF appeared effective in controlling mortality caused by bacterial coldwater disease. Results of trials indicated that mortality decreased during or following the treatment period, and remained at normal levels throughout the post-treatment period. Furthermore, investigators reported no evidence of toxicity or adverse effects related to OTF treatment. However, based on a general lack of untreated control fish, replication, randomization, etc., it is understood that these data can only be considered as ancillary data. None-the-less, the ancillary data described above should provide useful corroborative data to support a future expanded label claim for OTF. It is anticipated that additional ancillary efficacy data will continue to be collected under INAD #9332. In future trials conducted under INAD #9332, efforts will be directed towards the generation of higher quality data.

## References

Warren, J.W. 1991. Diseases of hatchery fish. U.S. Fish and Wildlife Service, Portland, Oregon, 92 p.

Table 1. This table is generated from database on Bonnie's computer (pages).

**Table 2. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Efficacious Studies**

| <b>Hatchery</b>               | <b>Number of Trials</b> | <b>Fish Species</b> | <b>Fish Size (inches)</b> | <b>Number of Fish</b> | <b>Disease</b>     | <b>Number of Treatment Days</b> | <b>Dose (g/100 lbs)</b> | <b>Temp. (°F)</b> |
|-------------------------------|-------------------------|---------------------|---------------------------|-----------------------|--------------------|---------------------------------|-------------------------|-------------------|
| Chalk Cliffs Rearing Unit     | 1                       | RBT                 | 2.50                      | 290,000               | CWD                | 10                              | 2.00 - 2.28             | 57.0              |
| The Abalone Farm, Inc         | 1                       | ABL                 | 2.90                      | 30,000                | Withering Syndrome | 13                              | 2.5 - 3.75              | 53.1              |
| Wray SFH                      | 1                       | BLC                 | 1.82                      | 8,975                 | Columnaris         | 10                              | 2.5 - 3.75              | 61.2              |
| Cowlitz Salmon Hatchery       | 1                       | COS                 | 1.00                      | 22,000                | CWD                | 10                              | 2.5 - 3.75              | 44.0              |
| Hidden Falls Hatchery         | 1                       | COS                 | 4.03                      | 1,608,616             | CWD                | 10                              | 2.5 - 3.75              | 44.0              |
| Clark Fork Hatchery           | 1                       | CUT                 | 2.45                      | 405,321               | CWD                | 10                              | 2.5 - 3.75              | 42.0              |
| Murray Springs Trout Hatchery | 1                       | CUT                 | 0.90                      | 162,000               | CWD                | 14                              | 2.5 - 3.75              | 52                |
| Washoe Park Trout Hatchery    | 2                       | CUT                 | 3.23 - 3.70               | 108,000               | CWD                | 10                              | 2.5 - 3.75              | 44.5              |
| Washoe Park Trout Hatchery    | 1                       | CUT                 | 4.88                      | 14,000                | CWD                | 10                              | 2.5 - 3.75              | 44.5              |
| Bellvue SFH                   | 2                       | RBT                 | 3.79 - 3.95               | 361,284               | CWD                | 10                              | 2.50 - 3.75             | 52.0              |
| Chalk Cliffs Rearing Unit     | 1                       | RBT                 | 6.40                      | 1,200,000             | CWD                | 10                              | 2.50 - 3.75             | 53.2              |
| Darrah Springs Hatchery       | 1                       | RBT                 | 4.00                      | 392,600               | Columnaris         | 11                              | 2.50 - 3.75             | 58.0              |
| Darrah Springs Hatchery       | 1                       | RBT                 | 7.50                      | 315,000               | Columnaris         | 10                              | 2.50 - 3.75             | 55.0              |
| Finger Rock Rearing Unit      | 1                       | RBT                 | 2.40                      | 130,000               | CWD                | 10                              | 2.50 - 3.75             | 47.5              |
| Hagerman Fish Hatchery        | 2                       | RBT                 | 4.30 - 4.50               | 262,000               | CWD                | 10 - 13                         | 2.50 - 3.75             | 59.0              |

**Table 2. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Efficacious Studies-cont.**

| <b>Hatchery</b>                   | <b>Number of Trials</b> | <b>Fish Species</b> | <b>Fish Size (inches)</b> | <b>Number of Fish</b> | <b>Disease</b>                       | <b>Number of Treatment Days</b> | <b>Dose (g/100 lbs)</b> | <b>Temp. (°F)</b> |
|-----------------------------------|-------------------------|---------------------|---------------------------|-----------------------|--------------------------------------|---------------------------------|-------------------------|-------------------|
| Hagerman Fish Hatchery            | 1                       | RBT                 | 4.20                      | 120,000               | CWD                                  | 10                              | 2.50 - 3.75             | 59.0              |
| Mt. Shavano SFH                   | 1                       | RBT                 | 3.40                      | 212,580               | CWD                                  | 11                              | 2.5 - 3.75              | 52.0              |
| Mt. Shavano SFH                   | 3                       | RBT                 | 3.66 - 3.90               | 157,991               | CWD                                  | 9 - 11                          | 2.50 - 3.75             | 52.0              |
| Mt. Shavano SFH                   | 2                       | RBT                 | 4.25 - 5.60               | 490,304               | CWD                                  | 10 - 21                         | 2.50 - 3.75             | 54 - 55           |
| Nampa Fish Hatchery               | 2                       | RBT                 | 4.50 - 6.00               | 325,352               | CWD                                  | 10                              | 2.50 - 3.75             | 59.0              |
| Chiwawa Ponds                     | 1                       | STT                 | 7.50                      | 172,400               | CWD                                  | 11                              | 2.50 - 3.75             | 39.2              |
| Hubbs Seaworld Research Institute | 1                       | WSB                 | 4.00                      | 17,400                | Gram Negative Bacteria               | 11                              | 2.50 - 3.75             | 64.4              |
| Stolt Sea Farm California, LLC    | 1                       | WHS                 | 1.00                      | 4,500                 | General Systemic Bacterial Infection | 11                              | 2.5 - 3.75              | 68                |
| Stolt Sea Farm California, LLC    | 3                       | WHS                 | 4.0 - 6.5                 | 7,450                 | General Systemic Bacterial Infection | 11                              | 2.5 - 3.75              | 68                |
| Stolt Sea Farm California, LLC    | 3                       | WHS                 | 8.0 - 11.0                | 1,150                 | General Systemic Bacterial Infection | 11                              | 2.5 - 3.75              | 68                |
| The Abalone Farm, Inc             | 1                       | ABL                 | 3.15                      | 84                    | Withering Syndrome                   | 14                              | 3.98 - 9.95             | 59.0              |
| Neets Bay Hatchery                | 1                       | COS                 | 4.80                      | 2,157,755             | CWD                                  | 15                              | 3.98 - 9.95             | 51.8              |
| Murray Springs Trout Hatchery     | 3                       | CUT                 | 0.90                      | 461,800               | CWD                                  | 11                              | 3.98 - 9.95             | 52.0              |
| Washoe Park Trout Hatchery        | 2                       | CUT                 | 1.70 - 2.20               | 97,700                | CWD                                  | 14                              | 3.98 - 9.95             | 56 - 57           |

**Table 2. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Efficacious Studies-cont.**

| Hatchery                      | Number of Trials | Fish Species | Fish Size (inches) | Number of Fish | Disease            | Number of Treatment Days | Dose (g/100 lbs) | Temp. (°F) |
|-------------------------------|------------------|--------------|--------------------|----------------|--------------------|--------------------------|------------------|------------|
| Washoe Park Trout Hatchery    | 1                | CUT          | 2.49               | 73,000         | CWD                | 10                       | 3.98 - 9.95      | 44.5       |
| Big Springs Trout Hatchery    | 1                | RBT          | 3.10               | 309,500        | CWD                | 14                       | 3.98 - 9.95      | 55.0       |
| Giant Springs Trout Hatchery  | 1                | RBT          | 2.26               | 63,000         | CWD                | 10                       | 3.98 - 9.95      | 54.0       |
| Poudre Canyon Rearing Unit    | 1                | RBT          | 5.09               | 59,949         | CWD                | 9                        | 3.98 - 9.95      | 42.0       |
| Mad River Hatchery            | 1                | STT          | 1.50               | 156,935        | CWD                | 14                       | 3.98 - 9.95      | 48.0       |
| Kent Sea Tech Corp.           | 2                | SXW          | 4.00               | 103,701        | Columnaris         | 10                       | 3.98 - 9.95      | 66.2       |
| Kent Sea Tech Corp.           | 1                | SXW          | 12.70              | 99,386         | Streptococcus      | 10                       | 3.98 - 9.95      | 82.4       |
| The Abalone Farm, Inc         | 1                | ABL          | 3.20               | 1,764          | Withering Syndrome | 14                       | 10.0             | 60.3       |
| Big Creek Hatchery            | 3                | COS          | 1.8 - 2.7          | 1,188,500      | CWD                | 14                       | 10.0             | 44.5-45.5  |
| Big Creek Hatchery            | 1                | COS          | 3.37               | 545,000        | CWD                | 14                       | 10.0             | 53.5       |
| Cascade Hatchery              | 1                | COS          | 2.42               | 4,912,786      | CWD                | 16                       | 10.0             | 48.2       |
| Cowlitz Salmon Hatchery       | 1                | COS          | 1.80               | 7,800          | CWD                | 14                       | 10.0             | 42.5       |
| Keta Creek Hatchery           | 1                | COS          | 1.30               | 500,000        | CWD                | 15                       | 10.0             | 52         |
| South Fork Klakanine Hatchery | 1                | COS          | 1.90               | 850,593        | CWD                | 14                       | 10.0             | 45.0       |

**Table 2. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Efficacious Studies-cont.**

| <b>Hatchery</b>               | <b>Number of Trials</b> | <b>Fish Species</b> | <b>Fish Size (inches)</b> | <b>Number of Fish</b> | <b>Disease</b> | <b>Number of Treatment Days</b> | <b>Dose (g/100 lbs)</b> | <b>Temp. (°F)</b> |
|-------------------------------|-------------------------|---------------------|---------------------------|-----------------------|----------------|---------------------------------|-------------------------|-------------------|
| Whitman Lake Hatchery         | 2                       | COS                 | 1.63 - 1.65               | 1,199,032             | CWD            | 14                              | 10.0                    | 39.4 -42.3        |
| Whitman Lake Hatchery         | 1                       | COS                 | 1.97                      | 768,009               | CWD            | 14                              | 10.0                    | 51.6              |
| Murray Springs Trout Hatchery | 1                       | CUT                 | 0.90                      | 28,000                | CWD            | 11                              | 10.0                    | 52.0              |
| Murray Springs Trout Hatchery | 1                       | CUT                 | 1.95                      | 45,000                | CWD            | 15                              | 10.0                    | 52.0              |
| Washoe Park Trout Hatchery    | 1                       | CUT                 | 1.80                      | 92,700                | CWD            | 14                              | 10.0                    | 50                |
| Bellvue SFH                   | 1                       | RBT                 | 3.76                      | 197,603               | CWD            | 10                              | 10.0                    | 54.5              |
| Crystal Lake Hatchery         | 1                       | RBT                 | 2.00                      | 358,000               | CWD            | 14                              | 10.0                    | 49                |
| Giant Springs Trout Hatchery  | 2                       | RBT                 | 1.4 - 1.5                 | 125,725               | CWD            | 14                              | 10.0                    | 54.0              |
| Giant Springs Trout Hatchery  | 2                       | RBT                 | 2.26 - 3.07               | 204,820               | CWD            | 14                              | 10.0                    | 54.0              |
| Leaburg Hatchery              | 1                       | RBT                 | 3.30                      | 235,127               | CWD            | 14                              | 10.0                    | 53.2              |
| Sawtooth Fish Hatchery        | 1                       | SCS                 | 4.06                      | 17,607                | BKD            | 14                              | 10.0                    | 56.3              |
| Burnett Inlet Hatchery        | 1                       | SOS                 | 1.38                      | 207,500               | CWD            | 10                              | 10.0                    | 44.4              |
| Irrigon Hatchery              | 1                       | STT                 | 1.90                      | 97,800                | CWD            | 14                              | 10.0                    | 54.5              |
| Mad River Hatchery            | 1                       | STT                 | 2.50                      | 145,835               | CWD            | 14                              | 10.0                    | 51.0              |

**Table 2. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Efficacious Studies-cont.**

| <b>Hatchery</b>               | <b>Number of Trials</b> | <b>Fish Species</b> | <b>Fish Size (inches)</b> | <b>Number of Fish</b> | <b>Disease</b> | <b>Number of Treatment Days</b> | <b>Dose (g/100 lbs)</b> | <b>Temp. (°F)</b> |
|-------------------------------|-------------------------|---------------------|---------------------------|-----------------------|----------------|---------------------------------|-------------------------|-------------------|
| Niagara Springs Fish Hatchery | 1                       | STT                 | 1.89                      | 213,374               | CWD            | 14                              | 10.0                    | 58.0              |
| Trinity River Hatchery        | 1                       | STT                 | 2.70                      | 425,000               | CWD            | 14                              | 10.0                    | 50.5              |
| Willamette Hatchery           | 1                       | STT                 | 3.03                      | 43,421                | CWD            | 16                              | 10.0                    | 56.0              |
| Murray Springs Trout Hatchery | 1                       | CUT                 | 1.63                      | 126,000               | CWD            | 14                              | 12.3 - 54.0             | 52.0              |
| Washoe Park Trout Hatchery    | 7                       | CUT                 | 0.75 - 1.42               | 346,300               | CWD            | 14                              | 12.3 - 54.0             | 56 - 57           |
| Dexter Ponds                  | 1                       | SCS                 | 5.20                      | 212,400               | Columnaris     | 14                              | 12.3 - 54.0             | 58.4              |

**Table 3. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Non-efficacious Studies**

| Hatchery                          | Number of Trials | Fish Species | Fish Size (inches) | Number of Fish | Disease                   | Number of Treatment Days | Dose (g/100 lbs) | Temp. (°F)  |
|-----------------------------------|------------------|--------------|--------------------|----------------|---------------------------|--------------------------|------------------|-------------|
| Hubbs Seaworld Research Institute | 3                | WSB          | 3.5 - 4.0          | 36,800         | Gram Negative Bacteria    | 9 - 10                   | 2.5 - 3.75       | 67.1 - 68.5 |
| Hubbs Seaworld Research Institute | 1                | WSB          | 2.50               | 6,877          | Systemic Flavobacteriosis | 11                       | 2.5 - 3.75       | 61.5        |
| Bellvue SFH                       | 1                | RBT          | 2.32               | 268,500        | CWD                       | 10                       | 3.98 - 9.95      | 53.0        |
| Cascade Hatchery                  | 1                | COS          | 1.90               | 6,014,258      | CWD                       | 14                       | 10.0             | 43.6        |
| Giant Springs Trout Hatchery      | 1                | RBT          | 1.84               | 100,732        | CWD                       | 14                       | 10.0             | 54.0        |
| Pitkin SFH                        | 1                | RBT          | 2.41               | 477,204        | CWD                       | 14                       | 10.0             | 51.0        |
| Willamette Hatchery               | 1                | RBT          | 3.14               | 213,000        | CWD                       | 14                       | 10.0             | 57.0        |
| Mad River Hatchery                | 2                | STT          | 2.0 - 2.5          | 312,670        | CWD                       | 14                       | 10.0             | 51 - 52     |
| Niagara Springs Fish Hatchery     | 1                | STT          | 1.48               | 207,375        | CWD                       | 14                       | 10.0             | 58.0        |

**Table 4. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Inconclusive Studies**

| Hatchery                          | Number of Trials | Fish Species | Fish Size (inches) | Number of Fish | Disease                | Number of treatment days | Dose (g/100 lbs) | Temp. (°F) |
|-----------------------------------|------------------|--------------|--------------------|----------------|------------------------|--------------------------|------------------|------------|
| Washoe Park Trout Hatchery        | 1                | CUT          | 3.54               | 50,000         | CWD                    | 11                       | 2.00 - 2.28      | 44.5       |
| Trask Hatchery                    | 1                | COS          | 1.60               | 208,729        | CWD                    | 11                       | 2.5 - 3.75       | 44.1       |
| Bellvue SFH                       | 1                | RBT          | 2.66               | 250,700        | CWD                    | 10                       | 2.5 - 3.75       | 53.0       |
| Crystal Lake Hatchery             | 1                | RBT          | 7.50               | 365,000        | CWD                    | 10                       | 2.5 - 3.75       | 49.0       |
| Hagerman Fish Hatchery            | 1                | RBT          | 3.70               | 100,000        | CWD                    | 10                       | 2.5 - 3.75       | 59.0       |
| Hagerman Fish Hatchery            | 1                | RBT          | 4.50               | 746,650        | CWD                    | 10                       | 2.5 - 3.75       | 59.0       |
| Cowlitz Salmon Hatchery           | 1                | SCS          | 8.30               | 196,788        | CWD                    | 10                       | 2.5 - 3.75       | 43.0       |
| Wray SFH                          | 1                | SMB          | 1.50               | 91,555         | Columnaris             | 10                       | 2.5 - 3.75       | 80.7       |
| Hubbs Seaworld Research Institute | 1                | WSB          | 1.00               | 33,791         | Gram Negative Bacteria | 10                       | 2.5 - 3.75       | 58.7       |
| Rathbun Fish Hatchery             | 3                | CCF          | 6.00               | 150,306        | Columnaris             | 5                        | 3.98 - 9.95      | 80.4       |
| Rathbun Fish Hatchery             | 1                | LMB          | 4.00               | 24,914         | Columnaris             | 2                        | 3.98 - 9.95      | 73.7       |
| Rathbun Fish Hatchery             | 1                | LMB          | 4.00               | 49,631         | Columnaris             | 5                        | 3.98 - 9.95      | 73.7       |
| Murray Springs Trout Hatchery     | 1                | RBT          | 1.00               | 60,000         | CWD                    | 14                       | 3.98 - 9.95      | 52.0       |
| Hubbs Seaworld Research Institute | 1                | WSB          | 2.50               | 20,000         | Gram Negative Bacteria | 10                       | 3.98 - 9.95      | 56.3       |

**Table 4. Summary of 1999 Oxytetracycline Medicated Feed Efficacy Results - Inconclusive Studies-cont.**

| <b>Hatchery</b>                   | <b>Number of Trials</b> | <b>Fish Species</b> | <b>Fish Size (inches)</b> | <b>Number of Fish</b> | <b>Disease</b>            | <b>Number of treatment days</b> | <b>Dose (g/100 lbs)</b> | <b>Temp. (°F)</b> |
|-----------------------------------|-------------------------|---------------------|---------------------------|-----------------------|---------------------------|---------------------------------|-------------------------|-------------------|
| Hubbs Seaworld Research Institute | 1                       | WSB                 | 5.00                      | 7,300                 | Systemic Flavobacteriosis | 14                              | 3.98 - 9.95             | 63.4              |
| Whitman Lake Hatchery             | 1                       | COS                 | 1.63                      | 1,125,942             | CWD                       | 14                              | 10.0                    | 46.6              |
| Murray Springs Trout Hatchery     | 1                       | CUT                 | 2.10                      | 9,580                 | CWD                       | 14                              | 10.0                    | 52.0              |
| Giant Springs Trout Hatchery      | 2                       | RBT                 | 1.6 - 1.9                 | 312,218               | CWD                       | 14                              | 10.0                    | 54.0              |
| Willamette Hatchery               | 1                       | RBT                 | 3.14                      | 149,721               | CWD                       | 14                              | 10.0                    | 54.5              |
| Clearwater Hatchery               | 1                       | SCS                 | 4.60                      | 1,274,059             | Myxobacteriosis           | 13                              | 10.0                    | 46.0              |
| Big Creek Hatchery                | 1                       | STT                 | 2.31                      | 431,484               | CWD                       | 14                              | 10.0                    | 52.0              |
| Clackamas Hatchery                | 1                       | STT                 | 2.70                      | 136,344               | CWD                       | 14                              | 10.0                    | 61.5              |
| Keta Creek Hatchery               | 1                       | STT                 | 1.70                      | 39,700                | CWD                       | 14                              | 10.0                    | 54.0              |

**Table 5. Summary Data Regarding 1999 Oxytetracycline Medicated Feed Efficacy Studies**

**Total Fish Treated:** **36,969,257**

|   |            |
|---|------------|
| Number of fish treated in efficacious studies     | 23,497,429 |
| Number of fish treated in non-efficacious studies | 7,637,416  |
| Number of fish treated in inconclusive studies    | 5,834,412  |

**Total number of studies:** **127**

|                         |    |
|-------------------------|----|
| Efficacious studies     | 89 |
| Non-efficacious studies | 12 |
| Inconclusive studies    | 26 |

**Studies that Included Control Fish:**

Study Number: 9332-2K-007; 9332-99-023; 9332-99-029; 9332-99-031; 9332-99-066; 9332-2K-068; 9332-99-086; 9332-2K-091; 9332-99-120; and 9332-99-122

**Treatment Regimes Used:**

|   |           |
|---|-----------|
| 2.0 - 2.28 g/100 lbs fish/day for 10 days (above 48.2°F)      | 1 trial   |
| 2.0 - 2.28 g/100 lbs fish/day for 11 days (below 48.2°F)      | 1 trial   |
| 2.5 - 3.75 g/100 lbs fish/day for 10 - 21 days (above 48.2°F) | 37 trials |
| 2.5 - 3.75 g/100 lbs fish/day for 10 - 11 days (below 48.2°F) | 10 trials |
| 3.98 - 9.95 g/100 lbs fish/day for 2 - 15 days (above 48.2°F) | 21 trials |
| 3.98 - 9.95 g/100 lbs fish/day for 9 - 14 days (below 48.2°F) | 3 trials  |
| 10.0 g/100 lbs fish/day for 10 - 16 days (above 48.2°F)       | 34 trials |
| 10.0 g/100 lbs fish/day for 10 - 15 days (below 48.2°F)       | 11 trials |
| 12.3 - 54.0 g/100 lbs fish/day for 14 days (above 48.2°F)     | 9 trials  |

**Treatment Water Temperature (°F):**

|                   |             |
|-------------------|-------------|
| Temperature Range | 39.2 - 82.4 |
| Mean Temperature  | 55.2        |

**Size of Treated Fish (in.):**

|            |             |
|------------|-------------|
| Size Range | 0.75 - 12.7 |
|------------|-------------|

**Species Treated:**

|  |   |
|--|---|
| rainbow and steelhead trout ( <i>Oncorhynchus mykiss</i> ) | cutthroat trout ( <i>O. clarki</i> )            |
| spring chinook salmon ( <i>O. tshawytscha</i> )            | sockeye salmon ( <i>O. nerka</i> )              |
| coho salmon ( <i>O. kisutch</i> )                          | smallmouth bass ( <i>M. dolomieu</i> )          |
| largemouth bass ( <i>Micropterus salmoides</i> )           | channel catfish ( <i>Ictalurus punctatus</i> )  |
| white sturgeon ( <i>Acipenser transmontanus</i> )          | white seabass ( <i>Atractoscion nobilis</i> )   |
| hybrid striped bass (white bass x striped bass)            | black crappie ( <i>Pomoxis nigromaculatus</i> ) |
| red abalone ( <i>Haliotis rufescens</i> )                  |   |