

Oxytetracycline Medicated Feed Clinical Field Trials - INAD 9332

Year 2005 Annual Summary Report on the Use of Oxytetracycline Medicated Feed in Field Efficacy Trials

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Summary

Oxytetracycline medicated feed has been used effectively in the U. S. under compassionate INAD Exemption #9332 to control/prevent mortality in a variety of fish/shellfish caused by common fish bacterial pathogens. In calendar year 2005 (CY05) the efficacy of oxytetracycline medicated feed (OTF) was evaluated in 104 disease trials involving approximately 15.4 million fish/shellfish to control mortality in a variety of test fish/shellfish caused by a variety of infectious fish pathogens. Trials were conducted at 22 fish culture facilities, including three U.S. Fish and Wildlife Service fish hatcheries, 14 state hatcheries, and five private fish culture facilities. The compassionate study protocol under which treatments were administered allowed the investigator to use OTF at a dosage of either 1) 2.5 - 3.75 g drug/100 lbs fish/d for 10 days; 2) 10 g drug/100 lbs fish/d for 14 days; or 3) 6.0 g drug/100 lbs abalone/d for 14 days. However, on occasion, Investigators deviated from the study protocol, and treatments were administered at dosages between 0.96 - 19.62 g drug/100 lbs fish/d for

1 - 18 days. Overall, results from trials conducted in CY05 indicated that treatments appeared effective in approximately 83% of the trials and ineffective in 7% of the trials. Treatments were characterized as inconclusive in the remaining 10% of the trials.

Introduction

The current label for oxytetracycline medicated feed (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.

Historically, OTF treatments have been used by fish culturists to control mortality in salmonids caused by bacterial cold water disease (CWD; causative agent *Flavobacterium psychrophilus*) and columnaris (causative agent *F. columnare*). Fish culturists and fish health professionals have also found that OTF is effective therapy to control mortality in fishes caused by enteric redmouth (causative agent *Yersinia ruckeri*), vibriosis (causative agent various members of the genus *Vibrio*), and other less

common bacterial diseases. However, at this time, OTF is not approved for such uses, and the only legal way to use OTF for such non-approved uses is through an INAD.

Purpose of Report

The purpose of this report is to summarize the results of calendar year 2005 (CY05) OTF field efficacy trials conducted under INAD #9332. Furthermore, it is expected that data from these trials will be used to enhance the existing OTF database that has been established from studies conducted in previous years for the purpose of expanding and/or extending the approved label for OTF.

Facilities, Materials, and Treatment Procedures

1. Facilities

A total of 104 trials were conducted at 22 fish culture facilities, including three U.S. Fish and Wildlife Service fish hatcheries, 14 state fish hatcheries, and five private fish culture facilities.. Mean water temperature during all trials was 60.7 °F, and water temperature ranged from 40.0 - 82.4 °F during the test periods at the different testing facilities.

2. Test article used

The OTF used in CY05 efficacy 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. Virtually all oxytetracycline medicated feed used in INAD trials was supplied by one of several commercial fish feed manufacturers.

3. Treatment regimen

As described in the Study Protocol, Investigators were allowed to use OTF either within the current label range of 2.5 - 3.75 g of active drug/100 lbs of fish/d for 10 - 15 days (approximately 47% of trials were conducted using this treatment regimen); 10.0 g of active drug/100 lbs of fish/d for 10 - 14 days (approximately 17% of trials were conducted using this treatment regimen); or at 6.0 g drug/100 lbs abalone/d for 1 day (approximately 2% of trials were conducted using this treatment regimen). However, the treatment regimen administered in the remaining 34% of the trials deviated from the protocol-mandated use. In these trials, fish were fed at rates of either 0.96 - 2.44 g drug/100 lbs fish/d for 10 - 17 days (22% of trials), 4.0 - 8.0 g drug/100 lbs fish/d for 10 - 18 days (8% of trials), 3.75 & 19.62 g drug/100 lbs fish/d for 10 days (1% of trials), or at 10.7 - 15.6 g drug/100 lbs fish/d for 14 days (3% of trials). In most cases in which deviations occurred, Investigators were made aware of the deviation and informed that adherence to the protocol is a vital element to the aquaculture INAD process.

Fish Species and Fish Diseases Involved in CY05 Trials

1. Species of fish treated

Fifteen fish species, including eight salmonids and seven non-salmonids, and one species of shellfish were treated during CY05. Treated fish ranged in length from 0.7 - 23.0 in. Mean length of treated abalone was 3.5 in. Fish species treated included:

Salmonids: (1) Apache trout *Oncorhynchus apache*; (2) chinook salmon *O. tshawytscha*; (3) coho salmon *O. kisutch*; (4) cutthroat trout *O. clarki*; (5) rainbow trout *O. mykiss*; (6) steelhead trout *O. mykiss*; (7) brook trout *Salvelinus fontinalis*; and (8) brown trout *Salmo trutta*

Non-salmonids: (1) cabezon *Scorpaenichthys marmoratus*; (2) channel catfish *Ictalurus punctatus*; (3) California halibut *Paralichthys californicus*; (4) hybrid striped bass *Morone chrysops* x *M. saxatilis*; (5) Tilapia *Oreochromis mossambica*; (6) white seabass *Atractoscion nobilis*; and (7) saugeye *Stizostedion canadense* x *S. vitreum*

Shellfish: red abalone *Haliotis rufescens*

2. Diseases treated

Test fish were treated to control/prevent mortality caused by the following diseases during CY05:

1. Coldwater disease (causative agent *Flavobacterium psychrophilus*)
2. Bacterial kidney disease (causative agent *Renibacterium salmoninarum*)
3. Columnaris (causative agent *F. Columnare*)
4. Enteric redmouth (causative agent *Yersinia ruckeri*)
5. Epitheliocystis
6. General systemic bacterial infection
7. Streptococcus (causative agent *Streptococcal iniae*)
8. Gram negative bacterial enteritis
9. Systemic bacterial infection (marine spp.)
10. Rickettsia-like organism
11. Withering syndrome

Bacterial coldwater disease (47% of trials), general systemic bacterial infection (18% of trials), and streptococcus (13% of trials) were the most frequently treated diseases during this period. Treatment of the other eight diseases listed above accounted for the remaining 22% of the treatment trials.

Data Collected

1. Pathologist's reports

A pathologist's report was submitted for 42% of the studies. Pathology reports are important for accurate interpretation of study results because they typically contain the following information:

- A. A description of how the identity of disease agent(s) was verified
- B. Disease identification records that confirm the presence of the disease agent
- C. The name and title of the individual performing the diagnosis.

Additionally, evidence would typically be provided to document that there were no secondary infections or infestations caused by unrelated disease agents in the population of test fish. As a result, pathology reports provide essential information if efforts are to expand/extend an existing approved label.

2. Mortality data

As stated in the Study Protocol, mortality data were to be collected five 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 post-treatment mortality data was not always possible due to factors such as fish being moved among tanks or raceways (i.e.,

splitting or combining fish), and fish being stocked to rivers and other bodies of water.

Discussion of Study Results:

1. Relevance of study to expanding current label claim for OTC

Results of CY05 trials conducted under Compassionate INAD exemption #9332 are similar to results detailed in reports previously submitted to FDA under INAD's #9332 and #9006.

2. General observations on the efficacy of OTF for the control of bacterial

diseases in salmonid and non-salmonid fishes (Note: Table 1 provides a summary of all trials characterized as effective; Table 2 provides a summary of all trials characterized as ineffective ; Table 3 provides a summary of all trials characterized as inconclusive; Table 4 provides summary data for all trials; and Tables 5a and 5b provide a summary of all trials conducted during CY05 under INAD #9332; Table 5a is sorted by study number; Table 5b is sorted first by disease treated, second by whether treatments were efficacious or not, and lastly by fish species).

A. Efficacy at 0.96 - 2.44 g/100 lbs fish/d for 10 - 17 days at water temperatures above 48.2° F

Fish were treated with 0.96 - 2.44 g OTF/100 lbs of fish/d for 10 - 17 days in 23 trials (Table 1) where water temperatures were above 48.2° F involving tilapia diagnosed with streptococcus and steelhead trout diagnosed with CWD. OTF treatments appeared efficacious in all trials.

B. Efficacy at 2.50 - 3.75 g/100 lbs fish/d for 10 - 15 days at water temperatures above 48.2° F

Fish were treated with 2.5 and 3.75 g OTF/100 lbs of fish/d for 10 - 15 days in 49 trials (Tables 1 - 3) where water temperatures were above 48.2° F. Included in these 49 trials were 12 trials in which rainbow trout were diagnosed with CWD; four trials in which rainbow trout, chinook salmon, and saugeye were diagnosed with columnaris; two trials in which chinook salmon were diagnosed with enteric redmouth; one trial in which California halibut were diagnosed with epitheliocystis; 18 trials in which Apache, brook, brown, and rainbow trout were diagnosed with general systemic bacterial infection; nine trials in which hybrid striped bass were diagnosed with gram negative bacterial enteritis; one trial in which white seabass were diagnosed with a rickettsia like organism; and two trials in which tilapia were diagnosed with streptococcus. Treatment resulted in the following:

- 1) Treatment appeared efficacious in all of the trials in which rainbow trout, chinook salmon, and saugeye were diagnosed with CWD or columnaris.
- 2) Of the two trials in which enteric redmouth was diagnosed in chinook salmon, one of the trials appeared efficacious, while one trial was ineffective.
- 3) Treatment in the trial involving California halibut diagnosed with epitheliocystis appeared efficacious.
- 4) Of the 18 trials in which general systemic bacterial infection was diagnosed, treatment in 16 (89%) of the trials involving Apache trout, brook trout, brown trout, and rainbow trout appeared efficacious, while treatment in the remaining two (11%) of the trials involving rainbow trout were characterized as inconclusive.
- 5) Of the nine trials in which gram negative bacterial enteritis was diagnosed in hybrid striped bass, seven (78%) of the trials appeared efficacious, while two (22%) trials were characterized as inconclusive.
- 6) Treatment in the trial involving white seabass diagnosed with a rickettsia like organism was ineffective.

7) Treatment in both of the trials in which streptococcus was diagnosed in tilapia appeared efficacious.

C. Efficacy at 3.75 & 19.62 g/100 lbs fish/d for 10 days at water temperatures above 48.2° F

Fish were treated with 3.75 & 19.62 g OTF/100 lbs of fish/d for 10 days in one trial (Table 1) involving steelhead trout diagnosed with CWD. The Investigator noted that fish were accidentally fed at 19.62 g OTF/100 lbs of fish/d for two days before the Investigator realized the mistake. At this point, fish were fed the correct dosage for the remainder of the study period. OTF treatment appeared efficacious in this trial.

D. Efficacy at 4.0 - 8.0 g/100 lbs fish/d for 10 - 18 days at water temperatures above 48.2° F

Fish were treated with 4.0 - 8.0 g OTF/100 lbs of fish/d for 10 - 18 days in eight trials (Tables 1 - 3). Included in these eight trials were three trials in which rainbow and cutthroat trout were diagnosed with CWD; one trial in which channel catfish were diagnosed with general systemic bacterial infection; three trials in which tilapia were diagnosed with streptococcus; and one trial in which cabezon were diagnosed with a systemic bacterial infection (similar to CWD in freshwater fish). Treatment resulted in the following:

1) Of the three trials in which CWD was diagnosed rainbow and cutthroat trout, treatment in two of the trials appeared efficacious, while treatment in the remaining trial was ineffective.

2) Treatment in the trial in which general systemic bacterial infection was diagnosed in channel catfish was characterized as inconclusive.

3) Of the three trials in which streptococcus was diagnosed in tilapia, treatment appeared efficacious in all trials.

3) Treatment in the single trial in which cabezon were diagnosed with a systemic bacterial infection appeared efficacious.

E. Efficacy at 6.0 - 6.1 g/100 lbs abalone/d for 1 day at water temperatures above 48.2° F

Abalone diagnosed with withering syndrome were treated with 6.0 - 6.1 g OTF/100 lbs of abalone/d for 1 day in two trials (Tables 1 & 3). OTF treatments appeared efficacious in one trial, while one trial was characterized as inconclusive.

F. Efficacy at 10 g/100 lbs fish/d for 14 days at water temperatures below 48.2° F

Fish were treated with 10 g OTF/100 lbs of fish/d for 14 days in two trials (Tables 1 & 3) involving chinook salmon diagnosed with bacterial kidney disease and steelhead trout diagnosed with CWD. OTF treatments appeared efficacious in the trial involving the steelhead trout diagnosed with CWD, whereas treatment results in the trial in which chinook salmon diagnosed with bacterial kidney disease was characterized as inconclusive.

G. Efficacy at 10.0 g/100 lbs fish/d for 10 - 14 days at water temperatures above 48.2°F

Fish were treated with 10.0 g OTF/100 lbs of fish/d for 10 - 14 days in 16 trials (Tables 1 - 3). In 15 of the trials, coho salmon, cutthroat, rainbow and steelhead trout were diagnosed with CWD; and one trial chinook salmon were diagnosed with columnaris. Treatments resulted in the following:

- 1) Of the 15 trials in which CWD was diagnosed, treatment in eight (53%) of the trials appeared efficacious, treatment in four (27%) of the trials involving cutthroat trout and coho salmon appeared ineffective, while treatment in three (20%) of the trials involving coho salmon and steelhead trout were characterized as inconclusive.

2) Treatment in the single trial in which chinook salmon were diagnosed with columnaris appeared efficacious.

H. Efficacy at 10.7 - 15.6 g/100 lbs fish/d for 14 days at water temperatures above 48.2°F

Fish were treated with 10.7 - 15.6 g OTF/100 lbs fish/d for 14 days in three trials (Table 1) involving rainbow and cutthroat trout diagnosed with CWD. OTF treatments appeared efficacious in two trials, while one trial involving rainbow trout was characterized as inconclusive.

2. Observed Toxicity

No toxicity or adverse effects relating to OTF treatment were reported in any of the trials conducted in CY05.

Summary of Study Results

Oxytetracycline medicated feed was used at dosages ranging from 0.96 - 19.62 g active drug/100 lbs fish/d. Treatment durations ranged from 1 - 18 days. Treatment trials involved fifteen different fish species and one species of shellfish (i.e., abalone), and approximately 15.4 million fish/shellfish. Treated fish ranged in length from 0.7 - 23.0 in. Mean length of treated abalone was 3.5 in. Water temperature during treatment ranged from 40.0 - 82.4 °F, with a mean treatment temperature of 60.7 °F. Overall results showed that treatment in approximately 83% of trials appeared

efficacious, treatment in 7% appeared ineffective, and treatment in the remaining 10% of the trials was characterized as inconclusive. No evidence of toxicity or adverse effects related to OTF treatment were reported in any of the trials. However, based on a general lack of untreated control fish, replication, randomization, etc., it is understood that these data will only be considered as supportive or ancillary data. None-the-less, the data described above should provide useful corroborative data to support a future expanded label claim for OTF for these disease indications. It is anticipated that additional ancillary efficacy data will continue to be collected under INAD #9332. In future trials conducted under this INAD, 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. Summary of CY 2005 OTF Treatment Results - Efficacious Trials

Hatchery	Number of Trials	Fish Species	Fish Size (inches)	Number of Fish	Disease	Number of Treatment Days	Dose (g/100 lbs)	Temp. (°F)
Simaron Fresh Water Fish Inc.	9	TIA	4.8 - 11.8	1,259,300	Streptococcus	14 - 17	0.96 - 2.44	73.4 - 78.8
Niagara Springs SFH	14	STT	7.72	1,705,078	CWD	10	0.96 - 2.44	59.0
Alchesay-Williams Creek NFH Complex	8	APT	0.9 - 4.0	422,004	General Systemic Bacterial Infection	10	2.5 - 3.75	52.0
	1	BKT	0.85	88,100	General Systemic Bacterial Infection	10	2.5 - 3.75	52.0
	1	BNT	0.85	82,000	General Systemic Bacterial Infection	10	2.5 - 3.75	52.0
Coleman NFH	2	FCS	3.00	187,239	Columnaris	10	2.5 - 3.75	66.0
	1	FCS	2.30	857,659	Enteric Redmouth	10	2.5 - 3.75	52.0
Hubbs Seaworld Research Institute	1	HAL	0.70	2,675	Epitheliocystis	10	2.5 - 3.75	62.1
Alchesay-Williams Creek NFH Complex	6	RBT	0.9 - 3.9	776,304	General Systemic Bacterial Infection	10	2.5 - 3.75	51.0 - 52.0
American Falls SFH	5	RBT	4.5 - 5.4	134,070	CWD	10	2.5 - 3.75	55.0
Hagerman SFH	4	RBT	3.1 - 3.6	929,897	CWD	10	2.5 - 3.75	59.0
	1	RBT	6.6 - 7.5	65,000	Columnaris	10	2.5 - 3.75	59.0
Nampa SFH	3	RBT	4.1 - 4.6	215,398	CWD	10	2.5 - 3.75	59.0

Table 1. Summary of CY 2005 OTF Treatment Results - Efficacious Trials - continued

Hatchery	Number of Trials	Fish Species	Fish Size (inches)	Number of Fish	Disease	Number of Treatment Days	Dose (g/100 lbs)	Temp. (°F)
Kent SeaTech Corp.	7	SXW	1.25	1,748,786	Gram Negative Bacterial Enteritis	10	2.5 - 3.75	77.0
Simaron Fresh Water Fish Inc.	2	TIA	6.3 - 7.5	98,183	Streptococcus	11 - 15	2.5 - 3.75	74.3 - 80.6
Milford SFH	1	WXS	2.50	24,000	Columnaris	10	2.5 - 3.75	78.0
Niagara Springs SFH	1	STT	2.13	203,547	CWD	10	3.75 & 19.62	59.0
The Abalone Farm, Inc	1	ABL	3.50	6,881	Withering Syndrome	1	6.10	57.5
The Abalone Farm, Inc	1	CAB	5.00	1,105	Systemic Bacterial Infection	10	4.0 - 8.0	60.0
Murray Springs Trout SFH	1	CUT	2.60	73,012	CWD	16	4.0 - 8.0	52.0
Giant Springs Trout SFH	1	RBT	2.93	48,444	CWD	14	4.0 - 8.0	54.0
Simaron Fresh Water Fish Inc.	3	TIA	6.4 - 11.4	51,500	Streptococcus	14 - 15	4.0 - 8.0	75.2 - 82.4
Dexter Ponds SFH	1	CKS	4.00	464,576	Columnaris	14	10	58.0
Whitman Lake Hatchery	1	COS	2.70	148,906	CWD	14	10	51.6
Murray Springs Trout SFH	2	CUT	0.9 - 1.0	297,998	CWD	14	10	52.0
Washoe Park Trout SFH	2	CUT	1.0 - 2.8	310,300	CWD	10 - 13	10	56.0

Table 1. Summary of CY 2005 OTF Treatment Results - Efficacious Trials - continued

Hatchery	Number of Trials	Fish Species	Fish Size (inches)	Number of Fish	Disease	Number of Treatment Days	Dose (g/100 lbs)	Temp. (°F)
Murray Springs Trout SFH	1	RBT	1.00	60,000	CWD	14	10	52.0
Nampa SFH	1	RBT	5.35	305,014	CWD	14	10	59.0
Clearwater SFH	1	STT	4.60	100,000	CWD	14	10	56.0
South Santiam SFH	1	STT	2.00	203,157	CWD	14	10	47.0
Murray Springs Trout SFH	1	CUT	1.50	34,400	CWD	14	10.7 - 15.6	52.0
	1	RBT	1.00	48,000	CWD	14	10.7 - 15.6	52.0

Table 2. Summary of CY 2005 OTF Treatment Results - Ineffective Trials

Hatchery	Number of Trials	Fish Species	Fish Size (inches)	Number of Fish	Disease	Number of Treatment Days	Dose (g/100 lbs)	Temp. (°F)
Coleman NFH	1	FCS	2.30	853,835	Enteric Redmouth	11	2.50 - 3.75	52.0
Hubbs Seaworld Research Institute	1	WSB	8.00	1,000	Rickettsia Like Organism	10	2.50 - 3.75	66.4
Murray Springs Trout SFH	1	CUT	2.00	75,000	CWD	18	4.0 - 8.0	52.0
Whitman Lake Hatchery	1	COS	2.70	270,690	CWD	14	20	51.6
Grace SFH	1	CUT	1.30	1,000,000	CWD	14	10	52.0
Murray Springs Trout SFH	2	CUT	1.5 - 2.1	116,738	CWD	14	10	52.0

Table 3. Summary of CY 2005 OTF Treatment Results - Inconclusive Trials

Hatchery	Number of Trials	Fish Species	Fish Size (inches)	Number of Fish	Disease	Number of treatment days	Dose (g/100 lbs)	Temp. (°F)
Alchesay-Williams Creek NFH Complex	2	RBT	0.9 - 3.8	539,310	General Systemic Bacterial Infection	10	2.50 - 3.75	51.0 -52.0
Kent SeaTech Corp.	2	SXW	1.25	323,007	Gram Negative Bacterial Enteritis	10	2.50 - 3.75	77.0
The Abalone Farm, Inc.	1	ABL	3.50	12,000	Withering Syndrome	1	6.0	61.0
Uvalde NFH	1	CCF	23.00	49	General Systemic Bacterial Infection	10	4.0 - 8.0	78.4
Whitman Lake Hatchery	1	COS	2.70	123,764	CWD	13	10	51.6
Magic Valley Steelhead SFH	2	STT	2.7 - 3.4	65,266	CWD	14	10	59.0
Pahsimeroi SFH	1	SUS	5.40	979,185	BKD	14	10	40.0
Murray Springs Trout SFH	1	RBT	1.00	100,000	CWD	14	10.7 - 15.6	52.0

Table 4. Summary Data Regarding Summary of CY 2005 OTF Treatment Trials

Total Fish Treated:	<u>15,412,377</u>
Number of fish treated in efficacious trials	10,952,533
Number of fish treated in ineffective trials	2,317,263
Number of fish treated in inconclusive trials	2,142,581
Total number of trials:	104
Efficacious trials	86 (83%)
Ineffective trials	7 (7%)
Inconclusive trials	11 (10%)
Treatment Regimens Used:	
0.96 - 2.44 g/100 lbs fish/day for 10 - 17 days (above 48.2°F)	23 trials
2.50 - 3.75 g/100 lbs fish/day for 10 days (above 48.2°F)	49 trials
3.75 & 19.62 g/100 lbs fish/day for 10 days (above 48.2°F)	1 trial
4.0 - 8.0 g/100 lbs fish/day for 10 - 18 days (above 48.2°F)	8 trials
6.0 & 6.1 g/100 lbs fish/day for 1 day (above 48.2°F)	2 trials
10.0 g/100 lbs fish/day for 14 days (below 48.2°F)	2 trials
10.0 g/100 lbs fish/day for 10 - 14 days (above 48.2°F)	16 trials
10.7 - 15.6 g/100 lbs fish/day for 14 days (above 48.2°F)	3 trials
Treatment Water Temperature (°F):	
Temperature Range	40.0 - 82.4
Mean Temperature	60.7
Size of Treated Fish (in.):	
Size Range	0.70 - 23.0
Species Treated:	
<u>Salmonids</u>	
Apache trout <i>apache Oncorhynchus</i>	
chinook salmon <i>O. tshawytscha</i>	
coho salmon <i>O. kisutch</i>	
cutthroat trout <i>O. clarki</i>	
rainbow trout <i>O. mykiss</i>	
steelhead trout <i>O. mykiss</i>	

brook trout *Salvelinus fontinalis*
brown trout *Salmo trutta*

Non-salmonids

cabezon *Scorpaenichthys marmoratus*
channel catfish *Ictalurus punctatus*
California halibut *Paralichthys californicus*
hybrid striped bass *Morone chrysops* x *M. saxatilis*
Tilapia *Oreochromis mossambica*
white seabass *Atractoscion nobilis*
saugeye *Stizostedion canadense* x *S. vitreum*

Shellfish:

red abalone *Haliotis rufescens*